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ISC

International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean

REPORT OF THE FIFTEENTH MEETING OF THE INTERNATIONAL SCIENTIFIC COMMITTEE FOR TUNA AND TUNA-LIKE SPECIES IN THE NORTH PACIFIC OCEAN

PLENARY SESSION

15-20 July 2015
Kona, Hawaii
United States of America

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ACRONYMS AND ABBERVIATIONS

Names and FAO Codes of ISC Species of Interest in the North Pacific Ocean

FAO Code	Common English Name	Scientific Name
	TUNAS	
ALB	Albacore	*Thunnus alalunga*
BET	Bigeye tuna	*Thunnus obesus*
PBF	Pacific bluefin tuna	*Thunnus orientalis*
SKJ	Skipjack tuna	*Katsuwonus pelamis*
YFT	Yellowfin tuna	*Thunnus albacares*
	BILLFISHES	
BIL	Other billfish	Family *Istiophoridae*
BLM	Black marlin	*Makaira indica*
BUM	Blue marlin	*Makaira nigricans*
MLS	Striped marlin	*Kajikia audax*
SFA	Sailfish	*Istiophorus platypterus*
SSP	Shortbill spearfish	*Tetrapturus angustirostris*
SWO	Swordfish	*Xiphias gladius*
	SHARKS	
ALV	Common thresher shark	*Alopias vulpinus*
BSH	Blue shark	*Prionace glauca*
BTH	Bigeye thresher shark	*Alopias superciliosus*
FAL	Silky shark	*Carcharhinus falciformis*
LMA	Longfin mako	*Isurus paucus*
LMD	Salmon shark	*Lamna ditropis*
OCS	Oceanic whitetip shark	*Carcharhinus longimanus*
PSK	Crocodile shark	*Pseudocarcharias kamonharai*
PTH	Pelagic thresher shark	*Alopias pelagicus*
SMA	Shortfin mako shark	*Isurus oxyrinchus*
SPN	Hammerhead spp.	*Sphyrna* spp.

ISC Working Groups

Acronym	Name	Chair
ALBWG	Albacore Working Group	John Holmes (Canada)
BILLWG	Billfish Working Group	Jon Brodziak (U.S.A.)
PBFWG	Pacific Bluefin Working Group	Hideki Nakano (Japan)
SHARKWG	Shark Working Group	Suzanne Kohin (U.S.A.)
STATWG	Statistics Working Group	Ren-Fen Wu (Chinese Taipei)

Other Abbreviations and Acronyms Used in the Report

CDS	Catch documentation scheme
CIE	Center for Independent Experts
CKMR	Close-kin mark-recapture
CMM	Conservation and Management Measure
CPFV	Charter passenger fishing vessel
CPUE	Catch-per-unit-of-effort
CSIRO	Commonwealth Scientific and Industrial Research Organization
DWLL	Distant-water longline
DWPS	Distant-water purse seine
EEZ	Exclusive economic zone
EPO	Eastern Pacific Ocean
F	Fishing mortality rate
FAD	Fish aggregation device
FAO	Fisheries and Agriculture Organization of the United Nations
FL	Fork length
HCR	Harvest control rule
HMS	Highly migratory species
H_{MSY}	Harvest rate at MSY
IATTC	Inter-American Tropical Tuna Commission
ISC	International Scientific Committee for Tuna and Tuna-Like Species in the North Pacific Ocean
ISSF	International Seafood Sustainability Foundation
LFSR	Low fecundity spawner recruitment relationship
LTLL	Large-scale tuna longline
LRP	Limit reference point
MSE	Management strategy evaluation
MSY	Maximum sustainable yield
NC	Northern Committee (WCPFC)
NRIFSF	National Research Institute of Far Seas Fisheries (Japan)
OFDC	Overseas Fisheries Development Council (Chinese Taipei)
PICES	North Pacific Marine Science Organization
PIFSC	Pacific Islands Fisheries Science Center (U.S.A.)
SAC	Scientific Advisory Committee (IATTC)
SC	Scientific Committee (WCPFC)
SG-SCISC	Study Group on Scientific Cooperation of ISC and PICES
SPC-OFP	Oceanic Fisheries Programme, Secretariat of the Pacific Community
SPR	Spawning potential ratio, spawner per recruit
SSB	Spawning stock biomass
$SSB_{F=0}$	Spawning stock biomass at a hypothetical unfished level
$SSB_{CURRENT}$	Current spawning stock biomass
SSB_{MSY}	Spawning stock biomass at maximum sustainable yield
STLL	Small-scale tuna longline
t, mt	Metric tons, tonnes
WCNPO	Western Central and North Pacific Ocean
WCPFC	Western and Central Pacific Fisheries Commission
WPO	Western Pacific Ocean
WWF	World Wildlife Fund for Nature - Japan
GRT	Gross registered tons

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Highlights of the ISC15 Plenary Meeting

The 15th ISC Plenary, held in Kona, Hawaii, U.S.A from 15-20 July 2014 was attended by members from Canada, Chinese Taipei, Japan, Korea, Mexico and the United States as well as the Western and Central Pacific Fisheries Management Commission and the North Pacific Marine Science Organization. The Plenary reviewed results, conclusions, new data and updated analyses of the Billfish, Albacore, Shark and Pacific Bluefin tuna working groups. The Plenary endorsed the findings that the Western and Central North Pacific striped marlin is experiencing overfishing and is overfished. It reviewed indicator analyses of North Pacific shortfin mako shark and concluded that better data are needed to determine the status of this stock. It re-iterated that the North Pacific albacore tuna, North Pacific blue shark, and Western Central North Pacific Ocean swordfish stocks are not overfished nor experiencing overfishing, the Pacific bluefin tuna stock is overfished and experiencing overfishing, the Pacific blue marlin stock is not overfished nor experiencing overfishing and that the Eastern Pacific Ocean swordfish stock is not overfished but likely experiencing overfishing. A special seminar on using close-kin mark recapture methods to estimate spawning stock biomass of Pacific Bluefin tuna was held and Plenary agreed to develop a sampling protocol for the method. Plenary endorsed the science objectives for ISC and PICES collaborations and discussed formalizing the ISC structure and administration and agreed to continue researching means of doing both. Over the past year, ISC further conducted a workshop on Management Strategy Evaluation (MSE), developed an MSE framework for NPALB. Plenary also noted the strides WGs had made in incorporating best available scientific information (BASI) into stock assessment work, enhanced stock assessment reports and the increased transparency in Working Group efforts. Observers from Pew Charitable Trusts, International Seafood Sustainability Foundation, World Wildlife Fund for Nature - Japan and Duke University attended. The ISC workplan for 2015-16 includes completing Pacific Bluefin tuna and blue marlin assessments, improving catch and CPUE time series and advancing biological information for shark species, conducing a workship for managers on fishery objectives and harvest control rules for MSE, and enhancing database and website management. The Plenary revised its operating procedures and endorsed an additional one-year term for the standing Albacore Working Group Chair, John Holmes. The next Plenary will likely be held in the Japan in July 2016.

1 INTRODUCTION AND OPENING OF THE MEETING

1.1 Introduction

The ISC was established in 1995 through an intergovernmental agreement between Japan and the United States (U.S.A.). Since its establishment and first meeting in 1996, the ISC has undergone a number of changes to its charter and name (from the Interim Scientific Committee to the International Scientific Committee) and has adopted a number of guidelines for its operations. The two main goals of the ISC are (1) to enhance scientific research and cooperation for conservation and rational utilization of the species of tuna and tuna-like fishes that inhabit the North Pacific Ocean during a part or all of their life cycle; and (2) to establish the scientific groundwork for the conservation and rational utilization of these species in this region. The ISC is made up of voting Members from coastal states and fishing entities of the region as well as coastal states and fishing entities with vessels fishing for highly migratory species in the region, and non-voting Members from relevant intergovernmental fishery and marine science organizations, recognized by all voting Members.

The ISC provides scientific advice on the stocks and fisheries of tuna and tuna-like species in the North North Pacific Ocean to the Member governments and regional fisheries management organizations. Fishery organizations. Fishery data tabulated by ISC Members and peer-reviewed by the species and statistics statistics Working Groups (WGs) form the basis for research conducted by the ISC. Although some data for some data for the most recent years are incomplete and provisional, the total catch of highly migratory migratory species (HMS) by ISC Members estimated from available information is in excess of 500,000 500,000 metric tons (t) annually and dominated by the tropical tuna species. In 2014 the catch of priority priority species monitored by ISC member countries was 77,720 t of North Pacific albacore tuna (NPALB, (NPALB, *Thunnus alalunga*), 17,065 t of Pacific bluefin tuna (PBF, *T. Orientalis*), 11,951 t of North Pacific North Pacific swordfish (SWO, *Xiphias gladius*), 2,466 t of North Pacific striped marlin (MLS, *Kajikia audax*), *Kajikia audax*), 8,143 t of Pacific blue marlin (BUM, *Makaira nigicans*), 141 t of shortfin mako shark (SMA, shark (SMA, *Isurus oxyrinchus*) and 24,800 t of North Pacific blue shark (BSH, *Prionace glauca*).[1] The total *glauca*).[1] The total estimated catch of these seven species is 142,286 t, or approximately 105% from the 2013 from the 2013 total estimated catch of 136,087 t. Annual catches of priority stocks throughout their ranges their ranges are shown in Table 15-1 through

[1] FAO three-letter species codes are used throughout this report interchangeably with common names.

Table 15-5. Retained catches (metric tons, whole weight) of ISC members of blue marlin (*Makaira nigricans*) by fishery in the North Pacific Ocean, north of the equator. "0"; Fishing effort was reported but no catch. "+"; Bellow 499kg catch. "-"; Unreported catch or catch information not available. *: Data from the most recent years are provisional.

Catch disposition	Year	JPN		KOR		TWN							USA						Species Grand Total
		Longline	JPN total	Longline	KOR total	Set-net	Gill-net (not specified)	Harpoon	Longline	Others	Purse seine	TWN total	Handline	Longline	Troll	Others	Purse seine	USA total	
Retained	1953								-			-							-
	1954								-			-							-
	1955								-			-							-
	1956								-			-							-
	1957								-			-							-
	1958								887			887							887
	1959								781			781							781
	1960								948			948							948
	1961								703			703							703
	1962								628			628							628
	1963								691			691							691
	1964								934			934							934
	1965								1,016			1,016							1,016
	1966								957			957							957
	1967					-	-	317	898	167		1,382							1,382
	1968					-	30	649	1,433	120		2,232							2,232
	1969					-	58	465	1,232	103		1,858							1,858
	1970					1	21	604	1,385	70		2,081							2,081
	1971	5,461	5,461	0	0	-	13	473	1,331	118		1,935							7,396
	1972	6,772	6,772	0	0	-	14	490	1,205	50		1,759							8,531
	1973	6,453	6,453	0	0	-	12	275	1,650	265		2,202							8,655
	1974	6,545	6,545	0	0	1	6	355	2,144	146		2,652							9,197
	1975	4,374	4,374	0	0	-	3	421	2,638	207		3,269							7,643
	1976	5,018	5,018	0	0	-	9	511	1,315	162		1,997							7,015
	1977	4,780	4,780	0	0	-	11	391	1,183	110		1,695							6,475
	1978	5,900	5,900	0	0	1	15	364	1,633	7		2,020							7,920
	1979	5,949	5,949	0	0	3	19	362	1,646	164		2,194							8,143
	1980	5,613	5,613	155	155	-	35	444	1,185	170		1,834							7,602
	1981	5,518	5,518	0	0	-	35	313	1,840	69		2,257							7,775
	1982	6,051	6,051	351	351	-	7	306	2,139	120		2,572							8,974
	1983	4,796	4,796	82	82	-	26	741	2,122	127		3,016							7,894
	1984	6,248	6,248	155	155	-	22	960	1,789	111		2,882							9,285
	1985	5,164	5,164	45	45	9	11	747	1,187	43		1,997			145			145	7,351
	1986	5,922	5,922	86	86	4	90	839	1,723	107		2,763			220			220	8,991
	1987	5,370	5,370	89	89	12	9	973	4,627	1		5,622		51	261			312	11,393
	1988	5,054	5,054	133	133	20	8	658	2,822	589		4,097		102	266			368	9,652
	1989	5,117	5,117	50	50	10	14	640	2,691	9		3,364		356	326			682	9,213
	1990	4,116	4,116	44	44	3	24	427	1,749	143		2,346		378	295			673	7,179
	1991	4,094	4,094	75	75	4	50	338	2,288	152		2,832		297	346			643	7,644
	1992	3,721	3,721	60	60	25	40	432	3,786	110		4,393		347	260			607	8,781
	1993	4,600	4,600	36	36	44	41	400	4,135	82		4,702		339	311			650	9,988
	1994	5,832	5,832	2	2	12	30	206	3,007	7		3,262		362	298			660	9,756
	1995	5,907	5,907	0	0	15	36	895	3,896	5		4,847		570	315			885	11,639
	1996	3,260	3,260	10	10	13	35	270	3,337	10	-	3,665		467	409			876	7,811
	1997	3,697	3,697	145	145	5	48	194	3,683	-	-	3,930		487	378			865	8,637
	1998	3,438	3,438	335	335	8	59	91	3,624	1	-	3,783		395	242			637	8,193
	1999	3,751	3,751	164	164	21	32	135	3,417	-	-	3,605		357	293			650	8,170
	2000	3,606	3,606	96	96	24	40	186	4,131	2	-	4,383		314	235			549	8,634
	2001	3,594	3,594	166	166	18	57	229	4,733	-	-	5,037		399	291			690	9,487
	2002	2,976	2,976	152	152	13	63	32	4,448	6	-	4,562		264	225	1		490	8,180
	2003	2,836	2,836	158	158	20	107	52	7,685	4	-	7,868		363	210			573	11,435
	2004	2,977	2,977	226	226	14	93	36	6,672	9	-	6,824		283	188	5		476	10,503
	2005	2,506	2,506	303	303	8	65	48	7,630	16	-	7,767		337	187			524	11,100
	2006	2,414	2,414	217	217	12	15	30	5,729	-	-	5,786		409	160			569	8,986
	2007	2,016	2,016	120	120	3	17	20	5,117	-	-	5,157	1	262	127			390	7,683
	2008	2,096	2,096	219	219	10	16	15	5,477	1	-	5,519	1	349	198			548	8,382
	2009	1,840	1,840	224	224	9	12	9	4,638	1	-	4,669	1	360	15			376	7,109
	2010	2,457	2,457	257	257	5	27	15	4,959	1	-	5,007	2	306	148			456	8,177
	2011	2,211	2,211	684	684	3	18	17	4,625	9	2	4,674	2	373	199			574	8,143
	2012	1,839	1,839	587	587	6	13	16	4,097	-	12	4,144	2	298	141			441	7,011
	2013	1,985	1,985	963	963	2	6	16	4,607	-	9	4,640	3	406	137			546	8,134
	2014*	1,752	1,752	801	801	2	6	16	4,861	-	7	4,892	4	535	159			698	8,143
Discards	2010																1	1	1
	2011																6	6	6
	2013										5	5							5

Table 15-6.

1.2 Opening of the Meeting

The Fifteenth Plenary session of the ISC (ISC15) was convened in Kona, Hawaii, U.S.A., at 0900 on 15 July 2015 by the ISC Chairman, G. DiNardo. A roll call confirmed the presence of delegates from Canada, Chinese Taipei, Japan, Korea, Mexico, and U.S.A. (*Annex* 1). Representatives from the Western and Central Pacific Fisheries Commission (WCPFC) and the North Pacific Marine Science Organization (PICES) were also present. The International Sustainable Seafood Foundation (ISSF), Pew Charitable Trusts, World Wildlife Fund for Nature - Japan (WWF), and Duke University were present as observers.

ISC Member China, the Secretariat of the Pacific Community (SPC), the Fisheries and Agriculture Organization of the United Nations (FAO), as well as organizations with significant interest, including the Inter-American Tropical Tuna Commission (IATTC), did not attend the Plenary.

G. DiNardo introduced Dr. Michael Seki, NMFS PIFSC Director, who gave the welcome address for the meeting:

> Good morning, *aloha kakou*, and welcome to Hawaii and to the 15th Meeting of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC).
>
> The ISC structure has evolved over the years and the quality of its science has grown with it. As a result, the ISC itself has evolved to become a respected and efficient organization. By providing the science necessary to effectively and properly manage fisheries, ISC plays a critical role in sustaining North Pacific fishery resources.
>
> What has maintained the organization are the values of collaboration and cooperation resplendent in its culture. This collaboration and cooperation has provided the foundation for ISC operations and has enabled the ISC to produce over 30 assessments since it was established in 1995. This achievement is not bad for an organization with no money and no legally binding agreement, a situation that hopefully will change in the near future. The commitment of ISC member countries to high-quality science has maintained ISC and enabled these accomplishments.
>
> As U.S. leadership for ISC transitions to me, I look forward to contributing to this effort and continuing the commitment, cooperation and collaboration that are the hallmarks of this essential organization.
>
> May we have a productive meeting and enjoy this wonderful venue. Again, welcome all!

2 ADOPTION OF AGENDA

The proposed agenda for the session was considered and adopted with no changes (*Annex 2*). It was noted that observers would be given the opportunity at the end of each day to offer comments and seek clarification on topics discussed. C. Dahl was assigned lead rapporteur duties. A list of meeting documents is contained in *Annex 3*.

3 DELEGATION REPORTS ON FISHERY MONITORING, DATA COLLECTION AND RESEARCH

3.1 Canada

J. Holmes presented a summary of Category I, II, and III data from Canadian fisheries for highly migratory species in 2014 (**ISC/15/PLENARY/04**). The Canadian fleet of 160 vessels targeted juvenile North Pacific albacore tuna (NPALB) exclusively and operated primarily in the coastal waters of Canada and the United States, with very little effort or catch outside of these areas in 2014. Preliminary estimates of catch and effort in 2014 are 4,781 t and 4,747 vessel days, respectively, which represent a 6% decrease in catch and a 27% decrease in effort relative to 2013. Catch and effort were split primarily between Canadian waters (55% of the catch and 62% of the effort) and U.S. waters (44% of the catch and 37% of the effort). More than 85% of the catch was made in sea surface temperature band of 16-18 °C. The pattern of seasonal change in nominal CPUE peaked well above average in July and then was below average through August and September. The fishery stopped by October 10, which is about three weeks earlier than in recent years. Fifty-seven (57) vessels participated in the size sampling program and measured 11,208 fish for a sampling rate of 1.6% of the reported catch. These measurements were dominated by fish between 65-71 cm fork length (FL) corresponding to 2-year old fish, and a significant number of fish between 76-81 cm FL, which are 3-years old. The Canadian fishery was highly coastal in 2014 and shifted north to Haida Gwaii (bordering southeast Alaska) in late August and September, consistent with reports (unverified) of NPALB in the waters of southeast Alaska. The anomalously warm water in the northeast Pacific Ocean may have influenced this northward distribution of albacore tuna. Research in 2014 was focused on modelling climatic effects on albacore stock productivity and distribution and abundance in the EPO.

<u>**Discussion**</u>

The long-term shift of fishing effort from offshore to inshore areas is primarily due to increases in fuel prices and an increase in NPALB abundance in coastal waters. The more recent increase in catch in the Canadian EEZ is due to changes in the fishing regime pursuant to the Canada-U.S. Albacore Treaty, although the availability of NPALB in Canadian waters obviously contributes to sustained catch levels. The size distribution is similar in both Canadian and U.S. waters, with two modes representing age-2 and age-3 fish. It should be noted that some discarding of small fish, for market reasons, was observed in 2014. Discard mortality is thought to be low because of a requirement to use barbless hooks.

PBF catch by Canadian albacore troll vessels normally occurs when they fish in U.S. waters off of California or adjacent high seas south of 40°N latitude. However, PBF are occasionally caught in Canadian waters. These catches were reported to the NC.

Research into the use of remote sensing is not yet at the point where it could be used to develop a survey index, because an appropriate habitat-based model has not been developed. This could be developed through future collaboration between ISC and PICES.

3.2 Chinese-Taipei

W.-J. Wang presented the Chinese-Taipei national report (**ISC/15/PLENARY/05**). There are two principal tuna fisheries of Chinese-Taipei operating in the North Pacific Ocean, the tuna longline fishery and the distant water purse seine fishery; other offshore and coastal fisheries include the harpoon, set net, and gill net fisheries, which account for a small proportion of overall tuna and tuna-like species catch. The catches of longline and purse seine fisheries account for 99% of the total tuna and tuna-like species catches in the North Pacific Ocean by Chinese-Taipei. Longline fisheries comprise the large-scale tuna longline (LTLL, vessels larger than or equal to 100 GRT) and small-scale tuna longline (STLL, vessels less than 100 GRT) fleets. The total catch of tunas and billfish (including SWO, MLS, BUM, BLM, and SFA) for the longline fishery (LTLL and STLL) in the North Pacific Ocean was 23,190 t in 2014. There were 73 active LTLL vessels of operating in the Pacific Ocean in 2014 and 1,275 active STLL vessels. Thirty-four purse seine vessels caught a total catch of 237,120 t in the Pacific Ocean in 2014.

For the LTLL fishery, Category I data sources include weekly catch reports and commercial data from individual fishing vessels. Categories II and III data are from logbook data. Fishermen are required to measure the length of the first 30 fish caught in each set. For the STLL fishery, Category I data sources include landings and auction records of local fish markets, reports of market sales, and monthly catch reports from individual fishing vessels. For the purse seine fishery, Category I and Category II data are obtained from logbooks.

In March 2010, a catch documentation scheme (CDS) was established and implemented for vessels fishing for PBF. When PBF are caught, fishermen are required to attach a tag and to measure length and weight of each PBF.

An observer program on the LTLL fleet in the Pacific Ocean was implemented in 2002. The program was gradually expanded in later years and hence the number of observers increased. The program was further expanded to the STLL fleet in 2012. In 2014,13 observers were deployed on LTLL vessels and 11 observers on STLL vessels.

<u>Discussion</u>

The LTLL fleet targets NPALB in more northerly waters and BET near the Equator. The STLL fleet targets YFT and bycatches billfish.

With respect to observer coverage, approximately 5% of fishing effort is observed in the LTLL fishery while the level in the STLL fishery is lower. Observers are part of the Regional Program under the WCPFC and they are Taiwanese nationals.

The decline in participation in LTLL and STLL fisheries in the Pacific Ocean in 2014 was mainly due to a decline in fish prices, exacerbated by depreciation of the Japanese yen. In 2012 and 2013, some vessels shifted operations to the Indian Ocean.

It was explained that in the purse seine fishery fishermen are required to provide length-frequency data, pursuant to requirements from the WCPFC.

3.3 Japan

H. Shimada presented the Japan National Report (**ISC/15/PLENARY/6**). Japanese tuna fisheries consist of the three major fisheries (longline, purse seine, and pole-and-line) and other miscellaneous fisheries like troll, drift-net, and set-net fisheries. The National Report describes the recent trend of Japanese tuna fisheries in the North Pacific Ocean and updates the statistics given in the previous National Report for ISC14. The total catch of tunas (excluding skipjack) caught by Japanese fisheries in the North Pacific Ocean was 100,142 t in 2013 and 113,380 t in 2014. The total catch of tunas (including skipjack) caught by Japanese fisheries in the North Pacific Ocean was 294,311 t in 2013 and 277,251 t in 2014. The total catch of swordfish and striped marlin was 6,903 t in 2013 and 7,754 t in 2014. In addition to describing fisheries, the Report briefly describes Japanese research activities on tuna and tuna-like species in the Pacific Ocean in 2014 and the NPALB MSE.

Discussion

The increase in PBF catch in the purse seine fishery in 2014 was explained by increased recruitment in 2013 and abundance of age-1 fish, which is the target of this fishery. However, no increase in age-0 PBF (recruitment) in the troll fishery was observed. Preliminary catch estimates indicate that catches of PBF less than 30 kg in 2014 were 85% of the 2002-2004 baseline.

The recruitment survey is a preliminary effort to develop a recruitment index, while at the same time serving as an early warning system on the condition of the stock. For example, in 2014 data from July to September was used as an early indicator of the recent recruitment trend even though the survey occurs throughout the year.

The Japanese PBF tagging program for both juveniles and adults is ongoing. One significant result to date is tracking of an adult to the spawning grounds. So far a tag return came from as far away as the EPO, reported by IATTC and NOAA staffs. It was noted that to be effective significantly more tags following a statistical design would need to be deployed, and other nations should be aware of tagging efforts.

Research is also ongoing about the location of spawning grounds. It appears that spawning areas are associated with oceanic eddies. Furthermore, the larval survey data are being correlated with oceanographic information to understand their effect on year class strength.

3.4 Korea

Y. Kwon presented the Korea National Report (**ISC/15/PLENARY/7**) including information on fisheries, statistics and research in the North Pacific Ocean for the year 2014. There were 113 active longline vessels in the tropical areas between 20°N and 20°S in both the WCPFC and the IATTC areas of competence, which caught 13,208 t of tuna and tuna-like species in the North Pacific Ocean. Overall catch composition was 58.6% BET, 15.9% YFT, 6.3% SWO, 6.1% BUM, 0.9% ALB, 0.6% MLS, and 0.2% BLM. There were 28 active purse seine vessels in the tropical area between 10°N and 15°S within the WCPFC area of competence, which caught 52,298 t of tuna and tuna-like species the North Pacific Ocean. Overall catch composition for this fleet was 77.8% SKJ, 21.7 % YFT and 0.5% BET. The distribution of purse seine fishing effort had a slightly more easterly distribution in 2014 compared to 2013. Longline fishing effort was relatively higher in the eastern area.

In 2014, coastal fisheries in the Korean EEZ caught 1,311 t of PBF, of which 1,305 t were caught by the offshore large purse seine and 6 t by set net and offshore trawl. The catch occurred in the South Sea around Jeju Island throughout the year with the highest catches in March to July and less than 10 t in August to November. The fork length frequency distribution of PBF differed by quarter. In the first quarter there were three modes of 50 cm, 80 cm, and 150 cm. In the second quarter there were more than three modes of fish sizes ranging from 45 cm to 215 cm. In the third and fourth quarters there was a single mode in the 30-50 cm range. Larval surveys have been carried out since 2011 to determine the potential for PBF spawning in Korean waters but no larva have been found. Korea suggested a tagging survey as the future direction.

Discussion

It was noted that tagging programs need to be carried out over a long period of time and collaboration with other nations is important to obtain sufficient data.

Larval surveys by Japan found more larvae around Okinawa compared to the Japan Sea. Korea could benefit by coordinating future surveys with the Japanese efforts and may be able to catch older, larger larval PBF in surveys in their waters.

It was noted that data on PBF catches in the offshore trawl fishery were not previously reported and are derived from archival sources, which are essentially market sales slips.

Korea has increased the logbook reporting frequency for the distant water fisheries from monthly to weekly. A full-fledged e-logbook program is slated for implementation in 2016.

Based on the discussion, it became apparent that a portion of reported BLM catch may in fact be BUM. Korea agreed to review its data submissions so the catch information in the ISC database can be corrected accordingly for 2016.

