REEF FISHERIES OBSERVATORY

Staff of the coastal component of the EU-funded Pacific Regional Oceanic and Coastal Fisheries Development Programme (PROCFish/C) and the Coastal Fisheries Development Programme (CoFish) continued writing site reports as well as conducting specific survey work at the request of member governments. The programme lost two staff members due to a lack of funding. Ferral Lasi (Fig. 1), who worked with the programme for three years as a Reef Fisheries Officer (invertebrates), was an integral member of the invertebrate team who conducted survey work and training in nine of the 17 participating countries and territories. His input during the remainder of the project will be sorely missed. Ferral has moved back to the Solomon Islands, where he hopes to complete a second master's degree with a focus on fisheries economics. The PROCFish/C and CoFish staff wish Ferral all the best in his future endeavours.

Aliti Vunisea (Fig. 2) worked for three years with PROCFish/C as a Community Fisheries Scientist. Aliti is no stranger to the region, and in this position she conducted survey work in seven of the 17 participating countries and territories. Although she will be greatly missed by the project team, Aliti will not be leaving SPC, as she has been recruited as the Human Development Programme Adviser for SPC's Pohnpei Office. The PROCFish/C and CoFish team wish Aliti well in her new position.

Figure 1 (left): Ferral Lasi, former Reef Fisheries Officer (invertebrates) with PROCFish/C.

Figure 2 (right): Aliti Vunisea, former Community Fisheries Scientist with PROCFish/C. Aliti now works as SPC's Human Development Programme Adviser in Pohnpei, Federated States of Micronesia.

Two staff recruited to work on country reports

Two staff have been hired on short-term contracts to work specifically on compiling and editing country reports. Céline Berre (Fig. 3) was hired on an eight-month contract to compile individual site reports into a complete report, identify missing data, format and lay out the reports, and incorporate any editorial changes. Céline has developed a style sheet and compiled and formatted reports for French Polynesia, Wallis and Futuna and Niue, which are now ready for editing. She has also worked to finalise the report for Nauru. We welcome Céline to the team and look forward to working with her in the coming months.

We also welcome Sarah Langi who has been hired on a six-month contract to edit country reports, as well as write executive summaries for each report. Sarah began work on 1 June and is currently editing the reports for Vanuatu, Nauru and Tuvalu. The team looks forward to working with Sarah and providing input on and clarification of her queries as she edits.

Figure 3 (left): Céline Barre will work with the programme for eight months compiling, formatting and laying out country reports. Figure 4 (right): Sarah Langi will work with the programme for six months editing country reports and writing executive summaries.

Trochus and sea cucumber surveys around Epi Island, Vanuatu

Trochus and sea cucumber resource surveys were conducted in five sites around Epi Island in Vanuatu during April 2008 (Fig. 5). The government of Vanuatu requested assistance in training local officers in survey work. Epi Island is one of several known trochus shell production areas in the country, and is where community-based management systems regulate the area's trochus and sea cucumber fisheries. However, no resource assessments have ever been conducted around the island and no information is available on the status of these resources or on the socioeconomic aspect of communities and their relationship with reef resources. Despite the existence of traditional customary marine tenure systems, which are practiced by communities and reef owners around Vanuatu, commercial reef fisheries (e.g. trochus and sea cucumber) have disappeared from many reefs around the country.

This survey work is valuable to Vanuatu's Fisheries Department, which is interested in knowing the present status of marine resources and community management systems so that they can make informed management decisions at the national level. In addition, local fisheries officers were trained in regional invertebrate survey techniques, which are being refined by the PROCFish/C and CoFish project. Staff from these projects will conduct similar trainings in other countries.

The PROCFish/C team consisted of Kalo Pakoa and Ferral Lasi, and Sompert Rena from Vanuatu Fisheries Department's Research and Aquaculture Section and Jason Raubani from the Coastal Fisheries Section. The socioeconomic component of the survey was conducted by Vanuatu Fisheries Department staff Tony Taleo and John Mahit, with advice from the PROCFish/C socioeconomist, Mecki Kronen. Socioeconomic surveys were conducted two weeks prior to resource surveys. Funding for field surveys was provided both by PROCFish/C and an FAO-funded mini-project with Vanuatu's Fisheries Department.

Reef environment

Epi Island has narrow fringing reef platforms (50–100 m wide) in

Figure 5 (top): Epi Island survey sites.

