Annex 10

REPORT OF THE PACIFIC BLUEFIN TUNA WORKING GROUP WORKSHOP

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

10-11 July 2009
Kaoshiung, Taiwan

1.0 INTRODUCTION

1.1. Welcome and introduction

The meeting was opened by the chairman, Yukio Takeuchi. Scientists from Japan, Korea, Taiwan, the U.S.A. and the IATTC and WCPFC were present (Appendix 2).

1.2. Adoption of agenda

A provisional Agenda was distributed to the participants for review and the Agenda was adopted. (Appendix 1)

1.3. Appointment of rapporteurs

Rapporteurs were appointed for each agenda topic. Names of rapporteurs are shown in parenthesis in Appendix 1.

2.0 UPDATE OF FISHERIES STATISTICS AND REVIEW OF FISHERIES (Oshima, Kang, Childers)

2.1. Catch by country and gear;

The PBFWG table of catches by country and gear was updated by Kazuhiro Oshima. Additional data for 2007 and 2008 were provided by participants. John Childers confirmed that PBF catches for U.S. purse seine and other fisheries were correct although the 2008 values are preliminary estimates. It was suggested that for fisheries in which 2008 catches are not yet reported, the 2007 catch value be carried over as an estimate for 2008. It was also confirmed that the table contained catches in round weight.

2.2. Reviews of recent PBF fisheries (including CPUE and Size data).

Recent fisheries statistics for the PBF fisheries of Japan, Korea and Taiwan were reviewed for qualitative information on status of the stocks and performance of the fisheries. Data for the review were contained in two working papers.

Kazuhiro Oshima described the Japanese PBF fisheries for 2008 (**ISC/09/PBFWG-2/03**).

Japanese catches of PBF were updated to include catches for 2008 in this paper. In 2008, a significantly large catch was recorded by small purse seine and set net fisheries. The former catch was the fifth largest in the past 21 years, and the latter catch was also the fifth largest one but in 57 years period. Monthly weight class compositions of catches by the small purse seine in 2008 indicated a possibility that a strong cohort was recruited in 2007, because PBF smaller than 6 kg accounted for a large percentage in the overall catch. In the case for set nets, the size composition of the catch and fishing pattern suggested that some factors such as oceanic environmental conditions and retention of young fish in the western Pacific might have caused the increased catches, but not due to the strong cohort or changes in seasonal migration patterns.

Discussion

The WG questioned if the length frequency data from the catch by the set net are representing their catches. Ichinokawa and Takeuchi (ISC/08/PBF-2/7) discussed some problems on length-frequency data of PBF caught by the set net. The catch of the set net are affected by the oceanic condition because of the passiveness of this gear. Furthermore distributions of size sampling efforts are not consistent among the set nets. Any actual solutions for this problem have not been found yet. At the present stage, the raw length data are tentatively used for the length frequency data of the catch of set net. Korea asked Japan to clarify the cause of rapid increase in 2008 PBF catch by PS that target small pelagic fish and set net fisheries; and if that is related to the increase in fishing effort. Japan answered that there was no indication of increasing fishing effort, though it is premature to conclude the definite cause for the increased catch.

Joon-Taek Yoo described the Korean PBF fisheries (**ISC/09/PBFWG-2/04**).

Korean PBF catch and size information in the Korean waters had been compiled in the database system (OFIRIS) of the National Fisheries Research & Development Institute. PBF are mainly caught by domestic offshore purse seiners as by-catch. The number of offshore purse seiners has gradually decreased since 1994. The annual catches of PBF, after 1994, tended to increase with large annual fluctuations. Total reported Korean catch in 2008 was 1,536 t. The quarterly proportions of the catch varied greatly since 2000, possibly due to the fact that PBF is not the target species of the Korean domestic purse seine fishery. The fork length of PBF ranged from 20 cm to 187 cm during 2000-2008. A strong mode at 27 cm in 2000 progressed to about 50 cm by 2002. Length-frequency distribution in 2003 had dominant modes at 30 cm, 40 cm and 64 cm, and then had several modes between about 30 and 80 cm. In particular, in 2008, two weak modes at 120 and 150 cm appeared in the length-frequency distribution. Annual mean fork length of Pacific bluefin tuna during 2000-2008 tended to increase reaching a peak in 2008 at 57.2 cm. The main fishing ground of PBF generally was around Jeju Island. However, in 2005 and 2007, additional fishing grounds were apparently formed around Tsushima Island. Finally, a research project for the next five years to collect biological and ecological information on Pacific bluefin tuna in Korean waters was presented.

