CCIF
Conservation and Community Investment Forum

Analysis of Destructive Reef Fishing Practices in the Indo-Pacific

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Chapter 1

Introduction

Only a coordinated approach which reforms the economics of the aquarium industry, creates actively enforced marine managed areas, and provides massive technological assistance to fisheries, NGOs, and communities alike, is likely to succeed.

The CCIF team has spent many months in the field in an attempt to understand why the Indo-Pacific reefs are being destroyed at such a prodigious rate. There are many questions and paradoxes that puzzled us:

How can such vast stretches of irreplaceable reefs be destroyed for such relatively small gains? Why aren't locals more protective of their home reefs? Why are heavily damaged reefs, which yield very little returns, so often hit again and again until they are completely obliterated? Can regulations work in Indonesia? What types of NGO interventions have worked?

This report summarizes our findings. This discussion is meant as a companion to CCIF's RPA Business Plan; it is targeted at readers who would like to learn about destructive reef fishing in more detail.

In Chapter 2, we look at the regulatory context of reef fishing – from the careful approach of the Queensland government in its Great Barrier Reef, to the complete "free-for-all" in Indonesia.

In Chapter 3, we look at the basic economics for every participant in the reef fishing value chain, and examine how a "perverse" set of incentives actually encourages reef destruction.

Lastly, in Chapter 4, we look at the efforts by NGOs and other groups to put an end to the destruction, and suggest further solutions toward this end. In this last section, we highlight the efforts and initiatives of CCIF that we believe are critical to the success of conservation efforts in the Indo-Pacific.

To sum up the major findings:

- While it is certainly possible to prepare and enforce a management plan which ensures the reef's long-term survival (barring further massive global bleaching events), such an approach is unlikely to take hold in Indonesia and the Philippines before it is too late.

- The current aquarium fishing economics pay off principally the most sophisticated exporters and importers, while local collectors and middle men earn so little that only massive collection rates, aided by the use of poison, ensure their economic survival. No single organization owns or controls the entire chain of aquarium fish from collector to the hobbyist's tank – making it impossible for ecologically conscious collectors to track their fish to the end consumer.

- Existing attempts of NGOs to provide local alternatives to reef destruction, while extremely helpful in places such as Komodo Island, are unlikely to solve the problem as a whole.

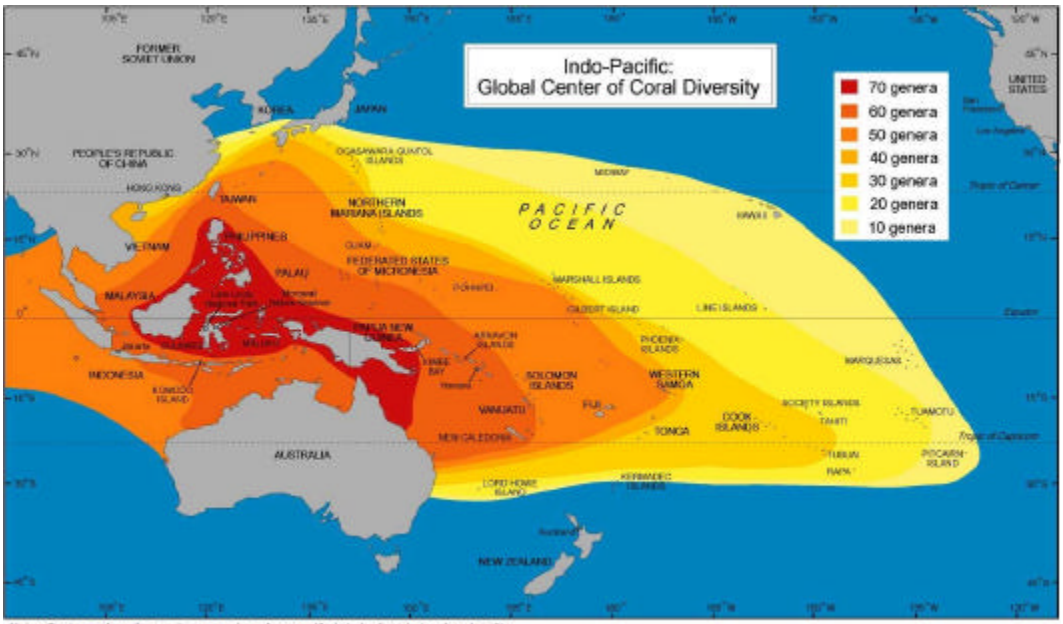
These findings lead us to our final conclusions. Only a coordinated approach which reforms the economics of the aquarium industry, creates actively enforced marine managed areas, and provides massive technological assistance to fisheries, NGOs and communities alike, is likely to succeed.

Chapter
2

Reef Fishing Regulations in the Indo-Pacific

The harvesting of aquarium fish and coral trade in the Philippines and Indonesia is highly destructive and almost completely out of control.

The unmatched biodiversity of the reef ecosystems in Indonesia and the Philippines is most compellingly demonstrated by the famous "bulls-eye chart" shown below. Indonesia, at the center of it all, also happens to be the world's most prolific practitioner of dynamite and cyanide fishing. Fortunately, not all the region is under equal stress – a number of countries have gotten reef fishing under control, or are in the process of doing so.



Note: Contours show the maximum number of genera likely to be found at a given locality.
Adapted from Veron (1986) "Corals of Australia and the Indo-Pacific". Produced by The Nature Conservancy's Hawaii Natural Heritage Program, September 1988.

The harvesting of coral reefs in the Southwest Pacific generally occurs under one of four basic regulatory environments:

- Free-for-all fisheries (Indonesia)
- Community fisheries (Philippines)
- Restricted fisheries (Fiji)
- Comprehensively managed coral reef fisheries (Australia)

Each of these is discussed in detail below.

Indonesia: Free-for-all Fisheries

Indonesia represents the worst regulatory case. Free access laws make local protection schemes difficult. No zoning exists. While registration with regional offices is required for all outsiders fishing within 4 miles of the shore, this is seldom enforced and never a hindrance to destructive fishing. There is no legal precedent which exempts local communities from the free access laws – local lease rights ("hak pangalolean") have been established for terrestrial areas only, and local communities do not have the right to enforce local fishery management plans (even if they existed).

Indonesia represents the worst regulatory case. Free access laws allow fishers to range where they please-- and virtually all use cyanide.

As a result, fishers are free to ply their trade where they please. Well-organized aquarium fishing fleets out of Java and Bali range all over Indonesia. Virtually all use cyanide. Dynamite fishing operations abound – some of them small, others highly organized and coordinated. Hong Kong-financed live food fishing operations, all of which use cyanide, are to be found in most areas with remaining grouper populations.

There are currently no effective controls on fishing practices. While technically illegal, local authorities (water police, fisheries departments, navy) mostly fail to enforce fishing practice laws. Cyanide fishing has been around for so long that it is considered "traditional" and local fishers, when arrested, tend to face very light fines. Organized dynamite fishing operations are profitable enough to secure the cooperation of local authorities; ditto for the illegal (i.e. non-CITES) export of coral to Singapore and elsewhere, and the cyanide capture of live food fish. The only systematic enforcement takes place when an existing dynamite/cyanide cartel pays for protection from potential competitors.

