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# Species Compositions of Bottom Trawlers in Relation to Towing Strata, Depths and Durations in the Continental Slope of the Northern South China Sea

## Abstract

A total of 38 bottom trawl operations were conducted from 20 June 1991 to 23 April 1995 along the continental slope of South China Sea at depths of 200 - 1,100 meters. The survey area was stratified into five sub-areas, and the highest CPUE was 381.4 kg/haul-hour at Sub-area D (115°30′ E - 116°40′ E, 20°05′ N - 20°55′ N). For different depth strata, we found that the depth stratum of 200 - 299 meters had the highest CPUE with a value of 257.9 kg/haul-hour. Catch of prawns as comprised principally of 16.76% *Parahepomadus vaubani*, 9.34% *Haliporoides sibogae*, 9.21% *Plesionika* spp., 9.18% *Acanthephyra armata*, and 7.89% *Heterocarpus woodmassoni*. The fishes composition was 13.09% *Raja* spp., 12.84% *Trichiurus lepturus*, 11.31% *Coelorhynchus* spp., 5.92% *Mytophidae* spp., 5.66% *Cubiceps squamiceps*, and 5.04% *Gadomus* spp..

**Key words:** Bottom trawl, Depth, Trawling duration, South China Sea

The area of 200-1,200 m deep ocean occupies 6.8% of the earth surface, and its standing stocks of fishes decrease exponentially with depth. However, this decrease is far from uniform, and even down to 1,000 meter still could find just as many fishes as on the bank[1]. The South China Sea is one of the primary marginal seas in the western Pacific, and in its northern slope the isobath go with NE-SW direction[2].

Based on the 1996 fisheries yearbook of Taiwan area[3], the marine fisheries production was 720,000 mt in 1978, and increased to 1,009,042 mt in 1995, though the catch per unit effort (metric ton/ship tonnage-year) decreased from 1.72 to 1.12. In order to sustain marine fishery and to increase fishery production, we need a systematic method to estimate accurate fishery resources. If we could exploit the continental slope of the South China Sea successfully and utilize the fishery resources properly, some of fishery problems, such as economic and social stress and open sea fishing grounds limitation would have possibly be solved. The goal of this study was to provide additional data for the evaluation of the fishery resources and the feasibility of their utilization by the improved bottom trawlers in the northern slope of the South China Sea.

Recent surveys on deep-water fisheries have shown that many deep-water fishes may potentially have commercial values, such as those in the central and western Pacific, eastern and western Atlantic, and Indian Oceans[4,5,6]. Fish stocks of the deep reef slopes of the Hawaiian Islands have been exploited for over 50 years and detail catch statistics on the fisheries are available from the late 1950s to present[7]. Interest in trawling at depths of over 700 m began in 1970 when Faroese factory trawlers reported catches of up to 100 mt of large cod per day at Banana Bank, West Greenland and Forlander Bank, Spitsbergen[8] in England. Unfortunately, there are only several papers

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concerned about deep-water fishery surveys[9,10,11] in Taiwan. However, Chinese scientists have conducted several surveys on demersal fishery resources in the waters of the South China Sea for many years[12].

Extention of national economic exclusive zone limited to 200 miles may adversely affect the viability of deep sea fleet unless new fishing grounds can be found. Thus, to use an improved bottom trawlers to explore fishery resources in the continental slope and to srengthen the evaluation and management of marine fisheries are important for Taiwan deep sea fisheries.

## Materials and Methods

A total of 38 bottom trawl operations were conducted by Research Vessel Fishery Researcher 1, of Taiwan Fisheries Research Institute, in the continental slope area, lying 18°00'N- 22°30'N, 113°30'E - 120°40'E of the South China Sea (Fig. 1) from 20 June 1991 to 23 April 1995 (Table 1). The survey area was along the transects at depths of 200 to 1,100 m and the trawling durations varied from 1.0 to 3.2 hours. The towing speed was at an average of 2 knots.

