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Procedure of the tag data preparation for the Japanese tagging program

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Abstract

1. Japanese Tagging Program (JPTP) data for the 2022 skipjack tuna stock assessment were updated from the 2019 assessment.
2. We describe outline of the updating process including the estimation method of length at release for those missing the length at release.
3. Scores of the reliability for the length at recapture and the recapture dates are newly added based on the process of how the tag was recaptured as a response to requirements for precise growth estimation in the assessment.

Introduction

Tagging data are important input for the western and central Pacific Ocean (WCPO) skipjack assessment, as they inform the stock assessment model, MULTIFAN-CL, of the fishery dynamics and biology of skipjack such as the fishing mortality, movements among regions, and growth (e.g., Vincent et al., 2019a). Japanese tagging program (JPTP) is one of the data rich sources of the tagging data that has been recorded since the 1960s to the present. The JPTP data has been updated to submit for the 2022 WCPO skipjack stock assessment from the data used in the 2019 assessment. In addition, there has been a request of re-organizing the tagging data for the precise growth estimation. To extract the highest quality recapture data, we scored data reliability of the length at recapture and the recapture date. Here we describe the procedures 1) to provide the entire JPTP data updated until 2021 and 2) to score the reliability of the length at recapture and recapture date based on the nature of the Japanese pole-and-line fishery and the recapture networks.

Materials and Methods

The procedures to provide the JPTP data

To prepare the data for the 2022 skipjack assessment, we combined the data file used in the 2019 assessment (hereafter, 2019 data) with the newly added data up to 2021 for both releases and recaptures. The substantial amount of data through recorded years have no lengths at release in 2019 data (**Figure 1**), thus the lengths were estimated by random sampling from the distribution of the length at release in the other records (Vincent et al., 2019b) to increase the number of data available in the 2019 assessment. For the 2022 assessment, we applied the same estimation method for the updated data, that is, the same length distribution prepared with 2019 data only (**Figure 2**) and the same seed for the sampling were used to keep consistency of the data. In total, 161,608 and 10,510 for release and recapture records were prepared, respectively.

Scoring the reliability of the tag recaptures

Since some of the recapture data include uncertainty (there are cases where the negative growth were found), these should be filtered to guarantee the data quality. Among the 161,608 JPTP data, following filters were applied to extract record sets that has minimum information for growth estimation.

- *Remove the release data having no measured fork length*
- *Remove the recapture lacking the length at recapture*
- *Remove the short recapture within 30 days*

Appling above filters left 339 data for the release and recapture sets.

Addition of the reliability of recapture date column

For the 339 data after the filtration, we re-checked JPTP database and original documents that tag finders filled out to create detailed gear category, as recapture information reliability highly depends on fishery gears. Based on the category, we gave scores to catch data according to their reliability of the recapture date in its accuracy (0: not reliable or 1: highly reliable) (**Table 1**). Fishery mainly operated in the distant water (PL2 and PS1) usually has a long trip for one cruise, which makes it difficult to identify the recapture date. Thus we gave 0 in the accuracy column for these fisheries as well as the unknown category of both PL and PS. These fisheries unload skipjack as frozen, while other fisheries such as PS0, PL0, PL1, TL, TR, SN unload fresh, no-frozen skipjack at port which means these fisheries must unload their fresh skipjack within 5 days maximum since their catch to sell them. According to these aspects, the recapture date of the fisheries other than PL2 and PS1 is relatively reliable, and we gave 1 for these fisheries.

Addition of the column for reliability of the length at recapture

We also scored the reliability for the lengths at recapture (0: not reliable,1: normal,2: highly reliable). In the case of tag returns with whole body to Japan Fisheries Research and Education Agency, the trained staffs measure the fork length and body weight precisely at our laboratory, so these data were qualified as a high rank of reliability, 2. Even in the cases without the whole body, in the cases that our experienced staffs who have been distributed at major skipjack landing ports reported the length, we also gave 2 for those data. For the data that were collected by other institutions/business in Japan, we gave 1. Other reports from foreign countries are scored 0, as we do not have any measures to confirm how these lengths were measured and their accuracy.

