

An Update of Taiwan's North Pacific Swordfish Fishery¹

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Swordfish is an incidental catch of the distant-water tuna longline fishery and the offshore tuna longline fishery in Taiwan. Also, the harpoon fishery catches a small amount of swordfish in the coastal waters of Taiwan (Sun et al., 1999). Annual catches of the three fisheries for the Pacific Ocean are shown in Fig. 1. In 1999, these three fisheries contributed an estimated 1,771 mt or 99% of the total swordfish catch in Taiwan. Of the three fisheries, the contribution of the offshore tuna longline fishery ranged between 43% in 1990 and 88% in 1997 with an average of 72%. The annual catches of the three fisheries in the North Pacific is shown in Fig. 2. In average, 84% of the annual catch (ranging from 63% in 1990 to 95% in 1987) was from the North Pacific.

This paper updates the brief review of Sun et al. (1999) on these three Taiwanese fisheries for swordfish in the North Pacific Ocean. The catch in weight and effort in vessels data used for harpoon and offshore tuna longline fisheries in this study were from the Yearbooks of Taiwan Fisheries Bureau before 1998 and from Yearbooks of Fisheries Administration since 1998. For the distant-water tuna longline fishery, we used the catch in both weight and number of fish and the effort in hooks data summarized by five-degree squares and month provided by the Taiwan Overseas Fisheries Development Council.

Distant-water tuna longline fishery

The distant-water tuna longline fishing fleets of Taiwan consist of vessels larger than 100 gross tons (GRT), mostly at 150-250 GRT. They have been operating in the Pacific Ocean since 1963. The main fishing ground is in the southwestern region of the Pacific with albacore as a target species and swordfish as a by-catch (Sun et al., 1999). Annual catch of swordfish has been small in the North Pacific. The 1999 catch in the North Pacific was only 41 mt (Fig. 3).

The trend of fishing effort (number of hooks) and CPUE (number of fish per thousand hooks) for the North Pacific was shown in Fig. 3. Although the catch and effort remained at very low level, the CPUE fluctuated relatively. As the catch from North Pacific accounted for a negligible fraction of the total catch, its trend will not be discussed here.

Fig. 4 shows the yearly distribution of CPUE for the Pacific Ocean during the period from 1967 to 1999. The distribution indicates that a high catch of swordfish occurred in the waters off southeastern Australia and northern New Zealand. Since 1995, some fleets have operated in the North Pacific Ocean for the northern albacore, and swordfish was found to be abundant in the region from 150° W to 180° W and from 20° N to 40° N.

Offshore tuna longline fishery

The offshore tuna longline fleets consist of vessels smaller than 100 GRT. There are two groups of vessels depending on the fishing ports they are based in. Group I vessels are mostly of 20-50 GRT, based in domestic fishing ports such as Tung-Kang and Kaohsiung. They operate in the seas nearby for a short trip of 7-10 days and land their catch to their homeport. Group II vessels are mostly of 50-70 GRT, based in fishing ports of western Pacific island countries. They have been fishing in the western Pacific since 1988. Both types of longline vessels target primarily yellowfin and bigeye tunas for Japanese sashimi market, and swordfish is their by-catch (Sun et al., 1999).

The annual catch of swordfish has fluctuated between 456 and 1000 mt except for the years 1987, 1989 and 1997-2000 when the catch increased to around 1400 mt (Fig. 5). The fishing effort (number of vessels) increased gradually and reached its maximum of 2,207 vessels in 1987. Thereafter, it decreased sharply and reached its lowest level of 800 vessels in 1991. The effort fluctuated between 1274 and 1898 vessels during 1992-2000 (Fig. 5). The CPUE decreased gradually from 1.15 mt per vessel in 1971 to its lowest level of 0.22 mt per vessel in 1986. Thereafter, the CPUE increased and reached 0.83 mt per vessel in 1989. The CPUE decreased again in 1990 and reduced to 0.32 mt in 1993. Thereafter the CPUE increased gradually. In 2000 the CPUE was 0.95 mt per vessel (Fig. 5).

Catch (number of fish) and effort (number of hooks) data of Group II vessels for 1988-2000, summarized by five-degree squares and month were obtained from Oceanic Fisheries Programme of the Pacific Community. We used these data to calculate the yearly nominal CPUE in number of fish per thousand hooks (Fig. 5). The CPUE

increased from 0.24 fish per thousand hooks in 1988 to its highest level of 0.43 fish per thousand hooks in 1989. Then CPUE decreased sharply and reached its lowest level of 0.02 fish per thousand hooks in 1991. CPUE increased again in 1993 and remained stable thereafter around 0.13 to 0.25 fish per thousand hooks during 1992-2000. The swordfish CPUE of offshore longline fishery were obviously much higher than those of the distant-water longline fishery .

Yearly distribution of CPUE from Group II offshore longline data during the period of 1988 to 2000 (Fig. 6) indicated that the swordfish fishing ground seems to be located at the latitudes between 15° N and 5° S and the longitude between 130° E and 180° E. Swordfish is abundant in the waters off north and east Papua New Guinea, from latitude 0° to 10°N and longitude from 130° to 165°E.

Harpoon fishery

The Japanese introduced harpoon fishery for billfishes to Taiwan in 1913. Its vessels operated primarily in the coastal waters of eastern Taiwan along the edge of the Kuroshio Current. This fishery appears to target a complex of billfishes with swordfish at a low rank. Blue marlin and black marlin are main target species of the harpoon fishery in the winter season (Sun et al., 1999). The historical swordfish catches by harpoon fishery are graphed over the years 1967-2000 in Fig. 7. Annual catches of swordfish were low in 1967-1972, 1978-1982, 1988-1989 and 1995-2000 at less than 100 mt although it appears to have stabilized around 200 mt in 1983-1987 and 1991-1994 with a maximum of 287 mt in 1992. The catch in 2000 was 74 mt.

The effort (number of vessels) increased from 215 vessels in 1967 to 453 vessels in 1987. Thereafter the effort has been decreasing and dropped to the lowest level around 120 vessels in 1997-2000 (Fig. 7). The trend of the yearly CPUE in mt per vessel is shown in Fig. 7. The CPUE trend was fairly similar to that of catch.