In such an environment, local communities have found it very difficult to protect their reefs. Ironically, one often encounters local cyanide fishers complaining bitterly about out-of-town dynamite crews blowing up their reefs. The recent decentralization of

power to local authorities has, in general, led to even faster natural resource exploitation by local operations.

Sustainability is impossible. Each method of destructive fishing takes its own toll.

Dynamite fishing is responsible for at least 50% of the destruction in places near population centers such as South Sulawesi and Bali Barat.[1] Pet Soede and Cesar studied dynamite fishing extensively and came to the conclusion that: "the size of the coral area destroyed by a single blast depended on the size of the bomb and position of the explosion relative to the coral reef. Our observations showed that a beer bottle bomb shattered stony corals in an area of approximately 5 meters in diameter. The radius of coral killed per blast was 2.5 m, hence the area affected per blast was 19.6 m^2."[2] A large dynamite boat, carrying 15 crew, can easily throw 10-15 bombs, 20 days per month, 10 months per year, for a total number of blasts estimated to be 2000-3000 per year. It takes 20 such boats less than a year to wipe out an entire square kilometer of reef.

Live food fishing, primarily grouper for the seafood markets of Hong Kong, is mainly an overfishing issue. An estimated 54,000 tons, or 630 kg per km^2 per year, of live fish are caught from Indonesia's coral reefs (assuming 50% death rate).[3] Fishers tend to target the annual spawning aggregations of groupers, a practice that can wipe out an entire regional population at one time. A typical grouper cyanide fishing operation that was studied as part of the research for this plan covers about 50% of the available reef area every year and takes about 75,000 grouper per year in a 11 km^2 harvest area. On many reefs in Indonesia, groupers have become exceedingly rare. However, impact on corals is less than that of aquarium and dynamite fishing, since the amount of cyanide used is relatively low: the reef-degrading capacity of the cyanide fishery for food fish on Indonesia's coral reefs amounts to a loss of live coral cover of about 0.052 m^2 per 100 m^2 of reef per year.[4]

Coral fishing is typically associated with the live grouper trade; a typical boat crew will go after both. The Convention on International Trade of Endangered Species (CITES) allows the export of about 1 million pieces of live coral per year from Indonesia.[5] Is has been estimated that the true export is over 9 million pieces.[6] In a

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[1] Lida Pet Soede, Dissertation.

[2] Pet-Soede, st.al., *Economic Issues Related to Blast Fishing on Indonesian Coral Reefs*, p. 37.

[3] Mous, Pet-Soede, Erdmann, *Cyanide Fishing on Indonesian Coral Reefs*, p. 20.

[4] Ibid., p. 22.

[5] "Pattern of Coral Reef Utilization in Indonesia", Ministry of Forestry and Estate Crops, Republic of Indonesia Cites Management Authority. (As presented at the International Coral Reef Conference in Jakarta, Indonesia, April 9, 2001.)

typical operation studied as part of the research for this plan, a community on the Spermonde archipelago harvests over 15,000 pieces of coral per day, which roughly translates into 3% of the available reef stripped per year. This particular operation has been in operation for 10 years, is well financed with over 20 boats, and, by itself, accounts for 80% of the CITES-approved export quota. It is neither the largest nor the only one of its kind.

Aquarium fishing is done with varying amounts of cyanide. Some fishers use cyanide for virtually all species, while others restrict themselves to those species at greater depth, such as the emperor cardinal. The problem is twofold: overfishing, and coral destruction through cyanide. Local overfishing is a big problem. In Bali Barat, for example, on the western tip of Bali, over 10% of fish are taken every year by a small army of approximately 200 fishermen.[7] In the Banggai area, one operation alone is taking 20,000 banggai cardinals per day, over 70% of which die on their way to the Bali exporter due to inadequate handling practices.[8]

As Lida Pet, Mark Erdman, and Peter Mous report in their study *Cyanide Fishing in Indonesia*: "The damage done by the cyanide fishery for the much smaller sized, ornamental fish is probably much greater than that for food fish, as the number of target fish per unit of reef area is much higher. Also, mechanical reef destruction in the fishery for ornamental fishes may be more extensive, as branching corals are broken apart over large areas, in order to retrieve small fish."

The anecdotal evidence, as reported by dive operators throughout the archipelago, is deeply worrying; there are reports of entire coastlines that have been essentially stripped of coral by aquarium fishers. Fishers interviewed as part of the research for this plan report that they have to travel far, up to eight days, into the far northern and eastern reaches of the archipelago to find good fish – travel times of eight days for a two-day harvest expedition are not uncommon. It is estimated that less than 10% of the Indonesian reefs are pristine at this point, 30-40% completely destroyed, and the remainder moderately to heavily damaged.[9]

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[6] Interviews with local experts, CCIF, May 2001.

[7] Field observation, CCIF, May 2001.

[8] Field observation, CCIF, May 2001.

[9] Ministry of Forestry and Estate Crops, Republic of Indonesia, "Pattern of Coral Reef Utilization in Indonesia", a presentation and report at the International Coral Trade Workshop – Development of Sustainable Management Guidelines, Jakarta, Indonesia, April 9-12, 2001.

Philippines: Community Fisheries

Overall, the regulatory situation in the Philippines is certainly bad, but there are rays of hope. For starters, the collection and export of corals is banned in the Philippines. To manage aquarium fishing operations certain regions/communities/cooperatives have taken matters into their own hands and have organized around some level of protection. However, free access laws that allow outsiders, and their destructive practices access to local waters continually threaten the efficacy of these arrangements.

Recent improvements in the traditionally spotty enforcement, as well as awareness building efforts, have brought some improvement.

Aquarium fishing. To be clear: cyanide and dynamite fishing in the Philippines are illegal. Recent improvements in the traditionally spotty enforcement, as well as awareness building efforts, have brought some improvement. Also, the Philippines have begun to set the legal precedent that allows local exemptions or modifications from the "free access" rule; pearl farmers have been successfully obtaining maritime leases for awhile now, and local communities have been given the right to establish and enforce local fishery management plans ("FARM Cs"). However, true protection of the reefs remains up to the local communities. Representative examples of successful local protection exist and our described in greater detail below, in descending order of efficacy.

Palawan/Coron. This area is unique. While the rest of the Philippines is regulated by the very resource limited Bureau of Fisheries and Aquatic Resources (BFAR), the Palawan Council for Sustainable Development (PCSD) has authority over the marine environment. Until recently, the PCSD has banned all aquarium collecting in Palawan. PCSD is now accrediting a limited amount of collectors, buyers and shippers out of Palawan. The accreditation will require a fishery management plan and adherence to fishing, handling, and monitoring standards consistent with those currently developed by MAC. One such organization in accordance within these regulations, The New Tribes Mission, is working within Coron Bay area (10 locations), with a hub near Coron Town, to train and equip 40-60 collectors in sustainable harvesting (via temporary PCSD accreditation). Further, because of the ban on all aquarium fishing, and the proliferation of pearl farms guarded by armed security personnel, the incidence of destructive fishing in Palawan is now quite low.

