

# C3b Pelagic trawl gear innovation discussion paper

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Council

June 7, 2025



# Action by Council

Council motion C2  
BBRKC closure areas  
February 10, 2024

- Review the discussion paper
- Action as necessary

2. The Council tasks staff with a discussion paper to inform options for incentivizing pelagic trawl gear innovation with the following objectives:

- minimizing bycatch to the extent practicable
- minimizing the impacts of pelagic trawl gear on sensitive benthic habitat and unobserved mortality of stocks that rely on such habitat
- improving or maintaining fishing efficiency
- flexibility for trawl gear innovation within the constraints of other objectives (e.g., adapting to new technologies)

The discussion paper should detail:

- the current limitations to gear innovation and modification (e.g., technological or enforcement constraints)
- the process for such gear revisions (e.g., EFP)
- examples of how past changes to gear definitions have been moved through the Council process (e.g., elevated sweeps on nonpelagic trawl gear)
- management tools that could be used to inform metrics to achieve these objectives (e.g., EFH and Fishing Effects model)
- downstream impacts to the management objectives of the various regulatory provisions that use the current definition of pelagic trawl gear and have been built upon the previous actions (if applicable)
- potential displacement and spillover impacts from any potential changes (e.g., PSC or target species catch)

The Council will review options for changes to the performance standard following this work.





# What's the difference?

## Definition EA/RIR

- Clarify current regs, allow enforcement to clearly & consistently identify legal and noncompliant gear, remove outdated text
- Updates may facilitate process to incentivize innovation (e.g., clarity, allowances for bycatch excluders, metallic instrumentation)

## Innovation DP

*Motion: The Council will review options for changes to the performance standard following this work.*

~~Trawl performance standards~~



### Current state of knowledge

- Innovations & research
- Regulatory, enforcement, and technological limitations
- Regulatory processes for gear revision
- Management tools

- Framed within Council objectives



# Working definitions

## Innovation

*A process or opportunity for flexibility, improvement, or change to existing fishing behaviors, sensor technologies, or gear, with variable implementation timelines*

## Incentive

*Reason or motivation that stimulates, persuades, or encourages action or a desired outcome*



## Regulatory limitations: specificity, clarity

Increased specificity = decreased flexibility, innovation

Increased generality = greater risk of ambiguity or enforcement uncertainty

Increased clarity = increased benefits and advancements from innovation

Feedback:

What do we innovate toward? What does the Council want limited?

What are specific objectives and metrics?

**Increased clarity in objectives, expectations, and possible incentives could help foster an environment for collaborative development of gear modifications and innovations.**



## Regulatory limitations: consistency

### State

“a pelagic trawl is a trawl where the net, or the trawl doors or other trawl-spreading device, **do not operate in contact with the seabed**, and which does not have attached to it any protective device, such as chafing gear, rollers, or bobbins, that would make it suitable for fishing in contact with the seabed.”

5 AAC 39.105(10)(C)

### Federal

“No person trawling in any GOA area limited to pelagic trawling under §679.22 may allow the footrope of that trawl to be in contact with the seabed for more than **10 percent of the period of any tow.**”

50 CFR 679.24(b)(3)

**Where possible, gear restrictions should also be consistent across State and Federal boundaries to reduce complexity and ease compliance and enforcement.**



# Performance standards

*Outcomes that must be achieved without prescribing specific means. To be effective, some specificity still required.*

## Ex:

Current pelagic trawl performance standard: discourage bycatch and seafloor contact by limiting the number of crab at any given of a certain carapace width – [Trawl Performance Standard Workshop](#) (Oct 2023)

(50 CFR 679.7(a)(14))

## Ex:

“No person trawling in any GOA area limited to pelagic trawling under §679.22 may allow the footrope of that trawl to be in contact with the seabed for more than **10 percent of the period of any tow.**”

50 CFR 679.24(b)(3)



# Enforcement constraints

- Sensor technology (e.g., bottom contact sensors)
  - not currently allowed via definition but can be complementary tool (e.g., VMS, EM monitoring)
  - Additional future considerations (training, data review, tech issues, point at which data is enforceable)
- Simple, accessible indicator of gear compliance
- **Include enforcement early in process**



Enforcement Committee Precepts (2015)

**pgs. 10-13**

**Table 5**

| Feature                                                                                                                                                                         | Common Use                                                                                                     | Sea | Air  | EM   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-----|------|------|
| Discs, bobbins, or rollers                                                                                                                                                      | Protection from bottom contact; Bycatch reduction; Aggregation of bottom fish ( <i>sweeps</i> )                | X   | X**  | X    |
| Chafe protection gear attached to the footrope or fishing line                                                                                                                  | Protection from bottom contact                                                                                 | X   | X**  | X    |
| Mesh tied to the fishing line, headrope, and breast lines with less than 20" between knots<br><i>*Requires measurements</i>                                                     | Bycatch reduction; Hydrodynamics                                                                               | X   |      |      |
| Stretched mesh sizes<br><i>*Requires measurements with gauge</i>                                                                                                                | Bycatch reduction; Hydrodynamics                                                                               | X   |      |      |
| Parallel lines spaced closer than 64" from all points on the fishing line, headrope, and breast lines<br><i>*Requires measurements</i>                                          | Aggregation of bottom fish ( <i>includes tickler chains</i> ), sink trawl to depth                             | X   |      |      |
| Configuration intended to reduce required stretched mesh sizes                                                                                                                  | Non-compliance with mesh size requirements                                                                     | X   | X*** | X*** |
| Flotation other than floats capable of providing up to 200 lb of buoyancy to accommodate the use of a net-sounder device;                                                       | Maintain net shape/opening at slow speeds                                                                      | X   | X    | X    |
| Weighted lines on the bottom of the trawl between the wing tip and fishing circle                                                                                               | Aggregation of bottom fish ( <i>includes tickler chains</i> ); Maintain net shape/opening; Sink trawl to depth | X   | X**  | X    |
| Metallic components aft of fishing circle and forward of 5.5" mesh<br><i>*Requires measurements</i>                                                                             | Maintain net shape/opening at slow speeds; Sink trawl to depth                                                 | X   |      |      |
| **Observable by aircraft primarily when setting/hauling gear.<br>***Observable only if such configurations have been previously documented, otherwise would require measurement |                                                                                                                |     |      |      |

