

Japan National Report to the Scientific Committee of the Indian Ocean Tuna Commission, 2012

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INFORMATION ON FISHERIES, RESEARCH AND STATISTICS

<p>In accordance with IOTC Resolution 10/02, final scientific data for the previous year was provided to the Secretariat by 30 June of the current year, for all fleets other than longline [e.g. for a National report submitted to the Secretariat in 2012 final data for the 2011 calendar year must be provided to the Secretariat by 30 June 2012)</p>	<p>YES 29/Jun/2012</p>
<p>In accordance with IOTC Resolution 10/02, provisional longline data for the previous year was provided to the Secretariat by 30 June of the current year [e.g. for a National report submitted to the Secretariat in 2012, preliminary data for the 2011 calendar year was provided to the Secretariat by 30 June 2012). REMINDER: Final longline data for the previous year is due to the Secretariat by 30 Dec of the current year [e.g. for a National report submitted to the Secretariat in 2012, final data for the 2011 calendar year must be provided to the Secretariat by 30 December 2012).</p>	<p>YES 29/Jun/2012</p>
<p>If no, please indicate the reason(s) and intended actions:</p>	

Executive Summary

This Japanese national report describes following 8 issues in recent five years (2007-2011), i.e., (1) tuna fisheries (longline fishery and purse seine fishery) (2) fleet information, (3) catch and effort by species and gear, (4) ecosystem and bycatch, (5) national data collection and processing systems including “logbook data collection and verification”, “vessel monitoring system”, “scientific observer programme”, “port sampling programme” and “unloading/transshipment”, (6) national research programs and (7) Implementation of Scientific Committee recommendations & resolutions of the IOTC relevant to the Scientific Committee and (8) literature cited and working documents.

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1. BACKGROUND/GENERAL FISHERY INFORMATION

Longline and purse seine fisheries are two types of Japanese tuna fisheries currently operating in the Indian Ocean. Longline fishery started its operation in 1952 when the limitation of operational area imposed by the GHQ*¹, was removed. On the other hand, commercial purse seine fleet commenced fishing in the Indian Ocean in 1991 after several years of experimental fishing.

The total fishing effort (the number of hooks) of Japanese longliners in the Indian Ocean had been keeping at similar level with fluctuation since 1971, i.e., around 100 million hooks, up until 2007. Thereafter, it has been decreasing down to about 26 million hooks in 2011 due to piracy activities. Percentage of effort used in this Ocean in the total effort in all oceans fluctuated around 20% until 2003 after when it increased to 35% in 2006 and 2007. Thereafter it has drastically decreased to 27%, 16% and 13% in 2009, 2010 and 2011 respectively, mainly because of increasing activity of piracy off Somalia.

As for the purse seine fishery, fishing took place mainly in the tropical western Indian Ocean until 1993 after when fishing effort shifted almost completely to the eastern Indian Ocean mainly because of economic problem derived from rise of Japanese Yen during that time.

2. FLEET STRUCTURE

All Japanese longline vessels operating in the Indian Ocean have been the distant water category (120-500GRT) with some exceptional offshore vessels (10-120GRT). Historical change in the number of longline vessels from 1987 to 2011 is shown in Table 1. In the last fifteen years, the number of vessels operated in this Ocean was around 170-250 per year until 2008. Although the number of operating vessels was relatively large in number (224-251) during 1995-1999, after that it decreased to less than 200 except for 228 in 2002. Although the number of vessels in 2007 increased to 250, it decreased rapidly year by year due to effect of piracy activities. The number of longline vessels in 2011 was 68.

Japanese purse seine vessels operating in the Indian Ocean are 350-700 GRT class (700-1000 carrying capacity). Historical change in the number of purse seine vessels from 1987 to 2011 is shown in Table 1. Although more than 10 Japanese purse seiners operated during 1991-1994, it decreased year by year and the last commercial purse seiner retreated from the Indian Ocean in 2001 leaving only one vessel “Nippon-Marū”, the research vessel of Fisheries Research Agency (FRA). A few commercial vessels have been operating since 2006. The number of purse seine vessels operated in 2011 was 1.

Table 1. Number of vessels operating in the IOTC area of competence, by gear type and size

Fleet/Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Longliner	272	235	245	216	184	181	206	206	224	251	243	242	223	192
Purse seiner	1	1	3	4	11	12	11	11	8	5	3	4	3	2

Fleet/Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Longliner	199	228	172	189	184	188	250	173	128	84	68
Purse seiner	2	1	1	1	1	3	3	3	2	1	1

* GHQ (General Headquarters) of the occupying forces of the Allies after the World War II

3. CATCH AND EFFORT (BY SPECIES AND GEAR)

3.1 Longline fishery

The latest available longline data is that of 2011.

Fishing effort

The longline fishery commenced in 1952 in the eastern equatorial waters in the Indian Ocean. In the late 1960s, the effort covered entire fishing ground of the longline in the Indian Ocean. The annual amount of the effort has increased until the late 1960s and fluctuated after that. However, fishing effort has been dramatically decreasing since 2008 (Table 2) because of the effect of piracy activities off Somalia. Fishing effort in 2011 (26 thousand hooks) was only about 22% of that in 2007.

Table 2. Annual catch and effort and primary species in the IOTC area of competence (longline fishery, 2007-2011).

(catch in mt and sets and hooks in thousand)

Year	Sets	Hooks	SBF	ALB	BET	YFT	SWO	MLS	BUM	BLM	SFA	SPF	SKJ
2007	37	117,675	2,751	5,263	18,168	18,592	2,198	79	770	204	545	108	13
2008	28	89,373	1,620	4,814	13,739	10,425	1,574	161	582	141	457	136	36
2009	20	64,951	1,911	3,568	8,993	4,878	1,027	57	416	107	161	92	44
2010	11	37,037	1,481	3,846	4,244	3,473	635	205	245	63	39	105	17
2011	8	26,314	1,384	2,416	3,281	4,131	528	288	195	45	26	158	27

Yearly distributions of longline effort for 2011 and average of 2007-2011 are shown in Fig. 2. Although the geographical distributions of the effort are basically similar for 2007-2011 average, the effort in African offshore area from off Cape Town to Tanzania and in the eastern part west off Australia and Indonesia seems relatively large. The effort in the northwestern area has dramatically decreased since 2008 and almost no effort in 2011 because of the expanded activity of piracy off Somalia.

Catch

Historical catch in weight by species and catch statistics for 2007-2011 by Japanese longliners in the Indian Ocean are shown in Fig. 1 and Table 2, respectively, and geographical distributions of catch in 2011 and average of 2007-2011 for major tuna and billfish species are shown in Fig. 3. Catch of albacore, yellowfin and southern bluefin tunas were very high during 1950s and 1960s, and then sharply decreased. After mid 1990s bigeye and yellowfin tunas have been main components of the catch, but catch of albacore has been similar level since 2009.

