



Trident's Modified Footrope EFP Project

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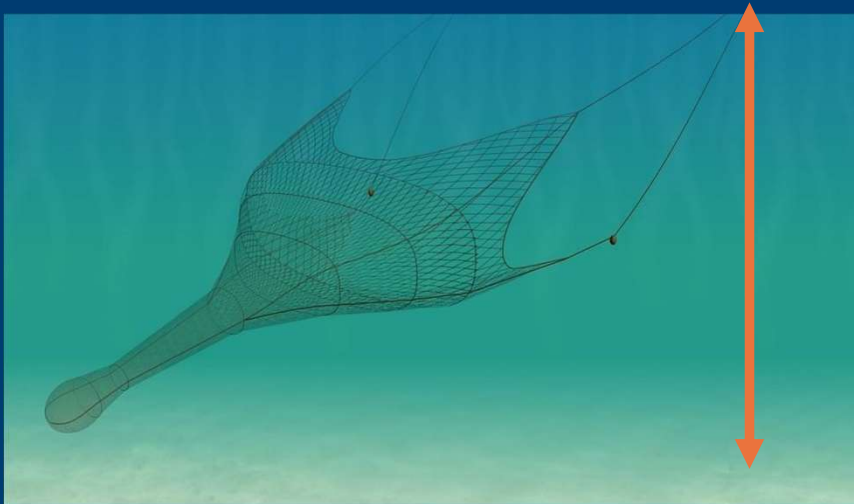
Joint Protocol Committee Meeting
16 October 2026

Measuring Seafloor Contact & Trawl Design



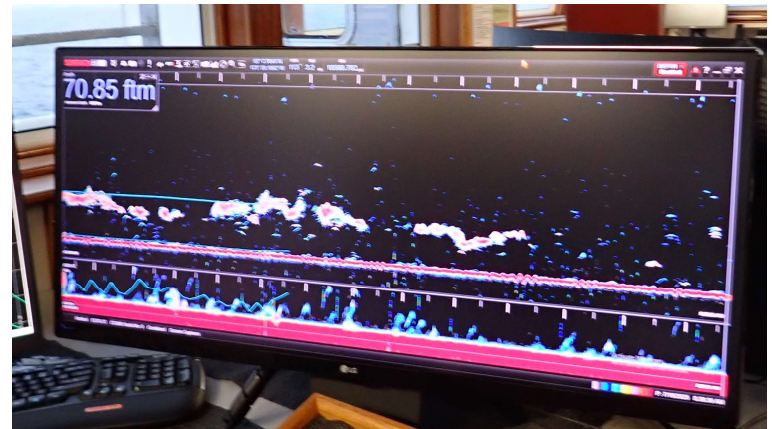
- Context for the focus on gear development (EFP project)

Pelagic Trawl

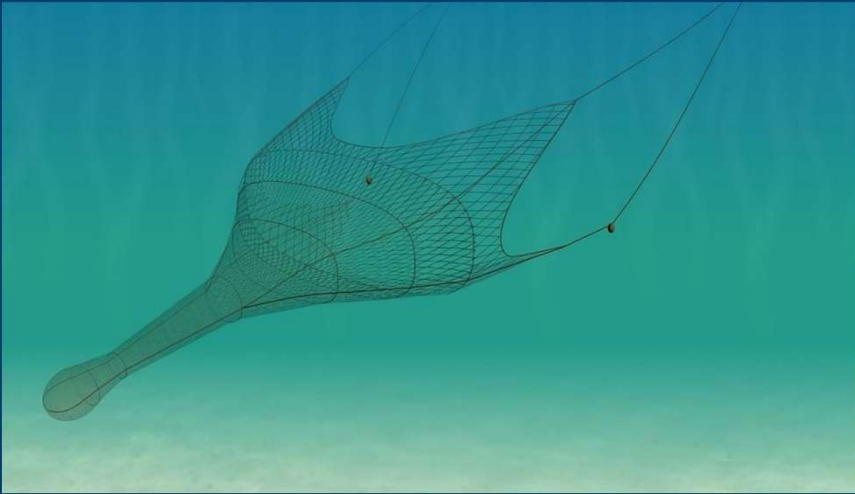


*Midwater trawls and their operation. (1971).
In Modern Fishing Gear of the World.*

- Works with an acoustic sounder for “**aimed trawling**”
- Acoustic “images” used to find the fish and target them where they are at: water column to the seafloor

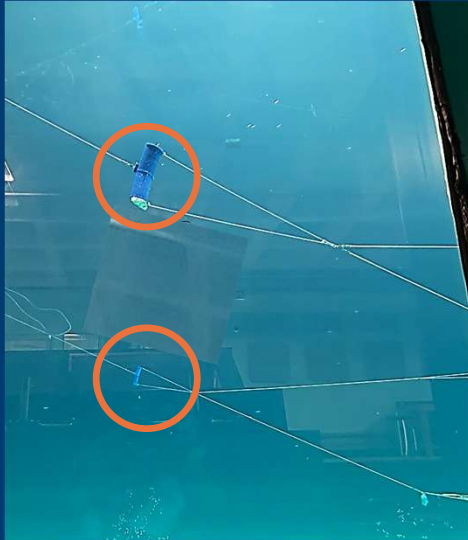


Pelagic Trawl



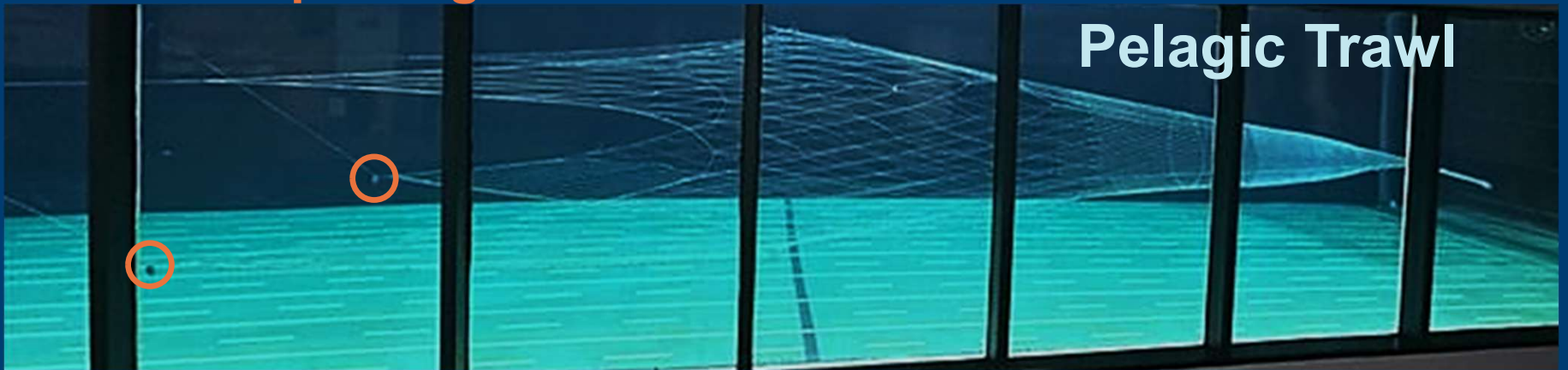
- Net with a large vertical and horizontal mouth opening
- Suspended in the water column
- Spreading/ lifting and weighting/ counteracting forces





Trawl “doors”

