Chapter 10

Summary, Conclusion, and Policy Recommendation

These concluding pages present a summary of the discussion and organize the findings into recommendations for policy development in the future.

10.1 Summary

The study was motivated by the increasing efforts to promote sustainable coastal and marine resources management, which recognized community participation in such efforts. A number of coral reef management programs and projects that had been promoted by the government or NGOs and supported by multilateral or bilateral donors had included local stakeholders. In this way, social capital investment had been prompted, in order to improve community’s capacity and participation in the management and protection of the ecosystem, where their livelihoods dependent upon.

There are three sets of questions answered by this study: How social capital contributes to sustainable resource use? Which dimensions of social capital, in terms of bonding, bridging and linking social capital, contributes to sustainable resource use and management? And to what extent social capital investment of fisher communities delivers collective action and institutional arrangements to govern sustainable resource use? In order to answer these questions, the study carried out a comparative study in several small islands situated in Taka Bonerate Atoll and Spermonde Archipelago, South Sulawesi. These islands had experienced the process of social capital investment aims at improving the management of coral reef resources.

Empirical findings are presented in Chapter 5 to 9. The analyses in these chapters comprise of four aspects: (1) status of coral reef ecosystem; (2) resource use, including the extent of destructive fishing and the status of fishery sustainability; (3) characteristics of resource users that include examination of various dimensions of social capital and its investment; and (4) rules and institutions governing resource use, which existed without any support from external assistance and improved during the process of social capital investment. The association and influence of these aspects are examined that presented in Figure 38. The findings are summarized in Table 66.
The status of coral reefs in the studied islands shows that Kapoposang had the best condition compared with other islands, where it had 70% in good condition. Taka Bonerate atoll where Tarupa, Rajuni Kecil and Rajuni Besar islands are located, had the average percent cover of hard coral 50%. The worst condition was in Barrang Caddi, where it had only 20% reefs in good condition (Chapter 5). There is no appropriate data covering the coral reef condition in each island studied in Taka Bonerate. Yet, this type of data will not be significant, while fishing grounds of fishers in the islands situated in all over atoll area.

Much of the degraded condition of the reef is primarily due to direct human conduct e.g., fishing using bomb and poison (column 2 to 5, Table 66). Kapoposang that had the best condition of coral reefs had neither fishers using bomb nor poison fishing. Rajuni Besar in 2004 had no bomb and poison fishing, but proliferated in 2005. Increase in bomb and poison fishing occurred in Tarupa and Rajuni Kecil. High rate of poison fishers in Barrang Caddi stayed unchanged, where the status of coral reefs were worst.
Table 66 Summary of findings

<table>
<thead>
<tr>
<th>Status of resources</th>
<th>Resource use</th>
<th>Fishery sustainability</th>
<th>Social capital</th>
<th>Rules and institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent reef in good condition</td>
<td>DF index (2004)</td>
<td>DF (with ext. assistance, 2004)</td>
<td>DF (without ext. assistance, 2005)</td>
<td>SIC economic</td>
</tr>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
</tr>
<tr>
<td>Tarupa</td>
<td>50</td>
<td>0.15</td>
<td>High, but restricted</td>
<td>0.94</td>
</tr>
<tr>
<td>Rajuni Kecil</td>
<td>as above</td>
<td>0.03</td>
<td>Low</td>
<td>0.89</td>
</tr>
<tr>
<td>Rajuni Besar</td>
<td>as above</td>
<td>0.00</td>
<td>Low</td>
<td>0.62</td>
</tr>
<tr>
<td>Barrang Caddi</td>
<td>25</td>
<td>0.23</td>
<td>High, not restricted</td>
<td>0.96</td>
</tr>
<tr>
<td>Kapoposang</td>
<td>70</td>
<td>0.00</td>
<td>None or low</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Similarly, destructive fishing are comparable with the results from the sustainability index of criteria (SIC) in each island (column 6 to 9, Table 66). SIC represents the current state of ecological, economic, social, and institutional aspects of the island. Islands with low rate of destructive fishing have low on the economic criterion of sustainability, such as Rajuni Besar and Kapoposang. In contrast, islands with high economic criterion of sustainability have high number of fishers using blast or poison fishing, like in Tarupa, Rajuni Kecil and Barrang Caddi. It appears that islands whose fishers using destructive fishing had better economic condition, compared with those that did not. This finding is important to notice, which infers that economic fulfillment is one of the main reasons fishers practicing destructive fishing.

