

Damselfishes are the laboratory rats of reef-fish ecology. Their abundance and easy access facilitates intensive study, allowing understanding based on manipulation and falsification. They have provided the opportunity for two generations of students to gain a close and holistic understanding of the dynamics of wild reef-fish stocks; a situation that is qualitatively different from the training and work experience of many fisheries biologists who have access only to industry catches. Damselfishes have inspired novel techniques and new ideas.

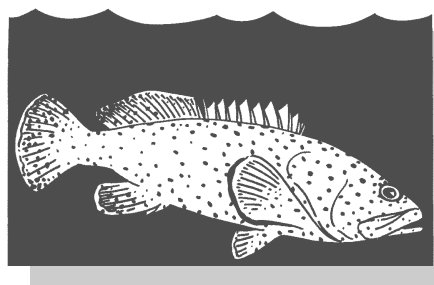
One surprise from the study of damselfishes has been their longevity: 20 years, matching many of the larger species. Despite the potential of sedentariness and territorial behaviour to produce density-dependent feedback and population regulation, variable replenishment has been shown to have stronger influence on abundance at reef-wide scales. Environmental forcing of recruitment in long-lived species is a characteristic that has contributed to past collapse of temperate fish stocks, and emphasises the central importance of replenishment to sustainable fishing. Recent work has confirmed the same phenomena in the dyna-

mics of large commercial fishes taken from the Great Barrier Reef.

We do not need further research to know that *Cheilinus* and the largest serranids have life histories that make them vulnerable to overfishing. Even if it were desirable, the scale and economies of coral reef fisheries in the Indo-Pacific will not support sophisticated management regimes that might demand accurate determination of biological reference points and detailed monitoring. Instead, the recruitment function may be protected best by quarantining adequate broodstock within no-fishing zones. For obvious reasons, networks of marine protected areas will not be designed on data about the larval dispersal and recruitment of large rare species. Instead, the job will continue to be done on the basis of knowledge gained from the poodles and their close relatives. In this task, we are fortunate that there are not separate ecologies for small and large fishes.

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Turning the poison tide: The International Marinelife Alliance's Cyanide Fishing Reform Pilot Program in Indonesia

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A poison tide threatens the Amazon of the Oceans

The coral reefs of Indonesia number among the most important on the face of the earth. Covering some 75 000 km², Indonesia's reefs constitute one-eighth of the world's total and lie at the very centre of global marine biodiversity. Hundreds of thousands of small-scale fishers rely on reef fisheries for a living. Their potential for dive tourism, barely tapped, is immense.

Unlike the Philippines, where cyanide fishing was invented for the aquarium trade in the 1960s and grew to encompass the Hong Kong-based live food fish trade in the late 1970s, large-scale cyanide fishing is a relatively recent phenomenon in Indonesia. But beginning around 1990, live-fish operators moved aggressively into Indonesia, seeking new sources to replace depleted Philippine stocks and feed a growing market fuelled by the booming East Asian economies (Johannes & Riepen, 1995).

At the present time, an out-of-control live reef fishery based on the use of cyanide threatens reefs across Indonesia, compounding damage from blast fishing, coral mining, overfishing, and runoffs of sediment and pollution. More than 50 per cent of the wild-caught live food fish in international trade are thought to originate from Indonesia (Johannes & Riepen, 1995). The aquarium fish trade is also immense and growing, with at least 4000 fishers thought to be involved, although accurate estimates are hard to come by (Cesar, 1996). Cyanide is thought to be used by the vast majority of live-fish operators—a survey inquiring about the extent of the live fish trade and the use of cyanide sent out by the Worldwide Fund for Nature Indonesia Programme to non-governmental organisations and university researchers around the country in 1996 elicited depressing results. In more than a dozen regions, observers on the ground responded that the trade was booming, and that cyanide was an integral part of it (Barber & Pratt, 1997).

Discussions about stopping cyanide fishing in Indonesia tend to draw expressions of helplessness, resignation and fatalism from government officials, international aid agencies and big environmental groups. 'Indonesia is so vast,' the argument goes, 'there is so much corruption, powerful people are involved, government enforcement capacities are weak, there will never be any way to stop it—but let's have another workshop to talk about it!'

