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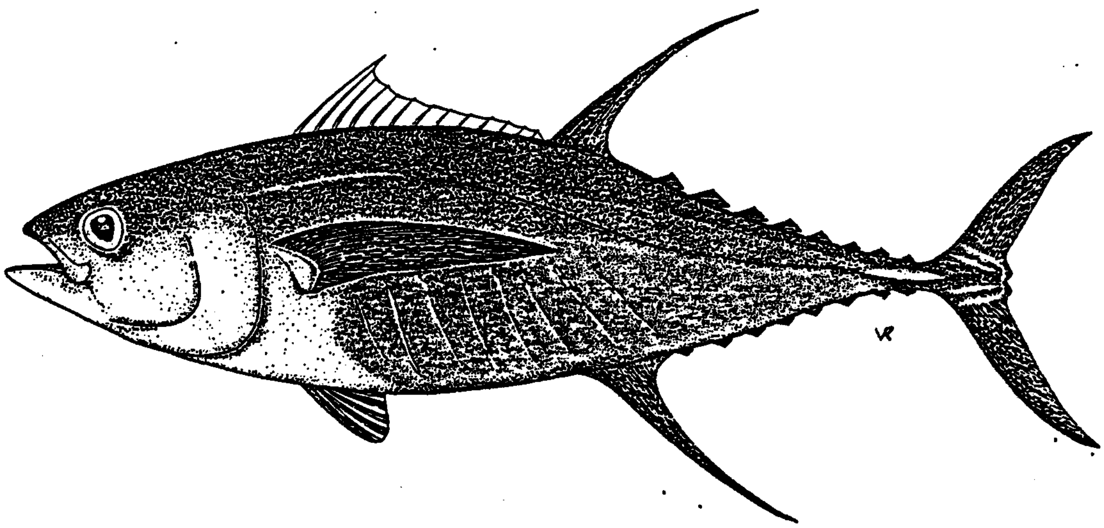
WORKING PAPER 12

STOCK STATUS OF SKIPJACK IN THE WESTERN TROPICAL PACIFIC



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1. INTRODUCTION

Skipjack tuna have a long history of exploitation in the Western Tropical Pacific (WTP), beginning in the 1920s as the target species of the long-range Japanese pole-and-line fishery. Various locally-based industrial pole-and-line fisheries have also targeted skipjack over the last 20 years, most notably in PNG, Solomon Islands, Fiji and Kiribati. In addition, skipjack is the principal tuna species taken by artisanal fishermen throughout the Pacific Islands region.

With increased fuel and labour costs during the 1970s and 1980s, long-range Japanese pole-and-line vessels have been steadily replaced by purse seiners, which began to move into the WTP in the late 1970s. An influx of US, Korean and Taiwanese seiners soon followed, and recently purse seiners from Philippines and Australian also joined the distant-water fleet. Including locally-based vessels in Solomon Islands, there are now at least 150 industrial purse seiners operating in the WTP. Skipjack is the principal target species of these fleets, with substantial quantities of yellowfin also taken.

In addition to the activities of distant-water fishing nations (DWFNs) and locally-based fleets, large catches of skipjack and other tuna and tuna-like species have occurred for many years in the waters of Philippines and Indonesia, both by industrial fleets and artisanal fishermen. While these areas are not normally thought of as part of the Pacific Islands region, it is almost certain that the tuna stocks of the WTP, particularly of the mobile species such as skipjack, yellowfin and bigeye, are continuous over the area from the Philippines and eastern Indonesia through at least Micronesia and Melanesia. This large diversity of fisheries and their distribution in numerous EEZ and high seas areas has made the task of compiling reliable catch statistics particularly difficult and would make the implementation of management measures, should they prove to be necessary, an even more challenging task.

The SPC's Skipjack Survey and Assessment Programme (SSAP) undertook an intensive study of the skipjack resource in the greater central and western Pacific through a large-scale tagging programme, carried out from 1978 to 1982. The resulting assessments of the skipjack resource and exploitation potential remain the only authoritative source of information that can be used as a guide for the orderly development of the fisheries.

