Effects of Raised Trawl Sweeps on Unobserved Crab Mortality and Pelagic Trawl Seafloor Contact

Craig S. Rose

FishNext Research,
Led AFSC Conservation Engineering (1987-2013)

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Reduce incidental effects of fishing (mainly trawls)

Outline

Raised sweeps description

Estimation of effects on crab mortality

Extension to Gulf of Alaska

Pelagic trawl seafloor contact

Modified Sweeps to Reduce Seafloor Effects of Trawling

Flatfish fishing – maximize seafloor coverage

Sweeps herd fish from wide area to a narrower net

Provided another tool for reducing habitat effects

Research collaboration between NMFS and Bering Sea bottom trawl fleet

Added to study estimating unobserved crab mortality rates

Passed by NPFMC 2009 - Implemented 2011

Extension to GOA considered 2010 and passed in 2012

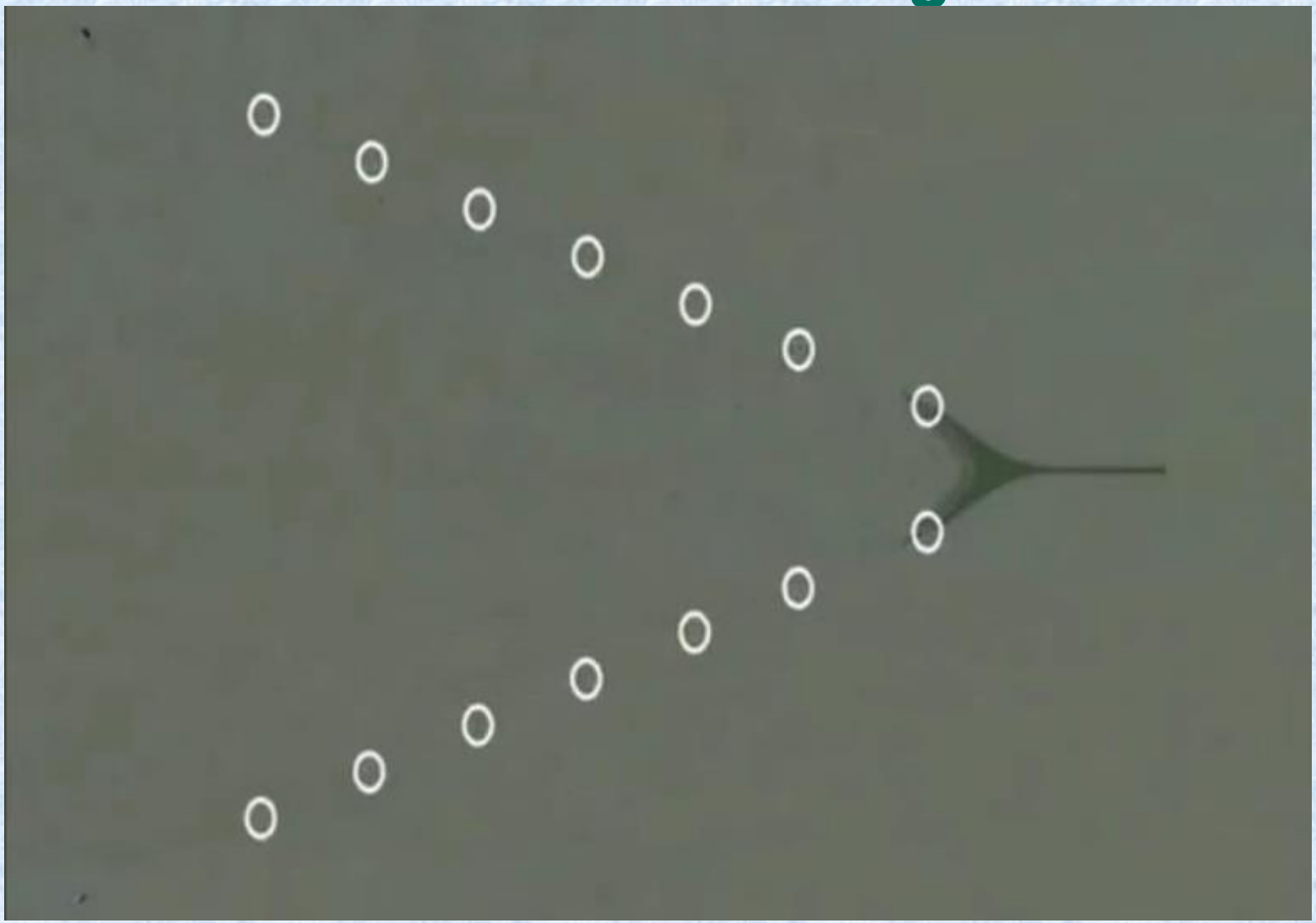
What are raised sweeps?

Raised sweeps

Conventional Sweeps

Widely spaced elevating devices that raise sweeps several inches above seafloor

Each bobbin makes a few inches of contact width every 90 feet over 90% of full width of the gear

