

Decisions to implement spatio-temporal fisheries closures to reduce entanglement threats to whales must also consider how those closures can change the nature of a fishery

Cole, A.K.^{1,2}; Brillant, S.W.^{1,3}

¹ *Canadian Wildlife Federation, Kanata, Ontario, Canada, K2M 2W1 (alexandrac@cwf-fcf.org)*

² *Marine Affairs Program, Dalhousie University, Halifax, Nova Scotia, Canada, B3H 4R2*

³ *Department of Oceanography, Dalhousie University, Halifax, Nova Scotia, Canada, B3H 4R2*

Spatio-temporal fisheries closures to protect whales aim to exclude fishing effort (i.e. sets or gear) from areas where there are large observed densities of whales, and thus areas of high probability of entanglement. This goal is based on the assumption that the displaced fishing effort (i.e. effort that was previously inside the closures) will contribute less risk of entanglement in their new locations than within the closed area. There are, however, two ways displaced effort may still contribute to entanglement risk: 1) they can surround the fishery closure, and thus threaten to entangle whales transiting to or from the area; or 2) displaced effort may move to a location that produces more risk than their original location. These concerns, along with the increased socio-economic costs to fishers, are often held as arguments against the use of spatio-temporal closures. We used snow crab logbook data from the southern Gulf of St. Lawrence to test these assumptions and developed a model to predict fishing effort displacement. Closures were predicted to displace 29% of fishing effort, increasing effort outside the closed areas by approximately 41%. While 14% of effort occurred in areas not historically fished, displacement did not further enclose the perimeter of the closures as predicted; however, fishing effort in those areas increased. We estimated that closures and the movement of effort increased the socio-economic cost to displaced fishing by 23%, while the overall increase to the fishery was 8%. Ultimately, spatio-temporal closures can alter the nature of a fishery such that patterns of fishing effort, and thus patterns of risk, can change. This study provides a tool to help predict how closures may change a fishery and the effect of those changes on both the fishery and the effort to mitigate entanglement risk.

How do Time/Area closures impact the nature of a fishery

Alex Cole, Fisheries Management Evaluation Specialist
Sean Brilliant, Senior Conservation Biologist
alexandrac@cwf-fcf.org

Balancing Fisheries & Conservation Management

Boater no-go zones, salmon closures aim to protect southern resident killer whales

Lindsay Kines / Times Colonist
MAY 10, 2019 02:49 PM



WHALES

More Than 17,500 Square Miles Protected for Hawaii's False Killer Whales



By Center for Biological Diversity | Jul. 24, 2018 09:52AM EST

ANIMALS

CANADA

Fisheries department announces new fishery closures, openings in bid to protect Right Whales



