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A PROPOSAL FOR A SKIPJACK SURVEY AND ASSESSMENT PROGRAMME
IN THE CENTRAL AND WESTERN EQUATORIAL PACIFIC OCEAN

Expert Committee on Tropical Skipjack
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South Pacific Commission
Noumea, New Caledonia

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I. INTRODUCTION

1. Catches of skipjack tuna (Katsuwonus pelamis) already account for more of the world's total tuna landings than any other single species. Skipjack is the only species, marketed as light meat tuna, which is considered to be appreciably underexploited; estimates of future yields from the Pacific as high as 1,000,000 tonnes have been projected (Otsu 1974). The significance of skipjack in any consideration of the world's tuna resources is therefore obvious. Unfortunately the dominance of tuna landings by skipjack has not been paralleled by equivalent research effort; the result is that much less is known about skipjack than many tuna species of less economic significance.
2. Most of the increase in skipjack landings since 1970 has been a result of rapid expansion of fisheries in the Western Pacific Ocean. The total skipjack catch from the region has increased from approximately 250,000 tonnes in 1970 to about 400,000 tonnes in 1973; this increase is largely due to a substantial expansion in the geographical distribution of the Japanese southern water skipjack pole and line fleet.
3. The developing nations of the region have increased their efforts to develop expert fishing industries as foreign exchange earners. The success of the skipjack fisheries in Papua New Guinea and the Solomon Islands has inspired other nations to consider the development of similar industries. In several of the smaller island groups (e. g. the Gilbert Islands) a skipjack fishery is considered to be the most likely basis for a substantial export industry, and in all countries there are opportunities for import replacements. Additionally, there has been an increase in the demand for fresh fish by the island communities.
4. While there has been an increase in the research effort in the region, largely due to the initiation of a comprehensive research programme by Papua New Guinea, the present status of knowledge is by no means adequate for future development or management of skipjack fisheries.
5. The importance of skipjack is appreciated by the countries of the central and western Pacific. At the Sixth Regional Technical Meeting on Fisheries, sponsored by the South Pacific Commission and held at Suva, Fiji, in July 1973, an Expert Committee on Tropical Skipjack was formed. This Committee was convened for the first time at Papeete, Tahiti, in February 1974 with the objectives of reviewing the present and proposed status of skipjack fisheries in the central and western Pacific and recommending procedures for the scientific study of the resources.
6. After considering all available alternatives for the study of skipjack in the area, the Expert Committee recommended a regional survey and tagging programme in which approximately 100,000 skipjack would be tagged and released over a three-year period.
7. The need for a major regional tagging effort cannot be over emphasised; however, the programme as proposed should not be considered as a substitute for existing tagging or survey programmes. It is essential that this programme be co-ordinated with other projects in the Pacific.

8. The SPC Seventh Regional Technical Meeting on Fisheries held at Nuku'alofa, Tonga, in July 1974, endorsed the Expert Committee's proposal as a "project of the highest priority and urgency". It was also strongly supported by the Sixteenth Session of the Indo-Pacific Fisheries Council, Jakarta, Indonesia, November 1974, and the Fourth Session of the Indian Ocean Fisheries Commission, Mombasa, Kenya, July 1975. The countries and territories of the South Pacific Commission area are therefore unanimous in their desire to see the project carried out and support has been expressed by many of the South Pacific Commission Participating Governments and international organisations.

Objectives

9. The survey and assessment programme will provide
- (a) a better understanding of the migrations and stock structure of skipjack, thus determining the degree to which fisheries in different areas exploit the same stock, and hence interact with each other;
 - (b) valuable survey information on the general distribution and availability of skipjack and baitfish as the basis for further development and management of these resources within the region;
 - (c) better knowledge of the population parameters (growth, mortality, etc.) of each skipjack stock, thus enabling better assessment of the current status of these stocks and of the effect of fishing on them.