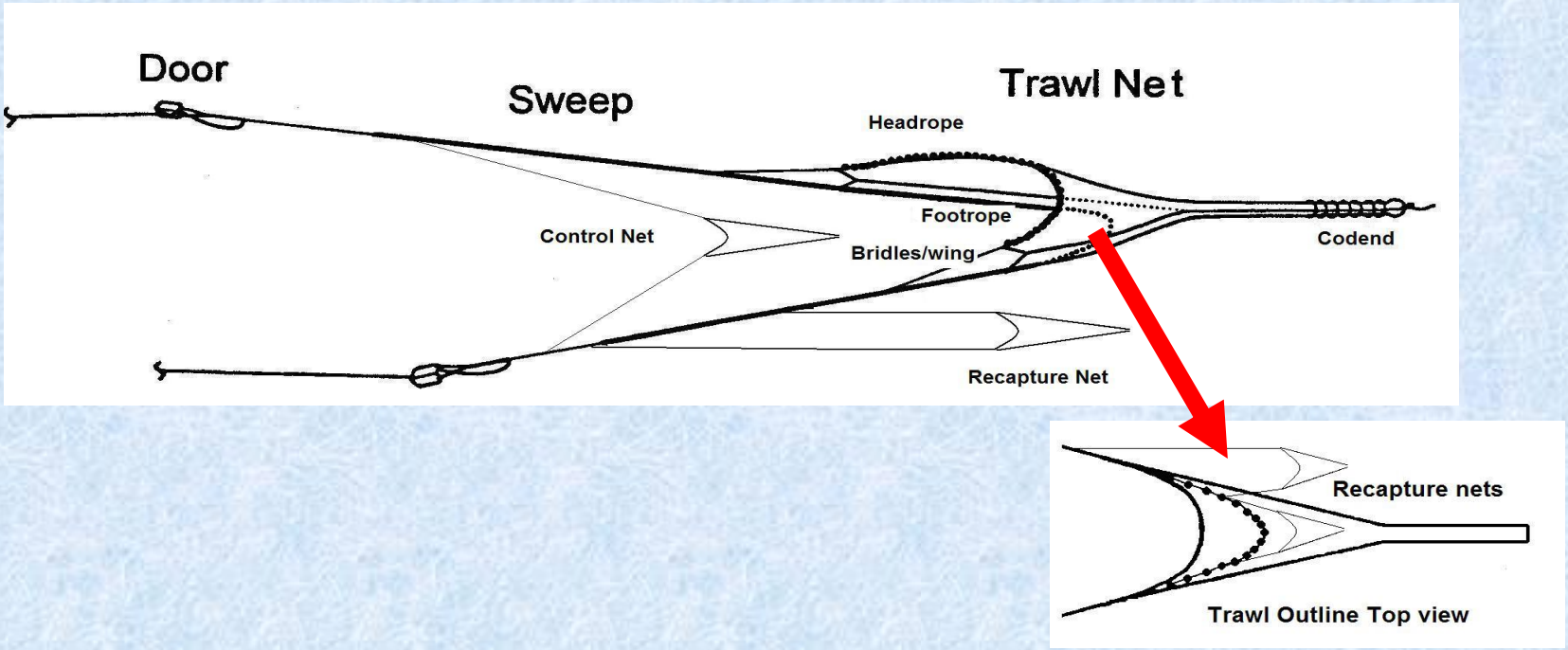


Video from Alaska Seafood cooperative

Bottom Trawls with Raised Sweeps as used in Alaska Flatfish Fisheries

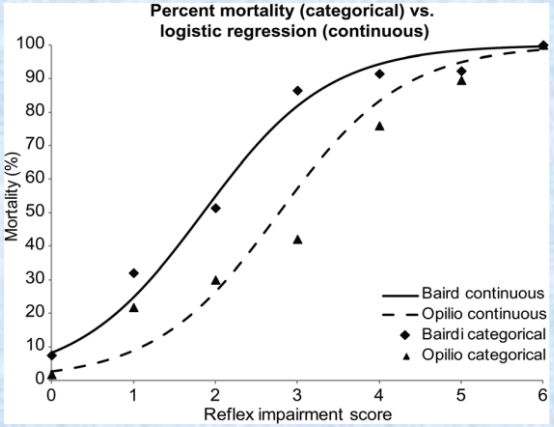
Video from Alaska Seafood cooperative

Estimating unobserved mortality of crabs encountering trawl sweeps



- Affected crabs captured in auxiliary nets after contact
- Control net to adjust for capture and handling damage

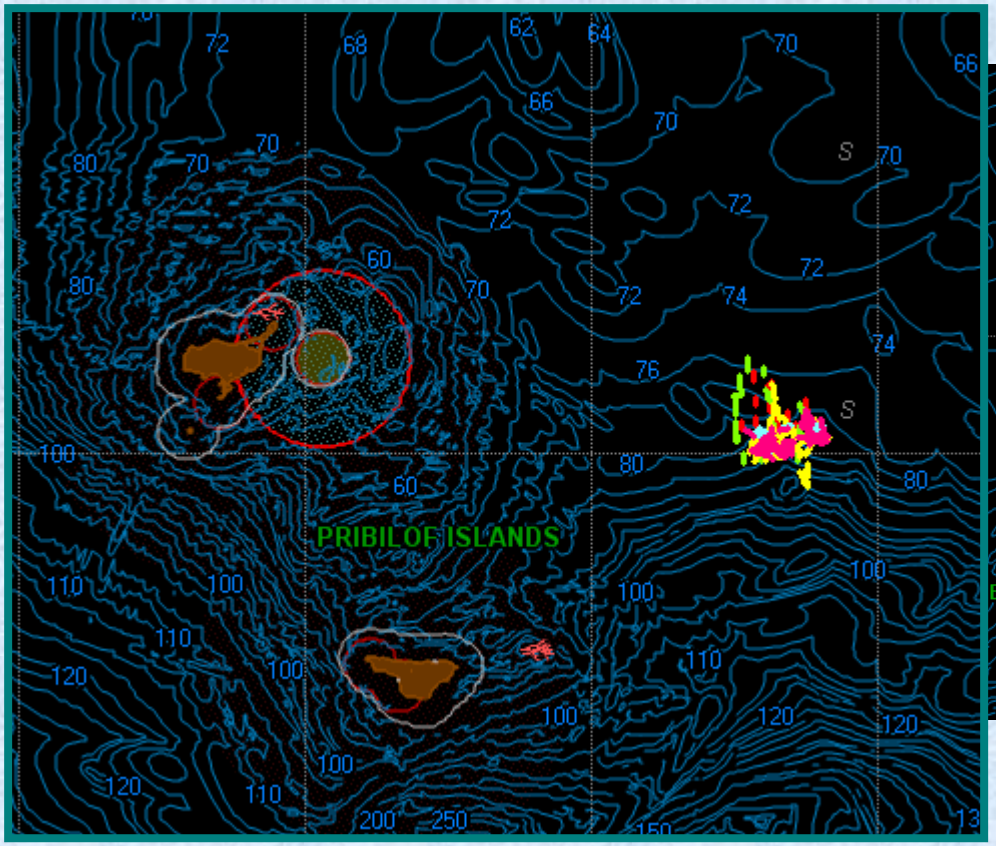
Estimating unobserved mortality of crabs encountering trawl sweeps



- Assessed six reflexes from all crabs (predicts mortality)
- Held a sample of crabs in on-board tanks to observe delayed mortality
- Number of reflexes present indicates survival probability (2007 study)

