Underwater Noise Impacts from Remediation Dredging

Best Practices & Mitigation Alternatives

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- Endangered Fish Species

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- Propagated Sound

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Introduction

Canada's Freshwater Ecosystems

Canada's freshwater systems are facing increasing pressure every day from ***pollution, habitat loss, invasive species*** *and* ***climate change*** *– among other threats.*

- WWF

Endangered Fish Species

- **80 species** in the world have already been declared **extinct**
- **One third** of all freshwater fish species are threatened with **extinction** (-WWF)
- In Canada, **62 species** are considered **endangered**, including:
  - White sturgeon
  - Atlantic salmon
  - Pacific salmon

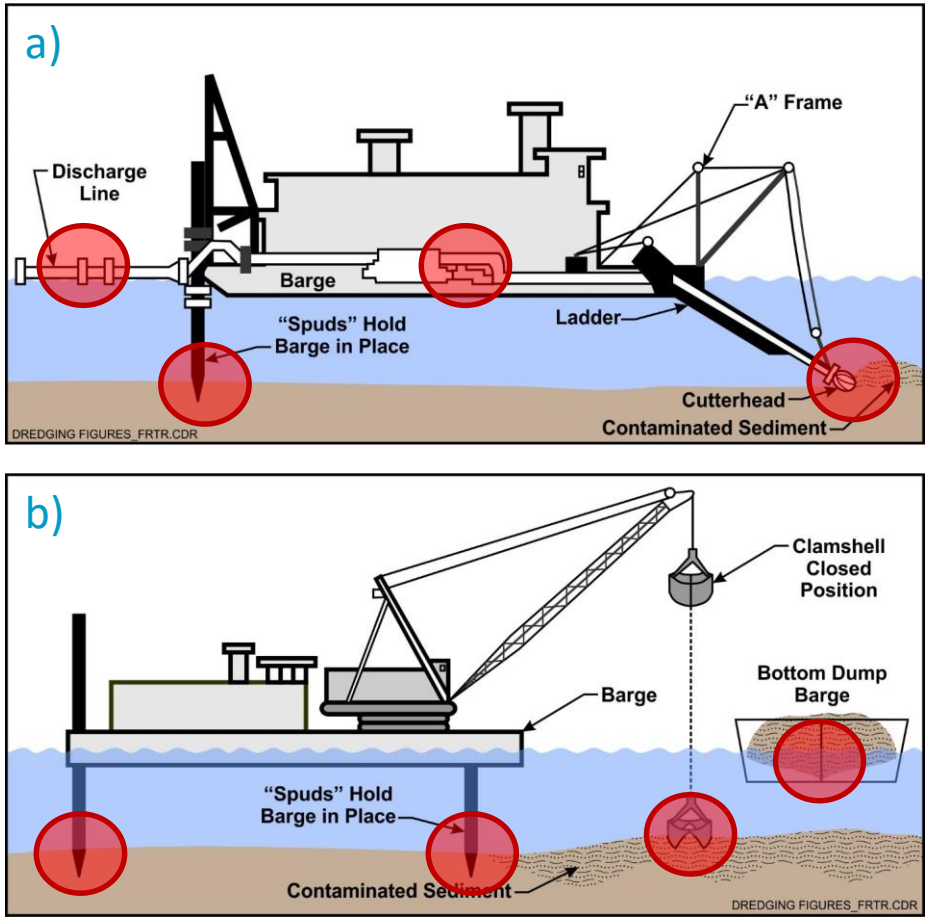
Remediation Dredging

Photo by Sheba_also
https://www.flickr.com/photos/shebalso/18668730480/

Remediation Dredging

Dredging is a commonly used remedial method for contaminated sediment removal.

Dredging Types



source: https://frtr.gov/matrix/Environmental-Dredging/

The sounds generated by dredging varies by the type of dredge being used. The two main categories of dredges are:

a) **hydraulic**

- Cutter Suction Dredge (CSD)

b) **mechanical**

- Grab Dredge (GD)

