

Community-based management for sustainable fishing or organizing the battle over the remaining resources? Analysis of an island's micro cosmos in the Spermonde Archipelago, Indonesia

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Abstract

The heterogeneous coastal and marine ecosystems are among the most productive ecosystems on the planet and are of fundamental importance to millions of people worldwide. The absence of rules for the use of natural resources tend to result in overexploitation of these resources. This article centers on the role of a local community in marine resource management. It analyzes factors that affect natural resource use patterns in the sea territory surrounding Langkai Island, a small island located in the Spermonde Archipelago off the coast of the south west Sulawesi Island in which the island population heavily depends on fisheries for their livelihood. Marine resource patterns in that area are influenced by three types of the Common-Pool Resource Regimes (i.e. state property regime, private property regime and community property regime) which have produced rule-in-use and influences the marine resource use patterns in the area whilst their enforcement, however, is fraught with difficulties. Moreover, environmental conservation effects of the locally devised rules in the area probably remain limited and should rather be considered incidental as the community-based management rather aims to organize the battle over the diminishing marine resources than organizing a sustainable regional fishery of the Spermonde Archipelago.

1. Introduction

Concerns about the world's oceans and coasts are rapidly growing (Burke, Reytar, Spalding, & Perry, 2011; Rockström et al., 2009; Visbeck et al., 2013; Zondervan, Gerhardinger, Torres de Noronha, Spalding, & Young, 2013). One of the most severe threats emanates from the condition of the sea as open access (The World Bank, 2006). Open access describes a situation in which any rules, regulations and management are either lacking or are not effectively enforced (*res nullius*) (The World Bank, 2006). In case of an open access situation to marine territories, the use of its associated flora and fauna is *de facto* free for everybody. This is widely assumed to lead to sustainability issues as marine resources are a classic case of Common Pool Resources (CPR) (Ostrom, 1990; Pomeroy & Berkes, 1997; The World Bank, 2006). CPR entail two characteristics which distinguish them from other kinds of resources. Firstly, the difficulty of exclusion or the control of access to the resource; and secondly the opportunity of each user subtracting from the welfare of others (Ostrom, 1990). These characteristics provide particular challenges for the sustainable use of CPR. In absence of regulatory mechanisms and incentives for sustainable resource use, the resource use pattern tend to result in the decline of species abundance and biological diversity since in many cases the extraction rate exceeds reproductive capacity of valuable marine species which leads to increasing overexploitation and degradation of resources (Astorkiza, del Valle, Astorkiza, Hegland, & Pascoe, 2006; Berkes, 2007; Hardin, 1968; Pomeroy & Berkes, 1997; The World Bank, 2006). This is simultaneously aggravated by the problem that, without governance arrangements, there is no opportunity to react to the feedback from the resources (e.g. decreasing target species abundance) through interventions aiming at balancing resource extraction and its reproductive capacity (Berkes, 2007). Therefore, the fundamental basis for sustainable use of CPRs is an effectively enforced system of regulations, incentives and sanctions in order to guide the behaviour of resource users (Schlager & Ostrom, 1992).

Most developing countries, however, are structurally very weak and the state interventions for the management of natural resources frequently do not yield the desired regulatory results (Olsen & Christie, 2000; Ostrom, 1990). Particularly the experience with shortcomings of solely government driven centralized natural resource management approaches has caused policy makers and scholars to reconsider the role of local communities in natural resource use management and conservation efforts (Agrawal & Gibson, 1999). Local communities all over the world have been involved in self-organized approaches to governing natural resources for centuries (Berkes, 2007; Graham, Amos, & Plumptre, 2003; Ostrom, 1990). The self-organization of resource users and the local community as focal points have thus been highlighted as an alternative strategy for managing natural resources in response to non-functioning command-and-control approaches and other centrally organized attempts to natural resource management (Agrawal & Gibson, 1999; Berkes, 2010; Ostrom, 1990). The advocacy of community-based management (CBM) approaches is triggered by the assumption that all individuals possess the innate ability to improve the quality of their life by engaging in self-organization for the sustainable management of the natural resources; especially in case natural resources build the very basis their livelihoods depend on (Pomeroy, 1994). The idea of CBM originated from the indigenous, traditional management systems for natural resources which were originally based on local knowledge, customary law and social institutions developed in response to environmental problems faced by the local communities (Hidayat, 2005). In response to environmental problems, indigenous and traditional communities developed a variety of traditional forms for management of natural resources based on local decision-making structures and informal norms tailored to their particular socio-cultural circumstances which can only function in this specific context (Borrini-Feyerabend, Pimbert, Farvar, Kothari, & Renard, 2004). Through such collaborative local endeavours, communities

may create solutions to secure its socio-economic well-being by inducing sustainable natural resource use (Alcala, 1998; Armitage, 2005; Pomeroy & Rivera-Guib, 2006).

This article centers on the role of a local community in marine resource management in a small island located in an archipelago of the coast of Sulawesi, Indonesia. Indonesia has a population of approximately 250 million people (Central Intelligence Agency, 2011). As a multi-ethnic nation, it comprises 350 recognized ethno-linguistic groups (Syarif, 2009). Although the majority of the population can speak the national language *Bahasa Indonesia*, most of the traditional languages are still spoken on a daily basis. The vast majority of the inhabitants are Muslim (88%) making Indonesia the biggest Islamic country in the world (Syarif, 2009). The country consists of more than 18000 islands with a territory of about 2.8 million square kilometers of water (including 92,877 square kilometers of inland waters) and 1,826,440 square kilometers of land (Cribb & Ford, 2009). Indonesia is located within the coral triangle, one of the biodiversity hotspots of marine species. It has about 81,000 km of coastline comprising about 4,000 ha of mangrove forests and the territory encompasses 5.8 million km² of sea area, of which approximately 51,000 km² are coral reefs (Syarif, 2009). However, according to estimates, the natural marine environment relevant for fish abundance, such as reefs and mangrove forests, are in a state of increasing degradation due to anthropogenic pressures (Syarif, 2009). Two closely linked major problems arise in Indonesia for environmental governance due to its character as an archipelagic nation. Firstly, the landmass is scattered across an immense territory separated by the sea which creates particular challenges for nationwide communication and coordination. Secondly, not only the natural resources on land but particularly the territorial marine waters are of particular strategic, economic and also environmental importance and are in dire need to be managed (Cribb & Ford, 2009). Building on previous work on the subject of informal rules in the Spermonde Archipelago by Deswandi (2012), and Glaser and colleagues (2010, 2015), this article offers a detailed analysis of factors that affect natural resource use patterns in the sea territory surrounding Langkai Island, a small island located in the Spermonde Archipelago off the coast of the south west Sulawesi Island. The island population heavily depends on fisheries for their livelihood while the local economy, however, is exposed to multiple nested drivers of change that create complex interdependencies.

