North Pacific Fisheries Commission

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Chub mackerel biology information from Song Hang survey in the Northwest Pacific from 2021 to 2024

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Summary

From 2021 to 2024, Shanghai Ocean University conducted comprehensive fishery surveys using the RV Song Hang in the Northwest Pacific. A total of 3,801 Chub mackerel samples were collected from this survey. This document presents some preliminary analysis of the length frequency, growth, and sex ratio of Chub mackerel in the high seas. More studies are in progress, e.g. age determination, growth and mortality estimation considering temporal heterogeneity, and spatial distribution considering environmental influence. This ongoing survey could be a potential data sources for estimating the life history traits and supporting future stock assessment, offering critical insights into the population dynamics of this species within the convention area.

Introduction

Shanghai Ocean University of China has been conducting a scientific survey program using its fishery research vessel "Song Hang" of in the NPFC convention area since 2021. This comprehensive program includes fisheries resources, larval-juvenile, plankton, and environmental surveys. Chub mackerel is an important pelagic economic species in the Northwest Pacific and a priority management species for NPFC, while also constituting a high proportion of the RV Song Hang's catches during the surveys. Through this project, we look forward to providing essential information to supplement the current scientific database of the SC and its subsidiary bodies to improve our understanding of the marine ecosystem in NPFC convention area.

Materials and Methods

Given the capacity and schedule of the "Song Hang" research vessel (3166 tons, 85-meters-length), we surveyed about two months from mid-June to early-August. In 2024, the program conducted from 11 June to 2 August, with 53 surveying days. This survey covered the area from 148°E to 164°E and from 35°N to 45°N on the high sea (Figure 1). This survey includes the fishery resources mid-trawling, squid jigging, egg-larva-juvenile trawling, zooplankton and phytoplankton vertical trawling, environmental factors monitoring, acoustic survey, and environment-DNA research.

Totally there are 46 stations in 2024, with trawling for 46 stations and squid-jigging for 27 stations (Figure 1). In 2024, systematic sampling and stratified sampling were used for station allocation. At each station, the mid-trawling covers about 1 hours, with 2~3kn speed. The catch was identified to species level, weighted, counted, and some important specimens will be measured for the biological information (growth, sex, maturity, feeding etc.)

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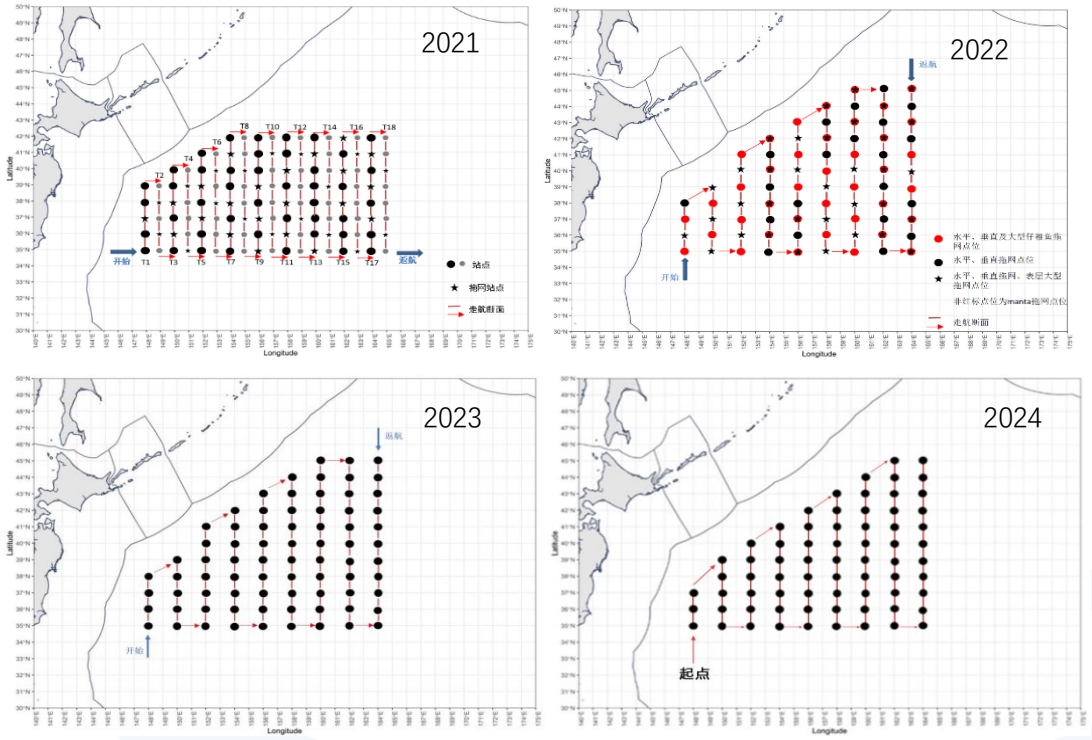

