REPORT OF THE PREDATION SURVEY BY THE JAPANESE COMMERCIAL TUNA LONGLINE FISHERIES (SEPTEMBER, 2000 - NOVEMBER, 2001)

Tom Nishida [1/] and Yukiko Shiba [2/]

1/ Research Coordinator for Ocean and Resources

2/ temporal technical assistant

National Research Institute of Far Seas Fisheries (NRIFSF)

5-7-1, Orido, Shimizu-City, Shizuoka, Japan 424-8633

ABSTRACT

This report summarizes the results of the predation survey conducted by the Japanese commercial tuna longline fisheries during September,2000-November, 2001. We conducted the descriptive analyses and also depicted the distribution maps of attacked fish and predators.

INTRODUCTION

Predation problems by killer whales (*Orcinus orca)* and false killer whales (*Pseudorca crassidens*) on Japanese tuna longline fisheries have been continued to the present in three Oceans since the start of its fisheries in 1952. The first report was from the Palau water in 1952. 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. 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 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 prefecture fisheries stations' longline vessels) for 18 years in 1954, 1958 and 1965-81. Summary of these survey results are compiled and reported in IOTC/WPTT/01/17 (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 to start investigating the situation of the predation problems. Upon this recommendation, Japan started the predation survey from September 1, 2000 for all the longliners belonging to Japan Tuna Federation in three Oceans. Currently about 450 longliners are cooperating to this survey.

MATERIALS AND METHODS

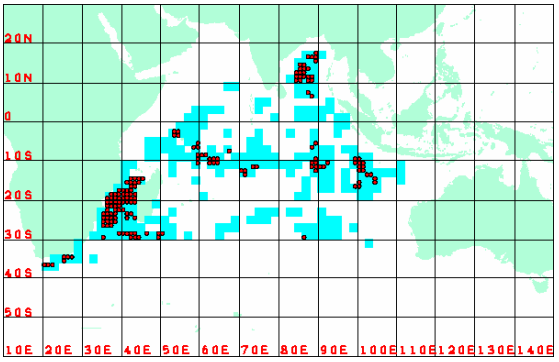
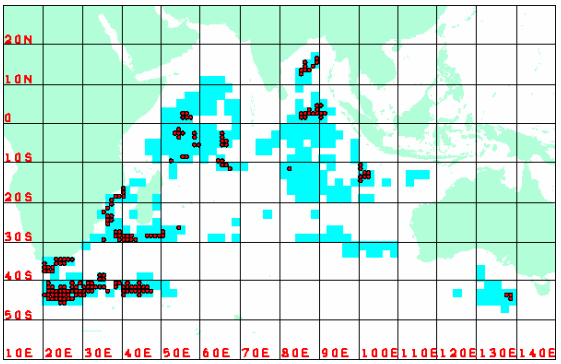
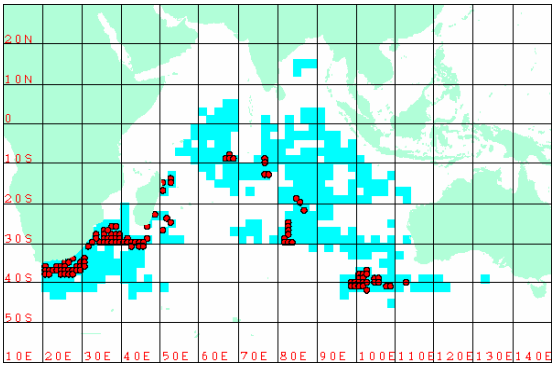
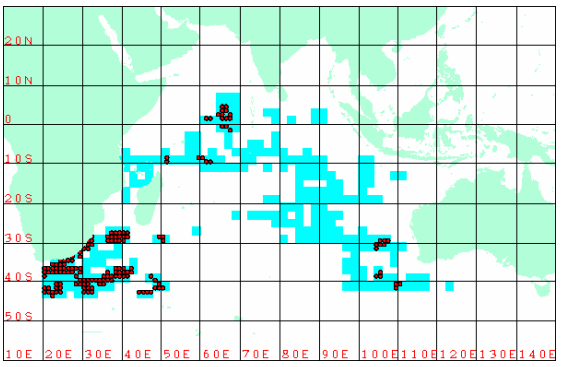
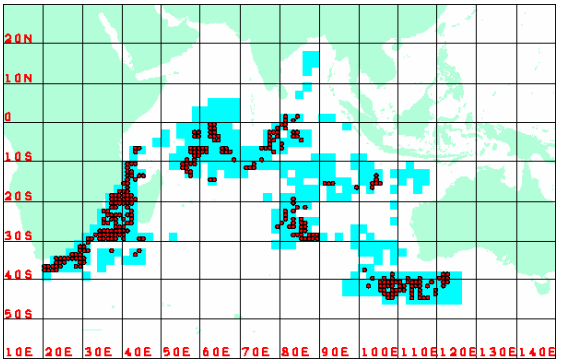
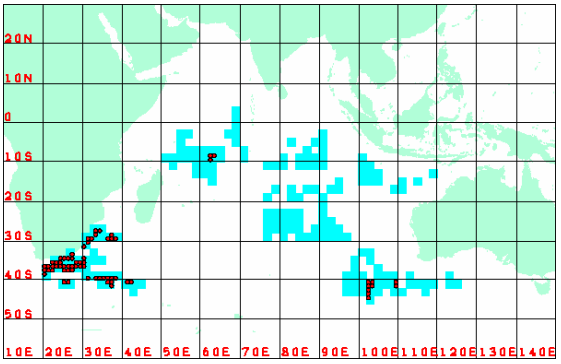
As of June, 2002, we have collected the data for 14 months (September, 2000- November, 2001) in the Indian Ocean and will summarize these information in this report. We conducted the descriptive analyses and also depicted the distribution maps of attacked fish and predators using *Marine Explorer* version 3.2 (GIS software) developed by Environmental Simulation Laboratory.

In the predation survey, number of fish damaged data by species are collected, but the catch data by species are not collected as such information are collected by the logbook, so that extra work to input duplicate (catch) information into the predation survey form can be reduced for the fishers who are busy for the fishing operations.

Thus, the predation rates (number of fish damaged/number of fish caught) can not be computed until the logbook is recovered and processed, which usually take 1-2 years to complete. For this time, the only partial logbook data are recovered and available and the preliminary predation rates are computed.

RESULTS

Area operated and surveyed

Map 1 shows the operating area in the Indian Ocean and also areas where the reporting vessels operated by quarter.		
	2000	2001
Q1		
Q2		
Q3		
Q4		

Situation of the predation

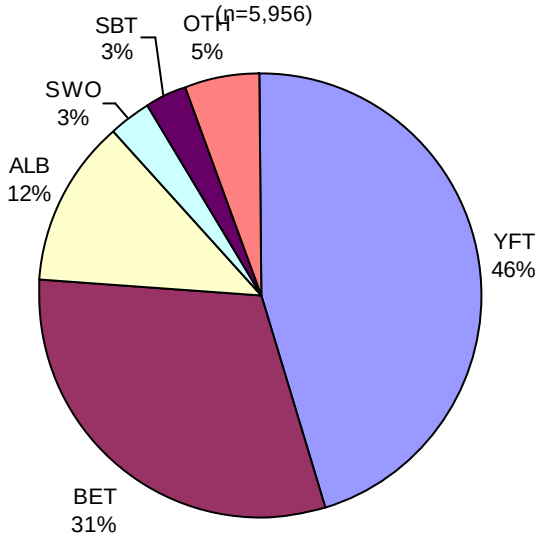
Table 1 summarizes the situation of the predation by quarter (September, 2000 – November, 2001). Fig. 1 shows the species compositions of attacked tuna, billfish and other species, while Fig.2 shows those for the predators by quarter. Map 2 shows the distributions of the attacked fish (all species combined), while Maps 3-6 present those for bigeye tuna(BET), yellowfin tuna(YFT), albacore (ALB) and swordfish(SWO). Maps 7-8 show distribution of predators, sharks and False killer whale & Killer whale combined, respectively.

