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Diversity of Fisheries Resources and Fishing Gear Ownerships on Fishing Capture at Surabaya Coastal Waters Indonesia

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----------**ABSTRACT**----------
Surabaya is a coastal town where some community works as fishermen. Sustainability of fishing activities require good fisheries management efforts. The aim of the study was to describe preparation of fishery resources and diversity of ownership in fishing gear. This study uses survey respondents chairman and member of the group of local fishermen in nine coastal districts of Surabaya. The results showed that type of fishery resources are exploited by fishermen are a small pelagic and bottom fish, crustaceans, bivalves, holothurians, cephalopods, gastropods, and arthropods. Overall fishery resources which have important economic value consists of sixty species. Production volume in 2013 was as much as 9095.68 tons. From the analysis of twenty types of fisheries resources that dominate the catch, and represents 90.64% of total production volume, indicating that the volume of the catch of fishermen during the year was dominated by the criteria of total catches ranging from 5-15 kg/crew/trip. The diversity of resource stocks over a period of one year showed a significance between different months. The diversity of different dosage consequences that fishermen should have more than one type of fishing gear, so that fishermen can still take advantage of the resources throughout the year.

KEY WORD: *Fisheries resources, Ownership of fishing gears, Coastal waters, Surabaya,*

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I. INTRODUCTION

The centers of fishing activities in Indonesia are basically not only in remote areas far from urban areas, urban centers synonymous with government, business or residential. Surabaya as the second largest metropolitan city in Indonesia is a coastal town, where some community activity fisheries using a variety of fishing gear, as well as the majority of fishermen are small-scale enterprises.

The presence of base fishing activities in Surabaya basically due to the fishing activity has existed long before the city of Surabaya grew into the metropolis it is today, so it is very possible because of the support of natural factors such as high levels of fertility in waters that exist in coastal areas.

Surabaya is a coastal town which has an area of approximately 33 048 ha of land and sea area of about 19 039 ha. The total length of coastline Surabaya reach approximately 47.4 miles to the length of the line to the East Coast Surabaya reaches approximately 26.5 km and for the North Coast Surabaya account for about 20.9 miles. In waters that are not too broad because it is in the western part of the Madura Strait region is narrowed, the pattern of use of an existing fishery resources have shown a negative impact. Real impact is a decrease in the amount of fish caught by fishermen (Subagio and Widagdo, 2013).

In these situations, the future management requires a comprehensive treatment and need to change the old paradigm oriented to the exploitation of new paradigm that emphasizes aspects of conservation, then oriented exploitation. For that it is necessary the availability of adequate data on existing fisheries Events diversity. The aim of the study was to describe the preparation of fishery resources and the diversity of fishing gear ownership on fishing capture of Surabaya.

II. MATERIALS AND METHODS

The method used in this study is a survey method. The survey was conducted to collect primary data in the form of the type organism of the catch, the type and amount of fishing gear, fishing technology, topography and coordinates coastal estuaries, as well as secondary data such as the type of resource and the catch of fishermen during the past year.

The primary data collection is done by following the fishing operation, while the organisms sampled catches for identification, obtained from fish landing centers scattered in every district. Identification of organisms catches made with reference to: Saanin, 1984a; Saanin, 1984b; Bianchi, 1985; Holthuis, 1980; Roper and Sweeney, 1984; Carpenter and Niem, 1998a; Carpenter and Niem, 1998b; Carpenter, 2002. While the data on fishing gear, coastal topography and river estuaries coordinates obtained by direct observation in the field.

Secondary data such as the type of resource and the catch of fishermen during the last year obtained through interview method with the chairman and members of existing groups of fishermen. The data were processed using descriptive statistics to get an idea of the diversity of fishery resources, fishing season, and the diversity of fishing gear used.

In this study fisherman catches categorized into 4 types: thee are no fish (0); there are fish in small amounts (total yield < 5 kg/crew/trip) (1); there are fish in moderate amounts (total yield 5-15 kg/crew/trip) (2); there are fish in large amounts (total yield > 15 kg/crew/trip) (3).