Figure 1 Survey stations of RV Song Hang in the northwest Pacific Ocean from 2021 to 2024.

Results

Fork Length and Body Weight Composition

From 2021 to 2024, a total of 3,801 Chub mackerel samples were collected by RV Song Hang. Specifically, 1,417 samples were collected in 2021, 417 in 2022, 1,303 in 2023, and 664 in 2024.

In 2021, the fork length of the samples ranged from 96 to 367 mm, with the dominant fork length group being 111–150 mm, accounting for 70% of the total samples. In 2022, the fork length ranged from 111 to 297 mm, with the dominant group being 151–180 mm, accounting for 52% of the samples. In 2023, the fork length ranged from 68 to 370 mm, with the dominant group being 201–240 mm, accounting for 38% of the samples. In 2024, the fork length ranged from 40 to 312 mm, with the dominant group being 131–160 mm, accounting for 52% of the samples. Across 2021–2024, the overall fork length of the samples ranged from 25 to 370 mm, with the dominant group being 121–160 mm, accounting for 42% of the total samples (Figure 3).

In 2021, the body weight of the samples ranged from 7.02 to 590.45 g, with the dominant weight group being 1–60 g, accounting for 85% of the samples. In 2022, the body weight ranged from 13.00 to 305.00 g, with the dominant group being 31–90 g, accounting for 68% of the samples. In 2023, the body weight ranged from 3.24 to 620.00 g, with the dominant group being 31–90 g, accounting for 38% of the samples. In 2024, the body weight ranged from 2.00 to 433.01 g, with the dominant group being 1–60 g, accounting for 69% of the samples. Across 2021–2024, the overall body weight of the samples ranged from 2.00 to 620.00 g, with the dominant group being 1–60 g, accounting for 62% of the total samples (Figure 4).

