

UCLA
Electronic Green Journal

Title

The Newfoundland Cod Stock Collapse: A Review and Analysis of Social Factors

Permalink

<https://escholarship.org/uc/item/19p7z78s>

Journal

Electronic Green Journal, 1(17)

ISSN

1076-7975

Author

Mason, Fred

Publication Date

2002-12-01

Peer reviewed

The Newfoundland Cod Stock Collapse: A Review and Analysis of Social Factors

Fred Mason

School of Kinesiology, University of Western Ontario, Canada

.....

In 1992, the once abundant cod stocks off the coast of Newfoundland collapsed and a moratorium was placed upon fishing them. This paper provides a review of a range of social and political factors that were implicated in the collapse of the stocks, including overfishing, government mismanagement, and the disregard of scientific uncertainty. The collapse is considered in terms of the "tragedy of commons theory" of resource exploitation, and the inevitability of overuse that the theory implies. The conclusion is drawn that the collapse was not necessarily inevitable, and that in similar situations, more input is needed from a variety of stakeholders in the management of an environmental resource, so that more of the social factors at work may be accounted for.

On July 2, 1992, the Canadian Federal Minister of Fisheries and Oceans at the time, the Honourable John Crosbie, announced a moratorium on fishing for northern cod in the waters surrounding the province of Newfoundland. This supposedly "short-term" solution has lasted until the present time, with minor exceptions of food fisheries for personal consumption. Some 19,000 fishers and plant workers were directly affected and up to 20,000 other jobs were lost or harmed in the economic backlash (Steele, Andersen & Green, 1992), while for rural Newfoundland it meant that the economic backbone of hundreds of communities where the fishery was the only large employer had been broken.

A wide number of social, economic, and environmental factors have been implicated in the collapse of the cod stocks. Drawing primarily on the prolific scholarship on the fishery of a small cadre of sociologists, historians, and political scientists from Memorial University of Newfoundland, this paper reviews a variety of social factors that had input in the scenario, and considers, from the "tragedy of the commons" theory of resource use, whether the collapse of the stocks was necessarily inevitable. The paper deals solely with social factors that had input in the collapse; more scientific factors such as changes in water temperature and the food chain are not considered here, as the author is not qualified to make an evaluation of these. As well, the vast social and economic impacts that the moratorium has had on Newfoundland's communities is beyond what can be considered

here, and could only be done justice in a separate review.

The Tragedy of the Commons

One of the better-known theories of resource use, which might be applicable to the Newfoundland fishery, is the tragedy of the commons theory. The tragedy of the commons has been a popular theory in regards to common property since it was first expounded by Garrett Hardin in 1968. As part of this theory, things such as fish, forest, or water resources are seen as "common property"-resources which can be used by everyone, yet no one truly owns. The tragedy of the commons comes in once competition for the resources commences. Hardin based his work on the theorization of 19th century English common grounds by W. F. Lloyd and others (1833, reprinted in part in Hardin, 1968). These theories contended that the cattle raised on the commons were weak, and the commons themselves denuded of fodder, due to intense overexploitation through competition. The carrying capacity of the commons field was of course finite, but each herdsman, seeking to get ahead, constantly increased the number of cattle he owned. Once the full carrying capacity was reached, deterioration occurred, yet the personal gain for each herdsman outweighed the shared loss and damage to the field, so all kept adding to their herds (Hardin, 1968). This kept going until the whole resource collapsed. Hardin called this inevitable collapse the "tragedy of the commons," and proposed that it could be applied to any sort of natural resource being exploited.

In 1977, Ophuls created a model of a fishery in the tragedy of the commons scenario. He suggested that once the critical point was reached, either privatization or collapse would occur. It is easy to see how the collapse of the Newfoundland fishery could have been a tragedy of the commons, with the many groups and countries that were taking from the resource base. Given the conditions necessary for a tragedy of the commons, and its ultimate outcome, the Newfoundland cod stock collapse would then have to be considered inevitable and unavoidable. This is a difficult proposition for anyone with environmental concerns to accept, and is also terribly simplistic. A more thorough examination of social factors is warranted, to draw out the input that various factors had, and to suggest some aspects that could be accounted for in similar situations.

Overfishing

When the collapse of a resource base like the Newfoundland cod stocks occur, the first and most obvious thing to look at is overexploitation of the resource. Many authors have cited overfishing as the cause of the cod stock collapse (Sinclair, 1996; Hannesson, 1996; Finlayson, 1994; Steele et al.,

1992, and others). In the case of the Newfoundland cod, there were three distinct groups involved in harvesting the resource-local Newfoundland inshore fishermen, Canadian druggers and trawlers, and deep-sea foreign fishing vessels.

Inshore Fishermen

The local fishermen of Newfoundland are the group most closely identified with the tragic social and economic fallout from the closure of the fishery. This is not entirely without merit, as many families and communities were almost totally dependent on the fishery for their livelihoods. Nevertheless, their role in the collapse must be scrutinized. Over the last three decades prior to the cod stock collapse, calls were frequently heard from groups of inshore fishermen for a bigger share of the catch quotas (Steele et al., 1992). Thus, some responsibility for the great pressure that was put on the stocks must be placed upon them.

