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Preliminary Study on the Fisheries Catches in South China Sea via Light Falling-Net Fishing Method

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Abstract: *This study reports a preliminary study on the fisheries catches in South China Sea via light falling-net fishing method. A total of 30 survey locations were evaluated from Paracel Islands to Spratly Islands sea area in South China Sea. Sthenoteuthis oualaniensis, Thunnus albacares, Katsuwonus pelamis, and Decapterus maruadsi were the most frequently caught species. S.oualaniensis was the domain species in fishery catches in this study. The highest fisheries caught was 20 t in Paracel Islands (15º41.861'N, 111º14.767'E), and the catch per unit effort (CPUE) and fishing rate (K) in this survey location were 3.80 t/time and 1164.95 kg/h, respectively. The value of both CPUE and K varied from Paracel Islands to Spratly Islands. Results from this study will provide useful information on fishery resource assessment and developing fishery resource in South China Sea.*

Keywords: *South China Sea; light falling-net fishing; catch per unit effort; fishing rate.*

1. INTRODUCTION

Due to the depletion of land resources and ecological crises, development and utilization of ocean resources have become an important means of marine-related national economic growth in China. South China Sea is the most important tuna fishing area of the China Sea, the main fishery tuna species includes yellowfin tuna *Thunnus albacares*, skipjack tuna *Katsuwonus pelamis*, yaito tuna *Euthynnus yaito*, and most of these species can be caught annually [1, 2]. Apart from the tuna fishery, South China Sea is also the traditional cephalopod fishing waters, and flying squid *Sthenoteuthis oualaniensis* is the major fishing species [3].

Light falling-net fishing mainly used for fishing of cephalopods and phototaxis fish, is a new type of fishing gear and methods appeared in early 1990s, and rapidly developed in the South China Sea [4]. Simple gear structure, low technical requirements, simple operation, high fishing efficiency, and low labor intensity are the main advantage using light falling-net fishing. Light falling-net fishing has now become the focus of the South China Sea offshore fishery development. It plays important roles in promoting the fishing restructuring, reducing inshore fishing intensity, and safeguarding the national interests of marine resources in South China Sea [1, 5].

In this study, we investigated the fisheries catches in South China Sea from February to June 2015. A total of 30 survey locations were investigated covering from Paracel Islands sea area to Spratly Islands sea area (Fig. 1). Results from this study will provide useful information on fishery resource assessment and developing fishery resource in South China Sea.

2. MATERIALS AND METHODS

This study was carried out from February to June 2015 in South China Sea. During this period, the weather conditions in most survey locations are suitable for light falling-net fishing method. A total of 22 survey locations were investigated in Paracel Islands sea area, and 8 survey locations were investigated in Spratly Islands sea area (Fig. 1). Light falling-net fishing vessel "Qiong'le'dong 110201" was used in present study. The length and width of "Qiong'le'dong 110201" were 34 m and 6.3 m, respectively. The vessel weight was 180 t, and the load capacity was 400 t. A total of 180 fish

lamps (2 kW per lamp) were carried on the top of vessel on both side. 1.0 cm mesh was used in the survey. The cover area of falling-net was 3,150 m^2, and the average cover depth was 50 m. In each survey location, fish lamps were operated upon sunset, and proceed to catch between 0000 h and 0500 h in the following day morning.

Due to the technical constrains and the resources limitation during this survey, we classified the target fishing species into three groups according to the regular catching amounts. Group 1 was classified as cephalopods which the major target species was *Sthenoteuthis oualaniensis*. Group 2 was classified as phototaxis fish, and the target fish species include *Thunnus albacares*, *Katsuwonus pelamis*, and *Decapterus maruadsi*. Group 3 was defined as other species, which were not regularly caught via light falling-net fishing method in the survey locations.

Fisheries catches were onsite weighted, and fish species were directly identified and measured. Catch per Unit Effort (CPUE) were calculated according to the following formula: CPUE = C / f, where C is the fisheries catches in each survey location (t), and f is the time of using falling-net. Fishing rate (K) was calculated by following equation: K = 1000×C/T, where K is the fishing catch rate (kg/h), C is the fishery catches (t), and T is fish lamp operating time (h).

