

Editors:

Rob van Ginkel and *Jojada Verrips* (University of Amsterdam)

Editorial Board:

Raoul R. Andersen (Memorial University of Newfoundland, Canada), *Jeremy F. Boissevain* (University of Amsterdam, The Netherlands), *Reginald F. Byron*, (The Queens University of Belfast, Northern Ireland), *Hal B. Levine* (Victoria University, New Zealand), *Bonnie J. McCay* (Rutgers University, USA), *James R. McGoodwin* (University of Colorado, USA), *Gísli Pálsson* (University of Iceland, Iceland), *Kenneth Ruddle* (National Museum of Ethnology, Osaka, Japan), *M. Estellie Smith* (State University of New York, College at Oswego, USA), *Lawrence J. Taylor* (Lafayette College, USA), *Torben A. Vestergaard* (Aarhus University, Denmark).

Consulting Editor: *Rod Aya* (University of Amsterdam, The Netherlands)

Editorial Assistent: *Brigitte Bonekamp*

MAST (Maritime Anthropological Studies) is an international journal of anthropology on fishing and maritime communities. Published twice yearly by the Department of European and Mediterranean Studies (Euromed) at the University of Amsterdam, the Netherlands, **MAST** aims to disseminate knowledge of contemporary and historical societies and cultures of people exploiting maritime environments.

Articles, comments, books for review, and business correspondence should be addressed to:

Euromed/Mast
Anthropological-Sociological Center
University of Amsterdam
O.Z. Achterburgwal 185
1012 DK Amsterdam
The Netherlands

Subscription price per volume (including postage): private individuals Dfl. 35.00 (US\$ 18.50), and institutions, libraries, etc. Dfl. 70.00. (US\$ 37.00). Please transfer the amount in Dfl. or US\$ to our postal giro account no. 3691970 or to J. Verrips/MAST, ABN Bank account no. 545446406, Amsterdam, the Netherlands, or pay with International Money Order.

Cover design: *Yvon Schuler*

Printed by Krips Repro, Meppel, The Netherlands

ISSN: 0922-1476

© **MAST**. All rights reserved

MAST

Maritime Anthropological Studies

Vol. 4, No. 1

1991

Contents

ECONOMIC ANTHROPOLOGY AND INTERDISCIPLINARITY IN COSTA RICA FISHING: THE PITFALLS OF PROBLEM FORMULATION	1
<i>Yvan Breton</i>	
INSIDIOUS RATIONALITIES: THE INSTITUTIONALISATION OF SMALL BOAT FISHING AND THE RISE OF THE RAPACIOUS FISHER	13
<i>Anthony Davis</i>	
SCIENCE AND THE DESTRUCTION OF A SHRIMP FLEET	32
<i>Thomas R. McGuire</i>	
THE LIFE AND DEATH OF A SMALL-SCALE FISHERY: SURF CLAM DREDGING IN SOUTHERN MAINE	56
<i>Craig T. Palmer</i>	
MEASURING OURSELVES: ADAPTATION AND ANXIETY ABOARD A FISHING VESSEL	73
<i>Peter Knutson</i>	
DISCUSSION	91
BOOK REVIEWS	98
BOOKS RECEIVED	102

Economic Anthropology and Interdisciplinarity in Costa Rica Fishing

The Pitfalls of Problem Formulation¹

Yvan Breton

Université Laval, Québec

ABSTRACT The social sciences have so far maintained a subordinate position within the realm of maritime studies. This essay seeks to understand the reasons for this situation. It first outlines the reasons that explain anthropologists' initial reluctance to engage more actively in interdisciplinary exchange. Afterwards, relying on a framework that borrows from economic anthropology, it examines the actions so far undertaken by international and national agencies in the development of artisanal fisheries in Costa Rica. The restricted results obtained in these projects lead to conclusions that show the necessity of enlarging our vision of the social dimension of fishing.

Introduction

Within the realm of maritime studies, the social sciences maintain a subordinate position. Here we seek to understand the reasons for this situation, and to identify the kinds of understandings and interpretations other disciplines should receive from the social anthropology of fishing.

Starting with a brief outline of the constraints that explain the maritime anthropologists' initial reluctance to engage more actively in interdisciplinary exchange, the essay will continue with an examination of the actions so far undertaken by international and national agencies in the development of artisanal fisheries in Costa Rica. Relying on a framework that borrows from economic anthropology, in which interdisciplinary premises form the essence of analytical questioning, we will draw some conclusions about the restricted results obtained so far in these projects. We then argue the necessity of enlarging our vision of the social dimension of fishing if we wish to render maritime anthropology a more applied subdiscipline and enhance its contribution and weight in relation to other disciplines.

Maritime Anthropology and Interdisciplinarity: A Fragile Connection

The arguments which follow amount to looking in a critical way at the internal evolution of maritime anthropology as a distinct subfield within social anthropology, seeking to explain why its practitioners did not initially engage in a more systematic collaboration with other scientists involved in the study of fisheries.

The progressive emergence of maritime anthropology on the North American academic scene in the 1960s and the 1970s paralleled a situation in which the identity of its members was not strong. As already noted by several authors,² this incipient phase was characterized by the extension of an ethnographic focus rather than the establishment of analytical devices for understanding the social dimensions of fishing. Reflecting a principle experienced in capitalist branches of production other than academics — relying upon a new product in order to expand the market and consumption spheres — the consolidation of maritime anthropology was to a large extent based on a false novelty. Even though some people questioned the usefulness of creating another subdiscipline, a majority of scholars implicitly accepted the term and generated a growing body of literature on the subject.³

Nevertheless, a lack of epistemological consistency, well illustrated by the wide variety of topics studied and the confusion prevailing between comparative studies and theoretical constructs,⁴ did not help anthropologists to undertake exchanges with colleagues involved in disciplines which were well established in the study of fisheries, and who were already using sophisticated models. This created an asymmetric situation that became reinforced by the greater visibility of the latter scientists within the state apparatus linked to fisheries.

Important also is that this process took place at a time during which the mother discipline, social anthropology, was itself characterized by a significant remodeling of its theoretical constructs. The prevailing culturalist and functionalist paradigms were progressively succeeded by renewed interests in evolutionism, transactionalism, ethnohistory, and symbolic anthropology. Economic anthropology simultaneously underwent a transition from formalism to substantivism and political economy.

This internal diversification, while taking into account the lack of communication between anthropologists and other scientists involved in fishing, exposed some contradictions since it too was based in interdisciplinary borrowings. Thus, while cultural ecology partly relied on findings of biology, nutrition, and botanical science, political anthropology was influenced by game-theory models and economic anthropology actively participated in internal debates taking place in formal and liberal economics.⁵

Why, then, did maritime anthropologists not undertake more active interchanges with marine biologists and economists at that time? I believe that in addition to the great ethnographic diversity anthropologists were faced with, and granting the apparently new anthropological object that maritime communities represented, this paradigmatic pluralism retarded the search for a more consistent theoretical apparatus for the study of the social dimension of fishing. And, besides anthropology's idiosyncratic status within the range of scientific disciplines related to fisheries development, this eclecticism contributed to the weak identity of maritime anthropology practitioners within the contexts of fisheries management and policy, which was not propitious for scientific exchanges and joint investigations.

With time, especially due to a reappraisal of the importance of artisanal fisheries in the 1970s, maritime anthropologists, marine economists and others interested in the fisheries slowly undertook more significant interdisciplinary collaboration about the effects of modernisation in fishing. However, the distance between anthropology and biology remained. In addition to strong differences at the level of their main scientific concern (natural resources versus human beings), I believe that as social scientists, maritime anthropologists had an intrinsic aversion to biological modes of explanation. This was rooted in the previous debates and criticism over the physiological content of early positivist approaches, be it Spencerian Evolutionism or Durkheimian functionalism. Given the preeminence of the biologists' advices in the conduct of fisheries, characterized in the 1970s by their even stronger presence in the state apparatus, many anthropologists could not accept the proposition that the rules based on a 'physiological normality' should serve as guidelines for establishing social and political strategies.⁶

These distorted views were, however, slowly changed when the 'tragedy of the commons' paradigm, first used to regulate captures among foreign countries after the extension of off-shore territories at the middle of the 1970s was extended to regional and local levels, affecting directly the regulation of fishing in communities in which anthropologists were already at ease.⁷ Anthropologists then gained more credibility, possessing an expertise that scientists working at a macro and quantitative level did not have. Therefore, a stronger collaboration in both the academic and applied spheres began to grow.

Despite this improved situation, however, there remains asymmetry between social and bio-economic approaches to fisheries. The important issue here is not to engage in a sterile debate about the scientific superiority of various disciplines, but instead to understand the amplitude and range of distortions that still exist, regarding their respective operational possibilities. Without mentioning the greater political and social visibility of disciplines related to the bio-economy of fisheries, one has to admit that they have at their disposal, in terms of problem formulation, a far wider range of information and sources of funding. I have always been impressed, as an anthropologist, to see that in almost all national contexts, there exists more information on the types of fish species, their reproductive mechanisms, their migration and fragility, the types and lengths of boats, the types and sizes of fishing gear, the range of capital assets and the volume and value of the catches than there is information on the people using the gear and catching the fish. Except for few statistics on the number of fishermen, there usually exist almost no data on their age, the number of their dependents, their migration patterns, technical qualifications, access to credit, social coalitions and links with other branches of production, and sources of revenues within the larger social division of labor. Quite simply, we possess a lot more information on marine species than we do on marine producers.

It is in the reduction of these discrepancies that joint efforts should be made

in the future. This process does not necessarily imply the disappearance of disciplinary barriers. Rather, it supposes a mutual internal critique leading to a recognition of the explanatory limits with which each discipline is faced. For instance, if biologists could develop a stronger concern for the producers' ethnoscientific and practical knowledge in fisheries, economists could reduce their tendency to 'naturalize' the labor force as a factor of production, giving more importance to the producers' view of economic planning and economic ends, and also develop a more balanced emphasis between production and distribution. And for their part, anthropologists should better objectivize their own 'social trajectory' in the fisheries by extending their research interests beyond the community level, and paying greater attention to the bureaucratic sphere, thus promoting, within paradigms already existing in their discipline, better channels of communication with practitioners in neighboring academic fields. I will try to illustrate such a process with an example derived from development experiences in Costa Rica's artisanal fisheries.

Economic Anthropology and Fisheries Development in Costa Rica: A Question of Problem Formulation

Compared to the organizational features of fisheries in many Latin American countries, those of Costa Rica are still at an incipient stage of development. Its 6,500 fishermen averaged a total annual catch of less than 20,000 metric tons over the last fifteen years, this amount including the landings of 70 draggers since 1970. With a production consisting mainly of shrimp and demersal species such as 'corvina' and 'pargo,' the activity represents 0.26% of the gross national income, and fishermen form only 0.8% of the total active labor force. In addition, Costa Rica imports about 20% of the fish sold in its internal market places.⁸

Taking into account the extension of its littoral zones, and especially the importance of its continental platform on the Pacific side, the wide variety of species encountered, and the nutritional problems which exist in several areas, no doubt production could be increased and the overall importance of fishing activity enhanced.⁹ To be sure, numerous specific actions by national and international agencies have addressed the development of the fishing sector. Why, therefore, did none of these attempts succeed in fundamentally changing the situation? We use here as a case study one of the major interventions in Costa Rica fisheries, promoted jointly between 1976 and 1983 by the Inter-American Bank for Development (BID) and the Costa Rica government.

This project, originally launched in several Latin American countries to increase production in the industrial and artisanal sectors, focused investments in fishing technology and infrastructure linked to landing and processing activities.¹⁰ A sum close to \$20 million (US), of which \$6 million came from the Costa Rica government, was to be invested. Sixty percent of the

amount was oriented towards fishing cooperatives in the artisanal sector. Most of the investments consisted of buying and constructing boats, as well as support for a fish plant in Puntarenas and sea-port facilities in Guajiniquil, with the remainder earmarked for professional training of fishermen and for administrative purposes. A group from a national bank (Banco Anglo Costaricense) and various government agencies took charge of the planning and execution of the project. The implementation phase was originally designed to last four years. Nonetheless, it lasted eight years, and, in spite of this extension, ended up with only modest results. Only 33% of the initially anticipated budget was used, the cooperative in charge of the promotion of much of the actions in the artisanal sector went into bankruptcy, and only 21 of the 51 boats planned for the artisanal fisheries were built. Because of the lack of specialized training, the fishermen could not use these boats adequately, and their fishing efforts generated increased debts and loss of revenues.

On balance, this important project, set up by international fishing experts and supported by large amounts of money, was a failure, not only at the financial level, but also at the level of fishermen's confidence in external aid and in the cooperative ideals. Now, in spite of some efforts of rectification by national and other international agents, many difficulties remain for the economic and social promotion of the sector.¹¹

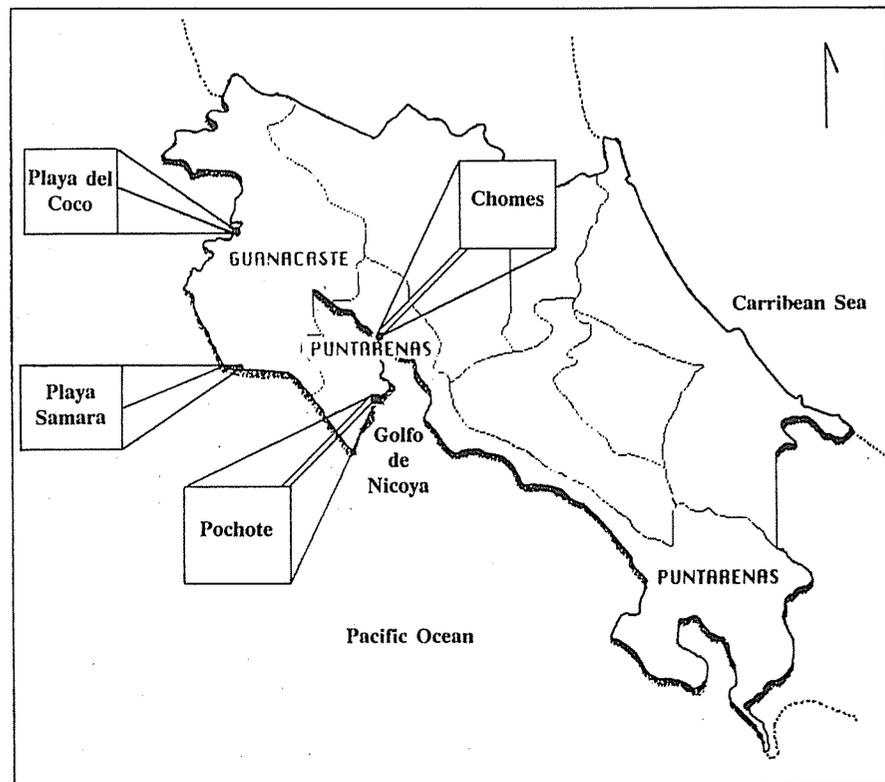
Several lessons can be derived from these development projects. Most critically, their interdisciplinary basis remained incomplete, as they relied most heavily on partial knowledge of the biological resources which was rooted in an almost unyielding faith in strict economic and administrative planning without any structured concern for the social dimension of the activity. By this, I mean not only a lack of attention to the fishermen's cultural values, forms of organization, and degree of familiarization with the cooperative formula, but, above all, a lack of knowledge about and indifference to human contexts in which the activities takes place.

The majority of the development programs that have been implemented in Costa Rica fisheries thus far share the following common characteristics. First, they were based on interventions that international institutions wished to export to underdeveloped countries in order to enhance their political visibility. Second, they were filtered through a national bureaucracy or internal agencies whose members have never thought about fishermen's values, since most staff members in these institutions are trained in academic fields dominated by formalist approaches that inevitably lead to the 'naturalization' of the producer as an economic variable. Third, they constantly sought to promote a cooperative model, itself stereotyped without verifying whether it was the most appropriate avenue in a given regional or community context. Even more dangerous was the concurrent establishment of fictitious cooperatives that functioned as bureaucratic offices, without significant administrative capacity but presumably representing the voice of the fishermen.¹²

Maritime social anthropologists, given their training and expertise in the social aspects of fisheries, could play a more active and positive role in the development of projects in this sector. I will illustrate this position by referring to a research project that a Université Laval team is presently conducting on artisanal fisheries in the Gulf of Nicoya and the Peninsula of Guanacaste. Previous analysis of the failure of several development projects in Costa Rica, added to former research experiences in different cultural contexts, led us to rely on a framework aimed at examining the social diversity of artisanal fisheries in these regions.

Diversification in Costa Rica Fisheries: Implications

We were aware that the economic crisis at the beginning of the 1980s had caused major structural modifications which had destabilized the existing division of labor and encouraged agricultural producers to engage in artisanal fishing. Thus we aimed first at reconstructing the social trajectory of fishing



Map 1. Costa Rica: Communities Selected for Study.

as economic activity. Taking into account the nature the resources, equipment, labor force and the institutions in charge of the promotion of the activity, we reached a first level of comprehension that rendered us more familiar with the macro-evolutionary context of the fisheries sector.¹³ This effort was useful not only to better objectivize the present-day situation but to understand the structural marginality of the sector, a feature that remains a key variable for the elaboration of future interventions.

Contrary to the rationale sustaining many development programs, we came to the conclusion that the evolution of fishing was more conditioned by external than internal factors. Its marginality at the economic and political levels led to a situation in which national policies were oriented towards the promotion of other activities, the conduct of which greatly affected the fishing industry. Agricultural fertilizers and industrial wastes increased pollution in the major fishing areas, namely in the Gulf of Nicoya. Access to credit became more difficult for the fishermen. Moreover, given the fragility of an agricultural production oriented towards external markets and the land concentration process that followed the economic crisis, primarily in the cattle-raising sector, many producers without former experience in fishing were drawn into the activity. So our initial effort to characterize the Costa Rica fisheries as a production process, with an approach derived from economic anthropology, greatly enriched our vision of the diversity existing among producers. At the analytical level, it was not helpful to simply distinguish artisanal from industrial fishermen or even to try to classify them according to the species captured. Of utmost significance in terms of practical interventions was the analysis of the depth of their involvement in the activity and consequently of the historical basis of their human capital.

A second level of diversification, in addition to the identification of various productive cycles according to the labor processes in fishing, lay in the relative importance of fishing within the total occupational structure of the communities themselves. In some communities, fishing represents the main occupation; in others, it has an ancillary character. Furthermore, this relativeness is itself embedded in a differentiated occupational structure, with the conduct of fishing varying according to the presence of agricultural, industrial, or tourist activities. From an anthropological point of view, this articulation would drastically change the economic planning attached to the activity, since it influences the availability of the pool of labor force at given periods and affects the channels of commercialization of the product. The presence or absence of a fishing cooperative in the community, in light of these elements, is of secondary importance.¹⁴

A third level of diversification consists in the internal features of the domestic units involved in fishing. While in some communities, especially those with long involvement in fishing, the majority of producers belong to families in which fishing appeals to most of the male members, in others, only one member of the unit actively participates in fishing. This situation creates discrepancies and variations in the accumulation process and greatly affects

planning and work continuity in the activity. With the increase in the total number of producers recently, in some communities we see the involvement of women in the acquisitive phases of the fishing activity, a situation that destabilizes former cultural patterns of gender relationships.

A fourth level lies in the presence or absence of structured coalitions at the community or regional level through which producers' aspirations and claims are channeled. Let me mention here that I refer not only to cooperative but likewise to other types of group relations such as the existence, in several Costa Rica regions, of an Association for Development (*Asociación para el Desarrollo*) whose members actively participate in the municipal political sphere or on local committees of fishermen. Rarely referred to in the development projects, they nevertheless constitute significant social entities which are often characterized by a stronger stability and efficiency than their counterparts in the cooperatives. Concerning the latter form of organization, cooperatives, we have been impressed by its structural weakness, its negative history of implantation in some areas, its fictive character in others, and, in the overall, its promotion by resort to an 'agrarian model' that fails to take into account the unique character of fishing as a social and economic activity in a given communal setting. There exists, therefore, a great diversity and an unequal understanding of the social coalitions at work in Costa Rica fishing communities.

A fifth level of differentiation derives from the communities' historical degree of familiarization with national and international institutions. Greatly influenced by the geographical location of the communities and the existing transport facilities – which, for example, affect the supply of equipment and the marketing of the product – this situation gives rise to a context in which some communities have already experienced various 'external' or 'directed' interventions while others have been consistently neglected. In either context, given the failure of several projects, greater attention should be paid to the people's cultural schemes and conceptions of bureaucratic actions. This demands a more careful examination of the social and ideological setting in which the promotion of a project can be done and a better identification of the cultural channels through which initial information can be transmitted.¹⁵

Finally, in Costa Rica fisheries, especially on the Pacific side, a strict correspondence between politico-administrative and ethnic boundaries does not exist. The people living in the Guanacaste Peninsula share a remote but otherwise common affiliation with the indigenous Chorotegan culture. Even though this affiliation was somewhat attenuated by the integration of this area into the Costa Rica nation during the last century, it remains, at some ideological and referential levels, an important factor explaining the fishermen's reluctance to engage in regional coalitions which crosscut their former cultural boundaries.¹⁶

Summary and Conclusions

This brief suggestion of the social diversity of artisanal fishing communities in Costa Rica shows that, depending upon the variables taken into account, problem formulation within development projects can lead to very different hypotheses and concrete solutions. On the one hand, the communities can be thought of as relatively identical and homogeneous social groupings in which there is no need for comprehending their internal components. In these cases, a few statistics on the demographic and occupational structures might be judged a sufficient basis for grasping social dynamics. On the other hand, efforts can be made to deepen our knowledge of this dimension and to increase one's control of variables that play a key role in accepting or rejecting interventions.

Rooted in an economic-anthropology framework, our vision of interdisciplinarity in fishing implies the existence of strong interactions between the technical and social aspects of production, while emphasizing the need to understand the genesis of present-day situations and the ideological setting that moulds them. At the operational level, this orientation does not mean the reliance on research efforts that would last almost indefinitely or which would constitute a form of pure, ongoing ethnography. Rather, it suggests the need for more middle-range and controlled comparisons suited to the identification of the structural variables at work in a given regional context, a procedure with which social scientists involved in fishing are familiar.

Without meaning to put forward too strong an analogy, the reproduction of the 'social biomass' also responds to certain rules, the content of which varies according to such things as the 'social climate,' 'population pressure,' 'individuals' migration patterns,' and the extent to which authorities are aware of their preservation needs. In this regard, the action of social scientists would be useful for establishing 'quotas' for certain types of development projects in fishing.

Notes

1. The research in Costa Rica was supported by a grant from the Social and Humanities Council of Canada for the period between June 1989 until May 1992 (Nr: 410-89-1370). I express my gratitude to the team members (E. Lopez, E. Houde, C. Benazera, M. Chavez, D. Roy and E. Breton) for their support and comments.

2. For the syntheses of the history of maritime anthropology, see Acheson (1981); Breton (1981); Diaw (1983); Galvan (1984); Fernandez (1988); Breton and Lopez (1989).

3. Bernard (1976) criticized the term 'maritime anthropology,' arguing that there was no need for an additional subdiscipline within social anthropology, but he was not followed by many people. Others advocated establishing this new field of studies, insisting on the unique character of maritime adaptations and the great specificity of maritime cultures. For example, see Smith (1977).

4. As it frequently happens in the expansion of the 'academic market,' the consolidation of maritime anthropology gave rise to a proliferation of collections, which incorporated a wide

range of ethnographic facts but without introductions or conclusions that would specify the conceptual issues at work. See, for instance, Casteel and Quimby (1975); Smith (1980). This greatly contrasts with more recent studies which include discussions of the conceptual basis upon which the contributors rely (e.g., *Journal of Canadian Studies* (1984); Marchack and Guppy (1987) and Pinkerton (1989).

5. The diversity is found, for instance, in the work of Davenport (1960), using game-theory analysis for the study of Jamaican fishermen, Charest (1979), discussing the political organization of marine producers located on the Lower North Shore of the St-Lawrence, and Bourgoignie (1972), relying on an ethnoscientific approach in his study of the Dahomey fishermen. These examples could be greatly multiplied, and are characterized by approaches that, even though they are influenced by paradigms at work in other disciplines, barely refer to the need for interdisciplinarity in the social study of fishing.

6. One can ask to what extent B.J. McCay, an anthropologist who did intensive field work in American fisheries, was influenced by this premise when, within the cultural ecology paradigm, she promoted the use of the term 'people ecology' (1978).

7. Many references now illustrate adequately this changed situation. For instance, see Kearney (1984); Lamson and Hanson (1984); McCay and Acheson (1987); Pinkerton (1989); Davis and Jentoft (forthcoming). It is also worthwhile to mention that as early as 1977 R. Andersen wrote a seminal essay aiming at promoting dialogue between social scientists and applied researchers in fisheries.

8. Bermudez and Pacheco have published various statistical and economic studies on the Costa Rica fisheries (cf. 1987, 1983, 1981).

9. Close to 90% of the national production is concentrated on the Pacific side, in the area of the Gulf of Nicoya, where there exist about 60 fishing communities.

10. At the beginning of the 1970s, Latin American countries produced between 10% and 15% of the world total fish catch. The BID (Inter-American Bank for Development) intended to promote fisheries development in 19 countries, with a total estimated budget of \$530 million US, of which \$218 million would come from external aid. The global project aimed at increasing by 46,000 the number of new jobs in fishing and the volume of production of the 2,000,000 Latin American fishermen from 3 to 18 metric tons a year (Pacheco and Bermudez 1984).

11. In addition to this extended project, Costa Rica fisheries have been the object of several interventions. Given the relative political stability of the country, international institutions are omnipresent in rural areas. In fishing, international projects were conducted by Japan, China, Spain, and more recently Canada (CIDA: Canadian International Development Agency and IDRC: International Development and Research Center). A Canadian NGO (Non Governmental Organization) is presently engaged in a \$2 million project in the Gulf of Nicoya.

12. Of about 25 fishing cooperatives created since the mid-seventies, a dozen or so still exist, some of them operating with great difficulties.

13. Seven months of individual research have been done by the team members during the first phase in the summer of 1989. They produced a preliminary report distributed afterwards among various Costa Rica institutions.

14. Our research includes the study of four communities (Pochote, Chomes, Playa del Coco, and Nosara), each characterized by specific types of fishing (mangrove, coastal, and aquaculture), with populations ranging from 150 to 2,000 individuals which in turn are embedded in diversified occupational structures.

15. The negative trajectory linked to the development of fishing cooperatives in Costa Rica strongly effects the fishermen's response to external aid. If the promoters are ready to provide them with money or equipment, they will not hesitate to engage in the cooperative formula, well aware, however, that it will not drastically modify their habits and thinking. More effective seems

to be the recently established fishermen's committees set up by the Ministry of Agriculture through which the producers can benefit from discounts on the price of gas and have more say in the management of their local resources. (COLOPES: comites locales de pesca).

16. The case is very obvious in the southern part of the Guanacaste Peninsula, an area which, at the politico-administrative level, depends upon the Province of Puntarenas. Several informants could not explain the rationale for such a delimitation without mentioning the political weight of a mercantile bourgeoisie in the town of Puntarenas which wished to take advantage of a rich and close territory, largely unexploited at the time administrative limits were defined. But culturally speaking, several inhabitants mentioned their Chorotegan roots and consider the town of Nicoya, located at the center of the Peninsula, more representative of their former culture.

References Cited

- Acheson, J.
1981 The Anthropology of Fishing. *Annual Review of Anthropology* 10:275-316.
- Andersen, R.
1977 *The Need for Human Sciences Research in the Atlantic Coast Fisheries*. Ottawa: Fisheries Research Board of Canada.
- Bermudez, M.A. and Pacheco, A.A.
1987 *La política estatal y el sector pesquero en Costa Rica*. Serie Divulgación económica, No. 25. San Jose: University of Costa Rica.
- Bermudez, M.A.
1981 *Perfil del sector pesquero costarricense*. Documento de trabajo No. 27, IICE. San Jose: University of Costa Rica.
- Bermudez, M.A. and Pacheco, A.A.
1983 Principales determinantes del consumo de pescado y productos marinos en Costa Rica. *Revista de Ciencias Economicas* III(2):71-78.
- Bernard, H.R.
1976 Is there an Anthropology for Everyone. *Reviews in Anthropology*. 3-5:478-485.
- Bourgoignie, G.
1972 *Les hommes de l'eau: ethno-écologie du Dahomey lacustre*, Paris: Ed. Université.
- Breton, Y.
1981 L'anthropologie sociale et les sociétés de pêcheurs: réflexions sur la naissance d'un sous-champ disciplinaire. *Anthropologie et sociétés* 5(1):7-27.
- Breton, Y. and Lopez, E.
1989 *Ciencias sociales y desarrollo pesquero: paradigmas y metodos aplicados al caso mexicano*. INAH, Mexico.
- Breton, Y., Lopez, E., Houde, E. and Benazera, C.
1990 *La diversidad e la pesca costera en Costa Rica: parámetros para una antropología marítima aplicada*. Rapport de recherche, Departement d'anthropologie, Université Laval.
- Casteel, R.W. and Quimby, G.J. (Eds.)
1975 *Maritime Adaptations of the Pacific*, The Hague and Paris: Mouton-Aldine Publ. Co.
- Charest, P.
1979 Development of Local and Regional Forms of Political Organizations in the Gulf of St-Lawrence. In: R. Andersen (Ed.), *North Atlantic Maritime Cultures*. The Hague: Mouton. Pp. 111-126.
- Davenport, W.
1960 Jamaican Fishermen: a Game-Theory Analysis. In: Sidney Mintz (Ed.), *Yale Univer-*

- sity Publications in Anthropology*. New Haven: HRAF Press. Pp. 57-64.
- Davis, A. and Jentoft, S.
1990 Proceedings of the Canadian-Norwegian Seminar on Social Research and I Formation in the Fisheries (in preparation).
- Diaw, M.
1989 Dynamique de recherche et dynamique de secteur: les relations interdisciplinaire: l'étude de la pêche et des sociétés de pêcheurs. Mimeo, Département d'anthrop Université Laval.
- Fernandez, J.P.
1989 Antropología marítima: historia, ecología, organización y cambio económico en pescadores. Manuscrito, Lab. de antropología social, Universidad de la La Tenerife.
- Galvan, T.A.
1984 La antropología de la pesca: problemas, conceptos y teoría. *Actas del coloq etnografía marítima*. Santiago de Compostela.
- Journal of Canadian Studies
1984 Special Issues on Fisheries. *Journal of Canadian Studies* 19(1).
- Kearney, J.
1984 The transformation of the Bay of Fundy Herring Fisheries: An Experim Fishermen-Government Co-Management. In: C. Lamson and A. Hanson (Atlantic Fisheries and Coastal Communities: Fisheries Decision-Making Case S Halifax: Dalhousie University. Pp. 165-204.
- Lamson, C. and Hanson, A.
1984 *Atlantic Fisheries and Coastal Communities: Fisheries Decision-Making Case S* Halifax: Dalhousie University.
- Marchak, P., Guppy, N. and McMullan, J. (Eds.)
1987 *Uncommon Property: The Fishing and Fish-Processing Industries in British C* bia. Toronto: Methuen.
- McCay, B.J.
1978 System Ecology, People Ecology and the Anthropology of Fishing. *Human E* 6(4):397-422.
- McCay, B.J. and Acheson, J. (Eds.)
1987 *The Question of the Commons: the Culture and Ecology of Communal Res* Tucson: University of Arizona Press.
- Pacheco, A.O. and Bermudez, M.A.
1984 *Préstamo del BID al sector pesquero: El fracaso de un programa de desarrollo* No. 77. San Jose: University of Costa Rica.
- Pinkerton, E. (Eds.)
1989 *Cooperative Management of Local Fisheries: New Directions for Improved M* ment and Community Development. Vancouver: University of British Co Press.
- Smith, E.
1977 Comments on the Heuristic Utility of Maritime Anthropology. *Maritime Anth* gist 1(1):2-8.
- Smith, E. (Ed.)
1977 *Those Who Live from the Sea: A Study in Maritime Anthropology*. Minnesot Publ. Co.
- Spoehr, A. (Ed.)
1980 *Maritime Adaptations: Essays on Contemporary Fishing Communities*. Pitt University of Pittsburgh Press.

