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Canada's Pacific groundfish trawl habitat agreement: A global first in an ecosystem approach to bottom trawl impacts

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ABSTRACT

The impact of bottom trawling to seafloor habitat has been one of the major marine conservation issues over the last two decades. This paper describes the pre-conditions, process, and the first two years of results of a precedent setting ecosystem based management plan to address the habitat impacts of bottom trawling in Canada's Pacific waters. In British Columbia, Canada, industry and conservation organizations worked collaboratively over a period of three years outside of government to develop measures which formally took effect on April 2, 2012. The measures include four main components: (1) ecosystem based trawling boundaries; (2) the world's first habitat quota; (3) an encounter protocol; and (4) formation of a habitat review committee. It is demonstrated that measures implemented have resulted in reduced impacts to sensitive benthic habitat features such as coral and sponge complexes. It is concluded that the conditions required to produce this agreement are not unique to British Columbia, yet that the potential to develop a similar agreement and management reform elsewhere does require a unique set of conditions involving seafood markets, an effective ENGO sector, a strong regulatory environment, intra-industry cooperation, and the proper incentives.

1. Introduction

The peaking of global wild capture fisheries in the mid-1990s brought with it the recognition that many of the world's fisheries were either fully or overfished [42]. Along with the increasing concern about fisheries overexploitation came growing awareness of the impacts of fishing on other aspects of the ecosystem, such as non-targeted species and habitat damage [43]. In the past, fishery regulators had, with few exceptions, given little attention to by-catch and habitat issues.

After the mid-1990s, conservation and research organizations focused increased attention upon fisheries related marine conservation issues, including the development of market based seafood sustainability programs (e.g., Seafood Watch and the Marine Stewardship Council). Environmental non-government organizations (ENGOs) involvement in fisheries related issues led to polarized positions with respect to how, if, and where, fisheries should be conducted.

The impact of bottom trawling to seafloor habitat has been one of the major marine conservation issues over the last two decades. The scientific community has generally agreed that the severity of the impact varies by habitat type and fishing gear being used, with biogenic habitats combined with mobile fishing gears being the most vulnerable [31]. In fishery jurisdictions where habitat protection has been given some consideration, the primary management measure has been to close vulnerable habitats to fishing effort through the use of spatial closures (e.g., [24]. While spatial closures for vulnerable habitats result in direct protection, it also comes with a suite of associated challenges: the full extent of habitats vulnerable to fishing are often not identified, costly to identify, widespread, and variable in size. Enforcement of closed areas can be difficult and their establishment is often opposed to by fishing interests, resulting in a political outcome to a conservation issue.

In British Columbia, Canada, industry and conservation organizations worked collaboratively over a period of three years to

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develop a unique habitat management plan for the groundfish bottom trawl fishery operating in Canada's Pacific waters. The result of this collaboration is the *British Columbia Groundfish Trawl. Habitat Conservation Collaboration Agreement*, which formally took effect on April 2, 2012. The agreement includes four main components: (1) ecosystem based trawling boundaries; (2) a habitat conservation bycatch limit (HCBL); (3) an encounter protocol; and (4) formation of a habitat review committee. These measures have been implemented through Fisheries and Oceans Canada (DFO) via the fishery's Integrated Fisheries Management Plan [12].

The agreement, at the time of writing, had passed the second anniversary of its implementation, and is now into its third year. Sufficient time has passed since the agreement's inception to allow us to assess the effectiveness of the new measures in achieving the ecological objectives, and to address additional fundamental questions regarding its development, such as how this agreement was possible and whether the agreement is replicable in other parts of the world. This paper describes the development and implementation of this comprehensive habitat management plan, and evaluates the effectiveness after two years of implementation.

1.1. Description of the issue and the regulatory environment

1.1.1. British Columbia's corals and sponges

Corals (Class Anthozoa) and sponges (Phylum Porifera) are abundant throughout the deep and cold waters of the northeastern Pacific. While these sponges and "deep sea" or "cold water" corals may not be as well known as their warm-water counterparts, they are important components of the marine ecosystem.

In the northeastern Pacific, cold water corals stretch from Hawaii to California [14] and northward to the Aleutian Islands [22] and Bering Sea [28]. Canada's Pacific waters are home to a minimum of 60 [25], and likely over 80 [10] species of cold water coral, including some that form substantial structures, such as those in the families Primnoidae, Paragorgiidae, and Isididae [1]. With rare exceptions, the corals found in British Columbia's waters are ahermatypic (i.e., they do not form reefs), but their colonies may be found growing in close proximity to one another in dense coral "groves" or "forests" [1]. Unlike corals found in warmer and shallower waters, most cold water corals of the northeast Pacific lack symbiotic zooxanthellae [25] and thus may be found well beyond the photic zone, at depths of hundreds to thousands of meters [14].

