



Food and Agriculture Organization
of the United Nations

Training course to enhance collection of fisheries and aquaculture statistics

Module 5 – Obtaining SSF and aquaculture statistics through a household approach

Introduction

- In 2017, the Global Strategy to improve Agricultural and Rural Statistics (GSARS) published Guidelines to Enhance Small-Scale Fisheries and Aquaculture Statistics through a Household Approach.
- This approach outlines how to obtain data on the SSF-related activities of households: fish production from artisanal fisheries and aquaculture; post-harvest processing fishery activities such as unloading, sorting/grading, bleeding/gutting/washing, preserving, processing and storage that are also found at the household level
- Nutritional, socio-economic and conservation data on fishing households and community are also collected at the same time
- This supports sustainable approaches to fisheries that optimize conservation, food security and poverty alleviation objectives to fulfill SDGs, national policy goals and other international commitments to report fishery sector data.

Module 5 – Obtaining SSF and aquaculture statistics through a household approach

Outline

1. Identifying the target population for SSF and aquaculture statistics through the household approach
2. Survey design for SSF and aquaculture statistics through the household approach
3. Communal surveys

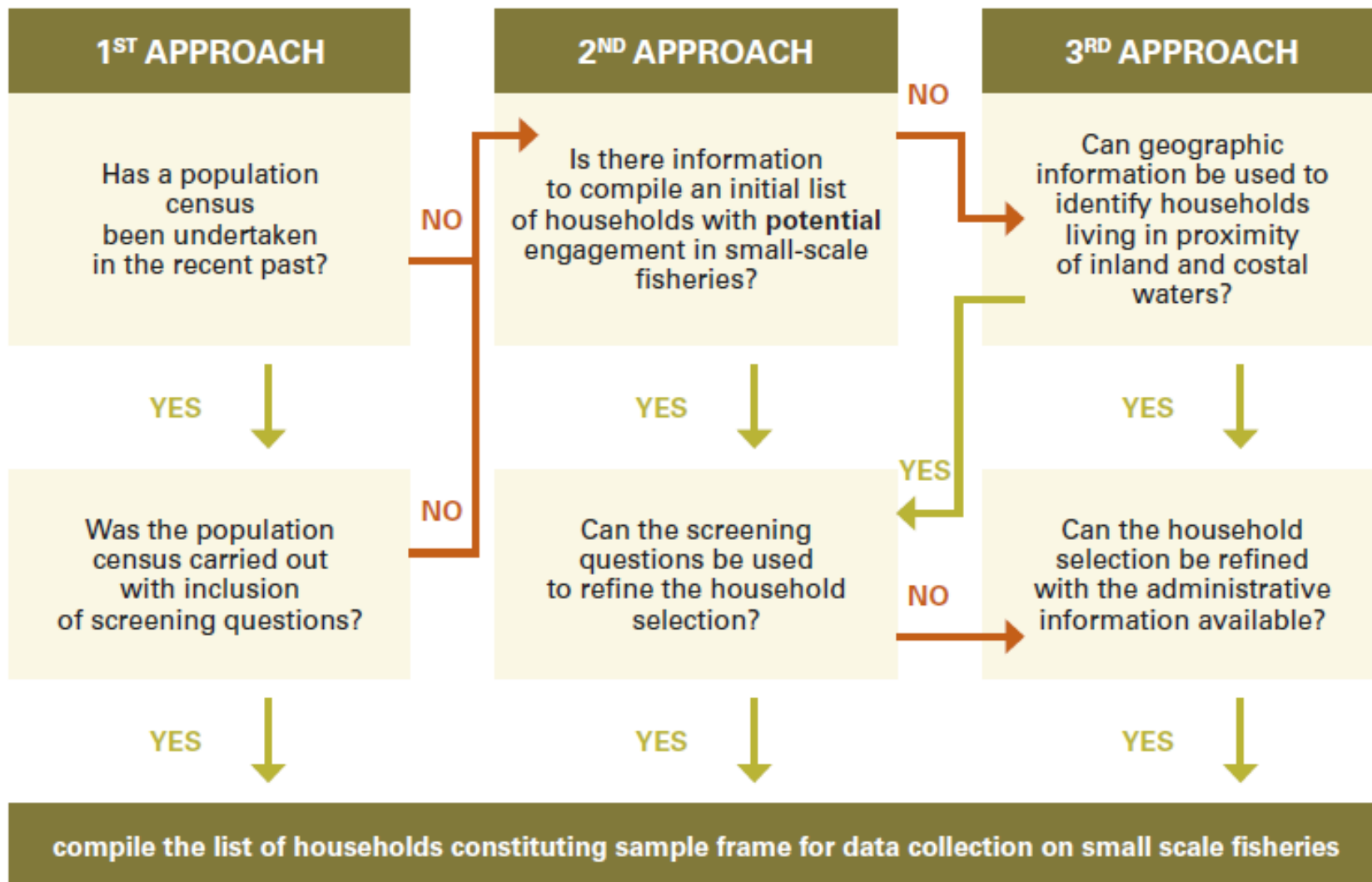


Identifying the target
population

Overview of the household approach

- The first step for a sampling survey is to build a frame of the target population
- For collecting SSF and aquaculture data, a cost effective solution is to take advantage of an upcoming population census or an upcoming agriculture census. However, the population census is preferred because of its broader population coverage
- **Screening questions** that probe household engagement in SSF and aquaculture as primary, secondary or subsistence activities may be added to the population census or agriculture census to identify fishing households and thus build the frame for fisheries surveys.
- The screening questions may be also used in a non-fishery household survey to identify the fishing households for a fishery survey
- If both population and agricultural censuses are lacking, geographical data such as satellite or aerial imagery may be used in conjunction with administrative data, to identify the target population and thus build the frame

