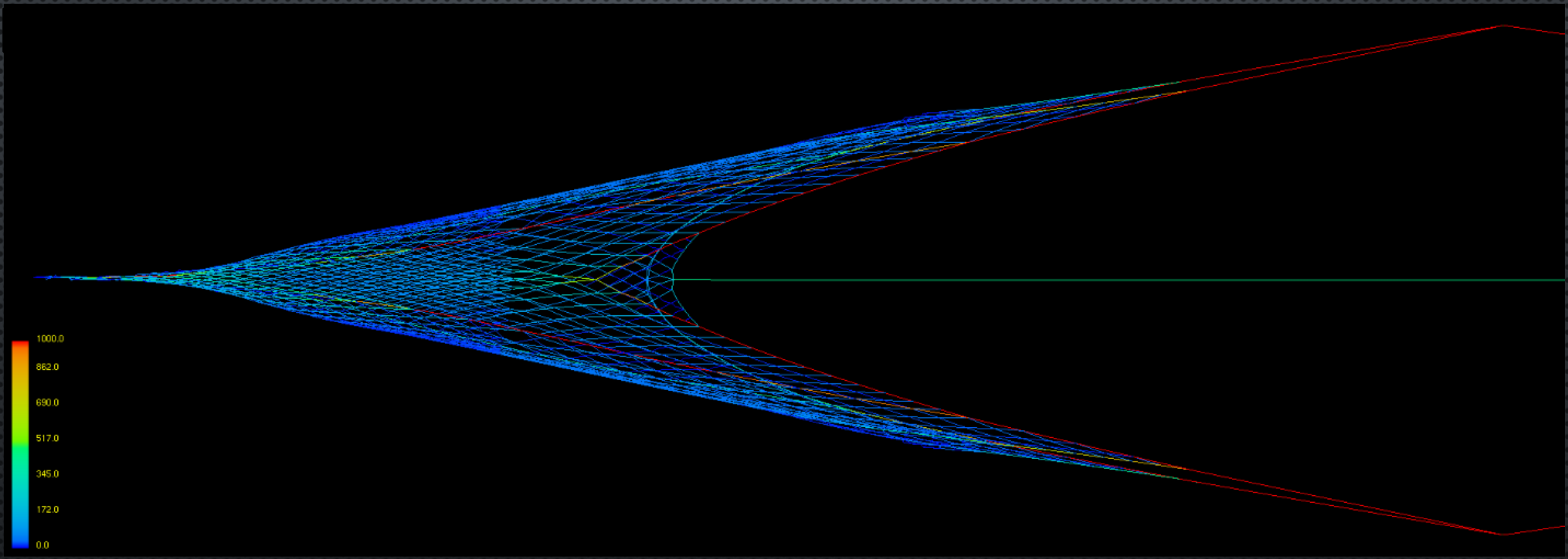
GEAR INNOVATION INITIATIVE



ALASKA PACIFIC UNIVERSITY

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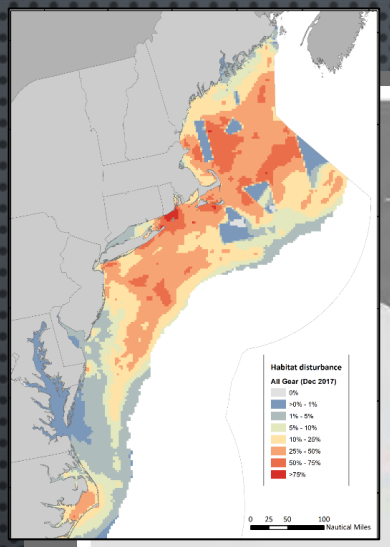
FISHING EFFECTS MODEL

- **Fishing Effects Model** is a decision-support tool. It employs spatially-explicit Vessel Monitoring System (VMS), Observer data, **gear dimensional and contact information** and literature-based habitat impact information to:
- Quantify and visualize fishing activity.
- Estimate fishing footprint and bottom contact.
- Estimate cumulative impacts of fishing on Essential Fish Habitat.



2022 EFH Fishing Effects Discussion Paper

Funding: NMFS ARO Hab Div., NPFMC, NEFMC, Atkinson Foundation (Cornell Univ.)
Science Publications: Grabowski et al., 2014, Smeltz et al., 2019, Smeltz 2023
Student Research: Alaska Education Tax Credit Program (APA, AKSC, APICDA)
Management Peer Reviews: NEFMC SSC (4+), NPFMC SSC (4), more coming …
Management Publications: NEFMC. 2011, 2020, Simpson et al., 2017, Zaleski et al., 2024, Bachman et al., 2025, and more….

