



**Establishment and Operation of a Regional System of  
Fisheries *Refugia* in the South China Sea and Gulf of Thailand**

**REPORT**

**BASELINE SURVEY FOR ESTABLISHING FISHERIES REFUGIA  
IN PROVINCE OF BANGKA BELITUNG ISLANDS**

**BANGKA BELITUNG, INDONESIA  
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## 1. PRELIMINARY

The Province of Bangka Belitung Islands is a province in Indonesia which consist of two main islands, namely Bangka Island and Belitung as well as hundreds of small islands. The total area of land and sea of Province of Bangka Belitung Islands reached 81,725.06 km<sup>2</sup> with the sea area of approximately 65,302 km<sup>2</sup>, or 79.90 percent of total area of Bangka Belitung Islands. Bangka Belitung sea waters contain a variety of fish. Small pelagic fish, coral reef fish, squid and other species of fishes can be found in auction market. The capture fisheries production in Bangka Belitung Island in the 2011-2018 period was recorded to reach 236,508.28 tons.

The squid is one of superior commodity of Bangka Belitung Islands. The squid is non-fishery export which higher compared to other commodities and has contributed high economic value to fisheries sector in Bangka Belitung. It is known that the quality of the frozen fresh squid caught from Bangka Belitung water sea is the highest quality in the export trade.

However, there are several threats faced by squid fisheries in Bangka Belitung Islands, such as a tendency to be over-exploited, and indications of damage to nursery habitat and spawning habitat. There are indications that exploitation of squid in the Bangka Belitung sea is not only for adult but also in juvenile. Additionally, the research that has been carried out for a decade shows that there are indications of damage to the habitat for squid to lay their eggs. These conditions should be overcome with proper management in order to ensure squid fishery sustainability in the future.

Management effort of fish resources is absolutely necessary to ensure its sustainability. The management effort should not only focus on managing catch but also on the protection of its important habitat, since the fish production being intrinsically linked to the quality of habitat. Therefore, integrated management of habitat and fish stock could be a good approach in fisheries management.

The fisheries refugia concept defined as “Spatially and geographically defined, marine or coastal areas in which specific management measures are applied to sustain important species [fisheries resources] during critical stages of their life cycle, for their sustainable use” (UNEP, 2005). This concept is a novel approach in fisheries management in which integrated fisheries and habitat management. The primary criteria for fisheries refugia site should focus on habitats critical to the life-cycle of important species.

In order to ensure sustainability of squid in Bangka Belitung, the fisheries refugia concept could be option in management tool. The critical habitat to squid life cycle should be identified accurately to avoid mis- determining of refugia site. Therefore, research and observation focused on critical habitat of squid is required to establish basis information in determining refugia area. The survey then was conducted by the team of refugia project of Indonesia as one of research series to collect all information about squid and its habitat which will be used as basis data for establishing fisheries refugia for squid in Bangka Belitung Islands.

## 2. OBJECTIVES

The objectives of the survey activity were:

- Identify critical habitat of squid (*Uroteuthis chinensis*) in Bangka Belitung and
- To assess critical habitat of squid in Bangka Belitung water including spawning and nursery ground of squid.
- To assess oceanography condition in Bangka Belitung sea;
- To assess biological aspect of squid, this includes growth pattern, length distribution; food habit, and genetic pattern of squid in Bangka Belitung;
- To obtain data & information regarding exploitation pattern of squid, fishing gears and fisher community of squid;
- To identify social system and institutions of fish squid community

### 3. METHOD

#### 3.1. Study area and survey

Observations were conducted at two sites of squid fishing bases in Province of Bangka Belitung Islands namely, Tuing (Bangka Regency) and the Lepar-Pongok (South Bangka Regency) (Figure 1). The total observations sites were 20 sites (Fig.1). Tuing coastal is located in Mapur Village, Riau Silip sub-district, Bangka Regency. Tuing sea is known as fishing site for squids in Bangka. Lepar-Pongok area is located in South Bangka Regency also known as fishing bases of squid that contribute to fisheries of Bangka Belitung Islands.