Illustration of the method

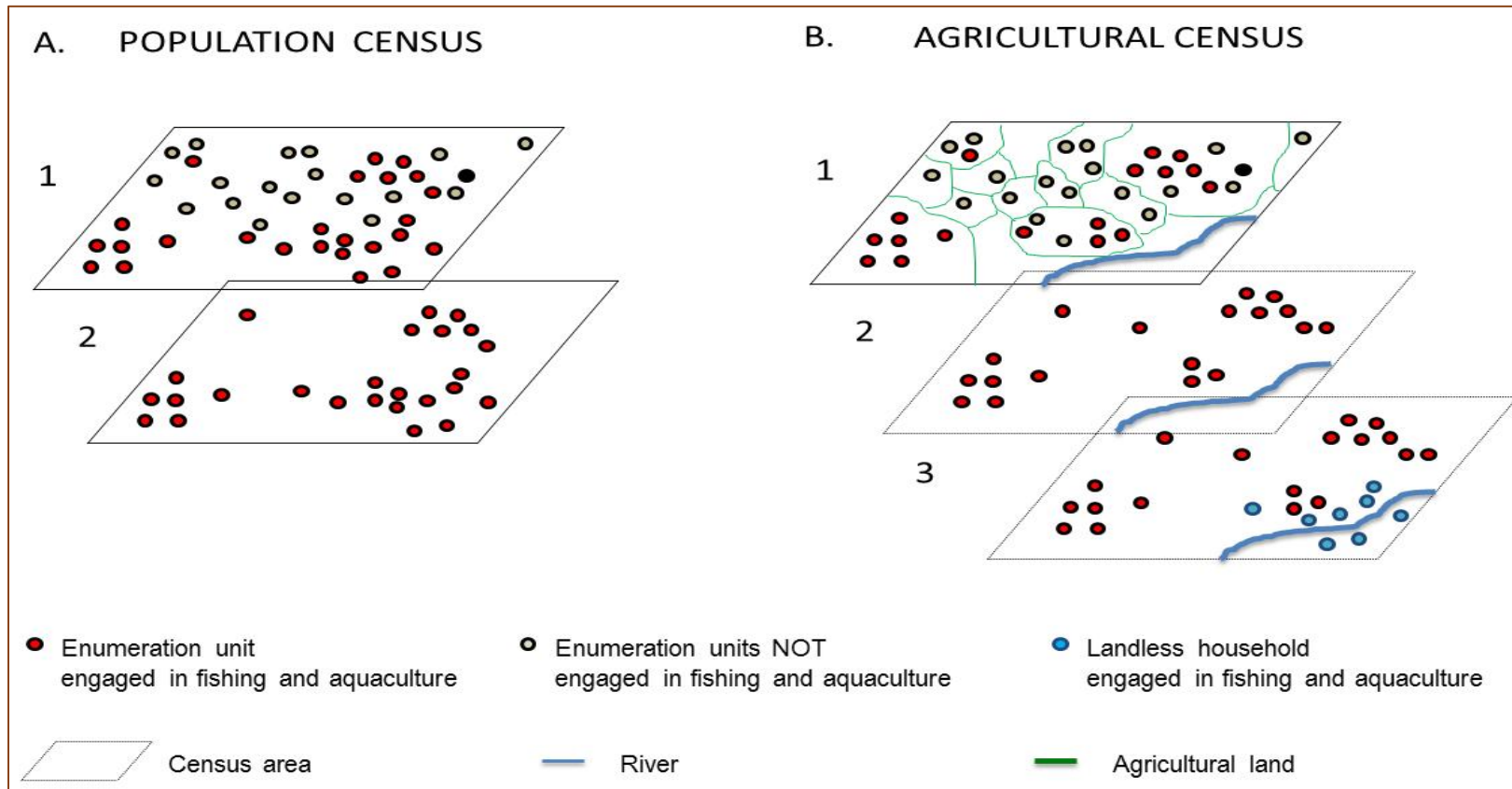


Special considerations for the case of agricultural census

In case of agricultural census, questions should be added to probe the “occurrence of aquaculture within an agricultural holding” or the “engagement of household members in fishing activities”

- **Note:** statistical units for the agricultural census are “agricultural holdings”, which use land for crop production, livestock rearing, aquaculture or other activities.
- Land (agricultural land) is a fundamental asset to the agricultural holding, while fishing activities may be undertaken by households that do not own agricultural land
- Therefore, the list of households owning agricultural land and engaged in SSF and aquaculture identified in agricultural censuses must be integrated, with a list of households without agricultural land but engaged in activities of fishing, aquaculture in public land or surface waters

Illustration of the use of censuses to identify the target population of small-scale fisheries.



- **Case A:** the population census includes screening questions to detect engagement in small-scale fisheries (Phase 1); the target population can be directly extracted from the census results (Phase 2).
- **Case B:** the agricultural census includes a module on fishing and aquaculture (Phase 1); therefore, an initial list of households can be extracted from the census results (Phase 2); however, this list must be integrated with any landless households engaged in fishing and aquaculture, which will not be covered by the frame used in the agricultural census.

Screening questions to identify SSF and aquaculture households

- These **screening questions** include information on
 - the engagement, over the past year, of any household member engaging in fishing and aquaculture activities on a full-time, part-time or occasional basis, and
