# CHANGES TO THE RED SNAPPER FISHERIES IN THE ARAFURA SEA FISHERIES MANAGEMENT AREA

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**ABSTRACT**

Red snappers are target species and exploited by industrial fisheries off the Bottom longline, trap and as by product of fish net in Arafura Sea. This study proposed to identify effect of industrial fishing on red snapper fishery; on size and catch composition. Data used in this study were catch data of bottom longline and trap landed in October-December 2004; landing data of the bottom longline and trap in 2005-2007, fish net catch data landed in Merauke. Information on day trips, number of vessel, number of fishing gears was gathered from fishing port Tenau, Kupang, Fisheries District of Probolinggo, and interviews to the captain and crew of bottom longline. Changes in the fishery of red snapper is define by comparing present fishery to those off ACIAR/RCCF Red Snapper research collaboration 1999-2002. Results of the study showed changes in the vessel size, gear size and number, and trip duration in red snapper fishery. The fishing vessels sized of bottom longline changes from higher than 70 GT to lower than 50 GT. Hook size from no.4-5 shift to 5-8. Day at sea decline from approximately 3-4 months per trip to aproximaly one month per trip. In total number of trip decrease from 3-4 trips per year decline to 4-6 trips per year. The catch composition of red snapper, *L. malabaricus* was decline from 47% in 2005 to 24.3% in 2007 of the total catch. Deep sea snapper, *Pristipomoides multidens* was caught 16.1% in 2005 increased to 36% in 2007. The length at firts capture of *L.* malabaricus decreased from 50.7 cm in 2001 to 41 cm in 2007.

**KEYWORDS:** **red snapper, catch composition, size structure, bottom longline, trap, fish net, Arafura Sea**

## INTRODUCTION

Red snappers species are belong to the family Lutjanidae. The fresh fish are easy to recognise from their colour, started from jellow to reddish, bright red, dark red to brownish. The family of Lutjanidae consisted of 9 genera, which include *Lutjanus, Pristipomoides, Pinjalo, Aphareus, Etelis, Aprion, Symphorus, Symphorichthys*, and *Macolor* (Allen, 1985). Except for the last genus with only one species called *Macolor niger* which is black in colour, other genera having several colour pattern from bright reddish, yellowish/greenish to dark brownish. In most part of the Indonesian waters the first two genera provide the most dominant catch.

The term red snapper or '*kakap merah*' in the field seem to be applied only to the genera *Lutjanus* and *Pinjalo*. Mc Pherson *et al.* (1992) categorized three species of snapper as the red snapper; i.e. red emperor (*L. sebae*), Scarlet sea perch (*L. malabaricus*) and Saddletail sea perch (*L. erythropterus*). Other genera such as *Pristipomoides, Aphareus, Etelis, Aprion, Symphorus, Symphorichthys*, and *Macolor* are never considered as red snapper even though the colour is bright reddish, such as *Etelis carbunculus*. Goldband snapper, (*Pristipomoides* sp.) or deep-water snapper with its popular name as *kurisi bali* that by some fishers called as *anggoli*, is likely come from the Singapore market name as *angkoh li*.

Most of Lutjanids fish especially the large size provide the most economically important fish. Of the lutjanid fish, the species *Lutjanus malabaricus, L. erythropterus, L. bohar, L. argentimaculatus, L. monostigma, L. timorensis, L. gibbus, L. lemniscatus, L. Sebae,* and *Pinjalo pinjalo* provide the common red snapper found in the Indonesian. In Kupang and Sape, scarlet snapper, *L. malabaricus* found matured at 41,3 cm TL and red emperor, *L. sebae* (Andamari *et al.*, 2004). The length at 50% maturity of *L. malabaricus*, *L. sebae*, *L. eryththropterus* was reported from the Great Barrier Reef at 54.8, 57.6, and 48.6 cm in SL each, respectively (McPherson *et al.*, 1992, McPherson & Squire, 1992).

Lutjanids are key species in the coral reef ecosystems (Parish, 1987) and major resources for tropical fisheries. They are exploited by industrial line fisheries for local and export market in Indonesia, Australia and Caribbean (Clark & Loyd, 2002; Mendoza & Larez, 1996; Badrudin *et al.*, 2004; Nuraini, 2007). Exploitation by artisanal fisheries directed on them with moderate and heavy fishing pressure being both selective and powerfull active gears in reefs (Herianti & Djamal 1993; Munro, 1967) and seagrass beds.

