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**Destructive fishing practices in Ende, Flores, Indonesia: the importance of designing co-governance programs and policy-making in dealing with climate change**

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**Abstract**

This article discusses the effects of unsustainable fishing practices (dynamite and potassium) and climate change in communal property systems among tuna fishers in Ende, Flores, Indonesia. It explores the dynamics associated with conflicts between the regulation of common pool resources and traditional practices, and their impact at the community and institutional levels. Marine ecosystems in the Eastern Pacific Ocean are experiencing an unprecedented rate of environmental change. Economic and ecological fluctuations have created new stressors that make the use of destructive fishing devices more common. In Ende, Flores, where over 40 percent of the population lives in poverty, conflicts between the regulation of depleted natural resources and private interests are prevalent. With the loss of nearly 2/3rds of coral beds and drastic reductions in the catch per unit of effort, regional governments are engaging in decentralization and bio economic management approaches. These efforts to stop environmental degradation, however, have been mostly unsuccessful, as bombing and dynamite use are still widespread in the area. Government organizations attribute the current situation to the non-regulation of traditional fishing grounds and to damaging fishing practices, directly blaming the local fishermen. But, the lack of opportunities in employment, the inadequacy of aid programs that further emphasize intensification, economic uncertainty, and corruption, all make damaging practices the best option for local people. Ethnographic and ecological research in Indonesia (22 months) indicate that despite the absence of regulatory practices at the village level, there is a strong awareness of the importance of protecting marine resources. Strict bio economic approaches to resource management are incapable of capturing the multiple intricacies behind resource use decisions and prevent the eradication of non-sustainable practices. Contrary to institutional perceptions, if co-participatory governance programs are devised, people will take part in conservation projects and aid in the control of illegal activities. Long-term sustainable policy-making requires the active engagement of all stakeholders.

**Keywords:** fishery, damaging fishing practices, governance, climate change, conflict.

**Introduction**

Fifteen years ago, Lida Pet Soede and Mark V. Erdmann published an article discussing blast fishing among Makassarese fishermen in Sulawesi, Indonesia. They found that blasting was a widespread method of fishing among Indonesian fisher folks, many of whom considered this technique “traditional”. Blast fishing was introduced during World War II by the Japanese occupation forces. As a highly effective scheme of procuring a substantial catch, it rapidly spread in the archipelago. When Soede and Erdmann conducted their study in the late 1990s, bombing was responsible for 10% to 40% of the catch in Ujung Pandang, Sulawesi, one of the biggest fish markets in Indonesia. To limit and eradicate this practice, the authors recommended the increase

of patrolling efforts and fines along with the development of management alternatives (i.e. ecotourism) that would incentivize local protection of the coral reefs against unsustainable fishing. This was the model followed in some regions in Indonesia for example, the Wakatobi National Marine Park (where the Soede's and Erdmann's study takes place) and Komodo National Park in Flores. In 2011, Indonesia committed to the creation of Marine Protected Areas (MPAs) reaching coverage of 139,000 square kilometers (WRI 2012:28).

Dynamite use experiences cycles of popularity in the Indonesian archipelago. The last few years have seen a re-emergence of this practice, especially in the Eastern provinces and the Sunda region (i.e. Lampung, Southern Sumatran coasts). The latest report from the World Resources Institute and the Coral Triangle Support Partnership indicate that “[d]estructive fishing (blast or poison fishing) is widespread and threatens nearly 80 percent of Indonesia’s reefs (about 31,000 sq km)” (2012:27). Reef at Risk in SEA estimated in 2002 (Burke et al. 2002) that the net economic loss in Indonesia from blast fishing over the next 20 years will be at least US\$570 million. The economic loss from cyanide fishing is estimated to be US\$46 million annually. Therefore, the finding of an effective solution to damaging fishing practices has become not only an ecological problem, but an economic one as well.

Although these types of statements are of critical importance for highlighting the situation, they also have a significant impact in the internal politics of countries like Indonesia. The country is experiencing considerable international pressure to make commitments to conservation goals, such as conserving the ecology of coral reefs. This pressure has resulted in the creation of the Coral Triangle Initiative by Indonesian president Yudhoyono in 2007, the development of community and ecosystem management conservation programs (Satria and Matsuda 2004, Williams and Staples 2010), increasing international NGO presence, and a “green” mentality among government officials across the multiple scales of bureaucracy. However, renewed attention on the Indonesian seas has also led to the implementation of top-down, generalized conservation policies or blue prints (Ostrom 2009), that mixed up with decentralization and neoliberal policies (Satria and Matsuda 2004), have devastating effects on the local populations.

One such example is the establishment of zones that prescribe the kind of activities that can be conducted in those environments. Projects of zonification or Marine Protected Areas, like the one, in Lamalera, Lembata were introduced in 2008 with the support and advice of WWF and TNC. The goal was to control the hunting of cetaceans, a traditional practice of that community, and to shift livelihoods towards ecotourism. However, simultaneous plans were proposed by private Chinese enterprises to relocate the town to allow for mining companies to look for gold. This created an acrid conflict between locals, conservationists and external actors that concluded with the expulsion of WWF personnel from the area (Kompas 05/29/2010). The following year the Taman Nasional Laut Savu was declared, and multiple MPAs were created. Lembata was not included, even though it constitutes a critical route for the migration of cetaceans, and thus has critical importance for biodiversity conservation (TNC personal communication). The outcome might have been different if local people had been engaged since the beginning. This speaks to the misconceptions inherent in conservation, government and NGOs initiatives on what should constitute the livelihoods of local people.