Benefits

National benefits

- (a) Estimation of the magnitude of the available stocks of skipjack occurring in coastal waters and indications of fluctuations in abundance with season and other environmental factors.
- (b) Description of the available natural baitfish stocks and their probable relative value as skipjack bait.
- (c) Determination of the best method for capturing and handling the natural baitfish in each area.
- (d) Evaluation of the effectiveness of alternative bait resources (e.g. cultured bait). The programme is geared for the testing of many different bait species.
- (e) Indications of the type and scale of operation best suited for the exploitation of the skipjack resources in each area.
- (f) Training of fisheries officers from each territory in the practical, technical and scientific aspects of skipjack fisheries and their research.
- (g) A better understanding of the possible effects should extended jurisdiction over fisheries resources be introduced.

Regional benefits

- (a) An increase in the total yield of skipjack from the region and a great decrease in the likelihood of over-fishing the resource or of over-capitalisation of the various fisheries.
- (b) A description of the various skipjack stocks occurring in the region.
- (c) Delineating migration patterns and determining the degree of intermingling of the stock and determination of which countries are exploiting common stocks.
- (d) Estimation of growth rates, natural and fishing mortalities and other biological parameters for population dynamics and stock assessment purposes.
- (e) Estimation of which populations are being exploited by various types of gear (e. g. pole and line, purse-seine, pearl shell lure, etc.). The fishing pressure from each gear will be estimated by a comparison of total catches and respectively tag recoveries.
- (f) Discovery of areas of good skipjack concentration in international waters outside the declared fishing zones of any nation.
- (g) Increased co-operation between countries on general fisheries matters as a result of involvement in a common project of regional importance.

II. THE PROGRAMME

11. As the project is to be coordinated through the South Pacific Commission, the area in which most of the research will be carried out will be primarily that designated as "The area of the South Pacific Commission"; however, it is appreciated that the skipjack is a wide-ranging oceanic species whose distribution and migrations are completely independent of national or international boundaries. To limit research purely to a predetermined area may well be shortsighted and result in the failure to gain vital information on the immigration and emigration of skipjack in the general region. The limits of the area should therefore be flexible but governed primarily by the total distribution of the skipjack stocks common to the countries and territories of the South Pacific Commission. The exact location of the research effort will be determined by the Programme Coordinator in consultation with the Expert Committee on Tropical Skipjack and will be under constant review depending on the results from the project as it progresses. Cruise timetables will be developed in accordance with information provided by fishermen and fisheries officers in the countries concerned.

12. The following guidelines (not in order of priority) will be considered when determining the areas for the initial expenditure of greatest research effort:

- (a) Those areas in which the skipjack resources have not previously been surveyed or for which the available information is obviously inadequate to give even a preliminary estimate of the potential.
 - (b) Localities in which tagging will facilitate the description of the boundaries of the different stocks proposed for the central and western Pacific (Kearney, 1975). In this regard there may be a tendency for considerable effort to be concentrated in the regions where the boundaries between the various stocks are thought to exist.
 - (c) Areas which are thought to be the centres of high spawning activity.
 - (d) Areas where it is known that the resource is underexploited.
 - (e) Areas currently not being fished because the known bait resources are inadequate.
13. It is planned that 30,000 tagged skipjack will be released each year with releases covering the entire area of the South Pacific Commission and being well distributed in time.
14. The tagging schedule will also be governed to a large extent by the need to elucidate certain specific anomalies which may be detected as the programme progresses.
15. It is assumed that the schedule for the second and third years would be revised in the light of the findings from year one, keeping in mind the necessity to examine seasonal variability.

III. SURVEY TECHNIQUES

Skipjack and other Tuna

16. The project has been designed to increase the understanding of the skipjack resources in the survey area with a view to future development and management of these resources. Tagging has been accepted as the primary research technique but concurrently many survey procedures and other research activities will be pursued as outlined.
17. The searching effort will be geared toward the location and exploitation of the areas of greatest concentration of skipjack. Rather than adhering to a predetermined grid type searching pattern, areas in which skipjack are known or thought to occur will receive particular attention.
18. All observed fish schools will be recorded and identified whenever possible by school type, species composition and estimated size in tonnes. The chumming success rate and other characteristics of the school behaviour will also be recorded where possible.
19. Priority will be given at all times to the tagging operations rather than the taking of commercial catches. Even so the hooking rates from each area will be determined and together with the sightings, reports will be used in comparing catches made by commercial vessels in the same time/area strata.