- GEAR INNOVATION INITIATIVE (GII) -

Purpose

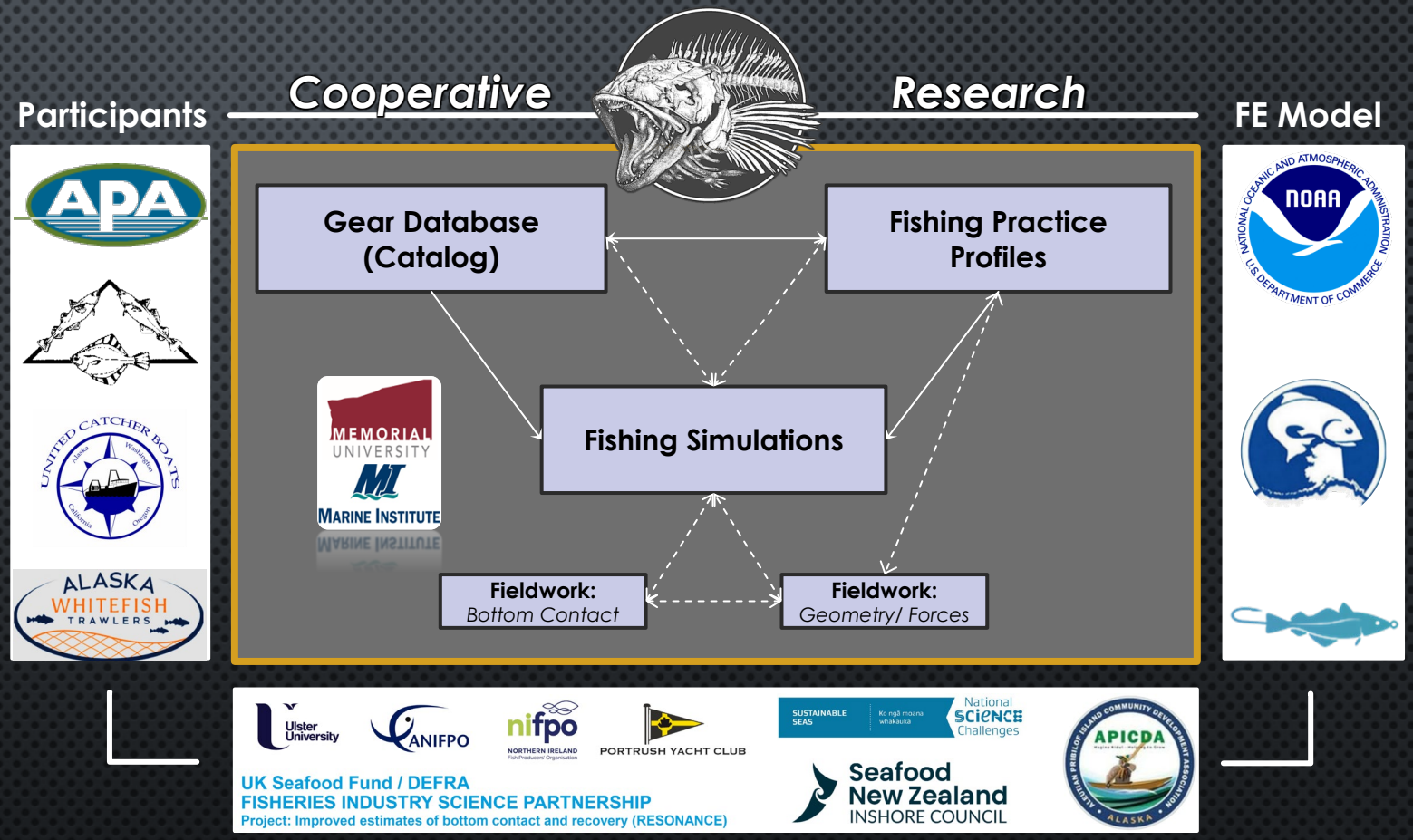
Improve Understanding of Pollock Gear and Fishery → Foundation for Innovation

- *What gear is currently used in BSAI and GOA pollock fisheries?*
- *How is this gear implemented in pollock fishing?*
- *When, where and how much is this gear fished?*
- *When, where and how much is this gear in contact with the bottom?*

Improve Fisheries Management Decision Support → Fishing Effects Model

- *Gear Tables*
- *Fishing footprint*
- *Bottom contact*
- *Benthic habitat disturbance*
- *Non-habitat species interactions (e.g., crab).*

Study Framework



- GEAR CATALOG -

Gear Catalog Structure:

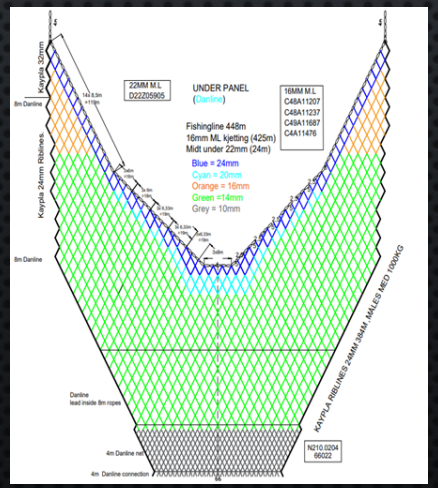
Each trawl is assigned a unique ID used to reference its components.

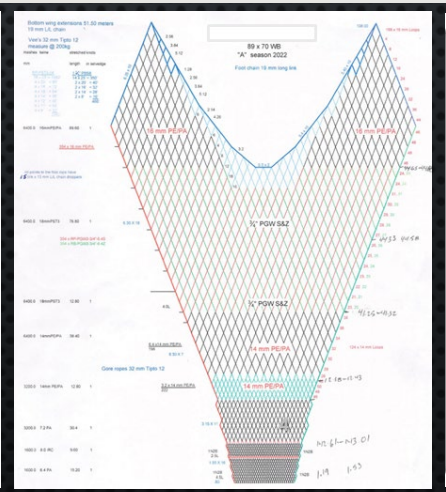
- **Design** – *Including individual net plan.*
- **Materials** *(e.g., footrope chain dimensions)*
- **Configuration** *(e.g., doors, bridle length, and set back)*
- **Modification** *(e.g., salmon excluders)*