BY [ALEXANDER QUON](#) - GLOBAL NEWS

Posted September 18, 2018 5:13 pm

California Crab Fisheries To Close Early To Protect Whales

Tuesday, March 26, 2019

By Associated Press

Concerns about Closures

1

Creation of new risk hotspots

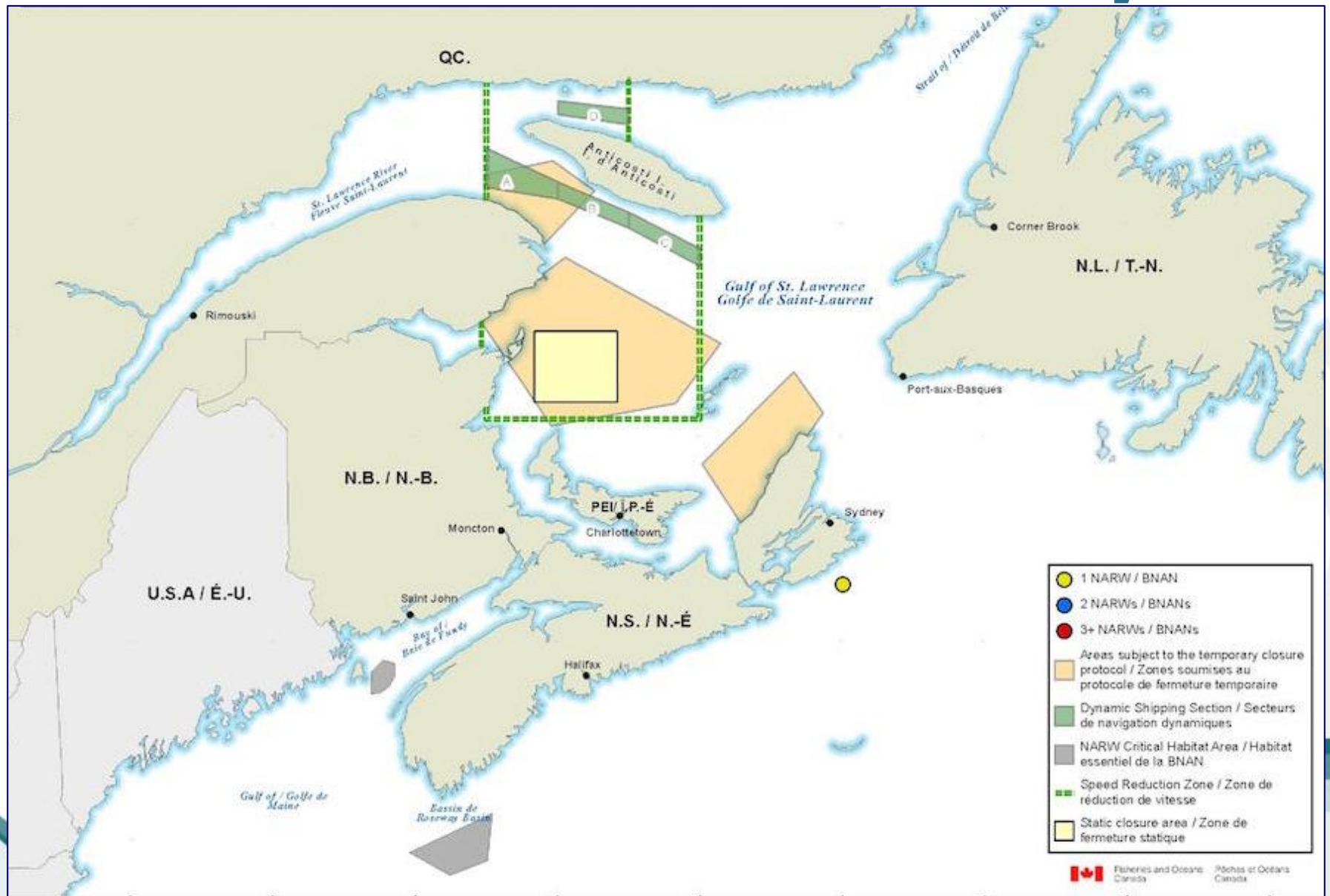
2

Creation of a “fence” around the closed area

3

Increased costs to fishers