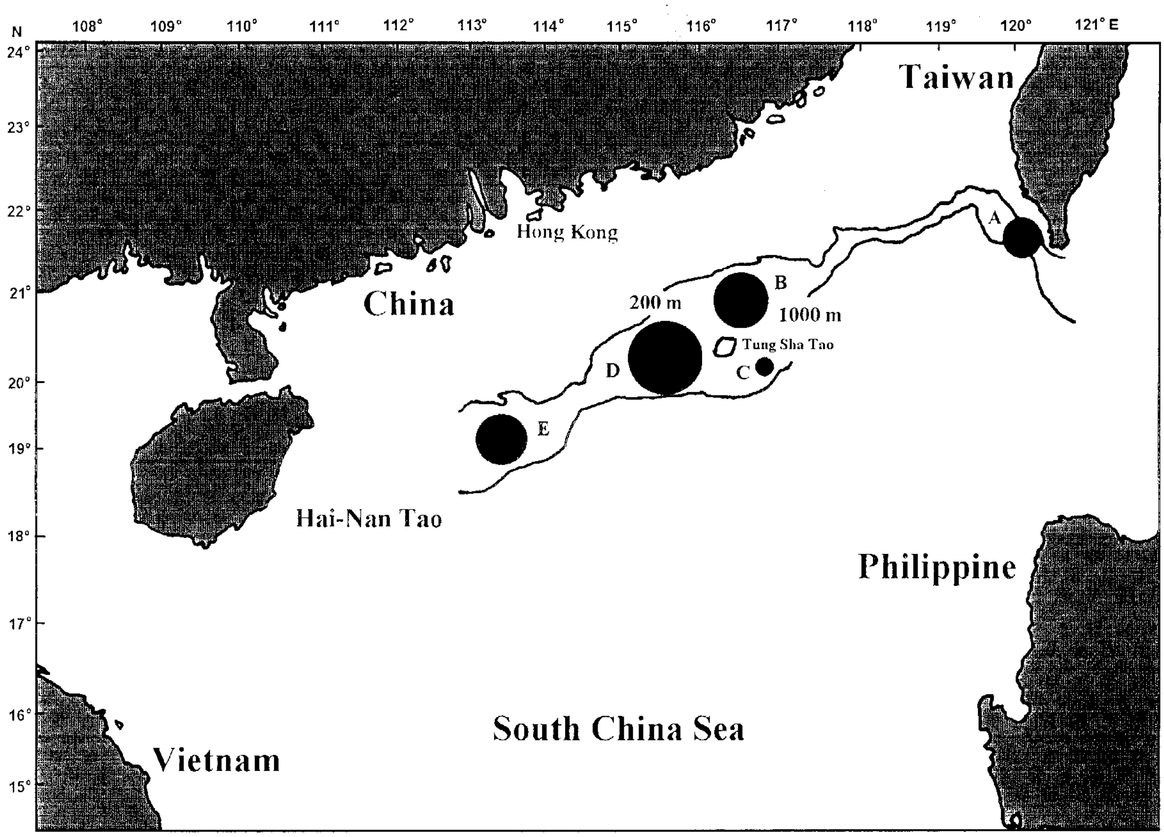


Fig. 1. Map shows the sub-areas (solid circles) of the bottom trawl operations in the continental slope of South China Sea..

The bottom trawler had a improved net which added an extra sinker leads and high water pressure resistance floaters, and consisted of a four-panel cod end net with a stretched-mesh of 6.0 cm. Covered net with a mesh size of 3.63 cm was used for the study net. The mesh sizes on the wings and on the body of the net were 20.0 cm and 10.0 cm, respectively. Fish density was expressed as catch per unit effort (CPUE, kg/haul-hour).

**Table 1.** Deep-water bottom trawl fishing ground survey: dates, location, depths and operating time.

| *St. no.* | *Dates* | *Station* | | *Depth(m)* | | *Trawling duration (h,hour; m,min)* | *Catches (kg)* |
|---|---|---|---|---|---|---|---|
| | | *Lat.* | *Long.* | *Shot* | *Retrieved* | | |
| 1 | 20 Jun. 1991 | 22° 11.5′N | 120° 25.5′E | 415.00 | 400.00 | 01h-14m | 78.0 |
| 2 | 20 Jun. 1991 | 22° 11.7′N | 120° 31.5′E | 346.00 | 331.00 | 01h-47m | 101.5 |
| 3 | 28 Apr. 1994 | 19° 37.8′N | 114° 02.6′E | 426.00 | 427.00 | 02h-02m | 370.5 |
| 4 | 28 Apr. 1994 | 19° 53.5′N | 114° 06.7′E | 432.00 | 442.00 | 02h-08m | 384.5 |
| 5 | 28 Apr. 1994 | 19° 55.2′N | 114° 09.1′E | 450.00 | 455.00 | 02h-02m | 507.5 |
| 6 | 28 Apr. 1994 | 19° 43.8′N | 114° 07.8′E | 510.00 | 510.00 | 03h-00m | 1067.0 |
| 7 | 28 Apr. 1994 | 19° 43.5′N | 114° 04.1′E | 468.00 | 477.00 | 02h-41m | 186.0 |
| 8 | 28 Apr. 1994 | 19° 36.7′N | 114° 08.3′E | 424.00 | 629.00 | 02h-50m | 363.5 |
| 9 | 16 Apr. 1995 | 21° 35.5′N | 117° 39.7′E | 520.00 | 502.00 | 01h-30m | 208.0 |
| 10 | 17 Apr. 1995 | 21° 33.7′N | 117° 36.1′E | 488.00 | 521.00 | 01h-10m | 172.5 |
| 11 | 17 Apr. 1995 | 21° 36.5′N | 117° 45.1′E | 458.00 | 520.00 | 01h-25m | 517.4 |
| 12 | 17 Apr. 1995 | 21° 19.9′N | 116° 48.6′E | 361.00 | 354.00 | 01h-00m | 342.5 |
| 13 | 17 Apr. 1995 | 21° 31.0′N | 116° 58.6′E | 326.00 | 326.00 | 01h-00m | 116.0 |
| 14 | 18 Apr. 1995 | 21° 37.6′N | 116° 51.6′E | 289.00 | 280.00 | 01h-00m | 326.5 |
| 15 | 18 Apr. 1995 | 21° 12.6′N | 116° 34.0′E | 337.00 | 335.00 | 01h-00m | 52.0 |
| 16 | 18 Apr. 1995 | 21° 09.6′N | 116° 30.2′E | 330.00 | 327.00 | 01h-00m | 220.0 |
| 17 | 18 Apr. 1995 | 21° 05.5′N | 116° 26.3′E | 328.00 | 320.00 | 01h-00m | 135.5 |
| 18 | 18 Apr. 1995 | 20° 37.1′N | 115° 46.9′E | 414.00 | 408.00 | 01h-00m | 113.5 |
| 19 | 19 Apr. 1995 | 20° 34.7′N | 115° 40.2′E | 404.00 | 418.00 | 01h-00m | 150.0 |
| 20 | 19 Apr. 1995 | 20° 35.5′N | 115° 44.8′E | 418.00 | 441.00 | 01h-00m | 606.0 |
| 21 | 19 Apr. 1995 | 20° 34.5′N | 115° 49.0′E | 447.00 | 444.00 | 01h-00m | 338.7 |
| 22 | 19 Apr. 1995 | 20° 32.2′N | 115° 43.0′E | 441.00 | 432.00 | 01h-00m | 207.5 |
| 23 | 19 Apr. 1995 | 20° 29.7′N | 115° 38.7′E | 442.00 | 414.00 | 01h-00m | 215.0 |
| 24 | 20 Apr. 1995 | 19° 55.2′N | 114° 21.4′E | 471.00 | 471.00 | 02h-00m | 638.5 |
| 25 | 20 Apr. 1995 | 19° 54.4′N | 114° 09.3′E | 468.00 | 427.00 | 02h-00m | 204.0 |
| 26 | 20 Apr. 1995 | 19° 52.9′N | 114° 07.4′E | 452.00 | 465.00 | 01h-00m | 599.0 |
| 27 | 21 Apr. 1995 | 19° 47.5′N | 114° 02.9′E | 431.00 | 460.00 | 01h-00m | 920.0 |
| 28 | 21 Apr. 1995 | 19° 41.3′N | 114° 57.6′E | 435.00 | 435.00 | 01h-00m | 1286.5 |
| 29 | 21 Apr. 1995 | 19° 32.0′N | 114° 00.0′E | 569.00 | 611.00 | 01h-00m | 137.0 |
| 30 | 21 Apr. 1995 | 19° 27.0′N | 113° 58.5′E | 404.00 | 603.00 | 01h-00m | 106.5 |
| 31 | 22 Apr. 1995 | 19° 29.9′N | 114° 03.8′E | 650.00 | 660.00 | 01h-00m | 138.5 |
| 32 | 22 Apr. 1995 | 19° 36.7′N | 114° 08.3′E | 424.00 | 629.00 | 02h-50m | 118.0 |
| 33 | 22 Apr. 1995 | 19° 24.0′N | 114° 00.3′E | 677.00 | 680.00 | 01h-00m | 92.5 |
| 34 | 22 Apr. 1995 | 19° 21.3′N | 113° 58.6′E | 683.00 | 693.00 | 01h-00m | 115.0 |
| 35 | 23 Apr. 1995 | 19° 24,9′N | 114° 04.5′E | 726.00 | 716.00 | 01h-00m | 85.0 |
| 36 | 23 Apr. 1995 | 19° 30.1′N | 114° 09.8′E | 754.00 | 767.00 | 01h-00m | 95.0 |
| 37 | 23 Apr. 1995 | 19° 34.7′N | 114° 14.4′E | 795.00 | 822.00 | 01h-00m | 108.0 |
| 38 | 23 Apr. 1995 | 19° 38.5′N | 114° 23.1′E | 990.00 | 1015.00 | 01h-00m | 152.0 |

