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CATCH AND SIZE DISTRIBUTION OF ALBACORE (*Thunnus alalunga*) IN THE EASTERN INDIAN OCEAN

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ABSTRACT

This paper presents the current information on catch and size distribution of Albacore (*Thunnus alalunga*) caught in the Eastern Indian Ocean based Benoa through catch monitoring and scientific observer program from 2011 – 2012 (up to June). The catch estimation of ALB landed at Benoa fishing port in 2011 about 384.3 tons lower compared to ATLI (Indonesia Tuna Longline Assosiation) which up to 2,303 tons. These differences caused by many of ALB landed were frozen and in some processing plant it could not be covered. Length of ALB caught distributed from 36 – 128 cm (FL) and dominated by size 90 – 115 cm (FL). Information on fishing ground, hook rate, and length – weight relationship also presented.

INTRODUCTION

Albacore (ALB) is highly migratory species and individuals swim large distances during their lifetime due to its capability of thermoregulation, high metabolic rate, and advanced cardiovascular and blood/gas exchange systems (IOTC, 2007). It is one of the main targets of the commercial tuna fishery and has a long history of scientific research, at least in Pacific (Chen *et al*., 2005). It is widely distributed in the three major oceans from 50^0 N to 40^0 S, with the exception of 25^0 N in the Indian Ocean (Collete & Nauen, 1983).

In the Indian Ocean albacore are caught almost exclusively under drifting longlines (98%), with remaining catches recorded under purse seines and other gears (IOTC, 2007; Nishida & Tanaka, 2008). Catch of ALB by Indonesian longline fleets operating in the Indian Ocean from 2004 – 2006 was estimated at 9,081 tons by the IOTC, while 53.4% of which

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was landed at Benoa Fishing Port (Proctor *et al.*, 2007). ALB mostly landed as frozen by-catch, and obtaining length measurement sometimes difficult, while weight still achievable. Indonesia's market for ALB is mainly Sweden (53.4%), Italy (18.7%), Poland (17.8%) and Japan (10%) (Davis & Andamari, 2003).

Our understanding of this species however comes mostly from studies in the Pacific Ocean. Albacore in the Indian Ocean have, for last four decades, been mainly exploited by Taiwan, Japan, and Korea (Chen *et al.*, 2005). Most studies of this species have examined stock discrimination, age determination, and production models (Hsu, 1994 *after* Chen, 2005). This paper presents information about catch and size distribution of albacore (*Thunnus alalunga*) in the Eastern Indian Ocean based by port-based catch monitoring and scientific observer program.

MATERIALS AND METHODS

Port-based Catch Monitoring Program

An integrated Port-based Catch Monitoring Program at three major Indonesian ports, where tuna and billfish caught by longline fleets operating in the Indian Ocean are landed and processed, was established in the mid-2002 (Prisantoso *et al.,* 2009). This was a collaborative research program between Indonesia's Research Centre for Capture Fisheries/Research Institute for Marine Fisheries (RCCF/RIMF) and Directorate General for Capture Fisheries (DGCF), CSIRO Marine and Atmospheric Research, Australia's Department of Agriculture of Fisheries and Forestry (DAFF), Australian Centre for International Agricultural Research (ACIAR), Indian Ocean Tuna Commission (IOTC) and Overseas Fisheries Cooperation Foundation of Japan (OFCF) (Prisantoso *et al*., 2009). The aim of this monitoring program was to monitor the catches of all tuna species landed, and also to record the number of landings by Benoa-based longline vessel (Davis *et al.,* 2003, Proctor *et al.,* 2006). This extended the earlier RCCF/RIMF/CSIRO monitoring program initiated in 1993 which fully focused at Benoa Fishing Port (Davis & Andamari, 2002). In February 2010, the RIMF commenced to undertake the sampling, collecting and monitoring

activities (Nugroho *et al.,* 2010). In 2011 all the responsibilities switched to RITF (Reasearch Institute for Tuna Fisheries) which broadening the port-based sampling to 7 location i.e. Sibolga (North Sumatera), Bungus (West Sumatera), Muara Baru (North Jakarta), Palabuhanratu (West Java), Cilacap (Central Java), Sendang Biru & Pacitan (East Java), and Benoa (Bali). However, this paper only provides information based on Benoa Port-based Monitoring Program since the monitoring program from other port has just began this year, and the data weren't sufficient enough.