Comparative Noise levels

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Comparative Noise levels

PRESSURE (Pa)	PRESSURE (dB re 1µPa)	COMMON UNDERWATER SOUNDS
1,000,000	240	maximum level / seismic air gun (1m)
100,000	220	typical active sonar (transmission level) /beluga vocalization (1m)
10,000	200	impact pile driving (1m)
1,000	180	large tanker (1m)
100	160	humpback whale song (1m)
10	140	orca vocalization (1m), small vessel traffic
1	120	bottlenose dolphin whistles (1m)
0.1	100	underwater earthquakes
0.01	80	heavy rain falling
0.001	60	ambient noise, sea state 4 (moderate)
0.0001	40	ambient noise, sea state 0 (in calm)
0.00001	20	bubbles (surface agitation)
0.000001	0	acoustic reference (re 1µPa)

Thunderlight 120 dB

Note: dB water ≅ dB air + 63

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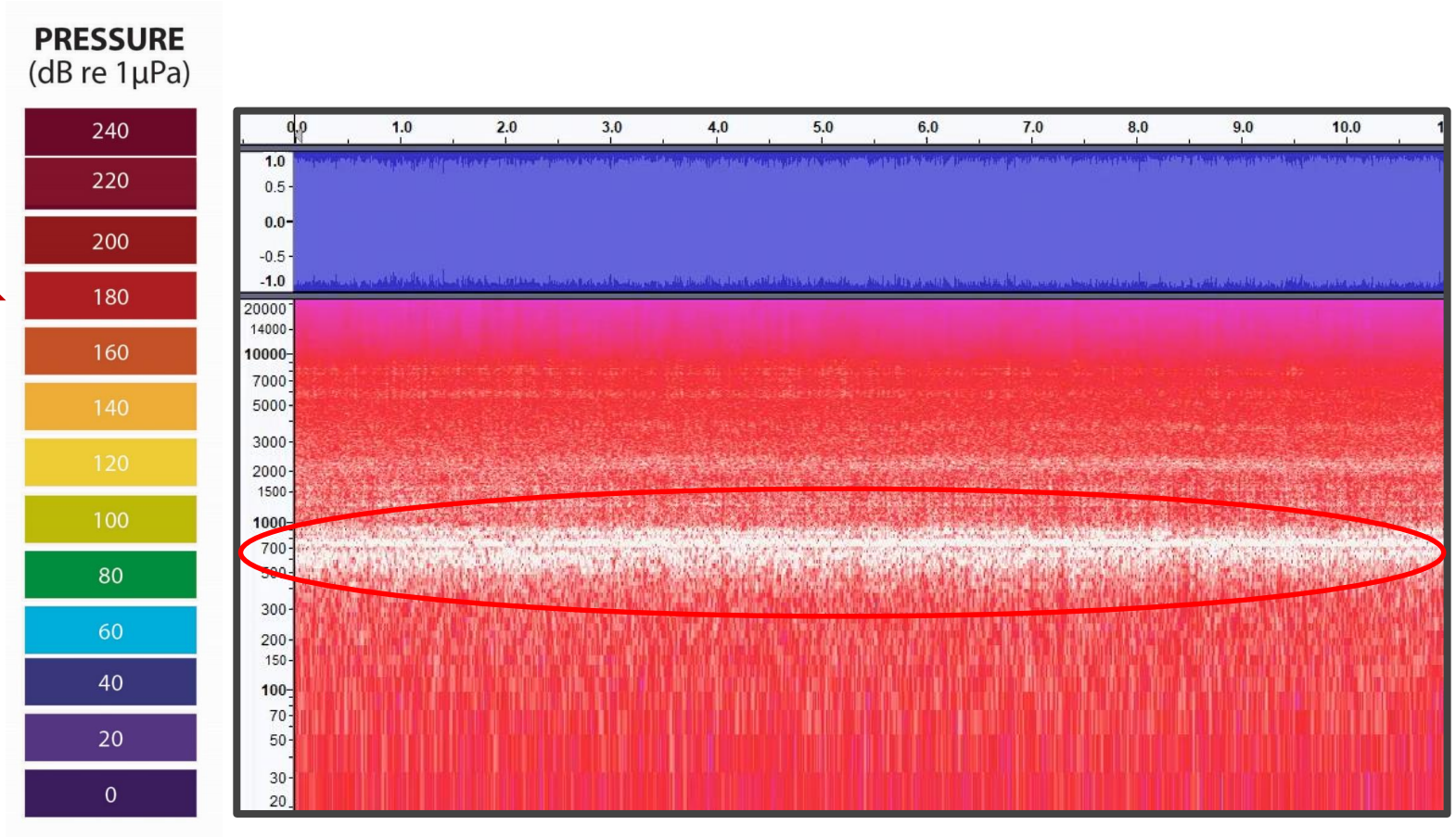
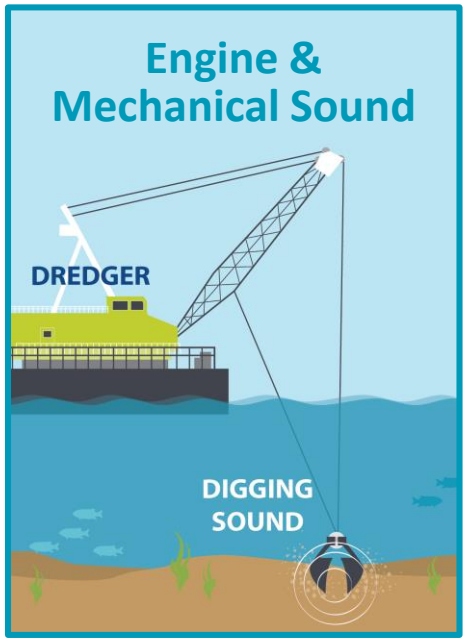
Dredging Sources

