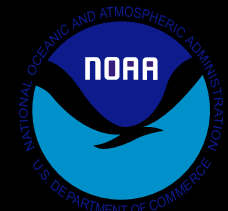
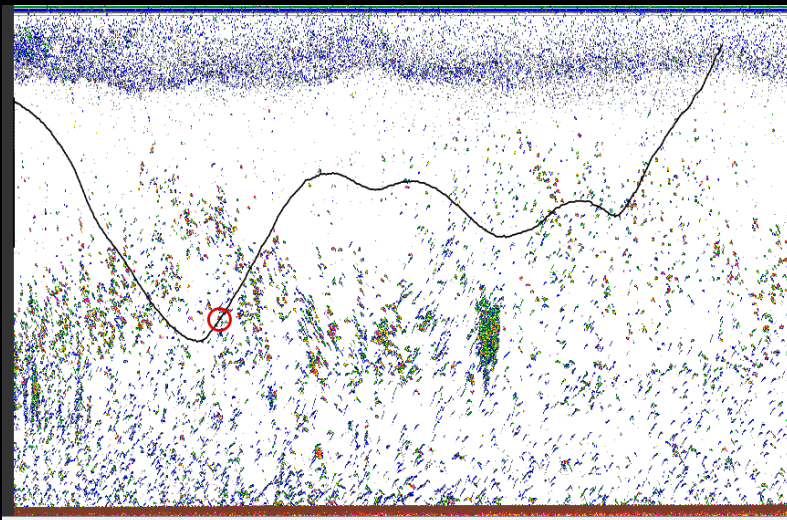


2016 Acoustic-trawl survey of eastern Bering Sea shelf walleye pollock – preliminary results

12 June –17 August
NOAA ship *Oscar Dyson*

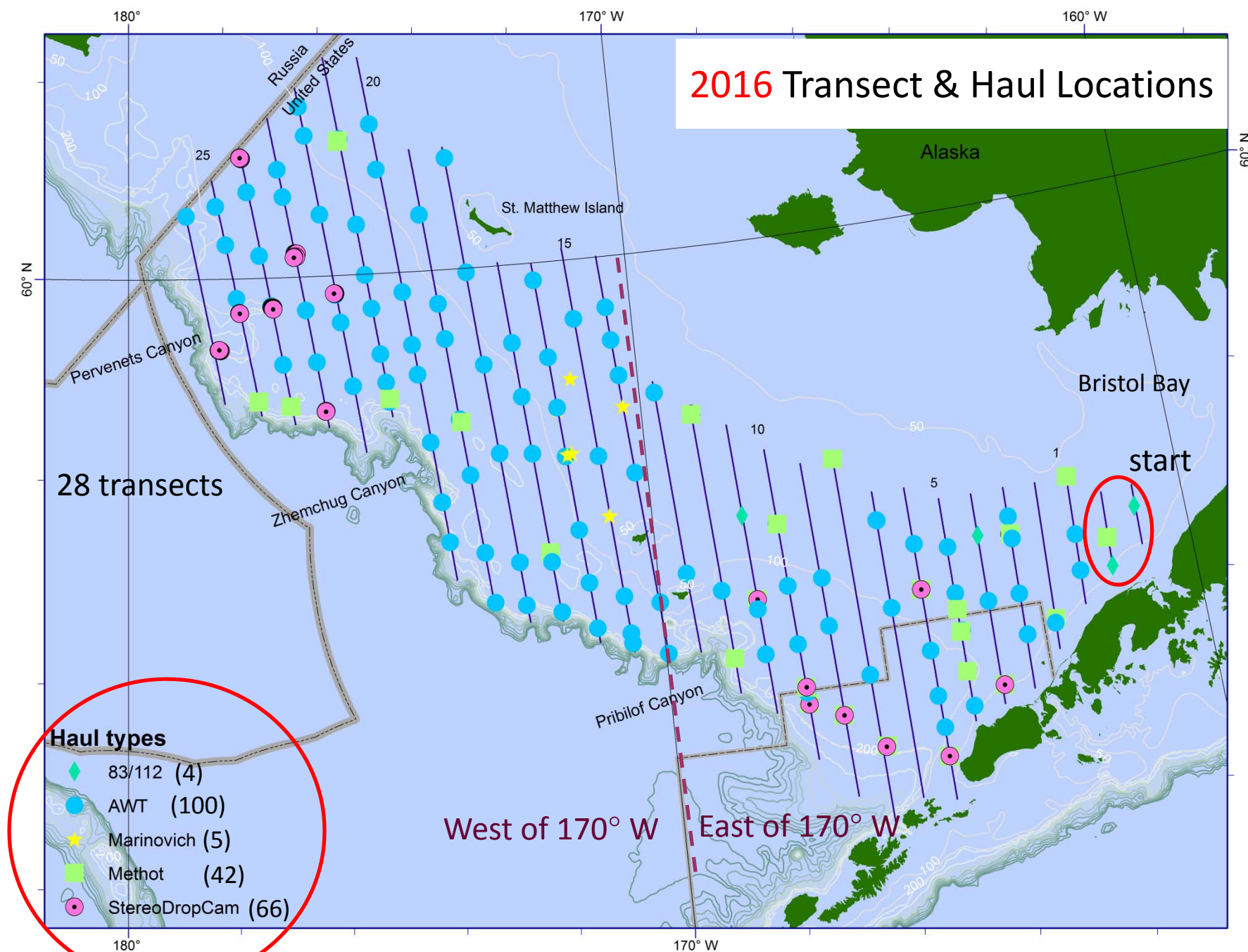
Taina Honkalehto and MACE Program
Alaska Fisheries Science Center



