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**Progress report of the research survey for 2023 by Chinese fishery research vessel
"Song Hang" in the WCPFC area**

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Xiaodong Li, Zhe Geng, Xiaojie Dai, Feng Wu, Jiangfeng Zhu

Summary

China as a member country has been conducting a five-year scientific survey program using its fishery research vessel "Song Hang" with longline as the main gear in the WCPFC convention area from 2021 to 2025. The survey has collected fundamental data and biological tissue samples to improve the commission's scientific research to support better management advice. The main objectives of our cruises are to improve the understanding of the stock structure and investigate the mechanisms of moving and aggregating by incorporating environmental factors for target and bycatch species. The survey covered the area in the high sea from 129°58'E to 138°03'E and 10°56' N to 16°01'N between August to September 2023. A total of 20 sets (8245 hooks) were released, and a total of 15 species were recorded in this survey. Preliminary result shows that harvest consists of Longnose lancetfish (43.15%) and blue shark (20%). Albacore tuna is the majority catch of commercial tuna. A total of 5 tags with satellites were released, and tissues sample of 87 individuals from 13 species were collected during the cruises.

Introduction

According to WCPFC Convention principles "on the need to collect and share data, including information from national research programs"(Article 5) and "The function of promoting the conduct of relevant scientific research and disseminating the results thereof is one of the functions of the Commission" (Article 10), China as a member country of WCPFC has conducted a five-year scientific survey program using its fishery research vessel "Song Hang" with longline as main gear in the WCPFC convention area. This series of research surveys are supported by the Ministry of Agriculture and Rural Affairs (MARA) of China and conducted by Shanghai Ocean University, focusing on the tuna and bycatch resource in the WCPFC convention area. Through this project, we look forward to providing essential information to supplement the current scientific database of the commission. We also hope that the survey will be a joint project with participants from SPC and other member scientists in the future.

The main objective of this project is based on various CMMs and recommendations raised by SC, including support and encouragement for CCMs to undertake scientific research to understand fisheries and species covered by the Convention. The survey will be conducted to collect fundamental data and conduct experiments to improve the commission's scientific research and support better management advice. Five tasks

would be included in this project, which are as below:

- a) Collecting fishery-independent data, including catch and effort, length-frequency, length-weight data (to estimate various conversion factors), and biological sampling (larvae survey, growth, stomach content, etc.).
- b) Investigating stock structure (tissue bank) and spatial distribution of longline target and bycatch species.
- c) Investigating the influence of different types of longline hooks and baits on fishing selectivity, catchability, and survival rate onboard.
- d) Collecting environment data for ecosystem model, including temperature, salinity, transparency, dissolved oxygen, pH, nitrogen, et al.
- e) Tagging and releasing experiments for sharks, marine mammals, and turtles if possible. The project would also be used to monitor bycatch migration and releasing mortality.

Methods and materials

Given the capacity and schedule of the “Song hang” research vessel, we surveyed from Aug to Sep of 2023. This survey covered the area from 129°58'E to 138°03'E and 10°58' N to 16°01'N on the high sea. This survey includes 74 survey stations, but half of them are only for the environment survey without fishing behavior. A total of 26 fishing sets (6 for trawl net and 20 for longline) were included in this survey, and a total of 8425 hooks were released in the WCPO (Table 1). For more details about spatial distribution, please refer to Figure 1.

For the requirement of environment data for the ecosystem model, we will collect data on temperature, salinity, transparency, dissolved oxygen, pH, nitrogen, etc. Conductivity Temperature Depth (CTD 9-11Plus, Sea-Bird) and its MOUNTED SBE43 probe will be 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.

This project has conducted tagging and releasing programs for sharks, marine mammals, and turtles. These programs will be used to monitor migration, habits, and releasing mortality. This voyage will include one type of label, as shown in Table 2.

Result

Detailed information on each operation of the longline is recorded in Table 3. A total of 13 species (95 individuals) were recorded in this survey. Preliminary result shows that harvest (including escape and released species) consists of Longnose lancetfish (43.15%) and blue shark (20%). For commercial tuna, Bigeye tuna is the majority

caught in this WCPO survey. More details can be found in Table 4. Hook position information for several major catches is recorded in Table 5. A total of 87 individuals have been sampled on board, and biological tissues include vertebra, gonad, stomach, heart, muscles, and so on (Table 6). The total catch of tuna and tuna-like species in the survey was 415.2 kg (Table 7). Biological characteristics of several species with high catches were recorded (Table 8). Figures 2-6 depicted the spatial distribution relationships between tuna catches and several major marine environmental factors (temperature, salinity, dissolved oxygen saturation, and seawater turbidity), respectively. Currently, our project is still in the process to collect the data and materials, therefore we only provide a brief description of our survey and sampling here.

