# The quality of Japanese catch statistics and reports of mistake in the SS3 model for the Western Central North Pacific striped marlin.

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## Abstract

In order to verify a stock assessment of the Western Central North Pacific striped marlin, this paper confirmed the quality of the Japanese catch statistics. The high seas driftnet and longline fisheries were focused. The driftnet catch was estimated again using the original landing note written by the prefecture government staff and some vessels' logbook data. For longline catch, the result of the Stock Synthesis 3 model was compared with the statistics submitted to the WCPFC. The estimated driftnet catch is still a tentative value, as it has to be checked for consistency with other species, but the statistics so far may have been underreported. Thus, the ISC billfish working group needs to consider its impact on the WCNPO striped marlin stock assessment. Longline catches are generally similar, except during periods when training vessel catches were not reported to the WCPFC. I also found an input error about a growth curve in the stock assessment model. In general, the growth curve has a significant influence on the stock assessment results. Therefore, the ISC billfish working group must recalculate the stock synthesis model using a correct assumption of striped marlin growth.


## Introduction

In the Western Central North Pacific Ocean (WCNPO) stock assessment of the striped marlin, the ISC Billfish Working Group (BILLWG) has pointed out five uncertainties, including Japanese offshore driftnet catch (ISC 2019). The commission of the WCPFC also has asked the reason increasing trend of fishing mortality after the high seas driftnet moratorium. Thus it needs to confirm the accuracy of the Japanese driftnet catch on high seas. The ISC BILLWG has used yearbook data in the stock synthesis 3 model (ISC 2019). However, the aggregation method of the yearbook is unclear. As an alternative data, there is a logbook of high seas driftnet fishery. Nakano et al. 1993., estimated a 1990 catch using observer data and Japanese effort data in logbooks. However, it is difficult to use the logbook as catch statistics because the reporting rate before 1990 is considered relatively low. I also found the paper-based original landing note that was recorded in the port. However, these ports are main landing port of drift net fishery but there is no information other ports. This study estimated the high seas driftnet catch using the original landing note and the logbook data.

Meanwhile, the WCPFC commission has also pointed out a discrepancy between SS3 output and WCPFC statistics regarding striped marlin in a WCPFC commission last year (WCPFC 2020). To answer this question, I compared the output of SS3 with the official statistics of WCPFC (XLS_NorthWCPFC.xlsx).

This study also reported an input error on the growth curve. This mistake has a significant impact on the stock assessment result.

## Materials and methods

### Estimate high seas large mesh driftnet catch

- **Data sets**

This study used the original landing note that prefecture government staff observed in the six major ports and logbook of high seas driftnet fishery. The six major ports are Choshi, Kamaishi, Kesennuma, Miyako, Nagasaki, and Shiogama. There is no original landing note other than the six major ports, and only the billfish species (e.g., striped marlin, swordfish, and blue marlin) are reported with the number of fish caught and the weight of the catch. Other species were reported only as of the catchweight. Although the logbook data has catch number data for 42 other ports, the reporting rate is not 100%. The logbook reports the number of fish. Both data have been available since 1977, and landing surveys were not conducted in the first and second quarters of 1977 and 1978. The number of fish in Kesennuma port was calculated from the average body weight because landed fish has been described since 1986.

- **Estimation of the catch**

I assumed that the original landing note is correct. The number of fish caught other than the six major ports was estimated using the original landing note and logbook data. The estimation procedure is as follows.

1. Extract the catch number of the logbook that was landed at the above six major ports.
2. Calculate the average unreported rate of logbook data for each year and quarter. The number of fish on the landing note was divided by the number of fish in the logbook (Fig. 1).
3. Multiply the unreported rate by the catch number other than the six major ports in the logbook data.
4. Calculate the north-south catch ratio by year and quarter using the logbook, multiply it by the number of catches estimated in step 3 (Fig. 2).
5. Finally, in order to compare the yearbook with the estimated values, the quarterly average body weight was calculated from the Kesennuma data, and the catchweight

was calculated.

