



**Northern Cod Fisheries Improvement Project:**  
*Improving the Future through Improved Science*

*BARCELONA APRIL 2023*

# ASP/AGC Northern Cod FIP – Our Objectives

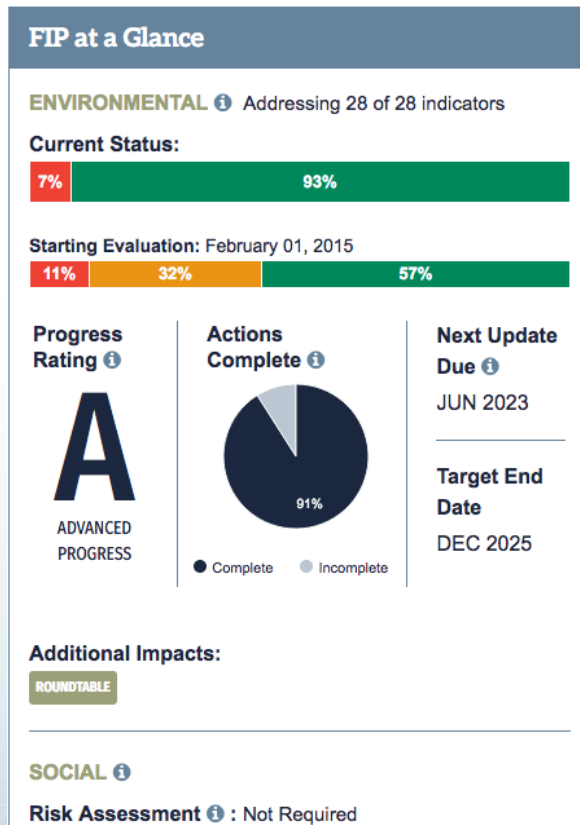
- Address gaps in scientific information to facilitate sustainable management of this important resource
- Prepare information and documentation for eventual MSC certification



# Partners

- DFO and Govt NL
- Important International Customers
  - Marks and Spencer (M&S)
  - Sysco France
  - High Liner Foods
  - Young's Seafood
- Sustainable Fisheries Partnership
- Academia
  - Ocean Tracking Network
  - Dalhousie University
  - Memorial University
- Inshore Processors + Year-round Harvesters
  - ASP Members
  - AGC Members

# FIP at a Glance



- FIP started in 2015
- 13 FIP tasks completed
- 3 Outstanding Action Items
  - Stock Status monitoring – Annual
  - HCR testing – To be completed during Rebuilding Plan review.
  - Northern Cod Acoustic Tracking (NCAT) Project – Stock migration and composition research



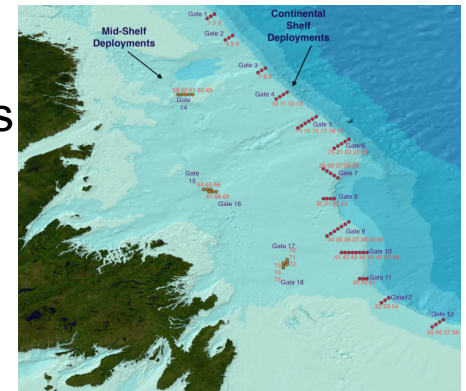
The background of the slide is a close-up photograph of blue water with gentle ripples and reflections, creating a textured, shimmering effect. The text is centered over this background.

ASP/AGC FIP Working Group:  
Data Collection and Research Continues

# Northern Cod Acoustic Tracking (NCAT) Project Update

- NCAT Project Elements

- Research plan to investigate Northern Cod migration & stock composition
- Genetic studies provided insight into genes linked to behavior, habitat choice and diet
- Objective to acoustically tag 1200 cod & track migrations on Newfoundland Shelf.
- 75 receiver acoustic array installed in 2020 →
- 775 cod tagged to date
- Receiver data uploaded via autonomous Wave Gliders



## 2019 Tagging Results



- July/ August 2019
- 338 acoustic tagged & genetically sampled cod
- Tagging conducted in 2J, 3K and 3L





## 2021 Tagging Results

- May 2021
- 66 cod tagged and genetically sampled, (51 in 2J, 15 in 3K)
- 49 additional cod externally floy tagged



## March 2022 Tagging Results

- 371 acoustic tagged & genetically sampled cod
- 298 Floy tagged cod, photographed for morphological body shape analysis
- 25 fishing sets
- 14 reconns to find cod aggregations
- Tagging team from HusseyLab at the University of Windsor and Fisheries and Oceans Arctic region / the University of Manitoba





## 2023 Spring Tagging Trip

- April 2023
- 7-day trip into 3L and 3K
- Bottom temps were colder
- Observed capelin, jellyfish, flatfish
- Unfortunately, no suitable cod found or tagged.