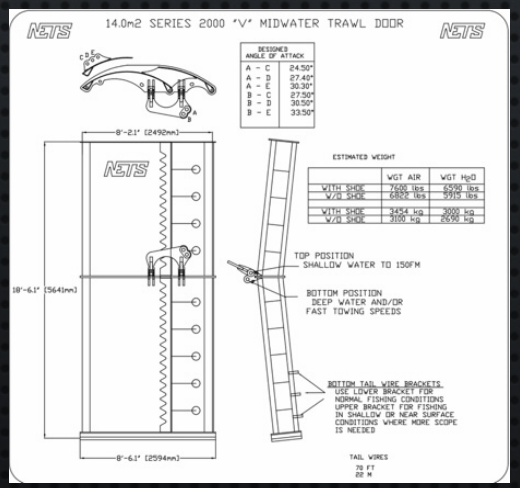
ID_trawl	Year	Company	Vessel	Trawl	Doors
1	2023			Egersund 1128	Thyboron Type 32 VF
2	2023			Egersund 1512	Thyboron Type 32 VF
3	2023			Egersund 1824	Thyboron Type 32 VF
4	2023			Egersund 1128	NETS Series 2000 V-shaped
5	2023			Egersund 1512	NETS Series 2000 V-shaped
6	2023			Egersund 1632	NETS Series 2000 V-shaped
7	2023			Egersund 1920	NETS Series 2000 V-shaped
8	2023			Egersund 1512	NETS Series 2000 Straight
9	2023			Swan 1280	NETS Series 2000 Straight
10	2023			Egersund 1920	NETS Series 2000 Straight
11	2023			Swan 1056	ThyboronType 32 VK
12	2023			Swan 1280	ThyboronType 32 VK
13	2023			Swan 1900	ThyboronType 32 VK
14	2023			Swan 1056	NETS Series 2000 V-shaped
15	2023			Swan 1280	NETS Series 2000 V-shaped
16	2023			Swan 1900	NETS Series 2000 V-shaped
17	2023			Swan 89 x70 Wide Body	NETS 14 m^2 Series 2000 V shaped door
18	2023			Swan 1280 x 5	Thyboron 14 m^2 Bluestream
19	2023			Swan 1056	Thyboron ?
20	2023			Swan 1280	Thyboron ?
21	2023			Swan 1900	Thyboron ?
22	2023			Swan 89X70	Thyboron-Bluestream T-22vk / 14m
23	2023			Swan 1280 Regular web	Thyboron-Bluestream T-22vk / 14m
24	2023			Swan 1280 Helix web	Thyboron-Bluestream T-22vk / 14m
25	2023			Swan 2000 Helix web	Thyboron-Bluestream T-22vk / 14m
26	2023			Swan 1280	Thyboron-Bluestream Type 32 standard 12.5
27	2023			Hampidjan Gloria Wide Body 1312m	Thyboron-Bluestream Type 32 standard 12.5
28	2023			Hampidjan Gloria Long Wing 1056m	Thyboron-Bluestream Type 32 standard 12.5
29	2023				
30	2023				
31	2023				

Confidential

Comp_Vess_Gear | Doors | Bridles | Weight Chains | Footrope | Nom and adj width | FEM_Table | +



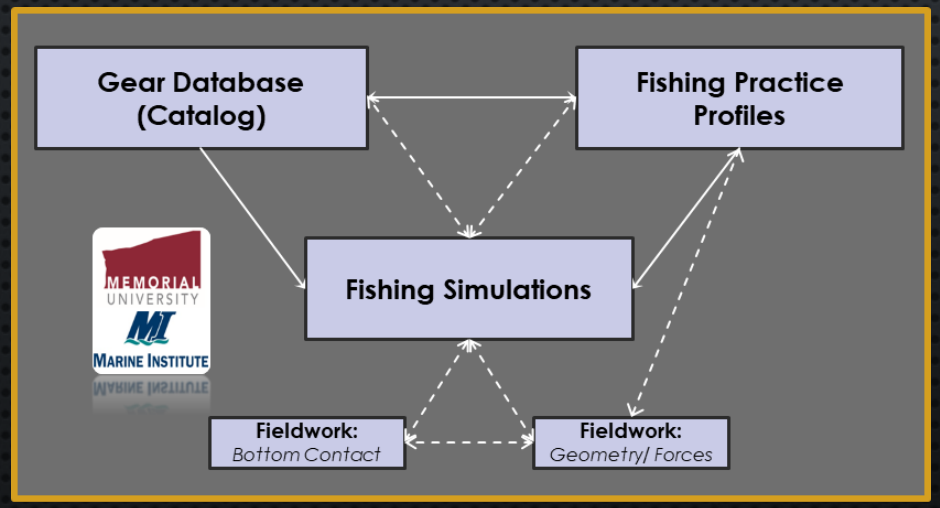




- FISHING PRACTICE PROFILES -

Fishing Practice Profile: *Set of operator-controlled parameters/ *targets that influence the vertical location, and geometry of the trawl.*

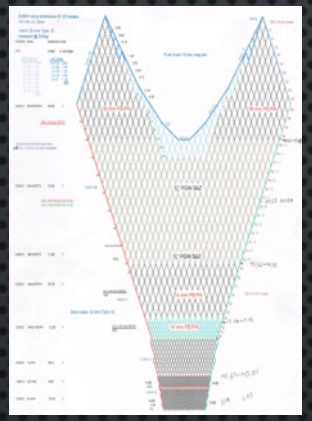
- Speed (k)
- Warp length (m, fa)
- Headline Scope (ratio)
- Wing weight (kg)
- Bridle length (m, fa)
- Setback (m, fa)
- Door roll (deg)
- *Headline depth (m, fa)
- *Vert. opening (m, fa)
- *Wing spread (m, fa)
- …