**Japanese longline catch statistics**

The output of SS3 is the sum of all Japanese longline catchweight that was estimated by the number of catch, weight at age information, and selectivity of Japanese longline fishery in the SS3 model. For the official WCPFC statistics, we downloaded the WCPFC sea area statistics in the Northern Hemisphere from our website and extracted the longline catch in Japan. These two catches values were plotted, and the variability was compared.

## Results and discussion

**The high seas driftnet catch of striped marlin**

Except for 1980 and 1981, the yearbook and landing note at the six major ports were similar (Fig. 3). This result indicated that the yearbook was based on the landing note reported by the six major ports. Between 1977 and 1978, yearbook catches were larger than the estimated major ports catches (Fig. 3). The landing note for these two years has not been surveyed in the first and second quarters. This study assumed that the catches in the first and second quarters of 1979 and 1980 were almost zero. In other words, it was considered that the prefecture government did not survey because of no landing. However, on the yearbook-making process, somebody might estimate the catch in the first and second quarters by some method in 1977-1978. Between 1980 and 1981, the yearbook is smaller than the major ports' total catch (Fig. 3). However, the reason is unknown. Between 1983 and 1993, the estimated catch of striped marlin exceeded the yearbook. During this period, the driftnet fishery's target has changed from billfish to albacore (Nakano et al, 1992), and it is possible that the landing port also moved due to changes in the target species.

This result is preliminary because we have not confirmed the statistics of other fish species, and we need to ensure the assumptions of this study. Also, the usable period is after 1977. However, the current use of driftnet catches might be under-represented, and this impact needs to be confirmed in the WCNPO striped marlin stock assessment.

**Comparison of longline catches of SS3 and WCPFC statistics**

Until 2000, SS3 catches exceeded WCPFC statistics, after which they showed relatively similar trends (Fig. 4). The longline catch data used for SS3 is the number of fish caught. SS3 estimates catchweight from the number of catches, the selectivity, and the average weight for each length bin. On the other hand, Japan reports catchweight to the WCPFC. The data manager has estimated these statistics. For example, in the early period, fisherman reports catch number only and catchweight was calculated by mean body weight and the catch number. In recent years, fisherman reports the catch amount, but this is the semi-dress fish weight and estimated the actual catch weight using convert factor. Therefore, the output of SS3 and the catchweight do not entirely match. In addition, it is considered that the WCPFC catch statistics tend to smaller in the early period because the WCPFC statistics of the early period do not include the training vessels catch.

From these facts, the catch output by SS3 is generally reasonable. Japanese scientists have recommended using catch number data for the age-based (number-based) stock assessment model because catchweight is the estimated value.

**Setting error of the stock synthesis 3**

It was found a mistake in the setting of the growth curve. Comparing the growth curve reported by the ISC BILLWG in 2011 (Sun et al., 2011) with the growth curve used in SS3, there was a big difference in younger age (Fig. 5). Therefore, when I checked the settings of SS3, the length of the age one fish was entered smaller than the actual value. The growth curve has the most significant impact on the stock assessment outcome (Yokoi et al, 2017) and must be revised immediately.

