

# MAIN DRIVERS AND ALTERNATIVE SOLUTIONS FOR DESTRUCTIVE FISHING IN SOUTH SULAWESI-INDONESIA: LESSONS LEARNED FROM SPERMONDE ARCHIPELAGO, TAKA BONERATE, AND SEMBILAN ISLAND

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**ABSTRACT:** *In Indonesia, a damage to the ocean ecosystems specifically on coral reef ecosystems and population decline of fisheries resources is an ancient problem that lasts to the present. Although through the scientific study of many disciplines (ecology and marine biology, marine science, socio-cultural sciences) have found various forms of fishing techniques as the main factor, as the implementation of various problem-solving strategies and models offered, the environmental issues that impacted the poverty of the fishers community has not yet showed any positive results mean to the present. This paper aims to review the main factors that influence the existence of destructive fishing and some alternative solutions of a socio-cultural perspective. The data and information on this paper were gained from several research reports with ethnographic methods such as Social Assessment Team Report COREMAP South Sulawesi (1996/1997-1997/1998), Resource Utilization in Taka Bonerate (2000), destructive Fishing in Spermonde Islands (DF-W. Indonesia-COREMAP 2003), and The Utilization of Sembilan Island Resources: Study on Various Fisherman Behavior in the context of an Internal and External Environmental Consequences (2006), and discourses that evolving in the community and scientific seminars up to lately. Through empiric clarification models in cognitive anthropology has been found various internal socio-cultural factors (fishermen communities) and external factors in the past until now. Based on those factors, proposed some alternative solution.*

**Keywords:** *destructive fishing, influencing factors, scientific/empirical explanation, and alternative solution*

## 1. INTRODUCTION

The issue of damage to coral reefs in Indonesia began in the early 1980s. A wide range of scientific research has proven that phenomena. One source of information about damage to coral reefs (*Taka Bugis-Makassar* term) and the caused factors reported in "Study of Social Analysis of COREMAP (Coral-Reef Rehabilitation and Management Program) by a team of [4]. COREMAP is a long term mega project management of coral reefs in Indonesia under LIPI (Indonesian Institute of Sciences) in collaboration with several universities in Indonesia, including the Hasanuddin University (Unhas), and several government agencies in central and local levels, NGOs, and international and local donor organizations in dealing with the research activities. Social Analysis studies aimed at analyzing the destructive practices of marine resource utilization associated with coral reefs, specifically fisheries, within the context of the influence of social and socio-economic factors, demographic, and socio-cultural (main drivers of destructive fishing).

The results shown ten sites proven that the damage of the coral reef ecosystem caused by conducting (various techniques) unfriendly fishing methods and gears in utilizing the valuable fisheries resources. Insistence on the fulfillment of economic needs, increasing market demand (local, regional, export), the construction of settlements, the social structure of the working group of fishermen, local-cultural views on sea and its contents as an open access, and poverty became the main factors affected behavior to assess destructive fishing practices. The report results are more or less are same within 2000 done by Unhas on "The Utilization

of Marine Resources of Taka Bonerate in Order to Optimizing the Indonesian Marine Park Zoning" and can be compared with the results of the study on "Resource Utilization of Taka Island Sembilan: study of Fisherman Practice Variations and Environmental Consequences in the context of Internal and external [6].

Although all of these studies fairly productive, but the findings on destructive fishing practice, impact, and the factors are still relatively similar to the 1990s. They also found that the various legal and regulatory policy management programs and the preservation of coral reefs which implemented by the government has not brought satisfactory results. For example: Tourism Water Park (Marine Nature Tourism), Water Preserve (Strict Marine Reserve), Marine Protected Area (Marine Sanctuary), Marine conservation area (Regional Marine Conservation Area), Coastal Preserve (Coastal Reserve), Fisheries Preserve (Fisheries Reserve), National Park (Marine National Parks), whose management has recently been transferred from the Ministry of forestry to the Ministry of marine and fisheries [3].

