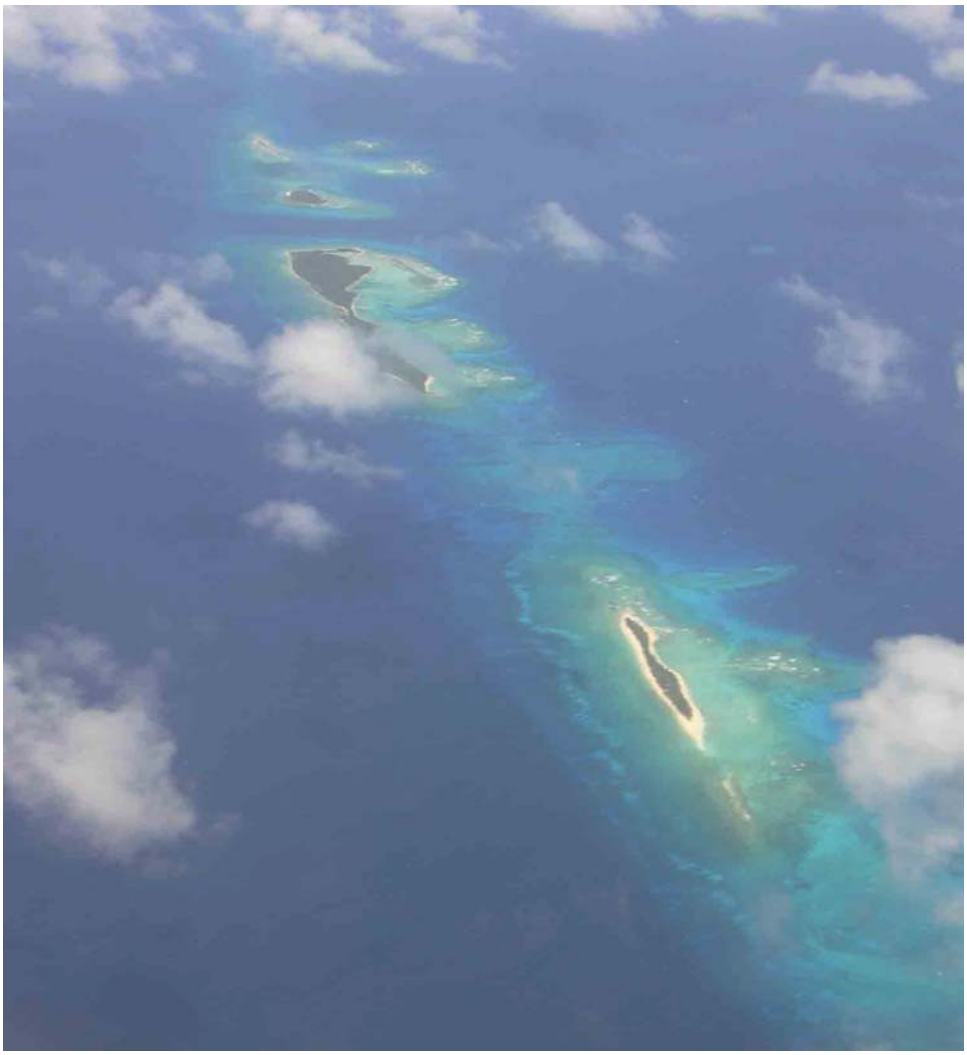
International Marinelife Alliance
Republic of the Marshall Islands

PHASE 1 FINAL REPORT
October 2002 – March 2004

NOAA Coral Reef Conservation Grant Program FY2003



Transforming the Live Reef Food Fish Trade towards sustainability in the Republic of the Marshall Islands through community-based coral reef conservation and fisheries management

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This phase 1 final report describes work completed on the project over 18 months from October 2002 to March 2004, providing a review of accomplishments, adaptations and lessons learned, some of which were reported in the first six-month report. A section in this report entitled **Second six months of project** has been submitted as a second progress report.

Project background

In 2002, IMA's project to transform a destructive live reef food fish fishery in the Marshall Islands, Micronesia (figure 1) was granted $50,000 from NOAA's Coral Reef Conservation FY2003 grant program. The overall goal of IMA's Marshall Islands program has been the conservation and sustainable use of the Republic of the Marshall Island's (RMI's) coral reef ecosystems and resources in partnership with Marshallese stakeholders. IMA started working in the Marshall Islands in 1999 following the invitation of the Marshall Islands Marine Resources Authority (MIMRA) to help assess the live reef food fish trade (LRFFT) that had been operating since 1997 in the remote northern atolls (figure 2).

Figure 1 *The Marshall Islands' location in the Central Pacific, 8°N of the Equator*

At that time, the Marshall Islands Overseas Development Company (MIOD) fishing company was found using cyanide, closed down by government, their vessel Ocean Glory confiscated and another foreign company Pacific Marine Resources and Development Company (PMRD), registered in Majuro and employing Filipino fishermen, operated until 2003. A number of aquarium trade operators were also apparently using cyanide in the Marshalls. Cyanide destroys the reef ecosystem and its use in squeeze bottles by divers has frequently been associated with the trades in live reef fish especially in SE Asia. In the Philippines, IMA tested over 48,000 fish for cyanide between 1993 and 2001, finding that 25% of the aquarium fish and 44% of the live groupers and humphead wrasse exported to Hong Kong for the restaurant trade were caught using cyanide (Rubec et al 2003). There was thus considerable reason for concern about the live food fish operation in the Marshall Islands, which had been proceeding largely without any monitoring, management or regulation.

Even where cyanide is not being used, the LRFFT fishery has depended upon other destructive practices such as fishing grouper spawning aggregation sites, intensively targeting fish of any size class (especially 1 kg. "plate-sized" juvenile fish) and the humphead wrasse with biological characteristics that make it highly vulnerable to over exploitation and extirpation (localized extinctions). As a result of such practices, overfishing has been the ubiquitous outcome of this industry, which depends upon finding new, un-fished reefs, creating a pattern of exploitation across the Indo and Western Pacific of moving from country to country and reef to reef. In the Pacific, LRFFT fishing was banned in Palau, parts of Vanuatu and Tonga, and foreign companies had started trials and failed in part because of early overfishing in Fiji, Kiribati, Solomon Islands and PNG. Operators pay fees but very little other benefit accrues locally since foreign fishermen are usually employed, leaving local fishermen and reef owners with a legacy of overfishing on reefs that are often important for local subsistence, stock replenishment and biodiversity purposes.

With these concerns in mind, in 2002 IMA and key local partners proposed this project for NOAA funding to assist communities and government agencies in the Marshall Islands to evaluate, reduce and ultimately eliminate destructive practices associated with the LRFFT and, if feasible, to transform the trade towards sustainability.

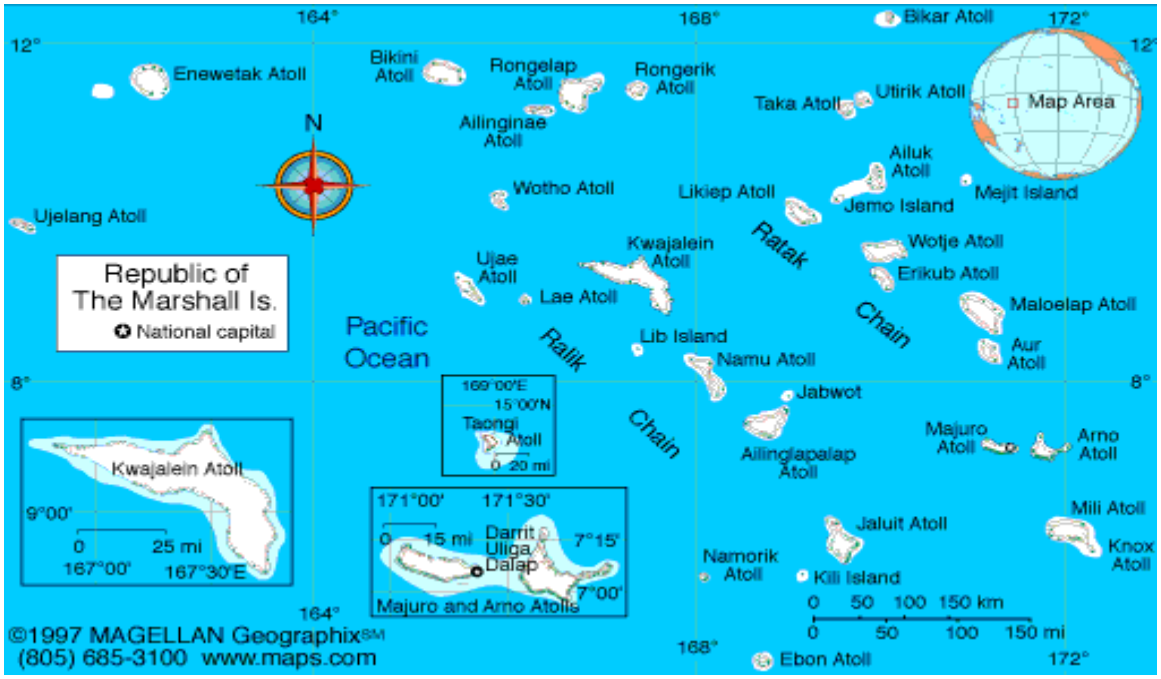


Figure 2 The 34 atolls of the Marshall Islands. Since 1997, LRFF harvested on Ujelang, Enewetak, Likiep, Ailuk, Maloelap, Aur, Namu, and Mili Atolls.

Given the intrinsic vulnerability of target species such as the humphead wrasse and an apparent dependency on destructive techniques such as fishing grouper spawning sites and juvenile reef fish, the project also set out to question whether or not this industry can be practiced sustainably at all, especially given management and monitoring capacity constraints in a country such as the Marshall Islands and the challenges of regulating a fishery in such remote locations as the northern atolls of the Marshall Islands.

The project was conscious of the importance of advocating strongly for the adoption of a precautionary approach to fisheries management and of encountering possible opposition (the door being slammed shut in our faces), with the possibility of having to call for a government moratorium on the industry if management goals seemed unlikely to be achieved. By not pursuing such an approach, the destruction of important reef ecosystems in the Marshall Islands would be allowed to continue with the all too familiar outcomes of overfishing, loss of biodiversity and irreversible destruction of the resource base.

More effective assessments of the practices and impacts of the LRFFT in the Marshall Islands were needed, plus a project that could help build management capacity and community awareness. Three project objectives were therefore identified:

Participatory and Scientific Assessments: To collaborate with Marshallese communities, the College of the Marshall Islands (CMI) and government agencies in the assessment of the LRFFT, its socio-economic and environmental impacts, degree of management and linkages to subsistence fisheries, producing a series of participatory management recommendations for building local capacity to eliminate the destructive aspects of this trade, sustain reef fisheries and protect RMI's coral reef ecosystems.

