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Proposed Japanese fishery definition for albacore stock assessment in the North Pacific Ocean

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SUMMALY

The purpose of this document is to propose fishery definition for Japanese fisheries, including pole-and-line, longline, gillnet and other fisheries for the scheduled albacore stock assessment in 2014 in the North Pacific Ocean. For the purpose we investigate size composition, historical changes of amount of catch, fishing ground distribution, standardized CPUEs and target species. Based on these evidences we concluded that the fishery definition for longline should be separated using criteria of the specific area (25-35N, 130-140E) and time period (before 1992 and after 1993) in the western side of the North Pacific Ocean.

1. INTRODUCTION

Stock assessment for albacore in the North Pacific Ocean is scheduled in 2014. In the last stock assessment (2011) for the species, fishery definition for Japanese pole-and-line and longline had been determined based on the concept for size composition, that is, the fisheries were separated these fish size (larger fish and smaller fish) using the criteria by season and geographical area. However the length frequencies of each fishery are not fully agreed the concept for fish size (Kiyofuji 2013).

Japanese longline vessel had been targeted albacore since early 1990s since decreasing in amount of supplies of bigeye and yellowfin, increasing amount of catch of albacore, and stability of market price for albacore (Satoh et al 2013). The catchability of a species can be greatly affected when a fleet changes its targeting practice from one species to another (Maunder 2006). Therefore we should consider targeting species for fishery definition.

The purpose of this document is to propose fishery definition for Japanese fisheries, including pole-and-line, longline, gillnet and other fisheries for the scheduled albacore stock assessment in

2014 in the North Pacific Ocean. For the purpose we investigate size composition, historical changes of amount of catch, fishing ground distribution, standardized CPUEs and target species.

2. MATERIALS AND METHODS

We used logbook and SID report for catch and effort data, and used fish size composition database in NRIFSF. The detail of the data source had been already described in Matsumoto et al (2011) for the last stock assessment.

For targeting analysis, we introduced concept of “potential target species (PTS)”, which is a combination of five factors (year, month, latitude, longitude and NHBF) indicate only one potential target species. PTS is interpreted as the species that fishermen expect to good catch in high provability. Determine criteria for PTS (Potentially Target Species) of four species (albacore, bigeye, yellowfin and swordfish) using tree-model. In first, species proportion of catch in number was calculated for all operation for four species (ALB, BET, YFT, SWO). We only used “dominated catch” data in operational level. The “dominated catch” is defined that for single species proportion of catch in number is more than 90% in a set. In second, Tree decision model (by year) is applied as follows; Species name = month + latitude + longitude + NHBF. Package “mvpart” for R was used for tree model analysis described in Tsujitani and Takezawa (2009). Number of terminal node was determined by 50 fold cross-validation with one SE rule. At last, the criterion (combination of the four factors) of PTS for each species is obtained. The coverage of the dominated catch for four species was 27% (688,192 sets／2,544,083 sets).

3. RESULTS AND DISCUSSIONS

Proposed seven fishery definitions are presented in **Table 1**, including one pole-and-line, four longline, one gill-net and one miscellaneous. Information about gillnet and miscellaneous are poor, therefore only pole-and-line and longline are discussed. One pole-and-line fisheries is characterized by smaller average size fish. We propose three LL fisheries in the west side of the North Pacific Ocean, and one LL fishery in the east side “JPN LL EPO”. For the LL fisheries in the west side is categorized by its fish size and its geographical area. The area for “JPN LL-S” is characterized by smaller average size fish and specific area (25-35N, 130-140E). The “JPN LL-L7592” and “JPN LL-L7592” other two fisheries in the western Pacific Ocean is characterized by larger average fish, which are caught out of the specific area, and also divided two time

period (before 1992, after 1993). There are a number of differences among geographical area using for CPUE standardization, size and catch data (**Fig. 1**).

For the basis of the proposed fisheries definition, we investigated historical changes of size composition, amount of catch, fishing ground distribution, standardized CPUEs and target species.

Size composition

Historical changes of size composition indicated that the mode for the pole-and-line was about FL 80 cm with some annual fluctuation (**Fig. 2**). For the "LL-S" in the specific area (25-35N, 130-140E), the mode of length frequency distributed from FL 70 to 80cm. On the other hand we can see larger size fish (about 100 cm in mode) for the "LL-L7592" and "LL-L9312", which also indicated that there is small gap around early 1990s, smaller fish had been caught after early 1990s. The length frequency was variable in annual for the "LL-EPO". We concluded that it is effective to set the specific area (25-35N, 130-140E) for detecting smaller fish group for western side of the North Pacific Ocean.

