

## The work plan to improve the fleet definition of Japanese longline fishery<sup>1</sup>

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## **Abstract**

This paper reviewed the fleet definition of Japanese longline fishery in Stock Synthesis 3 and performed a preliminary analysis to improve it. Specifically, this study tried to classify by operation which cohort was caught using CPUE and mean body weight value. Model-based cluster analysis called the finite mixture model was used. In September, we will report the analysis results to the ISC albacore working group. We propose to agree on a Japanese longline fleet definition before the data preparatory meeting because the fleet definition is necessary for the CPUE standardization.

## **Introduction**

The ISC Albacore Working Group (ALBWG) uses the integrated stock assessment model Stock Synthesis 3 (SS3) to conduct stock assessments. An area as the fleet approach was applied to the definition of the Japanese longline fishery (Waterhouse et al. 2014). In other words, the ALBWG has assumed that albacore length caught in North Pacific is different by areas of the Ocean. However, it has been concerned that some areas are not adequately size segregated (ALBWG. 2020). This paper reviews how the fleet definition of Japanese longline fishery was defined and identifies issues to improve this issue. It also provides a preliminary analysis to improve fleet definition and suggests a future study plan.

## **Review of the Japanese longline fleet definition**

The ALBWG first conducted a North Pacific albacore stock assessment in 2011 using the integrated stock assessment model SS3. Matsumoto 2010 standardized the Japanese longline CPUE by defining a fleet that assumed different lengths for each area. However, the methodology was ad hoc, and length composition by area did not show one modal distribution. In conducting the 2014 stock assessment, Sato et al. 2013 summarized the Japanese longline fishery focusing on length composition and trends in 5x5 degree CPUE. The Japanese longline fleet definitions were also revisited. This document reported that small albacore seasonally migrates to the 10X10 grid area near coastal Japan, and this area was treated as a separate fishery (Area 1). However, this definition was not based on any analysis and was not scientifically well-founded. To address this issue for the 2017 stock assessment, Japanese scientists proposed a new fishery definition based on a cluster analysis using length composition data (Ochi et al. 2016). However, Area 1, defined in the previous stock assessment, was not included in this analysis. As a result, Area 1 has still included different cohorts. In other words, Area 1 does not organize the fishery by cohort using statistical analysis.

## **Preliminary analysis**

This paper addressed statistical analysis to define a Japanese longline fleet, an alternative to the area as the fleet approach. Considering the Japanese albacore longline fishery, multiple cohorts may exist and be fished within a 10x10 grid area that is the unit of previous analysis. It was also considered that different cohorts show different CPUE trends. Therefore, this analysis attempted a higher resolution analysis than the previous study and used CPUE as well as length information. Specifically, the analysis was conducted using CPUE and mean body weight from the Japanese logbook data. The resolution was set at every

operation, and a model-based cluster analysis called the finite mixture model was used for the analysis (Grün and Leisch 2008, Ijima and Kanaiwa 2018). The grouping unit was a 5X5 degree grid, year, and quarter, and the number of clusters was set to two. Japanese logbook data in this analysis were randomly truncated to tenth percent for the preliminary analysis, and zero-catch data were also excluded.

## Results and Discussion

We were generally able to successfully separate the operational data into two clusters (Figure 1 and Figure 2). Adult and juvenile fish contained within a fixed area block (e.g., 10X10 grid) could also be separated (Figure 1). The advantages of this new analysis are (1) simplification of the fleet definition in the SS3 and (2) the ability to separate cohorts "in the same area" that could not be separated using the area as fleet approach, which was the previous method.

The future work plan is as follows.

- ✓ BIC will determine the number of clusters, that is, the number of fleets.
- ✓ CPUE standardization will be conducted for each separated cluster.
- ✓ Zero catch data will be added to each column.
- ✓ The operation that defined to another cluster would be set to zero catches.
- ✓ The number of catches of each fleet will be calculated by the total number of catch and catch ratios between the clusters.
- ✓ The size composition data of each fleet will be summarized by grouping factors.
- ✓ If the ALBWG approves this method, the analysis will be completed by September and be reported to the ALBWG in a short web meeting or e-mail. After that, we will start the CPUE standardization analysis.