III. RESULTS AND DISCUSSION

3.1 Geographical Conditions

Surabaya region bounded by two rivers, part south about on Kali Anyar River bordering Sidoarjo City, and Kalilamong River on the west side bordering Gresik City. In the coastal city of Surabaya there are many river mouths, estuaries overall number found on the east coast and the north coast of Surabaya is a twenty-four rivers. Coordinates of the to-twenty-four existing estuaries, respectively from the south east coast to the north coast of Surabaya is as indicated in Table 1.

A large of river estuaries at coastal region is an indication that in these waters is a fertile region, as confirmed in Subagio (2008), one of the characteristics of the territorial fertile waters territory are adjacent to the estuary waters. Furthermore, the presence of the basic characteristics of the coastal topography is very gentle, namely the intertidal zone up to the extent of about 800 meters, will lead to the fertile waters will be more widespread. The extent of fertile waters territory around Surabaya also implies to the abundance of fishery resources.

Along with the many estuaries and the wide distribution of mangrove forests in the coastal area of Surabaya, causing sedimentation processes that occur in the coastal waters of a very large contribution to the providers of organic materials that are needed by the existing biota. Existing geographical conditions such as high fertility is very supportive of the waters, which in turn will enrich the existing potential of fisheries resources.

Sedimentation is a very important factor in the ecology of mangroves (Ellison 1998), mangrov grows in coastal lowlands where the substance of sediment from the river empties into the sea. Sedimentation can provide positive and negative results. Positive impact, the addition of sediment deposition allows the formation of a new colony of habitats mangrov (Panapitukkul et al. 1998), on the contrary, if the intensity is too high and sedimentation took place during heavy rainfall can reduce growth and even cause death if the mangrove breathing roots covered by mud (Ellison 1998). In normal conditions, the sediment accumulated at a rate of about 1.5 centimeters per year, thereby allowing the system to adjust the mangrove roots, so that breathing can take place (Hutching and Saenger 1987). In addition, a decrease in the rate of sedimentation in coastal waters as a result of river water damed can also negatively impact the coastal environment. It also can lead to erosion in vulnerable areas including coastal waters dominated by mangrov (Bird *et al*., 2004).

Table 1. Coordinates Estuary in Surabaya

No.	Rivers Name	Coordinates Of Estuary
1.	Gunung Anyar	7°20'37.18"S - 112°49'33.63"E
2.	Roh Kelem	7°20'20.01"S - 112°49'37.15"E
3.	Kebon Agung	7°20'4.58"S - 112°49'46.99"E
4.	Dadapan	7°19'18.10"S - 112°50'15.60"E
5.	Jagir (Kali Londo)	7°18'16.90"S - 112°50'40.40"E
6.	Keputih	7°17'56.60"S - 112°50'45.50"E
7.	Kejawan Putih	7°16'27.50"S - 112°50'23.60"E
8.	Damean	7°16'3.69"S - 112°50'13.65"E
9.	ITS	7°15'41.02"S - 112°49'53.64"E
10.	Kalisari	7°15'23.88"S - 112°48'38.02"E
11.	Kenjeran	7°14'26.49"S - 112°47'51.76"E
12.	Kenjeran DAM	7°15'23.88"S - 112°48'38.02"E
13.	Bulak Cumpat	7°13'34.19"S - 112°47'21.23"E
14.	DAM Benteng (Gudang Peluru)	7°13'2.86"S - 112°47'5.87"E
15.	Kedung Cowek	7°12'32.36"S - 112°46'48.00"E
16.	Tambak Wedi (Kali Tebu)	7°12'11.30"S - 112°46'21.40"E
17.	Mas	7°11'50.31"S - 112°44'6.36"E