3.5 Mexico

M. Dreyfus presented the report from Mexico (**ISC/15/PLENARY/8**). The Pacific shark fishery has traditionally reported catch in two groups (big and small shark individuals). Starting in 2007 a new logbook system was implemented requiring fishermen to provide species composition of the catch. The fleet is composed of medium size longliners with VMS and an artisanal fishery. As a conservation measure, in 2012 Mexico implemented a 3-month closure covering the reproduction period for many of the shark species found in Mexican waters. Beginning in 2007, observer programs were implemented in both longline and artisanal fleets. Mexican scientists are participating in shark research within the IATTC, ISC and the WCPFC and for the first time Mexico hosted a meeting of the ISC SHARKWG.

Of the stocks assessed by the ISC, Mexico caught about 700 t of shortfn mako and approximately 5,000 t of blue shark in 2014.

The longline fleet in northwest Mexico catches SWO (about 3% of the total catch) in addition to sharks.

In relation to tunas, the Mexican purse seine fleet primarily targets YFT and complements this catch with SKJ. All vessels above 400 cubic meters capacity have a scientific observer on board from IATTC or the Mexican national observer program resulting in 100% coverage. Some of those vessels also participate each year in the PBF fishery. Nowadays this catch is transferred to the net pen farms in northwest Baja California. A quota was established for the PBF commercial fishery in 2012. For that reason, in 2014 Mexico´s catch was 4,862 t (which was below the quota for 2014). For 2015 a lower quota was established for the EPO, and Mexico in the recent IATTC annual meeting announced a voluntary extra reduction for 2016 due to its concern about the status of the stock and to encourage the rest of the PBF fishing nations to take further efforts to reduce fishing mortality on this stock.

Mexico also noted that a stock rebuilding plan for PBF was proposed by the U.S. at the 2015 IATTC meeting and all PBF fishing nations participated in discussions to adopt a rebuilding plan. During these discussions Mexico emphasized the need to link rebuilding efforts in both the IATTC and WCPFC to arrive at a proposal with consistent biological reference points and rebuilding targets in the respective commissions' conservation measures. Unfortunately one member country could not join consensus so a measure was not adopted.

Mexico also mentioned that its fishermen reported unusually high abundance of large-sized PBF and believes this is probably due to the fishery closures implemented in the EPO. However, Mexico is concerned that the benefits of EPO conservation measures might not be realized without comparable limits on catches of PBF above 30kg in the WCPO.

Discussion

It was noted that U.S. fishermen also saw large-sized PBF in waters off of California in 2014-2015, which were likely to begin their westward migration. Similar high abundance was also observed in Japanese waters in 2015. This has generated skepticism among fishermen about the veracity of the stock assessment. The ISC will need to look at these recent patterns in age/size distribution and abundance in the next stock assessment.

The spatial distribution of PBF catches off Baja California was discussed. Effort and catch moved north in 2014-2015 relative to previous years but no link with changes in environmental conditions has been found in Mexican fisheries.

A potential collaboration between the U.S.A. and Mexico on PBF tagging projects was noted.

It was noted that the main metrics used to monitor the benefits of the closed fishing season implemented in the shark fishery are catch/effort data and the results of future stock assessments. Mexico clarified that the closed fishing season is intended to encompass spawning/pupping grounds. Also, Mexico mentioned that most of these shark stocks are shared with other nations so that potential benefits might be less than expected.

It was pointed out that these management measures would be amenable to MSE, although the data available for sharks are sparse so MSE is not likely to be possible for those species until more data are compiled.

The utility of genetic tagging for sharks was mentioned. This could be a topic for a future ISC Seminar.

3.6 U.S.A.

C. Werner presented the United States National Report to the Plenary (**ISC/15/PLENARY/9**) covering fishery data submissions and relevant research by its Pacific Islands and Southwest Fisheries Science Centers related to its purse seine, albacore troll, and longline fisheries in the North Pacific in 2014. Research highlights were provided on socioeconomics of the Hawaiian seafood retail monitoring program, and the impact of the 2010 closure of the bigeye longline fishery (as measured by the shift of fishing effort to the EPO). Research results were also presented on the modeled response of the central North Pacific ecosystem and particularly the possible impact of climate change to pelagic species' catch, tagging studies of SMA, development of a genetic sex marker for NPALB, a length-conditional approach to estimate growth in NPALB, and the distribution of NPALB in relation to the presence of sea surface temperature fronts. Capacity building efforts by CAPAM (the Center for the Advancement of Population Assessment Methodology) were mentioned, including completed workshops on Selectivity (March 2013) and Growth (November 2014), and an upcoming Data Weighting (October 2015) workshop. A brief description of the unusually warm oceanic conditions in the eastern regions of the North Pacific (from the Bering Sea to Baja California) was provided including mention of anecdotal data and observations on the distribution and abundance of pelagic species, including PBF in the Southern California Bight.

<u>Discussion</u>

None.

4 REPORT OF CHAIRMAN

G. Dinardo, ISC Chair presented the following report to the Plenary.

The ISC had another busy year since the ISC Plenary met in Taipei, Taiwan, in July 2014. The year was spent completing a stock assessment update for North Pacific striped marlin, an analysis to assess the status of shortfin mako shark using indicators, as well as preparations for benchmark assessments on Pacific bluefin tuna in 2016. Progress was made by improving best practices and scientific reporting procedures, compiling a catalogue and inventory of the ISC database, and advancing development of the website and data enterprise system. Seven intercessional workshops were held to facilitate collaboration among Member scientists in implementing ISC work plans and coordinating research on the stocks. In addition, the ISC conducted international workshops on *Management Strategy Evaluations* in Yokohama, Japan and *Dynamics of Pelagic Fish in the North Pacific under Climate Change* at the PICES-2014 Annual Meeting in Yeosu, Korea, and made progress towards the development of a collaborative scientific research program with PICES. We continue to address recommendations stemming from the 2013 peer review of the ISC function, and Hideki Nakano was elected as Chair of the ISC Pacific Bluefin Tuna Working Group.

Managing ISC activities continued to be a challenge during the past year. As before, the challenge is an inherent consequence of the ISC framework adopted by the Members. That is, ISC relies on in-kind contributions from its Members rather than monetary contributions to support a "secretariat" to oversee day-to-day operations of the organization. Given this framework, the Office of the Chair takes on the role of a secretariat, but not a full-service one at that, owing to uncertain support from the Chairman's funding source. Likewise, the working groups depend on in-kind contributions from Members who elect to participate in specific working groups. This support is uneven among the Members, and Members with insufficient support cannot participate actively and hence, can delay progress of a working group in completing assignments. To date, the support for administration of ISC activities has been provided solely by the U.S. for day-to-day operations of the Office of the Chair, and by Japan for operating and maintaining the ISC website and database. Member countries with scientists serving as chairpersons of the working groups have contributed to supporting administrative services of the working groups. All of the support is appreciated and acknowledged.

I close this report by thanking all my colleagues who have worked on ISC tasks and who have provided the support to ISC and the Office of the Chair in advancing the objectives and purpose of the organization. The service of Chi-lu Sun, ISC Vice Chairman, for support and insightful advice is acknowledged. A special thanks and appreciation is owed to the Chairs of the Working Groups, namely Ren-Fen Wu, Jon Brodziak, John Holmes, Ziro Suzuki, and Suzanne Kohin, who provided unselfish leadership in guiding the work of the Working Groups. In addition, the leadership role of Hideki Nakano with respect to the Data Administrator, Izumi Yamasaki, and Webmaster, Yumi Okochi, is appreciated. Finally, I acknowledge the professional assistance and dedicated service of Sarah Shoffler to the ISC in completing tasks assigned to the Chairman. In that capacity, she served as point of contact for the Office of the Chair, led in organizing the facilities for annual meetings, led in writing and assembling technical information required for agenda items of meetings and for responding to inquiries, and served as advisor to me on all aspects of ISC operations. Thanks to all of you for contributing to another successful year for ISC and for the support and service provided.

5 INTERACTIONS WITH REGIONAL ORGANIZATIONS

5.1 WCPFC

T. Beeching reviewed interactions between WCPFC and ISC over the last year, highlighting the WCPFC SC responses to the ISC North Pacific blue shark and North Pacific albacore assessments. SC10 had recommended that ISC should continue to work towards developing limit reference points (LRPs) that were compatible with those accepted by WCPFC. The NC has already identified a 20% LRP for NPALB. Plenary was informed of the relevant outcomes from WCPFC11.

Discussion

The focus of the next WCPFC Management Objectives Workshop (MOW 4) was discussed. A preparatory meeting is yet to be convened but it is expected that one focus will be the development of a conservation measure for South Pacific albacore tuna (SPALB). Input from the SC and NC will help determine what other harvest strategies will be considered at the workshop. Australia is proposing a work plan to develop a harvest strategy for BET, YFT, SKJ and SPALB. It was noted that the Parties to the Nauru Agreement (PNA) is promoting a target reference point of $F_{SSB50\%}$, which is likely to be a topic of discussion.

The FAO is also funding a separate workshop on management objectives to be conducted by World-Wildlife Fund for Nature (WWF). At this point it is unclear how that workshop will complement the WCPFC MOW process.

The role of the ISC with respect to establishing biological reference points was discussed. While the ISC's role needs further clarification there was agreement that the ISC should provide scientific support to assist the WCPFC and IATTC with identifying an appropriate suite of biological reference points for northern stocks.

5.2 PICES

G. DiNardo reported on the results of the 13-14 July 2015 joint ISC-PICES Study Group meeting convened in Kona, Hawaii, U.S.A. The joint Study Group on Scientific Cooperation of ISC and PICES (SG-SCISC) was established in April 2015 to review each organization's scientific needs and identify where similar key questions or scientific issues might be explored jointly by both organizations. Membership of the SG-SCISC includes:

- Co-Chairperson: Gerard DiNardo (ISC, U.S.A.),
- Co-Chairperson: Jacquelynne King (PICES, Canada),
- Harold Batchelder (PICES Secretariat),
- Steven Bograd (PICES, U.S.A.),
- John Holmes (ISC, Canada),
- Zang Geun Kim (ISC, Korea),
- Jaebong Lee (PICES, Korea),
- Elizabeth Logerwell (PICES, U.S.A.),
- Hideki Nakano (ISC, Japan),
- Sei-Ichi Saitoh (PICES, Japan),
- Chi-lu Sun (ISC, Chinese-Taipei),
- Thomas Therriault (PICES, Science Board), and
- Cisco Werner (ISC, U.S.A.).

At the meeting, the SG-SCISC developed a draft framework of enhanced collaboration between the two organizations to achieve a greater understanding of pelagic ecosystem structure and variability, and its effect on the dynamics and production of Pacific pelagic fish populations. Improvements in our understanding of these factors will advance population modeling and stock assessment research, allowing for development of the next generation of stock assessment models that explicitly account for spatial structure and processes governing population regulation, allowing ISC and PICES scientists to add value to their science, provide synergies on regional and global issues, and enhance the visibility of both organizations. Three overarching research themes were identified by the SG-SCISC including:

1. Understanding the influence of oceanographic conditions on the distribution and production of commercial pelagic fish species in the North Pacific Ocean;
2. Linking oceanographic conditions to fleet and fisher behavior (ecosystem stressors) to improve understanding of fishery indices used in assessing stock status; and
3. Understanding climate change effects on North Pacific marine ecosystems and impacts on pelagic fish dynamics.

Joint activities under each research theme and the rationale for each, including the benefits to each organization from the joint activity, were identified by the study group, as well as processes for implementing the joint activities and mechanisms to periodically review and update the activities. The Co-Chairpersons will finalize the framework and submit the document to PICES for consideration at the 2015 PICES Annual Meeting in October 2015.

Discussion

None.

6 REPORT OF WORKING GROUPS AND REVIEW OF ASSIGNMENTS

6.1 Albacore

J. Holmes reported on the activities of the ALBWG over the past year (*Annex 8*). The ALBWG originally did not schedule any activities between ISC14 and ISC15, however, WCPFC NC10 tasked the WG with developing an MSE process to evaluate the performance of target reference points. The ISC and the Japan Fisheries Research Agency sponsored a workshop on MSE for tuna manager/stakeholders in Yokohama, Japan, 16-17 April 2015 which was attended by many members of the ALBWG (see Section 6.5). Immediately afterward (18-20 April), the ALBWG held a mini-workshop at NRIFSF in Shimizu to begin the process of developing an MSE process for NPALB. Work plans were developed for the next year for review and approval by ISC15. The April 2015 ALBWG workshop identified some principles for the MSE development and identified several areas in which managers/stakeholders will need to be engaged in the process. As a consequence, the ALBWG is proposing an MSE workshop on fishery objectives and harvest control rules for managers in April 2016 followed by a working group workshop to review the 2014 assessment model and new assessment-related research.

Based on the first workshop on MSE, the ALBWG makes the following observations:

- MSE is an ongoing process, not a one-time-only event that produces an "answer" and is complete;
- MSE can be used to address scientific and management issues;
- ALBWG members have identified the delivery of the next assessment in 2017 as their first priority;

- Therefore, an external MSE analyst is needed to deliver on the MSE process, given existing resources and commitments of WG scientists.

Accomplishments of the ALBWG over the past year include:

1. Initiating an MSE process for NPALB;
2. Developing work plans to implement the process (both optimistic and pessimistic)
3. Reviewing recommendations on stock status and conservation in light of 2014 data;
4. Reviewing the ALBWG catch table and identifying a data issues with non-member countries requiring clarification; and
5. Conducting an election for a new Chair; no candidates were identified and the WG voted to keep the standing Chair in place until ISC16, pending Plenary's approval.

The ALBWG proposes the following work plan and schedule for 2015/16:

1. Sept 2015 - J. Holmes will present the ALBWG MSE proposal to the WCPFC NC11 meeting;
2. April 2016 – Workshop for managers on fishery objectives and harvest control rules for MSE in Japan;
3. April 2016 – Intersessional workshop to review 2014 assessment model and new research to approve the stock assessment in Japan at a different location than the proposed workshop above; and
4. No time is requested for an update meeting in advance of ISC16.

The ALBWG identified the following issues for consideration by the ISC Plenary:

1. The ALBWG Chair has asked the STATWG Chair to seek clarification on two issues: (1) the latitudinal band in which catches were made by Vanuatu and reported to the ISC as FAO Area 87 since there is concern these catches may not be NPALB; and (2) whether non-ISC countries are reporting total NPALB catches (eastern and western and central Pacific) to the WCPFC and are published in the yearbook; and
2. The ALBWG is seeking advice on engaging with IATTC managers on the MSE process to get input on fishery objectives and harvest control rules.

The ALBWG Chair did not discuss the MSE proposal developed by the ALBWG but noted that it was included in *Annex 8* as Attachment 4.

Discussion

The ALBWG's plan for a workshop on the NPALB MSE was discussed. The ALBWG proposed an April 2016 meeting with two segments. In the first portion the ALBWG would meet with managers to discuss MSE and gain their input; the second portion will focus on technical issues related to model development for the 2017 stock assessment. No other meetings in advance of the 2016 Plenary are contemplated.

The ISC Chair agreed to discuss the need for input from IATTC managers with IATTC's Executive Director. The STATWG Chair was charged with providing an answer to the ALBWG Chair regarding reported catch statistics.

6.2 Pacific Bluefin Tuna

Z. Suzuki, PBFWG Chair, summarized the activities of the PBFWG *(Annex 9)*. PBF catch statistics provided by ISC members for the period from 1952 to 2014 by calendar year were updated. The preliminary PBF catch estimate for 2014 is 17,065 t, which is higher than the 2013 catch of 11,324 t. Each member country also provided information on their fisheries and research activities including catch and effort trends and operational changes. The updated Japanese CPUE time series for longline (adult fish) and troll (juvenile) series were presented.

The PBFWG met twice after ISC14, 20-24 April 2015 in Shimizu, Japan, for model and data improvements and 13 July 2015 in Kona, Hawaii, U.S.A., prior to the ISC15 Plenary. The April WG meeting was the first opportunity to discuss model and data improvements in preparation for the next full assessment; those discussions covered the CIE Review of the 2014 stock assessment and review of fishery data, biological parameters, and model and model structure improvements (see *Annex 9* for the report of WG meeting).

Z. Suzuki summarized the discussion on the impact of possible low recruitment in 2014, which was suggested by the 2014 troll survey targeting recruits. While the utility of this survey to provide reliable measures of PBF recruitment is still being assessed, the WG conducted a projection using the lowest estimated recruitment in the past (1958) as the recruitment for 2014, followed by a low recruitment phase throughout the projection period which is consistent with the 2014 ISC stock assessment projection scenario 6. The result showed that the stock is still able to achieve the interim management objective adopted by the WCPFC (to recover to SSB_{MED} by 2024 with more than 60% probability) with 72% probability compared to 89% in the 2014 ISC stock assessment Scenario 6. As before, the realization of benefits requires full implementation and strict compliance of current management measures. The risk of SSB declining below the historically lowest level observed at least one time within 10 years was about 34%, while it was about 24% in 2014 ISC stock assessment using projection scenario 6. Therefore, even if recruitment is low, the present results show that it is not likely to impede stock recovery. The WG agreed that it is not necessary to change the past conservation advice. The next full stock assessment scheduled for early 2016 will assess the utility of the recruitment survey and even the 2014 estimate.

The work plan for completing the next full assessment in early 2016 includes the following activities. The first WG workshop focused on model and data improvements and was held in Japan during 20-24 April 2015. The second WG workshop will be on data finalization for the full assessment 18-25 November 2015 in Kaohsiung, Taiwan. The third WG workshop will be held from 29 February to 11 March 2016 in La Jolla, California, U.S.A. to complete the full assessment.

Z. Suzuki stepped down as PBFWG Chair and H. Nakano from Japan was elected.

Discussion

The ISC Chair thanked. Z. Suzuki for serving as Chair of the PBFWG over the past two years.

There was a question about the difference in the confidence intervals in SSB projections under Scenario 6 and the updated scenario just conducted by the WG. This could be due to a wider range in recruitment values in the new scenario compared to Scenario 6 presented in the last stock assessment. The use of the lowest observed historical recruitment value (the 1958 year class) could contribute to this larger confidence interval.

Clarification was sought on the difference between the troll CPUE time series and the recruitment index. The CPUE time series uses the data from the winter-season fishery versus the index that uses survey data from the summer fishery.

It was noted that the catch in 2014 was higher than 2013 by about 6,000 t even though conservation measures have been implemented in this time period. This was mainly due to increased Japanese and Mexican catches even though both countries complied with current conservation measures in 2014. For Mexico, catches fell in 2013 due to the biennial catch limit, and this management measure is thought to have contributed to the apparent increase in 2014. The Korean catch in 2014 increased significantly.

It is uncertain if oceanographic conditions can be taken into account in the next stock assessment (scheduled for 2016). Results from the collaboration between ISC and PICES on this issue are unlikely to be available that soon, although the PBFWG could independently consider methods to integrate environmental conditions into the next stock assessment.

Some concern was expressed about the increased probability that SSB will fall below SSB_{LOSS} by 2024. This scenario will be updated as more information about recruitment trends becomes available.

With respect to the WG work plan, it was asked whether a better estimate of the steepness parameter in the stock-recruitment relationship will be attempted, recognizing that this was one of the recommendations of the external review. Methods that rely on existing data to produce a more plausible estimate have been discussed and will be explored in the next assessment. Alternatively, steepness could be estimated based on life history parameters. It was also pointed out that U.S. and Japanese scientists presented the possible range of steepness based on life history information in the last stock assessment and concluded steepness is likely very high.

There was concern about how the observed declines in recruitment in the troll boat survey will be taken into account in the conservation advice. It was noted that the new SSB projection scenario employed a worst case scenario.

6.3 Billfish

J. Brodziak, Chair of the BILLWG, provided the ISC15 Plenary with an overview of the work assignments and tasks completed by the BILLWG since ISC14 (*Annexes 5, 10, 11*). This included a list of future work expected to be conducted by the BILLWG following ISC15.

One work assignment was to hold an intersessional BILLWG workshop in January 2015 in Honolulu, Hawaii, U.S.A. to prepare data for the Western and Central North Pacific Ocean (WCNPO) striped marlin (MLS) stock assessment. This meeting included participants from Chinese Taipei, the IATTC, Japan, and the U.S.A. Twelve working papers were reviewed, revised, and accepted at this meeting by the BILLWG as providing the best available scientific information for striped marlin stock assessment. The meeting produced one ISC15 Plenary document, *Annex 5* Report of the Billfish WG Workshop (January 2015).

Assessment tasks completed during the January 2015 BILLWG workshop were to prepare fishery data for the stock assessment of WCNPO MLS in 2015 including catch by quarter data, CPUE standardization, size frequency data, tagging data, and life history parameters. Assessment tasks completed subsequent to the workshop were: (i) to submit all catch, standardized CPUE, and size composition data in electronic format to the data coordinator Darryl Tagami by 1 February 2015 and (ii) to submit final versions of working papers submitted during January 2015 workshop to Jon Brodziak by 10 February 2015.

Another work assignment was to hold an intersessional BILLWG workshop in April 2015 in Yokohama, Japan, for the purpose of conducting the stock assessment modeling for the WCNPO MLS stock assessment. This meeting included participants from Chinese Taipei, Japan, and the U.S.A. Three working papers were reviewed, revised, and accepted at this meeting by the BILLWG as providing the best available scientific information for the MLS stock assessment. The meeting produced two ISC15 Plenary documents. These were: *Annex 10* Report of the Billfish WG Workshop (April 2015) and *Annex 11* Stock Assessment of Striped Marlin in the North Pacific Ocean in 2015.

Tasks completed subsequent to the April 2015 workshop were: (i) to submit finalized copies of all working papers presented at this meeting to the BILLWG Chair, Jon Brodziak, by 20 May, 2015 and set up files of projections, (ii) to run the stock projection scenarios as agreed upon and distribute results to BILLWG by 29 May, 2015; and (iii) to draft the stock assessment report for submission to the ISC15 Plenary meeting.

The future work plan of the BILLWG for 2015-2016 included one primary work assignment, which is to conduct a Pacific blue marlin stock assessment update. This is the first priority task and is to be led by scientists from Japan and U.S.A. To accomplish this work, the BILLWG plans to hold two intersessional workshops: a data preparation workshop to be hosted in Honolulu, Hawaii, U.S.A. by the Pacific Islands Fishery Science Center (PIFSC) in December 2015 and an assessment modeling meeting to be hosted at a site to be determined in March 2016. Two second priority tasks are: (i) to conduct research on billfish life history parameters in a comparative study by scientists from Chinese Taipei, Japanese, and U.S.A. and (ii) for scientists from U.S.A., Chinese Taipei, Japan, Korea, and Chinese to conduct research on spatial and temporal variation in striped marlin size composition.

<u>Discussion</u>

None.

6.4 Shark

S. Kohin, SHARKWG Chair, provided a summary of SHARKWG activities over the past year (*Annexes 4, 7, 12*). The focus of the SHARKWG was on shortfin mako shark (SMA) with the working group developing data time series and a fishery indicator analysis of North Pacific SMA. Meetings of the SHARKWG since ISC 14 were held in Puerto Vallarta, Mexico, Shizuoka, Japan and Kona, Hawaii, U.S.A. The SHARKWG also held a webinar between meetings to provide an opportunity to review data updates and plan for the SMA fishery indicator analyses. Chinese Taipei, Japan, Mexico, U.S.A., and the WCPFC all actively participated in at least one intersessional SHARKWG meeting. Although blue shark (BSH) was not the focus of the working group over the past year, some information on BSH fishery data and biology was discussed over the past year.

Highlights of the two intersessional SHARKWG meetings, webinar, and one-day meeting held in advance of ISC15 were briefly presented; *Annexes 4 and 7* contain the full reports of the Working Group meetings. The SHARKWG Chair expressed appreciation to Mexico for hosting the SMA data preparatory meeting. The meeting was the first ISC meeting hosted by Mexico and was particularly valuable in enabling greater participation by Mexico in the SHARKWG. Hopefully more meetings in Mexico will follow. The webinar was considered a success, as it provided an opportunity for work group members to provide updates on ongoing work and for the SHARKWG Chair to reiterate assignments and plan for the assessment meeting, but it was not without challenges due to the difference of 11 hours between members in Mexico City and Taipei. The SHARKWG plans to hold other webinars in the future to progress work intersessionally.

The principal accomplishment of the SHARKWG since ISC14 was completion of the indicator-based analysis of North Pacific shortfin mako shark; *Annex 12* contains the full indicator analysis report. The indicator-analysis was conducted cooperatively by working group members.

The SHARKWG proposed a work plan for the coming year and an assessment schedule for providing stock status information on North Pacific BSH and SMA to the ISC Plenary in 2017 and 2018, respectively. The SHARKWG recognizes the difficulty in estimating shark catch and discards and the challenges presented by spatial segregation of pelagic sharks by size and sex. In addition, life history parameters for pelagic sharks are still rather uncertain. Work leading up to ISC16 will focus on improving catch and CPUE time series for both BSH and SMA and advancing research on biological and modeling studies. In the spring of 2017, the SHARKWG plans to conduct a benchmark assessment of BSH in the North Pacific using a Bayesian Surplus Production model.

The SHARKWG and ISC Chair discussed the request of the WCPFC NC to provide information to the WCPFC SC for their work on conducting analyses aimed at determining whether North Pacific BSH should be considered a northern stock. An information paper that will contain a list of relevant documents produced by the ISC SHARKWG is being prepared to forward to the WCPFC SC11 meeting.

Discussion

The proposed schedule of workshops for the next BSH assessment was discussed. Face-to-face meetings are an effective forum for resolving data uncertainties but are more costly both in terms of travel and time commitment. Given these tradeoffs it was recommended that the SHARKWG conduct one of the two proposed data preparation workshops as a webinar. This would respond to Members' concern about the number of meetings national scientists are expected to attend. The planned meeting schedule is listed in Table 11-1.

With respect to data and other assessment inputs, the SHARKWG places highest priority on improving the time series of catches, the CPUE index, and identifying a plausible stock-recruit relationship.

In the last assessment cycle the age structured model (Stock Synthesis) and the Bayesian surplus production model produced similar results and were endorsed by the WCPFC SC, suggesting that the simpler approach can produce reasonable results. Given the paucity of BSH data the Plenary decided that the SHARKWG should perform the next assessment using the Bayesian surplus production model. This model requires less data that are either readily available or estimable.

Focusing on a single assessment model platform would provide more time to resolve some of the current data and parameter issues. In particular, progress could be made on developing a plausible stock-recruitment relationship for low fecundity species and resolving uncertainties in the SMA catch and CPUE data sets. These efforts would support the production of a more sophisticated age-structured assessment in the future.

The Plenary endorsed the SHARKWG recommendation to convene a workshop with tuna RFMOs on the use of stock fishery indicators as an alternative to full assessments. Procedures to translate indicator results into management advice are needed. The ISC Chair will work with tuna RFMO Executive Directors to plan a workshop on this topic in 2016 or early 2017. It was noted that such a workshop would not solely focus on indicators for sharks.