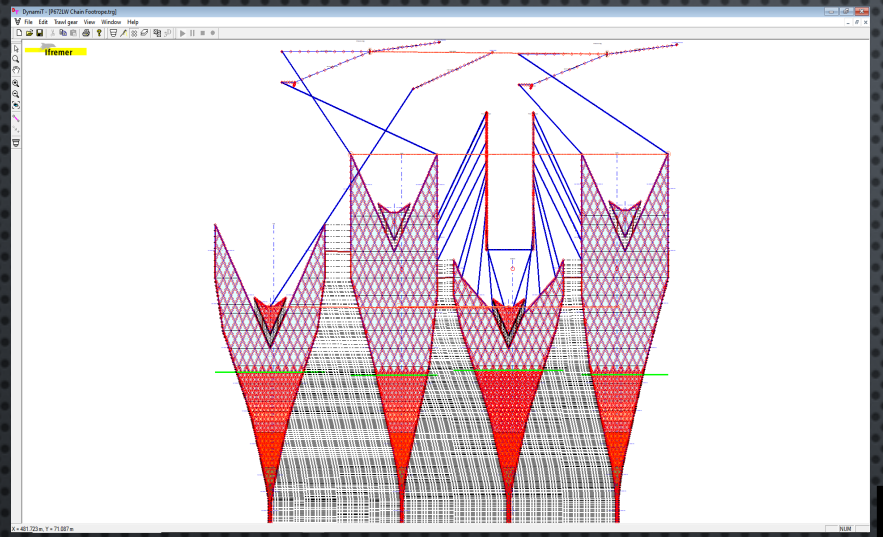


- FISHING GEAR MODELS AND SIMULATIONS -

Gear Plan + Cataloged Specifications + Fishing Scenario

→ Geometry, Horizontal / Vertical Forces, Seabed Contact





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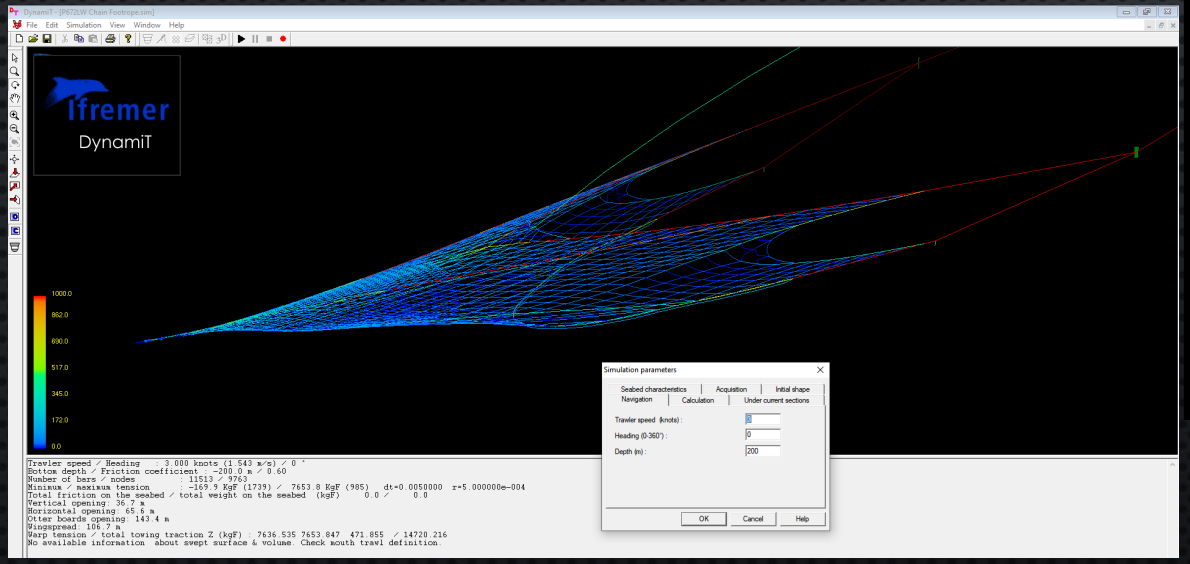
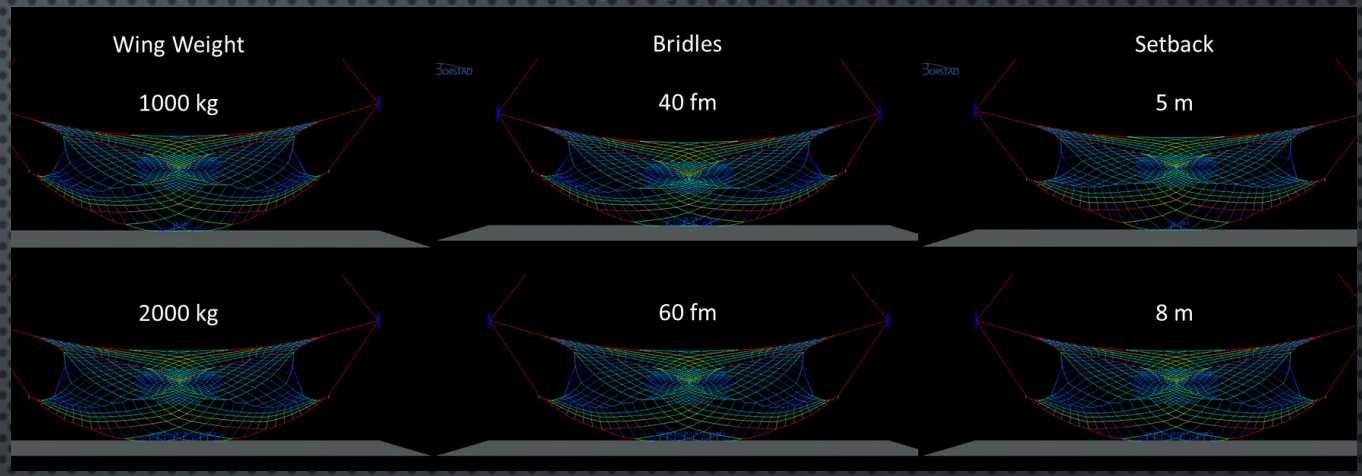
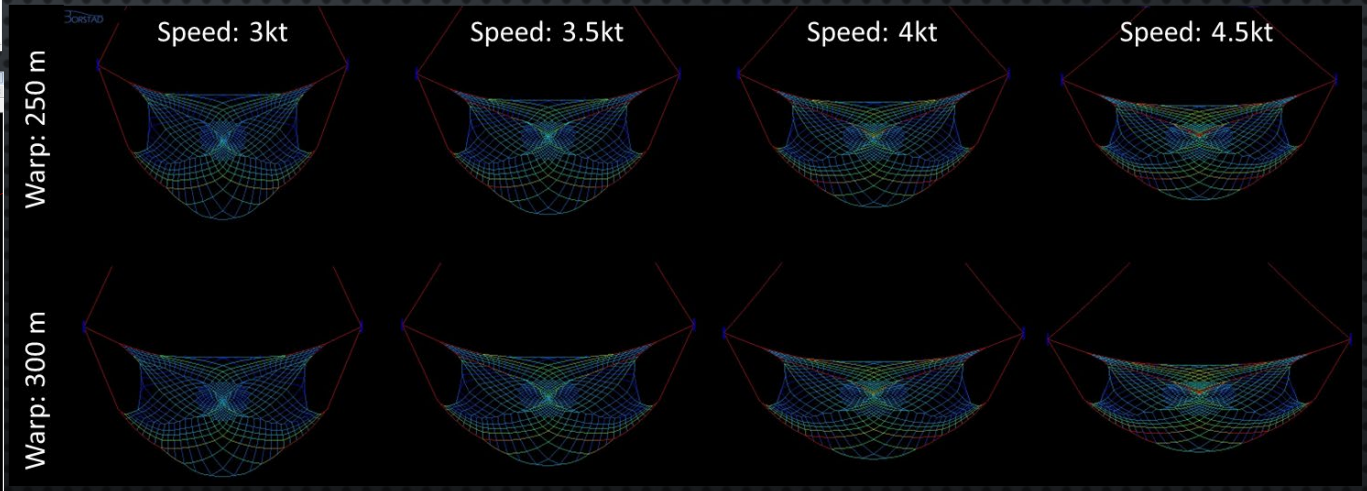