The International Marinelife Alliance – Philippines (IMA) has heard this before. When IMA began its work in the mid-1980s that led to the establishment of the government's Cyanide Fishing Reform Program (CFRP) in 1992, many of the same arguments were made about the Philippines. Some 13 years later, it is true that cyanide fishing has not been completely stamped out in the Philippines. But the CFRP has been effective in significantly reducing the problem, and with increased resources now beginning to flow to the programme from the United States Agency for International Development (USAID) and the Asian Development Bank, there is real hope that even more progress can be made in the next several years.

IMA believes that something *can* be done to reduce cyanide fishing in Indonesia, and has put itself on the line to prove it.

IMA's investigation of cyanide fishing in North Sulawesi

In late-1995, concerned by rumours that Filipino live-fish operators were moving into Indonesia's North Sulawesi province (which is just south of the Philippine island of Mindanao), IMA decided to

conduct an investigation in the area, with support from the USAID-funded Biodiversity Conservation Network (BCN).

In approaching a potential project area, IMA believes that a thorough field assessment of the live-fish trade in the area is a key prerequisite, and that the assessment must be carried out by people with direct, practical experience in cyanide fishing. IMA's investigators are mostly people who themselves were cyanide fishermen or exporters in the past. Fishermen tend to trust them faster, and they cannot be easily fooled—they have been there. Secondly, a good investigation requires a committed local partner with access to information that is often difficult to get, such as the identities of key exporters and boat owners and the locations of cyanide fishing grounds and fish-holding cages.

At the outset, the investigation in North Sulawesi was a bit of a cloak-and-dagger operation, with the IMA investigator staff hot on the trail of Filipino cyanide divers working the waters in the areas of Minahasa District (*Kabupaten*) and operating out of the provincial capital of Manado. First off, IMA needed to gather basic information: In what specific areas where these modern-day ecological pirates collecting fish? How many Indonesian fishermen were working with them? Who were the exporters, and by what routes were they getting the catch out of the country? These Filipino divers and their boss were aware of IMA's strong campaign in the Philippines against use of cyanide. Keeping the fact that he was from IMA under wraps, the investigator found it easy to befriend the Filipino boss of the operation and his employees, who were initially glad to meet a countryman with whom to pass the time over a few beers one night.

Both the boss and his divers, it turned out, were well aware of the Cyanide Fishing Reform Program in the Philippines and the Cyanide Detection Test Labs and monitoring activities that IMA operates under contract from the Bureau of Fisheries and Aquatic Resources (BFAR) as part of the programme. They complained that the CFRP was a big hindrance to their highly lucrative business. But here in Indonesia, they said, there were no such obstacles. 'It only takes money to solve the problem of legality' in Indonesia, the boss told IMA's investigator.

This Filipino operator, it turned out, was running a widespread cyanide fishing operation, stretching from Manado on Sulawesi's northern tip all the way to Ujung Pandang, in the far south of the huge island. Learning fast that it pays to have a partner skilled in navigating the complex and often corrupt local government bureaucracy, the Filipino had

brought an Indonesian businessman from Manado into his operation. Working together, they were able to capture large volumes of groupers and Napoleon wrasse. Indeed, the harvest was big enough that the partners chartered Hawker Sedely aircraft—each plane capable of carrying ten tons of cargo—to transport their cyanide-caught catch to Manila. From there the Filipino operator moved the fish on to the booming Hong Kong market. IMA's investigation also discovered that several other smaller cyanide-fishing operators were working the area, shipping their catch through Bali and Jakarta rather than Manila. Since exports of Napoleon wrasse from Indonesia are restricted to those smaller than three kilograms, the operators were routinely mislabelling the wrasse as groupers.

The investigators also heard numerous stories of large 'mother ships' to which a fleet of smaller cyanide fishing vessels would bring their fish. Once its live well holding tanks were full, the ship would return to Hong Kong. One such ship from Indonesia was photographed and filmed by IMA in August 1996 while unloading in Hong Kong. Aboard were some 8 t of Napoleon wrasse and an additional 12 t of various grouper species (Barber & Pratt, 1997).

Most disturbing, the IMA investigators were told by the Manado cyanide fishermen that they had been systematically introducing the cyanide fishing technique to new areas of North Sulawesi province and to part of adjacent Central Sulawesi province. In the Banggai island chain of Central Sulawesi, for example—an extensive coral reef area rich in stocks of grouper, Napoleon wrasse, and rock lobsters—fishermen had been recently taught how to use cyanide and supplied with the poison by exporters.