Amount of catch

There was sudden jump from 1992 (19,042 mt) to 1993 (29,934 mt) for total Japanese longline catch in the North Pacific Ocean (**Fig. 3**). In addition, the sudden jump is not related with changing logbook collecting system in 1994 and there is no changing for the data reporting definition in SID report from 1992 to 1993 reported in Satoh et al (2013).

Fishing ground

There had been developed new albacore fishing ground around 25N and 140-160E after 1993 (**Fig. 4**).

Standardized CPUE

Annual changes for standardized CPUE indices for "PL" and "LL-S" showed similar trend (**Fig. 5**), which are characterized by smaller average size fish (Ijima et al 2013, Kiyofuji et al 2013). There is two or three year time lag between indices among" LL-S" and "LL-L". The time lag is comparable for the average fish size of the fisheries (70-80cm for "LL-S" and around 100 cm for "LL-L").

Target species

The analysis for targeting species is pre-mature (**Figs 6, 7**). The criteria for "dominated catch" (for single species proportion of catch in number is more than 90% in a set) is not fully

explored. As it is, though, the model appears to perform quite well in predicting locations where ALB is the potential target species. There is large differences between ALB (78% in average and other species (around 30%), which indicate that classification of PTS for ALB is proper) (**Fig. 8**). There is large differences between BET (60% in average and other species (around 13 - 30%), which indicate that classification of PTS for BET is proper, however there is no differences between YFT in some years (**Fig. 8**).

There is also detected the newly developed albacore fishing ground in **Fig. 7** as in Figure 4. The effort around 25N and 140-160E in January when NHBF is 12 was estimated to target on albacore after 1993. The proportion of effort targeting on albacore in the North Pacific Ocean had been estimated to be larger than bigeye from 1993 to 2002 (**Fig. 9**).

Based on these evidences we concluded that the fishery definition for longline should be separated using criteria of the specific area (25-35N, 130-140E) and time period (before 1992 and after 1993) in the western side of the North Pacific Ocean. Therefore we proposed seven fishery definitions described in **Table 1**.

Table 1 Proposed fishery definition for stock assessment scheduled in 2014 of the North Pacific Ocean albacore

Fishery Description		CPUE	Length	Carch (mt)	Relative Contribution	Selectivity
JPN LL-S	smaller average-size fish	25N-35N, 130E-140E (specific area)	25N-35N, 130E-140E (specific area)	25N-35N, 130E-140E (specific area)	2 - 18 %	Dome
	qtr1 and qtr2	1975-2012	1975-2012	1970-2012		
JPN LL-L7592	larger average-size fish	25N-35N, 140E-180	10N-35N, 130E-180 but exclude JPN LL-S area	10N-55N, 120E-180 but exclude JPN LL-S area	6 - 22 %	Flat top
	qtr1 and qtr4	1975-1992	1975-1992	1970-1992		
JPN LL-L9312	larger average-size fish	10N-25N, 130E-180 but exclude JPN LL-S area	10N-35N, 130E-180 but exclude JPN LL-S area	10N-55N, 120E-180 but exclude JPN LL-S area	11 - 28 %	Flat top
	qtr1, qtr2 and qtr4	1993-2012	1993-2012	1993-2012		
JPN LL-EPO	varibale	25N-35N, 140W-180	10N-55N, 120W-180	10N-55N, 120W-180	>0 - 12 %	?
	qtr1 and qtr4	1975-2000	1975-2000	1970-2012		
JPN PL	smaller average-size fish	10N-55N, 130E-175W	10N-55N, 130E-175W	10N-55N, 120E-120W	14 - 67%	Dome
	qtr2 and qtr3	1972-2012	1972-2012	1972-2012		
JPN Gill net	Mirror ?	Mirror ?		1966-2012	>0 - 20 %	Mirror ?
JPN Miscellaneous	Mirror ?	Mirror ?		1966-2012	>0 - 10 %	Mirror ?

