



**Food and Agriculture Organization
of the United Nations**

**Ecosystem approach for fisheries management assessment for lobster fisheries and
proposed intervention management actions in Fisheries Management Area 573
in Indonesia**

**Report of
Enabling Transboundary Cooperation for Sustainable Management of the Indonesian Sea
(ISLME project) GEF/FAO project no: GCP/RAS/289/GFF**



GLOBAL ENVIRONMENT FACILITY
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CONTENTS

Foreword	vi
1. Introduction	1
1.1. Background	1
1.2. Objectives	1
1.3. Outputs	1
2. Methodology	2
2.1. Location and time of data collection	2
2.2. Data analysis	2
2.3. Assessment of the status of lobster fisheries management	3
2.4. Identification of problems and gaps in lobster fishing management	3
2.5. Inequality in lobster fishing management	4
3. Result and discussion	6
3.1 General conditions of lobster fisheries in Lombok Tengah District	6
3.2 Assessment of lobster fisheries EAFM indicators	8
3.2.1 Status of lobster fisheries management	8
3.2.2 Lobster resources	8
3.2.3 Habitat and ecosystem	10
3.2.4 Lobster fishing techniques	13
3.2.5 Social	14
3.2.6 Economy	16
3.2.7 Institutional	18
3.3 Problems and gap of lobster fisheries management	19
3.3.1 Stakeholders in lobster fishery activities	19
3.3.2 Rich picture of lobster fisheries	21
3.3.3 The conceptual model of lobster fisheries management	22
3.4 Recommendations for intervention to improve lobster fisheries management	26
4 References	29
5 Appendix	32

Tables

Table 1.	Criteria for evaluating aggregate composites on flag models	3
Table 2.	The number of fishermen and the number of fishermen groups in Pujut Subdistrict	6
Table 3.	Lobster species caught at the study site	6
Table 4.	The results of a composite assessment of 6 domains on the EAFM approach to lobster fisheries management in Lombok Tengah District.	8
Table 5.	Water Quality at Lobster fishing grounds	12
Table 6.	The size of mature lobster based on its type	14
Table 7.	Problems with lobster fisheries in Lombok Tengah District	22
Table 8.	Strategy for setting the quota and time for catching lobsters allowed, to solve the problem of decreasing production and size of lobster caught	23
Table 9.	The strategy of prohibiting the use of lobster seed catching tools to solve the problem of catching lobster seeds	23
Table 10.	Strategies for establishing a garbage bank organization to solve the problem of the existence of plastic waste	24
Table 11.	Strategy of identification of threats to coastal ecosystems to resolve the problem of threatened coastal ecosystems due to physical development	24
Table 12.	Optimization strategy of using <i>krendet</i> fishing gear to solve the problem of using prohibited fishing gear. <i>Krendet</i> is a kind of circle trap with a net inside the circle. Its operations are placed at the bottom of sandy or muddy waters.	24
Table 13.	Strategy for establishing a lobster fisheries management working group, to resolve the problem of low stakeholder participation in lobster fisheries management	25
Table 14.	Detailed zoning strategies within the region for resolving horizontal conflicts between lobster fishermen and conflicts between sectors related to lobster fisheries	25
Table 15.	Technology transfer strategy for developing lobster culture and marketing assistance for lobster and processed products, to solve the problem of low income of lobster fishermen	25
Table 16.	Strategies for strengthening <i>Pokmaswas</i> (watchdog community), to solve the problem of low levels of compliance for managing lobster fisheries.	26

Figures

Figure 1. Location of study: (A) Gerupuk Bay, (B) Bumbang Bay, (C) Awang Bay	2
Figure 2. Flow Chart Methodology	5
Figure 3. The types of lobster the size of the dominant consumption caught (Photo Source: Team Documentation, 2019)	6
Figure 4. <i>Pocong</i> , a fishing gear modified by local fishermen to catch lobster seeds (Photo Source: Team Documentation, 2019)	7
Figure 5. Scores for each indicator in the domain of fish resources in lobster fisheries in Lombok Tengah District, NTB Province.	9
Figure 6. Assessment of lobster resource domain indicators in lobster fisheries in Lombok Tengah District, NTB Province	9
Figure 7. Scores for each indicator in the domain of Habitat and ecosystem in lobster fisheries in Lombok Tengah District NTB Province	11
Figure 8. Assessment of habitat domain indicators and aquatic ecosystems in Lombok Tengah District, NTB Province	11
Figure 9. Scores for each indicator in the domain of Catching/fishing technique in lobster fisheries in Lombok Tengah District NTB Province.	13
Figure 10. Domain assessment of lobster fishing techniques in lobster fisheries in Lombok Tengah District	13
Figure 11. Scores for each indicator in the domain of Social in lobster fisheries in Lombok Tengah District NTB Province	15
Figure 12. Social domain assessment in Lombok Tengah District	15
Figure 13. Scores for each indicator in the domain of Economy in lobster fisheries in Lombok Tengah District NTB Province	16
Figure 14. Economic domain assessment in Lombok Tengah District	17
Figure 15. Scores for each indicator in the domain of Institutional in lobster fisheries in Lombok Tengah District NTB Province	18
Figure 16. Institutional domain assessment in Lombok Tengah District	18
Figure 17. Rich picture of lobster fishing activities in Lombok Tengah District	21

Foreword

With great support from all stakeholders and well-wishers, we have compiled a report "Ecosystem Approach for Fisheries Management assessment for lobster fisheries and proposed intervention management actions in Fisheries Management Area 573 in Indonesia."

This report includes introduction, method of implementing activities, general condition of lobster fisheries, assessment of lobster fisheries EAFM indicators, problems and gaps in lobster fisheries management in Lombok Tengah District, and recommendations for intervention to improve lobster fisheries management.

On behalf of Learning Center Ecosystem Approach to Fisheries Management-Mataram University, we would like to express our deepest gratitude for the attention of various parties for the improvement of this report. Finally, we hope that this report can be useful for the government and the community.

Mataram, November 2019

Authors

Learning Center - Ecosystem Approach to Fisheries Management,
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Executive summary

Lombok Tengah District is one of the regions in West Nusa Tenggara (NTB) Province of Indonesia, which has a high diversity of marine resources including lobster resources. It is situated in southern coast of NTB, and part of Fisheries Management Area (FMA) 573. However, the utilization of lobster resources has not been carried out properly, following the principles of sustainable fisheries i.e. prohibited fishing gear operations, catching immature size and other irresponsible violations. There are several problems related to lobster resources management, mainly related to the availability of lobster resources and the sustainability of the lobster fishing business. The objectives of the assessment are to (1) evaluate lobster fisheries management based on indicators on EAFM in Lombok Tengah District; (2) identify the main problems in lobster fisheries and gaps in lobster fisheries management that need to be intervened by the government; and (3) provide recommendation of interventions for ISLME activities based on the results of the EAFM assessment and identification of management gaps.

This assessment was conducted in three bays in Lombok Tengah District which are the center of lobster fishing activities, namely Awang Bay, Bumbang Bay and Gerupuk Bay. Data and information were collected through interviews using questionnaires, Focus Group Discussions (FGD), and public consultations. Moreover, secondary data related to lobster fisheries in Lombok Tengah District were also gathered from (1) Lombok Tengah Marine and Fisheries Office (DKP), (2) NTB Province Marine and Fisheries Office (DKP), (3) Lombok Tengah Statistics Office (BPS), and (4) NTB Province Statistics Office (BPS).

This assessment used indicators of the Ecosystem Approach to Fisheries Management (EAFM) to measure a current condition of lobster fisheries management in Lombok Tengah District. The indicators comprised of 6 domains i.e. fish resources, habitat and ecosystem, fishing techniques, social, economy, and institutional domains. The average value of domains determined the general condition of the lobster EAFM. Moreover, a Soft System Methodology (SSM) approach (Checkland & Poulter, 2006; Nurani *et al.*, 2018a; Nurani *et al.*, 2018b) was used to identify stakeholders in lobster fisheries in Lombok Tengah District, identify gaps in lobster fisheries management and find alternative intervention recommendations for improving lobster fisheries management in Lombok Tengah.

The results showed that in general the management of Lobster fisheries in Lombok Tengah District is in a medium condition. Only fish resource domain is shown to be in less condition. The medium condition in fisheries management refers to; fish resources are not caught responsibly, habitat and ecosystem quality in poor condition, the fishing gears used are not environmentally friendly, the lack of stakeholder involvement in managing fish resources, the welfare of fisheries business actors is not yet prosperous, low compliance with responsible fisheries principles and institutional incompleteness in fisheries management (Adrianto *et al.*, 2005; KKP, 2016).

In detail, the values of each domain can be seen in the following table of the EAFM assessment. A less condition of fish resource domain indicates that the fish resource is experiencing scarcity and high threat of extinction due to intense exploitation of catching seeds. The low value of lobster resources is not influenced by habitat conditions and aquatic ecosystems. But it is influenced by the activity of catching lobster of the size of seeds. Since the seeds have high economic value in international market, the fisherman tend to catch seed due to simple fishing techniques comparing to those for lobster of the size for consumption.

Domain	Composite	Description
Fish Resources	35	Less
Habitat and Ecosystem	67	Good
Fishing Techniques	43	Medium
Social	53	Medium
Economy	48	Medium
Institutional	55	Medium
Aggregate	50	Medium

The lobster resource should be considered as priority management intervention as its value is the lowest compared to the 5 other domains. However, it does not mean that the other domains are well managed. Some domains might influence the improvement and enhancement of the lobster resources, and some not. A more in-depth analysis to identify the impacts on the improvement and improvement of each indicator in each domain is further needed. These steps need to be taken so that the government can provide an effective and efficient program for the management of lobster fisheries in Lombok Tengah District.

The results of the stakeholder analysis showed that the central and regional government i.e. Ministry of Marine Affairs and Fisheries and NTB Province Marine and Fisheries Office (DKP), village heads and business actors were the main stakeholders in lobster fisheries activity. Priority issues in lobster fisheries in Lombok Tengah District were;

- (1) Decreased production and size of adult lobster (consumption size; >200 g) caught
- (2) Catching lobster seeds
- (3) The existence of plastic waste in the waters
- (4) Threatened coastal ecosystems due to infrastructure development
- (5) Irresponsible fishing gear and lobster catching tools, namely *pocong*
- (6) Low stakeholder participation in lobster fisheries management
- (7) Horizontal conflicts between lobster fishermen and conflicts between sectors related to lobster fisheries
- (8) Low income of lobster fishermen
- (9) The low level of compliance with the principles of fisheries responsible for managing lobster fisheries.

Based on the results of the EAFM assessment and the results of the analysis using the SSM approach, the recommendation for interventions to improve the status of lobster fisheries management in Lombok Tengah District are;

- (1) Data collection of lobster caught
- (2) Stock assessment for lobster in Fisheries Managemenet Area (FMA) 713 and 573
- (3) Improve supervision in the utilization of lobster resources
- (4) Development of artificial coral reef technology (habitat for lobsters)
- (5) Development of lobster conservation area in Awang Bay, Bumbang Bay and Gerupuk Bay
- (6) Waste Management

- (7) Arrangements / interventions for using new fishing gear to catch lobsters, especially for adult/consumption size. (e.g. optimizing the use of *bubu* traps)
- (8) Increase supervision in the use of prohibited fishing gear
- (9) Knowledge, Attitude and Practices assistance to fishing communities
- (10) Development of lobster fishery product processing
- (11) Development of marine tourism as an alternative livelihood
- (12) Development of fisheries supervisory facilities and infrastructure
- (13) Establishment of *Pokmaswas* (fishery watchdog community groups)
- (14) Preparation of a lobster fisheries management plan.

1. Introduction

1.1. Background

1. Lombok Tengah District is one of the regions in Nusa Tenggara Barat (NTB) Province with an area of 1 208.39 km² (DKP NTB Province, 2016). The southern part of Lombok Tengah coastal area (FMA (Fisheries Management Area) -NRI 573) has a high diversity of marine resources, and lobster resources are one of these (Yulius *et al.*, 2018). The most dominant type of Lobster exploited is scalloped spiny lobster (*Panulirus homarus*) with carapace length of 52.7 mm (weight \pm 110 g) (DKP NTB Province, 2016).

2. Lobster resources are classified as an important economic fish due to high market demand in Asia, Europe and the United States (Witomo & Nurlaili, 2015). This causes the potential of over fishing (Witomo & Nurlaili, 2015). Fishermen like the high price of lobster because it can improve their welfare. World market demand for lobsters is not only for consumption but they also want lobster seeds, which are less than 10 cm in size (Witomo & Nurlaili, 2015). This is an opportunity for lobster fishermen in Lombok Tengah to optimize the capture of existing lobster resources. However, no management of lobster fisheries in Lombok Tengah District has been carried out until now. Lobster fishing activities have not been done sustainably so several problems have occurred. One common problem is catching lobster seeds (Witomo & Nurlaili, 2015).

3. The management of lobster fisheries is important to maintain the availability of lobster resources and ensure the sustainability of the lobster fishing business in Lombok Tengah. Through this study an assessment will be made of the current condition of lobster fisheries in Lombok Tengah. Then, based on these assessments a management gap will be obtained which can be used as a basis for determining intervention recommendations in order to improve lobster fisheries management. The results obtained in this study will be used to decide a pilot site in the ISLME (The Indonesia Sea Large Marine Ecosystem) project which is one of the FAO activities, in collaboration with the Directorate of Fish Resource Management, Directorate General of Capture Fisheries, Ministry of Marine Affairs and Fisheries. The results of this study are expected to provide basic information and references for a national fisheries development program, especially for the development of sustainable lobster fisheries in Indonesia

1.2. Objectives

4. The overall objective of the work carried out by the service provider (SP) is to carry out an assessment of lobster fishery management in FMA 713 and FMA 573 according to adopted EAFM indicators as to provide an update on the status of the lobster fishery, and to recommend priority actions to improve lobster fishery in the ISLME pilot sites (Lombok Tengah, NTB).

5. The specific objectives within the scope of this work are to:

- Undertake an assessment for lobster fishery using EAFM indicators of the measures in the pilot sites;
- Identify main issues in lobster fishery and management gaps that need to be intervened by the SDI-MMAF;
- Provide recommendation on interventions for the ISLME project in response to EAFM assessment and identification of management gaps.

1.3. Outputs

6. The outputs of this activity are:

- Assessment Report of EAFM indicators on lobster fishery in pilot sites of the FMA 573 and 713, including the identification of main issues on lobster fishery and management gaps.
- A FGD Report with description of 1) the FGD process and stakeholders involved, 2) Final conclusion of the FGD and intervention recommendation to be implemented at ISLME pilot site.

2. Methodology

2.1. Location and time of data collection

7. The study was conducted in the areas of Awang Bay, Bumbang Bay and Gerupuk Bay (Figure 1) located in Mertak and Sengkol Villages, Pujut, Central Lombok District, Nusa Tenggara Barat Province. The location was chosen because it is a lobster fishing area in FMA 573. The study was conducted for 14 week, from August to November 2019.



Figure 1. Location of study: (A) Gerupuk Bay, (B) Bumbang Bay, (C) Awang Bay

2.2. Data analysis

8. Intervention recommendations for improving the management of lobster fisheries in Central Lombok District were produced through several stages. The first stage is to assess the status of lobster fisheries management using the Ecosystem Approach to Fisheries Management (EAFM) indicator (NWG EAFM, 2014; Staples *et al.*, 2014; KKP, 2016). The results of the assessment are then used as a basis for determining problems with lobster fisheries in Central Lombok Regency. Identification of alternative strategies to solve existing problems is done using the Soft System Methodology (SSM) approach (Checkland & Poulter, 2006; Nurani *et al.*, 2018a; Nurani *et al.*, 2018b).

9. The SSM approach consists of 7 stages; (1) understanding the situation of unstructured problems; (2) arranging problem situations; (3) develop a problem definition; (4) creating a conceptual model; (5) comparing conceptual models with the real world; (6) determine desired changes; and (7) take corrective actions (Checkland & Poulter, 2006). However, in this study, the SSM approach was carried out from step 1 to step 5. Phase 1 was carried out to identify problems with lobster fisheries in Central Lombok District based on the results of the EAFM assessment. Phase 2 is carried out to identify priority problems to be resolved immediately. Phase 3 is carried out to determine alternative coping strategies for each existing problem. Stage 4 is carried out to create a conceptual model as an illustration of the ideal form of alternative problem solving strategies. Phase 5 is carried out to find gaps in lobster fisheries management so that intervention recommendations can be determined to improve lobster fisheries management in Central Lombok District (Checkland & Poulter, 2006; Nurani *et al.*, 2018a; Nurani *et al.*, 2018b). The following is a detailed explanation of the stages of analysis conducted in this study:

2.3. Assessment of the status of lobster fisheries management

10. The EAFM approach with 6 domains and 32 indicators (Appendix 1), were conducted to assess the management of lobster fisheries in Lombok Tengah District, referring to the KKP (2016). The domains used were; fish resources, aquatic ecosystems and ecosystems, fishing techniques, social, economic, and institutional. The results of the assessment of each domain and indicators were analysed using flag modelling techniques, multi-criteria analysis, through the development of a composite index (Adrianto et al., 2005). Composite index calculations were performed to produce values in each domain, and used to determine aggregate composite values in lobster fishing activities. The criteria for evaluating aggregate composites in flag modelling can be seen in Table 1.

Table 1. Criteria for evaluating aggregate composites on flag models

Value	Range	Flag Model	Description
Low	High		
1	21		Poor
22	41		Less
42	60		Average
61	80		Good
81	100		Excellent

11. In assessing the status of lobster fisheries management, several constraints are used in this analysis;

- Resources analysed were limited to lobster species, both for consumption and seed size (*larvae*)
- The number of seeds caught at the study site were greater than the catch for size for consumption
- CPUE was calculated based on lobster production size for consumption. However, effort data was not available. So, the CPUE value in the resource domain was determined based on the results of the interview
- Lobster fisheries in Lombok Tengah are classified as small-scale fisheries. On several indicators related to the permit and completeness of ship documents, the scores are maximum. Because, it is not a requirement for small-scale fishing activities.
- The data used in the analysis were the best data available; from secondary data, calculation results, and from interview results

2.4. Identification of problems and gaps in lobster fishing management

12. The Soft System Methodology (SSM) approach was used to identify lobster fisheries problems in Lombok Tengah District. In the SSM approach, stakeholder analysis was carried out complexly, not only identifying actors involved in lobster fisheries management but also identifying the roles of each of these actors. Three analyses were conducted on stakeholder analysis;

- 1) Intervention analysis, identifying the actors who have roles as a client, problem solver, and problem owner.
- 2) Social analysis, identifying the roles, norms and values of each stakeholder that acts as a problem owner.
- 3) Political analysis, clarifying the disposition of power and nature of power for each stakeholder which is a problem owner.

13. Furthermore, the results of the three analyses above will clarify the interactions that occur in each stakeholder in lobster fishing activities. The interaction was arranged into a rich picture that showed the structure and process of lobster fishing activities in Lombok Tengah District. The structure depicts the reporting and communication patterns for each stakeholder, both formally and informally: while

the process in question is the implementation of monitoring and control. In addition, the rich picture will also show the problems that exist in each structure and process of lobster fishing.

