

## **A review of Taiwan's swordfish fishery in the Pacific Ocean<sup>1</sup>**

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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. Annual catches of the three fisheries are shown in Fig. 1. In 1997, these three fisheries contributed an estimate of 1,609 mt or 98% of the total swordfish catch in Taiwan. Of the three fisheries, the contribution of the offshore tuna longline fishery ranged between 53% in 1994 and 91% in 1989 with an average of 87%. The annual catches of the three fisheries in North Pacific and South Pacific are compared in Fig. 2. In average, 88% of the annual catch (ranging from 75% in 1980 to 97% in 1987) was from North Pacific. This paper briefly reviews these three Taiwanese fisheries for swordfish in the Pacific Ocean. The catch and effort data used for harpoon and offshore tuna longline fisheries in this study were from the Yearbooks of Taiwan Fisheries Bureau. For the distant-water tuna longline fishery, we used the catch and effort 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. Annual catch of swordfish fluctuated between 70 mt and 270 mt before 1982 and was less than 100 mt during the periods from 1982 to 1991 (Fig. 3). In 1992, the catch increased and reached its maximum of 285 mt in 1994. In 1997 the catch was 154 mt. The catches have been small in the North Pacific except for 1995, because the fishing is principally in the southeastern region for albacore. The 1995 catch in the North Pacific was 119 mt.

The trend of fishing effort (number of hooks) and CPUE (number of fish per thousand hooks) were shown in Fig. 3, respectively. For the South Pacific, the swordfish CPUE has remained fairly stable at a low level of 0.01 to 0.09 fish per thousand hooks except for 1967, 1969, 1979 and 1994 when the CPUE were between 0.1 and 0.7 fish per thousand hooks. Although the catch and effort in North Pacific remained at very low level, the trend of CPUE fluctuated dramatically. 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 during the period from 1967 to 1996. The distribution indicates that 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 25° 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 according to the fishing ports they based in. Group I vessels are mostly of 20-50 GRT, based in domestic fishing ports such as Tung-Kang and Kaohsiung. They operated in the seas nearby for a short trip of 7-10 days and landed their catch to their home-port. 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 at yellowfin and bigeye tunas for Japanese sashimi market, and swordfish is their by-catch.

The annual catch of swordfish have been fluctuated between 400 and 1000 mt except for the years 1987, 1989 and 1997 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 1992-1997 (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 0.85 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 1997 the CPUE was 0.84 mt per vessel (Fig. 5).

Catch (number of fish) and effort (number of hooks) data of Group II vessels for 1988-1997, summarized by five-degree squares and month were obtained from

Secretariat of 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 1992-1997. The swordfish CPUE of offshore longline fishery were obviously much higher than those of the distant-water longline fishery (Fig. 3).

Yearly distribution of CPUE from Group II offshore longline data during the period of 1988 to 1997 (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. The swordfish is abundant in the waters off north Papua New Guinea, at latitude from 0° to 10°N and longitude from 130° to 165°E.

### **Harpoon fishery**

The harpoon fishery for billfishes was introduced to Taiwan by Japanese 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. The historical swordfish catches by harpoon fishery are graphed over the years 1967-1997 in Fig. 7. Annual catches of swordfish were low in 1967-1972, 1978-1982, 1988-1989 at less than 100 mt. The catch appears to have stabilized around 200 mt in 1991-1994 with a maximum of 287 mt in 1992. In recent years (1995-1997) the catch was at a very low level of less than 30 mt.

The effort (number of vessels) has been decreasing since 1988 and dropped to the lowest level of 121 vessels in 1997 (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.

### **Summary**

Insignificant amounts of Swordfish have been caught by Taiwan's fisheries in the Pacific. This situation will be likely to persist in the near future. Since the offshore longline fishery plays a very important role in catching yellowfin and bigeye tunas, with by-catch of swordfish, a complete logsheet collection project has been carried out by the Taiwan Fisheries Bureau and the Overseas Fisheries Development Council since 1997 with a fund provided by Taiwan Fisheries Administration,

Council of Agriculture (FACOA). The offshore longline catch and effort, and the relevant information are collected to provide baseline knowledge for the purpose of its stock assessment. In order to assess and conserve the swordfish resource around Taiwan waters, the projects “Fishing ground and fishing condition of the swordfish fishery in Taiwan waters” and “Age determination and growth of swordfish in Taiwan waters” have been funded by FACOA since 1997 and conducted by National Taiwan University. The reproductive biology and stock assessment of swordfish will be studied in the next two years.