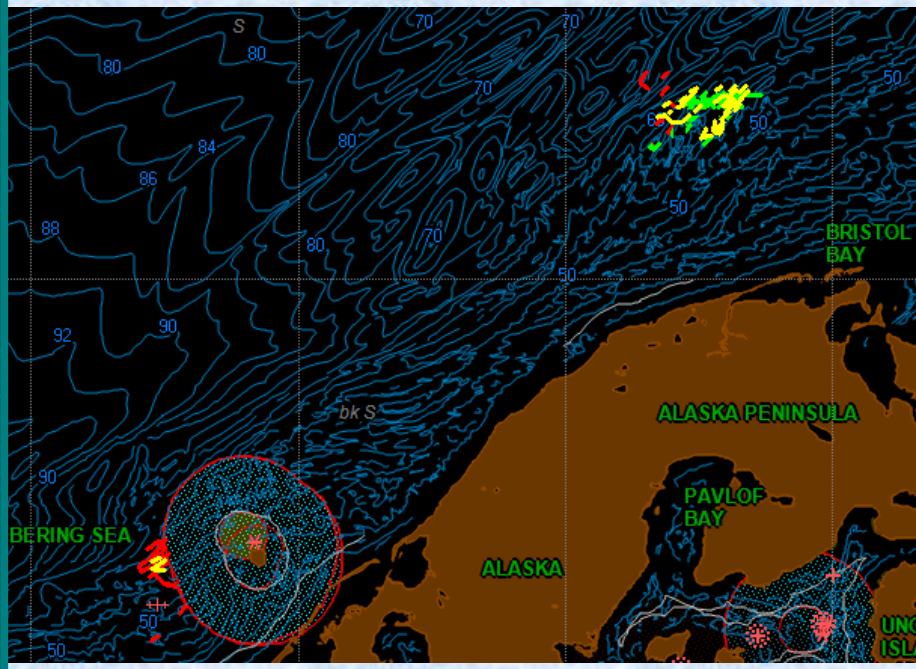
Stoner, A.W., **C.S. Rose**, J.E.Munk, C.F. Hammond, & M.W. Davis 2008. An assessment of discard mortality for two Alaskan crab species, Tanner crab (Chionoecetes bairdi) and snow crab (Chionoecetes opilio), based on reflex impairment. Fishery Bulletin 106: 337-347.

Tanner and Snow Crabs
(2008)



Hammond, C.F., Conquest, L.L., and **Rose, C.S.** 2013.Using reflex action mortality predictors (RAMP) to evaluate if trawl gear modifications reduce the unobserved mortality of Tanner crab (Chionoecetes bairdi) and snow crab (C. opilio). ICES Journal of Marine Science 70: 1308-1318.

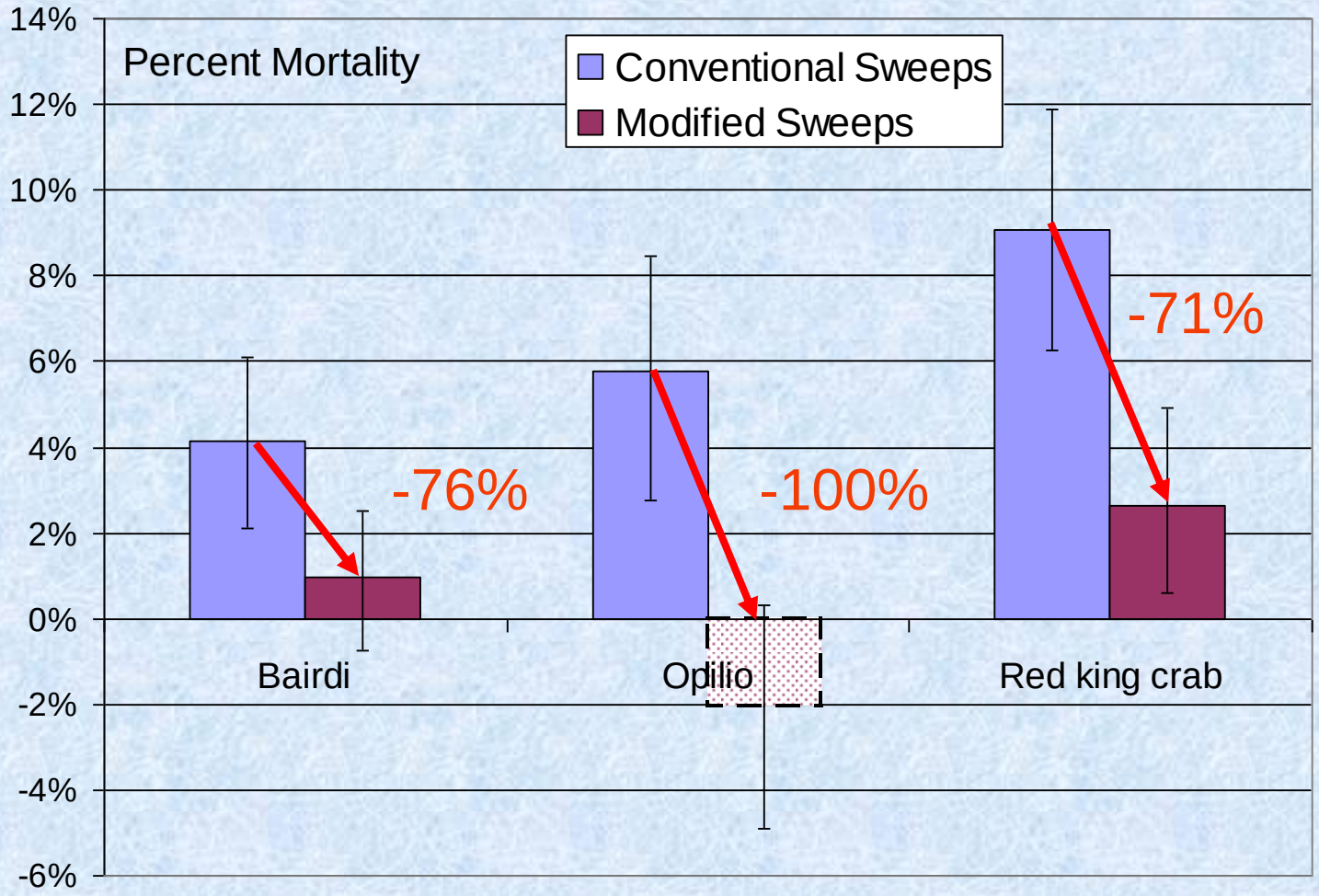
Red King Crabs
(2009)



Rose, C.S., C.F. Hammond, A.S. Stoner, J.E. Munk, & J.R. Gauvin. 2013. Quantification and reduction of unobserved mortality rates of snow, southern Tanner, and red king crabs *(Chionoecetes opilio*, *C. bairdi,* and *Paralithodes camtschaticus*) after encounters with trawls on the seafloor. Fishery Bulletin 111: 42-53.