## References

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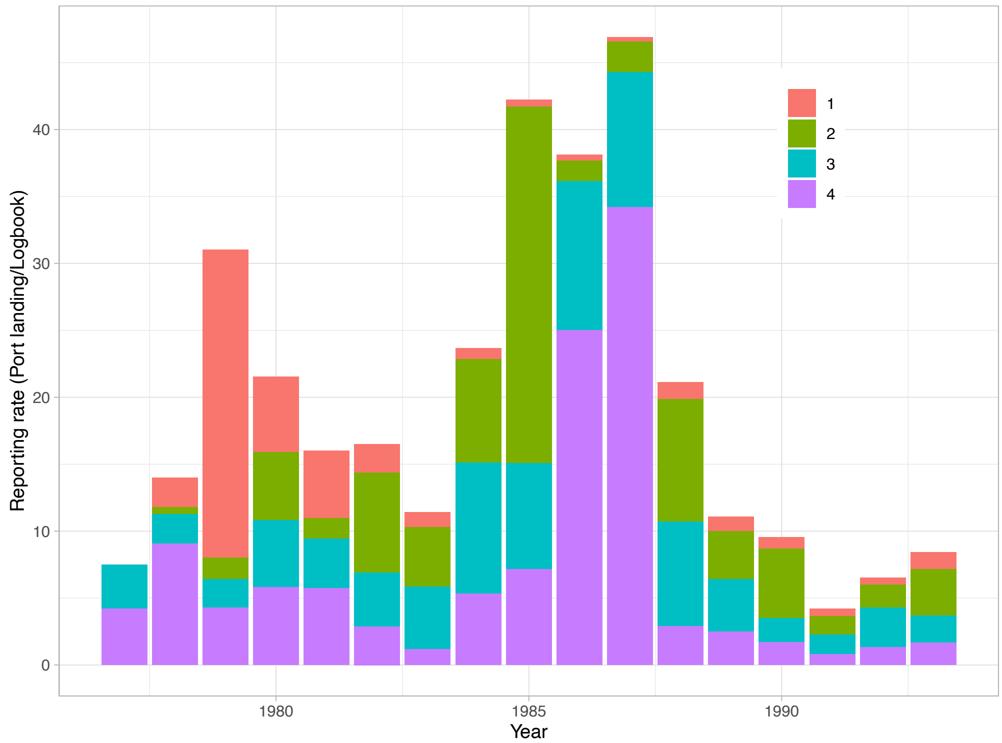


Fig 1. Unreported rate of logbook estimated by major six port.

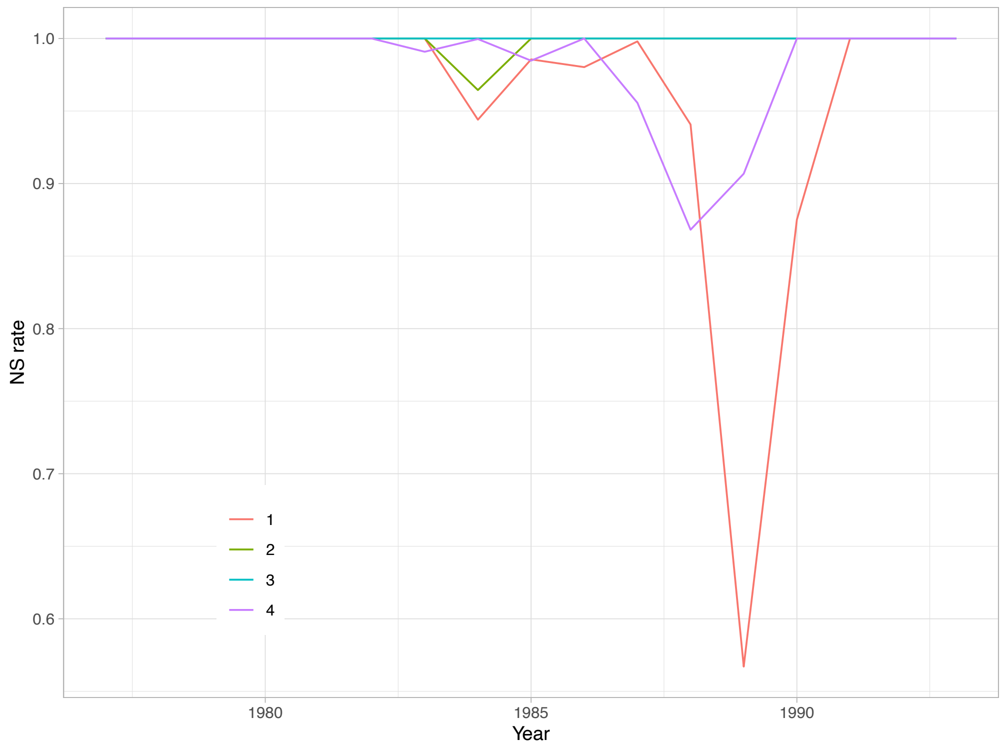


Fig 2. Catch ratio between North and South hemisphere calculated by logbook data.