At the WCPFC NC the ISC Chair will emphasize the need for member countries to submit working papers on methods to disaggregate grouped catch data for sharks into individual species. He will also emphasize that participation and preparation for WG activities is critical to the success of any science organization including the ISC. In many instances ISC WG participants have not completed tasks, delaying activities of the WG. Members need to support scientists both in terms of funding travel and allocating the time for them to do the work.

An annotated bibliography will be provided to the WCPFC SC to support its task of determining whether BSH is a northern stock. It was noted that the SHARKWG has not analyzed data to address this question.

6.5 Management Strategy Evaluation (MSE) Workshop

The following report on the MSE workshop was submitted by the ISC Chair.

The ISC convened a Management Strategy Evaluation Workshop in Yokohama, Japan, from 16-17 April 2015. The purpose of the workshop was to review the objectives, benefits, and requirements to implement an MSE, as well as recent progress made by tuna RFMOs towards adopting and implementing the MSE process. Discussions were aimed at defining the roles of managers, stakeholders and scientists in the MSE process, particularly as they relate to facilitating the completion of MSEs in the ISC. In attendance were 71 participants, including fishery managers, stakeholders and scientists. Keynote presentations defined the role of MSEs, including implementation strategies under fluctuating stock conditions. Application case studies of MSEs in the Pacific Ocean were presented, and the status of MSE development and implementation in the Western Central Pacific Fisheries Commission and Inter-American

Tropical Tuna Commission were discussed. An Expert Panel was convened during the workshop to stimulate further discussion among participants.

While the presentations were well received and informative, there was general agreement among participants that regular workshops on MSE would be beneficial. Managers are still unclear as to purpose and role of MSEs, despite the lengthy discussions during the workshop. While similar discussions on MSEs are occurring at other tuna RFMOs, implementation in the Pacific Ocean has been slow and limited to southern bluefin tuna in the Commission for the Conservation of Southern Bluefin Tuna.

Discussion

None.

7 STOCK STATUS AND CONSERVATION ADVICE

7.1 Albacore

J. Holmes, ALBWG Chair, summarized recommendations on stock status and conservation advice for NPALB. He noted that the last assessment was conducted in 2014 and that these recommendations were based on a qualitative review of 2014 fishery data from ISC member countries. This review showed that estimated total catch in 2014 (83,462 t) remains above but is declining toward the long-term mean (72,128 t), that catches by the major gear (troll, pole-and-line, longline) are around long-term means for each gear type, and that nominal effort (number of participating vessels) for each major gear type is either declining or has stabilized.

Discussion

It was noted that annual recruitment cannot be estimated in the short term between assessments, because there are no data sources for abundance prior to their initial recruitment to fisheries at age 2.

Long-term variation in the catch time series is evident; while this may be due to regime shifts, the ALBWG has not been able to establish a plausible link between abundance and environmental conditions.

China and non-ISC-member nations (principally Vanuatu) have not reported their WCPO NPALB catches but this probably doesn't substantially affect estimates of stock status, at least to date. Unreported catch is believed to be approximately 5,000 t annually in recent years.

Stock Status and Conservation Advice

Although the review of 2014 data did not include full catch data from China and non-ISC member countries, the ALBWG noted that these data were unlikely to change its view on stock status and conservation advice.

Stock Status

Because the calculated Fs for 2010-2012 relative to most candidate reference points, except F_{MED} and $F_{50\%}$ (which the ALBWG considers to be poor choices as reference points for this stock), are below 1.0, NPALB is not experiencing overfishing. The 2014 assessment estimated that spawning biomass in 2012 (110,101 t) was more than two times greater than the $20\%SSB_{CURRENT\ F=0}$ limit reference point established by the WCPFC, which means that the stock is not in an overfished state. Thus, the ISC concludes that overfishing is not occurring and that the stock is not in an overfished state (Figure 7-1**,** Figure 7-2**,** Figure 7-3**).**

Conservation Advice

The ISC concludes that the North Pacific albacore stock is healthy (SSB_{2012} >> $20\%SSB_{current\ F=0}$) and that current productivity (SSB_{2012}) is sufficient to sustain recent exploitation ($F_{2010\text{-}2012}$), assuming average historical recruitment (about 42.8 million fish annually) continues.

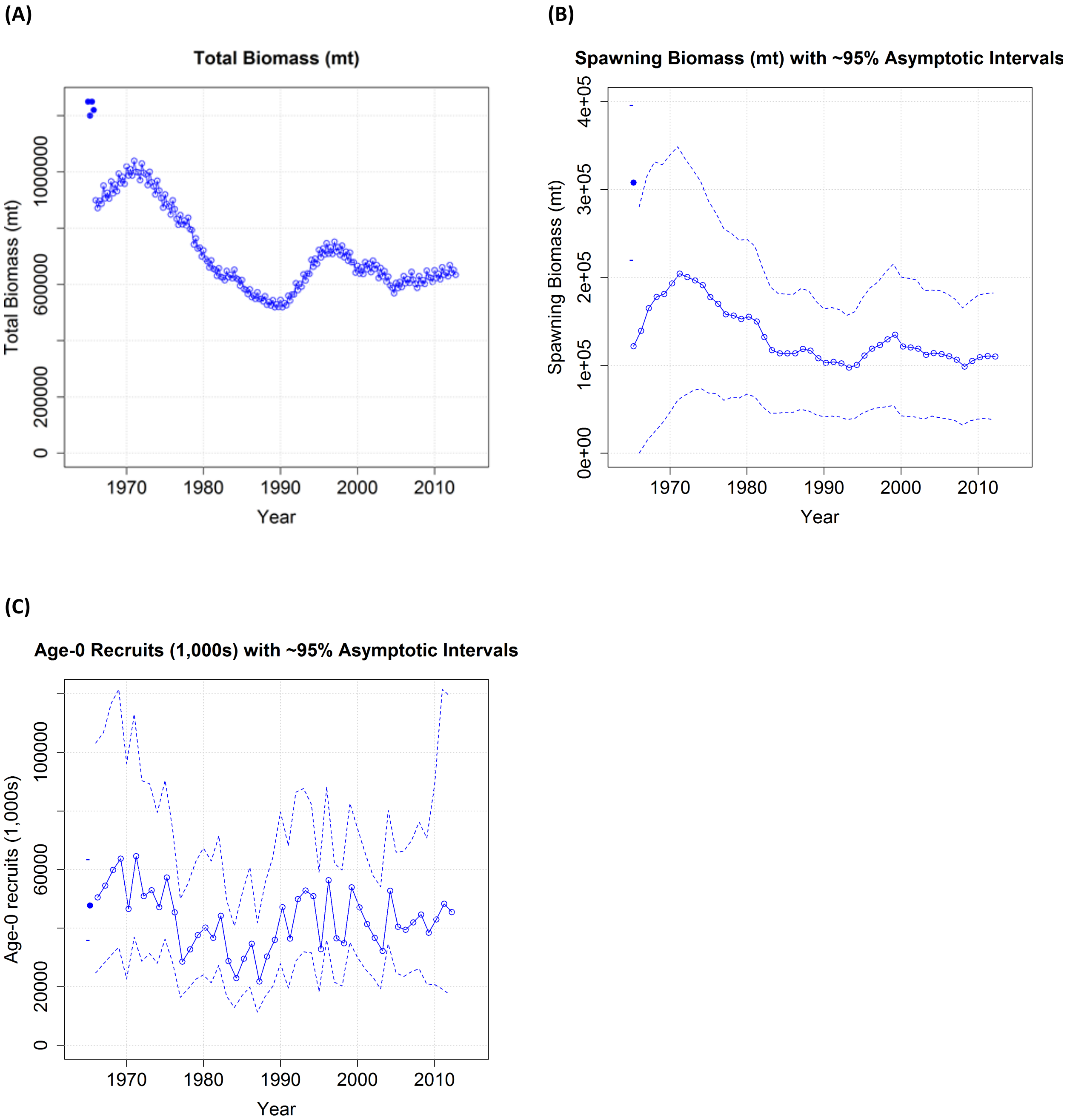

Figure 7-1. Estimated total age-1+ biomass (A), female spawning biomass (B), and age-0 recruitment (C) of North Pacific albacore tuna (*Thunnus alalunga*) including unfished biomass and recruitment estimates (closed circles). The open circles represent the maximum likelihood estimates of each quantity and the dashed lines in the SSB. (B) and recruitment (C) plots are the 95% asymptotic intervals of the estimates (± 2 standard deviations) in lognormal (SSB – B) and arithmetic (recruitment – C) space. Since the assessment model represents time on a quarterly basis, there are four estimates of total biomass (A) for each year, but only one annual estimate of spawning biomass (B) and recruitment (C).

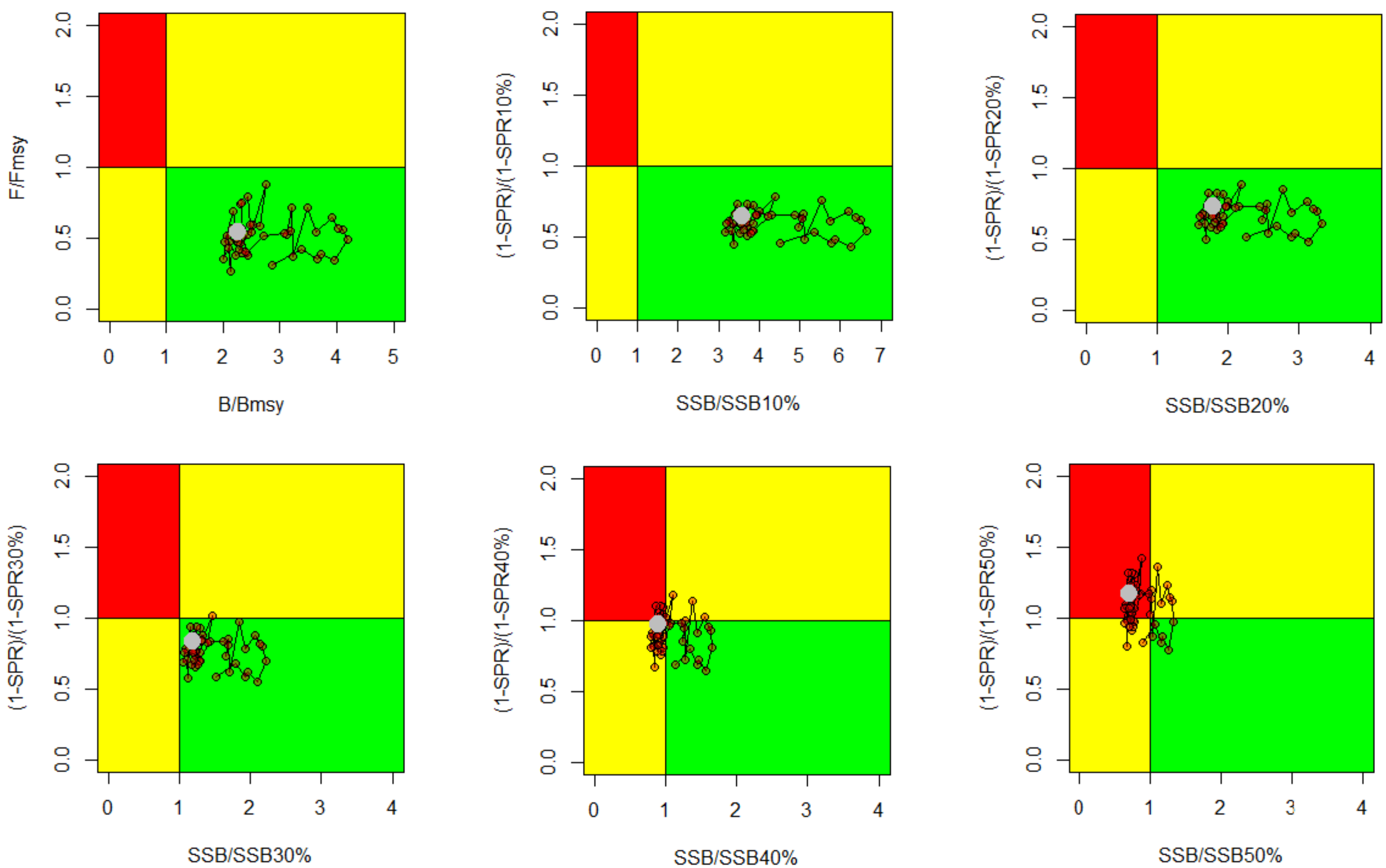

Figure 7-2 Alternative Kobe plots showing North Pacific albacore (*Thunnus alalunga*) stock status based on $F_{2010\text{-}2012}$ relative to MSY-based reference

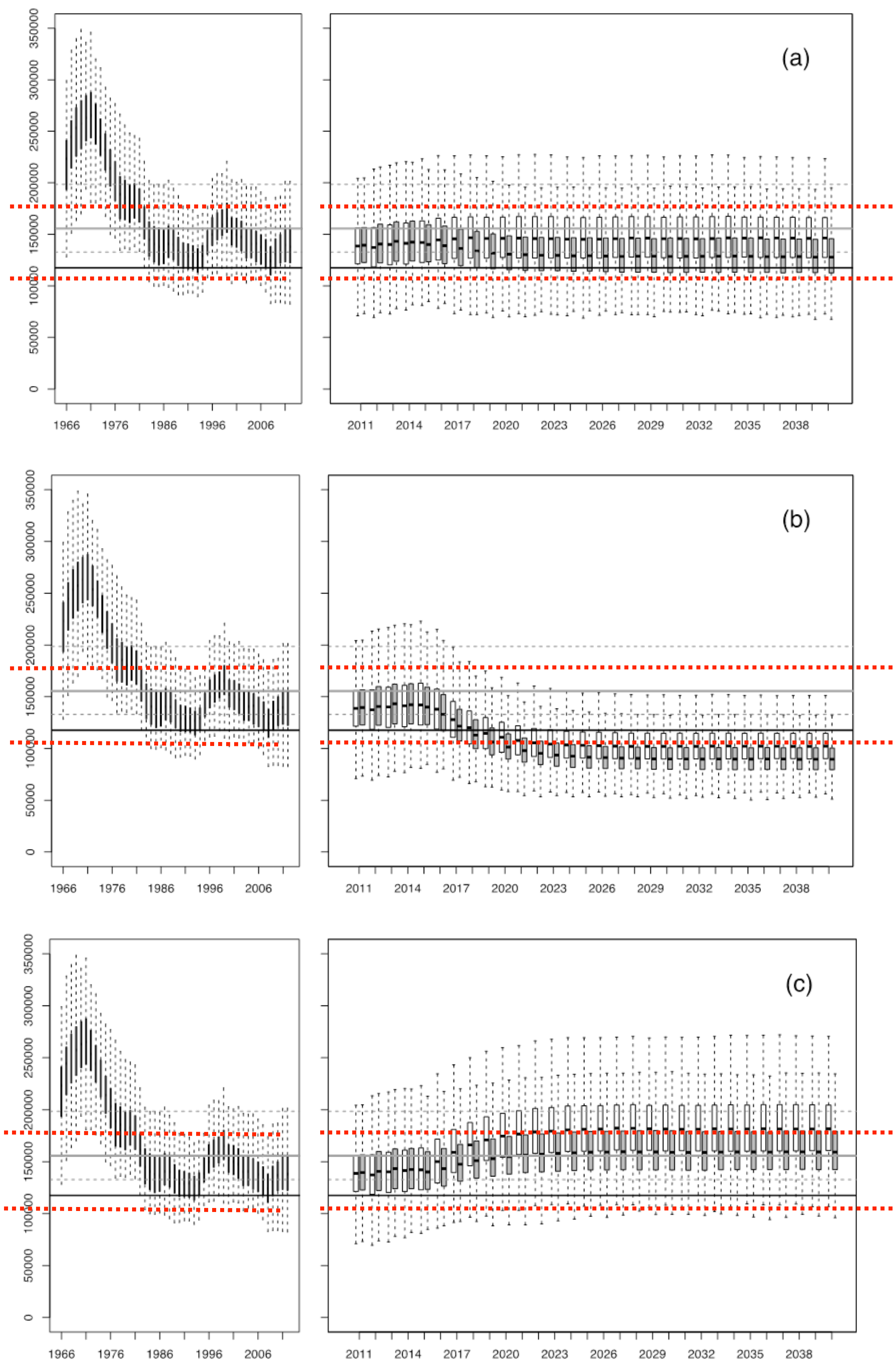

Figure 7-3. Historical (left) and future trajectories of north Pacific albacore (*Thunnus alalunga*) female spawning biomass (SSB) based on to two constant harvest scenarios ($F_{2002\text{-}2004}$ - gray boxplot; $F_{2010\text{-}2012}$ - white boxplot) for average historical recruitment (a), low historical recruitment (b) and high historical recruitment (c) scenarios. The solid gray and red dashed lines represent median, 25% and 75% quintiles of past SSB, respectively. The solid black line is the average of 10 lowest estimated historical female SSB values, i.e., the SSB-ATHL threshold, which is no longer in use. Outlier values are not shown in these figures.

7.2 Pacific Bluefin Tuna

Z. Suzuki, PBFWG Chair, reported that no new assessment was conducted by the PBFWG in 2015. The ISC conducted a full stock assessment in 2014. Based on the assessment results at ISC14, which concluded that “the current (2012) PBF biomass level is near historically low levels and experiencing high exploitation rates above all biological reference points except for F_{LOSS},” and the projection results of various scenarios the ISC in 2014 advised that “further substantial reductions in fishing mortality and juvenile catch over the whole range of juvenile ages should be considered to reduce the risk of SSB falling below its historically lowest level”.

Regarding fishing operations in 2015: in both the eastern and western Pacific Ocean, fishermen in general are reporting an increased catch rate and size of fish in the catch (in the case of Mexico) in 2015, while preliminary results from the Japanese recruitment survey index suggested low recruitment in 2014.

The PBFWG in April 2015 discussed the impact of possible low recruitment in 2014. The PBFWG noted that the recruitment information for 2014 is preliminary and uncertain and agreed that it is not necessary to change the past conservation advice.

The PBFWG plans to address comments from the 2012 external review as part of the next stock assessment.

Discussion

The implications of preliminary evidence of poor recruitment in 2014 and increased catch for most age classes compared to 2013 were discussed extensively in relation to drafting conservation advice for this stock.

It was noted that the WCPFC and IATTC strengthened their conservation measures to be applied in 2015 in response to the 2014 ISC Conservation Advice.

It was noted that the NC may request additional projection scenarios to be evaluated and the ISC may also formulate and analyze scenarios it deems useful to managers.

Stock Status and Conservation Advice

ISC did not conduct a new stock assessment in 2015 and provides advice based on the assessment conducted in 2014.

Stock Status

Although no target or limit reference points have been established for the PBF stock under the auspices of the WCPFC and IATTC, the current F average over 2009-2011 exceeds all target and limit biological reference points (BRPs) commonly used by fisheries managers except for F_{LOSS}, and the ratio of SSB in 2012 relative to unfished SSB (depletion ratio) is

less than 6%. In summary, based on candidate reference point ratios, overfishing is occurring and the stock is overfished.

Projections associated with the 2014 stock assessment examined a suite of recruitment hypotheses, including a low recruitment scenario which is consistent with the preliminary estimate of PBF recruitment in the WPO in 2014. Even with the low recruitment value resampled from the past low recruitment period, the projection results presented to the Plenary showed that the initial rebuilding goal adopted by WCPFC to recover to SSB_{MED} by 2024 with a >60% probability can be achieved.

The catch in 2014 (17,076 t) was similar to that in 2011 (17,107 t), and increased from the 2012-2013 level (13,109 t in average), in most size classes on both sides of the Pacific Ocean. However, there was no indication of a significant increase in fishing effort, which may suggest an increase in the availability or catchability of fish. Although the catch in 2014 was consistent with the conservation measures adopted by RFMOs, the increase could affect the recovery. The impact of these increases is yet to be analyzed and will be assessed by the PBFWG in the next assessment.

Based on the above observations, the ISC provides the following conservation advice.

Conservation Advice

In relation to the projections requested by NC9, only Scenario 6,[2] the strictest one, resulted in an increase in SSB even under a low recruitment scenario.

If the low recruitment of recent years continues, the risk of SSB falling below its historically lowest level observed would increase. This risk can be reduced with implementation of more conservative management measures.

If the specifications of the harvest control rules used in the projections were modified to include a definition of juveniles that is more consistent with the maturity ogive[3] used in the stock assessment, projection results could be different; for example, rebuilding may be faster. The various harvest scenario projections defined "juvenile" based on weight, which is inconsistent with what the WG used (age). Any proposed reductions in juvenile catch should consider all non-mature individuals.

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[2] For the WCPO, a 50% reduction of juvenile catches from the 2002-2004 average level and F no greater than $F_{2002\text{-}2004}$. For the EPO, a 50% reduction of catches from 5,500 t. From the scientific point of view, juvenile catches were not completely represented in the reductions modeled under Scenario 6 for some fisheries although these reductions comply with the definition applied by NC9.

[3] 20% at age 3; 50% at age 4; 100% at age 5 and older in the assessment versus <30 kg in the projections.

Given the low level of SSB, uncertainty in future recruitment, and importance of recruitment in influencing stock biomass, monitoring of recruitment and SSB should be strengthened to allow the trend of recruitment and SSB to be understood in a timely manner.

7.3 Blue Marlin

The most recent stock assessment was completed in 2013. J. Brodziak reported that no new stock assessment for Pacific blue marlin was conducted by the BILLWG in 2015.

ISC did not conduct a new assessment in 2015 and provides stock status and conservation advice adopted in 2013 with modifications to provide more specificity.

Stock Status and Conservation Advice

Stock Status

The Kobe plots from the 2013 stock assessment indicate that the Pacific blue marlin spawning stock biomass decreased to slightly above the BMSY level (19,437 t) by about 2005, and increased slightly from 2010-2011. The base case assessment model indicates that the Pacific blue marlin stock was not overfished and was not subject to overfishing relative to MSY-based reference points (see Figure 7-4**).**

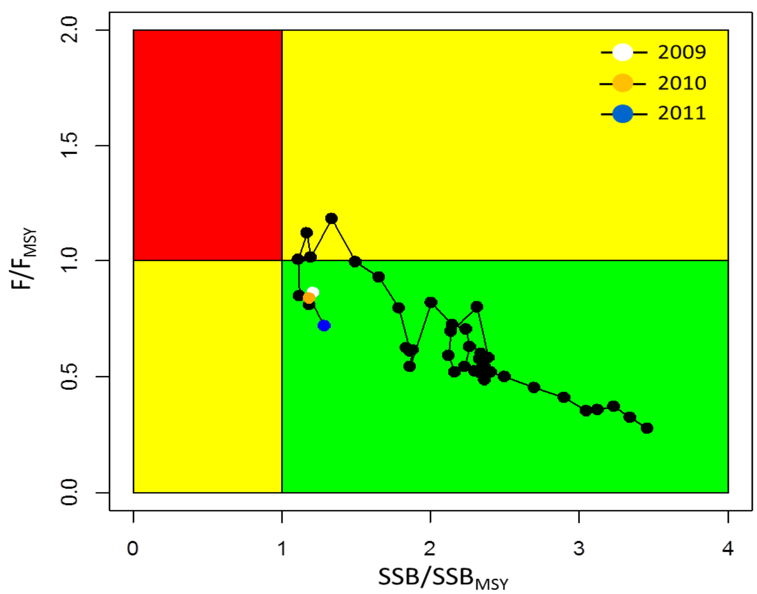


Figure 7-4. Kobe plot for blue marlin (*Makaira mazara*).

Conservation advice

Based on the 2013 stock assessment, the Pacific blue marlin stock was not overfished and was not experiencing overfishing. The stock is nearly fully exploited. Stock biomass has

declined since the 1970s, was stable from about 2005 to 2010, and then increased slightly through 2011. The fishing mortality rate should not be increased from the 2009-2011 level to avoid overfishing.

7.5 Striped marlin

The most recent stock assessment was completed in 2011. J. Brodziak reported that a stock assessment update for WCNPO striped marlin (MLS) was conducted by the BILLWG in 2015 (*Annexes 5, 10, 11*).

Stock Identification and Distribution: The WCNPO MLS stock is separated from the Eastern North Pacific stock based on results of population genetic studies and empirical patterns in the spatial distribution of fishery catch-per-unit effort. The boundary of the Western and Central North Pacific stock is defined to be the waters of the Pacific Ocean west of 140°W and north of the equator.

Catches: Catches of WCNPO MLS have exhibited a long-term decline since the 1970s. Annual catches averaged roughly 8,173 mt during 1975-1979 and declined by 59% to an average of 3,385 mt per year during 2004-2013. Reported catches in 2013 (the last year in the assessment update) totaled 2,984 mt, which was the third lowest reported catch since 1975 (Table 7-1).

Data and Assessment: Catch data was collected from all ISC countries and from countries reporting catches to the WCPFC (Table 7-1). The growth curve was re-estimated using newly developed ageing data and the values of steepness and natural mortality were also re-estimated using available biological information. Standardized CPUE data used to measure trends in relative abundance were provided by Japan, U.S.A., and Chinese Taipei. The stock assessment was conducted using the Stock Synthesis assessment model. The assessment model was fitted to relative abundance indices and size composition data in a likelihood-based statistical framework. Maximum likelihood estimates of model parameters, derived outputs, and their variances were used to characterize stock status and to develop stock projections (Figure 7-5).

Biological Reference Points: Reference points based on MSY were estimated in the Stock Synthesis assessment model. The point estimate of maximum sustainable yield (± 1 standard error) was MSY = 5,657 mt ± 176. The point estimate of the spawning stock biomass to produce MSY was SSB_{MSY} = 2,819 mt ± 85. The point estimate of F_{MSY}, the fishing mortality rate to produce MSY (average fishing mortality on ages 3 and older) was F_{MSY} = 0.63 ± 0.01 and the corresponding equilibrium value of spawning potential ratio at MSY was SPR_{MSY} = 18.1% ± 0.1%.

Projections: Stock projections for future spawning biomass and catch biomasses of WCNPO MLS during 2013 to 2020 account for uncertainty in future stock size and recruitment. Three states of nature for future recruitment were assumed for the projections. These were: **Recent Recruitment** in which the recent low recruitment pattern (2007-2011) was randomly resampled; **Medium-Term Recruitment** in which the moderate recruitment pattern since 1994 (1994-2011) was randomly resampled; and **Stock-Recruitment Curve** in which the residuals from the estimated stock-recruitment curve (1975-2011) were randomly resampled and added to expected recruitment. Projections were run using a pooled-sex, age-structured simulation model, included estimation uncertainty for the initial population size at age, and used life history and fishery parameters from the base case stock assessment model.

