ISC/13/ALBWG-01/10

Update standardized CPUE for albacore caught by the Japanese pole and line fishery in the northwestern North Pacific Ocean [1]

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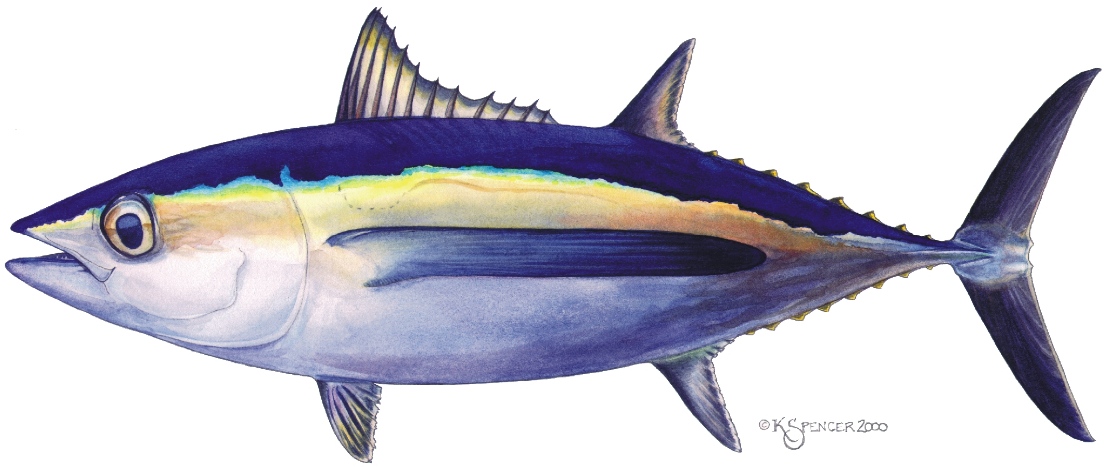

[1]This working paper was submitted to the ISC Albacore Working Group Intercessional Workshop, 19-26 March 2013, held at the College of Marine Sciences, Shanghai Ocean University, Shanghai, China. Document not to be cited without author 's permission.

Summary

In this document, standardized CPUE for North Pacific albacore caught by Japanese pole and line were estimated by the same method in 2011 stock assessment (Kiyofuji and Uosaki, 2010). Data were updated after the last stock assessment in 2011 but data used in 2011 stock assessment were also used for results comparison between last and updated data in this study. Standardized CPUEs were estimated by delta-lognormal model because of high percentage of zero catch and area was defined by latitudinal differences of target fish size. Smaller and larger albacore appeared in north and south of 35°N based on result of length composition analysis (Ichinokawa and Uosaki, 2009). Updated CPUEs show same trend as the result in 2011. Southern CPUE (PL2: larger fish) increased after 2009 and northern CPUE (PL3: smaller fish) were remained at the same level. Possible mechanisms were also discussed to reply to some questions raised by peer reviewers with respect to different CPUE trend in surface fisheries in EPO (US/CA TR) and WPO (JPN PL).

Key words: Catch per unit effort (CPUE), Japanese pole and line fishery

Introduction

In this document, standardized CPUE was estimated by the same method as described in previous 2011 NPALB stock assessment (Kiyofuji and Uosaki, 2010). Some questions raised by peer reviewers regarding different CPUE trend in surface fisheries in EPO (US/CA TR) and WPO (JPN PL) were also discussed.

Data and Method

Fishery Data
The operational level of catch and effort data for the Japanese pole and line during 1972 and 2011 with noon position in equidistant 1° × 1° grid cells was used. Date, number of poles, catch in weight and vessel size in gross register tonnage (GRT) were employed. Data used in 2011 NPALB stock assessment were also used for comparison.

CPUE standardization
In 2011 NPALB stock assessment, delta-lognormal model was applied to standardize for North Pacific albacore caught by Japanese pole and line fisheries. Following procedures were conducted and parameterization of each model was accomplished using two step generalized linear model; a first step (GENMOD; SAS 9.3) and second step (GLM; SAS 9.3), respectively. Detail model configurations can be found in the document submitted in 2010 data preparatory meeting (Kiyofuji and Uosaki, 2010). Definition of the explanatory variables and area for standardization are shown in Table 1 and Figure 1, respectively. The standardized CPUE were changed to area-weighted abundance indices.

