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Offsetting the Destruction of Marine Fish Habitat During Coastal Development Projects in Canada

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Abstract

Under the *Fisheries Act of Canada (2012)*, proponents of development projects are responsible for offsetting the destruction of freshwater and marine habitat if "serious harm" is expected to occur to fish supporting a commercial, recreational or Aboriginal fishery. One method of offsetting lost fish habitat in the coastal marine environment is the creation of artificial reefs. Artificial reefs are constructed with ships, rock or other hard substrate that creates surfaces upon which marine life can grow and seek shelter. We examine the conditions under which an artificial rock reef is equivalent to lost marine habitat and can satisfy the legislated requirement of maintaining or enhancing the productivity of a fishery impacted by a development project. To help achieve the objective of maintaining the productivity of the fisheries impacted by development projects, we recommend that coastal engineering plans for offsetting works incorporate the environmental requirements of the relevant fishery species during the critical juvenile stage of its life history.

Keywords: Artificial rock reef, *Fisheries Act of Canada,* Offsetting destroyed marine habitat

Introduction

Fisheries in Canada are highly valued, both for cultural and economic reasons. To manage fisheries sustainably, there exists federal legislation aimed at protecting fish habitat that support Canada's freshwater and marine fisheries. The *Fisheries Act* is the federal legislation addressing fish habitat protection. Several amendments were made to the *Fisheries Act* in 2012. These amendments are aimed at protecting the species and their habitats that support commercial, recreational, and Aboriginal fisheries.

This paper reviews the changes to the *Fisheries Act* in 2012 and regulations regarding fish habitat protection and current practices to offset habitat destruction. We focus on marine fish habitat, and make recommendations to improve the effectiveness of artificial rock reefs constructed to offset the destruction of marine fish habitat.

Amendments to the *Fisheries Act*

It has been long known that natural fish habitat is an essential requirement for sustaining the productivity of fish populations (Minns *et al*., 2011). Fish habitat is defined as "spawning grounds and any other areas, including nursery, rearing, food supply and migration areas, on which fish depend directly or indirectly in order to carry out their life processes" (Section 34(l) of the *Fisheries Act*, 2012). Coastal marine environments worldwide are being altered by a myriad of human activities.

As the abundance of fish populations and the economic success of fisheries are directly linked to the quantity and quality of fish habitat, there is consensus that fish habitat must be protected. In Canada, a mandate of the federal government is to sustainably manage living marine resources. The federal government is responsible for fisheries under the Constitution Act of 1867, and fulfills its constitutional obligations through the *Fisheries Act*. The *Fisheries Act* dates back to Confederation (1 July, 1867), when it was created to manage and protect Canada's fisheries resources. Today the Act applies to all of Canada's inland waters and Exclusive Economic Zone in coastal waters. The Act contains provisions that allow the federal government to make decisions concerning the environmental impact of human activities on fish habitat. The *Fisheries Act* is considered to be the legislative basis for the protection of aquatic environments, with the threat of fines or imprisonment for those convicted of destroying fish habitat.

The habitat protection provisions of the *Fisheries Act* were strengthened in 1976 by the addition of text in Section 35(1) that included comprehensive habitat protection for all fishes. Specifically, 35(1) stipulated that: "No person shall carry on any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat". On 29 June 2012, the *Jobs, Growth and Long-term Prosperity Act* omnibus Bill C 38 which contained amendments to the *Fisheries Act* received Royal Assent. The new fisheries protection provisions of the *Act* came into force on November 25, 2013. The revised *Act* contains a prohibition in Section 35(1): "*No person shall carry on any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery*" (Government of Canada, 2013). The prohibition is backed by definitions of commercial, recreational and Aboriginal fisheries in the *Fisheries Act* (2012). "Serious harm to fish" is defined as the "*death of fish or any permanent alteration to, or destruction of, fish habitat."*