Rigging Effects



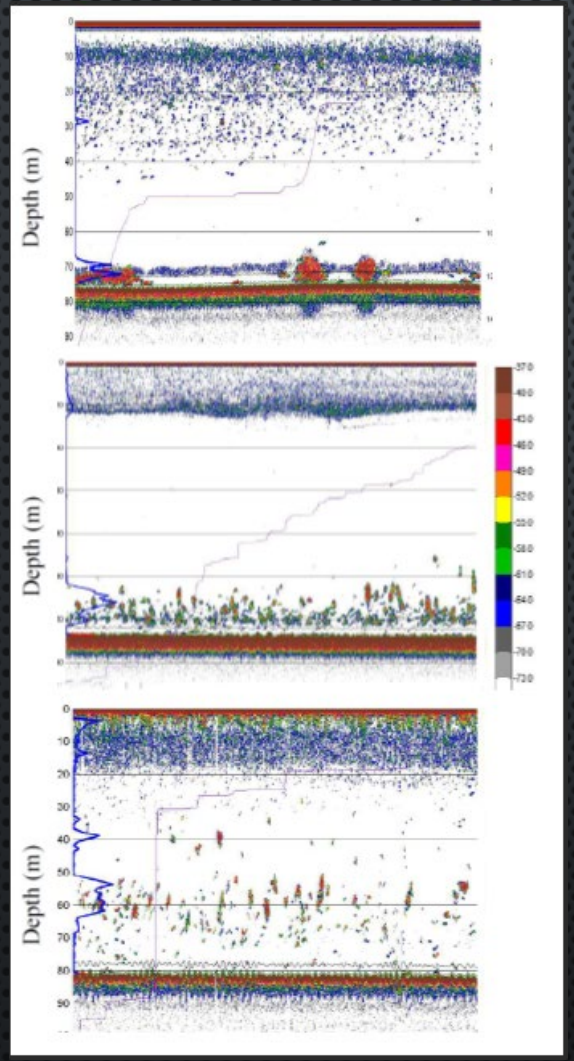
Fishing Practice Effects



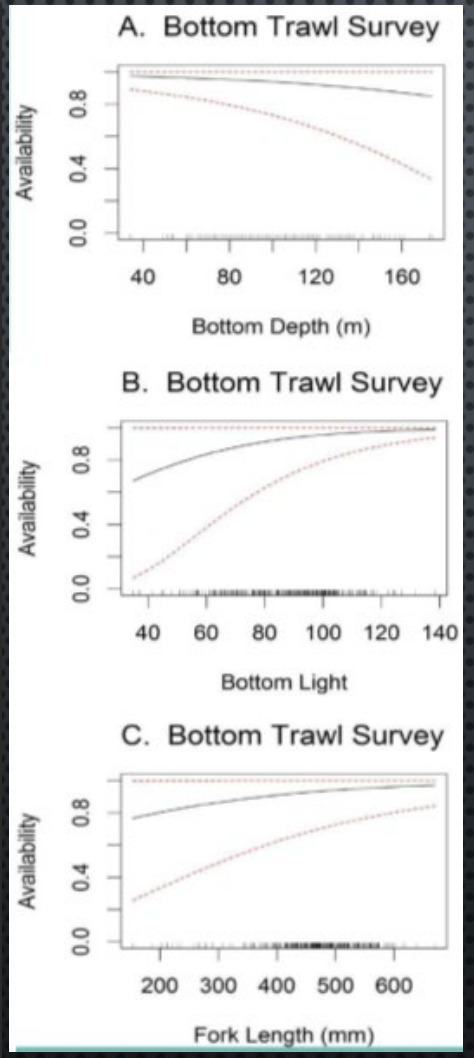
Simulations generate expected geometry and forces under realistic rigging and fishing practice iterations