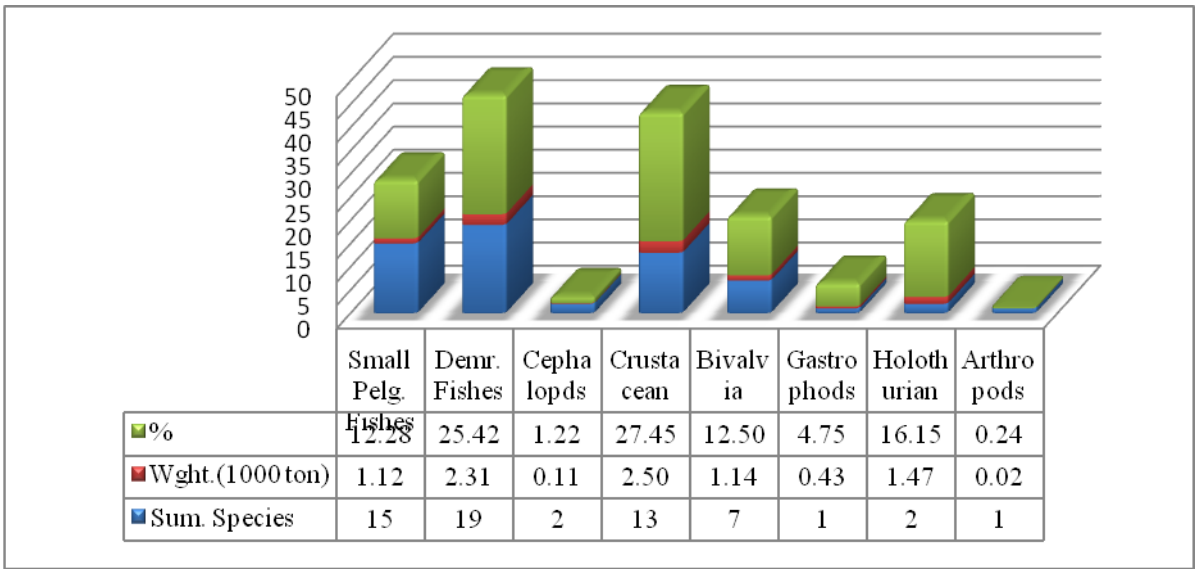
18.	Bosem Kalianak (Morokrembangan)	7°14'8.50"S - 112°42'55.30"E
19.	Kalianak	7°13'21.90"S - 112°42'22.50"E
20.	Greges	7°13'32.40"S - 112°41'9.30"E
21.	Manukan (Balong)	7°13'27.10"S - 112°40'38.10"E
22.	Tambak Langon	7°13'12.70"S - 112°40'6.20"E
23.	Sememi	7°12'26.10"S - 112°39'37.50"E
24.	Kali Lamong	7°11'35.60"S - 112°39'45.80"E

3.2 Fisheries Resources

Fishery resources, both marine and fresh waters, including natural resources that are renewable, however, the utilization of these resources must be rational. According Naamin (1987), in general fishery resources can be classified into 4 groups, among others: 1). Demersal fisheries resources, which is a type of fish that live at the bottom or near the bottom waters; 2). Small pelagic resources, the types of fish that are around surface waters; 3). Large pelagic resources, the kind of highly migratory oceanic fish so far (such as tuna); and 4). Shrimps and others marine life resources.

Economically fishery resources were landed by fishermen, identified as 60 species, which are categoried small pelagic fish comprises 15 species; demersal fish comprises 19 species; sefalopods comprises 2 species; crustaceans comprises 13 species; bivalves comprises 7 species; gastropods comprises 1 species; holothurians comprises 2 species, and arthropods comprises 1 species, as in Fig. 1.

Successively dominant organism resources are crustaceans (27.45%), demersal fishes (25.42%), holothurians (16.15%), bivalves (12.50%) and small pelagic fishes (12.28%). The majority of resources are demersals, that most of his time at around the bottom waters for foraging activity, reproduction and other activities. Numbers of demersal fisheries resources are characteristic of the region is due to the coastal waters of Surabaya is very gentle with the basic texture of a sandy mud as sedimentation substances, extent of mangrove habitat, many estuaries and accumulation of organic matter that is the region of the intertidal and coastal waters of Surabaya.



	Small Pelg. Fishes	Demr. Fishes	Cephalopds	Crustacean	Bivalvia	Gastrophods	Holothurian	Arthropods
%	12.28	25.42	1.22	27.45	12.50	4.75	16.15	0.24
Wght.(1000 ton)	1.12	2.31	0.11	2.50	1.14	0.43	1.47	0.02
Sum. Species	15	19	2	13	7	1	2	1

Figure 1. Production volume of fisheries yield.

