The WorldFish Center traces its roots back to 1977 when it was established in Manila, the Philippines, with support from the Rockefeller Foundation, as the International Center for Living Aquatic Resources Management – ICLARM. In 1992, the Center became a member of the Consultative Group on International Agricultural Research (CGIAR) and in 2000 the headquarters moved to Penang, Malaysia and ICLARM adopted a new name – the WorldFish Center.

The WorldFish Center in the Pacific

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WorldFish is an autonomous non-profit international scientific research organization. The Center's mission is to reduce poverty and hunger in developing countries by improving fisheries and aquaculture. WorldFish conducts projects with over 300 governmental, inter-governmental and private partners in approximately 50 different countries. The Center receives funding from a wide variety of sources including development banks, foundations, bilateral and multilateral aid agencies.

The WorldFish Center is headquartered in Penang, Malaysia. Offices and field sites are located in Egypt, Malawi and Cameroon (Africa), Bangladesh, Cambodia and The Philippines (Asia), New Caledonia and Solomon Islands (Pacific region).

The Center's research

The Center has achieved international recognition for the quality of its research. Four key areas relating to fisheries policies, management, and food security in developing countries are addressed, namely: aquaculture, inland (freshwater) fisheries, coastal and marine fisheries, policy and trade.

The Center's research in the Pacific focuses on:

- Aquaculture and restocking of high-value tropical marine species
- Coral reef research
- Tropical fisheries stock assessment and modeling
- Fisheries social science (including cooperative governance arrangements)
- Development of relational databases for aquatic resources and habitats
- Scientific advice for maintaining aquatic biodiversity
- Coastal zone management training
- Aquaculture and genetics of freshwater fish species important to developing countries
- Fisheries and aquaculture networks, communication and information.

The Center in the Pacific

The WorldFish Center is committed to assisting the Pacific Islands to increase the productivity of their coral reef fisheries resources on a sustainable basis to improve the well-being of coastal communities through better food security and opportunities to earn more income.

The Center has a strong focus on the Pacific because most of the island nations depend heavily on coral reef and coastal fisheries resources. Coral reefs support a rich variety of valuable animals, including fish, spiny lobsters, sea cucumbers, giant clams, pearl oysters and shells such as trochus and green snail. Traditionally, these animals were harvested at subsistence levels.

More recently, development of lucrative export markets has provided coastal villagers with more opportunities to earn money from coral reef species. These earnings are now an important source of income for many coastal communities. Unfortunately, the transition from a subsistence to a market economy has usually been far from ideal: chronic over-fishing has often occurred and, on many reefs, there are now too few of the most prized animals to sustain reasonable harvests. Rapid increases in human populations, changes

in land use and destructive fishing methods have compounded the problem by degrading some reefs to the point where they can no longer support valuable species. In other words, in some parts of the Pacific, the great benefits that coral reefs can provide are being lost.

Working with partners

The WorldFish Center is working with regional agencies, scientific institutions, national governments, local communities, NGOs and development agencies to find ways to regain and then maximize the productivity of coral reef fisheries. This collaborative research aims

to understand the requirements for healthy and productive coral reef ecosystems; restore damaged habitats; learn how to farm valuable species in a responsible way; restock populations and then manage them to obtain optimal yields on a sustainable basis.