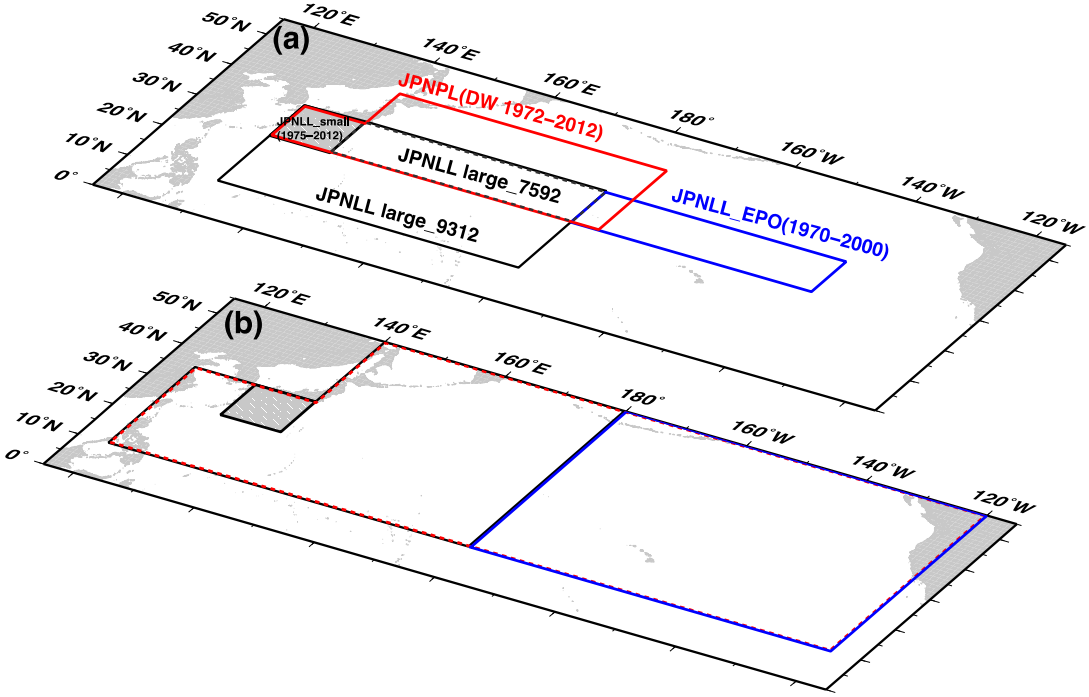

Fig. 1 Geographical area definition for Japanese longline and pole-and line fishery for the North Pacific albacore (a) CPUE standardization, (b) size-data and amount of catch

