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(FIMLAP)

REPORT OF A REGIONAL WORKSHOP ON FISHERIES MONITORING, CONTROL AND SURVEILLANCE

Albion, Mauritius, 16-20 December 1996

FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS

Rome, May 1997

PREPARATION OF DOCUMENT

This report was prepared during the course of the Regional Workshop on Fisheries Monitoring, Control and Surveillance held at the Albion Fisheries Research Centre, Mauritius, 16-20 December 1996. The Workshop was convened at the request of the FAO Indian Ocean Fisheries Commission (IOFC) at its 10th Session, Mombasa, Kenya, 1995. This report includes the work of several authors who worked as resource persons during the Workshop. The report's recommendations were developed through working groups during the Workshop. Subsequently, the Workshop, in plenary session, reviewed and endorsed the recommendations, on the understanding that the secretariat would consolidate them to avoid duplication.

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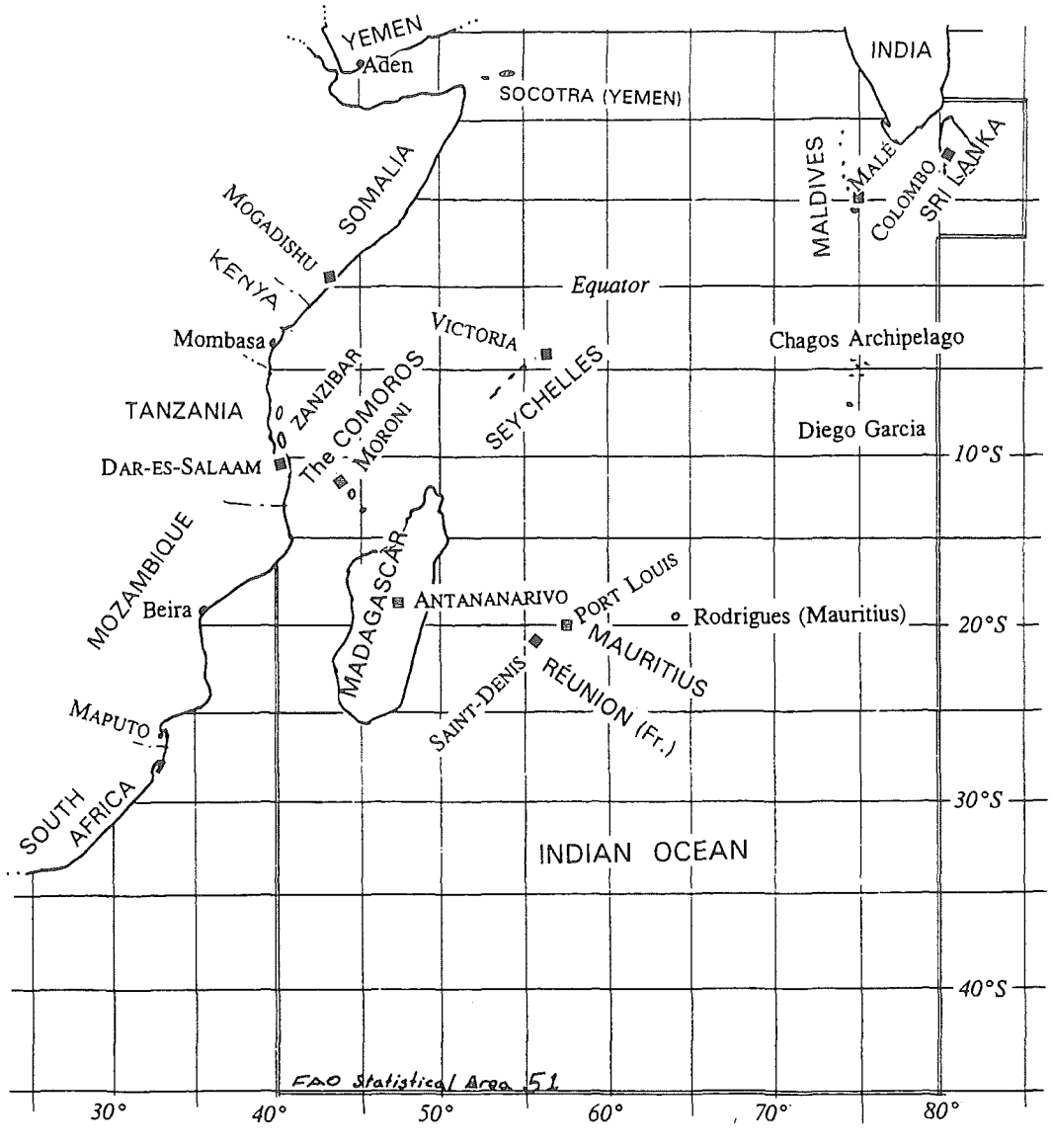
Sketch map of the South West Indian Ocean,

indicating the boundary of FAO Fisheries Statisitics Area 51



OPENING OF THE WORKSHOP

[1] The Regional Workshop on Fisheries Monitoring, Control and Surveillance for States bordering the Southwest Indian Ocean and Maldives, undertaken at the request of the FAO Indian Ocean Fisheries Commission (IOFC) took place at Albion Fisheries Research Centre, Mauritius, on 16-20 December 1996. It was funded by the FAO/Norway Fisheries Management and Law Advisory Programme (FIMLAP). The Workshop was attended by 47 participants representing 12 countries, the European Community and SADC, and, in addition, there were ten special participants from donor and other organizations active in monitoring, control and surveillance (MCS) in the Indian Ocean. The list of participants is given as Appendix B.

[2] The Honourable Mr S. Obeegadoo, Acting Minister for Cooperatives, Fisheries and Marine Resources Development, officially opened the Workshop. The text of his speech is given in Appendix C.

[3] On behalf of FAO, Mr André de La Porte, Resident Coordinator of the UN System in Mauritius, thanked the Government of Mauritius for the warm welcome and good arrangements. He noted that FAO had undertaken similar workshops in this field over the last fifteen years, and observed that recent UN Agreements had called for increased attention to be given to MCS within the framework of improved management. The text of his speech is given in Appendix C.

[4] Mr M. Munbodh, Principal Fisheries Officer, and Director of the Albion Fisheries Research Centre, chaired the Workshop.

PROGRAMME OF WORK AND OBJECTIVES

[5] The objectives of the workshop were to:

(i) review the status of national, regional and foreign fleet activity in the exclusive economic zones (EEZs) of the region, including the identification of problems and constraints associated with such fishing by both licensed and unlicensed vessels;

(ii) consider areas where States might strengthen existing MCS systems, including identification of constraints to MCS cooperation; and

(iii) propose recommendations for strategies that might be adopted to improve MCS capacities nationally, sub-regionally and regionally.

[6] The programme of work appears in Appendix A. The Workshop took the format of plenary sessions and working group discussions. The participants made also brief presentations on their respective national experiences in the formulation and implementation of MCS systems and sought to identify national and sub-regional problems encountered. Summaries of all the presentations are given here, and some of the technical papers appear in full in the Appendixes to this report.

SUMMARY OF PRESENTATIONS

Monday, 16 December

Fisheries Management and Monitoring, Control and Surveillance in the Southwest Indian Ocean and Maldives

[7] G.V. Everett of the Secretariat presented the paper by M.J. Sanders, *Summary Status Review for Selected Fisheries and Fishery Resources in the Southwest Indian Ocean (including Maldives)* and his own paper on *Some observations on Fisheries Management related to Monitoring, Control and Surveillance in the region of the Southwest Indian Ocean and Maldives.*

[8] Most stocks were observed to be fully or intensively exploited. The inshore resources were of great value to coastal communities depending on the fish resources for employment and food security. The shrimp resources were of importance to industrial fisheries in Tanzania, Mozambique and Madagascar. Tuna resources were important to many countries, and most particularly to Maldives, as well as countries where transhipment took place. Much of the fishing took place on the high seas, as well as in the EEZs of many countries by way of fishing agreements.

[9] It was emphasized that MCS was an integral part of the management process and that it was important that a well structured management frame be in place before MCS could be effective. "Monitoring" involved the collection, measurement and analysis of fishing activity; 'control' involved the specification of the terms under which resources can be harvested; and 'surveillance' included checking that conditions of access and management measures were observed. A number of variables need to be considered before arriving at optimal MCS for each country.

Legal aspects of cooperation in monitoring, control and surveillance in the Southwest Indian Ocean and Maldives

[10] The paper on *Legal Aspects of Cooperation in Monitoring, Control and Surveillance in the SWIO and Maldives* was presented by A. Van Houtte, member of the Secretariat. Her presentation centred in particular on the national legislation of the countries considered, with a view to noting the great differences existing between them. Particular attention was given to reporting requirements, licensing arrangements for national and foreign fisheries vessels, powers of the authorized officers and penalties. It was pointed out that harmonization in access arrangements could avoid Distant Water Fishing Nations (DWFNs) being in a position to play off the different islands' approaches and that compliance with regulations could be expected from the foreign fishing vessels if violation of regulations in one country had region-wide implications.

[11] There are also non-legal elements which may prevent problems of non-compliance, and hence facilitate enforcement of regulatory measures. Such non-legal elements include training, dissemination of information to those affected by the regulatory measures, involvement of people in the process of adopting legislation and, last but not least, in a regional perspective, cooperation.

[12] Regional cooperation in MCS must be encouraged as a means to overcome difficulties deriving from the lack of material and human resources in individual countries. Such cooperation could aim at streamlining data collection procedures, at jointly analysing such data, at establishing regional registers for identification and prosecution purposes, etc. This applies equally to high seas and to EEZ fisheries. International cooperation should also include harmonization of national legislation. Finally, cooperation in MCS should be extended to DWFNs whose national vessels fish in the region. Flag State control over such vessels must complement any national and regional MCS arrangements in order to significantly improve their effectiveness.

Legal framework of MCS

[13] A. Van Houtte of the Secretariat presented the paper prepared by C. Leria.

[14] An MCS programme has technical, legal and political implications. The basic consideration is that effective enforcement does not involve exclusively utilization of the latest technical equipment and/or use of force. Rather, effective enforcement is subject to the prior realistic consideration of the status of fishery resources (the concept of monitoring) and to the adoption of appropriate policy and legislation (concept of control). The provisions of the fisheries legislation which specifically concern MCS are those implementing the fisheries management measures and those regarding offences, penalties, officers responsible for enforcement and their powers.

[15] The problem of evidence is of great concern in prosecution procedures. For instance, not all judicial systems accept without corroboratory evidence Vessel Monitoring Systems (VMS) as a sufficient element of evidence of an illegal activity. Other legal issues relating to VMS may concern the ownership and confidentiality of the data.

[16] The speaker further discussed the Agreement for the Implementation of the Provisions of the *United Nations Convention on the Law of the Sea of 10 December 1992 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks* (the 1995 UN Fish Stocks Agreement). The Agreement includes interesting provisions which prescribe some required elements of agreements among States through sub-regional and regional fisheries management organizations. States must, for example, specify the mechanisms by which the organization must receive scientific advice and review the status of the stocks and highly migratory stocks. Other relevant provisions are those relating to sub-regional and regional cooperation for boarding and inspection on the high seas and those allowing coastal States to prohibit landings and transhipments where it has been established that the catch has been taken in a manner which undermines the effectiveness of sub-regional or regional management measures on the high seas.

Satellite data communications systems, remote sensing and other techniques as an aid to MCS

[17] The document *Satellite Data Communications Systems, Remote Sensing and Other Techniques as an aid to Monitoring, Control, Surveillance and Enforcement* was introduced by J. Fitzpatrick.

[18] He emphasized that the technology for data collection aboard vessels and subsequent downloading to a shore base over satellite networks had been in use for many years for both commercial and scientific purposes. In particular, he noted that the adoption of such

technology had made it possible to elaborate International Conventions and Protocols thereto for the maritime sector, some of which have to be applied to fishing vessels.

[19] He stressed that whereas the technology was suitable for application to the fisheries sector, any development should be on the basis of an integrated approach incorporating fishing vessel safety, fisheries research, vessel position monitoring systems and improved coastal zone navigation aids. Furthermore, any management system, so developed, should incorporate the principle of an "authorization to fish" and attendant records of vessels so authorized. With regard to VMS and catch data reporting, he cautioned that satellite-based technology should **not** be seen as a prerequisite for the artisanal sector. He went on to make proposals for ways and means to deal with artisanal fisheries, non-artisanal fisheries (in an EEZ) and for the High Seas. In this respect, the need for internationally agreed performance standards was also stressed, and efforts should be made to apply such standards at the legal level to ensure that evidence so gathered would be readily admissible in Court.

[20] Attention was drawn to the annexes to the document, that set out technical proposals for on-board sensing of machinery and equipment, standards to be met for VMS, fishing vessel records and means of control, and the final annex, containing tables on costs of systems and operations. The need to include the fishing industry and fishers' organizations in management deliberations prior to enacting legislation was heavily underlined.

Presentation on INMARSAT

[21] The International Maritime Satellite Organization (Inmarsat) offers the only mobile satellite communication service on a global basis anywhere in the world. The International Maritime Organization (IMO) organized Inmarsat in 1979, and it began operation in 1982. Its primary purpose was to:

> " ... to make provision for the space segment necessary for improving maritime communications ... thereby assisting in improving communications for distress and safety of life ... maritime public correspondence services ... ."
>
> (Inmarsat Convention, Article 3)

[22] Inmarsat's satellite communications services can meet three primary requirements of the fishing industry:

maritime safety services,
two-way messaging, and
satellite vessel monitoring.

[23] Although Inmarsat-A/B and Inmarsat-M may meet many requirements of authorities and the fishing industry, Inmarsat-C is uniquely equipped to meet the three requirements noted above. One small, low-weight Inmarsat-C unit can meet these requirements simultaneously. Fishing vessels equipped with Inmarsat-C can send and receive messages between the authorities, their owners and other vessels via E-mail, telex and facsimile. Files and free-form text messages up to 32 kb (including pre-formatted fish catch reports) can be exchanged.

[24] Further examination of the value and cost effectiveness of a centralized VMS utilizing Inmarsat-C services is recommended, in order to meet the needs of an effective MCS programme. The Forum Fisheries Agency (FFA) VMS planned for operation in 1997 is a reasonable model with which to begin. Its objectives may parallel those of the Indian Ocean Region with further development.

An overview of the South African fishing vessel monitoring system, with practical demonstration of the system

[25] F. Verhoeven provided the participants with information on the South African Fishing VMS which has been introduced for the purposes of monitoring the fishery for Patagonian toothfish. The system aimed initially at monitoring licensed vessels in the South Atlantic Ocean and is likely to be extended to other areas of the South African EEZ in the near future. The speaker further developed in detail the functioning of the system and concluded with a practical demonstration of a VMS.

[26] In the discussion that followed, participants noted the costs of the functioning of the system and wondered how South Africa dealt with the vessels fishing illegally the Patagonian toothfish. Actually the pressure of licensed fishing vessels on unlicensed vessels encourages the latter to apply for a licence.

Fisheries and MCS in Maldives

[27] Captain Z. Mansoor and A. Shahida made a general presentation on MCS in Maldives. The Maldivian MCS programme uses an Inmarsat/Global Positioning Satellite (GPS) tracking system to pin-point the location of licensed fishing vessels and possible areas of illegal fishing. The Maldivian Government would be prepared to share this technologically advanced system through electronic distribution of monitored data with a view *inter alia* to improving the sharing of monitored data among the countries of the region, setting up a regional database and in creating a regional register of vessels authorized to fish in the different EEZs. The Government is also in the process of implementing a satellite imaging based system. Officials are currently being trained to this effect.

Providing mobile satellite solutions

[28] An overview of various MCS technologies, such as satellite vessel tracking, earth imaging and HF Radio systems, was presented by R.G. Lovingfoss. This included brief discussions on the types and reasons for such MCS programmes, i.e., geographical area or activity monitoring, or both, and revenue-driven programmes. He pointed out that such technology-based programmes need not be expensive. Indeed, such programmes could and should be funded from vessel licensing fees and be self-sustaining in their continuing operations. The example was cited of the satellite-based VMS developed by his company for the Republic of Maldives. That very effective programme actually paid for itself within the first 6 months of operation.

[29] He closed his presentation by pointing out the need for and practical feasibility of a regional satellite-based programme for the Western Indian Ocean and the ease with which this could be developed.

Fisheries and MCS in Tanzania

[30] The participant from Tanzania informed the workshop of the institutional and legal framework governing MCS in Tanzania. The management of marine fisheries both in mainland Tanzania as well as Zanzibar needs more attention than has so far been possible. Monitoring activities need to be improved. The legal framework within which the resources are exploited comprises mainly conservation measures, such as closed fishing seasons,

restriction on the size of fishing vessels, the prohibition to use explosives, etc. Trawlers are required to stop working at night, so as to avoid interference with artisanal gear.

Fisheries and MCS in Madagascar

[31] Following a description of the coastal topography and the status of the fisheries, the participant from Madagascar focused his presentation on the management and conservation measures in force, the powers of the authorized officers, and the penalties. Within the fisheries sector, shrimp fisheries provide employment to thousands - on the vessels, in the processing plants, and in the marketing and distribution chain. Shrimp constitutes one of the major exports of the country. All fishing activities (except subsistence fisheries) are subject to a licence. There is no Coast Guard or Navy, but sometimes Army personnel have gone out with fishing vessels to apprehend vessels fishing illegally. It is understood that the Government wants to change the current MCS system towards ensuring an appropriate monitoring of the resources and control of the access of fishing vessels to the Malagasy waters.

Fisheries and MCS in South Africa

[32] The participant from South Africa informed the Workshop that a comprehensive new fisheries policy is currently being prepared in the country, which will be implemented by a new regulatory framework for fisheries. Meanwhile, a variety of different management measures currently apply. They aim at controlling fishing effort through the setting of a total allowable catch (TAC) for the various species and restrictions on the number of boats, traps or nets.

[33] The participant stressed the need for the regulatory measures to be enforceable and practicable, as well as being fair and just and acceptable to the whole community. To this end, such measures should be based on a transparent decision-making process and following consultation with those concerned. A VMS is now being introduced in order to reduce illegal fishing activity but will also serve for purposes of sustainable fisheries management. It will affect the inshore, offshore and deep-water fisheries.

[34] The participant concluded his presentations by underlining the need for regional cooperation, including a regional VMS between South Africa and the neighbouring countries, with regard to shared fish stocks and the migratory nature of many species.

Fisheries and MCS in Réunion, France

[35] In recent years, Réunion has seen a rapid and important development of its national fishing fleet, in particular the tuna and swordfish longline fishery. It also faces heavy competition from the activities of DWFN tuna fleets, in particular from Asian countries. The lead role in monitoring fishery activities is taken by IFREMER, in addition to activities of ORSTOM, and their information includes data on water temperature and movements of currents. The French Navy is responsible for patrolling the EEZ, which is extensive because of a number of islands.

[36] The need to boost a regional approach for MCS in the region was underlined. This was as a result of the increasing number of DWFN vessels in the region and the need for the resources to be managed and protected. Such regional cooperation should focus on exchange

of information and data, on setting up a harmonized approach to vessel monitoring and harmonizing the offences and related penalties for illegal fishing. There would be advantages in setting up a regional register for fishing vessels, which would allow countries in the region to blacklist specific vessels that did not pursue acceptable fishing practices.

Tuesday 17 December 1996

MCS - the Norwegian experience

[37] Following a brief introduction on the basic characteristics of the Norwegian fishing industry, T. Lobach described the legal framework governing the sector. Norway attaches a great importance to the implementation of appropriate means and instruments for control, surveillance and enforcement in order to ensure compliance to the existing laws and regulations. It is important to control the fishery at every level where fishing operations take place (at sea and in port). As problems with unlicensed fisheries, gears, closed areas, etc., now are minimal, the most important task is the control of catches. As far as foreign fishing is concerned, the competent authorities control the quotas at sea, enforce a system of active/passive reporting upon entering and leaving the EEZ, and a mandatory weekly reporting of catches. To reduce problems of misreporting, foreign fishing vessels are required at the end of their fishing activities to report and present themselves at certain designated checkpoints for possible control by the Coast Guard, unless the catch is landed in a Norwegian port, in which case control and inspection procedures will take place upon landing.

[38] The Directorate of Fisheries, the Coast Guard and the Sales Organizations are responsible for the monitoring, control and enforcement of the laws and regulations. The Sales Organizations are responsible for controlling whether the vessels quotas have not been overfished. They have the power to confiscate that part of the catch which exceeds the vessel's quota. An important characteristic of the institutional framework is the intense collaboration between the different institutions responsible for MCS. All work very closely with each other. Well trained staff are also essential for an effective MCS system. Experts from the Directorate of Fisheries, the Institute of Marine Research, the Coast Guard and the Prosecution Authorities provide lectures to each other, annually, during intensive courses. It is further worth noting that the MCS system has been developed in close cooperation with the fishing industry.

[39] The speaker highlighted that such a cooperative approach has not only developed at the national level, but also at regional level. Norway has indeed entered into several agreements with its neighbouring countries for the purposes of sustainable management of the shared migratory fish stocks. The countries concerned are Russia, United Kingdom, Denmark, Ireland and Faeroe Islands. Cooperation focuses on the sharing of information on inspections at sea, the exchange of information on landings, the exchange and training of personnel (involved in land-based inspection and marine surveillance) and operational surveillance and enforcement issues. Norway and Canada have signed a special agreement taking into account the recent 1995 UN Fish Stocks Agreement and the FAO Compliance Agreement, including enforcement and the closing of ports to vessels which have participated in illegal fishing activities on the high seas. Equally, similar approaches to cooperation are

being taken under the auspices of the regional Organizations covering the North Atlantic Ocean.

The South Pacific Forum Fisheries Agency and Legal Aspects of Fisheries MCS and Regional cooperation in MCS: the experience of the member States of the sub-regional fisheries commission (Papers by M.W. Lodge and by K. Roberts)

[40] The work of the Forum Fisheries Agency (FFA) in the South Pacific was described. It has an annual budget of some $US 9 million, much of which is provided by Australia. The Agency excludes DWFNs from becoming members at present. The Agency operates a regional register which has become an effective mechanism for compliance. Recently the USA has started to cooperate closely, and now provides a full-time adviser to the FFA.

[41] Successful observer programmes have been carried out, and as a result the monitoring of catches improved. VMS is also being introduced. Given the limited financial resources in the region, the FFA has so far relied on a MCS system that stresses the administrative, legal and diplomatic approach.

[42] The Secretariat briefly presented experiences in regional cooperation in MCS in six West African Member States of the Sub-Regional Fisheries Commission (SRFC). Created in 1985, it has provided and continues to provide the framework for its Member States to harmonize fisheries legislation and cooperate on matters of MCS. In particular, Member States of the SRFC have been working progressively toward harmonizing their licensing systems (common procedures), surveillance procedures as well as the observer arrangements and the marking of vessels. In terms of regional cooperation, one of the most significant developments has been the sub-regional air surveillance project, supported by Lux-Development and based in the Gambia. Work is currently on-going in establishing a sub-regional register of fishing vessels, and in preparing both a handbook for surveillance officials and a standard reporting format. Cooperation has encountered several difficulties, ranging from political, institutional and legal problems to practical day-to-day problems, as well as those related to cost. These difficulties have been progressively overcome.

Inspection procedures at sea and on land

[43] In checking fishing operations, the need for thorough preparation was emphasized. Inspectors should be familiar with the objectives of and reasons for boarding. If necessary, documents and credentials should be translated. Prior to boarding, the inspector should look out for signs of fishing activity by the vessel, which could be presented as evidence in Court if it was found necessary to bring a case against a skipper. Evidence taken on video was particularly useful. The actual patrol vessel from which an at-sea boarding takes place should be highly visible. An inspection manual should be prepared.

Maritime boarding and inspection procedures in Malaysia

[44] The MCS situation in Malaysia was described. There is close coordination between the Police, Navy, Air Force and Fisheries Department. Air Force planes regularly alert officials of the Fisheries Department if a foreign vessel is sighted passing through Malaysian waters. Patrol vessels often approach the foreign vessel to board and inspect. If the foreign vessel is found to be illegally fishing, or tries to escape, it is escorted to a Malaysian Port where the crew are taken to Court. If found guilty, the crew may be unable to pay the fine,

and be sent to jail. The vessel will be then sunk as part of an official reef. A video was shown to participants.

[45] The Malaysian systems involves complex procedures for licensing national fishing boats, which are required to fish in certain zones. All fishers and all type of gear are licensed. Annual fines as a result of irregular Malaysian fishing are substantial. All fishing operations are recorded on computer, and MCS officials are in E-mail contact with colleagues throughout the country, as well as with all patrol vessels, and information is updated daily in Kuala Lumpur.

[46] Following this presentation, a second video, produced by the Australian Navy, was shown, which is used for training Naval staff in fishery inspection.

Legal aspects of arrest and prosecution

[47] The presentation centred on crucial elements of prosecution procedures. T. Lobach outlined the information to be submitted to the prosecuting authorities (vessel name, skipper name, moment of seizure, short description of the violation, etc.), the questions to be asked during the prosecution to establish the criminal liability, how to define who needs to be prosecuted (skipper and/or shipping company) and the manner in which and the criteria for fixing the sentences and deciding whether (and which) objects (including the vessel) or value should be confiscated and forfeited. The speaker also highlighted the importance of defining the adequate reactions (level of fines, forfeiture, etc.) to be taken in case of illegal fishing activities.

Control of foreign fisheries

[48] *Control of Foreign Fisheries* was the subject of a presentation by G. Parkes, highlighting the need to develop methods for the assessment of optimal net benefits from the licensing of foreign vessels operating in EEZs. A description was given of how the marginal value of a nationally controlled fishery resource (considered as the difference between the income derived by a commercial operator from fishing inside a zone and the income from fishing outside the zone) could be used, in conjunction with the known parameters of fish price, catches, surveillance costs, etc., to estimate the optimum combination of surveillance cost, legal penalties, and fee levels to minimize the risk of illegal fishing and maximize benefits accruing to the coastal state.

[49] The basic model that had been developed was applied to case studies and it had become obvious that the detailed analysis would have to match the particular fisheries and surveillance characteristics of the region or country. Where multiple fisheries, fleets and states were involved, the data analysis necessary became quite time consuming and complex. Each of the case studies emphasized the importance of imposing large fines for illegal fishing activities.

Special aspects of MSC and trawling

[50] The representative of an association of fishing vessel owners in Madagascar described the situation in that country and the various requirements which should be in place before the fishing industry could play a full role in contributing to development of the national economy.

Fisheries and MCS in Mauritius

[51] Representatives of the Albion Fisheries Research Centre, the Fisheries Protection Service and the National Coast Guard discussed the situation of fisheries in Mauritius. The lagoon and inshore coastal fisheries provide employment and food to a large sector of the coastal population. The Banks fisheries also provide a high percentage of the total fish catch. The motherships, using dories, make long trips to these fishing grounds. The resources are subject to a TAC as well as quotas for the various companies involved in exploitation. The Fisheries Protection Service enforces the fisheries regulations in coastal waters whereas the Coast Guard applies the fisheries regulations in the EEZ, through use of patrol vessels and two surveillance aircraft. Government services provide advice to fishermen, as well as funds to cover periods when fishing is not possible. The overall objective is to ensure long-term sustainability of fish production. Port Louis is an important transhipment port, mainly for Asian-flag longliners, and many of these vessels are now acquiring licences to fish in the EEZ of Mauritius.

Fisheries and MCS in Seychelles

[52] The location of Seychelles is of critical importance with regard to the tropical tuna fishery in the Indian Ocean. The tuna purse seiners use transhipment facilities in Seychelles, and often fish in the course of moving through its EEZ either to or from the port at Victoria.

[53] The country aims to introduce an improved MCS system but is constrained by lack of funds and training. In addition to purse seiners, the country licenses many longliners to fish in its EEZ, and many of these vessels are known to fish not only on the high seas but also both legally and illegally in EEZs of neighbouring countries.

Fisheries and MCS in Mozambique

[54] The participant started with presenting the main characteristics of the fisheries and their present status. Almost all resources - of which shrimp is the most important - are within 20 to 25 nautical miles of the coast, with some tuna migrating into the waters near the 200 mile limit. Fishing activities are classified under the Fisheries Law as being industrial, semi-industrial, artisanal or subsistence, and are - together with the category to which they belong - subject to different authorization procedures and different levels of control. Mozambique is one of the countries in the region having a TAC and quota system for the industrial crustacean fisheries. For the purposes of MCS, reporting requirements are mandatory for all fisheries. No (coast guard) patrol vessels or planes are available because of the high costs involved. There is a system of 'self surveillance' whereby licensed vessels are expected to report on the presence and activity of unlicensed vessels. Besides this, there are 40 inspectors responsible to the National Directorate of Fisheries of the Ministry of Agriculture and Fisheries, who are based in major ports of Mozambique. Several of them go regularly on board fishing vessels in order to observe the activities of all vessels taking part in the fishery.

[55] Tuna fishing activities are undertaken legally by purse seiners and longliners from Spain, Taiwan (Province of China) and Japan.

[56] In the light of the characteristics of the fisheries sector, its needs and constraints, Mozambique is still progressing steadily towards finding the most appropriate MCS system.

Wednesday 18 December 1996

Field Trip

[57] A field trip was organized to visit the fish landing station at Pointe aux Sables. The Principal Fisheries Protection Officer and his staff, as well as the Head Fisherman, described the activity of fishers and the work of the Protection Service. The field trip then continued to Port Louis to visit the new Coast Guard ship *Le Vigilant* which then recently arrived after construction in Chile. The ship had a cruise capacity of one month. A helicopter was soon to be delivered. *Le Vigilant* was designed as a multipurpose craft, not only to assist with fisheries management but also to be ready for any eventuality for which a national presence might be required. The field trip then continued to the fishing port, where Asian tuna longliners, Mauritius Banks motherships, and research vessels of the Albion Fisheries Research Centre were visited.

Thursday, 19 December 1996

The special situation of artisanal fisheries

[58] The characteristics of coastal artisanal fisheries were first outlined, noting such items as economic status, location in regard to reef, lagoon, shelf (drop-off and banks or seamounts), and whether the fishery type was small or medium scale, multi-species or multi-gear, or both. The importance of setting out a management plan and overall objectives was emphasized. The data requirement for biological management of fish stocks were listed.

[59] It was important to reduce the need for conventional surveillance, to encourage compliance and reduce the need for enforcement. There should be a careful selection of appropriate management instruments, and maximum use made of potential for community management. There would appear to be scope to promote management ideas through extension.

Marine parks and reserves - the Mauritian experience

[60] To protect and monitor its delicate coral reef ecosystem in the face of threats from increasing industrialization, tourism and artisanal fisheries development, Mauritius is in the process of establishing Marine Protected Areas (MPAs). Mr Goorah referred in particular to the Balaclava Marine Park, and highlighted the various protection zones which are being defined for the purposes of facilitating the management of the MPA. The zoning of the area is crucial to allow for the definition of the various uses which are permitted and to resolve indirectly conflicts between the potential users.

[61] The speaker underlined the need for appropriate education and information of all those affected by the MPA in order to create a general awareness on the reasons for its establishment and to minimize non-compliance problems. In this respect, he also stressed that for the purposes of enforcement, sufficient human resources should be made available.

Monitoring, Control and Surveillance - the Australian Experience

[62] Australia has a vast EEZ: 8.94 million square kilometres. The Australian Fisheries Management Authority (AFMA) relies mainly on the Navy and Air Force to police the extensive fishing zone. A civil agency, Coastwatch, contracts aerial surveillance to the private sector. MCS is directed at domestic licensed, foreign licensed and unlicensed vessels. A range of agencies are involved in MCS operations. Foreign vessels are required to regularly report position and catch, and be subject to inspection and observer programmes.

[63] There have been a number of problems with incursions of Indonesian fishermen into Australian waters, and the assistance of the Indonesian government has been sought to reduce the number of these incursions. VMS has been introduced to monitor the orange roughy fishery, and it was soon to be introduced to the northern prawn fishery.

[64] The fishing industry contributed to cost recovery in observer and MCS programmes, and also made a contribution to MCS through a levy on access rights.

[65] A video on the Australian approach to boarding and inspection procedures was shown, as well as a video of the Australian observer programme on Japanese vessels.

Information systems for MCS

[66] The principal data flows in management of a fishery showed that the main items to be taken into account include licensing and control, stock assessment and management, monitoring of commercial fishing, and surveillance and enforcement. There is a close interaction between all components, and cross-checking of information at all levels is advisable. Some of the work of the Marine Resources Assessment Group (MRAG) in London in the field of fisheries management science was described. This includes the development of models for length frequency distribution analysis, catch effort data analysis, and models to provide management advice on lightly exploited stocks. In the course of discussion it was observed that the FAO Code of Conduct for Responsible Fisheries gave considerable attention to the need for improving data flow.

[67] A video was shown on procedures for boarding and inspecting vessels fishing for Patagonian toothfish by longline.

Fisheries and MCS in the Comoros

[68] Fisheries in the Comoros is dependent on the activity of small craft around the islands. Government prioritizes the need for increasing fish production and caring for the well-being of fisherfolk. There is an agreement with the EU, which is a framework within which Spanish and French tuna purse seiners can operate. The government discourages fishers from fishing the coelacanth; however, it is occasionally caught accidentally.

The European Union and Fishing in the Indian Ocean

[69] The presentation on this issue made by Mr Beslier listed the reasons for officials from the Commission of the EU being in this Workshop, namely because the Community is acting as a coastal State in this area, the Common Fishery Policy being directly applicable in the waters surrounding Reunion, the EU had a large tuna purse seiner fleet in the region, and there was a significant evolution of the international legal framework governing fisheries.

The EU was fully committed to the need to work through cooperative arrangements and control schemes which respect the rights of individuals, and particularly through the optimal functioning of regional fisheries bodies like the Indian Ocean Tuna Commission (IOTC). The EU would like to see inspection procedures, for example, in the case of boarding, verification of logbooks, compilation of evidence to bring before a Court, etc., that were compatible in different fishing zones.

Formation of Working Groups

[70] Four working groups were formed:

Working Group 1:	Institutional and cooperative arrangements.
Working Group 2:	Financial and economic considerations.
Working Group 3:	Operational aspects of MCS.
Working Group 4:	Legal matters.

[71] The membership of each group and their reports are given in Appendix E. The conclusions of the discussions in each working group provided a substantive basis for discussions. The resulting recommendations of the Workshop are in summarized in paragraphs [83] - [92], below.

Friday 20 December 1996

Fisheries and MCS and SADC

[72] Namibia coordinates the Sector for Marine Fisheries and Resources in the SADC Organization. The six coastal SADC member states are Angola, Mauritius, Mozambique, Namibia, South Africa and Tanzania, and they have important marine fisheries subsectors, and a number of stocks move between the waters of these countries. There are a number of advantages in cooperation between the members of SADC for information exchange, resource management, MCS and issues of development. MCS in Namibia is well developed. There has recently been an EU-financed feasibility study to examine possibilities for strengthening MCS in the region.

Fisheries and MCS in Kenya

[73] The marine fisheries are varied in nature and notably increasing in importance as a location for tourists to visit. This has caused increased pressures on the fishing population, that have seen a reduction in area available for fishing. Inspection of vessels in the EEZ is undertaken by the Navy. The Kenya Wildlife Service also has a plane which can spot fishing vessels in the EEZ, which should all be licensed.

Fisheries and MCS in Indonesia

[74] The vast EEZ to be covered with regard to MCS is a problem for government agencies involved in fisheries. The Navy is the main agency responsible for inspection at sea. The Directorate General of Fisheries is in the process of improving its effectiveness.

One of its priorities is to ensure that resource management is carried out in such a way that artisanal fisheries can continue to benefit coastal communities.

DISCUSSION AND CONCLUSIONS

[75] Following V. Soondron's presentation of the summary report of Working Group 1, on institutions and cooperation, there was a discussion on other regional fishery bodies not identified in the report. It was noted that the Western Indian Ocean Tuna Organization (WIOTO) should be referred to. The work of the FAO Indian Ocean Fisheries Commission (IOFC) was also discussed; it has subcommittees for the Gulfs, for the Bay of Bengal and for the Southwest Indian Ocean. The meeting agreed that further workshops and *ad hoc* technical working groups be convened under the framework of IOFC programmes to examine MCS in general, as well as specialized aspects of MCS in this region. Mention was made of the interest of the Indian Ocean Commission (COI) in MCS and that the EU will probably assist COI with MCS activities. The meeting recommended that, in due course, all vessels fishing in the area be fitted with a satellite transponder, and that further work on harmonization of MCS reporting and other necessary procedures be undertaken as soon as appropriately possible.

[76] The report of the Working Group 2, on financial and economic considerations of MCS, was presented by G. Parkes. The meeting supported the report and its recommendations, in particular the need to assess further the costs of surveillance technologies. The meeting agreed with the recommendation of the working group that, in some situations, the confiscation of a vessel fishing in contravention of regulations was a suitable penalty that should be incurred by a ship owner.

[77] It was agreed that with regard to this region it would be reasonable to focus on MCS matters related to one fishery, such as tuna, rather than to several fisheries simultaneously, in order to avoid the risk of confusion and dilution of limited financial resources.

[78] Attention should be given to effective following-up of the impact of technical assistance, and this was one issue the UK Overseas Development Administration (ODA) was giving attention to, in its attempt to justify a number of past and future activities in the field of fisheries management.

[79] In the course of the discussion, participants heard that in New Zealand the fishing industry itself was taking initiatives to ensure compliance with conservation measures, and in Canada the industry was pushing forward with setting a Code of Conduct for Responsible Fisheries appropriate to the Canadian situation, based on the FAO Code.

[80] Messrs Ramcharrun and Labrosse presented the results of Working Group 3, on operational aspects of MCS, which were approved by the meeting. The meeting then recommended that FAO organize further workshops similar to the present one, and the meeting also recommended that smaller, *ad hoc* meetings to examine specialist aspects of MCS be held with support of the project, now financed by Norway, to assist implementation of the FAO Code of Conduct.

[81] The report of Working Group 4, on legal aspects of MCS, was presented by M. Papaioannou, and the meeting adopted the report. The meeting then recommended that FAO update the compendium of legislation pertaining to fisheries in the region, and also recommended that FAO organize workshops, primarily for fisheries lawyers, to discuss specific MCS issues, such as the procedures for prosecution of fishermen; evidence; legal

impact of VMS-derived evidence; enforcement; and associated matters, including harmonization of legislation.

[82] The draft report of the workshop pertaining to the opening, objectives and presentations was circulated to all participants, and approved, subject to minor editorial changes.

WORKSHOP RECOMMENDATIONS

Working Group 1

[83] The Working Group recommended that all countries of the region should adopt a resolution requiring all foreign vessels engaged in common regional fisheries , regardless of nationality and regional port, be fitted out with a minimal satellite transponder. This could be a requirement for entry on a Regional Register.

[84] The advantages of this would be:

- No one country will be seen as the "Bad Guy" and should not experience repercussions, such as changes in transhipment ports.
- Countries may act then individually or bilaterally to develop adequate MCS programmes based on specific yet expanding needs.
- Such equipment will initially provide position location and movement activity, and can be expanded upon at a later time to include two-way communications, i.e., catch reporting.

Working Group 2

[85] The Working Group considered that one of the most important issues facing fisheries managers was to answer the question of how much can justifiably be spent on MCS. The costs of the various surveillance options should be considered in relation to the benefits derived from the expenditure. It was recommended that a table of standard and/or relative costs be drawn up, so that it would be possible to demonstrate, where appropriate, the economies of scale which could be achieved, for instance, through regional cooperation. It was also important to ensure liaison between fleet managers, skippers and fisheries managers.

[86] Alternatives to the specification of levels of fines in a fisheries law were considered. These included the development of a formula for calculating a fine, dependent on a number of factors, including the value of the vessel and the value of the fishery. This would assist the courts in the setting of appropriate penalties, and the option to confiscate the vessel for certain offences was recommended. The Working Group emphasized that the primary function of fines and other penalties is that of deterrence, rather than a means of generating revenue.

Working Group 3

[87] It was a general opinion of the Working Group that they felt that further assistance from FAO could be beneficial in elaborating solutions, identifying technology and procedure within the region, always bearing in mind, of course, that the adoption of technologies and

procedures sub-regionally will require harmonization of fisheries laws and regulations in this regard.

[88] The Group expressed its appreciation for the initiative taken by Norway to fund the sub-programme on MCS for the implementation of the Code of Conduct for Responsible Fisheries, and expressed an interest in cooperation with this initiative.

Working Group 4

[89] The Group recommended that regional legislation be updated on the Indian Ocean, with short comparative summaries of the provisions important for MCS.

[90] It also recommended that practical work be undertaken in legal matters, such as through holding a prosecutor's workshop, setting up guidelines and legislative drafting exercises. In this context, attention was drawn to the usefulness of a prosecution manual tailored to MCS requirements. A recent collection of relevant case law should be set up.

[91] In general in the discussion following presentation of the Working Groups' recommendations, there emerged consensus on the need to encourage harmonization of legislation and legal procedures.

[92] There was general agreement that there was a need for further workshops or technical working group meetings, including for legal aspects.

POSSIBLE FOLLOW-UP ACTIVITIES

[93] The meeting welcomed the invitation from Malaysia to FAO to organize a workshop on MCS for participants mainly from the Southeast Asia Region, most probably at Kuala Terenngannu, where the practical aspects of MCS could be given priority attention.

CLOSING OF THE WORKSHOP

[94] The Director of the Albion Fisheries Research Centre, Mr M. Munbodh, thanked FAO and all persons involved in the workshop, which he had found instructive and enjoyable. Mr G.V. Everett thanked the Director, as well as the Permanent Secretary of the Ministry of Cooperatives, Fisheries and Marine Resources Development, and his staff for their assistance. He particularly thanked Norway for their financial support for the workshop. Ms A. Van Houtte extended heartfelt thanks to the administrative, technical and support personnel of the Centre for their dedication and hard work which had ensured the success of the workshop. The UK Overseas Development Adminstration was also thanked for financing the participation of G. Parkes and C. Mees, who had made substantial contributions in the course of the workshop programme.

[95] The workshop closed at 12:40 on Friday, 20 December 1996.

Appendix A

FAO/Norway Government Cooperative Programme
GCP/INT/606/NOR, Fisheries Management and Law Advisory Programme (FIMLAP)

Regional Workshop on Fisheries Monitoring, Control and Surveillance

Albion Fisheries Research Centre, Albion, Mauritius,
16 - 20 December 1996

PROGRAMME AND TIMETABLE

Monday, 16 December

08:00	*Bus collects participants from hotels in Flic en Flac*
09:00	Registration
10:00	Opening
10:30	Introduction to administrative arrangements, and format of workshop (G.V. Everett)
10:45	"Some observations on fisheries management related to monitoring, control and surveillance in the region of the southwest Indian Ocean and Maldives", including introduction to the paper "Summary status review for selected fisheries and fishery resources in the Southwest Indian Ocean, including Maldives" (G.V. Everett)
11:30	"Legal aspects of cooperation in monitoring, control and surveillance in the Southwest Indian Ocean and Maldives" (A. Van Houtte) Legal framework for MCS (A. Bergin)
13:00	*Lunch*
13:45	"Satellite data communications systems, remote sensing and other techniques as an aid to MCS (J. Fitzpatrick)
14:30	"Presentation on INMARSAT" (F. August)
16:00	*tea*
16:10	"An overview of the South African fishing vessel monitoring system, with practical demonstration of the system" (F. Verhoeven/J. De Villiers)
16:45	"Fisheries and MCS in Maldives"
17:00	"Providing mobile satellite solutions" (G. Lovingfoss)
17:15	"Fisheries and MCS in Tanzania" "Fisheries and MCS in Madagascar" "Fisheries and MCS in South Africa" "Fisheries and MCS in Reunion"
18:00	*Return to hotels in Flic en Flac*

Tuesday 17 December

08:00	*Bus collects participants from hotels in Flic en Flac*
09:00	"MCS - the Norwegian experience" (T. Lobach)
09:45	"The South Pacific Forum Fisheries Agency and Legal Aspects of Fisheries MCS" and "Regional cooperation in MCS: the experience of the Member States of the sub-regional fisheries commission" Papers by M.W. Lodge and K. Roberts (A. Bergin and A. Van Houtte)
10:30	*tea*
10:40	"Inspection procedures at sea and on land" (G. Parkes)
11:30	"Maritime boarding and inspection – procedures in Malaysia" (Captain Abdul Wan Fatah)
12:30	"Legal aspects of arrest and prosecution" (T. Lobach)
13:00	*Lunch*
13:45	"Control of foreign fishing" (G. Parkes)
15:00	"Special aspects of MSC and trawling" (B. Couteaux)
15:15	"Fisheries and MCS in Mauritius"
15:45	*tea*
16:00	"Fisheries and MCS in Seychelles"
16:15	"Fisheries and MCS in Mozambique"
17:00	*Return to hotels in Flic en Flac*

Wednesday 18 December.

Field trip to port to see tuna vessels, transhipments, Banks vessels, the ships of the Coast Guard, and learn of their work.

08:00	*Departure from Pearl Beach Hotel*
08:15	*Departure from Villa Caroline*
09:00	Visit Point aux Sables landing beach to see the work of the Fisheries Protection Service (registration of boats; fishermen; allowances during closed season; measurement of mesh; checking gear; statistics; etc.)
10:00	Visit the Coast Guard Vessels at Port Louis (new vessel *Le Vigilant*; systems; procedures; etc.)
11:00	Visit the port at Port Louis (transhipment of tuna; high-seas long-liners; Banks motherships and dories; etc.)
12:00	*Either return by first 'bus to hotels or remain in Port Louis to visit museum, market, etc.*
15:30	*Second 'bus meets participants at Caudan Waterfront car park, and return to hotels.*
17:30	Informal technical working groups at Pearl Beach Hotel.

Thursday 19 December

08:00	*Bus collects participants from hotels in Flic en Flac*
09:00	"The special situation of artisanal fisheries" (C. Mees)
10:00	"Marine Parks and Reserves - the Mauritian experience" (Gourah)
10:30	"The European Union and Fishing in the Indian Ocean" (S. Beslier)
11:00	*tea*
11:15	"MCS - the Australian Experience" (A. Bergin)
11:45	"Information systems for MCS" (G. Parkes)
12:30	"Fisheries and MCS in the Comoros"
12:45	*Lunch*
13:40	Working groups

Friday 20 December

08:00	*Bus collects participants from hotels in Flic en Flac*
09:00	"Fisheries and MCS and SADC"
09:15	"Fisheries and MCS in Kenya"
09:30	"Fisheries and MCS in Indonesia"
10:00	"Presentations of the working group discussions"
	Final discussion
	Future priorities
	General conclusions of workshop
	Workshop declared closed.

Appendix B

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Appendix C

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Messrs Mulloo and Munbodh of the Ministry of Cooperatives, Fisheries and Marine Resources Development
Distinguished guests and participants
Ladies and gentlemen

I am pleased to be among you this morning on the occasion of the opening ceremony of the Regional Workshop on Fisheries Monitoring, Control and Surveillance, which FAO - through its Fisheries Management and Law Advisory Programme (FIMLAP) - is organizing in collaboration with the Ministry of Cooperatives, Fisheries and Marine Resource Development. This workshop is in fact part of the FAO/Norway Government Cooperative Programme.

In 1982, the United Nations Law of the Sea Conference laid the foundation for a more responsible management of fisheries resources, by extending coastal states jurisdiction to 200 nautical miles. It is now believed that 90% of the world's fisheries resources are found within the Exclusive Economic Zones (EEZs) of coastal states.

Implicit in the Law of the Sea Convention is an obligation on behalf of the coastal states to provide rational management of fisheries resources. However, most developing countries have not been able to derive full benefits from their EEZs, which were established in the early 1980s; the main reason being that effective management measures were lacking, thus leading to overfishing and a gradual decrease in the fish stocks.

Monitoring, Control and Surveillance (MCS) should in no way be perceived as the imposition of an additional burden on fishermen and fishing fleets be they local or foreign. MCS should rather be seen as an integral part of fishing activities as Monitoring, Control and Surveillance build up information which eventually constitutes an important and effective instrument in the management of fisheries and thus directly benefits the fishing industry.

Of course, those who would wish to fish in an irresponsible manner will not see MCS from this view point.

We should constantly bear in mind that considerable MCS work is already being carried out by way of fisheries inspection and collection of information from fishermen and fishing vessels. Fisheries management tools, such as limited entry, quota systems, closed areas and seasons, are not effective without an effective MCS system, whether in relation to foreign fishing or fishing by the country's own nationals. Cases occur where foreign vessels fish in the EEZs of countries and in restricted zones without licences. Often, the foreign fleet does not report while in the EEZ and sometimes carries out illegal transhipment. In coastal fisheries, compliance problems include the use of explosives, unlicensed fishing, and fishing with illegal gear.

Fisheries MCS is a vital aspect of fisheries management and is exercised by countries in their territorial seas and adjacent EEZs in order to enforce sovereignty over fisheries resources under their national jurisdiction, with a view to preventing unauthorized exploitation by citizens or foreigners, and to ensure that items of information which are necessary for the development of fisheries management programmes are collected and properly used.

There is a wide range of equipment and techniques available for fisheries MCS, but systems should be cost effective and affordable. It would be senseless if countries were to spend greater funds on conservation than the potential economic benefits. The number of participants in this workshop and countries testify the importance given to fisheries MCS in the region. Although a few countries have developed MCS systems, the majority have yet to set up such appropriate implementation mechanism.

As I said earlier, this workshop is an activity falling under the Fisheries Management and Law Advisory Programme of FAO, whose immediate objective is the enhancement of the fisheries management capacity of developing countries, individually and collectively. The objectives of this workshop are to assist countries with specific plans for improving MCS implementation in the region as a basic requirement for the more effective management of their fisheries.

I wish all the participants success in the work they will be undertaking during the next five days and hope that they will take advantage of the opportunity for interactions with participants of the region as well as the resource persons, ultimately to come up with proposals for effective MCS of fisheries resources.

It is my pleasure now to declare the workshop open.

E. Paul L. André de la Porte
United Nations Resident Coordinator, Mauritius

Honourable Mr S. Obeegadoo,
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Members of the Diplomatic Corps,
Distinguished Guests, Ladies and Gentlemen,

It is a priviledge for me to convey to you the warm greetings of the Director-General of the Food and Agriculture Organization of the United Nation (FAO), Dr Jacques Diouf, and to extend to you his best wishes for a successful workshop.

Let me also express our sincere thanks to the Government of the Republic of Mauritius, for accepting to hold this workshop at the Albion Fisheries Research Centre. We know that the staff of the Centre, as well as staff of the Ministry of Fisheries, Cooperatives and Marine Resource Development, have made exceptional efforts to make the most detailed arrangements and ensure that the programme runs smoothly.

I would also like to express my thanks to the Government of Norway, for their support to the Government Cooperative Programme with FAO, and the special support to the work of the Department of Fisheries. Their particular interest in the Fishery Management and Law Advisory Programme (commonly known as FIMLAP) has been continuing for many years, and has allowed interventions in many fields related to fisheries legislation, policy and planning, and fisheries management in general, both at the national and at the regional level. The funds being made available to ensure the organization of this workshop, as well as the participation of many technical staff from fisheries departments in this sub-region, originate from the FIMLAP programme.

In recent years, the fisheries sector has been the focus of increasing attention in many international fora. In the United Nations General Assembly, a number of resolutions have been approved, drawing attention to the need to avoid over-exploitation of fish stocks; to the need to deter re-flagging of fishing vessels, as a means of avoiding compliance with applicable stock conservation and management measures on the high seas; as well as to the need of reducing the use of fishing gear which is detrimental to the long-term sustainability of stocks. In 1993, the FAO Conference adopted the Agreement to promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas. This was followed in 1995 by the adoption of the UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks. Many of the principles for sound management, discussed and approved in the course of the adoption of the Agreement, will serve as guidelines for governments and authorities to follow in their approach to fisheries in the future, not only with reference to fishing on the high seas, but also in the Exclusive Economic Zones under national jurisdiction.

The 1995 UN Fish Stocks Agreement was followed by the approval of the Code of Conduct for Responsible Fisheries by the FAO Conference in October 1995, and the Kyoto Declaration and Plan of Action on the sustainable contribution of fisheries to food security, adopted in Japan in December 1995, which noted that:

> " ... unless appropriate action is taken very soon, the combination, at the global level, of population increase and economic growth, in conjunction with continued over-fishing, excess fishing capacity and degradation of the aquatic environment, will place enormous strains upon the fishery sector's capability to sustain its necessary contribution to food security."

This regional workshop is one of several that FAO has organized on this subject over the last fifteen years, in a number of regions in the world, as part of its activities to strengthen fishery management, through effective fisheries monitoring, control, and surveillance - MCS in short. In actual fact, it may be recalled that under the auspices of the Southwest Indian Ocean Fisheries Management and Development Programme, funded by UNDP and executed by FAO, in 1982 and 1984 workshops were held on this issue in Seychelles, to cover the particular interests of this region.

The holding of this workshop is the result of a recommendation of the tenth session of the FAO Indian Ocean Fisheries Commission, held in Mombasa in November 1994, that a regional workshop be organized for countries of this part of the Indian Ocean, so as to facilitate exchange of information on MCS, discuss cooperation, and to learn about specific fisheries MCS case studies as well. The particular objectives are:

(i) to consider areas where States might strengthen existing MCS systems, including identification of constraints to cooperation in this field;

(ii) to review the status of national, regional, and foreign fleet activity in the region and in the EEZs of States in the southwest Indian Ocean and Maldives, including the identification of problems and constraints associated with such fishing by licensed and unlicensed vessels; and

(iii) to propose recommendations for strategies that might be adopted to improve MCS capacities nationally, sub-regionally and regionally.

Fisheries in this region are marked by considerable diversity in activity, ranging from the canoe fisheries exploiting stocks close to shore, and providing economic activity for many coastal communities, through to coastal trawlers exploiting high-value species such as shrimp, and extending to the complex and great investment involved in the oceanic tuna fisheries, taking place quite often on the high seas. One should also not forget the increasingly important value of marine environments and coral reefs to the tourist industry throughout the region, and the need for conservation measures to protect these sites. All these activities pose a challenge for government authorities, and it is important that coastguard, and defence and security personnel, along with legal authorities, in addition to the staff of fisheries departments, be aware of the need to protect, and control, the resources in the most optimal way, and above all, realize the need for cooperation between specialists in different disciplines. I am pleased to note the attendance of specialists from these different disciplines here today.

I wish you a most successful workshop.

Thank you.

Appendix D

FAO/Norway Government Cooperative Programme

GCP/INT/606/NOR, Fisheries Management and Law Advisory Programme (FIMLAP)

Regional Workshop on Fisheries Monitoring, Control and Surveillance

Albion Fisheries Research Centre, Albion, Mauritius,

16 - 20 December 1996

LIST OF DOCUMENTS PRESENTED AT THE MEETING

Abiba Massalana, L., Muianga, E., & Russo de Sa, J. Fisheries administration in Mozambique.

Albion Fisheries Research Centre. 1996. *Annual Report 1995.* Ministry of Fisheries and Marine Resources, Republic of Mauritius.

August, F. Presentation on INMARSAT.

Cirelli, M., & Van Houtte, A. Legal aspects of cooperation in monitoring, control and surveillance in the Southwest Indian Ocean and Maldives. [Included here as Appendix H]

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Everett, G.V. Some observations on fisheries management related to monitoring, control and surveillance in the region of the Southwest Indian Ocean and Maldives. [Included here as Appendix F]

FAO. 1992. Report of a Regional Workshop on Monitoring, Control and Surveillance for African States Bordering the Atlantic Ocean. Accra, Ghana, 2-5 November 1992. Field Report 92/22 (En) of the FAO/Government of Norway Cooperative Programme project GCP/INT/466/NOR, Fisheries Management and Law Advisory Programme (FIMLAP).

Fitzpatrick, J. Satellite data communications systems, remote sensing and other techniques as an aid to monitoring, control, surveillance and enforcement. [Included here as Appendix J]

Flewwelling, P. 1994. An introduction to monitoring, control and surveillance systems for capture fisheries. *FAO Fisheries Technical Paper,* No. 338.

Hadi, S. Supervision to catch fish in Indonesia.

van Helvoort, G. 1986. Observer program operations manual. *FAO Fisheries Technical Paper,* No. 275.

van Houtte, A. Implementation of recent international fisheries agreements: a few issues for discussion. [Included here as Appendix I]

Leria, C. Marine parks and reserves: a brief legal overview. [Included here as Appendix N]

Løbach, T. Monitoring, Control and Surveillance – the Norwegian experience. [Included here as Appendix L]

Lodge, M.W. The South Pacific Forum Fisheries Agency and legal aspects of fisheries MCS. [Included here as Appendix K]

Lovingfoss & Associates, Inc. MCS Platform Comparisons.

Maldivian Delegation. Country statement.

Mees, C.C. The special situation of artisanal fisheries.

Office of Oceans, Bureau of Oceans and International Environmental and Scientific Affairs, US Department of State. 1995. Report of the Global Fisheries Enforcement Workshop. Washington DC, 25-27 October 1994. US Department of State Publication, No. 10256. 217 pp.

Parkes, G. Control of foreign fisheries. A summary report. [Included here as Appendix O]

Parkes, G. Inspection procedures introduction.

Roberts, K. Regional cooperation in MCS: the experience of the member States of the Sub-regional Fisheries Commission (West Africa). [Included here as Appendix M]

Sanders, M.J. Summary status review for selected fisheries and fishery resources in the Southwest Indian Ocean (including Maldives). [Included here as Appendix G]

Verhoeven, F. An overview of the South African fishing vessel monitoring system.

Wan Abdul Fatah Wan Omar. A paper on Monitoring, Control and Surveillance System of Malaysia.

Appendix E

REPORT OF WORKING GROUP 1: INSTITUTIONAL AND COOPERATIVE ARRANGEMENTS

[1] Participants: Harold MONGI, Tanzania
Joaquim RUSSO DA SA, Mozambique
Makame S. NASSOR, Zanzibar, Tanzania
Vishnu SOONDRON, Mauritius
Capt. S.L. LAURENCINE, Seychelles
Godfrey MONOR, Kenya
R.H. RANDRIAMIARANA, Madagascar
Boinali KAMARDINE, the Comoros
Zaha WAHEED, Maldives
James WILLIAMS, the Comoros
Anthony BERGIN, Australia

[2] Institutional, organizational and management issues can be categorized under the headings:

- Framework of law and regulations.
- Sectoral institutional backgrounds.
- Project structure, organization and management.
- Funding.
- Evaluation.

[3] The Working Group identified the key institutions or organizations involved in the MCS system in the Southest Indian Ocean, and the role played by each of these organizations.

[4] It is to be noted that the role of the institutions vary from country to country. For example, in Maldives, the Ministry of Trade issues Fishing Licences, whereas they are issued by the Fisheries Department in Mauritius.

[5] Before regional cooperation could take place it was felt necessary to achieve adequate cooperation and coordination at the national level. This could be achieved by establishing a key focal point as the national MCS organization, regular meetings with interested agencies, cost-sharing, common staff training, setting common objectives and regular exchange.

RECOMMENDATIONS

[6] At the **Regional Level**, cooperation could take place in a number of ways. The most important would be information exchange of fisheries, legal, economic and human resource data relevant to MCS.

[7] Other initiatives identified as warranting further study included establishing a Regional Register, Regional VMS, Joint Surveillance, third-party enforcement, agreement on hot

pursuit, observer programmes, regional training and data management. Most important was establishing the political will to start cooperation on MCS. It was also agreed that personnel exchange between countries' MCS officers and regional bodies was important to achieve regional cooperation.

[8] The group recommended that further workshops should follow-up these suggestions. The priority should be placed on ideas for regional cooperation in tuna management and MCS. Specific attention should be given to harmonization as a key determinant in regional cooperation.

INSTITUTIONS AND COOPERATIVE ARRANGEMENTS

[9] **Institutions involved:**

- Fisheries Department
- Navy/Defence
- Attorney General
- Coast Guard
- Port Authority
- Customs
- Civil Aviation
- Police
- Licensing authority
- Communications (telecommunications)
- Immigration
- Health
- Foreign Affairs
- Environment
- Transport
- Fish Agency
- Trade (licences assurance)

ROLES OF EACH INSTITUTION

[10] **Fisheries**

- Licensing
- Data collection
- Resource Management
- Training
- Research and Development

[11] **Navy/Defence**

- Surveillance assets
- Enforcement (law)
- Boarding and arrest

[12] **Attorney General**

- Prosecuting
- Legal advice
- Updating law

[13] **Customs**

- Define legal and illegal imports and exports
- Police customary marine areas

[14] **Civil Aviation**

- Tracking aerial movement
- Maintenance
- Sea safety

[15] **Police**

- Planning surveillance
- Provide logistics and assets

[16] **Coast Guard**

- Patrol
- Enforcement/Boarding and apprehension

[17] **Ports Authority**

- Inspecting vessels/safety
- Issue clearance
- Port movement
- Pilotage
- Transhipment

[18] **Trade**

- Issue licences

[19] **Telecommunication**

- Receive and send messages
- Allocate frequencies (licences)
- Provide and service equipment

[20] **Immigration**

- Deport arrested fishers
- Certify crew changes
- Passport control

[21] **Health**

- Quarantine
- Public Health

[22] **Foreign Affairs**

- Negotiating agreements
- Bilateral and multinational
- Sets diplomatic operations/foreign policy
- Give treaty guidelines
- Ratification of treaties
- Mediate conflicts

[23] **Environment**

- Conservation management
- Create environmental awareness
- Surveys

[24] **Transport**

- Registry of vessels
- Vessel traffic movement
- Regulate marine safety

[25] **Hydrographic Department**

- Mapping

[26] **Meteorology**

- Weather information

[27]**REGIONAL INTERNATIONAL BODIES**

- Indian Ocean Tuna Commission (IOTC)
- Indian Ocean Commission (COI)
- Indian Ocean Marine Affairs Commission
- SADC
- EU
- PRIDE
- IOR
- PRE/IOC
- CIDA

[28] INTERNATIONAL COOPERATION

- Establish a focal point to avoid overlapping
- Regular meetings
- Information exchange (Data transfer)
- Cost sharing
- Staff training
- Setting common objectives

REGIONAL COOPERATION

[29] **Fisheries**

- Statistics
- Sightings
- Vessels information
- Fishing grounds
- National laws
- International conventios
- Case laws and prosecuting procedures

[30] **Economics**

- Prices
- Demand and supply
- Exports
- GNP
- Labour supply
- Taxes

[31] **Human Resources**

- Expertise
- Training

[32] **Register**

- Updated
- Accessible
- Standardized report
- Regional requirement should be common to all vessels, e.g., standardized markings
- Ability to blacklist
- Operators bears administrative costs

[33] **Exchange of information**

- Communication systems/common procedures
- E-mail or fax concerning entering or leaving EEZs
- Regional VMS
- Monitoring centre computer
- Distribution of information to members
- Develop business plan
- First establish national VMS system

[34] **Surveillance**

- Sharing
- Strong country does surveillance for neighbours
- Hot pursuit
- Legal provision for third-party enforcement

[35] **Observers**

- Regional observer programme (cost savings)
- Data exchange
- Regional licence conditions

[36] **Regional training**

- Communications (network) personnel
- Operations - vessels
- data management in each country
- VMS training

- training for observers
- Boarding/arresting
- Maritime safety issues
- Prosecution procedures

[37] **Political will**

- Encourage idea of cooperation
- Involve ministers and top policy-makers

[38] **Data management**

- Workshops
- Regional network and common database
- Ownership of common data
- Evaluation of cooperation

[39] **Regional bodies**

- Personnel exchange

[40] WHAT NEXT?

- Precisely define requirements and expectations
- Terms of reference for regional framework
- Start at national level

REPORT OF WORKING GROUP 2: FINANCIAL AND ECONOMIC CONSIDERATIONS

[41] Participants: Susetya HADI, Indonesia
Francois RENE, Réunion, France
Bertrand COUTEAUX, Madagascar
Greg LOVINGFOSS, USA
Graeme PARKES, United Kingdom

Costs and benefits

[42] The Working Group considered that one of the most important issues facing fishery resource managers was to answer the question of how much can justifiably be spent on Monitoring, Control and Surveillance (MCS). The costs of various surveillance options are relatively simple to calculate, but they must be considered in relation to the benefits derived from the expenditure. The benefits are considerably more difficult to evaluate, particularly when they take the form of social rather than economic returns. In developing countries, where developing an MCS capability may only be possible through international loan arrangements, the evaluation of potential revenues and other benefits is particularly important. The Working Group agreed that the ODA *Control of Foreign Fisheries* project provided a very useful step in this direction.

[43] At the most basic level, the Working Group considered that the declaration of coastal state jurisdiction under the 1988 UN Convention on the Lof the Sea (UNCLOS), in addition to establishing the rights of the state to control over the living marine resources within the zone, carries with it an obligation and responsibility to manage these resources (UNCLOS 1982; UNCED 1992). If the coastal state does not have the capacity to utilize such resources, then it is obliged to make arrangements to allow access by foreign fishers to the resource. Thus some level of management of marine living resources within an EEZ is required under UNCLOS and is therefore justifiable on these grounds. The capability and capacity of states to comply with this obligation varies considerably, and some developing countries in particular have difficulties. In this respect, neighbouring countries with greater resources at their disposal are obliged to assist through the establishment of bilateral or regional arrangements.