The survey was conducted on 11<sup>th</sup>-20<sup>th</sup> November, 2020. Field observation was conducted for the purpose of obtaining and validating data and information, namely:

- Aquatic environment: water quality, oceanography condition and habitat typology;
- Squid resources: length distribution, size of maturity, food habit, distribution pattern of juvenile and mature squid;
- Fishing activity: fishing gear, exploitation pattern of squid,
- Socio economy and institution aspect: fishing community, perception and participation of fishermen in management.

#### 3.2. Method of data collection

Method for data collection was as follow:

Table 1. All parameters were observed in baseline study.

Parameters	Method
1. Aquatic environment	
▪ Oceanography	Survey, observation, desk study
▪ Water quality	Survey, observation
▪ Habitat tipology	Survey, observation, desk study
2. Squid resources:	
▪ Length distribution	Collecting data from fishing base & enumerator
▪ Length maturity	Collecting data from fishing base & enumerator
▪ Food habit	Collecting data from fishing base & enumerator
▪ Distribution pattern of juvenile squid	Survey & observation
▪ Distribution pattern of mature squid	Survey & observation
▪ Biomass and species diversity of squid	Experimental fishing, fishing base, enumerator
3. Squid fishery	
▪ Fishing ground distribution and fishing landing	Survey, observation, interview
▪ Type of fishing gear and exploitation pattern of squid	Survey, observation, interview
4. Socio economic and institution of squid fisheries:	
▪ Squid Fishermen distribution and fisher community	Survey, observation
▪ Community development, perception and participation	Interview
5. Policy regulation and related matters about fisheries management in Province of Bangka Belitung	interview