- TRAWL GEOMETRY -

Pollock Vert. Distribution



Pollock Survey Gear

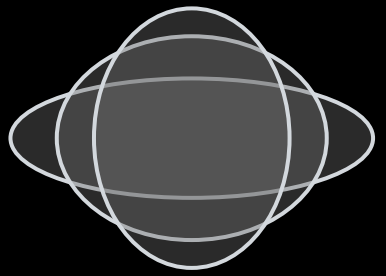


Pollock ***availability*** to the survey bottom trawl (3m height)

- High *availability* (80 -100%) in shelf waters (40 – 180m),
- Higher *availability* for large than small pollock,
- *Availability* decreases and becomes more variable in deeper waters and under low-light conditions

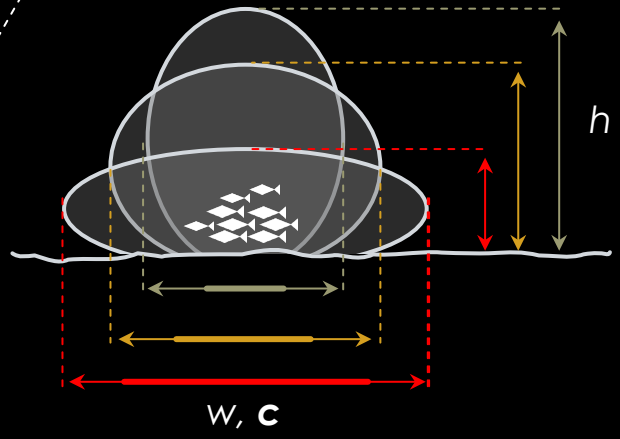
Gear Geometry and Vertical Location Matters

Pelagic trawl shape & location controlled by fishing practices and can vary substantially



- Scope (Wire: Depth)
- Speed
- Doors
- Wing Weights

Headline Height
→ Pollock CPUE
→ Size/ age comp
* PSC encounters

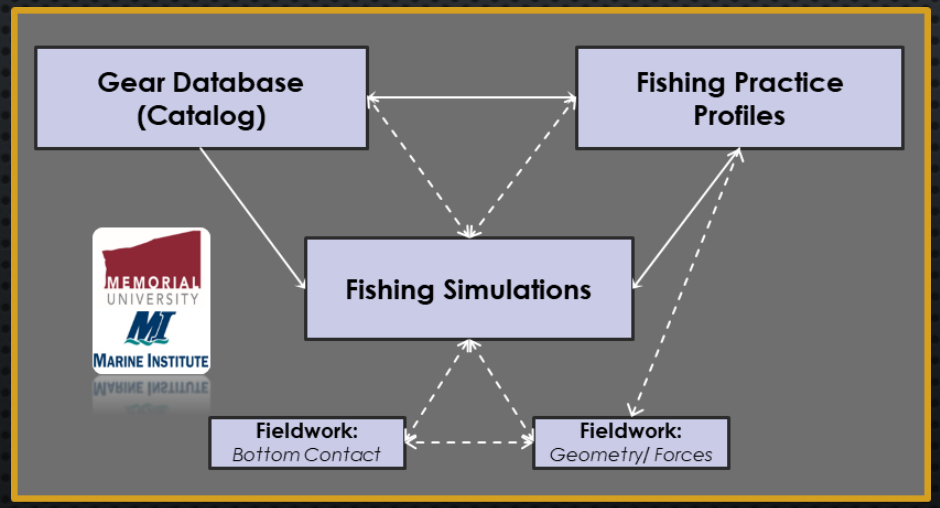


Width (*w*) → Footprint
Footprint + Headline **Height** (*h*) → Contact (**c**)
(Contact = % of footprint)

North Pacific Research Board Proj. #1507
Kotwicki et al., 2013. CJFAS, 70: 208–219.
Kotwicki et al., 2015. ICES J. Mar. Sci. 72: 1425-1439.

- FIELD SAMPLING: TRAWL GEOMETRY -

- *Gear specifications and haul-level fishing practice data*
- ***Realized** trawl geometry and forces (net mensuration sensors).*
- *Construct matching simulation*
- ***Compare simulated and realized trawl geometry and forces***