Further, the study suggests that the social capital of resource users influences the resource utilization, particularly destructive fishing (Chapter 6). The bonding and bridging social networks have been maintained by fishers in financing fishing activities and marketing their harvests (column 10 to 12, Table 66). The apparent influence of social capital dimension to destructive fishing is the extent of vertical bonding social capital. The vertical bonding social capital composes of patron-client relationship that is maintained by clients (fishers) to obtain financial capital and by patrons (capital owners) to obtain durable fishing harvest for trading. Moreover, fishing production networks that characterized by bridging or vertical bonding social capital were correlated with bomb or poison fishing, as demonstrated in Tarupa and Barrang Caddi. Fishing patrons in both islands predominantly supported bomb or poison fishing, who had connections with exporters and capital owners in the mainland, thus possessed strong financial capital.

The process of social capital investment that took a form of assistantship by field facilitators to local community had shaped the fishing practices of resident fishers. The presence of field facilitators entails improving bonding social capital within the community island, building bridging social capital between the community and outside community, as well as promoting linking relationships between island community and decision makers in government. The activities and relationships built were promoting sustainable resource use. During the period of external assistance in 2004, number of blast or poison fishers in Tarupa, Rajuni Kecil, and Rajuni Besar was lower compared in 2005 when field facilitators were not present. Thus, at least two aspects signify the existence of
destructive fishing, namely: (1) trading networks of blast or poison fishing and vertical bonding social capital; and (2) linking social capital between field facilitators and island community that promoted sustainable resource use.

Other dimension of social capital is cognitive social capital. Theories say that trust makes social and economic transactions predictable, and makes it easier for people to work together or cooperate (Folke et al. 2005). Empirical findings show that community trust is not necessarily related with the efforts to lower the destructive fishing. Barrang Caddi where poison fishers are prevalent has the highest community trust. It explains that trust is also needed for practicing blast or poison fishing.

Institutions shaped the extent of destructive fishing. Coastal environment of these islands is managed by different formal institutional arrangements, thus different monitoring and surveillance (column 13, Table 66). In many cases, sea patrols that organized by formal institutions could lower the practice. However, formal law enforcement has three weaknesses: high management cost, lack of ability to prevent free riders, and deficiency to sanction. For fishers, these weaknesses have lessened the benefit of compliance.

Moreover, at local level, existing informal rules had been collectively devised and enforced by local fishers, without support from external assistance. These rules were in place to overcome technological and assignment externalities that associated with fishery, by endorsing rules that particular fishing gears can only be utilized in particular locations or fishing grounds. This rules was significant to lessen fishers practicing blast and poison fishing in localities where traditional fishers present. The facilitation by external assistance had improved community capacity to establish access, withdrawal and exclusion rights by creating and enforcing local rules. It had produced several notable fishers’ collective actions to monitor, prohibit, and impose sanctions on destructive fishing.

However, local rules on prohibition of destructive fishing that had been promoted and improved were lessened or no longer in effect when the external assistance left. The decreased local rules enforcement impacted to the increase of bomb and poison fishing that occurred in Tarupa, Rajuni Kecil, and Rajuni Besar between 2004 and 2005. Local rules were not sustained because fishers could not overcome the collective action dilemmas, namely to maintain credible commitment, to monitor individual compliance, and to establish institution.
Credible commitment among fishers is not established. Local rules were established by resident fishers, who interacted with outside fishers who did not comply with the same rules or norms. Thus, norms of reciprocity are hard to achieve. By the same token, in Barrang Caddi and Tarupa, norms of reciprocity of resident fishers were not fully established, while part of fishers using destructive fishing gears. Local rules face a problem of scale in achieving credible commitment. Rules that devised and enforced by resident fishers are at local level, whereas fishing grounds where coral reefs situated, are regional in scale, because they are accessed and utilized by outside fishers.