2. Methodology

The study is based on multiple qualitative and quantitative research methods. Data was collected over a six month field research period in the Spermonde Archipelago from September 2012 to March 2013.

In-depth interviews with key informants were conducted in Langkai Island during three stays in the island of about two weeks each to gain an understanding of the factors that impact the marine resource use patterns in the waters surrounding the study island (for details on anthropological research methods used in this research see Bernard, 2006). All interviews particularly centred on understanding on the development of the Langkai Island economy, observed changes of the social, economic and ecological circumstances, the different mechanisms in place that aim at organizing the appropriation of fishery resources in the area, their strengths and weaknesses and reasons why some means work better than others. Information was triangulated in other interviews in the island and key aspects were also triangulated in interviews in other islands and on the mainland to verify data and cover a wider variety of perspectives.

Participatory observation is a research method mainly used in cultural anthropology (Yin, 2009) which includes a variety of facets (Bernard, 2006). For this study, it included building trust to stakeholders, attending relevant meetings, engaging in informal conversations on the matter and others more. For the purposes of this research, it

mainly serves to learn about social processes the interviewees may not be aware of or are reluctant to talk about and to further triangulate information obtained otherwise.

An adapted version of the research tool 'Netmap', described in detail by Schiffer and Hauck (2010), was used for this study to visualize implicit knowledge about the interplay of complex formal and informal social relations, the influence actors exert on marine resource use patterns and to deepen understanding of the social processes for marine governance in the waters surrounding Langkai Island. Two Netmaps were developed in group interview sessions with fishers in a three step process. A large sheet of paper was placed in front of the netmapping group. In a first step, the participants were invited to think of all actors that either are affected by or themselves affect by the management of natural resources in the waters surrounding the study island, i.e. who fishes there or who has an influence on the marine resource use patterns in the area. The identified actors are noted on cards and glued on the paper. In a second step, the netmapping group describes who exercises influence affecting another actor. Influence of one actors toward another actors is indicated by an arrow on the paper. In a third step, the netmapping group participants are asked to judge how much influence they considered the different actors to have on the way marine resources are used. A scale between zero and four (four representing the highest possible influence) was used to determine the degree of influence of the respective actor. Discussions of the reasons for the thus constructed map of relative power and influence followed. Hereby, the netmapping approach as adapted and used in this study, offers the opportunity to further understanding of the *de facto* governance system through the visualization of social relations that affect marine resource use in the Langkai Island area. Data was digitalized and visualized using the social network analysis software *Gephi*.

A survey was conducted in several islands in the Spermonde Archipelago. This article only draws on the results of the survey interviews conducted in Langkai Island. A geographically stratified random sampling was used for selecting the respondents. In Indonesia, the smallest political-administrative unit above the household is the Rukun Tetangga (RT). The households of a RT are located in direct vicinity to each other. The RT is not only important for administrative purposes but also plays an important role for social organization as a neighbourhood organization with an elected leader (Beard, 2002). Due to its character as a neighbourhood organization, it can not only be referred to as the smallest political-administrative unit but also is the smallest unit of social organization above the household level. The number of households per RT slightly differs in each RT. Yet, the advantage of this stratified sampling method is that it secures a geographical distribution of the households on the island rather than using a random sampling of the total population which neglects the different characteristics and the role of RTs. 38 survey interviews were conducted representing 20% of the island's fishing households. The survey participants were the household heads. The households were selected in lottery system from a list of fishers securing a proportional distribution of fishers of each RT. Yet, due to the low absolute number of participants in the survey, the results are not representative for the island but are used to provide background information for this article.