Discussion

Several questions were raised with regard to the by-catch of PBF by mackerel. fleet (purse seiners) in Korea. It was clarified that a fishing unit in the fleet is consist of one main fishing vessel and two light boats, which are very similar to those small purse seiners in Japan. The PBF WG suggested the following data to be secured from the Korean catches: 1) monthly or quarterly

catch data as well as annual, 2) size frequency data and 3) effort information. Korea explained that it already provided accurate temporal catch information and size frequency data to the PBFWG as requested by the ISC. Korean scientists also explained their size data sampling scheme on a random sampling basis by port samplers. Such data with temporal distribution of Korean catch would be useful, because it seemed to be different from Japanese one. The PBFWG welcomed the effort of the Korean scientists in reporting the recent catch by months and quarters. It was suggested that Korea needs adoption of a logbook system, though it was considered not to be easy to implement.

Chien-Chung Hsu briefly reviewed the 2008 Pacific bluefin fishery of Chinese Taipei **(oral presentation)**

The catch of PBF in recent 4 years (2005-2008) was updated to 1,368t, 1,148 t, 1,401t and 979t, respectively. The numbers of vessels as having caught bluefin for those years were 617, 518, 489 and 483 respectively. The 2008 catch was the lowest in the time series since 1993, which also had lower catches per vessel compared to the previous five years. The preliminary 2009 catch is currently just over one-third that of 2008. The size of PBF caught ranged from 170 cm to 260 cm in fork length during 2005-2008. For the sampled years, over 80% of unloaded PBF were measured on dockside.

Discussion

The WG noted that there were discrepancies of size-frequencies of PBF sampled by National Taiwan University (NTU) and Overseas Fisheries Development Council (OFDC). The cause for such difference was discussed and the WG recommended that the Taiwanese scientists continue collecting otolith samples from Pacific bluefin tuna. The WG expressed its appreciation for the significant effort NTU has put into this sampling program. The WG was informed that a new age and growth paper was recently accepted by *Fishery Research* and will be published soon (Shimose *et. al* 2008[1]).

2.4. Other

There were no other reports.

3.0 INVESTIGATION OF LOW PLAUSIBLE RESULTS IN THE 2008 STOCK ASSESSMENT

3.1. Review of "alternative M scenario" sensitivity run results (Kai, Lee)

A. Aires-da-Silva presented the working paper “A sensitivity analysis of alternative natural mortality assumptions in the PBF stock assessment” **(ISC/09/PBF-2/1).**

Major uncertainties remain to be solved in the 2008 PBF stock assessment. Among various issues the important uncertainties relate to the interpretation of extremely low levels for the spawning biomass ratio (SBR), or depletion, which was found to be below 5% over the whole

[1] Shimose, T., Tanabe, T., Chen, K.-S., Hsu, C.-C., Age determination and growth of Pacific bluefin tuna, *Thunnus orientalis*, off Japan and Taiwan, *Fisheries Research* (2008), doi:10.1016/j.fishres.2009.06.016

dynamic period of the assessment (1952-2005). Another unrealistic result is an extremely high estimate for the unfished spawning biomass (S_0 of about 1.4 million tons). A recent hypothesis advanced by the WG group is that these "implausible quantities" are the results of some form of model mis-specification. Furthermore, it was hypothesized that natural mortality (M) is the major source of model mis-specification in the assessment. Series of alternative M schedules have been considered by the WG which mainly assume higher M values for adults.

A presentation was made on the results from sensitivity analyses of the effect of alternative natural mortality assumptions on the PBF assessment. The issues related to the "quantities of low plausibility" were greatly minimized when higher levels of adult M were used. In addition, the model fit to the data was improved for the alternative M runs. This supports the previous life-history arguments advocating for higher natural mortality rates for adult PBF than those assumed in the 2008 assessment. However, there are issues still to be understood. In particular, the management quantities were found to be highly sensitive to minor changes of M, particularly on adult M. It is possible that there are other factors affecting the results, and this should be investigated.