sGSL Snow Crab Fishery



Data Collection & Analysis

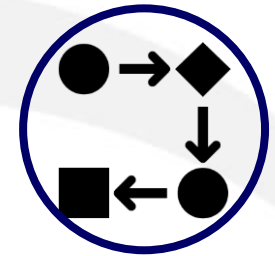


Collect Logbook Data

Historic Average
Observed 2018
Weekly Timescale

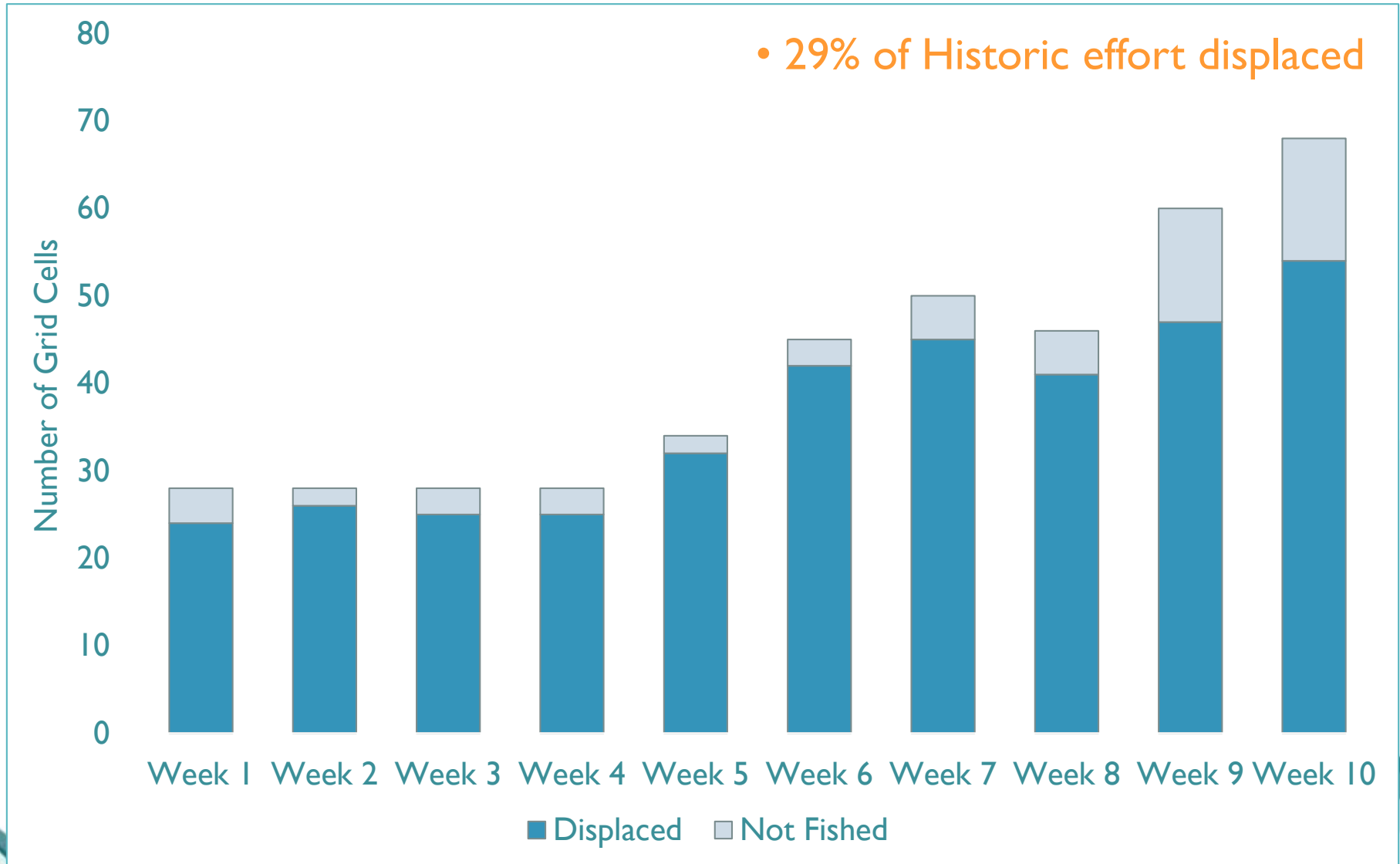


Personal Communication
Acadian Crabbers Association
DFO Gulf Science



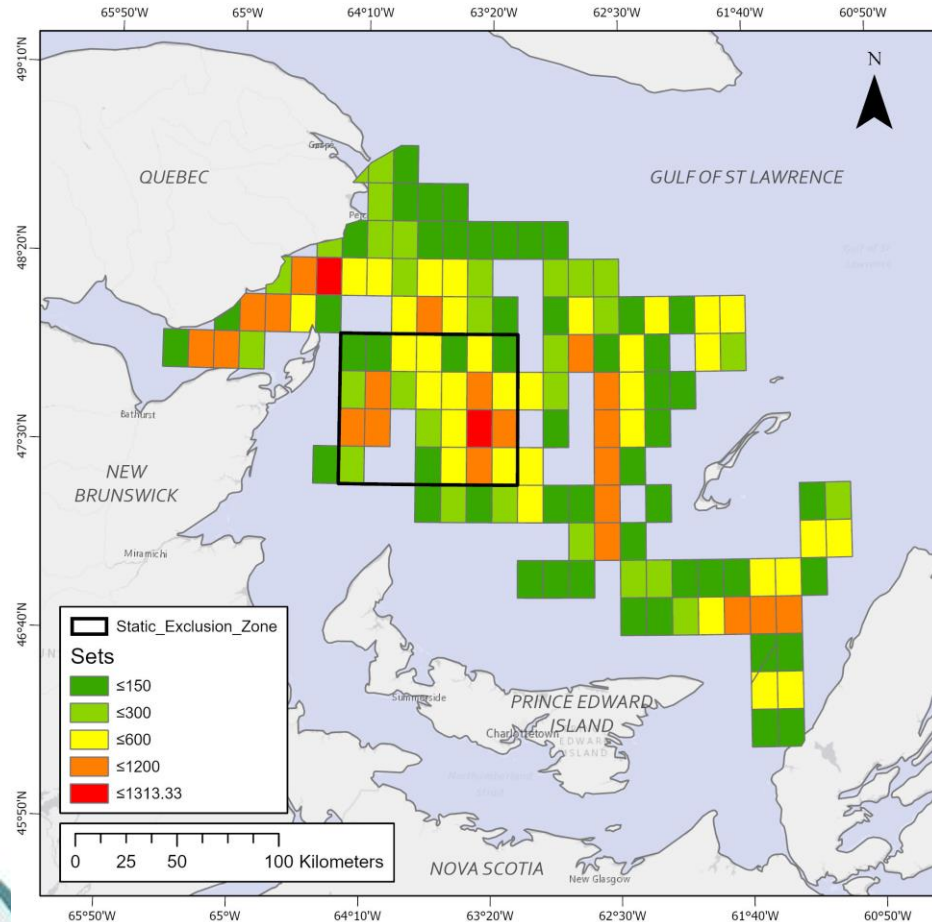
Model Predictions
Mimic Fisher Behaviour
Cost Approximation