To investigate possible reasons for different CPUE trend in surface fisheries in EPO (US/CA TR) and WPO (JPN PL) especially in PL3(smaller fish indices), albacore catch rate relative to total catch (skipjack and albacore) in 1 °× 1 ° were calculated and mapped during three periods. Three periods were defined as one high abundance periods (1999-2002) and two low abundance periods (2003-2006 and 2007-2011).

Results and Discussions

Standardized CPUEs were shown in figure 2 for data in last sock assessment and updated data in this study. Results with updated data shows same trend to results in last stock assessment but southern CPUE (PL2: larger fish) shows sharp increase after 2009 and northern CPUE (PL3: smaller fish) were remained same level.

Figure 3 represents spatial distribution of albacore catch ratio to total catch included both skipjack and albacore in 1 °× 1 ° equal grid during high abundance period (1999-2002) and low abundance (2003-2006 and 2007-2011) identified results of standardized CPUE in Fig.2(b). High ratio of albacore catch during high abundance period extended to the northern area (PL3) especially area between 160E°E and 180°E (Fig.3(a)). These area likely shrunk in low abundance period (Fig.2(b) and (c)), especially between 2007 and 2011 (Fig.3(c)). Albacore catch ratio after 2003 shows a remarkable decrease in PL3 (Fig.4) These results implies that one possible reason for decline of abundance indices inPL3 is due to the change of targeting to skipjack. Additionally, abundance indices kept increasing gradually in PL2. This could lead to another possible reason that albacore aggregated in PL2 and did not move to PL3.

This could be also consists with the sharp increase in PL2 identified in updated CPUE (Fig. 2(a)).

One potential mechanism of different albacore catch ratio trends between PL2 and PL3 is due to oceanographic changes since the major oceanographic feature in this area is the Kuroshio Extension, which lies in the latitude range from approximately 35 °N to 37 °N. Two major characteristic of Kuroshio Extension system are (1) elongated phase (defined as strong Kuroshio current which lead to small latitudinal variations of eddy kinetic energy) and contracted phase (weak Kuroshio current which lead to large latitudinal variations of eddy kinetic energy) (Qui and Chen, 2005; Fig.5). For example, Kuroshio and JPN PLOS fishing location during contracted (1999) and elongated phase (2004) are shown in upper Fig.5. JPN PLOS fishing locations likely aggregated in contracted mode and dispersed widely across Kuroshio Extension areas. These implies that two Kuroshio phase likely effected to abundance indices, however, further analysis should be conducted to investigate relationships between abundance and environmental variables.

In conclusion, standardized CPUE for albacore caught by Japanese pole and line were estimated by same method in 2011 stock assessment (Kiyofuji and Uosaki, 2010). Results with updated data shows same trend but southern CPUE (PL2: larger fish) increased after 2009 and northern CPUE (PL3: smaller fish) were remained same level. One possible reason for decline of abundance indices inPL3 is due to the change of targeting to skipjack.

References

Ichinokawa, M. and Uosaki, K. (2009) Rearrangement of Japanese fisheries for applying length-based SS3 to the stock of North Pacific albacore III: pole and line fishery.

Kiyofuji, H. and Uosaki, K. (2010) Revision of standardized CPUE for albacore caught by the Japanese pole and line fisheries in the northwestern North Pacific. *ISC/10/ALBWG-3/07*

Qui, B. and Chen, S. (2005) Variability of the Kuroshio extension Jet, recirculation gyre, and mesoscale eddies on decadal time scales. *J. Phys. Oceanogr.*, **35:** 2090-2103.

Table 1. Definition of the predictor variables included in the model.