# Cost and timeline mismatches

- Sources: industry, grants, regulated fee structures (Trawl EM program, §679.56)
  - Variable timing, availability, priorities may not align with gear research
  - Timeline: can be years (planning, application, pilot data, testing, analysis, reporting)
  - Ex: ActSel, funded via NOAA Bycatch Reduction Engineering Program (BREP) (ongoing; Rose and Barbee, 2022)
- Feedback: costs can be prohibitive to improve daily operations



# Current research & limitations - outline

- **Seafloor or bottom contact detection methods**
  - Model-based (e.g., FEM)
  - Tilt sensors
  - Physical wear (e.g., footrope chain)
  - Acoustic sensors (e.g., trawl sonar)
  - Cameras
  - Other innovation
- **Unobserved mortality**
- **Bycatch reduction**



# Model-based: Fishing Effects Model

FEM = 2 Modules

- Fishing Module
  - can standalone from Habitat Module
  - does not incorporate habitat information
  - Results: swept area and bottom contact area
- Habitat Module
  - Incorporates results from Fishing Module
  - Incorporates empirical habitat information
  - Results: habitat disturbance
- EX: average habitat disturbance in the entire North Pacific = 2.7% for the month of Feb 2022, all gear types combined
- Applications: EFH 5-year Review, Council analyses, gear research, and other broader uses



\*See C3a presentation

\*See C3 DRAFT FEM infographic

DRAFT MAY 2025

C3 DRAFT Fishing Effect Model Infographic  
JUNE 2025

## Fishing Effects Model (FEM)

A decision-support tool to quantify and visualize commercial fishing activity and resulting seafloor habitat disturbance. The Fishing Effects Model workflow has two parts: the **Fishing Module** and the **Habitat Module**.

### The Fishing Module

estimates the amount of **swept area** and **bottom contact area** on the seafloor by integrating track lines of fishing events with corresponding fishing gear parameters.



Gear parameters are the dimensions and combinations of vessel-specific gear components.

Fishing tracks are collected via satellite through the Vessel Monitoring System (VMS).

gear parameters (widths) x fishing track (lengths) = **swept area (total area fished)**

swept area x contact adjustment = **bottom contact area (seafloor contacted)**

The Fishing Module can be used on its own, separate from the Habitat Module, for fishery management decisions.

### The Habitat Module

estimates benthic **habitat disturbance** from fishing gear by integrating results from the Fishing Module along with the **susceptibility** (vulnerability to impacts) and **recovery time** (ability to return to original state) of an area.



Disturbance State

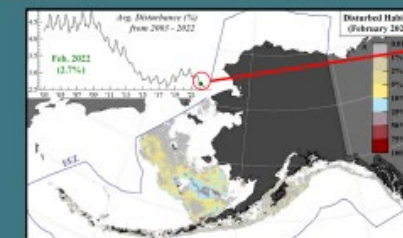
Pre-Impact

After Impact

Recovering

{prior disturbance} + {current fishing} = **habitat disturbance (% feature reduction)**

The Habitat Module incorporates the Fishing Module results and empirical habitat information to estimate seafloor habitat disturbance.



### Habitat Disturbance

is expressed as a cumulative percentage of habitat feature reduction on a monthly basis for a given area. For example, the average disturbance in the North Pacific in February 2022 was approximately 2.7%.



# Model-based: future considerations

- Model results
  - provide the best available estimate of the impacts of Alaska federal fisheries on Essential Fish Habitat
  - Fishing Module, intermediate outputs: swept area and bottom contact area – recognize fishing patterns and hotspots, but obscures other factors and doesn't incorporate habitat information
  - Future considerations – additional data on gear, net behavior, field measurements of bottom contact, and improved habitat information



**\*See C3a Innovations development presentation**

**\*C3 DRAFT FEM infographic**

**pgs. 20**



# Tilt sensors – bottom contact w/ trawl gear

NOAA Bottom Trawl Survey  
Currently deployed



Nonpelagic

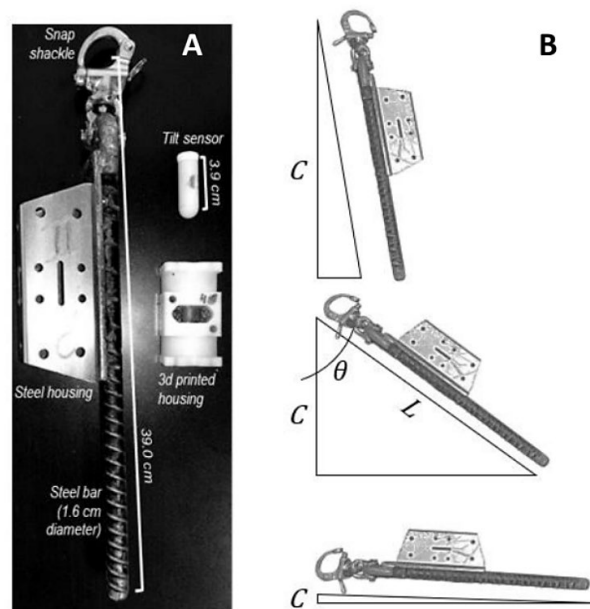
Images provided by FAST Lab, 2025

Alt. Groundgear  
Materials  
NPRB Proj. 1319  
(Rose et al., 2016)



Pelagic

Contact Sensor Performance  
CV Gear Study (King et al., 2019,  
Harris et al., *In Prep*)



Pelagic

Quantifying and reducing interactions between  
fishing gear and the seabed in New Zealand  
(Wilson et al., 2023)



Nonpelagic

Improving Estimates of  
Bottom Contact and Recovery  
(McGonigle et al., 2025)