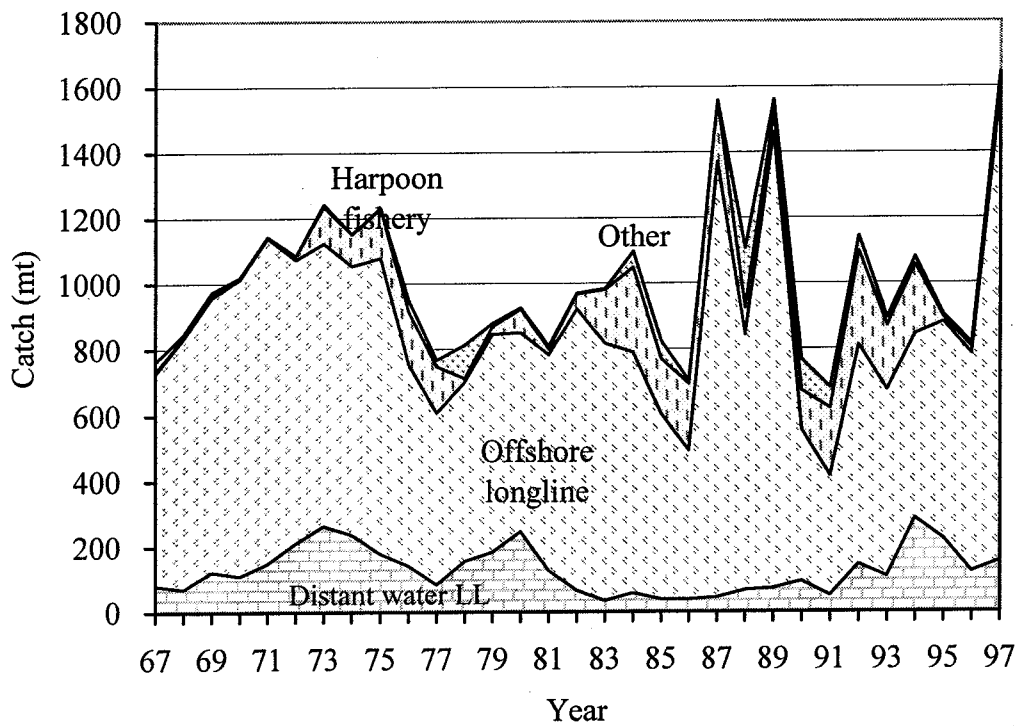


Figure 1. Taiwanese swordfish catch by gears in the Pacific Ocean.

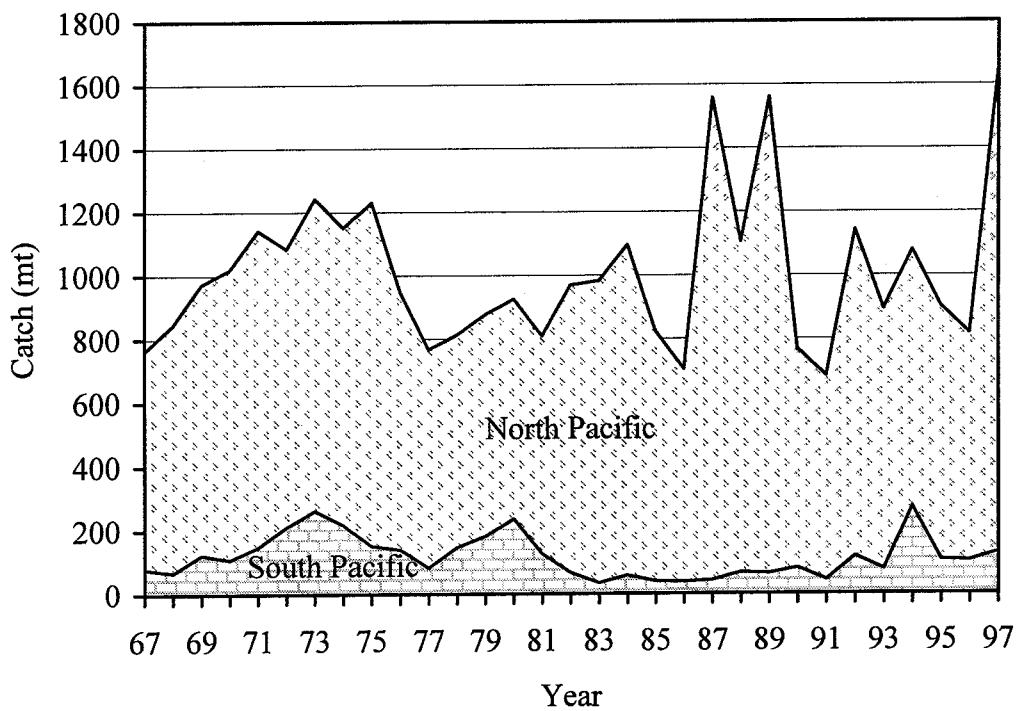


Figure 2. Taiwanese swordfish catch by North and South in the Pacific Ocean.