Of course, the research findings are in accordance with the facts on the field. Logically, if the problem still persist, alternative technical solution will not be far from that offered by previous researchers and development practitioners. Why do previous problem, in this case the destructive fishing, survive and derived by the strong factors? If the previous approach models (community based, co-management, or integrated management) yet precise, or precisely the applications have not coordinated properly, not based on a



Figure 2. Taka Bonerate Island

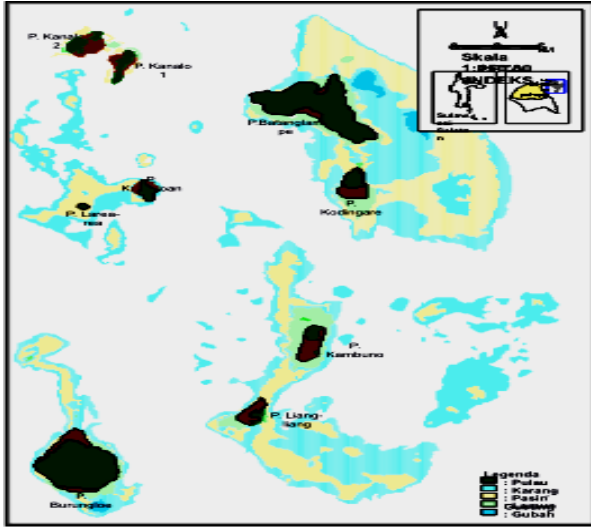


Figure 3. Sembilan Island

### 3. DESTRUCTIVE FISHING PRACTICES AND THE IMPACT ON CORAL REEF ECOSYSTEMS

Based on the field research (with the ethnographic method) could be identified six types of destructive fishing the fishermen in three reef island have used since a long time ago until now. The first, catching live fish and sea eel using traps of bubu. Bubu (bottom trap) anchoring installed at a depth of 25 m-30 m ideally no longer require the ballast and clamps rocks. Coral reef targeted fishes are *Plectropomus* spp, grouper (*Ephinepheulus*, *Mozambique*, *Cephalopolis*), *Lethrianus*, and napoleon (*Cheilinus Undulatus*).

In addition to fishing, the past few years that was roughly since 2011/2012 fishermen from some small islands in Spermonde Island also used drag traps to capture the sea eels (moray eel international name, *garonggong* Bugis-Makassar name) that live in *Taka-Taka* of Spermonde. The results of the fishing production in the form of meat and eel skin is a commodity exports to China and Taiwan. According to the observations of both researchers [8] that sea eel fishing activity which combines the three techniques of *bubu* (bottom trap), cyanide, and the demolition with a crowbar brings significant anesthetic effect on damage to coral reefs and over-harvesting of marine eel in populations in the Spermonde coral ecosystem.

The second, fishing fresh fishes using blast fishing technique. Blast fishermen from the three reef islands are generally operate in shallow reef areas which are intended to be easy to glean the dead fishes. Targeted fishes bombed in groups such as yellow tail (*Caesio Caerulara*), *Caesioxanthonota*, *Rastrelligerkanagurta*, *Decapterusrusselli*, and some fish base such as white fish, coral trout (*Plectropomus*), grouper (*Ephinepheulus*), napoleon (*Cheilinusundulatus*), and *Lethrianus*. Some fishermen in three coral islands admit fish bombing practices affect the destruction of coral reefs. Everywhere just around *Taka-Taka* away from the islands of coral, according to the information, found in an uncovered and destroyed coral by a bomb and white rarefied due to anesthesia.

The third type of destructive fishing is catching live fish and lobster with cyanide technique. It began to be used on the three reef islands of South Sulawesi since the late 1980s or early 1990s. The targeted fishes are *Plectropomus*, grouper (*Ephinepheulus*), napoleon (*Cheilinus Undulatus*), long-nosed emperor or *katamba* (*Lethrianus*) and a lobster (pearls lobster, bamboo lobster, fan lobster) that live in the coral reef area which all are the export commodities to Hong Kong.

The fourth, break down the lobster hidden place/coral with iron hammer. When the demand for live lobsters (along with live fish) increased demand in the export market since the second half of the 1980s, most of the fishermen on the three reef islands replaced darts with iron hammer as solvers of corals where lobsters hiding and used the *pukat lunri* (local term) to trap at and collect the catch. Catching lobsters with a hammer that are continuously being extended and intensive, especially in the period of the late 1980s until the second half of the 1990s, as well as the use of cyanide to catch live fish, causing damage to coral reef ecosystems in the three areas of the coral reefs in South Sulawesi.