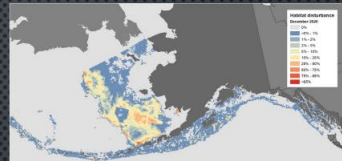
Nonpelagic

# Pollock Gear Project & Gear Innovation Initiative

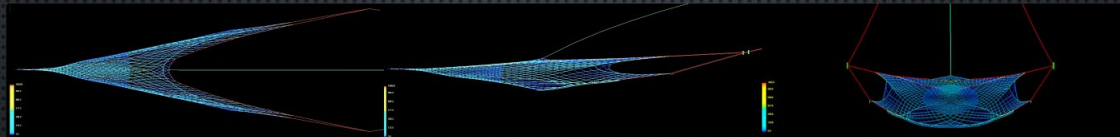
## POLLOCK GEAR PROJECT

### Cataloging the gear (K. Yahnke)

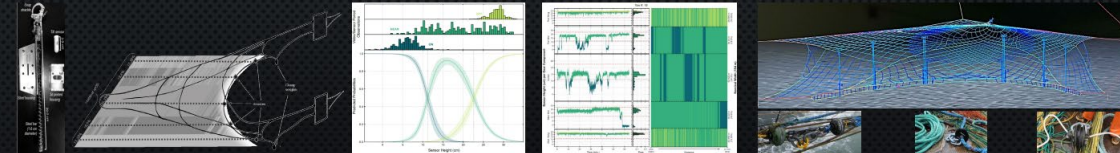
| ID | Year | Company | Vessel | Trawl         |
|----|------|---------|--------|---------------|
| 1  | 2023 |         |        | Egersund 1128 |
| 2  | 2023 |         |        | Egersund 1512 |
| 3  | 2023 |         |        | Egersund 1824 |
| 4  | 2023 |         |        | Egersund 1128 |
| 5  | 2023 |         |        | Egersund 1512 |
| 6  | 2023 |         |        | Egersund 1632 |
| 7  | 2023 |         |        | Egersund 1920 |
| 8  | 2023 |         |        | Egersund 1512 |
| 9  | 2023 |         |        | Swan 1280     |
| 10 | 2023 |         |        | Egersund 1920 |
| 11 | 2023 |         |        | Swan 1056     |
| 12 |      |         |        |               |



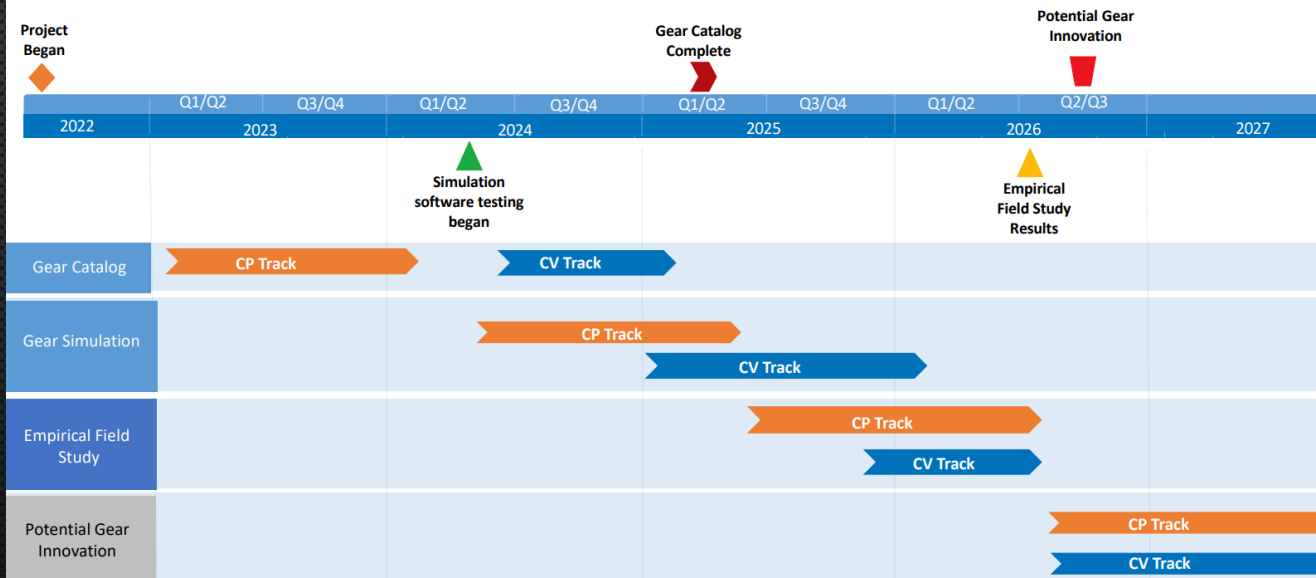
### Simulating the gear (FMI - Memorial University)



### Measuring gear – seabed interactions



## Gear Innovation Initiative Target Timeline



October 2024

February 2024



\*See C3a Industry/research update presentation

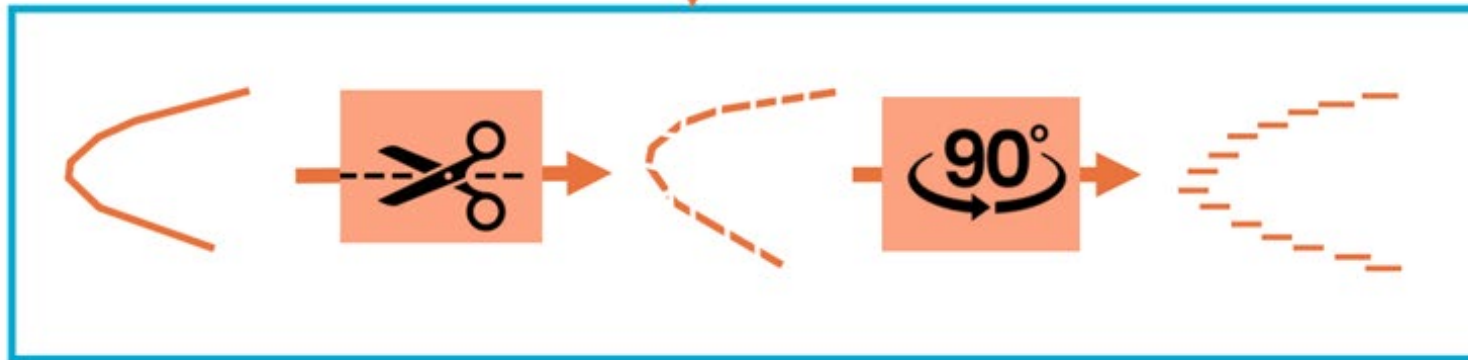
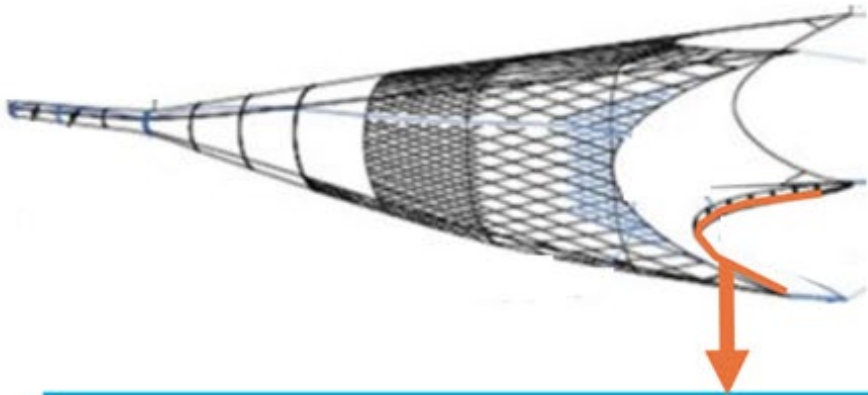
\*C3 DRAFT FEM infographic