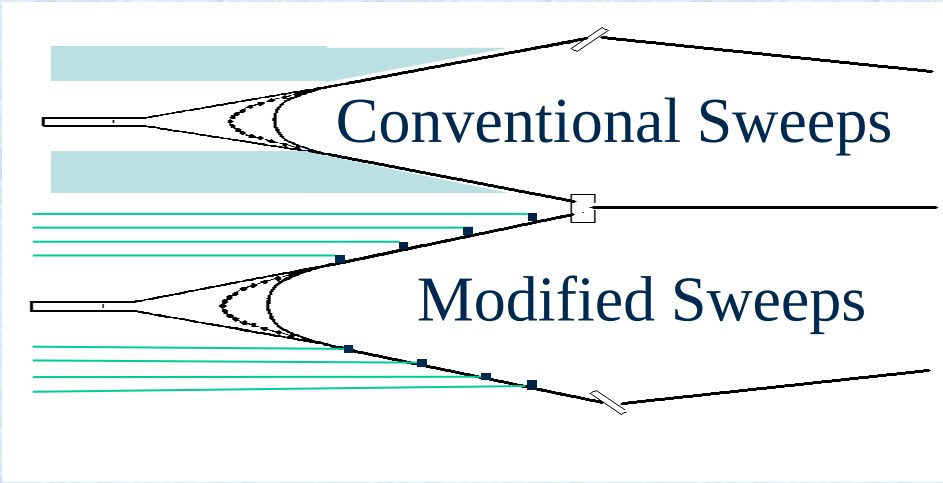
Reduced Mortality with Modified Sweeps

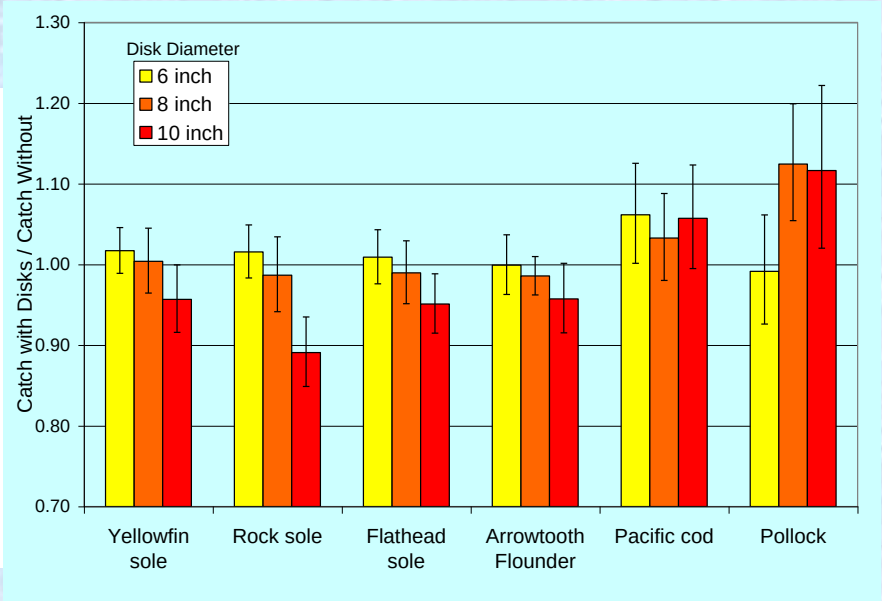
corrected for handling effects



Do modified sweeps reduce fish herding?

Twin trawl tests – FV Cape Horn





Implementing Raised Sweeps into Gulf of Alaska Flatfish Trawl Fisheries

Differences in sweep configurations and use?

Fleet survey

Are similar sweep clearances achieved?

At-sea tests on a range of configurations

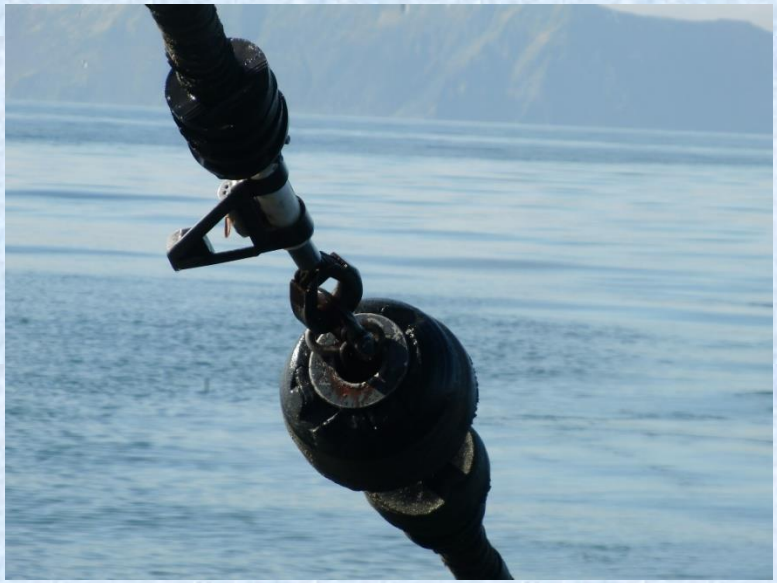
Are modifications feasible for vessels?