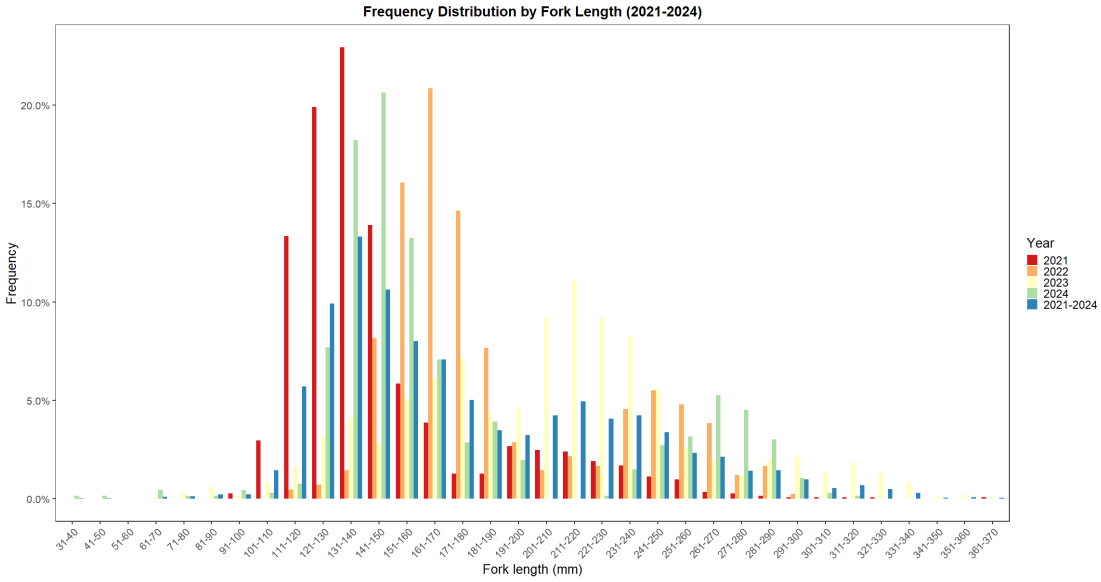

Figure 3 Fork length distribution of chub mackerel in the Northwest Pacific based on RV Song Hang from 2021 to 2024

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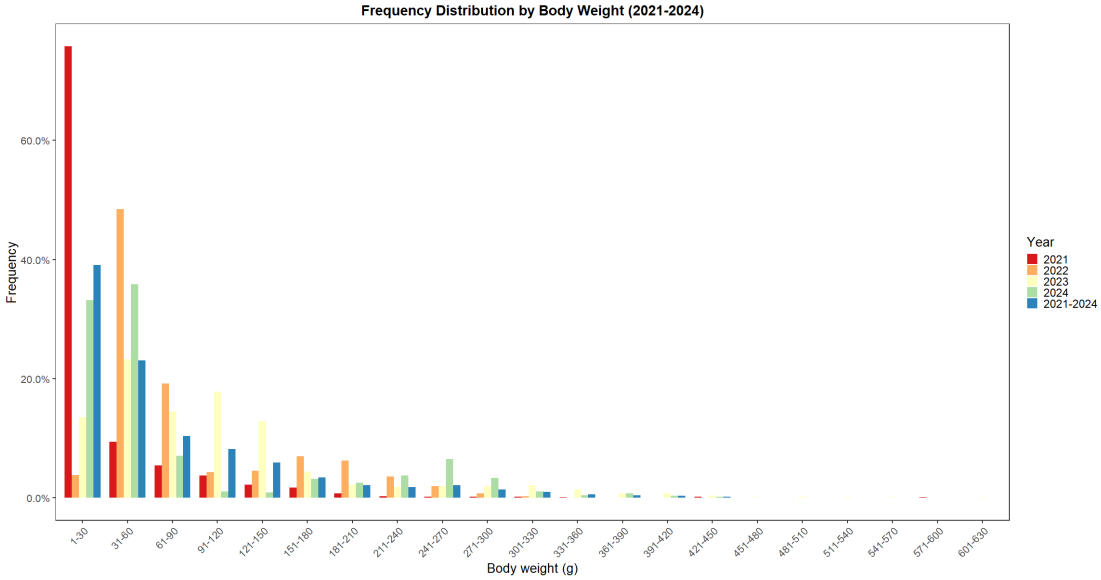

Figure 4 Body weight distribution of chub mackerel in the Northwest Pacific based on RV Song Hang from 2021 to 2024

The relationship of fork length and body weight

The relationship of fork length and body weight for chub mackerel are shown below for the overall period (2021–2024) and for each year (2021, 2022, 2023, and 2024) (Figure 5):

Table1 The relationship of fork length and body weight for chub mackerel

	Equations	*a*	*b*
2021	$W=2.50\times10^{-6}L^{3.24}$	2.50×10^{-6}	3.24
2022	$W=1.06\times10^{-5}L^{3.01}$	1.06×10^{-5}	3.01
2023	$W=2.74\times10^{-6}L^{3.23}$	2.74×10^{-6}	3.23
2024	$W=6.65\times10^{-6}L^{3.10}$	6.65×10^{-6}	3.10
2021-2024	$W=2.60\times10^{-6}L^{3.25}$	2.60×10^{-6}	3.25

