Monitoring mangroves & seagrasses

G4

Mangroves and seagrass beds are important habitats in many MPAs in the WIO, and it is important that their health is monitored. This sheet introduces available techniques and encourages MPA managers to develop monitoring programmes.

Many mangrove management and restoration programmes are underway in the WIO (see sheet H9), but there is little monitoring of mangroves or seagrasses. MPAs have the opportunity to set examples by developing monitoring programmes for these habitats. Simple techniques are now available that enable communities and non-professionals to assist, preferably under the guidance of experts. As with all monitoring, physical data should be collected (e.g. weather, state of the tide, water quality) at the same time (see sheet G5) and baseline maps and assessments are essential (see sheet C1).

MANGROVES

There are ten easily recognisable species in the WIO. Monitoring methods are described in English *et al*. (1997), but a comprehensive programme may be beyond the scope of many MPAs. Priority parameters should therefore be selected, and collaboration sought with local forest departments for personnel and equipment. The main parameters for monitoring mangroves are:

Community Structure and Biomass - The Transect Line Plot (TLP) is the basic approach and involves at least three transect lines perpendicular to the shore, in two sites at each location. Along each transect, three randomly located plots (usually 10 x 10m) are staked out, and their positions recorded with GPS. The species, position, height (using a tool called a hypsometer) and girth of each tree (including stumps) in each plot are recorded and the trees are tagged. This takes time, but need only be repeated every 2-3 years. A simpler method, that can involve local communities, uses a greater number of 5 x 5m plots over a wider area, recording samples of trees in each plot.

J. Rubens

Measuring mangrove tree girth, as part of a monitoring programme in Mafia Island Marine Park, Tanzania.

Primary Productivity - Leaf area is correlated with total photosynthesis and thus primary productivity and mangrove 'health'. The 'leaf area index' is measured using a portable light meter with an underwater quantum sensor (for protection from corrosion) and a clinometer to measure solar zenith angle. The method is quick and reliable.

Leaf litter production - This is sensitive to many environmental factors, and can be measured using suspended net traps to catch falling leaves that are dried and weighed.

Soil characteristics - The productivity and structure of forests are influenced by the soil. Monitoring soil changes requires collecting 5-10 samples from each location with a D-section corer, and measuring:

- Redox potential (Eh) (extent to which soils are conducive to microbial decomposition and thus nutrient production) and acidity/alkalinity (pH) (influences chemical transformation of nutrients), with a pH/Milli-voltmeter, preferably on site.
- Soil salinity (determines growth and zonation) with a refractometer.
- Temperature at a depth of 10 cm.
- Grain size (proportions of gravel, sand and mud determine soil permeability) using the time consuming particle size fractionation method or the simpler hydrometer method.

Area coverage - Aerial or satellite images (e.g. LANDSAT MSS, SPOT-XS) can be useful for monitoring changes, but ground-truthing using TLP methods, is essential to determine mangrove health and other information needed for management (see case study).

SEAGRASSES

There are 13 seagrass species in the WIO. They respond very differently to changes in water temperature, turbidity, nutrient levels and human disturbance and some species undergo annual die-back. Distribution, composition and density of seagrass beds may thus vary over time and seasonally which must be considered in a monitoring programme. There are two global monitoring programmes that provide advice: SeaGrassNet is primarily for managers and professionals, and involves quarterly data collection; and Seagrass Watch is for communities and volunteers. A SeagrassNet monitoring site has been set up in Tanzania by the University of Dar es Salaam. The following parameters are usually monitored for seagrass:

Community Structure - The standard method requires three transects for each location, perpendicular to the shore, 50-100m apart, extending to the outer limit of the seagrass bed or reef edge. At regular intervals, <5m for

heterogenous communities or up to 20m for homogeneous meadows, quadrats (ideally 50 x 50 cm, divided into 25 sectors) are used to calculate % cover for each species through visual estimation. Sometimes a scale (e.g. 0 for 'absent' to 5 for 'over half cover') is used to estimate cover. SeagrassNet provides a guide on how to standardise this to give % cover. Individual shoots can also be counted for each quadrat, and photographs taken of each quadrat or a video recording made of the entire transect, either on foot or using SCUBA.

Biomass - Digging up seagrass from within each quadrat to calculate biomass from wet and dried samples can be time consuming, requires laboratory equipment and damages habitat. Alternatively, a small biomass core sample may be taken to one side of the transect. A simpler, less destructive visual technique exists for above ground biomass, but good observer standardisation is important.

Area coverage - Can be calculated from satellite images, or by measuring and mapping seagrass beds at low tide.