Table 1. Hooks were released in the WCPO survey

Date	Set	Hooks	Hooks per day
August	4	1379	344
September	16	6866	429

Table 2 Tags were used in the WCPO survey

Name of tags	number
MiniPAT w/Attached, Dart, Domeier Medium, No Dacron	5

Table 3 Information on longline operations

Set No.	Date	Time		Location		Ship speed (kn)	Wind speed (m/s)	Catch (kg)
		Start	End	Latitude(N)	Longitude(E)			
1	2023.8.28	23:45	7:40	11°57.5872	130°57.7872	4.0	5.3	9.2
2	2023.8.29	23:53	7:45	11°08.0202	131°11.1752	5.6	3.1	0
3	2023.8.30	0:02	7:40	12°46.1652	131°56.9072	6.0	7	320
4	2023.8.31	0:28	7:35	14°23.2002	131°56.0822	7.2	3.3	38
5	2023.9.01	23:50	7:40	16°00.2002	132°17.8392	6.7	1.5	45.6
6	2023.9.02	23:55	7:45	14°39.9912	132°59.8382	7.5	1.5	9.51
7	2023.9.03	23:52	7:41	12°30.0072	133°00.0992	7.6	2.2	17.6
8	2023.9.04	23:50	7:45	12°37.3652	133°59.5642	6.2	2.3	32.9
9	2023.9.05	23:50	7:45	14°41.8412	133°59.5032	7.7	3.3	0
10	2023.9.06	23:51	7:40	16°04.3342	134°46.2172	7.8	1.2	139.7
11	2023.9.07	23:48	7:35	14°17.5132	135°03.1862	7.5	0.8	119.3
12	2023.9.08	23:48	7:35	12°21.9172	134°56.3462	7.5	3	109
13	2023.9.09	23:50	7:35	12°04.9172	135°00.2822	7.5	3	164.3

14	2023.9.10	23:51	7:35	13°38.3902	135°56.0472	7.4	2	140
15	2023.9.11	23:47	7:35	15°33.1932	135°57.6042	7.5	3.2	3.5
16	2023.9.12	23:50	7:38	15°55.7072	137°31.7972	7.5	3	42.3
17	2023.9.13	23:50	7:35	14°29.6802	138°04.3632	7.5	1.4	77.4
18	2023.9.14	23:45	7:35	11°57.5872	130°57.7872	7.3	1.2	9.2
19	2023.9.15	23:46	7:35	11°08.0202	131°11.1752	7.5	2.7	0
20	2023.9.16	23:49	7:35	12°46.1652	131°56.9072	7.5	1.2	320

Table 4 Harvest composition in the WCPO survey

English name	Scientific name	Individuals (num)	Proportion (%)
Longfin mako	<i>Isurus paucus</i>	1	1.05
Sickle Pomfret	<i>Taractichthys steindachneri</i>	6	6.31
Bigeye tuna	<i>Thunnus obesus</i>	4	4.21
Yellowfin tuna	<i>Thunnus albacares</i>	1	1.05
Snake Mackerel	<i>Gempylus serpens</i>	5	5.26
Blue shark	<i>Prionace glauca</i>	19	20
Escolar	<i>Lepidocybium flavobrunneum</i>	4	4.21
Albacore tuna	<i>Thunnus alalunga</i>	2	2.1
Pelagic stingray	<i>Dasyatis violacea</i>	4	4.21
Longnose lancetfish	<i>Alepisaurus ferox</i>	41	43.15
Bigeye thresher	<i>Alopias superciliosus</i>	2	2.1
Pelagic thresher	<i>Alopias pelagicus</i>	2	2.1
Swordfish	<i>Xiphias gladius</i>	4	4.21
Sum		95	100.00

Table 5 Hook position information for several major catches

Species	Hook position															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Blue shark	1	1	3	1	1	0	1	1	0	1	1	1	1	2	2	2
Bigeye tuna	0	0	1	1	1	0	0	0	0	1	0	0	0	0	0	0
Snake Mackerel	0	1	0	0	1	0	0	0	0	0	0	0	1	1	0	1
Bigeye thresher	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0
Sickle Pomfret	0	0	0	0	0	0	1	3	1	1	0	0	0	0	0	0
Longnose lancetfish	0	1	3	5	3	2	2	1	3	2	5	3	3	5	1	2