While these uncertainties are not reduced, other quantities which are more robust in the assessment should be sought for management recommendations. One of the key conclusions of the 2008 PBF assessment is that "Fs on recruits (age 0) and on juvenile (ages 1-3) have been generally increasing for more than a decade (1990-2005)". These observed F trends were found to be fairly robust across the alternative M scenarios investigated in this paper.

Discussion

A question was raised regarding that non-positive definite hessian in the 2008 base case model using Stock Synthesis 3 (SS3) with the same model configuration as the 2008 stock assessment using Stock Synthesis 2 (SS2). It was also noted that there were small differences in results in the transition from SS2 to SS3, while there was large differences in the results between the new natural mortality schedule (December 2008 meeting) and old natural mortality schedule (2008 stock assessment). Discussions on this topic were continued in the following presentations.

M. Kai presented the working paper "A sensitivity analysis of stock assessment for Pacific bluefin tuna using SS3 and the new mortality schedule" **(ISC/09/PBF-2/2)**

A sensitivity analysis was conducted to examine (1) effects of up-grading of stock synthesis model from SS2 to SS3; whether the updated stock synthesis model (SS3) would confirm or contradict the main conclusions of the stock assessment in 2008, and (2) effects of using the new natural mortality schedule ("New-M") on the conclusions. Comparison of the results from base-case run of SS2 and SS3 indicated that there was no clear difference on the management benchmarks as well as likelihood components. A lot of management benchmarks were examined in the comparisons, using proposed natural mortality schedules and it was concluded that the main conclusions, as those obtained in the stock assessment in 2008, were obtained by using "Original-M" with SS3.

These conclusions were found to be very sensitive to the "New-M". However, using the "Seasonal-M" (a new option for dealing with seasonal interpolated M) did not affect much on the assessment results. The benchmarks with "New-M" were more reasonable and the stock status seemed to be more realistic for Pacific bluefin tuna. Nevertheless, retrospective analyses showed

that several uncertainties still remain, even using "New-M" schedule, especially for the latest decades (1990-2005). These observations may suggest that the data-sets for recent years need to be updated for "New-M" that needs clarification and resolution in our future work.

Discussion

The issue raised on the Hessian matrix was solved in this analysis. It was clarified that the non-positive definite hessian was the result of a parameter estimated near a bound and that modifying the bound slightly produced a positive definite hessian. It was also noted that the transition from SS2 to SS3 produced only very minor differences in results. It was concluded that 1-2% spawning biomass ratio (SPR) derived from the 2008 stock assessment natural mortality schedule is implausible. The 20-30% SPR derived from the new natural mortality schedule appears to be more plausible though uncertainties still remain. The WG agreed that the assessment results are sensitive to different natural mortality schedules. The Working group recognized that more comprehensive analyses need to be conducted to explore the full range of sensitivity.

M. Ichinokawa presented the working paper "Supplement to the sensitivity analysis of natural mortality schedule on the stock assessment results of PBF: bootstrap, future projection and yield-per-recruit analysis" **(ISC/09/PBF-2/5)**

ISC/09/PBF-2/5 reported additional sensitivity analysis of a M schedule on the three topics of (1) uncertainty of SSB judged from bootstrapping simulation, (2) future projections and (3) simple spawning per recruit (SPR) and yield per recruit (YPR) analysis. Bootstrapping analysis and future projections pointed out some influences of alternative M (Ishigaki M) scenario on the stock assessment results. Firstly, the confidence interval and CV of estimated SSB became wider and larger, respectively, from the case using base M to alternative M; especially for the most recent stock assessment period. Secondly, future SSB shows gradual decline from the current SSB at 2005, which is at the upper 39% of historically observed SSB, to the historical median in alternative M. In addition, simple YPR and SPR analysis summarize changes of YPR and SPR from base M to alternative M. YPR decreased to 1.83 in alternative M from 2.04 in the base M, which is compensated by slight increase of R0 to 12,299 in Ishigaki M from 11,002. In turn, this slight increase of R0 with 12% is enough to decrease F for all ages, and to lead more than 3 times higher SPR, even assuming higher adult M in the alternative natural mortality schedule. The high sensitiveness of recruitment level to the estimated total amount of SSB would be caused by either specific fishing mortality schedule in this stock (i.e. high fishing mortality to age 0-1 fish), or life history parameters, which should be clarified for future work.

