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DEEP-BOTTOM FISHING IN VANUATU: INITIAL RESULTS

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Introduction

As Vanuatu has been actively developing the fishing of deep bottom species since 1982, it seems the time has come to draw preliminary conclusions and endeavour to determine what degree of fishing pressure this resource would be able to sustain.

The Vanuatu archipelago comprises eighty islands and lies between 13°S and 20°S approximately. The outer reef slope is relatively steep, so that the area of water that can be fished (depth between 100 and 400 metres) is fairly narrow. For the whole archipelago, the area of the sea bottom between 100 and 400 m deep is estimated at 736,000 ha and the slope has an average gradient of 10%; the total length of the 100m isobath is 1,400 nautical miles (2,600 km).

The Fishery: data collection and findings

Around Efate, a large portion of the deep bottom fish catch intended for sale in Port Vila is made by the Fisheries Department, and it is to that Department that we owe the major part of the information we have to date. (Several fisheries development operations are also under way in the other islands of Vanuatu and we have developed a simplified system of data collection from them in order to obtain information for the whole of Vanuatu).

At Port Vila, when the catch is landed, catch and effort data are carefully recorded; all the fish are identified, measured and weighed; sex and sexual maturity are noted and gonads are weighed; the sagittal otoliths and some scales of the medio-dorsal area are taken as samples. After coding, this information is transferred to log-sheets for data processing (Grandperrin and Brouard, 1983).

Beyond 100 m, sixty different species are caught, almost all of which are sold without any risk of causing fish-poisoning. Three genera make up about 80% of the catch by weight. In 1982 and until the beginning of 1983, Etelis spp. (deep-water red snappers) represented 52.4%, Pristipomoides spp. (jobfish) 5.1% and Epinephelus spp. (groupers) 23.1%. This particular distribution is a result of the depths at which fishing was commonly carried on during this period (more than 250m). In March 1983 fishing began in shallower waters, and it is already clear that the 1983 figure will show an increase in the relative abundance of Pristipomoides.

Around Efate, during the year 1982 and the first months of 1983, six tonnes of deep bottom fish were caught using the wooden hand-reels common throughout the Pacific. The fishing effort was 1,600 reel hours. The average catch per unit of effort over a period of 16 months was 3.49 kg/reel hour. The fishing effort having been irregular, it is not possible with the data