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In the framework of the ACIAR/RCCF Red Snapper research collaboration 1999-2003, three red snapper species have been intensively studied, the scarlet snapper *Lutjanus malabaricus*, red snapper, *L. erythropterus*, and goldband snapper, *Pristipomoides multidens*. The main finding of this research was that through the genetic characteristics of the mtDNA, it was concluded that the three species distributed in both Australian and Indonesian sectors of the Arafura Sea were belong to the same stock. Furthermore, Salini in Andamari *et al.*, 2004 stated that the red snapper, *L. malabaricus* from Arafura, Kupang, Tanimbar, Aru East Australia, Groote, and Weipa are from one stock. Consequently, these species should hopefully be exploited and managed appropriately if the two countries wish to exploit these resources sustainably.

This paper attempt to review the red snapper fisheries in the Arafura Sea Fisheries Magamenet Area, with special references to up date the results of the ACIAR-RCCF research collaboration 1999-2003.

## MATERIALS AND METHODS

In this study data analyzed were used catch data of 15 boats of bottom longline of trap landed in October-December 2004, catch data from 1977 boats of bottom longline and trap in 2005-2007 based in landing site Probolinggo, fish net catch data landed in Merauke. Information of day trips, number of vessels, number of fishing gears were gathered from fishing port of Tenau, Kupang, Fisheries District of Probolinggo and interviews with the captain and crews of bottom longline vessels. Catch data information includes, fleets name, company name, fishing gear, period of fishing, catch by species in local name in biomass. Catch and composition of red snapper in fish net was based on Merauke Fisheries District in 2005 and 2006.

Changes of in the fishery of red snapper is define by comparing present fishery to those the results of the ACIAR-RCCF research collaboration 1999-2003. Size of the dominant snapper i.e. *Lutjanus malabaricus, L. erythropterus, L. sebae, Pristipomoides multidense*, and *P. typus* were collected from landing site of Probolingo in March, July, and December 2007.

## RESULTS AND DISCUSSIONS

### Number and Size of Vessels

Information obtained from the licensing division of the Direcorate General of Capture Fisheries, regarding the number of license fishing vessel of >30 GT used by the boat targeted for pelagic fish and five fishing gear targetted on demersal fish group. The following five fishing gears targetted on demersal fish group was presented in Table 1. The number of fishing gear were dominated by the fish net, shrimp net and bottom longline. All the fishing boats were belong to the industrial scale of fisheries.

It is likely that for all of the licensed fishing vessel using fishing gear listed in the Table 1, the target species are not stated in each of the license. The license just only listed of one or more species group, such as pelagics group, demersal; but not for example, red snappers, groupers, and scads except shrimp. Concern sometimes proposed by the shrimp trawlers regarding their catch. It is commonly known that the shrimp tralwers are not allowed to catch and to land or to unload fish in substantial amount according to the inspectors. On the other hand, the catch of fish trawl or fish net consisted of many species group including pelagic fish, demersal fish, shrimp, squids, and others.

Arafura Sea fisheries as a whole were dominated by the fish net (fish trawl), shrimp trawl, and oceanic gill net fisheries. Fish net and shrimp net operate their gear in almost overlapping fishing ground, while the oceanic gill net seems to be operated in the offshore waters and targetted for large pelagics species. Except for fish net, shrimp net, and bottom longline,

Table 1. Number of licensed fishing vessel operated in the Arafura Sea issued in May 22, 2007

| Fishing gear | Range GT | | | | | Total |
|---|---|---|---|---|---|---|
| | <50 | 51-100 | 101-200 | 201-400 | >400 | |
| **Demersal** | | | | | | |
| 1. Traps | 8 | 3 | - | - | - | 11 |
| 2. Bottom gill net | 2 | 1 | - | - | - | 3 |
| 3. Bottom longline | 117 | 30 | 6 | 4 | | 157 |
| 4. Fish net | | 3 | 167 | 359 | 119 | 648 |
| 5. Shrimp net | 2 | 123 | 165 | 20 | 9 | 319 |
| **Total** | **129** | **160** | **338** | **383** | **128** | **1138** |

Sources: Anonymus (2007)

no catch sample collected from the others fisheries that can be used as an *anchor point* for further assessment of the fishery.

Looking at the total number of licensed fishing vessel of 1,137 boats, it is likely that these number is considered high compare to licensed fishing vessel operated in the Australian sector of the Arafura Sea. Apart from the licensed fishing vessel, it is concerned that until the end of 2007 or probably until the present time there were some illegal fishing vessel operated in the Arafura Sea.

