Fisheries and Oceans Canada | Pêches et Océans Canada

Canada

# DFO's approach to assessing risk of death of fish from collision with tidal energy devices

DFO uses an evidence-informed risk-based approach to assess the likelihood and extent of potential death of fish and its impact on fish and fish habitat, especially listed aquatic species at risk. The best available information informs this approach. More information on the department's approach for managing the death of fish associated with works, activities and undertakings under the *Fisheries Act* and *Species at Risk Act* (SARA) can be found in the departmental Position Statement (The Management of Death of Fish (other than fishing) under the *Fisheries Act* and the *Species at Risk Act*).

Table 1 describes select risk criteria specific to tidal power devices. When considering the risk associated with a project, the department examines these criteria to determine the likelihood and severity of impacts to fish and fish habitat.

**Risk Criteria – Death of Fish**

| | | |
|---|---|---|
| Low | **Number of Fish Species / Life History Stages Present During Operation** | High |
| Low | **Fish Abundance / Density During Operation** | High |
| No | **Species at Risk Present During Operation** | Yes |
| Not at Risk, Healthy Zone | **Fish Population / Stock Status** | Endangered, Critical Zone |
| Low | **Tidal Current Speed** | High |
| Low | **Blade Velocity (Tip Speed)** | High |
| Same | **Blade Orientation Relative to Current** | Perpendicular |
| Yes<br>Effective | **Project / Species-specific Avoidance and Mitigation Measures** | No<br>Not Effective |
| Field Demonstrated<br>Effective<br>Long-term (≥1 year) | **Environmental Effects Monitoring Program (Encounter / Collision Risk)** | Not Field Demonstrated<br>Not Effective<br>Short-term (≤1 year) |

**Lower Risk** ⟷ **Higher Risk**

***DFO considers a range of criteria in a project risk assessment. No one criteria on its own puts a project in a low-risk or high-risk category**

Table 1: Marine tidal energy project risk criteria scale

## Number of fish species/life-history stages present during operation

The collision risk is higher when many fish species and/or life-history stages (the different forms a


Cat. No.: Fs23-750/2024E-PDF ISBN: 978-0-660-73602-0
Fisheries and Oceans Canada. 2024. DFO's approach to assessing risk of death of fish from collision with tidal energy devices. 3 pp.

species takes as it ages) are present during turbine operation. The number of species and/or life-history stages of these species will vary by:

- location
- how species interact with themselves and other species
- environmental factors, such as water temperature and tidal current or current speeds

For example: vulnerable populations of large-sized fish that live in strong current environments could have a higher risk of collision.

## Fish abundance and density during operation

If fish abundances (the number of individual fish in an area) or densities (the number of fish per volume of water) are high during turbine operation, then the collision risk will be higher. Fish abundance and density can vary daily and seasonally. They can also vary by site location, species and environmental factors.

## Aquatic species at risk (SAR) present during operation

The presence of SAR around turbine operations will increase the consequences of a collision. Activities that may result in prohibited effects to listed aquatic species at risk require a permit under SARA.

## Fish population and stock status

The impact of a collision to a fish population (a group of fish of the same species that reproduce together) or stock (a population, population subset or more than one population) will be lower if the population is not at risk or the stock is within the healthy zone. There will be higher consequences if the population is at risk or endangered, or if the stock is in the critical zone. The consequence of collision is higher if there are SAR near the turbine during operation. This is because the death of SAR could affect population levels. SAR presence and abundance will vary by site location, species and environmental factors (such as water temperature and seasonal distribution).

## Tidal current and current speed

Higher tidal current and current speeds may result in a higher collision risk for fish. Other environmental factors, such as turbidity (a measure of the level of particles in a body of water), may also have compounding effects when associated with high current speeds.

## Blade velocity and tip speed

Considering blade velocity and tip speed when understanding collision risk is important because the blades move faster the farther they are from the center (hub) of the turbine. Higher blade velocities may result in higher injury and mortality.

## Blade orientation relative to current

Effective strike velocity is higher for blades rotating perpendicular to the current. Blades rotating in the same direction as the current and fish movement have lower strike velocity.

## Project and species-specific avoidance and mitigation measures

Using effective avoidance or mitigation measures could lower collision risk. Examples include:

- shutdown periods during migration or periods of high abundance or density
- slower rotational or tip speeds
- using a blade shape, barriers, buffers or compressible bumpers to reduce impact if a blade strike occurs
- using thicker blades, since thinner blades cause higher rates of injury and mortality

## Adaptive Environmental Effects Monitoring Programs (AEEMP)

If an AEEMP is not field demonstrated and is not shown to be effective at collecting the necessary monitoring data, it will impact the department's ability to manage risk to fish populations. Short-term (less than 1 year) AEEMP field programs are not preferred because they will not capture variability over time. Examples include:

- species habitat use
- environmental changes
- other external factors that might influence aquatic animal behaviour

Implementing an effective long-term monitoring program during turbine operation can produce results that reduce uncertainty and the level of risk related to death of fish. This improves our understanding of residual impacts and ensures proponents can implement effective mitigation measures. See DFO's Guide to Adaptive Environmental Effects Monitoring Programs (AEEMP) for Tidal Energy Devices in the Bay of Fundy for more information.

## Fish behaviour considerations

Collision risk will vary based on individual abilities (for example: swim speeds and overall condition) and species traits (for example: behaviours like engaging in tidal transport and the ability to detect and evade/avoid tidal devices). These behaviours will also vary based on the environment. For example, some species may be able to avoid a turbine at low flows, but not at higher flows.