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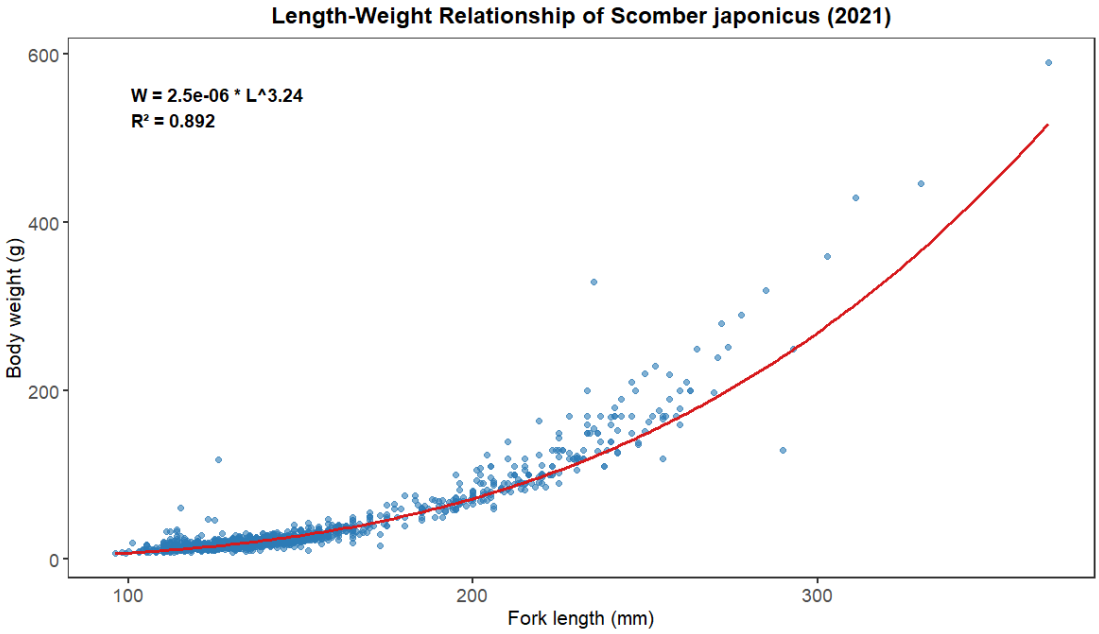