15

pgs. 21

# Physical wear - Pelagic trawl gear footrope EFP



(Trident EFP presentation, October 2024).



# Acoustic sensors



Simrad FS80 Trawl sonar

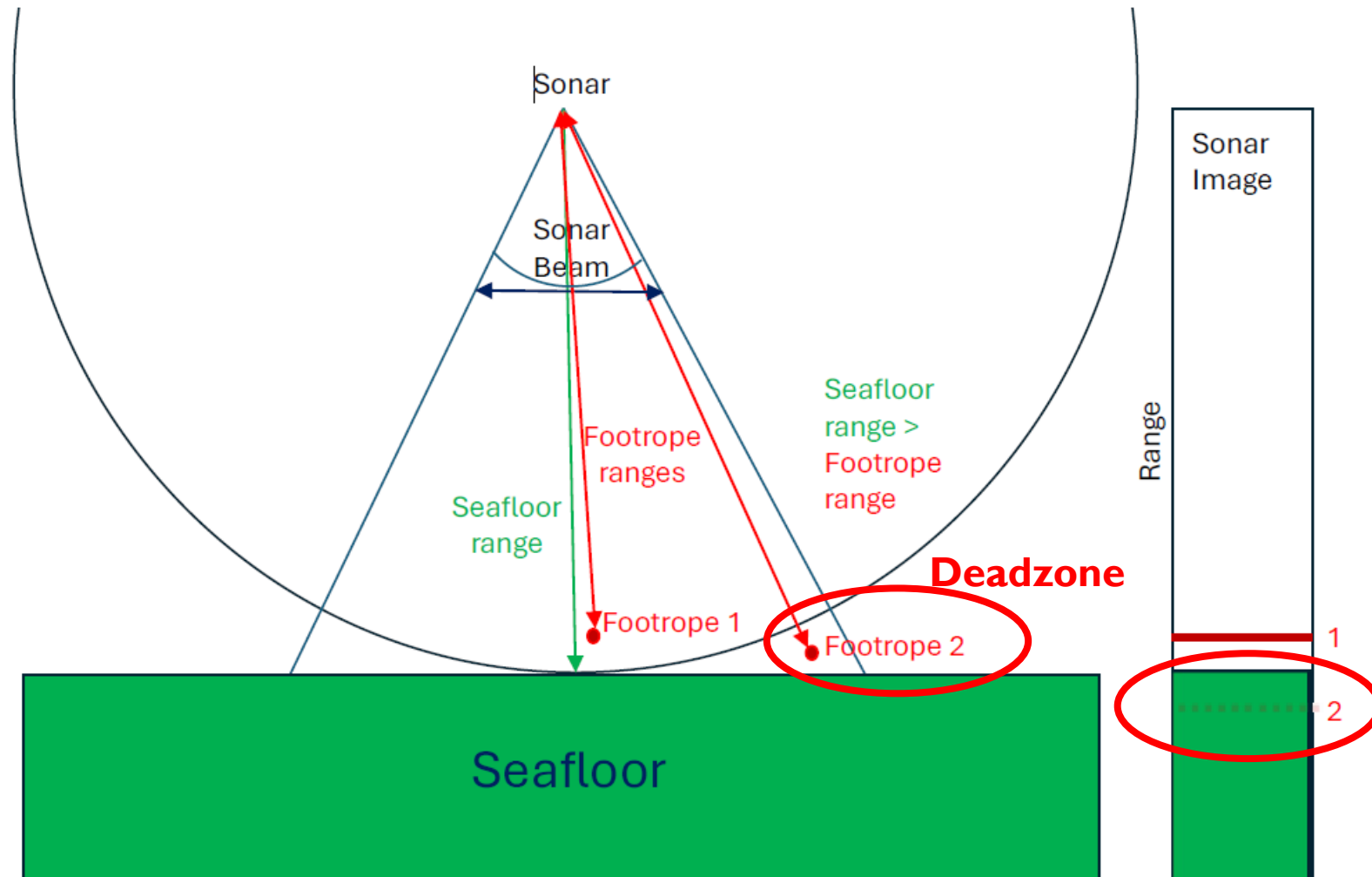


Image: C. Rose



# Cameras

- Electronic monitoring for catch accounting
- Live feed cameras (third, forth, or wireless system) to observe fish and net behavior
- Verification of tilt angle or footrope position or net behavior
- Turbidity challenges from mud, sand, particulate matter in the water column (NOAA bottom trawl survey modernization gear testing; tilt sensor bottom contact studies; FAST Lab bottom contact projects)