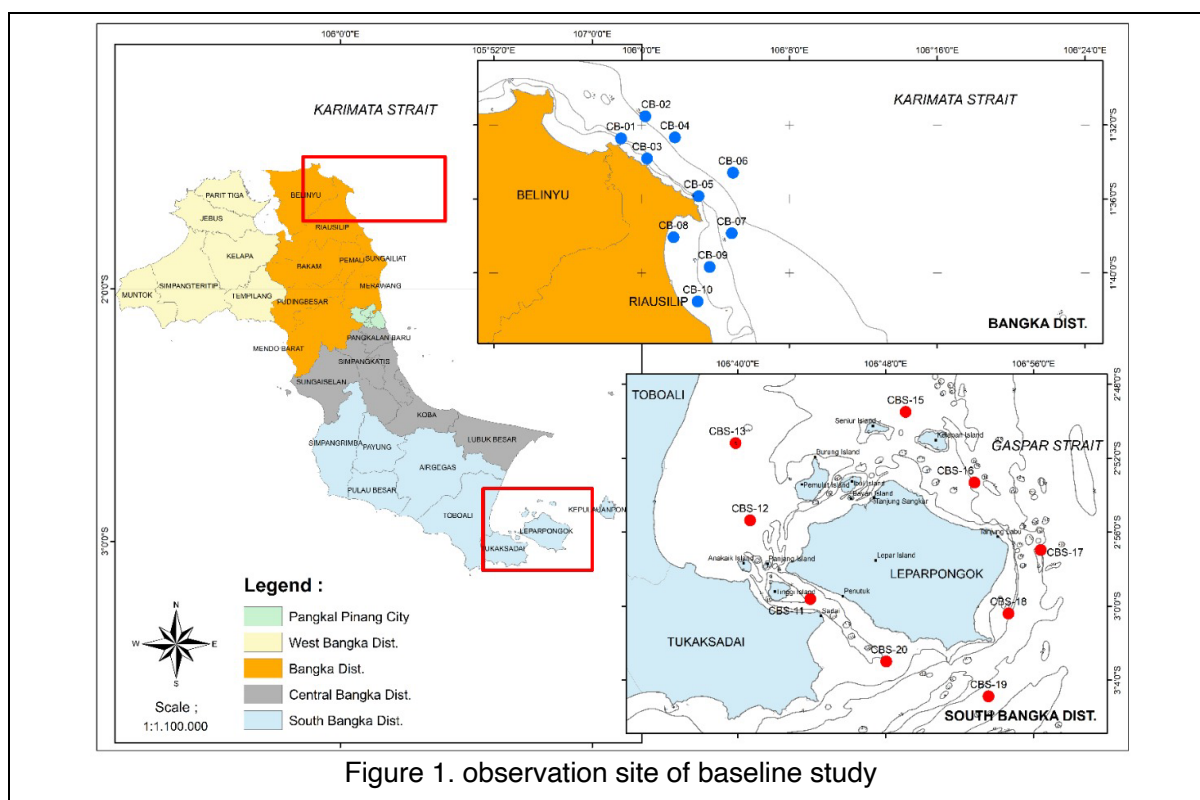


Figure 1. observation site of baseline study

## 4. Results

### 4.1. Water quality

The sampling sites consist of 20 points that were scattered in the north part of Bangka Island and in the south part.

Table 2. Water quality condition in observation site

Parameter	unit	Sampling site									
		CB-01	CB-02	CB-03	CB-04	CB-05	CB-06	CB-07	CB-08	CB-09	CB-10
Depth	m	15.8	22.2	12.4	12.4	9.3	26.3	13.3	5.3	8.4	6.1
Water temperature	°C	30.16	30.43	30.41	30.33	30.55	30.24	30.36	30.63	30.8	30.78
Water clarity	m	4	3.2	3.2	4.8	3.3	10.1	5.7	2.4	4.6	2.8
Turbidity	NTU	3.53	1.99	2.06	1.79	1.85	1.45	2.15	3.74	2.51	2.83
Total Dissolve solid	mg/L	25.9	26.2	26.3	26.3	26.3	26.1	26.4	26.2	26.3	26.1
pH		9.14	11.08	9.14	9.15	9.19	9.22	9.18	9.16	9.15	9.13
Dissolve oxygen	mg/L	9.51	7.47	6.89	6.82	9.89	8.06	9.42	9.53	9.25	9.8
Salinity	ppm	31	31.3	31.4	31.3	31.3	31.2	31.4	31.3	31.3	31.3
Chlorophyll-a	mg/L	0.425	0.6983	0.1185	0.1185	0.3377	10,376	0.7145	0.5439	0.63	0.6292
Total Suspenden Solid	mg/L	20.17	37	19.33	15.33	22.17	11.33	8.17	12.83	12	7.83
SO <sub>4</sub>	mg/L	113.4	183.93	257.69	68.41	99.16	113.26	63.05	144.72	79.27	148.81
NH <sub>4</sub>	mg/L	3.3	5.19	5.48	2.57	2.6	6.08	4.75	3.87	3.88	3.64
N-NO <sub>3</sub>	mg/L	0.56	0.44	0.61	0.54	0.51	0.63	0.56	0.47	0.51	0.45
BOT	mg/L	12.01	14.85	12.64	10.43	7.9	6.95	7.9	5.69	8.53	8.53

PO <sub>4</sub>	mg/L	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD
N-NO <sub>2</sub>	mg/L	0	0	0	0	0	< LOD	0	< LOD	< LOD	< LOD

CB-01, CB-02, CB-03, CB-04 (Tangkalat area); CB-05, CB-06 (Punggur coastal); CB-07 (Tuing); CB-08, CB-09, CB-10 (Tuing coastal);