Figure 6 (bottom): This Epi Island reef, shallow and partly exposed at low tide (left), drops abruptly to five metres with no reef slope zone (right).

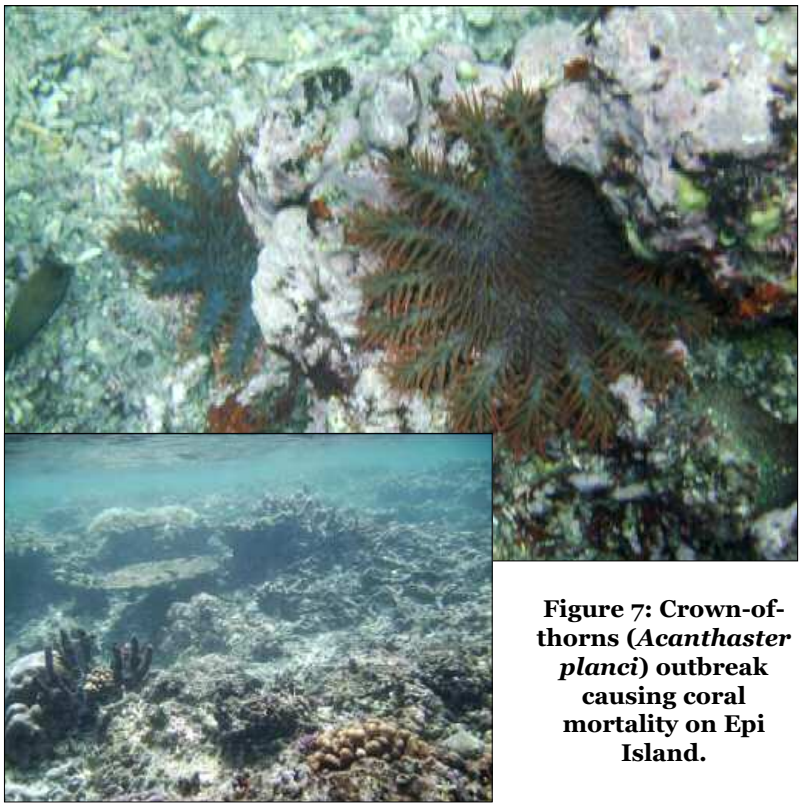

Figure 7: Crown-of-thorns (*Acanthaster planci*) outbreak causing coral mortality on Epi Island.

all the sites assessed (Fig. 6). These reef platforms drop off abruptly to around five meters (Fig. 6) to a mixed sand-rubble bottom, provide suitable habitat for trochus, which are collected by islanders walking the reefs at low tide or snorkelling in shallow water.

The general status of corals was poor at Lamen Bay, Ponkovio, Burumba and Mavelau (<20% coverage). A major crown-of-thorns (*Acanthaster planci*) starfish outbreak was recorded in these four sites (Fig. 7), with recent predation moving westward along the northern tip of Lamen Bay. Coral coverage was better (40–50% coverage) at Mapuna (NE) and the southern section of Mavelao (SW at Valesdir). River run-off from recent heavy rains contributed to sedimentation and poor visibility.

Preliminary findings

Invertebrate diversity and abundance was generally low at all five sites. Only nine out of 18 commercial sea cucumber species were recorded. Two giant clams (*Tridacna maxima*, and *T. squamosa*) and three species of turban snails were also recorded. In addition to fishing impacts, unsuitable habitat also limits the numbers of this invertebrate species. Trochus numbers varied across the five sites. Ponkovio and Burumba had higher numbers due to the relatively effective traditional management systems enforced by both communities. Both small and larger shells were recorded (Fig. 8), and Burumba had relatively larger and older shells compared with Ponkovio, which had relatively young shells. On the whole, however, trochus resources in all five sites were depleted and present stocks are not sufficent for continued fishing. In addition, the

Figure 8: Larger adults and juvenile trochus present at all survey sites.

presence of juveniles at all sites is indicative that with sufficient time, the resource could recover. The nine sea cucumber species recorded occured in very low densities. High-value black teatfish (*Holothuria nobilis*) and medium-value greenfish (*Stichopus chloronatus*) and *Actinopyga mauritiana* were present in moderate numbers. Apart from Lamen Bay — where the reef habitat is relatively well suited for sea cucumbers — the other sites had very few reef systems that were suitable for supporting a diversity of sea cucumber species.