Total catch (the catch of southern bluefin tuna, albacore, bigeye, yellowfin, swordfish, striped marlin, blue marlin, black marlin, sailfish, shortbill spearfish, and skipjack) in 2010 and 2011 was 14,397MT and 12,509MT, respectively. It should be noted that the catch of yellowfin and bigeye drastically decreased during 2007-2010, although the catch of albacore was roughly at the same level during this period. Furthermore, bigeye and yellowfin catch in 2011 were lowest after 1980s, and this decrease was mainly derived from decrease in effort.

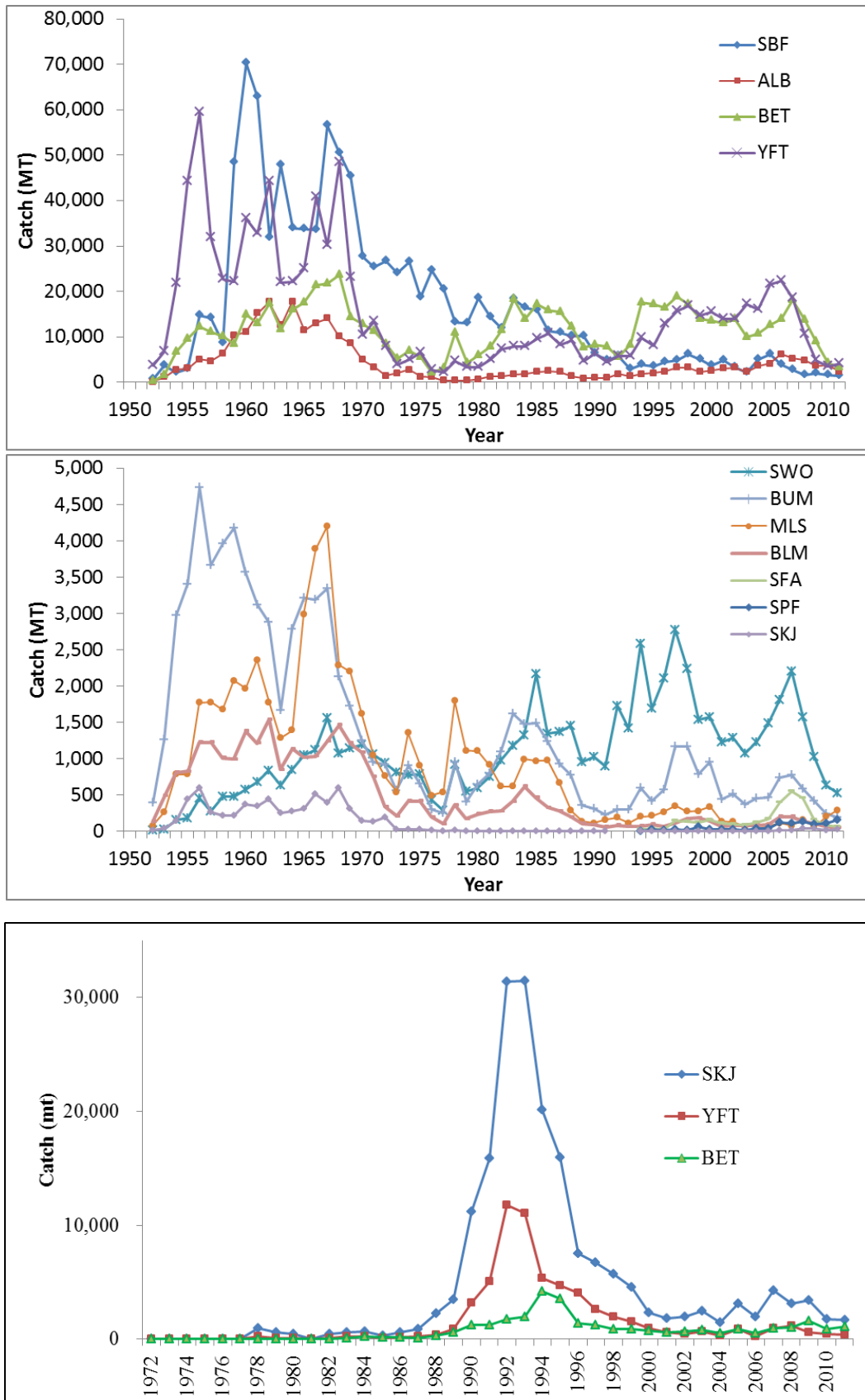


Fig. 1. Historical change of effort exerted into each of West and East Indian Ocean. Upper: longline (tuna species), middle: longline (skipjack and billfish species), lower: purse seine.