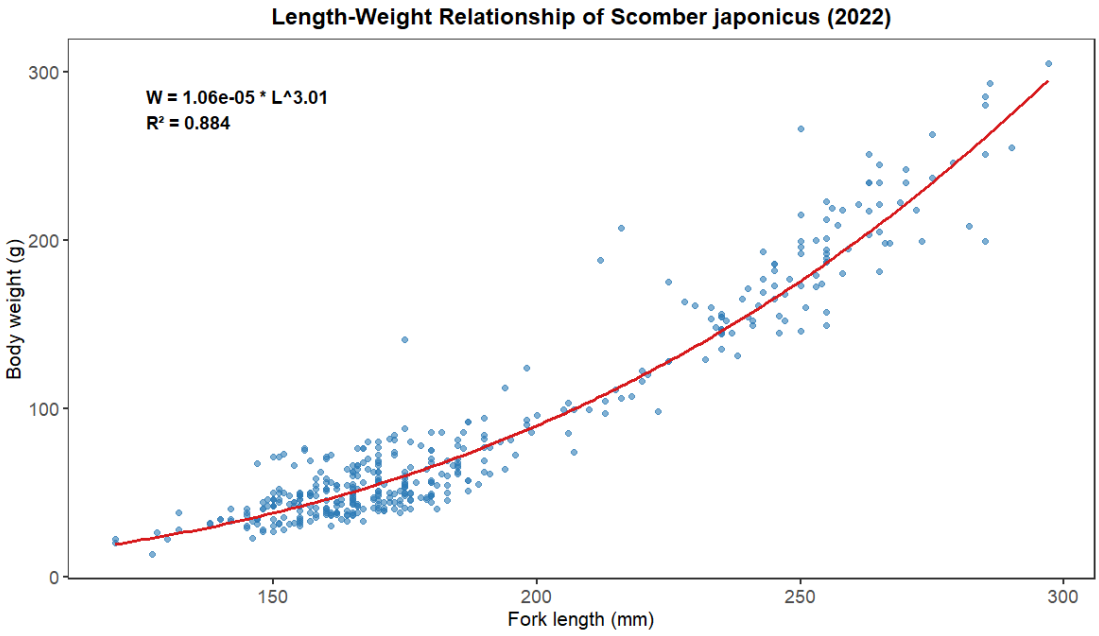

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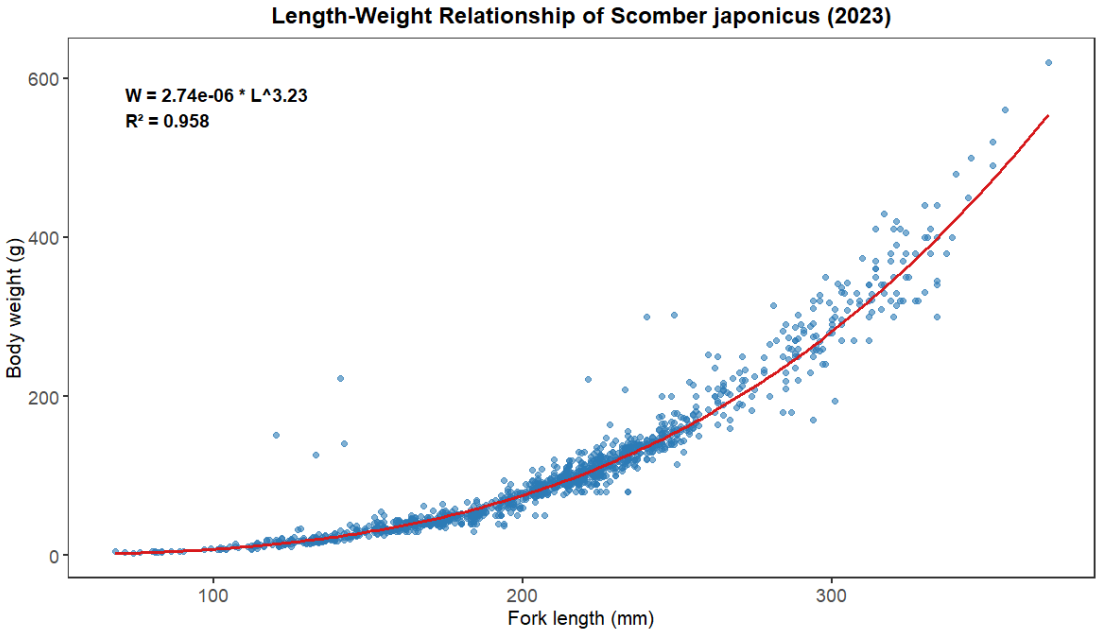