Size of Closures

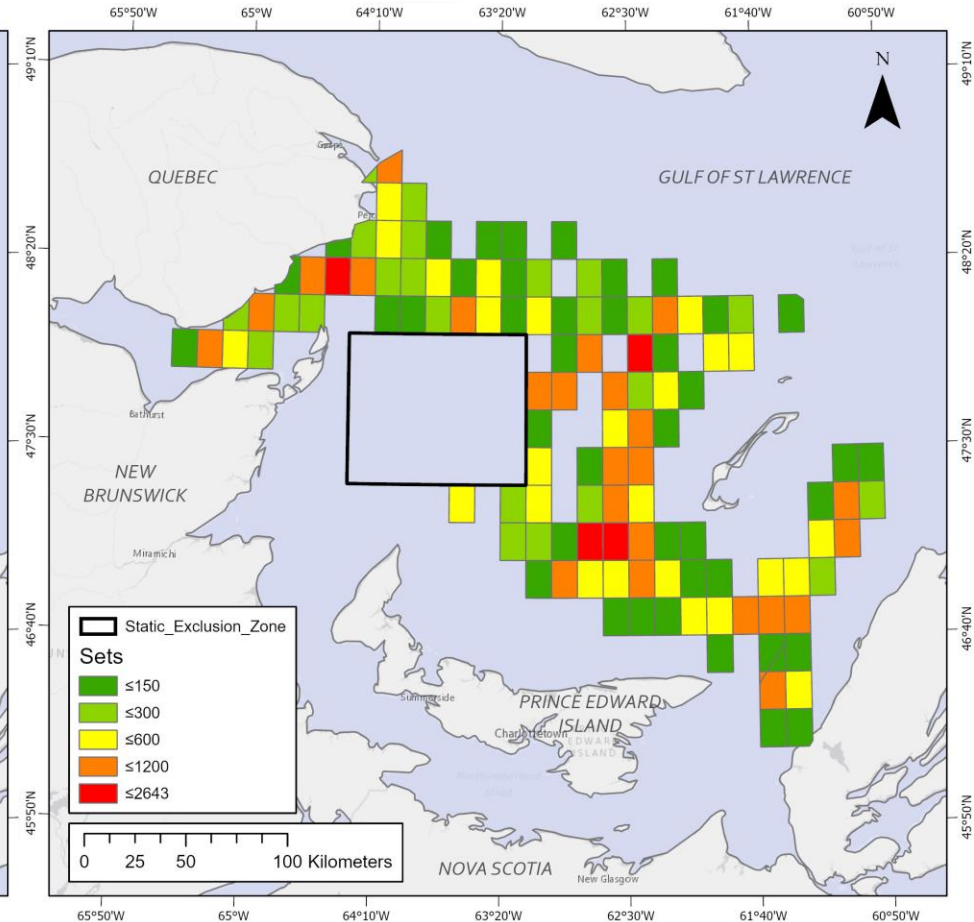


Displacement Impacts

Week 4 Historic Average



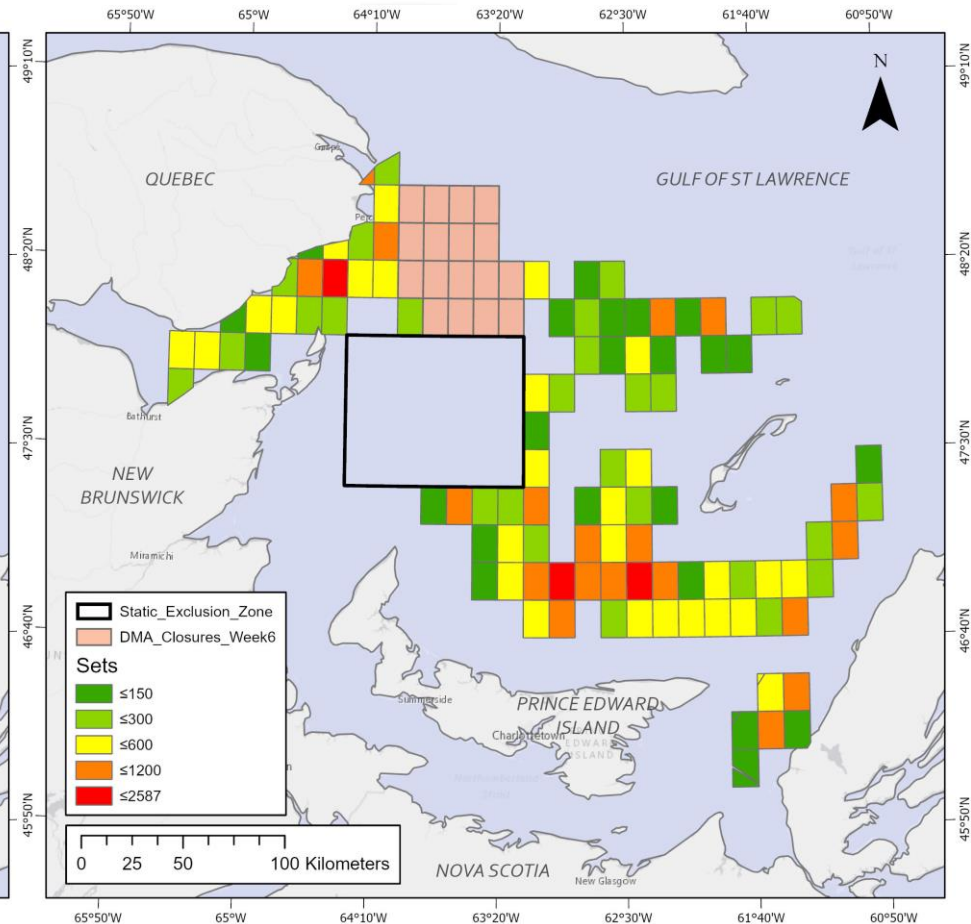
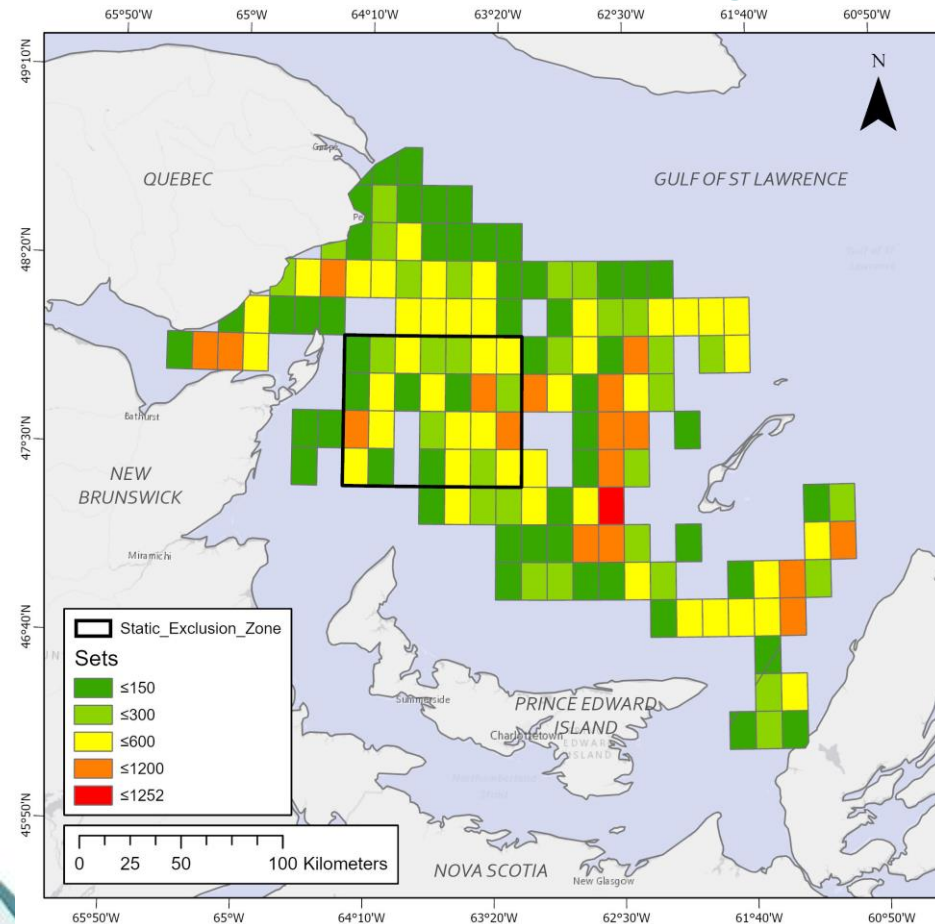
Week 4 Observed 2018



