North Pacific Fisheries Commission

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Updated summary of the longitudinal distribution of juvenile Pacific saury in response to NPFC CMM 2021-08

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Summary

Information on the geographical distribution of age-0 Pacific saury in June and July was updated based on the age-0 distribution predicted by the VAST model using the Japanese trawl net survey data up to 2022. The age-0 fish was mainly distributed in the waters east of 180° in the early fishing season in the latest three years (2020-2022). The age-0 biomass index in the waters west of 170°E has been below 20% of the total biomass index and rapidly increased along longitude east of 170°E in the last decade, except in 2017. Therefore, this paper supports the longitude of 170°E as the boundary for protecting most juvenile fish specified in the present CMM for Pacific saury.

1. Introduction

Paragraph 14 of the existing CMM for Pacific saury (NPFC CMM 2021-08) says:
"*In order to protect juvenile fish, Members of the Commission are encouraged to take measures for fishing vessels flying their flags to refrain from fishing for Pacific saury in the areas east of 170°E from June to July. The SC and its subsidiary Small Scientific Committee on Pacific Saury will submit to the Commission relevant scientific information on geographical distribution of juvenile fish in the Convention Area, and its migration patterns"*. In response to the CMM, geographical distribution of age-0 Pacific saury (a good proxy of juvenile fish) in the western and central North Pacific Ocean was described using the Japanese fishery-independent survey data in June and July from 2003 to 2019 (Fuji et al., 2020). They observed two major patterns in annual longitudinal distributions. One pattern was that most age-0 fish were distributed only in the waters east of 180° and the other pattern was that multiple peaks also appeared in the waters west of 180°.

The distributional variation of age-0 fish was likely to cause large uncertainty of the proportion of those fish to be preserved (Fuji et al. 2020). Therefore, monitoring the latest geographical distribution pattern is important. In this year, the age-specific

distribution was predicted by a vector autoregressive spatio-temporal (VAST) model using the survey data up to 2022 (Hashimoto et al., 2022). The objective of this working paper is to update information on geographical distribution of age-0 Pacific saury in the early fishing season and to provide information on how many age-0 fish could be preserved under the existing measure.

2. Materials and methods

Sea surface trawl net surveys have been conducted in the western and central North Pacific Ocean in June and July since 2003 (details were described in Ueno et al. 2004, Ueno et al. 2017 and Hashimoto et al. 2020). Age-specific densities (kg/km2) at 100 knots placed in the survey area were predicted by the VAST model using survey data up to 2022 (Hashimoto et al., 2022). In this working paper, the age-0 biomass index in each 1° x 1° grid cell within the survey area was first calculated by multiplying the cell area (km^2) by the density estimate at the knot closest to the cell, and then was summed for 5° longitudinal intervals. Finally, the cumulative ratio of the age-0 biomass index in the waters west of the longitudinal boundary to the total age-0 biomass index was calculated to indicate the proportion of age-0 fish targeted in the early fishing season.

3. Results

The longitudinal distribution patterns of age-0 Pacific saury were generally different between the early (2003-2012) and late (2013-2022) period (**Fig. 1**). In the early period, age-0 fish were distributed throughout the entire survey area, with multiple peaks in the waters east and west of 180° (**Fig. 1ab**, left panels). In contrast, they were distributed mainly in the waters east of 180° in the late period (**Fig. 1ab**, right panels). The cumulative ratio of the age-0 biomass index in the waters west of 170°E to the total age-0 biomass index has fluctuated annually from 6% in 2020 to 44% in 2006 (**Fig. 1c**) and was below 20% in the last decade except for 33% in 2017 (**Fig. 1c**, right panel).

4. Discussion

The output of the VAST model indicated the age-0 Pacific saury was mainly distributed in the waters east of 180° in the early fishing season in the last three years (2020-2022). The cumulative ratio of age-0 biomass index in the waters west of 170°E was low (less than 20%) and rapidly increased along longitude east of 170°E in recent years. Therefore, this paper supports the longitude of 170°E as the boundary for protecting most juvenile fish specified in the present CMM for Pacific saury.

Reference

Fuji T, Nakayama S, Hashimoto M, Oshima K and Suyama S (2020) Description of longitudinal distribution of Pacific saury juvenile in response to NPFC CMM 2019-08. NPFC-2020-SSC PS07-WP15.

Hashimoto M, Kidokoro H, Suyama S, Fuji T, Miyamoto H, Naya M, Vijai D, Ueno Y and Kitakado T (2020) Comparison of biomass estimates from multiple stratification approaches in a swept area method for Pacific saury *Cololabis saira* in the Northwestern Pacific Ocean. Fish Sci 86: 445-456.

Hashimoto M, Nakayama S, Fuji T, Suyama S, Miyamoto H, Naya M and Kubota H (2022) Japanese survey biomass index of Pacific saury up to 2022 using VAST model. NPFC-2022-SSC PS09-WP07 (Rev.1).