Monitoring individual compliance towards rules must be able to deter opportunistic behavior of destructive fishing. However, even though 60% responses not tolerate destructive fishing, but only 31% responses regarded that forbidding destructive fishing is fair, and only 19% responses said that fishers frequently forbid destructive fishing on the spot. This shows that fishers' reluctance to forbid destructive fishing was high. Likewise, credible sanction is required for rules enforcement, but informal sanctions in most islands were not regularly applied. Fishers' responses show that only 55% agree on sanctioning defector. Imposing informal sanction requires authority and legitimacy that often overshadowed by formal institutions and challenged by outsiders. Even when sanctions were imposed, it occurred during the period when the community had linkages with external assistance.

Local institution that had been built was not sustained, because of fisher's high discount rate towards future stock, competing interests at the community-level, and lack of policy supportive to the formulation and implementation of local rules. High discount rate of fishers is associated with the indefinite boundaries of resources, thus both destructive and non-destructive fishers can go to different fishing grounds where the former ones are no longer rewarding.

Competing interests on prohibiting destructive fishing had made local institution faced immense constraint, such as in Barrang Caddi and Tarupa, where a part of fishers utilized blast or poison fishing. Decision making process at the local level was shaped by local leaders that in some islands were fishing patrons that supported destructive fishing.

The authority and legitimacy of fishers' community to devise local rules were frequently not recognized by formal institutions and outsiders. Fishers' rules might be acknowledged at the operational level, though its implementation
repeatedly faced challenges. However, the collective-choice level, which specifying who may participate in changing operational rules, and the constitutional level in the form of written rules and law on the collective-choice level were unclear.

Establishment of rules was also introduced for managing community marine sanctuaries in four islands: Tarupa, Rajuni Kecil, Rajuni Besar, and Barrang Caddi. At the beginning, a high compliance of sanctuaries was attained, due to the presence of external facilitators and the recent establishment of sanctuaries. However, monitoring was not sustained over time, because communities were not able to overcome collective action dilemmas, including problems of credible commitment and monitoring individual compliance. There was inhomogeneity in the appreciation of environmental values and sanctuary. Information about sanctuary rules was problematic. Definite location of sanctuaries was difficult to retain, because mooring buoys were recurrently lost. Erratic monitoring promoted little assurance on enforcement rules and lower the likelihood of getting caught. Sanction was not given to offenders, except only warnings.

Similar findings on the effect of sanction on resource use is shown in a simulation experiment using an agent-based modelling in order to understand the dynamic impact of sanction on resource use and fishery (Chapter 9). The results show that sanction affects the way fishers' harvest. When charge of sanction and probability of sanction is high, the number of destructive fishing is likely to decrease and fish biomass is likely to sustain. This means sanctions among fishers work to deter opportunistic behavior of destructive fishing.

Another finding is related with fish price and production cost, and the extent of both may overcome destructive fishing. When price of fishes caught by destructive fishing is reduced, then it is more likely that destructive fishing is not proliferated. Similarly, when a disparity of production cost between destructive and non-destructive fishing is so high, then fishers tend not to use destructive fishing gears.

10.2 Conclusion

The study was prompted by a desire to understand the contribution of social capital and social capital investment of fisher communities to sustainable
c. The assessment shows that social capital indirectly contributes to sustainable coral reef resource use and management. A significant mechanism in which social capital contributes to sustainable resource use is through the presence and effectiveness of rules and institutions that prevent destructive fishing and promote community marine sanctuary. Social capital is manifested through fishers’ collective action to enforce local rules.

b. However, social capital is not only used for social or environmental virtues that produce beneficial outcomes such as sustainable coral reef resource use. Social capital, i.e., dimensions of bonding, bridging, and linking, are also existed in the networks supporting for destructive fishing. Similarly, community trust is a valuable factor in a locality where destructive fishing is prevalent.