Ten projected harvest scenarios (Table 7-1 through

Table 7-4) were analyzed; there were six fishing mortality rate scenarios and four constant catch biomass scenarios. The six annual fishing mortality scenarios were: (1) constant fishing mortality equal to the 2001-2003 average ($F_{2001\text{-}2003} = F_{10\%}$); (2) constant fishing mortality equal to the current F ($F_{current} = F_{12\%}$), the 2010-2012 average; (3) constant fishing mortality equal to F_{MSY} ($F_{MSY} = F_{18\%}$); (4) constant fishing mortality to produce a spawning potential ratio (SPR) of 0.2 ($F_{20\%}$); (5) constant fishing mortality to produce an SPR of 0.3 ($F_{30\%}$); and (6) no fishing ($F_{100\%}$). The four annual catch biomass scenarios were: 70% of the average catch during 2010-2012 ($C_{70\%}$ = 2,216 mt); 80% of the average catch during 2010-2012 ($C_{80\%}$ = 2,533 mt); 90% of the average catch during 2010-2012 ($C_{90\%}$ = 2,849 mt); and 80% of highest catch by country during 2000-2003 as described in the WCPFC CMM 2010-01 ($C_{CMM\ 2010\text{-}01}$ = 3,490 mt). Spawning stock biomass (SSB) in the last projection year (2020) relative to 2015 was the performance measure used to describe the future stock impacts while projected median annual catches during 2015-2020 measured the productivity of the fishery.

When the current status quo harvest rate is maintained ($F_{12\%}$), the stock is projected to have a 75% probability that $SSB_{2020} < SSB_{2015}$ under the recent recruitment hypothesis. The risk that $SSB_{2020} < SSB_{2015}$ is reduced to 25% and 5% under the medium-term recruitment and stock-recruitment curve hypotheses, respectively (Table 7-2). In contrast, if harvest rates were to increase to 2001-2003 levels ($F_{10\%}$), then the probabilities that $SSB_{2020} < SSB_{2015}$ increase for all three recruitment hypotheses, ranging from 50% to 95%. Conversely, if fishing mortality was reduced to the MSY level ($F_{18\%}$) the stock has a 0% probability that $SSB_{2020} < SSB_{2015}$ under the medium-term recruitment and stock-recruitment curve hypotheses, but a 5% probability that $SSB_{2020} < SSB_{2015}$ under the low recruitment hypothesis. Under all recruitment hypotheses, fishing at the F_{MSY} level provides a safe level of harvest if a less than a 50% probability of declining SSB ($SSB_{2020} < SSB_{2015}$) is used as a threshold. Also, fishing at the F_{MSY} level under the medium-term recruitment and stock-recruitment curve hypotheses would likely produce larger increases in catches from 2015 to 2020 compared to the recent recruitment hypothesis (Table 7-3).

If fishing intensity were reduced to $F_{30\%}$, then $SSB_{2020} > SSB_{2015}$ is estimated under all recruitment hypotheses and there would be a 50% probability of rebuilding the stock to SSB_{MSY} by 2019 and 2018 under the medium-term recruitment and stock-recruitment curve hypotheses, respectively (

Table 7-4). Last, if there was a cessation of fishing mortality after 2015, spawning stock biomass would have a 50% probability of rebuilding to the SSB_{MSY} level by 2017 under all recruitment hypotheses.

When catch is reduced 30% from the current level (2010-2012 level to 2,216 t), spawning stock biomass is projected to have a 5% probability of falling below the 2015 level for the recent recruitment hypothesis, but 0% probability under the medium-term recruitment and stock-recruitment curve hypotheses.

If catches were increased to 3,490 t (about 80% of highest catches during 2000-2003; the highest catch scenario, WCPFC CMM 2010-01), the stock would be projected to have a 25% probability that $SSB_{2020} < SSB_{2015}$ under the recent recruitment hypothesis, and a 0% probability that $SSB_{2020} < SSB_{2015}$ under the medium-term recruitment and stock-recruitment curve hypotheses.

Under the recent recruitment hypothesis, none of the constant catch scenarios result in a 50% probability that the stock rebuilds to SSB_{MSY} level within the projection period (2015-2020) (

Table 7-4). Under the medium-term recruitment and stock-recruitment curve hypotheses, most of the constant catches scenarios allow the population to rebuild to the SSB_{MSY} level within 2015-2020, except for constant catches of 3,500 t (

Table 7-4).

Under all recruitment hypotheses, constant catches at levels less than or equal to 2,850 t appear sustainable assuming a 50% probability of declining SSB is used as a threshold. Although constant catches at levels less than or equal to 3,500 t also has less that a 50% probability that SSB_{2020} < SSB_{2015}, constant catches at levels less than or equal to 2,850 mt would likely produce more stable catches over time under the three recruitment hypotheses (Table 7-3).

Table 7-1. Reported catch (mt), population biomass (mt), spawning stock biomass (mt), relative spawning biomass (SSB/SSB_{MSY}), recruitment (thousands), fishing mortality (average of ages 3 and older), relative fishing mortality (F/F_{MSY}), exploitation rate, and spawning potential ratio of WCNPO striped marlin.

Year	2007	2008	2009	2010	2011	2012	2013	Mean[1]	Min[1]	Max[1]
Reported Catch	3084	3503	2468	2852	3125	3521	2984	5822	2468	10594
Population Biomass	6915	6773	6409	5156	7823	7349	6819	12758	5156	28440
Spawning Stock Biomass	1192	1171	970	984	873	1013	1094	2025	815	6946
Relative Spawning Biomass	0.42	0.42	0.34	0.35	0.31	0.36	0.39	0.75	0.29	2.46
Recruitment (age 0)	240	242	63	496	155	224	352	410	63	1369
Fishing Mortality	0.82	0.99	0.80	0.96	0.89	0.97	0.76	0.95	0.47	1.54
Relative Fishing Mortality	1.29	1.57	1.27	1.51	1.41	1.53	1.20	1.50	0.74	2.44
Exploitation Rate	45%	52%	39%	55%	40%	48%	44%	48%	32%	65%
Spawning Potential Ratio	15%	12%	16%	13%	12%	12%	14%	13%	7%	24%

[1] During 1975-2013

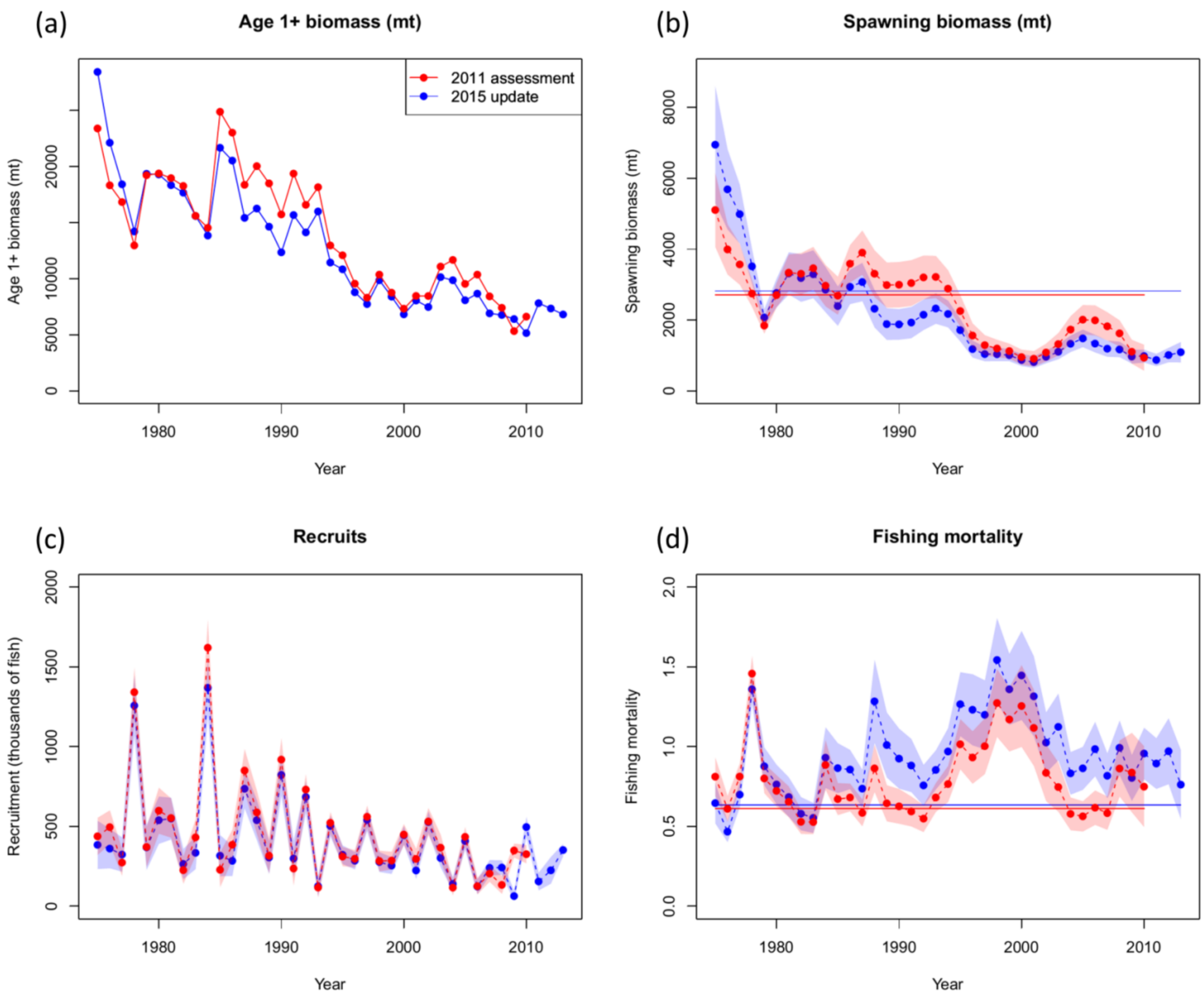


Figure 7-5 Comparison of time series of total biomass (age 1 and older) (a), spawning biomass (b), age-0 recruitment (c), and instantaneous fishing mortality (year-1) (d) for the WCNPO striped marlin between the 2011 stock assessment (red) and the 2015 update (blue). The solid line with circles represents the maximum likelihood estimates for each quantity and the shadowed area represents the 95% asymptotic intervals of the estimates (± 1.96 standard deviations). The solid horizontal lines indicated the MSY-based reference points for 2011 (red) and 2015 (blue).

Table 7-2. Decision table of projected percentiles of relative spawning stock biomass in 2020 relative to 2015 (SSB_{2020}/SSB_{2015}) for alternative states of nature (columns) and harvest scenarios (rows). Fishing intensity ($F_{x\%}$) alternatives are based on 10% (average 2001-2003), 12% (average 2010-2012 defined as current), 18% (MSY level), 20%, 30%, and 100% (no fishing). Catch alternatives are based on the 70%, 80%, and 90% of average catches during 2010-2012 (2,216; 2,533; and 2,849 mt), and 80% of average catches during 2000-2003 (3,490 mt). Red blocks indicate the declining trend of SSB in 2020 from 2015 where SSB_{2020}/SSB_{2015} is less than one.

Run	Harvest scenario	Recent Recruitment					Medium-Term Recruitment					Stock-Recruitment Curve				
		5th	25th	50th	75th	95th	5th	25th	50th	75th	95th	5th	25th	50th	75th	95th
1	$F_{2001\text{-}2003} = F_{10\%}$	0.46	0.58	0.68	0.80	0.92	0.63	0.78	0.86	0.94	1.02	0.59	0.76	0.91	1.08	1.32
2	$F_{2010\text{-}2012} = F_{12\%}$	0.57	0.71	0.82	0.94	1.08	0.78	0.94	1.04	1.12	1.21	0.79	1.00	1.18	1.37	1.65
3	$F_{MSY} = F_{18\%}$	0.92	1.10	1.25	1.40	1.56	1.26	1.44	1.55	1.66	1.78	1.42	1.71	1.95	2.22	2.59
4	$F_{20\%}$	1.02	1.22	1.38	1.53	1.72	1.41	1.59	1.71	1.82	1.94	1.60	1.92	2.18	2.46	2.86
5	$F_{30\%}$	1.56	1.83	2.05	2.22	2.45	2.12	2.36	2.49	2.62	2.78	2.51	2.91	3.25	3.62	4.13
6	$F_{100\%}$	4.26	4.77	5.23	5.55	5.93	5.45	5.91	6.17	6.37	6.66	6.43	7.09	7.78	8.46	9.31
7	$C_{70\%}$ = 2216.2 mt	0.92	1.21	1.67	2.06	2.53	1.58	2.19	2.56	2.87	3.16	2.04	2.99	3.70	4.52	5.58
8	$C_{80\%}$ = 2532.7 mt	0.90	1.05	1.39	1.74	2.24	1.32	1.82	2.21	2.54	2.86	1.67	2.54	3.29	4.13	5.27
9	$C_{90\%}$ = 2849.4 mt	0.88	1.01	1.19	1.48	1.96	1.25	1.53	1.89	2.22	2.58	1.46	2.17	2.91	3.76	4.95
10	$C_{CMM\ 2010\text{-}01}$ = 3490.1 mt	0.87	0.97	1.09	1.19	1.54	1.19	1.31	1.44	1.70	2.06	1.39	1.71	2.31	3.13	4.40

Table 7-3. Projected trajectory of catch (mt) for alternative states of nature (columns) and harvest scenarios (rows). Fishing intensity ($F_{x\%}$) alternatives are based on 10% (average 2001-2003), 12% (average 2010-2012 defined as current), 18% (MSY level), 20%, 30%, and 100% (no fishing). Catch alternatives are based on the 70%, 80%, and 90% of average catches during 2010-2012 (2,216; 2,533; and 2,849 mt), and 80% of average catches during 2000-2003 (3,490 mt).

Run	Harvest scenario	Recent Recruitment						Medium-Term Recruitment						Stock-Recruitment Curve					
		2015	2016	2017	2018	2019	2020	2015	2016	2017	2018	2019	2020	2015	2016	2017	2018	2019	2020
1	$F_{2001\text{-}2003} = F_{10\%}$	3858	3289	2943	2843	2861	2850	4229	3995	3882	3820	3811	3836	4270	4167	4101	4051	3985	3986
2	$F_{2010\text{-}2012} = F_{12\%}$	3391	3124	2838	2768	2760	2775	3707	3775	3757	3715	3710	3725	3744	3928	4031	4133	4166	4232
3	$F_{MSY} = F_{18\%}$	2458	2622	2646	2607	2590	2591	2674	3130	3335	3372	3381	3405	2697	3254	3632	3971	4213	4393
4	$F_{20\%}$	2254	2478	2559	2517	2528	2530	2451	2953	3201	3265	3290	3315	2472	3070	3494	3872	4141	4363
5	$F_{30\%}$	1525	1861	2068	2136	2178	2194	1652	2198	2558	2712	2791	2846	1665	2284	2797	3250	3624	3907
6	$F_{100\%}$	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	$C_{70\%}$ = 2216.2 mt	2216	2216	2216	2216	2216	2216	2216	2216	2216	2216	2216	2216	2216	2216	2216	2216	2216	2216
8	$C_{80\%}$ = 2532.7 mt	2533	2533	2533	2533	2533	2533	2533	2533	2533	2533	2533	2533	2533	2533	2533	2533	2533	2533
9	$C_{90\%}$ = 2849.4 mt	2802	2792	2782	2813	2847	2849	2849	2849	2849	2849	2849	2849	2849	2849	2849	2849	2849	2849
10	$C_{CMM\ 2010\text{-}01}$ = 3490.1 mt	2802	2760	2718	2653	2641	2644	3034	3310	3476	3490	3490	3490	3012	3447	3490	3490	3490	3490

Table 7-4. Projected trajectory of median spawning stock biomass (SSB in mt) for alternative states of nature (columns) and harvest scenarios (rows). Fishing intensity ($F_{x\%}$) alternatives are based on 10% (average 2001-2003), 12% (average 2010-2012 defined as current), 18% (MSY level), 20%, 30%, and 100% (no fishing). Catch alternatives are based on the 70%, 80%, and 90% of average catches during 2010-2012 (2,216; 2,533; and 2,849 mt), and 80% of average catches during 2000-2003 (3,490 mt). Green blocks indicate the projected SSB is greater than MSY level (SSB_{MSY} = 2,819 mt).

Run	Harvest scenario	Recent Recruitment						Medium-Term Recruitment						Stock-Recruitment Curve					
		2015	2016	2017	2018	2019	2020	2015	2016	2017	2018	2019	2020	2015	2016	2017	2018	2019	2020
1	$F_{2001\text{-}2003} = F_{10\%}$	1127	937	821	774	766	765	1182	1093	1051	1020	1014	1017	1185	1130	1111	1096	1085	1084
2	$F_{2010\text{-}2012} = F_{12\%}$	1127	1058	985	940	927	927	1182	1225	1241	1227	1220	1225	1185	1264	1314	1346	1383	1402
3	$F_{MSY} = F_{18\%}$	1127	1316	1393	1412	1420	1414	1182	1496	1709	1794	1825	1837	1185	1540	1812	2019	2198	2316
4	$F_{20\%}$	1127	1373	1495	1541	1559	1559	1182	1557	1830	1951	2001	2024	1185	1601	1936	2200	2425	2583
5	$F_{30\%}$	1127	1581	1924	2142	2264	2313	1182	1780	2310	2647	2850	2949	1185	1824	2447	2986	3473	3856
6	$F_{100\%}$	1127	2045	3109	4168	5105	5894	1182	2266	3611	5020	6270	7290	1185	2307	3797	5521	7380	9222
7	$C_{70\%}$ = 2216.2 mt	1324	1639	1829	1981	2100	2207	1378	1883	2368	2837	3217	3533	1391	1910	2556	3333	4190	5153
8	$C_{80\%}$ = 2532.7 mt	1324	1545	1639	1720	1774	1837	1378	1791	2168	2526	2807	3048	1391	1820	2356	3010	3745	4576
9	$C_{90\%}$ = 2849.4 mt	1324	1478	1494	1519	1556	1572	1378	1702	1997	2254	2443	2604	1391	1738	2170	2708	3360	4049
10	$C_{CMM\ 2010\text{-}01}$ = 3490.1 mt	1324	1466	1463	1456	1448	1438	1378	1648	1798	1886	1946	1978	1391	1683	1945	2281	2743	3211

Discussion

It was noted that fish smaller than 120 cm (eye to fork length) are caught in commercial fisheries although all sizes 120 cm and below are cumulated in a single bin in the assessment model. Recruitment pulses are detectable in fisheries catching age-0 fish; for example in the Hawaii longline fishery.

The next assessment is scheduled for 2018 and will be a benchmark assessment so many of the CPUE indices considered in this update will be scrutinized more closely at that time. Ideally future assessments could be spatially explicit rather than using fisheries as proxies.

Stock Status and Conservation Advice

Stock Status

Estimates of population biomass of the WCNPO striped marlin stock (*Kajikia audax*) exhibit a long-term decline (Table 7-1 and **Error! Reference source not found.**). Population biomass (age-1 and older) averaged roughly 20,513 t, or 46% of unfished biomass during 1975-1979, the first 5 years of the assessment time frame, and declined to 6,819 t, or 15% of unfished biomass in 2013. Spawning stock biomass is estimated to be 1,094 t in 2013 (39% of SSB_{MSY}, the spawning stock biomass to produce MSY, Figure 7-7). Fishing mortality on the stock (average F on ages 3 and older) is currently high (Figure 7-8) and averaged roughly $F = 0.94$ during 2010-2012, or 49% above F_{MSY}. The predicted value of the spawning potential ratio (SPR, the predicted spawning output at current F as a fraction of unfished spawning output) is currently $SPR_{2010\text{-}2012}$ = 12% ,which is 33% below the level of SPR required to produce MSY. Recruitment averaged about 308,000 recruits during 1994-2011, which was 25% below the 1975-2013 average. No target or limit reference points have been established for the WCNPO striped marlin stock under the auspices of the WCPFC.

The WCNPO striped marlin stock is expected to be highly productive due to its rapid growth and high resilience to reductions in spawning potential. The status of the stock is highly dependent on the magnitude of recruitment, which has been below its long-term average since 2007, with the exception of 2010 (Table 7-1). Changes in recent size composition data in comparison to the previous assessment resulted in changes in fishery selectivity estimates and also affected recruitment estimates. This, in turn, affected the scaling of biomass and fishing mortality to reference levels. See Figure 7-5.

When the status of striped marlin is evaluated relative to MSY-based reference points, the 2013 spawning stock biomass is 61% below SSB_{MSY} (2819 t) and the 2010-2012 fishing mortality exceeds F_{MSY} by 49% (Figure 7-9**). Therefore, overfishing is occurring relative to MSY-based reference points and the WCNPO striped marlin stock is overfished.**

Conservation Advice

The stock has been in an overfished condition since 1977, with the exception of 1982 and 1983, and fishing appears to be impeding rebuilding especially if recent (2007-2011) low recruitment levels persist. Projection results show that fishing at F_{MSY} could lead to median spawning biomass increases of 25%, 55%, and 95% from 2015 to 2020 under the recent

recruitment, medium-term recruitment, and stock recruitment-curve scenarios. Fishing at a constant catch of 2,850 t could lead to potential increases in spawning biomass of 19% to over 191% by 2020, depending upon the recruitment scenario. In comparison, fishing at the 2010-2012 fishing mortality rate, which is 49% above F_{MSY}, could lead to changes in spawning stock biomass of -18% to +18% by 2020, while fishing at the average 2001-2003 fishing mortality rate ($F_{2001\text{-}2003}$=1.15), which is 82% above F_{MSY}, could lead to spawning stock biomass decreases of -32% to -9% by 2020, depending upon the recruitment scenario.

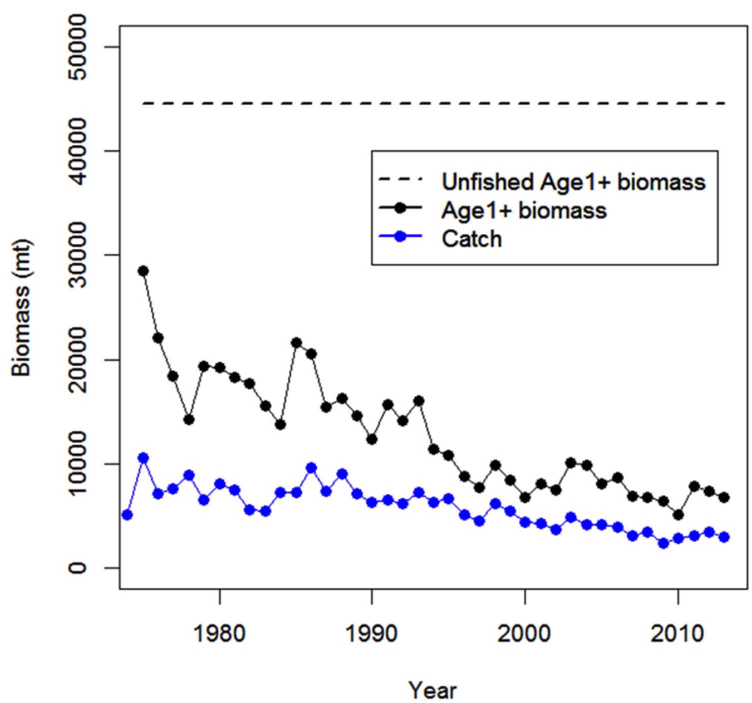


Figure 7-6. Trend in population biomass and reported catch biomass of Western and Central North Pacific striped marlin (*Kajikia audax*) during 1975-2013 relative to unfished biomass.

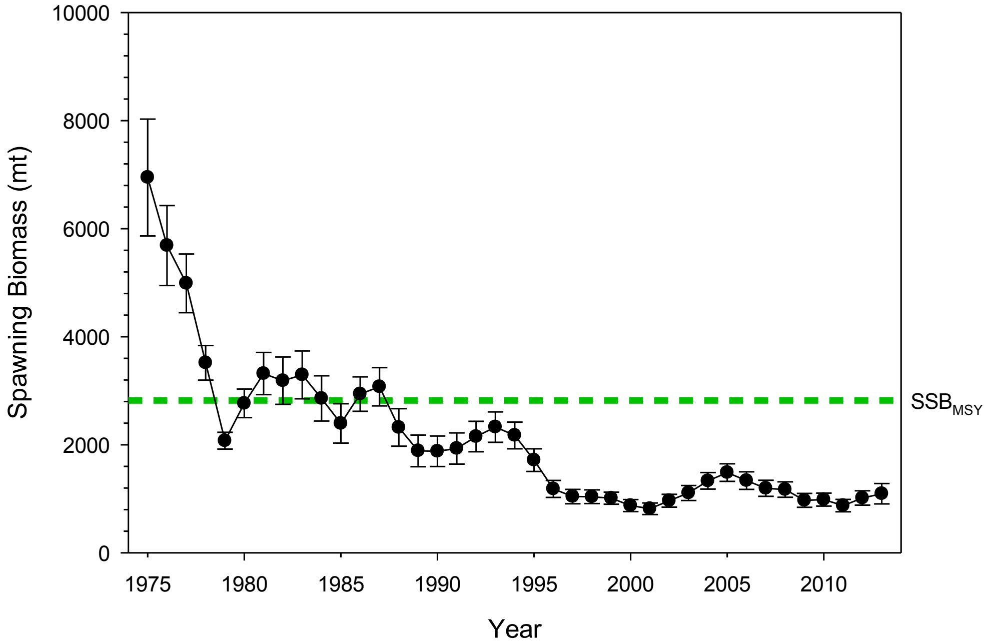


Figure 7-7. Trends in estimates of spawning biomass of Western and Central North Pacific striped marlin (*Kajikia audax*) during 1975-2015 along with 80% confident intervals. The dashed green line is the SSB needed to produce MSY (SSB_{MSY}, 2,819 t).

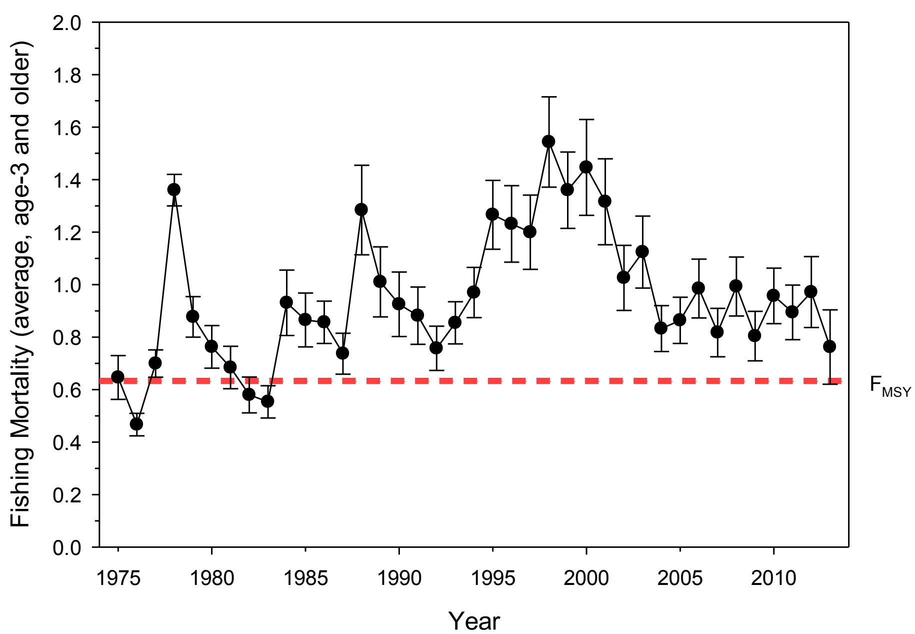


Figure 7-8. Trends in estimates of fishing mortality of Western and Central North Pacific striped marlin (*Kajikia audax*) during 1975-2013 along with 80% confident intervals. The dashed red line is the fishing mortality (F) that produces MSY, F_{MSY} = 0.63.