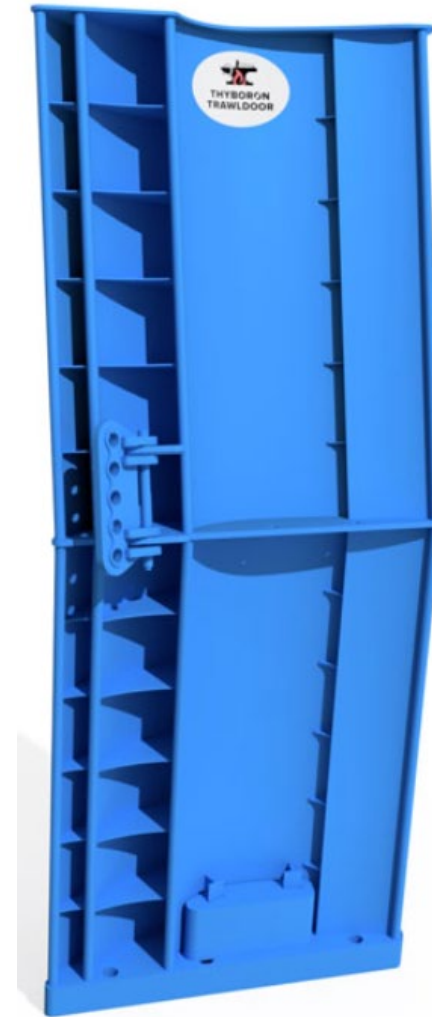


Ex: live feed camera system, Simrad FX80 camera and light



# Seafloor contact innovation - Other examples

- Midwater door adoption – widely used across nonpelagic and pelagic fleets
- Live feed camera system + manufacturer net plans – optimize spread and minimize contact by watching results in camera feed
  - under- or overspreading, camera clouded with turbid water, correct spread, camera view clear



Ex: Thyboron Type 15 VF pelagic trawl door



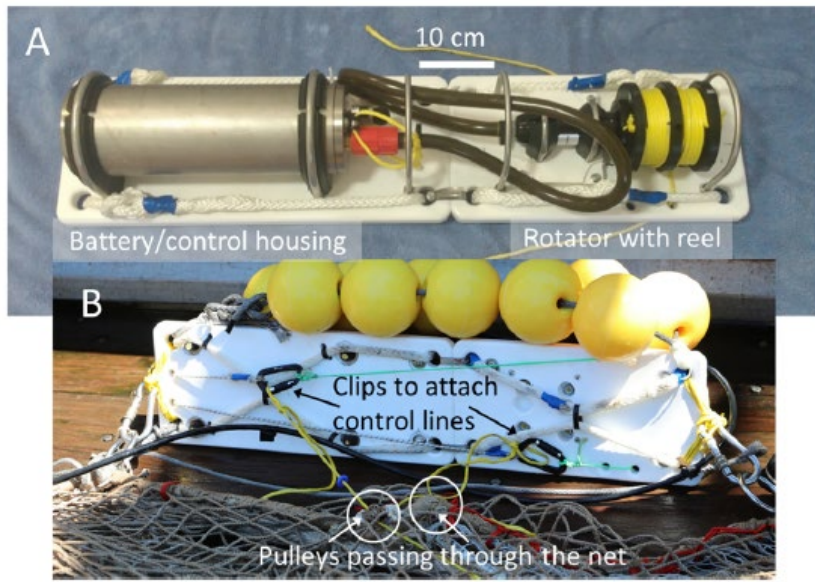
# Unobserved crab mortality

| Gear Type<br>(# of configs)   | Information Type        | Individual Event (e.g., pot/rawl) Level |                 |                     | Population Level                        |                      |
|-------------------------------|-------------------------|-----------------------------------------|-----------------|---------------------|-----------------------------------------|----------------------|
|                               |                         | Bottom Contact<br>Area                  | Time on Bottom  | "Lethality" of gear | Total # of Events<br>(pot lifts/trauls) | Overlap with<br>Crab |
| <b>Pots (2)</b>               | <i>Magnitude</i>        | 10 <sup>1</sup> m <sup>2</sup>          | Hours to Days   | High                | 10 <sup>5</sup>                         | High                 |
|                               | <i>Data Available</i>   | Yes                                     | Yes             | No                  | Yes                                     | Yes                  |
|                               | <i>Research Needed</i>  | Data mining                             | Data mining     | Field exp'ts        | Data mining                             | Data mining          |
|                               | <i>Priority</i>         | Low                                     | Low             | Low                 | Low                                     | Low                  |
|                               | <i>Timeline (years)</i> | 0.5-1                                   | 0.5-1           | 3-5                 | 0.5-1                                   | 0.5-1                |
| <b>Lost Pots (2)</b>          | <i>Magnitude</i>        | 10 <sup>1</sup> m <sup>2</sup>          | Months to Years | Medium              | Unknown                                 | High                 |
|                               | <i>Data Available</i>   | Yes                                     | Some            | Some                | Some                                    | Some                 |
|                               | <i>Research Needed</i>  | Data mining                             | Field exp't's   | Field exp't's       | Data mining/Field exp't's               | Data mining          |
|                               | <i>Priority</i>         | Low                                     | Medium          | Medium              | Medium                                  | Low                  |
|                               | <i>Timeline (years)</i> | 1-2                                     | 3-5+            | 1-3                 | 3-5                                     | 0.5-1                |
| <b>Hook-and-Line (3)</b>      | <i>Magnitude</i>        | 10 <sup>4</sup> m <sup>2</sup>          | Hours to Days   | Low                 | 10 <sup>4</sup>                         | Medium               |
|                               | <i>Data Available</i>   | Yes                                     | Yes             | No                  | Yes                                     | Some                 |
|                               | <i>Research Needed</i>  | Data mining                             | Data mining     | Field exp't's       | Data mining                             | Crab Dist.           |
|                               | <i>Priority</i>         | Low                                     | Low             | Low                 | Low                                     | Low                  |
|                               | <i>Timeline (years)</i> | 0.5-1                                   | 0.5-1           | 3-5                 | 0.5-1                                   | 0.5-1                |
| <b>Non-Pelagic Trawl (13)</b> | <i>Magnitude</i>        | 10 <sup>6</sup> m <sup>2</sup>          | Minutes         | High                | 10 <sup>4</sup>                         | Medium               |
|                               | <i>Data Available</i>   | Yes                                     | Yes             | Some                | Yes                                     | Some                 |
|                               | <i>Research Needed</i>  | Data mining                             | Data mining     | Field Exp'ts        | Data mining                             | Crab Dist.           |
|                               | <i>Priority</i>         | Medium                                  | Medium          | Medium              | Low                                     | Medium               |
|                               | <i>Timeline (years)</i> | 0.5-1                                   | 0.5-1           | 3-5                 | 0.5-1                                   | 1-5                  |
| <b>Pelagic Trawl (30)</b>     | <i>Magnitude</i>        | 10 <sup>5</sup> m <sup>2</sup>          | Minutes         | High                | 10 <sup>4</sup>                         | Medium               |
|                               | <i>Data Available</i>   | Yes                                     | Yes             | No                  | Yes                                     | Some                 |
|                               | <i>Research Needed</i>  | Data mining                             | Data mining     | Field Exp'ts        | Data mining                             | Crab Dist.           |
|                               | <i>Priority</i>         | Medium                                  | Medium          | High                | Low                                     | Medium               |
|                               | <i>Timeline (years)</i> | 0.5-1                                   | 0.5-1           | 3-5                 | 0.5-1                                   | 1-5                  |