Collaborative research projects

Farming and restocking giant clams

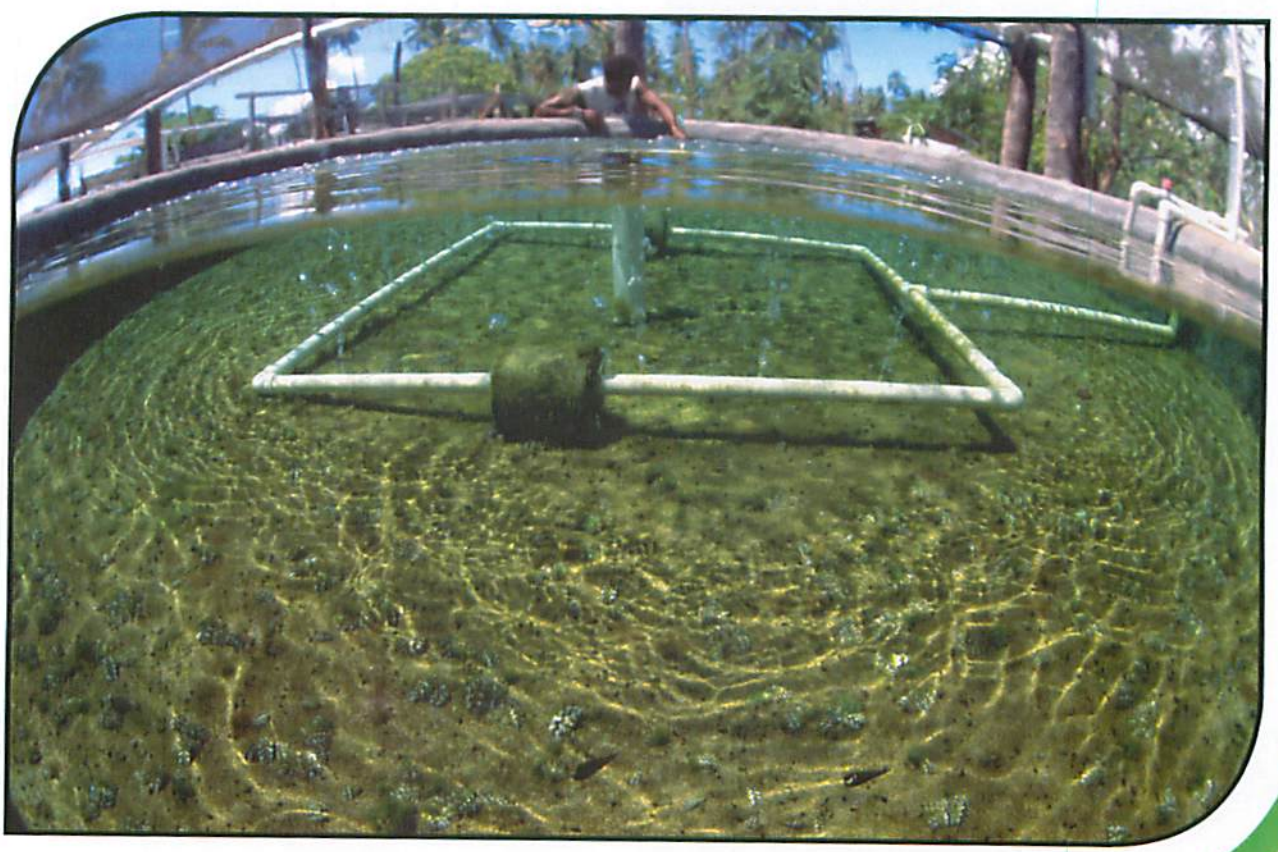
The Center, with James Cook University (JCU), Australia, and the Department of Fisheries and Marine Resources, Solomon Islands, has developed technology for producing giant clams in hatcheries and growing them in simple underwater farms. The research has been supported by the Australian Centre for International Agricultural Research (ACIAR) and the European Union and has demonstrated that coastal villagers can rear the "seed" of five species of giant clams for sale to the marine aquarium trade at a profit. The research team also identified the methods and costs for restocking giant clams on coral reefs to restore depleted or extinguished populations.

Recent research has aimed at reducing the cost of producing seed clams in hatcheries, adding value to cultured clams through enhancement of the mantle color, improving the survival of clams during grow-out, and developing cost-effective ways for linking the restocking of giant clams to farming for the aquarium industry. A cultured brood stock of the largest species of giant clam, *Tridacna gigas*, is maintained for projects involved in restoring this vulnerable species in Asian and Pacific countries.