Discussion

The WG noted that 2005 SSB estimated by using the new natural mortality schedule is above the median level observed during the dynamic period. Although there are small differences in projections, setting the starting point in 2005 or 2006 both resulted in a decline of future SSB to median levels over the long term with current F levels (2002-2004). The WG noted that recruitment derived from the new M model is higher than estimate from the base case model (2008 stock assessment). Although this change of recruitment is small, SSB and spawning biomass ratio were affected. The WG recommended that this should be investigated in the future. It was also noted that the estimated spawning biomass CV using the new M is slightly larger than the 2008 assessment estimate but similar to other tuna assessments.

3.2. Updated stock status and conservation advice based on revised M (Ichinokawa and Aires-da-Silva)

In accordance with the results presented in the previous Section 3.1, the WG reviewed the previous PBF-WG conclusions about the PBF stock status given in the ISC8 Plenary report, pp26-27. With the more plausible results of the preliminary sensitivity runs using a new M schedule, the WG considers the following text would be more appropriate: Text deleted or changed from the originals are shown in bold or in parentheses.

1. Recruitment has fluctuated without trend over the assessment period (1952-2005), and does not appear to have been adversely affected by the relatively high rate of exploitation. Recent recruitment (2005-present) is highly uncertain – making short-term forecasting difficult. In particular, the 2005 year class strength may have been underestimated in this assessment.

2. Spawning stock biomass (SSB) in 2005 is **above** the median level over the assessment period. If the future fishing mortality rate (F) continues at the current F level, the short-term **projections** (2009-2010) indicate SSB will **decline** ~~the short-term outlook (2009-2010) indicates SSB will either (i) decline until 2010 or (ii) remain at approximately the 2005 level~~. In the longer term, SSB is expected **to attain levels comparable to median SSB levels over the assessment period.**

3. No relationship between SSB and recruitment is apparent over the range of "observed" SSB from the assessment. The assessment structure tacitly assumes that at least over the SSB levels "observed," recruitment is more environmentally driven than SSB-driven.

4. Current F (2002-2004) is greater than commonly used biological reference points (BRP) that may serve, in principle, as potential target reference points. This includes F_{MAX} – a BRP that given the assessment structure and assumptions is theoretically equivalent to F_{MSY}. But the magnitude by which the $F_{current}$ exceeds the target BRPs is variable (Figure 1).

5. Conversely, current F is less than commonly used BRPs that may serve, in principle, as potential recruitment overfishing threshold BRPs, e.g. F_{MED} i.e. Fs above which, the likelihood of recruitment failure is high (Figure 1).

6. Fs on recruits (age 0) and on juveniles (ages 1-3) have been generally increasing for more than a decade (1990-2005). The catch (in weight) is dominated by recruits and juveniles (ages 0-3).

7. Total catch has fluctuated widely in the range of 9,000-40,000 t during the assessment time period. Recent catch is near the average for the assessment period (~22, 000 t) ~~Over the entire catch history, annual catch has never attained the equilibrium catch at F_{MAX} (45, 000t)'~~.

Assuming the more plausible "alternative M scenario", and the updated stock status conclusions above, the PBG-WG offers the following conservation advice (changes to ISC8 Plenary Report in bold) until the more complete stock assessments is conducted:

1. Given the conclusions of the May-June 2008 stock assessment with regard to the current level of F relative to potential target and limit reference points, and residual uncertainties associated with key model parameters, it is important that the current level of F is not increased.

2. If F remains at the current level and environmental conditions remain favorable, then recruitment should be sufficient to maintain current yield well into the future.

3. A reduction in F, in combination with favorable environmental conditions, should lead to greater ~~Y/R and~~ SPR ~~and after some lag, greater sustained yield~~.

4. Increases in F above the current level, and/or unfavorable changes in environmental conditions, may result in recruitment levels which are insufficient to sustain the current productivity of the stock.

The Working Group updated section 9 of the PBFWG December meeting (ISC9 Annex 4) by incorporating the new findings from this meeting. See Appendix 4.

