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Assessing the feasibility of surgically implanting acoustic tags into sensitive *Clupeid* fishes: considerations for telemetry studies

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Background

The Bay of Fundy is an important potential source for tidal power due to large tidal amplitudes and fast currents. In 2009, the Fundy Ocean Research Centre for Energy (FORCE) began testing tidal turbines in Minas Passage – a narrow channel that connects Minas Basin to the outer bay. This area is frequented by migratory fish such as Atlantic herring and alewife, two species in the family *Clupeidae* that support lucrative commercial fisheries in the maritime provinces of Canada. Tidal development could increase chances of injury and death to these fish as a result of interaction with turbine blades, but the extent of this threat is difficult to assess as there have been few studies focused on migration, distribution and habitat use of fish within the passage. Acoustic telemetry could help tackle this question, however, it requires surgical implantation of transmitters, which can be challenging for fish that are extremely sensitive to handling.

Objectives

This study will assess the feasibility of surgically implanting alewife and herring with newly developed, HR acoustic tags to minimize handling stress and ensure a good survival rate. If this can be done successfully, a subsequent acoustic tracking study will be conducted with both species, in order to determine temporal movements of tagged fishes within Minas Passage, and quantify residency at the FORCE test site.

Methodology

Preliminary trials were conducted from April to October 2018 to assess the short-term survival and response of fish to tagging.

V5-2H acoustic tags

Advantages: small, lightweight, emit 2 signals

- High Residence (HR) signal : 170 kHz, 1 ping, 1.5 s delays
- PPM signal: 180 kHz, 8 pings, 5-30 s delays

Tagging protocol

- Alewife captured from White Rock fish ladder, Gaspereau River. Herring captured on German Bank's spawning ground by a purse seine fishing vessel
- Sedation with tricaine methanesulfonate (MS-222) at 2g/10L.
- Intracoelomic implantation of tag on the right lateral side of the fish, 1-2 mm off the mid-ventral line (Figure 1)
- Continuous flow-through anaesthetic apparatus maintains sedation during surgeries (Figure 2)

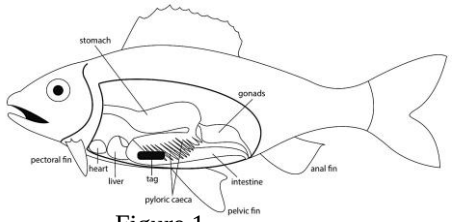

Figure 1

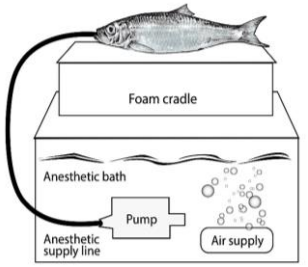

Figure 2

Treatment groups

Alewife:

- 10 anesthesia, no sutures
- 15 anesthesia + sutures
- Recovery time: 24-72 h

Herring:

- 25 anesthesia, no sutures
- 26 anesthesia + sutures
- Recovery time: 1-2 h

Results

- No observable differences in recovery times, survival or behaviour between sutured and non-sutured fish.
- No instances of tag loss, regardless of whether sutures were used or not.
- Swimming ability of treated fish did not visibly differ from that of control group after recovery.

Conclusions: surgical implantation of acoustic tags into small pelagic forage fish is feasible!

Next Steps

1) Assess long-term survival and response to tagging
   - Month-long detention of fish following surgeries
   - Assessing effects of implantation of different sized acoustic tags
2) Conduct range testing of HR tags in Minas Passage
3) Begin telemetry study to assess movement rates and residence of fish at FORCE test site.
   - Calculate residency indices (average number of detections for the season)

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