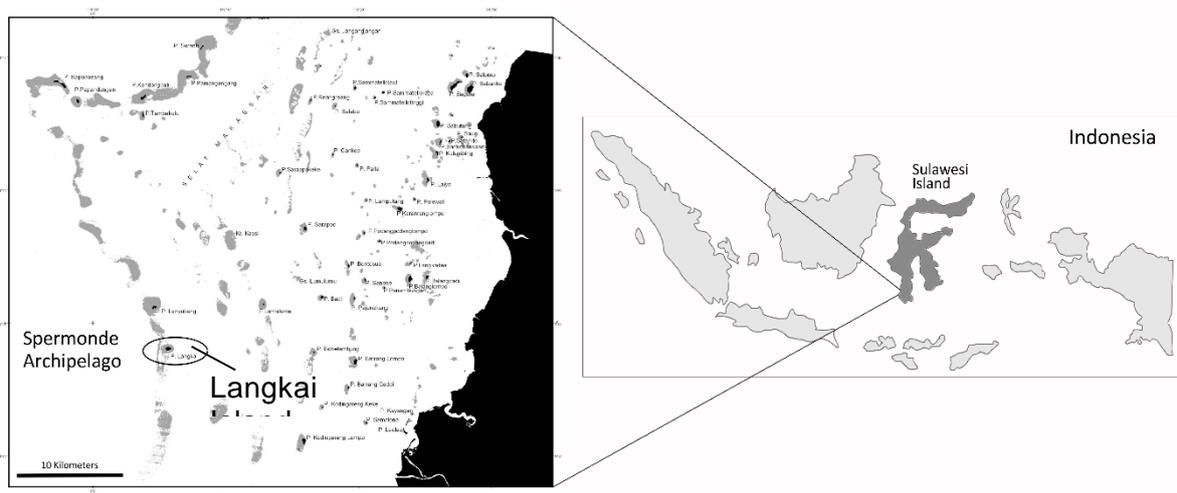
3. The Langkai Island micro cosmos

3.1 Context

Langkai Island is located in the Spermonde Archipelago, South Sulawesi (see Figure 1), which consists of about 80 – 100 small islands. In the Spermonde area, one of the largest reef fisheries of Indonesia can be found (Pet-soede & Erdmann, 1998). It is inhabited by about 35000 people (Sab & Katsuya, 2008). In addition to the national language Bahasa Indonesia, which most of the islanders are fluent in, two main local languages (Makassar and Bugis) are found in the archipelago, which are not specific per

island but to some extent spoken in most of the islands due to moving and intermarrying. The islands differ in terms economic, social and political characteristics (Glaeser & Glaser, 2010). In this area, one of the largest reef fisheries of Indonesia can be found (Pet-Soede & Erdmann, 1998) and fishery resources are fundamental to provide the households in the archipelago with monetary and subsistence income (Pet-Soede et al., 2001).

Figure 1: Langkai Island, South Sulawesi, Indonesia



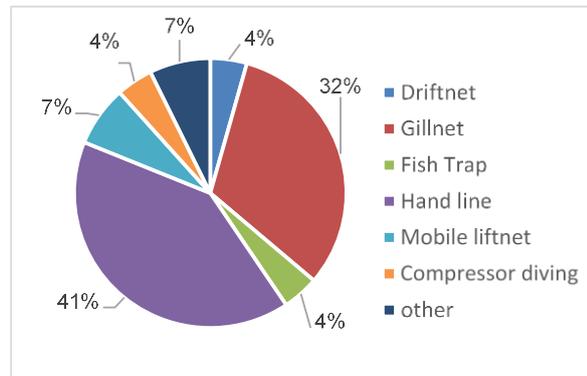
3.2 Fueling the local economy

Langkai Island (Figure 1) is located at the outer margins of the Spermonde Archipelago. Today, the island is home to 225 households of which 190 (~84%) have fishing as their primary source of income. This reflects the crucial importance of marine resources for local livelihoods of the island population. At the end of 40ies beginning of 50ies, only 10 people, all fishers, permanently lived on Langkai Island. During that time, the main fishing gear used by these fishers was hand-line (Kedo-Kedo) mainly targeting Tenggiri (Narrow-Barred Spanish Mackerel). The fish was preserved by adding salt, which was traded from Makassar, and then dried in the sun. In 1960ies, the use of Pukat (gillnet) started in Lankai. The technique was introduced by fishermen from Maros, Labbakang and Makassar who started to use gillnets in the area. Fishers from Lankai subsequently adopted the fishing technique to catch various kinds of fish without further modifications for catching particular species. In 1970ies, fishers from another adjacent area (Pencana in Baru regency) started to use the fishing ground in the Langkai area for catching flying fish. They used a driftnet (Pukat Torani) for catching flying fish. In parallel, the government in Makassar started a program to provide Pukat Torani to the Makassar fishers and only little after the initial introduction, the Pukat Torani was available all over Sulawesi area and intense fishing of flying fish started. According to local informants, the spread of the gear and the knowledge of operating the technique were presumably driven by a demand for flying fish in Java and the flying fish caught in the Spermonde Archipelago was traded to Java. During that time, the majority of fishermen in Langkai and many fishers from other areas started to catch flying fish in the Langkai area. Today, only 10 flying fish fishers are found in Langkai. Only little after the introduction of flying fish fishery, anchovies (Mairo) started to become a target fish approximately in the late 70ies or early 80ies. Anecdotal evidence states that people from Badi came for several days to the Langkai and stayed for about one week to catch anchovies using a special

form of gillnets (Pukat Mairo) for the first time. During their stay and their subsequent visits, the Langkai islanders learned how to use the fishing technique by observing the fishing operation and following the fishers to the fishing grounds where they would find the anchovies. Obtaining the required nets, however, proved to be difficult for the islanders because, at the time, the nets were still hand-made and hardly sold. Eventually, an islander managed to buy a net and fishers from Langkai started to copy it.

Today, numerous additional fishing gears are used by Langkai islanders and, depending on the season, most fishers use different gears during different times of the year. Hand line, which is still the most commonly used fishing gear (used by 41% of the fishers), however, to target a variety of fishery resources. The second most commonly used fishing gear is the gill net, used by 32% of Langkai's fishers. Further gears used include driftnet, fish trap, mobile lift net, compressor diving, and some other gear are used only to a minor extent (Figure 2).

Figure 1: Fishing gears used by Langkai fishers



Despite the introduction of new fishing gear to target a wider range of fishery resources, the Tenggiri fishery, caught by hand-line, remained particularly important for the local economy until today due to its high abundance in the area during southeast monsoon. Traditionally, it was fished using sailing or paddle boats. However, especially the emergence of motorized boats and the use of ice, which allowed the fishers to sell fresh instead of dried fish, triggered strong changes in the island's fisheries-based economy. The first motorized boat where available in the Spermonde area in the 1970ies (Deswandi, 2012). According to local informants, in Langkai Island, the first motorized boats were only available to the Langkai islanders in the early 80ies as the first temple engines were not very strong and the boats would not go long distances from the Sulawesi mainland. When the motorized boats started to visit Langkai on a regular basis, this development strongly affected the local economy in that the Narrow-barred mackerels could now be sold fresh to mobile traders instead of dried. As a result, the revenues generated from fishing by the islanders started to increase as the price for Tenggiri increased due to the possibility to now sell fresh fish instead of dried. In the realm of this change, the trade also changed from per fish to per kilo. According to the local informants, at that time, a Tenggiri of about 10-20 kilo could be sold dried for about 15-20,000 IDR per fish. Today, the price per kilo fresh Tenggiri, caught by hand line, ranges between 50-70,000 IDR. Thus, the price for Tenggiri obtained by the Langkai fishers increased about 50-70fold over the past approximately 30-35 years.

