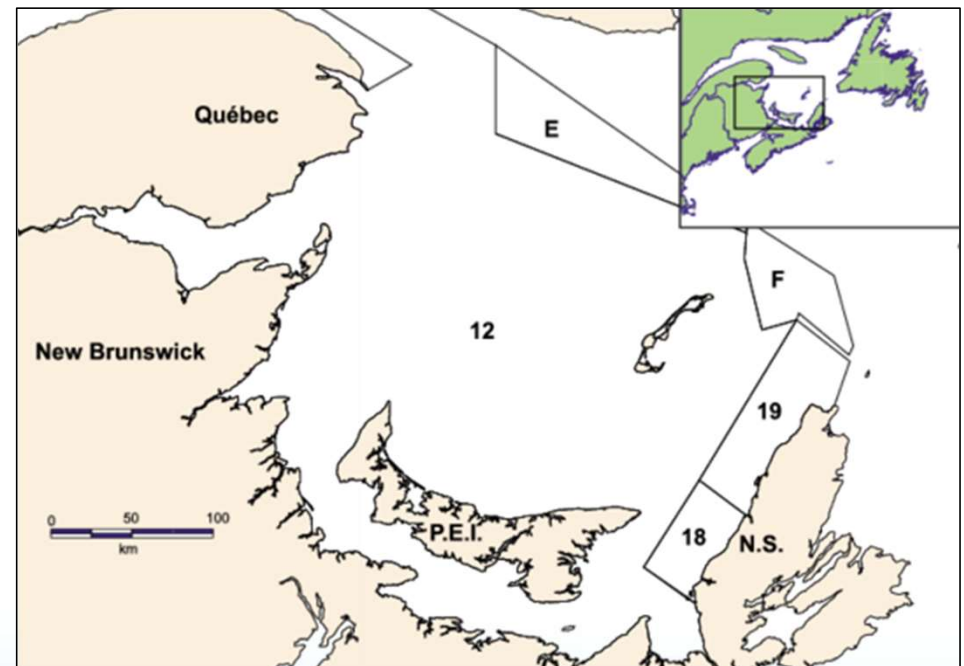


A pathway to innovation for the Gulf of St-Lawrence Snow Crab fishing fleet

Gear-on-demand experiments
Experiments with weak ropes
Experiment with Smart buoys

OVERVIEW OF SNOW CRAB FISHERY

- Approx. 400 licences
- Approx. 30,000 pots
- Average vessel length: ~70 feet
- Average fish hold capacity: 30,000 lbs
- Average fishing trip: 48 hours
- Single pot fishery
- Fast-paced fishery
- Fishing season: May-June



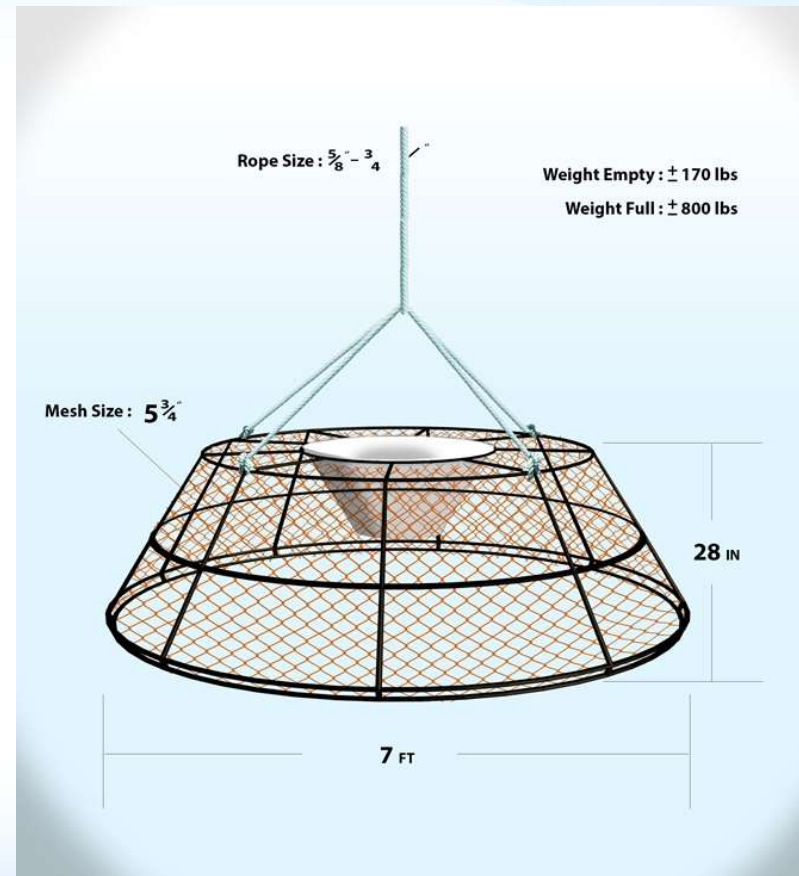
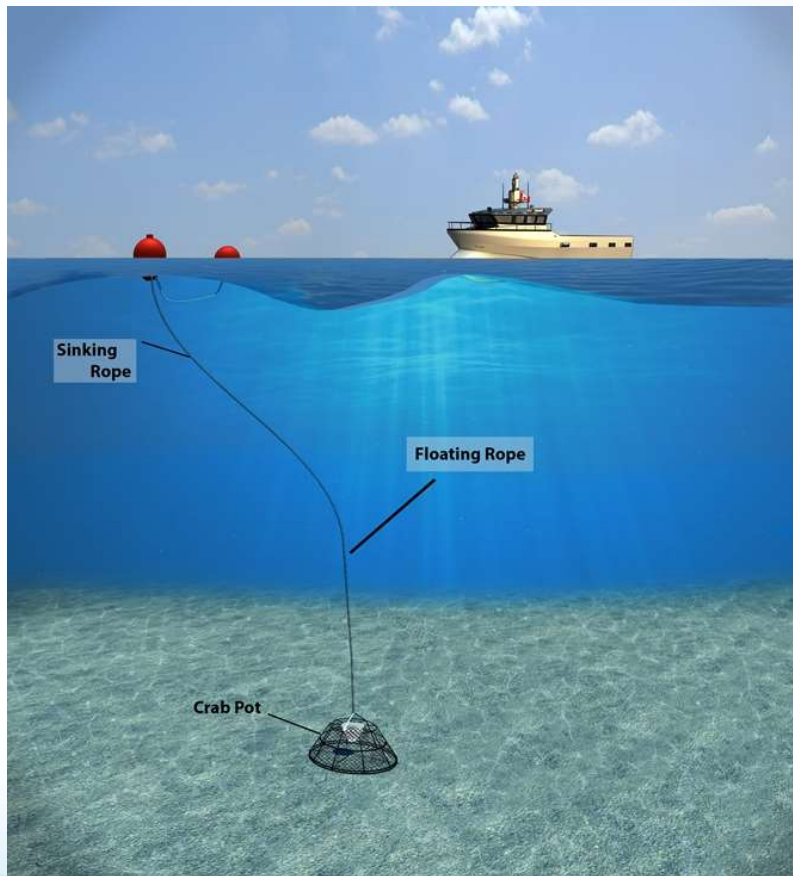
Source: Fisheries and Oceans Canada