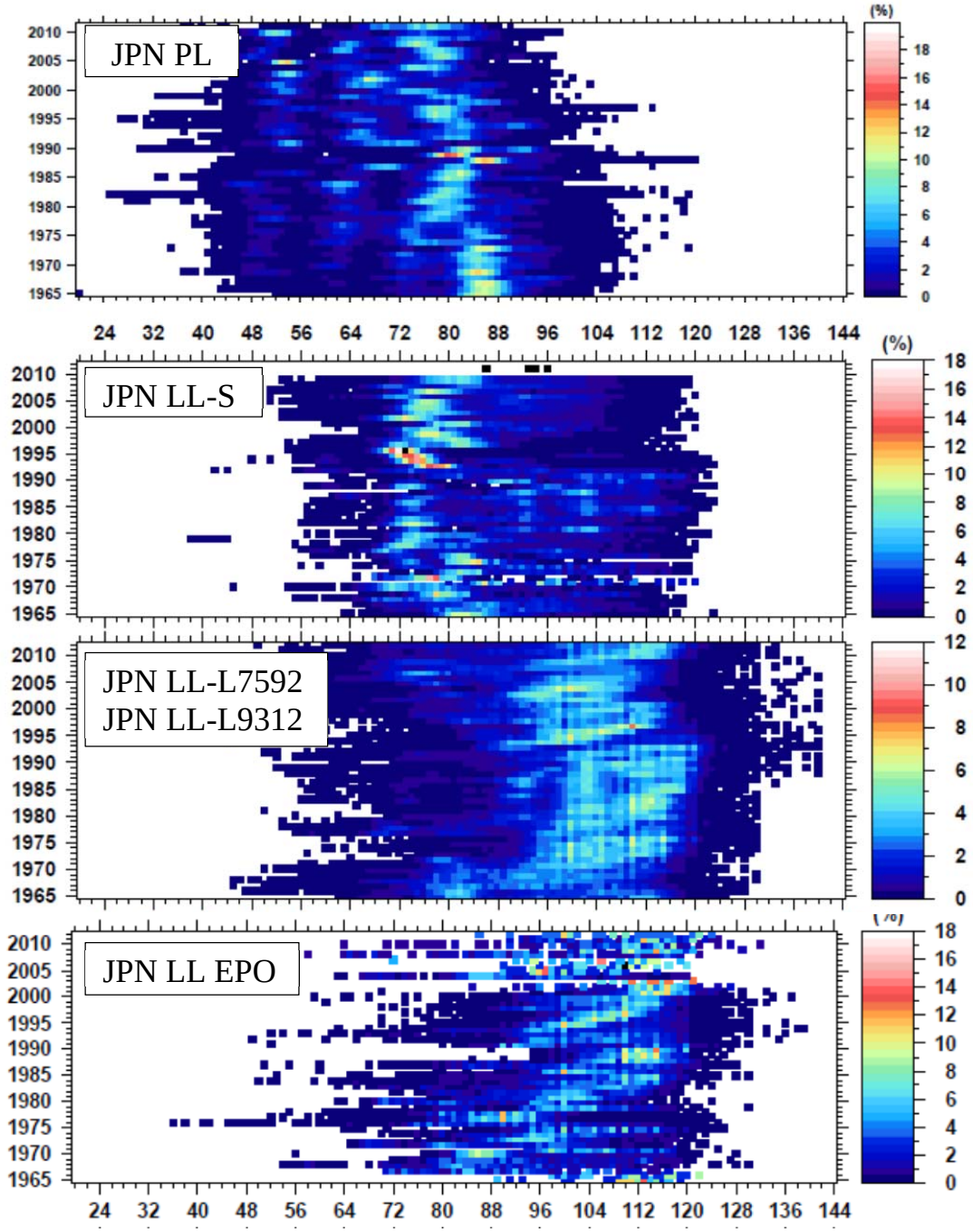

Fig. 2 Historical changes of size frequency by proposed Japanese fishery definition