MONITORING FISH IN MANGROVES AND SEAGRASS BEDS

Visual methods are not reliable due to low visibility, and samples must be collected. Beam trawl nets are generally used in seagrass beds but are not recommended for regular monitoring in MPAs because of seabed damage. For mangroves, gill nets and encircling nets (the latter for intertidal areas only) can be used. To avoid damaging the fish, they can be caught in traps or on hook-and-line and then released. Monitoring should be done at different times of day and night and at different times of year to cover seasonal variation due to migration and breeding.

KEY POINTS FOR THE MPA

- ❑ **MPAs should develop monitoring programmes for mangroves and seagrass beds, choosing methods that reflect the needs of the MPA, the time constraints, the personnel available and the budget.**
- ❑ **Collaboration with appropriate scientists, local government agencies (particularly forestry for mangroves) and NGOs, is recommended.**
- ❑ **Where possible, involve local people in monitoring.**

Sources of further information

Akwilapo, F.D. & Wagner, G.M. 2002. *Report on mangrove monitoring in Mbweni and Kunduchi conducted June 2002*. Kinondoni Integrated Coastal Area Management Programme (KICAMP), Dar es Salaam.

English, S. Wilkinson, C., & Baker, V. (eds.) 1997. *Survey Manual for Tropical Marine Resources*. (2nd Ed.), AIMS, Townsville, Australia.

Hussein, Y.A., Zuhair, M.M. & Weir, M. 1999. *Monitoring mangrove forests using remote sensing and GIS.* **www.gisdevelopment.net/aars/acrs/1999/ps5/weir@itc.nl**

Kirkman, H. 1996. Baseline and monitoring methods for seagrass meadows. *J. Environmental Management* **47**: 191-201.

Phillips, R.C. & McRoy, C.P. (eds.) 1990. *Seagrass Research Methods*. UNESCO, France. 210pp.

Semesi, A.K. 1991. *Management Plan for the Mangrove Ecosystem of Mainland Tanzania*. Ministries of Tourism, Natural Resources and Environment, Forest and Beekeeping Division, Catchment Forest Project, Dar es Salaam.

Short, F.T. & Coles, R.G. 2001. *Global Seagrass Research Methods*. Elsevier. Amsterdam, 482pp.

Short, F.T., *et al*. 2002. *SeagrassNet Manual for Scientific Monitoring of Seagrass Habitat*. Queensland Department of Primary Industries, QFS, Cairns, Australia. 56pp.

Talbot, F. & Wilkinson, C. 2001. *Coral Reefs, Mangroves and Seagrasses: a Sourcebook for Managers*. AIMS, Townsville, Australia.

Wang, Y. Q. *et al*. 2003. Remote sensing of mangrove change along the Tanzania coast. *Marine Geodesy* **26**: 35-48.

GLOMIS -Global Mangrove Database and Information System **www.glomis.com** - contains a global mangrove bibliography.

World Seagrass Association - **www.worldseagrass.org** - a Global Network of scientists and coastal managers committed to research, protection and management of seagrasses.

SeagrassNet - **www.seagrassnet.org** - a global programme to monitor and document the status of seagrasses.

CRC Reef Research Centre - **www.reef.crc.org.au** – information on monitoring including SeagrassWatch (community-based programme).

CASE STUDY

The Mangrove Management Project (MMP) in Tanzania

The national MMP was initiated in Tanzania in 1988 to promote mangrove conservation and sustainable utilisation. All mangrove forests in Tanzania are classified as Forest Reserves and zoned for different uses, with some areas strictly protected. To assess the impact of the MMP, changes in overall mangrove coverage were estimated by comparing Landsat TM images for the years 1988-1990, with Landsat-7 ETM+ images for the year 2000. Field observations and ground verification were undertaken with District natural resource and mangrove officers. The results showed that there has been little change over the last 10 years, with some Districts showing a slight increase (e.g. Tanga, Muheza, and Mtwara, where the MMP has been very active and has promoted restoration efforts) and others a decrease (e.g. Rufiji District).

National trends in mangrove cover do not, however, necessarily reflect trends in mangrove health, and in Tanzania there is evidence that the latter has declined. Monitoring mangrove forest quality at the local level is thus equally important for management, but is not yet being undertaken widely, even in MPAs. Short term monitoring activities have been carried out at a few sites to follow the effectiveness of restoration programmes. For example, at Mbweni Mangrove Forest, a restoration initiative was monitored for eight months with assistance of the village women's group, and the results showed that it was successful. However, monitoring of natural stands is as important, and MPAs could take the lead in developing appropriate simple long-term methods.