OVERVIEW OF SNOW CRAB GEAR

- Trap dimension – width 7'
- Trap + catch (max.) 649 lbs
- Max. depth of fishing 51 fathoms
- Min. depth of fishing 32 fathoms
- Length of rope 84 fathoms
- Sinking vs floating rope ratio 25 : 50
- Diameter of rope 9/16" - 3/4 "

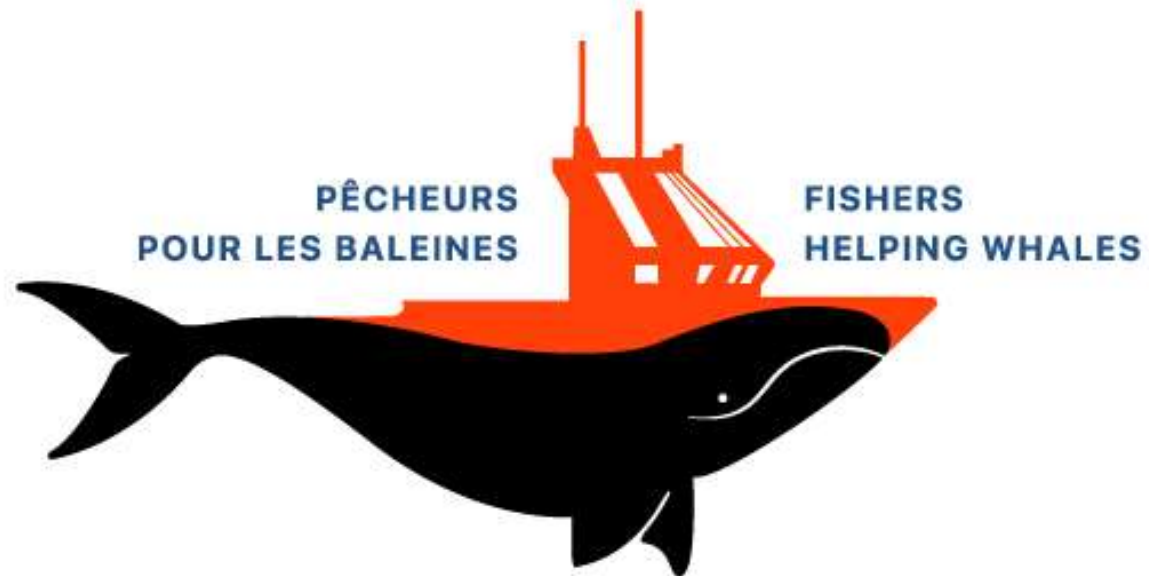


OVERVIEW OF SNOW CRAB FISHERY



Southern Gulf of St-Lawrence Snow Crab Fleet

GEAR-ON-DEMAND EXPERIMENTS



THE NORTH ATLANTIC RIGHT WHALE TRIGGER

Need to mitigate NARW entanglements in the Canadian Snow Crab fishery:

- Activities supported financially by the Atlantic Fisheries Fund and the Province of New-Brunswick
- Fostered by the New-Brunswick Snow Crab Fleet Associations
- Performed:
 - by CORBO Engineering from Caraquet
 - by other experts from Canada, the USA and France
 - by up to 22 professional snow crab fishers from the Gulf of St Lawrence



THE NORTH ATLANTIC RIGHT WHALE TRIGGER

- A first phase of experiments was deployed in 2018 & 2019
- A second phase of extended experiments was deployed in 2020 and will end next year
- A separate project was deployed in 2020 for Les Pêcheries L.E.F.
 - This fisher upgraded his full 150 snow crab regular gear set up with Smart buoys which he had tested during the second phase of our project



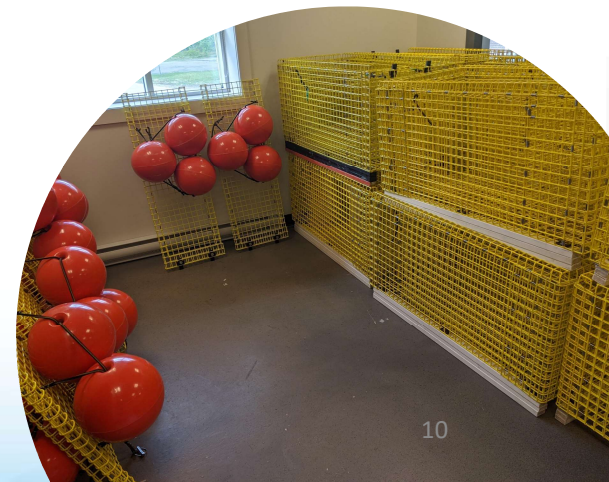
THE NORTH ATLANTIC RIGHT WHALE TRIGGER

- In 2018/2019: 5 fishers tested different ropeless gears
- In 2020: 10 fishers were allocated a trawl of ten (10) traps each to experiment some fishing in closed areas
- In 2021: limited experimentation due to COVID limitations and lack of quota to fish
- In 2022: 19 fishers got 55 ropeless traps each to fish in closed areas; over 1000 ropeless traps were fished extensively in the fishing season



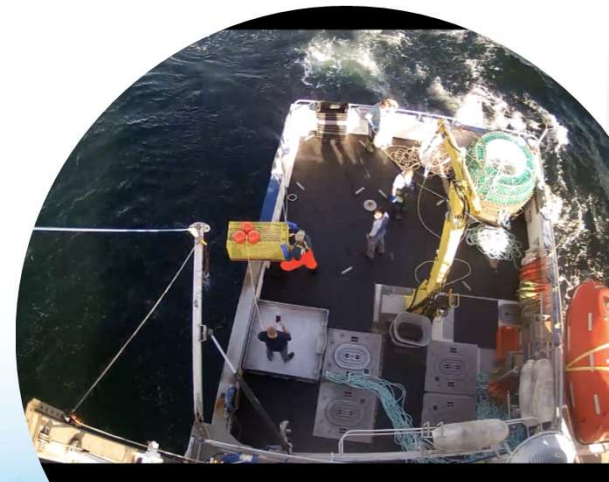
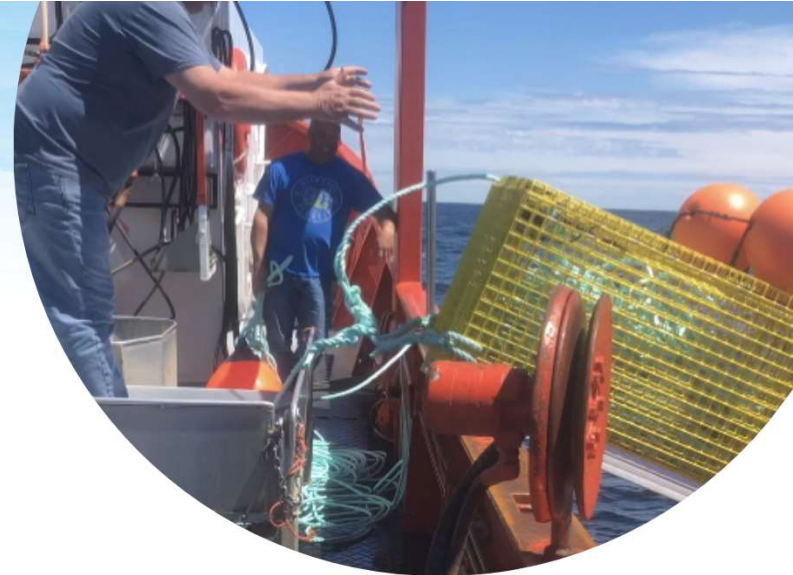
THE NORTH ATLANTIC RIGHT WHALE TRIGGER

