# *MAPS AND TRAPS:*

## A Geographer's Perspective on Fishing and Marine Protected Areas in Bonavista Bay, Newfoundland

by

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**ABSTRACT**

Since 1992 when the cod stocks were closed on Canada's east coast, the fishing communities of Bonavista Bay in northeast Newfoundland have been forced to consider precautionary approaches to the management of living marine resources. Amongst the range of conservation measures currently under discussion, marine protected areas have attracted considerable attention both from harvesters and scientists, particularly for the preservation of sedentary species and supporting habitats. There is growing evidence that areas closed to fishing might boost local egg production thereby enhancing the surrounding fisheries. Reacting to harvester demands that conservation agencies acknowledge and incorporate local patterns of sea use, this thesis initiates a collaborative effort to document inshore fishing grounds in the waters adjacent to Terra Nova National Park. The research comprises two principal components: i) the derivation of a large scale coastal basemap from topographic sources and digital hydrographic data, and ii) participatory mapping sessions conducted with members of the Eastport Fishermen's Committee to chart harvest areas, local toponyms and community-based management measures.

Individual and small-group mapping sessions reveal an extensive cognitive store of local knowledge including precise locational information and customary rules that continue to govern spatial access to fisheries resources in coastal Newfoundland. By drawing their own maps, harvesters are able to demonstrate effectively these informal management measures and local conservation priorities to neighbouring communities, scientists and government partners. Comments are also offered on the customization of coastal basemaps and other cartographic products to meet fisher specifications.

In concluding, the research suggests that candidate marine protected areas will emerge through relaxed rapport accompanied by graphic portrayals of the areas and activities familiar to inshore harvesters. Based on the conclusions, the thesis makes recommendations for future mapping of fishing grounds in Bonavista Bay and highlights research opportunities such as computer assisted visualization in the participatory stages of marine conservation planning.

## ACKNOWLEDGEMENTS

Dr. Gordon Nelson provided insight and constructive guidance throughout my explorations, most of which occurred in Newfoundland, well away from Waterloo and the Great Lakes coast. Gordon encouraged me to embrace multiple perspectives and to undertake research without borders; he also shared his passion for learning and his sense of social relevancy in academic pursuits. I shall be forever grateful for these and many other contributions. Ted Potter, Senior Park Warden at Terra Nova National Park, gets top honours for perseverance, dedication, patience and bureaucratic savvy; our interaction both professional and personal, helped immensely as my research took shape. In particular, we have shared the learning about marine protected areas for Newfoundland. George Feltham contributed at many stages; I was continually inspired by his leadership abilities, his unflinching integrity, his steadfast resolve and his belief in the future of the inshore fishery – William Coaker, founder of the Fishermen's Protective Union (1908), would be proud.

Dr. Jon Lien, whose sensible approach to marine conservation has been highly instructive, introduced me to the unfinished work of Bob Graham, and by extension, the Parks Canada Bonavista Bay initiative. John DelRizzo and Colin Taylor, geomatics instructors with Data Services International in St. John's, ably assisted by Gary Hare, contributed their substantial GIS talents to the development of a prototype coastal basemap. Dr. Grant Head of Wilfred Laurier University, an early pioneer in the study of Newfoundland's geography, shared his enthusiasm and sharp cartographer's eye.

The fine fisherfolk of Bonavista and Notre Dame Bays contributed their time, interest and consent. To contain the totality of their knowledge and wisdom would take tens of thousands of volumes the size of this thesis. I was humbled on many occasions and the learning has been permanently imbedded in my psyche. I am especially indebted to the harvesters at Eastport whose contributions enabled this project to realize its present cartographic life. I'll be back to spill more tea – and rum – on their wonderful maps. May they triumph in their long-term efforts to husband the living resources of Bonavista Bay.

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A personal thanks is due to staff and friends – including my Coast Guard neighbours – at Terra Nova National Park. Among the many people to pass through the Park, my housemates Randy and Mark deserve special mention for their unintentional contribution to my sanity. Trudy Taylor endured many long road trips and shared more than a few tense moments in front of angry fishermen's committees. Grettel Baldizon of Glovertown and Chris Feltham of Eastport opened their living rooms to me, prepared scrumptious meals and tolerated endless discussions of fish and ships. Catherine and Arthur gave me a home away from home in Ontario. Marianne Ward provided impeccable editing skills and unwavering support; she was always there to help move things along. Finally, I offer a special thanks to all of my family, but especially to my parents, Mary and Ron, for believing.

*I still get up before the day breaks*
*And I still walk down to the shore*
*I watch the sun rise from the eastern ocean*
*But I don't sail to meet it anymore.*

From the song, "Peter's Dream" (Gallant, 1994).

***For Robert Graham.***

A well-respected and much-loved champion of marine conservation in Canada. I never had the opportunity to meet Bob before his premature death but goodness knows, on several occasions I felt that he was with me. Like the time a sudden Autumn gust blew each and every page of his unfinished dissertation along Bower Street in the fair old harbour town of St. John's. Could I retrieve all of the pages which had been entrusted to me earlier that day? Was I prepared for the challenge, and could I pick up from where he had left off?

Bob was reportedly very generous with his students in Recreation and Leisure Studies at the University of Waterloo and though he has been remembered elsewhere, I wanted to provide something for his research in that part of the world for which he had such personal fondness, and for which his influence was not fully acknowledged while he was still alive. May the spirit of his forward-looking work with the coastal peoples of northeast Newfoundland live on in the present research.

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## LIST OF ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| ACAP | Atlantic Coastal Action Program |
| ACZISC | Atlantic Coastal Zone Information Steering Committee |
| AGC | Atlantic Geoscience Centre |
| CARIS | Computer Aided Resource Information System |
| COA | Canada Oceans Act |
| CHS | Canadian Hydrographic Service |
| COSEP | Career Oriented Summer Employment Program |
| CPS | Canadian Parks Service |
| CWS | Canadian Wildlife Service |
| DFO | Department of Fisheries and Oceans |
| DTM | Digital Terrain Model |
| EC | Environment Canada |
| ECDIS | Electronic Chart Display and Information System |
| EIFC | Eastport Inshore Fishermen's Committee |
| ENC | Electronic Navigation Chart |
| FRCC | Fisheries Resource Conservation Council |
| FSSEP | Federal Summer Student Employment Program |
| GIS | Geographic Information Systems |
| GSC | Geological Survey of Canada |
| MHW | Mean High Water |
| MLW | Mean Low Water |
| MUN | Memorial University of Newfoundland |
| NAD | North American Datum |
| NAFO | Northwest Atlantic Fisheries Organization |
| NFLD | Newfoundland |
| NMCA | National Marine Conservation Area |
| NTS | National Topographic Series |
| NTNB | Newfoundland Topographical Names Board |
| PRA | Participatory Rural Appraisal |
| RRA | Rapid Rural Appraisal |
| SPANS | Spatial Analysis System |
| TAGS | The Atlantic Groundfish Strategy |
| TNNP | Terra Nova National Park |
| UTM | Universal Transverse Mercator |

# CHAPTER 1

## *INTRODUCTION*

The precipitous decline and eventual collapse of the Northern cod stocks on Canada's East Coast have prompted great debate over precautionary approaches to the management of living marine resources (Association des Pêcheurs Professionels Acadiens, 1995; Fisheries Resource Conservation Council, 1995b; National Round Table on the Environment and the Economy, 1995; Russell and McConnell, 1995). Amongst the range of conservation measures being promoted to safeguard against future stock failures, marine protected areas (MPAs) have attracted perhaps the most attention and interest from academic researchers, government agencies, environmental groups and community organizations. Notwithstanding the scientific basis for establishing such refugia in the sea, the very notion of a marine "reserve" implies the cessation of some or all fishing activity, particularly so in regions like northeast Newfoundland where most coastal space is used by small boat fishers. To date, however, there have been few Atlantic Canadian efforts to implement harvest restrictions and area closures through processes that incorporate fishers and their harvesting patterns. Cartographic visualization of the marine space utilized for fisheries could help catalyze marine protected area establishment by illustrating site-specific fisher concerns in the emerging conservation dialogue among harvesters, scientists and managers.

The research described in this thesis has, as its primary purpose, the development of a collaborative process for mapping inshore fishing grounds in the waters adjacent to the Eastport Peninsula in Bonavista Bay, Newfoundland. The investigation occurred over a three year period from February 1994 to December 1997 within the context of a larger undertaking, namely, a Parks Canada marine conservation area planning exercise for Northeast Newfoundland. The research comprises three principal components: i) an examination of human factors and information needs in fisheries-related MPAs, ii) participatory research carried out with fishers to chart inshore harvesting grounds, and iii) a technical procedure involving the digital generation of a marine basemap.

Chapter 1 introduces the thesis and begins with a research overview, some background on MPAs, local knowledge and geographic information systems, and a description of the principal research goals and objectives. In order to help put the research in context, some explanation is then provided to situate the investigator and the principal collaborators. Next, the research approaches and methods are presented. After some comments are made on the language and format of the thesis, the Introduction closes with a synopsis of each chapter.

## 1.1 RESEARCH OVERVIEW

This thesis, which is intended to satisfy the requirements for a Master's Degree in Geography, is an interim project report reviewing the findings that have emerged from three years of investigation. The research evolved during three summers of employment and over several research terms with the Department of Canadian Heritage in Newfoundland. During this period, I worked from Terra Nova National Park in exploring the possibility of establishing a national marine conservation area (NMCA) in Bonavista Bay.

In my early terms with Parks Canada, I conducted a review of marine resource data and assessed information needs and gaps for NMCA planning and management (see Macnab, 1995a). I was also invited to participate in small boat fishing activities with local harvesters.[1] Later, I co-facilitated a series of community meetings to present and discuss conservation measures with inshore fishers (see Taylor, 1996 and Appendix B). Through the course of these investigations, three central issues emerged and became the basis for my thesis research: i) fishers expect to participate actively in the selection and design of marine reserves where harvest might be limited; ii) areas fished by small boats remain largely uncharted and unknown to those outside the fishery; and iii) existing cartographic products are unsuitable for marine resource inventory purposes. To address these concerns, I endeavoured to produce maps of inshore fishing grounds by employing participatory research methods and digital cartographic techniques.

Working in collaboration with several government agencies, a local fishermen's committee and two geomatics firms, I oversaw the digital production of a basemap depicting

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[1] Fisherman and occasionally, fisherwoman, remain the titles of choice for Newfoundland fishery workers. Here I adopt gender neutral designations considered appropriate for academic discourse (e.g., fisher and harvester) except in quotes and where reference is made to fishermen's committees and other official names.

topographic features and hydrographic data for the Eastport Peninsula, a prominent Bonavista Bay landform adjoining Terra Nova National Park. As a pilot project, this basemap was used during participatory mapping sessions with fishers to delineate inshore harvesting areas. Multiple harvest area sheets were compiled and digitally rendered to produce composite maps of the main species fished and gear types utilized.

## 1.2 BACKGROUND

### 1.2.1 Marine Protected Areas

Conservation is fast becoming a legitimate and enduring use of the world's oceans along with other relatively new sea uses like aquaculture, hydrocarbon extraction and aggregate mining (Smith and Lalwani, 1992). The most tangible evidence of this trend is the growing designation of protected areas on the sea.[2] A widely accepted definition from the International Union for the Conservation of Nature (IUCN) describes a marine protected area (MPA) as "any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law to protect part or all of the enclosed environment" (Kelleher and Kenchington, 1992, 7).

MPAs have been established for many purposes and to meet a variety of objectives including biodiversity conservation (de Fontaubert *et al.*, 1996; Sobel, 1996; Ticco, 1995), tourism and recreation (Agardy, 1993; Dixon *et al.*, 1993; Marsh, 1985), biophysical representation (Parks Canada, 1994), scientific study (Lindeboom, 1995), underwater archeology (Firth and Ferrari, 1992) and fisheries management (Shackell and Lien, 1995; Gimbel, 1994; Polacheck, 1990). Statutory MPAs dominate, but there are voluntary reserves in existence (Gubbay and Welton, 1995; Graham and Huff, 1985) as well as community-based refugia (Johannes, 1978). MPA size varies greatly, as does the degree of protection offered; there are large multiple-use MPAs with highly protected cores as exemplified by Australia's Great Barrier Reef Marine Park (Kelleher and Kenchington, 1984; Kenchington, 1990) and smaller "no take" MPAs such as New Zealand's seminal Cape Rodney to Okakari Point Marine

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[2] A recent survey counted more than 1300 MPAs worldwide (Kelleher *et al.* 1995). Also see surveys in Dartnall (1989), Huff (1983) and Graham and Huff (1983). Ballantine (1991) claims that over 80 titles are in use to designate various types of protected areas on the world's oceans and along its many seacoasts. I use the following terms interchangeably with "marine protected area": reserve, harvest refugia, closed area and highly protected zone or core.

Reserve (Ballantine, 1991) and British Columbia's Whytecliff Park (Kelsey *et al.*, 1995).

Despite a long and proud history of national parks and other protected areas, Canadian efforts to conserve representative and sensitive marine areas lag far behind achievements in terrestrial conservation (Duffus and Dearden, 1993; Graham *et al.*, 1992). Recognition of this unfortunate record has prompted a spate of interest in Canada as evidenced by the significant number of conferences and publications to appear during the 1980s and 1990s. The move towards establishing marine protected areas has been accelerated by recent policy development (Parks Canada, 1994; Canadian Wildlife Service [Zubrigg, 1996]; Fisheries and Oceans, 1997), increasing academic interest (e.g., Duffus and Dearden, 1993; Graham, 1990; Lien and Graham, 1985; Pitcher, 1997; Shackell and Willison, 1995) and pressure from non-governmental organizations (Canadian Arctic Resources Committee [Beckmann, 1996]; World Wildlife Fund [Recchia and Broadhead, 1995; Thurston, 1997]; Marine Life Sanctuaries Society of British Columbia, n.d.). In Newfoundland, there has also been growing interest from coastal communities in the potential for protected areas to preserve and enhance the traditional inshore fisheries (National Round Table on the Environment and the Economy, 1995; Protected Areas Association of Newfoundland and Labrador, 1996; Bryant and Martin, 1996; Taylor, 1995). MPAs have much to offer fisheries-dependent regions; in particular, MPAs can act as "insurance policies" (Ballantine, 1995) or "bet-hedging strategies" (Clark *et al.*, 1995) against overfishing. That being said, there still remains a considerable gap between the policy-makers, NGO's, academic researchers and fish harvesters.

Three factors account for the strong likelihood that northeast Newfoundland will become a testing ground for fisheries-related MPAs in Canada over the next five to ten years. First, redirection of harvesting effort away from cod and other closed groundfish stocks has placed detrimental pressures on remaining species. This trend has been recognized by fishers (e.g., see Observation 32 in Appendix B; Feltham *et al.*, 1996; Potter, 1996; Taylor, 1995) and highlights the urgent need for lobster reserves (see FRCC, 1995b) and other forms of harvest restriction. Second, the anticipated re-opening of the Northern[3] cod fishery off Labrador and northeast Newfoundland is drawing recommendations for lasting area closures. Scientific

[3] The "Northern" cod stocks are situated largely off the coasts of northeast Newfoundland and Labrador. This aggregation is thought to be distinct and separate from stocks in the Gulf of St. Lawrence and on the Scotian Shelf.

opinion is calling for a minimum of seasonal protection in areas where spawning fish congregate (e.g., see Hutchings, 1995), whereas small boat fishers have called for permanent area closures and bans on the large funnel-like nets used by otter trawlers.[4] Third, Parks Canada has proposed a National Marine Conservation Area for the waters of Bonavista and Notre Dame Bays (Mercier, 1995). With a purported focus on sustainable fisheries (Parks Canada, 1997), the NMCA feasibility study will stress community involvement and resource stewardship by local fish harvesters.

Although "marine protected area planning and integrated management is in its infancy as a formal discipline" (Agardy, 1995, 7), human factors have already emerged as prime determinants (Brunckhorst, 1994; Fiske, 1992; Gubbay, 1995; Kelleher *et al.*, 1995; Kelleher and Kenchington, 1992). As with ocean management in general, MPA management is rarely about the direct management of resources themselves; instead, it "is predominantly about managing how people use or do not use an area" (Laffoley, 1995, 105).[5] This point has been demonstrated in successful MPAs around the world where activity patterns, local knowledge and traditional management practices have been incorporated to secure practical meaning for adjacent communities (Wells and White, 1995). MPAs can "provide a mechanism for giving local people a sense of stewardship and control over their own futures" (Agardy, 1995, 7) and as the move to establish MPAs in northeast Newfoundland grows, the documentation of fishing grounds and related lore will be an important step in this direction.

### 1.2.2 Local Knowledge

The rich knowledge base of traditional resource users has been recognized as an important complement to scientific modes of inquiry for environmental management and

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[4] Just as there are places on land where no extraction and very little activity is permitted, scientists have suggested that there should be places in the sea where no harvesting occurs (e.g., Auster and Malatesta, 1995; Ballantine, 1995; Lien, 1995a; Lindeboom, 1995). By asking for a ban on dragger technology, fishers are not, however, necessarily calling for an end to fishing, only more discriminate catch methodologies. A terrestrial analogy might be the call to replace machinery-assisted clear cutting with horse-aided selective harvesting in British Columbia's old growth forests.

[5] Sea use planning, and more generally, ocean management (Miles, 1989; Smith and Lalwani, 1984; Vallega, 1992; Young and Fricke, 1975), are "fundamentally concerned with comprehensive spatial allocation" (Smith, 1985, 111). Graham *et al.* (1992) suggest that much of this experience and literature has been overlooked in Canadian MPA studies to date.

protected areas planning (e.g., Freeman, 1978; Graham and Payne, 1990; Harmon, 1994; Inglis, 1993; IUCN Inter-Commission Task Force, 1997; Johnson, 1992; Pimbert and Pretty, 1995; Sadler and Boothroyd, 1994; Stadel and Nelson, 1995). Despite this broad recognition, most approaches to conservation continue to neglect "... the needs and aspirations of local people, their indigenous knowledge and management systems, their institutions and social organizations and the value to them of wild resources" (Pimbert and Pretty, 1995, i).

Known variably as indigenous knowledge, traditional ecological knowledge, ethnoscience, and customary users' knowledge, local knowledge has been defined as "the sum of the data and ideas acquired by a human group on its environment as a result of the group's use and occupation of a region over many generations" (Mailhot, 1993, 11).[6] Johnson suggests that a body of local knowledge "includes a system of classification, a set of empirical observations about the local environment, and a system of self-management that governs resource use" (1992, 4). Research on local knowledge in marine and coastal settings has been undertaken by a range of investigators spanning anthropology, ecology, geography and sociology (e.g., Clay, 1996; Cordell, 1989; Dyer and McGoodwin, 1994; Johannes, 1978; Neis, 1992; Nietschmann, 1995; Ruddle, 1994b).

More specifically, there has been growing recognition that local knowledge should be included in fisheries and coastal management regimes (e.g., Coastal Zone Canada, 1996; Food and Agriculture Organization, 1995; Maguire *et al.*, 1995; National Advisory Board, 1994; Neis, 1992). The myriad demands from communities, NGOs and scientists in Newfoundland are expressed succinctly in the *Report of the Partnership for Sustainable Coastal Communities and Marine Ecosystems:*

> There is a neglect of fishers' information and an absence of serious efforts to use this to supplement scientific research. ... Partnerships should be established and supported between federal and provincial governments to develop appropriate databases for integrating scientific and traditional knowledge. (National Round

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[6] Johnson observes that "nonindigenous groups such as outport fishermen" also acquire knowledge and skills "through hands-on experience living in close contact with their environment" (1992, 4). The term "local knowledge" avoids some of the semantic and conceptual problems associated with other labels and is adopted here after Ruddle (1994b). (The Canadian Hydrographic Service also uses the term in sailing directions when it is suggested that "local knowledge" will be necessary for safe navigation [e.g., CHS, 1987]). Canadian reviews of the literature on indigenous ecological knowledge are available in Fast and Berkes (1994), Freeman and Carbyn (1988) and Gombay (1995). For international reviews, see Brokensha *et al.* (1980), Warren *et al.* (1994) and the *Indigenous Knowledge and Development Monitor*, a Dutch jounal published in paper and electronic formats.

Table, 1995, 32)

Another federal body, the Fisheries Resource Conservation Council (1994, 1995a), has recommended to the Minister of Fisheries and Oceans that the department work to incorporate the views and experience of fishers.[7]

Complexity and gaps in scientific understanding have often been suggested as reasons for collecting local knowledge in marine ecosystems, particularly with regards to conservation planning (Agardy, 1995; Kenchington, 1990; Norse, 1993). Following early recognition in the Pacific that local knowledge had much to offer MPA planning and management (e.g., Johannes, 1984) researchers have since attempted to incorporate local knowledge into Caribbean, Southeast Asian and Latin American MPAs (e.g., Carter *et al.*, 1994; Diegues, in press; Wells and White, 1995). The field has also attracted strong research proponents in Canada (e.g., Graham and Payne, 1990; Graham *et al.*, 1992; Neis, 1995; Younger *et al.*, 1996) many of whom have suggested that spawning areas and other "biological hotspots" in need of protection – and often overlooked by conventional scientific surveys – are well known to local observers.

### 1.2.3 Geographic Information Systems and Digital Cartography

As with graphics in general, spatial data are increasingly modelled and visualized with the aid of computers. Geographic information systems, which are fast "becoming ubiquitous and powerful tools for geographic inquiry" (MacEachren *et al.*, 1992, 130), enable compilation and synthesis of the multiple information sources (e.g., see Atlantic Coastal Zone Information Steering Committee, 1995) which exist for the world's oceans in both scientific and local formats. The flexibility afforded by GIS permits the storage, analysis and display of georeferenced data. At the land-sea interface, where most information about resources and uses has a distinct spatial component, "GIS are rapidly taking over from the traditional cartographic techniques that have typified most coastal mapping and resource inventory projects" (Ricketts,

[7] This has been addressed, in part, by the sentinel fishery, an Atlantic Canadian sampling experiment that incorporates the gear and expertise of inshore harvesters into the stock assessment process. The term "fishery workers' ecological knowledge" has been used to encompass a wider understanding, one that includes the observations of fish plant workers (Maguire *et al.*, 1995; Neis, 1995).

1992, 83).[8]

Oilspill sensitivity mapping has led to the proliferation of biological and geological databases for Canada's various shorelines (e.g., Fenton and Ricketts, 1994; Golumbia, 1995; Harper *et al.*, 1994; OCC Ltd., 1994; Sherin and Edwardson, 1995; St-Laurent *et al.*, 1996; Wedeles *et al.*, 1993). Additionally, a range of GIS have been developed specifically for fisheries applications: marine biogeography (Brown et al., 1996; Harper *et al.*, 1990; Howell *et al.*, 1996; Warner, 1987); coastal fish habitat in the tropics (Looijen *et al.*, 1995); aquaculture and inland fisheries (Meadon and Kapetsky, 1991); fisheries in a watershed context (Giles and Nielsen, 1992) and freshwater fisheries in the Great Lakes (Maynard, 1990). The use of GIS has also been described for MPA and marine conservation planning in Belize (Gibson *et al.*, 1993; Mumby *et al.*, 1995), Canada (Mondor, 1995), Central America (Nietschmann, 1995), Florida (Murphy and Smith, 1995), Australia (Davies and Wedderburn-Bisshop, 1989; Puotinen, 1994) and the Netherlands (Schauser *et al.*, 1992).

Many publications and policy statements recommend the use of GIS (e.g., Fisheries and Oceans, 1997; Kelleher and Kenchington, 1992; Parks Canada, 1994; Yurick, 1992), but very few explain anything of the limitations or underlying theories. Furthermore, despite the analysis and modelling potential of GIS in coastal and marine environments, the technology is still used primarily as a mapping tool for scientific applications and decision support.[9] There are many reasons for this, not least of which are the challenges and expenses posed by: i) a mobile ecosystem that demands mapping in four dimensions, and ii) a management regime that is administered by numerous agencies, each with distinct and at times redundant, conflicting and incompatible data collection programs. Indeed, given these fundamental challenges, a certain

[8] For a general discussion of the transition from paper maps to computer databases and digital cartography, see MacEachren (1987) and Monmonier (1985). In the context of coastal and marine resource inventories, paper maps and atlases persist (e.g. Wermund *et al.*, 1989) but there is clear movement towards electronic compilation. GIS and digital databases (e.g. Butler, Scarratt and Macleod, 1986; Mumby *et al.*, 1995; Needham and Lanzer, 1993; Ramster, 1991; Scarratt, 1989; Tortell, 1992).

[9] For a general discussion of GIS and emerging information technologies in marine and coastal environments, see any number of overview papers (e.g., Bartlett, 1994; Bradbury, 1995; Canessa, 1997; Davis and Davis, 1988; Furness, 1994; Gordon, 1994; Humphreys, 1989; Ji and Johnston, 1995; Langran and Kall, 1991; Lockwood and Li, 1995; O'Regan, 1996; Ricketts, 1992). Also see bibliographies and conference proceedings devoted to coastal applications in GIS (e.g., Bartlett, 1993; Furness, 1995; Rickman and Miller, 1995) and refer to the electronic archives of the SeaGIS listserver – originally CoastGIS – which are maintained at the University of Cork.

amount of perseverance and creativity is required to harness the potential of GIS in coastal and marine environments.

## 1.3 THESIS GOALS AND OBJECTIVES

The overall purpose of the research is to investigate the relationship between fishing and the establishment of MPAs in Bonavista Bay. The research orientation is that of applied geography and human ecology (Nelson, 1991a) with a particular focus on mapping and the potential role of emerging information technologies. As a case study, the thesis seeks to develop and initiate a collaborative process for mapping the inshore fishing grounds surrounding the Eastport Peninsula in Bonavista Bay. Three primary research goals and related objectives are as follows:

*1) To facilitate participatory mapping of inshore fishing grounds as an expeditious means for resource users and government agencies to begin a dialogue of site and species specific concerns.*

- To document local toponyms for terrestrial and submarine features
- To discuss location and way-finding techniques used by fishers
- To determine species fished, grounds, and gear types used
- To learn about spatial management controls at the community level

*2) To collect, compile and visualize marine resource information with fishers for use in their own deliberations and in their dealings with outside agencies.*

- To provide technical support in an interactive and adaptive fashion
- To coordinate exchanges of scientific information and fisher knowledge
- To record participant concerns and suggestions emerging from the exercise
- To discuss potential ways in which the resulting maps could be utilized

*3) To enhance and further develop procedures for the technical and social aspects of coastal resource mapping.*

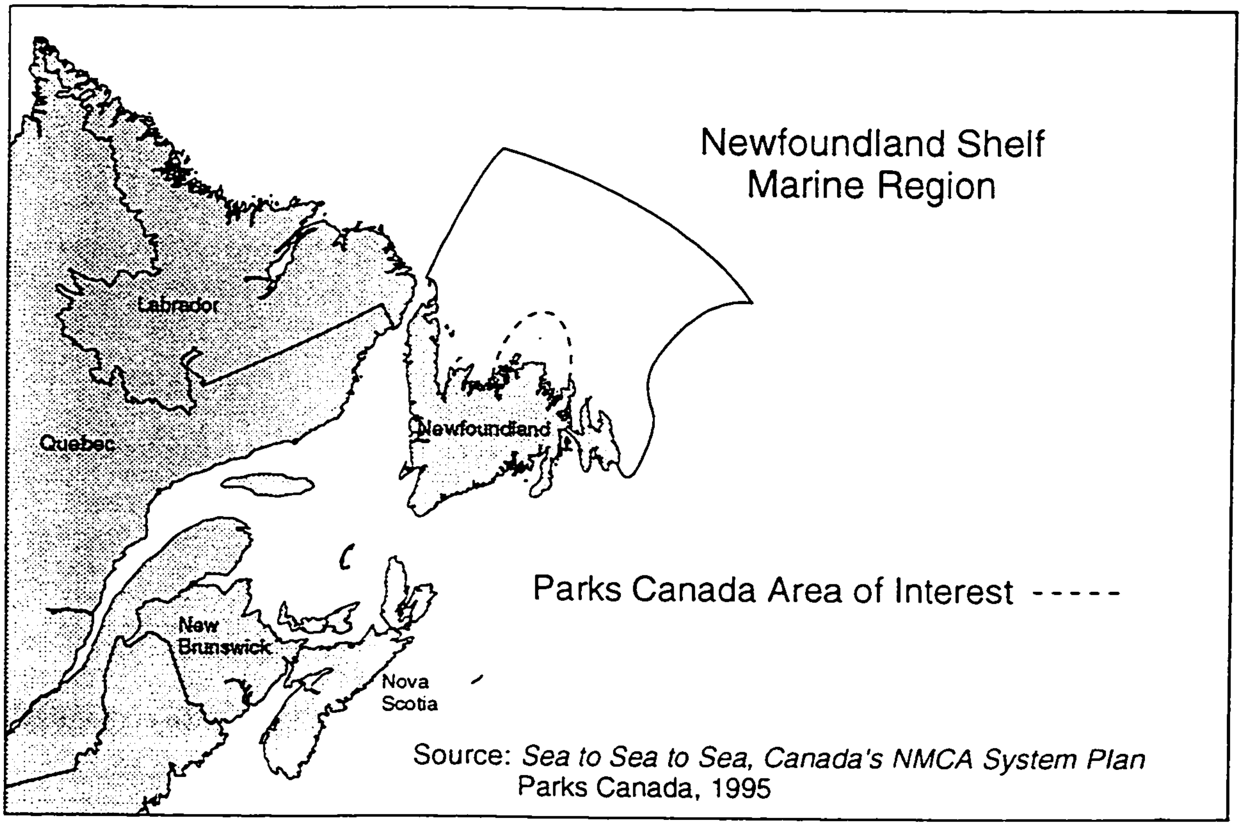
- To customize scientific data with GIS to assist local knowledge documentation
- To integrate hydro and topo digital data for improved map communication
- To record the challenges, problems and limitations in such an inventory
- To consider further work suggested by the present research

## 1.4 RESEARCH CONTEXT

### 1.4.1 Newfoundland Shelf Marine Conservation Area

The research described in the thesis was carried out as part of a marine conservation initiative launched by Parks Canada in northeast Newfoundland. When the research was conducted, a planning team based at Terra Nova National Park was beginning to examine conservation options for the waters of Bonavista Bay and eastern Notre Dame Bay. This area (see Figure 1.1) was selected by Parks Canada to best represent the biophysical characteristics of the Newfoundland Shelf marine region (see Ledrew, Fudge and Associates, 1990 and Mercier, 1995) and has since been proposed as a candidate national marine conservation area (NMCA).

Figure 1.1 Parks Canada Area of Interest on the Newfoundland Shelf




NMCAs are intended to "protect and conserve for all time national marine areas of Canadian significance that are representative of the country's ocean environments and the Great Lakes, and to encourage public understanding, appreciation and enjoyment of this marine heritage so as to leave it unimpaired for future generations" (Parks Canada, 1994, 49). From its antecedents, the National Marine Park concept (see McBurney, 1978; Mondor 1992b; Parks Canada, 1988), Canada's NMCA designation has evolved along with the international MPA experience to incorporate sustainable resource use:

> National Marine Conservation Areas are marine areas managed for sustainable use and containing smaller zones of high protection. They include the seabed, its subsoil and overlying water column and may encompass wetlands, river estuaries, islands and other coastal lands. They are owned and managed by the Government of Canada. While activities such as undersea mining, oil and gas exploration and extraction would not be permitted within the boundaries of NMCAs, most traditional fishing activities, managed on a sustainable basis, would continue. (Parks Canada, 1995, 8)

National Marine Conservation Areas are meant to:

- Represent the diversity of Canada's marine ecosystems
- Maintain marine ecological processes and life support systems
- Preserve biodiversity
- Serve as "models" of sustainable utilization of species and ecosystems
- Facilitate and encourage marine research and ecological monitoring
- Protect depleted, vulnerable, threatened, or endangered species and populations and preserve habitats considered critical to the survival of these species
- Protect and maintain areas critical to the lifecycles of economically important species
- Provide interpretation for the purposes of conservation, education and tourism

NMCAs are managed in partnership with other government departments and local stakeholders. While existing agencies continue their roles in marine management (e.g., Fisheries and Oceans in capture fisheries and Transportation in marine shipping), Canadians are encouraged to become stewards of their marine heritage so as to ensure long term sustainability and the preservation of ecological integrity. Typically, once a representative area is selected, Parks Canada undertakes studies to determine the feasibility of establishing an NMCA. In Newfoundland, this involved consultation with other branches of government as well as discussions with local communities and user groups to gauge general interest in marine protected area concepts.[10] Fishers, the dominant resource users in the NMCA study area, were interested in "no-fishing" stock

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[10] Appendix B describes general observations from community meetings. Two previous publications describe my preliminary research: *Fisheries Resources and Marine Heritage in Newfoundland: Crisis, Conservation and Conflict* (1996d) and *Exploratory Planning for a Proposed National Marine Conservation Area in Northeast Newfoundland* (in press).

replenishment zones as well as protection for spawning grounds and nursery areas.[11] In meetings, harvesters stressed the need for meaningful involvement in NMCA planning and management as well as strict attention to historical fishing grounds.

### 1.4.2 Research Collaborators

The Eastport Peninsula Inshore Fishermen's Committee and Parks Canada were important collaborators during the course of my research at Terra Nova National Park in Newfoundland. The Department of Fisheries and Oceans, St. John's, and several other organizations were also integral to the research.

#### *Eastport Peninsula Inshore Fishermen's Committee*

The communities surrounding Terra Nova National Park were given early attention in Parks Canada's initial outreach work because of the large number of resident fishers who harvest in the waters adjacent to the Park. In particular, fishers from the Eastport Peninsula worked closely with Parks Canada to discuss the proposed NMCA and to explore MPA concepts as they might be applied in the lobster fishery.

Most fish harvesters in the Eastport area are members of the Eastport Peninsula Inshore Fishermen's Committee (EPIFC).[12] Committee members – approximately 70 – all belong to the Fisheries, Food and Allied Workers Union. The Committee deals with local management issues and collects the views of fishers for representation at regional and provincial meetings of the Newfoundland Inshore Fishermen's Council. The Committee also sends representatives to DFO stock assessment and species advisory committee meetings.

Since the groundfish moratorium was declared (January, 1992), Committee members

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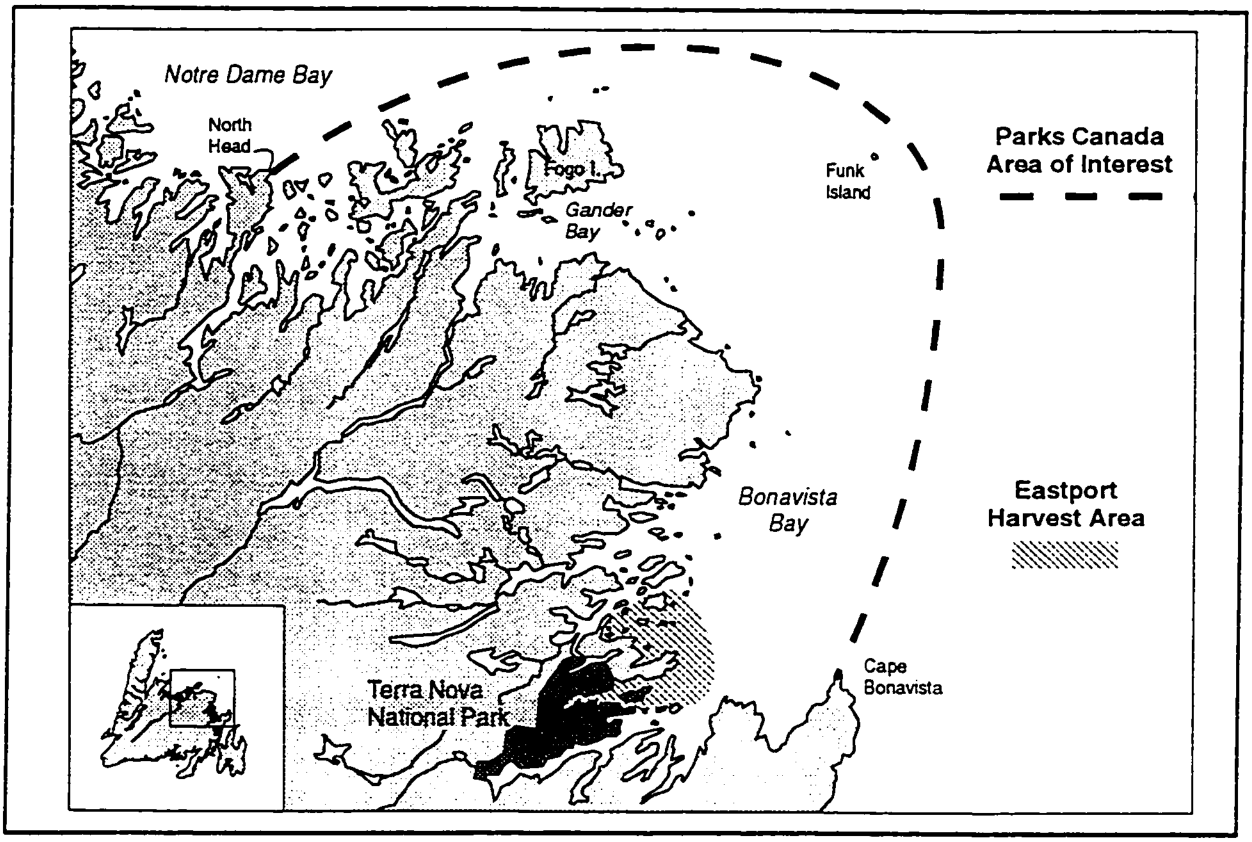
[11] As I will discuss in the next chapter, there is considerable harvester interest in no-fishing protected areas for single species such as lobster. Zones where certain gear types might be restricted (e.g., herring seines) have also been the subject of some debate. Off-limit zones and "no-take" cores, however, are still highly contentious concepts: for example, in areas where protection for lobster stocks is desirable, there may be interest in the experimental sea urchin fishery.

[12] The Newfoundland inshore fishery is a small boat fishery with few vessels exceeding 45 feet. Most inshore fishers work fairly close to the land: usually less than 3 miles offshore, and rarely beyond the 12 nautical mile territorial sea. (The sight of land remains important for location finding. I discuss the adoption of modern navigational aids in later sections.) Many harvest lobster and other nearshore species with fixed and mobile gear from open speedboats. See Gough *et al.* (1994) and Story *et al.* (1982) for additional Newfoundland fishing terminology and definitions.

have worked to safeguard remaining fisheries such as lobster (Feltham *et al.*, 1996) and crab in their fishing territory (see Figure 1.2 and Chapter 5). Maps showing member fishing grounds could be used to further illustrate site-specific conservation and management concerns to Parks Canada, DFO and other government agencies. Harvest area maps could also be used in a wide range of situations where the Committee wished to demonstrate user rights and marine tenure.[13] Clearly, as Figure 1.2 attests, marine conservation emanating from the land base at Terra Nova National Park would be a major concern for these adjacent fishers. The harvesters' proximity to Terra Nova, a committee structure and keen interest, coupled with existing relationships and an established rapport made the EPIFC a strong candidate for collaborative mapping. On an organizational level, the decision to work with the Committee helped to bound the thesis study area.

Figure 1.2 Eastport Harvest Area




[13] Traditional user rights and marine tenure are discussed at length in Chapter 3.

*Parks Canada*

Two policy references help to situate my research within the Parks Canada NMCA investigation for Bonavista Bay. First, Parks Canada is obligated to meet with residents and user groups to determine ways of incorporating local knowledge:

> Parks Canada will then initiate discussions with local communities and affected user groups to seek their cooperation in conducting a feasibility study, to determine the best timing and process for their active participation, and how to incorporate the knowledge of individuals living and working in the area. (Parks Canada, 1994, 51)

Second, during the course of a feasibility study, Parks Canada is required to prepare a draft zoning plan that describes permissible uses, "including fisheries" (Parks Canada, 1994, 51):

> Zoning is an essential part of the national marine conservation area management plan. Its main purposes are to define and map the different levels of protection and use that will occur in the marine conservation area and to separate potentially conflicting human activities. (Parks Canada, 1994, 53)

Providing support for a participatory mapping exercise with fishers was a demonstration of Parks Canada's interest in joint planning with resource users. In addition to collecting local perspectives, the research would also help the agency to acknowledge harvest areas well before the socially delicate exercise of preparing what could be a contentious draft zoning plan.[14]

*Department of Fisheries and Oceans*

With the arrival of the Canada Oceans Act (1996), the Department of Fisheries and Oceans was established as the lead agency for coastal zone management and marine protected areas in Canada. The Habitat Management Branch of DFO's Science Section has pursued community-based coastal resource inventories in Newfoundland to support this expanded departmental role (Fisheries and Oceans, 1996). As a central coordinating agency for coastal inventories, the Branch was interested in the methods developed and tested during the course of my research; officials also wished to add the collected information to a Province-wide database.

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[14] Zoning instruments have become the primary means of allocating sea use in space and time (Laffoley, 1995). Vertical zoning, as conceptualized for MPAs in Canada (Parks Canada, 1994; Fisheries and Oceans, 1997), might regulate use at different levels in the water column (e.g., bottom fisheries or surface use of motorized personal watercraft) while temporal zoning could restrict activities during specific times (e.g., spawning seasons). Canadian MPAs are also likely to borrow from conventional fisheries management (see Parsons, 1994) and implement zones based on gear restrictions (e.g., scallop dredges) and species limitations (e.g., Atlantic salmon).

*Other Contributors*

The research evolved with contributions from several other organizations. The Canadian Hydrographic Service released new sounding information for the Eastport area through their data distributor, Nautical Data International. Digital topographic map files were provided by the Surveys and Mapping Division of the Newfoundland Department of Natural Resources. Universal Systems Limited of Fredericton made available a student license for their CARIS (Computer Aided Resource Information System) software to enable the completion of this research. Finally, instructors and students in a geomatics training program operated by Data Services International of St. John's provided technical assistance and plotting services during the preparation of the Eastport Peninsula basemap.

### 1.4.3 Research Motivation

*Pragmatic Considerations*

From an operational or practical perspective, the research was motivated by the need to select theories and apply methods that would stimulate action-oriented conservation dialogue in Bonavista Bay. It became quite clear in my research terms with Parks Canada – a time during which fishers began discussing options for harvest refugia with scientists and managers – that moving from marine protected area concepts to site selection would be accelerated by documenting the actual grounds fished.

*Academic Interests*

Beyond the intended goal of producing a thesis that would meet the qualifications for a Master's degree, an interest in problem-oriented marine geography stimulated the academic nature of this research. My undergraduate examination of aquaculture planning in Nova Scotia (Macnab, 1994) introduced me to: i) the inadequacy of sea use planning as currently practised in Canada, ii) human perception in marine environments, and iii) geomatics technology in coastal areas with complex patterns of usage. Undertaking participatory cartographic research on fishing space and MPAs in Newfoundland allowed me to continue investigating these under-represented areas of Canadian geographical inquiry.

*Personal Basis*

Personal motivation to conduct the research was rooted in two related spheres: first, as a retired offshore fish harvester, I was acutely aware of the need for marine conservation. I also believed that conservation measures would be far more successful if they incorporated the views and experience of fishers. Second, a work history in literacy and experiential education led me to consider the possibilities of environmental learning where people could use maps of their own derivation. If adult humans learn to read and write more comfortably by incorporating their own words and manner of speaking – the much-debated "whole language" approach – I reasoned that they would also respond more actively to maps drawn by their own hands and based on their own experience of place.

## 1.5 RESEARCH APPROACH

Owing to the research context, i.e., mapping against the backdrop of an NMCA proposal and a mix of interested parties, there was a risk of alienating fishers, the key information providers. It was important, therefore, not to let the research become an extractive government exercise or an impersonal academic survey – it had to become a reflection of community interests. To address this concern, the mapping exercise was envisioned as an evolving ***collaborative*** process, one that would incorporate the views and concerns of community participants in an ***interactive*** and ***adaptive*** manner, as recommended by Nelson (1991a).

### 1.5.1 Collaboration

The necessity for collaborative approaches to research in resource and environmental fields is growing as scholars and professionals work with increasingly well-informed individuals and groups (Harmon, 1994; Irwin, 1995; Pimbert and Pretty, 1995; Posey *et al.*, 1995; Selin and Chavez, 1995; Waller, 1995; White *et al.*, 1994). Moreover, community participants and governing bodies, many with strict guidelines, routinely demand collaboration in research (Dene Cultural Institute, 1994; Greaves, 1994; IUCN Inter-Commission Task Force, 1997; Nelson, 1991a; Posey and Dutfield, 1996).

Gray defines collaboration as "the pooling of appreciations and/or tangible resources, e.g., information, money, labour, etc., by two or more stakeholders to solve a set of problems which neither can solve individually" (1985, 912). In the case of my own research, the problem was how to map fishing grounds; solving it would involve the collaboration of several players with complementary skills, resources and knowledge.[15]

### 1.5.2 Interaction and Research Adaptation

In essence, community-based collaborative research "involves a partnership of equal parties in which local communities are treated as expert collaborators" (Posey and Dutfield, 1996, 140). To develop a mapping partnership with expert local collaborators in Eastport, I interacted with inshore fishers at all stages of the research. Working relationships were established very early in the process through the kinds of interaction recommended for initiating collaborative projects in marine settings:

> Activities include making contact with important local leaders, establishing rapport with the community, attending meetings, initiating the project with the community, answering questions about the project and the roles of all concerned, participating in community life, and identifying potential leaders. (White *et al.*, 1994, 110)

This interaction cultivated an interest in the project and also enhanced the mapping process. Ongoing discussions with Eastport fishers improved the research by helping me adapt to their ideas (e.g., conversion of metres to fathoms for better cartographic association) and respond to their concerns (e.g., demonstrating a marine presence with maps). An appreciation for local methods of communication and decision making also aided in the selection of socially appropriate qualitative research methods.[16]

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[15] The widespread effort to involve stakeholders in research and decision-making has ushered in a range of descriptive terms including cooperation (Pinkerton, 1989), co-management (Jentoft and McCay, 1995; Pinkerton, 1994 and 1996), partnership (Kelsey *et al.*, 1995; King *et al.*, 1994; Rodal and Mulder, 1993; Wright and Rodal, 1993) and stewardship (Beavis, 1994; Lerner, 1993; Norrena, 1994). "Collaboration" is less problematic than some of these other terms – it also more accurately describes the nature of my research.

[16] Participatory social research is discussed in the third chapter. Chapter 4 details the interaction and feedback that occurred during the mapping process. My Ethics Review (Appendix C) discusses the appropriateness of formal print-based approaches in a rural setting where less formal oral traditions dominate.

## 1.6 RESEARCH METHODS

Flexibility and pluralism are valuable for applied research in cultural geography, human ecology and planning. Useful practices include wide ranging literature reviews, constant scoping throughout the research, applying different theories, adopting and adapting a variety of methods and learning from as many sources as possible (Nelson, 1991a). Participatory researchers in particular, are "concerned with what works, and what will work better" (Chambers, 1994b, 1262). Further, the documentation "of such a trial and error process and its results and implications is an important part of the research project" (Nelson, 1991a, 126). This section introduces the three principal research methods: i) literature review and scoping, ii) qualitative field work with fishers, and iii) GIS and digital cartography.

### 1.6.1 Literature, Experience and Map Review

As issues, problems and challenges presented themselves, I read and incorporated ideas from a variety of sources. The emergence of a research focus – inshore fishing grounds and collaborative mapping – necessitated that I become acquainted with several fields, methods and theories that were previously unfamiliar to me. What was the Atlantic Canadian and international experience, what seemed to work, and what were the concerns? As detailed in chapters 2 and 3, I looked to literature and documents related to local knowledge, marine resource surveys and community mapping. I read maritime anthropological literature to improve my understanding of inshore fishing space; reviewed methods in participatory rural appraisal to better facilitate fisher mapping sessions; and studied theories of environmental cognition to learn how people might recall spatial knowledge. I also spoke with practitioners (see Personal Communications), attended conferences (Macnab 1996a, 1996b, 1996c, 1997) and participated in resource inventory workshops (Parks Canada, 1995b; Fisheries and Oceans, 1996) to learn, share and receive feedback on my own research. Additional scoping was required to assess and evaluate available source materials for basemapping purposes. This involved the collection and examination of a wide range of published paper maps, electronic charts, compiled databases and digital source files for Bonavista Bay topography and hydrography.[17] At all stages of the investigation, I scanned the changing research context and

[17] Chapter 4 details the range of basemapping materials reviewed.

assimilated information from the activities described above, and in that sense, the process was cumulative, culminating in the present text.

### 1.6.2 Participatory Mapping

Once Eastport fishers agreed to collaborate on the production of harvest area maps, my role in the project was confirmed; I would help capture harvest area knowledge and provide a cartographic rendering of that knowledge. To collect the information on fishing grounds, I met with individual harvesters and small groups to draw impressions of inshore fishing space onto a customized coastal basemap. Elicitation and mapping methods were drawn from the experience in participatory rural appraisal (e.g., Chambers, 1994a, 1994b and 1994c) and indigenous cartography (e.g., Nietschmann, 1995; Poole, 1995b; Robinson *et al.*, 1994). Practitioners in these fields stress the importance of relaxed rapport and an informal check-list of potential items to be mapped (e.g., Fox, 1990). The outside "specialist" facilitates the mapping sessions, occasionally prompting for categories of information, but participants do the actual sketching and map delineation of features and activities.[18]

### 1.6.3 GIS and Digital Cartography

A geographic information system (GIS) was utilized to compile topographic and hydrographic data sources for the Eastport Peninsula. By using the modelling tools available within CARIS, it was possible to convert metric depth soundings to fathoms and then autogenerate a set of bathymetric contours which would be more comprehensible to fishers (see the discussion of technical procedures in Chapter 4 and Appendices F, G, and H). Successive composite land-sea maps were generated, reviewed and reworked to produce a prototype basemap for fishing grounds delineation. After completing the participatory mapping sessions, multiple harvest area sheets were compiled for final digital rendering and map production in a graphics software environment.

## 1.7 OPPORTUNITIES AND CONSTRAINTS

The research context, the general approach and the methods of this thesis provided a

[18] Participatory mapping is reviewed in Chapter 3. The mapping at Eastport is discussed in Chapter 4.

challenging opportunity for scholarship. The benefits of collaborative research were discussed earlier, but three other opportunities deserve mention here: i) access to government data, ii) financial and in-kind support, and iii) professional experience. On the down side, there were three principal constraints in the research as conducted: i) a certain loss of academic freedom, ii) fitting the research to agency needs, and iii) accommodating a range of collaborator expectations and timetables. (See further discussions in Chapters 6). My decision to use digital data provided a tremendous opportunity for cartographic development, but the technical focus also meant that less time was spent in the field than originally intended. As a result, the thesis is more about mapping than it is about fishing grounds.[19]

### 1.8 LANGUAGE AND FORMAT

Because readers of the thesis, like my collaborators and audiences over the last three years, will likely come from a variety of backgrounds, I have attempted to use jargon-free language throughout. If at times the writing appears almost conversational in tone, this is a reflection of the informal manner in which much of the research was conducted. The present write-up is not thesis-like in the classic sense; that is, with a hypothesis, sections on theory, methods and analysis followed by a conclusion. The intent is to provide an interesting and informative report, one that will elucidate the research by describing what I read, what was tried, what failed, what worked and what might be done in the future.

I have made extensive use of footnotes to explain how my thinking evolved and also to reference the numerous papers[20] and bodies of thought consulted. The notes are intended to reflect my learning, influences, the development of ideas and shifts in direction. In some cases, these notes may appear rather personal and introspective; if so, this is an accurate indication of the research process. I have also used appendices to elaborate on certain themes which might disrupt the narrative flow of the report were they included in the main body of the thesis (e.g., Appendix F describes modern hydrographic survey procedures).

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[19] At the outset of my research, I had hoped to generate harvest area maps and see them used in the process of community-based MPA selection and design. Time constraints prevented me from realizing this full application within the thesis reporting period.

[20] References are listed in alphabetical instead of chronological order. I have done this to expedite follow-up research by readers who might be interested in the long lists provided for specific fields (e.g., marine remote sensing).

Contentious policy issues, past experiences and questions of equity are described in a frank manner with full knowledge of the potential for offence; however, this is done in the spirit of communication, dialogue and learning. Where my interpretations are based on private and confidential personal communications, I have chosen to leave the informants anonymous. References or pseudonyms for individual mapping participants have also been avoided with the aim of privacy and confidentiality, and although I refer mostly to "Bonavista Bay" in the thesis, some of the notes and experiences recounted may reflect my interaction and learning in other parts of the NMCA study area (e.g., Fogo Island). Single quotation marks are used to indicate local terminology and paraphrased statements from fishers. Double quotation marks are reserved for published sources and emphasis.

The personal views and opinions expressed in this thesis come as result of extensive reading, interaction with hundreds of individuals and constant reflection as well as through my employment and experience in Newfoundland, but in no way should the content be construed as representative of those agencies and people with whom I have collaborated. I am also conscious of my own audacity and the potential for misrepresentation I might risk by posing as a translator of local knowledge and fisher concerns for a general audience. However, the pressing need for dialogue in Atlantic Canada that might lead to collaborative approaches in fisheries management and marine protected area establishment, to quote Rundstrom (1995), "appears sufficiently urgent to cause me to take these risks anyway."