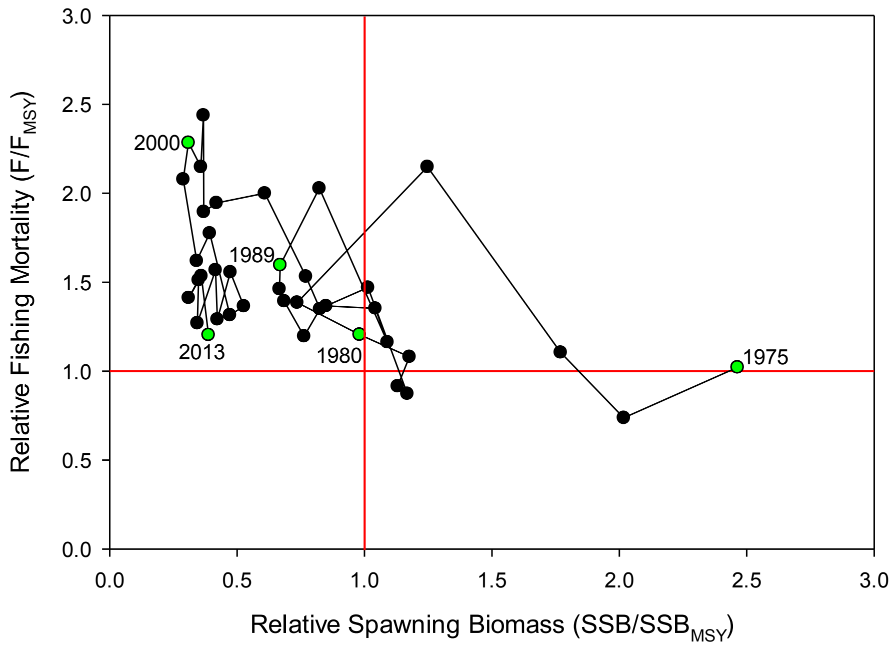


Figure 7-9. Kobe plot of the trends and estimates of relative fishing mortality and relative spawning biomass of Western and Central North Pacific striped marlin (*Kajikia audax*) during 1975-2013.

7.6 Swordfish

J. Brodziak reported that no new stock assessment for North Pacific swordfish was conducted by the BILLWG in 2015. The most recent stock assessment was completed in 2014 and defined two stocks in the North Pacific: the Western and Central North Pacific Ocean (WCNPO) stock and the Eastern Pacific Ocean (EPO) stock.

ISC did not conduct a new stock assessment in 2015 and provides the stock status and conservation advice adopted in 2014 with modifications to provide more specificity.

<u>Stock Status and Conservation Advice</u>

Stock Status

WCNPO: Catches and harvest rates of WCNPO swordfish had a declining trend from 2007-2011, with exploitable biomass fluctuating around 70,000 t. The Kobe plot shows that the WCNPO swordfish stock did not appear to have been overfished or to have experienced overfishing throughout most of the assessment time horizon of 1951-2012 (Figure 7-10).

Results indicated it was unlikely that the WCNPO swordfish population biomass was below B_{MSY} in 2012 ($Pr(B_{2012} < B_{MSY})$=14%). Similarly, it was extremely unlikely that the swordfish population was being fished in excess of H_{MSY} in 2012 ($Pr(H_{2012} > H_{MSY}) < 1\%$).

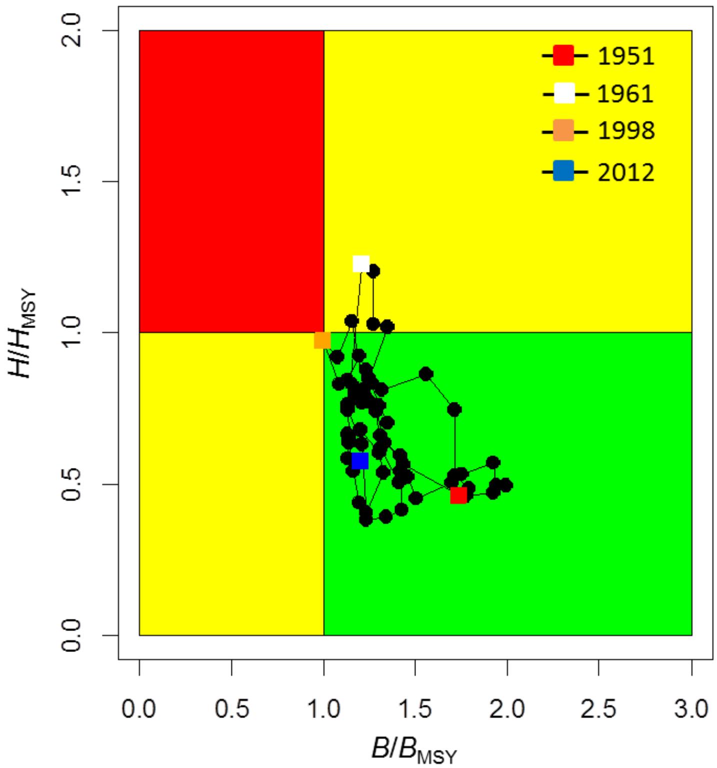


Figure 7-10. Kobe plot showing the estimated trajectories of relative exploitable biomass (B/B_{MSY}) and relative harvest rate (H/H_{MSY}) for swordfish (*Xiphias gladius*) in the WCNPO stock area during 1951-2012.

EPO SWO: For the EPO stock, exploitable biomass had a declining trend during 1969-1995 and increased from 31,000 t in 1995 to over 60,000 t in 2010, generally remaining above B_{MSY}. Harvest rates were initially low, have had a long-term increasing trend, and likely exceeded H_{MSY} in 1998, 2002, 2003, as well as in 2012, the terminal year of the stock assessment.

The Kobe plot shows that overfishing likely occurred in only a few years, but may have occurred from 2010 to 2012 (Figure 7-11**). There was a 55% probability that overfishing occurred in 2012, but there was a less than 1% probability that the stock was overfished.**

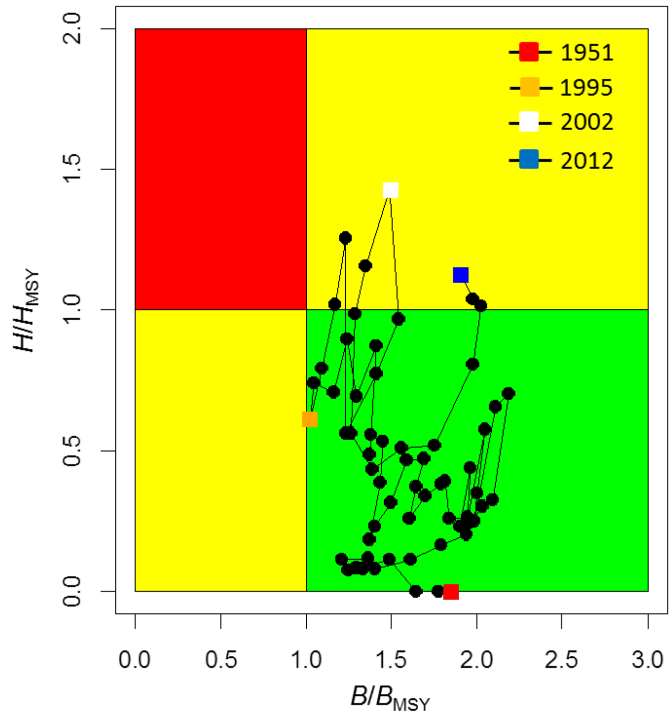


Figure 7-11. Kobe plot showing the estimated trajectories of relative exploitable biomass (B/B_{MSY}) and relative harvest rate (H/H_{MSY}) for swordfish (*Xiphias gladius*) in the EPO stock area during 1951-2012.

Conservation Advice

Stochastic projections for the WCNPO stock were conducted using eight harvest scenarios through 2016 (Figure 7-12 and Figure 7-13). Results relative to MSY-based reference points indicated that exploitable biomass would likely remain above 60,720 t (B_{MSY}) through 2016 under the status quo catch or status quo harvest rate scenarios (Figure 7-12). For the high harvest rate scenarios (i.e., maximum observed harvest rate, 150% of H_{MSY}, 125% of H_{MSY}), exploitable biomass was projected to decline below B_{MSY} by 2016 (Figure 7-12) with harvest rates exceeding H_{MSY}. In comparison, the stock would not be expected to experience any overfishing during 2014-2016 under the status quo catch and status quo harvest rate scenarios (Figure 7-12).

Stochastic projections for the EPO stock show that exploitable biomass will likely have a decreasing trajectory during 2014-2016 under the eight harvest scenarios examined (Figure 7-13) Under the high harvest rate scenarios (status quo catch, maximum observed harvest rate, 150% of H_{MSY}), exploitable biomass was projected to decline to 31,170 t (B_{MSY}) by 2016 (Figure 7-13) with corresponding harvest rates above H_{MSY}. In comparison, under the status quo harvest rate scenario, exploitable biomass was projected to decline to only 40,000 t by 2016, well above the B_{MSY} level (Figure 7-13). Overall, the projections showed that if recent high catch levels (9,700 t) persist, exploitable biomass will decrease and a moderate risk (50%) of overfishing will continue to occur.

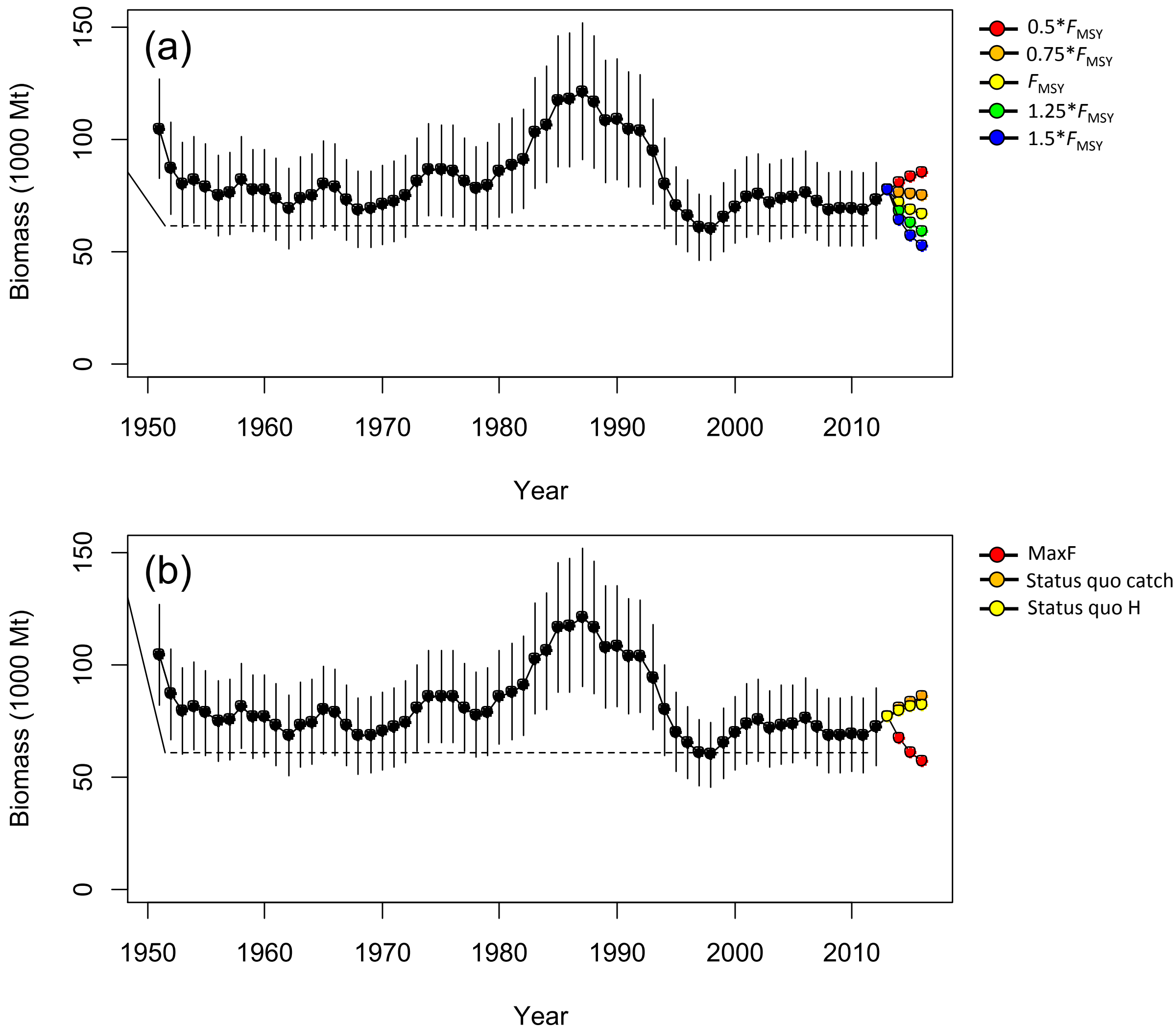


Figure 7-12. Stochastic projections of expected exploitable biomass (1000 metric tons) of swordfish (*Xiphias gladius*) in the WCNPO stock area during 2013-2016 under alternative harvest rates. Upper panel (a) shows projection results of applying a harvest rate set to be 50%, 75%, 100%, 125%, and 150% of the value of estimate of H_{MSY} (25%, denoted as F_{MSY} in the Figure). Lower panel (b) shows projection results of applying a status quo harvest rate based on the 2010-2012 average estimates, a status quo catch based on the 2010-2012 average catch, and the maximum observed harvest rate in the 1951-2012 time series. Dashed line represents BMSY = 60,720 t.

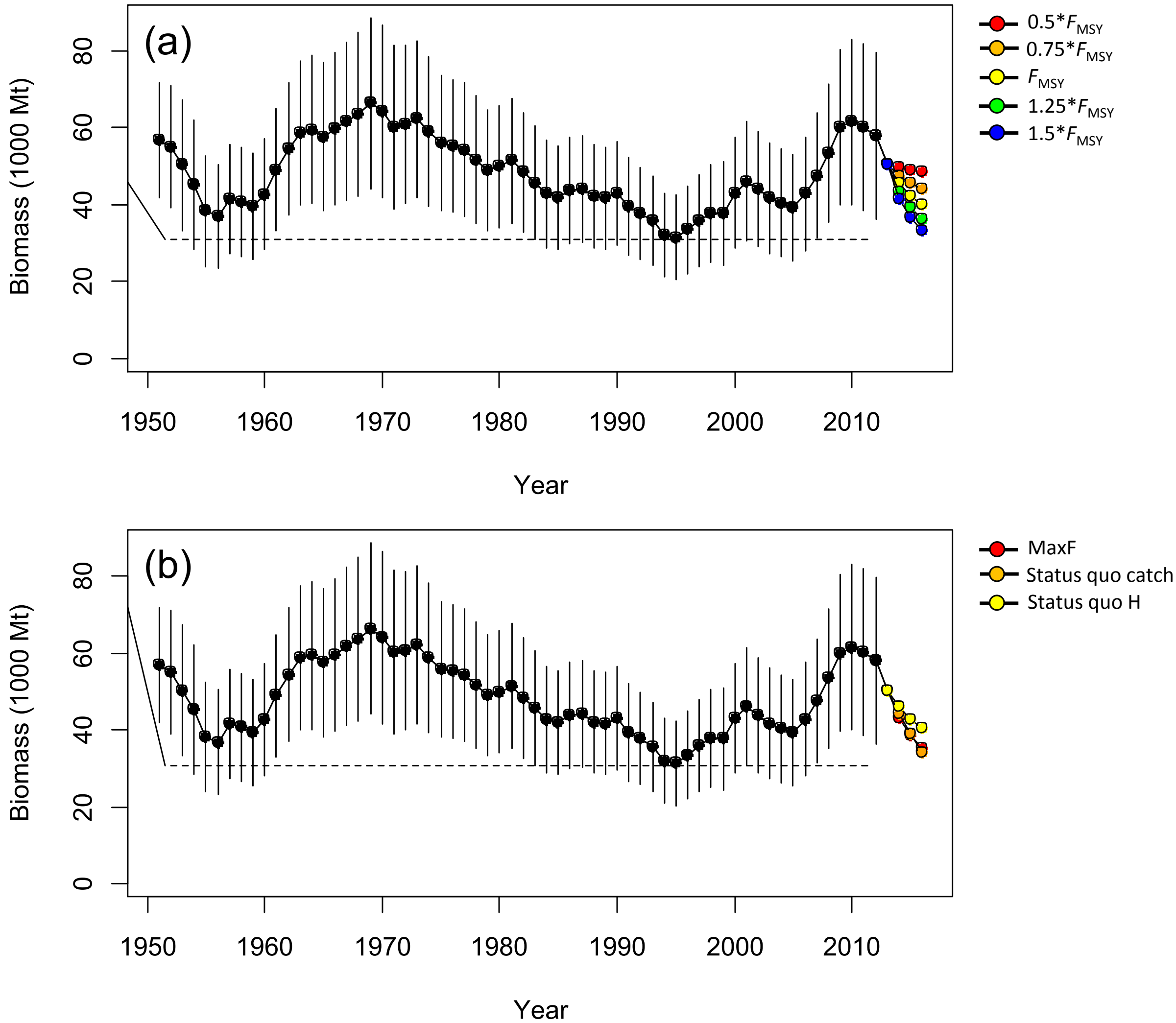
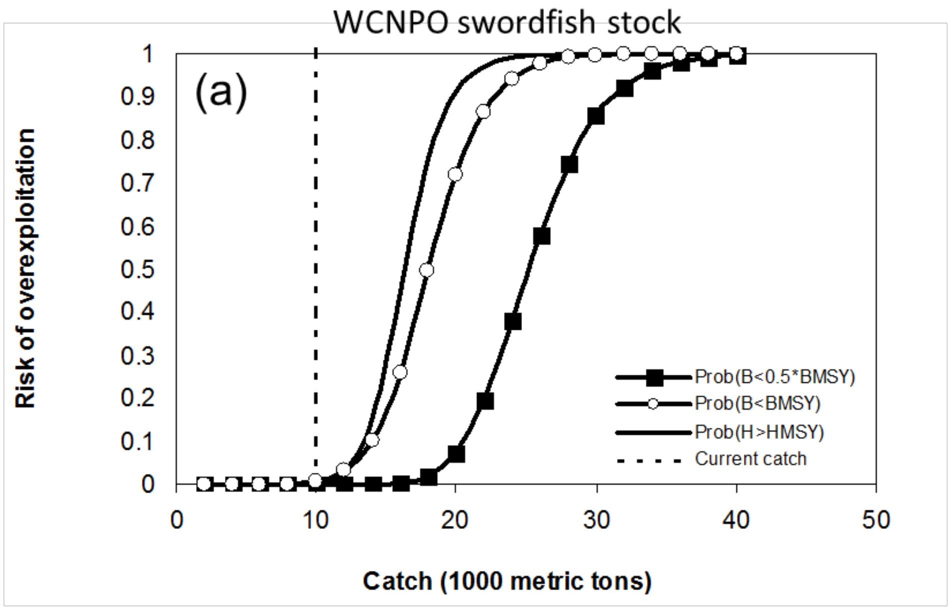


Figure 7-13. Stochastic projections of expected exploitable biomass (1000 metric tons) of swordfish (*Xiphias gladius*) in the EPO stock area during 2013-2016 under alternative harvest rates. Upper panel (a) shows projection results of applying a harvest rate set to be 50%, 75%, 100%, 125%, and 150% of the value of estimate of H_{MSY} (18%, denoted as F_{MSY} in the Figure). Lower panel (b) shows projection results of applying a status quo harvest rate based on the 2010-2012 average estimates, a status quo catch based on the 2010-2012 average catch, and the maximum observed harvest rate in the 1951-2012 time series. Dashed line represents BMSY = 31,170 t.

The risk analyses of harvesting a constant annual catch of WCNPO swordfish during 2014-2016 showed that there would be less than 1% probability of the stock being overfished or experiencing overfishing in 2016 (Figure 7-14) if current annual catches (2011-2012) of about 10,000 t were maintained.

The risk analyses for harvesting a constant catch of EPO swordfish during 2014-2016 showed that the probabilities of overfishing and becoming overfished increased as projected catch increased in the future (Figure 7-14). Maintaining the current (2010-2012) catch of EPO swordfish of approximately 9,700 t would lead to a 50% probability of overfishing in 2016 and a less than 1% probability of the stock being overfished in 2016 (see Figure 7-15, panel (b)).



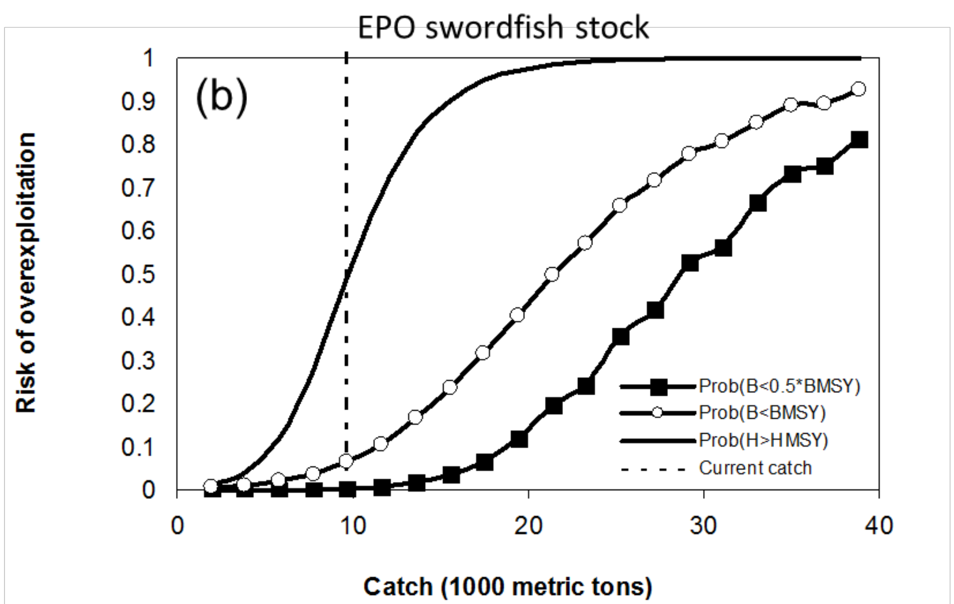


Figure 7-14. Probabilities of experiencing overfishing ($H > H_{MSY}$, solid line), of exploitable biomass falling below B_{MSY} ($B < 0.5*B_{MSY}$, open circles), and of being overfished relative to a reference level of ½B_{MSY} ($B < 0.5*B_{MSY}$, solid squares) in 2016 for swordfish in the WCNPO stock area (a) and EPO stock area (b) based on applying a constant catch biomass (x-axis, thousand t) in the stock projections. Current catch = average catch 2011-2012.

The WCPO swordfish stock is healthy ($B_{2010-2012}$>Bmsy) and is above the level required to sustain recent harvest rates ($H_{2010-2012}$<Hmsy).

For the EPO swordfish stock, overfishing may have occurred from 2010 to 2012, and the average yield of roughly 10,000 t in those years, or almost two times higher than the estimated MSY, is not likely to be sustainable in the long term. While biomass of the EPO

stock appears to be nearly twice B_{MSY}, any increases in catch above recent (3-year average 2010-2012) levels should consider the uncertainty in stock structure and unreported catch.

7.7 Blue shark

S. Kohin, SHARKWG Chair, reported that no new stock assessment for blue shark was conducted by the SHARKWG in 2015. The most recent stock assessment was completed in 2014.

Discussion

Characterization of the different model runs and their relationship to the reference cases was discussed. The reasons for using the term "reference case" versus "base case" were explained in relation to the range of plausible model outcomes. Representation of the different model runs in Kobe plots was also discussed.

Stock Status and Conservation Advice

Stock Status

Median stock biomass of blue shark in 2011 (B_{2011}) was estimated to be 622,000 t using a Bayesian surplus production (BSP) model and median annual fishing mortality in 2011 (F_{2011}) was approximately 32% of F_{MSY} (Figure 7-15). Female spawning stock biomass of blue shark in 2011 (SSB_{2011}) was estimated to be 449,930 t using a Stock Synthesis (SS) model and the estimate of F_{2011} was approximately 34% of F_{MSY}. Target and limit reference points have not yet been established for pelagic sharks in the Pacific.

Relative to *MSY*, the majority of BSP and SS models run with input parameter values considered more probable based on the biology of blue sharks, support the conclusion that the North Pacific blue shark stock is not overfished and overfishing is not occurring. Kobe plots showing the trajectories for the reference runs are shown in Figure 7-15.

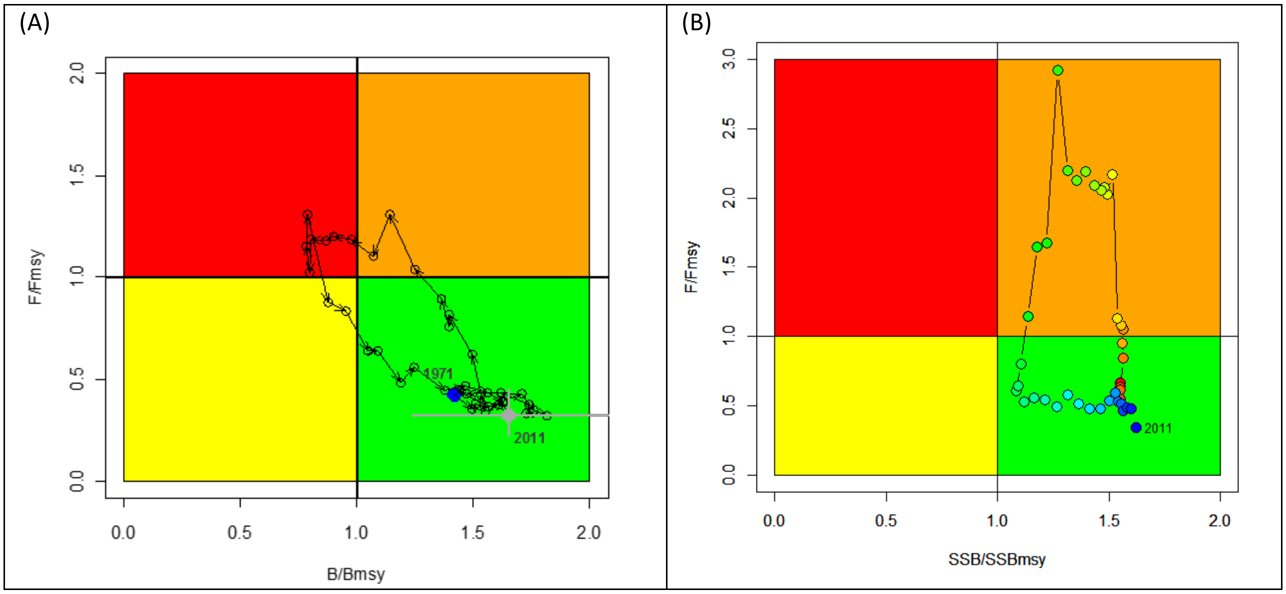


Figure 7-15. (A) Kobe plot showing median biomass and fishing mortality trajectories for the reference case Bayesian Surplus Production model for North Pacific blue shark (*Prionace glauca*). Solid blue circle indicates the median estimate in 1971 (initial year of the model). Solid gray circle and its horizontal and vertical bars indicate the median and 90% confidence limits in 2011. Open black circles and black arrows indicate the historical trajectory of stock status between 1971 and 2011. (B) Kobe plot showing estimated spawning biomass and fishing mortality trajectories for the reference case Stock Synthesis model for North Pacific blue shark. The circles indicate the historical trajectory from 1971-2011 colored from red (first year) to blue (terminal year).