[44] The Working Group noted that experience has shown that in some cases it is possible to cover the entire cost of MCS of resources through the raising of revenues in the form of licence fees and other levies. The concept of user pays is becoming widely accepted in fisheries management, but the capacity for development of such a system is dependent on the type and value of the resource. The potential for generating revenue from some resources, such as low-value artisanal fisheries, is low, but the cost of management of these resources may be offset by revenues derived from other, more valuable, fishery resources. Also, more cost effective approaches to MCS can be applied, such as in community-based management. Costs can also be reduced through sharing facilities on a regional basis, such as the regional application of VMS and joint investment in a fisheries patrol vessel (FPV). Certain countries with valuable non-fishery resources may be able to subsidize MCS of low-value fishery resources. However, international funding agencies are now generally discouraging subsidizing of the fisheries sector due to the tendency towards overdevelopment of fishing capacity.

[45] There may be conflict between revenue-generating fishing activity and other components of the fishery sector, particularly if the same resource is being exploited by both industrial and artisanal sectors. There are examples where industrial fishing activity has resulted in declines in resources targeted by artisanal fisheries, and vice versa. In this regard, the Working Group noted that it was rarely, if ever, possible to optimize all the usual goals of fisheries policy of labour generation, income generation and food security. Management policy needs to be clearly defined before all of the potential benefits of expenditure on MCS can be identified.

[46]Justification for expenditure on MCS also comes in the form of associated benefits, such as vessel support, search and rescue, medical and fire emergency service, pollution control and early warning weather information.

[47] In relation to costs, the Working Group recommended the development of a table of standard and/or relative costs of different surveillance methodologies. The figures would need to be drawn from a number of sources to make them as representative as possible, and should also be used to demonstrate, where appropriate, the economies of scale which could be achieved, for instance, through regional cooperation

Surveillance efficiency

[48] The model used in the Control of Foreign Fisheries project demonstrated the importance of surveillance efficiency. Surveillance provides benefits both in terms of

increasing the fisher's perception of the probability of being caught operating illegally, and also can bring in additional revenue in the form of paid fines. The Working Group agreed that the key to surveillance efficiency was the optimal combined use of a variety of facilities, including VMS, aircraft, FPVs, coastal radar and other methods. For example, relatively inexpensive VMS and coast watch systems have proved to be extremely useful in focusing and directing more expensive forms of surveillance, such as aircraft and FPVs for the collection of evidence. Licensed fisher's can be an important source of information on illegal fishing activity. Information can also be provided formally or informally through various non-fishery sources, such as domestic airline flights. Improving surveillance efficiency increases the probability of detection of illegal fishers. Other measures are important for increasing the probability of a successful prosecution, including carefully drafted legislation which allows, for example, for prosecution for a variety of offences, such as carrying unstowed fishing gear (indicating the intent to fish illegally).

Penalties

[49]The Working Group emphasized that the primary function of fines and other penalties is as a deterrent, rather than a means of generating revenue. With this in mind, the performance of a surveillance operation should not necessarily be measured in terms of the number of illegal fishing vessels detected. If the deterrent effect is working correctly, then all fishing vessels would be deterred from fishing illegally. The level of success of a surveillance and enforcement system should be considered in terms of the level of compliance with regulations and management measures. Such information may be difficult to obtain, but surveys are currently being undertaken in Canada and New Zealand in an attempt to assess the level of compliance. The Working Group recommended that the application of this approach should be considered in other areas, and also stressed the importance of liaison between fishery managers and the fishing industry in this regard.

[50] The Working Group agreed that there was now a considerable amount of work and experience which shows the importance of setting high penalties in order to have a sufficient deterrent effect. The Control of Foreign Fisheries project also demonstrated the relationship between the level of surveillance and the optimal penalty or fine.

[51] Alternatives to the specification of specific levels of fine in the fisheries law were considered. These included the development of a formula for calculating a fine, dependent on a number of factors, including the value of the vessel and the value of the fishery. This would assist courts in the setting of appropriate penalties. Also, the option to confiscate the vessel for certain offences was recommended.

REPORT OF WORKING GROUP 3: OPERATIONAL ASPECTS OF MCS

[52] Participants:

Félix LABROSSE, Seychelles
Gaudence KALIKELA, Tanzania
Capt. Abdul Fatah WAN, Malaysia
Lidia Abiba MASSALANA, Mozambique
Boodhun RAMCHARRUN, Mauritius
S. Prakkash TORUL, Mauritius
Theophile RAFALIMANANA, Madagascar
André HASHIYANA, Namibia
Zakariyya MANSOOR, Maldives
John FITZPATRICK, UK

Log Books

[53] The working group considered that the maintenance of log books, in written or electronic form, provided the main means for a country to meet its obligations under conventions, treaties and other arrangements for data collection and reporting, as well as for fisheries research and fisheries management purposes. Such recording of catch-related data and navigation data was also seen to be of direct benefit to fishers and consequently the log book should not be portrayed as a policing tool. It was noted, however, that there were language difficulties in the region with regard to foreign vessels, and it was proposed that log books (data logging) should follow a common standard and, where practical, it should be made possible for the vessel to log information in the language of the flag State. In such cases, the officers of the coastal State should be provided with a preformed transparent template (in the language of the coastal State) for the purpose of transcribing the data.

Marking

[54] It was recommended that a uniform system should be widely adopted for the marking of fishing vessels to identify ownership as an aid to fisheries management and safety at sea. In this respect, it was considered that the Standard Specifications for the Marking of Fishing Vessels, as adopted by FAO, should be implemented in the region.

[55]Fishing gear should also be marked for the purpose of:

- identification of ownership; and
- the identification of the position of deployed gear in the sea.

It was noted that the technical specifications for the marking of fishing gear, elaborated by FAO following a series of expert consultations, could also be adopted.

[56] The group recommended that these marking systems should be included as a condition of a licence to fish. It also recommended that an applicant for a licence should declare the operational frequency or frequencies of radio beacons carried for the purpose of locating fishing gear or FADS, or both.

Register

[57] It was recognized that the term 'register' could be applied to a record of fishing vessels or to the process of registration, including the allocation of a flag, through which details of the vessel, its ownership and mortgages (if any) are entered in the public record. The group agreed that, consistent with national practices, a record should be maintained of all fishing vessels issued with a licence or authorization to fish. The record should be maintained in such a manner that the information could be made readily available, by arrangement, to other countries in the region.

[58] With regard to foreign vessels licensed to operate in an EEZ, the coastal State should require such vessels to be duly registered and that they carry on board the original of the Certificate of Registry at all times. It was agreed that, within the region, States should take measures to discourage the allocation of a licence to a vessel with dual registry.

[59] To the extent possible, these records should contain a recent photograph of the vessel concerned.

Observers

[60] The use of observers was considered to be an important component of fisheries research and fisheries management programmes, and it was considered that such programmes should be a government responsibility. It was noted, however, that cost sharing with industry is currently successfully practiced within the region; therefore the funding arrangements to cover the costs of obsrevers need not be the sole responsibilty of govenment. However, in the case of high seas fishing operations being conducted in a regulatory area, it was agreed that arrangements for observer programmes could differ from those adopted by coastal States regarding operations in their EEZs.

VMS

[61] The working group was of the opinion that, due to the range of fisheries operations undertaken in the region, full recognition must be give to the various means for a vessel to report its position and catch data to the authorities ashore. These means include communication by radio over approved marine frequencies, as well by making use of satellite data communication systems. With regard to the latter, the group considered that data transmission by satellite from vessel to shore could enhance arrangements for MCS for certain fisheries, and in particular where EEZs converge or are close to converging. Since such conditions occur in the region, the group recommended a cooperative approach to satellite-based VMS. It noted, however, that the problems of mainland coastal States differed in some aspects from the problems of island States, and for this reason, in order to adopt a regional approach, there would be a need to develop suitable technical specifications and procedures. In the development of such specifications, the group emphasized the need for benefits to accrue to the operators of fishing vessels and that for this purpose, a two-way system of communications should be a prerequisite. The type of information to be made

available to a vessel should include, *inter alia,* safety information, weather forecasts, sea surface temperature charts and other information to promote responsible fishing operations. It was recognized that there could be a need to harmonize fisheries laws and regulations in the region to which such a system could or would be applied.

Training

[62] There was general agreement that the training needs for MCS personnel should reflect the special requirements of no-force strategies in fisheries protection, as well as Coast Guard type operations. However, in both cases, it was considered that existing training programmes may have to be reviewed in the light of new technologies for vessel monitoring and the reporting of catch data, as well as developments in port State control with regard to fisheries management, safety at sea and protection of the marine environment.

Boarding

[63] As outlined in the section on training, it was recognized that boarding procedures and the responsibilities of a Coast Guard would differ from those adopting no-force strategies. Nevertheless, there were common factors to be considered from the point of view of safety of human life, the safety of property at sea and for the purpose of boarding in relation to fishery matters. It was stressed that boarding procedures should be the subject of one of the modules of training programmes. Furthermore, it was recommended that such boarding procedures should include inspection guidelines for the boarding team. In addition, and subject to the provisions of national laws and regulations, there should be a common approach to inspection in the region. In this respect, the development of a standard form was recommended that would follow the format of a checklist.

Supervision problems

[64] The working group considered that although problems were numerous and that these varied in detail from country to country, each shared the common threat of unauthorized foreign vessel intervention in their respective EEZ. Furthermore, given the cumulative sea surface area of waters under the jurisdiction of the countries in the region, the present capabilities for MCS, as well as the proximity of lucrative adjacent fishing areas, a form of regional cooperation, backed up by enforceable international agreements, would appear to be essential if conservation and management measures are to have the desired effect.

REPORT OF WORKING GROUP 4: LEGAL MATTERS

[65] Participants:

Eugenio MUIANGA, Mozambique
Dennis FREDERICKS, South Africa
Eronica LYIMO, Tanzania
Jeerave LALSING, Mauritius
E. PAPPAIOANNOU, EU
Melchior A. VIDOT, Seychelles
J. Wainaina KARIUKI, Kenya
Terje LØBACH, Norway
Serge BESLIER, EU
Amintha SHAHIDA, Maldives

[66] The Working Group had a broad exchange of views on certain issues related to MCS. In particular, the Working Group examined in detail matters related to arrest and prosecution, the issue of community based management, the understanding of fisheries legislation by users, harmonisation of legislation of countries in the region and regional co-operation in enforcement.

Arrest and prosecution

[67] Participants presented their experiences in the application of their respective national procedures and laws. They *inter alia* highlighted the problems faced by prosecution authorities with regard to the gathering of evidence to ensure conviction, and the lack of knowledge of the relevant fisheries legislation by the various branches of the prosecution authorities, Coast Guard, Police, Magistrates, etc. Reference was also made to the gravity of sanctions, which in most cases is not comparable to the benefits resulting from illegal fishing.

[68] As to the nature of sanctions, some participants suggested that a system of administrative sanctions could ensure expediency. However, it was acknowledged by the working group that it is for each country to decide what kind of sanctions are most appropriate for fisheries offences, in accordance with national constitutional provisions.

[69]Participants recommended that all authorities involved in the application of enforcement procedures should be adequately trained and be familiar with applicable fisheries legislation. It was also suggested that guidelines could be drawn up laying out the elements of proof to present a case before the court, in order to help prosecution authorities in their tasks.

Community-based management

[70] Participants examined how the interests of local fishing communities are taken into account in the elaboration of national fisheries management policies and legislation. It was noted by some participants that the characteristics of subsistence and small-scale commercial artisanal fisheries are such that conventioned management instruments applied through national legislation are frequently ineffective. Alternative means to ensure compliance rather than the need for enforcement through legislation were also discussed. In this context the value of community-based management strategies related to customary management practices implemented through a co-management strategy were explored. Some participants suggested that customary management systems should be supported by a strong legal framework which re-organized both the authority of the community institutional and marine tenure. However, it is essential that sustainable management is effected and that customary and national legal management instruments are compatible.

[71] Thus, whilst it was recognized by the Working Group that increased participation of fishing communities is required at the local level, the institutional and legal framework for management should be established at a national level. In establishing national strategies, however, the need for enforceable and practical legislation was recognized, and it was recommended that adaptive research be applied through pilot projects to select the most appropriate management instruments.

Understanding of fisheries legislation by users

[72] Education was considered to be of primary importance, and participants referred to the need to ensure due publicity and effective dissemination of laws, regulations and other rules so as to facilitate their applications and gain increased support for their implementation by fishers. This could be achieved by way of leaflets, video presentations, radio and television programmes. Extension work by fisheries departments is critical in this process.

Regional cooperation in enforcement and harmonization of legislation

[73] The Working Group recognized that differences in national legislation concerning enforcement procedures and the application of sanctions could undermine the effectiveness of management measures at the regional level, especially with regard to migratory species and straddling stocks. Therefore it was recommended that States should try to achieve a certain level of harmonization for their respective laws and levels of sanctions, through regional cooperation.

Appendix F

SOME OBSERVATIONS ON FISHERIES MANAGEMENT RELATED TO MONITORING, CONTROL AND SURVEILLANCE ISSUES IN THE REGION OF THE SOUTHWEST INDIAN OCEAN AND MALDIVES

by

G.V. Everett,
Senior Fishery Planning Officer,
FIPP, FAO, Rome

INTRODUCTION

[1] The United Nations Convention on the Law of the Sea (UNCLOS), 1982, and the introduction of extended jurisdiction in the 1970s and 1980s ensured that States in the region of the Western Indian Ocean and the Southwest Indian Ocean in particular became more conscious of their responsibilities for managing resources off their coasts. A number of countries have been able to exert full control over their Exclusive Economic Zones (EEZs), although some countries have not; nevertheless all countries are striving to increase attention to the importance of sustaining marine and fishery resources.

[2] The pressure of fishing varies according to fishing zone and value of species but, in general, the high-value demersal species are now intensively fished, and the large pelagic fish such as tuna appear to be nearing full exploitation. The artisanal fishery is active throughout the region. A particular item of importance to the region is the expanding value of the tourist industry and the interest of tourists in marine life. The tourist industry is requesting that more areas be designated as marine parks or areas reserved for diving activity. Governments in general are demanding that the sector, and foreign fisheries in particular, contribute fairly to the central treasury for rights to continued fishing. In order to ensure sustainability of the resource it is essential that management measures be applied, and part of the management process is monitoring, control and surveillance (MCS).

[3] This paper highlights some of the main features which need to be taken into account in any discussion of MCS in the region of the Southwest Indian Ocean and the Maldives. In view of the changing situation, it has been difficult to present the most up-to-date information, and participants at this workshop may wish to contribute information on the latest situation in their home waters with regard to fishing activity and MCS.

BACKGROUND

[4] In general the continental shelf in the area is not extensive, and effectively this limits the area available for trawling. Somalia, Madagascar and Mozambique have the longest coastlines. The island States have a relatively extensive EEZ, due to a number of small islands being spread over an wide area.

[5] The movement of currents influences the movement of certain groups of fish, most notably the highly migratory tuna, that fluctuate in abundance in different parts of the region, with the season, according to ocean currents. The South Equatorial Current flows eastward through the region near 10-15° S. The Agulhas Current flows southward toward the southern extremity of the African continent; there is a southward flow along the east side of Madagascar, with a tendency for a clockwise gyral pattern north of Madagascar and a generally anti-clockwise flow pattern within the Mozambique channel. North of the equator the seasonal reversal of the Somali current dominates the circulation pattern. There seems generally also to be a flow reversal off south-western India.

[6] Some indicative figures for fishing areas, craft and catches are given in Table 1.

Table 1 Shelf areas, coast lengths, landings and vessels/canoes in the region

	Shelf area (km^2)	Coastline (km)	Av. annual landings (t)	Number of craft
Maldives	820 x 120 km	1200 isles	104 000	5 201
Seychelles	48 334	600	5 400	425
Seychelles EEZ	1 300 000			
Mauritius	1 630	170	18 881	1 073 (3 p/seiners)
Madagascar	135 000	4 000	74 648	21 450 (60 shrimpers)
Comoros	900	285	13 500	8
Reunion			1 305	97
			4 537	(2 trawlers)
Mozambique	70 000	2 500	25 300	
Tanzania	30 000	750	36 685	
Kenya	6 500	500	5 901	
Somalia	32 500	2 950	16 000	
EU			200 000	40 (purse seiners)
Taiwan			80 000	300 (longliners)
Korea			15 000	50 (longliners)
Japan			27 000	180 (longliners)
Iran			2 700	2 (purse seiners)

[7] Important localized stocks of shrimp (*Penaeus* spp.) are found mainly in the vicinity of large river mouths or lagoon entrances to the sea, such as off the Zambezi river in Mozambique; in southern Tanzania; as well as mainly the west coast of Madagascar.

[8] Tuna are captured offshore (by longliners and purse seiners), especially on the high seas, and also inshore (by pole-and-line vessels) throughout the region, and the most frequently caught species are skipjack (*Katsuwonus pelamis*), yellowfin (*Thunnus albacores*), albacore (*Thunnus alalunga*) and bigeye (*Thunnus obesus*).

[9] The demersal fish fauna (caught by inshore trawlers and by handliners) varies according to sea bed type and water temperature. In the central tropical area, where warm waters are consistently found, and in waters of less than 50 m depth, a 'croaker' fauna predominantly occurs over the soft sea beds, and consists of croakers (Scianidae), grunters (Pomadasydae), spadefish (Drepanidae), threadfins (Polynemidae) and soles (Cynoglossidae). A 'snapper' fauna over the hard sea bed principally consists of sea breams (Sparidae), snappers (Lutjanidae), groupers (Serranidae) and gurnards (Triglidae). In low salinity waters, particularly near lagoons and river mouths, the demersal fauna consists of large croakers (*Pseudotlithus* spp.) and catfish (*Arius* spp.).

[10] Unlike the northwest coast of Africa, there is no large fishery for small pelagic fish. There have been reports of large densities off the Somali coast, partly due to the movement of nutrient rich waters as a result of seasonal upwelling, but no large fishery has resulted.

[11] The many reefs in the area provide a colourful marine life and as a result tourists come from all over the world come to the region to see this.

MANAGEMENT ISSUES

[12] Although the objective of fisheries management is often perceived differently by the many persons involved in the activity, it is generally recognized that long-term sustainable use of fisheries resources is the overriding objective of conservation and management, and that appropriate management measures should be adopted on the basis of the best scientific evidence available, taking into account relevant environmental and economic factors. What is commonly referred to as the 'ecosystem approach' to fishery management implies that research must extend beyond an emphasis on target species and single species approaches to stock assessment, and that rather more emphasis be given to determine optimal relationships among populations in the same ecosystem. Sometimes it has been found useful to limit the objectives of management, and in practice governments often give less emphasis to biological considerations or economic performance, or both, in favour of considerations of reducing conflicts in the fishery. More and more governments and authorities now perceive the advantages of formulating a fishery management plan for each fishery, which may be amended either annually or at appropriate times to take into account the changing resource and fishery situation.

[13] Authorities are also accepting that the precautionary approach to management and exploitation of living aquatic resources (as set out in the FAO Code of Conduct for Responsible Fisheries) provides a satisfactory basis for setting the framework in which stocks are protected and the aquatic environment is preserved. The absence of adequate scientific information should not be used as a reason for postponing or failing to take conservation and management measures. In operating the precautionary approach, States should take into account such reference points as levels and distribution of fishing mortality and the impact of fishing activities, including discards, on non-target and associated or dependent species, as well as environmental (including biodiversity) and socio-economic factors.

[14] A distinction is normally made between fisheries conservation and fisheries management. The adoption of conservation measures that regulate fishing activity (e.g., closed seasons and areas, restrictions on types and use of gear, etc.) rather than fishing effort has a sole objective, that of attempting to prevent resources from being physically overexploited. These measures may be used in conjunction with effort reduction programmes. However, used alone they fail to address causes of the management problem, which often includes excess capacity (too many fishers and fishing units) and how to reduce it in a fishery. In the absence of effort reduction (or, at the very minimum, its 'freezing' at present levels, associated with controls) the long-term potential is often poor for improvement in the status of stocks and sustained welfare gains for fisherfolk.

[15] Management approaches for artisanal and industrial fisheries will be different, but the principles upon which management arrangements are based will be similar. Moreover, the implementation of arrangements for artisanal fisheries will be more difficult to achieve than in the industrial sector, principally because of the larger number of fishers and fishing units involved. Where industrial fisheries are unmanaged, or poorly managed, overcapitalization

will occur and capital will not receive an economic return, and subsidies will often be paid to fisherfolk in order to financially support their operations. This subsidization of fleets can exacerbate fisheries management problems.

[16] The implementation of management arrangements or plans, or both, often poses difficult decisions about access arrangements and resource allocations, and in most instances the need to exclude individuals already operating, or intending to operate, in a fishery. Moreover, it is not possible to concurrently satisfy the interests of all groups involved in the sector, and for this reason opposition to the introduction of management measures often results; however, in many countries it has been shown that when fisherfolk are closely involved in formulating management measures and implementing the whole process, then the fishery management can be better than when civil servants alone take the decisions. It hardly needs to be said that without a strong political commitment to fisheries management, the structure of management plans may well fail at the implementation stage.

[17] MCS programmes are required for fisheries both under national jurisdictions and on the high seas, as an integral component of management, and these programmes are required to ensure that management arrangements, once in place, are observed and not undermined by non-compliance (i.e., failure of fishers to abide by national laws, sub-regional or regional conventions, licensing terms and conditions, management requirements, etc.).

APPROACHES TO MCS

[18] In 1981, FAO organized in Rome a technical consultation of international experts in MCS for fishery management. The experts agreed on the following definitions:

[19] (i) Monitoring: involves the collection, measurement and analysis of fishing activity on catch, species composition, effort, discards, area of operation, etc., which is to assist fishery managers to arrive at management decisions.

[20] (ii) Control: involves the specifications of the terms and conditions under which resources can be harvested, and normally contained in national legislation, and provides a basis on which management arrangements are enforced.

[21] (iii) Surveillance: involves checking and supervision of fishing activity to ensure national legislation and terms of access and management measures are observed. This activity is critical to ensure that resources are not overexploited, poaching is minimized and management arrangements are implemented.

[22] A number of initiatives were taken at regional level to follow up on the consultation in Rome, and workshops for countries of the Southwest Indian Ocean were held both in 1982 and 1984 (at Mahe, Seychelles). The objectives were to assess the status and needs for MCS among countries of the region, and to make recommendations for follow-up assistance.

[23] Countries may decide to undertake MCS in their territorial seas and adjacent EEZs with specific regard to (i) fisheries (to ensure that information necessary for fisheries management is collected, and that such programmes are implemented and observed), or (ii) as part of an integrated or multi-tasked national administration and security activity (concerning exercise of sovereignty and law enforcement, customs and immigration duties, etc.). The approach adopted by a country is likely to reflect the economic importance of its fisheries sector, because there is little sense in having an elaborate MCS activity if its costs exceeds national revenue from the sector.

[24] In the Indian Ocean, there are the usual concerns about fish resources and the need to ensure their sustainability, as in other parts of the world. Exploitation of the resources is not only undertaken in inshore areas by fishermen with simple craft and gear, but also within EEZ waters by industrial vessels. In addition, the countries are particularly concerned with the high seas fishery for tuna, and the reef fisheries.

OVERALL ASSESSMENT AND ISSUES TO EXAMINE FURTHER

[25] The objectives and priorities of the different countries in this region with regard to fisheries management vary according to the nature of the fisheries within their EEZ, and this influences the priority that can be given to MCS. Most countries face the practical problem of financing adequate facilities so as to be in a position to carry out MCS. All countries give overall priority to the exercise of sovereignty (through a naval defence or coast guard force) in the EEZ and to stopping (controlling) the entry of unlicensed (often foreign) flag vessels fishing in their waters; a number appear to deny the right of any fishing vessel, whether fishing or not, to pass through its zone.

[26] The length of coastline and area of EEZ have implications for the design of the approach to surveillance that each country should ideally choose. Some countries may be in a position to place observers on vessels, yet other countries may with experience have found that this is costly and that the information obtained is not reliable or comprehensive enough to be of use for stock assessment or implementation of management measures in general.

[27] Countries have a stated priority to safeguard sustainability of the resource through collection of statistics, principally for stock assessment and application of management measures, yet in reality the research and other institutions charged with these tasks are often unable to ensure regular monitoring of catch landings and fleet activity. There is certainly a need to strengthen fisheries administrations and increase funding in some situations.

[28] An increasing thrust appears to be being made to conserve coral reef fisheries, due to the increasing economic value of tourism and the attractions of such sites to tourists.

[29] Regulations governing the activity of locally based vessels are relatively less costly to enforce than regulations covering fishing in distant waters of the EEZ. A priority in the inshore areas is often to discourage encroachment of industrial vessels into zones reserved for traditional and artisanal fishermen, mainly to avoid conflicts in competition for the resource. Shrimp trawlers often need to be given especial attention, and procedures adopted for their inspection or boarding, or both.

[30] In some fisheries, attention should be given to weights of marine product - to avoid under- or over-recording (for tax and export purposes) - and especially in the context of certain fisheries where there is a designated Total Allowable Catch (TAC).

[31] With regard to economic performance of the fishery, in some parts of the world there is a commitment to limiting entry to the fishery and the control of fishing effort as well as catches. This priority on economic performance is not yet widespread in the region, but it is gaining ground. Certainly more attention is now being given to the fees charged for fishing, and aspects of national benefits accruing from the resource, and cost recovery relative to government and other interventions in this field. It might well be useful that there be concertation between governments on a standard format for calculating entry fees based on type of fishing, power or GRT of the vessel, duration of fishing, and value of species caught and retained. Some countries at present require payment of a royalty fee for each

vessel of ECU 15/GRT/month, and this could be refined to fluctuate according to other criteria, such as value of fish caught.

[32] Distant water fishing nations (DWFNs) dominate the tuna fishery, with the notable exception of the Maldives (where almost all tuna, exceeding 90 000 t annually, caught in waters under its jurisdiction is taken by local boats). A number of vessels from within the region fish in waters of neighbouring countries, both for tuna and for high value species such as shrimp.

[33] With regard to the highly migratory tuna stocks, some regional co-operation between the countries has started through exchanging information on movement of fleets through the waters of neighbouring countries, their activity and their catches, and this is being carried out through the Indo-Pacific Tuna Development and Management Programme (IPTP). Nevertheless the initiative is far from comprehensive, as the further co-operation of all DWFNs partaking in the fishery, most notably on the high seas, is required. An authority such as IPTP, or a successor, such as the Indian Ocean Tuna Commission (IOTC), could facilitate the further exchange of all issues linked to management, through organization of working groups of technicians and scientists to discus specific issues.

[34] Vessel monitoring systems (VMS) are being tested, and undoubtedly will prove of benefit in many aspects of management, as satellite systems become more frequently used in MCS (and relating catch to specific location, specifically if the catch is taken in an EEZ). Nevertheless the requirement for ongoing maritime sea and aerial patrols will continue, in addition to land-based staff checking landings. There might be possibilities, however, to reduce the costs of tracking vessel activity by installing Global Positioning Satellite (GPS) systems devices with a memory, which can then be analysed at regular intervals of about a month, as a sort of check on the validity of the logbooks which should be completed by skippers. Recognition does need to be given, however, to the relatively complex nature of analysing data which would come from satellite or other systems, and to the uses it can best be put in overall fishery management.

[35] Throughout the region, there is a need to improve skills in locational aspects of fishing, in addition to such tasks as identification of vessels and gear, measurement of mesh size, and estimation of catches, both on deck and retained in the hold.

[36] Certainly all countries are taking steps to improve MCS according to their needs and capabilities, as illustrated in the course of this paper. Nevertheless, there is widespread scope for improvement, and this can only be done through exchanges of information and experience (notably at the regional level), and with overall regard to national objectives and priorities for fishery management (and formulation of management plans for each fishery).

SOME COUNTRY-LEVEL ISSUES OF MCS IN THE REGION

Maldives

[37] Almost nowhere else in the world are coral reefs and marine resources so important to a State as they are to Maldives. The coral reefs provide protection from the erosive force of waves, habitat for the artisanal fisheries resources, and an attraction for tourists.

[38] Coastal resources (by far the most important of which is the skipjack tuna, at about 90 000 t of a total annual catch of some 105 000 t) are reserved entirely for exploitation by Maldivians in the traditional manner, and only in the EEZ beyond 75 miles from the archipelago baseline is foreign fishing and fishing by 'non-traditional' methods authorized.

Prior to a licence being agreed, and issued by the Ministry of Trade and Industry (MTI), the TAC for the year must be determined by the Ministry of Fisheries and Agriculture (MOFA). All foreign-registered vessels must call into the port of Malé both before and after fishing in Maldives waters. There is also a close control on foreign-registered vessels which may require to pass through but not actually fish in the Maldives EEZ.

[39] No purse seining, gillnetting or longlining of tuna is allowed within the 75-mile zone. The office of the Atoll or Island Chief is responsible for fishing activity in their zone of authority, and this includes responsibility for collecting catch statistics. Normally the area of activity of vessels is restricted to certain areas. The use of gill nets is controlled, and they are prohibited in the tuna fishery. The local traditional fishery for tuna can be described as entirely 'environmentally friendly', which is an advantage nowadays in many markets where customers are becoming more aware of environmental issues (and that in certain areas dolphins are liable to be caught and killed in the process of catching tuna).

[40] All vessels should be registered with the Ministry of Transport, as well as with MOFA, but in order to be entitled to free registration as a fishing vessel, fishing must take place at least 120 days per year.

[41] The Marine Research Station (MRS) of MOFA undertakes stock assessment as well as studies of ecology of the maritime environment, and advises the Ministry on management matters pertaining to fisheries and maritime resources. MRS advises the customs authorities on quantities of *beche de mer*, sharks, snappers, live groupers, etc., that can be exported. There are restrictions on the export of giant clams and turtles, and on tropical aquarium fish.

[42] Certain areas have been specifically reserved as coral reef diving sites; this does not stop local fishers from carrying on traditional fishing activities but it does stop intensification of fishing. The main objective has been to preserve certain areas for the observation of sharks by visiting divers.

[43] Staff of the National Security Service of the Ministry of Defence and National Security have powers to stop, search, inspect and apprehend any vessel or person suspected of an offence under laws and regulations pertaining to fisheries and marine resources. In 1995, the NSS cooperated with MTI and MOFA to purchase a satellite tracking system (using the INMARSAT-C, integrated with GPS) for foreign vessels authorized to fish in Maldives waters, where each vessel should carry a transponder, along with a system to monitor water temperatures, thus indicating where tuna – and hence the fishing vessels – are most likely to be. Such a system requires maritime and aerial surveillance also to continue, for apprehending unlicensed vessels fishing, and in such an extensive zone as the Maldives EEZ this can be costly. The NSS does have a number of patrol vessels and regularly charters an Air Maldives plane for aerial surveillance.

[44] The overall fisheries situation of the Maldives differs in a number of ways from the situation found in other States of the Indian Ocean in that the very active local fishery has become well established, based on fishing tuna which appear mainly to be sedentary in the islands. Some of the tuna are however migratory, and their abundance could be affected by fishing activities of foreign flag vessels in the waters of the EEZ of neighbouring countries, as well as in high seas waters. It is vital for the Maldives to ensure long-term sustainability of its local and 'visiting migratory' stocks, for the continued employment of many thousands of persons employed in the sector.

Seychelles

[45] The catch from inshore fisheries is relatively small (less than 5 000 t/yr), but the subsector provides employment to many communities, is an important food supply, and is the basis for an increasing export activity. In recognition of the importance of the subsector the Seychelles Fishing Authority (SFA) provides support for stock assessment and research, statistics collection, construction of fish aggregating devices (FADs) and other development, as well as implementation of management decisions to prohibit industrial vessels encroaching on inshore fishing areas (in zones where depths are less than 200 m), and the prohibition of use of explosives in fishing. No industrial fishing is permitted within a distance of three miles from an FAD.

[46] Certain areas (e.g., around St Anne) have been designated marine parks, not only in the interests of conserving scientific biodiversity, but also as areas of interest for tourists, and, most specifically, divers. Outside the specified areas there is an increasing interest from tourists for swimming, snorkelling, etc., to observe marine life or for sport fishing in localities which at times are subject to commercial fishing.

[47] The most notable feature of the Seychelles fisheries is the catching of tuna, by purse seiners from countries of the European Union, and by longliners, mainly from Asian countries. The tuna caught by these vessels either within the EEZ or on the high seas or within the EEZ of neighbouring countries, is transhipped in relatively large quantities (exceeding 200 000 t annually) in the port of Mahe. SFA monitors the fishing activity, by weight as well as by location.

[48] Aspects of interest to MCS concern the status of the Coast Guard, which was set up in 1994 as an amalgamation of the Air Force and Navy, under the Ministry of Defence and National Security, but with a civilian task of being able to act as police of the seas up to the high tide mark, and in assisting search and rescue. One of the patrol vessels is on standby 24 hours per day. In view of the high cost of patrols, mainly due to costs of fuel, there is little continuous patrolling, and, indeed, when infractions are reported and need to be investigated in a distant island, the EEZ being so vast, it might take two or three days before the patrol vessel arrives on station, and be in a position to enforce regulations and if necessary proceed to prosecution. Coast Guard personnel do have experience in boarding and inspection procedures. The vessel could however be at sea more continuously if operational costs could be borne by or shared with another entity. A small aircraft is available at certain times, and charter costs are shared with the Island Development Authority. Under their extensive programme to assist similar authorities throughout the world, the US Coast Guard has been giving training and advice in creation of the Seychelles Coast Guard. An interesting fact of importance in MCS is that in 1995 the Seychelles ceased to maintain the observer programme on foreign vessels in view of the cost and difficulty of supervision and organization. It was not found to contribute substantially to better monitoring of foreign fleets, or in furthering scientific knowledge of the fishery.

[49] A recent case involving illegal fishing by foreign vessels was settled out of court. The vessels were seen fishing in a restricted zone near an island and a report was telephoned to the SFA. A civilian aircraft was immediately chartered, and voice contact made with the vessels, and the skipper voluntarily complied with the direction to sail into port, and the owners came to Seychelles to settle. There are reports of Taiwanese vessels fishing illegally with longlines, but no means of enforcement and prosecution.

[50] The EU agreement with Seychelles runs from 18 January 1996 to 17 January 1999, and grants fishing licences to the EU for 42 tuna trawlers and 15 surface longliners not

exceeding 37 m in length. The compensation will amount to ECU 6.9 million. If EU catches exceed 46 000 t, the EU will raise its compensation accordingly. Since the actual location of catch can affect the total payment to Seychelles, it is important that monitoring systems be available to assist authorities to pinpoint accurately the fishing location of vessels. Monitoring of transhipments made, and landings to the cannery in the port, both by EU and other foreign-registered vessels is necessary for following intensity of exploitation of the tuna stocks in the region, and is an important component of national MCS priorities.

Mauritius

[51] Although the continental shelf of Mauritius is narrow, the inshore fisheries provide employment and a food supply for many coastal communities. In addition, the inshore waters are becoming a valuable asset to the expanding tourist industry as visitors often come mainly to take advantage of the varied opportunities offered along the coast, including viewing the rich reef marine life. Indeed, the inshore marine life may now be of more value as a spectacle than as catch.

[52] Government has recognized the importance of coastal areas not only for fisheries but also for tourism, and the Ministry of Fisheries and Marine Resources is now takes overall responsibility for their integrated management and development. Two marine parks have been designated and will shortly become operational. The Albion Fisheries Research Centre provides the Ministry with advice on matters of fisheries management.

[53] The fishing fleet consists of small craft fishing inshore waters, as well as ships making trips of about one month to outer islands (the Banks fishery) with a number of smaller craft which are serviced by, and land to, the ships. There are also three Mauritius-flag purse seiners, which fish both inside and outside the EEZ. Additionally, there are a number of foreign-flag purse seiners and longliners which are licensed to fish - mainly tuna - in the EEZ (in particular the purse seine fleets of the European Union under an EU/Mauritius fishing agreement), and many foreign-flag vessels - mainly tuna longliners of Asian registry - tranship tuna in Port Louis. Procedures for monitoring national and foreign-registered vessels fishing the EEZ, in the EEZ of neighbouring countries and on the high seas have been established by IPTP, and it is require that they be followed. In both Mauritius and Seychelles, the license fee for foreign-registered longliners to fish in the respective EEZ is understood to be $US 15/GRT/month.

[54] The Banks fishery is considered to be heavily exploited and a licensing system has been introduced to effectively control further entry. In addition, each company with a licence to operate in the Banks fishery has its catch regulated by quota. Around the island of Mauritius itself, exploitation of traditional inshore fishery resources has attained such high levels that no further increase in yield can be expected. Some success has been attained with the use of FADs for encouraging fishermen to fish further off the inshore reef. A register of fishing boats is required to be kept (and fishermen receive benefits from registration), and nets must be licensed (according to location). Catch has to be landed at registered fish landing stations, and there are restrictions on fishing during a closed season, on use of spear guns, and on catching undersized fish and lobster. The Banks fishing licence includes, as a condition, a requirement to report on any unlicensed vessel fishing in Mauritius waters, as well as "information as may be required for the proper management of the fishery," in addition to reporting location and activity every three days to the harbour authority in Port Louis.

[55] The coastal fisheries are enforced by the Coast Guard (answerable to the Police) and the Fisheries Protection Service (of the Ministry of Fisheries and Marine Resources). The Coast Guard has seven vessels, two Dornier aircraft, and stations on each island; so far it is understood that the Coast Guard has not undertaken fishery enforcement. Since the EEZ is so extensive, effective MCS of fisheries is costly.

[56] Inshore fishery enforcement is undertaken by the Fisheries Protection Service, which has some 170 staff at 13 posts (in four regions). The Fisheries Protection Service functions are to protect the lagoon and outer lagoon from illegal fishing by monitoring the different activities of operators with large seine nets, gill nets, cast nets, etc., as well as trap, harpoon and line fisheries. Much of the time of protection service staff is now taken up with collecting statistics.

[57] The Service ensures that all fishing boats and gear are licensed, and registers all professional fisherfolk. The Service is carried on 24 hours a day, based on the landing stations. In 1995, 500 cases were brought against fishers for use of unlicensed nets - mainly with undersized mesh, etc. There is a closed season from the start of October to the end of February, which has to be enforced. Divers are not permitted to collect lobster, and spear guns are not permitted for fishing. No berried lobster or crab are permitted to be landed or sold. A number of fish are believed to be poisonous and are not allowed to be sold.

[58] Protection staff issue a card to registered fisherfolk - normally fishing as part of a group over a period of at least six months, and this must be stamped every two months, so that entitlements and privileges such as duty-free motors, life jackets, insurance, bad weather and close season compensation allowances, Development Bank loans, etc., can be obtained. It is planned to move 36 of the staff to allow 18 each to protect the marine parks which are to be created at Blue Bay and Balaclava.

[59] A priority for government fishery staff is also to monitor the activity of foreign-registered vessels calling at the port of Port Louis both for servicing as well as transhipment, storage or landing of tuna to the cannery. These vessels fish under agreement in the EEZs of countries of the region as well as on the high seas.

The Comoros

[60] A relatively rich marine life in the inshore waters of the Comorian archipelago provides the State with its main source of animal protein, and substantial employment. It has been estimated that there is an annual catch potential of some 8 000 t of fish from inshore waters around the islands of Grande Comore, Moheli and Anjouan, as well as the island of Mayotte, mainly of bonito and tuna. There are also relatively small but valuable resources of lobster, octopus and various shellfish (e.g., some oyster in the limited mangrove area, and some exotic shells in coral reef zones).

[61] In the period March to June there are migrations of tuna into the area. Some of the migratory tuna are caught by Asian longline fleets. In the framework of an overall EU/Comoros fishing agreement, Spanish and French purse seiners take tuna and the EU pays the Comoros Government some ECU 300 000 annually within a fishing agreement, for an annual catch in the 12- to 200-nautical-mile zone, based on an expected catch of 6 000 t.

[62] The Ministry for Rural Development, Fisheries and the Environment is the government unit with overall responsibility for the sector, and the Department of Fisheries undertakes day-to-day monitoring of activities. Government encourages the use of FADs to

enable inshore fishermen to increase catches. No fishing is permitted for the coelacanth, a relic fish species.

[63] A marine reserve has been designated at Nioumachoua, Moheli Island.

Madagascar

[64] Many communities along the extensive coastline, frequently using simple yet appropriate traditional fishing gear, depend almost entirely on fishing for their livelihood. In addition to this small-scale fishing activity, there are extensive semi-industrial and industrial trawl operations, mainly for shrimp and mainly along the west coast, which provides employment to thousands, both on the vessels and in the processing plants, as well in marketing and distribution. Marine products, predominantly crustacea, are one of the main exports of the country.

[65] For the shrimp fishery, licences are allocated according to zones, and the inter-ministerial fisheries commission sets the total number of vessels allowed per zone on an annual basis.

[66] It is believed that foreign fleets engage in unlicensed fishing (mainly for tuna) in the EEZ of Madagascar, but without the means for surveillance it is not possible to be certain of its intensity. The industrial shrimp trawl activity is normally subject to a close season in December and January. The cod end stretch mesh is regulated at 40 mm, and trawlers are not permitted to fish nearer than 2 nautical miles from the coast.

[67] Industrial fishing for shrimps is regulated by way of permits for vessels and companies. Artisanal industrial fishing is limited to 10 zones on the west coast and 4 zones on the east coast. Lobster fishing is closed from 1 January to 30 April each year. It is foreseen that an annual management plan, as foreseen in the decree of 1993 for the shrimp fishery, will be drawn up.

[68] There is no Coast Guard or Navy, but sometimes Army personnel have gone out with fishing vessels to apprehend vessels fishing illegally. It is understood that the Department of Fisheries has no official working full time on enforcement tasks, and although the respective zones for trawlers are generally respected there is a frequent incidence of trawlers coming close inshore. The Department does have plans to organize a system of observers on fishing vessels.

[69] It is planned to increase the number of marine parks around the coast.

[70] Monitoring of the activity of tuna vessels calling in to ports of Madagascar and landing to the cannery is a necessary component of MCS in the country.

France

[71] The island of Reunion and its EEZ have seasonal influxes of tuna in addition to the more sedentary species found normally throughout the Indian Ocean. The lead role in monitoring fishery activity is taken by IFREMER (the French research institute for the sea), in addition to activities of the agency for research overseas (ORSTOM). The French Navy is responsible for patrolling the EEZ, which is extensive, as a number of islands are included in the territory.

[72] A number of communities depend on fishing for a substantial part of their annual income. Recreational fishing is well developed. In recent years, a locally based long-line fishery has become established. Two large trawlers are based in Reunion and fish the continental shelf around French islands in waters further south.

Mozambique

[73] Almost all resources are within 20 to 25 nautical miles of the coast, with some migrant tuna coming into waters near the 200-mile limit. No (coastguard) vessels or planes can be made available for fishery surveillance because of the high costs involved. Thus a system of 'self-surveillance' is used whereby licensed vessels are expected to report on activity of unlicensed vessels.

[74] Shrimp resources are managed on a TAC basis, which is fixed at the beginning of each year, and quotas are allocated to each fishing company. It is understood that no further vessels are permitted to fish shrimp stocks (so there is closed access). The deepwater shrimp (*gamba*) fishery has vessels which should not come nearer than 12 nautical miles from the coast, and there may be some irregularities there, although if the vessels do catch some inshore shrimp they should comprise no more than 10% of the by-catch. The shrimp trawlers licensed to catch inshore shrimp should come no more than 500 m from the coast, and since this regulation dates from 1972 there is a probability it will be changed to reduce conflict with artisanal fishermen. The mesh size in the shrimp trawl cod end was increased from 45 mm to 60 mm in 1994. There is no limitation on the size of fish caught. There is a closed season for shrimp and gamba fishing in January and February. Each vessel is obliged to send in catch data every 10 days.

[75] There are 40 inspectors (*fiscais de pesca*) responsible to the National Directorate of Fisheries of the Ministry of Agriculture and Fisheries located at Maputo, Beira, Quelimane and Inhambane, that go to sea with the fishing vessels. The inspectors should never be more than 26 days at a time on the same vessel. Mozambique has no Maritime Defence (Navy) force.

[76] As an example of the routine work involved in MCS, the following information is available on fines imposed for illegal fishing: 2 in 1990; 8 in 1991; 11 in 1992; and 31 in 1993. The most frequent infractions have been (i) not to have on board copies of legislation and licence - 15; (ii) fishing during the closed season - 11; (iii) fishing without a licence - 7; and (iv) using an undersized mesh - 7.

Kenya

[77] Kenya took the lead in Africa by establishing protected marine areas and today there are four marine parks and six marine reserves, encompassing 5% of Kenya's reef areas, and this is a reflection of the increasing importance of tourism as an economic activity of national importance. User conflicts along the coast, and in marine parks and reserves, are increasing, with intensifying use including fishing, swimming, snorkelling, jet skiing, glass-bottom boat operations, sport fishing and wind surfing. In addition, local residents and fishermen are finding public access to the shoreline increasingly difficult as shorefront development continues. Tourism has replaced fishing as the dominant economic activity along the shoreline. Canoes are the main craft used, and rarely do fishermen venture beyond the outer

reef. Some 8 000 t is the estimated weight of catch taken annually from inshore areas; the offshore waters have not been found to be rich in fishery resources.

[78] In the past, traditional fishing was managed by village elders making decisions on the utilization of fishing grounds, selective fishing during specific times of the year as well as demarcation of marine *kayas* (traditional conservation areas) on the reef. These traditional management practices have broken down with the creation of modern institutions and governance arrangements. The Fisheries Department has a legal mandate that provides for development, management, exploitation, utilization and conservation of fisheries and connected resources. The Kenya Wildlife Service has a legal mandate to control fishing gear and practices within the marine parks and reserves.

[79] Other issues of interest to the coast concern the need to conserve certain mangrove areas, the protection of areas for turtle nesting, and the prohibition of coral destruction through uninhibited use of anchors, coral collection, etc.

[80] The Navy is charged with fisheries surveillance, but there does not appear to be any dedicated fisheries surveillance at this time. The Fisheries Act, 1989, and Regulations, gazetted in 1991, provide a sound framework for MCS. The Act provides for vessel registration and fishing licences, and relates to both national and foreign fishing. The powers of enforcement officers are clearly stated; however there are no reports of prosecutions within the marine subsector, as enforcement is focused on the freshwater fisheries.

[81] It is understood there is little potential for expecting an increase in catches in the offshore areas of the EEZ, and tuna fishing by foreign-flag vessels is infrequent. At times, however, there has been transhipment of tuna at Mombasa, which requires monitoring.

Tanzania

[82] The estimated landing of fish in Zanzibar was 11 329 t in 1994, almost all caught by artisanal fishermen to provide an important food and income source for local villagers. Critical marine and coastal habitats include coral reefs, mangroves, seagrass beds and beaches. Mangroves are harvested for poles for construction, as well as fuelwood, charcoal making, crabbing and beekeeping. The coastal area is also important for seaweed collection and farming. Prohibited fishing methods include the use of dynamite, poisons, monofilament nets, beach seines, spear guns and dredges in reef areas.

[83] Vessel registration is required, and the fee for foreign vessels is based on the GRT. Licences are also required, with a separate fee, but there is no licence for gear. The licensing period is one year, and before licence renewal a vessel must have complied with all licence criteria (including reporting requirements) during the previous licensing period. Vessels are not permitted to tranship at sea or discard by-catch (which must be landed in the local market). Vessels are required to radio their catch and position reports every two days. Daily logsheet reporting is required, and agents dispatch the logsheets to fisheries headquarters as they become available.

[84] There are three zones designated for trawling, and trawlers are not allowed to remain in only one zone throughout the year. The Navy has not so far participated in fisheries duties. A priority for the Fisheries Protection Unit is to control illegal fishing practices, including the use of explosives. There is cooperation with the marine police to check on violation of fishing conditions by trawlers. There are three observers for the shrimp fishery, one for each zone. No trawling is permitted in estuaries, and all trawling must stop at 18:00

hours each day; this allows sale of by-catch to collector boats and avoids industrial vessels running down canoe fishermen at night.

[85] Some industrial vessels based in Kenya obtain licences to fish along the coast. It is understood that little fishing occurs by foreign-flag vessels in the offshore areas of the EEZ.

[86] Marine parks are being established along the coast.

Regional fishing activities

[87] EU agreements to allow purse seining by French and Spanish vessels have been signed with Comoros, Madagascar, Mauritius, Mozambique and Seychelles. Vessel owners in a number of Asian countries (e.g., Indonesia, Iran, Japan, Korea and Taiwan (Province of China)) have also come to agreements with national authorities of a number of countries in the region with regard to access of longline vessels and purse seiners to various EEZs. Some vessel owners operate vessels in high seas fisheries only. The vessels call in to a number of ports of the region from time to time for servicing, transhipment, etc., and at these times the coastal countries could undertake certain monitoring activities.

[88] The EU had intended to introduce an EU-wide satellite monitoring system by the beginning of 1997, which would have affected the EU tuna fleet in the Indian Ocean. However, it has been reported that the introduction of this scheme has been postponed to a later date, will apply to vessels over 24 m in length, and for trips of more than 72 hours.

[89] It would not be reasonable to conclude this summary of activities with regard to MCS without mentioning the work of various assistance projects working on a regional or national basis.

[90] The European Development Fund financed activity through the Association Thoniere, based in Antananarivo, and linked to the Indian Ocean Commission. That support has been active for some ten years and was scheduled to terminate in 1996. One of the activities of the project was to promote MCS in the participating countries (Comoros, France (Reunion), Madagascar, Mauritius and Seychelles. Another successful activity in recent years has been to promote the use of longlines to catch tuna from relatively small vessels based locally; the technique was initiated in Reunion and is being introduced to Seychelles and Mauritius.

[91] The FAO/UNDP *Indo-Pacific Tuna Development and Management Programme* (IPTP), based in Colombo, has been developing methods for the collection and coordination of data on tuna activities, as well as their analyses, throughout the region. The Programme (which may be continued in the form of the Indian Ocean Tuna Commission (IOTC)) has been able to assist coastal countries monitor activity, location and catches of foreign vessels (which has an impact on the income to be earned within the framework of fishing agreements). The French agency ORSTOM collaborates and assists the IPTP to monitor fishing activities and carry out stock assessment (of tuna stocks in particular).

Appendix G

SUMMARY STATUS REVIEW FOR SELECTED FISHERIES AND FISHERY RESOURCES IN THE SOUTHWEST INDIAN OCEAN (INCLUDING MALDIVES)

by

M.J. Sanders, FAO Consultant

ABSTRACT

This review of information on selected fisheries and fishery resources was prepared as background reading for those attending the MCS Workshop. Regarding the trawl fisheries for shallow-water shrimp, it seems that these are all at a mature stage of development. The main shrimp producing countries (and yields) are Madagascar (≈ 8 500 t), Mozambique (≈ 8 000 t), Tanzania (≈ 1 400 t) and Kenya (≈ 350 t). The recent catches of shrimp are in all cases at about the estimated maximum sustainable yield (MSY) level. In recognition of this, the fisheries are under restrictive management. This has usually involved controls on the number and identity of the participating vessels. In Mozambique there are also limits on the quantity of catch (from the Sofala Bank) through the imposition of a total allowable catch (TAC) and allocation of quotas between fishing companies.

Surveys of the deep-water crustacean resources have been undertaken in most countries. Only in respect to Mozambique and Somalia were they found to be sufficiently abundant to justify exploitation. The recent catches from Mozambique include shrimp (≈ 1 800 t), lobster (≈ 250 t), crayfish (≈ 180 t) and crab (≈ 400 t). The associated management regimes include controls on the number of vessels and the imposition of TACs. Except for shrimp, for which there is currently low market demand, the catches are close to the estimates of MSY. In the case of Somalia, the catch from the trawlers in 1987 included lobster and shrimp (571 t) and high quality fish (9 020 t). Both the lobster and fish were considered fully exploited at the time. The fishery has subsequently been closed by action of the local administration.

There are two other fisheries within the region for which TAC management has been imposed. The trap fishery for shallow water lobster in the waters around the southern islands of St Paul and New Amsterdam involves one or two Réunion-based motherships. Initially the TAC for this fishery was set at 600 t, but has subsequently been reduced to around 400 t, in order to avoid overexploitation. The other fishery is the banks handline fishery, in which the target species is the emperor (*Lethrinus mahsena*). This fishery also involves the use of motherships (each with 10 to 20 dories), most of which are based in Mauritius. A TAC for 1995/96 in respect to the Mauritian vessels was set at 4 752 t, and was to be progressively reduced over 4 to 5 years to allow enable stock replenishment.

Fifty tuna purse seine vessels were operated within the region during 1994. Apart from three Mauritian vessels, the others were from outside the region. The

greatest number were from France (17 vessels), Spain (16 vessels) and Russia (9 vessels). The vessels operated over a wide area; off Somalia (0° to 10°N) from August to November; the south equatorial region (0° to 10°S) from November to February and in July; and in the Mozambique Channel (10° to 23°S) from March to June. The catch in 1994 was 272 187 t, comprising mainly yellowfin and skipjack. This was transshipped through the Seychelles (65%), and to a lesser extent through Madagascar (Antsiranana) and Somalia (Mogadishu).

Considerable quantities of tunas are also caught from Asian-based longliners. Korean vessels tend to target yellowfin, the Japanese target yellowfin and bigeye, and the Taiwanese target albacore. The main transshipment centre is Mauritius (14 772 t in 1995, of which 75% was albacore), while small quantities are also transshipped in Madagascar, Réunion and Seychelles. The livebait pole-and-line fishery operated around Maldives produced 96 842 t (14% yellowfin and 72% skipjack) in 1994. Another country with an important artisanal fishery for tunas was the Comoros, where the reported catch for 1994 was 8 996 t (62% yellowfin and 24% skipjack). The multi-day fishery based in Sri Lanka exploits the same stocks. In 1994, some 1 200 boats were operated for a catch of about 55 000 t, of which about 50% was yellowfin and skipjack.

The total production of tunas from the western Indian Ocean during 1994 was mainly skipjack (266 214 t), yellowfin (241 946 t), bigeye (52 532 t) and albacore (14 901 t). The exploitation status for all these is unclear, due mainly to there being inadequate knowledge about the distribution of the stocks. A recent analysis of the historical catch and effort trend (with the assumption that there are separate stocks in the western and eastern Indian Ocean) indicated that the yellowfin were close to fully exploited. A less pessimistic conclusion is obtained if it is assumed that there is a single Indian Ocean stock. Further increases in the catch of skipjack are thought likely. Both the bigeye and albacore appear fully exploited, based on the catch and effort trends in the longline fishery. This is somewhat contradicted by the observed recent increases in catch; from the development of the purse seine fishery in the case of bigeye, and from drift gillnetting by Taiwanese (which has now ceased) in the case of albacore.

Longlining trials in 1992 from Réunion have led to a locally based longline fishery targeting broadbill swordfish. There were 15 vessels participating in 1994 for a catch of about 600 t (64% swordfish). The fishing occurs within the EEZ and further south (25° to 30°S). Important catches of albacore are also taken. In concert with this development, longlining trials have also been undertaken in the EEZ of Seychelles. There were 14 experimental surveys between March 1994 and March 1995. Apart from swordfish, the catches included yellowfin (22%) and bigeye (17%). A local entrepreneur is reported to have purchased four 17-metre vessels to engage in this fishery. The exploitation status of the swordfish stock is unknown. The catch reported for the western Indian Ocean for 1994 was 7 501 t (including 5 333 t from longlining and 2 164 from gillnetting). This is substantially down from the catch of the previous year (16 031 t), although still part of the trend of increased catches.

The close-to-full exploitation status of most of the fisheries of the region has been reflected by the implementation (over the past decade) of more restrictive forms of management, and the associated increase in MCS activities. Recent developments include the establishment of a Coast Guard in Seychelles under the Ministry of Defence and National Security, with responsibility for fisheries patrols. It has the services of two operational gunboats (one of which is on 24 hour standby). In addition, the use of a small aircraft is shared with the Islands

Development Authority. Similarly, the National Coast Guard of Mauritius took delivery of a patrol vessel (with helicopter pad) in 1996. It also has the use of two Dornier aircraft. MCS activities in Maldives have included the requirement for satellite transmitters on foreign vessels to enable the tracking of vessels. In seeking to ensure compliance with the TAC applicable to Mauritian motherships engaged in the banks handline fishery, the skippers are required to report catches and locations to the port authority every three days.

INTRODUCTION

[1] The purpose of this document is to provide information on the status of the fisheries and fishery resources in the region. Some fisheries and resources could not be included due to lack of recent information. Emphasis has been given to the exploitation of the crustacean and large-pelagics stocks. Where possible, comments are also made on the associated implications for future management. Some recent changes in management are also identified. In the latter part of the document there is a brief account of some recent developments for achieving better management through monitoring, control and surveillance (MCS).

RECENT CATCH AND ACTIVITY TRENDS

The Comoros

[2] The catches of large pelagics have remained steady at around 9 000 t since 1989. The catch for 1994 was reported to be 8 996 t (with 62% yellowfin and 24% skipjack). About 70% of these catches was from trolling, and most of the rest from handlining. All of the effort was by artisanal fishermen operating from small craft in the nearshore waters.

France - Réunion

[3] The artisanal fishery in 1994 involved 987 craft (mostly 5 to 7 m in length) of which the majority (73%) were operated by sports fishermen. The estimated catch in that year was 1 305 t and the associated mean catch rate over all craft types was 22.6 kg/trip. Some 62% of the catch was from the professional boats, at a catch rate of between 50 and 60 kg/trip. Fishing trips were reported as not exceeding 8 hours, and 246 species were recorded in the landings, including all the main groups (i.e. small, medium and large pelagics, and demersals). The catch in 1988 was 735 t. Much of the increase since then has been from the greater number of professional operators.

[4] Longlining trials in 1992, undertaken by a local fishermen from a 12-metre boat, has led to a fishery targeting broadbill swordfish (*Xiphias gladius*). This coincided with new tax exemptions for investments in French overseas departments, which encouraged fishing companies to invest in Réunion. There were 15 boats (12 to 34 m in length, and with engines of 154 to 800 HP) active in 1994, fishing in the EEZ and further south (25° to 30°S). The catch in that year was about 600 t (64% swordfish). In 1992, albacore was the dominant species (40% of the catch). This shift from albacore is reported as largely due to the high demand for swordfish in American and European markets, and local difficulties with exporting sashimi-grade tunas to Japan.

[5] The industrial fishery currently involves two boats. They are operated in the trap fishery for spiny lobster (*Jasus paulensis*) adjacent to St Paul and New Amsterdam Islands, and the demersal trawl fishery for Antarctic fish species near the Kerguelan Islands. The catch from the trap fishery in 1994 was 520 t, including 439 t of lobster. The catch from trawling in the same year was 4 017 t.

[6] Twenty-eight Taiwanese longliners were authorized to operate in the EEZ of Réunion (beyond 50 miles from the coast) during 1994. Normally they operate in these waters during September to February, targeting the adult albacore and swordfish. Between October 1993 and March 1994, 21 boats transshipped 2 640 t. This was reported to have resulted from 1 896 fishing operations, indicating a catch rate of 1.4 t/operation. Some 85% of the catch was albacore, with the rest being mainly swordfish, yellowfin, bigeye and sharks.

French tropical purse seine fleet

[7] The tuna purse seine fleet operates in a wide area of the western Indian Ocean, with most of the transshipments occurring in Seychelles (Victoria) and to a lesser extent Madagascar (Antsiranana) and Somalia (Mogadishu). During the past decade the French fleet has varied between 17 and 20 vessels. The catches from these vessels in 1993 and 1994 were reported as being 92 000 t and 100 000 t, respectively. Yellowfin were about 40 to 50% of this, with much of the rest being skipjack. The fishery exploits both aggregated and free-swimming schools (respectively 60% and 40% of the total catch). Catch rates have continued to be high. In the case of yellowfin, the catch rates for 1993 and 1994 were about 10 t per 10 searching hours, with 60% coming from setting around free-swimming schools. About the same catch rates were achieved for skipjack, although mostly from setting on aggregated schools.

Madagascar

[8] The catch of shallow-water shrimp from trawling is reported to have been 8 536 t in 1993, of which 8 067 t was from the west coast. This was from the operations of 64 industrial trawlers (averaging 420 HP) and 30 mini-trawlers (< 50 HP). The 469 t from the east coast was from 4 industrial trawlers. Catch rates for the industrial trawlers in the period 1985-89 are reported to have averaged 34.3 kg/hr, but have since declined to about 25 kg/hr, as the consequence of increased fishing effort. The number of vessels, the engine horsepower of the vessels and the number of fishing hours per vessel have all increased. The catch rates from the mini-trawlers were reported to be 8.5 t/yr in 1989. Shrimp are also caught by fishermen using traditional gears (seine nets, cast nets and fixed traps). While the associated statistics are poor, it is thought that the annual catch from these is about 2 000 t.

[9] The tuna purse seine fishery commenced in the western Indian Ocean at the beginning of the 1980s. Subsequently, Madagascar entered into fishing agreements with the European Union, which have been renewed at 3-yearly intervals. The most recent agreement, signed in 1995, allows 40 purse seine vessels and 15 longliners to be operated in the EEZ of Madagascar. There have also been agreements with Asian countries, permitting the operation of 28 longliners in 1991, 19 longliners in each of 1992 and 1993, and 68 longliners in 1994. The catch from longlining in the EEZ of Madagascar was reported to be 5 990 t in 1993. Antsiranana is a major port of transshipment. A total of 57 000 t was transshipped in 1995, which included 12 700 t of yellowfin, 27 000 t of skipjack, 1 300 t of bigeye, 400 t of albacore and 15 500 t of other species.

Maldives

[10] The traditional livebait pole-and-line fishery has continued to expand. The catch was reported as 96 842 t (72 % skipjack, 14% yellowfin and 7% other tunas) in 1994. This represents 93% of the total catch for the country, most of which was from mechanized *masdhoni*. These craft are operated on a day-trip basis. The average catch rate from these in 1994 was reported to be 452 kg/trip. This is substantially higher than the roughly 400 kg/trip reported for each of the previous four years. The placement of ten fish aggregating devices (FADs) in 1994 is believed to have contributed to this increase. A very recent development is the licensing of 15 Indonesian vessels (semi-industrial) in 1996. The annual utilization of livebait, which is required in the pole-and-line fishery, is reported to range around 11 000 t.

Mauritius

[11] The catch from around the main island of Mauritius was 1 443 t in 1995. This was from 1 073 boats (235 oar and sail boats, 809 boats with outboard engines, and 29 boats with inboard engines) manned by 2 711 crew. About 650 t was caught in addition by sport fishermen targeting tunas and other large pelagics, often in the vicinity of FADs. A further 300 t was from near-shore and shore-based amateur fishing. The catch for Rodrigues and Agalega Islands was given as about 750 t. Production from aquaculture included 3 t of shrimp and 44 t of fish. The shrimp were from pond culture, while the fish were raised in barachois (man-made lagoon enclosures) which are seeded naturally. The culture of marine shrimp (also the giant freshwater prawn) appears to lack financial viability, due to modest production levels and competition from imported products.

[12] The offshore handline fishery conducted on the banks of the Mascarene Ridge involved 15 motherships in 1995. These vessels are mostly converted longliners, purchased from Asian countries. They are equipped with between 10-20 dories, each of which is manned by 3 crew. Fishing trips are typically of about 6 weeks in duration. The principal target species is the emperor (*Lethrinus mahsena*). The quantity landed in 1995 was reported as being 5 291 t (gutted and frozen). This was from the Saya de Malha Bank (2 682 t), Nazareth Bank (1 609 t), St Brandon Island (470 t), Albatross Bank (312 t) and Chagos Island (218 t). The fishery is now under quota management. The TAC for 1995/96 was set at 4 752 t. It was intended that this be reduced by 5% annually until 2000, to enable the recovery of stocks. An associated reduction in the number of motherships is also anticipated.

[13] The Mauritian fleet of 3 tuna purse seiners caught 7 327 t (with 25% yellowfin, 63% skipjack and 1% bigeye) in 1995. In addition, there was 14 772 t of fish (76% albacore) transshipped from tuna longliners. This involved 458 separate transshipments; 388 from Taiwanese vessels, 50 from Japanese vessels, 14 from Korean vessels, 1 from a Honduran vessel and 1 from a Mauritian vessel. Generally the Korean longliners target yellowfin, the Japanese target yellowfin and bigeye and the Taiwanese target albacore. The various attempts to develop a local tuna longline fleet have been largely unsuccessful so far.

Mozambique

[14] Both industrial and semi-industrial trawlers are engaged in the shallow-water shrimp fishery on the Sofala Bank. The reported catches are 6 429 t (1992), 6 698 t (1993), 6 321 t (1994) and 7 344 t (1995). The first TAC - 7 770 t - was set in 1991, but was not reached.

