TRANSLATION

CRUISE REPORT OF THE FLYING SQUID SURVEY BY THE

*Kanki maru No. 3* IN SEPTEMBER/OCTOBER, 1989

Akihiko Yatsu
Shigeo Hayase
Jun Ito
National Research Institute of Far Seas Fisheries

Takashi Domon
Fisheries Agency of Japan

1990 September
Fisheries Agency of Japan

THIS PAPER MAY BE CITED IN THE FOLLOWING MANNER:
A flying squid survey was conducted using the *Kanki maru No. 3* at 20 stations of 41° to 47°N and at 162° to 177°W in the North Pacific Ocean during September and October in 1989. The objectives of this survey were: (1) comparison of the catch of flying squid by surface and subsurface gillnets; (2) comparison of the catch of flying squid by gillnet and jigging, and (3) obtaining information on the distribution of flying squid and the incidental catch of salmonids, marine mammals, and sea birds in the vicinity of the northern boundary of the central fishing grounds for the Japanese squid driftnet fishery during September and October. A total of 60 tans (commercial net--115 mm mesh) of the surface (30 tans) and subsurface (30 tans) gillnet (the upper end of the netting was set at a depth of 3 m) was simultaneously used at each station, and four automatic squid jigging machines were operated for 120 to 210 minutes at night after the gillnet was deployed. In a total of 19 surface and subsurface gillnet operations, the number of individuals caught by surface and subsurface gillnets (number caught by the surface gillnet are in parentheses) was flying squid-380 (387), Pacific pomfret 586 (86), chum salmon 85 (53), coho salmon 1 (1), and sooty shearwater 2 (2), and in total amounted to 1,198 (611). The difference of CPUE for Pacific pomfret and sooty shearwater was statistically significant but there was no significant difference for flying squid. The statistical test for significance of salmonids could not be conducted, because of the few samples. There was no incidental catch of marine mammals and sea turtles. The number of individuals caught in 18 jigging operations (number of fishing line x operation hours = 162) was 2,974 flying squid, 75 boreal clubhook squid, and 53 eight armed squid. Flying squid were caught by gillnet at all stations (surface water temperature ranged from 11.0°C to 17.4°C) except at station 46°30'N and 175°00'W, but during the jigging operation, however flying squid were not caught at seven stations which were located in the northwestern part of the survey area. Salmonids were caught at only four stations which were located near 46°30'N (surface water temperature ranged from 11.3°C to 12.1°C). Mantle length of the flying squid ranged from 21 cm to 50 cm for the gillnet operation, and ranged from 16 cm to 49 cm for the jigging operation. There was a trend to catch large-sized squid in the north side for both gillnet and jigging operations. Mean body weight of flying squid by station ranged from 1.1 kg to 3.4 kg for the gillnet operation and ranged from 0.3 kg to 0.6 kg for the jigging operation. There was no difference in mantle length of flying squid in the surface gillnet and subsurface gillnet operations.
1. Introduction

The National Research Institute of Far Seas Fisheries conducted a survey on the flying squid resources in the North Pacific Ocean using four scientific research vessels in 1989 (Hayase et al. 1989). The objectives of the research conducted by the Kanki maru No. 3 were as follows: (1) comparison of the catch of flying squid by surface gillnet and subsurface gillnet operations; (2) comparison of the catch of flying squid by the gillnet and jigging operations, and (3) research on distribution of flying squid and on the incidental catch of salmonids, marine mammals and seabirds in the vicinity of the northern boundary of the central fishing ground for the Japanese squid driftnet fishery during September and October. The following report outlines the results on the research cruise by the Kanki maru No. 3.

2. Method of Research

1) Research Vessel

Kanki maru No. 3 246 GT 850 hp

2) Researcher

Takashi Domon (Resources Division, Fisheries Agency of Japan)

3) Crew

Captain Yasuyuki Fukushi and 11 crew members

4) Period

Departure from Osawa: August 24, research on catch and oceanographic observation: September 7 to October 6, arrival at Yamada: October 18. The dates used in this report are based on Japanese time.