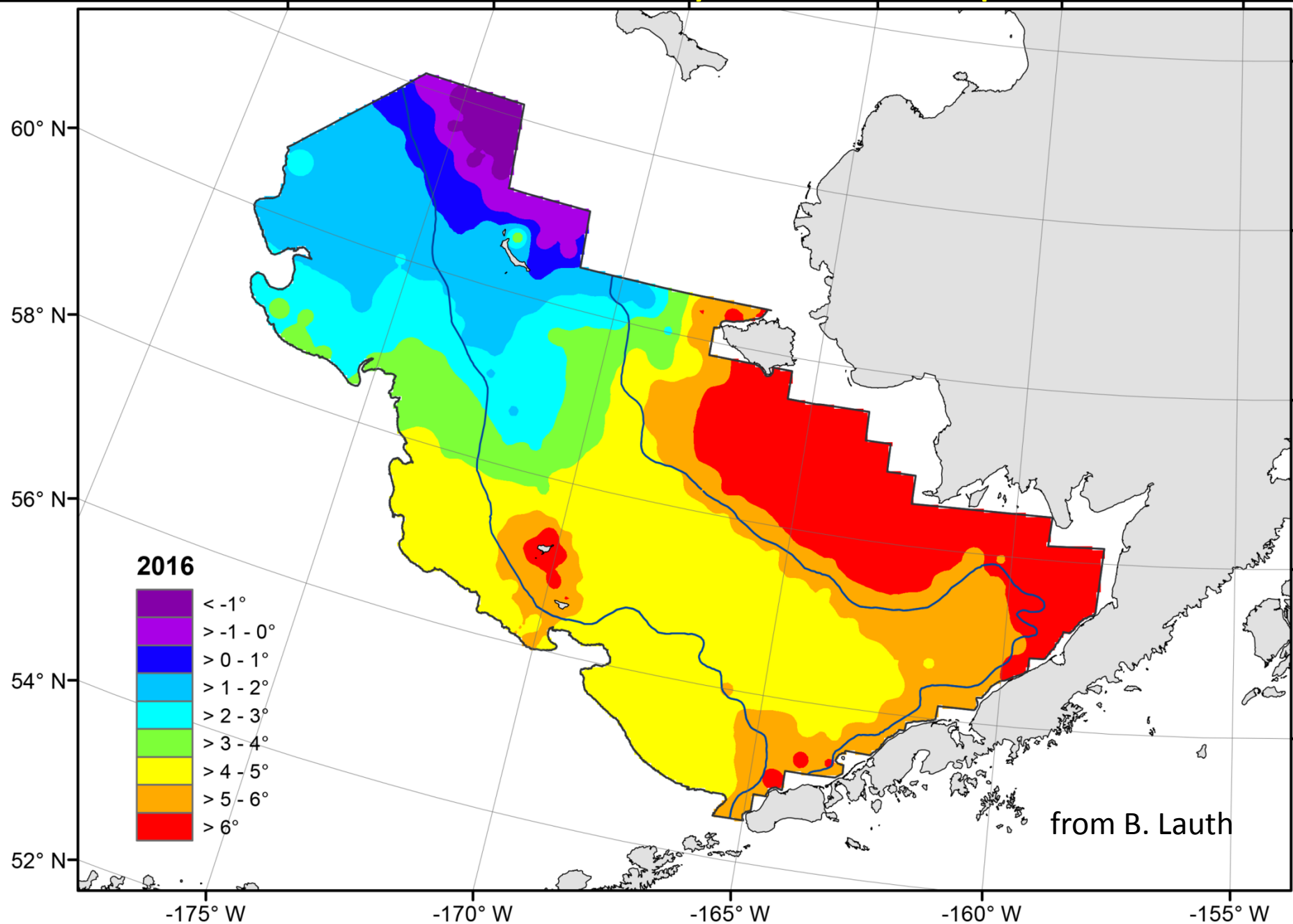
Methods

- Biennial, shelf-wide survey, conducted in 3 3-week legs
- Usually includes Cape Navarin, Russia – no permission in 2016
- 20 nmi-spaced N-S parallel transects, 5000 nmi, 100,000 sq. nmi
- Opportunistic trawls to ID backscatter focused on walleye pollock
- Daytime survey ~17 hrs/day, night time CTDs, test equipment, special projects

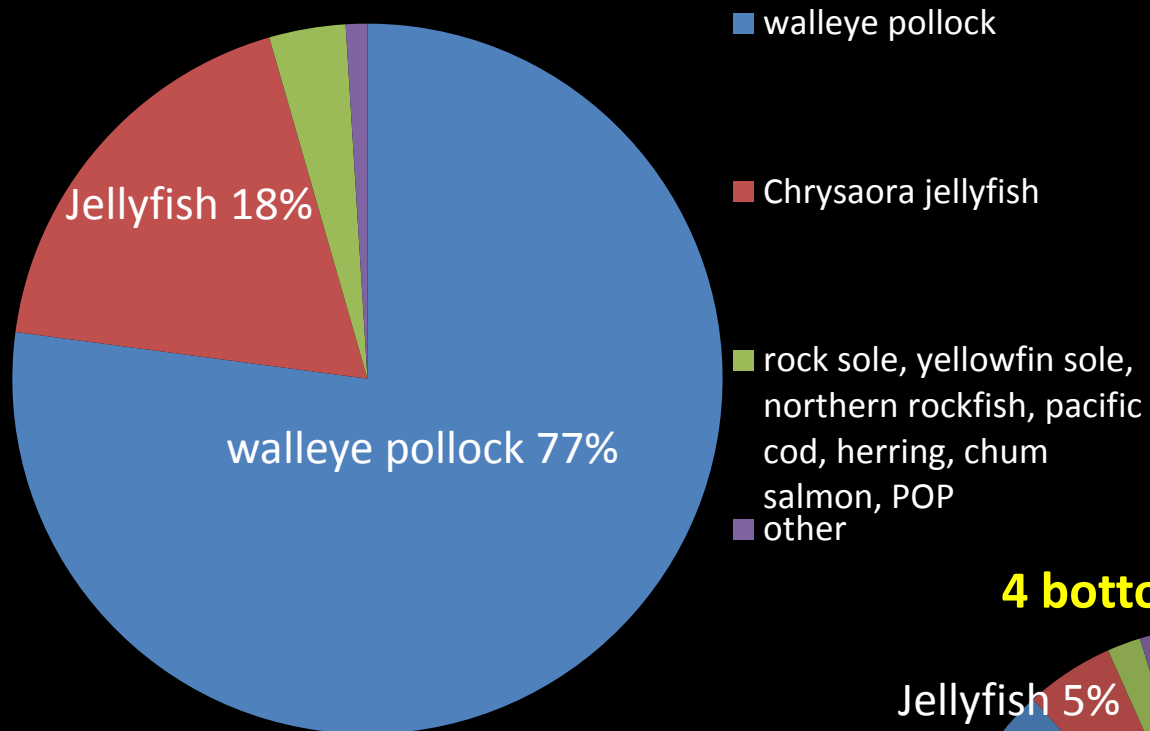
2016 Transect & Haul Locations



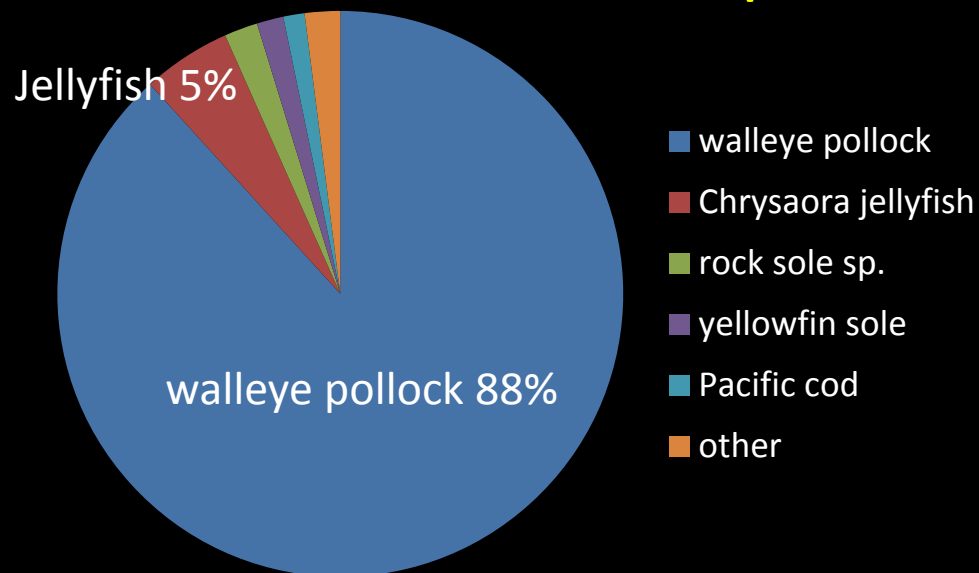
2016 Bottom trawl survey bottom temperatures



