Fisheries and Oceans Canada | Pêches et Océans Canada

FRAMEWORK FOR AQUACULTURE RISK MANAGEMENT

June 04, 2019

Canada

Chapter 1: Framework for Aquaculture Risk Management (FARM)

Introduction

Global demand for fish and seafood as a high-protein food source has increased significantly in the last decades. This demand is projected to increase as the world's population continues to grow. With pressures on global fish stocks, aquaculture is recognized as having a valuable contribution to food security while reducing pressure on wild fish stocks. Ensuring the environmental sustainability of Canada's aquatic resources requires a robust regulatory structure and a suite of policies to guide decision-making.

In Canada, the management of aquaculture is a shared jurisdiction between the federal, provincial, and territorial governments. Each jurisdiction has specific regulatory requirements, mitigation measures and risk tolerances, as outlined in specific legislation and regulations. Federally, in addition to Fisheries and Oceans Canada (DFO), departments and agencies such as Environment and Climate Change Canada, Health Canada, Transport Canada, and the Canadian Food Inspection Agency also have regulatory responsibilities and make decisions on aquaculture.

Four key pieces of federal legislation apply to fisheries, including aquaculture: the *Fisheries Act*, the *Coastal Fisheries Protection Act*, the *Oceans Act* and the *Species at Risk Act*. Consequently, DFO's mandate requires the consideration of the biodiversity within the ecosystem, and the habitat and productivity of fish species.

Ensuring the sustainable management of fisheries resources is supported through a well-defined risk management framework, one with a clear understanding of unacceptable harm, embraces the precautionary approach where uncertainty and risk of serious impacts exists, and clearly communicates underlying policies, management objectives and decisions. The purpose of this document is to describe DFO's aquaculture-specific risk management framework, the Framework for Aquaculture Risk Management (FARM).

Objectives for sustainable aquaculture

The Department's goal is to protect wild fish and their habitats using tools like avoidance, mitigation, monitoring, compliance and remediation approaches to reduce possible impacts to the environment. In this context, we seek to create the conditions for a sustainable aquaculture industry across Canada that also protects aquatic ecosystems and wild fish populations.

The threshold for unacceptable harm to fish or fish habitat is any aquaculture activity that is anticipated to cause population-level detrimental effects to fish populations. However, in making specific aquaculture decisions, the management objective is to avoid and/or mitigate effects on fish and fish habitat well below this threshold (i.e. at an "intervention threshold" similar to the upper stock reference point of the Sustainable Fisheries Framework). Considerations include local environmental conditions, status of local populations, the scale and intensity of the activity, and predicted effects on habitats, particularly those that have specific functions for fish populations (i.e., nursery grounds, spawning grounds, forage grounds, etc.)This level of harm

avoidance is similar to fishery harvest control rules and avoiding the lower stock reference point in managing fish stocks, which if exceeded may result in population impacts[1]. It is also aligned with the avoidance of population level effects for managing species at risk[2].

The FARM clearly describes how DFO will consistently carry out its responsibilities under the *Fisheries Act*, *Coastal Fisheries Protection Act*, *Species at Risk Act*, and *Oceans Act* as they relate to aquaculture.

Background to the development of the FARM

On December 10, 2018, the Minister of Fisheries, Oceans, and the Canadian Coast Guard presented a new vision for aquaculture in Canada and announced the implementation of an area-based approach that would complement a risk-based decision-making framework for aquaculture. These tools support how the precautionary approach guides DFO's decision-making.

The FARM was designed to be consistent with the Sustainable Fisheries Framework (SFF). It is intended to be the overarching framework for future policies and tools related to the science-based management of aquaculture. The SFF provides the foundation for an ecosystem-based and precautionary approach to fisheries management in Canada, and provides the basis for ensuring Canadian fisheries are managed in a manner which supports conservation and sustainable use of fisheries resources[3]. The FARM and associated polices consider and include similar language, approaches and principles as the SFF, to the extent possible, and also support conservation and sustainable use of the ecosystems where aquaculture facilities are located.

DFO's Framework for Aquaculture Risk Management (FARM)

The framework provides a consistent, predictable process to assess the risks and options for avoidance, mitigation or other management measures available to reduce the risks relative to specific objectives for the environment in which the aquaculture activity will be located.

There are six major elements in the Department's approach to managing the environmental risks that may arise in association with aquaculture activities (Figure 1).

[1] A Harvest Strategy Consistent with the Precautionary Approach - http://www.dfo-mpo.gc.ca/csas/Csas/status/2006/SAR-AS2006_023_E.pdf

[2]Guidance on Assessing Threats, Ecological Risk and Ecological Impacts for Species at Risk - http://waves-vagues.dfo-mpo.gc.ca/Library/363987.pdf

[3] Sustainable use is the use of biological resources in a way and at a rate that does not lead to their long-term decline, thereby maintaining the potential for future generations to meet their needs and aspirations. From DFO's Wild Salmon Policy [hyperlink]

(1) **Objectives** are driven by legislation, intergovernmental and international agreements, and considers ecological knowledge, cultural and societal values, economic goals, and are informed by Indigenous Knowledge (IK) and other local knowledge.

While the desired level of protection may be aimed at fish populations in general, each defined objective will have to consider unique local spatial and temporal elements. These specific objectives as it relates to different decisions and policies will be clearly communicated and posted on DFO's website.

(2) **Issue identification** considers the aquaculture-related activity, the associated stressors and predicted possible effects, using the scientifically peer-reviewed Aquaculture Pathways of Effects[4]. Additionally, new issues for assessment are identified through the results of scientific research or monitoring, through new information on environmental changes, including climate change, or through public engagement. Feedback from the implementation of risk management strategies, monitoring and evaluation activities through a formal performance evaluation of the efficacy of the risk management strategies can also identify issues to be managed.

The communication of identified issues occurs through the publication of policies, scientific results, and Departmental research priorities.

In British Columbia, Integrated Management of Aquaculture Plans are used for stakeholder engagement and identification of aquaculture-related issues. Going forward, we will look to build and improve on this process for involving stakeholders.

