Food and Agriculture Organization of the United Nations

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Lessons learned and public policy recommendations on adaptation to climate change in artisanal fisheries and small-scale aquaculture in Chile. Policy brief.

Introduction

According to the Intergovernmental Panel on Climate Change (IPCC), there is clear and unanimous understanding: global warming is an evident and discernible phenomenon of natural climate variability, in which the contribution of human beings is crucial (IPCC, 2014). Global warming drives changes in different parts of the atmosphere and impacts the components of the biosphere, including the ocean.

The Earth is a complex system that is regulated by the Sun's energy. The environmental variables are the different components of the climate system: atmosphere, hydrosphere, cryosphere, lithosphere and biosphere. These components are interrelated and vary in their response to changes in temperature. In other words, the Earth is an open system in which there is an exchange of both matter and energy among its components, thus keeping the system in equilibrium.

Against this backdrop, coastal communities are vulnerable – meaning they are susceptible or unable to cope with the impacts of climate change, including climate variability and extreme events. Vulnerability is a condition determined by physical, social, economic and environmental factors, or processes that increase the susceptibility of a region, sector or social group to potential impacts.

Chile is highly vulnerable to the impacts of climate change. The IPCC Fifth Assessment Report (2014) highlights the severe impacts of climate change on resources and ecosystems associated with fisheries

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and aquaculture. Some changes that are emerging in Chile are: (a) temperature increases, (b) acidification of the sea, (c) sea level rise, (d) a decrease in dissolved oxygen in seawater, (e) a decrease in precipitation, (f) an increase in salinity, (g) changes in atmospheric and oceanic circulation, and (h) an increase in the frequency and intensity of extreme weather events. These impacts can threaten the physiology, growth and reproduction of aquatic organisms, which implies changes in the abundance and distribution of marine resources. Specifically for the fisheries sector, threats are related to a decline of fishing activity due to fewer days of operation, reduced availability of resources and, therefore, fewer landings. In aquaculture, massive mortality may occur in crops due to fluctuating oxygen levels in sea water, while ocean acidification may affect the calcification process in the early life cycles of cultured organisms.

The vulnerability of fisheries and aquaculture activities is related to the condition or status of the exploited and cultivated resources and their ecosystems. Fisheries based on overexploited or depleted resources will be more vulnerable to the threats posed by climate change. Similarly, the culture of marine organisms such as seaweeds and molluscs exposed to lengthy periods of high temperatures and solar radiation may be affected in their development or by pests, parasites and harmful algal blooms, among other things.

In 2017, Chile ratified the Paris Agreement, an international agreement on climate change, making specific commitments on emission reductions and the development of climate change adaptation plans through the Nationally Determined Contribution. This non-binding national plan, which highlights climate action, was updated in 2020 and includes the National Climate Change Adaptation Plan (PNACC, 2014) and the Climate Change Adaptation Plan for the Fisheries and Aquaculture Sector (PACCPA, 2015), among others.

Men and women engaged in artisanal fisheries and small-scale aquaculture contribute significantly to food security and nutrition, the eradication of poverty and the sustainable use of natural resources. For this reason, global awareness and action is crucial to support them, strengthen their capacities and incorporate them into territorial development agendas.

Project activities began in 2017, with the objective of reducing vulnerability and increasing the adaptive capacity to climate change of Chile´s artisanal fisheries and small-scale aquaculture sector. It was developed in four pilot coves: Caleta Riquelme, in the Tarapaca region; Caleta Tongoy, in the Coquimbo region; Caleta Coliumo, in the Biobío region; and Caleta El Manzano-Hualaihué, in the Los Lagos region (FAO, 2019). The project reached its conclusion in July 2021.

It is in this context, and with the intention to support the Chilean government's effort to comply with its commitments, that the project "Strengthening the adaptive capacity to climate change in the fisheries and aquaculture sector of Chile" was initiated. The project has been executed by the Undersecretariat of Fisheries and Aquaculture (SUBPESCA) and the Ministry of the Environment (MMA) and implemented by the Food and Agriculture Organization of the United Nations (FAO), with funding from the Global Environment Facility (GEF).

GEF-funded projects strengthen countries' capacity to meet their commitments to United Nations conventions and it is expected that Chile will include the lessons learned from this project in its public policy instruments, such as the update of the PACCPA.

This document summarizes the lessons learned from the project and serves as a guide and/or model for other coastal communities in Chile. It is targeted at the project's beneficiary partners and the sectoral institutions working in the fisheries and aquaculture sector in Chile.