Table 2. Water quality condition in observation site

Parameter	unit	Sampling site									
		CB-11	CB-12	CB-13	CB-15	CB-16	CB-17	CB-18	CB-19	CB-20	
Depth	m	12,13	6,00	6,64	7,40	4,60	18,20	9,70	22,10	2,40	
Water temperature	°C	30,36	30,94	20,91	31,16	31,18	31,65	30,84	31,19	30,66	
Water clarity	m	1,9	0,3	2,1		4,2	9	3,4	3,7	2,4	
Turbidity	NTU	4,85	3,66	3,97	2,45	2,43	1,38	1,66	4,21	3,66	
Total Dissolve solid	mg/L	26,1	26,2	26,1	26,4	26,3	26,3	26,2	26	25,8	
pH		9,08	9,21	9,17	9,16	9,16	9,23	9,18	9,1	9,05	
Dissolve oxigen	mg/L	7,83	8,29	5,88	9,52	8,62	9,54	9,42	9,28	8,66	
Salinity	ppm	31,2	31,3	31,2	31,4	31,4	31,3	31,3	31	31	
Chlorophyl-a	mg/L	0,1185	0,6292	0,8314	0,9712	1,192	0,5131	0,5107	0,3401	0,4246	
Total Suspenden Solid	mg/L	10,00	7,00	17,33	9,17	16,50	10,17	25,50	23,33	30,50	
SO <sub>4</sub>	mg/L	69,26	85,48	120,31	123,42	104,66	123,98	100,99	111,15	113,69	
NH <sub>4</sub>	mg/L	4,87	4,20	2,34	5,88	3,17	4,45	1,86	1,70	4,08	
N-NO <sub>3</sub>	mg/L	0,65	0,58	0,56	0,52	0,58	0,64	0,70	0,79	0,64	
BOT	mg/L	6,64	5,37	5,37	5,37	7,90	13,27	12,32	10,74	10,11	
PO <sub>4</sub>	mg/L	0,00	< LOD	< LOD	< LOD	0,00	< LOD	< LOD	0,01	< LOD	
N-NO <sub>2</sub>	mg/L	0,00	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	

CB-11 (Penutuk); CB -12 (Tj. Sangkar Barat); CB-13, CB-14 (Tj. Sangkar); CB-15 (Tj. Sangkar Timur); CB-16 (Tj. Labuh Utara); CB-17 (Tj. Labuh); (CB-18 (Tj. Labuh Selatan); CB-19 (Merun luar), CB -20 (Merun Dalam)

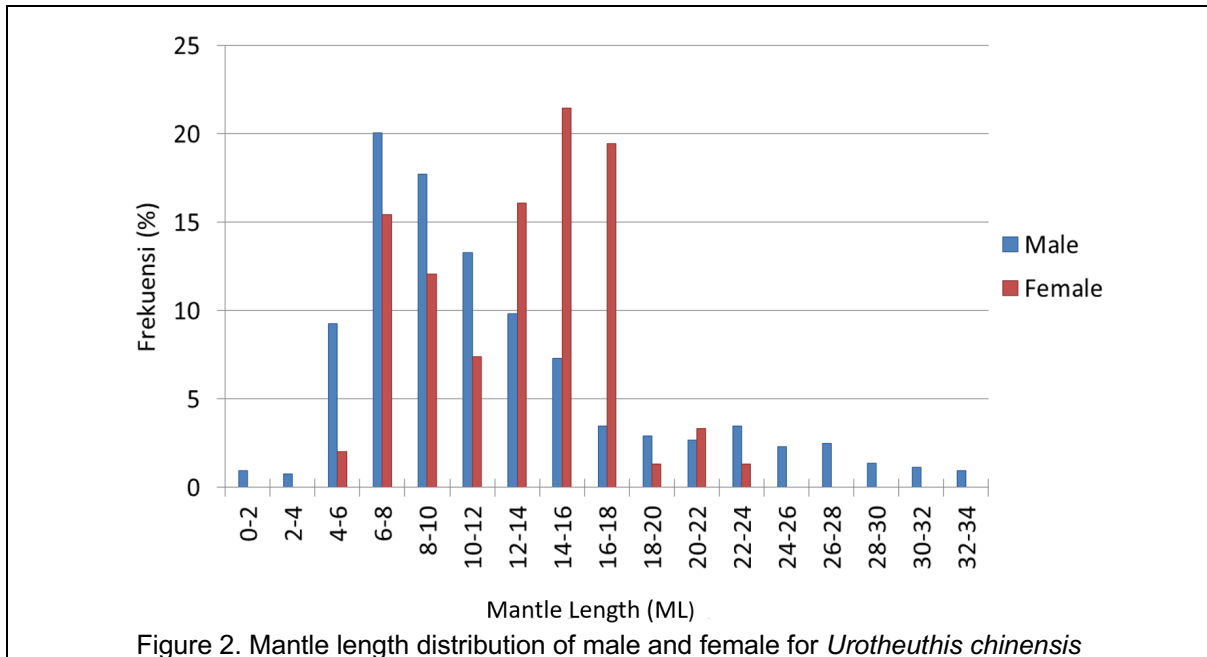
The observation of water quality in all sites showed that the condition of water quality in general was categorized good and supports for aquatic biota life including squid.