Awareness. To raise the awareness of the Marshallese about destructive fishing practices, the LRFFT and coral reef conservation in general to the extent that communities and governments in islands where the LRFFT has been practiced are demonstrating more informed decision-making about sustainable use and conservation of their coral reef ecosystems.

Capacity Building and Implementation. To help the Marshallese build and maintain community and government capacity for marine conservation, through the development and implementation of local and national management plans and initiatives for the LRFFT.

Two major stakeholder groups were identified - government and communities – focal points for IMA's awareness and capacity building programs.

The award period for the project was October 1, 2002 through March 31, 2004. Funds arrived in December 2002 and IMA was able to intensify its work in the Marshall Islands.

Discussion of early project work

The project issued a six-month progress report in June 2003. The initial assessment found that the live fish operations were centered on Enewetak atoll in the far north west of the chain of islands over a thousand miles from Majuro, the administrative center. Fish cages were anchored by the company inside the lagoon off Japtan Island (figure 3) holding thousands of groupers, coral trout and humphead wrasse caught on Enewetak's coral reefs and shipped periodically to Hong Kong. At the time of shipment, a fisheries officer would arrive by plane from MIMRA in Majuro, to count the number of fish being exported. It is understood that this was used to calculate resource rentals due from the company - Pacific Marine Resources and Development (PMRD). During the first half of the project, MIMRA periodically provided IMA with this data and as the project proceeded a more complete data set was secured allowing more in depth analysis during the second reporting period (discussed below).

Initial analysis showed that in addition to fishing taking place since 1997 on Enewetak, fish were also captured at Maloelap, Ailuk, Aur, Ujelang, Likiep, Namu, and Mili Atolls. The first shipment of 15 tons of live reef fish was from Maloelap Atoll to Hong Kong via the company owned fish carrier the *M/V World Image II*. From 1997 – 2002, at least 19 export shipments were completed. Each shipment carried 10,000 – 12,000 live reef fish, with marbled cod (*Epinephelus microdon*), making up the bulk of the shipments.

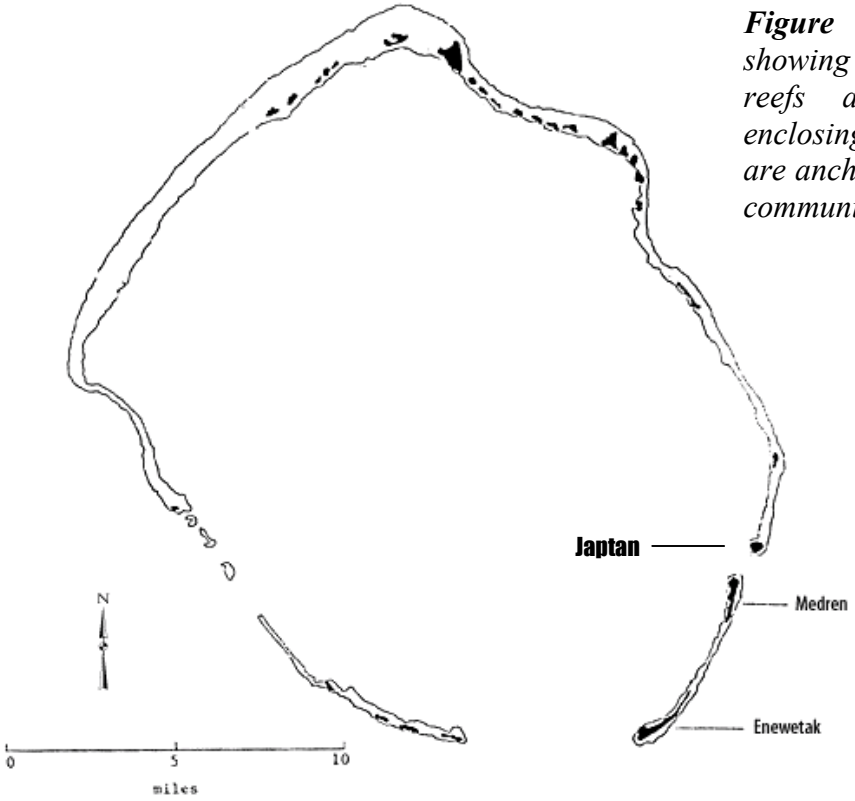


Figure 3 *Enewetak Atoll - showing outline of submerged reefs and islets or islands enclosing the lagoon. Fish cages are anchored off Japtan and local community lives on Enewetak Isl.*

This initial assessment of MIMRA data indicated an estimated 289 metric tons of grouper and humphead wrasse had been exported from the above atolls from 1997-2002, with approximately 60 percent of the harvest originating from Enewetak Atoll.

Juvenile humphead wrasse at the cages on Enewetak Atoll awaiting shipment

IMA had decided to concentrate under this project on Enewetak Atoll and held meetings and workshops with the Enewetak Island Council, the mayor and women's and men's groups. It was determined that the mayor, who was also the traditional paramount chief for the island and the main decision-maker, was leasing his lands to the fishing company and receiving a percentage of the value of the exported catch.

Enewetak Atoll showing lagoon, reef passages and ocean reefs. Women's group after workshop

During the workshops, it emerged that the council and citizen groups were against the fishing operation, and local fishermen complained about a reduction in catches of lagoon fish, important to the islanders' diet. Much of the land and lagoon at the north end of the lagoon had been rendered off limits due to residual radioactivity after the nuclear tests. Some 850 Enewetakese live on the island or islet of Enewetak to the south (figure 3), which the US scraped clean enabling the people to return after the tests. Most of the local fishing takes place in the south. Further investigation by the project and interviews with the Filipino fishermen in Visayan and Tagalog languages showed that the thousands of caged fish at Japtan were being fed for many months by fish caught using nets and longlines in the lagoon which may have caused the diminished catches of fish. Council members had often cut the longlines in protest to try to stop the practice.

The Filipino fishermen respond to questionnaires in Tagalog at their camp on Japtan Island

Council members and fishermen also stated that they thought cyanide was being used by the operation when it fished uninhabited Ujelang Atoll (figure 2), 150 miles to the southwest. Ujelang is where the Enewetakese lived after their atoll was rendered uninhabitable by the nuclear tests. The Enewetak mayor or paramount chief has been the authority responsible for giving the company access to Ujelang and Enewetak. During visits to the fishing camp and cages on Japtan Island, Enewetak, the IMA team was shown hook and line gear by the company and fishermen. However, a hookah compressor and a number of suspicious bottles had also been observed on the first trip. Given these observations and the lack of observer coverage and direct observations of fishing activities, plus the problem of MIMRA dragging its feet initially in entering a dialogue with IMA about the trade, in late March of 2003 IMA issued a press release in the Marshall Islands Journal about the suspected use of cyanide.

The following week (April 4, 2003) two articles appeared, one from the company (PMRD) refuting the claim and the other from the director of MIMRA calling for more observer coverage. Both the company and MIMRA then joined in more productively with the project activities. In Enewetak, company officials provided a more descriptive tour of the company facilities on Japtan, their local transporter vessel, the fish cages and the practices they claimed to be using. The senior company official explained that the main reason they came to Enewetak each year between November and April was to fish two grouper spawning sites in the channel adjacent to Japtan and also the channel south of Enewetak. In Majuro, MIMRA helped with a more complete set of data and commitments to work with IMA to develop observer training for MIMRA officials and to ban and enforce against the use of destructive practices *where IMA could prove they were in use,* such as the fishing of grouper spawning sites (agreeing they would be placed off limits), longlining in the lagoon (illegal already) and even a national ban on the export of humphead wrasse *if IMA could show that they were endangered*. These commitments would be the basis of a management plan, policies and an observer program.

At this time, IMA was now more than half way through the first year of the project and the expenditure of project funds. It was clear that in order to help MIMRA move forward with an observer program additional funding and more time would be required. A second phase of the project was therefore proposed and welcomed by MIMRA with the design of an observer program as one of the main elements to help meet MIMRA's needs. Only through an observer program with sufficient coverage could it be determined that cyanide was not being used and that any regulations applying to the trade might be enforced, such as spawning sites off limits, slot limits for groupers, cap on total catch, zoning and humphead wrasse protection, etc.

However, there were a number of reasons for not yet jumping wholeheartedly into proactive fisheries management mode and for questioning assumptions before proceeding with a management plan. The community and council on Enewetak were still opposed to the trade and wished to evict the company from their island.

Only the mayor and MIMRA appeared to be supporting the company. Other island mayors and communities were also chasing the company away from their atolls after the first harvests, including Likiep atoll (barred December 2001) and Mili atoll (told not to come back at the end of 2002). So, there was little agreement among the people that the company should be fishing these island reefs in the first place. A management plan would therefore have been premature and contrary to the intent of a participatory approach.

This is consistent with IMA's strategy in the Pacific. IMA has held firmly to the position that because of the inherent uncertainties about this trade and its patterns of exploitation and overfishing, in the Pacific Islands where the trade has yet to gain an irrevocable hold, NGOs and governments should not be introducing *management plans* prematurely for the LRFFT since this is essentially endorsing and giving substance to a trade that is currently only practiced in a destructive and inequitable manner. IMA's strategy is different in SE Asia where the *management plan* is a transformational tool to an entrenched and almost irrevocably destructive trade. The same argument can be applied to *standards*. By jumping into management planning or standards in the Pacific (Fiji, PNG, Kiribati), assumptions are made and expectations raised locally that this trade can be practiced sustainably when this has yet to be proven from both the resource capacity and exploitation standpoints.

Of course this is a cart-and-horse situation typical to fisheries management since by effectively implementing a well-designed management plan with adequate controls and monitoring then sufficient data could be obtained with which to regulate the activity and possibly make it sustainable (assuming the economics of a regulated operation are also viable). However, in the Pacific Islands where the capacity for effective management is not yet in place and there is insufficient research and data gathered (throughout the Indo-Pacific) on reef fish fisheries, then a precautionary approach in the Pacific should be interpreted as disallowing or limiting such commercial reef fisheries until many of the important questions have been *asked* and answered, assessments carried out and instruments put in place. This is all the more important since reefs are so quickly overfished (as demonstrated by the rapidity with which live fish operations move to new islands – see data below) and so few assessments have been completed on the size of stocks that are necessary for sustaining competing subsistence and resource replenishment needs. It is arguable that subsistence and replenishment should come first. All of the LRFFT operations and trials in the Pacific Islands have depended upon being able to move from island to island and reef-to-reef, which is indicative of overfishing. Unfortunately, this situation is often reached before the host government or local groups are aware of what's going on.