The project addressed gaps related to:

- Weaknesses in the institutional framework, including a lack of inter-institutional coordination and limitations in the capacity of the public and private sectors and civil society to understand and address climate variability and change in the fisheries and aquaculture sector.

- Limited experience and availability of technologies and good practices for climate change adaptation in the fisheries and aquaculture sector, which increases the vulnerability of coastal communities.

- Information and knowledge constraints at community level for proper management of fisheries and aquaculture resources in the face of expected climate change impacts.

This pioneering initiative in Chile and at a global level, reported the following results and innovations in execution:

1. **The capacity of public and private institutions to implement and enhance climate change adaptation in fisheries and aquaculture has been strengthened through:**

    a. The establishment and operation of inter-institutional working groups (IWGs) at national, regional and local levels. At the regional level, the IWGs were integrated into the regional climate change committees (CORECC). At the community level, the IWGs participated in municipal environmental committees. The work of the project implementers with the communities and regional authorities resulted in a sense of ownership and empowerment of the process of adapting to climate change.

    b. The training of 411 public officials, national experts and regional and community decision-makers contributed to the dissemination of information and knowledge about climate change and adaptation across territories. Through a diploma course, the institutional and geographic coverage was broadened (15 public entities and 159 students in the 16 administrative regions of the country) and the knowledge acquired was applied to a specific case study focused on climate change vulnerability in the territory where the students live. This increased knowledge will undoubtedly have a multiplier effect within the institutions, with other public entities and with the people who make up the fisheries and aquaculture sector.

    c. The design and implementation of an interoperable information system that systematizes and integrates country-level data on fisheries, aquaculture and climate change, providing information for users and decision-makers.

Artisanal fishing boats in Caleta Riquelme

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The main innovation of this system is the integration of available information. Its future challenges are a) to design useful indicators for decision making; and b) to keep the system updated with real-time oceanographic and climate information.

2. **More than 2 000 people (70 percent men and 30 percent women) in four pilot coves – Riquelme, Tongoy, Coliumo and El Manzano-Hualaihué – have increased their adaptive capacity and are thus more resilient and less vulnerable to climate change through the implementation of the following programmes and practices:**

   a. Training on climate change and environmental monitoring, an initiative that enhanced understanding among the beneficiaries and prompted a constructive dialogue with local, regional and national authorities.

   b. Diversification of productive activities through the transfer of farming and processing technologies used to add value to fisheries and aquaculture products. This involved integrating local knowledge (what resources and when to process) and cost-efficient processing techniques, while considering human and infrastructure resources.

   c. Livelihood diversification through practices and implementation of activities related to sustainable tourism and special interest tourism. This initiative allowed participants to discover and highlight the tourism attractions and value of the natural, historic and cultural heritage available in each locality.

   d. Implementation of a certification that indicates how prepared or adapted a cove is to the impacts of climate change. The proposed certification is unique in the world and, once implemented, will allow local communities to recognize their strengths and weaknesses.

3. **Communities associated with fisheries and aquaculture have more awareness, understanding and knowledge of climate change as a result of awareness raising and training workshops and the provision of support materials:**

   a. Awareness-raising and participatory training in the framework of adaptation practices involved eight workshops in schools with 280 students; four workshops in municipalities with 85 participants; and four workshops to present the project outcomes to over 3 000 participants, among other activities.

   b. Preparation of publications, scientific papers and reports on adaptation practices. This included four regional reports (one from each cove) and one general technical report systematizing best practices and lessons learned; 32 monthly newsletters; 96 media appearances; a project brochure; a basic guide on climate change; a manual for an environmental monitoring system; a practical manual on climate change for artisanal fisheries and small-scale aquaculture in Chile and a facilitator's guide; four special interest tourism strategies; five manuals on experimental aquaculture in management areas; five manuals for the creation of value-added fisheries and aquaculture products; and a children's game on climate change related to fisheries and aquaculture.

   c. Exchange of experiences between artisanal fishers from the pilot coves, to share learning and knowledge developed by the communities to adapt to climate change.

   d. High-quality audio-visual material, contributing to the dissemination and understanding of the relevant subjects, experiences and knowledge of the main actors; an inter-institutional seminar (http://www.fao.org/chile/noticias/detail-events/es/c/1390751/); project closure seminar (http://bit.ly/AdaptacionCambioClimaticoChile); and a documentary video including testimonies about the project's impact (https://www.youtube.com/watch?v=lyS3Z25zpBk). In addition, project closure workshops involving beneficiaries and national, regional and local authorities, were held in Tongoy and El Manzano coves.