(3) **Scientific Advice and Scientific Risk Assessments** provide peer-reviewed science advice on the scale and potential effects of predicted impacts on fish and fish habitat, mitigation measures, regulatory tools, etc[5]. Scientific risk assessments are comprised of the scientific characterization of the likelihood and consequences of an activity; and assessment of the overall risk to a specific ecosystem component, based on the current state of knowledge that has been peer-reviewed by scientific and technical experts, and includes the identification of areas, magnitude and type of uncertainty[6].

[4] Pathways of Effects for Finfish and Shellfish Aquaculture - http://www.dfo-mpo.gc.ca/csas-sccs/publications/sar-as/2009/2009_071-eng.htm

[5] Examples of Aquaculture Related Advice - http://www.dfo-mpo.gc.ca/aquaculture/sci-res/spr-eng.htm

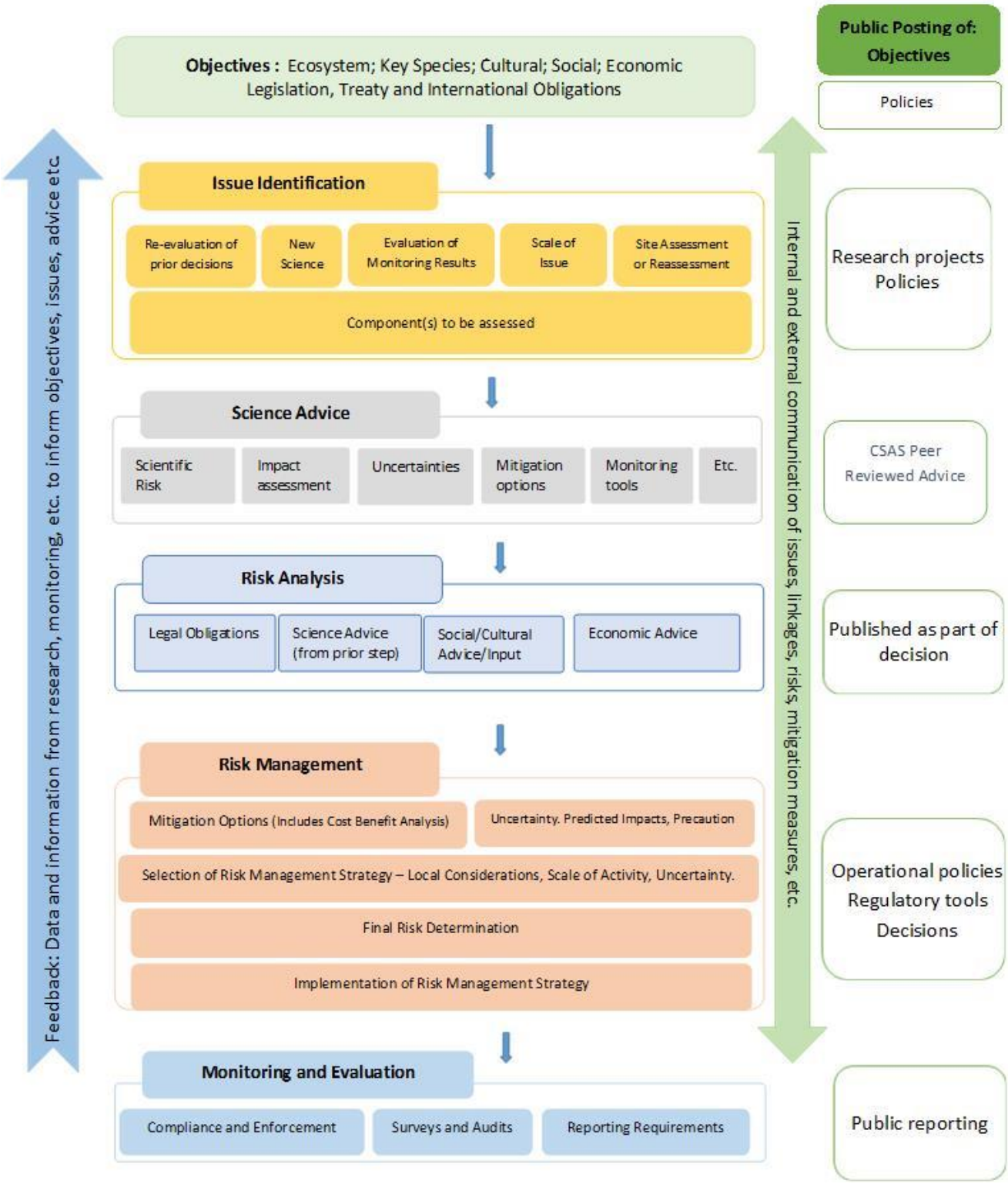
[6] Aquaculture Environmental Risk Assessment Initiative - http://www.dfo-mpo.gc.ca/aquaculture/sci-res/aserai-eng.htm

(4) **Risk Analysis** evaluates the broad range of social, cultural, legal, economic and scientific information, in the context of legal requirements and management objectives, to inform risk management approaches.

(5) **Risk management** includes the evaluation and selection of avoidance, mitigation, or other management measures, the use of the precautionary approach where there is scientific uncertainty, the selection of a risk management strategy, an assessment of the residual risks, and the implementation of the risk management strategy.

(6) **Monitoring and evaluation** of the activity is achieved through compliance monitoring, environmental monitoring, research, regulatory reporting and Compliance and Enforcement activities. This information is used in the issue identification step in support of adaptive management activities and the re-evaluation of risks and mitigation practices.

Figure 1: Framework for Aquaculture Risk Management



The effectiveness of the FARM requires continuous communication and feedback. It also includes adapting our management approaches to consider such things as, the results from environmental monitoring, scientific advice, routine re-evaluation, and new technologies. The development of new polices and management approaches, such as area-based management, will be informed by the evaluation of the efficacy of current and previous mitigation measures to manage environmental risks.

