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Commonly discarded fishes on Indonesian tuna longline fishery in Indian Ocean

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ABSTRACT

Incidental by-catch and associated discarding are difficult to estimate on the basis of logbook information because they are poorly reported by fishing masters and their importance varies with several interrelated factors. The purpose of this paper is to inform the commonly discarded fishes on the Indonesian tuna longline fishery in the Indian Ocean. The study was conducted during 2010 – 2011 following six commercial tuna longline vessels based in Port of Benoa. The results showed that discards composition reach almost 20% from total catch. Those discards composition was dominated by longnose lancetfish (32.73%) and pelagic stingrays (11.62%) which both species contribute almost half of total discards. Later followed by crocodile shark (6.07%), snake mackerel (0.41%), ocean sunfish (0.14%), olive ridley turtle (0.07%), with hammerhead shark, tappertail ribbonfish, false killer whale and leatherback sea turtle 0.02% each. Almost half of total catch are discards and half of discards are disposed dead or dying. These findings indicate the need for special management to reduce the discards for tuna longline in Indonesia.

Keywords: By-catch, discards, longline, Indian Ocean

INTRODUCTION

The term "by-catch" is widely used in scientific or popular literature which has variety of interpretation, and some might overlapping or contradictory. But in general it can be described as a fraction of the catch that consists of non-target species (Romanov, 2002, Pauly, 1984, Alverson & Hughes, 1996).Following to Alverson*et al.* (1994) by-catch has been customarily used to identify (1) species retained and sold, (2) species or sizes and sexes of species discarded as a result of economic, legal, or personal considerations, and (3) non-targeted species retained and sold, plus all discards.

By-catch has two components: byproduct, the non-target species catch that is retained and sold (Chapman, 2001) and discards, which a portion of the catch returned to the sea as a result of economic, legal, or personal considerations (Alverson*et al.*, 1994 *after* McCaughran, 1992) and it has either no or limited commercial value (Chapman, 2001) but might play important on ecological role. By definition, by-catch is pre-determined; while the decision to retain or discard may occur during the fishing take place, at some time later during the vessel trip, or, at times, on return to port.

Incidental by-catch and associated discarding are difficult to estimate on the basis of logbookinformation because they are poorly reported by fishing masters and their importance variesaccording with interrelated factors (Rochet and Trenkel 2005). The issues raised by by-catchand discarding are, however, of increasing concern because such practices are responsible foreconomic loss, juvenile mortality, ecological effects on key species that are relevant to theoverall ecosystem structure and functioning, and added threat to endangered or high ethical valuespecies (Amande et al., 2008).

However concern on this matter, especially in Indian Ocean was little and the information available are so far limited, while the issue of by-catch has become particularly significant in the region. The purpose of this paper is to inform the commonly discarded fishes on tuna longline fishery in Indian Ocean especially in south of Java and Nusa Tenggara.

MATERIALS AND METHODS

The study was done during 2010 – 2011 following on board six commercial tuna longline vessels based in Port of Benoa. In this study category discards is assigned to a portion of the catch returned to the sea as a result of economic, legal, or personal considerations (Alverson*et al.*, 1994*after* McCaughran, 1992) and it has either no or limited commercial value (Chapman, 2001). Data covers identification up to species level, hook rate, and condition at release. Samples were taken during fishing operation in Indian Ocean (south of Java and Nusa Tenggara) as shown in Figure 1.

