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Report of the predation* survey by the Japanese commercial tuna longline fisheries (September, 2000 – December, 2005**)

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Abstract

This report summarizes the results of the predation survey conducted by the Japanese commercial tuna longline fisheries for five years and three months from September, 2000-December, 2005. We conducted the descriptive data analyses to present results.

Contents

Submitted to the Eighth Working Party on the Tropical Tuna meeting (WPTT) (July 24-29, 2006), Victoria, Seychelles, organized by Indian Ocean Tuna Commission (IOTC).

Note (*): It is noted that "depredation" is the appropriate term in general because "predation" in our survey means that tuna once caught (predated) by LL are "re"-predated by predators by killer whales, sharks etc. But we use "predation" in this report as we have been using it as a common term in the past.

Note(**): 2005 data are not fully recovered.

1. Introduction

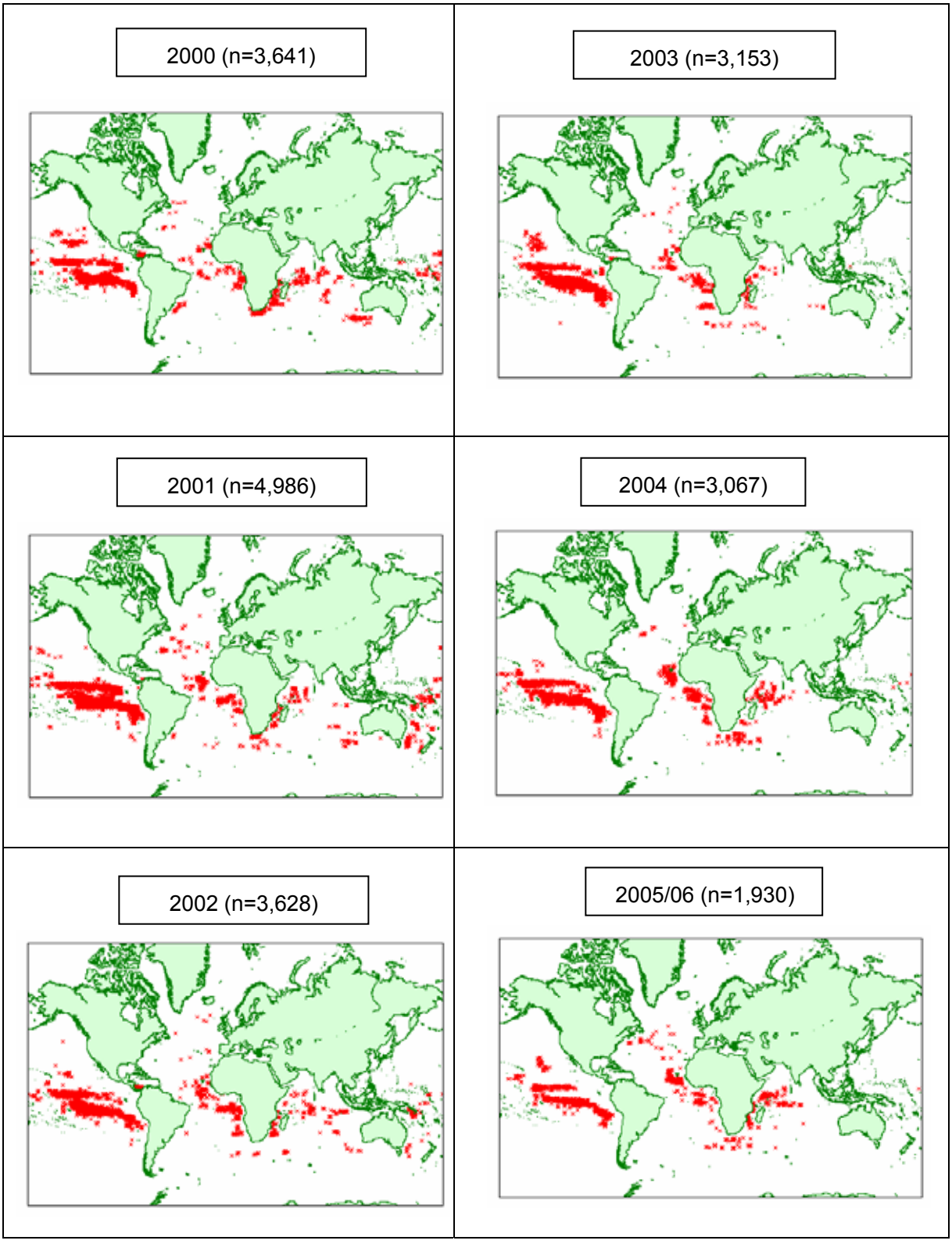
Predation problems by false killer whales (*Pseudorca crassidens*), killer whales (*Orcinus orca)* and sharks on tuna longline fisheries have been continued to the present in all three Oceans since tuna fisheries started. In case of Japan, the first report was from the Palau water in 1952 after the Second World War. In the earlier years, only some catch of the longliners where the predators had passed, were damaged. But, predation had become expanding to the whole catch of the longliners for some cases after they learned such effective process. In serious case, predators approach to the broadsides of the boats and attack the catch.