The fifth, unpacking the rock using crowbar as a hiding place for seven eyes snail (*Abalona*) and sea eel. Catching seven eyes snail (*panno-panno* local term) is one type of economic activity that was done by most fishers in *Sembilan* Island and Spermonde. In the two areas, catching the seven eyes snails that live in coral according to local fishermen, recently became popular in the late of 1990s and 2000s. On the Sembilan Island, a fairly productive economic activity has been adopted by most of Bajo Kanalo 1 fishers, even it involved a lot of fishers wife. On Spermonde, catching seven eyes snail is taking part in reef areas about Badi Island and the islands of Pajennekang, Mattiro Deceng, and Liukang Tupabbiring. Since seven eyes snail lives and likes to hide behind rocks so its catching behavior is always linked with the issue of the reef damage. In Pangkep, the damages of coral reefs resulting from the seven eyes snails catching activity occupied third place after blast and cyanide fishing, and the coral mining.

The sixth, fishing fish with *cantrang* (Danish Seine). The use of *cantrang* (Bugis-Makassar term) characterize the fishing activity in Spermonde. *Cantrang*, according to the fishermen, was at first adopted and used by the fishermen in Northern Galesong (Takalar). Gradually some fishermen in Liukang Tanggayya and Liukang Tupabbiring (Pangkep) and Makassar, adopted these fishing tool since the early 2000s. Due to operational technique is similar to mini trawl operational techniques so that it can capture bottom and surface organisms all at once. With an intensive operation, it can bring the consequences of the damage to coral reef habitat for spawning and breeding and so on.

From the perspective of individual rational action in anthropology ecology, it is assumed that any form of behavior of the exploitation of the coral reef resources together with its environmental consequences (positive or negative) does not happen by itself, but driven and directed by these two internal and external social cultural factors.

### 4. SOCIO-CULTURAL FACTORS DRIVE THE DESTRUCTIVE FISHING PRACTICES

In addressing the issues of why the fishermen decided destructive fishing gears that damage coral reef ecosystem, the empirical explanation needed on socio-cultural factors as the main driving decisive factors. From the field research with the ethnographic method, could be identified nine categories of the main driving factors to the destructive fishing practices at the three reef areas in South Sulawesi. The first, principles of maximizing existing catches, energy and time efficiency. Based on the fishermen information, known that a considerations based on the maximization principles of gains (profits) and efficiency (time and effort) greatly reinforce the decision of the fishermen in three reef islands who play significant role in destructive fishing practice from ancients to the present. All options of fishing such as installation of bottom trap (*bubu*) on the reef; using cyanide to catch fish and lobster on the rocks at *Taka*; throwing bombs at groups of fish on coral reef habitat with compressor; surround fish, shrimp, crab, squid with *cantrang* (*Danish Seine*); and lobster catch, snails, seven eyes and sea eel by cracking and prying the holes the rock with a hammer and crowbar showed the fishermen more results than the use of traditional static techniques such as traditional fishing method, trapping and so on. The use of diving equipment and compressor, they increase of the duration of the working time, deployment of a lot of labor, and outreach of divers to fish nests (and other marine biota) in the bottom of a deep cliffs.

The second, value orientation of quality catches. For most fishermen who deal with the export market, in addition to pursuit the value of the quantity, they also giving priority to the value of the quality of the catch. For that the anesthetic (with cyanide), a combination of bottom trap and anesthesia, iron hammer (rock breaker/lobster hiding place to remove it carefully), always considered more effective for obtaining quality catches than other traditional techniques including fishing rods, bottom trap, arrows etc. that caused disability on fish and lobster.

The third, most fishermen are practicing destructive fishing having confidence and a feeling of compatibility with some fishing techniques. A fisherman from the Sembilan Island who use bombs, said:

"We've found that as good method even we realized the risk and we have to be ready to face it. In using bomb we will have more time to have a talk/discussion and being home, we do not need spending more time in the ocean. We will start to work just when we have orders from the boss, but the job lasted a short time. This work contains elements of "art" especially when they could bring a big number of fish and pile them on the top of the boat. The accident often takes away the soul of the fisherman's body defects or is destiny "(interview, 2002).

For most fish bomber, cases of accident because of this job or being caught and put on jail, could not guarantee to stop this fishing practice.

