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Sustainable Fisheries in Asia in the New Millennium

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DESIGN AND CONSTRUCTION OF RUMPONS AS FISH AGGREGATION DEVICE IN INDONESIA

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The Indonesian fisheries have been using "rumpon" as Fish Aggregating Device to attract small pelagic fishes in coastal waters since long time ago. The intensive study on deep-sea rumpon for skipjack tuna fisheries was started in 1976. The Marine Fisheries Research Institute conducted the field experiments and fishing industrial sector since 1980, and the commercial operations was successful in 1985. Anticipating the implementation of the Code of Conduct for Responsible Fisheries, Indonesia will require an approach for design, construction and deployment of rumpon that could be carried out in a responsible manner. For that purpose, the information about design and construction of rumpon in Indonesia is very important as database for further development.

The main data were collected and compiled from various references, annual report of the Directorate General of Fisheries and research report of Central Research Institute for Fisheries. Additional data were made available from local fisheries agencies or related institutions.

Structure of the rumpons installed in the provinces of North Sumatra, West Sumatra, Lampung, West Java, East Java, North Celebes, Central Celebes, South Celebes, Maluku and Papua are given in detail. There are 2 types of rumpon: the deep-sea rumpon and shallow water rumpon. The differences among the rumpons in those areas are mostly found in material of mooring line, shape and material of float and structure of the attracting components. The mooring line is mostly made of polyethylene of 12–25 mm in diameter or nylon of 5–10 mm in diameter. There are wide variations of shape of floats. Generally they are divided into pontoon type or box shape made of steel and raft type made of bamboos. Attractors are made of coconut leaves, *nipah* leaves and *pinang* leaves. Some attractors are attached to the mooring line and the others are hung down from the float. They are operated in wide range of water depth from 20 to 1500 m. The fishing ground conditions, bottom topography and bottom configuration are among the factors considered for the rumpon design and construction. The differences in construction are mainly due to the rumpon location, target species in each area and the fishing gear applied.

KEYWORDS: Rumpon, Fish and Aggregating Device, Design and Construction, Indonesia

Introduction

The use of "rumpon", a type of FAD (Fish Aggregating Device), has been traditional in Indonesia, particularly in eastern Indonesian waters, since time immemorial (Reuter, 1938; Nasution *et al.*, 1986). They were also used tradionally in nearly Philippine waters where they are called "payaos" (Aprieto, 1988a, b, c, d, became more attractive than before because of significant rise of price due to expansion of demand as export commodity.

The intensive study on deep-sea rumpon for skipjack tuna fisheries was started in 1976. The Marine Fisheries Research Institute conducted the field experiments and fishing industrial sector since 1980, and the commercial operations was successful in 1985. Anticipating the

conditions, bottom topography and bottom configuration were collected from local fisheries agencies or related institutions.

Result and Discussion

The deep-sea rumpon for tuna have been utilized or tried in tuna fishing ground over the waters in eight provinces inclusive of North Sumatra, West Sumatra, Lampung, West Java, East Java, North Celebes, Central Celebes, South Celebes, Maluku and Papua (Fig 1). The shallow water rumpon have been utilized or tried in Lampung.

Fig. 1. Research area

As similar to the FAD's utilized in other countries, the construction of rumpon in Indonesia basically consists of four main components, namely the buoy or float, the aggregator or attractor, the mooring line, and the sinker or anchor. The detail structure of the rumpons installed in the provinces of North Sumatra, West Sumatra, Lampung, West Java, East Java, North Celebes, Central Celebes, South Celebes, Maluku and Papua are given in Table 1-9. Type of rumpon in eight provinces is similar and can be shown at Fig. 2. The differences among the rumpons in those areas are mostly found in material of mooring line, shape and material of float and structure of the attracting components.

The Sibolga type rumpon basically consist of bamboo buoy as the float. The attractor can use coconut leaves, nipah leaves and pinang leaves, depend on fishermen to choice. The mooring line is made of nylon. An anchor forms bottom sinker and thimble. The material used and size of the components is given in Table 1.

