4.10 Observer information and other biological samples

The role of observer programmes can vary widely. A primary focus can be enforcement, ensuring that international and national requirements are met during the operations of fishing vessels. Of more interest to this manual are scientific observers, whose role is the collection of scientific data, monitoring of fishing effort and bycatch numbers and rates. Observers also offer one of the few methods appropriate to obtain accurate location, catch and effort information for tuna caught for farming. This is of particular importance given the increased farming efforts within the Mediterranean. Access to individuals to collect biological data may be limited, however, due to fishermen's reluctance to allow handling and further stressing of tuna destined for pens.

Sampling at sea can be conducted either by a biologist, by a trained technician aboard, or occasionally by well instructed fishermen. This may be particularly relevant for longliners operating far from base ports, since trips for these vessels may last several months. Daily catches may be few, and consequently when the vessel returns to port for unloading, most of the fish in the hold will have lost their identity in terms of time, date and place where the fish were caught. Since the daily catch is rather small, it is easier to request fishermen to measure some of these fish.

4.10.1 Observer coverage

Observer coverage refers to the fraction of fishing effort (e.g. vessel trips) that is sampled at sea by trained scientific data collectors. As noted in section 4.2.4, sampling requirements from this coverage will depend on the aims of the survey – e.g. collection of length data, information on a non-target species, or a protected sea bird or mammal, for example. Sampling requirements for particular species will depend on the species frequency of occurrence, patchiness, seasonality, variability in recruitment, and other factors.

A key area has been the examination of observer coverage levels to assess threatened or endangered species, where low levels of mortality may jeopardize their recovery. In this case, an exact count of the total incidental mortality may be required, and 100% observer coverage becomes necessary. This is the case in the eastern tropical Pacific tuna purse seine fisheries, in which the Inter-American Tropical Tuna Commission requires 100% coverage so that individual vessel quotas on dolphin bycatch may be used.

As noted in section 4.2.4, often the level of observer coverage is limited by budget. 100% coverage may therefore not be possible. In these cases, coverage must be sufficient to ensure estimates are sufficiently accurate and precise for assessment and management purposes. Precision depends on the size of the sample, the size of the fishery, and the variability of the factor. Accuracy depends on these factors, as well as whether the sampled part of the fishery is representative of the entire fishery.

It is difficult to define coverage of observers based upon a desired precision in the value of outputs. Catch levels can vary widely between trips, due to environmental, economic, social and management influences. Within these constraints, the realistic approach may be to maximise coverage given available funds and observers, and operational considerations. Pooling of data may then be necessary to reduce uncertainty in outputs. Readers should be aware, however, that parameter estimates from observer data could easily be biased (i.e., not accurate) if the coverage is less than 100%.

As noted, the level of precision obtained from a given level of coverage depends upon a number of factors, including the number of time, area and gear categories to be covered, and the level of set-to-set and vessel-to-vessel variability in the factor to be studied. The former requires observer coverage to be spread among all nations/vessel types/gears/fishing strategies/areas to cover the range of potential situations. For example, samples taken in only one part of the year or from only one area covered by the fishery will usually not be representative of the annual landings. The latter requires a reasonable level of coverage within nation/vessel/gear/etc. category. These conflicting factors require substantial amounts of observer data to calculate.

Once homogenous spatial/temporal/gear strata have been identified, vessels can be selected randomly. If the sample is really random, coverage levels can be defined using the sampling formulae detailed in section 4.2.1. As noted in section 4.2.4 and above, however, practicalities, safety and feasibility must all be taken into account.

Adaptive sampling approaches can also be used, where coverage is modified based upon observations made during the observer programme. For example, identified areas of high abundance may be sampled more intensively using more observers on other vessels. The reader is referred to statistical texts (e.g. Thompson, 1992) for more information.