(a) PL2

Variable	Data type	Description
year	Categorical	unique year
mon	Categorical	unique month (March-July but March and April were combined)
Vessel size	Categorical	1: 20GRT - 200GRT; 2: larger than 200GRT
sub area	Categorical	1: 130°E-140°E 2: 140°E-150°E 3: 160°E-180°E
SKJ	Categorical	1: albacore catch is equal to zero but skipjack catch is not equal to zero 2: albacore catch is not equal to zero and skipjack catch is not equal to zero

(b) PL3 (between 1972 and 1984)

Variable	Data type	Description
year	Categorical	unique year
mon	Categorical	unique month (May-November but from Aug. to Nov. were combined)
Vessel size	Categorical	1: 20GRT - 200GRT; 2: larger than 200GRT
sub area	Categorical	1: 140°E-150°E 2: 150°E-160°E 3: 160°E-170°E 4: 170°E-180°E
SKJ	Categorical	1: albacore catch is equal to zero but skipjack catch is not equal to zero 2: albacore catch is not equal to zero and skipjack catch is not equal to zero

(c) PL3 (between 1985 and 2011)

Variable	Data type	Description
year	Categorical	unique year
mon	Categorical	unique month (June-November but from Sep. to Nov. were combined)
Vessel size	Categorical	1: 20GRT - 200GRT; 2: larger than 200GRT
sub area	Categorical	1: 140°E-150°E 2: 150°E-180°E
SKJ	Categorical	1: albacore catch is equal to zero but skipjack catch is not equal to zero 2: albacore catch is not equal to zero and skipjack catch is not equal to zero

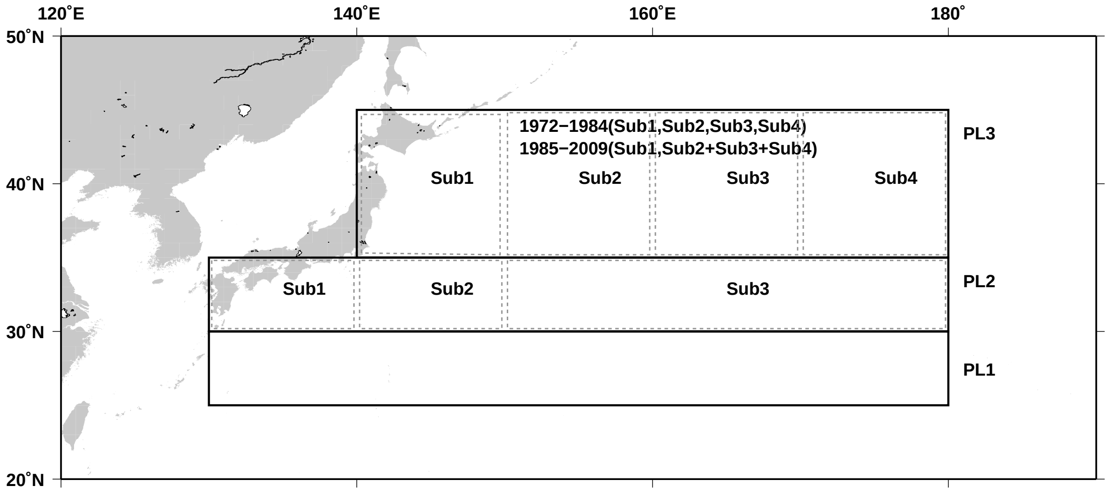

Figure 1. Area and subarea definition for CPUE standardization of the Japanese pole and line fisheries in 2011 stock assessment.