14. Determination of strategies to solve problems in lobster fisheries, were done by using root definitions (RDs) analysis. The RDs analysis states that efforts to solve the problem use the general PQR formula, which is to work P with Q to realize R. The letters P, Q and R are symbols used to answer what (P), how (Q), and why (R). The PQR formula is then analysed in more detail using CATWOE analysis, namely identifying customers, actors, process information, worldview, owner, and environment. This identification is the result of in-depth interviews with stakeholders.

15. The results of the RDs analysis were used to create a conceptual model. The conceptual model was created from formal and non-formal law/rules. Then, the concept will be verified. Verification was carried out for all stakeholders involved in lobster fishing activities in Central Lombok Regency, via discussion. The discussions carried out at this stage were a personal discussion with stakeholder representatives, part of problem owner.

2.5. Inequality in lobster fishing management

16. The gap that occurred in the management of lobster fisheries in Central Lombok Regency was analysed by gap analysis. Gap analysis using SSM approach was done through a comparison between conceptual models and real world, to find out what should be done and what has been done in lobster fishing activities. This comparison is expected to help know the gap between the conceptual model and the real world. The real world is the management of lobster fisheries in Lombok Tengah District.

17. Based on the result of gap analysis, an alternative formulation of management strategies then to be applied to resolve the problems inherent in lobster fishing activities. The formulation of management strategy was the result of discussions with stakeholders, which are classified as the problem owners. It is expected that the management strategy produced in this study can be accepted and carried out by the actors of lobster fishing activities in Lombok Tengah District. The flow diagram of the methodology is presented in Figure 2.

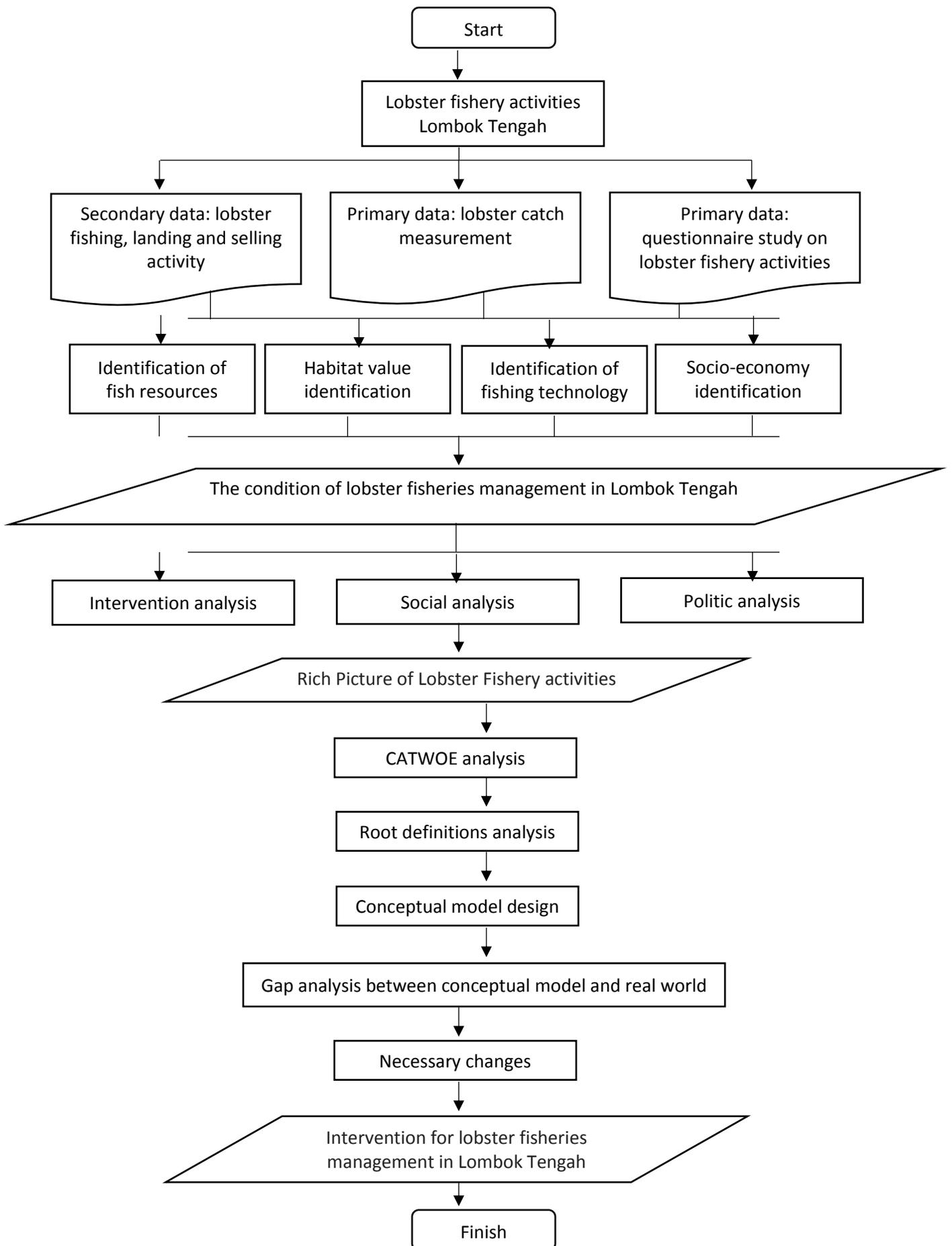


Figure 2 Flow chart methodology

3. Result and discussion

3.1 General conditions of lobster fisheries in Lombok Tengah District

18. The research location, administration of Pujut Sub-district, Lombok Tengah District, is directly adjacent to the Indian Ocean. The dominant population works as fishermen (Table 2) (BPS, Lombok Tengah District, 2019) and no women work as capture fishers. One of the fish resources caught by fishermen at that location is lobster. The lobster is caught using gillnet, trap, and compressor diving.

Table 2. The number of fishermen and the number of fishermen groups in Pujut Sub-district

Village	Number of fishermen	Number of fishermen groups
Mertak	544	12
Kuta	523	12
Sengkol	335	8

(Source: BPS Lombok Tengah District, 2019)

19. There are several types of lobster caught at the study site; Ornate Spiny Lobster (*Panulirus ornatus*), Scalloped Spiny Lobster (*Panulirus homarus*), Long-legged Spiny Lobster (*Panulirus longipes*), Painted Spiny Lobster (*Panulirus versicolor*), and Stone Lobster (*Panulirus spemicillatus*) (Table 3). Ornate Spiny Lobster, Scalloped Spiny Lobster and Longlegged Spiny Lobster are the dominant types caught for consumption (Figure 3).

Table 3. Lobster species caught at the study site

Species	Local name	English name	IUCN Status
<i>Panulirus ornatus</i>	lobster mutiara	Ornate Spiny Lobster	Least concern
<i>Panulirus homarus</i>	lobster pasir	Scalloped Spiny Lobster	Least concern
<i>Panulirus longipes</i>	lobster batik	Longlegged Spiny Lobster	Least concern
<i>Panulirus versicolor</i>	lobster bambu	Painted Spiny Lobster	Least concern
<i>Panulirus penicillatus</i>	lobster batu	Stone Lobster	Least concern

(Source: International Union for Conservation of Nature (UCN). The IUCN redlist threatened species www.iucnredlist.org; Survey result, 2019)



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Figure 3. The types of lobster the size of the dominant consumption caught

20. In 2015, the Minister of MMAF began enacting Permen KP No. 1/2015 concerning Catching Lobster (*Panulirus spp.*), Crab (*Scylla spp.*), and Blue Swimming Crab (*Portunus pelagicus*). Permen KP No. 1/2015 prohibits catching lobster laying eggs and regulates the size of lobster that can be caught; lobster with carapace length >8 cm. Then in 2016, the Permen KP No. 1/2015 was revoked and declared invalid due to the enactment of Permen KP No. 56/2016 concerning the Prohibition of Catching and/or Exporting of certain size/stage of Lobster (*Panulirus spp.*), Crab (*Scylla spp.*) and Blue Swimming Crab (*Portunus spp.*) from the Territory of the Republic of Indonesia. The Permen KP No. 56/2016 regulation bans the export of lobster which lay eggs and carapace length <8 cm from Indonesia. In addition, the Permen KP No. 56/2016 also prohibits selling lobster seeds for culture, except for education, research and development purposes. The government takes strict action against fishermen who catch lobster seeds. This caused the number of fishermen who caught lobster seeds to decrease and the fishermen returned to catching lobsters.

21. The existence of Permen KP Regulation No. 56/2016 has a significant impact on the economy of lobster fishermen in Lombok Tengah District, especially lobster fishermen in the Awang Bay, Bumbang Bay and Gerupuk Bay areas. The lobster fishermen experienced a drastic decline in income because fishermen made the catch and sale of lobster seeds. Then, Lobster the size of consumption is captured by using gillnet and *krendet* fishing gear. *Krendet* is a kind of circle trap with a net inside the circle. Its operations are placed at the bottom of sandy or muddy waters.

22. While the size of seeds, lobsters are caught by using *pocong*. *Pocong* is a fishing gear modified by local fishermen who put fan-shaped cement paper on the net/*waring* (Figure 4). The pockets are then tied to floating net cages for one night. Lobster seeds will stick to the folds of the fan, making it easier for fishermen to collect them. The use of fishing gear is simple and easy to operate then easy to get money causing fishermen in Lombok Tengah District to catch lobster seeds.

23. When lobster seeds have a price, almost all lobster fishermen turn to catching lobster seeds, although there are some fishermen who continue to catch adult lobsters. However, since Permen KP No. 56/2016 concerning the Prohibition of Catching and/or Exporting of certain size/stage of Lobster (*Panulirus spp.*), Crab (*Scylla spp.*) and Blue Swimming Crab (*Portunus spp.*) from the Territory of the Republic of Indonesia applies, The Government through the Supervision of Fisheries and Maritime Resources takes strict action against fishermen who catch lobster seeds. This caused the number of fishermen who caught lobster seeds began to decrease and the fishermen returned to catching adult lobsters.



Figure 4. *Pocong*, a fishing gear modified by local fishermen to catch lobster seeds (Photo Source: Team Documentation, 2019)

24. The number of fishermen who are active in catching lobster in the waters of Lombok Tengah District is 1 402 people. The average lobster fisherman catches lobster seeds ranging from 50—150 seeds per person per day. In one month, lobster fishermen catch seeds for 20 days. The price of lobster seeds ranges from IDR 6 000 – IDR 10 thousand per seed. Whereas in lobster consumption measurement activities, the average number of lobsters caught is between 5 to 15 seeds per person per week. The selling price of live lobster for consumption is IDR 375 000 per kilogram, while the selling price for consumption lobster in dead condition is IDR 275 000 per kilogram (in one kilogram, about 3-4 individuals). Thus, the average lobster fishermen's income for consumption is IDR 2 812 500 per month per person. Meanwhile, lobster fishermen who catch seeds have an average income of IDR 12 million per month per person. Lobster fishermen in Lombok Tengah District conduct lobster fishing activities for 7 months in 1 year. According to the community's perception, the average condition for other 5 months is not possible to catch because it is considered cold water. Then, the community does not catch lobsters, both lobster seeds and consumption size.

3.2 Assessment of lobster fisheries EAFM indicators

3.2.1 Status of lobster fisheries management

25. The results of the calculation of composite values for the 6 domains in the EAFM approach for lobster fisheries management in Lombok Tengah District are shown in Table 4. Of the six domains, the lowest composite value is fish resources (low/less) and the highest (good) is the habitat and aquatic ecosystem domain.

Table 4. The results of a composite assessment of 6 domains on the EAFM approach to lobster fisheries management in Lombok Tengah District.

Domain	Composite	Description
Fish Resources	35	Low
Habitat and Ecosystem	67	Good
Fishing Techniques	43	Medium
Social	53	Medium
Economy	48	Medium
Institutional	55	Medium
Aggregate	50	Medium

26. The low value of the composite domain resource not only shows the scarcity of resources at the moment, but also shows the high threat of resource extinction in the future due to high seed capture. The low value of lobster resources is not influenced by habitat conditions and aquatic ecosystems. This value is influenced by the capture of lobster, the size of the seed has a high economic value and is easier to catch compared to the size for consumption.

27. Although there are regulations regarding catch size and law enforcement, lobster resources in Lombok Tengah District are potentially over fished because, catching lobster seeds is quite massive. According to Israel & Cesar (1997), one of the causes of overfishing is, many fish are caught even before the fish have a chance to grow.

28. Meanwhile, in the real conditions at the study site, the lobster fishermen said that though they caught the lobster seeds constantly, they did not experience a reduction. They admit that they feel they protect the lobster seeds from being carried away by the current, by letting lobster seeds enter between sacks or *pocong*.

29. The lobster resource domain is a priority because its assessment results are lowest compared to the 5 other domains. However, that does not mean an increase in other domains is not done at all. It could be that some indicators in several domains have the effect of improving and enhancing the lobster resource domain. But, there are also other indicators and domains that did not show the impact of improvements to the lobster resource domain. So, it is necessary to do a more in-depth analysis to be able to find out what has impacted in the improvement of each indicator in each domain. This step needs to be done, so the Government can provide an effective and efficient program for the management of lobster fisheries in Lombok Tengah District. Explanation of each indicator for each domain is as follows;

3.2.2 Lobster resources

30. The composite value for the lobster resource domain in lobster fisheries in the Awang Bay, Bumbang Bay, Gerupuk Bay in Lombok Tengah District, NTB Province is 35 (light yellow flag) which is in low status. The status is because the score (score) for each indicator of the resource domain is 1 except for the ETP species (endangered, threatened and protected) (score = 2). The results of the multiplication of the scores and values of each indicator can be seen in Figure 5 and Figure 6.

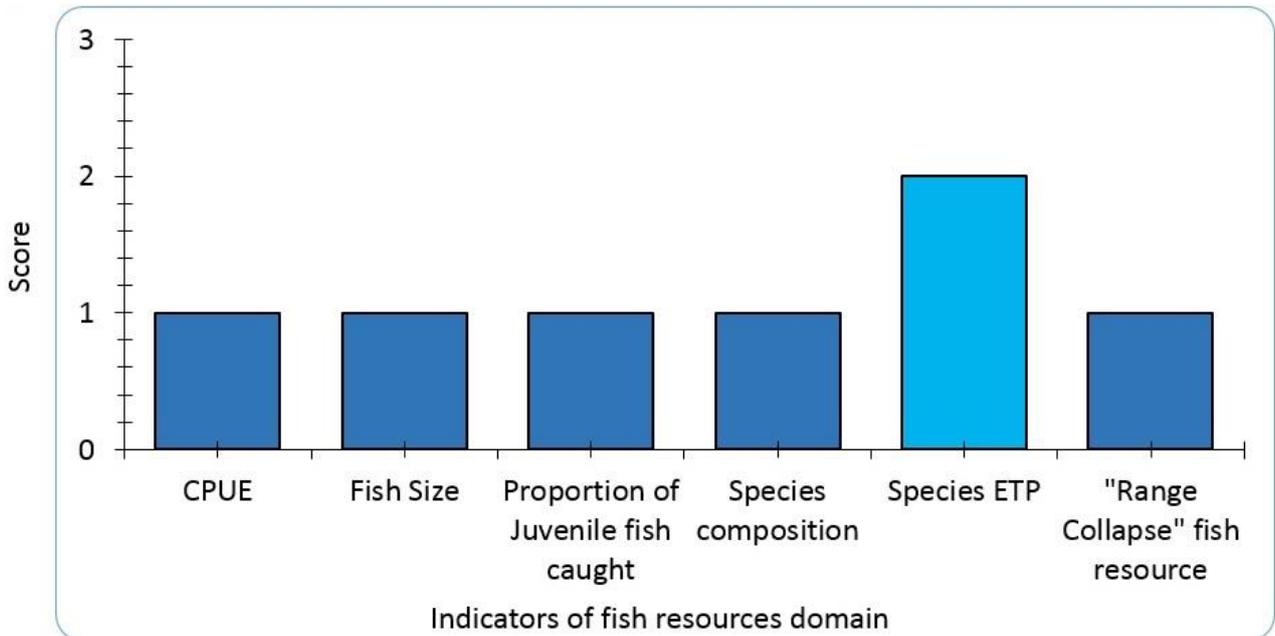


Figure 5. Scores for each indicator in the domain of fish resources in lobster fisheries in Lombok Tengah District, NTB Province.

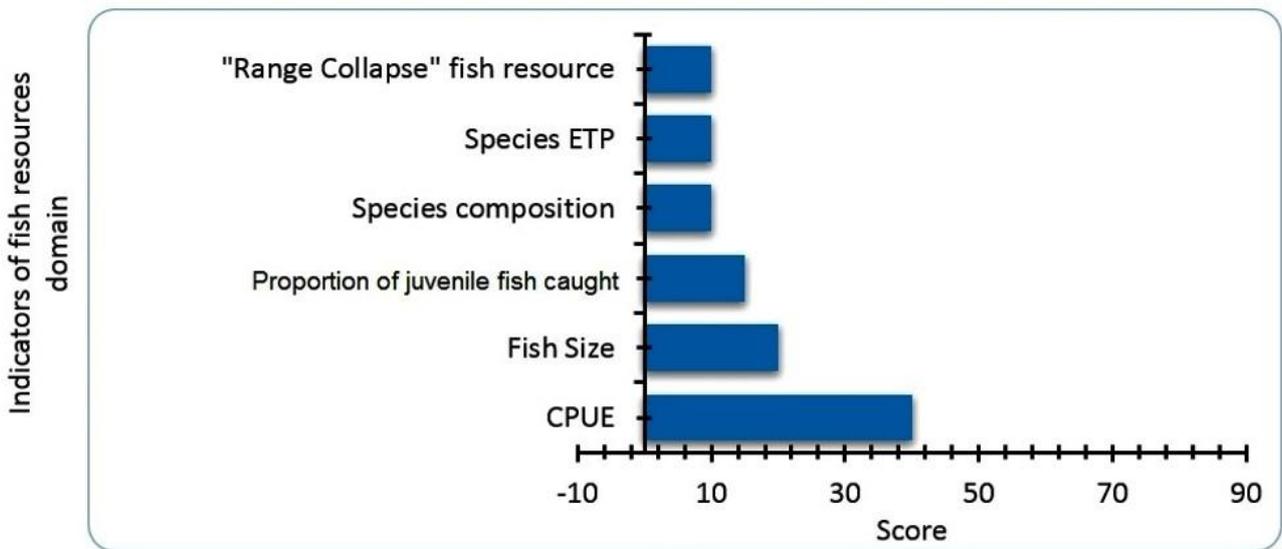


Figure 6. Assessment of lobster resource domain indicators in lobster fisheries in Lombok Tengah District, NTB Province

31. The default CPUE value cannot be calculated because the data available were only production data and no data effort were available. Therefore, CPUE values were obtained from interviews with lobster fishermen. The CPUE value is given a score of 1 based on fishermen's statement that lobster catches as a measure of that for consumption tend to lead to a decrease in the period of 1994 to 2019 (See Focus group discussion result, Appendix 6).

32. In 2018 until 2019, if lucky, lobster fishermen can catch 1—10 kg of lobster in one fishing trip. However, fishermen also often do not get catches, especially for fishermen who use bottom gillnets. The bottom gillnets are used by fishermen to catch lobsters as the main catch, but in reality, the basic gillnets are more dominant for catching reef fish. The ratio of the catch of the target species (lobster) to non-target species (other than lobster) using a basic gillnet catch is 1:100.