- The 2022 fishing season created ideal conditions for gear-on-demand experiments
- The size of the territory closed to fishing was the most important since the beginning of NARW measures
- The total quota allowed in the Southern Gulf of St-Lawrence was amongst the highest in recent years
- The crab was not trapping as well as expected causing a longer fishing season than expected with more trips in closed areas



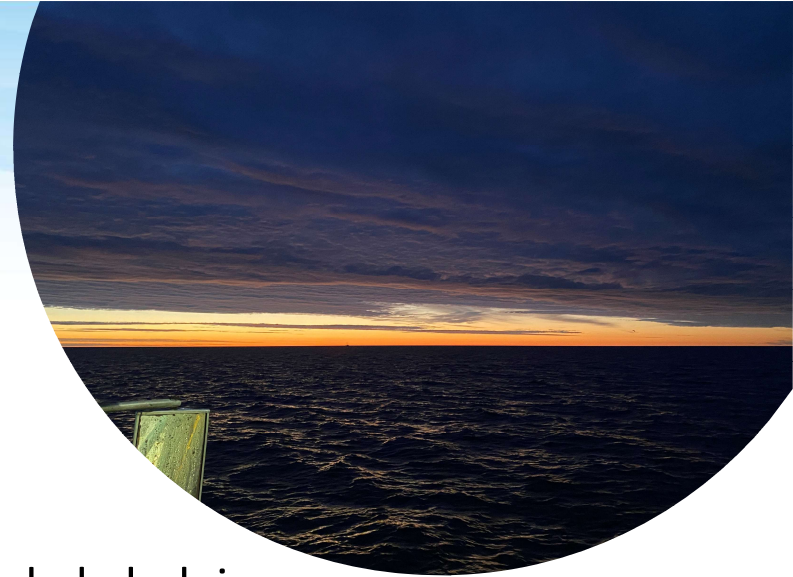
THE NORTH ATLANTIC RIGHT WHALE TRIGGER

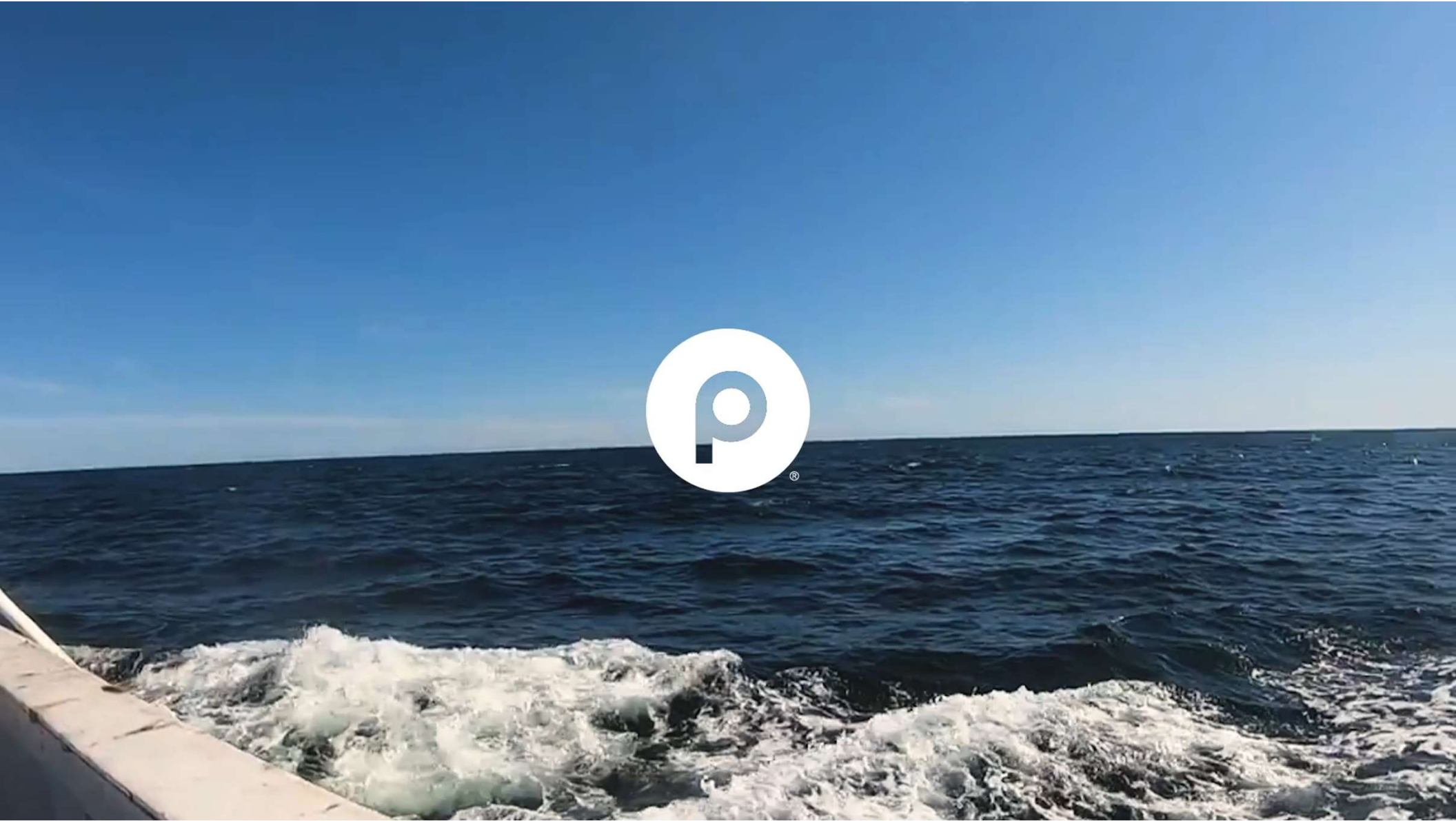
- Fishing activities in closed areas during the 2022 season were very important and successful
- Seventy-eight (78) fishing trips were made in closed areas ranging between 2 trips to 8 trips per fisher
- Over 450,000 lbs (203 MT) of snow crab was caught with ropeless gear
- 4 fishers caught over 50,000 lbs each
- 7 fishers caught between 15,000 and 50,000 lbs each
- 8 fisher caught between 2,000 and 15,000 lbs each