To investigate this predation problem and to find out possible mitigation methods, Fisheries Agency of Japan, Government of Japan, had conducted a number of surveys and research in the Pacific Ocean and the Indian Ocean, using public longline vessels (high school longline training vessels and/or prefecture fisheries stations' longline vessels) for 18 years in 1954, 1958 and 1965-81. Summary of these survey results were reported by Nishida and Tanio (IOTC-WPTT-2001-17, 2001).

In recent years, predation problems in the western Indian Ocean became also serious, thus the IOTC Scientific Committee and Commissioner's meetings in 1998 and 1999 recommended us to start investigating the situation of the predation problems. Upon this recommendation, Japan started the predation survey from September, 2000 for all the longliners belonging to Japan Tuna Federation (now renamed as Japan Tuna Fisheries Co-operative Association from April, 2006) and nationwide Fishers' Union called as the JF (Japan Fisheries Cooperatives or Zengyoren in Japanese) in three Oceans. Maximum about 450 longliners from Japan Tuna and 30 from the JF have been cooperating to this survey. This report summarizes the results of the surveys for five years and three months from September, 2000 to December, 2005.

2. Materials and methods

We have collected predation survey data for 5.5 years and from September, 2000 to March, 2006. But the data in 2005-2006 are not fully recovered yet. Map 1 shows the world-wide locations where predation occurred based on the survey reports from longliners by year (2000-2005/6). Table 1 and 2 show numbers of boats and operations reported by year, quarter and Ocean respectively. However, in this paper, we used the data for five years and three months (September, 2000-December, 2005) because only small part of the recent data in 2005 and 2006 has been recovered.



Map 1 Occurrence locations of predations reported by Japanese commercial longliners (as of June, 2006, total number=20,619 operations) (2000- 2005/06)

Table 1. Number of Japanese commercial tuna LL vessels reporting damages by predators by year, quarter and Ocean (2000-2006)

Year	Q (month)	Pacific	Indian	Atlantic	**TOTAL**
2000	Q3(7-9)	66	31	27	124
	Q4(10-12)	74	30	28	132
	TOTAL	140	61	55	256
2001	Q1(1-3)	39	5	14	58
	Q2(4-6)	47	6	14	67
	Q3(7-9)	50	11	4	65
	Q4(10-12)	52	11	10	73
	TOTAL	188	33	42	263
2002	Q1(1-3)	48	5	9	62
	Q2(4-6)	49	5	6	60
	Q3(7-9)	43	8	7	58
	Q4(10-12)	43	10	8	61
	TOTAL	183	28	30	241
2003	Q1(1-3)	39	4	8	51
	Q2(4-6)	39	3	9	51
	Q3(7-9)	39	2	10	51
	Q4(10-12)	36	1	13	50
	TOTAL	153	10	40	203
2004	Q1(1-3)	35	2	14	51
	Q2(4-6)	35	9	9	53
	Q3(7-9)	33	8	9	50
	Q4(10-12)	28	3	10	41
	TOTAL	131	22	42	195
2005	Q1(1-3)	25	4	12	41
	Q2(4-6)	19	9	6	34
	Q3(7-9)	15	8	8	31
	Q4(10-12)	7	1	2	10
	TOTAL	66	22	28	116
2006	Q1(1-3)	0	0	3	3
	TOTAL	0	0	3	3
TOTAL		861	176	237	1,277

