



North Pacific Fisheries Commission

NPFC-2023-SC08-WP12

Overview surveys from 2021 to 2023 by Chinese research vessel "Song Hang" in the NPFC convention area

Qiuyun MA, Bilin LIU, Libin DAI

College of Marine Sciences, Shanghai Ocean University, China

Summary

A scientific survey program has been conducted by Chinese research vessel "Song Hang" in the northwest Pacific Ocean from 2021 to 2023. This comprehensive program covers fisheries resources, larval-juvenile, plankton, and environmental surveys. Fundamental data and biological tissue samples have been collected in these three years, which could improve our understanding for the marine ecosystem in NPFC convention area. This document introduces a briefly overview of this research and we hope to get suggestions to improve the 2024 survey.

Introduction

China has been conducting a five-year scientific survey program using its fishery research vessel "Song Hang" with mid-trawl as the main survey gear in the NPFC convention area from 2021 to 2025. This series of research surveys are supported by the Ministry of Agriculture and Rural Affairs (MARA) of China and conducted by Shanghai Ocean University. This research includes fisheries resources, larval-juvenile, plankton, and environmental surveys.

This survey is comprehensive covering several tasks, which are as below:

- a) Investigating population structure and spatial distribution of pelagic species.
- b) Evaluating the relative abundance of NPFC species based on the trawl and acoustic data.
- c) Collecting fishery-independent data, including length-frequency, length-weight

data, and biological sampling of the main species in this ecosystem.

d) Collecting environment data and biology diversity for ecosystem modeling.

Through this project, we look forward to providing essential information to supplement the current scientific database of the SC and its subsidiary bodies in order 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 mid-August. This survey covered the area from 148°E to 165°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.

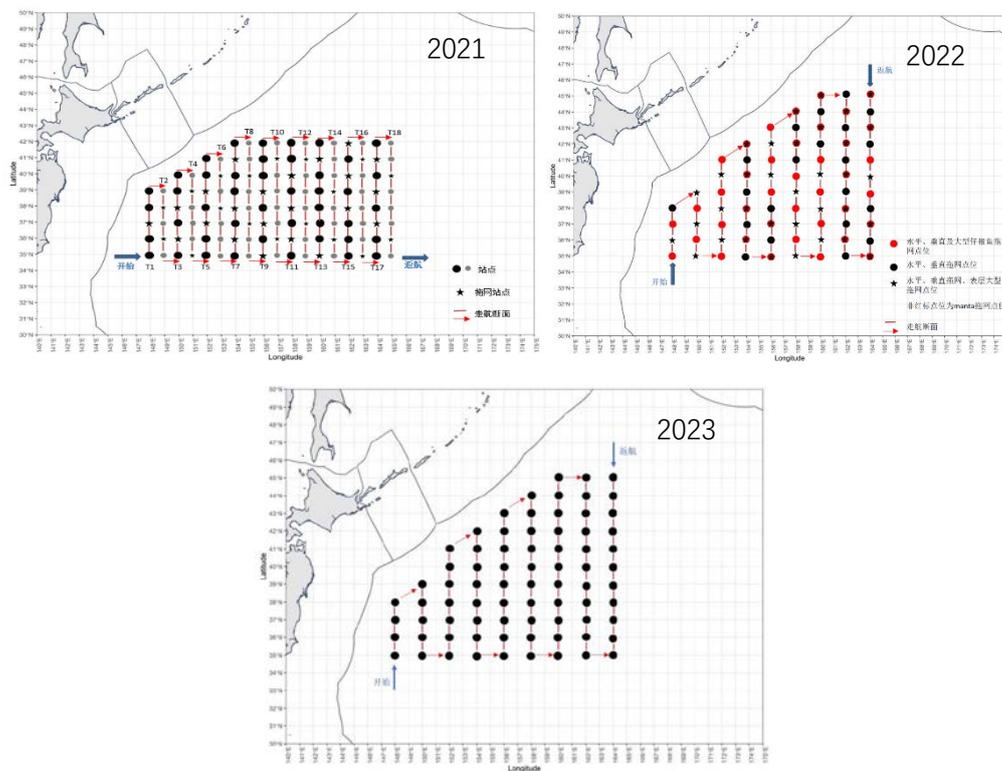


Figure 1 Survey stations of RV "Song Hang" in the northwest Pacific Ocean from 2021 to 2023.