Bataan, Luzon. Aquarium-fishing here is done by a self-regulating cooperative of 30 collectors that exclusively use hand-nets (no cyanide). This group has established species-specific closed seasons (spawning seasons, etc) and minimum size/age limits. Half of the divers are free divers, half use a hookah. Each collector is responsible for handling his fish (including all costs) until fish are sold.

It is estimated that there are some 400 fishermen collecting aquarium fish in the region surrounding Bataan. It is not clear to what extent these collectors are collecting from community reefs or are simply transient fishermen moving from reef to reef. It is

expected that many of these collectors (from neighboring Zambalis for instance) may use cyanide. The cooperative in Bataan deters cyanide activities from their community reefs through self-enforcement (many are deputized by BFAR) and peer pressure.

Bohol. Local communities own a maritime zone extending 15 km from the coast. Several local communities in the Bohol area, with the help of the CRMP (coastal resource management program- funded by USAID), have put together coastal management plans. Some communities have chosen to ban all commercial fishing in their areas, limiting the local areas available for aquarium fishing and forcing one local middleman to send his boats farther out to collect fish. However, the majority of the coastal communities in Bohol have informal management plans run by the "elders" of the village. The results are mixed. Although technically illegal, blast fishing and cyanide fishing are still prevalent. Several dive operators noted that they still heard dynamite blasts when they were underwater and the middlemen in Cebu stated that they were sure the freelance fishers they bought fish from were using cyanide to catch fish.

Zambalis. This area is more typical - a group of local innovators is struggling to move the area away from cyanide fishing. Zambalis is blessed with about 20 sq.km. of barrier reef, 50%-70% of which still has coral cover, with the remainder damaged by dynamite and cyanide. Approximately 40 collectors ply the reef to supply one middleman. Fifteen of these collectors work exclusively with nets, while the rest still use cyanide. A middleman is planning to work with only the 15 net collectors to comply with MAC standards in the future, and hopes to eventually entice the others to join in non-destructive practices.

So far, so good. However, this area is also used by 90 -120 transient fishermen, many using cyanide. Approximately 30 banca boats, 20 of which are outfitted with "hookah" air compressors for deep diving, compete with the 10 local boats, of which only 2 have deep dive equipment. As a result, the critically important high-value species, such as blue tangs, are becoming extremely scarce, encouraging the use of cyanide to catch more low-value "bread and butter" fish. This oversupply of low value fish is exploited by the exporters for extremely low prices; in many cases, "quality screeners" working for the exporters have to be bribed to accept shipments, which further cuts into the already meek profits for fishermen (average income: $50/month) and middlemen.

Sustainability. In general, sustainability of these local-based efforts is low. While there certainly are some areas such as Northern Palawan/Coron Bay, where a combination of good local planning and well-developed alternative enterprises (pearl farming) are keeping the destruction at bay, the reefs of the Philippines have suffered terribly, and continue to do so. About 40% of the reefs are completely destroyed, about 55% are damaged, and only 5% is pristine.[10]

[10] Field observation and analysis, CCIF, May 2001.

Live food fishing. As in Indonesia, live food fishing for grouper, or Lapu Lapu, for sustenance and the seafood markets of Hong Kong, is mainly an overfishing issue. Groupers have become exceedingly rare in the Philippines. While impact on corals is less than that of aquarium fishing, the reef still suffers from the broader effects of overfishing. In Coron Bay the grouper fisheries have been virtually wiped out. This has put pressure on the many villages that have traditionally relied on groupers for sustenance and income to now search for alternative sources of food and income. The incentive is great to engage in destructive and illegal fishing practices.

Fiji: Restricted Fisheries Model

This model represents the best of the fishery approaches in the LDCs. There are limited numbers of collection permits issued, destructive reef fishing is not allowed, and local community control over the reefs can provide basic levels of enforcement.

Fiji's laws governing the use and management of marine resources are set out in Fiji Law Chapters 158, 158A, and 159. The Fisheries Act, Chapter 158, regulates fisheries exploitation and recognizes the local fishing rights of indigenous Fijians and their ability to control areas enclosed by fringing or barrier reef systems in the waters from the coast.[11]

The Fisheries Division has the authority to write regulations to enforce the Fisheries Act, however, it lacks the necessary monetary resources and personnel to monitor and enforce the fishing activities in the country.

However, this collection of laws does not provide specifically for the conservation of marine habitats. Also, regulatory responsibility is spread out and can make implementation confusing, at best. Aquarium products (such as corals and live rock) are not specifically identified in the Fisheries Act- but considered an, "…aquatic animal whether picine or not…" Thus coral as well as fish are given protection from exploitation.[12]

The Fisheries Division of the Ministry of Agriculture, Fisheries, and Forests is in charge of managing and enforcing the Fijian laws. The Fisheries Division has the authority to write regulations to enforce the Fisheries Act, however, it lacks the necessary monetary resources and personnel to monitor and enforce the fishing activities in the country. [13]

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[11]Food and Agriculture Organization of the United Nations, Fisheries Country Profile, February 1998.

[12] Lovell, Edward and Manasa Tumuri, "Provisional Environmental Impact Assessment for the Extraction of Coral Reef Products for the Marine Aquarium and Curio Trade in Fiji," June 1999, p. 57.

[13] Ibid, p. 58.

Aquarium fishing. Both the central government (Fisheries Division) and the local villages have a role in managing activities in the coastal zone through a process called the Dual Tenure System. This system creates a two-step permitting/regulatory process for companies interested in harvesting products for the aquarium trade.

At the central government level, there are five established live aquarium product companies that hold export permits from the Fisheries Division. Historically there has been a moratorium on the issuance of additional export permits. However, after the 2000 coup, the new administration did issue an additional permit to Mare Research on the premise that it was 1) one third Fijian owned and 2) going to focus on research. In practice however, Mare Research has begun exporting live rock, calling into question the moratorium on export permits.[14]

Since each village has management rights over their local waters, aquarium companies must also secure permission from the local chiefs governing one or more of the 409 separate fishing areas. This generally requires a "use fee," and a requirement that local collectors be used. Both the local and Fisheries Division permits are required for commercial fishing. Currently, the only commercial fishing is done off the main island of Viti Levu and each operator harvests separate areas.

According to the Fisheries Code, if a company is caught with cyanide or other poisons, they lose their ministry permit. Historically, poison fishing has not been a problem in this area of the Pacific.

The five companies that export aquarium fish are estimated to export between 230,000 and 280,000 fish from Fiji in 2001.[15]

Live corals/live rock. Currently there is no limit on the amount of coral, live, rock or other invertebrates exporters may send out. The exporters employ approximately 55 coral and fish collectors and several villages who have teams to collect live rock. Approximately 2 million kg. of live rock and between 820,000 and 920,000 pieces of live coral will be exported in 2001.[16] A small percentage of the live rock and coral is farmed. There is a growing concern over the volumes of live rock and coral exported from the country. However, without assessment and monitoring of the harvest areas, it is difficult to determine if the current harvest levels are sustainable.

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[14] Lovell, Edward, "Abstract: Status of the Trade ion Stony Corals, Republic of Fiji," presented at the International Coral Trade Workshop – Development of Sustainable Management Guidelines, Jakarta, Indonesia, April 9-12, 2001.

[15] Ibid, p. 2.