The fisheries resources in the Spermonde Archipelago are heavily depleted today (Ferse, Knittweis, Krause, Maddusila, & Glaser, 2012; Glaeser & Glaser, 2010; Glaser et al., 2010) and the coral reef ecosystems are being heavily degraded (Edinger, Jompa, Limmon, Widjatmoko, & Risk, 1998). A growing number of fishers in the archipelago compete for increasingly scarce marine resources (Deswandi, 2012; Glaser et al., 2010). The lucrative target fish is unevenly distributed over the Spermonde Archipelago which has, together with a generally decreasing fish abundance, motivated fishermen to search for fish in the waters surrounding other islands and to perform fishing migrations to even more distant fishing grounds outside Spermonde Archipelago (Deswandi, 2012). The waters surrounding Langkai Island are a particularly rich fishing ground where a wide range of valuable marine resources are available and the waters around the island are not only subject to fishing by fishers from Langkai but also by fishermen from other islands and Sulawesi mainland. In case fishers come from distant areas during their

fishing trips to the prosperous fishing grounds of Langkai Island, or go fishing in the open water beyond the shelf of the Spermonde Archipelago platform, fishers stay overnight in the Langkai Island area. The term *Sawakung* refers to layovers in foreign islands or on their boats adjacent to the island during fishing trips, which plays an important role in the fishing. Such layovers by other fishers provide additional income for the island residents as they provide shelter and supply other goods and services such as for instance fresh water. Moreover, they facilitate knowledge exchange between the islanders and outsiders. The downside is that the island residents have to share the marine resources of their home fishing ground with outside fishers and, especially in the case of Langkai Island where an ever increasing number of outside fishers come to exploit the rich fishing grounds, rules are urgently needed to organize the marine resource use in the sea territory surrounding Langkai Island.

3.3 Organizing marine resource exploitation: Rules-in-use in the water surrounding Langkai Island

Unsustainable and destructive fishing practices including blast and poison fishing pose a major threat to marine resources and have a severe negative impact on the marine ecosystems (Wilkinson, 2008). Yet, they are found all over the archipelago (for more details on destructive fishing in the Spermonde Archipelago see esp. Chozin, 2008; but also Ferse, Glaser, et al., 2012; Haylor et al., 2003; Idrus, 2009; Pet-Soede, Cesar, & Pet, 1999). In order to provide for more sustainable resource use, myriad of laws have been developed at multiple administrative levels in Indonesia in an attempt to regulate the use of fishery resources (c.f. Syarif, 2009). These include for instance quotas for, or a total ban of, fisheries of protected and endangered species, the ban of destructive fishing gears (such as poison and bomb fishing) and legislation for marine protected areas (Glaeser, Ferse, & Gorris, *unpublished manuscript*). Yet, the laws pertaining to the regulation of fisheries have been found to only have little traction on ground in Indonesia in general and in the Spermonde area in particular (Ferrol-Schulte, Gorris, Baitoningsih, Adhuri, & Ferse, 2015; Glaser et al., 2010; Satria & Matsuda, 2004; Wever, Glaser, Gorris, & Ferrol-Schulte, 2012). Especially corruption has hampered an effective enforcement of fishery related legislation (Idrus, 2009; Radjawali, *unpublished manuscript*) and despite the existence of numerous laws in the Indonesian environmental realm, there have been only very few successful cases of effective enforcement through courts nationwide (Waddell, 2009). Especially in areas far away from larger towns and cities, such as Langkai Island, the enforcement of government rules including the prohibition of blast and poison fishing by enforcement agencies require high financial input for patrolling and site visits of the water police remain rare (Glaser et al., 2010).

Unlike elsewhere in Indonesia, traditional informal fishery management systems such as for instance the *sasi laut* in Maluku described in detail by Novaczek and colleagues (2001) are not found in the Spermonde Archipelago. However, in addition to government laws, binding agreements (*kesepakatan*) between fishers which constitute informal rules have developed over time which contribute to organizing the local fishery in the resource rich waters surrounding Langkai Island and elsewhere in the Spermonde Archipelago. Whilst not officially marked by flags or buoys for instance, as is usually the case with official marine protected areas, the “Langkai waters” is a relatively clearly defined marine territory surrounding the island which is perceived to belong the island by the island residents and is acknowledged by fishers from other islands. Both fishers from Langkai and elsewhere were able to relatively precisely draw the borders of this area on a very large naval navigation map and mainly based on aspect of the underwater topography and distinct features of the marine ecosystem describe the borders. As the area is perceived to belong to the island, the local community considers itself entitled to institute rules for the use of the area’s fishery resources. Certain locally devised rules thus apply for the use of marine resources in the Langkai waters based on informal locally binding