The data analyzed were part of the result of daily observation at processing plants in Port of Benoa, Bali and numerous trips from scientific observers conducted from 2011 – 2012 (up to June), following the IOTC protocol (IOTC, 2002). The data taken covers Fork Length (FL) and Fork Length Tape (FLT), weight, name and number of vessels, with notice: every sample were weighted but weren't always measure its length due to difficulty and limitation at the processing plant. Calculation of the total catch based on following formula (IOTC, 2002):

CM = LM * AVM……1)

Where:

CM : Total catch per month (in Ton)

LM : Total landing per month (in Ton)

AVM : Average catches per month (Catches sample/Landing sample)

Scientific Observer Program

Since the port-based monitoring program could not provide effort information for the fishery, Indonesia began to develop a trial observer program for the industrial tuna longline fishery based at Benoa Fishing Port, Bali, in late 2005, to address the shortage of CPUE information, and as a preliminary step to a broader observer program (see Sadiyah *et al*., (2007)).

This program is collaboration between Indonesia's Ministry of Marine Affairs and Fisheries (MMAF) through the Research Centre for Capture Fisheries (RCCF), and CSIRO

Marine and Atmospheric Research (Australia), and is funded by the Australian Centre for International Agricultural Research (ACIAR). This trial program was designed to produce accurate catch and effort data from Indonesia's Indian Ocean industrial tuna longline fishery based at Benoa, and also to provide detailed information in terms of fishing activities and environmental conditions. Since 2011, the Port-based Catch Monitoring Program and the Scientific Observer Program have been undertaken under Research Institute for Tuna Fisheries (RITF).

RESULT AND DISCUSSION

Catch Distribution

Catch distributed from $12^0 - 25^0$ S and $99^0 - 122^0$ E (Fig. 1). Data was obtained from scientific observers, following 9 commercial tuna longline vessels based in Benoa Fishing Port during 2011 – 2012 (June). Estimation of catch landed ALB in Indian Ocean was calculated from port-based monitoring in Benoa Fishing Port since the program is well-established and it contributes more than 60% of Indonesian tuna catch (Satria *et al*., 2011). The number of landings and the number of boat sampled in 2011, by month, are presented in Figure 2. The highest recorded boat landing occurred on January while the lowest was on December. This pattern was different compared to 2010 which the highest recorded was on May and the lowest was on February (Sadiyah *et al*., 2011). In 2011 RITF Benoa estimated total catch of ALB landed about 384.3 tons which comprised only 6.07% from total catch of tuna in the same year (Fig. 3). This number was lower compared to data recorded at ATLI (Indonesia Tuna Longline Association) which about 2,993 tons (Fig. 4), this discrepancy occurred because there are some processing plants/companies that (still) wouldn't allow any recording to their frozen catch and sometimes they sell it directly to collector (Sadiyah *et al.*, 2011).