Dredging produces sounds which are non-impulsive, continuous, discontinuous, and/or cyclic in nature.

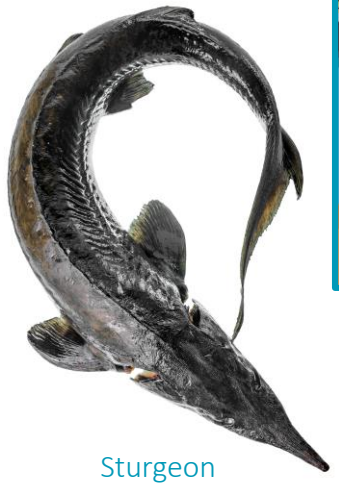
Sound Pressure Levels (SPL) occurring at the source (at 1 m) range from 107 to 190 dB re 1µPa.



Underwater Noise Impacts



Salmon



Sturgeon

186 dB SEL cum

Injury

physiological

150 dB RMS SPL

Disturbance

behavioral

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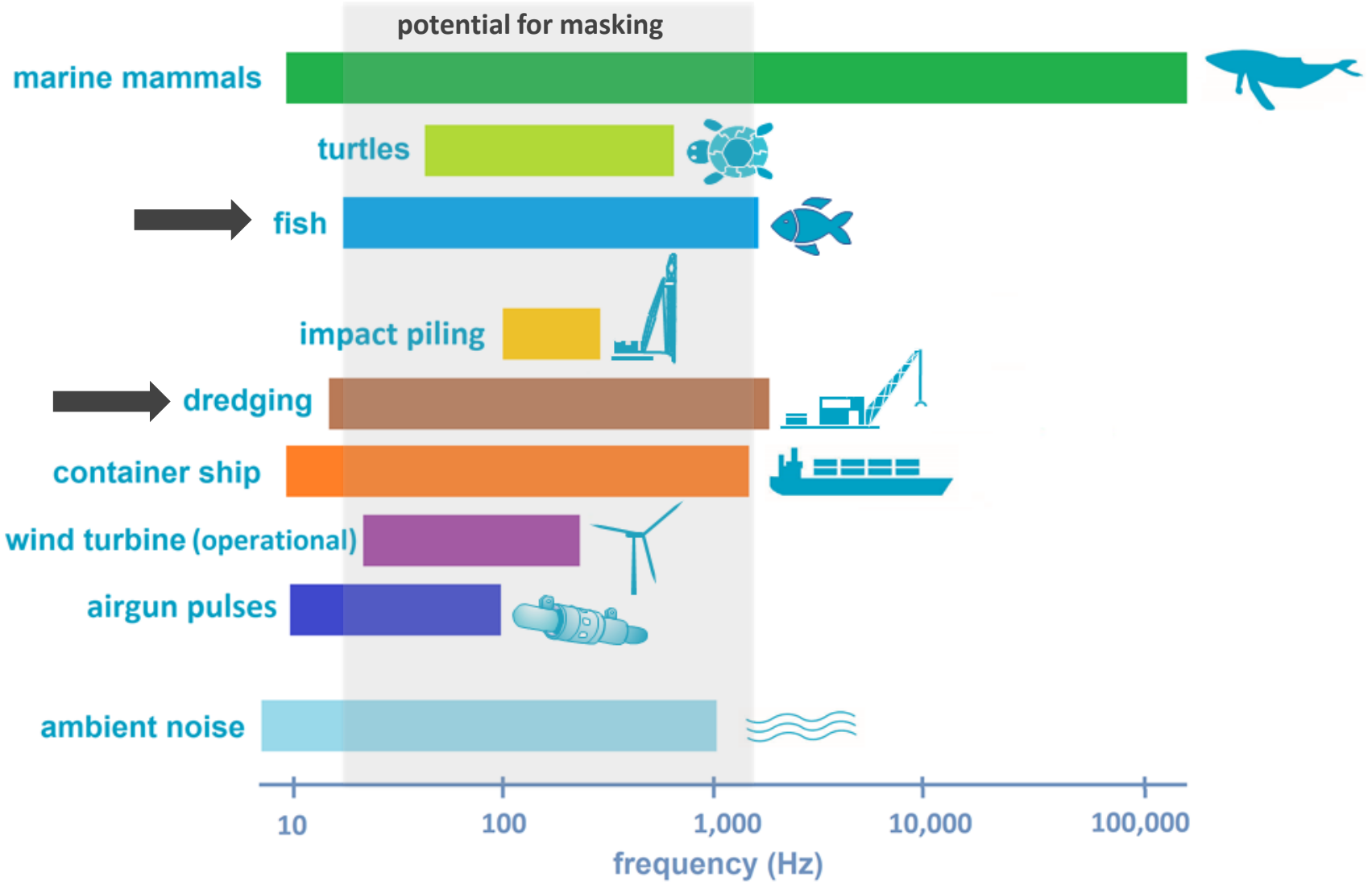
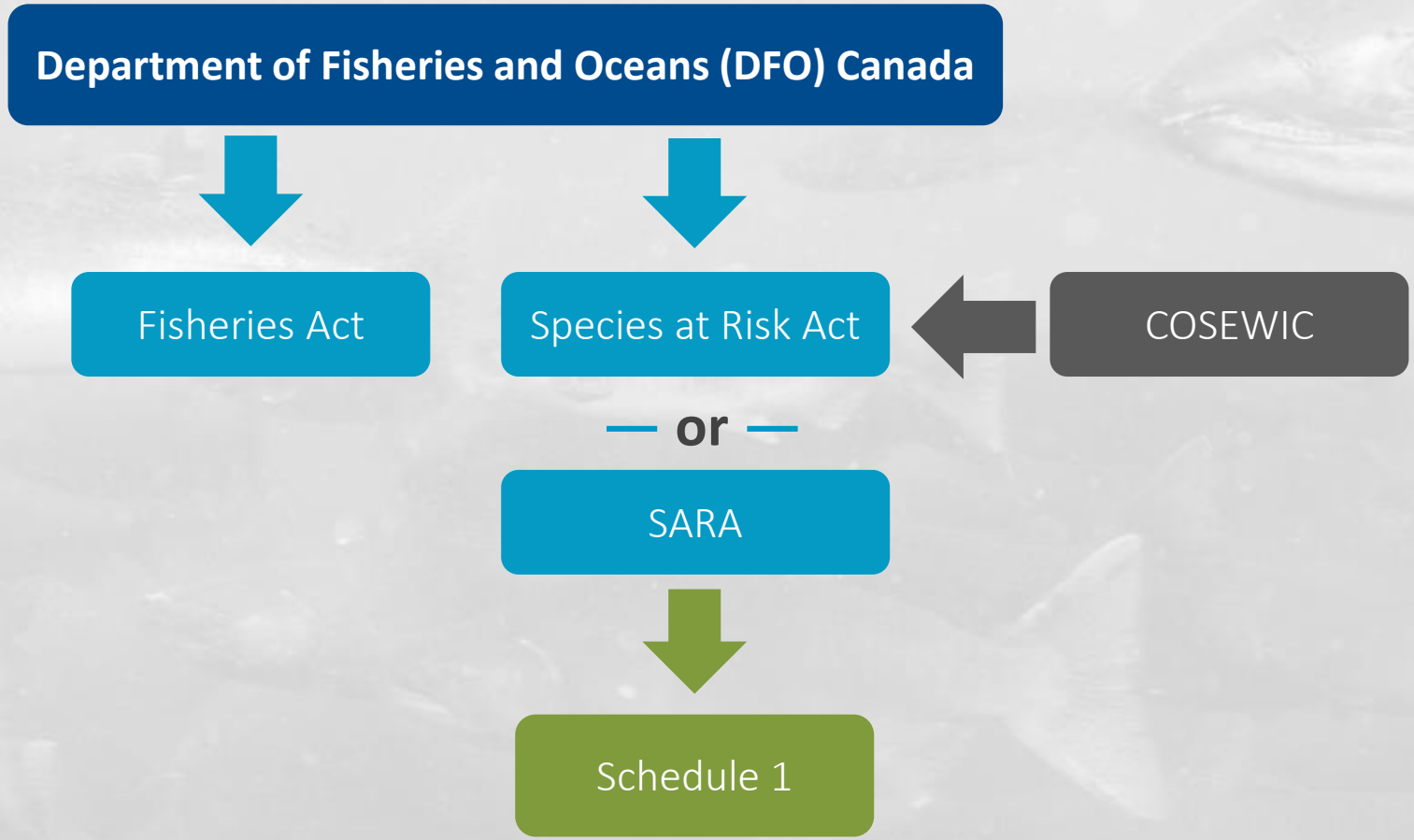
Underwater Noise Masking