My interviews with multiple NGO and government officers have shown that programs in Eastern Indonesia are indeed designed to incorporate all stakeholders in plans and initiatives. Many of

these ideas reflect major trends in participatory conservation promoted by government institutions in Java and Bali or transnational NGOs like the Red Cross or the Nature Conservancy. However, new programs that propose zonification in terms of coastal environments, ecotourism, and marine protected areas do not originate at the regional scale or as a result of communal initiatives. As an environmental officer once mentioned in one of my interviews, “*Saya lihat ke Jawa dulu*” (I look at Java, the West, first). This creates a series of problems. Firstly, it presupposes that even when solutions are designed to incorporate local communities, the space of integration is reduced. Local populations participate only in limited ways and through forms of engagement that are predetermined by extra-local actors. Secondly, without ensuring democratic participation emphasizing the need to include all stakeholders, it reifies and essentializes the local context. Mental frameworks of local realities do not change, but acquire a patina of moral relativity that can potentially allow for more exclusion. In the case of damaging fishing practices, it offers the necessary prescriptive narrative of good and bad ways of making a living that make efforts at eradication anachronistic (Lowe 2006).

Government entities and conservation organizations commonly blame overfishing and damaging fishing practices for the decline in coral and fish stocks; the use of dynamite and potassium constitute the most significant culprit. For example, in early 2001, Nancy Knolwton indicated that “Coral reefs, with their millions of species, have changed profoundly because of the effects of *people*, and will continue to do so for the foreseeable future” (2001:5419; emphasis is mine). Though blasting coral can produce serious damage (Mous et al. 2000), some of the most significant factors that affect corals are related to climatic events and the depletion of fish species (Wilkinson 1999). Environmental factors like extreme ENSO events that affect marine habitats are only discussed among experts – ENSO 1997, considered the strongest event of that type, has been the most significant disturbance, causing bleaching of about 80% of coral in the Indo-Pacific (Pulau Seribu Islands).

The second element within this institutional perception of what causes coral degradation is connected to the idea that fishermen are greedy and motivated alone by the prospect of making a profit. Not only this perception is highly biased, but it also ignores other causes, such as the intensification of fishing efforts, propelled indirectly by small regencies and big capital industries, and the market pressures that create the demand for coral products like wrasses (*Labrantoidea* family). The reemergence of unsustainable practices is explained by the psychological character of the fisherman, as always trying to obtain some gain, the “free-rider” or cheater, taking advantage in the lapse of control in certain areas.

However, local rationales and perceptions behind the proliferation of destructive practices have produced narratives pointing to the reduction in fish stocks, the increase in demand for marine products, and the deterioration of landscapes as the most significant causes. The difficulties in achieving effective surveillance of protected regions that lack infrastructure and personnel, decentralization, and corruption, also create suitable conditions for the reemergence of dynamite and potassium cyanide use.

In the following sections, I explore the efforts conducted by the local government in eradicating dynamite and potassium cyanide practices in the small regency of Ende in South Central Flores, Nusa Tenggara Timur, Indonesia. Through my research, I investigate the dynamics behind unsustainable fishing practices, the effects of climate change in communal property systems, and

the emerging conflicts associated to climatic and socioeconomic uncertainty. With this objective, I analyze within a critical lens my experiences among traditional Endenese fishing communities. I follow Nancy Peluso's approach to political ecology, examining “first the resource-related actions of local people and then linking them both to their webs of local social relations and to the broader political-economic setting” (1990:51). I also discuss the problems associated with regulating open-access resources and what uncertainty might pose for the future regulation of illegal practices. I rely on Elinor Ostrom’s Common Property Resources and Socio Ecological Systems theories to expose the challenges to governance and the importance of incorporating the perspectives of all stakeholders (Ostrom 2009).

I draw on 22 months of ethnographic work, including surveys, semi-structured interviews, observations and informal conversations with fishermen, fishermen’s wives, and various government officials. To protect the identity of my informants, I abstain from providing any kind of diagnostic information that could compromise the security of those involved in the research. In addition to interviews, I review local newspaper articles about blast fishing and other illegal practices connected to marine resource extraction.

My research indicates that despite the absence of regulatory practices at the village level, there is a strong awareness of the importance of protecting marine resources. If co-participatory programs are devised, people will take part in conservation projects and aid in the control of illegal activities. Independent organizations are already emerging to demand official responses and fair economic alternatives to fill this void. I conclude by indicating that the strict bio economic perspective of government and private institutions fails to capture the multiple intricacies behind resource use decisions, preventing the eradication of non-sustainable practices (Lowe 2006, Halim 2002). Further, the bio economic approach provides a political dynamic favoring corrupt local government officers, who conveniently ignore the destructive effects of illegal foreign fishing operations and blame local fishermen for environmental degradation. The approach has also affected local investment opportunities, and exacerbated poverty. Briefly, I describe what governability should look like in the face of future climate change and co-participatory stakeholder’s engagement.

## **Methods**

In order to explore perceptions and decisions about the environment, resource use, damaging fishing practices, uncertainty and climate change, I conducted ethnographic research, using semi-structured interviews and participant observation, in June-July 2009, November 2010-January 2011, and June 2011-December 2012 in the regency of Ende. I interviewed about 120 fishermen, and had repeated conversations with NGO and government and police officials. I also participated in meetings with fishermen and different organizations to socialize coral conservation and garbage disposal initiatives, and I attended an official workshop on the implementation of conservation, risk reduction and disaster management policies. Moreover, I carried out a visual coastal monitoring survey that included the assessment of perceptions of climate change, changes in fish species, drastic events, adaptability, and damaging fishing practices among other things. The sample size for the survey was 85 fishermen in the southern coasts of Ende Regency.

Data analyses included a combination of qualitative and quantitative techniques (bivariate statistics, theme coding) with the software packages JMP Pro 10, Gnumeric 1.10.16 and MaxQDA 11.