In short, the live fish operators were running a mirror image of IMA's CRFP—working with communities to systematically convert them to the use of cyanide.

The Filipino exporter who had shared beers and trade secrets with an IMA investigator eventually found out that IMA was on his trail. Soon, he packed up and went back to the Philippines. But the damage had already been done—Indonesians had proven quite adept at cyanide fishing, and were fully capable of spreading the technique without Filipino assistance.

IMA's Cyanide Fishing Reform Initiative at Tumbak, North Sulawesi

IMA felt it had to act. But how and where? With what local partner? As a Philippines-based organisation new to Indonesia, IMA felt strongly that it could not move beyond investigation to working with fishing communities without a local ally, and clear support from members of the target community. Discussions with a sympathetic Manado dive operator concerned about the destruction of the province's reefs—which are world famous in diving circles—let to a strategy. The dive operator, it turned out, was also a leader of Primkoveri, the provincial cooperative of military veterans, and Primkoveri became a key local partner.

One of the areas where IMA had investigated the local live reef fishery—in this case, for aquarium fish—was a village called Tumbak, on the south coast of North Sulawesi province, about three hours by road from Manado. Ringed on three sides by the sea and backed by mangroves, Tumbak is virtually surrounded by water. Its 135 hectares of land are unsuitable for agriculture, and its 257 families (nearly 1200 people) all gain their living from the sea. Net, spear and hook-and-line fishing, collection of marine invertebrates (molluscs, sea cucumbers, lobsters, etc.) and seaweed farming are all important parts of the local economy. But the live-fish trade has played a growing role in recent years. In early 1997, the buyer who held the local monopoly on the trade reported that he was shipping six-to-eight thousand aquarium fish from Tumbak *every week*—more than 120 fish per family per month (Pollnac et al., 1997).

With support from Primkoveri and initial funding from the Worldwide Fund for Nature Indonesia Programme, IMA began a dialogue with Tumbak fishermen to assess their interest in learning the barrier net method for collecting aquarium fish¹ and receiving assistance in marketing their catch.

IMA also conducted a survey to better understand the lives and interests of the fishermen who would be trained. Initial responses were favourable—a number of the fishermen expressed interest in learning the new method for catching aquarium fish as an alternative to using cyanide.

In July 1997, an IMA training team including two new Indonesian trainers recruited in Manado

1. The barrier net method of capturing live aquarium fish involves setting up a wall-like transparent net around the perimeter of the target coral area. The collector then scares the fish with sound or movement, and they instinctively dart back in the direction of their coral refuge. The barrier net, however, denies the fish access to coral crevices, giving the collector enough time to harvest them with scoop nets and specially-designed buckets with fine-mesh, zippered net tops. Unwanted fish are released, and the reef is left virtually undamaged.

began a formal training programme for 50 aquarium fishermen. The programme was inaugurated at a village ceremony featuring some 600 people from the village, a local brass band, speeches from numerous local and provincial officials, Primkoveri, IMA, and a visiting group from the World Resources Institute, a Washington-based policy-research institute with whom IMA has been collaborating for several years in developing an Asian regional cyanide-fishing reform programme.

The first few days of training with the Tumbak fishermen were tough. For one, there was the language barrier. IMA staff had to coordinate with an Indonesian interpreter who was heavily involved during training and lectures. Secondly, the fishermen lacked proper and safe equipment. Their regular gear consisted of make-shift bamboo goggles which easily filled up with water, made it difficult to see underwater, and thereby limited dive time. They dove wearing only their underwear.

Soon however, when the fishermen-trainees saw that they could catch as many or more fish with a barrier net, they embraced the new technology. Immediately they recognised that barrier net collection reduced fish mortality rates. After three weeks of training and their first successful shipment, the fishermen were pleased with their new technology and were willing to keep using it.

At present, IMA has helped the fishermen organise an association through which they have linked to buyers in Europe. No longer dependent on one middleman, they are able to obtain better prices for their fish. And with IMA guidance, they are now capturing some 35 species, where previously they only captured and sold five species.

Reduced mortality in the capture and post-harvest process, lack of by-catch (non-target fish killed by cyanide on the reef), and a wider variety of target species (meaning less pressure-per-species) mean that a clearly unsustainable fishery has been replaced with one that is certainly far more sustainable. More studies need to be carried out to determine what the maximum sustainable yield is for the Tumbak live reef fishery, but whatever that level may be, the barrier net training programme has moved Tumbak a long way towards meeting it.