In summary, the project activities provided the authorities and communities involved in the project with the capacity and tools to face the challenge of adapting to future climate scenarios. The project design and approach can be replicated in other coastal communities in Chile and Latin America.

The project outcomes have contributed to five of the Sustainable Development Goals (SDGs) committed to by Chile in the 2030 Agenda for Sustainable Development. Strengthening the adaptive capacity of coastal communities to climate change contributes to reducing poverty (SDG 1), increasing access to food (SDG 2) and achieving gender equality and empowering all women and girls (SDG 5). Training coastal communities and public authorities and officials on climate change and various adaptation practices are specific actions taken for the climate and for the sustainable use of marine ecosystems and their resources (SDG 13 and SDG 14, respectively).

Lessons learned

Lessons learned help to identify the gaps that need to be bridged through action, as well as strengths for further climate change adaptation initiatives. The following are the lessons learned from the project:

Strengthening public and private institutional capacities

- The project's initiatives, together with those of other public and private institutions, made fisheries and aquaculture visible as a sector that is highly vulnerable to climate change.
- There is an urgent need to improve the coordination of government agencies to manage the coastal zone and increase the integration of available capacities for adaptation.
- It is essential to empower local actors and institutions to develop alliances/agreements to stimulate and strengthen their management capacities. Municipalities, schools, foundations and companies must work together for the adaptation of fisheries and aquaculture to climate change.
- It is necessary to establish an integrated climate, fisheries and aquaculture information system to make timely and relevant decisions, especially at the local level. Such a system would improve future climate scenario forecasting models, build early warning systems and plan adaptation measures.
- The knowledge and training of authorities and civil servants on climate change should continue to be advanced. On-going training contributes to building knowledge, critical mass and networks to facilitate the design and implementation of public policies for the adaptation to climate change of the fisheries and aquaculture sector.
- With the existing capacity of national, regional and local public institutions, academia and research centres, it is possible to contribute information, knowledge and design of adaptation measures in a timely manner.

Improving resilience in artisanal fisheries and small-scale aquaculture

- The implementation of adaptation measures in the territory requires an initial outreach phase to integrate the local knowledge of fishers, shellfish divers, aquaculture farmers and shellfish and seaweed collectors and to identify the specificities and needs of beneficiaries. This process should be implemented by capacity building facilitators with relevant skills, using appropriate language.

- The unique attributes of each fishing cove, in terms of extractive cultures (type of resources, fishing gear and/or fishing equipment) and organizational capacities (grassroots organisations, supra-organizations), were identified for the purpose of better understanding and leading the implementation of adaptation actions.

- It is essential to engage the communities, their representatives and authorities. Local actors must be jointly responsible for the intervention initiatives, from the identification of the need to the design and expression of alliances with research centres, universities and high schools. It is also expected that the communities will have access to institutional and financial support to sustain them over time, to the extent that resources are available. It is recommended that the technical training teams are located in the same region and/or locality as the community, so that they have the required frequency of attendance for such purposes.

- It is important to strengthen links with the communities in the coves, to understand the socio-productive dimension and the interests that mobilize the actors, so that the communities can take ownership of the challenges and become the "driving force of their own development" in the face of future climate scenarios.

- Communities are aware of the need to diversify their productive activity through sustainable alternatives based on their natural environment. It is recommended that this type of project be implemented in stages, together with measures that make regulations more flexible and able to promote diversification.

- Climate change may provide new opportunities for aquaculture because of the diversity of farming systems available to aquaculturists.

- Sustainable tourism is a viable diversification and adaptation opportunity. Communities should consider an approach that is integrated with the environment and prioritize attracting visitors from their own region or from neighbouring regions, with the aim of reducing the carbon footprint of travel and tourism. Partnership and networking with local, regional and national tour operators should be encouraged to facilitate consolidation and sustainability.

Strengthening knowledge and raising awareness of climate change among fisheries and aquaculture communities

- The design and implementation of awareness raising activities and training on climate change for artisanal fishers and small-scale aquaculture farmers should consider the identification of climate hazards and risks in their territory and, in parallel, the status of the resources and environment that sustain their livelihoods.

- An important step is the appropriate participatory assessment of the risks and vulnerability of local fisheries and aquaculture to climate change. Such a step should explicitly include the quality of fisheries and environmental management. This process should recognize the individual and collective responsibilities from which improvements and opportunities for adaptation can be identified.