Fish are rarely distributed homogenously throughout a large geographical area. They tend to be contagiously distributed with a negative bionomial distribution, and often hypothesized even for areas of high density. In some parts of the survey area, fish of a particular species were quite rare. As a result, the variance of the sample mean was high. Before selecting the sampling areas, the population must be divided into sampling units, which must cover the whole population and not overlap[13]. Therefore, we divided the study area into several sub-areas and random sampling was conducted for each area. The five sub-areas were A, B, C, D and E (Fig. 1).

Using stratified random sampling method, an unbiased estimate of fishing density at the same sub-area with different depth strata was made by the weighted average method[13]. Each 100 meters as a depth stratum in this study. CPUE values obtained from different stations of the same sub-area were also calculated by the weighted average method. Analysis of variance (ANOVA) was used to test the differences of the fish density at the different depth strata or within the different sub-areas.

## Results and Discussion

### *I. Catch per unit of effort*

Table 2 shows that the fish density at the same sub-area with different depth strata were not significantly different ($p>0.05$), while those among five sub-areas were significantly different ($p<0.05$). Shen et al.[14] indicates that different fish communities existed at the different parts of inhabited area. Therefore, the CPUEs at the same sub-area with different depth strata were combined for each of the five sub-area.

**Table 2.** Two-way analysis of variance on catch per unit effort of different depth strata (row) and of different sub-areas (column).

| *Source of variation* | *Sum of squares* | *Degrees of freedom* | *Mean square* |
|---|---|---|---|
| Total | 329998.30 | | |
| Row | 66485.30 | 6 | 11080.88 |
| Column | 124186.72 | 4 | 31046.68 |
| Remainder | 139326.24 | 24 | 5805.26 |

The Row F-ratio=1.908
The Column F-ratio=5.348

(1) Sub-areas

Bottom trawls are often used as samplers for resource assessment surveys. Their survey data are extremely useful for monitoring the trends of changes in abundance of multispecies of fishes in the continental shelf areas[15]. Figure 2 shows CPUE values of both fishes and prawns with different sub-areas when both fishes and prawns were combined; the highest CPUE of 381.4 kg/haul-hour at Sub-area D; 186.4 at Sub-area E; 165.9 at Sub-area B; 70.9 at Sub-area A; the lowest value of 37.0 at Sub-area C. When CPUEs of fishes or prawns were separate, the highest CPUE of fish was at the Sub-area D with the value of 374.3, while the sub-area E was 153.6, and the lowest CPUEs of fish was at the Sub-area C with the value of 30.0. For prawns, the highest CPUE was 46.2 at Sub-area B. The lowest CPUE was 7.0 at Sub-area C. Zhong et al.[16] showed that the CPUEs of prawns in the marginal waters located at 21°00'N - 22°00'N, 116°30'E - 117°30'E (Sub-area B in this study) of the continental slope in the northeastern part of the South China Sea in 1978-1979, were 4.5-28.5 kg/haul-hour and its average was 8.73 kg/haul-hour. The catch ratio in weight of prawn and fish was about 1:13, and an estimate of the average CPUE was 124.71 kg/haul-hour. In this study, we found that the average value of the CPUE was only 41.2 kg/haul-hour in the same study area. The reasonable explanation of the difference in the CPUE values between the two study are: (1) decrease in abundance after a long-term commercial bottom trawling operations, (2) differences in scale of bottom trawler with different mesh sizes used; a mesh size 16 cm on the wings is much easier to catch prawn and fish than the mesh size of 20 cm, and (3) effect of bottom trawler operation on the demersal fish composition. Dalzell[17] also indicated that intensive fishing at a given location might lead to a rapid decline in CPUE and possibly change in the species composition, especially in a virgin fishing ground.