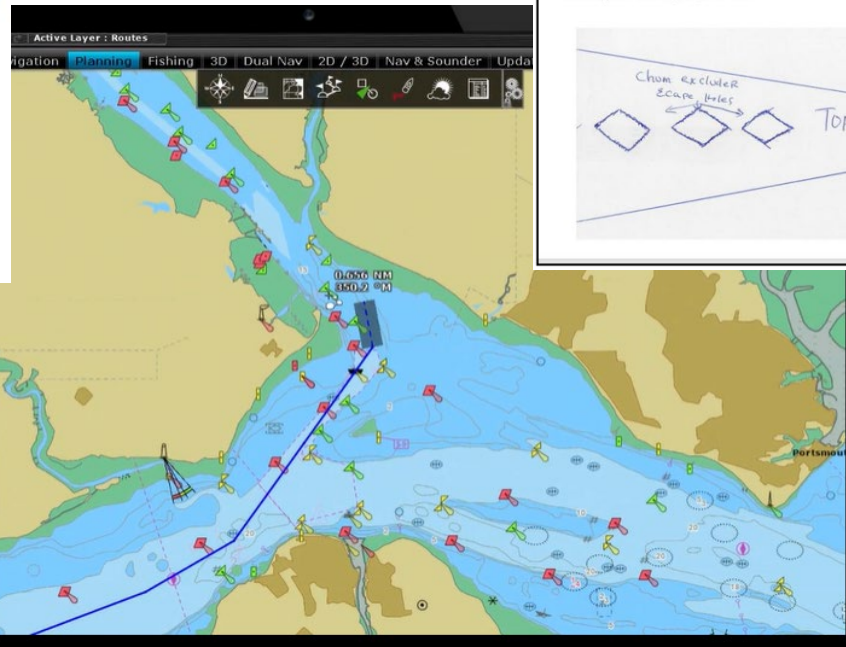
# Bycatch reduction

## Active Selection (ActSel)



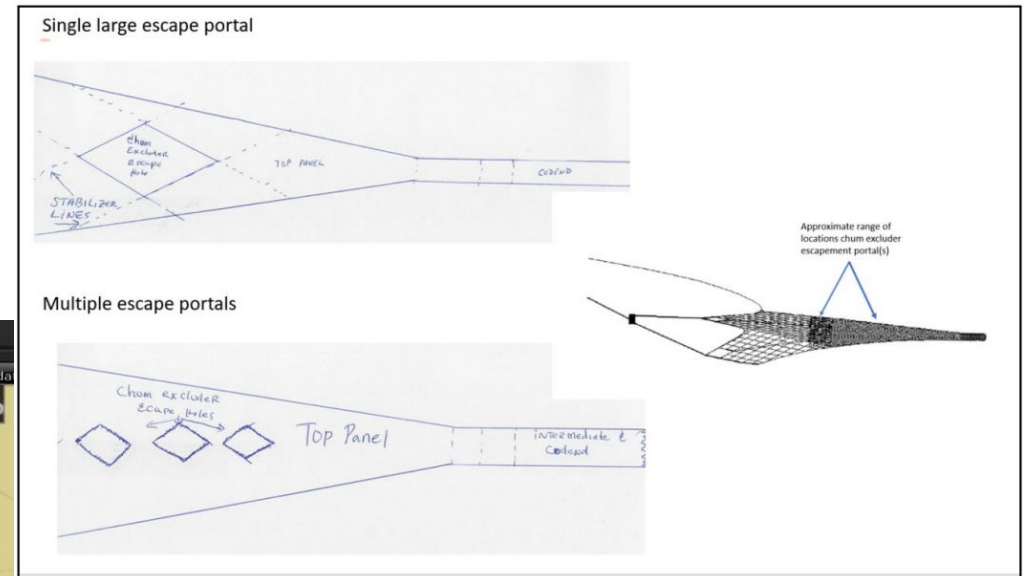
Rose and Barbee 2022

## Custom TIMEZERO



\*image copied from TIMEZERO, not an actual depiction

## Chum excluder EFP 2025-01



NPFRF, Gauvin 2025



|      |          |                                                                                                                                    |
|------|----------|------------------------------------------------------------------------------------------------------------------------------------|
| 2005 | FEB      | NMFS and Council considering actions to protect essential fish habitat                                                             |
|      |          | Final action on EFH left action on Bering Sea open for consideration of actions—including Gear Modifications                       |
|      | MAY      | First meeting with captains and trawl manufacturers - Develop concepts and plan research                                           |
| 2006 | SEPT     | Research to develop twin trawl tests of sweep effectiveness for fish capture (F/V Cape Horn)                                       |
|      | MAR      | Meeting with captains and trawl manufacturers - discuss results and research plan                                                  |
|      | SEPT     | Twin trawl experiment on effects of different sweep elevations on fish capture (F/V Cape Horn)                                     |
|      | MAY      | Experiment to measure effects on benthos—video / sonar sled (F/V Pacific Explorer)                                                 |
| 2007 | NOV      | Meeting with captains and trawl manufacturers - discuss results and research plan                                                  |
|      | DEC      | Presented initial results to Management Council (NPFMC)                                                                            |
|      | DEC      | Workshop - initial discussions of potential regulations and enforcement                                                            |
|      | MAR      | Meeting with captains and trawl manufacturers - discuss results and research plan                                                  |
|      | APR      | Workshop - Further discussions of potential regulations and enforcement                                                            |
|      | JUN      | Pilot research on crab mortality - Develop crab mortality methods and pilot test recapture nets (F/V Pacific Explorer)             |
|      | JUN/JUL  | Experiment to measure effects on benthos over day, week, month, year—video / sonar sled (F/V Pacific Explorer—R/V Oscar Dyson)     |
| 2008 | OCT      | Meeting with captains and trawl manufacturers - discuss results and research plan                                                  |
|      | JAN      | Presentation of results at annual captains meeting                                                                                 |