- It is essential to have a climate change strategy, action plan and communication teams with experience in artisanal fisheries and small-scale aquaculture, and with sufficient knowledge of the territory.

- It is also necessary to pay attention and avoid maladaptation processes, e.g. activities that require excessive exploitation of resources such as water, or which create pollution, because they can cause irreversible negative impacts.

Sustainability strategy recommendations

Coping with climate change means understanding and addressing its causes through mitigation, and its consequences and impacts through adaptation. In this sense, the IPCC recommends establishing transformational processes, i.e. systemic changes that allow for more ambitious progress in mitigation and adaptation, that are significant and rapid and that, at the same time, pursue the SDGs.

For the continuity of the initiatives implemented by the project, it is essential that the sustainability strategy is implemented through the efficient coordination and articulation of governance already in place in Chile at national, regional and local level.

It is essential to scale-up adaptation efforts in the pilot coves for the benefit of all coastal communities in Chile, and to ensure the project's sustainability beyond its end date.

The implementation of the strategy will depend on several factors, including adequate and timely allocation of human and financial resources, as determined by the relevant public entities.

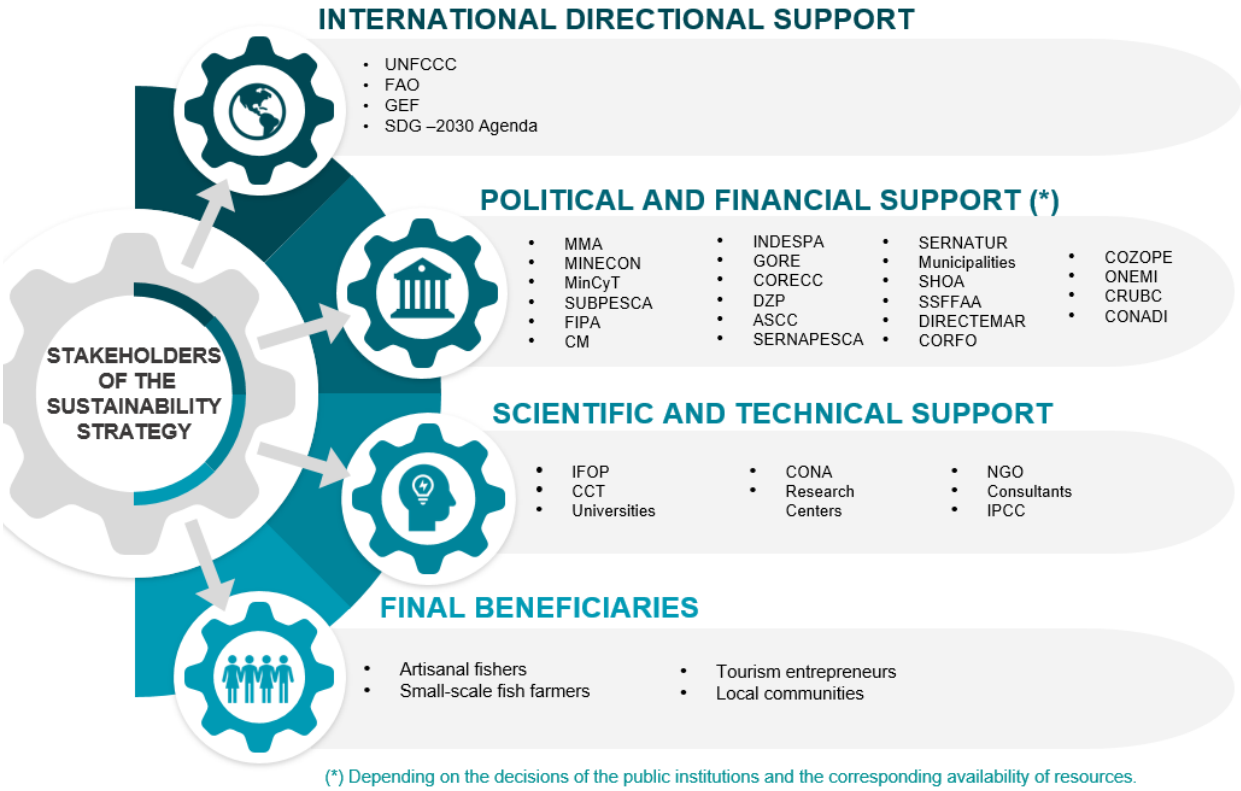
The results of the project and the lessons learned constitute a reference for the institutions working in the fisheries and aquaculture sector in Chile. They will be translated into inputs for the State and are expected to play a leading role in the implementation of the sustainability strategy.

