# Climate change study on Majuro Atoll, Marshall Islands

***Climate change and its possible impacts on coastal fisheries resources are well documented. However, no one knows what the scale and intensity of the changes will be or the degree to which these changes will affect people's lives. Monitoring activities are the only means of detecting changes in marine and fishery ecosystems.***

For the first time this year, SPC is implementing the "Vulnerability and adaptation of coastal fisheries to climate change" project, which is funded by the Australian Agency for International Development. The aim of the project is to assist Pacific Island countries and territories in designing and field-testing a monitoring programme that can be implemented by countries themselves over the long term. The pilot study will identify areas that countries need to address when developing long-term climate change monitoring programmes, and will determine whether changes are occurring in the productivity of coastal fisheries and whether these changes are caused by climate change or other impacts such as fishing, pollution and sedimentation.

A set of monitoring methods was selected during a workshop in April 2010 on the "Vulnerability and adaptation of coastal fisheries to climate change: Monitoring indicators and survey design for implementation in the Pacific". These methods include monitoring water temperature using temperature loggers, fish and invertebrate resource assessments using SPC resource assessment protocols, and habitat assessments using photo-quadrats. Five countries were selected for this pilot study: Marshall Islands (Majuro), Tuvalu (Funafuti), Kiribati (Abemama), Papua New Guinea (Manus) and Federated States of Micronesia (Pohnpei). These countries were selected based on their proximity to the equator where there is likely to be an increase in the intensity of seawater surface temperatures. In addition, these sites already have fish, invertebrate and socioeconomic data collected by the Pacific Regional Oceanic and Coastal Fisheries project, as well as from the Pacific Islands Applied Geoscience Commission multi-temporal image comparisons, and SEAFRAME gauges.

*Maria conducting a photo-quadrat survey.*

In April this year, two SPC Coastal Fisheries staff (Maria Sapatu, Pacific Islander attachment and Kalo Pakoa, Fisheries Scientist – Invertebrates) were in the Marshall Islands to initiate monitoring by conducting a baseline assessment. For reasons of cost and ease of follow-up monitoring by the trained team, Majuro Atoll was selected as the monitoring site. The team consisted of seven participants from the Marshall Islands Marine Resource Authority, Marshall Islands Environmental Protection Agency, College of the Marshall Islands, and the Marshall Islands Conservation Society.

Background information on the climate change project and on methodologies and materials used for monitoring the benthic environment was delivered at the start of the training. Additional information was given on data entry protocols, quality assurance of data, storage and analysis using the climate change online database. In the field, trainees learned how to lay a transect line and photograph quadrats using a special frame that allows divers to take photographs one meter above the substrate and to record the position of each photo taken at every meter along the transect line using a GPS.

Two stations of photo-gradrat samplings were completed at Laura, on the western side of Majuro Atoll, at the lagoon reef flat and reef front, totalling 18 photo-quadrat transects altogether. The photos will be used to produce habitat baseline information for the western side of Majuro. A similar sampling will be completed in a follow-up survey in May on Majuro's eastern side. The invertebrate resource baseline assessment and preliminary results of the assessment in Majuro are covered in a separate article on sea cucumber resources (see p. 4, this issue).

*Members of the Marshall Islands training team.*

The first part of the training was an introduction for the trainees leading up to the second stage of training planned for May. In the second training, temperature loggers will be deployed at Laura, two stations of photo-quadrats will be completed on Majuro's eastern side, and a baseline assessment of finfish resources will be made. The follow-up climate change work will be led by Maria Sapatu while the finfish resource baseline assessment will be led by Being Yeeting, SPC's Reef Fisheries Scientist (finfish).

**For more information:**

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**The photo-quadrat monitoring method**

A photo-quadrat transect is one where a diver uses a typical quadrat frame and measuring tape, but in addition, takes a photograph at every meter along the transect so that the benthic environment (e.g. live coral) can be monitored over time. The length of the measuring tape, and the area and height of the quadrat frame varies depending on the monitoring focus. For the SPC Climate Change monitoring project, transects are 50-meters long on a selected area of the sea floor. The photographed area (~0.25 $m^2$) is taken from a height of about 1 m.

About 1,800 photos will be taken at each pilot site: two stations in a managed area and two stations in an open-to-fishing area. Within each of these stations, three, 50-meter-long transects are laid out in three different reef zones (coast or fringing reef, back reef and outer reef) at depths of 5–15 m. The location of each photograph is recorded in track mode and coordinates of the start and end point of each transect are recorded using a global positioning system for mapping purposes and for re-surveying the same locations. It is planned to repeat the full operation every second year.

Habitat photographs are then analysed using SPC software (available online at: http://www.spc.int/CoastalFisheries/CPC/BrowseCPC, see picture), similar to the Coral Point Count (CPCe) analysis software by Kohler and Gill (2006)[1]. This software automatically creates five random points on the downloaded photographs (see picture) for which the researcher must identify the type of substrate by genus level. Results are then summarised in an MS Excel table, averaged by transect/category (genus of corals, algae, etc.) and grouped by class (live coral, dead coral, algae, etc).

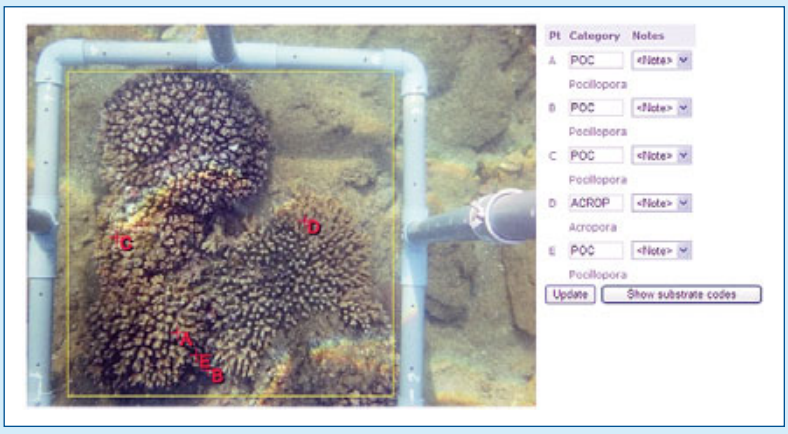


*Photo-quadrat showing the five randomly selected points (A, B, C, D, E) that must be identified.*

This type of monitoring method presents several challenges:

- Bad visibility and high turbidity of some areas may make details in photographs difficult to see.
- Strong wave action may make it difficult for divers to remain steady when taking pictures.
- The relief of the coral reef may make it hard to stabilise the quadrat frame.
- Depth (5–15 m) can make it very difficult to notice whether the camera and GPS are malfunctioning; double-checking this before starting each dive is very important.

[1] Kohler K.E. and Gill S.M. 2006. Coral Point Count with Excel extensions (CPCe): A Visual Basic program for the determination of coral and substrate coverage using random point count methodology. Computers and Geosciences 3(9):1259–1269.