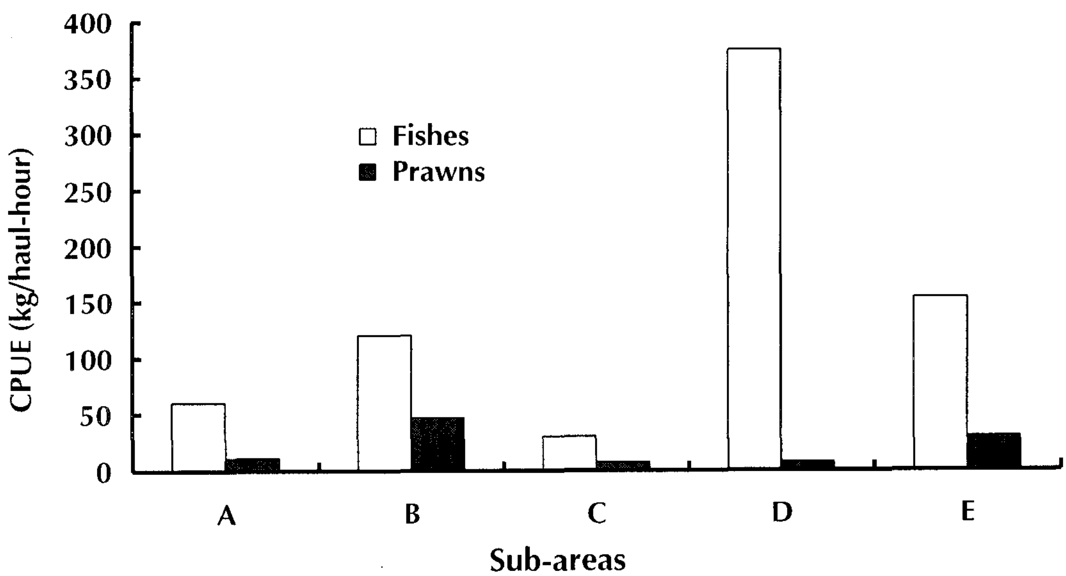


**Fig. 2.** CPUEs of fishes and prawns in Sub-areas A, B, C, D, and E.

(2) Depth stratum

Comparing with the fish density at different depths (Fig. 3), we found that the CPUEs of fishes were 257.9 kg/haul-hour at the depths of 200-299 m, 210.9 at the depths of 600-699 m, 207.7 at depths of 500-599 m; 189.5 at depths of 400-499 m, 166.6 at depths of 300-399 m; 99.8 at depths of 800-1,000 m, and 72.9 at depths of 700-799 m. The CPUE of prawns was 42.9 at depths of 500-599 m, 34.1 at depths of 400-499 m, and 4.5 at depths of 200-299 m.

(3) Trawling duration

Based on the relationships between the trawling durations and the catches (Fig. 4), it showed that the catches did not increase much even the trawling duration was longer than 3.0 hours, and the highest weighted average of CPUE was within the towing duration of 2.0-3.0 hour at depths of 300-500 m. Consequently, the three-hours trawling seems to be adequated in the study area. Low catches of the deep-water animals after three-hour towing duration may suggest that most of the continental slopes area where bottom trawling isobath are very limited, and their slope ratios are too high and the sea-beds are too rough for bottom trawl operation longer.