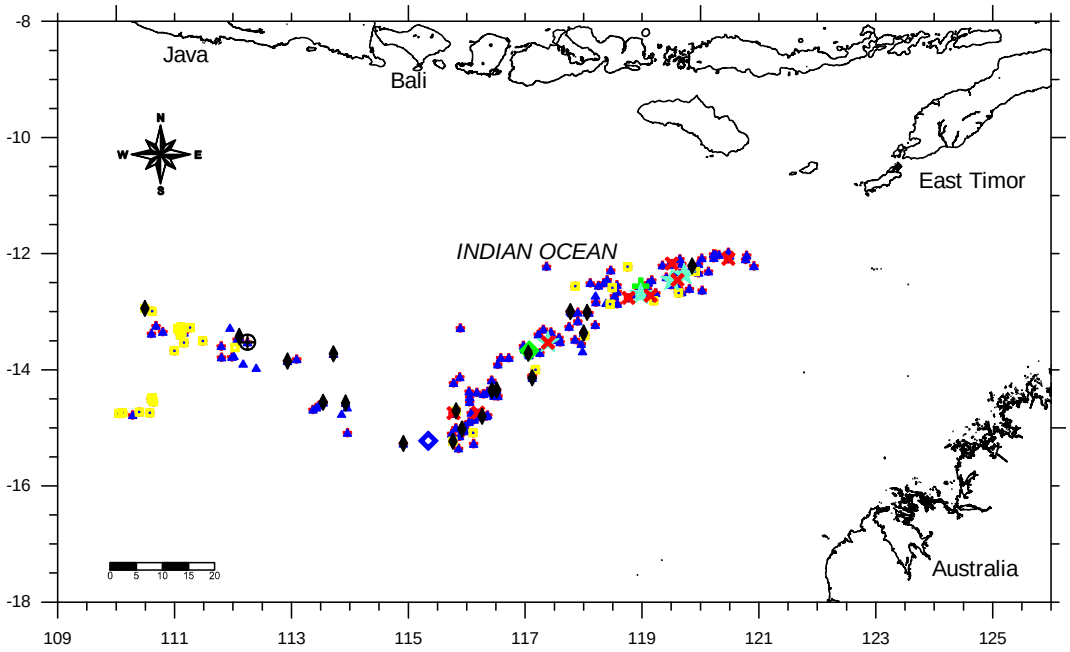

Figure 1.Distribution of samples collected (+ : longnoselancetfish; ▲**:** pelagic rays; □: crocodile shark; + : fake killer whale;✌: olive ridley turtle; ☭: sunfish; ◊: leatherback sea turtle; ◊: tappertail ribbonfish; 🕮: snake mackerel; ☹: hammerhead shark) in Eastern Indian Ocean

Analysis Data

Catch data were used to obtain the composition of tuna longline discards and analysed using microsoft™ office excel™ with descriptive analysis. Catch effort in tuna longline fishery was described as the number of hooks used on certain area of fishing, while hook rates calculated as number of fishes caught per 100/1,000 hooks (Klawe, 1980), it also called *Hook Rate* and the equation listed as follow:

$$HR = \frac{JI}{JP} \times A$$

where:

HR : hook rate (number of fishes/100 hooks)

JI : number of fishes caught

JP : number of hooks

A : 100 or 1,000 (per 100 or 1,000 hooks)

RESULTS AND DISCUSSION

RESULTS

Catch composition

A total 5,570 of fishes, reptiles, and sea mammal during 2010 - 2011 were managed to be recorded and classified onto two groups which is target species comprised of albacore (*Thunnus alalunga*), yellowfin tuna (*Thunnus albacores*), and bigeye tuna (*Thunnus obesus*); and non-target species, consist of by-product and discards.

The catch of tuna as target species only contributed 18.47% of total catch and 81.52% were catagorised as by-catch with discards dominated with 51.11% followed by by-product with 30.41% (Figure 2).The result was slightly higher than the longliners in Pacific Island Countries' Tuna Fishery Area (PICTFA) which only 10% (Chapman, 2001) and lower comparing to study by Rajruchithong *et al*. (2005) following MV. SEAFDEC in Eastern Indian Ocean and Andaman Sea which target species was up to 50.54%, but considering that billfishes and skipjack also taking into account it would be only as much as 13.51% of total tuna (yellowfin and bigeye) caught from total catch.

This result was an irony considering almost all tuna longline vessels based in Port of Benoa were set tuna as their main target yet almost half of their catches were release/discarded back to the sea.

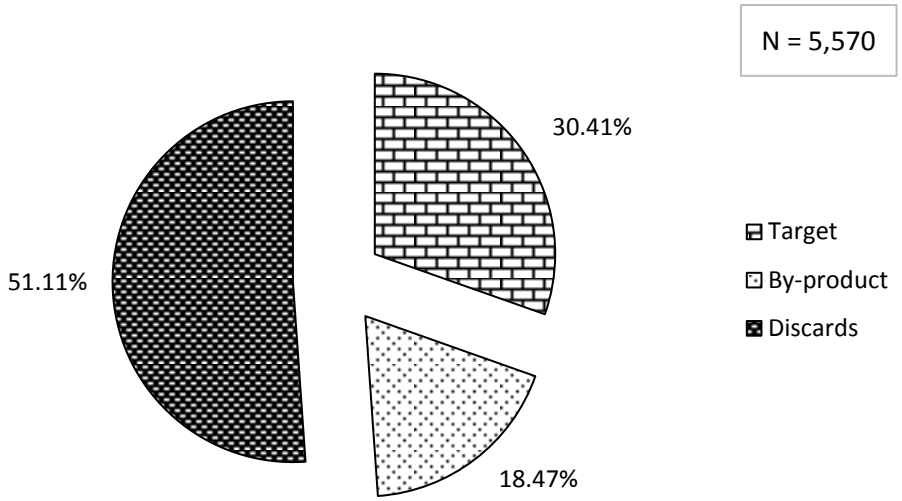

Figure 2. The catch composition of tuna longline vessels based in Port of Benoa.