2. Research question 2: Which dimensions of bonding, bridging and linking social capital contributes to sustainable resource use and management?

c. Establishment and enforcement of local rules and institution are influenced by the extent of the networks of fisher communities, namely bonding, bridging and linking social capital.

d. Fishers’ rules could be devised and applied when there was bonding social capital among local fishers. However, vertical bonding social capital that composes of patron-client relationship between fishers and capital owners proves to encourage destructive fishing and degraded coral reefs.

e. Bridging social capital can contribute to rules effectiveness, by way of recognition on the application of local rules by outside fishers.

f. Similarly, recognition from formal institutions on existing local rules is required for rules effectiveness. This can be achieved by linking social capital between local fishers and regulators in the government, which is usually promoted by field facilitators or local leaders.
3. Research question 3: To what extent social capital investment of fisher communities delivers collective action and institutional arrangements to govern sustainable resource use?

g. Local fishers’ rules that had already existed were improved during the process of social capital investment and the presence of field facilitators. During this period, enforcement of rules against destructive fishing embraced sea monitoring and imposing local social sanctions to rule breakers. Destructive fishing decreased or restricted when rules and sanction were enforced.

h. However, apart from Kapoposang, local rules and institution on preventing destructive fishing that had been built were not sustained. They were ended when the links to field facilitators and government institutions were ceased. Fishers were no longer collectively capable to enforce rules and impose sanctions to offenders. Poor formal law enforcement that unable to prevent free riders of both outside fishers and rent-seeking officers raised low trust in law enforcement and partly contributed to this situation.

10.3 Policy Recommendation

This section presents the findings discussed in the previous section into policy recommendations that divided into two parts. First set of recommendations is general recommendations for coral reef management. The second set of recommendations is designated specific for the study area.

Recommendations for coral reef management in future are:

a. Promoting multi-scale governance that can link up different levels of management organization, including the level of fishers or local community, in order to promote two-way or even multi-way of interaction and cooperation in establishing and enforcing rules, monitoring and sanctioning. This approach may entail assigning necessary rights to relevant stakeholders, and connect different levels of policy making and different types of knowledge: scientific and local knowledge. Networks that are characterized by bonding, bridging, and linking social capital can be invested through three methods: network or stakeholder interactions, capacity building for fishermen, and fishing organizations. Detailed recommendations are presented in Table 67.
### Table 67  Methods of social capital investment

<table>
<thead>
<tr>
<th>Social capital dimensions</th>
<th>Network/ stakeholder interactions</th>
<th>Capacity building for fishermen</th>
<th>Fishing organizations</th>
</tr>
</thead>
</table>
| Bonding                   | • Promote social interactions between local community members.  
• Promote accountability and transparency in village governance. | • Organize regular information gathering, trainings and meetings on marine environment, conservation norms, and economic improvement.  
• Organize trainings for fishers, fishing patrons, and local leaders. | • Promote establishment of fishers' organizations.  
• Establish local rules, monitoring and sanctions. |
| Bridging                  | • Organize meetings and discussions among fishers from different localities.  
• Promote relationships among different ethnic groups.  
• Provide medium for conflict resolution. | • Organize cross-visits among fishing communities.  
• Learn from other fishing communities.  
• Share knowledge and experiences with other fishing community. | • Promote regional fishing organization that consists of local fishers' groups or organizations.  
• Promote linkages between local organizations to similar organizations in a higher level. |
| Linking                   | • Facilitate regular visits and discussions between decision makers and local communities.  
• Establish regular visits of field facilitators to fishers' communities over the long run.  
• Promote transparency and accountability towards local communities in carrying out project/program.  
• Provide medium for conflict resolution. | • Organize training with resource users on coastal management. | • Recognize local fishers' organizations.  
• Recognize explicitly in laws or regulations on the rights of local community to craft and enforce rules on resource use.  
• Promote fishers' participation in developing and implementing laws or regulations.  
• Manage marine parks in cooperation with local fishers. |

b. Improving fishers' welfare through fulfillment of basic needs, in order to avert the use of destructive fishing gears for economic reason. Empirical findings show that to some extent poverty forced fishers to use destructive fishing, either imposed by fishing patrons or by choice. This has impacted to improved living standards. On the contrary, fishers that were unable or choose to not use destructive fishing gears were relatively poorer than others.