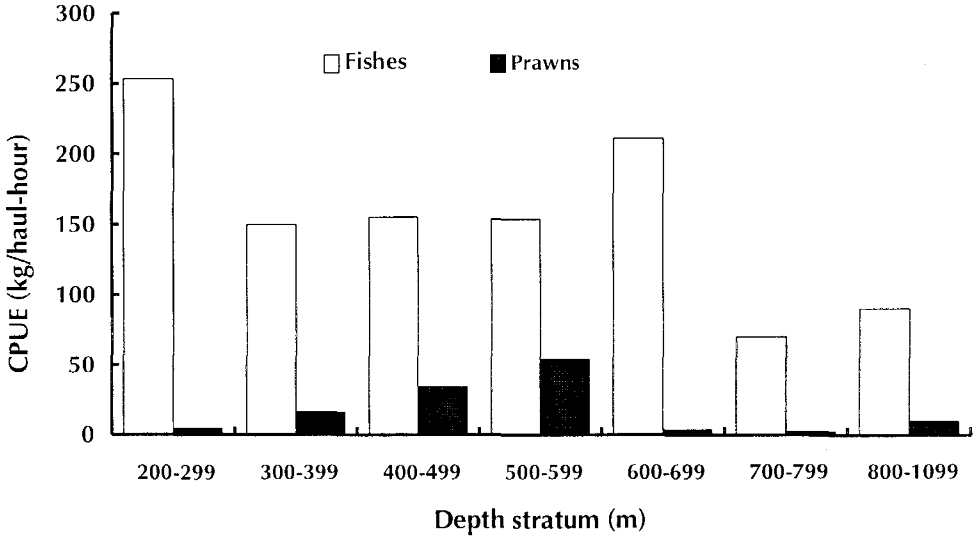


**Fig. 3.** CPUEs of fishes and prawns at various depth strata.

## *II. Species distribution and composition*

Many species of bathypelagic animals have a world-wide distribution, and few live at all depths from surface to deep-water floor. From birth until death each species lives within a certain limited range of depth[18]. In this study the major species of fish species collected were 6.70% *Diaphus* spp., 5.92% *Mytophidae* spp., 12.84% *Trichiurus leptueus,* 13.09% *Raja* spp., 5.04% *Gadomus* spp., 11.31% *Coelorhynchus* spp., 5.66% *Cubiceps squamiceps,* and others 15.25% (Fig. 5).

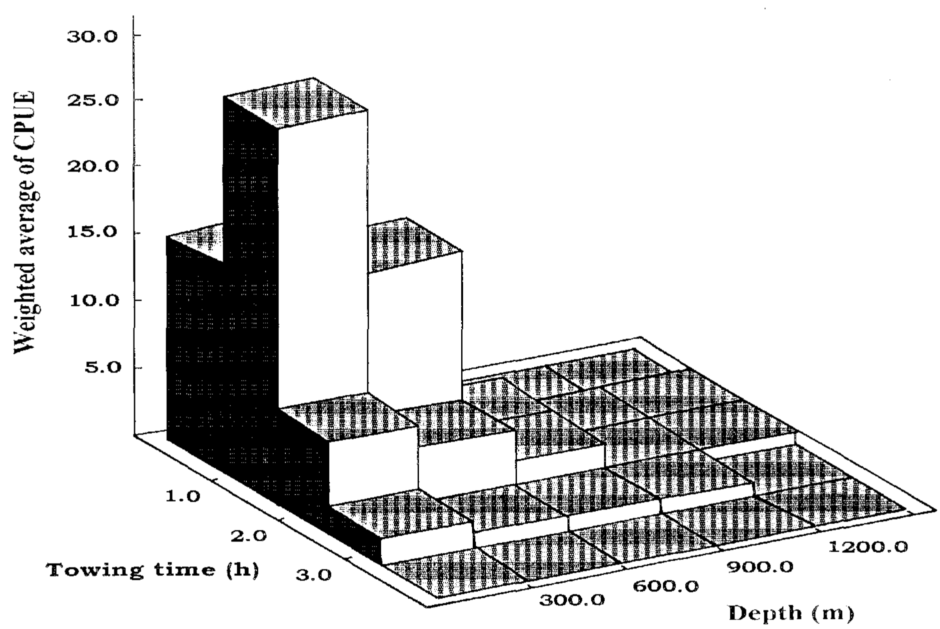


**Fig. 4.** Relationships between hauling durations and the catches in northern continental slope of South China Sea.

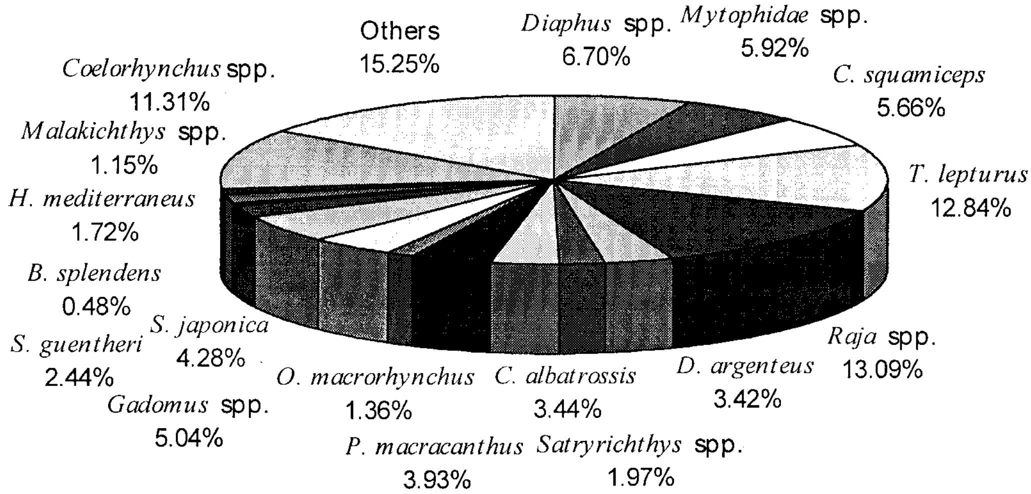


**Fig. 5.** Species composition of deep-water fishes.

For prawn species, the species composition was 9.34% *Haliporoides sibogae*, 3.97% *Aristaeomorpha foliacea*, 2.10% *Plesiopenaeus edwardsianus*, 2.68% *Heterocarpus dorsalis*, 9.21% *Plesionika* spp., 2.11% *Heterocarpus sibogae*, 0.22% *Nephropsis stewarti*, 7.89% *Heterocarpus woodmassoni*, 7.43% *Aristeus virilis*, 16.76% *Parahepomadus vaubani*, 3.16% *Plesiopenaeus coruscans*, 6.68% *Hepomadus glacialis*, 0.98% *Pasiphaea japonica*, 6.80% *Penaeopsis* sp., 9.18% *Acanthephyra armata*, and 10.02% others (Fig. 6).