The SSAP estimated the equilibrium standing stock of skipjack throughout the study area to be 3,000,000 mt, with a rate of attrition of 0.17 mo^{-1} (Kleiber *et al.* 1987). This implies a total throughput (or recruitment) of skipjack of 6,200,000 mt per year. It is clear that these population characteristics would allow much larger catches that those being taken at the time of the SSAP (about 260,000 mt per year). If one assumes that skipjack can sustain a fishing mortality rate equal to the natural mortality rate (i.e. a harvest ratio of 0.5), the potential yield from throughout the SSAP study area is approximately 3,000,000 mt per year.

It should be emphasised that this calculation assumes an even distribution of catch across the study area. In fact, most of the recent increase in skipjack catch has come from the area 10°N-10°S, 130°E-180°. While there are no concerns that the skipjack resource is approaching full exploitation in this area, it is appropriate at this stage to review the available fisheries data and develop a best estimate of the current status of the resource.

2. ESTIMATES OF TOTAL CATCH

Skipjack are caught in the WTP by purse seine and pole-and-line fleets of DWFN and Pacific Island countries, by ringnet and purse seine in the Philippines, and by pole-and-line in eastern Indonesia. Estimates of skipjack catch by these fisheries are shown in Table 1.

The pole-and-line and purse seine fisheries in the Pacific Islands region (WTP excluding Philippines and Indonesia) are directed primarily at skipjack. Prior to 1980, almost all of the skipjack catch in this area was taken by the Japanese distant-water pole-and-line fleet and pole-and-line fleets based in PNG, Solomon Islands and Fiji. Since 1980, the PNG fishery has been discontinued and the Japanese pole-and-line fleet greatly reduced, both for economic reasons. All of the increase in skipjack catch since 1980 has been due to the increase in purse seine fishing. The 1988 catch, estimated to be 514,000 mt, is the largest so far recorded in the Pacific Islands region.

Large catches of skipjack in Philippines and Indonesia were first recorded in the mid-1970s, although the magnitude of catches prior to this time is not clear from the available statistics. The combined skipjack catch of the two countries was around 80,000 mt during the latter half of the 1970s, and increased in the 1980s. The combined catch in recent years has exceeded 150,000 mt. Small skipjack, many as small as 20 cm, dominate the catch in both countries, with both the purse seine and ringnet fisheries in Philippines and the pole-and-line fishery in Indonesia being based on FADs moored in coastal waters.

The catch from the total WTP has increased steadily throughout the 1980s, and has exceeded 500,000 mt in each of the last three years. SSAP results suggested that a fully exploited skipjack fishery (again assuming a harvest ratio of 0.5) in the area 10°N-10°S, 130°E-180° could support catches of over 1,000,000 mt (calculated by combining the separate estimates for Palau, FSM, Marshall Islands, PNG and Solomon Islands). On this basis, we might expect that there is considerably more room for expansion of skipjack catches in this area. There are two qualifications to this conclusion that must be born in mind. First, the SSAP was carried out at a time when the skipjack fisheries of the region were quite different to what they are today. The results of the SSAP can only be extrapolated if no fundamental changes in the skipjack population (average level of recruitment, natural mortality rate, growth, etc) have resulted from the changes in the fishery. Fortunately, the Regional Tuna Tagging Project (RTTP) will allow a timely reassessment of the skipjack resource and will indicate whether or not such changes in the population have taken place. The second qualification is that expansion of skipjack catches may affect fisheries in other areas if a substantial fraction of their throughput (recruitment) originates from the area of increased catch. This is a classical fisheries interaction problem that is best addressed by modelling the movement and other characteristics of a tagged population. Such a study has not yet been undertaken because the fisheries data required to complement the SSAP tagging data have not been available to date. A collaborative study to address this problem has been proposed.