Discards composition was dominated by longnoselancetfish (*Alepisaurus ferox*) 32.73% and pelagic stingrays (*Pteroplatytrygon violacea*) 11.62% which composed almost half of total discards. Later followed by crocodile shark (*Pseudocarcharias kamoharai*) 6.07%,snake mackerel (*Gempylus serpens*) 0.41%, ocean sunfish (*Mola mola*) 0.14%, olive ridley turtle (*Lepidochelys olivacea*) 0.07%, and hammerhead shark (*Sphyrna* sp.), tappertail ribbonfish (*Trachipterus fukuzakii*), false killer whale (*Pseudorca crassidens*), alongside with leatherback sea turtle (*Dermochelys coriacea*) which composed each 0.02% (Figure 3).

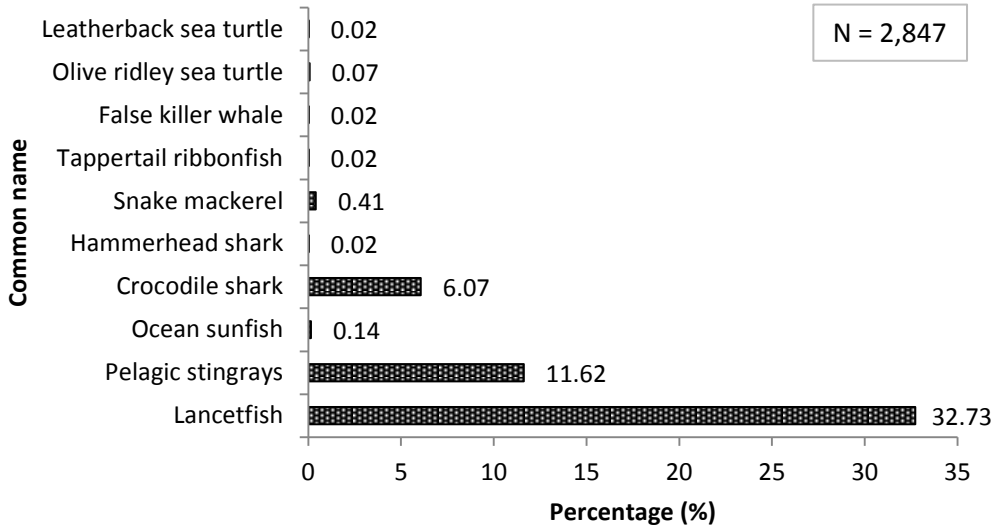

Figure 3. Composition of discards recorded from tuna longline vessels based in Port of Benoa.

Hook rates

Total 262,527 hooks were set from six vessels during 2010 – 2011 and longnose lancetfish got the most hook rate with 0.645 per 100 hooks followed by pelagic stingrays, crocodile shark, and snake mackerel with 0.237, 0.073, and 0.008 per 100 hooks. While the other also occurred but occasionally to rare, like the present of tappertail ribbonfish, hammerhead shark, false killer whale, and leatherback sea turtle which only popped out once with hook rate 0.0004 per 100 hooks (Table 1).

The hook rate of longnose lancetfish was the highest even among target species, even if compared the hook rate of yellowfin tuna, bigeye tuna and albacores which were only 0.05, 0.26, and 0.34 per 100 hooks.

Table 1. Hook rate of commonly discards from tuna longline vessels based in Port of Benoa.

Common name	Scientific name	Number (pcs)	Hook Rate (%)
Longnose lancetfish	*Alepisaurus ferox*	1,823	0.6944
Pelagic stingrays	*Pteroplatytrygon violacea*	647	0.2465
Hammerhead shark	*Sphyrna* spp.	8	0.0030
Crocodile shark	*Pseudocarcharias kamoharai*	338	0.1287
Snake mackerel	*Gempylus serpens*	1	0.0004
Tappertail ribbonfish	*Trachipterus fukuzakii*	23	0.0088
Ocean sunfish	*Mola mola*	1	0.0004
False killer whale	*Pseudorca crassidens*	1	0.0004
Olive ridley turtle	*Lepidochelys olivacea*	4	0.0015
Leatherback sea turtle	*Dermochelys coriacea*	1	0.0004

Note: Total hooks set : 262,527

DISCUSSION

The existence of longnose lancetfish and pelagic stingrays could also be found in Banda Sea (Nugraha & Wagiyo, 2006), South of Java (Barata & Prisantoso, 2009; Prisantoso *et al*., 2010; Nugraha & Triharyuni, 2009), and West Sumatra (Nugraha & Nurdin, 2006) which literally said that it exist in any longline fishery in Indonesia. And it's obvious because this species has important role on pelagic food chain as predator on micronecton organisms (Romanov *et al*., 2008a) and prey for billfishes and tunas (Potier *et al*., 2007a). And together they usually forming a schooling. Despite of their massive abundace at the ocean yet no information about the utilisation of this species, especially longnose lancetfish which perhaps due to the number of fine bones (which is a lot) and considerably high moisture content in the muscle (Wada *et al*., 1976), but scientist find it benefit for studying food chains in the pelagic ecosystem because of their digestive characterisctics: food is stored in the stomach and digestion occurs in the intestine (Potier *et al*., 2007b *after* Rofen, 1966).