Insidious Rationalities

The Institutionalisation of Small Boat Fishing and the Rise of the Rapacious Fisher

Anthony Davis

St. Francis Xavier University, Antigonish

ABSTRACT This essay contends that the Atlantic Canadian small boat fishery is being systematically dehumanised as the socio-economic and organisational conditions in which fishers work become ruled by capitalist-industrial formal institutions and their rationalities. More specifically, small boat fishers, largely participating in an owner/operator and small community referenced fishery, are driven from deeply rooted attachments and *modus operandi* articulated in familial and familiar social conditions to sharp-edged, self-interested utilitarian rationalities as their livelihoods become dependent upon and expressive of the imperatives and logic of capitalist-industrial formal institutions such as government and board-based representative organisations. Canadian federal government management interventions, the rise of representative organisations, and small fisher responses are examined through social historical and case study means for the purposes of investigating this contention and illustrating key moments in the process.

Introduction

The Atlantic Canadian fisheries are currently in the convulsions of yet another socio-economic crisis. While not the only factor, tremendous expansions in the capacity to catch and process marine resources, particularly since the declaration of the 200 mile economic management zone, have precipitated over-exploitation of resources and, possibly, ecological/environmental damage resulting in dramatic declines in groundfish stocks. This situation has left many small boat as well as industrial-scale fishers and fish companies without access to sufficient resources. Consequently, boats and plants now lie idle for lengthy portions of the year, and increasing numbers of catching and processing operators throughout Atlantic Canada are finding themselves unable to continue in the industry. As possessors of technologically sophisticated, specialised fishing capacity and its accompanying debt, numerous small boat owners face the prospects of either marginal incomes or creditor repossession since buyers for idled vessels and fishing licenses are few and far between. Many fisheries dependent communities are experiencing unemployment levels of such magnitude that their future as anything more than retirement villages is being placed in jeopardy (Department of Fisheries and Oceans 1989).

It is my contention that this crisis has been facilitated and expedited by transformations in the small boat sector, wherein owner/operators have undertaken the widespread adoption of industrial fishing practices and their

associated organisational forms and world views. In essence, the brand of utilitarian rationality particular to industrial capitalist market systems has been woven systematically into the socio-economic fabric of the Atlantic Canadian small boat fishery and its communities.

While always thoroughly integrated in the capitalist industrial market and class systems at the level of exchange, small boat fishers mainly engaged in fishing for their livelihoods rather than to accumulate capital. That is, the vast majority fished in order to satisfy their material and social requirements. Moreover, they recognised and expressed, in their behaviour more so than in their words, the necessity to fish in a manner which did not jeopardise the livelihoods of others and which did not inhibit access to livelihood for others. Equipped with more or less the same technical ability and know-how, socio-economic distinctions between small boat fishers within harbours arose situationally rather than substantively, expressing differences in factors such as work motivation, luck and risk taking. Rarely would such distinctions be derived from circumstances that violated the livelihood interests of others. Moreover, their sense of collective interest and collective destiny construed the small boat fishers' approach to and organisation of fishing. It also influenced within harbour fisher relations as well as the broader fishing communities' social dynamics (Acheson 1981; Andersen 1979; Davis 1984; McCay and Acheson 1987; and Pinkerton 1989).

The last twenty years in particular have seen considerable pressure brought to bear on these localised practices and norms. Federal and provincial government fisheries management and industrial development policies, changes in industry structure such as the movement away from salt fish and towards fresh and fresh-frozen fillets, and the thorough immersion of rural coastal communities in urban-referenced ideology through vehicles such as consolidated schooling and mass media are among the key vehicles that have facilitated the ascendancy of competitive utilitarian rationality among fishers and in coastal communities. Competitive utilitarian rationality has become predominant in fisher decisions to invest in expanded capacity and to specialise in mass harvesting approaches to resource exploitation, thereby, expediting intra-occupational and intra-community differentiation and the current resource crisis (Davis 1991; Environment Canada 1976; Government of Canada 1983; Department of Fisheries and Oceans 1989; Sinclair 1983; 1985; and Thiessen and Davis 1988).¹

In order to develop the argument this essay opens with a brief presentation of recent developments concerning the professionalisation and institutionalisation of small boat fishing. Here an emphasis is placed on fisher-government relations. This is followed by a presentation and analysis of some interview data concerning membership opinions, attitudes and attachments to an independent small boat fisher co-operative in Eastern Nova Scotia. These data are employed to illustrate the character and expression among many small boat fishers of competitive utilitarian rationality. These data are also employed to suggest avenues of interpretation regarding the characteristics of

response associated with whether or not co-op members also belong to a fishers' trade union.

Professionalising Small Boat Fishers

Notably, the rise of competitive utilitarian rationality among small boat fishers is coupled with the push to professionalise small boat fishing. In Canada, national surveys over the last three decades concerning the socio-economic status of occupations have reported fishing consistently in the bottom quarter of the occupational status system (Pineo and Porter 1967; Pineo, Porter and McRoberts 1977; and Blishen, Carroll and Moore 1987). Low in status, fishing and fish processing occupations are thought of as minimal skill pursuits, jobs done in the main by persons with a poor formal education and few alternatives. In short, these are viewed as occupations of last resort.

While some of these perceptions persist, considerable resources have been directed toward 'professionalising' fishing occupations, especially fishing itself. For instance, achievement of 'professional status' by fishers was identified as one of the key strategies in the new fisheries management policy proposed in 1976 (Environment Canada 1976:66). In large measure, professionalisation of fishing has been an objective of federal government development policy predicated on the notion that the small boat fishery must be made economically effective.

The effective matching of fishing effort to the resource ... require[s] a fair and practical means to distinguish the professional fisherman from the casual participant that is, to differentiate between the full-timer and the part-timer ... the fishery cannot possibly support all those who now claim to be fishermen (Government of Canada 1983:215).

Economic sensibility, in turn, is taken to mean consistent in organisation and performance with industrial capitalist market-driven dynamics. That is, small boat fishers would become professional once their livelihoods were derived from an organisation of production and occupational relations embodying a small business *ethos* as well as the efficiencies of economic competition.

To this end, the federal and provincial governments initiated training programmes, beginning in the mid-seventies, in areas such as accountancy, small business operations, and taxation/fiscal planning. These courses were designed for delivery within coastal communities during the winter months. While providing useful information, these programmes were also intended to seed and nurture the *ethos* of approaching fishing as a small business enterprise rather than simply as a way to make a living (Government of Nova Scotia 1972-85). Inherent in the new *ethos* was the rationality of competitive utilitarian individualism, the presumption that business enterprises are necessarily locked in competition with each other in their pursuit of scarce economically valuable goods; the idea that success is measured by the ability

of individual enterprises to maximise their portion of available wealth; the notion that future economic success in the fishery is contingent upon the ability of fishers to approach their occupation as professional small business operators.

Wedded to this ethos embodied in the government industrial development policy were measures prescribing access participation in regulation and in management. For instance, throughout the late sixties and seventies various government-fisher committees were required by the federal Department of Fisheries and Oceans (DFO) to recommend terms and conditions of fisher access and participation. Out of these meetings came the bonafide fisher designation, reserving primary access to participants who derived a substantial portion of their yearly income from fishing. These were to be considered the professional small boat fishers. Part-time, seasonal participants in specific fisheries such as lobster fishing were at first systematically constrained through special regulations prescribing the amount of gear they were permitted to deploy. Eventually, many part-timers were eliminated as the DFO refused to issue the necessary licenses to those without bonafide status (Davis and Thiessen 1988; and MacDonald 1984).

Of singular importance in this illustration is the setting within which the new policy decisions and recommendations were developed. Basically, it entailed a DFO constituted formal committee composed of fishers from various sectors, DFO policy and science officials, and others of expert and vested interest status including representatives of fishers' organisations such as co-operatives, associations and unions. These committees have since evolved into various management consultative mechanisms fully incorporated within the DFO and its policy formation and implementation processes (Department of Fisheries and Oceans 1985, 1988, 1989). Of course, fisher participation in the committees was and remains legitimatised by the assumption that these bodies constitute the basis whereby DFO consults directly with industry professionals before designing and implementing policy. As a stage in professionalising the occupation of commercial fishing, these committees formalise consultative processes and dynamics within institutional settings invented for this purpose, institutional settings foreign to most small boat fishers and their communities.

Moreover, representation in these institutional settings remains contingent upon bonafide fishers nominating or electing peers from among categories of participants largely specified by DFO, categories which largely reflect geographical location and sector participation, that is, the type of fishing gear used in conjunction with locational factors (e.g., inshore, midshore and offshore) and business characteristics (e.g., corporation, independent fisher). Sector representation was, from the outset, designated as a key element of fisher participation in the consultative process. From the DFO point of view, the industry is comprised of different groups defined by differences in technology and scale that compete for the resource and that are, as a result, often in conflict with one and another. This approach represented a large step in the

direction of legitimising and concretising sector divisions, beside the existing differences between livelihood and accumulation approaches, as 'real' organisational elements in the fishery. Moreover, in addition to being legitimised and concretised within the formal institutional setting, sector divisions have become definitive frames of reference and now underlie fishers' categorical thinking about their industry. Now, not only is the participant a bonafide fisher, he/she is also a bonafide, professional longline, gill net, lobster, drag net, crab or scallop fisher. These developments further facilitate fundamental transformations in the world view, behaviour and social organization of small boat fishers, transformations signifying the ascendancy of a competitive utilitarian rationality (MacInnes and Davis 1991).

The determination of representation on consultative committees, not to mention order among participants in the industry, provided impetus for federal and provincial government fisheries departments to encourage independent small boat fishers to form organisations through which they could pursue their interests and assure themselves a voice at government-industry councils. Throughout the seventies and eighties numerous organisations have arisen which purport to represent a body of independent small boat fishers. While most of these are associations organised along either geographical and/or sector participation lines (e.g., The Eastern Fishermen's Association, the Cape Breton Island Fishermen's Association, the Southwest Nova Scotia Inshore Longliner's Association and the like), several trade unions, particularly the Maritime Fishermen's Union (MFU) and The Canadian Automobile Workers Union (CAW), have had notable success in presenting themselves as representative voices (Clement 1986). The MFU, an organisation which arose during the mid-seventies from the struggles of Northeast New Brunswick Acadian small boat fishers, styles itself as concerned exclusively with organising Maritime small boat fishers in order that they have effective leverage in shaping economic and occupational futures (Theriault and Williams 1986). Regardless of the organisational form of preference, the DFO insisted that fisher participation on its consultative bodies be representative, whether derived from special pan-fisher elections or interest group formations. Either way, the voices of small boat fishers had to be derived from formal organisational contexts and institutionalised processes, the only references and processes sensible to the DFO and other governmental-industry agencies. Indeed, the ability of small boat fishers to form themselves into such organisations was considered indicative of the extent to which participants had matured as professional, independent business operators. After all, to be professional is to recognise that your particular interests, within the crucible of industrial capitalist dynamics, are furthered by working through institutions that provide voice which is especially necessary when other participants in the fishery are seen as competitive and antithetical to one's own particular goals.

Central to the professionalisation and institutionalisation of small boat fishers are the government access and resource management initiatives, such

as limited entry licensing and quota allocations. Stock collapses in the late 1960s and early 1970s created an industry crisis which compelled government to de-emphasise industrial development and focus upon the creation of stock and access management strategies. For the first time, the central problem of the industry was redefined as too much capacity uncontrollably pursuing too few fish. Consequently, the federal government developed policies intended to constrain fishing effort to within the biological capacity of the stocks to bear specific rates of exploitation.

Replacing the view that argued for the necessity to modernise through the adoption of new and better technologies was a biologically-grounded perspective that insisted the industry had too many fishermen pursuing too few fish. The solution for this problem was believed to reside in the development of a more refined, sophisticated and comprehensive management regime that would limit access to marine resources through mechanisms such as licenses and quotas. With this change came a much greater emphasis by government on 'policing' fish catching and processing activities in order to assure compliance with the regulations.

By the late seventies, commitment to this approach of fisheries management had become thoroughly entrenched. Now the thrust of government policy was to regulate precisely the exploitative effort directed at marine resources by making participation in the specific fisheries with particular technologies contingent upon the annual provision of governmentally issued licenses. Entry into fisheries such as scallop, lobster, shrimp, and snow crab, as well as those employing mobile gears (seine and drag nets), is only possible today after obtaining the necessary government issued limited entry permits which are commonly purchased from retiring fishermen for tens of thousands of dollars (Department of Fisheries and Oceans 1989; MacDonald 1984). Added to the capital cost for a boat and fishing equipment, this licence 'investment' assures that new entrants begin with a debt load that can only be serviced through high volume catches and heavy exploitative pressure on ocean resources and environments. Indeed, a fishing strategy solely expressing the individual needs and goals of the captain/owner, over all other concerns, must come to the fore in a set of circumstances shaped by debt servicing pressures. After all, it is the individual captain/owner who is professionalised, who benefits from and is targeted in government management and development programmes, and who must satisfy livelihood needs and enterprise costs. In short, government management and development policy assures that the self-interested harvester upon which the policy is predicated comes to dominate the socio-economic profile of the fishery, thereby creating fishers as pirates (Davis 1991; Davis and Thiessen 1988; and Sinclair 1983).

Of course, many fishers, especially those middle-aged and younger, have done little to resist and much to accelerate the industrialisation/professionalisation process. As they have entered the fisheries as captains and owners, these participants have demanded the latest and the best in boats, engines, electronics and equipment. Fueled by promises of endless prosperity following

the declaration of the 200 mile zone and buoyed by access to 'cheap' (low interest) money through provincial loan boards, many fishers have displayed an almost insatiable appetite for new capacity throughout the late seventies and early eighties. Thus, by the time caps were slammed into place in the mid-1990s the new fishing capacity and the debts it represented were in place and fishing, fishing at a pace and with an avarice previously unseen in the Atlantic Canadian small boat fisheries (Davis and Kasdan 1984). Competitive utilitarian rationality was well seeded and nurtured by these developments, developments that have placed the concerns and interests of individual small boat captain/owners front and centre in industry dynamics.

Government management programmes, particularly limited entry licensing, are imposing rules governing access and participation without regard for local-level conditions and practices. In the process, these initiatives are fundamentally altering the social topography of the fishing occupation. First and foremost in this process is the impact of government management programmes upon the social organisation of community- and familial-based fisheries.

In such fisheries key aspects of the decision-making processes are governed by an informal, locally-specific, system of rules worked out by the generations of fishers who have exploited ocean resources from particular harbours. These rules affect numerous areas of fishing activity. In many instances they define the boundaries of harbour-specific fishing grounds. In addition, these rules regulate certain aspects of exploitative behaviour. For instance, they specify the types of fishing gear permissible (e.g., hook and line as opposed to drag net or large mesh gill nets). Often these rules stipulate who can fish the ground (the persons from 'our' harbour). They also spell out expected behaviour, e.g., you don't sell 'tinkers' (undersized lobsters), you don't touch another person's gear, and you don't interfere intentionally with another person's gear (i.e., set lines or traps on top of someone else's, drag a net through set gear, and so on).

Persons who persistently transgress the rules suffer consequences ranging from verbal warnings, through tit-for-tat reprisals, to outright destruction of their capacity to fish. Regardless of reputation, economic worth or other measures of occupational success, individuals are expected to reflect in their words and deeds respect for these experientially-based and consensually-derived, local-level procedures. In effect, the rules constitute a fisher-generated access and use management system. As with the most management systems, this one constrains the expression of individualism by attaching conditions to participation, conditions which define the points at which 'rugged individualism' is subordinated to collective interest. This is particularly the case when the actions of individuals jeopardise the ability of other fishers to make their living from fishing (McCay and Acheson 1987; Pinkerton 1989).

Limited entry licensing and other management programmes focus on controlling individual enterprises and their owners. This frame of reference is

entirely different from and at odds with the familial/community context prevalent among fishing people. The definition and allocation of access and participation resources in terms of individual participants and enterprises is contrary to occupational and community-based solidarities and regulatory regimes. The local-level, community-based social framework exercises a diminishing influence in terms of construing participation. The key now is for each individual to obtain the necessary permits and resources. Local interpersonal relations among peers have become irrelevant to whether or not a person obtains desired resources from government dispensaries. Now the social field is institutional, and bureaucratic, largely the antithesis of the familial and communal-based essence of the livelihood fishery. Success in this field of action demands skills and points of reference substantially different than those associated with getting along in the pre-government access management era.

The successful fishers are increasingly those adept at pursuing personal objectives through bureaucratic systems. An individualised point of reference is now taking precedence over the community basis of occupational solidarity. That is, with economic and occupational outcomes becoming contingent upon access to state-controlled resources, fishers are adopting strategies that are necessarily self-focused an orientation which policy makers always assumed was an inherent feature of these rugged individuals. In short, government management policies, which were predicated on the premise that fishers were irresponsible self-seekers and, thus, prone to over exploit ocean resources, have created the very conditions necessary to fulfil their prophecy. With the basis of occupational and community solidarities becoming irrelevant to economic outcomes, fishers, as professionalised and institutionally referenced individuals, increasingly look to government agents for resources, participatory licenses and problem solving.

The specific quality and character of the presence of these processes is underlined in the brief discussion and analysis of the attitudes, opinions and attachments of fisher members concerning their independent fisheries co-operative.

An Illustrative Case

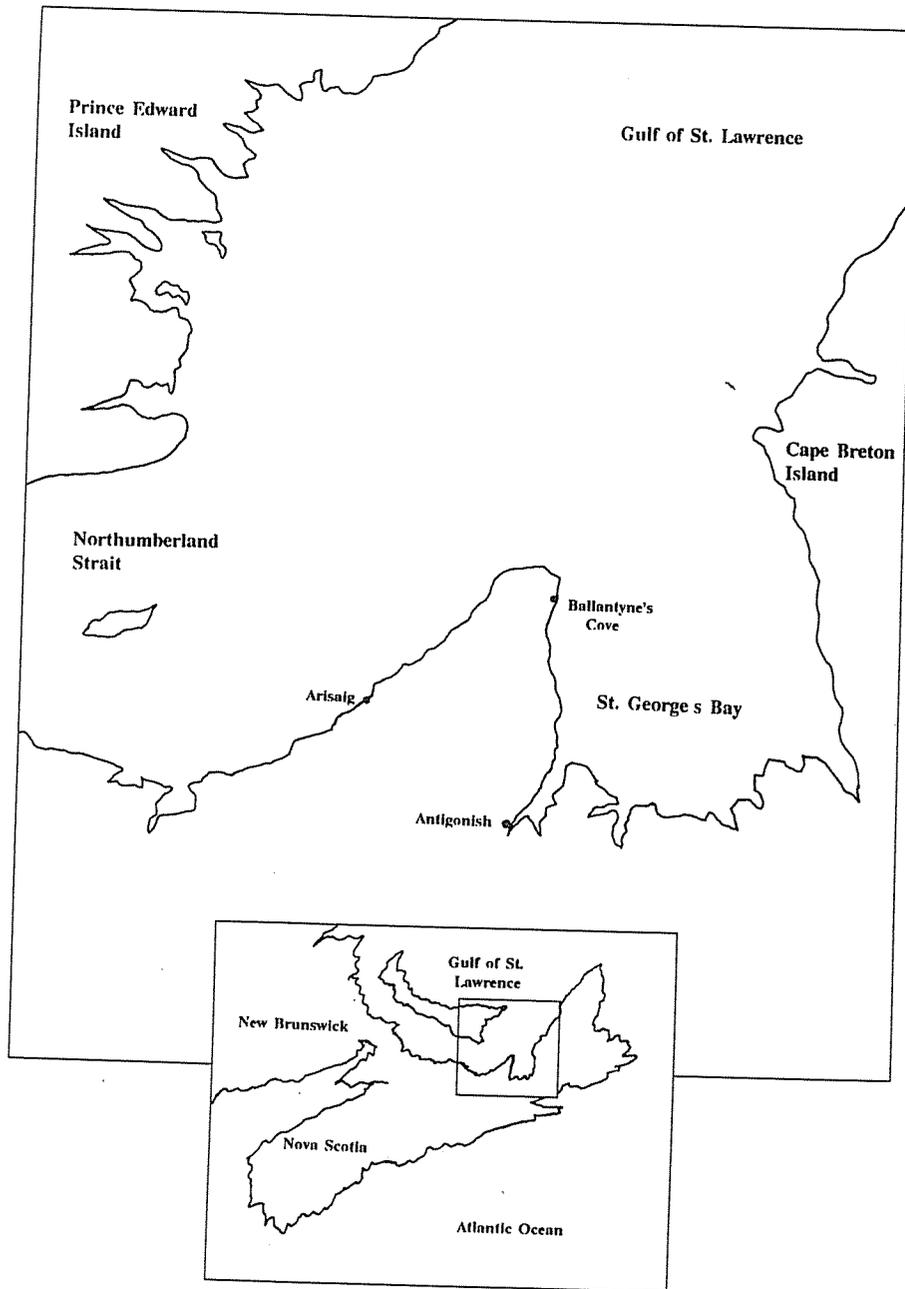
A study of membership attachment to and participation in an independent Eastern Nova Scotian small boat fisheries co-operative was conducted during the summer of 1988. The extent to which the Co-operative's membership is affiliated with the Maritime Fishermen's Union (MFU) was documented through the course of interviews. For the purposes of illustrating competitive utilitarian rationality and its institutionalisation within the small boat fishing sector, the data discussed below contrasts the attitudes, opinions, and involvements of union affiliated co-op members with those of the unaffiliated membership. The assumptions guiding this exercise are, first, that union-affiliated members are more likely to be involved in and supportive of formal

institutional mechanisms than are non-affiliated co-op members. Second, union-affiliated co-op members are more likely than unaffiliated members to consider formal institutions as necessary to representation and as appropriate vehicles for their specific individual economic interests.

The North Bay Fishermen's Co-operative (N.B.F.C.) arose in the early 1980s from the ashes of the Ballantyne's Cove, Antigonish County, Nova Scotia branch of the United Maritime Fishermen's Co-operative. Co-operative forms of organisation have a long history in this area, one which begins with the Antigonish Movement during the late 1920s and early 1930s. Coastal communities along the shores of St. Georges Bay and Northumberland Strait were among the early participants in the Antigonish Movement, a social movement which stressed self-help and co-operative organisation and which was initiated by several Catholic priests based in the St. Francis Xavier University Extension Department.

The St. Georges Co-operative based in Ballantyne's Cove was begun within this context. By the early 1950s, the fish processing and lobster marketing segment of its business were transferred to a county-wide fishers co-operative, the Antigonish Fisheries Co-op (A.F.C.). This, in turn, affiliated with the United Maritime Fishermen Co-operative (U.M.F.), an umbrella organisation developed as a vehicle within and through which local producer fishing co-operatives could concentrate their marketing and economic interests. However, once the A.F.C./U.M.F. business relationship failed, owner/operators in the St. George's Bay area formed the N.B.F.C. This co-operative purchased the A.F.C./U.M.F. office and processing facilities at Ballantyne's Cove. Since its inception in 1983, the N.B.F.C. has developed new facilities and aggressively pursued market opportunities. At the time the study reported herein was being constructed, the N.B.F.C. had sixty-one members fishing out of a number of ports, the major ones being Cribbon's Point, Ballantyne's Cove and Araisag/Lismore.

Fifty-one of the sixty-one members participated in the study. Of these members, thirty-one (60.8%) reported that they also belonged to the Maritime Fishermen's Union (M.F.U.). The remaining twenty members did not report any organisational affiliations other than the co-op. Notably, the M.F.U. fishers are, on average, younger (74.2% forty-five years of age or younger) and the possessors of more formal education (55.8% with vocational or university training) than co-op members who do not belong to the M.F.U. (50.0% are over forty-five years of age, while 40.0% have vocational school or university training). The trends in these data predict that M.F.U. co-op members are more likely than unaffiliated co-op members to have undergone capitalist industrial enculturation of the sort which both seeds and nurtures competitive utilitarian rationality such as has been documented to be elemental in formal schooling and exposure to mass media.



Map 1. Ballantyne's Cove and Environs.

Co-operative Attachments?

Table 1 provides a comparative profile of union and non-union co-op members' opinions, attitudes, and involvements concerning the fisheries co-operative. As indicated in the table, union-affiliated members are much more likely than unaffiliated members to attend co-op meetings (80.6% versus 40.0% respectively) and to hold official positions within the co-operative (41.9% versus 20.0%). Union members are also much more oriented than unaffiliated members towards participation in formal organisations. Of course, their membership in the union in addition to co-operative membership is testament to this.

While around two in every three of both the union and non-union members think that the co-operative *represents* their needs and concerns, three in every four non-union members, but only a little more than one in three union members, claim that the co-operative is *satisfying* their needs and concerns. One interpretation of this difference is that union members, having closer affiliation with institutional vehicles for pursuit of their interests, have more specific and demanding expectations of institutional performance than do unaffiliated members. Ironically a much larger proportion of non-union than union members report feeling that they are neither consulted enough about the co-operative's plans and initiatives (85% as compared with 45.2%), nor kept

Table 1. Comparative Profile of Union and Non-Union Members for Selected Categories of Opinions, Attitude and Involvement Concerning the Co-operative.

Categories	Membership			
	MFU Members (N = 31)		Non-MFU Members (N = 20)	
	Yes %	No %	Yes %	No %
Attend Meetings	80.6	19.4	40.0	60.0
Held Official Position in Co-op	41.9	58.1	20.0	80.0
Co-op <i>Represents</i> Needs and Concerns	67.7	32.3	60.0	40.0
Co-op <i>Satisfying</i> ** Needs and Concerns	35.5	64.5	75.0	25.0
Members Consulted Enough*** About Plans and Initiatives	45.2	54.8	15.0	85.0
Members Kept Adequately Informed*	62.0	35.5	15.0	85.0
Would Sell to Other Fish Buyers	29.0	71.0	45.0	55.0
Members Should be Required to Give Time to the Co-op	64.5	35.5	50.0	50.0

T test results

- * .001
- ** .01
- *** .05

adequately informed (85.0% as contrasted with 62.0%). Union members greater tendency to attend meetings and hold official positions no doubt positively influences their assessment of whether or not they are consulted and informed sufficiently. Active participation also explains, in part, union membership dissatisfaction with the co-operative's attention to their needs and concerns. Knowledge of the particulars concerning plans and activities allows union members to contrast the co-operative's performance and intentions with their particular expectations. Conversely, non-union members, while largely unsatisfied with the extent to which they feel that they are kept informed and consulted about plans and initiatives, have lower and more immediate expectations than union members regarding the co-operative, especially expectations which are being satisfied through sale of their catches at acceptable prices.

Notably, on the question measuring satisfaction with selling their landings to the co-operative, greater numbers of non-union than union members indicate ambivalence. For instance, in response to the question 'If another fish buyer were to set up here offering higher fish and lobster prices, would you sell to them?', almost one in two non-union members indicate that they would, while less than one in three union members were so disposed. Furthermore, fully 93.5% of union affiliated members claim they are satisfied with selling to the co-operative as contrasted with 65.0% of the non-union members (cf. Table 1 and 2). Again the union affiliated co-op members, when compared with non-union members, indicate a much stronger attachment and loyalty to formal institutions as vehicles necessary to furthering their specific interests, even while registering significant dissatisfaction with co-operative performance in regard to their needs and concerns.

