
RESEARCH ON TRADITIONAL TROPICAL FISHERIES: SOME IMPLICATIONS FOR
TORRES STRAIT AND AUSTRALIAN ABORIGINAL FISHERIES

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The past decade has witnessed an almost explosive growth of research on traditional fisheries in the tropics. In Australia, however, the subject has only very recently begun to attract the attention of more than a tiny group of policy makers and researchers. This delayed entry into the field provides Australia with the opportunity to learn from the findings - and benefit from the mistakes - of those who started earlier. Here I briefly outline some of the general conclusions arising from this research and discuss their relevance to traditional fisheries in northern Australia.

Although the catch-per-unit-effort of traditional fishermen is very low, their numbers are very high - eight to ten million throughout the tropics - and their total catch amounts to almost one-half of the world's food fish. Only about one-eighth as much fossil fuel is expended in these fisheries as on catching the remainder by higher technology fishing (Thompson, 1980).

Despite the high employment, low energy costs and high total yields afforded by traditional fisheries, they were little studied until the 1970s. This is because traditional fishermen are typically cash poor, are scattered widely in small, remote communities, and are out of touch with central government authorities. Thus they lack a strong political voice with which to draw attention to their problems and articulate the often impressive economic and nutritional significance of their activities.

The need for expanded research in this area became apparent in part because of the failure of countless foreign aid projects designed to assist traditional fisheries. Typically, these projects were based on the reflex introduction of training and new technology on the tacit assumption that what has proven useful to western high technology fishermen will ipso facto be useful to all fishermen. But classical fisheries theory is based on temperate zone species and high technology fisheries in capitalist economies and neither traditional fishermen nor tropical fishers behave according to such theory.

So it has become increasingly apparent that tropical marine resource managers must develop a much better understanding of both the biological and the socio-economic features of these fisheries if they are to formulate realistic objectives and achieve useful results. Accordingly, research on traditional fisheries has been given elevated priority by FAO, UNESCO, ICLARM, the Agency for International Development, the world Bank, the South Pacific Commission and a number of other multinational or international organisations.

Traditional fisheries involve, per unit of catch, far more fishermen, boats, methods, habitats fished, species caught, landing sites and distribution channels than do higher technology fisheries. Within Australia, traditional fisheries in the Torres Strait Islands provide an example. Here, in a population of about 5,000, people fish in ones and twos, on foot or from small boats, out of villages and tiny outlying settlements on seventeen different islands, and in several quite different types of marine environments spread over an area of 30,000 square kilometres. They use harpoons, poisons, spears, spearguns, various types of nets, reef gleaning, and trolling and droplines, in order to catch a host of reef, mangrove and pelagic fishes, as well, as rock lobsters, crabs, perhaps two dozen species of molluscs, and dugong and turtles. There is no central market. Landing, takes place at dozens of sites and at all times of day and night. Some of the catch is sold locally. Some is iced or frozen for export. Much is given away according to complex traditional systems of distribution;

Because of various environmental, geographic and cultural differences within the Strait, no one island fishery is representative of any other. Thus research on no single island or selected group of islands will provide information that adequately represents the islands as a whole.

The costs of gaining the information necessary for conventional fisheries management of all these sub-fisheries would greatly exceed the economic benefits. The costs of effective conventional enforcement of the resulting fisheries regulations would also be greatly disproportionate to the benefits. Why, then, do researchers not simply "write off" such fisheries?

ECONOMIC JUSTIFICATION

Research on most species harvested in these fisheries is not warranted on purely economic grounds. But there are often sound economic reasons for studying the segments of the fishery that involve certain high-value species important to traditional fishermen, or to higher technology fishermen exploiting the same stock.

In Australia a case in point is the barramundi, a valuable source of food for many coastal Aboriginal communities and certain Torres Strait communities, as well as a prized commercial and recreational species - one that has been subjected to excessive fishing pressure over wide areas.

