



Community –based Coral Reef Management – An Integrated Approach



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LEAD Indonesia
 Based at Yayasan Pembangunan Berkelanjutan
 Jl. BDN II No. 35 Cilandak Barat
 Jakarta 12430, Indonesia

Tel. +62 (0) 21 7695491
 +62 (0) 21 75816941
 Fax. +62 (0) 21 75816938
 Email lead@lead.or.id
 www.lead.or.id

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Community-Based Integrated Efforts

Towards Coastal & Marine Resource Management

Community-Based Integrated Efforts : Towards Coastal & Marine Resource Management







Community –based Coral Reef Management – An Integrated Approach



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Case Study

Community-based Integrated Efforts Towards Coastal and Marine Resource Management

Buleleng, Bali, Indonesia

**Nusya Kuswantin
Darwina S.Widjajanti
Ni Made Indrawati
Andrea Deri**

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1. Introduction: the challenge

Indonesia, with its 85,707 km² fringing coral reef, is the second largest supplier of marine ornamental fish in the world [WCMC-UNEP, 2003]. But behind the success of this luxury industry is a crisis that is threatening the region and the future of the industry.

Most fishermen in Indonesia use poisonous potassium cyanide to catch ornamental fish. Although this method is fast and effective, it is destroying ecosystem goods and services upon which the coastal communities depend for food and their livelihoods. Unless immediate action is taken, the reefs' marine resources will be destroyed.

Fishermen in Indonesia have been trading ornamental fish since the 1970s. In the early days they fished the traditional way, using nets but by the 1980s, when the ornamental fish trade reached a commercial scale, the fishermen had traded in their nets for cyanide¹.

In Bali, local people say an ornamental fish buyer first introduced the fishermen to cyanide. Whatever the source, the poison came to be widely used by fishermen as their main tool for catching ornamental fish. The chemical was cheap and readily available from middle-men in North Bali who often bought it in local fertiliser shops. The fishermen found that they could catch many more fish with cyanide than they could with nets in the same amount of time.

¹ Using nets may be seen environmentally friendly compared to cyanide but net fishing can also damage the reef if overfishing is not prevented.

The way cyanide works as a fishing tool is simple: the fisherman sprays the poisonous liquid where he thinks the ornamental fish is hiding. The cyanide intoxicates the fish so that it floats out from its coral hiding place, and the fisherman simply scoops the fish up with a small net.

But this speedy technique has had long-reaching consequences. Not only has the cyanide seriously harmed the fish, it has also damaged other forms of life in the surrounding area, such as coral. The situation has been made even worse by fishermen using explosives to catch fish to eat. Bit by bit, the blasts have turned the reef into rubble. A few seconds is all it takes to destroy the reef, but it will take decades or even centuries for the reef to fully recover. After years of exposure to these damaging practices, the Buleleng sea is in a grave state.

Although the government of Indonesia passed a law in 2004 – the Fishery Act No.341/2004 – making fishing with cyanide illegal, it was neither publicised nor enforced, and has made little impact. Although fishermen were aware of the new law, they continued using cyanide as it was easy and required less effort than net fishing, and they were under pressure economically to continue fishing with poison.

By using cyanide, fishermen are able to earn INR 70,000–120,000 (£4–7) each day, double what they earned using nets, and spend just three hours diving, rather than the whole day. Although many fishermen also raise cattle to make money, the sea is the most important source of their income. Unlike farming, fishing gives them access to cash the same day, an



important factor to families who have no savings and whose cash income barely covers daily expenses.

Up until recently there was no financial incentive for the fishermen to switch to more environmentally-friendly methods because the price of ‘eco-fish’ – ornamental fish caught using nets – was the same as fish caught using cyanide.

In addition, many fishermen are chronically trapped in debt and poverty as a result of taking out high-interest loans. These men, under pressure to make repayments to the money-lenders, are forced to use methods that enable them to catch as many fish as possible.

2. Working towards a solution

2.1 Introduction to the Buleleng district project

The idea of helping fishermen adopt less destructive fishing practices first took shape in the village of Les in northern Bali. In 2002–2004, a local nongovernmental organisation, ‘Bahtera Nusantara’, managed a community-based coral reef restoration project with technical support from the Marine Aquarium Council (MAC). The Global Environmental Facilities (GEF) in partnership with the United Nations Development Programme (UNDP) funded the project through their Small Grant Programme².

² GEF/UNDP project in Les, Bali:
http://sgp.undp.org/web/projects/6603/coral_reef_restoration_and_establishment_of_sustainable_community_based_ornamental_fish_business.html



LEAD Indonesia wanted to replicate this project with due adaptation and bring environmentally-friendly fishing to other parts of Bali. LEAD chose the Buleleng district (Gerokgak sub-district) as the site for their project (2005-2008) as it is one of the largest marine ornamental fish collection areas on the island [Yahya, Y., *et al*, 2008]. Around 500 collectors and 40 coral and ornamental fish exporters operate here, harvesting over 200 species of ornamental fish from the area’s patch reefs and fringing reefs for commercial trade. Coral reef grows on the sand beds in the shallow waters and on dead coral up to a depth of 40 metres.

Buleleng district (located at 8°03’40”–8°23’00” south latitude and 144°25’55”–115°27’28” east longitude) covers 1,365.88 km² and makes up over 24 per cent of the province, making it the largest district in Bali. More than 75 per cent (1,051.20 km²) of the district is sea, and it has 144 km of coastline, stretching from the town of Gilimanuk on the western tip of the island to Karangasem district in the east. (*See figure 1-2*).