The project maps included in the thesis were proportioned for the maximum bindable page size (11" x 17") and generated in monochrome. This is in keeping with the trend towards low cost demonstration maps when there is an interest in rapid and wide dissemination of project results (e.g., see Gibson *et al.*, 1993; Poole, 1996; Price *et al.*, 1992; Robinson *et al.*, 1994). Full scale colour maps (1.0m x 1.5m) would have been preferred for their superior visualization potential but production costs would have severely limited duplication and distribution.[21]

[21] By using 11" x 17" grey scale summary maps, it was possible to photocopy quickly and inexpensively a set of draft maps for each participant fisher. The exorbitant cost of colour reproduction, even for page-sized maps, would have made such an undertaking quite unlikely.

## 1.9 THESIS ORGANIZATION

In Chapter 2, I examine the multiple lines of inquiry that led to the research focus on maps and fishing areas in Eastport. Chapter 3 provides a review of the literature in four principal areas: i) marine resource mapping, ii) local knowledge documentation, iii) ethics in participatory cartography, and iv) maritime anthropology. The fourth chapter describes the thesis procedure beginning with the fishers' input, then the basemap review, and lastly, the technical process leading to the customized Eastport chart. In the fifth chapter I present the harvest area maps and discuss the Eastport fishery. In Chapter 6, I examine the research findings, consider potential map uses and discuss future research opportunities. The seventh and final chapter summarizes the research, presents recommendations for further mapping in Bonavista Bay and closes with some final observations. Meeting notes, a review of marine mapping, software procedures, the ethics review and other supplementary materials are included in appendices.

# CHAPTER 2

## *POINTS OF DEPARTURE*

### 2.1 INTRODUCTION

At the outset of my graduate studies, I had a partial notion of the direction that my research might take in Newfoundland, but instead of setting out with pre-defined research goals and objectives, I spent time in the field to discover how my background in the fishery and ocean mapping might be applied in support of MPA establishment. The intent of this chapter then, is to describe the thesis research in an evolutionary sense and more specifically, to reconstruct the progression from a general interest in marine protected areas and local knowledge through to the eventual focus and work on fishing maps at Eastport.[1]

The research direction evolved during three summers of employment with Parks Canada and on an extended research term at Terra Nova National Park (TNNP) supported by the Department of Fisheries and Oceans (DFO).[2] During the initial stages of the research (Summer 1994 thru Summer 1995), I reviewed marine resource information for northeast Newfoundland (see Section 2.3.2), examined past experiences with MPA establishment (see Appendix A) and met with fishers to explore options for marine protected areas in the waters of Bonavista Bay (see Appendix B). The numerous questions and issues that emerged as a result of this early scoping and interaction helped to define and frame the central research problem – how to map fish harvesting areas.[3]

For the sake of clarity in reporting, I've categorized the research evolution. In reality, however, many of the investigations were interconnected, simultaneous and ongoing. The shifts in direction were also more gradual and at times less sequential than the writing here may

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[1] Despite copious note-taking throughout, certain parts of the research have been difficult to reconstruct.

[2] My first two summers of research at Terra Nova were supported by COSEP, the Career Oriented Summer Employment Program of the federal government: the third summer was supported by FSSEP, the Federal Summer Student Employment Program. The DFO support for my research was delivered through the Partnership Program of the Habitat Action Plan. My undertakings as an employee informed my concurrent Master's research and vice-versa to the point that my professional and academic work were really one and the same.

[3] The subsequent branches of inquiry which helped to develop appropriate methodologies are detailed in Chapter 3.

suggest. A research chronology is presented below (Table 2.1) to give an approximate indication of the stages in the research.

Table 2.1 Research Chronology

| Dates | Location: Support | Accomplishments |
|---|---|---|
| 02/94 - 05/94 | Halifax | - developed research proposal with TNNP<br>- qualified for the Master's program at Waterloo |
| 06/94 - 08/94 | TNNP: COSEP | - learned about the NMCA initiative for NF<br>- assessed available marine resource information<br>- reviewed Graham's (1991) customary user survey |
| 09/94 - 04/95 | Waterloo: TA | - coursework in resource and environmental management, parks planning and public participation |
| 05/95 - 09/95 | TNNP: COSEP | - met with fishers; observed crab and lobster harvest<br>- identified data gaps for participatory MPA planning<br>- acquired topo/hydro files for Eastport Peninsula |
| 10/95 - 04/96 | TNNP: DFO grant | - researched community-based mapping programs<br>- fisher meetings to discuss MPAs and mapping<br>- digital compilation of topo/hydro data<br>- study area definition with Eastport Committee |
| 05/96 - 09/96 | TNNP: FSSEP | - adaptation of basemap to fisher specifications<br>- initial sessions with fishers to map harvest areas |
| 10/96 - 12/96 | TNNP: In kind | - final mapping sessions with Eastport fishers |
| 01/97 - 10/97 | Halifax | - digital compilation of harvest area map sheets<br>- hardcopy map generation and thesis preparation |

When I first arrived in Newfoundland, Parks Canada's study of Bonavista Bay was still at the initial stages and the agency was encouraging research that would support further exploration of the NMCA proposal. My early investigations were directed entirely towards the Parks Canada planning effort: what was the local setting, what was the past experience with MPA establishment, what might an NMCA look like in Bonavista Bay, what kind of information was needed, and how might the agency incorporate local knowledge? When Eastport fishers began to discuss seriously the establishment of trial harvest refugia for lobster, a role for applied cartographic research became apparent.

## 2.2 RESEARCH SETTING

### 2.2.1 Biophysical Characteristics

The Eastport area of Bonavista Bay encompasses a wide range of coastal and marine environments including shoals and deep troughs, exposed shorelines, archipelagos and sheltered fjords. The cold waters of the Labrador Current support Arctic benthos in the region; however, the inner reaches and areas of sheltered water are noted for temperate species and a higher diversity (Mercier, 1995).[4] The area is home to a wide variety of pelagic, demersal, crustacean, and anadromous fish species as well as populations of North Atlantic seabirds. Many of the same species that sustain birds and larger fish, particularly the diminutive capelin, also attract several varieties of whales and seals to the region.

### 2.2.2 Historical Overview

The area's rich living resources have supported human occupation for over seven thousand years as evidenced by prehistoric Indian and Eskimo sites, and more recently, by Beothuck and Mi'kmaq records (Carignan, 1977; Major, 1979). Although the region was only settled permanently by the English in the eighteenth and nineteenth centuries (Handcock, 1977; Macpherson, 1977) five hundred years of European presence were commemorated during 1997 in the Cape Bonavista area, the reputed 1497 landfall of John Cabot.[5] The early communities were coastal and most, with the exception of a few towns built during periods of logging activity, were populated by fishing families who carried out their trade in small homemade boats operating close to shore. Cod, the primary species harvested, was cleaned, salted and dried on cobble beaches and 'flakes' for export (see Ryan, 1986). As the population grew and competition for fishing areas increased, shipbuilders produced sturdy schooners so that local

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[4] Weather and ice patterns for Bonavista Bay are summarized in the *Newfoundland and Labrador Marine Weather Guide* (Environment Canada, 1993). Also see plates in the *Historical Atlas of Canada Volume I* for ocean circulation and ice limits (Harris, 1987). Currents and tidal ranges are described in the *Sailing Directions* for northeast Newfoundland (CHS, 1997).

[5] For a general historical perspective on Newfoundland settlement and the fisheries, see Cell (1969), Head (1976), Handcock (1989) and Innis (1954). For a cartographic depiction of settlement patterns, see plates 21, 22, 23, 25 and 26 in the *Historical Atlas of Canada Volume I* (Harris, 1987) and plates 8 and 37 in *Volume II* (Gentilcore *et al.*, 1993).

crews could prosecute the distant water fishery along the coast of Labrador (see Figure 1.1).[6] When Newfoundland joined Canada in 1949, families were gradually resettled from the island outports to towns around Bonavista Bay, including several on the Eastport Peninsula (see Head, 1967). Many families continued to summer on the islands and in more remote areas where they fished "traditional" grounds (ibid.).[7]

### 2.2.3 Fisheries in Transition

During the 1960's, 70's and 80's, many changes took place in the Newfoundland fishery. Where coastal fishers in wooden boats once relied upon simple 'hook and line' technology and 'codtrap' nets, larger boats made of fibreglass and new monofilament gear types were introduced to diversify the fishery. The expansion of the inshore fishery was accompanied by the imposition of an increasingly centralized management regime, new regulatory measures and scientific stock assessments. In 1977, when Canada declared a 200-mile fishing zone, Newfoundland embraced the offshore fishery. Stern trawlers that were capable of fishing through the ice delivered a welcome bounty from the offshore banks where foreign vessels once prospered. Newly opened fishplants shifted the rural economy from one of family oriented processing to one of increasingly mechanized industrial production.[8]

Beginning in the early 1980's, fishers from the small boat inshore sector started to express concerns about declining catch rates and decreasing fish size (Finlayson, 1994; Martin, 1995; National Film Board, 1994; Neis, 1992). A considerable drop in biomass was finally detected in the offshore fishery towards the end of the 80's and by 1992, the Atlantic Groundfish Moratorium was declared. As has been extensively reported, upwards of 30,000

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[6] Black (1960) provides a geographical perspective on the Labrador "floater fishery." Head (1967) reports that central Bonavista Bay crews stopped going to Labrador in 1954 and started returning in the early 1960's. After 1970, when 'only one fish' was caught all summer by a St. Brendan's crew, the Labrador schooner fishery is reported to have been discontinued (also see Britan, 1979).

[7] Many writers describe the "traditional" way of life in Newfoundland outport communities (e.g., Faris, 1972; Murray, 1979; Pocius, 1992; papers in Thomas and Widdowson, 1991). Britan (1978), Feltham (1986) and Head (1967) deal specifically with island communities in Bonavista Bay.

[8] For detailed reviews of fisheries "modernization" and the resulting socio-political changes in Newfoundland, see essays in Anderson (1979a), articles in Anderson and Wadel (1972), Lamson (1984), Martin (1990), Matthews (1976), Northern Cod Review Panel (1990), Schrank *et al.* (1995), Sinclair (1990, 1987 and 1985) and papers in Sinclair (1988).

Newfoundlanders were forced out of work when boats were tied up and fishplants closed down.[9] The federal Atlantic Groundfish Strategy, initially described as 'the package' but now more commonly known by its TAGS acronym, has provided income support for displaced fishery workers with a purported focus on retraining. A parallel process initiated by the Food and Fisheries Allied Workers Union (FFAW) has attempted to classify and separate "core" professional fishers from part-time harvesters and other workers thought to be less dependent on the fishery.

The urge to proportion blame for the groundfish collapse is common among inshore harvesters and many are suspicious of government agendas and distrusting of scientific opinion.[10] A common belief regarding the "fishery of the future," is a sense that the 'government' and 'big companies' wish to replace the small boat community-based fishery with larger vessels and centralized processing operations. Fishing continues to be an important component of the Bonavista Bay economy with herring, capelin, lobster and crab remaining viable, but redirection of effort has placed heavy demands on these and other species – especially lumpfish – prompting great concern amongst fishers, scientists and conservationists alike. Beyond the economic value, the fishery remains important in cultural and psychological terms. Harvesters want to be on the water applying their skills and expertise: "Coastal peoples and fishermen feel very much toward the ocean like native people do toward the land" (Lien, 1988, 40; also see observation 11 in Appendix B.).

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[9] The fisheries collapse has received a substantial amount of attention in the academic literature from both natural and social scientists. For an overview of the fisheries "crisis" see essays in Arnason and Felt (1995), Chantraine (1994), articles in Felt and Sinclair (1995), Hannesson (1996), Hinds (1995), Hutchings and Myers (1995 and 1994), Keating (1994), Neis and Williams (1996), Rogers (1996), papers in Russell and McConnell (1995) and Sinclair (1995).

[10] That there is considerable anger and resentment in fishing communities (observations 24, 25, 28-31 in Appendix B) is nothing new: e.g., see general comments on fisher attitudes towards government and science in Charles (1995), Lien (1988), Neis (1992) and Pringle (1985). Social scientists receive equal scorn – they've got something "interesting" to research at a time when fishers have nothing "interesting" to catch – and unlike many harvesters who are unable to meet their boat loan payments, researchers still have jobs. (At one point I was referred to as a 'f___ing academic.' This was hurtful, particularly in light of the fact that financial support for my research had long been terminated – I was not doing this for monetary gain.) At times, frustration among fishers appears contradictory and selective: for example, harvesters may question why a large bureaucracy is needed to administer a reduced fishery, yet days later they might lament the loss of staff from the same body. (Such was the case when fisheries officers dropped in number from 36 to 16 in the Grand Falls DFO office.)

### 2.2.4 The Social Milieu

Life in post-moratorium Bonavista Bay carries on, but coastal communities' modern day dependence on the fishery has become painfully evident since 1992. With thousands out of work as a result of the closures, the strengthening of other sectors such as tourism,[11] aquaculture[12] and mining[13] has been promoted (e.g., see Task Force, 1995). While alternative forms of employment and income generation would be welcomed, many assert that the survival of coastal communities in Bonavista Bay is inextricably linked to a renewed fishery (see Observation 11 in Appendix B); similar conclusions have been drawn for other parts of Newfoundland (National Round Table 1995; also see interviews in Roach, 1997). Reductions in general services, including schools and hospitals, have made for difficult decision-making, and rural communities are now experiencing net out-migration (Storey and Smith, 1995), particularly of families and young people in search of work. A symbolic as well as practical concern in coastal communities is the destaffing of lighthouses. Much to the consternation of navigators, friendly keepers who once functioned as radio operators, weather providers and backup rescue personnel, are being replaced by automated systems.

Despite these challenges and hardships, many residents have chosen to stay in Bonavista Bay where they continue to harvest remaining species (e.g., lobster) in husband and wife

[11] Seymour's comments reflect a perspective that still resonates in much of Newfoundland today: "Through the encouragement of small-scale local industry, of which tourism is one, it is hoped that the traditional fishery, which has been in decline since 1949, can be replaced" (1980, 39). The success of whale and seabird excursions at the Cape St. Mary's and Witless Bay Ecological Reserves (see Parks and Natural Areas Division, 1995) has certainly demonstrated the potential economic contributions of sightseeing on the Avalon Peninsula. Tourism is increasingly promoted in Bonavista Bay with TNNP as a focus for nature-based tourism and the new Ryan's Premises National Historic Site in the town of Bonavista as a focus for cultural tourism. On the Eastport peninsula, there are Provincial beach parks, the Salvage Fishermen's Museum, the Burnside Archaeology Centre and a growing number of campgrounds and tourist lodgings.

[12] Possibilities do exist for aquaculture development. There are some biophysically suitable areas which are also protected from drifting arctic ice, but in many cases, proponents are experiencing strong opposition from residents and cottage owners. Such is the case in Northeast Arm (see Place Name figure in Chapter 5), an ideally suited inlet bordering TNNP where four to six mussel farm applications have been delayed by landowner petitions.

[13] Few permanent jobs have materialized for ex-fishery workers in the promising Hibernia offshore oil and gas project. Likewise, the rich Voisey's Bay nickel deposit under development in Labrador has yet to absorb a prepared and eagerly mobile workforce.

teams.[14] With resettlement schemes of the post-confederation years (1949-1970) still fresh in memory, some have resisted relocatation. Many families have "dug in" for the long term, quite literally in fact, with renewed enthusiasm for vegetable gardening and winter storage in root cellars (Betts, pers. comm.). Berry-picking also remains popular as people continue with the tradition of "living off the land" (Omohundro, 1995; Welbourn, 1995). Families provide for themselves and manage to live comfortably with much less income than would be required in urban Canada. Jackson explains:

> Newfoundlanders and Labradorians treasure a long tradition of free use of our lands and waters and their resources. We have the highest percentage of Crown land–roughly 95 percent–of any province."The country"–unfenced and largely unguarded–has been regarded by many people as an extension of their own backyards. More than 60,000 Newfoundlanders cut their own firewood. Along with New Brunswick and the territories, we have the highest percentage of hunters in Canada. In the last decade, we have accumulated some 40,000 [all terrain vehicles], which access the farthest reaches of the land. (1995, 135)

Indeed, homes are still built, expanded and renovated with self-cut and locally-milled lumber. Moose, caribou, rabbit and birds remain an important source of protein and despite the fishery setbacks, a variety of commercial and non-commercial species remain popular in the outport diet: e.g., a limited food fishery has kept cod on the table; capelin is caught in the traditional fashion with dipnets along spawning beaches; anglers fish trout out of ponds, brooks and estuarine waters; and finally, the prized Atlantic salmon endures in its appeal for fly fishing enthusiasts on nearby rivers.[15] The *Report of the Partnership on Sustainable Coastal Communities and Marine Ecosystems in Newfoundland and Labrador* (National Round Table, 1995) confirms the voice of coastal communities: healthy ecosystems that will support long-

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[14] More profits are kept in the family when a spouse becomes the second crew member in a lobster fishing enterprise. This also enables both husband and wife to collect federal Employment Insurance benefits.

[15] Payne (1997) confirms the high number of Newfoundlanders that engage in hunting and fishing activities relative to the rest of Canada. Overton (1980a) discusses the historical importance of caribou and other traditional food sources; Welbourn (1995) offers a contemporary perspective. The inevitable harvest of wildlife outside of legal norms has generated some debate about societal norms: are people really breaking the law if they need to feed their families? Should there be different penalties for subsistence harvesting versus poaching for profit? (See discussions in Hanrahan, 1993, Okihiro, 1997 and Welbourn, 1995. Also see Observation 12 and 13 on lobster poaching in Appendix B). Late one night when returning home from my office at TNNP, I strolled past a cow moose and her calf. I was frighteningly close to a poaching incident when rifle shots rang out above my head minutes later. One thing is certain, and I was told this outright on numerous occasions: rules or no rules, people will fish and hunt when federal income support dwindles – they will be forced to do so if they are to provide for their families.

term fisheries and preserve the outport lifestyle for future generations are a high priority.

### 2.2.5 Terra Nova National Park

Terra Nova National Park (TNNP) was created in 1957 to protect a 400 square kilometre parcel of boreal forest, marshlands and a shoreline of mixed geology on the coast of northeast Newfoundland (Deichmann and Bradshaw, 1984; Gauthier, Poulin and Theriault, 1977). Located on the inner reaches of Bonavista Bay (see Figure 1.2), the Park contains 197 km of coastline characterized by deep fjords and rocky headlands. Inhabitants were compensated when the Park was established and, as I have discussed elsewhere (see Macnab, 1996d, 113), locals were promised unrealized jobs to compensate for the loss of access to forestry resources. Many families and communities still feel slighted in this regard and have an avowed distrust in the agency.[16]

Although the Park boundary ends at the mean low water mark, there has been fluctuating interest in adding a marine component for well over 25 years (e.g., see Airphoto Analysis Associates, 1972; Deichmann, 1984).[17] Parks Canada interpretive themes (Powell, 1985; Walsh, 1985; Whale Research Group, no date), and more recently, ecosystem-based management programs and a new Marine Interpretation Centre (opened June 1997) have emphasized the coastal and aquatic aspects of TNNP.[18] Terra Nova also serves as the headquarters for NMCA fieldstaff and would likely function as the administrative base if and when a Bonavista Bay NMCA is established.[19]

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[16] Kalff (1995. 104-123) provides a historical overview of the Park while an earlier work by Major (1977) describes human history up to and including the Park's establishment. Handcock (1985) examines the Park's toponomy with an emphasis on place names derived from original inhabitants.

[17] It has also been suggested that considerable academic interest in the region led to its selection as a priority for Parks Canada (Yurick. 1992). The possibility of establishing an MPA conterminous with an existing protected coastline (i.e.. with negligible development and minimal pollution) has stimulated additional attention.

[18] Airphoto Analysis Associates (1972). Hunter and Associates (1979). Noseworthy (1984), Gotceitas *et al.* (1996), Lambert (1992) and South (1983) examine a range of marine ecosystems and related concerns. Various internal reports and maps detail eagle nests. tern colonies. dive sites. geological anomalies (e.g., sea arches and underwater caves). One old book of maps (Terra Nova National Park. 1971) depicts marine resources for the Park on copies of the British Admiralty chart (1873) – a very meagre offering. as I was to discover from local fishers.

[19] Gwaii Hannas National Park Reserve functions as the planning base for a proposed NMCA surrounding the southern portions of the Queen Charlotte Islands. Fathom Five National Marine Park in Ontario is managed out of

## 2.3 INITIAL EXPLORATIONS IN BONAVISTA BAY

### 2.3.1 Early Community Feedback

Beginning in 1993, planning staff working from Terra Nova National Park set out to explore the possibilities for an NMCA in Bonavista Bay: if shipwrecks were protected in Ontario's Fathom Five National Marine Park (McClellan, 1992) as well as the endangered beluga whale in Quebec's Saguenay-St. Lawrence Marine Park (Boivin, 1996; Breau, 1993; Canadian Heritage, 1995; Dionne, 1995), what might conservation look like in a Bonavista Bay NMCA once representation was recognized as an implicit objective? How might an NMCA be successfully established? Against the backdrop of the fisheries crisis, there was very little question that fisheries resources would be an appropriate starting point; accordingly, considerable emphasis was placed on investigating the global experience with MPAs for commercially harvested species.[20] In light of the knowledge gained by Parks Canada during the feasibility assessment for the failed West Isles Marine Park proposal (Parks Canada and Tourism NB, 1983), preliminary discussions were also initiated with fishers throughout the Parks Canada study area to discuss NMCA objectives.[21]

Early feedback from harvesters amplified some of the anticipated planning challenges. To begin with, there was great concern that an NMCA would become a tourism and recreation oriented development in which fishers would be forced to absorb the costs of reduced harvesting privileges while tour operators and hoteliers benefitted from increased visitation

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the adjacent Bruce Peninsula National Park.

[20] For example: the protection of spawning areas in the offshore lobster grounds and in the so-called "haddock box" on the Scotian Shelf (Campbell and Pezzack, 1986; Halliday, 1988); coral reef closures (Bohnsack, 1993; Johannes, 1978; Roberts and Polunin, 1993; Ruddle, 1994a) and spiny lobster harvest refugia in New Zealand (Ballantine, 1991; MacDiarmid and Breen, 1992).

[21] As a researcher and Parks Canada employee, one of my roles was to facilitate community dialogue about MPA concepts in an effort to answer the following questions: i) was there any compatibility between local and federal conservation objectives; and, ii) what might MPAs have to offer fisheries-dependent communities in northeast Newfoundland? Before setting out to conduct NMCA information sessions with inshore fishermen's committees in the Parks Canada study area, I studied the Canadian and international experience with MPA establishment, including the West Isles experience (see Part One of Appendix A, sections 3.5.2 and 3.6.4), to help develop a research strategy and a meeting agenda. Summary observations from the fisher information sessions are documented in Appendix B.

(Macnab, 1996d).[22] Furthermore, the notion of a national system of protected areas proved very difficult to reconcile with the day-to-day realities of the East Coast fishing industry: put simply, rural residents did not relate to the concept of conserving nationally representative ecosystems.[23] Fishers were, however, generally supportive of sustainable resource use and conservation measures that would enable 'fisheries forever.' It certainly seemed as if the groundfish moratorium had engendered a better appreciation of the need for precautionary approaches, including MPAs, in fisheries management.[24] That being said, it was made known that MPAs established without the full involvement of fishers would be neither welcomed nor respected in Bonavista Bay.[25]

Despite the potential for conflict (see Macnab, 1996d), several local conservation objectives appeared to be compatible with many of the NMCA objectives: e.g., inshore fishers

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[22] Tourism, employment and other areas of economic growth may accompany MPAs and are often promoted as good reasons for their establishment (Agardy, 1993; Dixon, 1993; Dixon *et al.*, 1993), but it is not clear that fishing interests become principal beneficiaries of these development opportunities. Furthermore, as Butler notes for the southwest New Brunswick region where Parks Canada studied the feasibility of a West Isles Marine Park, "fishermen and local residents ... do not wish to be unwilling props in tourist snapshots" (1986, 41). This outlook became apparent in Bonavista Bay during the summer of 1994 when DFO issued a special cod jigging license for Terra Nova's tour boat concession: "At a time when Newfoundlanders were banned from recreational and food fisheries, irate local fishers saw this tour boat privilege as a sign of things to come" (Macnab, 1996d, 113). Following province-wide discontent, the license was revoked and tempers were diffused. (Also see Observation 30 in Appendix B on commercial fisher attitudes towards the recreational salmon fishery.)

[23] Harper (1978) made the same observation when residents rejected coastal park proposals in Nova Scotia. With reference to the West Isles proposal, Butler reveals another core issue that resonates in Bonavista Bay: "Ultimately it is a question of trust and many people potentially affected by the marine park think that Parks Canada's 'promises' are not worth much. Their attitude is that bureaucrats will come and go, but the fishermen and residents will remain. They don't want their lifestyle determined by government officials. The prevalence of this attitude sets an almost impossible precedent for Parks Canada" (1986, 41). Also see Observations 6 and 30 in Appendix B.

[24] The precautionary principle embodies "the intuitively simple idea that decision makers should act in advance of scientific certainty to protect the environment from incurring harm" (O'Riordan and Jordan, 1995, 194). Clark (1996) elaborates in the context of marine reserves; Garcia (1994) in fisheries; and Macdonald (1995) in ocean management generally. See Observation 27 in Appendix B for a recently articulated example from the herring fishery where a precautionary approach might have been prudent. (See Whitmarsh et al., [1995]for a case study of the UK herring industry.) Observations 11, 22, 26 and 32 on lumpfish, lobster and capelin describe cases in which the will to conserve is present but the will to act is thwarted by extenuating circumstances. It should also be stated that not all fishers agree that MPAs should be established prior to scientific evidence (see Observation 15 and 16).

[25] I was told outright that areas closed to harvesting without fisher input and support would be subject to poaching, abuse and other forms of non-compliance. In anticipation of questions about what Parks Canada meant by co-management and more specifically, questions about how much say fish harvesters would have in selecting and nominating areas for conservation, I prepared a conceptual model to demonstrate what I understood of Parks Canada's intent for participation (see Part Two of Appendix A).

have long called for the protection of spawning fish, juveniles and supporting habitats, especially in the offshore regions (See Observation 16 in Appendix B). Considerable interest was also expressed in the potential for spillover effects and larval dispersement from closed areas for lobster. The quickly-evolving theory is as follows: if areas are set aside from harvesting, resident species will grow in size, replenish the surrounding fishery and increase egg production (Bohnsack, 1993; Dugan and Davis, 1993; MacDiarmid and Breen, 1992; Rowley, 1994).[26] The notion that "no-take" MPAs could act as "insurance policies" against overfishing (Ballantine, 1995) received very little argument from fishers; however, where to establish such harvest refugia and how to make up for lost fishing space were questions not easily answered (see Observation 17 in Appendix B).[27]

### 2.3.2 NMCA Information Requirements

In my first summer at Terra Nova National Park (1994), much of my attention was devoted to generating a plan for a computerized database that would be used to compile resource information in an NMCA feasibility assessment (see Macnab, 1995a), and later for use in Parks Canada management planning. This investigation of inventory needs was influenced largely by the emerging fisheries focus described in the previous section and the expectation that a draft zoning plan would need to be prepared by Parks Canada. Table 2.2 presents a list of potential data parameters for a preliminary inventory of the NMCA study area. That summer, I conducted literature searches and spoke with government employees, scientists and academics to determine the availability of marine resource information for the NMCA study area. A large number of the data types listed in Table 2.2 were uncovered at different locations and in a wide range of digital and analog formats (see Macnab, 1995a).

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[26] Although the Parks Canada NMCA designation stresses biophysical representation, the highly protected zones that have been proposed (see Parks Canada, 1994) offer the same theoretical potential for fisheries replenishment and egg dispersal that has been observed in other types of MPAs worldwide.

[27] My personal interest in working closely with fishers has already been stated: some readers, however, may question the special attention devoted to harvesters by Parks Canada. See Part Three of Appendix A for a discussion of fishers as principal stakeholders.

Table 2.2 Potential Data Parameters for a Preliminary NMCA Inventory*

Base layers
coastline
soundings
bathymetry
contours
drainage

Administration
baseline
territorial seas
inland waters
200-mile limit
fisheries divisions
shellfish closures
net fisheries closures
protected areas
seabird hunting zones
military zones
navigation channels
mineral leases
aquaculture sites

Infrastructure
wharves
navigation aids
underwater cables
pipelines
roads
buildings
shoreline development
seawalls
breakwaters

Cultural features
shipwrecks
archaeological sites

Fishing grounds
lobster
cod trap berths
jigging grounds
herring seine/fixed gear
offshore otter trawl
hook and line
sea urchins
salmon berths
crab fisheries
lumpfish
capelin traps
winter flounder
turbot

Oceanography
currents
tides
salinity
chemistry
temperature
ice cover

Birds
tern rookeries
eagle nests
eider duck concentrations
reserves and sanctuaries

Spawning Areas
cod
herring
capelin beaches
lumpfish
turbot

Pollution sources
sewage outfalls
ocean dumpsites
fish plants
industry
agriculture
saw mills
pulp and paper

Minerals and hydrocarbons
active wells
capped wells
placer mining

Recreation
dive sites
sailing
anchorage
sea kayaking
fishing
hunting
onshore facilities
tour boats
birding

Shoretype
geology
intertidal communities
sensitivity ratings
sea caves
arches

Bottom type
geology
geomorphology
benthos

*Adapted from Kelleher and Kenchington (1992). Salm and Clarke (1984) and Welch (1992) to reflect conditions and activities in the Newfoundland Shelf marine region. Canessa (1997) provides a comprehensive list for a generic coastal inventory.

The database review, which extended over the next couple of years, highlighted three critical areas where information was lacking. First, there was very little documented information on inshore fishing patterns.[28] Head's comments still accurately describe the paucity of information in this regard:

> While inshore, the various cod populations become further concentrated and it is these concentrations that become the "fishing grounds" of Newfoundlanders. Although these grounds are well known to the fishermen, even today they are little known to the scientific observer. In very few places in Newfoundland have they been identified and mapped. (1976, 21)

Second, published or documented scientific knowledge of inshore spawning grounds, nursery and juvenile areas, and other sensitive areas, was virtually non-existent. Indeed, despite a long history of sampling and research in offshore areas, inshore waters and spawning grounds were only beginning to be studied by scientists (e.g., Anderson *et al.*, 1995; Gotceitas *et al.*, 1996; Hutchings *et al.*, 1993; Rose, 1993; Wroblewski *et al.*, 1994). Third, nautical chart coverage for inner Bonavista Bay (British Admiralty, 1873) was outdated, inaccurate, small-scaled and largely unsuitable for further inventory and basemap purposes. Modern surveys had been carried out in the Bay by the Canadian Hydrographic Service since 1989, but finished charts were estimated to be many years from publication (Sterling, pers. comm.). With the expectation that resource inventories would be part of an NMCA assessment – and a major part of my graduate studies – I started investigating the possibilities for generating a suitable marine basemap from hydrographic sounding data.[29]

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[28] I located four map sources: a general user survey for the entire northeast Newfoundland coast with some documentation of Bonavista Bay fishing (Graham, 1991); a student paper on the fishing grounds of Greenspond; a map of fish gathering areas in central Bonavista Bay (Head, 1967, 99); and a rudimentary inventory of fishing activities in the waters surrounding Terra Nova National Park (TNNP, 1972). Feltham (1986) writes of fishing grounds and uses aerial photographs for illustration.

[29] An accurate basemap depicting enduring features "is a prerequisite for the ecological assessment of marine resources" (Mumby *et al.*, 1995, 113) and thus, it became a priority for any further data collection in Bonavista Bay. Chapter Four traces the basemap and hydrographic data investigations. During the summer of 1994, I visited the *Matthew*, a low draft CHS survey vessel working in Bonavista Bay. The Chief Hydrographer gave a tour of the ship and demonstrated the technology and processes used to produce survey fieldsheets. This work will lead to some of Canada's first fully digital nautical publications: from soundings through to paper and electronic navigation charts, the work will utilize computer technology. See Appendix F.

### 2.3.3 Building on Local Knowledge

At the start of my research in Newfoundland, I was introduced to a survey of coastal and nearshore activities that had been carried out in the region by the late Bob Graham, a University of Waterloo professor in Recreation and Leisure Studies. Graham had a long standing interest in Canadian MPAs and argued fervently for approaches that built on the knowledge of fishers, indigenous peoples, navigators, recreationists and other local resource users (Graham, 1992a, 1992b and 1991; Graham and Payne, 1990; Graham *et al.*, 1992; Graham and Huff, 1985). To complete his *Customary Users Nearshore and Coastal Inventory* (1991), Graham met with a wide range of coastal peoples in Northeast Newfoundland to map their knowledge of the marine environment.[30] Inspired by Graham's approach, I reviewed various local knowledge studies (see Chapters 1 & 3) to predict the kinds of information that Bonavista Bay fishers might contribute to an NMCA feasibility assessment (Table 2.3).

Table 2.3 Local Knowledge Categories

- species distribution, sensitive sites and spawning areas
  (e.g., capelin beaches, feeding patterns)
- spatial/temporal extent of fish harvesting and gear types
- marine mammal and seabird hunting areas
- local toponyms and associated histories
  (e.g., "Hospital Cove" for sick lobster; shore markers)
- local terminology ("pigeon"= guillemot)
- community-based management practices
  (e.g., marine tenure, gear allocation, trap berths)

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[30] Graham's survey was eventually included as part of the "experts" consultation session that led to the selection of Bonavista Bay as the candidate NMCA for the NF Shelf Marine Region (see Mercier, 1995). The collection scale of Graham's survey – the entire northeast NF coast – and the ranking approach (e.g., 1st, 2nd and 3rd best crab fishing areas, but not ALL crab areas) were fine for a regional assessment but inadequate for more detailed and participatory planning purposes. For his unfinished dissertation in planning at the University of Waterloo, Graham had intended to analyze questionnaire data that he collected from a wide range of persons involved with coastal and marine management issues. Respondents were asked to review his customary users survey and then make comments regarding its usefulness, potential applications, and likely degree of acceptance within the agency represented by the participant. (Graham's academic estate was entrusted to me. I also spoke with his cartographer [Bonner, pers. comm.] and GIS analyst [Simms, pers. comm.] to trace the preparation of his maps.)

- suggestions for conservation (e.g., refugia, closures, quotas)
- a range of additional features and activities
  (e.g., community values, recreational areas, hazards, pollution sources)

I initially believed that fishers could provide valuable information about sensitive areas and thus help to guide further scientific investigations. With regards to harvest patterns, toponomy and local management, I believed that documentation would help Parks Canada to recognize an active fisheries presence and to acknowledge local ways of relating to the sea.[31]

## 2.4 COMMUNITY-BASED LOBSTER CONSERVATION

As explained in Chapter One, Parks staff worked closely with the Eastport Peninsula Inshore Fishermen's Committee to exchange ideas and discuss approaches to marine conservation. One of the key points to emerge from these meetings has been the broad acknowledgement that redirection of harvesting effort away from cod and other closed groundfish stocks has placed detrimental pressures on remaining species, particularly lobster, which remains one of the few active and viable fisheries. Ensuring that stocks remain healthy is an achievable and immediate priority. In an effort to stabilize the fishery and help safeguard against future stock collapse, Eastport fishers formed a Lobster Protection Committee to deal with poaching and other infractions (Feltham *et al.*, 1996). Self-policing and a partnership agreement with local fisheries officers led to better surveillance, pot checks, and easier reporting of suspicious activity. V-notching, the practice of marking and releasing egg-bearing females (see Fisheries Resource Conservation Council, 1995b), was also introduced by the new committee. As a result of these actions, compliance has improved and much of the past abuse has been replaced by pride and a sense of collective responsibility.

During this same period, the Fisheries Resource Conservation Council (FRCC) released a document on lobster conservation which reported that a threatening number of legal-sized females were being harvested before they had a chance to spawn (Fisheries Resource

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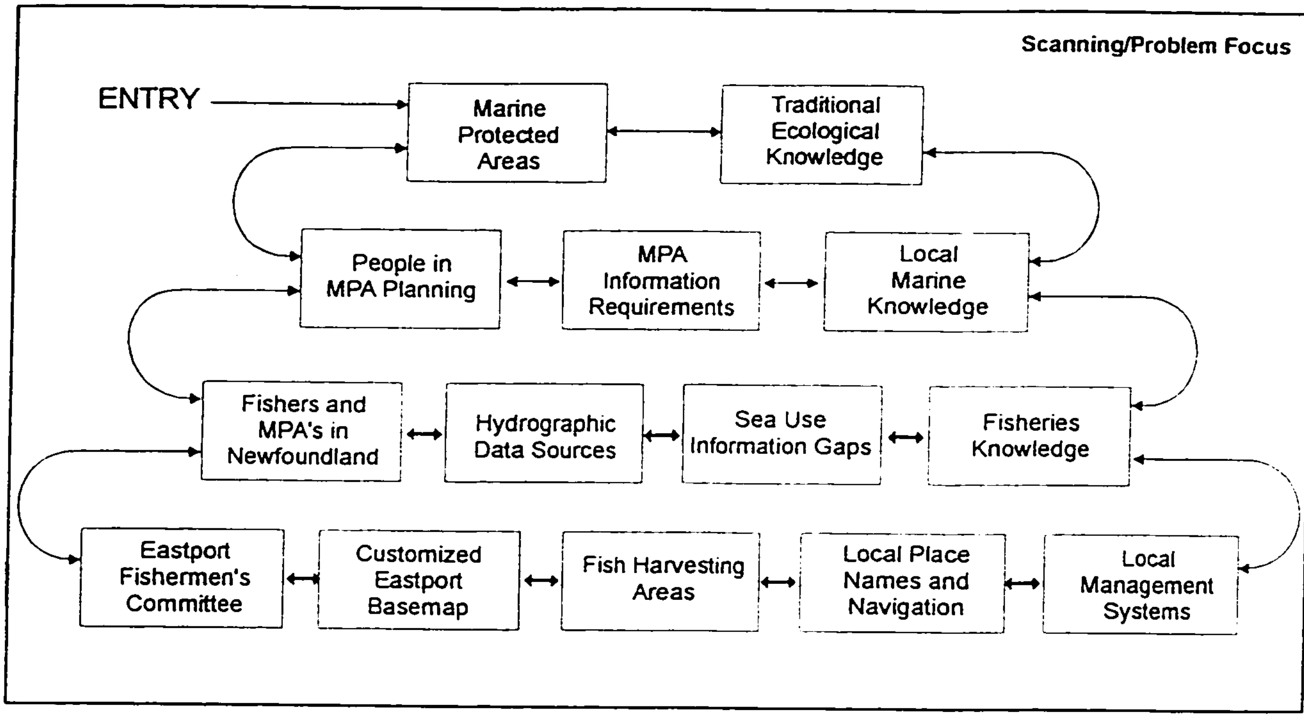
[31] Harvester's knowledge of spawning fish was later collected by a Parks Canada colleague (see Potter, 1996). MUN's interdisciplinary Eco-Research Project (see Ommer, 1993) also collected fishery workers' ecological knowledge in the region (Maguire *et al.*, 1995). My research orientation, which is decribed in Chapter 3, shifted from that of a Parks Canada planner to that of a community facitlitator.

Conservation Council, 1995b). With removal rates as high as 90% in some parts of Newfoundland, scientists estimated that egg production had dropped to 1% of the potential (i.e., if no females were landed). Shellfish biologists presented several measures to ensure safe levels of egg production including the suggestion that a small percentage (1-5%) of the lobster stock remain unfished. Meanwhile, there was renewed fisher interest in a group of Placentia Bay islets (the 'Shag Rocks') that had been closed to fishing for scientific purposes during the early eighties (Ennis, no date). After considering anecdotal evidence that lobster abundance and size had increased in this experimental reserve (e.g., see Taylor, 1995), Eastport harvesters eventually agreed that their own fishery might benefit from some type of trial closure. With very little scientific guidance available in the way of size or optimal placement, fishers started to discuss potential refugia based on local harvest patterns, long-term knowledge of the lobster stocks and observed oceanographic circulation. Not surprisingly, one of the chief concerns amongst fishers was that of interference from adjacent communities. First, mechanisms were sought to prevent outsiders from trapping in the proposed reserves. Second, Eastport harvesters wanted to ensure that their historical fishing territory – the area expected to benefit from voluntary closures – would be respected if they were going to sacrifice a portion of their grounds. At the time of writing, two island groups in the Eastport area had been closed to fishing for the 1997 lobster season. The Eastport Committee was also working with scientists to develop a monitoring plan.

## 2.5 RESEARCH FOCUS

After interacting with small boat fishers at Eastport and elsewhere in Bonavista Bay, it became evident that locally-supported harvest refugia might emerge through dialogue about MPA concepts as they related to actual fishing locations. Indeed, suggestions and site-specific recommendations for protective measures were volunteered at many of the meetings I conducted for Parks Canada. In cases where up-to-date hydrographic charts or new fieldsheets were available, fishers could easily delineate the areas in question, but in sections of Bonavista Bay where the latest sounding information existed on the 1873 British Admiralty chart, there was insufficient detail to provide a graphic display of fishing grounds and potential conservation zones. Here then, a focus for my thesis research emerged: customize existing hydrographic fieldsheet data, produce a large scale map and document fishing areas with local harvesters.[32] Close ties with the Fishermen's Committee at Eastport led to the collaborative undertaking described in the remaining chapters. The spiral diagram below (after Nelson, 1991a) illustrates the research progression from a general interest in MPAs and local knowledge through to the specific focus on mapping at Eastport.

Figure 2.1 Research Progression




[32] The need to work with and for harvesters, as discussed further in the next chapter and in Appendix A, was an important consideration. There were more categories of local knowledge that I was interested in collecting (e.g., spawning areas and oceanographic phenomena), but time limits and the priorities of Eastport fishers forced me to trim my expectations. Furthermore, once I realized the value of having fishers conduct their own inventories (see Chapter 3), my interests shifted from the earlier Parks Canada emphasis on GIS and marine database compilation to community planning and dialogue-enabling mapping tools.

# CHAPTER 3

## *LEARNING THE ROPES*

### 3.1 INTRODUCTION

To develop a collaborative process for mapping harvest areas within the research context outlined in Chapters 1 and 2, it was necessary to review and draw from literature spanning a number of fields. While map examples abound and practical marine resource mapping manuals do exist (e.g., Butler, LeBlanc *et al.*, 1986; Rutherford *et al.*, 1995), very little has been written to connect the theories that underlie the various approaches. The intent of this chapter is to review, link and synthesize several bodies of theory and method to explain how I informed my research. To accomplish this task, I use a framework of five principal questions: 1) how can inshore fishing grounds be mapped, 2) how do fishers relate to fishing areas, 3) how does one map cognitive earthscapes, 4) whose maps are they, and 5) how can local knowledge be made more compatible with scientific information? As the answer to each question emerged, other questions arose.[1]

### 3.2 MAPPING THE HUMAN OCEANS

Cultural mapping of the world's oceans – the human and social components – is in its infancy. Nelson *et al.* (1988) describe the importance of mapping abiotic, biotic and cultural features in comprehensive resource surveys, but in the case of oceans, mapping is only well-established as a scientific discipline in the abiotic sense (e.g., geodesy, hydrography and geology), and even there, the degree of coverage pales by comparison with that on the land.[2]

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[1] The organization of material in this chapter is not a reflection of the interactive and adaptive manner in which the research progressed: it is presented with an imposed order and sequence so that the reader might make some sense of the research process. The natural evolution of my investigation, which might best be described as "organic" or perhaps "intuitive," could never have been this structured. With the aim of brevity, I describe publications only where there is some direct relevance to the present study; otherwise, the sources I consulted are referenced for the interested reader.

[2] Humans have a better understanding of the moon's topography than that of the earth's seabed. In Canada, only 25 to 35 percent of ocean waters are "adequately mapped" (Fillmore and Sandilands, 1983), but thankfully, modern survey techniques are helping to rectify this situation. Appendix F summarizes the "state of the art" in Canadian hydrography.

Biotic coverage of marine environments is emerging, as discussed in the next section. Rarely, however, do we approach the human parameters of the oceans with "the same enthusiasm and zeal that we map the parameters that describe the physical characteristics" (Knecht and Cicin-Sain, 1993, 241).[3]

The delineation of legal boundaries is one of the few types of social mapping that has been practised for Canada's ocean regions.[4] The spatial and temporal aspects of many sea uses are recorded, but little of this kind of documentation exists for Canadian inshore fishing activities.[5] There are many reasons for this, including those challenges which make all ocean mapping difficult (e.g., a mobile ecosystem and data collection expense) and some which appear unique to fishing (e.g., flexible patterns, low detectability and problems of methodology). Whatever the reasons, fishing maps are now required. With increasing use and competition for ocean space from aquaculture, conservation, recreation and even expanding fisheries, the variety of maps relied upon for zonal style planning on *terra firma* (e.g., see Monmonier, 1996) will be required for the sea.

### 3.2.1 Mapping Fish and Fishing Maps

I knew from the outset that I would be mapping information with direct fisher input, but I did want to satisfy myself that there was not a more scientifically objective, rigorous or quantifiable means of approaching this undertaking. A review of the literature and contact with

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[3] The human oceans – legal, cultural, spiritual and economic entities – have not been given much attention by geographers: "While the land has been seen by cultural geographers and others as layered with proprietary rights, use rights and cultural symbols, the water has been seen as empty ... [and with very few exceptions] this field has not attracted the interest of human geographers" (Jackson, 1995).

[4] For example: terrestrial baselines, territorial seas, 200 mile limits, international boundaries, regulated hunting and fishing zones, shipping lanes, military areas, contaminated shellfish closures, aquaculture development zones, conservation areas, administrative units and hydrocarbon leases.

[5] Published *Sailing Directions* list buoys, channels, wharves and other information to assist navigators (e.g., CHS, 1997b). Precise GPS surveys and site plans are a standard part of the licensing process for many stationary sea uses such as aquaculture (Murphy, pers. comm.), hydrocarbon extraction (see Smith, 1985) and offshore leases (Ruffman, pers. comm.). Sewage outfalls (Evans, pers. comm.), underwater dumping sites (Pelley, pers. comm.) and shipwrecks (see Galgay, 1994) are often inventoried with geographic coordinates. Locations for recreational activities like scuba diving (Barron, 1988) and sailboat anchorage (Mills, 1993) are often published in guidebooks while anthropogenic and natural seabed obstructions to fishing gear (Smith and Lalwani, 1996) are often recorded as point data by a wide range of maritime interests.

ongoing inventory projects confirmed that there have been very few attempts to map inshore fishing activities with scientific methods, or perhaps more precisely, highly technical methods. In almost every Atlantic Canadian mapping effort to date, information on fishing grounds has been collected through interviews and other techniques more common to the social sciences. Various factors help to account for this trend, but here the discussion is directed towards the limitations that might be encountered when attempting to map inshore harvest areas in a technical fashion.[6]

Firstly, ***inshore harvest records*** have limited usefulness for mapping purposes. As Scarratt comments, "information based on fish catch data has been difficult to portray in mapped form, and this has led to some problems in developing environmental maps which should include fisheries information" (1989, 42).[7] Catch statistics for the small boat inshore fishery are compiled on a zonal basis and present limited scope for detailed spatial analysis (e.g. the Northwest Atlantic Fisheries Organization Zone 3L takes in all of Bonavista Bay). This contrasts sharply with the offshore fishery where regulations demand that Captains record and report precise coordinate information every time that gear is set and hauled. Locational data from these catch records and offshore research surveys have spawned tremendous growth in offshore fisheries biogeography which should greatly aid the environmental assessment review process for offshore project sites such as the Hibernia oilfield (see Storey, 1991).[8]

Second, ***remote sensing instruments*** (e.g., hydroacoustics, sounders, side-scan sonar, airborne sensors and satellites), which are used increasingly for mapping and biophysical monitoring of coastal and marine environments, remain limited for detecting actual harvest

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[6] Socio-political analysis (e.g., Finlayson, 1994; Hogan and Clarke, 1989; Neis, 1992; Pinkerton and Weinstein, 1995; Ripley, 1996; Sinclair, 1990) and popular opinion (e.g. National Film Board, 1994; NRTEE, 1995; Roach, 1997) might suggest that the lack of rigour in mapping, as with the inshore generally, is a result of scientific bias towards the offshore sector. (Later sections discuss social theory in cartography.)

[7] However, I take exception to Scarratt's assertion that "the location of registered sites of fixed gear fisheries and the distribution of mobile gear can be readily determined" (1989, 40). It might well be true that "this information can be supplied in cartographic form" but Scarratt does not explain how the information might be collected. Also see the discussion in Halliday and Pinhorn (1990) of statistical limitations in catch data from small boats

[8] Increasing scientific use of computers has led to much greater spatial analysis and mapping of Canadian offshore catch records. DFO surveys and fishery observer datasets (e.g., see Brown *et al.*, 1996; Gomes *et al.*, 1995 and 1992; Halliday and Pinhorn, 1990; Hogan and Clark, 1989; Howell *et al.*, 1996; Langton *et al.*, 1995; Walsh *et al.*, 1995; Wroblewski, 1995).

areas. While information derived from these devices may indicate where fish are, or where fish are likely to occur (i.e., habitat), it is still difficult to extrapolate where fish are caught.[9] Fishing boats are increasingly monitored by aircraft surveillance, radar (Ponsford and Premji, 1994) and satellite (Marsh and Butt, 1994), particularly on the grounds such as Georges Bank (see Herbert, 1995) and the Nose and Tail of the Grand Banks (see Day, 1995) which straddle international maritime borders, but even these sensors indicate only where a ship is located, and not what species is being caught or how much fish is being brought aboard.

Third, ***land use mapping*** (e.g., Aberley, 1993; Journaux, 1987; McHarg, 1971; Nelson *et al.*, 1988), a technique which relies heavily upon the correspondence between land cover and land use (e.g., a field indicates agriculture), has proven limited for inshore harvest area mapping.[10] Activities on land are relatively fixed and basically two dimensional (Bradbury, 1995); by comparison, fishing can be mobile, ephemeral and three dimensional (i.e., occurring at different levels in the water column: e.g., bottom lobster traps, midwater trawls and surface gillnets).[11] You can easily visit land sites to confirm remotely-sensed data, but as Langran and Kall observe, "[b]ecause undersea data are sensed but seldom seen, ground truthing is usually impossible" (1991, 127).

Fourth, ***gear surveys with Global Positioning Systems*** by non-fishers, a suggestion made early in the research (Lien, pers. comm.), poses two challenges: i) field investigation

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[9] The range of detectable variables includes: depth, shoretype, bottom type, schooling fish, reefs, temperature, primary productivity, vegetation, weather, ice cover and seals. For examples and case studies, see: Butler *et al.*, 1988; Davies and Wedderburn-Bissop, 1989; Fedra, 1995; Harper *et al.*, 1994; Karl *et al.*, 1994; Krause and Angel, 1994; Kunte and Wagle, 1994; Lambert, 1992; Loeng, 1994; Meadon and Kapetsky, 1991; Murphy and Smith, 1995; Rose, 1993; Sherin and Edwardson, 1995; and Simpson, 1994. Satellites and radio telemetry are also being used to track fish and cetaceans implanted with transmitters (Bernardo, 1997; Richard and Heide-Jorgensen, 1997). Conant (1994) claims that environmental remote sensing will generate a need for more – not less – fieldwork in human and cultural ecology.

[10] In one of the few published papers on aerial assessment of inshore fishing activities, Pringle and Duggan (1983) describe an experiment in which lobster buoys are mapped from aerial photographs. The authors report an 11 to 28% difference between aerial and ground truth counts. Photo interpretation relied upon the large and brightly-coloured buoys used in the Nova Scotia fishery. The small uncoloured buoys used in the sheltered waters of Bonavista Bay would make aerial assessment very difficult. The results are also static, representing one day – trap placement and grounds shift throughout the 11 week season in NF. (See Lien [1988, 40] for a lay description of the limits in aerial marine assesment.)

[11] Vertical zoning may be in place on land for urban construction (i.e., height limitations for new buildings) and in the atmosphere for aeronautical purposes, but this is hardly the same as multiple use of the same ocean location.

provides a single impression of constantly changing fishing patterns, and ii) a large proportion of Newfoundlanders' fishing gear has not been in the water since 1992; for example, you can't visit a codtrap. Furthermore, there is minimal fisher participation if researchers jump into a boat, cruise the bay and key in any visible trap locations.

Fifth, ***local boundaries***, and the names used to designate spaces as such – a very important component of inshore fishing grounds, as discussed in section 3.4 – are entirely invisible to outsiders. Unlike a cut boundary or a fence on land, or even a natural boundary (e.g., between a rock face and a scree slope), fishing territories cannot generally be detected, photographed or visited – and thus mapped – without local interpretation (e.g., see Brownstein and Tremblay, 1994 and maps in Davis, 1984, 142, 144). Acheson (1979) demonstrates this challenge with a mapped example of otherwise invisible local boundaries on the sea: community-derived lobster territories in Maine generated after interviews with 42 harvesters.[12]

### 3.2.2 Options for Eastport

Fishing activities, associated names and local traditions may be unknown or undetectable to science, external viewers and an array of sensors, but they are, of course, well known by those people who work the fishery and make use of this knowledge in everyday life. Basta affirms the lengthy process of collecting information in this manner from experts knowledgeable in ocean fields: "[t]here is no shortcut to accomplishing this task" (1990, 311). To collect such knowledge, only two options appear to be available: i) visit fishing locations with harvesters and map the grounds with GPS and sounders, as carried out with the Miskito peoples of Central America (see Nietschmann, 1995), or ii) sit down with fishers and map harvest areas from

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[12] Several authors describe the "invisible" local boundaries and meanings (practical, economic, spiritual and otherwise) connected to natural markers, e.g., see Armbrecht Forbes (1995), Gottesfeld (1994), Jacobs (1993), Rocheleau *et al.* (1995), Ryden (1993), Shields (1991) and Tyler (1993). Jackson (1995) examines this issue with regards to what is believed to be "empty" sea space. Shapiro (1991) mentions the "hidden" folklore and ocean culture among the "common people" in Japan. Diegues (in press) suggests that fishers generally are "socially invisible" while Neis (1995) speaks of the fishers' underwater "landscape that no one has ever seen." Mindful of technical limits, Warner (1987) attempts to map the "unmappable" in fisheries while Nelson *et al.* (1995) undertake ground surveys in Bali to collect information on the "nonvisible" coastal landscape – the human elements that evade satellite detection.

memory onto suitable basemaps as is done throughout Atlantic Canada.[13] Site visits are discussed in later sections and chapters; their expense and impracticality for a preliminary study (see McGoodwin, 1990) are self-evident. The remainder of the chapter deals with the second option.