Consistent with the Government of Canada's policy on Open Government and a commitment to increased transparency in how aquaculture decisions are made within the Department, additional information that supports the implementation of the FARM will be made public on DFO's website. This includes the publication of policies, scientific results, research priorities, scientific advice, operational polices, regulatory tools, management decisions and public reporting of regulatory compliance and regulatory reporting data.

Aquaculture risk management

Risk considers how likely an event is to occur (likelihood) and the severity of the potential environmental impact (consequence) should that event occur. For fisheries, the management of this risk is primarily through using decision rules focused on complying with pre-specified reference points for a fishery. In the aquaculture context, there are opportunities to manage risks at every decision-making stage. Adaptive management is informed by the results from compliance and audit monitoring, research, and science advice. This creates the ability to apply additional mitigation measures prior to the activity to address any risk of environmental or ecosystem impacts.

The level of acceptable risk is related to the status of the fish and habitat found in the local area where aquaculture is proposed or operating.

Uncertainty

There will always be a level of uncertainty when predicting impacts and how likely they are to occur for a specific activity. The uncertainty may be associated with the quantity, quality, and relevance of the data being used in this analysis. Additionally, there are uncertainties because of natural variability, that different environments respond differently to stressors, as well as in the level of scientific understanding of complex processes and interactions. When analyzing data, including environmental monitoring and fisheries data, we need to consider how errors in sampling, estimation, and measurement contribute to uncertainty, and whether this will increase or decrease the overall risk estimate.

Where there is greater uncertainty, we may have less confidence in our ability to accurately predict impacts and risk. Management measures may be effective at reducing the uncertainties and reducing the overall risk estimate.

Inclusion of the precautionary approach in aquaculture decision making

DFO applies precaution during the risk management step of the FARM, when delivering its regulatory and legislative responsibilities for aquaculture.

When the uncertainty impacts our understanding of either the likelihood or the impacts so that the predicted risk is too high, DFO can look at mitigation measures and assess if these measures reduce the risk or reduce the uncertainty. For mitigation measures to be effective, they must be reasonably expected to lower the likelihood or reduce the impact. The final risk is determined after these mitigation measures are applied, evaluating the risk to the aquatic ecosystem.

The document *Fisheries and Oceans' Management of Aquaculture and the Application of the Precautionary Approach* provides more details on how we apply the precautionary approach.

Further details on aquaculture activities, stressors and the effects on different ecosystem components can be found in the document *Overview of the Aquaculture Pathways of Effects Tool for Assessing Aquaculture Impacts.* The document *Framework for Aquaculture Risk Management: Application of the Aquaculture Pathways of Effects in Aquaculture Activities Decisions* describes management tools for avoiding, mitigating, monitoring or managing these effects.

Future policies and implementation plans

The FARM sets out a consistent process for evaluating aquaculture activities. The FARM process integrates concepts, such as the precautionary approach. In order to implement this process, new policies and procedures for future management approaches will need to be developed.

To effectively manage aquaculture, we'll need additional science advice, continued consideration of socio-economic factors, effective co-management with provincial governments, integration of Indigenous Knowledge and other forms of local knowledge.

Indigenous peoples have unique knowledge about their local environments and how they function. This knowledge is an important part of project planning and resource management. The application of Indigenous Knowledge contributes to the FARM elements of setting objectives for an area, identifying issues and potential environmental effects. This is consistent with the work to develop of specific area-based management plans.

We continue to develop policy and assessment tools, such as:

- regional implementation pans by sector;

- science-based national standards, including siting criteria
- area-based management models, such as the one piloted in BC
- science-based post-deposit monitoring program for drugs and pesticides
- pathogen-specific risk assessments to support new regulatory requirements
- integrated federal drug and pesticide assessment model for pest and pathogen treatments at aquaculture farms
- integration of Indigenous Knowledge and other local knowledge into FARM process, in a manner that is consistent with other departmental approaches.

To ensure the sustainable management of fisheries resources, we must share information on the risks to fish and fish habitat, the decisions that are made, and what information was used in making decisions related to aquaculture.

The sustainable management of aquaculture relies on including decisions taken under the FARM and the SFF. We will continue to develop this process and communicate it through policy documents.

Overview of Federal-Provincial-Territorial Management Aquaculture

Evaluation of the FARM

Once we implement the FARM, we'll conduct an evaluation every five years to see how it meets its objectives.

Chapter Two: Fisheries and Oceans' Management of Aquaculture and the Application of the Precautionary Approach

Introduction

The Government of Canada views its commitment to the precautionary approach as: "…recognizing that the absence of full scientific certainty shall not be used as a reason for postponing decisions where there is a risk of serious or irreversible harm."

While Fisheries and Oceans Canada (DFO) has policies on the precautionary approach related to fisheries management, specific policies for applying the precautionary approach to the management of aquaculture have not been developed.

The objective of this document is to further explain how DFO applies the precautionary approach within its Framework for Aquaculture Risk Management (FARM).

The precautionary approach

The application of precaution, within science-based risk management is characterized by three principles:

- the need for a decision
- a risk of serious or irreversible harm
- a lack of full scientific certainty

DFO incorporates the precautionary approach when making decisions about fisheries by ensuring that potential risks to aquatic environments are managed to reduce the risk of harm to fish populations and habitat. We are more cautious in our management decisions when scientific information is uncertain, unreliable or incomplete.

We will apply the precautionary approach as part of the FARM management of aquaculture activities even when large-scale or permanent environmental impacts are not at stake.

Precautionary measures will be taken with an understanding of the potential risk, as assessed by experts, the extent of the effect of an activity on fish and fish habitat, and the scientific uncertainty associated with the assessment of these effects.

The greater the uncertainty, the less confidence there is that impacts and risk are estimated/predicted with accuracy and precision. Therefore, the management of these risks will, by necessity, require more risk averse measures and decisions.

Additionally, precautionary measures must be appropriately scaled to our understanding of where we are on the risk spectrum and the significance of uncertainty in potentially underestimating or overestimating the risk. That is, the lower the risk, regardless of the

uncertainty, the extent of precautionary measures required will be reduced compared to if the risk is considered to be higher (Figure 1). The most effective precautionary measures should result in lowering the overall estimated risk to the target population or environment.

