Conceptualizing Human Fishers as Predators in Marine Ecosystems

Some Cautionary Notes for Fisheries Management

James R. McGoodwin
University of Colorado

ABSTRACT It has been suggested that models conceptualizing human fishers as predators in marine ecosystems hold potentials for developing fisheries-management policies. However, questionable assumptions inherent in some of these models may also lend them the potential for confounding that process: for example, the low degree of interdependency and lack of coevolution between human fishers and their prey, and the consequences for fishing effort which stem from human fishers' having culture.

Introduction

Formal models have a language and methodology all their own, which for some in fisheries management is seductive in its elegance and persuasive in its seeming authenticity. Hence, reliance upon such models may pose a tempting alternative to the otherwise formidable task of weighing and mediating the ambiguous, complex, and frustrating problems that often surround the development of appropriate fisheries-management policies. Yet, as Maiolo and Orbach (1982:13) observe regarding various formal models used by economists who are interested in fisheries management, 'Although they embody appealing language and method [they] somehow fail to predict the necessary range of consequences of policies.'

To this criticism advocates for the use of formal models in fisheries management often reply, 'Even if these models are not perfect, scientifically speaking they are still the best thing we have.' But, are they?

McGuire (1991), in a masterful article about the failure of certain shrimp fisheries around the world, explains how misconceived scientific discourses sometimes become hegemonic discourses in policy formulation, even though as Pálsson and Durrenberger (1990:138) remind us, 'Biological models are not simply descriptions of nature, they are cultural artefacts, too.' In other words, policy makers sometimes forget that scientific models emanate from a particular professional milieu – a fisheries-management subculture having its own theoretical ethos, initiation rites, rules governing group membership and rites of passage, linguistic usages, dialectical patterns for communicating, collective concerns for reducing professional risks and ensuring survival, and other shared concerns.

A grave problem may therefore arise when questionable scientific formulations amass sufficient power to sway the development of management

policies. As McGuire (1991:33) observes, drawing on ideas from several others,[1] a persistent problem in fisheries management today is how the seemingly 'authentic discourse' of the scientist becomes the 'authoritative discourse' as well, permitting it to play a decisive role in the establishment of management policies.

Moreover, while most formal models used in fisheries management are phrased in deterministic and mechanical form (including those simulating 'chaotic' population changes: e.g., Wilson *et al.* 1990), suggesting they are 'predictive models,' it should be noted that this is only a matter of their form. Otherwise they remain simplifications of reality which only rarely predict future fish populations corresponding with various projections of fishing effort, and almost never predict future populations of human fishers and/or their fishing behavior corresponding with various projections of fish stocks.

Modeling Human Fishers as 'Predators' in Marine Ecosystems

Human paleontologists generally agree that our human and nearly human ancestors passed through a long, evolutionary stage while subsisting mainly as predators (cf. Binford 1987; Dart 1953; Shipman 1984; and Trinkaus 1987:107). Indeed, the idea that the predator's way is still a fundamental aspect of even modern humanity's physical and behavioral make-up remains a popular idea. Robert Ardrey, for example, unquestionably the most renowned popularizer of this idea, states in his best-selling book, *African Genesis*: 'Children of all animal kind, we inherited many a social nicety as well as the predator's way' (1961:9). However, when it is proposed that modern fishers may be conceptualized as any other predators in marine ecosystems, and especially when this is asserted to hold potentials for the development of fisheries-management policies, then a few cautionary comments seem in order.[2]

McGuire's recent article on the failure of certain shrimp fisheries caused me to think back on an article by Jeffrey Kassner which appeared in *MAST* a few years ago. In it Kassner stated:

> An ecological profile of a fishermen population would present a more comprehensive ecological study, examining the ecological processes of predation, competition and adaptation from the perspective of the fishermen. All pertinent factors would therefore be taken into account (1988:182).

Furthermore, he said:

> The baymen are examined from the perspective of a predator on hard clams requiring a certain amount of harvest to survive and as competitors with each other and with other predators for hard clams as well as with those seeking to control access to bay bottom for shellfish culture, among others (ibid.).

Of course, formal models of the population dynamics of *non-human*

organisms in marine ecosystems have achieved some limited success in terms of their predictive power (e.g., Kremer and Nixon 1978). Many of these have employed versions of what is known as the 'Lotka-Volterra' predator-prey formulation, a mathematical framework which formalizes the population dynamics of a predator and its prey as a coupled system of nonlinear differential equations. This framework was developed by Lotka (1925) in *Elements of Physical Biology* and Volterra (1926) in 'Variations and Fluctuations of the Number of Individuals in Animal Species Living Together,' and later refined into nearly its modern form by Fleming (1939) in 'The Control of Diatom Populations by Grazing.'