Table 6 Sampling tissues and their numbers for each species of catch

English name	Sampling tissue	Individuals (num)
Pelagic stingray	Bring back as a whole	4
Longfin mako	Bring back as a whole	1
Sickle Pomfret	Otoliths, eyeballs, teeth, muscles, liver, heart, vertebrae, stomach, spleen, kidneys, intestines	6
Bigeye tuna	Eyeballs, teeth, white muscle, liver, gonads, heart, vertebrae, stomach, spleen, kidneys, intestines	4
Bigeye thresher	Blood, eyes, teeth, muscles, liver, gonads, heart, spleen, kidneys, intestines, brain	1
Yellowfin tuna	Bring back as a whole	1
Blue shark	Blood, eyes, teeth, muscles, liver, gonads, heart, vertebrae, stomach, spleen, kidneys, intestines, brain	12
Albacore tuna	Eyeballs, otoliths, muscles, vertebrae, stomach, intestines, liver, gonads, gall, heart	2
Longnose lancetfish	Bring back as a whole	40
Swordfish	Eyeballs, teeth, muscles, liver, gonads, heart, vertebrae, stomach, spleen, kidneys, intestines	4
Snake Mackerel	Bring back as a whole	5
Pelagic thresher	Blood, eyes, teeth, muscles, liver, gonads, heart, spleen, kidneys, intestines, brain	2
Escolar	Eyes, muscles, vertebrae, stomach, intestines, liver, gonads, kidneys, bile, pancreas, pyloric blind sac, heart	4
Sum		86

Table 7 Tuna and tuna-like species were caught in the WCPO survey

Species	Albacore tuna	Yellowfin tuna	Bigeye tuna	Swordfish
Weight(kg)	41	31	157	186.2
Individual(num)	2	1	4	4

Table 8 Biological characteristics of the main economic fish species and bycatch

species				
Species	Average length or width(cm)	Standard deviation of length	Minimum length (cm)	Maximum length (cm)
Bigeye tuna	120.3	14.4	100	134
Blue shark	202.50	13.05	180	226
Swordfish	201.00	114.18	99	356
Longnose lancetfish	119.78	31.93	69	182
Escolar	125.75	20.58	103	151
Snake Mackerel	100.40	10.99	84	112
Sickle pomfret	69.17	11.51	48	79

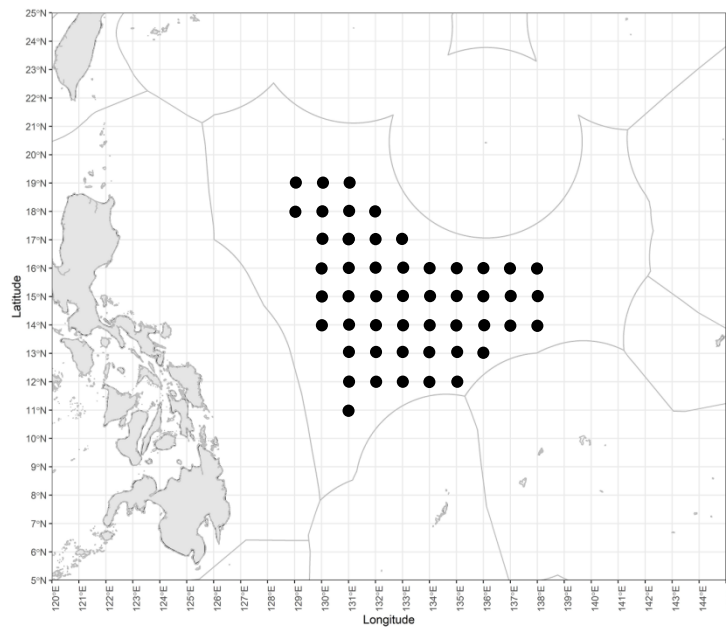


Figure 1 Spatial distribution for the scientific survey in WCPO.