Table 2 Number of Japanese commercial tuna LL operations reporting damages by predators by year, quarter and Ocean (2000-2006)

Year	Q (month)	Pacific	Indian	Atlantic	**TOTAL**
2000	Q3(7-9)	787	206	180	1,173
	Q4(10-12)	1,804	470	194	2,468
	TOTAL	2,591	676	374	3,641
2001	Q1(1-3)	1,113	94	284	1,491
	Q2(4-6)	999	113	134	1,246
	Q3(7-9)	1,034	109	10	1,153
	Q4(10-12)	939	66	91	1,096
	TOTAL	4,085	382	519	4,986
2002	Q1(1-3)	817	72	135	1,024
	Q2(4-6)	620	44	58	722
	Q3(7-9)	834	124	69	1,027
	Q4(10-12)	621	82	152	855
	TOTAL	2,892	322	414	3,628
2003	Q1(1-3)	543	66	129	738
	Q2(4-6)	602	28	94	724
	Q3(7-9)	810	13	94	917
	Q4(10-12)	672	5	97	774
	TOTAL	2,627	112	414	3,153
2004	Q1(1-3)	500	21	194	715
	Q2(4-6)	532	83	46	661
	Q3(7-9)	940	100	94	1,134
	Q4(10-12)	421	45	91	557
	TOTAL	2,393	249	425	3,067
2005	Q1(1-3)	397	129	125	651
	Q2(4-6)	475	94	45	614
	Q3(7-9)	458	52	90	600
	Q4(10-12)	58	2	5	65
	TOTAL	1,388	277	265	1,930
2006	Q1(1-3)	0	0	9	9
	TOTAL	0	0	9	9
TOTAL		15,976	2,018	2,420	20,414

We conducted descriptive data analyses for the Indian Ocean by different presentations , i.e., summary tables, Figures and Maps using by Marine Explorer version 4.2 (*http://www.esl.co.jp/index.htm*) (Marine GIS software).

In the predation survey, when at least one fish in each operation was damaged, number of the damaged fish by species is reported by the LL boats, while when there are no predations, they don't report. In addition, longliners don't record catch data in the predation survey form, although they are essential information to compute the predation rates. This is because we can get the catch data through the logbooks later, so that extra works can be avoided for LL fishers to re-write Catch data from the logbook and 0 predation data into the predation survey forms during their busy fishing operations. Thus, the predation rates (%) by species in each operation are computed by:

Predation rate (PR) (%) = a*100/ (total catch: A+B)

, where, A: number of damaged fish from the predation survey

B: number of catch from the logbook (no. of damaged fish are excluded)

Important note:

(1) This PR in our survey is the figure for the situation when at least one fish in each operation was damaged. This means that this PR does not included the situation when there are no predation (no damaged fish). Thus, the PR figures in our report is higher than the PR when 0 predation are included.

Fig. 1 shows the situation of our predation survey, i.e., the current predation rate in our survey are based on [B] & [B]', but the real predation rate should be based on [A] & [A]', [B] &[B]' and [C] & [C]' including the unreported predation and 0 predations cases. Thus the predation rates evaluated by our survey provide overestimated figures as 0 & unreported predation information are not included if we assume that predation rates of unreported cases were similar to those in our survey.