Table 1 Situation of the predation in the Japanese LL in the Indian Ocean during the survey period by quarter (September, 2000 – November, 2001)

Year		2000	2000	2001	2001	2001	2001	Total
Quarter		Q3	Q4	Q1	Q2	Q3	Q4	
No. of LL boats operated (reported) (%)		116 (31) (27%)	128 (35) (27%)	110 (4) (4%)	108 (6) (6%)	81 (9) (11%)	46 (6) (13%)	589 (91) (15%)
No. of LL operation (reported) (%)		2749 (547) (20%)	7533 (1664) (22%)	4807 (853) (18%)	5300 (1104) (21%)	4334 (975) (22%)	1720 (290) (17%)	26443 (5433) (21%)
No. of attacked tuna & billfish	Southern bluefin	14	26	-	33	54	2	181
	Albacore	224	195	81	11	165	57	733
	Bigeye	304	749	296	366	121	10	1846
	Yellowfin	437	994	631	481	126	20	2689
	Swordfish	31	91	6	25	14	15	182
	Striped M.	0	2	0	0	0	0	2
	Blue M.	8	29	0	3	0	-	40
	Black M.	1	0	1	0	-	0	2
	Sailfish	3	2	1	2	-	-	8
	Skipjack	0	0	-	-	-	-	0
	Sharks	1	5	0	0	0	0	6
	Un-identified	7	29	0	0	0	0	36
	Others	16	27	1	3	123	61	231
	Total	1046	2149	1017	924	603	217	5956
No. of predators	Killer whale or False killer whale	56	212	20	38	32	23	381
	Other whales	0	6	0	0	0	17	23
	Sharks	169	290	77	93	70	0	699
	Un-identified	6	5	0	0	2	0	13
	Squid	0	0	0	0	0	0	0
	Fur seal	0	1	0	0	0	0	1
	Total	231	514	97	131	104	40	1117

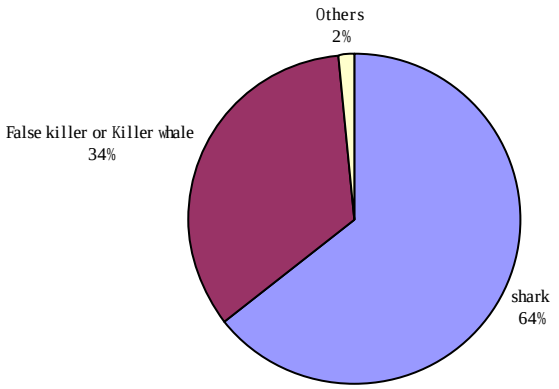
Note : (-) represents no catch

Fig. 1 Species compositions of attacked tuna & billfish (Sep. 2000-Nov. 2001) (n=5,956)



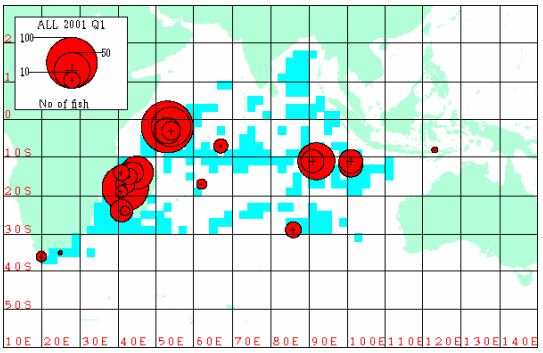
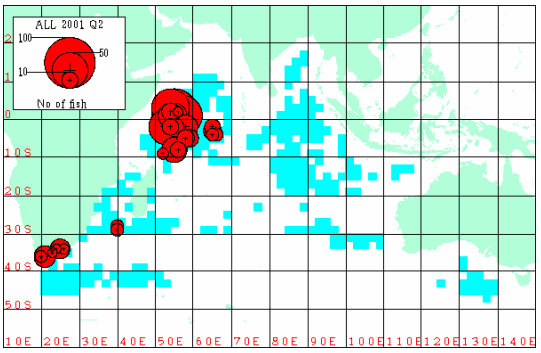
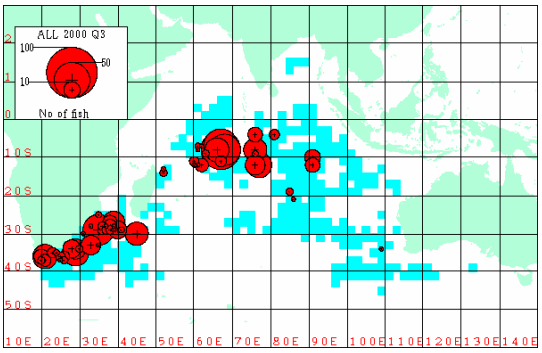
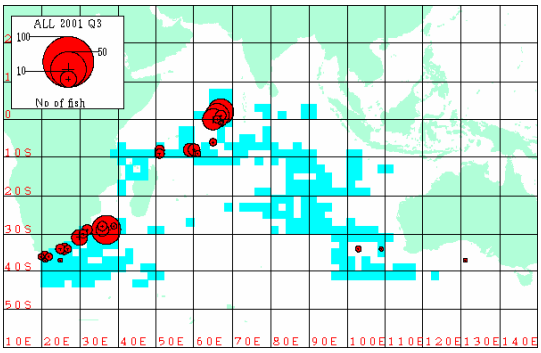
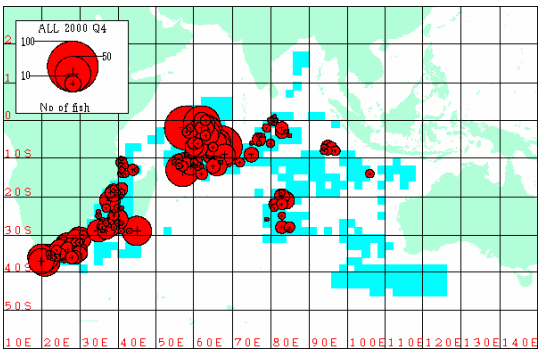
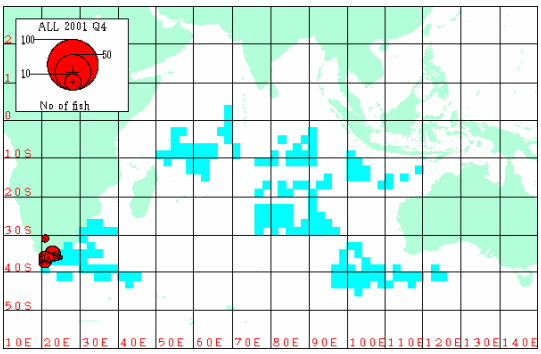
Note: Others (n=325 or 5%) include un-identified (un-confirmed) species (n=264), white marlin (n=40), sailfish (n=8), sharks (n=6), northern bluefin tuna (n=2), black marlin (n=2), striped marlin (n=2) and butterfly fish (n=1).