The catch in that year was 7 050 t. The TAC was subsequently reduced to 6 300 t from 1992. Some fish by-catch is also landed. Semi-industrial trawlers are engaged in Beira and Maputo bays. In the mid-1980s there were about 18 vessels engaged in Maputo Bay, for an annual catch of about 350 t of shrimp and about 650 t of fish. At the same time there were about 15 vessels operating from Beira for a shrimp catch of about 350 t. For all the trawling grounds, *Penaeus indicus* and *Metapenaeus monoceros* are the main shrimp species, contributing between 80 and 90% of the catches. Shrimp are also caught by artisanal fishers using seines and mosquito nets.

[15] Deep-water shrimp are trawled from water depths of 300-700 m off the southern coast. The catches reported for recent years are 1 833 t (1993), 2 250 t (1994), and 1 770 t (1995). Generally there have been about 30 vessels engaged in the fishery, mostly foreign owned, with some also licensed for catching shallow-water shrimp on the Sofala Bank. The dominant species in the catches – at between 70-90% of the total – is *Haliporoides triarthrus*. Other deep-water crustaceans are also exploited from these vessels. These are the deep-water lobster (*Palinurus delagoae*), which is caught in depths between 200 and 400 m, and the andaman crayfish (*Metanephrops andamanicus*), which occurs between 300 and 700 m. The catches for 1993, 1994 and 1994 were respectively 313 t, 307 t and 248 t for the lobster, and 443 t, 261 t and 179 t for the crayfish. An additional resource of deep water crab (*Geryon quiquedens*) occurs at depths of 300-1 000 m, and has mostly been exploited from a single vessel using traps. The catches for the same years were respectively 406 t, 345 t and 414 t.

[16] The industrial trawling for fish on the Sofala and Boa Paz Banks has now ceased. The peak catches of about 10 000 to 11 000 t occurred in 1986, 1987 and 1988, when there were about 8 vessels involved. The target species were scad (*Decapterus* spp.) and Indian mackerel, although some demersal species were also caught. The fishing depths were 20-100 m. The landings of fish from industrial and semi-industrial vessels is now largely confined to by-catch from the shallow water shrimp fisheries. The exception are the tunas, for which it is reported that 3 914 t were caught from industrial vessels in 1994, and 3 347 t in 1995. It is not clear whether or not these are from the activities of the western Indian Ocean purse seine fleet.

Seychelles

[17] In 1994, an estimated 4 427 t of fish were landed on Mahe, Praslin and la Digue from 380 local craft. The craft included 74 pirogues, 202 boats with outboards, 94 whalers, 9 schooners and a sports fishing boat. The catch in 1993 was 4 926 t from 428 boats. The most important species groups were carangue (24%), job (14%), maquerau doux (13%) and capitaine (6%). Generally, about 75% of the catches have been from the use of handlines, and slightly less than 10% from traps. In 1994, the catch from both encircling and set gill nets was 20%, which is about double that of the previous years. The distribution of the fishing effort in 1994 was 66 200 handline work-days, 85 500 trap-sets, 6 200 gill net sets, and 2 200 harpoon work-days. The harpoons are used by fishers (without boats) targeting octopus within the inter-tidal zone. The catch rates for the handline fishery in 1994 were 55 kg/work-day from schooners, 51 kg/work-day from whalers, 37 kg/work-day from boats powered with outboards and 17 kg/work-day from pirogues.

[18] In concert with the recent developments in Réunion, longlining trials to assess the feasibility of fishing for swordfish in the Seychelles EEZ were commenced in 1993, with promising results. There were a further 14 experimental surveys undertaken between March 1994 and March 1995, using the research vessel (length 18 m) of the Seychelles Fishing

Authority (SFA). In addition to swordfish, the catches included yellowfin (22%) and bigeye tuna (17%). Since then, a local entrepreneur has purchased four 17-metre vessels to engage in this fishery. Operations with these vessels were due to commence at the end of 1995.

[19] Fifty tuna purse seine vessels were licensed to operate in Seychelles waters in 1994. This is 6 vessels less than in the previous year, as the consequence of the Japanese purse seine fleet leaving the western Indian Ocean. Apart from the three vessels from Mauritius, all the others were based outside the region. The greatest number were from France (17 vessels), Spain (16 vessels) and Russia (9 vessels). The vessels operated over a wide area, including off Somalia (0° to 10°N) from August to November, the south equatorial region (0° to 10°S) from November to February and in July, and in the Mozambique Channel (10° to 23°S) from March to June. The total catch from the fleet was 276 911 t in 1993, and 272 187 t in 1994. In the latter year, the fishing effort was 12 196 days, with the associated catch rate being a record 22 t/fishing day. The catches were mainly of yellowfin and skipjack. About 65% of the purse seine catch was transshipped through Victoria (Seychelles). This is less than in earlier years.

[20] The longline fishery in and around the Seychelles EEZ is dominated by the Taiwanese, South Koreans and Japanese. Licences were issued for 149 vessels in 1993, and 150 vessels in 1994. The estimates for the catches from these waters in these two years were 13 700 t and 14 500 t, respectively, and associated with catch rates of 0.39 t/1 000 hooks and 0.35 t/1 000 hooks. The catch composition in 1994 was 47% yellowfin, 41% bigeye and 9% billfish. The amount of transshipment in Victoria from longline vessels was negligible. Most was transshipped in Mauritius.

Tanzania

[21] The shallow-water shrimp fishing grounds are in the Rufiji Delta, as well as adjacent to Bagamoyo and Sadaani. In 1994, the industrial trawl fleet comprised 16 vessels. The landings are reported as including about 1 400 t of shrimp. This value compares with 974 t of shrimp (and 1 069 t of fish) from the same number of vessels in 1989. The species composition in 1989 was 85% large shrimp (*Penaeus indicus, P. semisulcatus, P. monodon* and *P. japonicus*) and 15% small shrimp (*Metapenaeus monoceros*). Shrimp are also caught by artisanal fishermen using traditional gears (mesh nets, seine nets and fixed traps). According to the official statistics, the catch by these fishermen included 536 t of shrimp.

STATUS OF SELECTED FISHERY RESOURCES (EXCEPT TUNAS AND SWORDFISH)

France

[22] The exploitation of trawlfish adjacent to the Kerguelen Islands by the countries of the then East European bloc commenced in about 1971. The catches in the early years are reported as reaching 200 000 t/yr. Subsequently they varied around 25 000 t/yr, although reaching about 100 000 t in some years. The involvement of vessels from Réunion commenced in 1981. Usually there has been one trawler engaged, with the catches varying from 500 t to 2 000 t (depending on the time spent fishing). The target species were the

deep-water Antarctic species ('fish of the ice'). The productivity levels have been sufficiently good to justify the use of a second trawler in 1994. Stock assessments have been undertaken for some of the Antarctic fish species; however, the findings are not known to the author.

[23] The fishery for lobster around the St Paul and New Amsterdam Islands has been ongoing since the early 1960s. It has typically involved the use of a single mothership, supported by dories, making two trips from Réunion each year. The fishing method has always involved the use of pots. Over the years, the mean daily catch rates have ranged between about 5 and 10 t. A stock assessment was undertaken in the late 1980s using the available catch and effort data, and applying the production model of Schaefer. The resulting estimate for the MSY was 600 t (whole weight), and the TAC was set at this value in the early 1980s. Subsequently this was found not to be sustainable, and the allowable catch has been progressively reduced to the present TAC of about 400 t.

Kenya

[24] The semi-industrial trawl fishery for shallow-water shrimp occurs in Ungwana Bay. The principal species are *Penaeus indicus, P. monodon* and *Metapenaeus monoceros*. The initial survey work provided estimates of biomass of 112 t (March) and 353 t (May), over a fishing area of about 550 km^2. The most productive months have since been determined as July to November, although fishing occurs in all months. Since the mid-1980s, the annual catches have remained steady at around 350 t of shrimp and 500 t of fish by-catch. This was despite a steady increase in the number of trawlers, from 6 vessels in 1986 to more than 20 vessels in the early 1990s. The conclusion from these observations was that the MSY for shrimp was probably about 350 t. The conclusion from a subsequent bio-economic analysis was that a fleet of about 6 vessels would be sufficient to obtain the MSY. The associated potential to increase the fishery profits prompted the fisheries administration to mandate a reduction in the number of participating vessels.

[25] Exploratory fishing on the North Kenya Bank with bottom-set longlines was undertaken by the East Africa Marine Fisheries Organization (EAMFRO) during 1969 to 1976. On the basis of 2 000 km^2 being the area of suitable fishing ground, and some assumptions concerning the area of attraction of the baited hooks per hour of soak time (15 m^2 for rough bottom and 60 m^2 for smooth bottom) and the rate of natural mortality applying to the target species (snappers, groupers and emperors), the estimate obtained for the MSY was 1 700 t. In a subsequent bio-economic analysis using the same data, an alternative estimate of 1 250 t was obtained. It was also concluded that the catch rates associated with achieving the MSY were unlikely to be financially viable. A small fleet of 3 vessels catching a total of about 600 t annually (i.e., 35% of MSY) was recommended. There continues to be no longlining on the Kenya Bank.

[26] Deep-water shrimp (*Heterocarpus woodmasoni*), lobster (*Puerulus angulatus*) and small quantities of the Andaman crayfish were located in water depths beyond about 200 m during surveys from 1979 to 1981 with the R/V *Ujuzi*. Biomass estimates of 1 006 t for the shrimp and 1 177 t for the lobster were determined for a trawlable area of about 10 000 km^2. The highest densities of shrimp were off Malindi, where a biomass of 144 t was found in an area of 154 km^2. The associated estimate for the MSY was 108 t. The lobster were most densely concentrated off Ungwana Bay, where the biomass was determined to be 330 t for an area of 226 km^2. The MSY for this ground was estimated to be 140 t. An unsuccessful attempt to develop a fishery for lobster involved the F/V *Aegina* during five weeks in 1981. Commercial trawling for shrimp had previously been attempted with the F/V *Kusi* during a

14-month period from January 1978. More recently, the F/V *Stratos* was engaged in deep-water trawling during much of 1988, with a reported catch of 116 t of lobster, 65 t of shrimp and 1.3 t of deep-water crab.

Madagascar

[27] A number of assessments for the shallow-water shrimp have been undertaken since the early 1970s. In most cases, production models have been used with the annual catch and effort data from the industrial trawl fishery. A useful time series of such data are available for all years since 1967 (inclusive). The estimates obtained for the MSY have generally ranged around 8 000 t for the west and east coast fisheries combined. This is in close agreement with the annual catches in recent years. The trawl fishery has been intensely managed since the early 1980s, with the main elements being the creation of fishing zones, and restrictions on the number of companies and vessels allowed in each zone. The administration has allowed a gradual increase in the number and size of the vessels.

[28] The very preliminary MSY estimate for the demersal fish resources is 15 000 t for the south and east coasts (from surveys with the R/V *Dr Fridtjof Nansen*) and about 50 000 t for the west coast. So far the exploitation of trawlfish is as by-catch from the shrimp trawlers. The annual by-catch (most of which is discarded) was determined as about 6 900 t of marketable fish (about equal to the quantity of shrimp being landed) and 10 300 t of fish suitable for meal production. In the mid-1980s, the quantity being landed was reported as between about 500 and 1 000 t. Regarding the barrier reef off the northeast coast, there are resources of reef-associated species which are only lightly exploited at present. The potential productivity of the larger varieties (snappers, groupers and emperors) has been reported as being between 4 and 6 t/km^2, and the associated MSY as 800 t.

Maldives

[29] Assessment of the tuna resources has involved tagging, the analysis of catch and effort data, and an offshore survey. Ten thousand tuna were tagged in 1990, and another 7 000 in 1993/94. Nearly 97% of the returns from the first tagging were from local waters. The others were recovered from Sri Lanka and the western Indian Ocean. The recovery rates were greater for skipjack (17.8%) than for yellowfin (7.0%). The recoveries from outside Maldives were indicative of the fish having followed the prevailing currents. The tag data for the skipjack were used in a stock assessment model, from which it was concluded that the stocks were being lightly exploited in Maldives.

[30] The pole-and line fishery takes place within 30 miles of the shore. The exploratory fishing survey conducted during twelve months from December 1987 sought to determine the commercial feasibility of using multi-day boats with drift gill nets and pelagic longlines in the waters more offshore. The total catch from the survey vessel during 49 nights of fishing was 22.6 t (with shark 68%, skipjack 21%, billfish 7% and yellowfin 3%). There has been no subsequent development of a commercial fishery. This is in contrast to the situation in nearby Sri Lanka, where in 1994 there were some 1 200 multi-day boats, landing about 55 000 t of large pelagics, some of which was taken adjacent to and within the Maldives EEZ.

[31] Research on baitfish has been ongoing since 1984, particularly during the three years from 1988. Initial studies concentrated on identifying the species and quantities utilized in

the tuna pole-and line fishery, and in documenting the methods of capturing baitfish. Subsequently the research has been re-directed to studying the biology of the baitfish, including growth rates, reproduction and feeding. In association with this there was a study of the gut contents of the reef fish, in order to determine the possible levels of predation on baitfish. Over 20 species of baitfish were found to be utilized, with the fusiliers, cardinalfish and sprats being of greatest importance. Most were found to be short-lived and highly fecund, and hence able to withstand high levels of exploitation. At present the baitfish supplies are believed not to be overexploited.

[32] Surveys of the reef fisheries resources were undertaken in two phases from September 1986 to September 1991. The reefs in the north and centre were found to be more productive and with a different species composition compared to the reefs in the south. Using the longline catch data, and extrapolating to all the reef systems in Maldives, the estimate of MSY was 30 000 t (±13 000 t). While the reef stocks generally are lightly exploited, the giant clam and beche de mer fisheries have been placed under management to avoid overexploitation. The number of licences for exporting clams has been limited, and the use of scuba gear is prohibited for the taking of beche de mer. There have been studies on developing export markets for chilled, high quality fish, including groupers and deep-water snappers, to encourage greater use of these resources. The export of live grouper is being closely monitored.

Mauritius

[33] The industrial handline fishery commenced in its present form in the mid-1960s. The catches from the two most productive grounds (Saya de Malha and Nazareth Banks) have been at around 4 500 t/yr since the late 1980s. At the FAO-sponsored stock assessment workshop held in Mauritius in 1989, it was concluded that the catch from these banks was already at or slightly exceeding the MSY. Further, in examining the financial performance of the fishery, it appeared that the fishing effort should be reduced to about one-third of the contemporary level, in order to maximize the fishery profit. The likely yield at this level of effort was estimated to be about 3 800 t. An approach to managing the fishery, through establishing a TAC and allocating this between the fishing companies, was recommended. A TAC was introduced for the first time in 1995, to be reduced over the following 4 or 5 years to enable stock replenishment.

[34] A resource of deep-water shrimp (*Heterocarpus laevigatus* and *H. ensifer*) occurs adjacent to Mauritius Island. A substantial area of suitable ground (2 000 km^2 at about 500 to 1 000 m depth) exists to the north of the island, which has provided catch rates exceeding 2 kg/trap/day during exploratory fishing in the early 1990s. There continues to be no substantial exploitation of this resource, presumably from a lack of commercial viability.

Mozambique

[35] Assessments for the shallow-water shrimp fishery on the Sofala Bank have involved the conduct of trawl surveys, and the interpretation of catch and effort data. The estimates obtained for the biomass, from applying the 'swept area' method, were between 3 500 t and 4 000 t for the four years from 1983. The catches in those years were steady at around 8 000 t/yr. In 1986, there were reported to be 73 industrial trawlers and 15 semi-industrial trawlers. It was concluded that the stocks were being fully exploited at this time.

Subsequently, the high level of fishing effort was allowed to increase further. Quota management was introduced in 1991, but failed to achieve an increase in stocks. Catches declined to a low of 6 321 t in 1994. A substantial reduction in fishing effort is now required in order to rejuvenate the fishery. No assessments of MSY for the shallow-water shrimp stocks have been undertaken for Beira or Maputo Bays, although in both places they are believed to be fully exploited.

[36] There have been several surveys of the deep-water shrimp stocks. First from the R/V *Ernst Haeckel* in 1980-1982, and then later with other vessels, in 1987. The assessment based on the first surveys and the catch statistics led to the recommendation that the catch be kept at about 2 000 t/yr. An estimate for the stock biomass of 4 000 t was obtained from analysis of the data from the later surveys. It was suggested from this that the catch could be increased to 3 000 t. The TAC for the deep-water shrimp was initially set at about this level. The catch has been relatively low in recent years, presumably as a consequence of poor market demand.

[37] Similar survey data were obtained in respect to the stocks of deep-water lobster. The most comprehensive surveys were undertaken from the F/V *Aelita* during June to August 1976, October to February 1977, and April to June 1977. These were used to obtain estimates for the summer and winter biomass: 709 t and 222 t respectively. The associated estimate for the MSY was 400 t. This same value was obtained in a subsequent analysis of catch rate data from the operation of two commercial vessels in 1978-79. There have been no formal assessments for either the andaman lobster or deep-water crab. The TACs which have been established for these fisheries are 350 t and 400 t, respectively.

[38] The main species caught in the fishery for small pelagics on the Boa Paz and Sofala Banks are the scads (*Decapterus russelli* and *D. macrosoma*) and Indian mackerel. Detailed data have been collected for these since 1979, from the sampling of commercial catches. In addition, there were several acoustic and bottom-trawl surveys between 1976 and 1987. In an assessment which utilized data collected from 1984 to 1986 based on the virtual population analysis method, an estimate of about 37 000 t was obtained for the biomass of the three species (combined). This was subsequently used, after raising to take account of non-represented species, to obtain an estimate of 30 000 t for the MSY. This does not include anchovies (*Stolephorus* spp.) which are known to be abundant on the Sofala Bank. The fishery has declined from lack of demand for small pelagics.

Seychelles

[39] There have been a number of trawl surveys at different times from the mid-1970s. These have involved the R/V *Koyo Maru*, R/V *Professor Mesyatsev*, R/V *Dr Fridtjof Nansen*, R/V *Scyllarus*, and R/V*Nauka*. The estimates for the biomass of the larger varieties (snappers, groupers and emperors) on the offshore banks of the Mahe Plateau (6 500 km^2 at depths of 36 to 100 m) are between 8 000 and 9 000 t. Very similar biomass values were determined for the inshore banks (6 000 km^2 at depths of 0 to 35 m). An additional biomass of about 20 000 t was determined for the trawlable area (14 000 km^2 at depths of 10 to 100 m). The associated estimates for the MSY range from 1 000 to 1 800 t for the offshore banks, from 1 000 to 1 400 t for the inshore banks, and from 2 200 to 2 400 t for the trawlable grounds. The resources are being exploited by the demersal handline and trap fishers. Realization of the potential to increase yields would require increased fishing effort. Trawling on the Mahe Plateau is prohibited.

[40] An MSY of about 93 500 t has been determined for the small pelagics occurring on the Mahe Plateau. This is based on acoustic surveys from the R/V *Coriolis*. The main species are Indian mackerel and bigeye scad. Almost none of this potential is being utilized. The catches of small pelagics from encircling gill nets and beach seines was about 800 t in 1994. This was about double the values for the previous years. A Spanish venture investigated the feasibility of catching baitfish (in support of the development of a tuna pole-and-line fishery) during 1981 to 1983, but experienced difficulties in obtaining adequate supplies. The local demand for small pelagics, which is currently small, may increase with the further development of a longline fishery for swordfish.

Somalia

[41] Industrial trawlers have been engaged in Somali waters up until the early 1990s. In 1987, there were 8 vessels with a reported catch of 571 t of deep-water lobster (*Puerulus sewelli* and *P. carinatus*) and deep-water shrimp (*Heterocarpus* spp.), and 9 020 of high value trawlfish (snappers, emperors and groupers). The fish were caught in water depths of 20 to 70 m, while the crustacea were from 200-400 m depth. Using the data from a 40-day survey cruise with the F/V *Cusmaan Geedi Raage* in 1983, the biomass for the lobster was determined as 1 733 t over an area of 4 696 km^2. The associated estimates for the MSY were determined as 621 t (Fox model) and 726 t (Schaefer model). It was concluded that the lobster were already at or near full exploitation.

[42] Regarding the high value fish component of the catches, a review of data from the trawl surveys conducted in 1981 from the F/V *Ilsa de Lanzarote* and in 1984 from the R/V *Dr Fridtjof Nansen*, suggested that the exploited density might be between 1 t and 2 t/km^2. Applying this to the areas of the fishing ground (24 500 km^2 and 3 200 km^2 for the east and north coasts respectively), and assuming MSY to be 20% of the observed biomass, resulted in estimates for the MSY ranging from about 5 500 to 11 000 t. As with the lobster, it seems that the trawlfish stocks were being fully exploited. There is currently no demersal trawling, by decision of the local administration.

[43] Two Romanian factory ships were engaged in feasibility trawling for small pelagics between November 1983 and October 1984. Some 6 112 t were caught from 997 trawling hours, with catch rates ranging up to 12 t/hr. The predominant species were *Sardinella longiceps, Scomber japonicus, Etrumeus teres,* and *Decapterus* spp. The fishing ground was the upwelling area between Cape Guardafui and Cape Hafun. Using the catch rates, an assumed volume of sea swept by the gear, the volume occupied by the fish, and an assumed catching efficiency of 0.5326, the biomass of stock was estimated to be 131 000 t. The MSY was assumed to be a third of the biomass, and hence 43 700 t. The Romanian Government unsuccessfully sought approval for a joint venture to deploy a fleet of 5 factory trawlers.

[44] Earlier, the R/V *Dr Fridtjof Nansen* had been used for acoustic surveys during 1975 and 1976, and again in 1984 (in February-March and August). The estimates of biomass from the 1984 data were 245 000 t and 115 000 t. On the basis of the MSY being 23% of the biomass, the respective estimates for the MSY were 55 000 t and 25 000 t, and hence very similar to those obtained from the Romanian data.

Tanzania

[45] During a workshop held in July 1990, three stock assessments were undertaken for the trawl component of the shallow-water shrimp fishery. The 'swept area' method was used with the monthly catches for 1989 to estimate the MSY for the two main fishing grounds. For the Rufiji Delta, the estimates ranged from 932 to 1 209 t, and from 275 to 326 t for the stocks off Bagamoyo and Sadaani. The lower values correspond to an assumed natural mortality coefficient of M=2.4, and the higher values are when M=3.6 was assumed. In the second assessment, the Fox production model was used with the annual catches and efforts of 1986-89. An estimate of 1 001 t was obtained for the MSY (for the grounds combined). In a third assessment, length-based catch curve and cohort analyses were applied to the catch number in each 'commercial' size category for 1989. The resulting values for the fishing mortality coefficient, when used in a yield model, provided estimates for the MSY in close agreement with those obtained from the other methods. In part as the consequence of these findings, the trawler fleet was limited to 12 vessels in 1990.

[46] There have been a number of estimates of MSY for the demersal trawlfish, based on past surveys involving the R/V *Professor Mesyatsev* and the R/V *Dr Fridtjof Nansen*. The estimate of MSY based on using only the data for stock occurring at the higher densities at depths less than 50 m is 7 300 t. This is equivalent to a potential productivity of 0.88 t/km^2. Subsequently, the data from surveys on the mainland side of the Zanzibar Channel and west of Mafia Island with the M/V *Mafunzo* provided MSY estimates of 440 t for the Zanzibar Channel and 300 t for Mafia Island. The associated estimates for the potential productivity are 0.92 t/km^2 and 1.27 t/km^2, respectively. The quantity of fish reported to be landed from trawlers during 1990 was 767 t. These would have been the more readily marketable species. Assuming the amount of fish discarded to be three times that landed provides an estimate for the by-catch of about 3 000 t. An unknown quantity of trawlfish is landed by the artisanal fishermen. These stocks continue to be underexploited, with the principal constraint being the difficulties of marketing.

[47] At the FAO/IOP Workshop held in Seychelles in 1978, where the results from previous trawl and acoustic surveys involving the R/V *Dr Frithjof Nansen* were reviewed, it was decided to adopt a preliminary value of 20 000 t for the MSY of small pelagic fish. The reported catch for mainland Tanzania in 1990 was about 9 000 t, with possibly another 3 000 t from close to Zanzibar. The main target species are the sardinellas, anchovies, Indian mackerel and ponyfish. These catches were from semi-industrial purse seining at night, around schools aggregated by lights, as well as from the use of beach seines and gill nets by the artisanal fishermen. In 1980 and 1981, a single purse seine vessel was successfully engaged in fishing near Tanga. The vessel subsequently was shifted to Dar es Salaam. Presumably there is potential to re-establish the fishery at Tanga, as well as increase the catches elsewhere.

STATUS AND UTILIZATION OF THE TUNA AND SWORDFISH RESOURCES

Yellowfin tuna

[48] The yellowfin catch for the western Indian Ocean has increased almost continuously since the commencement of the purse seine fishery in 1983. The reported catch for 1984 of

88 115 t is less than 30% of the 311 357 t for 1993. A substantial downturn occurred in 1994, with the catch in that year being 241 946 t. The decline was experienced in both the purse seine and longlining components of the fishery, and is possibly indicative of the catches now being close to the MSY.

[49] Estimates of MSY based on the use of production models were obtained during the Sixth Expert Consultation on Indian Ocean Tunas. In this it was assumed that the catching efficiency of the fleet had increased by 8% annually. A value of 240 000 t was estimated on the presumption that there were separate western and eastern Indian Ocean stocks. A much less pessimistic outcome was obtained when the data for the two regions were combined. When assuming a single stock throughout the Indian Ocean, the conclusion reached was that the current levels of fishing effort are still modest, and not in urgent need of constraint. In view of these uncertainties, a cautious approach towards allowing increased exploitation has been recommended.

Skipjack tuna

[50] The catches of skipjack from the western Indian Ocean have remained steady at about 240 000 t since 1989. Prior to this there had been a rapid increase following the commencement of the purse seine fishery. The catch in 1994 was 266 214 t, 555 of which was from the purse seine fishery, and the rest from the small-scale pole-and-line, driftnet and troll-line fisheries (India, Maldives, Pakistan and Sri Lanka).. Research has established that skipjack are highly fecund, and spawn opportunistically throughout the year (principally in response to water temperature) and over a wide area of ocean. They reach sexual maturity at a young age (about 1.5 years old), and hence are generally mature prior to exploitation. They are also widely distributed over the Indian Ocean, for which it is presumed there is a single stock.

[51] These factors, coupled with the high natural mortality (and hence rapid turnover) rate, are indicative of the skipjack stock being able to remain productive at high levels of fishing effort. Notwithstanding, when catch rates declined in the Maldivian pole-and-line fishery between 1988 and 1993, concerns were expressed that the stock might be approaching a local MSY level. In 1994, the catch rate returned to the previous high levels.

Bigeye tuna

[52] The catch of bigeye in the western Indian Ocean from all methods was 52 532 t in 1994. The longline catches have shown no trend in recent years, and have fluctuated between 40 000 t and 50 000 t. The catches from the purse seine fishery in contrast have increased to between 10 000 and 15 000 t. Attempts to estimate MSY values have involved the application of production models to the standardized catch rates for the Japanese longline vessels. When the Schaefer model was used, the estimate obtained for the MSY was 52 000 t (for the western and eastern Indian Ocean), while with the Fox model the estimate was 60 000 t.

[53] The implication from these is that close to the MSY is already being attained. This is somewhat contradicted, however, by the observation that catches are continuing to rise with increasing effort (rather than stagnating). There has been a shift towards younger fish in the catches, due to the increase in the surface fishery. Whether the purse seine fishery will impact negatively on the future longline catches remains to be established.

Albacore tuna

[54] The catch of albacore in the western Indian Ocean peaked at 19 922 t in 1990. This included 13 795 t from Taiwanese vessels using drift gill nets. This activity commenced in 1987, and in response to international concerns, was discontinued in 1992. More recently the catches have ranged between 8 447 t (1992) and 14 901 t (1994). The catch in 1994 was from longlining (12 318 t), purse seining (2 543 t) and trolling (39 t).

[55] Evidence from DNA and morphometric studies suggests that there are either separate stocks in the western and eastern Indian Ocean, or that incomplete mixing occurs. The historic range of estimates of MSY, from using the catch and effort data for the western and eastern Indian Ocean combined, are between 14 500 t and 22 000 t. Apart from the period when gill nets were used, the catches have not exceeded the upper value. In the most recent years, the catches for the Indian Ocean were 20 819 (1992), 17 737 t (1993) and 21 735 t (1994). If there is to be a negative impact from the gillnetting, this will be noted in the immediately coming years.

Broadbill swordfish

[56] The catch of swordfish in the western Indian Ocean was reported as 7 501 t in 1994, of which 5 333 t was from longlining and 2 164 from gillnetting (Sri Lanka). This was substantially down from the catch of the previous year (16 031 t), although still part of the trend to increased catches. The productive areas are between 10°N and 10°S, and south of 25°S. Recent developments include the establishment of locally based longline fisheries in Réunion and Seychelles. Two main fishing grounds have been identified around Réunion, one within 120 miles of the island and which is exploited from small vessels, and a more distant area south of 25°S. So far the best catch rates (20 fish/1 000 hooks) have been during May to October.

[57] Similar gear and methods are being used in Seychelles. A ten-month exploratory fishing survey involving five Spanish longliners was undertaken in the area between 10°S and 20°S in 1993 and 1994. The hooks were set at 5 m to 30 m below the surface. Swordfish represented some 75-85% of the catches. The results were not considered sufficiently encouraging, however, to justify continued fishing. Research studies have commenced in both Réunion and Seychelles. This is to be expanded with European funding. In the absence of any assessments to date, the status of the stock(s) is unknown.

RECENT DEVELOPMENTS IN MONITORING, CONTROL AND SURVEILLANCE

Seychelles Coast Guard established

[58] The establishment of a Coast Guard occurred in 1994, under the Ministry of Defense and National Security, which combines the former Navy and Air Force. It is able to utilize the services of two operational gunboats (one of which is on 24-hour standby) for fisheries patrols within the EEZ and to conduct search and rescue operations. The associated personnel are experienced in boarding and inspection procedures. In addition, the use of a small aircraft is shared with the Islands Development Authority. The US Coast Guard has provided some training and advice. In a related development, the placement of observers on

foreign vessels ceased in 1995. This was in view of the cost and organizational difficulties, and the conclusion that the statistical data could better be obtained through other means (radio monitoring and inspections at transshipment).

New offshore patrol vessel for Mauritius

[59] The National Coast Guard of Mauritius took delivery in 1996 of a patrol vessel (P/V *Le Vigilant*) built in Chile. It is fitted with a helicopter pad. The Commander is being provided under technical assistance from India, and is responsible to the Commissioner of Police. The Coast Guard is also equipped with two Dornier aircraft. The MCS activities associated with the lagoon and inshore fisheries remains the responsibility of the separate Fisheries Protection Service.

Satellite transmitters on foreign vessels

[60] MCS activities in Maldives have included the requirement for satellite transmitters on foreign vessels. The signals identifying the position of the vessels are received via the Inmarsat satellite system, and passed on to the Coast Guard headquarters. The location of the vessels is displayed electronically on a map showing the Maldives EEZ and adjacent waters. Satellite imaging is also being used to determine sea surface temperatures, in order to provide local and foreign vessel operators with information useful in tracking the concentrations of tuna. Very recently, Maldives has enacted a Maritime Zones Law which re-defines – in accordance with UNCLOS - the archipelagic baselines, archipelagic waters, closing lines, internal waters, territorial waters, contiguous zone and EEZ.

Banks handline fishery

[61] Fifteen motherships based in Mauritius were engaged in this fishery during 1995. A single mothership from Réunion was also engaged. The TAC applying to the Mauritian vessels for the season September 1995 to August 1996 was 4 752 t, with quotas allocated to the companies owning the boats. In the coming years the TAC was to be reduced. The associated MCS activities included the requirement that the skippers provide radio reports to the port authority every three days, indicating catch levels and position. The vessels were also checked on leaving and entering port, again to ensure compliance with the TAC. Exceeding the quota by unloading catches in nearby Réunion is prevented through the monitoring of vessel positions. This could also be achieved through the installation of satellite transmitters on these vessels.

Shallow-water shrimp fisheries

[62] The important fisheries for shallow-water shrimp occur on either side of the Mozambique Channel. The fishery on the Sofala Bank is under TAC management, with quota entitlements being allocated annually to the participating companies. The companies have experienced difficulties in achieving the TAC in most of the recent years. The management of the fishery on the west coast of Madagascar includes zoning, and limiting the number of companies and vessels engaged in each zone. The largest shrimping company in Madagascar (Somapeche) is linked to a principal shrimping company in Mozambique (Efripel). The MCS priorities for these fisheries are to ensure compliance with the TAC and

quota entitlements in Mozambique, limited entry and zoning in Madagascar, and to prevent unauthorized movement of vessels between the two countries.

Sri Lanka's multi-day fleet

[63] Since the mid-1980s, there has been a rapid expansion in Sri Lanka's multi-day fleet. These boats are generally operated within and adjacent to the EEZ of that country, but there have been reports of incursions into the EEZ of Maldives. The boats are about 12 m in length, powered with inboards of 40 HP, and with 4 or 5 crew (including the skipper). The fishing trips are generally six to nine days in duration, and the main fishing gears are drift gill nets, and to a lesser extent longlines and troll-lines. In 1994, there were about 1 200 multi-day boats landing some 55 000 t. About half the catches were reported as yellowfin and skipjack, with most of the remainder being billfish, shark and other tunas. The alleged incursions into the Maldives EEZ may well be accidental, bearing in mind that few of the boats have modern navigation devices. The fisheries administration in Sri Lanka is examining the feasibility of requiring the installation of satellite transmitters on the multi-day boats. A Sri Lanka-Maldives Joint Commission exists to ensure cooperation in fisheries and related MCS activities.

Live fish exports

[64] The export of live grouper has commenced from Maldives. This utilizes an abundant resource and takes advantage of the very high prices available in Asian markets. It is being closely monitored to ensure adequate stock conservation, and in recognition of the eco-tourism value of the reef communities. Data from the reef fish resources surveys from 1986 to 1988 and 1989 to 1991 have been used to make preliminary estimates of stock size and sustainable yields. The MCS priorities are to ensure that exploitation does not become excessive (achieved in part by controls on the quantities exported) and that damaging methods of collection (e.g., sodium cyanide stunning) are prevented. Maldives has chosen to prohibit the live export of the more valuable (and vulnerable) Napoleon wrasse.

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Appendix H

LEGAL ASPECTS OF COOPERATION IN MONITORING, CONTROL AND SURVEILLANCE IN THE SOUTHWESTERN INDIAN OCEAN

by

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FOREWORD

[1] This study relies primarily on an analysis of legal issues and devices as they appear in the laws of the various countries concerned and copies of which are available within the FAO Legal Office in Rome. The authors of this study would welcome being kept informed of recent developments concerning relevant fisheries legislation.

1. INTRODUCTION

[2] The terminology "monitoring, control and surveillance" (MCS) reflects the wide range of issues involved in providing for effective regulation of the fisheries sector. In brief, the process includes the gathering of information on the basis of which to adopt appropriate rules, and the effective implementation (and, if necessary, enforcement) of those rules.

[3] According to the 1981 FAO Expert Consultation[1]:

(i) monitoring involves the "continuing requirement for the measurement of fishing effort characteristics and catches";

(ii) control concerns the "legal framework within which the resource must be exploited, i.e., management schemes;" and

(iii) surveillance "describes those measures required to ensure compliance with the regulations formulated under (ii)."

[4] The combined reference to all three terms has been generally adopted internationally in the past two decades, reflecting the wider approach now taken with respect to fisheries law enforcement. The basic consideration on which such an approach is based is that effective enforcement does not involve exclusively (nor necessarily) either the use of the latest

1. FAO. 1981. Report of the Consultation on Monitoring, Control and Surveillance. Dakar. CECAF/TECH/81/35.

technical equipment or the the use of force, or both. Rather, effective enforcement is subject to the prior realistic consideration of the state of the fish resources (the concept of *monitoring*) and to the adoption of appropriate policy and legislation (the concept of *control*).

[5] As regards legislation, many countries worldwide observe with great concern the number of violations to it and the difficulties in ensuring its adequate implementation. These often occur regardless of apparently adequate formulation of legal provisions for enforcement. People may tend to repeatedly violate some provisions even if, for example, serious consequences, such as imprisonment, are envisaged as a penalty for that violation. Consequently, there is little faith that legislative revisions may bring about significant improvements. The biggest problem seems to be ineffective administration rather than in the formulation of the legislation. This may be true under exceptional circumstances, such as periods of transition, in which respect for any legislation and State enforcement systems becomes rare. However, in many cases, adequate policy and legislative reforms can significantly facilitate MCS.

[6] Some suggestions toward better policy and legislation are given in Section 4 of this paper, following an analysis (Section 2) of the existing legislation of the countries of the southwestern Indian Ocean, with particular regard to MCS aspects, and a description of international initiatives taken at the global and regional level (Section 3).

2. DOMESTIC LEGISLATION OF THE COUNTRIES IN THE SOUTHWESTERN INDIAN OCEAN

THE COMOROS

[7] The fisheries sector of the Comoros is entirely artisanal. Most fishing occurs within two or three miles of the shore. These activities are not regulated as such. However, the fishing boats have to be registered with the Marine Marchande, and certain marine species, including marine mammals, are protected. Further, customary law has also played an important role in the regulation of fisheries and the settlement of disputes. Rules vary depending on area, fishing technique and level of cooperation among fishers.

Monitoring

[8] Reporting requirements may be attached as a condition to licences for foreign fishing vessels ('foreign fishing licence;' Law No. 82-015, art. 5). Further, in the EU bilateral fishing agreement, provision is made for the captain of the ship to complete a fishing form for each period spent fishing in the Comorian fishing zone. This form has to be sent, within one month of the end of each calendar quarter, to both ORSTOM and to El Instituto Oceanografico (EIO) for processing. Upon entry into and exit from Comorian waters, EU vessels are required to notify the Comorian radio station of their position and quantities of catch on board.

Elements of control

[9] Pursuant to Law No. 82-015, on the activity of foreign fishing vessels in Comorian maritime zones, fishing by foreign vessels is not allowed within the territorial sea (ibid., art. 2). Detailed conditions on stowage of fishing gear for unlicensed fishing vessels in transit are included (ibid., art. 4). The Minister may issue foreign fishing licences, subject to conditions specified in the licence. These may, among other things, relate to placing of observers on board, submission of statistics, marking of vessels, the entry into a port of the Comoros for inspection purposes, the installation of transponders on board, etc. (ibid., art. 5).

Licences provided for under bilateral fishing agreements

[10] The Annex to the Protocol defining, for the period 20/07/1994 to 19/07/1997, the fishing opportunities and the financial contribution provided for by the Agreement between the European Community and the Islamic Federal Republic of the Comoros on fishing off Comorian grounds provides for the "Conditions for the pursuit of fishing activities by Community vessels in Comorian waters." They relate to the application and issuance of the licences, the validity of the licence (one year) and the licence fees, observers programme, radio communication and reporting, fishing zones, ownership of rare species, and transhipment.

[11] The licence is issued following an advance payment to the Government of the Comoros of a lump sum of ECU 1 500/year for each tuna seiner, equivalent to fees for a catch of 75 t of tuna a year in Comorian waters. A compensation and counter check system is foreseen if the amount due for actual fishing exceeds the advance lump sum paid. Despite the above Law No. 82-015, Community vessels are not allowed to fish within 10 nautical miles of any of the islands nor within a radius of 3 nautical miles of fish aggregating devices placed by the Comorian authorities.[1]

Enforcement

[12] Law No. 82-015 specifies which officers have enforcement powers, namely "sworn officers of the oceanography and fisheries department; officers in charge of surveillance of the Comorian maritime zones; sworn merchant marine officers; customs officers; police officers; and officers of the national navy" (ibid., art. 13). Any authorized officer may, without warrant:

- order a foreign fishing vessel to stop and allow boarding;
- inspect relevant documentation, fishing gear and catch;
- give instructions to any persons on board in order to facilitate inspections;
- in case of commission of violations, seize the vessel and any objects and take the vessel and its crew into a port; and
- in case of absolute necessity, arrest any persons on board (ibid., arts 9 to 11).

[13] The right of hot pursuit is recognized in accordance with international law (ibid., art. 12).

1. Annex to the Protocol, condition 5

[14] Foreign fishing licences may be suspended or cancelled in case of violations or in the interest of good management of fisheries (ibid., art. 7).

[15] Penalties may consist of fines and forfeiture of any objects connected with the offence or the vessel. Activities such as fishing without a licence, violation of fishing licence conditions or failing to be in possession of a licence, are subject to a fine of between CF 10 million and CF 80 million. This amount may be doubled in the case of repetition of offences within 5 years of the last offence committed (ibid., art. 16). Violation of the rule on stowage of fishing gear may lead to a fine of from CF 7 million to CF 15 million (ibid., art. 15).

[16] In order to facilitate the exercise of powers of enforcement officers, obstruction to their work is subject to a fine ranging from CF 1 million to CF 3 million (ibid., art. 17)

[17] Article 20 of Law No. 82-015 provides for seizure of the fishing vessel, the gear(s), the equipment and fishery products on board until the payment of the fines and any other expenses defined by the Court.

KENYA

Monitoring

[18] The requirement to provide statistical data is a general condition in any licence (The Fisheries Act, No. 5 of 1989, sec. 8 (4)). However, the form and kind of information are prescribed by the Director of Fisheries.

Elements of control

[19] All fishing - foreign as well as domestic (unless for "own consumption purposes") - in Kenyan waters is subject to a licence (ibid., sec. 8). The licence specifies species, type of fishing gear, method of fishing and area. Further, the Act provides for a local fishing vessel licence and a foreign fishing vessel licence (ibid., sec. 10). Stowage of gear is mandatory for any foreign fishing vessel in transit through Kenyan fishery waters (ibid., sec. 11 (2)).

[20] Registration with the Director of Fisheries of all vessels fishing in Kenyan waters is required (ibid., sec. 7). In addition, Ministerial regulatory powers include power to provide for the registration of fishing gear (ibid., sec. 23 (2)(i)).

Enforcement

[21] The Act defines "authorized officers" to include fisheries officers (i.e., the Director of Fisheries and any person in the public service of or above the rank of Assistant Fisheries Officer, which are defined in detail); police officers of or above the rank of inspector; officers of the Navy or other armed force; and any other persons appointed by the Minister (ibid., sec. 2).

[22] Authorized officers may, without warrant:

- stop, board and inspect any fishing vessel in Kenyan fishery waters, and any local fishing vessel outside such waters;
- stop and inspect any other vessel or vehicle transporting fish;

- require to be produced and examine any catch or fishing gear;
- take fish as samples; and
- if they believe that an offence has been committed:
  - enter any premises,
  - arrest any person, and
  - seize any objects, including vessels or vehicles (ibid., sec. 18).

[23] Penalties include imprisonment as an alternative or in addition to a fine in every case (ibid., secs. 7, 8, 9, 11, 15, 16, 17, 22). Some offences and related penalties are illustrated in Table 1.

Table 1 Offences and related punshiments according to The Fisheries Act of the Republic of Kenya (Act No. 5 of 1989)

OFFENCE	FINE	IMPRISONMENT	BOTH
Lack of registration of fishing vessel	Upon 1st conviction: max. K Sh 10 000, or	max. 6 months	or both
	Upon 2nd conviction: min. K Sh 20 000, or	max. 1 year	or both
Unlicensed local fishing vessel	Max. K Sh 20 000, or	max. 1 year	or both
Unlicensed foreign fishing vessel	Min. K Sh 50 000, and max. K Sh 500 000, or	min. 6 months and max. 2 years	or both
Obstruction of authorized officers	Max. K Sh 20 000, or	max. 1 year	or both
Receiving or retaining any fish in respect of which an offence has been committed	Min. K Sh 5 000, and max. K Sh 500 000, or	min. 6 months and max. 2 years	or both
Fishing without a licence	Max. K Sh 20 000, or	max. 2 years	or both

[24] Arrested persons must be brought before a Court as soon as reasonably practicable. Seized articles may be released to entitled persons upon payment of adequate bond or security.

[25] The Director of Fisheries may, with the approval of the Minister and provided (obviously) that the person admits the commission of an offence, compound offences. The sum to be paid should not exceed the maximum fine envisaged for the offence. Under the same circumstances, the Director of Fisheries may order the release of any vessel or any other thing seized in connection with the offence on payment of a sum of money not exceeding the value of the vessel or other thing (ibid., sec. 20).

MADAGASCAR

Monitoring

[26] Special conditions applicable to foreign fishing vessels are prescribed in Part IV of the Fisheries Regulations (Decree 94/112 - arts. 20 to 30). For example, vessels in transit must keep any fishing gear securely stowed; vessels which are authorized to fish must notify

entry into Madagascar waters and exit from them; they must keep a logbook with all relevant information on the fishing activity.

Elements of control

[27] The fisheries legislation (*Ordonnance* No. 93.022 of 4 May 1993) requires the responsible Ministry, in cooperation with other interested Ministries, to prepare plans for the management and conservation of fisheries (Ibid., art. 6).

[28] Fishing activities - whether national or not - are in principle subject to a licence (ibid., art. 12).

[29] National fisheries are divided into subsistence, commercial (traditional, artisanal and industrial), sport and experimental fisheries (Decree No 94/112, arts. 4 to 7). Licences for artisanal or industrial fisheries are valid for a maximum of one year and are renewable (ibid., art. 13).

[30] Fisheries regulations (Decree No. 94/112) divide vessels into four categories, of which the third and the fourth are foreign vessels, which respectively are or are not based in Madagascar and land their whole catch there (ibid., arts. 8 and 9). Vessels of the fourth category are excluded from fishing some species. Other special conditions applicable to foreign fishing vessels are prescribed in Part IV (ibid., arts. 20 to 30). For example, vessels in transit must keep any fishing gear securely stowed; vessels which are authorized to fish must notify entry into Madagascar waters and exit from them; they must keep a logbook with all relevant information on the fishing activity; they must mark their vessel in the appropriate manner.

[31] Some conditions are established specifically on the contents of fisheries agreements which may be entered into under art. 13 of the fisheries law (Ordonnance No. 93.022 of 4 May 1993). In particular, the agreements must include an obligation for the other party to adopt all necessary measures to guarantee compliance with the agreement and all applicable legislation by the vessels authorized (ibid., art. 24).

[32] Quality controls on fishery and aquaculture products may be carried out at landing stations, processing establishments and selling places (ibid., art. 16, para. 3).

Enforcement

[33] Article 18 of Ordonnance No. 93.022 lists enforcement officers, which include the personnel of the fisheries and aquaculture administration, police officers who have been authorized for this purpose, officers in command of State vessels, merchant marine and customs officers, and officers who may have been authorized by agreement with other States.

[34] Enforcement powers are specified in art. 19 (ibid.). Any enforcement officer may:

- order any vessel to stop and allow boarding;
- inspect the vessel, its catch, fishing gear and documentation;
- enter and inspect any premises used for professional fishing;
- take samples of catches from vessels or premises which have been inspected;
- seize any vehicle or fishing instrument or any other object suspected of having been used in the commission of the offence; and
- in case of commission of an offence, order the vessel to be taken into a national port if this is necessary to obtain evidence of the offence or as a guarantee for the execution

of a possible conviction, or in any case if the offender is an unauthorized foreign vessel caught fishing.

[35] If the offender is an unauthorized foreign vessel caught fishing the vessel, with its crew, must be withheld until settlement of the procedure or payment of an adequate bond.

[36] Offences and related penalties are listed in arts. 21 to 24 of Ordonnance No 93-022. Violations by foreign fishing vessels are punished more seriously, i.e., the fine may be from SDR 80 000 to 400 000, against FMG 50 million to 500 million for an offence committed by an industrial national fishing vessel.

[37] Destroying or dissimulating documentary evidence and deliberate obstruction of officers is punished with a fine ranging from FMG 15 000 to 150 000 for sport fishing; from FMG 25 000 to 250 000 for traditional fishing; from FMG 500 000 to 5 million for scientific research fishing; and from FMG 50 million to 500 million for industrial fisheries. Reference is made (ibid., art. 25) to the Penal Code in cases of violent obstruction of the authorized officers in fulfilling their jobs. Imprisonment is not envisaged as a penalty. However, pursuant to art. 19 (2) of Ordonnance No. 93.022, the crew of a foreign vessel caught fishing illegally may be detained until the settlement of procedures or payment of a bond pursuant to art. 29 (ibid.).

[38] Pursuant to art. 28 (ibid.), any offence may be compounded by the Minister, by payment of an amount which may not be lower than the minimum nor higher than the maximum amount of the fine envisaged for the offence and the value of goods which could be confiscated. In the event of compounding, forfeiture of seized articles and cancellation of licences may still be ordered.

MALDIVES

[39] On 3 June 1996, the Government of the Republic of Maldives adopted a new maritime zones law which follows the logic found in the 1982 United Nations Convention on the Law of the Sea (1982 UN Convention)[1]. This law repeals Law No. 30/76 of 27 November 1976, which defined the exclusive economic zone (EEZ) of the Maldives as "the area, including the sea as well as the seabed and subsoil thereof, situated within the lines joining the points of which the coordinates are given." With the new law, Maldives has abandoned a rectangular EEZ and introduced five concentric rings of waters: internal waters, archipelagic waters, territorial waters, contiguous zone, and EEZ up to the neighbouring states' EEZ or the high seas.

[40] Law No. 5/87 of 24 August 1987 constitutes the basic fisheries law, and thus the basic framework governing fisheries in Maldives, including for MCS. It specifies the Ministry of Fisheries' responsibilities for fisheries development, the administration of the law and for fisheries research activities (ibid., art. 3)

Monitoring

[41] Law No. 5/87 makes the Ministry responsible for gathering the information necessary for fisheries management, and establishes a duty for all persons conducting fisheries in the

1. The 1982 UN Convention has been signed by the Government of the Republic of Maldives, but had not been ratified at the time of writing.

country, regardless of whether they are licenced or not, to supply "all fisheries data the Ministry may require" (ibid., art. 4).

[42] Hence the obligation for the fishermen to report to the Island and Atoll Chiefs; for the latter to report to the Ministry of Fisheries and Agriculture (MOFA); and for those fishing in the EEZ behind the Coastal Fisheries Zone (CFZ, see below) in a prescribed form. Regarding the last-named, appropriate reports are required on fishing gear, and activities in terms of time, location and catches.

[43] The Maldivian Government has developed and uses "port State controls" imposing pre-fishing port visits and after-fishing port visits for vessel inspection and the collection of basic data on catch, species, location, etc.

[44] One important gap in the current legal framework governing fisheries is the absence of a penalizing structure for omission of transmission of data: failing to file reports is not fined as such.

[45] Finally, under the law relating to giving information regarding fishing vessels belonging to foreign nations seen fishing within the EEZ (Law No. 20/78), reports must be forwarded to MOFA of foreign fishing vessels carrying out fishing activities. These reports are transmitted to the National Security Service through Island and Atoll Chief's Offices by radio, which is in continuous operation.

Elements of Control

[46] All foreign fishing activities and all foreign participation in Maldivian fisheries are come under the authority of the Ministry of Trade and Industries (MTI). Foreigners are defined as including Maldivian joint ventures with foreigners, and the government may in each case decide whether it wishes to permit such arrangements for fishing purposes (Law No. 5/87, art. 5).

[47] Fishing activities carried out for export or any other commercial purposes "in the waters of the Exclusive Economic Zone of the Maldives beyond the area most commonly used by Maldivians for fishing[1]" can only occur under the licensed authority of MTI and under payment of a fee to the Ministry (ibid., art. 6). For this purpose, "any party so fishing" is required to conclude a written agreement with MTI. Such agreements must include provisions which specify "the licence fee and the royalty," the rights for the Government to cancel and suspend the licence in case of contravention, to send a person or persons on board for inspection purposes whenever necessary, as well as provisions which require the use of traditional fishing methods and vessels for catching bait fish, and which foresee the competence of Maldivian courts for the trial of cases (ibid., art. 6).

[48] The Regulations for issuing licences to fish in the EEZ of the Republic of Maldives (undated) implement the aforesaid Article 6 of the law. The licence, issued by MTI, permits fishing in the sea "outside and beyond 75 miles from the archipelago baselines of the islands situated at the outer edge of the atoll of the Republic of Maldives" (art. 2 of the Regs). Before issuing such licences, the total allowable catch (TAC) for the year "shall have been

1. Article 14 (Law No. 5/87) specifies what is to be understood by "the fishing grounds most commonly used by Maldivians", namely an area "extending to a distance of 75 miles from the outer reefs of atolls, including the sea bottom." In doing so it defines the Coastal Fishery Zone: it is reserved exclusively for exploitation by Maldivian traditional fishermen, while the waters beyond the 75-mile line is for commercial and foreign fishing.

determined by MOFA" (ibid., art. 3). MTI determines the number of vessels to be licensed by each and every party, taking into account the overall TAC (art. 7 of the Regs). The licensee pays, as a condition of the issuance of a licence, a royalty on the net tonnage of the vessel, equivalent to ECU 20 per net ton in a convertible currency acceptable to the Maldivian Monetary Authority (art. 8 of the Regs). This royalty is adjusted against the actual catch when the vessel calls for port clearance before departure. Net tonnage means the measure of the useful capacity of a ship determined in accordance with the provisions of the International Convention of the Tonnage Measurement of Ships of 1969 (art. 8 of the Regs). In addition, the licensee is required to pay - in a convertible currency acceptable to the Maldivian Monetary Authority - for every licence a fee equivalent to ECU 5 per metric ton of the gross tonnage of the vessel (measured in accordance with the provisions of the International Convention on Tonnage Measurement of Ships of 1969) (art. 9 of the Regs). Under the Regulations, conditions attached to the licence include respect of the laws of Maldives (art. 11); collaboration in boarding and inspections (art. 12); the provision of adequate boarding, lodging and medical expenses for official(s) "stationed on any or all licensed vessels" when so decided by the Government (art. 13); the provision of training to Maldivian nationals, at no cost, when so required by the Government (art. 14); and the provision of statistical data in the form specified by MTI (art. 15).

[49] Foreign fishing vessels (including those with foreign participation in Maldivian fisheries) also have to apply for a registration certificate with the Foreign Investment Services Bureau, MTI.

[50] Licences shall only be granted for pole and line fishery, longline fishery and trolling (art. 5). Licensed vessels are not allowed to engage in bait fisheries: such activity may only be conducted by vessels which are traditionally engaged in bait fisheries in Maldives (art. 6).

[51] Article 7 of Law No. 5/87 requires any fishing vessel not licensed under the law and entering the EEZ of Maldives "for whatever reason" to obtain prior permission of MOFA.

Enforcement

[52] As an aid to enforcement, Article 8 of Law No. 5/87 provides that the Maldivian Government may cancel the licence issued to a vessel under Article 6 or cancel the entire agreement with the party concerned in the light an offence and its magnitude, or if necessary for peace or security purposes. This provision is usually attached as a condition to the fishing licence (arts. 16 and 17, respectively).

[53] A special regime is been provided for lagoon fisheries, under the *Rules for fishing in the lagoons of Maldives* and the *Law relating to the territory covered by the lagoons of uninhabited islands* (No. 29/78). The rules regulate (i) fishing by inhabitants from another island (hereinafter called 'visitors') in the lagoon of the islands of which they are not an inhabitant, (ii) fishing in enclosures, (iii) fishing by inhabitants from another atoll (hereinafter called 'visitors') in the lagoon of an atoll in which they do not reside and the setting aside of an area for common fishing in lagoons of a certain size. As such, an authorization system (lessee or sub-lessee system) is managed by island chiefs in the case of inhabited islands, or by person(s) in charge of uninhabited islands in other cases, and by the Atoll's Office in the case of fishing in another atoll for lagoon purposes. Where enclosures have been build by inhabitants of one or more island(s), fishing by visitors can only occur with the permission of those responsible for the enclosure. If people wish to make an enclosure in the lagoon of

an uninhabited island, permission is needed from the competent Atoll Chief. There is no aid to enforcement of these rules, i.e., no sanctions.

A.Restricted fishing activities relate to certain species (tortoises and turtles under a certain size; young female lobsters carrying eggs; and young lobsters) and to certain fishing methods (dynamite, underwater guns and spears). It is also forbidden to fish with nets, "sharp instruments" or "chains of hooks" within the northern breakwater of Malé (*Law relating to fishing inside the Northern Breakwater of Malé*, No. 22/78).

[54] Article 15 of Law No. 5/87 empowers the Ministry of Defence and National Security to stop, search, inspect and apprehend any vessel suspected of an offence against the Law, and to arrest any person or persons suspected of contravening the law and "required for investigations or trial in court" (ibid., art. 11). Article 12 provides for the transfer of seized items under the care of the Ministry of Defence and National Security until completion of the legal proceedings. Meanwhile, any perishable good (fish or other) may be sold by auction by the Ministry, which is allowed to keep "the proceeds of such sale."

[55] Art. 13 of Law No. 5/78 provides for penalties, depending on the magnitude of the offence:

- fishing or attempting to fish without a licence foreseen under art. 6: a fine of between Rf 100 000 and Rf 1 million, or a sum of money not exceeding the cost of the vessel employed for the offence, with confiscation of articles used and gains obtained out of such an offence;
- fishing in the EEZ without the permission specified in art. 5: a fine of between Rf 100 000 and Rf 1 million, or a sum of money not exceeding the cost of the vessel employed for the offence, with confiscation of articles used and gains obtained out of such an offence;
- vessel licensed under art. 6 contravening the law: a fine of between Rf 1 000 and Rf 1 million, or a sum of money not exceeding the cost of the vessel employed for the offence, with confiscation of articles used and gains obtained out of such an offence;
- offences committed against the law by persons having the right to fish (without a licence) in the fishing grounds most commonly used by Maldivians: a fine of between Rf 100 and Rf 10 000, or imprisonment or banishment or house arrest for a period between 3 months and 1 year.

[56] In the first three cases the fines are to be paid in a foreign currency likely to be accepted by the Government.

MCS and the institutions

[57] The Fishery Advisory Board, created in 1979, has the mandate to advise the government on fisheries policy. Although its formal responsibility is only advisory, through the Board, MOFA has in fact dictated the conditions under which the MTI may grant a fishing licence to Maldivian and foreign commercial fishing activities, i.e., fishing beyond 75 miles from the outer reef of the atolls.

[58] Law No. 5/87 provides for MOFA's responsibilities for fisheries development, the administration of the law and for fisheries research activities (art. 3). This includes regulatory powers. It makes MOFA responsible for gathering the information necessary for

fisheries management and establishes a duty for all persons conducting fisheries in the country, regardless whether licensed or not, to supply "all fisheries data the Ministry may require" (art. 4). MOFA has no power to issue licences, but does issue permits for fishing vessels not licensed under the law to enter the EEZ for whatever reason. It controls in this manner motorized fishing vessels not used for fishing purposes. More, MOFA determines the "total weight of the permitted catch" in the area beyond the 75-mile line.

[59] MTI is primarily responsible for issuing licences to fish in the waters beyond the 75-mile line, for granting foreign fishing licences and negotiating fishing agreements.

[60] The Ministry of Defence is given the responsibility "to patrol the EEZ of Maldives. To stop any unauthorized fishing activity conducted by foreigners within the Maldivian EEZ, to investigate in and stop any activity found to be detrimental to Maldivian fisheries, and to take the necessary action regarding such activities shall also be the responsibility of the said Ministry." This is done through the National Security Service, which includes the Coast Guard. It combines military and law enforcement functions, and has special responsibility for fisheries surveillance and enforcement. As such, it may apprehend any unlicensed fishing vessel (whether national or foreign) on the ground of its presence in the EEZ. As far as the CFZ is concerned, it does not enforce the fisheries law (rules related to prohibited gears, lagoon fisheries, etc.).

[61] The Ministry of Transport provides for registration of all vessels in Maldives, including fishing vessels. As such, it issues a registration number which allows for atoll and island identification. The number is to be marked on the vessels.

[62] Atoll Chiefs and Island Chiefs carry out most functions of the national administration. They are designated by the President upon advice of the Ministry of Atolls Administration, and are accountable to the latter. Atoll Chiefs and Island Chiefs (under delegation of authority) may perform enforcement duties. A communication system has been put in place between each Atoll Chief and the central government, and between the Island Chiefs and the Atoll Chiefs. Atoll Chiefs and Island Chiefs are responsible for collecting daily information from fishers on catch, species, weight, etc., for compiling these data into a form, and forwarding monthly such forms to MOFA. Under certain conditions, either the Atoll Chiefs or the Island Chiefs are responsible for issuing permits to fish in lagoons of the islands.

MAURITIUS

Monitoring

[63] As far as the Foreign Vessel Fishing Licences are concerned, as a condition of the fishing licence, reporting obligations are typically required of the agent of the owner and charterer of the vessel. The minimum requirement is a report by radio every 3 days, giving position and catch. This is complemented with landing and transhipment reports when the vessel is in port. Indeed, under the conditions attached to such licences, all fish caught in Mauritian waters ought to be transhipped in Port Louis Harbour. Before transhipment, the master or officer-in-charge of the vessel communicates to the Permanent Secretary, Ministry of Fisheries and Marine Resources (MFCMRD) information such as location of catches, amount of catches, and the fishing effort. Finally, while trip reports are not required, entry and exit reporting to the National Coast Guard (NCG) is required.

[64] Under the EU bilateral agreement, vessels above 50 GRT ought to communicate entry into and exit from Mauritian waters, and are subject to a three-day radio or fax reporting

obligation giving position and the volumes of catches on board. In addition, all licensed fishing vessels are required to compile and send a catch and effort report to the Mauritian authorities not later than three weeks after each fishing campaign (tuna purse seiners) and not later than one month after the end of each quarter for vessels fishing by line, tuna trollers and tuna surface longlines.

[65] Similar reporting obligations are a condition of national fishing vessel licences. These include the reporting, by the master or officer-in-charge, of "such information as may be required for the proper management of the fishery before disembarkation of the catch as well as of information concerning the position and catch every three days" or "as otherwise required by the Permanent Secretary, MFCMRD, and by radio or any other means". In the event of *force majeure*, the vessel may call at another port or tranship any catch at sea. Immediate communication thereof must be made to the Permanent Secretary, MFCMRD, or a written consent from the latter may be required. The Fisheries Protection Service (FPS) undertakes regular monitoring at landing stations and collaborates closely with Albion Fisheries Research Centre (AFREC).

Elements of Control

[66] Under the Maritime Zones Act of 1977, fishing in the EEZ is only permitted "in accordance with the terms of any agreement entered into with Mauritius or of a licence granted by or under the authority of the Prime Minister" except for Mauritian citizens and Mauritian companies approved by the Minister of Fisheries (ibid., Sections 7(2) and 7(5)). A licence for fishing by a foreign vessel may be granted under such conditions as the Prime Minister determines, including the kind and quantity of catch and fishing vessels, kinds of fishing and fishing gear, permitted areas and seasons, surveillance and enforcement measures and landing, training and employment requirements. The Maritime Zones (Fishing Licences) Regulations, 1978, as amended, determine an annual fee for vessels of Mau Rs 200 per GRT, and, apparently, in addition to fees, the permissible conditions allow for "charges to be paid." The regulations provide for forfeiture and other penalties for non-compliance with the terms and conditions of the licence.

[67] From an analysis of the terms and conditions attached to a Foreign Vessel Fishing Licence, it appears that foreign vessels (e.g., longliners) are usually only authorized to fish in the waters of Mauritius beyond 75 miles from the baseline. Conditions attached to the Foreign Vessel Fishing Licence refer to fishing zones, disposal of catch, reporting requirements, authorized landing place, and fees. Such a licence is issued to an operator (i.e., master or other individual on board a vessel and who is in charge of that vessel) for a designated vessel. It is not transferable and is to be held on board at all times. The licence fee for longliners is modest and amounts to $US 2 000/year. It is not based on vessel size nor on the landings. Further, the foreign licensed vessel needs to clearly display on both sides the radio call sign in "white markings at least one metre in height on a black background." The master or officer-in-charge of the vessel must inform NCG when entering and leaving Mauritian waters, giving its position of entry and exit, and must communicate on specified radio frequencies its position and catch every 3 days when in such waters. Finally, the issue of a licence does not relieve the vessel from the obligation to comply with any legislative instrument in force in Mauritius.

National fishing activities

[68]The Fisheries Act provides in considerable detail for the regulation of fisheries. Central to the Act are the provisions governing licences, the use of nets and the registration of fishers and fish mongers.

Nets

[69] A licence is required to possess most nets, with the exception of landing nets or carlet nets (Section 12), as well as to "import or deal in any net" (Section 15). Licensed nets must be stored in defined places and licensed dealers must record all purchases and sales and transmit such record to the Principal Assistant Secretary (Sections 13 and 15). Licences in general are not transferable (Section 3). Curiously the Act does not prohibit in an explicit manner the use of an unlicensed net. So far, there is only one seller and dealer in nets. A licence to import or deal, or both, in fishing nets costs Mau Rs 150 quarterly. (Schedule (Regulation 3) Third Schedule - Government Notice No. 9 of 1986 - Regulations made by the Minister under Section 38 of the Fisheries Act).

