

SEMINAR C

ASSESSMENT AND MANAGEMENT OF CORAL REEF FISHERIES : BIOLOGICAL, ENVIRONMENTAL AND SOCIO-ECONOMIC ASPECTS

EVALUATION ET GESTION DES PECHEES EN MILIEU RECIFAL : ASPECTS BIOLOGIQUES, ENVIRONNEMENTAUX ET SOCIO-ECONOMIQUES

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REPORT OF THE DISCUSSION

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1. INTRODUCTION

The authors opened discussion by briefly summarising the main points in their paper. Coral reefs occurred predominantly in developing countries and coral reef fisheries were predominantly artisanal. Fishery yields varied greatly from one region to another with an average of about 15 tonnes per kilometre squared per year. However, coral reefs were so remote from potential markets, that the yield possible if all reefs were efficiently exploited would not be reached. Coral reef fisheries were multi-species fisheries with all the problems for management that term implies.

Ecologists had until recently ignored demographic studies of reef fishes and had approached reef fish communities assuming an intrinsically regulated equilibrium. In recent years there had been changes to the ecological view of coral reef fishes, and it was now recognised that recruitment variability was just as pronounced in these species as in temperate species. Consequently, ecologists were now approaching coral reef systems with an assumption of non-equilibrium states. Substantially more information is necessary on the extent in space and time of the variation in recruitment of coral reef species and on the scale of dispersal of larvae. A knowledge of natural mortality which would be obtained from ecological studies would be useful in estimating potential yields of reef species.

Assessment of coral reef fisheries posed a number of problems. These related to the problems of collecting catch data on artisanal fisheries and to the lack of confidence that single species approaches would be useful in dealing with multi-species catches. A number of options for management of reef species were presented in the paper and the choice among these will inevitably vary from one location to another depending on the aims of management in the different areas.

Discussion of the paper centred on four major areas. First, a number of specific examples of reef fisheries and fisheries management were introduced. Second, the need to validate, explore and extend current fisheries methodology was discussed, as was the need to adequately test current ecological hypotheses on dispersal and recruitment patterns. Thirdly, a major need was recognised for closer integration of ecological and fisheries scientists interested in reef fish. This would involve the possibility of experimental testing of fisheries methodology. Finally, the need for public information and education in implementing management procedures was recognised, as was the need to consider management of reef fisheries in a broader coral reef management context.

2. EXAMPLES OF REEF FISHERIES

De Silva drew attention to the increasing importance of the aquarium fishery in coral reef regions. In Sri Lanka this major fishery currently employs 50,000 people. Because the aquarium trade practices highly selective fishing methods targeted on particular high value species, traditional, conventional, single species management techniques may be appropriate.

Other components of reef fisheries not given sufficient mention in the paper were recreational spearfishing, which also is often selective (Worthington) and gleaning from reef flats by women and children (McManus and N. Marshall). The latter is a major source of protein in developing countries, yet largely escapes record by fishery scientists. Gleaning may represent 25-30% of fish biomass taken from reefs.

Galzin reported that more than 50% of fish taken in Moorea, by-pass the market to be consumed locally. He estimated the size of this undocumented fishery as 3,400 tonnes per year, including a proportion obtained from reef flat areas.

Craik reported on the coral trout monitoring programme within the Great Barrier Reef Marine Park, and indicated the total catch of this favourite species was about 6,000 tonnes per year, or just 0.2 tonnes per kilometre squared per year. She reported nevertheless, that some differences in size distribution of this species had been detected when areas protected from fishing were compared with those fished.

3. VALIDATION AND EXTENSION OF TECHNIQUES USED BY FISHERIES BIOLOGISTS

Polovina stressed the need to explore new ways of estimating stock parameters. For example, the relationship among L , L_c and L_∞ can be used with linear regression of L on L_c to estimate Z/K and L . All that is required is a good sample of length frequency data. An extension requiring a time series of length frequency data permits fixing L_∞ and directly estimating K and Z .

He stressed also the need to validate formulae used to estimate parameters and to explore the magnitude of variation inherent in these estimates. He suggested that management procedures which manipulate a stock, or change the fishing pressure on it should be used by ecologists or fisheries biologists as experiments to explore these facets of stock assessment.

Others agreed with the need to use experimental methods in testing procedures and additional methods of estimation were briefly presented by Chavez. Munro drew attention to the March 1985 ICLARM Conference held in Sicily, where the robustness of length frequency techniques was examined.

Examples where management had allowed experimentation with the closing to areas of fishing in the Florida Keys (Appledorn citing Bohnsack) and in the Great Barrier Reef Marine Park (Craik).