Buleleng is home to 588,662 people, mostly Balinese, but also migrants from the Indonesian islands of Java, Madura, and Sulawesi. The district is known for its nature tourism; Lovina beach and the Bali Barat National Park – the habitat of the endemic and highly endangered Bali starling (*Leucopsar rothschildi*) – are the two most popular tourist destinations.

In 2005, LEAD Indonesia initiated a project modelled on ‘Les’ in the Buleleng district, entitled “*Conserving Coral Reefs through Community Ownership and Enterprise*”. The project was a revised, scaled-up version of the original project, and



included integrated capacity development and financial and governance tools.

The project was supported by the UK government’s Darwin Initiative³, and project partners included LEAD International (London, UK) and LEAD Indonesia (Jakarta, Indonesia), Lembaga Pilang, a local NGO based in Bali’s Gerokgak sub-district, Marine Aquarium Council (MAC) Indonesia and Reef Check Indonesia, both based in Denpasar, Bali.

Project activities (see figure 4) started in four villages: Pejarakan, Sumber Kima⁴, Pemuteran and Penyabangan (see figure 3). During the course of the project Pemuteran gradually pulled out⁵, while Penyabangan emerged as the most progressive community through its innovative solutions and outstanding results.

³ Darwin Initiative in Buleleng, Bali: <http://darwin.defra.gov.uk/project/14057/> ; Project website: <http://www.lead.org/page/139>

⁴ WWF Indonesia had previously conducted a project to introduce environmentally friendly fishing practices to Sumber Kima, a mixed Hindu and Muslim community. The project was part of conservation efforts to protect the marine area of the Bali Barat National Park. The current project supported the local fishing community with a wider adoption of MAC standards.

⁵ The entire coastline of Pemuteran has been declared by the villagers as a marine protected area, specifically a ‘no-take zone’. As fishermen are not allowed to fish in Pemuteran, they do not benefit from these strict conservation measures. Because this situation required a different approach to what was implemented in the three other communities, project activities in Pemuteran were gradually decreased.



Figure 1 Map⁶ of Bali (project area circled)

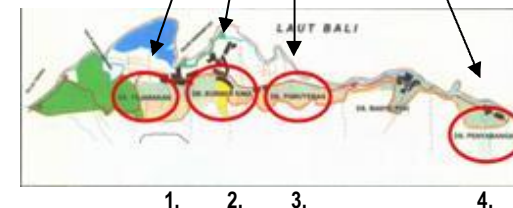


Figure 2 Map⁷ of Buleleng district (coloured area) Gerokgak sub-district (pink)



Figure 3 Four villages of project activities

Villages	Population
1. Pejarakan	9,507 ⁸
2. Sumber Kima	6,417 ⁹
3. Pemuteran	8,168 ¹⁰
4. Penyabangan	4,237 ¹¹



⁶ Source of map: Microsoft. Encarta. Reference Library 2005. © 1993-2004 Microsoft Corporation. All rights reserved.

⁷ Source of map: Peta Administrasi Kabupaten Buleleng, Dinas Kelautan Dan Perikanan Kabupaten Buleleng

⁸ Source: Profil Desa Pejarakan 2006

⁹ Source: Profil Desa Sumberkima 2004

¹⁰ Source: Profil Desa Pemuteran 2008

¹¹ Source: Profil Desa Penyabangan 2004



LEAD, MAC and Reef Check are all global professional networks and brought with them a wealth of experience on a local, national and global scale. This multi-scale perspective enabled them to achieve impressive results in a short amount of time, and to facilitate effective dissemination of the lessons learned from the project and to initiate replication elsewhere.

Each partner played a unique, complementary role in the project. **Lembaga Pilang** had the most frequent contact with the local fishermen, working as a community organiser and supporting all activities, particularly environmental education and advocacy.

MAC Indonesia trained and certified fishermen and exporters according to the international MAC standards of environmental harvesting and handling of ornamental fish¹².

Reef Check Indonesia¹³ conducted regular biodiversity monitoring in the collection areas and trained local fishermen in monitoring methods. Reef Check and MAC started collaboration in 2005 to coordinate their efforts and leverage resources.

LEAD Indonesia¹⁴ coordinated the project in Indonesia, particularly in the area of governance. **LEAD International**¹⁵ provided capacity development, technical support and an international platform to share lessons learned and replicate the successful model.

¹² MAC International Standards: <http://www.aquariumcouncil.org/macintstandard.html>

¹³ Reef Check Indonesia: <http://www.reefcheck.or.id/>

¹⁴ LEAD Indonesia: <http://www.lead.or.id/>

¹⁵ LEAD International: <http://www.lead.org/>



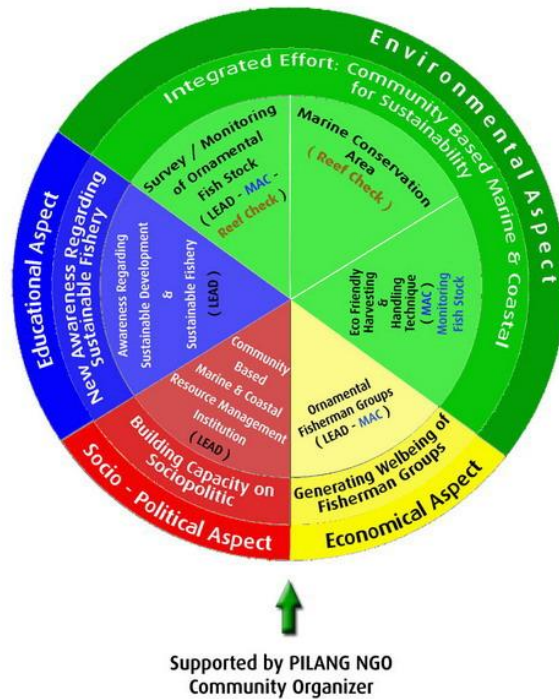
The project was based on the premise that the trade of live coral reef animals and plants for the global marine aquarium hobby industry is only justifiable if it improves the livelihoods of local fishermen and contributes to the recovery and conservation of the coral reefs.