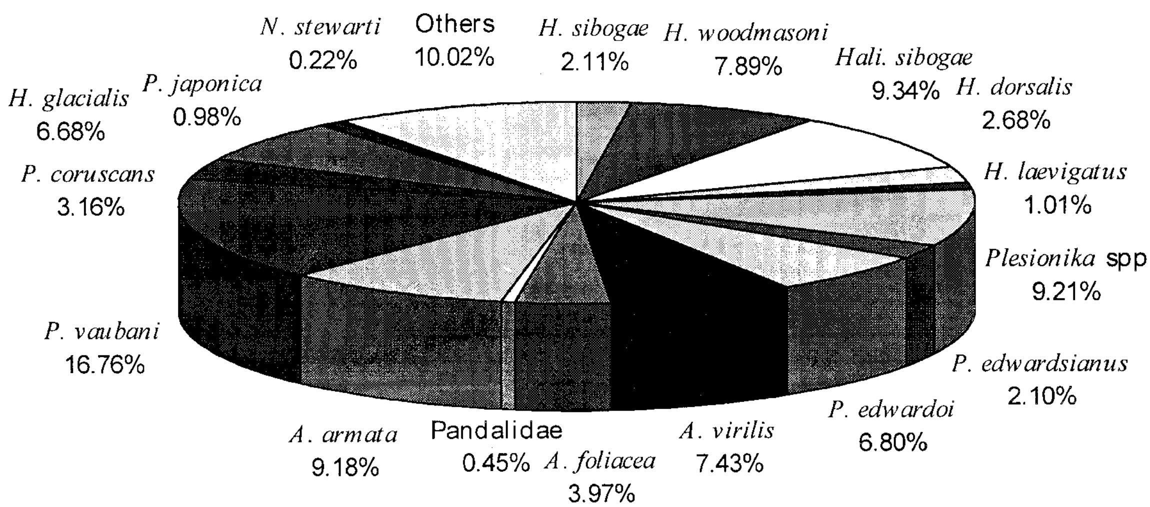


**Fig. 6.** Species composition of major deep-water prawns.

Figure 7 showed the percentages of prawn species collected at different depth strata. Each stratum had its most dominant species; *Plesionika* spp. occupied 36.5% at depths of 201-300 m, *Haliporoides sibogae* 55.3% at depths of 301-400 m; the percentages of *Plesionika* spp., *Penaeopsis edwardoi* and *Aristaeomorpha foliacea* were 19.38, 20.56 and 18.95% respectively at the depths of 401-500 m. *Penaeopsis edwardoi* 34.06% at depths of 501-600 m, and *Aristeus virilis* 46.78% at depths of 601-700 m. For some species such as *Parahepomadus vaubani, Plesiopenaeus coruscans, Hepomadus glacialis,* and *Pasiphaea japonica,* were sampled at depths under 700 m. *A. armata* was at depths of 600-800 m. *Heterocarpus laevigatus* was found only at the depths of 500-700 m.