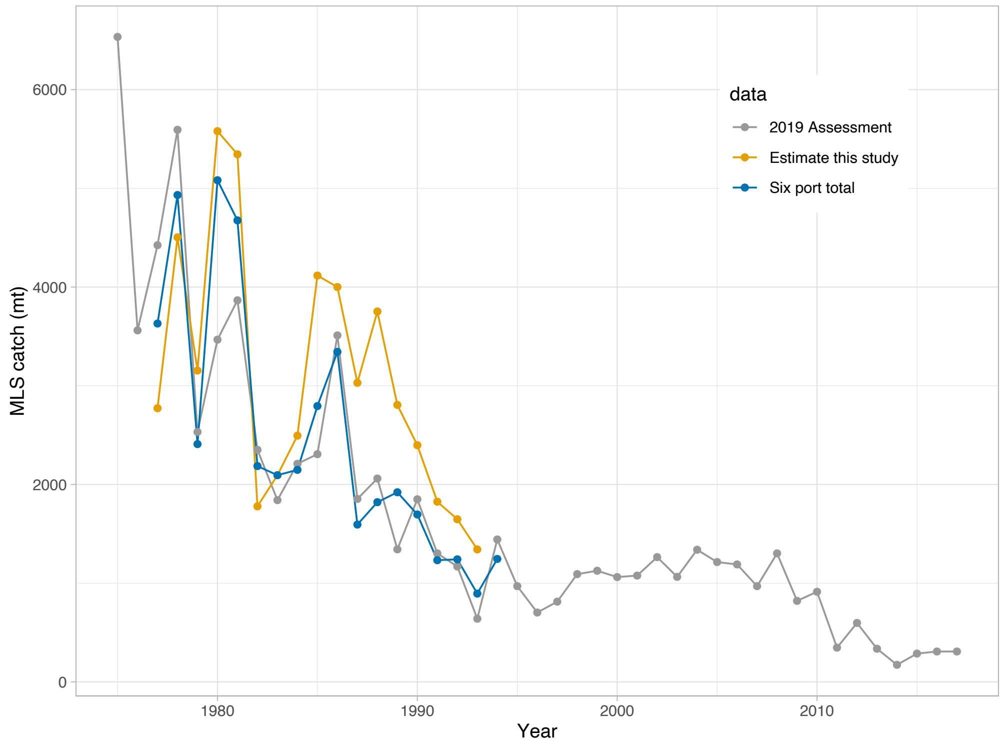


Fig 3. Striped marlin catch by Japanese large mesh drift net fishery in North pacific WCPFC convention area.