Research

Taiwan's fisheries in the Pacific have caught insignificant amounts of swordfish over the past years. This situation will likely persist in the near future. In order to assess and conserve the swordfish resource around Taiwan waters, a four-year project titled "Biological Studies and Stock Assessment of Swordfish in Taiwan Waters" was funded by Taiwan Fisheries Administration since 1997 and conducted by National Taiwan University. The following four studies were completed during this four-year period:

1. Fishing ground and fishing condition of swordfish fishery in Taiwan waters;

2. Age determination and growth of swordfish in Taiwan waters using anal fin spines;
3. Sex ratio and sex maturity of swordfish in the waters of Taiwan;
4. Yield per recruit analysis for swordfish around Taiwan waters (preliminary result).

Although the project was completed at the end of last year, we are conducting two further studies based on findings from our research over the past four years. These are:

- 1 Age and growth of juvenile swordfish using otolith;
- 2 Application of a sex-specific age-structure model to North Pacific swordfish.

We anticipate finishing these two studies within the next two years.

Reference

Sun, C.L., S.Z. Yeh, S.P. Wang, and S.K. Chang, 1999. A review of Taiwan's swordfish fishery in the Pacific Ocean. ISC2/99/1.4, 12 pp

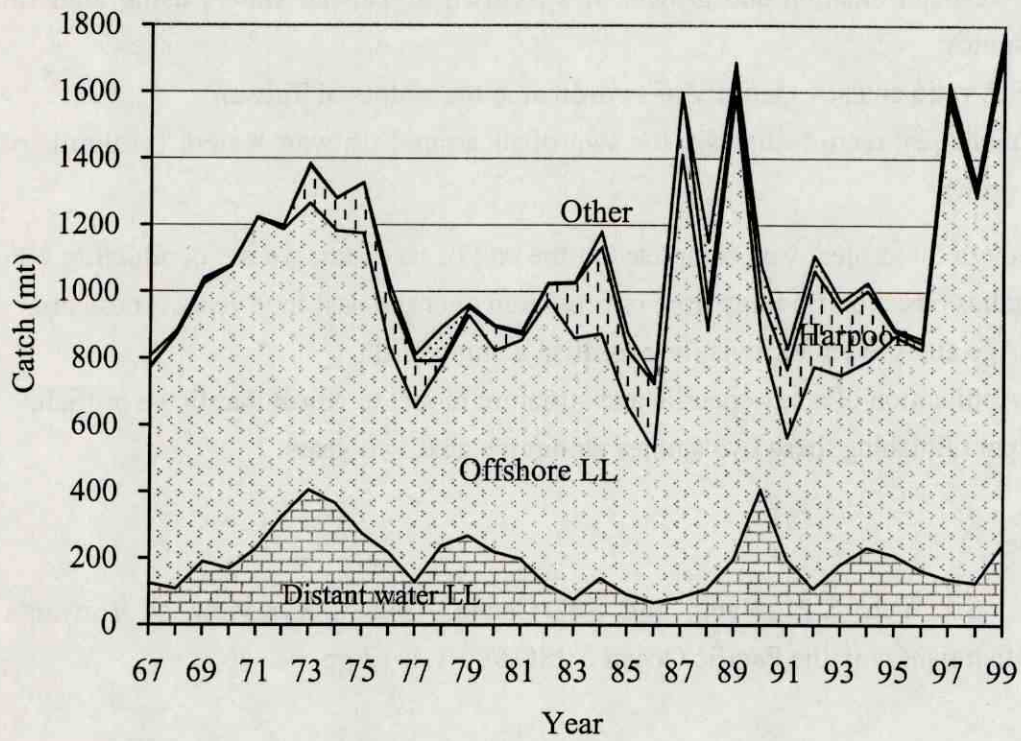


Figure 1. Taiwanese swordfish catch by gears in the Pacific Ocean.

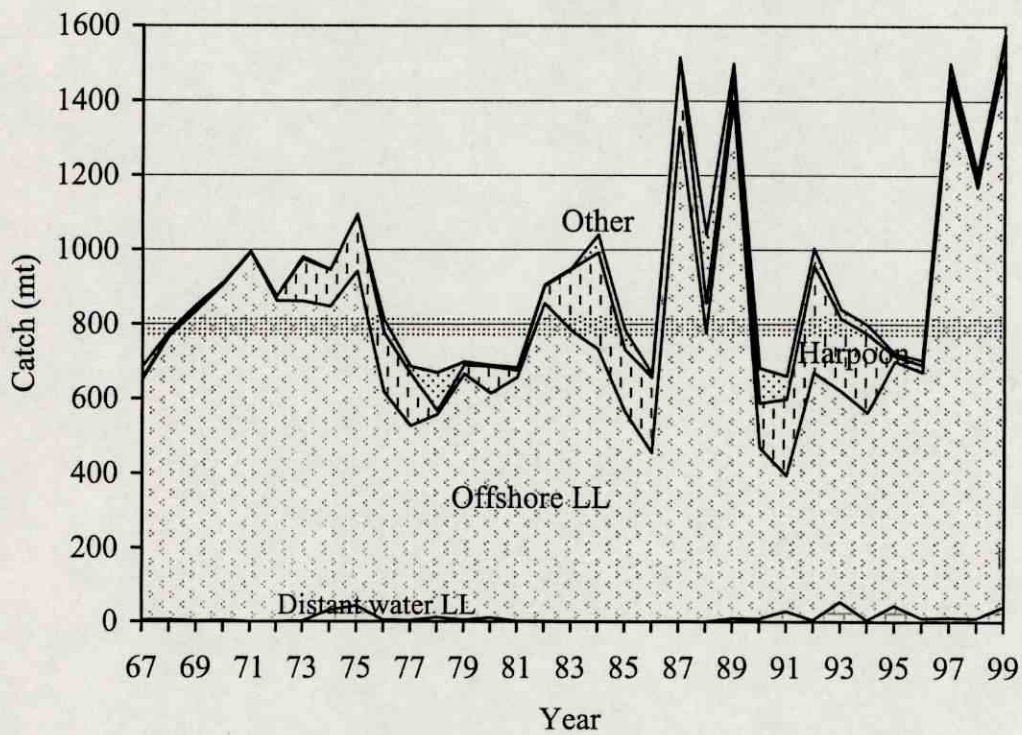


Figure 2. Taiwanese swordfish catch by gears in the North Pacific Ocean.