3. TRENDS IN ABUNDANCE INFERRED FROM CPUE

Some indication of the present status of the skipjack stock can be obtained by examining the time series of CPUE from the fisheries for which data coverage is reasonably good. CPUE for the Japanese distant-water pole-and-line fishery was stable until the early 1980s, after which the trend has been increasing (Figure 1). This probably results from the smaller, less efficient vessels being retired from the fishery with the onset of large-scale purse seining. The very large CPUEs in 1988 and 1989 might have resulted from a series of strong year classes or favourable environmental conditions for pole-and-line fishing.

Figure 2 gives the time series of CPUE for Japanese purse seiners fishing in the WTP and an abundance index that is corrected for changes in the spatial and temporal distribution of the fishery. In principal, the latter should provide a more accurate indication of apparent abundance than raw CPUE. In fact, the time series are very similar and suggest increasing apparent abundance up to 1989.

It should be emphasised that these time series are indicators of *apparent* abundance, i.e. the abundance of that portion of the stock that was available to the pole-and-line and purse seine fisheries in their areas of operation. In particular, no allowance has been made here for the effect of variations in environmental factors that are known to affect the success of pole-and-line and purse seine fishing, although such a study is currently in progress.

Technological advances in purse seining in particular that might result in an increase in CPUE (and hence apparent abundance) over time have not been specifically accounted for. For example, the increasing proficiency in the capture of free-swimming schools (as opposed to schools aggregated under logs, FADs or other attractors) could have been partly responsible for the increasing trend in purse seine CPUE. However, the effect of technological advance has probably been minimised to some extent in Figure 2 by only considering data from the Japanese fleet, which has operated predominantly 500 GRT purse seiners since the beginning of the fishery. Analyses of the data that specifically account for technological advance are in progress.

4. CURRENT STATUS OF THE STOCK

There is no evidence from CPUE trends that the standing stock of skipjack has been substantially reduced by the expansion of the purse seine fishery over the past decade, although it must be said that a minor reduction might be obscured by technological advances in the fisheries. Regardless, the current total catch appears to be well within safe bounds if the results of the SSAP are taken as a guide. Further increases in skipjack catch from the WTP could be sustained.

5. SKIPJACK FISHERY INTERACTION

The SSAP demonstrated that skipjack are capable of making substantial migrations, however because of other population characteristics, in particular the high rate of natural mortality, and the relatively low intensity of the fisheries operating at the time, it was concluded that there was little potential for interaction between widely separated fisheries. However, several instances of strong interaction were detected for neighbouring countries, e.g. FSM-Marshall Islands, Northern Mariana Islands-Marshall Islands and FSM-Northern Mariana Islands. Such potential interactions should be born in mind when contemplating increases in catch.

With the current distribution of skipjack fisheries, the largest potential interactions may be between the Philippines-Indonesian fishery and the distant-water fishery immediately to the east, and between the distant-water fishery and the Solomon Islands fishery. At present levels of fishing, there is no empirical evidence that such interactions are currently significant. It is anticipated that the RTTP, which is in the process of tagging large numbers of skipjack in all three areas, will provide a means of addressing specific interaction questions through the elucidation of movement patterns and other population characteristics of skipjack. A proposal for the further development of techniques for the analyses of these and the previous SSAP data has been prepared for the consideration of this meeting.

6. IMPLICATIONS FOR MANAGEMENT

The major conclusion of this review is that skipjack is currently under-exploited in the WTP, and that fisheries management for the purpose of skipjack conservation is not necessary. Economic considerations will probably be of overriding importance for the management of skipjack fisheries in the foreseeable future. However, all the skipjack fisheries of the WTP catch yellowfin to some extent, and the possibility of future management for the purpose of yellowfin conservation cannot be ruled out. Such management could well have an impact on skipjack catches; one of the key questions in the future might relate to the minimisation of such impacts.

