Information Paper No. 4

Original: English

Coastal fishery-dependent and fishery-independent surveys and data collection

FISHERY-DEPENDENT SURVEYS AND DATA

1. Fishery-dependent data is data collected from a fishery, including those resulting from fishers, vessels, sale points or markets. Fishery-dependent surveys provide information that managers, scientists and stakeholders use to answer one or more of the following questions:

    a) What quantity of fish is being caught?

    b) Is fishing impacting on the available stock biomass?

    c) What is the current stock status for the species captured?

    d) What fishery products are being sold and how do they contribute to food supply and local economy?

2. Logbooks are one of the most commonly used approaches for obtaining information on fishers' catches and behaviour. Fishers fill out logbooks, usually as a condition of their licence, and provide information on: date and location fished, the amount of fish caught (numbers and/or weight), and the effort that was used to catch the fish, including the type of fishing gear (method) and time spent fishing. The approach can yield simple yet highly valuable fisheries data at a minimal cost. However, the technique requires fishers to fill out their logbooks accurately and submit them, which fishers may not be willing to do in the absence of a licensing condition. For mixed-reef fisheries, the accuracy of data obtained may be limited by a fisher's species identification skills.

3. Another commonly used fishery-dependent approach is landing site surveys, also known as creel surveys. Here, surveys of a fisher's catches and activities are conducted by trained individuals at a landing site such as a boat ramp or wharf. Surveyors record similar data to that of a logbook – recording information on the fisher, date and location fished, the amount of fish caught (numbers and/or weight), and the effort that was used to catch the fish, including the type of fishing gear (method) and time spent fishing. Surveyors can also measure or weigh individual fish and collect biological samples such as otoliths or gonads for analysis to provide useful information on resource status. The technique is a relatively cost-effective method for obtaining high-value fisheries data at specific sites.

4. Market or vendor surveys focus on collecting information on the fish that is being traded either from an entire market or a sub-set of vendors. Information about the type of market, the type of fish, quantity, processing stage and prices is collected by trained individuals. Market surveys are good for gathering information about the economics of the fishery; however, they are not designed for deriving information on the condition or status of the fishery. Generally speaking, market surveys do not provide information on where and how fish were caught or how much effort was used. Fish that are sold at markets are in various processing stages and units such as whole, gilled and gutted, filleted, or in bundles, bags or on strings. Standardising this information can be challenging.

5. Household surveys are sometimes used to provide information about fishing activities, the use of the catch and consumption. This type of data collection survey relies on carefully designed questionnaires and is based on respondents' recollection, which may or may not be accurate.

6. To be cost-effective, fishery-dependent data collection approaches are typically based on surveying a sub-set of fishing, marketing activities or households, and the scaling-up of this information to reflect what is happening in the whole fishery. If designed appropriately, they can provide information on changes in the catch, including catch composition and effort, fishing mortality and the importance of the fishery for income and consumption.

INDEPENDENT SURVEYS AND DATA

7. Fishery-independent surveys aim to provide information about resources[1] through direct observation or experimental catch surveys, using data obtained in the absence of any fishing activity (i.e. commercial, artisanal, subsistence fishing). Fishery-independent surveys are typically used to examine the health, status and size of fish stocks independently of the associated fishery. These survey methods are typically based on sampling a proportion or a fraction of an area (e.g. through in-water surveys) or collecting a relatively small number of samples (e.g. by experimental fishing or research vessels) compared with fisheries that are dependent on data collection methods. Fishery-independent surveys can be particularly useful to collect information on the resource status when fisheries are closed (for example when there is a moratorium on sea cucumber or trochus) to decide on the re-opening of the fishing season, or to monitor marine protected areas, impacts of fishing, human activities or climate disturbances.

8. In shallow coral reef environments (usually not exceeding 20 m in depth), in-water surveys are often used to obtain an assessment of the resources and the status of populations through individual counts that are often combined by size measurements or estimates. There are a range of in-water survey techniques that have been used, and generalised as an Underwater Visual Census (UVC), including snorkel or SCUBA-based transects, manta tow, timed swims/walks, quadrats and stationary point counts. Underwater visual census techniques can be challenging for various reasons: they require extensive training of surveyors, especially for finfish surveys (species identification and size estimates) to reduce observer bias and can be logistically difficult and expensive – particularly in remote locations and/or when SCUBA is required. The behaviour of many species (in particular finfish) can be affected by the presence of surveyors (either in snorkel or SCUBA diving), with some species avoiding surveyors and others being attracted to surveyors. Despite these limitations, UVC techniques can be highly suitable for assessing sessile or slow moving invertebrates and they can be effective for comparing fished and unfished areas (Marine Protected Area vs open areas) as well as providing some biological information (e.g. size structures of populations).