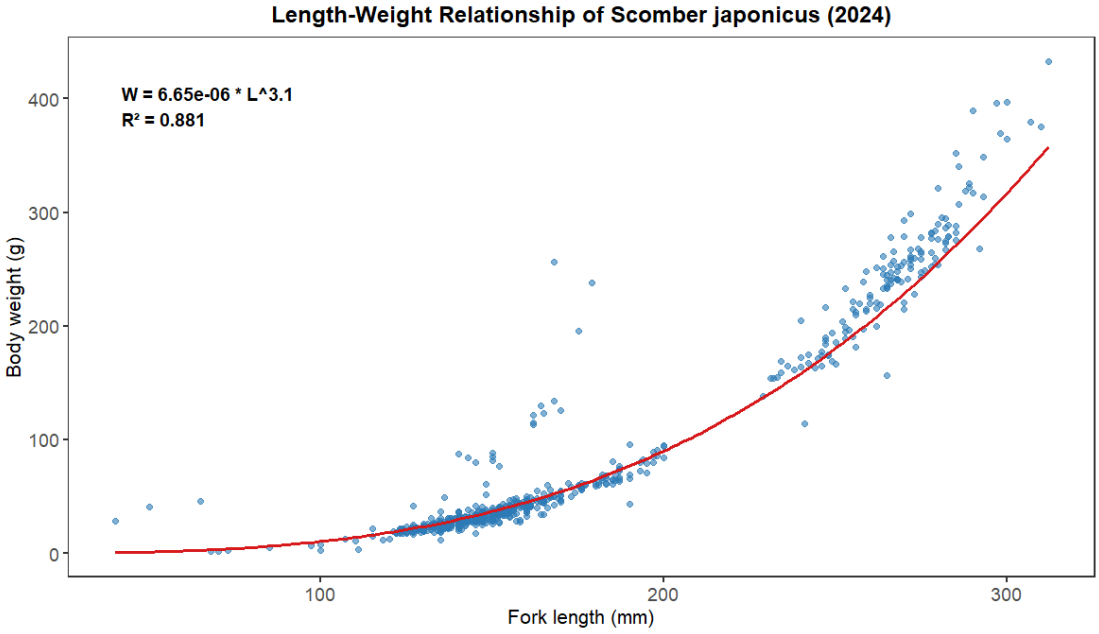

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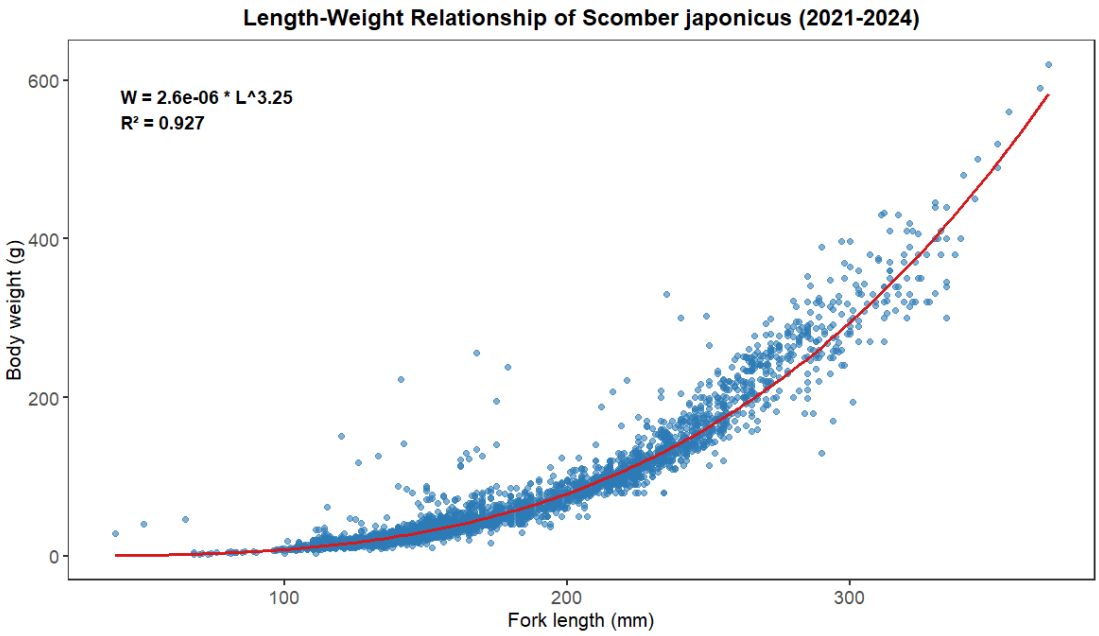

