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**Status report - Gillnet selectivity project**  
(Yap, Federated States of Micronesia)

by

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1. Gillnets represent one of the most important fishing methods in Yap, with an estimated 693 nets in operation in Yap proper. It is thought that spear fishing is the only fishing method that results in higher total landings than gillnetting in Yap lagoon. Experienced gillnet fishermen claim that gillnet catches have declined significantly in recent years.
2. The Marine Resources Management Division (MRMD) of the Yap State Department of Resources and Development initiated a one-year programme of gill net test fishing in May 1987. The aims of this programme are:
  - to compare the effects of various gillnet mesh sizes and record the characteristics of the catch from each mesh size.
  - to collect biological information on the most important components of the catch.
  - to obtain baseline information on the relative abundance of inshore fish in Yap proper.
  - to collect fish to add to a reference collection at MRMD.
  - to formulate a rationale gillnet management scheme.

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3. Planning the fieldwork and sampling strategy included a process of consultation with local fishermen to develop a fishing procedure that would approximate their activities and thus yield representative results. This was followed by a period of pre-survey fishing during which staff were able to become familiar with and refine operational procedures.

4. Test fishing includes both passive (set-net) and active (drive-in fishing using scare-lines) gillnetting. Sampling areas are representative of the fishing grounds preferred by experienced fishermen. The nets consist of panels of various mesh sizes to allow direct comparison of results.

5. A number of problem areas have interfered with field work, particularly weather, net damage by large fish, human interference with the nets, and limitations on the resources (staff and equipment) available. So far (September 1987) the most caught species are those of the families Holocentridae, Mullidae, Siganidae and Lethrinidae. The aim of catching the desired sample size of 100 individuals of each species has not yet been realised.

This is an interim paper on the methodology of the on-going gillnet selectivity project on the main island of Yap in the Federated States of Micronesia. The island is located nine degrees North latitude and 137 degrees East longitude. Yap proper is composed of four islands closely joined and surrounded by a barrier reef. The inshore lagoon is variable in depth making access easy to fishermen. Heavy fishing pressure on the inshore reef is what led Marine Resources to commence this project.

Objectives of this project include baseline biology on the major fish species and a reference collection of identified fish. Little biological research has been carried out on the fish species in Yap. There is a need for baseline information on taxonomy, abundance, biology, and ecology of reef fish. Prior to this project, Yap had no morphological reference collection of fish species. The only other collection is found in the archives of the California Academy of Science from 1967. Collected and identified fish from the project are to be displayed in a collection at Marine Resources for referral and education.

Another objective is to determine the mesh selectivity of reef fish using various mesh monofilament gillnets. Since monofilament gillnets were introduced, fishermen's catch is reported to have increased. Fishermen found the nets to be lighter and more durable than the traditional coconut fiber nets. The monofilament net has been used in Yap for over 20 years. It is available at low cost (\$60/100feet) from Guam and local markets.

From a study of village fishermen in 1987, Marine Resources found that there were 693 gillnets on Yap, a 39 square mile island with only 6000 people. The gillnets have the second largest annual catch at approximately 76,200 lbs per year. There have been no studies in Yap on the selectivity of different mesh sizes in relation to species, and maturity of fish caught. The information we have is based on the perceptions of fishermen who say there is not as many fish in the reef compared to 5 and 10 years ago.

The inshore reef in Yap may truly be depleted of fish. Sixty percent of the fishing trips per year entail night or day spearfishing and gillnet. It is envisioned, that Marine Resource Management Division will use the results of this study and an on-going traditional fisheries project, in formulating a workable management scheme for the controlled use of gillnets. The management plan will entail the cooperation of the chiefs, villages and reef owners as well as the governing body of legislators. It will have to be both environmentally sound and subsistence level sensitive.

The project began with an interview period noting the opinions and suggestions of local fishermen throughout Yap proper. It involved the recording of location, placement, time, tide, method, and species. From these interviews, a standard form of fishing was developed to encompass all possible fishing factors. These factors include moonlight, and moonphase, tide, current, species sought, migration and pathways in the reef, feeding habits, and behavior. Yapese have a dynamic multispecies fishery. Many

responses to questions concerning net use confirmed that there are various methods which depend on the conditions.

