Real-time recruitment monitoring for Pacific bluefin tuna using CPUE for troll vessels: Update up to 2018 fishing year

Yohei Tsukahara and Kana Chiba

National Research Institute of Far Seas Fisheries,
Japan Fisheries Research and Education Agency
5-7-1, Orido, Shimizu-ku, Shizuoka 424-8633, JAPAN

March 2019

Working document submitted to the ISC Pacific bluefin tuna Working Group, International Scientific Committee for Tuna and Tuna-Like Species in the North Pacific Ocean (ISC), from 18 to 22 March 2019, Jeju, Korea.

Summary

Japan has conducted a real-time monitoring of the CPUE from troll fisheries for strengthening the recruitment monitoring to comprehend the trend of most recent recruitment of Pacific bluefin tuna in a timely manner. The operation and catch information are recorded by data logger equipped on fishermen's boats participating the survey. These data are sent to the National Research Institute of Far Seas Fisheries (NRIFSF) on a real-time basis. The catch data per day by each boat were used as nominal CPUE and those were standardized for two regions as recruitment abundance of each spawning ground, Pacific side and the Sea of Japan, respectively. This paper shows updated results up to 2018 fishing year, the most recent recruitment. The both results of standardization show that the levels of recruitment in 2018 fishing year were less than those in 2017 but were higher than historical averages. These results were published on the Japan Fisheries Agency's web-site in a timely manner.

Introduction

The current stock assessment of Pacific Bluefin Tuna (PBF) uses standardized CPUE of Japanese troll fisheries, which operate in the East China Sea (coastal waters of western Kyusyu), as an index of recruitment (ISC 2016, ISC 2018). This CPUE was based on the sales slips and as it uses annual data, the index in most recent year is not available until October of the following year. Additionally, there is no information about zero-catch trips in the sales slip. Under these situations, ISC recommended the strengthening the monitoring of recruitment to comprehend the trend of recruitment in a timely manner (ISC 2013).

Japan has initiated a real-time monitoring of the operations of the troll fisheries in 2011 and has collected catch data per day from fishermen's boats participating in the survey. CPUE were calculated as catch in number per day and were standardized. The standardized CPUE could represent the level of recruitment of PBF in the most recent year. The result has been published on the Japan Fisheries Agency's web-site. The information in the most recent year (2018) was published for Pacific side and Sea of Japan in October and December 2018, respectively, each of which is assumed to represent the trend in recruitment from the main two spawning grounds.

Materials and Methods

The troll fisheries in Japan, which target age-0 PBF individuals, were operated mainly in coastal water of western Japan. Some of these fisheries harvest PBF for farming soon after the spawning , when PBF reaches around 20-30 cm in fork length. Depending on fishing grounds and period, the spawning ground where the targeted PBF by troll fishery was spawned can be distinguished. It is known that spawning in Nansei-islands area occurs in May to July while in the Sea of Japan in July to August.

Age-0 PBF spawned around Nansei-islands are caught off the coast of west Japan in the Pacific side in summer. On the other hand, age-0 PBF spawned in Sea of Japan are caught off the coast of Oki islands. National Research Institute of Far Seas Fisheries (NRIFSF), Japan, introduced recruitment monitoring system, which can collect operations and catch data in a timely manner from these two troll fisheries in Pacific side in July to August and in the Sea of Japan in September to November since 2011 (Fig. 1).

The data logger and transmitter are equipped on fishermen's boats participating in this survey. The fishermen input the number of caught PBF into data logger during the fishing operation. The catch information together with geographical position data are sent to the NRIFSF via cellular network in real-time. The received data are gathered as catch data per day and are analyzed for standardization in NRIFSF. The standardizations were conducted by negative binomial GLM model. Zero inflated model was applied to the standardization of Pacific side due to high ratio of zero catch trips in raw data. The best models were determined by the Bayesian information criterion (BIC). The candidate explanatory variables used for standardization were bellow;

- **Year**: 8 calendar years for Pacific side, 6 calendar years for Sea of Japan
- **Season**: 4 half-months in July to August for Pacific side, 3 months in September to November for Sea of Japan.
- **Block**: Rough distinction of operation site, 2 blocks for only Pacific side (Western coastal water of Kyusyu island and Southern coastal water of west Japan)
- **Area**: Fine distinction of operation site, 6 areas for Pacific side: Around Tsushima Island, Around Goto Islands, Bungo Channel, Tosa Bay, Kii Channel and Kumano-nada, and 2 areas for Sea of Japan: Douzen-area and Dougo-area.
- **Prefecture**: 5 Prefectures where fishermen belong (Nagasaki, Miyazaki, Kochi, Wakayama and Mie).