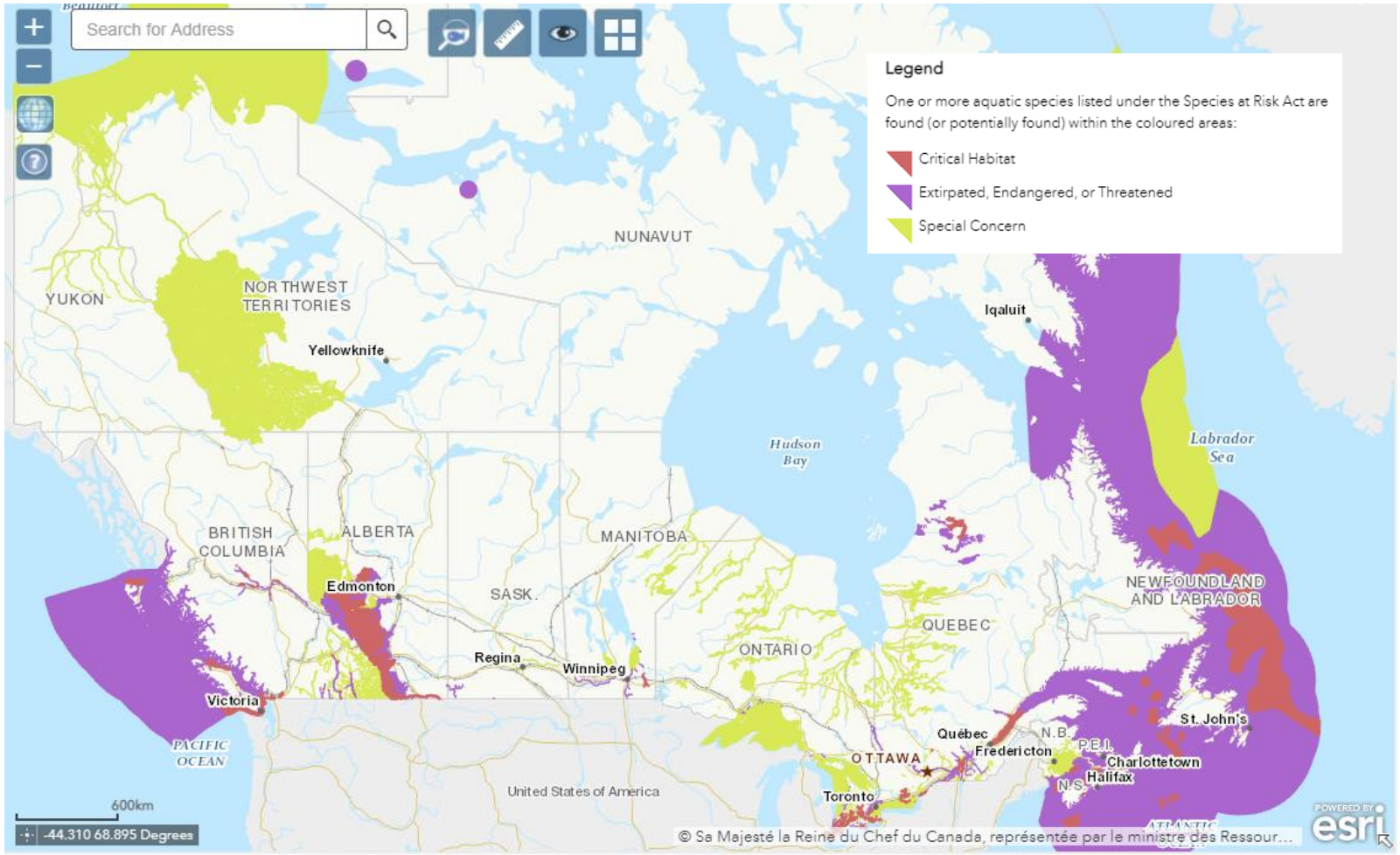


Best Practices

Canadian Regulation



Aquatic Species At Risk (SARA)