The timing of when a management plan should be developed has therefore been crucial within this project and has affected the implementation of tasks. With so much grassroots opposition to the LRFFT in the Marshalls and the possibility that the Marshallese would prefer to stop the trade completely, the project has held back from implementing the management planning component since IMA believes it would indirectly endorse the trade, raise expectations and at this stage would be like shooting oneself in the foot. One question then for the project has been how entrenched is this operation? Can the community voices against the trade curtail it or is the management plan required to help transform it? One of the main purposes of the early assessment has been to find out if there is opposition to the trade, and clearly there is – in Enewetak, Majuro and on other islands. Supporters of the operation appear to be the few beneficiaries (the company, the Enewetak mayor and MIMRA). Progress with these questions is discussed below in the second reporting period.

Nevertheless, to keep things moving forward with MIMRA, IMA presented the outline of a fisheries management program to MIMRA in May 2003 detailing possible control measures for the LRFFT and a cooperative research program. This was well received.

Raising awareness about the LRFFT and coral reef conservation in general has been another component of this project and IMA's program in the Marshall Islands. Before this project started, IMA arranged workshops on Ailinglaplap atoll in January 2001, Mili atoll in July 2001 and Likiep in November 2001 to raise awareness about the LRFFT, overfishing, destructive fishing practices, establishment of marine conservation areas and management of coastal marine resources. This may have helped Likiep and Mili mayors make the right decision to stop the live reef food fish operation on their islands and may also have influenced other mayors and councils as the LRFFT operation has searched for new islands on which to fish after repeated harvesting on Enewetak (see data discussion below). Following the workshop on Likiep, the landowners filed a complaint with the Attorney General that stopped the LRFFT fishing activity on Likiep. IMA continued the workshop series during this project with stakeholders on Enewetak atoll and also with Enewetak council members in Majuro.

To help coordinate these workshops and other activities, IMA had employed a local Marshallese coordinator, who continued to function throughout this project. In addition, given the physical separation from IMA technical staff based in Honolulu and capacity challenges, there was a need for more effective working partnerships in Majuro with other organizations such as the College of the Marshall Islands (CMI) who's staff might help backstop the project and provide the local IMA coordinator with additional support on the job and capacity building. For this to work, during the first six months of the project, IMA helped to identify, secure and fund a new lecturer in marine science recruited from Canada. IMA obtained partial funding for this position from the US Department of the Interior, Office of Insular Affairs. In addition to boosting CMI's marine science teaching, after school and mariculture programs, interagency partnerships were formed between MIMRA, MI EPA, Internal Affairs and the College ("MEIC") undertaking community-based management planning, outreach and dive surveys for fisheries and marine conservation on the outer islands. IMA's local coordinator participated in some of these activities, but did not reach his full potential. During the second reporting period (discussed below) the IMA coordinator and CMI staff member also surveyed areas of Majuro lagoon including the reef off the Outrigger Hotel for a possible marine reserve or marine park to help boost conservation awareness and visitor education in Majuro.

Ocean Glory – Originally confiscated by MIMRA around 1999 for using cyanide to catch live fish, the vessel rusted in Majuro Lagoon until 10 March, 2003 when it was towed into position and sunk in 75' of water off the Outrigger Hotel as an artificial reef and dive site. Organized by a local dive outfit with government approvals; fuel/oils apparently removed.

Second six months of project

During the second half of this project to assist communities and government agencies in the Marshall Islands to evaluate, reduce and ultimately eliminate destructive practices associated with the live reef food fish trade (LRFFT), IMA's staff:

- Completed analysis of MIMRA's 1997-2002 export data set for the LRFFT, and estimated trash fish feeding rates and impacts on lagoon and reef ecosystems.
- Tracked live food fish entering Hong Kong and regionally disseminated data.
- Encouraged MIMRA to impose an 18-month moratorium on LRRFT fishing until regulations could be put in place to control destructive aspects and protect against overfishing.
- Continued to monitor the LRFFT operator and foreign fishermen, observing they did not return to Enewetak for the Nov 2003 – April 2004 grouper spawning and fishing season in Enewetak, possibly due to MIMRA's actions and IMA's request for a moratorium.
- Presented a proposal to MIMRA to design an observer-training program, subsequently submitted to NOAA for CRC FY 2004 funding in March and as a final-updated proposal in June of 2004.
- Continued awareness, advocacy and support activities with Enewetak mayor, council, communities and other island groups.
- Reoriented emphasis from the community and council on Enewetak towards working more with MIMRA, given the mayor of Enewetak's controlling and apparently intractable support for the operation (contrary to the community and council's wishes).
- Monitored the December 2003 general election results, which showed a new "younger and environmentally aware" mayor was elected in Enewetak (by a narrow margin), suggesting opportunities for change and project success in Enewetak.
- Successfully enrolled the IMA Marshalls coordinator in a University of Guam coral reef assessment and management class, from June 2 thru July 2, 2003.
- Completed underwater survey and survey report of marine park concept offshore of the Outrigger Hotel with CMI, confirming that due to excessive sediment movement in this area of the lagoon, efforts would be better placed promoting a marine reserve with landowners on the islets to the north west of Majuro where visitors and locals alike could see more of Majuro lagoon's marine life and coral reefs. Maintained a dialogue with Outrigger Hotel about the marine park concept and the Ocean Glory artificial reef, until the March 2004 pullout from the Marshall Islands of Outrigger Hotels and Resorts.

The main points are discussed in more detail.

Export data assessment

Table 1 below shows MIMRA data for LRFF exports from the Marshall Islands for export shipments between 1997 and 2002. When notified by the company that a shipment was to take place, a fisheries officer would fly to the particular island from Majuro to report on the quantities of fish. On Enewetak, the mayor's representative would also participate. For each species being shipped it is understood that the fisheries officer would either count the fish or the company would provide the officer data on the number of fish as they were being transferred from the fish cages to the transporter vessel.

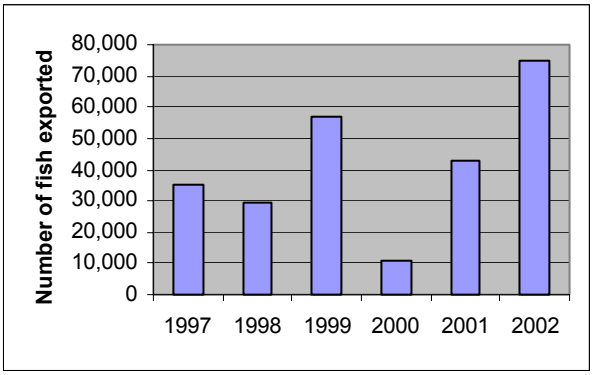
Assigned export #	Date	Area	Common Name	Species	Est. No.	No. @ shipment	Est. Avg wt	Calc. Wt. (kg)	Annual no.	Annual wt.
	6/12/1997	Maloelap	Marbled Cod	Epinephelus microdon	11,500		1.0	12,000		
1	6/12/1997	Maloelap	Big Spot Coral Trout	Plectropomus sp	500		1.0	500		
	6/12/1997	Maloelap	Purple Rock Cod	Epinephelus sp	500	12,500	1.0	500		
	9/3/1997	Enewetak	Marbled Cod	E. microdon	11,000		1.0	11,000		
2	9/3/1997	Enewetak	Big Spot Coral Trout	Plectropomus sp	450		1.1	500		
	9/3/1997	Enewetak	Purple Rock Cod	E. hoedti	350	11,800	1.4	500		
	12/23/1997	Enewetak	Marbled Cod	E. microdon	10,000		1.1	11,000		
3	12/23/1997	Enewetak	Big Spot Coral Trout	Plectropomus sp	450		1.1	500		
	12/23/1997	Enewetak	Purple Rock Cod	E. hoedti	450	10,900	1.1	500	35,200	37,000
	3/9/1998	Enewetak	Marbled Cod	E. microdon	16,000		1.0	16,000		
	3/9/1998	Enewetak	Purple Rock Cod	Plectropomus sp	200		1.0	200		
4 & 5	3/9/1998	Enewetak	Honeycomb Rockcod	E. fario	450		1.1	500		
	3/9/1998	Enewetak	Tiger Cod	E. itajara	5,000		0.6	3,000		
	3/9/1998	Enewetak	Napoleon Wrasse	Cheilinus undulatus	50	21,700	6.0	300		
	4/7/1998	En/Ailuk	Marbled Cod	E. microdon	5,700		1.0	5,700		
	4/7/1998	En/Ailuk	Purple Rock Cod	Plectropomus sp	500		1.0	500		
6	4/7/1998	En/Ailuk	Honeycomb Rockcod	E. fario	450		1.1	500		
	4/7/1998	En/Ailuk	Tiger Cod	E. itajara	800		6.0	4,800		
	4/7/1998	En/Ailuk	Napoleon Wrasse	C. undulatus	30		6.7	200		
	4/7/1998	En/Ailuk	Big Spot Coral Trout	Plectropomus sp	500	7,980	1.0	500	29,680	32,200
	5/19/1999	Enewetak	Marbled Rock Cod	E. microdon	11,500		1.0	11,500		
7	5/19/1999	Enewetak	Tiger Cod	E. itajara	120		1.0	120		
	5/19/1999	Enewetak	Napoleon Wrasse	C. undulatus	40		2.0	80		
	5/19/1999	Enewetak	Big Spot Coral Trout	Plectropomus sp	1,500	13,160	1.0	1,500		
8 & 9	9/17/1999	Enewetak	Marbled Cod	E. microdon	21,700		1.0	21,700		
	9/17/1999	Enewetak	Big Spot Coral Trout	Plectropomus sp	1,200	22,900	1.0	1,200		
10 & 11	9/17/1999	Namu	Marbled Cod	E. microdon	20,000		1.0	20,000		
	9/17/1999	Namu	Big Spot Coral Trout	Plectropomus sp	1,000	21,000	1.0	1,000	57,060	57,100
12	2/28/2000	Aur	Marbled Cod	E. microdon	10,000		1.0	10,000		
	2/28/2000	Aur	Big Spot Coral Trout	Plectropomus sp	1,000	11,000	1.0	1,000	11,000	11,000
	8/1/2001	Ujelang	Marbled Cod	E. microdon	11,000		1.0	11,000		
	8/1/2001	Ujelang	Purple Rock Cod	E. hoedti	700		1.4	1,000		
13	8/1/2001	Ujelang	Honeycomb Rockcod	E. fario	600		1.7	1,000		
	8/1/2001	Ujelang	Tiger Cod	E. itajara	250		3.2	800		
	8/1/2001	Ujelang	Napoleon Wrasse	C. undulatus	40	12,590	2.0	80		
	9/1/2001	Ujelang	Marbled Cod	E. microdon	12,000		0.8	9,653		
	9/1/2001	Ujelang	Big Spot Coral Trout	Plectropomus sp	2,500		0.8	2,120		
14	9/1/2001	Ujelang	Honeycomb Rockcod	E. fario	200		0.9	180		
	9/1/2001	Ujelang	Tiger Cod	E. itajara	200		1.5	300		
	9/1/2001	Ujelang	Napoleon Wrasse	C. undulatus	9	14,909	4.4	40		
	12/1/2001	Likiep	Marbled Cod	E. microdon	11,767		0.8	9,554		
	12/1/2001	Likiep	Big Spot Coral Trout	Plectropomus sp	2,365		0.7	1,699		
15	12/1/2001	Likiep	Purple Rock Cod	E. hoedti	100		2.4	240		
	12/1/2001	Likiep	Tiger Cod	E. itajara	40		5.0	200		
	12/1/2001	Likiep	Napoleon Wrasse	C. undulatus	822	15,094	0.7	565	42,593	38,431
16	2/1/2002	Enewetak	Marbled Cod	E. microdon	11,255		1.1	12,670		
	2/1/2002	Enewetak	Big Spot Coral Trout	Plectropomus sp	600	11,855	0.9	523		
	3/1/2002	Enewetak	Marbled Cod	E. microdon	9,200		1.0	8,800		
17	3/1/2002	Enewetak	Big Spot Coral Trout	Plectropomus sp	2,150		1.0	2,050		
	3/1/2002	Enewetak	Honeycomb Rockcod	E. fario	295		0.9	280		
	3/1/2002	Enewetak	Tiger Cod	E. itajara	780	12,425	1.2	950		
	3/1/2002	Uj/Enewe	Marbled Cod	E. microdon	10,850		0.9	9,500		
18	3/1/2002	Uj/Enewe	Big Spot Coral Trout	Plectropomus sp	1,150		0.9	980		
	3/1/2002	Uj/Enewe	Honeycomb Rockcod	E. fario	465		1.0	475		
	3/1/2002	Uj/Enewe	Napoleon Wrasse	C. undulatus	125	12,590	1.4	180		
	7/1/2002	Mili	Marbled Cod	E. microdon	12,345		1.0	12,320		
19	7/1/2002	Mili	Big Spot Coral Trout	Plectropomus sp	587		1.1	632		
	7/1/2002	Mili	Napoleon Wrasse	C. undulatus	30	12,962	4.0	120		
	7/1/2002	Mili	Marbled Cod	E. microdon	12,320		1.0	12,180		
	7/1/2002	Mili	Big Spot Coral Trout	Plectropomus sp	567		0.9	506		
20	7/1/2002	Mili	Honeycomb Rockcod	E. fario	330		1.0	345		
	7/1/2002	Mili	Tiger Cod	E. itajara	28		4.3	121		
	7/1/2002	Mili	Napoleon Wrasse	C. undulatus	11	13,256	3.0	33		
	11/1/2002	Ailuk	Marbled Cod	E. microdon	10,257		0.9	9,253		
21	11/1/2002	Ailuk	Big Spot Coral Trout	Plectropomus sp	786		0.7	547		
	11/1/2002	Ailuk	Honeycomb Rockcod	E. fario	447	11,490	0.7	326	74,578	72,791
				TOTAL	250,111			248,522		