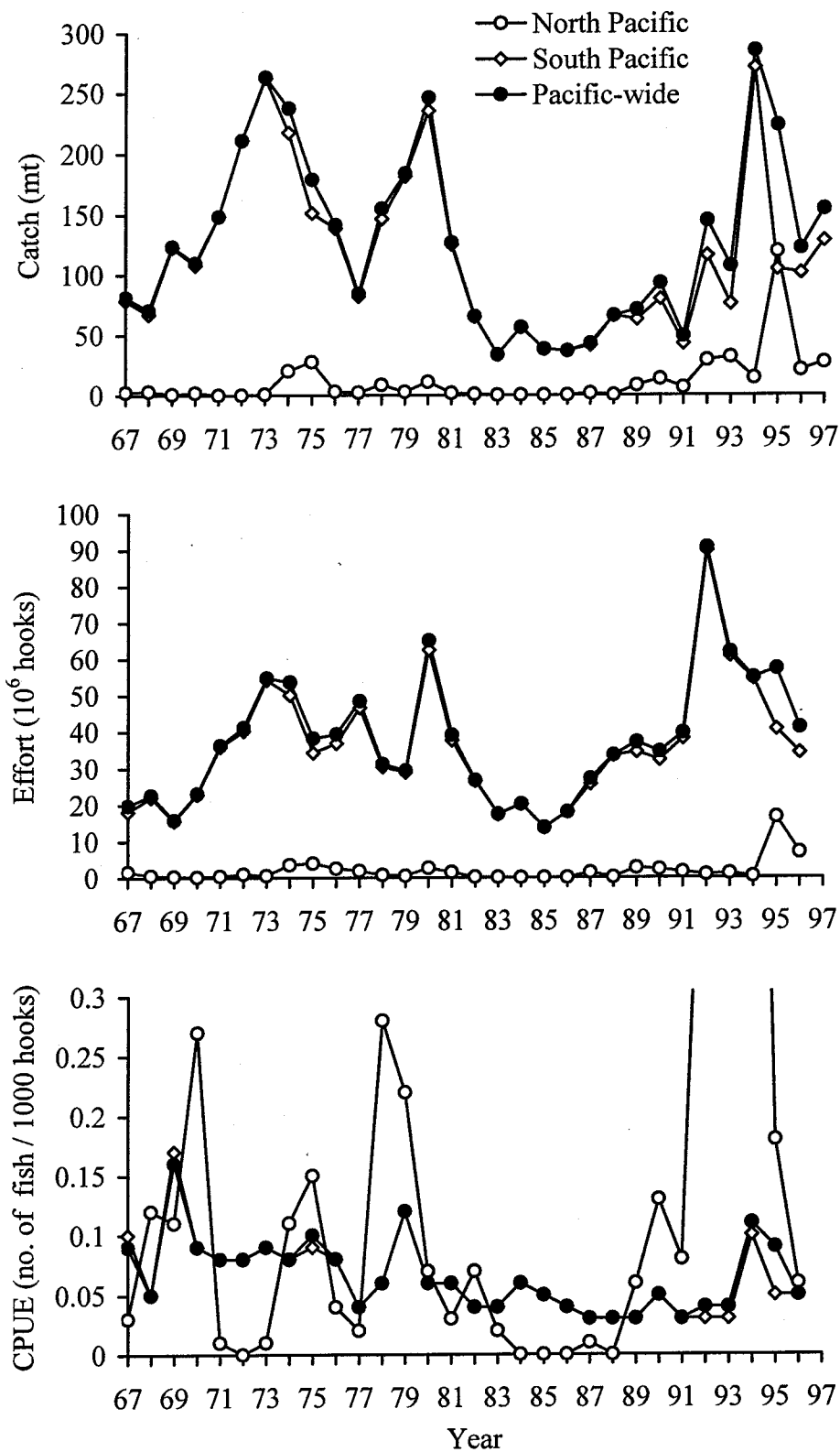


Figure 3. Swordfish catch, effort and CPUE of the Taiwanese distant-water tuna longline fishery in the western Pacific, 1967-1997.