The project was designed to be sustainable, harmonising conservation goals with livelihood development, and rejecting one-dimensional efforts, such as conservation without improving the livelihoods of the fishermen. The project adopted an integrated approach to community-based marine and coastal resource development with special focus on four areas: building local capacity (section 2.2), improving governance (2.3), developing new policies (2.4), and introducing financial incentives (2.5).



Figure 4: Model of the project’s integrated efforts in community-based marine and coastal resource management

Integrated Effort: Community-Based Marine & Coastal Resource Management



2.2 Building local capacity

The capacity of local stakeholders was developed through training workshops, designed to build skills and knowledge in a range of topics, and micro-credit loans designed to increase the financial capacity of local people and allow them to implement new ideas and change their behaviour.

The training workshops were designed to improve fishermen’s competencies in four areas:

- Sustainable development, with a special focus on fisheries
- MAC certified fishing and handling of ornamental fish
- Ecological monitoring of marine resources
- Financial planning and management

2.2.1 Sustainable development

LEAD facilitated a series of training workshops on sustainable development with a special focus on sustainable fisheries. The participants (27-50 people per session) included members of community-based resource management councils from Penyabangan, Sumber Kima and Pejarakan villages (see 2.3.2.), village government officials, sub-district and district officials, staff members of Pilang and interested fishermen.

The training workshops covered the following areas:

- sustainable management of coastal and marine biodiversity and other natural resources
- negotiation and decision making
- organisational management
- facilitation



At the end of the training workshops, nine participants were selected to form a core team of facilitators¹⁶. These participants were selected based on their standing in the community, and their knowledge and ability to facilitate the uptake and dissemination of sustainable development practices.

2.2.2 MAC certification

MAC Indonesia trained fishermen according to MAC's international standards.

MAC standards are designed to ensure the health of fish and coral reefs, as well as the health and safety of fishermen, and the sustainable management of coastal and marine resources by harvesting only from sustainable fisheries. The standards also require that the origin of the fish and other harvested marine organisms can be tracked.

The purpose of the MAC training workshops in Buleleng was to help fishermen:

- implement best practices in collecting and post-harvest handling of marine ornamental fish according to MAC standards
- maintain the optimal health of organisms during the transport and in temporary holding
- understand the buyers' expectations of the condition of ornamental fish and coral
- understand how to dive safely, adopt MAC's health and safety standards for diving

¹⁶ Core team of facilitators in Bahasa Indonesia: 'Facilitators Inti'



MAC training modules provided fishermen with the following:

- an introduction to the global ornamental fish trade, including current trends in the market;
- an introduction to Indonesia's coral reefs and fisheries;
- the concept of sustainable fishing and best practice (techniques and tools) for environmentally-friendly fishing of ornamental fish;
- post-harvest handling requirements, including fish identification, packing, acclimatisation and segregation;
- the benefits and requirements of documentation;
- safe diving techniques, health and safety standards for diving, equipment maintenance and emergency procedures.

By the end of the project, 243 people from Buleleng, including 235 ornamental fish collectors and 8 exporters, were certified by MAC. This represents over 47% of all the fishermen who depend on the ornamental fish trade in Buleleng. The hope is that these fishermen will form a critical mass and bring about universal use of MAC standards in the Buleleng district.

As a result of the MAC training workshops, most of the certified fishermen now apply environmentally-friendly fishing methods in spite of economic pressure to use faster methods. The fishermen report that the training workshops helped them realise that environmentally-friendly harvesting, not fishing with cyanide, would ensure their and their children's livelihoods.



MAC certified fishermen have created their own local enterprises and support groups:

- ‘Laut Lestari’ in Pejarakan¹⁷
- ‘Segara Indah’ in Sumber Kima¹⁸
- ‘Sinar Baru’ in Penyabangan.

2.2.3 Monitoring marine resources

Reef Check Indonesia conducted training in ecological monitoring for LPLP, one of the community-based coastal and marine resource management councils. Participants learned about the importance of monitoring their local marine resources, and how to conduct reliable field surveys, document their data and manage their protected area based on their monitoring results.

2.2.4 Financial planning and management

The objectives of the financial training workshops were to enable the fishermen to make the best use of financial assistance and assist them in increasing their income and decreasing their dependence on high-interest money lenders.

Fishermen learned about micro-finance institutions, and acquired the skills to write loan proposals and manage loans.

At the end of the training the fishermen were introduced to MAC certified exporters and Jakarta-based retailers as well as

¹⁷ Pejarakan fishermen formed their organisation in October 2004, before the Darwin project started, with the commitment to stop using cyanide and to restore their reefs.

¹⁸ Fishermen in Sumber Kima also formed their ‘environmental fishing’ group before the Darwin project.

micro finance institutions and representatives of the local government in order to develop their business network. These meetings were fruitful and provided fishermen with information and financial access to build up their business.

2.3 Improving governance

The goal of the project’s capacity development activities was to improve local (village) governance of coastal and marine resources.

2.3.1 The challenges of open access: roving fishermen

Strong local community-based governance provides more effective protection of local marine resources than management at higher levels. The district government of Bali has regional autonomy to manage waters within four miles off the coast¹⁹, but the limited number of government staff cannot apply effective surveillance and enforcement over such a huge area.