Figure 5 The relationship of fork length and body weight of chub mackerel in the Northwest Pacific based on RV Song Hang from 2021 to 2024

Sex Ratio

In 2021, female chub mackerel in the Northwest Pacific accounted for 45.21%, while males accounted for 54.79%, with a female-to-male ratio of 1:1.21. In 2022, females accounted for 50.82% and males for 49.18%, with a female-to-male ratio of 1:0.97. In 2023, females accounted for 59.54% and males for 40.46%, with a female-to-male ratio of 1:0.68. In 2024, females accounted for 41.22% and males for 58.78%, with a female-to-male ratio of 1:1.43. Overall, from 2021 to 2024, females accounted for 47.31% and males for 52.69%, with a female-to-male ratio of 1:1.11 in the Northwest Pacific, indicating that the proportion of males was slightly higher than that of females (Figure 6). The sex ratio is obviously different with 1:1, indicating attention should be paid to SSB estimation from biomass.

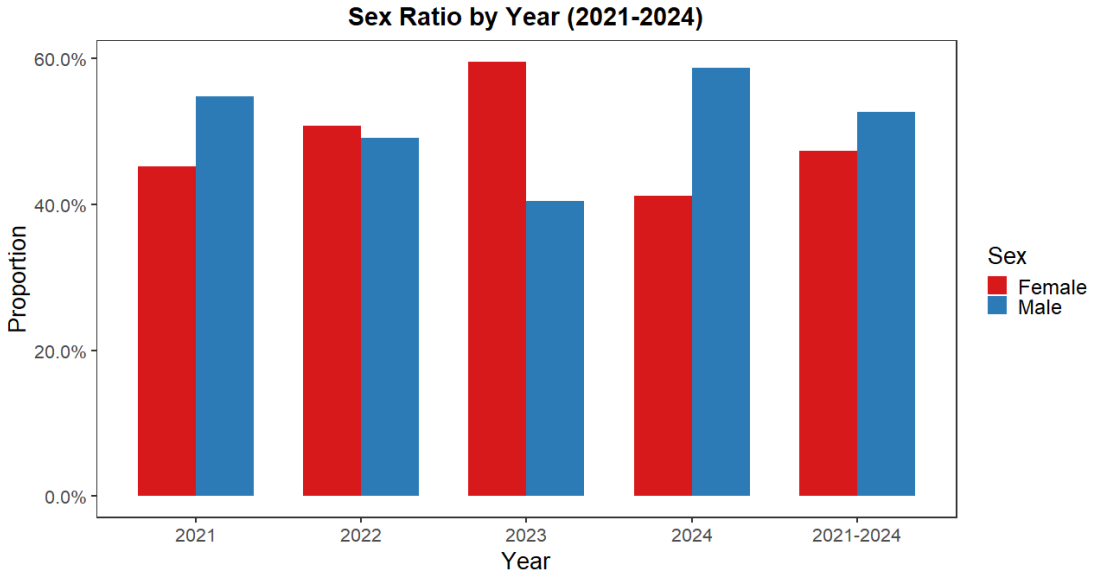

Figure 6 Sex ratio of chub mackerel samples based on RV Song Hang in the Northwest Pacific from 2021 to 2024

Discussion

This document just lists some description of Chub mackerel samples form the four years surveys. More studies are in progress, for example, age determination will be finished in this summer, for hundreds of samples covering different stations and different length group in all four years. After that, age-length-key and age structure could be got, growth function with growth rate k, and asymptotic length L_∞, and mortality (M and Z) could be estimated for Chub mackerel in 2021-2024. Additionally, spatial distribution patterns will be analyzed, and CPUE standardization will be explored as a potential index for stock assessment. Therefore, this ongoing survey could be a potential data sources for estimating the life history traits and supporting future stock assessment, offering critical insights into the population dynamics of this species within the convention area.

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