

**Monitoring of fisheries in and adjacent to an MPA is essential to determine the impact of fishing on the biodiversity within the MPA, and also whether it is having an impact on fishery yields and thus on the livelihoods of coastal communities. This sheet describes key issues to bear in mind when developing a fishery monitoring programme.**

Fishing both affects and is affected by the establishment of an MPA. Increased catches (or fishery yields), as a result of spill-over from no-take zones and areas of reduced fishing pressure, can lead to improved coastal livelihoods. Collecting information on fishing from within and adjacent to an MPA is thus essential to:

- determine the extent to which fishing is having an impact on stocks (or populations), species, and biodiversity within the MPA;
- detect changes (trends) in the fishery and their causes;
- estimate the contribution of fish to food security and the economy, and how the MPA plays a role in poverty alleviation, which is useful for influencing national and local policy-makers, planners and donors.

## DATA TO COLLECT

Before starting any fisheries monitoring, a profile (or frame survey) of the fisheries operating in and near the MPA should be undertaken. This identifies the number and types of vessels, gears, fishers (including migratory fishers and their seasonal movement) and locations of landing sites/home ports. Frame surveys tend to be costly but are not needed often, as artisanal fishing fleets do not change much between years. Note that the data may be available from Fisheries Departments.

Basic elements of a fisheries monitoring programme are:

**Catch** (weight) and **catch composition** (species and/or families harvested). Lengths are essential for standard species-specific fisheries stock assessments.

**Fishing effort** includes type, duration and location of fishing operations; e.g. number of boat-days, man-hours or gear-hours per month or year.

**Costs and revenues** are mainly those of fish prices, fuel, gear costs and wages.

Information on both catch and effort is needed for estimating catch rate, or Catch per Unit of Effort (CPUE). It is generally assumed that a continuing decline in CPUE reflects over-fishing, whereas increased CPUE may reflect recovery of a fish stock or effective management. However the relationship between CPUE and stock abundance is not simple, as it is confounded by changes in gear efficiency, changes in fishers' behaviour, and by schooling or seasonal movements of fish. Interpretation of CPUE trends should thus be cautious, but if both CPUE data and independent survey data on fishery populations (see Sheet G3) are used, it should be possible to assess the impacts of the MPA on a fishery.

To determine whether an MPA is contributing to food security and poverty alleviation a 'food balance sheet' can be created. This is developed from estimates of total fish catch and information on seasonality, marketing and distribution of the catch (both inside and outside the MPA), and the number of people using MPA resources regularly. The price of fish, ideally at all marketing stages, and the gross value of the catch should be recorded. Analysis of these data, with information on labour, effort and opportunity cost, allows assessment of a fleet's economic performance.

## DESIGNING A MONITORING PROGRAMME

Since there are often many types of fishing gear and vessels usually with quite different catch-rates, and even catch composition, it is necessary to sub-divide, or stratify, the 'fishery' into groups that have similar characteristics (e.g. same gear, same vessel-type, commercial, or subsistence). If dug-out canoes are grouped with larger sailing vessels the sampling is not stratified and the average catch, or income, will not be accurate. Ideally all strata should be sampled, but the cost of and manpower for this is usually prohibitive, because enough samples must be taken to ensure accuracy (see below). For a long term programme, monitoring just the dominant strata may be sufficient.

Accuracy and precision are two key factors in monitoring design. Data accuracy indicates how close the estimation (e.g. average catch per day) is to the actual or true parameter (i.e. if every fishing trip is measured) and depends on how well the sampling has been designed. For example, measuring catch and effort of a handline fishery



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Fisheries monitoring can benefit from the involvement of local fishers, shown here weighing fish catches.

in one season will not be an accurate reflection of the total fishery if most fish are taken by traps in a different season.

Effort is harder than catch to measure accurately, and FAO guidelines recommend that three-times more fishers should be asked about their fishing effort compared with their catch. Data precision (measured as the Coefficient of Variation, CoV) relates to the variability of the samples. An estimate based on a small number of unrepresentative samples tends to show a high variability and thus gives low precision. Precision improves with increasing numbers of samples or measurements, but if these are not representative, the data will be inaccurate.

Annual estimates of catch and effort can be improved using fleet and boat activity surveys. Fleet activity surveys show the number of days fished each month for each vessel/gear combination. This information can be obtained by asking a sample of fishers how many boats went fishing in the previous month, and how many days were missed due to bad weather, illness or holidays. Since such events affect the whole fleet, the sample does not have to be large. A boat activity (BAC) survey records the number of days fishers fished in a month, which may vary between individuals depending on their other commitments.

Since fish caught within the MPA may be landed some distance away and since fishing outside the MPA may have an impact on stocks within its boundaries, the monitoring programme will need to incorporate data collection at fishing grounds and landing sites outside the MPA.

## GATHERING THE DATA

Fishery catch and effort monitoring is generally done in one of the following three ways (in decreasing order of accuracy and cost):

- on-board vessels, recording catch/effort during fishing;
- at landing sites, when fishers land catches; or
- through interviews with fishers after trips, and personal records.

Although data are likely to be collected by local fisheries departments, this may not be sufficiently detailed for MPA purposes. However, any separate monitoring programme should be closely linked with existing government programmes, preferably involving local staff. Fishers can also be involved in data collection, as long as training is provided, methods are well understood and there is regular checking and calibration.

Standardised classifications for vessels, gears and species being fished should be used, but also local names where appropriate. Use of both scientific and local names allows scientists, managers and others to understand the data and results of analyses. Since fish catches are often very diverse and species are difficult to identify, it may be necessary to use a family-level or more generic nomenclature.

Data on illegal fishing activities should be obtained where possible, to monitor compliance with regulations. It can

be obtained from various sources including direct observations, particularly during patrols, and interviews with key informants.

## KEY POINTS FOR THE MPA

- In developing a fishery monitoring programme, ensure adequate training of those involved, aim to cover as many exploited species as possible, but set the priorities according to the MPA objectives.
- Use local fishers to help collect data where appropriate; examples include Kiunga (Kenya), Tanga (Tanzania), and projects underway through CORDIO and CRCP.
- Establish a good relationship with the local Fisheries Department and involve it and local communities in designing and implementing the programme.
- If the MPA is closed to fishing (see sheet I1), information on the adjacent fisheries may still be important; access to this will require cooperation with the relevant organisations.

## Sources of further information

FAO 2002. *Sample-Based Fishery Surveys - A Technical Handbook*. FAO Fisheries Tech. Paper 425, Rome.

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FAO Fisheries Website <http://www.fao.org/fi>

FAO Document Repository <http://www.fao.org/DOCREP>

FAO International Standard Statistical Classifications: Aquatic Animals and Plants (ISSCAAP); Fishing Gears (ISSCFG); Fishery Vessels (ISSCFV)