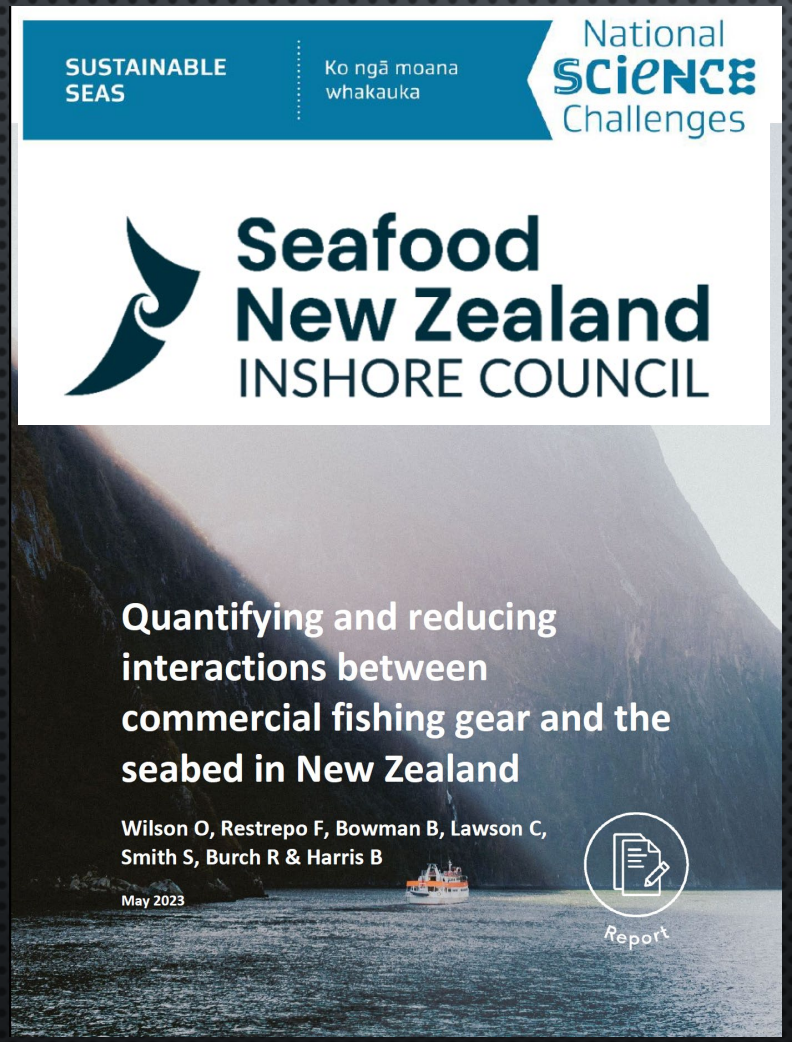


EXAMPLE

Vessel Name				
A Season				
Trawl in use: ☐ Swan 1056 ☐ Egersund 1512 ☑ Swan 1280 ☐ Other:_____				
Doors in use: ☑ Thyboron type 22 VK ☐ Other:_____				
Rigging:				
Bridle length: 35 fathoms/meters/feet				
Setback length: 15 fathoms/meters/feet				
Wing Weights per side: 2000 lbs/kg				
Haul Information:				
Haul Number: (Match to logbook #) 120		Date: 03/04/25		
Start of haul	Start time: 1230	Start Lat/Lon (dd.dddd): 54.4300 N 167.0977 W		
	Bottom Depth: 48 fathoms	Vessel Speed: 3.5 knots	Main wire payout: 90 fathoms	
	Headrope Height: 38 fathoms	Door Spread: 95 fathoms		
	Vertical Opening: 10 fathoms	Fishing circle width **IF AVAILABLE**: 75 fathoms		
	Seastate: 5 (on Beaufort Scale)	Notes:		
	Tension on winches **IF AVAILABLE**: 10100 kgf	towing into/with/cross current		
In tow entry	Time of entry: 1300			
	Bottom Depth: 50 fathoms	Vessel Speed: 3.4 knots	Main wire payout: 93 fathoms	
	Headrope Height: 39 fathoms	Door Spread: 93 fathoms		
	Vertical Opening: 11 fathoms	Fishing circle width **IF AVAILABLE**: 73 fathoms		
	Seastate: 4	Notes:		
	Tension on winches **IF AVAILABLE**: 10120 kgf			

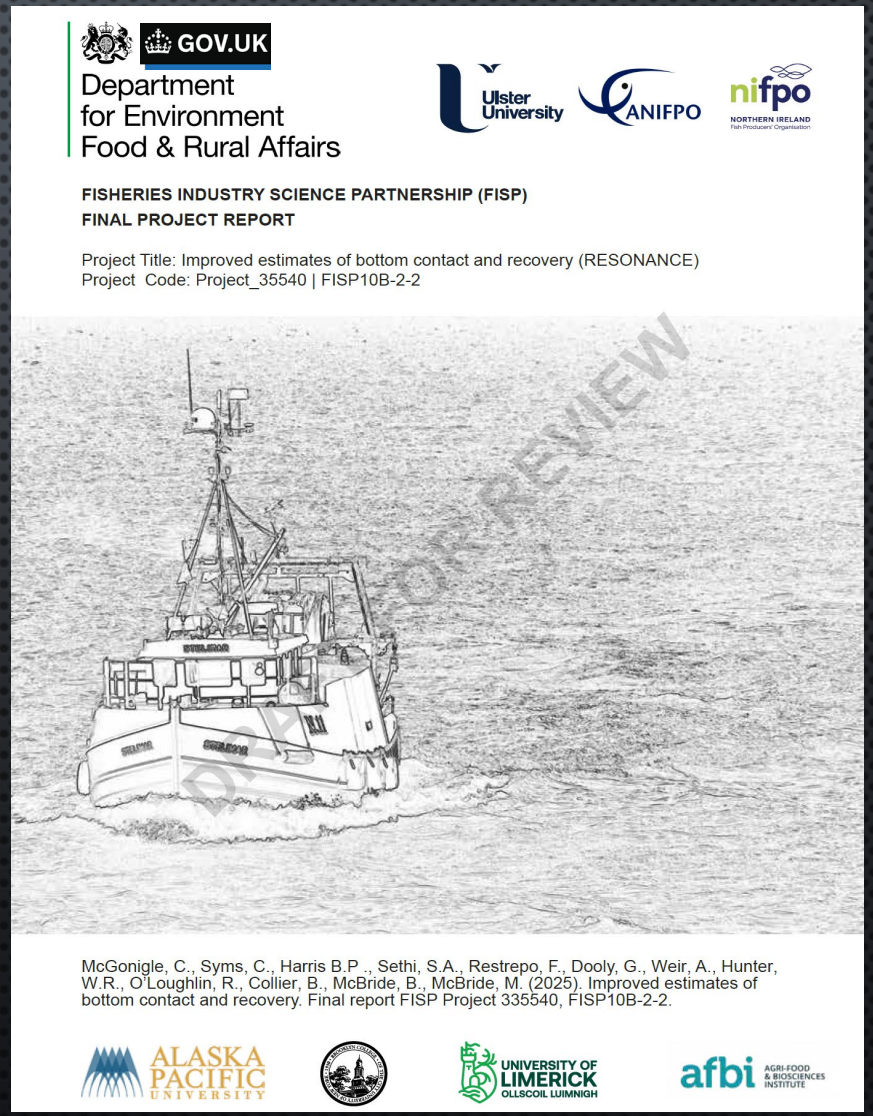
GEAR IMPACTS & INNOVATION PARTNERS

SUSTAINABLE SEAS: FISHERIES INSHORE NEW ZEALAND (FINZ)