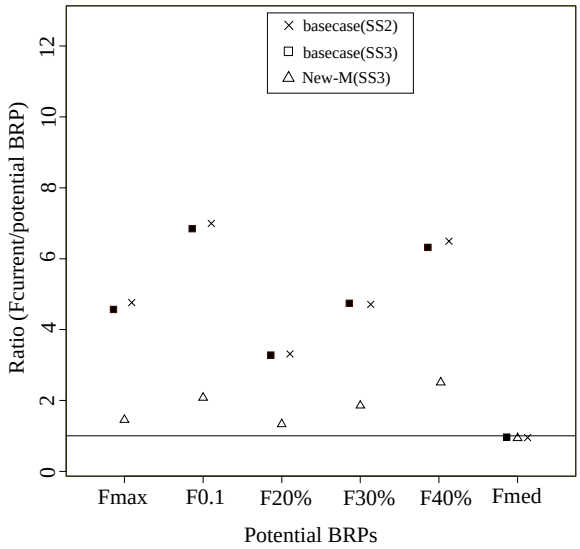

Figure 1 Box-plot of potential reference points (F_{max}, $F_{0.1}$, $F_{20\%}$, $F_{30\%}$, $F_{40\%}$, F_{med}) deriving from a base-case by SS2, SS3 and New-M. The horizontal line at y=1 indicates where the ratio of the current F to the F based BRPs.

4.0 REVIEW OF WORK PLANS FROM NOW TO NEXT STOCK ASSESSMENT IN 2011. (Piner, Yeh)

4.1. Before ISC 2010

The WG plans to hold a meeting during November 9-16, 2009 in La Jolla, CA, U.S.A., (following the IATTC Workshop). This meeting will focus on conducting a full range of sensitivity analyses using the new M schedule and the SS3 model. New data collected since the data set used in the 2008 stock assessment was prepared will not be compiled. Also the results will be presented in a similar format as with the 2008 stock assessment results.

4.2. Next stock assessment in 2011

A spirited discussion took place on timing of the next full stock assessments for PBF particularly in light of the 2008 assessment results indicating possible increase in F for young fish in recent years. After evaluating the work load and the likely work plan for a full stock assessment, the WG concluded that the next full stock assessment would be undertaken in 2011 at the earliest. A

two-day intercessional meeting process will be used with an initial data preparatory meeting held in March 20011 in Shimizu, Japan and the stock assessment meeting held in May 24-31, 2011, location to be decided.

Data to be used in the 2011 assessment will extend from 1952 to 2009 fishing year (through the 2nd quarter of 2010 calendar year). The working group noted that conducting an assessment earlier than 2011 is difficult due to the work load of key members who will be compiling and conducting the core stock assessment work. The working group also considered delaying the stock assessment until 2012 but decided that would be too long a delay given stock status concerns raised by the 2008 assessment.

5.0 ADMINISTRATIVE MATTERS (Miyake)

5.1. Clearing of 10-17 Dec 2008 PBFWG Workshop report.

The report of the Workshop held in 10-17 December 2008 at Ishigaki, Japan was reviewed and finalized. It is presented as Annex 4 to the Plenary (ISC9).

5.2. Review of biological research proposal for PBF

Korea proposed that the WG hold a special symposium or workshop on PBF biology in late 2011. Although the proposal was not fully scoped out for the WG to evaluate it in detail, the WG welcomed the proposal as useful for expanding PBF science and for encouraging cooperation among interested scientists. The WG suggested that the proposal include invitation to scientists working on other bluefin species (BFT and SBF) as well. It also felt further work needed on the details of the proposal.

The Chairman explained that in May 2008 a meeting was held by the BRTF and he represented the PBFWG at that meeting to provided input on PBF biological research and sampling programs. Two subjects relative to PBF were discussed at that meeting: (1). Biological sampling from Taiwanese LL catch; and (2) biological sampling of the Korean purse seine catch. During the discussion that followed, Chinese Taipei representative announced that Chinese Taipei scientists have already initiated a biological sampling program for their Taiwanese LL fleet in accordance with the BRT requirements. The Korean representative likewise announced that Korean scientists will start a new biological research program which is also expected to achieve BRT requirements.

The Chairman also noted that sampling of otoliths from Mexican catches in EPO for age and growth studies was recommended at the last PBFWG meeting in December 2008. The IATTC participant mentioned that the recommendation is being considered and that the IATTC has a historical collection of PBF otoliths that is available for research. The Chairman emphasized the importance of collaboration among WG members and this should continue.

6.0. ADJOURNMENT

The meeting was adjourned at 6pm.

