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Energy and Equity in World Fisheries

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Abstract

In his essay entitled, *Energy and Equity*, medieval historian and social critic Ivan Illich observed that the first step toward addressing the energy crisis is to recognize that there are thresholds "beyond which technical processes begin to dictate social relations. Calories are both biologically and socially healthy only as long as they stay within the narrow range that separates enough from too much."[1]

In order to uncover what "enough" might mean in the post-collapse cod fisheries of Newfoundland and Labrador, and the many other collapsed fisheries around the world, we focus on debates, since the 1850's, on the appropriateness of various fishing methods. We argue that the introduction of the cod jigger in the 19th century marks a transgression of natural thresholds beyond which technical imperatives began to dictate social relations, both among people and between codfish and people.

In the case of energy use, Illich shows that "the threshold of social disintegration by high energy quanta is independent from the threshold at which energy conservation produces physical destruction."[2] He argues that cultural and social thresholds are more sensitive than bio-physical ones, occurring much earlier and at lower levels of energy exploitation. More generally, his argument implies that the atrophy of the social imaginary by the industrial mind-set occurs far earlier than the damages to the physical environment due to runaway industrialization. This paper explores the extent to which the cod fisheries of Newfoundland and Labrador exemplify Illich's observations on the timing and relationships among cultural, social and biophysical thresholds. We conclude by arguing that contemporary policy and management discussions on world fisheries are ineffectual and irrelevant because they are blind to the existence of natural thresholds associated with fish and fishing.

Too many managers, too few fish

Worldwide the oceans are emptying of fish. Since the 1990s, wild fish landings have steadily declined. Officially, the Fisheries and Agriculture Organization of the United Nations reports that approximately 80% of global fish stocks are fully exploited or have collapsed. Ninety percent of large carnivorous fish have been removed from the world's oceans by industrial fishing fleets. A recent paper in *Science* notes that all commercially valuable species will collapse within a generation if current trends continue. Fish grown on farms now comprise close to half the global consumption of fish.[3]

Almost 500 years ago, the Grand Banks off the island of Newfoundland on Canada's east

[1] Ivan Illich, *Energy and Equity* IN. Toward a History of Needs (New York: Pantheon, 1978), 24
[2] *Ibid*, 26
[3] FAO, *The State of World Fisheries and Aquaculture 2008* (Rome: Food and Agricultural Organization of the United Nations, 2009); World Bank and FAO, *The Sunken Billions: The Economic Justification for Fisheries Reform (Washington, DC:* Agriculture and Rural Development Series, 2009); Pauly D, Watson R, Alder J. *Global trends in world fisheries: impacts on marine ecosystems and food security*. (Philosophical Transactions of the Royal Society of London Biological Sciences 360:5-12, 2005); Myers R, Worm, B *Rapid worldwide depletion of predatory fish communities* (Nature 423:280-283, 2003).

coast teemed with such an abundance of codfish that they reportedly choked the passage of vessels. Since 1992, cod have disappeared from the Northwest Atlantic and the resulting moratorium on cod fishing continues to this day. Yet, cod have not recovered and the fish has recently been recommended as a candidate for Canada's endangered species list. The moratorium on fishing also led to the largest single day layoff in Canadian history affecting over 30,000 people in a province with a population under 500,000.

The collapse of the Newfoundland and Labrador cod fishery (once the world's largest ground fishery) has become legendary and reflects global fishing trends writ large. While there are many studies adding footnotes to these dismal figures, the overwhelming scientific consensus implicates overfishing as the major cause—too many fishermen chasing too few fish. If excessive fishing has been identified as the problem, scientific management is seen as the solution and contemporary scientific research and policy are focused on the task of reinventing fisheries science and management.

All is not well, however, in the world of fisheries science and management. As early as 1980, Robert Francis noted a strange paradox: "Reasonably successful fisheries seem to be those about which little is known … and the least successful fisheries are those heavily studied." He posed a question that has yet to be answered: "What is it about fisheries science specifically, or the science of renewable resource management in general, that makes this true?"[4] The cod fishery collapse provides a clear example of the paradox identified by Francis. The cod fishery was scientifically managed into non-existence. Before the collapse it was considered the most successfully managed fishery in the world. While inshore cod fishermen warned that the cod fishery was on the verge of collapse well before the moratorium was imposed in 1992 their knowledge and arguments were dismissed as being anecdotal and unscientific. Since the collapse of the fishery in 1992, the policies and plans of fisheries scientists and managers continue to take precedence over the voices of fishermen. Contrary to the calm reassurances made by reform minded managers, we contend that since scientific management was the dominant cause of the collapse of the cod fishery the knowledge of fishermen rooted in the perception of natural thresholds should now guide the efforts to restore it.[5]