As Indonesian national law gives artisanal fishermen open access to all national waters (as long as they observe local regulations), strong local governance is critical if not the only way of protecting local resources from external fishers. Coastal waters without strong surveillance and local protection often fall prey to roving fishermen²⁰, fishing parties that roam the sea with well-equipped boats. They collect marine organisms for live trade without any environmental consideration, and leave destroyed reefs behind.

¹⁹ State Decree No 22, 1999

²⁰ See the global consequences of ‘roving bandits’ in Berkes *et al.*, 2006.



Bali also has its rovers. In fact, the majority of fishermen in North Bali are rovers. For example, Penyabangan fishermen rove to Banyupoh or Patas, their neighbouring villages, or Pejarakan fishermen rove to Penyabangan and vice versa. Some of them travel far from home to collect ornamental fish from the islands of Madura, Flores, Celebes, and even Kalimantan²¹. Here, where local governance and regulations are weak and are not enforced as they are in Bali, they can still use cyanide.

As Bali develops its reputation as an eco-fish centre, rovers who use cyanide try to sell their fish as eco-fish through Bali exporters. This further confuses retailers and hobbyists about the real value of eco-fish, and makes it more difficult for MAC certified fishermen to sell their authentic eco-fish for a higher price.

Giving local communities the legislative and financial power to manage and protect their own local reefs and marine resources is a high priority, followed closely by the need to address the national issue of roving bandits.

²¹ Kalimantan is the Indonesian part of Borneo.



2.3.2 Community-based coastal resource management councils

Three community-based coastal resource management councils were set up in the Gerogak sub-district:

1. LP3LP (Lembaga Pendi, Pengawas, Pengelola Laut dan Pesisir) in Pejarakan
2. BPWLP (Badan Pengelola Wilayah Laut dan Pesisir) in Sumber Kima
3. LPLP (Lembaga Pengelola Laut dan Pesisir) in Penyabangan

LPLP provides a good example of how these councils work.

LPLP is a group of 20 fishermen from Penyabangan village. In close cooperation with the members of their local community, LPLP takes responsibility for managing their local marine and coastal resources through various activities, including ecological monitoring of the local coral reef, surveillance and community-based law enforcement, representing the local community in policy dialogues, negotiating with new developers for the benefit of the local community, and mitigating conflicts over resource use.

For example, when a foreign developer Marine Shell Co. offered Penyabangan collaborative business, LPLP facilitated the multi-lateral negotiation between the foreign company, the MAC certified local fishermen's enterprise Sinar Baru, and the village government. LPLP made sure that all activities – including reef transplantation – would bring economic, social and environmental benefits to the local community.



2.3.3 Monitoring resources and capacities

A critical element of effective, adaptive governance is up-to-date information and regular feedback on the state of the society and their natural resources. LEAD worked closely with MAC and Reef Check to establish baseline data in the first year of the project, and began monitoring key socio-economic (well-being) and ecological (natural resources) parameters from year two onwards.

Socio-economic research

The socio-economic research included information on the local geography and population, as well as economic, political and social issues. The study was conducted over two years, and resulted in two reports, and helped the project partners design key interventions in capacity development, policy and financial improvement.

The results of the socio-economic research confirmed that effective local governance had to include the following components:

- establishment of community-based coastal and marine resource management organisations
- reviewing of existing policies and revising them when necessary
- developing new policies
- improvement of decentralisation of local government



Ecological research

Parallel to the socio-economic research, Reef Check and MAC conducted ecological surveys [MAC, 2005], [Reef Check, 2006] over two years in three villages: Pejarakan, Sumber Kima and Penyabangan. The reports include a list of ornamental fish species that require further research and close monitoring for collection, recommendations for Total Allowable Catch²² (TAC) and the Catch Per Unit Effort (CPUE).

The survey found that all three villages had good potential for sustainable fishing, for both food and ornamental fish.

2.4 Developing new policies

In close collaboration with Pilang, the local NGO, LEAD conducted a series of consultations that provided the fishing communities with access to policy making for the first time. The consultations also encouraged village governments to issue '*perdes*' (a village decree) to grant legal authority to the community-based marine resource management councils, like LPLP.

LPLP in Penyabangan is now authorised by a village decree to monitor the use of their local marine and coastal resources. Given its social status and high reputation, LPLP also exercises social sanction on those who violate the rules and disregard the commitment to conserve local marine resources. It is difficult to ignore social pressure in a community where people are tightly interdependent and where relationships are the social currency. Fishermen who do not conform to the

²² TAC: total number of individual fish that may be collected annually



fishermen’s self-imposed conservation rules are excluded from the fishing community.

An Indonesian policy expert was hired to support the fishermen with legal advice and facilitate the policy revision and policy making process. The following results were achieved:

- a new district policy was created waiving local tax for traditional boats
- a village decree was issued that authorises two resource management councils, LPLP and LP3LP, as legal entities and grants them resource management rights²³,
- a fishing license (*Ijin Usaha Perikanan*)²⁴ was created to regulate the trade of fishery resources and protect them from unfair law enforcement.

2.5 Introducing financial incentives

Law enforcement and social pressure are powerful tools to restrain fishermen from using cyanide, but fishermen need strong financial incentives as well. Conservation does not work without livelihood improvement of those who depend on the natural resources. The most obvious way to introduce financial incentives was to increase the selling price of eco-fish.

2.5.1 A new supply chain

LEAD designed and tested a supply chain for MAC certified ornamental fish traders who would buy eco-fish from local

²³ BPWLP in Sumber Kima is still to be authorised.