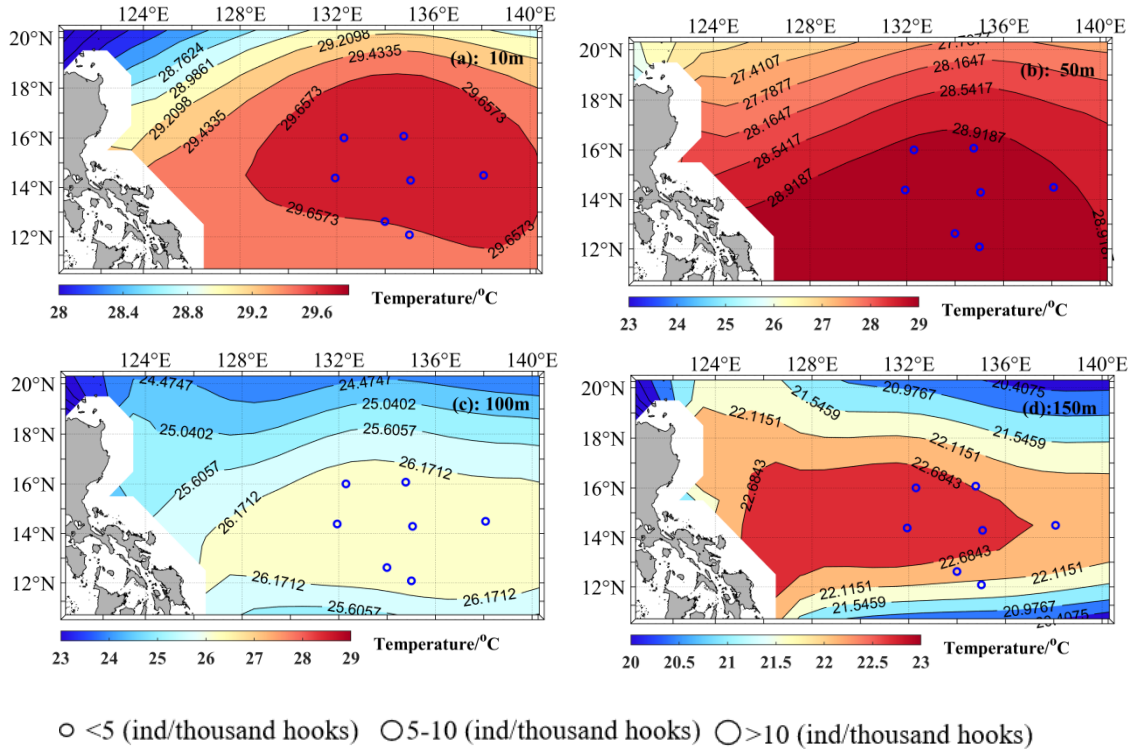


Figure 2 Spatial distribution of temperature in relation to tuna catch in the Western and Central Pacific survey area in September 2023.
 (a) : 10m; (b):50m; (c):100m; (d):150m

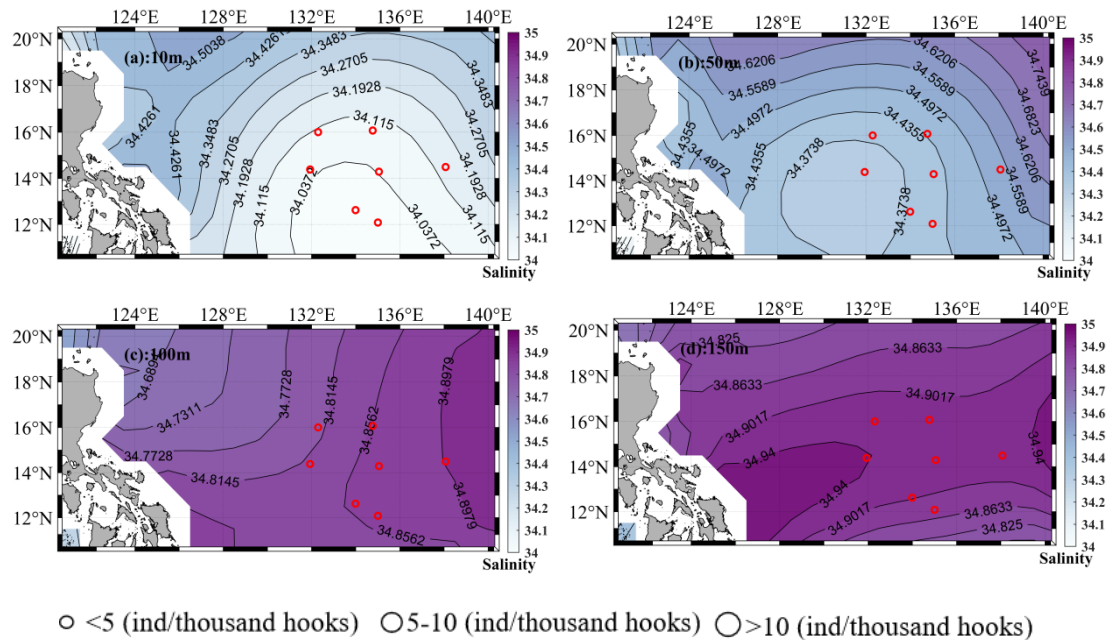


Figure 3 Spatial distribution of salinity in relation to tuna catch in the Western and Central Pacific survey area in September 2023.
 (a) : 10m; (b):50m; (c):100m; (d):150m

