Update on tuna monitoring program in Benoa port, Bali, Indonesia 2017

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Summary

This paper will provide an update information about the SBT monitoring program in Benoa port, Bali Indonesia 2017 provided in the 23rd ESC - CCSBT 2018. Based on 2016 monitoring program data, the sampling coverage was 60.28%, recorded 56% fresh and 44% frozen SBT. The length of SBT caught range from 84-210 cmFL from 2,232 individuals. Whereas, the 2017 data showed the increasing percentage of sampling coverage, accounting for 75.05%, consist of 25.2% fresh and 74.8% frozen SBT. The length frequency measurement data were collected from 2,444 individuals with range from 111-209 cmFL.

Introduction

Tuna fisheries are among the highest value commercial fisheries worldwide (Joseph *et al.* 2010; Miyake *et al.* 2010) and, as highly migratory species, pose particular challenges for regional management. Since 1990, Indonesia's tuna production has almost doubled (Stobutzki *et al.* 2014). Furthermore, Indonesia has been the country with the highest tuna production since 2004 (Sunoko and Huang 2014).

"Tuna" is the term commonly used by many fisheries officers at national, provincial and district levels to mean collectively: bigeye tuna (*T. obesus*), yellowfin tuna (*Thunnus albacares*), southern bluefin tuna (*T. maccoyii*) and albacore tuna (*T. alalunga*). To improve its participation in, and responsibilities for, the management of these internationally-shared stocks, Indonesia became a member of three Regional Fisheries Management Organisations (RFMOs): Indian Ocean Tuna Commission (IOTC), Commission for the Conservation of Southern Bluefin Tuna (CCSBT) and Western and Central Pacific Fisheries Commission

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(WCPFC). This improved Indonesia's position to contribute and to influence the management and utilization of tuna for the Indonesian economy (Djalal 2003) and regional cooperation. Regular assessment of the stock status of each species is important for Indonesia's current harvest strategy development of its tuna fisheries (FAO 2017).

In mid-2002, a monitoring program in three major Ports of Indonesia Benoa (Bali), Muara Baru (Jakarta), and Cilacap (south cost Central Java) was established (Farley *et al.* 2014). This program established through the series collaboration between Indonesia's marine fisheries research institutes[2] within the Ministry of Marine Affairs and Fisheries (MMAF) and Commonwealth Scientific and Industrial Research Organisation (CSIRO) since 1993 (Farley et al. 2017). The monitoring program aims to monitor the catch of all landing species and record the number of tuna longline vessel landings. Since 2011, the monitoring activities have been submitted to the Research Institute for Tuna Fisheries (RITF) as an institution that specializes in research on tuna resources in the Indian Ocean. This paper will provide an update information about the tuna monitoring program in Benoa port, Bali Indonesia 2017 provided by Jatmiko *et al.* (2017).

Materials and methods

Sampling

The SBT data collection conducted in 2017 (January-December) by enumerators from RITF at tuna fish processing company in Benoa port. In this period, there are nine companies that routinely organize tuna fish processing. The enumeration unit applied is the number of tuna longline vessels that perform SBT catch landings in Benoa port. The data collected, including the number of catch, fish weight, fish length, fish destination (export/reject/ bycatch), vessel name and company name.

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[2] Indonesian collaborating institutions, in chronological order: Central Research Institute for Fisheries Indonesia (CRIFI), Research Institute for Marine Fisheries (RIMF), Research Centre for Capture Fisheries (RCCF), Research Centre for Fisheries Management and Conservation (RCFMC), and currently Centre for Fisheries Research (CFR) in Jakarta, and Research Institute for Tuna Fisheries (RITF) in Bali.

The most important thing to verify is that every individual fish that represents all the fish caught from the tuna longline vessels must be recorded. If the weight per individual of tuna cannot be recorded, it is not allowed to make an estimate of the data itself. Registration of individual weights for all tuna longline vessel catches, will ensure that there is no bias in terms of sorting data by weight or by species (Jatmiko *et al.* 2017). Length measurements are conducted using callipers that have a precision of up to 0.5 cm. Length sizes are shown in order of priority according to international measurement standards. If not possible to measure the length of all fish catches, then measuring the length of the rejected fish can already be recorded as a random sampled (Jatmiko *et al.* 2017).

Statistical analysis

Estimation of total production can be calculated using formula modification from IOTC (2012):

$$CM = LM * AVM$$

Where:

CM : Estimation of total production per month (ton)

LM : Number of landed vessels per month which landed SBT (unit)

AVM : Production from sampled vessels per month which landed SBT (ton)/number of total vessels per month per processing plant which landed SBT (unit)

The relationship between fish length and weight was obtained using a multiplicative regression model ($y = ax^b$) (King 2013).