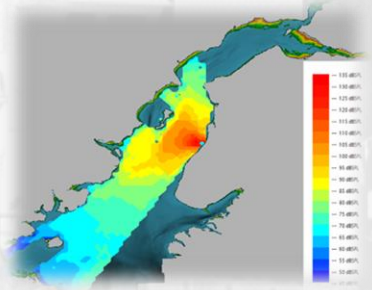


See [SARA map (dfo-mpo.gc.ca)] for more information

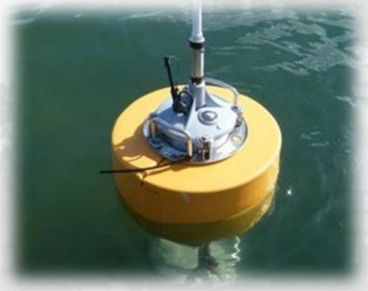
Environmental Impact Assessment

Environmental Impact Assessment

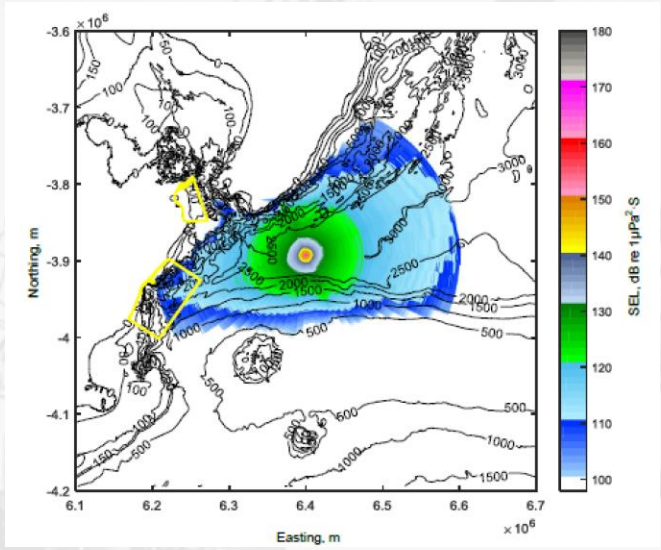
Prediction / Modeling

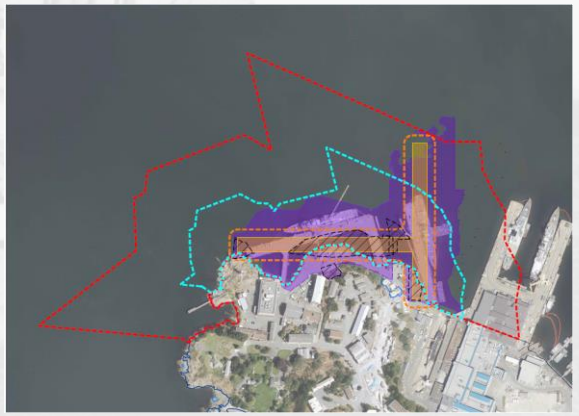


Baseline Monitoring



Mitigation Plan