**Development of Trap and Bottom Longline Fleets**

The trap fishery in Arafura Sea by the fleets from Tanjung Balai Karimun in 2004 was recorded; however no information on the development of this activity was reported. They operated about 250, 700, or 1,000 unit of trap depending on the size of vessel. The trap was made of iron bars of concrete of 10 mm diameters, constructed in a cube form and covered with PA net of 2 inches mesh size. The average size of the cube trap was 140x90x60 cm, with mouth width about 56 cm and the length of the cones of about 90-100 cm. The trap fishing gear is usually operated in a series of about 7-10 units/series at the depth of 40-60 m. Fishing period in sea per trip was 14 days and effective fishing operation was 7 days per trip. The number of trap was accounted for 34 boats in 2004 decrease to 11 boats in 2007 (Table 2). Decline in trap vessels due to the shift to bottom longline vessels as hundreds of trap was lost in the fishing ground.

The total number of bottom longline in 2001 was reported to be 33 boats (Anonymus, 2003) increase to be aproximately 217 vessels in 2004 and by 2007 decrease to 187 vessels in 2007 (Anonymus, 2007). Reduction in number of bottom longline fishing vessels due to firstly they were caught by the of Australian Goverment as entered the Australian waters. and secoondly by the increase of fuel price that tend to inrease operational cost. It is likely that aproximately half of the total number vessels were stop fishing.

Effect of fuel increase altered the bottom longline fishery system has caused decreased in the size of fishing vessels, fishing day, hook size, and its number (Table 3). The size of catcher of bottom longline changes from 70-120 GT to 30-70 GT, as cost operation of large vessels is higher than small boats. With the lower capacity of fishing vessels, catches were transshipped in the sea or in harbor into a fish carrier and transported to Probolinggo. This activities were carried boats out at sea or in Wanam (the ex Jayanti Group fishing base) or in Kupang fishing port. Total number of hooks showed increase between 2,500-3,000 hooks, with most of them used 3,000 hooks. The size of hook varied for no.5.5-8.

The total number of fishing days of bottom longline in the sea decrease from three to four months to 8-30 days per trip. In 2007, bottom longline made about 4-6 trips per year; formerly they made 3-4 trips per year. On average bottom longline managed 17.6±6.74 days per trip (Syahasta *et al.*, 2007) with one setting per day, in the evening or in the morning. Fishing trip in the Arafura Sea usually carry out in December to April, while in the Timor Sea from April-November. The baits used for bottom longline were sardines, scads or tuna-like fish loaded from Probolinggo with the average about 3-4 tones/trip.

**Fishing Ground**

Exploitation of fish resources in the Arafura Sea have been carried out for years by the industrial scale fisheries. For about the last twenty five years, the shrimp trawlers, fish trawlers (fish net), and bottom longliner provide the most active fisheries in this waters. Except for bottom longline fisheries that has different fishing ground, the shrimp trawl and the fish

Table 2. Development of trap and bottom longline vessels in landing site of Probolinggo, East Java

| Fishing boat by gear | Development | | | | |
|---|---|---|---|---|---|
| | 2001 | 2004 | 2006 | 2007 | Status |
| No. Trap vessels | - | 34 | 14 | 11 | decline |
| No. BLL vessels | 33 | ± 217* | - | 187 | Up and Down |

Notes: * Based on interview on the BLL manager/agent

Table 3. Changes of fishing vessels and hooks size of bottom longline fishery in Arafura Sea in the period 1999-2002 (ACIAR/RCCF) and present study

| | Boat size (GT) | Hook no | Size of hook | Day in sea/trip |
|---|---|---|---|---|
| 1999-2002 | 70-120 | 1,800-2,900 | 4-5 | 45-60 |
| Recent study | 30-70 | 2,500-3,000 | 5.5-8 | 8-15 |

trawl have almost operated in the same fishing ground. The fishing ground of bottom longline fisheries that can be considered as selective fishing gear are usually operated in the muddy coral habitat with a relatively larger size demersal finfish as the target species group.

The fishing ground of the bottom longline landed in Probolinggo covered the waters of the Arafura Sea, Aru Sea, Seram Sea, Dobo, Avona, Timor Sea, Flores Sea, and Java Sea. They usually covered three or four fishing grounds in one trip in coral reef flat or slope with a relatively larger size demersal finfish as the target species group. The fishing ground of trap fishery covered the reef slopes and shelves waters of the Arafura Sea, Aru Sea, Timor Sea, and Java Sea (Masalembo, Matasirih). The depth of bottom longline was reported at reef slope at 64-125 m depth with bottom substrate sandy mud, whereas fish net fished at 35-52 m depth in sandy mud area. The fishing area of trap was reported reef area adjacent to reef island in Aru Island, Timor, Fak-Fak to Masalembo, Java Sea (Anonymous, 2003).