Table 1. Material and size of rumpon used in North Sumatra

No	Component	Material	Size	Amount
1.	Buoy	Bamboo	ϕ = 8 cm L = 1,75 – 3 m	10-16 bar
2.	Attractor	Coconut leaves	-	15-90 sheet
		Nipah leaves	-	
		Pinang leaves	-	
3.	Mooring line	Nylon	L = 45 m	-
4.	Bottom sinker	Gunny bag	60 kg/pc	1-2 pc
	Thimble	Stone	5 kg/pc	1-2 pc

Source: Pentury B., 1994

Up to 1987 a total number of 11 units of rumpon had been put into trial in West Sumatra waters. The first three units were designed under the Marine Fisheries Research, while the rest of eight units were designed and deployed by PT. Usaha Mina. The details of components are presented in Table 2.

Table 2. Material and size of rumpon used in West Sumatra

No	Component	Material	Size	Amount
1.	Buoy	Bamboo	ϕ = 14 cm L = 9 m	38 bar
		Fibre glass	ϕ = 1 m D = 6 m	1 unit
2.	Attractor	Coconut leaves	-	225 sheet
3.	Mooring line	Wire rope	ϕ = 16 mm L = 6 m	- -
		Polyethylene	ϕ = 18 mm L = 50 m	- -
		Wire rope	ϕ = 16 mm L = 30 m	- -
		Polyethylene	ϕ = 22 mm	-
4.	Bottom sinker	Concrete cement + iron bar	200 lt of Drum oil	1 unit
		Mountain's Stone	- 6-8 kg/pc	200 pc -

Table 3. Material and size of rumpon used in Lampung

No	Component	Material	Size	Amount
1.	Buoy			
	Raft 1	Bamboo	ϕ = 10 cm L = 6 m B = 1.5 m	16 bar
	Raft 2	Bamboo	ϕ = 10 cm L = 6 m B = 0.5 m	16 bar
	Line	PE	ϕ = 15 mm L = 15 m	-
2.	Attractor			
	Attractor	Coconut leaves	-	25-35 sheet
		Nipah leaves	-	
		Sere leaves	-	
	Line	PE	ϕ = 10 mm L = 25 m	5 coil
	Sinker	Stone	10 kg/pc	5 pc
3.	Mooring line			
	Wire rope	Steel	ϕ = 1.5inch L = 30 m	-
	Line	PE	ϕ = 1 inch L = 150 m	-
	Swivel/segel	Stainless	10 kg	3 pc
	Chain	Stainless	ϕ = 1.5inch L = 4 m	-
4.	Bottom sinker			
	Sinker	Cement	200 kg	2 unit
	Anchor	Iron	25 kg	1 unit
	Chain	Stainless	4 m	-

Source: Romadhon, T., 1990

The rumpons deployed by the author in the Gulf of Pelabuhan Ratu, West Java, have the structure of two layers raft type float and an additional buoy of oil drum filled with polyethylene. The mooring line construction is similar to the PT. Usaha Mina type, with a minor modification in the material and sizes of the components. The components specifications are presented in Table 4. Fig. 3 shows the structure of the PT. Usaha Mina type, while the detailed information can be shown at Table 9. The Papua type of rumpon deployed by the PT. Usaha Mina.

Table 4. Material and size of rumpon used in West Java

No	Component	Material	Size	Unit
1.	Buoy			
	Raft buoy	Bamboo	7 m x (2m: 6m)	1
	Extra buoy	Oil drum	200	1
2.	Attractor			
	Main attractor	Coconut frond	33.5 m	17
	Ting rope	Nylon	16 mm x 30 cm	1
	Weight	Cement conc.	20x20x22 cm	1
	Shackle	Steel	18 mm	1