Results and discussions

Recapture rate of the JPTP data through years

Recapture rates through recorded years were shown in **figure 3**. Before 1987, the recapture rates were close to or exceeded 100%. This is due to the data digitalizing process, as only release data of recaptured tags were available for now for the period from 1966 to 1987, and as the recapture rate were calculated by years not by projects, those release and recapture across years cause the recapture rate exceeding 100%. The digitalizing of the entire release data based on the original release documents is now in the process of

data check, thus the recapture rates for the period will be available in few years. On the other hand, the recapture rates were properly calculated for the years after 1987 (**Figure 3**). Through the years, the recapture rate of the last 10 years average was 4.9% while the recapture rates of the recent 3 years average (2019-2021) was slightly lower (2.1%) than the last 10 years average. The decline in the number of tag reports in the recent years has been suggested by several factors. According to interviews with Japanese fishery cooperation staffs, they recognize that there are tags discarded via the distribution process. In addition, tags recaptured by countries other than Japan has been delayed a couple years in most cases, therefore, as the tag release areas in the recent research that are mainly tropical areas to subtropical areas, it also causes the low rates in the recent years. There are recaptured tags remained un-digitalized due to the delay in the reporting, and it would have lowered the recapture rate in the recent years.

Reliability of the recapture length

The length-weight relationships at recapture were compared with those obtained in lab measurements to reconfirm the validity of the recapture length (**Figure 4**). Overall, most of the length-weight relationships from the tag recapture data have the same trend with those obtained from our data base. Those of outliers tend to show negative growth (**Figure 5**, RECLF-Rellen<0 were considered to have negative growth). This indicate both/either of the length and/or weight at recapture are highly unreliable. Thus, we highly recommend removing these data that show negative growth as well as other low scored in reliability for the recapture length and recapture date.

Reference

Vincent, M. T, Pilling, G. M. and Hampton, J., 2019a. Stock assessment of skipjack tuna in the WCPO. Technical Report WCPFC-SC15-2019/SA-WP-05, Pohnpei, Federated States of Micronesia.

Vincent, M. T., Aoki, Y., Kiyofuji, H., Hampton, J. and Pilling, G. M., 2019b. Background analyses for the 2019 stock assessment of skipjack tuna. Technical Report WCPFC-SC15-2019/SA-IP-04, Pohnpei, Federated States of Micronesia.

Table 1. Score for the reliability of recapture date based on the fishing gear at recapture. Score is given by 0 (not reliable) or 1 (highly reliable).

Fishing gear code	Fishing gear	Score
PL	Pole-and-line (Vessel size unknown)	0
PL0	Coastal pole-and-line	1
PL1	Offshore pole-and-line	1
PL2	Distant water pole-and-line	0
PS	Purse sein (Vessel size unknown)	0
PS0	Offshore purse seine	1
PS1	Distant water purse seine	0
DN	Drift net	1
GN	Gillnet	1
HL	Hand line angling	1
LL	Longline	1
SN	Set net	1
TL	Troll line	1
RF	Recreational fishing	1
TR	Trawl	1

