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Interaction Among South Pacific Skipjack Fisheries

(Paper Prepared by the Secretariat)

Introduction

1. Pole-and-line and purse seine catches of skipjack in the SPC area increased from an insignificant amount in the early 1960s to approximately 220,000 tonnes in the early 1980s (Kleiber *et al.* 1983). Since then, there have been further increases in catch, mainly due to a large expansion of purse seine fishing in the western Pacific. An estimate of the 1987 skipjack catch in the SPC area is approximately 360,000 tonnes, 68% of which was produced by the purse seine fishery (SPC/Fisheries 20/WP.10). The advent of large-scale purse seining has also seen catches of yellowfin by surface gears increase from a small amount in the late 1970s to approximately 140,000 tonnes (97% by purse seining) in 1987.

2. Rapid development of the purse seine fishery has raised some concerns regarding the potential for interactions among the various interest groups involved in tuna fishing in the SPC area. Interest groups can be defined on the basis of scale of operation (subsistence, artisanal, local industrial and large-scale distant water fleets), type of fishing (pole-and-line, purse seine and longline) or geographic area (typically national EEZs).

3. A major objective of the Skipjack Survey and Assessment Programme (SSAP) was to assess the potential for interaction among skipjack fisheries in the SPC area. Between October 1977 and August 1980, approximately 140,000 skipjack were tagged throughout the area, and of these, over 6,000 were recaptured and reported to SPC. Most of the analyses of interaction carried out to date using these data have concentrated on between-country interactions. This is partly because international interaction was considered the most important issue at the time, and also because the necessary catch and effort data that were available (provided to countries under access agreements or generated by locally based fleets) were most appropriate for this type of analysis.

4. In this paper, a brief summary of the findings of the SSAP with regards skipjack fishery interaction is presented.

Factors controlling interaction

5. When two fisheries operate on the same stock, such as purse seine and pole-and-line fleets fishing surface schools in the same place at the same time, the interaction - or more accurately, competition - is direct and immediate; what one boat catches is no longer available to the other boats. Such direct competition is unusual in the western Pacific; the subsistence, artisanal, pole-and-line and purse seine fleets usually operate in spatially distinct areas, sometimes only a few kilometers apart, but more often hundreds of kilometers apart. In such cases, the effects of interaction are indirect and the analysis of the problem is more difficult.

6. In general, the effects and intensity of interaction between two fisheries depend on a number of factors.

7. ***Distance between fisheries.*** Distance is the most obvious factor that mediates interaction. If fishing grounds are large or widely separated, interaction between fisheries operating in them will be small. If we are concerned about the interaction between countries, the countries with large EEZs, such as Federated States of Micronesia, Kiribati and French Polynesia, would have less to be worried about than countries with smaller EEZs, such as Western Samoa and Wallis and Futuna. The first major surface tuna fisheries that developed (eastern Pacific and eastern Atlantic) both began in locations with very small EEZs, and the inter-country interaction is probably substantial. The EEZs in the western Pacific are very large, and inter-country interactions, at least with respect to skipjack, may be less important than in other areas of the world.

8. ***Movement rates.*** If fish are stationary, interaction between fisheries in separate areas will not occur. The traditional view of skipjack as highly migratory, moving rapidly from country to country suggests that movement rates are high. However, SSAP results suggest that long distance migrations by skipjack are relatively rare; only 17% of all recoveries were recaptured more than 200 miles from their release sites. As we shall see below, the degree of movement in relation to the distance between fisheries will greatly affect how strongly two fisheries interact.

9. ***Natural mortality rate.*** A more subtle factor that affects the intensity of interaction is the natural mortality rate. If individuals are dying at a high rate, few will live long enough to move from one country to another, and consequently interaction will be less than if natural mortality were low. Therefore, all other things being equal, we would expect skipjack fisheries to interact less than yellowfin fisheries simply because skipjack appear to have a higher natural mortality rate.

10. ***Intensity of fisheries.*** The final factor affecting interaction will be the intensity of the fisheries. Large fisheries have a larger impact and are in turn more severely affected than small fisheries.

Interaction between countries

11. Every SSAP Final Country Report contained a section on the potential for interaction between pole-and-line fisheries for skipjack in different countries. These evaluations were based on the number of tagged skipjack caught in one country that were released in another. The results were summarised in TBAP Technical Report No. 12 (Kleiber *et al.* 1984) and were expressed as the proportion of total throughput in a receiver country that is derived from immigration from a donor country (Table 1).

