

FEATURE

Project Review Under Canada's 2012 Fisheries Act: Risky Business for Fisheries Protection

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Whiteshell River, Pine Point Trail, Whiteshell Provincial Park, Manitoba, Canada. Photo credit: Robert Linsdell.

Canada's *Fisheries Act* provides essential protection for fish and their habitat. To manage thousands of projects a year, Fisheries and Oceans Canada implements a risk-based framework requiring authorization and offsetting for the highest risk projects. Projects considered lower risk proceed via letters of advice. Following changes to the Act in 2012, there were concerns about transparency and cumulative effects of low-risk projects. We used access to information requests to obtain documents and reviewed the department's 2012–2019 risk-based framework. Projects reviewed in Manitoba in 2016 were examined and the amount of permanent alteration and destruction approved without authorization was quantified (23,881 and 6,768 m², respectively). The risk-based framework focused reviews and regulatory decisions on project-by-project effects, rather than cumulative risks from multiple projects. Harm from lower risk projects was not tracked or offset. New mechanisms are needed to manage such projects to achieve the conservation purpose of the Act.

INTRODUCTION

The *Fisheries Act* (hereafter, the Act) is one of Canada's oldest environmental laws and the primary legislative tool protecting fish and their habitat. The Act prohibits the carrying on of any work, undertaking, or activity (WUA) that results in harm to fish habitat or death of fish, unless authorized by the Minister of Fisheries, Oceans, and the Canadian Coast Guard. Fisheries and Oceans Canada (DFO) implements this prohibition by developing policy and procedures that interpret the Act and guide application of regulatory and compliance measures, including the review and authorization of proposed projects that may harm fish habitat or cause the death of fish. Authorizations to alter or destroy habitat include legal requirements for proponents (people or entities, such as municipalities, agricultural producers, and forestry companies carrying out projects) to offset harm remaining after avoidance and mitigation efforts. Implementation of the fish habitat protection provisions has faced many challenges; however, the review and authorization of small, "low-risk" projects has been a dominant ongoing problem (Minns 2001; Olszynski 2015; Rice et al. 2015). Such projects number in the thousands annually, are not typically appropriate for application of habitat offsetting tools available under the Act, and become a regulatory burden to DFO and project proponents. However, small projects can destroy important habitat for fish production or lead to cumulative impacts in areas with intensive development pressure.

As written, the Act prohibits *any* alteration or destruction of fish habitat unless authorized by the Minister. In practice, it is not reasonable to apply the authorization and offsetting provisions of the Act with the same level of oversight and enforcement to every activity that affects habitat in marine and freshwater environments. This scenario is common to many environmental regulations and has led to the development of risk-based regulatory and compliance approaches that apply a suite of tools to regulated activities according to some framework for risk assessment (Hood et al. 2001). Ultimately, a risk-based approach requires that regulators be clear about which risks will be managed as lower priorities and be prepared to deal with the consequences, both political and practical, of setting a level of risk tolerance (Baldwin and Black 2008). In the case of the fish and fish habitat protection provisions, this means being clear about which types of habitat impacts will be managed intensively or not, and what the level of risk (habitat alteration and destruction) tolerance will mean for fish and fisheries.

A risk-based approach to project review has been implemented by DFO since 2005 (DFO 2015a). The approach uses surface area of impact and an estimate of habitat quality to classify impacts as high- or low-risk. Projects identified as low-risk based on the criteria proceed without an authorization and without a requirement to offset harm to fish habitat. Instead of an authorization, proponents receive a letter of advice (LOA) that indicates the project may proceed. These LOAs may also

include specific recommendations to avoid or mitigate impacts. In 2012, amendments to the Act further reduced regulatory burden on proponents and the department (Galloway 2013) and appeared to weaken protections by changing the language of the Act to a prohibition on "serious harm" to fish and fish habitat (see Hutchings and Post 2013), concurrent with a major reduction in regulatory staff capacity (DFO 2016a). Concerns that the 2012 revisions to the Act weakened protections for fish and fish habitat led to a Parliamentary review and legislative amendments in 2019.

From an ecosystem and fish production perspective, the concept of aquatic systems being resilient to some loss/alteration of habitat or death of fish is well supported (Koops et al. 2013; Rice et al. 2015); however, cumulative effects of multiple projects can exceed resiliency thresholds (Thrush et al. 2008; Koops et al. 2014). If cumulative alteration or loss of habitat is not tracked and cumulative impacts are not assessed for a watershed, lake, or coastal area, then the overall effects on aquatic ecosystems of projects that alter or destroy habitat will remain unquantified and overlooked, as was noted in a 2009 audit of the fish habitat protection program (OAGC 2009). In this context, concerns have been raised that DFO's risk-based approach is potentially facilitating detrimental cumulative effects (Olszynski 2015; Favaro and Olszynski 2017).