While the results of the sensitivity runs varied depending upon the input assumptions, a few parameters were most influential on the results, including the CPUE series selected as well as the shape parameters for the BSP models, and the equilibrium initial catch and form of the LFSR relationship for the SS models.

Conservation Advice

Future projections of the reference case models show that median blue shark biomass in the North Pacific will remain above B_{MSY} and SSB_{MSY} under the catch harvest policies examined (status quo, +20%, -20%). Similarly, future projections under different fishing mortality (*F*) harvest policies (status quo, +20%, -20%) show that median blue shark biomass in the North Pacific will likely remain above B_{MSY} and SSB_{MSY}.

Given uncertainties regarding the estimated catch and choice of input parameters for the assessment, the catch of and fishing effort on blue shark should be carefully monitored. Carefully designed observer programs and logbooks that record sharks by species as well as continued research into the fisheries, biology, and ecology of blue shark in the North Pacific are recommended to make improvements prior to the next assessment which is scheduled for 2017.

7.8 Shortfin mako shark

S. Kohin, SHARKWG Chair, presented results of the indicator analysis for North Pacific shortfin mako shark in 2015 (*Annex 12*).

Stock Identification and Distribution

SMA are distributed throughout the pelagic, temperate North Pacific Ocean. Nursery areas are found along the continental margins in both the western and eastern Pacific, and larger subadults and adults are observed in greater proportions in the Central Pacific. A single stock of shortfin mako sharks is assumed in the North Pacific Ocean based on evidence from genetics, tagging studies, and lower catch rates of SMA near the equator than in temperate areas. However, within the North Pacific some regional substructure is apparent as the majority of tagged makos have been recaptured within the same region where they were originally tagged, and examination of catch records by size and sex demonstrates some regional and seasonal segregation across the North Pacific.

Catch

Catch was estimated for many fleets and nations based on the best available information. Catch estimates for each fishery were made based on effort, knowledge of the species composition of catch, estimated catch per effort, and scientific knowledge of the operations and catch history. These time series provide an idea of recent catch history for many of the main fleets, but estimates of total catch for SMA in the North Pacific are incomplete. Data are lacking for several significant fishing nations (e.g., Korea and China) and fleets (e.g., Taiwan small-scale longline, Japan deep-set longline, and Japan training vessel fleets). Estimates are difficult to derive, because discards are often not recorded and retained catch data are available with low quality. Given that trends in catch cannot be derived from the incomplete catch information provided, the catch time series were not considered for the purposes of providing stock status information.

Indicator Data and Analysis

Simulation analyses were conducted to examine the effects of CPUE time series of varying lengths and precision, of CPUE time series from predominately adult versus juvenile areas, and of the contribution of trends in mean size versus CPUE in determining stock status. Results from the simulations showed that time series of mean size are less informative regarding the current stock condition (B_{CUR}/B_{MSY}) than CPUE indices. Simulation results also showed that CPUE indices that are derived from predominately adult areas provide better information on current stock status than CPUE indices from recruitment areas.

Four types of indicators were developed for the North Pacific shortfin mako shark: proportion of positive sets, abundance (CPUE) indices, sex-ratio, and size compositions.

The proportion of positive sets, defined as set/trip where at least one SMA is caught, is calculated for major fisheries. The trends for proportion of positive sets varied across fisheries with the Japanese shallow-set longline fishery having the highest proportion of positive catch sets (approximately 75% in 2013, with the rate nearly tripling over the time series). This indicator should be interpreted with caution, because it may be confounded with catchability and selectivity and is a component in some of the fishery abundance index standardizations.

Indices of SMA relative abundance were developed from eight fisheries or surveys ranging from 1985 to2014 and covering different areas across most of the North Pacific. All indices were reviewed by the SHARKWG; and three were selected as the most plausible indicators of abundance based on their spatial and temporal coverage, size of sharks, data quality, and model diagnostics (Figure 7-16). The Japanese shallow-set longline index was considered to be the best abundance indicator candidate. The standardized index showed a flat or slightly increasing trend from 1994 to 2004, before a substantial increase from 2005 to 2013. Abundance indices developed from the Hawaii-based deep-set and shallow-set longline fisheries were also both considered to be plausible indicators of stock abundance. Trends in abundance showed some variability for the two fishery sectors between 2004 and 2012. The standardized CPUE trends moved in opposite directions, with the trend for the shallow-set sector showing a slight decrease, while the trend for the deep-set sector increased overtime.

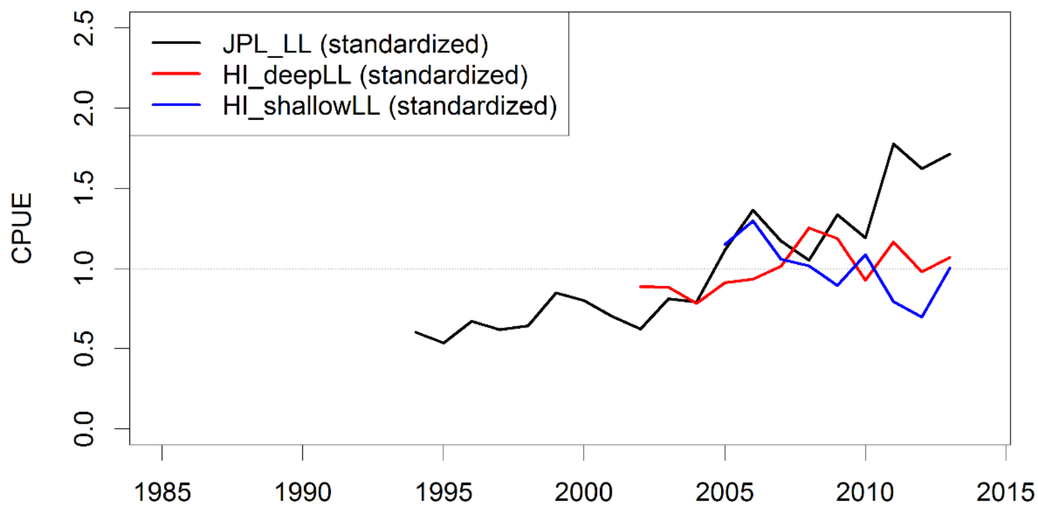


Figure 7-16. Standardized indices of abundance by fishery for shortfin mako sharks. While all of the available independent information was examined to draw conclusions about the stock, these three indices were considered to have the greatest value in determining stock status.

Overall, no trends in sex-ratio are apparent through time across fisheries, although sample sizes are generally low. It would probably be difficult to interpret any trends in sex-ratio because there is not a good understanding of population movement by size and sex through time. Thus, the SHARKWG considered sex-ratios to be of little value as indicators in this analysis of stock status.

The annual median and quartile percentiles of catch at size for SMA caught by the various fleets were examined. In general, sizes remained relatively stable for all fleets. Larger sizes were recorded for the deep-set sector of the Hawaiian fleet and the Japan research and training longline vessels, while smaller individuals were more common in the U.S. juvenile longline survey, U.S. drift gillnet, and Japan longline survey.

Recommendations

Given the plan to produce a full assessment of shortfin mako in 2018, the following priorities were identified.

- Improve data filtering and standardization for all CPUE indices. Improvements could help explain some of the implausible rates of change in currently accepted series. Other important series (notably the Taiwanese distant-water longline) could be valuable for an assessment with better statistical treatment of the data.
- Full accounting of all catch and discard mortality.
- Full accounting of size data by fishery.
- Work on spatial structure/fishery definitions.
- Continue to improve knowledge of life history (e.g., age and growth, spawner-recruit relationship, etc.) to move towards an age-structured assessment model.

Discussion

Discussion focused on the importance of alerting fishery managers to the fact that this is a data poor stock. Conservation advice should include the need to improve data gathering along with better characterization of existing data.

Because a full stock assessment could not be conducted it is not possible to determine the current status of the stock with respect to benchmarks.

Stock Status and Conservation Advice

Shortfin mako is a data poor species. Recognizing that information on important fisheries is missing, the untested validity of indicators for determining stock status, and conflicts in the available data, stock status (overfishing and overfished) could not be determined. Managers should consider the undetermined stock status of shortfin mako shark in the North Pacific when developing and implementing management measures.

The SHARKWG reviewed a suite of information to determine the stock status of shortfin mako shark in the North Pacific. Of the three indices considered to have the greatest value in providing stock status information, abundance trends in two of the series appear to be stable or increasing, while the abundance trend in the third series appears to be declining.

It is recommended that data for missing fleets be developed for use in the next stock assessment scheduled for 2018 and that available catch and CPUE data be monitored for changes in trends. It is further recommended that data collection programs be implemented or improved to provide species-specific shark catch data for fisheries in the North Pacific Ocean.

8 REVIEW OF STOCK STATUS OF SECONDARY STOCKS

8.1 EPO bigeye, yellowfin, skipjack tunas

M. Dreyfus provided an update on catches and status of secondary stocks in the IATTC Convention Area (**INFO DOCS 4, 6, 8, 10**). Catches of YFT are above 200,000 t, after record catches in 2002-2003 that were associated with very high recruitment. Most of the catch is taken by the purse seine fishery, especially in sets associated with dolphins. Nevertheless, the impact is more evenly distributed within the three types of sets in the purse seine fishery (dolphin associated, free swimming schools, and FAD/log sets), because of the size composition of the catch. FAD sets catch smaller individuals.

In the case of BET, the catch is around 80,000 t. Currently, most of the catch comes from the purse seine FAD fishery, although before 1993 it was basically a longline fishery. The FAD fishery has by far the biggest impact on this stock.

IATTC conducts full assessments for YFT and BET; in the recent past *SSB* estimates for these stocks have been close to the level that produces *MSY*. SKJ stock condition is analyzed with relative reference points, noting that there are no extraordinary values that would suggest overexploitation.

For those reasons, IATTC staff and Scientific Advisory Committee advised the IATTC to continue the already-agreed conservation measures for 2016.

Discussion

Although catch has declined since the early 2000s, no major shift of purse seine vessels from the EPO to the WCPO occurred in the past decade. In fact, overall capacity has increased during that period.

The measures applicable to EPO tropical tuna fisheries were discussed. The current conservation measure allows purse seine vessels to choose between two closure periods. Because individual vessels may choose which closure period to abide by, this measure may be less effective than if it was applied uniformly. The net result is that vessels fishing during one of the closure periods face less competition. There is an additional one-month area closure, the "corralito" west of the Galapagos Islands, which applies to all purse seine vessels. Longline vessels are subject to catch limits imposed on national fleets.

8.2 WPO bigeye, skipjack, yellowfin tunas

T. Beeching gave an overview of tuna production by gear and species in the WCPO, as well as the stock status of YFT, SKJ and BET, and the associated recommendations and management advice from WCPFC SC10 (INFO DOCS 5, 7, 9). It was noted that the 2014 catch was the highest on record. Attention was drawn to the need to reduce catches of BET, because the stock is thought to have exceeded its overfished LRP ($0.2SB_{F=0}$).

Discussion

With respect to measures in place to reduce BET catch, CMM 2014-01 has two main elements to control fishing on FADs, a major source of juvenile BET catch. Members may choose between a FAD closure and limits on FAD catches.

Clarification was provided that the current LRP ($0.2SB_{F=0}$) is based on a dynamic estimate of SB_0 (i.e., $SB_{F=0\ 2002\text{-}2011}$).

Three WCPFC management objective workshops have been conducted and they were all educational and informative, recognizing that many participants at the WCPFC Regular Sessions are not conversant with fishery management concepts. The Workshops have also addressed pertinent issues, which prepares participants for the Annual Meeting.

Clarification was provided that the request for SPC-OFP to conduct a Pacific-wide BET assessment in 2015 was not completed.

Range contraction of SKJ in the WCPO was discussed. This is a particular concern for Japan, because availability has declined in northern areas. Japan reported on the results of recent tagging research. It appears that SKJ follow regular migration routes between the tropics and northern areas, which are associated with undersea features such as seamounts. Oceanographic phenomena, such as cold water masses, also affect migration routes.

9 REVIEW OF STATISTICS AND DATA BASE ISSUES

9.1 Report of the STATWG

R.-F. Wu, the STATWG Chair, provided a summary of STATWG activities since ISC14 (*Annex 6*). The STATWG Steering Group held one inter-sessional meeting in Honolulu, Hawaii, U.S.A., 9-10 February 2015. A meeting of the entire STATWG was held in Kona, Hawaii, U.S.A., on 9-10 July 2015, prior to ISC15; two information papers and four working papers were submitted for this meeting.

The membership and purpose of the STATWG was presented. Major responsibilities included: overseeing the tasks of data collection, data archival, data dissemination, and data awareness through the ISC website. Other primary duties included development and maintenance of the ISC database; development and maintenance of the ISC website, including the Member's portal; exchange of ISC data inventories with RFMOs; providing training and support to Member Data Correspondents; and providing data support for the species Working Groups.

It was reported that major accomplishments for the ISC have been achieved by the STATWG since 2011. These included:

1. Online data submission for CAT I, II, and III: 2013-2015
2. Sharing ISC data inventories with WCPFC (since 2011) and IATTC (since 2013)
3. Archiving species WGs' stock assessment files: 2013
4. Development and maintenance of Member metadata: 2012
5. Resolving data sharing issues with WCPFC: 2012
6. Publishing catch graphs on the ISC website generated from the ISC database: 2011-2012
7. Ability to download CAT I data from the ISC website: 2012
8. General upgrading the ISC website: meetings, reports, species profiles, stock status: 2011-2013
9. Procedures for revising historical data in the ISC database: 2014
10. Requesting data from RFMOs for species Working Groups: 2014-2015
11. Generating the official ISC Plenary catch tales: 2015

The 2015 work plan for the STATWG was presented, as well as recommendations to the ISC15 Plenary.

The recommendations were:

1. Each Species Working Group should have a Data Manager who will attend meetings of the STATWG and may participate in intersessional activities of the STATWG.
2. Due to continued failure to submit data to the ISC, the ISC Chair needs to follow-up with China.
3. In order to improve data sharing between the ISC and the WCPFC and IATTC, it is recommended that the ISC Chair communicate with the heads of these RFMOs. [Elaborate on Chairman's task]

The current list of data correspondents for the STATWG was also provided (*Annex 13*).

The STATWG Steering Group will schedule their next meeting in January, 2016, and will request the scheduling of a 2-day meeting prior to the ISC16 Plenary.

Discussion

The flow of data both among ISC working groups and dissemination to member countries and the public was discussed at length. Views differed on what types of data should be made broadly available. While Category Ic data are currently available on the ISC website, some members expressed concern about providing Category II and III data publicly. It was pointed out that other RFMOs provide these types of data publicly in formats that do not compromise rules about data confidentiality.

With respect to the provision of WCPFC and IATTC data for exchanges with the ISC, formal agreements exist to facilitate this flow but further clarification is required. The ISC Chair will work with the Executive Directors of these two RFMOs in this regard. It was agreed that the Chair will discuss data rules and procedures with the WCPFC data manager on the margins of the upcoming WCPFC SC meeting in order to harmonize ISC processes with those of the WCPFC. Overall, the objective is to make data sharing and provision consistent and routine.

It was agreed that the species WG data managers be members of the STATWG. Their participation in STATWG meetings could be by webinar in order to make it manageable and cost effective.

No stock assessment data files prior to 2014, and none for billfish assessments have been submitted to the ISC STATWG for archiving. Species WG chairs were reminded of their responsibility to provide data and executable files for assessments prior to 2014.

9.2 Data Submission Report Card

I. Yamasaki, the Database Administrator, presented the Member data submission report card for 2015.

Member	CAT Ic	CATIe	CATII	CATIII
CAN				
CHN				
JPN				
KOR				
MEX				
TWN				
U.S.A.				

On time and complete

Submitted late and incomplete and/or not in ISC format

Not provided

Discussion

Mexico noted that its data submission was late due to personnel changes. However, data were provided to species WGs when requested.

9.3 Total Catch Tables

I. Yamasaki, the Database Administrator, presented the catch tables for ISC Member countries for 2013-2014, as well as the historical catch. The catch tables include the following ISC species of interest: albacore, blue shark, Pacific bluefin tuna, striped marlin, swordfish, blue marlin, and shortfin mako shark. The catch tables were generated from the ISC database, and are based on Category I data submitted by Data Correspondents for the major fisheries in the North Pacific Ocean of the Member Countries.

Discussion

The new ISC catch table review process was discussed. This prompted a discussion of the data review process.

1. DA will generate catch tables for each species from the official National submissions to the database.
2. DA will provide these catch tables to the National data correspondents for their review
3. Once reviewed by National Data Correspondents, the DA will provide tables to Office of the Chair for inclusion in the Plenary report. These constitute the official catch tables for that year.
4. DA will also provide the tables to the species working groups for their reference. WGs will not make changes to the tables; but DA will work with WGs, data correspondents and data managers to resolve any discrepancies.
5. WGs will only publish catch tables in their stock assessments to show the data they used.

This process will allow ISC to provide to the public one complete set of catch tables per year and should simplify things for the WGs, DA, STATWG and those looking for ISC data. It was agreed that the catch tables should be distributed earlier for review by the species WGs.

It was also emphasized that the most recent year's data (2014) are considered provisional. Members will have the opportunity to correct/update these data by the next year's data submission date, at which point the data will no longer be flagged as provisional.

10 REPORT OF THE SEMINAR

C. Werner reviewed the outcomes of the Seminar, *Close-Kin Mark Recapture (CKMR) as a Tool for Estimating Spawning Biomass in Pacific Bluefin Tuna* (*Annex 14*). Three presentations were made:

- Operationalizing the estimation of absolute spawning stock abundance for southern Bluefin tuna using close-kin genetics (R. Hillary)
- Progress in a Japanese Close-kin project in 2014-2015 (N. Suzuki)
- Close-kin Mark Recapture as a Tool for Estimation of Spawning Biomass in Pacific Bluefin Tuna (PBF): Outcomes from a Workshop on Developing CKMR techniques for Pacific Bluefin Tuna (R. Vetter)

It was agreed that the ISC should take a leading role in CKMR-PBF, especially in providing the samples for the work. The ISC Chair proposed to establish a small advisory group on CKMR in the next two to three months to develop a sampling program and sampling protocols and to inform the WCPFC NC and IATTC in 2015 about the developments on CKMR. The Plenary thanked the Chair and supported his proposals to move forward.

The Plenary recommended that mechanisms for moving forward on the genetics and modeling portions of CKMR be developed at the ISC. Future discussions should involve the PBFWG, because much of the expertise is already in the PBFWG, and it is important to include modelers throughout the project. It was recognized that there is substantial expertise on CKMR genetics methods within the ISC, and it was noted that Japan has already begun developing markers for the work. However, it is important that genetic markers used will be fully shared.

If possible, the sampling of adults and juveniles should begin in the spring (April-May) of 2016.

The Bluefin Futures Symposium, scheduled for 18-20 January 2016 in Monterey, California, U.S.A., would be an opportunity for ISC members to informally check in on progress. An overview of the project could also be a presentation at the Symposium.

The ISC Chair concluded by reiterating his thanks to the Plenary for their support and thanked U.S.A for an informative seminar.

11 REVIEW OF MEETING SCHEDULE

11.1 Time and Place of ISC16

Tentatively, ISC16 will be held in Japan at a location to be determined, July 13-18, 2016.

11.2 Time and Place of Working Group Intersessional Meetings

A draft schedule of proposed intersessional meetings was reviewed and amended, see Table 11-1.

Table 11-1. Schedule of working group meetings.

Date	Meeting	Contact
	2015	
Nov 18-25	PBFWG Data prep – Taiwan	H. Nakano hnakano@affrc.go.jp
Dec	BILLWG BUM data prep – Hawaii	J. Brodziak Jon.Brodziak@noaa.gov
	2016	
Jan	STATWG TBD + webinar	R.-F. Wu fan@ofdc.org.tw
Feb 29 – Mar 11	PBFWG Assmt – La Jolla, U.S.A.	H. Nakano hnakano@affrc.go.jp
Mar	BILLWG BUM assmt – Korea	J. Brodziak Jon.Brodziak@noaa.gov
Spring	SHARKWG SMA & BSH data and research – TBD	S. Kohin Suzanne.Kohin@noaa.gov
Apr	ALBWG MSE/A LB – J pan	J. Holmes John.Holmes@dfo-mpo.gc.ca
Jul 10	PBFWG (Meeting) – TBD	H. Nakano hnakano@affrc.go.jp
Jul 11	BILLWG (Meeting) – TBD	J. Brodziak Jon.Brodziak@noaa.gov
Jul 8-9	STATWG (Meeting) – TBD	R.-F. Wu fan@ofdc.org.tw
Jul 13-18	ISC16 (Plenary) – Japan	G. DiNardo Gerard.DiNardo@noaa.gov
Fall	SHARKWG	S. Kohin Suzanne.Kohin@noaa.gov
Nov	ALBWG Data prep – Nanaimo	J. Holmes John.Holmes@dfo-mpo.gc.ca
	2017	
Spring	SHARKWG BSH assm't – TBD	S. Kohin Suzanne.Kohin@noaa.gov
Apr	ALBWG Assmt – La Jolla U.S.A.	J. Holmes John.Holmes@dfo-mpo.gc.ca

12 ADMINISTRATIVE MATTERS

12.1 Formalization of ISC

The ISC Chair described recent consultations with the U.S. Department of State (DOS) on formalizing the ISC. The DOS contact thought formalization would take 5-7 years and will likely require Members to sign an MOU. Members need to identify the point of contact within their governments for this process and determine if an MOU would be the appropriate path forward. This information could be provided to the ISC Chair by October 1. This could facilitate the process for formalizing the ISC. DOS also views the developing relationship between ISC and PICES positively and would benefit the formalization of ISC.

It was noted that an MOU between the U.S. and Japan had been considered in the past. However, Members were not in a position to sign the MOU at that time. This previous MOU should be reviewed as a starting point for future negotiations. DOS also noted it will be important for Members to signal their willingness to move toward formalization early in the process so effort is not wasted.

12.2 Peer Review of Function and Process and Stock Assessments

S. Shoffler discussed the peer review process. A review of ISC's function is required every five years according to ISC operational procedures. Since the last one was completed in 2012-2013, it is necessary to begin planning for the next review, which would begin in 2017. The focus of the review and related budget will need to be resolved at ISC16.

The next peer review could focus on a particular aspect of ISC operations. Since the preparation of stock assessments is a central function of the organization, the next peer review could focus on external review of stock assessments. INFO DOCS 13 and 14 describe the ICCAT peer review process and issues learned from CIE reviews.

The recommendations from the last review of function are in ISC13 Plenary Document 10. The ISC Chair will review the list of recommendations from the last peer review, identify those that still need to be addressed and prioritize them and circulate that list to Members in preparation for ISC16.

12.3 Upcoming Election of the ISC Chair

The Plenary agreed to amend the Operations Manual to conform to a proposal from the ALBWG on the term of the WG Chair. Pending approval by Plenary of changes to the Operations Manual, the ALBWG elected J. Holmes to serve for another year and up to two years pending review after year one.

Revisions to the Operations Manual were presented to cover extension of the term of WG chairs and the ISC Chair, and the appointment of vice chairs for WGs. The Plenary adopted the following changes/additions to the Operations Manual (text in underline is new text for the Operations Manual):

1. WG Chairperson Term Extension

W2. Chairperson.

A Chairperson with appropriate expertise and knowledge is chosen or elected by Members of each Working Group.

The Working Group Chairperson is responsible for chairing meetings of the Working Group, facilitating the development of multi-year work plans and coordinating work plan assignments, organizing meetings, including advanced preparation of agendas, scheduling of presenters, appointing of rapporteurs, providing assignments for reports, and ensuring that Committee assignments are completed as required. The Chairperson also facilitates the meetings, to ensure that participants with differing views get an opportunity to be heard.

He/She strives for consensus of all members in reporting of Working Group findings, conclusions and decisions to the Committee. The Chairperson serves a three-year term and may be reappointed for an additional three-year term, but not for more than two consecutive terms. In the unusual event that no member is able to serve as Chairperson, a standing Chairperson may serve an additional two consecutive years beyond the two terms provided that (1) the standing Chairperson is willing to stand for re-appointment and (2) the Working Group re-elects the standing Chairperson. The Chairperson will be elected for a one-year term, and if a new Chairperson is still not identified the Working Group can re-elect the standing Chairperson for a second one-year term. A Chairperson cannot be re-elected beyond this additional two-year period.

2. Addition of WG Vice Chair

W3. Vice Chair

Members of the Working Group shall elect a Vice Chair. In the absence of the Chair, the Vice Chair assumes all duties and responsibilities of the Chair. This position will also serve to build capacity for future Chairs.

The Vice Chair serves for a term of one-to-three years, at the discretion of the Working Group, and is eligible for reelection for additional terms.