## 3.3 CARTOGRAPHIC SEASCAPES

In lieu of site visits, fishers must relate their knowledge of the marine environment to features and landforms depicted on paper maps. Effectively, a thematic layer is added to an existing map during this process. Methods vary somewhat, but the generally accepted procedure involves drawing local knowledge directly onto published charts, or transparent overlays (e.g., see Brice-Bennett, 1977; Butler, LeBlanc *et al.*, 1986; Rutherford *et al.*, 1995; Salm and Clarke, 1984). The first sub-section below considers existing models as a basis for designing a suitable basemap of the Eastport peninsula.[14] Next, the issue of data quality is addressed. The third sub-section examines the question of appropriate scale in harvest area mapping. The role and importance of map reading abilities for an "overlay" methodology are then reviewed. Finally, the section closes with a discussion of adaptive cartographic production.

### 3.3.1 Coastal Map Design

Early in the research, there were exhortations to use published maps for the collection of local knowledge. The age and scale of the official nautical chart for the area (described in Chapters 2 and 4) precluded its use as a basemap and led one co-author of the FAO's marine resource mapping manual (see Butler, LeBlanc *et al.*, 1986) to recommend collection with 1:50,000 maps from the National Topographic Series (NTS) (MacNeill, pers. comm.). When the research focus became fishing grounds, this predominantly terrestrial map series appeared

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[13] Other methodologies have been described. For example, in Louisiana's coastal waters, where "various submarine structures and features have been named by local fishermen," toponyms were mapped using magnetic headings from coastal navigation points (e.g., jetties), mileage and Loran C coordinates (Whelan and Phillips, 1984, 151). Gaffin (1994) gathered local place names for a village in the Faeroe Islands and later compiled them on an official Danish Survey map, but it is not clear whether the names were collected on site or through map interviews.

[14] I concentrated on coastal map design and other technical issues at the start of the research. Specific approaches to knowledge elicitation, which are examined in section 3.6, followed this initial exploration.

impractical for the capture of marine knowledge (see Basemap Review in Chapter 4).[15] It seemed opportune to take advantage of recent hydrographic data, digital topographic maps and the possibilities enabled by geographic information systems (e.g., thematic compilation, map customization, corrections, updates, flexible output and digital distribution) to create custom maps that more accurately depicted the local environment as conceptualized by fishers.[16] What then, according to "the literature," might constitute an appropriate coastal basemap?

In recent years, some consensus has emerged regarding standards in coastal mapping. In its basic form, such a map – and its composite data layers if prepared with digital means – ideally portrays the primary or enduring coastal features, including: topography and shoreline, place names, soundings and bathymetry, geodetic reference points and basic infrastructure (Bartlett, 1994; Canessa, 1997; Fay and MacNeill, 1993). While there is little precedent for this type of data integration and cartographic production in Canada, other countries have undertaken the production of combined land and sea coastal maps. For example, agencies in the United States (Fefe, 1984; Spencer, 1984) and Japan (Japan Cartographers Association, 1980; Tanioka *et al.*, 1991) produce so-called "topo-bathy" maps depicting contours on the land and in the sea as well as terrestrial and subsea infrastructure.[17]

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[15] I also wished to avoid the unpublished criticism associated with some of the past Newfoundland methodologies that had utilized terrestrial basemap sources (e.g. see Sheppard, Hedges and Green, 1982). Finally, as mentioned in Chapter 2 and detailed in Chapter 4, I had already been investigating multiple basemap sources with the intent of compiling a better coastal map for the Eastport area: a marine chart that could also accommodate land based threats (e.g., pollution sources) would become a necessity for NMCA planning.

[16] The review of data sources and final basemap derivation is detailed in the next chapter. There is some precedent for the production of custom basemaps for local knowledge documentation, albeit from a manual and terrestrial cartographic tradition as opposed to the digital processes described here for marine and coastal areas. In the Labrador Inuit land use and occupancy study described for Nain and Hopedale, the Surveys and Mapping Branch of the federal Department of Energy, Mines and Resources and the Cartographic Division of the Department of Indian Affairs and Northern Development assisted with the development of new base maps "made up of the individual topographic sheets needed to cover the maximum area of a community's land" Brice-Bennett (1977, 99).

[17] Until recently, Canada was not producing this style of map (see prototype maps for the NS coastal series, Government of Nova Scotia, 1996). Populous nations like the United States and Japan produced these charts earlier than Canada for three likely reasons: i) the availability of funds; ii) a greater dependence on coastal resources and the escalating use of ocean space (e.g., see Akaha, 1995 and Basta, 1990) which together, created the demand; and iii) single agencies are responsible for coastal mapping in these nations (i.e., United States Geological Survey and Geographical Survey Institute of Japan) whereas in Canada, the mandate is split between ocean and land mapping agencies (Butler, Leblanc *et al.*, 1986).

### 3.3.2 Data Quality for Planning and Management

Effective coastal and ocean management requires a solid information base, one that accurately portrays the ocean environment and its many uses (Ricketts, 1992). This is especially important in local-level participatory planning exercises where visual information is to be used as the basis for dialogue, planning and conflict resolution: "The acceptance of marine resource mapping as a management tool is dependent on the reliability of the contained information" (Butler, LeBlanc *et al.*, 1986, 89). Consider the decision-making stage of a British Columbia exercise in coastal zoning and multiple use analysis: local participants questioned the accuracy, detail and quality of the information portrayed on sea use maps. As a result of these inadequacies, the maps and accompanying GIS database were not as useful for spatial decision support as might have been be expected (Canessa, 1997). What happened? The maps did not reliably reflect the geographical extent of activities as they were spatially perceived by local stakeholders.

*Local* maps generated with *local* content at scales appropriate for *local* ways of seeing the world have proven to be effective planning tools for development and environmental management (e.g., see Aberley, 1993; Chambers, 1994a, 1994b, 1994c; Poole, 1995a, 1995c; Robinson *et al.*, 1994).[18] In the marine realm, maps reflecting local knowledge of sea use have been used to great effect for aquaculture zoning in Prince Edward Island (Jenkins, 1987 and pers. comm.); conflict avoidance (Macnab, 1994) and coastal planning in Nova Scotia; petroleum and fishery assessments in Lake Erie (Val and Nelson, 1983); multiple use conflict resolution and collaborative planning in St. Lucia (George and Nichols, 1994; Renard, 1996); selecting clam sanctuaries in New Jersey (McCay, 1989) and marine conservation planning in Australia's Great Barrier Reef Marine Park (Cocks, 1984; Kenchington, 1990) where experience-based sketch maps of local sea use – bits of paper, notes and scribbled maps (Otteson, pers. comm.) – are incorporated into zonation schemes.

In a review of the co-management literature, Hawkes concludes that "users are likely to hold a higher degree of confidence in data they have helped collect and analyse, and are

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[18] Walker *et al.* articulate a point that should be far more obvious than present planning practises would appear to indicate: "The creation of a knowledge base representing the indigenous ecological knowledge of a community of interests can have a significant utility in better understanding that community and thereby, making research and extension activities more relevant to that community" (1995, 244).

therefore more likely to comply with decisions based on that data" (1996, 89). This is particularly true for the management of marine developments, like an aquaculture installation or an MPA, the establishment of which could permanently alter livelihoods. As evidenced by community-based coastal resource inventories from Canada's Maritime provinces (see Rutherford *et al.*, 1995), local maps are highly regarded by those whose knowledge produces them; they also enable a less confrontational consideration of activities and interests.[19] For example, if a prospective aquaculturist checks a number of biophysically optimal sites against a map of fishing grounds, she might avoid the hostility that would be engendered were she to unknowingly locate over top of a productive lobster shoal.

### 3.3.3 The Question of Scale

Kaplan posits that environmental appraisals and problem solving approaches "must take into account the scale which humans can handle" and that when "people understand a situation, when it can draw on their knowledge, they can be competent and reasonable collaborators" (1993, 137). A recent review of 20 coastal management studies makes similar conclusions: success is more likely to occur when the project unit is a small area with which stakeholders can identify closely (Hildebrand, 1996). It follows that maps used in community-based conservation planning must portray the everyday spaces where people live, work and recreate: "[rural people] know the complexity and diversity of their livelihoods and environment. They are experts on their own, immediate, realities" (Pimbert and Pretty, 1995, 36).[20] Easily said, but to complete such research, one needs to determine a preliminary basemap scale. At what map scale might individual fish harvesters and other coastal resource users begin to see their own activities portrayed?

Examples from Newfoundland illustrate the range of scales presently in use for coastal

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[19] Perhaps more akin to terrestrial thematic maps of land use and property ownership, both in development and application, maps in this coastal series may not be highly scientific, but they are standardized through a rigorous and systematic collection process. Some federal biologists still can't believe the detail and scope of the information collected by community participants (Rutherford, pers. comm.).

[20] Ecologists address landscapes at a regional or "macro-level" and scientists examine biota at a process or "micro-level," but local knowledge resides at a "meso-level" the in-between scale "at which protected area management schemes are ultimately aimed" (Pimbert and Pretty, 1995, 30). Neis makes similar comments regarding the human scale of local fisheries knowledge and the regional scale of scientific cod stock assessment (1995, 268).

mapping. Consider a map of the province showing the approximate distribution of codtrap berths (Rose, 1992) and maps illustrating resources along the northeast coast (Graham, 1991; Mercier, 1995). Compare these with a map depicting the home and property of a woman residing in Labrador (Creates, 1990). While it is clear that the provincial and regional maps are far too impersonal for use in a local planning exercise, it is also evident that the roughly-sketched property map from Labrador is too personal for general use at a community level. What map ratio, then, might enable local activities to be portrayed at the scale of inshore fishing grounds, an appropriate level for implementing community-based protective measures?[21]

During coastal mapping projects conducted in Nova Scotia and New Brunswick "it was decided that [NTS] maps at the 1:50,000 scale could not adequately display the level of detail which was collected and compiled, and which was required by the [participating] communities to develop resource management plans" (Rutherford *et al.*, 1995, 13). Planimetric maps at the 1:10,000 scale were, however, found to be "valuable for accurate plotting of information during the data collection process."[22] The 1:60,000 scale of the available CHS charts was smaller than desired for inventory purposes, but the charts were still regarded as advantageous for collecting "fisheries-related data" in those provinces.

Topo/bathy maps generated at a scale of 1:25,000 in Japan (Tanioka *et al.*, 1991) and 1:24,000 in the US (Fefe, 1984; Spencer, 1984) appear to be a reasonable compromise between the local scale of Nova Scotia's 1:10,000 planimetric maps and the regional scale of Canada's 1:50,000 NTS and 1:60,000 CHS maps.[23] Moreover, with the combined topo/bathy maps,

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[21] Butler *et al.* (1986) describe four different scales for coastal mapping purposes. Fay and MacNeill (1993) recommend five different scales for coastal data compilation: i) 1:2,000,000 for a North Atlantic overview (e.g., see East Coast of North America Strategic Assessment Project, Brown *et al.*, 1996), ii) 1:500,000 for a provincial level (e.g., waterfowl and aquaculture in Newfoundland, Simms, 1994), iii) 1:50,000 for regional needs (e.g., oilspill sensitivity mapping, Wedeles *et al.*, 1993), iv) 1:10,000 for local information (e.g., community based coastal resource mapping in NS, Rutherford *et al.*, 1995), and v) 1:5000 for site level information (e.g., aquaculture sites, Jacques Whitford Environmental Limited, 1993).

[22] Use of Newfoundland's 1:12,500 forestry maps enabled Shepppard, Hedges and Green (1982) to collect reasonably accurate information on nearshore fisheries such as lobster and codtrap berths, but the lack of depth information on these maps makes the charted deeper water fisheries, such as gillnets, rather suspect. (It appears that the topographic information on the forestry maps is derived from the 1:50,000 NTS maps. See Chapter 4.)

[23] For a short period of time (1959-1975) 1:25,000 NTS maps were produced in Canada, but mostly just for cities, including St. John's, Newfoundland (Sebert, 1997). Many provinces have since produced their own topographic maps ranging in scales from 1:10,000 (e.g., NS and NB) to 1:25,000 (e.g., BC). Some large scale planimetric maps

"only one product is required instead of the previous two," and perhaps of even greater importance, users "can visualize the transition from land to water or vice versa" (Fefe, 1984, 433).[24]

### 3.3.4 Map Reading and Environmental Visualization

An exercise in which people record information on maps is as much about map reading as it is about the information held in memory. Participants must be able to visualize earthscapes as depicted on paper maps if there is to be some association with the more familiar lived-in environment.[25] This is not a difficult operation in regions where participants are accustomed to cartographic products and make regular use of adequate published maps (e.g., nautical charts along much of the Nova Scotia coast), but in regions where coastal maps are non-existent (e.g., Brazil) or rudimentary (e.g., Bonavista Bay), such a methodology may pose significant challenges. For example, during the Labrador mapping exercise, one researcher commented that very few of the Inuit interviewed had ever seen topographic maps:

> Although I explained how to read the map and pointed out familiar landmarks, many informants had difficulty finding areas in which they had hunted, trapped, and fished, and they would not draw on the maps. This problem was compounded – or perhaps was the result of – the fact that about one-third of the informants are illiterate. (Brice-Bennett, 1977, 206)

Oral descriptions, site visits, transect walks (and cruises or dives), modelling, diagramming and simple sketch maps require neither print literacy nor specialized technical knowledge (Chambers, 1994b). Overlay mapping on published charts, however, does require a certain degree of literacy and cartographic familiarity. Chambers asserts that "visual literacy is

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are available for rural areas in Newfoundland (e.g., 1:5,000 maps of Eastport and Port Blandford, a town at the south end of Terra Nova National Park) as well as orthophoto maps (1:12,500) and forestry maps (1:12,500) but there are no plans to produce a series of large or intermediate-scaled topographic maps for the province (Chafe, pers. comm.).

[24] Modern CHS charts show relief in the coastal landscape to aid visual navigation, but the actual detail is sparse by comparison with that available on large scale topo/bathy maps of Japan and the United States.

[25] This discussion draws from a seminal paper on cartographic communication in which a distinction is made between "environment-derived visualization" and "map-derived visualization" (Head, 1984). In essence, visualization is the "human ability to develop mental representations" (MacEachren *et al.*, 1992, 101). Geographic visualization is further defined as "... the use of concrete visual representations – whether on paper or through computer displays or other media – to make spatial contexts and problems visible, so as to engage the most powerful human information-processing abilities, those associated with vision" (ibid.).

independent of alphabetical literacy, and appears to be near universal" (1994b, 1263). This is simply not the case with published maps; a topographic or bathymetric chart is a technical drawing that demands a certain number of "prerequisite cognitive structures" (Head, 1984) if it is to be read and properly interpreted.[26]

### 3.3.5 Cognition and Cartographers

Where charts and maps are rudimentary, unfamiliar or non-existent, cartographic design leading to effective communication becomes even more essential for overlay mapping of local knowledge. In the case of Eastport, fishers require an easily-read chart, one that recreates the lived-in coastal environment and helps to stimulate recall of everyday fishing space. One would expect cartographers to solicit user feedback and that through time their maps "would be modified or re-designed to address users' comments and suggestions" (Keller, 1995, 32):

> [The cartographer] must grasp from the author's explanation a conception of reality and must then refine it for translation into cartographic language. This will probably require much exploratory dialogue as the cartographer builds facts, then conceptual hypotheses, then checks his hypotheses, then seeks further facts. (Head, 1984, 19)

In most cases, however, the map "author" will be a geographer, a scientist or a manager with specialized cartographic goals that may or may not reflect the needs of a potential user group (e.g., inshore fishers). Regrettably, expert cartographers often assume that they "know best what the user wants ... and therefore, do not need to solicit input from the users" (Keller, 1995, 33).[27] For mapmakers wishing to practise responsive[28] cartography – for example, to adapt their output for community needs – the "single overriding objective is simply to listen to the user, and to learn" (Keller, 1995, 35). An appropriately-scaled basemap showing both the land and sea, as described in the sections above, might be the ideal design for scientists, planners and coastal managers, but will fishers agree that it is the most suitable type of map for capturing

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[26] I am tempted to coin the term "cartographacy" (after numeracy) to differentiate map reading abilities from those associated with interpreting letters, numerals and other less demanding visual images.

[27] Keller (1995) finds this most alarming when cartographers embrace technological innovations. Researchers may make imaginative use of digital methods, but if maps are produced with little knowledge of user attitudes, needs and expectations, cartographers will not be taking full advantage of the flexibility afforded by modern software.

[28] See Relph (1989) for a discussion of responsive methods in human geography.

local knowledge and will it reflect their "conception of reality?"[29]

### 3.4 MARITIME PEOPLES AND FISHING SPACES

Local knowledge of fishing grounds can be mapped quickly and effectively by having fishers draw the location of their harvesting activities onto paper maps, but where does this knowledge reside and how do coastal fishers conceptualize ocean space? Nietschmann makes some preliminary observations on the conceptual dimensions of coastal waters:

> Sea territories are not just bounded sea space but areas named, known, used, claimed and sometimes defended. A social group's familiarity with an area creates a territory. A territory, whether terrestrial or marine is more than simply spatially delimited and defended resources for the exclusive use of a particular group. Sea space becomes an entity because a social group establishes and recognizes the location, pattern and interaction of marine things and processes. Water space is made familiar by naming and giving meaning to physical and biotic aspects. Places used are places named. People conceptually produce the environments they use, delimit and defend. (1989, 60)

Much of the forgoing appears to be universal as evidenced by an increasing number of coastal studies throughout the world in diverse fields such as anthropology, biology, ecology and folklore. This section examines environmental cognition among fishers, navigation and wayfinding techniques, local management schemes and place naming traditions.

#### 3.4.1 Maps in the Mind

> That's a good idea to get the fishing areas down on the charts. You know, it's like I've got a map of the grounds in my head. (Fogo Island fisher, 1996)

Cognitive mapping theory is often cited as the assumed basis of much environmental knowledge.[30] "Mental map" and related terms have been used to characterize the bathymetric

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[29] Adaptive map design for Eastport is described in Chapter 4. In this exercise, harvesters are the map authors instructing me, the cartographer.

[30] Graham's characterization of a cognitive map, "a model of the environment which is built up over time in an individual's brain" (1976, 259), complements a later simplification of the concept by Downs and Stea (1977): "the world in the head." Note the fundamental similarity with Mailhot's definition of traditional ecological knowledge: "the sum of the data and ideas acquired by a human group on its environment as a result of the group's use and occupation of a region over many generations" (1993, 11). True to Saarinen's prediction that cognitive map "research will continue regardless of what the geographers do" (1979, 467), the concepts have been adopted by many other fields to describe local knowledge: anthropology, art, bioregionalism, ecology, environmental studies, folklore, international development and sociology (e.g., see Aberley, 1993; Austin, 1994; Brody, 1981; Butler, 1983; Chambers, 1994b;

knowledge and wayfinding techniques of coastal fishers (e.g., Butler, 1983; Dahl, 1988; Diegues, in press; Eythorsson, 1993; Jorion, 1978; Neis, 1992; Nietschmann, 1989).[31] In many parts of the world, including inner Bonavista Bay, hydrographic charts are nonexistent, inaccurate, or of limited use to inshore fishers.[32] Furthermore, small-boat subsistence and commercial fishers are rarely equipped with the sonar technology that would enable seabed visualization or the electronic navigation aids that would enable automatic wayfinding. A system of cognitive mapping therefore becomes essential, as described for an outport fishing community in Newfoundland:[33]

> Fishing in Cat Harbour demands a precise knowledge of 'the grounds'; that is, the nobs, shoals, and ledges of the sea bottom. The successful fisherman is that person who can best 'work the grounds': find the ground, judge the temperature, current ('tide'), and skillfully set his trap or trawls or nets on just the right 'spot'. Men see the ocean floor as they see the surrounding countryside and barrens: a complex of rises, ledges, depressions, 'hummucks,' and ridges – a fair approximation of the sea bottom. (Faris, 1972, 28).

As has been well-documented by anthropologists, fishing peoples around the world employ two

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Creates. 1990; Harris *et al.*, 1995; Lindquist. 1995; Ryden, 1993; Weiner *et al.*, 1995).

[31] The concept of mental or cognitive maps began in psychology (Tolman, 1948) and was carried into geography through studies of environmental perception, spatial cognition and human behaviour (see Downs and Stea, 1973; Ittelson, 1973; Kaplan and Kaplan, 1982; Lowenthal, 1967; Moore and Golledge, 1976; Saarinen, 1976; Tuan, 1975). Theorists in these fields have suggested that individuals become familiar with local environments initially by recognizing landmarks. Over time, an experience-based mental representation of local surroundings is generated as the mind assembles multiple landmarks into routes: "Cognitive mapping is a process composed of a series of psychological transformations by which an individual acquires, codes, stores, recalls, and decodes information about the relative locations and attributes of phenomena in his everyday spatial environment" (Downs and Stea, 1973, 9). Continuing investigations have focussed on wayfinding, the conceptualization of geographic space, environmental psychology and the study of behaviour-environment interactions (e.g., Bell *et al.*, 1984; Garling and Evans, 1991; Garling and Golledge, 1993; Kitchin, 1994; Mark and Frank, 1990; Portugali, 1996). The theories of cognitive mapping have also been applied to the study of marine creatures, particularly sedentary and slow moving species (e.g., decapods) which can be easily tracked (e.g., see Vannini and Cannicci, 1995).

[32] Diegues (in press) comments that Brazil has thousands of published maps, but few for coastal areas used by artisanal fishers. The land side of the coastal interface is well mapped in northeast Newfoundland, but the water side remains poorly charted in many areas.

[33] In response to a question about incorporating information from fish harvesters into DFO databases, Scarratt responds that "[i]t is not always simply information that is in the written or mapped form, a lot of it is still locked in the minds of people and has to be extracted" (1989, 45). However, it remains unclear whether Scarratt is interested primarily in the knowledge of scientists and fishery officers, or if he might include harvesters as knowledgeable local experts, a recommendation endorsed by Butler, LeBlanc *et al.* (1986). Calling for the formalization of such information, Basta makes a plea for the use of atlases, questionnaires and interviews "to capture and encode, in usable formats, the knowledge base of experts" (1990, 311).

or more triangulation 'marks' in coastal landscapes (e.g., rocks, trees, hills, built structures) to locate otherwise unseen bottom features (Bjorklund, 1993; Butler, 1983; Faris, 1972; Forman, 1970; Igarashi, 1977; Jorion, 1978; Neis, 1995; Pocius, 1992; Samson, 1980).[34]

The systems of cognitive mapping developed by fish harvesters comprise at least seven components: 1) an above-water visual element to locate marks, 2) a collection of marker names, 3) a formula to relate the named marks to one another (e.g., 'open X on Y), 4) a knowledge of water depths, 5) a functional knowledge of subsea characteristics such as geology, temperature and plant life, 6) a store of information about the type of fish to be expected, and 7) a temporal or seasonal component.[35] This knowledge is generally transmitted orally during on-the-water experiential learning sessions and and not by written descriptions or with reference to artifact maps:

> When young fishermen begin to learn their new skills, they are taught the landmark configuration which indicates the fishing grounds. The descriptive nomenclature is a convenient means of impressing the marks on the memories of these debutants, as well as ensuring the continuity of the group's interpretation of reality.[36] (Butler, 1983, 18)

Most of the published studies appear to focus on two themes: i) the above water "points of concordance" and ii) the transmission of this local knowledge across generations and between competing crews. Very little appears to have been written on the mental images fishers have of undersea topography, but a considerable body of research does exist to explain the uses and

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[34] To locate fishing grounds, the "one-line" positioning method uses landmarks and a compass bearing from a known location. The "two line" method is based on the intersection of sight lines found by aligning four marks. See explanatory diagrams in Butler (1983), Jorion (1978), Igarashi (1977) and Samson (1980). While this particular type of location-finding appears not to have attracted the attention of cognitive researchers in geography and psychology, similar observations have been made regarding general spatial cognition: "Locations are by their very nature relative to some frame of reference. Whenever an object's location or orientation is specified it is done in relation to some other object" (Hirtle and Heidorn, 1993, 181). Pocius makes specific comments regarding spatial cognition among fishers: "No visual boundaries exist on the water to distinguish one place from another. Without complex attention to land features, no one could clearly recognize the location of trap berths" (1992, 71).

[35] Much of the research on environmental cognition among fishers has been conducted by anthropologists. Geographers and environmental psychologists might make a greater effort to study the little understood "vertical dimension" (Hirtle and Heidorn, 1993, 170) of fishers' cognitive maps.

[36] I do not mean to romanticize the Newfoundland outport or to suggest that fishers are not technologically adept. On the contrary, "fishing is a very technologically sophisticated business" (Lien, 1988, 41) and harvesters are constantly adapting with increasingly sophisticated gear types, navigational aids and fishfinding equipment, especially on the mid-size (35-65 feet) longliners used in the crab fishery. Also, many have computers at home to manage their fishing enterprises which may amount to several hundred thousand dollars.

applications of such knowledge.[37]

### 3.4.2 Spatial Management in Fisheries

A range of synonymous terms, including community-based management and customary user rights are in use to describe local management schemes in small boat fisheries (McGoodwin, 1990).[38] McCay states that most "known cases of indigenous fisheries management hinge upon the management of access to fishing space rather than levels of fishing effort" (1981, 5-6). Many studies of the Newfoundland fishery, including McCay's own doctoral research (1976), stress this point by demonstrating the existence of unwritten rules and rights, many with spatial components:

> Any attempt to understand Newfoundland's fisheries, inshore and offshore, in terms of their approach to resource management, must, we feel, confront the very elementary fact that Newfoundland fishermen do not, as a rule, manage their resources, but rather manage space – that is, the points of privileged access to the resource. (Anderson and Stiles, 1973, 45)

Many of the informal rules that once governed the Newfoundland inshore fishery (e.g., see Anderson, 1979b; Anderson and Stiles, 1973; Anderson and Wadel, 1972; Brice-Bennett, 1977; Faris, 1972; Martin, 1979; Shortall, 1973; Stiles, 1976) have eroded with the introduction of new regulations (e.g., quotas) and modern gear types (e.g., monofilament gillnets), but in many areas, "fishers still refer to local customs within the confines of formal DFO rules" (Phyne, 1990, 89; also see Matthews, 1993 and Neis, 1992).[39] This is particularly evident for inshore

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[37] Neis acknowledges the existence of Newfoundlanders' underwater knowledge: "Fishers deal on a regular basis with a landscape that no one has ever seen. For inshore fixed gear fishers and those who fish offshore routinely in the same places, its features are well-known to them, and a part of their vernacular. The land under their keels is composed of banks and gullies, deeps and knolls, edges and grounds. These have names or toponyms, some of them very descriptive: Hole in the Wall, Northeast Peak, Stoney Ground, etc. In among these places are located their fishing berths. In the inshore, these are found using land marks, which also have names" (1995, 266).

[38] "Sea tenure," another commonly used term for local management, has been described as "the ways in which fishermen perceive, define, delimit, 'own' and defend their rights to inshore fishing grounds" (Ruddle and Akimichi, 1984, 1). See additional case studies in Begossi (1995), Berkes (1989), Brownstein and Tremblay (1994), Christy (1982), Cordell (1989), Dahl (1988), Davis (1984), Doulman (1993), Dyer and McGoodwin (1994), Lamson and Hanson (1984), McCay and Acheson (1987), Pinkerton (1989), Pinkerton and Weinstein (1995) and Ruddle *et al.* (1992).

[39] This is explained in part by the lack of grounds suitable for inshore gear in much of the province. There are exceptions to these natural limits – the "narrow ecological niche" available for fishing (Phyne, 1990) – especially in areas where shoal waters abound. For example, along the straight shore between Gander Bay and Bonavista Bay (see

fisheries prosecuted with fixed gear types such as the traditional codtrap, a boxlike net set close to shore. Suitable shallow-water berths are generally fewer than the number of crews wishing to set these traps. As a result, local 'draws' are held annually to permit equitable access over time to the limited number of available berths (Matthews, 1993; Matthews and Phyne, 1988; Phyne, 1990; Stiles, 1976). In a few areas, notably Petty Harbour, fishing grounds are also reserved for the exclusive use of handlines (Bryant and Martin, 1996; Martin, 1979).[40]

### 3.4.3 Toponyms

User rights in the marine environment are intimately connected with historical fishing patterns and local knowledge, both of which are communicated with the aid of locally-derived toponomy.[41] Naming categorizes the physical environment "in a standardly acceptable form [and in] this way the seemingly amorphous ocean is impressed with an invariable order and structure which collective acceptance renders culturally real. Naming also serves as a learning device by means of which new initiates into the fishing occupation can be enculturated with the [community's] cognitive world view" (Butler, 1983, 18). Researchers in the Labrador land use and occupancy studies were quick to recognize the importance of local place names to envrionmental perception and thus, wilderness navigation:

> Place names constitute a descriptive record of the landscape and enable hunters to construct oral maps by which they can visualize areas, approximate distances, and recognize travel routes. They provide a cultural and historical dimension to land use, a testament to the continuity and the intimate relation of the people to

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Figure 1.2) I was told, with reference to soundings on navigation charts, that 'there's plenty of shoal water for lobster in this area.' See similar comments on the Trepassey fishing grounds in Martin (1979).

[40] Much of the social research conducted in Newfoundland fisheries has had cod as its focus and this is reflected in academic knowledge of existing local management regimes. Other fisheries may be subject to informal spatial regulations, but little is written of their existence. For example, maritime anthropologists have studied the Newfoundland lobster fishery (e.g., Palmer, 1993 and 1994), but without much focus on the spatial aspects of local management as stressed in studies for Nova Scotia (Brownstein and Tremblay, 1994), Maine (Acheson, 1988) or Mexico (Miller 1989 and 1994).

[41] Newfoundlanders have evolved their own unique ways of naming places. For a general discussion of Newfoundland toponomy, see Hamilton (1996); for a scholarly treatment, see Seary (1971). Essays in Brice-Bennett (1977) describe place naming traditions in Labrador. Handcock (1985) discusses topographic, descriptive and toponomic generic terms used in Newfoundland. Official place names are listed in the *Gazetteer of Canada: Newfoundland* (Canadian Permanent Committee on Geographical Names, 1983). Approved underwater toponyms can be found in the *Gazetteer of Undersea Feature Names* (Advisory Committee, 1987).

the land. (Brice-Bennett, 1977, 195)

As in Labrador, the standard topographical maps and nautical charts of Newfoundland "have left unnamed innumerable features and cannot, in the nature of things, contain such minor names as, for example, those of fishing berths" (Seary, 1971, 16).[42] That such "names are not unworthy of study" (ibid., 344) is demonstrated by the mention of names for Labrador codtrap berths in various papers (e.g., Black, 1960; Brice-Bennett, 1977) and in published maps of Avalon Peninsula berths (Bryant and Martin, 1996, 8; Martin, 1979, 280; Pocius, 1992, 70); and with "local appellations" charted for the waters surrounding Fogo Island (McCay, 1979, 158).[43]

In recent years, it has been argued that locally-derived names play a central role in reproducing the societies from which they spring: "Naming the objects of our places is a way of entering into relationships with those places, of making them our own, of creating a home" (Armbrecht Forbes, 1995, 70; also see Aberley, 1993; Alia, 1994; Gaffin, 1994; Nietschmann, 1989 and 1995; Poole, 1995b; Rundstrom, 1991). If this is the case, should these names and their underlying significance be "worthy of study" by toponymists, anthropologists and cultural geographers purely as a function of historical, linguistic and academic curiosity?

## 3.5 SOCIAL CARTOGRAPHIC THEORY

If it is assumed that cognitive maps and related names are indeed how fishers imprint meaning on their watery world, what kind of sensitivities should researchers be aware of as they approach the map collection and depiction of such knowledge? I first became aware of cartographic ethics and map blunders in the NMCA project during a Parks Canada presentation on the Bonavista initiative at the Marine Protected Areas Syposium held in Halifax during May 1994 (see Shackell and Willison, 1995). The original transparency map showing Parks

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[42] The same is true in many regions of the North Atlantic. Gaffin, for example, uses a sample illustration to demonstrate that none of the "hundreds of names used by local residents are included on official maps of the Faeroe Islands" (1994, 22). Nietschmann (1995) makes similar comments regarding British and American charts of the Caribbean.

[43] In the classic treatise on Newfoundland toponomy (i.e., Seary, 1971), the methodology seeks to interpret the place names published on contemporary topographic maps with the use of historical materials. Unfortunately, perhaps, for Newfoundland scholars, undersea names included on modern hydrographic charts are not given the same rigorous analysis in Seary's text. I have not exhausted the research materials available to toponomists, cultural anthropologists and hydrographers, but based on my preliminary reading, I must concur with Whelan and Phillips' assertion that the study of informal oceanic place names remains "an area untouched by geographers" (1984, 152).

Canada's study area in northeast Newfoundland labelled much of inner Bonavista Bay as a "core" area of interest. For the solitary harvester in attendance at the symposium, the revelation that his prime fishing grounds had been selected for "core" designation proved rather startling, especially after a week of presentations on the "core-buffer" protected area model (i.e., strictly enforced no-take zones surrounded by transitional areas managed intensively for sustainable use; see Price and Humphrey [1993] and Salm and Clarke, [1984]). During the fracas that ensued, all parties came to realize that the "core" areas of interest on the map should have been labelled "highly representative areas" to avoid misunderstandings. The graphic was revised (see Mercier, 1995, fig. 12) but I was permanently alerted to the "power of maps" (Wood, 1992).[44]

My concern for unintended visual messages, misdrawn lines and the potential for "cartocontroversy" (Monmonier, 1995) led me to examine the dubious history of mapmaking and the disenfranchising role of modern maps in planning and environmental management. What follows is a review of cartographic social analysis with specific map examples drawn from marine environments to show how information used in planning can alienate or empower local communities. In the first subsection, the historical role of cartography as practised by colonial powers is considered. Conventional government cartography is then described with a case study of planning maps from the West Isles Marine Park proposal. The third subsection examines indigenous and community-based efforts to re-map traditional territories, valued locations and common place names. The final section considers the implications for harvest area mapping in Bonavista Bay.

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[44] I was forced to return to this image on many occasions. Eventually, I drafted a second map to replace the troublesome original. (Figure 1.2 is derived from my redrawn version.) I still received questions from fishers curious to know 'how far off' an NMCA might extend, and no wonder; the source of the questioning – the offshore intent of Parks Canada – became obvious when I revisited the written study area description: "... Bonavista Bay to Bay of Exploits and out to the continental slope, including Funk Island" (Mercier, 1995, 248). To fishers, scientists and the legal community, the slope lies some distance from the deep water channel between Funk Island and the Funk Island Bank implied by the Parks map. Did the "Area of Interest" map really illustrate the *whole* study area, or did it just show the *landward extents* of the study area? If the latter, was this an appropriate map (i.e., accurate and honest) for distribution to fisheries interests, government departments, NGO's and the academic community? Beyond the ethical question, this became a practical question as I endeavoured to extract NMCA study area information from other data sets. The use of the original map as the basis for an NMCA MERA (Mineral and Energy Resource Assessment; see description in Yurick, 1988) also seemed to belie the actual study area as defined in writing. (Canadian jurisdiction beyond the 12 mile territorial sea remains a murky legal question, particularly with regards to international navigation, seabed ownership and water column resources.)

### 3.5.1 Maps, Geography and Empire Building

In *Deconstructing the Map,* widely regarded as the seminal paper on social cartographic theory, Harley asks for the nature of maps to be redefined as representations of power.[45] By calling for close scrutiny of the social context of map-making, Harley adds "a political dimension to the map's traditional representation of geographical features" (Belyea, 1992, 7) and makes it clear that "maps can rarely be considered as scientifically objective" (Taylor, D., 1994, 53). Building on Harley's work, Wood (1992) asserts that every map is biased and designed to serve the interests of its creators.

The decidedly "postmodern" analysis of maps appears to have begun with a re-evaluation of colonial era cartography: "European maps of the period can be viewed as statements of territorial appropriation, cultural reproduction, or as devices by which a native North American presence could be *silenced*" (Harley, 1992b, 522, emphasis added). Similar conclusions have been made about early maps of Newfoundland:

> The island's name itself bears witness to the *erasure* of the pre-colonial native presence. Whether it was as Newe Found Lande, Terra Nova, Tierra Nueva, or Terre-Neufsve, the naming of the place on sixteenth-century English, Portuguese, Spanish and French charts announced the common theme of novelty and discovery. (Sparke, 1995, 1, emphasis added)

If maps "silenced" and "erased" original occupants of the expanding European world, so too did the texts of geographers, writers and explorers.[46] The imagery formed by these early writings and maps contributed to the Western romantic notion of wide open lands, unpeopled places and seas full of fish.[47] In some cases, the full presence and knowledge of original peoples in such

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[45] Deconstruction developed in literary criticism as a "... technique for teasing out the incoherencies, limits and unintended effects of a text" but it has since been applied to all manner of cultural products, inlcuding maps (Cloke *et al.*, 1991, 192). See Dear (1994) for a general discussion of postmodernism in geography.

[46] For example, mountainous and northern regions that were intimately-known and well-travelled by their indigenous occupants were described as "unknown" and "inhospitable" to European audiences (Hewitt, 1988; Shields, 1991). Meanwhile, through the "conceptual emptying" of Australia, the Aborigines were dispossessed of their territories (Jacobs, 1993, 102). Despite this "erasure" of indigenous people, many acted as guides and some even helped to inscribe maps for explorers during the colonial era (e.g. see Harley, 1992b; Rundstrom, 1990; Spink and Moodie, 1972; Turnbull, 1993). In Newfoundland, the Mi'kmaq and Beothuck Nations certainly helped open up the interior for colonial powers (Sparke, 1995).

[47] See O'Dea (1967 and 1971) for a review of the historical cartography of Newfoundland. An earlier work by Ganong (1964) examines early maps of Atlantic Cananda. For many centuries, the offshore fishing banks were better mapped than the land mass of Newfoundland, a condition indicating the dominant economic interest of European

marginal regions has remained uncharted until well into this century.[48]

Maps are still used in the exercise of empire building.[49] For example, Canada made effective use of marine biogeographical maps to support maritime claims during international boundary disputes with the United States on George's Bank (Ricketts, 1986) and with France for the waters surrounding the islands of St. Pierre and Miquelon (Francalanci, 1995).[50] Day (1988) and Gray (1994) summarize and discuss Canada's unresolved maritime boundaries with ample map illustrations. Maps and GIS were also used during the turbot dispute with Spain on the Nose and Tail of the Grand Banks (see Day, 1995) to demonstrate scientific stock assessments and historical fishing patterns (O'Shaughnessy and Gélinas, 1995). Finally, preliminary mapping has been completed under United Nations Law of the Sea guidelines to support a Canadian claim for those portions of the continental shelf lying in international waters beyond the presently-claimed 200 nautical mile fishing zone (R. Macnab, 1994).

### 3.5.2 Alienation in Modern Cartography

Conventional cartography and its digital offshoots, whether practised by governments, the military or offshore oil and gas companies, have had as their goal the supposedly objective representation of geographical features. Many of the products generated, however, still depict a selective reality as is perhaps best exemplified by the "useful sterility of the topographic sheet"

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nations. O'Flaherty (1979) makes related comments regarding early literary depictions of Newfoundland. McCann (1988) discusses the invention of a "colonial consciousness" in the mid 1800's. Modern "constructions" have been described for Newfoundland cinema, literature and tourism promotions (e.g., Overton, 1980a, 1980b and 1987); myth-making in the media's treatment of the northern cod crisis (see Keating, 1994); and the manufacture of "spectacle" in the Cabot 500 celebrations (Norcliffe, 1997).

[48] Labrador and northern Quebec are described by Hare as an "empty, virgin territory" where the "geographer becomes once again an explorer" creating "filled-in maps where formerly there was only blank paper" (1967, 111-112). See the antithesis to this view in the map-based Inuit land use and occupancy study published ten years later (Brice-Bennett, 1977). Also see descriptions of the "unknown Labrador" peopled by early European settlers who became intimately familiar with their environs (Kennedy, 1995).

[49] I. Taylor (1994) discusses the role of maps in the conceptual "creation of Canada."

[50] Many citizens may not realize that Canada's ocean borders are not yet fixed. For a technical discussion of maritime boundary delimitation, see Beazley (1994), Kerr and Kapoor (1986) and Prescott (1985).

(Aberley, 1993, 2; also see the discussions in Pickles, 1995; Smith, 1992; Wood, 1992).[51] From a social perspective, maps are just as important for what is omitted as for what is included (Monmonier, 1996).[52] In the case of modern map-based resource inventories for protected areas planning and environmental assessments, categories of biophysical information, cultural themes and local perspectives are inevitably overlooked (Bastedo *et al.*, 1984; Nelson, 1991b and 1982). This is certainly true of early Canadian efforts to establish marine parks (Graham *et al.*, 1992; Graham and Payne, 1990).[53]

The use of maps by Parks Canada in the abandoned West Isles Marine Park Proposal was not overly sensitive to regional perspectives or traditional activities and likely contributed to the estrangement of local people.[54] The original concept document for the proposed park contains a resource atlas (see Parks Canada, 1983) that reflects the values and objectives of park planners (e.g., ecological units, seabirds, dive areas, beaches, shipwrecks and archeaological sites). Upon viewing such imagery, offense was registered by many local stakeholders, including one resident who arrived at a community meeting to discover "... on a proposed development map that his house and property had been replaced by a field of picnic tables" (Davies, 1993, 88). The planning maps also alienated residents in less obvious ways; for example, the "West Isles" name, borrowed from the Archdiocese, was not in common use locally (Butler, 1994). Area residents were symbolically eliminated from the proposed park by the omission of their hunting and fishing activities – activities replaced by "visitor use concepts" on the government maps (see Parks Canada and Tourism New Brunswick, 1983). The Fundy

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[51] Maps are necessarily limited in the information that they can portray. A certain degree of "cartographic abstraction" involving selection, classification, simplification and symbolization is required to depict physical environments in mapped formats (Muehrcke, 1980).

[52] The converse – that maps may contatin non-existent features – is of course true as well. For an interesting discussion of this issue as it relates to "phantom islands" shown on Atlantic Ocean maps, see Johnson (1994).

[53] Harley argues that the absence of social theory in cartography equates with the substitution of progress for colonial expansionism in the current use of maps: "in our own society, it is still easy for bureaucrats, developers and 'planners' to operate on the bodies of unique places without measuring the social dislocations of progress" (1989, 14). During a 1996 meeting with a Bonavista Bay Fishermen's Committee, this very concern was expressed by one individual: a long-time harvester wondered how 'some bureaucrat in Ottawa could put two pins in a map and close off Bonavista Bay for a marine park without asking communities?'

[54] Also see Part One of Appendix A for a discussion of the West Isles Marine Park proposal.

Weir Association, a powerful fishing lobby at the time (Wilbur, 1985), "complained that Parks Canada's proposals had more to say about how the fishery should adapt to the needs of the park than about the ways the park could adapt to the fishery" (Ricketts, 1988, 295).

### 3.5.3 Revisionist Cartography

The emergence of indigenous and community-based mapping projects is evidence that local concerns, local knowledge, and local ways of seeing the world have not always been reflected in official mapping programs. The overall trend has been summarized as follows: "Conventional maps are assumed to be objective. These maps are supposed to be *subjective*, expressing the things felt to be essential" (Poole, 1995c, 76, author's emphasis). The self-demarcation project is well under way as evidenced by over 60 indigenous and community-based GIS mapping projects in Canada alone (Bird, 1995). If those concerned with the official business of producing maps fail to reconsider their role voluntarily, this emerging "ethnocartography" will most certainly force a change in the politics of mapping.[55]

In the global effort to gain recognition of land and sea rights, indigenous peoples are "generating maps to articulate traditional knowledge and express ancient patterns of occupancy" (Poole, 1995a, 1). Government supported efforts include land use and occupancy studies for First Nation claims in Canada (described in section 3.6.2), the inclusion of black farmers' knowledge for land restitution in South Africa's cadastral reform (Fourie and van Gysen, 1995; Harris *et al.*, 1995; Weiner *et al.*, 1995), the incorporation of Maori knowledge in New Zealand conservation management (Laituri and Harvey, 1995) and the use of Aboriginal knowledge to support territorial claims in Australia (Jackson, S., 1995; Jacobs, 1993). Official topographic maps have also been updated to include Inuit place names in Canada (Alia, 1994; Rundstrom, 1995, 1993b and 1991) and Maori names in New Zealand (Dickson, 1996).

In recent years, indigenous communities have trained their own specialists and developed independent mapping programs for environmental assessment and land claims purposes: "The power of maps as packets of environmental data has been used to good effect

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[55] The 1995 Winter issue of *Cultural Survival Quarterly*, entitled "Geomatics: Who Needs It?" documents 15 indigenous and community-based mapping projects. Gonzalez *et al.* (1995, 31) have assigned the title "ethnocartography" to this revisionist movement. Others have used the term "counter-mapping" to describe the process of indigenous re-mapping (e.g., Peluso, 1995).

by indigenous peoples in their dealings with external agencies, as they realize the negotiating potential of deploying equivalent or better databases" (Poole, 1995c, 74; also see Aberley, 1993; Duerden and Keller, 1991; Johnson, 1992; Kemp and Brooke, 1995; Poole, 1995b; Robinson *et al.*, 1994; Wavey, 1993).[56] Mapping and inventory projects have also been completed with the assistance of academic researchers and non-governmental organizations, often to support and reinforce traditional stewardship activities (e.g., see Berkes *et al.*, 1995; Fox, 1990; Laituri and Harvey, 1995; Nietschmann, 1995; Sirait *et al.*, 1994).[57] A common element in many of these mapping exercises is the degree of control maintained by participating communities; ownership of local knowledge and map copyright is evident in many cases.

Non-indigenous groups have also used maps to counter or challenge dominant perpsectives. For example, Bunge (cited with illustrations in Wood,1992), depicts life for inner-city residents in Detroit, complete with maps of garbage dumpsters and children bitten by rats. In a sanitized update of Bunge's stark realism, Monmonier (1996) describes citizen alternatives to zoning, taxation and development maps. The emerging field of bioregionalism has also attracted strong community proponents owing to its focii on local values and the "reinhabitation of place" through mapping (Aberley, 1993).[58] Finally, maps of Newfoundland fishing grounds published in Bryant and Martin (1996) and Pinkerton and Weinstein (1995) are clearly meant to demonstrate pre-existing local management schemes.

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[56] Not all countries offer the constitutional protection that Canada's First Nations enjoy; in fact, many still offer no formal recognition of indigenous perspectives and historical land rights. This issue is further complicated when a peoples inhabit territory that spans two or more countries. Nietschmann offers a radical perspective on indigenous mapping based on his work with the Miskito, a marginalized coastal peoples occupying regions of Nicaragua and Honduras: "The approach and objectives are very straightforward: defend the land and sea territories by accurately mapping them using new technology and traditional knowledge; use the maps to show that territories have long been occupied and managed which is why they are still biologically rich; and use the maps to internationally promote political decentralization as a geographic-territorial fact and the best means to conserve the planet's biological and cultural diversity" (1995, 37).

[57] During my research, I received a Mi'kmaq map of Atlantic Canada. This map, created with the financial support of several government departments and assorted agencies, including Parks Canada, contains indigenous toponomy and Mi'kmaq nomenclature for fish and animals. Since publication, the Department of Indian Affairs has provided funding for The Aboriginal Title Project, a mapping initiative intended to demonstrate that all of Nova Scotia is occupied and used by indigenous inhabitants. Meanwhile, at Kedjimkujik National Park in western Nova Scotia, non-indigenous technical specialists are assisting with a Mi'kmaq cultural resource assessment (Weiler, pers. comm.). Might the Newfoundland Mi'kmaq undertake similar efforts?

[58] With a demonstration of "community values mapping" in the Cornerbrook area, Young and Coates (no date) provide evidence that the bioregional movement has arrived in Newfoundland.

### 3.5.4 Implications for Bonavista Bay

The "invisible" geographies of coastal Newfoundland – the historic patterns of sea use, the encoded sense of place and the knowledge of fish stocks – are only now, in the aftermath of the groundfish moratorium, receiving thorough documentation through projects such as the sentinel fishery and MUN's Eco-research Program (see Ommer, 1993). Before such comprehensive efforts, general practices may have been known (e.g, draws for trap berths), but the specifics of any given community remained little known to outsiders – even neighbouring communitites. Depending on the time of year, many visitors, including Parks Canada planners, might look upon the seemingly "unhumanized" seascape of Bonavista Bay and marvel at the apparent wildness and biological richness in much the same way that colonial explorers gazed. However, a visit during lobster season, or during the peak of the codtrap fishery, would create an entirely different impression.[59] Maps for use in local planning exercises must present this more fully "humanized" version of the seascape.[60]

## 3.6 KNOWLEDGE ELICITATION

The basic collection of local marine knowledge – as has been stated already – involves the translation of cognitive environmental impressions into more conventional cartographic language by means of overlay mapping on hydrographic basemaps (Butler, LeBlanc *et al.*, 1986; Rutherford *et al.*, 1995; Salm and Clarke, 1984).[61] To accomplish this elicitative task, scientific researchers often employ rigidly structured interviews and questionnaires, whereas cultural anthropologists and human geographers prefer the semi-structured map interviews developed for Canada's indigenous land use and occupancy studies. A third and perhaps alternative

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[59] During the three summers that I frequented those shores (1994-1996), there was indeed very little evidence of a fishery. One mapping participant later told me that in the years before the moratorium, 'a man could walk on the floats and lines strung out along the coast between Sandy Cove and Smokey's Hole.'

[60] Lien (pers. comm.) has suggested that MPAs will happen in "people's heads," not by lines drawn on a map and not solely through pre-emptive legislation. What goes on a marine conservation planning map should be an accurate reflection of what already exists in the collective mindscape of a user community.

[61] Golledge comments that cognitive "... knowledge is difficult to articulate and externally represent" (1993, 40). Although my concern is largely with map-based elicitation of local knowledge, there still exists a wide range of approaches. Gilmartin explains that "... the conceptual and methodological problems inherent in eliciting concrete representations of a mental construct have been a source of controversy in the field of cognitive research. No single approach has proven satisfactory for all disciplines, research objectives, and scales of reference" (1985, 56).

approach to mapping, one that is fast becoming a favourite among practitioners of participatory rural appraisal, requires outside researchers to act as detached facilitators and technical advisors for local communities wishing to generate their own maps. Following a discussion of these approaches, the section concludes with some comments on collaboration.

### 3.6.1 Formal Interviews

Increasing realization that local knowledge is at times the only source of information available, and greater recognition that such knowledge might make substantial contributions to scientific inquiry have prompted a growing number of formal interviews to learn from fish harvesters in Atlantic Canada. Academics, scientists and planners have made use of structured and semi-structured interviews to elicit fishers' knowledge about a wide range of marine concerns.[62] Fishers were interviewed to generate harvest area maps for the Newfoundland Inshore Fisheries Baseline Survey, a project completed by the Province in anticipation of the Hibernia oilfield development (Sheppard, Hedges and Green Limited, 1982). Graham (1991) surveyed a range of customary marine users along the northeast coast of Newfoundland to complement the concurrent NMCA biophysical study being done for Parks Canada (see Ledrew, Fudge and Associates, 1990). The Fishermen and Scientist Research Society (see King *et al.*, 1994) used interviews to chart fishers' knowledge of spawning sites in Nova Scotia (Younger *et al.*, 1996). Potter (1996) undertook a similar project to map inshore spawning areas for northeast Newfoundand using semi-structured open-ended interviews. Finally, the Eco-Research Group at MUN has been working to collect and chart fisheries knowledge on the Bonavista Peninsula (Maguire *et al.*, 1995; Neis *et al.*, 1994).[63] In most of these cases, fishers

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[62] There are many other local marine knowledge mapping projects ongoing in Atlantic Canada, but here I review only those for which publications are readily available. It is interesting to note that a decade ago, the Nova Scotian authors of the FAO's introductory manual for marine resource mapping implied that Canadians employed remotely sensed imagery, computerized data bases and other more technical approaches: "Surveys of the status of fisheries and marine related information within *developing nations* often indicate a dearth of such data, at least in a form which can be utilized for management purposes. This state of affairs, invariably due to a lack of manpower, money or expertise, confirms the requirement for fisheries resource mapping with an emphasis on the collection and presentation of marine information in its most basic form. The major source of such information in *developing nations* is often the fishing community, rather than the research and management agencies associated with *industrialized nations*" (Butler, LeBlanc *et al.*, 1986, 83, emphasis added).

[63] Clay (1996) offers a case study of harvester mapping in the northeastern United States. Her methodologies, observations and discussions are all relevant for similar investigations in Canada.

were interviewed "... individually to avoid bias" (Butler, LeBlanc *et al.*, 1986, 86).