 - the basic questions to identify SSF and aquaculture.
- Equally, it is important that measures to ensure cooperation of respondents are put in place to avoid nonresponse or false information, for example because of fear of taxation
- **The resulting frame of SSF and aquaculture households may**
 - **Become obsolete with time**, and must therefore be updated as frequently as possible
 - **Be built partially**. For example, an agricultural census may include screening questions to capture “Occurrence of aquaculture in an agricultural holding” and the “Engagement of household members engaging in fishing activities”, whether on their land or they are landless

Essential screening questions

BOX 1 DATA ITEMS CONSTITUTING SCREENING QUESTIONS TO IDENTIFY HOUSEHOLDS ENGAGED IN SMALL-SCALE FISHERIES.

2018 Engagement in fisheries

20181 Engagement in fisheries sector

Whether any household members engage in the following activities, and if so, indicate engagement status (full-time, seasonal, part-time, occasional):

- fishing (ISIC – 031)
- aquaculture (ISIC – 032)

Fisheries and aquaculture scale

Depending on the definition of small-scale fisheries and aquaculture adopted in the country, suitable questions should be elaborated for their identification. If the definition is based on a threshold of the size of specific gear, a simple question on the possession of the target gear and its size should be enough.

For example, in EU countries, the target gear is the vessel and the length threshold is 12 m. The identification question may simply be: “Do you possess a vessel that is more than 12 m long?”

Optional important screening questions

In addition to the essential questions, it is important to consider a few additional questions that mainly serve the purposes of stratification in the sampling design of the small-scale fisheries and aquaculture surveys.

BOX 2 OPTIONAL DATA ITEMS TO BE COLLECTED FOR STRATIFICATION PURPOSES.