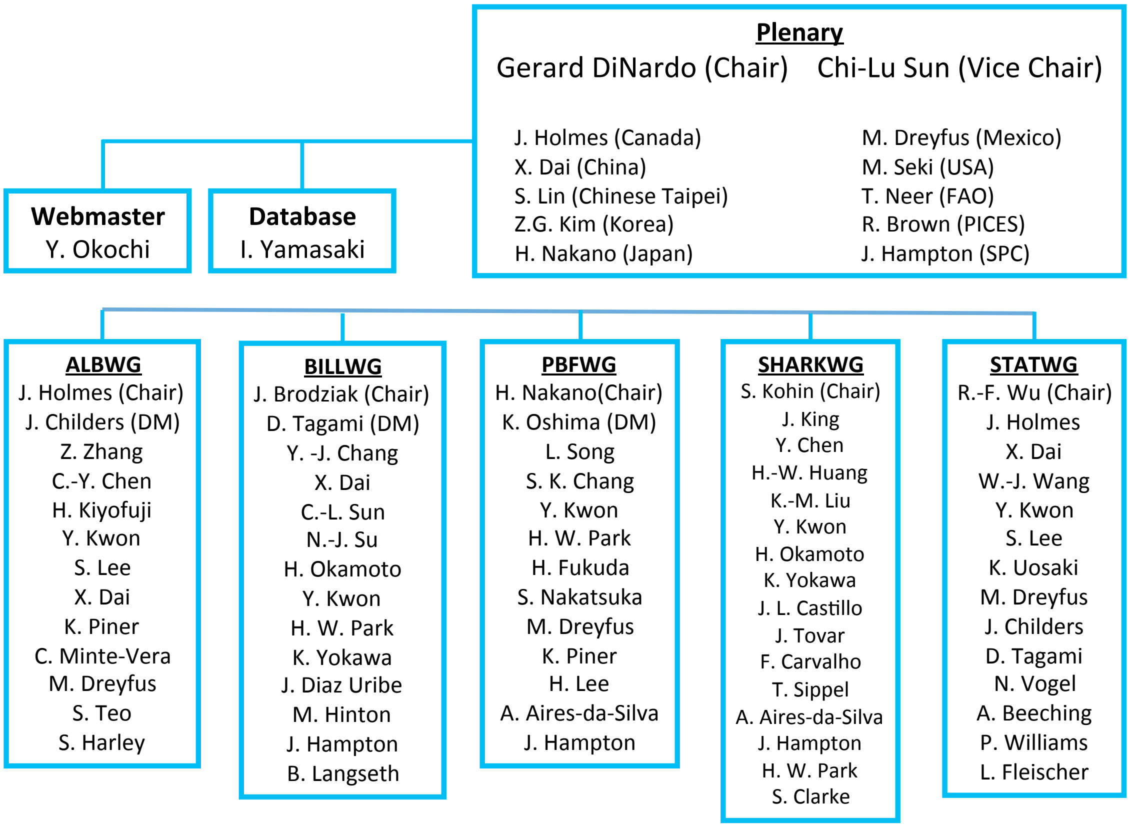
3. ISC Chairperson Term Extension

From C2 ISC Chairperson

The Chairperson serves for a term of three years and is eligible for re-election for one additional three-year term. In the unusual event that no member is able to serve as Chairperson, a standing Chairperson may serve an additional two consecutive years beyond the two terms provided that (1) the standing Chairperson is willing to stand for re-appointment and (2) the Committee re-elects the standing Chairperson. The Chairperson will be elected for a one-year term, and if a new Chairperson is still not identified the Committee can re-elect the standing Chairperson for a second one-year term. A Chairperson cannot be re-elected beyond this additional two-year period.

12.4 Organizational Chart and Contact Persons

ISC Organizational Chart (July 2015)



12.5 Process for handling requests from Other Organizations

The ISC Chair noted that there is only one case where the ISC has received a formal request in writing in the form of a letter to the Office of the Chair. More often, requests are noted in the minutes of RFMO and subsidiary body meetings. This requires the Office of the Chair to carefully review minutes and meeting reports and poses the risk that a request will be missed.

The ISC Chair will notify other organizations that they need to document requests to the ISC separately in a letter to the Office of the Chair. This will be specified in a future revision of the Operations Manual.

12.6 Other Business

The Chair and Vice Chair were tasked with developing a template for WGs to present information on stock status and conservation advice by 1 March 2016. This would produce greater consistency and facilitate Plenary deliberations.

It was agreed that meeting documents, and especially species WG reports and stock assessments, need more timely distribution. For this reason, an annual deadline of June 1 was agreed to for the distribution of all Plenary documents. The Office of the Chair will produce a schedule of document submission deadlines consistent with this objective for dissemination by March 1, 2015. Furthermore, best practices or terms of reference for stock assessment documents will be included in the Operations Manual.

13 ADOPTION OF REPORT

The Report of the Meeting was adopted.

14 CLOSE OF MEETING

G. DiNardo thanked NOAA Fisheries for hosting the meeting and the Southwest Fisheries Science Center for their support and commitment. He also expressed his appreciation to the Office of the Chair, namely Sarah Shoffler, Dawn Graham, Emily Gardner, Su-Zan Yeh, and Chi-Lu Sun, for their outstanding support. He thanked Kit Dahl for taking on the rapporteuring duties.

The meeting was closed at 12:45PM 20 July 2015

15 CATCH TABLES

Table 15-1. North Pacific albacore catches (in metric tons) by fisheries, 1952-2012. "0"; Fishing effort was reported but no catch. "+"; Bellow 499kg catch. "-"; Unreported catch or catch information not available. *: Data from the most recent years are provisional.

Catch disposition	Year	CAN		JPN								KOR		MEX		
		Troll	CAN total	Set-net	Drift gill-net	Longline	Pole-and-line	Troll	Others	Purse seine	JPN total	Longline	KOR total	Purse seine	Others	MEX total
Retained	1936															
	1937															
	1938															
	1939	1,290	1,290													
	1940	20	20													
	1941	350	350													
	1942															
	1943	130	130													
	1944	2,100	2,100													
	1945	6,480	6,480													
	1946	1,960	1,960													
	1947	360	360													
	1948	9,840	9,840													
	1949	10,120	10,120													
	1950	9,610	9,610													
	1951	860	860													
	1952	710	710	55	-	26,687	65,645	-	237	154	92,778			-	-	-
	1953	50	50	88	-	27,777	74,412	-	132	38	102,447			-	-	-
	1954			6	-	20,958	28,069	-	38	23	49,094			-	-	-
	1955			28	-	16,277	24,236	-	136	8	40,685			-	-	-
	1956	170	170	23	-	14,341	42,810	-	57	-	57,231			-	-	-
	1957	80	80	13	-	21,053	49,500	-	151	83	70,800			-	-	-
	1958	740	740	38	-	18,432	22,175	-	124	8	40,777			-	-	-
	1959	2,120	2,120	48	-	15,802	14,252	-	67	-	30,169			-	-	-
	1960	50	50	23	-	17,369	25,156	-	76	-	42,624			-	-	-
	1961	40	40	111	-	17,437	18,639	-	268	7	36,462			2	39	41
	1962	10	10	20	-	15,764	8,729	-	191	53	24,757			0	0	0
	1963	50	50	4	-	13,464	26,420	-	218	59	40,165			31	0	31
	1964	30	30	50	-	15,458	23,858	-	319	128	39,813			0	-	-
	1965	150	150	70	-	13,701	41,491	-	121	11	55,394			0	-	-
	1966	440	440	64	-	25,050	22,830	-	585	111	48,640			0	-	-
	1967	1,610	1,610	43	-	28,869	30,481	-	520	89	60,002			-	-	-
	1968	10,280	10,280	58	-	23,961	16,597	-	1,109	267	41,992			-	-	-
	1969	13,650	13,650	34	-	18,006	31,912	-	925	521	51,398			0	-	-
	1970	3,900	3,900	19	-	16,222	24,263	-	498	317	41,319			0	-	-
	1971	17,460	17,460	5	-	11,473	52,957	-	354	902	65,691	0	0	0	-	-
	1972	39,210	39,210	6	1	13,022	60,569	-	638	277	74,513	0	0	100	0	100
	1973	14,000	14,000	44	39	16,760	68,767	-	486	1,353	87,449	4	4	0	-	-
	1974	13,310	13,310	13	224	13,384	73,564	-	891	161	88,237	91	91	1	0	1
	1975	1,110	1,110	13	166	10,303	52,152	-	230	159	63,023	7,050	7,050	1	0	1
	1976	2,780	2,780	15	1,070	15,812	85,336	-	270	1,109	103,612	2,212	2,212	36	5	41
	1977	530	530	5	688	15,681	31,934	-	365	669	49,342	500	500	3	0	3
	1978	230	230	21	4,029	13,007	59,877	-	2,073	1,115	80,122	669	669	1	0	1
	1979	5,210	5,210	16	2,856	14,186	44,662	-	1,139	125	62,984	0	0	1	0	1
	1980	2,120	2,120	10	2,986	14,681	46,742	-	1,177	329	65,925	592	592	31	0	31
	1981	2,000	2,000	8	10,348	17,878	27,426	-	699	252	56,611	0	0	8	0	8
	1982	1,040	1,040	11	12,511	16,714	29,614	-	482	561	59,893	4,874	4,874	0	0	0
	1983	2,250	2,250	22	6,852	15,094	21,098	-	99	350	43,515	366	366	0	0	0
	1984	500	500	24	8,988	15,053	26,013	-	494	3,380	53,952	1,925	1,925	107	6	113
	1985	560	560	68	11,204	14,249	20,714	-	339	1,533	48,107	2,789	2,789	14	35	49
	1986	300	300	15	7,813	12,899	16,096	-	640	1,542	39,005	3,833	3,833	3	0	3
	1987	1,040	1,040	16	6,698	14,668	19,082	-	173	1,205	41,842	1,624	1,624	7	0	7
	1988	1,550	1,550	7	9,074	14,688	6,216	-	170	1,208	31,363	799	799	15	0	15
	1989	1,400	1,400	33	7,437	13,031	8,629	-	433	2,521	32,084	561	561	2	0	2
	1990	3,020	3,020	5	6,064	15,785	8,532	-	248	1,995	32,629	29	29	2	0	2
	1991	1,390	1,390	4	3,401	17,039	7,103	-	395	2,652	30,594	4	4	2	0	2
	1992	3,630	3,630	12	2,721	19,042	13,888	-	1,522	4,104	41,289	1	1	10	0	10
	1993	4,940	4,940	3	287	29,933	12,797	-	897	2,889	46,806	2	2	11	0	11
	1994	1,998	1,998	11	263	29,565	26,389	-	823	2,026	59,077	2	2	6	0	6
	1995	1,761	1,761	28	282	29,050	20,981	856	78	1,177	52,452	13	13	5	0	5
	1996	3,321	3,321	43	116	32,440	20,272	815	127	581	54,394	157	157	21	0	21
	1997	2,166	2,166	40	359	38,899	32,238	1,585	135	1,068	74,324	404	404	53	0	53
	1998	4,177	4,177	41	206	35,755	22,926	1,190	104	1,554	61,776	225	225	8	0	8
	1999	2,734	2,734	90	289	33,339	50,369	891	62	6,872	91,912	98	98	0	57	57
	2000	4,531	4,531	136	67	29,995	21,550	645	86	2,408	54,887	15	15	70	33	103
	2001	5,248	5,248	78	117	28,801	29,430	416	35	974	59,851	63	63	0	18	18
	2002	5,379	5,379	109	332	23,585	48,454	787	85	3,303	76,655	111	111	28	0	28
	2003	6,847	6,847	69	126	20,907	36,114	922	85	627	58,850	146	146	29	0	29
	2004	7,857	7,857	30	61	17,341	32,255	772	54	7,200	57,713	77	77	104	0	104
	2005	4,829	4,829	97	154	20,465	16,133	665	234	850	38,598	419	419	0	0	0
	2006	5,833	5,833	55	221	21,168	15,400	460	42	364	37,710	134	134	109	0	109
	2007	6,040	6,040	30	226	22,381	37,768	519	44	5,682	66,650	136	136	40	0	40
	2008	5,464	5,464	101	1,531	19,092	19,060	549	34	825	41,192	400	400	10	-	10
	2009	5,693	5,693	33	149	21,995	31,172	410	43	2,076	55,878	95	95	17	-	17
	2010	6,527	6,527	42	24	21,167	19,561	588	37	330	41,749	107	107	25	-	25
	2011	5,415	5,415	50	12	20,956	25,704	443	78	480	47,723	78	78	0	-	-
	2012	2,497	2,497	48	26	22,828	33,742	610	129	4,193	61,576	156	156	0	-	-
	2013	5,088	5,088	36	14	19,839	33,568	302	211	1,988	55,958	173	173	0		0
	2014*	4,781	4,781	36	14	19,355	33,576	302	211	1,988	55,482	116	116	0		0
Discards	2013	1	1													
	2014	7	7													

Table 15-1. Continued

TWN						USA									
Set-net	Gill-net (not specified)	Longline	Purse seine	Others	TWN total	Drift gill-net	Hand line	Longline	Pole-and-line	Troll	Others	Purse seine	Sport	USA total	Species Grand Total
										442				442	442
										1,681				1,681	1,681
										8,594				8,594	8,594
										8,586				8,586	9,876
										6,603				6,603	6,623
										5,412				5,412	5,762
										10,678				10,678	10,678
										17,071				17,071	17,201
										23,957				23,957	26,057
										17,886				17,886	24,366
										10,955				10,955	12,915
										12,235				12,235	12,595
								45		22,457				22,502	32,342
								33		24,901				24,934	35,054
								27		32,746				32,773	42,383
								24		15,629				15,653	16,513
								46		23,843			1,373	25,262	118,750
								23		15,740			171	15,934	118,431
								13		12,246			147	12,406	61,500
								9		13,264			577	13,850	54,535
								6		18,751			482	19,239	76,640
								4		21,165			304	21,473	92,353
								7		14,855			48	14,910	56,427
								5		20,990			+	20,995	53,284
								4		20,100			557	20,661	63,335
								5	2,837	12,055	1		1,355	16,253	52,796
								7	1,085	19,752	1		1,681	22,526	47,293
								7	2,432	25,140			1,161	28,740	68,986
								4	3,411	18,388			824	22,627	62,470
								3	417	16,542	1		731	17,694	73,238
								8	1,600	15,333			588	17,529	66,609
-	-	330		189	519			12	4,113	17,814			707	22,646	84,777
-	-	216		283	499			11	4,906	20,434			951	26,302	79,073
-	-	65		423	488			14	2,996	18,827			358	22,195	87,731
-	-	34		59	93			9	4,416	21,032			822	26,279	71,591
-	-	20		52	72			11	2,071	20,526			1,175	23,783	107,006
-	-	187		-	187			8	3,750	23,600			637	27,995	142,005
-	-	-		-	-			14	2,236	15,653			84	17,987	119,440
-	-	486		-	486			9	4,777	20,178			94	25,058	127,183
-	-	1,240		-	1,240			33	3,243	18,932	10		640	22,858	95,282
-	-	686		-	686			23	2,700	15,905	4		713	19,345	128,676
-	-	572		-	572			37	1,497	9,969			537	12,040	62,987
-	-	6		-	6			54	950	16,613	15		810	18,442	99,470
-	-	81		-	81				303	6,781			74	7,158	75,434
-	1	249		20	270				382	7,556			168	8,106	77,044
1	-	143		12	156			25	748	12,637			195	13,605	72,380
-	-	38		9	47			105	425	6,609	21		257	7,417	73,271
-	-	8		1	9			6	607	9,359			87	10,059	56,199
-	1	-		-	1			2	1,030	9,304		3,728	1,427	15,491	71,982
1	-	-		2	3	2				6,422	118	26	1,176	7,744	59,252
-	-	-		-	-	3				4,713	66	47	196	5,025	48,166
2	2,514	-		-	2,516	5		150		2,772	139	1	74	3,141	50,170
6	7,389	-		-	7,395	15		307		4,221	76	17	64	4,700	45,822
-	8,350	40		-	8,390	4		248		1,896	10	1	160	2,319	44,756
-	16,701	4		39	16,744	29		177		2,733	20	71	24	3,054	55,478
-	3,398	12		-	3,410	17		312		1,917	20		6	2,272	37,672
-	7,866	-		-	7,866			334		4,626	40		2	5,002	57,798
-	-	5		-	5			438		6,325	194		25	6,982	58,746
-	-	83		-	83	38		544		11,068	66		106	11,822	72,988
-	-	4,280		-	4,280	52		882		8,302	4		102	9,342	67,853
-	-	7,596	-	-	7,596	83		1,185		17,150	10	11	88	18,527	84,016
-	-	9,456	-	-	9,456	60		1,653		14,458	12	2	1,018	17,203	103,606
-	-	8,810	-	-	8,810	80		1,120		14,577	15	33	1,208	17,033	92,029
-	-	8,393	-	-	8,393	149		1,542		10,451	61	48	3,621	15,872	119,066
-	-	8,842	-	-	8,842	55		940		9,834	24	4	1,798	12,655	81,033
-	1	8,684	-	-	8,685	94		1,295		11,543	39	51	1,635	14,657	88,522
-	-	7,965	-	-	7,965	30		525		11,003	13	4	2,357	13,932	104,070
-	-	7,166	-	-	7,166	16		524		14,246	8	44	2,214	17,052	90,090
-	-	4,988	-	-	4,988	12		361		13,630	3	1	1,506	15,513	86,252
-	-	4,472	-	-	4,472	20		296		8,654	1		1,719	10,690	59,008
-	-	4,317	-	-	4,317	3		270		12,642	+		385	13,300	61,403
-	-	2,916	-	-	2,916	4	94	250		11,911	+	77	461	12,797	88,579
-	-	3,069	-	-	3,069	1	28	354		11,762	+		418	12,563	62,698
-	-	2,378	-	-	2,378	4	97	203		12,343	+	31	944	13,622	77,683
+	-	2,818	-	-	2,818	5	53	421		11,691	0		862	13,032	64,258
+	1	3,434	0	2	3,437	5	84	708		10,147	0		421	11,365	68,018
2	2	2,643	-	-	2,647	8	253	660		14,152	2	5	1,212	16,292	83,168
1	-	4,427	-	-	4,428	5	46	317		12,312	0		839	13,519	79,166
1	-	2,617	-	-	2,618	0	49	209		13,417			1,048	14,723	77,720
															1 7

Table 15-2. Pacific bluefin tuna catches (in metric tons) by fisheries, 1952-2012. “0”; Fishing effort was reported but no catch. “+”; Bellow 499kg catch. “-“; Unreported catch or catch information not available. *: Data from the most recent years are provisional.

Catch disposition	Year	JPN							KOR					MEX		
		Set-net	Longline	Pole-and-line	Troll	Others	Purse seine	JPN total	Set-net	Longline	Purse seine	Trawl l	KOR total	Others	Purse seine	MEX total
Retained	1952	2,145	2,694	2,198	667	1,700	7,680	17,084						-	-	-
	1953	2,335	3,040	3,052	1,472	160	5,570	15,629						-	-	-
	1954	5,579	3,088	3,044	1,656	266	5,366	18,999						-	-	-
	1955	3,256	2,951	2,841	1,507	1,151	14,016	25,722						-	-	-
	1956	4,170	2,672	4,060	1,763	385	20,979	34,029						-	-	-
	1957	2,822	1,685	1,795	2,392	414	18,147	27,255						-	-	-
	1958	1,187	818	2,337	1,497	215	8,586	14,640						-	-	-
	1959	1,575	3,136	586	736	167	9,996	16,196						32	171	203
	1960	2,032	5,910	600	1,885	369	10,541	21,337						-	-	-
	1961	2,710	6,364	662	3,193	599	9,124	22,652						-	130	130
	1962	2,545	5,769	747	1,683	293	10,657	21,694						-	294	294
	1963	2,797	6,077	1,256	2,542	294	9,786	22,752						-	412	412
	1964	1,475	3,140	1,037	2,784	1,884	8,973	19,293						-	131	131
	1965	2,121	2,569	831	1,963	1,106	11,496	20,086						-	289	289
	1966	1,261	1,370	613	1,614	129	10,082	15,069						-	435	435
	1967	2,603	878	1,210	3,273	302	6,462	14,728						-	371	371
	1968	3,058	500	983	1,568	217	9,268	15,594						-	195	195
	1969	2,187	878	721	2,219	195	3,236	9,436						-	260	260
	1970	1,779	607	723	1,198	224	2,907	7,438						-	92	92
	1971	1,555	697	938	1,492	317	3,721	8,720		0			0	-	555	555
	1972	1,107	512	944	842	197	4,212	7,814		0			0	-	1,646	1,646
	1973	2,351	838	526	2,108	636	2,266	8,725		0			0	-	1,084	1,084
	1974	6,019	1,177	1,192	1,656	754	4,106	14,904		0			0	-	344	344
	1975	2,433	1,061	1,401	1,031	808	4,491	11,225		3			3	-	2,145	2,145
	1976	2,996	320	1,082	830	1,237	2,148	8,613		5			5	-	1,968	1,968
	1977	2,257	338	2,256	2,166	1,052	5,110	13,179		0			0	-	2,186	2,186
	1978	2,546	648	1,154	4,517	2,276	10,427	21,568		3			3	-	545	545
	1979	4,558	729	1,250	2,655	2,429	13,881	25,502		0			0	-	213	213
	1980	2,521	811	1,392	1,531	1,953	11,327	19,535		0			0	-	582	582
	1981	2,129	590	754	1,777	2,653	25,422	33,325		0			0	-	218	218
	1982	1,667	718	1,777	864	1,709	19,234	25,969		0	31		31	-	506	506
	1983	972	217	356	2,028	1,117	14,774	19,464		0	13		13	-	214	214
	1984	2,234	142	587	1,874	868	4,433	10,138		1	4		5	-	166	166
	1985	2,562	105	1,817	1,850	1,175	4,154	11,663		0	1		1	-	676	676
	1986	2,914	102	1,086	1,467	719	7,412	13,700		0	344		344	-	189	189
	1987	2,198	211	1,565	880	445	8,653	13,952		13	89		102	-	119	119
	1988	843	157	907	1,124	498	3,605	7,134		0	32		32	1	447	448
	1989	748	209	754	903	283	6,190	9,087		0	71		71	-	57	57
	1990	716	309	536	1,250	455	2,989	6,255		0	132		132	-	50	50
	1991	1,485	218	286	2,069	650	9,808	14,516		0	265		265	-	9	9
	1992	1,208	513	166	915	1,081	7,162	11,045		0	288		288	-	0	-
	1993	848	812	129	546	365	6,600	9,300		0	40		40	-	-	-
	1994	1,158	1,206	162	4,111	398	8,131	15,166		0	50		50	2	63	65
	1995	1,859	678	270	4,778	586	18,909	27,080		0	821		821	-	11	11
	1996	1,149	901	94	3,640	570	7,644	13,998		0	102		102	-	3,700	3,700
	1997	803	1,300	34	2,740	811	13,152	18,840		0	1,054		1,054	-	367	367
	1998	874	1,255	85	2,876	700	5,391	11,181		0	188		188	0	1	1
	1999	1,097	1,157	35	3,440	709	16,173	22,611		0	256		256	35	2,369	2,404
	2000	1,125	953	102	5,217	689	16,486	24,572		0	2,401	0	2,401	99	3,019	3,118
	2001	1,366	791	180	3,466	782	7,620	14,205		0	1,176	10	1,176	-	863	863
	2002	1,100	841	99	2,607	631	8,903	14,181		0	932	1	932	2	1,708	1,710
	2003	839	1,237	44	2,060	446	5,768	10,394		0	2,601	0	2,601	43	3,211	3,254
	2004	896	1,847	132	2,445	514	8,257	14,091		0	773	0	773	14	8,880	8,894
	2005	2,182	1,925	549	3,633	548	12,817	21,654		0	1,318	9	1,318	-	4,542	4,542
	2006	1,421	1,121	108	1,860	777	8,880	14,167		0	1,012	3	1,012	-	9,927	9,927
	2007	1,503	1,762	236	2,823	657	6,840	13,821		0	1,281	4	1,281	-	4,147	4,147
	2008	2,358	1,390	64	2,377	770	10,221	17,180		0	1,866	10	1,866	15	4,392	4,407
	2009	2,236	1,080	50	2,003	575	8,077	14,021		0	936	4	936	-	3,019	3,019
	2010	1,603	890	83	1,583	495	3,742	8,396		0	1,196	16	1,196	-	7,746	7,746
	2011	1,651	837	63	1,820	283	8,340	12,994		0	670	14	670	1	2,730	2,731
	2012	1,932	673	113	570	343	2,462	6,093		0	1,421	2	1,421	1	6,667	6,668
	2013	1,415	784	8	904	529	2,771	6,411	1	-	604	0	604		3,154	3,154
	2014	1,907	715	5	1,023	499	5,456	9,605	6		1,305	-	1,311		4,862	4,862

1) Japanese coastal longline and other catch data from 2007 to 2013 were revised as a result of deleting double counting and changing the data source (ISC15/STATWG/WP-4).

2) Japanese troll catch since 1998 includes catch for farming.

3) Korea's catch statistics are derived from Japanese Import statistics for 1982-1999.

4) US catch in 1952-1958 contains catch from other countries - primarily Mexico. Other includes catches from gillnet, troll, pole-and-line, and longline.

5) Set-net catches in 2013 were updated based on the Japanese official statistics of annual catch.

6) The catch of Japanese coastal longline in 2014 is provisional and includes catch of the distant water and offshore longline.

Table 15-2. Continued

TWN							USA								Species Grand Total
Set-net	Gill-net (not specified)	Drift gill-net	Long line	Others	Purse seine	TWN total	Drift gill-net	Long line	Pole-and-line	Troll	Others	Purse seine	Sport	USA total	
												2,076	2	2,078	19,162
												4,433	48	4,481	20,110
												9,537	11	9,548	28,547
												6,173	93	6,266	31,988
												5,727	388	6,115	40,144
												9,215	73	9,288	36,543
												13,934	10	13,944	28,584
									56			3,506	13	3,575	19,974
									+			4,547	1	4,548	25,885
									16			7,989	23	8,028	30,810
									+			10,769	25	10,794	32,782
									28			11,832	7	11,867	35,031
									39			9,047	7	9,093	28,517
			54			54			11	+	66	6,523	1	6,601	27,030
			-			-			12			15,450	20	15,482	30,986
			53			53			+			5,517	32	5,549	20,701
			33			33			8			5,773	12	5,793	21,615
			23			23			9			6,657	15	6,681	16,400
			-			-			+			3,873	19	3,892	11,422
			1			1			+			7,804	8	7,812	17,088
			14			14			3		42	11,656	15	11,716	21,190
			33			33			5	+	20	9,639	54	9,718	19,560
			47	15		62			+	+	30	5,243	58	5,331	20,641
			61	5		66			83		1	7,353	34	7,471	20,910
			17	2		19			22	+	3	8,652	21	8,698	19,303
			131	2		133			10		3	3,259	19	3,291	18,789
			66	2		68			4		2	4,663	5	4,674	26,858
			58	-		58			5		1	5,889	11	5,906	31,679
			114	5		119			+		24	2,327	7	2,358	22,594
			179	-		179	4		+	10	+	867	9	890	34,612
		2	207	-		209	9		1		+	2,639	11	2,660	29,375
		2	175	-	9	186	31		59		2	629	33	754	20,631
		-	477	8	5	490	6	1	5		18	673	49	752	11,551
		11	210	-	80	301	8				20	3,320	89	3,437	16,078
		13	70	-	16	99	16				41	4,851	12	4,920	19,252
		14	365	-	21	400	2				18	861	34	915	15,488
		37	108	25	197	367	4				46	923	6	979	8,960
		51	205	3	259	518	3				18	1,046	112	1,179	10,912
		299	189	16	149	653	11				81	1,380	65	1,537	8,627
		107	342	12	-	461	4	2			+	410	92	508	15,759
		3	464	5	73	545	9	38			14	1,928	110	2,099	13,977
			471	3	1	475	32	42			29	580	283	966	10,781
			559	-		559	28	30			1	906	86	1,051	16,891
			335	2		337	20	29			+	657	245	951	29,200
-	-		956	-	-	956	43	25		2	+	4,639	40	4,749	23,505
-	-		1,814	-	-	1,814	58	26		1	48	2,240	131	2,504	24,579
-	-		1,910	-	-	1,910	40	54		128	59	1,771	422	2,474	15,754
-	-		3,089	-	-	3,089	22	54		20	88	184	408	776	29,136
-	1		2,780	1	-	2,782	30	19		1	11	693	319	1,073	33,946
-	2		1,839	2	-	1,843	35	6		6	1	292	344	684	18,781
-	3		1,523	1	-	1,527	7	2		1	2	50	613	675	19,026
-	10		1,863	11	-	1,884	14	1			3	22	355	395	18,528
-	1		1,714	2	-	1,717	10	1			+		50	61	25,536
1	-		1,368	1	-	1,370	5	1			1	201	73	281	29,174
1	-		1,149	-	-	1,150	1	1			+		94	96	26,355
2	8		1,401	-	-	1,411	2	+			+	42	12	56	20,720
1	1		979	-	-	981	1	+			+		63	64	24,508
1	10		877	-	-	888	3	1		0	2	410	156	572	19,440
29	7		373	-	-	409	1	0			0		88	89	17,852
16	7		292	1	0	316	18	0		0	100		225	343	17,068
2	-		210	2	-	214	4	0		0	38		400	442	14,840
2	1		332	-	-	335	7	1		0	3		809	820	11,325
2	1		480	-	-	483	4	0		0	1	401	398	804	17,065

Table 15-3. Annual catch of swordfish (*Xiphias gladius*) in metric tons for fisheries monitored by ISC for assessments of North Pacific Ocean stocks, 1951-2010. "0"; Fishing effort was reported but no catch. "+"; Bellow 499kg catch. "-"; Unreported catch or catch information not available. *: Data from the most recent years are provisional.