“Clump” weight

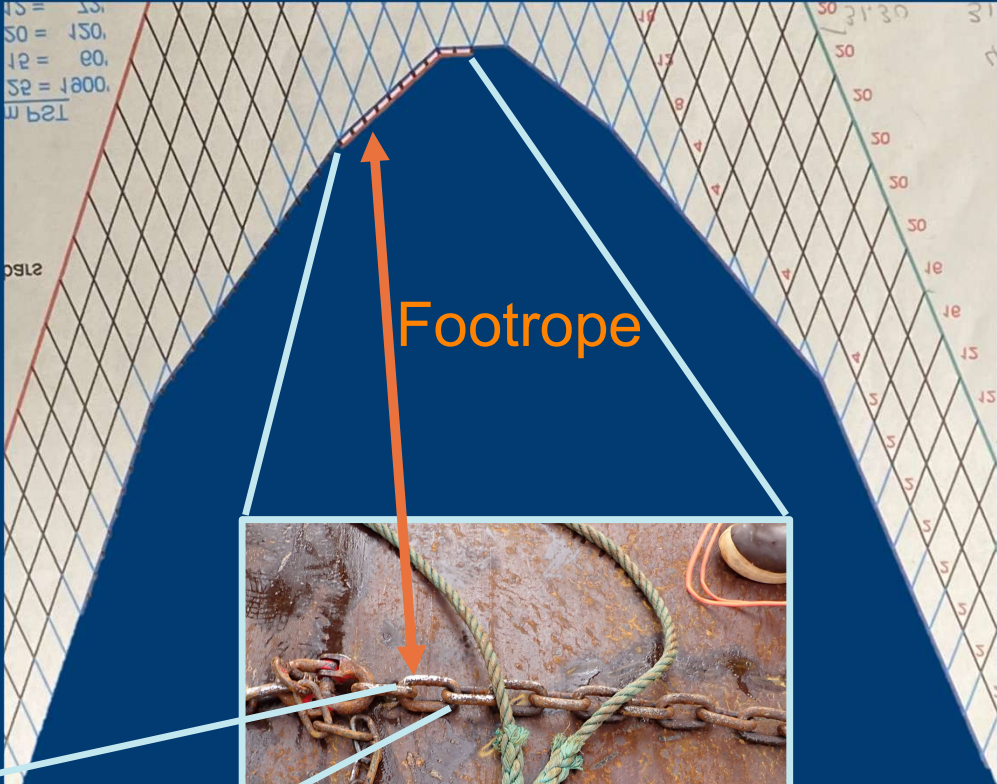


Pelagic Trawl

Pelagic Trawl Footrope



Footrope

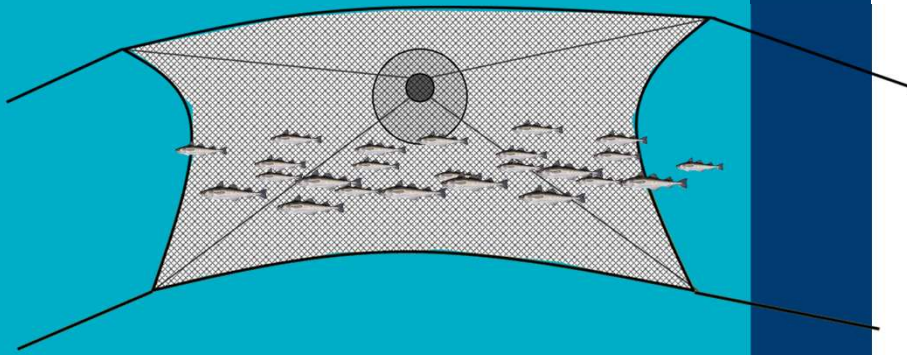


Footrope



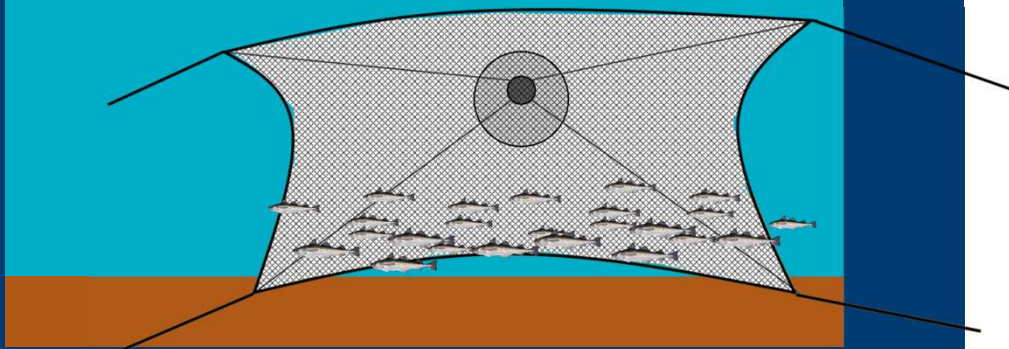
Pelagic Trawl

Aimed Trawling

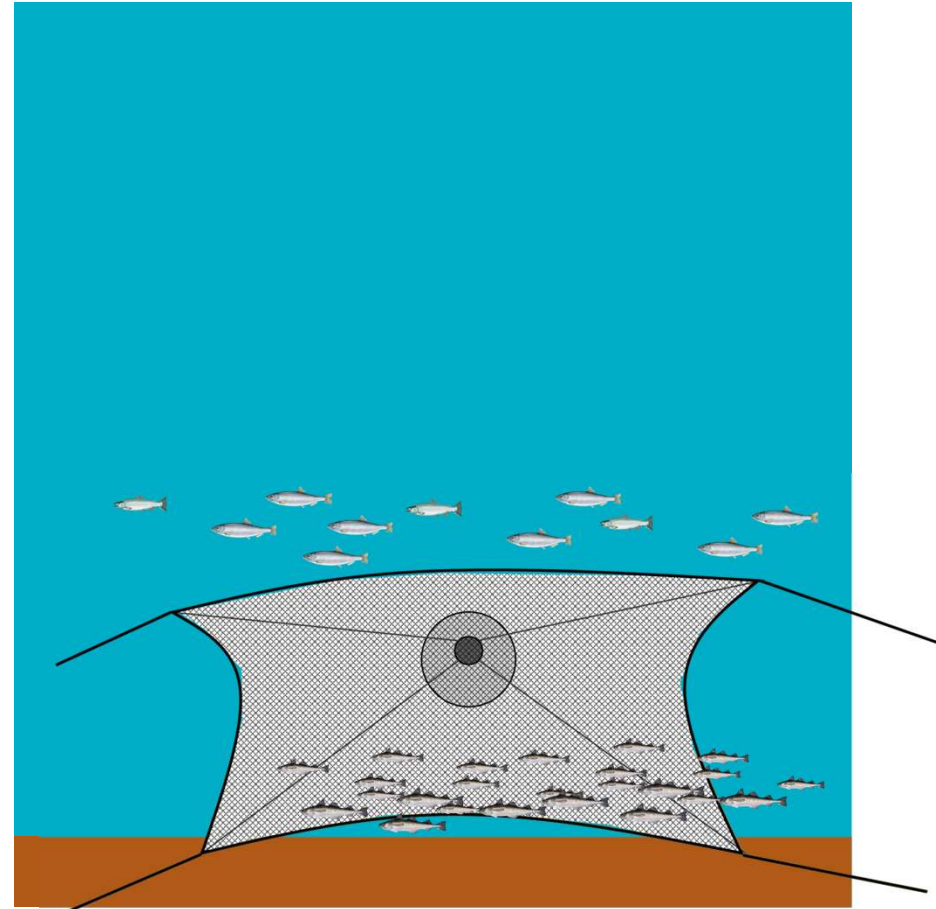


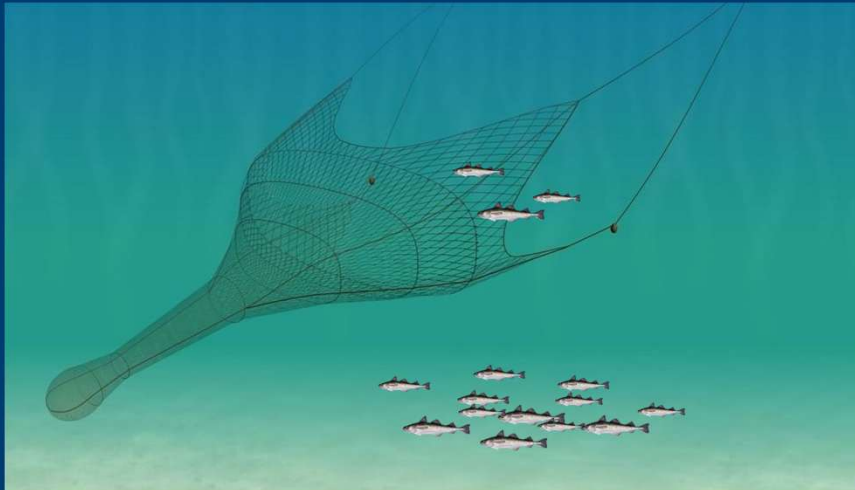
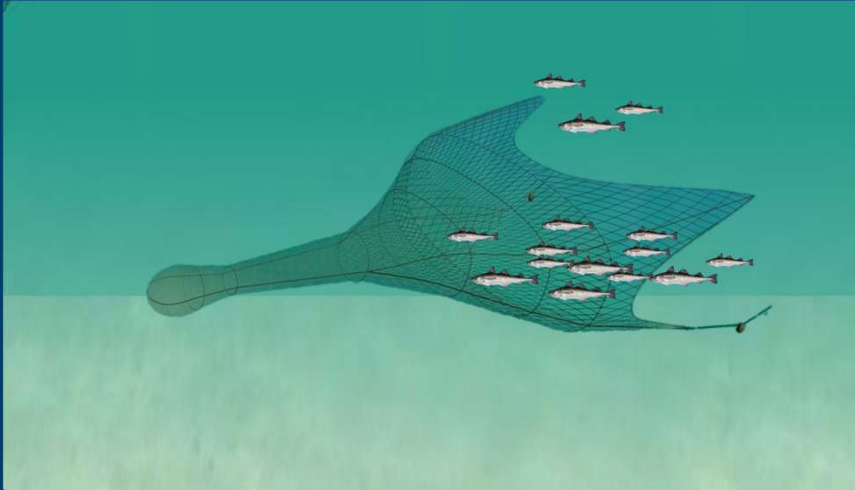
Pelagic Trawl