This interpretation is further reinforced by members responses to questions concerning the extent to which they are prepared to trust the co-operative's management and to sublimate individual interests to institutionally situated prerogatives. For example, almost one in three of the union affiliated members agreed that the co-operative's management knew what was best in terms of financial matters. Not one of the non-union members agreed with this statement. Over two in three union members indicate satisfaction with the co-operative's management, while less than one in two non-union members are so disposed. While less than ten per cent of both union and non-union members indicated they would transfer a fishing license to another co-op member, surrender a license, or reduce their fishing capacity if these steps were judged by the membership to be in the interests of the co-operative, almost two in three union members, as contrasted with less than one in three non-union members, would agree to reduce their fishing effort. Moreover, almost one in three union members claimed that they would allow the co-operative to hold and distribute fishing licenses and fishing quotas. Contrarily, little more than one in ten non-union members were disposed favourably to this scenario. In short, few of the non-union co-op members indicate that they are prepared to invest in or entrust their self-interests to the

co-operative, especially its decision-making and judgement dynamics. In contrast, many union-affiliated members indicate that they are prepared to do this.

While it could be argued that these data indicate non-union members are more individualistic than their union counterparts, virtually identical negative responses to the scenario of surrendering licenses and reducing fishing capacity suggests a different interpretation. Both union and non-union co-op members are adamantly protective of their individual prerogatives, particularly as these regard government regulated access to and participation in fishing. But, there is a fundamental difference in the rationality of the individualism evident in their orientations. On the one hand, the rationality of the non-union co-op members' individualism expresses the notion of untrammelled independence, a world view in which sublimation to institutional/formal organisational dynamics contradicts, erodes, and fetters independence. With this category of membership, the co-op is not to be trusted beyond its role to address immediate needs and concerns. Certainly, these

Table 2. Comparative Profile of Union and Non-Union Members for Selected Categories of Opinions, Attitude and Involvement Concerning the Cooperative.

Categories	Membership			
	MFU Members (N = 31)		Non-MFU Members (N = 20)	
	Yes %	No %	Yes %	No %
Management Knows Best	29.0	71.0	—	100.0
Satisfied with Co-op Management	67.7	32.3	45.0	55.0
Satisfied with Performance** of Federal Officials	22.6	77.4	60.0	40.0
Satisfied with Performance of Provincial Officials	46.7	53.3	68.4	31.6
Satisfied with Selling** to the Co-op	93.5	6.5	65.0	35.0
Would Reduce Fishing Effort*** if in Interests of the Co-op	64.5	35.9	31.6	68.4
Would Allow the Co-op to Distribute Licences/Quota	29.0	71.0	10.5	89.5
Would Advise a Young Person to Enter the Fishery	61.3	38.7	45.0	55.0
Would Advise Any Children to Enter the Fishery	64.5	35.5	55.0	45.0
T test results				
•	.001			
**	.01			
***	.05			

fishers, by and large, do not consider the co-operative as an appropriate site for working out key livelihood decisions and dynamics such as conditions regulating access and participation.

On the other hand, union-affiliated members are, by and large, likely to consider the co-operative to be both a *necessary* and an *appropriate* instrument through which they can further their individual interests. That is, instead of a suspicious, arms-length instrumental relation with formal organisations, the union fishers' rationality connects and situates individual interests to institutional/organisational settings and dynamics. In this view, institutions are vehicles through which individual interests and utilities can be furthered rather than impeded.

In order to examine the possibility that the more institutionally oriented union members simply express in their opinions, attitudes and attachments, a collectivist, union-consciousness concerning what is in their best interests, responses to questions regarding the acceptability of extending membership in the co-operative to persons other than fishers were examined. These data are presented in Table 3.

The notable quality of the response distributions is that, basically, there is not any meaningful differences in the attitudes of union-affiliated and non-union co-op members. If anything, union members are slightly less inclined than non-union members to extend membership to fishing crews and co-op wage workers. Certainly the lack of significant distinctions evident in these responses confirms that for most union members attachment to the co-op has little to do with collectivist, proletarian consciousness and its associated rationalities, forms of consciousness often argued as elemental to union formation (Clement 1986). Indeed, membership in both the union and co-operative organisations reflects a conviction, regardless of whether this is known to the fishers or not, that formal institutions are essential for furthering individual interests. These are small boat fishers for whom, unlike their rugged, independent individualist peers, institutional references, settings

Table 3. Comparative Profile of Union and Non-Union Member Responses to the Idea of Opening Co-op Membership to Selected Categories of Persons.

Categories	Membership			
	MFU Members (N = 31)		Non-MFU Members (N = 20)	
	Yes	No	Yes	No
	%	%	%	%
Membership to Fishing Crew	32.3	67.7	40.0	60.0
Membership to Office Staff and Plant Workers	32.3	67.7	40.0	60.0
Membership to Co-op Management	41.9	58.1	40.0	60.0

and dynamics are expected and accepted vehicles within which individual utilities are expressed and pursued. In short, the union co-op members are much more 'organisation persons' than are the non-union members, meaning that union members associate, in an elemental way, sensibility, activity, pursuit of interests, livelihood orientation and the like with institutional, not independent, settings.

The patterns in the findings reported here clearly differentiate institutionally referenced small boat fishing captains from the more stereotypically rugged, independent individualist, types. Given the character and content of small boat fishers' professionalisation coupled with the consequences of holding licenses and possessing industrialised fishing technologies, institutional references for the elemental furtherance of self-interest reveals that the competitive- individualistic rationality has become well-entrenched, especially among the younger and better-educated fishers. These fishers, like many others throughout Atlantic Canada, have formed a vested interest in formal institutionalised organisations and processes. Unlike their forebearers, these organisational forms and processes are fundamentally believed to be necessary to, not the antithesis of, present day prosperity, future success and the maintenance of independence. In all, this denotes a remarkable, though predictable, transition in small boat fisher rationality.

Conclusions

Social science has long recognised the process and transformational consequences of industrial, capitalist institutionalisation. Beginning with Weber, the incorporation of the human into an organisational matrix dominated by the formal institutions of industrial capitalism has been recognised as providing a mixed blessing for the human condition (Gerth and Mills 1946:212 ff.). On the one hand, this institutional form unlocks individual potentials from subjective and local fetters while creating possibilities for the generation and distribution of new wealth. On the other hand, industrial capitalist institutions dehumanise people by subjecting them to the rationalities of objectified economic calculation. The worth of humans becomes reduced to elements such as formal credentials, consumption patterns, income, and mobility within a market referenced economic rationality. At the same time, industrial institutions are bureaucratic and autocratic. They compel compliance and conformity to institutional objectives rather than to the intimacies of family, familiars, kin and community. In so doing, bureaucratic institutions dehumanise livelihoods and human relations.

Although simply put, this sketch draws into focus qualities of the professionalisation/institutionalisation processes. 'Professionalising' small boat fishers, especially those in the advantaged positions as vessel owners, license holders and/or quota controllers, is an intimate quality of institutionalisation. In turn, institutionalisation embeds the rationality of individual self-interest in and among advantaged fishers. Their socio-economic situation

becomes referenced by and dependent upon relations with bureaucracies rather than upon face-to-face relations with their family, friends, kin and community.

The professionalisation and institutionalisation of Atlantic Canadian small boat fishers have been fundamental intentions and consequences of both government development/allocation management policies, and, ironically, the adoption of broad-based representative forms of organisation such as associations and unions. The rise of the individualistic utilitarian and rapacious small boat fisher in concert with professionalisation and institutionalisation of the occupation is anything but coincidental. Indeed, the latter have contributed to the creation, in no small measure, of the former. The rationality of profession and formal institutions within the industrial capitalist system presumes, specifies and requires the isolation of individually defined interests as the meaningful units of reference and concern. This is the form and forum that makes sense to capitalist industrial bureaucrats and the socio-economic ideologies of market driven logic and evaluations. Pursuit of livelihoods and the determination of competence in such forms of organisation become contingent upon the extent to which players conform to the institutional rules governing the conditions of access and participation. Institutionalisation and professionalisation compel players to adopt the world views, the rationalities and behaviours of the dominant institutions which control access to livelihoods. In short, they compel compliance.

In the case of the small boat fisher, compliance translates into the adoption of the rationality of individual self-interest negotiated through and within formal capitalist industrial institutional settings. Consequently, the collective reference of family, familiars, kin and community become relatively meaningless to the individual fisher's pursuit of livelihood. In this manner, substantive socio-economic divisions rise among small boat fishers and their families and communities. Moreover, now unfettered by the constraints of making their living within the matrix of face-to-face intimate communities, advantaged fishers can become and increasingly are becoming, in their pursuit of self-interest, rapacious. Underscoring this process as a definitive feature of contemporary North American economy and culture, Lasch argues:

Both the growth of management and the proliferation of professions represent new forms of capitalist control... The struggle against bureaucracy therefore requires a struggle against capitalism itself. Ordinary citizens cannot resist professional dominance without also asserting control over production... In order to break the existing pattern of dependence and put an end to the erosion of competence, citizens will have to take the solution of their problems into their own hands (1979:396-397).

Small boat fishers and their families and communities have been subjected to the systematic erosion of their competence and way of life for under thirty years. Consequently, an ethos of self-help, co-operative self-reliance and community-referenced action remains expressed as more than a residual

memory of the way things were done in the past. This ethos can constitute the human resource foundation for the expression of an alternative approach to managing the socio-economic conditions in and through which small boat fishers and their communities realise satisfactory and sustainable livelihoods.

Acknowledgements

This research was supported by a grant from the Centre for Research on Work, St. Francis Xavier University. Gratitude is owed Dr. Richard Apostle, an anonymous reviewer and the editors of *MAST* for suggestions that have been helpful to the improvement of this essay.

Note

1. This process of change has been characterised in the American anthropological literature as the rise of atomistic communities and inter-personal relationships, especially within human settings undergoing so-called 'modernisation' (cf. Rubel and Kupferes 1968). Honigman (1968:220-221) identifies five characteristics of what he calls 'structural atomism,' including primary concern for one's own individual interests; retreat from intensive social contact with neighbours; focus on the nuclear family and reluctance to commit to large groups; reluctance to delegate or assume political authority; and local relationships characterised by strain and invidiousness. These qualities are all associated, in one way or another, with the social and interpersonal topographies consequent to the entrenchment of competitive utilitarian rationality in human behaviour, possibly terminating in what Lasch (1979) refers to as the culture of narcissism.

References Cited

- Acheson, J.M.
1981 Anthropology of Fishing. *Annual Review of Anthropology* 10:275-316.
- Andersen, R. (Ed.)
1979 *North Atlantic Maritime Cultures*. The Hague: Mouton Publications.
- Blishen, B.R., W.K. Carroll and C. Moore
1987 The 1981 Socioeconomic Index for Occupations in Canada. *Canadian Review of Sociology and Anthropology* 24(4):465-89.
- Clement, W.
1986 *The Struggle to Organise: Resistance in Canada's Fishery*. Toronto: McClelland and Stewart.
- Davis, A.
1984 Property Rights and Access Management in the Small Boat Fishery: A Case Study from Southwest Nova Scotia. In: C. Lamson and A. J. Hanson (Eds.), *Atlantic Fisheries and Coastal Communities*. Halifax; Dalhousie Ocean Studies Programme and the Institute for Resource and Environmental Studies. Pp. 133-36.
- Davis, A. and L. Kasdan
1984 Bankrupt Government Policy and Belligerent Fishermen's Response: Dependency and Conflict in Southwest Nova Scotia Small Boat Fisheries. *Journal of Canadian Studies* 19(1):108-24.
- Davis, A. and V. Thiessen
1988 Public Policy and Social Control in the Atlantic Fisheries. *Canadian Public Policy* XIV:66-77.

- Davis, A.
1991 *Dire Straits: The Dilemma of a Fishery, the Case of Digby Neck and the Islands*. St. John's: ISER Press.
- Department of Fisheries and Oceans
1989 *Report of the Scotia-Fundy Groundfish Task Force*. Department of Fisheries and Oceans, Ottawa: Supply and Services.
- Department of Fisheries and Oceans
1988 *1988 Inshore Lobster Fishery Management Plan*. Department of Fisheries and Oceans. Halifax: Communications Branch, Department of Fisheries and Oceans.
- Department of Fisheries and Oceans
1985 *Fisheries News, Scotia-Fundy Region, Special Supplement*, Department of Fisheries and Oceans. Halifax: Communications Branch, Department of Fisheries and Oceans, Vol. 5(3).
- Environment Canada
1976 *A Policy for Canada's Commercial Fisheries*. Ottawa: Department of the Environment.
- Gerth, H.H. and C.W. Mills (Eds.)
1946 *From Max Weber: Essays in Sociology*. New York: Oxford University Press.
- Government of Canada
1983 *Navigating Troubled Waters: A New Policy for the Atlantic Fisheries*. Ottawa: Supply and Services.
- Government of Nova Scotia
1972-85 *Annual Reports*, Department of Fisheries, Halifax, Nova Scotia.
- Honigman, J.J.
1968 Interpersonal Relations in Atomistic Communities. *Human Organization* 27(3):220-30.
- Lasch, C.
1979 *The Culture of Narcissism: American Life in An Age of Diminishing Expectations*. New York: Warner Books.
- Macdonald, R.D.S.
1984 Canadian Fisheries Policy and the Development of Atlantic Coast Ground Fisheries Management. In: C. Lamson and A.J. Hanson (Eds.), *Atlantic Fisheries and Coastal Communities*. Halifax: Dalhousie Ocean Studies Programme and the Institute for Resource and Environmental Studies. Pp. 15-75.
- McCay, B.J. and J.M. Acheson (Eds.)
1987 *The Question of the Commons: The Culture and Ecology of Communal Resources*. Tucson: University of Arizona Press.
- MacInnes, D. and A. Davis
1991 Representational Management or Management of Representation?: The Place of Fishers in Atlantic Canadian Fisheries Management (forthcoming from *The Sou'wester: The Voice of Atlantic Canada's Fishing and Marine Industries*).
- Pineo, P.C., and J. Porter
1967 Occupational Prestige in Canada. *Canadian Review of Sociology and Anthropology* 4:24-40.
- Pineo, P.C., J. Porter and H.A. McRoberts
1977 The 1971 Census and the Socioeconomic Classification of Occupations. *Canadian Review of Sociology and Anthropology* 14:91-102.
- Pinkerton, E. (Ed.)
1989 *Co-operative Management of Local-Fisheries: New Directions for Improved Manage-*

- ment and Community Development*. Vancouver: University of British Columbia Press.
- Rubel, A.J. and H.J. Kupferes (Eds.)
1968 Special Issue of *Human Organization* 27(3), Atomistic Type Societies.
- Sinclair, P.R.
1983 Fishermen Divided: The Impact of Limited Entry Licensing in Northwest Newfoundland. *Human Organization* 42(4):307-13.
- Sinclair, P.R.
1985 *From Traps to Dragnets: Domestic Commodity Production in Northwest Newfoundland, 1850-1982*. St. John's: ISER Books.
- Theriault, G. and R. Williams
1986 Bend and Be Strong: An Analysis of Ten Years of Experience in Building an Inshore Fishermen's Organisation in the Maritime Provinces. Paper presented to the International Working Seminar, *Social Research and Public Policy Formation in the Fisheries: Norwegian and Atlantic Canadian Experiences*.
- Thiessen, V. and A. Davis
1988 Recruitment to Small Boat Fishing and Public Policy in the Atlantic Canadian fisheries. *Canadian Review of Sociology and Anthropology* 25(4):603-27.

Science and the Destruction of a Shrimp Fleet

Thomas R. McGuire

University of Arizona

ABSTRACT Overcapacity is endemic to the tropical shrimp fisheries. This condition is routinely attributed to problems of open access and to the desires of developing countries to maximize export earnings. I argue here, through an analysis of two scientific debates as 'discursive formations,' that shrimp science itself has fundamentally aided and abetted this crisis. Over the last decade, there have been systematic efforts to bolster the received wisdom that (1) shrimp cannot be biologically overexploited (despite documented cases of resource collapse) and (2) there is thus no imperative to regulate fleet capacity in the fishery (despite widely acknowledged examples of economic overfishing). By giving scientific authorization to this received wisdom, I suggest, scientists have endeavored to absolve themselves of the crisis in tropical shrimp fisheries.

Black Thursday: A Prologue

A violent confrontation between two factions of Mexican shrimp fishermen broke out on May 24, 1990 – 'Black Thursday' – in the city of Guaymas, Sonora. The dispute continued through the year. No one died but offices were ransacked, cars and trucks burned, leaders jailed, roads blocked, strikes initiated. A host of government agencies were drawn into the conflict, on the side of one or the other of two competing federations of shrimp cooperatives. In the end – October 8, opening day of the offshore shrimp season in the Gulf of California – only 50 trawlers out of a fleet of 330 were allowed to leave port.

Black Thursday was about overcapacity in the fleet. It punctuated a trajectory of distress in the industry. Over the last decade, catches per vessel have been halved (Miller 1990:87). For lack of adequate earnings, cooperatives have not maintained their boats. Without the means to repay loans for operating costs, owners have been denied further credit. Unable to satisfy the economic expectations of their workers, cooperative leaders have been accused of all varieties of financial and political malfeasance. Fisheries authorities, in turn, have revoked the operating permits of contentious cooperatives.¹

Overcapacity is an endemic problem in shrimp fisheries, elsewhere in Mexico and throughout the tropical world. It is routinely blamed on open access (Johnson and Libecap 1982), on the unchecked desire of developing countries – enticed by lucrative export markets for shrimp – to subsidize and expand fleets (Platteau 1989), and on the willingness of international aid organizations to underwrite the modernization of fisheries in the developing world (Bailey, Cycom and Morris 1986; Evans 1976; Kurien 1985).

Submerged in the discourse of crisis is the role of shrimp science itself. Have the practitioners of this science forewarned of the crisis in the world's shrimp fisheries, or have they fostered it? An answer can be found in a close reading of two debates over the last decade.

One concerns spawners and recruits. Are shrimp stocks susceptible to biological collapse from overfishing? The second concerns the utility of surplus production models for shrimp fisheries. Can appropriate levels of fishing effort – fleet capacity – be specified?

Ostensibly, these address separate questions, one, the problem of recruitment overfishing, the other, of economic overfishing. I will suggest, however, that these questions have become inextricably linked in the dominant discourse on shrimp. Through this linkage, I will further argue, shrimp scientists have endeavored to deflect responsibility for the crisis in the fishery.

Scientific Discourse and Systems of Production

What I am suggesting, in a larger frame, is that we give serious attention to the casual claim recently put forward by Pálsson and Durrenberger: 'Biological models are not simply descriptions of nature, they are cultural artefacts, too' (1990:138). Science, they imply, has an epistemological status rather similar to 'folk models,' models which

are not necessarily authentic but are representations of current social relations of production; they are aspects of the way people represent their relations of production to themselves. The ideas have histories just as relations of production have histories (Pálsson and Durrenberger 1990:138).

Folk models and biological ones are, in short, equally products of social discourse.

While this is by no means a novel contention, most analysts focus their attention on the extratextual features of the discourse. Thus, for example, Pálsson and Durrenberger urge that we 'start to inquire about the place of biologists and other policymakers in the systems of production of which they are parts' (1990:138; cf. also Durrenberger 1988; Smith 1990; McEvoy 1988; Meehan 1984). The point of such inquiry is to unveil the processes by which the 'authentic discourse' of scientists becomes as well an 'authoritative discourse' (Asad 1979:623), informing, in Pálsson and Durrenberger's words, the 'making of the rules under which fishermen must work' (1990:138).²

As a complement to this agenda, I suggest that we attend as well to the textual features of science discourse. A useful guide to such analysis may be found in Peter Goodrich's treatment of 'discursive formations,' defined broadly as 'the relation of bodies of knowledge to social practice and structure' (Goodrich 1987:132).³ Goodrich distinguishes three elements of a discursive formation:

those of its material basis, or *institutionalisation*, its self-articulation or internal ordering, *intradiscourse*, and its relation to other discourses and discursive formations, its *interdiscourse* (1987:144).

In brief, institutionalization is concerned with the processes through which certain speakers – not any speakers – become authorized to speak. These are the processes with which Pálsson and Durrenberger, following Asad, are most directly concerned. Intradiscourse addresses the

self-authorisation of the discourse itself; characteristically, its delimitation of its objects, its elaboration of the rules and procedures appropriate to recognition or knowledge of such objects, and its privileging of specific terminologies, values and meanings in its systemisation (Goodrich 1987:146).

Interdiscourse, in turn, is concerned with the relations among discrete discursive formations, whereby the semantic materials of one formation, discipline, or 'text' may be 'in large measure predetermined or given by processes external to the text in question' (Goodrich 1987:150). The notion thus challenges 'conceptions of the autonomy or internal development of disciplines and their illusion of self-identity of subject matter, language and meaning' (Goodrich 1987:151).

In short, whereas institutionalization speaks to the question of who may speak, intradiscourse and interdiscourse are concerned with the production of *what* is said. While Pálsson and Durrenberger rightly direct us to the first question, my focus here will be on the equally critical issue of what, in fact, shrimp scientists are saying.

The Stock-Recruitment Relationship

The notion that populations of tropical shrimp (*Penaeus spp.*) can be biologically overfished entered the scientific discourse in the early 1980s. John A. Gulland, the dean of the stock assessment fraternity, offers some reasons for this tardy examination and of the potential for collapse:

The implicit assumption has been that recruitment is independent of adult stock, *ie*, the average recruitment is the same at all sizes of spawning stock. The scientific justification for this is obscure, though a common reason is that, by making it, the analysis is made much simpler and there has so far been no obvious case of recruitment overfishing among shrimp stocks (Gulland 1984:292-293).

Gulland's quizzical evaluation of the received wisdom on the stock-recruitment relationship (SRR) was presented at a workshop convened in 1981 at Key West, Florida. Jointly sponsored by the U.N. Food and Agriculture Organization and the United States' National Marine Fisheries Service, the conference assessed the states of several arts – of scientific models, of the actual status of the world's shrimp fisheries, and of management.

The summary statement from the workshop is an extraordinary document. Country by country, Mexico's experience was reproduced. By 1980, fishing effort was excessive; stocks were fully exploited. And there was a call for more scientific advice to correct the ills of the global industry (Anon. 1984:10-11). Indeed, the scientists assembled in Key West rather adroitly absolved themselves of responsibility for this state of affairs. By their own consensus, they were simply dependent agents:

Despite the growing problems being faced by the managers of shrimp fisheries, the scientists were, in many countries, not well prepared to provide the managers with the advice required. One reason for this has been lack of definition of the ultimate management objectives. Even for a single fishery these may be incompatible, contradictory, and sometimes amazingly vague. Unless the scientist has clear guidance on what the fisheries are being managed for, it is difficult for him to plan his research and frame his advice in an appropriate manner (Anon. 1984:11).

This is a rather fundamental claim proffered up by the scientific fraternity, a strategic interpretation of the relationships among science, polity, and economy. It need not go uncontested. I will suggest, provisionally, an alternative view: much of the scientific work which followed the gathering at Key West has been constituted not by the agendas of local resource managers but by the received wisdom itself. And, I suggest, that wisdom legitimized a consensus on management voiced by Serge Garcia of the Food and Agriculture Organization.

Garcia would shortly expand a paper he had prepared for the Key West workshop. The article, entitled 'The stock-recruitment relationship in shrimps: reality or artefacts and misinterpretations?' (Garcia 1983), offers the following advice on the management of penaeid shrimp fisheries:

For the want of better information it therefore seems advisable (both for economical and biological purposes) to manage a shrimp fishery by limiting the effort below some threshold level corresponding to an 'acceptable' level of risk. This is of course rather theoretical because this level is difficult to define in practice (except by trial and error, progressively increasing the level of effort allowed). It is likely that with the present fishing conditions, keeping the industrial fishery profitable (without government subsidies), would allow the biological objective (avoiding the critical level of effort) to also be met on average... (Garcia 1983:45).

These two brief texts, one claiming the deference of science to management, the other a rather irresolute example of the advice flowing from the scientist to the manager, frame the skirmish on Black Thursday in Guaymas. And they give meaning to the crisis of overcapacity in the world's shrimp fisheries. The texts themselves are grounded in the debate over SRR.

Exmouth Gulf: Questioning the Received Wisdom

At issue in the SRR debate is the relative importance of environmental perturbations and fishing pressure in determining the size of shrimp stocks from year to year. The initial attack on the traditional assumption came from the Australian biologist J.W. Penn at Key West. His argument was equivocal and, at the time, largely anecdotal. It was to gain substance with the collapse of the tiger prawn (*Penaeus esculentus*) fishery in the Exmouth Gulf, Western Australia, in 1982.

Penn's starting point (Penn 1984) was a typology of 'catchability.' Some species of shrimp are simply more vulnerable than others to fishing gear – because they aggregate in schools, because they are active in daylight hours, because they do not burrow. Penn used this simple notion to question both the economic and the biological foundations of the received wisdom. He suggested that the ease of catching some species belies the assumption that fishing will cease for economic reasons well before the stock is endangered. A corollary followed from this that stocks could indeed be destroyed (Penn 1984:178).

The notion that catchability has implications for the resilience of a stock is intuitively appealing. But Penn's proof was elusive. In the 1981 paper, he marshalled substantial evidence from a variety of tropical penaeid fisheries, showing the expected fluctuations in abundance from year to year – most readily explained by short-term environmental disturbances – but also some disturbing cases of long-term declines in catches. From this admittedly 'circumstantial evidence,' Penn warned that 'control of exploitation ... will become increasingly necessary for conservation as well as economic reasons as technological advances continue to increase effective effort in the established fisheries' (1984:185).

Technology was to blame, in part, for the decline of the tiger prawn in Exmouth. As Penn was positing a collapse because of the vulnerability of tigers to trawls, the Australian government was subsidizing the construction of larger trawlers. And older boats were retrofitted with propeller nozzles, increasing speed and trawling power. By the mid 1970s, mechanical shrimp peelers were introduced, allowing efficient processing of small prawns and enticing the fleet to commence fishing earlier in the season. Finally, record prices for the tiger prawn in 1978 and 1979 put further – transitorily fatal – pressure on the stock (Penn and Caputi 1985:166).

The Exmouth fishery, nonetheless, had been one of the most conscientiously managed in the world. Exploitation began in the Gulf shortly after the nearby Shark Bay fishery opened up in 1963. Both fisheries were subjected to limited entry restrictions from the beginning, determined and administered by the Western Australia Department of Fisheries and Wildlife (DFW).

In addition to controlling expansion – from 15 licenses in 1965 to 23 by the end of the 1970s in Exmouth, from 25 to 35 over the same period in Shark Bay – DFW amassed a substantial data base. These circumstances – limited

entry and close monitoring of effort, catch, and the environment – afforded John Penn the opportunity to detect and document a case of recruitment overfishing for shrimp. His argument, published with colleague N. Caputi in 1986, relied less on his earlier hypothesis about the susceptibility of certain species to capture and more on the events of 1981 and 1982 in the Exmouth Gulf.

An open bay along the arid western coast, Exmouth Gulf proved to be a propitious natural laboratory for the study of spawning stocks and recruitment. The isolated region has been spared major human disturbances of the littoral environment and the hydrologic parameters of the Gulf have been relatively stable over the period for which time-series data are available. With relative ease, then, Penn and Caputi were able to account for the two historic environmental perturbations in the Gulf – a cyclone in January of 1971, which devastated juvenile shrimp still on their nursery grounds, and a similarly severe storm in February of 1975, which had the opposite effect of improving the survival of adult shrimp in the offshore fishery by increasing the turbidity of the water and thus reducing predation and mortality of the stock (Penn and Caputi 1986:500).

Of the four penaeid species in the Gulf, Penn had suggested that the tiger prawn was most vulnerable: *P. esculentus* has adapted the unfortunate strategy of schooling during spawning season (Penn and Caputi 1986:503). But why did the catch, relatively stable up to 1980, drop to half in 1981, then to about a fifth of its former magnitude the following year?

Regression analyses revealed the expected conclusion: the environment (rainfall and hence salinity) of the juveniles and the fishing pressure exerted on spawning adults of the previous year explained 94% of the year-to-year variation in catch (Penn and Caputi 1986:500). Moreover, it was the wholesale expansion of effort in the late 1970s – by roughly 50% – that tipped the balance. Penn and Caputi conclude, simply, that the levels of fishing pressure had reduced the equilibrium between spawning stock and recruits to a 'relatively low' point – indeed a point close to a 'total collapse level of effort,' even under normal environmental conditions (1986:502).

Penn and Caputi close a companion paper on management with reasoned advice:

In practical terms the present study has ... shown that the possibility of recruitment overfishing of penaeid stocks can no longer be disregarded in management terms. As observed by Walters and Ludwig (1981) 'in the long term view it is simply irrelevant to comment that recruitment can often be predicted more accurately from environmental factors than from spawning stock, because it is the spawning stock which can be controlled through management decisions' (Penn and Caputi 1985:173).

In short, Penn and his colleagues questioned the authority of the received wisdom and invoked an alternate text on management. By the end of the decade, however, Walters and Ludwig would no longer provide a necessary piece of the Australians' argument.

The Gulf of Mexico: Sustaining the Received Wisdom

Serge Garcia of the FAO, Penn's protagonist in the SRR debate, had already challenged much of the data upon which the suspicion of recruitment overfishing rested. Garcia detailed his critique most fully in his 1983 paper, which begins with an approving nod to the received wisdom expressed in the management plan for the multi-million dollar shrimp fishery in the Gulf of Mexico. That plan, adopted by the United States' National Marine Fisheries Service in 1981, repeatedly asserted that the three commercially significant shrimp stocks in the Gulf are 'biologically impervious to the effects of intense fishing pressure' (Anon. 1980:74178) due to the classical wisdom: only a small population of these highly fecund spawners is needed to replenish the stock.

Two critical observations followed: (1) the maximum yield 'for a given year is essentially all the shrimp available to harvest, using current technology' (Anon. 1980:74274), and (2) 'no recommendations are made on limiting fishing effort because the resource is not biologically overfished' (Anon. 1980:74192).