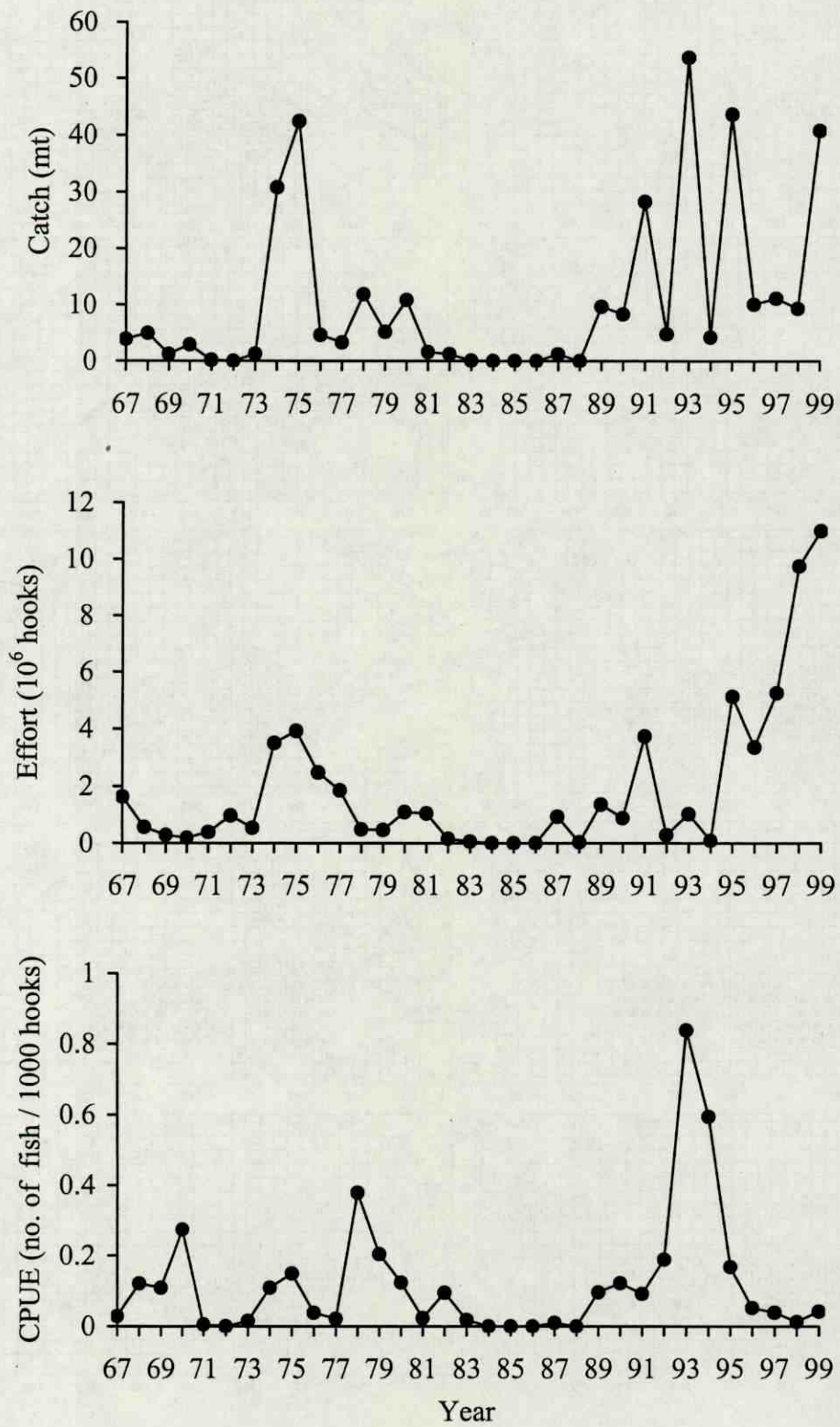


Figure 3. Swordfish catch, effort and CPUE of the Taiwanese distant-water tuna longline fishery in the North Pacific Ocean, 1967-1999.