Community meeting

In a debriefing meeting at the end of the surveys, chiefs and village elders from the five survey areas learned for the first time about the status of their trochus and sea cucumber fisheries. Despite the communities' active traditional management systems (mainly through tabus), the poor status of these fisheries raised serious questions among the elders regarding the effectiveness of traditional management systems. Issues highlighted by chiefs and elders at the meeting included a weakening power to enforce tabus. Too many clans are enforcing too many parcels of reef, compared to the past when only the paramount chief enforced such laws. This has greatly diminished community solidarity, thus contributing to the loss of power of tabus. Also highlighted was the lack of national harvesting controls. Communities fish whenever they desire, and shell buyers buy year round. This has contributed significantly to the creation of many smaller clan-controlled reefs, thereby further weakening the *tabu* system. Village elders stated that for their customary marine tenure systems to be effective, the national government needed to set harvesting seasons by province or by island.

Fisheries staff training

Local trainees Jason Raubani (Fig. 9) and Sompert Rena enthusiastically participated in the survey training and have learned the skills needed to conduct a survey on their own. Both officers are involved in various resource assessment activities, including the Japan International Cooperation Agency (JICA) trochus and green snail seeding project, trochus transplantation, coral reef monitoring, aquarium fish and sea cucumber assessments. The skills they gained will be used to conduct similar standardised resource surveys in other areas of Vanuatu.

Figure 9: Local counterpart Jason Raubani conducting a survey.

Four sites in Tonga revisited for socioeconomic surveys

Socioeconomic and finfish resource surveys were initially conducted in six sites in Tonga in 2001/2002 (see Fig. 10) under the (then) DemEcoFish project. The survey was a pilot study under the European Union-funded PROCFish/C programme. Because certain survey approaches have changed, four Tongan sites were revisited (Fig. 10). The Tongatapu socioeconomic surveys (conducted in April 2008) included 16 households in Ha'atafu and Manuka. Socioeconomic surveys on Ha'apai (conducted at the end of May 2008) included 20 households on Lofanga, and 27 households in Koulo. A summary of the 2008 socioeconomic

survey and a first comparison of results with the 2001/2002 survey are presented, using Lofanga as a case study. PROCFish/C staff Aliti Vunisea and Mecki Kronen conducted the surveys in Tongatapu and Ha'apai, respectively.

The programme thanks Tonga's Fisheries Department for its support and cooperation, and particularly acknowledges the following people: 'Ulunga Fa'anunu, Deputy Secretary for Fisheries; Siola Malimali, Fisheries Officer; Mele Makasini, Community Section; Martini Finau, Aquaculture Section; Poasi Fale Ngaluafe, Aquaculture Section; Fina Vili, Fisheries Officer Ha'apai; Fanueli Tongaonevai, staff of Ha'apai Fisheries; and all village chiefs and people of Manuka, Ha'atafu, Koulo and Lofanga for their patience and cooperation in answering all our questions.

Lofanga village is the sole community on Lofanga island in the Ha'apai group. The island is accessible only by boat, and a typical trip, weather permitting on a 4.5–6 m wooden skiff with a 30 hp outboard, takes between 1.5 and 2 hours from Pangai, the centre of the Ha'apai group (a distance of 20 km). Lofanga belongs to the crown prince Tupouto'a, who will be the crowned King of Tonga in August 2008. The crown prince also owns a small piece of land at Hihifo, a settlement attached to Pangai on Lifuka.

Lofanga has an area of about 1.4 km^2, and is mostly used for growing crops. Agricultural produce comprises the majority of goods transported and sold at the Pangai market. There are hardly any alternatives to fisheries for income generation. In fact, 70% of all households derive their primary income source from fisheries. This trend contrasts with the 2001/2002 situation, where hardly any households derived income exclusively from fisheries. Agricultural produce represented a very important source of income, and handicraft production complemented income in 2001/2002. Today, the market situation on Pangai has changed. Fuel prices for boat transport have increased, and the importance of agricultural production is more for subsistence matters rather than for income. Cash income is required to cover average annual household expenditures of USD 2,300, plus social and family obligations. Remittances from family members living overseas are important as they provide from USD 770 per year to 75% of all Lofangan households. The proportion of households benefiting from remittances was found to have almost doubled from the 2001/2002 survey.