The fourth, cultural perception of fishery resources associated with coral reefs are easily obtained by using bombs and cyanide. Fishermen have the complexity of knowledge of the coral reef ecosystem and biodiversity characteristics that mainly about the basic conditions of clear water, waves, and

current and the circulation of fish migration and other types of coral reef habitat. Through a long work experience growing perceptions that the fishermen shared fisheries resources who associated with coral reef ecosystems, especially those who living in the bottom of the control and easily exploited especially with bombs and pushers. The perception of a culture shared has always been a guideline for seafood seekers and fishermen export commodities (grouper, lobster, sea cucumber, shell pearls, scallop) on the three reef islands in South Sulawesi that adopting destructive fishing practice.

The fifth, understanding sea and its contents as the grace of god to be utilized along human. In the culture of fishing communities of Bugis-Makassar in South Sulawesi, it is very less of institutional ownership of communal areas (communal property rights) such as among others, *Sasi* (Maluku), or *Tyatiki* (Papua), *Kaombo* (Buton), *Panglima Laut* (Aceh), and Fish Aggregation Devices/FAD (Rumpon in Indonesian term) from Sulawesi Barat. Instead, the Bugis-Makassar fishing communities in general quite understand about sea and its contents as the grace of God to be utilized along human beings from wherever it comes from. With the view of a culture, most fishermen of Bugis-Makassar including those who do destructive fishing practice that freely shift from one fishing ground to the fishing grounds. And vice versa, groups of fishermen from a variety of other ethnic origin and may fishing in South Sulawesi, particularly in the three reef islands. It is assumed that destructive fishing practices stands with all its ecological impact on the three islands of the reef caused by rooted the open access perception in the fishing culture of the Bugis-Makassar until now.

The sixth, the well-preserved relation pattern of patron-clients in the structure of the *Ponggawa-Sawi*. *Ponggawa-Sawi* which is a working group of traditional fishermen of Bugis-Makassar and characterized by patron-clients relation pattern has survived since hundreds of years ago. Up to now there has been no signs of the emergence of a new working group that could replace the functions of the multi-language *Ponggawa-Sawi* facets and vital. Service assurance for sustainable socio-economic of *Ponggawa* (Patron) on the *Sawi* (Client), is the main strategy of building ties of loyalty of *Ponggawa* and domination against on wealthy family. Commitment to carry out the responsibilities of working with compact including practicing destructive fishing is an embodiment of the loyalty of *Sawi* to *Ponggawa* which in turn ensures its existence in groups and economic life bylaws [1,7,10].

The seventh, existence of group relationship patterns between fishermen and the police and destructive fishing materials seller. The issue of rampant collusion as a secret among fishermen for illegal fishing (blast fishing and tranquilizer) with a plurality of maritime security, including the police, is an old issue that is widely discussed in the media, seminars, research and open discussion by a variety of stakeholders (academics, bureaucrats, NGOs, environmentalists). According to the newspaper Fajar Makassar 2016, that over time more and more emerging entrepreneur of explosives and cyanide which gives service to fishermen in towns like Makassar, Maros, and Pangkep (South Sulawesi), however it

is difficult for the security to identified these persons because most of them are women.

Become the common assumption that a form of collusion that violates the law became one of the factors determining the existence of destructive fishing practices, especially in the three coral reef areas in South Sulawesi. The combination of patterns of patron-client relationship between the group *Ponggawa-Sawi* (Clients) and the maritime security persons (Patrons), and entrepreneurs/traders (the sellers of cyanide and the explosive materials) is a main adaptive strategies of the fishermen in defending their destructive fishing in the three reef islands since the several times ago [19,11,12]. The pattern of the relationship, according to the results of the research have been adopted from generation to generation in the group *Ponggawa-Sawi* Bugis-Makassar.

The eighth, the relative stable of demand for commodities and seafood prices in regional (domestic) and export markets. Because all seafood commodity markets were achieved (local, regional, export) so that the conditions of demand and prices are stable or increases always affects significantly decisions of fishermen to maintain and adopt new capture technology such as bombs and Danish Seine to catch fresh fish which sell to local and regional markets; adopting the cyanide, bottom trap, and destructive practices with a crowbar and a hammer iron to catch live fish and lobster, snails and eels, seven eyes of the sea without realizing the potential negative impact on coral reef ecosystems [12] [7] [10].