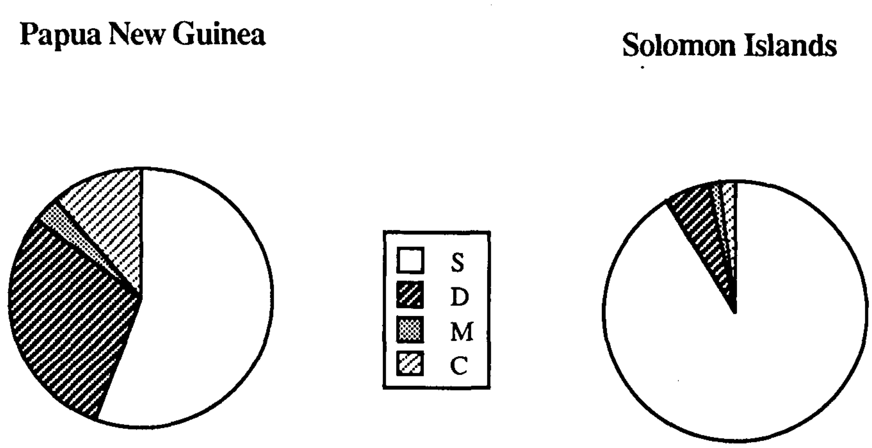
Table 1. Coefficients of interaction between fisheries operating in various countries and territories in the central and western Pacific. Receiver countries are listed across the top of the table and donor countries down the left margin. From Kleiber *et al.* 1984.

to →	Papua New Guinea (PNG)	Solomon Islands (SOL)	Palau (PAL)	Federated States of Micronesia (FSM)	Marshall Islands (MAS)	Northern Mariana Islands (MAR)	Fiji (FIJ)	New Zealand (ZEA)	Western Samoa (WES)	French Polynesia (SOC)
PNG	-	2.6	0.8	1.4	0.5					
SOL 1977	1.1	-								
SOL 1980	3.7	-								
PAL 1978			-	8.6	2.2					
PAL 1980	1.6	0.4	-	3.5	1.3	0.7				
FSM	0.7	0.9		-	37.0	10.8				
MAS					-					
MAR				17.4		-				
FIJ 1978							-	0.6		
ZEA							6.5	-	2.1	3.6
KIR				<0.1	0.1					

12. Most of the coefficients are low, indicating that under conditions prevailing when these data were gathered, there was generally little potential for fishery interaction. Most cases of significant exchange occurred between adjacent countries. In particular, the results suggested that 37% of throughput in the Marshall Islands fishery at the time of tagging resulted from immigration from Federated States of Micronesia. Relatively high exchange rates were also observed for Northern Mariana Islands - Federated States of Micronesia and to a lesser extent Palau - Federated States of Micronesia and Papua New Guinea - Solomon Islands, indicating some potential for fishery interaction between these countries. The only case of a relatively high rate of exchange between widely separated areas is that due to migration from New Zealand to Fiji, however this may have been an artifact of the timing of tag releases into the highly seasonal New Zealand fishery (Argue and Kearney 1983).

13. This is a relatively simple method that does not explicitly specify the factors controlling the level of interaction discussed above. These factors were incorporated in a more rigorous method to estimate interaction between countries in TBAP Technical Report No. 13 (Sibert 1984). The method was applied specifically to interaction between Papua New Guinea and Solomon Islands, since these countries had substantial locally-based pole-and-line fisheries from which detailed catch and effort data were available. Figure 1 shows the estimated exchange rates, losses from natural mortality and movement to other fisheries, the proportion that stay resident and live and the proportion that are locally caught on a monthly basis. The Solomon Islands skipjack stock is relatively stable with a low rate of natural mortality and emigration (resulting in high survival) and small exchange with Papua New Guinea. The Papua New Guinea stock (those skipjack available to the domestic pole-and-line fishery in the early 1980s) is more dynamic with a higher rate of natural mortality and emigration (lower survival), but with a small exchange with the Solomon Islands. The levels of exchange are consistent with the results given in Table 1.

Figure 1. Relative proportions of tagged skipjack released in Papua New Guinea and Solomon Islands that survive without migrating (S), disappear for unknown reasons (D), migrate to the other country (M) and are caught in the fishery of release (C) each month. From results given in Sibert (1984).



Conclusions

14. The results of the SSAP would suggest that interaction between skipjack fisheries in different countries in the western Pacific will not be severe, however a possible exception to this could be in the Federated States of Micronesia - Marshall Islands - Northern Mariana Islands area. It must be stressed that conditions in the fishery have changed enormously since these tagging experiments were carried out. The development of large-scale purse seining has seen a large increase in skipjack catch, and the distribution and intensity of the current fishery is vastly different from the pole-and-line fishery of the late 1970s. The upcoming Regional Tuna Tagging Project will provide an ideal opportunity to gather data on skipjack movement and mortality under current fishing conditions.

15. The results of the SSAP constitute one of the world's major tuna tagging data bases. These results have been well analysed in the context for which they were originally gathered - the assessment of regional skipjack stocks. However, the definitive analysis of these data, particularly with respect to movement and interaction, is impossible without accurate information on the fisheries in operation during the period that the tagged fish were at liberty. A collaborative analysis of tagging and fishery data could shed new light on these questions.

References

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