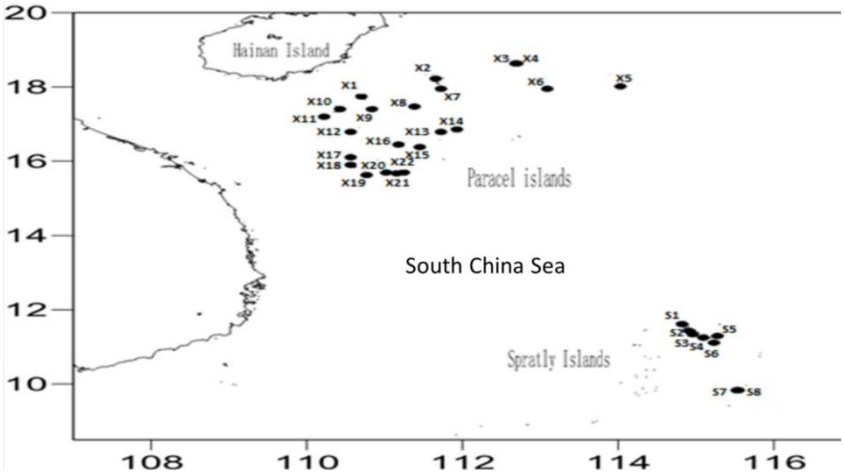

Fig1. *Map of the survey conducted in South China Sea. A total of 22 sampling locations were surveyed in Paracel Islands sea area (X1- X22), and 8 sampling locations were surveyed in Spratly Islands sea area (S1 – S8).*

3. RESULTS AND DISCUSSION

By using light falling-net fishing method, the target fish species are those fish inhabited in the upper layer of the ocean. In this study, the operating catch depth was 50 m, and major caught species include *Sthenoteuthis oualaniensis*, *Thunnus albacares*, *Katsuwonus pelamis*, and *Decapterus maruadsi*. In Paracel Islands sea area, *Sthenoteuthis oualaniensis* accounted for 61.52% of the total catches, and phototaxis fish includes *Thunnus albacares*, *Katsuwonus pelamis*, and *Decapterus maruadsi* accounted for 37.47% of the total catches (Table 1). In Paracel Islands survey locations, unregularly caught species such as *Caranx ignobilis*, *Selar crumenophthalmus*, *Auxis thazard*, *Gymnosarda unicolor*, *Scomberomorus commerson*, and *Amb lygaster leiogaster* accounted for 1.01% of the total catches. In Spratly Islands survey location, the catch percentage of *Sthenoteuthis oualaniensis* was 59.45%, which was lower than the catch percentage in Paracel Islands survey location. However, the catch percentage of photoaxis fish was 40.48%, which was higher than the data obtained in the Paracel Islands survey location (Table 1). In the present study, although the catch species were consistent with previous findings [6, 7], the catch percentage was different. The difference of catch percentage in species may due to the fishing method and seasons [4, 5].

Table1. *The target fishing species and catch percentage in South China Sea*

	Catch percentage	
Cephalopod	Paracel Islands	Spratly Islands
Sthenoteuthis oualaniensis	61.52%	59.45%
Phototaxis fish		
Thunnus albacares, Katsuwonus pelamis, and *Decapterus maruadsi*	37.47%	40.48%
Other species	1.01%	0.07%

In this study, the mean catch per unit effort (CPUE) in Paracel Islands survey location was 2.26 t/time. The highest CPUE was observed in survey location X16 (16º26.918'N, 111º10.678'E), where the CPUE was 4.75 t/time, and the lowest CPUE was obtained in X13 (16º47.398'N, 111º43.446'E). The mean CPUE in Spratly Islands survey location was 1.74 t/time, which was lower than data obtained in the Paracel Islands survey location (Table 2). The mean fishing rate of Paracel Islands survey location was 488.60 kg/h, which was higher than the value obtained in Spratly Islands survey location (410.63 kg/h). The highest fishing rate was observed in Paracel Islands survey location X22 (15º41.861'N, 111º14.767'E) , where the K value reached to 1164.95 kg/h. The highest fishing rate obtained in Spratly Islands survey location was S7 (09º49.957'N, 115º31.321'E), which was lower than the peak value collected in Paracel Islands survey location X22.

