Original paper

DOES MARINE FISHING CAPTURE DECLINE IN NORTH COAST OF CENTRAL JAVA?

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ABSTRACT

Marine fisheries productivity has been studied in North coast of central Java. Study was carried out at four coastal regions, i.e Brebes, Pemalang, Jepara , and Rembang from July to October 2002. The primary and secondary data were collected covering the existing marine habitats, namely mangrove, sea grass meadows, coral reefs, and fishing and marine culture production.

The result showed that most marine local habitats in the North coast of central Java, mainly in the studied sites were worse. Mangrove cover, from the total of 3,442.19 ha was only 979,8 (8,46%) in good condition, while remaining areas of 2,462,39 ha (71,54%) were in critical or bad condition. Similar trends were observed in the sea grass and coral reef habitats showing the decrease of living coral cover resulted in the decline in fishing capture production.

Key Words: Mangroves, sea grass meadows, coral reefs condition, marine fisheries production
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INTRODUCTION

Coastal waters are highly productive marine ecosystem in tropical areas. Primary productivity is very high, goes up to > 10 kg C/m^2/yr or 50-100 times higher than which was recorded at the offshore (Gordon and Kelly, 1962). The coastal areas have main roles as spawning, nursery, and feeding grounds of many marine fishes. The fisheries production, therefore, is also high in the coastal areas, i.e, 10-30 ton/ha/year.

Unfortunately, the human activities in exploiting the natural resources, such as industries, agricultural, capture of fisheries, culture of fisheries, tourism, harbor, navigation, often affect on marine resources in the coastal areas. Moreover, those activities also create negative impacts on marine systems at surrounding areas, mainly mangrove, sea grass beds, and coral reefs. Therefore, such activities need to be taken into account for coastal management in particular in relation with the marine fishing captures.

MATERIALS AND METHODS

Location and duration of the study

The study was conducted in the North coast of central Java from May to October, 2002. The sampling sites were chosen based on the existence of coastal resource habitats including mangrove, estuarine, sea grass meadows and coral reefs. The chosen sampling sites were Brebes, Pemalang, Jepara and Rembang.

Sampling technique

The method used was survey method. Two kinds of data were collected, i.e. primary and secondary data. Primary data were collected using a survey method, through a participatory discussion model. The discussion was only focused on certain objects (Focus Groups Discussion), related to the aim of the study, i,e accessibility of coastal resources and capture fisheries at the study sites. While, secondary data references, were collected from related institutions, including Marine and Fisheries Department, Fisheries and Marine agency, and marine researchers from various affiliated institutions.

Participants

The participants of discussion were selected fishers from each stratum of the fishers, i.e, fishing owners, both the owners and also fishers, and fishers only. Participants were proportionally chosen based on the number within fisher population.

RESULTS AND DISCUSSION

1 Existing of Supporting Habitat Condition

1.1 Mangrove

Mangroves are forest or community of plants, which grow in the coastal areas and could withstand to salinity changes. As a plant community, mangroves may have a high primary productivity, reach up to 5,000 g/C/m^2/yr (Lugo and Snedaker, 1974). The high primary productivity in mangrove areas is usually functioning as spawning, nursery, and feeding grounds by several living marine organisms such as fish, and shrimp. Therefore, mangrove ecosystem affects on fish production in the coastal areas.

Mangroves grew poorly in the North coast of central Java. From a total of 3,442. 19 ha mangroves areas, only 979.80 ha (28,46 %) were in good condition, while the rest of mangrove areas of 2,462.39 ha (71,54 %) were very bad or in critical condition (Dinas Perikanan dan Kelautan, Propinsi Jawa Tengah, 2002). Moreover, the majority the damaged mangroves were about 50%, even at some areas, such as Pekalongan, Jepara, Rembang, Tegal, Batang Pati Disricts and Tegal City, reached almost 100%. Mangrove damage of 50% (16,11% of the total mangrove areas) was only recorded at Pemalang District (Table 1). These were mainly dominated by *Avecernnia* sp *and Rhizophora* sp. Diferent from *Avecernnia* sp that naturally occurred, species of *Rhizophora* sp mostly resulted from the replanting program. Such condition, therefore may affect on the fish production in the Nort coast of central Java.