Registered vessels

The total number of registered longline vessels landed in Benoa port, sampled by RITF enumerator were 115 units in 2017. These vessels landed in 9 processing plants in Benoa port. In average, the number of longline vessels landed were about 32-65 ships per month with the total sampling coverage in 2017 is 75.05% (Appendix 1). This percentage resulted from the calculation on how many total vessels landed either one or more divide by the number of vessels that sampled.

SBT catch categories

The SBT catch of tuna longline vessels landed at Benoa port is divided into 2 categories of quality i.e. fresh and frozen. The enumeration program in 2017 reported that the SBT classified into the frozen category accounted for 74.8%, while the fresh SBT is 25.8% (Appendix 2).

Bycatch composition

A total 25 species of bycatch recorded in the longline vessels monitoring program at Benoa port in 2017. The catch composition is dominated by *Prionace glauca* with 27.136%, followed by *Lepidocybium flavobrunneum* 19.945%. Whereas, the bycatch composition which was less than 0.1% consist of 3 species, including *Sphyraena barracuda*, *Alopias sp*, and *Brama brama* (Appendix 3). The catch composition of tuna longline vessels based on fish number sampled provided in Appendix 4.

SBT length frequency and length-weight relationship

The length frequency of southern blue fin tuna (SBT) landed in Benoa port, Bali in 2017 is presented in Appendix 5. A total 2,444 SBT were measured in fork length (FL), ranged from 111 - 209 cm with the domination length is 160 cm. While the relationship between SBT length and weight, showed the strong correlation, with the high R value, 0.8785 (Appendix 6).

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Appendices

Appendix 1. Number of sampled and landed vessels and its proportion at Benoa Port in 2017

Month	Landed	Sampled	%
January	43	33	76.74%
February	32	23	71.88%
March	41	33	80.49%
April	46	35	76.09%
May	52	43	82.69%
June	65	54	83.08%
July	41	37	90.24%
August	35	30	85.71%
September	36	28	77.78%
October	45	25	55.56%
November	47	33	70.21%
December	34	14	70.21%

Appendix 2. Catch condition of SBT production landed in Benoa port, Bali in 2017
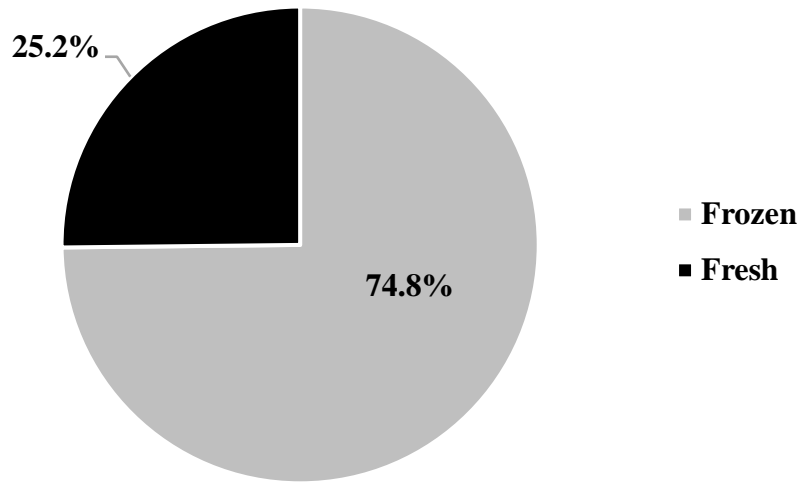
Appendix 3. Bycatch composition (%) based on fish weight percentage landed in Benoa port, Bali in 2017
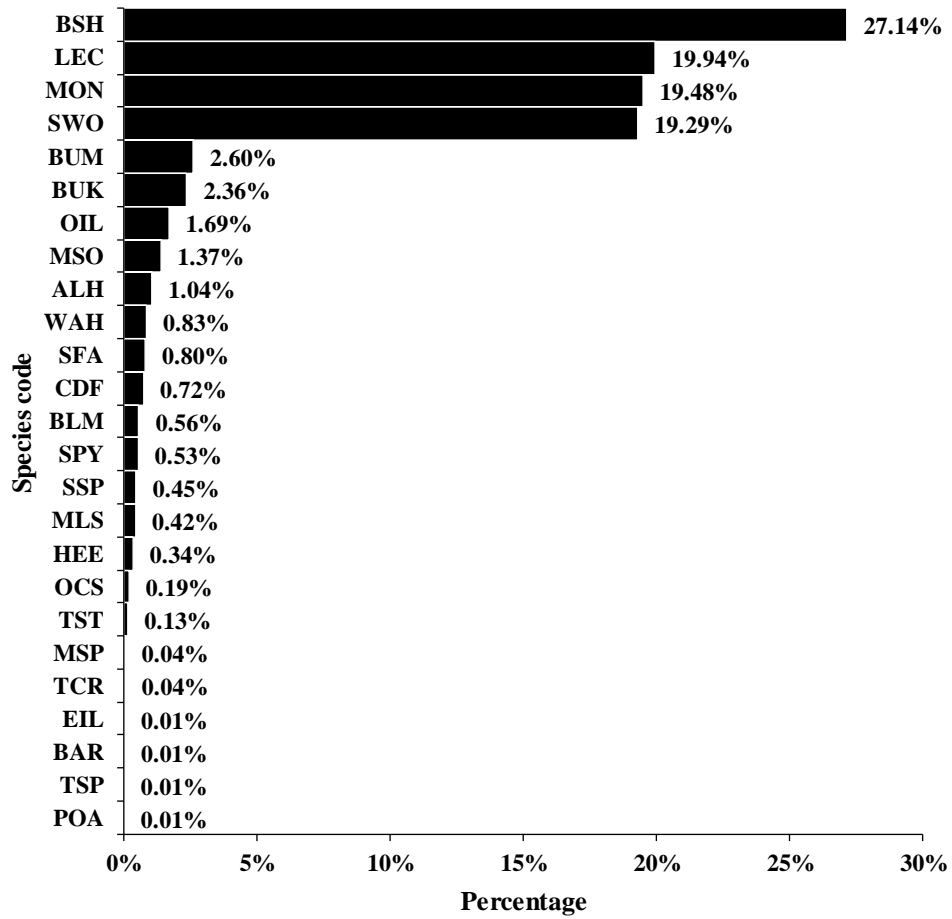
Appendix 4. Catch composition of bycatch of tuna longline vessels based on fish number sampled at Benoa port, Bali in 2017