33. The size of lobsters caught by fishermen in Central Lombok Regency can be grouped into two; Lobster of the size of consumption and Lobster the size of seeds.

34. Catching lobster seeds on a large scale began around 2012 because the selling price of lobster seeds is quite high. According to respondents, size of lobster that was caught by fishermen tends to decrease in the period of 2014 to 2019. According to fishermen who catch consumption sized lobster, large size (more than 1 kg per head) is increasingly difficult to find. Respondents stated that catching lobster the size of consumption is difficult because the number of fishermen is increasing. Ornate Spiny Lobster is the hardest to get and catch. In addition, fishermen also stated that fishing ground for catching lobster of the size of consumption is getting farther away. In 1994, it only took 30 minutes to get to the lobster fishing ground location, but in 2019 it took 2 hours to reach the lobster fishing ground.

35. Information obtained from local lobster fishermen in Lombok Tengah shows that ETP (Endangered species, Threatened species, and Protected species) have been caught. The species caught i.e. sea turtles. But in the last 2 years, no more ETP species was reported to be caught by lobster fishermen, because, Lombok Tengah Water is not a migration location and habitat for ETP species. Until now, no study explained Lombok Tengah District is habitat and/or migration pathway of ETP species.

36. The lobster resources in Lombok Tengah District is experiencing growth overfishing and recruitment overfishing. Atmaja *et al.*, (2011) states that growth overfishing occurs when fish are caught before they have time to grow, and recruitment overfishing occurs as a result of reducing the number of juvenile entering the catching area. In Lombok Tengah, overfishing recruitment occurs due to habitat degradation that affects the nursery area. The rise of development in the tourism sector in the coastal area of Central Lombok Regency has caused some coastal ecosystems degradation.

37. Therefore, the government needs to provide lobster fishermen with a correct understanding regarding the condition of lobster resources in the waters of Central Lombok Regency. In addition, there needs to be a study on the availability of lobster resources in the waters of Central Lombok Regency and their status, so that the results of the study can be informed to lobster fishermen.

38. Therefore, the government needs to share knowledge with lobster fishermen. In addition, studies on the availability of lobster resources and how their current status in Lombok Tengah is needs to be done. So, the results of the study can be informed to lobster fishermen.

3.2.3 Habitat and ecosystem

39. Habitat and ecosystem are in good status with a composite value of 67 (green flag). Each indicator has a score of ranged 2—3, except for the status of mangrove ecosystems and climate change, which is worth 1 (Figure 7). The results of the multiplication of scores and weights of each indicator can be seen in Figure 8.

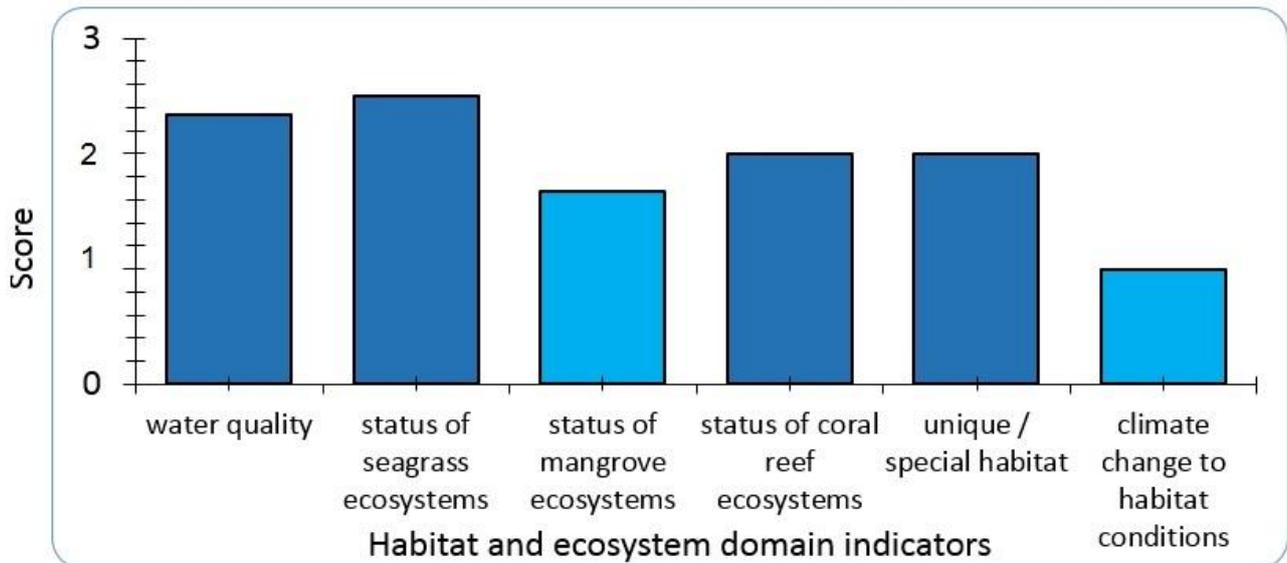


Figure 7. Scores for each indicator in the domain of Habitat and ecosystem in lobster fisheries in Lombok Tengah District NTB Province

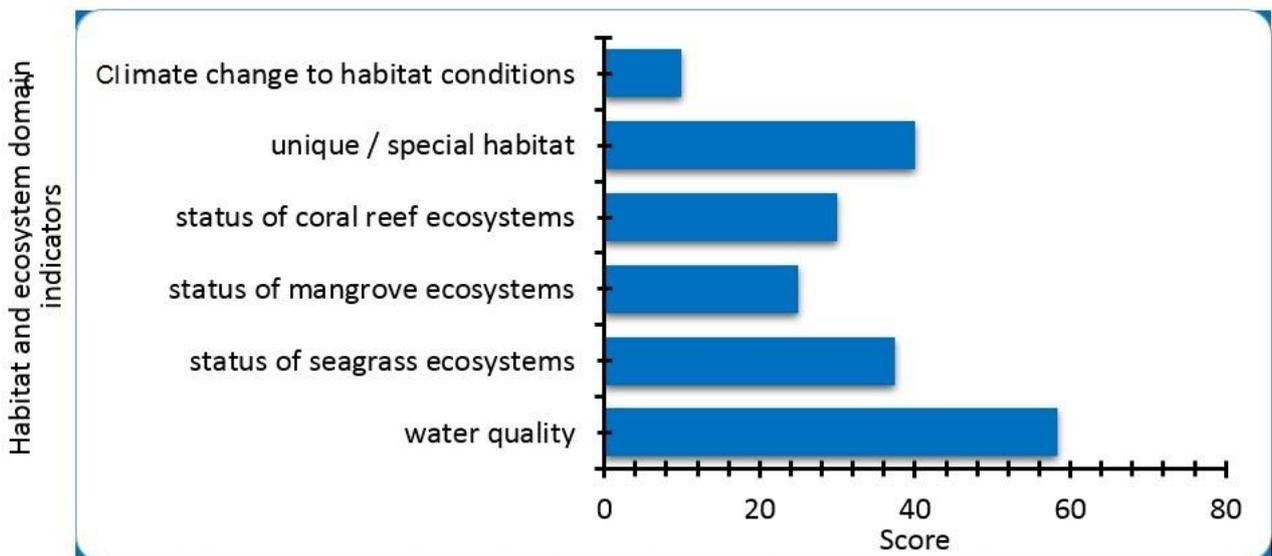


Figure 8. Assessment of habitat domain indicators and aquatic ecosystems in Lombok Tengah District, NTB Province

40. The value for the status of mangrove ecosystems is low because the area of mangrove areas has decreased since the last 20 years. Observations at the study site showed that the development of the tourism sector sacrificed the mangrove area. Meanwhile, the results of Rasyid *et al.*, 2014, showed that the mangrove area in the 1999 was 325.79 ha and decreased in 2006 to 202.68 ha. The mangrove forest is concentrated in the Bumbang Bay and Awang Bay (Pujut Subdistrict). Mangrove species in Lombok Tengah district are dominated by *Rhizophora mucronata*, *Rhizophora apiculata*, *Rhizophora Stylosa*, *Avicennia officinalis*, *Avicennia alba*, *Sonneratia griffithii*, and *Sonneratia alba*. Other types of mangroves rarely found are *Bruguiera gymnorhiza*, *Bruguiera sexangula*, *Ceriops decandra*, *Ceriops tagal*, *Excoecaria sp.*, *Xylocarpus mollucensis*, *Xylocarpus granatum*, *Aegicerias corniculatum*, *Aegerias deculsion* and *Ceriops tagal*, *Excoecaria sp.*

41. Indicator of the status of mangrove ecosystems and unique/special habitats indicates the priority for managing habitat and aquatic ecosystems in Lombok Tengah District. Mangrove ecosystem is a type of tropical forest that has a very important ecological function, especially in relation to coastal fishery commodities. Mangrove functions as a nursery ground, spawning ground, and feeding

ground (Saparinto, 2007). In more detail, Gunarto, 2004 states that primary production in the waters around mangroves is high enough for water fertility, so it becomes a feeding ground for macro fauna, it is then utilized by aquatic animals that are at higher trophic levels. Therefore, the loss of mangrove areas can cause negative impact for the diversity of fish resources in a coastal area. Meanwhile, effective management of unique/special habitats can guarantee the availability of fish resources in a coastal area because they are given the opportunity to breed.

42. Meanwhile, the scores for climate changes are given a low score because research related to climate change in the waters of Lombok Tengah District has not been yet conducted. The real impact of climate change on the lobster ecosystem in the Awang Bay, Bumbang Bay and Gerupuk Bay is not yet known.

43. The water quality of Awang, Bumbang and Gerupuk Bay is relatively good (Table 5), but there are several threats to aquatic habitats and ecosystems, including plastic waste and water pollution from boat/ship waste. In the Awang Bay area, a national port has been inaugurated. However, it is not operated optimally. However, if the port operates effectively, the waste discharged from the ship (ballast water) can affect the quality of the waters. Moreover, it will have an impact on the assessment of habitat and aquatic ecosystem status. Teluk Awang and Gerupuk Bay are public areas, while Bumbang Bay is being reserved as a conservation area. Teluk Bumbang is reserved as a conservation area because ecological, economic, and social parameters are suitable for conservation.

Table 5. Water quality at lobster fishing grounds

Water quality	Bumbang Bay ¹⁾	Awang Bay ¹⁾	Gerupuk Bay ^{2) 3)}
Depth (m)	3.5 – 15.1	1.5 – 9.6	4.5 – 9.8
visibility (m)	3.2 – 14	1.3 – 9	-
Temperature (°C)	29.75 °C – 31.2	29.65 – 30.7	26.5 – 32.10
Salinity (‰)	32.59 – 33.24	32.06 – 32.97	26 – 3.75
pH	8.61 – 8.85	8.51 – 8.67	7.97 – 8.46
DO (mg/l)	5.81 – 8.89	5.51 – 6.65	5.67 – 10.26
Ammonia (mg/l)	0.001 – 0.037	0.001– 0.018	0.00 – 0.09
Nitrate (mg/l)	0.012 – 0.675	0.02 – 0.901	0.01 – 0.04
Phosphate (mg/l)	0.03 – 1.855	0.03 – 0.685	0.03 – 2.64
Chlorophyll-a	0 – 0.1601	0 – 1.548	0.00 – 0.46
Area Status	Reserve of conservation area	Public Area	Public Area
Unique habitat	<i>Spawning ground/nursery ground lobster*</i>		

Note: * Not yet known, but the availability of captured seeds indicates the location of spawning ground/nursery ground (Source: ¹⁾Marpaung *et al.*, 2018; ²⁾Putra *et al.*, 2012; Radiarta & Erlania, 2015)

44. Lombok Tengah District has several areas that have seagrass, but the highest seagrass cover is on the coast of Kute Village, which is 43.61 percent, with sand substrate and has 103 cm of canopy. There are 11 species of seagrasses (out of 12 species of seagrass found in Indonesia); *Enhalus acoroides*, *Thalassia hemprichii*, *Cymodocea rotundata*, *Cymodocea serulata*, *Halodule uninervis*, *Halodule pinifolia*, *Syringodium isoetifolium*, *Halophila Ovalis*, *Halophilaulosa minor*, *Halophila spinosa* and *Halophilaosaosa Thalassodendron Ciliatum* (Rasyid *et al.*, 2014).

45. The results of research conducted by WCS (2011) in Rasyid *et al.*, (2014) showed that Lombok Tengah water were dominantly covered by 3 types of substrates; 33.10 percent algae, 29.48 hard corals, and 26.92 percent soft coral. In addition, there are also other types of substrates such as sand, but very low, no more than 10 percent. The hard coral genera found were quite diverse, including 27 coral genera; *Acropora* (27 percent), *Porites* (25 percent), and *Montipora* (13 percent), while other genera range less than 10 percent (WCS, 2011 in Rasyid *et al.*, 2014).

46. Result of interviews with lobster fishermen indicated that there are unique/special habitats in

Awang Bay, Bumbang Bay, and Gerupuk Bay. According to lobster fishermen, the unique/ special habitat is rocks or coral reefs ecosystem along the bay. The unique/special habitat is the location of spawning lobsters. However, lobster fishermen's knowledge is used to catch lobster seeds. Therefore, unique/special habitats have not been managed well. Until now, there has been no specific research to determine the unique/special habitat related to lobster fisheries in Lombok Tengah District.

3.2.4 Lobster fishing techniques

47. The technique of catching lobsters in the Awang Bay, Bumbang Bay, Gerupuk Bay in Lombok Tengah District, NTB Province is in average status with a composite value of 43 (yellow flag). Some indicators have a low value (1) due to the use of a modified fishing gear called *pocong*, causing the high amount of juvenile lobster caught (Figure 9). The results of the multiplication of the scores and values of each indicator can be seen in Figure 10.

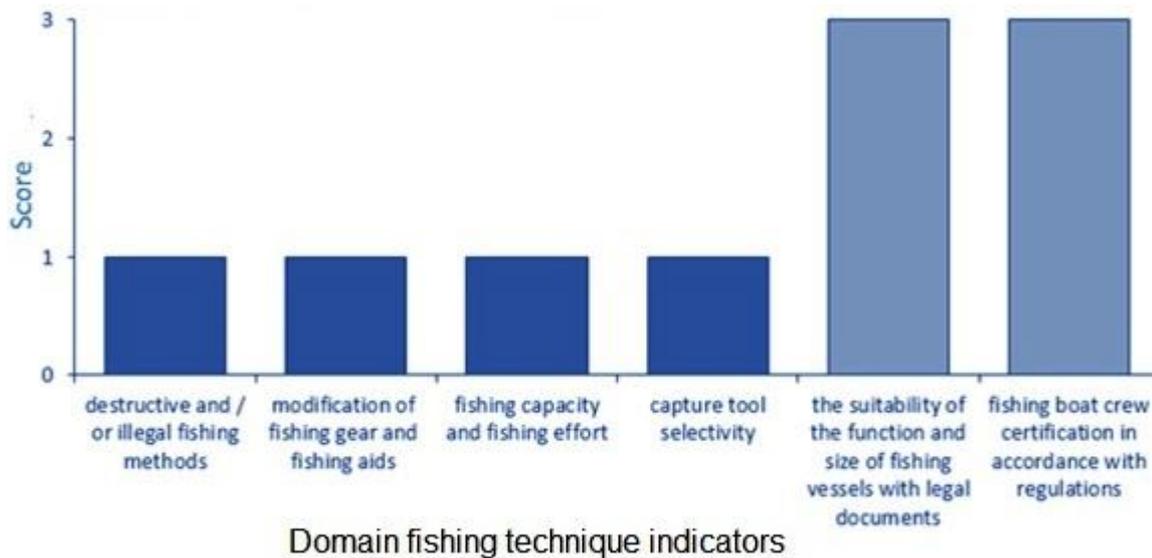


Figure 9. Scores for each indicator in the domain of Catching/fishing technique in lobster fisheries in Lombok Tengah District NTB Province.

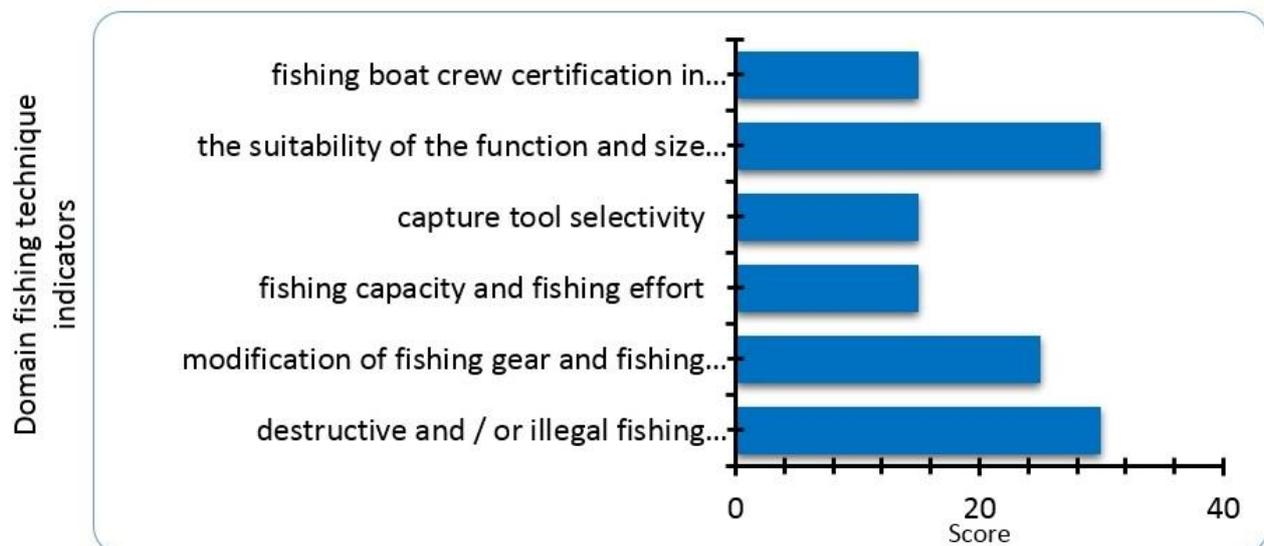


Figure 10. Domain assessment of lobster fishing techniques in lobster fisheries in Lombok Tengah District

48. The fishing gear used by fishermen to catch consumption-size lobsters in the Awang Bay, Bumbang Bay, and Gerupuk Bay area, basic gillnets, traps, and diving with a flashlight and compressor. Meanwhile, catching lobster seeds using modified fishing gear, called *pocong*.

49. Diving with compressor is prohibited based on Law No. 31/2004 concerning Fisheries and Law No. 45/2009 concerning Amendment to Law Number 31/2004 concerning Fisheries. Meanwhile, the modification of the basic gillnet fishing gear, equipped with *pocong*, is an irresponsible fishing gear because lobster seeds are targeted. Permen KP Regulation No. 56/2016 concerning lobsters, crabs and blue swimming crabs, regulates the prohibition of lobster catching <200 gram and/or carapace length <8 cm.

50. Lobster capture capacity in Lombok Tengah District has a ratio value <1 due to the ineffective use of lobster capture gears in catching lobster of consumption size. The effort to catch lobster continued every day, but the production of lobster caught has not increased.