[16] Lovell, Edward, "Abstract: Status of the Trade ion Stony Corals, Republic of Fiji," presented at the International Coral Trade Workshop – Development of Sustainable Management Guidelines, Jakarta, Indonesia, April 9-12, 2001.

Enforcement. Enforcement is largely based on local resources as the central government lacks resources; the village chiefs generally enforce the fishing agreements in their local waters. However, anecdotal evidence shows that for some foreign-owned aquarium operations, when other locally-owned companies fish in their areas, the fishing boundaries are not always enforced. Permitted companies can bring encroachment complaints to the Fisheries Division, however, limited resources again restrict the ability to implement a comprehensive enforcement program. The results of this local enforcement approach are somewhat mixed - some of the locals are good stewards, while others are more short-sighted and pursue short-term returns.

Sustainability. The sustainability of the aquarium trade is relatively unknown as the Fisheries Division does not have any baseline information on the condition of the reefs and there has never been a complete resource assessment. Compounding the lack of data is the fact that the Fisheries Division has included product from other Southern Pacific countries (Soloman Islands, Vanuatu, etc.) that is transshipped as Fijian exports. Additionally, the Fisheries Division records the number of species allowed on the permit, not the actual number exported. Exporters often ask for much larger permit numbers (often 4-10 times the actual) to ensure they are within the legal limits; therefore, the numbers collected by the Fisheries Division are often grossly inflated. Lastly, the organization and standardization of the data the Fisheries Division has collected has not been consistent, making any sort of assessments difficult.[17] The lack of data and monitoring activities severely limits the ability of the Fisheries Division to make sound management decisions.[18] However, anecdotal evidence suggests that in the absence of destructive reef fishing practices, ecological damage may be limited to localized overfishing.

Combined, these companies have little more than 6,000 km^2 of fishing areas. Assuming 5% reef cover in those areas, and assuming approximately 280,000 fish are taken off the reef, the operators are harvesting approximately 0.05% of the fish on the reef. While this appears overall to be a low level of harvest, there may be patches of overfishing. Baseline and monitoring programs need to be implemented to confirm the sustainability of the current local operations.

[17] Lovell, Edward and Manasa Tumuri, "Provisional Environmental Impact Assessment for the Extraction of Coral Reef Products for the Marine Aquarium and Curio Trade in Fiji," June 1999, p. 46.

[18] Lovell, Edward, "Abstract: Status of the Trade ion Stony Corals, Republic of Fiji," presented at the International Coral Trade Workshop – Development of Sustainable Management Guidelines, Jakarta, Indonesia, April 9-12, 2001.

Australia: Comprehensively Managed Coral Reef Fisheries Management Plan

This is the model for all other coral reef fisheries. Sadly, nobody comes close – not even Hawaii. In 1975, Australia enacted The Great Barrier Marine Park Act, the first legislation in the world to attempt complete management of a marine ecosystem. The Act created the Great Barrier Reef Marine Park Authority (GBRMPA), who, along with the local government of Queensland, undertook the development and implementation of the project. In 1981, the Reef was named the first marine World Heritage site. Along with the honor came tighter guidelines on improved conservation and intensive monitoring.

The Great Barrier Reef is the model for all other coral fisheries. Park Authorities balance conservation and economic needs without compromising either.

The Great Barrier Reef Marine Park Authority (GBRMPA) is faced with the task of continuously balancing the needs of commercial fishermen with the conservation concerns of the reef. The economic importance of reef fisheries is significant (in 1996 the direct economic value of the commercial fishery was estimated at AU$143,000,000), but it requires careful supervision to remain sustainable. The Queensland Department of Primary Industries/Fisheries and Aquaculture (DPI) implements and oversees all fishing activity on the reef, maintaining the highly regulated commercial fishery program.

Aquarium fish collection is limited to 40 licenses total, for 2 divers each. The DPI uses input controls to regulate the industry – including strict limits on gear, the number of divers/participants, and limited areas open for collection. It is a limited entry fishery with only 63 fishers currently authorized to collect aquarium fish throughout all of Queensland.

Aquarium coral collection is also a limited operation regulated by the DPI. Coral is monitored by both input and output controls (quota). Currently 39 operators are licensed to collect at 60 coral collecting sites that exist throughout the park. Each collection site has an annual harvest limit of four tons. However, current harvest levels are below 50 tons (25% of total allowable catch) and estimates do not predict the entire allowable catch will be collected. Coral export from Australia is strictly prohibited and Environment Minister Robert Hill recently announced that all coral harvesting will be phased out in coming years.

Comprehensive zoning is the primary guideline used in the GBRMPA management plan. The governmental zoning plan, similar to the zoning of a city or town, applies to the entire marine park, allowing for the reef to have multiple uses and serve all stakeholders. The zoning provides for a range of activities to take place in the park simultaneously, achieving a successful balance between reasonable use and conservation. Six zone distinctions are commonly used by the GBRMPA, ranging

from commercial/recreational General Use Zones to no-entry National Park Zones. Zone designations are reevaluated regularly through a standard process that involves community and industry input as well as scientific analysis.

Enforcement. The GBRMPA spends about AU$1.7 million a year on patrolling and enforcement along the reef. Boat and aircraft patrols operate in the Marine Park on a daily basis, checking on activities and monitoring ecological conditions. Approximately 100 Queensland Parks and Wildlife Service Marine Parks Officers are employed under the Day-to-day Management Program working out of 14 locations. These officers enforce fines up to AU$22 000 if an individual enters or uses a zone for a purpose other than that allowed for in the zoning plan. The owner of a vessel may face penalties of up to AU$220,000 or, where the owner is a company, AU$1.1 million.

Monitoring. The Great Barrier Reef Marine Park Act emphasizes the importance of monitoring to measure the effectiveness of the management plan and to gauge the current conditions of the park. The Act delegates these duties to a variety of governmental, academic, and scientific agencies within Queensland. The GBRMPA manages the general process and implementation of all monitoring programs, while individual agencies are responsible for specific duties. The Australian Institute of Marine Science (AIMS) and the Cooperative Research Center for Ecologically Sustainable Development (CRC Reef) manage the long-term monitoring of all species and coral within the park through annual assessments. The GBRMA and the Queensland Department of Environment and Heritage (QDEH) monitor high-use areas and the number of vessels along the reef. The Queensland Fisheries Management Authority (QFMA) monitors all commercial fishing on the reef.

Sustainability. Predictably, the harvest rate for Australia is extremely low. Assuming an average fish density of 1.5 fish/square meter, the total catch for a harvested reef area is less than 0.15% of total fish population. The harvest rate for coral is even lower - an extensive study in 1985 evaluated the ecological sustainability of the ornamental coral fishery, and reported that it was sustainable because the target corals grew rapidly and recruited well, and the fishery was small and restricted to limited areas. With no live food fish operations and careful management, the Great Barrier Reef features significant populations of large predators. While there are some remaining questions about the sustainable yield of certain species, many agree that Australia's aquarium fishing operations are the best existing example of a sustainable fishery.

Chapter 3

Economic Incentives for Reef Destruction

The current economic structure of the aquarium and food fish trade is tailor-made for reef destruction.