Aimed Trawling



Distance Above Bottom Can Affect Catch Efficiency and Bycatch

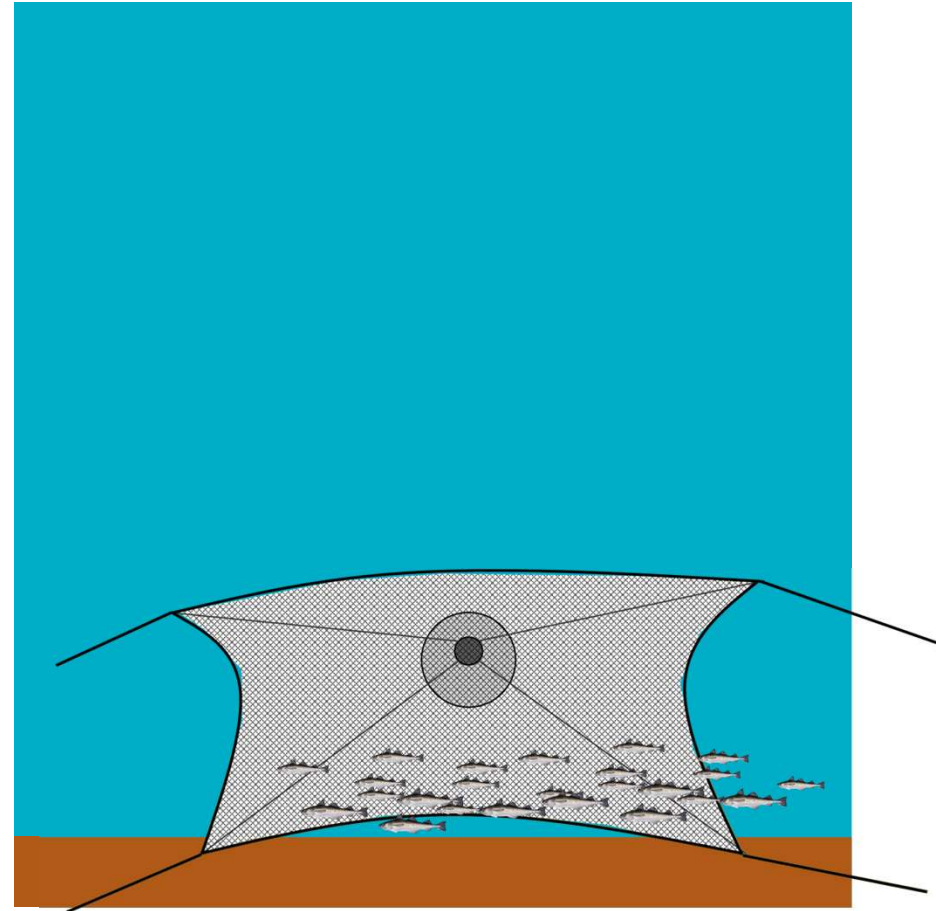




Efficiency Matters

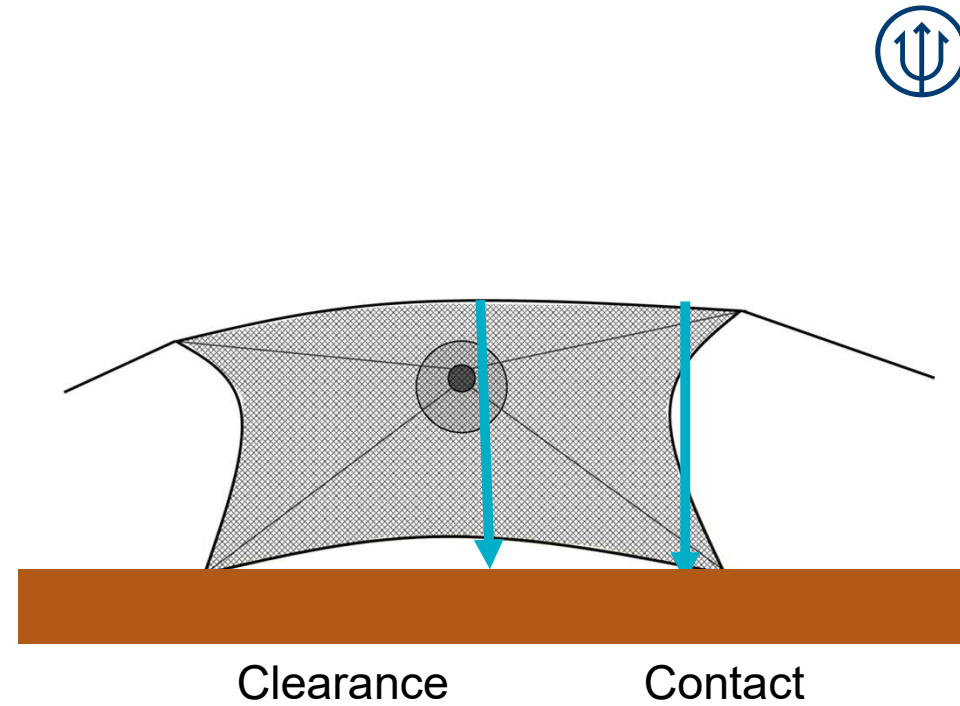
- Efficiency = fewer tows
- Can reduce:
 - Bycatch encounters
 - Bottom contact
 - Fuel consumption
 - Time at sea
 - ...

Measure Contact and Distance Above Bottom

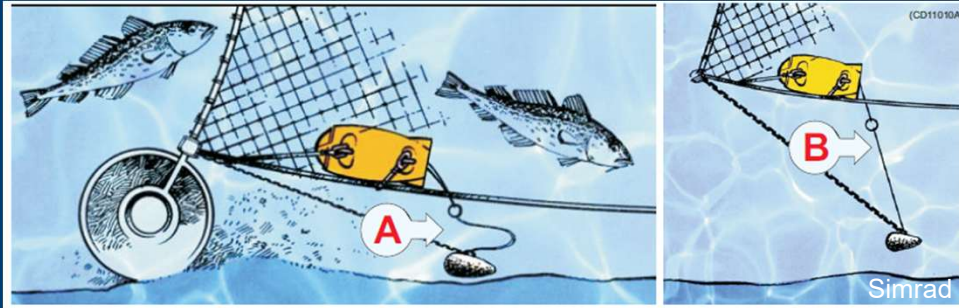


Measuring Seafloor Contact

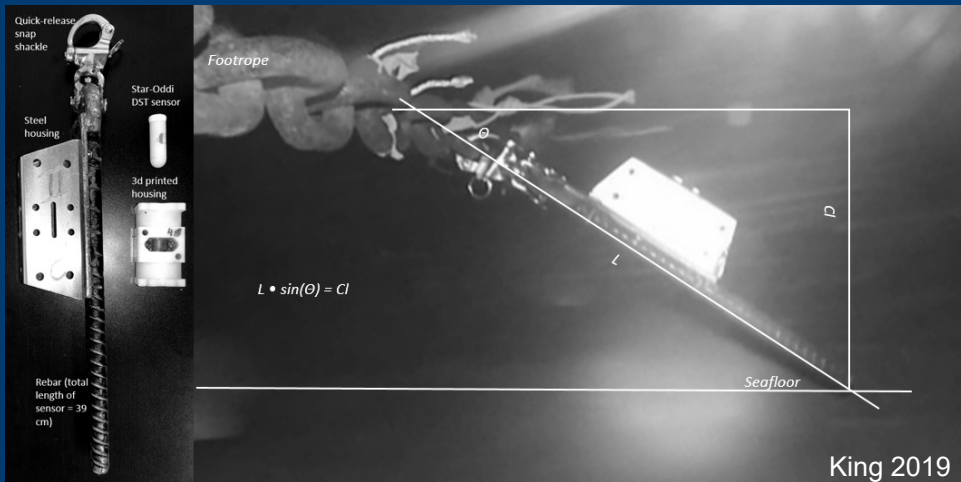
Contact and **clearance**: space between the footrope and seafloor



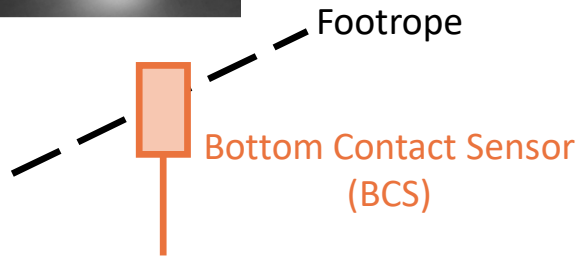
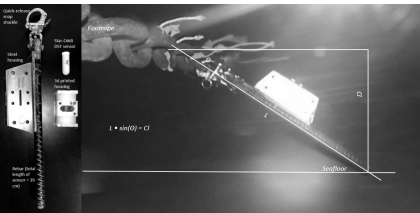
Measuring Seafloor Contact



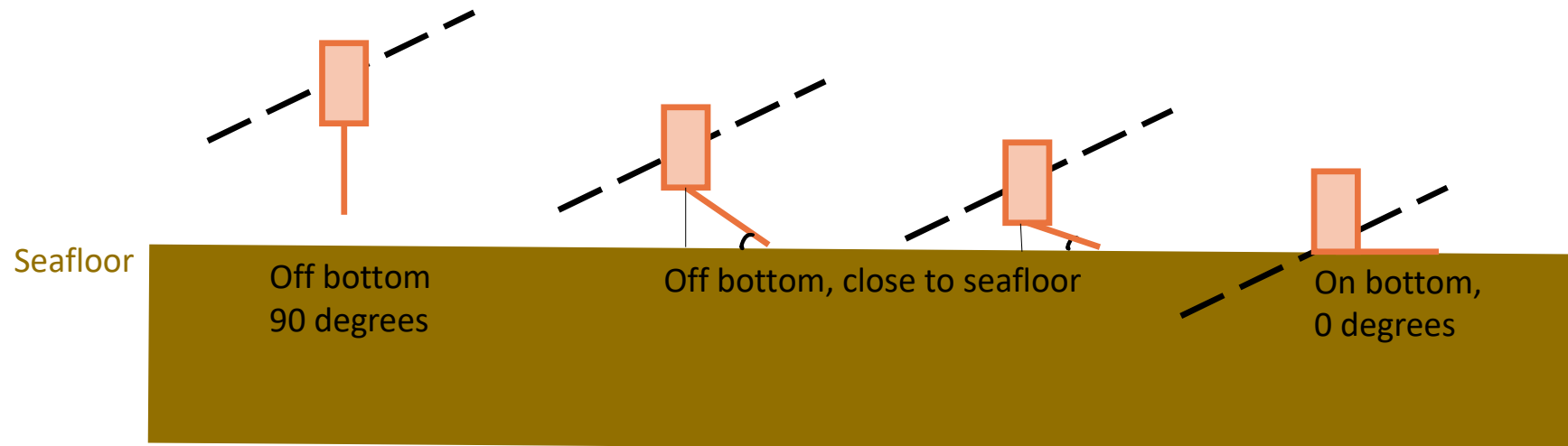
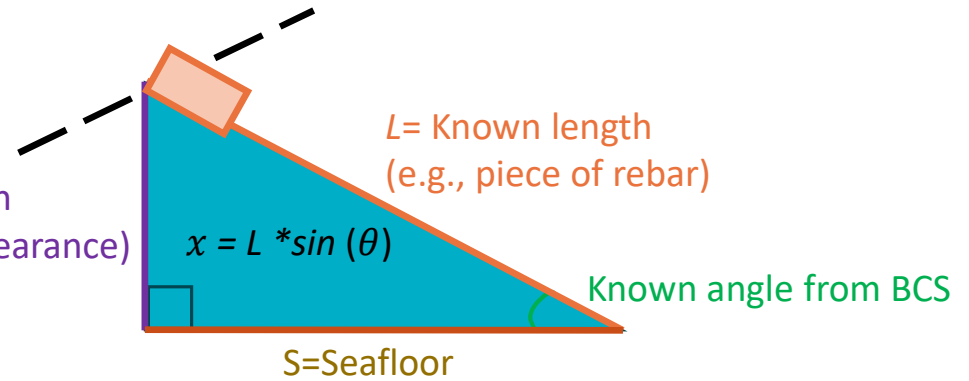
On or off bottom (contact)