Day cautioned that the emphasis seemed to be on fin-fisheries and suggested that procedures for assessment and management of invertebrate fisheries might be quite different.

The problems associated with multi-species fisheries were mentioned by Munro, but there was general agreement that the various multi-species formulations developed to date were not very useful. Polovina's ECOPATH model might be a useful future direction. In general however, it was noted that many reef fisheries were strongly dominated by small numbers of species and there was general willingness to continue to use traditional single species approaches in assessing these. Clearly, experimental work on the effects of multi-species fishing are needed badly. There was a plea for quick and dirty methods as a first approach to assessment and Williams drew attention to Pauly, 1984.

Parrish reported that the May 1985 workshop on groupers and snappers just completed in Hawaii had showed the effectiveness of traditional single species methods of assessment for these important fisheries. Polovina reported the simple rule of thumb which suggests for snappers that $F \sim m$ if l_c is $> l_m$ but that $F \sim 2m$ if l_c is $< l_m$.

4. GREATER INTERACTION OF FISHERIES BIOLOGISTS AND ECOLOGISTS

All participants noted the need for greater integration effort by reef fish ecologists and fisheries biologists. It was notable that such interaction was beginning to happen after many years of separate endeavour.

Appledorn was critical of reef fish ecologists for failing to address relevant questions and for persisting in working on small species at a very local scale. He suggested that more attention needs to be given to stock definition and argued that data were needed on the effects of fishing on natural mortality. Munro suggested that some useful theoretical work be done using small non-commercial and therefore unfished species. A few virgin stocks of commercially important species also existed in the Pacific and could be usefully examined. Galzin outlined an ecological approach he had used to estimate the potential yield of the Moorea Reef and suggested fisheries biologists might usefully apply some of the ecologists' techniques for estimating population size and structure. Polovina stressed that working together, ecologists and fisheries biologists could take advantage of closures and other management techniques to advance basic understanding of the effect of fishing.

Some attention was given to the inadequacies of some current ecological hypotheses concerning reef fish. Eckert stressed that the demonstrated variable rate of settlement of juvenile fish would vary in its effect on adult fishable populations, depending on the nature and rate of natural mortality after settlement. She also suggested that some reefs in an archipelago, because of the physical oceanographic regime surrounding them, may be quite unimportant as sources of larval fish. Their larvae might be swept to the open ocean and lost. Such reefs can be exploited heavily with no long-term consequences other than the reduction of populations locally present. Other reefs favourably located might be much more important as sources of larval reef fish and management might favour protecting them. Craik admitted that management of the Great Barrier Reef Marine Park included strong protection for some reefs, but there was no information on whether this practice enhanced the settlement to nearby fished reefs.

Harmelin-Vivien summarised data from Moorea which documented strong effects on both species composition and on species abundances caused by four independent kinds of degradation. These were hurricanes, commercial mining of sand and coral, outbreaks of *Acanthaster planci*, and cases of organic pollution. In all these cases, effects were most marked on shallow reefs which function as nurseries for a number of species. The changes in community composition which were quite marked in some cases are not predictable with current ecological knowledge. The community has generally shifted towards dominance by commercially less valued species.

5. NEED FOR PUBLIC INFORMATION AND BROADER MANAGEMENT PROGRAMMES

The meeting was unanimous in the need to increase and improve efforts at public information if management programmes would be successful. Craik and Zell emphasised the importance being attached to information programmes in managing the Great Barrier Reef Marine Park. Lindeman told of a planned marine sanctuary in Puerto Rico which had recently failed to receive legislative approval. This was due to the lack of attention by proposers of the sanctuary to the need to provide public information concerning it. Zell said scientists must be directly involved in such information programmes and Munro stated that we must begin in the schools, in what is inevitably a long-term programme. Russ reported on the recent breakdown of a reserve on Sumilon Island, Philippines, after ten years' existence. He suggested that even in situations where management was demonstrably successful, the task of properly informing the public and continuing public acceptance of the management was not easily accomplished.

Additions to current management procedures were mentioned by Holthus and De Silva. Holthus advocated use of traditional information and methods and Craik reported that sites believed to be spawning grounds were receiving seasonal protection in the Great Barrier Reef Marine Park. De Silva suggested a move towards mariculture for the aquarium fishery, visualising the stocking of areas with desired fish, the use of these areas for tourism, and the subsequent harvest of grown fish. Coeroli outlined the oyster culture programme in Tahiti. Culture techniques had taken ten years to establish and the growth and demand meant that attention was now being turned towards an oyster hatchery. Appeldorn stressed the need for fishery management in the context of a broader programme of reef and foreshore management.