	Total Catch		
	No predation (no damaged fish)	Predarion (damaged fish)	
Predation survey	*[A] (not available)*	[B] Reported *(availabe)*	[C] Unreported *(unknown)*
Correponding catch in the logbook	[A]' *(unknow as [C]' is unknown)*	[B]' *(available)*	[C]' *(unknown)*
Predatrion Rate (%) (PR)	REAL PR=([A]+[B]+[C])*100 / ([A]+[A]' + [B]+ [B]' + [C]+[C]')		
		Current PR = [B]*100 / ([B]+[B]')	*Unknown (not available)*

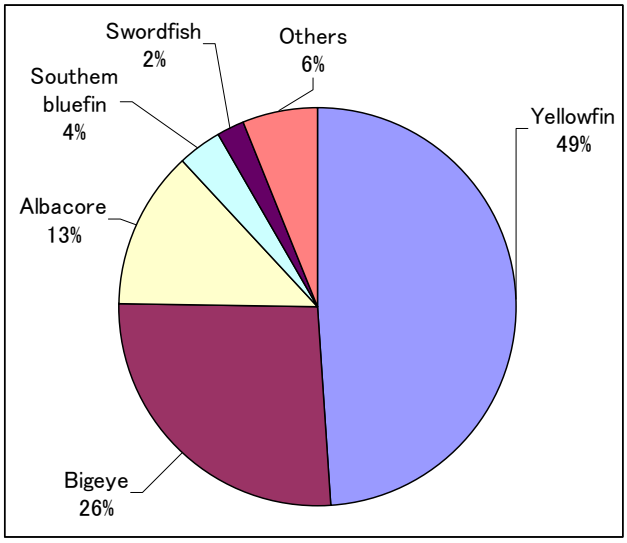
Fig. 1 Situation of the predation survey by Japanese commercial longliners

3. Results (Indian Ocean) (Table 3-4, Figs.2-3 and Maps 2-3)

Table 3 Reported number of fish attacked by year and species in the predation survey in the Indian Ocean

Species name	2000	2001	2002	2003	2004	2005
Southern bluefin	40	154	36	18	85	38
Albacore	419	348	342	32	174	46
Bigeye	1,053	806	337	80	187	295
Yellowfin	1,431	1,583	454	490	397	809
Swordfish	122	66	24	12	13	13
Blue marlin	2	0	0	0	0	0
Striped marlin	2	1	4	4	0	1
Black marlin	37	3	3	5	5	5
White marlin	1	1	0	0	0	0
Sailfish	5	15	9	5	13	48
Skipjack	0	0	2	0	0	3
Shirks	6	0	0	0	2	0
unidentified	36	0	0	0	0	0
Others	59	197	76	7	9	51
Butterfly fish	4	0	9	0	0	0
TOTAL	3,217	3,174	1,296	653	885	1,309

	TOTAL	%
Yellowfin	5,164	49.0
Bigeye	2,758	26.2
Albacore	1,361	12.9
Southern bluefin	371	3.5
Swordfish	250	2.4
Others	630	6.0
TOTAL	10,534	100.0



(Others: black marlin, sailfish, skipjack, sharks. butterfly fish, unidentified species and other species)

Fig. 2 Species compositions of attached fish (2002-2004) (n=8,296)

Note: These figures are based on the reported data when at least one fish is attacked in each operation, thus operations without any predation are not included.

Table 4 Reported number of predators by year and species in the predation survey in the Indian Ocean

Code	Species names	Category	2000	2001	2002	2003	2004	2005
A	Killer whale		237	116	56	27	65	85
A and/or B	False killer or Killer whale	False killer or Killer whale	7	2	20	36	54	41
B	False killer whale		13	21	31	16		13
D		Sharks	410	237	215	33	152	149
A and/or D	Killer whale or sharks						1	2
A and/or E	Killer whale or un-identified						1	
B and/or D	False killer whale or un-identified							1
C	Other whales	Others	1	5				
D and/or E	Sharks or un-identified						6	
E	Un-identified		11	3	0		6	1
F	Squid							2
G	fur seal		1					
H	Others							1
	TOTAL		680	384	322	112	285	295

	TOTAL	%
Sharks	1,196	57.6
False killer or Killer whales	840	40.4
Others	42	2.0
TOTAL	2,078	100.0