In this chapter, we discuss in detail the economics of two kinds of destructive reef fishing: Cyanide-based aquarium fishing and dynamite-based food fishing. Note that CCIF's study was primarily focused on the aquarium trade and therefore our analysis of dynamite food fishing is not as in-depth as cyanide based aquarium fishing. Also this analysis does not explore the economics of cyanide-based live food fishing in detail.[19]

Aquarium Fishing

Coral reefs can generate significant returns. Depending on the intensity of fishing, aquarium exporters can realize between $1,300 and $8,000 in net profits per km^2 of reef per year (see Table 1).[20]

[19] However, this is not to say that the economics of cyanide-based live food fishing is not significant. As Mous, Pet-Soede, Erdmann have pointed out on page 23 of *Cyanide Fishing on Indonesia*, "The specific nature of the market for live food fish, where rarity increases the price up to a level where it is economically sound to catch the very last specimen, puts the fish stocks that are targeted at very high risk." Field observation and analysis in Karangan made by CCIF staff in May 2001 suggest that for one small island in the Spermonde archipelago (near Makassar, Sulawesi), yearly revenues from live grouper fishing are in excess of US$400,000/yr. for Karangan alone.

[20] Field observation and analysis, CCIF, May 2001.

TABLE 1: EXPORTER PROFITS PER KM²

Country	Harvest Density	Typical Net Margin	Net Margin Per Km²
Australia	0.2%	20%	$ 1,300
Fiji	0.5%	TBD*	$ 3,400
Philippines	TBD*	TBD*	TBD*
Indonesia	7%	20%	$ 7,800

*to be determined

However, this economic value is concentrated away from the local fishers and middlemen. To understand the economics involved, it is helpful to "follow the dollar" as an aquarium fish moves through the industry chain from collector to the U.S. wholesaler's tank.

Collector wages in LDCs range from $2/day for a free-diving fisher in Bali, to $5/day for a hookah collector on an exporter's payroll. While this compares favorably to an unskilled labor rate of about $1/day, most fishermen cannot pursue this line of work past the age of 35. It is highly dangerous; hookahs are polluted and unreliable, dive tables are routinely ignored, and great numbers of fishers fall victim to the "bends". Most independent fishers have seen their income decrease as the price for lower value species (damsels, zebras, etc.) has been eroded by oversupply, the availability of more profitable species has decreased, and bribes required to local authorities and export "screening personnel" are increasing. In many cases, the collectors are terminally indebted to middlemen and/or exporters who provide loans for boats and engines. This is not a good life. By contrast, an Australian collector can make $3000 per month, with full benefits, and state-of-the-art equipment, including dive computers, is used. This is skilled work. It takes about a year to learn the art of hand-net fish capture, since each species requires a different strategy involving a combination of tickler sticks, hand nets, barrier nets, decompression procedures, handling procedures, etc.

Middlemen get a bad reputation as profiteers and prime drivers of the cyanide trade. In fact, most of them have small, simple organizations and barely get by.

Middlemen get a bad reputation as profiteers and prime drivers of the cyanide trade. In fact, most of them barely get by. They typically have very small operations, often consisting of little less than a shack on the beach, some holding cages off the beach, one or two boats, and (sometimes) a truck. Table 2 shows the income statement of four middlemen in Indonesia – the economics for Philippine middlemen are very similar.[21] The gross margins realized by middlemen, none of whom have an export license on their own, are extremely low, and many are in unsolvable debt situations with exporters in Bali, Jakarta, or Manila. It is doubtful that any of them at this time can realize sufficient profits to professionalize their operations with better holding facilities, order management infrastructure, and transportation

[21] Field observations and analysis, CCIF, May 2001.

logistics. The resulting primitive methods of handling and storage contribute greatly to fish mortality. In terms of propagation of cyanide practices, many middlemen are aware that a shift to net-caught techniques is necessary. However, without the capital to buy the nets, import experts, train the collectors, and absorb the inevitable initial volume hit as the collectors learn the new techniques, this simply cannot be done.

TABLE 2: MIDDLEMAN ECONOMICS (IN US$)

	Bali		Sulawesi	
	Middleman A	**Middleman B**	**Middleman C**	**Middleman D**
Revenue	15,470	12,514	43,951	79,133
COGS	10,099	6,443	20,348	30,541
Sales Costs				
Packaging	1,488	1,373	1,351	5,490
Direct Sales	287	539	457	2,413
Transportation	-	455	904	18,867
Gross Margin	1,820	1,792	19,085	13,919
Percent	12%	14%	43%	18%
SGA				
Boat Costs	4,250	-	12,750	4,000
Facility Costs	360	2,363	240	4,646
Labor	122	870	2,761	2,522
Depreciation	1,000	-	3000	1565
Net Margin	-			
	2,136	472	2,141	9,089
Percent	-14%	4%	5%	11%

The relationship between fishermen and middlemen is usually more than strictly commercial. It is a long-term personal relationship; frequently, the middleman helps out during emergencies and assumes a "godfather" role. Their function as consolidators and logistics providers is crucial to the many thousands of independent collectors. This distribution model is completely different from that of Australia and Hawaii where there are basically no middlemen – exporters are backward integrated with their own fishing fleets and holding stations.

Exporters, by contrast, can make considerable profits. This is primarily driven by their ability to market the fish to US and European markets at considerable mark-ups. Table 3, below, shows typical mark-ups for representative species of fish and coral at every level of the industry value chain. While middlemen can charge relatively small markups on a small base, the value accumulates at the exporter level.

TABLE 3: TYPICAL MARK-UPS, INDONESIA (IN US$)

Species	Collector	Middleman	Exporter	Importer
Three Spot Damsel	$0.01	$0.04	$0.27	$1.35
Blue Devil Damsel	$0.01	$0.04	$0.26	$1.25
Anemonefish	$0.04	$0.14	$0.78	$12.50
Clown Triggerfish	$3.00	$6.00	$14.90	$49.95
Emperor Angelfish	$3.00	$6.00	$15.25	$64.95
Koran Angelfish	$0.40	$1.00	$6.32	$23.95

The exporter's profit margins depend highly on the quality of supply – demand for high-end fish is virtually assured. The exporter has two basic options: rely on the network of middlemen for supply, or build a proprietary fleet of collection boats. The former is far less profitable, for the following reasons:

- Species selection is heavily weighed towards low-value "bread and butter" fish. Exporters frequently buy far too many of these fish in bundled purchases in order to secure the supply of high-value fish.

- Capacity utilization fluctuates greatly. This is a fixed-cost business that depends greatly on steady turnover at high capacity utilization rates. Without a captive fleet, this is not assured.

- Fish quality is generally bad. In many cases, fish have spent close to ten days in plastic bags without food before getting to the exporter's tanks. Handling has typically been shoddy, and chances are that cyanide has been used in capture (even those very easily captured by net).

- This applies mainly to the future, but the ability to do "chain of custody" certification of fish is virtually impossible since it is unclear how many hands a given fish has moved through.

Exporters with captive fleets avoid these problems. While very few exporters have been able to provide the necessary capital and management skills to successfully run a fleet of 20+ collection boats that is required to fill a full-scale export facility, many run a small number of boats and/or local collection stations to fill a base volume of supply.