Here, we review the 2012–2019 framework for risk-based project review to help inform changes to the regulatory approach currently under development to address amendments made to the Act in 2019. Our objective is to provide recommendations for improvements to the risk-based framework based on: (1) a review of DFO's internal triage and regulatory review processes that detail how decisions were made on whether to issue an LOA or advise proponents to apply for an authorization; (2) an examination of how the framework was applied in practice and the types of projects that proceeded without an authorization using projects reviewed in 2016 in Manitoba as a case study; and (3) an examination of the quantity of alteration and destruction of fish habitat that resulted from these projects.

METHODS

We used a federal Access to Information and Privacy (ATIP) request to acquire a copy of DFO's internal guidance documents for evaluating Requests for Review in March 2018 and received un-redacted copies in July 2018. We also requested all Subsection 35(2) Requests for Review, Applications for a *Species at Risk Act* (SARA) Permit, Applications for Authorization under Paragraph 35(2)(b) of the *Fisheries Act* Regulations and associated documentation for all projects for which a final decision was reached in 2016 across Canada. 2016 was selected, as it was the most recent year for which all decisions would be complete and information available. Given feedback from the ATIP office on the magnitude of this request, it was subsequently reduced to only projects in Manitoba.

Manitoba was selected because it was likely to involve a manageable number of projects in a variety of freshwater and marine habitats with significant inland fishery values (second only to Ontario; DFO 2016b).

We outlined the risk-based decision framework used by DFO for assessing Requests for Review based on internal guidance documents. This framework involved two stages: initial screening (triage), followed by regulatory review. The triage process was summarized based on internal triage guidance (DFO 2013a). The regulatory review process for determining the need for an authorization was summarized based on the Localized Effects Assessment Determination Record Guide (LEADR Guide; DFO 2016c). The overall process and decision points for each review stage were described.

All documents associated with projects in Manitoba for which a final decision was reached in 2016 were reviewed in chronological order. These documents included Requests for Review from proponents, internal records of DFO's assessments at each review stage (triage and, if applicable, regulatory review), and LOAs and authorizations issued to proponents outlining final decisions and recommendations. For each project, the following information was summarized: area of effect

(m²), a brief project description, residual impacts, habitat type (riverine, riparian, lacustrine, marine), and recommended course of action (generic or site-specific LOA, LOA with additional species at risk mitigation, authorization, SARA Permit). In compiling this information, we used the most recent data available in project files. For example, the estimated area of effect or determination of aquatic species at risk presence might have been updated from the initial Request for Review after regulatory review by a DFO biologist, in which case updated information was used.

Projects were categorized by review stage (triaged out or proceeded to regulatory review). For projects that received an LOA, we calculated: range of effect sizes, median, mean, and total habitat destroyed and/or habitat permanently altered, and the number of projects causing death of fish. Finally, three case studies were described to demonstrate the range of project activities and their effects.

RESULTS

Along with the triage and regulatory review guides, the ATIP request yielded 12 different document types used during project

Table 1. Descriptions of document types and number received from the 2018 Access to Information and Privacy Request for all Subsection 35(2) Requests for Review, Applications for a *Species at Risk Act* Permit, Applications for Authorization under Paragraph 35(2)(b) of the *Fisheries Act* regulations, and subsequent documentation for projects in Manitoba for which a final decision was reached in 2016.

Document type	Description	Number received
Request for Review	Proponents submitted a Request for Review outlining their project plans if they determined independently or through Fisheries and Oceans Canada (DFO)'s online self-assessment tool that it was likely their project could cause serious harm to fish and fish habitat (Available: http://bit.ly/3u4NLWh)	36
Request for Review Appendix	Appendices including additional project details were sometimes provided by proponents along with a Request for Review	2
Harm Determination Record (HDR)	A DFO internal review form used prior to March 2016 to assess Requests for Review. HDRs were completed by DFO staff using information provided in the Request for Review to evaluate the potential of a project to cause a "localized effect" (definition below) to fish or their habitat. The recommended course of action was based on assessments in this document	8
Localized Effect Assessment Documentation Record (LEADR)	A DFO internal review form used after March 2016 to assess Requests for Review. This had a similar purpose and structure to the HDR, with some additions. The recommended course of action was based on assessments in this document and guided by the associated LEADR guide	6
Generic Letter of Advice (LOA)	If DFO determined that the project was unlikely to cause localized effects to fish or their habitat after assessing the Request for Review, a generic LOA reiterating the proponent's responsibilities to avoid serious harm was issued. No offsetting was required	20
Site-specific Letter of Advice	Following assessment of the Request for Review, if DFO determined that additional mitigation was required to avoid localized effects, a site-specific LOA containing additional mitigation recommendations was issued. The recommendations were considered advice. No offsetting was required	16
Application for Authorization under Paragraph 35(2)(b) of the <i>Fisheries Act</i>	If either the proponent or DFO determined a project would cause unavoidable serious harm that would result in a localized effect to fish habitat in the vicinity of the project, the proponent submitted this form to apply for an authorization	1
Application for a <i>Species at Risk Act</i> (SARA) Permit	This application was submitted by the proponent if the project would result in the killing, harm, or harassment of individual aquatic species at risk or destruction of their critical habitat	1
Record of Consideration of Conditions (SARA)	This record was kept on behalf of the Minister to demonstrate how the conditions set out in Section 73 of SARA were considered prior to the issuance or refusal of a SARA Permit	1
Consideration of Factors in Section 6 of <i>Fisheries Act</i>	This record was kept on behalf of the Minister to demonstrate how the factors set out in Section 6 of the Act were considered prior to issuance or refusal of an authorization	1
Authorization	This document authorized proponents to proceed with a project causing a localized effect to fish and/or fish habitat, with requirements to offset unavoidable impacts	1
SARA Permit	This permitted proponents to engage in activities that killed, harmed, harassed, or captured individuals of threatened or endangered species or destroyed their critical habitat, provided the harm was incidental or would benefit the species, and that project implementation would satisfy conditions in Section 73 of SARA	1