Fig. 2 Species compositions of the predators (Sep., 2000 - Nov. 2001)(n=1,110)



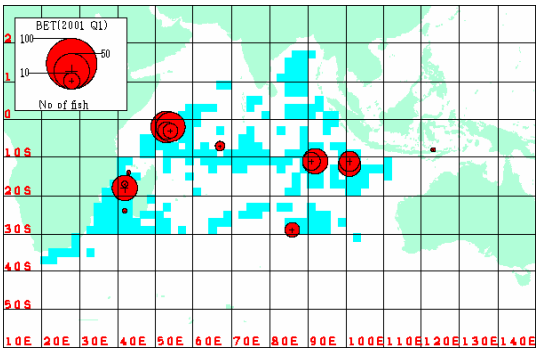
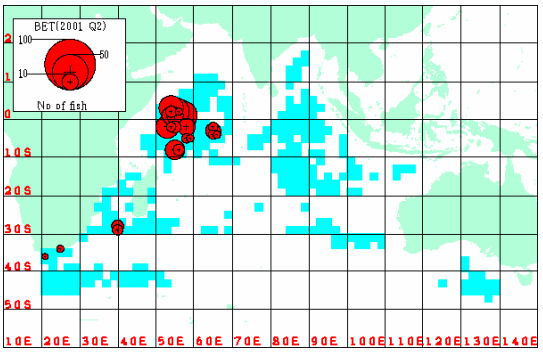
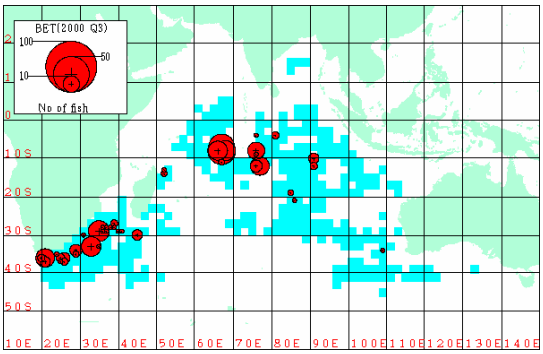
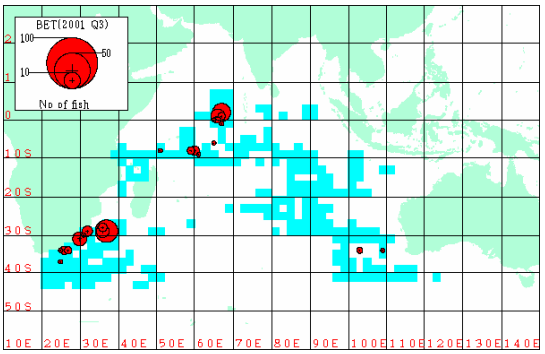
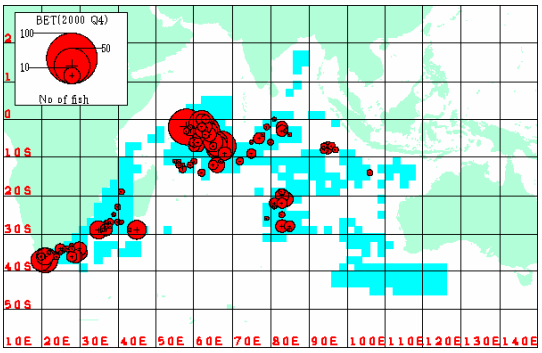
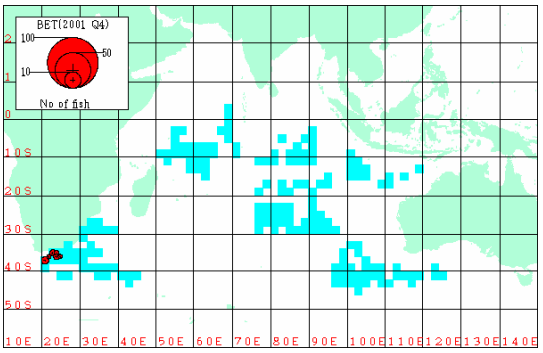
Note: Others (n=20 or 2%) include unidentified species (n=13), other whales (n=6) and fur seal (n=1). Within the False killer whale & Killer Whale combined category in the pie chart, there are number of identified cases by eye. However, we need more time to investigate accuracy of the data. Thus, we include such identified cases in this category for this time.

Map2 Distribution of attacked tuna & billfish (ALL species combined) by quarter (Red solid circle: attacked fish and Light blue zone: fishing grounds) (NB) The light blue areas imply cases that there are no attacks and/or no reporting of the predation survey.

	2000	2001
Q1		
Q2		
Q3		
Q4		

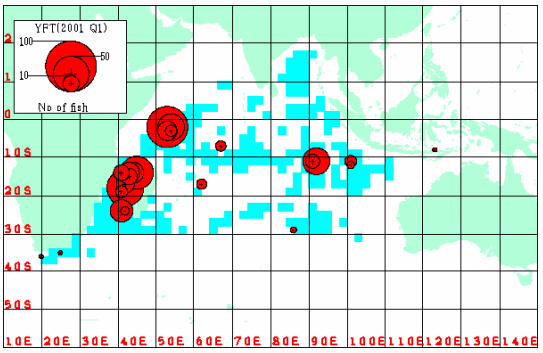
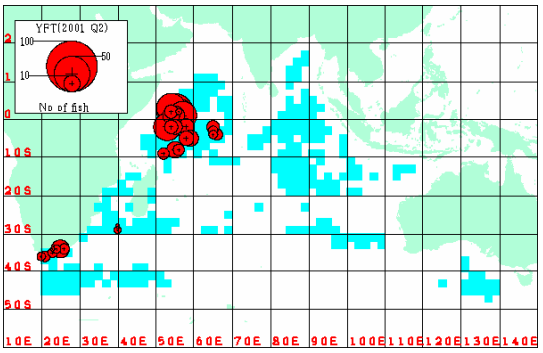
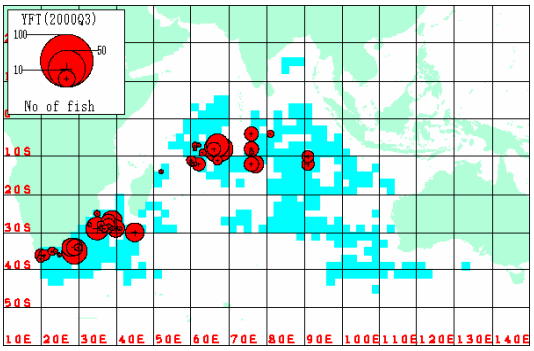
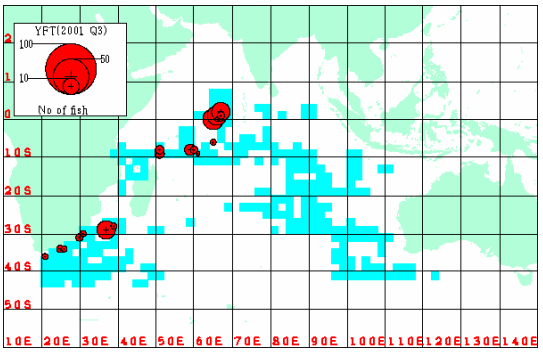
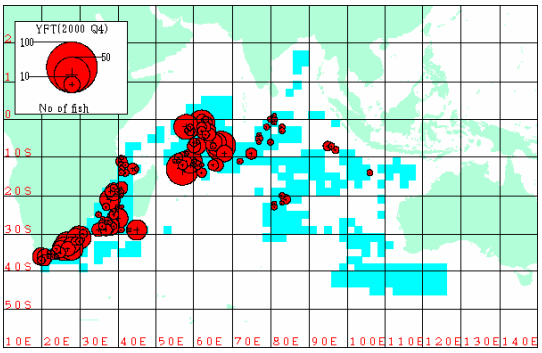
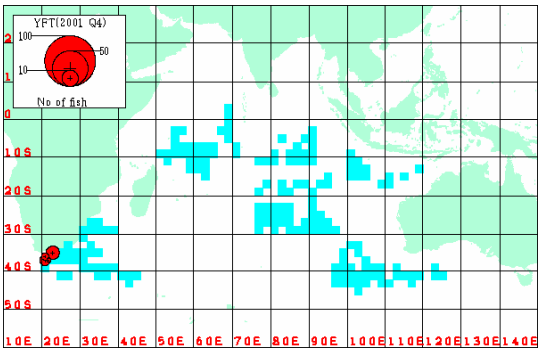
Map 3 Distribution of attacked BET (Red solid circle: attacked BET and Light blue zone: LL fishing grounds)

(NB) The light blue areas imply cases that there are no attacks and/or no reporting of the predation survey