Santoso (2000) states that the mangrove forest is a forest located in the coastal belt always or regularly inundated by sea water and is affected by the tide but not affected by climate. Mangrove ecosystem is the producer of detritus, nutrient sources and organic matter. Mangrove ecosystems also serve as habitat, foraging (feeding ground), the care and rearing (nursery grounds), where spawning (spawning ground) for many types of aquatic organisms (Santoso and Arifin, 1998)

Table 2. Diversity Amount of The Catch 20 Type of Fishery Resources Predominantly for One Year

No	Fish Kind	Result (%)	Month											
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	*Portunus pelagicus*	12.08	3	3	3	3	2	2	2	2	2	2	3	3
2	*Argyrosomusa moyensis*	11.17	3	3	3	2	2	2	2	2	2	2	3	3
3	*Sipunculus* sp.	8.69	2	2	2	2	2	2	2	2	2	2	2	2
4	*Metapenaeus* sp.	7.76	2	2	2	2	3	3	3	2	2	2	2	2
5	*Holothuria edulis*	7.46	2	2	2	2	2	2	2	2	2	2	2	2
6	*Anadara granosa*	7.13	3	3	2	2	2	2	2	2	2	3	3	3
7	*Babylonia spirata*	4.75	3	3	2	2	2	2	2	2	2	2	3	3
8	*Thryssa setirostris*	4.38	0	0	0	2	2	2	2	2	2	3	3	3
9	*Mugil cephalus*	4.25	2	2	3	3	1	1	1	1	1	1	2	2
10	*Pinna bicolor*	3.64	2	2	2	2	3	3	3	3	3	2	2	2
11	*Silago sihama*	3.30	2	2	3	3	3	3	3	2	2	2	2	2
12	*Netuma thalassina*	2.82	2	2	2	2	2	2	2	2	2	2	2	2
13	*Osteogeneiosus militaris*	2.58	2	2	2	2	3	3	3	3	2	2	2	2
14	*Scylla* sp.	2.43	3	3	3	3	2	2	2	2	2	2	3	3
15	*Stolephorus* sp.	1.92	2	2	2	2	2	2	2	2	2	2	2	2
16	*Macrophthalmus japonicus*	1.42	3	3	3	3	2	1	1	1	1	1	3	3
17	*Lates calcarifer*	1.31	0	0	0	0	0	0	0	0	0	2	2	2
18	*Penaeus merguensis*	1.26	3	3	3	3	2	2	2	2	3	3	3	3
19	*Plotosus canius*	1.18	1	1	1	1	1	1	1	1	1	1	1	1
20	*Penaeus monodon*	1.11	1	1	1	1	1	1	1	1	1	1	1	1
	Total	90,64	41	41	41	42	39	38	38	36	36	39	46	46
	Average		2.05	2.05	2.05	2.10	1.95	1.90	1.90	1.80	1.80	1.95	2.30	2.30

Note:
0 = there are no fish
1 = there are fish in small amounts (total yield <5 kg/crew/trip)
2 = there are fish in moderate amounts (total yield 5-15 kg/crew/trip)
3 = there are fish in large quantities (total yield > 15 kg/crew/trip)

3.3 Fishing Activity

Fishing activities which have the characteristics of the production plan can not be determined quantitatively, this is due to the presence of existing the mobile resources that quantitative and qualitatively always fluctuating. Fluctuation of the catch is considered as the effect of the fishing season.

Total catch volume production of the 60 types of aquatic organisms were landed by fishermen Surabaya in 2013 was as much as 9095.68 tons. While catches of 20 species, and most types of organisms that dominate the catches of fishermen during the period of one year are as presented in Table 2, with a total production volume of 8244.32 tons or 90.64% of the total production volume, so that 9.36% fishermen catch the rest is composed of 40 types of other fishery resources.

Literally understanding and definition of the fishing season up to now there is no. However, with the term 'fishing season', typically have a fisherman or academics on the same assumption, that the fishing season is a particular period where the number of fish caught by fishermen fluctuate significantly due to a change in resource stocks. In a period of one year, there are three commonly known fishing season are: the famine season, the mid season, and the peak season of fish. Furthermore, some of the terms associated with the different fish this season, until now there is no reference that can also be used as a basis for the quantification of the data as well as limits to categorize whether a certain moment in a state being a bad season, or the season is the peak season.

Based on Table 2 shows that the presence of 20 species of resource preparation dominant, along with other existing resources, can always be caught by fishermen throughout the year, with the quality and quantity of different catchment on a monthly basis. As stated by Santoso and Arifin (1998), that the condition of coastal ecosystems dominated by forests mangrov and supported by the many rivers that flow into the region will lead to the accumulation of nutrients and organic matter, which then makes these waters are rich in fisheries resources are becoming targets fishermen along the years.