On or off bottom (contact) & clearance



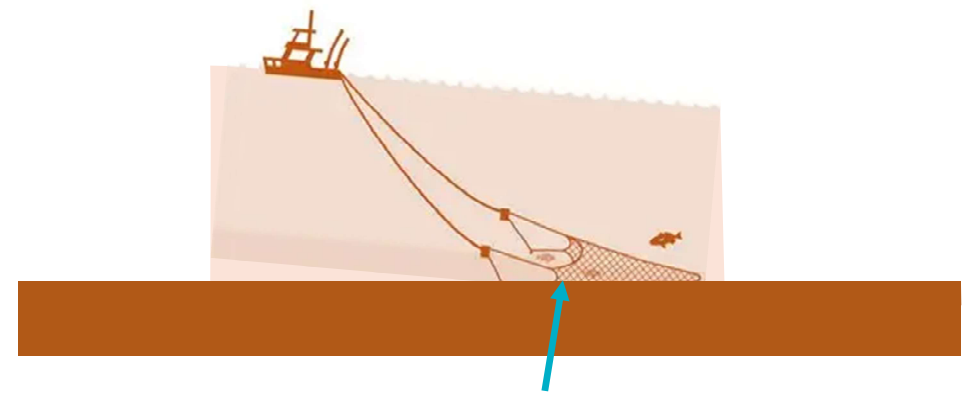
x = Unknown distance (clearance)



Measuring Seafloor Contact



Bottom Trawl Surveys

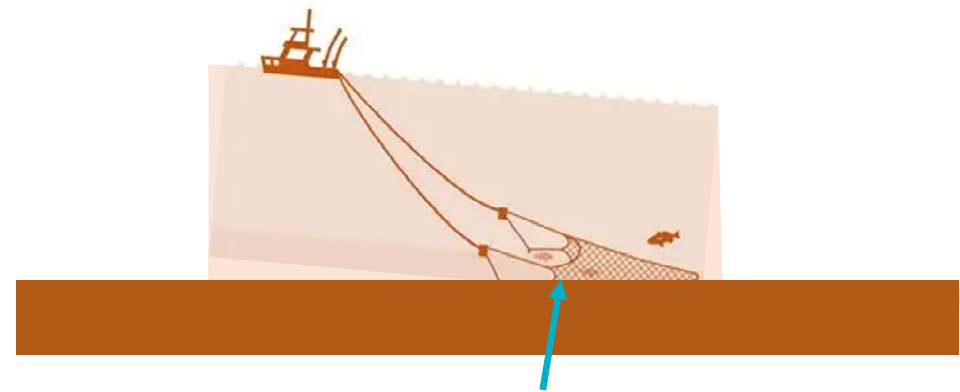


Bottom contact sensor

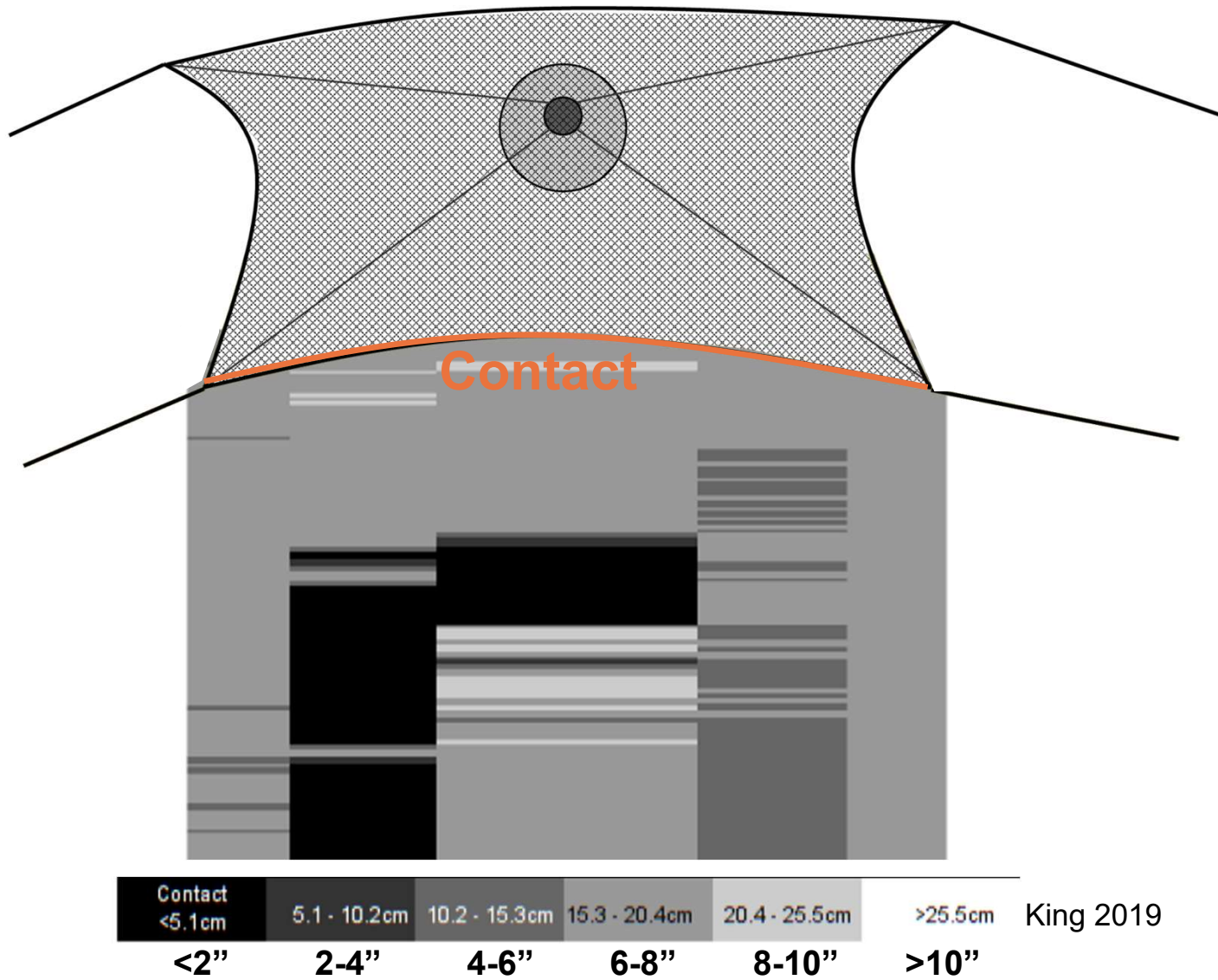
Measuring Seafloor Contact



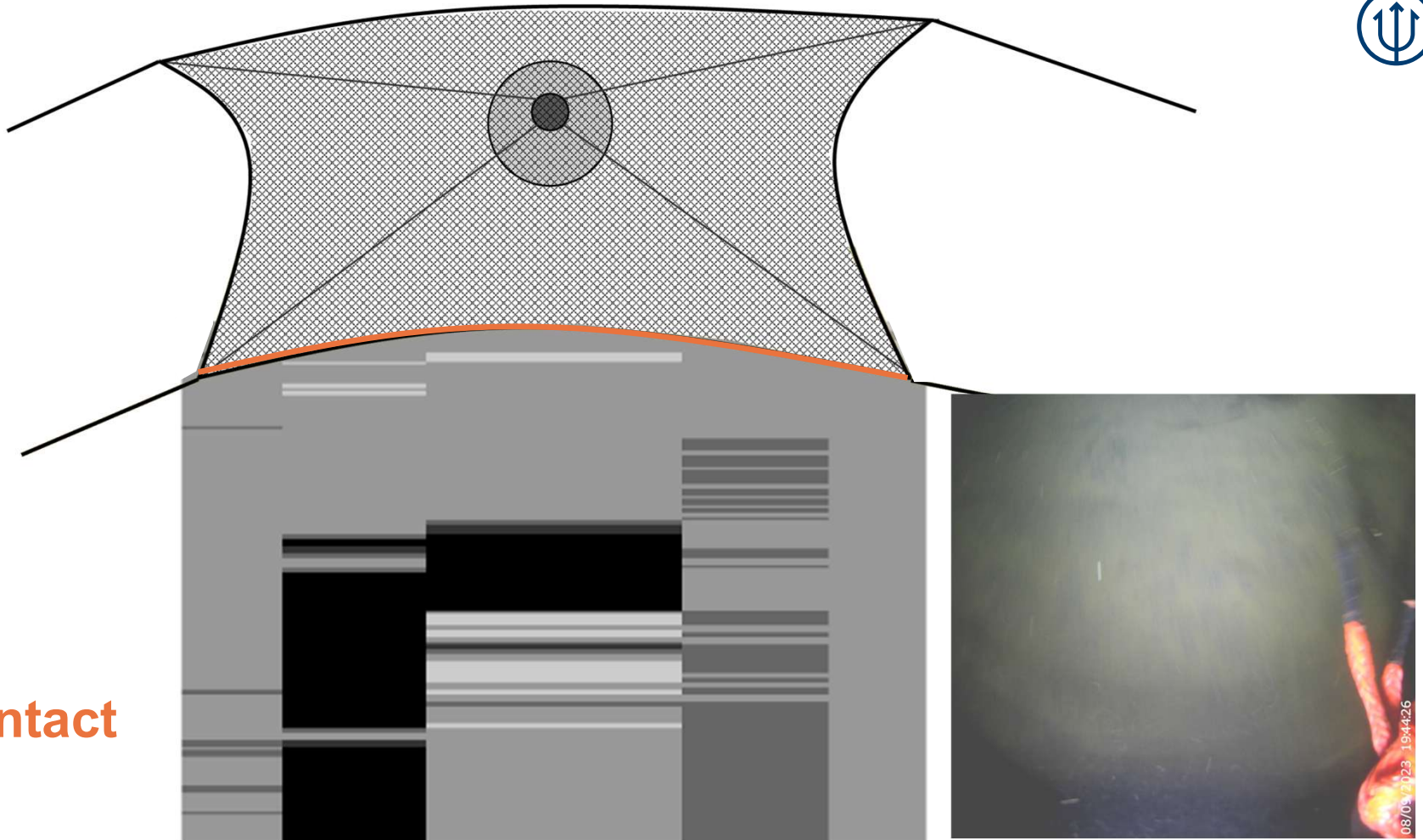
Bottom Trawl Surveys



- Were there any issues?
- Is the gear performing correctly?
- Are the tow data usable?
- Assumption of constant and consistent contact over the footrope