Very little had changed regarding the (predominantly) non-commercial exchange of fish and invertebrates among community members. Fish for sale mainly go to markets at Pangai and Ha'apai, with the occasional shipment to Tongatapu.

Results show that while 80–85% of all households consumed fish that they caught themselves (with 1–2 fishers per household), or that they were given, another 15–20% purchased fish. Invertebrates were not commercially purchased — in 85% of all cases they were caught by a household member, and in about 65% of all cases they were given by someone outside the household.

While the population has declined by about 14% since 2001/2002, total subsistence demand for fish has decreased even more. Today, it is estimated that Lofangans consume about 12 mt of fresh fish annually. Other food items, such as canned fish, have become increasingly more important in everyday nutrition. Lofangans consume an additional 21 kg of

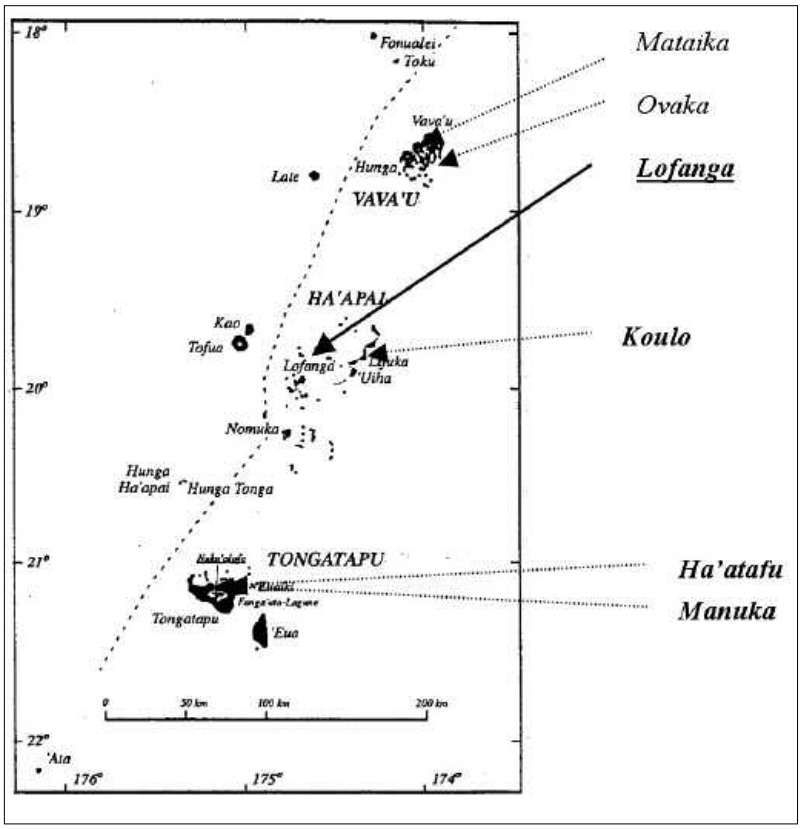

Figure 10: Location of DemEcoFish and PROCFish/C sites.

canned fish per capita annualy, corresponding to a total of about 4 mt/year.

Women generally were not involved in finfishing, although the 2008 survey revealed that the women on Lofanga specialise in the collection of a few invertebrates. Octopus, for example, is not only a delicacy for home consumption, also it is also cleaned and hung in trees to dry (Fig. 11) for later sale on the mainland.

Lofanga's fishermen catch more fish for sale than they do for home consumption. In fact, the relationship is widening in favour of sale. The recent increase in oil and fuel prices may add to the necessity to compensate with bigger catches per trip.

Invertebrate collection is mainly done for home consumption, and is mostly done by women. Major species collected on reeftops are *elili* (*Turbo* spp.), *feke* (*Octopus* spp.), and giant clams. Dried octopus and giant clam meat are sold by women on Ha'apai for additional income. Men sometimes collect invertebrates such as lobsters or giant clams while spear diving for finfish.

Figure 11: Octopus drying on Lofanga Island.

Trochus surveys in Kosrae and Pohnpei, Federated States of Micronesia

Following an initial request from the Director of the Kosrae Island Resource Management Authority (KIRMA) in late 2007, the government of the Federated States of Micronesia (FSM) requested technical assistance from SPC to assess trochus stocks around Kosrae and Pohnpei, and to train local counterparts in survey methodologies. Two Co-Fish Reef Fishery Officers — Kalo Pakoa and Emmanuel Tardy — were assigned to this project, with fieldwork in Kosrae undertaken from 2–9 June, and in Pohnpei from 11–19 June. The primary goals of the mission were to provide an initial assessment of trochus stocks, train the local team in PROCFish survey techniques, and provide advice for future management arrangements for trochus.