100 midwater trawls – catch composition

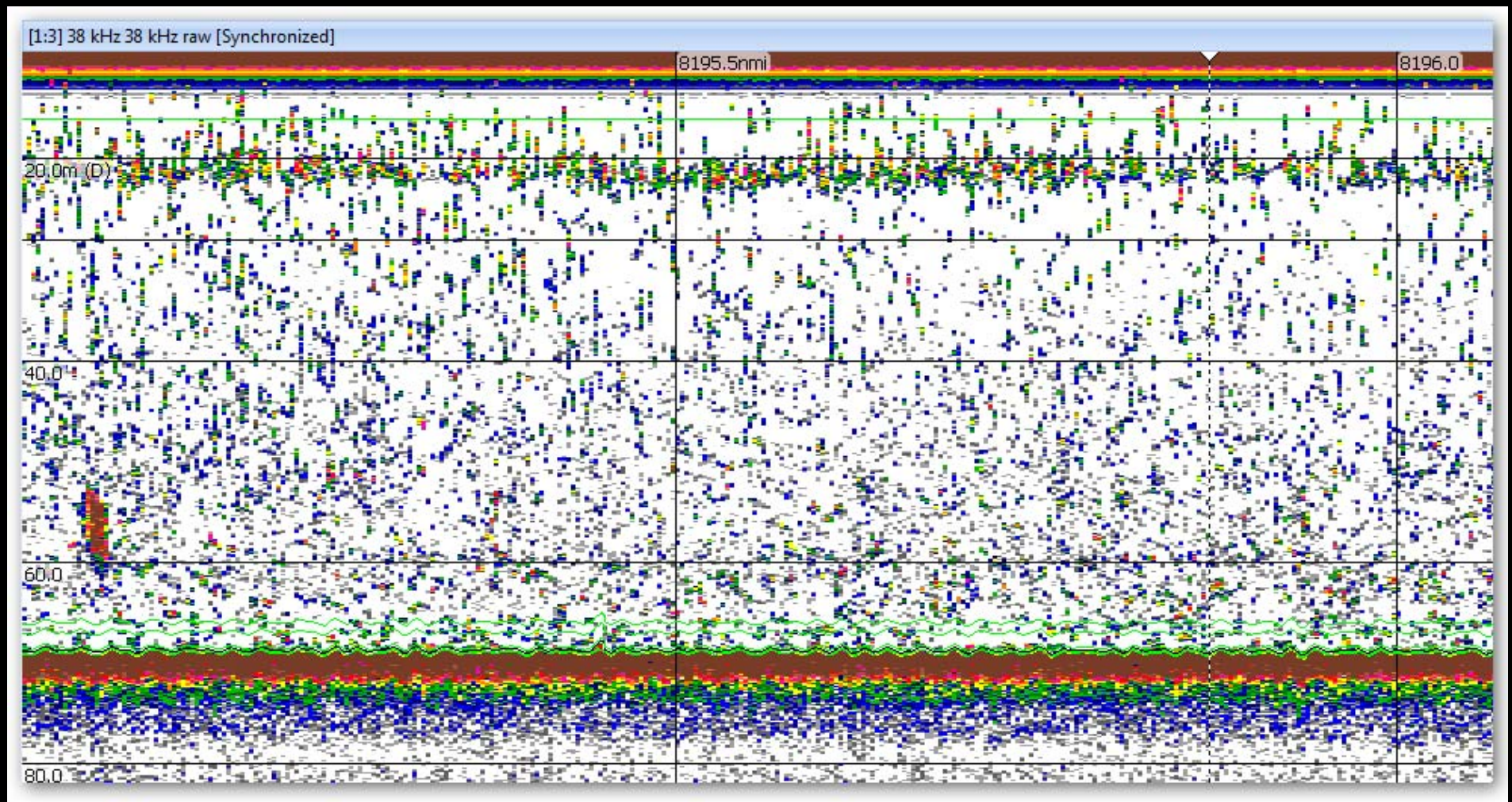


4 bottom trawls – catch composition

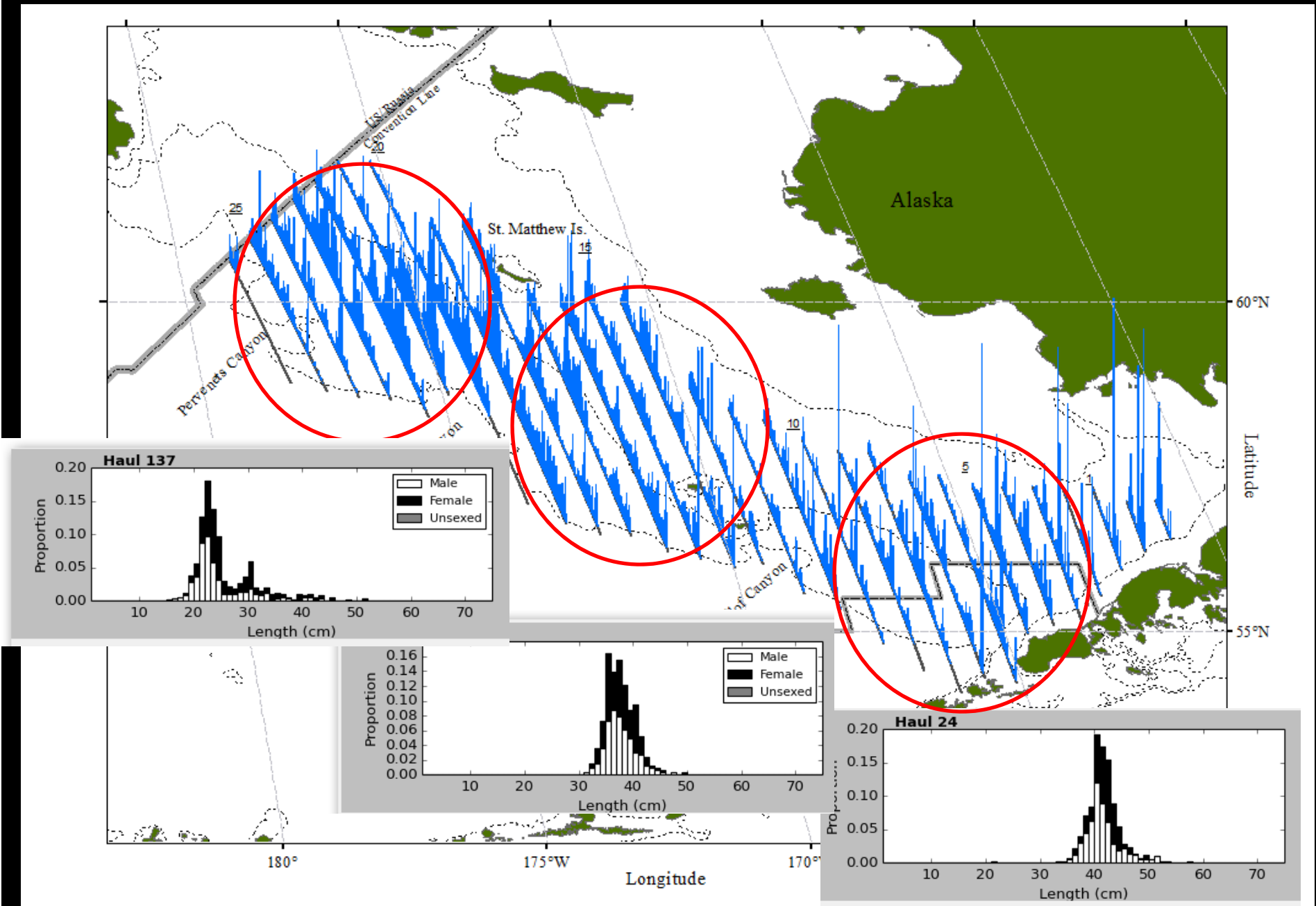


“other” – long list of species with v. small % wt

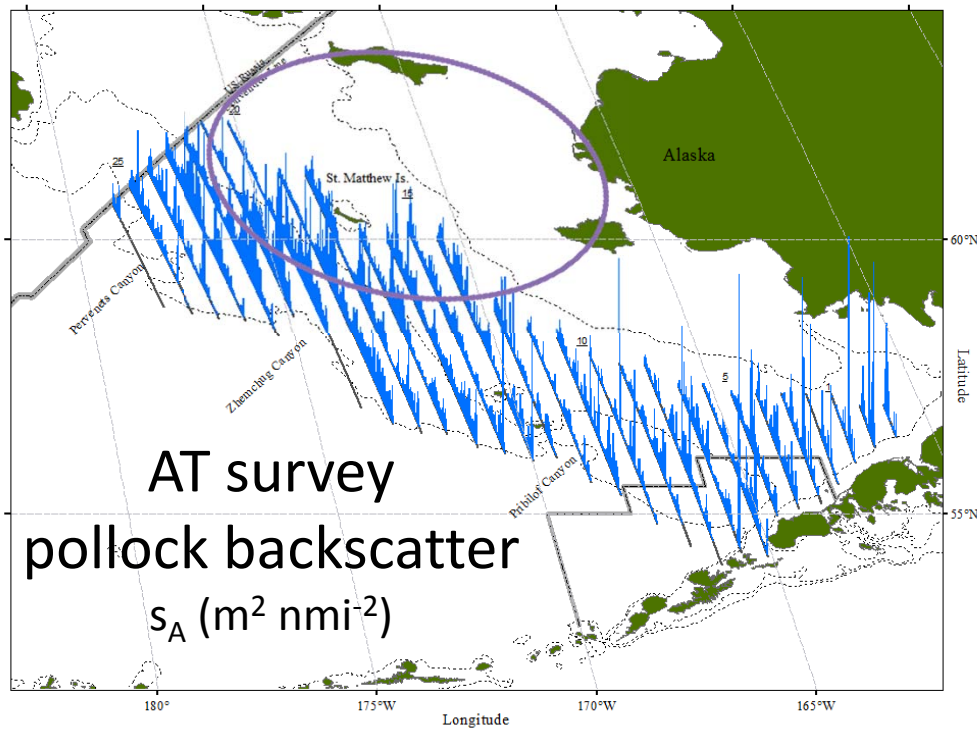
38 kHz backscatter complexity in central shelf area