#### 4.2. Biological Aspect of squid (*Urotheuthis chinensis*)

Total samples of squids were observed on November in study site were 668 squid. All the samples were collected using hook, lift net, and gill net. The results of the biological aspect of squids are as follows:

- **Length distribution of squid**

The total samples observed were 668 squids with mantel length 0.7-34 cm and weight 0.23-339.62 gram. The length distribution of squid samples collected from observation site as follows:



- **Length Weight Relationship**

The relationship between mantle length and weight of female squid (*Urotheuthis chinensis*) follows the equation  $W = 0.0062ML^{1.8669}$  and for male squid is  $W = 0.0018ML^{2.1455}$ , whereas the relationship between mantle length and weight of all squid samples is  $W = 0.0052ML^{1.9083}$ . the t-test with confidence level 95% ( $P < 0.05$ ), showed that growth pattern of both female and male squid is allometric negative ( $b < 3$ ). This means that growth of mantle length faster than the weight.

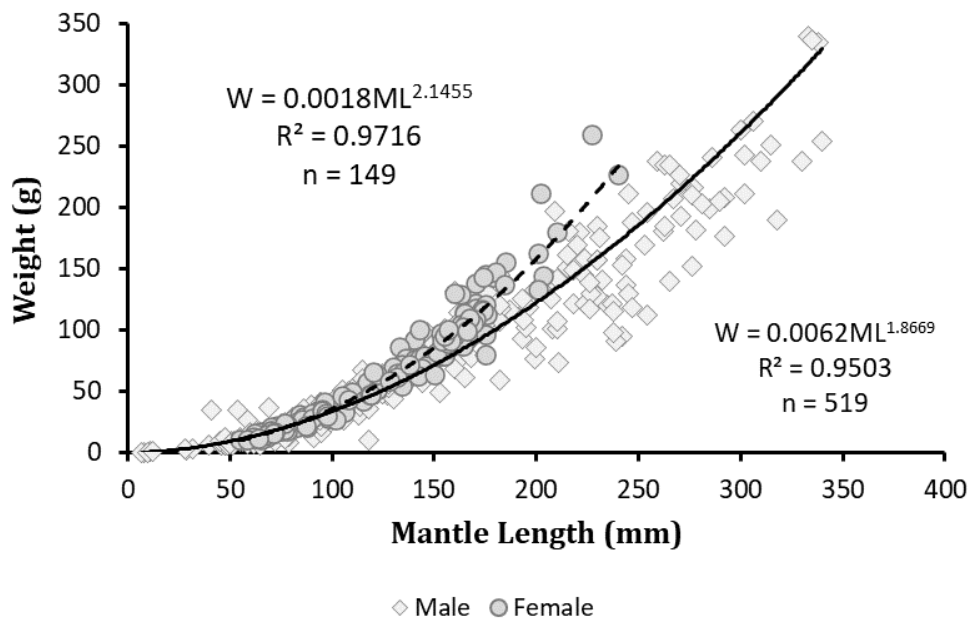


Figure 3. Mantle length-Weight relationship of *Urotheuthis chinensis*

- **Length of first capture (Lc) and Average of Length maturity**

Based on Logistic curve, the length at first capture (Lc) of *U. chinensis* caught in Bangka is 106 mm for males and 119 mm for females (Fig. 4.). The mean length of *U. chinensis* when

50% of the population reaches gonad maturity ( $L_{m50}$ ) is 167 mm for males and 143 mm for females.