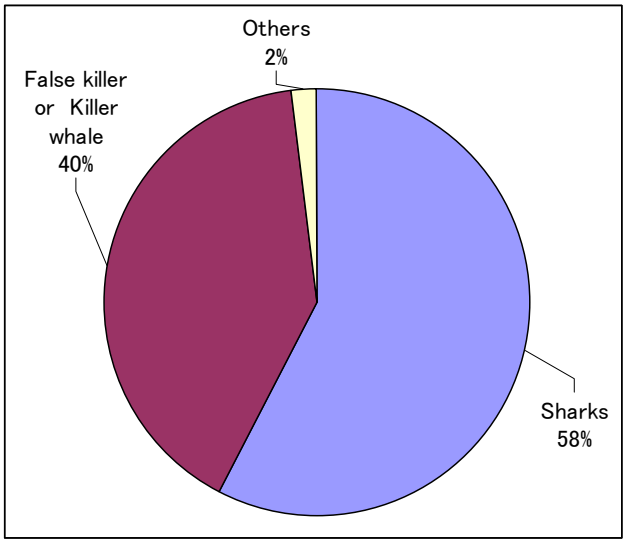
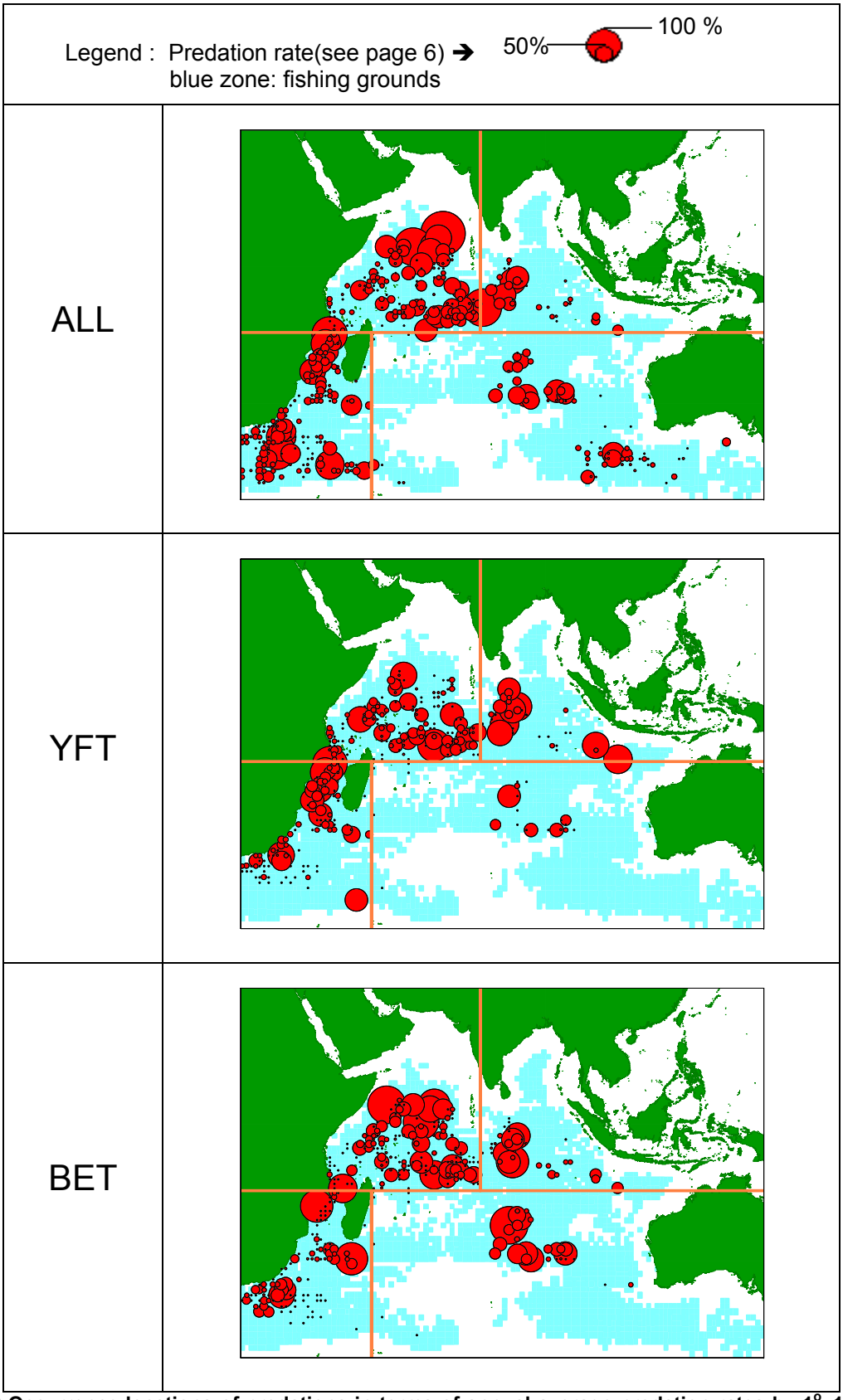