Research on traditional fisheries for trochus, rock lobsters, mud crabs, beche-de-mer and mackerel are, or have been, justified on purely economic grounds for similar reasons. At present, research on traditional fisheries for most other invertebrates and fin-fishes, sea turtles and dugong is not. This may change in the case of fin-fishes if adequate markets can be found for what is presently an under-utilised resource in much of northern Australia.

POLITICAL JUSTIFICATION

Political reasons for supporting research on traditional fisheries elsewhere in the tropics are varied., but many fall under the general headings of resolving boundary disputes and allocating resources. Such considerations are relevant to the traditional fisheries of both Aborigines and Torres Strait Islanders.

For example, the Torres Strait Treaty between Papua New Guinea and Australia, ratified in February 1985, arose from negotiations between the two countries relating to sovereignty and maritime boundaries in the Strait. One of the main objectives of the Treaty is, "to acknowledge and protect the traditional way of life and livelihood of the traditional inhabitants including their traditional fishing."

Because little information about the traditional fishery was available (other than that gleaned from anthropological studies carried out at the turn of the century) the governments of Australia and Papua New Guinea acknowledged the need for a broadly based research program. Accordingly the Commonwealth Department of Primary Industry requested the CSIRO Division of Fisheries to carry out studies on aspects of the traditional fishery that appear to relate to island welfare, the implementation of the Torres Strait Treaty, and the formulation of policy alternatives for securing sustained yield exploitation of those marine stocks which constitute important components of the fishery

Another political issue that has emerged recently in Australia is giving strong additional impetus to traditional fisheries research: traditional fishing rights. Although historical accounts reveal the existence of traditional fishing rights among Aboriginal people and Torres Strait Islanders, fisheries administrators in Australia were, until recently, largely unaware of these rights. Here I would like to discuss traditional fishing rights within the context of traditional marine resource management.

TRADITIONAL MARINE RESOURCE MANAGEMENT

Traditional fishermen in some tropical areas have been keenly aware that there are limits on how much they can harvest without depleting their stocks. For centuries, fishermen in Polynesia and Micronesia, for example, have practised all the basic marine fisheries conservation measures that westerners began to employ only around the turn of the century (Johannes, 1978).

Growing awareness of the existence and value of traditional resource management systems has led both UNESCO and the International Union for the Conservation of Nature and Natural Resources to establish formal working groups of social scientists and biologists to investigate these systems. A common theme of these groups is that modern natural resource management in traditional societies will achieve greater acceptance and thus be more effective if it incorporates, or is compatible with, traditional management concepts and cultural practices.

A subject that is receiving, much, attention from these groups and associated researchers is traditional use rights in fisheries (TURFs). TURFs provide a means of maintaining or improving the welfare of small fishing communities by facilitating sound marine resource management (for example, Cordell, 1974; Johannes, 1977; Christy, 1982; and many others).. Where TURFs exist, it is usually in the best interest of those who possess them not to overfish. The penalty for doing so - reduced future catches - accrues directly to the owners. Self-interest thus dictates conservation.

Where such resources are available to everyone, in contrast, it is in the best interest of fishermen to catch all they can. Since they cannot control the activities of other fishermen, the fish they refrain from catching will most likely be caught by someone else. In a fishery open to all, self-interest dictates overfishing. TURFs constitute a type of what the fisheries biologist refers to as limited entry, some form of which is essential for sound fisheries management.

Another group of researchers have emerged recently with contrasting views. They argue that TURFs are not always maintained by the owners with conservation in mind. Furthermore, TURFs can impede fisheries management and development because traditional owners may lock up coastal marine resources, excluding the outside capital and expertise needed for their effective exploitation (Haines, 1982; Polunin, 1984).

These contrasting views are based much less on differing interpretations of the facts than on different sets of facts. Systems of traditional marine tenure are very diverse. Some, accordingly, are more useful in the context of resource management than others.

Collectively, studies on TURFs appear to support the hypothesis that they function better as mechanisms for marine resource management in areas where marine resources are limited relative to the needs of the users and recognized as such by the users.