The Mississippi River set the course for research underlying the Gulf of Mexico shrimp fishery plan. The river disgorges much of the surface runoff of the continental United States into the Gulf, making that body of water the ecological antithesis of the arid and stable Exmouth Gulf in Western Australia. In the early 1950s, American researchers began a sustained effort to understand the effects of the environment on shrimp in the Gulf. The results may usefully be viewed through the strategic lens of Serge Garcia and his colleague, L. Le Reste, preparers of the definitive 'Life Cycles, Dynamics, Exploitation and Management of Coastal Penaeid Shrimp Stocks,' issued by FAO in 1981.

Within this comprehensive review, Garcia and Le Reste surveyed world-wide studies of interannual variations in abundance. As a preliminary, they distinguish short-term variation as 'noise' and long-term variation as 'signal.' And they suggest, for the latter, that it is 'tempting to look for the cause of this phenomenon in long-term climatic variations, as many authors have done' (Garcia and Le Reste 1981:119). The pivotal text from the Gulf of Mexico addressed the noise; Garcia and his colleague deftly read signals from the same data.

The data set was propitious: catch statistics for whites (*P. setiferus*) and browns (*P. aztecus*) in Louisiana and Texas, rainfall in Texas, river discharge from the Mississippi and Atchafalaya in Louisiana – from 1927 to 1964. Gordon Gunter and Judith Clark Edwards (1969), confirming studies Gunter had been pursuing for 20 years, obtained significant correlations, in the Texas time series, between high catches and heavy rains during the current and preceding two years – for white shrimp, but not the browns. And not in Louisiana. There, they found no significant correlation between river discharge and the catches of either species. Hence the picture of environmental noise – demonstrably affecting production in the Gulf – was complex. As

Garcia and Le Reste observe, 'freshwater outputs seem thus favorable to production in Texas and unfavorable in Louisiana for the same species' (1981:123).

What intrigued Garcia and his colleague, however, was not so much that interannual 'noise' might be comprehended but that the Gunter/Edwards data set simultaneously revealed longer term environmental signals. Reanalyzing the time-series data, the FAO researchers discovered synchronous variation in white shrimp catches off the two Gulf states, despite the fact that the species responded differentially to freshwater outflows. This, they suggested, 'would imply the action of a common factor, probably of climatological origin' (Garcia and Le Reste 1981:123).

Garcia and Le Reste do not attempt to define and evaluate the implicated factor in the Gulf of Mexico. Nor, interestingly, does the reinterpretation of the Gulf material play a significant role in Garcia's subsequent discussions of the stock-recruitment relationship. Thus, the epistemological status of the conclusion – the common climatological factor – may rest within the Garcia/Le Reste text itself. The critical context is found in their 2-page treatment of SRR. They observe, first, that

There are no shrimp stocks, even those which have been heavily exploited, for which it can be shown with certainty that the recruitment has been affected by the exploitation of adults, except perhaps recently in the gulf between Iran and the Arabian peninsula (Garcia and Le Reste 1981:135).

Then they argue the following:

For practical purposes ... if there is no clear relationship between the stock and the recruitment within a range of reasonable levels of exploitation, such relationship can be wholly neglected and recruitment can be considered to depend on the environment only. *This conclusion, even if not clearly expressed, underlies all the applications of predictive models based on the relation between the production and the climatological conditions* (Garcia and Le Reste 1981:135; emphasis added).

Two preliminary observations can be made. First, John Penn started with the assumption that shrimp stocks could fail through recruitment overfishing. Then the Exmouth Gulf fishery quickly obliged. Garcia and his colleague, as the highlighted passage above suggests, drive their review and analysis with the opposite assumption, the received wisdom. Second, the strength of this received wisdom into the early 1980s was such, apparently, that Garcia and Le Reste did not feel compelled to fully document their reading of the Gulf of Mexico data. A simple statistical representation of the climatological data sufficed.

Garcia did, however, immediately undertake a challenge of the one apparent case of recruitment overfishing (prior to Exmouth Gulf) cited in his review with Le Reste: the Persian Gulf.

The Kuwait Case

Garcia and co-author Gary Morgan of the Kuwait Institute for Scientific Research begin their brief analysis with the disturbing observation:

The catches from the shrimp stocks of the Gulf between the Arabian peninsula (the majority of which are *Penaeus semisulcatus*) have been declining since reaching a peak in the late 1960's, resulting in the closing down of most of the fishing companies in the Gulf (Morgan and Garcia 1982:133).

Off Kuwait, stocks improved in the early 1980s, and fishing resumed. Indeed, landings for the 1983/1984 season were at record levels, comparable to the previous peak season of 1966/1967. But the effort expended on this catch had increased four-fold over the relatively constant levels of the 1960s and 1970s, and indices of recruitment had declined steadily. One authority warned in 1985 that this 'long term decline, if continued indefinitely, could lead to zero recruitment (and, therefore, zero landings) in the early 1990's' (Mathews 1985:27).

Morgan and Garcia do not deny the observed trend, but they point suggestively to the environment, not overfishing:

...the reason for the recruitment decrease since the beginning of the fishery might have to be found largely in changes in the environment ... (trends such as land reclamation, decreases in ... [river] outflow by damming, etc.) (1982:136).

Morgan and Garcia arrive at this conclusion not through a direct route of measuring the presumed environmental changes, but through a comparative analysis of several stock assessment measures. First, they construct descriptive surplus production models for the Kuwaiti and Saudi Arabian fisheries, models which reveal wide variation in catches for given levels of effort. More importantly, though, the two fisheries display 'a rather different history in terms of effort development' (Morgan and Garcia 1982:136), even though the decreasing recruitment trends track one another. This suggests to them — as was the case in their comparison of Texas and Louisiana fisheries — a common, unmeasured, environmental influence. And they eyeball the fit among unrelated measures of recruitment, all of which show the same 'apparently quasi-linear' and decreasing trend between stock in one year and recruitment in the next. Since some of these measures incorporate the effects of fishing and some do not, the authors suggest that the similarity in trends exonerates fishing as the causal agent in the long-term decline in stocks (Morgan and Garcia 1982:136).

They conclude, finally, that the decline is unlikely to be reversed by limiting or withholding fishing effort: 'only the reversion of the causal environmental factors (provided they are reversible) will allow for a suitable recovery of the fishery' (Morgan and Garcia 1982:137).

By logical argument in the case of Kuwait and by correlation of rainfall and catches for the Gulf of Mexico fisheries, Garcia had thus constructed his defense of the received wisdom. His more comprehensive argument followed shortly upon the brief Persian Gulf study: the apparent manifestations of stock-recruitment relations in shrimp were all statistical artifacts, produced by autocorrelated environmental effects. As he argued confidently in 1983,

The short-lived nature of shrimp stocks ... introduces a direct linear relationship between the size of the recruitment in year n (R_n) and the size of the subsequent adult stock (S_n in the same year). As a consequence the existence of an environmentally-driven serial correlation in recruitment oscillations would therefore lead to the existence of a serial correlation in stock sizes, and to the production of a spurious positive relationship between S_n and $R_n + 1$ (justifying the word artefact) (Garcia 1983:41).

His position draws on sustained research efforts in the Gulf of Mexico to empirically document the recruitment or replacement function, $S_n = f(R_n)$. In the Gulf, however, this research effort was not undertaken to shore up the received wisdom but rather to facilitate the prediction of commercial stock sizes. The premise is simple: if there is a strong relation between the abundance of postlarval or juvenile shrimp during the estuarine growth phase and the subsequent abundance of adult shrimp offshore, then fishing effort could be adjusted seasonally to the forecasted stock.

Under this premise, Berry and Baxter (1969) sampled postlarval and juvenile abundance in Galveston Bay, Texas, as well as the reported catches of the bait shrimp fishery in lagoonal waters. Similar work undertaken in Louisiana (Barrett and Gillespie 1973) produced equally promising results: juvenile indices of abundance and actual inshore catches were indeed strongly correlated with offshore abundance and could provide sufficient lead time (roughly 3 months) to enable the industry to make appropriate production decisions.

Thus RSR — the demonstrated relationship between recruitment and stock, between juveniles and adults in the same year — would seemingly have utility for Garcia's arguments against SRR. Variations in commercial stock abundance are a direct function of environmental conditions and exploitation in estuaries, and progressive habitat destruction in the estuaries could indeed produce the 'quasi-linear' decline seen in Kuwait. Yet Garcia is surprisingly ambivalent about the value of predictive models generated from recruitment-stock relationships. He observes, for example,

Most of them have to prove their effectiveness... [W]hen the ability to predict cannot be developed at a reasonable cost the solution consists in evaluating and including uncertainty in the models... (1989:285).

Subtly, here, Garcia is privileging 'signal' over 'noise,' longer environmental trends over interannual variations. Within the specific *intradiscourse* over the

stock-recruitment relationship, this effort is necessitated by Garcia's 'artifact' argument: the apparent serial correlations of stock sizes from year to year are in fact spurious manifestations of autocorrelated environmental effects. But this emphasis has implications for the *interdiscourse* on shrimp as well. Garcia will argue that environmentally-driven trends invalidate the use of surplus production models, models designed to specify maximum sustainable yield and, correspondingly, fleet capacities.

And on the issue of noise – the lingering suspicion that short-term fluctuations in stock sizes may in fact be attributable to overfishing as much as to environmental oscillations – John Penn would himself, by the end of the decade, diffuse the concern.

Convergence

Penn and Garcia contributed to an important volume on the assessment and management of marine invertebrate fisheries (Caddy 1989a). There is, in a conjoint reading of these two statements, surprisingly little concern for SRR. Since Penn most directly challenged the received wisdom on stock and recruitment, it is useful to focus on his contribution to the 1989 collection, prepared with his Australian colleagues (Penn, Hall and Caputi 1989:128-130).

Highlighted in the 1989 paper is not the vulnerability of the tiger prawn to recruitment overfishing but rather its *recoverability*. The argument reproduces an analysis developed in the earlier works, but stripped of the cautions and caveats which had originally accompanied the schematic (Figure 1).

The analysis, based on the Exmouth Gulf data, explicitly seeks an accommodation with Garcia while retaining the documented reality of SRR. The three curves (A, B, and C) in Figure 1 represent initial stock-recruitment relations, modified by varying environmental conditions during the recruitment phase, resulting in a series of equilibrium levels for stock and recruitment. The effort lines, in turn, correspond to recruitment-stock relationships under varying fishing pressure. The intersections of these lines then depict equilibrium stock and recruitment levels under varying exploitation and environmental patterns. Thus, for example, curve B, reflecting average environmental conditions (e.g., for Exmouth, of low January and February rainfall) intersects with the fishing effort line of 60 units – characteristic of the fishery in the late 1970s – at a relatively low equilibrium point.

The analysis is formally identical to one presented by Garcia in his 1983 paper. There, Garcia directed his attention specifically to 'collapse levels of effort,' where the effort/RSR line no longer intersects the SRR/environment line. In the Penn/Caputi illustration, this would occur immediately if additional effort was applied to 'average' (B) conditions. And, indeed, Penn and Caputi note that 'recent levels of effort under normal environmental conditions are also very close to the total collapse level of effort' (1986:502) defined theoretically by Garcia.

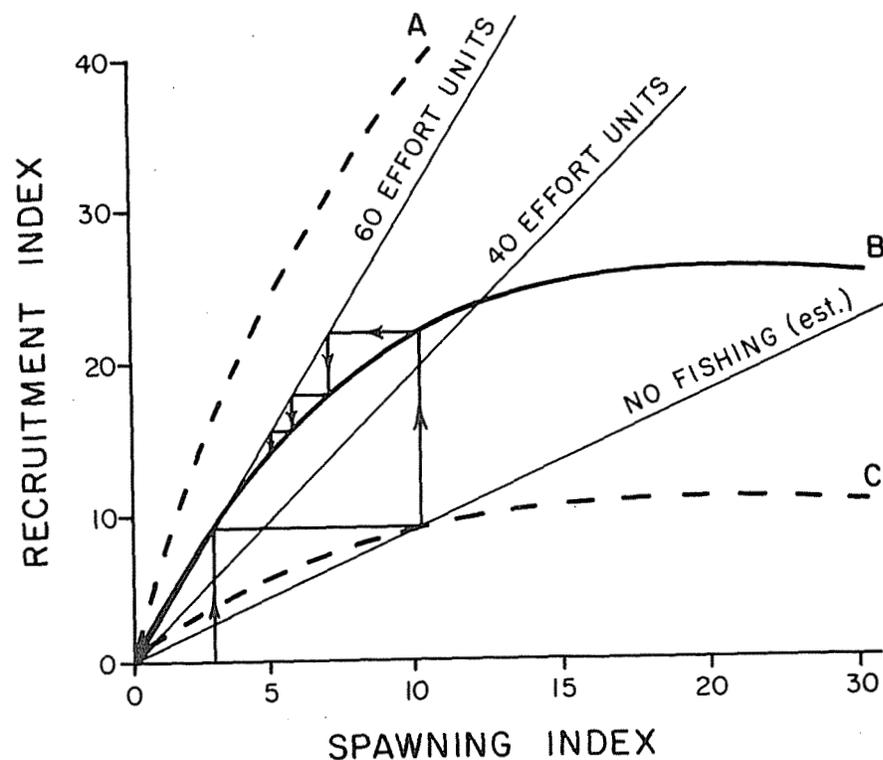


Figure 1. Exmouth Gulf: Interaction between SRR and RSR for tiger prawns under varying environmental and effort conditions (Source: adapted from Penn, Hall and Caputi 1989:130).

Let us follow through the Penn/Caputi reasoning. Contrary to Garcia, who with Morgan had rejected the utility of decreasing fishing effort to spur stock recovery, Penn and Caputi suggest that stocks will recover quickly with a curtailment of exploitation (indicated in Figure 1 by the arrowed line).

Their 1986 exposition was tentative, noting the synergistic biases likely if errors had been made in estimating the effective fishing effort and spawning stock and recruitment indices (1986:503). The 1989 reading of this graph is rather more confident. Penn, Hall and Caputi (1989:130-131) observe the following:

The zero effort line (i.e., no fishing), which has been extrapolated from the data, indicates that the recovery from low stock and recruitment levels could be quite rapid, say 1-2 yr, if fishing ceased... This suggests that with unrestricted fishing effort as vessels left the fishery, a rapid buildup of stocks would occur, thus encouraging fishing effort to increase again. High fishing effort would then lead to a reduction in abundance, followed again by a reduction in effort. This sequence of events would tend to repeat itself and produce cycles in abundance.

This is not the kind of argument Garcia would make: variations in stock abundance, below the 'collapse level of effort,' are — resolutely — driven by the environment and by the predation on juveniles by artisans.⁴ If this environment is deteriorating progressively or if the artisanal sector is expanding, little can be done to improve the fishery offshore (Garcia 1983:43).

But lost in Penn's new position is his earlier effort to give authority to Walters and Ludwig on the issue of management. Now, with the 'rapid buildup of stocks' presumed, there is no imperative to control long-term spawning stock size through management. Indeed, Penn's conclusion in 1989 closely mirrors the management edict offered by Garcia shortly after the Key West workshop: the patterns of profit (or loss) in the fishery itself, the short-term entry and exit of vessels, will sustain the stock — or at least allow it to recover from collapse.

Abetted, then, by Penn's willingness to model a variable environment and his logical capitulation on the issue of management, Garcia restricts his 1989 discussion of the stock-recruitment relationship to two paragraphs. Although acknowledging that the SRR question 'remains open and is certainly worth more attention than it has received in the past,' (1989:286), he rather glibly dismisses the Exmouth Gulf collapse:

It is of course obvious that at some high level of effort problems of recruitment can be encountered (Garcia 1989:286).

John Caddy of the FAO, prefacing these contributions, closes a decade of discussion on a Garcian note:

The debate between the relative effects of excessive effort and of environmental factors such as rainfall on shrimp still continues, with the balance perhaps now tipping toward environment as opposed to parent stock size as the main controlling factor for penaeid shrimps except under conditions of extreme stock depletion (1989b:6).

Thus the debate had collapsed. Garcia was convinced that the trouble in Exmouth Gulf was due to radically excessive effort. Penn acquiesced, but was confident that it didn't mean much to the resilient tiger prawn. With the help of his Australian colleague, then, Garcia had largely succeeded in reauthorizing the received wisdom: recruitment overfishing is, for Garcia, unlikely, and for Penn, irrelevant.

This convergence in turn shaped — 'preconstructed' (Goodich 1987:150) — a second discourse, the question of economic overfishing.

Surplus Production

'Surplus production,' simply defined as 'an increase in biomass in excess of losses to natural mortality' (Sissenwine 1978:23), is typically modeled as a dome-shaped (Schaefer) curve (Figure 2a). The shape of the curve is deter-

mined by three growth components: recruitment to the stock, individual growth of fish within the population, and natural mortality, including predation. In virgin, unexploited stocks, 'a point will be reached where recruitment and individual growth are just balanced by natural mortality and stock growth will cease (Anderson 1977:24).'

At that point ($P_{m,ax}$ in Fig. 2a), the unexploited stock size will be largest and there will be no 'surplus production.' Sissenwine reviews the curve's implications:

Under exploitation, the stock adjusts to a new equilibrium level, at which point yield equals surplus production. Clearly, the population is unable to cope with sustained yields in excess of MSY. Here, MSY is defined as the peak value of the surplus production curve. Surplus production equals MSY for a population size of $P_{m,SY}$. If the population is larger than $P_{m,SY}$, then a constant catch rate of MSY will result in a downward adjustment of population size to a new equilibrium at $P_{m,SY}$. If the catch rate continuously exceeds MSY or exceeds surplus production that is smaller than $P_{m,SY}$, then the population will eventually decline to economic extinction (abundance level at which it is no longer profitable to fish) (1978:23).

In theory, then, it is possible to specify a level of fishing effort, F (hence $F_{m,SY}$), required to capture MSY, a level of effort (typically to the left of MSY, less than $F_{m,SY}$) at which profits in the fishery are maximized (MEY), and, finally, for stock which display significant interannual variation, a long-term, maximum average yield (MAY).

For shrimp, however, the appropriateness of the domed-shaped sustainable yield curve of typical production models has been questioned. Shrimp have only a year-long lifespan, individuals reach their maximum growth rapidly, are captured before natural mortality becomes a significant factor in total biomass and, under the conventional wisdom, the size of the spawning stock surviving through the exploitation phase bears little relation to subsequent stock sizes. Thus shrimp are presumed not to exhibit the growth parameters shaping standard surplus production models (Gulland 1984:293). Rather, it is assumed that, for a single cohort, a flat-topped curve is more appropriate, one without a descending right-hand limb (Figure 2b). And, given the presumed environmental influences affecting annual stock sizes, year-by-year production models will replicate one another only if the driving environmental variables are serially correlated.

A critical implication is contained in this line of reasoning. If recruitment overfishing *cannot* occur, economic overfishing *will* occur. Poffenberger, with the U.S. National Marine Fisheries Service, argued this proposition at the Key West workshop. First, he observes that

Once effort has increased to a level which results in yields in the 'flat' portion of the curve then relatively large increases in effort would result in only modest increases in yield. The important point is that the sustainable yield would not decrease with increases in effort. Therefore, this model assumes that within the flat-topped part of the curve penaeid shrimp

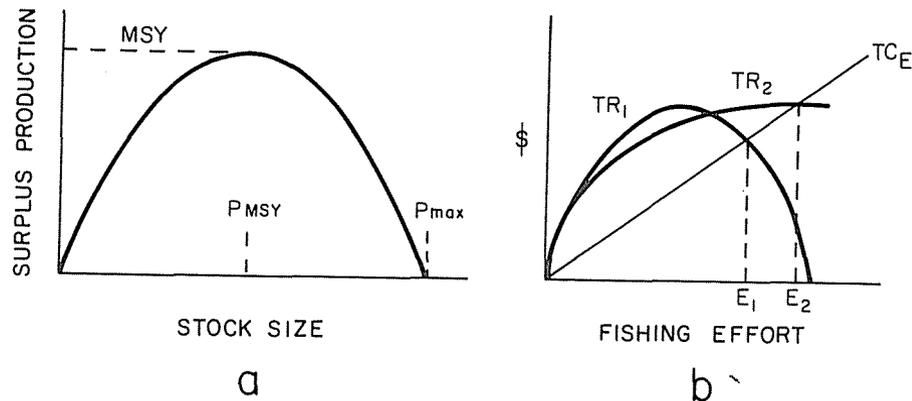


Figure 2. (A) Surplus Production Model (Source: adapted from Sissenwine 1978:23); (B) Domed-shaped (TR_1) and flat-topped (TR_2) total revenue curves (Source: adapted from Poffenberger 1984:303).

stocks are capable of maintaining sustainable yields for a wide range of fishing effort (1984:300-301).

Impervious to biological overfishing – given this assumption that no stock-recruitment relationship exists – shrimp stocks simultaneously invite economic overfishing. This again follows logically from the shape of the flat-topped growth curve. In open access fisheries, regardless of the population dynamics of the stock, fishing capacity will move toward the bionomic equilibrium – the point where total revenue and total cost curves intersect. This point exceeds MEY, the maximum difference between total cost and revenue curves, and thus represents an inefficient use of capital and/or labor: ‘economic overfishing.’

Figure 2b illustrates the comparative difficulties with flat-topped fisheries. The level of effort (E_2) associated with total revenues (TR_2) for asymptotic stocks, such as shrimp, exceeds the corresponding effort (E_1) for parabolic stocks. Thus, as Poffenberger deduces,

it can be argued that for an uncontrolled penaeid fishery there is an inherent tendency towards more fishery participation (effort) than for fisheries targeting longer-lived species (1984:303).

In theory, again, the regulatory imperatives of this model are obvious. At once impervious to recruitment overfishing and prone to economic overfishing, penaeid stocks should be managed for efficiency – by limiting effort at the point of MEY. But how robust is the model itself? Let us examine, again, the Gulf of Mexico.

Surplus Production in the Gulf of Mexico

The Gulf of Mexico shrimp fishery has been subjected to the most sophisticated surplus production modeling in the world, and yet Garcia and Le Reste chide the industry as ‘an excellent example of inefficiently managed fisheries’ (1981:167). The Gulf’s management plan, while devoting some discussion to the ills of economic overfishing, echoed Garcia in rejecting the utility of surplus production models for specifying maximum economic yield (Anon. 1980).

To be sure, the production models developed for the Gulf did reveal substantial confusion. Trends in effort and catch differed across the statistical reporting areas in the Gulf, differed by species, and were confounded by environmental oscillations. Several tentative conclusions were offered by the architects of the models: (1) stocks in the Gulf have been subjected to significant increases in effort since 1960; (2) catch per unit of effort has declined, indicating, according to Rothschild and Brunenmeister (1984:160), that ‘stocks ... are decreasing in abundance with the progression in time;’ and (3) several of the stocks appear to be ‘at the transition point’ between an asymptotic and a parabolic production function, suggesting the need for ‘careful monitoring of the status of the stocks’ (Rothschild and Brunenmeister 1984:160). But these authors admit to their own uncertainties:

...from a statistical viewpoint it is difficult to judge the descriptiveness of the asymptotic and parabolic forms of the production model with regard to the dynamics and status of Gulf of Mexico shrimp. If the asymptotic form holds, then the population is in good condition, but if the parabolic form holds then the considered population is on the verge of collapse (1984:170-171).

The problem arose when Brunenmeister tried to determine the appropriate ‘ m ,’ the exponential parameter in the nonlinear production model which gives shape to the fitted curve. For brown shrimp, Brunenmeister found the best fit ($R^2=0.572$) with m at 0.31, close to the m characteristic of a flat-topped curve. But nearly identical fits were obtained with m at 1.0 and 2.0, representative of parabolic curves (Brunenmeister 1984:203). Similar indiscrimination occurred for production models of white and pink shrimp although, in general, the estimated MSY with m close to 0.00 exceeded those derived from parabolic functions (Brunenmeister 1984:203-207).

Ironically, the surplus production modeling utilized in the Management Plan found the best fit with $m=3$, a model which, the plan dutifully observes,

is usually associated with species which are very susceptible to recruitment overfishing. Penaeid shrimp are very resistant to this type of overfishing (Anon. 1980:74278).

For heuristic purposes, the management plan adopted instead a GSP model with $m=2.0$, still a parabolic function, and estimated a MSY for the entire

Gulf at 85 million pounds of browns, 38 M lbs. of whites, and 14 M lbs. of pinks (Anon. 1980:74280).

However, what follows directly upon the MSY discussion in the Management Plan's narrative was not, as we might anticipate, an analysis of MEY and a specification of appropriate fleet capacity. Rather, there was a cursory review of catch estimates for the inshore sectors of the industry (with an implicit suggestion that unrecorded catches from these sectors may be responsible for generating the improbable parabolic shape of the production function [Anon. 1980:74280]), followed by an attempt to estimate 'maximum probable yield' – biomass of the fishery at oscillation peaks. Treatment of MEY, contained elsewhere in the 200-page document, was ephemeral.

The Council at once acknowledged the problem of overcapitalization in the fishery and rejected corrective measures. Again, the received wisdom that shrimp manifest no stock-recruitment relationship impregnates the Plan's discussion of economics: 'No recommendations are made on limiting fishing effort because the resource is not biologically overfished' (Anon. 1980:74192). The parabola, used to generate MSY, was here replaced by the flat-topped curve, and the economic rationale suggested above by Poffenberger (and Garcia and Penn) was thus invoked. The Gulf fishery, the Plan suggested, had approached an open access equilibrium, with vessels 'generating just enough revenue to cover total costs over a long period of time, and entering or exiting the fishery in the short run with prevailing economic conditions' (Anon. 1980:74292). But that equilibrium point exceeds the level of effort needed to harvest the maximum economic yield (Anon. 1980:74242).

The result, of course, is a reduction in earnings per vessel. As the Plan observed, however, other objectives would be satisfied. Employment, inshore and offshore, is enhanced (Anon. 1980:74292); capacity is retained in the fishery to fully exploit peak stock abundances; and there are savings to be had by not having to enforce effort limitations (Anon. 1980:74292). In short, the Management Plan aimed toward its primary goal: '...to attain the greatest overall benefit to the nation with particular reference to food production and recreational opportunities on the basis of maximum sustainable yield as modified by relevant economic, social or ecological factors' (Anon. 1980:74192).

There are critics of the Gulf shrimp plan, and there are culprits other than the Management Council contributing to the overcapitalization of the fishery. Maril, for example, remarks on the dramatic rise in new-vessel costs in the 1970s, the result, he suggests, of investment capital 'gone looking for someplace to hide' during an inflationary decade (1983:146). The effects have been to saddle owners with high interest payments, to retard exit from the fishery in poor years, and to substantially increase fishing effort in the Gulf. And, again, there is noise: the peaks and the troughs. As Maril reports,

Even if the shrimpers are out doing their best, they have 'bad' years. Bad years play havoc with the shrimper's income. In a bad year he will usually go into debt, and two bad years in a row can do him considerable harm (1983:148).

But to return specifically to the text at hand, the Gulf Council's management plan, some summary observations can be made. The structure of the argument appears to be as follows. (1) Since recruitment overfishing is assumed to be impossible, fleet capacity need not be regulated to prevent resource collapse. (2) Because of the strength of this received wisdom, the empirically-generated parabolic forms of surplus production models – implying the possibility for recruitment overfishing – must be discounted. (3) Nevertheless, because a parabolic function can be fitted to the historic catch and effort data for the fishery, MSY can be specified. (4) Existing capacity exceeds $f_{m, sy}$ but this excess ought not be reduced through entry limits and may, indeed, be beneficial for fully exploiting periodically large stocks.

The Gulf of Mexico's management plan, in short, closely replicates Serge Garcia's logic.

Garcia's Logic

Garcia is resigned to the fact that surplus production models are likely to persist in shrimp stock assessment. They are, as he notes, mathematically simple models with small data requirements, useful perhaps as empirical descriptions of the trajectories of fisheries (1988:238-239). Yet he rejects their validity as specifiers of MSY and $f_{m, sy}$ – because of the confounding effects of environmental signal (Garcia 1985:147). Without accounting for such signal, MSY will be misconstrued:

The trajectory of a developing fishery across a catch-effort-environment three-dimensional space will be wrongly taken as a traditional production curve on the catch-effort plane, while in fact basic properties of the model will have been lost. In particular, if few data points are available and environmental changes are autocorrelated, the apparent MSY may be grossly in error and the curve may not predict correctly the catches obtainable with substantial changes in effort (Garcia 1988:238).

Apparently, what is implied in the last clause above is this: in such cases as developing fisheries, where effort by definition is expanding and the data points are likely to be few, catch/effort models may grossly underestimate sustainable yields. And, once again, he introduces his irreversibility argument: if observed downward trends are due in large measure to autocorrelated environmental effects, then

the possibility of reversing the observed evolution of the fishery stock along the same trajectory by reducing the amount of effort is often not feasible (Garcia 1985:147).

Garcia thus invokes the environment to at once defend the received wisdom on the lack of a stock-recruitment relation and to question the utility of surplus production models. There is a temporal imperative in this logic which, I suggest, in large measure accounts for the crisis – in Guaymas and throughout the world's tropical shrimp fisheries. In short, Garcia privileges environmental signal over noise.

The bias surfaced first in the scientist's reanalysis of data from the Gulf of Mexico. Recall that these data were first analyzed by researchers for the purpose of identifying short-term environmental fluctuations – noise – as a means to forecast catches. Garcia and his colleagues addressed the data set to the question of signal, for the purpose of demonstrating the independence of long-term oscillations in stock abundance from short-term environmental fluctuations. By itself, the demonstration did not preclude the search for noise, and hence the possibility of developing short-term predictive models of seasonal abundance and adjusting seasonal fishing effort. But it did allow Garcia to invoke the notion of 'autocorrelation' repeatedly through the decade to refute claims for a stock-recruitment relationship and, as we have just seen, to question the use of surplus production models. ~

Once these arguments have been drawn, Garcia's management recommendations follow logically. Recall the advice: without fear of biological collapse, fishing effort can be allowed to increase so long as the industry remained 'profitable.' In turn, this would ensure that the biological objective – avoiding collapse – would be met *on average*. Here, John Penn and his colleagues fill the gap: if there is an unexpected collapse, the stocks may recover quickly.

