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ANALYSIS OF ISYP SKIPJACK TAGGING RESULTS USING THE METHODS OF THE SOUTH PACIFIC COMMISSION SKIPJACK PROGRAMME

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SUMMARY

Skipjack tag returns from releases by Japanese vessels during 1981 between latitudes 5 degress north and 5 degrees south in the Atlantic Ocean were analyzed by the methods employed by the South Pacific Commission for skipjack tagged in the central and western Pacific. The results are not significantly different from those presented at the 1983 meeting of the International Skipjack Year Program. The conclusions from both sets of results are that only moderate harvest occurs at present, and there is a potential for increased harvest.

RESUME

Les retours de marques de listao posées par les bateaux japonais dans l'Atlantique en 1981 entre 5ºN et 5ºS de latitude, ont été analysés en utilisant les méthodes employées par la Commission du Pacifique sud pour le listao marqué dans le Pacifique central et occidental. Les résultats ne diffèrent pas sensiblement de ceux qui ont été présentés à la réunion de 1983 du programme d'Année internationale du listao. Les conclusions fournies par les deux jeux de résultats sont que l'exploitation actuelle est modérée et qu'il existe un potentiel de production accrue.

RESUMEN

Con los mismos métodos empleados por la Comisión del Pacífico Sur con el listado marcado en el Pacífico occidental y central, se analizaron las recuperaciones de listados marcados por barcos japoneses durante el año 1981 entre las latitudes 5ºN y 5ºS en el Atlántico. Los resultados no difieren mucho de los presentados en la Conferencia Listado (1983). En ambas conclusiones se señala que actualmente se obtiene una captura moderada y que el potencial permite un incremento.

INTRODUCTION

The International Skipjack Year Program (ISYP) of the International Commission for the Conservation of Atlantic Tuna (ICCAT) carried out a skipjack tagging program in the Atlantic Ocean. Bard (1983) estimated various components of population turnover from the ISYP tag return data in order to assess the state of skipjack stocks in the Atlantic. At about the same time, a skipjack tagging program was also conducted in the central and western Pacific by the South Pacific Commission (SPC) (Kearney 1983), and a similar set of parameters was estimated (Kleiber, Argue, and Kearney 1983).

Though the situations of the two tagging experiments were somewhat different, we were interested in re-analyzing the ISYP tag data using the SPC methodology. The parameters estimated by the SPC method of analysis are as follows (defined more fully by Kleiber et al. 1983):

Attrition rate, the proportion of the stock which is lost per unit time due to all causes. This is an instantaneous rate. If steady state conditions prevail, this is also the rate of renewal of stock.

Fishing mortality, the proportion of stock harvested per unit time, also an instantaneous rate.

Harvest ratio, the ratio of fishing mortality to total attrition.

Standing stock, the number or tonnage of fish at large which are vulnerable to the fishery.

Throughput, the product of attrition rate and standing stock.

COMPUTATIONAL PROCEDURES

The analyses reported here employed two of the computer programs which were developed by the SPC's Tuna and Billfish Assessment Programme and were kindly supplied to the Southwest Fisheries Center (SWFC). The analytical model is an exponential decay type model which predicts the rate at which tags are returned as a function of time following tagging. Various forms of this model are fitted to observed tag return data by an iterative least squares technique (Kleiber et al. 1983).

INPUT DATA

Tag Releases and Returns

Tag release and recovery information was extracted from ICCAT data tapes for tags released in 1981 by Japanese vessels between the latitudes 5°N to 5°S. Recoveries were sorted into time-at-large categories defined by 30-day intervals (Table 1, column 2). An analogous compilation of ISYP tag data reported by Bard (1983) gave a greater number of returns in every time-at-large category than were found by us (Table 1). Presumably Bard included tag returns that had not been reported to ICCAT headquarters. Both data sets, the returns extracted by us (SWFC) and those reported by Bard, were run through the SPC analysis.

We counted 6,923 releases by Japanese vessels in 1981 between 5°N and 5°S. Bard (1983) reported 7,000 such releases. We assumed a value of 7,000 for these analyses.

Other Input Data

In addition to the tag returns, other input data are required for the SPC analysis.

The "type 1" tag retention and survivorship value is a factor which measures the retention of tags for a short time following tagging and indicates the short term ability of skipjack to survive the tagging experience. This factor was assumed by Bard (1983) to be 0.6, in reality a minimum value based on its supporting evidence (maximum return rate for a single school). On the assumption that ISYP fish were tagged with the same care as those tagged by the SPC, a higher value of 0.9 was utilized. This was

the value used by Kleiber et al. (1983) and justified by Kearney (1983) on the basis of an experiment in which captive skipjack were tagged and observed for one month.