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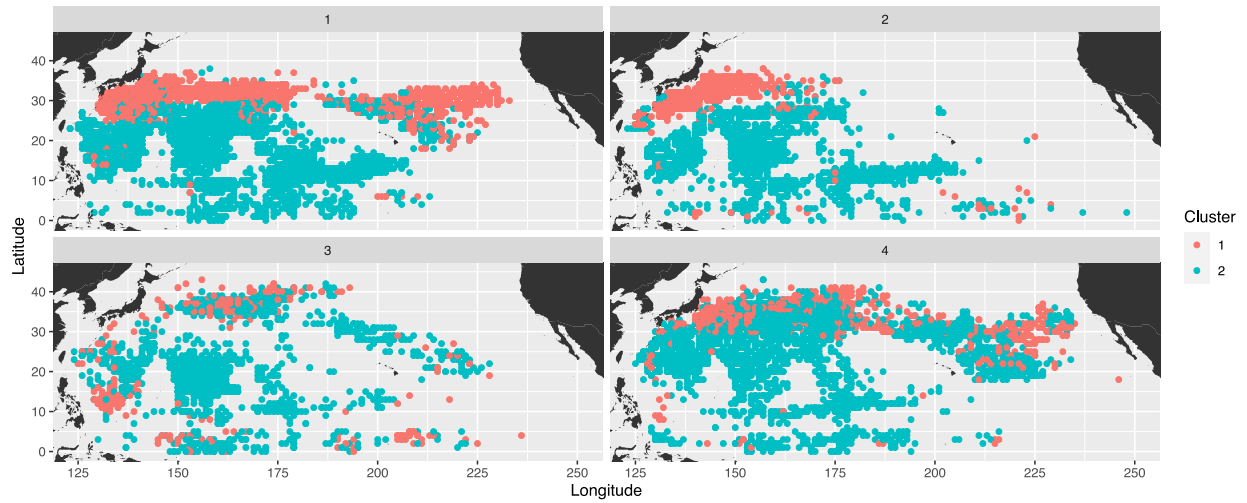


Figure 1. Spatial trends in the estimated cluster that was based on one operation of Japanese longline fishery.

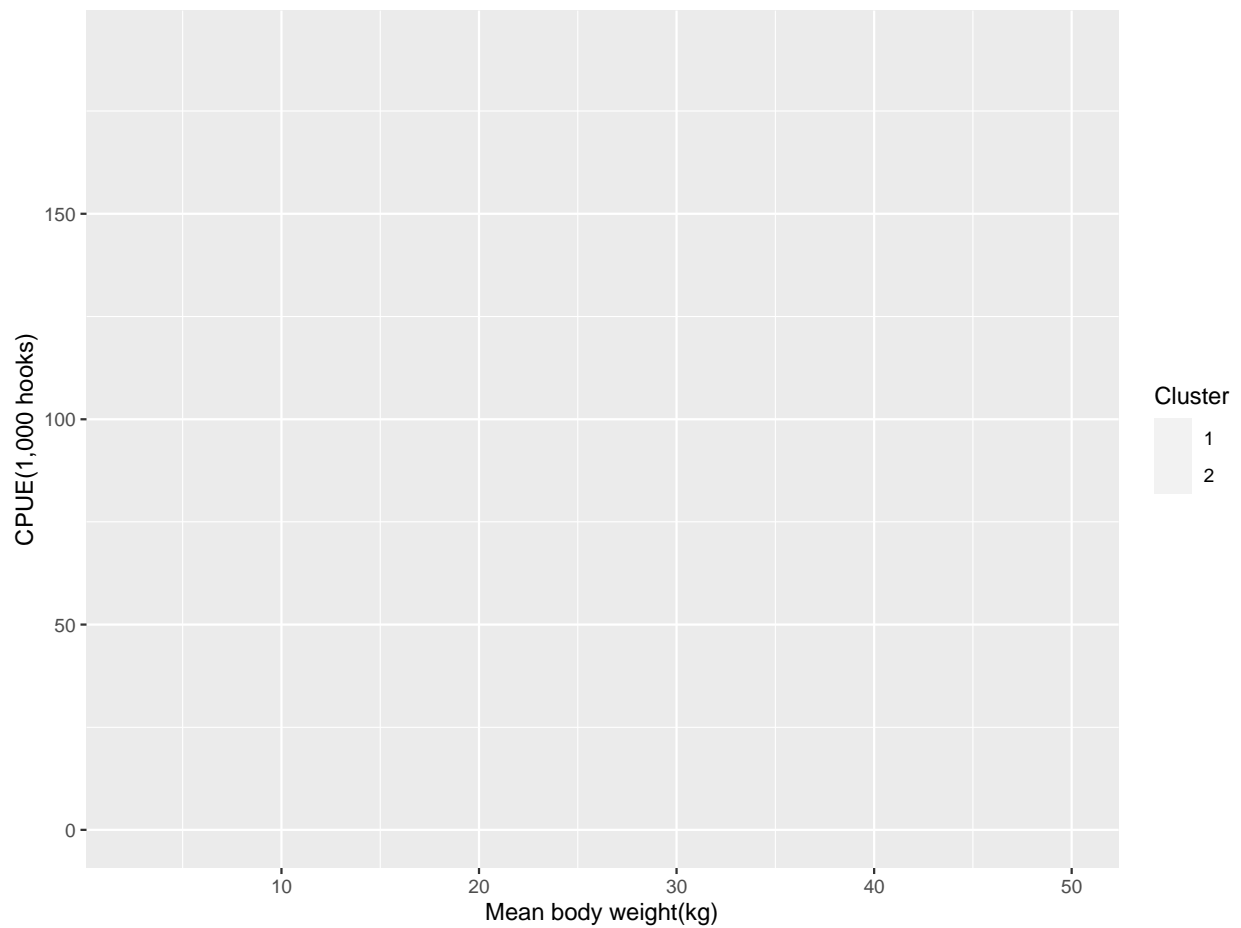


Figure 2. Scatter plots of CPUE and mean body weight with estimated cluster.