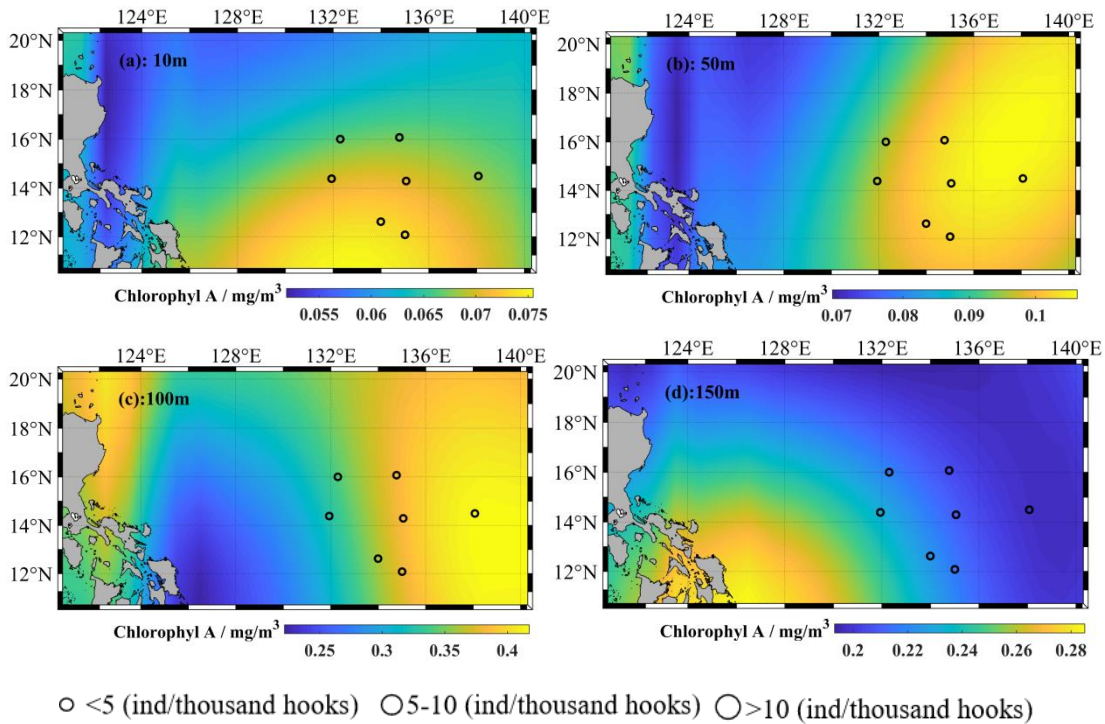


Figure 4 Spatial distribution of Chlorophyll a in relation to tuna catch in the Western and Central Pacific survey area in September 2023.