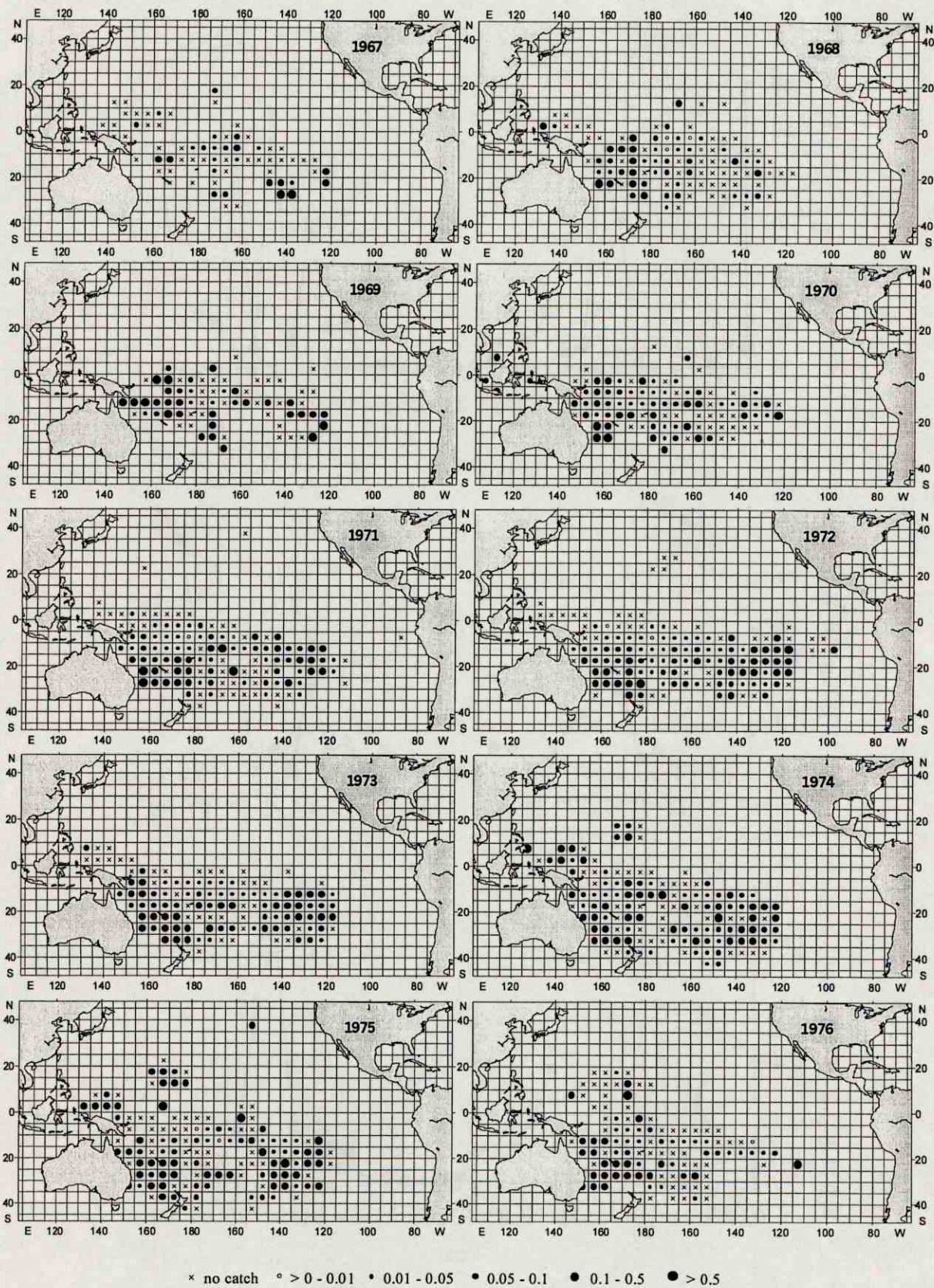


Fig. 4a. Distribution of the swordfish CPUE (number of fish per thousand hooks) of the Taiwanese distant-water tuna longline fishery in the Pacific Ocean, 1967-1976.