However, as Sinclair (1992) points out, the structure of the inshore fishery and the methods that were used in it meant that these fishermen did not have the capacity to overfish the resource. They used fixed gear and small nets that could usually be manipulated by hand or with little mechanical assistance, never leading to anywhere near as high a catch as those taken by the offshore sector. As well, the crews tended to be composed of household and family members, and were usually not interested in running their operation as a business venture whose sole goal was the generation of profit. It was almost like a subsistence economy for many.

As well, a sort of "commons regime" (*Whose common future?*, 1993) existed in many communities, where those who did aim to turn out profit and ostensibly display their wealth were looked down upon as getting "too big" for the community. This was a form of community sanction that lessened the impact of smaller inshore fishing groups on the stocks.

Despite some of the larger near-shore vessels being run as capitalist ventures (Sinclair, 1996) and the inshore lobby for more fish being frequently heard, overfishing by local inshore fishers must be discounted as a major factor in the collapse of the cod stocks. Unfortunately though, they seem to bear the brunt of the problems that have come from it.

To see the true culprits in overfishing one must look further offshore, to the Canadian and foreign fishing vessels that worked from 100 miles out to 200 miles and further. Foreign deep-sea fishing vessels have been demonized by the media and many Canadian politicians, but the expansionary dynamics of capitalism caused Canadian vessels to scour the seas for ever increasing

profit as well.

Canadian Deep-Sea Overfishing

Up until 1977, any vessel, Canadian or foreign, could fish just about anywhere off the coast of Newfoundland. In 1977 the United Nations Law of the Sea Convention set 200 mile exclusive fishing zones around many nations, including Canada and, hence, Newfoundland (Hannesson, 1996). Foreign vessels were relegated to outside the 200 mile limit, and the number of Canadian vessels subsequently increased to "pick up the surplus" (Sinclair, 1988). As Sinclair (1996) noted, "In the first period [1970s], foreign trawlers were clearly responsible for overfishing, but in the second [post 1977], this part was played mainly by Canadian trawlers, despite the highly publicized contribution of foreign fleets" (p. 231). After 1977, there were large increases in the number of Canadian (primarily Newfoundland operated) vessels, and they developed much more efficient methods of fish harvesting (Harris, 1998). Technological changes would have a great impact.

Draggers

The 1970's saw the emergence of the dragger fleet in the Newfoundland fishery. (The terms *dragger* and *trawler* could be used interchangeably, but staying with colloquial Newfoundland usage, the term trawler will be saved for a more specific type, the factory freezer trawler.) Draggers are named for the large gill-nets that they drag along behind them, with tows on larger ones capable of netting 25,000 pounds of fish at once (Palmer & Sinclair, 1997). Obviously, this catch was much larger than could have been achieved by inshore fishermen and had truly moved into the realm of fishing for profit. True to this capitalistic nature, the 1980s saw both the number of draggers increase greatly, and the size of the vessels themselves increase, with many going to over 65 feet in length (Palmer & Sinclair, 1997).

Even though this was starting to have negative effects on the inshore fishery, and the size of the fish that were caught was beginning to go down in the early 1980s (Palmer & Sinclair, 1997), the dragger had become crucial to the Newfoundland fishery. The number of fish processing plants, promoted by the Newfoundland government for employment and development purposes, had also increased in the early 1980s (Sinclair, 1985). These fish plants had become dependant on the dragger fleet and its catches. In answer to cries from inshore fishermen to limit the number of draggers, dragger crews would say, "if the draggers go, the plants go, and if the plants go, then we all go" (Palmer & Sinclair, 1997, p. 48). This was essentially true by the 1980s.

The dependence of plants on the draggers also brought an unusual socio-economic circumstance to the lives of inshore fishermen and their communities. As Palmer and Sinclair (1997) noted, the plants employed the wives and family members of fisherman, both inshore and off-shore. This income was necessary to support the constantly decreasing gains of the inshore fisherman, especially with inflation and the increasing costs of equipment. The voice against the draggers and their take of the fish was not, and could not be, very strong due to these concerns.

Until the early 1980s the dragger was king. However, more efficient methods would come and, coupled with more stringent government licensing rules, the dragger would lose much of its economic viability. The factory freezer trawler was to take over the crown.

Trawlers

Trawlers have been used for hundreds of years; the 1499 banning of their methods in Flanders is evidence of their long, controversial history (Berrill, 1997). Trawlers, like draggers, drag their nets along the bottom of the ocean substrate, sweeping up everything in their path. It is far and away the most efficient way to catch groundfish like cod, but there are two problems: the ocean substrate gets ripped up, causing great environmental damage, and the amount of bycatch is great. Bycatch is the catch of species other than the one the fishers were intending to get. Many of these were not as valuable as the main species that the boat was fishing for, or the boat was not licensed to catch them in the first place, often the case as boats were usually licensed for only two or three species at the most (Berrill, 1997). In both situations, the dead bycatch was often just dumped over the side, increasing the amount of destruction.

The most modern variant of the trawler, the factory freezer trawler, was (and still is for the species that are left) the method preferred by large companies like National Sea and Fisheries Products International, and by the foreign vessels that harvested off the coast of the Grand Banks of Newfoundland (Harris, 1998). This is because they have large collection and storage capacities, and can stay at sea for weeks to months at a time, as the catch is actually processed on board and frozen until it can be landed. In 1983, the Canada-Newfoundland Fishing Agreement permitted these boats back into Canadian waters (Sinclair, 1988). This considerably "upped the ante" on the cod stocks, as one of these vessels, with a rotating crew of 65-70, can harvest and process 15,000 tons of fish in one year (Sinclair, 1988).