While variously successful in terms of their predictive power, these models are of necessity simplifications of reality, since they simulate the interdependent dynamics of only a few organisms out of a milieu typically containing thousands. Furthermore, their creators usually acknowledge that there are still many other dynamics in the sea – that is, other than the interdependent dynamics between the populations of the predators and the prey being modeled – which sometimes make even the best conceived models go awry. Nevertheless, because of their formal elegance, their seeming ability to take all pertinent factors into account, and occasionally, their predictive power, these models early on drew the attention of fisheries managers.

Models of fisheries dynamics conceptualizing human fishers as predators in marine ecosystems have also been proposed (e.g., Clepper *et al.* 1979). A few are quite formal and have likewise utilized versions of the Lotka-Volterra formulation, and practically all were developed for purposes of informing fisheries management. But just how useful are they in fisheries management? The anthropologist Francis Bowles (1979:27) posed this same basic question more than 12 years ago. Speaking at the 1978 International Symposium on Predator-Prey Systems in Fish Communities and their Role in Fisheries Management, he said:

> I am trying to ask a very general question. Fishermen are clearly predators in a marine or estuarine ecosystem. [But] To what degree, from a biological standpoint, would you expect the same models, the same constraints, as you would see in another predator, to act on these fishermen as predators... In other words, if a group of fishermen has developed a set of internal rules to govern their behavior and govern the options they have for what species they want to go after and when they will switch prey species... How much correspondence might we expect to find between that situation and a predator-prey model which treated them like another fish species?

Returning now to Kassner, on first glance his ecosystemic conceptualization of the clammers of The Great South Bay, New York, as predators on hard clams *does* seem a parsimonious and valid description of the instrumental relationships among the fishers, the resource (hard clams), and other human competitors. But, when he concludes that 'The ecological profile also has potential management applications as it reveals fishermen dynamics and it could be used to predict how fishermen respond to management imposed

externalities' (1988:194), I wondered whether 'all pertinent factors' had indeed been taken into account.

Particularly troubling to me was a statement appearing in an early paragraph:

> A fishermen population (i.e., fishermen in a geographically discrete area harvesting the same organism) is no different than that of any other species (ibid.:182).

Certainly he meant 'a fishermen population ... is no different than that of any other species' for purposes of the model he proposed, but even so I began to feel uneasy with that proposition.[3]

Human versus Marine Predators in Marine Ecosystems

Most formal ecosystemic predator-prey models involving non-human organisms are concerned with *interdependent* predators and prey whose populations are affected by their interactive dynamic in conjunction with their respective birth and mortality rates. Thus, a high degree of interdependency between the predator and its prey is a necessary (even if tacitly assumed) condition for constructing these models.

However, when human fishers are conceptualized as predators in predator-prey models of marine ecosystems the same degree of interdependency between their populations and those of their prey cannot be assumed. This is because fishers' populations only partly derive from their success in capturing their targeted prey, while myriad other factors may be more decisive – historical and traditional residence and occupational patterns, for example, important symbolic orientations surrounding self identity, and other complex sociocultural, economic, political, and demographic dynamics, not to mention influences from forces completely external to the fishery. In essence, while most formal ecosystemic models posit predator and prey as mutually dependent variables, in reality human fishers have far greater degrees of freedom vis-à-vis those frameworks than the degrees of freedom that can be assumed for their prey.

This lesser degree of interdependency between human fishers and their prey, as compared with that which typically obtains between non-human predators and their prey, stems mainly from the fact that human fishers and their marine prey do not live in the same medium. Recall that Volterra's (1926) initial formulation was concerned with 'Variations and Fluctuations of the Number of Individuals in Animal Species *Living Together*' (emphasis mine). Thus, Lotka-Volterra formulations which conceptualize human fishers as predators in marine ecosystems significantly depart from Volterra's original conception.

Another factor undermining the necessary assumption of interdependence is that there has been no significant coevolution between human fishers and their marine prey. Whereas many predator-prey relationships among animals

may be seen as the result of long-term, mutually beneficial adaptive processes in which each organism influenced the physical and behavioral development of the other over a long period of time, this cannot be presumed regarding humans and any marine organisms.