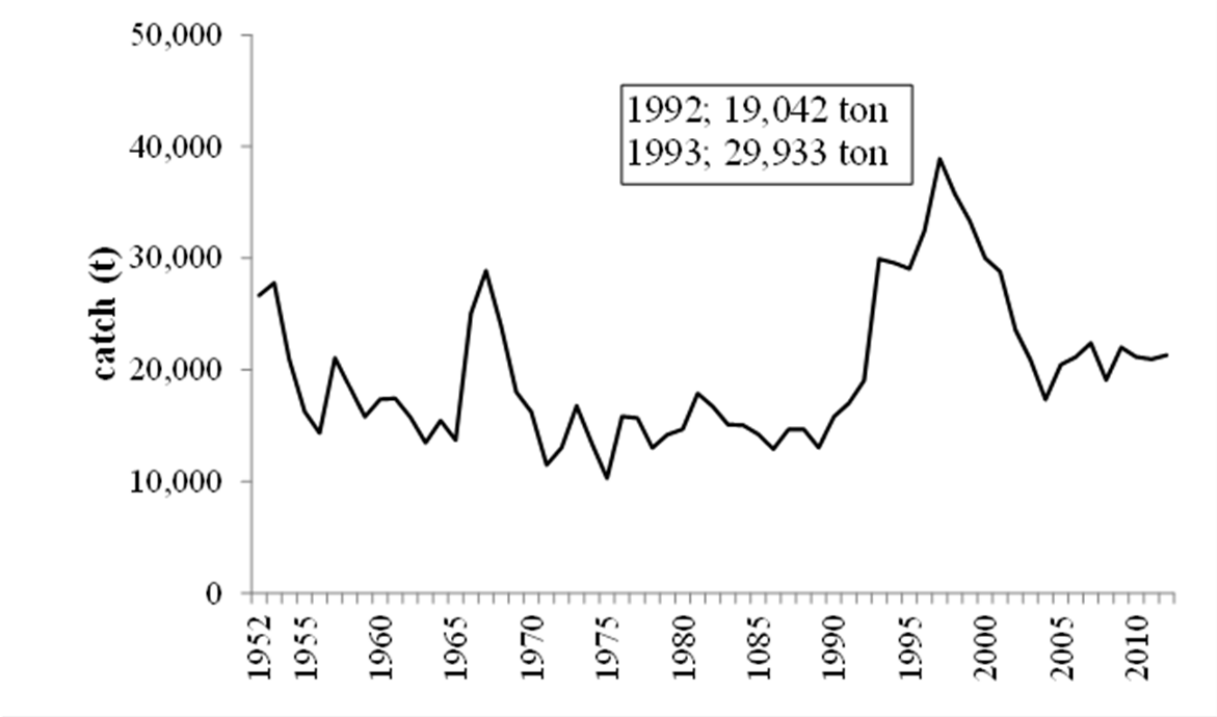

Fig.3 Historical changes of Japanese longline catch in the North Pacific Ocean

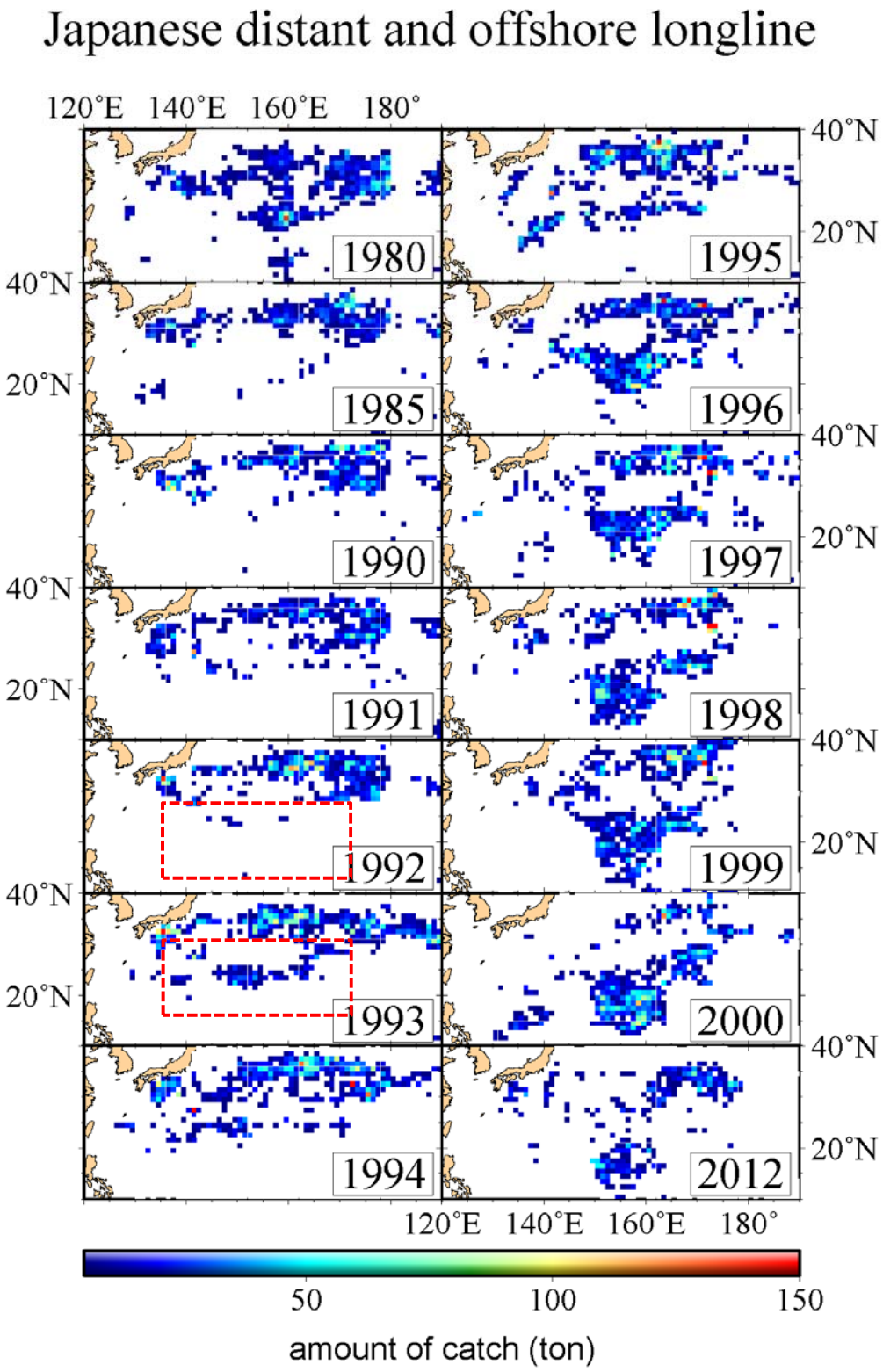

Fig. 4 Geographical distribution of amount of albacore catches for Japanese distant and offshore