Table 1 - MIMRA LRFFT 1997-2002 export data showing number of fish by species, island & shipment

IMA has not been present during transfers so for the purposes of this project the methodology is vague. The data set includes numbers of fish both rounded to the nearest thousand and what looks like actual counts. In addition, the observer either estimated an average weight per species, calculating the total weight per species, or measured or was given the total weight (and numbers of fish), and was then able to calculate an average weight per fish. The numbers of fish ("pieces") are considered more accurate, rather than the lumped weight data. In working with the data, it has been assumed that 15,000 fish could be transported to Hong Kong by the vessel. However, this figure may be bigger (more than 20,000 fish per trip) in which case the total number of trips would have been less than calculated. In cases where two islands are listed, the figure is halved to give a quantity per island.

The data in table 1 shows that between 13 and 21 export shipments were completed from June 1997 up until November 1, 2002. IMA has yet to receive data for fish shipped out of Enewetak in April 2003 (at the time of the SARS virus concerns in Asia) when we were visiting the cages and found them to be full and awaiting shipment*.

In the six years reported on, between 1997 and 2002 over 250,000 live fish were shipped from these atolls with a MIMRA-estimated total weight of approximately 250 tonnes.



According to the company and fishermen, the fishing season is November through April each year (also the spawning aggregation period) although the data set shows fish are held until later in the year depending on when the transporter vessel comes from Hong Kong, a voyage of over a month. The total for each calendar year is shown in the adjacent chart ranging from 11,000 fish in 2000 (Asian economic crisis?) to 75,000 fish exported in 2002. In general, the quantities of live fish exported have doubled over the six years. The average per year is 42,000 fish exported (table 2).

# of years		1997	1998	1999	2000	2001	2002	Tot.no.	%@ island	# Per year, per island
1	**Maloelap**	12,500						12,500	5	12,500
4	**Enewetak**	22,700	25,690	36,060			30,575	115,025	46	28,756
2	**Ailuk**		3,990				11,490	15,480	6	7,740
1	**Namu**			21,000				21,000	8	21,000
1	**Aur**				11,000			11,000	4	11,000
2	**Ujelang**					27,499	6,295	33,794	14	16,897
1	**Likiep**					15,094		15,094	6	15,094
1	**Mili**						26,218	26,218	10	26,218
	Total	35,200	29,680	57,060	11,000	42,593	74,578	250,111		17,401
# of islands fished	8	2	2	2	1	2	4			

*Late breaking report of 15,600 kg. shipped from Enewetak in May 2003

Table 2 – MIMRA LRFFT data totaled for each year and each island.

From 1997 to 2002, eight atolls were fished (table 2). Enewetak was fished in four of these years yielding over 115,000 live groupers and humphead wrasse, nearly 50% of the total exported catch. Neighboring and uninhabited Ujelang was fished for two years, revealing that 60% of the total fishing effort in the Marshall Islands was under the auspices of the Mayor of Enewetak who has responsibility over both islands. In general, fishing would take place on 2 atolls per year, except in 2002 when it increased to 4 atolls.

The data in table 2 shoes the fishermen returned to only 3 of the atolls: Enewetak, Ujelang and Ailuk, and there was a pattern of moving to a new atoll each year. Overfishing of target species, landowner conflicts, local awareness, access gained to new (spawning) sites and rotational fishing are probable reasons for moving. On average 17,400 fish were exported from each atoll per year. Enewetak was fished for three years in succession from 1997-99, with catches increasing from 23,000 to 36,000 fish per year, and then "given a rest" for two years, with neighboring Ujelang yielding 28,000 fish in 2001, before Enewetak was again fished in 2002 with a catch of 31,000 fish. The cages in Enewetak were also full in April 2003, so the 2002 figure for Enewetak will be higher. (Recent report of 15,600 kg. shipped in May 2004)

The Hong-Kong owned company and Filipino fishermen targeted six species of live reef fish (table 3). It is assumed that other species, and dead or injured fish, were either fed to the caged fish or eaten by the fishermen, bearing in mind that ciguatera toxicity is common. The reef fish targeted are commonly classified as groupers, rock cod, coral trout and humphead wrasse (also known as the Napoleon or Maori wrasse). The same common names have been used fairly consistently through the MIMRA data series. The Latin equivalents are less clear.

	Common name MIMRA (aka)	**Latin name MIMRA**	**Probable latin name (similar sp)**	**Total no./ species**	**% of total**	**Calc. Sp. wt. kg**	**Calc. Av. wt. kg.**
1	Marbled rock cod (camouflage, tiger)	*Epinephelus microdon*	*E.polyphekadion* (*E.fuscoguttatus*)	218,394	87.3%	213,830	0.98
2	Big spot coral trout	*Plectropomus* sp.	*Plectropomus leaopardus* etc?	17,305	6.9%	15,757	0.91
3	Tiger cod (Giant?)	*Epinephelus itajara*	*Epinephelus lanceolatus*?	7,218	2.9%	10,291	1.43
4	Honeycomb rock cod	*Epinephelus fario*	*Epinephelus merra*	3,237	1.3%	3,606	1.11
5	Purple rock cod	*Epinephelus hoedti*	*Epinephelus cyanopodus*	2,800	1.1%	3,440	1.23
6	Humphead wrasse	*Cheilinus undulatus*		1,157	0.5%	1,598	1.38
	TOTAL			**250,111**		**248,522**	

Table 3 – MIMRA LRFFT export data 1997-2002 totals for each species

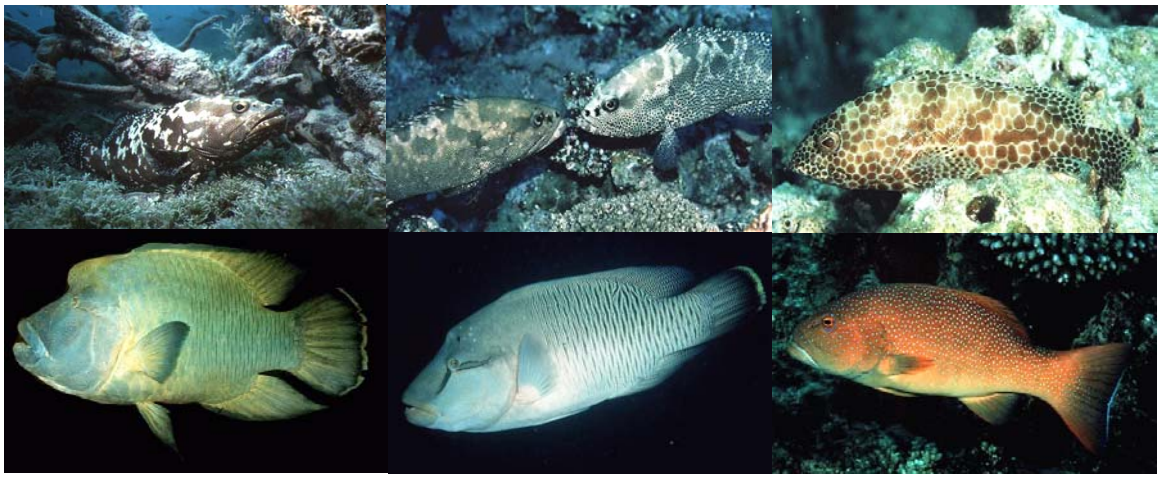
Species name clarification still needs to be finalized with MIMRA. In the meantime, an attempt has been made in table 3 to decipher the names used based on IMA observations at the cages. MIMRA's marbled cod may also be the camouflage cod. MIMRA's big spot coral trout is probably a couple of *Plectropomus* species. The tiger cod was called *E.itajara* by MIMRA, which may be only an Atlantic species – the goliath grouper - so it is assumed that MIMRA is referring to the giant grouper, *E.lanceolatus* which was seen at the cages. The honeycomb grouper is distinctive and also has the latin name *E.merra*. MIMRA's purple rock cod *E.hoedti* is also *E.cyanopodus* or blue speckled grouper, seen at the cages on Enewetak.