There were 2 kind of sharks which are recorded as discards, crocodile and hammerhead shark. The bigger portion goes to crocodile sharkwhich becomes abundant species in several areas of World Ocean, in particular Southern Indian Ocean (Romanov & Levesque, 2009) and informed to have highest catch rate in Indian Ocean, while off Western Australia become most frequently caught species (Romanov et al., 2008b). Hammerhead sharks (family: Sprynidae) are listed as vulnerable and endangered due to it ranked among the species with lowest prductivity.Eventough most of shark caught were drag back to the port, these sharks were unlikely, they usually released dead and utilised especially for their fins while their bodies are disposed.

Not much knowledge about snake mackerel and tappertail ribbonfish, they usually caught alongside tuna longline fishery but in a minor number (Froese & Pauly, 2009). Snake mackerel is usually marketed frozen or in sausages and fish cakes, in Hawaii, this fish is known as *hāuliuli* and is considered good eating cooked or dried (Nakamura & Parin, 1993). There yet an information about the utilisation of tapertail ribbonfish, the only interenting fact is that this fish also commonly called "earthquake fish" in Taiwan because the fish are popularly believed to appear following major earthquake events due to alleged sensitivity to disturbances in the ocean floor.

Except in Indonesian waters, thepresent of ocean sunfish also mentioned by Gamblin *et al*. (2007) in Seychelles waters. Ocean sunfish or common mola is the heaviest known bony fishes and has an average adult weight of 1,000 kg (Pope *et al.*, 2009), they are recognized as the most fecund extant vertebrate with a single female capable of producing as many as 3·108 eggs at one time (Bass *et al.*, 2005 *after* Parenti, 2003). The meat of the ocean sunfish is considered a delicacy in some regions, the largest markets being Taiwan and Japan. All parts of the

sunfish are used in cuisine, from the fins to the internal organs (Froese & Pauly, 2009).

False killer whale is a cetacean, marine mammal and the third largest member of the oceanic dolphin family (Delphinidae). Knowledge about this species is limited, the only known issue is that this species like to graze longline bait-caught fishes during hauling.

Two kind of sea turtle recorded during this study, the first is olive ridley sea turtle which occured 4 times, and leatherback sea turtle only once. All of them are released alive with minor injuries. The olive ridley sea turtle is a small extant sea turtle with distribution across Indian Ocean, usually appear as by-catch in longline fisheries but mostly caught by 'ghost fishing" (nets or bits of net that have been lost or jettisoned) (Anderson *et al*., 2009). According to the observations, L. olivacea seems the most impacted by the fishery and most of theby-catches occurred in the north of the west Indian Ocean (up to the equator) (Amande *et al*., 2008). Leatherback sea turtle is known to be the largest of all living sea turtles but yet little information about their life history.

With a total 5,034 discards recorded, 27.93% released alive, 24.75% injured, 4.37% dying, 42.78% dead, and 0.18% wrecked. Showing that most of the discards are released dead or with little survival probability it should be a concern. Indeed most of the species released are less economically valuable but it might ecologicallyimportant. So a step of action should be taking in order to not "wasting the sea", noting that almost half of the total catch are released back. A more in-depth research is needed in term of to look out the effect of discards both economically and ecologically.

CONCLUSION

Discards composition was dominated by longnose lancetfish(32.73%) and pelagic stingrays (11.62%) which composed almost half of total discards. Later followed by crocodile shark (6.07%), snake mackerel (0.41%), ocean sunfish (0.14%), olive ridley turtle (0.07%), with hammerhead shark, tappertail ribbonfish, false killer whale and leatherback sea turtle each 0.02%, respectively. Almost half of total catch are discards and half of discards are disposed dead or dying. Almost half of total catch are discards and half of discards are disposed dead or dying.

AKNOLEDGEMENT

This paper is part of authors' contribution in research on by-catch and tuna fisheries in Indian Ocean conducted during 2010 – 2011 under Research Institute for Marine Fisheries. Authors would also like to thank to all of scientific observers for their contribution in collecting onboard data throughout the years.

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