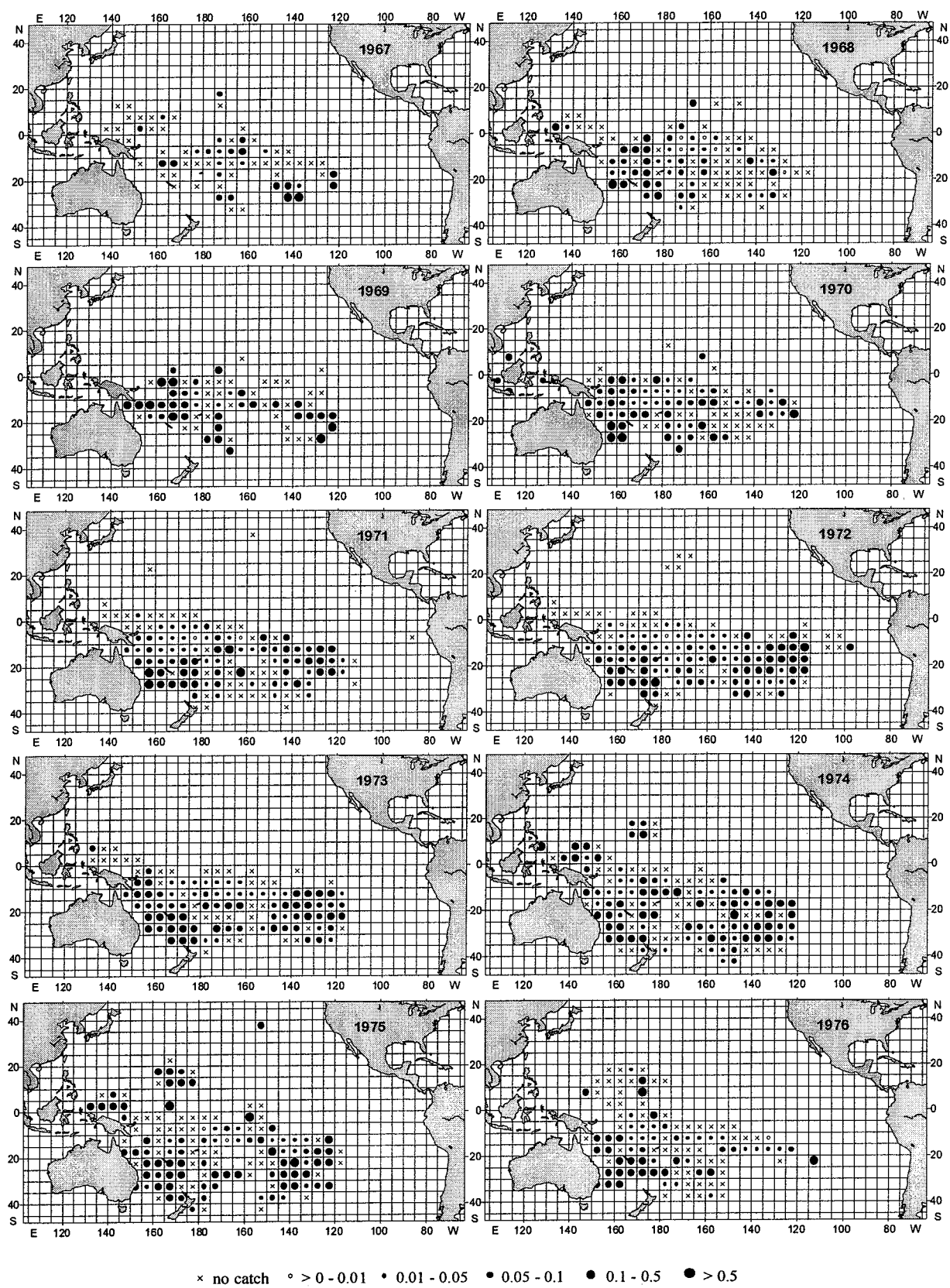


Fig. 4a. Distribution of the swordfish CPUE (number of fish per thousand hooks) of the Taiwanese distant-water tuna longline fishery in the Pacific Ocean, 1967-1976.