Results

Figure 2 shows the both standardized CPUEs. In 2018 the indices are higher than the historical averages of each index while both of them were lower than those in 2017. However, the confidence intervals in 2017 and 2018 were much wider than the previous ones, especially in the Sea of Japan. This was caused by artificially restrained catch due to catch limitation and/or low demand from fish farms. The number of catch and efforts were relatively low and stable since 2017 (Fig. 3). The recruitment index used in the 2018 stock assessment (Nishikawa and Tsukahara 2018) showed recruitment level in 2017 was around historical average from 1980, which is inconsistent with the real-time monitoring CPUEs presented here. The recruitment index in the assessment uses different data source; it is based on information from sales slips. All of the indices are apparently affected by artificial

restraint, therefore the standardized CPUEs using fishing data need to be interpreted carefully.

Conclusion

The recruitment levels of PBF were estimated using the standardized CPUE of troll fisheries which target 0-age PBF from two spawning areas respectively. The values of point estimation were both higher than respective historical average but lower than those in the previous year. On the other hand, the limited amount of data due to some management factors, such as catch limit, lead to the increase of uncertainties in standardization, thus recruitment levels should be monitored continuously with multiple information, such as sales slips and catch at age data.

References

Nishikawa, k. and Tsukahara, Y. 2019. Updated standardized CPUE for 0-age Pacific bluefin tuna caught by Japanese troll fisheries: Updated up to 2017 fishing year. ISC/19/PBFWG-1/XX.

ISC 2013. ISC13 Plenary. Report of the Pacific bluefin tuna working group workshop. 68p.

ISC 2016. 2016 Pacific bluefin tuna stock assessment. Report of the Pacific bluefin tuna working group. 140p.

ISC 2018. 2018 Pacific bluefin tuna stock assessment. Report of the Pacific bluefin tuna working group. 152p.

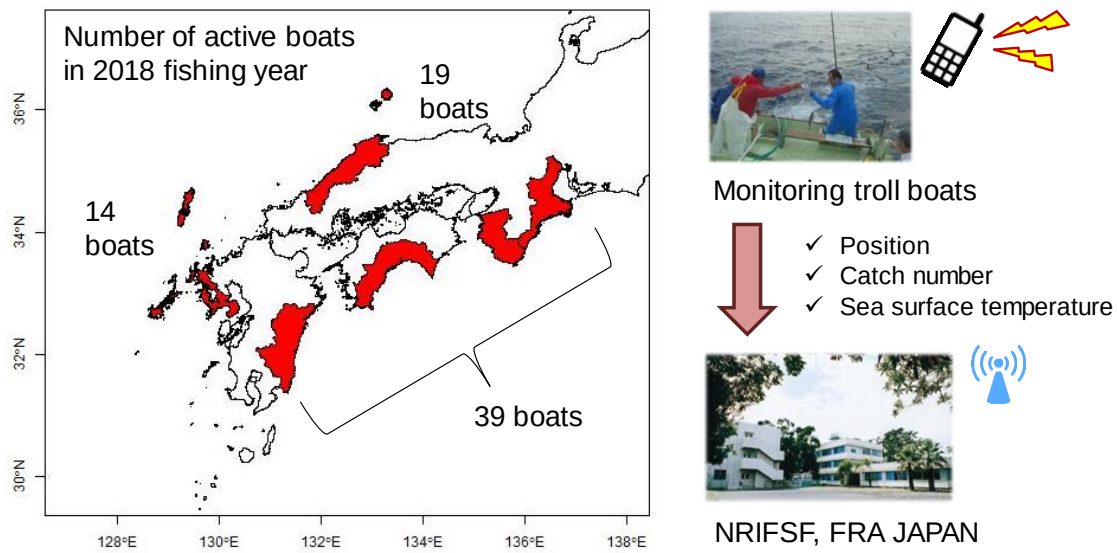

Fig. 1 Concept of Japan's real-time recruitment monitoring in 2018.