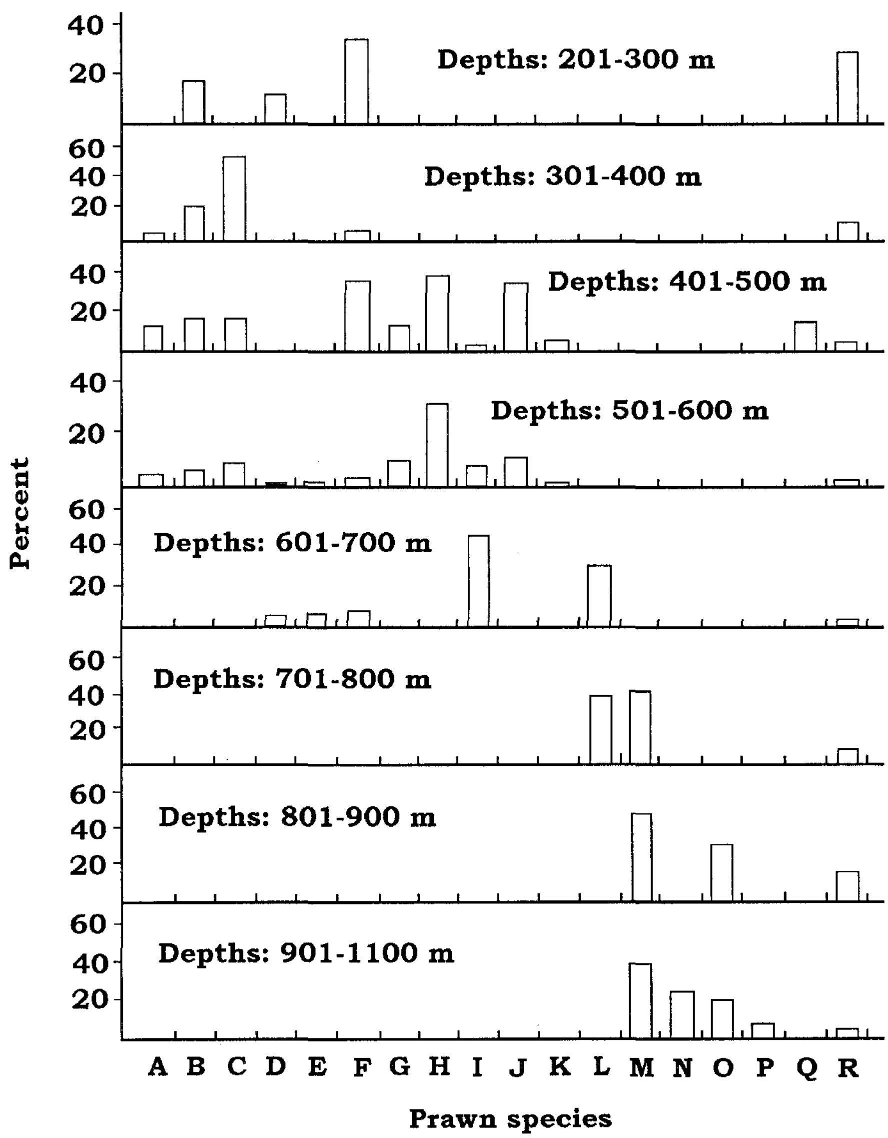


Fig. 7. Percentages of deep-water prawn species collected by bottom trawler. A: *Heterocarpus sibogae,* B: *Heterocarpus woodmasoni,* C: *Haliporoides sibogae,* D: *Heterocarpus dorsalis,* E: *Heterocarpus laevigatus,* F: *Plesionika* spp., G. *Plesiopenaeus edwardsianus,* H: *Penaeopsis edwardoi,* I: *Aristeus virilis,* J: *Aristaeomorpha foliacea,* K: Pandalidae, L: *Acanthephyra armata,* M: *Parahepomadua vaubani,* N: *Plesiopenaeus coruscans,* O: *Hepomadus glacialis,* P: *Pasiphaea japonica,* Q: *Nephropsis stewarti,* R: Others.

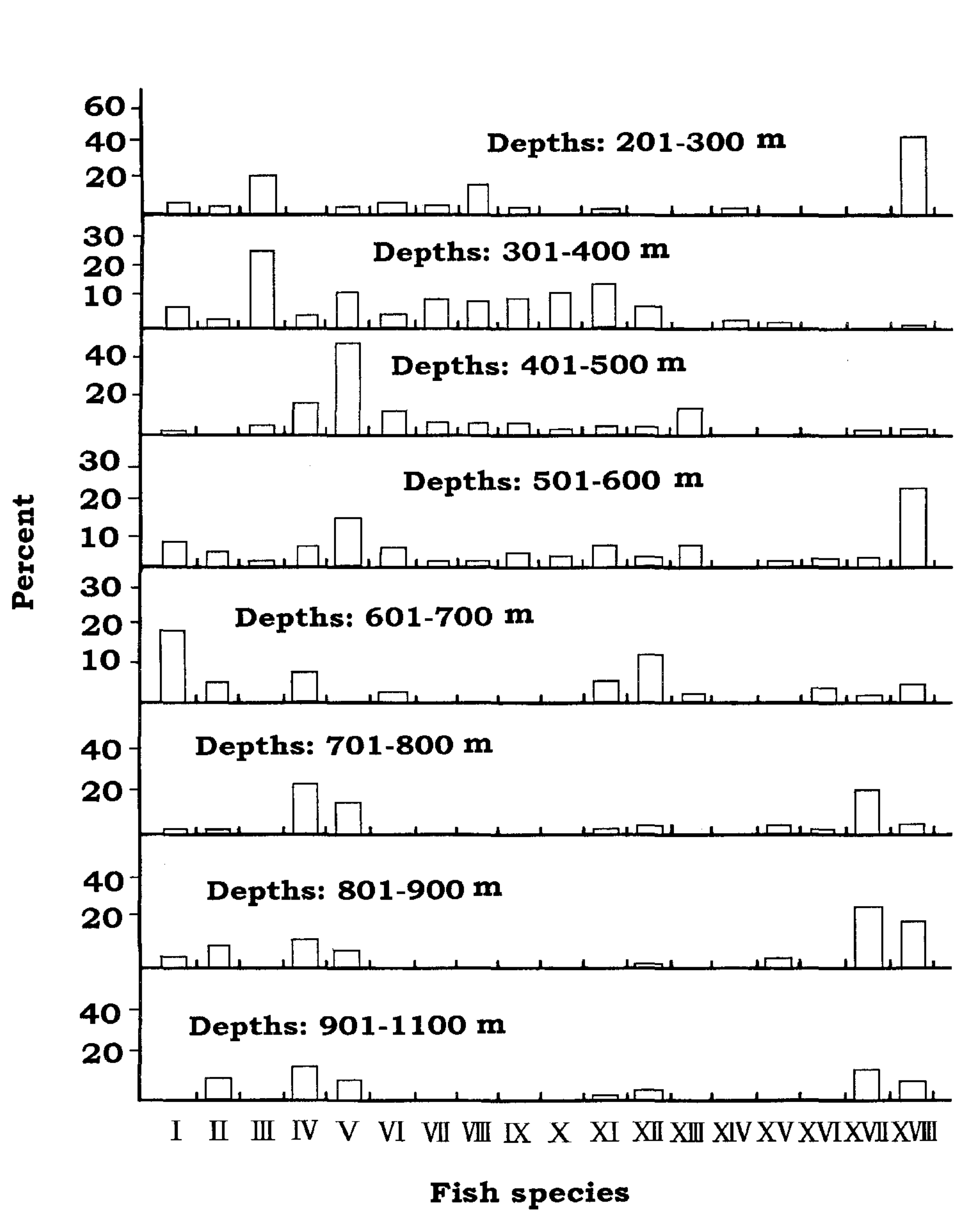


**Fig. 8.** Percentages of major deep-water fish species caught by bottom trawler. I. *Diaphus* spp., II. *Myctophidae* spp., III. *Cubiceps squamiceps,* IV. *Trichiurus lepturus,* V. *Raja* spp., VI. *Diretmus argenteus,* VII. *Satryrichthys* spp., VIII. *Chlorophthalmus albatrossis,* IX. *Pricanthus macracanthus,* X. *Ophisurus macrorhynchus,* XI. *Synagrops japonicus,* XII. *Gadomus* spp., XIII. *Setarches guentheri,* XIV. *Beryx splendens,* XV. *Hoplostethus mediterraneus,* XVI. *Malakichthys* spp., XVII. *Coelorhynchus* spp., XVIII. Others.