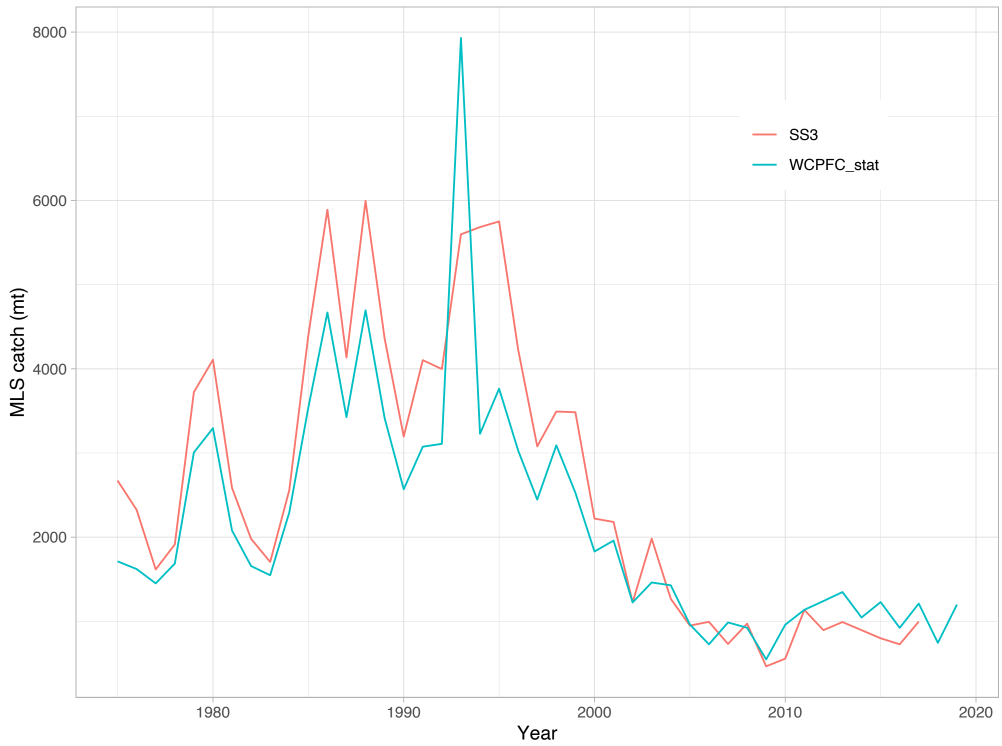


Fig 4. Striped marlin catch by Japanese longline fishery in North pacific WCPFC convention area.

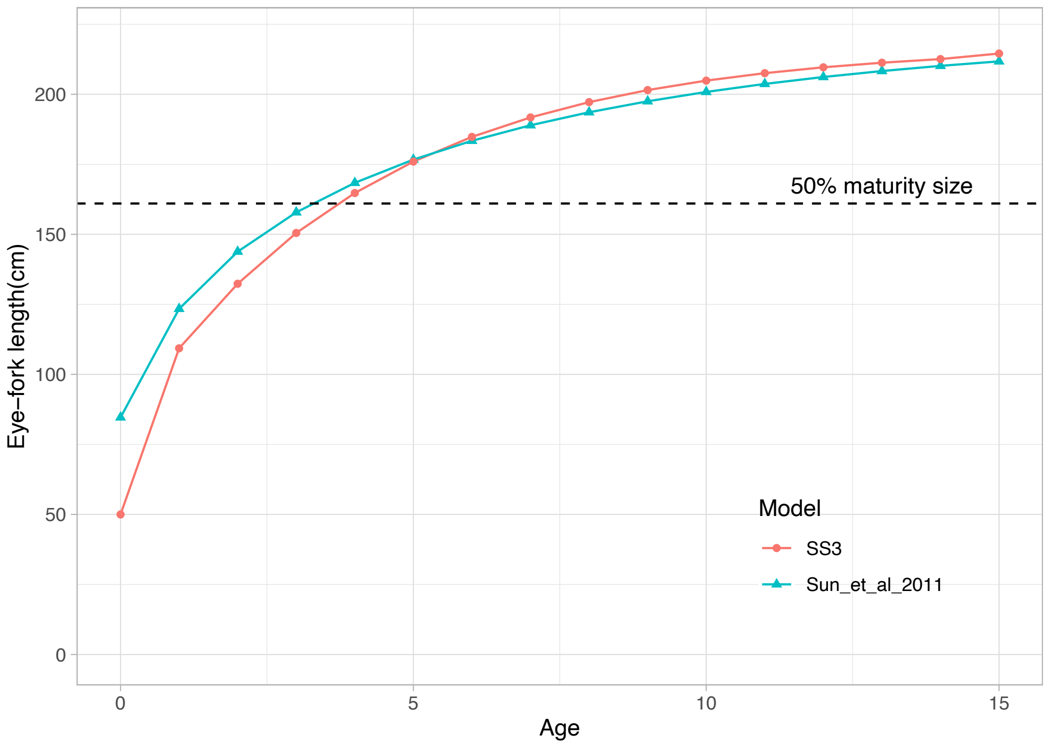


Fig 5. Growth curve of North Pacific Striped marlin. Sun et al 2011 was convert jaw-fork length to eye-fork length.