	2000	2001
Q1		
Q2		
Q3		
Q4		

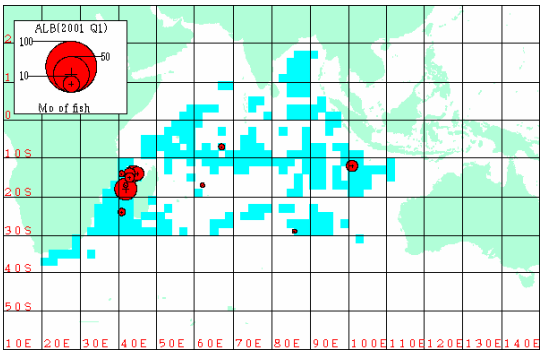
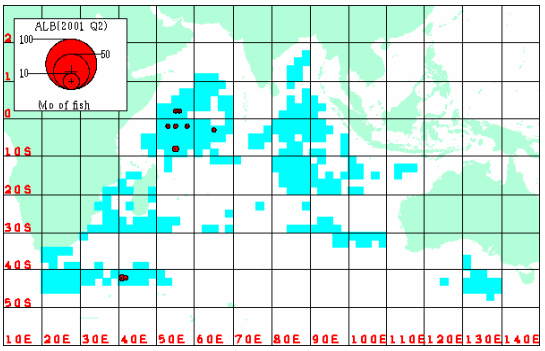
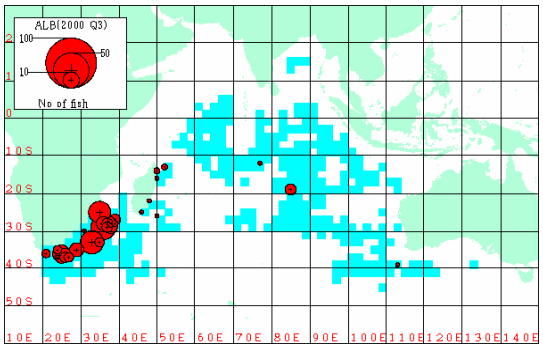
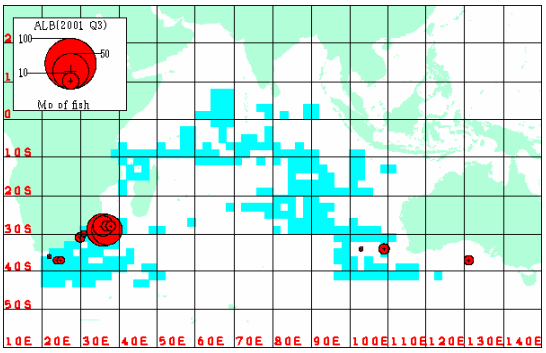
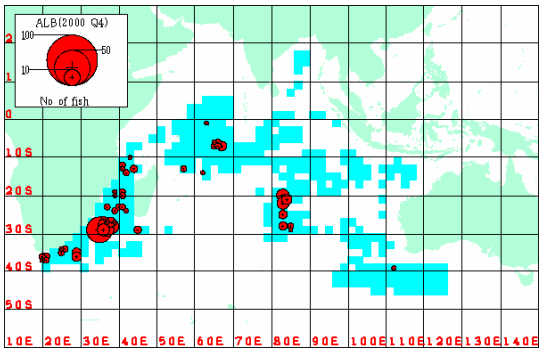
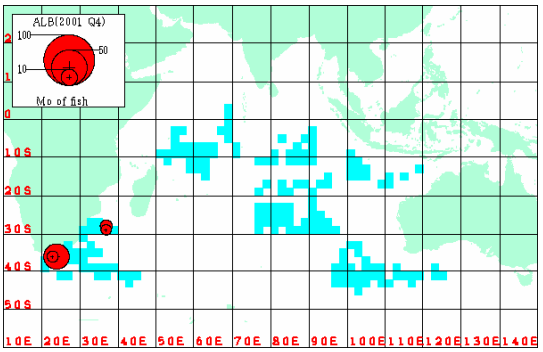
Map 4 Distribution of attacked YFT(Red solid circle: attacked YFT and Light blue zone: LL fishing grounds)

(NB) The light blue areas imply cases that there are no attacks and/or no reporting of the predation survey

	2000	2001
Q1		
Q2		
Q3		
Q4		

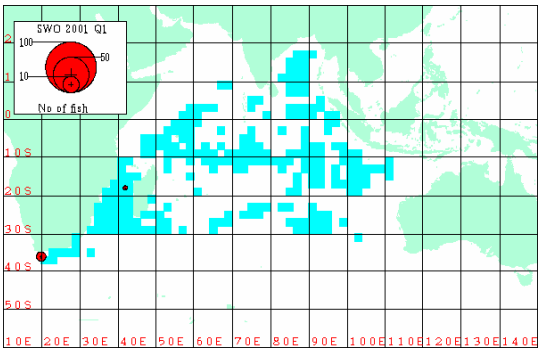
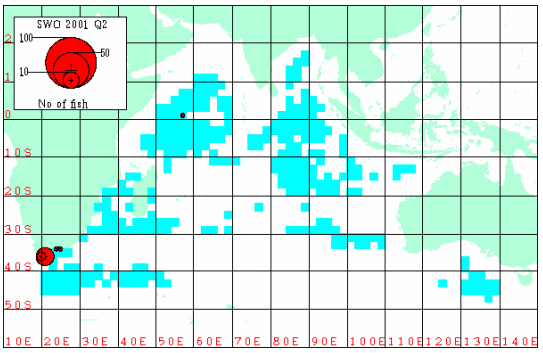
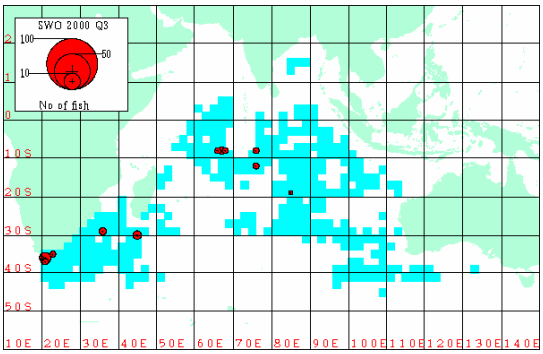
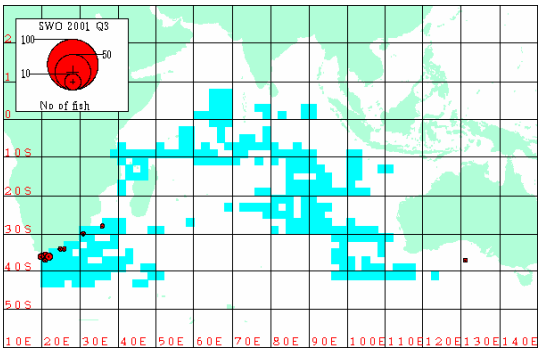
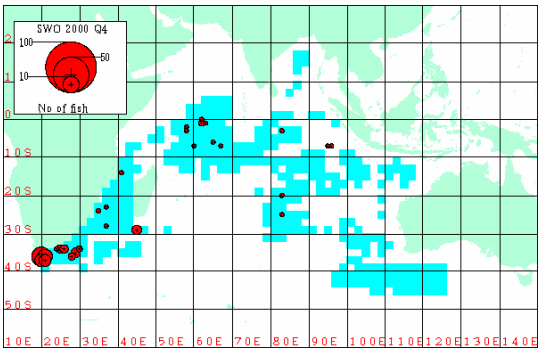
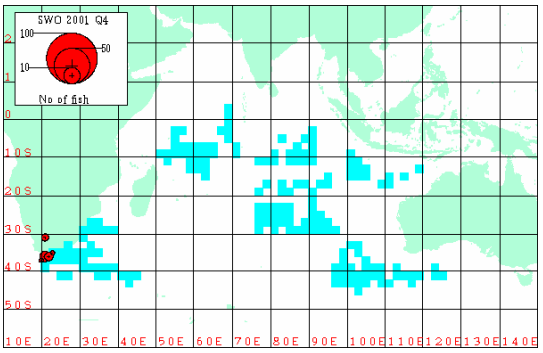
Map 5 Distribution of attacked ALB (Red solid circle: attacked ALB and Light blue zone: LL fishing grounds)

(NB) The light blue areas imply cases that there are no attacks and/or no reporting of the predation survey