[70] In respect of the island of Mauritius, fees for the possession of a canard net amount to Mau Rs 25/month, a cast net Mau Rs 15/quarter, a gillnet Mau Rs 25/quarter, a large net Mau Rs 50/quarter, and a shrimp net Mau Rs 15/quarter; in respect of Rodrigues and other islands, fees for a large net amount to Mau Rs 17.35/quarter and for a gill net Mau Rs 17.35/quarter (Government Notice No. 18 of 1983, First Schedule).

[71] Besides the licensing, only fishing with gears listed in the Act is allowed (Section 11). Exceptions may be authorized by the Minister upon advice of the Fishery Advisory Board provided for under the Act. In addition to the items listed, details such as type, dimensions and mesh size are defined in the Interpretation Section (Section 2).

Boats

[72] Any person who owns a fishing boat is required to register it (Section 23). A fishing boat is being defined as "any raft, craft or vessel of any size, used, intended to be used or capable of being used, for fishing" (Section 2). Every registered fishing boat receives an identification badge and an identification mark to be clearly displayed on the boat (Section 24). The Principal Assistant Secretary holds the register of 'fishing boats' (Section 25). Professional fishers as well as owners of 'fishing boats' (Section 2) are required to land all their catch at designated landing stations (Section 7). The Act is silent on the possibility to revoke or refuse registration, and on the possibility to attach conditions to a registration.

Registration of fishers and fishmongers

[73] Any person for whom fishing is the major income and main activity is likely to be registered with the MFCMRD as a professional fisher. In 1995, 2711 were registered. In addition, the person who buys the fish from the fishers for commercial purpose is required to register as fishmonger. Registration is a condition to obtain either licence. The fees for a fishmonger's licence for a company is Mau Rs 1 000/year; for an individual it is Mau Rs 200/year or Mau Rs 50/quarter (Schedule (Regulation 3) Third Schedule - Government Notice No. 9 of 1986 - Regulations made by the Minister under Section 38 of the Fisheries Act). Moreover, as far as fishers are concerned, registration as a professional fisher entitles them to special allowances, such as bad weather and closed seasons allowances.

Fishing licence (Mauritian vessels)

[74] The Fisheries Act No. 5 of 1980 requires a 'licence' granted by the Prime Minister for any fishing in the EEZ. It does not repeal the licensing provisions of the Maritime Zones Act of 1977, which are not in contradiction with the present licensing requirement.

[75] Terms and conditions attached to the licence specify the fishing operations authorized, the areas where fishing operations are authorized, mode of fishing, periods during which fishing is not authorized, landing stations (port and place), mode of preservation or of catch, TAC of gaffed fish in tonnes, and display of the licence number.

[76] Conditions attached to current licences are similar to Foreign Vessel Fishing Licences, but contain a few additional conditions, noted below.

[77] Under the Fishing Licence for Mauritian vessels, conditions give the Ministry the rights to modify the terms and conditions specified in the licence at any moment. Any modification will be brought to the attention of the licensee by means of a notice.

[78] Further, a vessel authorized to land fish in Port Louis Harbour can not leave for a fishing trip without being issued a "certificate from the Permanent Secretary, MFCMRD," whereas licensees of other vessels shall inform the Permanent Secretary of their departure at least 24 hours prior to departure. All fish caught must be landed within the limits of Port Louis Harbour or as otherwise stated in the licence. Reporting requisites include the requirement for the master or officer-in-charge of the licensed fishing vessel to report to the Permanent Secretary, MFCMRD, any vessel suspected to be unlicensed and fishing in the waters of Mauritius. Moreover, in addition to three-day radio reporting obligation, other "such information as may be requested for the proper management of the fishery before disembarkation of the catch" as may be required from the master or officer-in-charge. Finally, the vessel may not call at another port or tranship any fish at sea.

Licences provided for under bilateral fishing agreements

Mauritius - Seychelles

[79] Only two Mauritian purse seiners (of the five authorized) are at the time writing licensed by the Seychelles to fish tuna in Seychelles waters under the Agreement between the Government of the Republic of Seychelles and the Government of the Republic of Mauritius on fishing in Seychelles waters. This agreement entered into force on 10 April 1993, and was renewed on 10 April 1995, for two years. Under the agreement, the Mauritius is required to undertake all necessary steps to ensure that Mauritian vessels comply with this agreement.

[80] Of particular interest is the provision whereby both Parties undertake to coordinate their action to ensure the proper management and conservation of living resources, particularly highly migratory species in the Indian ocean, especially in and around Mauritian and Seychelles waters. Upon notification by Mauritius, Seychelles may also at any time take appropriate measures for purposes of conservation and protection of fish stocks in Seychelles waters.

[81] Fishing conditions relate to fishing zones, landing, transhipment, by-catch, radio communication, the presence of observers, and application procedure for a licence to fish provided for under the agreement. The fee ($US 70 000 for purse seiners and $US 80.00/GRT/year for longliners) is payable on a quarterly basis.

Mauritius - European Community

[82] The Annex to the Protocol defining, for the period 1 December 1993 to 30 November 1996, the fishing opportunities and the financial contribution provided for by the Agreement between the European Community and the Government of the Republic of Mauritius on fishing in the waters of Mauritius provides for "Conditions for the pursuit of fishing activities by Community vessels in the waters of Mauritius." They relate to the application and issuance of licences, their validity and fees; the observers programme; radio communication and reporting; fishing zones; and supply to the tuna canning industry.

[83] The licence fee for tuna purse seiners is ECU 20/t of catch. To this effect, a lump sum of ECU 1 000/year is paid for each vessel, in advance, before the issuance of the licence. The same rule applies to small tuna trollers and surface tuna longliners, but the licence fee is fixed at ECU 20/t caught, and the lump sum is ECU 500/year. A sort of compensation and counter check system is foreseen if the amount due for actual fishing exceeds the advance lump sum paid. In other words, fishing vessels have to pay an additional ECU 20/t of tuna caught in excess of the 50 t (purse seiners) or 25 t (small trollers and surface longliners).

[84] For vessels fishing by line (other than the above), licences are valid for three, six or twelve months and the fee is set in relation to the GRT, namely ECU 60/GRT *pro rata temporis*.

[85] Tuna purse seiners, tuna trollers and tuna surface longliners are only allowed to fish beyond the 12 mile limit, while vessels fishing by line are only authorized to fish in their traditional grounds, namely Soudan Bank and East Soudan Bank.

Enforcement

[86] Powers of enforcement officers are specified (Fisheries Act, No. 5 of 1980, Sections 26 to 32). They may:

- where they suspect that an offence has been committed, stop and inspect boats and vehicles (sec. 26);
- with a warrant issued by a magistrate or, in an emergency, by the Principal Assistant Secretary, enter and search any boat, vehicle or premises (secs. 27 and 28);
- arrest any person found committing an offence if they do not give satisfactory information as to their name and address (sec. 29); and
- seize articles used in connection with the offence, including the boat (sec. 31).

[87] Routine checks are therefore not envisaged, since there has to be a suspicion that an offence has been committed. However, pursuant to the Maritime Zones (Fishing Licences) Regulations, 1978, licence conditions may require that the licensee allow inspections at any time (art. 4(4)(d)). The licence condition does not appear to be appropriate for boarding offshore fishing boats, given the difficulty of proving an offence is suspected.

[88] Under the conditions attached to the Fishing Licence Foreign Vessel, the master or officer-in-charge of the vessel must, whenever requested by an officer authorized by the Permanent Secretary, MFRM, permit boarding and inspection of the vessels, produce for examination documents required to be maintained on board, all fishing gear and catch, and bring the vessel into port.

[89] Some conditions provide also for the possibility for Mauritius to have observers on board for part or all of a trip.

Penalties

[90] Sections 31 and 32 provide for seizure of nets, 'implements' or 'fishing boats' being used or having been used in the commission of an offence, and disposal of seized articles. In relation to disposal of siezed articles, it provides for forfeiture of seized article if not reclaimed within 15 days (Section 32(2)).

[91] Penalties are provided for under the Fisheries Act, imposing fines (max. Mau Rs 1 000) and prison sentences (max. 12 months) on contraventions to the Act or any conditions attached to any permit or licence granted under the Act. Imprisonment seems to be mandatory for almost every offence from the formulation of Section 34, stating that offenders are "liable to a fine not exceeding ... **and** to imprisonment ... " However, probably this is not the intended interpretation, since sub-section 3 of the same section, which envisages imprisonment as an additional penalty, is formulated differently (" ... imprisonment ... **together with a fine** ... ")

[92] Non-compliance with the terms and conditions attached to the Foreign Fishing Vessel Licence or the national fishing vessel licence may lead forfeiture of catch in the vessel or any support vessel, forfeiture of the vessel and revocation of the licence. Fishing-support vessels include vessels which carry out any activity in support of fishing, including storage, refrigeration or processing.

[93] It is worth noting that under the Special terms and conditions attached to the Fishing Licence (Mauritian Vessels), the master or officer-in-charge of the licensed fishing vessel is required to report to the Permanent Secretary, MFCMRD, any vessel suspected to be unlicensed and fishing in the waters of Mauritius.

Administrative structure

[94] Since 1993, the Ministry of Fisheries, Cooperatives and Marine Resources Development (MFCRM) is, generally speaking, responsible for the management and control of marine resources, including fisheries. The Albion Fisheries Research Centre (AFREC) is an important arm of the Ministry, responsible for research and development of fisheries. Headed by a Divisional Scientific Officer, it deals with stock assessment, import and export quality control, marine affairs, coastal and offshore fisheries, enforcement, extension, gear development and training. Another important service is the Fisheries Protection Service (FPS), which constitutes the enforcement branch of the Ministry as far as coastal fisheries are concerned. It comprises 210 members in Mauritius and 38 in Rodrigues, which work on a roster basis, with 3 persons continuously on call.

[95] FPS is responsible for ensuring compliance with the fisheries legislation by coastal fishers. As such, functions include (i) the protection of the lagoon and outer lagoon from illegal fishing by monitoring net licences, etc; (ii) control of registration of fishing boats and all professional fishers; (iii) control of landings (species, size, etc.) at the fish landing station level, and (iv) the initiation of legal proceedings against offenders. The number of cases referred to the courts for further prosecution were 594 in 1993, of which 224 were because of the use of unlicensed nets.

[96] The State Law Office and FPS collaborate closely in assessing contraventions. Furthermore, training is being provided to enforcement officers concerning aspects of prosecution.

[97] The National Coast Guard Act, 1988, established NCG for the purpose of exercising surveillance over the maritime waters of Mauritius. It is a "specialized unit of the Police Force" and comes "under the command of the Commissioner of Police" (Section 3). Duties of NCG include enforcing laws relating to national security, protecting maritime zones, and detecting, preventing and suppressing any illegal activity within the maritime jurisdiction (Section 6). Moreover, it performs similar duties which any other enactment will have enabled it so to do (Section 6(2)). The Act provides that at least five Coast Guard Areas are required to be created for the island of Mauritius and at least one for each island of Rodrigues, Agalega and Trommelin, and the archipelagoes of Cargados carajos and Chagos (Section 7). NCG has the authority to board any vessels (Section 10(1)). The Act also allows NCG to "fire at or into a vessel which does not bring to" upon being ordered so to do by any vessel or aircraft of the NCG and after warning signal (Section 10(4)). Failure to comply with the orders of NCG is an offence and may lead to a fine of from Mau Rs 500 to 5 000, and to imprisonment for a period not exceeding 2 years (Sections 13 and 15). Additional relevant authorities (limited to the maritime zones) include the authority to "prevent any activity which is likely to constitute a threat to the maritime zones, including seabed, the flora, the reefs, the beach and the coastline" (Section 12(b)); "to monitor and control all seaborne activities within the maritime zone" (Section 12(f)); "to stop, arrest, search, detain or seize any vessel or aircraft upon reasonable suspicion that it is engaged or about to be engaged in any illegal activity" (Section 12(h)); and "to cooperate or maintain contact with such department or authority or other agency as it may consider necessary in or for the execution of its duties and any related matter" (Section 12(r)).

MOZAMBIQUE

[98] The Fisheries Act of 1990 (*Lei* n. 3/90) is expressly applicable to all fishing vessels of Mozambique, even if in international waters or in the waters of other countries (art. 2(2)).

Monitoring

[99] Specific provisions in the Act are devoted to collection of data, which must be submitted as prescribed and are considered confidential (ibid., art. 25). Fishing vessels may be requested to notify their position or supply information on catches at any time (ibid., art. 27).

Elements of control

[100] Pursuant to the Act, the Council of Ministers must promote the preparation and updating of fisheries development plans (*desenvolvimiento*) and provide for their implementation. Involvement of concerned people in the preparation of the plans is encouraged (ibid., art. 8).

[101] A specific provision is devoted to international cooperation, stating that the Council of Ministers must promote the negotiation of international agreements for cooperation in fisheries, particularly at the regional level. Objectives of such agreements must include

harmonization of fisheries regulations (*ordenamento*), of management, of data collection, and of conditions of access for foreign vessels, particularly with regard to straddling stocks (ibid., art. 7).

[102] Fishing vessels and gear must be marked as may be prescribed by regulations (ibid., art. 23).

[103] *Tecnicos de investigacao* (scientific observers) and *agentes de fiscalizacao* (enforcement officers) must be allowed to remain on board and be given accommodation as required by the Fisheries Department (ibid., art. 24).

[104] All fishing vessels must be registered pursuant to the legislation on maritime safety (ibid., art. 30).

[105] Foreign fishing vessels may be allowed access under international agreements entered into for this purpose or by contracts, subject to some conditions (ibid., arts. 32 to 34).

Enforcement

[106] Enforcement officers, pursuant to art. 41, are officials, inspectors and other officers designated by the Fisheries Department (*Secretaria de Estado das Pescas*), authorized officers of the maritime or customs authorities, officers in command of military vessels or aircraft on fisheries enforcement actions, and any other competent officer.

[107] Their powers are specified in Articles 42 to 45. They may:

- order any fishing vessel to stop and allow boarding (routine checks are therefore allowed);
- inspect (*visitar*) fishing vessels anywhere;
- examine relevant documentation;
- order that any fishing gear be shown to them;
- inspect (*visitar*) any premises where there is reason to believe that illegally caught catch or illegal fishing gear may be found;
- inspect (*inspeccionar*) fish processing establishments;
- inspect (*inspeccionar*) books of fishing or transhipping companies;
- seize any objects, including the catch and the vessel, used in connection with an offence; and
- when a vessel is seized pursuant to these provisions, it may be detained with its crew in a port, until settlement of the relevant procedures. This is the only form of power of arrest envisaged in the Act.

[108] Officers must cause the least possible disturbance to fishing vessels (ibid., art. 44). The right of hot pursuit may be expressly exercised in accordance with international law (ibid., art. 45). Seized articles are disposed of in accordance with the procedure set out in Article 50 of the Act, and must be released upon payment of adequate bail (ibid., art. 62).

[109] Major offences are specified in the Act, while reference is made to regulations for specifying other conservation measures (ibid., arts. 35 and 36). Fishing without a licence by national or foreign vessels is punished by a fine and by seizure of all fishery products on board. In the case of foreign fishing, the fishing gear will also be seized (ibid., art. 52).

[110] Serious offences (*infracçoes de pesca graves*) are listed in art. 53, and are punishable with a fine. Serious offences include fishing in prohibited areas, fishing of prohibited species, the carrying on board fishing vessels of objects related to the use of explosives,

electricity or poisonous substances for fishing. In addition to the fine, the fishing licence may be revoked and the fishing gear or equipment and all fishery products on board may be seized. Imprisonment is not envisaged in any case. Reference is made to other applicable legislation for the punishment of violent obstruction of officers (ibid., art. 55). No minimum or maximum limits are given in the Act as to the amount of any fine (possibly this is regulated by other principal legislation, or is to be established by regulations). However, fines must be calculated taking into account the type of fishing, of fishing vessel and other factors (ibid., art. 58).

SEYCHELLES

Monitoring

[111] The basic fisheries legislation consists of the Fisheries Act, 1986, and associated Regulations, and the Licences Act, 1986, and associated Regulations.

[112] Pursuant to the Fisheries Act, 1986, the Seychelles Fishing Authority must prepare and update plans for the management and development of fisheries (Section 3). The collection and analysis of information on fisheries is a responsibility of the same Authority. Every person engaged in fishing or related activities must submit information as may be required by it. Reporting requirements are provided for in Section 5 of the Fisheries Act and Regulations 5, 6 and 7 of the Fisheries Regulations. Twice-weekly reporting of position is required as a standard provision of bilateral agreements (unless the agreement specifies otherwise) and as a condition of a licence to foreign vessels. The possibility is envisaged for the Minister to enter into agreements with other countries providing for the exchange of information (ibid., Section 5).

[113] Pursuant to the Protocol defining - for the period 18 January 1996 to 17 January 1999 - the fishing opportunities and the financial contribution provided for by the Agreement between the European Community and the Republic of Seychelles on fishing off Seychelles (EU-Seychelles Fishing Agreement), licensed Community vessels are required to complete a fishing form for each fishing trip undertaken in Seychelles waters. Even in the absence of catches, the fishing forms need still to be filled. Interestingly, such a fishing reporting form has also to be provided with the notation "Outside Seychelles' EEZ" while the licensed Community vessels are not "present in the Sechelles' EEZ." If they call into Port Victoria, the completed forms have to be submitted within 5 days of arrival, or in any event before they leave the port, whichever occurs first. In other cases, the completed forms have to be forwarded to the Seychelles authorities within 14 days of arrival in any port other than Victoria. In addition, within 3 hours of each entry and exit of the EEZ, and every 3 days during their fishing activities in Seychelles waters, Community vessels have to communicate directly to the Seychelles' authorities, preferably by fax or, in the event of failure, by radio, their position and the volume of catches held on board. Non-compliance with the above rules may lead to suspension, revocation or refusal to renew the vessel's fishing licence.

Elements of control

[114] The Fisheries Act requires a licence for any foreign vessel, and, unless it is exempted, for any local vessel, to fish in Seychelles waters. A chartered vessel and a vessel owned by a joint venture company (at least 51% Seychelles owned) can be licensed as a local vessel with the approval of the Minister.

[115] Licences to foreign fishing vessels can be issued exclusively under agreements entered into by the Government of Seychelles and the foreign State, inter-governmental organization or association to which the vessel belongs, unless otherwise determined by the Minister (ibid., Section 7). Seychelles has entered into agreements with Japanese Tuna Fisheries Cooperative Association, with the Government of Mauritius and with the Government of Russia. Unlicensed foreign fishing vessels must keep fishing gear securely stowed when passing through Seychelles waters (ibid., Sections 8, and Regulation 9 of the Fisheries Regulations, 1987).

[116] Under the Licences Act, licences are also required for large nets and lobsters, and there are several kinds of permits for turtles, shells and coral (Reg. 10 of the Fisheries Regulations, 1987).

[117] Provision is made within the regulations for a number of conditions to be attached to licences and, in particular, to foreign fishing licences. For instance, in addition to the reporting requirement mentioned above, licensees must appoint a local agent; a logbook reporting all fishing operations must be maintained; the vessel's position in Seychelles waters must be notified with the required frequency; observers must be allowed on board; and licensed vessels must be properly marked (Regulation 6).

[118] Fees for foreign fishing vessel licences are usually specified in the agreement (Fisheries Act, 1986, Section 6) or specified in the licence (Licences (Fisheries) Regulations, 1987, schedule 1(b)). They are based on GRT. For tuna long-lining the fee is SR 60/GRT for 1 month; SR 180/GRT for 4 months or more; SR 300/GRT for 8 months or more; and, for others, SR 1 000/GRT/year.

[119] The Annex to the Protocol defining, for the period 18 January 1996 to 17 January 1999, the fishing opportunities and the financial contribution provided for by the Agreement between the European Community and the Republic of Seychelles on fishing off Seychelles, provides for the "Conditions for the pursuit of fishing activities by Community vessels in the waters of Seychelles." They relate to the application and issuance of licences, the validity of licences and licence fees, observers programme, declaration of catches, employment of fishermen, landing, communications, fishing zones and port equipment, use of supplies and services, and sanctions.

[120] The licence fee amounts to ECU 20/t of catch. To this effect, a yearly lump sum of ECU 7 500 for tuna seiners and ECU 500 for surface longliners is paid for each vessel in advance, before issuance of the licence. This is equivalent to the fees for 375 t and 25 t, respectively, caught within Seychelles waters annually. Unless an exemption is granted by the Seychelles authorities, surface longliners are required before starting their fishing campaign in Seychelles' waters and then at the end of it to call into Port Victoria to check the catches held on board. Licensed surface longliners are allowed to fish tuna, swordfish, marlin and sailfish. Compensation and counter check systems are foreseen if the amount due for actual fishing exceeds the advance lump sum paid.

Enforcement

[121] Any licence may be suspended or cancelled in the event of violations of the terms of the lince, or if necessary for management purposes (Fisheries Act, 1986, Section 15).

[122] The compliance conditions referred to above facilitate surveillance, in addition to the powers of inspection granted to the Seychelles Fishery Authority and authorized officers.

Authorized officers include every public officer and officer of the Seychelles Fishing Authority authorized by the Minister. They may:

- stop, board and search any fishing vessel in Seychelles waters;
- examine documents, fishing gear and catch:
- where there is reason to believe that an offence has been committed, seize any articles used in connection with the offence, including the vessel, and take the vessel and its crew to a port (ibid., Section 19).

[123] Penalties consist of fines (ibid., Sections 24 and 25). Forfeiture of fish and any articles, and, in the case of an unlicensed foreign fishing vessel, of the vessel, may be ordered (ibid., section 25). A few examples of offences and the related fines applicable to foreign fishing vessels are given in Table 2 (from ibid., Section 24)

Table 2 Examples of offences and related fines applicable to foreign fishing vessels under the Fisheries Act, 1986, of the Republic of Seychelles

OFFENCE	FINE
Breach of any condition of the licence	SR 10 000 payable separately by the Operator and the Master
Illegal fishing	SR 10 000
Failure to stow gear in prescribed form	SR 5 000
Use of poisonous or explosive substances to kill, stain or disable fish	SR 50 000
Any interference with an authorized officer	SR 5 000
Failure to supply information under the Act or supply of false or misleading information	SR 50 000
Breach of regulations made under the Act	SR 20 000

[124] The Act as such does not allow for power of arrest. This is appropriate in that imprisonment is not envisaged as a penalty. However, the matter has been considered for revision, in order to allow power of arrest in some limited cases where it could be necessary. These would be in the event of obstruction of officers carrying out their functions, and where there is reason to believe that the offender will not respond to a summons. It appears from Table 2 that the fine for failing to file reports is five times the fine for a foreign fishing vessel's fishing without a licence (illegal fishing).

[125] It has also been considered to introduce a requirement for a bond to guarantee performance under a licence (pursuant to regulation promulgated under Section 17(1)(b) of the Fisheries Act, 1986). This would facilitate compliance with reporting requirements, which are often neglected by some vessels.

[126] Catch found on board a vessel which has been used in the commission of an offence is presumed to have been taken in the commission of the offence (ibid., Section 25(2)). The possession of illegally caught fish is considered to be an offence.

[127] The Minister may compound an offence upon payment of a sum not exceeding the maximum fine for the offence, and order the release of any vessel or other article seized in connection with the offence on payment of a sum of money not exceeding the value of the vessel or other articles involved (ibid., Section 26).

[128] A right of hot pursuit in accordance with international law is envisaged (ibid., Section 20).

[129] The possibility is envisaged for the Minister to enter into regional arrangements or agreements on surveillance and enforcement (ibid., Section 22).

TANZANIA

[130] The Fisheries Act, 1970, is a very brief statute providing for the making of orders and regulations. Even the offences under the Act, except for obstructing an officer, are prescribed by order and regulation. The Minister may establish penalties, which may consist of fines or imprisonment, within limits specified in the Act (art. 8).

[131] Powers of authorized officers (which are specified, and include fisheries officers and police officers of or above the rank of inspector) include:

- boarding and searching any vessel and any premises without a warrant;
- arresting any person suspected of having committed an offence;
- seizing any articles (except vessels and vehicles, although the forfeiture of vessels and vehicles is allowed for by Article 12 in the event of conviction) which may be in connection with the offence;
- directing any vessel or vehicle to proceed to a place where the fisheries produce may be unloaded, and detaining it exclusively for the time necessary for unloading (art. 9).

[132] The Fisheries Principal Regulations, 1989, require registration of fishing vessels (Reg. 3), and establish a central registry of fishing vessels (Reg. 9). Possession of any fish caught illegally is generally an offence (e.g., Reg. 25). Regulation 30 generally prohibits entry of foreign fishing vessels into territorial waters, unless authorized by legislation or international agreements, while Regulation 31 generally prohibits fishing and some related activities by foreign fishing vessels in the territorial sea.

ZANZIBAR

[133] The Fisheries Act, 1988[1], makes provision for the management of the fishing industry, establishing an obligation for the Director of Fisheries to develop fisheries management plans. With a view to protecting the traditional local fishing industry, the Minister has a specific duty to adopt appropriate measures (Section 8), and it is established that, in issuing licences, preference must be given to citizens. However, this provision is now seen as insufficient because enterprises which are in substance foreign can fairly easily be authorized to fish by obtaining licences formally in the name of a citizen. Pursuant to Section 2, application of the Act extends to the territorial waters and the EEZ of Zanzibar. This provision is now contrary to the United Republic's Territorial Sea and Exclusive

1. The Fisheries Act of Zanzibar was not available at the time of writing, so that this discussion is based on a fisheries-oriented report and so not truly MCS-oriented.

Economic Zone Act, which establishes the United Republic's responsibility over fishing and other matters in the whole of the EEZ. The Act also includes provisions for the issue of licences by authorized officers for fishing and for conducting scientific research (Part III), and provisions on prohibited fishing methods and other conservation measures (Part IV). Among the management measures the Director of fisheries can adopt are the closing of fishing areas and the establishment of "territorial parks and sanctuaries for any purpose" (Section 6).

[134] Fisheries Regulations further providing for licensing, including licences for sport fishing and for migrating fishermen, were issued in 1993, and are currently available in the Kiswahili language only. An English translation was being prepared in 1993.

3. INTERNATIONAL INITIATIVES

FISHERIES LEGISLATION BEYOND THE LIMITS OF NATIONAL JURISDICTION

[135] MCS in the Southwestern Indian Ocean must not be considered exclusively in confined national perspectives, given the nature of some of the fisheries in the area, which are highly migratory, and the fact that almost all countries envisage the possibility of allowing foreign fishing vessels into their maritime zones. Furthermore, foreign vessels allowed by the various States to fish in their maritime zones are often the same vessels fishing across the whole region, so joint initiatives in this regard are appropriate.

[136] Every country must ensure adequate MCS with respect to both national and foreign vessels fishing within the limits of its maritime zones. Some suggestions on how to facilitate this through adequate legislation are included in Section 4, below. However, an aspect which greatly affects the efficiency of any MCS arrangements are the powers which may be exercised by States beyond the limits of national jurisdiction, i.e., on the high seas.

[137] The international law of the sea, as embodied in Article 111 of the United Nations Convention on the Law of the Sea, 1982, allows a right of hot pursuit of foreign vessels for violations occurring within waters under the jurisdiction of the coastal State.

[138] Apart from this, other vessels on the high seas are free from interference, unless authorized by treaty, or if the vessel has been engaged in piracy, slave trading, unauthorized broadcasting or if the vessel has no flag or flies two flags (ibid., art. 110). The general regime governing the high seas remains freedom – although a freedom which is often referred to as 'qualified,' i.e., subject to some conditions. As applied to fishing, the rule is embodied in Articles 116 and 87(2) of the Convention: States have the right for their nationals to fish on the high seas, subject to treaty obligations, rights, duties and interests of coastal States, and the obligations deriving from the Convention to conserve the high seas resources. A further general limit imposed by Article 87(2) are the interests of other States in their exercise of freedom of the high seas.

[139] There are, therefore, limited possibilities to ensure enforcement of both national and international fishing rules on the high seas.

[140] The basic option remains effective flag-State control, which is made an obligation by Article 117. National legislation must therefore be designed in such a way as to ensure

enforcement by the flag State over its nationals that fish on the high seas. This may involve the requirement for a specific authorization to fish on the high seas, reporting requirements on high seas catches, and registration in a separate registry. A registry provides useful information on the capability of the fleet, and may be a way to identify possible violators more easily. However, whether or not deliberately, few countries in the world have been able to exercise effective control over their vessels fishing on the high seas. The practice of re-flagging makes the problems worse, since re-flagging of vessels allows them to escape any controls or other MCS arrangements.

[141] National arrangements for enforcement on the high seas must therefore be complemented by agreements among States. Usually, such agreements set out conservation measures, and include provisions which make the vessels of any of the parties to the agreement subject to the enforcement powers of any other of the parties. A useful instrument in some regions has proven to be regional registers, wherin vessels may or may not be recognized as being "in good standing" depending on their degree of compliance with fishing rules throughout the area concerned. The threat of losing their good standing is sometimes a sufficient disincentive to violation of the rules (it is also an incentive to accept jurisdiction and therefore not flee). The following section illustrates some of the initiatives taken by the international community in this regard, and particularly the Code of Conduct on Responsible Fisheries, which suggests provisions to this end. Some examples of international agreements establishing MCS arrangements are the International Convention for the High Seas Fisheries of the North Pacific Ocean of 1952; the Northwest Atlantic Fisheries Organization Convention on Future Multilateral Cooperation of 1978, and the Agreement between the USA and Certain Pacific Island States of 1987.

[142] States may also impose unilateral measures on other States whose nationals tend to repeatedly violate applicable fisheries rules. These measures may or may not be strictly related to fisheries and may consist, for example, of trade sanctions, denial of port access, or denial of EEZ access[1].

GLOBAL INITIATIVES

[143] In recent years, various international forums have addressed fisheries issues to provide a follow-up to the 1982 UN Convention, and particularly to those of its provisions which continue to require specification or have remained controversial. The legal instruments which have been adopted as a result of these initiatives are various in nature, but all are to some extent relevant to MCS. The main ones are the International Conference on Responsible Fishing, which adopted the *Cancun Declaration on Responsible Fishing* in May, 1992; the United Nations Conference on Environment and Development (UNCED) of June, 1992, which adopted *Agenda 21*, whose Chapter 17 deals with sustainable use and conservation of marine living resources of the high seas; the FAO Technical Consultation on High Seas Fishing (September 1992); and the FAO Conference adoption of the *Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas* (November, 1993). Subsequently, a Ministerial Meeting on Fisheries adopted the *Rome Consensus on World Fisheries* (March, 1995). Since then, the international community has adopted a twin track approach with regard to high seas

1. S.H. Marashi. 1996. Summary information on the role of international fishery and other bodies with regard to the conservation and management of living resources of the high seas. *FAO Fisheries Circular*, No. 908 (Doc. code FIPL/C908)

resources, upon the initiative of the United Nations and of FAO. Approximately at the same time, an *international agreement on straddling stocks and highly migratory species*, and a *code of conduct for responsible fisheries* which covered all aspects of management of fisheries were negotiated. The *Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks* was adopted by the UN Conference set up for this purpose in August, 1995. FAO Conference adopted the *Code of Conduct for Responsible Fisheries* in October, 1995.

[144] The 1995 *United Nations Fish Stocks Agreement* includes interesting provisions, which prescribe some required contents of agreements among States through sub-regional and regional fisheries management organizations (Articles 9 and 10). States must, for example, specify the mechanisms by which the organization must receive scientific advice and review the status of the stocks. There is also an obligation to agree on conservation and management measures on straddling stocks and highly migratory stocks.

[145] The Code of Conduct for Responsible Fisheries is "voluntary" and differs in nature from international agreements open for acceptance by States. Its objectives are rather to establish principles upon which national policies and legislation, as well as international agreements, could be based in order to pursue responsible fishing practices. Within these objectives, the Code covers virtually all aspects related to fishery and fishery products, considering both capture fisheries and aquaculture in their broad social and economic setting. This may be considered the Code's hidden strength. Furthermore, some of its provisions may have a binding effect in that they are already included in international law instruments or constitute part of general international law. Its geographic scope is global, and it refers to areas both within and beyond coastal States' jurisdiction. It is not exclusively directed to States, but also to international organizations at various levels and at any persons concerned with fisheries. A mechanism has been set up to monitor its implementation, through FAO. The Code consists of 12 Articles, and each Article has a number of sections.

[146] Specifically with regard to MCS, the Code calls on States to ensure compliance with and enforcement of conservation and management measures, and to establish effective mechanisms to monitor and control the activities of fishing and support vessels (Section 6.10). States should also exercise effective control over vessels flying their flag, ensuring that they abide by rules established by other States or internationally in accordance with international law, and by obligations as to reporting data (Section 6.11). This is a subject which has been considered most important in the preparation of the Code. The *Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas*, which is to be considered an integral part of the Code, includes more detailed, binding provisions to this end. An obligation for States to establish effective MCS arrangements, in accordance with their competence and capacity, is again stated in Section 7.1.7. The dissemination and explanation of relevant legislation is also encouraged as a means to facilitate its application (Section 7.1.10).

[147] A general management principle is stated in Section 7.1.1, which urges States, through appropriate policy, legal and institutional frameworks, to adopt measures for the long-term conservation and sustainable use of fishery resources. With respect to both domestic and internationally adopted conservation measures, States are urged to adopt adequate MCS arrangements in Section 7.1.7.

[148] Among various provisions which recommend the collection and analysis of data for management purposes, Section 7.4.6 specifically urges the compilation of data relating to fish

stocks in an internationally agreed format, whether or not these data are covered by regional or sub-regional management organizations.

[149] Specific suggestions on "implementation" are included in Section 7.7: States should ensure that an effective legal and administrative framework at the local and central level is established for fisheries. Laws and regulations are to provide for sanctions which are adequate in severity to be effective, including sanctions which allow for the refusal, withdrawal or suspension of authorizations to fish in case of non-compliance. MCS measures may have to include observer programmes, inspection schemes and vessel monitoring systems.

[150] For the purpose of controlling vessels, within national waters and on the high seas, States are urged to maintain records indicating details of ownership and authorization to fish. A Certificate of Registry should be required before vessels are entitled to fish beyond the limits of national waters, whether in other countries' waters or on the high seas. Such vessels should be marked in accordance with international standards, such as the FAO specifications (Article 8: Fishing Operations). Fishing gear should also be marked so that the owner of the gear can be identified (Sections 8.2.1 to 8.2.4).

[151] Flag States should take enforcement measures with respect to fishing vessels entitled to fly their flag which have violated management measures applicable beyond the limits of national jurisdiction, even by making the violation of such measures a violation under national legislation (Section 8.2.7).

REGIONAL

[152] Various regional initiatives have since been undertaken within the framework of international agreements among some of the countries concerned.

[153] The Indian Ocean Fisheries Commission (IOFC) was established by Resolution 2/48 of FAO Council (June, 1967) under Article VI(1) of the FAO Constitution. Pursuant to its statutes, its area of competence is the whole Indian Ocean and adjacent seas, excluding the Antarctic area (Res. CL 2/48, Section 1). Its terms of reference are to promote and assist national fishery programmes, to promote research and development activities especially through international aid programmes, and to examine management problems, with particular reference to those relating to the management of offshore resources (ibid., Section 2). Any living marine resources may be covered. Pursuant to the Commission's rules of procedure, each member has one vote, and decisions are taken by a majority of the votes cast (Rule VI).

[154] Three sub-regional Committees (respectively for the Gulfs, the Bay of Bengal and the Southwest Indian Ocean) are currently in place as advisory bodies to the Commission, since the sub-regional Committee on Tuna has been replaced by the newly created and independent Indian Ocean Tuna Commission. Species other than tuna in the Indian Ocean are geographically localized and therefore sub-regional bodies appear to be in a better position to manage fishery resources. At the moment, having exclusively advisory functions, they do not have sufficient mandate to be effective in management, but the status of the Commission and its subsidiary bodies is currently under review. One of the issues to be determined is the type of connection the Commission should maintain with FAO. The fact that the Commission was adopted under Article VI of the FAO Constitution implies a closer tie with the Organization than similar bodies adopted under Article XIV. Consequently, it may benefit from FAO's technical and financial support, but suffer some constraints to its possibilities of action. A provisional agenda for each session is prepared by FAO, while members may

propose additional items (Rule V of Article VI). The establishment of subsidiary bodies may be determined by the Commission, subject to the availability of funds in the budget of the Organization.

[155] The Indian Ocean Tuna Commission (IOTC) was established by an agreement adopted by FAO Council in November, 1993, under Article XIV of the FAO Constitution (hereafter 'the Agreement'), and entered into force upon receipt of the tenth instrument of ratification in March, 1996. Its area of competence is the Indian Ocean ("FAO statistical areas 51 and 57") and adjacent seas, north of the Antarctic convergence, "insofar as it is necessary to cover the management of tuna stocks which migrate into or out of the Indian Ocean" (Article II of the Agreement). Cooperation among the coastal States of the Indian Ocean and other States setting up the IOTC whose nationals harvest tuna in the region is expressly stated among the objectives.

[156] Pursuant to the Agreement establishing IOTC (Article V), the functions of the Commission include keeping under review the conditions of the stocks and analysing and disseminating scientific information and statistics; encouraging research on stocks; and adopting conservation and management measures. In this regard, States undertake to provide the data which the Commission may require (Article XI of the Agreement).

[157] The Commission has the power to issue "decisions and recommendations," i.e., either binding or non-binding legal instruments. Its regulatory powers are generally wider than those of the previously existing sub-committee. A two-thirds majority may adopt binding conservation measures. However, these are subject to an objection procedure. A unanimous vote of the member States is not necessary in order for such measures to become binding on all member States: a two-thirds majority is sufficient, pursuant to Article IX(2), unless a State expressly objects to the conservation measure within 120 days of its notification or other specified date. In the event of the raising of objections by one State, a further period of 60 days is given to other members within which to object. States undertake to ensure the implementation of the agreement and any conservation measures so adopted. Actions taken in this regard must be annually reported to the Commission (Article X 2 of the Agreement). Members must cooperate towards the establishment of an appropriate "system" to keep under review the implementation of conservation and management measures (Article X 3 of the Agreement).

[158] Members have an obligation to provide data on request. The Commission must also endeavour to obtain fisheries statistics from other fishing States or entities.

[159] At present, the members of the Commission are Australia, Eritrea, the European Union, France, India, Japan, Korea (Republic of), Madagascar, Mauritius, Pakistan, Seychelles, Sri Lanka, Sudan, and the United Kingdom.

[160] The Western Indian Ocean Tuna Organization (WIOTO) Convention was signed in Seychelles on 19 June 1991, and entered into force in 1994. It covers tuna and tuna-like species of an area coinciding with FAO statistical area 51. Present members are the Comoros, India, Mauritius and Seychelles. Its objectives include harmonization of policies, relations with distant water fishing nations (DWFNs), fisheries surveillance and enforcement, fisheries development and access to EEZs of the members.

[161] In addition to founding States (the Comoros, India, Kenya, Madagascar, Maldives, Mauritius, Mozambique, Seychelles, Sri Lanka, Tanzania), membership of WIOTO is open to any independent State bordering the Western Indian Ocean and whose territory is situated

principally in the Western Indian Ocean region, having a common interest with the parties with respect to the subjects covered by the Convention.

[162] The Committee (made up of a senior fisheries official for each party) should endeavour to take decisions by consensus, but may adopt them by a two-thirds majority. The Committee acts in an executive capacity and provides technical advice to the Board, which is made up of Ministers representing each member. Technical functions are however carried out by the Secretariat. These include collection and analysis of statistics, management plans, legislation, prices, technology and enforcement. The Secretariat is also responsible for providing technical advice to members, maintaining relations with relevant international and donor organizations, and preparing an annual report. Members have an obligation to provide all relevant information upon the request of the Secretariat (Article 9).

[163] Various initiatives have also been undertaken for MCS under the Indo-Pacific Tuna Development and Management Programme (IPTP), tending especially to an improvement of data collecting and processing capabilities, tagging programmes, etc.

[164] Agreements relate mainly to tuna fisheries, with the exception of Seychelles. Licences are issued on a yearly basis and allow for fishing activities in specified fishing zones. Common to - but not identical in - all agreements are provisions concerning observers, radio communications and reporting, and aspects of transhipment and supply. It is worth noting that harmonized terms and conditions of access for foreign fishing vessels may avoid DWFNs' attempts to play one island state off against another in order to secure the most favourable terms of access.

[165] A Sub-commission on fisheries has also been established under the Sri Lanka-Maldives Joint Commission. Its terms of reference include exchange of information, assistance in training, examination of trade opportunities related to fisheries between the two countries, and encouragement of contacts between fishers of the two countries.

[166] Several countries in the region have entered into agreements with the European Community regarding access of Community vessels into the EEZs of the region and related matters. These agreements set a framework for cooperation between the parties concerned for a period of three years. Their contents have been discussed under the relevant countries.

[167] A relevant contribution to cooperation with the European Community has been the recent formal acceptance by the Community of the *Agreement to promote compliance with international conservation and management measures by fishing vessels on the high seas*, by a decision of the Council of the European Community (Decision 96/428/CE of 25 June 1996). This implies that the contents of the agreement, which is made an integral part of the decision, become binding on all member States of the Community and therefore on vessels flying their flag, and in particular DWFN vessels.

4. DISCUSSION

[168] Recommendation for improvement of the legal framework of individual countries with regard to MCS would require a close examination of their national context and legal system. Nevertheless, some general considerations can be made.

[169] While national fisheries policy and legislation are part of the country's MCS arrangements (particularly the 'control' component, since legislation is necessary to enact any management schemes), they are also powerful tools for the overall improvement of MCS arrangements. Too often, countries have assumed that adequate management of the fisheries sector is made impossible by the insufficiency of the means at their disposal and have underestimated the potential benefits which may derive to those arrangements from a revision of fisheries policy and legislation. There is no fixed model to be followed, but every country should identify the most appropriate provisions for its MCS policy and legislation, although considering experiences of other countries.

[170] At the same time, the actual capabilities (both in terms of human resources and of any other resources) of every country must be borne in mind in order to conceive enforceable arrangements. The success of some of the legal provisions will of course remain subject to the availability of human and other resources to carry out controls. However, it is encouraging to see that the possible lack of personnel or even technical equipment does not automatically cut off every possibility of MCS.

[171] First of all, the provisions of the fisheries legislation which specifically concern MCS must be adequately formulated, on the basis of adequate policies.

[172] Among the most important in this regard are the provisions concerning offences, penalties and officers responsible for enforcement and their powers. Adequate provisions of the fisheries legislation must allow a clear, easily accessible response to at least the following points:

- Which actions and omissions constitute a violation of the law? Is there a difference between administrative and criminal violations? If so, is this made clear in the legislation, and are the respective consequences specified?
- What are the penalties envisaged for such violations?
- Who has the power to enforce fisheries legislation? (e.g., fisheries officers, but also, for example, the police, the navy or some of its divisions, any persons appointed by the minister for this purpose, etc.). The fisheries legislation should either list empowered people or refer to other sources providing in this regard (e.g., "such persons as may be from time to time appointed by the Minister ...").
- What powers do enforcement officers have? In particular the legislation should specify:

  - powers of search: Is a warrant always necessary? May routine searches be carried out or are inspections only allowed in the event of suspected violations? May land-based controls be carried out? May vessels carrying out activities related to fisheries (e.g., support vessels) be inspected?

  - powers of seizure: May the officers seize any objects used in the commission of an offence presumed to have been carried out, including vessels? This could be a powerful deterrent (e.g., the crew might even not mind imprisonment, but vessel owners will usually be very concerned by possible forfeiture of the vessel).

  - powers of arrest: May the officers arrest people? If so, in which cases? What procedure must they follow in case of arrest?

- Are there provisions which tend to facilitate the exercise of powers of enforcement officers? For example, a provision prohibiting obstruction of officers carrying out their functions is fairly common, and it is usually punished by serious penalties.

Powers of arrest may even be envisaged in case of resistance by offenders, even in countries which do not envisage imprisonment as a penalty for fisheries violations.

- Is compounding of offences allowed, and on what conditions? Compounding gives the possibility of paying a sum to avoid further prosecution for an offence, usually within the limit of the maximum fine prescribed for that offence. This possibility may on the one hand make enforcement more effective (avoiding lengthy court cases, with subsequent uncertainty of eventually cashing fines). On the other hand, it may offer the possibility for abuses.
- Is there a power to suspend and cancel licences in the event of violations? This may be a more powerful deterrent to the commission of offences than the provision of a fine.
- Are any discretionary powers given to officers as to the amount of penalties or the possibility of compounding? Is the extent of such discretion adequate?
- Are any rewards given to officers who identify violations? Are the rewards in fact actually adequate? Giving 'incentives' for the identification of violations reduces the risk of corruption, but may make enforcement officer's attitudes excessively harsh.
- Is recourse always allowed to the law courts to challenge decisions taken administratively on violations? Judicial and administrative procedures must be spelled out clearly in the fisheries or other relevant legislation.

[173] The legislation of the countries considered in this study varies greatly in the area of offences and penalties. Penalties range from envisaging imprisonment in every single case to provision of a fine exclusively. The ample discretionary powers left to the authorities imposing sanctions may partly eliminate such differences, but there remain significant differences in the treatment a violator would receive in one country relative to another. As the same vessels often fish in the other country's EEZs, this is inadequate, not only from the point of view of equity, but also from a practical point of view, as it encourages vessels to play off one jurisdiction against another. Such differences could be overcome only if the countries of the region undertook to harmonize their legislation.

[174] Particularly for the monitoring aspect, most countries in the region envisage some reporting requirements for licence holders, or could do so by inserting appropriate conditions in fishing licences. This is a minimum condition to ensure adequate monitoring of the sector. It would also be very useful if countries cooperated in the collection of data, in order to have a clear picture of the status of resources such as migratory species. For example, countries concerned would have to develop uniform forms to be filled out by the fishers. Some arrangements to this end set up through regional cooperation are already successful (e.g., the agreement between Seychelles and Mauritius).

[175] Once good efforts have been made for the collection of data, these data must be used as a basis for the preparation of management plans. Few countries in the region, however, require this by law. Even if this may appear to be obvious to existing fisheries administrations, attitudes of administrations can change, while the law should be an instrument to make management planning compulsory.

[176] For the surveillance aspect, the legislation of the countries considered varies widely. For example, enforcement powers of officers do not always include power to make routine inspections; sometimes they require a reasonable suspicion that an offence has been committed before they can stop and board a vessel. This may be appreciated from the point of view of preventing excessive State interference in private activities, but is inappropriate

to the exercise of effective control, especially in the case of large vessels. Control can hardly be carried out by patrol officers at sea without boarding.

[177] The legislation of almost all countries in the region envisages the possibility of allowing access to foreign vessels, subject to some conditions which tend to protect at the same time the local fisheries. Some prescribe a specific regime to be applied in the legislation, while others leave the specification of conditions to individual licences. Conditions are in any case not uniform. For example, the recognition of the status of local fishing vessels (as opposed to foreign vessels, which are usually identified) is rarely defined by law and may therefore vary widely. Such conditions should be appropriately designed for individual countries and their available resources. At the same time, adopting harmonized conditions by the various countries may increase the chance of obtaining compliance by foreign vessels fishing in the waters of the various countries of the region. Cooperative efforts in this regard should take this into account.

[178] Some countries envisage observer programmes, with powers varying from exclusively research purposes to full powers of enforcement.

[179] Other provisions of the fisheries legislation specifically concern enforcement and may be included in order to facilitate it. For example, as is done in many countries, the possession (and not only the action of taking) illegally caught catch (i.e., under the minimum size, out of season, etc.) may be prohibited, regardless of the origin of the catch. All catch found on board a vessel fishing illegally may be presumed to have been taken illegally. Foreign fishing vessels in transit through the waters of another State may be presumed to be fishing, unless their fishing gear is securely stowed. The transportation of objects which would be considered illegal fishing implements (e.g., prohibited gear, explosives, electric devices, etc.) may also be prohibited (as, for example, in the Mozambique Fisheries Act, Article 36(b)). Provisions of this sort relieve the burden of proof on the part of enforcement officers, making prosecution easier.

[180] Registration of fishing vessels is also commonly required as a means of allowing exact identification of vessels, thus facilitating monitoring and surveillance. This would important also in a regional MCS perspective, should the countries at some stage undertake to set up a regional register.

[181] Where fishing is carried out by way of fixed nets or other devices, licensing of the nets may be required, again with the primary purpose of facilitating enforcement. This is the case, for example, in the Mauritius Law (Section 12). The inclusion of such a provision is encouraged in the Code of Conduct on Responsible Fishing. It should be noted that this measure may result in excessive bureaucracy, and not necessarily in effective enforcement.

[182] A method sometimes used to facilitate inspections is to require landing only at specified landing stations (e.g., Mauritius Fisheries Act, 1990, Section 7), although the successful implementation of such a provision may depend on various factors (e.g., whether the shape of the coast facilitates it, whether it causes great inconvenience, etc.).

[183] In contrast, some provisions by their nature are difficult to enforce, and must be included in the legislation only after careful consideration of the country's actual resources available. This is the case, for example, of sharing resources on the basis of individual transferable quotas. Such a system requires an expensive surveillance system for effective control.

[184] Clearly formulated provisions, along the lines suggested above, constitute useful guidance both to people's activities and to enforcement officers' action. As to the latter

point, it is essential for enforcement officers to be fully conversant with the legislation they are called upon to enforce. Specific training, therefore, is essential. Officers must be familiar with international law concepts and provisions, as well as with all applicable provisions of domestic legislation. For example, they should know maritime boundaries and be aware of any agreements with foreign countries relating to boundary delimitation or fisheries matters. They should also receive specific training on judicial and administrative procedures, presentation of evidence, etc. Some countries, such as the Seychelles, have adopted specific guideline procedures for enforcement officers. FAO has published various material in this context.

[185] An application of the principle of certainty of law is to facilitate knowledge of the legislation by the people. This is of course also an important contributing factor to the success of enforcement, and must be promoted first by putting in place clear provisions which are easily and universally interpreted, and then by adequately disseminating the relevant legal instruments.

[186] A facilitating action is the involvement of people in the process of adoption of the legislation, in order to put in place provisions which may be more widely accepted and minimize problems of lack of compliance. If there is general understanding of the rationale of the legislation, people will tend to voluntarily submit to it and even advocate compliance by others. For example, rules on closed seasons which are not based on generally agreed upon reasons, such as spawning periods, etc., are unlikely to be respected. Decisions to establish protected areas without involving in the decision making process persons likely to be affected are also probably bound to fail ultimately. For this reason, encouraging public participation has become a common concern in the formulation of many policies and laws dealing with natural resources worldwide. Ideally, fishers must see the contents of fisheries legislation as being in their own interest. There may even be a possibility of facilitating enforcement by the fishing population itself, by way of reciprocal controls. However, even where fishers complain about other fisher's violations of provisions with which they agree, they may be unlikely to report it to the authorities.

[187] As to international initiatives, referred to in Section 3, the necessity of cooperation is certain from the point of view of appropriate management of resources. However, participation of the countries in cooperative arrangements is sometimes hindered by a number of considerations, not necessarily directly related to fisheries, such as financial constraints, unsatisfactory cost sharing arrangements, overall relationships with others, need to consider data as confidential, etc. Therefore, political will has been generally insufficient.

[188] Regional cooperation, however, must be encouraged also as a means to overcome difficulties deriving from the lack of material and human resources in individual countries, for example by streamlining data collection procedures, jointly analysing such data, establishing regional registers for identification and prosecution purposes as suggested above, and so forth.

[189] The contents of current regional agreements remain at the stage of establishing fisheries organizations, while substantive measures applicable to fisheries, whether or not under such organizations, remain to be adopted. Much less have the existing bodies had opportunities to establish joint management strategies for the resources of the region, or other MCS arrangements.

[190] Even when the organizations' functions in relation to the collection of information are relevant and may constitute the basis for useful consultations in light of actual data, provisions for the establishment of regulatory measures in the area by the organization are

non-existent (as in the WIOTO agreement) or insufficient, providing wide opportunities for objections (as in the IOTC agreement).

[191] A further shortcoming remains the fact that regional cooperation has been concentrated mainly on tuna and similar species, while it has been less advanced with respect to species which are also important, such as those upon which subsistence is sometimes dependent.

[192] Finally, international cooperation should include harmonization of national legislations. Some benefits of harmonization of legislation in a regional perspective have already been referred to (e.g., increase of chances of spontaneous implementation by foreigners if rules and penalties are the same; cost-saving streamlining of data collection procedures; easier identification of violators if marking and registration procedures are the same).

[193] It is not necessary to aim for the adoption of a single text, but rather at a gradual process. In other regions of the world, such as the South Pacific and the Organization of Eastern Caribbean States, the adoption of harmonized legislation has subsequently led to improved joint MCS arrangements. In the case of the Caribbean, the effort is currently extending to other countries by introducing various harmonized procedures, among which are those for collection of data. In the case of the South Pacific, cooperation among the local island States has extended to DWFNs, and particularly the United States of America.

CONCLUSIONS

[194] In the light of the above considerations, some summary conclusions may be drawn:

[195] 1. There are various ways of improving national legal frameworks for the purpose of strengthening MCS arrangements. In particular, national legislation may be formulated in such a way as to facilitate enforcement of fisheries legislation applicable to both national and international waters. National laws and regulations should be revised in this perspective. Section 4 made some suggestions in this regard. The Code of Conduct on Responsible Fisheries also includes numerous suggestions to this end, and its widespread acceptance by the countries of the region should be pursued for this purpose.

[196] 2. It is essential to pursue effective MCS arrangements also in a regional perspective in the South-western Indian Ocean. Various initiatives are being taken, but the process should be further pursued. The final part of Section 4 indicated some current shortcomings in this regard. Countries should also participate more widely in relevant global initiatives (in particular the Code of Conduct for Responsible Fisheries and related instruments, the FAO Compliance Agreement, and the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks).

[197] 3. Harmonization of legislation at the regional level may contribute to the success of MCS arrangements.

[198] 4. Cooperation must extend to DWFNs whose nationals fish in the region. Flag State control over such vessels must complement any national and regional MCS arrangements in order to significantly improve their effectiveness.

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IMPLEMENTATION OF RECENT INTERNATIONAL FISHERIES AGREEMENTS: A FEW ISSUES FOR DISCUSSION

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BACKGROUND

[1] In the South West Indian Ocean (SWIO), there are several important species which occur within and beyond areas under national jurisdiction and which migrate through the exclusive economic zones (EEZs) and fishing zones of countries bordering the SWIO. These include skipjack (*Katsuwonus pelamis*), yellowfin (*Thunnus albacores*), albacore tuna (*Thunnus alalunga*) and bigeye (*Thunnus obesus*). Capture of tuna occurs inshore as well as offshore, often also on the high seas. The harvesting of these stocks plays an important economic role in the SWIO. Tuna fisheries constitute an important source of revenue to the coastal nations, either through the licensing of vessels from distant water fishing nations (DWFNs) or directly from the export of derived products. Many foreign fleets are indeed engaged in fishing of tuna within countries' EEZs and on the high seas. All countries (the Comoros, Kenya, Madagascar, Maldives, Mauritius, Mozambique, Seychelles and Tanzania) have declared 200-nautical-mile EEZs and almost all of them have EEZs bordering the high seas. Recent rapid expansion of the tuna fisheries has led to some concerns with respect to their sustainability. Hence, the need for concerted management of shared fish stocks.

[2] Against this background, the Agreement for the Implementation of the Provisions of the UN Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks ('The 1995 UN Fish Stocks Agreement')[1] and the FAO Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas (the 'FAO Compliance Agreement') are likely to have in the future far-reaching implications for the management of the fish stocks, both within and beyond areas under national jurisdiction.[2] The UN Convention on the Law of the Sea (hereinafter referred to as 'the 1982 UN Convention') constitutes the background to the two agreements in that they are elaborated

1. This Agreement was adopted on 4 August 1995 by the United Nations Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks. It was opened for signature on 4 December 1995 and remained open until 4 December 1996. It will enter into force 30 days following the deposit of the thirtieth instrument of ratification or accession. As at 19 November 1996, the Agreement had been signed by 55 countries (of which Maldives and Sri Lanka) and had been ratified by 5 countries (Saint Lucia, Samoa, Sri Lanka, Tonga and the United States of America)

2. The Agreement was approved by the 27th Session of the FAO Conference on 24 November 1993 and will enter into force on the deposit with the Director-General of FAO of the 25th instrument of acceptance. To date 10 States have accepted the Agreement (Canada, Saint Kitts and Nevis, Georgia, Myanmar, Sweden, Madagascar, Norway, United Sates of America, Argentina and the European Community)

pursuant to the 1982 UN Convention and aim at implementing and consolidating its provisions[1].

[3] At national level, in respect of both agreements, each country would require either new legislation or amendments to existing legislation to regulate fishing on the high seas. At international level, the FAO Compliance Agreement, once it enters into force, will not need additional agreements and/or arrangements for the scheme and mechanism contemplated by the Agreement to function. This is not the case with the 1995 UN Fish Stocks Agreement. Once entering into force, it would be fully implemented only when (an) existing or future sub-regional or regional management organization(s) would be effectively competent to establish conservation and management measures for the highly migratory fish stocks which pass through their waters.

[4] Thus, realistically, the most effective way to implement the 1995 UN Fish Stocks Agreement would be at regional level. This would ensure that the highly migratory fish stocks which currently pass through the SWIO region are conserved and managed along the length of their migratory paths. The Indian Ocean Tuna Commission (IOTC) could provide a potential mechanism for shared management of common fish stocks.[2] Its area of competence is the Indian Ocean (FAO Statistical areas 51 and 57) and adjacent seas, north of the Antarctic Convergence, "insofar as it is necessary to cover the management of tuna stocks which migrate into or out of the Indian Ocean." The main objectives and functions of the Commission are to promote cooperation among members with a view to ensuring through appropriate management, the conservation and optimum utilization of stocks as well as to encourage sustainable development of fisheries based on them (Article 5). The Commission may by two-thirds majority of Members present and voting adopt conservation and management measures binding on its Members. Such management decisions are subject to an objection procedure (Article 9).

[5] In addition to IOTC, there is the Western Indian Ocean Tuna Organization (WIOTO) Convention. Its objectives include harmonization of policies, relations with DWFNs, fisheries surveillance and enforcement, fisheries development and access to EEZs of the members. It covers tuna and tuna-like species of an area coinciding with FAO's Statistical Area 51. Cooperation between WIOTO and IOTC could be enhanced in view of implementing, where and when appropriate and possible, the management decisions taken by IOTC and in view of improving monitoring, control and surveillance (MCS) in the region. It may be worth considering the desirability of developing a role for the IOTC, in cooperation with WIOTO eventually, in respect of the obligations generated by the recent international fisheries Agreements for the States Parties.

[6] This paper is intended to outline the key provisions of both agreements and to briefly highlight the relevance of the two agreements to the countries bordering the SWIO for the purposes of MCS.

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1. The 1982 UN Convention has been signed by Madagascar, Maldives and Mozambique, but ratified by the Comoros, Kenya, Mauritius, Seychelles and Tanzania.

2. The species covered under the Agreement establishing the IOTC are: yellowfin tuna, skipjack tuna, bigeye tuna, albacore, Southern blue fin tuna, long tail tuna, kawakawa, frigate tuna, bullet tuna, narrow-barred Spanish mackerel, Indo-pacific king mackerel, Indo-Pacific blue marlin, black marlin, striped marlin, Indo-Pacific sailfish and swordfish. (Annex B)

THE FAO COMPLIANCE AGREEMENT

Key provisions

[7] The FAO Compliance Agreement is concerned with the activities of vessels fishing on the high seas. It applies to "all vessels that are used or intended for fishing on the high seas" (Article II (1)). The agreement was originally intended to avoid the practice of vessel owners or operators avoiding compliance with internationally or regionally agreed conservation and management measures by re-flagging their vessels, i.e., re-registering their vessels under the flag of a State which is not party to any such international or regional management arrangement. In the other words, it seeks to reinforce the effectiveness of international fisheries management and conservation arrangements by increasing their members' capacity to instigate or influence non-members to constrain their vessels to comply with internationally agreed management and conservation measures.

[8] The main provisions of the FAO Compliance Agreement relate to:

- the increased responsibility of the flag State for the activities of their high seas fishing vessels; and
- the flow of information on high seas activities.

[9] Article III sets out the basic obligations of the flag State.[1] State Parties are required to request an authorization for their vessels fishing on the high seas and to deny or revoke the authorization of vessels that have undermined "international conservation and management measures"[2], whether global, regional or sub-regional[3].

[10] States are required not to grant authorizations to fish on the high seas unless they are satisfied that they are able, taking into account the links existing between them and the vessels concerned, to exercise effectively their responsibilities under the agreement in respect of those fishing vessels (Article III, 3).

[11] In addition, all parties to the agreement undertake not to grant authorizations to any fishing vessel which has, within the previous three years, had its authorization to fish on the high seas suspended or withdrawn by its former flag State. This provision is designed to prevent the practice of re-flagging fishing vessels to escape controls. There are some exceptions and limitations to this obligation, particularly where it can be shown that there has been a *bona fide* change in the ownership of the vessel, or where the new flag State, taking into account, *inter alia*, the circumstances in which the authorization was withdrawn, makes a determination that to grant the authorization would not undermine the object and purposes of the agreement.

[12] The agreement further requires the flag State to ensure that its vessels are properly marked according to generally accepted standards, such as the FAO Standard Specifications

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1. The general duties of the flag State in respect of vessels flying its flag are spelt out in Article 94 of the 1982 UN Convention, but the principles set out in the Convention are of general nature and underline the relationship between a State and its nationals rather than between a State and a vessel flying its flag.

2. "International conservation and management measures" means measures to conserve or manage one or more species of living marine resources that are adopted and applied in accordance with the relevant rules of international law as reflected in the 1982 UN Convention. Such measures may be adopted either by global, regional or sub-regional fisheries organizations, subject to the rights and obligations of their members, or by treaties or other international agreements (Article I)

3. "Each Party shall take such measures as may be necessary to ensure that fishing vessels entitled to fly its flag do not engage in any activity that undermines the effectiveness of international conservation and management measures" (Article III, 1)

for the Marking and Identification of Fishing Vessels, and provide it with the necessary information on their operations, including fishing area, catch and landing data (Article III, 6 & 7).

[13] The remaining set of provisions under the Agreement are those designed to ensure an appropriate flow of information on high seas activities. They contemplate

(i) the maintenance of a record of the fishing vessels authorized to fish on the high seas (Article IV),

(ii) the making of such information available to FAO (Article VI), and

(iii) aspects of international cooperation (Article V).

[14] In this respect, State parties are required to provide information to assist Flag States to identify those, if any, of their vessels which may have engaged in activities undermining international conservation and management measures. In addition, where a port State has reason to suspect that a foreign high seas fishing vessel, voluntarily in its port, has engaged in such activities, it is under the duty to notify the Flag State. It is stated further that, "Parties may make arrangements regarding the undertaking by port States of such investigatory measures as may be considered necessary to establish whether the fishing vessel has indeed been used contrary to the provisions of the Agreement" (Article V).

Key issues relevant to implementation of the FAO Compliance Agreement at national level

[15] Key provisions relevant for the purposes of MCS are mainly those covering:

- flag State Responsibility;
- requirement that vessels be authorized to fish on the high seas;
- conditions for the grant of such an authorization;
- vessel marking, the provision of information by the vessels and enforcement measures;
- records of authorized high seas fishing vessels;
- international cooperation; and
- exchange of information.

[16] At an initial stage, implementation into national legislation will require a close look at the scope of the basic fisheries legislation. The scope might be limited to the national waters. This would thus result in the exclusion of the application of the contents of the basic fisheries legislation to the high seas. Further, most States that become parties to the Agreement will need to provide for the obligation that their vessels have an authorization to fish on the high seas, to comply with the requirements of the Agreement with respect to compiling and disseminating information and to make it an offence to fish without the authorization and/or in contravention with international conservation and management measures. While a national record of high seas fishing vessels could, in theory, be kept without legislation, it would be preferable to make the maintenance of such record mandatory. Exchange of information does not require specific legislation except for the purposes of confidentiality. Article V would require a legal provision to permit authorized officers to undertake investigatory measures in respect of such foreign high seas vessels when so requested by the Flag State.

THE 1995 UN FISH STOCKS AGREEMENT

Key provisions

[17] This Agreement, as its title implies, is intended to give practical effect to Articles 63 and 64 of the 1982 UN Convention, which deal with straddling stocks and highly migratory species.[1]

[18] It is rather complicated, as, for instance, parts of it only apply to straddling and highly migratory stocks, while other provisions seem to apply generally to the high seas or to international fisheries management arrangements. Here only the main provisions relevant for MCS purposes will be considered. The Agreement sets out, in Article 5, general principles on the basis of which conservation and management measures are to be established for straddling fish stocks and highly migratory fish stocks. Many of these are drawn from Article 61 of the 1982 UN Convention. These principles are to be applied in the EEZ, as is already required by Article 61 and now, through the Agreement, they are also to be the basis for conservation and management measures in the adjacent high seas areas.