Culture of blacklip pearl oysters in the Western Pacific

Another collaborative project between the Center, JCU and ACIAR has led to the transfer of technology for catching and rearing wild spat of the blacklip pearl oyster, *Pinctada margaritifera*, from Polynesia to the Western Pacific. The transfer involved overcoming the effects of high levels of nutrients and sediments, and more intense predation, on the juvenile oysters around the high islands of the Western Pacific, and utilized expertise in pearl seeding from the Cook Islands.

A demonstration black pearl farm has been established in Solomon Islands and the methods for spat collection have been passed on to the Ministry of Agriculture, Fisheries and Forests in Fiji and the Ministry of Fisheries in Tonga. Private pearl farms in Fiji have since developed, and the anticipated benefits to local communities, through the collection of oyster spat by the villagers that they sell to the pearl farmer, are being realised. Future research on blacklip pearl oysters will



assess differences in pearl quality from oysters derived from wild and hatchery-reared spat, and perhaps the transfer of hatchery technology for the larger goldlip pearl oyster, *Pinctada maxima*, to the Western Pacific.

Restocking sea cucumbers

The methods for producing one of the most valuable species of sea cucumbers, the sandfish *(Holothuria scabra)*, in captivity were developed in Solomon Islands from 1996-1999 with support from ACIAR and the Canadian International Development Agency (CIDA).

The second stage of the research, learning how to release cultured juveniles so that a high proportion survives, is now underway in New Caledonia with continued support from ACIAR in collaboration with the Northern and Southern Provincial Governments, Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER), the Secretariat of the Pacific Community (SPC) and the French Delegation for the Pacific. This project is expected to deliver major benefits to coastal communities that rely on producing *bêche-de-mer* (processed sea cucumbers) for income.

The success of large-scale production and release of juvenile sea cucumber to restock depleted populations will require an intermediate nursery stage, in either earthen ponds or enclosures in the sea. Future research will examine whether it is possible to mass-produce juvenile sea cucumber in earthen ponds as a shrimp-farming by-crop. As part of a Pacific aquaculture development project funded by ACIAR, the feasibility of using sea cucumber as bioremediation agents for shrimp ponds is being examined.

Capture and culture of postlarval coral reef fish

The harvest of coral reef fish for the tropical marine aquarium trade is a growing industry in Asia and the Pacific. Unfortunately, specimens are sometimes gathered in ways that damage the coral. In the worst cases, fish are collected using sodium cyanide, which can kill the coral and other reef invertebrates. In a recently concluded study, the WorldFish Center, the Australian Institute of Marine Science, the Ministry of Fisheries and Marine Resources, Solomon Islands, and the National Fisheries Authority, Papua New Guinea, have shown that artisanal fisheries can be established to catch and grow the young stages of coral reef fish. By using crest nets the fishers avoid damaging the habitat. This project is supported by ACIAR.

Results show that a wide variety of species can be caught by these methods, and that species of interest to the aquarium trade can be reared quickly to market size on locally available diets. Further research aimed at identifying places where commercially viable numbers of fish can be collected by villagers has commenced, with further support from ACIAR. The methods are being extended to other places in Solomon Islands and will be transferred to other countries in the region.

Sustainable management of sea cucumber fisheries

While the project on restocking sea cucumber will help to accelerate the rate of recovery of overfished sea cucumber populations, a new project in Solomon Islands will address the overfishing problem at its source, by assisting coastal communities to fish their sea cucumber

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resources in a sustainable way. With the support of ACIAR, and in collaboration with the Department of Fisheries and Marine Resources and the Provincial governments, the project will also assist communities obtain better returns for their *bêche-de-mer* in the market place by adopting processing methods that yield high-quality dried product.