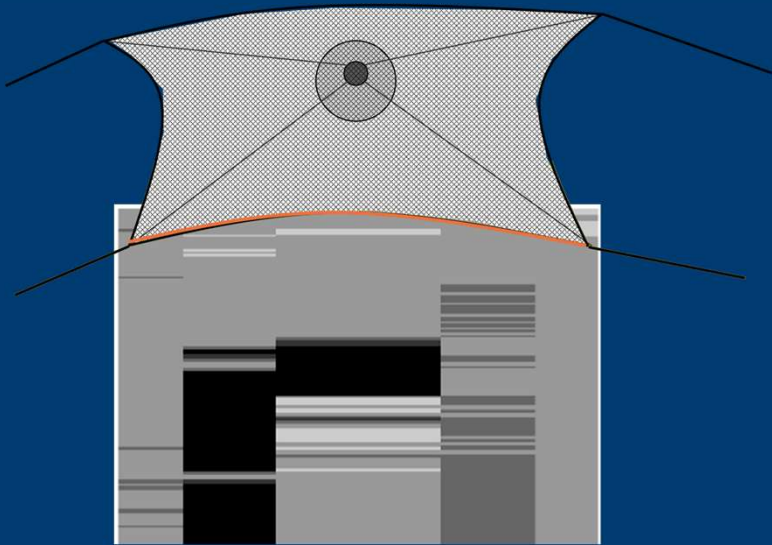
Variable



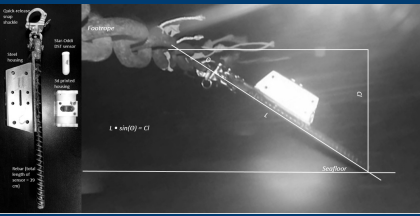
Variable Contact

Contact <5.1cm	5.1 - 10.2cm	10.2 - 15.3cm	15.3 - 20.4cm	20.4 - 25.5cm	>25.5cm	King 2019
<2"	2-4"	4-6"	6-8"	8-10"	>10"	

Measuring Seafloor Contact



- Contact is highly variable over the extent of the footrope and duration of the tow
 - Trawl dynamics
 - Intentional changes in depth of fishing (moving with the fish)
 - Turns
 - Bathymetry/ seafloor contour
 - ...

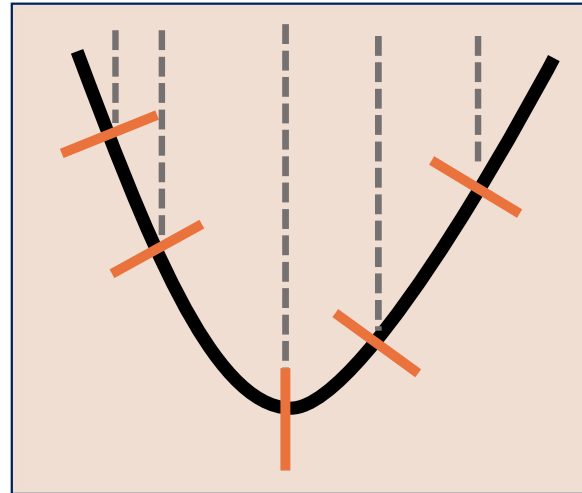


Challenges

- Clearance measurement is limited by rebar length
 - Too long = can snag in the mesh or be an obstacle/ safety hazard
- Lack of attachment locations/ can tangle in the netting
- Durability is needed for repeated deployments
- Impedes operations (attaching/removing each tow)
- Cost
- Time intensive data processing (noisy/ erroneous data)
 - Sensor bouncing on and off bottom
 - Interactions with debris
 - Hydrodynamics near the bottom/ currents/ tow speed
 - Twisting of the sensor or binding up due to the attachment



- Design complicated by the changing angle of the footrope



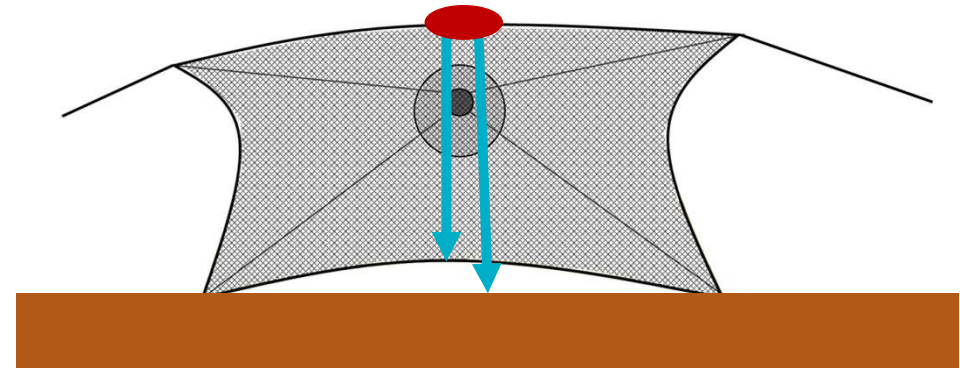
- Video is needed to understand the variables affecting the sensor readings and to ground truth
- Not designed for the fine scale resolution needed for this fishery