Fisheries

- Number of the main fisheries gears (vessel, boats, nets, hook etc.)
Note: if the country's definition of small-scale fisheries is based on the size of specific gear (e.g. for EU countries, vessels under 12 m long), it will be necessary to obtain the number of that gear by category, based on size.
- Number of main post-harvest processing gear (Ice maker, Freezers, Salting/brining equipment, Drying racks, Smoking facilities etc.)

Aquaculture

- Number of main aquaculture gear (cage or net pen, pond, etc.)
- Area of aquaculture



Survey design for SSF and aquaculture statistics through the household approach

Sampling approach

- **The sampling frame** is the complete list of all households engaged in fishing and aquaculture, built from a population census or an agricultural census with/or geographic map data complemented with administrative data
- **Two domains** for the population must be created: one for “SSF” (the artisanal fishing households identified) and one for the households identified as practicing aquaculture
- These two domains may require different sampling approaches, even though data collection may occur at the same time
- **Stratification** contributes to the greater precision of the estimates that will be calculated (it reduces variability)
- The stratification can be on the basis of the geographical location or distribution of the SSF and aquaculture households, as well as of the characteristics of households revealed by data from the screening questions

Data collection frequency

- **For Small-scale Fishery**

Two types of variables are distinguished: **structural and conjunctural variables**

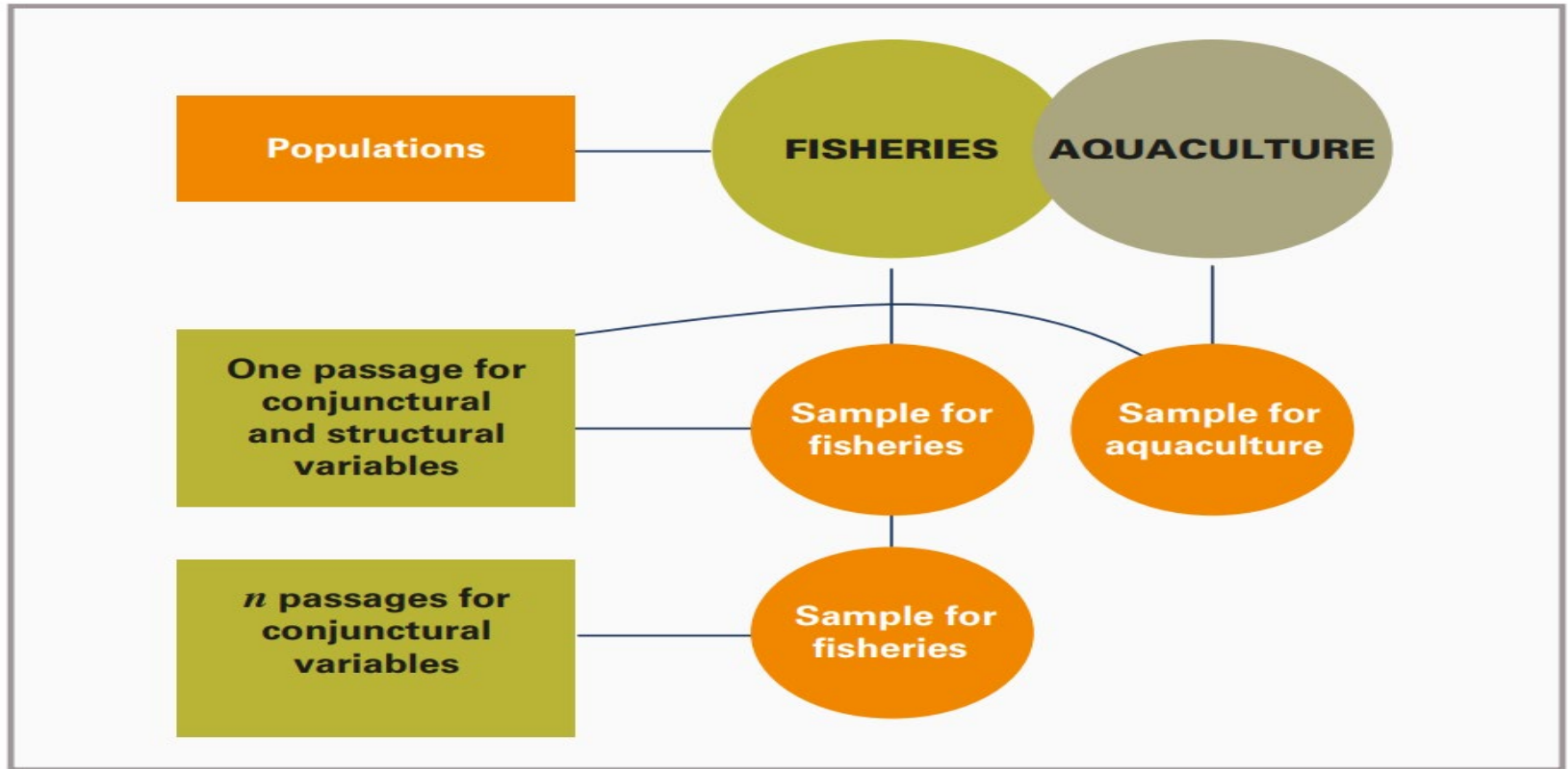
- **Structural variables** are those that do not vary significantly over one year. Households can easily recall and provide information for these variables for the year. Examples are equipment, water use and labour.
- **Conjunctural variables** are those that vary to a significant extent during a year. Depending on the country, this may be one fishing season, one month, a quarter of a year, etc. Households **cannot** easily recall and provide information for these variables for the year. **Several rounds of data** collection must be done to avoid recall errors. Examples of such variables are catches, consumption and sales.