Smaller catches had been noted in the inshore fishery for some time, but the amount of fish caught in the industry increased greatly year by year until the

late 1980s (Sinclair, 1992) when smaller catches and smaller fish being caught by dragger and trawler crews set off alarm bells with them (Harris, 1998). By then, Canadian overfishing had seriously damaged the cod stocks, and the path to the moratorium had already been well started.

Foreign Overfishing

Canadian media and government public relations people often cite foreign overfishing as the primary cause of the "fishing out" of the north Atlantic cod stocks. Many nations took fish off the coast of Newfoundland, including Spain, Portugal, other countries of the European Community (EC), the former Soviet Union, Japan, and Korea. All used deep-sea trawlers, and many often blatantly exceeded established catch quotas and treaty agreements (Steele et al., 1992). In his book *Lament for an Ocean*, journalist Michael Harris (1998) vividly described many incidences experienced by Department of Fisheries and Oceans observers on foreign vessels, and Fishery Patrol officers, in the years before and after the moratorium. Even after the Canadian moratorium on fishing in 1992, disputes between Canada, Spain and the EC over fishing in the regions adjacent to the 200 mile limit had to be settled by the North Atlantic Fisheries Organization. Canadian Coast Guard and the Royal Canadian Navy vessels were often involved, and some foreign fishing boats were seized.

The history of abuses here is long, with many foreign companies frequently disregarding agreements and treaty conventions. There can be little doubt that foreign overfishing was a contributing factor in the cod stock collapse, and that the capitalist dynamics that were at work in Canada were all too similar for the foreign vessels and companies. But all of the blame cannot be put there, no matter how easy it is to do.

As detailed above, overfishing, primarily driven by the capitalist ethic, was one of the major causes of the collapse of the North Atlantic Cod fishery. This over-exploitation seems to perfectly fit the tragedy of the commons theory, with many groups taking what they could, when they could. However, the tragedy of the commons model has been criticized, as it does not account for the management of the resources. This criticism is particularly pertinent in the Newfoundland fishery scenario.

Critique of the Tragedy of the Commons Model

As noted before, the tragedy of the commons is a simplistic and fairly abstract model. Factors such as regulating mechanisms and community sanctions are not accounted for in the theory, as the assumption is made that common property means open access to all (McCay & Acheson, 1987).

Many assert that what the theory describes is not a true commons, but an open access regime or free-for-all situation, where no authority has any control (*Whose common future?*, 1993; Marchak, 1987). One would be hard pressed to find a scenario where a natural resource is being used and a true free-for-all situation exists, particularly in the more developed areas of the world. In most instances of resource exploitation the state plays a regulatory role, in order to maximize the capital gains from the resource and ensure conservation (Marchak, 1987). The inevitability of the tragedy of the commons theory then becomes questionable, as these regulatory mechanisms are not accounted for. In the case of the Northwest Atlantic fishery, the state (the Canadian Federal government) was heavily involved in the regulation and management of the fishery, primarily through the federal Department of Fisheries and Oceans (DFO). The role of government management/mismanagement is crucial to the discussion of the Newfoundland fishery and its collapse.

Government (Mis)Management

The government's involvement in the fishery is best explained by a statement made by Sinclair (1992), "Since 1977, the Government of Canada has been the manager of the fisheries. Instead of fish being a resource available to anyone with the means to catch them [i.e. a commons], they became state property, the rights to which were delegated in the management plans. Therefore, the management policy of the Canadian state has become a major factor in the condition of the industry since this time" (p. 93). The Federal government, through the DFO, controlled the number of fishermen through licensing systems, set quotas for different types of vessels, and, acting upon information from its own scientists, set the Total Allowable Catch (TAC) for the industry each year (McGraw, 1996; Palmer & Sinclair, 1997). So quite obviously, a lot of the blame for the overfishing has to be placed there, as the DFO told the fishermen what they could go out and get. Acting upon faulty data (an issue discussed later), the DFO licensed too many fishermen and set TAC's that were too high.

Licensing

The main method of licensing fishermen, the Personal Registration System, was instituted by the DFO in 1981. Tied to this was the Limited Entry Licensing system, in which fishermen had to obtain an individual license to harvest different species, such as the more lucrative crab and lobster (Hanrahan, 1988). This was the medium through which government could have controlled the number of fishermen, and it was used somewhat for this purpose. In the classification system, new fishermen were almost always classified as part-time (although not official policy), and hence had to

undergo an unofficial apprenticeship period before getting a full-time license. While it was sometimes difficult to break into the industry, and the number of fishers did decline over the 1980s, the numbers stayed fairly stable in Newfoundland at around 25,000 (Hanrahan, 1988). This number was large, but the government tended to see the resource as "never-ending," a belief not initially debunked by its own scientists.

Another aspect of note with licensing is that under the classification system, the so-called "part-time fishermen" (some 11,000 of the approximately 25,000) were only allowed to fish for groundfish, such as cod (Hanrahan, 1988). This may have unknowingly further increased pressure on the cod stocks.