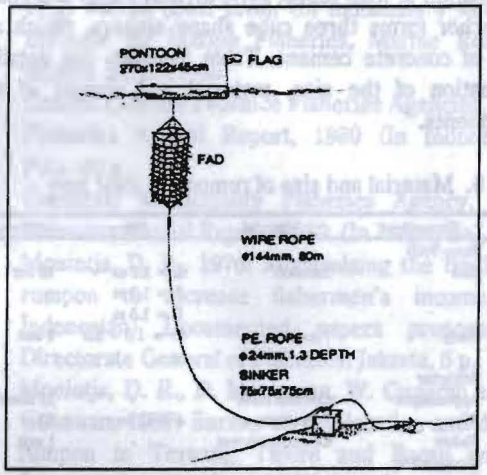

Fig. 2. Structure of rumpon PT. Usaha Mina Type.

Table 9. Material and size of rumpon used by PT. Usaha Mina

No	Component	Material	Size	Amount
1.	Buoy			
	Pontoon	Steel plate	L = 3.66 m B = 2.2 m D = 0.61 m	1 unit
	Hanging ring	Iron	ϕ = 5/8 m	3 unit
	Swivel	Iron	ϕ = 7/8 m	1 unit
2.	Vertical line /attractor			
	Main line att.			
	Chain/wire rope	Iron/Stainless steel	ϕ = 5/8 inch L = 100 inch	-
	Shackle	Iron	ϕ = 5/8 inch	-
	Frame attractor			
	Ring of iron	Iron	ϕ = 5/8 inch L = 100 inch	2 unit
	Ring diameter Attractor	Lorry tirerope	-	4 unit
	Wire rope	Polyethylene	ϕ = 3/8 inch	-
	Appendages	Coconut leaves	-	40-60 sheet
3.	Buoy stabilizer			
	Sinker	Concrete cement	ϕ = 30 cm	1 unit
	Ring of lorry tire	Used lorry tire	-	2 unit
	Hanging ring	Iron	ϕ = 5/8 inch	2 unit
4.	Connecting of Wire			
	First line	Polyethylene	ϕ = 5/8 inch L = 0.5 x depth	-
	Swivel	Iron	ϕ = 0.5 inch	2 unit

combination of wire ropes, polyethylene ropes and chain. An anchor forms three cube shape sinkers, which are made of concrete cement. Table 5 shows the detailed information of the size, material and weight of the components.

Table 5. Material and size of rumpon in East Java

No	Component	Material	Size	Amount
1.	Buoy/FAD			
	Raft	Bamboo	L = 5.7 m B = 1.0 m D = 1.5 m	18 bar -
	Buoy	Plastic	D = 1.6 – 2.6 m	6 unit
2.	Attractor			
	Appendages	Coconut leave	-	18 sheet
	Rope	Polyethylene	ϕ = 12 mm	30 m
	Sinker	Concrete cement	-	1 unit
3.	Mooring line			
	Wire rope	Steel	ϕ = 14 mm L = 30 m	-
	Rope	Polyethylene	ϕ = 4 – 6 mm L = 400 m	6 coil
	Chain	Iron	ϕ = 9.37 mm L = 10 m	-
	Counterweight	Concrete cement	-	1 unit
	Swivel	Iron	ϕ = 18.45 mm	6 pc
	Shackle	Iron	ϕ = 21.87 mm	10 pc
			ϕ = 9.39 mm	6 pc
	Thimble	Iron	ϕ = 25 mm	4 pc
			ϕ = 12.5 mm	6 pc
4.	Bottom sinker			
	First sinker	Concrete cement	-	1 unit
	Second sinker	Concrete cement	-	1 unit
	Third sinker	Concrete cement	-	1 unit
	Chain	Iron	L = 10 m	-

Source: Barus *et al.*, 1984

Late Mr. Ogawa, a Japanese fishing technologist who used to provide technical assistance for the company, first designed the rumpon in North Celebes. The float consists of a bamboo raft and a pontoon as the attractor. The sinker comprises of two oil drums (filled with concrete cement) and an anchor. Rattan webbing is installed to protect the PE rope from abrasion. The materials used and size of the components are given in Table 7. This type of rumpon is also used in tuna fisheries in the province of Central Celebes.