5) Area

North Pacific Ocean (41°25’ to 46°30’N and 162°30’ to 177°30’W) (Fig. 1)

6) Items of Research

(1) Oceanographic Observations

Water temperature from surface to a depth of 300 m was measured by MBT. In addition to this, surface temperature was recorded each hour of the cruise, and the sea weather.

(2) Gillnet Survey
The number of survey stations was 19 (Fig. 1). A total of 60 tans of gillnet was used for the operations at each station, 30 tans of commercial squid gillnet (115 mm mesh, 53 m in length, and 6 m in depth) was operated at the surface in its customary operation style, and 30 tans of subsurface gillnet was set up with the position of the upper end of the netting at a depth of about 3 m by putting the net of 600 mm mesh between the cork line and the netting (115 mm mesh) of the ordinary commercial net (Fig. 2). The net was deployed before sunset, and the net was hauled after sunrise. The catch reported is the number of fish which were retrieved on board the vessel, and fish which were entangled in the net but dropped out in visible scope were recorded as dropouts.

(3) Jigging Survey

The number of survey stations was 18 (Fig. 1). A total of 4 automatic jigging machines (double reels), 2 machines at each gunwale were used. Twenty-five air-tube elastic jigs (trademark: Murasaki sofuto SM-1) were attached at about 1 m interval to a fishing line. The maximum fishing depth was about 60 m. Six incandescent electric lamps were used as fish-luring lights. Jigging operations were conducted between the deployment and retrieval of the gillnet (1500 to 2000 hours, Japanese time). The operation time at one station was 120 to 210 minutes.

7) Sampling

For flying squid samples, a part of the catch obtained from each operation was brought back to the National Research Institute of the Far Seas Fisheries as frozen samples. These samples included whole squid and tentacles of squid which had dropped off. All dead sea birds were brought back as frozen samples to the Faculty of Fisheries, Hokkaido University. Scales of salmonids were brought back to the National Research Institute of Far Seas Fisheries.

8) Biological Measurements

A maximum of about 50 flying squid were sampled randomly from the catch obtained from the surface and subsurface gillnets and jigging operations, and the mantle length were recorded without the separation of males and females. For salmonids, fork length, sex, and gonad weight were measured and scale samples were taken. For other fishes, the body length of a maximum of 30 fish were measured.

3. Results

1) Oceanographic Observation

The lowest surface water temperature at each station was 11.0°C (St. 19) and the highest temperature was 17.4°C (St. 13). As seen from the horizontal distribution of surface water temperature (Fig. 3), the isothermal
line stretched nearly east to west, but even at the same latitude, the surface water temperature was slightly higher towards the east. According to the vertical profile of water temperature (Fig. 4), the thermocline of about 8° to 15°C was observed at depths of about 20 to 50 m, and warm water was distributed at the extreme surface.

2) Results of Catch

The total catch in number by fishing method (excluding dropouts) is shown in Table 1. The dominant species in the catch (in number) by the gillnet was flying squid, followed by Pacific pomfret and these two species accounted for 80% of the total catch. The number of flying squid that dropped out was 24 in the surface gillnet, 36 in the subsurface gillnet, and 346 in the jiggling operation; accounting for 6%, 9% and 12% of the total, respectively.

3) Distribution of Flying Squid and Salmonids in the Gillnet Operation

Flying squid were caught at all stations except St. 6 (Fig. 5). Salmonids were caught in St. 5, 6, 7 and 18 (Fig. 6). The northern boundary of the Japanese squid drift net fishing grounds is at 46°N for September, and 44°N for October, and no salmonids were caught at the south side of the northern boundary. The species of salmonids caught were 138 chum salmon and 2 coho salmon. The relationship between the surface water temperature and CPUE is shown in Fig. 7. The surface water temperature in which flying squid were caught ranged from 11.0°C to 17.4°C, and the CPUE value was relatively high at 11.8°C and up. The surface water temperature in which salmonids were caught ranged from 11.3°C to 12.1°C.