reviews in Manitoba in 2016. Table 1 provides descriptions of each document and the number of each received (94 total).

Project review began by proponents evaluating whether serious harm (language of the Act from 2012 to 2019) may result from the project (Figure 1). When uncertain, proponents submitted a Request for Review directly or determined the need for review using DFO’s online self-assessment process. If proponents were certain that the nature of impacts would require an authorization or *Species at Risk Act* Permit, they would apply directly for them rather than submit a Request for Review.

Triage

Requests for Review were processed by DFO Fisheries Protection Program (FPP) triage staff using a screening process (Figure 2). A Triage Tracking Guidance Form (DFO 2013a) was used to evaluate projects and decide whether regulatory review was required. First, projects were screened out of regulatory review if habitat present at the project location was considered low priority based on a Low Priority Waterbody List included in the guidance. Examples of low-priority habitats included non-fish-bearing waterbodies and industrial or man-made ponds or irrigation channels.

Second, projects were screened for impact types considered higher risk: those that should be prioritized for review based on past authorizations, existing guidelines, scientific advice, and

staff expertise. Triage staff referred to a High Priority Impact Table that included advice and past decisions on whether to recommend regulatory review for common activities such as infilling, deposition of non-deleterious substances in water, changes in flows/water levels, dredging/excavating, watercourse alteration, and fish mortality. For example, it was advised that previously authorized dredging projects in 2011–2012 (the most recent fiscal year prior to development of the guide) ranged in area from 4,000 m² to over 2 million m², and that dredging and infilling proposals >250 m² should undergo regulatory review.

Finally, habitats and species for which regulatory review should be undertaken irrespective of impact type or size were identified based on region-specific guidelines (the High Priority Species and Habitat List). These included projects proposed in rare or limiting habitat, in ecologically sensitive areas, or that could affect aquatic species at risk and their residences or critical habitat. If projects did not meet any criteria for regulatory review, proponents were sent a generic or, in some cases, site-specific LOA, indicating the project could proceed without an authorization. However, FPP triage staff could still recommend regulatory review, despite a project not meeting the criteria, if specific justification was provided. For example, a project proposal not on the Low Priority Waterbody List and falling below thresholds for a high-priority impact (an infill <250 m²) could be sent for further regulatory review if the risk