Totally there are about 144 (2021), 76 (2022) and 70 (2023) stations, while the survey covers different objectives in each station. From 2021 to 2023, the fishery resources trawling stations numbers are 42, 36, and 39, respectively. Squid jigging was conducted in 15 stations of 2022, and 25 stations of 2023. At each station, the mid-trawling covers about 2~3 hours, with 4~5kn speed and the squid jigging for 5 hours. 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.)

For environment factors, we collect data on temperature, salinity, transparency, dissolved oxygen, pH, nitrogen, etc. Conductivity Temperature Depth (CTD 9-11Plus, Sea-Bird) and its MOUNTED SBE43 probe was used to collect 0-300m vertical hydrological data of the above information at each station. Water samples were collected in layers of 25m, 50m, 75m, 100m, 200m, and 300m, and 12 bottles *250ml/ bottle per station, used for multiple purposes, e.g. environment-DNA analysis.

Results

The trawling and squid jigging surveys collected many species, which are mainly fishes and cephalopoda (Tables 1-2). The dominate fishery species in trawling survey are Chub mackerel *Scomber japonicus*, Blue mackerel *Scomber australasicus*, Japanese sardine *Sardinops sagax*, and Japanese anchovy *Engraulis japonicus* (Figure 2), while the dominant species in squid jigging survey are Neon flying squid *Ommastrephes bartrami* and Boreopacific gonate squid *Gonatopsis borealis* (Figure 3).

The catch spatial distribution of mackerels and Japanese sardine were shown in the figures 4 and 5, while the length distribution of 2023 specimens were exhibited in the figure 6. The density of species could be estimated from both the trawling and acoustic survey (Figure 7). Through the acoustic analysis, the density of Chub mackerel was estimated to be 22.98t/nmi², while Blue mackerel's density was 3.52t/nmi², and the Japanese sardine was 211.31t/nmi².

Table 1 The fishes collected in the three years fishery resources survey by RV Song Hang in the northwest Pacific.

Family	Species	2021	2022	2023
BATHYLAGIDAE	<i>Dolicholagus longirostris</i>			√
	<i>Lipolagus ochotensis</i>			√
BRAMIDAE	<i>Brama japonica</i>		√	√
	<i>Brama myersi</i>	√	√	√
	<i>Oncorhynchus gorbuscha</i>			√
	<i>Taractes rubescens</i>		√	
CARCHARHINIDAE	<i>Prionace glauca</i>	√	√	√
CENTROLOPHIDAE	<i>Hyperoglyphe japonica</i>			√
CLUPEIDAE	<i>Sardinops sagax</i>	√	√	√
DASYATIDAE	<i>Pteroplatytrygon violacea</i>	√		
ENGRAULIDAE	<i>Engraulis japonicus</i>	√	√	√
EXOCOETIDAE	<i>Cypselurus oligolepis</i>			√
ICOSTEIDAE	<i>Icosteus aenigmaticus</i>			√
LAMNIDAE	<i>Lamna nasus</i>			√
LAMPRIDIDA	<i>Lampris guttatus</i>			√
MOLIDAE	<i>Mola mola</i>		√	√
MYCTOPHIDAE	<i>Ceratoscopelus townsendi</i>			√
	<i>Diaphus garmani</i>	√		
	<i>Diaphus gigas</i>			√
	<i>Diaphus perspicillatus</i>			√
	<i>Diaphus suborbitalis</i>			√
	<i>Lampanyctus tenuiformis</i>			√
	<i>Myctophidae</i>		√	√
	<i>Myctophum asperum</i>	√	√	√
	<i>Myctophum nitidulum</i>	√		√
	<i>Nannobranchium nigrum</i>			√
	<i>Notoscopelus caudispinosus</i>			√
	<i>Notoscopelus japonicus</i>			√
	<i>Notoscopelus resplendens</i>	√		√
	<i>Poropanchax normani</i>			√
	<i>Symbolophorus californiensis</i>	√		√
	<i>Tarletonbeania taylora</i>			√
NOMEIDAE	<i>Cubiceps whiteleggii</i>		√	√
	<i>Psenes arafurensis</i>			√
	<i>Psenes pellucidus</i>		√	√
NOTOSUDIDAE	<i>Scopelosaurus hoedti</i>	√		√
OSTRACIONTIDAE	<i>Lactoria diaphana</i>			√
PARALEPIDIDAE	<i>Lestidiops jayakari jayakari</i>			√