7. SUMMARY

(i) Skipjack are caught in the WTP by purse seine and pole-and-line fleets of DWFN and Pacific Island countries, by ringnet and purse seine in the Philippines, and by pole-and-line in eastern Indonesia. In recent years, the total catch has been about 560,000-660,000 mt.

(ii) The results of the SSAP suggested that the skipjack resource in the Pacific Islands region is large and capable of supporting a catch throughout this region possibly as high as 3,000,000 mt per year. In the area currently occupied by the major fisheries, catches of the order of 1,000,000 mt per year might be sustained under certain conditions. The RTTP will provide a timely reassessment of skipjack resource potential in this region.

(iii) The CPUE trends in the Japanese pole-and-line and purse seine fisheries have generally been stable or increasing. There is no evidence of decline in skipjack standing stock as a result of activities of the fisheries.

(iv) There is no empirical evidence of significant interaction between the Philippines-Indonesian fishery, the distant-water fishery immediately to the east and the Solomon Islands fishery. Such interactions might become apparent under conditions of increased exploitation. Interactions on more localised scales have been demonstrated by the SSAP. A more thorough treatment of this topic is planned through the development of a generalised movement model for skipjack in the WTP.

REFERENCES

Kleiber, P., A. W. Argue and R. E. Kearney. 1987. Assessment of Pacific skipjack tuna (*Katsuwonus pelamis*) resources by estimating standing stock and components of population turnover from tagging data. *Can. J. Fish. Aquat. Sci.* **44**:1122-1134.

TABLE 1 Estimates of total skipjack tuna catches (mt x 10^3) for the Western Tropical Pacific.

Year	Pacific Islands	Indonesia/ Philippines	Total WTP
1970	54	1	55
1971	105	1	106
1972	101	20	121
1973	150	26	175
1974	256	53	309
1975	159	55	214
1976	221	55	276
1977	217	81	299
1978	299	79	378
1979	233	81	314
1980	253	75	328
1981	264	89	353
1982	245	101	345
1983	369	121	491
1984	406	109	514
1985	359	137	496
1986	435	151	586
1987	396	164	560
1988	514	150	664

FIGURE 1 **Trend in Western Pacific skipjack tuna abundance in the area 10°N-10°S, 130°E-180° indicated by raw Japanese pole-and-line CPUE. Source: 1972-1979 Japan Fishery Agency statistics; 1980-1989 Regional Tuna Fisheries Database.**

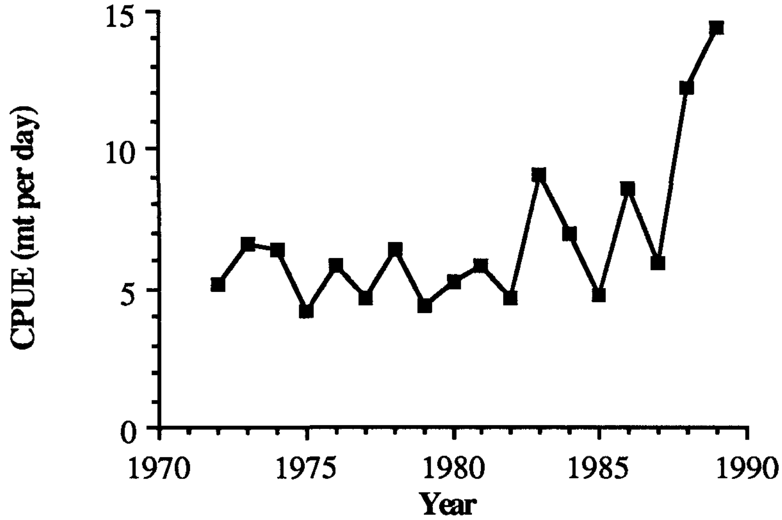

FIGURE 2 **Trend in Western Pacific skipjack tuna abundance in the area 10°N-10°S, 130°E-180° indicated by raw Japanese purse seine CPUE and an abundance index that accounts for changes in the temporal and spatial distribution of fishing. Source: Regional Tuna Fisheries Database.**