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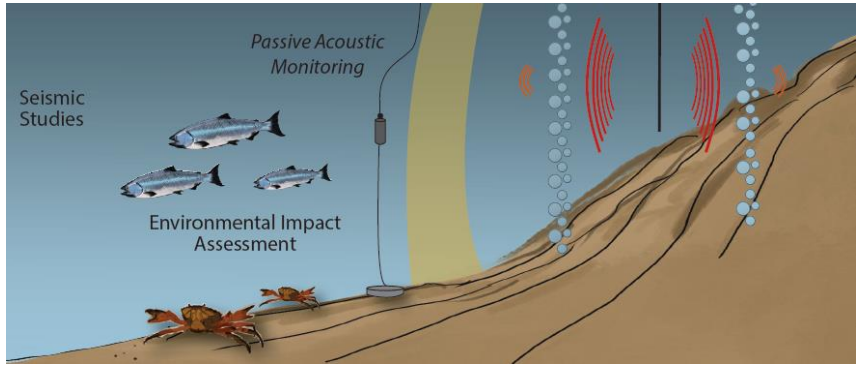
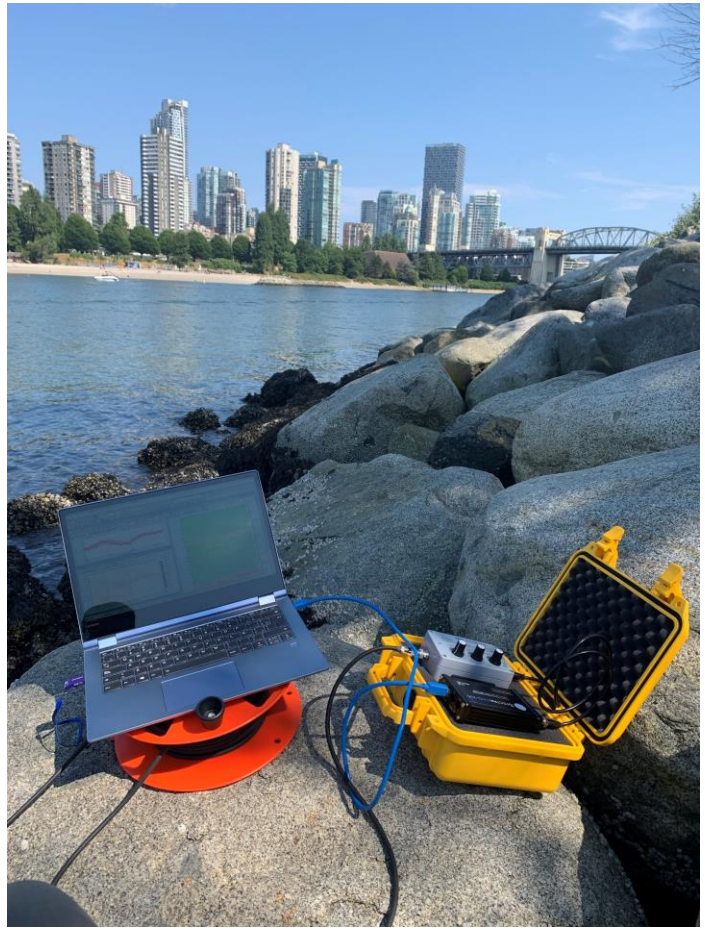
Mitigation

Underwater Noise Monitoring



Passive Acoustic Monitoring **(PAM)**



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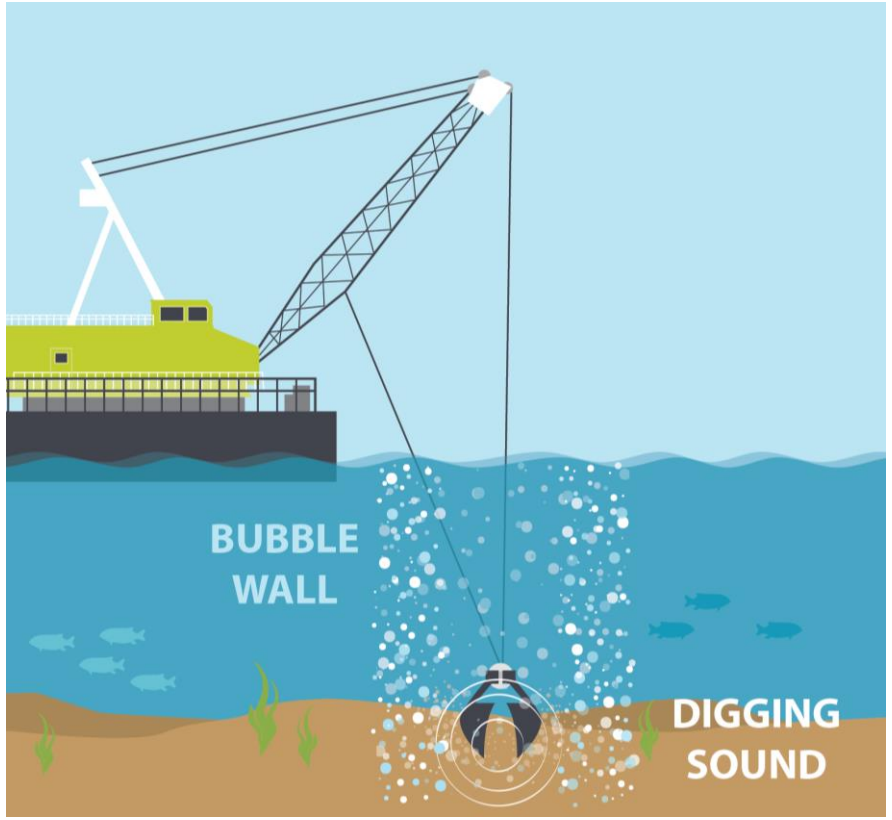
Attenuation of the Propagated Noise