### **Ende and the southern coast of Flores: the setting**

Ende city, the capital of the Ende Regency, is a medium-sized port inhabited by approximately 17,000 people (Badan Pusat Statistik Kabupaten Ende 2010). Across the bay from the city is Pulau Ende, a small island that includes seven villages with a total of 8,000 people and about 1500 fishermen.

Coastal Endenese have a complex origin. They reflect a mix between local hinterland groups ('*Ata Lio*' and '*Ata Keo*'), Javanese and Chinese traders, Bimanese warriors, Sumbanese slaves, and migrant Bugis, Butonese and Makassarese fishermen from Sulawesi (Tule 2004, Nakagawa 1984, 1996, Sareng Orin Bao 1969, Dietrich 1983, Knaap and Sutherland 2004, Needham 1968, 1980). Islam spread to the area in the 16<sup>th</sup> century through trading interactions and resulted in the consolidation of Buginese cultural traits (Edjid 1979). Buginese traits include a unique syllabic alphabet system called *Bahasa Lota* (Van Suchtelen 1921, Roos 1877, Banda 2005), complex descent myths (Pelras 1996), food prescriptions, birth and wedding ceremonies, and an intricate symbolism and set of ritual practices that link the social representations of the house and the boat (*perahu* or '*sampa*'; Chou 2003, Southon 1995, Sopher 1965). Also among these traits is the practice of *mencari rezeki* or the search for fortune ('*nggae ka*') as a way to explain one's decisions in all aspects of life (Acciaioli 2004, Pelras 1996).

In comparison to other parts of Indonesia like Kalimantan or Java, development programs have progressed at a slower rate in Flores (Resosudarmo and Jotzo 2009). In Ende, fishing is still carried out by traditional boats (*sampans*) or smaller motorboats with 4 to 1 inch fishing nets. Activities are mostly for subsistence or small-scale trade as there is no industry operating in the district or external investment to support the improvement of fishing gear. Even so, Ende has suffered from a steady intensification of fishing activities in the last twenty to fifteen years. For example, in 1986 the number of fishing boats was 196 *jukungs*, 613 *papans*, and 72 motorboats. By 2009 these numbers had increased many fold. According to BPS Ende (2010), there are now 472 *jukungs*, 1051 *papans*, 247 *tempels* and 634 motorboats.

When working with fishermen in the Endenese district of Flores, it is common to see a landscape of hardship and struggle in terms of procuring the means to subsist. Ende is located in one of the poorest regions in Indonesia, the province of Nusa Tenggara Timur. According to local statistics at the provincial level, poverty reaches 20 %, with the poverty line cutoff about Rp. 222.507 (~ \$20, BPS NTT 2011). However, more realistic estimations place poverty indexes around 40% (Resosudano and Jotzo 2009). This is not surprising, as the yearly GDP for Ende is only Rp. 2,970,200 (~ \$270, BPS NTT 2011). The impact of low salaries and general socioeconomic uncertainty has an important correlate in terms of health and morbidity. Malnutrition has been reported as 6.23 % (NTT Ende 2011), with a 52% prevalence of stunting for children under the age of 6 years (Reinhard 1997).

Over 80% of the Endenese-Lio population over the age of 15 are directly engaged in labor, agricultural, or fishing activities on a subsistence scale (BPS Ende 2011). There are no local industries in the region except new mining initiatives. Unlike other areas of Indonesia, Flores is considered very poor in terms of natural resources (Monk et al. 1997). Low precipitation indexes

and increasingly frequent droughts limit the agricultural potential (Metzner 1987). On the other hand, the seas around Flores are known for their wealth of marine species, especially tunas (*Scombridae* Family), marlins (*Istiophoridae* Family) and cetaceans (Weber 1902).

Researchers estimate that Indian, Eastern, and Western Pacific waters of South East Asia are being overfished and/or intensely harvested (UNEP 2008). Organizations such as WWF (World Wildlife Fund) or The Nature Conservancy (TNC) have reported decreases in tuna catches of one third in the last ten years in the seas surrounding Flores (Ingles 2008). Tunas have also been heavily fished as boats and location devices have facilitated their access (Mc Ilgorm et al. 2010, Ellis 2009, Helfman 2007). Similar decreases in overall productivity are expected to occur with increases in sea surface temperature over the next hundred years (Cheung et al. 2009, UNEP 2008). Climate change is expected to drive tropical and subtropical species' ranges toward the poles and temperate areas, critically impacting the composition of local ecosystems and creating unpredictable consequences in biological interactions between marine and freshwater communities (Badjeck et al. 2009, Perry et al. 2003, 2005).

This creates additional stressors that fishermen feel inadequate to deal with. Many have resorted to migration, as employment in other sectors of the industry is unavailable in Ende. During my interviews, fishermen usually complained about the speed of intensification and the unpredictability of weather conditions that would affect the catch. According to most fishermen, it is widespread knowledge that fishing patches are selected on the basis of an annual calendar regulated by the monsoon seasons and moon phases that help predict the presence and abundance of certain species. In this system, winds might be one of the most important factors determining catch, unit of effort, and sailing conditions. But as a consequence of increased climatic alterations, the onset of the dry and wet monsoon seasons has changed. As a result, many interviewees have mentioned that calendars are no longer reliable for establishing the availability of fish species.

### **The events**

I first heard about the use of bombs during an initial survey in my preliminary dissertation research. Informants were emphatic that this practice was successfully eradicated because the local fishing commission provided other means of livelihoods, such as seaweed cultivation. Having experience with the formality of the Indonesian system and the strict control exerted over resource use in other regions, I did not initially question that assumption. It was not until I returned on subsequent trips, including my dissertation fieldwork, when I realized that I had not been told the whole story.