In the first section of this paper, we sketch out when, why, and how the cod fisheries in Newfoundland came to be managed and describe four mutually provoked moments that constitute the epistemic space for the scientific management of fish, fishermen and fishing (*see* Figure 1). We focus on the history of fisheries science and technology to show that scientific fisheries management necessarily devastates the objects of its concern. In the second half of the paper, we explore alternatives to scientific fisheries management by attending to the voices of cod fishermen and their consistent protests at the introduction of novel fishing technology. We conclude by arguing that fisheries policy makers, scientists and managers consistently fail to understand the words and deeds of fishing people due in part to a general blindness to the existence of natural thresholds in fishing.

[4] Robert Francis, *Fisheries science now and in the future: a personal view* (New Zealand Journal of Marine & Freshwater Research 14 (1): 95-100, 1980)
[5] Dean Bavington, *Managed Annihilation: An Unnatural History of the Newfoundland Cod Collapse*. (Vancouver, BC: UBC Press, 2010)

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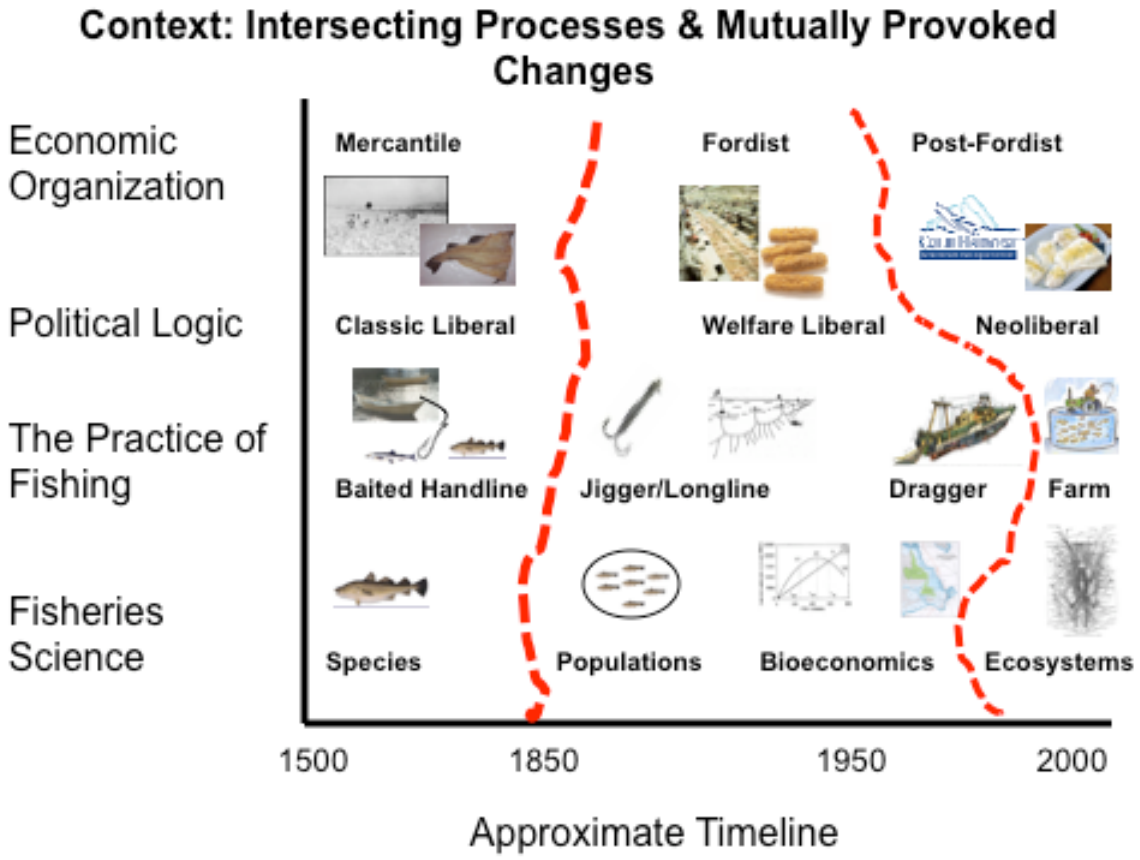
Figure 1