Guaymas Revisited

The workshop in Key West in 1981 was a watershed. The received wisdom on SRR first came under close scrutiny and stimulated much activity in the scientific fraternity through the decade. But the operation of the wisdom had already worked itself out. Shrimp fleets throughout the tropical world approached or occasionally exceeded collapse levels of effort. Frequently – as in the case of Mexico (Edwards 1978:146) – these expansions themselves were encouraged and subsidized by FAO and other aid agencies. They occurred in developed countries – Australia and the United States – and developing ones alike. The scientific discourse of the 1980s was largely a post-mortem, disingenuously validating the received wisdom.

Ultimately, the truth of this authoritative discourse turns out to be a great deal less important than what it authorizes. Simply put, it shapes the events which occurred on Black Thursday in Guaymas. Neither the loan schedules of boat owners nor the nutritional demands of the shrimpers and their dependents are indexed to indices of recruitment. Pressures on the fishermen do not oscillate with environmental signals and noise. But these are the ones who must finally contend with the received wisdom. In Guaymas, Garcia's project of 'keeping the industrial fishery profitable' may occur, as captains and cooperatives watch their boats rot at the docks.

Notes

1. Information on the current events in Guaymas has been obtained from Sonoran newspapers,

primarily *El Imparcial*, Hermosillo, Sonora, Mexico, and from discussions with officials of the Secretaría de Pesca and its research unit, the Centro Regional de Investigacion Pesquera, in Guaymas. Details of the conflict are reviewed in Vasquez-Leon, McGuire and Cederstrom (1991). Background on the Pacific Coast shrimp fisheries may be found in McGoodwin (1980; 1987); McGuire (1983); Magallon-Barajas (1987); and Chávez and Lluch (1971). Hoyos (1991) briefly reviews the recent deterioration in yields in the Gulf of California and suggests that shrimpers themselves are attributing the decline to fishing during the spawning season, *i.e.*, the reality of a stock-recruitment relationship.

2. A similar agenda has been set for the 'juridical field' by Pierre Bourdieu (1987). Translator Richard Terdiman summarizes: 'Bourdieu traces in detail the social and particularly the linguistic strategies by which the inhabitants of the legal universe pursue this effort to impose their internal norms on broader realms and to establish the legitimacy of interpretations favorable to the self-conception of the field, to the ratification of its values, and to the internal consistency and outward extension of its prerogatives and practices (1987:809).'

3. Goodrich's scheme, which he applies to legal discourse, draws primarily upon Mikhail Bakhtin's *The Dialogic Imagination* (1981) and Michel Pêcheux' *Language, Semantics and Ideology* (1982).

4. In an FAO *Technical Paper*, Willmann and Garcia construct a bioeconomic simulation model of the sequential (inshore, small-boat sector; offshore, industrial sector) shrimp fishery in Surinam. They offer the following advice: '...an expansion of artisanal shrimp in coastal swamps will imply a reduction in income, employment and foreign exchange earnings to the Surinamese economy. A promotion of artisanal fisheries could be justified on account of re-distributing income and employment to rural areas, and in respect to greater supply of protein to rural consumers. In regard to both these objectives, alternative ways and means may, however, be more appropriate considering the great loss in foreign exchange earnings resulting from such a policy (1985:42).'

References Cited

- Anderson, Lee G.
1977 *The Economics of Fisheries Management*. Baltimore: The Johns Hopkins Press.
- Anon.
1980 Shrimp Fishery of the Gulf of Mexico: Plan Approval and Proposed Regulations. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. *Federal Register* 45(218):74178-74308.
- Anon.
1984 Report of the Workshop on the Scientific Bases for the Management of Penaeid Shrimp. In: John A. Gulland and Brian J. Rothschild (Eds.), *Penaeid Shrimps Their Biology and Management*. Surrey, England: Fishing News Books, Ltd. Pp. 9-30.
- Asad, Talal
1979 Anthropology and the Analysis of Ideology. *Man* 14:607-627.
- Bailey, Conner, Dean Cycom, and Michael Morris
1986 Fisheries Development in the Third World: The Role of International Agencies. *World Development* 14(10-11):1269-1275
- Bakhtin, Mikhail
1981 *The Dialogic Imagination*. Austin: University of Texas Press.
- Berry, Richard J., and Kenneth N. Baxter
1969 Predicting Brown Shrimp Abundance in the Northwestern Gulf of Mexico. In: M.N. Mistakadis (Ed.), *Proceedings of the World Scientific Conference on the Biology and*

- Culture of Shrimps and Prawns. *FAO Fisheries Report No. 57*, Vol. 3. Rome: Food and Agriculture Organization. Pp. 775-798.
- Bourdieu, Pierre
1987 The Force of Law: Toward a Sociology of the Juridical Field. With Translator's Introduction by Richard Terdiman. *Hastings Law Journal* 38:805-853.
- Brunenmeister, S.L.
1984 Standardization of Fishing Effort and Production Models for Brown, White and Pink Shrimp Stocks Fished in U.S. Waters of the Gulf of Mexico. In: John A. Gulland and Brian J. Rothschild (Eds.), *Penaeid Shrimps Their Biology and Management*. Surrey, England: Fishing News Books, Ltd. Pp. 187-211.
- Caddy, John F. (Ed.)
1989a *Marine Invertebrate Fisheries: Their Assessment and Management*. New York: John Wiley & Sons.
- Caddy, John F.
1989b Overview of Crustacean Fisheries: Assessment and Population Dynamics. In: John F. Caddy (Ed.), *Marine Invertebrate Fisheries: Their Assessment and Management*. New York: John Wiley & Sons. Pp. 3-12.
- Chávez, E.A., and D. Lluch
1971 Estado Actual de la Pesca de Camarón en el Noroeste de México. *Revista de la Sociedad Mexicana de Historia Natural* 32:141-156.
- 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.
- Edwards, R.R.C.
1978 The Fishery and Fisheries Biology of Penaeid Shrimp on the Pacific Coast of Mexico. In: Harold Barnes (Ed.), *Oceanography and Marine Biology: An Annual Review*. Aberdeen, Scotland: Aberdeen University Press. Pp. 145-180.
- Evans, Emmit B., Jr.
1976 Marine Scientific and Technological Assistance to Developing Countries: Science for Development or Technology for Malintegrated Growth? *Economic Development and Cultural Change* 24(2):375-385.
- Garcia, S.
1983 The Stock-Recruitment Relationship in Shrimps: Reality or Artefacts and Misinterpretations? *Océanographic Tropicale* 18(1):25-48.
- Garcia, S.
1984 Environmental Aspects of Penaeid Shrimp Biology and Dynamics. In: John A. Gulland and Brian J. Rothschild (Eds.), *Penaeid Shrimps - Their Biology and Management*. Surrey, England: Fishing News Books, Ltd. Pp. 268-271.
- Garcia, S.
1985 Reproduction, Stock Assessment Models and Population Parameters in Exploited Penaeid Shrimp Populations. In: P.C. Rothlisberg, B.J. Hill, and D.J. Staples (Eds.), *Second Australian National Prawn Seminar*. Queensland, Australia: NPS2. Pp. 139-158.
- Garcia, S.
1988 Tropical Penaeid Prawns. In: J.A. Gulland (Ed.), *Fish Population Dynamics*. 2nd. Ed. Chichester, England: John Wiley & Sons. Pp. 219-250.
- Garcia, S.
1989 The Management of Coastal Penaeid Shrimp Fisheries. In: John F. Caddy (Ed.), *Marine Invertebrate Fisheries: Their Assessment and Management*. New York: John Wiley & Sons. Pp. 281-306.

- Garcia, S., and L. Le Reste
1981 Life Cycles, Dynamics, Exploitation and Management of Coastal Penaeid Shrimp Stocks. *FAO Fisheries Technical Paper No. 203*. Rome: Food and Agriculture Organization.
- Goodrich, Peter
1987 *Legal Discourse: Studies in Linguistics, Rhetoric and Legal Analysis*. London: Macmillan.
- Gulland, J.A.
1984 Introductory Guidelines to Shrimp Management: Some Further Thoughts. In: John A. Gulland and Brian J. Rothschild (Eds.), *Penaeid Shrimps - Their Biology and Management*. Surrey, England: Fishing News Books, Ltd. Pp. 290-299.
- Gunter, Gordon, and Judith Clark Edwards
1969 The Relation of Rainfall and Fresh-Water Drainage to the Production of the Penaeid Shrimps (*Penaeus fluviatilis* Say and *Penaeus aztecus* Ives) in Texas and Louisiana Waters. In: M.N. Mistakidis (Ed.), *Proceedings of the World Scientific Conference on the Biology and Culture of Shrimps and Prawns. FAO Fisheries Report No. 57*, Vol. 3. Rome: Food and Agriculture Organization. Pp. 875-891.
- Hoyos, David
1991 Shortened Season for Shrimp Industry? *CEDO News* [Puerto Peñasco, Sonora, Mexico: Intercultural Center for the Study of Deserts and Oceans, Inc.] 3(2):5.
- Johnson, Ronald N., and Gary D. Libecap
1982 Contracting Problems and Regulation: The Case of the Fishery. *American Economic Review* 72(5):1005-1022.
- Kurien, John
1985 Technical Assistance Projects and Socio-Economic Change: Norwegian Intervention in Kerala's Fisheries Development. *Economic and Political Weekly* 20(24-25):A-70 to A-87.
- Magallon-Barajas, Francisco J.
1987 The Pacific Shrimp Fishery of Mexico. *CalCOFI Report* 28:43-52.
- Maril, Robert Lee
1983 *Texas Shrimpers: Community, Capitalism, and the Sea*. College Station: Texas A & M University Press.
- Mathews, C.P.
1985 The Present State of Kuwait's Shrimp Fishery. In: C.P. Mathews (Ed.), *The Proceedings of the 1984 Shrimp and Fin Fisheries Management Workshop*. Kuwait: Kuwait Institute for Scientific Research. Pp. 3-31.
- 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. 211-229.
- McGoodwin, James R.
1980 Mexico's Marginal Inshore Pacific Fishing Cooperatives. *Anthropological Quarterly* 53(1):39-47.
- McGoodwin, James R.
1987 Mexico's Conflictual Inshore Pacific Fisheries: Problem Analysis and Policy Recommendations. *Human Organization* 46(3):221-232.
- McGuire, Thomas R.
1983 The Political Economy of Shrimping in the Gulf of California. *Human Organization* 42(2):132-145.

- Meehan, Richard L.
1984 *The Atom and the Fault: Experts, Earthquakes, and Nuclear Power*. Cambridge, MA.: MIT Press.
- Miller, Margaret
1990 Shrimp Aquaculture in Mexico. *Food Research Institute Studies* 22(1):83-107.
- Morgan, Gary R., and Serge Garcia
1982 The Relationship between Stock and Recruitment in the Shrimp Stocks of Kuwait and Saudi Arabia. *Océanographic Tropicale* 17(2):133-137.
- Pálsson, Gísli, and E. Paul Durrenberger
1990 Systems of Production and Social Discourse: The Skipper Effect Revisited. *American Anthropologist* 92:130-141.
- Pêcheux, Michel
1982 *Language, Semantics and Ideology*. London: Macmillan.
- Penn, J.W.
1984 The Behavior and Catchability of some Commercially Exploited Penaeids and their Relation to Stock and Recruitment. In: John A. Gulland and Brian J. Rothschild (Eds.), *Penaeid Shrimps – Their Biology and Management*. Surrey, England: Fishing News Books, Ltd. Pp. 173-186.
- Penn, J.W., and N. Caputi
1985 Stock Recruitment Relations for the Tiger Prawn, *Penaeus esculentus*, Fishery in Exmouth Gulf, Western Australia, and their Implications for Management. In: P.C. Rothlisberg, B.J. Hill, and D.J. Staples (Eds.), *Second Australian National Prawn Seminar*. Queensland, Australia: NPS2. Pp. 165-173.
- Penn, J.W., and N. Caputi
1986 Spawning Stock-Recruitment Relationships and Environmental Influences on the Tiger Prawn (*Penaeus esculentus*) Fishery in Exmouth Gulf, Western Australia. *Australian Journal for Marine and Freshwater Resources* 37:491-505.
- Penn, J.W., N.G. Hall, and N. Caputi
1989 Resource Assessment and Management Perspectives of the Penaeid Prawn Fisheries of Western Australia. In: John F. Caddy (Ed.), *Marine Invertebrate Fisheries: Their Assessment and Management*. New York: John Wiley & Sons. Pp. 115-140.
- Platteau, Jean-Philippe
1989 The Dynamics of Fisheries Development in Developing Countries: A General Overview. *Development and Change* 20(4):565-597.
- Poffenberger, J.R.
1984 An Economic Perspective of Problems in the Management of Penaeid Shrimp Fisheries. In: John A. Gulland and Brian J. Rothschild (Eds.), *Penaeid Shrimps – Their Biology and Management*. Surrey, England: Fishing News Books, Ltd. Pp. 299-308.
- Rothschild, B.J., and S.L. Brunenmeister
1984 The Dynamics and Management of Shrimp in the Northern Gulf of Mexico. In: John A. Gulland and Brian J. Rothschild (Eds.), *Penaeid Shrimps – Their Biology and Management*. Surrey, England: Fishing News Books, Ltd. Pp. 145-172.
- Sissenwine, Michael P.
1978 Is MSY an Adequate Foundation for Optimum Yield? *Fisheries* 3(6):22-42.
- Smith, M. Estellie
1990 Chaos in Fisheries Management. *Maritime Anthropological Studies* 3(2):1-13.
- Vasquez-Leon, Marcela, Thomas R. McGuire, and Thoric Cederstrom
1991 Sonoran Shrimp: New Developments in the Eternal Conflict. Proceedings, Rocky

- Mountain Council for Latin American Studies (forthcoming).
- Walters, Carl J., and Donald Ludwig
1981 Effects of Measurement Error on the Assessment of Stock-Recruitment Relationships. *Canadian Journal of Fisheries and Aquatic Science* 38:704-710.
- Willmann, R., and S.M. Garcia
1985 A Bio-Economic Model for the Analysis of Sequential Artisanal and Industrial Fisheries for Tropical Shrimp. *FAO Fisheries Technical Paper* No. 270. Rome: Food and Agriculture Organization.

The Life and Death of a Small-Scale Fishery

Surf Clam Dredging in Southern Maine

Craig T. Palmer

Memorial University of Newfoundland

ABSTRACT This paper describes the history of small-scale surf clam dredging along the coast of southern Maine. By identifying the economic, social, and environmental factors leading to the adoption and subsequent abandonment of surf clam dredging, this history illustrates the interaction of two major factors in the social and ecological conditions of Maine lobstermen. The first is the importance of seasonally pursuing other species in order to supplement lobster fishing. The second is the fragile relationship between lobstermen and regulatory agencies. Through their management of potential pollution problems in surf clams, regulatory agencies became the primary determinant of the seasonal fishing tactics of some lobstermen. Hence, the paper stresses the importance of commercial fishermen having easy access to the evidence on which regulatory decisions are based.

Introduction

The following history of surf clam dredging in Southern Maine is set in the context of three problems: seasonal fluctuations in the supply of lobsters, pollution, and a deteriorating relationship between fishers and regulatory agencies. The innovation, adoption, and abandonment of this fishery are traced with data from published sources, conversations with state officials in charge of regulating the fishery, interviews and questionnaire surveys of area fishermen, financial records and daily journals of the lobsterman who started the new fishery, and five years of participant observation as a sternman on his boat. Although this paper is only a case study (indeed, it is largely the story of one man's fishing career), it illustrates the potential problems in the relationship between fishers and regulatory agencies. The fact that surf clam dredging (locally referred to as 'dragging') remained nearly the private domain of its innovator for two decades, and then failed almost immediately after it began to be adopted by others, provides a unique opportunity to examine the role of regulatory decisions throughout the entire history of a local fishery (see Sinclair 1985).

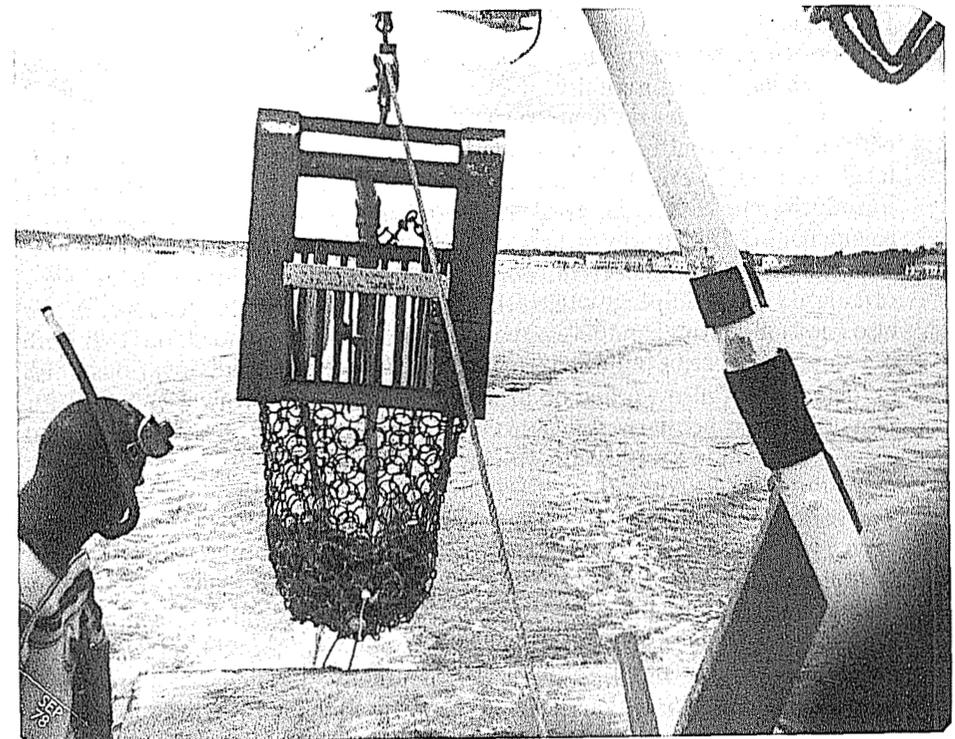
Maine Lobstermen

The term 'lobsterman' refers to a commercial fisherman whose primary prey species is the American Lobster (*Homarus americanus*). However, the actual activities of many lobstermen are not nearly as monolithic as the name implies (see Acheson 1980a). This is because the lobster industry's 'chronic seasonal gyrations between scarcity and abundance' (Martin and Lipfert 1985:89) has required lobstermen to make various seasonal shifts throughout their 200-year

history. Although each location has its unique variations, lobsters tend to be abundant in shallow water during late summer and early fall, while they are found only in less accessible deep water during the winter and early spring (see Wilder and Murray 1958; Dow 1969; Cooper and Uzmann 1971; Acheson 1980b, 1988).

Lobstering had to be abandoned during the winter months until recent technological advances such as engines, radar, sternmen (known as 'helpers'), and larger boats made winter lobstering possible. In fact, 'The forties and fifties were the first years in which lobster fishing was at least marginally profitable as a full-time year-round endeavor' (Martin and Lipfert 1985:87; see also Wilson and Acheson 1980). Even now, offshore lobstering is not a practical alternative for many lobstermen, and few earn enough from lobstering during the summer months to last through the winter. This means that 'the difference between financial success and failure in many cases is closely connected with the ability to change species fished as prices or the availability of various fish stocks change' (Acheson 1980a:452).

Although there are over a dozen commercial species of fish and shellfish caught off the coast of Maine (see Acheson 1988:108), and short-trip fishing



is often the preferred source of supplemental income (Acheson, Poggie, Pollnac & Wilson 1980; see also Pollnac & Poggie 1980a, 1980b, 1980c; Poggie & Pollnac 1980), most lobstermen are quite limited in their ability to pursue other species. This ability is limited by the location of alternative species, markets, the need for specialized equipment (including crew), regulations, climate, opportunities for non-fishing sources of income, and the need for specialized skills. Access to many species and types of fishing would require lobstermen purchasing larger boats than their typical 28 to 38-foot crafts. While some lobstermen have made such a switch in fishing styles (see Acheson 1980a), the majority of Maine lobstermen have chosen against such an option. This limits them primarily to shrimping, scallop dragging, and using some type of fixed gear for ground fishing (see Wilson and Acheson 1980; Acheson 1980a).

The Study Area: 'Southern Harbor'

The small fishing community that I will call 'Southern Harbor' has existed since the 1870's. It is located in the southwestern part of Maine where economic development, particularly tourism, is rapidly increasing. However, the majority of the 18 full-time, and several of the part-time lobstermen come from families who have lived and fished in the area for generations (see Palmer 1989, 1990a, 1990b, 1991). The traditional winter occupation of the lobstermen in Southern Harbor has been the digging of soft-shelled clams (*Mya arenia*). The proximity of clam flats enabled several generations of lobstermen and other residents to supplement both their income and their diet with clams. This pattern began to change in the early 1960's when many of the local clam flats were closed due to pollution. While a few took non-fishing jobs during the winter, many of the lobstermen attempted some type of year round fishing. Since winter lobstering proved to be of only limited value, many of the lobstermen tried other types of fishing. The larger boats were often used for shrimping, while others were used to drag for scallops. A few also tried gill-netting, and several continued to dig clams in locations that were not closed because of pollution. Some of the lobstermen had, at various times in their careers, also worked on draggers (also known as trawlers) fishing for groundfish in other harbors. Table One lists the ages and types of commercial fishing engaged in by 19 Southern Harbor lobstermen.

The Birth of a Fishery: 1967-1971

Surf clams (*Spisula solidissima*) also known as hen clams or sea clams, have been a source of food on the east coast since the seventeenth century (see Parker 1971; Yancy 1970). Their commercial use did not really develop until hydraulic dredging replaced the use of manually-operated rakes and tongs after the Second World War. During the 1950s and 1960s, hydraulic dredges were used off the coast of New Jersey, New York, Maryland, Delaware and

Table 1. Type of additional commercial fishing engaged in by each lobstermen at some point in his career (Survey performed in 1988).

Age of Lobsterman	Scallop	Shrimp	Surf Clam	Soft-Shell Clams	Gillnet	Dragger
24	-	-	x	-	-	-
25	-	-	-	-	-	-
25	-	-	x	-	-	-
30	x	-	-	-	-	x
30	x	x	-	-	-	x
31	-	-	-	-	-	-
34	x	-	-	-	x	-
34	-	-	-	-	-	x
35	x	-	-	-	-	-
35	x	-	-	-	-	x
35	x	x	x	-	-	x
38	x	-	-	x	-	-
46	-	-	-	-	x	-
47	-	x	-	-	-	x
48	-	-	-	-	-	x
49	-	-	-	-	-	x
54	-	-	-	x	-	-
59	x	x	x	x	-	-
78	-	-	-	-	x	-

Virginia. By the early 1980s surf clam dredging was also done along the coast of Rhode Island, Massachusetts, and along the Georges Banks. During the 1950s and 1960s most of the dredging was done with forty inch drags on boats from 40 to 60 feet in length (see Parker 1971; Lothrop 1954). By the 1980s boats up to 100 gross registered tons with up to 240-inch dredges were being used (see MAFMC 1986; Strand et al. 1981; Ropes 1980; and McCay and Creed in press).

Surf clams have long been known to wash up on the beaches around Southern Harbor following storms. Residents of the area have also been known to wade out along the beaches at low tide to dig surf clams for dinner. However, the only commercial exploitation of this resource was an unsuccessful attempt at dry dredging (dredging without the use of hydraulic jets of water used to loosen the sand in front of the dredge) along a nearby beach in 1949. The lack of interest in applying the large-scale hydraulic dredging to Maine surf clams was probably due to the small area of suitable beaches in Maine and the extremely limited stock of clams compared to other areas of the Atlantic coast.

In 1967 a local clam processing plant that had been using surf clams from

New Jersey asked local engineers to construct and test a small-scale hydraulic clam dredge as a prototype for one to be used in the search for new clam sources off the coast of South America. In early autumn, the dredge with its twelve-inch blade, two three-inch pumps, and fifty feet of fire hose was taken out on the only local boat equipped with the necessary winch and boom. A state official and a local lobsterman accompanied the crew out of curiosity. They picked a spot where surf clams were known to wash up in storms and made a short five-minute tow. The two bushel chain net attached to the dredge came up overflowing with clams. The accompanying lobsterman immediately saw a possibility to 'make some money without breaking my back at lobstering,' and the small-scale commercial surf clam 'industry' of Maine was born.

Due to the originality of the idea, there were no regulations, no established capturing or processing techniques, and no established market. Hence, the first step was to find a buyer. The lobsterman managed to talk his uncle who owned a local shell-fish market to 'take a look' at his clams. With this minimal assurance, the lobsterman had a duplicate dredge made, borrowed a pump from the state, and bought the other necessary equipment for a total of \$1325.



Photo 2. The original surf clam dredger's boat hauled out for the winter.

He tried the dredge for the first time the following spring. His log book for May 22, 1968 reads 'tried new drag, not much luck, I think pump isn't big enough.' On July 17, 1968 he bought a larger pump and was able to deliver clams he shucked on the boat to his uncle for 25 cents per pound. Surf clam dredging started off very slowly during the years of 1968 and 1969. Since the dredging equipment did not interfere with the hauling of lobster traps, the lobsterman continued to devote most of his time to lobstering. The time that was spent on dredging consisted of experimenting with equipment adjustments and searching for beds of clams. There was no particular seasonality to the activity during these early years and its economic contribution was minimal (see Table 2).

Surf clam dredging was little more than a 'hobby' during 1968 and 1969, but it became an economic necessity during the summer of 1970. Southern Harbor had been plagued by a few lobstermen stealing lobsters and destroying the traps of the other lobstermen. This problem came to a violent climax during

Table 2. Sources of Fishing Income for Original Surf Clam Dredger: 1967-1987.

Year	Surf Clams	Lobster	Soft-Shell Clams	Shrimp	Yearly Income Compared to 1967*
1967	—	67%	21%	12%	100.0%
1968	7%	61%	13%	19%	95.6%
1969	9%	72%	16%	3%	94.1%
1970	17%	21%	50%	12%	73.1%
1971	60%	—	40%	—	81.5%
1972	37%	22%	41%	—	78.0%
1973	—	—	incomplete records		—
1974	34%	41%	25%	—	86.7%
1975	—	85%	15%	—	116.2%
1976	34%	48%	18%	—	127.8%
1977	67%	33%	—	—	103.6%
1978	26%	74%	—	—	102.5%
1979	35%	65%	—	—	153.2%
1980	34%	66%	—	—	166.7%
1981	8%	92%	—	—	142.0%
1982	11%	89%	—	—	155.2%
1983	10%	90%	—	—	156.7%
1984	15%	85%	—	—	158.3%
1985	28%	72%	—	—	163.0%
1986	2%	98%	—	—	172.5%
1987	—	100%	—	—	180.3%

Source: Original Surf Clam Dredger's Personal Records

*Incomes Not Adjusted for Inflation.

July of 1970. Having so many of their lobsters stolen and traps destroyed was forcing many of the lobstermen to consider abandoning the industry, at least until the trouble was over. The lobsterman who had started the clam dredging 'industry' decided that his only options were to become a 'helper' on a friend's boat (a degrading position for an established lobsterman), or to rely on the surf clams. He decided to take a chance on the new 'industry.' Just as the surf clam dredging started to improve in the late summer, and it looked as if his decision had been correct, he was forced to abandon all fishing three months early due to mechanical problems with his boat on September 21, 1970.

Although the new 'industry' had not prevented an economically disastrous year in 1970 (see Table 2), the lobsterman had been impressed with the number of surf clams in the late summer. The price for surf clams had also risen from 25 to 40 cents per pound due to rising prices for local soft-shell clams and imported surf clams. Hence, even though the trap thefts had ended the previous fall with the arrest of the culprits, the lobsterman relied again on the surf clams the following year and did not set any lobster traps during 1971. The new fishery responded moderately well, providing the largest source of fishing income that year (see Table 2).

The income from 1971 was enough for the lobsterman to again decide to invest in a larger pump and continue pursuing surf clams instead of lobsters the following year. With the new pump, the 'industry' looked very promising during the spring and summer of 1972. For the first time, the lobsterman saw a future in which surf clam dredging would replace lobstering as his predominant source of income. This optimism ended abruptly that autumn.

Red Tide: 1972-1976

September 16, 1972 is a crucial day in the history of Maine surf clam dredging and in the relations between the local commercial fishermen and state regulatory agencies. It was on this date that the toxic plankton *Gonyaulix tamasensi*, better known as 'red tide,' was found in the state's surf clams and other shellfish. Red tide had caused few problems when it appeared in small concentrations in Maine during the 1950's, but the concentrations found in 1972 forced an end to the harvesting of all infected species (see Manville 1972). The surf clam dredger was now forced to become a 'helper' on a friend's lobster boat until he was able to lobster for himself again the following spring (see Table 2).

The period from 1972 to 1975 was marked by periodic red tide closures for different species and different areas. Throughout these years, the clam dredger continued to dredge when allowed, although he was now having to market many of his clams in small quantities to private individuals since his previous market had been withdrawn due to the threat of red tide. Despite the economic hardship caused by the red tide, the clam dredger fully cooperated with state officials. In fact, he voluntarily provided the first evidence that the surf clams had been infected with red tide. He also showed state officials the

location of clam beds when they needed clams for testing, and helped the state test a hydraulic dredge to be used for quahogs (*Mercenaria mercenaria*) see Mahogany 1976; Mathieson and De Rocher 1974).

After three years of periodic closures, a turning point in relations with the state came when the surf clams were prohibited continuously from August 1975 until June 1976. Up until this point the closures had been perceived by the clam dredger as the direct result of tests finding pollution in the surf clams of a given area. During this year-long closure he began having difficulty finding out the results of tests, or even when and where tests had been done. His journal records numerous telephone conversations and letters with various state officials (including the governor) expressing growing frustration over the apparent infrequency of tests and secretiveness of the testing and closure procedures.