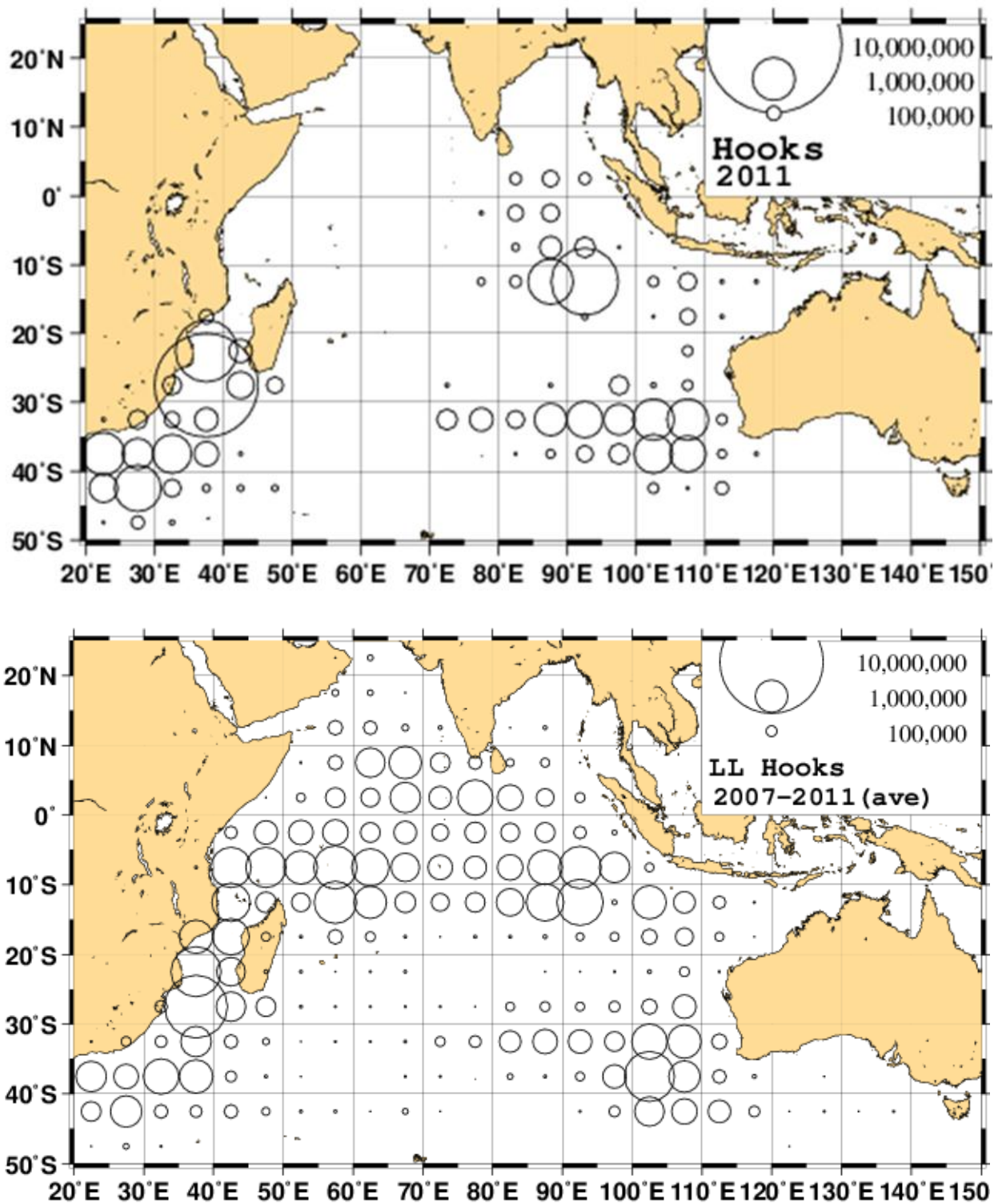


Fig 2. Yearly distributions of longline effort for 2011 (above) and average of 2007-2011 (below)

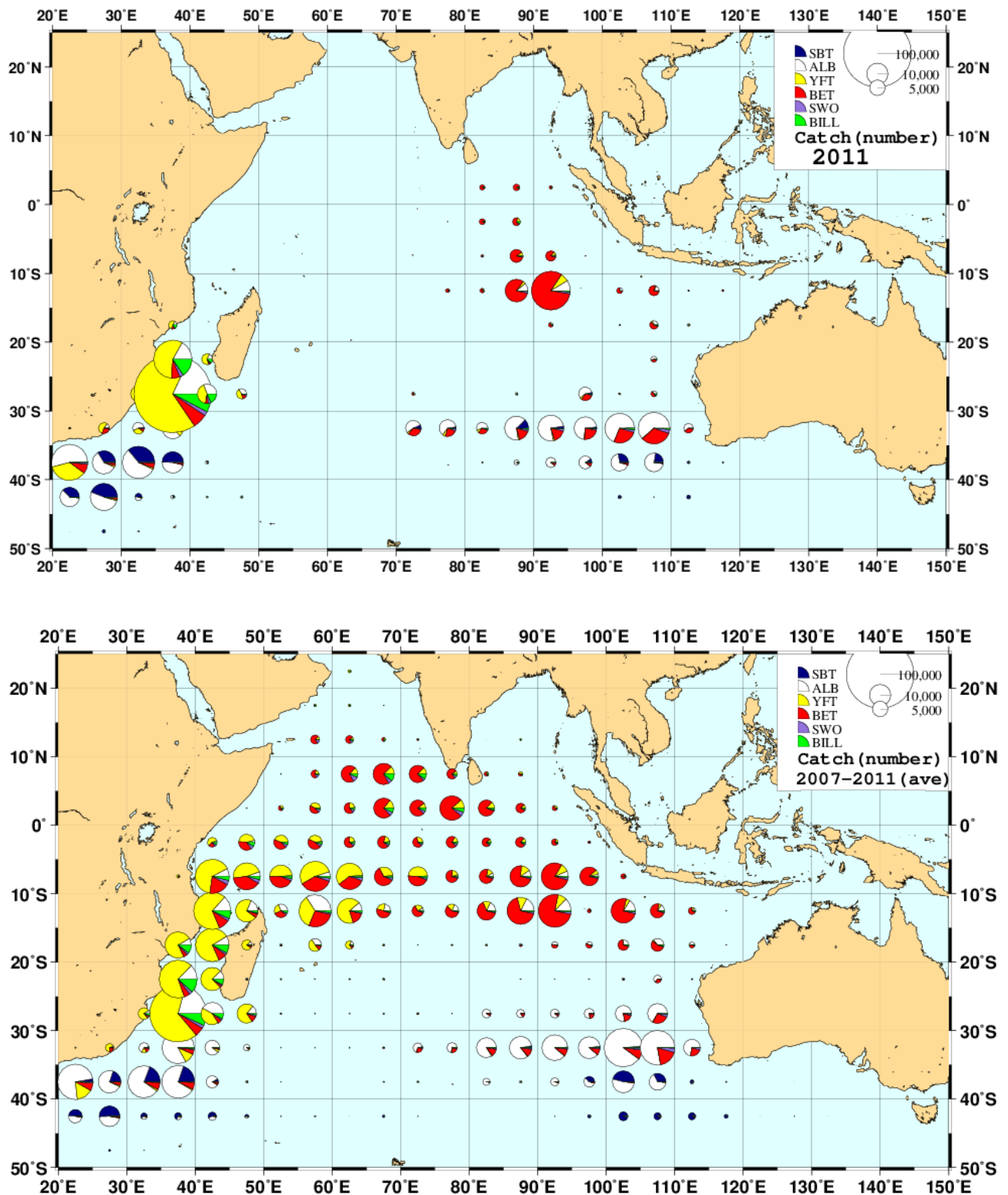


Fig. 3 Geographical distributions of catch (in number) of major species in 2011 (upper) and in average of 2007-2011(lower). southern bluefin tuna (SBT), albacore (ALB), bigeye tuna (BET), yellowfin tuna (YFT), swordfish (SWO) and billfishes (BILL).

Seeing geographical distribution of the catch, yellowfin and bigeye tunas are mainly caught in the western and eastern part, respectively. Albacore is mainly caught in the temperate area around South Africa and west off Australia, where this species is one of main components of the catch. In 2011 there was no effort in the

northwestern area and so yellowfin was mainly caught in the area around Madagascar.

3.2 Purse seine fishery

The latest available data for Japanese purse seine fishery is that for 2011.

Fishing Effort

Total fishing effort (number of set) was 92 in 2010 and 105 in 2011 (Table 3). Geographical distributions of effort for 2011 and the average of 2007-2011 are shown in Fig. 4. Operations were conducted almost only in the eastern part in recent years.

Table 3. Annual catch and effort and primary species in the IOTC area of competence (2007-2011) (purse seine fisheries).