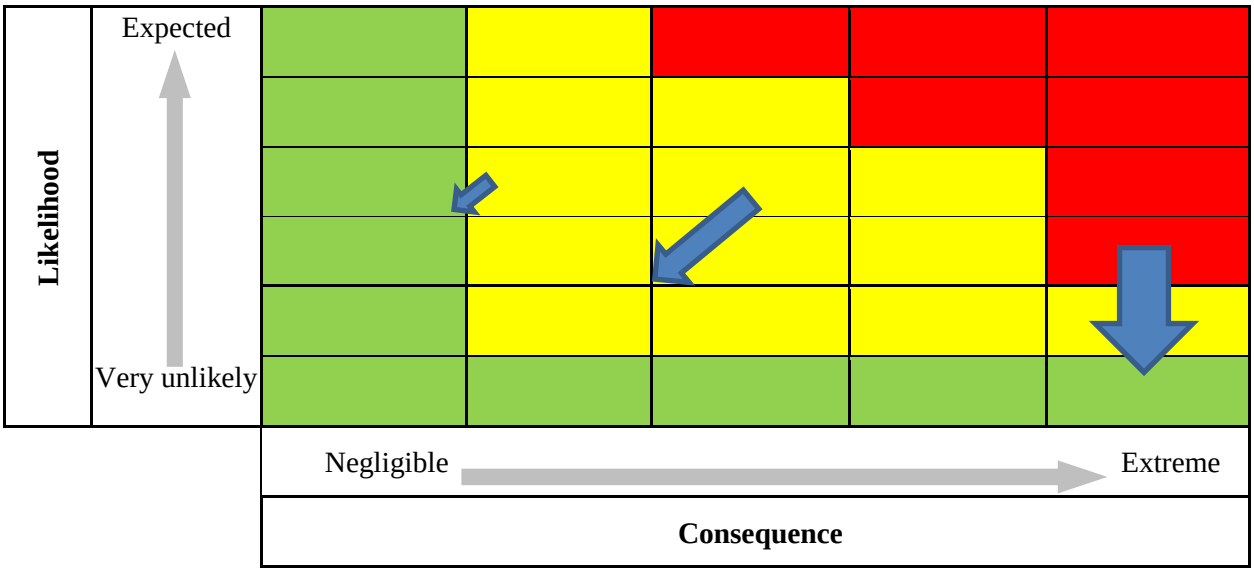


Figure 1: Scale of precautionary measures associated with risk (size of arrows indicate relative scale of precautionary measures applied; "red" represents the high probability of being in a state of unacceptable, potentially irreversible harm)

An appropriate selection of precautionary measures will consider:

- the types and sources of uncertainties, and
- the predicted impacts.

If errors and uncertainties are thought to increase the risk then precautionary measures may be employed, however if they are considered to decrease the risk, then further measures are not required.

If the overall uncertainty is high, and the target population or environment has specific protection objectives or measures in place, precautionary measures that address specific elements may also be appropriate, particularly if they are expected to increase the confidence in the risk estimation (Figure 2).

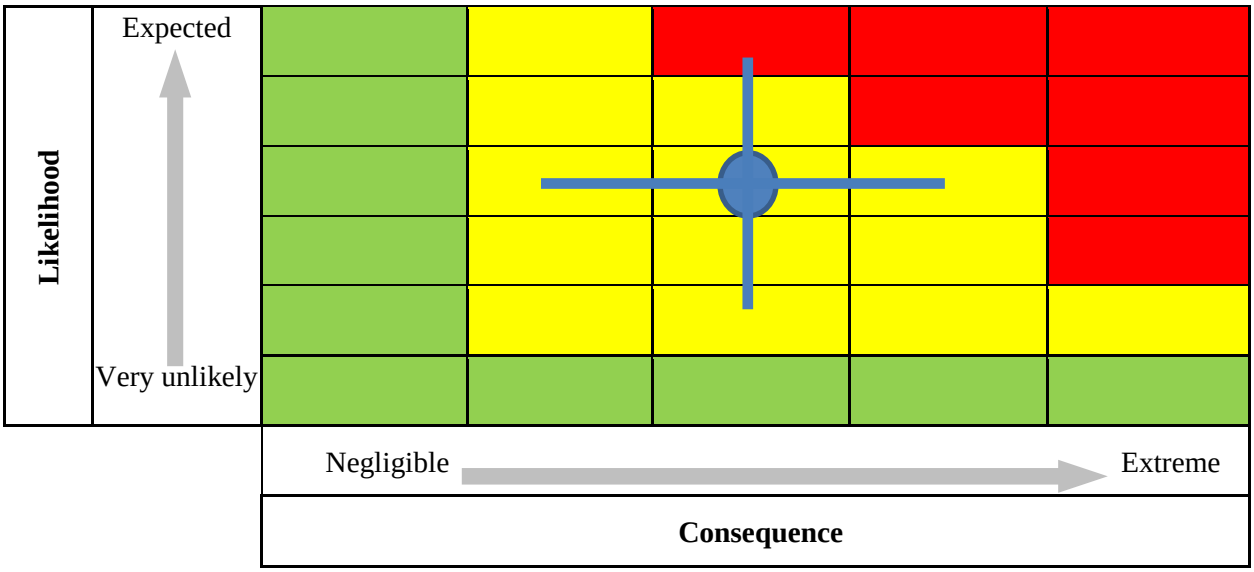


Figure 2a: Scale of uncertainty associated with risk estimation prior to precautionary measures