	2000	2001
Q1		
Q2		
Q3		
Q4		

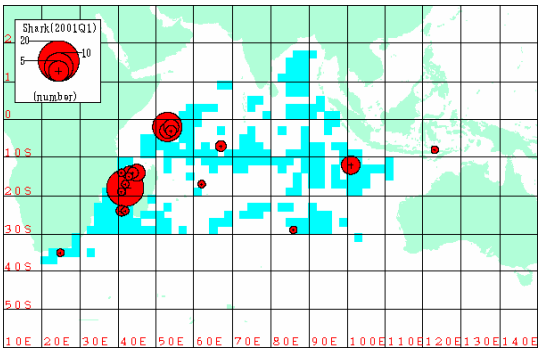
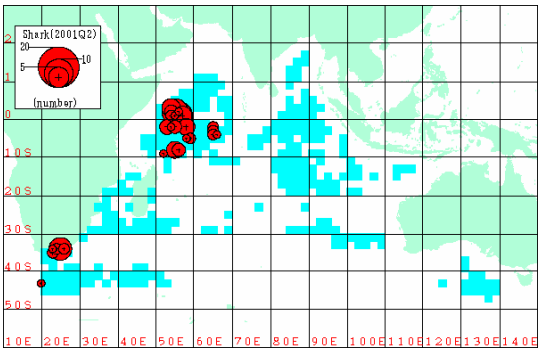
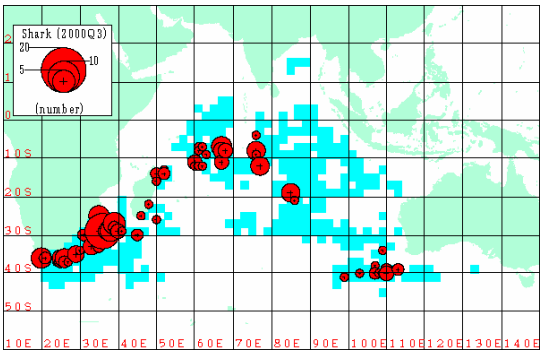
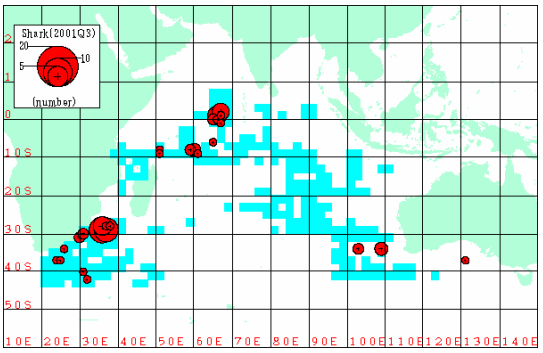
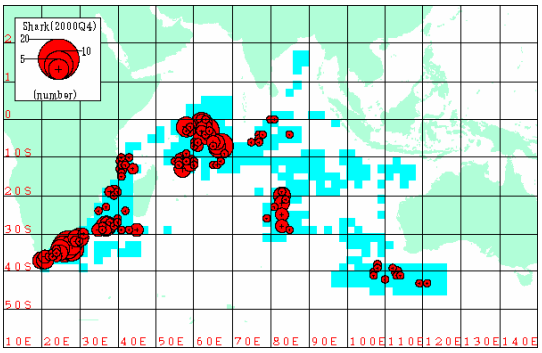
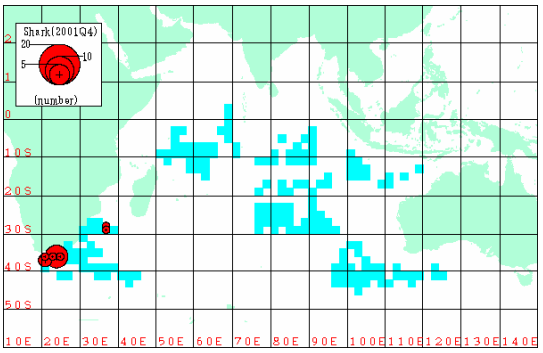
Map 6 Distribution of attacked SWO (Red solid circle: attacked SWO and Light blue zone: LL fishing grounds)

(NB) The light blue areas imply cases that there are no attacks and/or no reporting of the predation survey

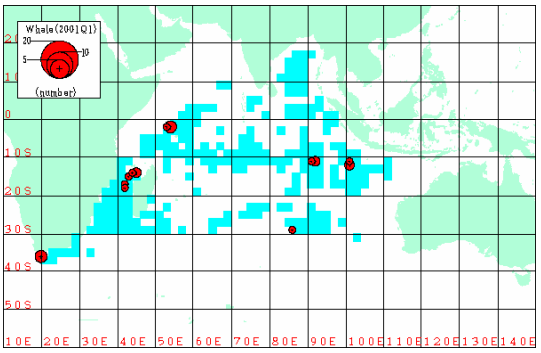
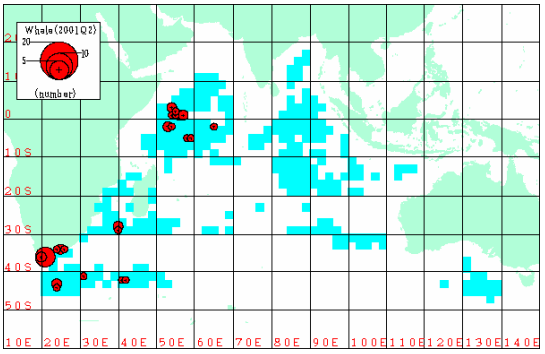
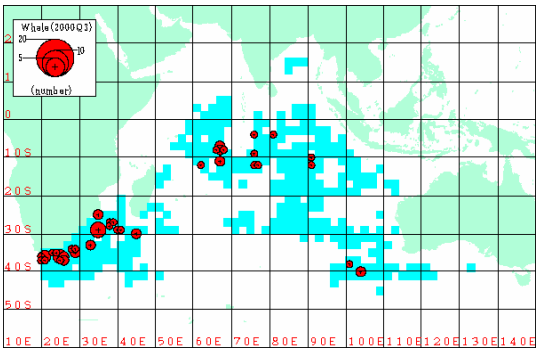
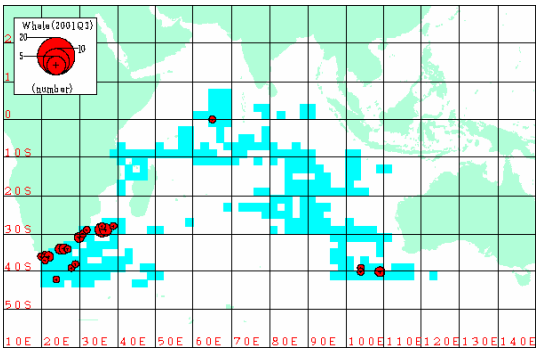
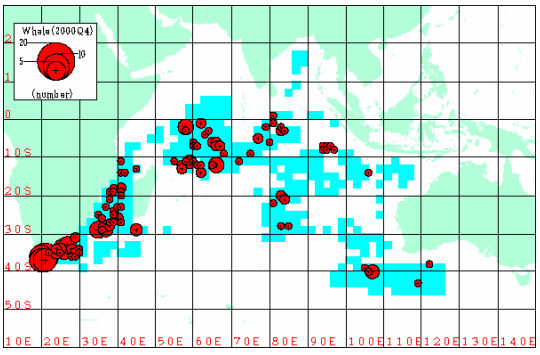
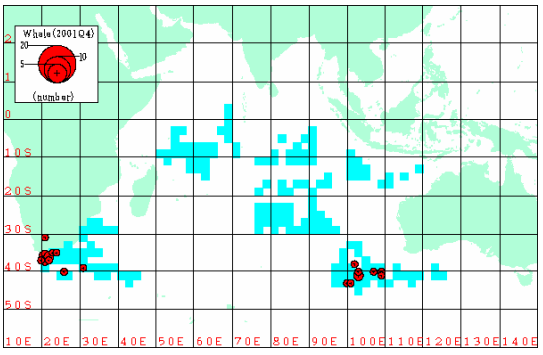
	2000	2001
Q1		
Q2		
Q3		
Q4		

Map 7 Distribution of the predator (Sharks) (Red solid circle : Sharks and Light blue zone: LL fishing grounds)

(NB) The light blue areas imply cases that there are no attacks and/or no reporting of the predation survey.