Table 1. Catches of PBF by country and fishing gears, 1952-2008

Year	Western Pacific States														Eastern Pacific States						Out of ISC members		Grand Total
	Japan [1]							Korea [3]		Chinese Taipei					United States [4]			Mexico					
	Purse Seine	Dist. & Off. Longline	Coastal Longline	Troll [2]	Pole and Line	Set Net	Others	Purse Seine	Trawl	Longline	Purse Seine	Distant Driftnet	Others	Sub Total	Purse Seine	Others	Sport	Purse Seine	Others	Sub Total	NZ [5]	Others [6]	
1966	10,082	1,370	174		1,614	613	1,261	129						15,243	15,450	12	20	435		6,890			27,224
1967	6,462	878	44		3,273	1,210	2,603	302		53				14,825	5,517	0	32	371		15,918			31,161
1968	9,268	500	7		1,568	983	3,058	217		33				15,634	5,773	8	12	195		5,920			20,745
1969	3,236	313	20	565	2,219	721	2,187	195		23				9,479	6,657	9	15	260		5,989			21,623
1970	2,907	181	11	426	1,198	723	1,779	224						7,448	3,873	0	19	92		6,940			16,419
1971	3,721	280	51	417	1,492	938	1,555	317		1				8,773	7,804	0	8	555		3,983			11,432
1972	4,212	107	27	405	842	944	1,107	197		14				7,854	11,656	45	15	1,646		8,367			17,140
1973	2,266	110	63	728	2,108	526	2,351	636		33				8,821	9,639	21	54	1,084		13,362			21,216
1974	4,106	108	43	1,069	1,656	1,192	6,019	754		47			15	15,010	5,243	30	58	344		10,798			19,619
1975	4,491	215	41	846	1,031	1,401	2,433	808		61			5	11,332	7,353	84	34	2,145		5,675			20,685
1976	2,148	87	83	233	830	1,082	2,996	1,237		17			2	8,716	8,652	25	21	1,968		9,616			20,948
1977	5,110	155	23	183	2,166	2,256	2,257	1,052		131			2	13,335	3,259	13	19	2,186		10,666			19,381
1978	10,427	444	7	204	4,517	1,154	2,546	2,276		66			2	21,645	4,663	6	5	545		5,477			18,811
1979	13,881	220	35	509	2,655	1,250	4,558	2,429		58				25,595	5,889	6	11	213		5,218			26,863
1980	11,327	140	40	671	1,531	1,392	2,521	1,953		114			5	19,693	2,327	24	7	582		6,119			31,715
1981	25,422	313	29	277	1,777	754	2,129	2,653		179				33,532	867	14	9	218		2,940			22,634
1982	19,234	206	20	512	864	1,777	1,667	1,709	31	207		2		26,228	2,639	2	11	506		1,109			34,641
1983	14,774	87	8	130	2,028	356	972	1,117	13	175	9	2		19,670	629	11	33	214		3,159			29,387
1984	4,433	57	22	85	1,874	587	2,234	868	4	477	5		8	10,655	673	29	49	166		887			20,557
1985	4,154	38	9	67	1,850	1,817	2,562	1,175	1	210	80	11		11,975	3,320	28	89	676		917			11,573
1986	7,412	30	14	72	1,467	1,086	2,914	719	344	70	16	13		14,157	4,851	57	12	189		4,113			16,089
1987	8,653	30	33	181	880	1,565	2,198	445	89	365	21	14		14,474	861	20	34	119		5,109			19,266
1988	3,583	22	51	30	106	1,124	907	843	498	32	108	197	37	25	7,562	923	50	6	447	1	1,033			15,507
1989	6,077	113	37	32	172	903	754	748	283	71	205	259	51	3	9,707	1,046	21	112	57		1,427			8,989
1990	2,834	155	42	27	267	1,250	536	716	455	132	189	149	299	16	7,067	1,380	92	65	50		1,236			10,943
1991	4,336	5,472	48	20	170	2,069	286	1,485	650	265	342		107	12	15,262	410	6	92	9		1,587			8,653
1992	4,255	2,907	85	16	428	915	166	1,208	1,081	288	464	73	3	5	11,896	1,928	61	110	0		517	2		15,781
1993	5,156	1,444	145	10	667	546	129	848	365	40	471	1		3	9,825	580	103	298			2,099	0		13,995
1994	7,345	786	238	20	968	4,111	162	1,158	398	50	559				15,795	906	59	89	63	2	981	6		10,811
1995	5,334	13,575	107	10	571	4,778	270	1,859	586	821	335			2	28,248	657	49	258	11		1,118	2		16,916
1996	5,540	2,104	123	9	778	3,640	94	1,149	570	102	956				15,066	4,639	70	40	3,700		975	2		29,225
1997	6,137	7,015	142	12	1,158	2,740	34	803	811	1,054	1,814				21,720	2,240	133	156	367		8,449	4		23,519
1998	2,715	2,676	169	10	1,086	2,865	85	874	700	188	1,910				13,277	1,771	281	413	1	0	2,897	14		24,632
1999	11,619	4,554	127	17	1,030	3,387	35	1,097	709	256	3,089				25,919	184	184	441	2,369	35	2,466	20		15,763
2000	8,193	8,293	121	7	832	5,121	102	1,125	689	1,976	0	2,780		2	29,240	693	61	342	3,019	99	3,213	21		29,153
2001	3,139	4,481	63	6	728	3,329	180	1,366	782	968	10	1,839		4	16,895	292	48	356	863		4,214	21		33,475
2002	4,171	5,102	47	5	794	2,427	99	1,100	631	767	1	1,523		4	16,672	50	12	654	1,708	2	1,559	50		18,504
2003	1,033	5,399	85	12	1,152	1,839	44	839	446	2,141	0	1,863		21	14,874	22	18	394	3,211	43	2,427	55	10	19,164
2004	4,844	2,577	231	9	1,616	2,182	132	896	514	636	0	1,714		3	15,353		11	49	8,880	14	3,689	41	19	18,622
2005	4,061	7,390	107	14	1,818	3,406	549	2,182	548	1,085		1,368			22,527	201	7	79	4,542		8,954	67	10	24,384
2006	3,962	3,272	63	11	1,058	1,544	108	1,421	777	833		1,149			14,198		2	96	9,816		4,830	20	7	27,384
2007	3,058	2,841	84	8	2,225	2,385	236	1,503	1,209	1,054		1,401			16,004	42	2	14	4,147		9,915	21	3	24,136
2008	2,954	6,299	-[7]	-[7]	883	3,229	64	3,265	1,193	1,536		979			20,403		1	93	4,407		4,205	21 [8]	3 [8]	20,233
																					4,501	21 [8]	3 [8]	24,928