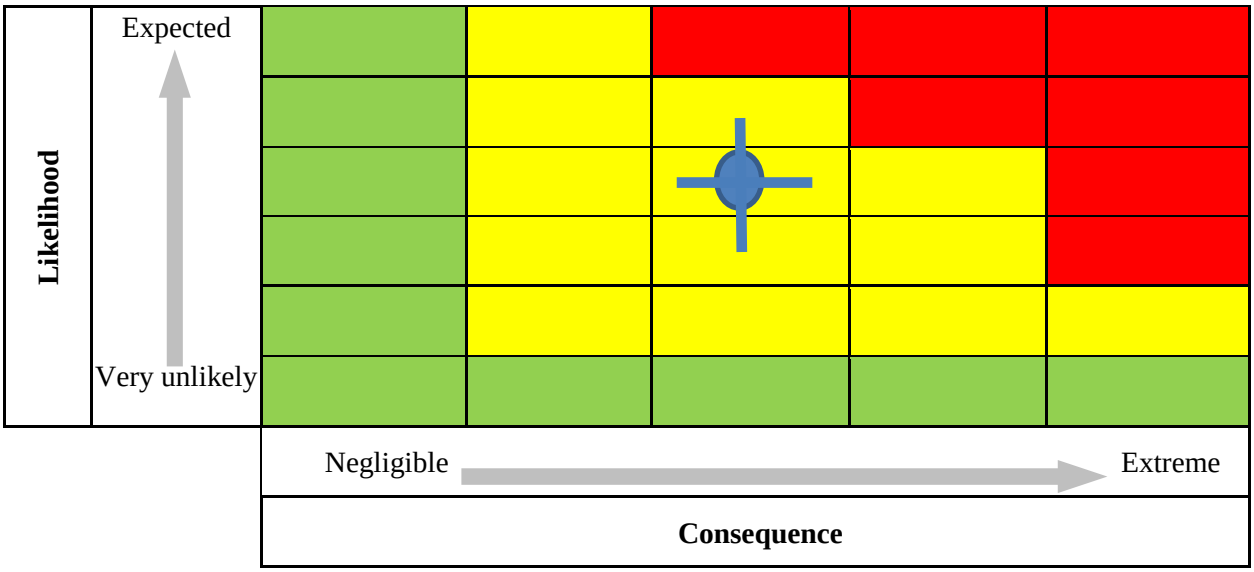


Figure 2b: Scale of uncertainty associated with risk estimation following the application of precautionary measures

Consideration will be given to existing or proposed precautionary measures for other purposes that mitigate the need for further measures (e.g. if fisheries management has incorporated measures that are expected to result in a change in the status of a conservation unit, stock or populations, especially if there is a demonstrated trend in the stock status towards the healthy zone).

The application of the precautionary approach is guided by peer-reviewed scientific advice and other knowledge available, and can consider values and priorities.

Related Information:

- A Fishery Decision-Making Framework Incorporating the Precautionary Approach
- A Framework for the Application of Precaution in Science-Based Decision Making about Risk

Chapter Three: Overview of the Aquaculture Pathways of Effects Tool for Assessing Aquaculture Impacts

Introduction

A Pathways of Effects (PoE) model is a tool that conveys complex interactions between human activities, the type of cause-effect relationships that are known to exist, and the mechanisms by which stressors ultimately lead to effects in the aquatic environment. The model recognizes that a single environmental stressor can have multiple source activities and can lead to one or more environmental effects. It also recognizes that a single environmental effect can be influenced by one or more stressors or activities. In considering a specific activity, it is important that site specific attributes and anticipated ecosystem changes (in addition to specific aquaculture stressors), like climate change, be incorporated into the assessment of effects and the evaluation of the efficacy of potential mitigation measures.

Fisheries and Oceans (DFO) Fisheries Protection Program (FPP) uses Pathways of Effects models in evaluating projects. Consistent with this approach, fish and fish habitat impact evaluation of new aquaculture sites by DFO consider the range of activities, associated stressors and the effects of these stressors on different components of the ecosystem.

In making decisions around aquaculture activities, following the Framework for Aquaculture Risk Management (FARM), the Aquaculture Pathways of Effects are used to identify issues for scientific assessment and advice, and support the risk management steps of identifying mitigation options, the selection of risk management strategies and the determination of the residual risk after the application of mitigation measures. See the *Framework for Aquaculture Risk Management* for more details.