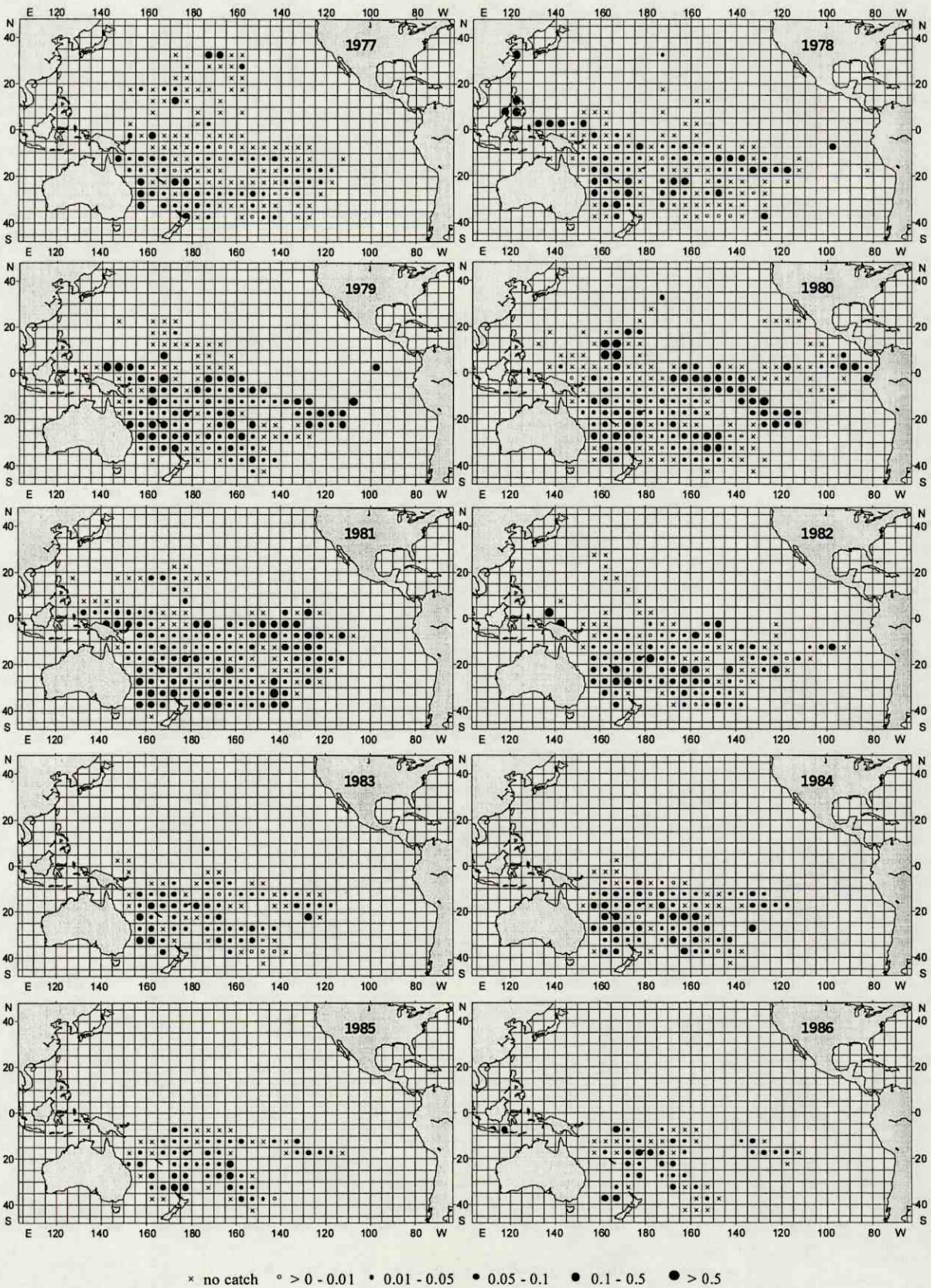
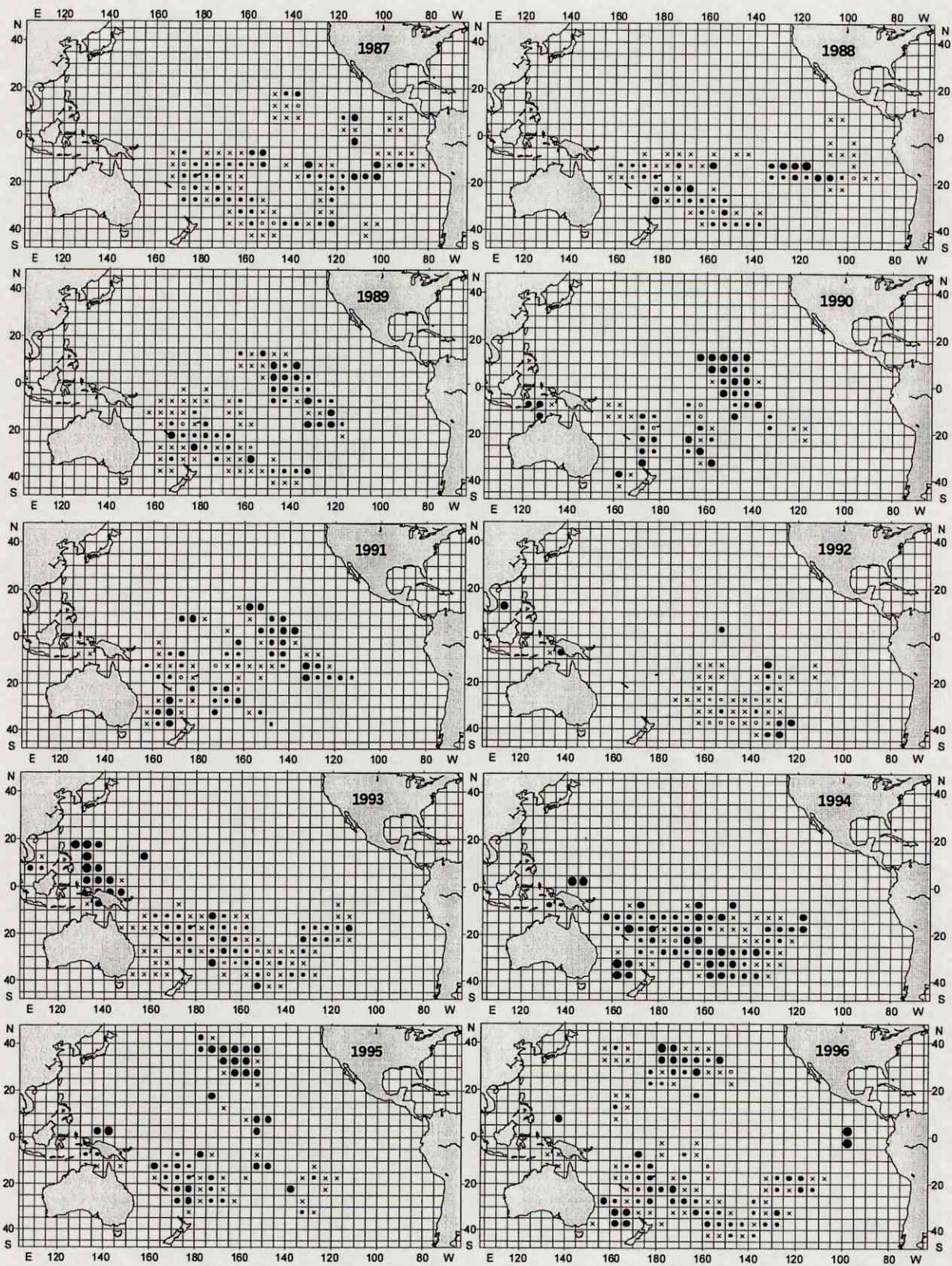


Fig. 4b. Distribution of the swordfish CPUE (number of fish per thousand hooks) of the Taiwanese distant-water tuna longline fishery in the Pacific Ocean, 1977-1986.



× no catch ○ > 0 - 0.01 ● 0.01 - 0.05 ● 0.05 - 0.1 ● 0.1 - 0.5 ● > 0.5

Fig. 4c. Distribution of the swordfish CPUE (number of fish per thousand hooks) of the Taiwanese distant-water tuna longline fishery in the Pacific Ocean, 1987-1996.