[19] The measures taken must secure long-term sustainability of straddling fish stocks and highly migratory fish stocks. They must be based on the best scientific evidence available and must be designed to maintain and restore stocks at levels capable of producing maximum sustainable yield (Article 5, a). States are required to collect and share, in a timely manner, complete and accurate data concerning fishing activities, such as vessel position, catch of target and non-target species, and fishing effort, as well as information from national and international research programmes (Article 5, j). In accordance with Article 6, the precautionary approach is to be applied widely to conservation, management and exploitation of straddling fish stocks and highly migratory fish stocks and States are obliged to apply the guidelines set out in Annex II in order to set stock-specific precautionary reference points and the action to be taken if such reference points are exceeded.

[20] Conservation and management measures for fisheries can only be effective if they are complied with; this implies that there must be effective enforcement. Article 18 sets out the duties of the flag State and essentially repeats the FAO Compliance Agreement except for the restrictions on authorizing re-flagged vessels. The Agreement permits a State to authorize the use of a vessels flying its flag for fishing on the high seas only where such State is able to exercise effectively its responsibilities in respect of such vessel. The basic duties of flag States include requirements that vessels are issued with licences, authorizations or permits, are marked in accordance with FAO Standard Specifications and record and report vessel position and catch of target and non-target species. Flag States are required to implement inspection schemes and observer programmes and to regulate transhipment on the high seas to ensure that the effectiveness of conservation and management measures is not undermined.

[21] The enforcement provisions of the 1995 UN Fish Stocks Agreement are contemplated in Part VI and, in many respects, significantly extend the boundaries of existing international law. Under Article 19, flag States are required to ensure compliance and, to this end, to enforce conservation and management measures by investigating alleged violations and, if evidence so warrants, taking appropriate enforcement action. States are required to cooperate to ensure compliance with and enforcement of conservation and management measures for straddling fish stocks and highly migratory fish stocks, including by taking cooperative action

1. Article 2 states that the objective of the Agreement is to ensure the long-term conservation and sustainable use of straddling fish stocks and highly migratory fish stocks through effective implementation of the relevant provisions of the 1982 UN Convention.

to deter vessels from fishing on the high seas until such time as appropriate enforcement action is taken by the flag State (Article 20).

[22] Articles 21 and 22, entitled "Sub-regional and regional cooperation in enforcement" and "Basic procedures for boarding and inspection pursuant to Article 21" deal with boarding and inspection of fishing vessels on the high seas. Article 21 allows a State which is a member of a regional organization or a participant in a regional arrangement to board and inspect any fishing vessel of a State Party to the 1995 UN Fish Stocks Agreement, even if it is not party to the organization or arrangement for the purposes of ensuring compliance with measures relating to straddling or migratory stocks. This power may be exercised in the high seas or in the waters of the boarding State. States, through sub-regional and regional organizations and arrangements, are required to establish procedures for boarding and inspection. If, within two years of the date of adoption of the Agreement, any organization or arrangement has not established such procedures, boarding and inspection is to be carried out in accordance with the basic procedures contained in Article 22.

[23] Where, following a boarding and inspection, there are clear grounds for believing that the vessel has contravened conservation and management measures, the inspecting State is required to notify the flag State. The flag State must respond within three days and must either take action to fulfil its obligations under Article 19 or authorize the inspecting State to investigate the violation. In the case of a serious violation, and where the flag State fails to respond or fails or refuses to act, the inspecting State is given additional powers to bring the vessel into port for further investigation. Serious violations are defined in Article 21 by reference to a list of potentially serious violations. A flag State can resume control at any time during the procedures set out in Articles 21 and 22.

[24] Article 22 provides the basic procedures for exercising the powers under Article 21 unless the regional fisheries body agrees on its own procedures. This Article requires flag states to ensure that vessel masters cooperate, and if one refuses to do so, to suspend the vessel's authorization to fish and order the vessel to return to port.

[25] Measures taken by a port state are dealt with in Article 23. It allows port States to inspect fishing vessels, which are voluntarily in its ports or at offshore terminals, as well as to take measures to prohibit landings and transshipment of catches collected in a manner that undermines international conservation and management measures on the high seas.

[26] Even though less relevant for MCS purposes it is convenient to note that special provision is made in the Agreement for assistance to developing States as to enable them to fulfil their duties under the Agreement[1]. Specific assistance should address collection, reporting, verification and analysis of catch data; stock assessment and scientific research; MCS; and enforcement.

[27] Equally, the Agreement provides that all fisheries disputes should be settled by peaceful means through negotiation, inquiry, mediation, conciliation or through compulsory and binding dispute settlement procedures. The provisions of Part XV of the 1982 Convention are to apply *mutatis mutandis* to any dispute between States Parties to the Agreement concerning the interpretation or application of the Agreement whether or not they

1. States are required to take into account the special requirements of developing States, in particular the vulnerability of such States which are dependent on the exploitation of living marine resources for nutritional needs, and the need to avoid adverse impacts on subsistence and artisanal fishermen. Article 25 requires States to cooperate to enhance the ability of developing States, particularly small island developing States, to conserve and manage straddling fish stocks and highly migratory fish stocks and to develop their own fisheries for such stocks.

are also Parties to the Convention. The provisions of Part XV are also to apply *mutatis mutandis* to any dispute concerning the interpretation or application of a sub-regional, regional or global fisheries agreement relating to straddling fish stocks or highly migratory fish stocks. Failing agreement between the parties to the dispute on provisional arrangements, the court or tribunal to which the dispute has been submitted may prescribe provisional measures to preserve the respective rights of the parties to the dispute or to prevent damage to the stocks in question (Article 31).

Key issues relevant to implementation of the 1995 UN Fish Stocks Agreement at national level

[28] The provisions of the 1995 UN Fish Stocks Agreement which are most likely to require national legislation for their implementation, as far as MCS is concerned, are mainly those dealing with flag State responsibility and enforcement. Further, for most countries bordering the SWIO, the practical implications of implementation will await the development of high seas fishing capacity. Nevertheless, an important category of provisions is that which must be implemented by States acting cooperatively. These include the provisions in Part III of the Agreement relating to Cooperation through the establishment of sub-regional or regional fisheries management organizations or arrangements, and the provisions of Articles 21 and 22 relating to sub-regional and regional cooperation for boarding and inspection of the high seas.

[29] Implementation of the provisions of part II may require specific legislative action in respect of:

- the taking of conservation and management measures in general (e.g., licensing regimes, vessel limits); and
- the collection and sharing of data in accordance with Annex I of the Agreement. The minimum information to be collected by the States from their vessels fishing for straddling and migratory stocks should comprise: time series of catch and effort statistics by fishery and fleet, total catch in number, nominal weight, or both, by species (both target and non-target) as is appropriate to each fishery, discards, statistics appropriate to each fishing method, fishing location, date and time fished and other "statistics on fishing operations as appropriate." This information is to be provided to the relevant sub-regional or regional fisheries management organization or arrangement. The Annex contains additional provisions on vessel data and information which will become more relevant should high seas fleets be developed.

[30] Part V deals with the duties of the flag State and essentially recapitulates the FAO Compliance Agreement, the contents of which and its related implementation have been discussed above.

[31] Most relevant for this study are the provisions of Part VI (Articles 19-23), dealing with compliance and enforcement, and in particular with international cooperation in enforcement. At national level, compliance and enforcement duties of the flag State (Article 19) may be easily accommodated by requiring a licence for the high seas, imposing a condition of complying with applicable international measures, and making unauthorized fishing or violation of conditions an offence. Articles 20 to 22 comprise a number of important provisions on international cooperation on the high seas to ensure compliance with any regional or sub-regional agreement or arrangement. Any State ratifying the 1995 UN Fish Stocks Agreement will need to amend its national legislation to require its vessel to

comply with boarding and inspections on the high seas by the officers of other State Parties (Article 20). The need for amending national legislation will largely depend on the powers of the authorized officers and on the existence of relevant offences. In order to implement Article 21 (on sub-regional and regional cooperation in enforcement), basic fisheries legislation would need to authorize boarding and inspection not only outside national waters but also on any high seas area covered by a regional fisheries management organization, in respect of vessels of any Party to the 1995 UN Fish Stocks Agreement, even if it is not party to the relevant organization or arrangement for the "purpose of ensuring compliance with conservation and management measures for straddling fish stocks and highly migratory fish stocks established by that organization or arrangement." Such enforcement action by a non-flag State on the high seas is an important development in international law. The inspecting and boarding procedures are set out in Articles 21 and 22 of the 1995 UN Fish Stocks Agreement. They will apply automatically unless, within two years of the date of the adoption of the Agreement, (i.e., 4 August 1997), the parties to a regional agreement have established their own procedures for boarding and inspection which are consistent with the procedures set out in Articles 21 and 22.

Issues for implementation of the 1995 UN Fish Stocks Agreement at regional level

[32] Some consideration should be given at this stage as to how the 1995 UN Fish Stocks Agreement could be implemented at sub-regional or regional level, for instance under the auspices of IOTC. In this respect it is worth noting that Part III of the 1995 UN Fish Stocks Agreement covers matters of international cooperation in the conservation and management of straddling fish stocks and highly migratory fish stocks. It invites coastal states and States fishing on the high seas to "pursue cooperation in relation to straddling fish stocks and highly migratory fish stocks" taking into account the specific characteristics of the subregion or region. In the present, case and in accordance with the Agreement, such cooperation could be enhanced under IOTC, i.e., an existing regional fisheries management organization or arrangement having particular competence for the management of straddling fish stocks and highly migratory fish stocks. Further, it comprises as its members, coastal States and States "having a real interest in the fisheries concerned." It is important to bear in mind that, under Article 17, a State which is not a member of or a participant in a sub-regional or regional fisheries organization or arrangement "shall not authorize vessels flying its flag to engage in fishing operations for straddling fish stocks and highly migratory fish stocks which are subject to the conservation and management measures established by the organization or arrangement."

[33] In the light of the nature of the fishing activities and the important presence of DWFN vessels, it may further be appropriate to consider the role for the IOTC in:

- the collation of the information referred to in the previous section, both to encourage regional management and to serve as focal point to interact with any regional arrangement or agreement (Article 5 (j) and Article 14);
- the setting of conservation and management measures for straddling fish stocks and highly migratory species;
- where possible and practicable, the establishment of inspection and boarding procedures of fishing vessels according to Articles 21 and 22 of the Agreement. Equally, it could enhance the development under the national legislation of its members of harmonized powers conferred on the authorized officers. IOTC members should get

involved at the outset in the creation of any regional management arrangement in respect of the highly migratory fish stocks to ensure that their interests, as coastal States, are fully considered and protected.

CONCLUSION

[34] The two recent international fisheries agreements raise important issues for the countries bordering the SWIO. Participants in this Regional Workshop may therefore wish to recommend the organization of a regional Meeting, with the appropriate assistance from FAO, where possible, to consider in greater depth matters raised in this paper.

Appendix J

SATELLITE DATA COMMUNICATION SYSTEMS, REMOTE SENSING AND OTHER TECHNIQUES AS AN AID TO MONITORING, CONTROL, SURVEILLANCE AND ENFORCEMENT

by

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SUMMARY

This document takes into consideration the provisions of the Agreement to Promote Compliance with Conservation and Management Measures by Fishing Vessels on The High Seas; the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks; the Code of Conduct for Responsible Fisheries and International Conventions concerning the safety of life and property at sea.

Standards for the purpose of MCS are proposed for artisanal and non-artisanal fisheries as well as for the high seas. Suggestions are also made for a global agreement for performance standards with regard to remote sensing and satellite communications systems as an aid to fisheries management and enforcement.

The document is supported by appendixes concerning the monitoring of equipment and machinery of a fishing vessel, as well as extracts from relevant parts of the Technical Guidelines for the application of the Code of Conduct with regard to fishing operations.

CONTENTS

1. PREAMBLE

[1] With regard to fisheries protection and law enforcement, the FAO World Conference on Fisheries Management and Development, 1984, stressed, *inter alia,* that:

- States, in cooperation with the competent organizations, should adopt standard specifications for the identification and marking of fishing vessels; and
- where appropriate, use should be made of the latest technology in communications and other fields.

[2] Rapid progress was made on the matter of the marking of fishing vessels, fishing or intending to fish in waters of States other than those of the flag State as an aid to fisheries management and safety at sea. In 1989, the *Standard Specifications for the Marking and Identification of Fishing Vessels*, were adopted on a voluntary basis by the Conference of FAO. The ITU radio call sign is used as the basis for these standards, which were reviewed at IMO prior to submission to the FAO Conference.

[3] The World Fisheries Conference, in Mexico, 1992, expressed concern at the wide-spread problems associated with the re-flagging of fishing vessels. This led to the development of the *Agreement to Promote Compliance with Conservation and Management Measures by Fishing Vessels on the High Seas* (the Compliance Agreement), adopted by the Conference of FAO in November 1993. The Compliance Agreement makes it a requirement for a vessel to be provided with an authorization to fish and for the State to maintain records of the authorization to fish, as well as details of the vessel. It also requires vessels to be marked in such a way that they can be readily identified in accordance with generally acceptable standards, such as the *FAO Standard Specifications for the Marking and Identification of Fishing Vessels*. The Compliance Agreement will enter into force as from the date of receipt by the Director-General of FAO of the twenty-fifth instrument of acceptance.

[4] High seas issues were further debated at the UN Conference on Straddling Fish Stock and Highly Migratory Fish Stocks, which concluded its work in August 1995. That Conference adopted an agreement - *Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks* - (the UN Agreement) that requires vessels and gear to be marked for identification in accordance with uniform and internationally acceptable vessel and gear marking systems, such as the FAO Standard Specifications for the Marking and Identification of Fishing Vessels. The agreement also sets out requirements with respect to monitoring, control, surveillance (MCS) and enforcement for vessels fishing on the high seas. It contains references to reporting of the position of a vessel and the type of catch data to be reported. In Annex I to the UN Agreement, it is set out that such data collected by the vessels shall be transmitted, where necessary, by radio, facsimile or satellite transmission or by other means. This agreement will enter into force 30 days after the date of deposit of the thirtieth instrument of ratification or accession with the secretary-general of the United Nations.

[5] In October 1995, the Conference of FAO adopted the *Code of Conduct for Responsible Fisheries* (the Code) and this also makes provision for MCS and enforcement, as well as data collection and reporting. However, in the case of the Code, its provisions refer to *all fisheries*. Although the Code is voluntary, certain parts of it are based on relevant rules of international law, including those reflected in *United Nations Convention on the Law of the Sea of 10 December 1982* (UNCLOS 1982). The Code also contains

provisions that may be or have already been given binding effect by means of other obligatory legal instruments, such as the Compliance Agreement mentioned above.

[6] The FAO Conference, by resolution, requested the elaboration of technical guidelines for the application of the Code. FAO has prepared the Guidelines with regard to Article 8, Fishing Operations, and a number of supporting annexes. One annex, yet to be completed, will provide guidelines on aspects of MCS and remote sensing.

[7] FAO also prepared an *Inter-regional Programme of Assistance to Developing Countries for the Implementation of the Code of Conduct for Responsible Fisheries* that contains a sub-programme entitled *Upgrading Capabilities in Monitoring, Control and Surveillance*. In September, 1996, the Government of Norway agreed to provide FAO with funds for the execution of this sub-programme.

[8] If the provisions of the Compliance Agreement, the UN Agreement and the Code are to be applied, the States concerned would require, *inter alia*:

- an MCS and enforcement capability;
- an overall integrated system of MCS and fishing vessel safety;
- access to technology and the availability of equipment;
- guarantee of the technology;
- suitability to the fishery of the system to be deployed;
- cooperation of the industry;
- the training of fisheries management personnel, as well as awareness programmes for the industry;
- agreed performance standards; and,
- that selected data related to the position to a vessel and its operational mode (fishing/ steaming) would be admissible as evidence in a court of law.

2. BACKGROUND TO REMOTE SENSING TECHNOLOGY

2.1 MARITIME TRANSPORT

[9] The monitoring of the position of a ship at sea and the operation of its machinery has a long history in the merchant marine. Systems were initially set up for preventive maintenance purposes to enable shore-based managers to plan repair work within the overall scheduling of voyages of the fleet as well as of the individual ship. The system gained greater credibility as satellite communication systems (satcomms) improved, since the data gathered on board could be more readily transmitted to the shore base quickly and accurately. A typical installation sensed and stored detailed information on the main engines, auxiliary engines, pumps, refrigeration compressors and refrigerated-cargo-hold temperatures, as well as, information on navigation related to position, speed, course and weather; at least 250 readings or measurements were monitored and transmitted as a log abstract on a daily basis. Current applications are more complex and sophisticated, and a noteworthy example is the NATO research ship *Alliance*. Since this ship is designed to be acoustically quiet, even the changes in the levels of vibration of machinery are monitored and transmitted to the fleet manager (commercial) ashore. The software for the exercise is commercially available and the cost of transmitting large quantities of data is comparatively low.

2.2 FISHERIES RESEARCH

[10] With regard to fisheries research, Coastal Zone Colour Scanner (CZCS) data provides ocean colour information, allowing phytoplankton pigment concentration estimates from space. The relationship between CZCS measurements and phytoplankton distribution was first documented as long ago as 1980, by members of the NIMBUS Experiment Team, and has since been applied to physical and biological studies in many parts of the world. The ability to remotely sense phytoplankton pigment over large areas has provided biological information at spatial and temporal scales unavailable from shipboard measurement alone. When used in conjunction with shipboard sampling, satellite data may enhance the analysis process related to fisheries. Indeed, CZCS imagery has been successfully applied to both fisheries research and commercial operations. Most researchers also incorporate data derived from the Advanced Very High Resolution Radiometer (AVHRR) that provides sea surface temperature unavailable from CZCS (see Wittenberg-Fay, 1987; Kumari *et al.*, 1993).

2.3 FISHING VESSEL SAFETY

[11] Chapter IX, Radiocommunications, of the Protocol of 1993 to the *Torremolinos International Convention on Fishing Vessel Safety*, 1977, (the Torremolinos Convention) sets regulations for fishing vessels of 45 m in length and over. These include, *inter alia*, provisions for equipment that makes use of satellite communications systems such as:

- NAVTEX;
- the INMARSAT Geostationary Satellite Service; and,
- for an INMARSAT Ship Earth Station (SES) to be used, under certain circumstances, as an alternative to equipment otherwise specified in the regulations.

[12] NAVTEX is a component of the International Maritime Organization (IMO)/ International Hydrographic Organization (IHO) World-Wide Navigational Warning System (WWNWS) defined by IMO resolution A.706 (17). It has also been included as an element of the Global Maritime Distress and Safety System (GMDSS). The NAVTEX system provides shipping with navigational and meteorological warnings and urgent information by automatic printout from a dedicated receiver; it is suitable for use in all sizes and types of ships.

[13] Information on electronic aids to navigation is also fed into the system, which is used to advise mariners of significant degradation of a particular service such as, DECCA, LORAN, OMEGA or SATNAV. This is essential information for MCS officers concerned with the application of vessel monitoring systems (VMS) for position at sea.

[14] The International SafetyNET is a service of INMARSAT's enhanced group call (EGC) system, and was specially designed for promulgation of maritime safety information as part of GMDSS. It meets the requirements of the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended for broadcasting area, regional or local navigation warnings, meteorological warnings and forecasts, chart correction services, and shore-to-ship distress alerts. It is designed with the capability to provide services within the coverage areas of geostationary maritime communications satellites; it also provides the means of disseminating maritime safety information to coastal waters not covered by NAVTEX.

[15] Also provided is the FleetNET service, that allows authorized Information Providers, such as commercial subscription services, shipping companies and governments, which have registered with a Coastal Earth Station (CES) that supports the FleetNET service, to broadcast messages to selected groups of SES, each of which has registered with the Information Provider, and been added to a FleetNET EGC Closed Network. Typical applications of FleetNET include:

- fleet or company broadcasts;
- news broadcasts;
- commercial weather services;
- market quotations; and
- government broadcasts to all vessels on the national register.

2.4 SHIP POSITIONING SYSTEMS

[16] The position of a ship may be determined in a number of ways and, for those engaged in international voyages, specific requirements, according to ship size and type, are set out in SOLAS and the Protocol to the Torremolinos Convention [1]The equipment covered by these Conventions include:

- sextant;
- navigation charts and instruments;
- magnetic compass;
- steering compass;
- gyro compass;
- radio direction finder;
- radar;
- aids to navigation, such as global positioning satellite (GPS) systems, DECCA, LORAN and OMEGA; and
- fathometers.

[17] Additional equipment to ensure accurate navigation may be required for vessels wishing to use ship traffic separation schemes, depending on the system in use. Such schemes and the equipment to be used are subject to approval by IMO. The regulations apply to all vessels in transit through such areas and there are also rules related to the conduct of fishing in a traffic separation zone.

[18] The use of satellite-based systems as an aid to safety of life and property at sea, whether for the purpose of navigation or search and rescue, requires that the international user community has a commitment from the 'owner' of each satellite network to the effect that:

- the satellites will be maintained in service with no degradation in quality;
- public service obligations continue to be honoured: and,
- that there will be no discrimination on the basis of nationality.

[19] The introduction of GMDSS is a case in point, with INMARSAT confirming that there would be no change with respect to these commitments as set out in its constitution. INMARSAT could become a limited liability company in the future. Furthermore, in the case of the GPS operated by the United States of America, written assurance has been deposited with IMO to the effect that sufficient warning will be given should it be decided to phase out the service.

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1. The Torremolinos Conference noted that there could be confusion when the Protocol came into force and by resolution invited the IMO to: "adopt, by the time of the entry into force of the 1993 Torremolinos Protocol, an amendment to SOLAS Chapter V so that the requirements for shipborne navigational equipment and arrangements for fishing vessels contained therein should not apply to fishing vessels required to comply with Chapter X of the Protocol."

[20] Many fishing vessels carry equipment in excess of the requirements of the above-mentioned international conventions. Navigational aids that make use of satellite systems are now commonplace and available at an affordable cost to virtually all sizes of fishing vessels and land mobile units; most commercially available components can be readily interfaced with other aids to safe navigation and to fishing operations.

[21] Satellite communications installations are increasing in number as are facsimile receivers, and many users subscribe to commercial information services that give indications of where and when to fish, and there are more and more fishing vessels using E-mail. An important factor in the growth of this market is the level of confidentiality offered by satcomms.

[22] Furthermore, by taking advantage of the commercially available fisheries information services, the operator can reduce search time and lower operational costs (principally by reducing fuel consumption). In addition, market information is also provided which enables the operator to aim for the best price for the catch.

2.5 FISHERIES MANAGEMENT

[23] Fisheries managers have at their disposal a further aid to enable States to meet their obligations with regard to UNCLOS 1982 and better management through the adoption of elements of satellite technology, provided that the managers have an integrated management plan on the basis of:

- improved research and monitoring of stocks
- remote sensing of fishing operations;
- a vessel position reporting scheme; and,
- the reporting and processing of catch data.

The current generation of satellite systems and software packages offer a wide range of services of direct interest to those involved in fisheries research, fishing vessel safety, fishing operations and fisheries management. Some countries, notably Australia, New Zealand, USA and Canada, have already introduced remote sensing to determine the position of fishing vessels. Others (fishing nations) have agreed to comply with reporting schemes as well as to cooperate in experiments.

[24] Furthermore, a series of studies were undertaken recently by countries of the European Union and Norway, while Canada will shortly embark on another set of trials on its Atlantic coast. Indeed, in the summer of 1996, the European Commission put forward a Proposal for a Council Regulation for each Member State to establish a satellite-based VMS, to monitor the position of Community fishing vessels. The intent was for the system to apply from 1 January 1997 to:

- vessels operating on the high seas, except in the Mediterranean sea;
- vessels operating in waters of third countries;
- vessels catching fish for reduction to meal and oil;
- vessels using driftnets longer than one kilometre;

as well as, no later than 1 January 1999, to

- all other Community fishing vessels exceeding 15 m in length.

Although the proposal calls for position data and, where applicable, effort data to be transmitted by the vessel, the documents available at the time of writing did not contain details of the equipment to be used.

[25] There have also been a number of international meetings and workshops on the subject, in particular:

- Workshop on Enforcement Measures. OECD, Paris, September, 1993.
- Oceans '94' Conference. Brest, France, September, 1994.
- Global Fisheries Enforcement Workshop. Washington DC, USA, October, 1994.
- The Multilateral High-Level Conference on South Pacific Tuna Fisheries. Honiara, Solomon Islands, December, 1994.
- International Symposium on Fisheries Enforcement. Madrid, Spain, November, 1995.

[26] However, notwithstanding the interest generated amongst fisheries administrations and progress made to date, there is still substantial opposition, not only from the industry, but also from administrations, as witnessed at the Conference at the United Nations on Straddling Fish Stocks and Highly Migratory Fish Stocks, and during the development of the Code of Conduct for Responsible Fisheries. In addition, there are no internationally adopted standards for remote sensing as an aid to MCS. Furthermore, the three common systems in use - ARGOS, EUTELSAT and INMARSAT-C - although coming closer, are not exactly compatible, one with the others.

3. BASIC MCS CONSIDERATIONS

[27] Arrangements for MCS and enforcement would be greatly enhanced through the implementation of a system of 'authorizations to fish' as set out in the Code of Conduct.

[28] The authorization to fish should be conditional and those conditions should include requirements, where applicable, for the fitting of equipment for the remote sensing of the position of the vessel and for catch data reporting. National laws and fisheries regulations should be amended accordingly.

[29] States should ensure that navigation charts covering areas under their jurisdiction clearly indicate lines of demarcation between zones dedicated to the different types of fisheries (for example artisanal fisheries), types of fishing gear and methods. The charts (and notices to mariners) should indicate seasonal or time limitations. It should be noted that, with the current development of digital charts (ECDIS), their updating will be relatively simple, less costly and they will carry more information than hitherto.

[30] States should ensure that those responsible for the execution of regulations related to MCS are appropriately equipped and financed for the purpose and that there is a close relationship with related government bodies, such as:

- search and rescue services;
- the hydrographer; and,
- the authority responsible for navigation beacons and buoys.

[31] Furthermore, there should be a close relationship with the industry and its organizations, both in the development of a new scheme for MCS and its implementation. This would be of particular importance if remote sensing technology were to be adopted, since the industry, being subject to the provisions of international conventions, is well aware of its responsibilities and well aware of what is mandatory and what is optional. In this respect, fisheries managers might be less conversant with these regulations, since, in general,

they are not the responsible authority with regard to the regulations promulgated at IMO; in many cases, MCS administrators could fall into the same category as the fisheries managers.

[32] The industry also understands that the mandatory equipment required by convention has to meet internationally agreed performance standards, and they would expect the same to apply to MCS systems. They are also aware that suppliers have to undergo severe type-testing procedures and thus the conditions to be met are equal to all. The choice of actual supplier (and price to be paid) is then the prerogative of the buyer. Furthermore, under such international conventions, there is an obligation for States to provide and fund appropriate support services.

[33] Fishers would therefore more readily accept a well thought out plan that took into consideration the type of equipment already required to be fitted to a ship or a fishing vessel, the benefits that would accrue to the fishing industry (better safety procedures, less harassment, less interaction between artisanal and industrial fisheries as well as between fishing gears, and less poaching). Furthermore, fishing vessels are in the front line and are more likely to spot an intruder or an allegedly illegal act, long before it is detected by an MCS unit, and to report accordingly.

4. MCS OPTIONS

4.1 RECORDS OF FISHING VESSELS

[34] In developing MCS systems, a full knowledge of what is available nationally, sub-regionally, regionally and globally would be advantageous in general and, in many cases, essential. In this respect, there are national records of vessels, and, in many case, records of each fisher. There are also sub-regional and regional records of fishing vessels. In addition, FAO has established a computerized system to maintain records of fishing vessels authorized to fish on the high seas, and to facilitate exchange of information in preparation for the implementation of the Compliance Agreement. Under the Agreement, certain information is foreseen:

I The data to be provided by each Party to the agreement:

- (a) name of fishing vessel, registration number, previous names (if known) and port of registry;
- (b) previous flag (if any);
- (c) International Radio Call Sign (IRCS) (if any);
- (d) name and address of owner or owners;
- (e) where and when built;
- (f) type of vessel; and
- (g) length.

II Each Party shall, to the extent practical, make available to FAO the following information:

- (a) name and address of operator (manager) or operators (managers) (if any);
- (b) type of fishing method methods;
- (c) moulded depth;
- (d) gross register tonnage; and
- (e) power of main engine or engines.

III Each Party shall promptly notify FAO of any modification to the information listed above. Furthermore, each Party shall also promptly inform FAO of:

(a) any addition to the record;

(b) any deletion from the record by reason of:

- the voluntary relinquishment or non-renewal of the fishing authorization by the fishing vessel owner or operator;
- the withdrawal of the fishing authorization issued in respect of the fishing vessel (under Paragraph 8 of Article III of the Agreement);
- the fact that the fishing vessel concerned is no longer entitled to fly its flag;
- the scrapping, decommissioning or loss of the fishing vessel concerned; or
- any other.

[35] The intention is that the database could be directly interrogated by Parties to the Compliance Agreement. This interrogation would also be possible from suitably equipped authorized fisheries protection vessels.

[36] FAO has also entered into a form of contract with Lloyds Information Services through which FAO receives ASCII files containing information on fishing vessels that are in the Lloyds Register of Ships. The information supplied under this contract is currently limited to:

- name of owner(s)/vessel name;
- previous name (if any);
- Lloyds number;
- flag State;
- previous flag (if any);
- IRCS; and
- registered length.

[37] In general, the Lloyds records refer only to fishing vessels of 100 GRT and over, although there are exceptions to the rule, as in the case of vessels of less than 100 GRT that are 'in class.' The records are used by FAO to monitor flag changes and compare changes in fleet capacity with the catch data reported separately by countries (to FAO). Nevertheless, the database can be used as a supplement to the Compliance Agreement database to obtain information on vessels of non-States Parties. It could also be used to trace vessels that are not entered in sub-regional or regional records. Such information could be put to good use by aggrieved regional organizations wishing to take a matter up directly with the owner or operator, or the flag State concerned in the case of a vessel allegedly fishing in a regulated area.

[38] However, anyone can make a similar contract with Lloyds and go directly on-line or receive data in the same way as FAO. In addition, most good reference libraries in ports throughout the world hold hard copies of Lloyds Register of Ships.

[39] The weaknesses are that:

- in the absence of boarding, the vessels name or number and port of registry or IRCS must be recognizable; and
- the Lloyds database does not contain a full list of all fishing vessels in the world that are of 100 GRT and over. Thus, whereas the Lloyds database contained 613 entries for China, the flag State reported a greater number to IMO during the 1993 Conference on the Protocol to the Torremolinos Convention.

4.2 SATELLITE EARTH STATIONS

4.2.1 INMARSAT

[40] A system of CES is maintained in a number of the signatory States of INMARSAT. The operator of the CES is typically a large telecommunications company, which can provide a wide range of communications services to SES, communicating through the CES. The INMARSAT systems refer to Ocean Regions, and each system has a Network Coordination System (NCS) located in each ocean region. When a SES moves between ocean regions, logging in to the new region can be effected automatically or manually. The problems that cropped up in earlier fishing vessel position monitoring trials with the INMARSAT system would appear to have been overcome.

[41] The NCS and CES are linked to Rescue Coordination Centres, and the INMARSAT-C system is accepted by IMO as meeting the requirements of GMDSS, as INMARSAT does not manufacture the equipment used on board vessels or by the coast stations. When fitted with Enhanced Group Call processors, SafetyNET and FleetNET services (as described earlier) are also available.

[42] It should be noted that a SES can be barred, but only after a due process to barring has been completed, namely:

- if an SES is malfunctioning and causing interference to the system and/or to other users, a CES which detects the interference may request INMARSAT to issue a Technical Barring, to stop the SES communicating until repairs are carried out;
- or if the SES fails to settle any outstanding invoices with a Coast Station Operator within a reasonable time (Financial Barring).

[43] The pattern of billing is that INMARSAT charges the CES for the space segment of the call (satellite to earth); the CES charges an approved Accounting Authority or a Billing Entity; that in turn invoices the user (e.g., a shipping company). Although the cost of the space segment follows a scale of charges agreed at INMARSAT, the total charges by the CES may differ, for equal periods of call time, due to the rates to be applied for terrestrial lines.

4.2.2 ARGOS

[44] Through an agreement between France, Japan and the USA, the ARGOS system, provided by France, is installed in 4 satellites that were launched by Japan and France. The ARGOS programme is a long-term, non-profit initiative dedicated to monitoring the environment.

[45] A private company, Collecte Localisation Satellites (CLS), which is a subsidiary of the French Space Agency, is the world-wide operator of the ARGOS system. Arrangements for making use of the system, as well as the supply of equipment, are through a contract between CLS and the user.

[46] Data is transmitted to the satellites as they pass over a vessel and downloaded to a land-based processing centre operated by CLS. The actual number of times in 24 hours that a satellite will be over a vessel depends on the latitude in which the vessels is operating (fewer passes the closer to the equator). There are two such centres in operation (both linked) one in Toulouse, France, and the other in Landover, MD, USA. The processed data, vessel position, catch data, etc., is communicated to the end user through public communication networks.

[47] The end user must maintain a receiving centre equipped with a computer and modem. CLS offers a software package known as ELSA, through which the user may monitor the positions of vessels on maps and manage the database.

[48] Where required, positioning accuracy can be enhanced with incorporation of GPS and an on-board terminal can be provided to allow the input and transmission of catch data and any other information required by an MCS unit (or fleet operator). The system also provides for the transmission of alarm messages, but although the CLS earth station will process the data and transmit it to the user with a high level of priority, CLS takes no responsibility for any action with regard to the safety of the fishing vessel.

[49] Although the basic system is arranged for one way communications, the most recent satellite, launched by Japan, contains an ARGOS system capable of two-way data communications.

[50] Invoicing is by CLS to the user. A vessel transmitting data is charged per day, i.e., for each day that a report or even a series of reports are sent.

4.2.3 EUTELSAT

[51] EUTELSAT, the European Telecommunications Satellite Organization, was created in 1977 under an agreement between the post and telecommunications authorities of 17 of the countries that are now EUTELSAT members. It operates under an intergovernmental Convention of 1985 to which all European States can accede. The organization has its headquarters in Paris and there are over 34 member countries.

[52] EUTELSAT's mission is to provide satellites to meet the demand for public telecommunications services in Europe, telephony, telegraphy, telex, data transmissions, television transmissions and land mobile satellite services, as well as the control, monitoring and other ground facilities necessary for satellite operational support. BOATRACS, the company that assisted in trials in the USA, was linked to the EUTELSAT system.

[53] The system provides for two-way direct communication with a high level of security; long (standard) messages can be transmitted in a coded format.

4.2.4 RadarSat International

[54] The Canadian earth observation satellite RadarSat was launched in November, 1995, and has been commercially operational since March, 1996. Among the many uses claimed is the detection of ships and ships' wakes and the surveillance of fishing vessels (illegal fishing).

[55] The technology offers the possibility to back up other vessel position monitoring systems, including those using other satellite-based systems, but there would appear to be a number of drawbacks to its adoption, except perhaps in special circumstances. Apart from the apparent high cost to the user, in this case an MCS unit, there are other negative aspects, such as:

- requirements for advanced programming;
- accuracy is affected by the speed of the vessel and sea surface conditions;
- due to the wide swath (a point in favour) the State MCS unit would have to eliminate vessels fishing legally by cross checking against other systems, in order to isolate a vessel that would appear to be unauthorized; in order to follow up it would be necessary to download further information on the next satellite pass (and this may raise some problems due to the stated need for advanced programming); and

- the system can not readily differentiate between a fishing vessel and a cargo ship, any counter argument on size would hardly be relevant considering the existence of some very large fishing vessels (up to 10 000 GRT).

[56] However, this technology should not be discarded out of hand. The experience gained by the operators of remote sensing systems should be monitored (such as the use of synthetic aperture radar (SAR) and Advanced Very High Resolution Radar (AVHRR)). Furthermore, an organization such as FAO could enter into a dialogue with the operators with regard to possible improvements to enhance the use of the system for MCS purposes under certain, well-defined conditions.

4.3 AUTHORIZATIONS TO FISH

[57] As stated earlier in this document, national legislation should make an 'authorization to fish' a requirement for all fishing vessels operating in its exclusive economic zone (EEZ) and for its flag vessels intent on operating on the high seas. A record should be kept of the authorization to fish, which should contain details of the vessel, generally as set out in Section 4.1, above, as well as appropriate conditions to be met, such as :

- compliance with of the provisions of the Code of Conduct;
- species to be fished (quotas where appropriate) and time restrictions;
- areas to be fished and periodic or seasonal closures or restrictions;
- authorized fishing gear and methods, including mesh sizes, lengths of gear, etc.;
- marking of fishing vessels;
- marking of fishing gear;
- navigation aids and vessel position recognition;
- vessel position reporting;
- catch data reporting;

[58] Consideration should also be given to the inclusion of a photograph of the vessel in the record (updated as may be necessary to record changes).

[59] In the case of foreign fishing vessels, on innocent passage (without an authorization to fish in the EEZ), the law should require such vessels to stow all fishing gear and prior to [24 hours?] entering the EEZ, advise the coastal State by radio or other means of:

- the vessel's name or number, port of registry and radio call sign;
- intended point of entry, intended course and destination;
- the type of vessel and type of fishing gear carried;
- its intent or otherwise to enter a port in the coastal State;
- how the vessel is marked for identification; and, where applicable,
- the type of VMS on board.

[60] The coastal State should not unreasonably refuse permission for a foreign fishing vessel intent on innocent passage, but it may well require the vessel to report its position at regular intervals while on passage through the EEZ or to carry a satellite transponder. Further requirements would be applicable in the case of vessels carrying harpoon guns.

[61] The coastal State should provide information with regard to its laws and penalties for non-compliance with its national legislation. It should also ensure fairness in the application of its fishing regulations by providing navigational information and services to promote compliance with its laws.

5. APPLICATION

5.1 ARTISANAL FISHERIES

[62] The definition of artisanal fisheries differs from State to State and the sophistication of the vessels and their equipment varies accordingly. Globally, this sector encompasses some 3 million vessels, decked and undecked, and many are not even mechanized. In some instances, these vessels operate within sight of land and in others cases they may range far afield. Nevertheless, in most artisanal fisheries, the areas of operation are relatively well known. From a technical point of view, the use of satellites for vessel monitoring and catch data reporting should **not** be seen as a prerequisite for this sector.

[63] Furthermore, although there are some financially profitable artisanal fisheries in the world, the majority often barely subsist. For this reason, the additional cost to the fisher, resulting from a system of MCS, should be relatively low and a minuscule portion of the overall costs if the 'user pays' policy is adopted, which seems to be the norm. In the case of systems based on satellite communications technology, simply reporting the position of the vessel on an hourly basis could be equal to the salary of a crew member in the less financially rewarding fisheries, for each day spent at sea.

[64] The above arguments should not be seen to imply that remote sensing technologies should be neglected: simply that the approach may be more basic in the development of MCS systems. To begin with, the self-regulation of the fishery should be encouraged and this means organizing the fishers and giving them authority to discipline their members.

[65] A priority, however, should be to make known to all users of the seas, the position and extent of the zones - implying timely and close cooperation with the Hydrographer - exclusive to the artisanal sector and in this respect the coastal State should:

- ensure that the zones are correctly marked on navigation charts;
- where appropriate, place buoys at the boundaries of the zones; the buoys to have suitable markings, radar reflectors and lights for use at times of poor visibility;
- where appropriate, set radar beacons (racons[1]) on land, particularly in the case of long shorelines of low definition; and
- maintain radio beacons for direction finding.

[66] It would follow that vessels authorized to fish in the zones exclusive to artisanal fisheries should be fitted with the necessary navigation equipment for the recognition of the boundaries of the zone(s) in daylight and at night time in accordance with the system adopted by the coastal State. In addition, where applicable, there could be a requirement for the vessel to be fitted with means for the identification of its position by MCS officers operating a radar watch from the land, sea or air. This requirement would often be limited to a radar reflector, but it may also be necessary to fit low-cost echo enhancers[2].

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1. A responder beacon (racon) radiates a pulse in all directions as soon as it receives a radar pulse from a ship. Care should be taken to ensure that the frequency selected (or allowed) falls within standard marine bands.

2. It may be possible to make use of coded radar transponders and, in fact, this could apply to all classes of vessels. The term transponder is a contraction of the words *trans*mitter and re*sponder* and is a general term for a radar system that, upon reception of coded or uncoded pulses, transmits one or more coded or uncoded pulses. In coded format it would be possible to identify a vessel and to determine its position.

[67] The system should also require all vessels to carry identification marks and in this regard it is noted that the FAO Standard Specifications can be applied to all sizes of vessels, as well as to those vessels without a radio call sign.

[68] With regard to the reporting of catch data, there cannot be a globally agreed requirement for artisanal fishing units on the basis of electronic equipment or even written log books. There are obvious reasons for this, with varying levels of literacy being only one, and consequently methods and regulations will differ from State to State. What is important is that the State does adopt a system of collecting and processing the data to enable it to make a rapid assessment of the state of the stocks.

[69] Although satellite-based VMS is not the first consideration for this sector, small island States should pay particular attention to the safety aspects of artisanal fisheries that may call for the adoption of higher levels of technology than those normally associated with artisanal fisheries, principally due to the consequences of the breakdown of an engine-powered vessel. Such regulations could set the minimum survival equipment to be carried, such as a means of radio communication with a shore station (including EPIRBs), radar transponder and GPS.

5.2 NON-ARTISANAL FISHERIES

[70] Notwithstanding the arrangements made for fishing in the zones exclusive to artisanal fisheries, it is often the case that these artisanal vessels are also authorized to fish outside these zones. In such cases, these vessels, when so deployed, should comply with conditions set by the coastal State for the reporting of the position of the vessel and catch data by all vessels authorized to fish in its EEZ. The frequency of such reports would depend on an number of factors, including, *inter alia*:

- the critical nature of the fishery;
- operational patterns or sequence of landing; and
- data processing capability and capacity ashore.

[71] This sector may cover a wide spectrum within the fishery, with some vessels working well offshore and some sizeable vessels working fairly close to shore, as well as those that spend many days at sea and others confined to shorter voyages. From the point of view of good conduct, there is the threat of interactions, not only with artisanal fisheries, but also within the sector.

[72] Remote sensing techniques can greatly enhance MCS services, but it may not be practicable to apply the same requirement across the board to all classes of vessels with regard to how the position of a vessel is to be monitored or in what way and how often catch data should be reported. In this respect, an excessive demand for reporting, particularly catch data, would be counter productive if the data could not be realistically processed quickly on shore. In fact, in the majority of fisheries, if catch data (where, what and when caught) were to be stored on board in machine readable format (i.e., an 'Electronic Log Book'), these data could be retrieved by administration when the vessel lands its catch. Administrations could, of course, consider the sub-contracting of data analysis to specialized institutions or companies at home or abroad. In the event of transshipment, the log would also record the details of the transshipment, including the identity of the other fishing vessel or reefer.

[73] Clearly, the management of some fisheries, particularly where the vessels spend a long time at sea, may benefit from daily or weekly catch data reporting, and this could be achieved by voice, telex, fax or by the satellite systems currently in use for VMS. The choice to administrations would be directly related to their shore-side capability and facilities.

[74] Therefore, one possible approach to setting priorities, although there would always be exceptions to the rule, would be to classify by:

- vessel length on the basis of length as defined in the International Convention on Tonnage Measurement of Ships, 1969; and
- type of fishing activity.

[75] Three length-classes could be selected in the first instance:

- vessels of 24 m in length and over;
- vessels 15 m in length and over, but less than 24 m in length; and
- vessels below 15 m in length.

The type of fishing activities could be:

- gill netting, irrespective of size of vessel;
- bottom trawling (including shrimp trawling);
- purse seining;
- vessels engaged in mid-water trawling; and
- vessels engaged in fishing for reduction to fish meal.

[76] Therefore, taking into consideration the provisions made by administrations as set out in paragraph [65] above, the minimum requirements for all vessels of 24 m in length and over, authorized to fish in waters under the jurisdiction of a coastal State, but not in the zones exclusive to artisanal fisheries mentioned above, could be for:

(a) Navigation equipment that:

- allows the vessel to clearly and accurately (within 100 m) determine the boundaries of zones exclusive to artisanal fisheries and the boundaries of the EEZ;
- meets the requirement of SOLAS and, where applicable, the 1993 Protocol to the Torremolinos Convention;
- provides (continuous) and accurate coordinates of longitude and latitude; and
- in the case of position sensing by satellite, it can be interfaced with data communications equipment.

(b) Data acquisition and storage equipment that:

- can be interfaced with navigation aids so that it can automatically and continuously receive and store information on the position of the vessel, its heading and speed; and
- can store other data, such as manually entered catch data and data automatically sensed on the fishing activity. In his context, the assumption that if a vessel is steaming above a certain speed means it is not fishing and if steaming below a certain speed it is fishing, is nonsense. Therefore, if an administration really wants more accurate remotely-sensed information as evidence of a vessel's activities, parameters other than speed have to be taken in to consideration. See Appendix 1; and
- that does not allow alteration of data received automatically, as well as ensuring that all actions in manually inputting catch data are recorded (including error corrections).

(c) Communication equipment that:

- complies with the requirements of SOLAS and, as applicable, the 1993 Protocol to the Torremolinos Convention;
- automatically transmits the position, heading, speed of the vessel and other data if required by an administration; and

- allows the frequency of the reports to be set or changed remotely, as well as being capable of being polled.

[77] The minimum requirements for vessels from 15 to 24 m in length should include:

(a) Aids to navigation that:

- allow the vessel to avoid the zones exclusive to artisanal fisheries and to keep within the boundaries of the EEZ;
- meets the requirement of SOLAS; and
- provides (continuous) and accurate coordinates of longitude and latitude.

(b) Communication equipment that meets the requirements of GMDSS; and

- facilitates position reporting.

[78] The provisions of paragraph [76] above should also apply, in full, to all vessels of from 15 m to 24 m in length engaged in:

- fishing with drift gill nets ≥1 500 m in length, but less than defined by convention; and
- vessels fishing for fish meal.

5.3 HIGH SEAS

[79] According to the Code of Conduct, Article 7.7.3, States, in conformity with their national laws, should implement effective fisheries MCS and enforcement measures including, where appropriate, observers programmes, inspection schemes and VMS. Such measures should be promoted and, where appropriate, implemented by sub-regional or regional fisheries management organizations and arrangements in accordance with procedures agreed by such organizations or arrangements.

[80] The UN Agreement recognizes the difficulties with regard to fishing vessels on the high seas and in Part V, Article 18, it sets out a flag State's responsibility for MCS of such vessels, their fishing operations and related activities by, *inter alia:*

- " ... the implementation of national inspection programmes and sub-regional and regional enforcement schemes ... ";
- " ... the implementation of national observer programmes in which the flag State is a participant ... ";
- " ... the development and implementation of vessel monitoring systems, including as appropriate, satellite transmitting systems, in accordance with any national programmes and those which have been sub-regionally, regionally or globally agreed among the States concerned."

The use of satellite systems for remote sensing of fishing operations on the high seas as an aid to fisheries management is logical, given the fact that vessels so fishing could be spread over large sea areas, particularly where the targeted stocks are widely dispersed. Furthermore, satellite systems have proved to be a cheaper and better option than the currently available SAR and infrared systems.

However, although the UN Agreement sets out provision for the conduct of MCS on the high seas, there is no similar agreement on a global basis for remote sensing of the activities of fishing vessels. Agreements do exist on performance standards for systems using satellite communication within the maritime sector, and are set at IMO.

[81] The lack of a global approach to performance standards has contributed to doubts being cast on the accuracy and dependability of the information obtained with respect to the admissibility of the data as evidence by MCS and enforcement officers. The matter is further

complicated in the higher latitudes, where accuracy of position data may be questioned. Nevertheless, some national laws have already been amended and now set out requirements for vessels to be fitted with equipment suitable for position monitoring by satellite. This in fact has led to operational difficulties for vessels that move from one EEZ to another.

[82] Clearly there should be common standards, but if they are to be established and agreed for the purpose of fisheries MCS, such standards should not be in contradiction with those set at IMO. Similarly, care should be taken to avoid conflict by selecting operational frequencies that would not lead to problems such as confusion in a search and rescue operation.

[83] As a first approach, there should be a widely agreed outline of a remote sensing system and satellite communications system for high seas fisheries, but with the understanding that special consideration would have to be given to areas, such as the Mediterranean Sea, where many small vessels actually fish in international waters. This should take into consideration the proposals for non-artisanal fisheries within EEZ set out under Section 5.2 above, as well as the fact that many States have or are contemplating the use of remote sensing techniques within waters under their jurisdiction. At the same time – and without prejudice to the position of States with regard to the UN Agreement – its provisions should also be considered with regard to the reporting of catch data and the monitoring of the position of vessels on the high seas.

[84] The outline should also be seen as a model for other fisheries where it is deemed appropriate to monitor the activities of fishing vessels through the use of satellite and data communications technology. Hence it should, as a minimum, set the following conditions:

- the system should be suitable for all weather conditions;
- the network of satellites and earth stations should be provided to the world community (without discrimination), have a public service obligation and be guaranteed;
- it should provide for the communication of data between a ship earth station (SES) between a land earth station (LES), and between the LES and the land-based user (including incorporation of a distress alerting feature), and from computer to computer over PSDN and PSTN networks;
- it should provide a link to rescue coordination centres (RCCs);
- it should ensure that users can meet their obligations to other States under bilateral and multilateral agreements with regard to the exchange of data;
- the method of computing and entering the position of the vessel, its course and speed should be automatic;
- the position error should not exceed 0.1 nautical mile, although there may be a need to set greater latitude in the limits within which the system could be approved;
- the equipment should have an emergency power supply and be fitted with low-voltage alarms;
- the system should be designed to alert the LES in the event of a switch over to the emergency power source and when the low-voltage alarm is activated;
- the system should be capable of accepting data entered manually as well as remotely sensed; storing and transmitting data both automatically and when polled by an earth station or by an authorized SES (e.g., fisheries protection vessel);
- remotely sensed information should include data obtained from equipment and machinery with regard to the operational modes of the vessel (free steaming, searching, fishing);

- the data should be securely stored (tamper proof) on board the fishing vessel in machine readable format; and
- the equipment should be type approved, and in a truly integrated VMS/vessel safety system, the equipment may also have to be type approved in the same way that INMARSAT-C is accepted by IMO for NAVTEX and GMDSS.

6. OBSERVATIONS

6.1 WHO PAYS?

[85] Who pays for an advanced form of monitoring fishing activities is a major issue and one on which administrations and the industry disagree in many cases. In general, the trend is to treat such costs as simply another of the cost centres in the operational account of a fishing vessel.

[86] However, there are other cost associated with the equipping and manning of MCS units in setting up advanced systems, and the fishing industry sees these costs as accruing to the administration. They argue that if VMS is efficient and if the industry behaves responsibly, the overall cost of MCS should decrease and the industry should benefit from lower levies rather than face increases. With this in mind, there would certainly be a need to approach the issue very carefully if the confidence and cooperation of the industry is to be assured.

6.2 GENERAL

[87] Within the greater Indian Ocean region there are a number of areas of conflict between neighbouring States, in addition to conflicts with distant water fishing nations (DWFNs). Such conflicts are not limited to the non-artisanal fisheries, and in these cases it may be necessary to consider the application of measures to the artisanal sector that mirror arrangements for the high seas. Examples of such areas of conflict include, but might not be limited to:

- the Southern India - Sri Lanka - Maldives triangle;
- Malaysia - Thailand; and
- Australia - Indonesia.

[88] Furthermore, there is a special problem off the Horn of Africa, where illegal fishing still continues and indiscriminate dumping by merchant ships takes place.

[89] There are other areas within EEZs, perhaps of lesser gravity than mentioned above, that may benefit from a generally improved MCS system at national level. In this respect, the shared experience of the coastal States participating in this workshop may help to identify low-cost solutions to these problems.

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Annex 1

DETERMINATION OF FISHING AND STEAMING MODES THROUGH MONITORING THE PERFORMANCE OF THE EQUIPMENT AND MACHINERY OF A FISHING VESSEL

INTRODUCTION

[90] Prior to the acceptance by owners of a new ship, or after a refit, the ship undergoes a series of trials. The actual specification of the trials are agreed between the owner and the builder but these must include the requirements of the national administration and, where applicable, a classification society. A record of the trials, duly certified by the builder/ administration/classification society and the owner, also serves to provide the benchmarks against which the future performance of the ship, its machinery and equipment can be compared. In the case of a fishing vessel, it is normal to carry out fishing trials.

[91] On completion of the trials, the builder would normally remove the special gear and instruments used to record performance, but, in recent years, particularly with the trend to unmanned engine rooms, the means for monitoring performance have become part of the building of the ship. In this respect, fishing vessels are no exception, with fuel consumption being a case in point, as well as the advent of auto-trawling, auto-lining and advanced purse-seining techniques. These developments of course are industry driven and their adoption has led to greater efficiency of the fishing unit; they do, however, also offer excellent examples of on-board remote sensing, data processing and data communication technology.

[92] If, for the purpose of MCS and enforcement, a fisheries administration would deem it necessary to obtain evidence of the activities of a fishing vessel, it would require more information than the position of the vessel, its heading and speed. In this respect, there would be a need to have an agreed definition of a vessel engaged in fishing. For example, when its gear is set or when the vessel is in the act of setting the fishing gear; thus, for example, as soon as the dan buoy is away, it is fishing.

[93] To provide more substantial evidence, it would be necessary to obtain information on the performance of various equipment on board, such as the main machinery, auxiliary machinery, deck machinery and the steering or gyro compass, and, in some cases, information generated by electronic equipment may also have to be sensed. The actual details and combination of information needed for proof of fishing would vary according to the fishing methods used and the specification of the vessel.

[94] Fortunately, the very fact that fishing gears and methods differ so much should make it easier to decide what, where and when to remotely sense. The very act of setting gear in the purse seine operation and in trawling are as different from each other as they are to most of the other fishing methods.

[95] However, to take a general approach to remote sensing, the industry must also derive benefits from any extension of the use of such technologies adopted for the purpose of MCS and enforcement. For this reason, it would be more appropriate to consider the introduction of systems that can sense and process data, display the information (visually or by printout to the operator) as well as storing the data in a machine readable format. This would be of more benefit in real time to the operator rather than to an administration. Furthermore, the operator may be able to spot any anomalies and manually annotate (not make a correction as such) this information in the (electronic) log. Under certain conditions, the data, processed on board, could be polled by an MCS unit and, in the event of the need to board a fishing

vessel, an authorized MCS officer, holding the agreed password, could interrogate the data base there and then. This would have the advantage of avoiding a situation in which an otherwise doubtful assessment by the MCS officer could cause a vessel to stop fishing and be ordered to return to port.

[96] Notwithstanding the distinct advantages to the operator and MCS officers alike, it would be premature to advocate, as a general rule, that all vessels fishing in an EEZ or on the high seas should be fitted with sensors as an aid to determining whether or not a vessel is actually fishing. Even in the case of vessels already fitted with the equipment for VMS, it may difficult, for technical rather than financial reasons, to fit a full range of sensors. On the other hand, in promulgating fleet re-structuring policies - including technology to be adopted by the fleet - an administration should certainly give consideration to the elaboration of technical specifications that can accommodate a system of monitoring and control that uses data obtained from machinery and equipment sensors.

[97] However, the purpose of this document is to provide information on available technology that could be used in the VMS context. The technology associated with Supervisory Control and Data Acquisition (SCADA), falls into this category. Indeed, as mentioned in the main document, the technology has been in use for many years and it was recently employed in some of the VMS trials with fishing vessels in Europe. Properly used, the information obtained could support an allegation of fishing or strengthen the defence of the accused, as the case may be.

[98] In addition to the navigational data that would be required under VMS, examples are given below of what may have to be remotely sensed and stored to more accurately determine whether or not a vessel is or was engaged in fishing.

[99] For all types of vessels:

- time sensed;
- main engine exhaust gas temperature (after the exhaust manifold but before the silencer in an normally aspirated engine; after the turbo-charger but before the silencer in a turbo-charged engine);
- main engine RPM;
- pressure in inlet air manifold (turbo-charged engines);
- propeller shaft torque (with the addition of propeller shaft RPM and or propeller pitch setting as appropriate);
- voltage and amperage of the main motor in the case of electric drives; and
- vessel speed (although this is currently computed from position data in VMS applications, inputs from a Doppler log or electro-magnetic log are foreseen for this application).

[100] For vessels engaged in trawling:

- tension in warps;
- cod end bag tension (optional where sensors are fitted); and
- warp length.

[101] For vessels engaged in long lining:

- vessels heading;
- length of line deployed (auto-longlining systems can provide number of snoods/hooks); and
- hauling device (pressure or speed).

[102] For vessels engaged in gill netting:

- position of spar buoy at extremity of gear (this can be achieved by fitting a radio beacon to the spar buoy, as covered in the *Technical Guidelines for the Implementation of the Code of Conduct for Responsible Fishing - Fishing Operations*);
- length of gear retrieved; and
- pressure in hydraulic hauler or clutch engagement (in many cases the winch or nethauler might be mechanically driven. In such cases the torque can still be measured and the activation of the clutch monitored, but it should be recognized that there could be additional installation costs compared to vessels fitted with hydrostatic transmissions or electrics).

[103] For vessels engaged in fly-dragging or anchor seining:

- vessels heading; and
- rope tension.

[104] For vessels engaged in purse seine fishing:

- vessel's heading; and
- pressure in hydraulic supply to the power block or netwinch, or voltage and amperage of electric drive, or both.

[105] For vessels engaged in squid jigging:

- pressure in hydraulic supply line to jigging machine;
- amperage in jigging machine supply; and
- number of machines in operation.

[106] The above are typical examples, and provisions can be made for other types of fishing such as trolling, pole-and-line, hauling traps, etc., if so required and irrespective of the types of drive. Hand operations, of course, obviously present problems, but in general the types of vessels one would want to monitor in this way would be mechanized.

[107] In certain cases, there could also be a requirement to monitor the temperatures in the freezer tunnels, plate freezers, etc., as well as fish rooms and the refrigeration machinery. From this exercise, it would be possible to obtain confirmation of processing of the catch from the loading of the compressors. Reefers, under VMS, would could also be more readily controlled by sensing the refrigeration machinery and storage temperatures.

[108] The operators would also benefit as there would be an 'official record' of the storage temperatures in cases of disputes, and a record of compressor performance for preventative maintenance purposes.

Annex 2

SATELLITE TRACKING DATA COMMUNICATIONS

[109] For a **Shore-based MCS Unit:**

1. Communications Centre

1.1. Dedicated PC OR Sun WorkStation for extensive operations

- Pentium (90 Mhz or better)
- 1.2 Gb hard disk
- 16 Mb RAM or better
- 17-inch colour screen

1.2 Peripherals

- X25 communications board
- modem
- inkjet colour printer
- plotter

1.3 Software to allow:

- reading out as ASCII files;
- customized mapping digital charts, with additional high resolution capability in area(s) of operations;
- geographical information system (GIS) capability;
- vessel tracking and display (in different colours) of free steaming/fishing modes;
- local language capability (especially in the light of the largest fleets of fishing vessels being located in the Far East; China is the largest. In fact, more than 50% of the fishing vessels of the world $\geq$24 m have the flags of far eastern countries);
- time-variable polling;
- time management (world time zones);
- print out or writing to DOS files;
- decoding ship data.

1.4 Fisheries Protection Vessels:

- 2-way data communications system; and
- PC and software compatible with MCS Unit and SES.

1.5 Costs:

Cost vary dramatically depending on the size of the operation, irrespective of ARGOS/ INMARSAT/EUTELSAT. Minimum would be $US 10 000 for PC-based system, increasing accordingly if a Sun WorkStation is selected. Each protection vessel would be not less than $US 10 000.

[110] For **Ship Earth Stations**

1. Data Transmitter/Receiver

- GPS/accurate vessel position interface;

- polling capability;
- catch data processor interface;
- ship distress call function; and
- shipboard data acquisition unit interface.

2. Data processor:
- laptop or hand-held computer;
- data acquisition and storage interface; and
- dedicated printer (plotter optional).

3. Data Acquisition and storage (These are often incorporated in the communications unit and are intended to be secure and tamperproof):
- machinery and equipment sensors;
- vessel position data; and
- catch data.

4. Costs:

4.1 Equipment and Installation:
- ARGOS – $US 3 000 to 5 000 (Palm-Top Terminal; simple, one-position data communications station are cheaper;
- EUTELSAT – $US 7 000 to 10 000 (Laptop terminal); or
- INMARSAT – $US 7 000 to 10 000 (Laptop terminal).

4.2 Message Services (cost based roughly on hourly reporting):
- ARGOS – ca $US 220 (costing structure differs from the other two in that any number of reports can be transmitted each day);
- EUTELSAT – ca $US 70;or
- INMARSAT – ca $US 65.

[111] For **Land Earth Stations**

1. Processing Centres:
- data communications satellite service;
- data decoding;
- PSTN and PSDN networks (X25 obligatory; X400 optional);
- leased lines; and
- RCC.

Annex 3

EXTRACTS FROM THE TECHNICAL GUIDELINES IN SUPPORT OF THE IMPLEMENTATION OF THE CODE OF CONDUCT FOR RESPONSIBLE FISHERIES

'FISHING OPERATIONS'

PART 1 - FISHING VESSEL RECORDS AND REPORTING REQUIREMENTS

Introductory note

The adoption of standard practices with regard to the allocation of a flag, the maintenance of records of fishing vessels, authorizations to fish and the type of records to be kept by those in charge of a fishing vessel, would be a further aid to an officer in the execution of MCS duties ashore and afloat. The following notes may be of assistance in this regard.

1. FLAG ALLOCATION, AUTHORIZATION TO FISH AND RECORDS

[112] A flag State should establish a system to record details of vessels entitled to fly its flag whether through the process of the issue of a Certificate of Registry or other document in connection with the allocation of a flag or licence to fish. In addition, the system should allow ready comparison with the record of authorizations to fish granted to fishing vessels. Since, in many countries, the competent authority for the register of a fishing vessel is often different from the authority that would issue an authorization to fish, there should be a link between both activities; this is particularly important in the case of vessels changing flags.

[113] The 'authorization to fish' issued to a fishing vessel should contain conditions to be met by the owners, managers and/or charterers with regard to:

- the allocation of a flag to a fishing vessel;
- information on the vessel required for entry in the national record;
- information on catch retained and on catch discarded; and
- vessel position reporting.

[114] All fishing vessels operating or intending to operate in waters of States other than those of the flag State or on the high seas should carry a document that attests to its nationality.

[115] In general, fishing vessels should be subject to a process of registration and a public record should be kept in a register of fishing vessels. Unfortunately, there are no internationally agreed standards for the register of a fishing vessel. This is also the case for merchant ships, since the Convention on Conditions for the Registration of Ships brought in by UNCTAD in 1977 is still not in force. Nevertheless, for vessels engaged on international voyages, documents related to the registry of the vessel, the crew and its cargo, must be presented for inspection by the appropriate authority on entering port.

[116] The Code provides an opportunity to advise on minimum standards and requirements to ensure that States are not placed in a disadvantaged position with respect to reporting on fleets, catch data, safety at sea or with regard to their involvement in international fisheries. In the register the following information, as appropriate, should be recorded:

- name of vessel or number;

- port of registry/home port;
- ITU IRCS (details of the ITU system of call signs assigned by the Union and States are given in Annex II to the Standard Specifications for the Marking of Fishing Vessels);
- length overall as used to measure length for the purpose of the International Regulations for Preventing Collisions at Sea, 1972;
- registered length as defined in the Torremolinos Convention, as modified by the Torremolinos Protocol of 1993 relating thereto;
- GRT as defined in the International Convention on Tonnage Measurement of Ships, 1969;
- material of build;
- vessel type/fishing method(s);
- hold capacities in cubic meters;
- number of crew;
- power of main engine(s) (kw or HP);
- date built;
- Lloyds register number (where applicable);
- INMARSAT number (where applicable);
- name(s) and address of owner(s) and/or manager(s); and
- details of mortgages, maritime liens and other encumbrances.

[117] The flag State should ensure that vessels to which it has allocated its flag carry on board the original of the Certificate of Registry or document in connection with the allocation of a flag. The vessels should also carry the authorization to fish issued by the competent authority.

[118] A flag State may issue a document in which it calls on all other States to recognize that the vessel is sailing under its protection. This facility is often used when a vessel is being delivered to the flag State from the place where it had been built or in the case of a vessel that has had its registry closed by another State on the sale of the vessel to an entity in a new flag State. On arrival in the new flag State, a regular Certificate of Register (or Provisional Certificate) would normally be issued.

[119] An application for closure of the register or entry in a national record of fishing vessels should be accompanied by supporting information as to:

- the reason for the application (decommissioning/scrapping/sale); and
- the name(s) and nationality or nationalities of the new owner(s) (when applicable).

[120] The flag State should provide details of the closure and, where known, the name of the new flag State to the appropriate international organization and to States Parties to any international agreement for the conservation and management of living marine resources, to which the flag State is a party.