TAC's and Mismanagement

The DFO set the Total Allowable Catch (TAC) based upon models of the cod stocks that its own scientists developed and employed. In the first case, these models were to prove faulty, so that much of the underlying cause of the overfishing was that TACs were set too high for the stocks to absorb (Steele et al., 1992). Government mismanagement went beyond simply this. Several times throughout the 1980s, the TAC was set higher than even DFO scientists had recommended (Steel et al., 1992). Even when the scientists' mistake had been picked up (by the independent Task Group on Newfoundland Inshore Fisheries in 1987), and DFO scientists were recommending drastic cuts of over 50% to the TAC in 1989, the government still set it much higher than they sensibly should have (Harris, 1998). Social, economic, and political factors were largely at work, where the drastic cuts in the TAC required for conservation of the cod stocks would have caused economic upheaval in an already depressed region, and meant political suicide in a number of cases. Such blatant disregard by the Canadian government for warnings from their own scientists and the rest of the scientific community did much to lead to the destruction of the cod stocks, and the moratorium.

The only really significant federal government intervention in the Newfoundland fishery had nothing to do with conservation-it actually was aimed at more efficient processing and marketing of fish. In response to economic hardship in the fishery in the early 1980s, and at the advice of the Kirby Commission of 1983, the government set up Fishery Products International, a crown corporation with a mandate to sell fish and increase the market (Sinclair, 1985).

Scientific Calculation, and the Creation and Control of Knowledge

While politics was the root of much of the issue, one of the more crucial parts of the state's mismanagement was played by scientific miscalculation of the cod stocks and their ability to regenerate. The estimates of the cod stock made by DFO scientists were based largely upon commercial catch rates, with calculations mixed in for re-growth and natural mortality (Palmer & Sinclair, 1997). There were problems with this method of estimation. One was that with the increasing technological efficiency of the fleet and the developed knowledge of ship's crews on where to find fish, the catch remained quite high, while the stock was actually in drastic decline. Secondly, blatant misreporting on actual catch, "under the table" sales, and the large bycatch of Cod from fishers harvesting other species meant that more cod was being taken than the estimates allowed for.

In 1987, the Newfoundland Inshore Fisheries Association commissioned an independent analysis of the cod stocks, and of the DFO science (Harris, 1998). The commission's findings, the Alverson report, showed that the "assessments of abundance" were wrong. They found that fish mortality was higher than estimated, that fishermen were catching high numbers of the fish of the cohort that the DFO was counting on for reproduction, and that there was a mathematical fault in the model in use, which got expanded over the years (Alverson, 1987). Alverson himself said, "it took several years to find it [the mathematical fault] and by then, the stocks were on the downturn. I think it came as a shock to all of the fishermen and some of the scientists" (Harris, 1998, p. 104).

The DFO scientists initially resisted the view that they were incorrect, but by 1989, the problem was recognized, the assessment tool was changed and the recommended TAC was drastically cut (Sinclair, 1996). By then, most of the damage was already done.

Control and Application of Knowledge

Many of the problems in the overestimation of the stocks were not generated by the scientists themselves but were the result of honest error, if in drastic proportions. For example, the misreporting of catch rates and the massive discarding of fish greatly damaged the estimate's accuracy. Yet, even when doubt about the scientific certainty of things was raised in the early 1980s and the Alverson report was tabled in 1987, government decision makers either ignored or forcefully quieted the naysayers (Finlayson, 1994).

Part of the problem lies in the social creation and use of scientific knowledge. Wynne (1994) sees scientific knowledge as a social construct, in which many outside pressures and social issues have to be dealt with before knowledge

is ultimately "created," making the development of scientific knowledge a mediated process. How this happened at the DFO was described by Finlayson (1994). Government pressure on scientists for high TACs was heavy. Despite uncertainty in the process, government pressure pushed the scientists to come through with larger estimates than they were sure was safe. Even when doubt was raised later on, it was swept aside due to socio-economic reasons. The end result was that overestimates lead to the TACs being set too high, and government market interventions and the capitalist ethos drove fishermen to go out and fill those TACs.

Much of the matter was attitudinal-throughout the fishery the attitude was that the cod was an abundant, never-ending resource, even in the face of contrary evidence. The dynamics of the government-sponsored Kirby Commission of 1983 exemplifies this attitude. This commission was set up to examine "all aspects of the Newfoundland fishery" (Kirby, 1983, p. 1.); the one crucial aspect that they left out was to study the fish themselves.

Local Ecological Knowledge?

Recent sociological inquiry has turned towards the question of local ecological knowledge, so-called "traditional knowledge." This is usually set up in opposition to scientific knowledge, and is often disregarded by policy makers (*Whose common future?*, 1993). In the Newfoundland fishery, there was some local ecological knowledge that knew about what was happening. For many years prior to the cod collapse, inshore fishermen (the ones "closest to the sea") were crying out about their diminishing takes, and pointing to the great loads being hauled in by the offshore trawlers and dragnets. Most of what was being said, though widely covered by the media, was filtered out long before it got to the ears of the policy makers or, as in the case with much traditional knowledge, was simply disregarded (Finlayson, 1994). Towards the end, inshore fishermen got desperate enough to commission their own study on the cod stocks, the Alverson Commission. However, even this attempt to give scientific credibility to what the inshore sector already knew was widely ignored, and not acted upon until far too late.