### 3.6.2 Land Use and Occupancy Studies

Mapping has become the standard means of demonstrating Canadian First Nations land claims (Elias, 1989; Usher *et al.*, 1992). Employing methods pioneered in the early land use and occupancy studies in the North (e.g., see Brody, 1981; Freeman, 1976; Riewe, 1992) and in Labrador (Brice-Bennett, 1977), anthropologists working through translators – and increasingly, indigenous data collectors – conduct map interviews with hunters, harvesters and elders. These "map biographies" capture place names, an individual's harvesting areas, related ecological knowledge and cultural features on standard topographic sheets.[64] Compilation of numerous interview sheets helps to develop composite regional maps depicting a group's traditional territories and commonly-used place names. The popularity and success of land use and occupancy studies has been attributed to "the ease and straightforwardness of documentation, the visual effectiveness of the composite map and the aura of 'scientific objectivity' derived from the survey methodology" (Usher *et al.*, 1992, 125).

### 3.6.3 Participatory Rural Appraisal

Participatory Rural Appraisal (PRA), which has been described as "a growing family of approaches and methodologies to enable local people to share, enhance and analyze their knowledge of life and conditions, to plan and to act" (Chambers, 1994a, 953), makes use of mapping to animate discussions, to show land ownership and to illustrate environmental variables and land use decisions (Poole, 1995a). Maps "... express different perspectives on what is significant in villages and landscapes. They serve to mobilize local talents and resources – and sometimes provide a medium for airing and resolving local tensions. Mapping signifies what is happening *within* communitites" (Poole, 1995a, 1, author's emphasis). Sketch maps can be drawn on paper or even on the ground and require very little in the way of expert training.[65]

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[64] Wavey (1993) uses "oral map" to describe a similar documentation process.

[65] A sketch map, whether of city streets, vegetable rows or fishing areas is essentially a cognitive map representing the "everyday spatial environment: everyday in the sense that it is the world that we interact with regularly and that serves as the normal setting for our activities" (Downs and Stea, 1977, 6).

This ease of application has made mapping popular in a range of international development projects where facilitators initiate drawing at a local scale, perhaps to show homes in a village, footpaths or the layout of a community's fields (e.g., Fox, 1990; Sirait *et al.*, 1994).

PRA differs considerably from academic research and even from similar interactive approaches to data gathering, such as Rapid Rural Appraisal (RRA) and Participatory Action Research (PAR).[66] Practitioners do not elicit and extract local knowledge in PRA:

> Outsiders are facilitators, learners and consultants. Their activities are to establish rapport, to convene and catalyze, to enquire, to help in the use of methods, and to encourage local people to choose and improvise methods for themselves. Outsiders watch, listen and learn. (Chambers, 1994b, 1255).

Facilitators working in the all-important "catalytic role" (Western *et al.*, 1994) have been described as "agents of change" (Burkey, 1993; Wells *et al.*, 1992) or "environmental community organizers" (Wells and White, 1995) and generally, they concentrate on applications rather than publications. Unlike formal interviews and questionnaires, which seek to extract local knowledge from individuals, information in PRA is "generated, analyzed, owned and shared by local people as part of a process of their empowerment" (Chambers, 1994b, 1253).[67] Maps enable local people to visualize their own conditions. Recognition of local knowledge leads to collective pride and responsibility, both of which are important pre-conditions for resource stewardship. Finally, there is growing evidence that information shared by local people through maps and other visual means is more valid and reliable than data collected through traditional (i.e., extractive) qualitative research methods (Chambers, 1994b).

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[66] See Chambers (1994a, b and c) for futher distinctions between RRA, PAR and PRA. These newer approaches to qualitative social research have evolved from participant observation (e.g., see Geertz, 1983; Lindquist, 1995). See Townsley (1993) for a guide to RRA in rural communities; Pido (1995) for a discussion of RRA in coastal resource planning; Robinson *et al.* (1994) for a review of PAR with indigenous communities; Burkey (1993) for a discussion of participatory appraisal in development; and Williams (1996) for an annotated bibliography of participatory field research methods. It is not my intention in this thesis to present a "thick description," or a full ethnographic survey of the Eastport Peninsula. Although a broad human ecological survey is desirable, the time required for such an undertaking is beyond the scope of the present study.

[67] Success in PRA tends to be measured in terms of realized solutions and community satisfaction; not in terms of career advancement (Chambers, 1994a). For critical reviews of social research methods used in rural communities, see Burkey (1993), Cernea (1991), Chambers (1994a, b, c, 1982) and Pimbert and Pretty (1995). These authors are especially critical of interviews, questionnaires and surveys which extract local knowledge for use, analysis, publication and profit by academics and other outsiders.

### 3.6.4 Discussion

The capture, display, dissemination and application of local knowledge is fraught with social and political issues, many of which are only beginning to be examined. As a result, researchers are far from unanimous in their support for various methods of eliciting local knowledge. Several writers have suggested that local knowledge should be integrated or somehow blended with scientific forms of knowledge after collection and careful evaluation by "outsiders" (e.g., DeWalt, 1994; Maquire *et al.*, 1995; Murdoch and Clarke, 1994; Peepre, 1992; Ruddle, 1994b).[68] It has also been argued that local knowledge is developed and transmitted *in situ*, and therefore must be captured and applied by people that live "inside" the socio-cultural setting where it has evolved (e.g., Agrawal, 1995a and 1995b; Heyd, 1995).[69] Is it really a "black and white" case of one way or another? Is there not some middle ground that might accommodate both of these perspectives?[70]

Few would disagree that fishers and other customary users of marine resources have a substantial body of knowledge that might be useful for science and management, but if the

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[68] Ruddle summarizes the contemporary importance of local knowledge in fisheries and marine environments: i) inherent academic interest, ii) practical usefulness, and iii) an instrument of empowerment (1994b, 192). Many academic and government-supported studies reflect Ruddle's second point regarding the practical significance of local knowledge "for the rest of the world": i) new biological and ecological insights, ii) resource management, iii) protected areas and conservation education, iv) development planning and, v) environmental assessment (IUCN, 1986, cited in Berkes, 1993). Rundstrom summarizes this perspective: "the underlying attitude is that indigenous peoples and their geographical knowledge must be 'saved,' i.e., before we destroy them, because *they* have information that *we* need" (1995, 55, author's emphasis). Others have recognized this trend towards extraction with increasing demands that local knowledge "not be reduced to an interesting research topic for western science to explore" (Kemp and Brooke, 1995, 27).

[69] Indigenous groups collect local knowledge with aims of empowerment: i) recognition of land rights, ii) demarcation of traditional territories, iii) protection of demarcated lands, iv) gathering and guarding knowledge, v) management of lands and resources and, vi) mobilizing community awareness and resolving conflicts (Poole, 1995b; also see Kloppenburg, 1991 and Thrupp, 1989). This illustration of an alternative vision for local knowledge reads initially as a criticism of the IUCN list above and the researchers who are compelled by it; my intent, however, is to convey the different sense of priority in the two approaches. In Poole's version, biodiversity conservation – the ecological dimension – will be achievable once autonomy is secured and people have real control over their resources. And, in all fairness to the IUCN and its adherents, the importance of maintaining community local knowledge ownership – the political dimension – is regularly discussed as an afterthought to the ecological motivations (e.g., see Johannes, 1993; Johnson, 1992; Lalonde and Akhtar, 1994).

[70] For the purposes of this investigation, the focus is on the use of maps to collect and display local knowledge. For a general discussion of intellectual property rights appropriate for other types of knowledge (e.g., artistic symbols, medicinal plants and genetic resources) see Greaves (1994), IUCN Inter-Commission Task Force (1997) and Posey and Dutfield (1996). Also see rejoinders to Agrawal (1995b) in 1996 issues of the *Indigenous Knowledge and Development Monitor*.

information flow is only in one direction – knowledge extracted for use by outsiders – communities may be reluctant to contribute.[71] Park planners with an interest in collecting local knowledge during the establishment phase of marine and terrestrial national parks are offered a stern warning in this regard by Graham and Payne:

> If the communication is only one way and dedicated solely to data development, failing to lead to meaningful involvement in planning and management, considerable resentment against acceptance for the park and its staff and limited involvement in long-term planning and management programs may result. (1990, 126-127)

A coastal and marine resource inventory that stimulates local concern for resources and results in stewardship activities must be community-based, and ideally, it should be community-driven: "Our experience in Canada tells us that it is at the community level where the required actions to maintain coastal resources are implemented; it is from this level that the true effort springs" (Norrena, 1994, 160). Verification of local knowledge and integration with scientific information are desirable goals, but straight forward locational information about where people fish can be applied immediately; perhaps not in a bio-statistical model or a "total allowable catch" approach to fisheries management, but certainly in a coastal management or sea use zoning framework (e.g., selecting closed areas for lobster or designating conflict-free aquaculture sites).

It is fine to have a conceptual notion of a community-driven inventory, but it is quite another thing to enable one. Unless such a plan originates at the community level, as was the case in Nova Scotia's Shelburne County (MacCullough, pers. comm.), how is a community to become interested and see the mapping process as its own?[72] There are also structural

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[71] It should come as no surprise that harvesters are tired of contributing to studies. (Attitudes are changing with substantial inshore participation in DFO's Sentinel fishery.) In the past, Newfoundland fishers have given information without receiving much in return. The Newfoundland Inshore Fisheries Baseline Survey (see Sheppard, Hedges and Green, 1982) is a case in point. The survey included detailed maps of fishing grounds surrounding the Avalon Peninsula and despite the reliance on harvesters for most this information, the maps were never returned to the contributors or released to the general public (Warren, pers. comm.). John Kearney (pers. comm.; also see Kearney, 1984 and 1989), Policy Advisor to the Canadian Council of Professional Fish Harvesters (see CCPFH, 1996), expressed similar concerns when invited by the Fishermen and Scientist Research Society (see King *et al.*, 1994) to advise on a project to map fishers' knowledge of spawning locations in Nova Scotia and New Brunswick (see Younger *et al.*, 1996). He questioned to what degree this mapping would empower the fishing community.

[72] The DFO supported Marine Resource Mapping Project now being carried out in Nova Scotia on a county by county basis had its start with the Community Futures group in Shelburne. Local planners considering various coastal

considerations: communities should draw their own maps, but with limited access to government information and cartographic production techniques – manual or digital – how can community groups best capture and display their knowledge? Here there is a definite role for initiating agencies, especially when it comes to technical assistance and project funding. Acting in a facilitator role, an outside agency might help communities conduct their own studies and inventories. Such a process will, of course, work better when coordination is provided by existing community organizations (e.g., First Nation Elder Councils or Fishermen's Committees). Facilitators provide elicitation skills and cartographic technical support, but the knowledge is captured, held and applied by the community.[73] Where government participation is regarded with suspicion at the local level, academic researchers and non-governmental organizations can help to gather and organize information with and for interested communities (e.g., see Nelson, 1993; Nietschmann, 1995; Poole, 1996; Roots, 1993).

Information may be collected in a collaborative fashion with invited outside technical assistance, but caution is advisable for several reasons. First, with formal methods of elicitation, interview "subjects" are made uncomfortable; they may also feel that they are contributing to "someone else's" project even when the intent may be to help visualize local knowledge for local people.[74] Second, people may lie when asked to provide information about their activities, particularly if there is a perceived, or real threat to their livelihoods.[75] Third, initial capture by

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development opportunities, such as aquaculture, underutilized species and ecotourism, realized that they needed to know where resources were located before they could manage them. When it became apparent that government inventories were grossly inadequate for planning purposes, displaced fisheries workers were employed to collect and compile detailed local knowledge of coastal and marine resources. The mapping exercise was carried out with the financial and technical support of various levels and departments of government.

[73] It has even been suggested that outside facilitators, particularly cartographers, can help to "enfranchise the disenfranchised" (Rundstrom, 1991, 8).

[74] In Nova Scotia's Coastal Resource Inventory Project (see Rutherford *et al.*, 1995), one of Atlantic Canada's most successful community-based mapping exercises, organizers learned that elaborate questionnaires and structured interviews were inappropriate for local settings (MacCullough, pers. comm.). Data collectors hired from the community have had considerable success with open-ended questioning and other informal methods of information capture. Detailed pictographic legends have been especially helpful for prompting responses from interviewees.

[75] Graeme Kelleher, now retired from the Great Barrier Reef Marine Park Authority in Australia, recounts the story of harvest area maps drawn by fishers in the early stages of the Park's establishment (pers. comm.). It seems that when members of the fishing industry were asked to delineate prime grounds, the threat of reduced harvesting privileges led participants to shade areas that were of marginal importance. The industry "smokescreen" vanished when scientists and managers recognized the cartographic lie. Not to be outdone, the Park Authority hinted that the

and with local people may be faithful, but further treatment and analysis by outsiders could lead to misinterpretation, misuse and even further alienation of already marginalized groups.[76] Communities may be more inclined to share their knowledge with outsiders in an open and honest fashion: i) if the sharing offers some potential for local empowerment (e.g., local participation in fisheries research and decision making), and ii) if the end product is useful for participants (e.g., maps for local planning).[77]

Residents of southwest New Brunswick might not have felt marginalized and ignored in the West Isles Marine Park feasibility assessment had they been able to draw and later recognize their own place names and activities on the Parks Canada maps.[78] Consider the herring fishery as an example of how mapping and connected dialogue might have been more amenable to regional priorities in the abandoned proposal. The original concept document speaks about temporal zoning to restrict tourism and recreation around herring weirs (see Parks Canada and Tourism New Brunswick, 1983). It is later written that there are 56 berths in the study area. What if planners had located the weirs on aerial photographs and included them in the proposal maps as an open acknowledgment of fishing activities? Even better, what if planners had collaborated with the Fundy Weir Association to map the locations of fixed weir berths then discussed options for marine park zoning, and finally, left copies of the maps with the fishers for

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seemingly unimportant areas on the fishers' maps would be zoned for strict protection. Naturally, the fishing industry was forced to recant.

[76] Comments in this vein by Harris *et al.* are of particular relevance to the present study: "... because of the nature of current GIS technology, community knowledge transfer into a GIS must be filtered by outsiders. ... This 'knowledge distortion' necessarily separates the local community from their own cognitive information. The nuances of the local context, which underpins local knowledge, may easily be lost in the encoding process" (1995, 217).

[77] Trusting relationships and effective partnerships between resource users and scientists were acknowledged at the first Coastal Zone Canada conference. Recommendations for shared knowledge building were the outcome: 1) equip all stakeholders with accurate and understandable scientific information as well as traditional knowledge, 2) encourage scientists to communicate more effectively with local community groups, and to act on the ideas expressed through public participation, and 3) increase scientific research efforts, with local community input, in identifying and understanding the functioning of coastal ecosystems (see Coastal Zone Canada Association, 1996, 13).

[78] One can only speculate that cartographic sensitivity would have at least created the impression that Parks Canada was listening. I do not mean to advocate patronage or cartographic tokenism, but rather, to point out the obvious lack of public relations savvy on the part of somebody at Parks Canada. Communications specialists surely must know such basics as the emotional power of visual language.

use in deliberations with the burgeoning and spatially competitive aquaculture industry?[79]

## 3.7 TECHNICAL CONSIDERATIONS

### 3.7.1 Audio Recordings

Portable tape recorders have long been an essential tool of the folklorist (e.g., see Hamilton, 1974; Wilson, 1986) and they are now used extensively to capture all of the information that indigenous participants might contribute to land use and occupancy studies (e.g., Robinson *et al.*, 1994). The recording and transcription of local histories, ecological knowledge, folklore and traditional customs is doubtless "... of great value in understanding the general pattern of land use," but for the purposes of map biographies in Labrador, anthropologists found that "this method of taking notes proved to be of minimal value. ... Informants would refer to the map with such statements as 'I hunted here' (pointing out the area) or 'My trap line was there,' without using place-names. Such an omission made it difficult to plot data on a map" (Brice-Bennett, 1977, 280). Beyond this practical concern, tape recorders generally make people uncomfortable; they are also extractive by their very nature when employed by outsiders.[80]

### 3.7.2 Approaching Quantification and Objectivity

Local knowledge is often dismissed as being too "unscientific" (Agardy, 1995, 10), particularly within a positivist conservation paradigm that "... gives credibility to opinion only when it is defined in scientific language" (Pretty and Pimbert, 1995, 8).[81] For researchers working with fishing communities, a "lack of standardized methodologies and low quantitative

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[79] Stephenson (1990) describes the conflict between salmon farmers and herring weir fishers in the Bay of Fundy.

[80] The agreed upon goal of the field portion of this research was to generate harvest area maps in a collaborative fashion. I was invited by the Eastport Fishermen's Committee to facilitate the mapping and to provide technical assistance, but not to extract local knowledge solely for the interest of, and use by outsiders. As a result of the discomfort caused when I taped an early meeting in Eastport, I chose not to record the mapping sessions. I made this decision with full knowledge that valuable information would be lost; however, I did plan to take note of circumstances in which tape recording would be useful for mapping purposes.

[81] For a geographical perspective (i.e., distinctly spatial) on the quantification of local knowledge for conservation planning purposes, see recent efforts in New Zealand to blend Maori ways of knowing with scientific forms of knowledge (Laituri and Harvey, 1995).

salience" have prevented broader acceptance of their research findings and recommendations (McGoodwin, 1990, 187). Clearly, there is a need for fisheries social scientists to "... develop more rigorous techniques and the kind of data that will permit comparability, as well as integration, with other already formalized means of analysis" (ibid.).[82] For the marine geographer interested in the human oceans at a community scale, this implies improving mapped forms of local knowledge so that they might be more compatible with scientific data sets (e.g., measurements of depth, temperature, subsea geology and biota). Geo-encoding offers considerable promise in this regard.

### 3.7.3 Geomatics Technology

Various forms of computer technology are helping to facilitate the collection and compilation of local knowledge.[83] When sketched without scale, orientation and formal grid reference, local knowledge remains anecdotal, "[a]nd because sketch maps are so uncontrolled and individualistic, the researcher's comparison and generalization among a group of sketch maps are often vague and subjective" (Gilmartin, 1985, 56).[84] Geomatics technology, which is revolutionizing the mapmaking trade, has provided a more technical and precise, if not more "scientific," means of capturing local knowledge.[85] Geomatics can also combine the

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[82] Thapa *et al.* assert that "... insight into the depth of farmers' knowledge may have been gained by researchers adopting a less formal approach to knowledge acquisition [i.e., descriptive ethnographic surveys], [but] without an explicit, durable and manipulable record, subsequent analyses and continued use of the knowledge in the research and development process might not be achieved" (1995, 249).

[83] For a general discussion of the interface between local and computer knowledge systems, see Bardini (1992) and Schoenhoff (1993). Thapa *et al.* (1995) comment on computer-encoding of local agricultural information. D. Taylor (1994) suggests that computer-assisted visualization has the potential to bridge scientific positivism (precise, quantitative and objective) and the humanists (fuzzy, qualitative, subjective).

[84] Modern tools help convert sketches of local knowledge and traditional land use patterns into cartographic forms (i.e., georeferenced) "... which the relevant government agencies find digestible – or at least difficult to dismiss" (Poole, 1995a, 1). Peluso (1995) makes similar comments regarding meetings between government mappers and "peasant groups" with their own legitimate and technically acceptable maps. Contrast the reception of these digitally-enhanced products with the legitimacy bestowed upon sketch maps "prepared by peasants" in an effort to claim lake portions of the Titicaca National Reserve in Peru (Orlove, 1993).

[85] Geomatics is becoming the preferred title to describe the digital convergence of several fields including cartography, hydrography, geographic information systems, remote sensing, photogrammetry, geodesy, surveying and satellite positioning systems. The Canadian journal, *Geomatica*, defines geomatics as "... a field of activities which, using a systemic approach, integrates all the means used to acquire and manage spatial data required as part of

community-scale strengths of local knowledge with the regional-scale strengths of remote sensing and government mapping programs. When cognitive earthscapes are inscribed and georeferenced in the field with affordable GPS units, or merged with government maps and remotely-sensed digital imagery, local knowledge assumes far more authority than possible with oral descriptions and simple sketch maps (Nietschmann, 1995; Poole, 1995b).[86]

### 3.8 SUMMARY

This chapter reviews, links and synthesizes several bodies of theory and method in an effort to answer five principal research questions. First, ***how can inshore fishing grounds be mapped?*** Aside from legal boundaries, very little mapping of the human oceans has taken place in Canada. Fishing activities are typical of many sea uses in that they are difficult to map without user input and local interpretation. Two options appear to be available for harvest area charting at Eastport: site visits and mapping from memory. Next, ***how do fishers relate to fishing areas?*** Cognitive maps form the basis of harvester's knowledge. Places on land are named with descriptive terms to enable fast environmental recall and thus enable navigation and undersea location finding. Spatial management units on the water are also demarcated with reference to named landmarks. Third, ***how does one map cognitive earthscapes?*** Fishers are generally asked to draw their harvest patterns onto a familiar basemap, but if no suitable published charts exist, this becomes a more challenging operation as the cartographer will need to derive an appropriate basemap. A useful chart should be easily read; it must recreate the coastal environment as conceptualized by fishers; and ideally, it includes local topography and

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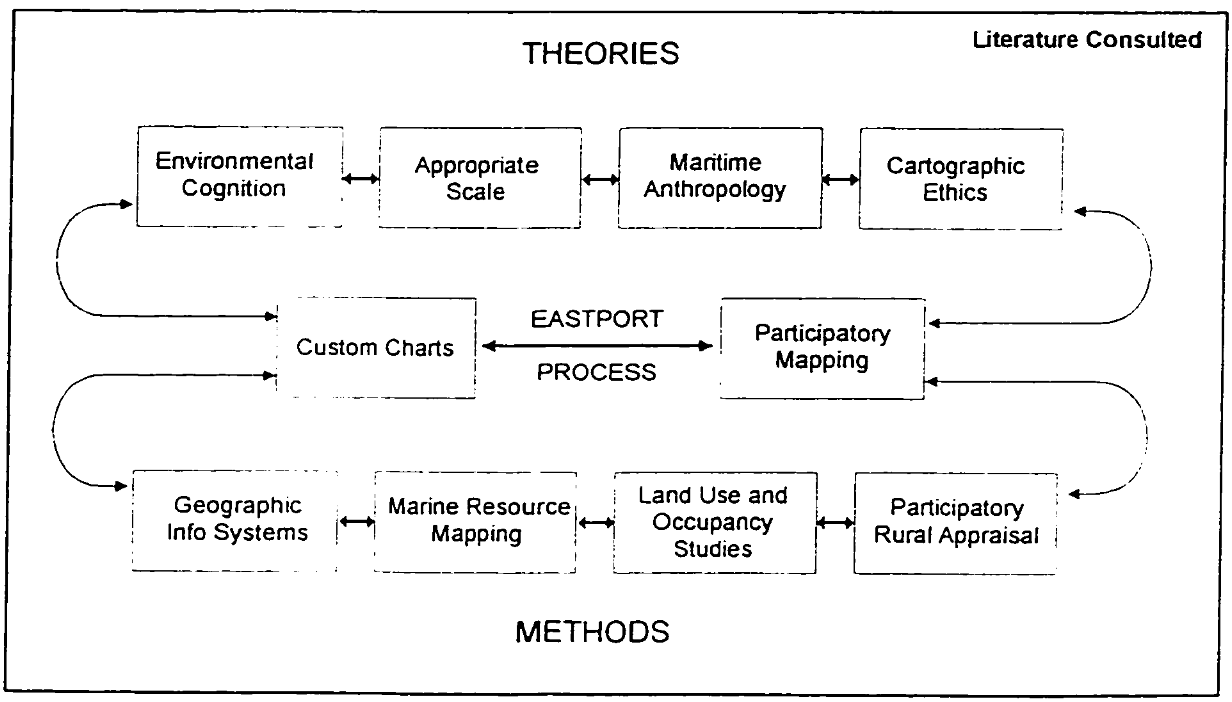
scientific, administrative, legal and technical operations involved in the process of the production and management of spatial information." Here the discussion is limited to geomatics and local knowledge. Chapter 4 and Appendix H detail the use of GIS for topo/bathy map generation.

[86] Decreasing costs have permitted geomatics to be applied in local knowledge projects around the globe. See general overviews in Conant (1994), Dunn *et al.* (1997), Poole (1995b), Tabor and Hutchinson (1994) and Thomas (1994). Published applications include studies in forestry (Barry, 1996; Fox, 1990; Peluso, 1995; Sirait *et al.*, 1994; Sussman *et al.*, 1994), cadastral reform (Fourie and van Gysen, 1995; Williamson, 1997), coral reef and coastal habitats (Diegues, in press; Nietschmann, 1995; Stoffle *et al.*, 1994) and agriculture (Gonzalez, 1995; Lawas and Luning, 1996; Tabor and Hutchinson, 1994). Satellite data and ethnographic survey data have also been combined in a range of studies (e.g., Bronsveld, 1994; Conant, 1994; Harris *et al.*, 1995; Nelson *et al.*, 1992; Weiner *et al.*, 1995). Despite the plethora of practical applications, GIS and cognitive map research by geographers remains curiously limited and largely technical in nature (e.g., Duerden and Keller, 1991; Kitchin, 1996; Kitchin and Fotheringham, 1997).

bathymetry, preferably at a maximum scale of 1:25,000. Fourth, ***whose maps are they?*** Mapped local knowledge is clearly the intellectual property of the contributors and it should be shared with outsiders only under terms acceptable to the participating harvesters. External facilitators invited to function in a technical role can, however, employ participatory methods that are responsive and sensitive to local circumstances. Finally, ***how can local knowledge be made more compatible with scientific information?*** Geo-referencing with the aid of GIS enables local knowledge to be converted into a format that is comparable – at least in spatial terms – with scientific information. Figure 3.1 illustrates the the range of literature consulted to arrive at a process for collaborative mapping with customized charts and participatory sessions at Eastport.

Figure 3.1 Designing a Methodology



# CHAPTER 4

## *CHARTING A COURSE*

This chapter documents the harvest area mapping project carried out in Bonavista Bay. Although the research evolved through simultaneous investigations in many areas, the research is described in sections for the sake of clarity. The first section on participatory fieldwork chronicles my interaction with the Eastport Peninsula Inshore Fishermen's Committee. Next, I describe the review carried out to discover appropriate basemapping materials. The third section on technical procedures details the use of GIS for basemap preparation and adaptation.

### 4.1 PARTICIPATORY FIELDWORK

#### 4.1.1 Interaction and Observation

As explained in Chapter One, I lived in Terra Nova National Park during the course of my research and met with fishers to explore their ideas for marine conservation and coastal resource mapping. Participation in lobster and crab trips enabled me to see fishing patterns up close well before setting out to map them; it also demonstrated to the fishers that I was genuinely willing to learn from them.[1] In dry land map discussions that involved displays of digitally-produced hydrographic data, I was the specialist with something to contribute, but on the water, fishers were clearly the specialists with expertise of their own to offer. Situating myself as an eager learner led to a relaxed and open rapport both on and off the water. Spending time in boats with fishers and TNNP staff also helped me become familiar with the waters and coastlines of Newman Sound (see Place Names figure in Chapter 5), a substantial part of the area to be mapped.

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[1] Marine mammal behaviouralist and conservationist, Jon Lien, and his students from MUN's Whale Research Group gained respectability with harvesters by learning to fish with them: "I have always insisted my students go out and fish with Newfoundland fishermen and see how it is to haul nets, how it is to work on the ocean" (Lien, 1988, 37). Although I did come to the research with a fishing background – which was acknowledged by many to be an important factor in my acceptance as a collaborator – I had limited experience in the small boat inshore fishery. Furthermore, I was an academic, a government employee and a 'come from away' Nova Scotian.

### 4.1.2 Project Initiation

The idea for a fishing grounds mapping project was discussed initially with the Chair of the Eastport Peninsula Inshore Fishermen's Committee (EPIFC); if the Chair believed it to be a good idea, he could present it to his committee as such. I had been investigating marine mapping for some time and had regularly communicated my findings (see Section 4.2 below) to the Chair, so he was aware of the recent CHS survey efforts as well as local mapping projects in other areas. Because of this familiarity, it was unnecessary to present the mapping project in a predetermined manner.

A discussion of local place names signalled the launch of the collaborative mapping project. While reviewing topographic maps and hydrographic fieldsheets with the Chair, his wide knowledge and local perspective were demonstrated with reference to specific locations on the charts. For example, while discussing some of the features that he had pointed out on an earlier lobster fishing trip, the Chair motioned to an inlet far too small for annotation on a government topographic map. The inlet was known locally as 'Hospital Cove,' named for a past fishers' practice of leaving sick and injured lobsters there to recover without the threat of capture. I suggested that we could relabel the maps with local toponomy and document marine knowledge and fishing patterns. My function, I explained, would be to provide the cartographic support necessary for such an undertaking; they would provide the information to be mapped.

### 4.1.3 Promoting the Concept

The Committee Chair could see the value in documenting local knowledge, but would other fishers share his interest? To find out, the idea was demonstrated at a committee meeting with a display of sample maps from similar projects in Trinity Bay (NF Inshore Baseline Survey maps; Sheppard, Hedges and Green Limited, 1982) and Nova Scotia (Scotia-Fundy Marine Resource Mapping Project; Rutherford *et al.*, 1995). New hydrographic fieldsheets, which many fishers knew existed, but few had ever seen, were also displayed. To provide a historical and perhaps more familiar perspective, I also displayed the standard nautical chart for the Bay (British Admiralty, 1873) and a marine resource inventory that had been completed many years earlier (Terra Nova National Park, 1972). In keeping with the theories and experience outlined in Chapter 3, the project was presented not as a government or academic initiative, but as way for fishers to demonstrate their concerns and share conservation and local objectives with outside agencies.[2] Visualization by way of cartographic display, I suggested, could demonstrate local knowledge and help to identify conservation priorities to Parks Canada and other management partners. Attention was drawn to the copyright statement on the demonstrator maps from Nova Scotia and the message was simple: fishers' knowledge leads to fishers' maps.[3]

The sample maps attracted considerable study and elicited some interesting responses. The idea of capturing local knowledge on paper seemed intuitive and simple enough, but it was the motivation for drawing the maps that sparked the most interest. Demonstrating fisher knowledge and local patterns of use to aquaculturists, mobile gear fleets, developers, scientists, managers, fisheries officers, conservationists and others, seemed like a good way to begin some constructive dialogue. As one participant phrased it, 'This should have been done long ago!'[4]

Before I had a chance to offer technical support for mapping in Eastport, the Chair sensed general support in the room and asked openly whether I could assist the committee with such a project. At that point I replied that I was keen to collaborate as part of my Master's research. The group's interest in moving ahead was evident and one senior fisher expressed the support as follows: 'Well, it can't hurt; we know something's got to be done about the state of the resource, and we've got to start somewhere.'

The Chair borrowed a sample map from Trinity Bay and took it to the next committee gathering to see if the larger membership agreed that harvest area mapping was a desirable undertaking. At that session, which included members absent from the initial meeting, the committee discussed and endorsed the project. Afterwards, the Chair indicated formal

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[2] In a paper describing participatory diagnostic tools for social forestry, Fox makes the following instructive comments: "Because social forestry programs have a practical rather than theoretical goal, it is important to see this process not as an 'academic' exercise but as a process whereby farmers and foresters learn about each other, develop a foundation for cooperation, and begin negotiating on the design and implementation of forest management plans (1990, 120).

[3] The sample maps from Nova Scotia bear the following note: "This mapping series was compiled under the direction of the Guysborough County Community Futures Fisheries Sub-Committee and is now the property of the Guysborough County Inshore Fisherman's Association. The information and basemaps can only be duplicated or altered with permission of the Association."

[4] The TNNP inventory from 1971 was greeted with a certain amused skepticism (e.g., 'this is all wrong and they missed that'), but curiously, also a certain amount of reconstructive excitement (e.g., 'Yes b'y, we used to get herring in the bottom of the Arm, but that's been gone for years now'). (See Observation 10 in Appendix B on the importance of images of past abundance.)

acceptance of the mapping project and invited me to proceed.

### 4.1.4 Basemap Preparation and Adaptation

In early discussions and meetings with fishers, there were many opportunities to review existing basemap products, most of which turned out to be unsuitable for reasons detailed below in section 4.2. Feedback from participants indicated that the ideal basemap would enable fishers to locate themselves relative to water depths and coastal landforms. (The process leading to the production of such a customized basemap is examined in Section 4.3 and Appendix H.) The committee Chair also indicated the range of the Eastport fishery, or at least the area for an initial mapping exercise (see Figure 1.2) which enabled the appropriate digital fieldsheets to be ordered and compiled. The final basemap was produced collaboratively with digital source data and maps-on-demand GIS technology (Section 4.3).

### 4.1.5 Mapping Sessions

***Organization***

Once a basemap was generated, the Committee Chair identified key fishers and helped to set up individual and small group mapping sessions.[5] A total of 9 sessions were conducted during which time 12 participants drew their knowledge of harvest areas onto the basemap. Except for one mapping session in which four participants collaborated, most sessions involved only one person. Contributors were selected to encompass a wide range of ages, gear types, species and fishing areas.[6] It was hoped that the sampling would provide composite coverage for the areas fished by the Committee membership. The mapping took place on kitchen tables at participants' homes and averaged between 2 and 3 hours per session. Each session was started with a review of the project, a demonstration of fisher drawn maps from elsewhere, and an explanation of the basemap's origins.

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[5] Pringle (1985. 392) concludes that "fishermen tend to choose well" when selecting representative delegates from within their ranks.

[6] In the Labrador Land Use and Occupancy Study. the "selection of informants who had experience in different areas ensured a good coverage of the whole Rigolet region and did not bias the survey toward one area or another" (Brice-Bennett. 1977. 280).

*Data Capture*

As a first step and a familiarity exercise, local place names were charted on mylar overlaying the Eastport topographic map (NTS, 2 C/12).[7] Fishers then used coloured pencils to draw harvesting patterns and related knowledge onto mylar film affixed to the prepared prototype basemap. In most sessions, very little prompting was necessary as most participants knew that they had to work through the different gear types and species fished. Occasionally it was necessary to prompt for categories that had been overlooked or forgotten. As the mapping progressed in each session, I referred to a list of semi-structured questions (see Appendix D) to make sure that we were covering the common species and gear types.

Most of my questioning was related to the accurate map depiction of harvest areas. For example, when a single line was drawn along a 100 fathom contour to demarcate cod gillnets, I asked several questions to clarify the spatial extent of the area used. In this instance, it turned out that nets were set across a slope that begins at 90 fathoms and extends to 120 fathoms. Proper map delineation therefore demanded a section be shaded to contain the entire slope as a gillnet harvest area.

*Map Production and Peer Review*

Mylar sheets from the mapping sessions were compiled to enable the digital generation of composite harvest area maps. At the time of writing, a full set of draft maps had been returned to each of the participants for review and corrections. Some corrections were suggested but these are not reflected into the final maps presented in the next chapter.

## 4.2 BASEMAP REVIEW

A review of available basemapping materials began early in the research (Summer 1994). Existing paper maps and digital datasets were examined to find appropriate features and resolutions for inshore coastal mapping. Fisher meetings helped to select and design the most appropriate cartographic foundation for mapping harvest areas.

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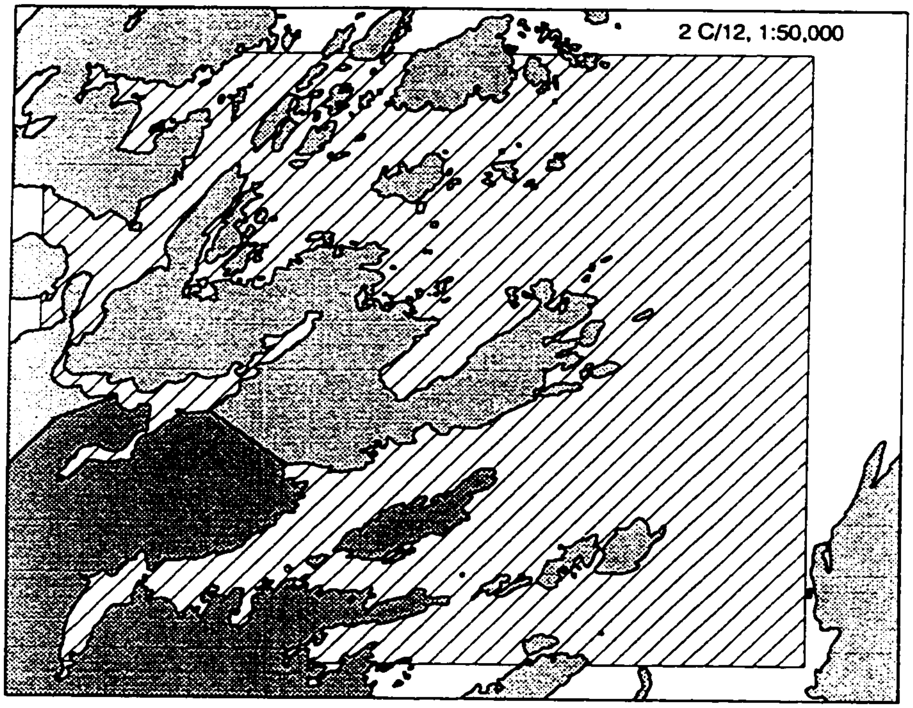
[7] Initially, this was done to help participants review and incorporate a standardized cartographic representation of their world, before moving on to the somewhat abstract topo/bathy prototype.

### 4.2.1 Topographic Maps

Maps from the National Topographic Series (NTS) were examined as potential basemaps. Although they contain place names, landforms and recognizable coastal features, they do not have the depth soundings and bathymetry that would help to translate mental impressions of fishing space into map themes.[8] Furthermore, the NTS scales (1:250,000 and 1:50,000) would only permit generalized delineation of fishing grounds. The NTS map sheet for Eastport does, however, cover most of the EPIFC harvest areas (see Figure 4.1).

Figure 4.1 Eastport Topographic Map




The province of Newfoundland has generated a series of forestry maps at a scale of 1:12,500. The maps were produced in a digital environment and contain forest classifications

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[8] In the Maritime Provinces, individuals "consulted for fisheries related data are more familiar with the CHS charts [than the topographic maps] and can relate their information to the location of shoals, banks, buoys, markers and other features on these charts" (Rutherford *et al.*, 1995, 13). Occasional place name labels and the colour blue are the only indicators of water on the NTS maps. Also, there is little to distinguish between fresh, brackish and salt water themes on these maps.

derived from aerial photos at the map scale, but the remainder of the information was captured from the 1:50,000 NTS map sheets (Nolan, pers. comm.). The coverage is incomplete for the federal lands protected within Terra Nova National Park. Non-forested areas such as bogs and coastal barrens are also given little attention in the maps.

A series of orthophoto maps exists for the Eastport Peninsula at a scale of 1:12,500, but the poor quality of reproduction makes them unsuitable for coastal mapping purposes. Geopositioning on the orthophotos was also found to be inaccurate: shorelines digitized by the CHS for use in Bonavista Bay were off by as much as 250 metres when compared with GPS measurements (Sterling, pers. comm.).

#### 4.2.2 Published Hydrographic Charts

Several CHS publications include the waters of Bonavista Bay (e.g., 4017, 4520, 4560 and 4562), but none of the existing charts depict the inner Bay at a scale appropriate for mapping inshore fishing grounds (see Chapter 3). A common British Admiralty chart for Bonavista Bay (Chart #291) shows depth soundings at a very crude scale (approximately 1:168,000), but the age of the map (1873) and its gross inaccuracies mean that very few fishers actually use it. Furthermore, most fishers operating from small open boats rarely refer to a chart and navigate by coastal landforms instead.[9]

#### 4.2.3 Hydrographic Datasets

A CD-ROM containing the Digital Chart of the Oceans was reviewed to check for basemap potential. The Newfoundland coast was derived from the World Vector Shoreline dataset (1:250,000). Bathymetry was derived from the GEBCO series (General Bathymetric Charts of the Oceans) and included very little information for inshore areas (See Figure 2.1).

A metric North Atlantic dataset developed by DFO for use in the Science Branch (Kulka, pers. comm.) was acquired and examined as a possible basemap source. The hydrography contained in the SPANS file (Spatial Analysis Software by Intera Tydac of Ottawa) was derived from existing CHS charts and provided a good regional overview, but its use in nearshore mapping would be limited by its 50 metre contour interval. Metadata for the

[9] Some topography is depicted on modern CHS charts, but the detail and contour interval varies from map to map.

file's creation was non-existent, but it appeared that the Bonavista Bay portion might have been derived in part from the British Admiralty Chart described above.[10]

#### 4.2.4 CHS Survey Fieldsheets

New Bonavista Bay fieldsheets from recent Canadian Hydrographic Service (CHS) surveys looked initially like a suitable base upon which to draw fishing activities. As the source material for future nautical charts, survey sheets are highly accurate in their depiction of undersea features and their average scale (1:25,000) would seem to offer a fair degree of precision for placement of fishing activities. (Appendix F reviews modern survey methods and the generation of CHS fieldsheets.) A search was requested of the CHS data holdings for Bonavista Bay, resulting in a list and computer generated index map of fieldsheets. All paper copies for the Eastport fishing grounds were ordered to review and to have on hand for the discussions and mapping sessions. Figure 4.2 shows fieldsheets for the Peninsula.

After displaying the CHS fieldsheets to fishers, I realized that they were inappropriate as basemaps for a number of reasons: the volume of information provided is overwhelming for many viewers; the metric soundings are difficult to relate to fisheries conducted in fathoms and feet; the land side of the shoreline has very little information; five separate sheets are both awkward to handle and challenging for spatial continuity (i.e., reading between or across adjacent sheets); and finally, the lack of cartographic convention makes them difficult to read. Indeed, never having seen such representations before, some fishers couldn't situate their communities on the sheets, much less their lobster grounds or codtrap berths. A few viewers had trouble distinguishing the sea from the land; others pointed out the absence of a map graticule (grid) which would help plot coordinate information (e.g., global positioning system latitudes and longitudes for crab grounds). The fieldsheets are little more than mapped data; to become useful and more familiar maps, further processing is needed.

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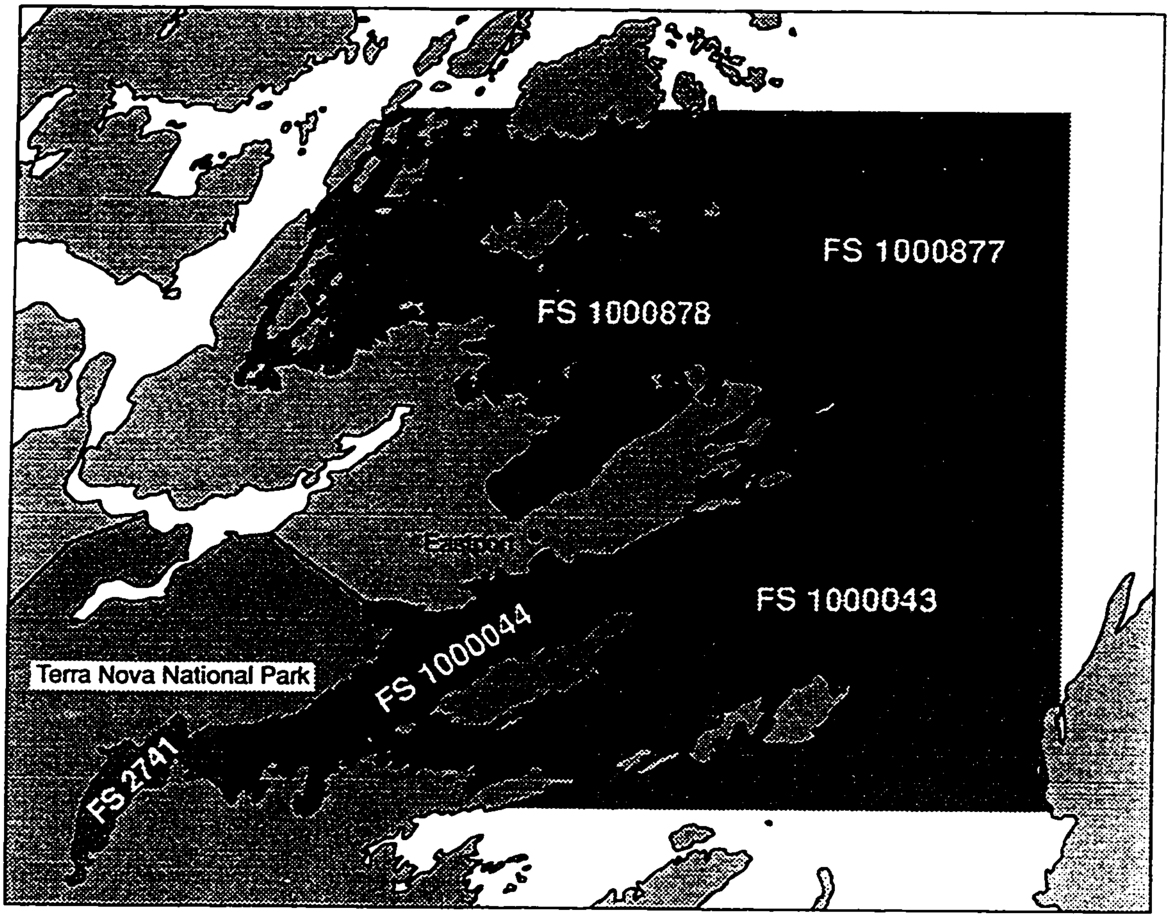
[10] See Canessa and Keller (1994) for a discussion of the importance of metadata in coastal and marine datasets. For the benefit of future users, it is essential that originators leave an "audit trail" or file header explaining the data source as well as comments on the data collection, quality and reliability.

Figure 4.2 Eastport Peninsula CHS Fieldsheets




### 4.2.5 Marine and Terrestrial Compilation

After consulting with the Chair, I made the decision to produce a combined land-sea data set for the Eastport fishing grounds by merging digital topographic maps with digital hydrographic fieldsheets.[11] The availability of electronic data presented a unique opportunity to use geographic information systems for the generation of a customized coastal map product.[12]

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[11] During this basemap review, I examined existing coastal map products. I ordered three sample topo/bathy maps from the USGS for review purposes. Earlier research in Japan (Macnab, 1993) had introduced me to the Japanese variation.

[12] As discussed in Chapter 3, topo/bathy maps are a fairly new cartographic product. In most Atlantic Canadian coastal mapping projects, separate topographic and hydrographic maps are used to plot resource information manually. In the Scotia-Fundy resource inventories, digital compilation occurs after collection and map production have been completed. The NS 1:10,000 digital basemaps are employed, but there are plans to incorporate electronic navigation charts as they become available (MacCullough, pers. comm.; Rutherford *et al.*, 1995).

### 4.3 TECHNICAL PROCEDURES

The Eastport Peninsula basemap was prepared in collaboration with fishers and a St. John's geomatics training program operated by Data Services International. Test plots were reviewed with the EPIFC chair as the digital data was manipulated and structured. Fisher suggestions helped to design and adapt the basemap, but ultimately, reporting deadlines forced the use of a prototype chart in mapping sessions. Educational licenses of CARIS (Computer Aided Resource Information System) software were used to compile the digital data and generate basemap samples on an HP colour plotter.

#### 4.3.1 Hydro/Topo Compilation

To produce a combined land and sea coastal basemap for the Eastport Peninsula, it was necessary to merge topographic maps with hydrographic fieldsheets. Figure 4.2 shows the digital files from CHS surveys around the Peninsula while Figure 4.1 shows the Eastport NTS mapsheet, which also exists as a digital product. The compilation procedure was as follows: 1) the CHS files were combined, 2) the topo sheet was converted to match the hydro data (1:25000, Universal Transverse Mercator, North American Datum 27), and 3) the topo file was merged with the hydro file.[13]

Initial test plots from the combined data set incorporated topographic features: water themes, coastline, roads and contours; and hydrographic features: metric contours (2, 5, 10, 20, 50, 100, 200), and the CHS coastline. The CHS and NTS coastlines, which had been plotted in different colours to enable visual comparison, were not in alignment, possibly due to errors in the projection and datum shift. At this point, the CHS coastline was chosen for two reasons: i) it was derived with greater accuracy and detail, and ii) it would be utilized in the new chart scheduled for production, a likely base for all future mapping projects. We eventually stopped

[13] Three instances were uncovered during this review where digital data sources had been combined to produce topo/bathy maps. For the Saguenay-St. Lawrence Marine Park database (see INRS-EAU, 1993), planners chose Quebec's 1:20,000 basemap series for a shoreline vector and then had custom hydrographic data (soundings at a given resolution) generated from the Canadian Hydrographic Service datasets (Dionne, pers. comm). St. Lawrence Islands National Park combined Ontario's 1:10,000 basemaps and 1:24,000 basemaps for New York State with CHS charts for the St. Lawrence River (Leggo, pers. comm.; Nolan, pers. comm.). Several compilation projects have been undertaken at the Atlantic Geosciences Centre, but the maps have portrayed topo/bathy information at regional scales (e.g., the Arctic) using shaded relief models (e.g., see figures in R. Macnab, 1995) and not the more familiar contour portrayals.

trying to incorporate the terrestrial contours in the basemap because they too were poorly aligned and ran over the CHS coastline in many spots.[14]

### 4.3.2 Conversion to Fathoms

Fishers' negative response to metric data was reiterated when sample plots showing metric isobaths were demonstrated. Depth contours were preferable to a mass of soundings, but they would be best if displayed in fathoms.[15] The existing metric contours could have been labelled in fathoms after some minor calculations (e.g. 10m x .5468f/m = 5.468 fathoms), but with gaps between 20-50m, 50-100m and 100-200m, the range was inadequate for marking harvest areas. Could GIS help to build the necessary isobaths in fathoms?

In order to experiment with contour generation, a digital terrain model (DTM) was built with the CARIS software.[16] The DTM was used to interpolate a set of new contours from metric equivalents calculated for a 10 fathom contour interval. For example, 70 fathoms was derived by commanding the software to build a contour at 128 metres (70f x 1.8288 m/f = 128 m). A smoothing function was then applied to remove the contours' jagged appearance. Experimental plots with isobaths every 10 fathoms were cluttered and confusing, especially in areas where the bottom drops off quite steeply (e.g., Newman Sound 'edges'). To balance the level of detail against visual acuity, the following depths were picked for the final basemap: 6, 10, 20, 30, 40, 50, 75, 100, 125, 150, 175, 200 and 225 fathoms. Fishers asked for 6 fathom contour to represent the maximum depth for lobster fishing; they suggested any areas within the range of depths from 0-6 fathom that were not fished for lobster could simply be shaded. The 225 fathom contour was the deepest generated as there were no soundings greater than 457 metres (250 fathoms) in the CHS data.

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[14] Shoreline derivation from mixed land and sea information poses a number of cartographic production challenges related to projection, datum and tidal reference; for a thorough discussion, see Butler *et al.* (1986), Canessa (1997), Fay and MacNeill (1993) and Henderson (1994).

[15] A fathom is six feet. Depths are conveniently measured with outstretched arms while hauling in fishing lines.

[16] Part One of Appendix H provides more detail of the procedure and problems encountered. See Deveau (1986) and Watson (1992) for technical discussions of computer generated and generalized contours.

### 4.3.3 Basemap Finalization

After several months of experimentation and numerous test plots, it became clear that the participatory mapping exercise would have to be conducted with a less than ideal basemap. Further work on a prototype coastal map was desirable, but with the primary thesis goal of producing harvest area maps, the basemap work had to be cut short.[17] For the final basemap plots, isobaths and the CHS shoreline along with roads, lakes and rivers from the topo map were selected and assigned colours. Small crosses (from the fieldsheet files) were plotted at each grid intersection point to function as registration marks for subsequent map overlays and finally, fathom labels were manually added to the plotted depth contours.

### 4.3.4 Thesis Map Production

Manual digitizing for direct entry into CARIS was planned for the mylar sheets after the mapping sessions were completed with fishers. Reporting deadlines for thesis submission, delays in upgrading CARIS, and limited access to a digitizer forced interim map drafting in a graphics environment. Exportation of the basemap to CorelDraw graphics software enabled fast on-screen digitization of the collected information with relative georeferencing.[18] Following the addition of symbols, place names and annotations, the maps were plotted on a large format (11" x 17") laser printer with a 600 dot-per-inch resolution.[19]

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[17] Part Two of Appendix H explains the efforts to enhance the basemap.

[18] On screen digitization in a graphics environment provided passable accuracy for the page-sized output scale of the thesis maps (approximately 1:200,000). Ideally, graphics software would have been used only after the information was captured using a proper digitizing table and the on-screen data entry tools available within CARIS. The strict positioning afforded by these devices would certainly be required for map output at the collection scale (1:25,000).

[19] Desktop publishing software, high quality laser printers and large format colour plotters are used increasingly in cartographic production for draft and final hardcopy maps. During updates to the Puget Sound Environmental Atlas, 422 such digital maps were produced (Needham and Lanzer, 1993). The CorelDraw graphics package was used extensively by the Department of Survey and Land Information for map production in the New Zealand Historical Atlas (O'Malley and Fraser, 1993). Technicians at the Atlantic Geoscience Centre also use CorelDraw to compile and plot a significant number of geological maps (R. Macnab, pers. comm.).

# CHAPTER 5

## *EASTPORT IN FOCUS*

The harvest area information documented with Eastport fishers is illustrated and described in this chapter. Local place names, wayfinding, species harvested and local management practices are discussed with reference to composite maps. The images presented here are preliminary samples only. Although they are far from definitive geo-encoded cartographic products, the maps are nonetheless valuable for illustrative purposes.

### 5.1 LOCAL PLACE NAMES

Figure 5.1 shows local place names for the Eastport Peninsula. The Place Names map contains three categories: i) names recognized as "locally correct" on the 1:50,000 Eastport NTS mapsheet, ii) local variations for the "incorrect" names, and iii) names missing from the official Eastport NTS map. Appendix I lists published names that are unfamiliar to area fishers.