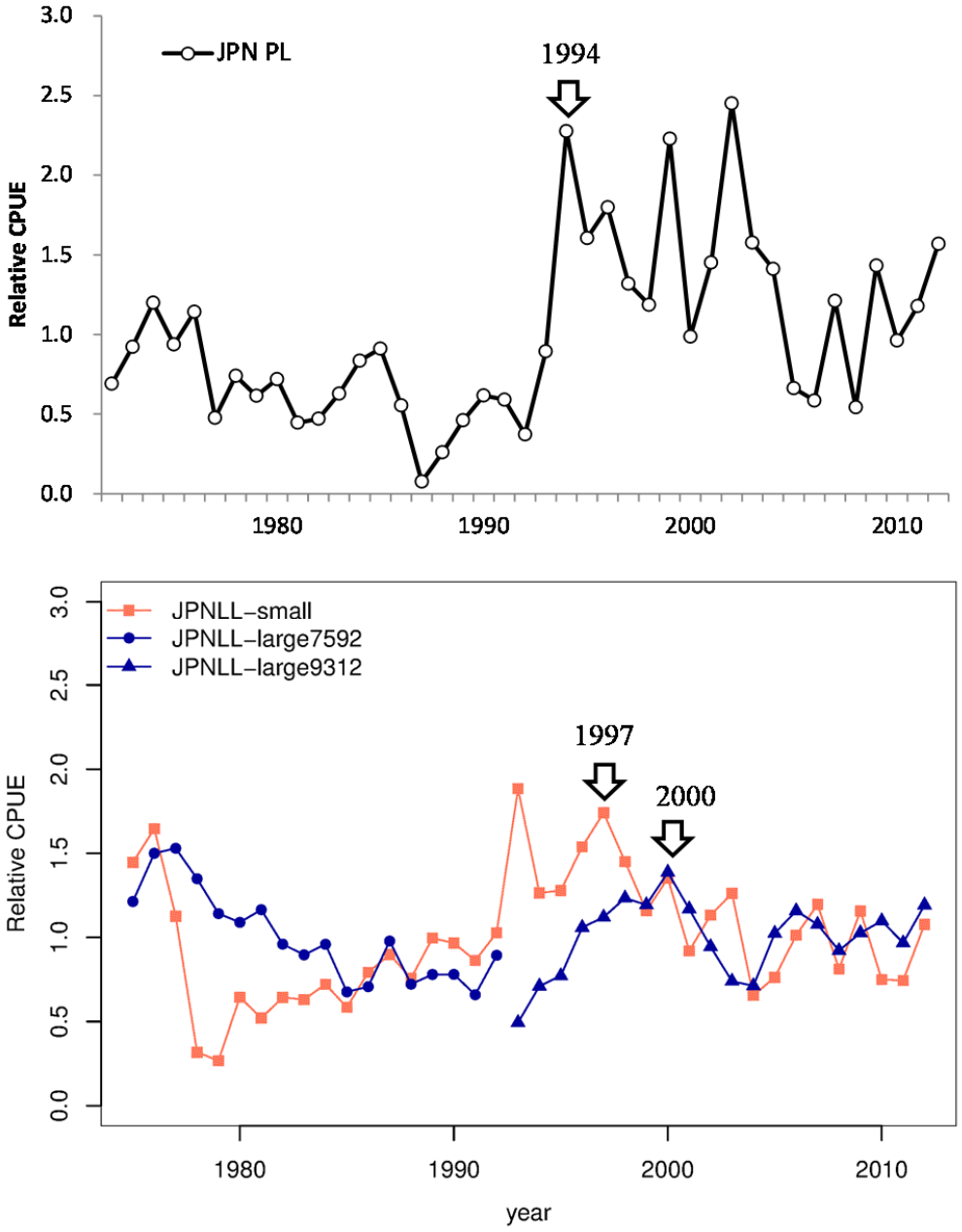

Fig. 5 Comparison of standardized albacore CPUE indices for proposed Japanese fishery definition in the North Pacific Ocean. See detail of these indices for longline in Ijima et al (2013) and for pole-and-line in Kiyofuji et al (2013).