Newfoundland Government Involvement

In the discussion of state involvement, the provincial government of Newfoundland must shoulder some of the blame. They were responsible for the control of the number of fish plants in the province, and had a stake in companies such as Fishery Products International (Sinclair, 1985). As such, the provincial government was often (if not always) putting pressure on the DFO to increase the TAC, and helped put great pressure on the stocks. The

Newfoundland government was also always one of the staunchest promoters of the abundance argument. But as for the management of the fishery itself, the provincial government did not have much of a hand in it. In Canada, natural resources fall under the control of the federal government. With the fishery, as with most resources in whichever province they are in, the federal government kept (and still keeps) almost all of the power and control.

The Tragedy of State Mismanagement

As the exploitation of the Newfoundland fishery was so predominantly guided by the government, the (mis)management of the fishery and its subsequent collapse match well with ideas put forth by Patricia Marchak (1987) in her book *Uncommon Property*. McGraw (1996) calls this "the tragedy of state mismanagement" theory (unit 4, p. 3). In her book, Marchak argues that a fishery is not a true commons, as the fisher lacks management rights normally associated with property and common property. The state has appropriated the property, and makes all of the management decisions. Fishermen get told who can fish, what they can fish, and essentially, what to do with the fish once it is caught. In this regard then, when a resource such as the Newfoundland fishery collapses, it is more a tragedy of state mismanagement than a tragedy of the commons.

Possible Environmental Contributors to the Collapse

Environmental contributors to the fishery's collapse have gotten the most press of any that have been put forward, so a brief treatment of some is appropriate. Most of these environmental contributors were generally proposed by government spokes-people soon after the announcement of the moratorium. Much of the early "environmental factors" argument put forth by the DFO hinged upon lower annual water temperatures of recent years, suggesting that this affected cod mortality and migration patterns (Steele et al., 1992). However, historical work by environmental scientists Hutchings and Myers (1995) showed that temperatures were also lower in the 19th century, with no apparent effects. In the same way, Hutchings and Myers also discounted arguments based on greater water salinity put forth by DFO personnel.

Other environmental factors that have been implicated include greater predation of cod by seals because of the decreased seal hunt, and an increase in the mortality of capelin, one of the cod's main food sources (Steele et al., 1992). Many of these environmental factors had impacts on the Cod stocks, but one must still look back to government mismanagement and overfishing as primary causes. This is not to discount environmental

factors, but to suggest that they probably factored in at the most inopportune time.

Conclusions

The collapse of the Newfoundland fishery was due to many factors. In a chapter on the Newfoundland fishery in his book *The Plundered Seas*, Berrill (1997) made a good summary of many of these:

Biologists overestimated size of stocks. Managers proposed quotas that did not allow for natural large declines in populations, and they consistently set quotas that were higher than what the biologists proposed. Fishermen lobbied hard for greater access to the fish. Trawlers scooped up everything that could swim. Bycatch levels were high; as much was wasted as was kept. Politicians lacked the strength to listen to the biologists and managers who called out warnings, knowing that statements of stock sizes were really estimates and that estimates are often wrong. Fishers, with little role to play in setting the rules, fished when they were allowed to and broke what rules they could get away with to make ends meet. At the same time, at the worst of times, the temperature of the summer sea was lower than usual, as the Labrador Current was pushing more strongly further South than usual. As a result, some of the fish may have moved away. When it became clear that stocks were dropping rapidly, quotas were cut, but it was too little too late. Northern Cod stocks in 1994 had dropped to less than 5% of their 1990 level (p. 120).

Add to this foreign overfishing, provincial government involvement, and other environmental factors, and it is an amazingly complicated scenario.

To summarize, we can see some elements of the tragedy of the commons, but the model is obviously too simple to encompass all that was happening. We also see some elements of Marchak's notion of the tragedy of state mismanagement. The state's mismanagement did play a large role, but this theory perhaps does not account enough for the capitalist dynamics at work. Neither theory allows for the influence of science and the environment. Due to all of the factors involved, a complete model for the collapse of the Newfoundland Fishery is not really available. Assessing the collapse of the Newfoundland fishery demonstrates that singular or exclusionary viewpoints are not terribly useful in environmental issues.

A major question that arises from the consideration of the tragedy of the commons theory is whether or not the situation in Newfoundland was inevitable. The answer would have to be "No," as many of the implicated factors could have been managed, accounted for, or at least recognized. In

this situation, the state held too much power, and was open to being swayed by economic and political considerations that were not in the interests of the conservation of the resource. A tragedy such as this suggests that more interdisciplinary work should be done at both the practical and theoretical levels, so that the vast array of factors that weigh into the protection and use of a resource or environment might be synthesized into something manageable and maintainable. Such work would require input from environmentalists, scientists, sociologists, political analysts, government managers, people who live with the environment in question, and a host of others. Perhaps then, we will not need to discuss further tragedies.