**Fishing Port**

For the three industrial scale fisheries of fish trawlers, shrimp trawler and bottom longline that have been operated for years, almost no change in their fishing base. The fish trawler or fish net fishing base are Tual, Wanam, Sorong, Merauke, and Ambon. Tual fishing port has long been used by some fishing companies. Some large fishing companies have their own fishing port/landing site.

In Merauke, as the capital city of the Merauke District, there are some branch office or agents of some fishing companies. These agents usually managed license supply all necessary provision needed to support fishing operations. Some biological data of red snappers have been collected during this study in Merauke. Most fish were caught by fish trawlers, some of fish were collected from the Laboratory of Fish Quality Controle.

Wanam is a fishing base built by Jayanti Group. It is likely that nowdays this port has been used by some others fishing boats from different companies either for unloading catch, fish/catch collectors, and to get some provisions (drink water, ice, vegetables etc.).

Sorong is one of the large fishing base for shrimp trawlers since the Arafura Sea shrimp fisheries began in the 1968-70$^{th}$. It is also provide the fishing base of the former PT. Usaha Mina, the tuna/skipjack fishing base that in the late 1980 has also operate their boat ton catch red snappers and some large demersal fish.

Kupang and Probolinggo provide a transit fishing base of bottom longline fisheries operated by their headquaters in Tanjung Balai Karimun. The bottom longline fishing boats stop over in Tenau Coastal Fishing Port for collecting provisions for and from fishing operation in the Timor Sea and Arafura Sea. Some bottom longline fishing boats back from the Arafura Sea usually unloaded part their catch especially fish that having lower market prices. Some first quality fish of scarlet snapper, *L. malabaricus* and goldband snapper, *P. multidens*, are usually transported to TBK, and directly exported.

**Catch Composition**

Information on catch composition is one of the aspects for biomass assessment. Changes in catch composition may involve in shift biomass or size-specific biomass off different trophic groups. Shift in catch compsition can be used as one index of the extended exploitation in reef fisheries. In light fishing intensity catches consist of large predator fishes i.e. grouper and snapper in bottom long lining catches. As the fishing pressure increase, catches of predator fish decline and replaced by small emperors (Jenings & Lock, 1996). Overall catch were recorded 70 fish categories in local name. The dominant catch were recorded deep-sea snapper or locally Angoli (36%), red snapper (24.7%), Carangid (putih) 10%, and grouper (kerapu) 9%.

**1. Trap catch composition**

Catches of trap off the Tanjung Balai Karimun fleets in October-November 2004 ranged from the lowest 2,143 kg and the highest of 11,876 kg per trip per boat. The mean catch of red snapper was about 5,324 kg per trip per boat. Red snapper dominated catches for 22.7-69.5% of the trap catches. On average red snapper dominated 40.3% of the overall catches. Goldband snapper were caught on average 5.7% of the total catch (Figure 1). *L. erythropterus* caught very small contributed for 6.5% of the overall trap catches. No record on shift in catch composition from this area.

**2. Bottom longline catch composition**

Total catches of the bottom longline of the Tanjung Balai Karimun fleets in October-December 2004 varied from lowest 566-14,505 kg per trip per boat. The average red snapper catches provide 3-93% of the overall catch. The average catch of red snapper contributed 40,4% of the total catch. Goldband

snapper provided from 0.4-79% of the total catch. On average goldband snapper contributed 27.1% of the total catch (Figure 2). High variation in catch composition of snapper in trap and bottom longline might be due to fishing activity was conducted in several places, i.e. Arafura Sea, Timor Sea, and or Flores, Seram and Macassar strait with diffrent habitat and abundance of the fish. Other reason might be due to effect of misrecorded on catch data. The catch reported by this company (Anonymus, 2005) operated in the continental shelf of most area of the eastern Indonesia region including Arafura, Seram Sea, and others, consisted of 58% red snappers (*Lutjanus* spp.), 16% goldband snapper (*Pristipomoides* spp.), and 7.8% groupers (Serranidae) and others.