For the small number of large operations that have the capital and know-how to run their own fleets, aquarium fishing is a highly profitable business. Table 4 shows the proforma economics for a hypothetical exporter with a fleet of proprietary boats.[22]

Net margins for non-integrated exporters are lower, for the reasons stated above. In Indonesia, the competition for non-integrated exporters has become quite fierce, as the number of exporters alone in Bali has grown from five to over 20 in the past five years alone. For large, well-run operations, net margins can range from zero to over 30%.

TABLE 4: EXPORTER ECONOMICS IN INDONESIA (IN US$)

Revenue		**1,531**
	Collector Costs	120
	Skiffs	33
	Collection Stations	282
	Transp. to Central Facility	11
COGS		446
Gross Profit		**1,085**
	Salaries	227
	Travel	18
	Facilities	98
	Packaging	59
	Transportation	12
	Insurance	15
	Permits	153
	Monitoring	52
	Training of Collectors	3
	Other	30
Operating Expenses		667
Operating Income		**418**
	Net Margin	**27%**
	EBITDA	557
	ROIC	36%

Importers. There are many types of "importers" – consolidators, jobbers, trans-shippers, wholesalers, etc. The majority of fish will go through a wholesaler's tank. For the wholesale importer, the quality and quantity of supply is the most critical profit driver. By relying on a proprietary (or at least fully controlled) collection operation, an importer can:

- Control the quality of fish
- Assure quantity and proper species mix

[22] Exporter interviews and analysis, CCIF, May 2001.

- Cut out exporter margins
- Develop a superior brand

However, this is very difficult to do, and only two operations in the US today have built a successful fully integrated operation. The major barrier to integration is capital: n an industry where even the largest importers have sales below $8 million, the capital required to build (semi) proprietary collection infrastructure is difficult to come by – a fully scaled in-country collection operation will cost about $1,000,000, with another $500,000 required for working capital. In the absence of an integrated operation, importer net margins are between 2% and 10%.

Unfortunately, these economics are tailor-made for destructive fishing methods, for the following reasons:

- Mortality matters little. In the aquarium trade, the exporter's profits are relatively insensitive to the cost/mortality of the fish – the cost of goods sold for the lower-value fish (about 80% of total sales) accounts for less than 5% of revenues! The major profit driver for exporters are turnover, capacity utilization, and species mix. From a strictly economic standpoint, it thus makes little sense to switch to non-destructive methods, at least in the short term. It saves very little in terms of mortality costs, and it costs plenty in terms of direct training and infrastructure expenses, as well as indirect costs associated with a temporary reduction in volume. (Note: while cyanide prices have recently increased sharply, this does not yet offset the costs of switching to non-destructive fishing methods).

- Outsiders profit most. A very significant portion of cyanide fishing is done by non-local collectors. Live food fish syndicates, often financed by Hong Kong importers, are fanning out all over Indonesia. Bali and Java-owned aquarium collection boats are similarly peripatetic. In the Philippines, travelling collector boats probably account for over 50% of the total harvest.[23] This effectively divorces the local community from any economic interest in the well-being of "its" reefs. In Indonesia, the free access issue looms large; communities have no legal basis for keeping outsiders out. This makes the development, implementation and enforcement strategy to ban destructive fishing practices, even if pursued at the national level, exceedingly difficult.[24] In Fiji, a very different model applies: Reefs are owned by local communities, and exporters have to contract with local collectors for their fish. This way, the economic value of the reef is recognized locally, and it is of no surprise that the Fijian reefs are in far better shape than their Indonesian counterparts.

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[23] Interviews with local fishermen, CCIF, May 2001.

[24] Pet-Soede, et.al., *Economic Issues Related to Blast Fishing on Indonesian Coral Reefs*, p. 34.

- Destructive reef fishing is well organized. As shown above, capital accumulates in relatively few hands in the aquarium trade; the harvesting, handling and long-distance transportation/distribution of aquarium fish and corals is reasonably complex and capital-intensive. Exporters are therefore well organized, highly profitable, and able to dictate terms and practices. Where blatantly illegal practices come into play, such as the non-CITES export of live coral, operators and authorities often work together in organizing highly profitable, protected cartels.

- Distribution channels are undifferentiated and ambivalent. The current chain of custody for the average reef fish involving any number of independent fishers, middlemen, exporters, transshippers, consolidators, etc., is virtually impossible to control. A single fish, or a batch of fishes from one harvest operation, simply cannot be traced through. As a result, fish caught in a non-destructive fashion are almost always co-mingled with "cyanide" fish, and the U.S. consumer has no way to purchase a fish which is guaranteed cyanide free – even if they are willing to pay more for a more vigorous fish that has lower mortality. Unable to reap returns on their investment in non-destructive harvest training and equipment, even anti-cyanide collectors are thus often forced to return to destructive practices. In addition, a spot check of US retailers has shown that consumers often do not get the full truth about the origin of the fish – many retailers claim that their Indonesian and Philippine fish are cyanide free, which is, plain and simply wrong.

Food Fishing

Dynamite-based food fishing is pursued by highly organized cartels as well as by local fishers who consider blast fishing the last opportunity to catch and earn enough to feed their families. When pristine reefs are available for dynamiting, the economics are very attractive. Recent interviews indicate that a 7-10 day dynamite fishing operation from a 70-ft ship carrying 10-12 fishers can gross over $6,000 – a considerable sum in Indonesia. In the most complete treatise on the subject by Cesar and Pet-Soede, the profitability is described as follows: "The gross revenues for blast fishing, were estimated at US$15,000 per km^2 in year 1 and US$3,200 per km^2 in year 20. After correcting for operational costs, which were US$1,300 per year, and opportunity cost of labor, which were US$360 per year, the annual net revenue of blast fishing, was US$13,300 per km^2 in year 1 and US$1,500 per km^2 in year 20."[25] The steep decline of profitability is caused by the rapid rate of reef destruction involved. Fishers tend to compensate for this decline in profits by scaling up their operations, which further accelerates the pace of destruction.

When pristine reefs are available for dynamiting, the economics for dynamite food fishing are very attractive.

[25] Pet-Soede, et.al., *An Economic Analysis of Blast Fishing on Indonesian Coral Reefs*, p. 88.

There is therefore virtually no chance that the economics of the operations will force the fishers to stop "in time" – before the reefs are damaged past the point of no return. To quote Cesar and Pet-Soede again: "At the level of individual fishing households, the net income per person in small blast fishing operations decreased in 20 years from US$6,450 to US$550. The high income in year 1 when blast fishing was newly introduced formed the incentive to start blast fishing. Comparison with non-destructive fishing in an area without blast fishing, where each of 10 full-time fishers had annual income of US$1,470, showed that blast fishing in the initial years was 4 times more rewarding than non-destructive fishing. The difference was only sustained for a short period, in the long run (more than 20 years) the income from blast fishing will reach the level of opportunity costs. In year 20 the income from blast fishing was only one fifth of what could have been derived if blast fishing had not been introduced."[26]

To make things worse, recent inquiries show an alarming degree of organization behind the dynamite trade. Several interviewees indicated that an average 10-day dynamite fishing trip requires payments to local authorities of $800.[27] To ensure that these operations remain under full control and that they are of sufficient scale to create such payments, authorities often enforce a regional "cartel" which assigns dynamite fishing "privileges" to selected communities only. With such protection afforded the dynamite fishers, other communities have little hope of protecting their reefs.