Family	Species	2021	2022	2023
	<i>Lestrolepis intermedia</i>			√
	<i>Magnisudis indica</i>	√		
REGALECIDAE	<i>Regalecus russllii</i>		√	
SALMONIDAE	<i>Oncorhynchus gorbuscha</i>			√
SCOMBERESOCIDAE	<i>Cololabis saira</i>	√		
SCOMBRIDAE	<i>Diplospinus multistriatus</i>			√
	<i>Nealotus tripes</i>	√	√	√
	<i>Scomber australasicus</i>	√		√
	<i>Scomber japonicus</i>	√	√	√
	<i>Thyrsitoides marleyi</i>			√
STOMIAS AFFINIS	<i>Astronesthes quasiindicus</i>			√
TETRAGONURIDAE	<i>Tetragonurus cuvieri</i>		√	√
TRACHIPTERIDAE	<i>Trachipterus ishikawae</i>		√	√
TRICHIURIDAE	<i>Assurger anzac</i>	√		
XIPHIIDAE	<i>Xiphias gladius</i>			√
ZEIDAE	<i>Zenopsis nebulosa</i>	√	√	√

Table 2 The cephalopoda collected in the three years fishery resources survey by RV Song Hang in the northwest Pacific.

Family	Species	2021	2022	2023
ALLOPOSIDAE	<i>Haliphron atlanticus</i>		1	
AMPHITRETIDAE	<i>Amphitretus pelagicus</i>	1	1	
BOLITAEMIDAE	<i>Japetella diaphana</i>	1	1	
CRANCHIIDAE	<i>Cranchia scabra</i>			1
	<i>Galiteuthis sp.</i>		1	
	<i>Leachia pacifica</i>			1
	<i>Liocranchia reinhardti</i>		1	1
	<i>Taonius pavo</i>			1
ENOPLOTEUTHIDAE	<i>Enoploteuthis chunii</i>			1
	<i>Watasenia scintillans</i>	1	1	1
GONATIDAE	<i>Gonatopsis borealis</i>	1	1	1
	<i>Gonatopsis octopedatus</i>	1	1	
OCTOPOTEUTHIDAE	<i>Octopoteuthis sicula</i>			1
OMMASTREPHIDAE	<i>Eucleoteuthis luminosa</i>		1	1
	<i>Eucleoteuthis luminosa</i>	1		
	<i>Ommastrephes bartrami</i>		1	
	<i>Sthenoteuthis oualaniensis</i>	1		
	<i>Todarodes pacificus</i>	1	1	1
ONYCHOTEUTHIDAE	<i>Moroteuthis</i>			1
	<i>Moroteuthis robusta</i>	1	1	
	<i>Onychoteuthis borealijaponicus</i>	1	1	
	<i>Onychoteuthis compacta</i>	1	1	1