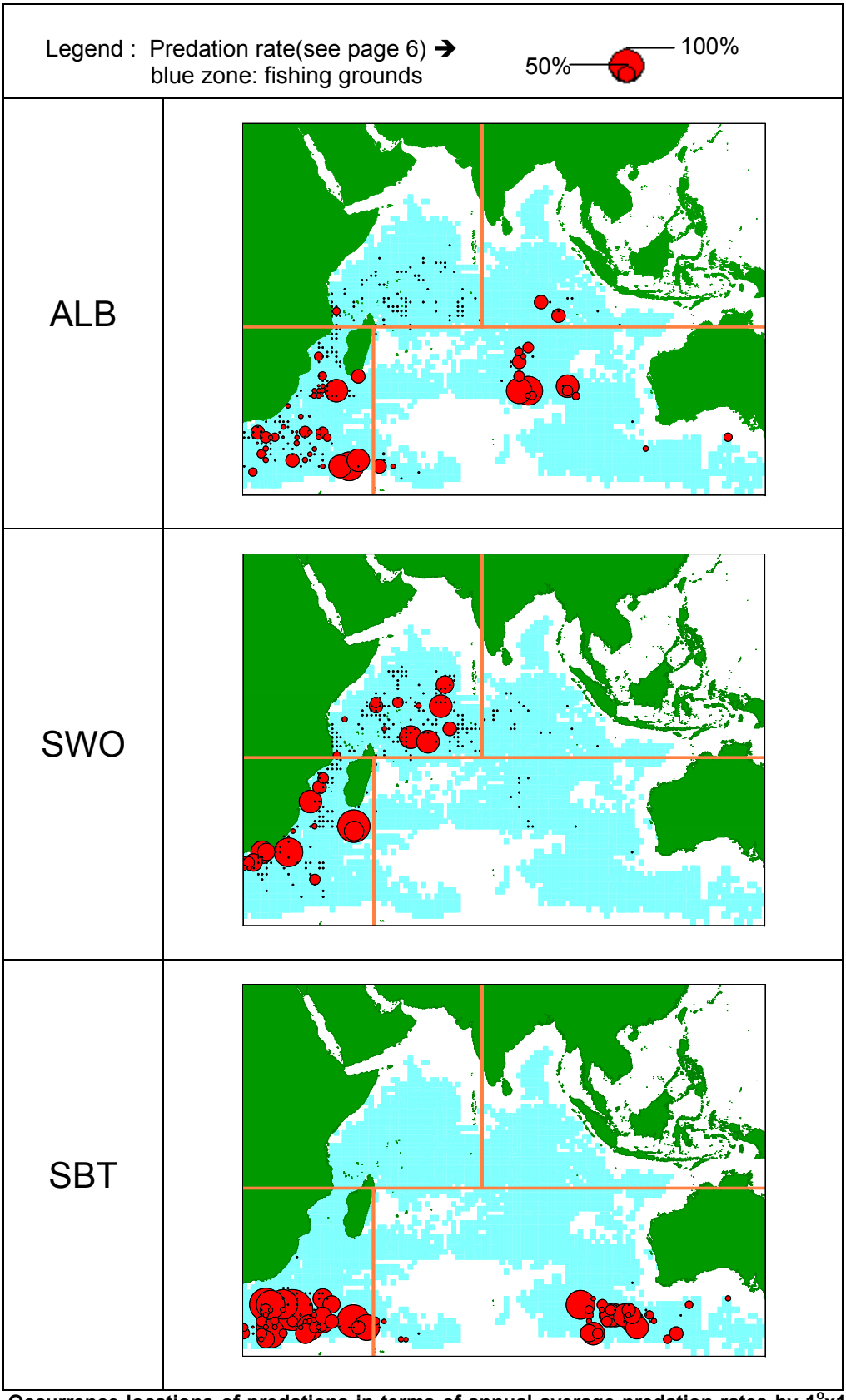