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## References

1. Murray, J. and J. Hjort (1912) Depths of the ocean. A general account of the modern science of oceanography based largely on the scientific researches of the Norwegian Steamer Michael Sars. Macmillan and Co., Limited, London, 387-456.
2. Mao, S. Z. and Y. X. Xie (1982) The feature of the submarine relief of the central and northern areas of South China Sea. Symposium on research reports on the sea area of South China Sea, **1**: 25-38.
3. Fisheries Yearbook Taiwan Area (1996) Taiwan Fisheries Bureau, Department of Agriculture and Forestry, Provinicial Government of Taiwan.
4. Holthuis, L. B. (1980) FAO species catalogue. Vol. 1. Shrimps and prawns of the world: an annotated catalogue of species of interest to fisheries. FAO Fish. Synop., **125**(1): 1-271.
5. King, M. G. (1984) The species and depth distribution of deepwater caridean shrimp (Decapoda, Caridea) near some southwest Pacific Islands. Crustaceana, **47**: 174-191.
6. Wilder, M. N. (1977) Biological aspects and the fisheries potential of two deepwater shrimp, *Heterocarpus encifer* and *H. laevigatus* in waters surrounding Guam. M. S. Thesis, Univ. Guam. Agana, Guam, 79 pp.
7. Polovina, J. J. and S. Ralston (1987) Tropical Snappers and Groupers: biology and fisheries management. Westview Press, Boulder & London, 659pp.
8. Lee, D. A. and C. L. Lee (1990) Preliminary studies on the deep-sea fishery resources of pot fishing in northeast and southwest Taiwan. Bull. Taiwan Fish. Res. Inst., **49**: 257-285. (in Chinese with English Abstract)
9. Lee, C. L. and D. A. Lee (1992) The effectiveness of different (Pot) structures and other factors for harvesting deep-sea animals. J. Fish. Soc. Taiwan, **19**(1): 35-43.
10. Chi, T. S. (1972) Studies on the deep-water bottom trawl fisheries (I). Bull. Taiwan Fish. Res. Inst., **21**: 1-36.
11. Yang, H. C. (1969) Fish composition collected by deep-water bottom trawl in Tong-Kang Trench. Bull. Taiwan Fish. Res. Inst., **15**: 123-138. (in Chinese)
12. Liu, R. Y. and Z. R. Zhong (1986) Penaeid shrimps of the South China Sea. Agricul. Pub. House, Beijing, China, 278 pp. (in Chinese)
13. Macdonald, A. G. and I. G. Priede (1983) Experimental Biology at Sea. Department of Physiology and Zoology. Univ. Aberdeen, Scotland. Academic Press, 97.
14. Shen, J. A. and Y. H. Cheng (1989) On the deep-sea demersal fish communities of the East China Sea. Chin. J. Oceanol. Limnol., **7**(2): 157-167. (in English)
15. Sissenwine, M. P., T. R. Azarovitz and J. B. Suomala (1983) Determining the abundance of fish. Experimental biology at sea. Aberdeen Univ. Physiol. Zool. Dep., 51-101.
16. Zhong, Z. R., H. G. Li and M. Chen (1991) The resources of shrimps in the marginal waters of continental shelf of the northeastern part of the South China Sea and their prospects for exploitation. Mar. Fish. Haiyang-Yuye, **13**(5): 201-204.
17. Dalzell, P. and G. L. Preston (1992) Deep reef slope fishery resources of the South Pacific. A summary and analysis of the dropline fishing survey data generated by the activities of the SPC Fisheries Programme between 1974 and 1988. South Pacific Commission Noumea, New Caledonia, 1-40.
18. Marshall, N. B. (1954) Aspects of deep sea biology. Hutchinsons, London, 380 pp.

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# 南海陸坡底拖網之漁獲組成與拖曳時間、作業區域及漁獲深度之關係

## 摘 要

本研究係自 1991 年 6 月 20 日至 1995 年 4 月23 日止，針對南海陸坡水深 200 至 1,100 公尺等深線之陸坡台階進行調查，共計實施 38 網次底拖試驗。使用二因子變方分析檢定不同作業深度與漁區別之單位努力漁獲量結果發現，作業深度別之單位努力漁獲量不具差異性 ($p>0.05$)，但漁區別則具有顯著差異 ($p<0.05$)。各漁區之單位努力漁獲量以 115°30′E－116°30′E，20°05′ N－20°55′ N 間之每拖網小時 381.4 公斤最高。深度別之單位努力漁獲量，以水深介於 200 至 299 公尺之每拖網小時 257.9 公斤最高。主要蝦類有：東方擬海蝦 9.34%、長帶近對蝦 2.10%、紅蝦類 9.21%、單刺異腕蝦 7.81%、雄壯鬚蝦 7.43%、擬肝刺蝦等 16.76%；魚類有：燈籠魚科 5.92%、鱗首方頭鯧 5.66%、白帶魚 12.84%、紅目鰱 3.93%、鼠鱈屬 5.04%、鯒屬 13.09%、腔吻鱈屬 11.31%、尖牙鯛 4.28% 等。

**關鍵詞：**底拖網，深海底層，拖曳時間，中國南海

李嘉林 (1996) 南海陸坡底拖網之漁獲組成與拖曳時間、作業區域及漁獲深度之關係. 水產研究, 4(2): 95-105.