In Australia we need to find out just how consistent traditional marine tenure systems are with contemporary marine resource management. We need to establish for each TURF whether it contributes - or has the potential to contribute - to the effective conservation, the equitable allocation and/or the sound economic management of the resource. These questions raise a host of subsidiary ones. For example, should our main economic goal be to maximise profit, yield or employment? It is rarely, if ever, possible to maximise for even two of these simultaneously. In the case of allocation, who decides what is equitable?

As for conservation, do we have, or can we reasonably expect to get, enough biological data to answer the question confidently? The cost-benefit ratio of biological research on small but typically very complex tropical fisheries is, as already mentioned, **very high**.

Another conservation issue characterises many traditional fisheries, including those of Australian Aboriginal fishermen. It concerns the many taboos and other restrictions on catching or consuming certain species. Some researchers have assumed that such practices automatically serve a conservation function. Undoubtedly some do. But when the use of one species is proscribed, it puts additional pressure on other species. Only when a restriction directs demand away from a limited resource to a more plentiful one can it be said to result in useful conservation. Some restrictions may actually shift demand in the opposite direction.

TRADITIONAL KNOWLEDGE

Biologists have come to realise that traditional fishermen can be a rich source of information on the species they catch and the environments in which they fish.

In the Pacific islands, for example, it has been stated that "the native fisherman is possessed of a store of precise knowledge that may be truly characterized as a natural science" (Handy, 1932). Marine biologists, Ottino and Plessis (1972) comment that such fishermen possess a knowledge of fish behaviour "of a stupefying richness and at times of such precision that the poverty of our own conceptions makes inquiry very difficult."

Traditional fishermen can often provide information essential to management on aspects of the biology of species in their waters - information on such subjects as the timing and routes taken by migrating fishes, spawning seasons and localities, behaviour in relation to fishing gear (Johannes, 1981 for instance). Do such findings pertain to traditional fishing in northern Australia?

It is becoming increasingly clear that both Torres Strait Islanders and Aborigines possess knowledge of the behaviour of marine animals that is valuable to researchers. Some of their knowledge of dugong and turtle behaviour has been documented by Anderson and Heinsohn (1978) and Nietschmann and Nietschmann (1981). Aboriginal fishermen in northern Arnhem Land also possess valuable knowledge about such things as seasonal variations in feeding, migration and reproduction of many coastal marine species (Davis, 1984a), including barramundi.

For many years biologists argued heatedly over the question of whether barramundi spawn in rivers or in shallow coastal waters. The answer is fundamentally important to the management of this species. But the circumstantial evidence was ambiguous, and persistent but unsubstantiated reports were in conflict. Light could have been thrown on the issue long ago if biologists had sought the knowledge of native fishermen.

The question appeared to have been resolved when Moore (1982) demonstrated that barramundi in the Fly River system of Papua New Guinea migrated downstream into Torres Strait and 100 kilometres or more along the coast before spawning. But Aboriginal fishermen in northern Arnhem Land had always maintained that barramundi commonly spawned well upstream in local rivers (S. Davis, pers. comm.). When informed that a biologist had proved

otherwise in the Torres, Strait area, these fishermen were firm in, their insistence that in their waters barramundi spawned in rivers.

This apparent conflict between fishermen and biologists was resolved when T. Davis (1985) demonstrated that barramundi did indeed spawn well upstream in rivers in northern Arnhem Land. The characteristic common to spawning locations in both Torres Strait and northern Arnhem Land turned out to be not a particular type of geographic space, but salinity.

Barramundi spawn in waters more saline than fresh water but somewhat less saline than ocean water. Salinities in this range are found along the coast in northern Torres Strait. But the appropriate salinities in northern Arnhem Land have been found as much as several tens of kilometers upstream in rivers. Here the much gentler incline of the rivers and the much greater tidal amplitude result in the transport of high salinity waters far upstream.

Another intriguing example of potentially valuable traditional knowledge concerns rock lobsters. Aboriginal fishermen report seeing rock lobsters moving eastward, single file, head to tail, across shallow open sandy areas along certain portions of the coast of the Northern Territory during the dry season. These movements are strikingly similar to the migrations of a Caribbean species of rock lobster described by Herrnkind et al. (1973). (It is worth noting that the phenomenon was, well known to Caribbean fishermen long before marine biologists learned about it). Both migrations are described as:

- being in single file;
- involving head to tail contact;
- occurring during a season of decreasing temperatures;
- having a clear longshore component, and;
- occurring over open, sandy areas where lobsters are rarely seen at other times.