Managed endangerment

For most of human history, fisheries have neither been managed, nor been an object of techno-scientific research and development. To this day, fishing is primarily a small-scale subsistence activity, subjected to the rhythms of season and tide, subservient to the nature of fish, and of the ability of fishermen. By the latest count, artisanal fishermen outnumber workers on the world's industrialized fleets by a factor of sixty. They receive a fifth of the public money given to the industrial fleets and yet catch as much fish. They produce none of the pollution routinely generated by industrial fishing, avoid harm to spawning fish and habitat, and waste none of their catch. Oriented primarily toward fishing for food instead of for profit, the wide array of artisanal fisheries do not mistake fish for a commodity, fishermen for workers, or fishing as employment.

It is widely recognized that the science of fisheries management is just over a century old. In this retelling of the history of the Newfoundland cod fishery, we identify four mutually provoked moments that together constitute the space for the scientific management of the fishery. In what follows, we highlight, (1) The economic organization of the cod fishery; (2) The political logics that governed it; and focus on (3) The techniques of fishing and; (4) Fisheries science (Figure 1). We focus on techno-science to avoid the all too facile explanation of the cod fisheries collapse as an instance of the inappropriate use or application of techno-science by

economic and political interests. We use the term 'techno-science' to highlight the inapplicability of a supposed distinction between a 'pure' science and an 'applied' technology or indeed between 'science' and 'politics' in the history of fisheries management. In contrast, fisheries management reveals precisely an arena in which techniques, science, and politics, and economics are deliberately brought into mutual play.

Therefore, we understand each of the four moments as forming a network or assemblage and in theory we could have begun with any of the four. Furthermore, none of these are self-sufficient categories. They shade and even blend into each other. We assume for example that economic arrangements cannot be neatly separated from political logics, that technical innovations in fishing are not necessarily independent of scientific theories of fish and fisher folk. Nor do events captured within these four analytical moments unfold in perfect concert. For example, there are no facile casual links between neo-liberalism and fish farms (*see* Figure 1).

Instead, each of these moments has their own trajectories, periodicities, and points of displacement. One element can provoke another much later in time and space; a given change here could well influence or modulate another one there. To speak of networks, complex systems or assemblages is to leave the world of simple linear causality. However, we will leave the observation and description of such 'science in the making' to others. Our focus in this paper is on giving a plausible account of the techno-scientific destruction of the Newfoundland cod fisheries and the contemporary relevance of the knowledge and practices of cod fishermen.

A brief history of the cod fishery

For most of the 500-year history of the cod fishery, fishing was done using a baited hook on a single line dropped over the side of a small row boat called a dory. Though larger boats were used seasonally to reach the offshore fishing banks, fishing required cod to be hungry to go for the bait which limited the fishing season to the roughly 6-8 week period when cod followed their main food source—capelin—in from the offshore banks. Once cod gorged themselves on capelin they would stop biting at the baited hooks and the cod fishery would come to an end.

Merchants, who loaned money as capital to the fishermen, usually indexed the repayments to the sale of fish. Accordingly, the customary practice was for loans and interest to be repaid during the fishing season. As the scale of the merchant's operations grew, the mismatch between the abstract, numerically driven loan repayment schedules and the comings and goings of the codfish became unprofitable for the merchant. Not only was the length of the fishing season variable, but more crucially, the quantity of the catch in a given season would also naturally fluctuate. The customary practice of carrying forward loans or forgiving debts on account of unexpected changes in catch thus became a problem for finance capital. Merchants wanted a more reliable flow of codfish to match the constancy of mathematically induced loan repayments. The fishermen could do little to change the natural rhythms of codfish, attuned to seasons, temperature, and other imponderables. However, fishermen were tempted and encouraged to the solution of increasing the catch. Specifically, in response to the demand for increasing the annual catch, many fishermen began to experiment with and adopt more intensive technologies for fishing.

In the middle of the nineteenth century (1850s), after close to 350 years using the baited hook and line method, the practice of cod fishing began to change with the introduction of a slew of new technologies. These technologies intensified the fishery, dramatically increasing the amount of baited hooks in the water and extending the fishing season in time and across space.