SUBPESCA and the MMA are expected to continue to lead the process of adaptation to climate change in fisheries and aquaculture through the updating and implementation of the PNACC and the PACCPA.

The great challenge in this decade will be to strengthen regional and local government to implement appropriate and timely climate change adaptation measures in their territories. The regional governments; Regional Ministerial Secretariats (SEREMIS) of Economy, Development and Tourism and Environment; the Coastal Regional Commissions; Zonal Management of Fisheries and Aquaculture; the municipalities; and the CORECC will play a key role in this process at regional and local level, especially if the institutions are adequately coordinated.

Figure 1 maps the key actors for the implementation of the sustainability strategy for adaptation measures in the fisheries and aquaculture sector. Their active and ongoing contribution will be essential to achieve the transformation and adaptation processes required to make coastal communities more resilient to future climate scenarios.

FIGURE 1
Stakeholders in the sustainability strategy

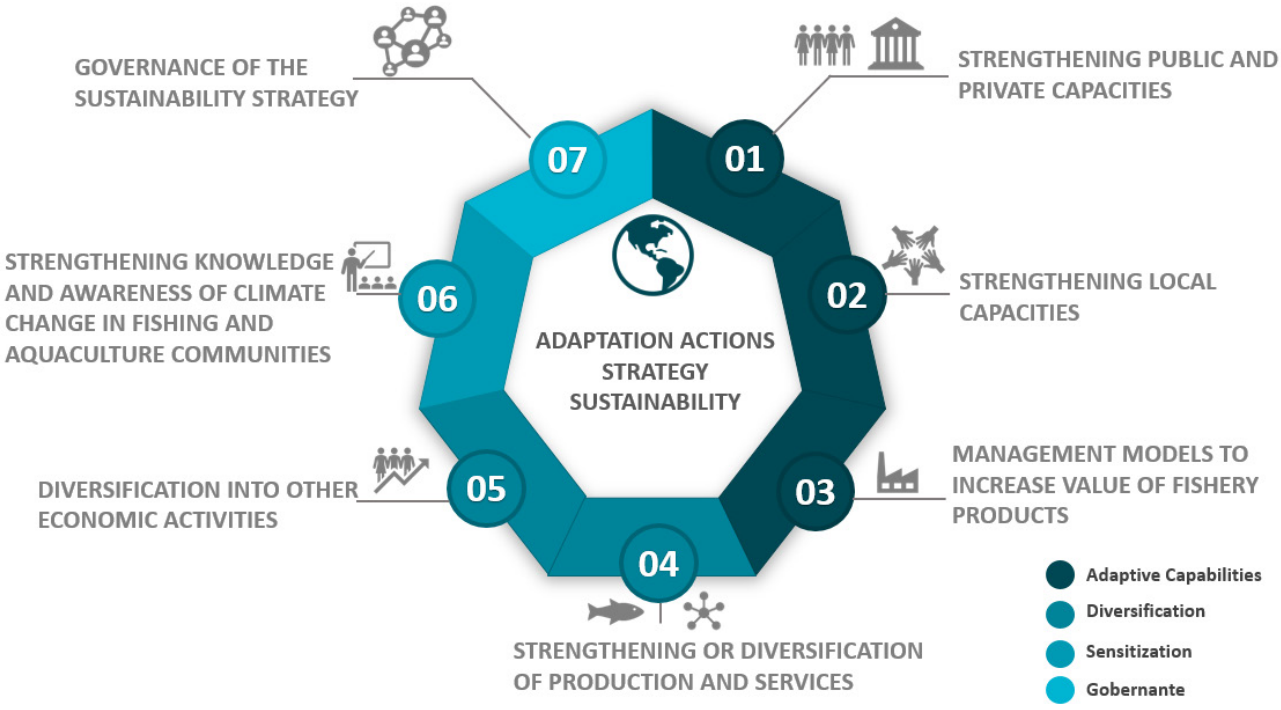


Note: ASCC (Sustainability and Climate Change Agency); STC (Scientific Technical Committee); MC (Management Committee); UNFCC (United Nations Framework Convention on Climate Change); CONADI (National Corporation for Indigenous Development); CONA (National Oceanographic Committee); RCCC (Regional Climate Change Committees); CORFO (Production Development Corporation); COZOPE (Zonal Fisheries Council); CRUBC (Coastal Regional Commission); DIRECTEMAR (General Directorate of the Maritime Territory and Merchant Marine); DZP (Zonal Management of Fisheries); FAO (Food and Agriculture Organization of the United Nations); FIPA (Fund for Fishing Research and Aquaculture); GEF (Global Environment Facility); GORE (Regional Government); IFOP (Fisheries Development Institute); INDESPA (National Institute for Sustainable Development of Artisanal Fisheries and Small-Scale Aquaculture); IPCC (Intergovernmental Panel on Climate Change); MinCyT (Ministry of Science and Technology); MINECON (Ministry of Economy, Development and Tourism); MMA (Ministry of the Environment); SDG (Sustainable Development Goals); ONEMI (Chilean National Office for Emergency), NGO (Non-Governmental Organization); SERNAPESCA (National Fisheries and Aquaculture Service); SERNATUR (National Tourism Service); SHOA (Hydrographic and Oceanographic Service of the Chilean Navy); SSFFAA (Undersecretariat of the Armed Forces); SUBPESCA (Undersecretariat of Fisheries and Aquaculture).

The interventions in the sustainability strategy are divided into seven blocks of actions. It is essential to continue strengthening the capacity of national public institutions, especially at the regional and local levels, to improve and implement sectoral adaptation plans. At the same time, it is necessary to educate and train local communities to understand the climate change process, to be aware of their vulnerabilities and to actively participate in the design and implementation of adaptation measures. Such measures should strengthen capacity to add value to fisheries and aquaculture products, diversify production in aquaculture and promote the adoption of new means of living, such as sustainable tourism based on the unique characteristics of each cove. This adaptation and transformation process requires that sectoral and environmental governance at local, regional and national levels is strengthened, with the committed and active participation of all key actors, and with a gender focus (**Figure 2**).