The rate of type 2 (long term) tag losses (proportion lost per unit time) was assumed to be .0073 per month, also the value used by Kleiber et al. (1983) and justified on the basis of a double tagging experiment.

Bard's estimate of 0.8 (1981 data) was utilized for the reporting efficiency (proportion of recaptured tags which are actually reported). It was unclear whether this figure included the effect of unusable tag returns (i.e., those with unknown date or position of recapture). If those were not included, then the standing stock and throughput estimates reported below would be biased upward by approximately 20%, and the fishing mortality and harvest ratio biased downward by the same factor. The attrition rate would be unaffected.

The equivalent of the SPC aggregate analysis is reported here for the ISYP data. This means that the only catch data needed was an average monthly figure. Table 10 in Bard (1983) gives monthly catch data (presumably surface fisheries) for the 5°N to 5°S zone. The average for July 1981 through March 1982 (5,800 tonnes per month) was used.

RESULTS AND DISCUSSION

Five of the quantities estimated with the SPC computer programs are given in Table 2 for ISYP tag returns compiled by us and by Bard (1983). Estimates from Bard's own calculations are also given in Table 2 for the attrition rate, fishing mortality, and harvest ratio.

The differences between Bard's calculations and the SPC analysis of his data can be explained by the difference in the assumed factor for type 1 tag retention and survivorship (0.6 in Bard's analysis and 0.9 in the SPC analysis). There was little difference between the SPC type analysis of Bard's data and the same analysis of the tag data available to the SWFC. The 95% confidence ranges overlap for three of the five quantities and are close in the other two. Note that these 95% confidence ranges do not take full account of all possibilities of variability (Kleiber et al., 1983) and are therefore minimum estimates.

CONCLUSIONS

Our analyses of the ISYP tag returns yield similar results to those reported by Bard (1983). The numerical differences are mostly due to a different assumed value for type 1 tag retention and survivorship. The essential conclusions are the same, namely, that the skipjack stocks in the Atlantic are only moderately harvested and could likely support a considerable increase in fishing pressure.

LITERATURE CITED

Bard, F. X. 1983. Analyse des taux de décroissance des listaos marqués en Atlantic Est. ISYP Manuscript.

Kearney, R. E. 1983. Assessment of the skipjack and baitfish resources in the central and western tropical Pacific Ocean: A summary of the Skipjack Survey and Assessment Programme. South Pacific Commission, Noumea, New Caledonia, 37 pp.

Kleiber, P., A. W. Argue, and R. E. Kearney. 1983. Assessment of skipjack (Katsuwonus pelamis) resources in the central and western Pacific by estimating standing stock and components of population turnover from tagging data. Tuna and Billfish Assessment Programme Technical Report No. 8, South Pacific Commission, Noumea, New Caledonia.

Table 1. Tag return data employed in analyses. The first column gives the boundaries of the time-at-large categories in units of 30 days. The second column gives the number of tag returns discovered on the ICCAT data tape sent to SWFC, and the third column gives the number of tag returns reported by Bard (1983). All returns are from releases by Japanese vessels in 1981.

Time at Large	TAG RETURNS SWFC	BARD
0-1	111	153
1-2	77	106
2-3	72	97
3-4	35	64
4-5	32	50
5-6	49	64
6-7	44	45
7-8	8	15
8-9	4	10
9-10	5	17
10-11	3	22
11-12	4	10
12-13	3	9
13-14	0	4
14-15	3	7
15-16	2	9
16-17	0	1
17-18	0	2
18-19	0	1
19-20	0	2
20-21	0	1

Table 2. The first two columns are the results of SPC tag analysis on ISYP returns of releases in 1981 by Japanese vessels between 5°N and 5°S. The 95% confidence limits are in brackets. Results reported by Bard (1983) are in the third column.

	SWFC data	Bard data	Bard's analysis
total attrition (month^{-1})	.31 [.24 - .40]	.23 [.20 - .28]	.21
fishing mort (month^{-1})	.028 [.019 - .039]	.033 [.026 - .041]	.045
harvest ratio (tonnes)	.088 [.068 - .112]	.14 [.12 - .16]	.21
standing stock (tonnes)	210K [150K - 300K]	180K [140K - 220K]	
throughput (tonnes/month)	66K [52K - 86K]	42K [36K - 49K]	