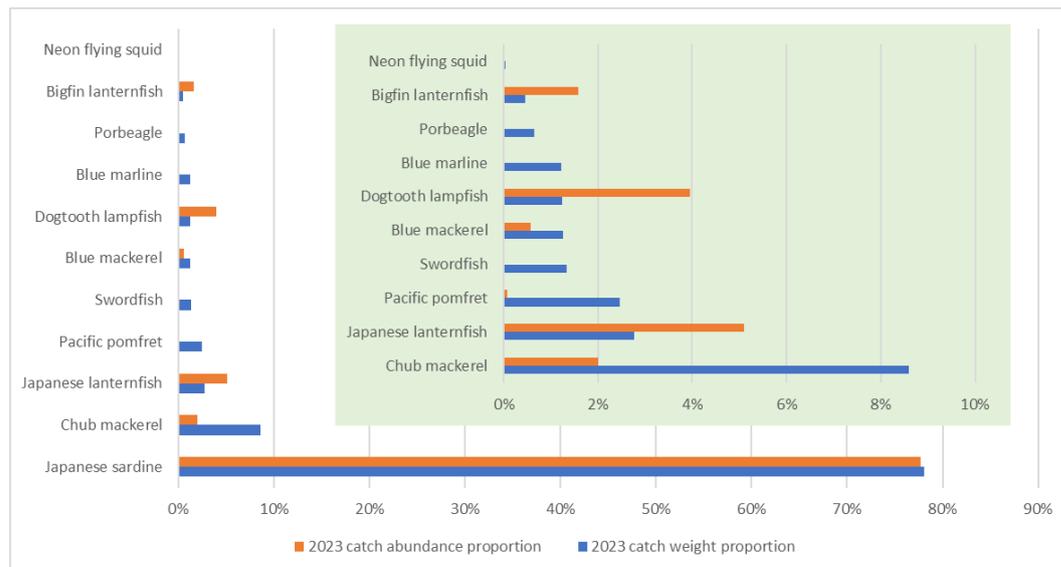


Figure 2 The catch weight and abundance proportions of main species in the 2023 trawling survey

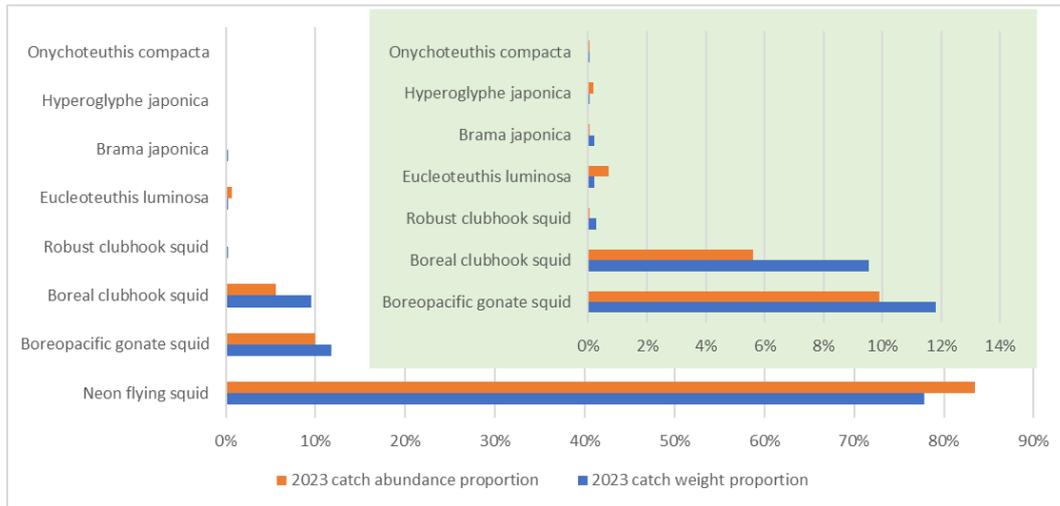


Figure 3 The catch weight and abundance proportions of main species in the 2023 squid jigging survey