POSITIVE EXPOSURE

- Radio Canada
- RCI
- CBC
- La Presse Canadienne
- La Presse
- L'actualité
- Montreal Gazette
- The Nature of Things
- The Last of the Right Whales
- Le Soleil
- BBC
- Le dernier chant de la baleine
- Navigator Magazine
- Smithsonian Magazine
- SeafoodNews.com
- New York Times
- Undercurrent Journal
- The Guardian





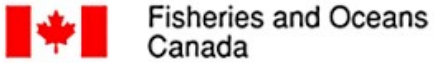
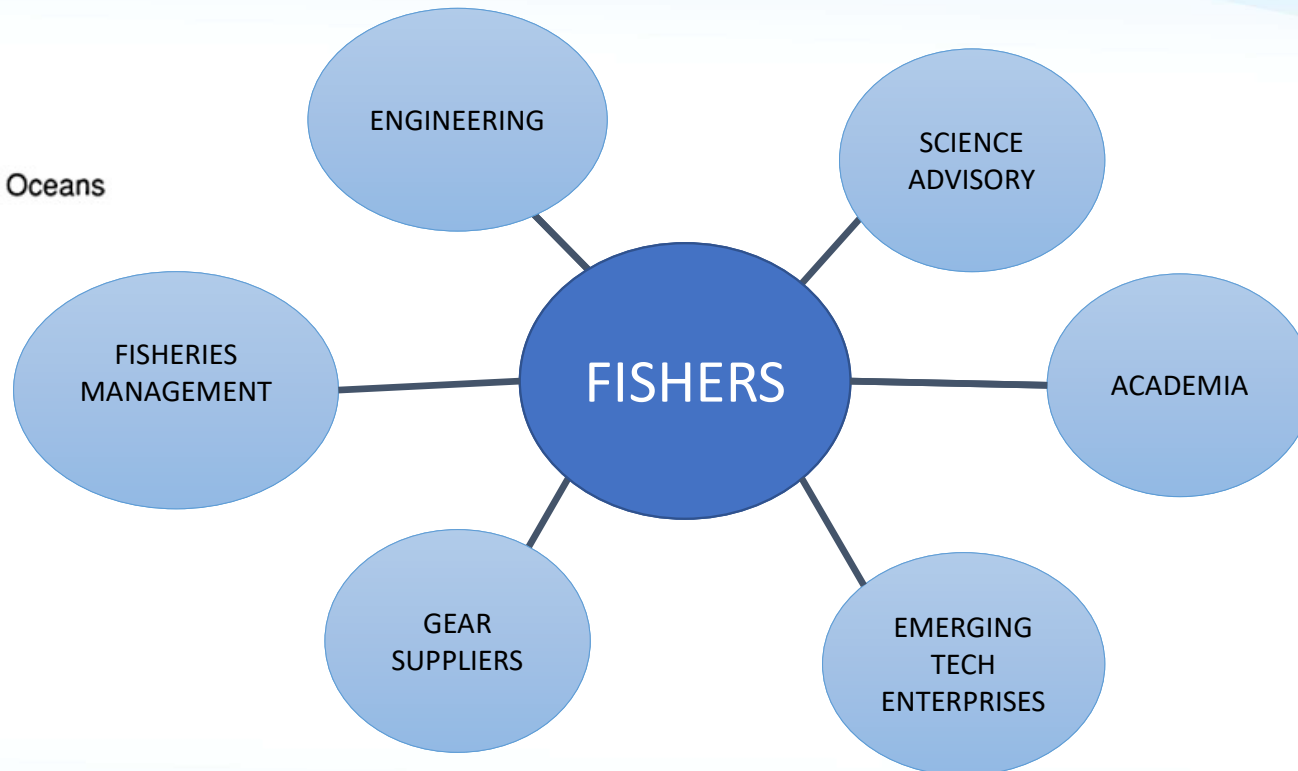
EQUIPMENT COST EVALUATION PER BOAT