c. Increasing the disparities of fish price and production costs between fishing using destructive gears and those that do not. Reduced price of fishes caught by destructive fishing can offer an incentive for not using destructive gears. Similarly, high production costs of destructive gears may deter fishers from destructive fishing.
The following recommendations are designated for the study area:

a. Managing community marine sanctuary
   - Fairness of sanction. Sanctions will be regarded fair if defined by local community who establish and enforce the rules. Community’s ability to impose sanction to offenders must be recognized by: local people; outsiders; local and regional government; government officials assigned at local level, i.e., *bina*, *binmas*.
   - Benefit of sanctuary. Managing sanctuary entails costs that must be balanced with benefits. Even though ecological benefits of coral reef protection may accrue in the long term, however gradual benefits must knowledgeable to local people who manage and enforce the rules. Hence, regular ecological monitoring on sanctuary’s improvement is crucial and must be easily accessed to local people.

b. Reducing destructive fishing
   - In general, reducing destructive fishing can be done in three approaches: (a) ecological, (b) socio-economic, and (c) institutional.
   - Ecological approach is to ask fishers to notice (detrimental) effects of destructive fishing on coral reef, which may affect their fishing catch.
   - Socio-economic approach is to reduce dependency of fishers on destructive fishing, through promotion of better and effective fishing gears, introduction of aquaculture, improvement of post-harvest skills. This also includes reducing incentives for destructive fishing, by lowering price of fish caught by destructive fishing gears and increasing costs of destructive fishing.
   - Institutional approach is to maintain institutional arrangements that fit into particular locality.
     - *Kapoposang* is situated in a Tourism Marine Park. Management of the park must promote linkages with local people. Currently, the park had appointed a few local people to act as park ranger assistants for daily monitoring. The assistants must not only be accountable to the park management, but also to local people. Linkages between park management, local assistants, and local people can be promoted, in order to endorse symmetric information among stakeholders. Due to limitation of authority and
facility, the work of local assistants will only be effective if supported by local people.

- Tarupa, Rajuni Kecil and Rajuni Besar are situated in Taka Bonerate Marine National Park. The management capacity of a national park is better than that of tourism marine park. Park rangers are assigned and lived in the islands. Park management still faces problems of limited facility and management capacity. Therefore, cooperation with local people is necessary to complement their limited capacity, for example in monitoring.
- Barrang Caddi is not part of national authority management like above locations, but it is located not far from provincial capital city. Reducing destructive fishing in this locality is generally improving law enforcement against destructive fishing, such as improving law to easily capture offenders and promoting land-based monitoring rather than sea monitoring.

### 10.4 Recommendation for Further Study

With regard to policy focus and research on coastal and marine resources management, including coral reef ecosystem, it is important to give attention to multi-scale governance. Therefore, supporting research will be needed, as can be recommended in the following:

1. Advancing the use of agent-based modelling to model resource use, external monitoring, and resource condition. The model can incorporate not only fishers, but also other stakeholders such as government officials and NGO.
2. Relating the variables of social capital, community welfare, and resource use. This is important to answer an enquiry whether to improve social capital or to improve welfare in order to have sustainable resource use.
3. Relating the variables social capital and fishery indicators such as fish biomass and fish efforts. Social capital can be entered as one variable of fishing efforts that may influence fishing output and fish biomass.
4. Assessing the extent and benefit of bridging and linking social capital in resolving existing problems and promoting fair and sustainable resource use. This is essential considering that bridging and linking social will be more improved as multi-stakeholder management will be increasingly promoted in future.