Challenges

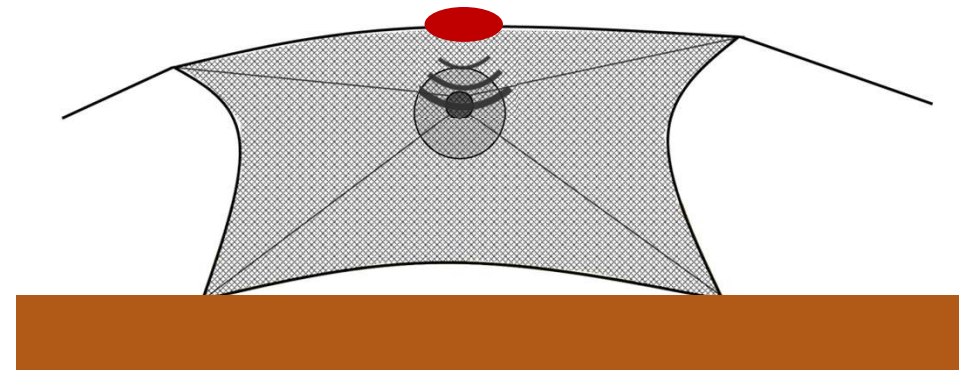
Measuring Seafloor Contact



“Headrope unit”/ Third-wire trawl sonar

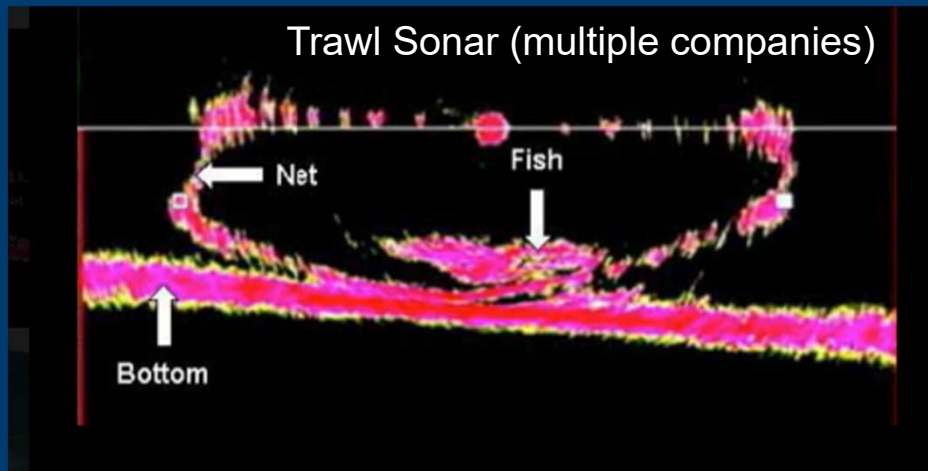


Measuring Seafloor Contact





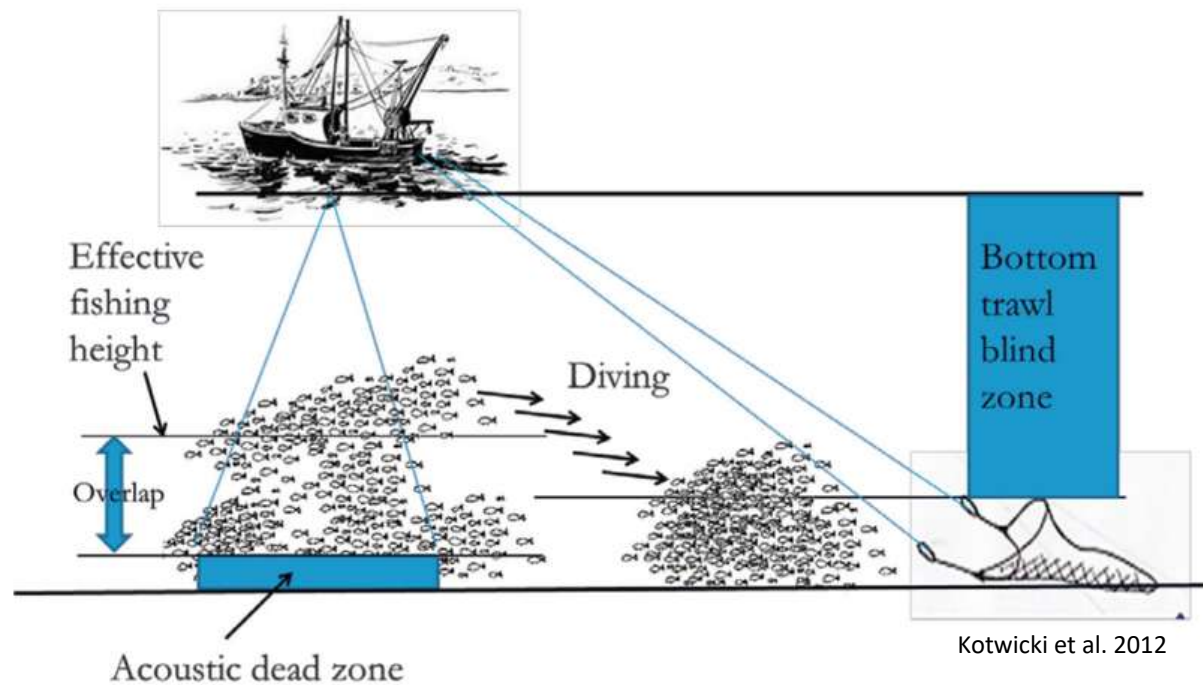
Measuring Seafloor Contact: Challenges



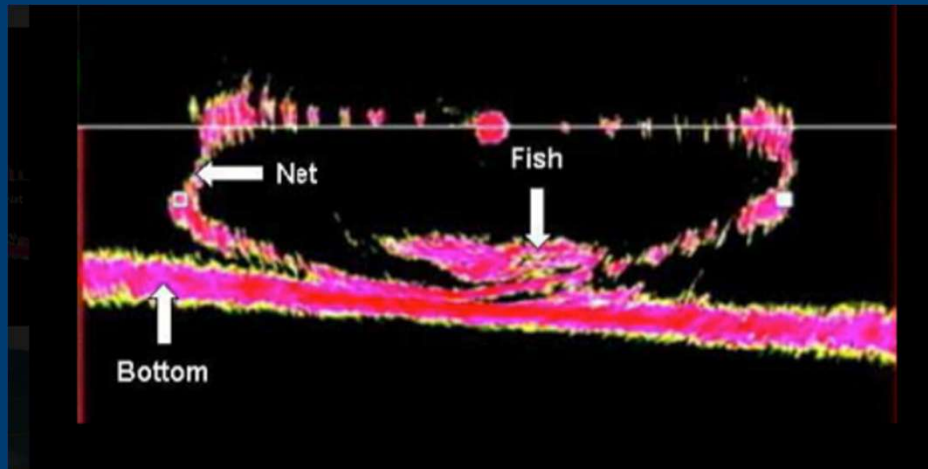
- Error when the footrope is in close proximity to the seafloor
- Confidence is at the center of the footrope (below the unit)
- Output affected by the sensor settings, orientation of the unit (e.g., pitch, roll), acoustic dead zone/ side lobes, ...



Fig. 1. Illustration of conceptual model of walleye pollock sampling by an echo sounder and a bottom trawl. Note that acoustic data are collected directly under the survey vessel, while the bottom trawl catches walleye pollock some distance behind the vessel. Diving occurs in the time between the vessel passing over the school of walleye pollock and the trawl catching the same school.



Measuring Seafloor Contact: Challenges



- Similar to mechanical sensors
- These sensors are not designed for the resolution needed for this fishery

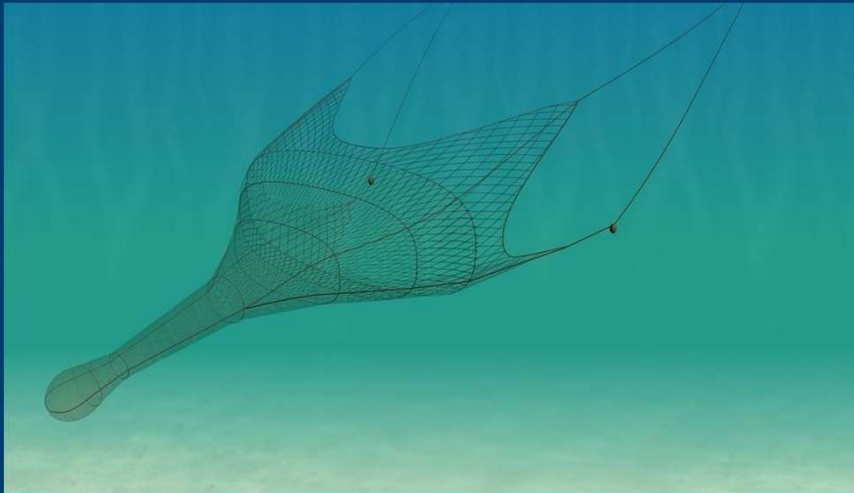




Integration of BCS

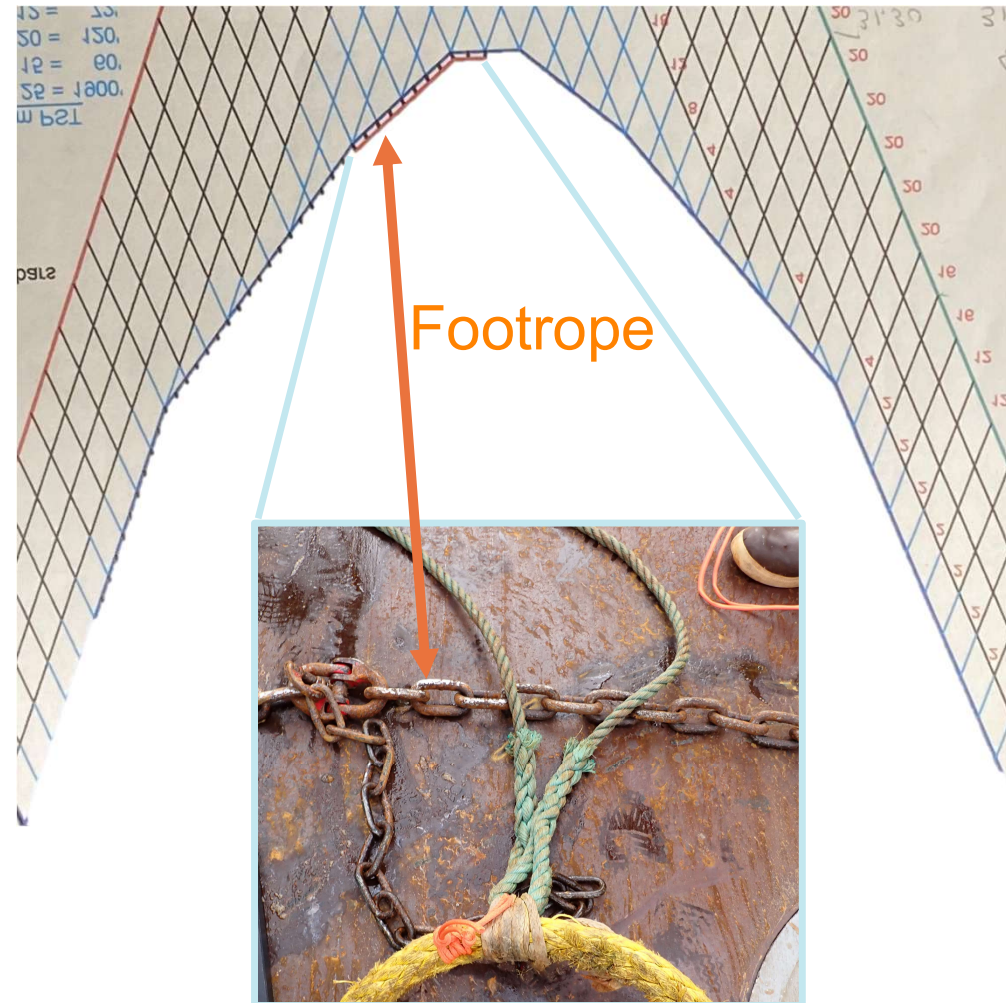
- Challenges, time/effort, to integrate a new technology
 - Development of technology
 - Development of best practices
 - Data collection and processing
 - ...
- Focus on gear modification and understanding fishing parameters