51. Trap fishing gear used by lobster fishermen in the Awang Bay, Bumbang, and Gerupuk Bay areas, and has a high level of selectivity. Trap is a selective fishing gear, because small sized catches can escape from the trap. The potential for bycatch is relatively small and has a very minimum impact on bottom communities (Groneveld, 2000; Eno *et al.*, 2001).

52. The bottom gillnets used by lobster fishermen in the Awang, Bumbang, and Gerupuk Bays are not selective in fish species. Species caught by bottom gillnets are dominated by non-target species, with a ratio of 1:100. In addition, bottom gillnets with attached *pocong* caught dominantly the lobster of seed size. The size of mature lobster based on its type is presented in Table 6.

Table 6. The size of mature lobster based on its type

No.	Species	Carapace length of mature lobster (mm)	Source
1	Ornate spiny lobster	>98.10	Zakaria, 1999
2	Scalloped spiny lobster	>57.50	Kulmiye, 2006
3	Longlegged spiny lobster	>55.00	Gomez, 1994
4	Painted spiny lobster	>78.00	Frisch, 2007
5	Stone lobster	>66.63	Chang, 2007

(Source: Irfannur *et al.*, 2017)

53. Lobster fishermen in Central Lombok Regency are small-scale fishermen category, because the boat units are <5 GT with Length Overall (LOA) of 4.5—10 meter. Therefore, lobster fishermen are not required to have ship documents. Fishermen only have a fishing card as a legal document to carry out fishing activities. In Permen KP No. 5/2019 concerning Amendment to Permen KP Number 23 concerning Registration and Marking of Fishing Vessels, vessels that must be registered are >10 GT. In addition, lobster fishermen in Lombok Tengah District also do not have a crew certification or other expertise certificates related to fishing activities.

3.2.5 Social

54. The social domain in the Awang Bay, Bumbang Bay, Gerupuk Bay in Lombok Tengah District, NTB Province is in the average status with a composite value of 53 (yellow flag). Stakeholder participation has the lowest score, because the community considers that government involvement in the management of lobster resources was still lacking. Fishermen have a perception that they are not a part of the stakeholders. Therefore, the value of participation is very low.

55. So far, there has been involvement of the government and other related parties in assisting and improving lobster fisheries. However, the frequency of activities and supervision were still low due to the limited human resources available. The results of the multiplication of the scores and values of each indicator can be seen in Figure 11 and Figure 12.

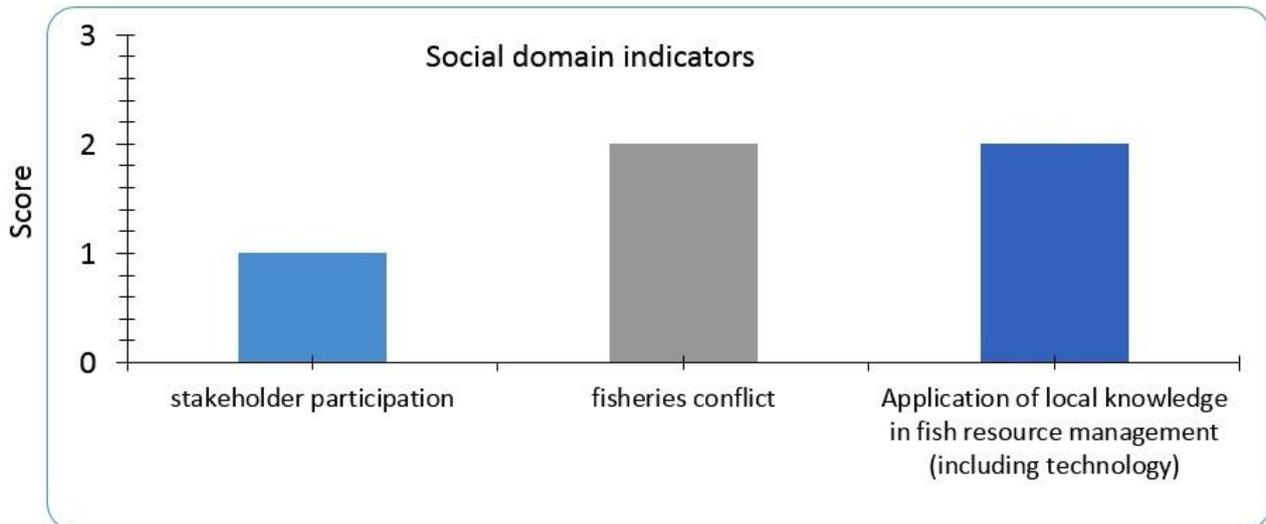


Figure 11. Scores for each indicator in the domain of Social in lobster fisheries in Lombok Tengah District NTB Province

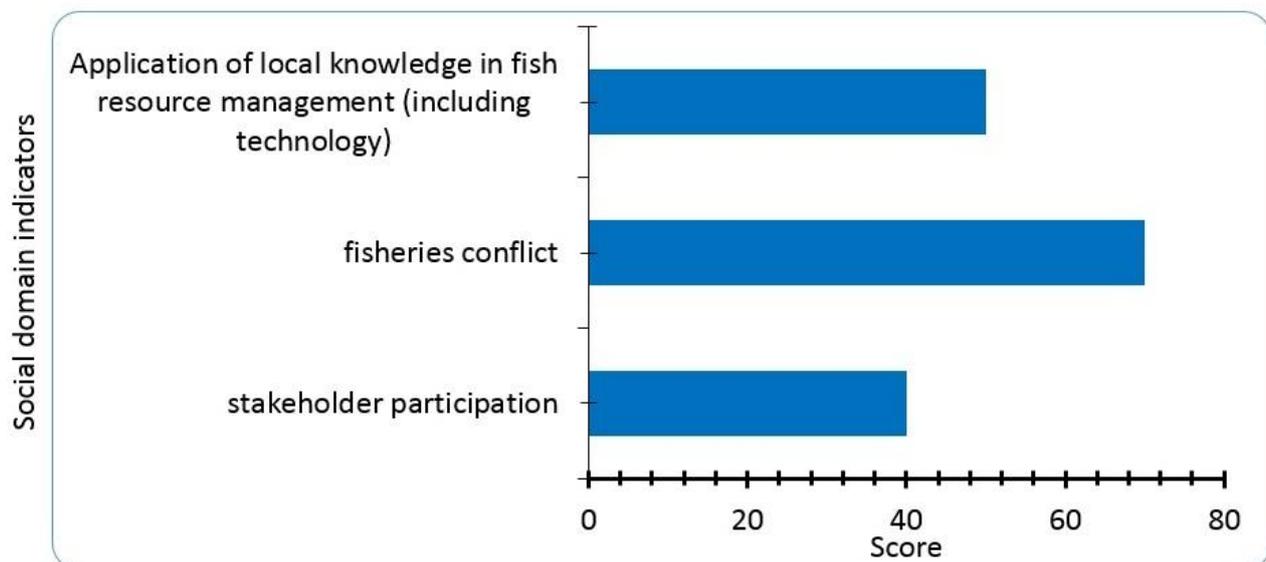


Figure 12. Social domain assessment in Lombok Tengah District

56. Lobster fishermen in the Awang Bay, Bumbang Bay, and Gerupuk Bay areas stated that the local government is only involved in providing socialization related to Permen KP No. 56 /2016 concerning Prohibition of Lobster Capture and/or Exporting (*Panulirus* spp.), Crab (*Scylla* spp.), and Blue Swimming Crab (*Portunus* spp.) from the Territory of the Republic of Indonesia. According to the lobster fishermen, socialization related to the Permen KP conducted by (Fisheries and Marine Office) DKP NTB Province and NGOs (non-government organizations). In addition, based on observations, there are involvement of fisheries supervisors and police in conducting surveillance and taking action against lobster fishermen who catch lobster seeds.

57. Lobster fishing in Lombok Tengah District has conflicts. The horizontal conflict occurred between them; the conflict over the lobster fishing area between Bumbang Bay and Gerupuk Bay lobster fishermen. Lobster fishermen from Bumbang Bay catch lobster using lights. According to Gerupuk Bay fishermen, this causes the lobster seeds in Gerupuk Bay to be reduced because they moved to Bumbang Bay following the lights. In addition, lobster fisheries have also a vertical conflict between lobster fishermen and the government due to the policies/regulations. Lobster fishermen, around 20 years ago caught lobster seeds as their main livelihood, felt wronged by the existence of Permen KP No. 56/2016. Therefore, until now, lobster fishermen still hope a review of the policy/regulation. Lobster fishermen in Lombok Tengah District do not agree with the Permen KP No.

56/2016, which should aim to conserve lobster resources and provide business sustainability for the lobster catching business.

58. Lobster fishermen have good local knowledge related to lobster resources based on experience in fishing activities; they know where lobster is spawning and foraging. However, the knowledge they gained was not fully utilized in managing lobster resources. Meanwhile, the use of *awik-awik*, the local rules of the Sasak tribe, are no longer applied due to their limitations. *Awik-awik* only applies to very limited areas, only applied within a village and not applied between villages. The interview results showed that 52.63 percent of respondents answered that there were local rules applied in the management of lobster resources; *ajikrame* or social sanctions for violators of the agreement.

59. *Awik-awik* is an unwritten local policy such as norms, customary law, regulations, prohibitions, and sanctions regarding community relations such as marriage, theft and others. These *awik-awik* are often adopted to manage coastal fishery resources (Indrawasih, 2008; Ayunda & Anna, 2015).

60. There needs to be an improvement in public perception regarding stakeholder participation. This participation can help strengthen the local knowledge of fishermen about their best practices in managing lobster fisheries. According to Suhardono (2015), conflicts can be resolved democratically and constructively, so the conflicting parties can get the opportunity to solve the problems they have. Moreover, involving neutral and fair third parties help solve their problems.

3.2.6 Economy

61. The economic domain in the Awang Bay, Bumbang Bay, Gerupuk Bay in Lombok Tengah District, NTB Province is in the medium status with a composite value of 48 (yellow flag). Asset ownership is not reduced, but the monthly income of dominant fishery households is below the provincial minimum wage (Figure 13). The results of the multiplication of the scores and values of each indicator can be seen in Figure 14.

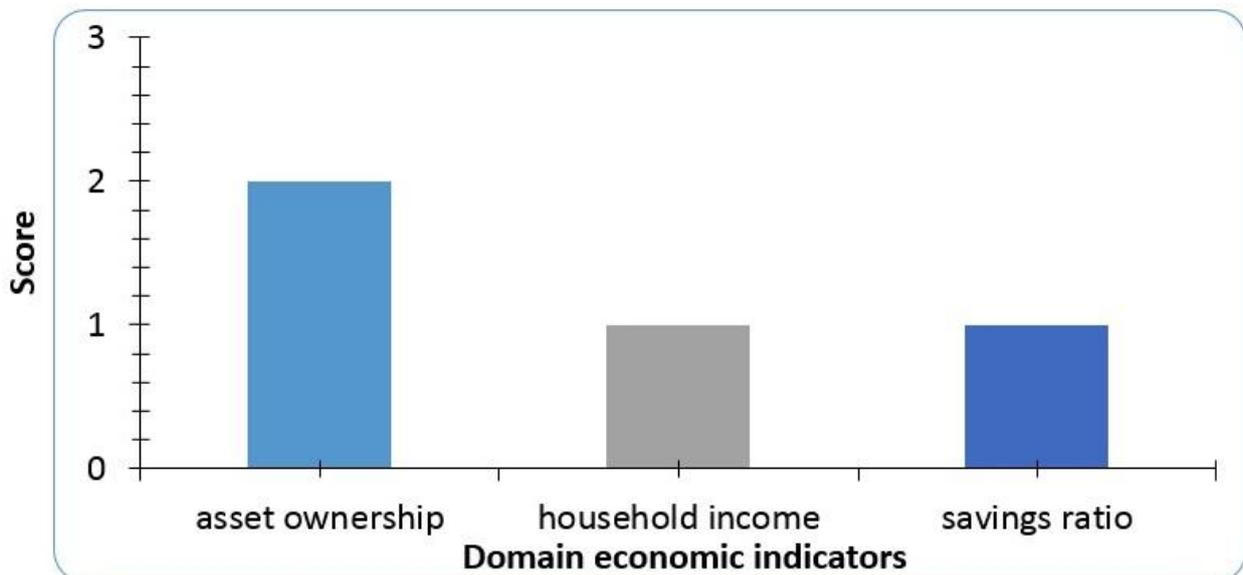


Figure 13. Scores for each indicator in the domain of Economy in lobster fisheries in Lombok Tengah District NTB Province

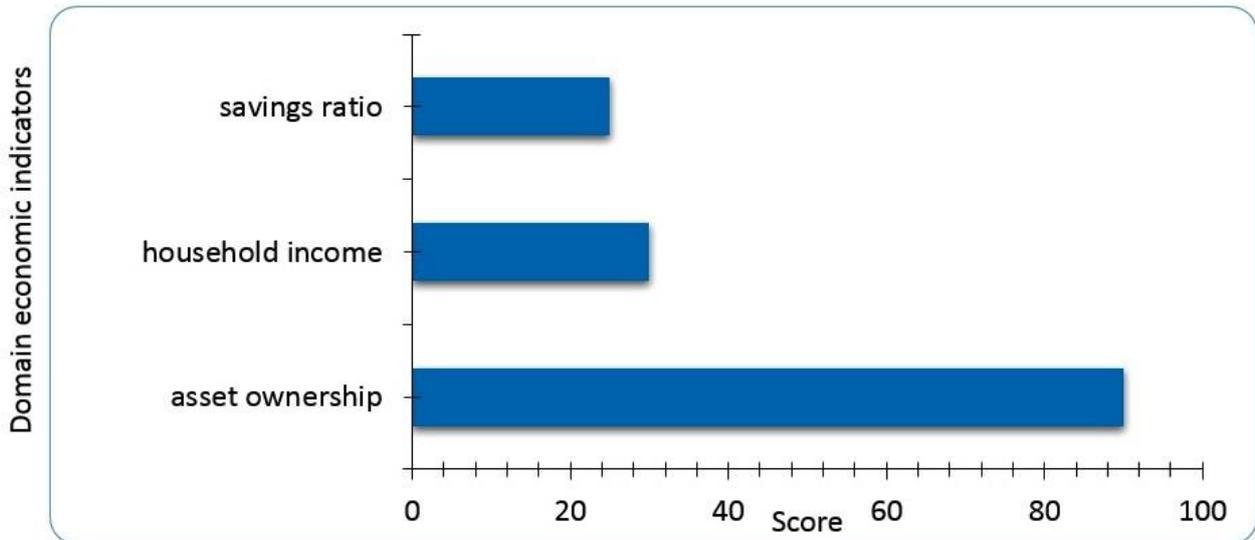


Figure 14. Economic domain assessment in Lombok Tengah District

62. Lobster fishermen in Lombok Tengah District have productive assets; boats and fishing gear. For more than 5 years as a lobster fisherman, the value of these productive assets has not increased. Lobster fishermen claim to have decreased income because of Permen KP No. 56/2016. Prior to 2016, lobster fishermen had an average income of more than IDR 3 million per day from catching and selling lobster seeds. However, since the enactment of Permen KP No. 56/2016, lobster fishermen admit to having income below IDR 3 million per month, even only IDR 3 thousand per month. But, the income can reach more than IDR 2 million per month if catching and selling other fish (reef fish) are added.

63. The results of interviews with lobster fishermen showed that 18.42 percent of respondents had a net income >IDR 3 million per month; 18.42 percent of respondents have a net income of IDR2—3 000 000 per month; 51.32 percent of respondents have a net income of IDR1—2 million per month; and 11.84 percent of respondents net income <IDR1 million. Based on the NTB Governor Decree No. 561-774/2018, the minimum salary for the NTB Province is IDR 2 012 610 per month. Most of lobster fishermen in Lombok Tengah District have income below the minimum salary value.

64. Lobster fishermen families' habit is spend all the income they earned and only a few save their money. The results of interviews showed that only 31.58 percent of respondents had an awareness to save money every month. They save every month about 20—50 percent of the income earned. The purpose of their savings is for health insurance, school children's needs, and incidental urgent needs. Meanwhile, 68.42 percent of respondents do not save every month; they do not have kids who have to go to school anymore.

65. Indicators in the economic domain indicate the need of increasing lobster fishermen income and number of fishermen saving their money. According to Imron (2003), several factors caused fishermen to have a low income; the limitations of technology in conducting fisheries activity, debt trap, and the limitations of market place. Almost all of lobster fishermen claimed that they have no debt. So, the government can focus on catching technology and marketing management to improve lobster fishermen income. Hopefully they no longer catch lobster seeds.

66. Fishermen have the potential to further increase income through the development of various activities: added selling value, i.e. developing various fisheries commodity-based products processing. In fact, not many fish processing activities are carried out, although the potential is significant enough to increase income.

67. After the enactment of Permen KP 56/2016, the government tried to carry out a compensation program, e.g. seaweed culture and black pomfret fish culture. However, this is not yet established, because there is not much technical and marketing assistance done. Moreover, there is little motivation for the fishermen, because the income from selling lobster seeds is bigger

than culture activity.

3.2.7 Institutional

68. The economic domain in the Awang Bay, Bumbang Bay, Gerupuk Bay in Lombok Tengah District, NTB Province is in the average status with a composite value of 48 (yellow flag). In terms of regulations, lobster fisheries are sufficient with a variety of rules, both national and local scale. However, compliance is still low. Figure 15 shows the scores for each indicator in the institutional domain. The results of the multiplication of the scores and values of each indicator can be seen in Figure 16.

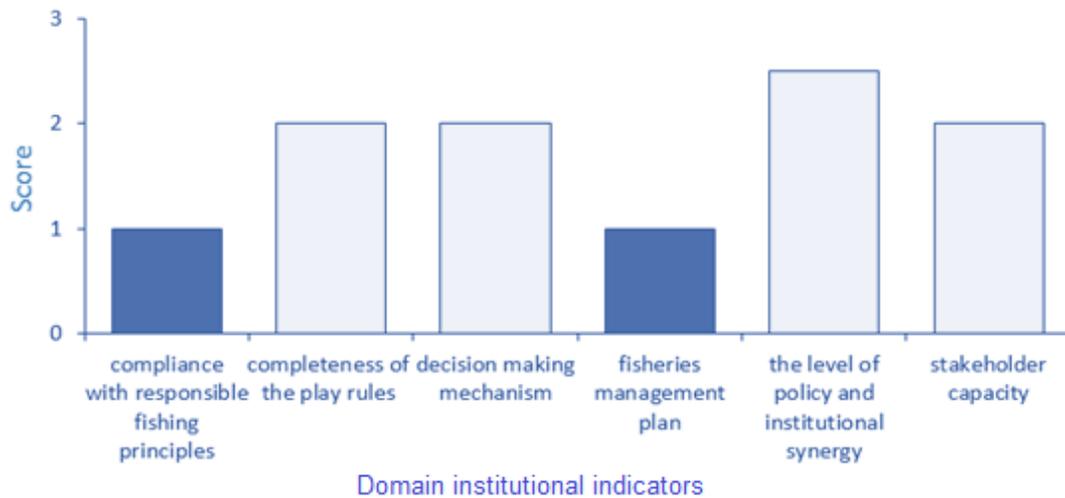


Figure 15. Scores for each indicator in the domain of Institutional in lobster fisheries in Lombok Tengah District NTB Province



Figure 16. Institutional domain assessment in Lombok Tengah District

69. Lobster in Awang Bay, Bumbang Bay and Gerupuk Bay are dominated by seed size lobsters. Since the promulgation of Permen KP No. 56/2016, the government has banned the capture and sale of lobster seeds. However, fishermen still catch lobster seeds secretly. According to fishermen the management plan described by the government is unclear. So, the keep catching lobster seeds.