Governance refers to a way of governing where various public and private actors aim to satisfy the public interest through collaboration and coordination based on rules and agreements, in addition to traditional political and economic processes (Ostrom, 1990). Because of the nature of the sustainability strategy of adaptation, its governance must be highly coordinated and reconciled with the effective management of fisheries and aquaculture to reduce the risks of deterioration of the activity in the face of climate change threats.

FIGURE 2
Blocks of sustainability actions



Public policy recommendations

The sustainability and replicability of the outcomes and achievements of the project require adequate and appropriate policies for effective implementation. The main aspects requiring policy support include:

1. **Plans and programmes for artisanal fisheries and small-scale aquaculture**

    - Strengthen and update the design and implementation of fisheries and aquaculture adaptation plans, programmes and projects at regional/local level.

    - Promote the incorporation of climate change mitigation and adaptation in all artisanal fisheries and small-scale aquaculture policies, plans, programmes and projects.

    - Recognize the diverse characteristics and attributes of communities and coves throughout Chile.

    - Promote the strengthening of men's and women's organizations associated with artisanal fisheries and small-scale aquaculture.

    - Promote climate-resilient aquaculture with appropriate planning and management to understand where and how aquaculture can address climate change and other external impacts on the food system.

    - Promote nature-based fisheries and aquaculture practices for climate change adaptation that have the added benefit of the conservation and sustainable use of resources.

2. **Training at national and local level**

    - Implement education and training programmes on climate change and its consequences in the public sector and coastal communities. The objective is to develop a common/shared language to propose measures/actions for the adaptation of the fisheries and aquaculture sector, so that it is better able to cope with the expected impacts of climate change.

- Strengthen capacities and tools to conduct, coordinate and implement adaptation measures/ actions in the fisheries and aquaculture sector.

3. Climate and oceanographic information

- Strengthen oceanographic and climate observing systems that provide local and real-time information.

- Build national and regional capacities to design early warning models and indicators that can demonstrate climate change impacts on fisheries and aquaculture.

- Strengthen and update the Climate Risk Atlas of Chile (ARClim) for artisanal fisheries and small-scale aquaculture (MMA, 2020).

4. Productive diversification

- Support the diversification of livelihoods of communities dependent on fisheries and aquaculture, considering the impact of climate change.

- Strengthen existing sectoral programmes for artisanal fisheries and small-scale aquaculture to improve their production skills and contribution to food security.

5. Gender mainstreaming

- Promote the relevant and timely inclusion of fisheries and aquaculture managers, with a gender focus, to promote the adaptation of the artisanal fisheries and small-scale aquaculture sector to the expected impacts of climate change (Naranjo Solano, Gallardo Lagno and Crowley, 2021).

Women shellfish and seaweed collectors in Caleta El Manzano-Hualaihué

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