Caribbean fishermen catch many more lobsters than usual during such migrations. In Australia, rock lobsters are a lucrative export; in 1985 the price to fishermen was around \$15 per kilogram. Could the migrations described by Aboriginal fishermen form the basis of a local industry? If they do, it will be because Aboriginal fishermen brought to the attention of biologists observations made in waters about which the latter have very little knowledge.

Many traditional fishing peoples in the tropics relish fat-laden, fish, invertebrates, dugong and sea turtles. In consequence, traditional Aboriginal fishermen, among others, are keenly aware of the predictable seasonal variations and unpredictable year to year variations in the fatness of these species. Torres Strait Islanders commonly associate a marked and anomalous decline in the fattiness of turtles and dugong (and a decline in abundance of some fishes) with an unusual and extensive dieoff of seagrass that they report to have occurred in the 1970s.

Biologists know that in certain species (studied mainly in temperate waters) variations in fat content sometimes relate to seasonal spawning and migration cycles. They may also relate to variations in food quality and quantity associated with variations in rainfall. But biologists have not availed themselves of traditional fishermen's knowledge of fatness cycles of a great many tropical species, knowledge that should aid in exploring the causes and consequences in more detail. The fat content of marine animals influences their flavour, shelf-life and smoking qualities.

Until recently, biologists working in the tropics tended to work in splendid isolation from the cultures that were supposed to benefit from their research. The realisation is spreading, however, that native peoples and biologists have convergent interests as well as complementary sets of knowledge and skills. Brownrigg (1982) states, for example, that for natural resource managers:

"the benefits of working with native peoples include gaining an additional constituency, recruiting personnel with profound knowledge of local areas and learning about long-term resource strategies which have proven their adaptability for thousands of years. For native peoples, the benefits include legal recognition of ecologically sound traditional land-use practices, appropriate employment of their traditional lands, and new advocates at-a. national level."
(Brownrigg, 1982)

But there are not nearly enough biologists interested in, or in a position to record, all the important traditional practices of native peoples and their knowledge of natural resources they use.

Moreover, individuals who reveal their traditional knowledge to outsiders are relinquishing a certain amount of status or power. Naturally they will sometimes be reluctant, especially if they can see no benefits arising from disclosure of this knowledge.

Traditional knowledge is often no longer being transmitted effectively even within cultures; it is being lost as its owners die. Young members of the educated elite whose formal education is often obtained far from their own communities are among the people in these cultures who know least about such knowledge. Ironically it is these very people who will be most responsible for influencing patterns of natural resource and conservation in their communities in future years. Their technical and political sophistication cannot possibly be put to best use without the knowledge of their natural resources possessed by their elders. Educational institutions have a responsibility to retain such knowledge. Its absence from their curricula amounts to the damning assertion that it is no longer worth learning.

I have suggested in various forums that a course on traditional knowledge and management of natural resources be part of the curricula in native schools. But the transmission of such information cannot be achieved entirely in a typical classroom setting. As one of the course requirements, students might

therefore be asked to do reports describing some aspects of traditional management or knowledge of natural resources, obtained by interviewing their elders and observing their practices. Copies of such reports could be kept on permanent file in the schools where, collectively, **they would** grow to become a unique and valuable source of traditional knowledge. As an incentive, where appropriate, national and local prizes might be offered for the best projects.

Responses to this notion outside Australia have been encouraging. For-example, organizers of Canada's Man in the Biosphere Program have adopted the idea and are sponsoring prizes for student essays on traditional native American knowledge and practices relating to natural resources (Freeman, personal communication). A teacher of fisheries science in Papua New Guinea set his students the task of reporting on traditional fishing in their respective villages. The reports were recently published as a book (Quinn et al, 1984) and the projects are continuing.