Local place names are derived from many sources and include people's names (e.g., Tommy Hobb's Cove), coastal structures (e.g., Piggery Cove), coastal characteristics (e.g., Sandy Cove), physical resemblance (e.g., Baker's Loaf), events (e.g., Capelin Gulch), position (e.g., Offer Rock compressed from 'Off Her') and sentiment (e.g., Lousy Cove). Some places are only recently named while many others have lengthy histories. A noteworthy example is 'Damn the Bell Bay,' erroneously labelled as "Damnable Bay" by visiting British navigators who reportedly could not follow the dialect of the local settlers. Legend has it that pirates were successfully hiding from an English warship until the pirate cook accidentally hit the ship's bell. Having alerted the approaching English with his mistaken tolling, the pirate cook yelled, 'damn the bell!'

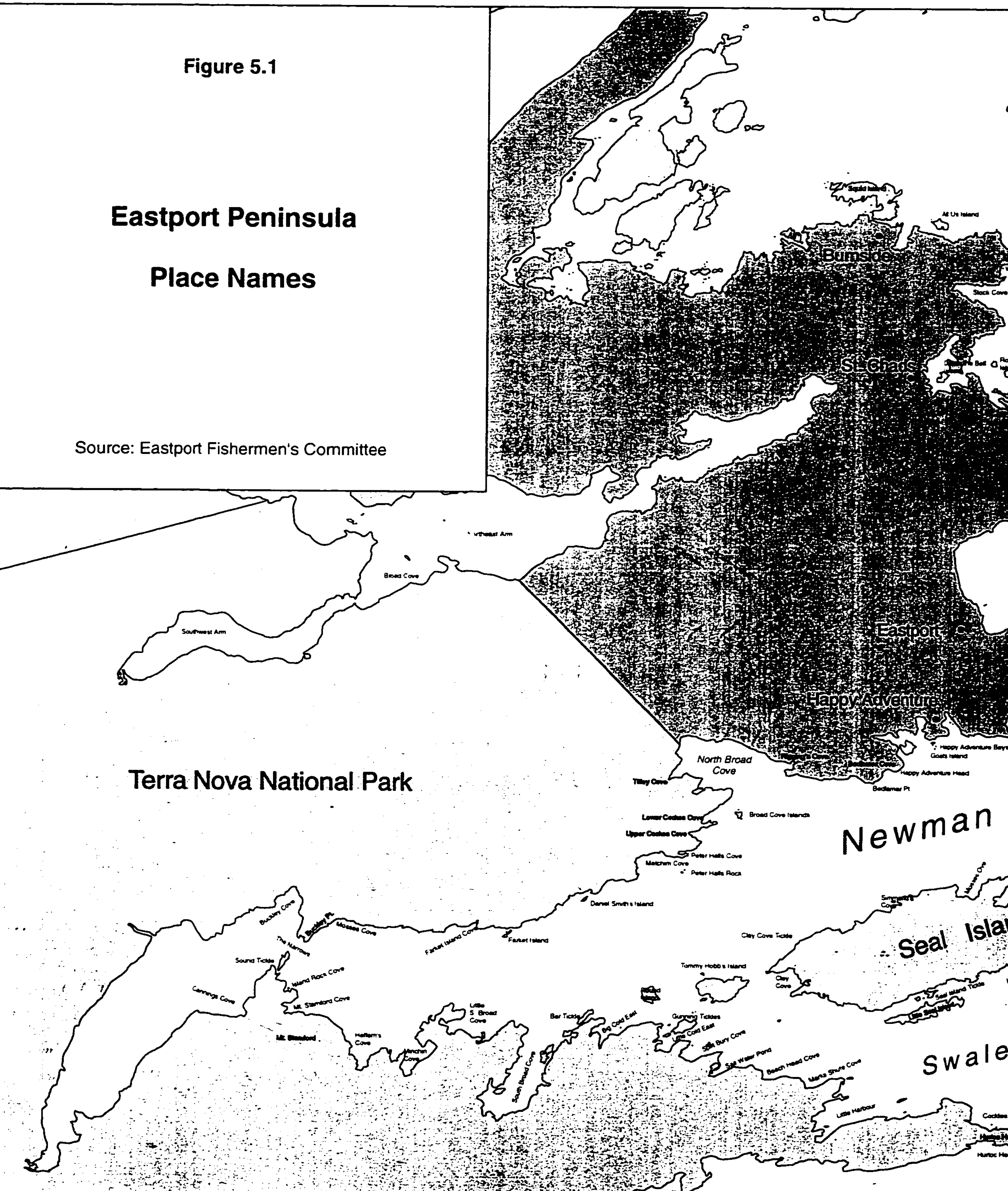
In addition to landform, bay, cove, tickle and rock names, local toponyms exist for underwater features such as fishing grounds, shoals, shelves, ledges and slopes. Fishing berths for fixed gear (often just an iron ring attached to shoreline) also have distinct names (e.g., The Cheque, a codtrap berth at Salvage with historically high landings).

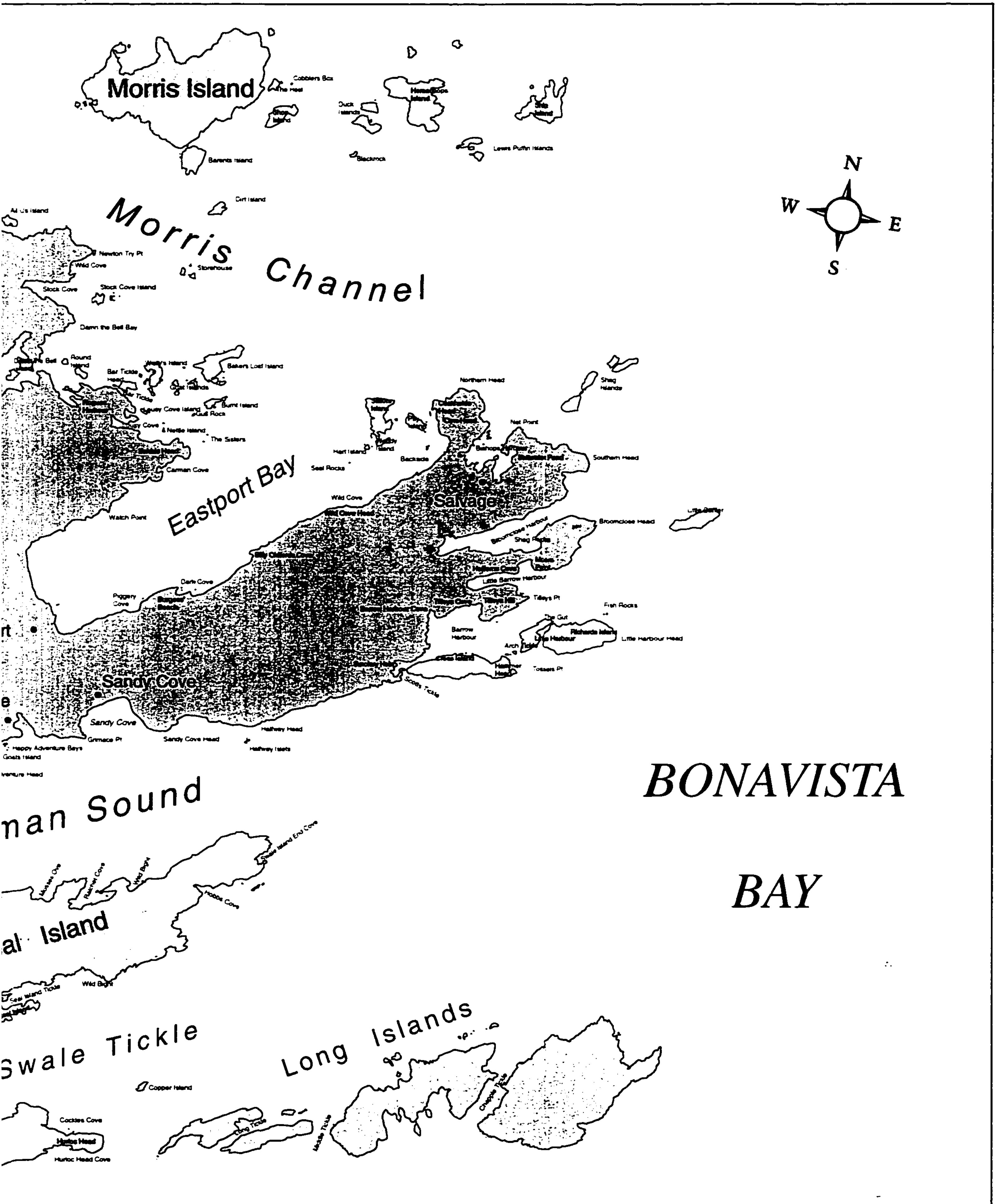
**Figure 5.1**

# Eastport Peninsula

## Place Names

Source: Eastport Fishermen's Committee




Morris Island
Morris Channel
N
W
E
S
Eastport Bay
Salvage
Sandy Cove
Sandy Cove
man Sound
al Island
Swale Tickle
Long Islands
BONAVISTA
BAY

## 5.2 NAVIGATION AND WAYFINDING

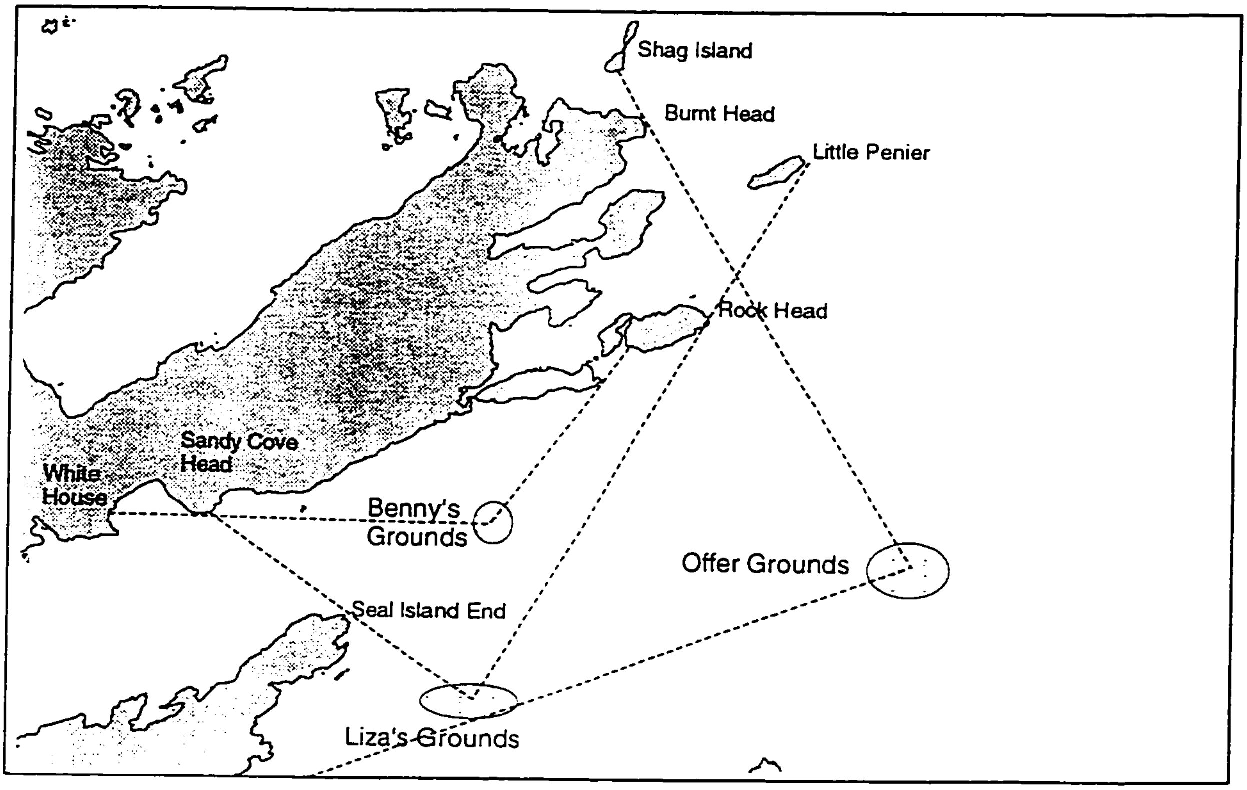
### 5.2.1 Shore Markers

Owing largely to the small boat characteristics (see Chapter 2) of the inshore fishery in Eastport, most fishers rarely move far off the land and thus rely on visual cues for navigation. Daily visits to the same sections of coast over many years provide the familiarity necessary for instinctive wayfinding. Landforms and marks along the shoreline are used to find established or well known harvest areas that lie some distance from the coast. As explained in Chapter 3, the navigator triangulates with two or more marks to locate a given spot. Figure 5.2 below illustrates the sightlines used to position oneself over three well-used fishing areas in Newman Sound. For example, to locate Liza's Grounds, the navigator lines up the end of Little Denier Island with Rock Head and 'opens' Sandy Cove Head on Seal Island End.

The common shore markers tend to be well known by all fishers and are freely transmitted. However, subtle variations – many of which help to locate a specific part of a given ground – are secretly guarded and passed on only to family members. One participant said that his private marks would die with him. Generally, older and retired fishers were more familiar with shore markers. Many younger fishers learned the marks but have either forgotten them, or are only able to locate them from a vantage point on the water.

Some of the larger boats (longliners between 25 and 45 feet) that venture into deeper water are equipped with GPS units and other navigational and fishfinding aids such as Loran C, electronic navigation charts, autopilot, radar and echo sounders. Once appropriate grounds are located (either by sounder or historical records) and the gear is set, waypoints are programmed to enable automatic return for hauling.

Figure 5.2 Locating Fishing Ground in Newman Sound




### 5.2.2 Depth Detection

Fishing depths are well known for areas like those illustrated in Figure 5.2. Fishers presume that these grounds were discovered through experimentation over many decades by past fishers. Originally, the grounds would have been sounded with handline fishing gear; in modern times, fishers still 'sound' for depths using jiggers. When asked how they came to learn of depths in any given area, some participants responded that they 'just knew' the grounds because they'd been fishing there for years after learning from others.[1]

Younger fishers grew up with shallow water sounders and now just cruise in a likely area until they find desirable fishing depths. In deeper water where the inexpensive sounders don't work, markers are still relied upon. Sometimes the marks are used to locate the grounds,

[1] Butler confirms that in western Newfoundland, "the fishing grounds had been discovered by trial and error" and then offers that "[o]nce discovered, a method was needed to locate these areas in an immediate environment devoid of permanent distinguishing features" (1983, 16).

then the sounder is turned on to reveal the intricacies of the subsea topography.[2]

## 5.3 FISH AND FISHING METHODS

### 5.3.1 Invertebrate Species

Invertebrates are animals such as shellfish which do not have a backbone. Most mollusc species such as clams, scallops and mussels have a soft body inside a hard shell, but there are exceptions such as the squid which is soft-bodied. Crustacean species such as lobsters, crabs and shrimps have an exoskeleton and are characterized by segmented body parts such as legs and claws.[3] Figure 5.3 shows the lobster fishing grounds for the Peninsula. Lobster (*Homarus americanus*) is caught with traps baited and set in water no deeper than six fathoms. Because of the extreme depths in the area, the harvest is limited to a narrow band along the shoreline. In Newman Sound, the grounds rarely extend beyond 50 fathoms from the shoreline and can only accommodate one row of traps. In Eastport Bay, the grounds extend a little further offshore but still no more than 100 fathoms. The area at the base of Mount Stamford is one of the few places that supports several rows of traps. The scree slope at the base of the cliff extends underwater for some distance and provides the shallow water and rocky bottom favoured by lobsters.

Crab (snow crab, *Chionoecetes opilio*) fishing areas are also shown on Figure 5.3. In this fishery, baited pots are set on a sand or mud bottom in deep water. The larger vessels harvesting outside of Newman Sound set fleets of fifty pots. Squid (*Illex illecebrosus*) jigging sites are illustrated in Figure 5.3 as well. Sea urchin and shrimp are new experimental fisheries and the grounds are not well-established (not mapped). The widely abundant sea urchin (*Strongylocentrotus droebachien*) is collected off the bottom by scuba divers. There is evidence of shrimp (*Pandalus borealis*) in the area, but few fishers have invested in the specialized pots required to harvest the species.

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[2] Jorion (1978) made a similar observation in his Brittany research.

[3] Definitions are derived from Gough *et al.* (1994).

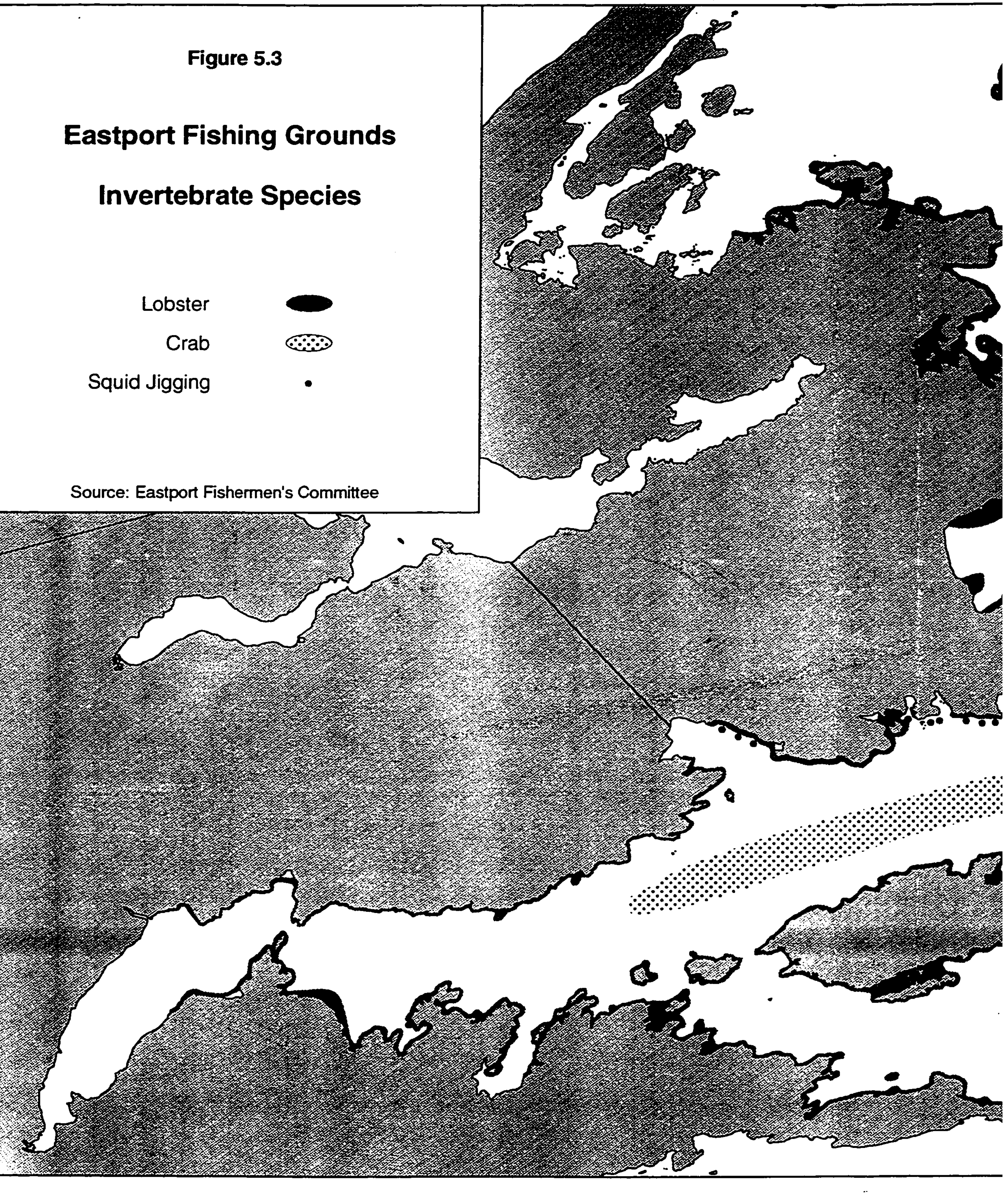


Figure 5.3
Eastport Fishing Grounds
Invertebrate Species
Lobster
Crab
Squid Jigging
Source: Eastport Fishermen's Committee


Burden's
Brook
Hurloc Head

### 5.3.2 Pelagic Species

Pelagic species such as herring, capelin and tuna stay closer to the surface of the water column than groundfish. Generally, these darker-fleshed species also migrate over long distances. The herring (*Clupea harengus*) fishery is conducted primarily as a bait fishery (for lobster traps), but it has emerged as a food fishery with the changing global demand for seafood. The fishery, depicted in Figure 5.4, is prosecuted with three gear types: mobile seines which surround a school; surface gillnets set out from and fixed to the shoreline; and bar seines, which close off coves and bays to entrap the fish. The limited fishery for mackerel (*Scomber scombrus*) employs surface gillnets and produces bait for the lobster fishery.

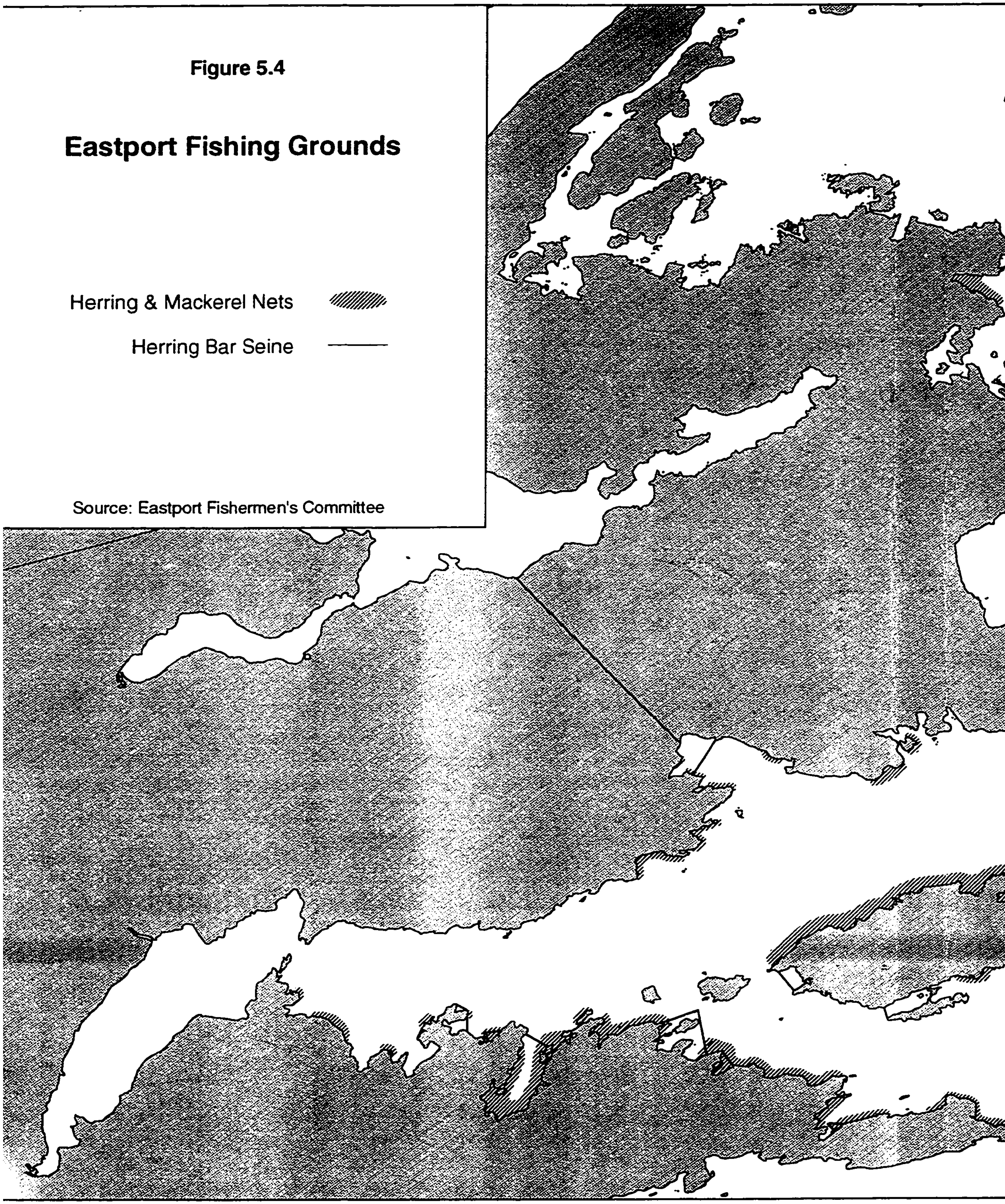
Figure 5.5 illustrates harvest areas and spawning beaches for capelin (*Mallotus villosus*). The species is commercially harvested with mobile seines and shore-anchored box-like traps. When capelin spawn in the shallow water next to beaches, they are collected with dip nets for personal consumption.

### 5.3.3 Demersal Species

Demersal species are bottom or mid-water feeders such as cod and flounder. Also known as groundfish or bottomfish, these species tend to be white-fleshed. Figure 5.6 shows the areas and gear types used to harvest cod (*Gadhus morhua*). The traditional codtrap has a mesh leader that directs fish into a box-shaped net. It is set from the shore and anchored at its four corners. Handlines with steel jiggers or baited hooks are set and fished from the surface. Inshore trawl, not to be mistaken with the otter trawl used by draggers, is a line set on the seabed with several hundred baited hooks. Cod gillnets are essentially a wall of mesh set on the bottom.

## Figure 5.4

# Eastport Fishing Grounds




Source: Eastport Fishermen's Committee

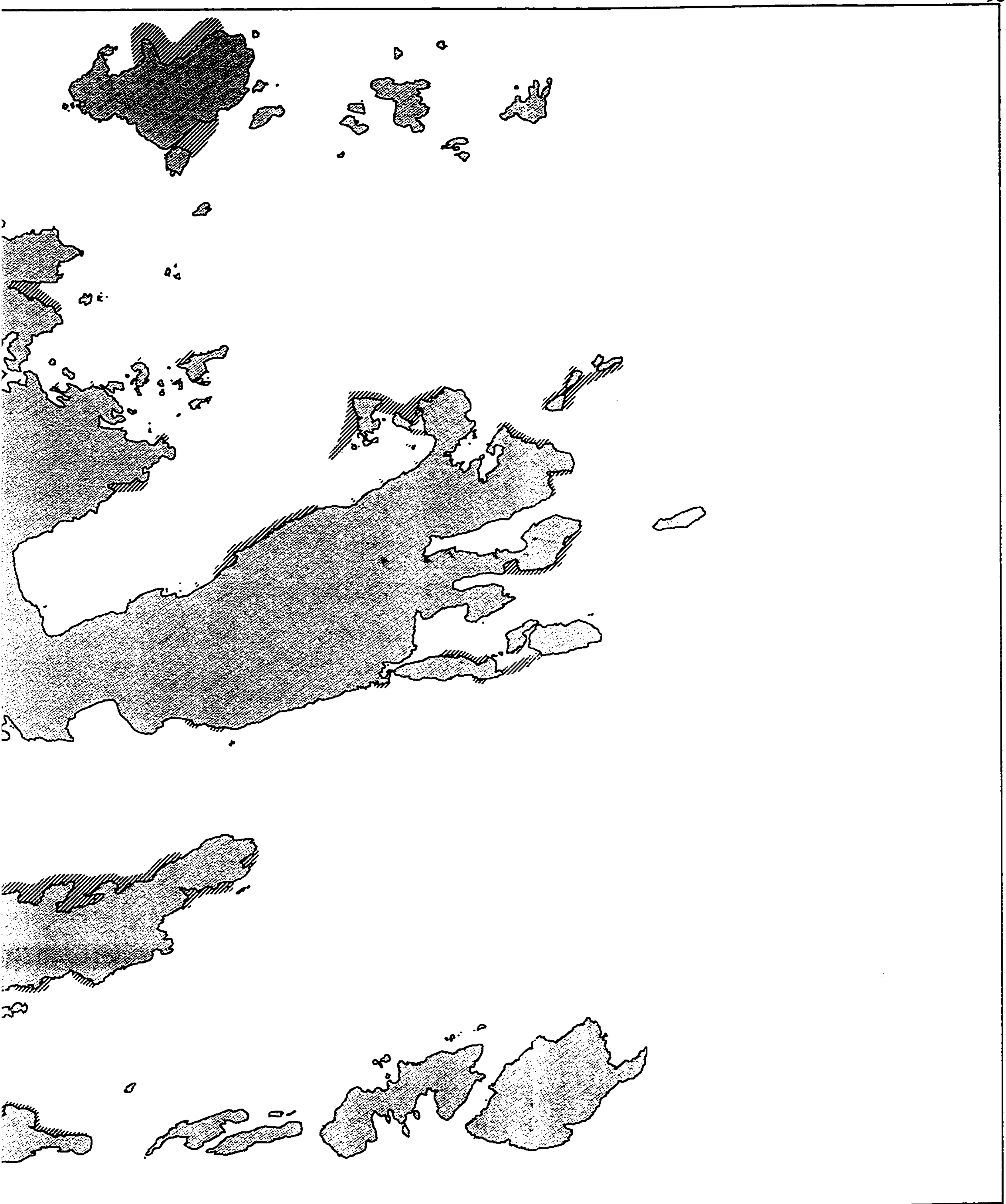
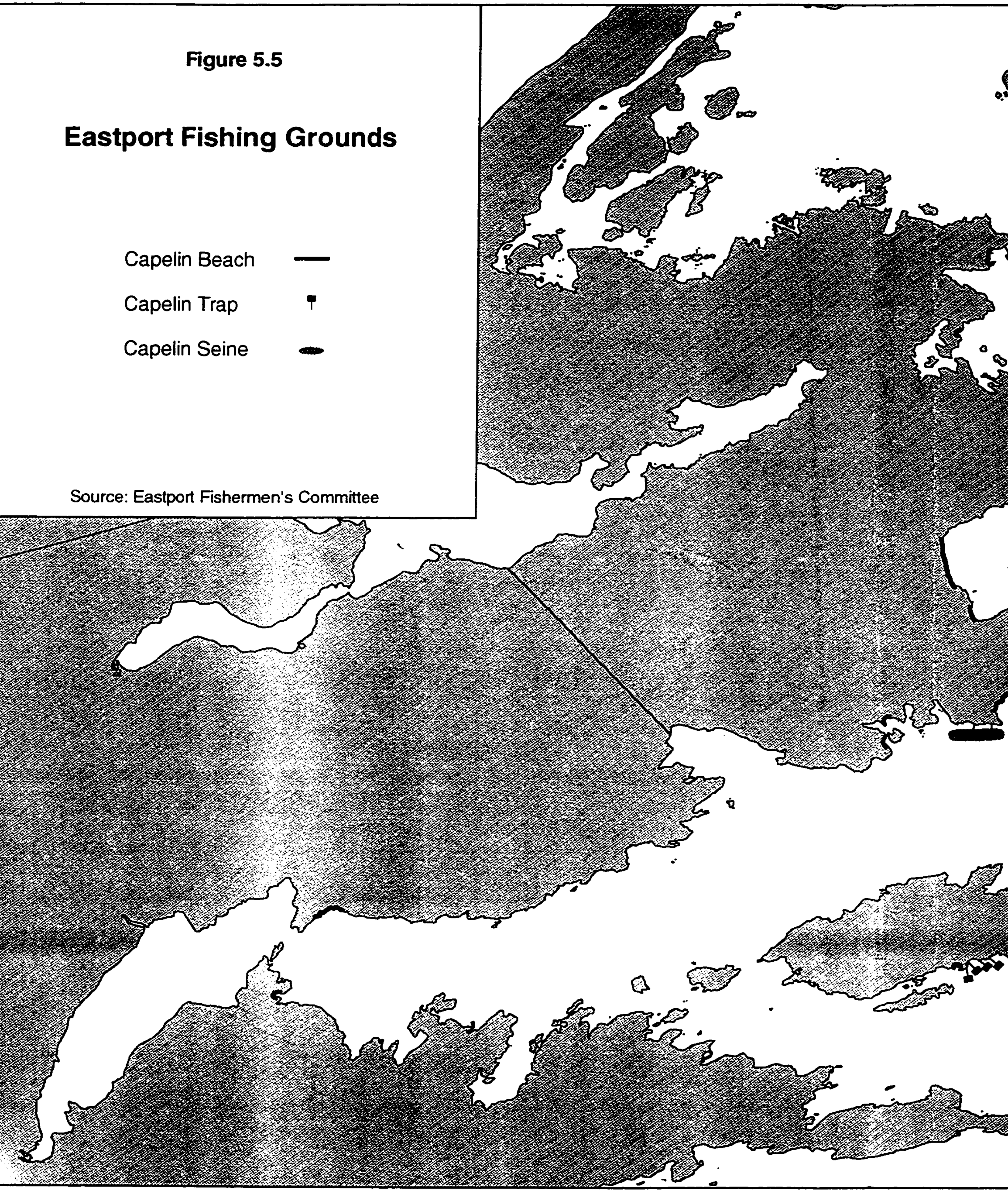
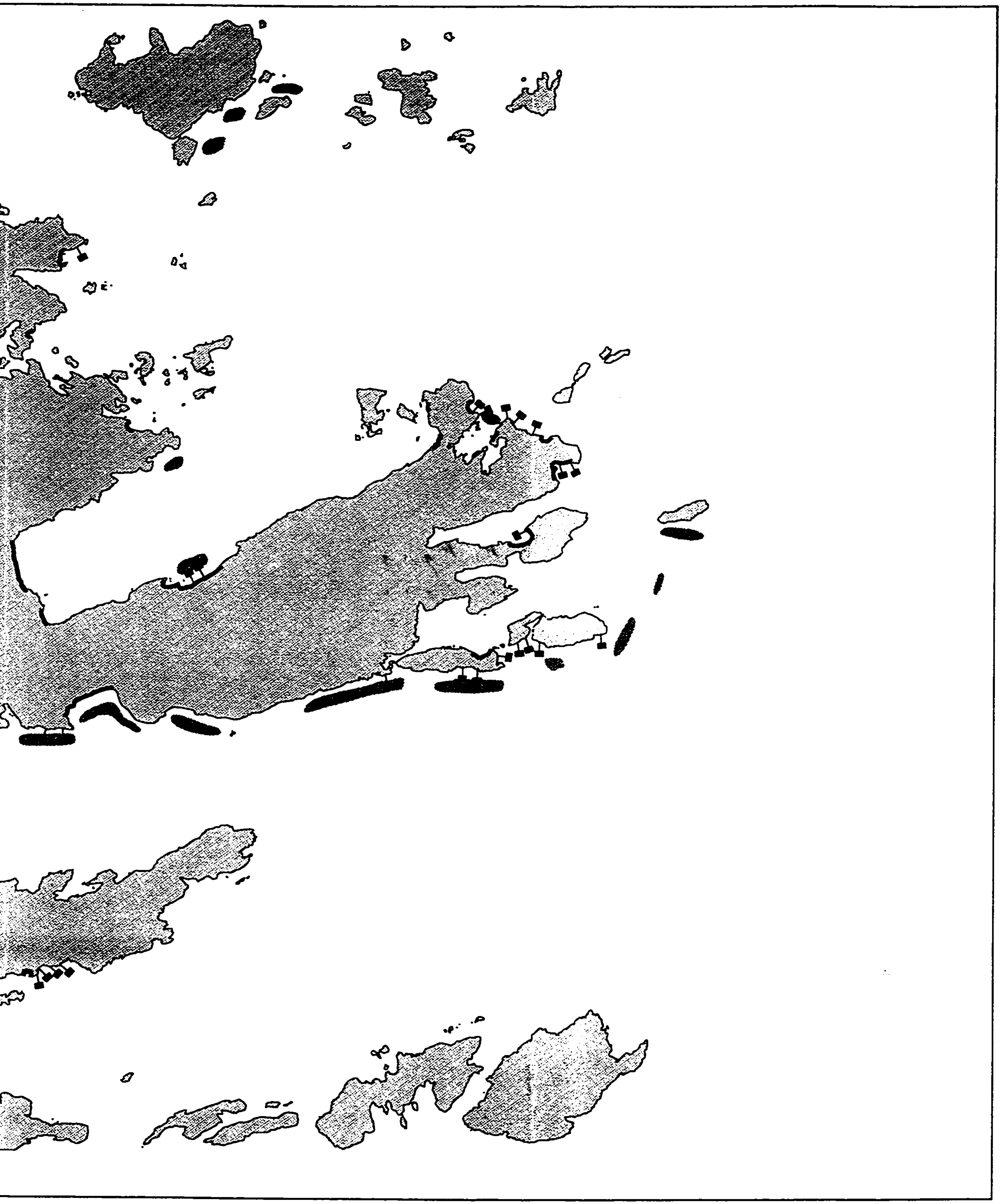


Figure 5.5

## Eastport Fishing Grounds




Source: Eastport Fishermen's Committee



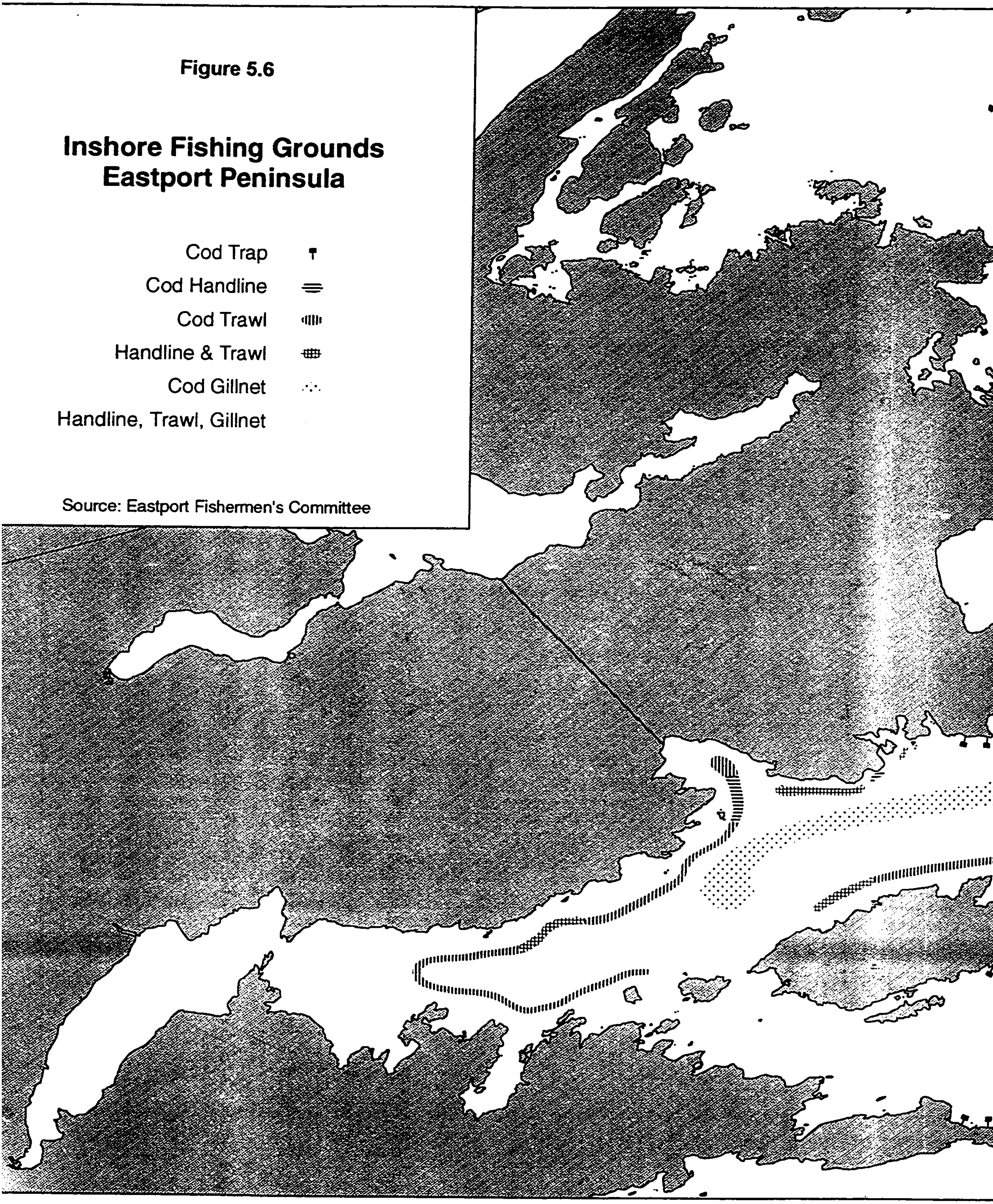
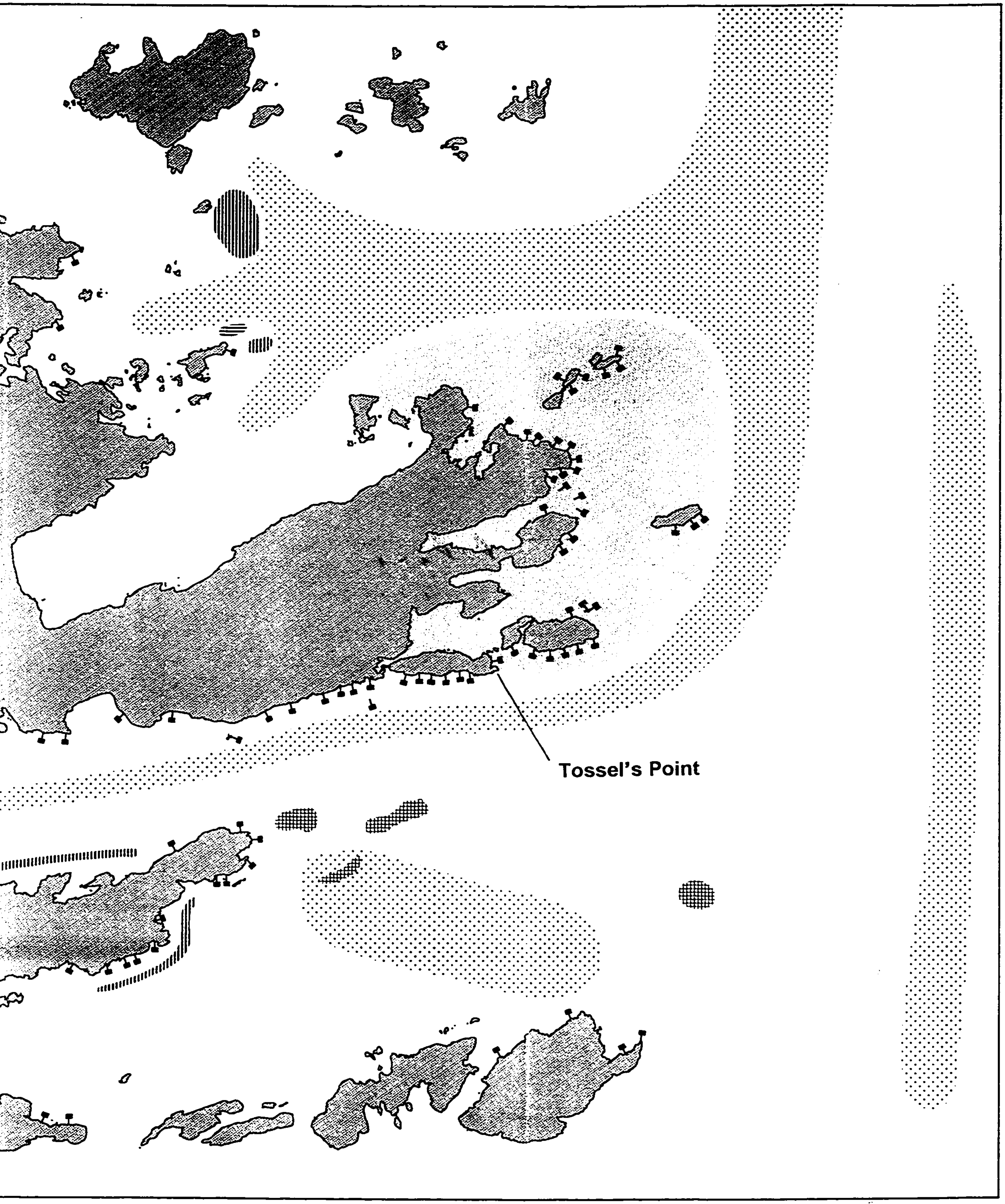



**Figure 5.6**

## Inshore Fishing Grounds
## Eastport Peninsula

Source: Eastport Fishermen's Committee


Tossel's Point

The female lumpfish (*Cyclopterus lumpus*) is captured with bottom gillnets in the areas delineated in Figure 5.7. The species is harvested primarily for its roe, a delicacy in Japan. Figure 5.8 depicts flatfish gillnet areas. Flounder (yellowtail flounder, *Limanda ferruginea*) and grey sole (witch flounder, *Glyptocephalus cynoglossus*) are harvested for food, but blackback (winter flounder, *Pleuronectes americanus*), is caught for lobster bait. Skate (*Raja ocellata*), which was long considered undesirable, has emerged as a promising food fishery amongst the range of once underutilized species. There has been very little fishing for turbot (Greenland halibut, *Reinhardtius hippoglossoides*, not illustrated) during the last ten years, but participants recalled extensive bottom gillnetting on the muddy flats in the centre depths of Newman Sound. Atlantic halibut (*Hippoglossus hippoglosus*, not mapped) is still landed occasionally as bycatch.

### 5.3.4 Anadromous and Catadromous Species

Anadromous species such as salmon spawn in fresh water streams and spend much of their life in the ocean whereas catadromous species such as eels spawn in salt water and live in fresh water. The commercial fishery for Atlantic salmon (*Salmo salar*) was closed in 1993 due to low numbers of fish returning to Newfoundland spawning rivers. Some fishers refused the subsequent license and gear buyout in the hopes of a renewed fishery.[4] The fiercely-defended harvest was conducted with surface gillnets set in codtrap berths (not mapped). Eels are caught elsewhere in Bonavista Bay (e.g., Hare Bay), but there does not appear to be much of a fishery around the Eastport peninsula.

## 5.4 HARVEST SEASONS

Fishing seasons are governed by dates set in regulations. A table included on maps compiled for the Newfoundland Inshore Fisheries Baseline Survey (see Sheppard, Hedges and Green, 1982) shows the dates that different gear types are generally fished in eastern Newfoundland. The table presented below is an adaptation of that survey.[5]

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[4] Fishers are still upset over the conservation measures adopted for Atlantic Salmon. See Observation 30 in Appendix B.

[5] Fishing seasons were not thoroughly documented owing to time restrictions but participants did confirm the approximate dates indicated here.

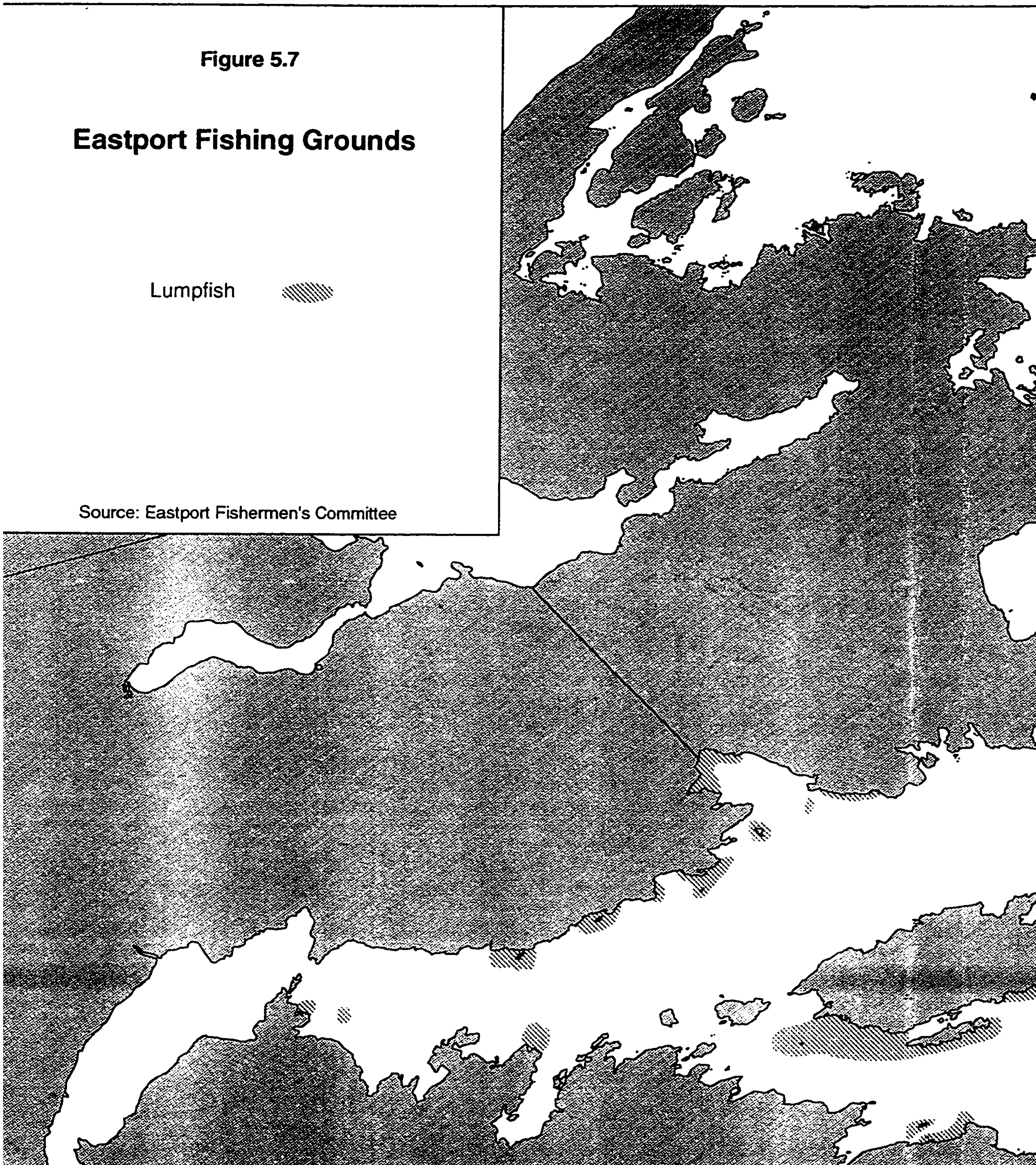
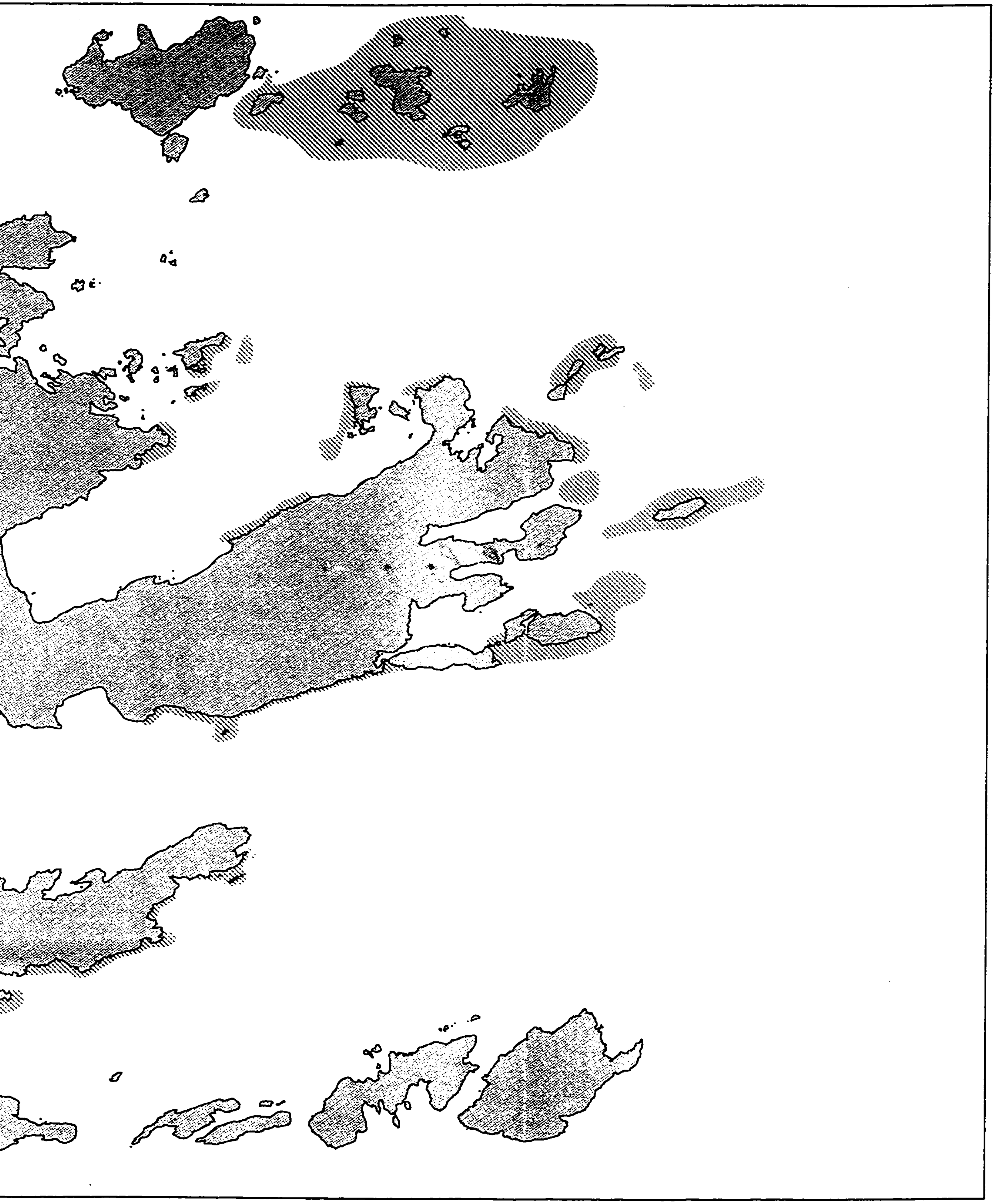



Figure 5.7

Eastport Fishing Grounds

Source: Eastport Fishermen's Committee



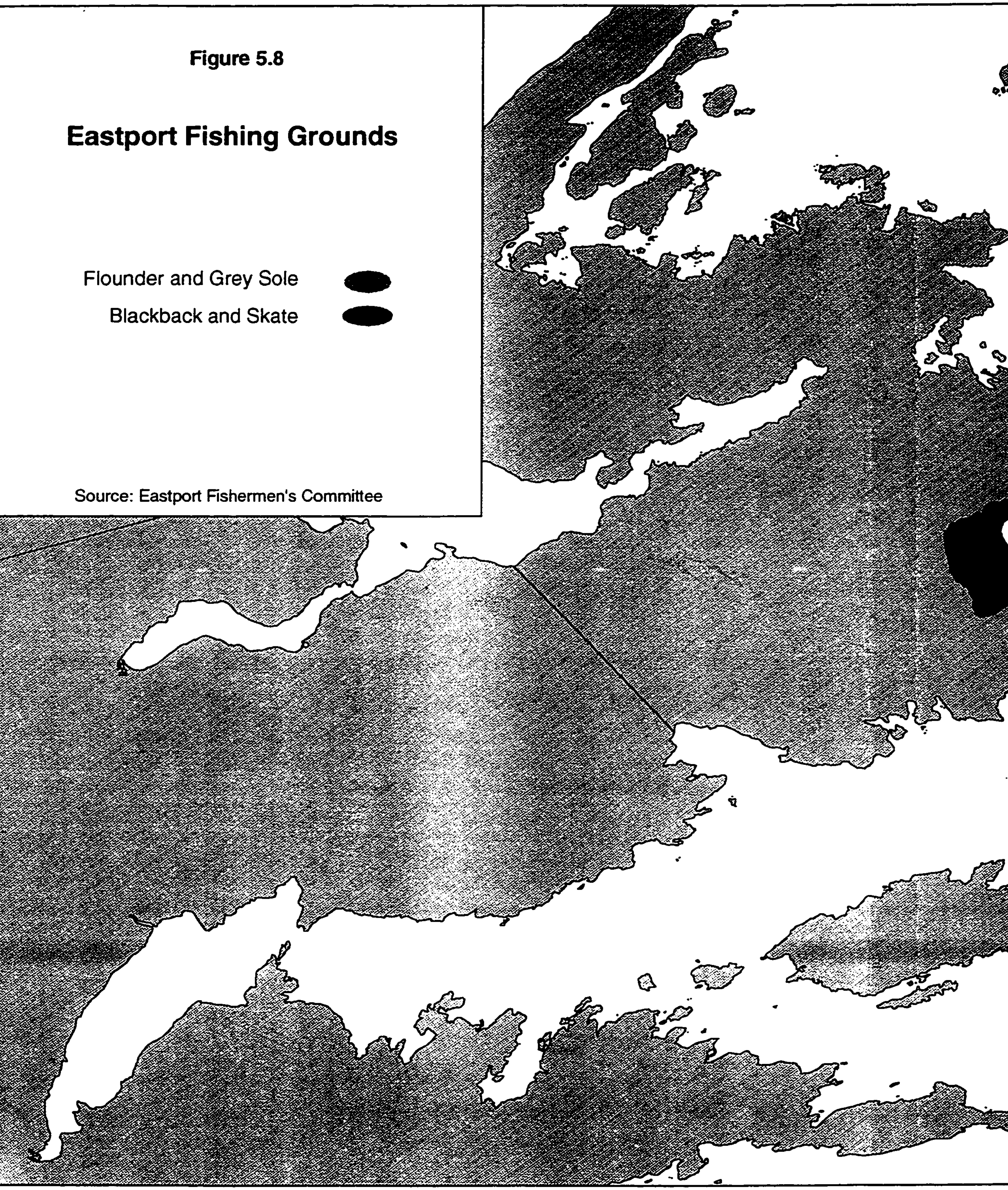
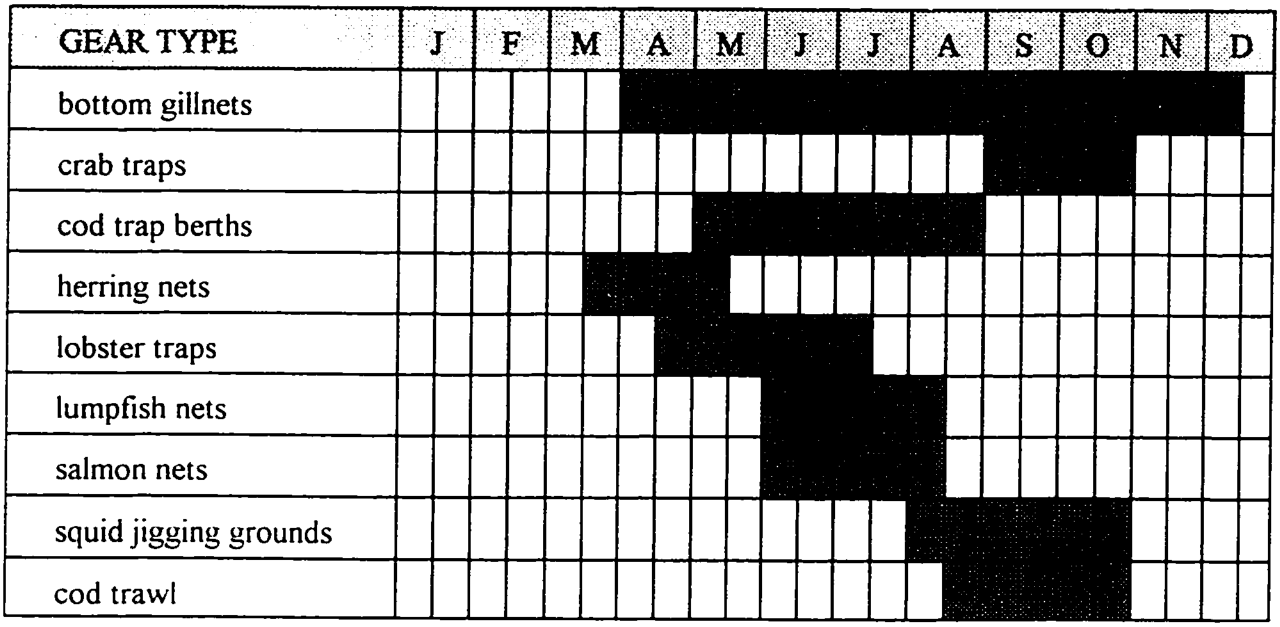


Figure 5.8
Eastport Fishing Grounds
Flounder and Grey Sole
Blackback and Skate
Source: Eastport Fishermen's Committee

Table 5.1 Gear Types and Dates Normally Fished




## 5.5 LOCAL MANAGEMENT

Within the Eastport Inshore Fishermen's Committee, there are several sub-committees which oversee single species fisheries including crab, codtraps and lobster.