Code	Common name	Scientific name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Des	Total
ALH	Slickheads nei	*Alepocephalus spp*	1	2	-	44	63	106	425	82	36	9	-	-	768
BAR	Barracuda	*Sphyraena barracuda*	2	3	-	-	-	-	-	-	-	-	-	-	5
BLM	Black marlin	*Makaira indica*	2	1	17	4	-	18	4	-	2	-	-	-	48
BSH	Blue shark	*Prionace glauca*	1,125	547	47	1,465	607	808	2,344	513	435	220	293	-	8,404
BUK	Butterfly king fish	*Gasterochisma melampus*	-	-	-	11	92	116	182	76	15	3	-	-	495
BUM	Blue marlin	*Makaira mazara*	8	4	157	11	13	12	6	3	1	-	1	-	216
CDF	Common dolphinfish	*Coryphaena hippurus*	5	164	-	59	22	59	504	7	101	-	-	-	921
EIL	Brilliant pomfret	*Eumegistus illustris*	-	-	-	-	-	17	-	-	2	-	-	-	19
HEE	Long nose chimaeras	*Harriotta spp*	12	5	1	11	1	4	10	3	22	33	11	-	113
LEC	Escolar	*Lepidocybium flavobrunneum*	232	1,026	299	808	692	2,530	6,341	919	1,582	525	52	-	15,006
MLS	Striped Marlin	*Tetrapturus audax*	2	4	23	4	2	8	11	-	5	-	1	-	60
MON	Moon fish	*Lampris guttatus*	55	13	6	375	653	767	1,420	880	258	339	54	-	4,820
MSO	Shortfin mako shark	*Isurus oxyrhinchus*	18	7	1	13	40	22	27	19	10	8	3	-	168
MSP	Longfin mako shark	*Isurus paucus*	1	-	-	2	-	-	1	-	-	-	-	-	4
OCS	Oceanic whitetip shark	*Carcharhinus longimanus*	4	2	-	-	1	7	3	-	3	-	-	-	20
OIL	Oilfish	*Ruvettus pretiosus*	33	45	14	64	72	91	239	110	93	73	15	-	849
POA	Atlantic pomfret	*Brama brama*	-	-	-	-	-	-	-	-	12	-	-	-	12
SFA	Sailfish	*Istiophorus platypterus*	20	46	43	122	28	63	52	3	4	10	-	-	391
SPY	Hammerhead shark	*Sphyrna sp*	-	-	1	2	2	1	5	6	1	9	1	-	28
SSP	Shortbill Spearfish	*Tetrapturus angustirostris*	6	38	2	4	22	19	87	5	26	-	-	-	209
SWO	Swordfish	*Xiphias gladius*	140	124	265	195	192	201	693	186	188	87	47	-	2,318
TCR	Pomfret	*Taractes rubescens*	-	1	-	-	-	4	17	8	5	1	5	-	41
TSP	Thresher shark	*Alopias sp*	-	-	-	-	-	-	2	-	-	-	-	-	2
TST	Sickle pomfret	*Taractichthys steindachneri*	6	-	2	1	1	16	53	20	17	2	5	-	123
WAH	Wahoo	*Acanthocybium solandri*	5	48	-	-	4	65	175	-	28	-	-	-	325