During my first month of systematic fieldwork, I was collecting data from one of my weather stations near the coast when a loud boom brought me straight to the shore. My field assistants, who were faster than me, saw how some of the local fishermen rapidly came out of the water holding coral fish. As they saw us approaching, they began to converse and sat by their speed boats while younger children dove into the nearby corals and resurfaced with smaller fish. It did not take long to realize that they were waiting for us to disappear so they could all go and get the bigger fish that were floating in deeper water. After that, we started paying more attention to the comments and rumors about coral blasting and potassium use. People were very eager to discuss these topics somewhat openly as their frustrations were augmented by the lack of official response. It did not take long until we started hearing about two or three explosions a day.

On one occasion, while conducting a boat trip around one of the islands with four fishermen, we witnessed an explosion about 50 meters from our position. The nearby corals that surrounded this location showed traces of previous blasts, with very limited areas that appeared to have formations in good health. We had been having a discussion with one of the fishermen about the general health of the corals when the bomb went off. Near the explosion site a column of water about 10 meters rose into the air.

It was only a few seconds later that we saw the small *sampan* that was responsible for the blast. As we approached the detonation site, we started seeing all kinds, types and sizes of coral fish coming to the surface. The smaller ones reached the upper layers more rapidly, while dozens of numerous individuals floated in lower strata of water. They looked to be the size of a sardine, but were actually between 10 to 25 cm in total length and weighed 1 kilogram or more; the depths of the water distorting size perception. On the surface, there were 15 cm butterfly, surgeon, cow, puffer and cardinal fishes (*Chaetodontidae*, *Acanthuridae*, *Ostraciidae*, *Tetraodontidae* and *Apogonidae* families). A few minutes went by and motorboats started approaching the explosion site. Youngsters and kids started diving in to collect whatever they could. Our crew joined the activity. It became apparent that, while not a collaborative endeavor, it was an occasion that allowed for outsiders not directly involved in the blast to obtain benefits. We found out later that when a bomb is detonated the responsible party couldn't demand other nearby fishermen to abstain from profiting. In 15 minutes, there were possibly between 10 to 12 boats from the nearby village including, more than one individual diving. At last, the noise could be heard of a bigger boat approaching. Upon reaching the location, the compressor was set in motion and two divers with hoses got into the water. Our boat collected about 37 fish or more, whereas other boats had more substantial catches. When we left, there were plenty of fish still waiting to be collected. Some of the fish brought on board were still alive, but had trouble swimming, as their vertebral lines were possibly broken. The damage was not obvious to the naked eye, but internal.

While this activity went on, we were constantly on the lookout for the police patrol. Local people on the other hand, were not scared. They knew better. A few showed some concerns that a white person (*bule*), me, was in one of the boats. But they dismissed them rapidly when they realized that I was not going anywhere, but paddling miserably next to the boat. Later we found out that the bombers, probably Endenese in origin, were from the other side of the island. They were using local geography to their advantage since it allowed them to remain hidden from the police station and the district office located on the opposite side. Although the local police did not own a motorboat or patrol, they could still report the fishermen and monitor them more closely in the future.

Over the next several months, we heard stories about bombs and potassium almost daily. We saw people who physically bore the scars of bomb use, with missing limbs and amputated fingers. We heard stories about fishermen buried at sea or in the middle of the night away from prying eyes. The wealth of some very successful individuals was also tied to bombing in certain villages, and some marine species, we learned, could only be procured through bombs (dolphins and Yellow-striped Goatfish *Mulloidichthys vanicolensis*). These fish "*mati kaget*", died in surprise, and could be distinguished by their color. Other informants told us about how bombs were made: a combination of fertilizer (*pupuk*,  $\text{NH}_4\text{NO}_3$ ), common laundry detergent (Rinso or Vita) and kerosene (*minyak tanah*), is placed inside a small glass soda bottle (Sprite or Coca-Cola) and lit

with a fuse. One kilogram of detergent provides approximately six explosives with decent potency. They also described more sophisticated ignition methods such as the use of cables and distant detonators that could trigger a cascade of bombs.

Bomb users would usually choose distant places, sometimes leaving their home-port for days and traveling for several nights to the northern coasts of Sumba or to Larantuka in Eastern Flores. In the past, when the activity was not prohibited, fishermen would bomb the neighboring coasts, causing the destruction of many coral reefs in and around Ende Bay. They would also rely on a *sampan* (small canoe) and use bombs when they were expecting a huge catch of tunas or skipjacks. Nowadays, bombers deploy big nets (purse seine/ *pukat lampara*) before throwing an explosive into the center of the circle created by the mesh. This causes concern because purse seiners employ big motorized boats that can secure catches by the tons. Artisan fishermen, who cannot rely on blasting methods due to police control, have complained repeatedly to the local fishing commission without luck. However, it is not true that all purse seiners rely on bombs, nor that artisan fishermen do not use them. This conflict reveals the antagonism between selected individuals, sponsored by Indonesian institutions to intensify and modernize their fleets, and the rest of the fishermen who have no access to investments or subsidies. It also exposes a conflict in terms of the lack of regulation of an open access fishery that is showing important changes in the catch availability and composition.

### **Results: Blast fishing as a solution: management of open access resources, enforcement and wider political context**

#### Semi-structured Interviews and ethnography

My interviews with former bomb users and fishermen revealed that prevailing uncertainties have made the use of damaging practices an alternative solution. Positions regarding bomb use were complex and contradictory. And in some cases reflected different perceptions of how resources should be used. As in the case of other fisheries, Endenese institutions do not recognize any kind of rule of access or customary law regulating the extraction of resources. There is only one prescription that involves the fishing of red snappers and groupers and is related to taking turns when discovering a suitable fishing spot. Hence, the fishery is literally open to the plunging of other migrant Bugis and Bajau populations who circle the archipelago in their pursuit of marine resources (Fox 2005). Government institutions try to control this exploitation by setting licenses, but in many cases migrant fishermen are free to roam about if proper bribes and power relations are acknowledged.