(a): 10m; (b):50m; (c):100m; (d):150m

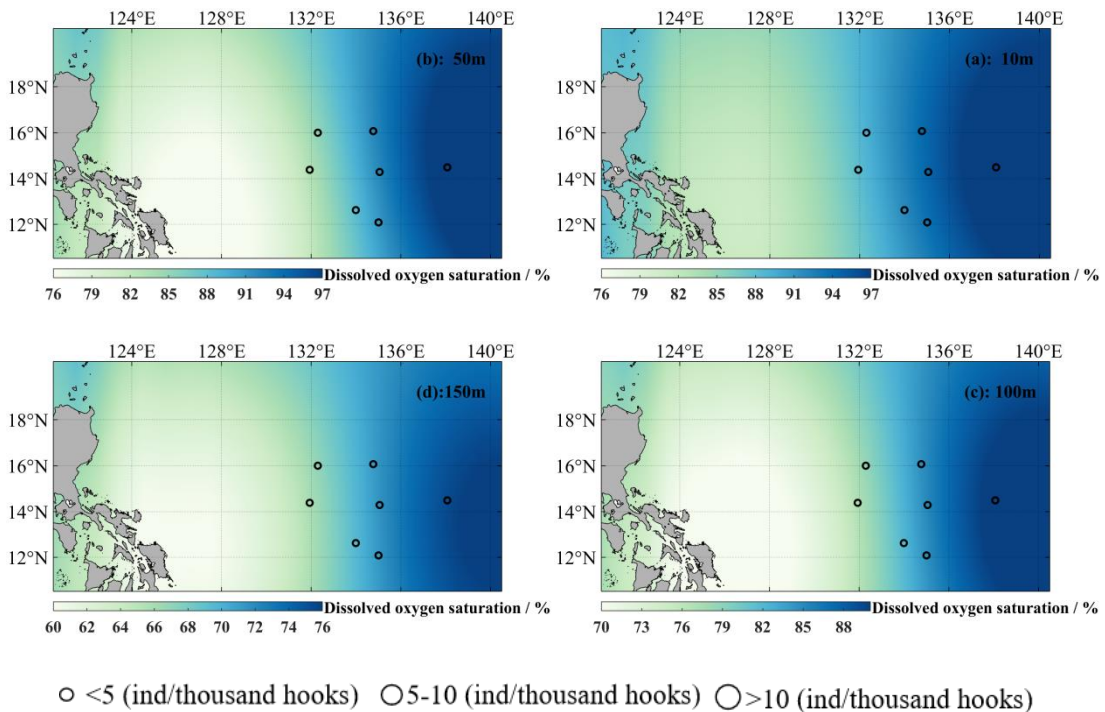


Figure 5 Spatial distribution of dissolved oxygen saturation in relation to tuna catch in the Western and Central Pacific survey area in September 2023.

(a) : 10m; (b):50m; (c):100m; (d):150m

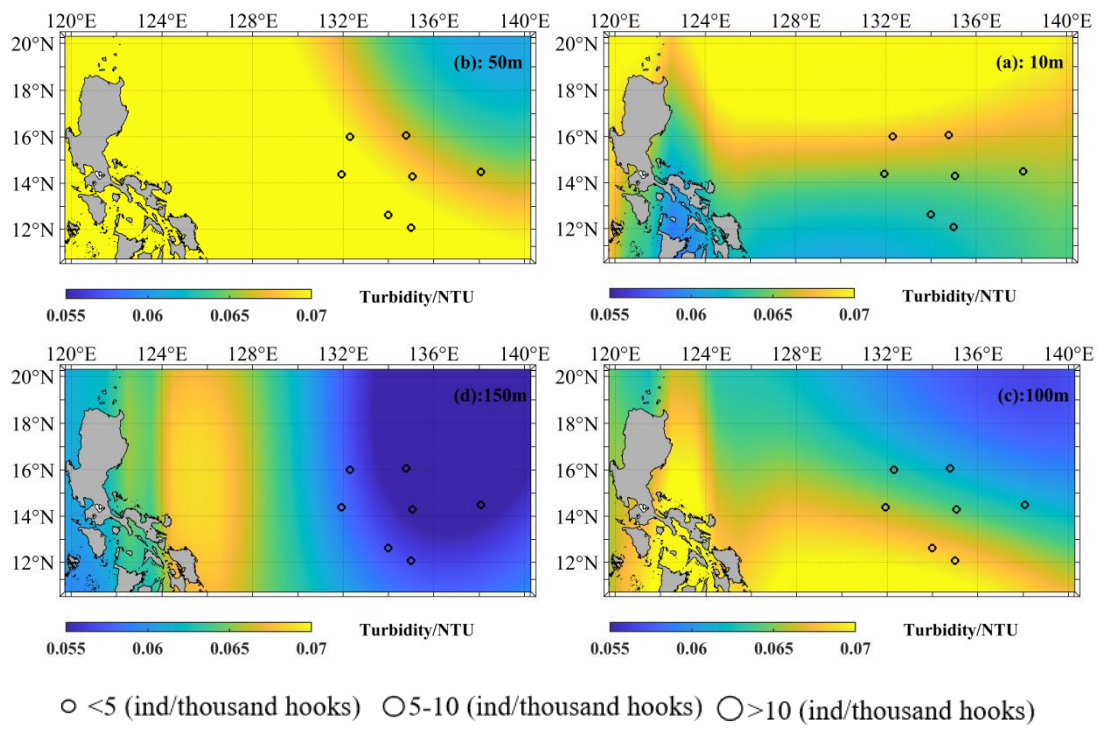


Figure 6 Spatial distribution of seawater turbidity in relation to tuna catch in the Western and Central Pacific survey area in September 2023.

(a) : 10m; (b):50m; (c):100m; (d):150m