Hennemuth (1979:8), for example, doubts 'that man can be a prudent predator [in the marine environment], taking only what would die or not be produced in his absence,' or by culling mainly the most vulnerable, that is, the very young or the very old, the less vigorous, or the otherwise 'unfit.' It is highly unlikely, he stresses, that humans and any marine organisms could have decisively influenced each other's evolutionary development by 'learning' from one another, inheriting beneficial traits from their respective ancestors which enhanced their chances for survival. Why? Because the marine prey of the earliest humans who relied primarily on marine foods had already evolved into essentially their contemporary forms long before human 'predation' in marine environments had become significant. Considering that the first peoples to rely primarily on marine organisms did not emerge until the Mesolithic era, a mere 10,000 years ago, there simply has not been enough time for any significant coevolution between humans and marine organisms (see Clark 1948 and 1952).

There are some other fundamental differences between human fishers and non-human predators in marine environments which stem from human fishers' not living in the same medium as their prey. First, unlike most marine predators human fishers do not return their own biomass back to the marine ecosystem at the end of their life cycles, but instead transfer it more or less permanently to terrestrial ecosystems. Second, some marine organisms not only feed on their own eggs and juveniles, but are also linked in predator-prey relationships with other organisms such that each is alternately the predator and the prey of the other at different stages of their respective life cycles. This, of course, has no pertinent analogues in any human-marine organism relationships, and especially no pertinency for managing human fishers.

In a broader sense, conceptualizing human fishers as any other marine predator in a formal model – whether Lotka-Volterra, or otherwise – is of doubtful validity because humans alone have culture.[4] Non-human marine predators, on the other hand, are locked into patterned ways of life which are constrained by their physical make-up and mostly instinctual behaviors. Human fishing effort, to the contrary, while responsive to the customary behavior of the prey, is culturally learned and aided by technologies which far transcend the capture capabilities of the human body alone, and unlike non-human marine predators when fisheries fail humans will quickly turn to a variety of other, non-fishing subsistence strategies. And, quite unlike other marine predators, human fishers may establish localized systems of self control, or see their fishing behavior influenced by still other factors arising from either amongst themselves or from sectors of their society which are quite remote from their immediate milieu.

The motivational bases underlying human fishing activity are also quite

different from those of other predators in marine environments. Whereas non-human marine predators are motivated by the simple and singular desire to consume their prey, humans fish for that as well as a multiplicity of other, more complex reasons. Even in the case of subsistence-oriented human fishing activity in which consumption is indeed the primary motivation underlying fishing activity, the catch is usually redistributed in the local society of which the fisher is a part – a behavior having no pertinent analogues among other marine predators. Furthermore, even if purely subsistence-oriented human fisheries more closely conform to classical predator-prey conceptions, these are otherwise a disappearing societal type around the world. Nowadays most fishing activity is motivated by participation in human-instituted market economies, and it is this sort of fishing that most urgently prompts the need for fisheries management and which makes human fishing quite different, both substantively and in terms of its scale, from fishing by other marine predators.

For most non-human marine predators there are upper bound limits on consumption. Shoemaker (1990:78), for instance, commenting on formal aspects of predator-prey models, reminds us that '... a predator's capacity to consume is finite,' and once a marine predator has satisfied its immediate consumption needs it will cease its predatory activity for awhile. For human fishers involved in market economies, on the other hand, there is usually no comparable upper-bound limit on the demand for cash.

Because human fishing is an integral part of a larger cultural dynamic, human fishers are also sometimes motivated to fish for reasons which are quite remote from the need to produce adequate food. These may include aesthetic orientations regarding maintenance of traditional and preferred lifestyles, self identity, and occupational pride, or fishing in order to become wealthy. Human fishing may also entail the production of fad or luxury food items, the demand and clamor for which cannot be understood in terms of their nutritional value. And, of course, only humans fish merely for fun and recreation. In sum, human fishers do not fish solely for purposes of feeding themselves, but instead for a variety of reasons which are remote indeed from the motivational assumptions implied in most formal predator-prey models being developed today.

Thus, Kassner's (1988:182) statement that 'A fishermen population ... is no different than that of any other species' does not hold up to closer scrutiny. It simply is not true, as he continues, that

> [b]oth have biological requirements and must confront the same suite of basic survival problems: securing sufficient energy (i.e., food, cash) for maintenance, growth, and reproduction, obtaining resources also being sought by others, and responding (adapting) to changing conditions (ibid.).

To the contrary, humans and marine organisms do not confront the same suite of basic survival problems. Certainly both have similar biological requirements in terms of their necessity to secure sufficient food energy, but

human survival also entails the maintenance of complex sociocultural dynamics. And for most of modern humanity this dynamic prompts demands for natural resources which far exceed what is needed merely for biological maintenance, growth, and reproduction.