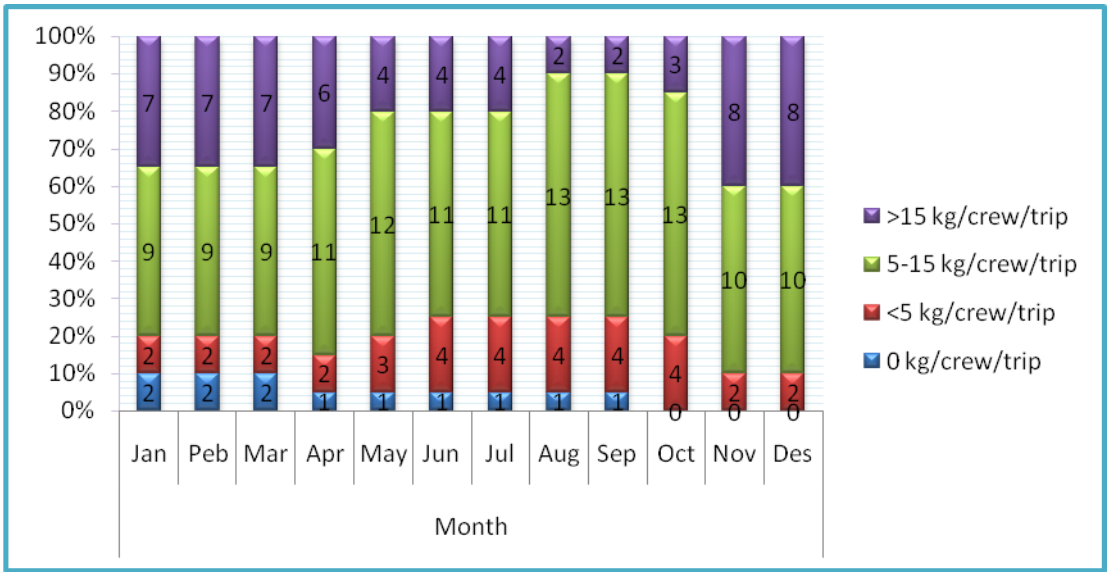


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Figure 1. Distribution of catches of the 20th type of fishery resources for one year (source: 2013 survey results)

Of the 20 types of fishery resources that dominate the catch of fishermen during the period of one year, the percent distribution is as shown in Fig. 2. Percentage of resource availability on a monthly basis is varied in quality and quantity, it is the diversity of the nature and consequences of behavior catch the target fish that fishermen using different gear types. Does not rule out the possibility that fishermen should carry more than one type of fishing gear, as well as a solution to avoid the anticipation of competition arrest at a certain gear types so that they can use alternative fishing gear to reduce competition and increase chances of obtaining results.

Table 3 The Diversity of Fishing Gear With 20 Yield of Dominant Fishery Resources

No	Fish	Type of Fishing Gear																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Ttl
1	*Portunus pelagicus*	v			v			v	v				v					5
2	*Argyrosomusa moyensis*	v	v		v	v			v	v								6
3	*Sipunculus* sp.															v		1
4	*Metapenaeus* sp.	v			v				v	v		v						5
5	*Holothuria edulis*															v		1
6	*Anadara granosa*												v	v				2
7	*Babylonia spirata*												v					1
8	*Thryssa setirostris*		v		v													2
9	*Mugil cephalus*	v	v	v	v				v		v	v					v	8
10	*Pinna bicolor*												v	v				2
11	*Silago sihama*				v													1
12	*Netuma thalassina*	v	v		v				v									4

13	*Osteogeneiosus militaris*	v	v		v	v			v									5
14	*Scylla* sp.	v					v	v					v		v			5
15	*Stolephorus* sp.		v															1
16	*Macrophthalmus japonicus*												v					1
17	*Lates calcarifer*	v	v		v	v			v				v					6
18	*Penaeus merguensis*		v		v				v		v							4
19	*Plotosus canius*	v	v		v	v							v	v				6
20	*Penaeus monodon*				v					v								2
	Total	9	9	1	12	4	1	2	8	3	2	2	8	3	1	2	1	