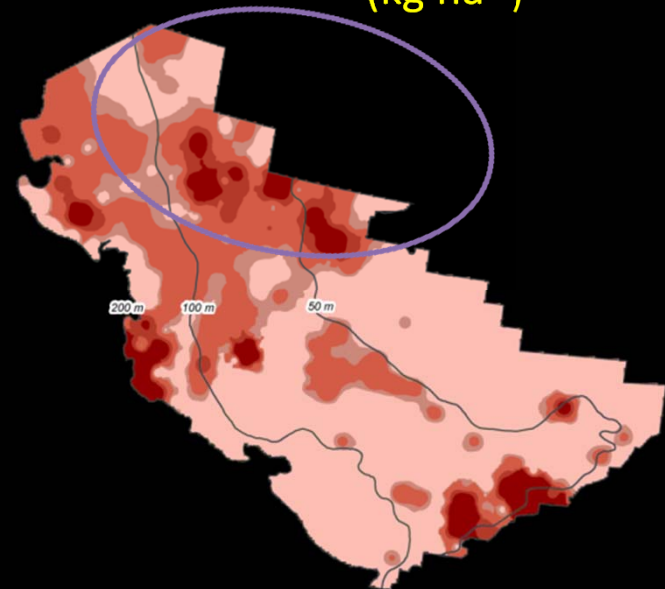
2016 AT survey midwater pollock backscatter ($\text{m}^2 \text{nmi}^{-2}$)



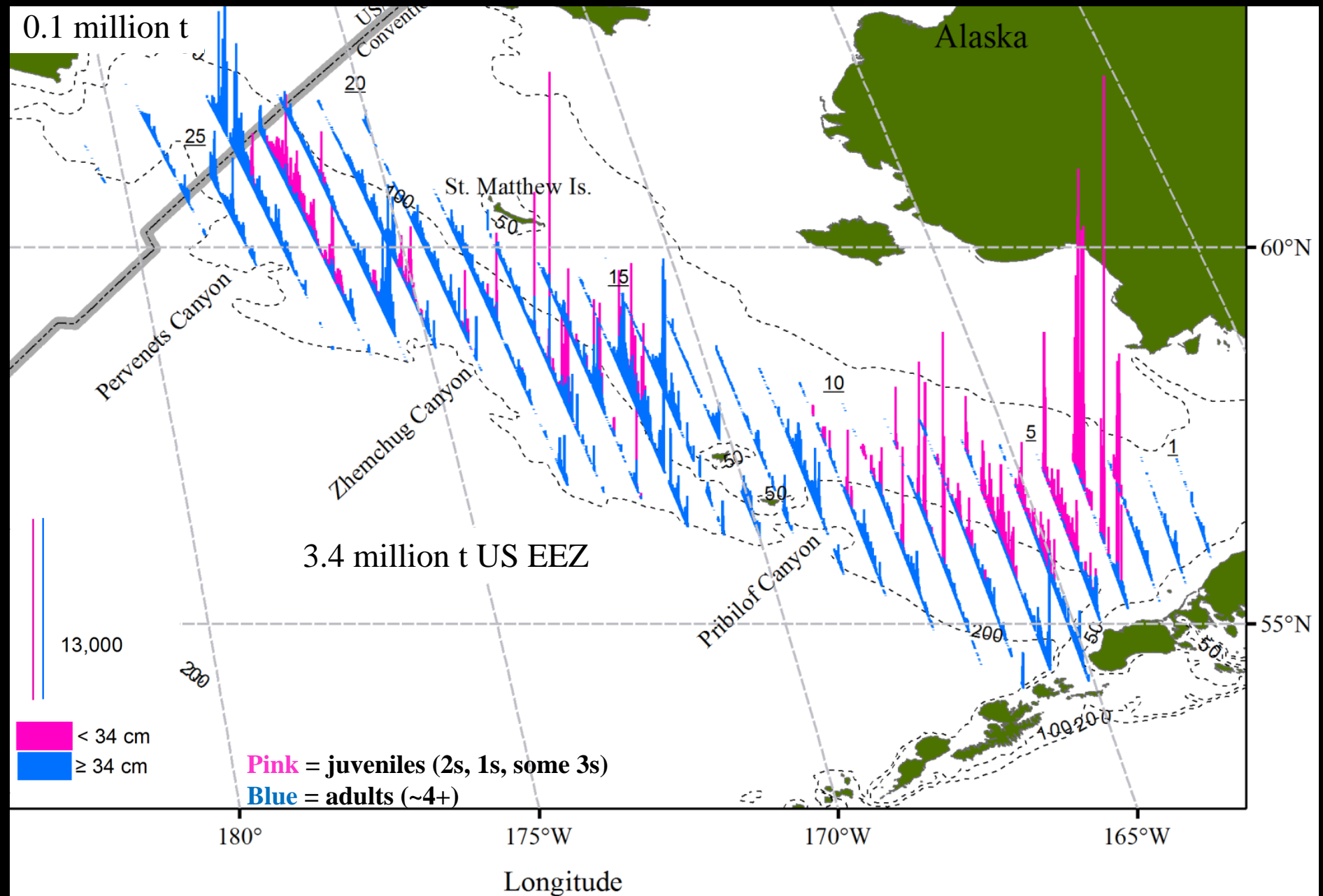
2016



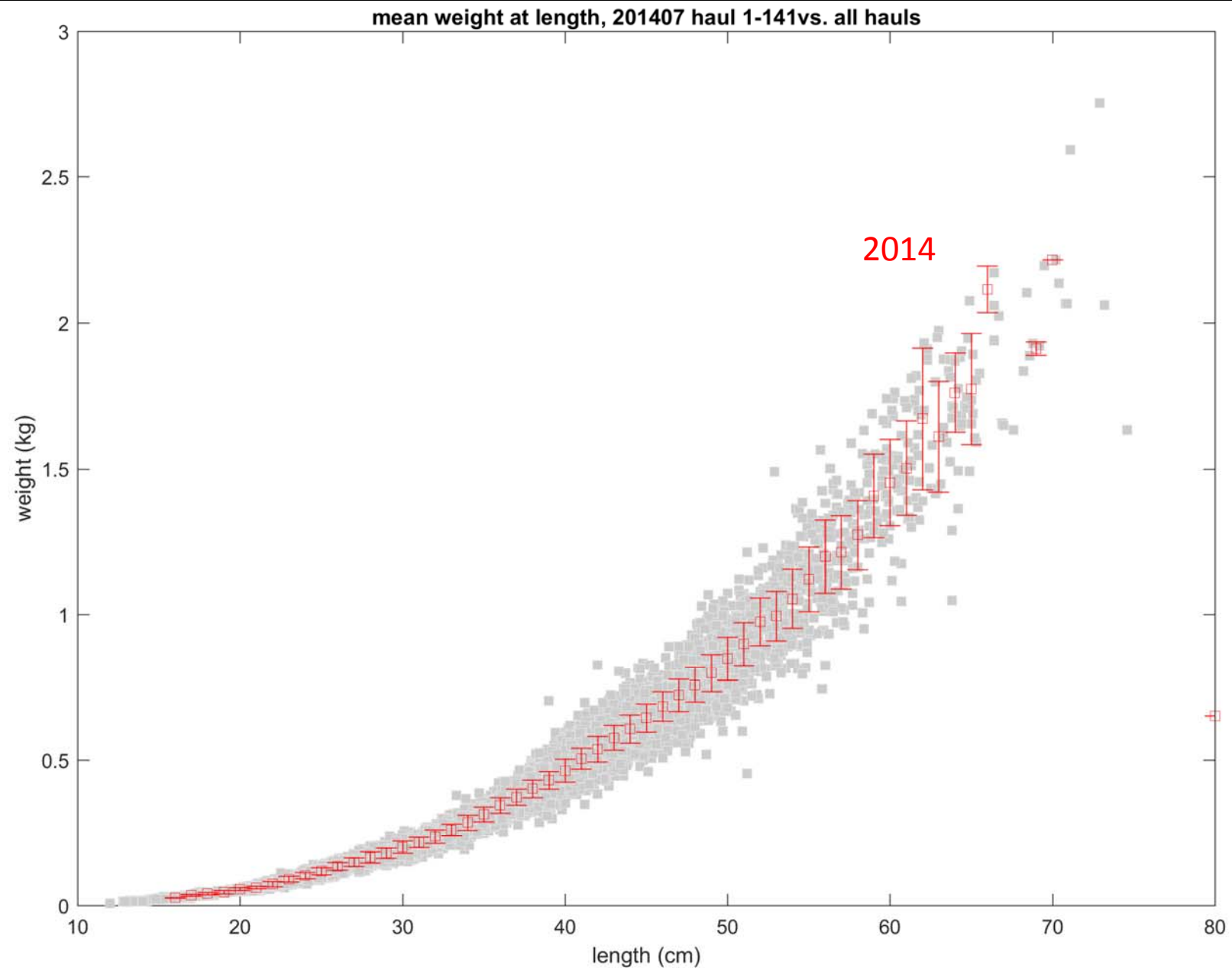
BT survey pollock biomass
(kg ha^{-1})