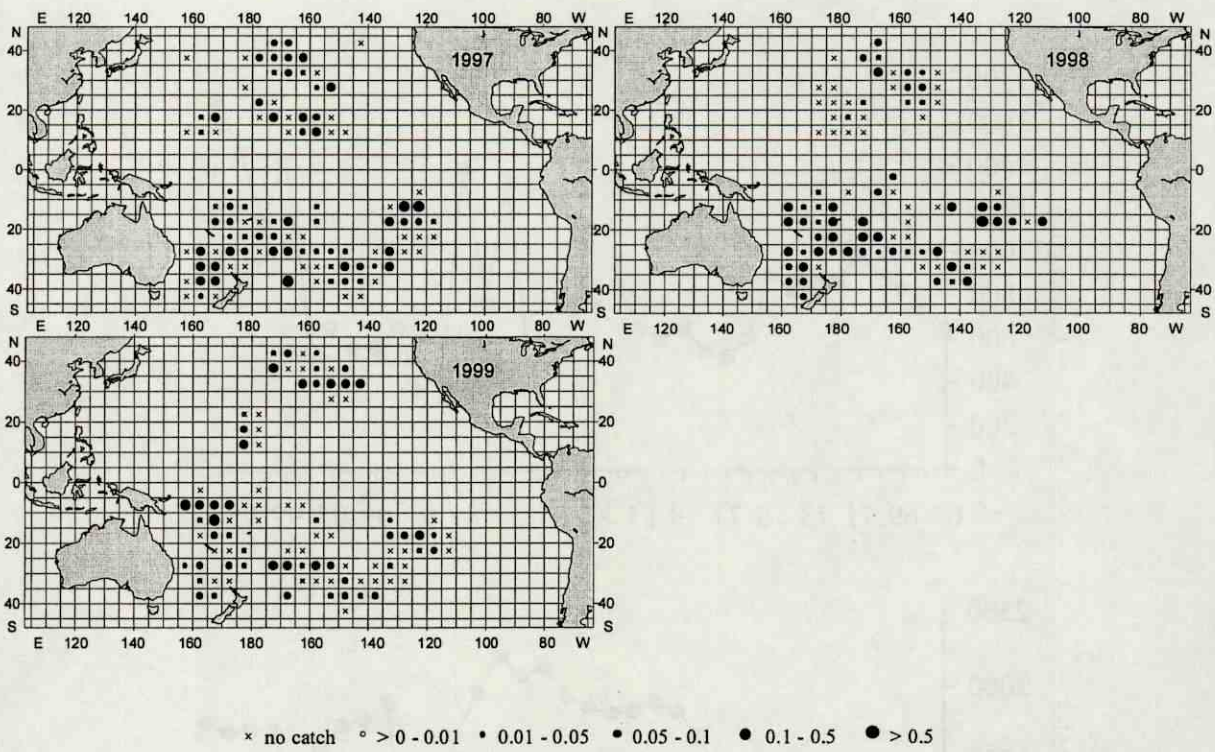


Fig. 4d. Distribution of the swordfish CPUE (number of fish per thousand hooks) of the Taiwanese distant-water tuna longline fishery in the Pacific Ocean, 1997-1999.

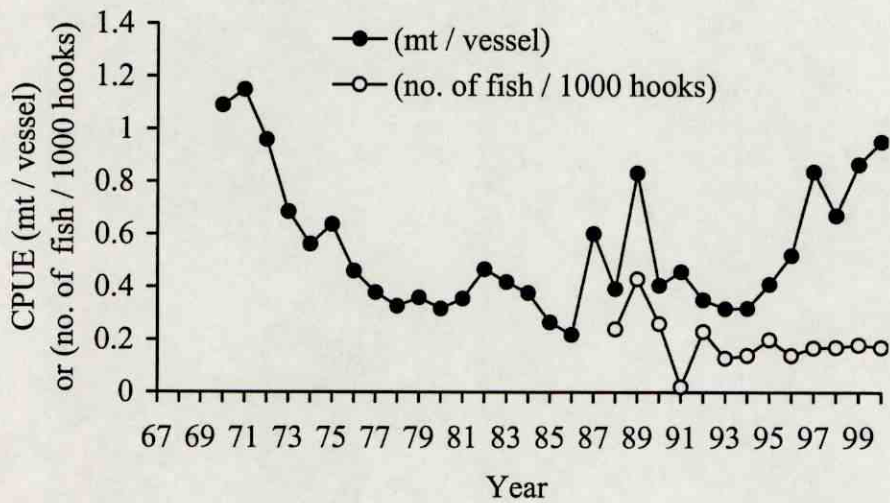
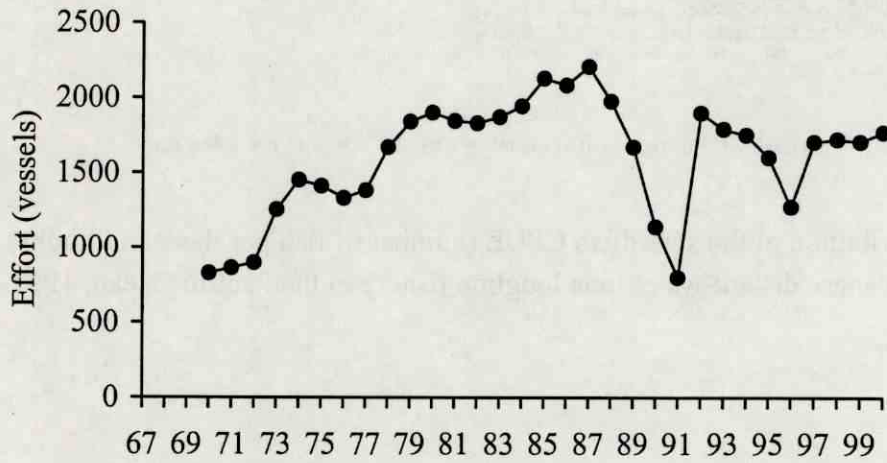
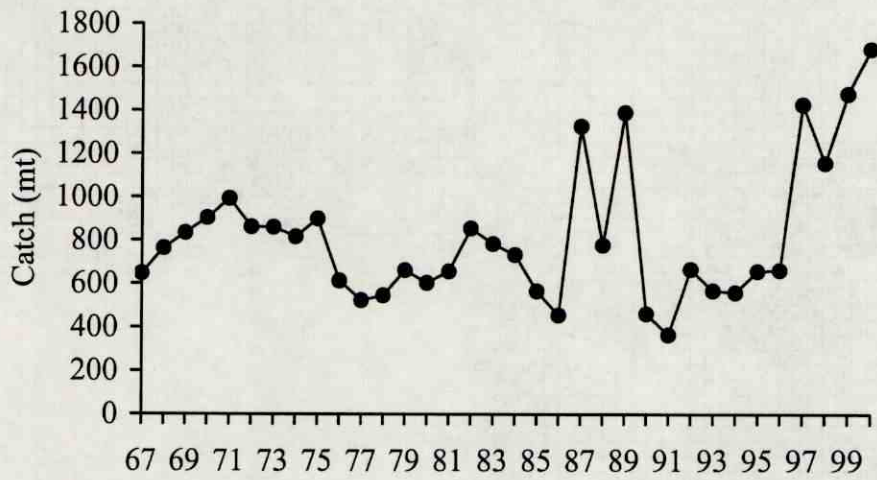


Figure 5. Swordfish catch, effort and CPUE of the Taiwanese offshore tuna longline fishery in the North Pacific Ocean, 1967-2000.