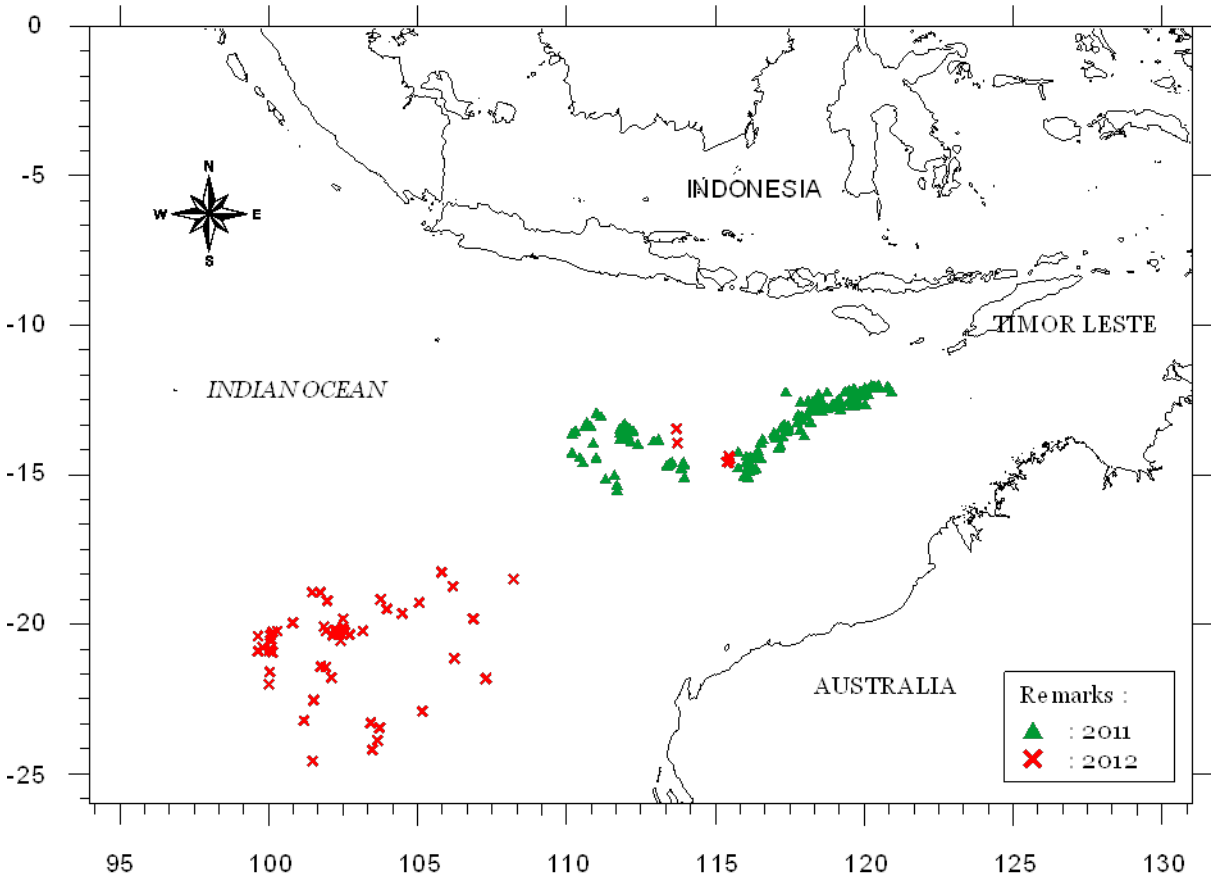

Figure 1. Distribution of Albacore caught by Indonesian tuna longline fleets from 2011 – 2012 (up to June) recorded by Scientific Observers.