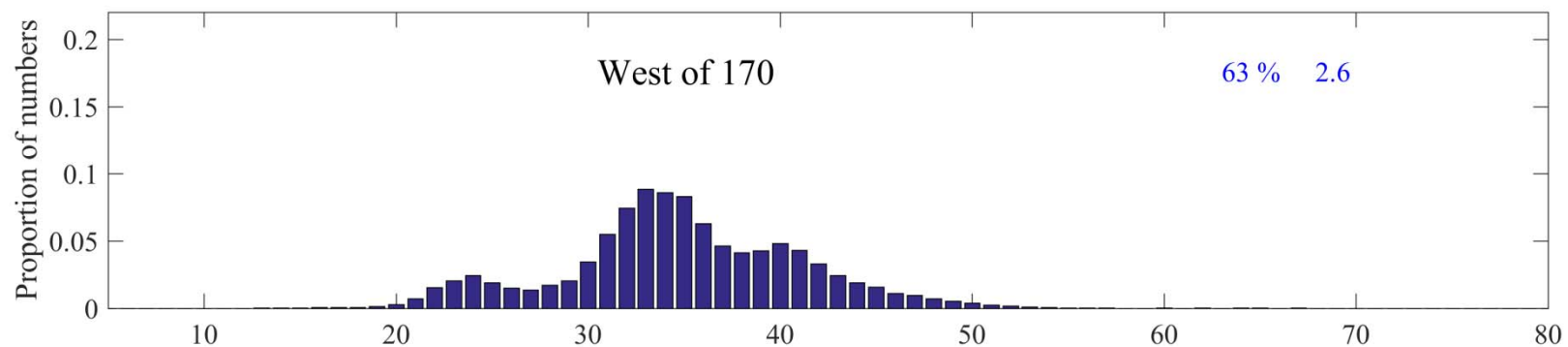
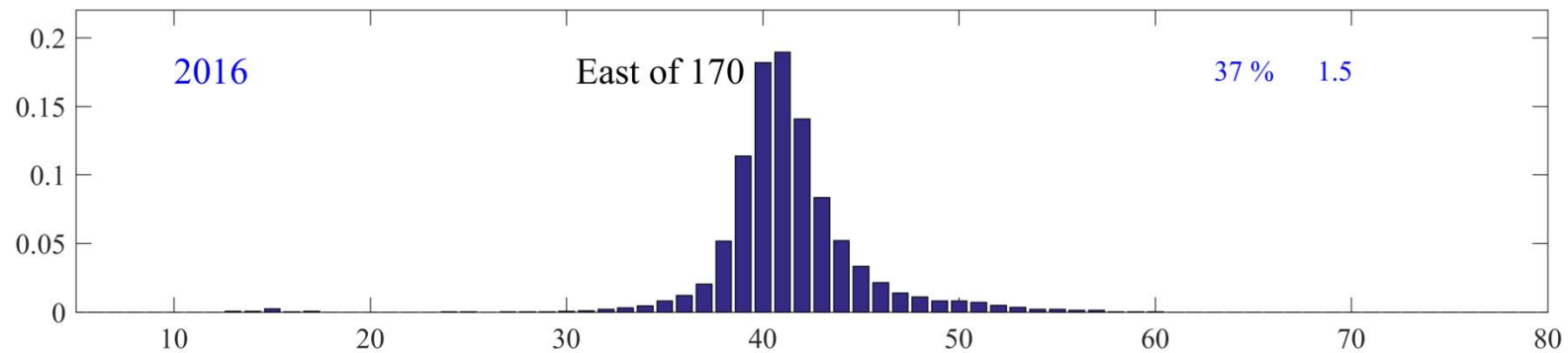


2014 AT survey midwater pollock biomass

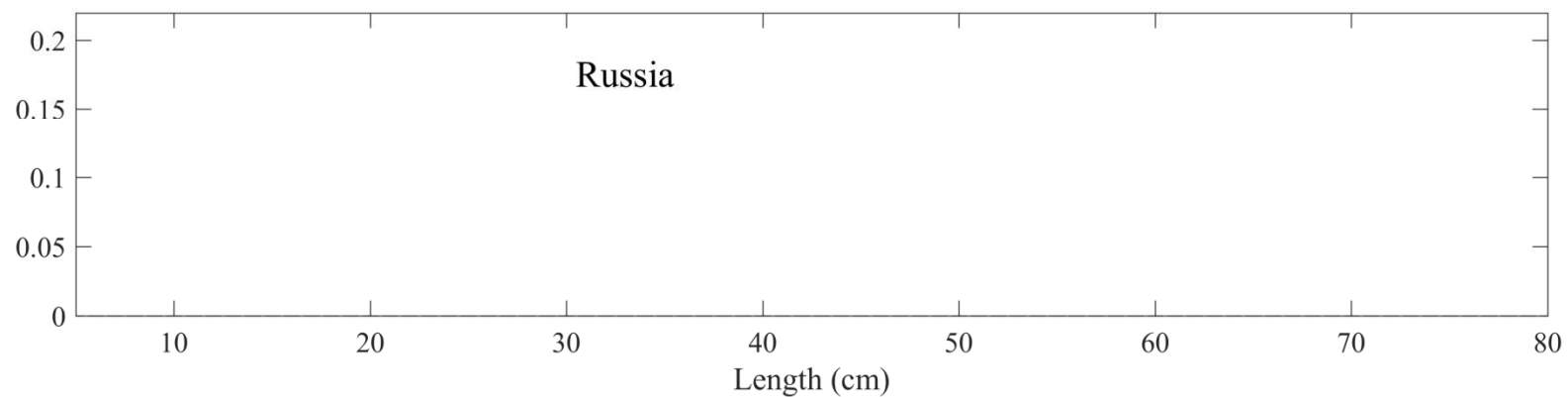


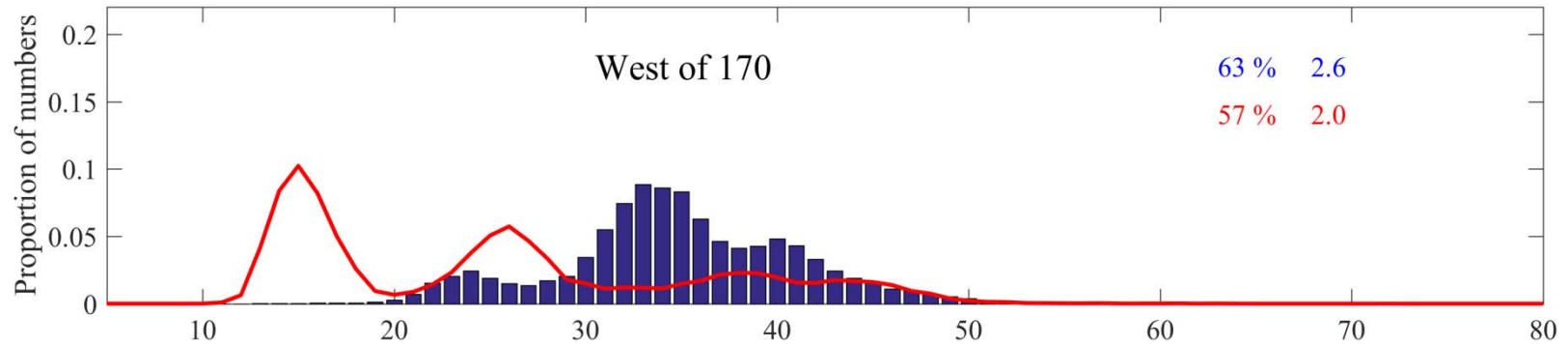
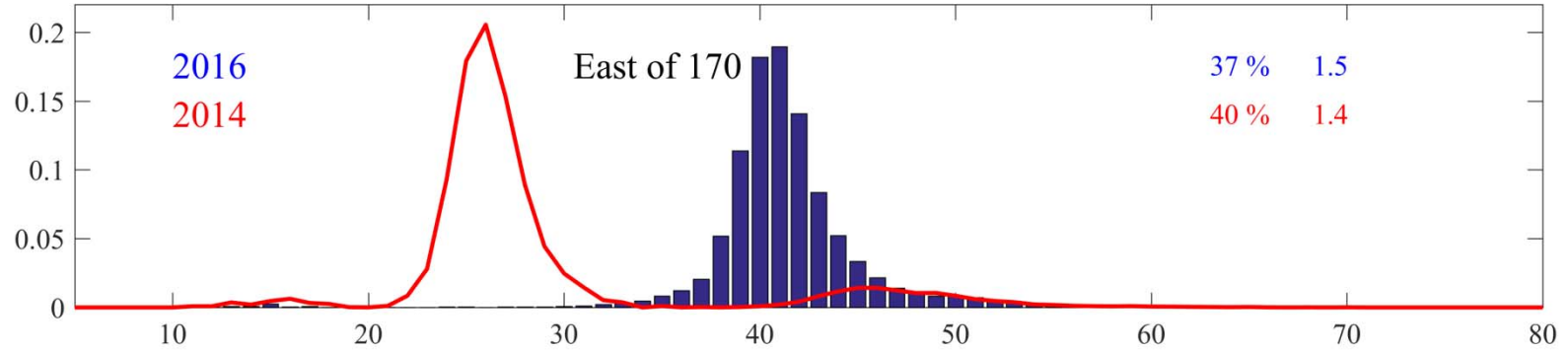
Walleye pollock 2016 length – weight relationship