Appendix 5. Length frequency of southern blue fin tuna (SBT) landed in Benoa port, Bali in 2017
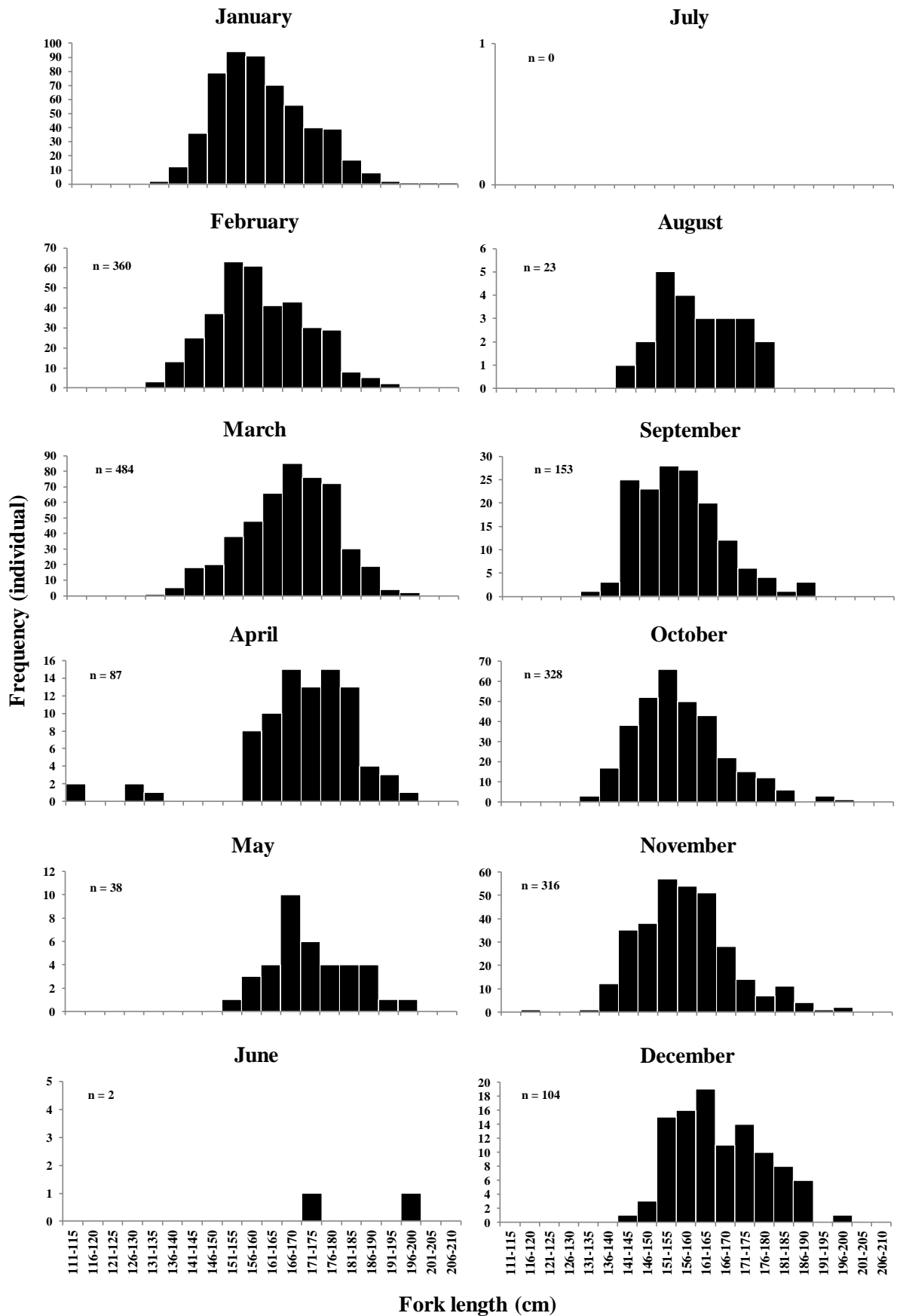
Appendix 6. Length-weight relationship of southern blue fin tuna (SBT) landed in Benoa port, Bali in 2017

$$W = 9.8 \times 10^{-6} \, FL^{3.1292}$$
$$R^2 = 0.8785$$
$$n = 2444$$