

FISHING EFFICIENCY OF OTTER TRAWL AIDED WITH A KITE

by

Shigene Takayama

Tokai Regional Fisheries Research Laboratory
Tokyo, Japan.

ABSTRACT

Designed on the basis of model experiments for studying hydraulic resistance and other effects on the net configuration, the kite under report was proved capable of lifting the mouth of a trawl with a 146 ft. head line, twice as high as without the kite. On the basis of average catch per day during the 1956-57 and 1957-58 seasons, fishing efficiency was compared between the kite trawl and ordinary ones, both operated for prawn in the East China and Yellow Seas. When boats of different capacities (270, 300, and 500 gross tons) were operated on a comparable basis, the kite trawler of 360 gross tons was found superior in the amount of catch to any other boat operating without the kite. It has been confirmed that use of the kite could augment the catch of the prawn one half or twice over the ordinary boat operating in the trawling grounds in these waters.

INTRODUCTION

A kite is a device to lift up the mouth of a trawl under operation so as to increase fishing efficiency. The device has already been in use by trawlers in the seas around North Europe. However, references at hand show no accounts of a kite which was designed and constructed on the basis of theoretical research into efficient configuration of the net.

Model experiments conducted at a laboratory tank for years resulted in materialization of a kite reported in this paper. After successful field tests in Tokyo Bay by the R.V. *TARU MENYO* (240 G.T.) of the Tokai Regional Fisheries Research Laboratory, the kite has been in commercial use in the East China and Yellow Seas since February 1957.

MATERIALS AND METHODS

Construction

As the present paper aims at comparing fishing efficiency between the kite trawler and the control, the author refers to a previous paper (Takayama *et al.*, 1957:2-10) for theoretical aspects of the study leading ultimately to construction of the kite. However, it may be convenient for the reader to summarize important points about the kite below.

1. In the ordinary trawl with the head line measuring 146 ft., the mouth usually opens about 2 meters. For the purpose of lifting up the height twice as much, different types of kites were

designed on a miniature scale and subjected to a series of tank experiments together with a model net. The measurement of the most efficient type was converted into a full scale size, 130×93 cm. The full scale kite made of wood weighed 80 kg. The operative efficiency of this kite observed in the field with the help of an echo sounder was compared with that obtained in the tank experiments.

2. In trawling with the kite at 3-4 knots iron chains, 1.2 cm. in diameter and about 40 m. in length, have to be added to the ground rope so that it may sweep along the bottom. The length of the false head rope on which the kite would slide must be 85 per cent of the head rope; the connecting rope is about 3 m. long between the lower corners of the kite and the square.
3. When furnished with a kite and gussets, the distance between the wings became about 3-4 m. shorter. The gusset is a triangular piece of net inserted between the end of the square and the posterior end of the wing to hold the mouth of the net high without straining it when pulled up by the kite.
4. The shape of the nets has been found almost similar in the model and the field experiments.

Source of Data: In the East China and Yellow Seas the prawn (*Penaeus orientalis* Kishinouye) is important for numerous Japanese trawlers operating there during the season from early December to ensuing April. With relatively sufficient knowledge made available on the seasonal migration of this species, this prawn resource was well protected under an international voluntary agreement which was effective between the fishermen of the interested countries throughout the period under report.

In the present work examining efficiency of kite trawling, the catch data of three trawlers,

each equipped with a kite of the above description have been compared with those obtained from 14 ordinary trawlers, both types of boat having operated for prawn under nearly the same conditions as to season and locality.

RESULTS AND DISCUSSION

General Decrease in Catch: The total catch of prawn, more or less fluctuating from year to year, showed a decrease of 30 per cent in the 1957-58 season from the preceding season, as far as the fishery statistics of Japan are concerned.

Table 1. Comparison of Prawn Catch by Non-Kite Trawlers (270 G.T.) of T. Company, 1956-57 and 1957-58 Seasons.

Name of ship	December 1957 to April 1958			December 1956 to April 1957		
	Total catch (case)*	Number of fishing days	Mean catch per day (case)	Total catch (case)	Number of fishing days	Mean catch per day (case)
TB 1	2,079	81	25.7	7,175	115	62.4
TB 2	4,401	103	42.7	5,221	103	50.7
TB 3	3,930	90	43.7	7,784	102	69.5
TB 4	3,570	88	40.6	6,546	114	57.4
TB 5	4,256	97	43.0	8,180	117	69.9
			Mean : 39.3			Mean : 62.0

In the case of non-kite trawlers of 270-ton class the decrease in the catch per day in the last fishing season compared to the 1956-57

season was 63%; 300-ton class had a decrease of 73%, and 500-ton class, 81% (Table 1, 2 and 3).