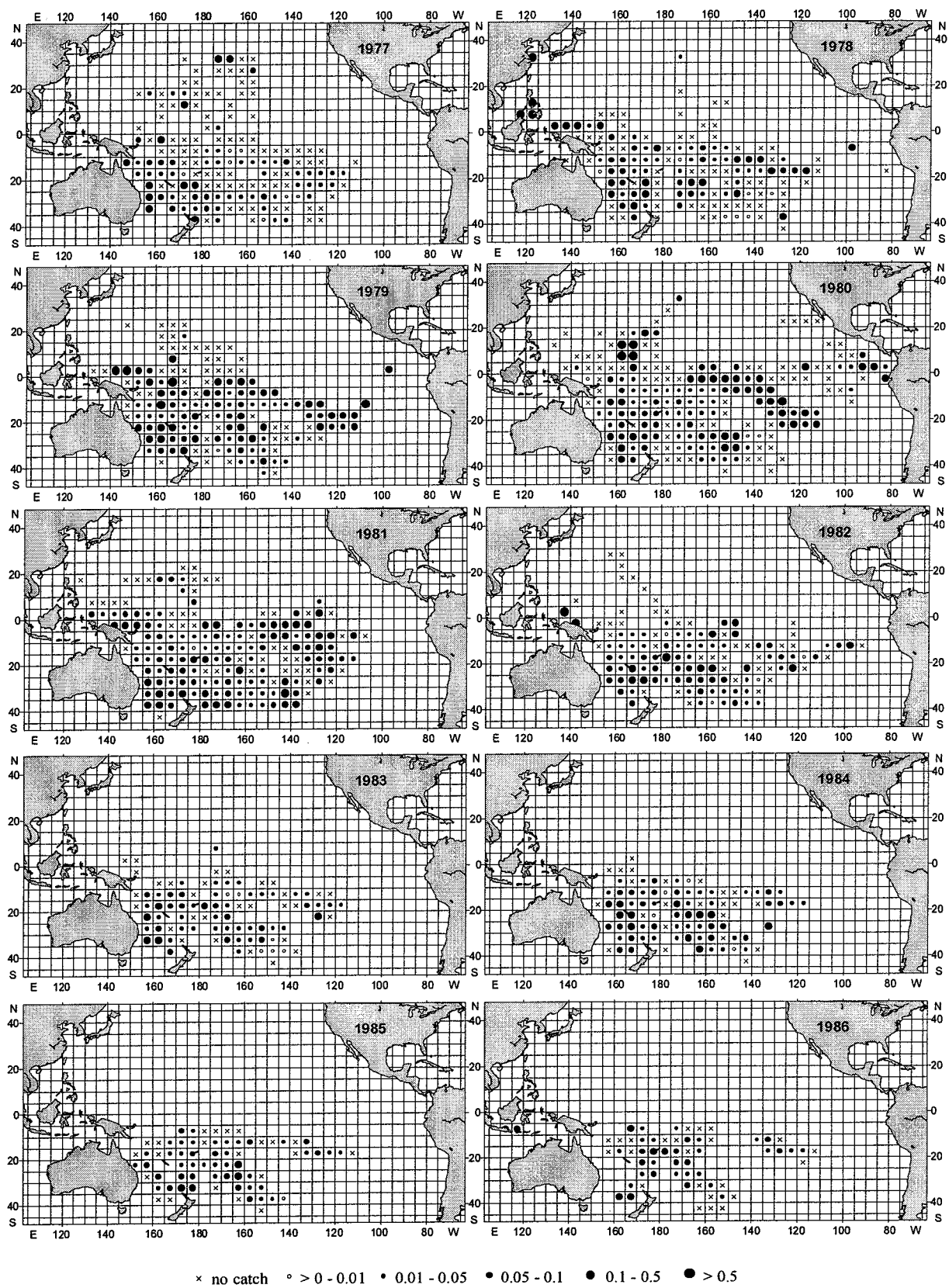


Fig. 4b. Distribution of the swordfish CPUE (number of fish per thousand hooks) of the Taiwanese distant-water tuna longline fishery in the Pacific Ocean, 1977-1986.