agreements include the prohibition of bomb fishing, poison fishing and the use of spear-guns for Tenggiri fishing. It was argued in the interviews that the island head (*Ketua Rukun Warga*) and also to some extent the islanders are responsible for controlling what gear is used in the waters. The prevailing opinion in the interviews was, however, that this is primarily the responsibility of the community head of Langkai Island. Officially, however, the local community in Langkai Island does not have a formal authority to develop and enforce such local rules. Therefore, they rely on the cooperation with the police or other informal means. If somebody is spotted in the Langkai waters who obviously uses or is suspect of using gears locally prohibited, fishers form a group and inform the respective fisher about the rules that apply to the Langkai waters. Usually, this is sufficient to scare the fishers away. If not, Langkai Islanders may also throw stones at the rule-breakers. It was argued in the interviews that once these fishers are back to their home island, the fishers will disseminate what happened to them and other members of the fishing community will learn about the rule. This information was widely confirmed by fishers from other islands including Barang Lompo, Lumu-Lumu, Kodingareng Lompo and others, whose inhabitants are particularly famous of generally using bombs, poison and spear-guns. In fact, it was stated in the interviews in other islands that they heard that the fishers of Langkai Island would even confiscate the fishing gears or set fishing boats on fire, which both would cause severe economic loss. While it was widely confirmed in the Langkai Island community and elsewhere, that stones are used to scare rule-breakers away, the more drastic measures may also be a legend spread in the area.

3.3.1. Blast fishing

Whilst not very effectively enforced by government agencies, both the prohibition of blast and poison fishing is prohibited by national law, which the fishers in the Spermonde Archipelago are generally know of. With regards to the local prohibition of these destructive fishing techniques in the Langkai waters, there are differences in the enforcement of the agreement of not using poison fishing and of not using blast fishing despite the general awareness of the islanders that both generally cause severe environmental damage. These differences in rule enforcement by the community stem from local economic rationales. Whilst a number of persons on Langkai Island are also very strict on enforcing the rule that bomb fishing is forbidden in the island waters, other fishers argued that they tend to tolerate the use of blast fishing in the island waters for several reasons. One reason highlighted relates to the problems of enforcement. If islanders see fishers who use these illegal fishing gears or are act suspiciously and they want to search their boats for illegal fishing gears, a problem is that the fishers who use explosives for fishing frequently have boats with very strong engines, which can go much faster than most of the rather simple and small boats used by the Langkai fishers. So the bomb fisher often just leave before the Langkai islanders get the chance to come aboard. Another reason emphasized is that some of the Langkai fishers sometimes also themselves perform long fishing trips and have to do layovers in other islands. These fishers expressed the concerns that if they would engage in scaring fishers away, this would create problems for them in case they needed to visit the home island of these fishers for a layover, they would be received with hostility instead of the needed hospitality. It is expected that this would seriously affect their fishing operation in a negative way as they were not able anymore to visit the fishing grounds close the respective islands since they themselves rely on the goods and services offered by the host community at the island they need to stay overnight. Another more general worry raised in the interviews concerned the fact that it is assumed by the local community that the fishers using illegal fishing gears have very good relations with important people in Makassar which is why they will most probably will not be prosecuted for illegal fishing but, instead, interviewees worried that they themselves would get problems by handing illegal fishers over to the police as it might be taken as an offence by the important

people in Makassar to apprehend blast fisher who are under their protectorate. A very strong argument produced in the interview was that there is a general understanding in the Spermonde Archipelago that if the bomb fishers use the bomb, everybody can come and assist the blast fishers in collecting the harvested fish, of which the respective helpers would get a share of one out of three parts of the fish collected by them (see also Chozin, 2008 and Deswandi, 2012). This provides a strong economic incentive for some islanders to assist the bomb fishers instead of scaring them away or even apprehend them. By hand-line fishers (which is the most frequently used gear) who target Tenggiri, other reasons for remaining inactive in enforcement of the existing rule was given in response to the question of whether bomb operations would not have negative consequences for their own fishing. It seems to be commonly perceived by these fishers that this is not the case as the Tenggiri is none of the target fish for bomb fishing since it firstly only occurs in small groups of 3-5 individuals and bomb fishers only target schools of fish to increase the profitability of the blast fishing operation. Moreover, it was argued that the Tenggiri moves too fast for bomb operation. Hence, the blast fishers seem to only catch Tenggiri accidentally, which was referred to as “a lucky accident for them”, but not on purpose. Another factor relates to the fact that it is commonly perceived by interviewees that the Tenggiri spawns on the seafloor whilst the bomb is not operated close to the seafloor due to the danger of particles that may be expelled from the water by the explosion. For that reason, it is perceived that blast fishing neither affects the abundance of their target fish nor its spawning grounds and, thus, has no severe negative consequences on their fishery yields. Hence, despite the existence of an agreement to not use blast fishing in the Langkai waters, a number of local fishers would rather tolerate blast fishing in the Langkai island waters and remain “inactive” in enforcement.

3.3.2. Poison fishing

The situation with poison fishing is different and, according to the respondents, the prohibition of poison fishing is much more strictly enforced. The difficulties regarding the enforcement of the agreement by the local community and the concerns about the problems for future layovers by certain fishers as described in the previous section remain the same. Yet, in contrast to the perceived less severe negative consequences of the environmental destruction to the local fishers caused by blast fishing, it was argued in the interviews that poison fishing is believed to cause much stronger negative environmental impacts. Poison fishers specifically target coral reef fish and anecdotal evidence suggests that the poison, distributed by the local currents, may turn a vast marine area into a dead zone, including the destruction of large coral reef areas, its entire flora and fauna, and also kills the majority of marine life that happens to be in that area during the time of fishing operation. In addition, unlike the blast fishers who provide an economic incentive in exchange for the environmental degradation caused, poison fishers do not share their catch with other fishers. Hence, poison fishing offers no economic incentives for the local community to tolerate it but it only causes economic loss for the Langkai fishers and, therefore, none of the respondents stated that he remains “inactive” in enforcement.