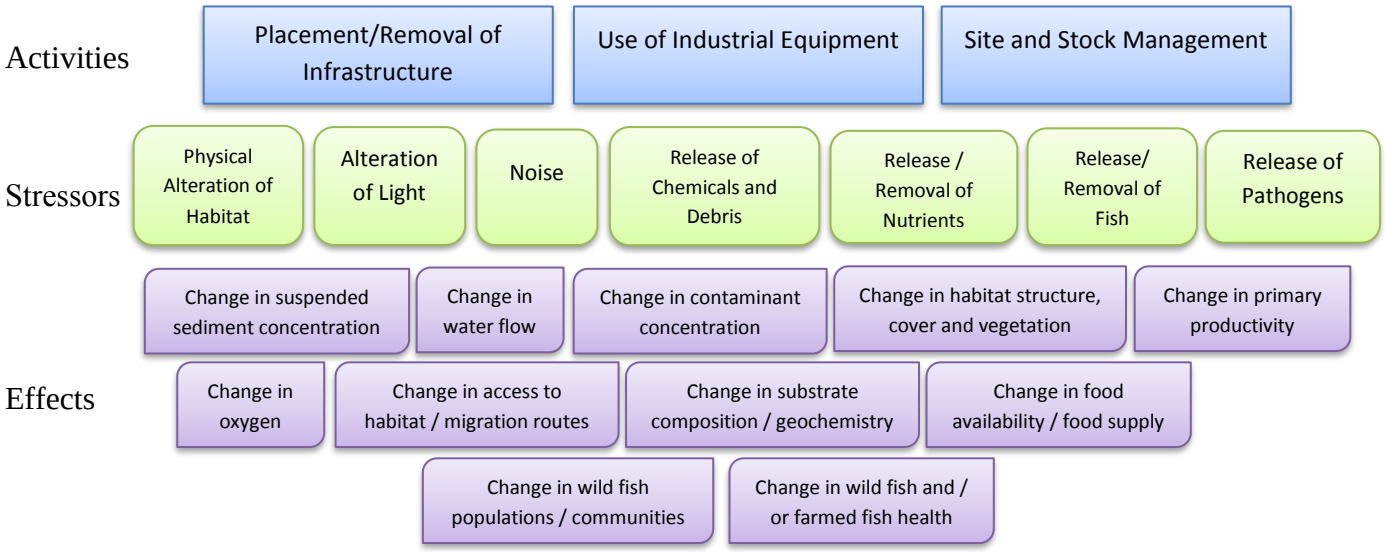
Aquaculture Pathways of Effects

The Aquaculture Pathways of Effects model (Figure 1) was developed collaboratively with Provincial and Territorial regulators. A Canadian Science Advisory Secretariat (CSAS) process confirmed the scientific basis for the linkages between the following major stressor categories associated with aquaculture activities, the resulting stressors that can result, and the potential effects of these stressors on different ecosystem and environmental components[7] (Figure 1).

As additional data from monitoring around aquaculture sites and new scientific research results becomes available, the characterization of the duration, scale and intensity of the stressor-effects relationships will need to be reviewed and updated to reflect this new information.

[7] DFO. 2009. Pathways of Effects for Finfish and Shellfish Aquaculture. Science Advisory Report 2009/071. http://www.dfo-mpo.gc.ca/csas-sccs/publications/sar-as/2009/2009_071-eng.htm

Figure 4: Pathways of Effects for Finfish and Shellfish Aquaculture



At the point of evaluating a specific aquaculture application, the linkages between each of the stressors and the relevant effects described in the Aquaculture Pathways of Effects Tool are considered. The specific environment and activity will determine which stressor-effect linkages exist, and what mitigation measures can be used to effectively and sustainably "break" or lessen the stressor-effect linkages. The residual risks to each of the environmental components from the aquaculture activities following the application of mitigation measures, are then considered in the Risk Management Strategy.

Stressor Descriptions

- **Physical alterations to the habitat** occurs during the placement or removal of physical infrastructure (e.g., net pens, longlines, rafts, anchors and moorings, shellfish beach culture structures), as well as during the use of husbandry equipment (e.g., underwater lights to increase growth in marine finfish or acoustic deterrent devices to discourage predators[8]).

  The extent and impact of the predicted physical alterations to habitat are considered primarily during the pre-operational stage (e.g., site application), which includes an evaluation of the type of benthic habitat in the area being proposed for aquaculture.

- **Release of chemicals and debris** occurs primarily with activities associated with site and stock management, and the use of operational equipment where chemicals and debris may be released. Examples include the use of authorized pesticides, drugs and antifouling

[8] Note that the use of acoustic deterrent devices is not a current practice in Canadian aquaculture.

agents, and the use of materials in construction (e.g., steel, wood, floatation) and operations (e.g., feed bags, ropes), which can be lost from sites as debris.

The effect of the use of pesticides, drugs and antifoulants on the receiving environment, including on non-target organisms, is assessed by Health Canada.

DFO and it's regulatory partners (HC and ECCC) are working collaboratively to develop an assessment tool for determining post-deposit monitoring for drugs or pesticides. Once implemented, the initial assessment will occur at the pre-operational stage and results from any post-deposit monitoring will inform future requirements for on-going monitoring.

- **Release of organic and related matter** occurs as a result of stock management activities (e.g., the feeding and cultivation of fish, removal or natural sloughing of biofouling organisms from physical infrastructure) that have an organic or related component (e.g., nutrients).

  The predicted extent of organic deposition on the surrounding seafloor is assessed at the pre-operational stage. As part of the on-going operational compliance under the *Aquaculture Activities Regulations*, marine finfish aquaculture operations must meet a performance-based regulatory requirement related to the release of organic matter. Similar regulatory standards could also be applicable to freshwater finfish and shellfish operations in the future.

- **Removal of nutrients and organic matter** occurs as a result of stock management activities where some cultured species (e.g., bivalves) remove particulate matter, nutrients and oxygen from the water column.

  The predicted extent of the removal of nutrients by the addition of cultured shellfish and the predicted effects on wild populations is assessed at the pre-operational stage.

- **Release or removal of fish** occurs primarily as a result of stock management activities.

  The removal of fish is considered and managed under DFO's bycatch policy[9]. This occurs when some individual wild fish may be temporarily or permanently removed from waters along with cultured fish (e.g., during grading or at harvest), or as part of biofouling or predator control.

  The addition of fish to the environment occurs either as a result of intentional stocking of cultured fish into aquatic environments for cultivation (e.g., salmon enhancement), or as a result of unintentional release of fish (e.g., escapes).

  The impact on wild populations from the unintentional release of cultured organisms is currently considered at the pre-operational stage, and is linked to fiduciary

[9] DFO's Policy on Managing Bycatch under the Sustainable Fisheries Framework http://www.dfo-mpo.gc.ca/reports-rapports/regs/sff-cpd/bycatch-policy-prise-access-eng.pdf

responsibilities associated with the *Species at Risk Act* and the *Fisheries Act*. It is also considered by the Introductions and Transfers Committee in the assessment of requests for non-routine introductions or transfers, under the s.56c of the *Fishery (General) Regulations.*

- **Release of pathogens and pests** is associated with site and stock management. The increase in biomass of fish within an area due to an aquaculture site can influence the presence or abundance of fish pathogens (e.g., bacteria, viruses) and pests (e.g., sea lice and tunicates).

  The introduction of pathogens or pests is evaluated at the operational stage, primarily by the Introductions and Transfers Committees (ITC). Conditions of licence (either provincial, territorial, or federal) outline mitigation measures for the management of the abundance of pathogens or pests.

  Notifiable diseases are regulated by the Canadian Food Inspection Agency.

Information and examples of how the Aquaculture Pathways of Effects Tool can be used to support aquaculture decisions within the Framework for Aquaculture Risk Management can be found in the associated document *Framework for Aquaculture Risk Management: Application of the Aquaculture Pathways of Effects in Aquaculture Activities Decisions*.