As a result of the interviews, it was clear that the Yapese do not always use the monofilament gillnet as passive gear. Instead, they are involved in a drive-in fishery. It entails the cooperation of two or more people and can be used with an extended net. This extension of the net is locally referred to as a "ruwol". Ruwol Fishing involves the use of a long garland of palm leaves to extend the sweep of the net. It is made of stripped leaflets of a palm frond which are twisted around a long hibiscus vine. It is used to scare fish into the net by its shadow or movement.

The sampling design was based on the interviews with local fishermen, the practicality in accomplishing the task, the test fishing effort, and the safety of those involved. It is solely a night fishing survey due to the low catch in the day and the approval of the former MRMD chief. Fishing is carried out during the different moon phases to compare fish biology, behavior, and distribution. Both set and chase methods of fishing are performed. Two sites were chosen to compare distribution within the reef: the municipality of Map on the Northeast side of the island, and Delipebinaw on the Southwestern side of Yap proper.

The sampling locations were chosen to represent the typical reef found in Yap. Each location required three sites: a mangrove, a seagrass flat, and a sandy coral area. The sites were marked using floats and anchors. Specimens of the catch in the mangrove are: Siganus lineatus, canaliculatus, Lethrinus sp., Lutianus fulvus, monostigma, Megalops cyprinoides, and Valamugil sp. The seagrass flat, dominated by Thalassia, typically finds: Siganus, calaliculatus, lineatus, and argenteus, Caranx and Carangioides sp., Lethrinus sp., Gerres abbreviatus, and Kyphosus cinerascens. The sandy coral area is dominated by Acropora or staghorn coral. Typical species in fishermen's catch are: Acathurus sp., Scarus sp., Neoniphon sammara, N. argenteus, Mulloidichthys parupeneus, N. barberinus, Chelinus fasciatus, C. undulatus, Thalassoma sp. as well as previous fish mentioned.

The experimental monofilament nets used in this project are roughly 200 feet long by 6 feet high. There are eight 25 foot length sections per net to cover the wide use of mesh sizes in Yap. The mesh size ranges from one inch (2.54 cm) to six inch (15.24 cm) stretched. The test strength of the net is 9 to 12 lbs test, and the hang-in ratio is 50 percent. A set net is fished for five hours as the tide is ebbing or going out. Effort is calculated by the average height of the net from set to haul-in multiplied by the length to get square area fished.

Passive fishing methods entail setting the net in a crescent shape with the open end toward the shore. It is to be placed during the ebbing tide perpendicular to the current in the pathways used by fish. Reasons for these requirements are that Yapese fishermen say the fish know the net and once a fish encounters the net it will swim parallel to the net until it can escape. The net is fished for five hours and the average height is calculated from depth at net set and depth at haul-in.

For chasefishing we use three people with flashlights for standard effort. The area is approached silently and the net is set without the use of lights. The two ruwol are tied to the ends of the net and pulled to drive the fish into the net. The flashlights are turned on and splashing begins as the ruwol are pulled into the net. Drive in fishing is performed onle once at the site. Yapese fishermen will set and chase like this threeto four times a night. Our effort and catch is then multiplied to account for this.

Environmental parameters such as wind, current, salinity, dissolved oxygen, temperature, and barometer pressure are recorded at each net set to document the conditions suitable for fishing. These will be compared to the catch. Regression analysis will be performed on each comparison; mesh, moonphase, location, and method. For each mesh size, all fish caught are given an identification number and their fork length and weight are recorded. Stomach and gonad samples are collected and preserved for laboratory analysis.