### 5.5.1 Codtrap Berths

There are two formal committees for codtraps: one administers the Salvage berths, the other looks after Eastport, Happy Adventure and Sandy Cove areas. Each named berth is drawn for at the start of the fishing season and registered (by name and general location only) with the local fishery officer. DFO then issues a fishing license specific to the named berth received in the draw. The Salvage Committee has operated for decades but the Eastport Committee only came together in the 1980's as a result of conflict. During the formation of the committee, the eventual Chair drew the berths onto a topographic map to quell arguments over the actual number of available berths.[6]

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[6] This original map was made available during my research. I was also provided with copies of the Provincial guidelines (Anon., 1986) and regulations (Department of Fisheries, 1984) for cod and salmon trap berths.

Tossels Point, named on Figure 5.6, is the boundary between codtrap committees: all berths north of the point are fished by Salvage fishers; all berths to the west are fished by Eastport, Happy Adventure and Sandy Cove harvesters. The three berths near St. Chad's received little use in the years immediately preceding the groundfish moratorium, but when they were fished, they were regarded as family berths.

### 5.5.2 Lobster Territory

Burden's Brook, named on Figure 5.3, represents the boundary between Salvage and Sandy Cove lobster fisheries. Hurloc Head on the south side of Newman Sound signifies the end of the Eastport lobster area and the start of the grounds fished by Cannings Cove, a community located across the Bay.

### 5.5.3 Net Spacing

Fisheries regulations contain a fifty fathom rule which is intended to help space fixed gear at safe distances along the shoreline. Fishers overlook the regulations in at least two circumstances: i) when an individual sets multiple nets along the same section of coast; and ii) when two or more fishers agree to shorter spacing between nets.[7]

### 5.5.4 Net Orientation

The gillnet fishery for cod makes heavy use of the deep water slope extending from 90 to 120 fathoms on the north side of Newman Sound (see figure 5.9). If a fleet of gillnets were set along the choice grounds between 90 and 95 fathoms, there would only be room for a small number of fishers to access the grounds. To overcome this spatial limitation, Bonavista Bay gillnetters agree to fish across the slope with nets set in a northeast to southwest direction.[8]

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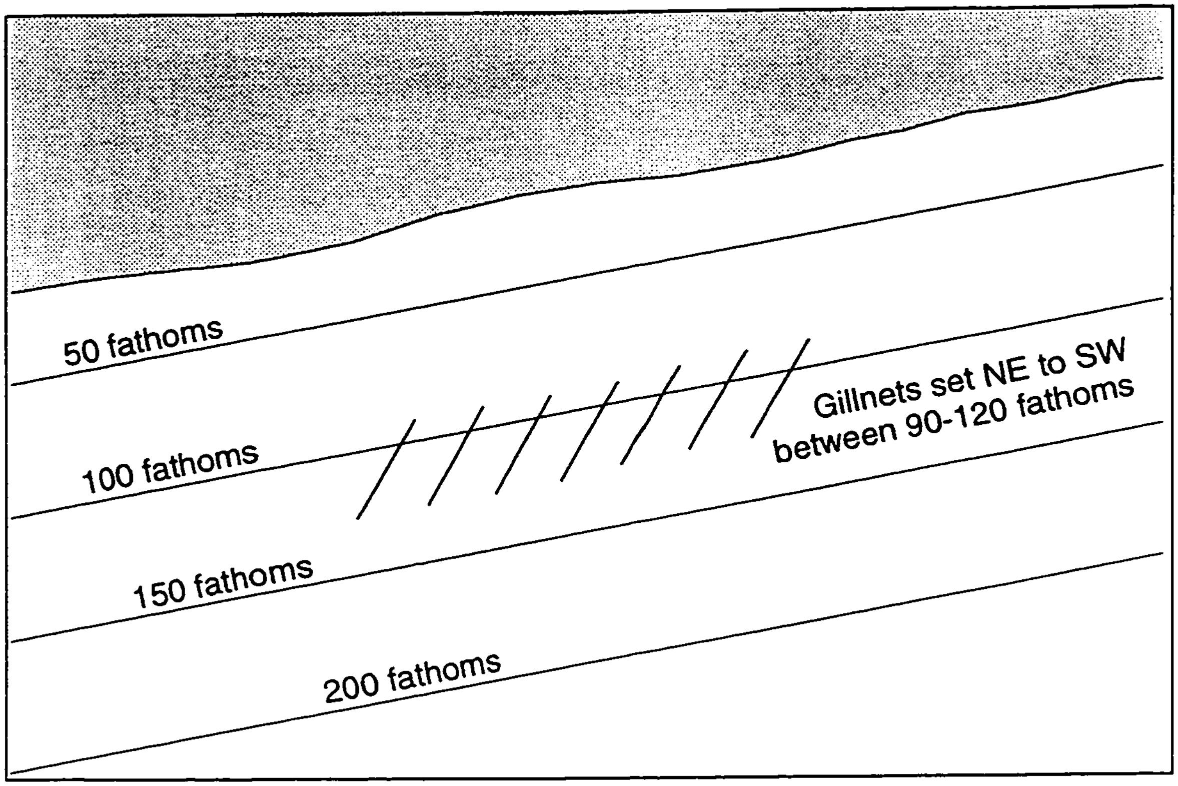
[7] Formal and informal net-spacing rules are discussed by Phyne (1990).

[8] This degree of cooperation contrasts sharply with the competition described for choice 90 fahom grounds on the island's southwest coast (see Anderson and Stiles, 1973, 49).

Figure 5.9 Gillnet Orientation



# CHAPTER 6

## *FISH OR CUT BAIT!*

The thesis offers a preliminary harvest area inventory of the Eastport peninsula; it presents a "snapshot" – a demonstration of what might be accomplished with participatory and collaborative approaches to mapping in the context of marine conservation planning. The work is neither a broad human ecology of fishing at Eastport, nor a thorough ethnographic survey, but it does portend a direction for the geographical assessment of inshore fishing patterns. What have I learned? Have I accomplished those tasks which I envisioned from the outset? Did I meet the research goals and objectives?

### 6.1 INSHORE FISHING GROUNDS

The first research goal was to facilitate participatory mapping of inshore fishing grounds as an expeditious means for resource users and government agencies to begin a dialogue of site and species specific concerns. Chapter Five documents local place names, navigation, species fished and community-based management controls. This section discusses the toponymic research, describes way-finding and comments on several themes that were not mapped.

#### 6.1.1 Local Toponymy

In what started as an intuitive and curious sense about places (i.e., hearing names that I couldn't later find on maps), it seemed sensible to learn the common names so that I would be conversant in local ways of relating (e.g., when someone said Round Island might make a good lobster reserve, I wanted to know where that was).[1] Later, as the mapping discussions began, and it became more evident that landscapes remained central in everyday life and identity at

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[1] Butler says of nomenclature and landscape in L'Anse-à-Canards, Newfoundland that a cognitive or conceptual "absence of either of these components renders effective communication difficult, if not impossible" (1983, 9). A researcher working in the Faroe Islands makes a similar observation: "An outsider's ignorance of local names impedes intimacy with local life, so for several weeks I familiarized myself with the topographic features and local places mentioned in ordinary talk" (Gaffin, 1994, 21). In mapping exercises with farmers, Fox (1990) explains that interviewers first point out a few well-known objects and then ask the participant to do the same.

Eastport – and not just in "non-Western tribal societies" (Gaffin, 1994, 20) – I grew more interested in the cultural aspect of place names. Names, as I discovered through interaction and further reading also serve a practical importance in wayfinding and communication. Finally, during the mapping sessions, it became apparent that local names would have greatly improved the prototype map's ability to communicate and thus help people visualize their familiar environment.

*Landforms/Bays/Subsea Features*

The subsea features received much less attention than the landforms, not surprisingly given the greater likelihood that places seen will be places named. Also, the topographic map showed all of the bays as compared with the protoype which did not show all of the subsea features: the bottom depiction did not recreate the mental images well enough to trigger, remind or elicit names of bathymetric features.[2] Also, I used overlays on the NTS map as part of the familiarization exercise, and related the exercise to existing names, which of course are predominantly terrestrial on the topo series. Perhaps I should have been more explicit in asking for names of fishing grounds. Better bottom visualization would undoubtedly assist in the collection of undersea toponomy.

*Trap Berths*

Trap berth names were noted during the group mapping exercise, but there were far too many to write down all at once. Here a listing or tape recorder might also have helped, maybe with numbers keyed to map annotation (see example in Martin, 1979) for later annotation and labelling (e.g., 'here's the third berth [pointing on map] we call it 'Crack in the Wall' because of the spit in the rock'). This naming information is reportedly available from DFO local offices where trap berth committees register the results from draws and named berth licenses are issued, but why get it "second-hand" from fisheries officers? As suggested more than two decades ago, "[t]rap locations are in fact very precisely known, as are the advantages of one berth over another" (Stiles, 1976, 246). The chairs of the codtrap committees will be the key

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[2] A similar concern with inadequate map portrayal of natural features is described for terrestrial mapping in Labrador: "The interior lands are sparsely named because the informants had difficulty in distinguishing among the countless streams and brooks, ponds and lakes" (Brice-Bennett, 1977, 305)

informants as the knowledge is still current.

*Loss of Names*

Grounds and markers are being lost with the passing of older fishers and with the introduction of sounders, inexpensive Loran C units, affordable GPS units and electronic navigation charts. Jorion predicted that the introduction of sounders would "rapidly render obsolete" (1978, 87) these techniques which have been used for generations. Faris describes the "newly-emergent problem in Cat Harbour" where the marks are not being transmitted to the younger men, who don't take time to learn the marks; "unless precise bearings are taken, many of them may be lost in future" (1972, 29). I witnessed this loss of names and heard about it from fishers of all ages. An older fisher recounted a jigging trip during the recreational fishery with a boat load of younger people who urged him to stop. He kept going to find areas where he knew there would be fish; few of the younger people onboard had such detailed knowledge.[3] Head (pers. comm.) expresses similar concerns and suggests that less than six people still knew the marks in Twillingate.

### 6.1.2 Navigation and Location Finding

Fishers' cognitive maps appear to be high in detail, complex, and at times, easily related to large scale hydrographic maps. This was most notable when fishers mentioned features missing from the prototype topo/bathy map. Participants pointed out where rocks were located and later checks against the paper CHS fieldsheets usually confirmed the local knowledge.[4] In one instance, lumpfish grounds were marked on the blue ocean of the Eastport topographic map without depths for guidance. When compared visually with the fieldsheet

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[3] One might ask whether this knowledge is important from a fishing perspective with the arrival of new fishfinding and seabed visualization techniques. Biologists, ecologists, and historians are trying to reconstruct the fisheries; knowing where there were fish at one time could assist modern invetigations. From a cultural or historical perspective, this knowledge is also valuable. I will not argue the point at this time, but I will draw two parallels for future consideration: Newfoudland ponies, whose numbers have dropped from 6,000 to 60, have been replaced by all terrain vehicles for hauling wood; and thousands of unique home-built wooden boats (e.g., trap skiffs and longliners) have been replaced by uniform and low maintenance fibreglass models.

[4] Most of the hunters interviewed in Labrador were "so intimately familiar with the topography of their hunting areas that they could describe verbally their main features and even landmarks, such as small islands, that were missing from the base map" (Brice-Bennett, 1977, 99).

soundings, the depths and shape of the lumpfish bottom corresponded very closely.

Sight lines and marker names for grounds were only collected sporadically, owing in part to the lack of topographic information on the derived base map.[5] A properly combined topo/bathy map would help immeasurably for this collection exercise. Still, some traditional markers such as trees, houses, or strange-coloration in rocks would not show up on any basemap, not even large scale maps such as the 1:10,000 planimetric series available in Nova Scotia. Jorion's observations on navigation by shore marks are accurate and instructive in this regard:

> [T]he analyst [or geographer] will have a 'spontaneous' tendency to represent this operation as if it were taking place within the framework of a map; i.e., he will tend to a 'bird's eye view' of the terrain within which the fisherman operates. During my fieldwork ... I came to realize that, of the experienced fishermen, there were some (aged more than about forty) who had difficulty in understanding how things were represented in the marine charts that I was using ... While I was trying to get my informant to operate in terms of a map without any particular directionality at any moment, he was trying to operate in terms of the diachronic order of a particular route or journey. The kind of map which would have been interpretable to him would have been one of those medieval maps on which the route between say, Jerusalem and Rome, represented by a straight line, marked with the halting places and with borders to the left and right of it showing any place of note. (1987, 92)

Much of this echoes my own research experience in Eastport. Harvesters would explain a formula and then try to find the points on the map. This was an unfamiliar way to look at landmarks and reconstruct sightlines, a process which would be quite unconscious while on the water. When fishing, the system of location finding would not be broken down into points, lines and intersections – coordinates, arcs and nodes in GIS parlance – as I was attempting to capture them in the two-dimensional Cartesian world-view of a conventional map.[6] Colour

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[5] Where triangulation points are marked by headlands and the ends of islands, topography is not as essential for map documentation.

[6] Generally, fishers relate to landforms for all navigation (i.e., they know where they are based on the land they see). To visualize this point, imagine the navigation charts of old which included transects or cross sections of bays showing the hills and other prominent features (e.g., see British Admirality, 1869) – this is what a navigator would expect to see from the deck of a boat. (The art of drawing such coastal views was a standard part of the training for navigators in the British Navy [Whitfield, 1996].) Pocius (1992) comments on the unconscious alignment of landmarks for wayfinding. He suggests that this process is something that people only think about when asked to explain their actions. (Rundstrom [1995] and Turnbull [1993] discuss non-Cartesian world-views; Turnbull conentrates on artifact maps while Rundstrom considers the reduction of such views for the GIS interface. Also see the discussion in Hirtle and Heidorn [1993] on "point of view" in cognitive maps.)

aerial photographs (vertical and oblique) and possibly even orthophoto maps (available at a scale of 1:12,500 in Newfoundland), which more closely resemble the lived-in environment, might be of some assistance for these situations. A sketch map, a tape recorder, or a verbatim transcription would have been helpful, perhaps without reference to a map so that at least the fundamentals would be captured.

### 6.1.3 Unmapped Species/Themes

Several species and themes went unmapped or were only partially mapped in Eastport. For a few species, such as salmon, some participants were keen to map while others were indifferent. Seals frequent the nearshore waters where they are routinely shot, but the majority of the hunt occurs at the edge of the Arctic ice and thus varies spatially from year to year. Sea otter 'slides' and eagles' nests are well known to fishers, but no attempt was made to capture these themes. Non-directed species (e.g., sculpin, juvenile cod) as well as ecological and oceanographic phenomena remained unmapped. Numerous stories of past abundance are recorded in my notes, but few of the areas have been mapped (e.g., seabirds on rocky islets, historical range of lobster).[7] New fisheries for the so-called "underutilized species" such as skate, urchin and shrimp are still at the exploratory stage and the grounds are still being "found" for the first time. Furthermore, people may not share knowledge for these new fisheries in the way that they might for more established and widely known grounds such as those for cod and lobster. Unfished areas, which could be ecologically important for non-commercial species and features, might provide relatively conflict-free areas for conservation interests (see item 18 in Appendix B). Like many features that were not mapped, this theme might require a different style of elicitation and documentation, perhaps more along the lines of rapid rural appraisal. Despite the value to science and other interests, this information may also be a very low priority for harvesters.

## 6.2 COLLECTION AND VISUALIZATION

The second primary research goal was to collect, compile and visualize marine

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[7] Beyond the ecological insight offered by such memories, there are important emotional and ethical dimensions to these reconstructions: e.g., 'the ducks were millions when I was a boy hunting with my father, but a few people got greedy and now there's none left.' Also see items 10 and 28 in Appendix B.

resource information with fishers for use in their own deliberations and in their dealings with outside agencies. This section reviews four related objectives: i) to provide technical support in an interactive and adaptive fashion, ii) to exchange scientific and local knowledge, iii) to record participant concerns and suggestions, and iv) to discuss ways in which the maps might be utilized.

### 6.2.1 Interaction and Research Adaptation

In mapping sessions with one person, the individual has a lot of pressure to "get it right" and also has to concentrate on a map for a long period of time. In those cases, I was acting more like a practitioner of rapid rural appraisal. When crews that fish in the same areas sit down together, collective impressions are captured with built-in peer review. In the Eastport exercise, a group of four experienced fishers were able to chart approximately 30 square kilometres of intensively fished grounds in one 3.5 hour mapping session. In the group setting, some participants were better at map reading and interpretation; others were better at visualizing the grounds, and others were better at recalling toponyms and berth names. There was a heightened level of interest and excitement surrounding the group mapping, as well as a feeling of accomplishment.[8] My minor role as a facilitator was in keeping with that of other practitioners of participatory rural appraisal – only occasionally did I have to interject with questions, prompts and drafting instructions.

Aside from peer review by fishers, there are very few tests available to ensure that information collected is accurate as portrayed on final maps.[9] Furthermore, vested interests might alter the way in which information is offered by fishers. If, for example, someone feared that he might somehow lose access to a particularly good lobster area through a government-imposed conservation measure, he might not volunteer that ground during the mapping process. If the project is carried out by fishers for use in their community and in dealings with

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[8] Chambers (1994c) assigns the title "group synergy" to this process of self-checking and reinforcement. Note the contrast with an earlier recommendation for individual interviews to "avoid bias" (Butler, LeBlanc *et al.*, 1986; see section 3.6.1).

[9] Rutherford *et al.* recommend visual verification where possible (e.g., visiting a wharf or slipway); otherwise, "[i]nformation obtained during the interviews ... must be confirmed by at least two other sources" (1995, 11). Open houses are used in Nova Scotia to present the compiled manuscript maps as a final means of verification before publication.

outside agencies, the chances of misleading portrayals will be lessened. Furthermore, in a group setting, others would likely call on the individual for withholding information as neighbouring fishers usually have a good idea of the extent of local fishing grounds. Where this issue will be problematic is not in collective fisher dealings with government agencies, but between fishers living and fishing in the same area. It was stated, for example that urchin grounds will not be volunteered easily during mapping sessions.[10]

### 6.2.2 Information Exchanges

*Scientific Knowledge to Harvesters*

In terms of information flow from scientists to harvesters, fishers were very interested in the detail portrayed on the paper fieldsheets produced by the CHS. When a fisher looked at a "high-tech" hydrographic chart through 3-D glasses at a conference, the implication for his livelihood was obvious – this was desirable imagery that would help him earn a living. The fishing industry is very interested in the range of bottom imaging presently available, but at this point it is mostly the offshore sector that could afford the costs associated with the more sophisticated technology. Obviously, Eastport harvesters could benefit from customized CHS data products.

*Harvester Knowledge to Scientists*

The conversion of local knowledge into a geo-referenced format takes it out of the "anecdotal" realm. This process makes harvesters' knowledge more compatible with technical approaches to resource management and enables a better integration of traditional and scientific forms of knowledge. Such a process could lead to the genuine exchange of information between government, scientists and stakeholders. Scientists from several ongoing projects have already indicated an interest in pursuing the exchange of scientific and traditional knowledge. A research team from the Ocean Science Centre (see Gotceitas *et al.*,1996) could benefit from fisher identification of eelgrass beds where the settling habits of juvenile cod are being studied. The Chair in Fisheries Conservation at MUN also expressed an interest in fisher

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[10] Fishers are waiting for exploratory licenses so that they might access this particular underutilized species. What are the chances that they'll broadcast to their fishing competitors all of the places where they know urchins exist in economically viable quantities?

knowledge of inshore spawning locations and a DFO team researching cod in Newman Sound requested copies of the Eastport harvest area maps. With little funding available, it only makes sense to concentrate research efforts where there is a strong likelihood of finding stocks suitable for study.

### *Database Collaboration*

Through the course of this research, several additional mapping organizations and educational facilities were contacted and consulted for information and advice. A mapping program in Bonavista Bay warrants some formalized linkage and continued collaboration with many of these groups (e.g., ACZISC, AGC, CHS, Nfld., MUN). A recent example illustrates the potential for improved data compilation or, as Warnecke (1995) explains, an opportunity to "overcome the government GIS maze." The Atlantic Geoscience Centre (AGC) has been generating a digital shoreline classification scheme for Newfoundland from helicopter videos (Sherin and Edwardson, 1995) and is working on the Bonavista Bay portion. Terra Nova has 165 kilometres of coast classified (see Gauthier, Poulin and Theriault Ltd., 1977) and would like to see the rest of the NMCA study area completed. Another potential partner, the Oilspill Mapping Program of Environment Canada (see Environment Canada, 1994; OCC Ltd., 1994; Wedeles *et al.*, 1993) translates the AGC classifications into shoreline sensitivity ratings and builds on the data set by adding human activities (e.g., fishing areas, mussel beds) and important ecosystem components (e.g., wetlands, bird nesting areas) (Leblanc, pers. comm.). The Habitat Management Branch at Fisheries and Oceans, Parks Canada and the Eastport Fishermen's Committee also expect to collect similar information, so through collaboration, standardization and sharing, duplication can be avoided.

### *Product Distribution*

Experience from Nova Scotia shows that most communities do not have the need for fully computerized geographic information systems; in most cases, people were after paper maps in atlas form which could be used at meetings and in planning exercises.[11] Indeed, the

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[11] Tortell argues that "... the constituency sought for resource maps and atlases is wider than those who have access to the latest computer technologies. Therefore, in deference to the majority of potential users which include coastal zone managers in developing countries and interested members of the general public anywhere,

expense of computer operation makes GIS impractical for most community map users; however, low cost mapping and display software (e.g., IDRISI, AtlasGIS) and freeware (e.g., Arc View 1.0) is readily available and could be provided for the casual user (e.g., school and fishers). Pending further investigations of copyright, intellectual property rights and limitations on data use, digital versions of the maps presented here could be made available to interested parties on CD-ROM or through the Internet.

### 6.2.3 Participant Concerns and Suggestions

Beyond those concerns already explained in earlier sections (e.g., metric depth soundings on CHS products and the loss of markers and names), fishers had many useful and helpful suggestions, only a small number of which are detailed here. Throughout the mapping exercise in Eastport, participants explained the importance of having maps to depict the "modern" fishing grounds. It was most important to be able to show managers the state of the fishery now and at the time of moratorium. For example, with mapped trap berths, committees would be better equipped to resolve internal conflicts and conflicts with adjacent communities. Some harvesters also thought that the maps could be used to help expand DFO's sentinel fishery into key areas. Maps of the historical fishery (e.g., salmon berths) were acknowledged to be important, but not urgent for a reopening groundfish harvest. Most participants would have appreciated copies of the CHS fieldsheets for Bonavista Bay. Several even asked for customized charts of their own fishing areas to be plotted at 1:10,000 complete with all of the information available on the fieldsheets. Fishers were most generous in their offers to take me out on the water for ground truthing of trap berths and other fishing locations.[12] With some exceptions, winter is regarded as the best time of year to carry out the mapping; summer, during lobster season, is the worst. Overall, harvesters were keen to illustrate local fishing

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resource maps and atlases are still required in the traditional, hardcopy paper format" (1992, 92). (Here I make the assumption that scientific interests in Canada can access digital forms of data.) Reporting on coastal resource mapping in the Caribbean, Mumby *et al.* claim that "[v]isual evaluation of this information was adequate for the purposes of planning, and therefore the GIS was not required to conduct user-defined queries on the data set" (1995, 118).

[12] The Warden Service at Terra Nova National Park has obtained a portable GPS unit and established a base station to enable field survey accuracy of several metres.

grounds as the basis for community-based management areas.[13]

### 6.2.4 Map Applications

> One of the problems experienced by TEK researchers is that funding agencies often require concrete examples of how the information gathered will be applied. (Johnson, 1992, 16)

At this early stage, it is difficult to demonstrate the full value of a community-based coastal inventory. The information collected is highly valuable in itself, but the benefits to be gained by having communities take an active interest in the management of their resources, and the potential of local knowledge in building co-management regimes are beyond quantification. Five likely applications follow.

*MPA Suggestions/Conservation Planning*

Maps of fishing grounds and locally-known biological "hotspots" will enable fishers to identify spatial conservation priorities to Parks Canada and other management partners. With local knowledge maps as a catalyst for discussion, agencies will be better-equipped to deliver the management actions (e.g., zoning and license conditions) that will translate conservation priorities into practicable measures. Conservation suggestions (e.g., potential lobster reserves) and other concerns emerged during the mapping exercise, but the maps were not used directly for this purpose. The next step is to use the maps in a planning context. Chambers (1994) explains that communities might "interview the map" to learn more about their own conditions.

*Lobster Territory*

At the MPA Symposium held as part of the Second SAMPAA Conference (see

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[13] More than 20 years ago, Stiles suggested that we might "... find much of an instructive nature from studying and analyzing the conduct of small communities in their own efforts to achieve management of the local resource base" (1976, 251). The point is still being made today; for example, see the discussion in Pinkerton and Weinstein (1995) on the long term sustainability of community-based management measures in Newfoundland. (They also reproduce a map from the seminal 1973 study of spatial patterns in Newfoundland inshore fisheries [see Martin, 1979].)

Shackell and Willison, 1994) there was a general ignorance of spatial fishing patterns in the whole process of MPA designation. For example, scientists wondered why we could not just shut down a couple of kilometres of coast here or an island or two there. People did not seem to realize just how little fishing ground was available in places like Newman Sound. Unlike the expansive shoal waters that support a rich lobster fishery in places such as southwest Nova Scotia, much of Bonavista Bay's lobster habitat is restricted to a narrow band along the shoreline where a kilometre might support numerous harvesters (see the invertebrate maps in Chapter 5). Many of those in attendance at SAMPAA also seemed unable to grapple with the practical questions of effort displacement and compensation for loss of access to historical grounds. Had maps been available to show the "narrow ecological niche" (Phyne, 1990) available to coastal communities on the Eastport Peninsula, scientists might have tempered their demands for large area closures. Do Eastport harvesters need maps to establish lobster reserves? No, but they do appreciate having maps to illustrate where they fish and where they have stopped fishing. Maps are already being used in discussions with scientists and managers to show the extent of lobster grounds and to demonstrate the communities' traditional fishing territory (e.g., Feltham *et al.*, 1996).[14]

### *Official Topographical Names*

During the course of this research, correspondence was received at Terra Nova National Park concerning recommendations for toponyms in TNNP from the Newfoundland Geographical Names Board. I was approached by the Park ecologist (Robinson, pers. comm.) to look at a list of 74 toponyms in TNNP on the Eastport map (NTS 2C/12) "requiring a joint decision."[15] A preliminary review of the NGNB list shows many names not mentioned

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[14] The maps are now being used to show fishing areas to shellfish biologists as they plan an experimental test fishery with harvesters. Traps have been placed inside and adjacent to the closed areas for monitoring and tagging purposes.

[15] In 1985, Handcock reported that "[n]umerous [TNNP] features are yet to be officially named, and others should perhaps have their names amended to accord better with the known historical development of the area, both prior to and since the park was founded" (1985, 27). The exact wording of the TNNP correspondence from the NGNB is as follows: "We request that you examine these names to determine whether or not they are satisfactory to your office." (Parks Canada, it should be noted, takes the business of toponomy very seriously, particularly with regards to the provision of place names in both official languages for national parks and historic sites [see Parks Canada, 1995c]). Here, I will not debate the potentially suspect role of government officials in the process of name approval, but I will ask one question as an extension of the Chapter 3 discussion on cartographic ethics.

during my research; should this official list now be checked against names recorded in the present study?[16] Shouldn't a provisional map be made for local display and discussion?[17] Another consideration, one also encountered in the Labrador mapping exercise (Brice-Bennett, 1977), is the likelihood of a single location carrying more than one commonly used name; for example, the cod handlining area referred to as 'Liza's Grounds' in Chapter 5 was also described as 'George's Ground' by more than one reviewer. Several communities share areas so it should come as no surprise that more than one name may exist, but if this is the case, which name should get recommended for an official map?[18] Furthermore, what if, as revealed in Brice-Bennett, "particular areas are intimately known only to the men who have hunted and trapped there" (1977, 305); should such personal names make it to an official map intended for consumption by the general populace?

*Coastal Zone Management*

Ultimately, local knowledge as captured through coastal resource inventories will be an important tool for integrated coastal zone management: "ICZM is a dynamic process in which a coordinated strategy is developed and implemented for the allocation of environmental, socio-cultural and institutional resources to achieve the conservation and sustainable multiple use of the coastal zone" (Hildebrand and Norrena, 1992, 94). Aquaculture development, marine protected areas, changing recreational patterns (e.g., motorized personal watercraft) new fisheries, mineral extraction and hydrocarbon activities will all add to the complexity of sea use in Newfoundland during the coming years. Detailed inventories of resources and

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Names used by incoming Parks staff are learned from exisiting staff and published maps; should this version of the cultural landscape be promulgated over that of local residents, likely users of future map editions?

[16] Place names mapped in Chapter 5 and the conflicting names recorded in Appendix I have not been compared with the list assembled by the NGNB or the observations of Handcock (1985). The NGNB may have official guidelines that parallel those of the Canadian Permanent Committee on Geographical Names (see CPCGN, 1990) but no attempt was made in the present research to investigate the review process.

[17] Any further investigation of place names for official maps and gazateer publications should extend beyond fishers to include a wider cross section of interests. MUN geographer Gordon Handcock (see 1977, 1984, 1985 and 1989) was born to a fishing family in Eastport and is reported to have a considerable appreciation for toponymy (Hamilton, 1996) and local history in the region (Major, 1979). I did not contact Professor Handcock during the research though he would seem an obvious person for follow up.

[18] When a feature bears two names, the CPCGN (1990) recommends adopting the older of the two.

activities will undoubtedly be an important decision support tool for conflict resolution and multi-stakeholder co-management in Newfoundland's coastal waters. Over the longer term, there is a need to continue building coastal data sets with input from multiple parties, and in this respect, recent comments regarding the North Sea are instructive:

> [P]erhaps a natural starting point for the continuing evolution of the North Sea management system, is the construction of data bases for spatially referenced data which integrate physical features with uses of the sea on a priority basis varying with intensity of use, comparable to the building up of national land surveys and their associated map series. In the near future this means preparation of electronic chart series in priority geographical areas ... designed primarily for use by fishermen, the offshore oil industry and submarine cable firms. Such a tool, with GIS extensions and paper outputs where required for speciali[z]ed applications, will provide the necessary visual bases for the integrated management of the North – and other – seas, during the next long wave of development. (Smith and Lalwani, 1996, 114)

Improvements, updating and the addition of new information should continue with inputs from a variety of formal and informal sources making the inventory and its map products ever more useful.[19] As Aberley suggests, maps could be updated and replotted every couple of years to improve the "collective understanding of the potentials and limits of place" (1993, 16). The preliminary documentation included here will add to the knowledge base of fishing activities.

### *Education and Interpretation*

Relevant, local data sets are a challenge for Atlantic Canadian training institutions; doubly so for marine case studies (Taylor, pers. comm.; Day, pers. comm.). Data Services International was quite interested in the potential for "real world" learning opportunities; one that was so close to the fishing backgrounds of the TAGS students proved highly motivational. A demonstrator package based on genuine government data and plausible "real-world" scenarios would prove much more rewarding and interesting than the typical data sample sets supplied with software tutorials (e.g., census data for the state of Texas is bundled with the SpansMap tutorial). With due regard for the copyright issues described earlier, a generalized

[19] I seem to have come full circle back to where I started at TNNP with the intention of assembling a comprehensive database of marine resources and uses (Macnab, 1995).

subset of the Eastport data set could be developed for educational purposes.[20]

Maps of harvester knowledge and local place names could also enrich the visitor experience at Terra Nova's new marine interpretaion centre: "Including fishery workers' toponyms, taxonomies and narratives in the design of MPAs and in interpretation centres for visitors will strengthen their accessibility to visitors, and interest for both visitors and members of local communitites" (Neis 1995, 267).[21] The question of acceptable and locally appropriate forms of tourism in Bonavista Bay is not easily answered, but communities will certainly be more supportive of displays and themes that reflect their world view – as opposed to that of parks planners. As discussed in Chapter 2, fish harvesters have legitimate concerns about tourism development. Unfortunately, the Parks Canada record is not very encouraging.[22] It has even been suggested that the fishermen's interpretive centre at Gros Morne National Park is insulting for locals, "a parody of their daily work down on the beach" (Welbourn, 1995, 42).[23] With a little sensitivity and tact, planners at Terra Nova might avoid some of this apparent conflict.[24]

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[20] For example, students could be walked through the topo/bathy compilation and troubleshooting processes, then be asked to generate digital terrain models, contours, and perhaps incorporate a range of other information; e.g., point data, shoreline classification collected through fieldwork with GPS, table digitizing of lobster grounds and some place name textual annotations. As a guideline, see the teaching tools that have been assembled for IDRISI software (e.g., St. Martin, 1993). Also see Warren (1995) for a sobering perspective on GIS realism in the classroom.

[21] Cultural interpretation is perhaps better suited for settings like the recently opened Ryan's Premises at Bonavista. This new National Historic Site (opened June, 1997) has as its focus the interpretation of the inshore fishery and coastal way of life in rural Newfoundland.

[22] The West Isles Marine Park proposal has already been dealt with in some detail. Graham *et al.* (1992) discuss community alienation during the construction of a visitor's centre for Fathom Five Marine Park in Tobermory. See similar concerns in Corbin (1996) regarding the town of Louisbourg and the nearby Parks Canada reconstruction of the French fortress.

[23] For a related discussion, see Overton's treatment (1980) of Newfoundland culture as a "tourist commodity." (Also see discussions of Peggy's Cove as an "invented" tourist haven in Nova Scotia [McKay, 1988].) There has been quite a shift over the last four decades in Parks Canada's policy regarding coastal residents. Terra Nova removed original dwellings whereas in Quebec's Forillon National Park families were peacefully relocated but their homes were maintained. Kouchibouguac in New Brunswick witnessed armed standoffs when residents refused to move; hereditary fishing licenses remain. Gros Morne made accommodation for Sally's Cove fishers by carving out an enclave within the Park.

[24] It is worthy to note that Strouds Pond, a TNNP lake originally named after one of the area's earliest British inhabitants, was renamed Dunphy's Pond "... probably after Fred Dunphy who in 1957 was the Acting Park Superintendent" (Handcock, 1985, 26). (I discuss other TNNP conflicts in an earlier publication [1996d]).

## 6.3 PROCEDURES FOR COASTAL RESOURCE MAPPING

The third research goal was to enhance and further develop procedures for the technical and social aspects of coastal resource mapping. This section reviews the research objectives: i) to customize scientific data with GIS, ii) to integrate hydrographic and topographic data, iii) to record the challenges, problems and limitations encountered, and iv) to consider further work suggested by the present research.

### 6.3.1 Customized Scientific Data

GIS provided for the adaptive improvement of basemaps, and in that fashion, it did assist in the documentation of local knowledge. Lockwood and Li mirror my general conclusion regarding the fieldsheet data: "If cost was not a consideration, one would prefer to have standard, high quality, large-scale, high resolution base map layers in digital form for all of the coastal areas" (1995, 158). Cost is a key factor: digital data offers considerable promise, but the processing is labour intensive and the technology does tend to frustrate as Appendix H attests. Was it worth all of the fuss? We have this data and the right tools; it seems a shame not to use them as Tortell hints, to "tailor-make" the printed map to meet the user's needs (1992, 91; also see Ricketts, 1992 and MacEachren *et al.*, 1992). It certainly helped me answer a series of questions for the thesis, but in the grand scheme of things, the delays proved frustrating for fishers, Parks Canada, DFO and the University of Waterloo. I could have done considerably more harvest area mapping in a much shorter time period had I not gone "high tech."[25]

*New CHS Maps*

When this research was undertaken, there were indications from the CHS that a finished chart for inner Bonavista Bay – complete with topographic features – was many years away. It was also anticipated that the proposed 1:60,000 scale for the new chart would eliminate much of the detail contained in the fieldsheets. Towards the end of the research, I

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[25] I never lost sight of the participatory components of the research, but in retrospect, I have learned a very important lesson: "What happens to maps in the future depends in part on the extent to which cartographers are willing to shed their inward turning habits and to come to terms with the social and political grounding of their own knowledge. If they are eventually assigned a subordinate role in society, it will be their own obsession with technology that will be to blame" (Harley, 1990, 19).

received a draft chart for the inner Bay which was derived from a mosaic of all the recent fieldsheets and the adjacent topographic map sheets. By June of 1997, a published chart was available for the celebrations surrounding the 500th anniversary of John Cabot's arrival at Cape Bonavista and, as predicted, much of the detail contained in the fieldsheets was not evident on the final chart (CHS # 4855). Eastport fishers are reportedly upset with metric depth soundings and the lack of detail on these final charts (Potter, pers. comm.); this only reinforces the need for customized maps.

### *Cartographic Communication and Computers*

Official mapmaking was once the sole concern of a specialized trade, but in recent years, low cost GIS packages and graphics software have put the sophisticated visual power of maps within much greater reach:

> Before the personal computer, folk cartography consisted largely of hand-drawn maps giving directions. The direction giver had full control over pencil and paper and usually had no difficulty transferring routes, landmarks, and other relevant recollections from mind to map. The computer allows [people] without cartographic savvy to strongly influence the look of the map and gives modern-day folk maps the crisp type, uniform symbols, and verisimilitude of maps from the cartographic priesthood. (Monmonier, 1996, 1-2)

GIS will not, however, produce perfect maps easily (Weibel and Buttenfield, 1992) and CARIS is no exception to the rule – the software can do most of what is required, but the task demands skilled operators and a solid grounding in cartographic design principles.[26] Furthermore, the unthinking acceptance of pleasant graphics – the "pretty picture syndrome" (Basta, 1990, 312) – applies to all maps, not just those drawn with the aid of computer technology. Whether drafted by highly-skilled cartographers, government scientists or community activists, all maps are suspect; computers simply help make polished and more authoritative looking maps. As with any knowledge, mapped or otherwise, readers must look beyond the presentation and evaluate the quality of the information. They should also consider the manner in which the data was collected and they ought to question any analyses or

[26] Based on the communication limits associated with the computer generated contours on the Eastport topy/bathy prototype, I must disagree with Lloyd's assertion that "[o]nce a map exists, it matters little to the person using the maps whether a GIS or a draftsman with coloured pencils constructed it", 1993, 148).

manipulations that may have been performed.[27]

*Limits to Cartographic Portrayal*

Fishers speak of changes in short and long-term units of time. Fluctuating environments and shifting locations of catch effort vary between years and even between weeks. Lobsters are a case in point: fishers contend that they move into shoal water with temperature increases and that they trap well in a variety of depths and places at different times during the season. Temporal inputs could be linked with spatial entities in a GIS for on screen display, but the generation of maps remains a challenge.[28] Portrayal of trap movement might be facilitated through a series of maps showing different times, but for initial inventory purposes, it may be best just to delineate, on one map, all areas fished for lobster at some point in the season. Another limitation in map-based marine resource inventories relates to statistical inputs. Many fishers have catch records that they would like to incorporate. Such inputs can be accommodated by an attribute database linked to a GIS, but the challenge of cartographic representation remains. Finally, unlike the predominantly two dimensional human use of terrestrial ecosystems, marine ecosystems are subject to human activities in three dimensions. This characteristic allows for considerably more multiple use of marine environments than terrestrial ones. While a given location on land is typically subject to only one major use (e.g., mining, forestry or farming), a marine area might support numerous fishing activities at different levels in the water column (e.g., surface nets, midwater trawling, and bottom traps). Capture of overlapping use is easily facilitated with the use of separate mylar sheets, and GIS can store such data, but the production of hardcopy maps that portray

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[27] Monmonier observes that "a single map is but one of an indefinitely large number of maps that might be produced for the same situation or from the same data" (1996, 2). Lucas and Budgell (1996) cleverly demonstrate this truism with a display of several computer-generated maps depicting identical phenomena for the Kara Sea in northern Russia. While all of the maps "look" fine and each is derived from thoroughly-checked measurements and statistically-correct methods, the images show wildly varying results. The use of computer mapping in my research is intended to make the process more rigorous, not more flashy. The "high tech" applications are not an attempt to "dupe" anyone – where people fish is where they fish. Unfortunately, my experience has shown that government agencies are often more excited by snazzy "deliverable" maps of local knowledge than they are by the information contained or by the learning and communication that has taken place during their production.

[28] Neis (pers. comm.) explains that Memorial University's Eco-research group encountered significant difficulties with map depiction of fishing effort as it changed over space and time. (See Langran [1993] for a technical discussion of temporal data in GIS.)

multi-layer information remains a significant challenge for cartography (Macnab, 1994).[29]

### *Further Data Treatment*

Operational concerns and scientific investigations require larger scale maps than initial planning efforts in MPAs; e.g. 1:2,000 habitat maps were generated for New Zealand's Cape Rodney-Okakari Point Marine Reserve (atlas cited in Tortell, 1992) and 1:8,000 side scan sonar maps were generated for New England's Stellwagen Bank Marine Sanctuary by a Canadian survey vessel, the Creed (Barr, pers. comm.). The closed lobster areas at Eastport could be mapped in this fashion.[30] As a preliminary step, the source data from the recent CHS cruises could be revisited to save costs and see where there might be gaps or survey needs.

Blais *et al.* predict that "[i]nteractive computer display systems will soon replace conventional topographical maps with terrain rendering and spatial process visualization" (1994, 23). It is not premature to anticipate 3-D topo/bathy virtual reality, enabling Bonavista Bay fly-throughs and adjustable perspectives on the environment as this technology is readily available and most of the required digital data already exists.[31] Multi-media technology and animated cartography could be used to further visualize emerging information sources for scientific interpretation and educational purposes.[32] For example, hydroacoustically sampled

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[29] The Eastport harvest areas are presented here in multiple figures. A larger map format and colourization would permit more themes to be displayed on a single sheet. Depending on the amount and complexity of information captured, and the desire for basemap features (e.g. depth contours), it might still be necessary to split categories between two or more plots in order to avoid map clutter and unintelligibility. Hawley (1979) explains similar limits and the need to generalize in the maps prepared for the *Inuit Land Use and Occupancy Study* (see Freeman, 1976).

[30] Lobster habitat surrounding the Magdalen Islands in the Gulf of St. Lawrence (Gendron, pers. comm.) and on Brown's Bank in southwest Nova Scotia (Costello, 1996) have been the subject of high resolution side-scan sonar studies.

[31] For a technical discussion of visualization possibilities, treatment and modelling of digital contours and relief data, see Hobbs (1995), Fuller and Faig (1995), Blais *et al.* (1994), Li (1994). MacEachren *et al.* (1992) discuss the theories and tools of geographic visualization. See Bishop and Hull (1991) for a review of the various technologies available for geographic visualization and Buttenfield and Weber (1993) for a review specifically of visualization with GIS. O'Brien *et al.* (1995) offer a "state-of-the-art" review of visualization in decision support.

[32] Black and white negatives are available for hundreds of pictures used in *Sailing Directions* (e.g., CHS, 1997b) to detail coastlines, harbours and wharves (Smith, pers. comm.) AGC maintains bottom photos (Lawrence *et al.*, 1985) and coastal videos shot from a helicopter (Sherin and Edwardson, 1995). Terra Nova has a substantial bank of coastal and undersea slides.

data of migrating schools of fish (e.g., Rose, 1993) could be "draped"[33] over top of a digital terrain model of the 'slopes' in Newman Sound as could 3-D telemetry survey tracks of tagged whales and seals (e.g., see Bernardo, 1997; Richard and Heide-Jorgensen, 1997).[34] Currents, tides and temperatures could also be worked in. Clearly, the opportunity to generate a "true" four dimensional GIS is well within reach.[35]

Nelson argues that Canadian "... shorelines remain in the back of our minds, dimly understood, seldom thought about, and incompletely attended to by politicians who are basically indifferent because of the lack of knowledge, concern and pressure from scientists, professionals and the public" (1990, 32). Indeed, many have argued that until people begin to "see the sea"– its shape and the life contained therein – there will never be enough awareness to support collective support for ocean conservation (e.g., Kaza, 1988, 1995; Steele, 1992).[36] Many opportunities exist for further applications in this realm.[37]

### 6.3.2 Hydrographic and Topographic Data Integration

The final basemap prepared for use in the Eastport mapping sessions was a less than ideal visualization tool. As explained in Chapter 4, the rush to proceed with harvest area delineation meant that an unfinished prototype was used for mapping sessions. Head discusses the use of unfinished maps:

> It is important to recognize, too, that this dialogue may also be carried on with a series of maps, perhaps roughly done ... perhaps made by computer or as an initial plotting in space of only partially analyzed data, for the private use of the cartographer for this purpose. Such private maps should be an essential stage in

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[33] Colour figures in Blais *et al.* (1994) illustrate the "draping" of thematic rasters over digital terrain models.

[34] Radio transmitters have been implanted in fish at TNNP to study migratory patterns (Potter, pers. comm.). When combined with bathymetric information, this research could lead to 3-D cognitive map studies in codfish.

[35] I am well aware – as will be many readers – of the seeming paradox of improved marine visualization: on one hand, it can help us to better understand and protect living marine resources, but on the other hand it can help us track and harvest those very same organisms.

[36] Heeps (1996a and 1996b) describes British efforts to help others sense the biophysical sea through underwater photography, hydroacoustics and multi-media presentations.

[37] Stroud (pers. comm.) has expressed considerable interest in multi-media applications for Terra Nova National Park. The Park has installed touch screen monitors; with the addition of a "joystick," visitors could pilot a virtual submarine through a 3-D simulation of Newman Sound.

> the recognition and definition of map messages, but too often are used, prettily-dressed, as final published works. (1984, 19)

For future cartographic product development, there appear to be two options: i) generate a series of standardized 1:25,000 basemaps or ii) utilize the hydrographic fieldsheet data to deliver custom maps "on demand." While the Eastport basemap was being generated, Geomatics Nova Scotia completed a 1:50,000 Coastal Series Prototype Map which portrayed topo-bathy information (Government of Nova Scotia, 1996). To produce this map, GIS was used to merge 1:10,000 topographic maps files and rasterized (i.e., "dummy") CHS charts (Speight, pers comm.). The "smart" CHS vector data available for Eastport offers a more "intelligent" and thus customizable database structure.