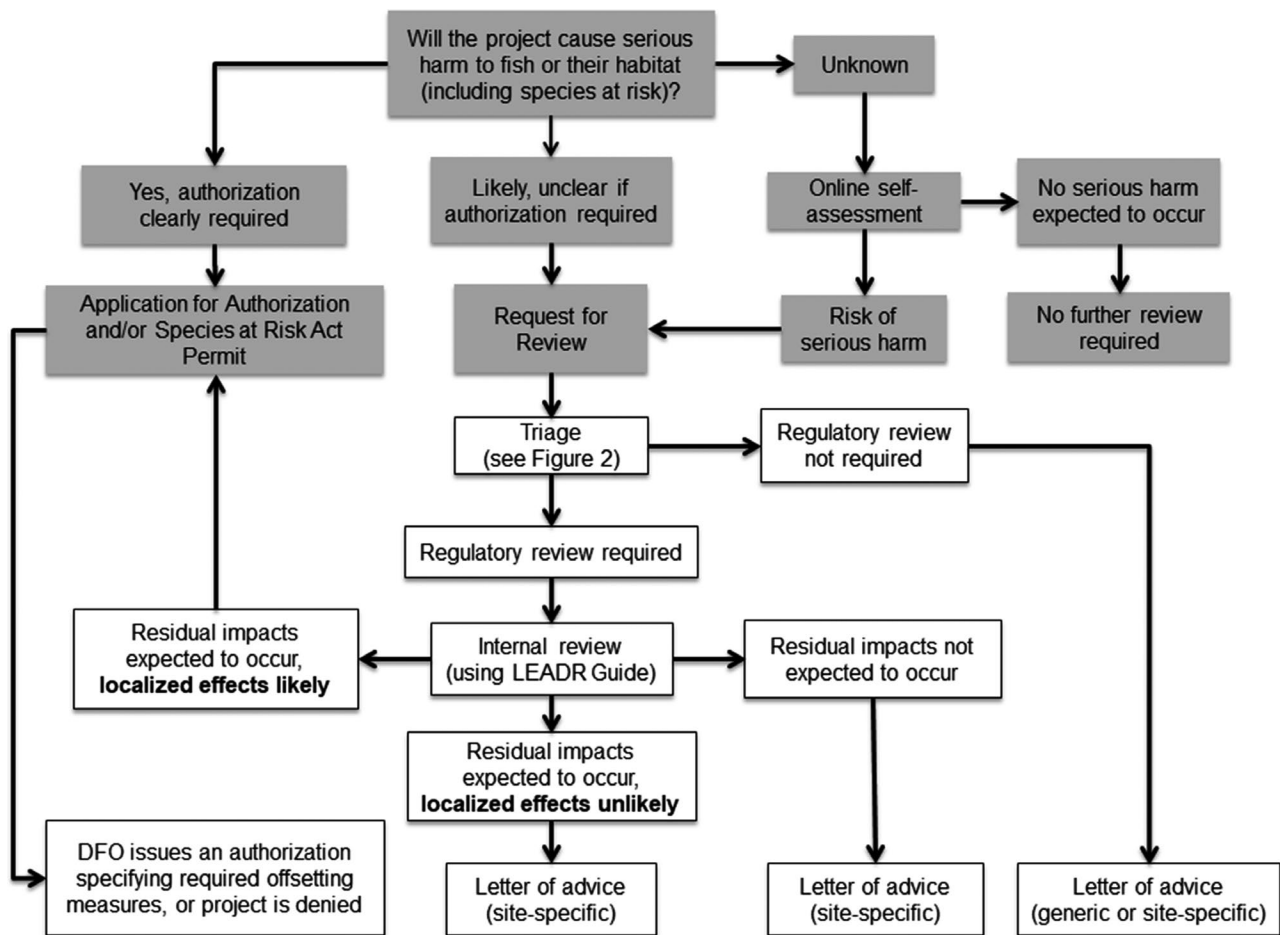


Figure 1. Sequence of actions and decisions made by proponents (shaded) and Fisheries and Oceans Canada (DFO; white) when determining whether a project is likely to have a localized effect and therefore require an authorization. LEADR Guide = Localized Effects Assessment Determination Record Guide

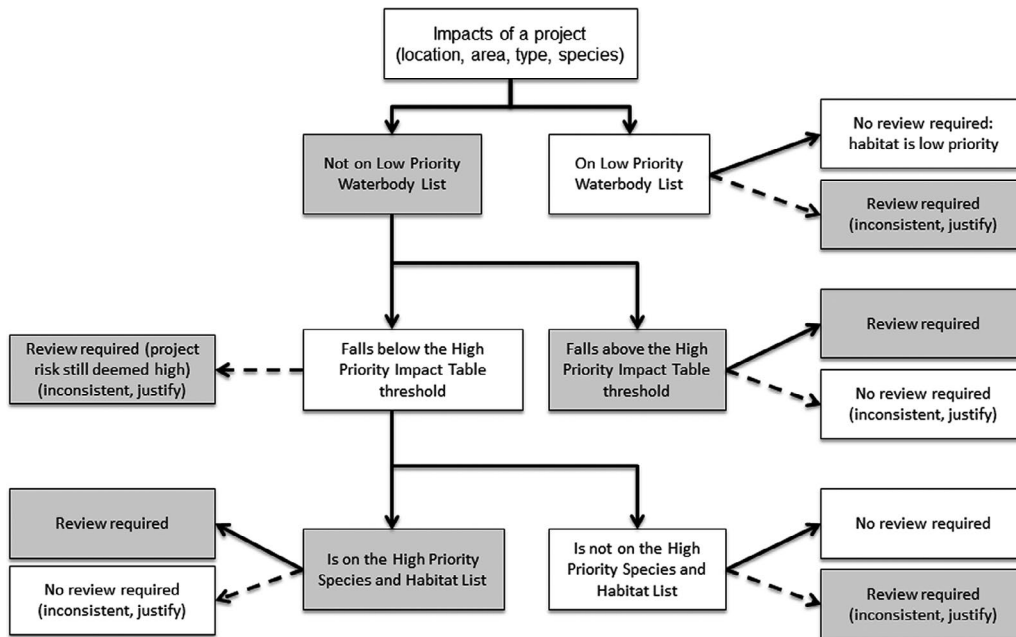


Figure 2. Sequence of criteria assessed by Fisheries and Oceans Canada triage staff when deciding whether a project should require regulatory review. Criteria and decisions leading to regulatory review are represented as shaded boxes. Dashed arrows represent decisions that are inconsistent with the Triage Tracking Guidance Form recommendations and require justification from triage staff (Figure adapted from DFO 2013a).

associated with the impact size or activity type was deemed high (e.g., infill size relative to waterbody size).