On the other hand, Endenese fishermen are well known for exploiting far off fishing grounds, and especially for their use of bombs. They do not necessarily follow any rationale in terms of limiting access to their own fishing grounds consistently and they always search for spots where permits are not required or regulations not enforced. Many have been in jail for fishing without proper licenses or in protected areas (Komodo National Park). However, over the past decades this seems to be changing as younger generations become aware of conservation initiatives, degradation and the benefits of managing a sustainable fishery. For this reason, among my interviewees, many complained about how coral blasting and potassium use were creating unsustainable conditions for the future. In my surveys, almost all of the fishermen interviewed indicated that they experienced a reduction in the size of the catch over the last thirty years and directly blamed damaging fishing practices and illegal fishing as the cause. Reductions have also



affected mammals like dolphins and whales. The latter were frequently spotted in the bay in the past, but are now very rare. Furthermore, fishermen mentioned that they have to travel farther out to sea to catch fish. In the past, fish used to be plentiful near the surf, not far from the beach, but that has changed.

Bomb users were described as selfish, careless people, who do not adhere to modern sustainable practices. They were considered unlike other fishermen in that their way of procuring money was immoral. Bombs were considered “*barang panas*” (hot things) that brought impure luck (“*rezeki kotor*”). According to Allah, the proper way of being granted *berkah* (blessings) and luck is through hard work and effort. Having a pure heart (*Hati Ikhlas*) is an important part of this process. Therefore, bombers were considered cheaters.

Despite widespread agreement on the damaging effects of bombing, the anger expressed in these narratives often belied the continued benefits that many received from bombs or cyanide, either through their direct use or through a piece of the catch. Or censorship was short lived due to the existence of what were considered valid excuses for using bombs and cyanide to obtain money quickly. The uncertainties among fishermen were of a different kind from those discussed in NGOs or government offices. We commonly heard complaints about increasing prices, increasing school fees and the impossibility of finding other employment.

People were disappointed by long-standing institutional promises to provide more powerful engines, nets and contracts with processing plants to develop the fishery. “*Sudah lama kejanjian ini dan belum jadi*” (It has been long promised but it has not happened yet). Market pressures were also creating more demand for high value fish items like groupers (*Serranidae* family), snappers (*Lutjanidae* family) and wrasses (*Labridae* family) and big tunas (*Thunnus albacares* and *Thunnus obesus*) that were directly exported to Bali and then Singapur and Hong-Kong through aircrafts. With lower catches as a result of more fishing pressure, climatic change, and illegal foreign fleets, with highly uncertain returns after substantial investments in fuel and energy, and debts, it was understandable that, on occasion, the blasting of corals could be employed as a solution.

In other cases, the notion that dynamite use was a normal way of fishing in the past, allowing whole families to subsist, continued to proliferate. After all the prohibition in terms of using bombs and potassium cyanide was introduced only very recently (less than 5 or 6 years). Efforts on eradication became consistent after 2006, when complaints were made at the provincial level by officers in Sumba after arresting Endenese fishermen in their coasts. Looking back into the near past, some fishermen remembered those times with joy, as a period where they could be roguish or mischievous (*nakal*), where they would hide their catch in over-sized pants and escape the police patrols.

Nowadays, the relationship with the police has changed in many ways. Maritime patrols are authorized to shoot precautionary bullets and even target fishermen when warnings are not heard. We heard multiple stories of people being shot by police, and sons or nephews dying. We also heard stories of connivance and corruption, where police officers received parts of the catch, especially when it consisted of yellow-fin tunas (they can reach an internal price close to 100 u\$ at the local market). But as it was discussed before, all of these statements have to be considered critically. Interviews with enforcement officers presented a very distinct picture. First of all, there are multiple dependencies and divisions that have different jurisdictions and competencies in

relation to damaging fishing practices. There are naval police (Polisi Angkatan Laut), local police (Polisi Daerah), district police (Polisi Kabupaten) and the army (Pri Mob). There are also the court officers, judges and lawyers (Kejaaksan and Keadilan), the fishing commission (Dinas Perikanan), and the administrative employees of the environmental office (Badan Lingkungan Hidup Daerah). All play their own parts in the multi-step process of preventing, detecting, apprehending, arresting, processing, convicting and rehabilitating a bomb or potassium user. Because they all respond to different duties and authority hierarchies and they engage in diverse stages of the process, they have dissimilar opinions on blasting and cyanide fishing, its causes and how to successfully eradicate them. Opposite or contradictory representations create a lot of friction when offices overlap.

Due to the nature of the activity, finding proof of bomb or potassium use is, at best, difficult. In order to convict a person, two pieces of evidence are required. Because the district only owns one patrol boat and there are 3 officers working at a given time, there is not enough man-power to detect damaging fishing practices when they are occurring. Officers rely on particular cues to establish the crime: they patrol when rumors of blasting or potassium use are heard, they inspect fish at the local market to determine its origin, they control for equipment that is not considered legal to possess (hookahs), they wait for bombers to come back to land to sell their catch and then seize the evidence, or they basically rely on hearsay and visit the villages to control and monitor fishing practices. That is why it is not surprising that only 6 cases have been processed since 2006, with only one case per year ending up in the judicial system since 2009-2010 (this amounts to a total of 3 convictions).