Year	Number of set	Catch (mt)			
		SKJ	YFT	BET	others
2007	178	4297	958	987	0
2008	239	3133	1175	1009	0
2009	185	3434	557	1571	0
2010	92	1731	481	868	0
2011	105	1675	352	1130	0

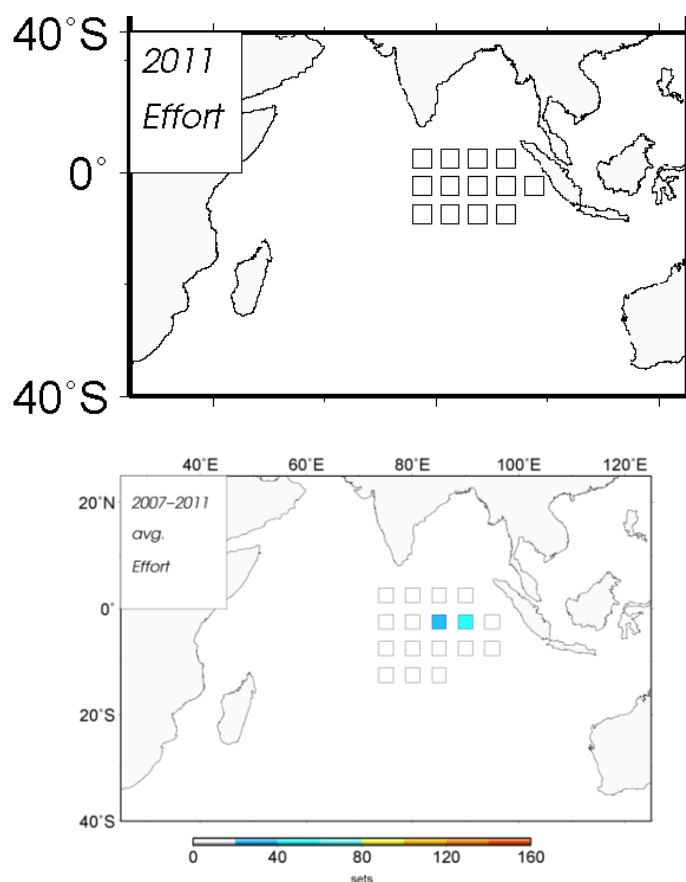


Fig. 4. Distributions of fishing effort in the Indian Ocean in 2011(above) and average of 2007-2011 (below) (Purse seine fisheries)

Catch

Total catch was low (around 1,000 MT or less) until mid-1980s, then increased rapidly to about 44 thousand MT in 1992 and 1993 after when it decreased to 10 thousand MT in 1997 and 7 thousand MT in 1999 (Fig. 1). Thereafter it has fluctuated between 2.3 and 6.2 thousand MT and total catch in 2011 was 3.2 thousand MT. Catch in weight of skipjack, yellowfin and bigeye in 2011 (2010) was 1,675 (1,731) MT, 352 (481) MT and 1,130 (868) MT, respectively. Geographical distributions of catch in 2010-2011 and average of 2007-2011 for major tuna species are shown in Fig. 5. Main component of the catch was skipjack tuna in all the area operating.

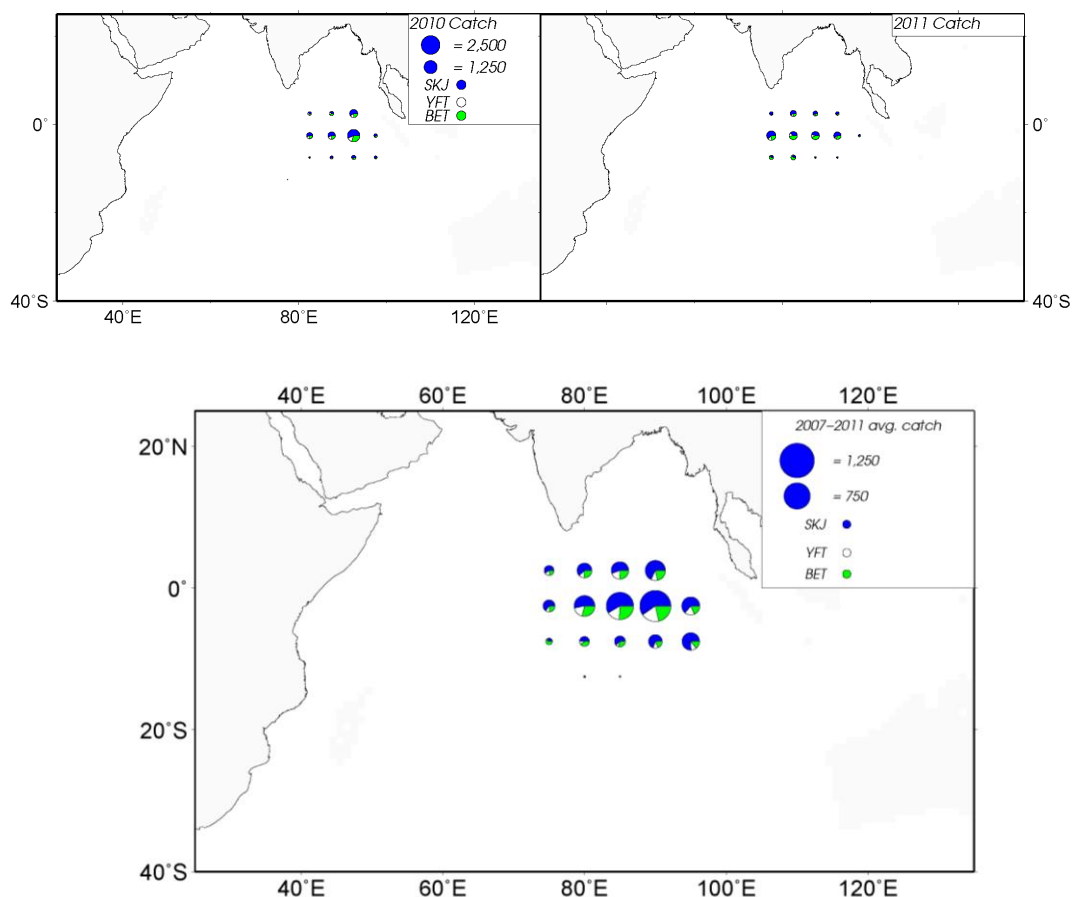


Fig. 5 Geographical distributions of catch of major species in 2010-2011(upper) and the average in 2007-2011(lower)

4. RECREATIONAL FISHERY

None

5. ECOSYSTEM AND BYCATCH ISSUES

In accordance with FAO International Action Plans on sharks and seabirds, Japan established the National Action Plans on sharks and seabirds in 2001 then revised in 2009 and 2012. In addition, Japan has been taking actions in accordance with the FAO Guidelines on sea turtle by-catch. Japan has been taking actions in accordance with IOTC conservation and management measures on by-catch of sharks, sea turtles and seabirds. The catch of major

three shark species by Japanese longliners (2005-2011) is shown in Table 4.