The Objective



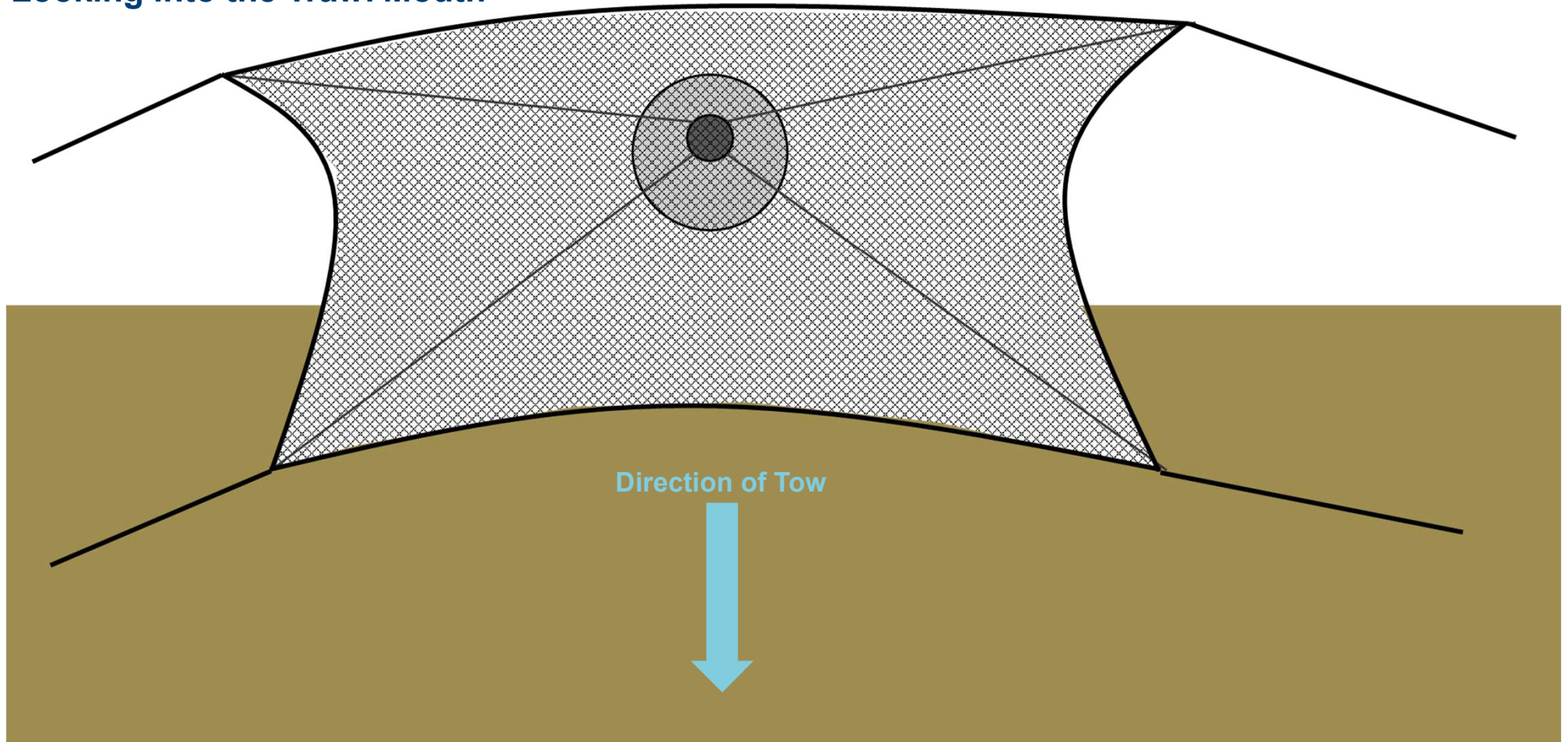
- Find an engineering solution that can overcome the presumption of UFM and negative impacts through reduced bottom contact points...
- ... while also:
 - Not impacting operations or safety
 - Being applicable to most nets used in the CV/CP fleets
 - Being affordable
 - Not requiring major modifications or change to repair/replacement schedule
 - Not increasing bycatch (e.g., salmon)
 - Not reducing efficiency (i.e., pollock catch)

Trident Seafoods' Exempted Fishing Permit (EFP) Project: Modified Footrope to Reduce Bottom Contact



A Standard Footrope Design

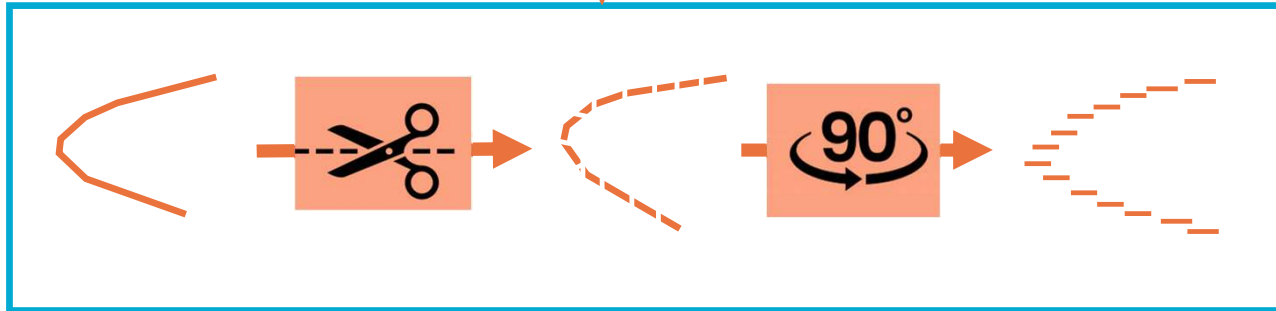
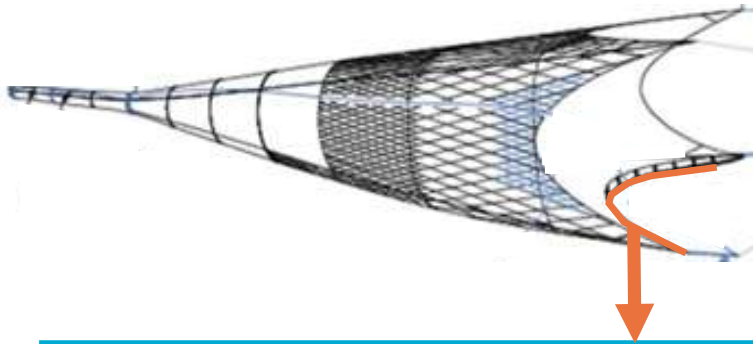
Looking into the Trawl Mouth



One current footrope design (not to scale)

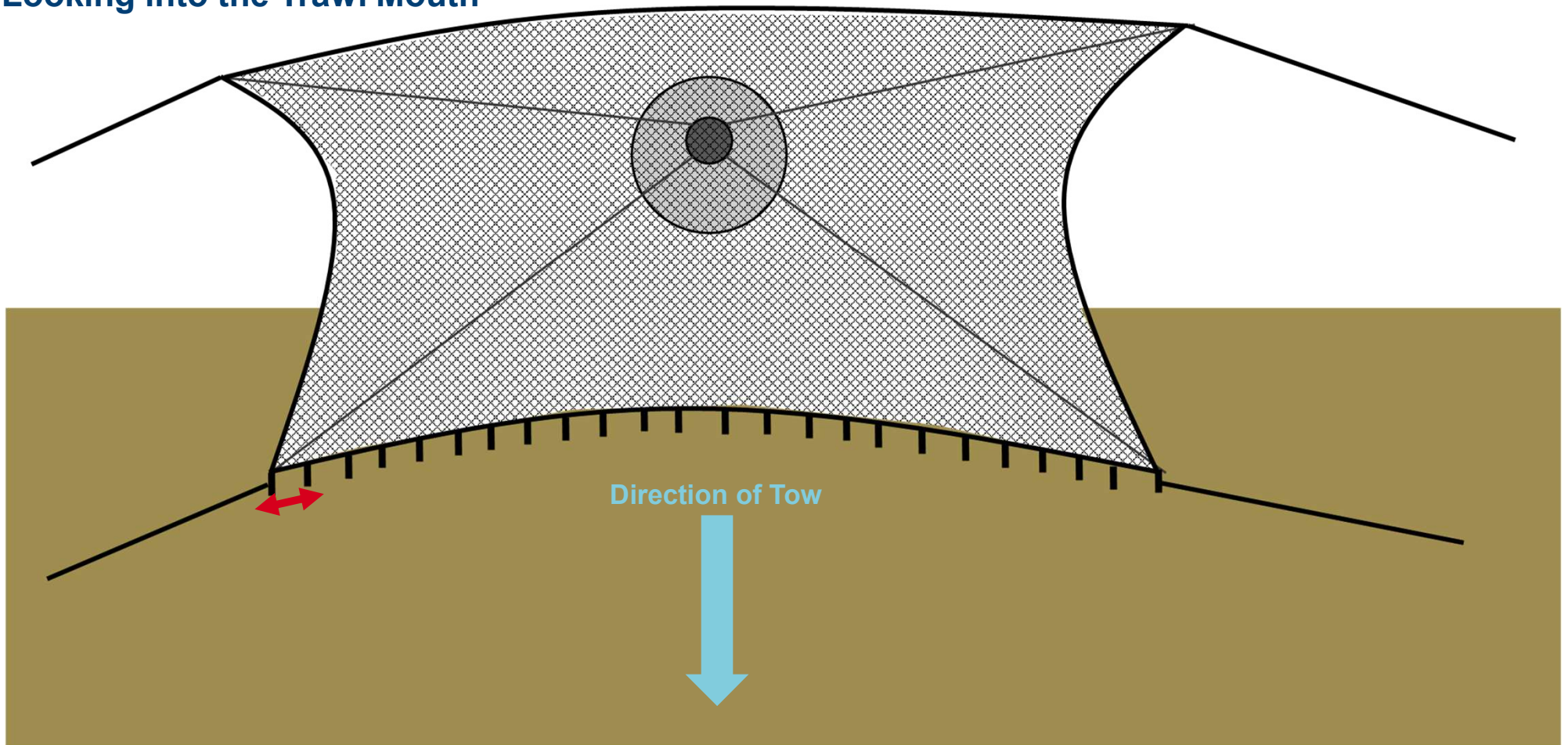
Original Design Concept

Seamus Melly (Swan Net USA)