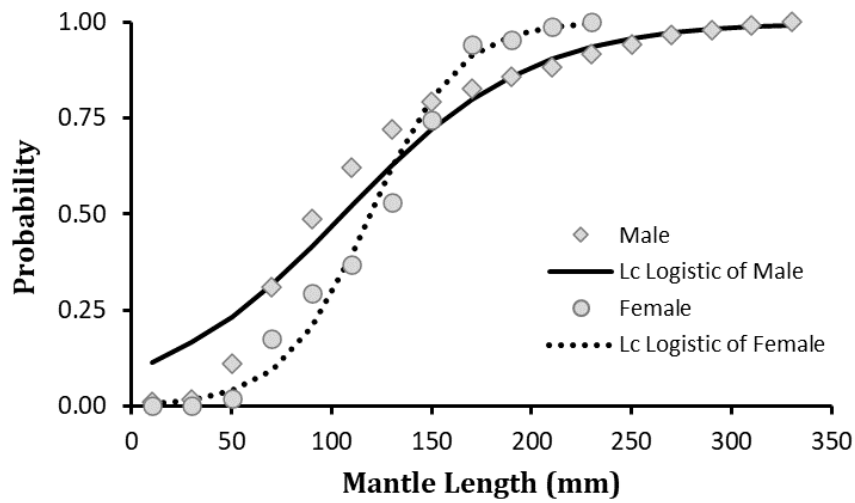


Figure 4. Length at first capture ( $L_{c50}$ ) of male and female *Uroteuthis chinensis*

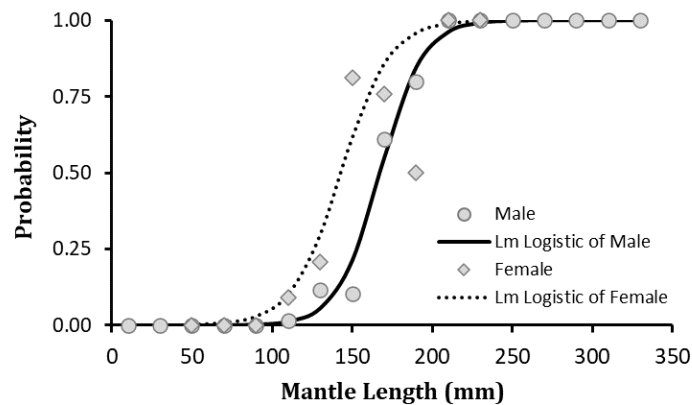


Figure 5. Length at first mature ( $L_{m50}$ ) of male and female *Uroteuthis chinensis*

• **Food habits**

Analysis of stomach content from 134 samples of *U.chinensis* showed that the dominant food in *U.chinensis* was fish ( $li=64.59\%$ ) and the rest was crustacea ( $li=4.04\%$ ) (Figure 6)

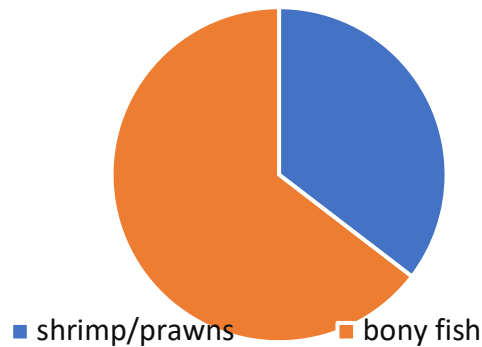


Figure 6. Food habits of *Uroteuthis chinensis* in Bangka



- **Social economy condition and community institution in observation site**

Observation were conducted at two sites of squid fisheries centres, Tuing (Bangka regency) and Liat-Lepar (South Bangka). Tuing is located in administrative area of Mapur Village, Riau Silip District, Bangka Regency, which is one of the coastal villages in Bangka Regency. The Tuing sea was proposed as sustainable fisheries zone and conservation for squid.

- **Number and profile of squid fishermen**

Fishermen are one of the professions in society as a means of living to meet the needs of life and their families among various other professions. In the Riau Silip, the livelihood of the population is dominated by the profession of farmers, reaching 80.58%, while the percentage of fishermen is only around 3.28% (513 people). This condition is in line with the regional typology where out of the 12 villages administrative area, only 2 villages are coastal village.