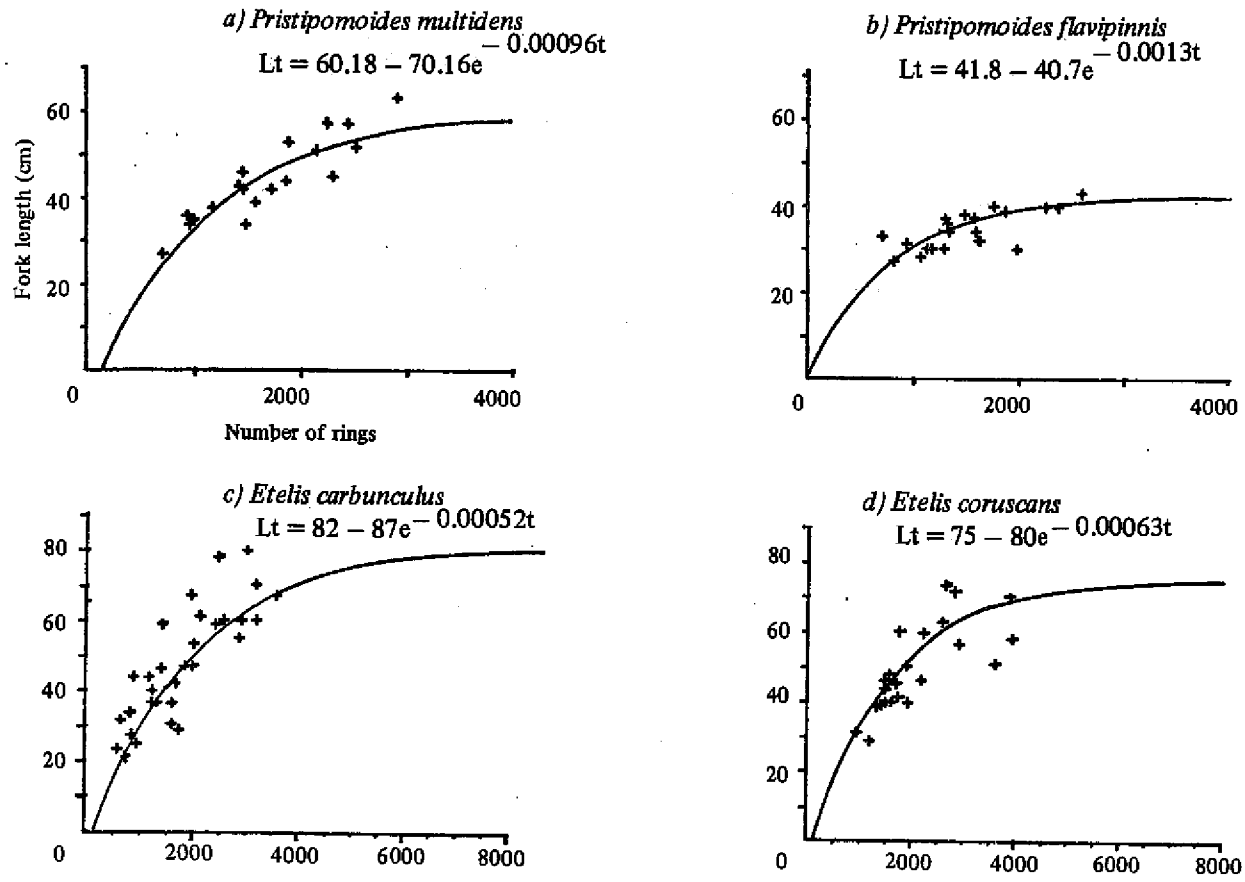

Figure 1: Relationship between number of daily growth rings and caudal fork length.

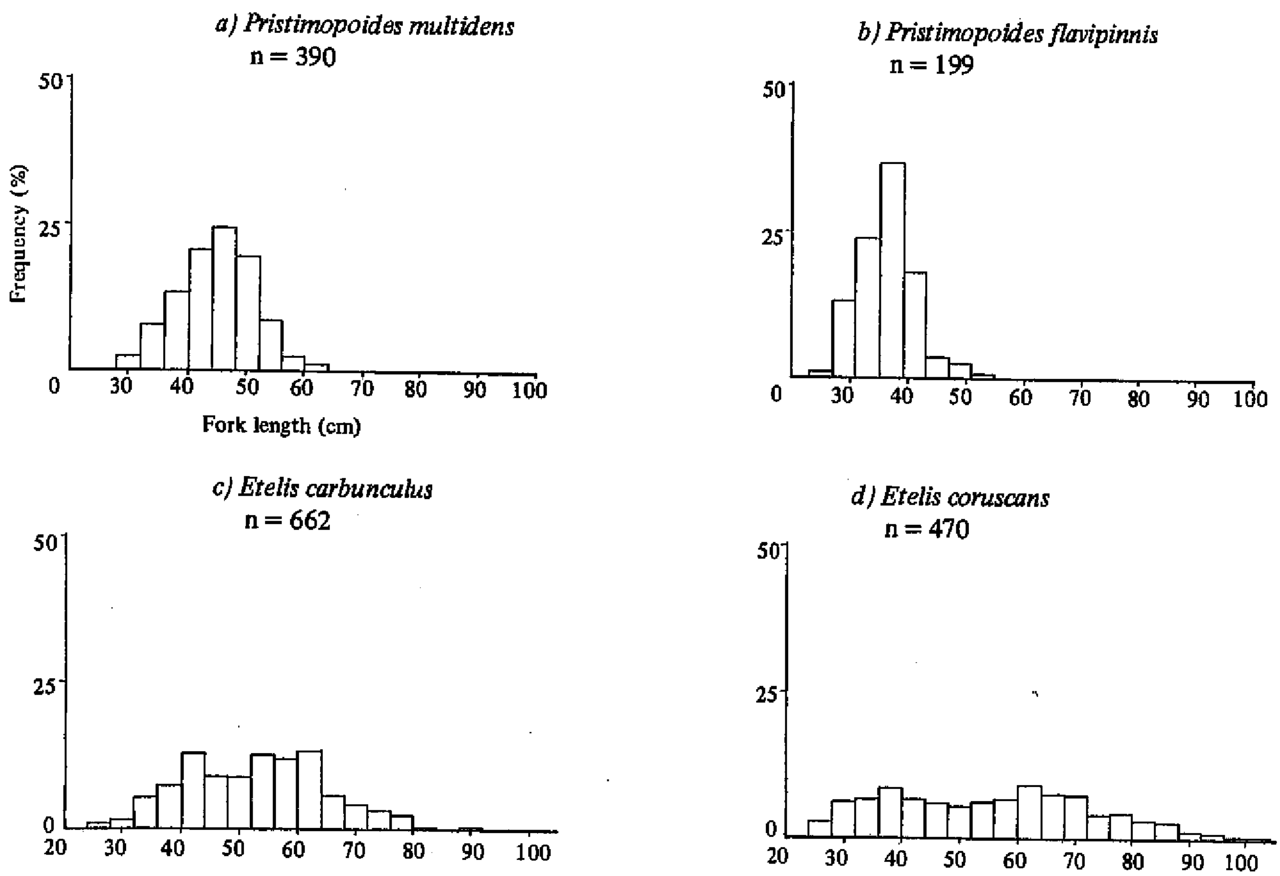

Figure 2: Length – frequency distributions.

currently available to pinpoint any seasonal variations that there might be in abundance or in catchability of fish.