	2000	2001
Q1		
Q2		
Q3		
Q4		

Map 8 Distribution of the predator (False killer whale & Killer whale combined)) (Red solid circle : two spp. of whales and Light blue zone: LL fishing grounds) (NB) The light blue areas imply cases that there are no attacks and/or no reporting of the predation survey.

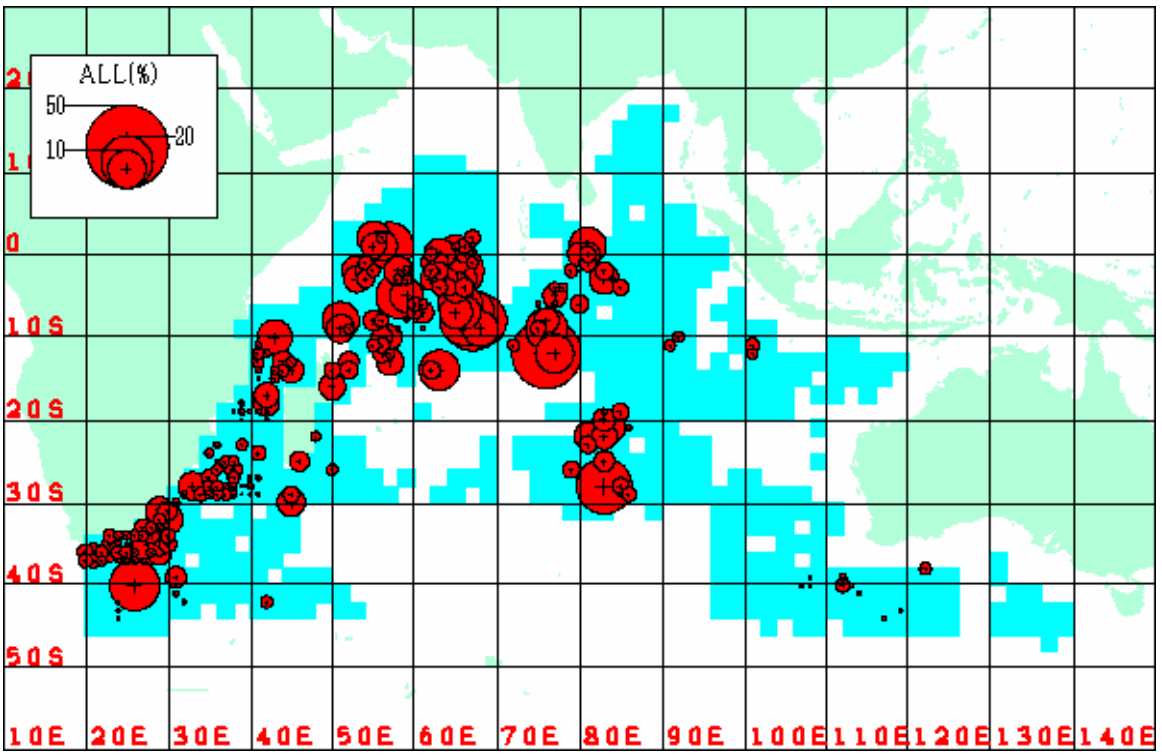
	2000	2001
Q1		
Q2		
Q3		
Q4		

Predation rates

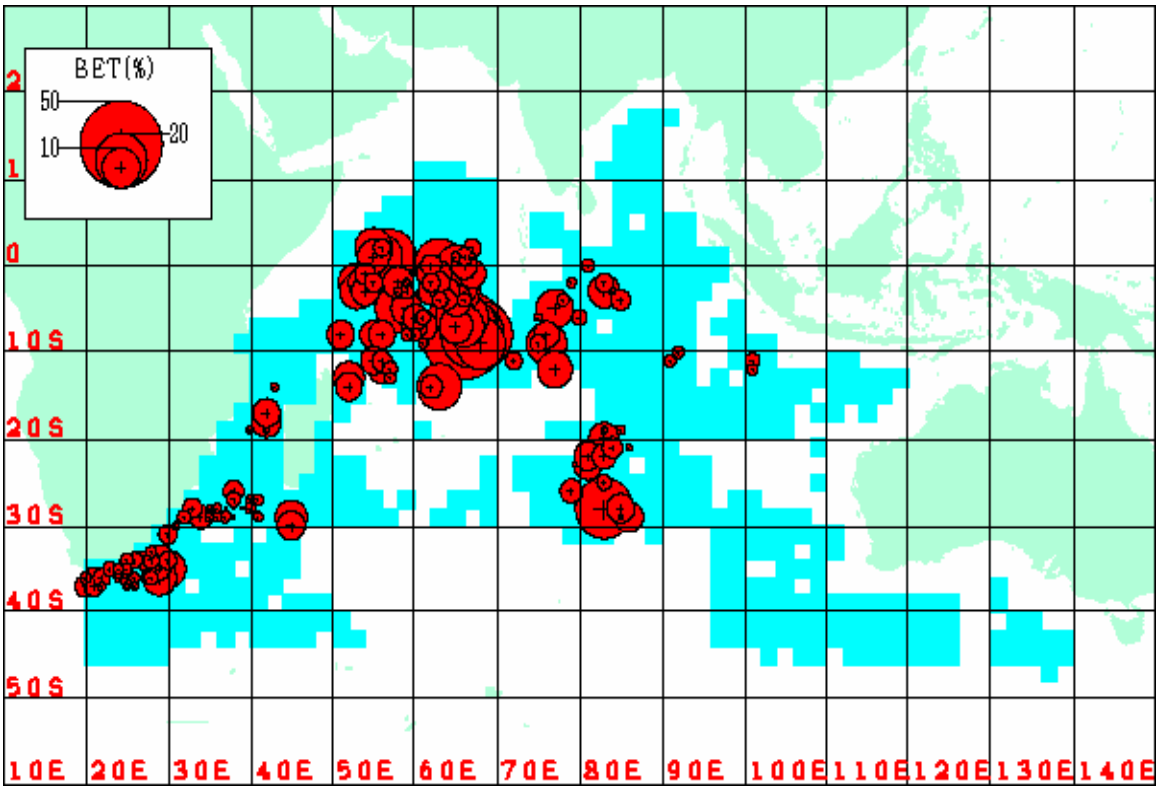
Table 2 summarizes the two types of predation rates by quarter (September, 2000 – November, 2001). The first type (type 1) is the predation rate ONLY when there are attacks, while the second type (type 2) is the OVERALL average including NO attack cases. These figures are considered to be seriously under-estimated as the reporting vessels do not always report the predation. Map 7 shows the distributions of predation rates (type 1) for all species combined, while Maps 8-11 present those for bigeye tuna, yellowfin tuna, albacore and swordfish.

Table 2 Summary of the predation rates by quarter based on the information from the reporting LL boats (September, 2000 – November, 2001)