### 3. Fish net catch composition

Total landing of red snapper from catcher of Thai fishnet vessels in Merauke in 2005 accounted for 254.43 tonnes and in 2006 for 456.98 ton. The most dominant catches in fish net were scads (10.7%), seabream, Nemidterids (9.7%), and cat fish (8.8%). Overall mean catch of snapper was found to be 41 kg/day/trip. Red snapper accounted for 1.1% of the total catch in biomass. The mean catches of snapper in 2005 was found to be 31kg/day/trip and in 2006 for 42kg/day/trip. Daily catches of overall snapper in 2005 and 2006, ranged from 11kg/trip/day to 53kg/trip/day.

A similar result was reported by Badrudin *et al.*, (2004). They stated that sea breams (Nemipteridae), lizard fish (Synodontidae), and cat fish (Scianidae) were caught dominant among demersal fishes in fish net in Arafura, whilst Chub mackerel (*Rastreliger* spp.) and Cephalopods dominated pelagic fish. Red snapper was caught for less than 2% of the total catch. Similarly, fish net in Arafura Sea of the Australian license dominated by Sea breams groups in 1972-1979 (Ram & Xiao, 1996).

### 4. Shift on red snapper catch composition

Based on landing data of 1977 fleets base of bottom longline and trap catches in Probolinggo from 2005-2007, it showed some changes in catch composition in term of biomass of red snapper and deep sea snapper (Table 2). The red snapper catches decline from 42.1% in 2005 to 24.7% in 2007. Catches of goldband in bottom longline catches increase from 16.1% in 2005 to 36% in 2007 of the total catch.

Changes in catch composition of red snapper and deep sea snapper in term of biomass in the last

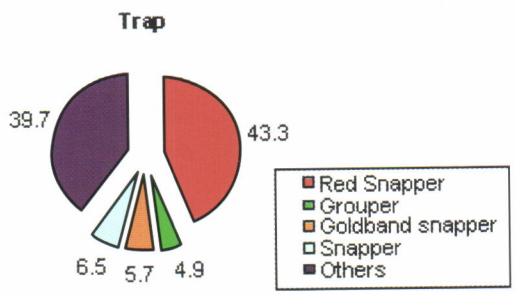


Figure 1. Catch composition of red snapper and goldband snapper in trap fisheries from October-December in 2004 landed in Air Tembaga, Probolinggo, East Java.

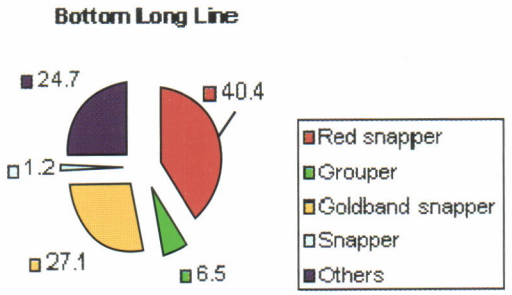


Figure 2. Catch composition of red snapper and goldband snapper in bottom longline fishery from October-December in 2004 landed in Probolinggo, East Java.

decade was detected (Table 4). The red snapper catches decline from 58% in 1995 (Usaha Mina report) reduced to 42.1% in 2005 and to 24.7% in 2007. Catches of Goldband, *P. multidense* in bottom longline catches in 1995 is the same as in 2005 for 16%. By 2007 catches increase to be 36% of the total catch. Badrudin & Blaber (2003), reported red snapper found for 21,3% and *P. multidens* for 1.1-5,1% of total catch in Aru Sea. Variability in red snapper composition in bottom longline catches might be affected by variability in the fish abundance, habitat structure of fishing ground, environmental condition, seasonal, and technical interaction in the red snapper fishery.

Lowered in red snapper catches is followed by increasing of other species such as deep sea snapper, however often followed an increase of carangids, or emperor. In initial fishery, catches targeted for large predator fish (snapper and grouper), later fishery, catches shift from large predator fishes to small emperors dominated in lining fishery (Jenning & Lock, 1996).

## 5. Size distribution

Bottom long line is probably the most commonly fishing gear to catch reef fishes and select mainly large predator species such as snapper and grouper. The size of the fish caught influenced by size of gear (Ralstone, 1990). Large size of hook tend to catch larger fish and smaller hook size caught smaller fish.

The red snapper species collected in landing base, were between 22-75 cm in TL. The dominant snapper *L. malabaricus* were recorded at 22.5-75 cm; *L. erythropterus* between 30.5-50.5 cm, and *L. sebae* between 38.5-64.5 cm in FL. Deep sea snapper of the species *P. multidense* recorded at size between 26.5-65 cm and smallest size was *P. typus* between 22.5-52.5 cm in TL.