Summary and Conclusions

Ecosystemic models which conceptualize humans as any other predator in a marine environment – even those which are informally constructed as prose texts such as in Kassner (1988) – assert or at least imply erroneous parallels between human fishers and other marine predators by inhering questionable assumptions about the nature of the relationships between the human fishers and their prey. Such models may have heuristic value for facilitating discovery of the main instrumental relationships in an ecosystem, and are potentially of greatest use when biological conservation of the prey species is the first concern. Otherwise, they offer little insight concerning how to manage human fishers.

What they most lack – even when they succeed in predicting future fish stocks corresponding with varying types and levels of fishing effort – and that which is so difficult to formally link to them, are two other objective functions. These are what Shoemaker (1990:102) calls '*a criterion function* for determining management's success and permitting comparison with other management programs,' and '*constraint equations*,' which place limits either on the decision variables or on the dynamics of the system. Failing integration of these latter two functions, ecosystemic predator-prey models fall short of being true management models.

In a different vein, another problem inherent in conceptualizing human fishers as predators stems from the pejorative connotations surrounding the word 'predator' itself, which include 'plunderer,' 'destroyer,' 'devourer,' 'pillager,' and 'robber.' Thus, by labelling human fishers as 'predators' in marine ecosystems we risk dehumanizing them in fisheries-management contexts.

Models conceptualizing human fishers as predators in marine ecosystems may offer useful perspectives for framing management-policy questions, but they should be only one voice among many. A diversity of voices which are authoritatively vested in diverse ways, and which propose models of many types, should always inform fisheries-management policies.

I have no doubts that our ancestors passed through a long, evolutionary stage by living essentially as predators. Nor do I doubt that 'the predator's way' remains a fundamental aspect of even modern human nature. But when we make the leap from those general assumptions to more formalized conceptualizations of humans-as-predators in the fisheries we may run into trouble. This is because of limitations in the models themselves, because the dynamics they inhere are not necessarily analogous to modern human nature, and because in doing so we risk dehumanizing the very people whose lives we otherwise hope to improve.

Notes

1. Specifically, Asad (1979:623), Bourdieu (1987:809), Durrenberger (1988), Goodrich (1987:132), McEvoy (1988), Meehan (1984), Pálsson and Durrenberger (1990:138), and Smith (1990).

2. In a very general sense, most bioeconomic models utilized in fisheries management today imply that human fishers are 'predators' in marine ecosystems, since they presume the existence of equilibrium states regarding human fishing effort on the one hand and managed fish populations on the other.

3. My main concerns in this article are briefly discussed in McGoodwin (1990:87-88).

4. Some scholars refute this notion – notably Ingold (1986a:16-17 and 248-49, 1986b, and 1988:9-11). Citing Bock (1980:148), Ingold develops an argument that culture is not the sole province of human beings because 'some species of animals (primarily vertebrates) have "culture histories"' (1986b:217). This, he says, is because a large part of 'the transmission of tradition' in humans and higher animal forms 'entails a kind of observational learning' (ibid.:359), and is not restricted to traditions learned through intentional teaching. Voegelin (1951:370), who similarly relies on this broader interpretation of learning, likewise asserts that 'infra-human animals' have culture.

I feel these views are irrelevant for fisheries management for two main reasons: first, because none of the marine prey which is the object of human fishing effort today can be regarded as 'infra-human'; and second, because no discrete populations of any marine species which are exploited by human fishers seem to 'learn' differential behaviors analogous to different localized 'traditions' which significantly help them to evade the particular method of capture being applied to them.

References Cited

Ardrey, Robert
1961 *African Genesis: A Personal Investigation into the Animal Origins and Nature of Man*. New York: Dell Publishing Co., Inc.

Asad, Talal
1979 Anthropology and the Analysis of Ideology. *Man* 14:607-27.

Binford, Lewis R.
1987 Were there Elephant Hunters at Torralba? In: Matthew H. Nitecki and Doris V. Nitecki (Eds.), *The Evolution of Human Hunting*. New York: Plenum Press. Pp. 47-105.

Bock, K. E.
1980 *Human Nature and History: A Response to Sociobiology*. New York: Columbia University Press.

Bourdieu, Pierre
1987 The Force of Law: Toward a Sociology of the Juridical Field. With Translator's Introduction by Richard Terdiman. *Hastings Law Journal* 38:805-53.

Bowles, Francis P.
1979 Discussant. In: Clepper (Ed.), *Predator-Prey Systems in Fisheries Management*. Washington, D.C.: Sport Fishing Institute. P. 27.

Clark, J. G. D.
1948 The Development of Fishing in Prehistoric Europe. *Antiquaries Journal* 28:45-85.