Chapter Four: Framework for Aquaculture Risk Management: Application of the Aquaculture Pathways of Effects in Aquaculture Activities Decisions

Introduction

The Framework for Aquaculture Risk Management (FARM) describes a structured and transparent process by which Fisheries and Oceans Canada will be conducting and communicating the assessment of risk from aquaculture activities and the selection of measures to reduce this risk to a level that will meet the Department's sustainable development and conservation and protection goals. Decisions and advice related to the management of aquaculture are considered prior to the establishment of a site, prior to significant changes to an existing site, prior to the movement of fish to an aquaculture facility, and in evaluating the operational performance of aquaculture facilities.

As part of the implementation of the FARM, new policies and more formal risk management strategies will be developed (see the associated document, *Framework for Aquaculture Risk Management* for a description of the framework and planned initial polices and strategies).

Pre-Site or Pre-Change Assessments

Prior to the establishment of a new aquaculture facility or significant changes to an existing aquaculture facility, the Provincial, Territorial and Federal governments require the aquaculture industry to submit information for assessment as part of the leasing and licensing process.

Regardless of where the new or expanded facility is located, DFO considers the following stressors and effects in determining the advice regarding risks that the proposed activity poses to the environment and ecosystem. The specific stressor-effect relationships are characterized as the Aquaculture Pathways of Effects (see the accompanying document *Overview of the Aquaculture Pathways of Effects Tool for Assessing Aquaculture Impacts* for details, or the DFO Science Advisory Report[10]).

Therefore, the broad threshold for unacceptable harm to fish or fish habitat is any aquaculture activity that is anticipated to cause population-level detrimental effects to fish populations. However, in making specific aquaculture decisions, the management objective is to avoid and/or mitigate effects on fish and fish habitat well below this threshold (i.e. at an "intervention threshold" analogous to the *upper stock reference point* of the Sustainable Fisheries Framework). Considerations include local environmental conditions, status of local populations, the scale and intensity of the activity, and predicted effects on habitats, particularly those that have specific functions for fish populations (i.e., nursery grounds, spawning grounds, forage grounds, etc.)This level of harm avoidance is analogous to fishery harvest control rules and avoiding the *lower stock reference point* in managing fish stocks, which if exceeded may result in population impacts[11]. It is also aligned with the avoidance of population level effects for managing species at risk[12]. The assessments and risk management strategies applied prior to the establishment of an

[10] Aquaculture Pathways of Effects, DFO, 2019. http://www.dfo-mpo.gc.ca/csas-sccs/publications/sar-as/2009/2009_071-eng.htm

[11] A Harvest Strategy Consistent with the Precautionary Approach - http://www.dfo-mpo.gc.ca/csas/Csas/status/2006/SAR-AS2006_023_E.pdf

[12] Guidance on Assessing Threats, Ecological Risk and Ecological Impacts for Species at Risk - http://waves-vagues.dfo-mpo.gc.ca/Library/363987.pdf

aquaculture facility are critical to avoiding impacts on fish and fish habitat. Through proper siting, many stressor-effects can be avoided. Those that remain may then be mitigated through operational or site-specific requirements, and the acceptable impacts may then be evaluated by comparing operational performance monitoring results to regulatory thresholds.

All of the stressor-effects relationships should be evaluated at the pre-site stage. Figure 1 outlines the stressor and associated effects, examples of considerations and questions posed as part of the pre-site assessment, and examples of options for risk management and mitigation.