70. On the other hand, fishermen's compliance with responsible fisheries principles is also low, coupled with the low level of policy and institutional synergy because it is not clearly programmed. The existing policies and institutions still run separately, there is no visible synergy between policies and the existing institutions to support responsible lobster fishing activities. For example,

there is no synergy between marine and fisheries policies and tourism policies to support sustainable lobster fisheries.

71. Although, the management of lobster fisheries in Lombok Tengah District has been supplemented by several national regulations, mentioned below, but it needs a more detailed description according to local conditions:

- a. Law Number 31/2004 concerning Fisheries.
- b. Law Number 45/2009 concerning Amendment to Law Number 31/2004 concerning Fisheries.
- c. Permen KP No. 56/2016 concerning the Prohibition of Catching and/or Exporting Lobster (*Panulirus spp.*), Crab (*Scylla spp.*), and Blue Swimming Crab (*Portunus spp.*) from the Territory of the Republic of Indonesia.
- d. Permen KP No. 71/2016 concerning Fishing Lines and the Placement of Fishing Equipment in the Fisheries Management Territory of the Republic of Indonesia.

72. Law enforcement related to Permen KP No. 56/2016 has been carried out by fisheries supervisors and police. Based on the results of the interview, some fishermen prefer to stop catching lobster seeds rather than being caught by the police. Some fishermen have been jailed. But in reality, they still catch lobster secretly due to economic factors. Therefore, legal tools and actions are often applied. Reprimand by supervisor (Marine and Fisheries Resources Supervisor/PSDKP-KKP; Marine Police; and Indonesian Navy/TNI-AL) are conducted to control irresponsible lobster seed catching activities.

73. Enforcement of rules and supervision of lobster fishing activities in Lombok Tengah District has been equipped with a decision-making mechanism (Constitution through Permen KP, technical instructions and standard operational procedure for law enforcement against violations of responsible fisheries rules), although not yet effective. The mechanism is not yet effective due to limited facilities and infrastructure in monitoring and carrying out lobster management activities.

74. Management of lobster fisheries in Lombok Tengah District, synergy between stakeholders/institutions has not yet been established. Although, communication and coordination is still carried out. Moreover, the development in the tourism sector is very massive in the coastal areas, causing a drastic reduction in the area of mangroves, which has an impact on lobster fisheries.

3.3 Problems and gap of lobster fisheries management

3.3.1 Stakeholders in lobster fishery activities

75. The results of stakeholder identification with intervention analysis, social analysis, and political analysis are explained as follows;

a) Intervention analysis

76. Determination of three parties that play a very important role in lobster fisheries are:

- Client, in this study, the clients are: Learning Center Ecosystem Approach to Fisheries Management (LC-EAFM) Mataram University and FAO-Indonesia.
- Problem solver, in this study, problem solvers are: Learning Center Ecosystem Approach to Fisheries Management (LC-EAFM) Mataram University, FAO-Indonesia, Directorate of Fish Resource Management- KKP, Fisheries and Marine Office- NTB Province, Fisheries and Marine Office- Lombok Tengah District, Head of Mertak Village, Head of Sengkol Village.
- Problem owner, In this study, problem owners are:
 - a. Government: Directorate of Fish Resource Management- KKP, Fisheries and Marine

Office- NTB Province, Fisheries and Marine Office Lombok Tengah District.

- b. Head of Village: Head of Mertak Village, Head of Sengkol Village.
- c. Business actors: lobster fishermen, lobster culture, lobster collectors (no women involved).

b) Social analysis

77. Three elements are used to understand the intended social situation; roles, norms, and values (Checkland & Poulter, 2006). Each of these elements is discussed below:

- Role. In this study, the role of each problem owner are:
 - a. The government, has the role to provide direction, regulate and oversee lobster fisheries activities (based on the Permen KP No. 6/2017 and No. 26/2016)
 - b. The Village Head, has the role of carrying out development, fostering and empowerment in lobster fishing activities (based on Law No. 6/2014)
 - c. Business Actors, have the role of producing and utilizing good quality and competitive lobster resources. Specifically, lobster fishermen play a role in catching lobsters; lobster growers play a role in producing lobsters; and collectors play a role in providing the needs of lobsters for exporting companies.
- Norms. In this study, the role of each problem owner are:
 - a. Government: maintain the preservation of lobster resources and the sustainability of the lobster fishery business and conduct control and supervision of lobster capture, aquaculture, and sales activities.
 - b. Village Head: provide information on the potential of lobster resources and other potential natural resources, potential conflicts, and the welfare of lobster fishermen.
 - c. Business Actors: carry out lobster catching activities using fishing gear and responsible fishing methods; lobster cultivation in accordance with applicable regulations; selling lobster with the size that has been set and complete the required documents.
- Values. In this study, the role of each problem owner are:
 - a. Government: establish policies related to the use of lobster so that businesses can use the activities responsibly.
 - b. Village Head: refers to government policies and regulations that have been agreed with the lobster fishing business community.
 - c. Business Actor: refers to the policies imposed by the government, as well as local rules that apply (e.g. customary rules).

c) Power analysis

78. In this power analysis, identification of the disposition of power and the process to fill the power (nature of power) were carried out (Checkland & Poulter, 2006). In this case, the functions of the KKP can be seen in Presidential Decree (Perpres) No. 63/2015 concerning the Ministry of Marine Affairs and Fisheries. The Director General of Supervision of Marine Resources and Fisheries (PSDKP), Director General of Capture Fisheries and the directorates below can be seen in Permen KP Regulation No.23/ 2015. Meanwhile, the duties and functions of Village Heads are stipulated in Law No. 47/2015.

82. Some problems in each aspect of management with the EAFM approach. Table 7 details the problems found in each of these aspects. Table 7 shows problems with different identification stages, but the results are similar to Table 4. Table 4 shows the aggregate results for each indicator in each domain. While Table 7 shows the results of problem identification based on the EAFM assessment conducted.

Table 7. Problems with lobster fisheries in Lombok Tengah District

Aspect	Problem
Fish Resources	Lobster production has declined over the past 5 years The size of lobster caught has decreased in the last 5 years Catching lobster seeds Lobster catching areas are increasingly difficult and become very far away
Habitat and Ecosystem	Pollution by plastic waste Degradation of coastal ecosystems, which are threatened by physical development
Fishing Technology	Modification of fishing equipment that has an impact on responsible fishing activities The use of prohibited fishing gear (compressor)
Social	Low stakeholder participation in lobster fisheries management Horizontal and vertical conflicts, between fishermen and between sectors
Economy	Lobster fishermen income is below the provincial average Lack of access of the lobster fishing community to banking institutions
Institutional	Low levels of compliance about responsible fishing principles Not yet optimal policy and institutional synergy in fisheries management

3.3.3 The conceptual model of lobster fisheries management

83. The identification results showed 14 problems (Table 7) in lobster fisheries in Lombok Tengah District. These problems are then grouped into 9 problem groups;

- (1) decreasing production and size of lobster caught
- (2) catching lobster seeds
- (3) the presence of plastic waste in the waters
- (4) threatened coastal ecosystems due to development
- (5) the use of fishing gear and lobster fishing aids which are not in accordance with responsible fisheries
- (6) low stakeholder participation in lobster fisheries management
- (7) horizontal conflicts between lobster fishermen and conflicts between sectors assembled with lobster fisheries
- (8) low income of lobster fishermen
- (9) the low level of compliance with the principles of responsible fisheries for managing lobster fisheries

84. The results of RDs analysis, CATWOE analysis, and conceptual models for each of the problem groups above can be seen in Appendix 2.

Inequality in lobster fishing management

85. The results of the gap analysis are carried out for each problem group. The aim is to find out what the government has not done in the management of lobster fisheries, compared to the conceptual model that has been designed previously. Through the results of this gap analysis, the government will better understand what program activities need to be carried out. So, it will improve lobster fisheries management in Lombok Tengah District.

Table 8. Strategy for setting the quota and time for catching lobsters allowed, to solve the problem of decreasing production and size of lobster caught

No.	Conceptual model	Real world
1.	Data collection of catches (size, number, species composition, type of fishing gear used, and location of capture)	<ul style="list-style-type: none"> ➤ Catching data collection is only limited to the overall lobster production, not done per species ➤ Small-scale fisheries cause fishermen not to have the obligation to fill in a lobster capture log book so that fishing location information is only obtained if an interview is conducted
2.	Study of lobster habitat	Unique / special habitat for lobsters is known from fishermen information
3.	Study of lobster resource stock	There is no information on the status of lobster resource stocks
4.	Determination of allowed quota and catch time of lobster	The quota and time allowed for lobster catching have not been determined yet
5.	Public Consultation	Not occurring
6.	Determination of allowed quota and lobster catch time	Not occurring
7.	Academic paper regarding the amount of lobster catch allowed	Not occurring
8.	Regent Regulations related to lobster fisheries management	Not occurring
9.	Socialization	Not occurring

Table 9. The strategy of prohibiting the use of lobster seed catching tools to solve the problem of catching lobster seeds

No.	Conceptual model	Real world
1.	Identification of lobster fishing gear that is destructive and irresponsible	It is known that there are irresponsible fishing gear operated by lobster fishermen
2.	Socialization	Socialization has been carried out several times by Provincial DKP, DKP Lombok Tengah District and NGOs regarding Permen KP 56/2016 concerning the Prohibition of Lobster Arrest (<i>Panulirus</i> spp.), And Crab (<i>Scylla</i> spp.) and Blue Swimming crab (<i>Portunus</i> spp.) From the Region Republic of Indonesia
3.	Agreement on the use of responsible fishing gear	There is no direct agreement with lobster fishermen in Lombok Regency until now, because lobster fishermen are still of the opinion that the use of <i>pocong</i> is legal and

No.	Conceptual model	Real world
		not destructive. Until now, lobster fishermen are of the opinion that catching lobster seeds with <i>pocong</i> does not disturb lobster stocks in the waters of Lombok Tengah District
4.	Registration and data collection on the number and types of lobster fishing gears that operate	Not specifically done for lobster fishing gear, what has been done is to collect data on the number and type of fishing gear
5.	Supervision of the use of lobster fishing gear	There has been surveillance, and even fishermen have been jailed for using <i>pocong</i> . However, supervision has not been fully effective in stopping (zero violations) the use of <i>pocong</i> in catching lobsters

Table 10. Strategies for establishing a garbage bank organization to solve the problem of the existence of plastic waste

No.	Conceptual model	Real world
1.	Dissemination of the importance of waste management	The lack of socialization regarding the importance of waste management
2.	Formation of community groups concerned about waste	There is no community group that cares about waste
3.	Waste management training	Waste management training has never been done before
4.	Plastic and organic waste separation activities	Not yet done by coastal communities in Central Lombok Regency
5.	Recycling plastic and organic waste	Not occurring

Table 11. Strategy of identification of threats to coastal ecosystems to resolve the problem of threatened coastal ecosystems due to physical development

No.	Conceptual model	Real world
1.	Identification of hazards or threats to coastal ecosystems	Not yet done Environmental Risk Analysis on the coast of Lombok Tengah District
2.	Identification of risks due to hazards or threats to coastal ecosystems	
3.	Conducting an Environmental Risk Analysis	Not occurring
4.	Socialization	Not occurring
5.	Integrate coastal ecosystem conservation with tourism	There has not been a directional integration between coastal ecosystem conservation and tourism. This is proven by the decreasing extent of mangrove areas on the coast of Lombok Tengah District

Table 12. Optimization strategy of using *Krendet* fishing gear to solve the problem of using prohibited fishing gear. *Krendet* is a kind of circle trap with a net inside the circle. Its operations are placed at the bottom of sandy or muddy waters.

No.	Conceptual model	Real world
1.	Analyzing business sustainability for <i>Krendet</i> fisheries	An analysis of business sustainability for <i>Krendet</i> fisheries has not been conducted yet
2.	Socialization	Until now there has been no assistance program to increase the <i>Krendet</i> fisheries business
3.	<i>Krendet</i> fishing unit training assistance to lobster fishing groups	
4.	Assistance to increase the <i>Krendet</i> fisheries business	

Table 13. Strategy for establishing a lobster fisheries management working group, to resolve the problem of low stakeholder participation in lobster fisheries management

No.	Conceptual model	Real world
1.	Public consultation regarding stakeholder involvement in lobster fisheries management	Until now there has been no program aimed at increasing stakeholder participation in lobster fisheries management
2.	Establishment of a lobster fisheries management working group	
3.	The division of roles and tasks in each work group	
4.	Making a work plan for a period of 1 year, 5 years and for future	

Table 14. Detailed zoning strategies within the region for resolving horizontal conflicts between lobster fishermen and conflicts between sectors related to lobster fisheries

No.	Conceptual model	Real world
1.	Identification and designation of prospective water conservation area categories	The waters in the southern part of Central Lombok Regency have been reserved as a regional marine conservation area (KKLD). Fishery activities are allowed in sustainable fishing zones. This zone is designated for 1. Protection of fish habitats and populations; 2. Fishing with environmentally friendly tools and methods; 3.Environmentally friendly (fishery) cultivation; 4. Research and development; and 5. Education.
2.	Socializing the location of prospective water conservation areas	
3.	Reserve the location of prospective water conservation areas	
4.	Preparation of management plans and zoning of prospective water conservation areas	
5.	Proposal of prospective water conservation areas	
6.	Structuring the boundaries of prospective waters conservation areas	
7.	Compilation of plans for the utilization of prospective water conservation areas	

Table 15. Technology transfer strategy for developing lobster culture and marketing assistance for lobster and processed products, to solve the problem of low income of lobster fishermen

No.	Conceptual model	Real world
1.	Training on technology for developing lobster culture	There is no training on technology for developing lobster culture. Moreover, there is no lobster culture technology developed and standardized in Indonesia. Cultivation is still done traditionally
2.	Fisherman assistance for lobster farming activities	Until now there has been no intensive assistance done by the government to fishermen for lobster farming activities
3.	Increasing the added value of lobster fishery products through product processing	There are villages that conduct training programs to increase the added value of fishery products, such as seaweed and reef fish. But to increase the added value of lobster fisheries products has not been done until now
4.	Assistance in marketing lobster products and processed products	Until now there has been no intensive assistance done by the government related to the lobster fishing business
5.	Business management assistance and business bookkeeping	
6.	Establishment of a microfinance institution at the village level to access capital in the business activities of coastal communities	

Table 16. Strategies for strengthening *Pokmaswas* (watchdog community), to solve the problem of low levels of compliance for managing lobster fisheries.

No.	Conceptual model	Real world
1.	Establishment of <i>Pokmaswas</i>	There is no <i>Pokmaswas</i> for managing lobster fisheries in Lombok Tengah District
2.	Allocation of village funds to support <i>Pokmaswas</i> activities	Not Occurring
3.	Training to increase the capacity of <i>Pokmaswas</i> members	Not Occurring
4.	Dissemination to lobster fishing businesses	Not Occurring
5.	Implement law enforcement in a transparent and accountable manner by law enforcement officials	Law enforcement against rule breakers, especially related to lobster fisheries in Lombok Tengah District has been carried out, but has not been effective in applying the principles of responsible lobster fisheries.

3.4 Recommendations for intervention to improve lobster fisheries management

86. Based on the results of the EAFM assessment and analysis, the recommended interventions to improve the status of lobster management within a period of 5 years (2020—2024) are:

Domain	Indicator	Main issue	Proposed improvement	Program intervention
Lobster Resources	- CPUE	- Lack of data in making decisions on lobster resource management	- Completeness of time series lobster fishing data	- Collection of lobster resources
	- Fish size			
	Proportion of Seed fish (larvae) caught	- Low supervision in the utilization of lobster resources	- Fisheries supervision facilities and infrastructure	- Stock assessment in FMA 713 and 573
	Species composition			
	- ETP species			
"Range Collapse" fish resources		- Completeness of lobster resource control	- Increase supervision in the use of lobster resources	
Aquatic /water habitat and ecosystem	- Water quality	- Coral reef cover that tends to be stable	- Increasing coral reef percent cover	- Development of artificial coral reef technology
	Seagrass ecosystem status			
	Status of mangrove ecosystems	- Knowledge about the existence of unique / special habitats has not been effectively used in lobster fisheries management	- Effectiveness of knowledge of the existence of unique / special habitats	- Development of lobster conservation areas
	Status of coral reef ecosystems			
	Special / unique habitat			
	Climate change to waters and habitat conditions	- Low awareness of coastal communities towards waste management	- Increasing awareness of coastal communities regarding waste management	- Waste Management
Fishing technology	Destructive and / or illegal fishing methods	- Use of "pocong" fishing gear to catch lobster seeds	- Effective and effective use of lobster fishing gear in accordance with the principles of sustainable and responsible fishing	- Arrangement / intervention of new fishing gear for catching lobster consumption size (bubu)
	Modified fishing gear and fishing aids	- Use of a compressor to dive for lobster		
	Fishing capacity and fishing effort	- Low awareness of lobster fishermen towards sustainable and responsible lobster fishing	- Fisheries supervision facilities and infrastructure	- Increase supervision in the use of illegal fishing
	Selectivity of capture tools			
Conformance of the function and size of fishing vessels with		- Completeness of the fishery supervisory apparatus,		

Domain	Indicator	Main issue	Proposed improvement	Program intervention
	legal documents			
	Certification of Fishing vessel crew in accordance with regulations			
Social	Stakeholder participation	· The community feels not part of the stakeholders, and imposes management of lobster fisheries to the government	- Involvement of lobster fishermen and coastal communities in carrying out sustainable and responsible lobster fisheries management	- Knowledge assistance, Attitude and Practices to the fishing community
	- Fisheries conflict			
	Utilization of local knowledge in fish resource management (Including Technology, traditional ecological knowledge)			
Economy	Ownership of assets	- Lobster fishermen's income is below the minimum average wage in NTB Province, especially after the ban on lobster seed catching	- Optimization of processed lobster products with added value	- Development of processing lobster fishery products
	Household income		- Alternative livelihood for lobster seed catchers	- Development of marine tourism
	Saving Ratio			
Institutional	Compliance with responsible fishing principles	· Low awareness of lobster fishermen towards responsible fishing principles	- Providing a deterrent effect on lobster fishermen who carry out lobster catching activities that are both destructive and unsustainable	· Development of fisheries supervisory facilities and infrastructure
	Completeness of regulations (play role)	· The lack of fisheries supervisors	- Adequate fisheries supervisors, both in quantity and quality	· Establishment of Pokmaswas (fishery watchdog community groups)
	Decision making mechanism			
	Fisheries management plan	- The incomplete rules in the management of lobster fisheries	- The existence of a lobster fisheries management plan	· Preparation of lobster fisheries management plan

Domain	Indicator	Main issue	Proposed improvement	Program intervention
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Note:  score 1 = poor,  score 2 = medium,  score 3 = excellent

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5 Appendix

Appendix 1. Data requirements and data analysis on the assessment of EAFM indicators