Laboratory procedures entail preserving collected fish in Ten percent Formaldehyde and seawater, and identifying these fish to species. Our findings are compared to the previous visual species lists by Amesbury and Molina and Gawel from Army Corps of Engineers. Collected viscera are preserved in whorlpacks with identification numbers corresponding to the data sheets. Gonads are measured, weighed, and maturity is determined by physical appearance. Methods used in determination are modified from Uchiyama and Shomura, and Munro and Thompson. Gonadal somatic index, length at maturity, GSI to maturity, and seasonality of maturation will be determined for the major species.

Feeding characteristics of fish are determined by examining gut contents. Weight in grams and volume by water displacement are recorded. The contents are sorted to identifiable groups and each group is reweighed. Percentage frequency of occurrence and total volume of each food item can be estimated. The diurnal and seasonal feeding habits of the fish can be documented. The gut contents are hoped to give added information from the paralled plankton survey.

Observations to date indicate that some questions will remain unanswered. A very low and sporadic catch indicates that an estimate of relative abundance of stocks will not be accomplished with this method. Bycatch species may not get the required numbers to make firm statements on tidal and seasonal distribution of species. In order to get the needed species for identification, the reference collection has been aided by a faunal collection project. The reference collection is identified and awaiting verification by an ichthyologist.

The catch characteristics of the various mesh sizes will be determined by catch per unit effort, catch composition, and fish maturity for each mesh. Species composition, migration, growth, spawning, and feeding characteristics will be determined for the target species. Spawning seasons for the target species, and mesh sizes which are catching juvenile fish, will be presented

to the decisionmakers. The analysis of the information will give MRMD evidence to recommend some important laws to protect inshore reef fish using a rational gillnet management scheme.

There are three major concerns associated with the project. First, the low catch is not representative of the catch which Yapese fishermen are getting. This is due to the inexperience of the field staff and the reserved assistance by the local fishermen. The good catch by Yapese fishermen can be attributed to their knowledge of the fish, fish behavior, and proper tides for specific fishing methods; knowledge acquired over centuries. Because of the multispecies fishery and the variety of net fishing, the standard form of net fishing used in the project can't fully represent the real fishery.

Second, net placement for this project is fixed at each site for the duration of a year in anticipation that the fish which use that area for their migratory passage will be sampled. Loss of anchors and floats have affected the sites and forced MRMD staff to try to duplicate the site just as the net is ready to be placed. Thus, it is not always in the exact same spot. In addition, Yapese fishermen will determine their net placement according to environmental conditions.

The third concern is maintaining a standard unit of effort when chasing. Some MRMD staff will not show for sampling without warning. Also, the inflexibility of the sampling will cause MRMD staff to sample on nights when Yapese fishermen claim it is not a good night to fish with this method or in a particular location. Low or no catch on these nights give value to the perceptions of the fishermen.

My gender may have caused some resistance in collecting information. In Yap, it is only the men who know the tides, moon, and currents relative to fishing. I had to make it clear that I was a scientist and not a competing fishermen. Yapese, as any fishermen, are reluctant to give away their best fishing spots and methods. I cannot be sure if the sites and methods are reflective of the Yapese subsistence and artisanal gillnet fishery. It may be difficult for the Yapese to trust that the information collected is for the purpose of conservation and preservation to allow continued subsistence.

The project is now into the tenth month of fielding. Any significant changes to sample design would interfere with previous data. All environmental parameters, catch, and biological data is entered into a Dbase III plus program. The analysis expected is still in the designing stage. I am no fisheries statistician, as I learn the programming portions of DBase III I will analyze and present the data from the project.

This project was designed to give quantitative information on fish biology, taxonomy, abundance, and ecology using monofilament gillnets. The various mesh in the gillnet should give MRMD information on fish size and relative abundance since the project fished in the same locations for a year. With this basic information, effective management plans can be made allowing subsistence and artisanal fisheries to work in conjunction with the growing need for conservation.

I realize the objectives and expectations of this project were very high. I am presently developing a more reasonable sampling scheme which would give more information on fish biology. It will require the assistance of Yapese fishermen to carry out the actual fishing using MRMD nets. The catch can be sampled in the field and the information returned to Marine Resources for laboratory analysis and interpretation. Any questions, comments or suggestions are very welcome.

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