[121] A flag State should not delete the entry in its registry of a fishing vessel that is the subject of a joint venture agreement and it shall remain responsible for the vessel at all times. In this respect, it would be important to note that there may be a case for exceptions to this rule with respect to a vessel under a demise charter (bareboat charter). In such cases, a vessel is leased bare of officers and crew for a fixed period of time. Charterers may appoint their own officers and crew and assume full responsibility for the operations of the vessel; the charterers may be considered as owners with respect to third party claims arising out of the operations. There are no international agreements governing the bareboat charter of a fishing vessel. The Convention on Conditions for the Register of Ships, 1977, and the

Conventions on Maritime Mortgages and Liens, 1993, provide guidance on bareboat charter, but neither are in force and, in any event, they exclude fishing vessels.

2. POSITION REPORTING OF A FISHING VESSEL

[122] All fishing vessels should keep appropriate fishing and navigational logs and regularly report the position of the vessel to the competent authority. The position of the vessel may be reported in a number of ways and the requirement would differ with regard to the size of the vessel, its area of operation, the type of safety network in force and weather patterns. The authorization to fish could include a requirement for the carriage of equipment for the transmission of the position of a vessel over a local radio network or satellite communications system.

3. RECORDS OF FISHING VESSEL ACTIVITIES

[123] Fishing vessel owners, managers and fishers should ensure that the regulations set by the competent authority with respect to fishing gear, fishing methods and reporting on catch taken are followed. Records required by the competent authority should be maintained by those in charge of a fishing vessel in the form of log books or electronic logs, or both, [but in this context, see note on artisanal fisheries in main text] and should include, as appropriate:

[124] In the **Deck Log.**:

- date, time and port of departure;
- officer of the watch;
- noon position by long/lat, DECCA or LORAN readings;
- weather and sea state;
- auto-pilot on/off - time and date;
- time and date of changing from steaming to fishing mode and vice versa;
- time, date and position of transshipment;
- date, time and port of arrival; and
- interventions by authorized persons at sea or in port to be recorded in the remarks column.

[125] In the **Fishing Log**:

- time, date and position of setting fishing gear;
- type, extent/amount of fishing gear deployed;
- time, date and position gear retrieved;
- composition and weight of catch taken;
- catch processed on board and storage details;
- catch landed by species/weight;
- details of discards; and
- observers remarks.

[126] In the **Machinery Log**:

- date, time and port of departure;
- fuel consumption by watch or day;
- weather and sea state;

- officer of the watch;
- noon readings;
- hours run or revolutions per watch/day by main engine(s);
- hours run by auxiliary engines per watch/day;
- hours run by refrigeration machinery per watch/day;
- fish room temperatures;
- time oily-water separator in use;
- average main engine exhaust and water temperatures, watch/day;
- engine RPM in free running and fishing mode;
- times and dates deck machinery in use; and
- details of ballasting and de-ballasting.

[127] To enable those on board to comply with regulations concerning the maintenance of log books, owners should ensure that fishing vessels are equipped with appropriate navigation equipment and instrumentation.

[128] In addition to log books kept in a hand-written format, fishing vessels should be fitted with electronic data storage devices and – to the extent possible – remote sensing devices that would record the position and performance of the fishing vessel for the purpose of fisheries management and safety at sea. To the extent practical, such systems should be fully automatic and only require that the catch data be manually entered.

PART 2 – PORT STATE CONTROL

Introductory Note

MCS units can take advantage of the authority of a State to exercise port State control over shipping voluntarily entering its ports. This authority would be enhanced if fisheries aspects were further developed in legislation. The following notes expand on the general understanding of port State control.

1. ASSISTANCE TO A FOREIGN FLAG STATE

[129] Port States should establish procedures in their national legislation, in accordance with international law, including applicable international agreements or arrangements, for it to achieve and to assist other States in achieving the objectives of the Code of Conduct for Responsible Fisheries. Details of these procedures and measures to be taken to enforce them, should be made available by the port State to all other States.

[130] A port State should not discriminate in form or in fact against vessels of any other State.

2. INSPECTION BY A PORT STATE

[131] A port State should inspect such documentation required to be presented to the competent authority on entering a port with regard to the fishing vessel[1], its crew and its cargo. The examination of the fishing vessel and its documents should include, *inter alia*:

- a certificate in connection with the registry of the vessel or other document associated with the allocation of the flag it wears;
- safety certificate of the vessel;
- the authorization to fish;
- where applicable, its authorization to fish on the high seas; and
- the examination of the fishing gear and catch to determine whether or not these comply with national regulations for vessels operating within the EEZ of the port State and/or international agreements for the conservation and management of living marine resources and protection of the environment.

[132] When a vessel is required to comply with a VMS, the details would be contained in the authorization to fish. A port State surveyor could then check that the vessel so complies, check that it is working and, if it is not in working order, the appropriate administration can be alerted.

3. DETENTION

[133] A port State may detain a fishing vessel if it has sufficient reason to believe that the vessel does not comply with the above requirements, unless, in the case of sub-paragraph 3 (b), that:

- the deficiencies cannot be rectified in the port;
- in the case of navigation equipment and the vessel's propulsion machinery, the emergency or stand-by equipment has been adequately demonstrated; and
- in the case of vessels in class, the classification society surveyor concerned is in agreement.

The port State should immediately inform the flag State of any deficiencies found and of any action taken. The port State should also be prepared to take any, or further action as the case may be, at the request of the flag State.

[134] A fishing vessel may not be unreasonably detained (Provisions are made for detention under international convention; see also the Protocol to Torremolinos). If, in the opinion of the owner, a vessel is unreasonably detained, compensation may be claimed from the port State. However, the owner of a fishing vessel should not have the right to claim for lost fishing time or for alleged loss of income with respect to sale of the catch. For this purpose, the Master of a fishing vessel is considered to be an agent of the owner.

[135] Pursuant to paragraph [133] above, the port State should also inform the relevant international organization as may be required under any international convention, legal instrument or regional arrangement to which the port State is a Party.

1. Further guidance is set out in IMO Conventions. See: *Convention on Facilitation of International Marine Traffic* (FAL); *Convention on the Safety of Life at Sea* (SOLAS); *Torremolinos International Convention for the Safety of Fishing Vessels*, 1977, as modified by the *Torremolinos Protocol* of 1993 relating thereto.

5. TRAINING

[136] States should cooperate with each other to adopt common standards of training for port State inspectors and surveyors. For large cargo ships, a number of memoranda of understanding have been developed that exclude fishing vessels, but not other vessels covered by the Code of Conduct. Complaints of discrimination by port State surveyors has led IMO to elaborate common standards of behaviour. If MCS units adopt remote sensing techniques, their staff and possibly the general port State surveyor may require additional training in the inspection of fishing vessels.

Appendix K

THE SOUTH PACIFIC FORUM FISHERIES AGENCY AND LEGAL ASPECTS OF FISHERIES MONITORING, CONTROL AND SURVEILLANCE

by

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INTRODUCTION

[1] This paper examines current trends in fisheries monitoring, control and surveillance (MCS) in the South Pacific area, and examines how MCS is part of the overall process of fisheries management in the region. In the South Pacific, regional cooperation in fisheries management is intended to enhance the prospects for the coastal States in the region to maximize the benefits accruing from sustainable utilization of the fisheries resources under their jurisdiction. MCS is an essential part of fisheries management. Without adequate MCS, it is very difficult for the fishery management authority to gather the information needed to manage a fishery and to enforce the regulations applicable to the fishery.

[2] In a modern commercial fishery, conventional means of MCS include surface surveillance by fishery patrol vessels, aerial surveillance, observer programmes and port inspection programmes. Each of these methods has its advantages and disadvantages. No single technique is sufficient to ensure compliance. In most fisheries a combination of two or more techniques will produce the most effective MCS. In the South Pacific, however, most of the countries in the region are classified as small-island developing states, and lack the physical enforcement capability needed to apprehend foreign offenders while still in the 200 nautical mile exclusive economic zone (EEZ) and then to prosecute them by conventional legal processes. Consequently, strong emphasis has been placed on sub-regional and regional cooperation in MCS through regional institutions such as the South Pacific Forum Fisheries Agency (FFA) and the development of new "long-arm" approaches to enforcement.

[3] This paper reviews the evolution of some of the MCS techniques that have been adopted in the South Pacific region, examines the problems and constraints that have been encountered, and offers some thoughts on future directions.

THE SOUTH PACIFIC REGION

[4] The South Pacific region is a large and diverse area of the western and central Pacific Ocean, stretching from the Republic of Palau in the northwest, to New Zealand in the south, the Pitcairn Islands in the east and the Republic of the Marshall Islands in the northeast. The region is made up of a large number of island States, including some of the smallest in the world. Divided into three great, geo-ethnic regions - Polynesia, Micronesia and Melanesia - a striking feature of the region is an extraordinary degree of homogeneity and social and political cooperation, despite significant cultural differences. The western tropical Pacific region, which encompasses the area served by the FFA, covers an area of approximately

24.8 million km^2. The combined EEZs of the 14 island States which are members of the FFA[1] cover an area of around 20.1 million km^2, or 81% of the total area. In contrast, the total land area of these island countries is 0.527 million km^2, or 2% of the total, the remaining 19% of the total area being high seas. The small-island States support a population of some 5.25 million (of whom 67% are in Papua New Guinea) relying heavily on fisheries resources as a major source of food and foreign earnings.

[5] The declaration of 200-mile EEZs or fisheries zones in the early 1980s enabled island States in the South Pacific to claim jurisdiction over the abundant stocks of highly migratory tunas in the region. Although in recent years the trend has been towards the development of viable domestic tuna industries, the tuna stocks are, for the most part, harvested by the fleets of distant water fishing nations (DWFNs). The policy of granting access to DWFNs is a result of several factors, including the inability of the island States to fully exploit the resources on their own behalf, the need for revenue from the sale of fishing licences and the fact that most of the developing island States lack the resources to enforce their sovereign rights over the resources within their zones. Nevertheless, for nearly all the island States in the region, fisheries provides one of the few opportunities to realize much-needed development goals.

OVERVIEW OF THE FISHERIES IN THE SOUTH PACIFIC

[6] The most important commercial fisheries in the South Pacific are the tuna fisheries of the central and western Pacific, based on skipjack (*Katsuwonus pelamis*), yellowfin (*Thunnus albacares*), albacore (*Thunnus alalunga*) and bigeye (*Thunnus obesus*). By far the most significant of these, in terms of quantity of catch, is the western Pacific purse seine fishery for yellowfin and skipjack. Large industrial fisheries for skipjack occur in the western Pacific from the Philippines and Indonesia to about 160° W. The majority of the catch is taken by purse seine vessels in the area between 10° S and 10° N. A Japanese pole-and-line fishery, currently of dwindling importance, extends north to about 40° N. Yellowfin are fished throughout the Pacific by long-liners, in the eastern and western Pacific by large purse-seiners, and in the Philippines and eastern Indonesia by pole-and-line, handline and other small-scale methods.

[7] Japanese pole-and-line fishing for skipjack tuna started in Micronesia as early as 1922, with the establishment of bases on several of the islands administered by Japan under the Treaty of Versailles. Nevertheless, the fishery did not attract the interest of other DWFNs until after the end of the Second World War, since when it continued to expand steadily. Over the past fifteen years the tuna fisheries have undergone significant expansion, partly as a result of the introduction of new and improved gear types, such as purse seining, and partly as a result of the dramatic expansion of the distant water fleets of the new industrial economies such as Taiwan and Korea. Between 1980 and 1991, catches of skipjack tuna more than trebled. Meanwhile, western Pacific yellowfin catches doubled between 1980 and 1991, with much of the increase resulting from the expansion of purse seining. Recently reductions in total landings have occurred as a result of a decline in the catches of DWFN fleets, including Japan, Korea, Taiwan and the USA. The reduction in skipjack landings is considered to be due partly to enhanced MCS and partly to a shift towards the higher-value,

1. The Member States of the South Pacific Forum Fisheries Agency are Australia, Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Solomon Islands, Tonga, Tuvalu, Vanuatu and Western Samoa.

long-line fishery. In the past five years, significant domestic long-line fisheries for fresh chilled yellowfin and bigeye tuna have developed off Fiji, Palau, the Federated States of Micronesia, the Marshall Islands and Tonga.

[8] Currently, the South Pacific region sustains one of the largest tuna fisheries in the world. In 1991, 1 261 350 t of tuna was taken from FAO statistical area 71, which includes much of the FFA region. The FAO statistics indicate that some 42% of the total world tuna catch is taken from the South Pacific region (including Indonesia and the Philippines) (FAO, 1993)[1]. The total offshore tuna landings from the western and central Pacific currently amount to around 1 000 000 t/yr, with a nominal value of 1 000 million dollars. FAO reports the total skipjack catch in 1992 to have been 454 000 t.

SOUTH PACIFIC FORUM FISHERIES AGENCY

[9] FFA was established in 1979 in response to a need for increased regional cooperation in fisheries matters, as a result of the changes in the management and use of the ocean's resources under consideration by the Third United Nations Conference on the Law of the Sea. For a concise history of the negotiations leading to the establishment of FFA, see Gubon, 1987. The subsequent recognition of the legal concept of the EEZ under the 1982 Convention had a significant impact upon the island States of the South Pacific region, bringing vast areas of ocean space under their jurisdiction. Most of the FFA Member States are parties to the 1982 Convention, and all of them have declared 200-nautical-mile EEZs or fisheries zones.

[10] The primary purpose of FFA is to assist Member States in the exercise of their sovereign rights of management and to promote regional cooperation. The Convention establishing FFA reflects the common interest of its member states in deriving maximum economic benefit from their marine resources, and is virtually unique among regional fisheries agreements in that it explicitly excludes DWFNs from membership. The FFA Convention makes it clear that FFA is not a fisheries management organization in the traditional sense; thus it does not have the mandate to determine access to resources or establish conservation and management measures. Nevertheless, in accordance with the 1982 Convention, the FFA Convention recognizes that effective cooperation for the conservation and optimum utilization of the highly migratory species of the region will require the establishment of additional international machinery to provide for cooperation between coastal states in the region and all states involved in harvesting the resource.

[11] The Agency functions primarily as a consultative and advisory body. It takes its direction from member governments through the Forum Fisheries Committee (FFC), which meets annually to review the previous year's work and approve the Agency's work programme and budget. Funding for FFA comes from contributions by Member States and extra-budgetary funds from international aid donors. Core FFA activities include an economics and marketing programme, a legal programme, an information technology programme and an MCS programme.

1. The SPC statistical area does not include Indonesia and the Philippines. However, SPC estimates for total catches from the SPC statistical area, plus Indonesia and the Philippines, are slightly higher than FAO's figures, and would indicate that the proportion of the world tuna catch taken from this area is over 50%.

THE FFA MCS PROGRAMME

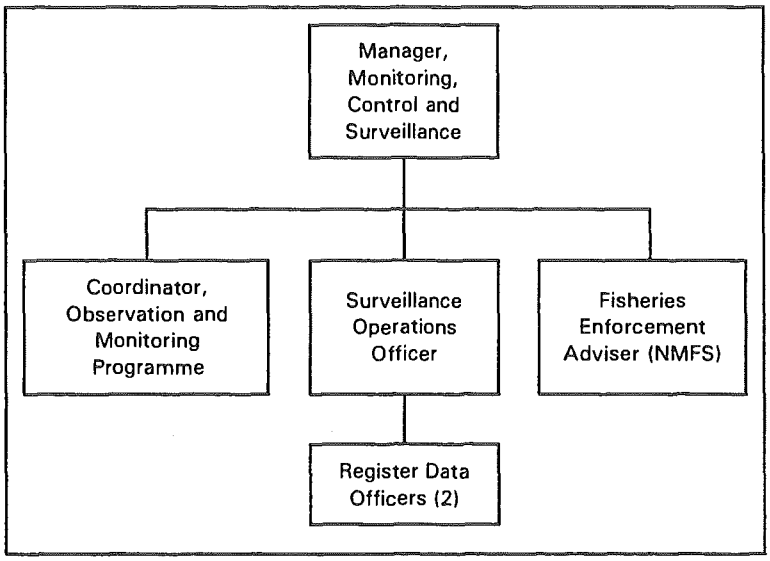
[12] A critical requirement for effective regional MCS is the establishment of a coordinating mechanism, with well-defined objectives and a clear work plan. The regional fisheries surveillance programme was established at FFA in 1986 in order to promote regional coordination and cooperation in fisheries surveillance and enforcement. Originally part of the Agency's legal division, the programme became fully established as one of FFA's core activities in 1992. Since then it has continued to expand and is now one of the most important aspects of FFA's work programme.

[13] The primary objective of the programme is to enhance the MCS capabilities of FFA Member States. This is to be achieved through:

- regional coordination of fisheries surveillance and enforcement operations;
- collating reports and information on the activities of foreign fishing vessels and other appropriate information for distribution to member governments;
- provision of technical assistance to governments in areas such as the provision of information on alternative surveillance equipment, systems and arrangements; the evaluation of fisheries surveillance requirements; evaluation of technical, legal and economic aspects of fisheries surveillance capacity and efficiency; and the preparation of manuals for fisheries surveillance and enforcement staff; and
- training for fisheries surveillance and enforcement officials.

[14] The structure of the MCS programme is shown in Figure 1. The programme has four sub-programmes, namely: Regional Register; observation and monitoring; vessel monitoring systems; and the Maritime Surveillance Communications Network (MSCN). These sub-programmes are each supported by input from FFA's other core activities, as appropriate. Funding for the programme is obtained from a variety of sources, including significant extrabudgetary funding, mainly from Australia. A meeting of regional fisheries surveillance and enforcement officers is convened annually to approve a work plan for future activities. Recommendations from the regional surveillance officers meeting are submitted to the FFC for endorsement, thus ensuring that MCS activities are supported at the highest level. The regional surveillance officers meeting also provides an opportunity for fisheries enforcement officers to exchange ideas and keep abreast of developments taking place both in the region and globally. Additional, *ad hoc*, meetings are convened as and when necessary to consider specific issues.

Figure 1. Structure of the FFA MCS programme



REGIONAL COOPERATION IN MCS

[15] This section reviews some of the key areas of regional cooperation and the way in which coordination at the regional level can lead to enhanced MCS at the national level.

Coordination of air and surface surveillance

[16] At the operational level, FFA provides coordinating assistance to two regional programmes involving conventional air and surface surveillance. These are the Pacific Patrol Boat Programme and the aerial surveillance patrols provided by the Australian and New Zealand armed forces. The Pacific Patrol Boat Programme, funded entirely by Australia, is intended to equip the island States with dedicated fisheries patrol vessels. Nationals of recipient States are trained to operate and maintain the patrol vessels. Associated with the programme is the establishment of a network of National Operations Centres (NOCs) in each Member State, linked to a Regional Fisheries Surveillance Centre (RFSC) at FFA. The NOCs are purpose-built operations centres, housed at the dockside, comprising accommodation for personnel, a secure communications facility, a workshop and training areas. FFA assists with the provision of training, computer equipment and expertise, and coordination of operations between NOCs. Both Australia and New Zealand have conducted aerial surveillance in the region for a number of years. FFA assists in the planning and operational phases of these patrols and ensures that maximum benefit is received from the surveillance flights by collating information and disseminating it to the relevant NOCs. In order to ensure that information can be obtained and disseminated in a secure and timely manner, Australia has also established the satellite-based MSCN to connect NOCs. This provides back-up to and supplements the commercial telecommunications networks in the region.

National and regional observer programme

[17] It is widely recognised that observer programmes are one of the most effective mechanisms for ensuring compliance with conservation and management measures, as well as for the collection of important scientific data. Well-trained observers can provide the fisheries manager with a wealth of information about the fishery, including precise details of catches, fishing patterns and techniques, and can be used to collect simple scientific data at sea. Observer reports of illegal activity have been used as the basis for successful prosecutions, but it is often unrealistic to expect observers to act as enforcement officers when they have to remain on board a fishing vessel for a lengthy period of time and build up a working relationship with the master and crew. Unfortunately, observer programmes are also costly, labour-intensive, and require a high degree of coordination if a significant level of coverage is to be achieved.

[18] There has been an active observer programme in the FFA region since 1987, but, until recently, this was confined to the USA purse-seine fleet fishing under the *Treaty on Fisheries Between the Governments of Certain Pacific Island States and the Government of the United States of America* (MFT). However, in 1994, additional funding was secured to significantly expand the regional observer programme, and a full-time Observer Programme Coordinator is now based at FFA headquarters. The programme, which works closely with SPC, aims to develop national and regional observer programmes, provide specialized training for observers, and collect, analyse and disseminate observer data. Specialized training courses have been developed, and, during 1994/95, almost 100 observers were

trained in basic seamanship, safety at sea, fishing technology, observer data collection, and reporting techniques. In addition, national observer training courses have been established in Kiribati and Papua New Guinea.

Training

[19] Without strong national MCS programmes, efforts to enhance MCS at the regional level are largely wasted. Accordingly, FFA has placed great emphasis on improving national programmes through providing technical advice, assistance and training. Practical training of surveillance officers through short-term attachments with FFA and other governments in the region is particularly encouraged in order to promote the development of expertise within the region. FFA also runs national and sub-regional training courses in areas such as communications technology, boarding procedures and the Regional Register.

LEGAL ASPECTS

[20] An effective MCS programme, whether at the national or regional level, also requires attention to be given to issues relating to enforcement. This was recognized by FFA as long ago as the mid-1980s, and considerable effort has been put into developing training programmes and manuals for all those involved in the prosecution of fisheries offences, including investigators and prosecutors. The first FFA Fisheries Prosecution Manual was issued in 1988, with a second, fully-revised edition, in 1994. As well as containing precedents for charges and advice on evidence gathering and presentation, the manual also contains information on fishing techniques, navigation and fishing gear technology to help the prosecutor who may be unfamiliar with such matters. The manual forms the basis for fisheries prosecution workshops, which are held several times a year. Recently, to raise awareness of the impact of illegal fishing upon the resources and the economies of FFA Member States, FFA convened a regional seminar for senior members of the judiciary, during which a compendium of cases involving foreign fishing offences was issued.

[21] In addition, FFA from time to time convenes sub-regional and regional consultations of legal experts to discuss issues of current interest and formulate recommendations for consideration by the FFC. These consultations, some of which have involved FAO, have led to the adoption of several new initiatives, including the *Niue Treaty on Cooperation in Fisheries Surveillance and Law Enforcement in the South Pacific Region*. The Niue Treaty is discussed below.

Harmonization of fisheries legislation

[22] Harmonization of legal regimes, at the regional level, is widely regarded as an essential first step towards closer cooperation in MCS. If there is to be effective cooperation in surveillance and enforcement matters, it is particularly important that the legal powers given to enforcement officers in each jurisdiction are broadly similar and that offences are categorized according to a broadly similar scale. This is a philosophy which has been adopted globally by FAO, and regional programmes for the harmonization of fisheries legislation are well-advanced in a number of areas, including the Eastern Caribbean and in West Africa. FFA has promoted the objective of harmonized regional fisheries legislation since the 1980s, and provides a continuous programme of assistance to Member States in the review of fisheries laws and regulations.

[23] There are limits to the extent to which legislative regimes can be harmonized. A major constraints is where contrasting legal systems exist in the same region. Where, for example, some States follow Roman-Dutch law, while others follow Islamic or Common Law systems, there can be great difficulty in achieving compatibility because of the fundamental difference in the basis of the legal system. The FFA region is relatively fortunate in this regard because, while there is a division between those Member States which follow a North-American-based jurisprudence and those with a Common Law system based on English law, the differences between the legal systems are differences of style rather than substance.

Minimum terms and conditions of access

[24] As well as recognizing the benefits of harmonized fisheries laws and regulations, FFA member States also recognize the benefit of harmonized terms and conditions of access for foreign fishing vessels. Agreement on harmonized "minimum terms and conditions of access" (MTCs) was a response to attempts by DWFNs to play one island State off against another in order to secure the most favourable terms of access. The MTCs were first adopted in 1982 and contain a number of measures intended to improve MCS. They require the operators of foreign fishing vessels to:

- mark vessels in accordance with the FAO Standard Specification for the Marking and Identification of Fishing Vessels;
- report details of catch and position according to a standardized format;
- use standardized catch and effort logsheets;
- accept observers on board at the request of the licensing State;
- appoint agents to respond to legal process in each Member State in which they are licensed to fish; and
- not tranship at sea.

[25] In addition, the MTCs require that all access agreements contain an undertaking by the flag State to ensure compliance by its vessels with the terms and conditions of access and the laws and regulations of the licensing State.

[26] The MTCs aroused considerable opposition amongst DWFNs when they were first introduced. Nevertheless, in 1987, the MTCs were incorporated as part of the terms and conditions of access for the USA fleet under the MFT, and thereafter it was only a matter of time before the MTCs were successfully applied to all DWFN fleets operating in the region. The process was assisted by the fact that many FFA member States chose to incorporate the MTCs into national legislation, thus making them non-negotiable.

NIUE TREATY ON COOPERATION IN FISHERIES SURVEILLANCE AND LAW ENFORCEMENT IN THE SOUTH PACIFIC REGION

[27] The Niue Treaty was adopted by the FFA member States at Alofi, Niue, in May 1992. The treaty was opened for signature on 9 July 1993 at Honiara, Solomon Islands, during the 23rd South Pacific Forum, and entered into force on 20 May 1993. As of June 1996, the Treaty had been ratified by 12 of the 16 FFA Member States. The text of the Niue Treaty is appended as Annex 1 to this paper.

[28] The main objective of the Niue Treaty is to establish a legal basis for regional cooperation in fisheries surveillance and law enforcement. The preamble to the Treaty notes that it is based on Article 73 of the Convention and Article 5 of the FFA Convention, which states that one of the functions of FFA is to promote intra-regional coordination and cooperation in fisheries surveillance and law enforcement.

[29] Article 3 of the Treaty requires the Parties to cooperate in the enforcement of their fisheries laws and regulations and to establish regionally agreed procedures for fisheries surveillance and law enforcement. The operative provisions of the Treaty are found in Articles 4 to 8. Article 4 provides that the parties shall cooperate in the implementation of the harmonized minimum terms and conditions of fisheries access and shall ensure that no foreign fishing vessel shall be licensed for fishing unless the vessel has good standing on the Regional Register. Article 5 provides that the parties shall exchange information regarding the activities of foreign fishing vessels within their EEZs.

[30] Perhaps the most important provision of the Treaty is Article 6, which provides that the parties to the Treaty may enter into subsidiary agreements under which the surveillance assets and personnel of one country may be authorized to carry out surveillance and law enforcement in the EEZ of another country. The Treaty specifies the markings that must be shown by vessels and aircraft operating pursuant to the Treaty, and the identification card to be carried by enforcement officers. Articles 7 and 8 encourage the parties to cooperate in the prosecution of fisheries offences by, *inter alia*, developing extradition procedures and mechanisms for reciprocal enforcement of judgments.

[31] It is important to note that, although the Niue Treaty establishes the general legal framework for much of the activities currently being implemented by FFA, the full benefits of the Treaty can only be realized through the establishment of subsidiary agreements on a bilateral or sub-regional basis. Subsidiary agreements would be expected to cover such issues as jurisdiction, control of surveillance assets and responsibility, operational procedures, including use of force, identification of officers and costs. To date, only one subsidiary agreement has actually been implemented: that between Tonga and Tuvalu. Under this agreement, the Kingdom of Tonga agreed to loan a fisheries patrol vessel to Tuvalu (which does not have a national surveillance capability) for the conduct of fisheries surveillance operations in Tuvalu's EEZ.

[32] Recently, FFA has developed a "pro forma subsidiary agreement" with a view to encouraging Member States to enter into agreements to maximize the benefits of scarce surveillance assets. In practice, however, Member States have been reluctant to confront some of the more difficult issues raised by the Niue Treaty, such as the use of force, the handing over of control and responsibility for surveillance vessels and aircraft, and mutual assistance in prosecutions. It is likely that this situation will continue for the time being. The real value of the Niue Treaty is that it demonstrates the strong political commitment to regional cooperation in MCS.

THE REGIONAL REGISTER

[33] The Regional Register of Foreign Fishing Vessels is a compliance mechanism aimed at keeping track of all foreign fishing vessels active in the FFA Region. The Register was started in 1983, and is regarded as one of the most important FFA functions. For a discussion and analysis of the regional register, see Doulman and Terawati, 1990. The Regional Register database contains detailed information on vessels, vessel owners, operators

and masters, and is capable of providing a history of any changes in that information occurring over the years. Registration is an annual requirement and the registration year runs from 1 September to 31 August. For the 1995/96 registration year, some 1 400 fishing and support vessels were on the Register.

[34] The fundamental requirement of the Register is that, before any foreign fishing vessel may be licensed by any FFA member State, it must be in good standing on the Regional Register. Good standing is a status which is automatically conferred on a vessel upon first registration. The status may be withdrawn or suspended in certain circumstances, including where there is strong evidence that the vessel has committed a serious fisheries offence and it has not been possible to apprehend the vessel, or where the vessel or its operator has been convicted of an offence but has absconded without paying the fine. Withdrawal or suspension of good standing is usually initiated at the request of the Member State whose laws have been violated, although a permanent withdrawal of good standing requires the support of at least three other Member States. The Member States have agreed not to issue licences to vessels which do not have good standing and, therefore, once good standing is withdrawn or suspended, the vessel is effectively prevented from fishing in the region.

[35] The suspension procedure, or 'blacklisting' as it is commonly termed, has been used to good effect on a number of occasions. To get re-instated on the Register, the vessel operator is usually required to negotiate an out-of-court settlement with the Member State concerned, or to surrender to the jurisdiction. In 1992, for example, six purse seiners were sighted fishing illegally in Nauru's EEZ. The photographic evidence proved sufficiently convincing to justify a request for suspension of good standing, which was supported by other Member States. Good standing was eventually re-instated but only after an out-of-court settlement of $US 1 million had been negotiated.

[36] Unfortunately, if a vessel operator is so determined to avoid sanctions that they are prepared to forfeit the chance of fishing in the FFA region, there is little that can be done. In one case, for example, two vessels escaped from custody and refused to return, even though good standing was withdrawn. It later became apparent that the vessels had been withdrawn from the fishery and relocated to the Indian Ocean.

[37] The Regional Register is now working effectively, and is a significant aid to compliance control in the region. This has not always been the case, however, and the present success of the Register is entirely due to strong regional commitment to making it work. Initially, the procedure for registration was for the vessel operator either to submit an application in person to the Director of FFA or to apply through the licensing State. In the case of those States which used a 'per vessel per trip' licensing system, where individual licences may be issued within 24 hours of application, this meant that Regional Register applications were submitted simultaneously with the licence application. Since applications for registration inevitably take time to process, this meant that vessels were frequently issued with fishing licences before they received good standing on the Regional Register. In addition, owing to delays in circulating information about registrations, foreign fishing vessels operating in the zones of more than one Member State would often need to submit multiple applications for regional registration. To a great extent, problems of this nature undermined the effectiveness of the Regional Register in the late 1980s.

[38] Efforts to insist that applications for registration were submitted direct to FFA did not meet with any significant degree of success until 1993. Although USA vessels had been submitting Regional Register applications direct since the entry into force of the MFT in 1987, Japan and other DWFNs had followed a deliberate policy of submitting applications

only through the licensing State. This policy stemmed from Japan's long-held position that FFA was not an "appropriate management organization" under Article 64 of the Convention.

[39] A breakthrough was achieved in 1993, with the negotiation of an agreement between FFA and the Japanese Fishing Associations[1], under which the Associations agree to submit all Regional Register applications, on an annual basis, through FFA. The Agreement has been regarded as a success by both sides and is symptomatic of much improved relations generally in fisheries matters.

[40] Since 1993, therefore, all Regional Register applications have been submitted direct to FFA. The application form has been enhanced so that it now requires full details of the vessel's physical characteristics and gear, as well as details of the base port, fishing master, vessel master and owner. A recent photograph of the vessel, with the vessel name and international radio call sign clearly displayed, must accompany the application. In addition, since 1994, a registration fee has been collected. The fee is currently $US 200 per application. With some 1 400 vessels on the Register, this amounts to a significant source of funding for FFA. The Regional Register is now self-financing and additional income has been used to introduce a number of technological enhancements to the database.

[41] Regional Register information is circulated to FFA Member States on a monthly basis. In addition, the NOC or Fisheries Division in each member State has access to the Regional Register database through FFA's sophisticated computer network. FFA also responds to requests for information on individual vessels from vessel operators, owners and other entities involved in the fishing industry, as well as from Member States. At present, FFA is working towards the establishment of a licensing database, linked to the Regional Register, so that information on the licensing history of every vessel will be instantly available to Member States.

VESSEL MONITORING SYSTEMS

[42] An increasingly useful element of an integrated MCS programme is the use of a vessel monitoring system (VMS) using modern computer and communications technology. VMS by itself cannot meet all MCS requirements. For example, it cannot detect the presence of unlicensed vessels, but it can enhance substantially the effectiveness of conventional MCS techniques. At the most basic level, VMS provides simultaneous near-real-time position monitoring of all vessels fitted with transponders. This information is usually sufficient, at least to enable the fishery manager to target conventional air and surface surveillance assets more effectively. More sophisticated options include the ability to use VMS for catch reporting and communications purposes. Capital costs are much lower than the cost of a surface patrol vessel or aircraft, and most of the recurrent costs involved in VMS can be passed on the fishing vessel operators through increased licence fees.

[43] FFA has been aware of the potential for a regional VMS since the early 1990s. Already, the two largest countries in the region, Australia and New Zealand, have introduced VMS for some of their domestic fisheries. To exchange information on the development of such systems, and to promote the adoption of regional standards for VMS, FFA has convened a number of technical consultations on VMS. The first such consultation was held in Suva,

1. Comprising the Federation of Japan Tuna Fisheries Cooperative Associations, the National Offshore Tuna Fisheries Association of Japan, the Japan Far Seas Purse Seine Fishing Association and the Federation of North Pacific District Purse Seine Fisheries Cooperative Associations.

Fiji, in 1991. The most recent consultation, the fifth, was held in Hawaii in 1995 and, for the first time, involved experts from DWFNs, including Japan, Korea and the USA.

[44] After some initial difficulties, FFA has secured funding to research, develop and test a regional VMS over a two-year period. If the trials are successful, the long-term objective is to introduce the VMS on a regional basis, with all fishing vessels and support vessels being required to carry FFA-approved equipment as a condition of licensing.

FUTURE DIRECTIONS

[45] It is useful to consider briefly some of the possible future directions for MCS in the South Pacific. A particularly interesting trend in recent years has been the enhanced level of cooperation on MCS issues between FFA member States and DWFNs, particularly the USA and Japan. Both countries have actively participated in the technical consultations on VMS and the development of the agreement regarding regional registration with Japan must be seen as a major step forward. Relations between the FFA Member States and the USA have continued to improve since the entry into force of the MFT, and the USA now provides a significant level of assistance to the MCS programme at FFA by providing an enforcement adviser and taking part in training courses and information exchanges.

[46] One aspect of increased cooperation with the USA which merits attention is the use of the Lacey Act as a means of enforcing FFA Member States' laws. The Lacey Act is a US Federal Law which prohibits the importation of illegally-caught wildlife, including fish, into the USA. Any vessel entering the USA may be inspected and, if found to have on board fish which were caught illegally in the waters of another State, the operator of the vessel may be fined and the fish confiscated. In the South Pacific, a large number of transhipments take place at Guam and Pago Pago (both USA territories) and this provides an ideal opportunity for USA inspectors, in cooperation with national authorities in FFA Member States, to inspect catches and logbooks for evidence of illegal fishing in the region. Over the past three years, the Lacey Act has been used on a number of occasions to apply sanctions against vessels found to have fished illegally in the waters of FFA Member States. At least one FFA Member State has adopted national legislation in similar terms to the Lacey Act. Papua New Guinea's Fisheries Act of 1994 includes a provision making it an offence to bring into Papua New Guinea fish caught illegally in another jurisdiction. Under this provision, a Taiwanese fishing vessel was arrested in February 1996 after examination of its logbook revealed that it had fished illegally in waters under the jurisdiction of Solomon Islands. Upon conviction, the master of the vessel was fined K 20 000 and the vessel and catch forfeited.

[47] It would appear that there is scope for other countries to adopt similar legislation. Further, although the existence of any enforcement jurisdiction for port States in relation to fisheries is, to say the least, controversial, the possibility exists to develop a regional scheme of port State enforcement under the terms of the Niue Treaty. The provisions of the Treaty could form the basis of a regional scheme of port State enforcement in respect of vessels flying the flags of FFA Member States. Such a scheme could also be open to participation by other flag States in the region.

[48] Future regional MCS developments will probably be influenced by the 1995 *Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks* ('the UN Agreement'). Undoubtedly, the UN Agreement will have significant implications for the FFA Member

States and will necessitate a review of existing mechanisms for international cooperation in the conservation and management of highly migratory fish stocks in the region. The UN Agreement contains far-reaching provisions relating to enforcement, including provisions relating to boarding and inspection on the high seas and port State control. Provisions of like this offer scope for much greater control over the activities of foreign fishing vessels and one of the key challenges facing the South Pacific will be to develop a framework for regional tuna management which complies with the UN Agreement and allows the FFA Member States to take advantage of the enforcement provisions of the Agreement. Again, the Niue Treaty provides a starting point. There is no reason, in theory, why the Treaty could not be extended to cover other States in the region, including DWFNs, and high seas areas.

CONCLUSIONS

[49] For other regions, the South Pacific provides an excellent example of the benefits of regional cooperation in MCS. As a result of the adoption of coordinated policies towards MCS, it is generally considered that the level of compliance with national fisheries laws and regulations has increased substantially. The enhanced effectiveness of the Regional Register and the development of a regional observer programme are particularly noteworthy successes, with the potential for replication in other regions. Of more concern, perhaps, is what appears to be a trend towards increased reliance on technological solutions, including VMS. While VMS are a useful adjunct to conventional forms of MCS, they should not be viewed as an end in themselves. FFA needs to ensure that the pace of development at the regional level does not exceed the pace of development at the national level.

[50] MCS is invariably one of the most costly elements of fisheries management. For developing States in particular, there are formidable obstacles in the way of establishing effective national MCS programmes. On the other hand, regional cooperation can significantly enhance the effectiveness of individual MCS programmes at relatively low cost. At its most advanced level, such cooperation might involve the establishment of a legal framework for MCS, such as the Niue Treaty. Nevertheless, many of the basic goals of MCS can be achieved through more straightforward, less politically-sensitive, initiatives such as, for example, the establishment of regional vessel registers, the adoption of harmonized fisheries laws and regulations, and the establishment of a regional coordinating mechanism for the exchange of information. New law enforcement techniques, in particular the use of 'long-arm' enforcement mechanisms can often be more effective than increasing the level of conventional surveillance, and it is important that fisheries laws and regulations are reviewed on a regular basis and maintained current so as to take advantage of new legal developments.

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Annex 1

NIUE TREATY ON COOPERATION IN FISHERIES SURVEILLANCE AND LAW ENFORCEMENT IN THE SOUTH PACIFIC REGION

THE PARTIES TO THIS TREATY:

GIVEN that in accordance with international law as expressed in the United Nations Convention on the Law of the Sea, coastal States have sovereign rights for the purposes of exploring and exploiting, conserving and managing the fisheries resources of their exclusive economic zones and fisheries zones;

TAKING INTO ACCOUNT Article 73 of the United Nations Convention on the Law of the Sea;

NOTING that the Parties to the South Pacific Forum Fisheries Agency Convention, 1979, have agreed under Article 5 of that Convention that the Forum Fisheries Committee shall promote intra-regional coordination and cooperation in fisheries surveillance and law enforcement;

CONSIDERING the vast areas of ocean covered by the exclusive economic zones and fisheries zones of coastal States in the South Pacific region and the vital economic significance of such zones to the economic development of South Pacific coastal States;

WISHING THEREFORE to enhance their ability to enforce effectively their fisheries laws, and deter breaches of such laws;

HAVE AGREED AS FOLLOWS:

ARTICLE I - DEFINITIONS

In this Treaty:

(a) 'fishing' means:

(i) searching for, catching, taking or harvesting fish;

(ii) attempting to search for, catch, take or harvest fish;

(iii) engaging in any other activity which can reasonably be expected to result in the locating, catching, taking or harvesting of fish;

(iv) placing, searching for or recovering fish aggregating devices or associated electronic equipment such as radio beacons;

(v) any operations at sea directly in support of, or in preparation for, any activity described in this paragraph;

(vi) use of any craft, air- or sea-borne, for any activity described in this paragraph except for emergencies involving the health and safety of the crew or the safety of a vessel;

(vii) the processing, carrying or transhipping of fish that have been taken.

(b) 'fishing vessel' means any boat, ship or other craft which is used for, equipped to be used for, or of a type normally used for fishing;

(c) 'foreign fishing agreement' means an agreement or arrangement authorising or permitting foreign fishing vessels to fish in the exclusive economic zone or fisheries zone of any Party;

(d) 'foreign fishing vessel' in relation to a Party means a fishing vessel which is not part of the domestic fleet of that Party;

(e) 'South Pacific Forum Fisheries Agency' means the Agency of that name established by the South Pacific Forum Fisheries Agency Convention, 1979; and

(f) 'Subsidiary Agreement' means an agreement or an arrangement entered into by any two or more Parties in accordance with this Treaty.

ARTICLE II - RELATIONSHIP WITH OTHER TREATIES

1. Rights and obligations under this Treaty shall apply as between the Parties in addition to any right or obligation concerning a similar matter applicable to a Party under any other Treaty.

2. A Subsidiary Agreement may expand upon rights and obligations under this Treaty in their application between the Parties to the Subsidiary Agreement.

ARTICLE III - GENERAL COOPERATION

1. The Parties shall cooperate in the enforcement of their fisheries laws and regulations in accordance with this Treaty and may agree on forms of assistance for that purpose.

2. The Parties shall cooperate to develop regionally agreed procedures for the conduct of fisheries surveillance and law enforcement. Where appropriate, fisheries surveillance and law enforcement will be conducted in accordance with such regionally agreed procedures.

ARTICLE IV - COOPERATION IN THE IMPLEMENTATION OF HARMONIZED MINIMUM TERMS AND CONDITIONS OF FISHERIES ACCESS

1. The Parties shall cooperate in the implementation of harmonized minimum terms and conditions of fisheries access as may be agreed upon from time to time.

2. The Parties shall ensure that no foreign fishing vessel shall be licensed for fishing unless the vessel has good standing on the Regional Register of Foreign Fishing Vessels maintained by the South Pacific Forum Fisheries Agency.

3. The Parties shall ensure that foreign fishing vessels licensed to fish under foreign fishing agreements are, as a minimum, required to provide reports in accordance with the standard forms of reporting as set out in the harmonized minimum terms and conditions of fisheries access from time to time.

4. The Parties shall ensure that fishing vessels licensed to fish under foreign fishing agreements are required to be readily identifiable from the sea and the air by way of distinctive markings.

5. The Parties shall, as far as possible, ensure that foreign fishing agreements with flag States require the flag State to take responsibility for the compliance by its flag vessels with the terms of any such agreement and applicable laws.

6. The Parties shall, as far as possible, ensure that foreign fishing arrangements with foreign parties, including Fishing Associations, require the foreign party to take responsibility for the compliance by its vessels with the terms of any such arrangement and applicable laws.

ARTICLE V - EXCHANGE OF INFORMATION

1. Each Party shall, to the extent permitted by its national laws and regulations, provide to the South Pacific Forum Fisheries Agency, or to any other Party directly, information relevant to the purposes of this Treaty, including but not limited to information about:

(a) the location and movement of foreign fishing vessels;

(b) foreign fishing vessel licensing; and

(c) fisheries surveillance and law enforcement activities.

2. The Parties shall develop standard forms and procedures for reporting information provided under Paragraph 1 of this Article and effective methods for communicating such information.

ARTICLE VI - COOPERATION IN FISHERIES SURVEILLANCE AND LAW ENFORCEMENT

1. A Party may, by way of provisions in a Subsidiary Agreement or otherwise, permit another Party to extend its fisheries surveillance and law enforcement activities to the territorial sea and archipelagic waters of that Party. In such circumstances, the conditions and method of stopping, inspecting, detaining, directing to port and seizing vessels shall be governed by the national laws and regulations applicable in the State in whose territorial sea or archipelagic waters the fisheries surveillance or law enforcement activity was carried out.

2. Vessels seized by another Party pursuant to an agreement under Paragraph 1 of this Article in the territorial sea or archipelagic waters of a Party shall, together with the persons on board, be handed over as soon as possible to the authorities of that Party.

3. Any two or more Parties may enter into a Subsidiary Agreement under which they would cooperate in the provision of personnel and the use of vessels, aircraft or other items of equipment for fisheries surveillance and law enforcement purposes. Vessels and aircraft shall be identified as set out in Annex 1 [omitted].

4. Any Party wishing to authorize its officers to perform fisheries surveillance and law enforcement functions on its behalf while on board a vessel or aircraft of another Party shall by instrument in writing designate the officers accordingly and such officers shall be identified as set out in Annex 2 [Omitted].

5. Any Party wishing to authorize the officers of another Party to perform fisheries surveillance and law enforcement functions on its behalf while on board a vessel of that other Party shall by instrument in writing designate such officers accordingly. Officers carrying out enforcement functions shall be identified by a card in the form set out in Annex 2 [Omitted] with such variations as may be agreed to in a Subsidiary Agreement or otherwise.

ARTICLE VII - COOPERATION IN PROSECUTIONS

1. The Parties may, by way of provisions in a Subsidiary Agreement or otherwise, agree on procedures for the extradition to a Party of persons charged with offences against the fisheries laws of that Party.

2. A Party may request another Party which is holding a person or any equipment (including a vessel) in custody for an offence against the laws of the holding Party to assist the requesting Party to enforce its fisheries laws in respect of that person or equipment. The holding Party shall provide such assistance upon completion of its legal processes and to the extent permitted by its national laws and regulations. Such assistance shall be provided on such conditions as to cost recovery or other matters as the Parties agree in each case.

3. The Parties may agree on procedures whereby persons permitted to appear as advocates or expert witnesses in the courts of one Party are, for the purposes of judicial proceedings involving offences against fisheries laws, entitled to perform the same or substantially similar functions in the courts of another Party.

4. Where there are waters over which more than one Party claims to have jurisdiction for the purposes of the application of fisheries laws, the Parties concerned shall for the purposes of the

application of this Agreement seek to adopt the provisional lines used for the distribution of revenue received under the Treaty on Fisheries between the Governments of Certain Pacific Island States and the Government of the United States of America done at Port Moresby on 2 April 1987.

ARTICLE VIII - COOPERATION IN ENFORCEMENT OF PENALTIES

Should two or more Parties wish to provide that a penalty imposed by one Party under its fisheries laws be enforced by another Party, they may, by way of provisions in a Subsidiary Agreement or otherwise, agree on procedures for that purpose consistent with their national laws.

ARTICLE IX - CONSULTATIONS

The Director of the South Pacific Forum Fisheries Agency, at the request of any three or more Parties, shall convene a meeting to discuss any matter arising out of the application of this Treaty. The meeting shall be held at such time and place as the Parties may agree, but shall be held not more than 90 days after the request is notified to the Director.

ARTICLE X - NOTIFICATION

1. Each Party shall notify the Director of the South Pacific Forum Fisheries Agency of the current postal, cable, telex and facsimile addresses which it wishes to be used for the receipt of notices given pursuant to this Treaty, and of any changes to a notified address. The Director of the South Pacific Forum Fisheries Agency shall inform all Parties of the notified addresses.

2. Any notice given under this Treaty shall be in writing and may be served by hand, post, cable, telex or facsimile to the notified address.

ARTICLE XI - DEPOSITARY

The depositary for this Treaty shall be the Government of Niue.

ARTICLE XII - AMENDMENTS

1. Any Party may propose to the depositary an amendment to this Treaty, which shall be considered by the Parties at a meeting arranged in accordance with Article IX.

2. The text of any amendments shall be adopted by unanimous decision of the Parties to the Treaty.

3. Any amendment to this Treaty which is adopted by the Parties shall enter into force upon the receipt by the depositary of the instruments of ratification, acceptance or approval by all of the Parties, or on such later date as may be specified in the amendment.

4. The depositary shall notify all of the Parties of the entry into force of an amendment.

ARTICLE XIII - FINAL CLAUSES

1. This Treaty shall be open for signature by:

(a) any member of the South Pacific Forum Fisheries Agency;

(b) any Territory of a Member of the South Pacific Forum Fisheries Agency which has been authorized to sign the Treaty and to assume rights and obligations under it by the Government of the State which is internationally responsible for it.

2. This Treaty is subject to ratification by members of the South Pacific Forum Fisheries Agency and the Territories referred to in Paragraph 1 of this Article. The instruments of ratification shall be deposited with the depositary.

3. This Treaty shall enter into force on the date of deposit of the fourth instrument of ratification.

4. This Treaty shall remain open for accession by the members of the South Pacific Forum Fisheries Agency and the Territories referred to in Paragraph 1 of this Article. The instruments of accession shall be deposited with the depositary.

5. If all of the Parties agree, a State which is not a Party to the South Pacific Forum Fisheries Agency Convention may accede to this Treaty.

6. For any member of the South Pacific Forum Fisheries Agency or a State or Territory which ratifies or accedes to the Treaty after the date of deposit of the fourth instrument of ratification, the Treaty shall enter into force on the date of deposit of its instrument of ratification or accession.

ARTICLE XIV - CERTIFICATION AND REGISTRATION

1. The original of the Treaty shall be deposited with the depositary, which shall transmit certified copies to all States and Territories eligible to become party to this Treaty.

2. The depositary shall register this Treaty in accordance with Article 102 of the Charter of the United Nations.

IN WITNESS WHEREOF the undersigned, being duly authorised by their respective Governments, have signed this Treaty.

OPENED FOR SIGNATURE at Honiara, Solomon Islands on the ninth day of July, One thousand nine hundred and ninety two.

REPRESENTATIVES OF:

Australia

Cook Islands

Federated States of Micronesia

Fiji

Kiribati

Marshall Islands

Nauru

New Zealand

Niue

Palau

Papua New Guinea

Tonga

Tuvalu

Vanuatu

Western Samoa

Appendix L

MONITORING, CONTROL AND SURVEILLANCE - THE NORWEGIAN EXPERIENCE

by

Terje Løbach

INTRODUCTION

[1] Norway has made advances in the field of fisheries management during recent years after having experienced the consequences of inadequate resource management and the resultant negative impact on fish stocks, and thereby also on the fishing industry. A comprehensive system of policies and instruments for regulating key fisheries has now been developed. Among these instruments is a Monitoring, Control and Surveillance (MCS) system considered to be one of the most efficient in the world, thus sometimes being used as a model when discussing the establishment and improvement of MCS systems. This is a western-type system in a country with a long tradition of management of fisheries, and also a lot of resources available for management, control and research. When examining the Norwegian system, the underlying special conditions should be taken into account, and there are of course limitations when examining the Norwegian experience in other parts of the world.

BASIC FACTS ABOUT THE NORWEGIAN FISHING INDUSTRY

[2] The demography of Norway reflects the fundamental importance of the sea to settlement patterns. The marine eco-system of the waters adjacent to the Norwegian mainland has made it possible to sustain coastal communities and settlement under arctic and sub-arctic climatic conditions for centuries. The Norwegian mainland coastline, including fjords and inlets, measures some 21 300 km. More than 300 communities in which fisheries are primary means of livelihood are scattered along the coast. The seagoing and the coastal fleets, the fish farming industry and the processing industry all form a network of economic activities vital to the maintenance, viability and development of coastal communities.

[3] In the overall Norwegian economy, fisheries play a limited role, amounting to only one per cent of GNP and two per cent of employment. However, as most of the fish is exported, it is in this respect the second most important industry after oil and gas. The total export value was in 1995 close to $US 4 thousand million, which is approximately eight per cent of total Norwegian exports.

[4] The Norwegian fishing fleet provides employment for approximately 25 000 persons, and consists of some 15 000 vessels. The majority of these vessels measure less than 10 m, have a crew of only one or two, and are mainly engaged in coastal fisheries. The larger, ocean-going fleet comprises around 500 vessels engaged in off-shore fisheries. Total

production varies according to the size of the major stock, but has traditionally amounted to between two and three million tons per year, and Norway is number ten in the world in terms of quantities.

[5] The processing industry employs 10 000 persons and consists of more than 500 plants, producing traditional products like dried and salted cod, frozen and filleted fish, canned products and fishmeal and oil. The location of the processing industry reflects the settlement pattern and the close ties to the various segments of the fishing fleet.

THE FRAMEWORK

[6] By the establishment of the economic zones, the areas under Norwegian jurisdiction cover more than 2.2 million square km, including the Norwegian Economic Zone, the Fishery Protection Zone around Svalbard, and the Fishery Zone around Jan Mayen (see Annex 1). The first two of these were established in 1977, the third in 1980. Within these zones, fisheries are managed according to a number of fundamental objectives, including a biologically defensible pattern of exploitation, with catches not exceeding advisable limits and a reasonable opportunity for fishermen to exploit resources. Other objectives are maintenance of adequate supplies for the fish processing industry in the country and optimization of the long-term alignment of resources and catching capacity.

[7] Few stocks are confined to Norwegian waters all their life cycle, and the fish migrate from the economic zones of neighbouring countries, and vice versa. These migrations are partly seasonal and partly dependent on the age of the fish. The migration pattern may also be dependent on the size of the stocks and changes in environmental conditions. The Arctic cod, for example, spawn off the Norwegian coast and the larvae drift northwards and into the Russian Economic Zone. Older fish from the stock return to the Norwegian coast in search of food and spawning. Herring and mackerel in the North Sea migrate into Norwegian waters during the feeding season. After the establishment of EEZs, Norway shares stocks with Iceland and Greenland in the Jan Mayen area; with Russia in the Barents Sea; and with the European Union in the North Sea and Skagerrak. Norway has entered into agreements about the sharing of joint stocks with these countries and these agreements also include exchange of quotas of stocks which are exclusively found in the respective zones.

[8] This is the basis for the rights of a foreign fleet to operate in Norwegian waters. There exists a two pillar system, one for the domestic fleet and another for the foreign fleet. When it comes to conservation measures, such as minimum sizes, by-catches, closed areas, etc., the control and enforcement of the regulations are more or less the same. The major difference is the monitoring of quotas, which for nationals are based on landed figures and for foreigners are based on reports from the sea.

DISPUTED AREAS

[9] In the Barents Sea, extension of coastal state jurisdiction has increased the legal complexity in the area. The area which remained international waters is now a fraction of its former size. Together with the areas under Norwegian fisheries jurisdiction and the Russian economic zone, these areas cover all fishing banks in the Barents Sea except for an area often known as the "Loophole." Here fisheries are still subject to open access rules, but all nations with fishing rights in the Barents Sea comply with the Norwegian-Russian management regime in the area. However, there are problems with some countries and

vessels under flags of convenience, and Norway envisages that the UN agreement on straddling fish stocks and highly migratory fish stocks and the Compliance agreement will be instruments which will reduce or solve the problem.

[10] Most of the former international waters have come under the jurisdiction of Norway and Russia. Since the two countries rely on different principles for drawing up boundaries, the extension of jurisdiction has resulted in a 175 000 km^2 disputed area, called "the Grey Zone," where claims overlap. In this area, Norway and Russia regulate and control their own fishermen and third-country fishermen licensed by each of them.

[11] The area around the Spitsbergen archipelago is of specific interest. Pursuant to a Treaty from 1920 concerning Spitsbergen, Norway has full sovereignty over the archipelago. There should be no doubt that Norway has the right to establish a 200-mile economic zone, and that the Norwegian sovereignty means that the country may lay down legislation and enforce it in relation to fishing operations in the area. The point in an ongoing dispute is whether the provisions of the Spitsbergen Treaty that the nationals of all parties to the Treaty shall have equal rights to hunting and fishing on the islands and in their territorial waters also apply to a 200-mile economic zone. In Norway's view, the rules of the Treaty relating to equal treatment only apply as far as the limits of territorial waters. However, Norway has chosen not to pursue to its conclusion the uncertainty regarding the application of the principle of equal treatment set out in the Spitsbergen Treaty, and in 1977 established a non-discriminatory fisheries protection zone around the islands. This was an essential measure as the area is the most important nursery area for cod in the Barents Sea. Resource management in the Barents Sea would become impossible without regulation of fisheries in this area.

CONTROL AND ENFORCEMENT

[12] Norway attaches great importance to the need for necessary means and instruments of surveillance, control and enforcement, in order to ensure that fishing quotas and other regulations are respected. A key aspect of monitoring and inspection concerns control at sea of quotas and technical regulations. Control at sea is essential in order to observe fishing activities where they take place and to monitor the actual takeout of the fish stocks. In order to control quotas, a sufficient reporting system is of vital importance. For the foreign fleet, Norway has established a system of active/passive reporting upon entering and leaving areas and reporting of catches on a weekly basis. These requirements have been introduced in the light of the vast areas that have to be controlled, the serious and extensive problem of misreporting, and the fact that if sea control is to be carried out effectively, the control authorities must be given the possibility of verifying the consistency between logbook information, reported catches and the catches on board.

[13] The overwhelming majority of Norwegian catches are landed in Norway, and thus made subject to the integrated resource control system at sea, upon landing and in connection with the subsequent administrative control. In the absence of control upon landing, an integrated control system must necessarily be based of other measures. This is the case for non-Norwegian vessels fishing in Norwegian waters. In order to reduce the serious problems of misreporting, Norway two years ago introduced an additional control measure. Third-country vessels have to report in advance when concluding their fishing activity and present themselves at certain designated *check-points* for possible control by the Coast Guard. If the catch is landed in Norwegian ports, such presentation and control shall take place upon landing.

[14] There are three bodies responsible for the control and enforcement of Norwegian legislation, namely the Directorate of Fisheries, the Coast Guard and the Sales Organizations.

The Directorate of Fisheries

[15] The Directorate of Fisheries has assigned to the Control Authority responsibility for ensuring that fishes and buyers of fish comply with the regulations. The Control Authority is organized in five regions under the supervision of District Leaders. The regional offices have a total of around 100 inspectors stationed in the most important fishing harbours along the coast. The inspectors, when carrying out their duties, shall be given free access to vessels, processing plants, consignments in transit, storage buildings and harbour areas and be given all necessary assistance and information on documents, logbooks, etc. Vessels may be stopped for inspection and the Directorate of Fisheries may, if necessary, request the police for assistance to carry out control.

[16] The Directorate of Fisheries is authorized to close fisheries when the quotas are exhausted or when the abundance of undersized fish or by-catches are too high.

[17] In order to conduct control of foreign vessels fishing in areas under Norwegian jurisdiction, the Directorate of Fisheries established a computerized quota control system as early as 1977. Vessels have to report when entering and leaving Norwegian waters, and catches must be reported on a weekly basis. The declarations shall include quantities of species in kilograms (wet weight). The reports are entered into the data base consecutively and provide updated information on the number of vessels, where the vessels are operating and the catches by foreign vessels in Norwegian waters. The catches reported and entered into this system provide the basis for the closure of a fishery when the quotas are exhausted.

[18] There is also a separate surveillance unit, with responsibility for closing and opening sensitive areas, i.e., areas where the percentage of juveniles in the catch is above certain levels, or where spawning is occurring. Thorough this unit, important areas may be closed on very short notice, and then re-opened for fishing after test fishing indicates that the percentage make up and content of the catches are once again acceptable.

The Coast Guard

[19] The Coast Guard is administratively under the Ministry of Defence. Almost 80 per cent of the activity is devoted to the monitoring of fisheries. The activities comprise various types of control, and important tasks are control of minimum sizes of fish, mesh sizes, by-catches, logbooks and catches in the hold.

[20] The Coast Guard has at its disposal 15 ordinary vessels, of which 3 are equipped with helicopters. In addition there are 14 chartered vessels, mainly operating in coastal waters, with the aim of preventing possible gear conflicts. The Coast Guard also has 2 Orion aeroplanes and 6 Lynx helicopters at its disposal, as well as 2 hired small civil aircraft.

[21] The Coast Guard may of course stop and inspect vessels, and inspectors may be placed on board. Food and lodging shall be provided at the vessel's expense and the inspector shall be given access to radio and other means of communication. The master of the fishing vessel shall give all necessary information, provide relevant objects and documents, confirm copies and allow notes regarding infringements to be entered into the logbooks. The master may also be ordered to haul on board gear for inspection. The master shall sign the report drawn up by the inspector, but may add any comments deemed necessary.

[22] The Coast Guard performs nearly 3 000 boardings and inspections each year, of which 20 to 30 per cent end with some kind of reaction, normally a written warning.

[23] The most extensive inspections may last for twenty-four hours, but the average time spent in inspection is about 4 to 5 hours.

The Sales Organizations

[24] A specifically tailored marketing system in Norway includes the competence granted to sales organizations to organize primary sales of fish, fix minimum prices and regulate fishing activities for market reasons.

[25] The sales organizations also play an important role in the overall system for controlling quotas. Due to the nature and length of the Norwegian coastline and the numerous landing sites, the compulsory primary sales system provides for an integrated, efficient control of declarations on catches, landings and sales of fish.

[26] The sales organizations are responsible for checking that vessel quotas are not exceeded. This responsibility implies that the value of the catches exceeding a vessel's quota shall be confiscated. The sales organizations check papers, catches against quotas and sometimes the personnel turns up in ports and at processing plants.

Cooperation between the enforcement bodies

[27] As there are different bodies responsible for various parts of control and since their responsibility overlaps, good and fruitful cooperation is essential. There has also over the last 3 - 4 years been established cooperation between enforcement bodies in Norway and a number of other countries. The key word in this respect is transparency.

Nationally

[28] In theory, the Coast Guard is independent from the fisheries authority, as it is administratively part of the Ministry of Defence. However, as a major part of their duties involves control and enforcement of fisheries regulations, it should be noted that there is extensive cooperation between the Coast Guard and the fisheries authorities, i.e., the Directorate of Fisheries. This cooperation varies from regular meetings and training of new Coast Guard personnel, to assistance in connection with specific control and enforcement matters. Exchange of information and views is a vital part of this broad cooperation. There is a division of labour between the two bodies, inasmuch as the Coast Guard is responsible for control and enforcement at sea while the Directorate of Fisheries assumes responsibility in port.

[29] The sales organizations check papers, catches against vessel quotas, and deploy enforcement personnel in ports and at processing plants, and thereby play a significant role as collectors and suppliers of statistical material for the fisheries authorities. This material is compiled and further processed by the Directorate of Fisheries. An essential implication of this responsibility is that the sales organizations are obliged by law to confiscate the value of the catch in excess of a vessel's quota. This extra money is administrated by the sales organizations, by which it may be used for control and enforcement purposes.

[30] It should be underlined that there are close contacts and connections between the three bodies. The Directorate of Fisheries is the principal agent responsible for enforcing all existing legislation. For effective enforcement the Directorate is totally dependent on a smooth and well-working relationship with the two other organizations. The value of the control at sea by the Coast Guard cannot be overestimated. As noted previously, control at sea is in accordance with the general conservation philosophy in Norway.

[31] It is of course important to control and enforce regulations at every level - from the fishing operations taking place at sea to the fish trading onshore. The essential part of the Norwegian control scheme is the agreed need to physically survey all the transactions in relation to fishing. This means that Norway considers mere checking and comparison of documents to be an insufficient means for control and enforcement.

Internationally

[32] Norway has so far entered into agreements about cooperation in the field of monitoring, surveillance and control with Russia, United Kingdom, Denmark, Ireland and Faroe Islands. It is agreed that there are significant benefits in sharing relevant information and intelligence, and enhancing cooperation in areas of mutual interest. In particular, the following initiatives are pursued: exchange of information on inspections at sea; exchange information on landings; exchange of personnel (involved in land-based inspection and marine surveillance) between relevant control services and to cooperate on training of personnel (courses and seminars); and to arrange regular meetings at head of operations level to discuss operational surveillance and enforcement issues.

[33] Norway and Canada have signed a special agreement, taking note of the UN-agreement on straddling fish stocks and highly migratory fish stocks. The parties recognize that fishing operations beyond the 200-mile zone of each party for stocks which occur both within that zone and the area beyond must be conducted in a manner which does not undermine the effectiveness of applicable conservation and management measures. Each party will deny access to its ports to vessels that engage in activities that undermine such measures, except in cases of *force majeure*, and will prohibit the landing of the catch of such vessels. Furthermore, the appropriate authorities of each party may board, inspect and search a vessel flying the flag of the other party (flag party). If the authorities of the inspecting party find evidence of undermining conservation and management measures, they may seize the vessel and institute proceedings against it or present such evidence to the flag party. There are specific paragraphs dealing with the obligations of the flag party upon receipt of such evidence.

[34] Norway and Russia are now in a process of establishing a regulation for the international fishery in the Loophole refereed to above. The approach is to make use of the UN-agreement on straddling fish stocks and highly migratory fish stocks, including not least Part VI of the agreement concerning compliance and enforcement.

[35] A similar approach is used in the regional organizations in the North Atlantic responsible for the management of fisheries in international waters (NAFO) and NEAFC).

Training

[36] A well trained staff is essential for running an effective MCS system. Norway has put a lot of effort into training, and experts from the Directorate of Fisheries, the Institute

of Marine Research, the Coast Guard and the Prosecution Authorities give lectures during intensive annual courses of two-weeks length. The programme contains topics such as the biological inputs to managers (methodology and recommendations), the international framework (obligations and limitations) for management, the legal framework, the basis and the thinking behind technical regulations, practical inspections of gears, catch, logbooks etc., enforcement and punishment.