Displacement Impacts

Week 6 Historic Average

Week 6 Observed 2018



Tightening Effect



More abandoned
grids
Less exploration

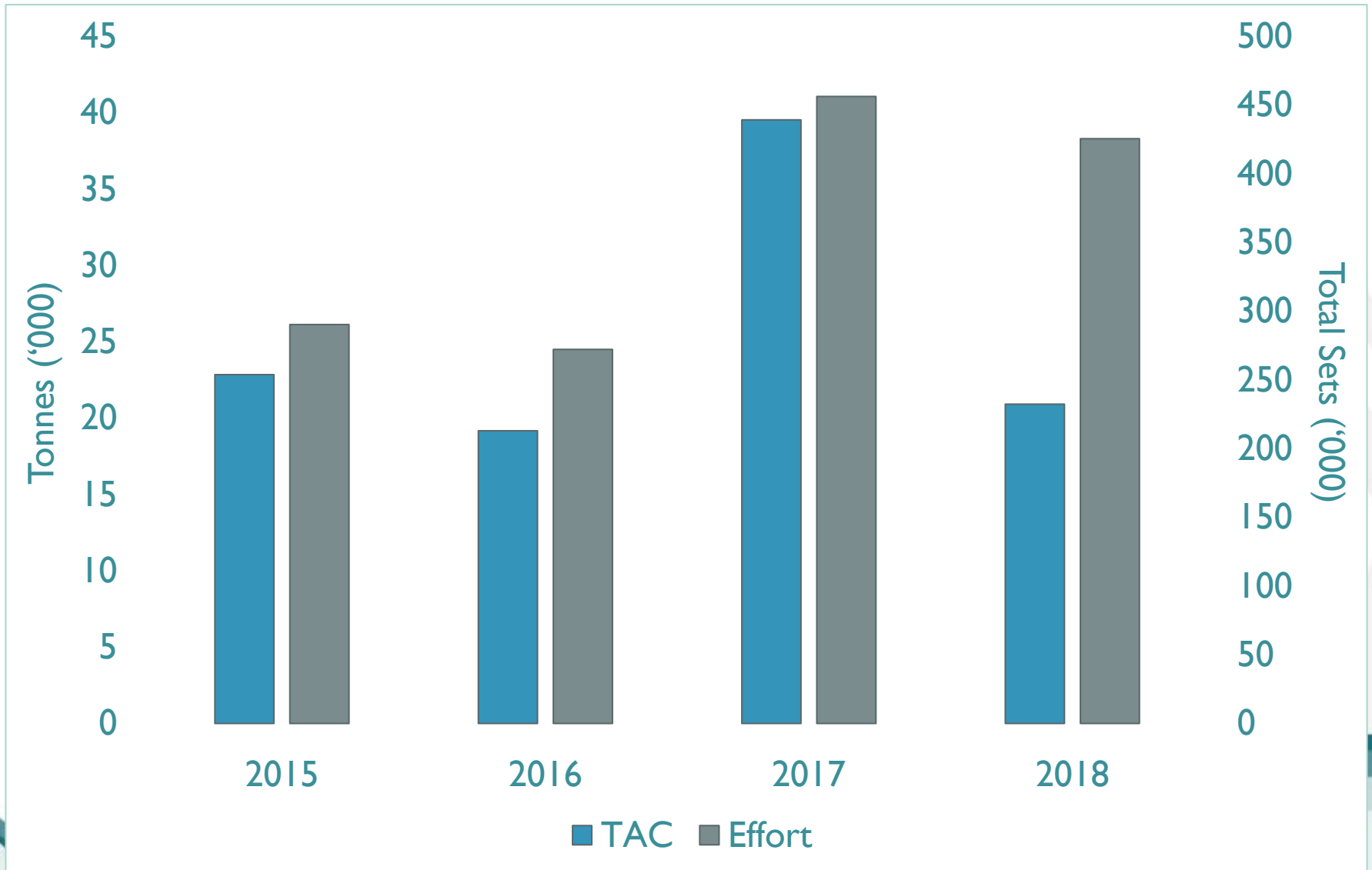