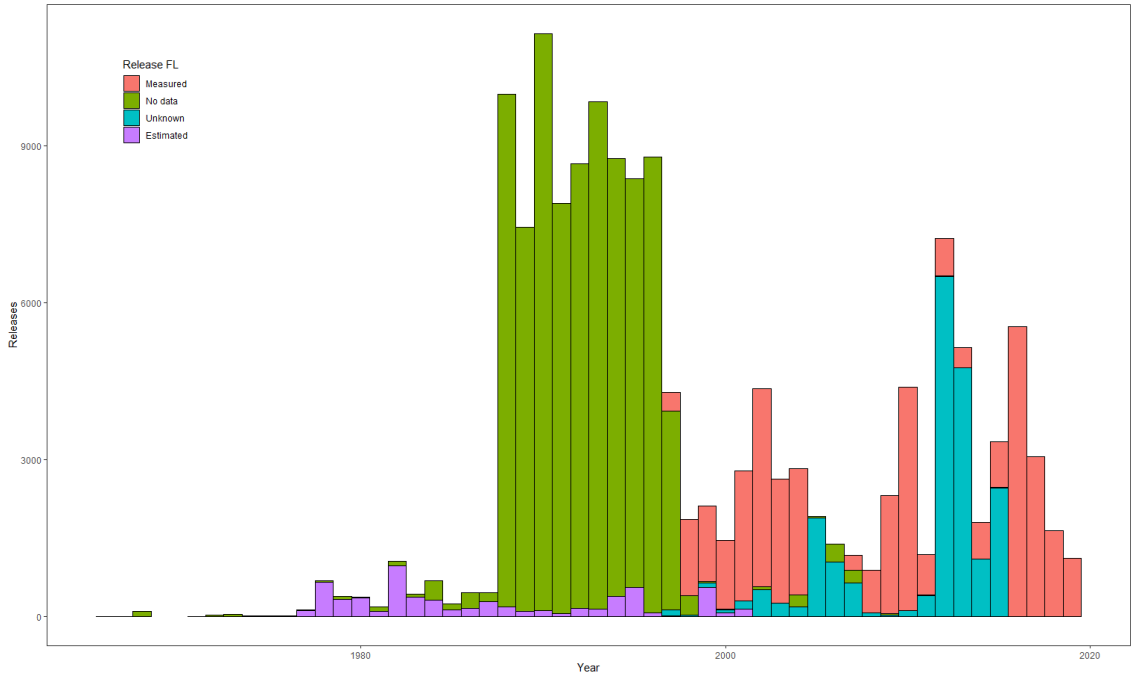

Figure 1. The number of released tags through years for the data used in the 2019 skipjack stock assessment. Each color shows the status of the fork length (FL) at release.

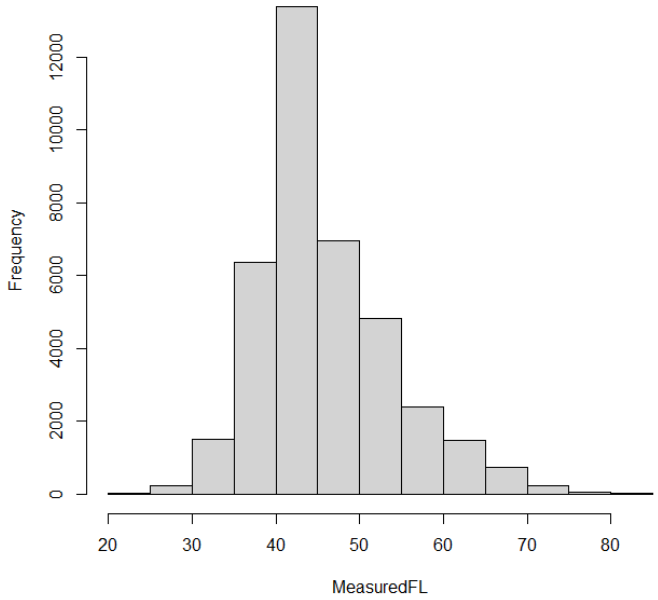

Figure 2. Distribution of the measured fork length (FL) at release for the data used in the 2019 assessment.