The catch data were collected through the logbook and compiled in the National Research Institute of Far Seas Fisheries (NRIFSF). In August 2008, the Japanese government obliged Japanese distant water longliners to land all the parts of sharks (although heading, gutting and skinning are allowed) and the quantities given in Table 4 represents the whole weight including the weight of fins.

Table 4 Reported annual catch (tons and numbers) of three major sharks species caught by Japanese tuna longliners in the Indian Ocean (2006-2011).

year	blue shark		Porbeagle		Shortfin mako shark	
	tons	number	tons	number	tons	number
2005	329	18681	14	755	207	5398
2006	228	13633	16	896	162	4083
2007	452	25993	8	607	122	3190
2008	1280	67992	35	2515	156	4399
2009	1518	73053	17	1087	116	3096
2010	875	48284	9	853	132	3080
2011	820	44441	12	1139	125	3685

The Japanese scientific observers on the longliners have been collecting bycatch information since 2006 in the Indian Ocean as a part of the southern bluefin tuna observer activities. Observers take photo of bycatch species according to the procedures given in the observer manual made by the NRIFSF scientists. Bycatch experts in the NRIFSF identified species using these photos. Table 5 shows the summary of bycatch information collected by 6 observers (2010-2011) after IOTC ROP started.

Table 5 Summary of bycatch information collected by 6 observers (vessels) after the IOTC ROP started (2010-2011)

SHARKS	number	RAYs	number
Un-identified sharks	3	Sting ray	549
Velvet dogfish	126	Un-identified Sting ray	1
Crocodile shark	211		
Un-identified thresher shark	12	SEA BIRDS	
Un-identified mackerel shark	4	Un-identified albatrosses	1
Shortfin mako shark	32	Wandering albatross	1
Longfin mako shark	4	Black-browed albatross	2
Porbeagle	54	White-capped albatross	1
Silky shark	3	Yellow nosed albatross	2
Oceanic whitetip shark	10	Un-identified petrels	1
Tiger shark	2	Flesh-footed shearwater	2
Blue shark	961	Un-identified gannets & boobys	1
Scalloped hammerhead shark	1		
Smooth hammerhead shark	1	SEA TURTLES	
Bigeye thresher shark	162	Loggerhead turtles	1
		Olive ridley turtle	12
		Leatherback turtle	1

6. NATIONAL DATA COLLECTION AND PROCESSING SYSTEMS

6.1 Logbook data collection and verification

Longline

In the logbook of longline, set by set data on catch number and weight in each species, and other information data such as fishing date and location, fishing effort (the number of basket and hooks used), water temperature are included. The number of hooks per basket is important information as it suggests the depth of the gear and target species. As tuna and tuna-like fishes, six tunas (bluefin, southern bluefin, albacore, bigeye, yellowfin and skipjack), and six billfishes (swordfish, striped marlin, blue marlin, black marlin, sailfish and shortbill spearfish) are separately recorded in the logbook. Additionally, information on the cruise (date and port of departure and arrival of the cruise), vessel (name, size, license number and call sign), number of crew and the configurations of the fishing gear (material of main and branch lines) are asked to fill on the top part of the sheet by each cruise. Submitted logbooks are processed into electronic data files. Various error checks, such as date, location, range of weight of the fish, CPUE, are conducted before these data are finalized. Vessel characteristics (call sign, name, license number, etc) are verified with a register.

Purse seine

The logbooks of purse seiners are required to be submitted every month to the Japanese government. The reported catch by species could be verified by comparing with the landing data, which were obtained from market receipts of three major unloading ports (Yaizu, Makurazaki, and Yamagawa).

6.2 Vessel Monitoring System

VMS installation on all distant water and offshore longline and distant water purse seine vessels is obligated since 1st August in 2007.

6.3 Scientific Observer programme

In July, 2010 Japan started the IOTC regional observer program and to now, 15 observers (10 Japanese and 5 Indonesians) for longliners have been dispatched, which covered more than 5% of the total operations. The first observer data (for 6 vessels) submitted to the IOTC and the second data (8 vessels) will be submitted in January, 2013.

6.4 Port sampling programme

Because catch in the Indian Ocean is mainly unloaded abroad, the port sampling in Japanese ports was held only once in 2008 recently.

6.5 Unloading/Transshipment

Unloading

The owners of fishing vessels are required to submit relevant documents to the Japanese Government 10 days before the planned landing date. In case of unloading abroad the owner of fishing vessels are required to obtain approval from the Government of Japan in advance. To apply for unloading abroad, fishers have to submit relevant documents to the Government of Japan 10 days before the planned date.

Transshipment

The owners of fishing vessels are required to obtain approval from the Government of Japan for at port transshipments in advance. To apply for at port transshipment, fishers have to submit relevant documents to the Government of Japan 10 days before the planned transshipment date. Fishers shall complete the IOTC transshipment declaration and transmit it to the Government of Japan not later than 15 days after the transshipment. Japan controls at sea transshipments by its vessels in accordance with the Resolution 08/02 on establishing a programme for transshipment by large-scale fishing vessels.

7. NATIONAL RESEARCH PROGRAMS

7.1 Research cruises by Nippon maru (JAMARC, Fisheries Research Agency) (2010-2012)

In recent 5 years, RV Nippon-maru has been conducting the experimental purse seine fishing in the eastern Indian Ocean. During the experimental fishing, RV Nippon-maru has been developing methods to mitigate by-catch of juvenile yellowfin and bigeye tuna using large mesh section in the purse seine nets and light stimuli.

RV Nippon-maru has been also attempting to estimate species composition of fish schools around FADs using wide the band echo sounder before fishing. In this way, fish schools with large species compositions of juvenile yellowfin and bigeye tuna can be recognized in advance, so that juveniles will be protected by halting fishing operations.

7.2 Tag and release research for tunas and skipjack in the eastern Indian Ocean.

JAMARC (Fisheries Research Agency) tagging by Nippon maru (2004-2006)

[2004-2005]

Nippon-Mar (JAMARC, Fisheries Research Agency) cooperated the IOTC tagging from 2004 to 2006 using the spaghetti tags provided by the IOTC in the eastern Indian Ocean. In 2004, 2005 and 2006 (until end of March), 214 (39 SKJ, 89 YFT and 86 BET), 368 (154 SKJ, 10 YFT and 204 BET), and 258 (99 SKJ, 48 YFT and 111 BET) fishes were tagged and released from her purse seine catch.

[2006]

After the new Nippon maru started her operation in the late 2006 no tagging has been conducted because it is very

difficult to capture individual fish without damage as the new vessel does not have skiff boat.