The first of the new tools introduced was the cod jigger. The jigger allowed cod to be fished after they were glutted full of capelin, lied logy on the bottom of the fishing grounds, refusing to bite at baited hooks. The jigger (two hooks attached to a lead weight cast into the *image* of a capelin) would be dropped down into a school of satiated cod and quickly moved up and down until one of the hooks pierced a codfish so that it could be hauled aboard the boat. A related fishing tool was the longline or bultow, introduced by the French which consisted of a main long line attached to dozens of fishing lines and hooks launched off the end of a boat and kept afloat with glass buoys on either end. Traps, seines and gillnets were other fishing technologies introduced during the last half of the 19th century. These new technologies transformed fishing from the agonal activity of hunting a living being to the activity of harvesting a valuable resource. Thus technological innovation presupposed ignoring the nature of fish and the culture of fishing.

With the arrival of the first bottom dragger in 1956, natural thresholds in the cod fishery were completely transcended. Draggers allowed cod fishing to take place at any time of the year and in almost any part of the ocean without concern about weather conditions, the hunger of cod, or other natural phenomena. The diesel-powered factory freezer trawler or "dragger" was constructed in the post-WWII period when the technologies of war were applied to capturing fish, vastly increasing production. Of the 100 million tons of cod that is estimated to have been captured from 1500-1992, it took 400 years to hunt down half of that number, and under 100 years for the new technologies to harvest the remaining 50 million tons.

Since the cod have collapsed, the latest fishing technology to be applied is the industrial cod farm. Referred to as the culture verses capture fishery by Canadian fisheries managers, the complete lifecycle of cod can now be controlled and industrially produced from "egg-to-plate."

A history of cod fisheries science

For most of the history of the cod fishery, knowledge of the fish was based on qualitative observations made by fishermen. Little was known about the movements of cod or what caused inter-annual fluctuations in landings. There were no quantitative models, laws or paradigms of research—in short fisheries *science* did not exist. This phase was largely disconnected from the development interests of both the state and the fishing industry and began to change in the 1850s when governments (under pressure from fish merchants and investors) started to recruit scientists to discover what caused inter-annual fluctuations in landings and to uncover the natural laws that determined years of lean and plenty.

When biological research began into marine fisheries the dominant theory explaining inter-annual fluctuations in catches was the so-called Polar Migration Theory. This theory hypothesized that all marine fish migrated en masse in the fall and winter to the polar region and returned south the following spring and summer. Fluctuations in the availability of cod on specific fishing grounds was thought to be caused by the vagaries of individual cod migration routes to and from the Pole.

In the 1880s German biologist Frederick Heincke started to combine statistical methods he borrowed from the study of human populations to observations of morphological features of herring that had been caught in different fishing locales. He was the first to apply quantitative methods to the study of fish and was insistent that population thinking be applied to the study of

fisheries.[6] By the 1930s, the notion of "population" derived from the science of demography had created a scientific field devoted to understanding fish as members of statistically determined single species populations. By the 1950s, population models were developed to predict the amount of surplus-biomass (or live weight of fish) produced each year by a specific fish population, labeled Maximum Sustainable Yield (MSY), which if extracted would maintain stable annual landings in perpetuity. MSY became a global fisheries policy goal after WWII when the United States fought to have the construct embedded in international fisheries agreements to allow their distant-water industrial fleets to continue the practice of taking fish from the coastal waters of undeveloped, poorer countries.[7]

While the surplus-production model allowed fisheries scientists to determine the maximum sustainable yield from fish populations, there was no way to guarantee that fishermen would behave accordingly. This was especially true of new fishing technologies that allowed continuous fishing on factory freezer trawlers. At the peak of the Newfoundland cod fishery, trawlers from over 20 nations were competing for the fish on the offshore banks creating a "city of lights" on the fishing grounds. By 1968, this "cod rush" off Newfoundland resulted in a "killer spike"—the largest annual landings of cod ever recorded—and a precipitous decline in landings thereafter.

By reframing this decline as a "tragedy of the commons," economists joined biologists to widen the scope of scientific fisheries management. Economists claimed to be able to predict how fishermen would act and the economically rational rate to harvest fish populations. Fishermen would behave as rational economic actors and profit would be maximized from cod only if access to the fish could be limited and controlled. The economic logic of transforming the commons into property led to enclosing Canadian fishing grounds within a 200 mile limit, enshrined in the United Nations Law of the Sea. This public property, divided and allocated as quotas, was thought to create the incentives necessary for economically rational fishermen.