EAFM indicator	Data collected	Data analysis
1. Fish Resource Domain a. CPUE b. Lobster size trends c. Proportion of larvae fish caught d. Composition of catch species e. "Range Collapse" Fish resource f. Species ETP (Endangered species, Threatened species, and Protected species)	a. Minimum data of 5 years for lobster production and lobster catching effort (based on previous research results) b. based on previous research results c. based on previous research results d. based on previous research results e. based on previous research results f. based on previous research results	a. $CPUE = \frac{\text{catch}}{\text{effort}}$ b. Length frequency analysis c. percent Juvenile/larvae = $\frac{\text{Total of Juvenile/larvae}}{\text{Total of Catch}}$ d. percent Target species = $\frac{\text{Total of target species caught}}{\text{Total of Catch}}$ e. Descriptive f. Descriptive (comparing catch fish with a list of organisms included in IUCN and Government Regulation No. 7 of 1999)
2. Domain of aquatic habitat and ecosystem a. Water quality b. Status of seagrass ecosystems c. Mangrove ecosystem status	a. based on previous research results b. based on previous research results c. based on previous research results	a. Descriptive (according to pollution standards or water quality standards in Indonesia in Government Regulation Number 82 of 2001 and Minister of the Environment Decree Number 51 of 2004) b. Descriptive (in accordance with Ministry of Environment Decree Number 200 of 2004) c. Descriptive

EAFM indicator	Data collected	Data analysis
d. Status of coral reef ecosystems e. Unique / special habitat f. Climate change to waters and habitat conditions	d. based on previous research results e. based on previous research results f. based on previous research results	d. Descriptive (in accordance with Minister of the Environment Decree Number 4 of 2001 concerning the standard criteria for damage to coral reefs) e. Descriptive f. Descriptive
3. Domain of Fishing Technique a. Destructive and / or illegal fishing methods b. Modification of fishing gear and fishing aids c. Fishing capacity and effort d. Catching selectivity	a. Based on previous research result b. Based on previous research result c. Based on previous research result d. Based on previous research result	a. Descriptive b. Descriptive c. <i>Data Envelopment Analysis (DEA)</i> Formula: $R = \frac{\text{fishing capacity 1st year}}{\text{fishing capacity Latest year}} ; FC = \sum_{i=1}^m \sum_{j=1}^n V_{ij} \times C_{ij} \times E_{ij}$ d. Descriptive $PS' = \frac{S'}{T} \times 100 \text{ percent}$ Note <ul style="list-style-type: none"> • PS 'is the percentage of fishing equipment usage that is classified as not or less selective • S 'is the number of fishing gear classified as not or less selective in a waters • T is the total number of fishing equipment in a waters
e. The suitability of the function and size of fishing vessels with legal documents	e. Type of lobster fishing gear (based on the results of previous studies)	e. Descriptive $K = \frac{p}{n} \times 100 \text{ percent}$ Note :

EAFM indicator	Data collected	Data analysis
f. Certification of fishing vessel crews	f. Gather information from fishermen *	<ul style="list-style-type: none"> • K is the percentage of the number of legal documents that are not in accordance with the facts in the field • p is the number of samples of legal documents from sample vessels that are not in accordance with the facts of the function and size of existing fishing vessels • n is the number of samples of legal documents that will be examined under real conditions in the field <p>f. Descriptive</p> $A = \frac{q}{v} \times 100 \text{ percent}$ <p>Note:</p> <ul style="list-style-type: none"> • A is the percentage of fishing vessels operated by a crew member that is certified in accordance with regulations • q is the number of times when fishing from a sample ship is operated by a certified crew in accordance with regulations • v is the total sample of 5 GT fishing vessels that will be inspected by the crew
4. Domain Economy a. Asset ownership b. Fisheries household income (RTP) c. Saving ratio	Gather information from fishermen *	<p>a. Comparison of the current number of productive assets owned by fisheries households with the previous year</p> <p>b. Descriptive</p> <p>c. Saving Ratio = $\frac{\text{Income} - \text{Expenditure}}{\text{Income}} \times 100 \text{ percent}$</p>
5. Domain Social a. Stakeholder participation b. Fisheries conflict	a. Number of stakeholders involved and active in lobster fisheries management *	<p>a. Descriptive</p> <p>b. Descriptive</p>

EAFM indicator	Data collected	Data analysis
<p>c. Utilization of local knowledge in fish resource management (including traditional ecological knowledge/technology)</p>	<p>b. Number of conflicts related to lobster fisheries in recent years *</p> <p>c. Local knowledge information related to lobster fisheries *</p>	<p>c. Descriptive</p>
<p>6. Domain Institutional</p>		
<p>a. Compliance with the principles of fisheries responsible for fisheries management that have been established both formally and informally</p>	<p>a. Number of violations that occur in lobster fishing activities</p>	<p>a. Descriptive</p>
<p>b. Completeness of the rules of the game in fisheries management</p>	<p>b. The existence of formal and informal regulations</p>	<p>b. Descriptive</p>
<p>c. Decision making mechanism</p>	<p>c. The existence of rules in decision making *</p>	<p>c. Descriptive</p>
<p>d. Fisheries management plan</p>	<p>d. Existence of fisheries management plans</p>	<p>d. Descriptive</p>
<p>e. The level of policy and institutional synergy in fisheries management</p>	<p>e. Synergy between fisheries management policies and institutions</p>	<p>e. Descriptive</p>
<p>f. Stakeholder capacity</p>	<p>f. The role of stakeholders in the management of lobster fisheries</p>	<p>f. Descriptive</p>

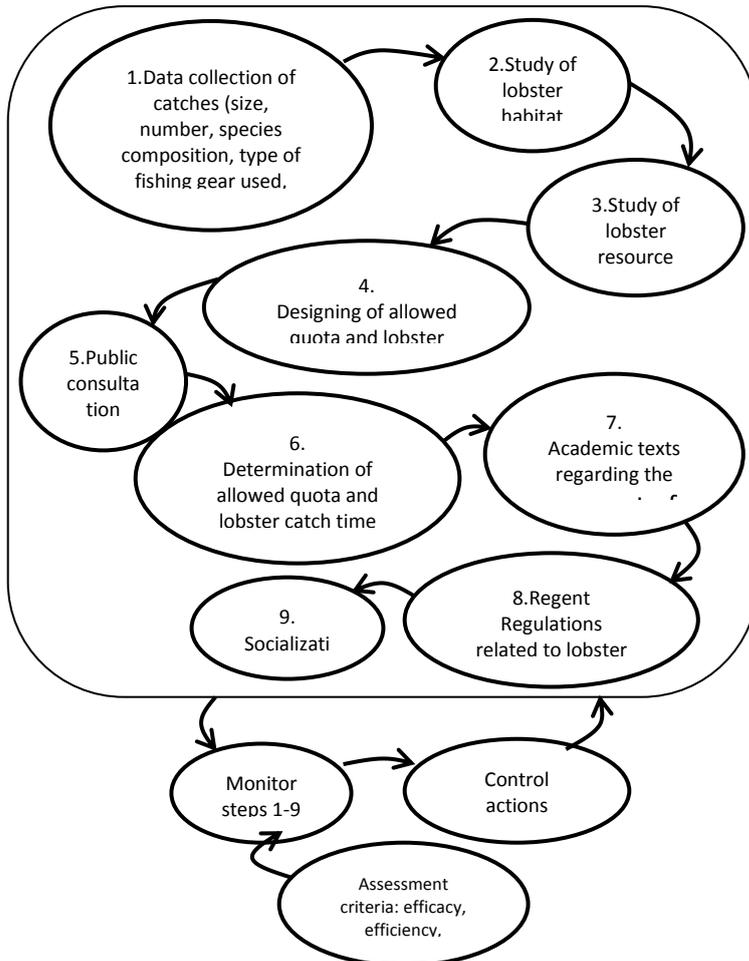
Appendix 2. The results of the RDs analysis, CATWOE analysis, and conceptual models for each group of problems

(1) Problems with decreasing production and size of caught lobster

- *Root definition 1:* The government regulates the allowed quota and lobster catch time through bioecological studies to determine the lobster capture quota and the allowed lobster catch time in order to achieve the availability of sustainable and internationally competitive lobster resources
- Analysis CATWOE:

<i>Customer</i>	Lobster fisherman, lobster collector
<i>Actor</i>	Lobster fishermen, lobster collectors, Provincial DKP, Regency DKP, PSDI-KKP, PSDKP, Universities, NGOs
<i>Transformation</i>	Lobster fishermen, lobster collectors, Provincial DKP, Regency DKP, PSDI-KKP, PSDKP, Universities, NGOs
<i>Worldview</i>	Bioecological studies for determining lobster catch quota and allowed fishing time
<i>Owners</i>	Government
<i>Environment</i>	<ul style="list-style-type: none"> • The lack of enumerators in recording and collecting catch data • Awareness of lobster fishermen in conducting responsible lobster fishing activities

- Conceptual Model 1 for setting allowed quota and catch time for lobster:

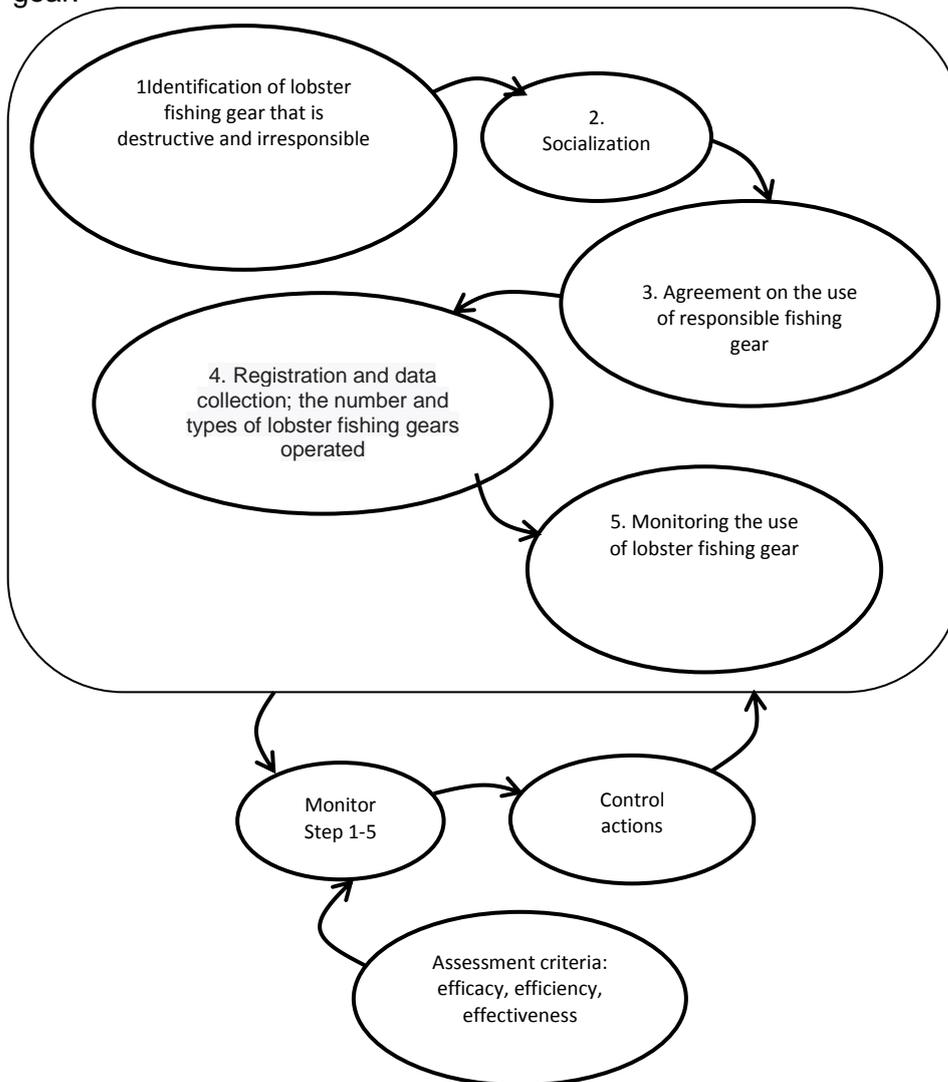


(2) Problems with catching lobster seeds

- *Root definition 2:* The government identifies and confirms the use of destructive fishing gear through a ban on the use of lobster seed fishing gear so that the lobster resources are sustainable and sustainable
- Analysis CATWOE:

Customer	Lobster fisherman, lobster collector
Actor	Lobster fishermen, lobster collectors, Provincial DKP, Regency DKP, PSDI-KKP, PSDKP, Universities, NGOs
Transformation	Identification and confirmation of the use of destructive fishing gear
Worldview	Identification and confirmation of the use of destructive fishing gear
Owners	Government
Environment	<ul style="list-style-type: none"> • Changes in income of lobster seed fishermen • The lack of fisheries supervisory facilities and infrastructure

- Conceptual model 2 for identification and confirmation of the use of destructive fishing gear:

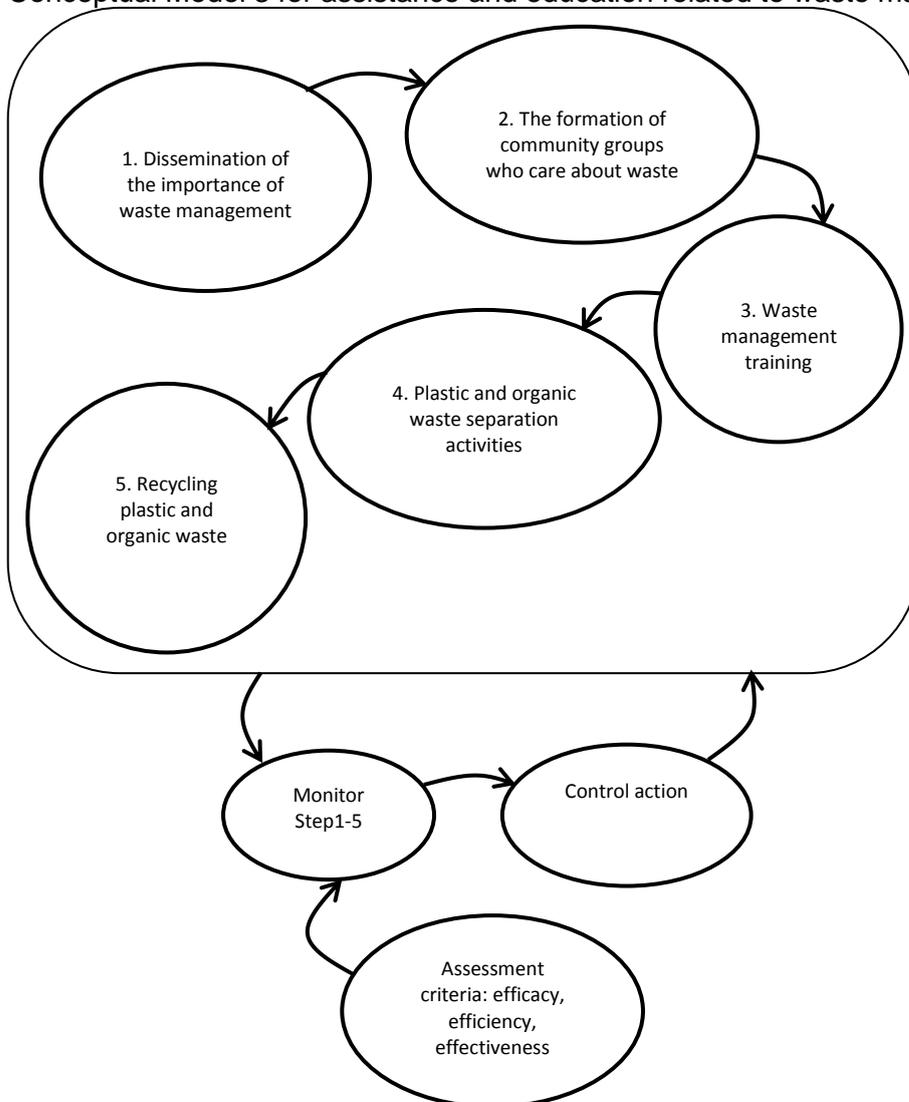


(3) Problems with the existence of plastic waste in the waters

- *Root definition 3*: Provincial DKP provides assistance and education related to waste management through the establishment of a waste bank so that the community's ability to improve household waste management
- Analysis CATWOE:

Customer	Lobster fisherman
Actor	Lobster fishermen, Provincial DKP, Regency DKP, coastal communities, Universities, NGOs
Transformation	Assistance and education related to waste management
Worldview	Establishment of a garbage bank
Owners	DKP Province
Environment	<ul style="list-style-type: none"> • Lack of awareness of coastal communities regarding waste disposal • Low community participation in activities related to waste management

- Conceptual Model 3 for assistance and education related to waste management:

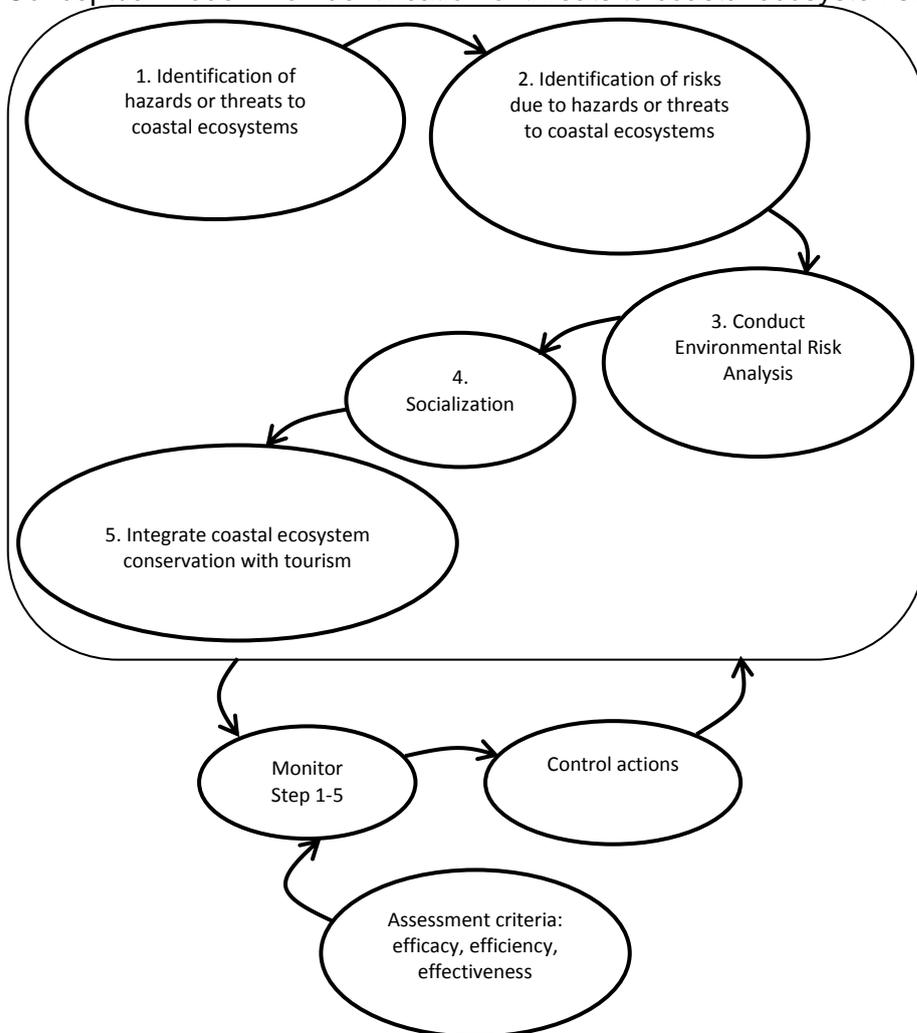


(4) Problems of threatened coastal ecosystems due to development

- *Root definition 4:* The government integrates coastal ecosystem conservation with tourism through identifying threats to coastal ecosystems to maintain the condition of coastal ecosystems and environmental quality
- Analysis CATWOE:

Customer	Lobster fisherman
Actor	Lobster fishermen, Provincial DKP, Regency DKP, coastal communities, Universities, NGOs
Transformation	Integration between conservation of coastal ecosystems with tourism
Worldview	Identification of threats to coastal ecosystems
Owners	Government
Environment	<ul style="list-style-type: none"> • Development of the tourism sector in Central Lombok Regency • The ability of the government related to the budget in conducting regular monitoring

- Conceptual Model 4 for identification of threats to coastal ecosystems:



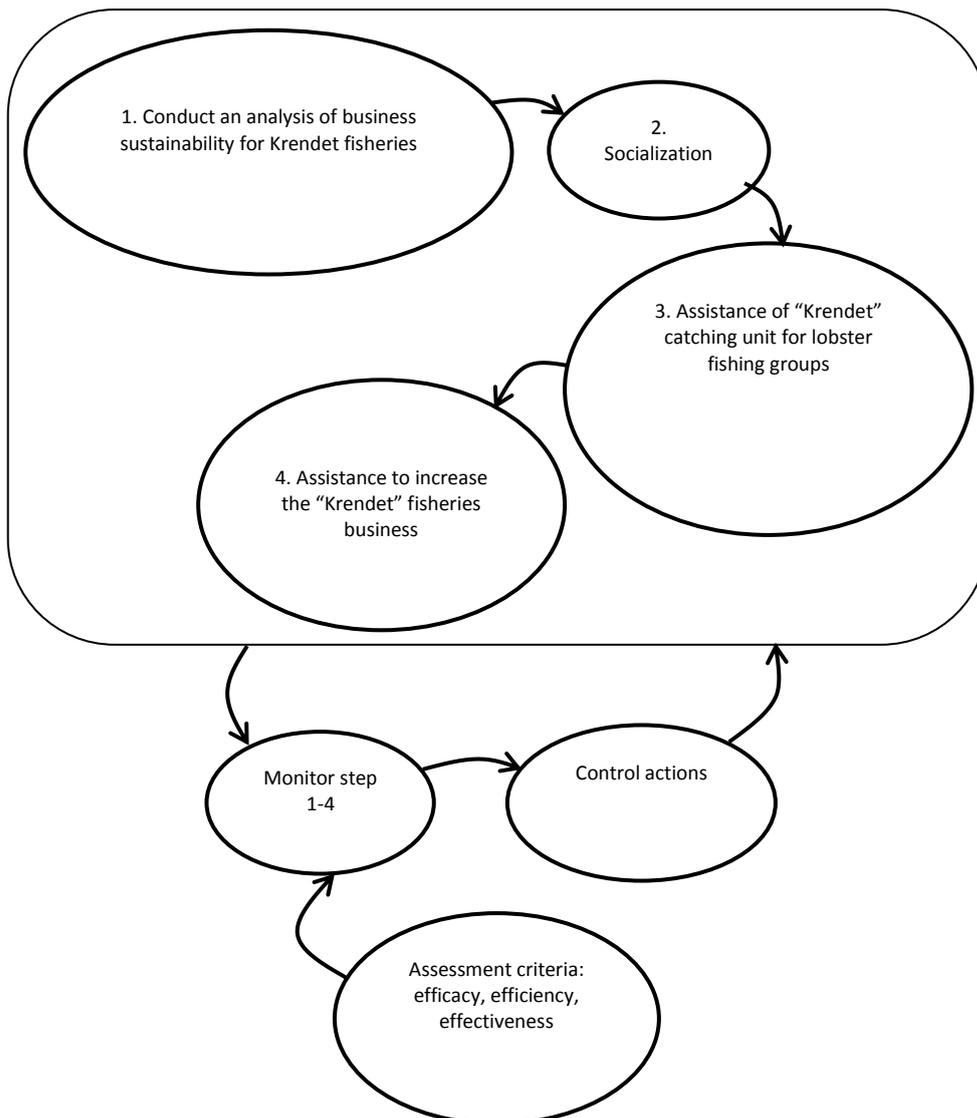
(5) Problems with the use of fishing gear and lobster fishing aids that are not in accordance with responsible fisheries

- *Root definition 5:* The government provides an alternative to effective and efficient lobster fishing tools by optimizing the use of *Krendet* fishing gear so that lobster fishermen can switch from using lobster fishing gear and fishing aids that are not compatible with responsible fisheries

➤ Analysis CATWOE:

Customer	Lobster fisherman
Actor	Lobster fishermen, Provincial DKP, Regency DKP, PSDI-KKP, PSDKP, Universities, NGOs
Transformation	Alternative lobster catchers that are effective and efficient
Worldview	Optimizing the use of <i>Krendet</i> fishing gear
Owners	Government
Environment	<ul style="list-style-type: none"> • Difficult to change the habits of lobster fishermen who have for years used certain types of fishing gear • The income needed by lobster seed fishermen will be reduced compared to still catching lobster

➤ Conceptual Model 5 for optimizing the use of *Krendet* fishing gear:



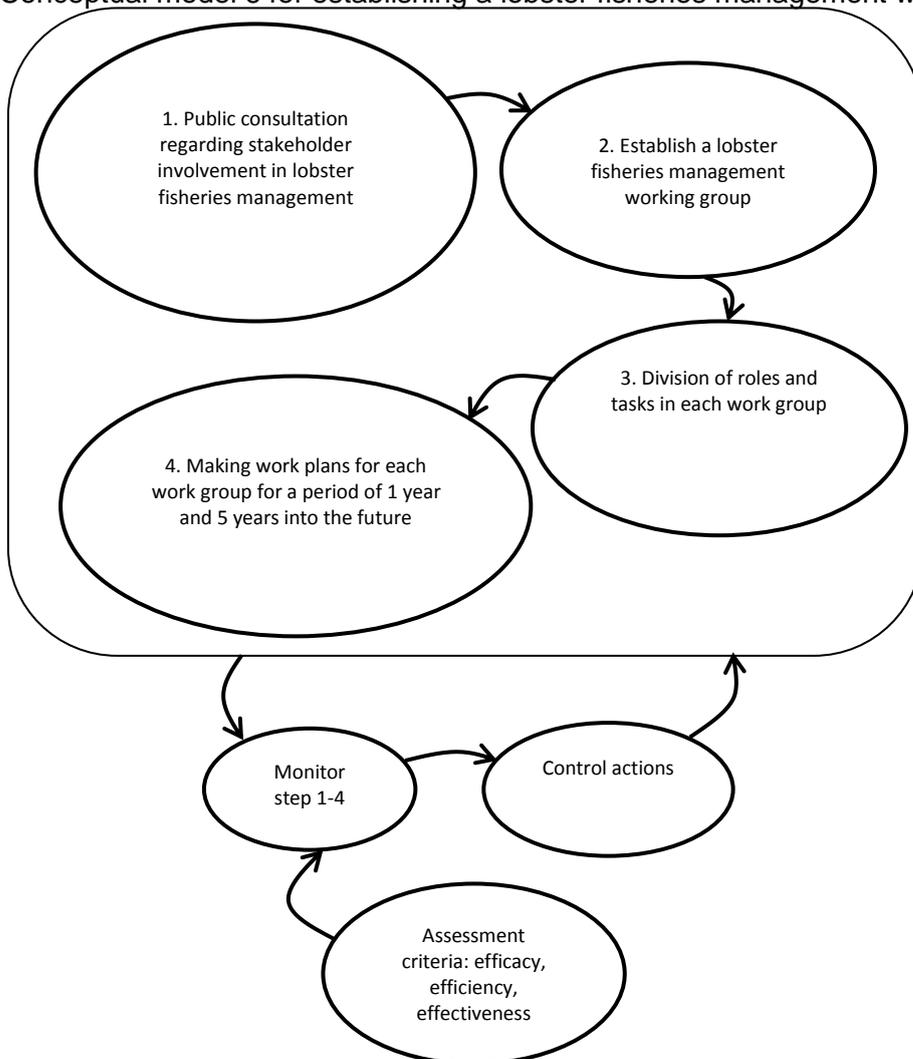
(6) Problems with the low participation of stakeholders in the management of lobster fisheries

- *Root definition* 6: The NTB Provincial DKP has increased the intensity of coordination among stakeholders through the establishment of a lobster fisheries management working group to realize stakeholder participation in lobster fisheries management

➤ Analysis CATWOE:

Customer	Lobster fishermen, lobster collectors, Provincial DKP
Actor	Provincial DKP, Regency DKP, Higher Education, NGOs
Transformation	Increased intensity of coordination between stakeholders
Worldview	Establishment of a lobster fisheries management working group
Owners	DKP Province
Environment	• There are government agencies that have never been present at the working group discussion meetings

➤ Conceptual model 6 for establishing a lobster fisheries management working group:

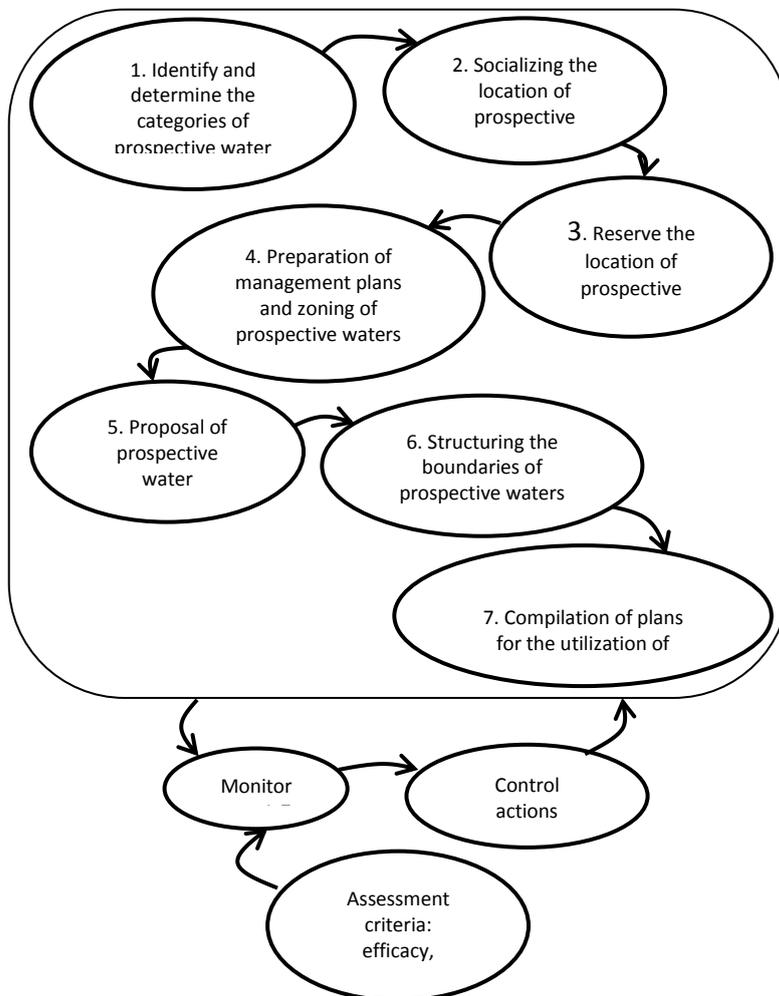


(7) Horizontal conflict between lobster fishermen and conflict between sectors related to lobster fisheries

- *Root definition 7:* The government draws an agreement between users of sea space through the preparation of detailed zones within the area to minimize horizontal conflicts and conflicts between sectors related to lobster fisheries
- Analysis CATWOE:

Customer	Lobster fisherman
Actor	Lobster fishermen, Provincial DKP, Regency DKP, Universities, NGOs
Transformation	Agreement between marine area users
Worldview	Detailed zoning within the region
Owners	Government
Environment	<ul style="list-style-type: none"> • The desire of lobster fishermen to be accommodated in all their interests • The existence of conflicting interests

- Conceptual model 7 for the preparation of detailed zones within a region:

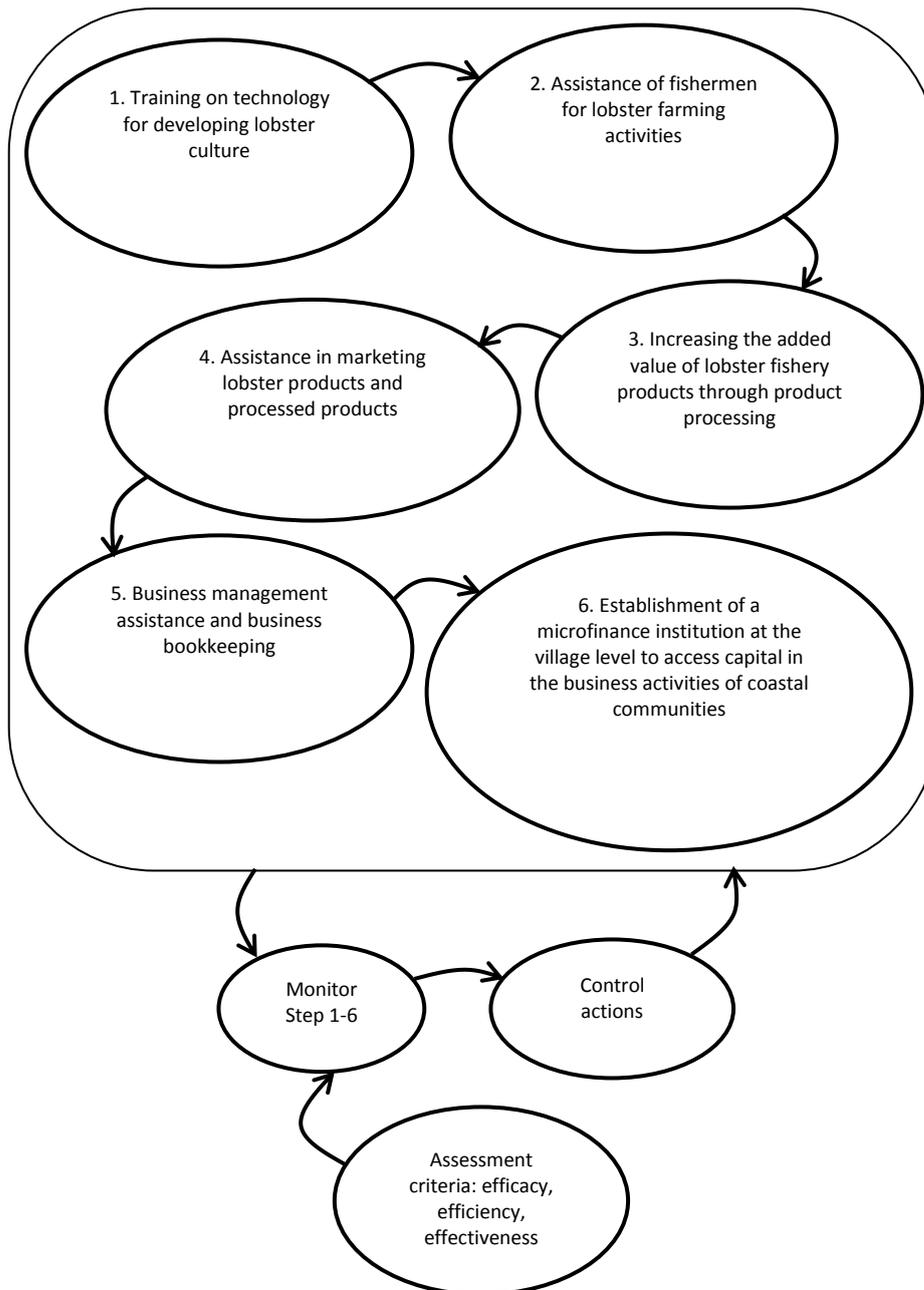


(8) Problems with the low income of lobster fishermen

- *Root definition 8*: The government creates and extends alternative livelihoods through the transfer of technology for developing lobster culture and mentoring marketing of lobsters and processed products to increase the income of lobster fishermen.
- Analysis CATWOE:

Customer	Lobster fisherman
Actor	Lobster fishermen, Provincial DKP, Regency DKP, PSDI-KKP, Universities, NGOs
Transformation	Creation and expansion of alternative livelihoods
Worldview	Technology transfer for developing lobster culture and marketing assistance for lobsters and processed products
Owners	Government
Environment	<ul style="list-style-type: none"> • Limited capital of lobster fishermen in processing and marketing lobster products • Insufficient assistance provided by the government to lobster fishermen

- Conceptual Model 8 for technology transfer for developing lobster culture and marketing assistance for lobster and processed products:



(9) Problems with the low level of compliance with the principles of fisheries responsible for managing lobster fisheries

- *Root definition* 9: Provincial DKP conducts increased oversight of lobster fisheries activities by strengthening the *Pokmaswas* institutions so that the management of lobster fisheries is in accordance with the principles of responsible fisheries.
- Analysis CATWOE:

Customer	Lobster fisherman
Actor	Provincial DKP, Regency DKP, PSDKP, <i>Pokmaswas</i> , Village Heads
Transformation	Increased supervision of lobster fishing activities
Worldview	Strengthening the <i>Pokmaswas</i> institutional
Owners	DKP Province
Environment	<ul style="list-style-type: none"> • Lack of budget allocated by the government for monitoring activities • Not optimal facilities and infrastructure for patrol and supervision activities

b) Habitat domain and aquatic/water ecosystems

Indicator Value	Value Year 0	Duration														
		Short-term					Short-term					Short-term				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Aquatic Quality	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
Status of Seagrass Ecosystems	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
Mangrove Ecosystem Status	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
Status of Coral Reef Ecosystems	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
Unique / Special Habitat	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3
Climate Change on Waters and Habitat Conditions	1	1	1	1	1	1	1	1	2	2	2	2	2	3	3	3

c) Lobster catching/fishing technique domain

Indicator Value	Value Year 0	Duration														
		Short-term					Short-term					Short-term				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Destructive and / or illegal lobster catching methods	1	1	1	1	2	2	2	2	3	3	3	3	3	3	3	3
Modification of lobster fishing gear and fishing aids	1	1	1	1	1	1	2	2	2	3	3	3	3	3	3	3
Fishing capacity and fishing effort	1	1	1	1	2	2	2	2	2	3	3	3	3	3	3	3
Catching selectivity	1	1	1	1	2	2	2	2	3	3	3	3	3	3	3	3
The suitability of the size and function of lobster fishing vessels with legal documents	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Fishing boat crew certificates in accordance with regulations	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

d) Social domain

Indicator Value	Value Year 0	Duration														
		Short-term					Short-term					Short-term				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Stakeholder participation	1	1	1	1	2	2	2	2	2	3	3	3	3	3	3	3
Fisheries conflict	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3
Utilization of local knowledge in fish resource management (including Technology, traditional ecological knowledge)	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3

e) **Economy domain**

Indicator Value	Value Year 0	Duration														
		Short-term					Short-term					Short-term				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Asset Ownership	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3
Household income (RTP)	1	1	1	1	1	1	2	2	2	2	3	3	3	3	3	3
Savings ratio	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3

f) **Institutional domain**

Indicator Value	Value Year 0	Duration														
		Short-term					Short-term					Short-term				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Compliance with the principles of fisheries responsible for fisheries management that have been established both formally and informally	1	1	1	1	2	2	2	2	3	3	3	3	3	3	3	3
Completeness of the rules of the game in fisheries management	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
Decision making mechanism	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3
Fisheries management plan	1	1	1	1	2	2	3	3	3	3	3	3	3	3	3	3
The level of policy and institutional synergy in fisheries management	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
Stakeholder capacity	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3