The CoFish team acknowledges and thanks the following people who assisted and/or worked with the team during the surveys. In Kosrae, Simpson Abraham, Director of KIRMA and the field team Steven Palik, Cornelius Nena, and Maxton Nithan, KIRMA; and Bruno Ned, Kosrae Department of Resources and Economic Affairs. In Pohnpei, Donald David, Director of Pohnpei's Marine Development Division and Valentine Martin, Deputy Assistant Secretary, Marine Resource Units of the Department of Resources and Development; and the field team Dave Mathias and Scotty Malakai, Pohnpei Forestry and Marine Conservation Division; Pelson Moses, Pohnpei Marine Development Division; Allen Marcus, Chuuk Department of Marine Resources and Damasus Mailing, Yap Marine Resources Management Division. Thanks also to SPC's Northern Regional Office for assisting, especially Amena Yauvoli.

Surveys in Kosrae

Kosrae is a high mountainous island surrounded by coastal mangrove swamps and a fringing reef system. Reefs along the east and south coasts are narrow, but wide along the west and north coasts. The reef flat zone on the west and north is mostly exposed at low tide. The reefs all around the island are favourable for adult trochus (shallow outer reef). Large areas of back reef, especially on the northwest, north and east sides of the island, are favourable for the settlement of juveniles.

Trochus niloticus, or *takasangai* in Kosraean, was introduced to the island by the Japanese administration, perhaps from Pohnpei, around the late 1930s. It is not clear when the first harvest was made but harvests have occurred since the 1970s. Very little information is available about this resource in Kosrae. It is reported that a 10-year fishing closure was instituted around 1995/1996. In 2007, fishing was opened for a period of five days when a harvest of approximately 26 mt was made and sold for USD 78,255. The trochus fishery represents one of only a few income earning options for the island's 9,000 people. While there is a high local interest in the fishery, there is a lack of data on resource status. The results of this current assessment will constitute the baseline for reviewing regulations and future management decisions. A new management plan and harvest regulations will be developed based on the results of this assessment.

The survey covered a large amount of Kosrae's coastline, and comprised 49 stations of scuba and/or snorkel transects, consisting of 24 mother-of-pearl transects (timed swims), 18 reef front searches, 2 shallow water reef benthos transects, 4 reef front search walks as shown in Figure 12. In addition, a single mother-of-pearl search was undertaken to locate trochus aggregations.

Trochus niloticus was present in moderate to large numbers around the island, with the highest densities recorded at the eastern reef of Lelu, Tafunsak in the north, and Okat and Walung in the west. In general, trochus were mainly found in deeper waters (5–10 m), and the stock consisted predominantly of larger, older shells (>100 mm). For all survey sites, the full size range was found, including juveniles, which is promising for future recruitment. However, the majority of trochus were larger, older adults. Trochus were found to aggregate more in pockets of dead coral bottoms (Fig. 13) with epiphytic algal growth, rather than in areas of high live coral growth.

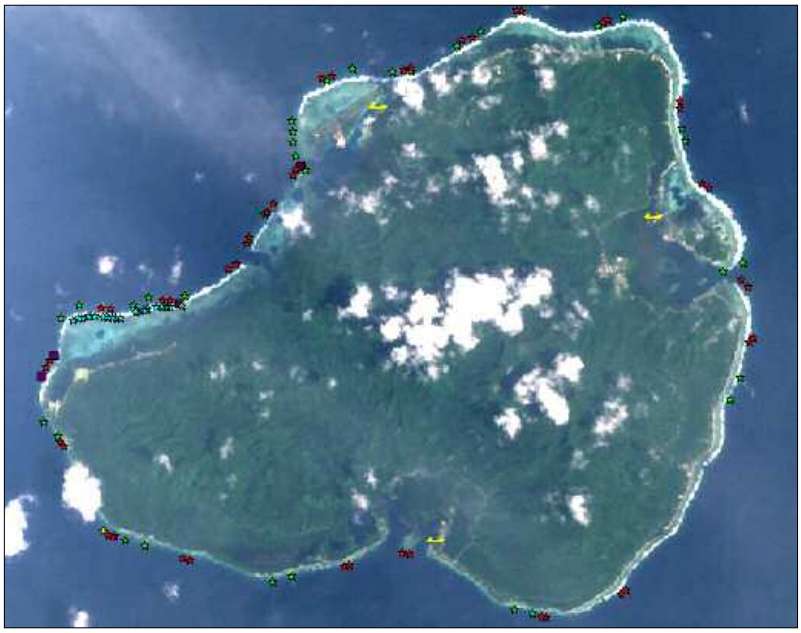

Figure 12 (top): Survey coverage (stars and squares) around Kosrae Island.
Figure 13 (bottom): *Trochus niloticus* in a crevice.