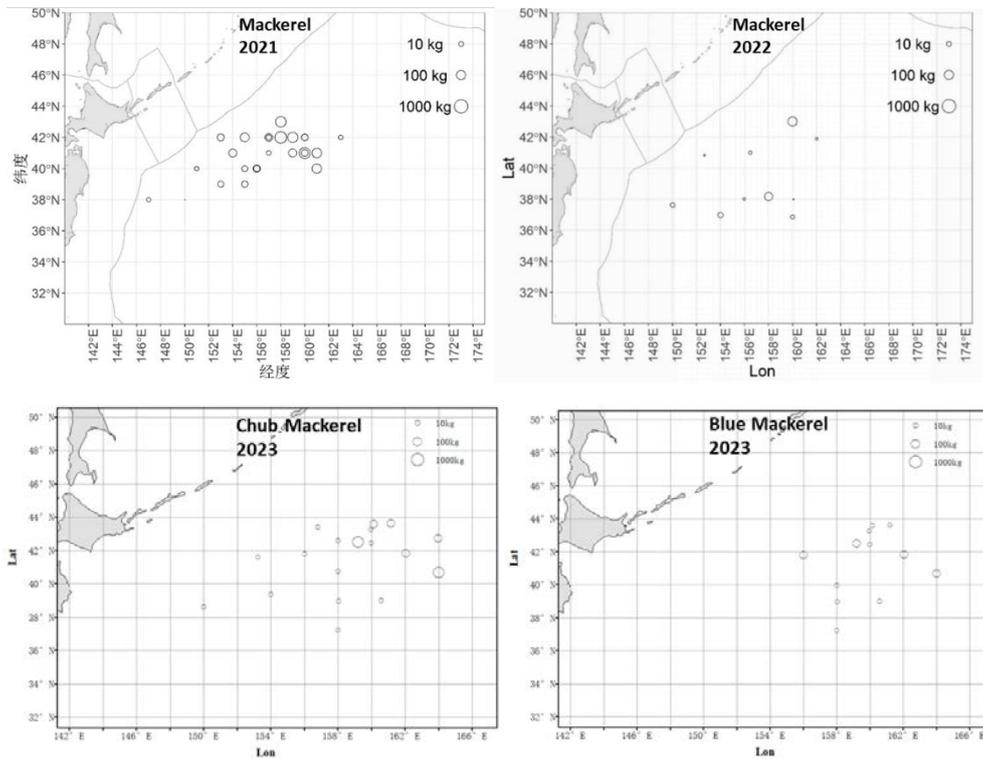


Figure 4 The catch distribution of mackerels surveyed in the three years fishery resources survey by RV Song Hang in the northwest Pacific.

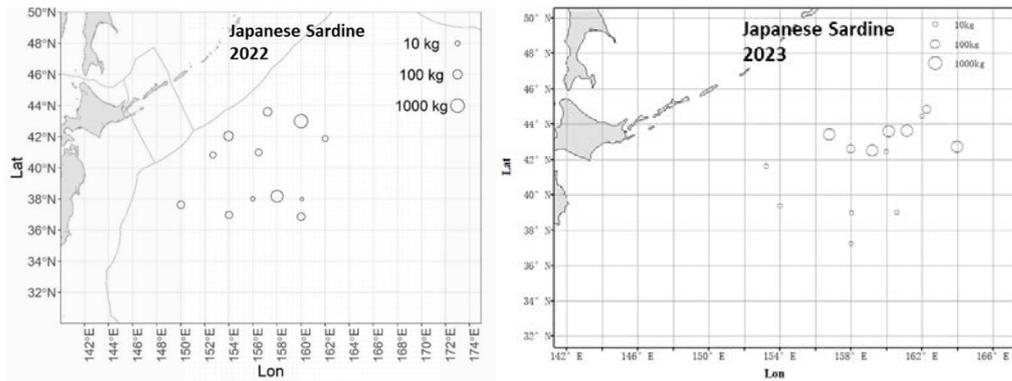


Figure 5 The catch distribution of Japanese sardine surveyed in the three years fishery resources survey by RV Song Hang in the northwest Pacific.