²⁴ Regulated by the local authority, regulation number: 10/2007



fishermen for 10 per cent more than conventionally harvested and handled fish. The new supply chain was shorter as a result of cutting out the money-lending middle-men. In the new supply chain, fishermen interacted directly with the exporter(s) who paid a higher price for eco-fish.

Facilitated by Buleleng district’s Department of Marine Affairs and Fisheries and LEAD, CV Blue Star, an ornamental fish exporter in Bali and Jakarta, and Sinar Baru, an ornamental fishermen enterprise in Penyabangan, signed a Memorandum of Understanding to collaborate according to the rules of the new supply chain.

To promote and market eco-fish, posters, neon-signs and brochures were developed and distributed to willing and conservation-minded retailers of marine ornamental fish kiosks in Jakarta.

2.5.2 Micro-finance through community cooperatives

As fishermen live on daily cash, it was important to involve micro-finance institutions that could support fishermen with better loan conditions.

Wana Agung, a local cooperative committed to environmental conservation, received a financial grant of IDR 45 million (£2,800) from Indonesia Power, a state-owned company. The grant enabled Wana Agung to give low-interest loans to fishermen and they encouraged fishermen to start a saving scheme.



3. How successful has it been?

3.1 Behaviour change

During the three years of the project, the fishermen of Bali's Gerokgak sub-district have developed an awareness of the importance of sustainably managing their local marine and coastal resources. Many of them have stopped using cyanide and are applying environmentally-friendly harvesting and handling methods in their own coastal waters.

Three factors have been critical to the relatively quick success: effective training, peer-pressure and law enforcement. The law enforcement in this sub-district is now more effective than earlier and has played a large role in the fishermen's behaviour changes.

3.2 Traditional ecological knowledge

Environmentally-friendly fishing takes time, but innovative fishermen have found ways of increasing their catch without damaging the reefs. They have 'rediscovered' their traditional ecological knowledge of marine life, and are using this to catch more fish and increase their efficiency.

Abu Kasim, a MAC certified fishermen and member of the Sinar Baru group, has designed experiments to find out when and how he can catch the most fish and other marine organisms (e.g. worms). For one of his experiments he made a gazebo-like structure of green palm leaves and lowered it onto a sand-flat, close to the live corals. He knew that the

algae and bacteria coating developing on the leaves would attract certain fish species. Abu Kasim took daily notes on what species were attracted and how many individuals he could see grazing on the leaves. When he saw the most fish at a time, he used his net and collected the fish. Abu Kasim has shared his knowledge with other members of Sinar Baru to increase the whole group's effectiveness.

The revitalisation of traditional ecological knowledge may hold the promise of balancing livelihood improvement and conservation of coral reefs in Buleleng district, Bali. Its success, however, depends on all parties in the new supply chain monitoring and observing the recommended annual Total Allowable Catch for each species. This requires close collaboration between the community-based ornamental fish enterprises (fish collectors), exporters and the community-based resource management councils who monitor marine resources.

Although MAC and Reef Check have developed a sophisticated database that can record all catch and monitor how much allowable catch remains, this database is still not widely used by key stakeholders. Easy access to an up-to-date shared database is necessary for effective evidence-based resource management.

3.3 Improving the biodiversity

A slow but steady improvement of the state of local coral reefs can already be seen in the project area. In October 2007, the fishermen of Penyabangan found fish species, such as the blue/gold striped snapper or Ketambak Kucir as it's known



locally in Bahasa Indonesia (*Symphoricthys spilurus*), barracuda or Bara Kuda (*Sphyraena barracuda*) and blue-girdled angelfish or Angel Piama (*Pomacanthus navarchus*), which had not been seen for many years (some for 13 years) in the local waters.

Shortly afterwards, MAC conducted a survey [Yahya, Y., *et al*, 2008] to determine the abundance and diversity of ornamental fish in the Buleleng district. MAC’s findings confirmed the fishermen’s observations. MAC recorded an increase in the diversity of species in the area in their annual surveys over time: 99 species in 2004, 132 species in 2005, and 185 species in 2007 (see figure 2) as well as an increase in the abundance of ornamental fish.



Figure 5: Diversity (number of species) and abundance of ornamental fish species in Bali’s Gerokgak sub-district in 2004, 2005 and 2007 [Yahya, Y., *et al*, 2008].