Description, type of fishing gear:

1. Fixed gill nets	7. Pots	12. Pick slide board
2. Drift gill nets	8. Fyke nets	13. Pick with diving
3. Encircling gill nets	9. Waring	14. Hook crabs
4. Trammel nets	10. Cast nets	15. Dredges
5. Set longlines	11. Push nets	16. Pick with light
6. Pole lines		

Related to seasonal of fish appears that throughout the year, quantitatively the catch was dominated by a fisherman who catches the 2nd category, or the catch of a moderate amount (the total yield of 5-15 kg/crew/trip), followed by the 3rd category (the total yield > 15 kg/crew/trip), followed by the 1st category (the total yield < 5 kg/crew/trip) and the last one is no fish. This suggests that the availability of resources throughout the year is to be continuous, so that the whole year was able to get the catch fishermen in moderate amounts, ranging from 5-15 kg/crew/trip. This condition is in fact a logical consequence of the characteristics of a fishing ground and a high fertility rate, is rich in fishery resources of the target catch of fishermen throughout the year.

3.4 Fishing Gear Ownership

From the survey results, the overall number of fishermen who conduct fishing activities are as many 2,630 people. Fishermen who have fishing gear is as much as 2,019, and the remaining 611 fishermen have no fishing gear. They work as fishermen collected without tools/'skilot' board, or as laborers fishermen. Skilot is a board measuring 1.7 m of length and 0.6 m width which serves as a sled, used for sliding on the mud while doing the collection of aquatic organisms. The diversity of the target resource stocks catch also carries consequences diverse types of fishing gear used by fishermen. The diversity of fishing gear can be seen in Table 3.

As in Table 3 above shows that to capture a particular type of resource use more than one type of fishing gear, as well as in Sulestiani and Subagio (2011), except in the capture of resources holothurians (eggplant and cucumbers) only use one type of fishing gear is typical, in the form of garit, a fishing gear is hook the target catch. Likewise, the fishing gear and fishing methods commonly used fishing, generally have more than one type of target organisms catch, except the three types of fishing gear that is dedicated to capturing certain target species, namely: a special circular gill net catch mullet, fishing special sticks catch mangrove crabs, rek (hook crabs) special catch mangrove crabs, and torch (light) special catch mullet. From the data processing to determine the level of diversity of resource stocks for the period of one year (Table 2) are as presented in Table 4.

Table 4 Test Preparation Resource Diversity Over A Period Of One Year

N	20
Chi-Square	20.708
df	11
Asymp. Sig.	0.037

a. Friedman Test

The test results showed that the significance is less than 0.05, this means that the preparation of fishery resource diversity dominant there is a different between months during the period of one year. This leads to the condition that the fisherman whose capital is very limited, ranging from 0.53 to 1.49 GT vessel size, and condition of boat and engine are not optimal for a distance of over 10 miles. Forcing fishermen should continue to be able to get the catch throughout the year when there is a change dosage of fishery resources. To anticipate changes in the type of preparation that is the target of this catch, the fishermen must have more than one type of fishing gear.

Strengthened by the results of a survey conducted in the field, it was found that the diversity of gear types in Surabaya is quite high, the high diversity of fishing gear is none other than due to the various types of fisheries resources as a target catch (Subagio, 2011). If the terms of the type of fishing gear, in Surabaya recorded as many as 4,500 units of fishing gear, including fishing picking up, which is operated by as many as 2,019 fishermen.

A total of 4,500 units of existing fishing gear, fishermen who have boats are as many as 1,431 people, who do not have as many as 1,199 people were aboard. Means any vessel fishing with more than one type of fishing gear. From the survey results, every fishing boat has 1-5 pieces of gear types. This is a feature of fisheries artisal in the city of Surabaya.

IV. CONCLUSIONS

The diversity of resource stocks over a period of one year showed a significance between different months. To anticipate changes in the type of preparation is the target catch force fishermen must have more than one type of fishing gear.

In Surabaya recorded as many as 4,500 units of fishing gear including fishing picking up, which is operated by as many as 2,019 fishermen. For each fishing boat has between 1-5 types of fishing gear fishing gear.

From the results of the study suggested the need for the study of the spawning season and reproductive maturity of the organism fishermen catch, so it can be used as a basis for future management efforts.

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