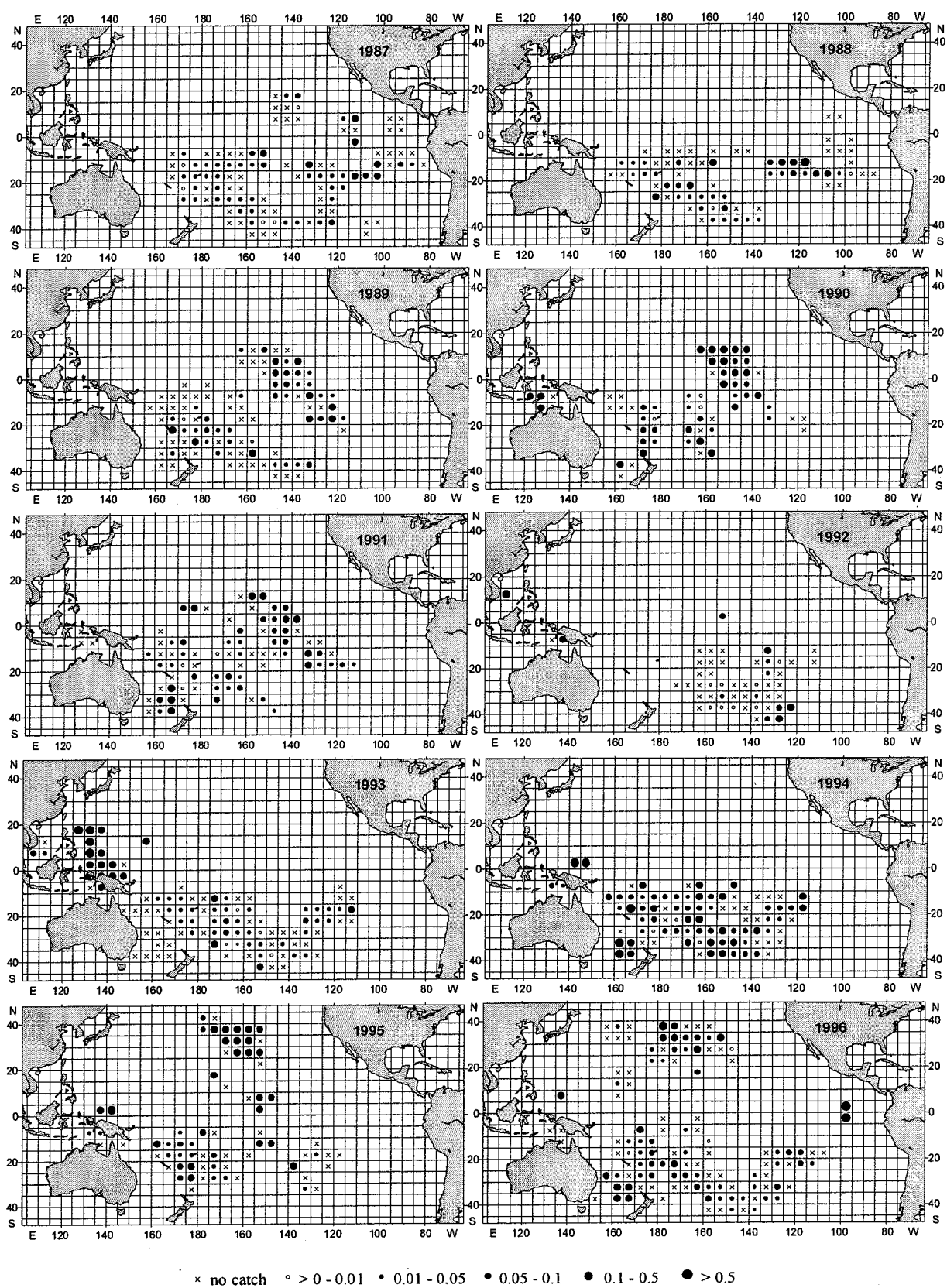


Fig. 4c. Distribution of the swordfish CPUE (number of fish per thousand hooks) of the Taiwanese distant-water tuna longline fishery in the Pacific Ocean, 1987-1996.