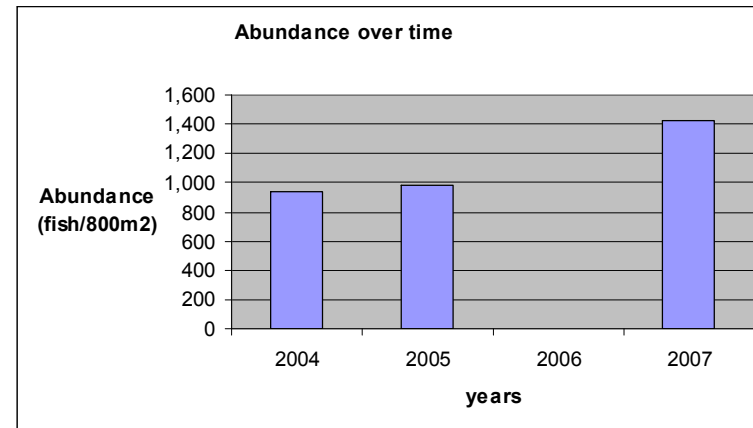
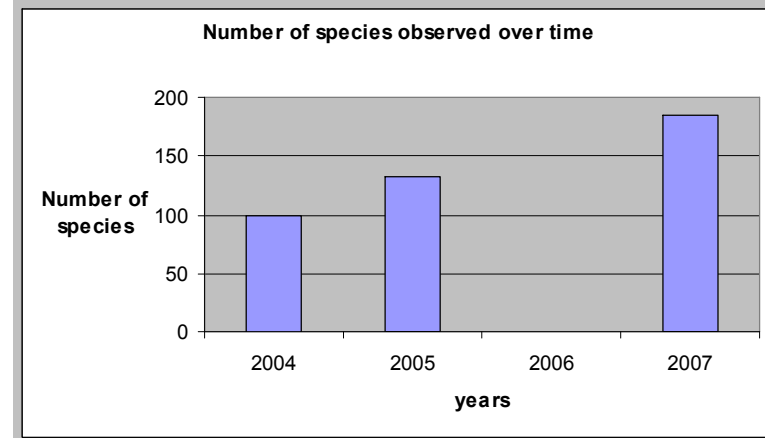
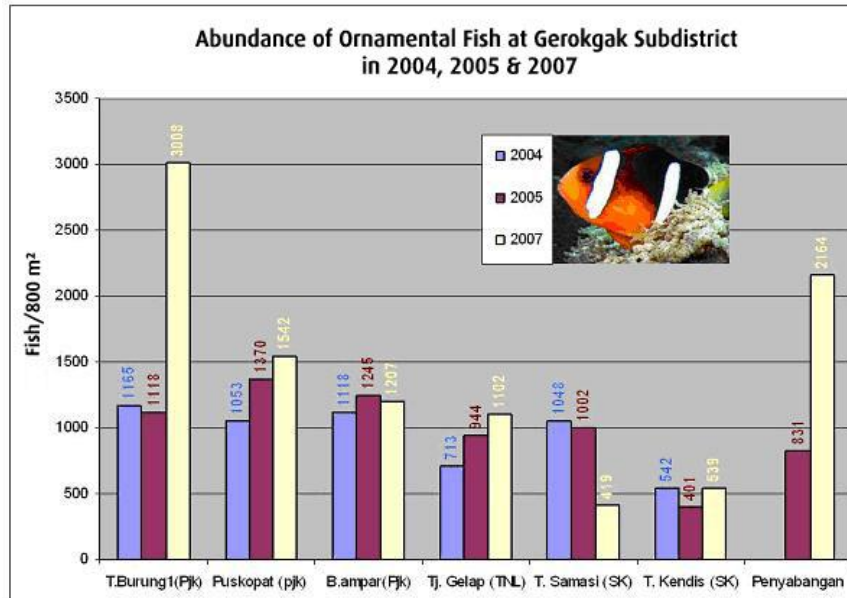


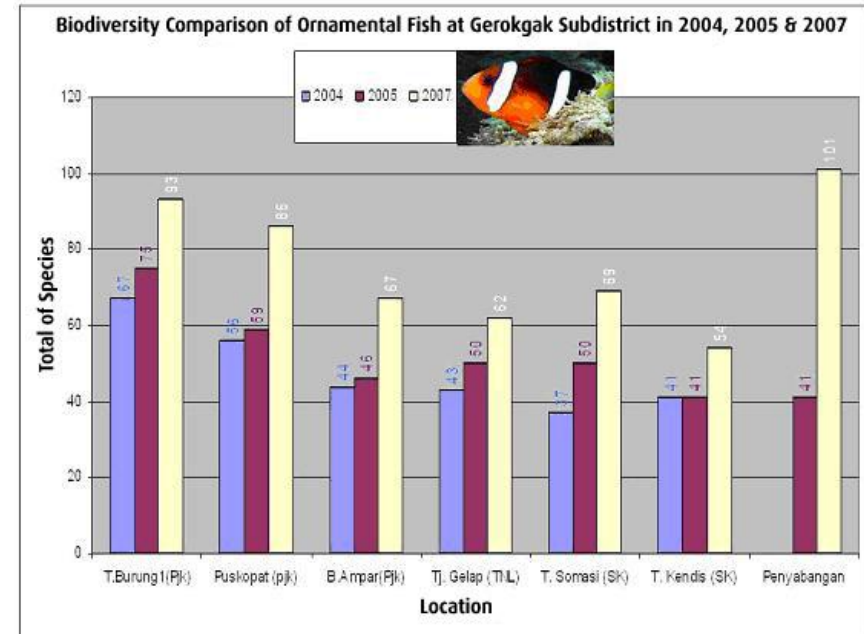
Figure 6: Abundance of ornamental fish in seven locations in Bali's Gerokgak sub-district in 2004, 2005 and 2007 [Yahya, Y., *et al*, 2008]



The reefs near Tanjung Burung and Penyabangan showed the best results (see figures 6 and 7). MAC found the highest diversity of ornamental fish in:

- 2004 in Tanjung Burung (67 species)
- 2005 in Tanjung Burung (75 species)
- 2007 in Penyabangan (101 species)

Figure 7: Diversity of ornamental fish in seven locations in Bali's Gerokgak sub-district in 2004, 2005 and 2007 [Yahya, Y., *et al*, 2008]



Within two years, the diversity of ornamental fish species in Penyabangan village increased by almost 60 per cent.

The results are promising, but further studies with more frequent (quarterly) monitoring are necessary to claim victory. Regular surveys are required for a complete understanding of the pattern of reef recovery in Buleleng, especially the seasonality of abundance and diversity.



3.4 Proactive self-governance

Penyabangan has become the project's model village. Here fishermen have established a solid and pro-active governance system. There are two fishermen groups in this village that play important role in their marine resource management and coral reef conservation: Sinar Baru, a group of 19 MAC certified fishermen, and LPLP, the authorised community-based coastal and marine resource management council. These two groups closely coordinate their efforts to manage their local marine resources and business sustainably.