Table 2. Comparison of Prawn Catch by Non-kite Trawlers (300 G.T.) of N. Company, 1956-57 and 1957-58 Seasons.

Name of ship	December 1957 to April 1958			December 1956 to April 1957		
	Total catch (case)*	Number of fishing days	Mean catch per day (case)	Total catch (case)	Number of fishing days	Mean catch per day (case)
NB 1	4,807	130	36.9	7,431	121	61.4
NB 2	5,522	109	50.7	7,410	131	58.7
NB 3	4,036	113	44.5	8,211	129	63.7
			Mean : 44.0			Mean : 60.1

* Case = Headless 100 pieces, approximately 4.76 kg.

In the absence of conclusive evidence, one may take the liberty of attributing this phenomenon to changes in oceanographical and fishing conditions.

Table 3. Comparison of Prawn Catch by Non-Kite Trawlers (500 G.T.) of T. Company, 1956-57 and 1957-58 Seasons.

Name of ship	December 1957 to April 1958			December 1956 to April 1957		
	Total catch (case)*	Number of fishing days	Mean catch per day (case)	Total catch (case)	Number of fishing days	Mean catch per day (case)
Tc 1	5,157	125	41.3	5,460	98	58.7
Tc 2	3,578	76	47.1	4,068	80	50.9
			Mean : 44.2			Mean : 54.8

Comparative Efficiency:

Compared with that of a non-kite boat of the same tonnage, the catch per day of a kite trawler (360 gross tons) in the 1957-58 season was almost as good as in the preceding season, while the catch of the latter showed a decrease. The fact that the kite trawler had steady yields during both seasons while there was a general

decrease in the catch in one season after another seems to speak in favor of the kite (Table 4). In the same months of 1957-58 season, the kite trawler (360 gross tons, 700 HP) harvested 1.5 times as much as the non-kite trawler of the identical capacity, again demonstrating the advantage of the kite (Table 4).

Table 4. Comparison of Prawn Catch by Types of Trawlers, 1956-57 and 1957-58 Season.

Type of Vessel	Fishing Season	Name of ship	Total Catch (case)*	Number of Fishing Days	Mean Catch per Day (case)*
Kite trawler of 360 G.T. type	December 1957	TAK 1	6,566	98	67.0
	to	TAK 2	7,617	97	78.5
	April 1958	TAK 3	7,779	96	81.0
					Mean : 75.5
Non-Kite trawler of 360 G.T. type	December 1956	TA 1	9,648	114	84.6
	to	TA 2	6,286	96	65.5
	April 1957	TA 3	7,898	104	75.9
					Mean : 75.3
Non-Kite trawler of 360 G.T. type	December 1957	NA 1	4,852	102	47.6
	to	NA 2	6,365	115	55.3
	April 1958	NA 3	4,459	115	38.8
		NA 4	5,497	92	59.7
				Mean : 50.4	

* Case = Headless 100 pieces, approximately 4.76 kg.

Where the catches per day throughout the 1957-58 season of the 360-ton kite-trawler and non-kite trawlers of different sizes, are compared, the superiority of the former becomes

all the more evident as the haul is either 1.9 times greater than a non-kite boat of 270 tons or 1.7 times greater than another boat of 500 tons (Table 5).

Table 5. Comparison of Prawn Catch by Type of Trawlers, 1957-58 Season.

Type of Vessel	Name of Ship	Total Catch (Case)*	Number of Fishing Days	Mean Catch per Day (Case)
Kite trawler of 360 G.T. type	TAK 1	6,566	98	67.0
	TAK 2	7,617	97	78.5
	TAK 3	7,779	96	81.0
				Mean : 75.5
Non-Kite trawler of 270 G.T. type	TB 1	2,079	81	25.7
	TB 2	4,401	103	42.7
	TB 3	3,930	90	43.7
	TB 4	3,570	88	40.6
	TB 5	4,256	97	43.9
			Mean : 39.3	
Non-Kite trawler of 500 G.T. type	TC 1	5,157	125	41.3
	TC 2	3,578	78	47.1
			Mean : 44.2	

It may be worth noting that the trawling catch varies depending on time of the day, even in the same size of boat with or without the kite. With this fact in mind, the average catch per haul during day time and night for both types of trawler (360 tons) has been compared. The ratio of catch per haul by day between them was 126:100, and that by night 141:100. The ratios may be interpreted as an evidence proving that the kite-type trawling is effective for the

day operation just as well at night as long as it aims at those groups of fish swimming on a layer five or six meters above the sea-bed.

REFERENCES

TAKAYAMA, S. and T. KOYAMA (1957). Studies on the trawl net-I: A net-mouth stretcher working on the kite principle. *FAO Internat. Fish Gear Cong. 1957, Hamburg.*, Paper 39 (b): 13.

* Case - Headless 100 pieces approximately 4.76 kg.