Table 1. Mangrove condition in the North coast of Central Java

Location	Coastal Line (km)	Good		Bad		Total	
		(ha)	(%)	(ha)	(%)	(ha)	(%)
Brebes District	37.0	274.00	42,81	366,00	57,19	640,00	100,0
Tegal District	20,3	0,00	0,0	88,62	100,0	88,62	100,0
Tegal City	10,5	1,00	8,33	11,00	91,67	12,00	100,0
Pemalang District	35,0	302,00	83,89	58,00	16,11	360,00	100,0
Pekalongan District	12,0	6,00	18,95	25,67	81,05	31,67	100,0
Pekalongan City	7,0	0,00	0,00	13,50	100,0	13,50	100,0
Batang District	40,0	8,50	14,29	51,00	85,71	59,50	100,0
Kendal District	41,0	15,00	23,66	48,40	76,34	63,40	100,0
Semarang City	25,0	4,00	26,67	11,00	73,33	15,00	100,0
Demak District	34,1	295,80	43,37	386,20	56,63	682,00	100,0
Jepara District	72,0	5,00	1,64	300,60	98,36	305,60	100,0
Pati District	60,0	8,50	14,17	51,50	85,83	60,00	100,0
Rembang District	61,2	50,00	4,50	1.060,90	95,50	1.110,90	100,0
Total	455,1	979,80	**28,46**	2.462,39	**71,54**	3.442,19	**100,0**

Source : Dinas Perikanan dan Kelautan, Propinsi Jawa Tengah (2002)
Note : Printed in bold meant average

1.2 Sea grass beds

Sea grass is another marine plant community in the shallow coastal waters. As a plant community, sea grass does produce a high primary productivity. Their primary productivity has been recorded about 120 – 320 g C/m^2/yr. The secondary or fisheries productivity, therefore, is also high in this ecosystem.

Sea grass beds were also observed in the North coast of central Java, mainly at Tegal, Jepara and Rembang, sharing with the corals covering six different genera, namely *Cymodocea, Enhalodule, Halophyla , Syringodium,* and *Thalassia*. While, the dominant species were *Thalassia testudinum* and *Cymodosea serrulata.* These plants, in majority, had poor growth. It is believed that these due to high sedimentation and other human activities on the sea grass beds, mainly boating. Living sea grass coverage was less than 10%, and those were mainly young colonies, while the old colonies, many of them were died.

1.3. Coral Reefs

Coral refs are also another productive marine ecosystem in the coastal waters with primary productivity reach up to more than 10.000 g C/m^2/yr (Gordon and Kelly, 1962). The high of primary productivity resulted in that the coral reefs may be good habitat, either spawning nursery, or feeding grounds, for many marine organisms. Eventually, the secondary productivity is very high in this ecosystem.

Coral reefs grew and developed in the North coast of central Java, mainly in Tegal, Jepara, Rembang and Pati. The majority of corals in these locations grew close to coastal line, ranging from 100-400 m. Some corals, however, grew far from the main land, such as at Karang Jeruk, Tegal, at which coral reefs grew about 63 miles away. Similarly, at Karimunjawa Island, corals also grew at surrounding waters of island located about 60 kms

from Jepara. While at Rembang district, the farer island could be located as far as 5 km from the land of Rembang.

The majority of the corals have poorly grown, particularly those that close to the main land, which is plenty with the human activities, such as Kartini Bay, Panjang Island, Bandengan Bay, Mandalika Island (Jepara), Karang Jeruk (Tegal), dan several islands waters which located about 300 – 400 m from Rembang. Living coral coverage was less than 50 % in those reefs, even it was only 5-10%, particularly in the reef flats. Conversely, in island which far away from the main land of Java, such as Karimunjawa Islands, Jepara and some islands in Rembang, the majority of corals tend to have better growth with a coverage reached up to more 75%.