And yet in 1992, the cod fisheries collapsed. Permanently. Despite what was recognized worldwide as the most advanced, well-funded, scientific fisheries management regime, the cod fishery of Newfoundland was destroyed.

Yet the response to the techno-scientifically engineered collapse of cod has been to expand the scope of techno-science. The failure *of* cod fisheries management has been misread as a failure *in* management. Therefore, attention has been directed at developing a new and improved science of fisheries management resulting in two main responses. First, the elaboration of the ecosystem view in the context of fisheries is establishing versions of ecosystem-based fisheries management. Fisheries scientists are increasingly representing wild

[6] Heincke encouraged the shift from qualitative natural history to quantitative fisheries science with the following rhetoric: "Pronounced aversion toward measurements and numbers…is admissible when it is a manner of gaining a quick overview about the manifold varieties of organic forms, and is pardonable when the pleasure of the composing artist in the beauty and variety of forms and in His fanciful conceptions is greater than the sense for exploration of the analytical scholar; but this aversion toward measurement and numbers, which at times is heightened into contempt, is incomprehensible, inadmissible, and unpardonable when the scholar demands that his labours be regarded as a contribution to the knowledge of the true laws of nature. - Frederick Heincke 1898 *quoted in* Sinclair, M. and Solemdal, P. *The Development of "Population Thinking" in Fisheries Biology Between 1878-1930* (Aquatic Living Resources. 1: 189-213, 1988), 195

[7] The history of the MSY construct and its political verses scientific virtues in particular for the cold war era United States are detailed in Carmel Finley, *A Political History of Maximum Sustained Yield, 1945-1955* in *Oceans Past: Management insights from the history of marine animal populations*, ed. David Starkey, Paol Holm, and Michaela Barnard (London: Earthscan, 2008), 189-214. And Smith, T. *Scaling Fisheries: The science of measuring the effects of fishing, 1855-1955*. (Cambridge: Cambridge University Press, 1994).

cod as elements in complex ecosystems where many of the equilibrium and averaging assumptions, which permitted predictions of population biomass and MSY are now admitted to being false. However, since ecosystem models with accurate predictive ability have not yet become available (and some scientists argue they are theoretically impossible given the uncertainty and complexity of perturbed aquatic systems) the bio-economic models still remain the dominant tools in use, even if used with increased caution and ironic recognition of their unreliability. Fisheries science, therefore, is in the middle of a crisis, searching for a revolution to operationalize the ecosystem paradigm into fisheries management.

The second response to the collapse of the cod fisheries in 1992 has been the development of egg-to-plate aquaculture. In the post-moratorium period scientists and entrepreneurs—with the help of significant expertise from regional public universities and extensive financing and enabling policies from provincial and federal Canadian governments—learned how to manage domesticated cod populations throughout their entire lifecycle. A cod hatchery was built and cod brood stocks were developed through a cod genome project that identified genetic traits in the fish that were amenable to rapid growth and resistance to diseases and stressors associated with confined growth in sea cages. Coastal grow out sites were surveyed and licenses issued. Dependable, scientifically formulated feed sources were engineered and government loan guarantees for the aquaculture industry established. The demise of *Gadus morhua* was now presented as a profitable business opportunity. By 2003, *Fish Farming International*, the world's leading source of aquaculture information, was proclaiming a "Cod Comeback" in Canada.

Natural thresholds and environmental justice

[T]he avoidance of an even more horrible degradation depends on the effective recognition of a threshold in energy consumption beyond which technical processes begin to dictate social relations — Ivan Illich[8]

In *Energy and Equity,* Ivan Illich argues that the first step toward addressing environmental and social issues like energy use and transportation in industrial society, or the loss of fish and fishermen as we have been describing, is to recognize that there are thresholds "beyond which technical processes begin to dictate social relations." Just as with calories, fishing is both "biologically and socially healthy only as long as they stay within the narrow range that separates enough from too much." [9] Determining what sufficiency, or enough might mean in world fisheries runs counter to scientific fisheries management that is oriented toward sustaining maximum annual fish landings.

