Review of indicator-based analysis of North Pacific shortfin mako conducted in 2021 [1]

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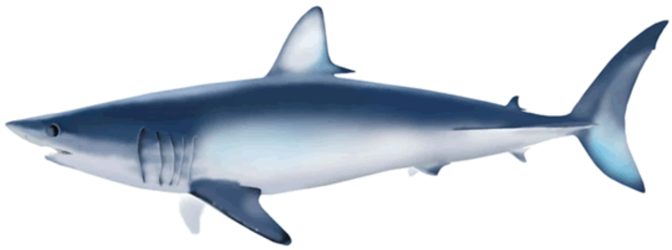

[1] Working document submitted to the ISC Shark Working Group Workshop, 8-12 December 2022 (JST), Hybrid-meeting. **Document not to be cited without author's permission.**

Summary

This working paper shortly reviews an indicator-based analysis of North Pacific shortfin mako conducted in 2021. Although annual catch, annual abundance indices and length frequency data were provided in the indicator-based analysis in 2021, only abundance index was focused on in this review because abundance index is a useful material to examine the trends in the abundance which is of the most importance to check the stock status. One future issue is raised to enhance the usefulness of indicator-based analyses.

Introduction

The stock assessment of shortfin mako, *Isurus oxyrinchus*, and blue shark, *Prionace glauca*, in the North Pacific Ocean was completed in 2018 and 2022, respectively (ISC, 2018; 2022), using Stock Synthesis (SS3; Methot and Wetzel, 2013). Indicator-based analysis of North Pacific shortfin mako shark was also completed in 2021 using annual catch, annual standardized CPUE (abundance indices) and length composition data up to 2019 (ISC, 2021). The next benchmark stock assessment of shortfin mako and blue shark is scheduled in 2024 and 2027, respectively. In the interim, an indicator-based analysis is scheduled in 2025 for blue shark and in 2026 for shortfin mako shark to monitor key fisheries indicators for signs of potential changes in the stocks abundance or fisheries dynamics which could warrant a shift in the schedule for the next benchmark stock assessment.

The objective of this working paper is to shortly review an indicator-based analysis of North Pacific shortfin mako conducted in 2021.

Fishery data

In the indicator-based analysis in 2021 (ISC, 2021), annual catch, annual abundance indices, and annual length frequency data of shortfin mako sharks were updated for three years until 2019 based on the fishery data used in the benchmark stock assessment in 2018 (ISC, 2018).

Catch data comprises of annual catches of 19 fleets (F1_CA_COM; F2_US_HI_SS; F3_US_CAL_LL; F4_US_HI_DS; F5_US_DGN; F6_US_REC; F7_TW_LALL_N; F8_TW_LALL_S; F9_TW_SMLL; F10_JPN_SS; F11_JPN_DS; F12_JPN_CST; F13_JPN_DFN; F14_JPN_OTH; F15_MEX_N; F16_MEX_S; F17_WCPFC; F18_IATTC; F19_KOR_LL) provided by Canada, Chinese Taipei (or Taiwan), Japan, Mexico, Republic of Korea, United States (US), Western and Central Pacific Fisheries Commission (WCPFC), and Inter-American Tropical Tuna Commission (IATTC). Republic of Korea presented catch time series of shortfin mako caught by Korea longline fishery (F19_KOR_LL) as a new fleet in the indicator-based analysis in 2021 (ISC, 2021).

CPUE data comprises of annual CPUEs of 7 fleets (S1_US_SS; S2_US_DS; S3_TW_LALL; S4_JPN_SS; S5_JPN_RTV; S6_JPN_OBS; S8_MX_OBS) provided by 4 countries (Chinese Taipei, Japan, Mexico, and United States). Four major abundance indices (S1, S3, S5, and S8) were used as key indicators to determine whether the next benchmark stock assessment, scheduled for 2024, should be expedited.

Sex-specific annual length composition data of shortfin mako caught by Taiwanese small-scale tuna longline fishery (F9_TW_SMLL) and Taiwanese large-scale tuna longline fishery (F7_TW_LALL_N; F8_TW_LALL_S) were provided (Liu et al., 2021). In addition, sex-specific length composition data of shortfin mako caught by Japanese fisheries was provided, in which most of the length frequency data was collected by Japanese shallow-set longline fishery (Semba, 2021).

Summary results and conclusions of indicator-based analysis for CPUE

The scaled CPUEs indicated a stable and slightly increasing trend in the four major fleets (**Figure**

1). The conclusions are that (1) we had a consensus not to give a conclusion about the stock status based on our indicator analysis as our information is insufficient to determine the stock status, (2) we also agreed to use 4 key abundance indices (S1_US_SS; S3_TW_LRG; S5_JPN_RTV; S8_MEX) (**Figure 2**) to decide whether the stock is showing any major "red flags" or not, (3) we determined to use a 5 year moving average (e.g., the moving average in 2019 is a mean value between 2015 to 2019) and percent change of annual CPUE from the beginning to the end of the time period (**Table 1**), and (4) we also decided not to use the last year's data for the calculation of percent change of CPUE.

One issue of this indicator analysis was that we had no threshold to determine whether we will conduct the benchmark stock assessment of both species earlier than the scheduled in 2024 and 2027. We therefore need to explore the threshold in the future work. The next indicator analysis will be conducted for the North Pacific blue shark in 2025.

References

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Table 1. The percent change of moving average of CPUE for four major fleets used in the indicator analysis in 2021. The moving average was calculated using the mean value of CPUE for five years. The last year was removed from the calculation due to the preliminary result. The percentage indicates the positive and negative changes in the moving average of CPUE between start and end of the period.