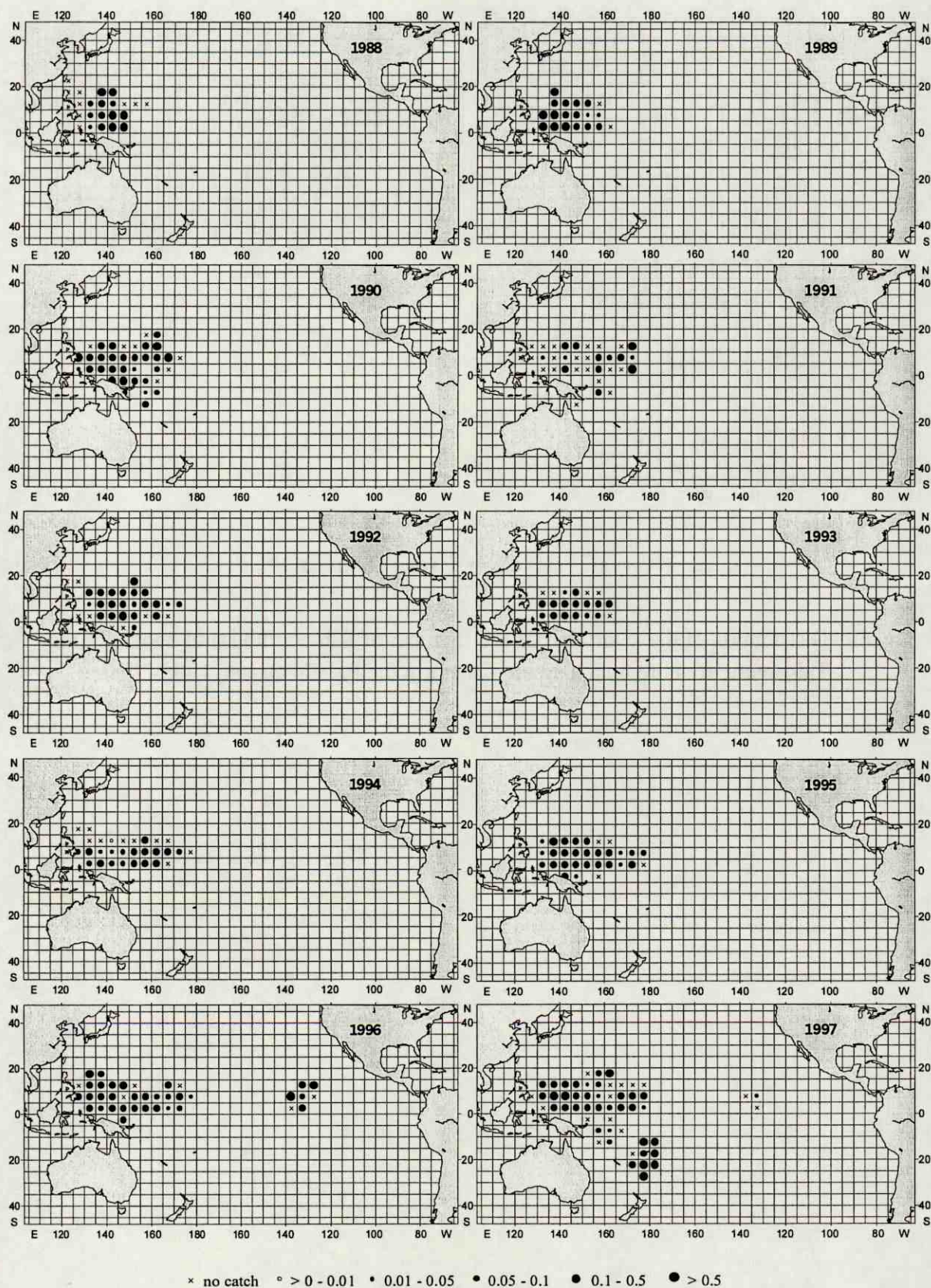


Fig. 6a. Distribution of the swordfish CPUE (number of fish per thousand hooks) of the Taiwanese offshore tuna longline fishery in the Pacific Ocean, 1988-1997.