Survey and Trials

Effectively raise sweeps: GOA vs Bering Sea

Measurement of sweep clearance with modifications

4 vessels, 31 tows, likely configurations and locations

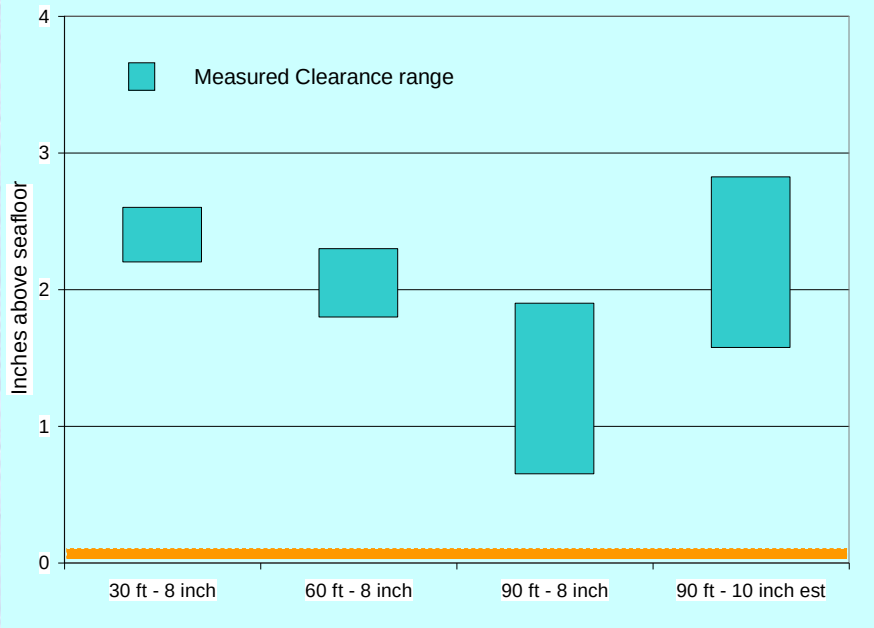


Effectively raise sweeps: GOA vs Bering Sea

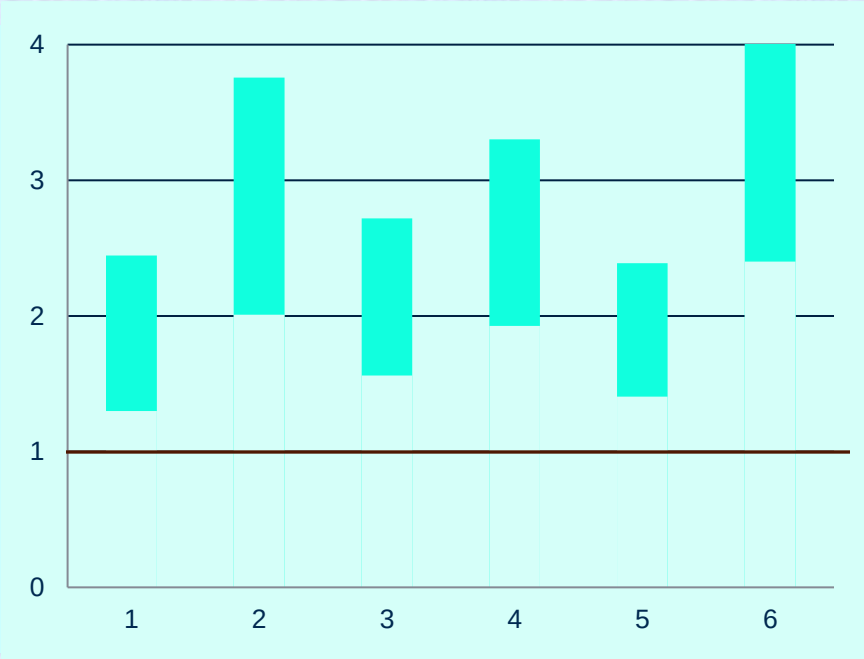
Six configurations tried on four GOA vessels

Similar clearance ranges to Bering Sea tests

Bering Sea



Gulf of Alaska

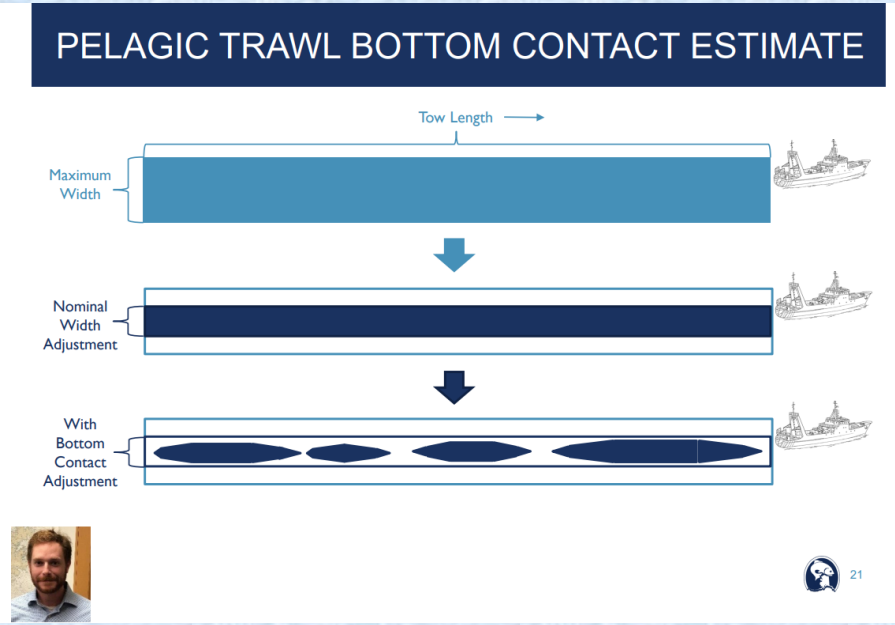


Questions?

Pelagic Trawl Contact Widths for assessments of effects on EFH

- Much more complex than bottom trawl contact

- Both net width and proportion of contact vary with:
  - Depth, Season, Night/Day



From Sam Cunningham presentation to NPFMC
https://meetings.npfmc.org/CommentReview/DownloadFile?p=79eb7c12-4dd0-4082-9280-136bae70416d.pdf&fileName=PPT%20D1%20BBRKC.pdf

Pelagic Trawl Contact Widths for assessments of effects on EFH

- No direct measurements (observations from trawl sonars)

- Fleet discussed factors affecting trawl spread and seafloor contact and the direction of effect
  - (initial values in 2003, more detailed in 2015)

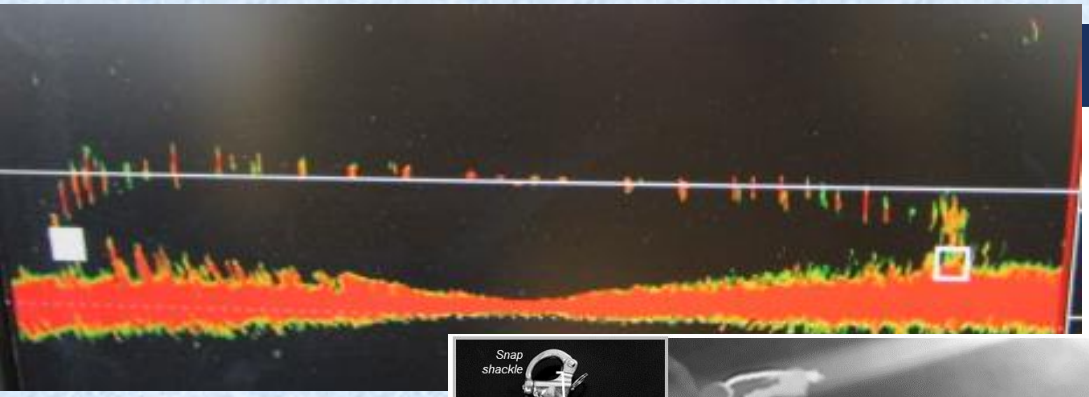
- Compiled bycatch of seafloor organisms, both obligate (e.g., crabs, seawhips, anemones) and associated (e.g., flatfish)