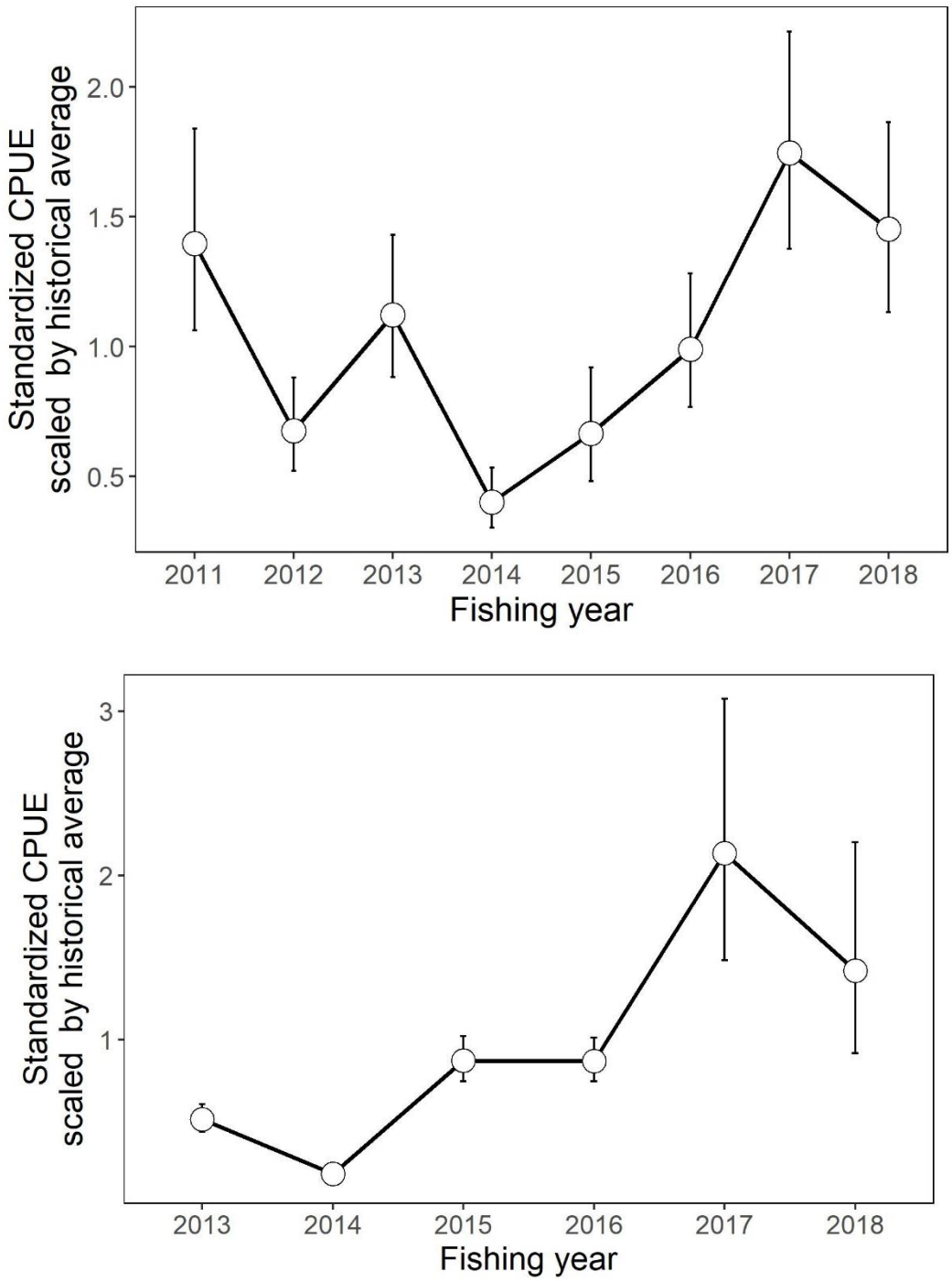

Fig. 2 The standardized CPUE in Pacific side (Upper) and Sea of Japan (Bottom).