New Approaches Required for Transformative Change

The current efforts by regulators, NGO's and local communities to significantly slow or even stop the pace of destruction are likely to fail for a number of reasons.

Regulatory efforts, particularly in Indonesia, are undermined by rampant corruption, the current trend towards decentralization of power to ill-equipped regional governments, and considerable political instability in the country. As explained above, major destructive reef fishing operations are not only tolerated but are actually organized by the very authorities entrusted to enforce the laws. Even where outright corruption is lacking, there is very little institutional capability to enforce existing laws against destructive fishing practices. The situation is unlikely to improve in the near future.

In the Philippines, regulatory efforts have a greater chance of succeeding. There are local fishery management plan instruments ("FARM C's"), legal precedents or

[26] Pet-Soede, et.al., *Economic Issues Related to Blast Fishing on Indonesian Coral Reefs*, p. 37.

[27] Exporter interviews and analysis, CCIF, May 2001.

maritime leases, and some regional planning approaches such as the Palawan Council for Sustainable Development – all of which signify an initial commitment on the part of national and local governments to address the issue. However, there is very little institutional ability to enforce regulations or maritime use restrictions. Without an integrated economic concept that provides a strong local monetary incentive to preservation, these regulations will not effectively stop destructive reef fishing.

International efforts to regulate the export of reef products are equally problematic. The efforts of CITES to control the harvest of corals in Indonesia through a quota system do not appear to be effective. According to current estimates of many experts in the field, ten times the current quota of coral (approximately 1 million/yr.) is illegally exported through Singapore and other ports – with active cooperation from the relevant authorities. The current export holders use their monopoly power to depress coral prices to the point where collectors have no choice but to supply the illegal export markets. Any attempt by import countries to ban the import of aquarium fish would most likely also be counterproductive, as it would force the collectors who are dependent on the industry into even more destructive forms of fishing.

Community based approaches offer some local alternatives to destructive fishing. However, the record of such initiatives is spotty, and a very significant level of investments in local alternative employment schemes on the part of multi-lateral institutions has not slowed the pace of reef destruction. In a country of 210 million mostly poor people, the very idea of "alternative employment" may be fundamentally flawed. There is no doubt that Indonesia and the Philippines offer significant opportunities for the development of mariculture. In some cases, such as pearl farming in Northern Palawan, highly profitable applications have already been developed at scale. The Nature Conservancy is currently implementing a fish culture plan in Komodo that was launched in 1999. When fully operational, they expect the facility to produce 27 tons of fish per year valued at US$648,000. Profits are expected to be US$435,000 per year. The facility is expected to employ 74, but that number may be underestimated.[28]

However, considerable additional research needs to be done before mariculture can emerge as a realistic alternative to destructive reef fishing – while there is plenty of anecdotal information on lobster/grouper/seaweed/pearl/coral farming, no systematic set of best application practices exists as of yet. For a local economic development official or investor it is an almost insurmountable task to determine which mariculture application could be "in the money" in the particular local context. In addition, the availability of local management talent to run what is often a relatively complex business is often a problem. Many maricultural applications, such as seaweed farming, offer employment for relatively few locals, are highly space intensive, and require very specific conditions for success. Lastly, much more needs to be known

[28] Jos Pet, *Mariculture Development*, The Nature Conservancy, 1999.

about the environmental characteristics of certain intensive mariculture operations such as grouper grow-out farms.

Tourism can, in specific instances, have a very significant effect. In Bunaken Park (Northern Sulawesi), for example, a coalition of dive operators is instrumental in enforcing the park's ban on destructive fishing. In a specific local context, the economic value created can outstrip that of the (incompatible) destructive reef fishing. It can thus be a powerful deterrent. It is estimated that the net present value of a tourist operation can be as high as US$55,900.[29] However, there are over 150,000 km^2 of reefs in Indonesia and the Philippines and in countries as politically volatile as these, tourism will offer protection only to a very small number of sites.

[29] Pet-Soede, et.al., *Economic Issues Related to Blast Fishing on Indonesian Coral Reefs*, p. 37.

Chapter 4

Next Step: Towards Integrated Marine Area Management Plans and Concessions

It is exceedingly important that integrated, site-specific conservation plans be realized for the richest reefs in Indonesia and the Philippines.

To be very clear: a fully reformed aquarium fishing industry would greatly contribute to the health of the Indo-Pacific reefs. However, it would by no means guarantee the full protection of the reefs from the destructive forces of dynamite and live food fishing. At sustainable levels of aquarium fish harvesting, a coral reef simply does not generate sufficient profits to pay for an army charged with the enforcement of all maritime protection and fisheries laws, and such an army will eventually be required.

However, it is still extremely important that the reform be undertaken. For some reefs, it will mean the difference between survival and destruction. For other reefs, it will be one of the factors among others (conservation concession, enlightened local government, tourism, etc.) that will make the difference. Most importantly, it will demonstrate that it is possible to generate local income without destroying the resource.[30]

Having said that, it is also exceedingly important that integrated, site-specific conservation plans be realized for at least some of the richest reefs in Indonesia and the Philippines. Aquarium fishing will be an important contributor to such endeavors, but a strong overall management approach will be required.

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[30]The government of Papua New Guinea is requiring commercial flights in and out of Manus island to make available a fixed percentage of its freight areas for aquarium fish, because it is the only industry that employs local fishermen in a way that does not harm the reefs.

CCIF is laying out a foundation to respond effectively and comprehensively on both of these fronts through:

1. The Reef Product Alliance (RPA) business plan that calls for the formation of a for-profit limited liability investment corporation managed by professional venture capitalists and tropical fisheries experts, and

2. The development of specific site-based management strategies to ensure long-term protection of reef resources.

RPA's objective is to finance the conversion of leading companies in the international aquarium fish and marine ornamentals trade to fully sustainable fish collection, handling, holding, transporting, and marketing practices. RPA investments in the Philippines and Indonesia will compliment and can be incorporated into CCIF's site specific strategy to ensure long-term protection of reef resources through community focused marine area management plan approaches. While these long-term protection schemes will necessarily differ between Indonesia and the Philippines, they will have the same objectives:

- establish a social process for developing effective fisheries and conservation management systems,

- establish local knowledge system of resources and foster community "ownership" of these resources,

- determine threats and set use regulations to manage these threats,

- create recognition by community, outsiders, and local and central governments of area status,

- use regulation and management authorities, and

- identify and develop sustainable enterprise activities to offset concession payments and cover continuous costs of conservation.

Philippines

In the Philippines, the Bureau of Fisheries and Aquatic Resources (BFAR) now requires local communities to establish and enforce local fishery management plans ("FARM Cs"). With this legal mechanism in place it is now possible for communities to protect their reef resources and establish proper management systems and enforcement measures. Unfortunately, at this point, few communities have the necessary resources or leadership to implement a "FARM-C" management plan.

In the few regions where FARM-C development has begun it has been primarily through the efforts of local NGO's in conjunction with large-scale marine extraction industries (blue crab fishery in the Visayas) or with communities who understand the problem and are interested in protecting and conserving the local resources (various efforts in Palawan). In these cases the local community/industry has teamed with an NGO to provide the resources and skills to develop and implement the FARM-C program. CCIF will evaluate the potential to establish and implement a FARM-C program as part of the site selection process for aquarium collection stations in the Philippines.