Regulatory Review

Projects requiring regulatory review were forwarded to FPP regulatory review biologists who used internal guidance documents to assess projects and determine if an authorization was required. The guidance documentation changed part way through the time period of our analysis of project reviews in Manitoba. From January to March 2016, a regulatory review document called the Harm Determination Record (HDR) was used. In March 2016, this was replaced by a document called the Localized Effect Assessment Documentation Record (LEADR) Guide (DFO 2016c), and the associated LEADR Form. Reviewers filled out LEADR Forms based on information provided by proponents in a Request for Review, an application for an authorization or SARA Permit, or a provincial application from an area where a DFO-provincial agreement was in place. We did not receive a guide for HDR

Forms; however, based on the similarity between HDR and LEADR Forms (the LEADR Form added options to recommend species at risk mitigation within an LOA or SARA conditions within an authorization) we understood that they served the same purpose.

The purpose of the LEADR Guide was to aid regulatory review biologists in deciding whether to issue an LOA or recommend that proponents apply for an authorization. The basis of this decision was whether residual impacts (unavoidable serious harm after measures to avoid and mitigate) would result in a “localized effect...of a spatial scale, duration or intensity that cause the death of fish that may negatively affect the population of fish in the vicinity of the project, or that diminish or eliminate the ability of fish to use habitats within the vicinity of the project to carry out one or more of their life processes” (DFO 2016c). The vicinity of the project was defined as the area in which impacts were likely to occur directly or indirectly and its size could vary depending on the magnitude of project impacts and habitat type (rarity, quality).

		Fish Habitat Category				
		Category	No Habitat	Low	Average	Important
Size of impact (m ²)	<100					
	100-250					
	250-500					
	500-1000					
	1000-5000					
	5000-10 000					
	>10 000					

Figure 3. Habitat decision matrix included in the Localized Effects Assessment Determination Record Guide used when determining the course of regulatory action for a proposed project (light = letter of advice, shaded = recommend applying for authorization) based on habitat quality and size of impact (DFO 2016c).

Regulatory review biologists recorded the following information in the LEADR Form as the basis for their decision: project description, fish species present, habitat description, presence of species at risk and their habitat, measures taken to avoid and mitigate, residual impacts, and whether these residual impacts were significant enough that a localized effect was likely. The LEADR Guide provided a list of recommended considerations for the likelihood of fish mortality to result in a localized effect: life-history characteristics, spawning success, generation time, population status, and natural or other major sources of mortality. The LEADR Guide also provided a decision matrix based on size of impact and quality of affected habitat (Figure 3).

This matrix provided regulatory review staff with thresholds beyond which permanent alteration or destruction caused by the project were expected to result in a localized effect and require an authorization. Habitat quality could range from low to exceptional. Exceptional habitats were described as those that were rare or limiting, exceptionally productive, or residences/critical habitat for aquatic species at risk. Low-quality habitats were described as not meaningfully contributing to the productivity of fisheries, ubiquitous and not limiting in any way, or historically altered by human activities. Projects whose size of impact and quality of affected habitat fell below the thresholds in the decision matrix were issued an LOA.

Table 2. Summary of Requests for Review in Manitoba in 2016 that were triaged out of requiring regulatory review. For each project the following information was extracted and summarized: area of effect (m²), brief project description, residual impacts (permanent alteration, destruction, death of fish, *Species at Risk Act*, not applicable [NA], or unknown), habitat type (riparian, lacustrine, riverine, marine), and resulting action (generic or site-specific letter of advice [LOA]).

Project #	Area of effect (m ²)	Description	Residual impacts	Habitat type	Course of action
2	0	Directional drilling under a river	NA	Riparian	LOA (generic)
4	0	Replacing a gravel boat launch with a concrete one	NA	Lacustrine	LOA (generic)
5	0	Replacement of a trestle with a bridge	NA	Riparian	LOA (site-specific)
7	50	Reinforcement of a float-plane launch ramp	NA	Riparian	LOA (generic)
8	500	Trenchless installation of a watermain	NA	Riparian	LOA (site-specific)
11	700	Infrastructure and river-walk upgrades	NA	Riparian	LOA (generic)
12	27.1	Culvert widening, bridge replacement	Permanent alteration, destruction	Riverine	LOA (generic)
13	27.1	Bridge replacement	Permanent alteration, destruction	Riverine	LOA (generic)
14	27.1	Bridge replacement	Permanent alteration, destruction	Riverine	LOA (generic)
17	60	Remediation of a failed riverbank	Permanent alteration, destruction	Riverine	LOA (generic)
18	100	Bridge replacement	Permanent alteration	Riverine	LOA (generic)
20	120	Bridge repairs, rip rap placement	Permanent alteration, destruction	Riverine	LOA (generic)
22	108	Emergency culvert replacement	NA	Riparian	LOA (generic)
23	60	Shoreline stabilization	NA	Riparian	LOA (generic)
24	74	Shoreline stabilization, riprap placement	Permanent alteration, destruction of habitat	Riverine	LOA (generic)
25	1	Geotechnical investigation for a sewer pipe	Destruction of habitat	Riverine	LOA (site-specific)
26	32	Culvert installation	Permanent alteration, destruction	Riverine	LOA (generic)
29	12	Dredging silt in a creek cut-out	NA	Riverine	LOA (generic)
30	160	Boat launch, ramp replacement	NA	Riparian and riverine	LOA (generic)
32	150	Shoreline stabilization, riprap placement	Permanent alteration, destruction	Riparian and riverine	LOA (generic)
35	15	Boat launch	NA	Riverine	LOA (generic)
36	929	Canal cleanout	Unknown	Lacustrine	LOA (generic)
37	625	Removal of rocks from tidal flats	NA	Marine	LOA (generic)