Competitors and Complaints: 1977-1978

The years 1977 and 1978 saw a general pattern of red tide closures during the summer months. This helped turn surf clam dredging into a seasonal fishery

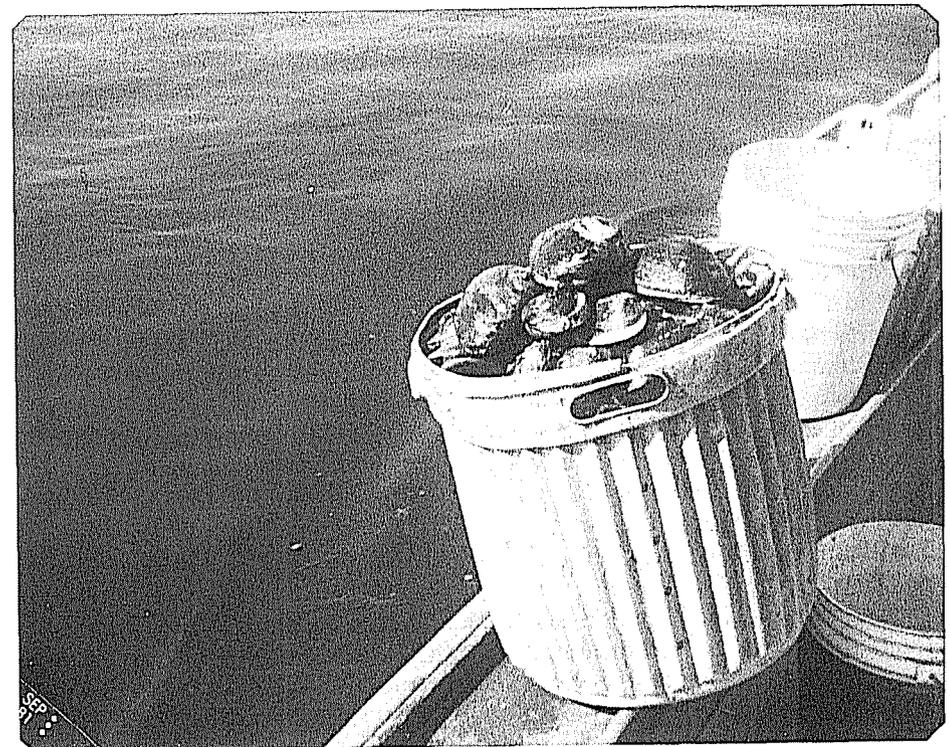


Photo 3. A bucket of surf clams about to be shucked on the deck of the boat.

that replaced lobstering during the early spring and late fall. Despite the restrictions, new markets in local restaurants and a rise in price to approximately 75 cents per pound (see table three) enabled the clam dragger to make a major part of his income from surf clams (see Table 2). It also brought about new interest in surf clams, as one local fisherman and two from out of state brought larger boats with 36-inch dredges into the bay and met with considerable success. Although none of the three new boats would last more than a season, their presence was to have two significant effects.

The first effect was to provide the circumstances for the last instance of cooperation between the original clam dredger and state regulatory agencies. This was in the form of a petition in 1978 by the original clam dredger that banned dredging with blades larger than 24 inches, thus effectively excluding the two out of state boats. The second effect was that the dredging of surf clams now drew the attention of the local tourist industry that dominated this section of Maine coast. While the presence of one small boat dredging along the beaches was just a quaint amusement to tourists who often waded out to the boat, a 'fleet' of four boats – some sixty feet long – brought complaints from tourists and hotel owners. Tourists claimed that the boats were polluting the beaches and their mere presence degraded the scenic quality of the area. The owners of the many beach-front hotels petitioned to have the boats banned. Although the pollution was found to be the result of a dredging operation in a nearby river, the area was closed to surf clam dredging. Red tide was given as the reason, but the original clam dredger was convinced that the complaints of tourists had been the real reason for the closure.

Red Tape: 1979-1983

For the original clam dredger, the problem was now a matter of 'red tape' instead of 'red tide' (see Morrison 1981). He no longer perceived the surf clam closures to be based on evidence of pollution. The conflict between the clam dredger and the state Department of Marine Resources (D.M.R.) centered on several aspects of the red tide testing procedures. The first was the infrequency of red tide tests. His other major complaint was the closing of areas below the acceptable level of contamination because nearby areas were polluted. Letters from the D.M.R. explained to the clam dredger that such decisions were based on the 'judgement' of one man. This helped transform the conflict into a personal battle between the original surf clam dredger and the D.M.R. official in charge of red tide testing.

The frequent red tide closings and the failure of the price to rise above 70 cents per pound reduced the economic contribution of surf clams (see Table 2). It also kept other local fishermen from becoming interested in the industry, and the original clam dredger again had the surf clams to himself until 1984.

Boom and Bust: 1984-1986

While the price of lobsters remained fairly constant, local catches began to decline in the mid 1980s (see Acheson 1984; Townsend and Briggs 1982). Most of the lobsterman in Southern Harbor attributed this to overfishing, resulting largely from the end of a self-imposed trap limit that had been in effect for over ten years (see Morrison 1976). Expenses, particularly the price of bait, also rose dramatically (see Acheson 1980a). Some of the lobstermen had a few good winters exploiting scallops and shrimp, but these proved to be unreliable sources of income (see Acheson 1980a). At the same time several local restaurants and shellfish dealers became willing to buy local surf clams. The increase in markets brought the price of surf clams up to nearly one dollar per pound.

These conditions brought two of the local lobstermen into the surf clam 'industry.' While the original clam dredger had pursued the surf clams in the early spring and late fall, ceasing fishing during the winter months, the newcomers saw surf clams as a winter fishery. They exploited the resource primarily from the end of the in-shore lobster season in December until it began again in April. With larger pumps, 24-inch dredges, and two 'helpers' shucking the clams on the boat, these boats were quite successful during the 1984-85 season, making several times more from the industry than the original clam dredger had ever made. Even though the price dropped back down to around 75 cents per pound, their success brought another local lobsterman and one from a nearby harbor into the 'industry' the following season. The market for the local surf clams was growing dramatically among local restaurants and shellfish dealers, with some surf clams even being exported to other states.

In 1981, the original surf clam dredger had chastised state officials for neglecting to help what he claimed was an economic 'sleeping giant' for the state of Maine (see Morrison 1981). By 1986 his prediction about the potential of local surf clams was at least partially materializing. Over forty local people were employed in the capture, processing, and marketing of the resource. This growth did bring increased interest from state authorities, but it was an interest that would mean the death of the industry.

The increasing production of surf clams, particularly the expansion of markets into other states, led state officials to incorporate surf clams under the same regulations that govern other shellfish. This meant that the surf clams would have to be processed in the same sanitary conditions as regular soft-shell clams. This necessitated bringing the unshucked clams to markets since such sanitary processing was impossible on the small boats. Since shucking the clams reduces their weight by over 75%, the clam dredgers were concerned about their boats being overloaded and dismayed at having to unload fifty or more 90-pound trays at the end of each day. The new regulation would make the exploitation of surf clams nearly impossible.

The local fishermen felt the regulation was unfair and questioned whether

it was really based on a question of sanitation (see Morelli 1986). In a series of public meetings they emphasized that there had been no problems with contamination in the past and pointed out irregular procedures used in the D.M.R. tests for contamination. They also pointed to the fact that it was legal to shuck scallops on boats (an argument countered by the fact that only the muscles of scallops are marketed, and the muscles contain lower levels of contamination than other parts of shellfish). Finally the fishermen suggested that the clams simply be limited to Maine markets. Although attempts to find such compromises were promised, the regulation eventually went into effect in 1987. A sympathetic state representative pointed to the irony of the situation:

In a way, it's the industry's success in developing a market for the clams that has drawn the State's attention. If these guys hadn't been so successful, they wouldn't be in the mess they're in now (Linwood Higgins, quoted in Morelli 1986).

Many of the fishermen added that while the surf clam industry had become too big to escape state attention, it was not big enough to fight for its rights the way larger industries like scallop dragging could. They also pointed to the ironical fact that Maine will now have to import surf clams from other states in order to continue to produce chowders and clam cakes.

Nearing the end of his career, needing new equipment, and knowing he would be unable to deal economically with unshucked clams the following year, the original clam dredger gave up the fight and removed his dredging gear. In an attempt to salvage something from their newly purchased, and now unsaleable equipment, two of the new clam dredgers tried to market the bulky unshucked clams for brief periods in 1988. One boat dredged for clams for about one month in 1989, but the owner doubts that he will ever dredge for clams again.

Discussion

Although this is only a case study limited to a small number of commercial fishermen in one area of Maine, the history of the surf clam dredging operation in southern Maine adds to our understanding of the relationship between commercial fishermen and regulatory agencies. It also illustrates the importance of this relationship in changing the outcome of attempts to diversify fishing endeavors.

Although he remembers being pessimistic about the lobster industry, the original clam dredger was attracted to the new industry mainly because it would be an easier way to make a living. While the new fishery required new technology and skill, it was also generally compatible with the material, social, and cultural traditions of lobstermen. The dredging could be done from a lobster boat in the same local lobstering 'territory' (see Acheson 1975a, 1975b, 1987) which was both convenient (especially important during winter months)

and intimately familiar to the local lobstermen. It was compatible with established social patterns of work organization since it could be done alone or with a 'helper.' It also involved the same sense of self-employed independence as lobstering. In fact, it is clear that the original clam dredger highly valued the extra challenge and independence of pioneering a type of fishing never before attempted in the area.

For the original clam dredger, these incentives were enough to offset the very shaky market for the new product. In fact, Table 2 indicates that the clam dredger's yearly income from fishing did not increase during the first seven years after he began surf clam dredging. While there are numerous variables involved in these figures, it is clear that surf clam dredging was not of significant economic advantage to the lobsterman. It did, however, allow him to remain self-employed as a fisherman during certain times when he would have otherwise been forced to seek other employment.

Despite an awareness of the problems the clam dredger was having with regulatory agencies, the lack of an economic advantage is clearly the main reason the new fishery was not adopted by other lobstermen in the area for over fifteen years. Adoption of the new industry would have almost certainly entailed an economic loss for many of the other lobstermen in the area. Since the original clam dredger had never made more than a moderate living from lobstering, the limited income from surf clams was sufficient to maintain his overall income. For lobstermen who had invested more into lobstering and were used to greater incomes, a shift to surf clams would have meant a substantial drop in income. It was the rise in price in 1984 that influenced two local lobstermen to adopt clam dredging. They had observed the quantities of clams brought in by the original clam dredger for many years and calculated they could now make more from surf clams than winter lobstering or scalloping. The fact that they did much better than expected their first year brought the fourth lobsterman into the fishery.

Although the small number of people involved makes it impossible to generalize, the adoption of surf clam dredging does not appear to be the result of some general type of innovative personality (see Barnett 1953; Barth 1967; Acheson and Reidman 1982; Downs and Mohr 1976). For example, the original clam dredger has failed to adopt many of types of navigational technology possessed by most of the lobstermen in Southern Harbor. Neither is there a clear correlation between exploiting other alternative prey species and the adoption of surf clam dredging (see Table 1). While the men who adopted surf clam dragging in the 1980s were all fairly successful lobstermen in their prime, if the original clam dredger had been an extremely successful 'highliner' the clam dredging industry would probably have never been started (see also Andersen 1979:308). The adoption of surf clam dredging occurred at different times because it solved different problems for different lobstermen.

The adoption of surf clam dredging at different times also entailed different problems in regard to markets, competition, complaints from tourists,

pollution, and especially regulatory agencies. Since he was the only one exploiting the resource, the original clam dredger's complaints against red tide closures often drew little or no attention. This lack of power may have been a blessing in disguise since he was able to dredge clams, at least periodically, for nearly twenty years. Instead of greater strength, an increase in the number of clam dredgers eventually brought an end to the industry.

The relationship between commercial fishermen and regulatory agencies is likely to entail a certain amount of conflict since it may be inevitable that resource management sometimes 'means putting people out of business, with all that indicates for social and economic dislocation' (Acheson 1980a:452; see also McCay 1981; Sinclair 1985). However, the history of surf clam dredging in Maine indicates certain factors that may increase or decrease the degree of conflict. These can be illustrated by examining the regulatory problems occurring during various stages of the 'industry's' history.

During the nearly two decades in which the original surf-clam dredger had the 'industry' virtually to himself, communication appears to be the key variable in determining the relationship with regulatory agencies. It is crucial to remember that the detection of red tide, and the subsequent closing of the surf clam beds, did not immediately produce a hostile relationship between the surf clam dredger and the D.M.R. As long as the closing was perceived by the surf clam dredger as the result of a health risk, the relationship was marked by cooperation. Conflict only developed when the fisherman no longer saw a clear correlation between dangerous levels of pollution and the closing of certain areas. The key feature in this change was the surf clam dredger's perception of the testing procedure as inadequate and secretive. Tests appeared to be done at arbitrary times, causing the fisherman to feel his problems were being ignored by the regulatory agency as areas remained closed for weeks after the pollution levels might have dropped below acceptable limits. The secrecy with which tests were conducted and evaluated led to requests for independent tests, which were also denied.

Conversations with the D.M.R. official in charge of testing surf clams indicated that much of the conflict over closures was simply the result of the different interests of fishermen and regulatory agencies. Other conflicts may have resulted from discrepancies between the 'scientific' authority of regulatory agencies and the fishermen's 'practical experience' (see van den Hoonard 1983) concerning such issues as the frequency of testing necessary for proper management. There does, however, appear to have been one crucial flaw in the testing procedure. The regulation governing the harvest of surf clams sets a specific limit of 80 micrograms of toxin for every 100 grams of shellfish. The D.M.R., however, only announced whether an area was open or closed, and fishermen were not allowed access to the exact 'scores' of tests. The official in charge of testing told me that this policy was followed because he needed to have flexibility in determining which areas should be closed. For example, he might close an area as it 'approached' the official level because of the ability of toxin levels to increase rapidly. He stated that keeping the exact

scores of tests secret helped him to avoid arguments with the fishermen over these decisions.

The secrecy of test scores appears to be the key to the deterioration of the relationship between fishermen and regulatory agencies because it created a pervasive attitude of distrust. I have no reason to believe that the desire for greater flexibility in closing certain areas was based on anything other than a genuine concern for public health. However, if the current criteria of closing an area at a given amount of contamination is inadequate, then a new criteria needs to be established and followed. Using secrecy to improve an inadequate regulation is clearly unacceptable.

The regulatory conflicts eventually ending the industry, although also based on health risks, were different and more complex than those previously faced by the original surf clam dredger. Throughout the negotiations over the new shucking regulations, the fishermen had a sense that there must be some other reason for the regulation, or at least for the inability to find a compromise solution. Unlike the earlier discovery of 'red-tide,' there had been no health problems resulting from the shucking of clams on board the boats. Tests for evidence of contamination in the clams were equivocal, and numerous improvements in handling procedures were suggested in order to insure quality. The surf clam dredgers were also more than willing to restrict their clams to in-state markets since the law in question referred to only the transfer of shellfish across state lines. The inability to establish any such compromise led to speculation among the fishermen of ulterior motives for wanting the surf clam operations to end. These suspicions ranged from pressure from other fishing industries such as soft-shell clams, quahogs, and scallops, to the desire for some type of alleged government grant in order to 'further study the problem.' While none of these speculations can be substantiated, there was general agreement among the fishermen that a compromise would have been worked out if the industry had been on a larger regulations destroy what would have otherwise been a major new fishery that would have greatly improved the standard of living for many people along the Maine coast? Or did the regulation problems simply tip the scales against what was destined to be a very marginal and short-lived enterprise? The answer depends on your point of view. There are probably few areas of Maine in which surf clams could be commercially harvested, and the original surf clam dredger estimates that the beds of surf clams around Southern Harbor could never support more than five boats with small 18' blades. To these few fishermen, some of whom grossed over thirty thousand dollars more by surf clam dredging one winter than they would have made by lobstering during those months, the end of the fishery was a major blow to their long term economic future.

For the state of Maine as a whole, the greatest loss entailed by the death of the surf clam dredging industry may not be the immediate economic loss, but in the relationship between state authorities and commercial lobstermen in an industry that badly needs cooperation for its continued survival. Sinclair

(1989) points out that communication between fishers and regulatory agencies is crucial to successful fishery management: 'Distrust and jealousy must be overcome by creating a structure for management that involves openness with regard to information and policy formation' (Sinclair 1987:13). The history of surf clam dredging provides further evidence for this position, and supports calls for greater co-management of fisheries.

Acknowledgements

The author wishes to thank the fishermen and officials of the Department of Marine Resources who cooperated in this study. Reed Wadley also made helpful suggestions on an earlier version of this manuscript.

References Cited

- Acheson, J. M.
 1975a Fisheries Management and Social Context: The Case of the Maine Lobster Fishery. *Transactions of the American Fisheries Society* 104(4):653-668.
 1975b The Lobster Fiefs: Economic and Ecological Effects of Territoriality in the Maine Lobster Industry. *Human Ecology* 3(3):183-207.
 1980a Patterns of Gear Changes in the Northern New England Fishing Industry. In: *Essays on Social and Cultural Aspects of New England Fisheries: Implications for Management*. Final Report to the National Science Foundation, University of Rhode Island/University of Maine Study of Social and Cultural Aspects of Fisheries Management in New England under Extended Jurisdiction, NSG Grant No.AER 77-06018. Pp. 451-499.
 1980b Factors Influencing Productivity of Metal and Wooden Lobster Traps. *Maine Sea Grant Technical Report* no. 63, Orono: University of Maine Sea Grant Office.
 1984 Government Regulation and Exploitative Capacity: The Case of the New England Ground Fishery. *Human Organization* 43(4):319-329.
 1987 The Lobster Fiefs Revisited: Economic and Ecological Effects of Territoriality in the Maine Lobster Industry. In: B.J. McCay & J.M. Acheson (Eds.), *The Question of the Commons: The Culture and Ecology of Communal Resources*. Tucson, Arizona: The University of Arizona Press. Pp. 37-65.
 1988 *The Lobster Gangs of Maine*. Hanover, New Hampshire: University Press of New England.
- Acheson, James M., and Robert Reidman
 1982 Technical Innovation in the New England Fishing Industry: An Examination of the Downs-Mohr Hypothesis. *American Ethnologist* 9(3):538-558.
- Acheson, James, John J. Poggie, Jr., Richard Pollnac, and James A. Wilson
 1980 The Tragedy of the Commons: An Uncommon View. In: *Final Report to the National Science Foundation, vol. 2: Essays on Social and Cultural Aspects of New England Fisheries: Implications for Management*. Pp. 803-822. (see Acheson 1980a).
- Andersen, Raoul
 1979 Public and Private Access Management in Newfoundland Fishing. In: Raoul Andersen (Ed.), *North Atlantic Maritime Cultures*. The Hague: Mouton Publishers. Pp. 299-336.
- Barnett, Homer G.
 1953 *Innovation: The Basis of Cultural Change*. New York: McGraw-Hill.
- Barth, F. ed.
 1963 *The Role of the Entrepreneur in Social Change in Northern Norway*. Bergen: Universitetsforlaget.
- Cooper, Richard A., and Joseph R. Uzmann
 1971 Migration and Growth of Deep-Sea Lobsters. *Science* 171:288-290.
- Dow, Robert L.
 1969 Cyclic and Geographic Trends in Seawater Temperature and Abundance of American Lobster. *Science* 164: 1060-1063.
- Downs, George W., and Lawrence Mohr
 1976 Conceptual Issues in the Study of Innovation. *Science Quarterly* 21:700-714.
- Lothrop, Donald H.
 1954 *The Story of Snow's*. New York: F.H. Snow Canning Co., Inc.
- MAFMC
 1986 Mid-Atlantic Fishery Management Council: *Surf Clam and Ocean Quahog Fishery Management Plan Review*.
- Mahogany
 1976 Mahogany Quahog Dredge Developed. *Maine Commercial Fisheries* 4(2):10.
- Manville, Vicki
 1972 Red Tide Puts Clamp on Clammers. *Maine Sunday Telegram* 84(6):1.
- Martin, Kenneth R. and Nathan R. Lipfert
 1985 *Lobstering and the Maine Coast*. Bath, Maine: Maine Maritime Museum.
- Mathieson, John H., and Paul DeRocher
 1974 *Application of Maryland Clam Dredge on the Maine Coast*. Augusta, Maine: Maine Department of Marine Resources.
- McCay, Bonnie J.
 1981 Optimal Foragers or Political Actors? Ecological Analyses of a New Jersey Fishery. *American Ethnologist* 8:356-382.
- McCay, Bonnie J. and C.F. Creed
 in press Social Structure and Debates on Fisheries Management in the Atlantic Surf Clam Fishery. *Ocean and Shoreline Management*.
- Morelli, Peter
 1986 Aw, Shucks! Rules Threaten Surf Clam Harvest. *Portland Evening Express* 107(89):1.
- Morrison, Susan
 1976 Limited Entry Proposed for Southern Maine. *Maine Commercial Fisheries* 4(2):3.
 1981 Sea Clams Hang on to Red Tide - Tough for Both Fishermen and Testers. *Commercial Fisheries News*, January.
- Palmer, Craig T.
 1989 The Ritual-Taboos of Fishermen: An Alternative Explanation. *Maritime Anthropological Studies* 2(1):59-68.
- 1990a Telling the Truth (Up to a Point): Radio Communication Among Maine Lobstermen. *Human Organization* 49(2):157-163.
 1990b Balancing Competition and Cooperation: Verbal Etiquette Among Maine Lobstermen. *Maritime Anthropological Studies* 3(1):87-105.
 1991 Organizing the Coast: Information and Misinformation During the 1989 Maine Lobstermen's Tie-up. *Human Organization*, in press.
- Parker, Phillip S.
 1971 *History and Development of Surf Clam Harvesting Gear*. Seattle, Washington: U. S. Department of Commerce.

- Poggie, John J. Jr., and Richard Pollnac
 1980 Social Desirability of Work and Management Among Fishermen in Two New England Ports. In: *Final Report to the National Science Foundation, vol. 2: Essays on Social And Cultural Aspects of New England Fisheries: Implications for Management*. Pp. 230-255. (see Acheson 1980a).
- Pollnac, Richard, and John J. Poggie, Jr.
 1980a The Structure of Job Satisfaction Among New England Fishermen. In: *Final Report to the National Science Foundation, vol. 2: Essays on Social And Cultural Aspects of New England Fisheries: Implications for Management*. Pp. 256-294. (see Acheson 1980a).
 1980b Factors Influencing Preferred Fishing Type Among Fishermen in Southern New England. In: *Final Report to the National Science Foundation, vol. 2: Essays on Social And Cultural Aspects of New England Fisheries: Implications for Management*. Pp. 211-229. (see Acheson 1980a).
 1980c Sociocultural Variables Related to Variance in Perceptions of Alternative Fishing Types in Southern New England. In: *Final Report to the National Science Foundation, vol. 2: Essays on Social And Cultural Aspects of New England Fisheries: Implications for Management*. Pp. 191-210. (see Acheson 1980a).
- Ropes, J. W.
 1980 Biological and fisheries data on the Atlantic surf clam, *Spisula solidissima*. *Tech. Ser. Rept. No.2*, Northeast Fisheries Center, Woods Hole, MA.
- Sinclair, Peter R.
 1985 *From Traps to Dragnets*. St. John's, Newfoundland. Institute of Social and Economic Research.
 1989 Fisheries Management and Problems of Social Justice: Reflections on Northwest Newfoundland. Paper presented to the Project Prospero Seminar on Fisheries Management at KFA, Julich, Federal Republic of Germany. May, 1989.
- Strand, I. E., Jr., J. E. Kirley, and K.E. McConnell
 1981 Economic Analysis and the Management of Atlantic Surf Clams. In: *Economic Analysis for Fisheries Management Plans*. L.G. Andersen, ed. Pp. 113-138. Ann Arbor, MI: Science Publishers.
- Townsend, Ralph, and Hugh Briggs, III
 1982 *Maine's Marine Fisheries: Annual Data 1947-1981*. Orono, Maine: Sea Grant Marine Advisory Board.
- van den Hoonaard, W.C.
 1983 Occupational Ideology and the Character of Fishery Policy: A Case from Iceland. *Resource Management and Optimization* 2(3):225-242.
- Wilder, D.G., and R.C. Murray
 1958 Do Lobsters Move Offshore and Onshore in the Fall and Spring? *Fisheries Research Board of Canada, Atlantic Progress Report* 69:12-15.
- Wilson, James A., and James M. Acheson
 1980 A Model of Adaptive Behavior in the New England Fishing Industry. *Report to the National Science Foundation*. vol. 3. University of Rhode Island/University of Maine.
- Yancy, Robert M.
 1970 Atlantic Surf clams. *Commercial Fisheries Review* 32(8-9):40-46.

Measuring Ourselves

Adaptation and Anxiety Aboard a Fishing Vessel¹

Peter Knutson

Fishing Vessel Loki

ABSTRACT This article is a criticism of the view that social interaction aboard fishing vessels can be understood primarily as an adaptive response to the technological demands of the fishing operation. Such an understanding privileges the technical system over the lifeworld, falsely assumes social harmony and overlooks social pathology. In the following, I consider the work of Barth (1966) and Orbach (1977) in light of my own twenty years aboard fishing vessels. I offer my own insights into social life and identity as they are constructed within the confines of a fishing vessel hierarchy.

'It was very much like being mad, only it was worse because one was aware of it.'
- Joseph Conrad, *The Secret Sharer*.

In my bunk I dream on a stormy night. My face presses harder against the cold steel skin of the hull. I am on watch. My eyes still cannot see. Wake up, I have to wake up.

Our seiner pushes across an open stretch of ocean off the British Columbian Coast bound for Ketchikan and the 1978 fishing season. The skipper is at the helm and four crewmen lie in narrow bunks below.

Suddenly I am wrenched awake as someone throws open the fo'c'sle door and screams over the diesel's roar, 'Everybody on deck! Water in the lazarette!' We bolt up the ladder in boots and underwear to find our stern dangerously down. A following sea breaks on the transom, sloshing water into the open 'laz' hatch. We jump into the half-swamped 'laz' and form a bailing chain using empty lube oil buckets. I surmise that the skipper had gone back to the 'laz' to get his customary six-pack of Budweiser and had left the watertight hatch unsecured. As I pass the bucket, I think of the graduate school paper I have just written explaining Barth's functional model of a fishing boat crew. Supposedly skipper and crew are bound together in a functional unit through a rational exchange of prestations. Where now is that rationality? What kind of prestation is this? As seawater fills my hip boots, I am struck by the irony of a logic more evident to the anthropologist than to those of us bailing for our lives.

The Invisible Hand

In his 1966 monograph Barth argued that successful skippers and crews in the Norwegian herring fishery overcame distinctions based upon 'positional

MAST 1991, 4(1): 73-90

authority' and created a relationship based upon 'trust.' In this way crew relations were supposedly experienced as if they were voluntary and egalitarian in character despite the overarching context of private property. This pleasant arrangement is said to have produced greater motivation amongst the crewmen and hence a more efficient fishing operation.

According to Barth, the captain 'transformed his relationship of command over the fishermen into a voluntary relationship of leadership and acceptance...'

[He] exhibits behavior suggesting confidence, knowledge and experience. He gives very few clues to what he is thinking, communicates little, in contrast to the others on the bridge, and never elicits comments, evaluations or advice from any other person... Through this pattern he can assert leadership without referring to positional authority; he claims rationality without making the basis and logic of his decision available for critical scrutiny (1966:8).

Barth argues that the captain's silent performance is part of an exchange with the crew. Without speaking the skipper 'claims rationality' and 'asserts leadership.' The captain somehow creates a 'voluntary relationship.'

For their part, the crew offers the captain a 'token prestation ... of willingness or eagerness and constant readiness to work, as well as their interest in observing, evaluating and controlling the dispositions of the skipper.' (1966:8) Barth presumes a consensus aboard ship yet gives no clue as to how it is negotiated. It simply occurs. The fishing operation functions and the different members of the crew contribute their peculiar behaviours to a harmonious arrangement. The logic is there to be seen by the observer.

Barth's evidence for rational social exchange suggests an alternative interpretation. If, in fact, 'positional authority' has been operatively suspended aboard ship why does the skipper remain uncommunicative? Presumably if 'positional authority' were nullified there would be every incentive to intensify communication regarding the common project, catching herring. If the skipper has good information, proven intuition and a sound theory upon which to make his fishing decisions then he could certainly defend them. If not, he stands to benefit from a verbal exchange with the crew. In refusing to justify himself, he claims exemption from the reciprocity which would characterize a 'voluntary relationship.' Were the skipper to take questions about his decisions from crewmen he would be recognizing them as potential equals. His silence rests upon the original arbitrariness of the property relation which gives the captain the right to separate employees from the property of the owner. His silence points to 'positional authority.' Like casual laborers or prostitutes competing on the street for the attention of potential employers, perhaps Barth's faceless crew flex their 'willingness' and 'eagerness' and 'constant readiness' to tell the boss: I am more competent than the others — choose me.

What happens when this presumed exchange breaks down? How is the

'disposition of the skipper' to be controlled by the crew if he cannot be addressed? Do they pretend the skipper is competent when he begins work on the second six-pack? Will their display of 'eagerness' then control his disposition? How can the relation between skipper and crew be regulated by 'trust' if that relation cannot be discussed on the vessel?

Ratifying an apparently functional state, Barth presumes an underlying agreement between skipper and crew despite skewed relations of control and ownership. Read differently, his evidence suggests a different interpretation.

Fighting with Tools

'...the machine is not neutral; technical reason is the social reason ruling a given society...'

- Herbert Marcuse (1968:225).

In my experience, a veneer of technical discourse inhibits the direct address of 'positional authority' aboard ship. This does not, however, support Barth's contention that social interaction therefore acquires a 'voluntary' character. Instead, this taboo distorts interaction into oblique and cryptic pathways.