2. Capture Fisheries Production in the North Coast of Central Java

There were several factors affecting the capture fisheries production. Among other factors were the condition of local or supporting habitats for fish production, the number and types of fishing boats, and the types of fishing techniques. It had a positive correlation between marine habitat, e.g. mangrove, sea grass meadows, coral reefs, condition and associated marine organisms in the surrounding locations.

Based on this fact, it can be predicted how the fishing capture production would be overlooked like with habitat conditions at surrounding areas. As mentioned in the previous discussion, the marine habitats, i.e. mangrove, sea grass meadows, and coral reefs, were very poor in conditions. These were suspected to affect their fishing capture production. As well, the fishing boat and fishing technique, might also affect the fishing capture production. These fisheries tools, moreover, are described as follows.

2.1. Fishing Boats Development

Fishing production may be related with the numbers of fishing boats, particularly boats which equiped with motor. The numbers of fishing boats tend to increase in the study sites from year to year, especially in the last 11 years **(Table 2)**

These occurred both in numbers and the fishing technique used. Motor boats seemed to be significantly increased. This indicated that the fishing operation of the fishers may be farther compared with non-motor boats. Qonsequently, the over exploitation may occurred in North coast of Central Java.

Table 2. Increase of fishing vessels in North coast of central Java

Year	Cannoe	Wooden Boat	Motor in Board	Motor Out Board	Total
1988	1.201	1.186	8.907	201	11.495
1989	1.008	317	9.504	165	10.994
1990	1.008	1.173	9.593	276	11.320
1991	249	1.279	9.466	324	11.318
1992	235	1.308	9.766	330	11.639
1993	350	1.086	9.905	388	11.729
1994	1.145	46	10.675	393	12.259
1995	876	1	10.956	413	12.246

1996	404	435	11.081	452	12.372
1997	30	398	11.454	1.288	13.170
1998	206	542	11.995	615	13.358
1999	0	211	12.812	1.411	14.434

Source : Buku Tahunan Statistik Perikanan dan Kelautan
Propinsi Jawa Tengah (2000)

2.2. Marine Fishing Gears in the North Coast of Central Java

Marine fishing gears increased from year to year, along with increasing the number of fishing boats in North coast of central Java**. Table 3** shows that the fishing gears, particularly, non selected gears (pukat kantong), such as payang, dogol, and pukat pantai, were significantly increased. On the other hand, the other non selected fishing gears , such as cotok not recorded in fisheries statistical report, were observed in the study sites, and the numbers tended to increase from time to time. Some of these, even, were equiped with small mesh size of nets that proved the possibility of over fishing in North coast of Central Java.

Table 3. Fishing gears development in North coast of Central Java from 1988 to 1999.

Year	Type of fishing gears					
	Pukat kantong	Pukat Cincin	Gill Net	Lift Net	Hooks	Trapped
1988	1.245	885	12.022	1.189	756	1.233
1989	1.166	816	12.443	1.401	1.437	1.156
1990	1.223	747	8.806	530	1.756	27
1991	1.207	719	25.277	510	2.022	162
1992	1.634	742	16.697	1.062	2.346	309
1993	1.787	760	16.811	821	2.478	220
1994	2.943	808	16.803	1.459	2.798	239
1995	3.314	858	17.607	1.184	2.943	353
1996	3.217	921	15.614	1.154	2.880	1.565
1997	3.775	1.038	15.232	1.117	2.999	549
1998	4.124	1.043	17.613	896	2.786	388
1999	6.155	1.158	15.616	916	3.279	911

Source : Buku Tahunan Statistik Perikanan ,Dinas Perikanan dan Kelautan Propinsi Jawa Tengah (2000)

2.3. Fishing Capture Production

Fishing capture production increased about 5.66% per year in central Java since the last decade, i.e. 140,081.00 ton in 1988 to 277,263.90 ton in 1999. Production value, consequently, also increased, i.e. Rp. 92,730,605.00,- in 1988 to Rp. 878,842,632.00 in 1999 **(Table 4).** It also shows that the average mass production increased, but yearly production might be up and down. Biomass production tends to decline from 1995, and it significantly occurred in 1997 to 1999. In fact, their values of production always increased from year to year and it is believed due to increasing of fish prices from time to time.