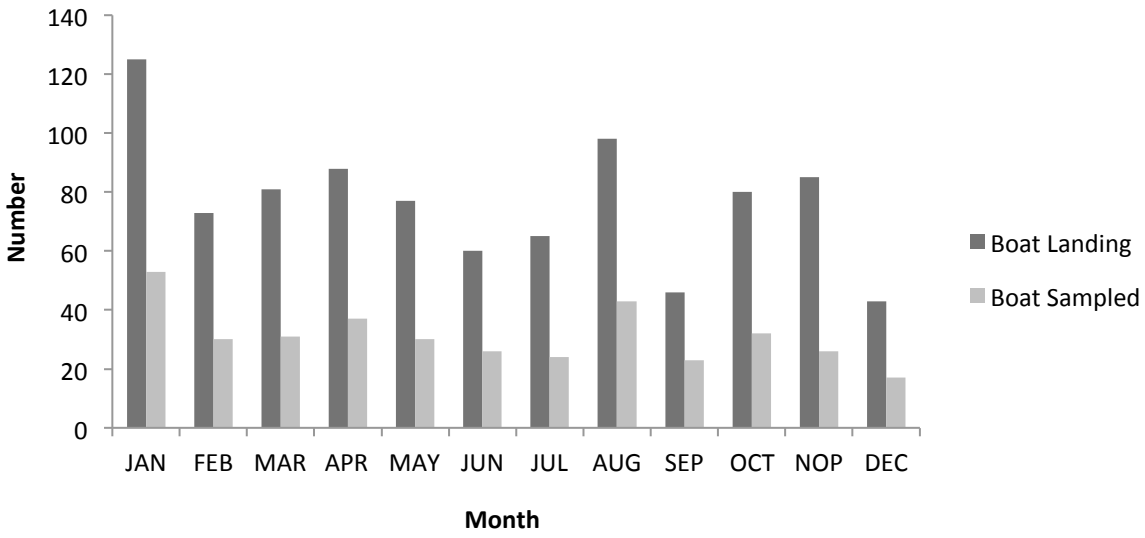

Figure 2. Monthly boat landings and sampling activities in 2011(source: RITF Benoa annual report)

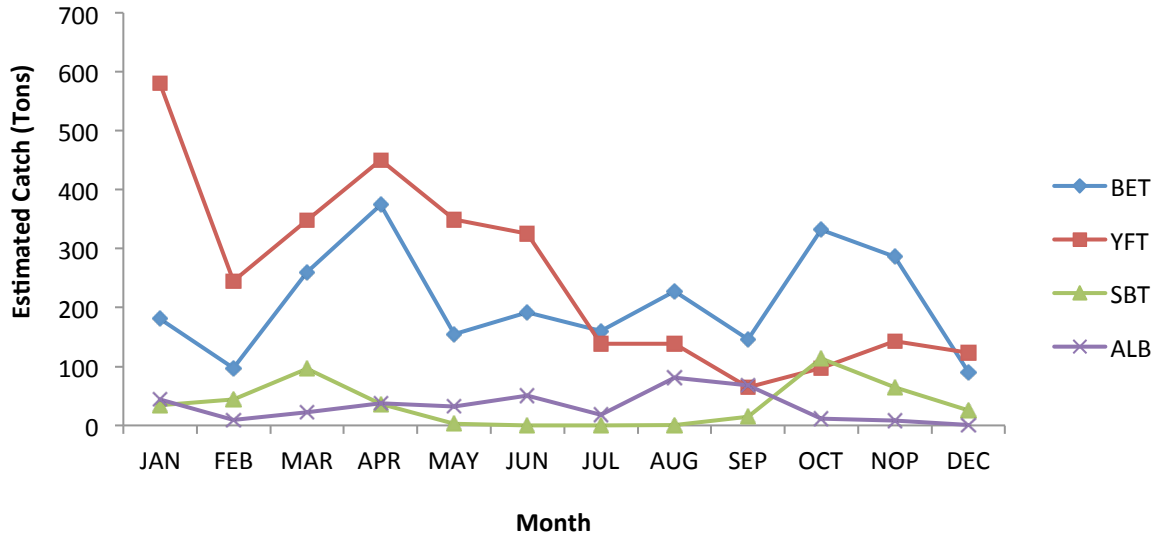

Figure 3. Estimated catch of ALB landed at Benoa Fishing Port in 2011 by month (source: RITF Benoa annual report)