Catch disposition	Year	JPN					KOR		MEX	
		Set-net	Drift gill-net	Longline	Others	JPN total	Longline	KOR total	Others	MEX total
Retained	1951	78	10	7,246	4,344	11,678				
	1952	68	-	8,890	2,733	11,691				
	1953	21	-	10,796	1,591	12,408				
	1954	18	-	12,563	1,030	13,611				
	1955	37	-	13,064	1,010	14,111				
	1956	31	-	14,596	859	15,486				
	1957	18	-	14,268	965	15,251				
	1958	31	-	18,525	1,178	19,734				
	1959	31	-	17,236	1,000	18,267				
	1960	67	1	20,058	1,273	21,399				
	1961	15	2	19,715	1,416	21,148				
	1962	15	-	10,607	1,493	12,115				
	1963	17	-	10,322	904	11,243				
	1964	16	4	7,669	1,163	8,852				
	1965	14	0	8,742	2,235	10,991				
	1966	11	0	9,866	1,886	11,763				
	1967	12	0	10,883	1,113	12,008				
	1968	14	0	9,810	1,825	11,649				
	1969	11	0	9,702	1,623	11,336				
	1970	9	0	7,715	1,823	9,547				
	1971	37	1	7,369	539	7,946	0	0		
	1972	1	55	7,316	315	7,687	0	0		
	1973	23	720	7,564	160	8,467	0	0		
	1974	16	1,304	6,523	365	8,208	0	0		
	1975	18	2,672	7,659	283	10,632	0	0		
	1976	14	3,488	8,786	554	12,842	0	0		
	1977	7	2,344	9,255	320	11,926	0	0		
	1978	22	2,475	9,022	288	11,807	0	0		
	1979	15	983	9,627	275	10,900	0	0		
	1980	15	1,746	6,873	453	9,087	135	135		
	1981	9	1,848	7,789	242	9,888	0	0		
	1982	7	1,257	6,963	289	8,516	166	166		
	1983	9	1,033	8,708	242	9,992	47	47		
	1984	13	1,053	8,375	251	9,692	27	27		
	1985	10	1,133	10,368	279	11,790	12	12		
	1986	9	1,264	9,738	247	11,258	18	18		
	1987	11	1,051	10,370	173	11,605	50	50		
	1988	8	1,234	9,304	205	10,751	27	27		
	1989	10	1,596	7,482	393	9,481	7	7		
	1990	4	1,074	6,595	144	7,817	46	46		-
	1991	5	498	5,682	181	6,366	37	37		-
	1992	6	887	8,497	405	9,795	32	32		-
	1993	4	292	9,777	353	10,426	27	27		-
	1994	4	421	8,723	345	9,493	4	4		-
	1995	7	561	7,808	458	8,834	9	9		-
	1996	4	428	7,979	646	9,057	15	15		-
	1997	5	365	8,215	409	8,994	99	99		-
	1998	2	471	7,419	548	8,440	153	153		-
	1999	5	724	6,604	465	7,798	131	131		-
	2000	5	808	7,292	555	8,660	202	202	602	602
	2001	15	732	7,831	269	8,847	438	438	516	516
	2002	11	1,164	7,185	240	8,600	438	438	215	215
	2003	4	1,198	6,434	182	7,818	380	380	237	237
	2004	4	1,062	6,900	263	8,229	410	410	268	268
	2005	3	956	6,647	530	8,136	403	403	234	234
	2006	5	796	7,687	590	9,078	465	465	328	328
	2007	2	829	8,123	492	9,446	453	453	172	172
	2008	3	648	6,187	524	7,362	794	794	242	242
	2009	3	682	6,006	489	7,180	993	993	394	394
	2010	8	494	5,398	342	6,242	662	662	222	222
	2011	2	193	4,019	245	4,459	962	962	-	-
	2012	8	371	4,026	351	4,756	856	856	-	-
	2013	13	290	4,230	459	4,992	1,071	1,071	-	-
	2014*	13	290	5,407	459	6,169	829	829	-	-
Discards	2010									
	2011									

Table 15-3. Continued.

TWN							USA									
Set-net	Gill-net (not	Harpoon	Longline	Others	Purse seine	TWN total	Drift gill-net	Harpoon	Handline	Longline	Pole-and-line	Troll	Others	Purse seine	USA total	Species Grand Total
																11,678
																11,691
			-			-										12,408
			-			-										13,611
			-			-										14,111
			-			-										15,486
			-			-										15,251
			-			-										19,734
			427			427										18,694
			520			520										21,919
			318			318										21,466
			494			494										12,609
			343			343										11,586
			358			358										9,210
			331			331										11,322
			489			489										12,252
-	-	5	646	30		681										12,689
-	8	3	763	1		775										12,424
-	1	6	843	-		850										12,186
-	1	5	904	-		910		612		5					617	11,074
-	-	3	992	-		995		99		1					100	9,041
-	-	12	862	-		874		171							171	8,732
-	-	113	860	6		979		399							399	9,845
-	-	98	881	38		1,017		406							406	9,631
-	-	152	928	1		1,081		557							557	12,270
-	-	159	636	35		830		42							42	13,714
-	2	139	578	-		719		318		17					335	12,980
-	3	10	546	-		559		1,699		9					1,708	14,074
-	5	24	668	4		701		329		7					336	11,937
-	4	72	613	1		690	160	566		5					731	10,643
-	3	18	658	4		683	473	271		3	2				749	11,320
-	3	46	856	-		905	945	156		5	3	6	1		1,116	10,703
-	3	164	783	-		950	1,693	58		5	2	3	1	1	1,763	12,752
43	5	259	733	-		1,040	2,647	104		15	49			26	2,841	13,600
3	29	166	566	61		825	2,990	305	4	2			104		3,405	16,032
3	1	201	456	6		667	2,069	291	4	2			109		2,475	14,418
-	-	187	1,331	3		1,521	1,529	235	4	24			31		1,823	14,999
-	1	80	777	183		1,041	1,376	198	6	24			64		1,668	13,487
3	2	61	1,541	35		1,642	1,243	62	7	218			56		1,586	12,716
4	2	118	1,452	88		1,664	1,131	64	5	2,437			43		3,680	13,207
4	2	205	1,430	56		1,697	944	20	6	4,535			44		5,549	13,649
12	1	287	1,494	33		1,827	1,356	75	1	5,762			47		7,241	18,895
13	3	194	1,228	100		1,538	1,412	168	4	5,936			161		7,681	19,672
12	3	211	1,155	9		1,390	792	157	4	3,807			24		4,784	15,671
6	2	14	1,185	203		1,410	771	97	6	2,981			29		3,884	14,137
10	2	19	710	1	-	742	761	81	5	2,848			15		3,710	13,524
8	1	27	1,397	1	-	1,434	708	84	7	3,393			11		4,203	14,730
15	9	17	1,198	-	-	1,239	931	48	7	3,681			19		4,686	14,518
5	5	51	1,455	-	-	1,516	606	81	9	4,329			27		5,052	14,497
5	6	74	3,716	-	-	3,801	649	90		4,834			33		5,606	18,871
8	18	64	4,853	-	-	4,943	375	52		1,969			19		2,415	17,159
16	8	1	5,400	1	-	5,426	302	90		1,524			3		1,919	16,598
8	3	-	4,771	-	-	4,782	216	107	10	1,958			11		2,302	15,519
7	6	1	4,248	2	-	4,264	182	69	7	1,185			44		1,487	14,658
5	3	16	3,964	2	-	3,990	220	77	5	1,622			5		1,929	14,692
7	2	49	4,382	3	-	4,443	443	71	4	1,211			5		1,734	16,048
2	2	20	4,099	2	-	4,125	490	59	5	1,735		1			2,290	16,486
3	6	39	3,745	-	-	3,793	405	48	6	2,014			19		2,492	14,683
83	7	31	3,550	-	-	3,671	253	50	5	1,817		0	0		2,125	14,363
6	4	42	2,844	-	-	2,896	62	37	3	1,676			18		1,796	11,818
8	17	52	3,577	1	+	3,655	119	24	5	1,623			90		1,861	10,937
3	15	30	3,746	-	-	3,794	118	5	6	1,395		1	1		1,526	10,932
2	8	-	2,846	1	-	2,857	95	6	6	1,270		1	7		1,385	10,305
2	8	-	3,177	1	+	3,188	71	5	7	1,663		1	18		1,765	11,951
														0	0	0
														0	0	0

Table 15-4. Annual catch of striped marlin (*Kajikia audax*) in metric tons for fisheries monitored by ISC for assessments of North Pacific Ocean stocks, 1951-2011 "0"; Fishing effort was reported but no catch. "+"; Bellow 499kg catch. "-"; Unreported catch or catch information not available. *: Data from the most recents years are provisional.

Catch disposition	Year	JPN					KOR		MEX		TWN							USA						Species Grand Total
		Set-net	Drift gill-net	Longline	Others	JPN total	Longline	KOR total	Sport	MEX total	Set-net	Gill-net (not	Harpoon	Longline	Others	Purse seine	TWN total	Handline	Longline	Troll	Purse seine	Sport	USA total	
Retained	1951	92	-	2,494	1,861	4,447																		4,447
	1952	203	-	2,901	2,083	5,187																23	23	5,210
	1953	126	-	2,138	876	3,140									-		-					5	5	3,145
	1954	82	-	3,068	1,057	4,207									-		-					16	16	4,223
	1955	106	-	3,082	960	4,148									-		-					5	5	4,153
	1956	133	-	3,729	1,922	5,784									-		-					34	34	5,818
	1957	71	-	3,189	2,507	5,767									-		-					42	42	5,809
	1958	82	3	4,106	3,108	7,299								543	387		930					59	59	8,288
	1959	87	2	4,152	3,261	7,502								391	354		745					65	65	8,312
	1960	161	4	3,862	1,877	5,904								398	350		748					30	30	6,682
	1961	161	2	4,420	1,805	6,388								306	342		648					24	24	7,060
	1962	197	8	5,739	1,825	7,769								332	211		543					5	5	8,317
	1963	92	17	6,135	1,882	8,126								560	199		759					68	68	8,953
	1964	81	2	14,304	2,305	16,692								392	175		567					58	58	17,317
	1965	81	1	11,602	2,732	14,416								355	157		512					23	23	14,951
	1966	226	2	8,419	1,456	10,103								370	180		550					36	36	10,689
	1967	82	3	11,698	1,596	13,379					-	-	141	387	63		591					49	49	14,019
	1968	71	0	15,913	1,202	17,186					-	40	134	333	34		541					51	51	17,778
	1969	71	3	9,144	2,600	11,818					-	5	159	573	28		765					30	30	12,613
	1970	55	3	13,686	1,158	14,902					-	8	175	495	6		684					18	18	15,604
	1971	61	10	11,632	2,240	13,943	0	0			-	16	101	449	18		584					17	17	14,544
	1972	72	243	7,843	1,066	9,224	0	0			-	1	124	389	1		515					21	21	9,760
	1973	80	3,265	6,989	740	11,074	0	0			-	4	115	569	20		708					9	9	11,791
	1974	90	3,112	7,027	734	10,963	0	0			-	7	53	674	58		792					55	55	11,810
	1975	105	6,534	5,567	619	12,825	0	0			-	7	86	796	3		892					27	27	13,744
	1976	37	3,561	5,380	582	9,560	0	0			-	9	61	379	70		519					31	31	10,110
	1977	103	4,424	3,275	459	8,261	0	0			-	9	207	541	3		760					41	41	9,062
	1978	93	5,593	4,200	480	10,366	0	0			-	7	70	618	1		696					37	37	11,099
	1979	66	2,532	5,927	481	9,006	0	0			2	18	104	458	-		582					36	36	9,624
	1980	80	3,467	6,985	461	10,993	73	73			-	39	92	284	1		416					33	33	11,515
	1981	88	3,866	4,365	466	8,785	0	0			-	25	70	508	-		603					60	60	9,448
	1982	52	2,351	5,653	617	8,673	102	102			-	26	112	404	-		542					41	41	9,358
	1983	124	1,867	4,042	713	6,746	49	49			-	31	144	555	39		769					39	39	7,603
	1984	144	2,333	3,892	584	6,953	39	39			-	16	314	965	-		1,295					36	36	8,323
	1985	81	2,363	4,608	676	7,728	13	13			1	6	152	513	23		695			18		42	60	8,496
	1986	131	3,584	7,303	479	11,497	14	14			-	13	119	179	16		327			19		19	38	11,876
	1987	102	1,888	8,725	417	11,132	15	15			1	2	132	414	16		565	1	272	29		28	330	12,042
	1988	63	2,211	7,023	612	9,909	16	16			7	12	70	464	80		633		504	54		30	588	11,146
	1989	47	1,664	5,821	503	8,035	24	24			-	23	124	192	10		349	+	612	24		52	688	9,096
	1990	65	1,945	3,493	483	5,986	1	1	-	-	12	16	207	139	21		395	+	538	27		23	588	6,970
	1991	56	1,329	4,042	454	5,881	7	7	-	-	-	81	173	290	32		576	+	663	41		12	716	7,180
	1992	71	1,204	4,202	242	5,719	53	53	-	-	-	11	163	220	24		418	1	459	37		25	522	6,712
	1993	27	828	5,199	682	6,736	568	568	-	-	3	7	132	226	-		368	1	471	67		11	550	8,222
	1994	73	1,443	4,195	311	6,022	556	556	-	-	4	5	176	138	11		334	+	326	35		17	378	7,290
	1995	58	970	5,334	228	6,590	307	307	-	-	4	5	67	110	6		192	+	543	52		14	609	7,698
	1996	39	703	3,787	117	4,646	429	429	-	-	3	8	30	188	6	-	235	1	418	53		20	492	5,802
	1997	34	813	3,520	132	4,499	1,017	1,017	-	-	3	9	33	351	-	-	396	1	352	37		21	411	6,323
	1998	34	1,092	3,759	272	5,157	635	635	-	-	6	16	19	304	-	-	345	+	378	26		23	427	6,564
	1999	28	1,126	3,159	160	4,473	433	433	-	-	5	8	26	197	-	-	236	1	364	27		12	404	5,546
	2000	41	1,062	2,261	264	3,628	536	536	-	-	6	18	29	315	1	-	369		200	15		10	225	4,758
	2001	51	1,077	2,311	197	3,636	253	253	-	-	5	16	30	250	-	-	301		351	44		+	395	4,585
	2002	80	1,264	1,560	215	3,119	187	187	-	-	8	15	6	477	-	-	506	+	226	30		+	256	4,068
	2003	41	1,064	1,855	165	3,125	205	205	-	-	5	27	11	922	+	-	965	+	538	29		+	567	4,862
	2004	23	1,339	1,699	69	3,130	75	75	-	-	5	10	7	522	2	-	546	2	376	31		+	409	4,160
	2005	28	1,214	1,230	71	2,543	136	136	-	-	9	9	5	783	9	-	815	+	511	20		+	531	4,025
	2006	30	1,190	1,161	66	2,447	55	55	-	-	-	30	117	741	-	-	888	+	611	21		+	632	4,022
	2007	21	970	1,166	63	2,220	46	46	-	-	-	29	141	301	-	-	471		276	13		+	289	3,026
	2008	26	1,302	999	81	2,408	29	29	-	-	-	43	168	270	2	-	483		427	14			441	3,361
	2009	17	821	788	94	1,720	22	22	-	-	-	46	92	262	-	-	400		258	10			268	2,410
	2010	20	913	1,019	104	2,056	18	18	-	-	-	42	131	253	3	-	429		165	19			184	2,687
	2011	30	347	1,251	113	1,741	48	48	-	-	1	27	95	343	4	0	470		362	16			378	2,637
	2012	52	597	1,306	96	2,051	33	33			+	34	114	443	1	+	592		282	11			293	2,969
	2013	39	336	1,450	86	1,911	65	65			+	24	197	372	-	+	593		398	8			406	2,975
	2014	39	336	1,124	86	1,585	82	82			+	24	197	139	-	1	361		426	12			438	2,466
Discards	2010																				1		1	1
	2011																				0		0	0

Table 15-5. Retained catches (metric tons, whole weight) of ISC members of blue marlin (*Makaira nigricans*) by fishery in the North Pacific Ocean, north of the equator. "0"; Fishing effort was reported but no catch. "+"; Bellow 499kg catch. "-"; Unreported catch or catch information not available. *: Data from the most recent years are provisional.

Catch disposition	Year	JPN		KOR		TWN							USA						Species Grand Total
		Longline	JPN total	Longline	KOR total	Set-net	Gill-net (not specified)	Harpoon	Longline	Others	Purse seine	TWN total	Handline	Longline	Troll	Others	Purse seine	USA total	
Retained	1953								-			-							-
	1954								-			-							-
	1955								-			-							-
	1956								-			-							-
	1957								-			-							-
	1958								887			887							887
	1959								781			781							781
	1960								948			948							948
	1961								703			703							703
	1962								628			628							628
	1963								691			691							691
	1964								934			934							934
	1965								1,016			1,016							1,016
	1966								957			957							957
	1967					-	-	317	898	167		1,382							1,382
	1968					-	30	649	1,433	120		2,232							2,232
	1969					-	58	465	1,232	103		1,858							1,858
	1970					1	21	604	1,385	70		2,081							2,081
	1971	5,461	5,461	0	0	-	13	473	1,331	118		1,935							7,396
	1972	6,772	6,772	0	0	-	14	490	1,205	50		1,759							8,531
	1973	6,453	6,453	0	0	-	12	275	1,650	265		2,202							8,655
	1974	6,545	6,545	0	0	1	6	355	2,144	146		2,652							9,197
	1975	4,374	4,374	0	0	-	3	421	2,638	207		3,269							7,643
	1976	5,018	5,018	0	0	-	9	511	1,315	162		1,997							7,015
	1977	4,780	4,780	0	0	-	11	391	1,183	110		1,695							6,475
	1978	5,900	5,900	0	0	1	15	364	1,633	7		2,020							7,920
	1979	5,949	5,949	0	0	3	19	362	1,646	164		2,194							8,143
	1980	5,613	5,613	155	155	-	35	444	1,185	170		1,834							7,602
	1981	5,518	5,518	0	0	-	35	313	1,840	69		2,257							7,775
	1982	6,051	6,051	351	351	-	7	306	2,139	120		2,572							8,974
	1983	4,796	4,796	82	82	-	26	741	2,122	127		3,016							7,894
	1984	6,248	6,248	155	155	-	22	960	1,789	111		2,882							9,285
	1985	5,164	5,164	45	45	9	11	747	1,187	43		1,997			145			145	7,351
	1986	5,922	5,922	86	86	4	90	839	1,723	107		2,763			220			220	8,991
	1987	5,370	5,370	89	89	12	9	973	4,627	1		5,622		51	261			312	11,393
	1988	5,054	5,054	133	133	20	8	658	2,822	589		4,097		102	266			368	9,652
	1989	5,117	5,117	50	50	10	14	640	2,691	9		3,364		356	326			682	9,213
	1990	4,116	4,116	44	44	3	24	427	1,749	143		2,346		378	295			673	7,179
	1991	4,094	4,094	75	75	4	50	338	2,288	152		2,832		297	346			643	7,644
	1992	3,721	3,721	60	60	25	40	432	3,786	110		4,393		347	260			607	8,781
	1993	4,600	4,600	36	36	44	41	400	4,135	82		4,702		339	311			650	9,988
	1994	5,832	5,832	2	2	12	30	206	3,007	7		3,262		362	298			660	9,756
	1995	5,907	5,907	0	0	15	36	895	3,896	5		4,847		570	315			885	11,639
	1996	3,260	3,260	10	10	13	35	270	3,337	10	-	3,665		467	409			876	7,811
	1997	3,697	3,697	145	145	5	48	194	3,683	-	-	3,930		487	378			865	8,637
	1998	3,438	3,438	335	335	8	59	91	3,624	1	-	3,783		395	242			637	8,193
	1999	3,751	3,751	164	164	21	32	135	3,417	-	-	3,605		357	293			650	8,170
	2000	3,606	3,606	96	96	24	40	186	4,131	2	-	4,383		314	235			549	8,634
	2001	3,594	3,594	166	166	18	57	229	4,733	-	-	5,037		399	291			690	9,487
	2002	2,976	2,976	152	152	13	63	32	4,448	6	-	4,562		264	225	1		490	8,180
	2003	2,836	2,836	158	158	20	107	52	7,685	4	-	7,868		363	210			573	11,435
	2004	2,977	2,977	226	226	14	93	36	6,672	9	-	6,824		283	188	5		476	10,503
	2005	2,506	2,506	303	303	8	65	48	7,630	16	-	7,767		337	187			524	11,100
	2006	2,414	2,414	217	217	12	15	30	5,729	-	-	5,786		409	160			569	8,986
	2007	2,016	2,016	120	120	3	17	20	5,117	-	-	5,157	1	262	127			390	7,683
	2008	2,096	2,096	219	219	10	16	15	5,477	1	-	5,519	1	349	198			548	8,382
	2009	1,840	1,840	224	224	9	12	9	4,638	1	-	4,669	1	360	15			376	7,109
	2010	2,457	2,457	257	257	5	27	15	4,959	1	-	5,007	2	306	148			456	8,177
	2011	2,211	2,211	684	684	3	18	17	4,625	9	2	4,674	2	373	199			574	8,143
	2012	1,839	1,839	587	587	6	13	16	4,097	-	12	4,144	2	298	141			441	7,011
	2013	1,985	1,985	963	963	2	6	16	4,607	-	9	4,640	3	406	137			546	8,134
	2014*	1,752	1,752	801	801	2	6	16	4,861	-	7	4,892	4	535	159			698	8,143
Discards	2010																1	1	1
	2011																6	6	6
	2013										5	5							5

Table 15-6. Retained catches (metric tons, whole weight) of ISC members of blue sharks (*Prionace glauca*) by fishery in the North Pacific Ocean, north of the equator. "0"; Fishing effort was reported but no catch. "+"; Bellow 499kg catch. "-"; Unreported catch or catch information not available. *: Data from the most recent years are provisional.

Catch disposition	Year	JPN		KOR		MEX		TWN		USA					Species Grand Total
		Longline	JPN total	Longline	KOR total	Others	MEX total	Longline	TWN total	Drift gill-net	Longline	Troll	Others	USA total	
Retained	1985									+			1	1	1
	1986									1			1	2	2
	1987									1			1	2	2
	1988									+			3	3	3
	1989												6	6	6
	1990									+			20	20	20
	1991									+			1	1	1
	1992									1			1	2	2
	1993									+			+	+	+
	1994	20,062	20,062							+			12	12	20,074
	1995	18,427	18,427							+			5	5	18,432
	1996	21,251	21,251							+			+	+	21,251
	1997	26,105	26,105							+			+	+	26,105
	1998	23,988	23,988							+			1	1	23,989
	1999	26,541	26,541							+			+	+	26,541
	2000	27,511	27,511							+			+	+	27,511
	2001	28,126	28,126			-	-						+	+	28,126
	2002	26,345	26,345			-	-						+	+	26,345
	2003	26,278	26,278			-	-			+			+	+	26,278
	2004	22,470	22,470			-	-						+	+	22,470
	2005	21,887	21,887			-	-						+	+	21,887
	2006	19,063	19,063			-	-						+	+	19,063
	2007	15,190	15,190			2,073	2,073			9	8		+	17	17,280
	2008	21,773	21,773			3,530	3,530				7			7	25,310
	2009	13,721	13,721			3,260	3,260	11,541	11,541	1	9		1	11	28,533
	2010	13,084	13,084			3,700	3,700	7,670	7,670	+	7		0	7	24,461
	2011	6,916	6,916			3,365	3,365	13,117	13,117		13		0	13	23,411
	2012	11,137	11,137			4,107	4,107	10,606	10,606		16		0	16	25,866
	2013	12,438	12,438	75	75	4,494	4,494	6,321	6,321		1	0	0	1	23,329
	2014*	11,037	11,037	100	100	5,513	5,513	8,150	8,150		0		0	0	24,800

1) Shark catch is all retained, and no discard data.

Table 15-7. Retained catches (metric tons, whole weight) of ISC members of shortfin mako sharks (*Isurus oxyrhinchus*) by fishery in the North Pacific Ocean, north of the equator. "0"; Fishing effort was reported but no catch. "+"; Bellow 499kg catch. "-"; Unreported catch or catch information not available. *: Data from the most recent years are provisional.

Catch disposition	Year	KOR		MEX		TWN		USA						Species
		Longline	KOR total	Others	MEX total	Longline	TWN total	Gill-net (not	Drift gill-net	Harpoon	Troll	Others	USA total	Grand Total
Retained	1985			43	43				129	1		19	149	192
	1986			84	84				250	1		59	310	394
	1987			197	197				208	3		188	399	596
	1988			248	248				106	3		214	323	571
	1989			135	135				117	1		137	255	390
	1990			288	288				229	3		141	373	661
	1991			228	228				125	1		91	217	445
	1992			376	376				118	3		19	140	516
	1993			442	442				87	1		32	120	562
	1994			336	336				80	1		46	127	463
	1995			333	333				79	1		14	94	427
	1996			413	413				85	1		9	95	508
	1997			401	401				118	3		11	132	533
	1998			386	386				85	1		12	98	484
	1999			439	439				52	+		9	61	500
	2000			539	539				64	+		12	76	615
	2001			491	491				30	1		10	41	532
	2002			488	488				69	+		12	81	569
	2003			471	471				57	+		9	66	537
	2004			865	865				38	1		13	52	917
	2005			609	609				25	1		8	34	643
	2006			641	641				38	+		7	45	686
	2007			689	689				37	+		6	43	732
	2008	-	-	609	609				27	1		5	33	642
	2009	-	-	653	653	78	78	21		1	0	7	29	760
	2010	-	-	760	760	54	54	10		0		10	20	834
	2011	-	-	758	758	208	208	8		0		8	16	982
	2012	-	-	715	715	74	74	9		0	0	11	20	809
	2013	8	8	711	711	107	107	16		0		12	28	854
	2014*	8	8	-	-	119	119	5		0		9	14	141

1) Shark catch is all retained, and no discard data.