This condition are quite different from Lepar-Pogok, where all villages are coastal villages with the number of fishermen reached 27.02% (1,254 people). Nevertheless, people living in non-coastal villages generally prefer to work on land (farming) with a fairly dominant number of around 56.96%.

Table 3. Livelihood of community in observation sites

Livelihood	Riau Silip (Orang)	percentage (%)	Lepar-Pogok (orang)	percentage (%)
Mining	433	2,76	108	2,33
Agriculture	12,622	80.58	2.643	56,95
Fishery	513	3.28	1.254	27,02
Industry	97	0.62	132	2,84
Construction	37	0.24	30	0,65
Trader	390	2.49	156	3,36
Transportation Government employee	156	1.00	133	2,87
others	177	1.13	116	2,50
	1238	7.9	69	1.48

However, the results of field observation showed that Tuing sea and coastal not only fishing ground for fishermen from Mapur village, but also from other villages in Riau Silip district. Moreover, the Tuing water sea is the only site that have not been utilized for offshore tin mining, so that the fish resources are still in good condition.

- **Squid Fishery Stakeholders**

The results of observations and interviews with number of key informants indicate that stakeholders related to squid fishery : (1) Ministry of Marine Affairs and Fisheries; (2) Provincial/Regency Government; (3) fishermen; (4) Collector; (5) Exporters; (6) fisheries supervisory community groups;(7) fishing port/auction market; (8) fishery extension officers; (9) fishery quarantine; (10) DG of marine and fisher resources supervision; (11) NGO; (12) University/Research Institutions, and (13)village government.

The stakeholders were grouped into primary and secondary stakeholders. Townsles(1998) defines that primary stakeholders are those who have direct interest in the resources and area either as livelihoods or take a part in utilization and management. Meanwhile, secondary stakeholders are parties that have an indirectly interest, or parties that depend on part of the business generated by these resources. Based on the definition above, stakeholders group and theirs interest/roles in squid resources management are presented in Table 4.

Table 4. Identification of stakeholder's interest and role in squid fisheries

Groups	Stakeholders	Interest/Role
Primary	Fishermen	have an interest in the utilization and management of fishery resources to meet their daily needs
	Collector	have an interest in the utilization and management of fishery resources to meet their daily needs
	Exporters	has an interest in the utilization and management of fishery resources to meet the needs of his business / company
Secondary	Ministry of marine Affairs & Fisheries	managing stock status and protecting sustainability of squid resources
	Provincial/Regency Government fisheries supervisory community groups	management, utilization, capacity building and contribution on sustainability of the resources Play a role ini monitoring the use/control of resources.
	Village government	play a role in improving the welfare of the fishing community
	NGO	Play a role in increasing community capacity through mentoring and strengthening community institution
	fishing port/auction market;	play a role in building community capacity through the provison of facilities and infrastructure.
	DG of marine and fisher resources supervision	Providing monitoring support and taking action against violations of resources utilization.
	University/Research institutions	Providing applied research to the community and promote effective management.
	fishery extension officers	Play a role in increasing community capacity through mentoring and strengthening community institutions.

- **Group Development Level**

The result of the study on the potency of community institutional development to participate in management indicated that the community institution in the observation sites were at the *norming* level. Norming is a form of adult-level institutional growth, where the aspects of supervision and sanctions have become part of the integrity of regional institutions in carrying out their roles and functions. However, several elements at the adult level have not been implemented in the local institutional system, so institutional strengthening needs to be done through coaching and mentoring.

**The Involved Person:**

The persons were involved in the baseline survey activities are:

1. Dr. Amula Nurfiarini Research Leader (Research institute for Fish Resources Enhancement/RIFE)
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3. Dr. Khairul Amri GIS researcher (Research Institute for Marine Fisheries)
4. Astri Suryandari, S.Si., MSi Fish Biology Researcher (RIFE)
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PHOTOGRAPH ACTIVITIES