Only 8% of total
effort in new grid
cells



41% increase in
effort density

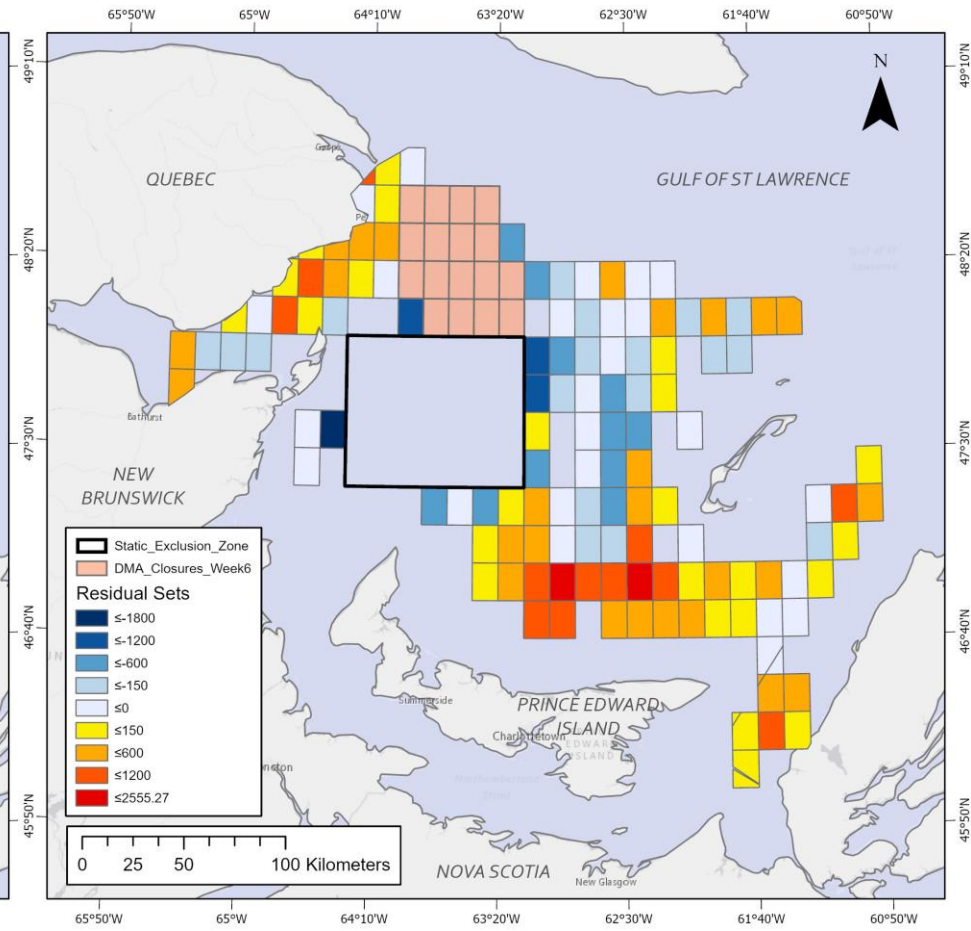
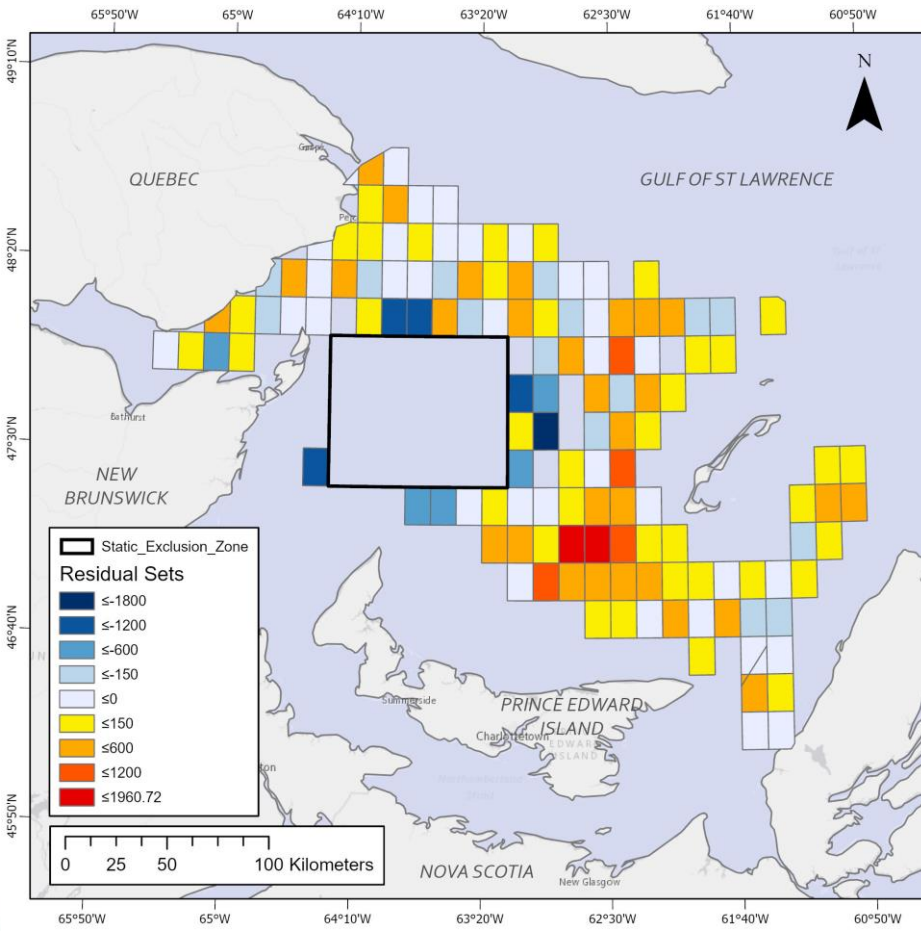
Increasing Effort