3.3.3. Spear-gun fishing

The third local rule-in-use relates to the prohibition of spear-gun fishing for Tenggiri, the marine resource most valuable to the Langkai fishing community. Hand-line and spear-gun are the two fishing gears most adequate to target Tenggiri. At the time of this research, the price for Tenggiri caught by hand line was between 50-70,000 IDR per kilo. The kilo price for Tenggiri caught by spear-gun is with 40-45,000 IDR much lower as the fish displays strong marks and the spear-gun is not used by the Langkai community, but only by outsiders. The spear-gun, however, is more effective than using hand-lines

as more fish can be caught in less time. For the Langkai Island waters, therefore, the use of spear-gun, a superior gear which can produce higher catch but only yields a lower total price per kilo, is prohibited. According to the informants, the agreement has two objectives. The first reason relates to fairness and gaining the highest economic gain from the overall fishery yield. If fishers from other areas use spear-guns, they have an advantage over the Langkai fishers and can catch a larger share of the total fish in the area, but the overall yield will only be sold at a lower overall price which would decrease the overall revenue that could be generated from the fish in the area. The second reason for the agreement is that the local Tenggiri fishers perceive that if Tenggiri is caught by a spear-gun, the remaining fish will be scared away due to the fast movement of the spear and the blood spilled in to the water. It was argued that if only hand-lines are used to catch Tenggiri, the “fellow fish” will not notice that “somebody” is missing and stay for one week in one location while the spear-gun scares “them” away immediately. While fishers would thus prefer an overall prohibition of the use of spear-guns for Tenggiri fishing in the entire archipelago, it was argued that the Langkai Island community can only influence what happens in the Langkai waters whilst the area further away from the island remains free for all to use.

3.3.4. Fish Aggregation Devices (FADs)

In addition to the rules pertaining to the Langkai waters, a further local informal agreement is found in the area. A Fish Aggregation Device (FAD, locally called *Rumpon*) is a tool to attract fish and keep them nearby. It is an effective tool to concentrate fish in a certain area which then can be easily harvested. Langkai fishers installed FAD westwards off the island, already outside the Langkai waters. Nevertheless, the general understanding among the fishers, not only in Langkai Island but also in other areas of the Spermonde Archipelago (c.f. Chozin, 2008), is that who owns the FAD, and maintains it, also privately owns the fish that it aggregates and fishing around the FAD is prohibited, or requires the permission of the owner. For harvesting the fish around the FAD, some owners in Langkai collaborate with Purse-Seine fishers from other areas such as Papandangan (Maros district, Sulawesi mainland). The harvest of a FAD in the area usually takes place in November. The general agreement for the FAD is that if there is enough fish in the area, the Purse-Seine fishers will inform the owner that they now start to harvest. When fishing in the Rumpon area, the catch will be shared and the total amount of harvested fish divided into four parts, of which one part goes to the FAD owner whilst the other three parts go to the boat.¹ In case the FAD owner himself harvests the FAD, of course, he keeps the fish to himself. In case these rules are broken by other “illegally” fishing around the FAD, the owner will claim a large compensation from the rule-breaker, which already happened in the past as reported in the interviews. This arrangement is also agreed upon with district government officials, who may support the owners of FADs in settling their claim, without formal recognition of the arrangement however. Whilst the incentive is high to “steal” from FAD owners, again, especially outside fishers are dependent on the hospitality of the Langkai islanders during layovers, and problems with the island residents may cause that outside fishers cannot come back for fishing in the Langkai area or beyond the platform in the open sea as islanders may not provide the goods and services needed by the fishers during a layover.

¹ Note that there seem to be different agreements related to the FADs in the Spermonde area. Chozin (2008) describes the FAD as a tool that is harvested by blast fishers using bombs. According to his detailed description, the sharing ratio is 2:3 in which the owner of the FAD gets two portions of the fish and the harvester gets three. Yet, similar to the situation in Langkai, he states that “(...) for the blast fishers in the Spermonde Archipelago, the rumpon has also the additional function of marking territory. (...) It is a common convention among them that whoever owns the rumpons has the right to bomb the area surrounding it” (Chozin, 2008: 78).

3.4 The role of local communities in natural resource management

This section illuminates the role of the Langkai Island community in the management of the fisheries resources based on two group interview sessions with fishers in which social relations were mapped that constitute the *de facto* governance system of the Langkai Island waters as perceived by the participants². One group session was conducted with fishers from Langkai Island and the other group interview session was

Figure 3: Governing marine resource use in the Langkai waters

The figure shows the *de facto* governance of marine resources in the Langkai waters based on the Netmap group interviews with fishers from Barrang Lompo Island (Figure 3a) and with fishers from Langkai Island (Figure 3b). The arrows indicate that actors exercise force towards actors in the Langkai Island area. The size of the dots is scaled to the influence on resource use in the area the actor has in the perception of the interview participants on a scale between 1 and the highest influence of 4.

Figure 3a

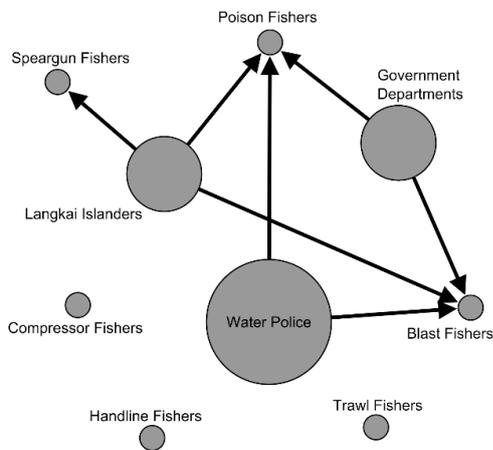
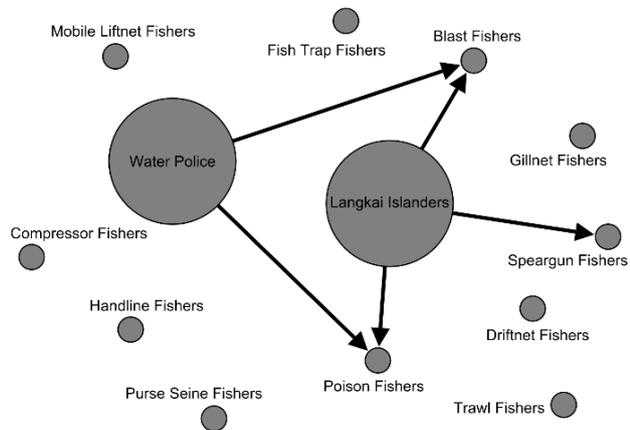


Figure 3b



carried out with fishers from Barrang Lompo Island, who are well-known for using illegal fishing methods and spear-guns for Tenggiri fishing, and who frequently fish in the general Langkai Island area. Figure 3a shows the results of the group session with Barrang Lompo Island fishers and Figure 3b shows the results of interview with Langkai fishers.