- A **bubble curtain** may be installed at the bottom of the water column to avoid the carrying away of spoils from the operational area.
- A bubble curtain can either be designed as a **single, double or triple** curtain system.
- The **advantages** this noise mitigation system bring are:
  - prevent sediment from drifting
  - low noise during operation



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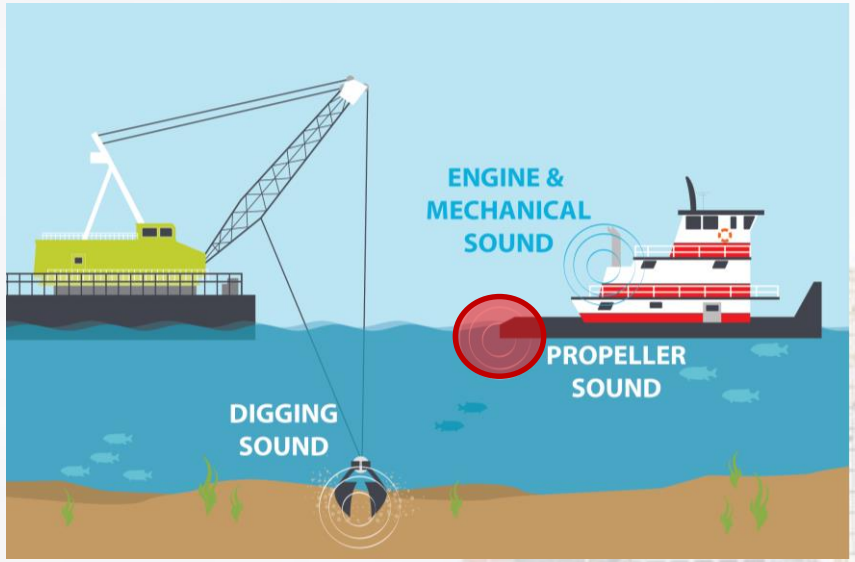
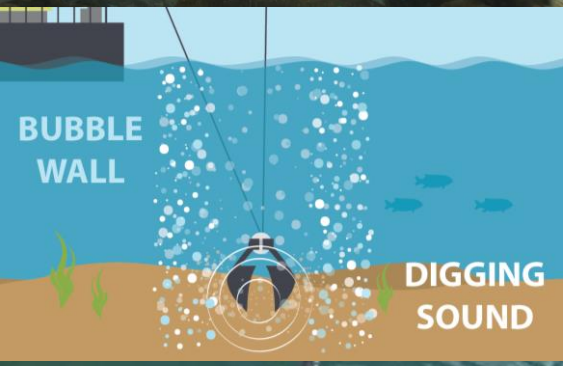
Attenuation of noise generated at the source

Ship propellers design for quieter vessels comprise:

- Optimized propellers
- Propellor Boss Cap Fins (PBCF)
- Propeller Wake flow field





Key Points

- **Remediation dredging** is a solution to improve water quality for both people and aquatic life.
  - A **best practice** is to look at the aquatic SARA map and see if, based on the location of the site activity, aquatic species could potentially be affected by remedial dredging activities.
  - If underwater noise **mitigation alternatives** are not applied, the collateral impacts could adversely affect freshwater ecosystems.
- Implementing an **environmental impact assessment** and developing a **mitigation & management plan** are critical for successful project delivery.

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Questions?

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