References

- Alverson, D. L. (1987). *A study of trends of cod stocks off Newfoundland and factors influencing their abundance and availability*. Ottawa, Ontario, Canada: Department of Fisheries and Oceans.
- Berrill, M. (1997). *The plundered seas: Can the world's fish be saved?*. Vancouver, British Columbia, Canada: Greystone Books.
- Finlayson, A. C. (1994). *Fishing for truth: A sociological analysis of northern cod stock assessments from 1977-1990*. St. John's, Newfoundland, Canada: Memorial University of Newfoundland, Institute of Social and Economic Research.
- Hannesson, R. (1996). *Fisheries (mis)management: The case of the north Atlantic cod*. Oxford, England: Fishing News Books.
- Hanrahan, M. (1988). *Living on the dead: Fishermen's licensing and unemployment insurance programs in Newfoundland* (ISER Research and Policy Papers #8). St. John's, Newfoundland, Canada: Memorial University of Newfoundland, Institute of Social and Economic Research.
- Hardin, G. (1968). The tragedy of the commons. *Science*, 162(3), 1243-1248.
- Harris, M. (1998). *Lament for an ocean: The collapse of the Atlantic cod fishery, A true crime story*. Toronto, Ontario, Canada: McLelland & Stewart Inc.
- Hutchings, J. A. & Myers, R. A. (1995). The biological collapse of northern

- cod off Newfoundland and Labrador: An exploration of historical changes in exploitation, harvesting technology and management. In *The North Atlantic fishery: Strengths, weaknesses and challenges*. Charlottetown, Prince Edward Island, Canada: Institute of Island Studies.
- Kirby, M. (1983). *Navigating troubled waters: A new policy for the Atlantic fisheries*. Ottawa, Ontario, Canada: Supply and Services Canada.
- Lloyd, W. F. (1833). *Two lectures on the checks to population*. Oxford: Oxford University Press. Reprinted in part in G. Hardin (Ed.). (1964). *Population, evolution and birth control*. San Francisco, CA: Freeman.
- Marchak, P. (1987). Uncommon property. In P. Marchak, N. Guppy, & J. McMullan (Eds.), *Uncommon property: The fishing and fish-processing industries in British Columbia*. Toronto, Ontario, Canada: Methuen Publications.
- McCay, B. & Acheson, J. (1987). *The question of the commons*. Tucson, AZ: The University of Arizona Press.
- McGraw, D. (1996). *Course manual, Sociology/Anthropology 3322 (7th ed.)*. St. John's, Newfoundland, Canada: Memorial University of Newfoundland, Division of Continuing Education.
- Ophuls, W. (1977). *Ecology and the politics of scarcity*. San Francisco, CA: W. H. Freeman and Company.
- Palmer, C., & Sinclair, P. (1997). *When the fish are gone: Ecological disaster and fishers in Northwest Newfoundland*. Halifax, Nova Scotia, Canada: Fernwood Publishing.
- Sinclair, P. R. (1985). *The state goes fishing: The emergence of public ownership in the Newfoundland fishing industry* (ISER Research and Policy Papers #1). St. John's, Newfoundland, Canada: Memorial University of Newfoundland, Institute of Social and Economic Research.
- Sinclair, P. R. (1988). The state encloses the commons: Fisheries management from the 200 mile limit to factory freezer trawlers. In P. R. Sinclair (Ed.), *A Question of survival: The fisheries and Newfoundland society*. St. John's, Newfoundland, Canada: Memorial University of Newfoundland, Institute of Social and Economic

Research.

Sinclair, P. R. (1992). Atlantic Canada's fishing communities: The impact of change. In D. A. Hay, & G. S. Basran (Eds.), *Rural sociology in Canada*. Don Mills, Ontario, Canada: Oxford University Press.

Sinclair, P. R. (1996). Sustainable development in fisheries dependant regions? Reflections on Newfoundland Cod fisheries. *Sociologia Ruralis*, 36(2), 225-235.

Steele, D. H., Andersen, R., & Green, J.M. (1992). The managed commercial annihilation of northern cod. *Newfoundland Studies*, 8(1), 34-68.

Whose common future? Reclaiming the commons: The ecologist. (1993). Philadelphia, PA: New Society Publishers.

Wynne, B. (1994). Scientific knowledge and the global environment. In M. Redclift, & T. Benton (Eds.), *Social theory and the global environment*. London: Routledge.

For Further Reading

General Works

Arnason, R., & Felt, L. (Eds.). (1995). *The Atlantic fishery: Successes, failures and challenges*. Charlottetown, Prince Edward Island, Canada: Institute for Island Studies.

Feehan, J. (1992). Review article: Reports on the Newfoundland fishery. *Newfoundland Studies*, 8(2), 189-201.

Hennessey, T. M., & LeBlanc, M. (1987). Fisheries administration and management in Canada and the United States. In R. H. Backus, & D. W. Bourne (Eds.), *Georges Bank*. Cambridge, MA: M.I.T. Press.

Lear, W. H., Baird, J. W., Rice, J. C., Carscadden, J. E., Lilly, G. R., & Aikenhead, S. A. (1986). An examination of factors affecting catch in the inshore cod fishery of Labrador and eastern Newfoundland. *Canadian Technical Report of Fisheries and Aquatic Sciences*, No. 1469.

Matthews, D. R. (1993). *Controlling common property: Regulating Canada's east coast fishery*. Toronto, Ontario, Canada: University of Toronto

Press.

McGoodwin, J. R. (1990). *Crisis in the world's fisheries: People, problems and policies*. Stanford, CA: Stanford University Press.

Newell, D. & Ommer, R. E. (Eds.). (1999). *Fishing places, fishing people: Traditions and issues in Canadian small-scale fisheries*. Toronto, Ontario, Canada: University of Toronto Press.