Clark, J. G. D.
1952 *Prehistoric Europe: The Economic Basis*. London: Methuen.
Clepper, Henry (Ed.)
1979 *Predator-Prey Systems in Fisheries Management*. Proceedings of the International Symposium on Predator-Prey Systems in Fish Communities and their Role in Fisheries Management, Atlanta, Georgia, July 24-27, 1978. Washington, D.C.: Sport Fishing Institute.
Dart, Raymond A.
1953 The Predatory Transition from Ape to Man. *International Anthropological and Linguistic Review* 1(4).
Durrenberger, E. Paul
1988 Shrimpers and Turtles on the Gulf Coast: The Formation of Fisheries Policy in the United States. *Maritime Anthropological Studies* 1(2):196-214.
Fleming, R. H.
1939 The Control of Diatom Populations by Grazing. *Journal du Conseil International pour l'Exploration de la Mer* 14:210-27.
Goodrich, Peter
1987 *Legal Discourse: Studies in Linguistics, Rhetoric and Legal Analysis*. London: Macmillan.
Hennemuth, Richard C.
1979 Marine Fisheries: Food for the Future. *Oceanus* 22(1):2-12.
Ingold, Tim
1986a *The Appropriation of Nature: Essays on Human Ecology and Social Relations*. Manchester: Manchester University Press.
Ingold, Tim
1986b *Evolution and Social Life*. Cambridge: Cambridge University Press.
Ingold, Tim
1988 Introduction. In: T. Ingold (Ed.), *What is an Animal?* London: Unwin Hyman. Pp. 1-16.
Kassner, Jeffrey
1988 The Baymen of the Great South Bay, New York: A Preliminary Ecological Profile. *Maritime Anthropological Studies* 1(2):182-95.
Kremer, J. N. and S. W. Nixon
1978 *A Coastal Marine Ecosystem: Simulation and Analysis*. New York: Springer-Verlag Berlin-Heidelberg.
Lotka, A. J.
1925 *Elements of Physical Biology*. Baltimore: Williams and Wilkins.
Maiolo, John R., and Michael K. Orbach (Eds.)
1982 *Modernization and Marine Fisheries Policy*. Ann Arbor, Michigan: Ann Arbor Science Publishers.
McEvoy, Arthur F.
1988 Toward an Interactive Theory of Nature and Culture: Ecology, Production, and Cognition in the California Fishing Industry. In: Donald Worster (Ed.), *The Ends of the Earth: Perspectives on Modern Environmental History*. Cambridge: Cambridge University Press. Pp. 211-29.
McGoodwin, James R.
1990 *Crisis in the World's Fisheries: People, Problems, and Policies*. Stanford, California: Stanford University Press.

McGuire, Thomas R.
1991 Science and the Destruction of a Shrimp Fleet. *Maritime Anthropological Studies* 4(1):32-55.
Meehan, Richard L.
1984 *The Atom and the Fault: Experts, Earthquakes, and Nuclear Power*. Cambridge, MA.: MIT Press.
Pálsson, Gísli, and E. Paul Durrenberger
1990 Systems of Production and Social Discourse: The Skipper Effect Revisited. *American Anthropologist* 92:130-41.
Shipman, P.
1984 Ancestors: Scavenger Hunt. *Natural History* 93(4):20-27.
Shoemaker, Christine A.
1990 Mathematical Construction of Ecological Models. In: Charles A. S. Hall and John W. Day, Jr. (Eds.), *Ecosystem Modeling in Theory and Practice: An Introduction with Case Histories*, 2nd Edition. Niwot, Colorado: University Press of Colorado (first edition 1977 by John Wiley and Sons). Pp. 75-114.
Smith, M. Estellie
1990 Chaos in Fisheries Management. *Maritime Anthropological Studies* 3(2):1-13.
Trinkaus, Erik
1987 Bodies, Brawn, Brains, and Noses: Human Ancestors and Human Predation. In: Matthew H. Nitecki and Doris V. Nitecki (Eds.), *The Evolution of Human Hunting*. New York: Plenum Press. Pp. 107-45.
Voegelin, C. F.
1951 Culture, Language, and the Human Organism. *Southwestern Journal of Anthropology* 7:357-73.
Volterra, V.
1926 Variations and Fluctuations of the Number of Individuals in Animal Species Living Together. In: R. N. Chapman (Ed.). *Animal Ecology*. New York: McGraw-Hill. Pp. 409-48.
Wilson, James A. *et al.*
1990 Managing Unpredictable Resources: Traditional Policies Applied to Chaotic Populations. *Ocean and Shoreline Management* 13:179-97.