The numbers are a little bit higher in other regencies. For example, during 2012 there were 50 people in jail in Ruteng, Manggarai Regency, for relying on illegal practices (04/14/2012 Flores Pos). However, similar stories are heard about the lack of police force and the difficulties in finding evidence and commitment from the community. Government institutions and NGOs interpret the setbacks in controlling illegal practices as a direct result of the non-regulation of resources and the greedy character of the Endenese. In the discussion section I elaborate on these narratives and interpret their meaning in terms of governance and the future regulation of fisheries.

### Surveys on Environmental Monitoring and Resilience

As a part of a survey to monitor environmental conditions in coral reefs, coasts, and beaches and to assess local memory of drastic events, we conducted a series of questions that pertained to climate change, uncertainty, adaptability, community support and perception of the use of damaging fishing practices.

In terms of climate change and uncertainty, nearly all respondents indicated that they perceived a change in precipitation patterns and the onset of the rainy season. They indicated that it is impossible to predict the weather and that they perceive a reduction in certain species of fish (). In addition, informants during interviews also mentioned that “*ikan tidak kenal musim lagi*” (fish do not recognize seasons anymore) referring to the alterations in seasonality in terms of recruitment and migration.

In terms of adaptability, we discovered that disponibility or access to resources is difficult. This increases the local perceptions of vulnerability and uncertainty (see Table 1.1). Electricity is only available at night (6 PM to 6 AM) in best cases, and is highly unreliable. There is no running

water, and in some cases the proportions of freshwater wells to people is about 3 or 4 wells to 8000 people. Access to health facilities is more common, though consultation is not very frequent.

Table 1.1

<b>Item</b>	<b>Percentage owning/having access</b>
Generator	8%
Water tank	42%
Motorcycle or automobile	20%
Motorboat	41%
Access to shelter	9%
Access to health services	95%
Health coverage (Jankemas)	74%

Local opinions in relation to government support at the village level to prevent/deal with drastic events or natural disasters: the majority of respondents (68%) indicated that there is support.

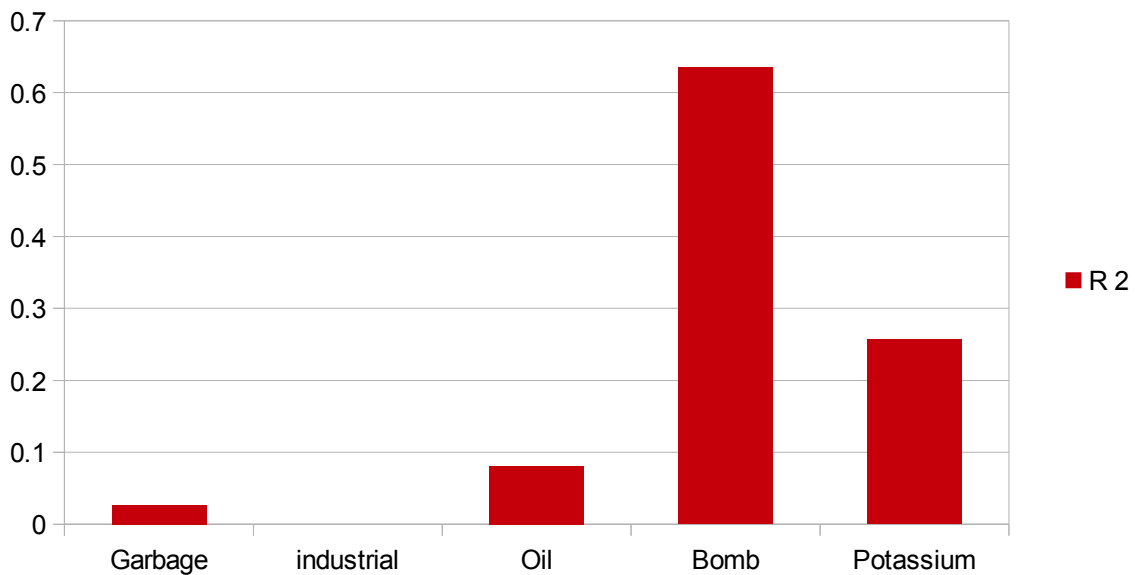
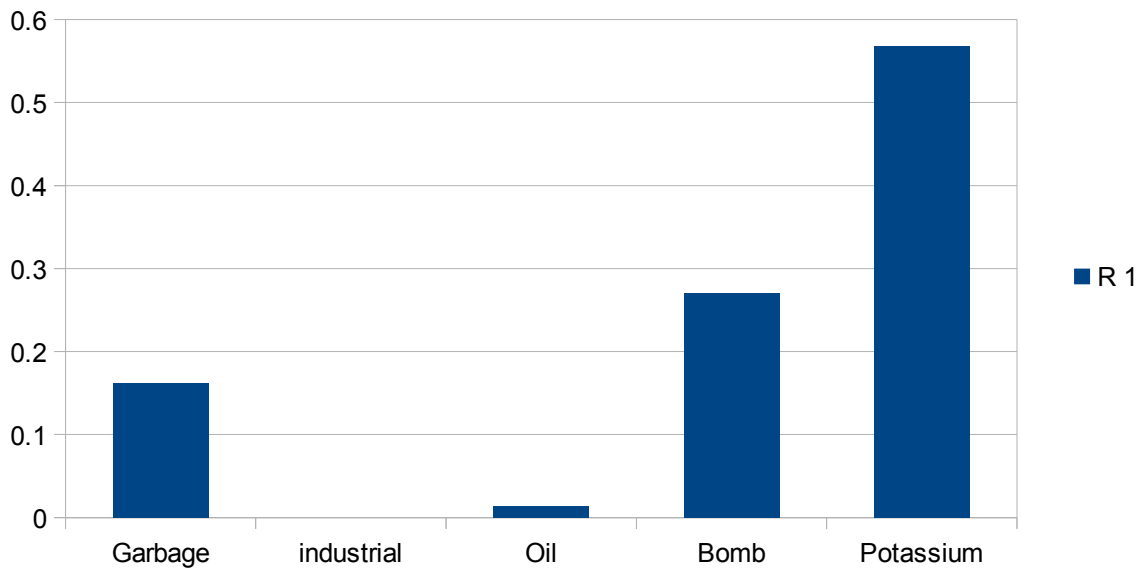
Local opinions in terms of the presence of village institutions and leaders to deal with drastic events or natural disasters: the majority of respondents (62%) answered positively.