Palmer, C. T. (1992). *The Northwest Newfoundland fisheries crisis* (ISER Research and Policy Papers #6). St. John's, Newfoundland, Canada: Memorial University of Newfoundland, Institute of Social and Economic Research.

Rogers, R. (1995). *The Oceans are emptying: Fish wars and sustainability*. Montreal, Quebec, Canada: Black Rose Books.

Roughgarden, J. & Smith, F. (1996). Why fisheries collapse and what to do about it. *Proceedings of the National Academy of Sciences of the United States of America*, 93(10), 5078-5083.

Historical Perspectives

Lear, W. H. (1998). History of fisheries in the northwest Atlantic: The 500-year perspective. *Journal of Northwest Atlantic Fishery Science*, 23, 41-73.

Norcliffe, G. (1999). John Cabot's legacy in Newfoundland: Resource depletion and the resource cycle. *Geography*, 84(2), 97-109.

Ommer, R. (1994). 100 years of fishery crisis in Newfoundland. *Acadiensis*, 23(2), 5-20.

Wright, M. (1997a). Fishing in the Cold War: Canada, Newfoundland and the international politics of the twelve-mile fishing limit, 1958-1969. *Journal of the Canadian Historical Association-Revue de la Societe Historique du Canada*, 8, 228-258.

Wright, M. (1997b). Frozen fish companies, the state, and fisheries development in Newfoundland, 1940-1966. *Business and Economic History*, 26(2), 727-737.

Wright, M. (1998). Young men and technology: Government attempts to create a "modern" fisheries workforce in Newfoundland, 1949-1970.

Labour-Le Travail, 42, 143-159.

Management

Arnason, R., Hannesson, R. & Schrank, W. E. (2000). Costs of fisheries management: The case of Iceland, Norway and Newfoundland. *Marine Policy, 24*(3), 233-243.

Haedrich, R. L., & Hamilton, L. C. (2000). The fall and future of Newfoundland's cod fishery. *Society & Natural Resources, 13*(4), 359-372.

Hoffmann, E. E. & Powell, Y. M. (1998). Environmental variability effects on marine fisheries-Four case histories. *Ecological Applications, 8*(1 Supplement), S23-S32.

Lane, D. E. & Palsson, H. P. (1996). Stock rebuilding strategies under uncertainty: The case for sentinel fisheries. *Canadian Journal of Economics, 29* (special issue), S151-S156.

Maguire, J. J., Neis, B., & Sinclair, P. R. (1995). What are we managing anyway? The need for an interdisciplinary approach to managing fisheries ecosystems. *Dalhousie Law Journal, 18, 141-153.*

Nakken, O., Sandberg, P., & Steinsham, S. I. (1996). Reference points for optimal fish stock management: A lesson to be learned from the northeast arctic cod stock. *Marine Policy, 20*(6), 447-462.

Noble, B. F. (2000). Institutional criteria for co-management. *Marine Policy, 24*(1), 69-77.

Pontecorvo, G., & Schrank, W. E. (2001). A small-core fishery: A new approach to fisheries management. *Marine Policy, 25*(1), 43-48.

Rogers, R. (1996). Sustainability and dis-integration of conservation and development in the northwest Atlantic fishery. *Journal of Canadian Studies, 31*(1), 7-24.

Schrank, W. E., Roy, N., Ommer, R. & Skoda, B. (1992). The future of the Newfoundland fishery. *Canadian Plains Proceedings, 22, 122-151.*

Canadian Government Policy

Milich, L. (1999). Resource mismanagement versus sustainable livelihoods:

The collapse of the Newfoundland Cod fishery. *Society and Natural Resources*, 12(7), 625-642.

Phyne, J. (1992). Changes from compliance to deterrence among federal fishery officers: An atypical case of regulatory policing? *Canadian Review of Sociology and Anthropology*, 29(4), 524-535.

Schrank, W. E., Roy, N., Ommer, R. & Skoda, B. (1992). An inshore fishery: A commercially viable industry or an employer of last resort. *Ocean Development and International Law*, 23(4), 335-367.

Schrank, W. E., Skoda, B., Parsons, P. & Roy, N. (1995). The cost to government of maintaining a commercially unviable fishery: The case of Newfoundland, 1981/2 to 1990/1. *Ocean Development and International Law*, 26(4), 357-390.

Woodrow, M. (1998). A case study of fisheries reduction programs during the northern cod moratorium. *Ocean and Coastal Management*, 39(1-2), 105-118.

Licensing

Neis, B. (1991). Flexible specialization: What's that got to do with the price of fish? *Studies in Political Economy*, 36, 145-170.

Sinclair, P. R. (1983). Fishermen Divided: The impact of limited entry licensing in northwest Newfoundland. *Human Organization*, 42(4), 307-314.

International Politics

Matthews, D. R. (1996). Mere anarchy? Canada's "Turbot War" as the moral regulation of nature. *Canadian Journal of Sociology/Cahiers Canadiens de Sociologie*, 21(4), 505-522.

Missios, P. C., & Plourde, C. (1996). The Canada-European Union turbot war: A brief game theoretic analysis. *Canadian Public Policy-Analyse de Politiques*, 22(2), 144-150.

Thompson, A. (2000). Canadian foreign policy and straddling stocks: Sustainability in an interdependent world. *Policy Studies Journal*, 28(1), 219-236.