Table 4. Development of marine fisheries capture in central Java from 1988 to 1999

Year	Volume (Ton)	Increased (%)	Value (Rp.000)	Increased (%)
1988	140,081.00	-	92,730,605.00	-
1989	163,935.70	14.55	111,860,559.00	17.10
1990	180,500.30	9.18	129,665,442.00	13.73
1991	214,930.60	16.02	158,931,000.00	18.41
1992	247,146.70	13.04	172,828,555.00	8.04
1993	249,045.10	0.76	195,494,456.00	11.59
1994	286,446.50	13.06	269,504,266.90	27.46
1995	271,328.70	5.57	247,051,003.60	9.09
1996	284,304.60	4.56	296,189,193.00	16,59
1997	311,222.10	8.65	351,208,050.05	15.67
1998	303,899.40	2.41	730,235,220.00	51.90
1999	277,263.90	9.61	878,842.632.00	16.91
Avarage Increased		5.66		17.12

Source : Statistik Perikanan dan Kelautan Propinsi Jawa Tengah (2000).

The decrease on mass production showed an indication of over fishing, particularly for the group of smaller pelagic fish. According to Komnas Kajiskanlaut (1998) fishing pressure of smaller pelagic fish were higher than 100% in Indonesian waters, included in the Java Sea. **Table 5** shows the potential, production and fishing pressure of some groups of fish captured in Java Sea. This table showed that fishing capture (production) of smaller pelagic fish was higher than the potential production. While larger pelagic fish has been close to the maximum level (82.47%). It was only demersal (bottom) fish still under exploitation.

Table 5. Potential, production and fishing pressure of large and smaller pelagic, and demersal fish in Java Sea in 1997

No.	Fish Groups	Area distribution (10^3 km$^{2)}$	Density (kg/100p)	Potential 10^3ton/yr)	Production 10^3 ton	Fishing pressure (%)
1	Larger Pelagic Fish	400.00	275.00	55.00	45.36	82.47
2.	Smaller Pelagic Fish	400.00	1.70	340.00	442.90	130.26
3.	Demersal Fish	392.00	2.20	431.20	242.00	56.12

Source : Komnas Kajiskanlaut (1998)

Regarding with the fisheries production in the study sites i.e.Brebes, Pemalang, Jepara, and Rembang, it is shown that the value of CPUE (catch per unit effort) of fishing gears for pelagic fish (purse seine), demersal fish (dogol), and prawn (trammel net) tended to increase, and decreased in the end of periods, mainly in 1999.**(Table 6-9).** This phenomenon showed that over fishing may have occurred in the study sites. These over fishing occurred in almost all the groups of fish, i.e. demersal fish, pelagic fish and prawn.

Table 6. Fiheries production according to the group of fisheries resources and the Value of CPUE in Brebes.

Year	AnnualProduction (ton)			CPUE Standart Fishing Gear		
	Demarsal	Palagic Fish	Prawn	Demersal	Palagic Fish	Prawn
1988	138.6	977,6	51,0	0,00	0,03	0,003
1989	173,8	1.358,0	56,6	0,00	0,00	0,008
1990	160,1	1.857,6	40,0	0,12	0,00	0,005
1991	386,0	1.392,0	79,4	0,16	0,08	0,008
1992	423,5	1.046,1	66,7	0,10	0,00	0,005
1993	233,8	1.328,4	57,6	0,11	0,59	0,000
1994	423,5	1.897,5	18,7	0,15	0,12	0,004
1995	220,4	555,5	13,5	0,20	0,12	0,004
1996	1.286,5	611,5	6,0	0,18	0,22	0,006
1997	1.447,3	550,3	10,4	0,12	0,10	0,005
1998	1.530,9	644,8	0,5	1,84	0,18	0,026
1999	1.306,1	1.100,4	2,5	0,00	0,00	0,000

Source : Buku Tahunan Statistik Perikanan Kelautan Propinsi Jawa Tengah. (2000).

Table 7 . Fiheries production according to the group of fisheries resources and the value of CPUE in Pemalang.