The background of the slide is a close-up photograph of blue water with gentle ripples and reflections, creating a textured, shimmering effect. The text "Initial Results!" is centered in the middle of the image in a white, sans-serif font.

Initial Results!

# Initial Genomic and Telemetry Results!

- MITACS funding to complement salary of postdoctoral fellow.
- Continue data analyses to integrate telemetry results with genomics.
- PhD Lisette Delgado
  - Postdoctoral fellow at Dalhousie University, currently working on Northern Cod.
  - Biologist, specialized in population genomics and bioinformatics.
  - M.Sc. studies, Michigan State University & Ph.D. studies, Dalhousie University.
  - Proficient in molecular lab techniques and data analyses in the fields of genomics (reduce representation and whole genome) and transcriptomics.
  - Skilled in programming languages: bash, R, and python.
  - Published in top tier journals (ecology and evolution fields).

# Previous NCAT Genetics Studies vs Whole Genome

- 2019 & 2020 genetics studies on Northern Cod
  - Provided valuable information on genetic make up
  - Analyzed 12K – 25K markers using reduced representation SNPs
  - Coarse assessment indicated genetically similar population
  - Example:

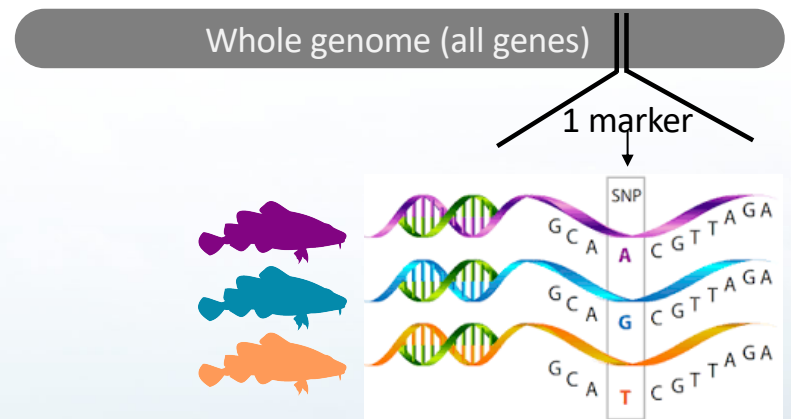
REGULAR PAPER

JOURNAL OF FISH BIOLOGY

Life-stage-dependent supergene haplotype frequencies and metapopulation neutral genetic patterns of Atlantic cod, *Gadus morhua*, from Canada's Northern cod stock region and adjacent areas

Gregory Neils Puncher<sup>1,2,3</sup> | Sherrylynn Rowe<sup>3</sup> | George A. Rose<sup>4</sup> |  
Geneviève J. Parent<sup>2</sup> | Yanjun Wang<sup>5</sup> | Scott A. Pavey<sup>1</sup>

- Current work:
  - Whole genome approach (complete set of cod genes)
  - Analyses > 1 million markers
  - Fine-scale differentiation looking at all genes for biological traits linked to migratory, spawning and other characteristics
  - Temporal analysis: samples from the early 1990s and late 2010s.