In a news post by Fisheries and Oceans Canada (DFO) in October 2013, it was stated that upon implementation, the amendments made to the *Fisheries Act* will focus the fisheries protection provisions on managing threats to the sustainability and ongoing productivity of the commercial, recreational, and Aboriginal fisheries, or to fish that support such a fishery (DFO, 2013). Fully implemented, the amendments are expected to impact the scope, language, and the approval process for future developments, undertakings or activities (hereafter referred to as "projects"; DFO, 2013). The changes that particularly affect fish habitat protection include:

- a shift in the Act's focus from protecting all fish habitat to protecting the productivity of the commercial, recreational and Aboriginal fisheries;

- the definition of "serious harm to fish" as the death of fish or any permanent alteration to, or destruction of, fish habitat; applicable only to the fish supporting the three categories of a fishery;
- a duty for developers to report unauthorized serious harm to fish that are included in one or several of the three categories of a fishery.

Authorization for Development Projects under the *Fisheries Act*

Proponents of development activities that could adversely affect fish or fish habitat have certain responsibilities under the *Fisheries Act* and the Fisheries Protection Program. These responsibilities include understanding the types of impacts the project is likely to cause; taking measures to avoid or mitigate impacts as feasible; and requesting an authorization through Paragraph 35(2) (b) of the *Fisheries Act* if serious harm to fish is likely to occur. This provision in the Act allows the Minister of Fisheries and Oceans to authorize, with conditions, a project that will contravene Subsection 35(1) and result in serious harm to fish. Proponents are considered responsible for determining whether their projects are likely to require authorization, using standard guidance made available by DFO, or by seeking expert advice as required.

The information requirements and documentation that proponents must submit in order to obtain an authorization is set out in the "Applications for Authorization under Paragraph 35(2) (b) of the *Fisheries Act* Regulations*"* (DFO, 2013). Specific to offsetting the destruction of fish habitat, these regulations require that proponents submit offsetting plans to DFO for the serious harm to fish that is expected to occur. Proponents are responsible for making the necessary investments for the protection of fisheries and are required to offset any remaining impacts that the project may cause. *The Fisheries Productivity Investment Policy*: *A Proponent's Guide to Offsetting* has been published by DFO for the purpose of assisting proponents of existing or proposed projects that could result in serious harm to fish (DFO, 2013).

The *Fisheries Productivity Investment Policy* contains an outline of the content and key steps for the offsetting plan that must be included as part of a proponent's application for authorization under Paragraph 35(2) (b) of the *Fisheries Act*. An overview of a developer's process in preparing an offsetting plan is presented in Figure 1 (DFO, 2013).

Steps	Considerations
Step 1: Characterize the residual *serious harm to fish*	• Quantify project impacts
Step 2: Select offsetting measures	• Follow guiding principles for offsetting measures
Step 3: Determine the amount of offsetting required	• Quantify offset benefits • Balance offset benefits with project impact • Account for uncertainty • Address implementation time lags
Step 4: Monitoring and reporting conditions	• Assess offset effectiveness • Describe contingency measures
Step 5: Submit plan to DFO	• Letter of credit • Estimate offset implementation costs • Secure access to lands and water bodies

Figure 1- Steps for proponents in preparing an offsetting plan (DFO's *Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting*, 2013).

Fish Habitat Destruction Offsetting Practices

Fish habitat is scientifically defined through functions of the biotic and abiotic environments where a fish lives (Anderson *et al*., 2008). Marine fish habitat primarily refers to the physical nature of seafloor characteristics. Habitats in the marine environment include natural sea bottom substrates (such as mud, sand, gravel, cobble, boulder, bedrock, reefs and seaweeds), and man-made structures (such as wharves, oil drilling platforms, breakwaters, and artificial rock reefs) (Sargent *et al*., 2006).

Seascape complexity is a key component of fish habitat, and elements such as spatial pattern (size, shape, fragmentation, connectivity) and physical location (relative to major feeding and spawning areas) are seen as important determinants of fish productivity (Beck *et al*., 2001). Several studies have assessed the local effects of habitat complexity, reporting increased richness and abundance in more complex habitats (Gee and Warwick, 1994; Matias *et al*., 2010), though the mechanisms behind this effect are varied (Kovalenko *et al*., 2012). It has been found

that structurally complex habitats provide fish with shelter from predators and have a higher invertebrate prey density than do barren sea floors (Sargent et al., 2006).