Project Summaries

A total of 37 projects containing 41 WUAs and their corresponding documents were evaluated. The type of habitat affected across all projects was: 58% riverine, 27% riparian, 8% lacustrine, 5% both riparian and riverine, and 2% marine. Of these projects, 23 were triaged out (Table 2) and 14 underwent regulatory review (Table 3). The majority of projects (36) received an LOA and one project received an authorization.

Of the 23 projects (23 WUAs) that were triaged out of regulatory review, 10 resulted in permanent alteration or destruction of habitat ranging from 27.1 to 150 m² with a median and average impact size of 46 and 62 m², respectively, 12 projects had no impact on fish or fish habitat, and 1 project, a clean out of a canal, had an unknown impact. The total amount of habitat permanently altered or destroyed by these projects was 618.3 m² (517.3 m² unspecified permanent alteration/destruction, 1 m² destroyed, and 100 m² permanently altered). None of the projects triaged out listed death of fish as a potential harm. These estimates of area of impact are from information provided by the proponent in Requests for Review and were not adjusted by DFO biologists during their review.

Of the 14 projects that underwent regulatory review, 1 project proposing realignment of 515 m of a creek resulting in the destruction of 5,496 m² of riverine habitat required and received an authorization on the condition that the newly constructed streambed incorporate fish habitat features to offset the loss. Of the 13 projects (17 WUAs) that received an

LOA following regulatory review, 11 resulted in permanent alteration or destruction of habitat (13 WUAs), with impact sizes ranging from 27 to 12,950 m², with a median and average impact size of 737 and 2,777 m², respectively. The total amount of habitat permanently altered or destroyed by these projects was 30,548 m² (23,781 m² altered, 6,767 m² destroyed). Two projects listed death of fish as a residual impact, however it was noted that the actual number of fish killed was unknown/difficult to predict. No evidence was provided of projects being cancelled by proponents prior to implementation; therefore, we assume that all reported impacts to fish habitat occurred. The total area of habitat altered or destroyed by all 36 projects that received LOAs was 31,166 m² (6,768 m² destroyed, 23,881 m² altered, and 517 m² unspecified as either destroyed or altered). The following projects provide examples of the range of activities that received a letter of advice.

Replacement of a trestle with a bridge

The project involved installing a pedestrian footbridge where a former trestle was using the existing structures. The project was planned for late summer, after spawning periods, when flow was expected to be minimal or non-existent. There were no species at risk or their habitats present, and the project planned to implement strategies for erosion and sediment control and shoreline revegetation. The project was triaged out, no regulatory review was undertaken, and a site-specific LOA was issued for this project.

Table 3. Summary of projects in Manitoba in 2016 that underwent regulatory review. For each project the following information was extracted and summarized: area of effect (m²), brief project description, residual impacts (permanent alteration, destruction, death of fish, *Species at Risk Act* [SARA], not applicable [NA], or unknown), habitat type (riparian, lacustrine, riverine, marine), and resulting action (site-specific letter of advice [LOA] or authorization). For projects 1, 9, 15 and 28, which each contained two different undertakings, area of effect and residual impacts for each undertaking are separated by a /. Project 28 listed residual effects of riprap placement as NA, however we included this impact size as permanent alterations to maintain consistency with decisions made for similar projects in our analysis.

Project #	Area of effect (m ²)	Description	Residual impacts	Habitat type	Course of action
1	5,000/500	Shoreline stabilization/riprap placement	Destruction/permanent alteration	Riparian	LOA (site-specific)
3	67	Install of sheet pile wall in a harbour	Destruction	Lacustrine	LOA (site-specific)
6	350	Bridge replacement	Permanent alteration	Riverine	LOA (site-specific)
9	400/1,600	Riprap to protect a pipeline/Mapleleaf mussel <i>Quadrula quadrula</i> salvage	Permanent alteration/SARA	Riverine	LOA (site-specific) with SARA Permit
10	5,496	Emergency watercourse realignment	Destruction	Riverine	Authorization
12	318.75	Lock & dam armor and riprap maintenance	Permanent alteration	Riverine	LOA (site-specific)
15	27.3/+2,000	Creek lengthening/excavating a new stream	Death of fish, permanent alteration/habitat creation	Riverine	LOA (site-specific)
16	104,000	Two 2-hour shutdowns of 9.5 km of the Assiniboine River	Death of fish	Riverine	LOA (site-specific)
19	18	Directional drilling for water intake pipes	NA	Riverine	LOA (site-specific)
21	1,700	Infilling to protect road erosion	Destruction	Riverine	LOA (site-specific)
27	737.1	Culvert replacement	Permanent alteration	Riverine	LOA (site-specific)
28	2,500/2,500	Shoreline grading/riprap placement	Permanent alteration/permanent alteration	Riparian	LOA (site-specific)
31	2,343/1,155	Shoreline stabilization/riprap placement	Permanent alteration/permanent alteration	Riverine	LOA (site-specific)
34	12,950	Canal dredging	Permanent alteration	Riparian	LOA (site-specific)