Both groups identified a number of fishers using different gear types in the Langkai water area. The fishers of Langkai Island created a more detailed of the fishing gears used in the area, which is certainly due to their more in-depth knowledge of the marine resources use patterns close to their island. With regards to who has an influence on marine resource use patterns in the area, both groups identified the water police and local community in Langkai Island. Whilst it is clear that the water police is responsible for enforcing the prohibition illegal fishing gears, the notion of the Langkai islanders in both group sessions represents their influence on marine resource use patterns in the Langkai waters. Government departments, and particularly the Department of Fishery and Marine Conservation (DKP), were only mentioned by the fishers of Barrang Lompo Island. The interview participants from Langkai did not see their direct influence on the resource use patterns in the Langkai waters. This may be explained by the fact that Barrang Lompo Island is relatively close to Makassar city, where the government departments reside, and, due to this proximity and maybe also due the fact that the

² Note that the FADs are located outside this area and are thus not included in these interviews.

Barrang Lompo Island residents are well-known throughout the Spermonde Archipelago for using destructive fishing, government programs such as awareness rising campaigns frequently target fishers from Barrang Lompo Island whilst such activities occur very rarely on Langkai Island.

Subsequently, social relations in terms of influence on the resource use patterns in the Langkai Island waters were identified by the participants. Both groups argued in the interviews that, as a matter of course, the water police has an influence on poison and bomb fishers, both illegal fishing operations, who attempt to fish in the area. Based on the view of the Barrang Lompo Island fishers, also the government department contribute to impact the illegal fishers. The Langkai Island community was also found to affect these two types of fishing operations as a result of the informal agreements for this certain portion of marine territory. Moreover, the Langkai Islanders also influence the use of spear-gun fishers as, based on the agreement, they are not allowed to fish for Tenggiri in that area. Hereby, the results of both sessions reflect a *de facto* governance system of the Langkai waters in which the island community contributes to organizing marine resource use in the Langkai waters based on informal agreements.

Participants of both sessions agreed that the Water Police has with for “influence points” the maximum possible influence on the resources use patterns in the Langkai waters due to their official power of apprehending fishers using illegal fishing gears. Despite the fact that illegal fisher will most probably not be prosecuted in court, participants in both groups argued that, if caught by the Water Police, illegal fishers will still spend some days or even weeks in jail during which they cannot generate income for the family and that they also have to spend a significant amount of money for their release through their security network (for further details also see for instance Idrus, 2009). This means a substantial financial loss for these fishers. However, it was argued in both interview session that, while the Water Police generally exerts strong influence on the resource use patterns, patrolling only occurs rarely in the general Langkai Island area as it is far from the police station and patrolling the area requires high financial input in terms of gasoline. In addition, police boats are visible from long distance and if the police is in the area, fishers will not carry out illegal fishing operations. Therefore, while the general influence of the Water Police in terms of deterring bomb and poison fishers from fishing operation when in the area, their actual impact on avoiding illegal fishing operation in the Langkai waters is limited due to their rare presence in the area. By the participants of the Barrang Lompo Island interview group, the influence of the government departments was awarded three “influence point”. It was argued that especially their awareness rising campaigns about the danger of blast and poison fishing in combination with the fact that already a number of fishers have become paralyzed by inadequate diving makes some of respective fishers to reconsider. This indicates that such awareness rising campaigns may have an impact on the choice of fishing gear used in the communities these activities are carried out.

The perception about the influence of the local community in Langkai Island on the resources use patterns in the area slightly varies between the fishers in the two islands. The Barrang Lompo Island interview group attributed 3 out of 4 “influence points” to the Langkai Island community. The Langkai Island interview group also saw a very strong influence of the island community with the maximum of four “influence points”. Participants in the Langkai Island group stated that they can develop rules for the area, which are complied with by the majority of fishers from Langkai Island itself and also by outsiders. Yet, the participants also highlighted that their means of actual enforcement is limited as they do not possess official legal enforcement authority. Whenever the Langkai islanders want to amerce fishers using bomb and poison fishing in the area by apprehending them, they always have to cooperate with the police. Participants reported, however, that the cooperation with the police “is not always easy” as the police may be in other parts of the Spermonde Archipelago, or elsewhere, and may not come to Langkai Island, even upon request by the islanders. In addition, it was stated that it

also happened that the police did not have enough petrol to come the long distance to Langkai Island, or at least the police argued this way. In those cases, Langkai islanders had to let the rule-breakers go. Therefore, Langkai islanders usually rather tend to only scare rule-breakers away from the area. As for the enforcement of the rule concerning spear-gun fishing for Tenggiri, there generally is no other opportunity as scaring rule-breakers away as the islanders lack legal authority for enforcement. The participants in the Barrang Lompo Island interview group argued along similar lines and they especially highlighted that the islanders do not possess official authority to enforce rule in the Langkai waters and, therefore, awarded the local community in Langkai Island with less than the maximum amount of “influence points”.