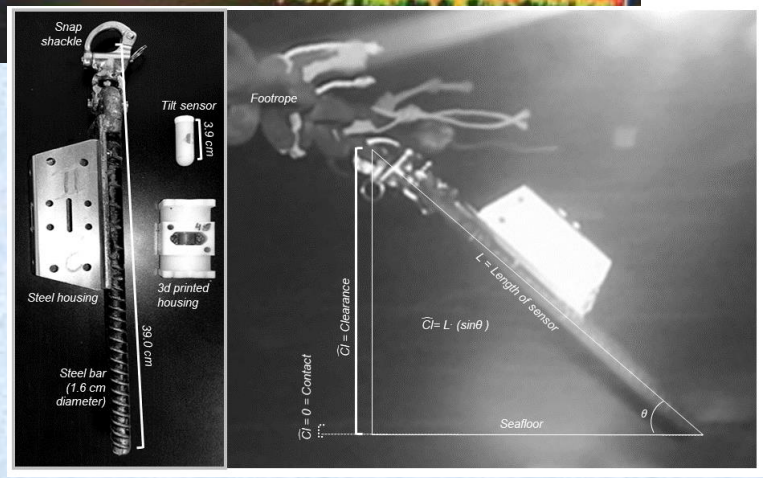
- Reasonable ranges developed and confirmed

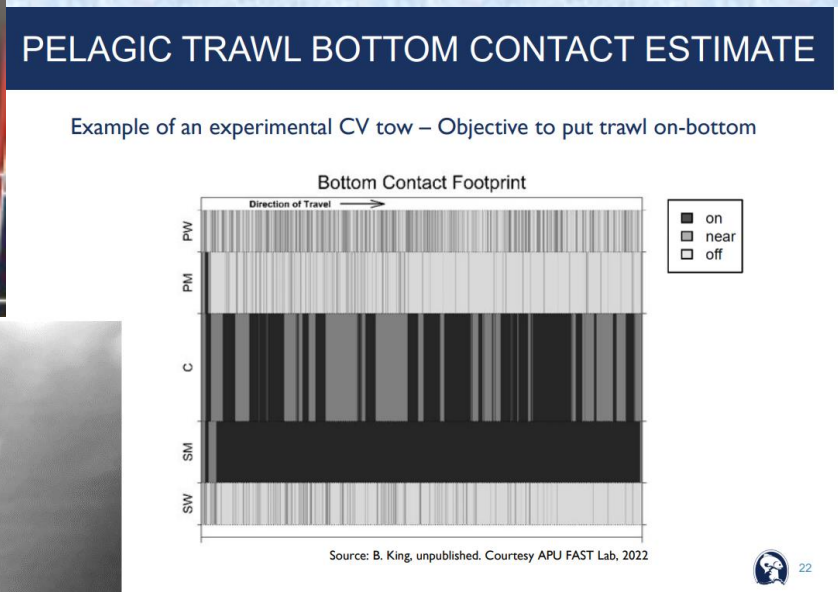
- Also assessed distribution of net height
  - (gear depth – bottom depth)

Measuring Pelagic Trawl Seafloor Contact (B. King thesis)

- Even when trawl sonars show on-bottom, seafloor clearance on the scale of inches would not appear
- Brianna King thesis measured clearance at 5 points during 12 tows with trawl against seafloor
  - Used tilt meters attached to footrope
  - Measured contact about 1/3 of EFH estimates

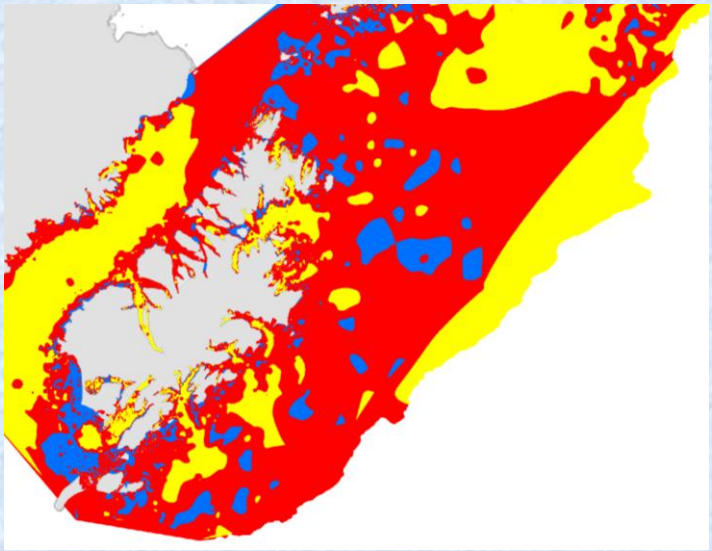


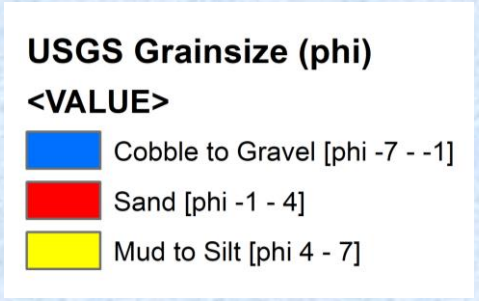




Questions?

Substrate difference from Bering?

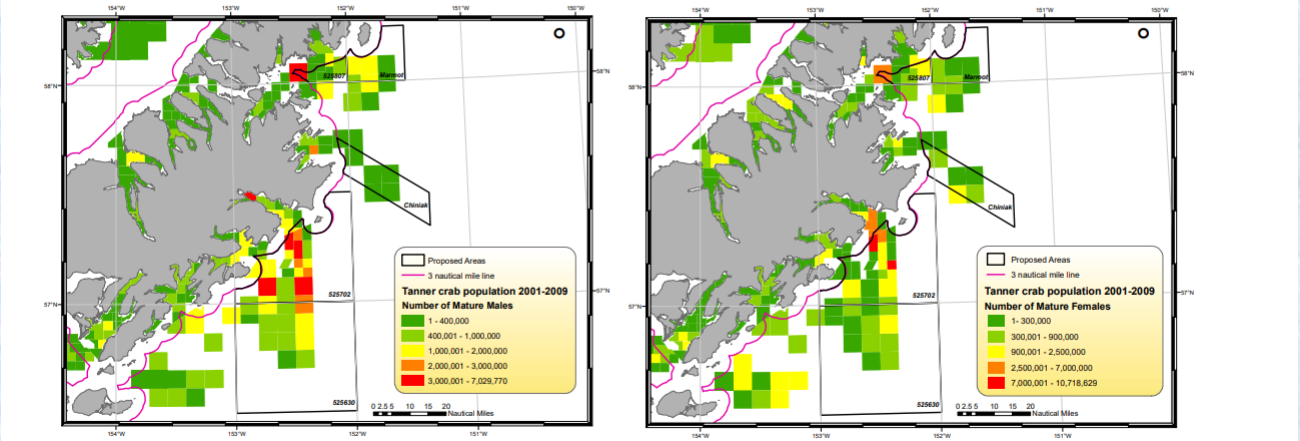




Golden et al. 2016 USGS GOA

Some cobble – gravel. Bering Sea is sand/mud mixes

Figure 13 Numbers of mature male and mature female Tanner crab as surveyed by the ADF&G trawl survey, summed 2001-2009