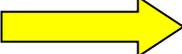
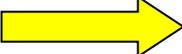
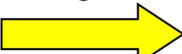
Appendix 4. Recommendations for management of lobster fisheries for the short term on each of the EAFM indicators

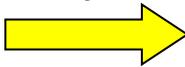
a. Lobster resources domain

Indicator	Current score		Goal Score		Management Activities
	score	Criteria	score	Criteria	
Raw CpUE	1	Increase 	2	Increase 	<ul style="list-style-type: none"> o Encourage DKP to take notes, especially in TPI / PPI o Stock Assessment
Fish size trends	2	Relatively fixed 	3	The size is getting bigger 	<ul style="list-style-type: none"> o Socialization of lobster size worth catching in year-1 o Selective fishing gear and / or lobster catch techniques recommendations in year 1 and year 2 o Monitoring and recording of fish caught per catching effort, years 1-5
Proportion of juvenile/ larvae fish caught	1	More than 60 percent 	2	The number of juveniles caught is 30—60 percent 	<ul style="list-style-type: none"> o Socialization of lobster size worth catching in year-1 o Selective fishing gear and or lobster catching techniques recommendations for Year 1 and Year 2 o Monitoring and recording of lobster caught per catch attempt, years 1-5
Composition of catch species	1	Less than 15 percent of the total volume 	2	16—30 percent of the total volume 	<ul style="list-style-type: none"> o Monitoring and recording of lobster caught per catch attempt, years 1-5 o Selective fishing gear and or lobster catching techniques recommendations for Year 1 and Year 2
<i>Range Collapse Fish Resource</i>	1	More difficult and farther fishing ground 	2	Relatively fixed and far fishing ground 	<ul style="list-style-type: none"> o Study of potential SPAGS locations, nursery grounds, and other unique habitats, 1-2 years o Creating alternative jobs for fishermen, year 2 o Zone zoning in year 3 o Integrated monitoring and evaluation years 4-5
Species ETP	2	One catch of ETP species 	3	No ETP species were caught 	<ul style="list-style-type: none"> o Socialization, regulations related to the protection of biota protected year-1 o Joint participatory mapping of ETP species o Monitoring and evaluation

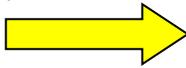
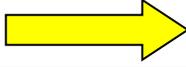
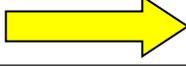
Indicator	Current score		Goal Score		Management Activities of 4-5 years
	score	Criteria	score	Criteria	

b. Habitat domain and aquatic/water ecosystems

Indicator	Current score		Goal Score		Management activities
	score	Criteria	Score	Criteria	
Aquatic/ water quality	2	Moderately polluted, low turbidity, moderate eutropication 	3	Not polluted, low turbidity, no eutropication 	<ul style="list-style-type: none"> o Conducting waste management education o Preservation of coastal and marine ecosystems
Status of seagrass ecosystems	2	Medium cover with high diversity, number of species > 7 	3	Seagrass cover is high, diversity is high 	<ul style="list-style-type: none"> o Education on the conservation and protection of seagrass ecosystems o Rehabilitation of seagrass ecosystems o Permanent plot sampling
Status of mangrove ecosystems	2	Low density, high diversity, reduced mangrove area 	3	High density, high diversity, mangrove area increased 	<ul style="list-style-type: none"> o Education on the preservation and protection of mangrove ecosystems o Rehabilitation of mangrove ecosystems o Permanent plot sampling
Status of coral reef ecosystems	2	Medium cover and medium diversity 	3	High cover and high diversity 	<ul style="list-style-type: none"> o Education on coral reef ecosystem conservation and protection o Rehabilitation of coral reef ecosystems o Permanent plot sampling
Unique / special habitat	2	A unique / special habitat is identified but is not well managed 	3	A unique / special and well- managed habitat is known 	<ul style="list-style-type: none"> o Study of spawning / nursery ground locations o Study the lobster life cycle o Study of Unit Stock
Climate change on waters and habitat conditions	1	There is no study of the impacts of climate change	2	Climate change impacts are known but not followed by	<ul style="list-style-type: none"> o Climate Change Study of water conditions

Indicator	Current score		Goal Score		Management activities
	score	Criteria	Score	Criteria	
				adaptation and mitigation strategies	
					

c. Lobster domain of lobster catching techniques

Indicator	Current score		Goal Score		Management activities
	Score	Criteria	Score	Criteria	
Destructive and / or illegal lobster catching methods	1	Frequency of violations > 10 cases	2	Frequency of violations 5—10 cases per year	<ul style="list-style-type: none"> o Fishing gear settings that are destructive o Monitoring the use of lobster fishing gear that is destructive
					
Modification of lobster fishing gear and fishing aids	1	More than 50 percent of target species size < Lm	2	25—50 percent species target size < Lm	<ul style="list-style-type: none"> o New arrangement / intervention of fishing gear for catching lobster (bubu) consumption o Monitoring the use of lobster fishing gear
					
Fishing capacity and fishing effort	1	Catchment ratio < 1	2	Catch ratio = 1	<ul style="list-style-type: none"> o Study of lobster fishing season
					
Catching selectivity	1	Low (> 75 percent) use of non-selective fishing gear	2	Medium (50-75 percent) use of non-selective fishing gear	<ul style="list-style-type: none"> o New fishing gear settings / interventions that are more selective for catching lobster consumption (bubu)
					
The suitability of the size and function of lobster fishing vessels with legal documents	3	High compatibility	3	High compatibility	<ul style="list-style-type: none"> o Maintaining existing conditions o Vessel data collection
					
Fishing crew certificate in accordance with regulations	3	Certificate ownership < 75 percent	3	Certificate ownership > 75 percent	<ul style="list-style-type: none"> o Maintaining existing conditions o Training in improving the skills of fishermen in operating the recommended fishing
					

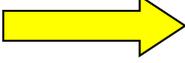
Indicator	Current score		Goal Score		Management activities
	Score	Criteria	Score	Criteria	
					gear (bubu)

d. Social domain

Indicator	Current score		Goal Score		Management activities
	Score	Criteria	Score	Criteria	
Stakeholder participation	1	Less than 50 percent	2	50—100 percent	<ul style="list-style-type: none"> o Increasing awareness of lobster fishermen related to sustainable lobster fisheries management o Increase participation and coordination for lobster fisheries o Stakeholder involvement in managing lobster fisheries in accordance with their respective duties and functions
Fisheries conflict	2	2—5 times/year	3	Less than 2 times/year	<ul style="list-style-type: none"> o Arranging zoning of water areas o Arranging agreements between sea space users so that each interest can be accommodated
Utilization of local knowledge in fish resource management (including Tech, traditional ecological knowledge)	2	exists but not yet effective	3	exists and effective	<ul style="list-style-type: none"> o Lobster management rules in the lobster fishing community o Develop a curriculum for education based on coastal ecosystems

e. Economy domain

Indicator	Current score		Goal Score		Management activities
	Score	Criteria	Score	Criteria	
Asset Ownership	2	Value of fixed assets (less than 50 percent)	3	Asset value increases (above 50 percent)	<ul style="list-style-type: none"> o Conduct business management training and simple accounting books o Establishment of a microfinance institution at the village level to access capital in the business activities of coastal communities

Indicator	Current score		Goal Score		Management activities
	Score	Criteria	Score	Criteria	
Household income (RTP)	1	Less than the average UMP/ average minimum wage 	2	Same as the average UMP 	<ul style="list-style-type: none"> o Increasing the availability of facilities and infrastructure o Creation and expansion of alternative livelihoods o Encourage and enhance entrepreneurial spirit among coastal communities o Transfer of technology for developing lobster culture o Assistance and training in the use of marine culture development technology o Increasing the added value of fishery products through processing lobster fishery products o Assistance in marketing lobster and processed products o Facilitating / building fisheries business networks o Developing lobster-based marine tourism
(saving ratio)	1	Less than loan interest rates 	2	Same with loan interest 	<ul style="list-style-type: none"> o Education about family financial planning

f. domain institutional

Indicator	Current score		Goal Score		Management activities
	Score	Criteria	Score	Criteria	
Compliance with the principles of fisheries responsible for fisheries management that have been established both formally and informally	1	More than 5 times there were violations of law in formal rules and more than 5 information violations in non-formal rules 	2	2-4 times violations of the law in the formal rules and more than 3 violations of information in non-formal rules 	<ul style="list-style-type: none"> o Improved monitoring of lobster capture o Implement law enforcement in a transparent and accountable manner by law enforcement officials o Increasing the capacity of the Pokmaswas (watchdog community groups) o Funding support from village funds for Pokmaswas activities

Indicator	Current score		Goal Score		Management activities
	Score	Criteria	Score	Criteria	
					o Increase knowledge and awareness related to sustainable lobster fisheries management
Completeness of the rules of the game in fisheries management	2	Exist but is not complete and the amount is fixed, there is enforcement of rules but it is not effective, there are tools and people but there is no action, there is a reprimand or punishment 	3	Exist and is complete, there is enforcement of the rules of the game and it is effective, there are tools and people as well as there are actions, there are reprimands and penalties 	o Formulation of regulations concerning the development of lobster culture
Decision making mechanism	2	Exist, a decision making mechanism as well as a decision but it is not fully implemented 	3	There is a mechanism and it is effective and there are decisions and on the road fully 	o Development of standard operating procedures (SOP) for developing lobster culture o Monitoring the implementation of SOPs that have been set
Fisheries management plan	1	There is no RPP 	2	There is a lesson plan but it has not yet been fully implemented 	o Preparation of lobster fisheries management plan documents o Socialization of lobster RPP at the local and national level
The level of policy and institutional synergy in fisheries management	2	Communication between institutions is ineffective, and policies support one another 	3	Synergy between institutions works well, and policies support one another 	o Strengthening the capacity of fisheries management institutions at the regional organizational level (OPD) o Enhancing institutional performance in fisheries management

Indicator	Current score		Goal Score		Management activities
	Score	Criteria	Score	Criteria	
Stakeholder capacity	2	Exist but does not function (the expertise obtained is not in accordance with the function of the work)		Exist and function (expertise gained in accordance with the work function)	<ul style="list-style-type: none"> o Strengthening the functional bureaucracy in managing lobster fisheries o EAFM-based fisheries management training at local and national level



Appendix 5. Documentation

a) Preparation:



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Meeting team (22 August 2019)



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Coaching surveyor (26 and 28 August 2019)

b) Survey:



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Discussions with village secretary and village head in Desa Mertak (31 August 2019)



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Discussion with sub-village head in Dusun Gerupuk (31 August 2019)

c) Focus Group Discussion (FGD):



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FGD in area of Teluk Gerupuk (2 September 2019)



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FGD in area of Teluk Bumbang (2 September 2019)



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FGD in area of Teluk Awang (2 September 2019)

d) Interviews with questionnaire:



The surveyors interviewing the fishermen of lobster in area of Teluk Awang, Teluk Bumbang and Teluk Gerupuk(3-7 September 2019)

e) Meeting team:



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Validation meeting to present the draft assessment report (26—27 October 2019)

f) Public Consultation:



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FGD with stakeholders to discuss on the recommended intervention at ISLME pilot site (7 November 2019)

Appendix 6. FGD report

1. Background

Central Lombok Regency waters are one of the areas that has potential lobster resource. However, there are several problems and issues that have arisen in lobster fisheries in Central Lombok Regency, this includes catching lobster larvae in the Awang Bay, Bumbang Bay and Gerupuk Bay areas. In addition, the presence of lobster consumption size is not known with certainty, causing many activities of catching lobster larvae. It is easier to get lobster larvae and it has good selling prices that allow fishermen to make simple money. The existence of these problems and issues causes the management of lobster fisheries trending to an alarming direction and can even lead to suboptimal use of lobster resources in the Awang Bay, Bumbang Bay and Gerupuk Bay areas.

An assessment of the current status of lobster fisheries management with an EAFM indicator assessment needs to be carried out in order to know the existing problems. This will allow appropriate interventions to be given to improve the management of lobster fisheries. The limitation of secondary data and time series data in supporting the assessment of EAFM indicators causes the need for a focus group discussion (FGD). In addition, through the FGD we can map human resources that are stakeholders in the management of lobster fisheries in the Awang Bay, Bumbang Bay and Gerupuk Bay; while also including the general Central Lombok District. Through human resource mapping the role of each stakeholder can be determined when referencing the implementation of interventions. These interventions are designed to improve lobster fisheries management in Central Lombok District, as well as in the three bay areas.

2. Purpose of FGD

The purpose of the initial FGDs in the Awang Bay, Bumbang and Gerupuk Bay areas is to identify the current problems and conditions of lobster fisheries. This will be done from the perception of fishermen and lobster collectors who are active within these three areas. Furthermore, the next stage of the FGD aims to verify the results of the analysis that has been done, from the initial FGD, EAFM assessment, management gaps and management improvement intervention recommendations.

3. FGD process and stakeholder involved

Activities that must be completed before conducting FGDs, are include conducting initial surveys to identify who are involved as FGD participants in the Awang Bay, Bumbang Bay and Gerupuk Bay areas. After conducting the initial survey, in order for the FGD to be carried out successfully the next step is to carry out the following stages:

a. Preparation:

- 1) Identify the person or group to be invited
- 2) Determine the number of invited participants
- 3) Determine the location of the FGD
- 4) Prepare the invitation
- 5) Determine the facilitator
- 6) Determine the minutes of meeting
- 7) Prepare FGD equipment

b. FGD activities:

- 1) Participants fill out the attendance list.
- 2) The facilitator introduces himself and the team present.
- 3) The facilitator gives an explanation of the objectives held by the FGD.
- 4) The facilitator identifies the groups present.
- 5) The facilitator asks about lobster fisheries in each area of Awang Bay, Bumbang Bay, and Gerupuk Bay. In the advanced FGD, the facilitator clarified the EAFM assessment, management gap, and strategic plan for improving lobster fisheries management.
- 6) The facilitator digs information about unclear information.

The initial FGD was held on 2 September 2019, for the Awang Bay and Bumbang Bay areas in the

Mertak Village Office, and for the Gerupuk Bay area in Gerupuk BBL (Marine Aquaculture Center). In each bay area, the team divided into 4 functions, as facilitators, *notulis*, administrators, and photographers. Participants who attended the initial FGD were as follows:

- a. Awang Bay Area
Participants who attended were 27 people consisting of lobster fishermen and lobster collectors.
- b. Bumbang Bay Area
The participants who attended were 25 people consisting of lobster fishermen, lobster collectors, and lobster fishermen's wives.
- c. Gerupuk Bay area
The participants who attended were 40 people consisting of lobster fishermen and lobster collectors.

The follow-up FGD was held on 7 November 2019 at D'MAX Hotel, Central Lombok. As in the initial FGD, in the advanced phase FGD the team was divided into 4 functions, namely as a facilitator, *notulis*, administrator and photographer. Participants who attended were 58 people consisting of representatives;

- a. University of Mataram
- b. University of 45 Mataram
- c. University of Gunung Rinjani
- d. Indonesia Tourism Development Corporation (ITDC)
- e. Fish Quarantine and Inspection Agency (BKIPM) - Mataram
- f. Ministry of Marine Affairs & Fisheries (DKP) - Nusa Tenggara Barat
- g. Regional Development Planning Agency - Central Lombok Regency
- h. Marine Aquaculture Fisheries Center- Lombok
- i. Industry and Trade Office - Central Lombok Regency
- j. Community and Village Empowerment Office - Central Lombok Regency
- k. Tourism Office - Central Lombok Regency
- l. Marine and Fishery Office - Central Lombok Regency
- m. Supervisory Unit SDKP – East Lombok Regency
- n. Village government of Mertak
- o. Village government of Sengkol
- p. Village Consultative Assembly (BPD) - Village government of Mertak
- q. Village Consultative Assembly (BPD) - Village government of Sengkol
- r. Village Chief of Gerupuk
- s. Village Chief of Bumbang
- t. Village Chief of Awang
- u. Association of Fisheries Entrepreneurs
- v. Fisheries instructor
- w. Fish collectors
- x. Fisheries entrepreneurs
- y. Fisherman

4. Final conclusion and intervention recommendations

a. Initial FGD

1) Awang Bay Area

- The Awang Bay area is the most favorite area for lobster fisheries, especially related to catching lobster larvae. The use of *pocong* fishing gear to catch lobster larvae in Central Lombok Regency started with fishermen in the Awang Bay area.
- Capturing lobster larvae in the Awang Bay area began in 2002, when it was discovered that there were lobster seeds attached to the cage culture net for grouper culture. The fishermen then enlarged lobster larvae up to the size of a finger and then sold them for IDR3 000 per fish. However, the activities of catching and enlarging lobster larvae drastically reduced when a ban on lobster seed catching in 2015 was implemented and a prohibition on catching and raising lobster seeds in 2016.

- Fishermen experience difficulties when enlarging lobster up to 200 grams in size, this includes: expensive production costs, failure to grow because of long growing time periods (reaching 2 years) and issues regarding feed. Fishermen say that enlarging lobsters up to 1 ounce size only makes a small profit, while enlarging lobsters up to 2 ounces will cause a loss. This causes more fishermen to catch lobster larvae and cultivate up to 1 ounce size.
- Fishermen are aware of the potential of skipjack tuna and mackerel fish in Awang Bay, but do not have fishing gear or knowledge on how to catch these fish.
- Fishermen agreed and supported government policies to ban the capture of lobster brooders and prohibit the use of fishing gear that damage the ecosystem. However, they requested that the government impose a ban evenly throughout all regions in Indonesia. They also requested that the government consider a ban on lobster larvae cultivation activities.

Lobster fishermen and collectors in the Awang Bay area expect intervention regarding the development of lobster seed cultivation technology. Even lobster fishermen need assistance to learn lobster cultivation techniques adopted from the lobster culture in Vietnam. In addition, there is a need for an alternative livelihood recommended by the government for fishermen who previously caught lobster larvae. This is suggested because of the enactment of Minister of Maritime Affairs and Fisheries Regulation Number 56 of 2016 concerning the Prohibition of Catching and / or Spending of Lobster (*Panulirus* spp.), Mud Crab (*Scylla* spp.), and Blue Swimming Crab (*Portunus* spp.) from the Territory of the Republic of Indonesia, high unemployment rates that cause crime to increase.

2) Bumbang Bay area

- Lobsters caught by fishermen in the Bumbang Bay region consist of lobster larvae and consumption sized lobsters. Lobster larvae are caught using *pocong*, while consumption sized lobsters are caught by diving and using a gill nets.
- Fishermen in the Bumbang Bay area do not catch consumption size lobster as the main target. Fishermen claim that consumption size lobster is netted when fishermen search or catch other fish as the main target.

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