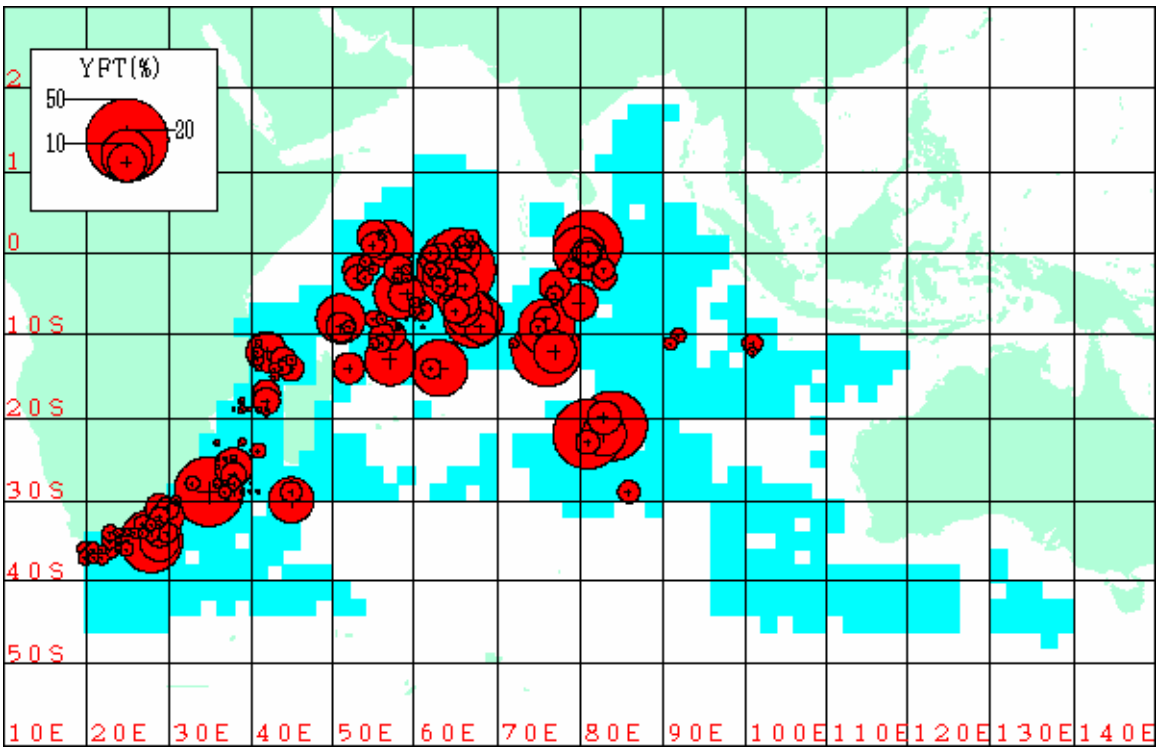
Year		2000	2000	2001	2001	2001	2001	Total
Quarter		Q3	Q4	Q1	Q2	Q3	Q4	
Predation rates (1) only when predation occur (2) including 0 predation (overall average) Legend : % (attacked fish/catch)	Albacore (1) (2)	7%(224/3030) (224/8457)	86%(195/2965) 2(195/9815)	9%(81/ 874) 2%(81/5021)	6%(11/ 183) 1%(11/1896)	13%(165/1307) 1%(165/14278)	15%(57/378) 2%(57/2446)	8%(733/8737) 2%(733/41913)
	Bigeye (1) (2)	17%(304/1771) 10%(304/5370)	18%(749/4119) 7% (749/11185)	21%(296/1408) 3%(296/9249)	23%(366/1586) 5%(366/6996)	15%(121/832) 1%(121/10632)	5%(10/220) 0%(10/2679)	19%(1864/9936) 4%(1864/46111)
	Yellowfin (1) (2)	24%(437/1845) 10%(437/4434)	15%(994/6562) 4%(994/22162)	12%(631/5138) 2%(631/28982)	14%(481/3367) 7%(481/7365)	5%(126/2426) 1%(126/14677)	5%(20/382) 1%(20/2922)	13%(2689/19720) 3%(2689/80542)
	Swordfish (1) (2)	18%(31/168) 9%(31/347)	21%(91/432) 7%(91/ 1216)	4%(6/142) 1%(6/952)	11%(25/237) 7%(25/375)	11%(14/123) 2%(14 /686)	36%(15/42) 5%(15/ 279)	16%(182/1144) 5%(182/3855)
	Striped M. (1) (2)	0%(0/2) 0%(0/ 3)	2%(2/106) 1%(2 / 226)	0%(0/24) 0%(0/ 142)	0%(0/20) 0%(0/ 73)	0%(0/ 3) 0%(0/ 21)	0%(0/ 4) 0%(0/ 33)	1%(2/159) 0%(2/498)
	Blue M (1) (2)	31%(8/26) 24%(8/33)	21%(29/138) 11%(29/260)	0%(0/ 27) 0%(0/ 370)	3%(3/ 87) 2%(3/178)	0%(0 /31) 0%(0/57)	0%(0/0) 0%(0/14)	13%(40/309) 4%(40/912)
	Black M. (1) (2)	25%(1/4) 14%(1/7)	0%(0/ 29) 0%(0/68)	14%(1/7) 2%(1/58)	0%(0/10) 0%(0/27)	- -	0%(0/3) 0%(0/19)	14%(2/53) 1%(2/197)
	Sailfish (1) (2)	100%(3/3) 75%(3/4)	4%(2/47) 0%(2/409)	100%(1/1) 0%(1/738)	100%(2/2) 2%(2/89)	- -	- -	15%(8/53) 1%(8/1246)
	Total (1) (2)	13%(929/7153) 4%(929/ 21128)	13%(1946/14822) 4%(1946/52699)	13%(1016/7653) 2%(1016/45911)	16%(921/5752) 4%(921/ 24824)	10%(480/4938) 1%(480/46627)	8%(156/1087) 2%(156/ 9358)	13%(5448/41405) 3%(5448/200547)



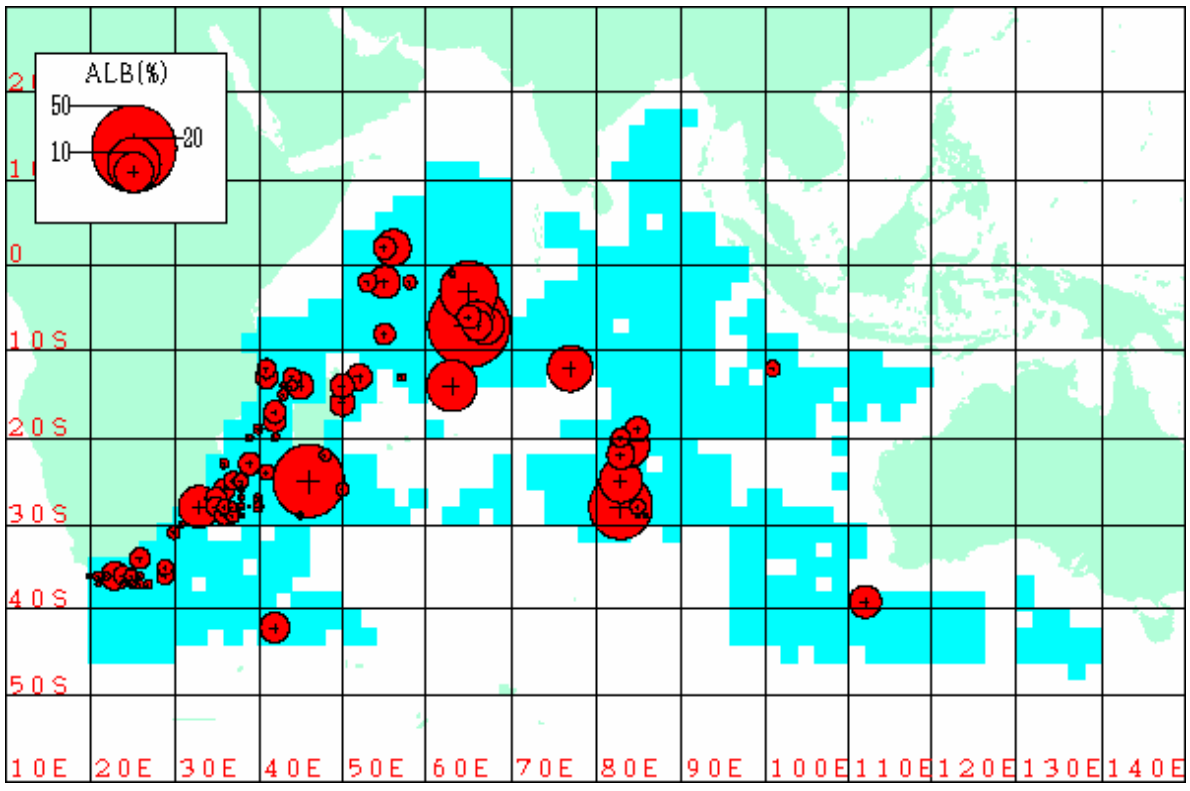
Map 9 Distribution of overall average predation rates (all species combined) (Sep., 2000 - Nov.,2001)