Fig. 3 Species compositions of predators (2002-2004) (n=1,564)

Note (*) killer whales are included.
Others: other whales, unidentified species, squids and fur seals)
Note: These figures are based on the reported data when at least one fish is attacked in each operation, thus operations without any predation are not included.



Map 2 Occurrence locations of predations in terms of annual average predation rates by 1°x1° area (2000-2005) for ALL(all species combined), YFT (Yellowfin tuna) and BET (bigeye tuna).



Map 3 Occurrence locations of predations in terms of annual average predation rates by 1°x1° area (2000-2005) for ALB(albacore), SWO (swordfish) and SBT (southern bluefin tuna).

4. Discussion and Summary

(1) Attacked fish (Table 3 and Fig.2)

Total number of fish attacked during 2000-2005 was 10,534 YFT, BET and ALB are three major attacked species by predations, which account 49%, 26% and 13% respectively. Those for SWO and SBT are 4% and 2% respectively.

(2) Predators (Table 4 and Fig. 3)

Number of predators reported in 2000-2005 was 2,078 individuals. Of these, 58% were sharks, 40% false killer or killer whales and others for 2%. According to the Japanese LL fishers, majority of the toothed whales attacking the LL caught tuna in the tropical and sub-tropical waters are likely false killer whales.

In average, one predator species attacked in one operation. In a few cases, two predator's species attacked against one longline operation. There are a few cases that shark attacked the longline caught sharks. There are a few cases that squids and fur seals attacked tuna.

(3) Annual distribution of predation rates by species (Maps 2-3)

As for YFT & BET there are high predations in the tropical western and the SW Indian Ocean. For ALB, predation areas are sporadic and scattered in the southern Indian Ocean. For SWO, predation areas are concentrated in the western Indian Ocean and the waters off SE African coast. For SBT, they are in the temperate waters off Cape Good Hope and Fremantle.

(4) Workshop on the five years' predation survey (to be discussed in Agenda 7 : OTHER BUSINESS)

Reference

Nishida, T. and Tanio, M. (2001) : Summary of the predation surveys for the tuna longline catch in the Indian and the Pacific Ocean based on the Japanese investigation cruises (1954, 1958 and 1966-82), IOTC Third tropical tuna working group meeting (IOTC/WPTT/01/17):31pp.

Unlisted references will be provided by the first author upon request.

Acknowledgements

We very much appreciate for all the crews of the Japanese longliners (formally Japan Tuna Federation and now renamed as Japan Tuna Fisheries Co-operative Association from April, 2006) who cooperated this predation survey and sent the records even in the tough work conditions. We further thank Mr. Miura (Japan Tuna Fisheries Co-operative Association) and Mr. Hiyama (Japan Fisheries Cooperatives：JF or Zengyoren) who coordinate this survey.

(in Japanese)

操業で忙しいにもかかわらず本食害調査に協力し記録を送付してくださった、日かつ連および全漁連所属のはえ縄船乗組員の皆様へ深謝いたします。また、本調査のコーディネートをしていただいている、日かつ連国際部（三浦様）、全漁連海外事業課（桧山課長）にもこの場をかりて深くお礼申しあげます。

REVISED FIG. 1 and the relevant text (p.7): Please replace to the one below

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REVISED PART

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