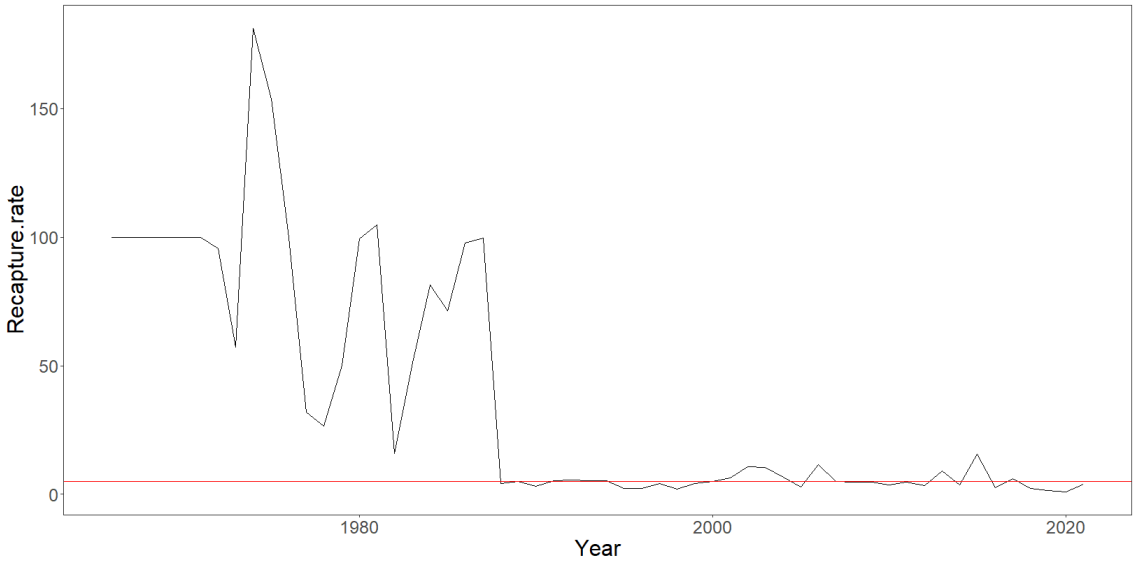

Figure 3. Recapture rate of the updated 2022 JPTP data through years. Red line shows the last 10 years average (4.9%). Note that the recapture rates before 1987 were not reliable due to lack of the release data.

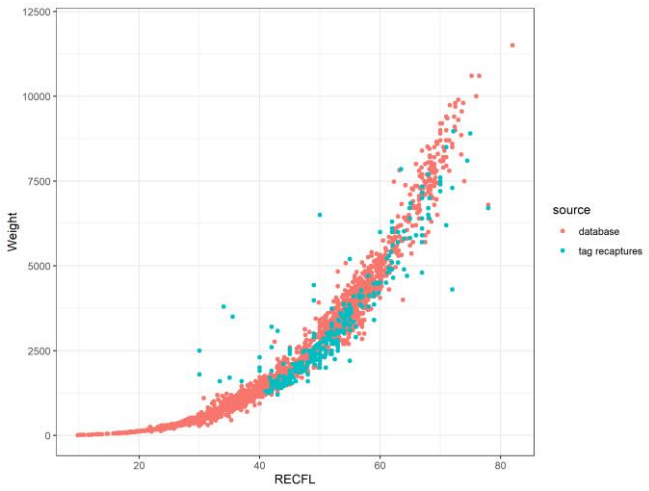

Figure 4. Length-weight relationships obtained from our database (red circles) and at tag recaptures (blue circles)

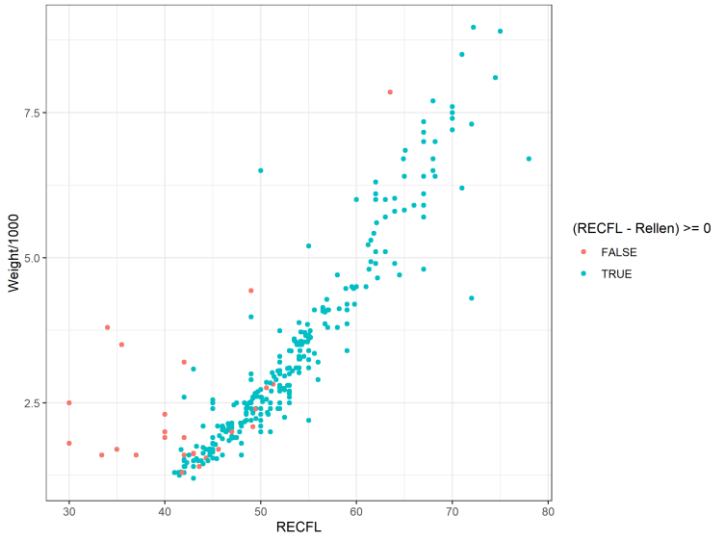

Figure 5. Length-weight relationships of negative growth data (red circles) and positive growth data (blue circles) in the tag recapture data.