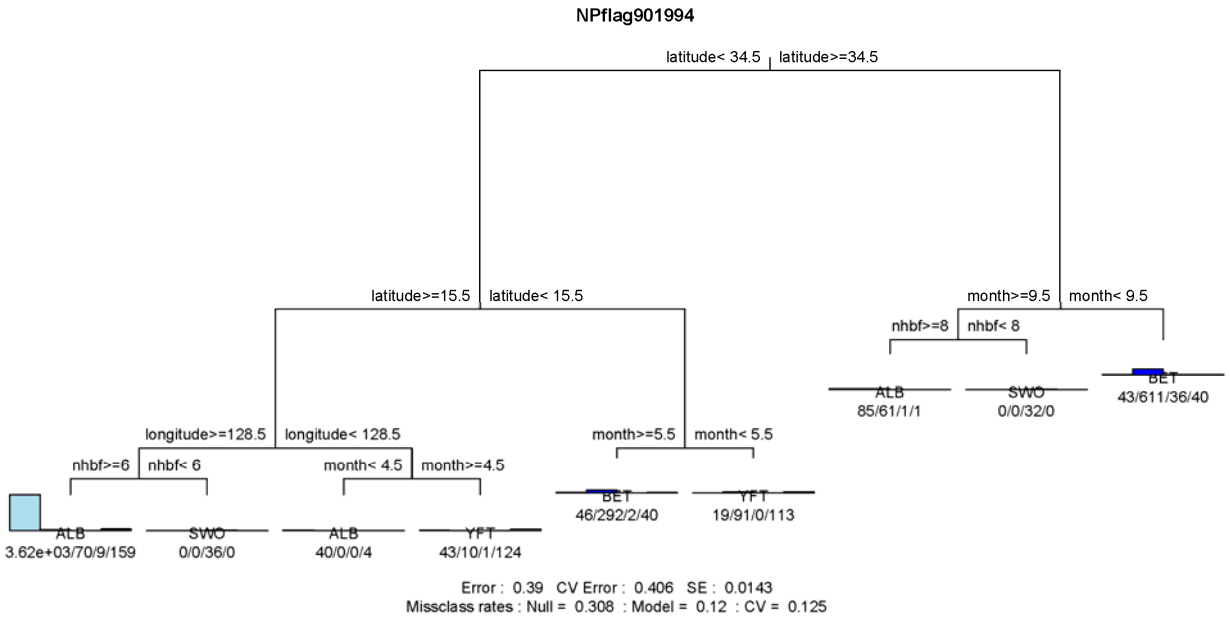

Fig. 6 Example of result of tree model analysis for 1994

The most left node is dominated by ALB (3620, 70, 9 159 sets for ALB, BET, SWO and YFT, respectively), which determined as latitude if from 15.5 to 34.5, longitude is larger than 128.5, nhbf is larger than 6 and all month. The overall total error classification is 12% (0% is no miss classification).We obtained classification rule for 1994 (**IF year**＝1994 and **latitude** >= 15.5 and **latitude** < 34.5 and **longitude** >=128.5 and **NHBF** >=6 and month >=1 **THEN PTS=ALB).**

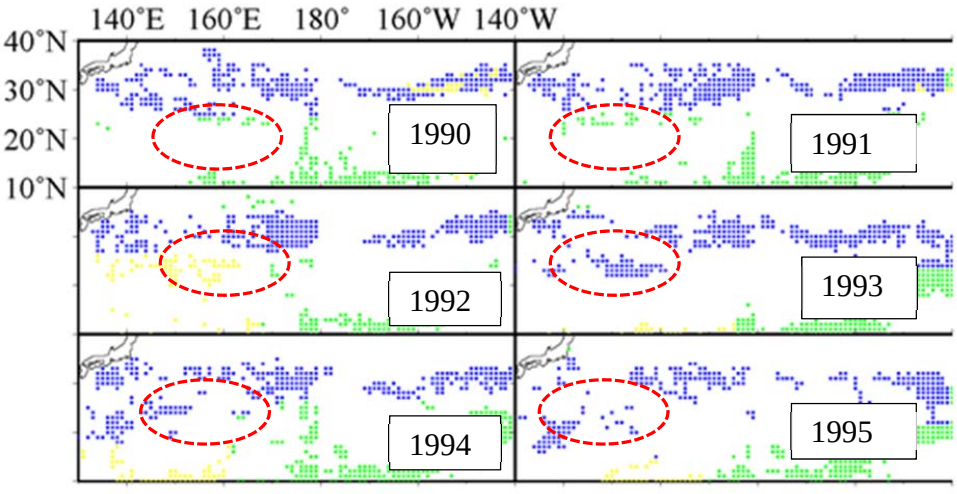

Fig. 7 Geographical distribution of PTS in early 1990s (example for January and NHBF is 12)