Sinar Baru, with its limited resources, is putting a lot of effort into making fishermen stay committed to environmentally-friendly fishing.

Sinar Baru is well organised, meets regularly, conducts well documented meetings and recently developed a five year plan with the following objectives:

1. To develop Sinar Baru's organisational and individual capacity. Activities include management training, advanced training in environmentally-friendly harvesting, building an office with a meeting hall, and issuing membership cards;
2. To diversify and widen their network with government, business organisations, NGOs at local, national and international levels;
3. To diversify their income generation sources by creating experimental ornamental fish habitats, starting



coral reef culture, improving their marketing techniques, and negotiating better prices for ornamental fish;

4. To conserve Penyabangan's marine and coastal resources by planting mangroves, guarding (surveillance) the village's marine and coastal areas, organising beach clean ups, building a waste water treatment system, and continuing awareness raising programmes about the detrimental impacts of using cyanide;
5. To strengthen sustainable coastal and marine management in Penyabangan village.

Although LPLP has been authorised by a village decree, it does not have an operational budget yet. The lack of money does not hamper their enthusiasm: they work voluntarily and monitor the management of the village's marine and coastal resources. LPLP has also developed a five year plan which is similar to and coordinates with Sinar Baru's plan. An additional objective of LPLP's plan is to develop a management plan for their coastal and marine resources through village wide consultation and thorough data collection.



3.5 Green and fair supply chain

The green and fair supply chain experiment was designed to ensure that all phases of the supply chain comply with MAC standards, from collection through to delivery to retailers. The eco-fish are collected by certified fishermen, purchased by certified exporters for a higher price, and transported to certified retailers.

The experiment of creating a 'green and fair' supply chain for ornamental fish in Bali was successful. Fishermen, members of Sinar Baru, were able to directly sell their eco-fish to the exporter, CV Blue Star, and received 10% more for certain species (30 out of 85 species). Some of the eco-fish were sold by committed retailers in Jakarta.

The experimental supply chain revealed several important lessons:

- Orders from exporters to fish collectors should be realistic. Fishermen complained that they often received orders for species that did not exist in the Buleleng district. Fishermen had the choice of not delivering the fish, which reflected poorly on them, or delivering the order from an unguaranteed source. The agreement between the exporter and the certified fishermen's enterprise needs to address the eco-fish standard. If the required species is not available in the area, the fish should be deleted from the order. This ensures that the green supply chain delivers trustworthy commodities.

- There were disputes between the fishermen and the exporters over which party should take responsibility for fish that die during transport from the exporter to retailers or hobbyists. The agreement did not cover this particular issue. In the future there should be a new arrangement between the fishermen's enterprise and the exporter assigning responsibility for fish that die during the journey, including during collection, transportation and upon arrival at the exporter's fish centre.
- Fishermen expect exporters to pay in cash at the site of sale. However, the exporter uses a banking system to deliver the funds to the fishermen's enterprise which takes one or two weeks to reach the fishermen. This is a major cash flow problem for fishermen who rely on daily cash to survive. In future, the exporter should pay the fishermen's enterprise in cash, or the local cooperative should take responsibility for paying the fishermen immediately and receive the payment later from the exporter.
- Transportation from the collection site to the exporter costs the fishermen money. In any future agreement, the cost for local transportation should be shared, or the price of the eco-fish should be increased to cover transportation expenses.



3.6 Loans from cooperatives: terms and conditions

The project was able to connect fishermen with a local micro-finance institution. This new access to loans from a cooperative was important in sustaining the new supply chain.

Members of the Sinar Baru group received loans from the Wana Agung Cooperative, a local micro-finance institution committed to a green and fair ornamental fish trade. The terms of the loan were more favourable to fishermen than the terms middle-men had imposed on them previously.

Fishermen used the loans for various purposes: some of them bought a motor-bike; others purchased mobile phones and environmentally-friendly fishing tools. There was also a member who started a snack shop with his wife to supplement their income and lessen their reliance on the ornamental fish trade.

Fishermen also applied for loans to purchase motorboats and compressors to allow them to collect ornamental fish in deeper seas. The application for motorboats and compressors has raised serious concerns:

- MAC strongly advises fishermen not to collect ornamental fish in deeper seas to protect the breeding grounds of many species. Easy access to loans that make fishermen able to buy motorboats and compressors could result in stock depletion.
- Fishermen use compressors to dive deeper and longer to catch more and better value fish. Compressors

present hazards to the fishermen's health and safety. Unsafe use of compressors, or compressors without the appropriate safety gears (which is very common in Bali) are known to have caused fatal accidents in the past. Access to loans to buy compressors therefore raises serious ethical dilemmas.

- The above issues call for developing new and/or reviewing current credit policies in order to prevent unexpected and unwanted negative health and environmental effects.



4. Lessons learned and recommendations

The project achieved significant results in coastal and marine resource management and conservation in a relatively short timeframe. There is much to learn from this project.

4.1 Conservation and sustainable livelihoods

- Conservation of the coastal and marine resources implies controlled use to ensure the regeneration of resources and their availability in the future. Fishermen who participated in our training have realised the importance of conservation, and they have developed an attitude which values biodiversity over short-term economic benefits. This is a very unique situation given the poverty of these local fishermen.
- The application of MAC standards contributes to conservation of reef resources but unfortunately such eco-friendly practices do not ensure better income for the fishermen. Although fishermen know that eco-fish are healthier, and survive better during overseas transport, they cannot sell their product for a better price yet. The price of eco-fish on the market remains the same as regular fish.
- Sustainable fishing ought to provide a sustainable livelihood. Economic incentives are needed to strengthen fishermen's commitment to conservation and the sustainable use of coastal marine resources. A higher price for eco-fish could serve as an economic incentive.