Small-scale tagging activities based on the Japanese fund (2005-2009)

There have been tagging activities in 3 areas using the Japanese funds to the IOTC, i.e., in the waters off west Sumatra, in the waters around the Andaman Sea and in the Maldivian waters. 1 or 2 Japanese tagging staff from National Research Institute of Far Seas Fisheries (Asakawa, temporal survey staff and Nishida, scientist) have participated in these tagging activities.

[Off West Sumatra (2006-2007)]

The tagging off western Sumatra was conducted in October- November, 2006, but due to the strong El Niño effect, tuna and skipjack were not caught at all due to the cold surface temperature. Thus the tagging was ceased in November after the first leg was over. Then in September, 2007, the second and third legs were resumed. In the 5 days before ending the leg 3, it was stopped due to the large earthquake off southern Sumatra. In the 2nd and 3rd legs about 300 tags were released.

[Andaman Sea (2008)]

The tagging in Andaman waters were conducted from January 19 to February 28, 2008 based in the port of Barmananla, south of Port Blair City in the Andaman Islands. During this period, 28 tagging trips were achieved including 16 live-bait stockings and 18 separate tagging operations.

[Maldives (2007-2009)]

In 2007 the tagging in the Maldivian waters was held for 2 weeks in October 2007 and tagged 750 fish. One Japanese staff (Asakawa, temporal survey staff in the NRIFSF) participated. Due to the bad weather and oceanographic conditions, planned later tagging cruises in 2007-2008 were cancelled. During 2008-2009, the last tagging experiments were conducted from December, 2008- April, 2009.

IOTC tagging workshops (2008-2009)

[2nd workshop (2008)]

The second workshop was held in May, 2008 Indonesia. The tagging activities off Sumatra, in the Andaman Sea and Maldives were reviewed. As a result, (a) tagging in the Andaman waters would not be conducted any more as it was expected that not enough fish could be released, (b) last tagging activities off Sumatra and Maldives would be implemented in the beginning of 2008 using the remaining fund.

[3rd workshop (2009)]

The third (final) workshop was held in May, 2009, Add atoll, Maldives in May 4-5, 2009. In this workshop the review of the past tagging experiments funded by Japan (2005-2009) were reviewed and recommendation for the future tagging activities were made.

7.3 IOTC-OFCF projects (2002-2011)

The IOTC-OFCF joint project to improve tuna fisheries statistics in the IOTC water have been implemented for last 11 years in three phases (1st phase for 5 years: 2002-2006, 2nd phase for 3 years: 2007-2009 and 3rd phase:

2010-2012). This year (2012) is the last year in the 3rd phase.

Along with the IOTC-OFCF joint project, 2 additional activities on capacity buildings for fisheries officers and scientists in developing countries have been also implemented by OFCF and NRIFS staff, i.e., (a), one month training course on tuna fisheries statistics (phase 1-2) and in addition to fisheries managements (phase 3) in Japan (2002-2012) and (b) the atlas project to create tuna fisheries and resources atlas in Indonesian, Thai, Maldives and Sri Lanka using Marine Explorer (GIS) developed by Environmental Simulation Laboratory for 3 years in the 2nd phase (2007-2009).

8. IMPLEMENTATION OF SC RECOMMENDATIONS & RESOLUTIONS OF THE IOTC RELEVANT TO THE SC.

Progress on the implementation of recommendations of the past SCs relating to Japan is as below:

8.1 Collection of more size data

Tuna longliners in Japan have been collecting size data voluntary basis. In 1960-70's, size data were covered up to 20% of the total catch, afterwards the coverage decreased to a few percent. In 1980-1990's, high school training vessels off Java Island, Indonesia collected high percentage levels, for example, as for bigeye tuna, its coverage of size data was 10-20% of the total catch in the Indian Ocean before 1992, but afterwards it sharply decreased to only a few percents. This is mainly because these training vessels shifted their operation to the Pacific Ocean due to the pirate problems in the Strait of Malacca. Under such situation, size data sampled are limited to the particular waters and not from the whole area. Therefore, they are not effective for the stock assessments.

In accordance with the Resolution 10/02, Japan started to deploy observers from July 1, 2010, covering 5% of the fishing operations by observers to collect size data to now. Table 5 shows number of size measured and collected by 6 observers (longliners) during 2010–2011. Additional size data from the observer reports (8 vessels) in 2011-2012 will be sent to the IOTC Secretariat in January, 2013.

Table 5. No. of size measured for 4 major species by 6 observers (6 longliners) during 2010–2011 in the IOTC ROP.

Species	Yellowfin tuna	Bigeye tuna	Albacore tuna	Swordfish
Number	2,217	4,086	1,452	223

8.2 Modification of log-sheet collection system

The owners of fishing vessels larger than or equal to 10 GRT are required to submit the logbook on their operations and catch information to the Japanese government within three months after each cruise was finished. As the duration of one cruise for distant water longliners is long, sometimes longer than one year, it used to take about two years to complete compiling statistics of longline fishery. Starting in August 2008, distant water longliners are required to submit it every ten days. This change in submission rule of logbook has facilitated earlier compilation of tuna statistics.

8.3 Improvement to speed up to submit fisheries data to the IOTC

From August 1, 2008 Japan started to mandate all the long-distance longline vessels to submit the logbook in quick manner by revising the current law.

8.4 Improvement of the CPUE standardization

[2008]

One study has been accomplished, i.e., “Japanese longline CPUE for yellowfin tuna in the Indian Ocean up to 2007 standardized by GLM (IOTC-2008-WPTT10-19) by Okamoto *et al.* During the 10th tropical tuna working group (WPTT10) meeting in October 2008 in Thailand this Japanese CPUE played a key role in the stock assessments conducted by MULTIFAN-CL, SS2 PM and ASPM.

[2009]

Four studies (papers) have been made, i.e., (i) “Japanese longline CPUE for yellowfin tuna in the Indian Ocean up to 2008 standardized by Okamoto *et al.* (ii) “Japanese longline CPUE for bigeye tuna in the Indian Ocean up to 2008 standardized by Okamoto *et al.* and (iii) “Fine scale bigeye tuna CPUE standardization” by Satoh *et al.* During the 11th tropical tuna working group (WPTT11) meeting in October 2009 in Kenya. These three Japanese CPUE series played key roles in the stock assessments conducted by MULTIFAN-CL, SS3, PROFIT, ASPM, ASPIC and PROCEAN. The last work is (iv) CPUE paper for swordfish by Nishida and Wang which was also used as the key CPUE data for its stock assessments by SS3, ASIA, ASPM and ASPIC in the 5th WPB in July in Seychelles.