Other invertebrate species included eight commercially valuable sea cucumbers — dominated in numbers by greenfish, *Stichopus chloronotus*, and surf redfish, *Actinopyga mauritiana* — one giant clam (*Tridacna maxima*), one turban snail *Turbo argyrostomus* (*kaweng*), and a spider conch (*Lambis truncata*) (*ful mula*). *Tridacna gigas* is extinct from the island and old shells were observed from the dredged materials along the Lelu Harbour jetty. *Tridacna derasa* is being farmed for re-introduction purposes. Kosrae has a very healthy live coral cover with some areas reaching 80% coverage. However, crown-of-thorns (*Acanthaster planci*) outbreaks were detected in two pockets of reef at Tafunsak (north) and in the outer reefs at Walung (west) in 6–12 m depth.

A presentation of preliminary survey findings was made to the Governor of Kosrae, Robert Weilbacher, who was especially interested to know if another open season for trochus would be possible in the near future. The answer was "no answer just yet" until survey data have been analysed. Only then can advice on harvesting be provided. More importantly, the crown-of-thorns outbreak is considered to be an urgent issue, and early clean-up work is recommended while their numbers are still manageable.

Surveys in Pohnpei

A well developed reef system comprising mangrove forest, extensive fringing reefs, sea grass beds, lagoon and barrier reefs exist in Pohnpei. The lagoon encircling most parts of the island contains numerous patch reefs and some 15 passage breaks. An extensive barrier reef about 3 km offshore encircles much of the island. Trochus are found outside the barrier reef and reefs inside passes where suitable habitat exists.

Trochus niloticus was introduced to Pohnpei by the Japanese administration in 1939 from Palau. First harvests were transplanted to two of Pohnpei's outer islands, Sapwuafik and Mwoakiloa atolls. In 1958, 16 trochus sanctuaries were established around Pohnpei proper, and the first harvest of 65 mt was made in 1969. Afterwards, 18 harvests were made in Pohnpei proper between 1969 and 1994. Today, seven of the trochus sanctuaries are actively enforced, along with two recent grouper spawning aggregation sites at Kehpara and Kepidau Pilen. Current trochus harvest control measures include a minimum basal shell width of 3 inches (7.6 cm) and a maximum size of 4 inches (10.2 cm), a shorter harvest season (six hours), and a harvestable quota based on assessment.

The recent re-structuring of Pohnpei's fisheries sector has resulted in the fisheries management section — the section traditionally in charge of trochus management — moved to the Department of Forestry and Marine Conservation. The new changes created confusion about the enforcement of existing harvest regulations, and because the Fisheries Department was not included in the new arrangements, poaching occurred within the sanctuaries, the open season was extended, no surveillance took place, and no catch monitoring was undertaken. According to the Chief of the Marine Development Division, some 200 mt of shell may have been collected in the 2004 season. The quota allocated was 100 mt. The current resource assessment survey is essential to providing an accurate picture of trochus numbers for management purposes. Last year's harvest (2007) of 18 short tons was made at Sapwuafik Atoll, one of Pohnpei's outer islands, and sold to a local buyer at USD1.65 a pound ($3.64/kg) of cleaned shell (i.e. no meat).

In total, 63 stations of scuba and/or snorkel transects were made, consisting of 26 mother-of-pearl transects (timed swims), 22 reef front searches, and 15 shallow water reef benthos transects (see Fig. 14). The data collected are sufficient for providing an overview of the resource status.

Trochus were found at all survey stations at 0–10 m depth.