During the six years of fishing on eight different atolls, over 218,000 marbled rock cod (*Epinephelus microdon*) were caught, making up 87% of the total catch exported. On average, over 12,000 marbled rock cod were harvested from each island and included in every shipment to Hong Kong, with a range of 5,700 to 21,700 marbled cod in shipments. In September 1999, 21,700 marbled rock cod were exported from Enewetak, and two and half years later in February and March 2002 another 25,900 marbled rock cod were shipped out from Enewetak, making up 95% and 85% of the shipments, respectively. In both cases the average size recorded was 1.0 kg. One wonders how robust marbled rock cod populations are.

Epinephelus microdon
Marbled grouper

E.polyphekadion
Flowery grouper

E.merra
Honeycomb grouper



Cheilinus undulatus (adult)
Humphead wrasse

C.undulatus (juvenile)
Humphead wrasse

Plectropomus leopardus
Leopard coral trout

The next most common fish was big spot coral trout (Plectropomus sp.) with 17,300 collected over the total period, then 7,200 tiger cod, 3,200 honeycomb rock cod, 2,800 purple rock cod, and a total of 1,157 humphead wrasse (*Cheilinus undulatus*) shipped out. The latter is currently being considered for CITES Appendix II listing (Sadovy, pers.comm.) given its threatened and endangered status throughout its range, primarily because of LRFFT harvesting and intrinsic vulnerability due to unique life history characteristics.

Date	Area	Est. No.	Est. Avg wt.	Calc. Wt. (kg)
3/9/98	Enewetak	50	6.0	300
4/7/98	En/Ailuk	30	6.7	200
5/19/99	Enewetak	40	2.0	80
8/1/01	Ujelang	40	2.0	80
9/1/01	Ujelang	9	4.4	40
12/1/01	Likiep	822	0.7	565
3/1/02	Uj/Enewetak	125	1.4	180
7/1/02	Mili	30	4.0	120
7/1/02	Mili	11	3.0	33
	TOTAL	1,157		1,598

Table 4 – Shipments of live Humphead wrasse from the Marshall Islands

The data says very little in detail about the size or age of fish exported, and few trends can be extracted. However, some interpretations may be attempted in looking at the humphead wrasse shipments in table 4 above. The MIMRA data indicates that 1,157 humphead wrasse were exported between 1998 and 2002, with around 170 humphead wrasse harvested from Enewetak Atoll. In 1998, two shipments of 50 and 30 fish were made where the average size was reported as 6.0 kg and 6.7 kg., respectively (table 4). A year later in 1999 the average size per fish from Enewetak was reported as 2.0 kg. (n=40), and four years later the average size had dropped to just 1.4 kg. (n=125/2 for 2 islands – Ujelang and Enewetak). Similarly in 2001, nine humphead wrasse were harvested from Ujelang with an average size of 4.4 kg, and 40 with an average size of 2.0 kg. A year later the average size was down to 1.4 kg (n=125/2). These data suggest that after just a couple of years of fishing, the average size of humphead wrasse has been reduced significantly, the bigger and old-age reproductive fish having been culled from the population leaving the juveniles and young adults to be gradually wiped out.

Air Marshalls at Enewetak. Once a week schedule

HK live fish transporter at Majuro awaiting clearance for Enewetak

Enewetak fish cages full. Local transporter waits for HK ship.

Dory with Filipino fisherman, Chinese operator. Live fish wells amidships.

The situation seems even more extreme in Likiep in 2001, where 822 humphead wrasse were exported with an average size reported as 0.7 kg (taking what must have been a significant proportion of the population, both juveniles and adults), and in Mili during the one season of fishing, 30 and 11 fish were exported with an average size of 4.0 and 3.0 kg., respectively – many, probably adults and the breeding stock for the island. The overall numbers -- *tens* of humphead wrasse compared with *thousands* of grouper and coral trout, exported – attest to the intrinsic low densities of humphead wrasse on coral reefs in Marshall Islands.

Taking a final look at the estimated average weight per fish for all shipments in table 1, if it is assumed for discussion that reef fish of 1 kg. are still juvenile and pre-productive, then a very large proportion of the harvest and exports (more than 50%) must have been juvenile fish.

The project's next step will be to evaluate further the significance of these harvesting intensities and to find out more about characteristics such as age of first reproduction, slot limits and caps on harvests, as precursors to a possible fisheries management plan.

Trash fish feeding

The communities on Enewetak have complained about reduced catches of lagoon fish in the vicinity of their villages and have protested the company's use of longlining and large gill nets in the lagoon to catch trash and feed fish for feeding the caged groupers. This issue had not been recognized in the Pacific region live reef fish community until it was first identified by this project on Enewetak. According to Mike Rimmer at Queensland's Department of Primary Industries (pers. comm.), the recommended trash fish feeding rate for groupers of more than 200 g. body weight is 5% average body weight per day. Assuming an average size of fish in the Enewetak cages of 1 kg. then 10,000 to 20,000 fish kept for three months (≈100 days) would consume five times their body weight or 50,000 to 100,000 kg. of trash fish. From discussions with the Filipino fishermen sharks, schools of lagoon fish, ocean fish, non-target species and dead or diseased fish from the cages were used as feed.

Conservatively speaking, then, if just one or two times the body weight is fed over three months (versus 5 times), then an average of 42,000 fish exported per year (table 2) would require an additional 42,000 to 84,000 kg. of trash fish to be harvested from Enewetak lagoons, reefs and surrounding ocean. This means that in total (including the live fish exported), on average over 100 tonnes of fish are being removed each year; possibly twice this in 2002 (table 2), and over the six years of fishing nearly three quarters of a million reef fish may have been harvested.

The necessity of fish feeding is another factor that compounds the risk of overfishing on reefs and lagoons and should be considered in any mitigation strategy.

Hungry fish at Enewetak, clock wise from left top:
Juvenile humpheads
Giant grouper
Marbled grouper
Yellow edged lyretail

Hong Kong data assessment.

By coordinating with IMA staff in Hong Kong, the project tracked the importation of Marshall Islands live fish to Hong Kong in 2001 and 2002 (table 5). In 2002, 60 tonnes of live fish arrived in Hong Kong from the Marshall Islands. This is comparable to the 72 tonnes recorded in the MIMRA data (table 1). In 2001, 12 T. was reported in Hong Kong coming from "US Oceania" interpreted as the Marshall Islands; 36 T. in the MIMRA data for 2001.

	Country	2001		2002	
1	Mainland China	3,566,444	30.436%	3,306,531	29.046%
2	Thailand	3,030,016	25.858%	3,013,003	26.468%
3	Philippines	1,200,963	10.249%	1,425,664	12.524%
4	Australia	1,150,725	9.820%	1,401,902	12.315%
5	Indonesia	1,282,090	10.941%	1,205,782	10.592%
6	Malaysia	481,803	4.112%	486,063	4.270%
7	Vietnam	198,535	1.694%	132,304	1.162%
8	Taiwan	473,913	4.044%	98,894	0.869%
9	Japan	60,391	0.515%	77,867	0.684%
10	**Marshall Islands**	***12,293**	**0.105%**	**60,097**	**0.528%**
11	Maldives R	113,500	0.969%	59,000	0.518%
12	France	57,959	0.495%	47,866	0.420%
13	Cambodia	35,627	0.304%	43,408	0.381%
14	Singapore R	13,416	0.114%	11,002	0.097%
15	Myanmar	6,939	0.059%	5,409	0.048%
16	PNG	0		1,707	0.015%
17	USA	0		1,595	0.014%
18	Brunei	5,180	0.044%	1,453	0.013%
19	Hong Kong SAR	0		1,176	0.010%
20	Togo	0		714	0.006%
21	New Zealand	1,639	0.014%	565	0.005%
22	India	5,127	0.044%	550	0.005%
23	Mexico	0		420	0.004%
24	United Kingdom	6,146	0.052%	368	0.003%
25	Namibia	525	0.004%	251	0.002%
26	Chile	0		106	0.001%
27	Fiji	9,214	0.079%	0	
28	Korea R	2,286	0.020%	0	
29	Bangladesh	1,436	0.012%	0	
30	Canada	924	0.008%	0	
31	Norway	580	0.005%	0	
32	Tajikistan R	204	0.002%	0	
33	Benin R	0		0	
34	Colombia	0		0	
35	Iceland	0		0	
36	Kenya	0		0	
37	Kiribati	0		0	
38	Mali	0		0	
39	Morocco	0		0	
40	Nauru	0		0	
41	Palau	0		0	
42	Seychelles	0		0	
43	Solomon Islands	0		0	
44	South Africa R	0		0	
45	Sri Lanka	0		0	
	Total CSD (kg.)	11,717,875	100%	11,383,697	100%
	AFCD	2,120,101		1,737,717	
	Grand Total (kg.)	**13,837,976**		**13,121,414**	
	Total from table 6 (c.f.)	13,834,177		13,123,898	

* referred to as US Oceania in 2001. All figures in kg.