4.2 Eco-fish supply chain

- There exists an opportunity to create a new supply chain for eco-fish where fishermen work directly with exporters and thus get higher price for their fish. But the obligations of both parties must be clarified for effective and long term collaboration.

4.3 Higher price for eco-fish

- Ornamental fish collectors ought to receive at least double the normal price for eco-fish, paid in cash. This will act as a strong incentive to encourage fishermen to apply MAC standards which are designed to protect coral reef resources.
- All market players, including exporters, retailers and the hobbyists, ought to commit to paying more for eco-fish, as is the case with other certified organic and fair-trade commodities, such as coffee and cocoa.
- Increased and more effective communication among market players, especially between exporters and retailers, may help raise the price of eco-fish.
- Special training for retailers is necessary to raise their awareness of the issues in the ornamental fish trade and coral reef conservation. This training should include marketing suggestions to increase the confidence of retailers and their effectiveness in sales.



- Intensive promotion, public awareness campaigns, and social marketing could increase the popularity of eco-fish among hobbyists, who hold the key to success. Hobbyists must understand that they can help preserve marine habitats by only buying eco-fish from retailers. This in turn will encourage retailers to only stock eco-fish, and will help the ornamental fish supply chain to become green and fair.

4.4 Cooperation between stakeholders

- Cooperation between multiple stakeholders is necessary to initiate and maintain sustainable ornamental fisheries at any level. Collaboration between stakeholders at the local level is the most critical for harmonizing conservation goals with poverty alleviation.
- The ornamental fish trade can be a sustainable enterprise so long as it is regulated at national and international levels. These regulations need to be harmonized and enforced to make an impact.
- International regulation should include ornamental fish species in CITES. Currently only giant clams and live corals are included in CITES. CITES, however, does not always help to regulate and control domestic fishery issues. Better domestic management practices are prerequisites to make CITES work.

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4.5 Community-based resource management

- Community-based coastal and marine resource management councils and certified fishermen enterprises ensure the conservation of coastal and marine resources and provide a way of involving the community at a village level in managing their marine resources. We strongly recommend the formation of similar institutions in other coastal villages.

4.6 Loans: terms and conditions

- Financial support from cooperatives or other micro-finance institutions helps fishermen avoid dependency on high interest loans from local middle-men.
- Financial institutions, however, should adopt and enforce policies that make sure the loan is used only to purchase goods and services that support sustainable livelihood development and sustainable coral reef resource management.
- Credit policies need to be reviewed on a regular basis to make sure they do not have loop-holes that contribute to further deterioration of coral reefs or the well-being of the fishing community.



4.7 Leadership

- It is clear that the project's message has resonated with fishermen. This is particularly true in Penyabangan village, where most fishermen have stopped using cyanide and have become guardians of eco-fish. They have realised that destructive fishing practices jeopardise their livelihood, while eco-friendly fishing practices safeguard their marine resources for the long term.
- Leadership has an important role in social change. Replacing destructive fishing methods with environmentally-friendly ones requires commitment, encouragement, incentives and a role model or leader of high integrity. Penyabangan's exceptional success can be attributed to its exceptional leadership.
- Leaders of the community organisations – the certified fishermen's enterprise and the community-based marine resource management organisation – , and the community organiser local NGO were able to inspire the local community to change their fishing practices and act with the future in mind.



4.8 Pollution control

- Fishermen are often blamed for the destruction of coral reefs regardless of whether other factors are involved, like pollution or climate change.
- The coastal waters in the region are eutropic as a result of the nutrient rich waste water coming from the hatchery in Penyabangan and Sumber Kima. A thick carpet of filamentous algae has developed at Penyabangan. Although phalanxes of sea urchins control the spread of the algae, the high nutrient level poses an imminent threat to the neighbouring reefs.
- Boat fuel at the traditional harbour of Sumber Kima is also known to pollute and destroy the reef. The fishermen believe that fuel pollution is responsible for the death of the mangroves in the area.
- Sewage treatment and a preventive pollution control system by the local government would greatly contribute to the effective conservation of coral reefs along the shores of Buleleng.



4.9 Adaptation to climate change

- The 1997 El Nino caused significant coral reef destruction in Bali. With global warming, the frequency of similar events is expected to increase. This will have a serious negative impact on ornamental fishing. Different scenarios of adaptation to climate change in Bali must be explored, with special reference to the ornamental fish trade.

4.10 Diversifying fishermen's income

- Fishermen need assistance in diversifying their sources of income outside of coastal and marine resource based activities. This will help them adjust to any losses in income that result from limitations on the number of fish they can catch, or bad weather, such as during the January/February western monsoon period, when strong waves prevent them from fishing.

4.11 Replication

- Members of the successful MAC certified fishermen group in Penyabangan, Sinar Baru, have offered to share their knowledge and skills with other fishermen in Bali.
- The project's integrated approach can be replicated throughout the Buleleng district and the entire Bali province, and on a national scale, throughout the entire country of Indonesia.



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Contacts

Please kindly contact Andrea Deri and Darwina S. Widjajanti if you want to use or quote this case study.

- Andrea Deri, LEAD International, UK
andreaderi@btinternet.com
- Darwina S. Widjajanti, LEAD Indonesia, Indonesia
darwina@lead.or.id
- Ni Made Indrawati, Lembaga Piland, Indonesia
dekindra@yahoo.com
- Nusya Kuswantin, LEAD Indonesia, Indonesia
nusyakuswantin@yahoo.com