Biodiversity serves as the basis for the habitat complexity concept in conservation science (e.g. Hueckel *et al*., 1989; Sargent et al., 2006; Hunter and Sayer, 2009). Artificial reefs increase habitat complexity in the aquatic environment and are used as a tool for investigating the effects of habitat complexity on fish populations (Bohnsack, 1991). Artificial reefs are typically constructed from waste rock materials, or can develop from sunken shipwrecks, offshore oil structures, and many other structures that contribute to increased habitat complexity on the seafloor. There is an extensive body of published literature studying artificial reefs, the majority of which have been based in tropical or subtropical regions. When compared to this, few studies have looked at artificial reefs in cold temperate and subarctic waters, such as those found off the coasts of Newfoundland and Labrador (Sargent *et al*., 2006).

Monitoring is required to evaluate changes in artificial reef biological productivity as well as its structural stability. Without effective monitoring, it is not possible to make any conclusions as to whether the offsetting works are successful in satisfying the intent of the federal legislation. There has been a reported lack of expertise in habitat compensation science in Canada, with insufficient monitoring conducted (Drodge, *et al*., 1999; Harper and Quigley 2005a, 2005b). A standardized approach to designing and implementing monitoring programs that can assess the effectiveness of habitat compensation does not currently exist (Cudmore-Vokey, *et al*., 2000; Harper and Quigley, 2005b).

A review of coastal infrastructure (breakwaters, rock walls, jetties) in marine environments suggests that man-made infrastructure supports different epibiota and associated assemblages and is not a direct replacement for natural rocky habitats (Bulleri and Chapman, 2010). Coastal structures may contribute to habitat fragmentation and alter biodiversity by modifying natural patterns of species dispersal (Bulleri and Chapman, 2010).

A study published in 2006 (Sargent et al.) looking at the density responses of marine fish in Newfoundland to artificial rock reefs found that the densities of some fish species increased near artificial reefs when compared to baseline conditions. For the species that showed an association with the artificial reefs, densities tapered to baseline levels within 20 m from the reefs; indicating that inter-reef spacing should not be overlooked in the design phase (Sargent et al., 2006).

The guidance provided by DFO (2009) on artificial rock reefs as marine habitat compensation works provided several recommendations to be followed for an effective monitoring effort. It was recommended that a control site be selected in the nearby area but at a sufficient distance to avoid any productivity influences from the artificial rock reefs. The control site should be an area with habitat features similar to the pre-construction conditions at the artificial reef locations. It was also recommended that a survey be conducted following the completion of rock reef construction to verify the amount of habitat created. Monitoring surveys should be also conducted several years after construction to assess the stability of the artificial reefs as well as document biological recolonization (DFO, 2009).

Conclusions

The amendments to the *Fisheries Act* in 2012 have re-defined the fish habitat protection provisions to focus on maintaining the productivity and sustainability of Canada's fisheries. Development projects in Canada that have received authorization to cause "serious harm" to fish under the *Fisheries Act* (2012) are required to achieve successful fish habitat offsetting – but it remains to be measured and proven that past efforts have been enough to satisfy the intent of the federal legislation. This places an emphasis on having quantitative monitoring programs implemented for the completed offsetting works.

Because the Fisheries Act (2012) now focuses on commercial, recreational and Aboriginal fisheries, the coastal engineering construction of offsetting works should consider the specific environmental requirements of the critical juvenile life stage of these fishery species. Artificial rock reefs should be designed to provide the juvenile stage of these species with maximum shelter from predation. In addition, the artificial reefs should provide adequately hard substrate surfaces upon which marine life can grow, providing food for the fishery species. If these considerations are worked into the engineering designs for fish habitat offsetting projects and coupled with a quantitative monitoring effort, the offsetting works have the potential to be successful in maintaining or enhancing the productivity of Canada's fisheries.

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