COLLABORATION OF BIOLOGISTS AND SOCIAL SCIENTISTS

Emmerson (1980) examined in detail the roles of economics, law, anthropology and biology in artisanal fisheries development. He concluded that

as points of departure for inshore fisheries development in low-income countries, other things being equal, anthropological and biological questions should prove more useful than economic or legal ones. Biology is basic. Depending on whether the resource is physically under or over-fished radically different implications for development result.

The advantage of anthropology, on the other hand, lies in understanding the behaviour of fishermen and their families as members of rural communities that may need assistance not for the sake of their resources but in their own right.

The importance of social science research to fisheries management is now widely **recognised** outside Australia. Increasingly in the United States, for example, fisheries management plans are incorporating formal social impact assessments. A recently formed Fisheries Social Science Network, organized by the U.S. National **Marine** Fisheries Service, has a membership of well over 300 individuals in the U.S. and Canada. A wide range of disciplines is represented, with anthropologists and fisheries management specialists (usually biologists) predominating.

In Australia, the recognition of the close ties between technological and social issues is stated to be an integral part of government policy (Tegart, 1984). But sadly, some biologists still scorn the social sciences as being non-quantitative and therefore not truly scientific. They thereby **demonstrate not** only a complete ignorance of modern social science, but also a fundamental misunderstanding of what constitutes legitimate science. In their quest for better **quantification** in research

areas where it is essential, they have somehow convinced themselves that only quantitative research is legitimate research.

Many millions of dollars of resource development aid have been wasted in the past because of inadequate attention to the qualitative social dimensions of the problem. Often project managers have been completely unaware, for example, that social relations governing traditional subsistence activities are frequently inconsistent with capitalistic behaviour and have attributed their project failures simply to "laziness" on the part of the aid recipients. Halapua (1982) provides an excellent discussion of the subject as it pertains to traditional fisheries.

Social science helps reveal ways of introducing developments that are more likely to succeed. (But it also teaches the biologist to think about the ethical dilemma of promoting development projects that may transform traditional societies profoundly).

For anthropologists the benefits of bringing biology into their studies have long been obvious. Ethnobiology is one example. In the field of maritime anthropology the recent realisation that traditional fishermen, unlike most high technology fishermen, widely practice limited entry and that this has important implications for resource management has been described as "a startling discovery" (Cordell, 1984).

-- -- This realisation has been helped, along by fisheries biologists; until they pointed out the significance of TURFs in the context of marine resource management, studies of traditional marine tenure systems were rare. Where they were studied at all, they were generally accorded only a few paragraphs as an afterthought in treatises on land tenure.

Within the past year, however, two books of collected papers on the subject have been published (Ruddle and Akimichi, 1984; Ruddle and Johannes, 1985) and a third is in press (Cordell). All three exemplify close collaboration among social and biological researchers and fishermen. They should prove useful in helping to analyze the issues raised by the existence of traditional marine tenure in Australia.

The resolution of this issue and other problems relating to traditional fisheries will not progress satisfactorily in Australia without fishermen, biologists and social scientists understanding each other's knowledge, customs and perceptions. This workshop provides an excellent beginning.

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WORKSHOP DISCUSSION

The discussion covered the following points:

Aid **programs** have not worked well in relation to traditional fisheries, one reason being a lack of social science input. An example is given in the publication 'The Fishermen of **Tonga**'.

The question of costs and benefits of biological research of tropical fisheries is sensitive because the number of species and complex distribution makes research expensive.

The greatest problem in studying traditional fisheries is data collection, and interviews may provide a 'useful short cut in biological research.

It is important both to interview fishermen and to cross-check biological information.

Local knowledge of traditional fishermen can modify generalisations from biologists who have worked only in limited areas.

Rock lobsters migrating in single file over sandy areas (as in the Caribbean) have been reported by an Aboriginal community in the Northern Territory.

There is a need for education and training in schools regarding traditional fishing, particularly along the lines of the work done by Norman Quinn in Papua New Guinea.

Information collection in schools should be acknowledged as a valuable research tool.