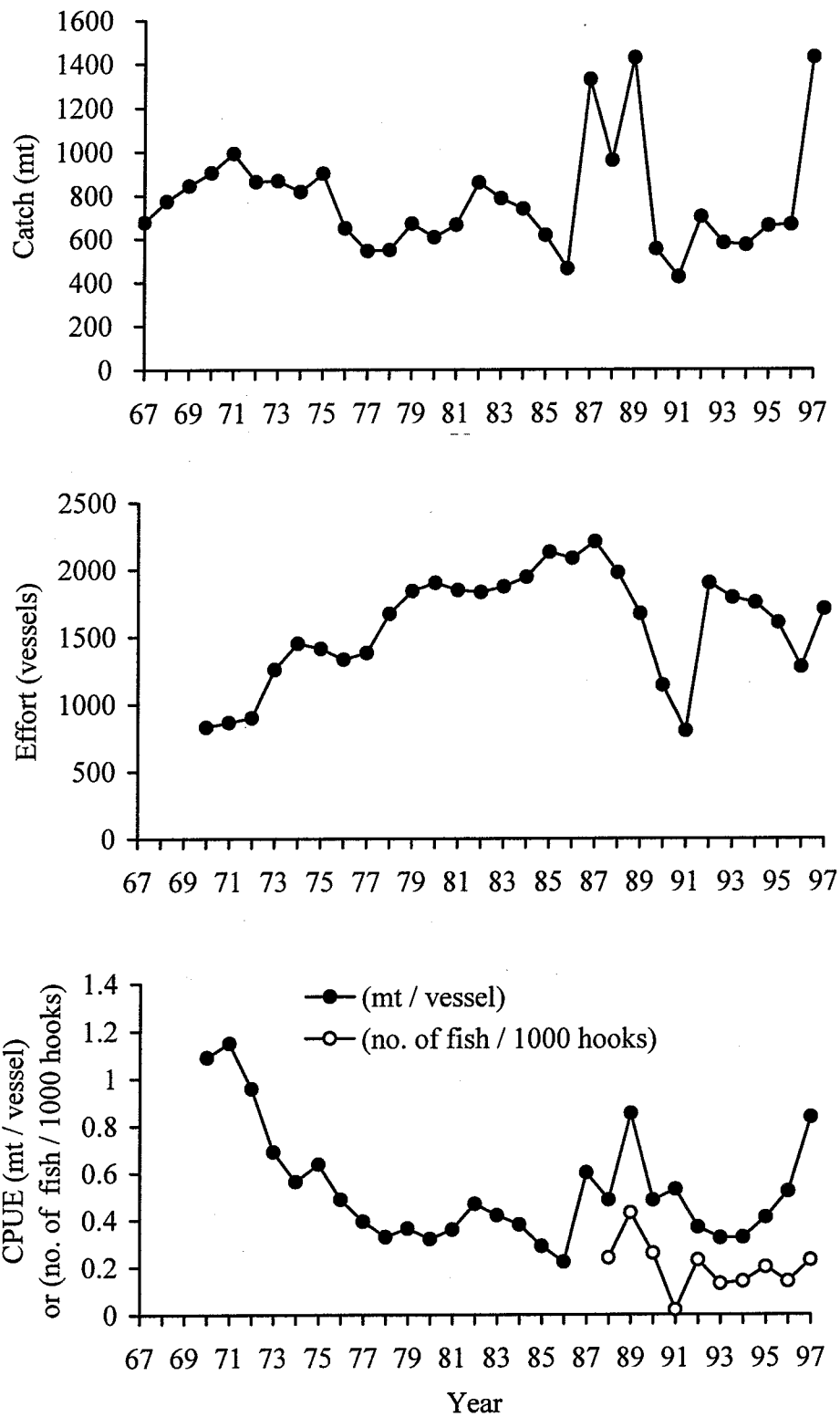


Figure 5. Swordfish catch, effort and CPUE of the Taiwanese offshore tuna longline fishery in the Pacific Ocean, 1967-1997.

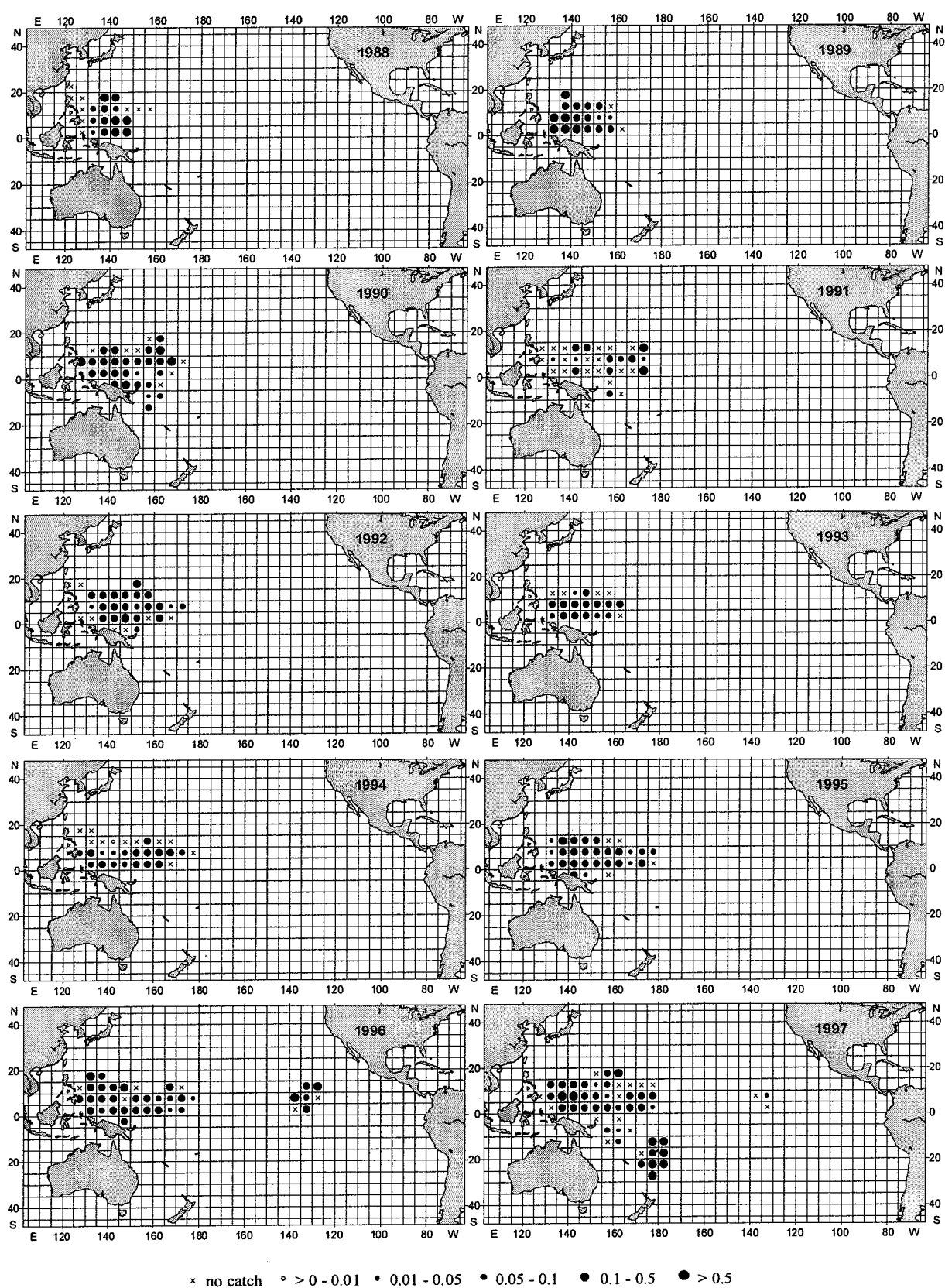


Fig. 6. Distribution of the swordfish CPUE (number of fish per thousand hooks) of the Taiwanese offshore tuna longline fishery in the Pacific Ocean, 1988-1997.