20. The tagging activities will be governed by the following guidelines:
- (a) Skipjack will remain the target species at all times but other tuna species taken incidentally to skipjack catches will be tagged and released whenever practicable.
 - (b) A general priority will be given to the release of small fish.
 - (c) Double numbered yellow dart tags will be used.
 - (d) Initially, at least, all fish released will be measured in the tagging cradle.
 - (e) Two tagging teams will operate on the vessel simultaneously.
 - (f) A number of fish will be double-tagged until reliable estimates of slippage rates and comparative mortalities between single and double-tagged fish have been obtained. Probably of the order of 3,000 fish will be double-tagged in an area where the recovery rate is anticipated to be high and cover a long time period.
21. From the skipjack which are poled but not tagged and released the following data will be collected:
- (a) Length frequency distribution of each school fished (a minimum of 50 individuals to be measured from each school).
 - (b) Length weight relationship for estimating condition factors (20 weights of measured fish).
 - (c) Sex, stage of maturity and gonad weight of 20 individuals from each school and samples to be taken from selected individuals for fecundity studies.
 - (d) Stomach contents of 5-10 individuals from each school.
22. Appreciating the importance of stock identification large numbers of blood samples will be taken from skipjack and other tuna species and forwarded to the appropriate laboratories. Other biological samples will be collected if required.
23. Although the study of tuna species other than skipjack will remain a minor adjunct to the project, much valuable information will undoubtedly be collected.

Baitfish

24. Although the baitfish resources of several countries in the survey area are currently being exploited for skipjack fishing, little information has been accumulated on the area as a whole. The information accumulated from past research in the central and western Pacific has made it possible, from an examination of the detailed nautical charts, to determine which areas are most likely to harbour good stocks of baitfish. As the number of good fishing sites on any coastline is normally quite small it should be possible to survey most probable areas in all of the island regions to be investigated. The methods of survey will be based on the following:

- (a) Numerous methods of baitfish capture will be tried but it is anticipated that most fishing will be done with stickheld dipnets or beach seines.
- (b) Identification of the abundant species in each area:
Many species will be encountered on an occasional basis but detailed research will be limited largely to those of possible economic significance.
- (c) Each of the common species will be assessed as a baitfish according to the following criteria:
 - (i) abundance,
 - (ii) catchability,
 - (iii) attractiveness to skipjack; gauged from the comparative chumming success with each species,
 - (iv) hardiness and longevity when transferred into the bait tank,
 - (v) capacity to be crowded in a bait tank.
- (d) The proximity of the bait resource to areas of occurrence of skipjack will also greatly influence future development. A great deal of experimentation with carrying baitfish long distances is planned for the survey period.

IV. ADVANTAGES IN THE USE OF A SINGLE RESEARCH VESSEL

25. The international sponsorship of the project through the South Pacific Commission should enable the vessel to catch both skipjack and baitfish in areas not accessible to a vessel of a single nationality. The advantages from a comparative viewpoint of such a programme are numerous.

Skipjack Fishing and Survey

26. Survey work will be possible in all island regions of the research area. Many of these regions currently have neither the finance nor expertise to undertake such surveys but, as indicated at the Seventh Regional Technical Meeting on Fisheries, all are extremely anxious to have such surveys carried out.

27. By using a single vessel the catch rates and fishing information (school sightings, etc.) from the different areas will be comparable, thus enabling countries planning skipjack fisheries to compare their prospects with those of a country with an existing fishery.

28. The search for concentrations of skipjack can be made in national and international waters.

29. When good concentrations of skipjack are detected, it will be possible to follow and study them even though they may traverse the declared fishing zones of several nations.

30. By operating in different areas the vessel will provide a unique opportunity for the fisheries officers from the various countries or territories to participate in survey and tagging studies and thus gain invaluable experience in skipjack research.