### 6.3.3 Challenges, Problems and Limitations

*Cartographic Literacy*

A mapping project in which mental impressions of lived-in space are captured on paper necessitates the fundamental ability to read, interpret and relate to conventional maps – in this case, nautical charts and topographic maps. As with print literacy and numeracy, an individual's capability to make good use of maps relates to aptitude, experience with the medium and familiarity. Many fishers demonstrated a command of the topographic map, likely as a result of having used them for hunting purposes and for woodlot registration, but the use of nautical charts was confounding in areas where the inaccurate older chart was not in use. Before engaging people in the exercise of mapping on mylar overlays, it was imperative to familiarize fishers with the basemaps presented. It was suggested by one fisher that participants would 'know the coast' and therefore wouldn't need the land contours to help locate themselves on the map. While this was true in many cases, some participants would have benefitted from more terrestrial information. Others had excellent environmental recall as evidenced by their oral descriptions, but may have had a tough time generally with map reading (i.e., they were intimately familiar with grounds, yet unfamiliar with maps – especially my rather peculiar and incomplete prototypes).[38]

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[38] Similar problems were encountered and dealt with in the Labrador exercise: "In such cases, I described the landscape with reference to local landmarks, rivers, coves, hills, etc, and mapped the territory used by the informant for him" (Brice-Bennett, 1977, 206). I also assumed print literacy – but not cartographic literacy – which could have been frustrating for many participants during the naming exercise (if it was, nobody indicated as

In Chapter 3 I acknowledged that people "named places within their range of land use as a guide to travel" (Brice-Bennett, 1977, 195). I also explained in Chapter 4 that the prototype base map contained topo/bathy information; it did not contain any text save for the manual annotatons I added to label contours. That people navigate by familiar route markers should have alerted me to the importance of names in cartographic communication. Most importantly for participatory mapping, place names would help with map reading and the process of seascape and landscape visualization.[39]

*Limitations in Local Knowledge*

Traditional knowledge will provide an incomplete picture of any given marine setting.[40] This point became apparent when it was remarked that beach seining on eelgrass beds in Newman Sound wouldn't reveal much. The local experience of fish size and abundance was based on the traditional capture fishery and the gear selectivity regulations that govern it. Fishers had never directed for juvenile cod so they were surprised to hear that upwards of 180,000 first year cod (Gotceitas, pers. comm.) were making inner Newman Sound their home. In asserting that the juveniles might not have been present in the past, some fishers cited changing water temperatures, stock decimation and natural fluctuations. That fishers could immediately suggest eelgrass beds for further study does not repudiate their original contention. Local knowledge has also undergone a certain amount of erosion through the imposition of conventional regulatory-style management and the introduction of modern gear technologies. Furthermore, gear types and fishing activities now thought to be "traditional" have had detrimental impacts. For example, fishers claim that increasing mesh sizes in monofilament gillnets may have led to the complete removal of the large egg-bearing cod, the

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such). In some cases, print literacy had no bearing on the problem, particularly with local names that had likely only ever been heard, and not read or ever written down. For example, a pair of inlets just west of Happy Adventure in Newman Sound are known locally as Upper and Lower Coackes Coves (pronounced 'coxes,' like foxes). We labelled them phonetically as best as we could and only later did I see the proper spelling of the original family name.

39 "Relating new information to what is familiar to the individual is a time-honoured way of taking advantage of preexisting cognitve structure" (Kaplan and Kaplan, 1989, 81).

40 "Cognitive mappers may selectively acquire only certain information and only for parts of the environment" (Lloyd, 1993, 149). See general discussions on the "uncritical espousal" of local marine knowledge in Johannes (1978), McGoodwin (1990) and Ruddle *et al.* (1992).

so-called 'motherfish' which might have been helping to perpetuate inshore stocks (see Observation 28 in Appendix B; also see Neis [1992]).

### *Quantifying Cognitive Environments*

Harris *et al.* observe that "... cognitive information is geographically imprecise and is not expressed comfortably within a point/line/polygon paradigm" (1995, 216), but as Bowie enthuses "the fact that socioeconomic factors may be ... less amenable to precise measurements than biophysical ones is not a reason for excluding them from environmental mapping" (1995, 17). Once digitized, cognitive information may be regarded with the same degree of precision as any underlying data layers, and this is a genuine concern for future uses.

### *Gender Bias*

In my many meetings with fishers, very few women were present, yet many lobster licenses are held and fished by female partners in husband and wife enterprises.[41] Traditional gender expectations in coastal communities reinforce the male role in matters related to fishing and the female role in running households and keeping fishing records. As a result of these social structures, the exercise of mapping in this undertaking did not accommodate women's impressions of fishing space and coastal environments.[42] That women have a considerable body of accumulated knowledge is unquestionable; however, recording such information remains a challenge: "There have been few studies of the role of women in fisheries, and even fewer of their fisheries and marine-environmental knowledge" (Ruddle, 1994, 173).

There is some valid concern about gender roles and power relations as they relate to

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[41] Before the Atlantic groundfish moratorium was announced in 1992, women comprised 12% of Newfoundland harvesters and more than 50% of the plant workers (National Film Board, 1997).

[42] Women and women's perspectives have been overlooked in much of the body of research on Newfoundland fishing communities (Porter, 1993). Anthropological and folkloric works describe historical gender roles in Newfoundland communities (e.g., Faris, 1972; Feltham, 1986; Murray, 1979) while later research has examined the changing role of women and government responses in the industrializing fishery (e.g., McCay, 1988; Neis, 1988; Neis and Williams, 1996; National Film Board, 1997). Women's everyday space is described by Pocius (1992) and preliminary research appears to have been initiated on challenges to "patrilocality," including terrestrial property rights and trap berths (Palmer, 1995b). Interviews with female fish plant workers on the Bonavista Peninsula promise to capture important ecological knowledge; e.g., the dates when new machinery was introduced thus permitting the processing of smaller fish (Neis, pers. comm.).

women's map input in a truly comprehensive community based mapping project.[43] Chambers, however, reports that participatory mapping "can enable marginalized women to express their preferences and priorities in a physical form which does not entail personal confrontation with otherwise dominating men" (1994b, 1263). A further question is that of the facilitator's gender in women's mapping sessions: might a female community member – or female geographer – create a more relaxed rapport and have a better appreciation for women's spaces and perspectives?

### *Environmental Values*

There is an important distinction to be made between the use of an environment (e.g., berry picking) and the values that it holds for people (e.g., symbolic meaning): one has relatively concrete spatial coordinates that can be mapped, and the other has subjective components which are difficult to render in any graphic format.[44] The discipline of landscape ecology is attempting to quantify landscape aesthetics (e.g., Dearden, 1988) and to build approaches to visual resource management (Miller, 1988; O'Brien *et al.*, 1995), but methodologies for mapping these concerns are still evolving.[45] Environmentally valued locations can be mapped (e.g., Young and Coates, no date), but it is still recommended that associated preferences, attachments, myths and stories be documented in an oral or written format (e.g., see Bowerbank, 1997; Wilson, 1986; Ryden, 1993).

### *Bureaucratic Acceptance*

As explained in Chapter 5, there was a fair degree of local support in Eastport for a mapping initiative. The very nature of a community-based coastal resource inventory,

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[43] Many women that I met during the course of my research spoke quite openly about their lives and the fishery, but many more seemed content to let men, particularly their spouses, speak for them, even when asked a direct question.

[44] Obviously the fishing grounds are valued; here I mean emotional or spiritual value which may or may not be attached to particular earthscapes. Relph (1989) opposes efforts to measure and record the "geography of experience" with standardized scientific and reductionist methods. For corresponding viewpoints, see the body of work on attempts to capture indigenous concepts of space within a Euro-centric or Cartesian tradition (e.g., Jackson, 1995; Jacobs, 1993; Rundstrom, 1995).

[45] A special issue of the *Coastal Zone Management* journal deals with visual resources, but most of the contributions stress the terrestrial side of the land sea interface (Smardon and Felleman, 1982).

however, poses significant challenges to the way government departments have historically operated. The challenges encountered during this research are not unlike those noted for the Atlantic Coastal Action Program:

> For the Federal (and undoubtedly Provincial) governments, the program has presented many challenges including: shifting from the command and control mode to one of enabler and facilitator; the adaptation of information/data to meet community needs; the opening of effective communications channels; the redirecting of current programs and resources to support community initiatives; the changing of the corporate culture from a hierarchical, linear delivery to one of horizontal, or team, delivery; and the recognition by the government of management scenarios arrived at through community consensus. (Donaldson, 1994, 696)

Within the greater challenge of bureaucratic acceptance, there exists a conflict between local knowledge and scientific approaches to coastal inventories and fisheries management. Many biologists questioned the value of early results in the Scotia-Fundy approach (Rutherford, pers. comm.), but in Newfoundland, the conflict takes on an adversarial tone. Some investigators (e.g., Finlayson, 1994) have suggested that better incorporation of fishers' knowledge might have helped limit overfishing in the 1980's. The use of local knowledge to proportion blame will not help to engender constructive dialogue and positive working relationships between fishers and scientists.

### *Knowledge and Copyright*

Two unresolved issues relate to copyright and intellectual property rights. In the first instance, license agreements exist between Parks Canada, NDI, CHS, and Newfoundland Surveys and Mapping for the use of digital data; implications for third party use remain unclear. For example, harvesters would like to get customized maps of their main fishing grounds. As for recognition of the local knowledge held by inshore fishers, there is no question that the community maintains ownership. What remains to be discussed is the holding and use of that knowledge by Parks Canada and cooperating parties; namely, DSI and DFO. These issues became most apparent when a private consultant grew upset at my refusal to supply him with copies of the information I had been collecting for fishers and Parks Canada: "Why can't you give it to me? It is government data isn't it?" None of the information, especially the mapped local knowledge, was mine to give away.[46] It is essential that Park staff and researchers proceed with caution while instating safeguards that respect community wishes.[47]

### *Reflections on the Research Process*

A multi-partner project like the one described in this thesis is difficult to complete within the regulations, time frame, academic traditions and reporting requirements of a graduate degree program.[48] The research evolved in a professional context where there was a pressing and practical need for such an approach.[49] Collaboration, interaction and research adaptation enabled people, knowledge, data and processes to be assembled for far greater efficacy than would have been possible with a solo effort. However, along the way, there were a number of difficulties which deserve mentioning.

Much has been written on the high hopes for GIS and the importance of product delivery in a mangement context (e.g., Montgomery and Schuch, 1993; Warnecke, 1995).[50] If organizations do not see tangible results from GIS investments, they will not continue to support the technology. Unfortunately, expectations are high and there is still a perception that digital mapping is somehow quick and easy: "Premature delivery of products will be demanded, and then the recipients will be disappointed. Plans must be made to avoid the stresses and unreal expectations of this event" (Giles and Nielsen, 1992, 91). With multi-

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[46] That the consultant was going to use "our" maps in his own company's sales pitch to partners in an oilspill response team was not lost on me. Shell provided $15,000 to support *community-based* coastal mapping initiatives in Nova Scotia (MacCullough, pers. comm.); why might Hibernia interests not offer the same for Newfoundland *communities*?

[47] Preliminary discussions of copyright as it relates to GIS and geographic databases are available in Eldred (1996) and Montgomery and Schuch (1993). This issue will be most troublesome in multiparty datasets involving information shared between government and community sources.

[48] Admittedly, I missed several important deadlines and in retrospect, it is easy to see that I tried to do too much. In my attempt to work and study full time, I may have made promises beyond my ability to "deliver."

[49] Professionalism also poses significant challenges for academic research as I discovered in my time with Parks Canada. Censorship of my writing and some rather questionable (i.e., dishonest) editing demands prompted me to ask whether I was reporting on my research or Parks Canada research? I was also asked not to go to meetings that I'd been invited to attend as an interested researcher.

[50] Managers and administrators ask several predictable questions: "We keep spending all of this money on GIS and databases. Why haven't I seen any useful maps yet? Is this investment helping us make any better decisions?"

participant GIS databases, a "project champion" is of utmost importance (Montgomery and Schuch, 1993, 170). Someone must secure senior-level interest, funding support and staff committments from one or more organizations if collaborative GIS projects are to succeed.[51] Insecure funding for the research culminated in the apparent bankruptcy of my geomatics collaborators, Data Services International. The informal partnership with a TAGS training program seemed cost effective and entirely appropriate given the subjects at hand, but when the school's computer gear was confiscated to pay rent owed, my plans to finish the prototype basemap were severely curtailed.

Expectations at Waterloo also proved rather daunting at various stages in the research. First, as I approached participatory mapping in Eastport, I discovered that the University's ethics guidelines "... reflect an empirical-realist model of research derived from medicine and the 'hard' sciences which anticipates mass surveys, quantitative analysis and replicable results" (Winchester,1996, 117). My conclusions regarding the suitability of such procedures for cultural studies and participatory research in human geography concur with those of Winchester: "... many of these procedures intended originally for invasive medical procedures such as blood-sampling tests, are of less significance in qualitative studies where interviews are being undertaken with *not only consenting but interested, and sometimes locally powerful, adults*" (1996, 128, emphasis added).[52] Second, several years into the research, it became apparent that I could have written a shorter Master's thesis on my first 18 months learning in MPAs, and then gone on to do the harvest area mapping as part of a dissertation. Regrettably, MPAs are largely reduced to research context and appendices in the present text. I was given stern warnings by the University in the fifth and sixth terms of my degree program to complete my studies, but once I had committed personally and professionally to harvest area mapping with fishers, Parks Canada and DFO, there was very little opportunity to step back and write up the initial research findings for submission as a Master's.

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[51] My experience at TNNP is mirrored by Warnecke: "Initiation – and success – was often the result of ingenuity and perseverance of dedicated employees, instead of – or sometimes even despite – agency direction" (1995, 39).

[52] I have included my Ethics Review as Appendix C for two main reasons: i) it describes the intent of my project in plain language, and ii) the subsequent dialogue is an indication of the inherent challenges for participatory fieldwork and collaborative research within the existing ethics framework. Note my use of the term "mental maps" in the application (see Appendix C, Part 2, question 2 and responses). This seemed to raise some concern, possibly because it sounded like I might be doing some kind of psychological testing.

### 6.3.4 Future Research Opportunities

*Project Expansion*

Many additional areas are fished by Eastport Committee members beyond the area presently mapped. Two areas require more attention: first, the deeper waters in central Bonavista Bay are used for harvesting crab and various groundfish species; second, the central Bonavista Bay archipelago, which is fished by past residents, presents a confusing mix of users who are now resettled in many different coastal towns surrounding the Bay (Head, 1967). Pending the outcome of the Eastport exercise, the procedure could be repeated with other fishermen's committees in the study area. Once a process and full scale map product emerge from the Eastport exercise, it will be much easier to demonstrate the concept to other fishers. Ideally, the concept would be presented by Eastport participants, for as Kaplan points out in a discussion of planning approaches custom fit to local circumstances, "the imagery and results of successful experiments are an essential ingredient in encouraging further attempts in another place" (1993, 137). Gradual documentation throughout Bonavista Bay and compilation in a GIS would help to generate an area-wide composite of traditional knowledge and fishing patterns. With due respect for the sensitivities surrounding fisheries conflicts (see Macnab, 1996d), the mapping approach could be expanded to include user activities and local knowledge from additional groups and other community interests. The midshore and offshore fishing sectors could contribute data, as might general community members, especially women (see Section 6.3.5). Members of two additional stakeholder groups have already expressed a willingness to help identify valued marine resources in Bonavista Bay from a recreational perspective: scuba divers (e.g., see Barron, 1988) and the yachting community (e.g., see Mills, 1993).[53]

*Toponymic Research*

The present research suggests a whole range of topics for future investigations of local place names in Bonavista Bay. There are many questions pertaining to the toponymic knowledge of neighbouring communities; for example, do harvesters working from small boats

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[53] Scuba divers provided information about many undocumented sites to maritime archaeologists working on an inventory of known shipwrecks for the Nova Scotia Museum (MacCullough, pers. comm.).

in Newman Sound know local names in Eastport Bay, and vice-versa? Are mobile gear fishers (e.g., gillnetters and seiners) better aquainted with local appelations away from their own communities? Morris Island lobster grounds are fished by St. Chad's and Eastport harvesters; do both groups use the same names and markers? And what about the use of temporary marks, taken "at the moment" (Jorion, 1978, 94) while fishing? I did not pursue these lines of inquiry owing to their inherently "academic" nature, but I am compelled by them at the close of this phase of my research. In particular, I wonder if the same "modernizing" technologies that are replacing traditional location finding methods might not be used to capture the associated names and navigation formulas before they are forever lost. An oral description and a straight line "medieval intinerary" sketch map after Jorion (1978, 93) for each 'spot' of ground would be very beneficial, especially where the informant is immobile or incapacitated, but the ideal approach would be on-the-water fieldwork with a depth sounder patched into a GPS unit. With the addition of compass bearings, taped descriptions and photographs or even video documentation, this information could be integrated into digital databases (e.g., bathymetry) and assembled for multi-media display. Conversely, topo/bathy data could be displayed on screen so that 'oldtimers' might navigate with a digital "rudder" through a "virtual" bay and pinpoint their traditional grounds.

### *Local People as Facilitators*

When I started the research, I was aware that other projects, particularly the community-based coastal inventories conducted in Nova Scotia (see Rutherford *et al.*, 1995) employ and train local data collectors with great success (MacCullough, pers. comm.). This practice has several benefits as discovered in the Labrador Land Use and Occupancy Study:

> A local person has the advantage over a stranger that he does not have to establish rapport with the community (often a difficult task for an outsider), because he is already an established and accepted member of it. Moreover, because he himself has grown up in the community, he already has a store of valuable knowledge that would take an outsider a long time to acquire. His knowledge of the community, the residents, their backgrounds, and the areas in which they have lived makes it much easier for him to select the informants whose contributions are likely to be of the greater value. (Brice-Bennett, 1977, 279)

Problems of cross-cultural communication would indeed be lessened if local people collected knowledge and worked as facilitators in their own commuities. With only a small amount of training in cartography and PRA techniques, community members could conduct map based inventories. That "fishermen learn best from other fishermen" (Lien *et al.*, 1985, 235) is evidenced by successful harvester delivery of the "Fishermen's Lifeline" safety course offered throughout Newfoundland (B. Smith, pers. comm.; also see Observation 8 in Appendix B).[54] During the fishing season, when harvesters are apt to be busy, wives have proven exemplary researchers because they already 'know everybody' (Sheppard, pers. comm.; see Sheppard, Hedges and Green, 1982).

*General Research Opportunities*

- Continued analysis of Bob Graham's local knowledge questionnaire data
- Comparative studies of toponomy, marks and tenure in North Atlantic fisheries
- Comparative legal research on indigenous and non-indigenous knowledge
- Global comparison of MPAs established by indigenous and local communities
- Ethical guidelines for local knowledge collection in non-indigenous settings
- Generate a typology of local knowledge as portrayed on marine maps
- Applicability of the IUCN protected seascape category to local marine reserves.
- Adaptive management applied through flexible marine zonation
- Coastal data quality as it relates to user perceptions
- Database copyright, community access to data and use of GIS and GPS
- Customized maps for specific user groups
- Introduction of electronic navigation and fishfinding devices to the fishery
- Parallels in PRA, literacy, theories of social learning and civics models
- Conflicts between fishing activities and tourism/recreation
- Commodification of Nfld. environments and culture for tourism marketing
- Public participation, marine stewardship activities and fisheries co-management
- Social analysis of ocean maps to review the fisheries in Newfoundland's history
- Decline of the small wooden fishing boat

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[54] See parallels in PRA (Chambers, 1994c) and the literacy movement, especially the labourer/teacher tradition of Canada's Frontier College (Carpenter, 1986).

### 6.3.5 Directions in Academic and Applied Marine Geography

> Attention is long overdue in geography to the management of the 71 percent of the Earth's surface comprising the oceans and seas.... Henceforth management will become progressively more important, with considerable potential for geographical study. (Smith, 1985, 109)
>
> The discipline of geography in all its forms, has a major contribution to make to the processes of designing and applying ocean management frameworks. This is not just because of the long-standing involvement in the process of regional/ resource development in non-marine environments, but also because of the synthesizing and spatial nature of the discipline. (Harrison, 1980, 112)

The oceans are geography's neglected region as a casual glance at the discipline's current journals will indicate. The present research indicates several possible areas where physical, human and technically oriented geographers might find opportunity for research and investigation. The provision of spatial data products falls within the traditional academic purview of geography; less obvious, perhaps, are the gendered and indigenous aspects of ocean space. Finally, the relationships between cognitive maps and hydrographic charts invite considerable investigation.

*Spatial Data Products*

Usher *et al.* observe that "[g]eographers have played a significant role in the development and application of land use mapping techniques" in Canadian First Nations land claims (1992, 125). The same cannot be said of coastal and marine resource mapping within Canada. Why have geographers not made a larger contribution? This may in part be explained by the fact that there "... are too few geographers specializing in marine resources who also have functional appreciation of GIS. The two subfields simply have not coalesced" (Davis and Davis, 1988, 160). This is slowly changing, but there are still far more marine biologists using GIS and mapping than there are geographers studying fish. Furness suggests that the "... expertise of cartographers in bringing together disparate geographical data sets and providing graphical interpretations to assist managers is ideally suited to realise the latent potential in many existing data sets" (1994, 11). He also predicts that "... the many data sets that should become available over the next few years will only increase the demand for the interpretive skills of cartographers as mapping scientists, to enable the full potential of the data sets to be unlocked" (ibid.).[55] The theoretical, methodological, technical and social challenges encountered during the development of this project are likely to be met by any group attempting to carry out community-based coastal resource inventories in Newfoundland, elsewhere in Atlantic Canada, or indeed anywhere that small scale coastal fisheries persist. There must be more sharing and publication of successful results; demonstrator maps must be made available for display to interested communities; and a plain language handbook would be a logical and welcome output from this thesis.[56]

### *Gendered Coastal Space*

Geographic research on women's lived and conceptual space is in its infancy, as is conceptualized sea space (e.g. Cole-King, 1995; Jackson, 1995; Nietschmann, 1989). Gendered sea space in Newfoundland, which combines these unlikely strands, is most certainly under-represented in geography and deserving of further investigation. Little appears to have been written on techniques for cultural mapping of women's perspectives on place.[57] Rocheleau *et al.* (1995) review gendered resource mapping, and although their discussion relates mostly to agricultural communities, the principles and methods they highlight could be applied in coastal communities.

An important characteristic of women's spaces is that of scale: maps will be based on environmental spheres or scales of personal reference and experience.[58] Certainly there are

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[55] I do not mean to discredit other scientists – natural and social – who have used maps historically (e.g., see Hall, 1992; Monmonier, 1993), and are starting to use GIS for marine applications. However, I am suggesting that researchers in these other fields might benefit from increased collaboration with technically-oriented geographers, researchers for whom space and its graphic portrayal are a focus.

[56] This project would have been greatly assisted had a practical manual or guidebook been available from one of the ongoing efforts to collect local knowledge. Rutherford *et al.* (1995), appear to have made a good start. DFO, Newfoundland Region, was to have prepared a mapping manual (O'Brien, pers. comm.) but successive requests to the Department for a review copy went unanswered over the final 18 months of the research.

[57] Though not well read on this subject or in feminist geography, I have reviewed general studies on exploring women (e.g., Squire, 1995), women in landscape interpretation (e.g., Rose, 1993), and women in development (e.g., Shiva, 1989 and papers in *Indigenous Knowledge and Development Monitor* 2(3), 1994) only to find scant evidence of gender-specific mapping methodologies.

[58] Rocheleau *et al.* (1995) describe the "invisible" and "sub-community level" of women's spaces, many of which "fall between" spaces controlled by men (e.g., property boundaries), and most of which are smaller than the

women harvesters in Newfoundland who could contribute to maps of fishing locations, but generally, women's maps might differ from men's in their depiction of features from "everyday space" (Pocius, 1992) like garden plots, root cellars, clothes lines, wells, springs, berry fields, meeting places and former flake locations, all of which would be traditionally female oriented or valued spaces.[59]

### *North Atlantic Indigenous Ocean*

Although the Mi'kmaq people lived in the Terra Nova area well into this century (Major, 1979), there does not appear to be any Mi'kmaq population within the Eastport area at the present time. However, there are indigenous lobster licenses under review for a food fishery in Gander Bay (Macnab, 1996e) which falls within the Parks Canada NMCA study area. This development may entail some form of special treaty negotiation and the possibility for conflict is high (see Berneshawi, 1994; Dearden and Berg, 1993; Jones, 1994; Wildsmith, 1995; Smyth, 1995).[60] Jones forewarns Canadians of this potential: "Marine reserves that incorporate no-take zones or restrict a First Nation's access without their consent may encounter critical legal and organizational obstacles. (1997, 19). Further research on conceptual and legal indigenous ocean space will be required prior to any NMCA agreement where indigenous Canadians may have an interest.

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average area represented by a single "pixel" in a conventional GIS.

[59] Butler (1983, 19) suggests that women in L'anse-à-Canards, Newfoundland, do "not share the cognitive map of the men" and that they "may know the names [and] that the names refer to certain fishing grounds," but that "such knowledge is passive in that it is gleaned purely at second hand from what the men say." This, of course, does not preclude other cognitive impressions as pointed out in the Labrador mapping project: "Although I interviewed only males for the map biographies and supplementary data, I found some of the older women who had lived around the bay before settling in Postville to be helpful and informative. Their trapping and fishing experiences were limited, but they presented the domestic side of traditional life around the bay" (Brice-Bennett, 1977, 206). Creates (1990) offers coastal sketch maps of women's "domestic life" in Labrador while Pocius (1992) provides cartographic renderings of women's knowledge on the Avalon Peninsula.

[60] Indigenous entrants and special fishing rights have engendered a certain amount of hostility in Newfoundland. The resulting derision prompted one fisher to declare 'We've been here longer than the MicMacs!' Interpreted broadly, and notwithstanding the Beothuck peoples, historical research does support the longer residency of European settlers (Major, 1979).

***Cartographic Communication and Cognitive Theory***

The present research has reviewed literature from many fields related to mapping, people's experience and the subsequent encoding of environments. The fieldwork component of the research confirms the existence of several gaps and areas in need of further synthesis:

- Interface between local knowledge, sketch maps and mental maps
- Recording local knowledge on published maps and the importance of cartographic literacy for visualization and landscape association
- Cognitive maps and cartographic products with a special focus on appropriate scale for local environments
- Whole language theory investigations for cartography and PRA
- Cognitive maps in four-dimensional marine environments
- Collecting and integrating local knowledge with GPS and GIS
- PRA methodologies for mapping local knowledge with GPS and GIS

Publications on cognitive maps as they relate to artifact maps (e.g., Kitchen, 1995; Lloyd, 1993) continue to show that "... conceptual research is considerably more developed and actively practised than applied research" (Kitchin, 1994, 14). Most geographers conducting research in this field are concerned with making "better maps" and not with making "better use" of maps. The focus seems to be centered on integrating "map information into the cognitive map" (ibid., 12) and not the reverse, a seemingly important consideration in light of the increasing use of map-based local knowledge surveys.

# CHAPTER 7

## *HAULING THE LINES*

In this final chapter, I review the thesis and comment on the associated findings. The chapter begins with a summary of the research. Next, I describe what I have learned about marine protected areas and inshore fisheries in Bonavista Bay. In the third section, entitled Sea Use Planning, I consider the need for greater attention to human activities in the Canada's emerging ocean management regime. Participatory mapping and digital cartography are reviewed in section 7.4. The modern day fishery at Eastport is summarized in the following section. The sixth section discusses possibilities for project continuance. Guidelines are then offered for future mapping in Bonavista Bay. The chapter closes with a final geographic perspective on fishing, ocean mapping and the potential role of geographers.

### 7.1 RESEARCH SUMMARY

I began my investigations in Newfoundland with a broad interest in fishing, marine protected areas and mapping. Through the course of my employment with Parks Canada, I had the opportunity to observe fishing activities and participate in a marine conservation planning exercise. I also read extensively and interacted with a wide range of scientific, community and government interests. Three issues emerged and became the foci of my thesis research: i) inshore harvesters were interested in selecting and establishing single species "no-take" marine reserves, ii) fishing grounds were well known to local harvesters, but were otherwise undocumented, and iii) basemaps suitable for marine inventory purposes in Bonavista Bay were somewhat lacking. I was most interested in seeing that local knowledge and fisher concerns were communicated, and to that end, I chose to adopt a facilitator role. To inform my research, I examined questions of theory, method and process. Working in collaboration with the Eastport Fishermen's Committee, government agencies and a geomatics training program, I endeavoured to produce a coastal basemap and then used that chart in mapping sessions with harvesters to document fishing locations.

## 7.2 MARINE PROTECTED AREAS AND INSHORE FISHERIES

There is a pressing need for Newfoundland MPAs to be practically implemented and locally supported if they are to be effectively conservative. Whether MPA proponents are from Fishermen's Committees, Parks Canada, Fisheries and Oceans, the province of Newfoundland or community groups, they will be forced to acknowledge and possibly accommodate fisheries in all but the rarest of occasions. The idea of foisting agency-defined resource management and conservation objectives in Newfoundland is outmoded and destined to fail given the current climate of environmental and economic uncertainty and widespread distrust in government. Indeed, the heavy use of coastal ocean space for fisheries is unavoidable in MPA planning efforts for northeast Newfoundland and elsewhere in Atlantic Canada, especially if there is interest in harvest refugia or highly protected cores. It is also doubtful whether effective MPAs in this region can be disassociated from fisheries management, integrated coastal management and broader marine conservation issues such as biodiversity and land-based pollution.

The economic needs, conservation priorities, and long-term goals and objectives of coastal fishing communities in times of crisis are likely to be quite different from those of scientists, academics, NGO's and government departments, but this does not preclude the potential for compatibility as evidenced by the lobster reserves established in Eastport. In light of the need for community based measures, the types information most necessary for MPA establishment are those which are most important for enabling dialogue and planning at the community level – coastal bathymetry and inshore harvest areas. Incorporating fishing patterns and local management practices into MPAs through user-related zoning schemes is broadly supported by international experience and in this regard, the lobster closures in Eastport offer an encouraging model for initial MPA selection and establishment in coastal regions of Canada where fishing is the dominant sea use. Pending initial success in fisheries-related MPAs, and assuming broad harvester, scientist and political acceptance of MPAs as a legitimate fisheries management tool, other more ecologically-motivated MPAs may gradually be welcomed by current opponents. Strict no-take MPAs will come with time as people grow accustomed to the concept of ocean spaces where extractive activities are limited.

To advance from MPA concepts, like closed areas for spawning fish, towards community-directed measures on the water, there is a need for dialogue about MPA theories as they might relate to formal and informal management schemes, actual fishing locations and spatial harvest effort. This dialogue may be accomplished through open processes of face-to-face consultation and by exchanges of scientific information and local knowledge. Outside technical facilitators can help communities inventory their fishing grounds and other valued ecosystem components in a scientifically acceptable cartographic fashion. With a collective visual rendering of the familiar biophysical and cultural seascape, communities can identify site-specific conservation needs and candidate MPAs by "interviewing" their maps. Inventory collaboration with government and academic partners provides an opportunity for genuine fisher participation and meaningful community involvement; it could also serve as the basis for planning in evolving co-management arrangements. MPAs will certainly be identified and discussed among fishers, managers, scientists and planners without reliance on maps, but graphic depiction will be necessary to illustrate areas selected as well as those under consideration. Maps are also useful for illustrating the relationships between fishing, marine biophysical parameters and conservation management measures. Use of the thesis maps during presentations, meetings and scientific investigations has demonstrated their value for effective communications.

For Parks Canada, beluga whales dictated the focus at the Saguenay-St. Lawrence Marine Park while shipwrecks dominated the agenda at Fathom Five. In Bonavista Bay, where fisheries issues and interdepartmental co-operation are inescapable, planners must continue to incorporate harvesters, local knowledge and community viewpoints if Parks Canada wishes to avert another West Isles fiasco. Implications for Eastern Canada or other heavily fished regions are clear: MPAs are likely to be more acceptable if: I) 'no-fishing' zones are nominated and co-managed or at the very least co-nominated by harvesters, and ii) if fisheries conservation and stock replenishment are treated as explicit objectives, rather than as a secondary effects.

In summary, fisheries-related MPAs established for sedentary species in northeast Newfoundland will succeed if they are based on voluntary suspension of harvesting effort and community stewardship. There will be a substantial opportunity to monitor and evaluate the effects of area closures if MPAs are related to fishing grounds at a local scale, co-managed by resident harvesters with government agencies and supported by cooperative scientific research. The social learning process necessary to reach these conditions is achievable. Relaxed rapport characterised by plain language and supported by cartographic aids can demonstrate MPA concepts, illustrate relevant case studies and could lead to conservation measures like those in place at Eastport.

## 7.3 SEA USE PLANNING

Within Canada's evolving oceans management regime, there has been wide recognition of the need for ecosystem, holistic and interdisciplinary approaches. Unfortunately, many of those concerned with marine resource management and MPA establishment continue to discount the advantages to be gained from a sea use planning perspective. Researchers in the social sciences routinely cite operational MPAs as textbook cases for marine activity zoning and integrated ocean management, yet Canadian MPA planners rarely consider the sea use planning discourse.

Despite growing efforts to combine local and scientific forms of knowledge, ocean mapping and decision making in Canada is still dominated by physical and biological concerns. Canada's cultural oceans, particularly the increasingly utilized coastal areas, deserve the kind of attention given to land use planning and terrestrial property mapping. Integrated ocean management regimes that will accommodate aquaculture installations, MPA establishment, unexploited fisheries, community-based quotas, hydrocarbon extraction and modern forms of marine recreation will most certainly require a human ecological perspective.

When planning for a permanent sea use, why would we not proceed in a fashion similar to that for a new landfill sight; that is, with the collection and compilation of land type *and* land use information? In many cases, information collected from user groups such as fishers and GPS-encoded site visits will be the only ways to map human activities on the sea. Information collected in this manner for say, the North Sea or perhaps the Great Barrier Reef Marine Park, would be considered practical and necessary for effective planning and management; how much longer will it be regarded as informal, traditional, curious, quaint or anecdotal in Canada?

## 7.4 PARTICIPATORY MAPPING AND DIGITAL CARTOGRAPHY

While not eligible for comprehensive land and sea claims in the First Nations sense, coastal fishers have fought battles against spatial intrusions by new resource uses such as hydrocarbon exploration, mobile gear fisheries and aquaculture. There is little reason not to expect similar conflicts as the desire to establish MPAs grows. Community maps drawn in collaboration with outside researchers can be used for local planning purpose and for the avoidance of conflicts. Digital cartographic methods offer considerable promise for joint mapping and inventory efforts.

Collaborative and participatory approaches to mapping are beneficial, particularly when there is community enthusiasm, but there is a clear need for organizational commitment, financial support and management interest if projects are to succeed. Working with an existing social structures (i.e., the fishermen's committee) proved to be an important factor for the success of this research. A common set of mapping goals led to greater openness, trust and sharing on the part of the Eastport harvesters. Relaxed approaches drawing on methods developed for participatory rural appraisal were most useful. The built-in peer review that accompanies small group mapping sessions ensures that maps are accurate and complete in the eyes of the harvesters. Such an approach, however, will miss some items and categories that might be considered essential to outsiders. Conventional questionnaires and surveying will be required to elicit other information types of interest to oceanographers and biologists (e.g., spawning behaviour).

An interactive and adaptive approach to research enabled me to customize maps for local applications. Large scale maps depicting the "everyday environment" are more personal, and in that sense, are more useful for local planning purposes. Geographic information systems enabling "maps on demand" were helpful in this regard, but time consuming. The images and work presented here only hint at the potential for cartographic rendering and seabed visualization. With careful attention to cartographic principles, GIS operators can produce easier-read maps and a host of other digital representations. Indeed, the wealth of digital hydrographic data available for Bonavista Bay invites considerable experimentation.

## 7.5 EASTPORT PENINSULA FISHERIES

The small boat fishery for lobster, squid, herring and crab is generally alive and well in the waters surrounding Eastport. New fisheries, such as urchin, shrimp and skate are emerging, but these species have done little to take the place of once vibrant flatfish, cod, lumpfish and capelin fisheries. Local knowledge – spatial, biological, technical, ecological and historical – continues to inform the cognitive basis of inshore fishing. The names and markers of past cod fishing grounds are remembered, and for a few brief days during the annual recreational fishery, people still make use of this information to help situate themselves over the prime grounds. Local toponyms, with new additions and personal variations, remain in use to denote bays, tickles, rocks, islands, landforms and other coastal features. Cognitive maps exist in high detail as demonstrated by tremendous above and below water environmental recall during the mapping sessions, but modern navigation and sonar technology is increasingly employed, particularly amongst younger fishers, those who will inherit the fishery of the future.

Eastport fishers also continue to regulate fishing space within their communities by means of informal local boundaries, individual tenure for lobster territories and acceptance of local customs for bottom and surface gillnet-spacing. The DFO sanctioned draws for codtrap berths could be revived tomorrow and little would have changed since the final pre-moratorium draws. The historical local management measures have been expanded in recent years to include peer enforcement in the lobster fishery and precautionary experimental closures. Interest in mapping local fishing grounds is strong because the Committee wishes to demonstrate their occupancy to others who might creep in hoping to profit from Eastport's conservation and fisheries enhancement measures.

## 7.6 PROJECT FINALIZATION

With some additional processing and cartographic refinement, the prototype basemap generated during the course of this research could be made more useful for interpretive purposes. The harvest areas should also be properly digitized from the mylar overlays with an awareness of the fact that the cognitive maps from which they were generated are much less accurate than the basemap upon which they were drawn. Full scale (1:25,000) colour maps of the fishing grounds, complete with topographic and bathymetric information, could be generated with proper shading for review, verification and additional annotations by the Eastport Fishermen's Committee. Terra Nova National Park has acquired a large format colour plotter and has offered to print these maps. The Park also has a more economical blueprint machine which could be used to produce large format monochrome maps in quantity.

Terra Nova staff expressed interest in facilitating a workshop where the maps would be presented in Eastport. Once final corrections and adjustments are made in a committee meeting or in workshop sessions, the draft maps should be updated and replotted. The final output maps would then go back to the Eastport Committee and other collaborators in hardcopy formats. Once the maps are completed, some attention must be directed towards copyright and guidelines for digital distribution.

## 7.7 RECOMMENDED PROCEDURES/IN BONAVISTA BAY

The guidelines that follow are based on the experience gained through the thesis research period. Suggestions are offered for mapping at two levels: i) at a basic overview scale for general inventory purposes, and ii) at a large scale for detailed inventory and participatory planning purposes. Some of the recommended procedures are structured around the availability of new hydrographic data and are presented primarily for harvest area mapping projects in Bonavista Bay. Many of the steps could, however, be applied elsewhere.

### 7.7.1 Basic Fishing Grounds Inventory

A simplified inventory could be conducted with published maps and cartographic interview techniques to provide an overview of fishing areas for all of Bonavista Bay. Information at this scale would be useful for planning at a regional level, but it would be fairly limited for management at the local or site level. Such a basic degree of documentation might be useful for Parks Canada at the feasibility assessment stage of NMCA establishment. The recommended sequence of steps is as follows:

1. Contact Fishermen Committee Chairs to explain mapping goals and procedures. For each committee, schedule a mapping session with the Chair and ask him to invite key fishers so that all areas and gear types are represented. Winter months will avoid the fishing season.

2. Start each mapping session with a review of published navigation charts and sample harvest area maps drawn at Eastport. Display the older British Admiralty chart, but plan to use the new CHS nautical charts (1:60,000) for Bonavista Bay.

3. Have fathom equivalencies for metric depths on hand and prompt for species/gear types. Draw harvest areas directly onto paper charts using multiple copies if necessary.

4. Repeat mapping interviews with other Bonavista Bay Committees.

5. Use companion electronic charts for theme digitization, compilation and map output.

6. Conduct a review meeting with fishers in each committee for corrections and changes.

8. Edit, print and distribute final maps with a notice assigning copyright to the fishers.

If carried out in this fashion, a basic fishing grounds inventory could be conducted by one data collector with mapping and GIS experience. Familiarity with inshore harvest methods would also be recommended. Two or three weeks of preparation and scheduling followed by one month of intensive map interviews could secure harvest area information from the sixteen committees surrounding Bonavista Bay (assuming one session per committee). Another month of computer processing would enable the production of draft maps. A third and final month would be used for map review and final editing. Even though the maps would be returned to the harvesters, this approach would be more like rapid rural appraisal, where data collectors would extract information without much concern for the dialogic potential of the mapping process.

### 7.7.2 Detailed Fisheries Knowledge Mapping

Participatory mapping could be conducted with large scale digitally-customized charts to provide detailed information for specific arms or sections of coast in Bonavista Bay. Mapping at this level would generate accurate depictions of fishing activity which could be used for zoning or other management purposes. Harvesters would relate on a personal level to the graphic display of local fishing patterns. Documenting the fishing grounds at this scale could be the first step towards spatially-defined community-based management.

For Parks Canada, this level of detail would be useful for highly protected core designation and zoning scheme development in a NMCA management plan. Sewage facility placement, aquaculture site evaluation and many other development projects could similarly benefit from local level maps. In the sub-sections that follow, I recommend procedures for different components of a detailed mapping project.

*Fishing Grounds*

1. Make initial contacts and visit fishers from areas where committees have expressed an interest in collaborative mapping projects. In many cases, the committee chair will act as the lead proponent. Discuss the level of formality desired: informal, sub-committee or advisory committee, and whether some kind of verbal agreement will suffice or if the respective committments should be written up by contract or memorandum of understanding.

2. Hold a committee meeting to discuss mapping possibilities. Display sample harvest area maps from Eastport and review basemap sources: 1:50,000 topo maps, British Admiralty chart, new 1:60,000 CHS charts and CHS Fieldsheets. Winter is likely the best time of year.

3. At the first meeting, define the study area boundaries by drawing a box around all of the nearshore areas fished by the committee. Break into smaller groups to label surface and subsea features and missing or erroneous place names on the published maps.

4. Produce a customized local basemap using the CHS fieldsheet mosaic files. Include topographic features, the collected place names, generalized soundings in fathoms and labelled depth contours with appropriate indicators for shoals and deeps (e.g., down ticks). Colourize and plot the basemap, in several sheets if necessary, at a scale of 1:10,000.

5. Schedule small group sessions for harvest area mapping. Meet with 3 or 4 committee members who use a particular section of coast, or alternatively, meet with users of a particular gear type; for example, all codtrap fishers.

6. Chart the following themes on the custom basemaps: place names in greater detail; gear types, species and seasons fished; berth names; committee jurisdiction and local boundaries; and spatial components of local management measures. For fisheries prosecuted in areas outside of the nearshore study window (e.g., mobile seine areas or mid-Bay gillnet and crab fisheries), use the published CHS charts or generate custom 1:25,000 maps from the fieldsheet source data.

7. Digitize the information collected during all of the committee mapping sessions. Apply colours and pictographic symbols then produce draft plots.

8. Schedule a second committee meeting for map review. Encourage changes, additions and corrections to the draft maps.

9. Adjust and edit the map files as necessary before final plotting.

10. Archive original materials and distribute the finished maps (and any digital files) as per the initial agreement.

In addition to interested harvesters, a fishing grounds inventory as described above would require a minimum of two specialists for efficient and timely reporting. The first resource person would work as a data collection facilitator to schedule and conduct participatory mapping sessions. The second specialist, a GIS technician, would work with hydrographic data files and the collected fisheries information to produce maps on demand.

The number of mapping sessions required to thoroughly delineate the grounds would depend on the number of committee members and the size of the area fished. Assuming that fishers were available, two weeks of daily mapping sessions would be sufficient for most committees. As for basemap preparation, several days of digital processing would be required to generate and label contours in fathoms. Allowing another couple of days for polygon shading and place name annotation, roughly a week would be needed to produce a custom map. An additional week would be anticipated for digital compilation and draft map preparation after the sessions with fishers were completed. Review and final editing would bring the total time to six weeks. Successive committees and increased familiarity with software commands would streamline the procedures and shorten the overall time requirements. Extra data collectors could also reduce the project duration. The mapping would be approached in the spirit of participatory rural appraisal, with the technical participants acting in a facilitation role.

### *Fisheries Ethnographic Survey*

Since the collapse of the cod stocks, many experienced older fishers have retired, leaving the fishery and taking with them a tremendous body of experience and knowledge. While much of this "folk knowledge" (Dyer and McGoodwin, 1994) has been transmitted over the decades to still active fishers, the recall and application of the information has dwindled with the adoption of new gear types and technological aids. The intrinsic value of this knowledge – historical and cultural as well as ecological – invites thorough documentation before it is forever lost. In coastal communities, this information is a source of pride; it also holds great potential for education. Parks Canada might be interested in mapping this kind of knowledge as part of an anthropological or human history study.[1] A

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[1] See examples for Terra Nova (Major, 1979) and Forillion National Park (Samson, 1980).

sample procedure follows:

1. Locate older fishers and their spouses; committee chairs will be key informants.

2. Meet participants in their homes and cottages, or at their fishing camps, to explain project goals. Start the interviews with personal histories.

3. While collecting map biographies, tape record the sessions to capture fishing grounds, place names, markers, etymologies and any other information that is volunteered.[2]

4. Spend as much time on the water with participants as is necessary (and welcome) to locate traditional markers, grounds and berths. Take GPS coordinates, depth sounder readings, compass bearings and land mark photographs once positioned on the fishing grounds. Video and audio taping will also help to animate the stories and references.

5. Digitize map biographies and enter field measurements. Incorporate aerial photographs and process all information for optimal cartographic display, and potentially, multi-media presentation.

6. Display output graphics at a community open house for acknowledgement, celebration, comment and further annotations. Provide final maps to contributors and send copies to local libraries. Develop educational packages with the mapped information and finally, archive the collected materials.

The scope and duration of such an undertaking would depend on funding and levels of interest. A well-prepared individual or an interdisciplinary team (e.g., cultural geographers, maritime anthropologists and Newfoundland folklorists) could provide the necesssary structure and guidance for systematic documentation. Training for community volunteers would provide a much larger number of collectors.

### *Additional Parameters*

While much of the preceding discussion relates to map depiction of harvest areas, it should be reiterated that fishing grounds are only a small part of the knowledge possessed by harvesters. The range of information held includes many parameters with spatial attributes: e.g., spawning areas, historical changes, relative abundance, predator/prey relationships, catch rates, fishing effort, gear introductions, ice cover, temperature, currents and upwelling. Where possible, these parameters should be mapped and any corresponding statistics or

[2] Jensen (1995) collected women's personal histories and women's experiences in the British Columbia fisheries.

abundancy indices be recorded to benefit investigations in biology, marine ecology and fisheries management. If conducted as part of a two-way exchange of information, this collection does not have to extract the knowledge solely for use by outsiders.

***Integrated Coastal Zone Database***

The collaborative project described in this thesis demonstrates the gains that can be made when several groups work in partnership towards common mapping goals. During the course of the research, several organizations expressed an interest in human use information for coastal areas; many also expressed an interest in biophysical information. Although the assembly of a comprehensive coastal database was beyond the scope of this thesis, the research completed does help point the way.

## 7.8 A CLOSING GEOGRAPHICAL PERSPECTIVE

Maritime regions, coastal peoples, the fishing industry and ocean cartography are underrepresented in the study of Canada's physical and human geography. Geographers have much to learn from other disciplines immersed in the study of the world's oceans, but there are also many areas where a geographical perspective might improve our understanding and appreciation of salt water environments. Beyond the obvious academic appeal of a neglected realm, the application of geographical methods may offer practical solutions to some of the problems confronting ocean stakeholders. In particular, the creative use of cartography and digital visualization techniques offers significant promise for community dialogue, decision support, sea use planning and scientific investigation. Finally, there exists considerable potential for geographers in the study and documentation of local knowledge systems as was first recognized more than 140 years ago:

> The primary object of "*The Wind and Current Charts*," out of which has grown this *Treatise on the Physical Geography of the Sea*, was to collect the experience of every navigator as to the winds and currents of the ocean, to discuss his observations upon them, and then to present the world with the results on charts for the improvement of commerce and navigation... The results tended to increase human knowledge with regard to the sea and its wonders, and therefore the system of research could not be wanting in attractions to right-minded men. (Maury, 1855)

Although the present study has employed recent advances in geomatics technology to collect experiential knowledge with a degree of sophistication unimaginable in Maury's time, many of the underlying principles and motivations remain unchanged across the decades. I have attempted to combine the research traditions of folklore, maritime anthropology and human geography with marine biogeography, technical mapping methodologies and action-oriented participatory fieldwork. If the thesis compels in its latent argument for a human ecological approach in matters related to oceans and fisheries, I have met a far greater goal than initially intended.

# APPENDIX A - PRIMER ON PARTICIPATION

## Part One - Public Participation in MPAs

A growing body of literature attests to the importance of having local communities play an active role in protected areas planning and management (e.g., see Amend and Amend, 1995; Pimbert and Pretty, 1995; Wells *et al.*, 1992; West and Brechin, 1991; Western *et al.*, 1994). In the context of marine protected areas, the imperative for meaningful participation can not be overstated; only with user input and community support is success likely (Brunckhorst 1994; Kelleher *et al.*, 1995; Wells and White 1995). Unless it can be demonstrated early in the establishment process that local communities might derive tangible benefits from an MPA (e.g., tourism revenue or long-term fisheries security), conservation agencies have been warned to expect fierce opposition and an unwillingness to follow management measures (Kelleher *et al.*, 1995).[1]

Experience in terrestrial conservation (e.g., Child, 1996; Durbin and Ralambo, 1994; IUCN Inter-Commission Task Force, 1997; Kellert, 1986; McNeely, 1995; Tisdell, 1995; Wilcock, 1995) and in other fields such as fisheries management (Jentoft and McCay, 1995; McGoodwin, 1990; Pinkerton, 1989; Pinkerton and Weinstein, 1995;) and international development (Cernea, 1991; Chambers, 1982) has shown that "bottom-up" participatory approaches to planning can generate local understanding and build the necessary support for conservation measures.[2] The use of such approaches in MPA planning and management, however, remains limited, and in practice, "very few of the many projects committed to local involvement have managed to elicit effective participation" (Andersson and Ngazi, 1995, 475).[3] The result has been conflict, suspicion and general mistrust among extractive users of the marine environment, many of whom still regard the ocean as an area somehow exempt from governance.

Two examples contrast the success of exclusive and inclusive approaches to MPA establishment in Canada. In the terminated West Isles National Marine Park proposal for Southwest New Brunswick (Parks Canada, 1985), the public was invited to comment on the

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[1] Protected areas closed to harvesting without the input and support of customary users may result in poaching and general deterioration, a condition often referred to as paper protection – parks in name only. Without local compliance, self-policing, and resource stewardship, the integrity of protected areas will be compromised, especially in regions where funds are insufficient for surveillance and enforcement by more conventional methods (i.e., wildlife officers) (Pimbert and Pretty, 1995).

[2] "Participation," as examined in Part Two, can be used to characterize a continuum of public involvement. By participatory approaches, I mean to imply activities which are more inclusive than simply asking people for input or seeking feedback on prepared plans.

[3] There are some notable examples, such as Australia's Great Barrier Reef Marine Park where broad-based public participation has been encouraged, usually to help develop zoning plans (Cocks, 1984; Kenchington, 1988 and 1990) and perhaps the Florida Keys National Marine Sanctuary (Barley, 1993; National Oceanic and Atmospheric Administration, 1995), where the suggestions and input of multiple user groups have been sought.

Confusion over the continuance of commercial fisheries in the proposed park had meanwhile built strong opposition to the tourism and recreation-oriented concept stressed under the then emerging National Marine Parks Policy (Butler, 1986; Davies, 1993; Ricketts, 1988; Wilbur, 1985; Wood, 1984).[4] In a marked contrast, the Saguenay-St. Lawrence Marine Park was much quicker in collecting the views and opinions of area residents (Dionne, 1994 and 1995; Dufour, 1992; Lien, 1989). The planning circumstances were also quite different; first, owing to strong local voices and pressing environmental concerns, namely, the threatened beluga whale population of the St. Lawrence River, there was already significant momentum in conservation, a condition that led to public calls for an increase in the Park's area; and second, there was minimal commercial fishing in the area under consideration (Boivin, pers. comm.).

Some valuable lessons have been learned in Canada and globally for successful MPA establishment.[5] Foremost is the importance of open and relaxed dialogue in face-to-face meetings where communities receive plain language descriptions of MPA concepts and planners listen to local perspectives (Wells and White, 1995).[6] Where possible, there is a need to discover how local priorities, be they ecological, social or economic, might be met in an MPA (Kelleher *et al.*, 1995). This may in part be accomplished by highlighting compatibilities between local objectives and scientific or national conservation objectives. The establishment process should also entail the exchange of scientific information and local knowledge. By incorporating the ways local people use, perceive, delimit and manage ocean resources, MPAs can be made more relevant to communities.[7] Finally, successful MPAs give some management responsibilities (e.g., scientific study, ecological monitoring, education, interpretation and enforcement) to local resource users.

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[4] In a discussion of the problems encountered during the West Isles feasibility study, Yurick explains that local fishers were "fearful of a presumed hidden agenda of new fishing restrictions and regulations, and of a major influx of new users of 'their' waters, such as tour boats, divers and so on" (1992, 76). This region of southwest New Brunswick has since become the centre of Atlantic Canada's burgeoning aquaculture industry.

[5] For additional case studies of communities in MPA establishment, see Alder (1996), Andersson and Ngazi (1995), Barley (1993), Carter *et al.* (1994), Fiske (1992), Gilman (1997), Nickels *et al.* (1992), Pajaro and Vincent (1996), Thomas (1987), Wells and White (1995) and Wolfendale *et al.* (1994).

[6] The importance of having permanent and accessible local community workers (Wells and White, 1995) was a painful lesson learned by Parks Canada from the West Isles Marine Park proposal. Lien (1989) and Butler (1994), amongst others, attribute the West Isles failure to poor communication and the exclusion of area residents from the planning process. Fiske (1992) draws similar conclusions from the abandoned proposal for a USA marine sanctuary.