In order to uncover what "enough" might mean in the cod fishery, we focus on the debates that emerged during the 1850s (and which continue today) surrounding the appropriateness of baited-hooks-and-hand-lines verses cod jiggers and other fishing technologies. We argue that the jigger marks the transgression of a natural threshold. Baited hooks and hand lines have an unmatched ability to stay within crucial biological and social thresholds associated with the nature of codfish, fishermen and the practice of fishing. Fishing people have persistently recognized the importance of thresholds related to fishing and have consistently demanded laws to ban fishing practices they deemed to have violated the thresholds. Those in charge of fisheries (scientists, governors, managers, investors and industrialists),

[8] Ivan Illich, *Energy and Equity* IN. Toward a History of Needs (New York: Pantheon, 1978), 28
[9] Ivan Illich, *Energy and Equity* IN. Toward a History of Needs (New York: Pantheon, 1978), 24

however, have consistently failed to respond to the charges of fishermen, they often cannot recognize even the existence of thresholds favoring representations of fish as calculable and controllable single species populations.

The jigger inaugurates the transformation of cod fishing from an agonal hunting of fleshy wild cod to a harvesting of cod understood as biomass, a natural resource, standing reserve, industrial input, and swimming inventory. And the documented resistance of fishing people in Newfoundland and Labrador to the jigger, from the moment it appears, illustrates their sophisticated understanding of the consequences of threshold crossing on the nature of cod and the character of the fisherman and the fishing community. The resistance of cod fishermen to the jigger and other novel fishing gears continues to be dismissed by fisheries scientists and managers because the biological and social consequences perceived by fishermen often fail to manifest themselves in ways detectable to fisheries science.

The arguments of fishermen against fishing gear deemed to violate crucial thresholds are fundamentally different in kind from scientific management that focuses on identifying underlying problems amenable to technological solutions. Baited hooks and hand lines embed cod fishermen in thick and interconnected biological and social contexts. When cod fishing occurs with a baited hook and line, in the hands of an experienced fisherman, the human senses become engaged with the ocean and its creatures. The baited hook and line does augment the powers of the fisherman beyond what he can do with a spear or with his bare hands. Yet it does not magnify his powers to a point beyond his physical capacities as do powered tools. Nor does it diminish the powers of the codfish as do jiggers. The baited hook and line gives the codfish its due, respecting its migratory patterns, rhythms of eating and sleeping, and cycles of reproduction. When limited by the baited hook and line, the cod-fisheries end when the fish migrate, the codfish can be hunted only when they are hungry, and Mother fish are not killed especially when spawning. Fisheries science on the other hand, requires no engagement with the fish as a living being. Instead, the fish is understood to be an economic resource whose harvest quantity is determined through statistical sampling and population modeling.

In *Energy and Equity* Illich explains what causes such a time lag between the recognition of transgressed thresholds by fishermen, and the appearance of fishery problems that call out for solutions delivered by scientists and managers. In the case of energy use, Illich shows that "the threshold of social disintegration by high energy quanta is independent from the threshold at which energy conservation produces physical destruction."[10] He argues that social and cultural thresholds are more sensitive than bio-physical ones, occurring much earlier in human history and at lower levels of energy exploitation. Protests against jiggers in the 1850s prefigure, by over one hundred years, the emergence of fisheries science and management and precede by 150 years the actual biological collapse of cod stocks and the social collapse of cod fishing as a way of life.[11]

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[10] Ivan Illich, *Energy and Equity* IN. Toward a History of Needs (New York: Pantheon, 1978), 23

[11] For a list of the many attempts by fishing people to protest the introduction of threshold breaching fishing gears see Callum Roberts *The Unnatural History of the Sea* (Washington, DC: Island Press,2007) especially chapter ten. For examples specific to the cod fisheries of Newfoundland and Labrador see the canonical Harold Innis, *The Cod Fisheries: The History of an International Economy* (Toronto: University of Toronto Press, 1954) and Cadigan, S. *Hope and Deception in Conception Bay: Merchant-settler relations in Newfoundland, 1785-1855*. (Toronto: University Of Toronto Press, 1995); The Moral Economy of the Commons: Ecology and Equity in the Newfoundland Cod Fishery, 1815-1855. *Labour/Le Travail*. 43(Spring):9-42; Failed Proposals for Fisheries Management and Conservation in Newfoundland, 1855-1880. In. *Fishing Places, Fishing People*. Eds. D. Newell and R. Ommer. University of Toronto Press: Toronto; and 2003, The Moral Economy of Retrenchment and