4) Distribution of Flying Squid in the Jigging Operation

The horizontal distribution of flying squid as determined by the catch from jigging is shown in Fig. 8. The surface water temperature in which flying squid were caught ranged from 12.7°C to 17.4°C. Although no flying squid were caught or dropped out in the jigging operations at 7 stations (St. 3, 4, 5, 7, 8, 9 and 19) which were located in the northwestern part of the research area, flying squid were caught at these stations in the gillnet operation (except that there was no gillnet operation at St. 8).

5) Comparison of the Catch in the Surface Gillnet and Subsurface Gillnets

The CPUE (the number of fish caught per 100 effective tans) of flying squid and salmonids by surface and subsurface operations are shown in Fig. 9. The catch (in number) of flying squid was almost the same in both types of net, and the catch of Pacific pomfret by the subsurface gillnet operations was 15% of the catch by the surface gillnet operations, the catch of salmonids by the subsurface gillnet operations was 63% of the catch by the surface gillnet operations, and the catch of sooty shearwater by the subsurface gillnet operations was 9% of the catch by the surface gillnet.
operations (Table 1). The entanglement of two sooty shearwaters in the subsurface gillnet occurred in the gillnet with meshes of 600 mm. Therefore, it appears that when the netting is suspended with ropes, this kind of incidental catch seems to be avoided. Whether or not there are statistical differences between the catch of these nets were examined by the Wilcoxon paired-sample test. Species in which a significant difference was recognized by the one-sided test was Pacific pomfret (0.01 < t < 0.025) and sooty shearwater (t < 0.01). A significant difference was not recognized in flying squid (t > 0.05). Test for salmonids were not conducted, because there were only 4 samples.

6) Mean Body Weight of Flying Squid

The mean body weight of flying squid at each station was compared between (1) surface gillnet and subsurface gillnet operations, and (2) surface gillnet and jigging operations (Fig. 10). Differences by type of net were not apparent, but the mean body weight of flying squid taken in surface nets was about 1/3 of that by the jigging.

7) Size Composition of Flying Squid

Since the mantle length composition of flying squid which were caught by the surface and subsurface gillnets were almost the same, they were combined and shown in Fig. 11 by station. The mantle length ranged from 21 cm to 50 cm. The position of the mode varied by station, but most of the modes were found at 30 cm to 35 cm and around 45 cm. The mantle length composition of flying squid caught by the commercial net (115 mm mesh) is different from that in nature, because the large-sized squid of about 30 cm to 55 cm in mantle length is caught selectively due to its mesh selectivity (Kubodera and Yoshida 1981). Although there is such a limitation, there was a trend for the large-sized individuals to be distributed on the north side of 177°30’W and 172°30’W.

The mantle length composition of flying squid which were caught by jigging by station is shown in Fig. 12. The mantle length ranged from 16 cm to 49 cm. Although modes varied by station, these were around 20 cm and 25 cm. The mantle length of flying squid which had dropped off was estimated from the club length of tentacle samples which remained on the jig (Fig. 13). The mantle length of flying squid dropped off were 2 cm to 3 cm larger than those of the flying squid that were caught, and the large-sized flying squid dropped out more than the average-sized flying squid. The reason for the low catch (in number) of large-sized flying squid by jigging was the dropping off due to their weak tentacles (Murata et al. 1981). Large-sized squid were caught more often at the northern stations in jigging operations.

8) Marine Mammals

No marine mammals were entangled.

3539--6
9) **Sea Birds**

A total of 22 seabirds (all sooty shearwater) were caught incidentally by the surface gillnets: four dead at St. 2, four dead at St. 4, one dead at St. 5, one dead at St. 7, one dead at St. 9, one live and two dead at St. 10, one live at St. 12, one dead at St. 14, one live and three dead at St. 15, and two dead at St. 18. The number of sea birds which were caught incidentally by the subsurface gillnet were as follows: one dead sooty shearwater was caught at St. 4 and one dead sooty shearwater was caught at St. 5. No sea birds dropped off.

References, Table 1 and Figs. 1 to 13 are in English in the Japanese document.