Table 7. Material and size of rumpon used by PN. Perikani Sulawesi Utara - Tengah

composed by rattan string combined with polyethylene ropes. Fishermen are using mountain stones fixed by rattan string at the end of mooring line as the sinker. The materials used and size of the components are given in Table 6.

Table 6. Material and size of rumpon in Mamuju

No	Component	Material	Size	Amount
1.	Tuna Rumpon Buoy			
	Raft	Bamboo	L = 11 m	80 – 120 bar
	Wooden bar	Wooden bar	D = 1.6-2.6 m	-
	Pajala		L = 12 cm	
	Rompong		D = 8 cm	-
	Main and addition Raft	Bamboo	L = 9 m B = 1.6-1.8 m	80 – 100 bar
2.	Attractor			
	Appendages	Coconut leaves	-	20–30 sheet
	Rope	Polyethylene	ϕ = 4 – 6 mm	-
	Pajala		L = 30 – 50 m	
3.	Mooring line pajala	Polyethylene	ϕ = 14 – 16 mm	10 – 4 coil
			ϕ = 8 – 10 m	5,000 bar
4.	Sinker	Stone	-	60–70 piece

Source: Nasution *et al.*, 1986

The rumpons deployed by the Perum. Perikanan Maluku in Maluku has the structure of steel plate as belong. The attractors composed by rattan and bamboo, the mooring line are composed by chain, wire rope, swivel, thimble, wire clamps with polyethylene ropes. An anchor form iron with concrete cement sinker. Table 8 shows the detailed information of the size, material and weight of the components. Fig. 4 shows the structure of the rumpon.

Table 8. Material and size of rumpon used by Perum. Perikani Maluku

No	Component	Material	Size	Amount
1.	Buoy	Steel plate	TL = 270 cm BL = 220 cm B = 122 cm D = 45 cm	1 unit - - -
2.	Attractor			
	Top/bottom ring	Rattan	ϕ = 16–18 cm L = 6 m	2 unit
	Bamboo pieces	Bamboo	ϕ = 5 – 6 cm L = 6 cm	-
3.	Mooring line			
	Chain	Iron	ϕ = 16 mm L = 20 m	-
	Wire rope	Steel	ϕ = 14 mm	

There are a lot of factors influencing the choice of methods and gear to be used.

Oceanography condition of the waters in the surveyed areas, specifically the surface water temperature and the salinity are among the parameters that satisfy a good habitat for the fish. Surface currents in the area under discussion are carry seasonally. The variation of surface circulation is corresponding to the atmospheric circulation. The surface water temperature is between 27°C during the raining season and 29°C during the dry season. The 28°C isotherm occurs in the area during both seasons. The bottom topography of the fishing grounds, which are marked by deep basins surrounded by isodepths of 400 m to 1,500 m, is considered good for the rumpon sites. The skipjack tuna and the other pelagic fish are caught throughout the year in the area.

The structure of the rumpon is among the important limiting factors in using the kind of tuna fishing gear, specifically the existence of the mooring line and the suspended aggregator. Those structures will hinder the horizontal movement of the gear, where the gear is vulnerable to entangle on those components of the rumpon. With this respect, the gillnet and the long line are among the gears that either will damaged by the rumpon or will cause some fouls on the rumpon. Examination on methods of fishing tunas in rumpons indicates that pole and line, troll line and purse seine are pelagic species. Pole and lining is the most common method used for skipjack, while hand lining is used to catch yellow fin tuna.

Concluding Remarks

The differences design and construction rumpon in Indonesia depend on fisheries resources in each area, target species, rumpon location, availability of the materials used of the components and the fishing gear applied.

Design and construction of rumpon as fish aggregating device in Indonesia should be more development as to work out the current issues on sustainable fisheries and environmental friendly fishing

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