Fishing as a way of life attuned to natural thresholds

While changes in the practice of cod fishing are most often presented as linear stories of progress, with baited hooks and hand lines being inevitably replaced by more efficient capital-intensive fishing technologies, there have been weak but consistent voices that tell a very different tale. These voices are best understood in their own words. Below are the words of an inshore cod fisherman who addressed an assembly of government officials, fisheries scientists, students, researchers and fellow cod fishermen: "Killing fish, that's what I do for a living. And do it quite proudly too. But we've got the technology developed that we can catch the last one that's out there…We've developed and become very very efficient at killing fish. But we started out with the hook and line -- Inshore cod fisherman."[12]

Repeated protests and political action by fishing people from around the world in response to the introduction of industrial fishing technologies, has mostly not received significant support from fisheries scientists, managers or politicians. The current official position of Canadian fisheries managers and politicians is "that no specific gear type is inherently destructive depending on how they are used."[13] This stance has led the government to focus on techno-scientific approaches to resolve Canadian fisheries issues. The Canadian government has also recently rejected a United Nations proposal for a global ban on bottom trawling. Fisheries scientists and managers seem blind to thresholds that are perceptible to the common sense of fishermen. Most often, fisheries issues are reduced to scientific problems amenable to managerial solutions. Once fishing issues are framed in techno-scientific terms, the management of fishing technology, rather than political and juridical interventions to ban specific fishing gears (as demanded by cod fishermen since the 1850s), becomes the approach taken toward fisheries. Unlike the fishermen, fisheries scientists, managers and politicians have repeatedly failed to grasp essential distinctions between different fishing gears and practices. Ever since Heincke's founding work, fisheries science and management have focused on quantitative measures to discover how much fishy biomass is available for maximum industrial exploitation rather than developing a detailed sense of how fishing is actually conducted, or and the implications of different types of gear on the nature of fish and the character of the fisherperson and their community.

Figure 1 provides a good opportunity to examine some of the thresholds associated with the history of fishing practices, the identity of the cod fisherperson, and the biological status of codfish under baited hook and hand lining verses cod jigging. The baited hook and hand line method requires the codfish to be alive & hungry; that fishing be actively conducted in baiting, throwing, enticing and hauling in the line with the wild fish struggling on the other end; and finally that the agonistic relation between cod and the fisherperson be played out. The fisherman uses all his senses and experienced skills to entice a hungry codfish to bite a baited hook at a particular time and place.

In contrast, jiggers, trawlers and gill nets are techniques to capture even sleeping,

Regeneration in the History of Rural Newfoundland. In. *Retrenchment and Regeneration in Rural Newfoundland*. Ed. R. Byron. University of Toronto Press: Toronto.

[12] Comments by an inshore cod fisherman on March 24th, 2003 at a meeting of the Department of Fisheries and Oceans, St. John's, Newfoundland, Canada.

[13] Canadian Fisheries Minister, 2004, United Nations Address at New York headquarters on technology and overfishing.

spawning and satiated cod—the nature of the cod's behavior is eclipsed and obscured by the power of the technology. Fish hunting is reduced to fish harvesting—operating tools that demand no relationship between cod and the fisherperson since cod are killed and scooped out of the sea as an abstract quota of biomass—legally sanctioned property.

Differences between fishing practices are embedded within a large set of intersecting processes with complex histories. What we believe is crucially important today is to help clarify the thresholds that separate "enough" from "too much" in world fisheries. Following Illich, we expect this to require hard work to create an effective political sphere where deliberations on what is appropriate and fitting for human relationships with fish remain open to the common sense of fishing people rather than being dominated, as in the past, by the deadly nonsense spouted by fisheries scientists, investors and managers.

Contemporary discussions surrounding world fisheries consistently fail to understand the arguments of fishing people in part because of a generalized blindness to the existence of thresholds that high energy industrial tools and ways of living transgress and ultimately obliterate. The colonization of the mind by scientific constructs such as single species fish populations and maximum sustainable yield (MSY) occurs prior to the social disruption and ecological collapse that often follows their real world application. Recovering from the atrophies of the mind caused by techno-scientific constructs is necessary if we are to avoid the deadly paradox of fisheries knowledge that produces what it is designed to prevent. The continued reliance on a form of scientific fisheries management that is oblivious to natural thresholds opens to a kind of life-boat ethics-where the survival of each requires suppressing the liberty of all. Listening to the arguments of hook-and-line fishermen, restoring the priority of subsistence over commercial production, and joining the global ban on bottom trawling could start to address the history of threshold breeching in world fisheries.

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