The ninth, adoption of technological innovation in fishing. After the remnants of the old bomb belonging to the army of Japan Expires at the end of the decade in 1970s or the early 1980s, and then the amoniac fertilizer industry as the main source of obtaining bomb ingredients fish. As for cyanide industry still remains the primary source of obtaining material contains toxic to live fish and lobster. It is just as important as is the innovation of modern submarines means either a gas tank (the period of the 1980s) followed by the compressor (since the 1990s). By tracking the technology innovation adoption history note that the components of the bomb, the pushers, and modern diving equipment accepted by the fishing communities along with learning techniques, provision and use. Army in Japan teaches the technique of assembling and throw bombs; entrepreneurs of Chinese descend teaches diving with gas tube below the compressor; and entrepreneurs of Chinese in Hong Kong teaches mixing and spraying anesthesia.

##### 5. AN ALTERNATIVE PROBLEM SOLVING

In the framework of problem solved for environmental degradation and deterioration of marine fisheries resources as a result of destructive fishing practices, models of co-management approach and integrated management still always appropriately applied. Even the top-down approach is also relevant to the circumstances or character of a particular target group. The proposed steps for an alternative or complementary to all the programs that already exist as follows:

1. Support and empower the creative-innovative fishermen in the development of marine fishery exceeds the productive efforts and stun bombs. For example: fishermen in

Batang Lampe, Kambuno, and Leang-Leang (in Sembilan Island) who cultured grouper and lobster in floating cages; several fishermen in Kambuno (Sembilan Island) and *Badi* Island (Pangkep) who cultured pearl and sea cucumbers; a fisherman in Rajuni (Taka Bonerate) which in the early 2000s trying to cultured turtle, and according to the story, that in a few months the turtle began to flourish; and some fishermen in Kanalo 1 and 2 since 2000s tended to switch from diving to net more. It is said that most of them are former user's bomb, pushers, and divers.

2. Building a competitive culture retains the honor/self-esteem (*siri'*) between the owner, *Boss* or *Ponggawa* through achievement of economic business productive, sustainable, and family welfare environment, including the workers replacing the achievements gained through the efforts of the bomb and pushers.

3. Giving appreciation through continuous media to any fisherman (individual, group) economic achievement. The move will strengthen the motivation of fishermen in turns to seize a record of achievement/championship status. The method since ancient fishing communities applied in advanced Europe, America, Japan, and others.

4. Launch a formal educational program leading productive, sustainable socio-economic, law, and the environment at the levels of primary, *JSS*, *ADMIN*, and *PT* (long term) for producing the younger generation educated community that would more easily understand and adopt the new positive ideas and practices.

5. Law enforcement (with enforcement of firm) that much abused by members of the police, in cooperation with certain groups of fishermen. To that end, top-down paradigm is still very necessary.

6. The increase for the community facilitator/professionalism practitioners in managing joint program of target groups/fisherman.

##### 6. CONCLUSION

The issue about coral reef ecosystem degradation in Indonesia began in the early 1980s. A wide range of scientific researches has proven some phenomena such as changes on conditions of the coral reef ecosystems, emergence of coral reef death, fractional coral (ruble), coral bleaching, etc. Furthermore, the research results show that coral reef ecosystem degradation on the three reef islands of South Sulawesi caused by using (various techniques) unfriendly fishing methods and gears in utilizing the valuable fisheries resources for export market. There were six forms of the fishing techniques categorized as main destructive fishing techniques on the reef fishing grounds. By applying the empirical explanation model of cognitive anthropology, the main driven/factors influencing the destructive fishing techniques could be identified. As shown formerly, there were ten internal and external socio-cultural items of fishermen as the main driven on the destructive fishing to coral reef ecosystems on the three reef lands.

In reviewing several scientific researches comparatively (including socio-cultural researches) conducted from 1980s to 2000s on the three reef islands indicates the same results in terms of destructive fishing and driven factors, likewise the

solutions that offered by previous researchers and practitioners evolving. Why do previous problems, in this case the destructive fishing, and the main factors survive? If the previous approach models (community based, co-management, or integrated management) yet precise, or precisely the applications have not coordinated properly, not based on a strong commitment, unsustainable, and not implemented professionalism? Lessons learned from a lot of cultural views and observed life experiences of fishermen such as attitude or tendency to respond or reject the implementation of policies or government programs, innovative creativity-building strategies (e.g. switching to floating nets, raising turtles, seaweed cultivation, and so on), then from anthropological perspective (bottom up approach) offered some items of solutions by reference to combine the community based, co-management, or integrated management. The last but not less that presumably information on destructive fishing and the main factors surviving on the three locations provides benefit of cross-regional studies and historical future.

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