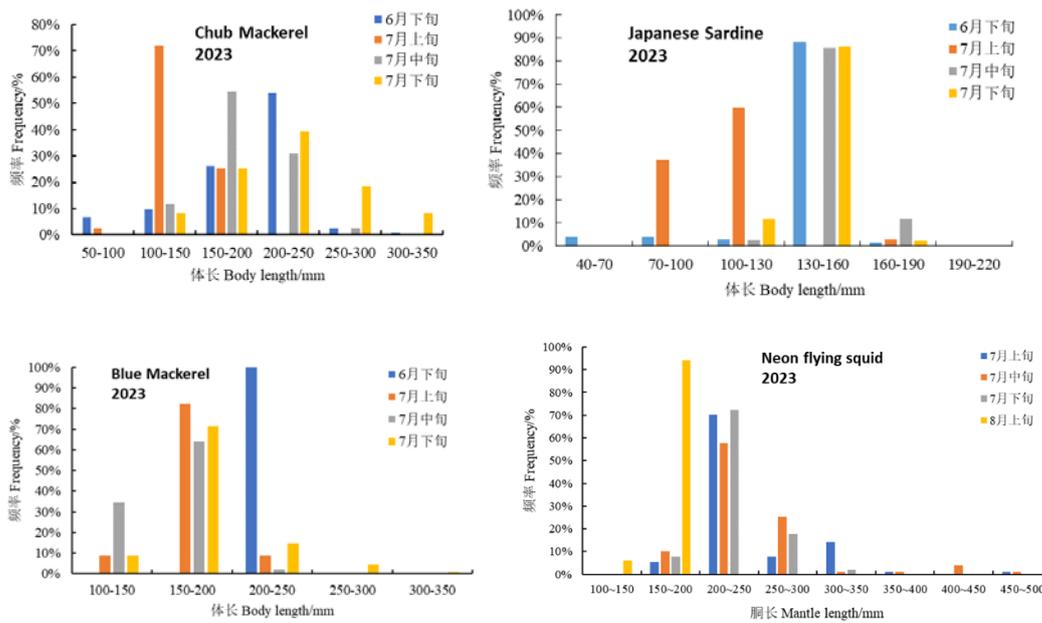


Figure 6 The length distribution of four main species surveyed in 2023 fishery resources survey by RV Song Hang in the northwest Pacific.

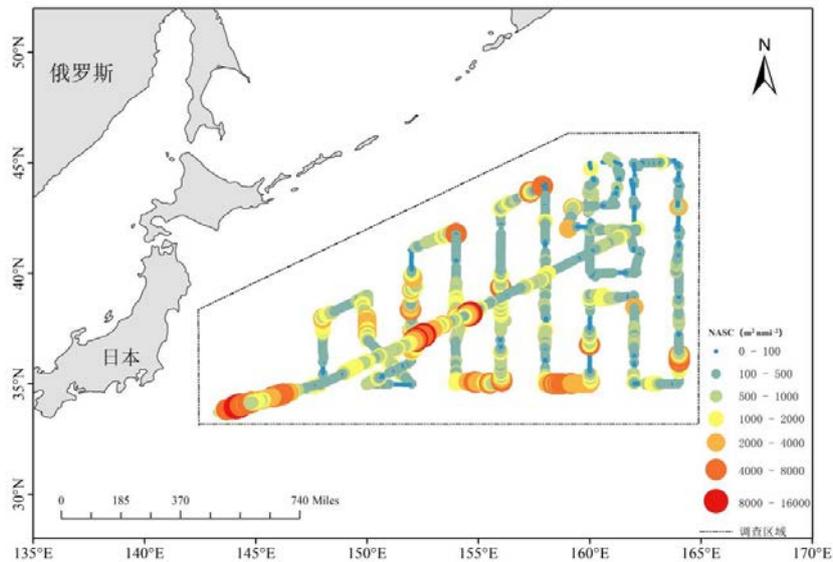


Figure 7 The spatial distribution of Nautical Area Scattering coefficient from the 2023 acoustic survey

Discussion

In the three years survey, more than 65 species were measured, with the associated environmental factors with multiple approaches. The main species surveyed in this research are Chub mackerel, Blue mackerel, Japanese sardine and Neon flying squid, with high priority in NPFC. Due to the gear limit and capacity of RV Song hang, Pacific saury and Japanese flying squid were seldom collected by this survey. Spatial distribution, abundance, and biology of the four main species would supplement the current scientific database of NPFC.

The collected fundamental data and biological tissue samples could support the study for the life history traits, population dynamics, spatial-temporal distribution, feeding ecology, interspecies relation, community ecology, the abiotic environment, etc. This information could improve our understanding for the marine ecosystem in the northwest Pacific Ocean. Currently, our project is still in the process to collect the data and materials. In this scientific meeting, comments and suggestions are specially needed and welcomed to improve the survey in 2024.

Acknowledgement

The document is supported by Program on the Survey, Monitoring and Assessment of Global Fishery Resources (Comprehensive scientific survey of fisheries resources at the high seas) sponsored by the Ministry of Agriculture and Rural Affairs, and the National Natural Science Foundation of China (32202934).