Table 5 – IMA Hong Kong data for live food fish imported to HK in 2001 and 2002, in kg., showing country of export

Table 5 shows the imports by country of live food fish to Hong Kong during 2001 and 2002 in kilograms. A total of 13,800 tonnes of live fish for the restaurant trade were imported to Hong Kong in 2001 from 26 countries and 13,100 tonnes in 2002, also from 26 countries (six of which were different). The Marshall Islands total for 2002 was just half a percent of the total imports for the year. 45 countries have exported live food fish to Hong Kong since IMA started bringing together records. In 2002, the Marshall Islands was tenth on the list of countries in terms of quantities imported by Hong Kong, and just behind Japan. Mainland China and Thailand each supplied about 30% or 3 million fish. Five countries – China, Thailand, Philippines, Australia and Indonesia – shipped 90% of the live food fish, two years in a row. It is understood that some 50% of the fish from countries such as Thailand, Australia and Taiwan are cultured groupers (not necessarily full cycle, still depending on fry and juvenile grow out from the wild). In terms of other Pacific Islands where the trade has been at the "trials" stage, PNG shipped 1.7 tonnes in 2002 although IMA in Kavieng, PNG reported 6 tonnes exported in total, and Fiji shipped 9.2 tonnes in 2001. According to the HK data, Kiribati, Nauru, Palau and the Solomon Islands have also sold live food fish in the past. Live food fish coming from non-tropical countries such as Canada, the UK, Norway, France and New Zealand are undoubtedly not reef fish.

Transporter vessels can often pick up fish in a number of countries, so some data may include transshipped live fish, obscuring the country of origin. This is particularly the case in shipments from the Pacific Islands given the lower quantities of fish and the distance traveled. Ciguatoxic fish and fish caught using cyanide can also be hidden in this way. China is a big importer of live food fish and in an effort to start monitoring Chinese imports, IMA gathered price data from Guangzhou, Shenzhen and Shanghai wholesale markets and restaurants during 2001 and 2002. The imports data also include fish air freighted live to Hong Kong.

Tracking shipments of live reef food fish into Hong Kong is a complicated process and has been achieved in part by IMA Hong Kong developing relationships with importers over a number of years, particularly the HK Chamber of Seafood Merchants (HKCSM). Cargo entering in Hong Kong registered vessels does not have to be declared. However, the HK Agriculture Fisheries and Conservation Dept. (AFCD) informally monitors these imports and in table 5 IMA has combined the AFCD data with monthly import figures from the Census and Statistic Dept. (CSD) for non HK-flagged vessels that *are* required to declare imports, calculating the estimated total live food fish imports for the year. These figures of 13,837,976 and 13,121,414 kg. of live fish for 2001 and 2002, respectively, differ slightly from the totals calculated in table 6 from adding up the weight of fish per species.

IMA's work in Hong Kong has been supported in the past by grants from the US EAPEI (East Asia Pacific Environmental Initiative) and also private foundations such as the MacArthur Foundation. However, a lack of funding caused the Hong Kong project to be closed at the end of 2003, and it is hoped to resurrect this internationally important component of IMA's work when additional funds are secured, possibly in relation to a regional cyanide detection program starting in 2004, since many of the live food fish sold in Hong Kong are caught using cyanide. Cyanide testing of 48,000 fish by IMA in the Philippines showed that 44% of the live groupers shipped to Hong Kong were caught using cyanide (25% of the aquarium fish). Cyanide is also used in Indonesia, Malaysia and Vietnam by unscrupulous operators and fishermen to catch fish for the Hong Kong and Chinese live food fish markets. In many cases the buyers supply the fishermen with cyanide in exchange for fish. In the Marshall Islands, according to the company, cyanide is not being used but, as discussed above, a MIMRA/IMA observer program is needed to confirm this (the proposed phase two of this IMA project).

Table 6 breaks down the total HK imports for 2001 and 2002 into species, and table 7 shows wholesale and retail prices gathered by IMA over four years. Two of the three rarest fish species are also the most expensive, as might be expected. 26,000 kg. of high finned grouper, 32,000 kg. of giant grouper and 48,000 kg. of humphead wrasse were imported into Hong Kong in 2002. For the CSD component, the 28,642 kg. of humphead wrasse supplied by non HK registered vessels in 2002 came from the Philippines (21,101 kg.), Indonesia (4,995 kg.), Malaysia (2,497 kg.) and Australia (49 kg.). These are also the top three countries for cyanide use (not Australia!) and, so the figures show, the top three countries for humphead wrasse shipments, which leads one to postulate that many of the humphead wrasse are caught using cyanide. Just 4% of the fish sold in Hong Kong are humphead wrasse.

		2001	2002
Common name	**Latin name**	**kg.**	**kg.**
High-finned grouper	*Cromileptis altivelis*	18,136	26,375
Giant grouper	*Epinephelus lanceolatus*	27,605	31,707
Humphead wrasse	*Cheilinus undulatus*	36,953	48,674
Other wrasses & parrotfish		70,488	102,858
Mangrove snapper	*Lutjanus argentimaculatus*	494,838	238,619
Spotted coral trout	*Plectropomus areolatus*	261,791	317,837
Flowery grouper	*Epinephelus polyphekadion*	317,657	344,431
Tiger grouper	*Epinephelus fuscoguttatus*	343,410	418,296
Snooks & basses		1,749,513	1,217,382
Green grouper	*Epinephelus coioides*	1,760,225	1,502,984
Other groupers		2,290,753	1,716,179
Leopard coral trout	*Plectropomus leopardus*	2,295,853	2,468,726
Other marine fish		4,166,955	4,689,830
TOTAL		**13,834,177**	**13,123,898**

Table 6 – IMA Hong Kong data for 2001 and 2002 showing total weight in kg. of the main species of live food fish imported to HK- AFCD and CSD data.

The most commonly traded species of live fish in Hong Kong is the leopard coral trout, popular because of its red color. 2,500 tonnes were imported in 2002. Coral trout make up at least 21% of the whole restaurant trade and groupers represent more than 30% of the trade. Coral reefs and mariculture are therefore two important supply components of this trade.

The leopard coral trout (*Plectropomus leopardus*) was also the third most expensive fish in the Hong Kong live food fish market (table 7) selling on average over the last four years for US$35.47 per kg. ($16 a pound) wholesale and $58.05 per kg. ($26 a pound) retail, about the same price as top grade sashimi retailing in Honolulu! Live humphead wrasse and high finned grouper retailed in Hong Kong for twice that amount.

Latin name	Common name	Declared export value in Marshall Islands	USD Wholesale price in HK per kg.					USD Retail price in HK per kg.				
			2000	2001	2002	2003	Mean	2000	2001	2002	2003	Mean
Cromileptes altivelis	Panther grouper or high finned grouper		$66.55	$66.44	$61.95	$61.68	$64.16	$102.76	$100.29	$100.09	$105.49	$102.16
Epinephelus coioides & Epinephelus malabaricus	Orange spotted & Malabar grouper		$12.64	$12.30	$10.34	$9.21	$11.12	$26.74	$23.65	$22.10	$20.09	$23.14
Epinephelus fuscoguttatus	Brown marbled or Tiger grouper	**$9.00**	$24.13	$24.10	$24.74	$22.78	**$23.94**	$49.22	$47.64	$45.24	$42.66	**$46.19**
Epinephelus lanceolatus	Giant grouper	**$9.00**	$25.45	$21.25	$24.17	$24.50	**$23.84**	$65.66	$55.10	$44.41	$33.74	**$49.73**
Epinephelus polyphekadion Epinephelus microdon	Camouflage or flowery grouper	**$9.00**	$22.13	$21.08	$22.00	$20.64	**$21.46**	$44.22	$42.74	$39.74	$39.31	**$41.50**
Plectropomus areolatus	Squaretail coral trout		$23.49	$20.59	$22.13	$20.95	**$21.79**	$50.35	$47.67	$45.05	$42.01	**$46.27**
Plectropomus laevis	Saddle grouper	**$12.00**	$31.79	$21.54	$24.61	$26.47	**$26.10**	$56.49	$60.30	$50.30	$48.99	**$54.02**
Plectropomus leopardus	Leopard coral trout		$37.35	$34.15	$34.19	$36.16	**$35.47**	$62.25	$58.35	$54.50	$57.09	**$58.05**
Cheilinus undulatus	Humphead wrasse	**$15.00**	$54.34	$55.33	$58.37	$55.37	**$55.85**	$109.36	$107.66	$99.72	$105.43	**$105.54**
Lutjanus argentimaculatus	Mangrove snapper		$7.34	$7.79	$5.73	$4.56	$6.36	$16.17	$15.74	$16.76	$16.71	$16.34
Australian Rock Lobster										$32.06	$34.14	$33.10
Average No. of restaurants surveyed, monthly								135	138	138	123	

Figures in US dollars, converted from HKD at 7.8. Seven months of data for 2003

Table 7 – IMA Hong Kong data for prices in USD per kg. for 2000-2003 wholesale and retail live reef food fish sales, collected monthly, with declared export value in the Marshall Islands (MIMRA data)

From November 1999 until July 2003, IMA Hong Kong surveyed wholesale markets and over 130 restaurants and retail outlets every month for prices of the main species of live fish listed in table 7. Wholesale and retail prices are listed for four years 2001-2003. They varied very little so mean wholesale and retail prices for each species have been calculated. The most expensive live fish was the humphead wrasse at an average retail price of $106 per kg., followed by the high finned grouper retailing on average for $102 per kg. The coral trout and groupers sold retail for $40 to $65 per kg. and the less desirable green grouper (also known as the orange spotted or Malabar grouper) sold for $23 a kg. and the mangrove snapper for around $16 a kg. The latter two are mainly cultured selling for half the price of wild caught fish because of an apparently poorer taste and customer preferences. In general, the wholesale market price for all fish was about half the retail price.

A 2 kg. live juvenile humphead wrasse therefore sells in a restaurant for around $200 and an adult fish might cost $1000. Although very few adults humphead wrasse are now seen in Hong Kong. (A foreign operator in Vanuatu told IMA that adult humpheads were being shipped to Taiwan for an experimental breeding program). An adult coral trout of 2 to 3 kg. would cost $100 to $150. Hong Kong's restaurant trade in live fish is therefore reserved for banqueting and special occasions!

Included in table 7 are the declared export prices for the main species of fish exported from the Marshall Islands. Fees due to MIMRA and others such as the mayor of Enewetak were calculated based on these rates. The declared export price for live groupers was $9/kg., for coral trout $12/kg. and for humphead wrasse $15/kg. The price paid to the fishermen is thought to be considerably less. The company's Filipino fishermen receive a flat monthly rate and a bonus when they return to Manila. A comparable industry is Hawaii's tuna longline industry, where indentured Filipino fishermen are paid $3-400/month and a bonus based on the catch. In PNG, the price paid to a fisherman for live food fish is around 60¢/kg.