Blue: albacore, green: bigeye, yellow: yellowfin, purple; swordfish

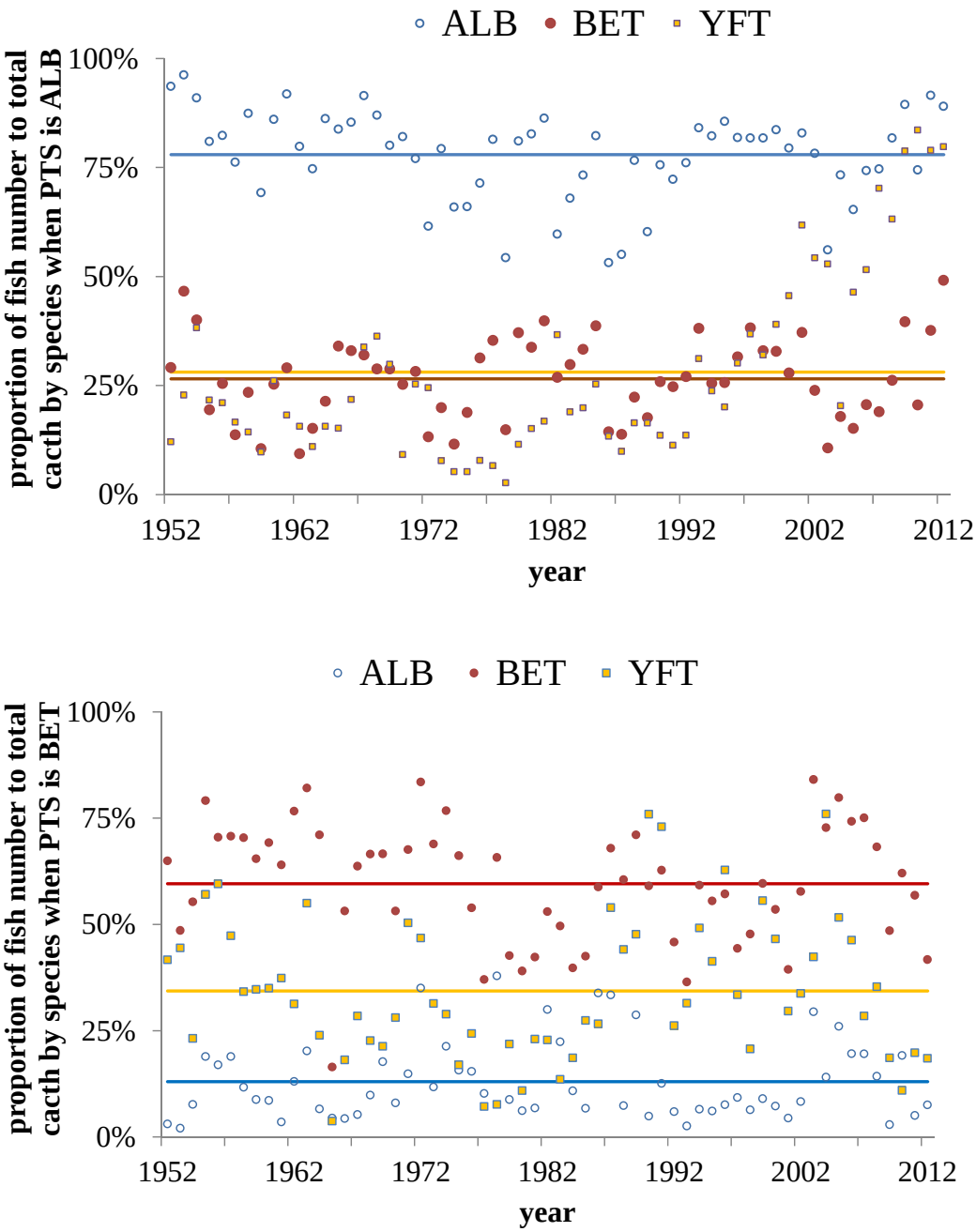

Fig. 8 Annual species composition in number in case of albacore as PTS (upper panel), and bigeye as PTS

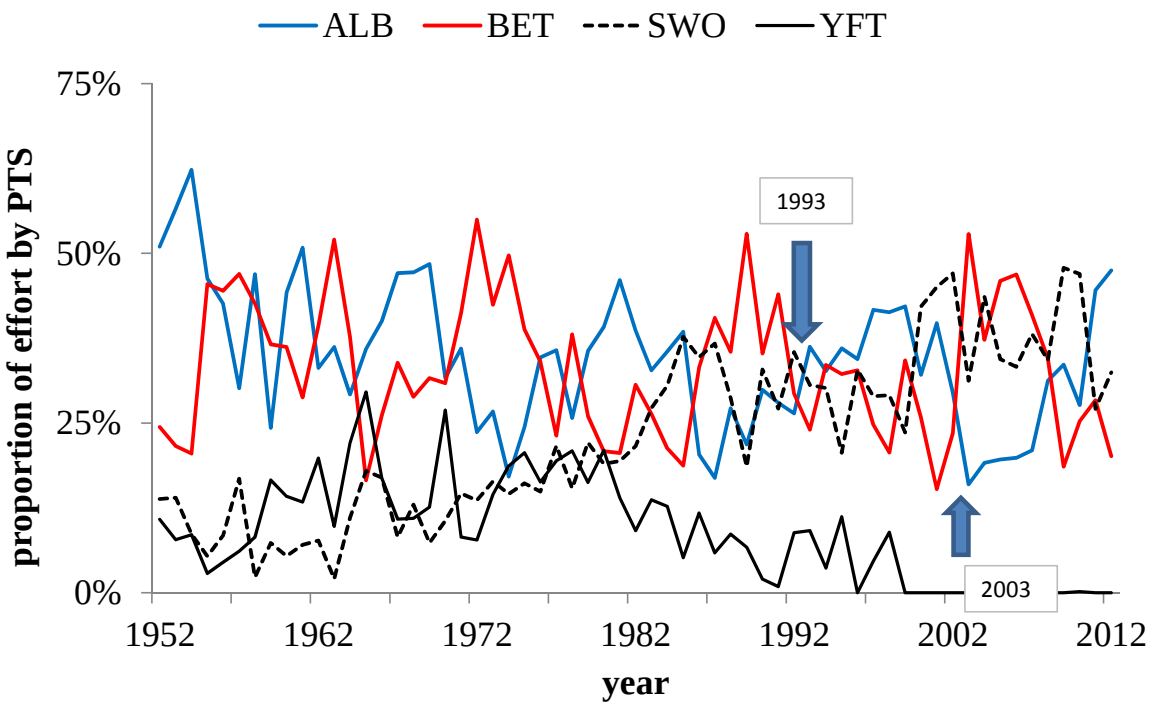

Fig. 9 Annual changes of proportion of effort by PTS in the North Pacific Ocean

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