Year	Annual Production (ton)			CPUE Standard Fishing Gear		
	Demersal	Pelagic Fish	Prawn	Demersal	Pelagic Fish	Prawn
1988	4.727,5	2.778,5	1.765,4	1,27	0,77	0,085

1989	4.817,0	2.836,9	1.298,8	0,28	0,18	0,065
1990	5.327,6	3.505,7	664,2	0,55	0,80	0,063
1991	4.682,1	3.008,3	553,2	0,46	0,88	0,079
1992	5.699,9	3.025,3	462,2	0,51	0,83	0,126
1993	5.818,3	4.577,7	505,4	0,75	0,52	0,097
1994	8.580,4	3.994,5	457,4	0,66	1,24	0,089
1995	6.125,7	2.268,3	250,2	0,63	1,63	0,136
1996	6.978,5	2.477,6	621,8	0,65	1,02	0,322
1997	6.764,5	1.652,2	87,0	0,50	0,53	0,286
1998	6.512,8	2.426,3	1o8,0	0,34	0,55	0,056
1999	4.791,1	2.481,5	0,0	0,38	0,77	0,043

Source : After Buku Tahunan Statistik Perikanan Propinsi Jawa Tengah (2000).

Table 8. Fiheries production according to the group of fisheries resources and the value of CPUE in Jepara

Year	Annual Production (ton)			CPUE Standard Fishing Gear		
	Demersal	Pelagic Fish	Prawn	Demersal	Pelagic Fish	Prawn
1998	753,8	1.422,9	80,6	0,58	0,77	0,00
1999	794,9	2.374,2	135,7	0,69	0,39	0,01
1990	679,4	2.499,4	150,4	3,00	2,00	1,00
1991	1.331,6	2.129,4	113,7	0,64	0,34	0,01
1992	851,3	2.594,2	191,3	0,68	0,36	0,00
1993	1.073,3	2.229,8	143,9	2,43	0,63	0,01
1994	771,1	2.417,6	120,5	0,59	0,63	0,01
1995	955,4	2.396,7	63,5	0,66	0,82	0,01
1996	1.091,0	3.143,4	41,5	0,61	0,92	0,01
1997	843,1	2.672,3	49,6	0,60	1,64	0,01
1998	979,2	2.882,0	29,1	-	-	0,05
1999	2.040,8	9.198,7	36,1	-	-	0,10

Source : After Buku Tahunan Statistik Perikanan Propinsi Jawa Tengah.

Table 9. Fisheries production according to the group of fisheries resources and the of CPUE in Rembang

Year	Annual Production (ton)			CPUE Standard Fishing Gear		
	Demersal	Pelagic Fish	Prawn	Demersal	Pelagic Fish	Prawn
1988	2.916,9	11.812,5	122,5	0,23	0,13	0,02

1989	1.592,0	11.005,7	151,6	0,05	0,40	0,03
1990	2.608,8	16.269,5	173,6	0,04	0,44	0,04
1991	2.895,7	17.202,8	311,4	0,04	0,34	0,07
1992	4.943,4	19.639,7	620,0	0,05	0,39	0,06
1993	12.744,2	12.832,0	636,6	0,05	0,33	0,08
1994	5.298,3	21.467,4	663,4	0,06	0,33	0,06
1995	5.787,9	22.244,0	669,0	0,08	0,29	0,07
1996	5.864,4	23.485,7	681,3	0,10	0,37	0,38
1997	9.571,8	27.527,7	842,0	0,68	5,34	1,65
1998	12.827,9	36.417,6	1.451,7	14,06	3,55	1,82
1999	10.301,3	23.323,1	1.182,3	11,43	1,99	1,30

Source : After Buku Tahunan Statistik Perikanan Propinsi Jawa Tengah 2000.

CONCLUSION

Based on the data of CPUE and the supporting habitats for fisheries growth, it may be concluded that fisheries potential has already declined in the study sites of Brebes, Pemalang, Jepara and Rembang. This condition also proved that the marine fishing capture has already been declined in studied areas. There are several factors which affected the decrease of fisheries resources, among others were decreasing of the local conditions, such as estuarine, mangrove, sea grass beds, coral reefs, and the high fishing pressures.

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