Shoreline Protection in an Inlet

The project involved shoreline protection using 10,000 m³ of riprap along ~755 m of an eroding shore. This resulted in infilling 5,500 m² of fish habitat (below the high-water mark) with quarried angular granite rock, where 5,000 m² of habitat would be destroyed and 500 m² would be permanently altered. Impacts to riparian habitat above the high-water level were not included in estimates of harm. Work was planned for early spring, during the egg incubation period for Lake Whitefish *Coregonus clupeaformis*, which were known to spawn in the area, and outside the spawning period for other fish. No species at risk or their habitat were present in the vicinity of the project. Following regulatory review, a site-specific LOA was issued.

Dewatering 9.5 km of the Assiniboine River to Inspect a Water-Control Structure

This project proposed to stop the flows to the lower Assiniboine River, temporarily affecting 104,000 m² of habitat. Species at risk and their critical habitat were present. Fewer than 100 fish were expected to be killed in favorable conditions, otherwise mortality could reach thousands. The Request for Review was submitted May 5, 2016, with a plan to commence work between August 15 and October 31, 2016. The LEADR Form was completed September 14, and a site-specific LOA was sent on October 14, 2016. Generally, DFO recommends at least 5 months for review in case an authorization is required. In this LOA, DFO noted that the time allowed to review this activity was insufficient for consideration of an authorization should one have been required, affecting the advice that DFO provided.

DISCUSSION

The risk-based project review process as applied in Manitoba in 2016 was successful at reducing the regulatory burden on DFO and proponents and focusing the department's resources on projects with the largest individual impacts. Internal departmental guidance focused on clarifying which types of habitat impacts would not be prioritized for authorization and identifying areas of uncertainty such as whether riparian alteration should require regulatory review. This chosen level of risk tolerance meant some impacts received more regulatory oversight than others. Guidance documents did not elaborate on how to consider long-term consequences of reduced oversight, nor were processes put in place to track and quantify effects of projects screened out of requiring an authorization. The Manitoba case study indicates that DFO's risk-based approach would likely come at a cost to fish and fish habitat when considered at a national scale across the thousands of projects that receive an LOA. Of the projects issued an LOA in 2016 in Manitoba, 58% resulted in alteration or destruction of habitat. Nationally, DFO reviewed 3,121 projects in 2016–2017 that did not result in issuing an authorization (DFO 2017). Based on our findings in Manitoba, this would potentially correspond to over 2 million square meters of habitat altered or destroyed without offsetting and without a public record.

Applying a risk-based regulatory regime to activities that result in harm and that may accumulate over time is particularly challenging and subject to the regulator obscuring risks by focusing on individual sites rather than the frequency or prevalence of specific activities in an area (Black and Baldwin 2012). For harm that accumulates, risk-management

frameworks should address the total risk posed by the suite of projects or impacts, rather than focusing narrowly on the risks posed by individual projects. Aquatic ecosystems can be resilient to some disturbances, such as changes in daily flow that do not destroy critical habitats or alter ecosystem function beyond thresholds (DFO 2013b; Rice et al. 2015), as well as occurrences of mortality where there is consideration for factors like density dependence (Mace 1994), life-history strategy (Musick et al. 2000), and current population status/fishing pressure (Rice 2009; Randall et al. 2013). However, cumulative changes of a sufficient scale or intensity may cause aquatic systems to cross ecological thresholds beyond which they may degrade or shift to alternative states (Davies-Colley and Smith 2001; Schröder et al. 2005; Finley 2011). Application of a risk-based approach to fish-habitat protection, particularly in areas with many projects occurring over time, is more likely to avoid cumulative impacts from multiple low- and high-risk projects when guided by: knowledge of the current status of ecosystem characteristic affected by the suite of projects (Capon et al. 2015); relevant ecosystem-level thresholds that cannot be exceeded (Hunter et al. 2009); and an assessment of the risk that projects will push this ecosystem characteristic closer to or over its threshold (Link 2005; Martin et al. 2009). For example, invasive species, a history of disturbance, and projects occurring simultaneously could all potentially reduce a riparian habitat's ability to be rehabilitated through replanting (Richardson et al. 2007). Treating projects on a site-by-site basis with limited reference to broader ecosystem characteristics and status was deeply entrenched within the triage and regulatory review process developed by DFO. Central to this was development of the concept of "localized effects," which became the basis for classifying risks from a project as sufficient to require authorization or not. While there was some direction and guidance around the consideration of cumulative effects, the guidance documents and forms focused the reviewer on determining if an individual project was likely to have a localized effect in its immediate vicinity. The LEADR Guide recommends that reviewers consider broader ecosystem characteristics, but does not reference guidance on how they be considered or require that they be estimated or included in evaluations. Based on the documentation for project reviews in Manitoba, it was clear that consideration of these factors was left to the knowledge and experience of regulatory review biologists who varied in their field of expertise and had limited resources to understand the location and impact type in the context of the broader ecosystem. With no tracking of accumulated harm by area or activity type, no reporting on the status of the ecosystem being impacted, and no public registry of projects that proceeded with an LOA, the regulatory framework was likely to obscure the level of risk allowed to occur.