[7] Neis encapsulates several of these points: "MPAs that are, where possible, based on local management systems and fishers' [traditional ecological knowledge] are more likely to meet the cultural and economic needs of fishing communities and to be accepted by those communities" (1995, 270). In the context of community-based fisheries co-management, Charles observes that the substantive involvement of community institutions "maximizes the moral suasion acting in support of conservation" (1995, 70).

**Part Two - Conceptualizing Participation**

The IUCN working group on "protected areas for people" suggests that a "... growing body of literature on public participation in resource management is not adequately available or interpreted for effective use by protected areas managers and conservationists" (IUCN, 1995). There is insufficient space in this report to attempt such a distillation of current thinking on public involvement; however, a generalized model of participation is presented.

A Ladder of Participation (Figure A.1) was drafted specifically with fisheries examples to use in meetings with fishermen's committees.[8] The graphic was intended to help illustrate levels of public involvement and as such, it contains relevant examples from fisheries management. The schema draws its inspiration from Arnstein's (1969) seminal paper in which participation is conceptualized as a ladder: public input to government actions and planning decisions increases as the rungs are ascended. Subsequent literature was consulted to help build an understanding of co-management within the range of participatory mechanisms available.

Several authors present theories that conceptualize participation as a continuum that extends from government control through to citizen control: Pinkerton and Weinstein (1995) describe a continuum of involvement for community-based fisheries co-management; Pimbert and Pretty (1995) generate a typology of participation based on experience in agricultural projects; Stadel and Nelson (1995) offer a ladder of participation for citizen environmental monitoring; Barchard and Hildebrand (1993) illustrate a continuum of public involvement to explain joint planning in the Atlantic Coastal Action Plan; and Rodal and Mulder (1993) build a consultations-partnerships-devolution continuum to illuminate the move towards government partnerships.

In the simplified version presented here, the intent was to situate shared planning responsibilities and co-management in the middle of the public participation continuum where communities and government work together in partnerships and with genuine power-sharing. The case given for fisheries co-management, the Eastport Lobster Protection Committee, could then be used to provide a familiar example of what co-management might look like in an NMCA.[9]

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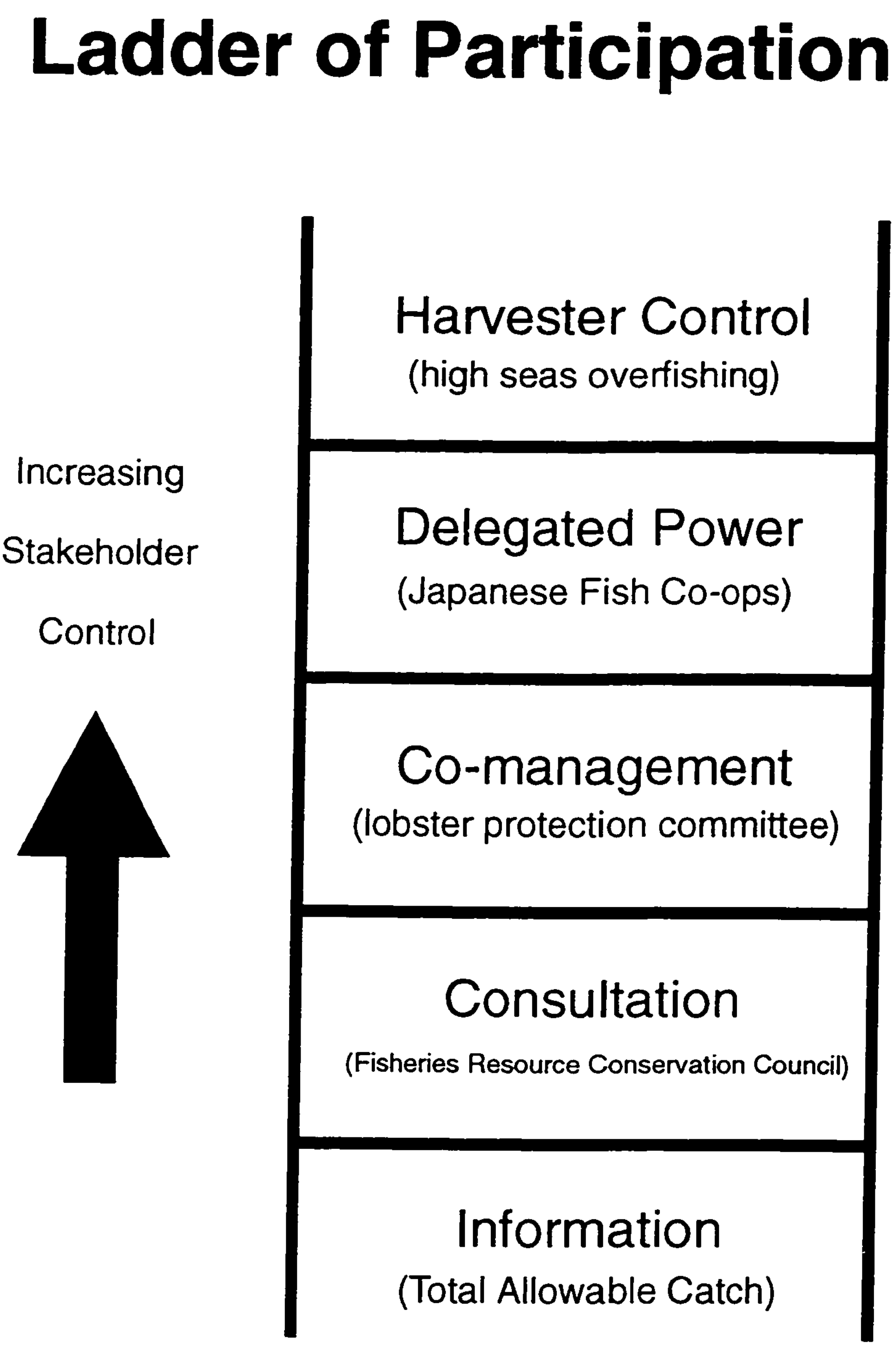
[8] In anticipation of questions from fishers about co-management and mechanisms for involvement in an NMCA, I drafted this figure and based my subsequent meeting presentations on what I had been told by my employers – that fishers would select and nominate areas for conservation. Parks seemed to know that the process was to be open, participatory and collaborative, with some kind of shared management, but nobody really knew how this would be formalized during a feasibility assessment and upon NMCA establishment.

[9] This should in no way be thought of as a position of Parks Canada. That being said, I used the ladder in discussions and presentations with other planning staff and while there was some debate about the example used for the anarchy represented by the top rung – overfishing and ineffective regulation of straddling stocks (e.g., turbot depletion beyond Canada's 200 mile limit; see Day, 1995) – nobody disagreed with the general schema, or the assertion that management and planning in an NMCA would be shared. Perhaps fishers were not the only ones to appreciate the graphic rendering of a concept so variably understood as participation.

Figure A.1 - Ladder of Participation



## Part Three - Fish Harvesters as Primary Stakeholders

*Why work with fishers and what makes harvest areas so important?*

With the West Isles failure still fresh, Parks Canada initiated early discussions with fishers in Bonavista Bay. Not only are harvesters the major user group, they are almost the sole user group of marine resources in northeast Newfoundland. Fishers are certainly the most "extractive" user group.[10] Unlike heavily-utilized coasts in British Columbia, along the Great Lakes and in the Maritimes, divers, recreational boaters and aquaculture installations are scarce. Furthermore, the inshore fishery is still active and perhaps most in need of – and most likely to benefit from – conservation measures.

In studies of fisheries management, sociologists and perhaps social scientists generally tend to "... inject sympathy into fishery policy-making by portraying fishing communities as victims not only of an industry made volatile by the fluctuations of nature, but also of governmental incompetence or sensitivity" (Johnston, 1995, 165). Agardy elaborates in the context of MPAs:

> . . . a dichotomy already exists between those who are pro-science and those who are anti-science. The division between factions results from misunderstanding. Extremists view the pro-science conservationists as nature-centrists, ignorant or unfeeling of human needs and desires. The anti-science group is more anthro-centric, fearing the focus on ecosystems will shift conservation towards traditional preservation and exclusion of even those people with legitimate rights to resources. (Agardy, 1995, 7)

We certainly need good science; "to be approaching conservation and natural resource management without science is like taking a desperate stab in the dark" (Agardy, 1995, 7). Even the harvesters at Eastport realize this and have approached federal shellfish biologist and Newfoundland lobster specialist Gerry Ennis (Ennis, 1995 and no date) to help answer many of the same questions that Agardy (1995) suggests science can help answer. The central concern is "to monitor to see if our goals – anthro-centric and nature-centric – are being met" (Agardy, 1995, 7-8).

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[10] Certain criticisms will doubtless be aimed at Parks Canada for targeting a single resource sector despite the international calls for specialized MPA literature and consultation geared towards specific user groups (see Kelleher *et al.*, 1995). Consider the recent interest in protecting the bottlenose whale (Faucher and Whitehead, 1995) and the biologically rich "Gulley" in the Scotian Shelf. Expanding oil and gas interests at nearby Sable Island pose the greatest threat, so why would conservation groups and scientists not target the hydrocarbon industry (Recchia, pers. comm.)? See alternate viewpoints: e.g., the caution in Graham *et al.* (1992) against insider's knowledge before the public at large has an opportunity for input; Dearden and Berg (1993) on special interest groups and Parks Canada; Young (1995) on the problems of parks in Northern Canada; and the outcry in McNamee and Wallis (1995) on the movement away from protection towards consensus building and compromise in conservation agencies.

In the research, I was attempting to be pragmatic and practical. Based on my experience and interaction, this work needs to be done: marine conservation science applied without attention to harvesting is also guaranteed to be a "stab in the dark," especially where communities in crisis are concerned. Fishers have a tremendous volume of knowledge, but more importantly, they are primary stakeholders in the nearshore waters of northeast Newfoundland and any management effort, conservation or otherwise, must involve them. As one IUCN co-management expert has asserted: "It is no use negotiating with people who are not going to benefit, or with people who are not the real people harvesting the forest, or harvesting the fisheries, or using whatever the resource may be" (Bayon, 1996, 3). With fishing opportunities greatly reduced already, as a result of the groundfish moratorium, the very notion of limiting access to scant remaining harvest areas is received as threat to a way of life in Bonavista Bay. Without substantial and genuine participation, non-compliance will hamper any government attempt at conservation.

Pringle comments "that scientists and managers rarely look at the system of fishery resource management ... from the fishermen's perspective" (1985, 390). Pringle also dispels some of the negative stereotyping – "that fishermen have little concern for either the resource base or the future of the fishery" – with his assertion "that many bona fide fishermen are concerned about their resource and will work toward conservation if approached in a positive manner and permitted to have input into the management plans" (1985, 389). This is borne out by the Eastport areas protected for lobster described in Chapter 2. When prepared from a user's viewpoint, marine protected areas will be accepted.[11]

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[11] Readers may suspect a bias. Indeed, it is difficult to hide my leanings as a retired offshore harvester who witnessed, and likely contributed to, the groundfish crisis. I also admit freely that I am keen to see the small boat inshore fishery persevere. My efforts were not so much to champion the cause of inshore fishers – which is how the research may appear on the surface, and may be interpreted by some – but more so, to present an alternative and presently unconsidered perspective on the use of the marine environment. Nor am I "anti-science" – I simply do not have a background in biology, oceanography or geology. As a human geographer, my interests are more closely aligned with the cultural oceans, the study of which lags far behind that of the natural oceans (see arguments in Chapters 3 and 6). I could have focussed on any number of information categories (e.g. sewage outfalls or coastal infrastructure) but I doubt that this would have done much to alleviate fishing pressure, the immediate conservation priority in Bonavista Bay.

Many common concerns were expressed by meeting participants throughout the region. The selection of issues that follows provides a summary of frequently heard points.

1. Meeting attendance was extremely variable ranging from a low of five to a high of 32. Several factors come into play here: the level of organization and commitment in fishermen's committees, the effectiveness of fisher communication channels, the degree and nature of advance knowledge in the community, whether an announcement was made on CBC Radio's nightly Fisheries Broadcast, the time of day, and the absence of other community events. Even though the winter months see little fishing, people are still active and difficult to pull together.

2. Some suggested that a different title would have brought more people out in some communities, for example: "A discussion of Lobster Conservation in Bonavista Bay." Others asserted that nothing short of threatening subject matter, such as cuts to TAGS, or opportunities, like the issuance of crab licenses, would succeed in bringing out more people. In any event, there was high value to having a meeting theme for those that did attend; lobster conservation was new, immediate, relevant, and it offered something to take away and apply.

3. Hostilities were experienced at very few meetings. In most cases, the disruptions were attributable to one or two key agitators who had predetermined points to make, regardless of what might be presented to them. Unnerved at first, the facilitators eventually learned not to let the vocal minority direct the meetings. Furthermore, original impressions of tough meetings were altered once chairs revealed that the overall impact and reception of the conservation message had been good despite sour voices. Misinformation and the resulting negative reactions at the Bonavista meeting highlighted the need to give committee chairs and other organizers a clear image of what the meetings were about.

4. Facilitators were alerted to the existence of unpredictable local sensitivities: a point made to little reaction in one community could have huge negative connotations in the next. Some instances involved the mention of a personality, another town, a report or a connected agency; others involved enforcement issues, practices, gear types and science. As meetings progressed, the facilitators took care not to pledge any strong allegiances or voice any key preferences.

5. With the exception of one lobster buyer and two deckhands from a 65' dragger, the meetings were attended exclusively by small boat inshore fishers, most of whom possess lobster licenses. Many of the attending inshore fishers (boats < 45') participate in deep water longline and crab fisheries, but to the best of our knowledge, no one from the offshore trawler or nearshore seiner fleet participated in the discussions.

6. Several comments reflected the importance of long-term continuity and commitment in the Parks Canada planning team. That different facilitators held this round of meetings was greeted with skepticism by many participants. For some, it confirmed the belief that new

"government" faces come and go, each secure in his or her job with their own agenda yet mindless of immobile communities and their resource challenges. There was great concern that what was said today might not be honoured in the future when and if new individuals become involved (e.g., gillnets permitted in an area closed to lobster fishing).

7. Small groups of six to ten fishers allow free discussion and tend to be more productive and less confrontational than large groups. Unfortunately, a small number of participants can not speak for all license holders in a given area. This makes it very difficult to assess whether an accurate image has been received from fishers; whether the Parks Canada message will get back to absent committee members; and, in what substance and form the message will be passed along. In towns where 50% or more of the lobster license holders were present (e.g., Newtown, Greenspond and Musgrave Harbour) we can be quite certain that the meeting contents were effectively relayed. In some areas, however, we were warned that the few who regularly attend meetings are the ones most concerned about the state of the resource; the larger number of absent members are the ones most in need of being reached, it was suggested, but they are also more likely to be less supportive of the NMCA concept.

8. In many instances, fishers took the floor and spoke – at times quite eloquently – about the need for committees to move ahead on conservation measures. Words and concepts uttered by the facilitators to unresponsive ears came alive with relevancy and immediacy when echoed by respected fishers. Some spoke with complete spontaneity; others had a good sense of the meeting objectives and took it upon themselves to champion the NMCA message. Clearly, delivery of a conservation message by a fellow fisher carries far more weight and urgency than delivery by a representative of the government.

9. During meetings and in follow up discussions, fishers elaborated on the role of appropriate educational media. With reference to our sample v-notcher, demonstration, display and discussion were encouraged. Print media was scorned on the basis that much of it would never be read, although one group did suggest that after hearing a good presentation, many would delve into the accompanying literature. Facilitators were advised that tools such as videos would make lasting impressions; for example, if fishers could see a lobster molt and then mate while it's shell was soft, they would gain a far greater appreciation for the life stages and reproductive cycle of the animal.

10. It is important to observe that descriptions by fishers of past abundance, fish health and seabird presence serve as emotional triggers for the need to act on conservation. The restoration of a thriving ecosystem has strong economic and spiritual implications for coastal communities; if conservation helps get back to a time of plenty, protective measures become more relevant to the goals and aspirations of local residents.

11. Despite the broadly understood imperative to conserve fish stocks, many fishers are not in a position to alter their harvesting patterns. For economic reasons, open fisheries must be prosecuted to the allowable gear and season limits. Unemployment and TAGS eligibility aside, participants also cautioned that there was nothing else to do but fish. Being on the water, facilitators were told, is what people have always known and always done; few opportunities exist for lifestyle diversification – economic and otherwise.

12. Poaching by fishers and other community members was a major concern in all but a few locations. A common assertion was that conservation measures would be inappropriate until such time that poaching was curtailed or altogether eliminated. Many believe that existing regulations in the lobster fishery are adequate to conserve the stocks; the problem, it was suggested, relates to insufficient enforcement of those regulations.

13. The variability of the coastline throughout the region brought several issues to light. Most importantly, fishers believe that relatively straight shores are less prone to poaching given their ease of community surveillance while heavily inundated shores and areas with islands offer refuge for illegal fishing activities. This has serious implications for the willingness to establish harvest refugia in areas away from populated coasts.

14. The question of quotas and dockside monitoring in the lobster fishery was raised at some meetings. Such a measure might be effective in communities where local buyers purchase catches daily from a central wharf. Fishers in most communities, however, use private wharves and hold their catches for periodic sales to regional buyers.

15. On the topic of new conservation measures, several committees and individuals were highly doubtful of the efficacy of closed areas. Many requested that science first demonstrate the positive results of such actions. Furthermore, it was desirable to prove that local closures would benefit local fishers, and not harvesters in adjacent or distant communities.

16. Support for cod closures on the offshore spawning grounds was readily evident, but the idea of inshore protected areas for migratory species was suspect. Why stop catching cod here, one fisher questioned, when it's only going to swim further into the Bay and get caught by another community?

17. A frequently asked question on the subject of closed lobster areas related to effort displacement: wouldn't protected grounds encourage more pressure in other areas? In the same discourse, fishers raised the predictable issues of trap reductions, license buyouts and compensation for loss of access to traditional grounds.

18. After the presentation on lobster egg production, which stressed the importance of protecting breeders and the potential of closed areas to sustain and enhance the fishery, people started to talk about unfished lobster shoals and some even speculated that these areas might be seeding the remainder of the grounds. The facilitators pointed out that these shoals were *de facto* marine protected areas and that little would be required to formalize their protected status. That option was attractive to some participants in communities where redirection of effort into the lobster fishery has forced people to move farther afield and onto non-traditional grounds in search of profitable catch rates.

19. As successive meetings were held, it became increasingly apparent that each community fishes on distinct grounds clearly delineated in space. Most committees spoke about their lobster grounds as covering X miles from point A to point B and out to a depth of Y fathoms. In the isolated cases where communities share portions of their grounds, there

appears to be a good understanding of the use of the shared zones.

20. Display of the NF Inshore Baseline Survey maps and samples from the Scotia-Fundy Marine Resource Mapping Project elicited some interesting responses. To begin with, the maps were a source of great study. The idea of capturing traditional knowledge on paper seemed intuitive and simple enough, but it was the motivation for drawing the maps that sparked the most interest. Demonstrating fisher knowledge and local patterns of use to aquaculturists, mobile gear fleets, developers, scientists, managers, officers, conservationists and others, sounded like a way to begin regaining some control of the resources. As one participant phrased it, "This should have been done long ago!"

21. Suggestions and site-specific recommendations for protective measures were volunteered at many meetings. In cases where up-to-date hydrographic charts or new fieldsheets were available, fishers could easily delineate the areas in question. In sections of Bonavista Bay where the latest sounding information exists on the 1873 Admiralty chart, fishers did not have the necessary detail or scale to provide a graphic display of their fishing grounds and potential conservation zones.

22. Several committees explained that the limited extent of their lobster grounds precludes the option of closed areas. In the island community of Greenspond, for example, the growth in licenses from three to 18 means that the narrow shelf surrounding the island is blocked with 3600 traps, up from 600 in 1980. The universal support for v-notching, however, demonstrated a willingness to conserve.

23. In addition to geographically-distinct communities and fishing areas, committees also conveyed a sense of socially-distinct communities. In some areas, such as the stretch of coast between Musgrave Harbour and Newtown, committees enjoy a helpful and friendly rapport. In other areas, communities sometimes demonstrate ill-will and a lack of respect for the fishing conduct of neighbouring towns. Facilitators learned to regard such vocal admonitions and committee allegiances with caution after a community was decried by its neighbours on either side. Considerable bracing on the part of the facilitators prior to meeting with the maligned committee proved unnecessary: the much warned about group turned out to be entirely receptive and supportive of the NMCA concepts presented.

24. Throughout the study area, participants described an overall distrust in government. Many feel that decisions have always been made, and will continue to be made without much input from communities, particularly with regards to fisheries issues such as TAGS, limited entry, individual transferable quotas, and Employment Insurance. Several people commented that Parks Canada's approach differed from others in that information was being presented and solicited; participants were unaccustomed to the latter. Still, many doubted that their concerns as voiced at the meetings would go any farther than into a little-noticed report.

25. Many of the so-called "motherhood" concepts – stewardship, co-management, ecosystem approach, partnerships, etc. – are quite familiar to coastal fishers; so familiar in fact that some areas are tired of hearing about them from government. Scant tangible evidence exists at the community level to demonstrate that agencies are serious about these ideas.

Enough talk, the facilitators were told, get on with it!

26. The "powerless" voice of fishers in issues of conservation was most often mentioned in reference to the tenuous lumpfish stocks. Most committees and members voted against a continued fishery, but the few who wished to see it remain open prevailed. Once open, participation in the fishery is necessary in order to maintain licenses. Competition and a commons mentality – if 15% are going after the fish, the rest might as well follow – is also pervasive. The result: everybody goes fishing, many with full knowledge that the stocks may not sustain the effort. Underlying these concerns is the belief that plant operators and buyers push the government to have declining fisheries kept open.

27. Many committees repeated matching descriptions of the perceived impact of seiners on the inshore herring fishery. Fishers allege that spawning grounds sustained commercial catch rates of gillnet herring until the mobile seiner fleet moved into these nearshore areas and "cleaned up" the stocks over a three to four year period. Now, many contend that it is difficult to secure enough herring from the same areas to satisfy the minuscule demands for lobster bait. Fishers also suspect complicity on the part of buyers and some point to the inadequacy of attention to spatial scale in stock assessment and quota allocations; if local stocks do exist, a statistical unit the size of NAFO statistical zone 3L may be inappropriate. Similar concerns were expressed with regards to the mobile and fixed gear fisheries for inshore capelin.

28. Angered by the state of the resource, the urge to proportion blame for the groundfish collapse is common amongst inshore fishers. While few doubt that dragger technology has had a major impact on the stocks, a small number of outspoken individuals admit that inshore fishers played a part in the decline. Recalling the introduction of monofilaments and the addition of roofs to cod traps, a few speculated that improvements to fixed gear technologies may have contributed to the drop in biomass. What is more important than laying blame, claim some, is making sure that the lesson learned is not repeated.

29. Communities believe that governments and "big business" have hidden agendas. The theories differ, but the general consensus is that the inshore fishery and the communities built upon it are being marginalized in favour of larger vessels, efficient centralized plants and a professional core of privileged fishers.

30. There is some fear that marine conservation as envisioned by Parks Canada might lead to tourist fisheries in areas closed to commercial extraction. Facilitators worked to dispel the concept of "marine parks" and the no fishing/no take connotations that the designation carries for fishers. Unfortunately, "marine conservation" has also engendered some negative meanings as explained by fishers in several instances. The multi-million dollar effort to "conserve" Newfoundland salmon stocks was the most often cited example. Salmon work that includes watershed protection, strict enforcement, restocking and extensive science has benefitted the recreational fishery and its economic linkages, but provided little to the commercial fishers who were banned from fishing– banned in the name of conservation.

31. Facilitators were questioned repeatedly about Parks Canada ties with the Department of Fisheries and Oceans. Many complained that DFO representatives should have been in

attendance given the agency's mandate to manage marine resources. Others reviled the federal department and its unpopular role in fisheries management.

32. Fishers are acutely aware of declines in lobster, lumpfish and capelin stocks. Grave concern for the state of the resource is universal and most agree that something must be done to prevent further stock collapses. After witnessing the results of effort redirection, many went so far as to postulate that the entire fishery should have been closed at the time of the groundfish moratorium.

33. Facilitators can safely characterize the tenor of the meetings as one of cautious interest. MPA concepts and the associated benefits – as presented – were rarely rejected; most of the feedback related to the cultural, social, economic and political dimensions of fisheries conservation. Many of the ideas presented (e.g., protecting juveniles and nursery grounds) prompted little or no verbal reaction; were fishers supportive, or just disinterested? Facilitators interpreted the silences and nodding heads to be an indication of the former.

34. Many fishers resounded the imperative to act on conservation. This in itself was not a sign of wholehearted acceptance for the NMCA initiative, but it was a demonstration that people were listening. As perhaps a final measure of the meetings' success, the facilitators were invited to return to a large number of the communities at a later date to continue the discussion.

Notes Prepared by Paul Macnab
Terra Nova National Park
March 21, 1996

## APPENDIX C - ETHICS REVIEW

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## PART 1. - INITIAL PROJECT APPLICATION

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### UNIVERSITY OF WATERLOO
### OFFICE OF HUMAN RESEARCH AND ANIMAL CARE

**Application for Ethics Review of Research with Human Participants**

*A. GENERAL INFORMATION*
*1. Title of Project:*

Fishing Grounds Inventory for the Eastport Peninsula, Newfoundland

***3. Supervisor***

Dr. Gordon Nelson

***4. Student Investigator***

Paul A. Macnab

*B. SUMMARY OF PROPOSED RESEARCH*
***1. Purpose and/or Rationale for Proposed Research***
*(Describe the purpose and background rationale for the proposed project as well as the hypothesis/research questions to be examined. Where available, include a copy of a research proposal.)*

The purpose of this project is to complete an inventory of fishing grounds and related environmental parameters for the marine waters adjacent to the Eastport Peninsula, Bonavista Bay, Newfoundland. Although information of this nature is well known by local residents, it has rarely been documented in a systematic fashion and thus remains unknown to the government agencies responsible for marine resource management. By capturing local knowledge in a cartographic fonn, it will be made more useful for planning, management and decision-making.

*2. Methodology/Procedures*
*(Describe, sequentially and in detail, all procedures in which the research participants will be involved, e.g., paper and pencil tasks, interviews, surveys, questionnaires, physical assessments, physiological tests, doses and methods of administration of drugs, time requirements, etc.)*

The research participants will draw their knowledge of fishing grounds onto a hydrographic basemap of the Eastport area. Following the interactive, adaptive and facilitative approaches of participatory rural appraisal, the student investigator may prompt – in an unstructured fashion – for certain categories of information. The attached list of questions is intended to serve as a guideline for the investigator only; it will not be handed out to the participants.

***3. Participants Involved in the Study***
*(Describe in detail the sample to be recruited including number of participants, gender, age range and any special characteristics.)*

The participants are members of the Eastport Peninsula Inshore Fishermen's Committee. The committee has approximately 70 members, mostly male, ranging in age from early twenties to mid sixties. About 20 fishers will participate in the mapping exercise so as to provide composite coverage for the region. Final map review and editing will be open to the entire committee.

***4. Recruitment Process***
*(Describe how and from what source the participants will be recruited. Indicate where the study will take place. Attach a copy of any posters(s), advertisement(s) or letter(s) to be used for recruitment.)*

The participants will be recruited and assembled into small working groups (2-3 fishers from the same area) by the Chair of the Fishermen's committee. The actual mapping will take place at kitchen tables in fisher residences. The idea for the project was first discussed with the Chair, and then presented by the investigator at a committee meeting. At a follow up meeting, without the investigator, the committee discussed and endorsed the project.

***5. Compensation of Participants***
*Will participants receive compensation for participation?*

No.

***6. Feedback to Participants***
*(Whenever possible, and upon completion of their part in the study, participants should receive a feedback letter expressing appreciation for their involvement and providing general information about the objectives/goals of the study. Upon final completion of the study, an executive summary should be offered. Describe below the arrangements for provision of these two types of feedback, and attach a copy of a generic feedback letter to be used in the first instance.)*

Project feedback will be provided to the participants in the form of a resource atlas for their fishing grounds. All maps hand-drawn by the fishers will be digitally processed and compiled for final cartographic output. The committee will also be provided with a copy of the finished thesis and any related publications.

*C. POTENTIAL BENEFITS FROM THE STUDY*
*Discuss any potential direct benefits to participants from their involvement in the project. Comment on the (potential) benefits to the scientific community/society that would justify involvement of participants in this study.*

By participating in this project, the Eastport Fishermen's Committee will obtain an accurate graphic portrayal of their traditional fishing grounds. Such a tool will help fishers to better manage their resources; it will also help them to demonstrate site specific concerns to government management partners. The scientific community, meanwhile, stands to learn from the collective ecological insight of the participants. From a social perspective, maps of existing sea uses will help to reduce spatial conflicts during the introduction of new coastal activities such as aquaculture.

*D. POTENTIAL RISKS FROM THE STUDY*
*1. Discuss the known and anticipated risks of the proposed research, specifying the particular risk(s) associated with each procedure or test. Consider both physical and psychological/emotional risks.*

There are no anticipated risks for the fishers who participate in this mapping exercise.

*2. Describe the procedures or safeguards in place to protect the physical and psychological health of the participants.*

Does not apply.

*E. INFORMATION AND CONSENT PROCESS*
*1. Attach a copy of a Letter of Information describing the procedures and a separate Consent Form. If written consent will not/cannot be obtained or is considered inadvisable, justify this and outline the process to be used to otherwise fully inform participants.*

The discomfort with print media amongst fishers – coupled with the strong oral tradition in Newfoundland outports – demands an informal approach to social geographic research. Relaxed rapport, openness on the part of the investigator and complete disclosure of the project goals to the Eastport Committee led to their eventual consent and support for the mapping project. The procedure resulting in this acceptance followed customary practice within the Committee structure: information>discussion>decision-making. Final maps and any electronic files generated shall bear a statement assigning copyright to the Eastport Peninsula Fishermen's Committee.

*2. In the case of minors, describe the process to be used to obtain permission of parent or guardian. Attach a copy of an information-permission letter to be used.*

Does not apply.

*F. CONFIDENTIALITY*
*(Describe the procedures to be used to ensure anonymity of participants and confidentiality of data both during the conduct of the research and in the release of its findings. Explain how written records, video/audio tapes, and questionnaires will be secured and provide details of their final disposal.)*

Mylar overlays used to capture mapped information will be dated. A list of the contributors for each date will be recorded elsewhere by the investigator to allow for cross referencing and data-checking. The final map output will be credited to the Eastport Peninsula Fishermen's Committee as a whole, and not to individual fishers.

*G. DECEPTION*
*Will deception be used in this study?*
*(If yes, please describe and justify the need for deception. Explain the debriefing procedures to be used and attach a copy of the written debriefing and post-debriefing consent form.)*

No. Does not apply.

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## PART 2. - ETHICS COMMITTEE CONCERNS AND REPLIES

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***1. Relationship between Fishers and Eastport Peninsula Inshore Fishermen's Committee.*** *It wasn't clear from the application whether any of the 20 or so fishers to be interviewed also serve/sit on the EPIFC. Could you explain what the relationship is between the two groups. For example, is it a 'grass roots' kind of Committee?*

The Fishermen's Committee is comprised of all the FFAW union-member fishers within the geographical area of the Eastport Peninsula, so technically, everyone I speak with will be part of the committee. As for function, the committee deals with local issues and collects the views of the fishers for representation at regional and provincial meetings. For example, when the Department of Fisheries and Oceans met to discuss lobster licensing for Eastern Newfoundland, the Chair of the Eastport Committee attended so as to voice the concerns of his membership.

***2. Written Consent.*** *Your explanation about the need to keep the entire process informal is appreciated. However, do you anticipate that the fishers would be unwilling to sign a consent form? My only concern would be to ensure that they receive full written information about the uses of the maps to which they contribute. For example, you mentioned when we spoke that you were not certain what uses the Committee would ultimately have for the maps. Could you comment on this further? You mention a number of benefits of developing these maps; would there be any risks/drawbacks? For example, will the fishers stand to lose anything by having their 'mental' maps now on paper?*

I could probably get fishers to sign a release form, but that would only serve to abstract the project from them! As it now stands, they see this exercise as something that they are doing with me as a technical advisor. From their perspective, this is not an academic exercise – it is an affirmation of their life and livelihood, something that they want to do with or without my assistance. A consent form would be tantamount to issuing me a license to extract their knowledge, and that is most certainly not my intention.

As for uses of the maps, this is a difficult thing for me to answer because ultimately it won't be me who makes use of them. If I were collecting aquatic plants or traditional musical rhythms, I might be able to say that I was going to use the information in a certain way, but here again, I am not extracting; rather, facilitating. Once the committee has the maps in hand, they could be used for a great number of things. Fishers are well aware that maps can, as I state in the letter of information, "be used to explain local concerns to government managers." An immediate application has already been described to me. Recently, fishers have worked to limit overharvesting and abuse in the lobster fishery. Because of the shortage of lobster grounds and the current level of effort, the committee has considered limiting fishing in certain areas thought to be important for breeding and stock replenishment. Maps could provide a graphic and locational description of these sensitive sites for enforcement personnel.

If at some point outside parties such as Environment Canada's oilspill preparedness mapping section, or Hibernia Corporation were interested in obtaining copies of the maps, the Eastport Committee would have to be approached directly.

I must apologize for the "Mental map" jargon. This is not some dark inner sanctum to be probed by psychologists! Perhaps I can best explain the term by first describing the challenge in marine resource mapping. Basically, I am helping to generate maps of sea uses, patterns which only exist in people's routines and in their minds. If you think of a land use planning map for Kitchener-Waterloo: certain areas are zoned industrial, others educational, some as greenspace and many more as residential. How might such a map be generated? By aerial photography and ground surveys usually. Now, when attempting to map fishing grounds, conventional terrestrial methods are not of much use. Unlike buildings or parks, herring nets might only be in the water for a few days, and cod traps, well, they haven't been in the water for 4 years because of the groundfish moratorium. Therefore, the only practical way to delineate such sea uses is to talk to people and capture their memory or mental "snap shot" of where the fishing grounds are located. This is done by relating personal experience of the marine environment to paper depictions (i.e., nautical charts and topographic maps) of that same environment. Geographers have ascribed the title "mental maps" to these cognitive impressions of spatial features and activities.

*3. Concerning the Letter of Information.*

*3.1* ***I recommend that Gord's name as supervisor*** *be added to the letter of information and that the collaborative nature of the project be mentioned i.e. with the Committee-I assume that this is the case?*

Please see the revised letter. Gord's name is mentioned and the recipients are all committee members as explained above.

***3.2 What do you mean by 'new sounding information'?***

Water depths are measured in two ways: a piece of rope with a weight on the end, or some signal bounced off the bottom and received by a ship on the surface. In either case, one is said to be "sounding" the bottom. In Bonavista Bay where I am working, the Hydrographic Service has measured depths in anticipation of many vessels arriving for the Cabot 500 celebrations this summer. I acquired this new source data and used it to prepare maps of the bottom. Fishers know that government surveying took place and they are keenly awaiting new navigation charts to replace the one produced in 1869!

***3.3 The fishers may be more inclined to participate** if they know that there will be approximately 20 fishers in total invited to be part of the project.*

Participation is not really a problem. More people would like to participate than I have time to devote! The committee sees this effort as a first draft, one that would be added to and refined in successive projects.

***3.4 You note that credit for the information will go to the Committee.** It isn't clear what is meant by this; can you provide more of an explanation? It sounds as if the fishers do not receive any 'credit' for their contributions. Perhaps you did not intend this. You could, for example, 'acknowledge the contributions of a group of 20 fishers....'*

Once again, all participants are committee members. I was acting on two precedents here: first, I went by your sample letter indicating no personal identification; and second, I am following the lead of Nova Scotia's Marine Resource Mapping Project in which the maps contain wording similar to the following: "This map and the information contained on it are the property of the Guysborough County Fishermen's Association. No unauthorized uses or copying permitted." I have been demonstrating this with Nova Scotia sample maps and would start each mapping session by displaying the NS maps.

***3.5 Some reference to the OHR.** I noted that you do not include any reference to the OHR either vis a vis ethics approval or as a contact. I assume that you prefer not to use the standard statement, again to keep your process informal. However, I believe some reference should be there. You could use a more 'lay' translation of the standard reference to the OHR.*

Please see revised letter.

***3.6 Option to withdraw consent/agreement.** Participants always need to know that they can withdraw consent at any time even after they have agreed to participate in a study. Some similar statement to this should appear in the letter.*

Please see revisions.

***4. Interview.** I assume that the interview with the fishers is the method you plan to use to generate information to identify the fishing locations for the map. However, there seem to be* *other questions which are more general information and not 'map type questions. Thus, I think you should mention this to the fishers so that they realize that there is more to the couple of hours than marking areas on a map. You could, for example, just expand the second para.*

I don't expect to do much interviewing, really. When I've laid out charts in the past, fishers have immediately started motioning to local areas and harvesting grounds. My role is to make sure that information is depicted in a consistent and cartographically appropriate fashion. The fishers know what they intend to map, but with so many species fished, and so many gear types used, it is best to have a list prepared to serve as a reminder and a prompt.

Here are the likely map themes: local place names, lobster traps, cod trap berths, crab grounds, gillnets for cod, line trawls, handlines and jigs, lumpfish nets, capelin nets, capelin beaches, herring grounds, salmon berths, turbot, squid jigging, mussel and scallop beds, local boundaries.

*5. **Feedback.** I noted that participants will receive a resource atlas and agree that it is appropriate that they receive something in appreciation for their involvement in the project. Can you provide more information about what a resource atlas is and how this would be similar to and differ from the maps? Is the atlas specific to each fisher's fishing area or based on the whole group? Would the fishers have access to the map?*

Once again, it is their project that I am involved in, not vice versa! By resource atlas I meant simply a collection of maps. The information captured will likely have to be portrayed on several maps, each with three or four themes. The maps would encompass the entire region fished by the committee and they would be accessible to all fishers in the area.

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## PART 3 - NOTE CONFIRMING FULL ETHICS APPROVAL

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*Thank you for your email in which you commented on each of the issues raised during the ethics review process. I believe that each has been well addressed. Your additional information clarified the relationship between the fishers, the Committee and yourself as researcher- thank you. Please note in the third paragraph of the Information Letter that the reference to the Research Office should read Office of Human Research- the rest is fine.*

*This is an interesting and ambitious project. I hope that it goes well.*

*Susan E. Sykes, Ph.D.,C.Psych.*
*Director, Research Ethics*
*Needles Hall, University of Waterloo*

## APPENDIX D - MAP INTERVIEW QUESTIONS

Although the focus here is on generating a map, please feel comfortable to describe other things that might not be easy to draw. Place names are very important. If a particular area or site has a local name in common usage, please write it on the chart as we go through this mapping exercise.

1. Where do you fish lobster? When?

2. Can you pinpoint the traditional cod trap berths? Which months were they used? Do the berths have customary users or are they drawn for in a lottery?

3. What about gillnets for cod; what are the preferred fishing grounds? When were they fished?

4. Are there any particular grounds favoured for line trawls?

5. Many people still fished commercially or for private use with handlines and jigs. Can you mark these locations on the map and tell me when they were fished. Ice fishing locations as well?

6. Are there any specific places where lumpfish nets are set? When?

7. Where have you set nets for capelin in the past? When? Which beaches are known for their capelin spawn? When? Is there any relationship between your net placement and these beaches?

8. Where are the herring fishing grounds? And the spawning areas? Do these correspond?

9. Salmon berths were used before the fishery was closed. Can you describe their locations? When were nets set? Were the berths held by individuals or were they drawn for as well?

10. People also talk about a bay fishery for turbot. Can you recall any good areas and times for netting turbot?

11. Squid has not been an important fishery in these waters for some time but there were some good places to jig them. Can you show these grounds to me. When?

12. Can you label the important areas for mussel and scallop beds.

13. Fishermen have always used hills and markers on the shoreline to navigate, to find their positions and to remember good fishing areas. Can you recognize these features on the map, and if so, label them?

14. There is much discussion of "bay stocks" versus "offshore stocks" of cod. Are there any areas where you've seen evidence of spawning or overwintering?

15. Can you draw seabird nesting areas on the map. Terns, ducks?

16. Are there any places where seals gather or haul out on to the rocks?

17. Describe conservation concerns, related to specific areas, that you may have.

18. Besides DFO regulations, do you have any local methods for managing fisheries and fishing areas (e.g., gear restrictions, fishing rights, area closures)

19. Can you remember any local conservation stories from the past (e.g., seasonal closures)?

20. Is there anything else from your experience and background that you would like to mention?

21. General comments.

## APPENDIX E - LETTER OF INFORMATION

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### EASTPORT MAPPING PROJECT

As part of my graduate research in marine geography at the University of Waterloo, I would like to help the Eastport Fishermen's Committee draw a series of maps to show the fishing grounds around the Eastport Peninsula. These maps will help the Committee plan for existing and future fisheries. They can also be used to explain local concerns to government managers.

I have used new sounding information from the Canadian Hydrographic Service to make a basemap of the waters in your area. A couple of hours of your time will be needed to mark fishing areas on this new chart. I will then combine all of the information collected to show fishing grounds for the whole Eastport area. You will not be identified by name on the maps or in my write-up. Instead, credit for the information provided will go to the Committee. Copies of the final maps and a project report will be left with the Committee. Terra Nova National Park, which is providing some support for this work, will also receive copies.

As an experienced fisherman, your knowledge and input will help to generate accurate maps for the area. If there is information you don't wish to provide, or if you change your mind about participating, we can stop at any time. Please contact me at the address given below if you have any questions or concerns. My supervisor, Gordon Nelson, and the University's Office of Human Research have reviewed and approved this project. You may also contact them if you have any questions or concerns. Thank you for your assistance.

Yours sincerely,

Paul Macnab

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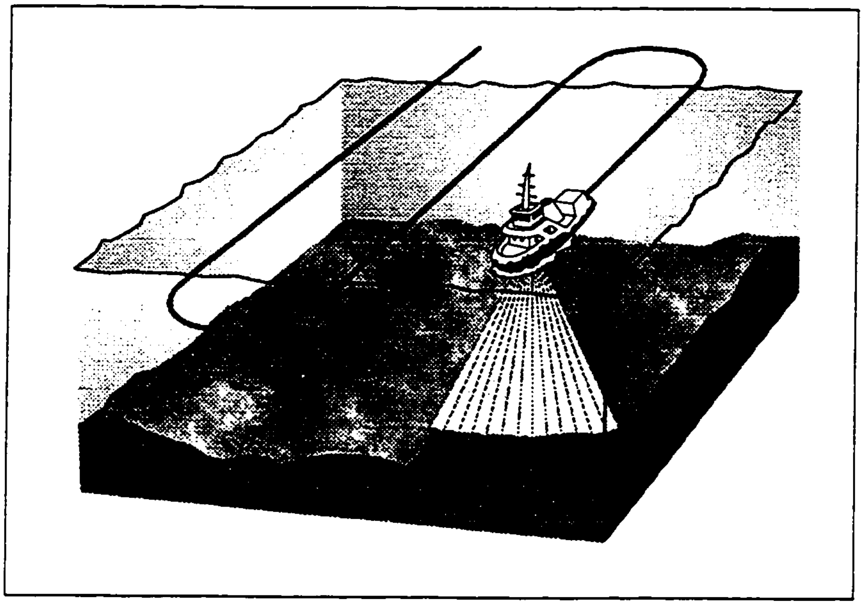
Relative to terrestrial mapping, ocean mapping is young, but recent technological advances have led to greatly improved hydrographic surveying capabilities. In the last ten years, hydrography has advanced from single beam to computer-assisted multibeam echo sounding (see Figure A.2). This newer technology enables continuous sampling and more complete bathymetric coverage (Fillmore and Sandilands, 1983; Haskins, 1992; Safer, 1997; Ziqin *et al.*, 1996).[12]

Figure A.2 - Multibeam Sounder



Hydrographic surveys recently conducted in Bonavista Bay by the Matthew, a CHS vessel, illustrate digital survey procedures. Small launches use GPS and sounders to obtain measurements in shallow water while the Matthew surveys deeper water. As the information is collected, onboard computers store and display the measurements. The data are compiled and generalized into a manageable volume for digital and hardcopy fieldsheet production. Coastline information is derived from Provincial orthometric charts and corrected to mean high water with field truthing. Coastal geormorphology (ie. shoretype) is also recorded. Finished fieldsheets are transferred to land offices for quality control and then on to Ottawa for paper and electronic chart production.

[12] A wide range of biophysical sampling is still conducted with devices at fixed locations (e.g., salinity meters, temperature and current buoys, bottom samples, scuba dive transects). Ji and Johnson (1995, 230) observe that marine data "are represented in most cases as point features associated with sampling locations" while Lucas and Budgell (1996) comment that "in-situ observations tend to be sparsely sampled in both time and space."

### *Software Criteria*

During the preparatory stages of the research, a considerable amount of experimentation was conducted to evaluate software capability for hydrographic data handling. In some software packages, depth soundings are treated as "negative" heights and I wished to avoid this interpretation. The first criterion was the capability to accept the complex fieldsheet data generated by the Canadian Hydrographic Service (Table A.1 lists the CARIS feature codes used by CHS). Secondly, it was important to maintain the maximum resolution of the data, and for this reason, a vector system was preferable. In order to structure the data for customized cartographic applications, I required software that could generate digital terrain models and interpolate contours. Finally, I wished to select Canadian software as a means of strengthening the collaborative and regional nature of the research.

### *Why CARIS?*

In the final analysis, the CARIS software package (Computer Aided Resource Information System) from Universal Systems Ltd. of Fredericton, New Brunswick, was chosen. CARIS was selected primarily because it is used by both the Canadian Hydrographic Service and the Surveys and Mapping Division of the Newfoundland's Department of Natural Resources. These government agencies provided data, so by using the same software, file transfer was relatively straight forward. CARIS also has the capability for specialized hydrographic applications.

### *Strengths and Weaknesses*

CARIS runs on the PC platform and provides output for standard plotters through the Windows interface. The software was satisfactory for data editing, but the procedures were technical and time-demanding. For example, contour labelling can be semi-automated, but a considerable amount of interaction is required for label placement. Very few software packages produce an acceptable map automatically. The CARIS operator, or map author, needs to understand basic cartographic principles if he or she is to find the appropriate software commands for producing the desired visual effect.

Table A.1 - CARIS Feature Codes for CHS Fieldsheet Data

| CODE | DESCRIPTION |
|---|---|
| ALBD | Building |
| ALBM | Bench Mark (Vertical Control Station) |
| ALCO1H | First Order Horizontal Control Station |
| ALCO2H | Second Order Horizontal Control Station |
| ALRO | Road |
| ALTS | Triangulation Station |
| AWPP | Single Line Pier, Wharf, Jetty |
| AWPR | Wharf, Pier, Jetty |
| AWPRWHARF | Wharf, Pier, Jetty |
| AWRM | Ramp (Boat) |
| BQ | Bottom Quality |
| BRIDGEFIX | Fixed Bridge |
| CLIK | Coastline Inadequately Known |
| CLIS | Coastline, Small Island |
| CLLW | Coastline Low Water |
| CLLEGR | Coastline Low Water Gravel |
| CLLWML | Coastline Low Water Mudline |
| CLLWRL1R | Coastline Low Water Rocky Ledge |
| CLLWRLLTSM | Coastline Low Water Rocky Ledge-small left |
| CLLWSD | Coastline Low Water Sand |
| CLLWSG | Coastline Low Water Sand/Gravel |
| CLSL | Coastline Shoreline |
| CLSLGR | Coastline Shoreline - Gravel |
| CLSLRB | Coastline Shoreline - Rubble/Boulders |
| CLSLSD | Coastline Shoreline Sand |
| CODTMR | Contour Line |
| DLFG | Danger Line Foul Ground |
| DLLD | Danger Line |
| DLRA | Danger Line Rock Awash |
| DLSF | Snowflake Symbol (pinnacle rock) |
| DLWKSTRAND | Danger Line, Stranded Wreck |
| MSRERTINT | Misc. Fitting/Registration Mark |
| NABYLP03 | Navigation Buoy - Lateral, Port Pillar |
| NABYLP05 | Navigation Buoy - Lateral, Port Can/Large |
| NABYLS13 | Navigation Buoy - Lateral, Starboard Pillar |
| NABYOFF | Navigation Buoy - Offset position |
| NALTLT | Navigation Light |
| NFCFME | Cliff - Medium Left |
| NFCFSM | Cliff - Small Left |
| NFSUELEVUPR | Summit/Spot Height Elevation |
| NPANRNDL | Recommended Anchorage area |
| NPLI | Light Flash |
| NPLIBUOY | Light Flash - Buoy |
| RIVERII | Intermittent/Indefinite Stream |
| RIVERSL | River, Stream - Single Line |
| SGEXAMLC | Shoal Examination - lower case 'e' |
| SGEXAMUC | Shoal Examination - upper case 'E' |
| SGSL | Sounding (Sloped) |
| TEXT | General Text |
| ZPAH | Misc. Line - Arrow Head |
| ZPLD020/040 | Dashed Line |
| ZPLD020/020 | Dashed Line |
| ZPL105 | Black Line 0.005 |
| ZPL110 | Black Line 0.010 |

# APPENDIX H - CARIS PROCEDURES

## PART ONE - CONTOUR GENERATION

1. Initial attempts to build a DTM were hampered by the DXF file format of the inner Newman Sound fieldsheets (FS2741 and FS100044). These files had been delivered in the Autocad format prior to the acquisition of CARIS. In the DXF format, the soundings appeared as georeferenced labels (ie., x and y coordinates without z values) so they could not be used to generate a DTM. The CHS source files were reordered in the CARIS NTX file format to maintain the integrity of the sounding data. A subsequent CARIS Newsletter (Universal Systems Ltd., 1996) alerted readers to this limitation in DXF files and suggested a technical solution.

2. Experimentation with DTM generation was carried out with the original metric soundings, so once it was time to build contours in fathoms, simple conversions were applied to save time. Collaborators intended to rebuild the DTM after converting the original data into fathoms and feet, but the opportunities for further processing were limited. (The CARIS header file does allow conversion from metres and centimetres into fathoms and feet.)

3. The software required a zero elevation reference to prevent interpolated contours from running over the land. The shoreline vector depicts the highest highwater line while the soundings measure lowest low water depths, so choosing the CHS coastline to represent the land barrier may have led to some inaccuracies, particularly in the first contour line (6 fathoms). With at least three options for contour generation, the CHS version of CARIS is better equipped to handle such tasks relating to the horizontal datum ('contgen' command in CHS version, Palmer, pers. comm.). With the standard release of CARIS, it might be better to chose the two metre depth contour as a fixed reference point when generating future DTM's with the data set.

4. The port communities of Burnside and Salvage were subject to detailed surveys, perhaps with map insets in mind. The resulting 1:5000 fieldsheets were not acquired owing to the expectation that selected soundings from those surveys would be included in the smaller scale fieldsheets. The absence of this data skewed the DTM and resulted in inaccurate contours where soundings were missing.

## PART TWO - CARTOGRAPHIC ENHANCEMENTS

5. The tools within CARIS could not be used to autogenerate contour labels. The tedious labelling process involves selecting the location of each desired label. To aid viewer recognition of the represented depth, different colours were applied to each contour. The output was rather psychedelic so greens and blues were applied.

6. An attempt was made to thin the sounding data so that selective depths could be plotted. This would have lessened the need for contour labels and helped to locate the reader. I experimented with the "suppress soundings" tool offered in CARIS, but in the final analysis, I decided that on screen selection of graphically appropriate depths would be required. For output at a larger scale (e.g., 1:10,000) all depth soundings contained in the file could be plotted.

7. As a final aid to depth recognition, an attempt was made to apply graduated blue shading to the contour ranges. This required considerable error editing and the construction of polygon topology. (The processing was started but not finished in time for the thesis). Another option would be the use of "down ticks" to show slope direction.

8. The CHS shoreline vector had gaps in places and was entirely absent for Burnside and Salvage. As a result, no polygon could be built and shaded to help differentiate the water. The CHS vector was patched with segments from the topographic shoreline, but not before the basemap was plotted.

9. The CHS fieldsheets contain different coastlines, sometimes two in one section of shore line (e.g., debris line and low water line on a beach), which when plotted, result in small and graphically confusing polygons. (See Table A.1 for a description CHS shoreline feature codes.) For the final map, we choose the "high water" vector where there were multiple representations in the data.

## APPENDIX I - UNRECOGNIZED PLACE NAMES

| | |
|---|---|
| Athwart Islet | The Narrows |
| Black Duck Islets | North Point |
| Brown Store Islet | Otter Cove |
| Burnt Point Cove | Padners Cove |
| Cramptons Cove | Pulpit Head |
| Damnable Bay | Sailors Harbour |
| East Point | Sandy Cove Point |
| Goodmans Island | Seal Island |
| Halls Rock | Shag Islet |
| Holbrook Head | Ship Cove |
| Keats Island | Swale Island |
| Minchin Head | White Islets |

The place names listed above are published on the Eastport 1:50,000 topographic map (2 C/12). Most of the toponyms were not recognized by mapping participants during the course of this research. In some cases, the names were known, but not in common use.

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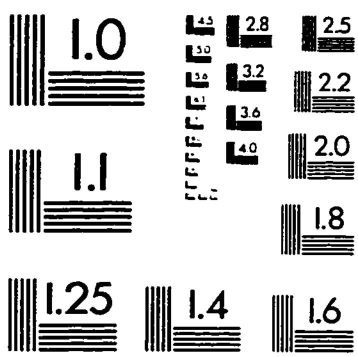
# IMAGE EVALUATION TEST TARGET (QA-3)



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