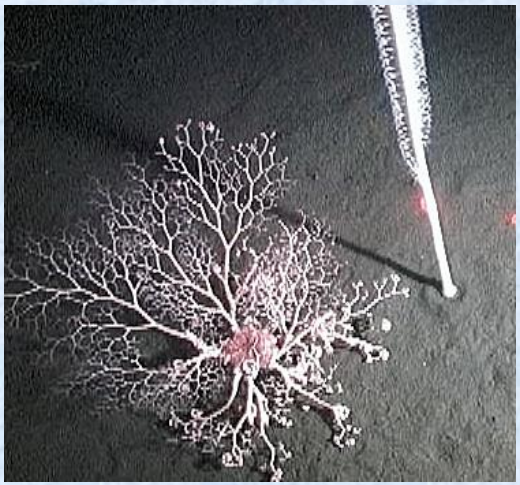


https://www.npfmc.org/wp-content/PDFdocuments/bycatch/GOAcrab.pdf

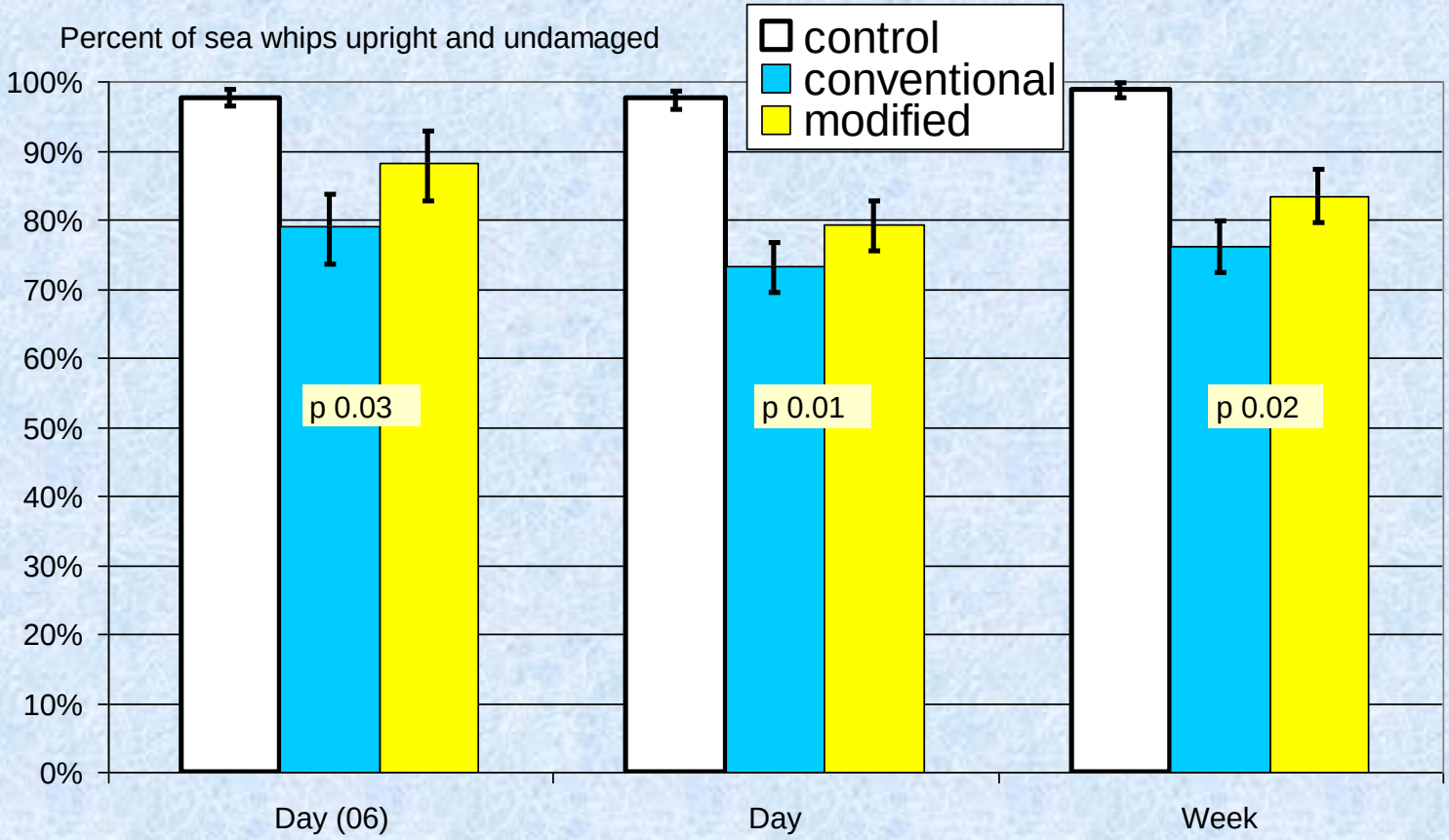
Tanner crab in sand or mud areas

Do modified sweeps reduce damage to seafloor animals?