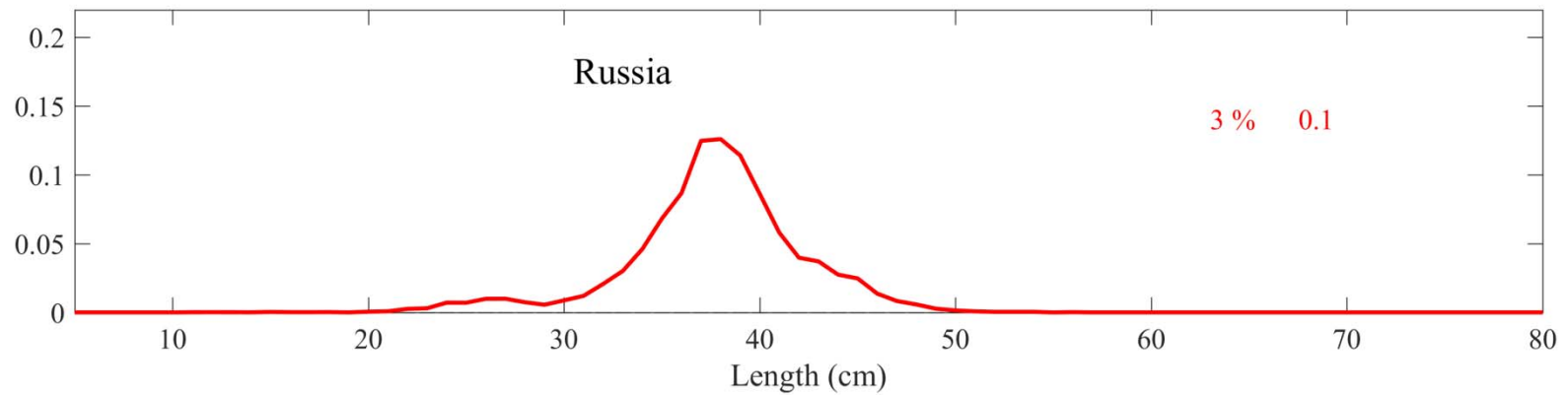


2016 preliminary estimates (to 3 m): 4 million t, 10.6 billion fish

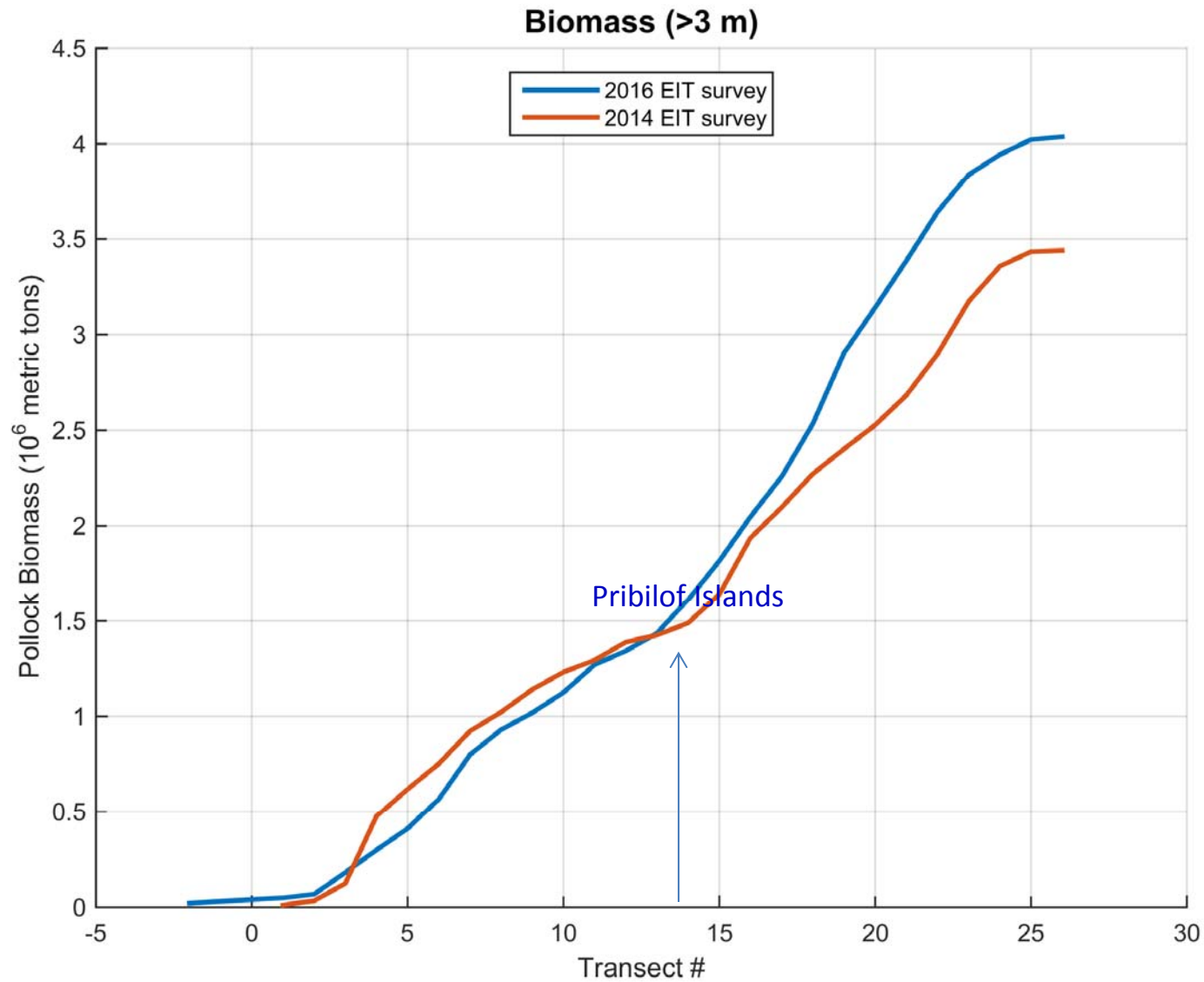




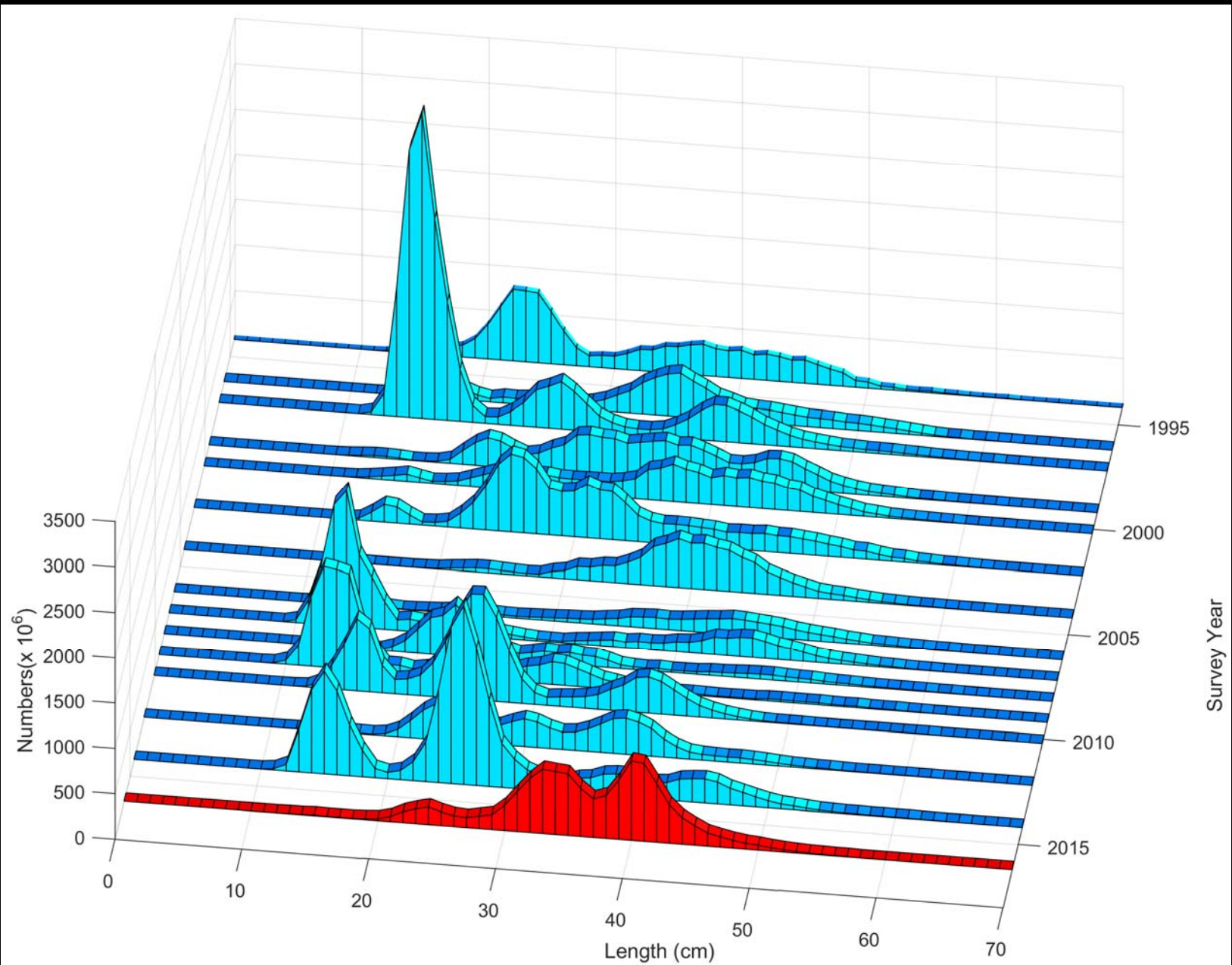