- Fix Equipment ~\$10,000 cad
 - Bleat Control Unit
 - Transducer
 - Tablet
 - Satellite Com. System

- Underwater Equipment ~\$6,000 cad
 - Release system
 - Release cage
 - Rope

1 boat equipped with 10 units
1x \$10,000
10x \$6,000
\$70,000 cad

NEW COLLABORATIONS – NEW INSIGHTS





NEW COLLABORATIONS- NEW INSIGHTS

Looking for reliable conditions:

- Seeking the right circumstances to attract new ways of harvesting snow crab safely and profitably without the presence of ropes in the water column
- Relying on the fulfillment of two (2) measures before allowing “real life” experimentation of new gear:
 - Expert approval of the system’s technical reliability
 - Harvesters’ acknowledgement that the system can work in a real fishery setting



CHALLENGES TO OVERCOME

- Efficiency of the overall system was found to be limited due to the following:
 - Satellite communication not reliable
 - Wireless communication between the components (Wi-Fi, Bluetooth, GPS) not reliable
 - Software issues
 - Duplication of several tasks
 - Possibilities for human errors
- Fishing in trawls with large pots:
 - Many cases of pots full of mud were reported
 - Can only be done safely in calm weather
- Opening this practice to more harvesters without having outside coordination

PROPOSED AMENDMENT FOR 2023

Increase the number of participant fishers in the gear-on-demand experiment to 31 fishers

- High request from members to experiment with gear-on-demand equipment
- Willingness to contribute financially to the project as was done by the previous group of fishers
- Need to get more data from more fishers to document the appropriateness of the actual gear-on-demand configuration used in closed areas
- Increase the opportunities related to needed adjustments of equipment and at sea operations done by a larger number of fishers
- Increase the opportunity of the Conservation & Protection components to monitor a larger deployment of gear in closed areas
- Improve our analysis of gear-on-demand performance compared to traditional buoyed gear



Southern Gulf of St-Lawrence Snow Crab Fleet

EXPERIMENTS WITH WEAK ROPES



WHERE DID THIS CONCEPT OF A WHALE SAFE ROPE ORIGINATED?

In 2016, researcher Amy Knowlton published an article entitled "Effects of fishing rope strength on the severity of large whale entanglements" in which she highlights the low risk of a whale becoming entangled in ropes of less than 1,700 lbf (7.56 kN) breaking strength





ROPE CURRENTLY BEING USED

According to a survey made with a group of snow crab fishermen, here is the type of rope currently being used:

- 9/16" : 8,800 lbf
- 5/8" : 10,500 lbf
- 3/4" : 11,700 lbf





Version 2



Version 1



Version 3

DEVELOPMENT OF THE WEAK ROPE

Development of a weak rope prototype by Entreprises Shippagan and Tufropes :

- 2018 – Version 1
- 2019 - Version 2
- 2020 - Version 3

SEA TRIALS

- In 2018:
 - First tension tests with the Simulated Loaded Trap (SLT)
 - Accelerated aging tests on weak ropes Version 1
- In 2019:
 - Simulated Loaded Trap vs. Crab Pot filled with 600 lbs of crab
 - Data collection of tension taken with Simulated Loaded Trap in various weather conditions
- In 2020:
 - Tension data taken during a full fishing season on 3 vessels using traditional ropes
 - Tests using Time Tension Line Cutter on shore



SEA TRIALS

- In 2021:
 - Off-Season trials with Simulated loaded traps
 - Accelerated aging tests on weak ropes Version 3
- In 2022:
 - Tension data from 17 harvesters during full season
 - Tests with various weak links with 3 harvester:
 - Full Weak Rope (25 ftms sinking - 50 ftms floating)
 - 1 Ftms Weak Rope inserts (3 splice per rope)
 - Breakaway Release Link (3 splice per rope)
 - Nova Braid Sleeves (3 splice per rope)