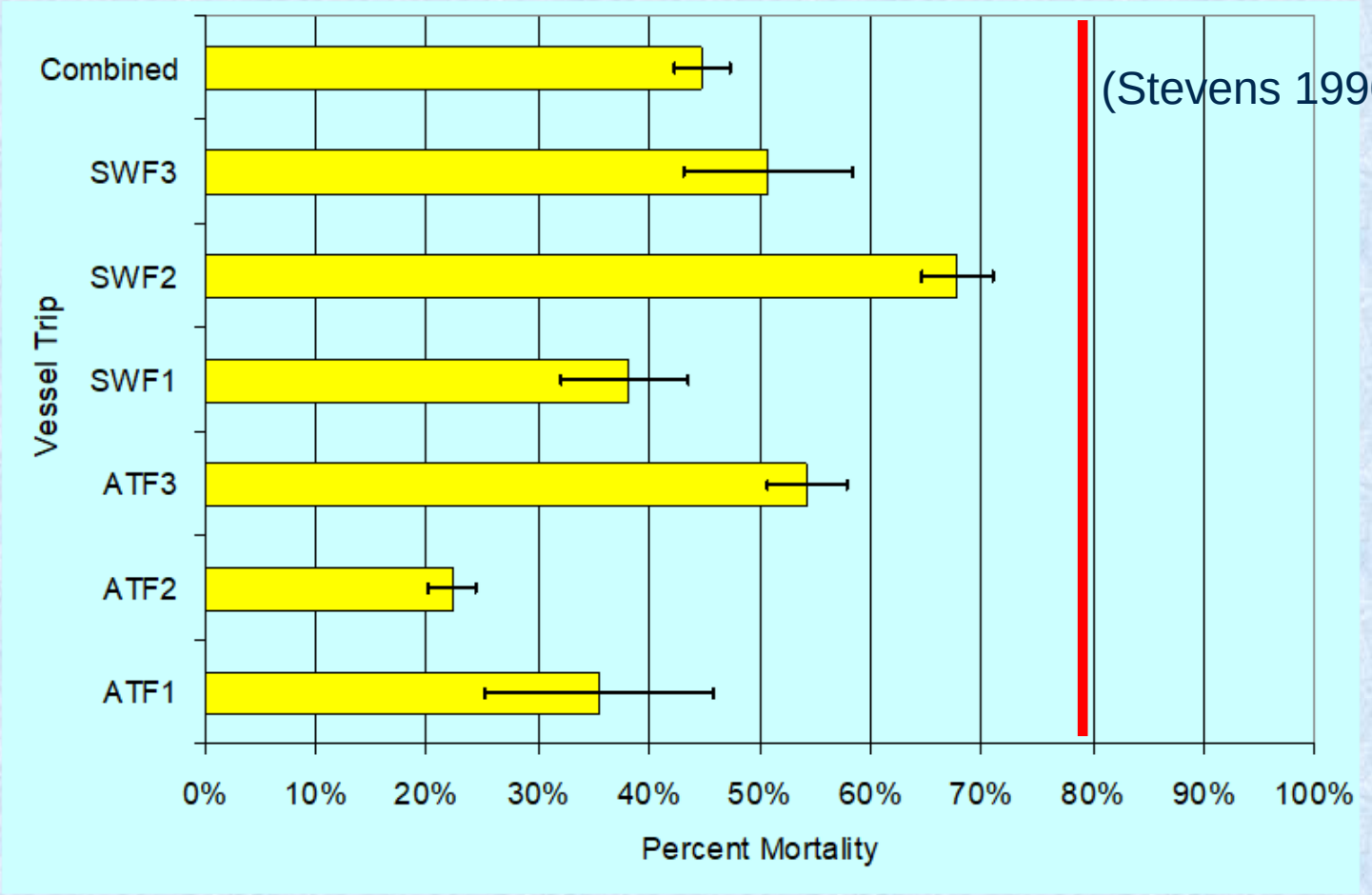
Seafloor sled with video and sonar to locate and assess trawl tracks



Effects on living-structure animals – Sea whips

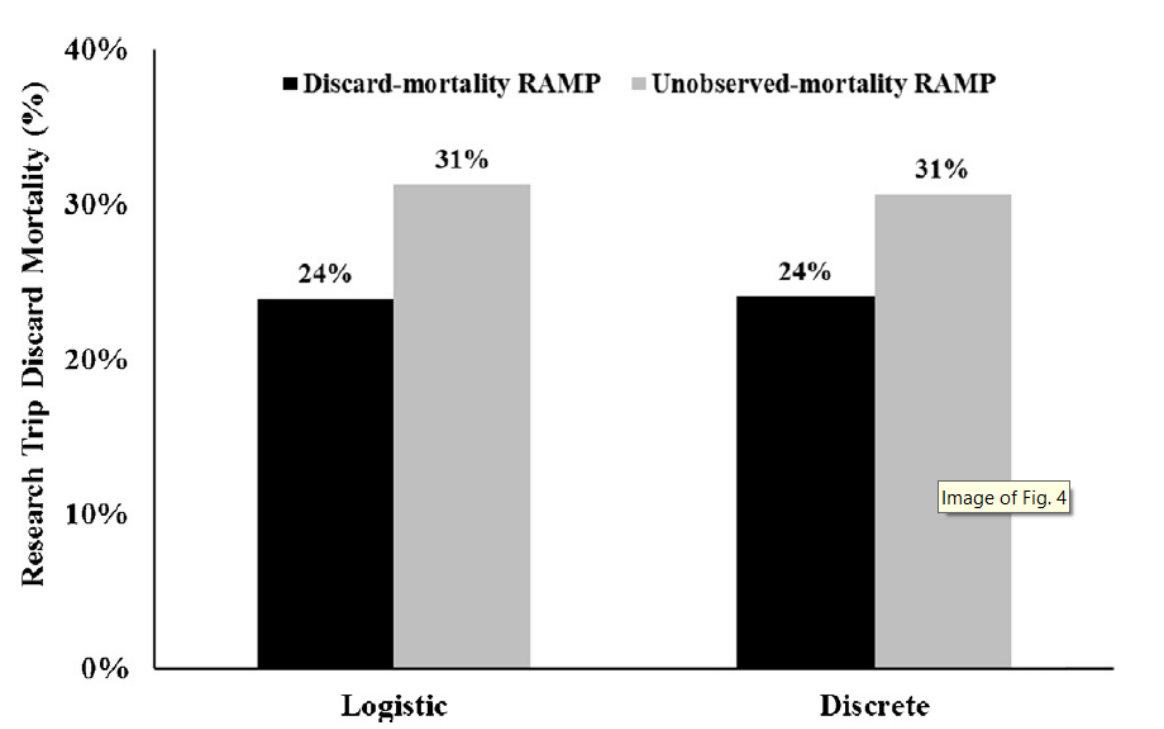


Mortality rates for GOA trawl bycatch 2010 study



Used unobserved mortality reflex relationship

Reflex estimation of deaths for discards vs unobserved mortalities



Reflexes predict less mortality from discards than unobs. mortality

Air exposure is a major factor for discards, not unobserved morts.

Mortalities from 2012 GOA overestimated

Yochum, N., **C.S.Rose**, C.F. Hammond. 2015. Evaluating the flexibility of a reflex action mortality predictor to determine bycatch mortality rates: A case study of Tanner crab (Chionoecetes bairdi) bycaught in Alaska bottom trawls. Fisheries Research 161: 226–234.