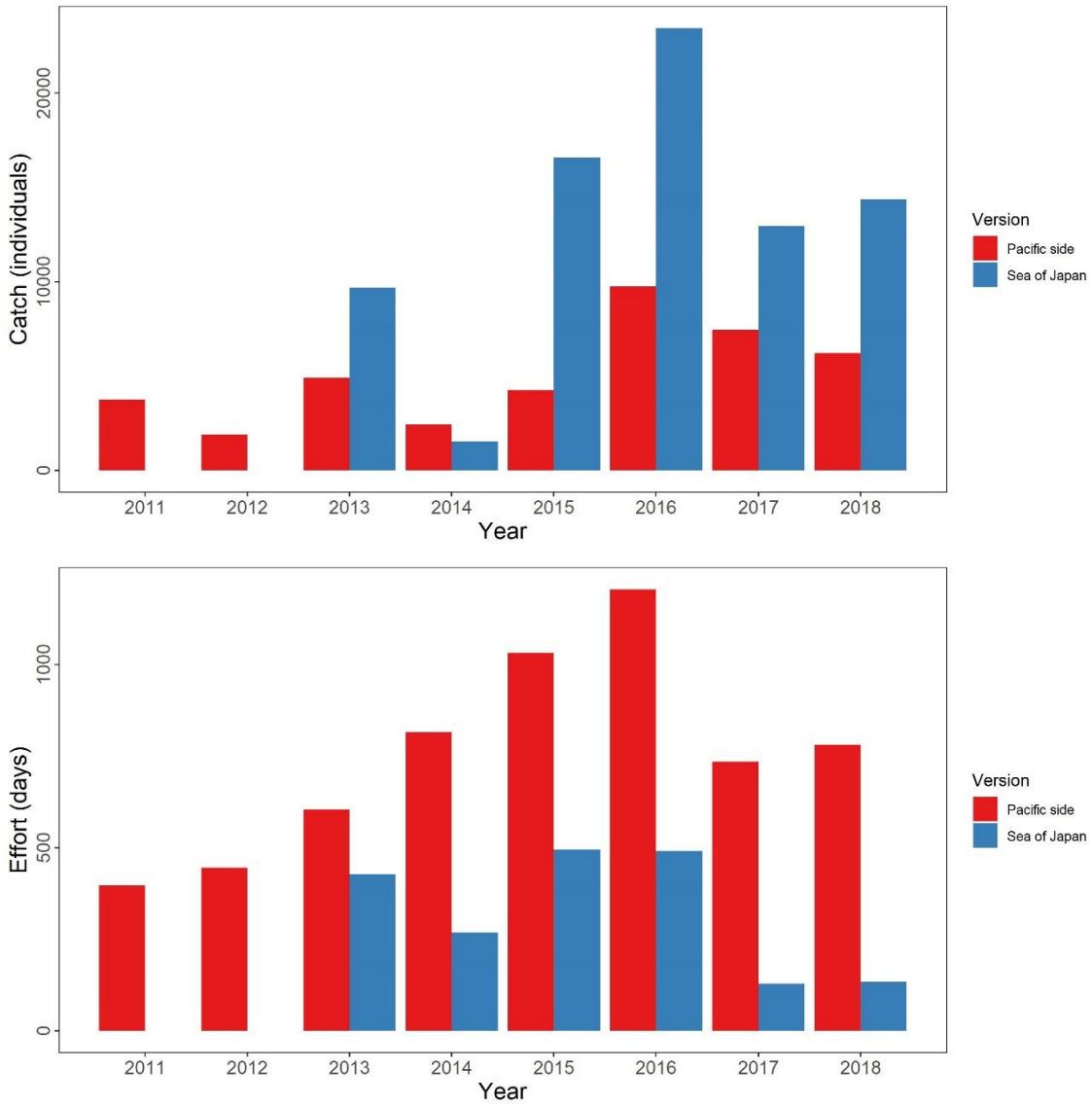

Fig. 3 Annual change of the number of catch (Upper) and operation days (Lower) for vessels participating the survey.