# Preliminary Results Summary

## Genomics

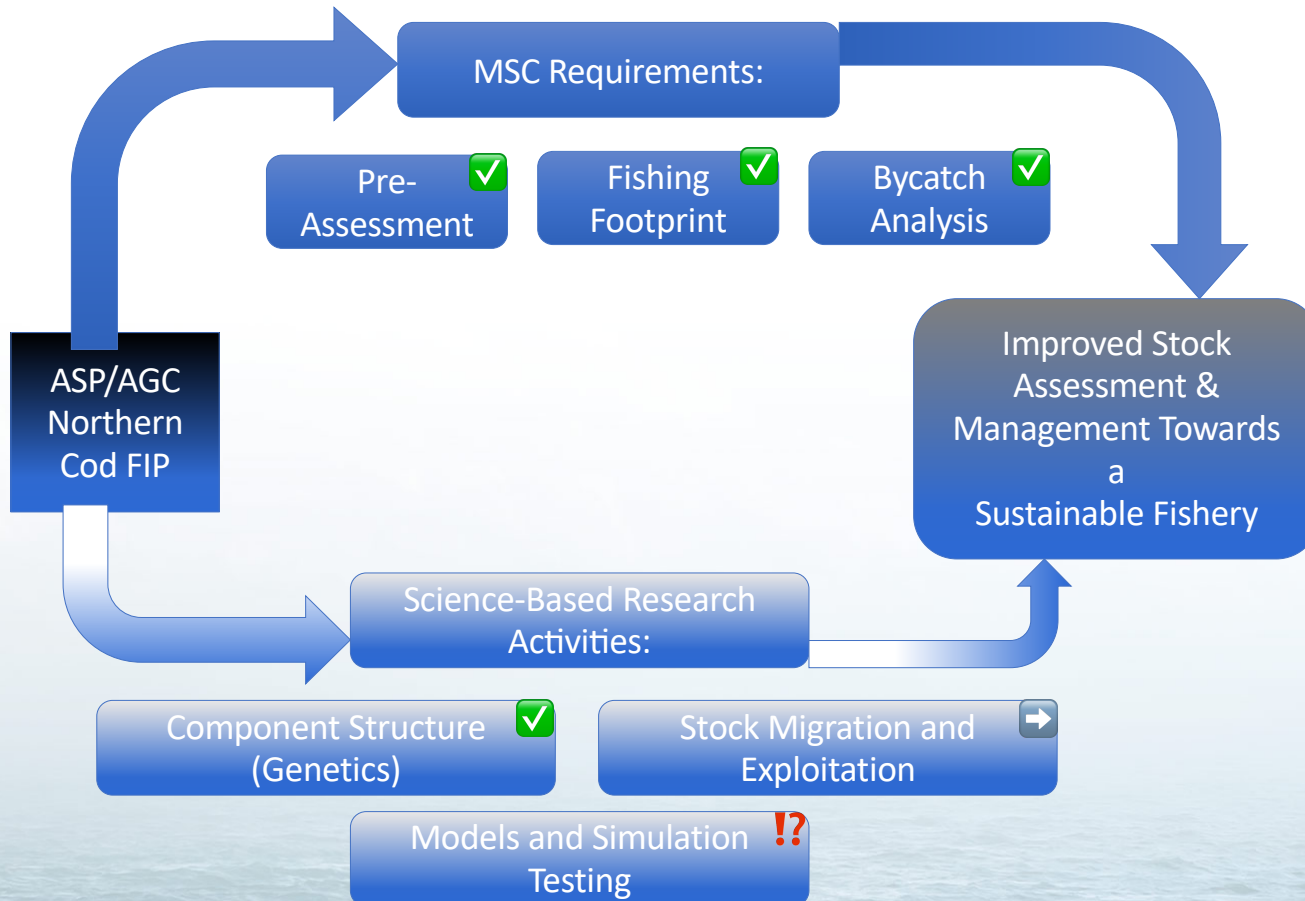
- Identified >1.5 million markers
- Inshore Labrador individuals are the most genetically distinct
- Genetic differentiation in 2J3KL is driven by two supergenes, these variations might be associated with migratory behavior and spawning time.

## Telemetry (tracking acoustically tagged cod)

- >300,000 detections
- 378 individuals were detected at least once after their release
- Individual movement can be classified:
  - Wide distribution (move between 2J, 3K, 3L, and 4R divisions)
  - Narrow distribution (remain within one division)
- ~20% of NCAT tagged individuals seem to remain only at inshore locations
- Remaining ~80%, spend the winter and spring at mostly at offshore locations.
- Too soon to estimate what percentage remain offshore throughout the year.



# ASP-AGC FIP Roadmap – What's next for NCAT?



May 2023

- Convene scientists and stakeholders to discuss:
- Summer 2023 tagging approach
- Next phase of NCAT project:
  - Data analysis
  - Expected projects
  - Incorporation in stock assessment process

# Questions?

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