It has been suggested that environmental factors can significantly affect the fisheries catches [8, 9, 10]. In this study, the survey was conducted between February and May 2015. Most pelagic fish are under their breeding and migration routine in South China Sea. The fishery catches and group classification may reflect their migration in South China Sea. However, several key components were not classified to individual fish species due to the time and resources limitation. Furthermore, the present study was conducted by single fishery vessel and within one fishery season, results and conclusion presented in this study may need to be further verified in the future study.

Table2. *Survey location, month, catch per unit effort (t/time), and fishing rate (kg/h) in South China Sea*

Location	Month	Catch Per Unit Effort (CPUE)	Fishing rate (K)
X1 (17º44.742'N，110º42.006'E)	Feb	1.58	291.24
X2 (18º13.414'N，111º39.350'E)	Feb	2.38	436.86
X3 (18º37.990'N，112º40.790'E)	Feb	1.43	262.11
X4 (18º37.990'N，112º42.230'E)	Feb	2.85	524.23
X5 (18º01.126'N，114º01.710'E)	Feb	3.17	582.47
X6 (17º57.030'N，113º05.366'E)	Feb	1.58	291.24
X7 (17º57.030'N，111º43.446'E)	Feb	1.90	447.07
X8 (17º28.358'N，111º22.966'E)	Mar	1.43	262.11
X9 (17º24.262'N，110º50.198'E)	Mar	1.90	349.48
X10 (17º24.262'N，110º25.622'E)	Mar	1.90	190.32
X11 (17º11.974'N，110º13.334'E)	Mar	0.95	232.99
X12 (16º47.398'N，110º33.814'E)	Mar	1.43	349.48
X13 (16º47.398'N，111º43.446'E)	Mar	0.76	378.61
X14 (16º51.494'N，111º55.734'E)	Mar	2.06	378.61
X15 (16º22.822'N，111º27.062'E)	Mar	0.95	232.99
X16 (16º26.918'N，111º10.678'E)	Apr	4.75	879.67
X17 (16º06.428'N，110º33.814'E)	Apr	3.56	873.71
X18 (15º54.150'N，110º33.814'E)	May	3.80	582.47
X19 (15º37.766'N，110º46.102'E)	May	2.38	582.47
X20 (15º41.861'N，111º01.117'E)	May	2.85	873.71
X21 (15º40.496'N，111º09.307'E)	May	2.38	582.47
X22 (15º41.861'N，111º14.767'E)	May	3.80	1164.95
S1 (11º36.857'N，114º49.256'E)	Feb	1.78	436.86
S2 (11º25.937'N，114º54.716'E)	Feb	1.43	232.99
S3 (11º20.477'N，114º57.446'E)	Feb	1.78	436.86
S4 (11º15.016'N，115º05.637'E)	Feb	1.19	291.24
S5 (11º17.746'N，115º16.557'E)	Feb	1.07	262.11
S6 (11º06.826'N，115º13.827'E)	Feb	0.86	197.93
S7 (09º49.957'N，115º31.321'E)	Feb	2.97	728.09
S8 (09º50.059'N，115º32.870'E)	Jun	2.95	698.97

4. CONCLUSIONS

A total of 30 survey locations were investigated from Paracel Islands to Spratly Islands sea area. *Sthenoteuthis oualaniensis*, *Thunnus albacares*, *Katsuwonus pelamis*, and *Decapterus maruadsi* were

the most frequently caught species in this study. The highest fishery catches were observed in Paracel Islands survey location X22 (15º41.861'N, 111º14.767'E), where the K value reached to 1164.95 kg/h. The highest CPUE was observed in survey location X16 (16º26.918'N, 111º10.678'E), where the CPUE was 4.75 t/time, and the lowest CPUE was obtained in X13 (16º47.398'N, 111º43.446'E). Fishery catches and group classification presented in this study may reflect the routine migration of studied species in South China Sea. Such information will advantage fishery resource assessment and developing fishery resource in South China Sea.

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