	US	Taiwan	Japan	Mexico
Percent change	**Hawaii shallow-set**	**Taiwanese large-scale LL**	**Japanese RTV**	**Mexican commercial fishery**
whole period	16%	39%	93%	10%
recent five years (excluding 2019)	20%	-8%	47%	-31%

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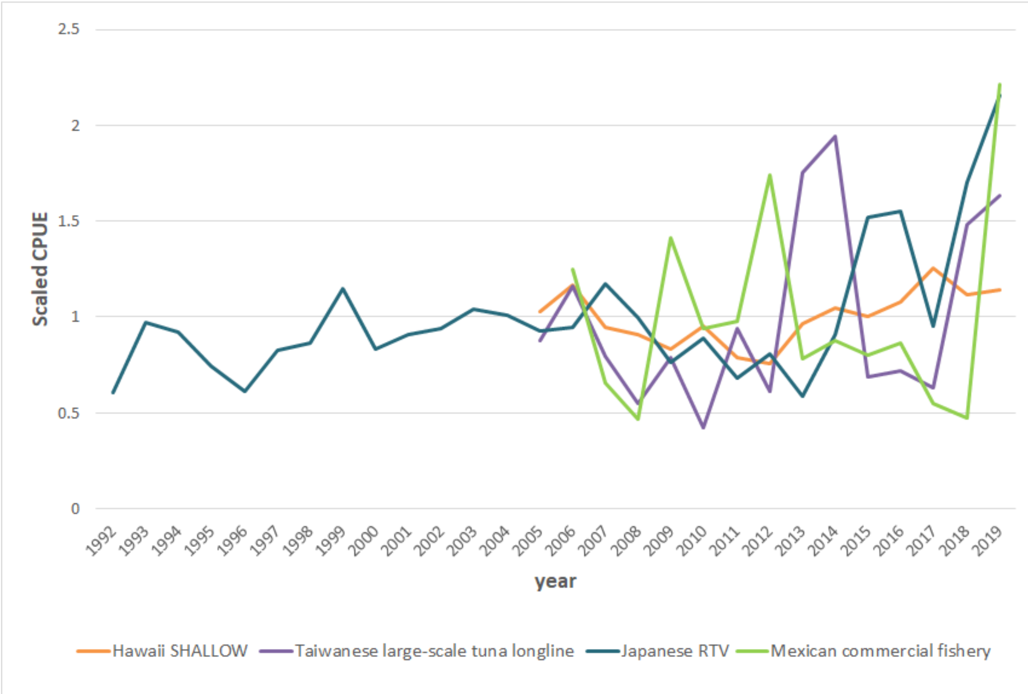

Fig. 1. Fleet specific annual CPUE of shortfin mako between 1992 and 2019 for four major fleets used in the indicator analysis in 2021.

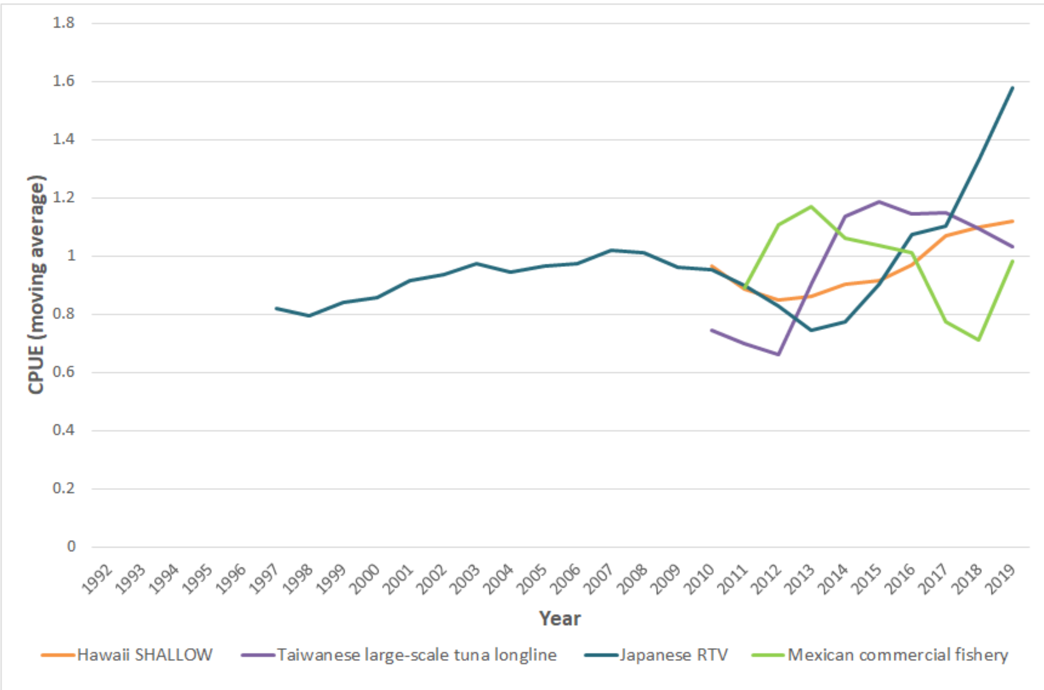

Fig. 2. Moving average of fleet specific annual CPUE of shortfin mako between 1997 and 2018 four major fleets used in the indicator analysis in 2021. The CPUE of last year for each fleet was removed due to preliminary output.