The live food fish trade is generally considered to be a lucrative trade (for some). Table 8 below calculates the value of live food fish harvested from the Marshall Islands based on data generated in tables 1, 3 and 7. For the six years it has been operating in the Marshall Islands, the trade exported 250 tonnes of live fish, bringing in an estimated US$2.3 million in "declared" revenue to the country; an average of $383,000 per year. The company has sold this fish from the Marshall Islands in the wholesale markets in Hong Kong for an estimated US$5.5 million over six years, equivalent to $922,000 per year (table 8). The retail value of the Marshall Islands fish sold in restaurants and other outlets was $11 million over six years, or $1.8 million per year.

One question is how much of the "declared" value actually accrues in the Marshall Islands since the company is a foreign company (with a locally registered subsidiary that avoids paying foreign investment fees), pays the Filipino fishermen in Manila, and controls the fish from reef to export. As mentioned above, some level of fees are paid to MIMRA and the mayor. However, the economic benefit to the Marshall Islands may be negligible.

In contrast, the total value of the Hong Kong live food fish trade in 2002 has been calculated in table 9 as being worth about USD $550 million, based on retail sales of 13,000 tonnes of live fish.

	Marshall Island total wt./sp. kg.	Declared export value $/kg	Total RMI export value $	Wholesale price HK US$/kg	Total HK wholesale value $	Retail price HK US$/kg	Total HK retail value US$
Marbled rock cod *E.microdon*	213,830	$9	$1,924,470	$21.46	$4,588,792	$41.50	$8,873,945
Big spot coral trout *Plectropomus* sp	15,757	12	189,084	27.79	437,820	$65.97	1,039,492
Tiger cod *E.itajara*	10,291	9	92,619	23.84	245,337	49.73	511,771
Honeycomb rock cod *E.fario*	3,606	9	32,454	21.46	77,385	41.50	149,649
Purple rock cod *E.hoedti*	3,440	12	41,280	27.79	95,583	65.97	226,937
Humphead wrasse *C.undulatus*	1,598	15	23,970	55.85	89,248	105.54	168,653
Total value for 6 years in USD	248,522kg		$2,303,877		$5,534,165		$10,970,447
Total value per year in USD			$383,980		$922,361		$1,828,408

Table 8 – The value of live food fish harvested from the Marshall Islands

	Weight in kg	**Wholesale price/kg**	**Wholesale value USD**	**Retail price/kg**	**Retail value USD**
Giant grouper *E.lanceolatus*	31,707	$23.84	$755,928	$49.73	$1,576,743
High-finned grouper *C.altivelis*	26,375	64.16	1,692,116	102.16	2,694,351
Green grouper *E.coioides*	1,502,984	11.12	16,716,893	23.14	34,782,866
Tiger grouper *E.fuscoguttatus*	418,296	23.94	10,012,082	46.19	19,320,668
Flowery grouper *E.polyphekadion*	344,431	21.46	7,392,134	41.50	14,293,734
Leopard coral trout *P.leopardus*	2,468,726	35.47	87,554,510	58.05	143,309,826
Spotted coral trout *P.areolatus*	317,837	21.79	6,926,139	46.27	14,706,070
Other groupers	1,716,179	**20.57*	35,297,852	**40.17*	68,947,173
Humphead wrasse *C.undulatus*	48,674	55.85	2,718,548	105.54	5,137,233
Other wrasses & parrotfish	102,858	**20.57*	2,115,552	**40.17*	4,132,301
Snooks & basses	1,217,382	**20.57*	25,038,746	**40.17*	48,908,096
Mangrove snapper *L.argentimaculatus*	238,619	6.36	1,516,700	16.34	3,900,168
Other marine fish	4,689,830	**20.57*	96,459,008	**40.17*	188,413,051
TOTAL	13,123,898kg		$294,196,209		$550,122,280

* estimated as mean of 7 lowest priced species

Table 9 – The wholesale and retail value of the 2002 live food fish trade in Hong Kong (USD)

Suggestion to MIMRA to impose a moratorium

In September 2003, IMA staff in Honolulu wrote to the director of MIMRA suggesting that MIMRA should impose a moratorium of at least 18 months on this fishing operation in the Marshall Islands. IMA's local staff in Majuro also visited the MIMRA office to talk with the director and LRFFT fisheries officers about this. There were a number of reasons for the moratorium suggestion, included in the letter to MIMRA. Spawning aggregation sites for groupers and other species were now known to be fished in Enewetak and other atolls by the company who had admitted this. The company was expected to return to Enewetak in November, as usual, to begin fishing (although they had mentioned to IMA in April 2003 that they were not returning) and more time was needed for MIMRA and IMA to work on a plan for protecting these sites. MIMRA had previously agreed that continued fishing of spawning sites would be banned. The proposed observer program would also need time and funds to be developed. In addition, it was pointed out that the communities and council on Enewetak were against the fishing operation, and people were annoyed that their subsistence fishery was declining. More time was needed in which to sort these things out.

From a project perspective IMA was also coming to the end of this first phase and project funds were now running low. An initial grant application submitted to NOAA CRC in February 2003 for phase 2 funding to continue the work and design an observer program had not been successful, so continuity of funding was not available. (The project proposal was subsequently updated and resubmitted in March 2004 receiving a more favorable response, and at the time of writing this report a decision is still pending). So, an 18 month moratorium would also give time for IMA to secure funding to continue working in the Marshall Islands.

Although IMA did not receive a written response from MIMRA, it is understood from the local discussions that MIMRA officials favored IMA's suggestion for a moratorium and did write to the company and claimed they did not have the proper license for Enewetak. There remains some uncertainty about whether they came back or not during the 2004-2004 fishing season. However, recent unconfirmed information from the Marshall Islands suggests that a new "Chinese" company started operations in 2003-4 on another island, working "below the radar screen" by not applying for export permits, either not declaring exports, possibly smuggling out shipments in tuna and shark fin transporters, or stock piling live fish on an undisclosed outer island. They are expected to continue in 2004-2005.

Conclusion.

With expectations high about receiving phase 2 funds, IMA is gearing up to continue this work in the Marshall Islands. The long term issues associated with this trade have to be considered and worked on. Table 2 demonstrated that the company will move to other islands for a number of years before returning to continue fishing, and more recent news shows that new companies are being encouraged to start up. If local stakeholders agree that they want this type of fishing to continue, then a management plan and observer program has to be put in place to reduce the destructive impacts. Either way, legislation and policies are required to control the fishery or prevent it from getting started again in a destructive manner. IMA must therefore continue to work proactively with MIMRA and other stakeholders to achieve these outcomes and to help the Marshallese protect and sustain their coral reef ecosystems.

EVALUATION OF PROJECT TASKS AND OUTPUTS

The following is a concise evaluation of project objectives and activities as they appeared in the original project document.

Assessment

Objective 1: To collaborate with Marshall Island communities, College of the Marshall Islands and government agencies in the assessment of the LRFFT, its socio-economic and environmental impacts, degree of management and linkages to subsistence fisheries, producing a series of participatory management recommendations for building local capacity to eliminate destructive aspects of this trade, sustain fisheries and protect the Marshall Islands' coral reef ecosystems.

- Draft community-based Coral Reef and Fisheries Conservation Plan for Enewetak Atoll and other atolls targeted by the LRFFT.
- Scientific assessment.
- Validated Coral Reef and Conservation Plan.

The rationale for this component of the project was to combine local community-based assessment of the LRFFT issue with scientific assessment. During community workshops at Enewetak, community groups and council members spoke out strongly against the LRFFT operations on their island saying they wished to evict the company and fishing operation. The mayor was the main supporter of the LRFFT activities on the island. The project therefore decided to put on hold the development of a community-based management plan on Enewetak for the LRFFT activities since it would have been premature and would have meant going against the wishes of the community. This could be re-floated once the communities have decided what to do on Enewetak. Other islands have also decided against the trade.

The scientific assessment was completed as planned and results are discussed above in the main report, covering the trade, management capacity, stakeholders, spawning sites, ciguatera, impact on subsistence fisheries and feed fish requirements. Capacity building of a local project officer took place throughout the project. Given limited project resources and the expanding focus on more islands including Majuro, this local staff member was more effective based in Majuro rather than Enewetak as originally proposed. CMI helped backstop the project and local staff member. Underwater surveys on Enewetak were determined to be logistically expensive given the isolation.

Awareness

Objective 2: To raise the awareness of the Marshallese about destructive fishing practices, the LRFFT and coral reef conservation in general to the extent that communities and governments in islands where the LRFFT has been practiced are demonstrating more informed decision-making about sustainable use and conservation of their coral reef resources.

- Conservation awareness and extension training strategy, with updates
- Conservation awareness workshops and focal point training
- Information materials and video in collaboration with Enewetak community
- Elementary curriculum outlined for coral reef education
- 2002 and 2003 September ICC events completed and data cards submitted
- Monitoring data on changing attitudes
- CMI strategy for national extension training program in coral reef conservation

Conservation and LRFFT workshops took place with the community on Enewetak on three weeklong occasions and also in Majuro at the Enewetak council office. These workshops were very successful, participation was high (20-30+ participants per meeting), and have proven invaluable and one of the most effective means of getting information disseminated about the trade so that communities can act on it in their own way and at their own pace. More workshops on more islands are called for. Training for the local IMA coordinator was ongoing and peaked with his participation in a coral reef assessment and management course at the University of Guam in 2003. The local staff member was effective and invaluable when it came to running the awareness workshops and teaching communities in Marshallese about conservation and sustainable fisheries.

The project workshops were successful in helping stakeholders make better decisions about the LRFFT and destructive practices. The council and community on Enewetak were quick to oppose the trade since they already had misgivings about the fishing before IMA arrived; IMA was the catalyst for speaking out against the trade. The Mayor supported the operation and initially avoided project workshops, but subsequently increased his attendance and became more aware about conservation issues and community opposition. He was not re elected in November 2003, but remains an influential chief.

After IMA justifiably raised concerns and national awareness in the Marshall Islands Journal about possible cyanide use and started talking about an observer program, MIMRA appeared to change attitude and participated more fully in the project. MIMRA's own suggestions to protect spawning sites, potentially ban the export of the humphead wrasse and increase observer coverage were good signs that the conservation awareness was beginning to work at the national level. However, it is not yet clear whether the awareness raising was indirectly responsible for the company not coming back or being allowed back in the 2003-4 fishing season. MIMRA staff members appeared sufficiently aware about the destructive nature of the fishing operation at Enewetak and elsewhere that when the suggestion came to implement a moratorium, it was not overtly opposed. However, the recent news about a new "Chinese" company replacing Pacific Marine Resources and Development indicates that the problems are still ongoing, possibly more complex and that more outreach is required.