Value-neutral questions of technical correctness and competence constitute an official techno-speak against which a guerilla struggle is conducted. Because work language is limited to technical questions, issues of social fairness in the conduct of work process are exiled from discussion. Yet through nuances of tone, volume and percussion, these issues surface. We learn to 'read' the politics embedded in the operation of Weber's 'lifeless machine.'² We learn that the power of technology conceals the technology of power.

We prepare to take several tons of ice into the hold at the New England Cold Storage dock. Sam (a fellow deckhand), Jerry (the skipper's son), and I are experienced crewmen and have iced the vessel many times before. We are aware that our preparations were being observed by the skipper and by the crew of the San Juan Maid, known by reputation as one of the elite crews in the fishing fleet.

We arrived last night in town after three days fishing. This morning the skipper gets us up at 7, then he goes back to his bunk with a bad stomach. We stand around for 45 minutes. Then he gets up, and we move the boat to the cannery ice dock, tying up behind the San Juan Maid. We slip the boat back two pilings in order to be directly underneath the ice chute. As I slack the hawser Jerry starts yelling 'Fuck! Fuck!', shaking his head, rolling his eyes skyward, as if pleading to his Heavenly Father. I infer that I am slacking the lines incorrectly. Apparently I failed this test. I further interpret his behavior as a demonstration to his father and the watching crew of the San Juan Maid that he's surrounded by incompetents.



Photo 1. An older wooden seiner hauling the seine through the power block. The skiff is towing the seiner away from the gear. Southeast Alaska.

As we wait for ice under the cannery's ice hose, Sam and I suggest that we take the hatchcover off the coamings so as to be ready. But Jerry tells us definitively,

'No, leave it on.'

Then, 30 seconds before the ice comes down the chute, he gives us the word,

'Okay, now!'

We scramble to lift the heavy hatches before the pressurized jetstream of ice arrives...

Later I'm down in the hold shoveling ice over the binboards. Jerry yells down, 'Shovel that ice!' Then as I climb out of the hold he immediately orders me to put on the hatchcovers, which was my next move in any case. At that point I get the pleasure of contradicting him, yelling,

'No! We've got to put the tarp over the ice first!'

The trick to asserting one's superiority (and the other's inferiority) involves commanding in such a way that any challenge to the latent insult makes the subordinate appear to be disrupting the work process. What shall I say, 'No, I won't put the hatchcover on!'

The skipper's son demonstrated his technical competence to the observers, cleverly evincing his claim to power while hiding behind signs of function. He indirectly asserted a higher status by redundantly ordering us to perform small actions in a task sequence that was already of rote familiarity to us. In the same way, he inhibited us from taking preparatory actions in the task sequence until he had authorized us to perform the movements. Sam and I called this irritating habit 'ordering the obvious.'

In the course of ordering us about, he omitted a step in the icing procedure. My rejoinder, 'No, we've got to put the tarp on first!,' asserted a sign of my own technical competence, challenged Jerry's, and was expressed in the same 'value-free' technical idiom that Jerry employed. In this way, the incidental signifiers of the work process became laden with repressed, conflicting, strategically understood intentions. Technical language was only the medium through which we struggled for recognition. Our interaction, far from being an implicit social contract, was a barely-contained skirmish over our legitimacy as members of the fishing community. Yet, it was a functional exchange in two senses: first, because we successfully iced the vessel and secondly, because, we did not directly broach 'positional authority' and consequently reproduced the alienated pattern of interaction which daily reconstituted the vessel's hierarchy.

In its dynamics, this struggle for recognition reenacts the prototypical Protestant struggle over the meaning of a 'good work.' It confirms Weber's insight into the anxiety basic to motivation under capitalist organization:

Thus, however useless good works might be as a means of attaining salvation, for even the elect remain beings of the flesh, and everything they do falls infinitely short of divine standards, nevertheless, they are indispensable as a sign of election. They are the technical means, not of purchasing salvation, but of getting rid of the fear of damnation (1958:115).

Striving to overcome anxiety, striving to establish an identity as a competent crewman, the subordinate projects 'signs of election.' Jerry's barking, his

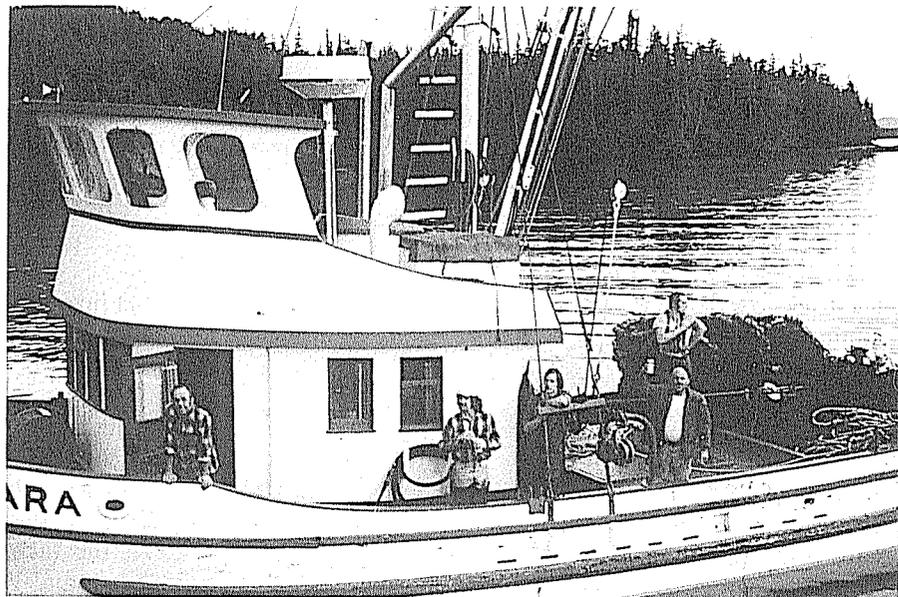


Photo 2. A shot of the crew on a wooden seiner. The deck boss salutes the author's camera with a can of Old Milwaukee. Southeast Alaska.

'good work,' demonstrated to the observer that he was of the elect and that I was of the damned. These 'technical means ... of getting rid of the fear' functioned as the the armature which propelled the blind reproduction of the hierarchy. Such 'signs of election' were simultaneously indexical and metaphorical, innocently referring to a necessary technical action while covertly reinforcing strategic social relations.³

Within the context of an economic enterprise such as a fishing vessel, actions are justified in terms of their contribution to the success of the operation. However, the relations of ownership and control themselves are exempt from demands for justification by subordinates.

As I punch the power block button on and begin to bring the seine up over the bulwarks, the seine snags up on the davit which sticks out over the bulwarks.

'BACK 'ER DOWN!'

the skipper shouts at me.

Momentarily, I turn the hydraulic handle the wrong way and he screams with vehemence,

'WRONG WAY! BACK!'

Sam and I look at each other, reading the vehemence in his voice the same way.

Later the web snags again and the skipper shouts at his son who is now operating the power block:

'Get the power block, the POWER block, the POWER block, goddam it!'

Sam and I both noticed his emphasis on the word 'Power.'

Now he assumes the power block controls and the web snags again on the davit. The skipper doesn't see the hang-up so his son yells at him,

'BACK 'ER DOWN!'

Instinctively the skipper jumps to the command and shuts off the control. Then he turns on his son, saying in a low voice,

'Shutup goddamit! Don't you yell at me you sunuvabitch!'

Staring at his son, he turns the power block back on and rips a fathom of web. Not comprehending his father's statement, the son yells again,

'BACK 'ER DOWN!'

The skipper shuts off the power block again and tells his son in low tones,

'Don't you yell at me, goddamit!'

The skipper rips his net rather than jump to an order given by his son. At issue is not the technical correctness of the son's communication but its political impact. Even though his son was technically right, he was wrong to presume he could yet bark as a man with authority.

Here the skipper violates the hoax of technical egalitarianism and rips his own net, asserting priority based on power. His action confirms the anxiety which underlies what Barth considers an exchange of 'prestations' and verifies the fiat of authoritarian social relations over the crew's interpretation of technical necessity. This illustrates again the shallowness of Barth's contention that an egalitarian ethic supplants positional authority in the daily workings of a fishing vessel.

In a famous scene, Dana portrays a flogging aboard the trading vessel upon which he was a mate. As the captain prepared to whip a man for the act of asking a question, the offender committed another crime, asking:

'Can't a man ask a question here without being flogged?' 'No,' shouted the captain. 'If you want to know what I flog you for, I'll tell you. It's because I like to do it...' (1940:91).



Photo 3. *The web man and the leads man stack seine.*

Just Kidding

Once a man is hired aboard a seiner he must fit the requirements of the fishing process, his social circumstances, and his personal needs into a workable cognitive and operational orientation (Orbach 1977:219).

Orbach's study of San Diego tuna purse seiners attempts to demonstrate and explain the workings of a 'cultural system' (1977:1). In a Durkheimian fashion, Orbach sees the division of labor aboard ship as an integrative force. Divisions of status, power and function originate as rational solutions to problems of seafaring. Hierarchy is understood as a rational adjunct of a neutral

technology deployed against natural threat. The individual crewman must grasp the 'system' properly and adapt. Social interaction is grounded in a presumed rationality. There is, for Orbach, no hint of arbitrariness, structural violence or pathology aboard ship.

The tradition of a strict shipboard hierarchy prevails among most seafaring groups. To carry out the mission of the vessel; to provide for the safety of the ship and its crew; to deal with those whose behavior threatens the accomplishment of these goals; because the sea is a dangerous and unpredictable environment which necessitates the greatest skill and split-second decisions and reactions; and because the ship's environment is isolated from all other authority structures, a community in itself — these are all the reasons usually given for the maintenance of a strict hierarchy of status and authority at sea (1977:237).

All of these factors ... press for a system in which certain of the crew acquire 'power' of various kinds over the fishing process and in the interactions between crewmen themselves (1977:239).

These behavior patterns and their attendant understandings are adaptations to the requirements of the fishing and navigational processes and to the factors in personal interaction described here (1977:265).

These are traditional articles of authority-worship. The crew needs Ulysses to stuff their ears up! Left to their own senses they would never make it past the bar. In such a corporate model of social interaction, cultural norms are not understood as contested by the participants. In reality, a cultural 'style' or a 'behavior pattern' may be only a hegemonic appearance of social harmony. Experienced from below, a 'workable cognitive and operational orientation' may seem less than value-free.

Consider Orbach's apologia for the verbal abuse of subordinates on the work deck of a tuna seiner. He writes,

The skipper and the deckboss are the prime sources of this sort of angry-toned, sometimes personally degrading direction... [A new man] learns that the volume and abusive character of the exchange does not necessarily imply real scorn, and often not even real chastisement for him personally or his actions. ... Some men grasp this more quickly than others. I know of more than one situation where a man has left a boat or even the industry altogether because he failed to come to an understanding of this 'system' (1977:221).

Like Barth, Orbach imputes a pretentious quality to social interaction and to 'power,' as if crewmembers were self-consciously acting out roles delineated by an invisible hand. Unlike the cognitively deficient man who did not understand that his humiliation should not be taken seriously, Orbach apparently learned to trivialize his own effacement. Of course the anthropologist could productively exploit his humiliation for its value as publishable data, a feat difficult for one not objectifying his daily life as fieldwork.

The loud, violent and even abusive character of the activity during the set 'functions' in

this sense (as a catharsis). It feels good to shove the throttle of the speedboat to full and leap over the crest of a swell; it feels good to pull with all your strength on the net; it feels good to sweat and heave that 250-pound shark over the side; it feels good to curse and yell, the institutionalized mode of behavior in sets (Orbach 1977:268).

Orbach's catharsis calls forth Dana's captain. Why do I act abusively? 'Because I like to ...' It feels good to flog a man. Why not? There is no basis for criticism of the ship's hierarchy; it is, by virtue of its adaptive utility, rational. Given the presumed justification of the cultural system, catharsis becomes the only logical object of individual desire. Who are we, from the outside, to criticize on the basis of our cultural apriori? Orbach's understanding reflects that functionalist/relativist dualism in anthropological thinking which seeks to set aside the observer's cultural bias, only to enshrine the dominant prejudices of the 'native' community. The anthropologist seeks the rite of passage, the Turnerian conversion experience, which permits him to submerge his otherness beneath the surface of a cultural essence, which is, in reality, his own projection.

Homophobic Anxiety as an 'Operational Orientation'

While on an extended tuna trip, one of Orbach's crewmates seriously injured his hand. Although the other crewmen ignored the injury, Orbach fashioned an aluminum splint for the injured crewman which successfully relieved the man's pain. The crewman subsequently told him that the hand felt better not only because of the splint, but also because someone simply showed some care. Orbach and the crewmen then conversed about how 'things can feel better because of attention' (1977:265).

In the following days, the crewman, superior in rank, did not acknowledge Orbach's help and treated him with a brusque, authoritarian manner. Orbach, initially surprised and confused, later explained the crewman's behavior in relation to the 'hazy social norms' which prevailed on the vessel.

One can understand his behavior. The crew knew that I had made the cast for him, and although they said nothing he may have been trying to show the crew that we were not too friendly' (1977:265).

Crewmen who were perceived to be 'too friendly' were sanctioned by means of 'thinly veiled homosexual jokes, always made at a meal or in the company of several other crewmen...' (1977:263). Orbach understands such 'joking' as a means by which norms of the cultural system regarding personal space are enforced. He interprets such behavior as a culturally normal attempt to preserve 'personal space' aboard ship, citing Herbst's article (1968) regarding shipboard interpersonal distance regulation in support of this thesis. Orbach's interpretation of this incident is unsatisfying. Against whom must 'personal space' be defended? What is the function of this defense? If, in fact,

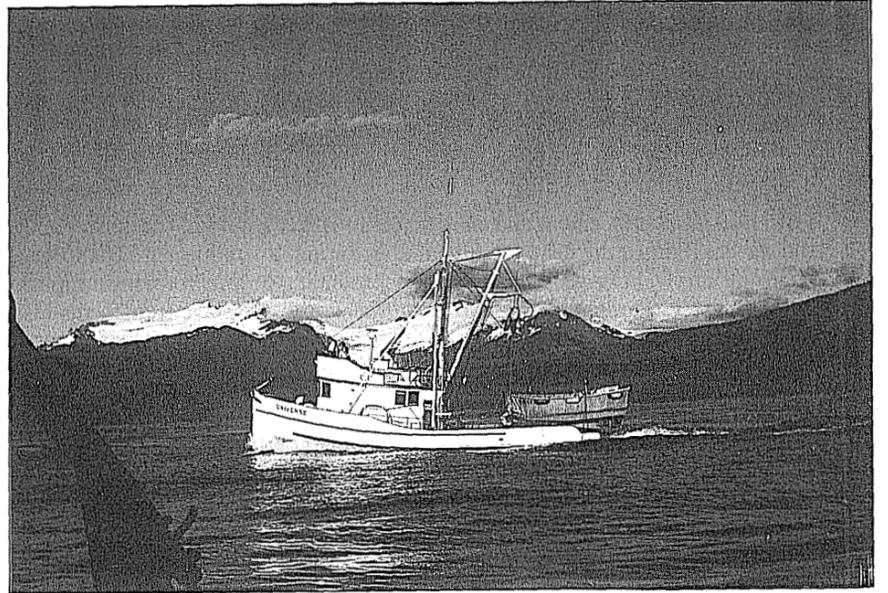


Photo 4. *The Universe*, an old seiner of 1920s vintage, went down outside Seattle on a howling November night some years ago. One man survived.

homophobic strictures against being 'too close' are justifiable based on the need to preserve 'personal space' then why must those strictures be enforced through joking behavior, rather than through a direct cognitive appeal? Homophobic joking suggests elements of fear, repression and anxiety which do not correspond to the model of a cohesive cultural system rationally predicated upon the needs of the fishing process. Precisely because Orbach presumes an organic shipboard solidarity, he brackets the sting of 'power' and 'abuse,' fails to recognize the structural bedrock of economic violence everpresent in the threat of severance, and is consequently unable to understand the distorted relationship between the defense of the self and the defense of the ship's hierarchy. He imputes an intrinsic 'workability' to social action without a critical examination of the claims and disclaims made by the actors themselves.⁴ Once Orbach could file the crewman's apparent ingratitude under a reified norm of 'personal space,' then Orbach's own initial reactions, like those of his fellow crewman who did not grasp the 'system' of abuse, could be devalued as a cognitive mistakes. Yet, even if one could explain that homophobic joking is a 'workable cognitive orientation,' can one justify it?

'FAGGOT! GODDAM FAGGOT!'

Apoplectic and besotted, they seize the attention of the dance floor, causing the dancers to cease their motion. The seiners chant: 'FAGGOT, FAGGOT, FAGGOT!' as they advance on the stage. We seem on the verge of a lynching. Without breaking rhythm, the band shifts from salsa to Rolling Stones. The dancers resume. Their faces red as beets, veins bulging, they continue to yell but the strident chords of 'Street Fighting Man' annihilate them. Puffed up, spitting invective, they retreat screaming to their drinks.

* * *

Sexuality and exploitation are fused in the word 'fuck.' Its correct use signifies subscription to the cultural ethos. Who is 'fucked'? Someone who has no value. Who is a 'fuck-up'? Someone who interferes with the downward chain of exploitation. A 'fuck-down' would make no sense: it would merely mark a category which is unexceptional.

The company, the skipper, the crewman, anyone who has power can 'fuck' somebody. One who does this with exceptional violence has 'balls'⁹ The company does it with 'no vaseline.'¹⁰ The victim 'takes a fucking.'

Yet, the thought of 'fucking' a 'faggot' is abhorrent. A 'man' needs to exploit another 'man' to be a 'man.' The 'faggot' inverts the normal pathways inscribed during the disciplinary process and finds pleasure in his humiliation. He does not defend 'personal space' through 'fucking' another and, in that failure, threatens to bring down the hierarchy. The slave's unhappy consciousness is mocked by this shadow of its own humiliation.

* * *

In the galley I argue that repression is not necessary to organize and defend society.

The skipper gimbals his jigger of booze between thumb and middle finger, assaying this contention. He speaks,

'You damn well need the service or you'd be bowing to the Rising Sun today! To be strong you need discipline. Iron Discipline!

'When you're in the service, the hate you build up inside makes you sharp. You hate those bastards making you fall out at three in the morning to pick up cigarette butts 'cause some guy lipped off to the CO.

'You gotta go through the shit but you do it! So what! You've still got your mind!

'We were outta the rack at 7:30 every morning with our bunks tied up. I've gotta be active. It drives me crazy if I don't get out of bed and DO something! You young guys get out of bunk to take a shit!

'There's no fucking way you're going to organize the service without authority! How in hell are you going to take 200 guys, most of 'em from big cities, who haven't worked, haven't done a fucking thing in their lives, and make em into a unit if you don't have somebody on top forcing them?'

'You've gotta go through that shit, boot camp and all that, at first. When they figured I became a man, then I was through with that bullshit. Then we had some great times.

'But you gotta TAKE IT before you can GIVE IT!'¹¹

* * *

The rite of passage is never complete and therein lies its efficacy. A subordinate cannot not be fully a 'man' unless he can 'give it.' Yet even the skipper has to take 'the hate inside' from the company. Waiting for the end of this ambiguous trip, we sharpen our knives and 'love the inevitable.'¹²

* * *

'What happens to your pride on this boat?' says the new crewman. We know but say nothing. Today on the fishing grounds we simply refuse to put the seine out, forcing the skipper and his mate to run us into port, costing them one day's fishing. This is our final prestation to them. It feels good to 'fuck' them as they have 'fucked' us. We now fully grasp the cultural system.

Notes

1. Between 1972 and 1978 I purse seined as a crewman in southeast Alaska and Puget Sound during the salmon season. Since 1979 I have gillnetted my own boat for salmon in the same regions. Journal excerpts cited in this work derive from my tenure as a purse seine crewman. I chose to focus on purse seining rather than gillnetting because it is much closer in scale and social organization to the herring and tuna fisheries examined by Barth and Orbach. There are antagonistic cultural differences between these two net fisheries which have to do with the political economy of the region.

Purse seining, as a result of its capital-intensivity and catching efficiency, facilitates the centralization of wealth within fishing communities and overarching corporate control. This has been noted in Malaysia (Firth 1966), southeast Alaska (Gilbertsen 1985, 1990), (Langdon 1977) and in the Puget Sound treaty tribe fisheries (Knutson 1987) In southeast Alaska multinational corporations dominate this fishery through direct ownership, financial control of vessels and through control of processing outlets. These interests support the pre-eminence of purse seining as the dominant mode of harvest in the region.

Purse seining occurs in a competitive, highly-leveraged, and driven environment. Seine crewmen commonly refer to their work as 'grinding' or 'clanking.' Deck-work requires little knowledge of the hunting aspect of the fishing trip. The crew's labor, tied to the speed of machinery and subject to a complex division of labor, is closer to a factory model than the labor in less capitalized salmon fisheries such as trolling or gillnetting.

2. The 'lifeless machine is congealed spirit (Geist)' (Weber, cited in Marcuse 1968:222).
3. This strategic exploitation of the ambiguities in language is considered by Silverstein (1976). He discusses the use of referential indexes, 'shifters,' in the multifunctional context of daily pragmatics. In 'value-neutral' work language I would add that these 'shifters' are strategically exploited in a systematic fashion.
4. See Rabinow's 1983 criticism of American cultural anthropology on precisely this 'bracketing of truth and seriousness.'
5. Adorno and Horkheimer (1972) converge with Foucault (1979, 1980b) on this point. They see an extension and radicalization of domination arising from increasing human mastery of nature. However, where Adorno and Horkheimer understand this dialectic as tragedy, Foucault traces the extension of 'technologies of power' in a much more concrete, historical fashion. Habermas (1971) argues convincingly for an emancipatory possibility. He undermines the master/slave narrative by restoring the exiled potentials of human reciprocity always presumed in communication to the context of the Hegel's story.
6. The cook occupies a role fraught with sexual ambivalence. His role as domestic clashes with the dominant cultural ethos of production and the associated sexual ideology. The priority of his job is reflected in a skipper's comment, 'Fuck food when there's fishing.'
7. I am struck by the convergent functions of this suspension of 'seriousness' pragmatically, in terms of the maintenance of hierarchy on the vessel, and theoretically, in terms of the structural-functional ratification of the 'cultural system.' In both cases such bracketing functions to deny and thus naturalize the sting of power. The individual who takes the exercise of power seriously has not learned the ropes.
8. That, of course, is precisely the point of 'hazing.' The subordinate learns not to distinguish between what Marcuse (1962) called 'necessary' and 'surplus' repression. It is all to be considered necessary.
9. 'Balls' literally refers to the scrotum. Metaphorically it refers to the core of a man's sexual being.
10. I.e., no sexual lubricant. On the occasion of a cut in fish prices, I once watched a skipper enter the cannery office, slam down a jar of vaseline on the superintendent's desk and storm out. This is a commonly acknowledged metaphor.
11. Recorded the night Richard Nixon resigned the Presidency in August 1974.
12. Bourdieu (1977:77) defines cultural ethos as that which allow an individual 'to refuse what is anyway refused and to love the inevitable.'

References Cited

- Barth, Frederik
1966 The Analytical Importance of Transaction. In: Models of Social Organization. *Royal Anthropological Institute Occasional Paper* No. 23.
- Brittan, Arthur
1989 *Masculinity and Power*. New York: Basil Blackwell.
- Bourdieu, Pierre
1979 *Outline of a Theory of Practice*. Cambridge: Cambridge University Press.
- Conrad, Joseph
1984 The Secret Sharer. In: *Sea Stories*. London: Granada.
- Dana, Richard Henry
1940 *Two Years Before the Mast*. New York: Books, Inc.
- Firth, Raymond
1966 *Malay Fishermen. Their Peasant Economy*. New York: Norton.
- Foucault, Michel
1979 *Discipline and Punish: The Birth of the Prison*. New York: Random House.
- Foucault, Michel
1980a *The History of Sexuality. Volume I: An Introduction*. New York: Random House.
- Foucault, Michel
1980b *Power/Knowledge: Selected Interviews and Other Writings 1972-1977*. New York: Pantheon.
- Gilbertsen, Neil
1985 *Allocation and Equity in the Southeast Alaska Net Fisheries: A Report Prepared for the United Southeast Alaska Gillnetter's Association*. Juneau: United Southeast Alaska Gillnetters Association.
- Gilbertsen, Neil
1990 Corporate Control of Common Property Fisheries: The Impacts of Limited Entry Upon the Salmon Net Fisheries of Southeast Alaska and British Columbia. Paper prepared for presentation at the Canadian Political Science Association Annual Convention 1990.
- Habermas, Jürgen
1971 Labor and Interaction: Remarks on Hegel's Jena Philosophy of Mind. In: *Knowledge and Human Interests*. Translated by Jeremy J. Shapiro. Boston: Beacon.
- Habermas, Jürgen
1976 Systematically Distorted Communication. In: Connerton (Ed.), *Critical Sociology*. New York: Penguin.
- Hegel, G.W.F.
1967 Lordship and Bondage. In: *The Phenomenology of Mind*. Translated by J.B. Baillie. New York: Harper and Row.
- Herbst, P.G.
1968 Interpersonal Distance Regulation and Affective Control in Merchant Ships. *European Journal of Social Psychology* 1(1):47-58.
- Horkheimer, Max and Adorno, Theodor
1972 *Dialectic of Enlightenment*. New York: Herder and Herder.
- Kafka, Franz
1961 *The Penal Colony*. New York: Schocken.
- Knutson, Peter
1987 *'You Take Serious What's Said in Play!': Systematic Distortion of Communication on a Fishing Boat*. Ph.D. thesis, University of Washington, Seattle.
- Knutson, Peter
1989 The Unintended Consequences of the Boldt Decision. In: John Cordell (Ed.), *A Sea of Small Boats*. Cambridge, Mass.: Cultural Survival Press.
- Langdon, Stephen
1977 *Technology, Ecology and Economy: Fishing Systems in Southeast Alaska*. Ph.D. Dissertation, Stanford University.
- Marcuse, Herbert
1962 *Eros and Civilization: A Philosophical Inquiry into Freud*. New York: Vintage.
- Marcuse, Herbert
1968 Industrialization and Capitalism in the Work of Max Weber. In: *Negations*. Boston: Beacon. Pp. 201-226.
- Melville, Herman
1964 *Moby Dick or The Whale*. New York: Holt, Rinehart and Winston.

Orbach, Michael

- 1977 *Hunters, Seamen and Entrepreneurs: The Tuna Seiners of San Diego*. Berkeley: University of California Press.

Rabinow, Paul

- 1983 Humanism as Nihilism: The Bracketing of Truth and Seriousness in American Cultural Anthropology. In: Haan *et al.*, (Eds.), *Social Science as Moral Inquiry*. New York: Columbia University Press. Pp. 234-261.

Silverstein, Michael

- 1976 Shifters, Linguistic Categories and Cultural Description. In: Basso and Selby (Eds.) *Meaning in Anthropology*. Albuquerque, New Mexico: University of New Mexico Press.

Weber, Max

- 1958 *The Protestant Ethic and the Spirit of Capitalism*. New York: Charles Scribner's Sons.

Discussion

Notes on Chaos in Fisheries Management by

Estellie Smith

(MAST Vol. 3(2) 1990)

Chris Finlayson

Memorial University of Newfoundland

The reader of this commentary may find it useful to know that I am currently working on a social constructivist¹ analysis of the Canadian Department of Fisheries and Oceans (DFO) stock assessment science with particular reference to the role of science in the current perception of a 'crisis' in northern cod stocks.

In the course of my research I have found many of the ideas emerging from chaos theory to be of substantial help in coming to an understanding of why DFO scientists have had difficulty in making assessments and predictions with any useful degree of accuracy, and why it is that DFO (and the institutionalized fisheries management structures of all other industrialized nations that I am aware of) so often fail in their attempts to bring some measure of socio-economic and biological stability to a fishery.

Irrespective of the ultimate acceptance or rejection of the central tenets of chaos theory, it *is* having one undeniably salubrious effect on intellectual activity and academic life. This is its challenge to classical reductionist science and its concomitant tendency to dissolve the barriers that have traditionally separated academic disciplines.² In fact, from the perspective of chaos theory, the categorization, compartmentalization and hierarchical ordering of human intellectual activity can be seen as a reflection of the deep structure of the classical scientific paradigm.

In short, I have become deeply impressed with the potential of chaos theory to be a powerful tool in our quest for understanding of the natural world. It appears to have both illuminatory power when directed at problems of complex dynamic systems, such as fisheries, and has entirely welcome tendencies to encourage interdisciplinary research and reintegrate institutionally discrete spheres of human knowledge. That said, I must also acknowledge its current trendiness and, therefore, be unusually critical in my assessments of its incorporation into serious, scholarly work.

The heart of Smith's argument is that the management plans generated through United States regional fisheries councils are generally perceived by all parties as 'failures' because they are the product of a process that attempts to incorporate two fundamentally conflicting 'cognitive models' of natural reality: that of the 'administrators, scientists, [and] technicians ... who view Nature in classic Newtonian terms,' and 'the user groups - primarily members of the commercial fishing industry ... whose understanding of natural processes is strikingly parallel to the model being suggested by the newly emerging science of Chaos' (Smith 1990:1,4).

This hypothesis is intriguing and not without considerable intuitive appeal, but the paucity of supporting data in the article is a serious weakness. Only one secondary source is cited (unconvincingly) in support of Smith's construction of the administra-

tors' world view: the director of the National Marine Fisheries Service (NMFS), Dr. William W. Fox, is quoted in an article in the *National Fisherman* – a leading industry periodical which has an obvious, 'though unmentioned, stake in the debate. Apropos of a drift gillnet ban imposed by the NFMS the author writes:

Fox argues that poor information leads to honest differences of opinion. [He states that] '...it depends on what you do with uncertain data. You can say, 'Well, this doesn't prove that there is a problem even though it might imply it. Therefore, we aren't going to take any action until we can prove it.' My view is ... to react in a conservative manner in the face of uncertainty' (Fee 1990:15).