31. Because the tagging will be carried out by a single group of biologists experienced in the techniques and using uniform tags and methods, it can be anticipated that the survival rate of tagged fish will be maximised and the results obtained from the different regions will be directly comparable.

Baitfish capture, handling and utilisation

32. A variety of baitfish catching techniques, successful in other island regions, will be utilised and will undoubtedly prove of great value in many areas, particularly the less developed regions where little or no information on baitfish abundance is currently available.

33. A vessel with international status should be able to catch bait in any country or territory of the designated research area and would therefore not be limited by the restrictions inherent in carrying bait from a single source.

34. Tropical Pacific waters harbour many species of baitfish with potential as skipjack bait. Most of these species have been the subject of few, if any, studies to investigate their suitability for forming the basis of a commercial skipjack fishery. Many of these baitfish require specialised capture and handling techniques, peculiar to the species, before their potential as a baitfish can be fully realised. Undoubtedly the operation of the proposed research vessel would result in improved methods for the efficient utilisation of the more common species.

35. Recent research has shown that several of the most abundant baitfish species in the western Pacific, can contrary to previous thinking, be transported long distances without excessive mortality. The programme will afford an excellent medium for further research on methods of bait transportation.

V. THE ANALYSIS OF RESULTS

36. During the survey the accumulated results will be constantly monitored to assist in the direction of further operations within the terms of the project. The most modern data processing techniques will be used and it is hoped that additional expertise will be available on a part-time basis from the nations and international organisations supporting the programme. Progress reports will be provided on a timely basis.

VI. REFERENCES

Kearney, R. E., The stock structure of the skipjack resources and the possible implications on the development of skipjack fisheries in the central and western Pacific.
FAO Fish. Tech. Pap., FIRS/T 144.

Otsu, T., Translator's note. In Atlas of skipjack tuna fishing grounds in southern waters, 1973 fishing season (July 1973 - May 1974). Translated by T. Otsu, Honolulu. NOAA/NMFS Southwest Fisheries Center.

B U D G E T
VESSEL AND OTHER REQUIREMENTS

The major expense of the programme will be the charter of a modern 250-ton Japanese live bait and pole vessel. The approximate cost of such a vessel, including essential crew will be of the order of \$A400, 000 per annum (i. e. 250 days at \$A1, 600).

The research and non-specialised staff would be as listed in the staff requirements or could be seconded from the fisheries staff of the countries involved in the project.

Essential vessel specifications (other than those of a typical 250-ton long-range pole vessel):

- (a) A minimum of 6 bait wells,
- (b) suitable accommodation to enable 3 scientists and 2 technicians to work on board simultaneously,
- (c) a small dry laboratory,
- (d) a small wet laboratory.

Staff

	A\$
1 Project Officer	35, 000*
4 Biologists	120, 000*
3 Technicians	75, 000*
4 Research Assistants (which may be supplied by the fisheries staff of the countries in whose region the tagging is being carried out)	20, 000*
Total	250, 000

Back-up facilities

- (a) Computer Programmer (part-time only)
- (b) Data Processing, as required
- (c) Access to a computer and funding for computer time
- (d) Appropriate secretarial and typing facilities
- (e) Publication facilities

These services will be made available by the South Pacific Commission and other organisations.

* These figures include recruitment, establishment and support costs and are based on current employment costs by the South Pacific Commission and FAO.

Additional major items* (preliminary estimates only)

	A\$
(a) Tagging equipment (includes 100,000 tags, applicators, cradles, etc.)	19,500
(b) Reward on tags (4,000 at A\$2.00)	8,000
(c) Biological sampling and analysis equipment (includes field microscopes, balances, glassware, chemicals, etc.)	9,000
(d) Nets (includes scoops and bait keeper pens)	4,500
(e) Fishing gear (poles, lures, lines, etc.)	4,000
(f) Travel (relocation of scientific staff, etc.)	16,000
	61,000
Total	

TOTAL YEAR ONE A\$711,000

TOTAL YEAR TWO A\$671,000

* Most of these items would be purchased in the first year of operation but there would be some continuing expenses, for new or improved equipment, and recurring expenses.