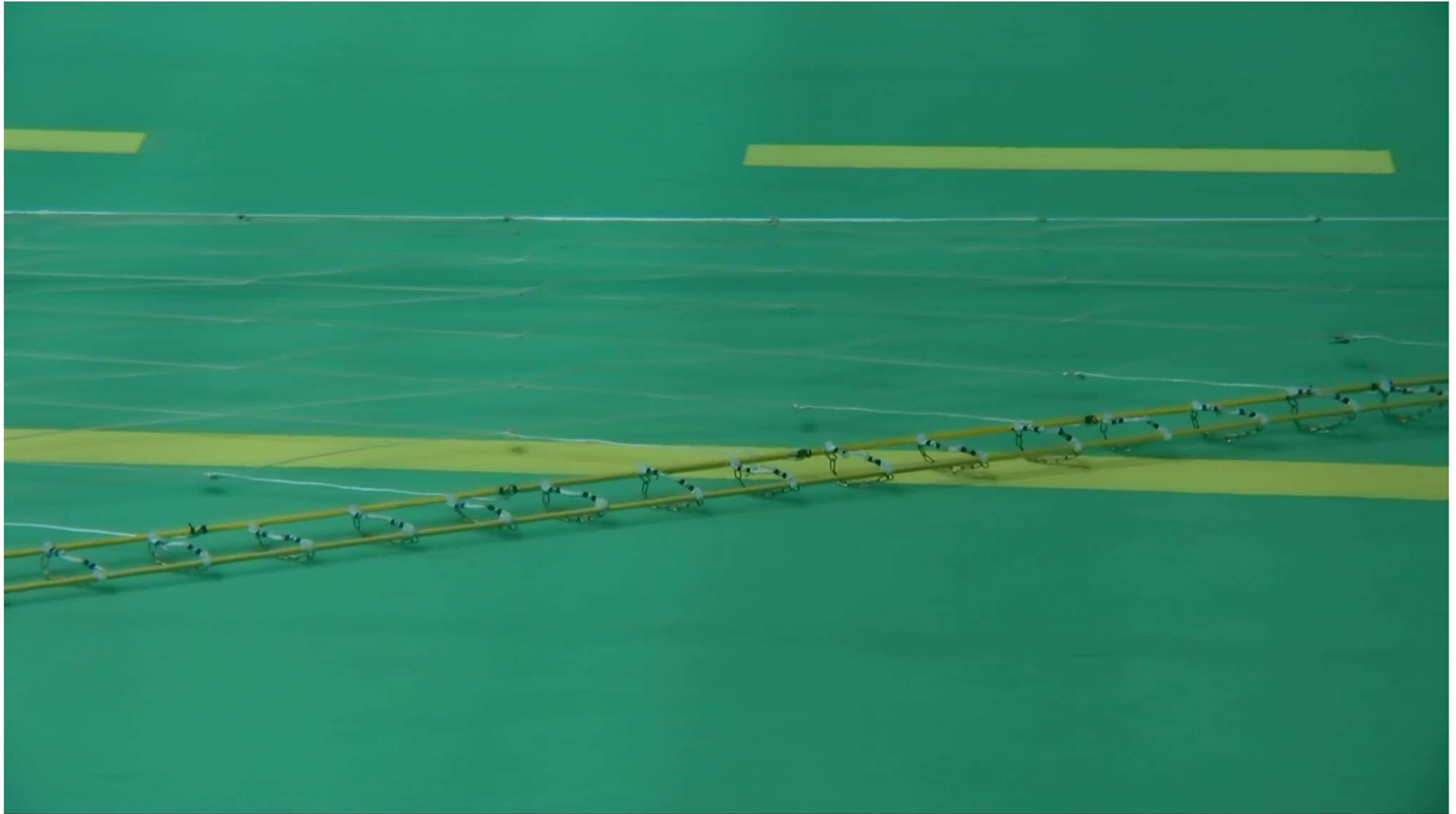


Modified Footrope Design Concept

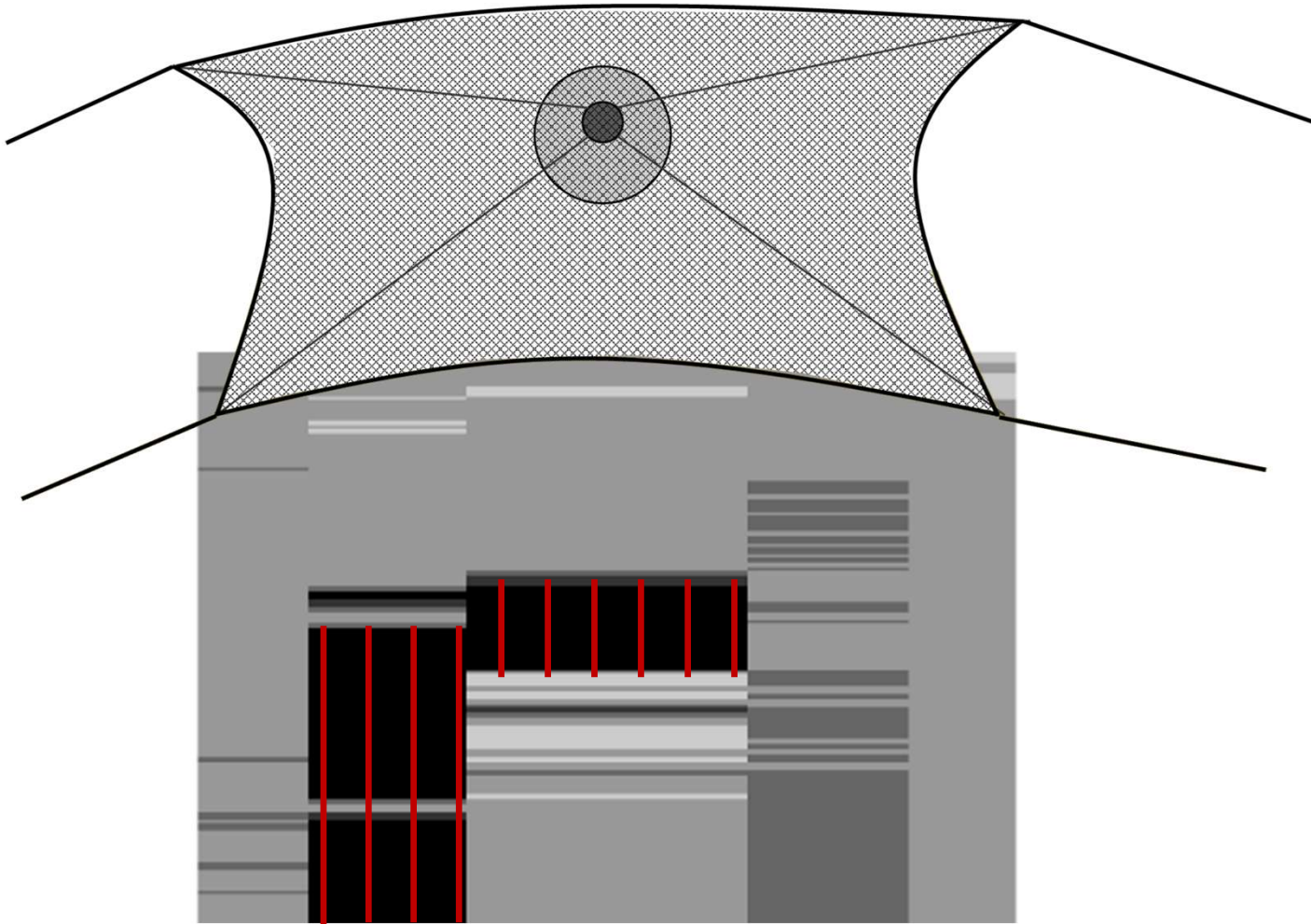
Looking into the Trawl Mouth



S.P.F. (not to scale)



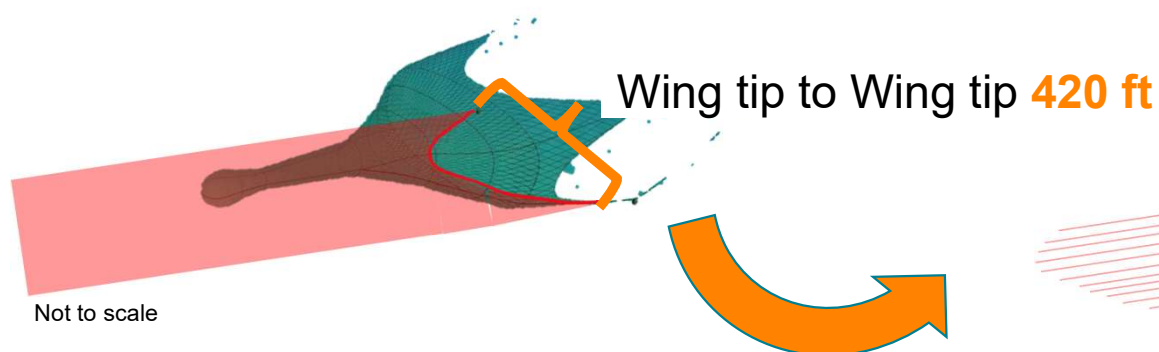
Demonstration purposes only – assumes full contact



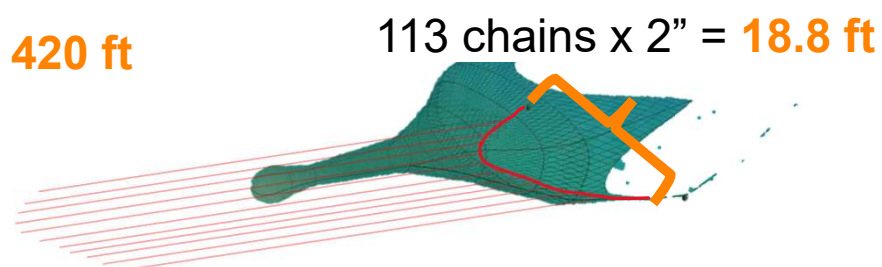
Approximated Reduction in Contact



Current footrope design



S.P.F. design



➤ $420 - 18.8 = 401.2$ ft less contact *

➤ $401.2 / 420 = 96\%$ reduction in contact *

* Assuming even contact over the footrope and the duration of tow for illustrative purposes (overestimating contact based on King 2019 and observations from this study)



Currently on all Trident Bering Sea pollock CVs and CPS

Next Steps:

Vessel Data - Efficiency

- Evaluate drivers of efficiency
–footrope and other

Videos- Contact

- Percentage of time the footrope is in contact
- Compare locations and designs

Flume - Performance

- Variables that affect contact

Other

- Finish publication with Seamus Melly (Swan Net)
- Integrate with the Gear Innovation Initiative model (APU FAST lab) to estimate contact
- Continue to evaluate and improve the design with Swan Net (track international developments)
- Encourage others to test/ improve



Summary

- Sensors to measure bottom contact and clearance exist, but do not work for our purpose
- Efficiency means less impact, which means the trawl needs to be where the pollock are
- The SPF demonstrates how gear design can reduce contact while maintaining efficiency

Acknowledging
the time and
commitment to
this project by
our captains and
crew, and to
Swan Net USA





Thank you