Ueno Y, Suyama S, Kurita Y, Kumazawa T (2004) Design and operation methods of a mid-water trawl for quantitative sampling of a surface pelagic fish, Pacific saury (*Cololabis saira*). Fish Res 66:3-17.

Ueno Y, Suyama S, Nakagami M, Naya M, Sakai M, Kurita Y (2017) Direct estimation of stock abundance of Pacific saury *Cololabis saira* in the northwestern Pacific Ocean using a mid-water trawl. Fish Sci 83:23-33.

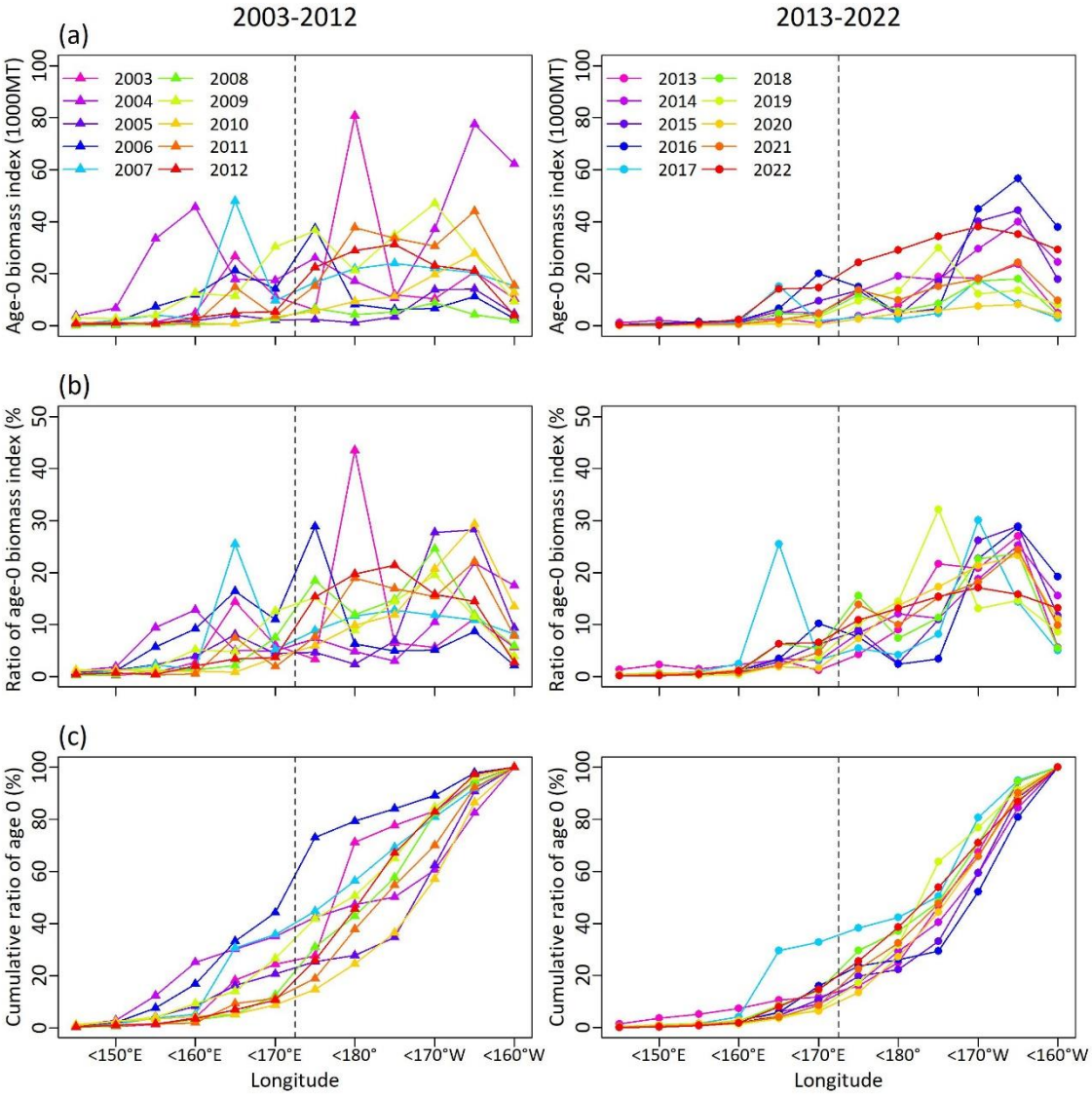

Fig. 1 Variations in (a) biomass index for age-0 Pacific saury, (b) ratio of age-0 biomass index and (c) cumulative ratio of age-0 biomass index for the early (left panels) and late (right panels) period. Vertical dashed lines denote 170°E, the present boundary.