CCIF has discussed the potential for collaboration on the development of community managed FARM-C's with WWF Philippines, International Marinelife Alliance, and various other NGO's and community groups. Once CCIF has identified the best locations for collection stations in the Philippines, we will engage the appropriate stakeholders in those regions to discuss the resource requirements for developing a FARM-C.

The two sites for local collection stations in the Philippines will be chosen from the following list (see Table 5). (Note to reader: The following sites are being evaluated for ease of logistics, population pressure, reef quality, receptivity of government, and existing conservation efforts. The next step is to choose several sites that this project will focus on.)

TABLE 5: POSSIBLE PHILLIPINO SITES

Island	Area	Site
Luzon	*North*	Zambalis
		Bataan
	Central	Batangaas
Visayas		Cebu
Bohol		Bohol
Mindanao		Davao Bay
Palawan	*North*	Coron Bay
		El Nido
	Central	Puerto Princessa
	South	Balabac

In addition, CCIF has met with and discussed the potential for working with authorities in Palawan to establish a fully sustainable aquarium fishing trade that will be a model for the trade throughout the Philippines. As mentioned earlier in the RPA Business Plan, while the BFAR regulates the rest of the Philippines, the Palawan Council for Sustainable Development (PCSD) has authority over the marine environment. The PCSD is interested in working with CCIF to accredit aquarium fishing operations in Palawan that include a fisheries and aquatic resources management plan and adherence to fishing, handling, and monitoring standards

consistent with those currently developed by the Marine Aquarium Council. The management plan will be managed by the local community and supported by the PCSD. CCIF will continue discussions with the PCSD to establish such an operation and will identify and prioritize the appropriate sites for setting up collection stations in the Philippines.

Indonesia

In Indonesia, the situation is far less convenient as no legal basis exists for comprehensive marine resources management planning. The conditions described throughout this analysis all point to the urgent need to immediately set aside specific marine environments under formal conservation concessions.[31] These conditions include: the rapid rate of reef and fishery destruction in some of the most ecologically important regions, threats driven by large-scale extractive industries and opportunistic cottage industries, the lack of stable, responsible government intervention (indeed in many cases the presence of government involvement in the destructive activities), and the lack of community sensitivity to, and recognition of, the threats facing their resources. If Indonesia hopes to preserve these areas of marine biodiversity, action must be taken immediately. Individual reform to the multiple industries that are profiting from the reef will not solve the problem before the reefs are completely destroyed. Reforming one industry at a time will take forever.

A conservation concession would provide a safety net to ensure protection and enforcement while the necessary conditions and objectives of a marine area management plan can be realized.

Currently a number of multi-laterals and NGOs have invested heavily in reform efforts, such as alternative enterprise and community training and monitoring. These organizations have not succeeded in creating a solution for a number of reasons:

[31] To describe it fully, a conservation concession is a program that establishes direct economic incentives for the service of "conservation'. A mechanism is developed where payments from conservation groups, governments, development organizations, or corporations are paid to entities controlling natural ecosystems in exchange for the 'conservation services' that they provide. The efficient price for these services is equivalent to the social opportunity cost of not destroying the natural resources embodied in the conserved ecosystems. The resources in most threatened tropical ecosystems yield poor returns, making this opportunity cost very low.
A successful concession must have:

- Identification of interested local counterparts (NGOs currently working in the field),
- Identification of key sites of prevention,
- An economical model that supports the feasibility of a concession at a particular site (correct opportunity cost and current land value – considering current industry and government taxes),
- An existing legal and institutional framework that supports this form of financial incentive,
- A stakeholder analysis that supports the model and identifies intangible values and benefits to stakeholders and the community from the concession,
- An assessment that determines the long-term viability of the concession.

- the proposed solution solves only one part of the problem (such as only aquarium fishing or only coral harvesting) but does not address the many other industries continuing to fish destructively on the reef;
- the problem comes back after the funding dries up; or
- as in the example of alternative employment, the solution will take years before providing a true alternative to destructive fishing – the reef does not have that much time.

In Indonesia there is a precedent for establishing land-based concessions, however, no marine-based conservation concessions have been awarded to-date. There are marine conservation concessions that are close to completion in Komodo and in Bunaken, but no others.

The next step is for CCIF to conduct a feasibility study of the areas that may be good candidates for a conservation concession. We have already started this process and have identified preliminarily sites in Indonesia with the help of the local NGOs (see Table 6). It is clear that implementing a successful marine conservation concession in Indonesia will be challenging and difficult. Key to the success of a conservation concession is two-fold: 1) working at the local level to develop the social systems and local "ownership" in the process and 2) bringing together the people and information from different arenas (government, NGOs, investors) that do not normally collaborate.

TABLE 6: POSSIBLE SITES IN INDONESIA

Island	Area	Site
Java	*North*	Kep. Seribu
		Karimunjawa
	South	Lampung
	West	Ujung Kulong
Sumatra		Riau
Sulawesi	*North*	Sangihe Talaud
		Manado/Gorontalo
		Togean Isl.
	Central	Banggai
	South	Taka Bone Rate Atol
		Spermonde Isl.
		Masalimo Isl.
		Tukang Besi Isl.
Kalimantan	*East*	Derawan Isl.
		Sangkulirang
Bali	*West*	Bali Barat
	East	Nusa Penida
Moluccas		Kei Isl.
		Aru Isl.
		Banda Isl.
Flores	*East*	Alor and surr. Isl.
	West	Mangarrai/Komodo
Timor		Kupang Bay
Irian Jaya	*West*	Cendrawasih Bay
		Raja Empat

CCIF has already laid the initial groundwork that will assist us in successfully creating a conservation concession. We have established connections with local groups that will work with us (International Marinelife Alliance, Telepak, Conservation International, The Nature Conservancy, World Wildlife Fund, Bahtera Nusantara), and have started the process of engaging the necessary government authorities needed to support a concession in the areas we are considering (Ministry of Environment, Ministry of Forestry, Ministry of Marine Affairs). CCIF is committed to 1) introducing the idea of marine concessions in Indonesia and 2) incorporating sustainable businesses into these concessions to provide an economic incentive for locals to try preserve reefs (the aquarium fishing industry to start, then mariculture, ecotoursim, etc.).

Conclusion

Current regulations of coral reefs in the Indo-Pacific vary widely and protection in the most biodiverse areas is not effective. The economics of destructive reef fishing are such that they will destroys these reefs well after the point of no (ecological) return. Existing attempts of NGOs to provide local alternatives to reef destruction are unlikely to solve the problem as a whole; comprehensive management is key to preserving these precious marine resources. While it is certainly possible to use traditional methods to prepare and enforce a management plan which ensures the reef's long-term survival, such an approach is unlikely to take hold in Indonesia and the Philippines before it is too late. Only a coordinated approach which reforms the economics of the aquarium industry creates actively enforced marine managed areas, and provides massive technological assistance to fisheries, NGOs and communities alike, is likely to succeed. CCIF plans to coordinate and facilitate these types of coordinated efforts in the coming years.