OFF-SEASON TESTING RESULTS



OFF-SEASON TESTING RESULTS



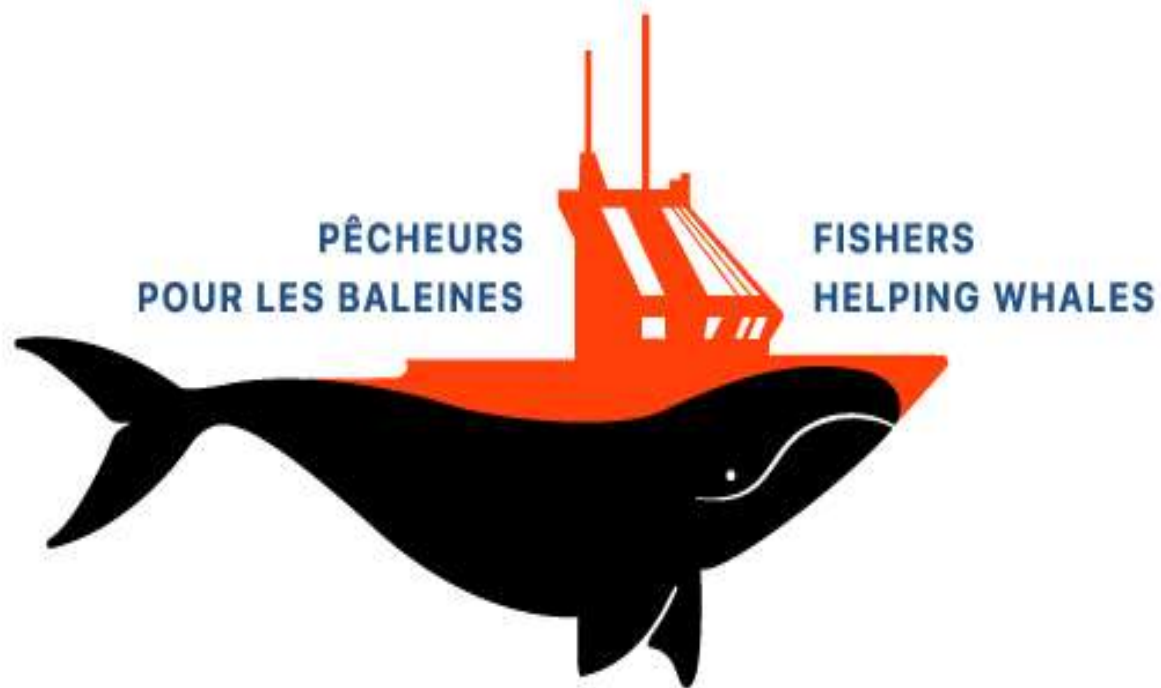


PRELIMINARY CONCLUSIONS

- Full length of Weak Rope seems to be the best option for the whales' perspective but not fit to be used with current equipment
- Weak rope inserts worked in good weather and low catch rates
- Other weak links tested failed
- To prevent creating more ghost gear and for crew safety we need at least 2 more years to do more testing

Southern Gulf of St-Lawrence Snow Crab Fleet

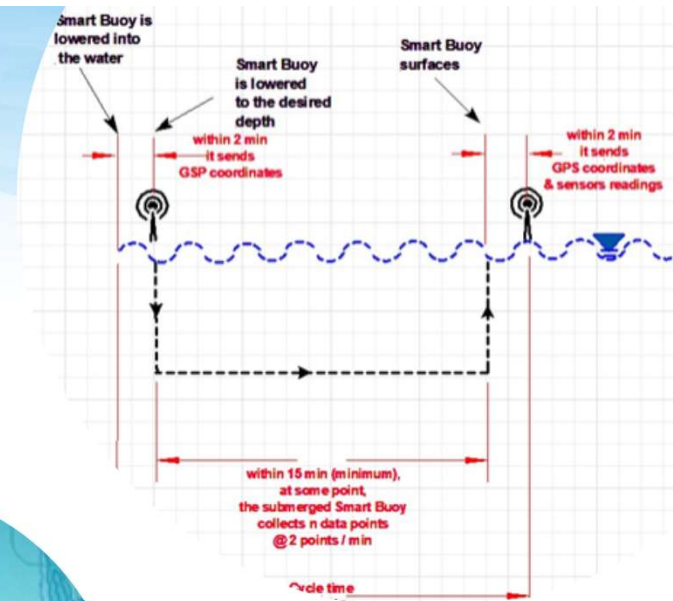
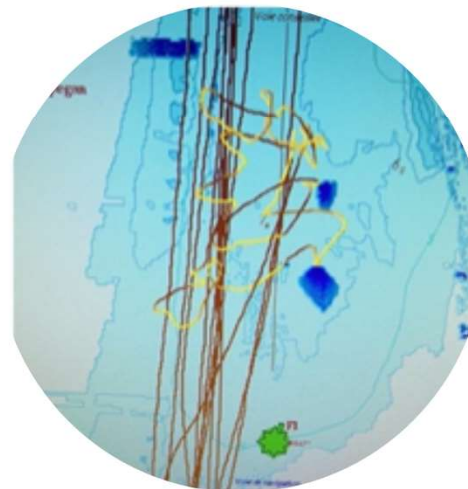
SMART BUOYS EXPERIMENT