[2010]

Seven studies to improve CPUE standardizations have been made, i.e., (1) IOTC-2010-WPB8-09 :Estimation of the Abundance Index (AI) of swordfish in the Indian Ocean based on the fine scale catch and effort data in the Japanese tuna longline fisheries (1980-2008) (Nishida and Wang), (2) IOTC-2010-WPB8-11: CPUE standardization of swordfish caught by Taiwanese longline fishery in the Indian Ocean during 1995-2008 (Wang and Nishida), (3) IOTC-2010- WPTT-29: Japanese longline CPUE for bigeye tuna in the Indian Ocean up to 2009 standardized by GLM (Okamoto and Shono), (4) IOTC-2010- WPTT-30: Japanese longline CPUE for yellowfin tuna in the Indian Ocean up to 2009 standardized by general linear model (Okamoto and Shono), (5) IOTC-2010-WPTT-32: Searching comparable standardized YFT CPUE between Japanese and Taiwanese tuna longline fisheries in the common fishing grounds in the Indian Ocean (Nishida and Chang), (6) IOTC-2010- WPTT-33: Yellowfin tuna CPUE standardization of the Korean tuna longline fisheries in the Indian Ocean (1980-2009) (Hwang and Nishida) and (7) IOTC-2010-WPTT-44: Comparisons of STD YFT CPUE of tuna longline fisheries among Japan, Korea and Taiwan (Nishida). These CPUE studies played key roles in the stock assessments conducted by MULTIFAN-CL, SS3 and ASPIC for yellowfin tuna, swordfish and bigeye tuna.

[2011]

Six studies to improve CPUE standardizations have been made in WPB09 (July, 2011), i.e., (1) IOTC–2011–WPB09–11: Validation of the Global Ocean Data Assimilation System (GODAS) data in the NOAA National Center for Environmental System (NCEP) by theory, comparative studies, applications and sea truth (T. Nishida, T. Kitakado, H. Matsuura and S. P. Wang), (2) IOTC–2011–WPB09–12_rev2: CPUE standardization of blue marlin (*Makaira mazara*) caught by Taiwanese longline fishery in the Indian Ocean (S. P. Wang, S. H. Lin and T. Nishida), (3) IOTC–2011–WPB09–14: Estimation of the Abundance Index (AI) of swordfish (*Xiphias gladius*) in the Indian Ocean (IO) based on the fine scale catch and effort data of the Japanese tuna longline fisheries (1980–

2010) (T. Nishida, T. Kitakado and S. P. Wang), (4) IOTC–2011–WPB09–15: Investigation of the sharp drop of swordfish CPUE of Japanese tuna longline fisheries in 1990's in the SW Indian Ocean (T. Nishida and T. Kitakado), (5) IOTC–2011–WPB09–16_rev1: CPUE standardization of swordfish (*Xiphias gladius*) caught by Taiwanese longline fishery in the Indian Ocean (S. P. Wang and T. Nishida), (6) IOTC–2011–WPB09–25: Note for discussion on the Indian Ocean (IO) swordfish (SWO) CPUE (T. Nishida and T. Kitakado)

One study to improve CPUE standardizations have been made in WPTmT03 (September, 2011), i.e., IOTC–2011–WPTmT03–15: Standardization of albacore CPUE by Japanese longline fishery in the Indian Ocean (T. Matsumoto and K. Uosaki).

Seven studies to improve CPUE standardizations have been made in WPTT13 (October, 2011), i.e., (1) IOTC–2011–WPTT13–32: A comparison of methods for prediction of Integrated Habitat Index of *Thunnus albacares* in the Indian Ocean – general linear model and quantile regression model considerations (L. Song, Y. Wu and T. Nishida), (2) IOTC–2011–WPTT13–34 Rev_1: Japanese longline CPUE for yellowfin tuna in the Indian Ocean up to 2010 standardized by general linear model (H. Okamoto), (3) IOTC–2011–WPTT13–38: Standardization of bigeye tuna CPUE of Korean tuna longline fisheries in the Indian Ocean (S. Lee, Z. Kim and T. Nishida), (4) IOTC–2011–WPTT13–44: Preliminary analyses of the effect of the Piracy activity in the northwestern Indian Ocean on the CPUE trend of bigeye and yellowfin (H. Okamoto), (5) IOTC–2011–WPTT13–52: Updated Japanese longline CPUE for bigeye tuna in the Indian Ocean standardized by GLM for the period from 1960 to 2010 (H. Okamoto), (6) IOTC–2011–WPTT13–INF05: Validation of the Global Ocean Data Assimilation System (GODAS) data in the NOAA National Centre for Environmental System (NCEP) by theory, comparative studies, applications and sea truth (T. Nishida, T. Kitakado, H. Matsuura and S.-P. Wang), (7) IOTC–2011–WPTT13–INF12: Influence of the marine environment variability on the yellowfin tuna (*Thunnus albacares*) catch rate by the Taiwanese longline fishery in the Arabian sea, with special reference to the high catch in 2004 (K.-W. Lan, T. Nishida, M.-A. Lee, H.-J. Lu, H.-W., Huang, S.-K. Chang and Y.-C. Lan)

Three studies to improve CPUE standardizations have been made in WPEB07 (October, 2011), i.e., (1) IOTC–2011–WPEB07–33 Rev_1: Standardized CPUE for blue shark caught by Japanese tuna longline fishery in the Indian Ocean, 1971-1993 and 1994-2010 (Y. Hiraoka and K. Yokawa), (2) IOTC–2011–WPEB07–34: Standardized CPUE of shortfin mako shark (*Isurus oxyrinchus*) caught by Japanese longliners in the Indian Ocean in the period between 1994 and 2010 (A. Kimoto, Y. Hiraoka, T. Ando and K. Yokawa) and (3) IOTC–2011–WPEB07–35: Trends of standardized CPUE of oceanic whitetip shark (*Carcharhinus longimanus*) caught by Japanese longline fishery in the Indian Ocean (Y. Semba and K. Yokawa)

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Following works improved CPUE standardization and also contributed stock assessments such as ASPIC, ASPM, SS3 and MFCL in WPTmT04, WPB10, WPEB07 and WPTP14 in 2012:

For albacore, IOTC–2012–WPTmT04–10 Rev_1: Standardization of albacore CPUE by Japanese longline fishery in the Indian Ocean (Takayuki Matsumoto, Toshihide Kitakado and Hiroaki Okamoto).

For billfish, IOTC–2012–WPB10–19 Rev_2. Standardization of catch rates for Striped marlin (*Tetrapturus*

audax) and Blue marlin (*Makaira nigricans*) in the Indian Ocean based on the operational catch and effort data of the Japanese tuna longline fisheries incorporating time-lag environmental effects (1971–2011) (T. Nishida, Y. Shiba, H. Matsuura and S.-P. Wang). IOTC–2012–WPB10–20: CPUE standardization of blue marlin (*Makaira mazara*) caught by Taiwanese longline fishery in the Indian Ocean for 1980 to 2010 (S.-P. Wang, S.-H. Lin and T. Nishida). IOTC–2012–WPB10–21: CPUE standardization of striped marlin (*Tetrapterus audax*) caught by Taiwanese longline fishery in the Indian Ocean for 1980 to 2010 (S.P. Wang and T. Nishida).