The struggle to reform the cyanide fishery in Tumbak is not over, of course. More training and continuous monitoring are needed to ensure that the barrier net tradition is firmly implanted in the village's values and traditions. And the association needs long-term assistance in managing its relationship to the international market for optimum advantage. USAID's ongoing Coastal Resources Management Project is providing support for some

of the follow-up activities, and IMA is working with WRI to identify other sources of longer-term funding to ensure that the work thus far at Tumbak endures into the future, and to expand the project to neighbouring villages where other fisherman are interested in joining.

Thinking ahead to the thousands of villages like Tumbak throughout Indonesia where the same process needs to be carried out, IMA is hoping to utilise Tumbak as a centre for training Indonesian trainers. This will give the prospective trainers real-world experience, and will further institutionalise Tumbak's cyanide-free live fishery tradition. In addition, as IMA and its partners begin to work in other parts of Sulawesi and beyond, IMA hopes to be able to bring fishermen from other areas currently using cyanide to see what the fishermen of Tumbak are doing with their own eyes, and to hear about it from the residents of Tumbak themselves.

Conclusion: Do *not* abandon hope, all Ye who enter Indonesia

IMA concludes from its initial experience in Tumbak that cyanide fishing can be stopped in villages like Tumbak throughout Indonesia. Some will be more difficult, and some may be impossible. In other cases, cyanide fishing is being carried out by large 'mother ships' far from population centres, a situation where repressive enforcement approaches are more important than community-based programmes. But there are plenty of Tumbaks throughout Indonesia, and if just 20 of them in key coral reef areas can be weaned from cyanide, the impact will be considerable.

It is important to remember, too, that once a village is organised and is getting a good income from a sustainable live reef fishery, it becomes much more easy to talk with villagers about reducing other destructive fishing practices such as hunting of sea turtle, blast fishing and shark finning.

IMA will continue to report on progress at Tumbak and at other sites in Indonesia where IMA plans to work with local partners to develop similar programmes. And IMA and its partners in North Sulawesi would welcome others to have a look at what is going on in Tumbak and judge progress and obstacles there for themselves.

There is no magic bullet, and IMA has no illusions about saving the whole world, or even all of Indonesia's coral reefs. But with committed partnerships among NGOs, local governments, donors, and, most importantly, with a clear focus on field-level initiatives founded in trust, respect, and collaboration with fishermen themselves, maybe together we can save at least a piece of it.

References

BARBER, C.V. & V.R. PRATT. (1997). *Sullied Seas: Strategies for Combating Cyanide Fishing in Southeast Asia and Beyond*. World Resources Institute and International Marinelife Alliance – Philippines, September 1997.

CESAR, H. (1996). *Economic Analysis of Indonesian Coral Reefs*. The World Bank.

JOHANNES, R.E. & M. RIEPEN. (1995). *Environmental, economic and social implications of the live reef fish trade in Asia and the western Pacific*. Report to The Nature Conservancy and the South Pacific Commission. 82 p.

POLLNAC, R.B., C. ROTINSULU & A. SOEMODINOTO. (1997). *Rapid Assessment of Coastal Management Issues on the Coast of Minahasa*. Draft Technical Report, Coastal Resources Management Project – Indonesia (April 1997).

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The Haribon Netsman Training Program

The net training programme of the Haribon Foundation was conceived in 1989 as a result of the growing problem of cyanide use and its effects on coral reefs.

In 1984, Steve Robinson, a professional fish collector from the Sea of Cortez, Mexico, returned to the Philippines to participate in a programme to train Filipinos in the use of nets for collecting marine fish. Sponsored by the Environmental Center of the Philippines, a 10-day training course was developed and implemented for two classes of fishermen from Santiago Island, Bolinao and Pangasinan. A third training course was held in Bohol.

Since then, a number of international agencies have shown interest in supporting the net training pro-

gramme. In January 1989, a grant from the International Development and Research Center of Canada was obtained to implement a nationwide training programme. The Haribon Foundation and International Marinelife Alliance Canada were chosen to implement the programme then known as the Netsman Training Program.

Local conditions indicated that training alone was not sufficient to ensure conversion of cyanide users to net use, and that the training programme must be part of a holistic approach that helped steer communities toward community-based coastal resource management. Thus a combination of approaches—community organising, training, and research—was used to effect resource management, with the net training as the entry point to the community.