9. In shallow environments, video-based in-water surveys are used and target two main objectives: 1) to use video as a means of recording rather than recording on paper, and 2) to minimise fish behaviour changes due to the presence of a snorkeler or diver by using Baited Remote Underwater Video systems (BRUVs) or Unbaited BRUVs (UBRUVs). In-water video-based surveys provide a permanent record. Video-based surveys can save in-field survey time, however specialist equipment and significant time is required for data analysis.

[1] Including the associated/supporting habitat (coral reefs, mangroves sea grass, etc.). For the sake of simplicity, this paper discusses fishery-independent approaches as a means of surveying fisheries resources, including finfish and invertebrates and does not cover habitats.

10. Mark-recapture surveys involve catching, tagging and releasing a known number of individuals into a population. The proportion of recaptured individuals in follow-up surveys or from fishing is used to estimate the population or stock size. This method is more suitable for closed populations and for species with a high survival rate after release. If the follow-up surveys are maintained for an extended time, these surveys can provide invaluable information to managers regarding stock movement or migrations as well as biological information such as growth rates. Mark-recapture surveys can be cost-effective, but to be useful a few assumptions have to be made: the handling and presence of the tag will not affect the survival or behaviour of the tagged individuals, tagged individuals are randomly distributed into the population, and there is no recruitment or net migration during the survey period.

11. Biological sampling involves sampling of biological parameters such as length, weight, sex, maturity stage and age from otoliths, or genetic samples for stock connectivity, of representative samples of stock. The information can be collected by both dependent and independent surveys to provide stock status including size at maturity. Biological sampling is costly (time and money) and requires specialised equipment to process samples such as gonads or otoliths. However the cost of deriving some biological parameters can be reduced by sharing information. For example, knowledge of the size at maturity for species 'x, y, z' from a study in one of the Pacific Island countries and territories (PICTs) could be shared with neighbouring PICTs.

ISSUES AND CONCERNS

12. Questions on the quality of information collected from dependent and independent data surveys can arise due to the choice of method, sampling design, surveyors, or the coverage of surveys over the distribution of fishing activities or resources. An example of these questions is as follows:

    - Are the days sampled at a landing site reflective of what happens for all days at the landing site, or at all the other landing sites?
    - What is the proportion of fishing trips covered/monitored and is this representative of the fleet activity?
    - Are all fishers filling in and providing logbooks or are logbooks only provided by some fishers whose catch may not be representative of the fleet catch?
    - What is the proportion of reef sampling relative to the entire reef system?
    - Is there a need to stratify the sampling/survey?

13. Data collection surveys can be biased and incorrectly interpreted if the data collection protocols are not clearly described and recorded. A pilot survey will help in developing a good sampling design to remove most of the biases of inadequate representation of the resources.

14. Some fishery-dependent strategies, such as recording catch and effort data to obtain catch per unit effort, require a long-term time series of data before they provide information on the

status of harvested species. Often, these activities are funded externally by aid agencies over timeframes that are insufficient to provide status information.

15. In-water surveys are costly and difficult to implement adequately for countries with long coastlines (> 100 km) or scattered islands or reef systems. Moreover, fishery-independent survey methods can be more costly when compared to fishery-dependent sampling. It can be time consuming to do UVC of reef fish to get a statistically useful data set on fish abundance and distribution. For example, most UVC methods require a minimum of two experienced surveyors, a boat and boat driver or between one and four hours to complete a UVC station, depending on distance between stations of the resource that is being surveyed. In addition to being cost prohibitive in some cases, at best, fishery-independent surveys such as UVC may provide an indication of the status of stocks, but tell us nothing about the fishers that are part of the 'fishery' and very little about how a fishery is impacting a community.

POSSIBLE DISCUSSION POINTS

When deciding what data collection techniques to use we need to take the following into account:

- What questions are to be answered and what survey methods will provide the answer?
- Given budget limitations, what surveys can one afford to undertake and how often would one do a snapshot or long-term time series of data?
- Can the data be sourced electronically to reduce some of the labour costs?