Local opinions in terms of coordination of rapid response at the village level: the majority of respondents (62%) indicated that there is a rapid response.

When we asked participants to rank the most important factors that are responsible for environmental degradation, bombs and potassium cyanide ranked consistently as second and first cause. Other elements were garbage and contamination from oil and industries in third, fourth and fifth place respectively (see table 1.2). These results indicate that fishermen were able to identify the destructive potential of these practices. However, it is hard to say whether they were responding to what was expected of them and whether these rankings reflect real perceptions.

Table 1.2

<b>Factor</b>	<b>Ranking mean</b>	<b>Ranking standard deviation</b>
Garbage	3.1	1.09
Industrial	4.8	0.46
Oil	3.4	0.82
Bombs	1.8	0.61
Potassium Cyanide	1.7	1



These charts represent the proportion of factors that were ranked first (blue) and second (red) in their importance in terms of environmental degradation.

Concerning opinions, we asked fishermen to rank on a Likert scale from 1 (Strongly Agree) to 5 (Strongly Disagree) ten statements related to coral reefs, the services they provide and damaging fishing practices (see table 1.3).

Table 1.3

Statement	Mean Score
1. Coral reefs are important to protect beaches from intense waves and as a nursery for fish.	1.11
2. Because there are coral reefs here nets and fishing equipment break.	3.51
3. The police know that there are people that use bombs and potassium in this area.	1.97
4. I want my children to be able to enjoy healthy coral reefs and beaches.	1.21
5. To catch fish it is necessary to delimit a special area to protect coral reefs and fish, and to control people that use bombs and potassium.	1.77
6. If we do not take care of the coral reefs we will not be able to catch more fish.	1.31
7. People that use bombs or potassium are fishermen like us.	4.55
8. Seaweed farming is not adequate for local fishermen.	3.68
9. People that use bombs or potassium do not damage the environment/ do not do anything wrong.	4.55
10. Coral fishes are not important to us.	4.51

Low mean scores for statements 1 and 6 indicate that fishermen were able to identify the importance of coral reefs to the continuation of marine environments as barriers against erosion and as nurseries for coral fish species. Statement 2 with a mean score of 3.51 (NA/ to disagreeing) is one of the most frequent excuses for fishermen destroying the corals or using compressors in other areas of Indonesia or the Philippines. However, these results seem to indicate that fishermen do not recognize this as a normal threat. Statements 10, 4 and 5 talk about the importance of protecting corals for the future and the potential for agreeing on creating a regulated zone. Statement 8 is particularly interesting, as the fishing commission has been introducing seaweed cultivation as an alternative livelihood. Nevertheless, the score indicates that fishermen are somewhat neutral to the idea that seaweed farming is adequate to the particular environment. Finally, statement 3, 7 and 9 speak directly in terms of conceptions about damaging fishing practices, their role in degradation and whether police authorities know of these practices.

## **Discussion: Governance, open access systems and the challenges of prevailing uncertainties in regulating illegal practices**

How can we explain this disconnection/ambivalence between practices, policies and uncertainties? I think one possible way to answer this question lies in analyzing how the Endenese regency has dealt with regulating open access marine resources. To do so, I will briefly discuss the history of marine policy development in Indonesia.

Despite being one of the largest producers of marine products, Indonesia has only recently (in the last 15 years) begun to address the problem of developing their fish based industries (Chouzin 2008). Before the movement towards democratic government in 1998, the country was under the influence of neoliberal policies from the New Order at the hands of Suharto (Vatikiotis 1998). Those policies put considerable emphasis in the agricultural sector in detriment to other local economies. For this reason, it should not be surprising that the Ministry of Marine Affairs and Fisheries was created only in 1999 (Chouzin 2008). The lack of attention in fisheries before this time might have had a critical impact on the development of sustainable policies and the continuity of damaging fishing practices.

Comprehensive historical analysis of marine fisheries in Southeast Asia have discussed the different assumptions in which exploitation and intensification of fishing effort were justified among these countries (Butcher 2004, 2005, Fox 2005). The idea that the seas were limitless in their potential<sup>1</sup> brought many demersal, reef and benthic species to extinction (Boomgard 2005, Lowe 2006, Semedi 2001). Indonesia was no exception to this. The decades that follow World War II saw an intensification of the pressure in the Southeast Asian seas. Such initiative has been characterized as the “great fish race” (Butcher 2005, Henley and Osseweijer 2005). This is when destructive methods, like dynamite fishing, became popular. The following decades saw a reduction of fish biodiversity in the Gulf of Thailand up to 90% and in the Javanese coasts (Semedi 2001).

Regulation progressed early up until the 1980s when trawling was declared illegal in the Indonesian seas (with exception of the Arafura and Banda seas). By this time, the depletion of fisheries and the impacts of unregulated harvesting were critical. As a consequence of the trawling ban, large fishing fleets commenced a migration of their fishing effort to eastern areas of the archipelago where control and regulation were not as efficient as in more populated areas (Monk et al. 1997, Boomgard 2005). This eastward movement continues until the present, where some areas like the Banda Seas have been characterized as “clouded by the illegal operations” of mainly by Taiwanese, Philippine, Korean, and Japanese trawling boats (Fox 2005).