|      | MAR      | Tests of sweep clearance achieved with alternative bobbin spacing and height (F/V Unimak)                                          |
|      | MAY      | Tests of sweep clearance achieved with alternative bobbin spacing and height (F/V Arica)                                           |
|      | JUN      | Presented results of sweep clearance tests to Council                                                                              |
|      | AUG      | Crab mortality research—Modifications reduce mortality of Tanner and snow crabs (F/V Pacific Explorer)                             |
|      | SEPT     | Workshop at net shed with captains, gear manufacturers, scientists, enforcement and council regional staff on regs and enforcement |
|      | JAN      | Presentation of results at annual captains' meeting                                                                                |
| 2009 | JAN      | Onboard meeting with enforcement, Council and regional staff to clarify regulations and enforcement issues                         |
|      | JUN      | Twin trawl tests of fish capture with thinner cables (F/V Cape Horn)                                                               |
|      | FEB      | Council presentation on crab mortality research                                                                                    |
|      | AUG      | Crab mortality research - Modifications reduce mortality of king crab (F/V Pacific Explorer)                                       |
|      | OCT      | Presentation to Council - research update                                                                                          |
|      | OCT      | Council recommends regulations                                                                                                     |
|      | NOV      | Two workshops explaining draft regulations and discussing enforcement                                                              |
| 2010 |          | Regulations drafted, discussed, reviewed and finalized                                                                             |
|      | ALL YEAR | Fleet and gear manufacturers pretest specific devices, handling and attachment alternatives – comment on draft regulations         |
|      | OCT      | Final Rule published (Ammendment 94)                                                                                               |
| 2011 | JAN      | Requirement goes into effect                                                                                                       |

# Gear revision process – Trawl sweeps

## Trawl sweep modification to nonpelagic trawl gear

- BSAI FMP Amendment 94 (6 yrs) and subsequent extension - GOA FMP Amendment 89, 3 more years
- Planned incentive: reopen a portion of Northern Bering Sea Research Area (NBSRA) once trawl gear modification was implemented and research plan in place.

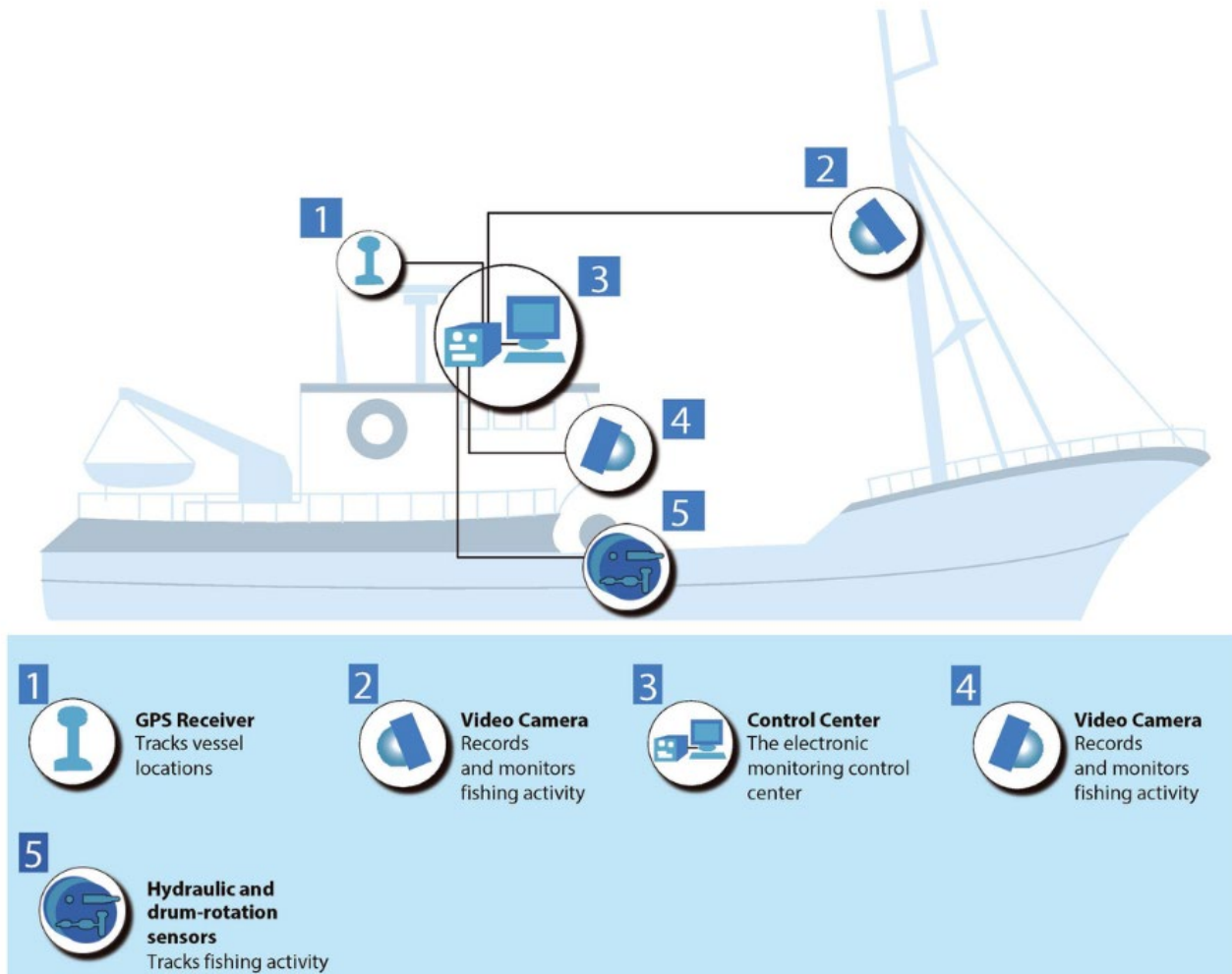
**Figure 6**

Cooperative participation of the fleet in all project stages:

- concept development and research planning,
- field research, gear development and testing
- review and presentation of results to management, and
- preparation for implementation (concepts and review for regulations and enforcement)



# Gear revision process – Trawl EM



- BSAI FMP Amendment 126, GOA FMP Amendment 114
- Applies to: Catcher vessels, pelagic gear, tender vessels delivering pollock
- 2018 – pilot testing w/ volunteers
- 2019 – EFP w/ 79 CVs
- 2022 – draft EA/RIR
- 2024 – final rule published in August

# Management tools to inform metrics to achieve Council objectives

- **EFP** – allow for testing
- **EFH 5-year Review** – Component 2, Fishing activities that may adversely affect EFH, determination of adverse effects (50 CFR 600.815(a)(2))
- **FEM** – currently our best tool to determine habitat disturbance from commercial fishing gear
- **Ad hoc committees or working groups** – e.g., UFMWG (2023), Trawl EM Committee (2023)
- **IPAs** – salmon bycatch avoidance
- **Performance standards**
- **Outreach** – e.g., workshops, webinars, Trawl Performance Standard Workshop in 2023

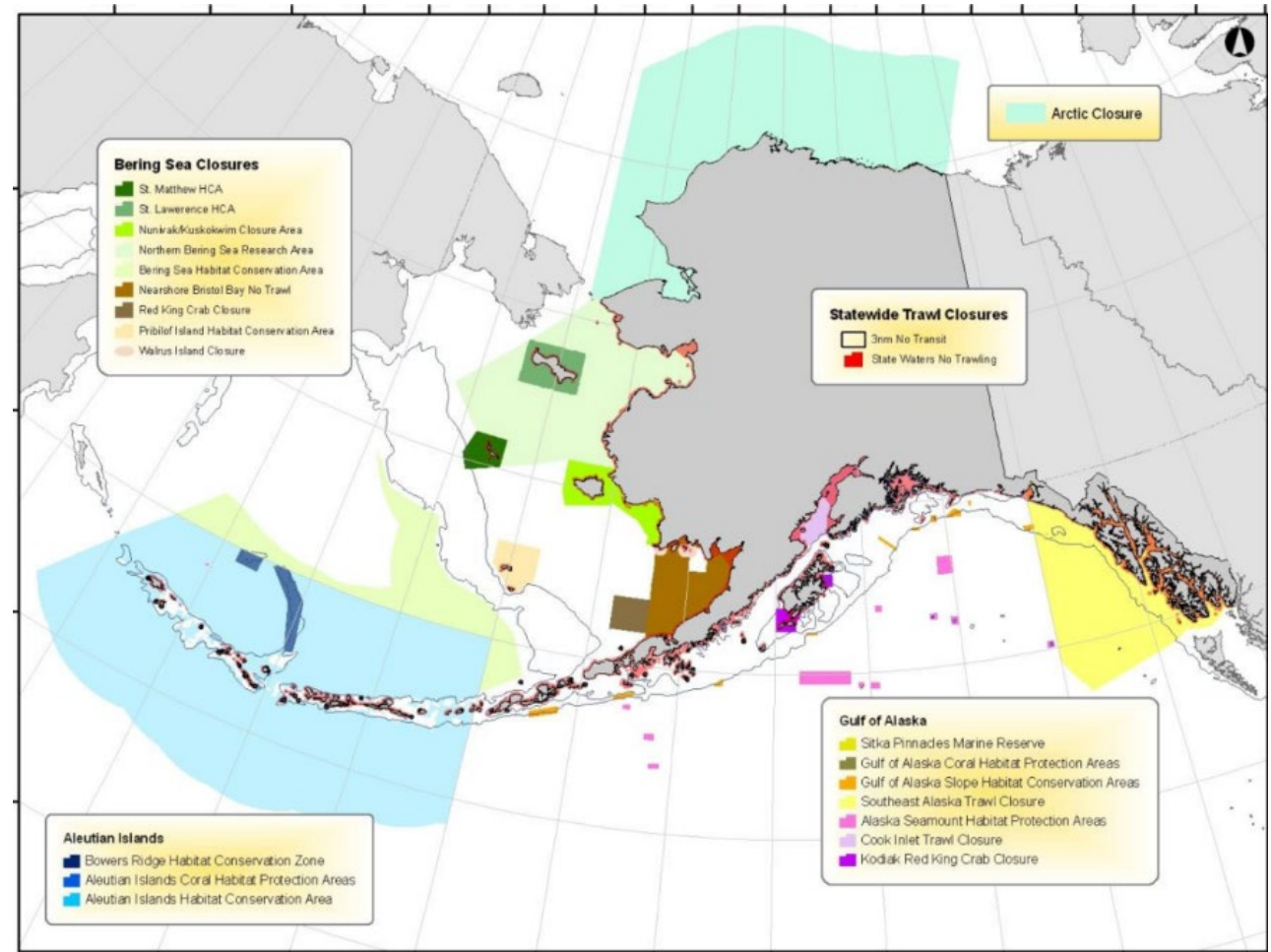


# Future considerations

- Closure areas, gear limitations - Several regs rely upon definition
- Displacement/spillover – e.g., changes to CPUE or PSC rates



\*See [C3c EA/RIR analysis](#) to modify PTR definition for complete list



## Council action at this meeting

- Expanded discussion paper
- Move to analysis:
  - Establish Purpose and Need, alternatives for analysis
- No further action



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# Thank you!