Residuals

Week 4 Model Residual

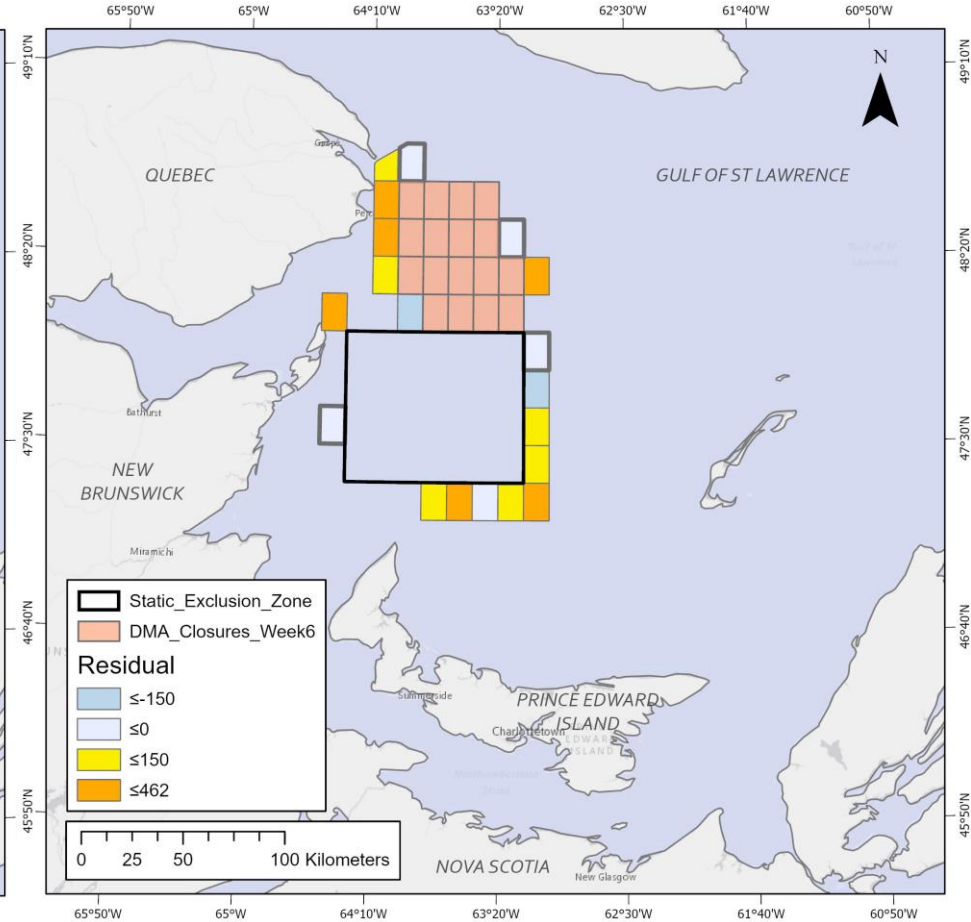
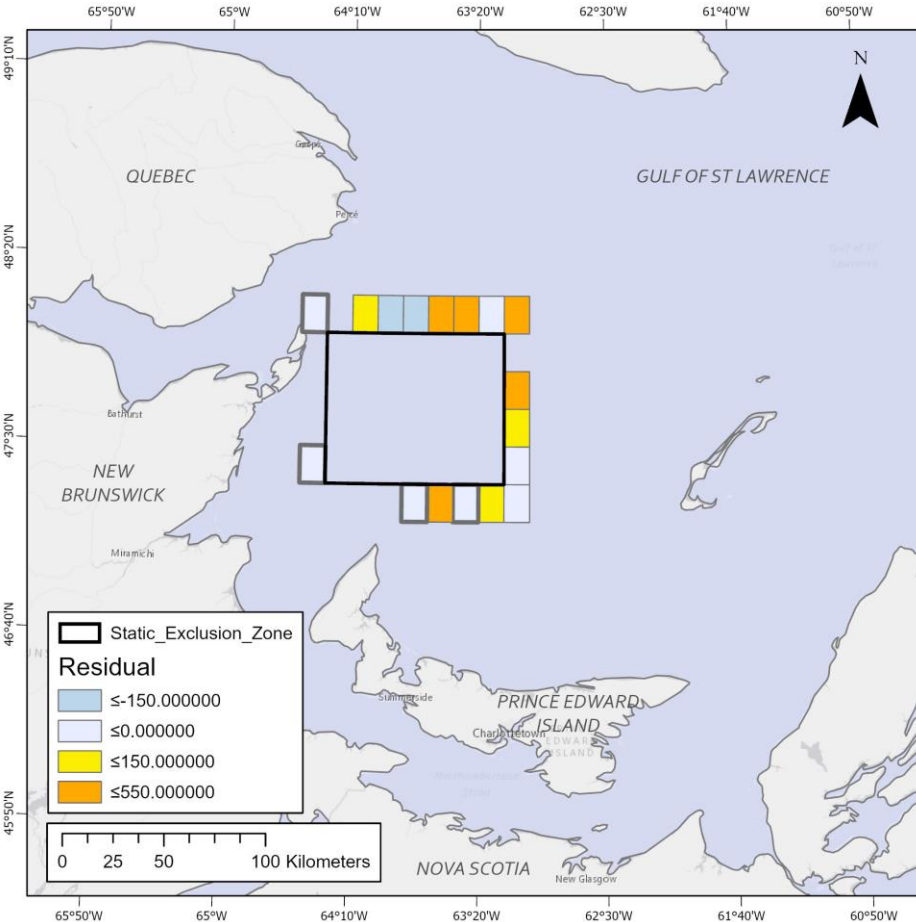
Week 6 Model Residual