Scientific Knowledge

- Charles, A. T. (1998). Living with uncertainty in fisheries: Analytical methods, management priorities and the Canadian groundfishery experience. *Fisheries Research*, 37(1-3), 37-50.
- De Young, B., & Rose, G. A. (1993). On recruitment and distribution of Atlantic cod (*Gadus Morhua*) off Newfoundland. *Canadian Journal of Fisheries and Aquatic Sciences*, 50, 2279-2741.
- Myers, R. A., Hutchings, J. A., & Barrowman, N. J. (1997). Why do fish stocks collapse? The example of cod in Atlantic Canada. *Ecological Applications*, 7(1), 91-106.

Local Ecological Knowledge

- Felt, L. (1994). Two tales of fish: The social construction of indigenous knowledge among Atlantic Canada salmon fishers. In C. Dyer, & J. McGoodwin (Eds.), *Folk management in world fisheries*. Denver, CO: University Press of Colorado.
- Matthews, R., & Phyne, J. (1988). Regulating the Newfoundland inshore fishery: Traditional values versus state control in the regulation of a common property resource. *Journal of Canadian Studies*, 23(1-2), 158-176.
- Neis, B., Schneider, D. C., Felt, L., Haedrich, R. L., Fischer, J., & Hutchings, J. A. (1999). Fisheries assessment: What can be learned from interviewing resource users? *Canadian Journal of Fisheries and Aquatic Sciences*, 56(10), 1949-1963.
- Palmer, C. T. (1993). Folk management, "soft evolutionism," and fisher's motives: Implications for the regulation of the Lobster fisheries of Maine and Newfoundland. *Human Organization*, 52(4), 414-420.
- Palmer, C. T. & Sinclair, P. R. (1996). Perceptions of a fishery in crisis: Dragger skippers on the Gulf of St. Lawrence cod moratorium. *Society & Natural Resources*, 9(3), 267-279.

Environmental Factors

- Campbell, J. S., Schwinghamer, P. & Symons, P. E. K. (Eds.). (1997). Selected proceedings of the symposium on the biology and ecology of the northwest Atlantic cod, St. John's, Newfoundland, October, 1994.

Canadian Journal of Fisheries and Aquatic Sciences, 54 (supplement 1).

Hutchings, J. A. (1996). Spatial and temporal variation in the density of northern cod and a review of hypotheses for the stock's collapse. *Canadian Journal of Fisheries and Aquatic Sciences*, 53(5), 943-962.

Hutchings, J. A. & Myers, R. A. (1994) What can be learned from the collapse of a renewable resource? Atlantic cod, *Gadhus Morhua*, of Newfoundland and Labrador. *Canadian Journal of Fisheries and Aquatic Sciences*, 51(9), 2126-2146.

Myers, R. A., & Cadigan, N. G. (1996). Was an increase in natural mortality responsible for the collapse of northern cod? *Oceanographic Literature Review*, 43(6), 608.

Walters, C. & Maguire, J. J. (1996). Lessons for stock assessment from the northern cod collapse. *Reviews in Fish Biology & Fisheries*, 6(2), 125-137.

Community Impact

Baum, T. (1999). The decline of traditional North Atlantic fisheries and tourism's response: The cases of Iceland and Newfoundland. *Current Issues in Tourism*, 2(1), 47-61.

Bavington, D. (2001). From jigging to farming. *Alternatives Journal*, 27(4), 16-21.

Davis, D. (2000). Gendered cultures of conflict and discontent: Living 'the crisis' in a Newfoundland community. *Women's Studies International Forum*, 23(3), 343-353.

Hamilton, L. C., & Haedrich, R. L. (1999). Ecological and population changes in fishing communities of the North Atlantic Arc. *Polar Research*, 18(2), 383-388.

Hamilton, L. C., & Seyfrit, C. L. (1994). Resources and hopes in Newfoundland. *Society-and-Natural-Resources*, 7(6), 561-578.

Kennedy, J. C. (1997). At the crossroads: Newfoundland and Labrador communities in a changing international context. *Canadian Review of Sociology and Anthropology*, 34(3), 293-317.

Leith, B. (1995). The social cost of sustainability: Distribution and equity in environmental policy. *Alternatives*, 21(1), 18-24.

Neis, B. (2000). In the eye of the storm: Research, activism and teaching within the Newfoundland fishery crisis. *Women's Studies International Forum*, 23(2), 287-298.

Ommer, R. E. (1995). Fisheries policy and the survival of fishing communities in eastern Canada. In A. G. Hopper (Ed.), *Deep water fisheries of the North Atlantic oceanic slope. Proceedings of NATO Advanced Research Workshop*. Dordrecht: Kluwer Academic Publishers.

Ommer, R. E. (1998). Sustainability of communities of fish and fishers on the east coast of Canada. *Transactions of the Royal Society of Canada*, 9: 65-84.

The author would like to acknowledge Dr. Darrin McGraw of Memorial University of Newfoundland and his distance course in the Sociology of Natural Resource Development, taken by the author in 1996, for the basic structure of some of the ideas presented in this paper, and for exposure to many of the references used.

.....

Fred Mason <fmason@uwo.ca>, Ph.D. Candidate in Socio-Cultural Studies, School of Kinesiology, University of Western Ontario, Thames Hall/3M Centre, London, Ontario, Canada, N6A 3K7. TEL: (519) 661-2111, ext. 85494.