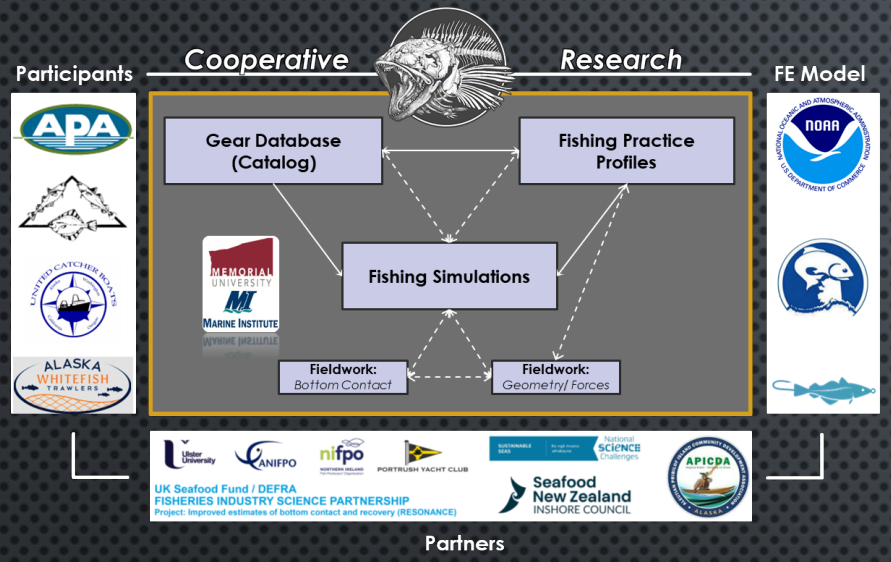


Wilson, O.L., Restrepo, F., Bowman, B., Lawson, C., Smith, S., Burch, R., and Harris, B.P (2023). Quantifying and reducing interactions between commercial fishing gear and the seabed in New Zealand, March 2023.

FISHING INDUSTRY SCIENCE PARTNERSHIP (FISP)



GEAR INNOVATION INITIATIVE



Fishing Effects Model

- Building a Foundation for Gear Innovation
- Improving Precision and Accuracy of the NPFMC's Fishing Effects Decision Support Tool

Trends by (Management) Area

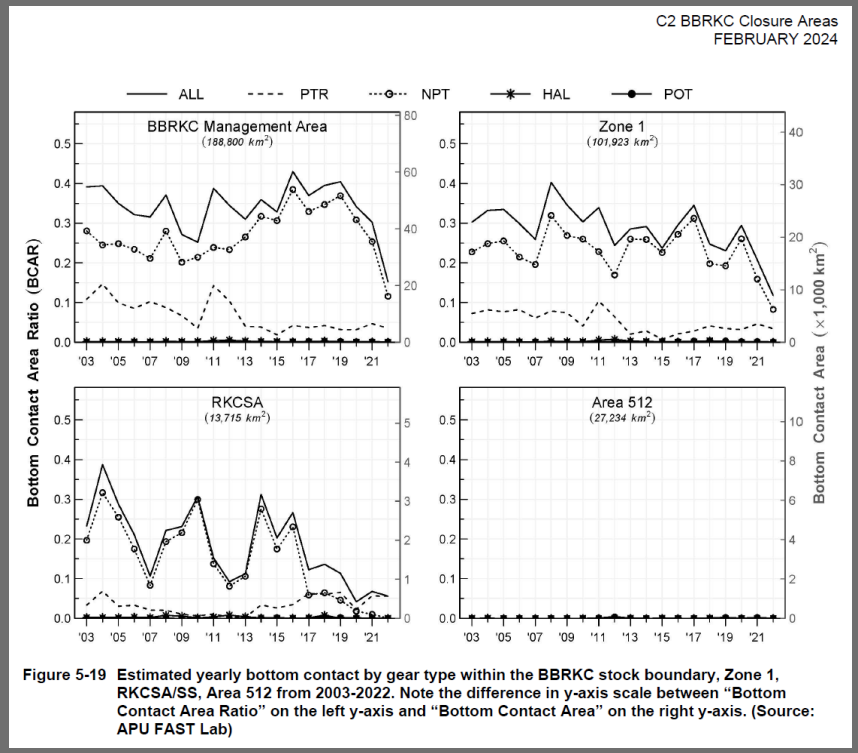


Figure 5-19 Estimated yearly bottom contact by gear type within the BBRKC stock boundary, Zone 1, RKCSA/SS, Area 512 from 2003-2022. Note the difference in y-axis scale between "Bottom Contact Area Ratio" on the left y-axis and "Bottom Contact Area" on the right y-axis. (Source: APU FAST Lab)

Thank You

Dr. S. Smeltz
F. Restrepo
Dr. S. Sethi
*J. Olson
M. Eagleton
Dr. S. Lewis
Dr. C. Rose
Dr. J. Pirtle
*A. Nimick
*S. Zagorski
*B. King
*K. Yahnke
NPFMC SSC
AKRO Habitat
NEFMC SSC
NEFMC Habitat PT
… and MANY more!

* Student