1 Part of Japanese catch is estimated by the WG from best available source for the stock assessment use.
2 The troll catch for farming estimating 10 - 20 mt since 2000, is excluded.
3 Catch statistics of Korea derived from Japanese Import statistics for 1982-1999.
4 US in 1952-1958 contains catch from other countries - primarily Mexico. Other includes catches from gillnet, troll, pole-and-line, and longline.
5 Catches by NZ are derived from the Ministry of Fisheries, Science Group (Compilers) 2006: Report from the Fishery Assessment Plenary, May 2006: stock assessments and yield estimates. 875 p. (Unpublished report held in NIWA library). Other countries include AUS, Cooks, Palau and so on. Catches derived from Japanese Imort Statistics as minimum estimates.
6 Other countries include AUS, Cooks, Palau and so on. Catches derived from Japanese Imort Statistics as minimum estimates.
7 Catch for Japanese coastal longline in 2008 includes that of the distant water and offshore lonliners.
8 Catches in New Zealand and Other countries since 2007 are carry-over of that in 2005.

Catches in shaded cell is provisional.

Appendix 1

Agenda

Pacific Bluefin Tuna Working Group Meeting

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

10-11 July, 2009
Kaoshiung, Taiwan

1.0 Introduction (Miyake)
1.1. Welcome and introduction
1.2. Adoption of agenda
1.3. Appointment of rapporteurs

2.0. Update of fisheries statistics and review of fisheries (Oshima, Kang, Childers)
2.1. Catch by country and gear;
2.2. Reviews of recent PBF fisheries (including CPUE and Size data).
2.3. Other matters

3.0. Investigation of low plausible results in the 2008 stock assessment for ISC9
3.1. Review of "alternative M scenario" sensitivity run results (Kai, Lee)
3.2. Updated stock status and conservation advice based on revised M (Ichinokawa and Aires-da-Silva)