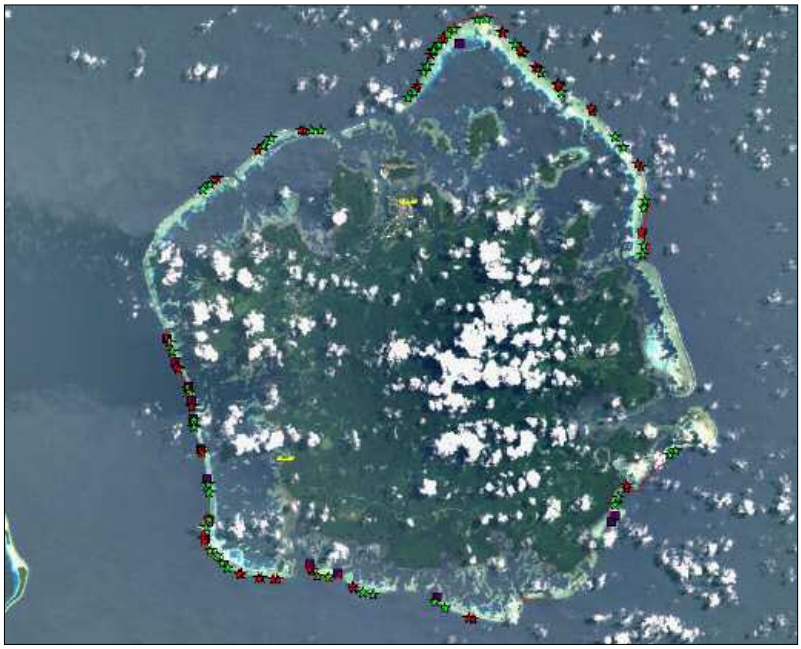

Figure 14: Survey coverage for Pohnpei.

High aggregations were common all around the island, with regular higher densities in the west and south. A range of sizes was recorded, but in most cases the majority of shells were large (>10 cm) and old. Abundance inside existing sanctuaries does not seem to be much different that found outside the sanctuaries. The relatively high trochus abundance at Pohnpei is an indication of good management efforts since the 2004 harvest.

In addition, five sea cucumber species were present with *Stichopus chloronotus* and *Actinopyga mauritiana* being the most commonly found on the barrier reef. The elongated giant clam (*Tridacna maxima*) was the only giant clam recorded but was found in very low numbers. Other gastropods commonly found included *Turbo argyrostomus*, *Tectus pyramis*, *Dendropoma maxima*, and various species of Cypraeidae, Conidae, and Turbinellidae.

Pohnpei is facing a long-term outbreak of the crown-of-thorn starfish (*Acanthaster planci*) (Fig. 15), which is abundant from the northern tip of the barrier reef, all the way down to the southwest reef at Black Coral Island Sanctuary. Relatively fewer numbers were recorded on south and east facing reefs, but live corals in these areas were not abundant. High numbers of remaining dead coral heads (Fig. 16) at 5–11 m depth, suggest that this outbreak may have occurred several years ago.

Pohnpei is planning a trochus survey for one of its outer islands in July and will be using the new surveying techniques during that survey. Basic survey tools (2 slates and 1 Chainman, a string measure tool) have been provided to the Pohnpei team to assist them with this work.

Preliminary results of the trochus survey were presented at the governor's office. As in Kosrae, a serious concern is whether fishing will remain possible. The team maintained that only proper data analysis will provide the answer. Shell buyers from Fiji and Vietnam, who were visiting FSM in search of raw shell, were also present at the meeting, as well as the manager of SPC's Northern Regional Office, Amena Yauvoli. Crown-of-thorns was reported to be an urgent problem in Pohnpei, and clean-up action was recommended.

Figure 15 (top): A crown-of-thorns starfish feeding on corals is an all too common site in Pohnpei.

Figure 16 (bottom): Dead coral reef in Pohnpei.

First sub-regional underwater visual census (UVC) finfish workshop

The first sub-regional underwater visual census (UVC) finfish workshop was held in Noumea from 16–25 June. Participants included William Saladrau and Tarisi Toroca Shaw from Fiji; Delvin Thoma and Jake Debao from Nauru; and Peter Rex Lausu and Rosalie Masu from the Solomon Islands. Céline Barré from SPC, and a local fisheries scientist, Matthieu Junker, also attended. Four workshops in total will be held.