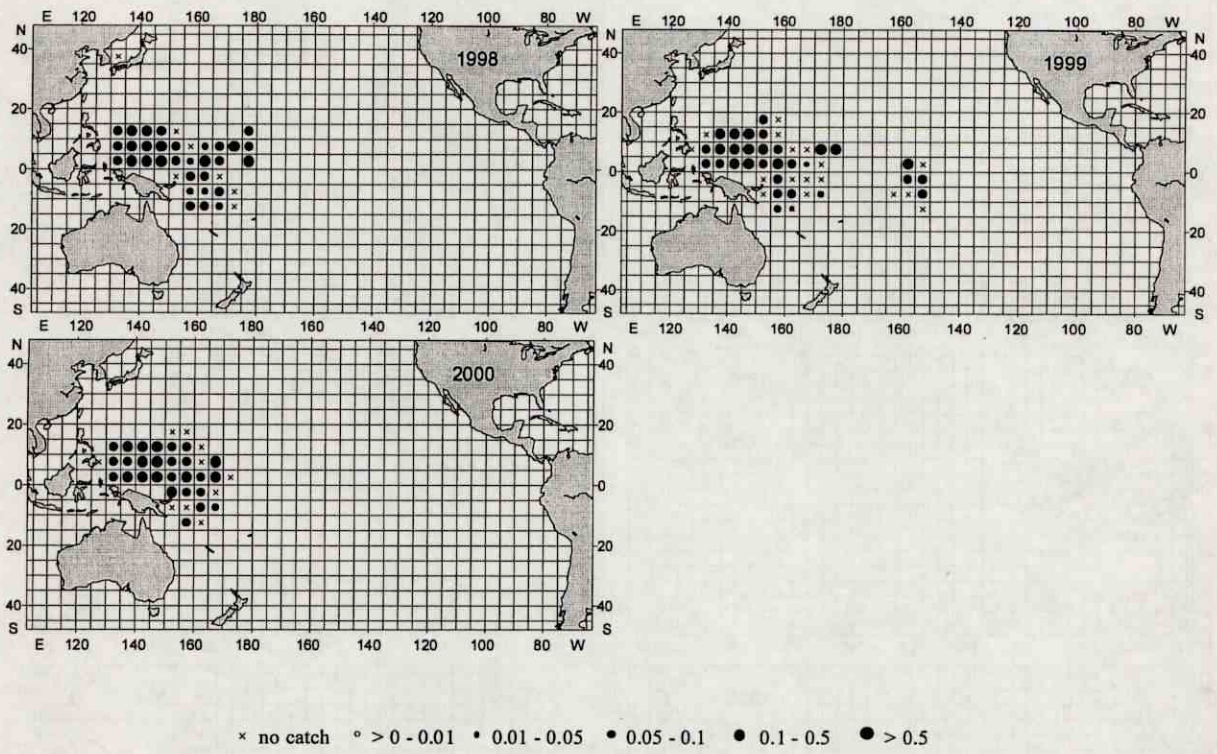


Fig. 6b. Distribution of the swordfish CPUE (number of fish per thousand hooks) of the Taiwanese offshore tuna longline fishery in the Pacific Ocean, 1998-2000.

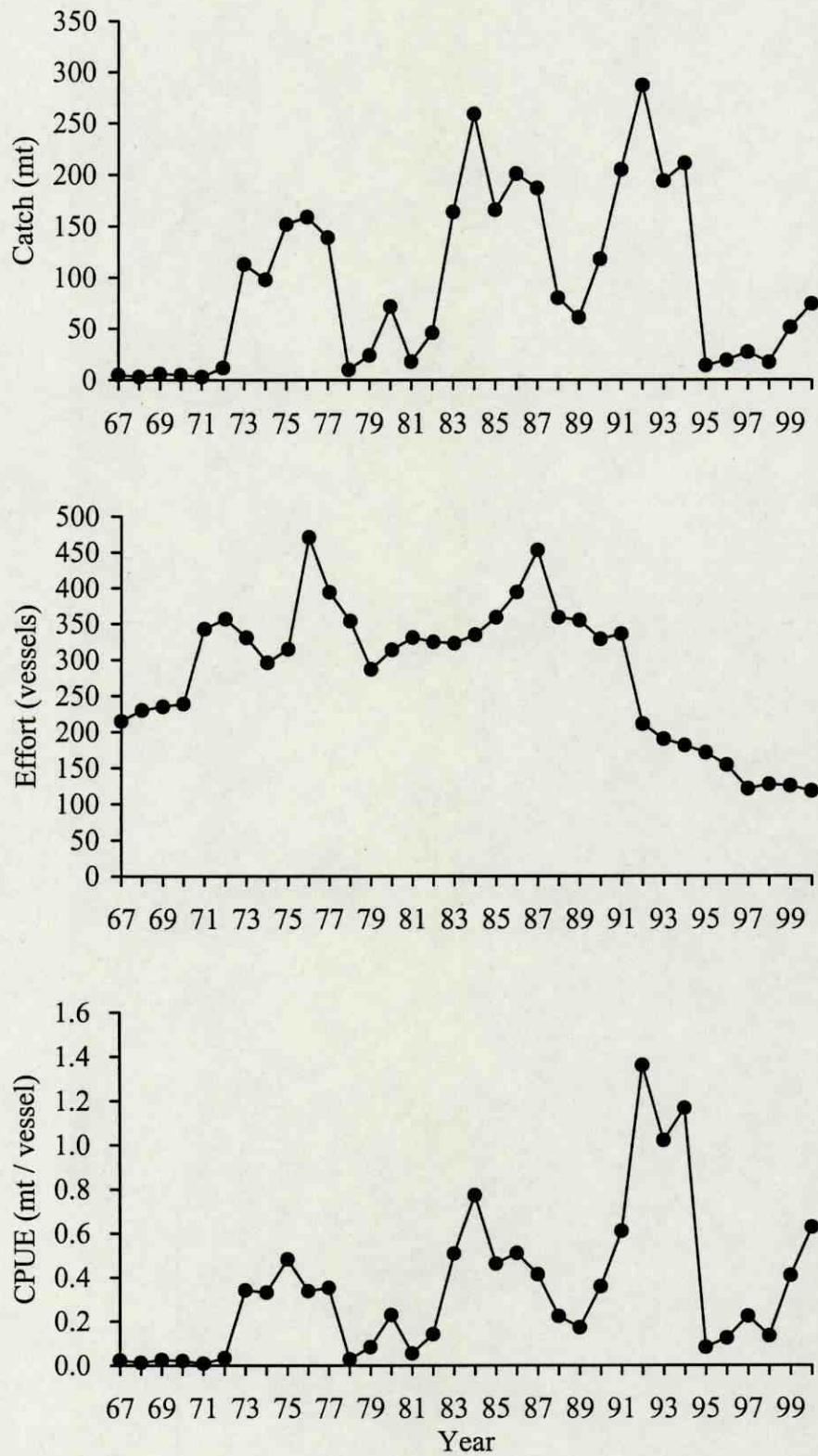


Figure 7. Swordfish catch, effort and CPUE of the Taiwanese harpoon fishery in the North Pacific Ocean, 1967-2000.



Figure 1: A line graph showing a fluctuating data series over 10 units.



Figure 2: A line graph showing a data series that generally increases from left to right over 10 units.



Figure 3: A line graph showing a data series with multiple peaks and troughs over 10 units.

Figure 1: A line graph showing a fluctuating data series over 10 units. The y-axis is labeled with values 0, 50, 100, and 150. The x-axis has 10 major tick marks.