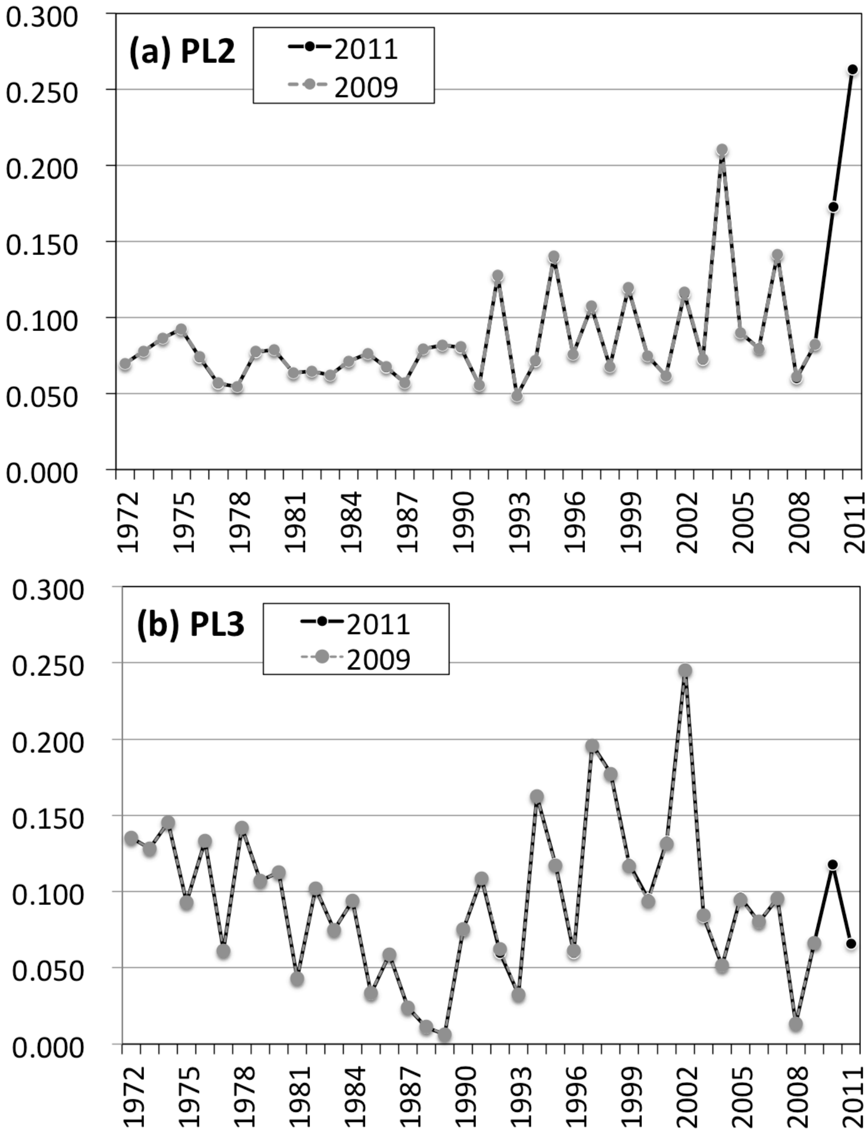

Figure 2. Estimated CPUE in 2009 (gray dashed line) and 2011 (black solid line) for PL2 (a) and PL3 (b), respectively .