While there are over 300 species of sponges found in or near Canada's Pacific waters [18], the primary structure-forming taxa are the glass sponges of class Hexactinellida. Among British Columbia's hexactinellid taxa are three that are primarily responsible for building British Columbia's glass sponge reefs (*Aphrocallistes vastus*, *Heterochone calyx*, and *Farrea occa*; [26]), and several others that do not build reefs, but which may develop into large, highly complex individual structures [27].

Much of the ecological importance of corals and sponges is associated with their capacity to create three-dimensional structure. Such structure can modify hydrodynamics near the seafloor and thus affect flows of food and larvae [40], harbor invertebrates that are preyed upon by other invertebrates and fish [28], and provide substrate for egg cases, attachment platforms for sedentary invertebrates, shelter from predators, and energy-conserving refuge from water currents [7]. Recent research from Dixon Entrance [13], the Gulf of Alaska [17], the Aleutian Islands [37], and the Bering Sea [28] highlights the close associations between certain fish species (in these cases, *Sebastes* spp.) and corals and/or sponges.

Bottom-tending fishing gears can damage and destroy cold water corals and sponges and consequently the habitat associations. While fixed gears such as longlines and pots can cause damage [21], it is broadly acknowledged that mobile gears, and in particular bottom trawls and dredges, have the greatest impact [7]. The role of bottom trawling as a primary threat to corals and sponges has been supported through direct observations of trawled areas (e.g., [13,21]), and indirectly, via surveys of fisheries experts' knowledge [6].

1.1.2. The fishery, the ENGOs, and the issue

Canada's Pacific multispecies groundfish bottom trawl fishery (hereafter referred to as "the fishery") is a complex fishery, comprising approximately 70 active vessels that target a variety of flatfishes, rockfish (*Sebastes* spp.), thornyheads (*Sebastolobus* spp.), lingcod, pollock, sablefish, dogfish, skate, and Pacific cod [12]. Since 1997, the fleet has operated under a system of Individual Transferrable Quotas (ITQs), which are currently broken down into 58 species/area quota combinations [10]. In 2014 there as a total of 151,000 t of allocation covering most of the marketable species captured in the fishery. In addition there are also allocations for non-marketable species as a means of controlling bycatch (e.g., bocaccio rockfish and Pacific halibut). The fleet receives 100% at-sea observer coverage combined with 100% dockside monitoring of off-loaded catch [12].

Prior to the turn of the 21st century, British Columbia's structure-forming sponges and cold water corals had received relatively scant attention from scientists [1], but research efforts and general awareness of their ecological importance began to increase in the early 2000s. As awareness increased, Canadian ENGOs began criticizing the trawl fishery and its management for the fishery's impacts on corals and sponges in part due to comprehensive at sea observer data recording the capture of habitat forming corals and sponges. The ENGOs' campaigns included the publication of reports that called attention to the issue, direct research efforts, and a variety of other media and outreach actions [5]. Areas containing three large glass sponge reefs were closed to bottom trawling in 2002, but no further management measures were taken to address the fishery's impacts on corals and sponges [5].

A factor that was likely a significant hindrance to improved management was the lack of a legal or policy mandate for fisheries managers to manage fishing gear impacts on habitat. Canada's *Fisheries Act* is the country's guiding piece of fisheries legislation. In 2004, a federal court ruled that the *Act's* prohibitions against the harmful alteration, disturbance, or destruction of fish habitat did not apply to commercial fisheries [15].

Without the impetus provided by a legal mandate, management of habitat impacts from Canadian fisheries has only recently been considered within a national policy framework. In response to the 2006 United Nations' Sustainable Fisheries Resolution, DFO released its Policy for Managing the Impacts of Fishing on Sensitive Benthic Areas in 2009 [9], and in 2013 released an accompanying Ecological Risk Assessment Framework (ERAF) *for Cold-water Corals and Sponge Dominated Communities* [10,11]. At the time of this publication, however, the policy, framework, and strategy have yet to be applied to any fishery in Canada.

In 2010, with this science, policy, and advocacy context in the background, and without any signs of immediate government action on the issue, the trawl fishery represented by the Canadian Groundfish Research and Conservation Society (CGRCS) and the Deepsea Trawlers Association, and the ENGOs, represented by the David Suzuki Foundation and Living Oceans Society, initiated informal discussions regarding a mutually acceptable path forward on the issue of trawl damage to corals and sponges.

1.2. Theory: internalizing externalities

Economists are fond of talking about negative "externalities", where such externalities are costs arising from the activities of