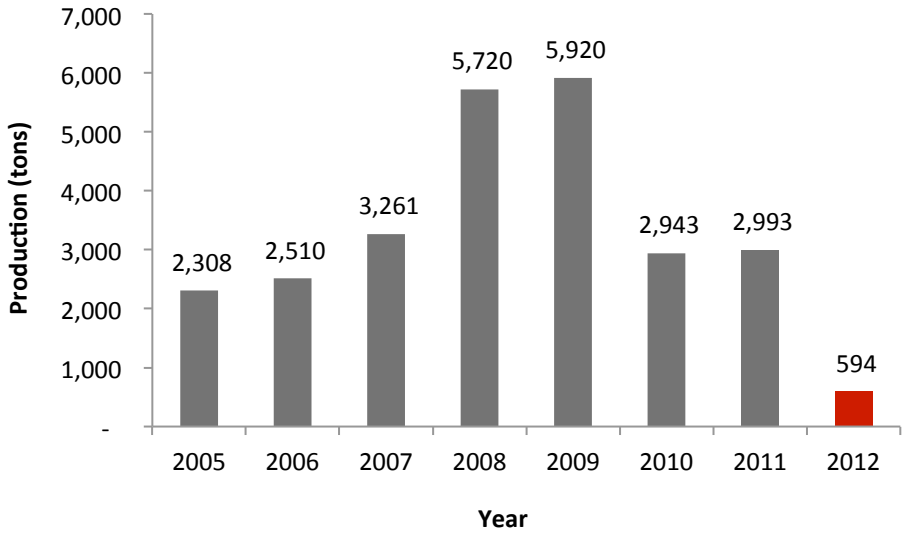

Figure 4. ALB catch landed at Benoa Fishing Port by year from 2005 to 2012 (2012 catch was total catch from January up to June 2012) (Source: ATLI, 2012)

Size Distribution

Total ALB samples that could be retrieved were 2,324 which taken from scientific observer data from 2011 – 2012 (June). The pattern was similar during 2011 – 2012 which ALB length (FLT) distributed from 36 – 126 cm, and dominated at size 93 – 112 cm (Fig. 5).

There is considerable variability in the size composition from year to year. It could also inform that more than 90% of catch recorded were above 90 cm, which is size of maturity for Albacore in Indian Ocean[3]. The number of sampling was rapidly increase from year to year, in 2011 there were 855 samples obtained while in mid-2012, it already reached 1,469 samples and expected to double the number in the end of the year.