4.0. Review of work plans from now to next stock assessment in 2011. (Piner, Yeh)
4.1. Before ISC 2010
4.2. Next stock assessment in 2011
4.3. Other matters

5.0. Administrative matters (Miyake)
5.1. Clearing of Dec 2008 WS report.
5.2. Review of biological research proposal for PBF

Appendix 2

List of documents

ISC/09/PBF-2/01	A Sensitivity Analysis of Alternative Natural Mortality Assumptions in the PBF Stock Assessment (Alexandre Aires-da-Silva [alexdasilva@iattc.org], Mark Maunder, Rick Deriso,Kevin Piner and Hui-Hua Lee)
ISC/09/PBF-2/02	A sensitivity analysis of stock assessment for Pacific bluefin tuna using SS3 and the new mortality schedule (Mikihiko Kai[kaim@affrc.go.jp], Momoko Ichinokawa and Yukio Takeuchi)
ISC/09/PBF-2/03	Japanese catch updates for Pacific bluefin tuna (Kazuhiro Oshima[oshimaka@affrc.go.jp] and Yukio Takeuchi)
ISC/09/PBF-2/04	Temporal and spatial variations in the catch of Pacific bluefin tuna by Korean domestic offshore fishery (Yoo[yoojt@nfrdi.go.kr], Joon-Taek, Sukyung Kang, Hyung-Kee Cha, Dae-Yeon Moon, Doo-Hae An, Dae-Soo Chang, Seon-Jae Hwang, Hyun-Su Jo, Doo-Nam Kim and Kyu-Jin Seok)
ISC/09/PBF-2/05	Supplement to the sensitivity analysis of natural mortality schedule on the stock assessment results of PBF: bootstrap, future projection and yield-per-recruit analysis (Momoko Ichinokawa[ichimomo@fra.affrc.go.jp], Mikihiko Kai and Yukio Takeuchi)

Appendix 3

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Appendix 4

UPDATED response to issues raised by ISC plenary with additional analysis (H. Honda, and Y. Takeuchi)

The WG considered several factors of the 2008 stock assessment which may have led to a very high unfished biomass estimate (see discussions in Agenda Item 7.0). Considerations include several elements of biological parameters, model mis-specifications and alternative model considerations.

From the examination of biological information of this species, the WG determined that the uncertainties in age and growth of young fish, maturity at age, possibility of sex differential growth, the effects of lack of information on the relationship between two spawning grounds and different spawning seasons between spawning grounds, all may have influenced the estimates of unfished biomass. However due to a limited understanding of PBF biology, the WG can only evaluate the partial effects of these factors by simple calculation in relation to the effects of density dependence. During the workshop in May 2008, the effects of density dependence on the unfished biomass estimate were discussed. The WG concluded that, although density-dependent effects could be ruled out, it was unlikely that density dependence can fully explain the large unfished biomass estimated. In addition, the spatial segregation of age classes observed on spawning grounds and the migratory nature of PBF may reduce competition and intra-specific predation, thus bluefin may not show large density-dependent effects. It is difficult to identify specific model mis-specification; only the modification of M from the 2008 stock assessment can resolve the high estimated unfished biomass in the 2008 stock assessment.

For this reason the WG recommended revising the assumptions for M and fully evaluating the effects of uncertainties in M on the stock assessment. Based on updated life-history considerations and analysis of reproductive value, the WG concluded that higher natural mortality rates for adults PBF are more plausible biologically. Accordingly, the WG has recommended adding another sensitivity analysis using the new PBF natural mortality schedule with higher natural mortality.

The effect of the updated natural mortality schedule on the PBF stock assessment results have been evaluated by the WG (see section 3.1 for details). The controversial quantities of “low plausibility” have been eliminated with the alternative PBF M schedule: low SBR levels (<5%) for the base case model was replaced with around 10-24%, which seem more plausible in the tuna world. Also, an improvement of the model fit to the PBF data has been noted. On the other hand, most of conclusions about stock status and conservation advice presented in ISC plenary last year seem to be robust to a natural mortality schedule, except for the results related to unfished biomass and minor differences on short-term future projections and shapes of YPR curve (see section 3.2). Based upon the new analysis assuming the new M assumptions, the WG has updated its conclusions about stock status and conservation advice (see section 3.2).