[37] Fisheries managers in Norway have realized the need of having a good relationship with the police and the prosecution authorities. Otherwise these forces tend to give priority to other crimes and violation of the fisheries legislation is not followed up. Therefore it is important to motivate these forces to understand and to take an interest in fishery matters. Similar courses as described above are held every second year.

[38] There are also training courses arranged for Norwegian inspectors abroad and foreign inspectors in Norway. This cooperation in training has to a great extent been developed between Russia and Norway.

[39] Norway has experienced the advantage of manuals for the use by personnel working with MCS matters. These manuals cover administrative and technical procedures, including investigation procedures and gathering of evidence. There are also written instructions where the most common offences are described and what reactions should be given.

Satellite technology

[40] Norway has for some years carried out a number of trials on research vessels, control vessels and some fishing vessels to learn about the possible use of various satellite systems for tracking and data reporting purposes. The first of these trials was to some extent triggered by the use of satellite tracking in the North Pacific fishing regulations from 1990 onwards. Different systems have been tested, such as ARGOS Mar-90, INMARSAT-C and EUTELRACS.

[41] In 1996 the Norwegian authorities initiated a large-scale national pilot programme, using satellite technology on board fishing vessels. One part of the programme covers commercial applications, the other part will cover possible use in national fisheries management. Tracking is one of the elements in this part of the trial, as are also experiments with satellite-based catch and activity reporting systems. This-large scale national trial will continue at least until the end of 1997, and provide valuable operational experience.

[42] So far, however, the experience obtained in monitoring Norwegian fisheries in the Convention Area of NAFO is the most valuable. In 1995, the contracting parties, in order to improve compliance with their conservation and enforcement measures, agreed to implement a Pilot project for satellite tracking of fishing vessels. At the same time, effort regulation for the shrimp fishery was introduced, by allowing each of the contracting parties to fish only for a number of days. The numbers were calculated on previous effort record in the regulatory area and Norway was allocated 2206 fishing days in 1996. Satellite tracking was used to monitor that the number of days allocated not were exceeded. It was also decided that the satellite devices on board the Norwegian vessels should trigger an automatic hail message every time a vessel crosses a subdivision line, whether this be between divisions or between divisions and outside the Convention Area.

[43] Satellite technology is evolving rapidly as a tool for surveying and managing fishing activity. The question of international standards will be very important if satellite systems

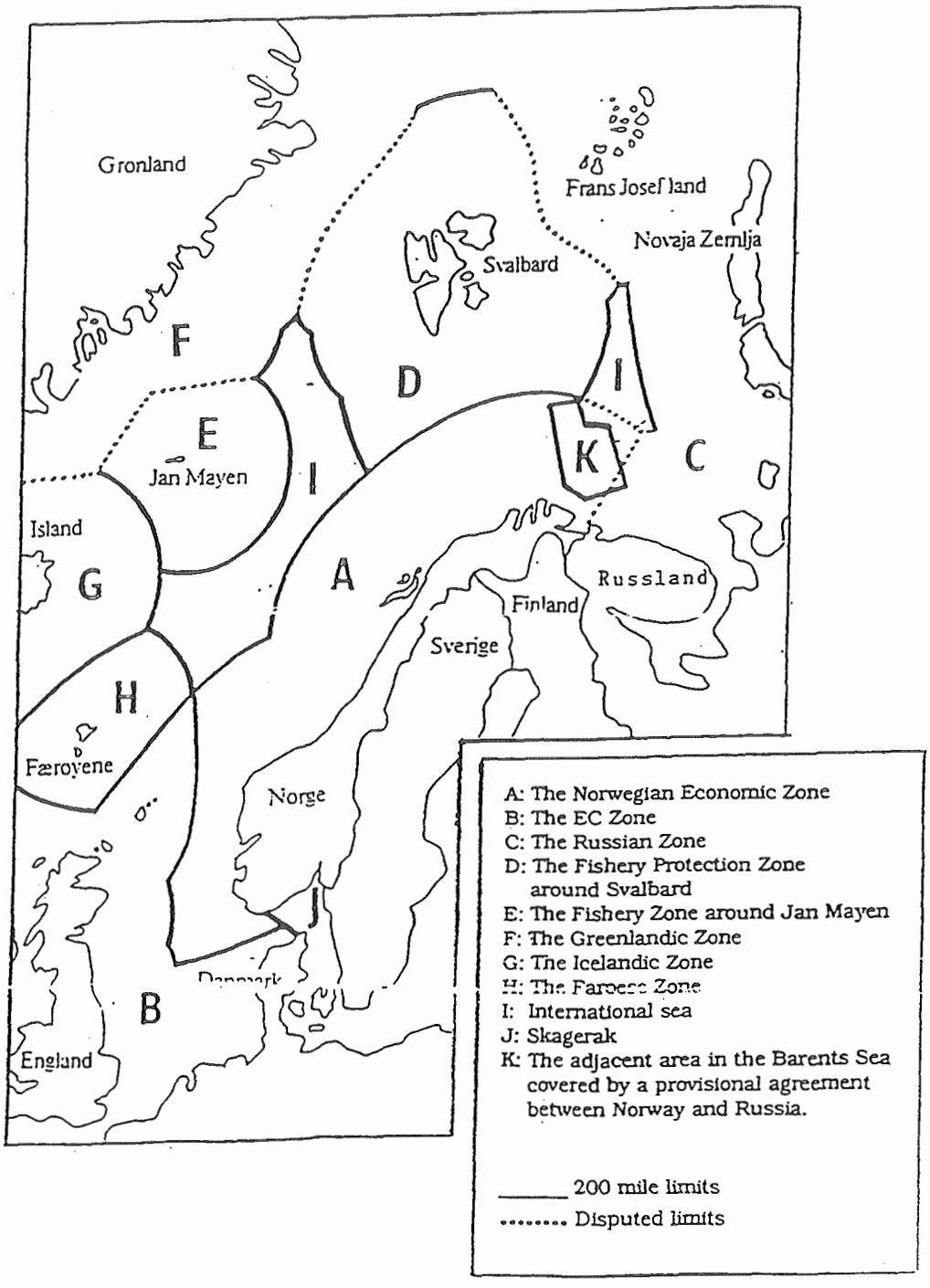
are to be employed on a larger scale in future fisheries surveillance. Norway cooperates with a number of countries in this field and intends to be well informed in all areas where decisions are taken that will be important.

Closing remarks

[44] The Norwegian MCS system is considered to be quite comprehensive, but there are still loopholes. The size of the areas and the number of vessels imply that total effective control is impossible. The increasing numbers of foreign vessels landing in Norway and Norwegian vessels landing in foreign ports complicates the control task, even if the cooperation agreements with different countries to some extent reduce the problem. The fishing taking place outside the area of Norwegian jurisdiction has also contributed to the problem of effective biological control, especially when the vessel is under a flag of convenience. But hopefully the UN agreement on straddling fish stocks and highly migratory fish stocks and the FAO Compliance Agreement will be milestones in the effort to get this kind of activity under control.

[45] When using the Norwegian system as a possible model, some points should be underlined. Firstly, the system has been established for a long time, although it has been improved in more recent years. Secondly, the system is rather expensive. It is difficult to calculate the exact costs of the system, but an estimate of around 10% of the value of the catches should not be so far out. Thirdly, the system has developed in close cooperation with the fishing industry and thereby secures legitimacy.

MAP OVER EXCLUSIVE ECONOMIC ZONES IN THE NORTH ATLANTIC



Appendix M

REGIONAL COOPERATION IN MCS: THE EXPERIENCE OF THE MEMBER STATES OF THE SUB-REGIONAL FISHERIES COMMISSION (WEST AFRICA)

by

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INTRODUCTION

[1] The coastal States of North-West Africa benefit from substantial maritime resources under their jurisdiction. Demersal stocks in the sub-region are generally heavily exploited. However, there is some room for expanded fishing effort in pelagics and in some specific deep water stocks. Traditionally there has been a substantial number of foreign fleets fishing high value species such as shrimp, cephalopods and hake. In some countries of the sub-region, industrial fleets compete for resources with a substantial artisanal sector.

[2] In order to ensure the sustainability of these fisheries, of critical importance both economically and socially, there is a need for the implementation of resource management plans and legislation which in turn depend on monitoring, control and surveillance (MCS). Effective MCS is required to ensure that resource management plans and options, once in place and implemented through an appropriate legal framework, are observed and are not undermined by non-compliance (i.e. failure of fishermen to abide by national laws, sub-regional conventions, licensing terms and conditions, and management requirements) (Doulman, 1992: 46). MCS measures have been taken by member States of the Sub-Regional Fisheries Commission (SRFC) at both national and sub-regional levels.

MCS AT THE NATIONAL LEVEL

General MCS structure

[3] At a national level, the implementation of MCS measures have varied in both their scope and their success. There has been general acceptance of the need to effectively coordinate different government agencies involved in MCS, but the achievement of such coordination has posed difficulties. Several countries in the sub-region have established national MCS centres with civilian and military components.

[4] In Senegal, the MCS system is based on a coordinating structure, the 'Projet de Surveillance des Pêches du Sénégal' (PSPS), within the Ministry responsible for fisheries. The project is managed by a naval officer and includes among its staff both civilians and military. It involves the activities of the navy, an aircraft and the research institution Centre de recherches océanographiques de Dakar-Thiaroye (CRODT). Since 1990 the system has

been entirely operated and financed by Senegal, after initial assistance from Canada (FAO, 1992: 5). At PSPS headquarters in Dakar, the computer system monitors observer deployments, observer reports twice-weekly, infractions and the results of action taken. The 24-hour-per-day operations room monitors six coastal area sub-stations through reports from the stations each morning and evening (FAO, 1995: 4). The data from observers in Senegal is made available to CRODT, where it is analysed for fisheries management purposes.

[5] In 1992 a special body along these lines was created in Guinea by Presidential decree to take care of the surveillance and protection of fisheries, the "Centre National de Surveillance et de Protection des Pêches" (CNSP). It is an autonomous body, including representatives of the departments in charge of fisheries, national defence and transport, and is now responsible for surveillance in the EEZ, as well as for control, research, and recording offences (FAO, 1994a: 7). In addition, the CNSP is responsible for the coordination of the observer programme.

[6] In Mauritania, surveillance activities have been centralized under the "Direction de la Commande des Pêches" (DCP) since 1987. DCP is under the general supervision of the Ministry of Fishing and Maritime Economy, in conformity with Article 14 of Decree 109-87. The DCP, which includes military among its staff, is the coordinator of all the component parts of surveillance operations and solely responsible for dealing with any other administrations involved in surveillance activities.

[7] The establishment of a structure similar to those in Senegal and Mauritania is currently under consideration in Guinea-Bissau.

Observers

[8] One common practice throughout the sub-region is the use of observers on foreign and sometimes national vessels, reflecting Article 62(4)(g) of the United Nations Convention on the Law of the Sea, which provides for the placement of observers. Observers are potentially one of the most effective MCS tools which a coastal state can have, with the additional benefit for developing states of creating employment and exposure of observers to more advanced fishing technology. The primary function of observers is information-gathering for the purpose of coastal state monitoring and verification. All except one country in the sub-region now have an observer system in place.

[9] In general, the very nature of the work of the observer, conducted in a hostile environment, limits their effectiveness. Other problems with systems presently in place include low levels of remuneration, the precarious nature of employment (excessive numbers of observers as compared to vessels to which they can be assigned), and often insufficient qualifications. In one country observers are required to serve a dual observer/crewman role, again with a negative effect on their work.

[10] A recent technical consultation, organized in Dakar, Senegal, from 11-13 December 1995 by FAO project GCP/RAF/302/EEC, focusing on fisheries observers in West Africa, allowed for an in-depth review of the situation and the formulation of a number of proposals to improve the system. Conclusions of the consultation included the following: States are (or should be) moving away from dual roles for observers (i.e. working both as an observer and as a vessel crew member), as well as from direct payment by vessel captains; remuneration of observers is increasing to deter bribery; it is necessary to improve the ability of observers to cross check and validate data before this data can be used effectively; and there is a need to recruit and train highly qualified observers. In the region, observers'

powers do not extend to enforcement or issuing records of offence, but include observation, recording and reporting on fishing activities.

Self-reporting of position and catch

[11] Reporting position and catch by radio is required in Mauritania, Cape Verde, Guinea-Bissau and Guinea. Thus in Guinea-Bissau, for example, industrial and semi-industrial fishing vessels are required to communicate their position daily to the Ministry responsible for fisheries, while under the provisions Décret-loi No. 2/86, Articles 3 and 9, and Décret-loi No. 10/86, Articles 14 and 15, monthly catch reports must be communicated every quarter. Reporting by radio can be particularly cost-effective, reducing the need for air and sea surveillance. Reporting is intended to help obtain a global view of the evolution of fishing activities (activity of ships and location of fishing stocks) for better knowledge of fishing activities and localization of stocks. However, it is not certain that these objectives have always been or are likely to be reached. There are practical difficulties blocking the implementation of these requirements. Shipowners do not like to communicate their positions for fear of competition in fishing areas. They are even more reluctant when it comes to communicating their catches (FAO, 1994b). It seems that as long as radio reporting requirements are not supported by a credible surveillance system, they risk remaining theoretical. Effective, regular communication between observers and their base may reduce the importance of these problems. Alternative forms of communication of position and catches (for instance, on the basis of a grid) can obviate some of the problems encountered.

[12] In support of radio reporting, there is usually a requirement for the provision of data on catches in a fishing register or log which is made available to the coastal State authorities after the voyage. This information is obviously slower to arrive and also needs to be cross-checked in order to ensure accuracy.

Marking of vessels

[13] National norms regarding the marking of vessels have in the past differed considerably from one State to another in the sub-region, causing problems for ships that move in and out of several jurisdictions. For that reason, no requirements for the marking of vessels were implemented. Following endorsement by the SRFC (subject to some proposals regarding minor adjustments to character dimensions. For a comparative table of FAO and SRFC recommendations regarding character dimensions see p.49 in FAO, 1995b.), five countries have now incorporated in their national legislation recommendations regarding technical specifications based on FAO's Standard Specifications for the Marking and Identification of Fishing Vessels.[1] These recommendations include the marking of fishing vessels for their identification on the basis of the International Telecommunication Union Radio Call Signs (IRCS) system. In two other Member States, texts making marking obligatory are in the process of adoption.

1. In the 1980s, FAO and the Canadian Government organized meetings aimed at the definition of general criteria and specifications for the marking of vessels, resulting in *Standard Specifications for the Marking and Identification of Fishing Vessels* in 1989. The document's recommendations were endorsed by the Eighteenth Session of the FAO Committee on Fisheries, Rome, April 1989, for adoption by States on a voluntary basis as a standard system to identify fishing vessels operating, or likely to operate, in waters of States other than those of the flag State. For full text, see: FAO, 1989.

[14] In practice, there have been some difficulties in implementing the new standards. It is reported that it is difficult to display characters in a legible manner on some boats because of the vessels's construction. In addition, the use of the radio call sign followed by the registration number or the license number often results in markings of eight or more characters. As a result, it is difficult to read, and the system would seem to lack the simplicity it was originally designed to achieve. Within the sub-region, some vessels hide their radio call sign (e.g., with nets) for fear that other vessels will use it fraudulently to avoid payment of radio frequency user fees. Finally, it is not certain that a significant number of vessels from foreign countries are actually using this system. Seen from the point of view of the sub-region, on the basis of reports from surveillance officers, there is a feeling that the system is not attaining its objective of simplicity and convenience.

Control of artisanal fishing

[15] Artisanal fishing plays an important role in the fishing sector of several of the Member States of this sub-region. Such fishing activity, dispersed among many different landing sites along the length of the coast, is very difficult to monitor and control. The problem is all the more acute where, as in some countries, the artisanal sub-sector accounts for a major part of the overall catch. Some administrations are attempting to introduce licensing at a local level to deal with this problem. In the long run, it will be essential to address this problem in the sub-region if fishing effort is to be effectively subject to MCS. It is already a major surveillance problem in Senegal.

Control of industrial fishing

[16] Some countries are moving from a simple system of control of fishing effort to a more sophisticated approach which involves differentiated licensing regimes. For instance, Senegal used to have three or four categories of licences for industrial fishing vessels. The need then arose to establish more specific licences for combinations of fisheries and fishing zones. A similar evolution is taking place in Mauritania. This improvement in licensing schemes poses problems of monitoring and surveillance. Differentiated licensing regimes in the context of multispecies fisheries require tight monitoring of vessel activities, which may be beyond the capabilities of some countries.

Offences and penalties

[17] Legislation plays a key role in the control of fishing activity. Several offences are common to the national legislation of most countries in the sub-region. These include: fishing without a license; fishing outside authorized zones; fishing with nets with mesh below the legal size limit; catching, landing and marketing fish below the legal size limit; failure to land a certain percentage of captures; and transhipment without a permit.

[18] There is a tendency in the sub-region towards the imposition of penalties by administrative bodies. In some countries this process allows for the possibility of compounding minor offences. Such an administrative structure brings with it some disadvantages. To a certain extent it allows for the negotiation of fines, and means that, in practice, fines tend to get reduced from their initial level. Also, in situations in which the fishing vessel flies the flag of a State which gives significant aid to the coastal country, the prosecution of the offence may be influenced by this outside consideration.

[19] Most of the offences are common to the legislation of all countries in the sub-region. However, the treatment of the offences is not necessarily the same. Taking the example of illegal transhipment at sea, penalties are more severe in some countries than others. The gravity of the offence tends to be dependent on the objectives of the policy in place, which may depend on other considerations, such as foreign policy, aid and development.

A FRAMEWORK FOR COOPERATION: THE SUB-REGIONAL FISHERIES COMMISSION[1]

[20] There are several advantages to be gained from the regional harmonization of MCS measures through the coordination of policies and operations. These advantages include cost-effectiveness - an important consideration for developing countries. Harmonization of fisheries legislation can increase leverage in exacting compliance with the laws, and greater efforts to comply with legislation may be expected on the part of foreign fishing interests if violations hold region-wide implications.

[21] For the past two decades there has been an awareness in the region of these potential benefits from cooperation, with an increasing political will to implement appropriate measures. The first efforts aimed at cooperation in the sub-region were initiated in 1976, when the first Conference of Ministers was organized in Dakar on the initiative of the Senegalese Minister in charge of fisheries (Conférence des Ministres, 1976). The objective was to establish the basis for close sub-regional cooperation in matters of preservation, conservation and exploitation of fisheries resources. In 1978, at the 2nd Conference of Ministers, held in Banjul, the Conference asked FAO to examine what institutional arrangements would be most appropriate for the sub-region. Representatives of FAO presented a report to the 3rd Conference of Ministers, in 1980 in Nouakchott, Mauritania, allowing the Conference to specify its objectives of cooperation and define an institutional structure in order to attain them. Among these objectives were the adoption of common policies toward foreign fishers, harmonization of fisheries legislation and regulations, and the development of cooperation in matters of surveillance and research capacity.

[22] After the 4th and 5th sessions, a draft convention was prepared and signed in Dakar, 29 March 1985, creating SRFC, consisting originally of Mauritania, Senegal, Cape Verde, the Gambia and Guinea-Bissau. Guinea became a member in 1986. SRFC is financed by contributions from Member States, which have been obligatory since 1993. Guinea, Mauritania and Senegal each contribute 20% of the budget; Cape Verde and the Gambia contribute 13.3% each; and Guinea-Bissau contributes 13.4%.

[23] SRFC has provided and continues to provide the framework for its Member States to harmonize fisheries legislation and cooperate on matters of MCS. It is generally mandated to strengthen cooperation in fisheries matters on a sub-regional basis. It includes a Conference of Ministers (from departments responsible for fisheries), a coordinating committee, a permanent secretariat with its headquarters in Dakar, and *ad hoc* working groups.

[24] The Conference of Ministers brings together the Ministers responsible for fisheries of the Member States. It has the power to define the objectives of sub-regional cooperation

1. This discussion is based substantially on pp. 240-241 in N'Diaye and Tavares de Pinho, 1994.

and to rule on any question concerning the preservation, the conservation and the exploitation of fisheries resources in the sub-region. Ordinary sessions are held annually and are supplemented by extraordinary sessions when initiated by the President or requested by a majority of members. The Presidency is held by the Minister of Fisheries of the State having organized the last ordinary session.

[25] The coordinating committee is composed of directors of fisheries or any other official designated by the Member State. This committee's mandate is to set out recommendations at the Conference of Ministers on questions to be examined and to guide the work of the permanent secretary, notably in the organization of meetings and the implementation of decisions of the Conference of Ministers. It meets in extraordinary session as required. The coordinating committee now meets three times a year. It is the centre of gravity of the SRFC, except for very important decisions.

[26] The permanent secretariat is the SRFC's executing body, and is directed by a Permanent Secretary named by the Conference of Ministers. The Permanent Secretary is responsible for the execution of the decisions of the Conference of Ministers, organizing meetings, preparing reports on management measures and elaborating research programmes.

[27] Finally, working groups on technical, legal or economic questions are convened with the approval of the President of the Conference of Ministers. The duration of these working group meetings depends on the matters being examined.

SRFC ACHIEVEMENTS IN MCS COOPERATION

[28] From 1987 onwards, several legal documents were adopted by SRFC, including a convention on the conditions of access to resources, a convention relating to sub-regional cooperation in the exercise of the right of maritime hot pursuit, a protocol relating to certain practical measures for the coordination of surveillance operations, and various reference documents on the status of observers and the marking of fishing vessels. In addition, SRFC has been involved in several regional and sub-regional conferences regarding the harmonization of fisheries legislation and management measures.

Harmonization of fisheries legislation

[29] The harmonization of national legislation and regulations concerning MCS has become a sub-regional priority in recent years. It is important to note that harmonization does not seek the enactment of the same laws in each country, but rather that legal provisions in force or foreseen are made compatible, especially when that compatibility is required to ensure that fisheries resources are properly managed or that management problems encountered at the sub-regional level are solved FAO, 1994b). On some matters, harmonization might be achieved through uniform texts or provisions which could be proposed and submitted to the relevant bodies of the SRFC and Governments for an integration of rules and regulations. For other matters, international conventions could be proposed. For still others, guidelines without legally binding force could be used. These documents could be a reference that could gradually be imposed upon member states.

[30] Since meeting in Dakar in late 1994 at the Seminar on the Harmonization of Fisheries Legislation of the States Members of the Sub-Regional Fisheries Commission (29 November-2 December 1994), organized by FAO Project GCP/RAF/302/EEC, the Member States of SRFC have been working progressively on the identification of normative sectors where

harmonization measures appear necessary. Currently in the sub-region, as a result of harmonization efforts, licensing systems are similar and based on common procedures. Surveillance procedures are also similar. However, there remain fundamental differences between the French, English and Portuguese approaches to legislation beyond the obvious difference in language. The systems are different, and have an impact on legislation, as proven by certain examples related to fishing surveillance. In the common-law type of legal system, the activities of surveillance officials are limited by restrictive rules that circumscribe their freedom of action considerably more than in countries with a Napoleonic type of legal tradition (FAO, 1994b). Legislation has also been harmonized in areas discussed earlier in this paper, such as observers and the marking of vessels.

Regional convention on access and exploitation

[31] On 14 July 1993, SRFC adopted the *Convention regarding the determination of conditions of access to and exploitation of fisheries resources off the coasts of Member States of the Sub-Regional Fisheries Commission.* This Convention defines minimum standards of access for vessels fishing in the area covered by the SRFC. It encourages States to adopt concerted measures concerning fisheries observers, the punishment of offences, and the maximum length of fishing agreements. In practice, this Convention has lost much of its interest as members have fulfilled its conditions.

Sub-regional register of fishing vessels

[32] A regional register for fishing vessels had its conceptual origins in discussions in 1977, at the Eleventh Session of the FAO Committee on Fisheries. At that time there were proposals for a global register of fishing vessels, which could "blacklist" those vessels which persistently violated coastal State jurisdiction. It was noted that, while there might be too many difficulties at the global level, registers would be possible at the regional level (Moore, 1987).

[33] Five countries in the sub-region have incorporated in their basic fisheries laws, or in regulations implementing these laws, the principle of the establishment of national registers of fishing vessels. During a recent workshop on the harmonization of fisheries legislation, Member States discussed the need to work towards a uniform vessel registration form, with the implication that there should be agreement on what information should be supplied by shipowners. SRFC is now working towards the establishment of a sub-regional register of fishing vessels, to be set up with support from Canada. This would be based on interaction among the various national registers.

Convention on hot pursuit and Protocol on surveillance coordination

[34] The *Convention on Sub-Regional Cooperation in the Exercise of Maritime Hot Pursuit* defines (Article 5) the procedures for exercising the right to hot pursuit in another Member State's waters, establishing the framework of cooperation between "the pursuing State" and the "State of refuge." Hot pursuit must be uninterrupted, continuing until the pursued vessel enters the territorial sea of its own or of a third State. If the State in which a vessel seeks refuge is party to the Convention, its authorities may be required to cooperate with the pursuing State in order to apprehend and escort the vessel to the pursuer. This Convention is slated to come into force when at least 4 ratifications are deposited. While it is not yet

legally in force, Member States have already begun to follow a number of its provisions in practice. The actual provisions of the Convention on hot pursuit are to be elaborated by bilateral protocols. This process is intended to give more flexibility to the application of the Convention. Some bilateral protocols are in the process of being negotiated.

[35] The *Protocol regarding practical modalities for the coordination of surveillance activities in the member States of the Sub-Regional Fisheries Commission* makes provisions for periodic joint surveillance operations, the exchange of information, training, the installation of equipment of a common standard, and port facilities. Already, there are organized and systematic contacts and data exchange procedures between administrations of certain countries (e.g., communications between radio surveillance units at certain periods of the week). Similarly, joint fisheries surveillance operations have been carried out. There are several quasi-daily informal contacts between fishing authorities in the sub-region, and an awareness by authorities of the importance of cooperation and working towards common policies (FAO, 1994b).

Sub-regional surveillance

[36] In terms of regional cooperation, one of the most significant developments has been the sub-regional air surveillance project, supported by Lux-Development and based in the Gambia. Beginning in July 1995, this project has targeted the Member States of SRFC and Sierra Leone. By February 1996, 360 flight hours had been completed out of the 600 envisaged for one year (Conférence des Ministres, 1996). The purpose is to collect air surveillance data and assist countries in taking appropriate action when infractions occur. In addition, observers are trained in each country.

[37] This project is representative of difficulties which can be encountered and progressively overcome. It was necessary to obtain permission for an air observer from one country to overfly a neighbouring country, thus necessitating a return to home base each day and reducing the cost-effectiveness of the project as a regional tool for MCS. There is a need for low-level flying for fisheries surveillance, which contradicts some international regulations. Surveillance is hindered in the absence of appropriate vessel marking regulations for ease in identification. In the sub-region, there is an overcapacity of surveillance planes (Cape Verde, Mauritania and Senegal all have aeroplanes, in addition to the Lux-Development aeroplane). As a result, the project is considering using the local aircraft rather than its own aeroplane.

[38] There were difficulties in obtaining common software to integrate air surveillance data for each country in the region, but this problem may have been solved through Mauritania providing its surveillance software for use by the project.

[39] The possible use of Global Positioning System (GPS) satellite technology for surveillance purposes has been considered in the region (notably at the technical consultation on observers) but to date remains in limited use by Member States of the SRFC. It was concluded, at the technical consultation on observers, that before acquiring the equipment there was a need to assess the appropriateness and cost-effectiveness of the new technology in light of the specific fisheries concerned.

FUTURE ACTIVITIES

[40] In order to ensure that maximum benefit is drawn from observer programmes, observers must be properly trained. For an example of an observer training programme, see Flewwelling. A handbook for surveillance officials in the sub-region could serve as a reference document, covering the provisions of the main national legislation; introducing surveillance procedures; providing identification data cards for the various species, main gear and engines; measurement procedures for mesh sizes; etc. Such a handbook is currently in preparation by a member of the Lux-Development air surveillance project, and was expected to be available towards the end of 1996.

[41] There is a need to move towards a standard reporting format to facilitate the exchange of information between Member States. Standardization can result in cost savings and operational benefits in areas such as programme development, training, data sharing, and timeliness of analysis. No matter what degree of data sharing may be foreseen, common reporting formats will accelerate cooperation initiatives. In practice there is are great differences in the recording of catches in the sub-region. The disparity of data gathered does not as yet allow for their efficient utilization.

[42] An essential part of MCS - whether it be observer programmes, surveillance and enforcement powers, or the obligation to supply information through licences and logbooks - relies on support in national fisheries legislation. A State should attempt to give effect to its fisheries management plan through legislation and regulations. The importance of improving national legislation and working towards harmonization has been recognized within the region, but there remains a great deal of work to be done. To this end, SRFC has been - and will continue to be - working closely with FAO project GCP/RAF/302/EEC, *Improvement of the legal framework for fisheries cooperation, management and development of coastal States of West Africa.*

[43] In the pipeline is an extensive aid programme financed by the Canadian International Development Agency (CIDA), *Projet d'appui et gestion des ressources halieutiques* (AGREH). This was originally envisaged as a strictly MCS project, as requested by SRFC around 1989. After some further development by CIDA, the project came to encompass four elements: management of resources; MCS; research; and training. It is expected to last seven years, with a total budget of $Can 25 million, and was provisionally due to start in 1996. Individual protocols of understanding were to be signed between Canada and each of the six Member States of the SRFC. The MCS part of the project is to include support to national MCS structures in the sub-region, support to MCS activities, establishment of a database on fishing vessels, and technical studies (e.g., concerning the measurement of gross registered tonnage).

CONSTRAINTS TO THE IMPLEMENTATION OF COOPERATION IN MCS

[44] Compared to some other regions, West Africa has significant cultural, linguistic and geographical differences to overcome when attempting to cooperate regionally. There are different languages, different traditions, and different political, institutional and legal frameworks. This creates not only political problems but also practical day-to-day problems, such as the maintenance of registers in more than one language (Bonucci, 1992: 61).

[45] Cost must inevitably play a role in both the selection of resource management system and the determination of appropriate MCS measures in any developing country. MCS costs, particularly those associated with surveillance activities, can make it impractical for

developing states to implement traditional MCS measures. Conventional surveillance programmes normally involve the deployment of surface craft and aircraft, individually or in support of each other. Related costs fall into two categories: the capital costs of purchasing and replacing equipment (e.g., patrol boats, aircraft, computers, etc.), and recurring or operating costs of maintaining equipment and programmes (e.g., fuel for patrol craft, training, salaries of MCS personnel, etc.). Regional cooperation can lead to lower costs, as the Lux-Development air surveillance project in Banjul has shown.

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MARINE PARKS AND RESERVES: A BRIEF LEGAL OVERVIEW

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1. INTRODUCTION

[1] Since 1986, the World Conservation Union (IUCN) Commission on National Parks and Protected Areas (CNPPA) has been promoting the establishment and management of a global system of marine protected areas (MPAs). An MPA is defined by IUCN as:

> "any area of intertidal or sub-tidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment."
> (GBRMPA/WB/IUCN, 1995)

[2] This definition envisages a wide spectrum of marine protected areas. Marine protected areas need not be limited to small, non-extractive reserves. Increasingly, marine conservationists are turning towards establishment of large, zoned marine protected areas that encompass a variety of human activities (Agardy, 1995, cited in GBRMPA/WB/IUCN, 1995). The IUCN definition does not specify what constitutes 'protection.' Clearly, human activities that are incompatible with conservation objectives must be prohibited or strictly restricted within marine protected areas. One reasonable reference point, consistent with IUCN protection classification, would be prohibition of large-scale mechanized and non-mechanized resource extraction and habitat disturbance within marine protected areas. Many other activities can have unacceptable impacts on natural ecosystems through their direct effects on habitat and wildlife populations, and through their access to especially sensitive features within the protected area. Only human activities with known, acceptable ecological impacts should be permitted within marine protected areas (Recchia *et al.*, 1995, cited in GBRMPA/WB/IUCN, 1995).

[3] In recent years, marine parks and reserves have emerged as important tools for conservation and tourism in the Indian Ocean region. Countries experimenting with this relatively new device find that it raises a number of critical institutional and policy challenges. Among these challenges is the need to design an appropriate legal framework.

[4] In approaching this question, countries have most often drawn upon two established bodies of legal doctrine. The overall protection of marine resources has typically been the job of fisheries legislation, assisted by general environmental laws. At the same time, the 'park' and 'reserve' aspects draw heavily from well-established legal models for protected areas. These models, however, have evolved to a great extent in the context of the development of terrestrial protected areas. How appropriate these models are for the aquatic

environment remains a matter of debate. Some observers have concluded that the terrestrial concepts of national parks and protected areas can be transferred quite easily to the marine context. Issues such as buffer zones, the need to involve resource-dependent communities, management of tourism pressures and the search for innovative financing mechanisms arise in marine protected areas just as they have in their more established counterparts on land. Other observers, however, find more differences than similarities, and argue for the need for better adaptation of land-based doctrine to the marine context (e.g., Beurier and Le Morvan, 1980; du Saussay, 1980).

[5] CNPPA has divided the marine areas of the world into 18 marine regions, largely on the basis of bio-geographic criteria, with consideration for political boundaries for practical reasons. In 1990, working groups were established in each region, consisting, wherever possible, of both marine resource managers and marine scientists.

[6] The aims of the working groups have been to:

- summarize the main physical and biological characteristics of the marine environment;
- divide each marine region into its constituent bio-geographical zones;
- make an inventory of existing MPAs;
- identify gaps in the representation of the bio-geographic zones in MPAs;
- identify areas of national or regional priority for the establishment of new MPAs or for management strengthening and support to existing MPAs; and
- determine other recommendations for establishing or improving the management of MPAs in each marine region.

2. INTERNATIONAL CONVENTIONS

[7] There are several international instruments that address the creation of MPAs directly, including the African Convention on the Conservation of Nature and Natural Resources (Algiers, 1968); the United Nations Convention on the Law of the Sea (1982); and the Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region (Nairobi, 1985). There are also a number of international instruments that address more generally the designation and protection of national parks and other protected areas, such as art. 8(a) of the United Nations Convention on Biological Diversity, 1992, which states that "each Contracting Party shall, as far as possible and as appropriate: establish a system of protected areas or areas where special measures need to be taken to conserve biological diversity." These international instruments have important significance for countries developing marine parks and similar areas.

[8] Two of the conventions that focus specifically on the designation and protection of national parks and other areas are considered below.

2.1 UNESCO CONVENTION CONCERNING THE PROTECTION OF THE WORLD CULTURAL AND NATURAL HERITAGE (Paris, 1972)

[9] This Convention protects both 'cultural heritage' and 'natural heritage' (physical and biological formations and areas) which are of "outstanding universal value." Areas may be inscribed on the World Heritage List only with the permission and consent of the state concerned.

[10] Under this Convention, each party commits itself to "do all it can" to accomplish the Convention's goals of: identification, protection, conservation, presentation and transmission to future generations of cultural and natural sites (whether listed or not). To this end, a party must act "to the utmost of its own resources and, where appropriate with ... international assistance and cooperation."

[11] Each state, in fulfilling these commitments, must:

- adopt a general policy integrating these protection schemes into comprehensive planning and community awareness programmes;
- develop services for the conservation, protection and presentation of protected areas "with the appropriate staff in possession of means to discharge their functions;"
- undertake scientific and technical research into means of counteracting the dangers to these areas;
- develop the necessary legal, scientific, technical and administrative framework to backstop the protection; and
- develop more formal training concerning the conservation, protection and presentation of protected areas, as well as scientific research into these matters.

[12] Each party must also establish national, public and private foundations or associations to invite donations for the protection of the cultural and natural heritage. The parties also agree to undertake educational and information programmes "to strengthen appreciation and respect by their people of their cultural and natural heritage." The convention also requires the parties to report to UNESCO legislative and administrative provisions adopted to further this convention.

[13] The Convention recognizes that there is an international responsibility regarding such natural and cultural heritage, as well. The Convention provides a mechanism for international cooperation, and a small fund of money, for the assistance of parties in the protection of areas designated under the Convention. Such an assistance may only be provided at the request of a party, regarding a listed property, generally only in conjunction with co-payments by the concerned state. Preferred types of assistance projects are stated, but emergency assistance may also be available (Young, unpubl.).

[14] As of May 1995, the countries in the Southwest Indian Ocean region party to this convention were Madagascar, Maldives, Mozambique, Seychelles, Sri Lanka and Tanzania. There is one coastal World Heritage Site in the region, namely Aldabra Atoll, which was created a World Heritage Site in 1982. Round Islands and Serpent Island, shelf islands on the Mascarene Plateau, are considered worthy of World Heritage Site Status, principally for their endemic terrestrial fauna and flora. The Bazarauto Archipelago in Mozambique might be considered for World Heritage Status.

2.2 RAMSAR CONVENTION ON WETLANDS OF INTERNATIONAL IMPORTANCE ESPECIALLY AS WATERFOWL HABITAT (1971)

[15] This Convention is designed to regulate the deterioration of wetlands by human activity (drainage, pollution or saltwater intrusion). For this Convention, the term 'wetlands' includes swamps, bogs, salt-water marshes and other wet areas, including marine areas with a depth at low tide of 6 metres or less.

[16] The Convention requires the member states to:

- designate areas for listing as wetlands of international importance (based primarily on their use by waterfowl). A state is required to list at least one wetland, by submission of a precise decision or map, at the time it becomes a party to the convention;
- promote conservation of listed wetlands;
- promote conservation of unlisted wetlands; and
- promote the conservation of waterfowl.

[17] In addition the Convention requires parties to protect non-listed wetlands "by establishing nature reserves ... and providing adequately for their wardening." Loss of wetlands should be avoided and minimized. Where all or part of a listed wetland is lost, other areas should be listed and protected in its stead.

[18] The parties are also required to provide education, research, training, publication and information exchange regarding wetlands and their flora and fauna. IUCN performs administrative functions under the Convention, and a conference of members convenes regularly to perform advisory and supervisory functions (Young, unpubl.).

[19] As of May 1995, the countries party to this convention in the Southwest Indian Ocean Region were: Kenya and Sri Lanka.

2.3 OTHER CONVENTIONS

[20] There are two other Conventions which refer to the protection of the marine environment.

2.3.1 The United Nations Convention on the Law of the Sea (UNCLOS, 1982)

[21] UNCLOS provides specifically for marine scientific research, protection of the marine environment and the promotion of research centres. (Part XII: Protection and Preservation of the Marine Environment, arts. 192-196).

2.3.2 Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region. Nairobi, 21 May 1985

[22] This Convention has a protocol on protected areas and wild fauna and flora. It requires the parties to protect, or manage sustainably, the species listed in four Annexes; establish protected areas for rare, threatened, endemic, migratory and economically important marine species; and establish a regional programme for the creation of a network of protected areas. This Convention has not yet come into force (December 1996). So far, four countries have ratified it (France, Kenya, Seychelles and Somalia) and one, Madagascar, is a signatory.

3. MARINE PROTECTED AREAS IN THE SOUTHWEST INDIAN OCEAN REGION: NATIONAL LEGAL APPROACHES

[23] In accordance with the recommendations of CNPPA, a number of marine protected areas have been established in the Southwest Indian Ocean Region. As the following brief summaries indicate, there are a wide variety of legal and institutional approaches being used (GBRMPA/WB/IUCN, 1995).

THE COMOROS

[24] There are no MPAs in the Comoros, although one is being developed. In 1993, a National Policy for the Environment was adopted. An Environmental Action Plan is being developed for submission to donors, and new environmental legislation is being prepared.

KENYA

[25] Kenya has one of the most extensive MPA systems in the region, with one of the longest-established sites. There are two types of MPA in Kenya. *Marine National Parks,* which are strictly protected areas for biodiversity and natural resources, in which fishing and removal of marine organisms are prohibited and only tourism is permitted, within designated areas, and *Marine Reserves,* where traditional forms of fishing are permitted. In some areas, the Marine National Parks lie within or adjacent to the Marine Reserves, so the whole area comprises a strictly protected core area and a buffer zone in which sustainable exploitation is allowed. There are currently four Marine National Parks and six Marine National Reserves.

MADAGASCAR

[26] There is one Marine Park that includes coastal waters and one Special Reserve that includes coastal land, but neither of these two areas has effective management. Very little is currently being invested in marine conservation and MPA establishment compared with that for the terrestrial resources.

MALDIVES

[27] No MPAs have been established. However, a number of other activities related to the protection and management of the marine environment are under way. In particular, the National Environmental Action Plan provides a framework for environmental planning and management. Measures are in place to restrict coral mining and reduce marine pollution.

MAURITIUS

[28] There are no effective MPAs in Mauritius. There are six fishing reserves in which fishing is prohibited, but this prohibition is very poorly enforced. There are a number of other protected areas, principally on offshore islets.

MOZAMBIQUE

[29] There are two MPAs that include relatively large areas of coastal waters (Ilhas da Inhaca e Dos Portugueses Reserve, and Parque Nacional do Bazarauto).

SEYCHELLES

[30] The Seychelles has 22 protected areas that include habitats of importance to marine biodiversity. There are 15 MPAs that include coastal waters (including four areas established to protect marine molluscs).

SRI LANKA

[31] The focus of marine conservation in Sri Lanka is coastal zone management. MPAs, *per se*, have received less direct attention. The Coastal Conservation Act enacted in 1981 covers the area within 300 m landward of mean high water level and 2 km seaward of mean low water. The Act required the development and implementation of a coastal zone management plan, placing most emphasis on control of erosion and sand and coral mining, with a permit system for development activities. There are 16 protected areas that include coastal elements, four of which include sub-tidal elements.

THE UNITED REPUBLIC OF TANZANIA

[32] Several areas were gazetted as marine reserves under Government Notice, 1975, and are the responsibility of the Ministry of Natural Resources. However none of these sites have been implemented as MPAs and many have deteriorated to such an extent that they may no longer be worth protecting. The institutional framework for the management of marine resources and MPAs needs improvement. New legislation in both Tanzania and Zanzibar is being proposed.

4. CONCLUSIONS

[33] In the last two decades, the legislation relating to the establishment of marine parks and reserves was included in the fisheries acts. In this respect, in Mauritius, the Fisheries Act of 1980 authorizes the designation of reserved areas, in which fishing with a large or a gill net is prohibited, as well as other fishing methods. In regulations promulgated in 1983, five such reserves were designated. Although there is a reference in the Fisheries Act to reserved areas, these provisions are insufficiently detailed to protect the potential marine parks. Therefore, specific legislation in Marine Parks and MPAs is needed. It is generally agreed that

> "if a marine protected area is to be treated seriously by the people, the power to establish any marine protection or conservation management system should be provided by law, with approval and any subsequent amendments requiring endorsement by the highest body responsible for such legislative matters in the country concerned. The legislation for establishment should contain enough detail for:

- proper implementation and compliance;
- delineation of boundaries;
- provision of an adequate statement of authority and precedence; and
- provision of sufficient infrastructure support and resources to back up necessary tasks." (Kelleher and Kenchington, 1993)

[34] In this regard, specific legislation relating to marine parks has been enacted. Tanzania Marine Parks and Reserves Act, No. 29 of 1994, is an interesting case study (Hitchcock and Shauri, unpubl.). The Act creates a special category of national parks that are not under Tanzania National Parks Authority's jurisdiction, except in special circumstances, as noted below. The Minister may, after consultation with local government authorities and upon resolution of Parliament, declare a marine park by notice in the Gazette (Marine Parks Act, Section 8(1) stipulates that "parks may be created if ... " but fails to list the criteria due to an apparent mis-print.). Marine Reserves may be created similarly, except that no Parliamentary resolution is required. Criteria for the creation of a marine reserve include furthering the objectives of marine reserves (ibid., sec. 10) if the area is of particular natural scenic, scientific, historical or other importance, etc. (ibid., sec. 8(2)). The Act also stipulates that the Minister responsible for National Parks may declare any marine park to be a national park, provided that the objectives of marine parks and reserves would be met, and that certain other provisions of this Act would apply (ibid., sec. 8(3)). While this action has never been taken, the provisions of the Act are laid out below, in order to understand what Tanzania National Parks Authority's role might be in the future.

[35] Pursuant to the Act, the objectives of marine parks and reserves include (ibid., sec. 10):

(a) to protect, conserve and restore the species and genetic diversity of living and non-living marine resources as well as the ecosystem processes of marine coastal areas;

(b) to stimulate the rational development of under-utilized natural resources;

(c) to manage marine and coastal areas so as to promote sustainability of existing resource use, and the recovery of areas and resources that have been overexploited or otherwise damaged;

(d) To ensure that the villages and other local resident users in the vicinity of, or dependent on, a marine park or marine reserve are involved in all phases of the planning, development and management of that marine park or marine reserve, share in the benefits of the operation of the protected area, and have priority in the resource use and economic opportunity afforded by the establishment of the marine park or reserve;

(e) to promote community-oriented education and dissemination of information concerning conservation and sustainable use of the marine parks and reserves; and

(f) to facilitate research and to monitor resource conditions and uses within the marine parks and reserves.

[36] The Statute establishes the Marine Parks and Reserves Unit ('the Unit') of the Fisheries Division, to establish and monitor the control, management and administration of marine parks and reserves, seek funds for establishment and development of marine parks and reserves, expend funds in furtherance of establishment and development of such parks and reserves, implement and enforce the provisions of the Act and its subsidiary legislation,

and to do all such other things which are necessary and within the Unit's powers (ibid., sec. 3(3)). The Unit is also given authority to establish, operate or manage offices and services for the purposes of their duties and functions; provide educational and informal services to local resident users; establish, operate, manage or grant concessions or licences to other persons to operate accommodations and restaurants; and to operate transport services for conveyance of visitors to marine parks (ibid., sec. 3(4)).

[37] In addition, the Act creates a Board of Trustees of the Marine Parks to be appointed by the Minister (ibid., sec. 4(1)). The Board's function is to formulate policies on marine parks, oversee the use of the Marine Parks Fund, to advise the Director of Fisheries on management of marine reserves, and to advise the Minister on approval, revision and amendment of the general management plan of any marine parks (ibid., sec. 4(3)). Advisory committees are also to be created for each marine park, with the function of advising the Board on the management and regulations on marine parks; overseeing the operation of marine parks; consulting with the warden on technical, scientific and operational matters concerning the marine parks; and proposing potential wardens to the Board (ibid., sec. 5). The Act also specifies that wardens shall be appointed to manage each park (ibid., sec. 6).

[38] The Minister is required to adopt a General Management Plan (GMP) for every marine park and reserve (ibid., sec. 14). Furthermore, no activities, rights, licences, titles, interests, franchises, leases, claims, privileges, exemptions or immunities may be granted within a marine park or reserve unless such grant is consistent with the GMP and regulations (ibid., sec. 13(1)). The GMP is to include designated zones, with a description of activities permitted therein (ibid., sec. 17). A time limit exists for development of a GMP after a park is declared, and the Board is to consider such plan and recommend its adoption to the Minister (ibid., sec. 14(1)).

[39] The Government is required to involve village councils or affected villages in preparation of the GMP, as well as the enactment of regulations and zoning of the marine park or reserve (ibid., sec. 8(1)). Provisions of the Act establish the opportunity for 'local resident users' to sustainably utilize the marine parks and reserves, as well as to reside in the areas. The Minister may make regulations governing the activities of these 'local resident users' (ibid., secs. 18 and 19). Both general and specific authority is given to the Minister for Fisheries and the Board of Directors to restrict or permit certain activities within marine parks and reserves (ibid., sec. 13(1) and secs. 18 to 23).

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CONTROL OF FOREIGN FISHERIES
A SUMMARY REPORT

by

G. Parkes[1]

CONTENTS

1. This paper was prepared by Graeme Parkes, for MRAG Ltd., under contract to the Fisheries Management Science Programme of the Overseas Development Administration (ODA), UK

1. INTRODUCTION

1.1 OBJECTIVES

[1] The Control of Foreign Fisheries project was undertaken over a six-year period between 1990 and 1995. It was divided into two main research phases, which can be characterized as strategic and adaptive. Each of these phases had a specific set of objectives.

1.1.1 Phase 1 – Strategic Research

[2] The objectives of this research phase were to investigate and develop methods for the assessment of optimal net benefits from the licensing of foreign vessels operating in national fisheries jurisdictions (the exclusive economic zone (EEZ) or other extended zone).

1.1.2 Phase 2 – Adaptive Research

[3] The objective of this phase was to apply the methodology and results of the analyses undertaken in Phase 1 to assess the extent to which they could be used in practice by governments of developing countries in forming policies for controlling foreign fishing in their EEZs, and to make modifications to the model as necessary.

1.2 APPROACH

1.2.1 Phase 1

[4] The approach during the strategic phase was limited to theoretical investigations. These considered ways in which the marginal value of a nationally controlled fishery

resource[1] could be used, in conjunction with the known parameters of fish price, catches, surveillance costs, etc., to estimate the optimum combination of surveillance cost, legal penalties and fee levels to minimize the risk of illegal fishing and maximize benefits accruing to the coastal state.

[5] The theoretical models developed are described in detail in a separate report. A computer model was developed to put the theoretical model into practice, which was the precursor to the more detailed analyses undertaken for specific case studies in Phase 2 - Adaptive Research.

1.2.2 Phase 2

[6] The work carried out during the adaptive project revolved around the case studies. Four separate case study areas received attention. Field visits were undertaken for familiarization and collation of data on the fisheries, surveillance capabilities and fisheries law. Analysis of these data provided estimates of benefits of fishing in the EEZs for foreign fishermen, estimates of detection probabilities resulting from surveillance, and information on likely penalties for illegal fishing.

[7] Some amendments were made to the methodology developed during Phase 1 in order to be able to account for complexities that became apparent in the case studies. In particular, the surveillance model was substantially improved.

1.3 BACKGROUND: THE NEED FOR CONTROL OF FOREIGN FISHERIES

1.3.1 Global overcapacity

[8] In a recent review of the status of world fisheries (FAO, 1995), it was reported that the rate of increase in global annual fish catch declined during the 1980s. The total catch reached a peak at the turn of the decade and since then it has declined. Whether this declining trend will continue is unclear, in part because of the major contribution to these catches of small pelagic and other species that exhibit large inter-annual fluctuations in abundance. However, it is clear that the scope for sustained increases in catches is extremely limited. FAO (1995) estimated that over 70% of the world's fish stocks are either fully or overexploited, and there are extreme levels of overcapacity in the world's fishing fleets. As the fish stocks available to the domestic fleets of major fishing countries have declined due to overfishing, these countries have greatly increased their distant water fishing fleets, to the extent that the global fisheries sector is now dominated by fleets from only a few maritime nations, including France, Japan, Korea, Russia (and other former USSR countries), Spain, Taiwan and USA.

1.3.2 The United Nations Convention on the Law of the Sea

[9] The historical increase in distant water fishing fleets has been matched by a general movement towards unilateral extensions of marine zone sovereignty, as a direct response to the threat by distant water fishing nations (DWFNs) to stocks of fish adjacent to countries which had their own domestic requirements or developing fishing industries. This began in

1. This can be considered simply as the difference between the income derived by a commercial operator from fishing inside a zone and the income from fishing outside that zone.

the late 1970s and was finally embodied in the 1982 United Nations Convention on the Law of the Sea (UNCLOS). This convention was finally ratified in November 1994, but well before then it was widely accepted that extended fisheries jurisdiction, and the resultant 200-nautical-mile EEZ, constituted customary international law.

[10] Of the principles that underlie the provisions set out in the Convention, the most important for the purposes of this research project is the principle of extended jurisdiction by coastal states over all living and non-living resources within their EEZs. Essentially, this gives coastal states the right to manage fishing activities within their EEZs, including the right to grant or deny access to foreign fishing vessels to take fish within EEZs, subject to certain guidelines. Prior to UNCLOS, all waters outside a 12-nautical-mile zone were considered to be high seas, and thus open to fishing fleets from all countries.

[11] For developed countries with large domestic fleets that were already exploiting fish stocks in what became their EEZs, the experience with extended fisheries jurisdiction has generally been good. This is particularly true in cases where the domestic fleet was capable of fully exploiting stocks that generally remained within a single country's EEZ; extended fisheries jurisdiction granted the right to deny access to foreign fishermen, thus easing the pressure on heavily fished stocks. Where fish stocks range across several EEZs, the same rights apply for each country concerned regarding granting of access to foreign fishermen, but proper management of the stocks requires cooperation between the countries.

1.3.3 Highly migratory stocks

[12] Highly migratory fish are a special case, in that their range frequently includes parts of the EEZs of several coastal states, as well as large areas of what remains international waters. Management of these stocks, of which tunas are an archetypical example, is generally carried out under the provisions of international fishery management bodies governed by international convention, such as the International Commission for the Conservation of Atlantic Tunas (ICCAT). Typically, these bodies determine annual total allowable catches (TACs), which are then divided by agreement amongst member governments. For these species, responsibility for overall management of the stocks has been ceded to the inter-governmental organization, but the coastal states still have the right to charge for access to their EEZs for foreign fishermen to take those species.

1.3.4 Developing countries' experience

[13] In contrast to developed coastal states, the experience with extended fisheries jurisdiction for developing countries has been more mixed. At least in principle, permitting access to foreign fishing, usually involving transfer of income from the DWFN to the coastal state, can be of considerable value to a developing country, especially if it is unable itself to exploit the resource fully. Benefits other than just licence fees may also be realized by coastal states, such as increased local landings and local fishery development through joint ventures with DWFNs. An example of such a joint venture is in Mauritania, where French fishermen exploiting langoustine stocks could either accept substantial increases in access fees, or agree to form joint ventures for investment in development using the coastal state fishing fleet. This situation, common to many developing countries, arises when the allocation of access rights through licence fees contributes little in the way of economic growth and development. The so-called Second Generation Agreements currently being negotiated between the EU and developing countries are based on a move away from simple

licensing agreements towards more long-term, development-orientated relationships. These can extend to the granting, in reciprocation for fishing access, of benefits-in-kind in trade or other areas not directly related to fisheries.

[14] In practice, however, the lack of local expertise in developing countries and of frameworks that could be used to manage newly acquired fish stocks to ensure their conservation while securing optimal economic benefits from their exploitation, has severely hampered developing coastal states. Most, with a few exceptions, have proceeded by trial and error. In particular, developing countries have the dilemma of deciding to what extent they should develop a fishing industry of their own, or to what extent they can obtain benefits from licensing foreign fleets and permitting access of these fleets to their fish resources.

[15] Clearly, in most cases, such decisions belong in the political arena, rather than the biological or economic one. However, if the decision is taken to permit foreign fishing, then it is essential that optimum terms and conditions of access to areas under coastal state jurisdiction be imposed upon the distant water fleets. Devising such terms and conditions involves a series of secondary decisions about what level of licence fees should be set, what amount of money should be spent on surveillance and enforcement, and what legal framework should be developed, especially what levels of fines should be imposed for illegal fishing activities.

1.3.5 The Control of Foreign Fisheries project

[16] Phase 1 of the Control of Foreign Fisheries research project was aimed at developing a suitable framework, based on modern mathematical bio-economics and optimal control theory, that answered these questions for developing countries in a practical and rigorous way. The results of the project revealed a number of principles underlying the optimal management of foreign fishing activities by a coastal state that had very general applicability. The primary recommendation of Phase 1 was that under Phase 2 further research should be undertaken, using a limited number of specific case studies, to determine the applicability of the methodology and results in the field.

1.4 CONFIDENTIALITY

[17] Some of the data on which the analyses of case studies in Phase 2 were based, especially those relating to licensing and surveillance, were provided to MRAG on the understanding that they were to be treated as strictly confidential. In a similar vein, it is obvious that many of the detailed recommendations relating to licensing and surveillance policy are equally sensitive.

[18] Detailed confidential reports describing in full all the analyses and conclusions were sent separately to the Governments concerned. However, for this summary report all material relating to specific case study areas has been omitted and the results are discussed only in terms of the resulting modifications to the model. Inevitably, this has led to a degree of vagueness in the concluding sections, but was unavoidable.

2. OPTIMAL CONTROL OF FOREIGN FISHERIES

2.1 BACKGROUND

[19] The scenario examined in Phase 1 was one in which a coastal state has declared a 200 nautical mile EEZ containing a single exploitable fish stock. Provided they perceive a benefit in doing so, foreign fishing vessels will want to exploit this fish stock, and they will approach the coastal state with a view to gaining access to the EEZ. They are prepared to pay a fee for that access. The coastal state wishes to maximize the net revenue it can accrue from granting access to the foreign vessels. At least initially, it is assumed that there is no alternative domestic fleet, nor any stock conservation problem associated with granting access to the foreign fishermen.

[20] For the state, the principal potential source of revenue derives from licence fees charged to the foreign fishermen for access to the EEZ. Clearly, from this restricted point of view, the larger the individual licence fee, the greater the revenue accruing to the state. However, if the licence fee is set too high, it will no longer be considered worthwhile by the foreign fishermen to try to gain access to the EEZ. Even if licence fees are set at levels such that gaining access to the EEZ is still attractive, some vessels may opt not to pay the licence fee and rather to fish illegally inside the EEZ. To counteract this, the state must enforce the EEZ by detecting and penalizing illegal fishing. However the surveillance and enforcement activity itself bears a cost, which may or may not be offset by the fines paid by vessels fishing illegally that have been detected and successfully prosecuted.

[21] Throughout this section, the benefits to either the coastal state or the foreign fishermen will be assessed in terms of net revenues. For the coastal state, the net revenues will consist of the total income from licence fees, less the cost of surveillance, plus the revenue from fines paid by foreign fishing vessels operating illegally that have been detected by the state's surveillance activities. For the foreign fishermen, the net revenue accruing from fishing within the zone is made up of the net increase in catch value attained by fishing within the EEZ as opposed to fishing elsewhere, minus the licence fee (if paid) or minus any fines if detected fishing illegally.

[22] The first obvious conclusion from this very simple formulation is that the foreign fishermen will not seek to buy licences, nor will they have any incentive to fish illegally inside the coastal state's EEZ, unless the value of the catches that can be taken within the EEZ exceed those that could be taken elsewhere. It further follows that the incentive to fish within the zone will increase as the (perceived) value of fishing within the EEZ increases. The most obvious case in which there will be a net benefit in fishing within the EEZ is one in which the catch rates for the target species are higher within the EEZ than outside it.

[23] Phase 1 showed that the choice the foreign fisherman would make regarding whether to seek a licence, fish illegally or fish elsewhere would be predicated on the values of three variables:

- ***MR*** the marginal revenue available from fishing inside the EEZ as opposed to outside the EEZ;
- ***L*** the licence fee charged by the coastal state for access to the EEZ; and
- ***E(F)*** the expected fine the fishermen would face if they were caught fishing illegally within the EEZ.

[24] In the simplest case, a risk-neutral foreign fisherman will either:

- purchase a licence and fish legally inside the EEZ if $L \leq MR$ and $L < E(F)$;
- not purchase a licence and fish illegally within the EEZ if $E(F) \leq MR$ and $E(F) < L$;
- or not purchase a licence and fish legally outside the EEZ if $L > MR$ or $E(F) > MR$.

[25] In the special case when $L = E(F)$ and both are $\leq MR$, then the fishermen will be indifferent between fishing illegally and legally.

[26] In Phase 1, all variables were effectively treated as being deterministic. In Phase 2, it was recognized that actually both *MR* and *E(F)* represent statistical expectations of random variables. Only the licence fee is fixed and certain. In some cases, mainly those where the EEZ contains the preferred habitat of the target species, it is reasonable to expect that it will always be preferable to have access to the EEZ to catch the target species, provided the licence fees are not set too high. In other circumstances this might not be the case. A typical example is one in which the EEZ lies near the migration route of a highly migratory species. In some years, the species may migrate through the EEZ, in which case it will be attractive to be able to fish within the EEZ, but in other years this may not occur. In Phase 1 it was assumed that the fishermen would base their decisions on their expected marginal revenues, which would take account of both the good years and the bad years.

[27] The role of the statistical expectation is even clearer when considering the expected fine *E(F)*. This is made up of the product of two other variables:

- q the probability that an illegally fishing vessel is detected, with 'detected' in this context taken to encompass the process of encountering a vessel fishing illegally, collecting evidence of the illegal activity, and undertaking a successful prosecution for that activity; and
- F the fine imposed by the coastal state.

[28] While it is perfectly rational to base decisions on the expectation of the fine, it is important to recognize that there may be a considerable difference between the fishermen's perception of the probability of their being detected and the actual probability based on the real surveillance activities of the state. Furthermore, the fishermen's perception may change over time, depending on the coastal state's record in detecting illegal fishing. This distinction becomes important in later case studies.

[29] In Phase 1, a simple theoretical model was assumed to relate the per-vessel expenditure on surveillance, S, and the resulting probability of detection, q. This was:

$$q = Q \times (1 - \exp(-KS))$$

where $Q \leq 1$ and K is a measure of the searching efficiency per unit of surveillance cost.

[30] This model reflects the diminishing returns in terms of increased probability of per-vessel detection that arises as the expenditure on surveillance increases. It also allows for the possibility that it might never be possible to detect vessels with certainty, regardless of the expenditure. The model is illustrated in Figure 2.1.

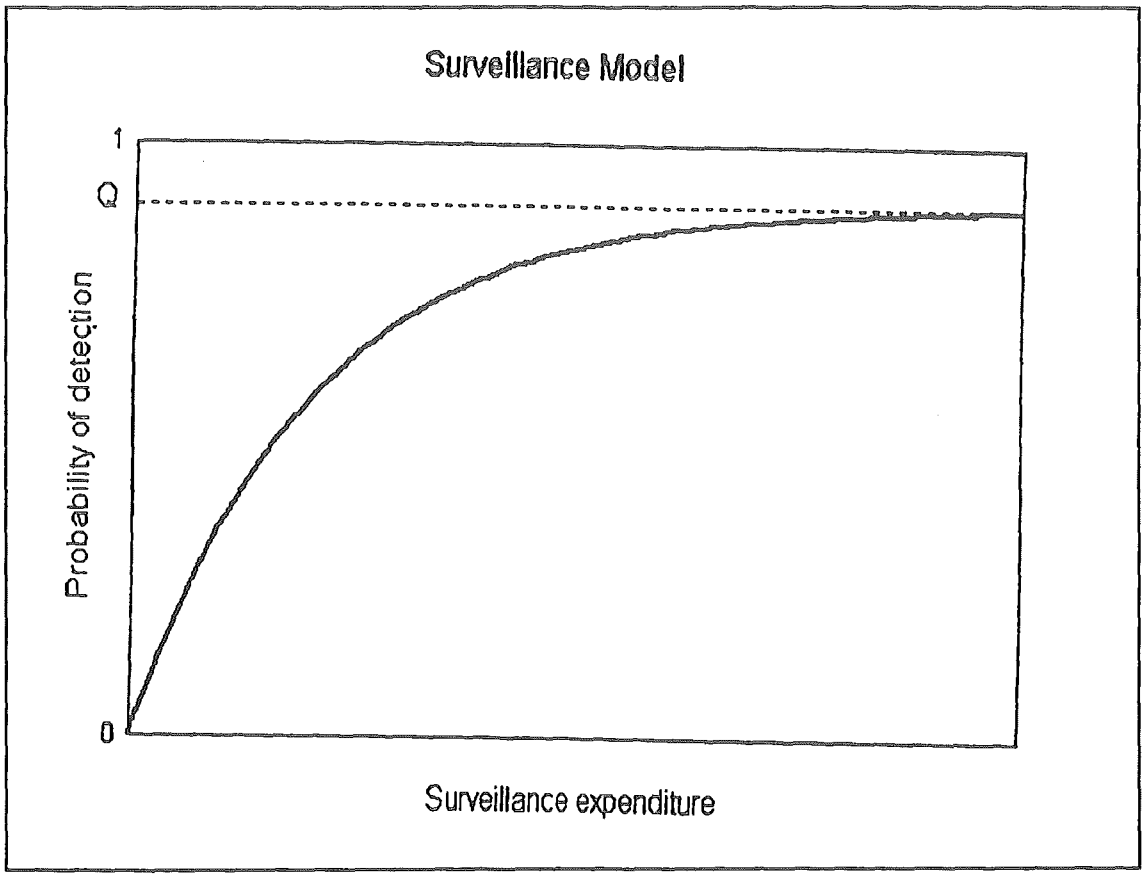

Figure 2.1 Surveillance model

[31] As indicated above, it is assumed that the coastal state wishes to maximize its net revenues from foreign fishing activities. To achieve this, it has three control variables it can set:

- L the level of licence fee;
- F the fine to be imposed on illegal fishing; and
- S the amount of money to spend on surveillance and enforcement.

[32] If there is a single fleet of N foreign fishing vessels wishing to gain access to the EEZ, then the total net revenue accruing to the state is given by:

$$\text{Net revenue to state} = (N \times L) + (N \times q \times F) - (N \times S)$$

[33] The most basic decision rule for the state regarding the issuing of licences, in cases where the foreign fishing fleet does want to gain access to fish in the zone either legally or illegally, is:

- if $L < E(F)$ then refuse to issue licences even if fishermen want them;
- if $L > E(F)$ then seek to issue licences;
- if $L = E(F)$ then do either.