4. Discussion

Common Pool Resource Regime (CPRR) provide for producing rules to organize Common-Pool Resource (CPR) patterns (Ostrom, 1990; Young, 2006). In literature, broad consensus can be found that, apart from open access, classically there are three types of CPRR. These are a state property regime, a communal property regime and a private property regimes (Bromley & Cernea, 1989; Ostrom, 1990; Pomeroy & Berkes, 1997; Pomeroy & Rivera-Guib, 2006). In a *state property regime*, the state has the control over the resources. Individuals and groups can only use the resources with the consent of the state and must comply with the regulations made by government laws. The state can grant the right to exploit resource units to individuals or groups. But control over its resources is exercised by the state (i.e. by government agencies) (Bromley & Cernea, 1989). A *private property regime* refers to the exclusive and permanent possession of an area or resources by private entities. Such private entities may not necessarily be individuals, but private ownership can also be transferred to clearly defined groups (corporate property) (Bromley & Cernea, 1989). In a private property regime, the control over a territory and its resources and products are given to private entities such as individual for instance. They hereby gain the right to exercise their rewarded power to exclude others from the use of their terrain or prevent usage of their resources from non-owners including the opportunity to sell the territory based on their own decisions. The third category is *community property regime* which has attracted particular attention over the last two decades. The related approaches describe a management system for natural resources that relies on a clearly defined group of people in community-based management (CBM) approach (Berkes, 2010). As CBM encompasses many different management situations in which natural resources or whole ecosystems are managed by local groups, there is no general definition available. But the essence of CBM is that the management authority is transferred to a clearly defined and geographically limited group on a local level, which share certain characteristics (e.g. ethnicity) or a geographical area such as an island and the responsibility rests on the community level (Armitage 2005).

In the waters surrounding Langkai Island all three CPRR are found to have an influence on marine resource use patterns in the area. The Indonesian national government has developed law on illegal fishing enforced by government departments such as the Water Police. While these laws still have strong influence on the marine resource use patterns, severe shortcomings in enforcement hamper their success. The informal agreements related to the FADs can be considered a private property regime in which individuals own a set of marine resources defined marine area. The locally devised rules for the well-known sea territory Langkai waters based on informal agreements represent a community property regime for the associated set of marine resources. While their authority to devise rules for the Langkai waters is acknowledged by outside fishers, the islanders in Langkai, however, lack the official authority to formally develop and especially to locally enforce rules. Langkai Island is part of Makassar district, an urban district. Whilst local communities in rural districts (*Kabupaten*) are entitled to develop

village law (*Peraturan Desa*), the local community of Langkai Island has no legal entitlement to do so due to their location in an urban district (*Kota*). However, in both types of local community in the Spermonde Archipelago, the official enforcement of local formal rules still depends on enforcement agencies. In order to contribute to increase the role of Langkai islanders, a clear allocation of rights to devise and enforce rules by official transfer of authority would be needed for a more effective role in governing fishery resources (Ostrom, 1990, 2005). Despite some pitfalls, an example of how CBM can be formally instituted may be the *awig-awig* resource management system found in West Lombok described by Satria, Matsuda, & Sano (2006).

CBM approaches for natural resources harbor a series of hazards and cannot be assumed to a "panacea" or "blueprint" for successful natural resource management. Various studies have shown that the risk of failure is high (c.f. Adhuri, 2013; Berkes, 2007; Christie & White, 2007; Cinner et al., 2012; Cudney-Bueno & Basurto, 2009; Satria et al., 2006). In addition, Fikret Berkes also highlights that a "community" is a complex, elusive, multidimensional construct under constant change (Berkes, 2004: 623). Even small communities, therefore, cannot be seen as a unitary actor who *per se* acts towards the long term benefit of the entire community. In every community, whether small or large, there are internal divergences of interests because any community is made up of various individuals and groups, which are embedded in larger systems and affected by influences from the outside (Berkes, 2004). This is confirmed by the study presented in this article. The engagement of the Langkai Islanders in the actual enforcement of the informal rules-in-use pertaining to the Langkai waters and the FADs are mainly based short-term economic considerations, i.e. on a "give-and-take" basis in the local context and only function this way under the specific local conditions of the micro-cosmos. Hereby, this study confirms Elinor Ostrom's (1990: 34) concerns that resource users may value the expected future opportunity of resource availability and possible future gains less than the immediate value they can generate now or in the near future. Despite the presence of a diversity of rules-in-use organizing the marine resource use in the Langkai Island fishing area, conservation effects for the marine environment are thus limited. Instead, local rules in that area mainly aim at getting a share of the local marine resources rather than at environmental sustainability and balancing resource extraction with its reproductive capacity.

5. Conclusion

The heterogeneous coastal and marine ecosystems are among the most productive ecosystems on the planet (Agardy et al., 2005) and are of fundamental importance to millions of people worldwide (United Nations Secretary-General's High-level Panel on Global Sustainability, 2012). The absence of rules for the use of natural resources tend to result in overexploitation of these resources (Allen, Duvander, Kubiszewski, & Ostrom, 2012; Hardin, 1968; Ostrom, 1990; The World Bank, 2006). This article offers a detailed analysis of factors that affect natural resource use patterns in the sea territory surrounding Langkai Island, a small island located in the Spermonde Archipelago off the coast of the south west Sulawesi Island in which the island population heavily depends on fisheries for their livelihood. In addition to the government laws to organized marine resource use patterns, rules-in-use have been devised based on informal agreements to regulate the marine resources exploitation. Each of the three types of the Common-Pool Resource Regimes (i.e. state property regime, private property regime and community property regime) has produced rule-in-use and influences the marine resource use patterns in the area whilst their enforcement, however, is fraught with difficulties. Moreover, the environmental conservation effects of the locally devised rules in the area remain limited and should be considered incidental as the community-based management rather aims to organize the battle over the diminishing marine resources than organizing a sustainable regional fishery in the Spermonde Archipelago.

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