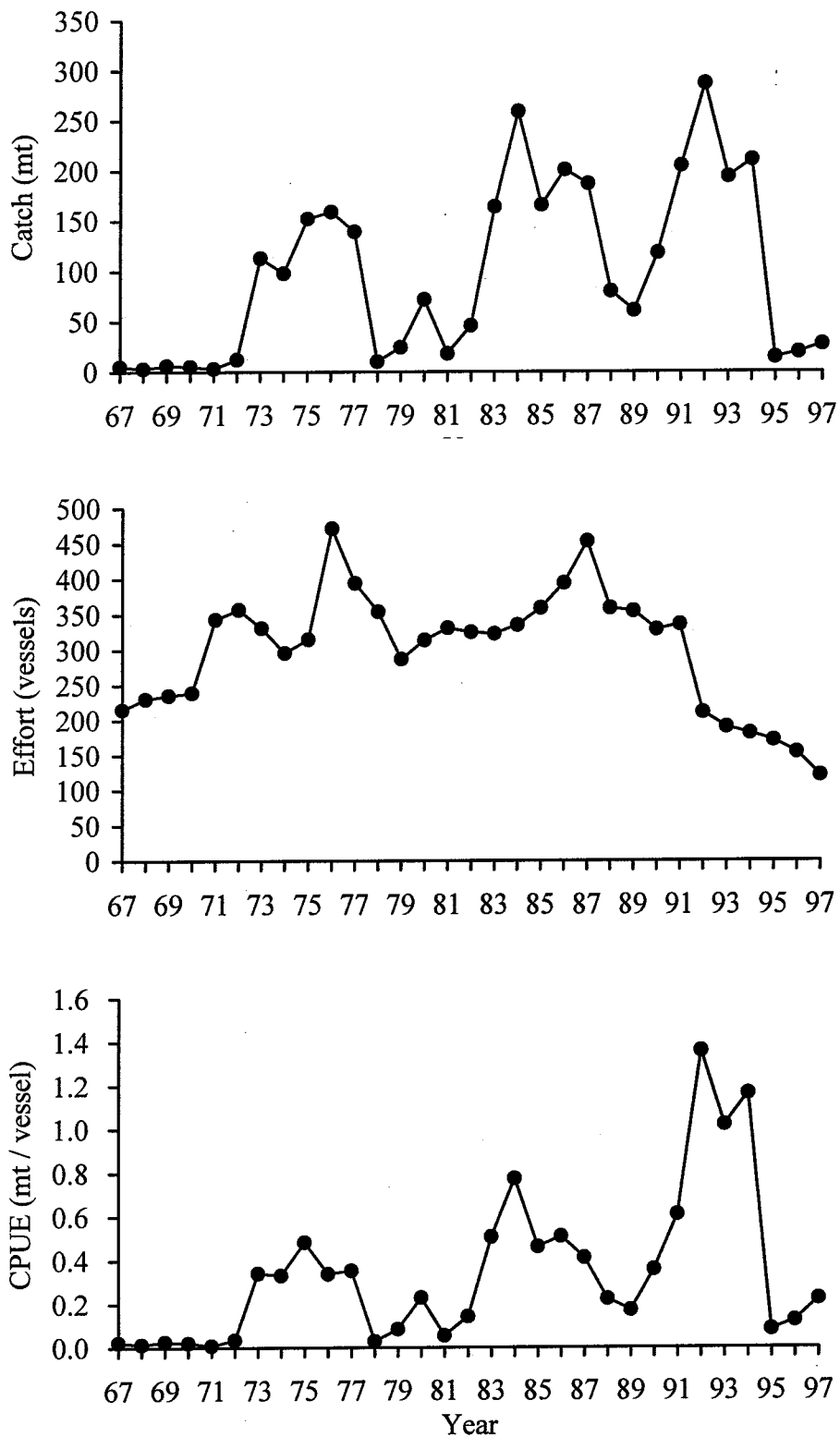


Figure 7. Swordfish catch, effort and CPUE of the Taiwanese harpoon fishery in the Pacific Ocean, 1967-1997.