Boundary Threat

Week 4 Boundary Residual

Week 6 Boundary Residual



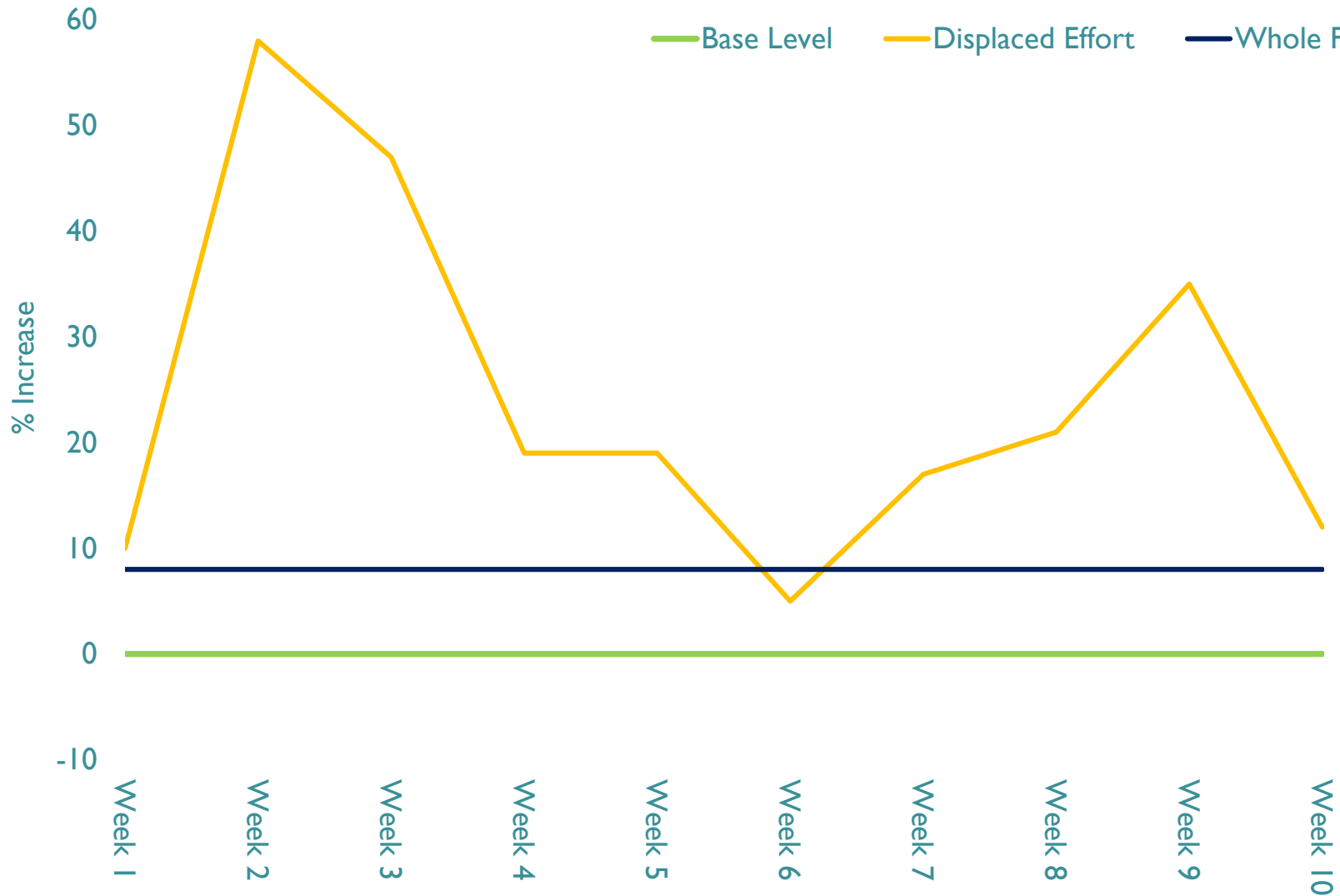
**Did Fencing
Happen?**

✗ Increased Proportion of Fished Grid Cells
✓ Increased Effort Density in Fished Grid Cells

Movement Cost Approximation

Powers & Abeare (2009). *Fisheries Research*.

— Base Level — Displaced Effort — Whole Fishery



Conclusions



Tightening Effect: higher set density in a smaller area



Shift in fishing location: potential new risk hotspots



Less enclosure of boundary but higher set density



Displaced effort absorb majority of movement costs



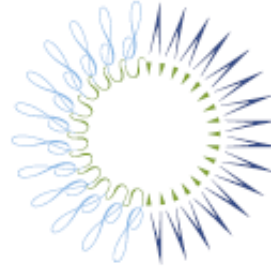
Whale data needed to determine changes in risk



Government
of Canada

Gouvernement
du Canada

Canada 



THE
PEW
CHARITABLE TRUSTS

Thank You!

Questions?

Alex Cole & Sean Brilliant
alexandrac@cwf-fcf.org