[34] It may seem somewhat perverse that the coastal state may consider not issuing licences even when the foreign fishermen want them. This option arises because it is indeed possible with some combinations of parameters that the state could gain more revenue by detecting and fining illegal fishermen than by licensing legal ones. However, this would not result in a satisfactory management regime, either for the coastal state or the foreign fishermen. In practice, the state may be far more comfortable with having every fisherman fishing legally, and it may even be prepared to forego some revenue to ensure this. Under such circumstances, the first inequality could be replaced by:

- if $L < S$ then issue no licences;
- if $S < L < E(F)$ then consider issuing licences.

[35] These new conditions differentiate between two regions. In the first, the per-vessel surveillance cost is greater than the licence fee, so issuing licences is unprofitable. It is almost inconceivable that the state could be in this position, unless fishermen are just not prepared to pay more for licences. In this case, the state would choose do nothing, i.e., not to issue licences and not to mount any surveillance operations. However, if the state had obligations to manage or conserve stocks, it would have to accept that the fishery would run at a loss.

[36] The second inequality describes a region where the state can afford to be more flexible. Issuing licences in this region would indeed be profitable for the state. However, the expected fine is greater than the licence fee, so the state could actually make more by fining a vessel than by licensing it. This region could therefore be one within which licence fees are negotiated.

[37] The objective of Phase 1 was to determine values of the three state control parameters (licence fee; fine; expenditure on surveillance) that maximize the state's revenue. The next sections summarize the results of that analysis, while including a few modifications that were made to the model during Phase 2.

2.2 SINGLE FLEET OF FOREIGN FISHING VESSELS; RISK-NEUTRAL FISHERMEN

[38] The first principle that arises from analysis of this scenario is a powerful one, and it seems to have very wide generality.

[39] While the licence fee enters the calculation of net revenue to the state in a very straightforward way, there is a clear interaction between the level of fine set and the amount spent on surveillance. If we consider the issue of optimal surveillance and penalty on its own, it can be shown that if one wishes to maximize the net benefit from surveillance activities, the level of the fine for illegal fishing should be set at its maximum possible value.

[40] A formal proof of this was given in the full report of Phase 1, but heuristically it is clear why this is true. The decision rules for the state and the fishermen depend on the parameter $E(F)$, which is the product of the fine F and the probability of detection, q, which itself is an increasing function of surveillance expenditure. Any given value of $E(F)$ can be attained by different pairs of values of $\mathbf{q}$ and $\mathbf{F}$, such that $q \times F = E(F)$, but clearly the cost to the state is least when the surveillance expenditure is lowest, which can only occur when F is at its maximum (F_{max}).

[41] In practice, the maximum fine is likely to be related to the value of the fishing vessel and its fishing gear, plus the value of the catch in its hold on arrest[1]. In most cases, fishing vessels and gear have such a high value that the maximum fine is far larger than the marginal revenue, i.e., $Q \times F_{max} > MR$. The following discussion will assume that this so, while the alternative case will be described later.

[42] If the optimal value of the fine control variable is set as:

$$F^* = F_{max}$$

Phase 1 showed that the net revenue to the state is maximized in the limit by setting:

$$L^* = MR, \text{ and } E(F)^* = MR,$$

i.e., both the licence fee and the expected fine are set equal to the marginal revenue the fishermen would attain from fishing within the zone. In fact, at these parameter values the fishermen will actually be indifferent amongst their alternative decisions (buy licence, fish illegally or fish outside), so the true optimal policy would be to set L^* and $E(F)^*$ just fractionally below MR.

[43] It is intuitively clear that this result holds in theory, but in practice if this policy were followed it would be extremely unlikely that any fishermen would seek to buy a licence. This is because the values of both MR and of $E(F)$ that would be attained in any one year can be highly uncertain, while the licence fee, L, is fixed. A rather more likely situation is one in which there is an effective maximum proportion of the marginal revenue the fishermen would be prepared to pay for a licence, say

$$L \leq a \times MR, \text{ where } a \leq 1,$$

in which case the optimal policy is:

if $Q \times F_{max} - 1/K \geq a \times MR$,	then $L^* = E(F)^* = a \times MR$
otherwise	$L^* = E(F)^* = Q \times F_{max} - 1/\mathrm{K}$.

[44] The point $L = Q \times F_{max} - 1/K$ is the point at which the licence fee minus the surveillance cost per vessel is the greatest, i.e., where the state revenue is at a maximum. The optimum licence fee will thus be $a \times MR$ or $Q \times F_{max} - 1/K$, whichever is the smallest. The second option will arise only if K is quite small, which corresponds to a situation where surveillance is very ineffective. For example, this could be the case if fishermen manage to find out in advance when and where surveillance flights are to take place. If K becomes so small that $K \leq 1/Q \times F_{max}$, then there is no profitable level of licensing at all.

[45] The two situations described above are illustrated graphically in Figures 2.2(a) and 2.2(b), in the form of decision rules and optima for state and fishermen. The figures depict the state's and the fishermen's decisions for various combinations of licence fee and surveillance expenditure; the fine is assumed constant at its maximum value. S' is the level of surveillance required for the expected fine to be equal to MR. This is considered an upper bound for S, since the fishermen will not risk more than the profit which they could make from fishing inside the zone.

1. There may be an additional component associated with the loss of the fishing vessel (for instance either as part of the penalty, or by default due to non-payment of a fine), which is the loss of the opportunity to make future profits from fishing, but this is more difficult to quantify. The potential size of the maximum possible fine is considered further in Section 2.5, in relation to the imposition of extended penalties, such as the barring of offending vessels from being issued licences for some period of time following conviction.

[46] Note that the scale of the surveillance axes in the two figures is different. The $L = S$ line always has a gradient of 1, but because K is smaller in Figure 2.2(b), it takes much more surveillance expenditure for the $L = E(f)$ line to reach MR. If the figures were drawn to the same scale, Figure 2.2(b) would have to be far wider than it is.

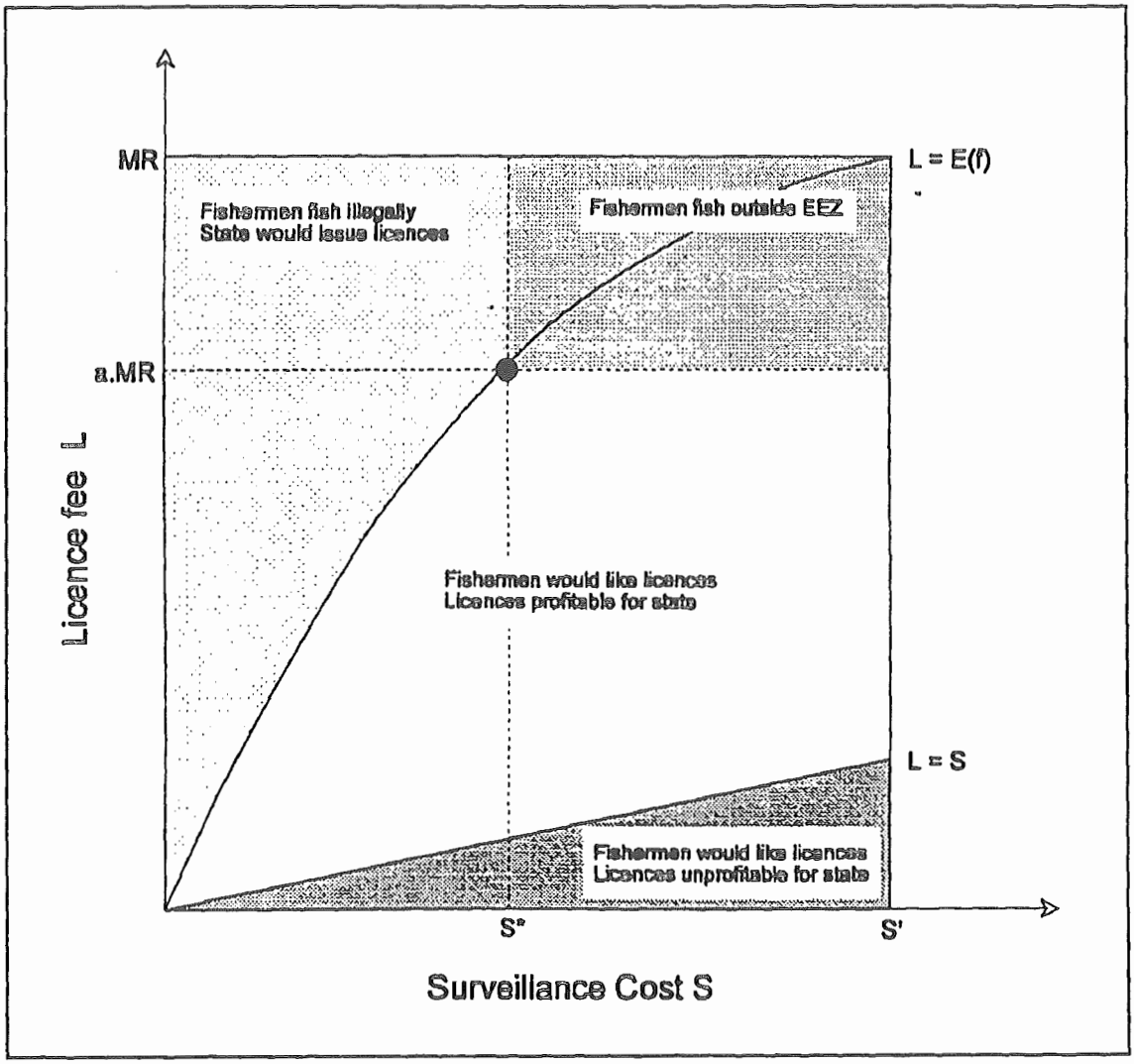

Figure 2.2(a) Normal surveillance, i.e., $(F \times Q - 1/K) \geq (a \times MR)$

[47] Graphs such as these are useful to a fishery manager in that they portray the decision space in a manner that is easy to interpret. The white area in the figures represents a region of potential negotiation. Here, the fishermen are prepared to buy licences, although they would like the fees to be as low as possible, so they will try to negotiate to a point near the bottom of the region. The state is prepared to issue licences even though it could make more from fines, but the most profitable points are at the top of the region. The graphs assist the state by clarifying the extent of this region, e.g., for a given level of surveillance, one can read off the range of licence fees within which both parties' requirements could be accommodated. This could be useful during subsequent negotiations.

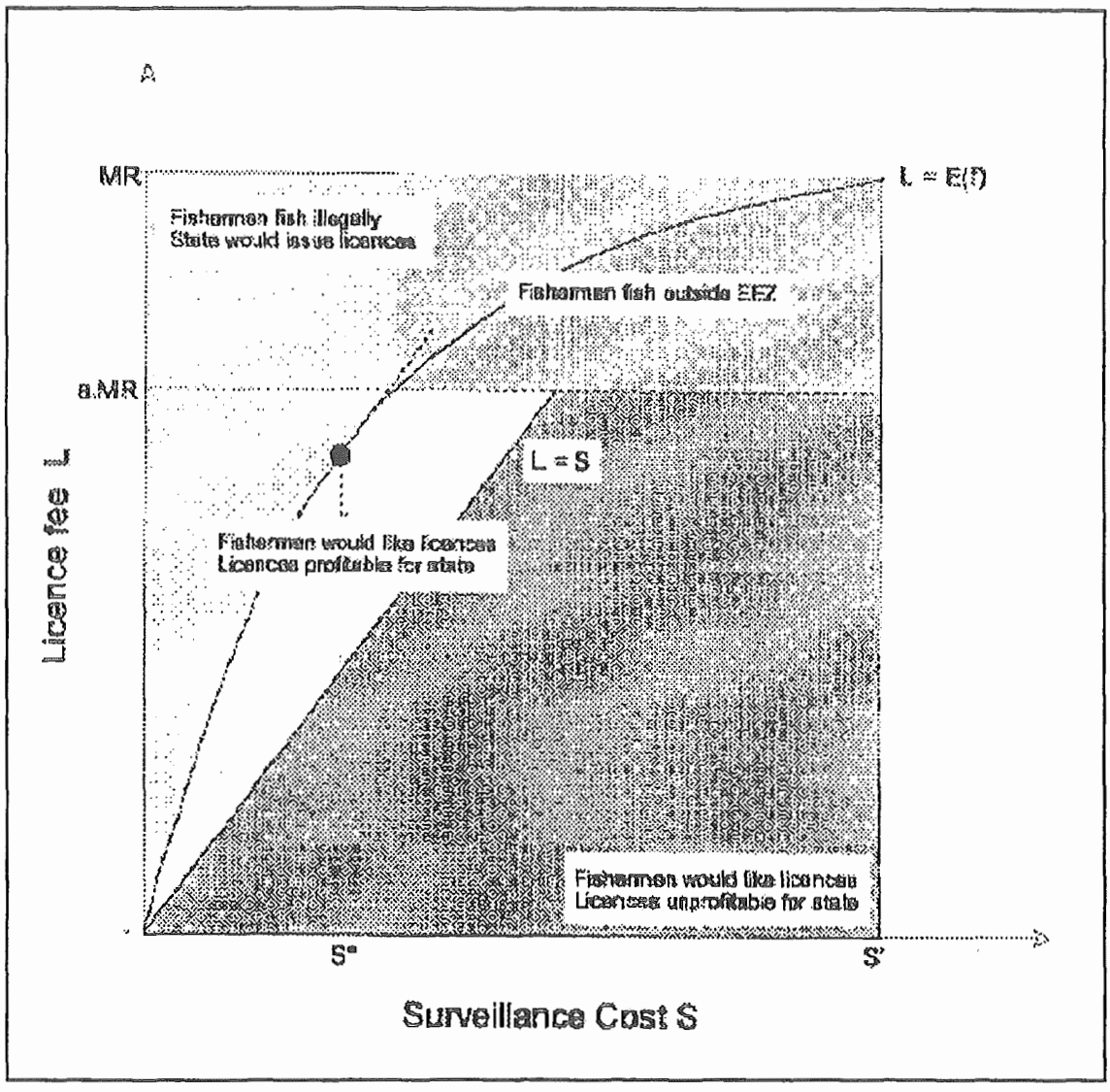

Figure 2.2(b) Inefficient surveillance (lower *K*)

[48] The optimal point for the state in each of the two figures is marked with a black dot. In Figure 2.2(a), the optimum licence fee is set at the maximum that fishermen are prepared to pay. The surveillance expenditure is then the minimum necessary to deter illegal fishing, given that fee. In case (b), where surveillance is inefficient, this licence fee would require a level of surveillance that is so expensive that the state's profits would be lower than could be otherwise obtained. Here, the optimum licence fee is lower than in (a), while the corresponding cost of surveillance is higher. Also, you can see that the height of the region of negotiation is considerably smaller. This means that the state's scope for negotiation on licence fees has been reduced.

[49] If the actual optimal points were used, then in case (a) the fishermen would theoretically have no clear preference between fishing legally, illegally or outside the EEZ. In case (b), they would wish to fish within the EEZ, but would be indifferent between fishing legally or illegally. It is tempting to assume that when fishermen are, in principle, indifferent between fishing legally or illegally, they would actually opt to fish legally. There may well

be some incentive to act lawfully when there is no benefit in acting unlawfully, but, as already noted, the licence fee is a certain cost to the fishermen, but it is by no means certain that the expected marginal revenue or the expected risk of detection when fishing illegally would actually be realized in any one year. Under these circumstances, it is quite likely that the fishermen may show risk-prone behaviour. This is the subject of the next section.

2.3 SINGLE FLEET OF FOREIGN FISHING VESSELS; RISK-PRONE FISHERMEN

[50] In the first case studied, it was assumed that there would be some threshold level, namely $L = a \times MR$, with $a < 1$, which would constitute the maximum licence fee fishermen would be prepared to pay to fish in the zone. Due to the uncertainty about whether they may or may not be detected when fishing illegally, or because their perceptions of the risk of capture might be optimistic, assume now that they are prepared to fish illegally when the expected fine $E(F) \leq (b \times L)$, where $b \geq 1$. This means that they are prepared to risk a fine greater than the current licence fee. For risk-averse fishermen, $b \leq 1$, since they will not risk even as much as the licence fee. Risk-averse fishermen are not considered in this analysis.

[51] For ease of notation, we define $c = 1/b$. The parameters a and c bring an asymmetry into the decision making process, and the modified set of decision rules for the fishermen is now:

- If $L \leq (a \times MR)$ and $L < (c \times E(F))$ then fish inside the EEZ with a licence
- If $L > (c \times E(F))$ and $(c \times E(F)) < (a \times MR)$ then fish illegally inside the EEZ
- If $L > (a \times MR)$ and $(c \times E(F)) > (a \times MR)$ then fish legally outside the zone

The decision rules for the state remain as before.

[52] The optimal point differs for the two cases $c > a$ and $c < a$:

- Optimal licence fee

$$L^* = (a \times MR) \qquad \text{if } c > a$$

$$L^* = (c \times MR) \qquad \text{if } c < a$$

- Optimal fine level $F^* = F_{max}$
- Optimal surveillance cost

$$S^* = -1/K \, ln(1 - (a \times MR)/(c \times Q \times F_{max})) \qquad \text{if } c > a$$

$$S^* = -1/K \, ln(1 - MR/(Q \times F_{max})) \qquad \text{if } c < a$$

- Optimal detection probability

$$q^* = (a \times MR)/(c \times F_{max}) \qquad \text{if } c > a$$

$$q^* = MR/F_{max} \qquad \text{if } c < a$$

[53] The combined rules for the fishermen and the state are depicted graphically in Figures 2.3(a) and 2.3(b) for the cases $c > a$ and $c < a$ respectively. Remember that c is an indicator of risk proneness: the smaller c is, the more risk-prone the fishermen.

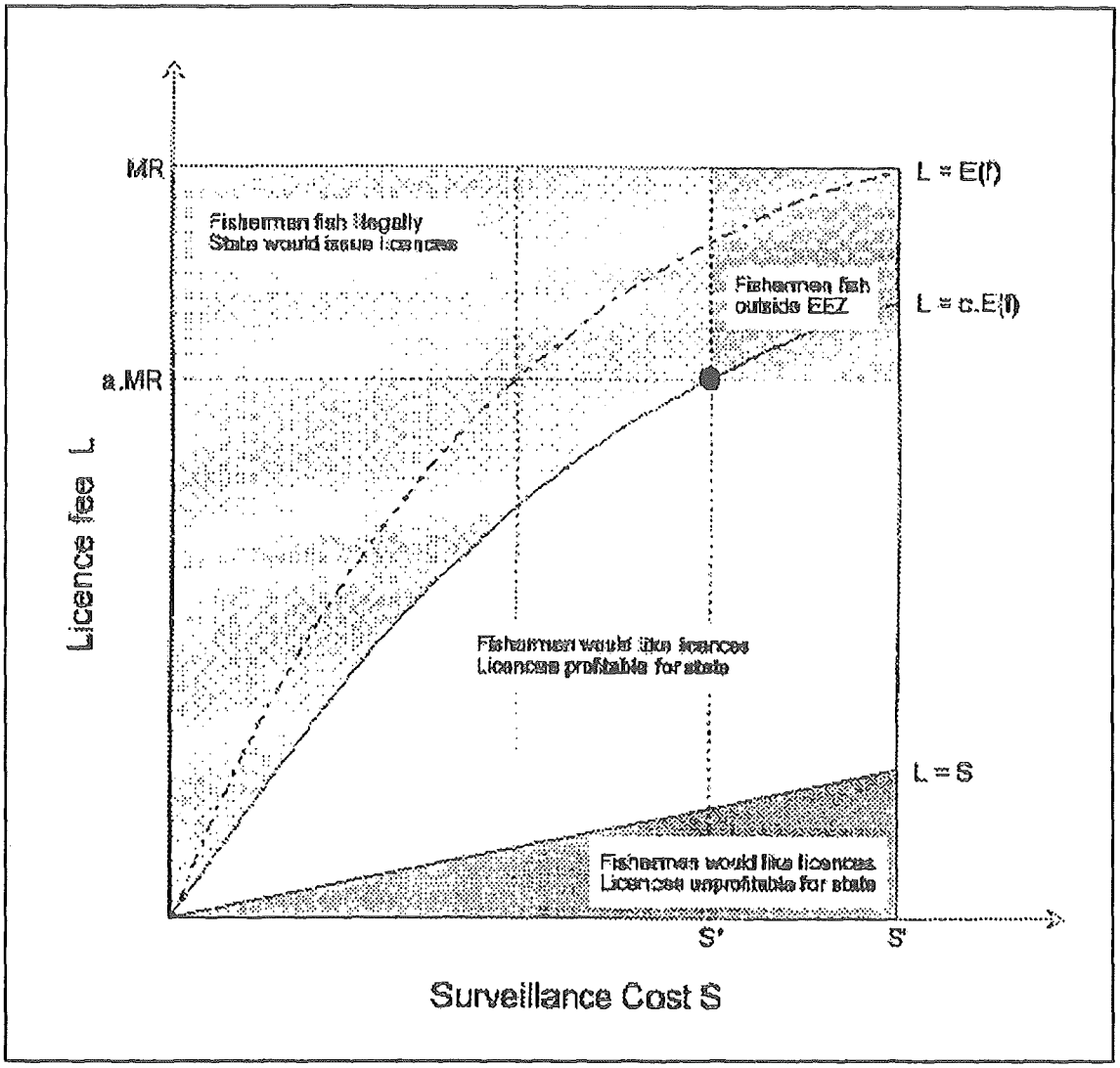

Figure 2.3(a) Combined decisions for the state and fishermen where $c > a$

[54] Notice that the original region of negotiation has become smaller. In the risk-neutral case, the upper boundary of the region used to lie along the line $L = E(f)$, but here it becomes lower as c decreases. The more risk prone the fishermen are, the smaller the area of negotiation will be. Points which were in the interior of the risk-neutral region now become optimal in the risk-prone case, and the state has to settle for points close to the new upper boundary.

[55] Figure 2.3(a) is similar to Figure 2.2(a) in that the optimum licence fee is the maximum that fishermen are prepared to pay. The surveillance expenditure needed to enforce the optimum fee is higher than in the risk-neutral case, and the more risk prone the fishermen are, the greater the level of surveillance required. With increasing risk proneness, the stage is eventually reached where the level of surveillance is so high that the expected fine is greater than the potential profit from fishing inside the zone. Any further increase in surveillance merely forces the fishermen outside the EEZ. This point is therefore the optimum, and it corresponds to a lower licence fee than the maximum fishermen would otherwise have been prepared to pay for licences.

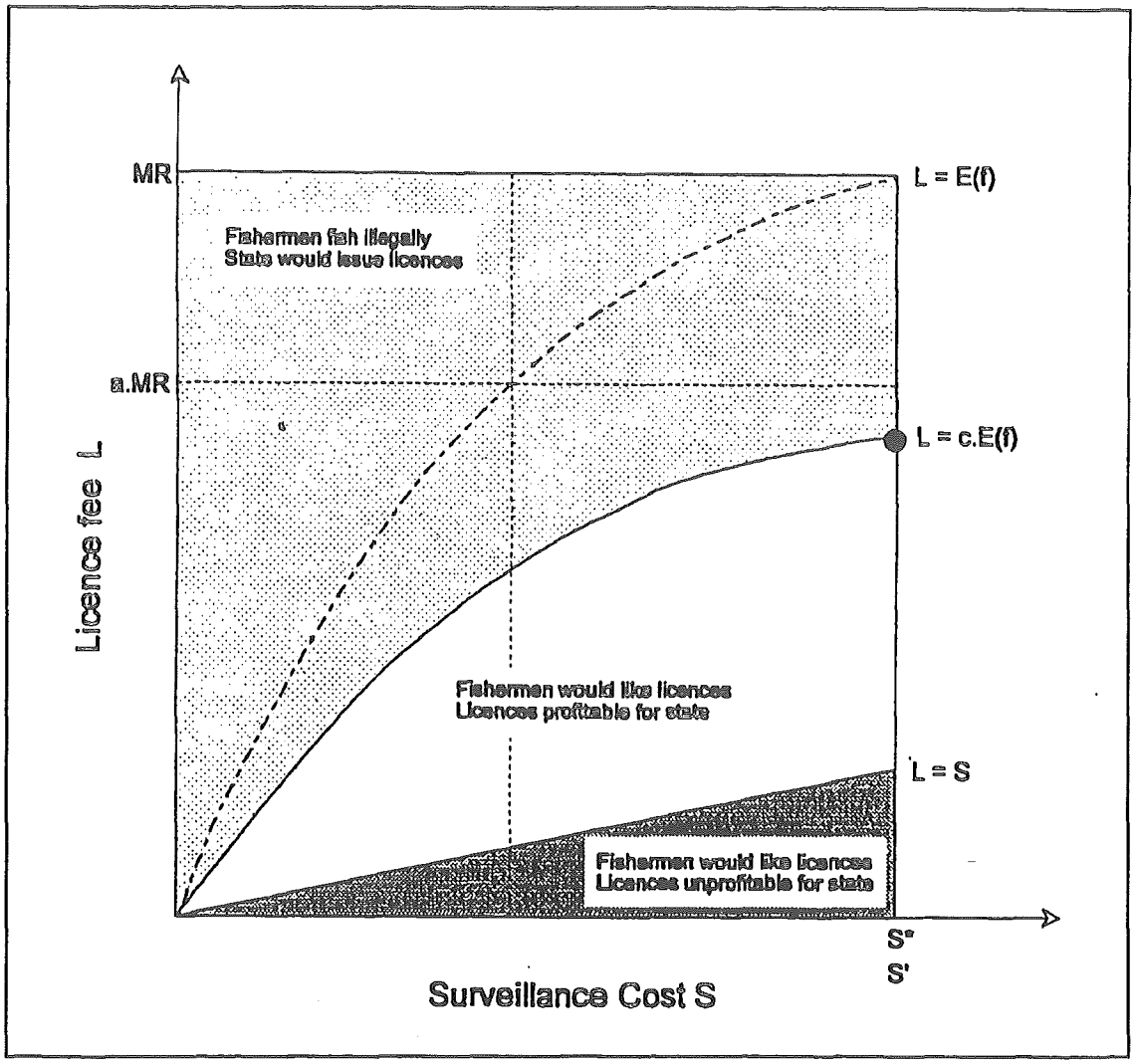

Figure 2.3(b) Combined decisions for the state and fishermen where $c < a$

2.4 LOW MAXIMUM FINES

[56] In Section 2.2, we motivated the assumption that $(Q \times F_{max}) > MR$ by saying that the maximum fine is usually much higher than the potential annual profits to be made from fishing inside the EEZ. For example, the maximum fine is often of the same order of magnitude as the value of the vessels. In these cases, there will always be some level of surveillance which will lead to an expected fine greater than or equal to the potential profit, which is the maximum that fishermen are prepared to risk. This assumption will normally be valid, particularly for foreign vessels. However, there are two circumstances under which this may not be true. The one is when the marginal rate for the stock is very high, i.e., the potential profits from fishing in the zone are very large. The other is when the maximum fine is low, due either to the vessels having low value or political considerations making it impossible for the state to set large fines. Under these conditions, it may be that $(Q \times F_{max}) < MR$.

[57] Then, for $c < a$,

- Optimal licence fee: $L^* = (Q \times F_{max}) - 1/K$
- Optimal fine level: $F^* = F_{max}$
- Optimal surveillance cost: $S^* = -1/K \ ln(1/K \times c \times Q \times F_{max})$
- Optimal detection probability: $q^* = Q(1 - 1/K \times c \times Q \times F_{max})$

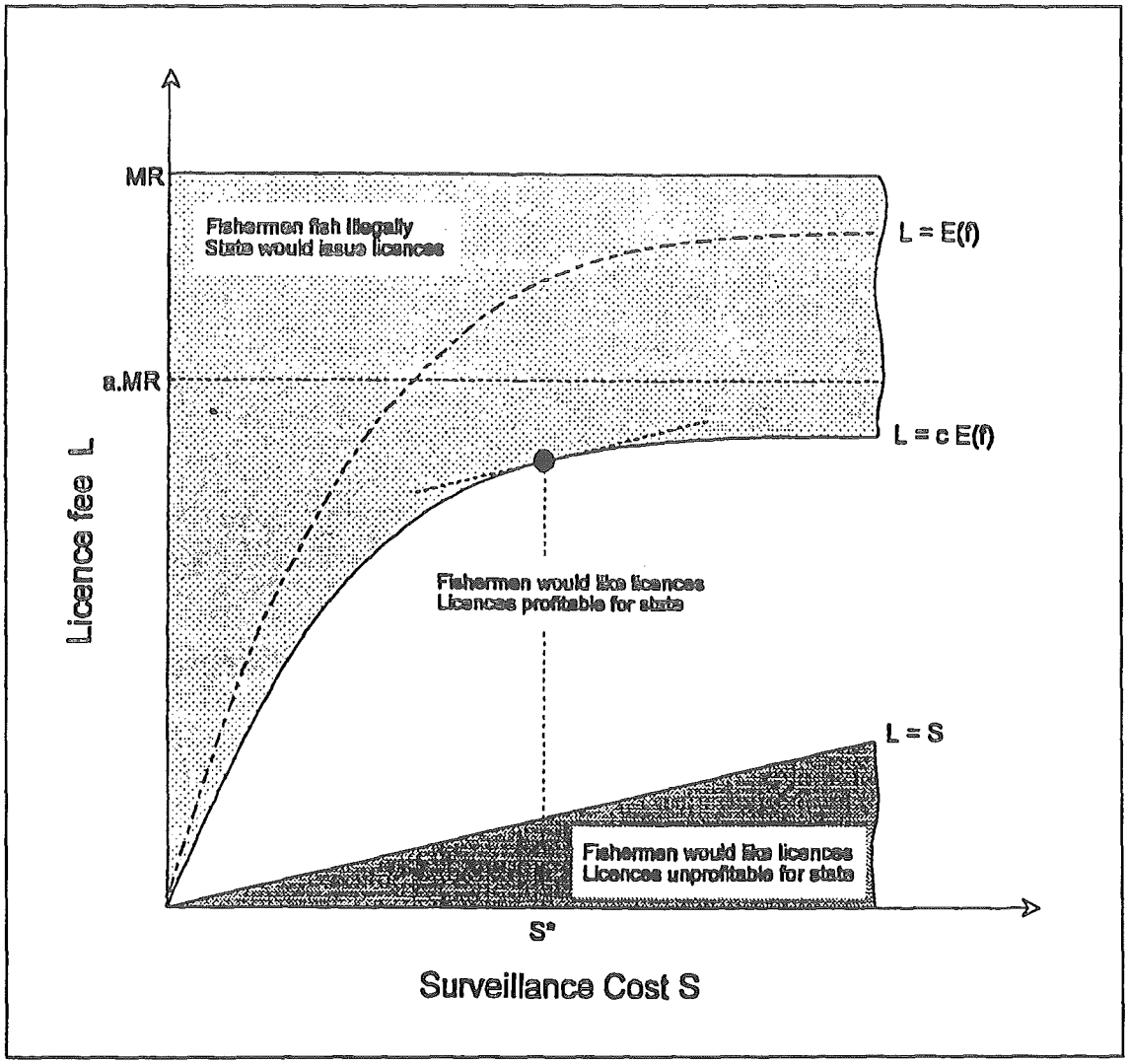

Figure 2.4 Combined decisions for the state and fishermen where F_{max} is low

[58] The optimum for $c > a$ is the same as in the previous section, because under these circumstances, $L = c \times E(f)$ does intersect $L = a \times MR$. The case $c < a$ is illustrated in Figure 2.4.

[59] The figure has no right hand boundary because the expected fine can never exceed the potential profits to be made from fishing inside the zone. There is therefore no level of surveillance high enough to force fishermen to fish outside the zone. There is also no level of surveillance which could enforce a licence fee equal to $a \times MR$, which is the maximum that the fishermen would be prepared to pay for a licence if the expected fine were greater. This means that the optimum can not be on a boundary or intersection point, as happened in

most of the previous instances. This case is rather more similar to that of Figure 2.2(b), in that the optimum is merely the point where the licence fee minus the surveillance expenditure is at a maximum. Graphically, this is where the slope of the curve $L = c \times E(f)$ is the same as that of the line $L = S$.

[60] The optimum point is designated by the large black dot in the figure. As in some of the earlier cases, the optimal licence fee is lower than the maximum fishermen would be prepared to pay. The optimal surveillance expenditure cannot be said to be lower or higher than before; this is affected by the efficiency of surveillance and risk proneness of the fishermen as discussed in the previous examples.

2.5 SINGLE FLEET OF FOREIGN FISHING VESSELS WITH A CONSERVATION CONSTRAINT

[61] The previous two cases assumed that the coastal state would in principle be willing to licence all foreign fishing vessels that applied for licences. This might be appropriate for a previously unexploited or underexploited fishery, or for a highly migratory stock that spent only part of the year in the coastal state's EEZ. In a number of cases, however, it may well be inappropriate to issue licences to all the applicants, because to do so may lead to overexploitation of the stock.

[62] If the coastal state has a domestic fleet that already fishes the stock, then this would be a circumstance in which it might well be appropriate to issue no licences at all to foreign fishermen. Such an action is entirely consistent with UNCLOS. However, there are other cases where there is no domestic fleet available but a conservation risk still exists. A classic example of this is the Falkland Islands squid fishery, where many fewer licences are issued for foreign fishermen than are applied for, in order to ensure stock conservation.

[63] In the previous cases, it was generally within the power of the coastal state to discourage illegal fishing, if it wished to, by setting licence fees at an appropriate level. Where it is not possible to issue licences to all who wish them, this is no longer an option, because those who are refused licences will have a strong incentive to fish illegally. The only solution here is to raise the expected fine for illegal fishing to such a level that illegal fishing is no longer attractive. On the basis of the previous analysis, that will occur when

$$E(F) = q \times F > \min(a, c) \times MR.$$

[64] Now more than ever it is necessary to set the level of the fine as high as possible. As indicated previously, it is normally considered that the maximum possible fine would be the value of the vessel and its fishing gear plus the value of the fish in its hold. An additional possibility is that of extended penalties, in which the offending vessel is barred from being issued a licence for some period into the future. Once the fine has been set at the maximum possible value, the only response for the coastal state is to increase the probability of detection to exceed $\min(a, c) \times MR / F_{max}$. This will of course mean increased surveillance expenditure, but that may be at least partly offset by revenue from fines.

[65] It is worth making a final obvious but important point in this case. In the absence of a conservation constraint, as in the previous two cases, it was appropriate to consider only the current year in the calculations. When a conservation constraint applies, consideration of just the current year is appropriate only if the stock is in equilibrium; that is, if the number of licences issued corresponds to a sustainable level of fishing effort and there is no illegal

fishing. If there is excess fishing effort through illegal fishing, then the stocks will decline in future years, and if it continues unchecked eventually the state of the stock will become so poor that the incentive to fish illegally will disappear. The bad news, of course, is that the incentive to fish legally and pay for licences will also disappear, so the coastal state will be left with a badly depleted stock and no revenue until the stock recovers, if it does. The point here is that increased expenditure on surveillance now not only will produce more income in the current year from fines, but it will also contribute to future cash flows from fishing on a conserved stock.

2.6 MULTIPLE FLEETS OF FOREIGN FISHING VESSELS OF DIFFERENT TYPES

[66] In the earlier cases, decision rules were formulated on the assumption that vessels fishing in the zone were all of the same size and fishing efficiency, and so the decision of a single vessel could be extrapolated to the whole fleet. This is often not true in real fisheries. In many cases, quite different vessel types may be interested in fishing in the zone. Even if the vessels are broadly similar, they may vary significantly in fishing power. In these cases, a state's licensing policy will impact differently on different categories of vessel, and so the fishermen's decisions will vary between category. The decision rules need therefore to be generalized to include the case of multiple fleets.

[67] As soon as we move away from considering a single uniform fleet, it becomes much more difficult to obtain analytical results similar to those in the previous cases. Phase 1 showed that such results can be obtained in one special case, and this is described briefly below, before moving to the more general case.

2.6.1 Constant ratio of marginal revenue to maximum fine

[68] Assume that vessels can be grouped together according to some characteristic, such as gross registered tonnage, country of origin, or fishing method, in such a way that it is reasonable to treat vessels in each category as effectively identical. Also make the simplifying assumptions that:

- for all categories, the values of parameters a and c are the same; and
- for each category, i, the maximum fine, $F_{max,\,i}$, and the marginal revenue, MR_i, are different, but their ratios MR_i / $F_{max,\,i}$ are constant, and equal to R, say.

[69] Also assume, as before, that fishermen are risk prone and that for all vessel categories: $(a \times MR_i) < (Q \times F_{max,\,i} - 1/K)$.

[70] While the marginal revenues and maximum fines are allowed to vary amongst vessel categories, it seems sensible to assume the probability of being detected fishing illegally is the same across each vessel category. In some fisheries, it may be possible for surveillance to 'target' a certain type of vessel. This might be true, for example, if different types of vessels tended to fish in different areas, such as longliners and purse seiners in a tuna fishery. In the same vein, it is assumed that the surveillance cost per vessel is the same irrespective of the vessel's category. Again, this seems a sensible first assumption.

[71] With these simplifying assumptions, the optimal policy is directly analogous to that for a single fleet.

- $L_i^* = \min(a, c)\ MR_i$

- $F_i^* = F_{max,\,i}$
- $S^* = -1/K \text{ Ln}(1 - \min(a/c, 1)\ R/Q)$
- $q^* = \min(a/c, 1)\ R$

[72] This special case is relatively simple because the assumptions guarantee that the optimal detection probability q^* is the same across vessel categories and that the optimal expected fine $q^* \times F_{max,\,i}$ is equal to $\min(a, c)\ MR$.

2.6.2 Variable ratio of marginal revenue to maximum fine

[73] The assumption that the ratio of marginal revenue to maximum fine is constant across fleets is far too restrictive and unlikely. In particular, different categories of fishing vessels are likely to differ considerably in their value and the value of their fishing gear, while differences in marginal revenue are much more a function of the relative densities of the fish inside and outside the zones. If the assumption that the ratio is constant is dropped, however, it is no longer possible to derive analytical solutions.

[74] The simplest way of examining the effect of having marginal revenue to maximum fine ratios differing amongst vessel categories is first to look at each vessel category separately. If we retain the assumption that $(a \times MR_i) < (Q \times F_{max,\,i} - 1/K)$ for each vessel category, then the results obtained before suggest that for category i:

- $L_i^* = \min(a, c)\ MR_i$
- $F_i^* = F_{max,\,i}$
- $q^* = \min(a/c, 1)\ MR_i / F_{max,\,i}$

[75] Because of our revised assumptions, the values of the optimal detection probability, q_i^*, calculated on an

individual fleet basis, will now differ for the different categories. But we have also assumed that in fact the same value of detection probability should apply across all categories because it is not possible to target different categories.

[76] One obvious possibility is to see what happens if we select a constant q^* equal to the maximum of the individual q_i^* values. The problem now is that for all vessel categories other than that for which $q_i^* = q^*$, we have

$$\text{Expected fine} = (q^* \times F_{max,\,i}) > \min(a/c, 1)\ MR_i$$

which violates the constraints. It follows in this case that the optimum fine must be set at a level $(\min(a/c, 1)\ MR_i / q^*)$, which is less than the maximum fine for that vessel category. At the other extreme, we could have set q^* equal to the minimum of the individual q_i^* values. Now we find that, for all but one vessel category, the expected fine is less than the constraint value even when the fine is set at its maximum for that category.

[77] Simple numerical examples in Phase 1 demonstrated the following.

- It is not necessarily optimal to set the fine to its maximum value for all categories of vessel.
- The relative fleet sizes in each category affects the optimum value of q.
- For vessel categories with optimal expected fine $E(F)^* = (\min(a/c, 1)\ MR_i$, one can licence these vessels, setting $L_i = \min(a, c)\ MR_i$. That is, the licence fee is set equal

to c times the expected fine. Since the state is assured the licence fee, whereas the fine income has an associated uncertainty, it is better to licence than to fine, all other things being equal. However, fishermen may prefer the high-risk option of fishing illegally and not take up the licences offered to them. For these vessel categories, it is also true that the optimum fine is less than the maximum fine. It is therefore possible to set the fine higher, e.g., at $F_{max,\,i}$, which could imply that $E(F)^* > (\min(a/c, 1)\ MR_i$. This would discourage vessels from fishing illegally.

- For categories with $E(F)^* < (\min(a/c, 1)\ MR_i$, it would be necessary to let these vessels fish illegally, since with the licence fee set at $\min(a, c)\ MR_i$, the fishermen would expect to gain more from illegal fishing than from legal fishing. Alternatively, of course, it would also be possible to reduce the licence fee for these categories (to $L_i = c \times E(F)$) but this may be seen to be unfair. In any case, it would not lead to any increase in income to the state.

2.7 NUMERICAL EXAMPLES

[78] While - at least in their simplest form - the formulas given above for the decision rules and optimal control parameters are relatively easy to understand, a fuller appreciation of some of their implications is best gained by investigation of some numerical examples. All these examples consider the case of a single fishing vessel.

2.7.1 Base case

[79] Consider a longline fishery for a tuna species taking place within a country's EEZ. To make it attractive to fish inside the EEZ, we will assume that the typical catch rates achieved inside the EEZ are greater than those outside. Some typical values of fishery parameters for a single vessel then might be:

- Season length 100 days
- Daily catch rate inside EEZ 5 t/day
- Daily catch rate outside EEZ 4.9 t/day
- Value of catch $US 8 000/t

[80] With these figures, the value of the expected catch inside the EEZ each year would be $US 4 000 000, and the gross benefit to the fisherman for fishing within the EEZ would be $US 80 000. This latter sum will also be the maximum the fisherman would be prepared to pay for a licence. This represents 2% of the EEZ catch value, which is actually somewhat lower than the normal rate at which licence fees tend to be set.

2.7.2 Increase the advantage of fishing inside the EEZ

[81] The assumed difference between catch rates inside and outside the EEZ is very small (0.1 t/day). The first obvious question is "What would happen if the advantage for fishing inside the EEZ were increased?" This, of course, is just a matter of arithmetic. Some results are shown in Table 2.7.1, in which the catch rate inside the zone (and therefore the annual catch value) is kept constant, while that outside the zone is decreased.

[82] As the advantage of fishing within the zone increases, the maximum amount the fisherman would be prepared to pay for a licence fee naturally increases. Because our assumptions led the annual catch value within the EEZ to remain constant at $US 4 000 000, that means the percentage that the maximum licence fee is of the annual catch value increases from a low value of 2% to a high value of 10%. Licence fees of 10% of catch value are extremely rare in tuna fisheries, though this rate is currently being paid by the USA purse seine fleet for licences in the South Pacific tuna fishery. The important point here is that, in principle, the licence fee should be set as a proportion of the marginal revenue accruing to the fisherman, rather than as a proportion of the catch value. As the table illustrates, the standard rule of thumb that licence fees should be approximately 4 to 5% of the EEZ catch value will in some cases completely deter a fisherman from seeking a licence, while in others it will be far less than he would be prepared to pay. This may seem a trivial and obvious result, but differences in attractiveness to foreign fishing amongst different countries' EEZs cause real problems when licence fees are set as a fixed percentage of catch value, as is the case amongst the South Pacific Forum Fisheries Member Governments.

Table 2.7.1

INSIDE-EEZ CATCH RATE ADVANTAGE	LICENCE FEE ($US)	AS % OF CATCH VALUE
0.1 t/day	80 000	2
0.2 t/day	160 000	4
0.3 t/day	240 000	6
0.4 t/day	320 000	8
0.5 t/day	400 000	10

2.7.3 Reduce the maximum fine

[83] The analyses in earlier sections stressed that a consistent optimal policy is to set the fine for illegal fishing at its maximum value. The highest possible value the fine could take in normal circumstances is the value of the vessel, its fishing gear and the catch in its hold. If the vessel involved is a modern purse seiner with a full hold of yellowfin tuna, or a long-liner with a full hold of top grade sashimi tuna, this can amount to a lot of money. However, some coastal states will be reluctant to set fines at such hugh amounts. The effect of reducing the maximum fine is investigated next.

[84] Assume now that the catch rate advantage in fishing within the EEZ reverts to 0.1 t/day. Then the maximum licence value will be $US 80 000. Also assume that the relationship between surveillance cost S and probability of detection q is given by

$q = 1 - \exp(-KS)$, where $K = 3.0e - 6$.

Recall that the optimal surveillance expenditure is such that the expected fine (probability of detection times fine) equals the licence fee. The effect of decreasing maximum fines is shown in Table 2.7.2. The base value of the maximum fine is taken to be $US 1 million.

Table 2.7.2

MAXIMUM FINE ($US)	OPTIMUM SURVEILLANCE COST ($US)	COST AS % OF LICENCE FEE
1 000 000	27 794	34.7
800 000	35 120	43.9
600 000	47 700	59.6
400 000	74 381	93.0
200 000	170 275	212.8

[85] With the parameter value chosen for the surveillance function K, even when the fine is at its maximum the expenditure needed to produce the required probability of detection

(0.08) is quite a high percentage of the licence fee, which of course in this simple case is the income to the state. As the maximum fine decreases, the corresponding probability of detection needed increases, and thus so does the surveillance expenditure. In this numerical example, by the time the maximum fine has dropped to $US 200 000, the surveillance expenditure greatly exceeds the licence fee (and thus the income to the state). Naturally, such a circumstance would be intolerable to the state, which would certainly not dream of spending so much on surveillance.

[86] However, the state cannot just reduce expenditure on surveillance, because if it did so the fishermen would find it more attractive to fish illegally in the EEZ and refuse to buy a licence.

2.7.4 More cost-efficient surveillance methods (reduce *K*)

[87] One alternative is that it might be possible to use more cost-efficient surveillance methods. This can be mimicked by reducing the *K* parameter value assumed. This is illustrated in Table 2.7.3.

Table 2.7.3

MAXIMUM FINE ($US)	OPTIMUM SURVEILLANCE COST ($US)	COST AS % OF LICENCE FEE
1 000 000	8 338	10.4
800 000	10 536	13.2
600 000	14 310	17.9
400 000	22 314	27.9
200 000	51 083	63.9

[88] This certainly has helped substantially, though if the maximum fine is very low, then there will still be a problem as the surveillance expenditure gets uncomfortably close to the licence revenue.

2.7.5 Reduce the licence fee

[89] The possible response by the state of retaining the licence fee at its current level but only spending what can be afforded on surveillance was dismissed above, because it will only lead to illegal fishing and no licence revenue. Another option perhaps is to reduce the licence fee. Recall that the optimal expected fine is equal to the optimal licence fee. It follows, in the case considered here, that if the maximum the state is prepared to spend on surveillance is $US 27 794 (the optimal level when the maximum fine is $US 1 million and $K = 3.0e - 6$), the maximum licence fee will be reduced from $US 80 000 by the same percentage that the maximum fine is reduced from $US 1 million. That results in Table 2.7.4.

Table 2.7.4

MAXIMUM FINE ($US)	MAXIMUM LICENCE FEE ($US)	SURVEILLANCE COST AS % OF LICENCE FEE
1 000 000	80 000	34.7
800 000	64 000	43.4
600 000	48 000	57.9
400 000	32 000	86.9
200 000	16 000	173.7

[90] Comparing Table 2.7.4 with Table 2.7.2, there is an improvement, but not much. Essentially one trades off reduced licence fees against reduced surveillance expenditure, but this becomes impossible when the maximum fine is too low.

[91] It has to be emphasized that these numerical examples are not based on 'real' parameter values, so little should be read into the individual numbers themselves. However, it is clear that this strong interaction among surveillance costs, maximum fine levels and

licence fees will definitely carry over to the real world. In particular, if the maximum fine is set too low, it may prove almost impossible effectively to deter illegal fishing.

[92] If there really is a maximum amount that can be spent on surveillance, the state's best response is probably to reduce its expectations on licence fees (as in Table 2.7.4). At least that will get some licence revenue flowing in. However, that solution will not work if the fishery is operating under a conservation constraint, such that only a limited number of licences can be issued. Only maximizing the fine can then work to deter illegal fishing.

3. SELECTION OF CASE STUDIES AND RESEARCH STRATEGY

3.1 SELECTION OF CASE STUDIES

[93] The objective of Phase 2 was to apply the methodology and principles developed in Phase 1 in an attempt to:

- assess the extent to which they could be used in practice by governments of developing countries in forming policies for controlling foreign fishing in their EEZs; and
- to make modifications as necessary.

[94] This was to be achieved by collaborative research with the fishery management authorities in several selected case studies.

[95] Potential case study sites were selected at the start of Phase 2 according to the following principal criteria:

- A fishery existed within the EEZ of a developing coastal state which was currently being exploited by foreign fishermen, either under an existing or potential future licensing scheme. Strong preference was given to cases where the potential revenue to the coastal state was substantial.
- A reliable database of foreign fishing activities both inside and near to the EEZ of the coastal state existed, to which access would be made available. Information on existing or potential surveillance activities should also be available.
- Subject to meeting the first two criteria, a variety of types of fishery and foreign fishing should be included.

[96] Using these criteria, four sites for case studies were identified and studied. Two of these already had major fisheries for several species of tunas, targeted by a number of foreign fishing fleets, and there existed a detailed historical database of fishing activities. In both cases, the fisheries provide a very important source of revenue to the coastal states.

[97] The other two examples represented novel fisheries management regimes which came into force during the term of the research project. One of these, in particular, had incorporated some of the lessons learnt from Phase 1. It therefore provided an excellent case study of the introduction of a new regime in waters that had previously been considered to be high seas, and of the responses of foreign fishermen to the new regime. The other new fishery was particularly interesting because it was a high-value fishery where the maximum number of licences that could be issued is heavily restricted due to conservation concerns. Thus the potential for illegal fishing was very high.

3.2 RESEARCH STRATEGY

3.2.1 Revisions to decision model

[98] The research strategy adopted in Phase 1 was that a primarily theoretical approach should be taken, where initially analytical results were sought for a simple generic model in which a single foreign fleet was fishing a single stock of fish. This proved a highly successful strategy, and important general properties and principles were identified. However, extension to the case of multiple fleets had already revealed that optimal policies could only be determined numerically.

[99] In particular, with respect to modelling the fishery, it was assumed that:

(i) the foreign fishing fleets were exploiting a single stock of fish;

(ii) each fleet sought to fish in the zone either all year round, or at least in the same fixed fishing season each year, and they would spend the entire time either fishing within the zone (legally or illegally) or outside the zone;

(iii) vessels within each fleet were identical. Furthermore, the differences amongst fleets lay solely in the catch rates and product values that could be achieved, and in the values of the vessel, gear and expected EEZ catch;

and, with respect to surveillance, that

(iv) the entire zone was subject to random surveillance activity throughout the entire year (or season);

(v) all vessels in the zone were equally likely to be detected by the surveillance activity (no targeting was allowed); and

(vi) a particularly simple functional relationship between surveillance expenditure and probability of detecting a vessel was assumed.

[100] It was immediately clear that for Phase 2 it would be essential to inject more realism if quantitative results were to be derived. How this might best be achieved was less obvious, however.

[101] One possibility was effectively to start from scratch in each case study, developing a bespoke integrated analysis that took basic fishery and surveillance data as inputs and produced the optimal control parameters as outputs. The advantages of this approach are obvious, in that from the start the special characteristics of each application can be taken into account from the design stage, and there is no need to try to 'twist' some of these characteristics to fit a more generic, but less flexible, model. The disadvantage, however, is that much of the attractive generality of the original analysis will be lost, and it is likely to be quite difficult to identify the essential features that led to particular optimal policies.

[102] This disadvantage is rather more critical than it may first appear. Discussions with potential users early in the project revealed that the ease of understanding why a particular policy was optimal was a very attractive feature of the results of Phase 1. In contrast, the output from what was effectively an impenetrable 'black box' was considerably less attractive. Another factor was that any change to the circumstances in a fishery would require modification, possibly substantial, to a complex computer program.

[103] The alternative approach, which was the one adopted, was to seek a middle ground, in which the model of the fishery and surveillance was made more realistic, but still the essential simplicity of the determination of the optimal policy was retained. To do this, it was necessary to identify both changes to the model and revised input parameters.

[104] The key to this was to return to the basic model and see precisely what were the parameters that were critical to the determination of the optimal policy. For the individual

fisherman, the decision on whether to seek a licence, fish illegally or go elsewhere depends on his marginal revenue. In the simplest case, this is calculated as the product of three numbers: the value per tonne of fish caught, the length of the season, and the difference between the daily catch rates he would get from fishing inside the zone and fishing outside the zone. However, if different fishermen or fleets take different mixes of species over different fishing seasons at different catch rates, then apparently it will be necessary to perform separate calculations for each fleet and possibly each vessel. This is indeed unavoidable, but the critical question is at what stage this calculation need be done.

[105] For the optimization, as the theoretical formulation in section 2.2 makes clear, the fishermen's decision is based actually on a marginal revenue calculated as the difference between the value of their expected catch over the year or season if they take up a licence (or fish illegally, though it is unlikely that data will be available to estimate this directly for obvious reasons) and the value of the catch if they do not take up a licence. With one exception (covered below), for the purpose of optimization it is irrelevant how this value is made up (i.e., species mix, number of days fished, etc.). All that is required is that it can be calculated reliably. This can therefore be done externally. Provided the marginal revenue input parameter is understood in this way, then only a single value per fisherman need be provided. Normally this would be averaged over a fleet, with fleets being split if there were too much variability within fleet. Note that this calculation may be quite complicated, but it is straightforward and, if circumstances change, it can be revised without adjusting the optimization model.

[106] At least as far as the fishery is concerned, this effectively deals with points (i) and (iii) above. Dealing with point (ii), however, does require a change to the basic model. For instance, in situations such as exist in Seychelles, two types of fishing gear are employed to take tuna: purse seine and longlines. Historically, the purse seiners have tended to fish in or around the EEZ throughout the year, and thus they tend to pay a single annual licence fee that entitles them to fish at any time they wish throughout the year. Note that in any month they may spend more or less time in the zone, depending on which is better. In contrast, longliners tend to spend only part of the year in the Seychelles region, and to accommodate this they are offered the possibility of purchasing monthly licences. The situation is further complicated by the fact that different longline fleets have tended to seek licences in different months.

[107] It follows in this scenario that in any one month, there will be purse seiners in or around the EEZ that either do or do not have licences, and there may also be longliners with or without licences in the area if that month coincides with their desired fishing season. There will be other months, however, when the longliners will be elsewhere and therefore not involved in the fishery at all. If the possibility of illegal fishing could be completely ruled out, this would still not pose real problems. However if it cannot be ruled out, it is obviously essential that proper account be taken of who is available to fish, and at what times during the year. The model therefore needs to be amended so that it deals individually with decisions on licensing and surveillance each month or season, while still maximizing overall annual net revenue to the coastal state. Dealing with licensing separately by month or season is clearly easy, however surveillance is more complex.

3.2.2 Revised surveillance model

[108] The original surveillance model used to relate the expenditure on surveillance (S) and the resulting probability of detection (q) was

$$q = 1 - \exp(-KS)$$

when Q, the maximum possible probability of detection, is equal to 1.

[109] The functional form chosen was based on the theory of random search proposed by Koopman (1980). In the simplest form of that theory, it is assumed that a surveillance vessel or aircraft searches an area of size A for a single vessel randomly placed within that area. If the search is conducted on a randomly chosen track line within the area at speed v for a time t, and if the vessel lies within an effective search width $\frac{1}{2}W$ either side of the track line, then Koopman shows that the probability that the vessel is detected is given by the formula

$$q = 1 - \exp(-W \times v \times t / A).$$

[110] It is easily seen that the numerator within the exponential is simply the area searched in time t, so the exponent is simply the ratio of the area effectively searched to the overall area. Experience has shown that this simple model is surprisingly accurate (Mange], 1984).

[111] Koopman defined the effective search width as satisfying the equation

$$\Pr_{\text{[Not detecting the object within } \frac{1}{2}W \text{ either size of the track line]}} = \Pr_{\text{[Detecting the object outside of } \frac{1}{2}W \text{ either side of the track line]}}$$

[112] This definition takes account of the case when the probability of detection decreases steadily as the distance from the track line increases.

[113] Obviously, the surveillance expenditure enters directly through the time spent searching. Note, however, that it is unlikely to be directly proportional to the time spent searching, since normally it will be necessary to steam or fly some distance from the home port before effective search activities can commence.

[114] The great advantage of starting from the Koopman formulation is that the probability of detection is now a function of parameters that can readily be estimated, at least for directed surveillance from a platform such as an aircraft or a vessel.

[115] It is convenient to treat the above probability of detection as relating to searching on a single day, so that it is highly likely that the proportion of the area searched on that day really is very small. Now suppose that searching is carried out on N days each season, and assume that the fishing vessels move randomly between days, so that each daily search can be treated as being independent, then it follows that the probability that the vessel will be detected at least once in the N days is

$$q = 1 - \exp(-N \times W \times v \times t / A).$$

[116] Again, provided the exponent is not too large, the probability of actually being detected more than once will be negligible. If searching takes place on N days during the season, and if vessels that decide to fish illegally do so for the entire season (or at least until they are detected), then we have returned to the original formulation, except now each of the parameters is easily specified.

[117] As noted earlier, however, it is quite unreasonable to assume that the fishing seasons are necessarily the same for each fleet. Further, available data on vessel movements also suggest that frequently even licensed vessels do not spend their entire season within the zone. Thus on different days, it is likely that there will be different numbers of vessels available

to be detected inside the zone. We therefore need to take account of the possibility that an illegal fishing vessel may not always be fishing illegally (and so available to be detected) on the days on which flights are made.

[118] Consider a vessel that spends a proportion θ of the days in a season fishing illegally inside the zone. We treat this as equivalent to the probability that the vessel was fishing illegally on the day of a flight.

[119] Then, if

$$\lambda = \theta \left(1 - \exp\left(- \frac{Wvt}{A}\right)\right)$$

it follows that

$$\Pr_{[i \text{ detections during season}]} = \binom{N}{i} \lambda^i (1 - \lambda)^{N-i}$$

and

$$\Pr_{[\text{Detected at least once during season}]} = 1 - (1 - \lambda)^N$$

[120] If $\theta = 1$ (i.e., the vessel was always fishing when the surveillance was undertaken), this formula reduces to the one before. Generalizations are straightforward, to allow, for example, each month of the year to be considered separately.

[121] With this formulation, the control variable for the coastal state is now the number of surveillance flights or cruises undertaken each month (or season). The probability of detection is no longer a continuous variable; it rises in steps coinciding with an additional flight or cruise that month or season, and it may vary between fleets. The total cost of surveillance will be the cost of the total number of flights or cruises undertaken in the year.

[122] Until now, we have been attempting to model the detection of a single vessel, whereas there may be several fleets of many vessels. The approach to this extension is that we assume that the expected number of vessels detected is just the product of the number of vessels available to be detected and the probability of detection of a single vessel. This does still assume a random distribution of vessels within the zone (or a well defined part of it). This is almost certainly strictly incorrect, but taking account of clumped distributions of vessels would be extremely difficult, and the effect could go either way.

[123] Potentially rather more serious is the fact that only the event of vessel detection (usually by radar) has been considered so far. What is really wanted is to calculate an expected fine resulting from surveillance activities. This has loosely been treated as the product of the probability of detection and a fixed fine, which is a control variable set by the coastal state. In practice, a sequence of events must occur before a fine is actually levied:

- the illegal fishing vessel must be detected;
- it must be closed upon by the surveillance platform;
- evidence of illegal fishing must be collected;
- the vessel must be detained;
- a successful prosecution must be made under the relevant legislation; and, finally,
- the fine or penalty must be collected.

[124] Most examples of fishery legislation at least envisage different fines for different offences, which in turn require different types of evidence. Maximum fines invariably

require unequivocal evidence that the unlicensed vessel was actually fishing at the time an arrest was made. If, for example, a vessel was illegally fishing when first detected on radar, but by the time a patrol vessel came alongside it had been able to retrieve and stow its fishing gear, then there is unlikely to be unequivocal evidence of illegal fishing that would satisfy a court of law. At best a lower fine might be imposed, although it is quite possible that the vessel will get away without penalty, or worse, demand compensation for lost fishing days.

[125] In the case studies that follow, where there was sufficient information, account has been taken of the problem of the need to arrest a vessel with its gear still in the water, but otherwise it has generally been assumed that a single certain fine applies in base case analyses. To allow for this element of unrealism, especially since the optimal policy generally is to set the fine at or near its maximum, we also consider sensitivity analyses where the maximum fine is reduced to much lower levels.

[126] A final point relates to the assumed direct connection between surveillance expenditure and detection probability. In the South Pacific, as in other areas, the fishery surveillance activities are undertaken - often by the military - as part of wider customs and immigration surveillance activities. In such cases, it is very difficult to relate directly fishery detections to the costs of surveillance. In the South Pacific, the costs of these wider surveillance activities are generally met out of development funds and they are commonly carried out by vessels or aircraft operated by donor countries. In such cases, this can simply be treated as generating a baseline probability of detection that is free to the coastal state. Taking this as a given, the only surveillance issue then is to determine whether it is worthwhile for the coastal state to spend additional money of its own on supplementary surveillance to supplement this free surveillance. Taking account of two different types of surveillance activities in the model is again straightforward.

4. SUMMARY OF RESULTS

4.1 PHASE 1 - STRATEGIC RESEARCH

[127] In Phase 1, a basic analytic framework was developed to allow evaluation of the effectiveness of alternative policies for controlling foreign fishing activities in the EEZ of a developing country. Potential management policies essentially involve selecting appropriate levels for three control variables: the level of licence fees, the extent of surveillance activities and the level of penalties set for illegal fishing. The analytic framework was used to identify those combinations of control variables that maximized the net income to the country from the management of foreign fishing. The results of this work were very encouraging, with a number of important general principles emerging. Of necessity, however, the model on which the analysis was based was a rather simplified version of what actually occurs in practice. The aim of the adaptive project was to examine how well these results transferred to the practical situations faced in developing countries. This was to be achieved by detailed analysis of a number of case studies.

4.2 PHASE 2 - THE CASE STUDIES

[128] The four case studies were pursued with considerable success. Detailed reports providing advice on strategies for optimal control of foreign fisheries were prepared for the

Governments concerned. Due to considerations of confidentiality, specific results are not discussed in this paper.

[129] The principal conclusion from the case studies is that it is indeed possible to apply the methodology and results developed in the Control of Foreign Fisheries research project to develop practical advice on management of foreign fishing. In order to apply the methodology, it is necessary to start with two types of analyses:

- Catch and effort data pertaining to fishing both inside and outside the coastal state's EEZ must be analysed in order to determine the estimated benefits to foreign fishermen of fishing within the EEZ.
- Estimates need to be made of the probabilities of detection and successful arrest of unlicensed fishing vessels arising from different levels of surveillance activities.

[130] For both of these, it is necessary to tailor the analysis to match the particular fisheries and surveillance characteristics of the region or country. For two of the case studies this was relatively simple because only a single fishery, fishing fleet and state was involved. For the third the situation was rather more complicated, with a number of fleets taking different species at different times of the year, and thus the analyses and interpretation of the catch and effort data were rather more complex. For the fourth case, the situation was so complex, with multiple fisheries, fleets and states, that it was only possible within the time and funds available to detail the research and analyses that needed to be done before applying the methodology. This was clearly a special case, but it remains true that the data analyses necessary to apply the methodology can be quite time consuming and complex.

[131] Each of the case studies emphasized the importance of imposing large fines for illegal fishing activities. This was also a general conclusion of Phase 1 of this project. In each case study, the funds available to the coastal state to pay for surveillance activities were very limited. If there is a significant benefit associated with fishing inside the EEZ, then it is reasonable for the coastal state to want to set quite high licence fees. This is only possible, however, provided the expected fine faced by the fishermen for unlicensed fishing considerably exceeds the licence fee. If the amount of surveillance that can be afforded is limited, this can only be ensured by imposing very high fines. The importance of affordable surveillance is particularly clear in a fishery where deterrence of illegal fishing is the primary management issue. Again, the key to achieving this is large fines.

[132] One of the case studies with a new management regime particularly emphasized the vital difference between the perceived and actual risks of detection when fishing illegally. For the first three seasons after the zone was declared, exactly the same levels of surveillance activities were maintained. For the first two of these seasons, there were few licence applications from foreign fishing vessels. However, following a very large fine imposed on one vessel for illegal fishing activities, there was a sudden rush to obtain licences. Clearly this arose because the perceived risk of being detected and fined had risen to a sufficient level that the expected fine now exceeded the cost of obtaining a licence, though the actual risk had not changed at all. While this single arrest had a major effect on the fishermen, it is important that any heightened perception of risk is maintained. For this to occur, it is necessary that fishermen remain aware of continuing surveillance activities.

[133] In Phase 1 it was found that licence fees should be calculated as a proportion of the marginal benefit arising from fishing inside the EEZ, rather than as a proportion of the catch taken within the zone. In some fisheries, when these benefits were estimated from the available data, there can be strong inter-annual variability in the estimated benefits. In

calculating appropriate levels of licence fees in this study, average estimated benefits were used, but this still meant that in some years the cost of a licence fee considerably exceeded the actual benefit gained. Should this occur several years in a row, foreign fishermen are likely to become increasingly reluctant to continue to seek licences. A case therefore can be made that licence fees perhaps should include some element that takes account of the effort expended in the zone.

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