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<sup>1</sup>As Allison and Ellis clearly point out (2001:377) there is an underlying tenet in marine fishery policies that states that fishing capacity actually reflects the productive capacity of the resource. Improving productivity by modernizing and developing fisheries, thus, can only lead to the achievement of bigger yields. However intuitive this perspective seems, it has been proved far from the empirical reality (McIlgorm et al. 2010). Not only do fish stocks oscillate in response to complex environmental variables that are only partially understood, but also increased fishing fleets has led to smaller yields as particular fish populations—i.e.: cod (Kurlanski 1997) and tunas (Ellis 2009)--approach extermination.

Taking into account this story of an absent state in terms of marine regulations, many of the limitations in achieving efficient and sustainable governability of the open-access fisheries can be contextualized. 1999 is not only the year in which the most important organism of marine regulation comes into existence, as indicated above, but also when new regulations are approved in term of autonomy and jurisdiction (*Undang-undang Otonomi Daerah No. 22, 25 /1999*, and *No. 32/2004*). Through these new legislative acts, the development and control of fisheries was transferred from the central to the local government.

Curiously the latter, the integration of smaller authorities and communities to policy design and implementation, was one of the goals of the decentralization process enacted by the *Undang Undang 22/ 1999*, the Local Autonomy Law (Hill 1998, Satria and Matsuda 2004). Decentralization was supposed to transfer the control and management of resources to the local administration. Provinces would have a 12 mile zone of control beyond their shores, and district or local governments would have authority for the first 4 miles. At the community level, the UU 22/1999 meant that the system of resource management (governance) would depend on their own regulations, the *adat* or the *sasi*, and on district regulations. This would lower the costs of a centralized administration and reinforce traditional laws that were undermined in the legislation of the previous periods. Most importantly, it stated that district or local governments were in charge of exploration, exploitation, conservation, management, and law enforcement of regulations (Satria and Matsuda 2004:438).

As well intended as they were, the implementation of these new policies not only proved unsuccessful in developing small-scale fisheries in certain regions of Nusa Tenggara Timur, but might have also contributed to the emergence of conflicts and constraints to effective management (Satria and Matsuda 2004). The lack of resources, infrastructure, and personnel to put these changes into effect is one of the most significant stressors and it can be seen in the weak institutional presence in Ende and in the emergence of confrontations between the local fishermen in terms of fishing gear. In concrete, local fishing commissions left to their own in the management of fishing incentives, establishing rules and permits, and controlling the enforcement of laws, had different rates of success depending on the level of corruption and institutional bureaucracy.

Overall, for Ende, the lack of an effective co-management program signifies the loss of opportunities in administering and developing their own fishery and seaweed aquaculture. It keeps the living standards within the community at subsistence levels. The absence of fair economic incentives and programs of regional development has consequences in the high incidence of preventable diseases like diarrhea and in nutritional pathologies (BPS Ende 2011).

So how can social sciences assist in the design of conservation and development policies that are appropriate to the challenges faced by Eastern Indonesia? A way to start is by recognizing the failure of fishery management schemes that treat different individual motivations alike, that look at intentions and agents as purely influenced by selfishness or blind altruism.

Among fishery management biologists, conservation officers, and politicians there has been a common assumption that local fishermen are mainly driven by maximization and intensification in their allocation of fishing effort (Cordell 1974, Allison and Ellis 2001, Perry et al. 2003). Rational choice has been the underlying principle explaining resource exploitation and the absence or existence of conservation practices (Gowdy 2008). This misconception of

motivations arises from a lack of studies on fishing behavior. Such studies could inform marine policies about resource use (Bene and Tewfik 2001, Colfer et al. 1999). Fisheries have also been mischaracterized in their aspect of open-access resource systems; assuming that common property implies that everybody's property is nobody's (Gordon 1954, McCay 1981).

Whereas it is highly indisputable that commercial fisheries in South east Asia are creating unnatural pressures on fish stocks of species such as bluefin tuna (*Thunnus thynnus*), groupers, snappers, wrasses, and sharks through non-sustainable fishing practices (i.e.: Ellis 2009, Bailey et al. 2000, Helfman 2007, Butcher 2004), there is no equal certainty of the role of small-scale fisheries in this process. Decision-making about resource use is multifaceted (McGoodwin 1990, Bene and Tewfik 2001); and even when fish are harvested without management or controls, there are other factors at work aside from mere economic motivation that explain decisions about sustainability. It is only in relation to a socio-political context that motivations can be explored. Therefore, fishery sciences and policies need to be humanized, that is, address local interests, systems of values, and needs if they are to devise responsible and effective strategies (McGoodwin 1990).

To conclude, research in Common Pool Resources, Open access systems and Governance throughout the world has emphasized the importance of understanding the factors that affect local participation in the regulation of resource use (Ostrom 2009, Basurto and Ostrom 2008, Basurto 2005, Filipe et al. 2008, Wamukota et al. 2011). Many of these approaches stress that successful policy-making has to “encourage local governance and assist in the development of resource rights that align individual self-interest with the long-term health of the resource” (Berkes et al. 2006:1558). Hence, sustainable governance in the case of Ende should assume the form of a real co-participatory regime, where all stakeholders participate in all processes. That is, in the 1) recollection of necessary diagnostic information about resources, uncertainties in socio-economic and ecological spheres, livelihoods and alternative investment sources; 2) design of rules that control and define the potential use of resources and fishing grounds; 3) create documentation and materials for community and institutional education; 4) generate a set of solutions to possible threats that might affect the fishery; 5) generate a collective perspective of the future of the system and all stakeholders.

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