In PROCFish/C and CoFish projects, training in underwater visual census techniques has been conducted during all in-country fieldwork. However, today, a large number of staff trained in these methodologies have changed activities or positions. Therefore, to ensure local capacity at the country level, this series of workshops has been organised. The objective of these courses is to equip fisheries departments and associate agencies with the tools to undertake underwater assessments and monitoring of finfish resources on their own. A two-person team per country will be trained so that necessary repeated assessments of fish stocks and habitat conditions can be carried out to ensure the sound management of artisanal fisheries.

The first two days of the workshop in Noumea were devoted to theoretical and practical classroom exercises. The following six days were spent on underwater trainings using different methods for identifying fish at the species level, as well as estimating their size and distance from the observer. Trainees dove once or twice a day, practicing the different techniques (Fig. 17). They then spent time discussing their data with the instructor. The dives took place in the shallow waters of intermediate lagoonal reefs off Noumea and nearby areas. Several practice dives focused on describing habitat and on evaluating (quantitatively and qualitatively) the different parameters used to describe environmental conditions. The last day of training was used to explain how the database software is used and to give participants a achance to practice using its different functions: data record and quality check analysis.

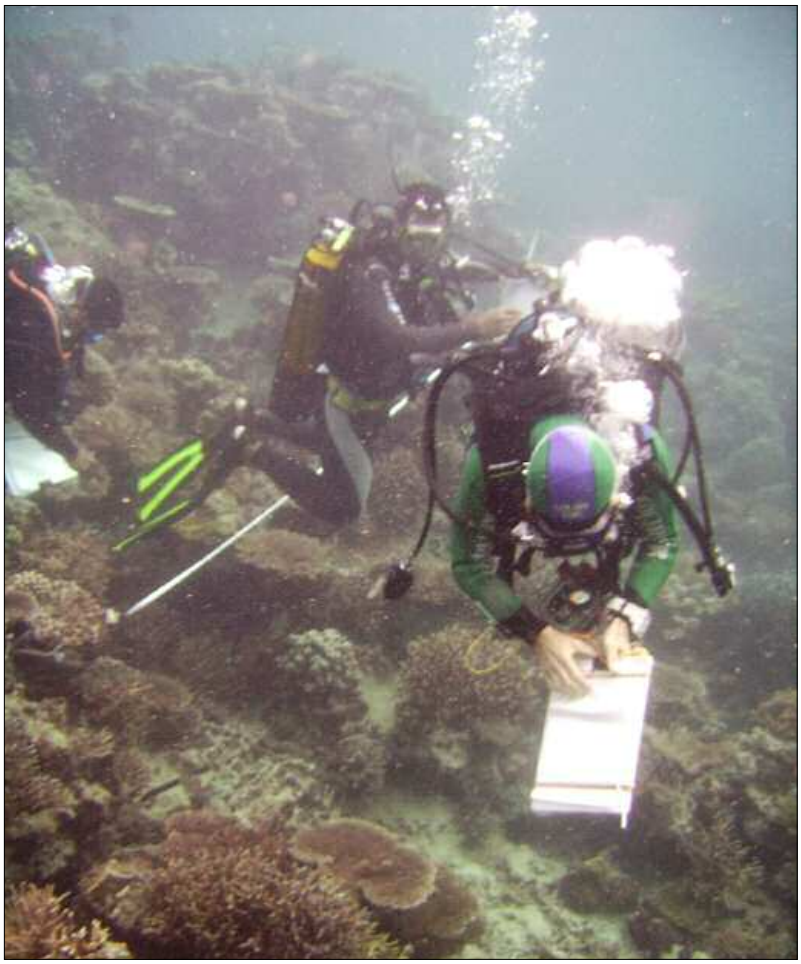

Figure 17: Training dive during workshop.

Regional workshop on the economics of marine protected areas

The PROCFish/C Reef Fisheries Information Manager, Franck Magron, attended a workshop on the economics of marine protected areas (MPAs). The workshop was held in Suva, Fiji from 26–30 May 2008 and was organised by the Coral Reef Initiative for the Pacific (CRISP), the International Union for Conservation of Nature (IUCN), and the Secretariat of the Pacific Regional Environment Programme (SPREP).

This workshop brought together economists and practitioners of marine managed areas (MMAs) from various non-governmental organisations and CROP (Council of Regional Organisations in the Pacific) agencies. These groups discussed the best economic instruments to use (e.g. cost–benefit analyses, multi-criteria analyses, business plans) for establishing and managing MMAs. The workshop was the first step in a continuing process to assess the economics of MPAs and determine future collaborations that could assist in this area.