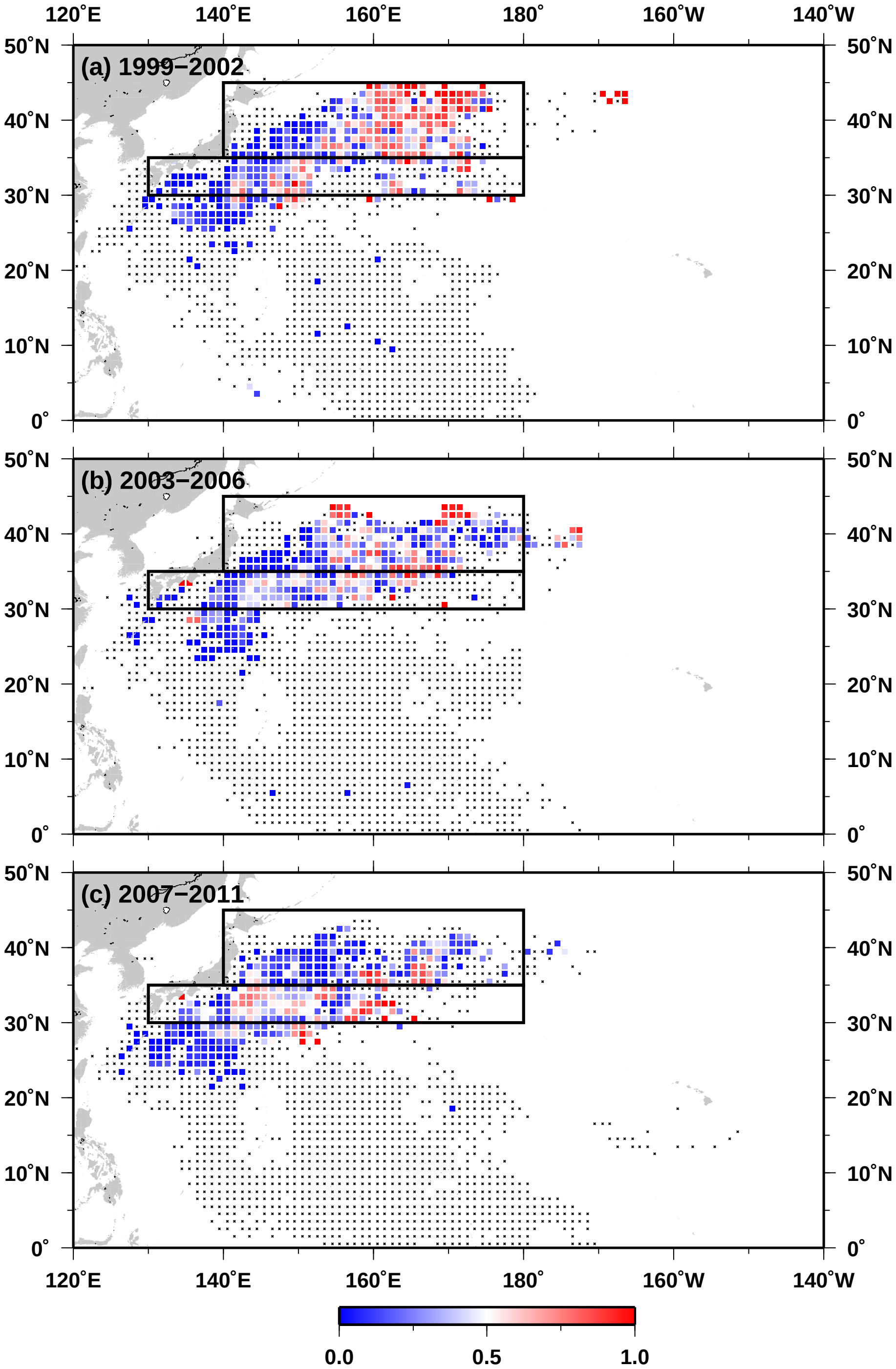

Figure 3. Spatial distribution of albacore catch ratio to skipjack. (a) 1999-2002, (b) 2003-2006 and (c) 2007-2011.

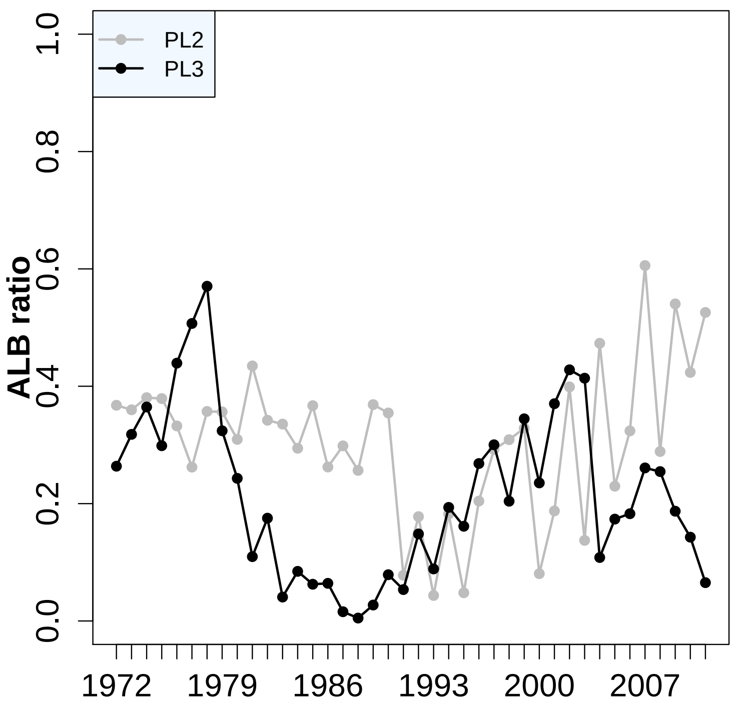

Figure 4. Time series of albacore catch ratio to skipjack from 1972 to 2011 in each area shown in figure 1 (gray: PL2, black: PL3).