The reader should be aware of a number of potential biases in observer data, and attempt to mitigate against them. They include:

- Bias caused by observer effects (e.g. vessel behaviour is changed due to the presence of an observer)
- Bias due to non-random allocation of sampling effort
- Bias caused by logistical constraints (e.g. components of the fishery which are logistically difficult to sample)
- Bias caused by inaccurate recording of data by observers
- Bias caused by small sample size
- Bias caused by inappropriate stratification

4.10.2 Examination of fishing practices

Observers are ideally placed to examine the characteristics of the vessel on which they are stationed, and its practices of setting and hauling (longlines), searching and setting (purse seines) etc. ICCAT forms are available for this purpose (see **Annex 1**). Details to examine include:

Details	**Specifics**
Vessel characteristics	Vessel name/code, flag, type, storage capacity, tonnage, horsepower
Gear characteristics	Purse seine: length, depth, mesh Longline: line length, number of hooks, hooks between buoys Bait boat: baiting gear, length, depth, bait capacity, basket/scoop
Trip characteristics	Port of departure, departure date, return port, return date
Sighting (more for purse seiners)	Searching and setting based on birds, mammals, flotsam, FADs, fish jumping, aircraft
Searching (purse seine) or setting (longline) characteristics	Course (in degrees), vessel speed, binocular power and number, radar specifications, weather and Beaufort state

NOTE that this list is not exhaustive. Observers should refer to already developed data forms Gaertner and Pallares (2002a).

Although effort for CPUE calculations (see section 4.4) are likely to be pre-defined by vessel logbook information such as ‘days fishing’, ‘number of sets’, ‘number of hooks’ etc., observers can identify finer scale factors including those relevant to searching success (Gaertner *et al*, 1999; e.g. number and power of binoculars, radar power, vessel power and speed of both vessel and skip). These may lead to refinements in effort estimation in the future (Gaertner and Pallares (2002b).

Catch may be more difficult to monitor, particularly if biological sampling is being carried out as the fish are brought on board. However, observer information can provide a general check on the levels entered into the vessel logbook.

As noted in section 4.2.4, catch and landings of key species are often not equal, due to discarding at sea. Furthermore, other ‘bycatch’ species of little economic value may be caught by the gear and discarded at sea. These may not be noted in vessel logbooks. Scientific observers are well placed to monitor these bycatches and discards, which are key to identifying the impact of fishing operations on the wider ecosystem (Gaertner *et al*, 2002). Specific species may be discarded due to certain market or regulatory conditions, including minimum size limits or catch limits. In addition, non-targeted bycatch, which may be hooked or entangled in the gear, may similarly be discarded. A proportion of these will be discarded dead. Data on the number and status of discard species collected by observers is invaluable. The calculation of discard rates is discussed further in section 4.10.4.

4.10.3 Biological information

The collection of biological information has been detailed in the previous sections of this manual. The advantage of observers collecting such information at sea is that they can directly link it with the location from which the samples were taken (as in the geographic location of the catch). This is in contrast to sampling from wells that may contain individuals from a large number of catches in a general area, or longline catches where the catches from sets made over an extended period and geographical range may be present. The association of the caught individuals with particular features (e.g. FADs) can also be noted.

4.10.4 Discards and discard rate estimation

As noted, the estimation of discard rates is a topic of considerable importance in tuna fisheries. The issue has been much debated in U.S. tuna fisheries in particular, with the interaction of gears with dolphins being discussed in great detail within IAATC. As noted, where the bycatch species is endangered, the level of precision required in bycatch estimates may result in the requirement for 100% vessel coverage. Where bycatch estimates are required for stock assessment, the level of precision required may depend on the stock assessment methodology and the management system itself. Where bycatch mortality is high compared to other sources of mortality on a stock, higher levels of coverage may be needed.

The methodology of estimating discard rates will not be detailed here. As references, Brown (2001) presents an estimation approach to assess dead bluefin tuna discards in the U.S. Atlantic pelagic longline fleet. O'Brien *et al*. (2003) devised an alternative approach to estimating discard rates and overall discard levels in the U.S. longline tuna fishery, employing the ideas of conditionality, flexible mixture distributions (in this case the negative binomial) and generalized linear models. It is often appropriate to test data with a range of models, and further study indicated that the estimates devised by Brown (2001) were not inappropriate, despite potential issues with the statistical assumptions made. However, the benefits of conditioning should be investigated when estimating discards.

4.10.5 Further reading

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