2016 preliminary estimates (to 3 m): 4 million t, 10.6 billion fish



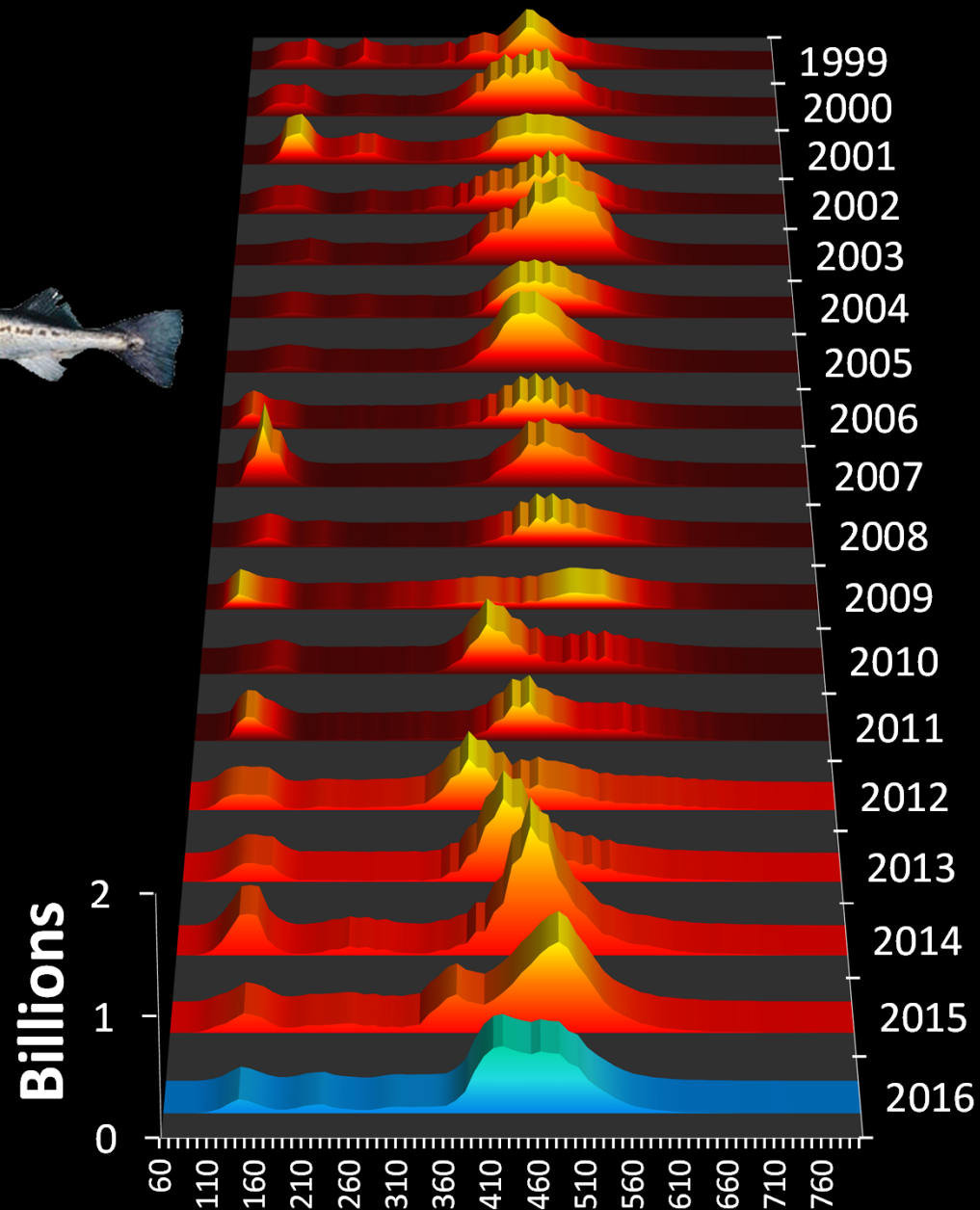
Cumulative biomass by transect 2016 vs. 2014