Length at first capture (Lc), with assumption that the samples were proportion to the fish population, it is likely that size structure of snappers decline in the last decade (Figure 3, Table 5). Looking at $Lc_{50\%}$ of each red snapper species, it appeared that most of red snapper caught were of immature fish and young brood stock. In contrast to catches in the period 1999-2002, most of the snapper that caught were old brood stock at size higher than 60cm in TL (Badrudin *et al.*, 2004).

Unlike off bottom longline, red snapper catches in fish net in Merauke showed similar size ranged in recent study to earlier study reported by Badrudin & Blabber (2003). At present, the red snapper size ranged between 22-78 cm, with modus at length class at 26-27 cm contributed for 23%. Badrudin & Blabber

Table 4. Changes on red snapper and goldband snapper in 1995-2007. Data was gathered from Usaha Mina, ACIAR and Landing in (2007)

| Local name | Scientific name | % catch composition | | | | |
|---|---|---|---|---|---|---|
| CPUE (kg/trip/boat) | | 1995* | ACIAR | 2005 | 2006 | 2007 |
| Kakap merah | *L. malabaricus* | 58 | 47.3 | 42.1 | 30.8 | 24.7 |
| Kakap seto | *L. erythropterus* | | | 0.4 | 0.8 | 4.84 |
| Kakap sawo | *L. sebae* | | | | 0.3 | 0.74 |
| Tungku | *Lutjanus* sp. | | | 0.2 | 0.8 | 0.8 |
| Angoli | *P. multidense.* | 16 | | 16.1 | 25.1 | 36 |

Notes: * based on Usaha Mina; ** ACIAR 1999-2002

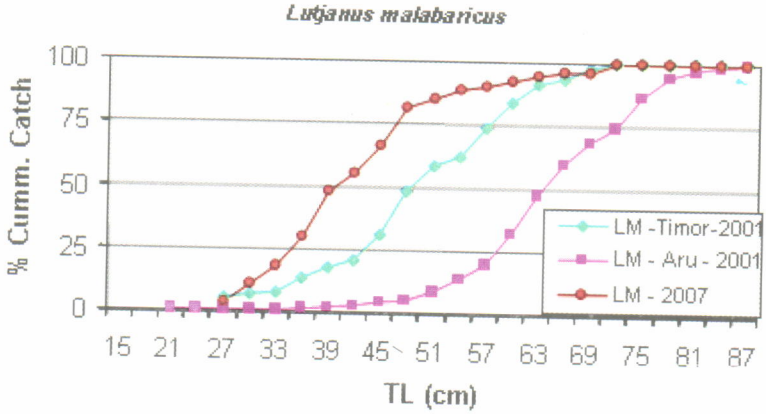


Figure 3. Changes in length at first capture of red snapper (*Lutjanus malabaricus*) in 2001-2007.

Table 5. The length (cm in TL) at 50% capture of the *L. malabaricus, L. erythropterus*, and *P. multidense* caught in Arafura Sea in landing site in Probolinggo, East Java

| | $LC_{50\%}$ in 2000/02* | $LC_{50\%}$ in 2007** | $Lm_{50\%}$ (cm)*** |
|---|---|---|---|
| **Bottom longline** | | | |
| *L. malabaricus* | 50.7 and 67.3 | 41 | 54.8 |
| *L. erythropterus* | 59 | 39 | 48.6 |
| *L. sebae* | 53 | 45 | 57.6 |
| *P. multidense* | 43.4 and 69 | 40.5 | |
| **Fish net** | | | |
| *L. malabaricus* in Merauke | 27.1 | 26-27 | 54.8 |

Sources: * ACIAR; ** Landed in Probolinggo in 2007; *** in McPherson *et al.* (1992), McPherson & Squire (1992)

(2003) reported red snapper caught by fish net from Arafura in 2002 was recorded to be 27.1 cm.

## CONCLUSION

1. Changes in fishing effort and size of bottom longline fleets have been observed since 2005. The size of vessel shift from higher than 70 GT to lower 50 GT. Using smaller fishing vessel cause shorter in fishing day. Hook size shifted to smaller size but the number of hook increased.

2. Shift in catches of red snapper and deep sea snapper of bottom longline fishery was recorded and was likely as the results of high exploitation.

3. Smaller size of red snapper and gold band snapper in Arafura management area was observed. Decrease in size structure of red snapper from large adult brood stock to immature and young brood stock could be probably due to effect of over fishing.

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