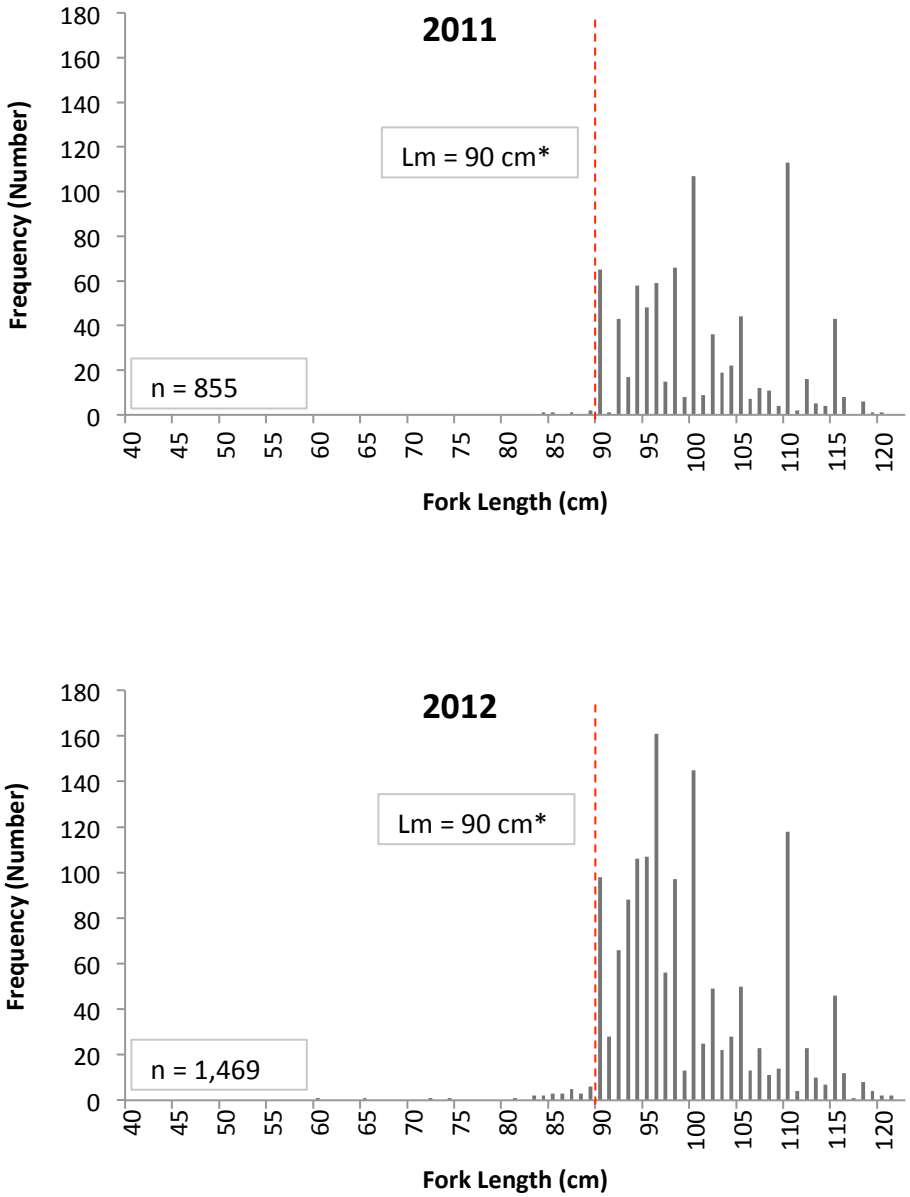

Figure 5. Length distribution of Albacore based on scientific observers program from 2011 – 2012 (up to June)

[3] Based on Wu & Kuo (1993)

Length and Weight Relationship

The data was taken from port-based monitoring in 2011, involved 497 samples. Result of the t-test of the b for ALB was < 3, with b = 2.7271 (Fig. 6). It means the growth pattern of ALB landed were likely perform negative allometric, where growth in length is faster than growth in weight. The slope was slightly lower compared to Hsu (1999) but higher than Zhu *et al.* (2010). Complete comparison is shown in Table 1.

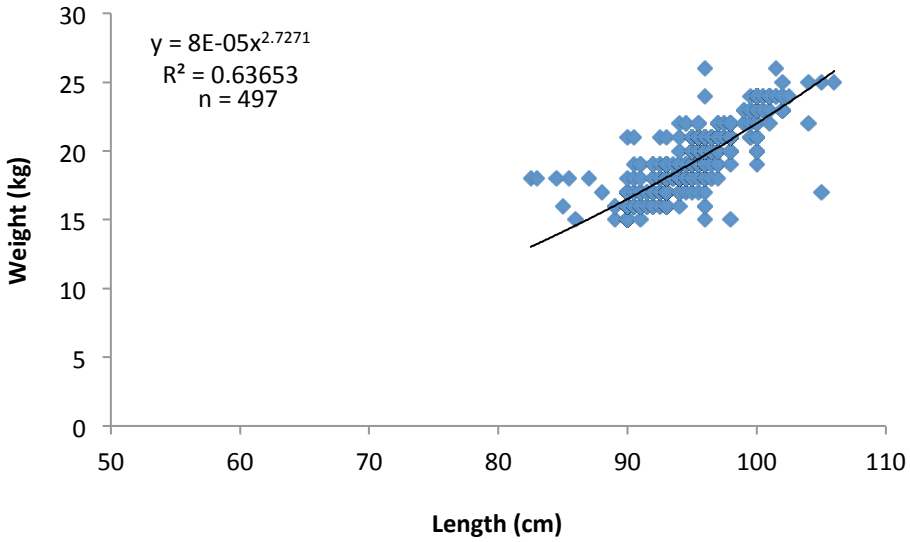

Figure 6. The scatter plot of 497 pairs of length vs. weight of albacore from the Indian Ocean based on port-based monitoring program in 2011.

Table 1. Length vs. weight relationship of albacore in the Indian Ocean (compiled from several authors).

No	Author	n	FL Range (cm)	Intercept (a)	Slope (b)	R^2
1	Setyadji *et al.* (2012)	497	83 - 106	0.00008	2.7271	0.6365
2	Zhu *et al.* (2010)	88	93 - 119	0.00043	2.3428	0.7644
3	Hsu (1999)	2,499	46 - 112	0.05691	2.7514	0.9190

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