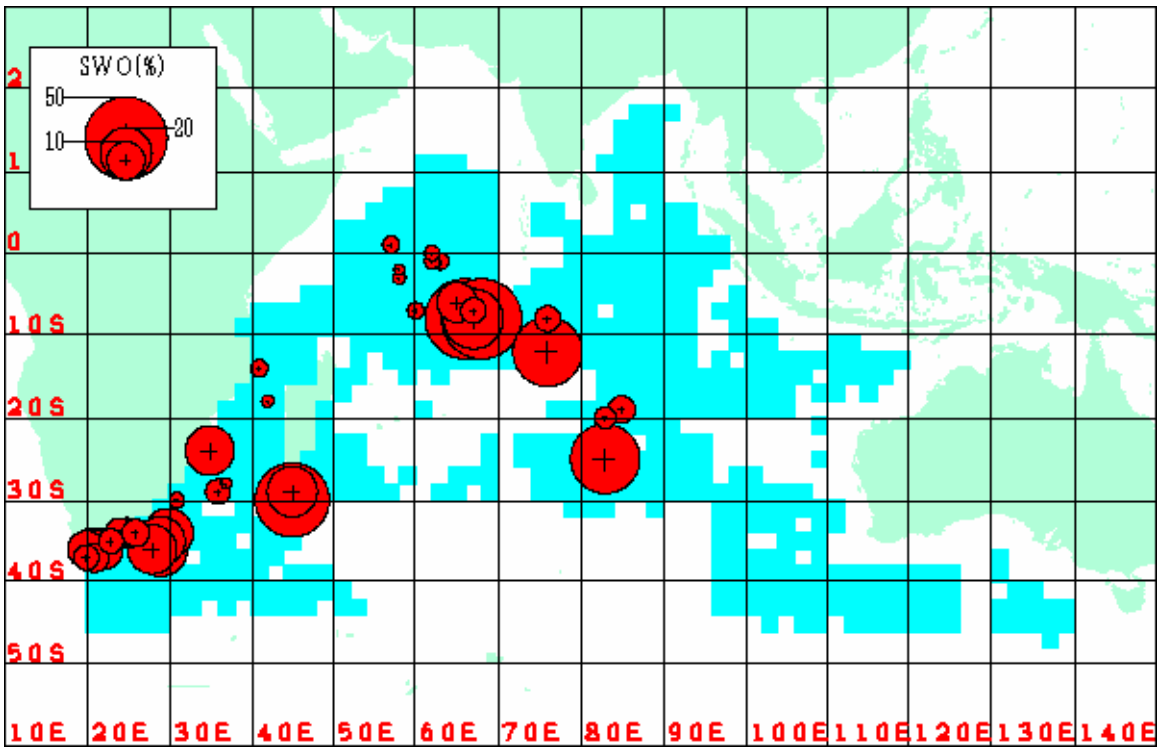
Map 10 Distribution of overall average predation rates (%) (BET) (Sep., 2000 - Nov.,2001)



Map 11 Distribution of overall average predation rates (YFT) (Sep., 2000 - Nov.,2001)



Map 12 Distribution of overall average predation rates (ALB) (Sep., 2000 - Nov.,2001)



Map 13 Distribution of overall average predation rates (SWO) (Sep., 2000 - Nov.,2001)

DISCUSSION AND SUMMARY

Although we collected the predation survey data for 14 months, the reporting boats have been decreasing from 27% (beginning) to 11-13% (last two quarters 2001). To solve this problem, we plan to send the letter to the LL boats for further cooperation with the survey results.

The predation are reported mainly from the SW Indian Ocean and the tropical central Indian Ocean. There are less reports from the SE Indian ocean. This may reflect the locations of the actual predation.

There are seasonality in the distribution of the predators(sharks and toothed whales). Accordingly, attacked tuna and billfish have similar seasonality in their distribution patterns. .

YFT, BET and ALB are three major attacked species by predations, which account 46%, 31% and 12% respectively. SWO and SBT are 3% respectively.

As we obtained the partial log book information, we could compute the predation rates for this time. However, it is likely that the computed predation rates are seriously under-estimated. This is because the reporting LL boats do not always report the predation even when it occurs.

Keeping this problem in mind, high predation rates are seen in the central tropical waters and the SE Indian Ocean.

Although the overall average predation rates are low, if we compute them in high predation areas, we will get like 20-30% predation rates as were reported in the waters around Seychelles.

As the Japanese LL survey cover the low to high predation waters, the overall average are rather lower in addition to the fact that not all reporting LL boats send the predation information which make the average predation rates much lower.

Hence, for the future analyses, we need some stratification to examine more realistic predation rates.

From predation Maps, we observe that there are extremely high predation areas.

In the future, it is suggested to make analyses with other surveys (eg Seychelles, India and China).

Sharks and toothed whales (false killer whale and killer whale combined) are two major predators, which account 64% and 34% respectively.

LL fishers can identify two types of predators between sharks and tooth whales based on the bite marks without any doubt. However, they have difficulty to identify two whale species between False killer whale and Killer whales, even looking at the bite marks as they are similar patterns. It is suggested to develop to estimate species compositions between these two whales.

It is suggested to start developing the mitigation methods.

In average, one predator species attacked in one operation. In a few cases, two predators species attacked in one longline operation.

There are a few cases that shark attacked the longline caught sharks.

? ? ? ? ? ? ? ?

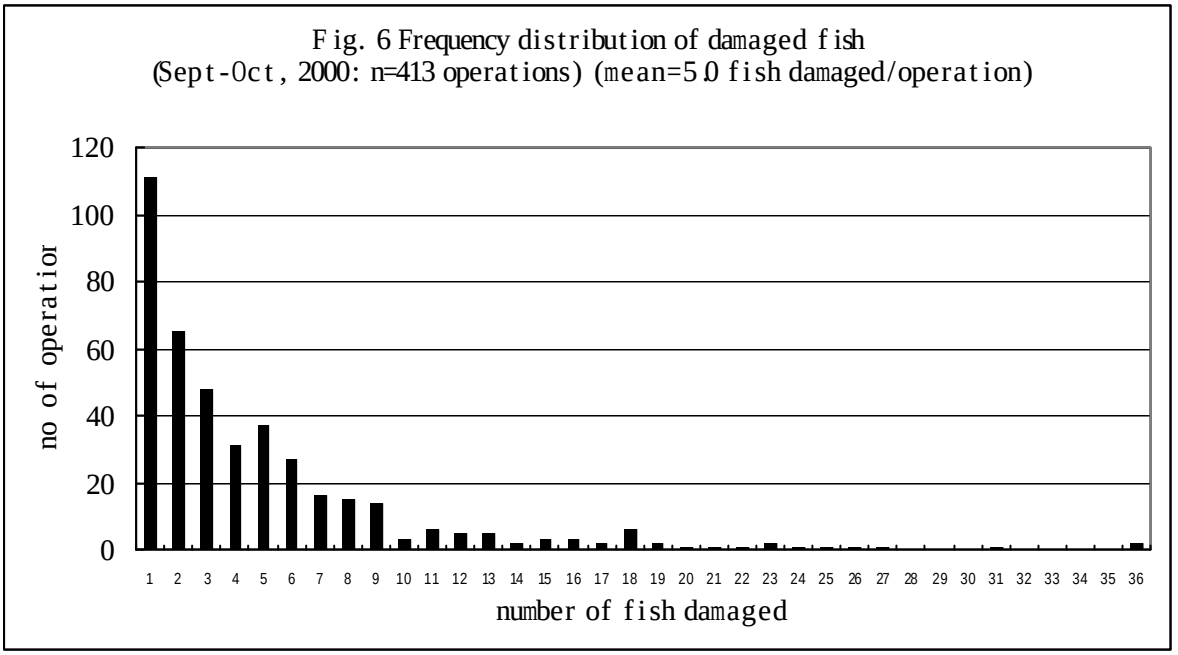


Fig. 6 Frequency distribution of damaged fish
(Sept-Oct, 2000: n=413 operations) (mean=5.0 fish damaged/operation)
no of operation
120
100
80
60
40
20
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
number of fish damaged