Use of marine protected areas to manage coral reef fisheries

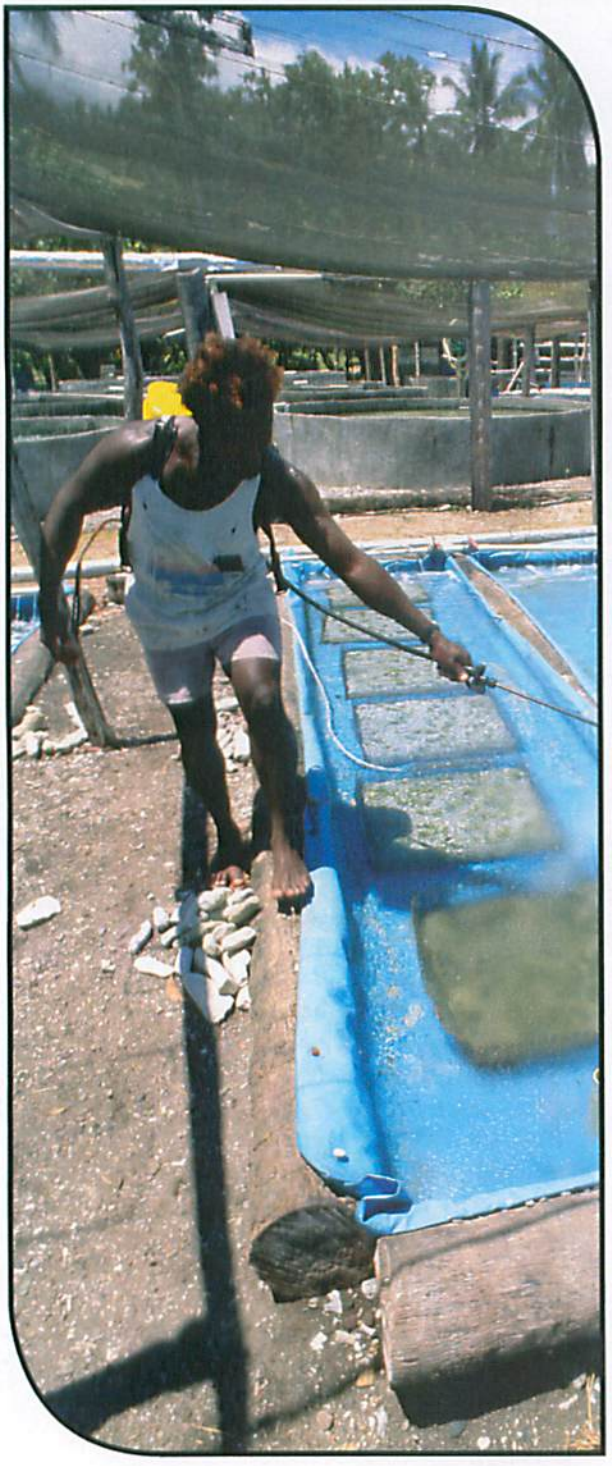
One of the most promising ways of managing multi-species coral reef fisheries for sustainable harvests is to set up marine protected areas to provide a continual source of replenishment for reefs that remain open to fishing.

This form of management is expected to be a success because protection from fishing allows the number of spawning fish to increase and grow to a larger size. As large fish produce exponentially greater numbers of eggs than smaller fish, increased numbers of juveniles should be available to replenish the fishing areas. Importantly, the process of setting up and monitoring a marine protected area can lead to community-based sustainable fishing practices, and these benefits can extend beyond the reserve itself.

These expectations have been tested at the Arnavon Islands Marine Conservation Area (MCA) in Solomon Islands in conjunction with community and government conservation efforts, supported by ACIAR and The Nature Conservancy (a non-government agency). There has been a rapid response to protection from fishing for trochus, but further research is needed to determine how long it takes for the stocks of other commercially important invertebrates to recover in the MCA. Future research will also concentrate on models for distributing the benefits of increased populations in the MCA to surrounding communities.

ReefBase

ReefBase (www.reefbase.org) is a global information system on coral reefs, developed by the WorldFish Center. This online database provides quality data and information on the location, status, threats, and management of coral reefs in nearly 100 coral reef countries and territories. ReefBase serves as the central database for the global Coral Reef Monitoring Network (GCRMN), and provides valuable information services to managers, policy-makers, researchers, conservationists, educators and students around the world.