SMART BUOYS MONITORING OF TRAPS

Work 2018 to 2020

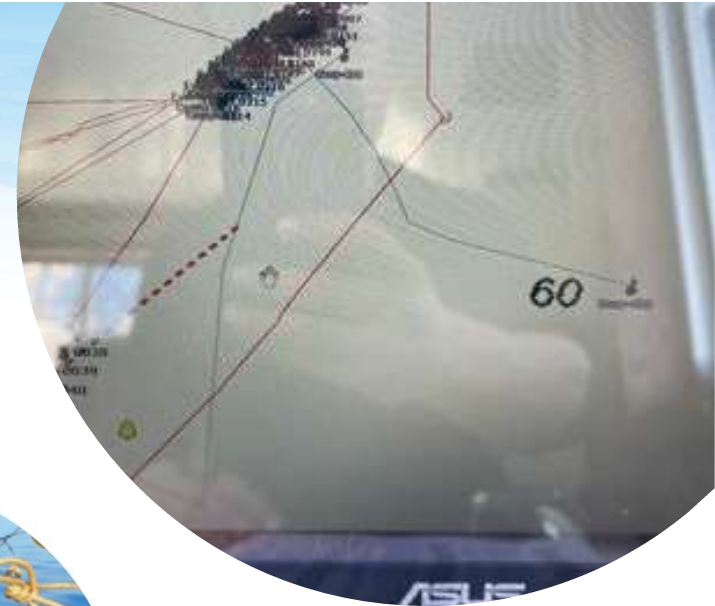
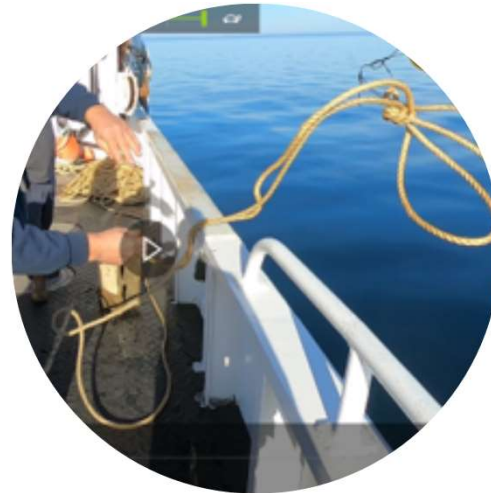
- Proof of concept of the Smart Buoy
- Sea trials of the Blue Ocean Gear Smart Buoy prototype for:
 - Simulation of an entangled whale
 - Simulation of pot piracy



SMART BUOYS MONITORING OF TRAPS

Work in 2022

- One full set of 150 traps were equipped with Smart Buoys throughout the fishing season
- The owner of the gear was able to monitor the location and behaviour of all his traps at all time.



SMART BUOYS MONITORING OF TRAPS

Work in 2022

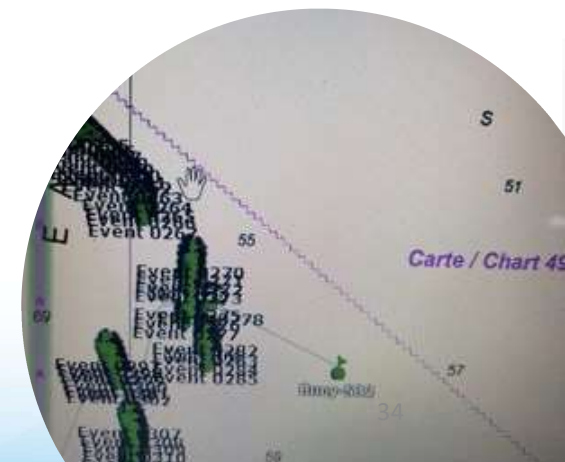
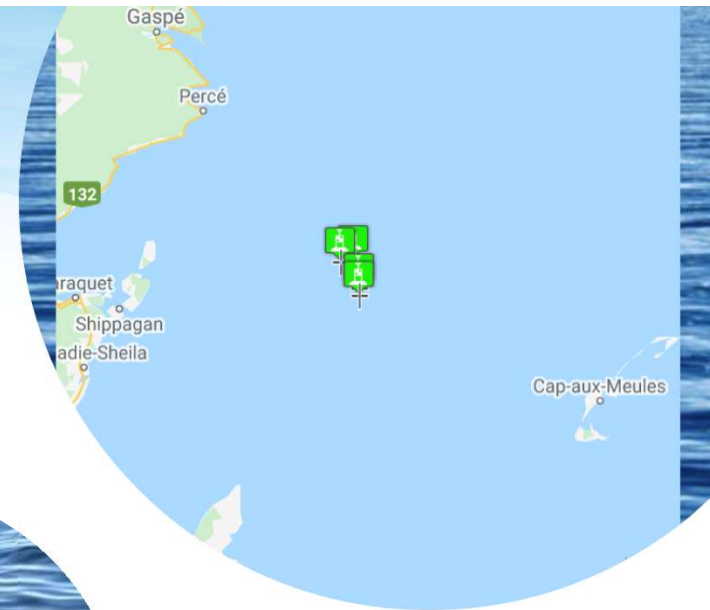
- Any significant displacement of trap was recorded and sent in near real time to the owner's iPhone and to the Blue Ocean Gear server in California
- The timing and location of one presumed event of trap poaching was thus monitored by the owner
- The duration and trajectory of a trap caught and pulled by a vessel was also monitored by the owner



SMART BUOYS MONITORING OF TRAPS

Proposal for 2023

- Implement a scientific protocol for testing the performance of Smart buoys during the fishing season
- Testing and documenting experiments done by 3 different vessels simulating:
 - A vertical rope caught by a whale or a vessel stabilizer
 - The poaching of a snow crab trap



Southern Gulf of St-Lawrence Snow Crab Fleet

THANK YOU!