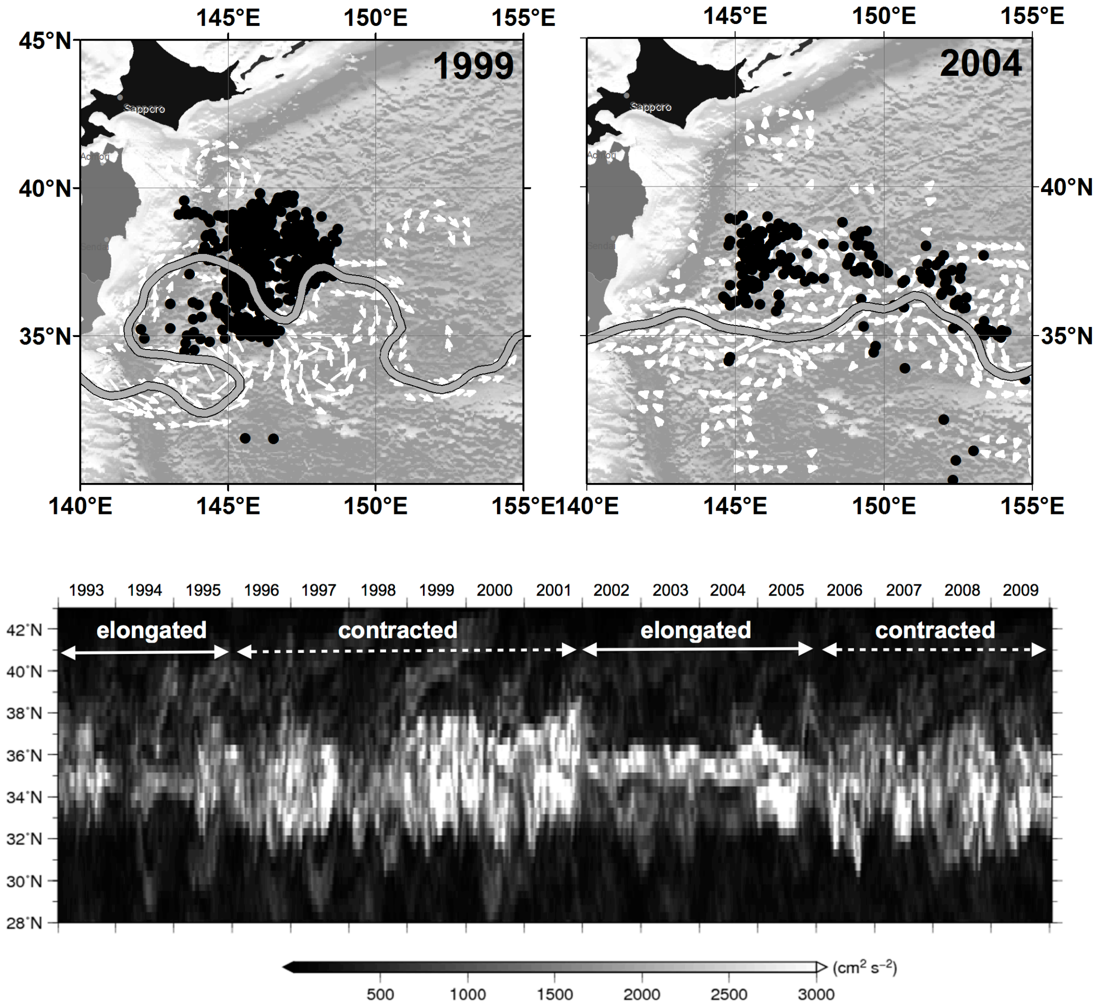

Figure 5. Kuroshio-axis (gray) and current (white arrow) in 1999 and 2004 (upper, black dots represent JPN PLOS positions). Latitude-year plot of averaged EKE (Eddy Kinetic Energy; cm^2m^{-2}) between 140°E and 147°E. (lower, elongated phase: 1993-1995, 2002-2005; contracted phase: 1996-2001, 2006-2009)