Data collection frequency

- **For aquaculture**

- **It is assumed** that there are few conjunctural variables
- Thus, it is also assumed that households can recall most of the information for the period of one year
- For this reason, a **single round of data** collection for a year is assumed to be sufficient

General overview of producing SSF and aquaculture statistics using a household approach



Sampling design through a household approach

- **Two independent samples** should be selected from the frame or population: one for “SSF” (artisanal fishing households) and one for households practicing aquaculture
- **A two-stage** sampling design is recommended
- **The Primary Sampling Units (PSUs)** may be the enumeration areas (EAs) or other administrative localities, such as village or county, selected with **probability proportional to size**
- **The Secondary Sampling Units (SSUs)** are households engaged in SSF (artisanal fishing) and aquaculture, and are **randomly selected**
- **The sampling weights and estimation** can be addressed as proposed in the example in the following slides

Sample selection

- A TWO-STAGE stratified random sampling is applied as follows:
 - 1) Select a sample of EAs as the PSUs
 - 2) Select randomly a sample** of households in each selected PSU as SSUs
- PSUs are selected with probability proportional to size of PSU
- In selected PSU, a sample of households (SSUs) is selected with equal probability
- Sampling weights and estimators are used to obtain the total population estimates

Sampling weights and estimators

Notation

- M = number of EAs
- H = number of strata
- M_h = number of EAs of stratum h
- N_{ih} = number of households of stratum h in EA i
- m_h = size of the sample of EAs of stratum h
- $m = \sum_h m_h$ = size of the sample of EAs

Sampling weights and estimators

Notation (cont'd):

- n_{ih} = size of the sample of households of stratum h in EA i
- $n_h = \sum_i n_{ih}$ = size of the sample of households of stratum h
- $i = 1, 2, \dots, M_h$: indexes of EAs in stratum h
- $j = 1, 2, \dots, N_{hi}$: indexes of households in EA i and in stratum h
- y_{ihj} = value of the variable of interest for household j of stratum h ; this could be the kg of fish produced by an aquaculture household or the fish captured by an SSF (artisanal fishing) household in EA i of stratum h declared by a respondent

Sampling weights and estimators

- First, calculate the probability of selection of EA i in stratum h (first-stage probability of selection) denoted as π_{ih}

First stage – m_h EAs selected from stratum h with probability **proportional to size**

Second stage – n_{ih} households selected with equal probabilities in each stratum h of EA i

- First, compute $p_{ih} = \frac{N_{ih}}{\sum_{i=1}^{M_h} N_{ih}}$, then $\pi_{ih} = m_h p_{ih}$

Sampling weights and estimators

- Finally, **calculate the selection probability of household (HH) j of stratum h in EA i as follows:**

$$\pi_{ijh} = \pi_{ih} \frac{n_{ih}}{N_{ih}}$$

- Notice that the **inverse of the selection probability of HH j is the Weight of HH j**

$$Weight_{HH} = \frac{1}{\pi_{ihj}}$$

Sampling weights and estimators

- The estimator for the **population total** is

$$\hat{Y} = \sum_h \sum_i \sum_j \frac{1}{\pi_{jih}} y_{ihj}$$

- The estimator for the **population mean** is

$$\hat{\bar{y}} = \frac{1}{M} \hat{Y} = \frac{1}{M} \sum_h \sum_i \sum_j \frac{1}{\pi_{jih}} y_{ihj}$$