From this Smith concludes that 'it is obvious that, for Fox ... uncertainty mandates linear modelling...' In fact, his remarks are sufficiently ambiguous that they could be interpreted as deriving from either of the two cognitive models under discussion.

Two original sources are quoted as illustrative of fishers' allegedly chaotic cognitive model. The first – unidentified except as 'one fisherman' and offered in no context – is a colloquially eloquent and apparently convincing witness for Smith's case. The second, a 'New Bedford scalloper,' speaks briefly and to no particular purpose.

That said, I must add that I think Smith's hypothesis may well prove to have considerable validity. I suspect, however, that more intensive research will show that the real problem is not so clearly drawn. For instance, I have recently conducted in-depth interviews with more than a dozen Canadian fisheries scientists and managers. Some of them could be loosely characterized as fitting Smith's model while others are, however reluctantly, beginning to suspect that they are dealing with a 'chaotic' system.³

Having done no personal research with fishers, I can only say that I expect a similar diversity of cognitive models could be found on this side of the problem as well. I imagine that the skipper of a high-tech deep sea trawler thinks about the marine world in a very different way from the skipper of an open trap skiff. Also, I would suggest that the population dynamics and behavioural characteristics of the target species may be a significant variable in the construction of a fisher's world view.⁴

Contrary to my speculations above, general support for Smith's argument is provided in an editorial in the February, 1991 issue of *Commercial Fisheries News*. Publisher and editor, Robin Alden states:

Our groundfish debate⁵ is crippled by a fundamental difference in perceptions between responsible fishermen and managers ... They [fishermen] perceive both the ecosystem and the market they use as dynamic and unpredictable. They succeed or fail depending on their skill in dealing with uncertainty. Managers, in contrast, have far less at stake and their prescriptions suggest that the ecosystem can be both stable and predictable.

By continuing this line of inquiry (albeit with an expanded data base), Smith, and others, will be making a valuable contribution to our efforts to understand and improve the dynamics and results of fisheries management.

Having dispensed with my discomfiting duty as critic I will now offer some more positive commentary and conclude with a brief discussion of chaos theory as it might be applied to fisheries science and management.

In the introductory statement of the problem, Smith identifies several important dynamics at play in the systemic whole. By associating what we have traditionally thought of as 'environmental' processes (biological and oceanographic) with market

processes (changes or persistence of consumer demands), technological processes (the ever-increasing 'fishing power' of the harvesting sector), economic processes (the increasing capital cost of harvesting technology), and social processes (conflicting interests of commercial users, recreational users and preservationists),⁶ Smith alludes to one of the basic concepts of chaos theory: that the segregation of natural reality into discrete dynamic systems, sub-systems, and successively smaller components, is a product and necessary illusion of reductionist, linear science. In fact, nonlinear dynamic systems may be so sensitive to minor perturbations originating in adjacent or associated systems (the 'butterfly effect' [Lorenz 1979]) that the theoretical boundaries of the concept of 'system' are reached only on the cosmic scale.

If the dynamics of a fisheries ecosystem are predominantly nonlinear, then *all* fisheries management strategies based on linear cause-and-effect models, single-species assessments, predictions and quotas are profoundly flawed and unlikely to achieve their intended results. The essential question then becomes, how *should* we organize and manage our interventions in these systems? The answers will depend on the intended results of fishing and its acceptable and unacceptable known possible effects on the system.

Among the intended results could be, singly or in various combinations and degrees: maximizing the available protein for human consumption, promoting stability and order in the human socio-economic system dependent on fishing, maximizing return on capital or minimizing the fishing-induced perturbations in the system. Among the known possible (extreme) effects it is conceivable that, in a given time and place, it may be acceptable to deliberately fish a stock to commercial or even biological extinction with no regard for the systemic repercussions of such an event. In another time and place it may be entirely unacceptable to risk any such effect.

'But,' you say 'in a nonlinear dynamic system with unknown sensitivity to minor perturbations and unpredictable effects of those perturbations, it is clearly impossible to predict the results or effects of any human intervention in the system no matter how small!' The answer is, well, yes and no. According to chaos theorists and those who are building and testing nonlinear models of fisheries ecosystems, nonlinearity does not necessarily mean unpredictability.⁷

In fact, 'chaos' theory is a deceptive and, perhaps, unfortunate name for this new science. If this body of work can be said to have a central theme, it is that there is a 'strange' kind of order in apparently random or chaotic phenomena. Moreover, this order can be found and is said to be 'self-similar' at all scales of investigation from the cosmic to the sub-atomic. (See note 8 for a short discussion of self-similarity.)

Although the behaviour of natural dynamic systems (the weather, a river, a marine ecosystem) are fundamentally deterministic, the number of determining variables is essentially infinite, and the extreme sensitivity of such systems to initial conditions means that classical linear science is limited in the kind and amount of useful knowledge it can generate about these systems. This is because classical science proceeds on the assumption that the behaviour of natural systems is dominated by a relatively few critical variables. (Ironically, when looking at a system susceptible to the 'butterfly effect,' a classical scientist sees mostly chaos whereas a 'chaotic' scientist sees a 'strange' kind of order. See below)

On the other hand, investigation of dynamic systems with nonlinear analytical tools has revealed that they seem to contain and be dominated by 'strange attractors,' tendencies towards order that exist in 'fractal phase-space.'⁸ What this means in practical terms is that, at various knowable (usually fractional) space-time dimensions

and energy levels, these systems exhibit dynamic regularity. Realistic models and simulations can be constructed that, in turn, can be used to make useful predictions about the system's future behaviour and likely response to variations in certain parameters. But perhaps the most important aspect of these models is that they can indicate those aspects of the system which we can *never* know – fractal regions of space-time forever obscured from our gaze by an impenetrable, nonlinear chaos. The trick to understanding and coping with nonlinear reality is knowing what questions can be usefully answered and which can not, no matter how much we may wish it. Valid answers and high-probability predictions can only be derived from probing a system in the vicinity of its strange attractors, the fractal space-time dimensions where regularity is found.

Weather forecasting offers a familiar and excellent example. By analyzing available data one may be able to say with a high degree of probability that it will rain heavily this afternoon in Boston but not in New York. (This is because what we call 'humidity, barometric pressure, isotherms, clouds' and so on are also aspects of a nonlinear dynamic system that has been observed to behave with regularity in well-known fractal space-time dimensions.) Between Boston and New York is a huge area of uncertainty where it may or may not rain. Similarly, there is great uncertainty about exactly when the rain will begin and end and exactly how much rain will fall. There are strange attractors in the fractal space-time dimension of 'Boston this afternoon heavy rain' and 'New York this afternoon no rain.' In the fractal dimensions between these strange attractors is chaos. As much as we might wish to know exactly which areas will receive how much rain when, it is, and will forever be, impossible. Still, it is useful to know that it will rain heavily in Boston this afternoon but not in New York.

The fractal space-time dimension of 'Boston rain April' also contains a strange attractor while 'Boston rain April 30' does not. The fractal space-time dimension of 'Boston rain next year' contains a powerful strange attractor while 'Boston rain 200,000 years from now' does not. Notice that strange attractors appear and disappear with changes in scale and that scale is an artifact of the perspective of the observer. The observer is also an interactive part of the dynamic system and, by posing a particular question from a particular point in space-time (and not an infinity of others) and making specific observations (and not others) is actually creating a fractal space-time dimension. It follows that, if the presence or absence of strange attractors is an artifact of observation, then the apparent presence of regularity or chaos must also be a relativistic creation of the act of observation. Further, because the observer cannot create apparent or 'virtual' order or chaos at will, observation must be a dynamic, interactive process existing *within* the system itself; a system containing an infinity of determinant variables massively interactive in an infinity of nonlinear feedback relationships.

An experienced meteorologist chooses to pose questions and make observations – that is, interact within the system in ways – that are known to have a high probability of creating fractal space-time dimensions containing strange attractors.

The point is that we all know and, however grudgingly, accept the relativistic, nonlinear, fractal nature of weather and the limits this places on our knowledge. However, most of us have not yet accepted the relativistic, nonlinear, fractal nature of other dynamic systems such as a marine ecosystem.

What I am rather circuitously arguing is that, to the extent that our fisheries scientists and managers have failed, and will continue to fail, to achieve most of their laudable objectives, it may well be because they are using the wrong conceptual and analytical

tools for the job. They are looking for the old, familiar 'A + B = C' linear regularity in space-time dimensions of the system where linear logic would suggest that they find it: relationships between fishing mortality, stock size, spawning biomass, recruitment, predator-prey interactions etc. Occasionally they get lucky and stumble across a strange attractor. More often, though, they are fruitlessly creating and probing fractal dimensions that contain only aperiodic noise: chaos.

They are simply using the wrong tool for the job; rather like trying to eat soup with a fork. It is terribly frustrating, makes a mess and yields meager results. There is nothing wrong with classical linear science. It is an admirable, well-developed tool for exploring and exploiting certain orders of phenomena. It has been, and will continue to be, of great benefit to humankind. But until we reconceptualize our approach to fisheries science and management, we will continue to beat our linear heads on a nonlinear brick wall.

Notes

1. From the 'social constructivist' view we see scientific knowledge primarily as a social artifact and a social accomplishment rather than an objective description of external natural reality (Pinch 1986, Mulkay 1979, 1983, Knorr-Cetina 1981, 1983). The most radical treatments portray modern science as the enabling and legitimating belief system of the industrial revolution and the liberal-capitalist State.

2. For example, people with whom I have direct contact who are working on the problems of creating nonlinear, or chaotic, models of fish stock population dynamics include Herb Gaskill, a mathematician at Memorial University of Newfoundland, and Jim Wilson, an economist at the University of Maine at Orono, as well as biologists employed by DFO. These people follow each other's work closely and consider themselves to be colleagues working at the very heart of the same problem; not different, specialized, aspects of a problem. Both Gaskill and Wilson have delved deeply into the body of knowledge traditionally reserved for marine biologists to ensure that the parameters of their models are consistent with current knowledge and the biologists are fluent in the language of mathematics. Further, all of them are aware that social and economic forces have a great deal to do with fisheries management policy and practice and must ultimately be incorporated in any realistic model.

3. In fact, high-energy physicists – traditionally considered to be the 'hardest' scientists of all – have been routinely dealing with uncertainty for quite some time in the form of quantum field theory and quantum mechanics. The two most familiar expressions of the quantum world are Heisenberg's 'Uncertainty Principle' and the famous paradox of 'Schrodinger's Cat.'

4. In her comments on a draft of this paper, Bonnie McCay of Rutgers suggested a radical and potentially productive extension of chaos theory. This is that non-material systems such as public opinion or, in this case, cognitive models, may also be amenable to nonlinear analysis. Specifically, the linear Newtonian model and the nonlinear chaotic model attributed, respectively, by Smith to managers and scientists and to fishers may be thought of as containing 'strange attractors.' In this way we can account for the power and persistence of a belief system irrespective of the real diversity of perception and belief of the system's individual adherents. (See the second half of this paper for a discussion of strange attractors and other aspects of chaos theory.)

5. Regarding proposed measures to achieve a 50 per cent reduction in the fishing mortality rate over the next five years.

6. See the papers of Wilson et al. and Gaskill noted in the appended references for provocative modellings of some of these critical variables.

7. See works by Gleick, Wilson et al., Gaskill and Bak and Chen noted in the appended references.

8. The concept of 'strange attractor' is not too difficult and should become reasonably obvious through its context in the following text. The idea of 'fractal' geometry is considerably tougher. Below I attempt a crude approximation of an explanation.

(However, those interested in furthering their acquaintance with these bizarre but exciting and very useful concepts are strongly recommended to *Chaos: Making a New Science* by James Gleick. This work is universally regarded as the best general introduction to the subject. It also has the great advantage of being splendidly written and a joy to read. A less-heralded but equally interesting text is *Turbulent Mirror* by John Briggs and F. David Peat.)

The classical, Euclidian geometry that we are familiar with is elegantly simple; a point has no dimension, a line one dimension, a plane two dimensions, and space three dimensions. These dimensions can be expressed quantitatively. A point is always '0.' The others are expressed as some variable but absolute quantity respectively called 'length,' 'surface area' and 'volume.'

'Fractal' geometry is the result of Benoit Mandelbrot's disturbing (but retrospectively transparent) observation that it is very difficult, if not impossible, to find these dimensions in the natural world. In *The Fractal Geometry of Nature* (1982) Mandelbrot asked the deceptively simple question, 'What is the length of the British coastline?' His answer was that it varies from zero to infinity depending on the scale of measurement. On a cosmic scale of measurement, light-years, it appears as a point. As the units of measurement are reduced (miles, yards, feet, inches, grains of sand, molecules) the length of the coastline becomes greater until it approaches infinity on the sub-atomic level where it suddenly collapses back into a probabilistic quantum point. Obviously the same is true for the question of the surface area of Britain or the volume of a British lake.

Further, between the cosmic and the atomic scale, at all scales between the macroscopic and microscopic, the shapes and patterns of the British coast were strikingly alike. This, in spite of the fact that these shapes and patterns were the product of undeniably random processes. In many instances it was impossible to determine the scale from the image. Mandelbrot called this phenomenon 'self-similarity.'

Mandelbrot's solution to this problem was to dismiss the idea of absolute quantitative measurement as irrelevant to our investigation of the fundamental properties of nature. What is relevant, he says, is the relative complexity of an object or dynamic process and this can be expressed as a fractional 'fractal' number.

'It's a single model [fractal geometry] that allows us to cope with the range of changing dimensions of the earth. It gives you mathematical and geometric tools to describe and make predictions. Once you get over the hump, and you understand the paradigm, you can actually start measuring things and thinking about things in a new way. You see them differently. You have a new vision. It's not the same as the old vision at all it's much broader' (Scholz in Gleick 1987).

While all of this has no bearing on our mundane activities such as buying rope by a linear measure, cloth by a square measure or concrete by a cubic measure, it is very bad news for many scientists. They are generally trained to take a firmly quantitative approach to natural reality. They prefer precision to messiness. They prefer absolutes to relativity. Even theoretical physicists, who have had a long time to become acquainted with relativity and quantum mechanics, continue to look forward to the day when one of their number will discover the 'theory of everything' that will encapsulate natural reality in one simple mathematical expression.

References Cited

Alden, Robin

- 1991 The Voice of the Responsible Groundfisherman. Listen [editorial]. *Commercial Fisheries News*, February.

Bak, Per and Chen, Kan

- 1991 Self-Organized Criticality. *Scientific American*, January.

Briggs, John and Peat, F. David

- 1989 *Turbulent Mirror*. New York: Harper & Row.

Gaskill, Herbert S.

- n.d. A Model of the Northern Cod Stock (forthcoming).

Gleick, James

- 1987 *Chaos: Making a New Science*. New York: Viking Penguin.

Knorr-Cetina, Karin D. and Mulkay, Michael (Eds.)

- 1983 *Science Observed: Perspectives on the Social Study of Science*. London: SAGE Publications Ltd.

Latour, Bruno and Woolgar, Steve

- 1986 *Laboratory Life*. 2nd. Ed. Princeton: Princeton University Press.

Mandelbrot, Benoit

- 1982 *The Fractal Geometry of Nature*. San Francisco: W.H. Freeman.

Mulkay, Michael

- 1979 *Science and the Sociology of Knowledge*. London: George Allen & Unwin Ltd.

Pinch, Trevor

- 1986 *Confronting Nature: The Sociology of Solar-Neutrino Detection*. Dordrecht: D. Reidel Publishing Co.

Smith, Estellie

- 1990 Chaos in Fisheries Management. *Maritime Anthropological Studies* 3(2):1-13.

Wilson, James A., et al.

- 1990 Managing Unpredictable Resources: Traditional Policies Applied to Chaotic Populations. *Ocean & Shoreline Management* 13.

Wilson, James A., et al.

- n.d. Chaotic Dynamics in a Multiple Species Fisheries. A Model of Community Predation (forthcoming).

Wilson, James A., et al.

- n.d. Management of Multiple Species Fisheries with Chaotic Population Dynamics (forthcoming).

Wilson, James A. and Roy, Noel

- 1989 Constraint-Induced Chaos in a Multispecies Fisheries Model, notes (unpublished) for a presentation to the Journées du Groupe de recherche en économie de l'énergie et des ressources naturelles (GREEN) at the Université Laval, October 27, 1989.

Book Reviews

RODMAN, Margaret *Deep Water: Development and Change in Pacific Village Fisheries*. Boulder, Colorado: Waterview Press, 1989.

The book is about fisheries development in Vanuatu, a small group of Southwest Pacific islands known until recently as the New Hebrides. It's purpose is to describe development from the disparate perspectives of the villagers of Vanuatu and of the government fisheries personnel.

If the goal of fisheries development is self-sufficiency, one must ask, self-sufficiency for whom? Increased commercial productivity, enhances national self-reliance, but it may simultaneously erode it among fishermen; 'if these villagers reach the point where they have to go fishing in order to earn a wage instead of going fishing in order to catch supper, they may be less self-reliant as a result of "development"' (p. 5). This (as Rodman acknowledges) is not an original insight in the development literature. But it needs to be repeated and explained in a Pacific island context if island policy-makers and aid-givers are to be expected to take note.

Rodman describes different perceptions within Vanuatu of 'cargo' – freezers, fishing boats etc. – obtained with foreign aid. The Vanuatu Fisheries Department, she says, views cargo as beneficial, tending to equate development with increased capital investment because aid donors prefer to support the purchase of equipment rather than to cover services which are less tangible. It judges the success of development less in terms of what it accomplishes for the village recipients than in terms of how much additional aid it attracts. One village is described as 'a showcase of development' for the Fisheries Department because 'the cold room and 15 boats looked impressive to Japanese aid donors,' although business was poor and benefits spread inequitably (p. 151).

In contrast, 'islanders, while enjoying the cargo, are wary of finding themselves in a position where they would have to do nothing but catch fish,' and 'display a passive resistance to commercialization of their labor' (p. 149). 'Ni-Vanuatu are well aware of some of the perils of commercialization, even if the ones that worry them are not always those of consumerism and the profligate uses of natural resources that concern [western observers],' she asserts (p. 7); their concerns are more with maintaining their 'social and economic options' (p. 7) in a society where 'no one ... is willing to be a full-time anything' (p. 7). 'While participation in the cash economy through markets is part of everyday life for islanders, relatively few are, or want to be, more deeply involved' (p. 8).

This is a message that one hopes will reach those who distribute development aid in the region. Few of them have lived in island villages, for which much of the aid is intended. They are thus often poorly informed about such realities and, in consequence, sometimes have unrealistic expectations about the feasibility of directed changes, and the speed with which they can be accomplished.

While Rodman states that 'a radical change in peoples' attitudes toward money, work, and government is required to transform intermittent simple commodity producers into people who work regularly to provide the money that creates the tax base to keep local government running' (p. 147), she stresses that this change should be accomplished only by degrees, 'through slow, steady change that does not disrupt traditional lifestyles' (p. 153).

But is even *this* cautious goal achievable? I made similar assertions a decade ago (see also Lingenfelter 1977), but I can't think of any examples of shallow-water fisheries development in Oceania that have since justified my optimism. Assuming that transforming the simple commodity economies of many Pacific islanders to capitalist economies can be accomplished without seriously disrupting traditional lifestyles ignores a whole suite of grim social and related medical problems widely associated with economic development in the region. In parts of Oceania where cash economies have expanded further than in Vanuatu villages, traditional lifestyles have often been replaced by ones characterized by escalating rates of heart disease, diabetes and alcoholism (e.g., Coyne 1984), mental illness and suicide (e.g., Pacific Islands Studies Program 1985) drug use and crime, and that contribute, as well, to serious environmental degradation (e.g., Hatcher *et al.* 1989). (One might argue that the causal connections in the region between developing market economies and these problems are not rigorously proven, but the relationship is too strong to ignore.)

Rodman is capable of artful evocation of setting and mood; the first paragraph in the book, for example, is a little gem of this sort. But the writing moves abruptly and sometimes jarringly to and from this poetic prose to an expository style more typical of writing on development anthropology. This seems to lie at the root of the vague dissatisfaction some readers expressed to me about the book. But it would be a pity to undervalue it because of these stylistic inconsistencies. The story Rodman has to tell is interesting and instructive.

One might wish, however, for a more detailed treatment of Vanuatu's political economy, as well as greater acknowledgement that the problems she describes are not the only important ones facing fisheries development in the country. And the author made many of her points more concisely in a journal article (Rodman 1987). But, for natural resource managers and foreign aid donors in the region, the dimensions of some of the problems and issues they face are captured in the book in a more personal – and thus perhaps more persuasive – way than is possible in a journal article.

References Cited

- Coyne, T.
1984 *The Effect of Urbanization and Western Diet on the Health of Pacific Island Populations*. South Pacific Commission, Noumea, New Caledonia.
- Hatcher, B.G., R.E. Johannes and A.L. Robertson
1989 Review of Research Relevant to the Conservation of Shallow Tropical Marine Ecosystems. *Oceanography and Marine Biology Annual Reviews* 27:337-414.
- Lingenfelter, S.G.
1977 Socioeconomic Change in Oceania. *Oceania* 68:101-25.
Pacific Islands Studies Program
1985 Culture, Youth and Suicide in the Pacific. Papers from an East-West Center Conference. *Working Papers*, Pacific Islands Studies Program. Honolulu, Hawaii.
- Rodman, M.
1987 Constraining Capitalism? Contradictions of Self-Reliance in Vanuatu Fisheries Development. *American Ethnologist* 14(4):108-22.

HANNIG, Wolfgang *Towards a Blue Revolution. Socio-Economic Aspects of Brackishwater Pond Cultivation in Java*. Yogyakarta (Indonesia): Gadjah Mada University Press, 1988. xxxii + 404 pp. ISBN 979-420-110-3.

In one of the early evaluation studies of Indonesia's Green Revolution programme, a research team pointed to the negative impacts of this type of agricultural modernization. In particular, they criticized its employment effects, the more so as these tended to be highly gender-specific. As criticism in Indonesia's New Order political climate is frowned upon if it is not considered to be 'constructive,' the authors hastily added to their conclusions that probably the final solution to Indonesia's food problem, rural poverty and declining employment could come from a 'Blue Revolution.'¹ By this, they meant a programme for modernizing the extensive coastal fishing sector as practised in brackish-water ponds (*tambak*) along the North coast of Java (as well as in parts of the Lesser Sunda islands, Sumatera and Sulawesi).

It is this sector of the rural economy which Hannig discusses in the commercial edition of his Bielefeld Ph.D. thesis. Fieldwork for this dissertation in development sociology was carried out in the mid-1980s in several areas of North Central Java.

Social research into these fishing communities has been very limited, and, as such, Hannig's study certainly is a pioneering effort in tackling both the organization of 'aquacultural production,' the way it is linked to other sectors of the rural and national economy, the socio-economic impact it has on social differentiation, and the way in which the Indonesian government has tried to boost production of milkfish, prawns and shrimps through intensification and credit programmes. Hannig's main conclusion is that particularly government policies during the last two decades have reinforced and often exacerbated unequal access to resources and that they have led to further socio-economic differentiation in the *tambak* communities.

In many respects, the structural impact of this 'Blue Revolution' bears a close similarity to what has been reported on the Green Revolution in Javanese rice cultivation: a rapid increase in production and productivity on the one hand (*tambak* production more than doubled between 1968 and 1982), and a concentration of resources among a small coastal elite of village notables on the other. Accelerated commercialization has brought a tighter control over production by trading networks, and, hence, a greater dependency on world market prices.

The author discusses the structure of the coastal economy and the importance of *tambak* cultivation in Central Java in general, and in two villages in particular. It is these case studies which show a richness of detail on the ecology and technology of fish farming, the social organization of production (through systems of tenancy and sharecropping), the increased control of the village elites over fish ponds and the expanding role of formal and informal credit systems among these 'peasant-fishermen.' Evaluating past experiences with Indonesia's development programmes brings him in his final chapter to outlining an 'integrated and target-group oriented development planning' which is better suited to the needs of the pond cultivators and their tenants and sharecroppers.

The study provides the reader with a wealth of data and analytical observations which make Hannig's study a major source of information on the economic organization of *tambak* cultivation in Java. It shows, however, a number of weaknesses which leave the reader with more questions than answers. These weaknesses regard both the historical depth of the study, the theoretical analysis, the methodological approach and the presentation of the material.

An analysis of social transformation like Hannig presupposes sufficient information on the baseline of social change in order to compare contemporary developments with

the situation before the 'Blue Revolution' came to Indonesia. Previous research on *tambak* cultivation may be scanty, but it is certainly not completely absent. In fact, a detailed study of this sector of the economy and moreover one carried out in Hannig's research area itself, encompassing one of the villages he studied in depth has been published in 1930 in the Dutch journal *Koloniaal Tijdschrift*.² As Burger addresses exactly the same topics (ecology, technology, access to fish ponds, tenancy, concentration of ownership, etc.) Hannig could have benefitted immensely from a historical comparison with the pre-Independence situation, and it would have prevented him from exclusively focusing upon present-day government intervention as a major factor in bringing about social differentiation.

In coping with the general theoretical implications of his findings, Hannig prefers sweeping statements in his discussion of rural transformation and social differentiation by applying rigid economic conceptions of social class (pp. 147-49). A similar deterministically inclined approach is visible in his analysis of the relationship between ecology and production technology in *tambak* cultivation. Moreover, his preference for 'policy-relevant' research brings him to often include normative or moralistic statements in his analysis of local politics and government intervention.

This theoretical shallowness seems to be closely related to Hannig's research methodology, and, in particular, his quest for 'objectification.' The leading Indonesian sociologist Sajogyo who wrote a foreword to the volume, has pointed to the fact that 'pond cultivators (...), labourers, tenants, and traders and on the other hand, development administrators, from village heads, extension officers to higher officials, are presented as people "without a face." The story remains abstract' (p. x). The author of the preface to Hannig's book, Hans-Dieter Evers, adds, with a peculiar sense of understatement, that 'the study does not quite reach the level of sophistication required of a "thick description" in the sense of Clifford Geertz. Local knowledge, cultural values, and emic interpretations do not form a central theme of the study' (p. xii).

It is, indeed, hard to imagine that Hannig who apparently is well acquainted with the way of life of *tambak* fishermen and their families, never mentions 'real people' rather than the 'social categories' that wander through the pages of his book. Even in the case studies of villages in Pati and Semarang, the author distances himself nearly completely from the 'participants' view' of what is happening inside their communities. This way of presenting the intricacies of socio-economic transformation contrasts sharply with Hannig's blaming the Indonesian government for treating peasants as a mere 'factor of production' (p. 357). He urges the government to trade this attitude for the idea that 'originally and objectively they are probably the most decisive subject of development.' If so, they certainly would deserve to be the subject of a sociological analysis.

So we are unfortunately left with a study of an important sector of the rural Javanese economy which provides a host of information on its structure and organization but little on the dynamics of social and cultural change accompanying the rapid transition from small-scale to international fish and shrimp production.

References Cited

- Collier, W.L. et al.
1974 Agricultural Technology and Institutional Change in Java. *Food Research Institute Studies* 13(2):192-93.
- Burger, D.H.
1930 De Zoutwatervisshijvers in het Regentschap Pati. *Koloniaal Tijdschrift* 19:402-434.

Books Received

Alegret, Joan-Lluís

1990 *Els armelladers de Palamós: Una aproximació a la flota artesanal dede l'anthropologia de la pesca.*

Amend, Thora

1990 *Marine und litorale Nationalparks in Venezuela. Anspruch, Wirklichkeit und Zukunftsperspektiven.* (Mainzer Geographische Studien, Heft 32). Mainz: Geographisches Institut der Johannes Gutenberg-Universität.

Fernández, José Pascual

1990 Monográfico de pesca. Actas previas del grupo de trabajo de pesca v congreso de antropología. *Eres. Serie de Antropología.* Granada: Museo Etnográfico/Cabildo de Tenerife-OAMC.

Ginkel, Rob van

1991 *Elk vist op zijn tij. Een historisch-antropologische studie van een Zeeuwse maritieme gemeenschap, Yerseke 1870-1914.* Zutphen: Walburg Pers.

McGoodwin, James R.

1990 *Crisis in the World's Fisheries. People, Problems, and Policies.* Stanford, California: Stanford University Press.

Instructions for authors

MAST welcomes articles, commentaries, review essays, and book reviews. To spare editors needless work, and themselves frustration, authors should be sure to:

1. Double-space *all* copy, including notes and references, on quarto or A-4 paper, using one side of the page only.
2. Type footnotes and references on separate pages at the end of the article.
3. Limit articles to 10,000 words, maximum, and include a 150-word summary.
4. Place figures, tables, graphs, charts, and maps (titled and numbered) on separate pages, and note clearly in the text where they should appear. Draw charts and maps in black waterproof ink, and submit them camera-ready.
5. Use author-date references (Byron 1980:228-31; Taylor 1983; Löfgren 1979), and list all works cited alphabetically by author:

Byron, R.

1980 Skippers and Strategies: Leadership and Innovation in Shetland Fishing Crews. *Human Organization* 39(3):227-32.

Löfgren, O.

1979 Marine Ecotypes in Preindustrial Sweden: A Comparative Discussion of Swedish Peasant Fishermen. In: R. Andersen (Ed.), *North Atlantic Maritime Cultures. Anthropological Essays on Changing Adaptations.* The Hague: Mouton. Pp. 83-109.

Taylor, Lawrence J.

1983 *Dutchmen on the Bay. The Ethnohistory of a Contractual Community.* Philadelphia: University of Pennsylvania Press.

6. Consider the option of submitting "on disk" final versions of manuscripts accepted for publication. (The editors of MAST will provide detailed information about this on request.)

7. Carefully correct – but *not* rewrite – page proofs of contributions, and return them to MAST on time as noted. (If page proofs are not returned on time, the editors will send their own corrected copy to the printer.)

8. Understand that they will receive three complimentary copies of each issue in which their work appears, but no offprints, and that MAST holds copyright on all material published in its pages.