Growth and size frequency of Etelidae

The technique of reading daily growth rings of otoliths that was proposed by Pannella (1974) and later used by several authors for tropical fish (Ralston, 1976; Uchida et al., 1982, Uchiyama, T.H., personal communication), was used in Vanuatu to assess the age and growth of Etelis carbunculus, E. coruscans, Pristipomoides flavipinnis and P. multidens (Brouard et al., 1983). Figure 1 shows the growth curves that have been plotted; size frequency distributions are given in figure 2. The von Bertalanffy parameters that have been obtained have made it possible to assess natural mortality using Pauly's formula (1980) (Table 1).

Table 1. Parameters of growth and natural mortality of four Etelidae

	E. carbunculus	E. coruscans	P. multidens	P. flavipinnis
L (cm)	82	75	60.2	41.8
L_o (cm)	-5	-5	-10	1.1
$K(a^{-1})$	0.19	0.23	0.35	0.47
$M(a^{-1})$ (1)	0.38	0.44.	0.66	0.89

(1) according to Pauly's formula (1980):

$$\log(M) = -0.0066 - 0.279 \log L + 0.654 \log K + 0.463 \log T$$

(where T = average temperature of the water expressed in ^{o}C).

Estimating the potential yield of deep bottom fish in Vanuatu waters

There are not yet of course enough catch and effort data from Vanuatu to be able to make any kind of model at this stage. However, it is possible, as has already been suggested (Welcomme and Gulland, 1980; FAO, 1980), to determine orders of magnitude of potential yields in comparison with other regions with similar ecology in respect of which yields are already well defined. Hawaii, which, like Vanuatu, is situated in the tropical zone, has been used as a reference (Ralston and Polovina, 1982).

Both archipelagoes have the same structure in that there is no lagoon and the outer reef slope is very steep. The physico-chemical features and primary organisms are similar (Brouard and Grandperrin, 1983) and the fish species found very similar also. In the Hawaii islands, the main species caught at depths between 80 and 240 m are: Pristipomoides filamentosus, Epinephelus quernus, Seriola dumerili, Pristipomoides zonatus. Between 200 and 350 m the most common species are Aphareus rutilans, Pontinus macrocephalus, Etelis coruscans, E. carbunculus, Pristipomoides sieboldi. With the exception of Pontinus macrocephalus (Scorpaenidae) these species (or closely related ones) are found in Vanuatu. P. filamentosus, which makes up the greater part of catches in Hawaii would be rather less abundant in our area where P. multidens and P. flavipinnis predominate. According to our data and those of Uchida et al. (1979, 1982) catches per unit of effort are of the same order of magnitude in the two areas. There does not therefore appear to be any great difference in abundance.

If one applies the figures obtained in Hawaii to the whole of Vanuatu the estimated maximum sustainable yield (MSY) is between 147.0 and 380.8 tonnes/year. Around Efate, the MSY would be between 13.7 and 35.4 tonnes/year. As the Hawaiian catches are underestimated for certain islands because recreational fishing is not taken into account, it seems permissible to increase figures slightly. For the whole of Vanuatu, the MSY would be about 300 tonnes/year, i.e. 0.4 kg/ha/year. For Efate it would be 30 tonnes/year.

With a view to correcting our data, we examined the results obtained by Munro (1973) in the Caribbean zone. The author demonstrates that the abundance of fish on the outer reef slope (deeper than 100 m) is ten times smaller there than it is on the "continental shelf" (less than 100 m). He estimates the yield for the "continental shelf" to be between 11.3 and 15.1 kg/ha/year, which gives an estimated MSY of 1kg/ha/year for the outer reef slope in the Caribbean tropical zone. Marten and Polovina (1982), making a general analysis of yields of the different tropical ecosystems, in which they include consideration of primary productivity and depth, find similar orders of magnitude. Assuming that our MSY of 0.4 kg/ha/year could be multiplied by 2 or 3, it is still probable that it would hardly exceed 1 kg/ha/year. This being so, the number of vessels (of the alia catamaran type) that would lead to maximum sustainable exploitation would be between 50 and 100 for the whole of Vanuatu (MSY: 300 to 600 tonnes/year) and between 5 and 10 in the waters around Efate (MSY: 30 to 60 tonnes/year). These figures should help development planners in selecting their objectives. The bottom fish resources of the outer reef slope appear fairly limited and this means that very great vigilance must be exercised in fishing these waters.

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