Another limitation of the risk-based regulatory approach noted in our review of projects in Manitoba was the limited use of evidence to support decision criteria within the triage and LEADR guides and the completed review forms. Four references were cited in the LEADR guide: two for describing/assessing habitat (DFO 2004; Randall et al. 2014), one to support development of area thresholds in the matrix (DFO 2015b, although this study acknowledges its limited usefulness), and one to define ongoing fisheries productivity (DFO 2014). Reviewers were encouraged to seek out relevant resources where available, such as DFO's pathways of

effects guidance, the FPP Fish and Fish Habitat database, and Integrated Fisheries Management Plans. For other critical elements of the decision framework, no evidence or resources were provided to guide reviewers' interpretation. This included concepts such as project vicinity, ecosystem context, and resilience. Reviewers were not asked to document evidence or rationale for their decisions, and ultimately decisions reviewed here seemed to be based primarily on the habitat decision matrix (Figure 3) using a subjective assessment of habitat quality to guide the decision.

There was also a lack of transparency in the development and implementation of the risk-based regulatory process. The triage and LEADR processes were not established in consultation with affected communities and the multiple stakeholders involved, including Indigenous groups, fisheries resource users, NGO's, and common project proponents such as municipalities and natural resource companies. The review process was not made public and remained basically unknown to proponents and other stakeholders and rights-holders. The decision framework focused on concepts not described in the Act or clearly defined in policy (localized effects, the habitat decision matrix; DFO 2013c). If broad consultation and engagement with stakeholders and the regulated community on development of the risk-based review process had been undertaken, it may have helped DFO identify and address gaps in the decision framework as well as helped build consensus around the acceptable level of risk tolerance for habitat impacts and fish mortality.

Fisheries and Oceans Canada has limited resources to focus on a broad suite of high- to low-risk activities. Risk-based regulation can be problematic when applied to legislation that did not contemplate risk-based decision making or when confronted with societal norms that view the costs and benefits of a chosen level of risk tolerance differently (Rothstein et al. 2006). The issuing of LOAs for projects that caused harmful alteration, disruption, or destruction of fish habitat or death of fish was potentially outside the powers of the Act (Kwasniak 2004; Olszynski 2015) and led to criticism that DFO was not exercising sufficient oversight on projects that proceeded without an authorization. Following best practices in building a risk-based regulatory regime can ensure an efficient, effective, and transparent risk management framework that avoids accumulation of harm. An essential first step is to determine what distribution of resources best manages the hazards projects pose to policy objectives, across all levels of risk, and from this, develop a transparent and justifiable system (Black and Baldwin 2012). This framework should be dynamic and respond accordingly to changes in risk (SNIFFER 2010). Many tools can be applied to manage the lower risks in this framework, such as: self-regulation with third-party monitoring, themed or random audits and inspections, engagement and incentives, encouraging stakeholder or industry-led solutions, and exemptions that require notification, registration, or a permit (Black and Baldwin 2012). Both the frequency and intensity of auditing and inspection activities and the level of enforcement and intervention actions can be tailored according to levels of risk and a proponent's history of cooperation and ability to comply (Baldwin and Black 2008). The 2019 *Fisheries Act* provides DFO with several new regulatory mechanisms to manage projects causing harm. The use of a suite of regulatory tools that are applied according to the risk level of the activity, ensure that impacts to fish habitat

are tracked and offset, and enable auditing and enforcement should replace the use of LOAs for projects that cause harm to fish or fish habitat. Finally, improved transparency in development of the review process and consultation with affected stakeholders and rights-holders would help ensure a revised regulatory approach and risk-based framework are successful at protecting and conserving fish and fish habitat. Together, these options and approaches could form the basis for a more robust regulatory approach that ensures a healthy future for Canadian fisheries.

ACKNOWLEDGMENTS

We would like to thank Ken Minns, Emma Baldwin, and two anonymous reviewers for their valuable contributions throughout the development of this paper. There is no conflict of interest declared in this article.

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