Coral Reef Maps
ReefBase also features a state-of-the-art Geographic Information System (GIS), providing access to a wide range of coral reef related datasets from multiple sources on interactive maps. Through collaboration in a NASA-funded, multi-partner project on remote sensing of coral reefs, a new generation of base maps of coral reefs are now being developed. These new datasets allow for better integration with reef monitoring data and information at scales more relevant to reef managers. In this way, remote sensing products are helping ReefBase, GCRMN, and its numerous partners to develop coral reef information products with a far greater potential for practical applications.

ReefBase Pacific
In 2005 we plan to initiate a Pacific node of ReefBase, which will be based in New Caledonia. In collaboration with Pacific partners, this regional node will assist in the communication and transfer of scientific information and other data useful in the assessment, monitoring and management of living marine resources in the Pacific.

International Coral Reef Action Network (ICRAN)
Together with the United Nations Environment Programme, the South Pacific Regional Environment Programme (SPREP) and other partners, the Center has received support from the United Nations Foundation to establish a series of demonstration sites on sustainable use of coral reefs in the Pacific and generate information for the sustainable management of reefs.

The ReefBase Project, and the GCRMN, will also contribute to this initiative. Other activities planned for the Pacific include a "Reefs at Risk" analysis with the World Resources Institute, coral reef mapping for each country with the World Conservation Monitoring Centre, and analyses of the value, fisheries and aquaculture production, and policies pertaining to responsible management of coral reefs.

Achievements and impacts

Opportunities to earn income
More than 30 small-scale giant clam farms were established in Solomon Islands and hatchery technology was transferred to private enterprise.

Farming of hard coral by village women has been a direct "spin-off" from the success of village-based giant clam farming.

The transfer of methods for collection of spat of blacklip pearl oyster to Fiji has led to investment in pearl farming. Benefits have flowed to local communities by the sale of captured and on-grown oyster spat to the pearl farms. The demonstration black pearl farm in Solomon Islands has raised awareness of the potential for pearl farming and attracted expressions of interest by the private sector.

The Government of Solomon Islands is planning to develop village-based aquaculture, including pearl farming and giant clams for the aquarium trade, with assistance from development agencies.

Training in marine aquaculture
Several national staff working on projects at the Center and/or on joint projects with Solomon Islands Fisheries Division have received support for postgraduate education in marine aquaculture (two funded by ACIAR, one by AusAID and one by CIDA). National postgraduate students in aquaculture benefit from the sea cucumber restocking project in New Caledonia, where they receive several months of training in sea cucumber aquaculture and grow-out techniques. The Center and ACIAR have been requested to assist fisheries departments in Tonga and Vanuatu with hatchery production of pearls and giant clams.

Sustaining coral reef resources
The Government of Solomon Islands has introduced legislation banning the export of wild pearl oysters, giant clams and the sea cucumber, *H. scabra*, as a measure to promote restoration of natural stocks.

The Future

In response to increased calls from Pacific Island nations for assistance with the development of aquaculture and associated methods for managing their inshore marine resources, the Center, the Secretariat of the Pacific Community (SPC) and the University of the South Pacific (USP), have developed a strategy to continue the development of aquaculture in the region. SPC is the focal point for the strategy, USP provides the education and training necessary to support aquaculture and the Center co-ordinates the applied research required

to underpin its further development. The Center has signed a Memorandum of Understanding (MOU) with SPC that facilitates collaboration on the regional aquaculture strategy and other joint activities on management of inshore marine resources.

Initiatives to improve livelihoods from coral reef fisheries being developed by the Center will assist countries and communities to manage their resources sustainably for future generations.

With the assistance of France, New Caledonia and SPC, and with the support of the New Zealand Ministry of Foreign Affairs and Trade, the Center has established a Pacific Office in Noumea to coordinate all our projects in the region and further strengthen our collaborations in the Pacific.

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