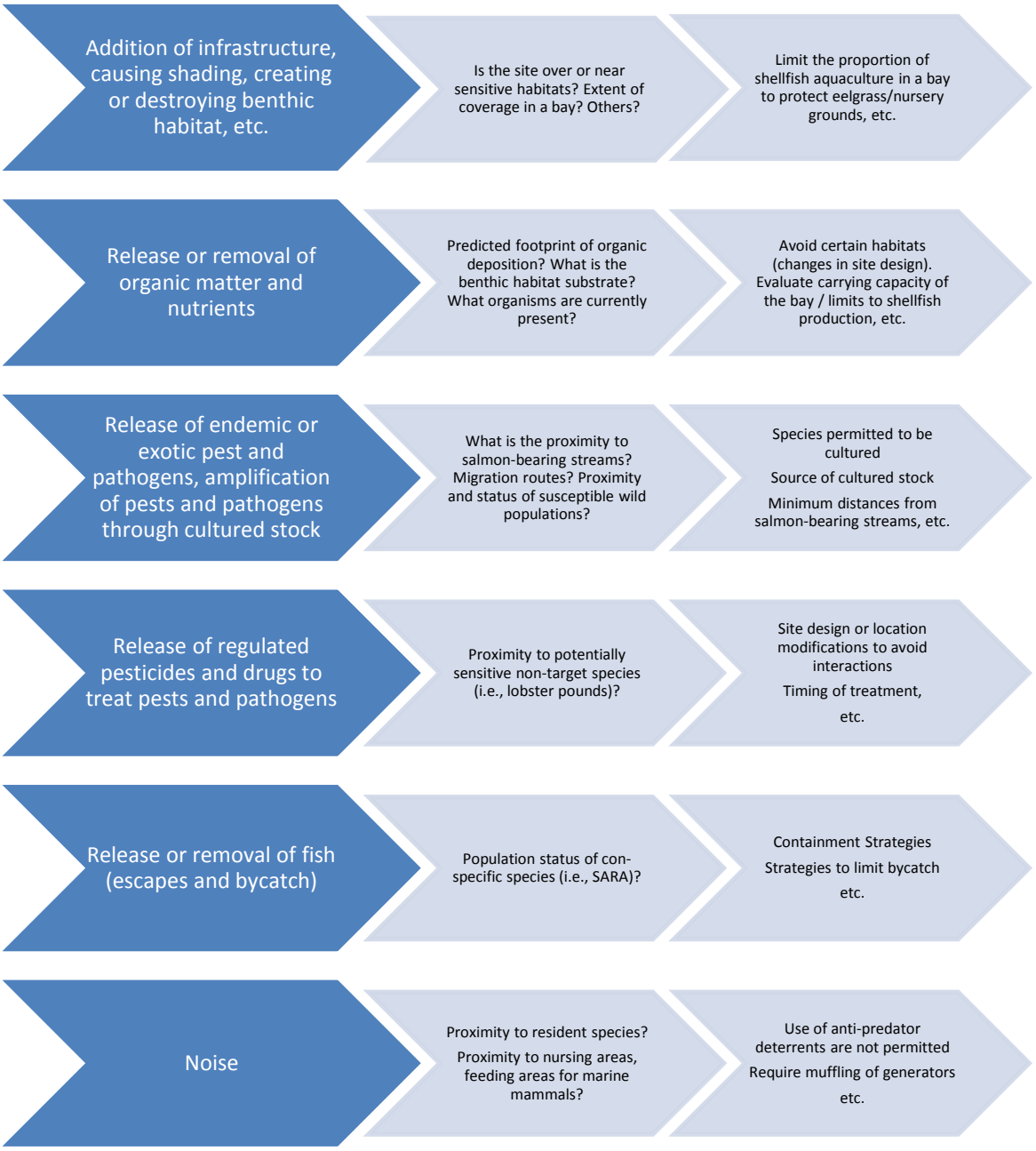


Figure 5 : Pre-site assessment consideration of Aquaculture Pathways of Effects, examples of key considerations or questions, and examples of potential risk mitigation options to avoid or limit effects on fish, fish populations and habitat.

Introductions and Transfer of Fish to an Aquaculture Facility

As part of aquaculture site and stock management activities, aquaculture facilities request permission to introduce or transfer fish stock to their sites. These requests are evaluated by the Introductions and Transfers Committee under the National Code on Introductions and Transfers of Aquatic Organisms. The regulatory authority for these evaluations is s.56 of the *Fishery (General) Regulations*. The Canadian Food Inspection Agency is the competent authority for aquatic animal health under the *Health of Animals Act*.

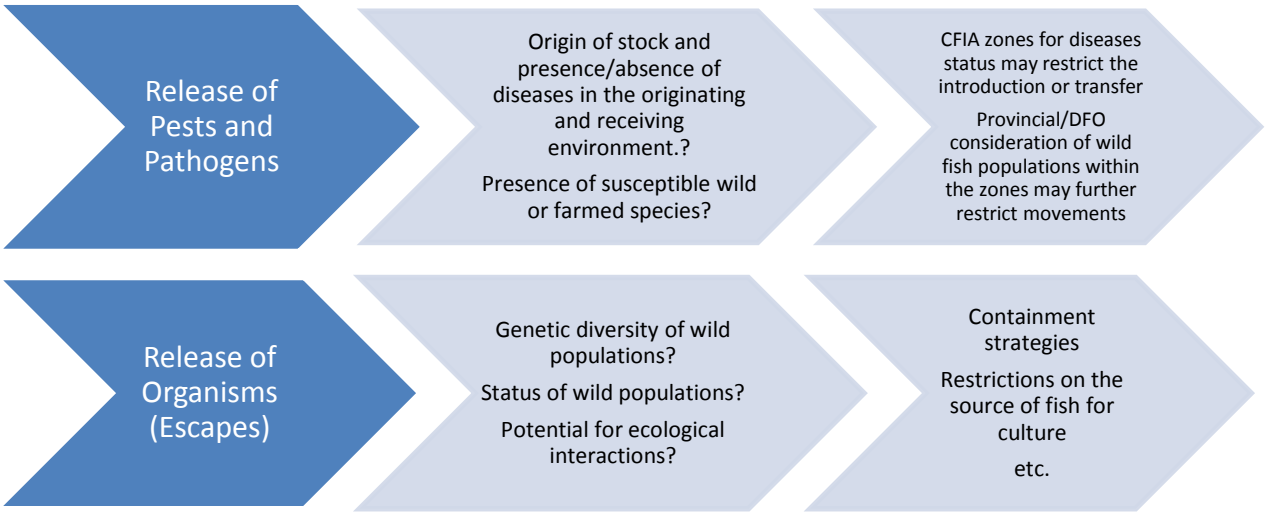


Figure 6. The Introductions and Transfers Committee may assess the following pathways within the Aquaculture Pathways of Effects Tool.

Operational Performance Monitoring, Thresholds and Reporting Requirements

Aquaculture activities will produce some level of impact, much of which would have been considered at the pre-site assessment stage. The remaining impacts are then permitted, with the application of site-specific mitigation measures. Operational performance monitoring provides information on whether or not the predicted impact is above or below the regulatory threshold. Regulatory auditing of aquaculture practices allows for the assessment of compliance with mitigation measures and can inform on the efficacy of these measures to limit the effects.

The data collected as part of operational performance monitoring and other regulatory reporting requirements are important sources of data that can inform adaptive management approaches for aquaculture. This data can permit the evaluation of the validity of the assumptions and estimations made during the pre-site assessment and the efficacy of site-specific mitigation measures in protecting fish and fish habitat. As well, it can be incorporated into the identification of issues and the need for future science advice, as well as in subsequent aquaculture decisions related to operations and site assessments.

Currently, the only national, federal operational regulatory threshold that is used in the management of aquaculture in Canada is the organic deposition threshold to limit the scale and impact of the deposit of feed and faeces from marine finfish farms, as defined in the *Aquaculture Activities Regulations*.

In addition, there are fish health management and reporting requirements that are defined by the provincial regulatory authority. Details on the reporting requirements for aquaculture in British Columbia can be found in the *Pacific Aquaculture Regulations,* in Conditions of Licence and at http://www.pac.dfo-mpo.gc.ca/aquaculture/reporting-rapports/index-eng.html.

The National Aquaculture Public Reporting Data provides information submitted to the DFO by industry owners or operators as a reporting requirement under the *Aquaculture Activities Regulations* and can be found at https://open.canada.ca/data/en/dataset/288b6dc4-16dc-43cc-80a4-2a45b1f93383