For sharks, IOTC–2012–WPEB08–26: Update of the standardized CPUE of oceanic whitetip shark *Carcharhinus longimanus*) caught by Japanese longline fishery in the Indian Ocean (K. Yokawa and Y. Senba) IOTC–2012–WPEB08–28: "Update of CPUE of blue shark caught by Japanese longliner and estimation of annual catch series in the Indian Ocean (Y. Hiraoka and K. Yokawa)".

For yellowfin and bigeye tuna, IOTC–2012–WPTT14–26 Rev_1: Updated Japanese longline CPUE for bigeye tuna in the Indian Ocean standardized by GLM (K. Satoh and H. Okamoto), IOTC–2012–WPTT14–34 Rev_1: CPUE standardization for yellowfin tuna caught by Korean tuna longline fisheries in the Indian Ocean (1978–2011) (S.I. Lee, Z.G. Kim, M.K Lee, D.W. Lee and T. Nishida), IOTC–2012–WPTT14–35: Rev_1 Japanese longline CPUE for yellowfin tuna in the Indian Ocean up to 2011 standardized by general linear model (T. Matsumoto, H. Okamoto and T. Kitakado).

9. LITERATURE CITED AND WORKING DOCUMENTS

WPB10

IOTC–2012–WPB10–19 Rev_2: Standardization of catch rates for Striped marlin (*Tetrapturus audax*) and Blue marlin (*Makaira nigricans*) in the Indian Ocean based on the operational catch and effort data of the Japanese tuna longline fisheries incorporating time-lag environmental effects (1971–2011) (T. Nishida, Y. Shiba, H. Matsuura and S.-P. Wang)

IOTC–2012–WPB10–20: CPUE standardization of blue marlin (*Makaira mazara*) caught by Taiwanese longline fishery in the Indian Ocean for 1980 to 2010 (S.-P. Wang, S.-H. Lin and T. Nishida)

IOTC–2012–WPB10–21: CPUE standardization of striped marlin (*Tetrapterus audax*) caught by Taiwanese longline fishery in the Indian Ocean for 1980 to 2010 (S.P. Wang and T. Nishida)

WPTmT04

IOTC–2012–WPTmT04–09: "Review of Japanese longline fishery and its albacore catch in the Indian Ocean (Takayuki Matsumoto)"

IOTC–2012–WPTmT04–10 Rev_1: Standardization of albacore CPUE by Japanese longline fishery in the Indian Ocean (Takayuki Matsumoto, Toshihide Kitakado and Hiroaki Okamoto)

IOTC–2012–WPTmT04–11 Rev_2: First attempt of stock assessment using Stock Synthesis III (SS3) for the Indian Ocean albacore tuna (*Thunnus alalunga*) (Toshihide Kitakado, Eri Takashima, Takayuki Matsumoto, Takahiro Ijima and Tom Nishida)

IOTC–2012–WPTmT04–17 Rev_1: Standardization of albacore catch rates of Korean tuna longline fisheries in the Indian Ocean (1986–2010) (Sung IILee, Zang Geun Kim, Tom Nishida and Mi Kyung Lee)

IOTC–2012–WPTmT04–20 Rev_1 : Stock and risk assessments of albacore in the Indian Ocean based on ASPIC (Takayuki Matsumoto, Tom Nishida and Toshihide Kitakado)

IOTC–2012–WPTmT04–21 Rev_4: "Stock and risk assessments on albacore (*Thunnus alalunga*) in the Indian Ocean based on AD Model Builder implemented Age-Structured Production Model (ASPM) (Tom Nishida, Takayuki Matsumoto and Toshihide Kitakado)

WPTT14

- IOTC–2012–WPTT14–17 Rev_1: Review of Japanese fisheries and tropical tuna catch in the Indian Ocean (T. Matsumoto and K. Satoh)
- IOTC–2012–WPTT14–25 Rev_1: CPUE standardization for bigeye tuna caught by Korean tuna longline fisheries in the Indian Ocean (1978–2011) (S.I. Lee, Z.G. Kim, M.K Lee, D.W. Lee and T. Nishida)
- IOTC–2012–WPTT14–26 Rev_1: Updated Japanese longline CPUE for bigeye tuna in the Indian Ocean standardized by GLM (K. Satoh and H. Okamoto)
- IOTC–2012–WPTT14–34 Rev_1: CPUE standardization for yellowfin tuna caught by Korean tuna longline fisheries in the Indian Ocean (1978–2011) (S.I. Lee, Z.G. Kim, M.K Lee, D.W. Lee and T. Nishida)
- IOTC–2012–WPTT14–35: Rev_1 Japanese longline CPUE for yellowfin tuna in the Indian Ocean up to 2011 standardized by general linear model (T. Matsumoto, H. Okamoto and T. Kitakado)
- IOTC–2012–WPTT14–39: Preliminary stock assessment of yellowfin tuna in the Indian Ocean using SS3 (H. Ijima, K. Sato, T. Matsumoto, T. Nishida and T. Kitakado)
- IOTC–2012–WPTT14–40 Rev_2: Stock and risk assessments on yellowfin tuna (*Thunnus albacares*) in the Indian Ocean based on AD Model Builder implemented Age-Structured Production Model (ASPM) and Kobe I + II software (T. Nishida, R. Rademeyer, H. Ijima, K. Sato, T. Matsumoto, T. Kitakado and A. Fonteneau)

WPEB08

- IOTC–2012–WPEB08–26: Update of the standardized CPUE of oceanic whitetip shark (*Carcharhinus longimanus*) caught by Japanese longline fishery in the Indian Ocean (K. Yokawa and Y. Senba)
- IOTC–2012–WPEB08–28: "Update of CPUE of blue shark caught by Japanese longliner and estimation of annual catch series in the Indian Ocean (Y. Hiraoka and K. Yokawa)"

WPM04

- IOTC–2012–WPM04–04: Working towards the evaluation of reference points and harvest control rules for IOTC stocks (I. Mosqueira and T. Kitakado)
- IOTC–2012–WPM04–05 Rev_1: "Kobe plot I (stock trajectory) + Kobe II (risk assessment matrix diagram) software (Version 2 for 32- and 64-bit PC) Users' manual (T. Nishida, Y. Matsuo, T. Kitakado and K. Itoh)"
- IOTC–2012–WPM04–06: AD Model Builder implemented Age-Structured Production Model (ASPM) (Version 2 with graphic functions) (R. Rademeyer, T. Nishida, Y. Matsuo and K. Itoh)