- y_{ihj} = value of the variable of interest for household j of stratum h . This could be the kg of fish produced by an aquaculture household or fish captured by an SSF (artisanal fishing) household in EA i of stratum h declared by a respondent

Estimators of variances

- First, rewrite mean as

- $\hat{\bar{Y}} = \sum_{h=1}^H W_h \bar{y}_h$ where

- $W_h = \frac{N_h \sum_{i=1}^m M_{hi}}{\sum_{h=1}^H N_h \sum_{i=1}^m M_{hi}}$ and $\bar{y}_h = \sum_{i=1}^m \frac{n_{ih}}{n_h} \left(\frac{1}{n_{ih}} \sum_{j=1}^{n_{ih}} y_{ihj} \right)$

Estimators of variances

- Variance is estimated by proxy, assuming that the PSUs are selected with equal probabilities because of complications arising from original unequal selection probabilities
- For a discussion of this point, see

<http://www.fao.org/docrep/009/a0198e/A0198E08.htm>

- The estimator of the **variance of the mean** is

$$V(\hat{\bar{Y}}) = \sum_{h=1}^{h=k} W_h^2 \left[\frac{(1 - f_{1h})}{m_h} S_{1h}^2 + \frac{(1 - f_{2h})}{n_h m_h} S_{2h}^2 \right]$$

- Where

$$f_{1h} = \frac{m_h}{M_h}, f_{2h} = \frac{n_h}{N_h}$$

Estimators of variances

- The estimator of the **variance of the total** can be deduced to be

$$V(Y) = V(\hat{\bar{Y}}) = M^2 V(\hat{\bar{Y}}) = M^2 \sum_{h=1}^{h=k} W_h^2 \left[\frac{(1-f_{1h})}{m_h} S_{1h}^2 + \frac{(1-f_{2h})}{n_n m_h} S_{2h}^2 \right]$$

- Where

$$S_{1h}^2 = \frac{1}{M_h - 1} \sum_{i=1}^{M_h} (y_{hi} - \bar{y}_h)^2, S_{2h}^2 = \frac{1}{N_h - 1} \sum_{j=1}^{N_h} (y_{hj} - \bar{y}_h)^2$$

Estimators of variances

- The estimators of **population total and population mean**, together with the **variances and standard error**, are automatically computed and displayed by most statistical softwares once a clean data set is fed into the software for analysis



Communal surveys

Communal surveys

Communal surveys may be carried out by administering a communal questionnaire on selected PSUs. The communal questionnaire is completed by eligible respondents (fishing community leaders, village heads, etc., assisted by the most knowledgeable persons)

Advantages	Issues
helps to obtain data on • area of communal land, access to shared facilities and type of governance • existence of associations or co-operatives	If administered through focus group discussions, the reliability of the resulting estimates cannot be quantified
complements the data collected from households	
effective in detailing involvement of women in SSF and aquaculture	

Using communal surveys

- Clearly define and identify groups within SSF and aquaculture production systems, to avoid any ambiguity when collecting information using communal surveys
- The data categories collected should be:
 - Mutually exclusive (the group or category boundaries in question should be clear to providers and users of information)
 - Exhaustive (almost all frequently expected data categories should be listed)
 - Manageable in number (the list should be short enough to be usable employing a category called “Other”, representing less frequently applied options)

Conclusion

- The household approach method (GSARS, 2017) is a method to produce statistics on SSF (artisanal fishing) and aquaculture, including
 - *Output or production*
 - *Socio-economic data on the household and the community*
- The household approach allows for obtaining wide-ranging data needed to support conservation, nutrition and poverty alleviation objectives
- Although both SSF (artisanal fishing) and aquaculture have been addressed, it is noteworthy that aquaculture statistics on households can be obtained by this approach

References

- Global Strategy to improve Agricultural and Rural Statistics. GSARS. 2017. *Guidelines to Enhance Small-Scale Fisheries and Aquaculture through a Household Approach*, available at <http://gsars.org/en/guidelines-to-enhance-small-scale-fisheries-and-aquaculture-statistics-through-a-household-approach/>

Thank you