During the first phase of the project, with the shift in project strategy away from the community on Enewetak to working more with MIMRA in Majuro due to the entrenched position of the mayor, the growing participation of MIMRA and the emerging need for a national level approach, the Enewetak information materials, video and elementary curriculum were put on hold. IMA remained uncertain about what the information materials should say. If most communities on the islands are against the trade then surely the message should reflect that. A watered down message that tries not to offend anyone by presenting a balanced approach that says that it "could" be sustainably practiced is, in the opinion of IMA, the wrong message to be sending out to the islands. As discussed above, it confuses the community, and gives the fishing operation an endorsement and just the right window in which to gain access under a "trial basis", harvest the fish, and move on. IMA has had some experience trying to develop these mixed-message type of materials with SPC (Secretariat of the Pacific Community) in Noumea and The Nature Conservancy (TNC) and found the process to be frustrating and in the end ineffective. Communities need their governments to present a clear message about this trade: that it leads to overfishing and that in practice commercial fisheries based on harvesting reef fish populations, especially apex predators, cannot be sustained; and that reef fisheries should instead be limited and carefully controlled for the benefit of local subsistence fishing which includes regeneration of the resource. However, at this stage of the project there is some risk of permanently alienating groups such as MIMRA if we come out in print strongly against the fishery. As a compromise, IMA circulated brochures in Marshallese about cyanide use and its destructive impacts.

Discussing cyanide use and containment of destructive practices that the trade is known to be using allows for more unification amongst stakeholders and provides a more acceptable strategy for outreach and the message in the awareness materials. This in turn can set the stage for more acceptable management planning: focus first on removing the destructive practices and transforming the trade, without endorsing it. Then, if the trade cannot function without fishing spawning sites or taking undersized fish, it will either continue fishing in an illegal manner or decide to move on. An effective observer program and good leadership then becomes crucial.

This strategy and rationale for awareness and management planning is expressed in objective 1 of the project. However, it has been a challenge to implement during the first phase of the project ("the devil is in the detail"), at times becoming a dilemma, since there is a fine line in practice between trying to transform something and endorsing it. This subtle difference has been at the heart of what IMA tries to do. However, when something appears so unsustainable or destructive, it is hard not to come out heavily against it. Reviewing and rationalizing this approach, now, during this evaluation of the project's first phase, has helped to identify where the project has struggled somewhat and in turn sets a course for the next phase.

For the school program components, discussions were held with the Department of Education to apply IMA's CREST program and this will be looked at in more detail in the next phase. A great number of digital pictures of all aspects of the project and cage operations were taken and have been used in reports and on IMA's website www.marine.org.

The local IMA staff member successfully helped coordinate ICC (International Coastal Cleanup) activities in September, although the turnout for the beach component was not as high as expected. CMI staff were effective in coordinating underwater clean up activities. CMI has also introduced a coral reef conservation practitioner specialization for Marshallese high school graduates, in addition to boosting after school and classroom teaching in marine conservation,

Building capacity for managing LRFFT and for coral reef conservation

Objective 3: To help the Marshallese build and maintain community and government capacity for marine conservation, through the development and implementation of local and national management plans and initiatives for the LRFFT.

- Assessment of existing capacity for LRFFT management and implementing Conservation Plan
- Best Practices Standards for LRFFT adapted to RMI, and Management Guidelines adapted from Australia/PNG
- Management and community leader workshop in implementing participatory Coral Reef Conservation and Fisheries Management plan
- Plan for ongoing training, external support and organizational development
- Management intervention monitoring, and project evaluation with recommendations for expansion to other atolls in Marshalls and Micronesia.

The challenge with this objective as originally crafted is that with management capacity in MIMRA being development-oriented and with the LRFFT being so inherently non-sustainable and reliant on destructive practices, management planning for the LRFFT within MIMRA may never lead to the conservation of coral reefs.

Overfishing seems to be the ubiquitous outcome of commercial reef fisheries. Even in the "model" country of Australia, regulations are becoming increasingly strict against the "line fishery" for live groupers, coral trout and humphead wrasse. In Queensland, humphead wrasse and many of the groupers previously exported to Hong Kong are now off limits to commercial fishermen. Only the coral trout, *Plectropomus leopardus*, seems to be able to support commercial fishing in Australia because of faster growth rates, but still requires regulations on size and volume.

At this point in the Marshall Islands an intelligent conservation plan for coral reefs would be a permanent ban on LRFFT operations and other commercial fisheries that target slow growing species. Management capacity for this type of decision seems more likely to be built in an agency such as MI EPA and through CITES rather than more development oriented MIMRA. However, the project is still moving forward optimistically under a capacity-building partnership with MIMRA hoping to arrive at some level of protection for reef fish in the Marshall Islands by containment of destructive practices and a more effective observer program. Although, things may only move slowly towards this objective. This coming year the project should also look at options for branching out with agencies such as MI EPA if progress with MIMRA is not achieved.

Other projects such as SPC's regional community-based fisheries program may also help build capacity in the Marshalls and other Pacific Islands for more rational and conservation-oriented decision-making about reef fisheries. An optimistic outcome of such regional initiatives would be the recommendation that Pacific Island countries reserve their reef fish fisheries and regulate for sustainable local consumption and subsistence purposes within the carrying capacities of reef fish populations. Some aquarium trade uses also appear within the carrying capacities of reefs.

Capacity building for more effective management takes a long time and may exceed the allocations of time and resources made available through projects such as this, but remains one of the primary objectives. Building capacity for coral reef conservation continues to be a challenge in the Marshall Islands. One of the major lessons learned is that for this type of complex project to be successful IMA technical staff must be prepared to spend the maximum amount of time in the field helping to implement the project tasks rather than relying too much on delegation and a capacity-building approach. It is possible that effective coral reef conservation will always depend upon partnerships.

The presence of an NGO such as IMA in the Marshall Islands can help augment government capacity; help fill gaps. MIMRA has a fairly large local staff but is responsible for many different types of fisheries including tuna fisheries. As in all Pacific Island countries, a dominant focus has been the management of offshore tuna fishing and foreign vessel licensing given the importance to the national the economy. Reef and inshore fisheries management have tended to get left behind leading to inevitable outcomes such as overfishing. There is just too much for MIMRA to do. The MEIC interagency group has been tackling community-based fisheries, but may be running out of steam after the first year. One challenge for IMA in trying to help is to become accepted by an agency such as MIMRA. During this first phase of the project, IMA did not achieve full acceptance. By focusing this coming year on helping MIMRA to remove destructive practices and develop the observer program then perhaps this will lead to greater acceptance. However, the project has also been concerned about the LRFFT's tendency to use corruption as way of maintaining its position, and because of this, it is feasible that IMA may never be permitted into the fold. Focusing carefully on helping MIMRA to meet expressed needs such as an observer program will be an important strategy for fostering acceptance. The IMA project manager also intends to spend much more time in the Marshall Islands rather than periodic visits and trying to supervise at a distance.

"Standards" are still being pursued for the LRFFT by the likes of MAC (the Marine Aquarium Council) as an extension of the standards and certification program for the aquarium trade. Standards may be an effective way to go for the aquarium trade since many of the targeted organisms have fast enough growth and replenishment rates that can support managed exploitation. However, the project believes that standards for the LRFFT are a big mistake since the target species have life history characteristics that make them inherently vulnerable and susceptible to overfishing and extirpation, and trying to create standards for the harvesting of these slow growing species will ignore such vulnerabilities and from the get-go endorse an industry that is by definition destructive.

Nothing has been seen in writing yet about the LRFFT standards. The model for the live reef food fish trade was thought to be Australia. However, even there regulations are still evolving, for example humphead wrasse and slow growing groupers are now being placed completely off limits. Indeed, Australia is starting to approach what IMA has been arguing all along, that because of the species' inherent vulnerabilities the LRFFT is just not sustainable. Much of Australia's production comes from mariculture and the faster growing coral trout.

IMA in the Pacific therefore adamantly believes that a "standards" approach for the LRFFT is not just premature but irrelevant. If the Pacific Islands attempt to craft standards or best practices for this trade they will be based on the perception that groupers and humphead wrasse can be fished sustainably and concepts such as pulse fishing of groupers spawning sites. Even if the standards include an avoidance of groupers, how is a Pacific Island or Filipino fisherman with a hook and line going to be convinced to use a looking glass to target only coral trout which a sustainable industry is going to be have be predominantly based upon? How can they avoid catching groupers that live in the same habitat? This may work in Australia because of the threat of authorities seizing gear if the wrong fish are onboard, but it's not likely to work in the Pacific Islands. Plus, in Australia, this is not based on standards or best practices but on government regulation.

An idea inherent within standards is that the industry will become self-regulating. This concept has grown from MAC's industry-centered approach and a philosophy that government regulation and management of trades in reef species does not work. IMA in the Pacific begs to differ and continues to believe that building government capacity should be the main focus of coral reef management efforts. An industry-centered approach may work in the aquarium trade since consumers in the US and Europe will choose to buy certified green products. However, this is not going to be the case in the live food fish trade where consumer preferences in SE Asia are completely different. The rarer, more endangered and expensive a fish is in Hong Kong and China the more prestige there is in eating it. Left to itself the trade will continue to seek out and harvest increasingly endangered species until there are none left. A trade that has got away with using cyanide for decades and with preferences for fishing grouper spawning sites beyond prying eyes and gaining access to the next set of reefs to plunder is not going to voluntarily accept or implement standards. The idea is therefore inherently flawed.

Government and communities will remain fundamentally important in the Pacific Islands for monitoring, regulating and keeping an eye on such activities. Observer programs will still be crucial. MAC believes that standards and certifications can replace government regulation and make government's work easier. Government agencies have therefore been attracted to this idea. This Marshall Islands project originally included the idea of looking at "standards" but other than paying attention to what MAC is up to next, the idea has been dropped.

IMA Hong Kong originally floated the idea of best practices as a transformational tool for the SE Asia live food fish trade because it was located in Hong Kong and had come to depend on maintaining a good relationship with the trade if it was to continue receiving information. IMA in the Pacific was always very concerned that IMA in Hong Kong was becoming too industry centered. MAC has since grabbed onto the concept. That said, IMA in the Pacific will continue to encourage certification in the aquarium trade.

This coming year, IMA will continue to research what is happening in Australia with management of the live food fish trade and use this as a guide for advising MIMRA and other Pacific Island fisheries agencies on how to regulate and build management capacity against the use of destructive fishing practices. Potential training for MIMRA staff and observers could be arranged in Australia. Improving MIMRA's observer program capacities is also important for enhanced management of the Marshall Islands' tuna, shark and other fisheries, and the protection of endangered sea turtles and marine mammals. Continued support by NOAA for the Marshall Islands program is therefore all the more crucial.

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