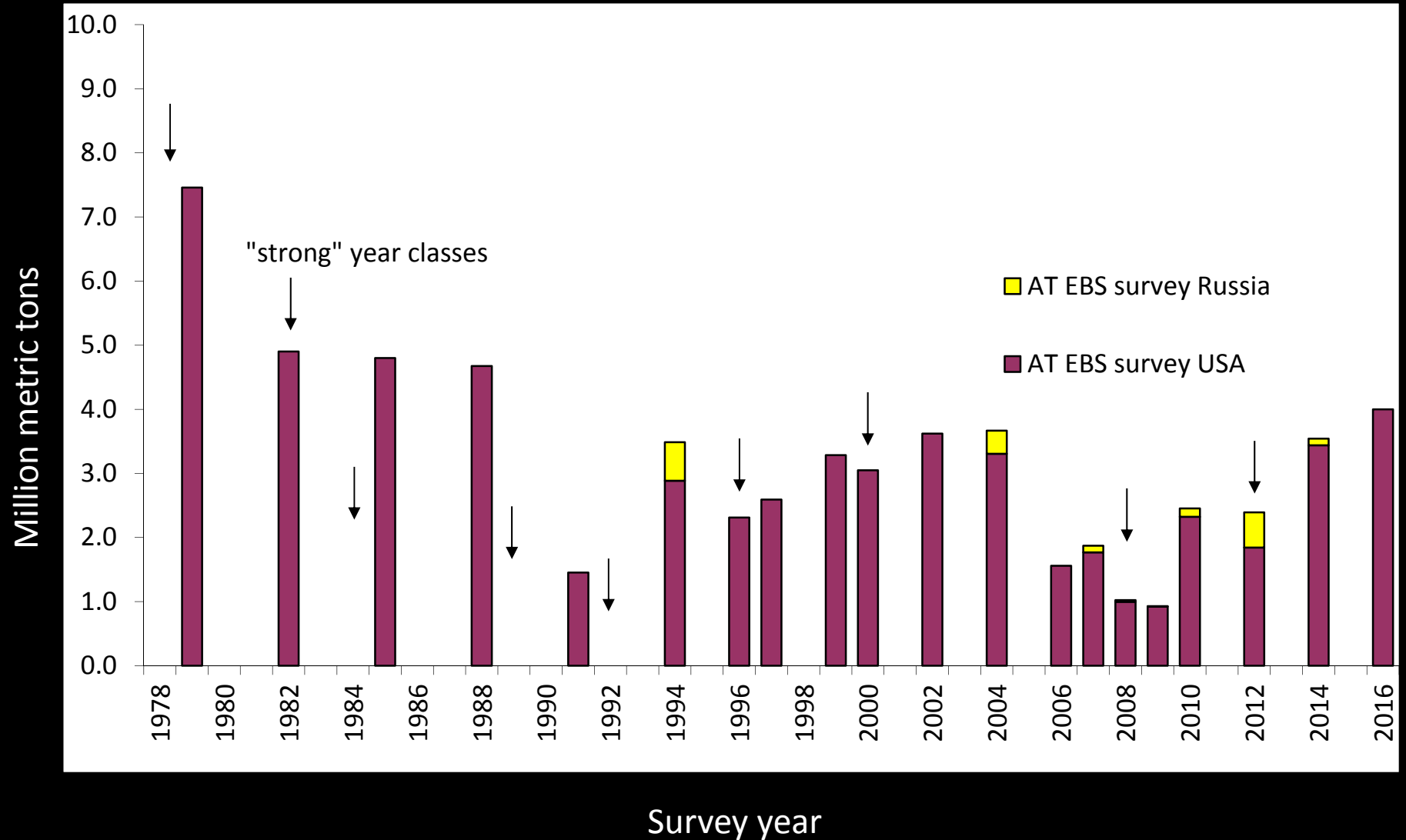
Historical numbers at length



Bottom trawl survey abundance-at-length



Acoustic-trawl survey walleye pollock biomass to 3 m off bottom



Special projects

- Euphausiid TS measurements, etc. — Ressler et al.
- Saildrone — De Robertis et al.
- Broadband acoustic collections — Bassett et al.
- Stereo drop camera expts — Williams et al.
- CamTrawl auto-length measurements — Williams et al.
- Radiated vessel noise measurements — Bassett et al.

2016 AT survey preliminary results

- EBS summer shelf waters very **WARM** (warmer than 2014-15)
- 2016 US EEZ midwater pollock biomass 4.0 million t
highest estimated since 1988 – extended north of transects
- ~37 % pollock biomass east of 170 ° W in U.S. -- mainly age 4s
- Ages 4, 3, 2 – very few 1s
2012, 2013, and 2014 year classes
- No survey of Russia's Cape Navarin area
- More large jellyfish & complex backscatter



Future acoustic-trawl surveys

Summer 2017 -- Gulf of Alaska survey
(2016-2017 AVO index to EBS stock assessment)

Summer 2018 – Bering Sea survey





AT estimates between 0.5 and 3 meters off bottom

Backscatter between 0.5 and 3 meters off bottom has been collected but not used in AT estimates for historical reasons

Expanding analysis region down to 0.5 m above bottom could improve the survey

BUT, this semi-pelagic region is more diverse:
roughly 25% of catch from the bottom trawls is pollock

The goal:

1. Estimate the contribution of pollock to backscatter between 0.5 and 3 m
2. Use these results to estimate pollock biomass/numbers in this region as a new product of our survey

Method:

Establish an empirical relationship between the bottom trawl catch and the simultaneous acoustics measured between 0.5 and 3 meters

AT estimates between 0.5 and 3 meters off bottom

Approach:

Analyze simultaneously collected bottom trawl and acoustic measurements.

Combine simultaneous bottom trawl catch data with acoustic data (2006 – 2011, 791 trawls, between 0.5 and 3 meters off bottom) by fitting species specific coefficients:

$$\sum_{h=0.5}^3 s_A = A_{pk} \cdot CPUE_{pk} + A_{pcod} \cdot CPUE_{pcod} + A_{flatfishes} \cdot CPUE_{flatfishes} + \dots$$

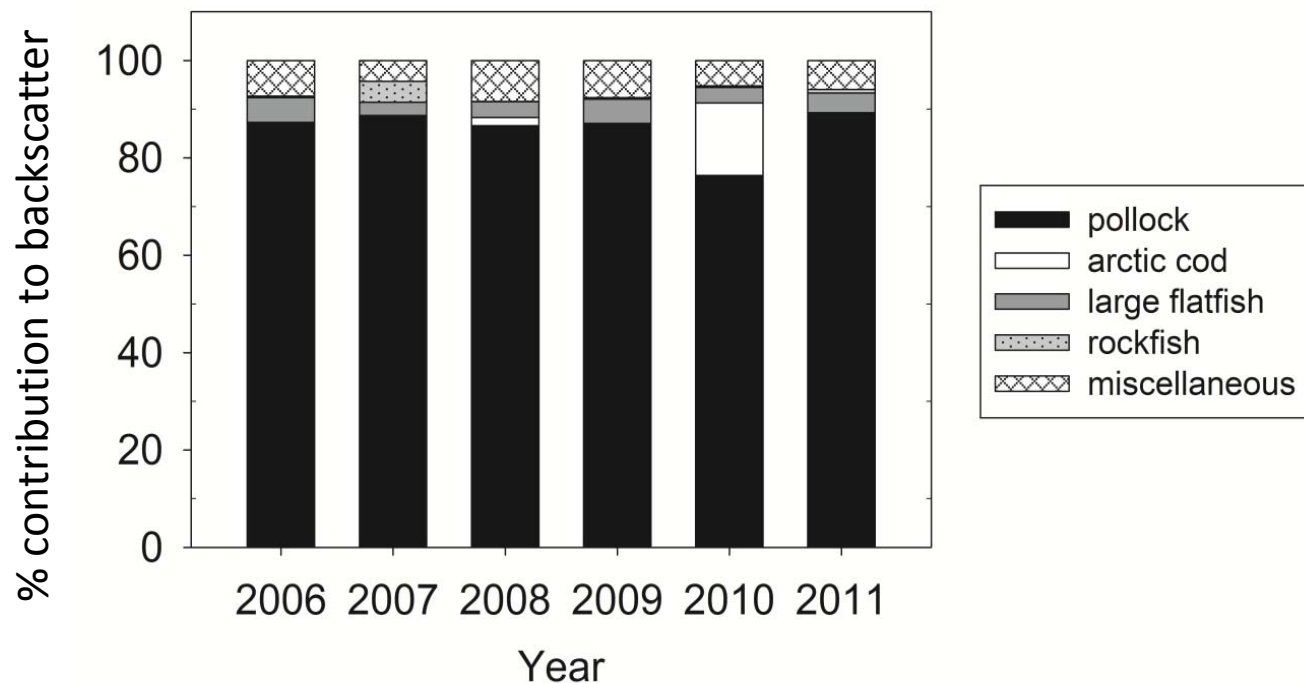
Then use these coefficients to find the proportion of backscatter attributable to pollock (and other species):

$$Prop_{pk} = \frac{A_{pk} \cdot CPUE_{pk}}{\sum_{sp} (A_{sp} \cdot CPUE_{sp})}$$

AT estimates between 0.5 and 3 meters off bottom

The proportion of acoustic backscatter attributable to pollock (and other species) between 0.5 and 3 meters off bottom from 2006 – 2011:

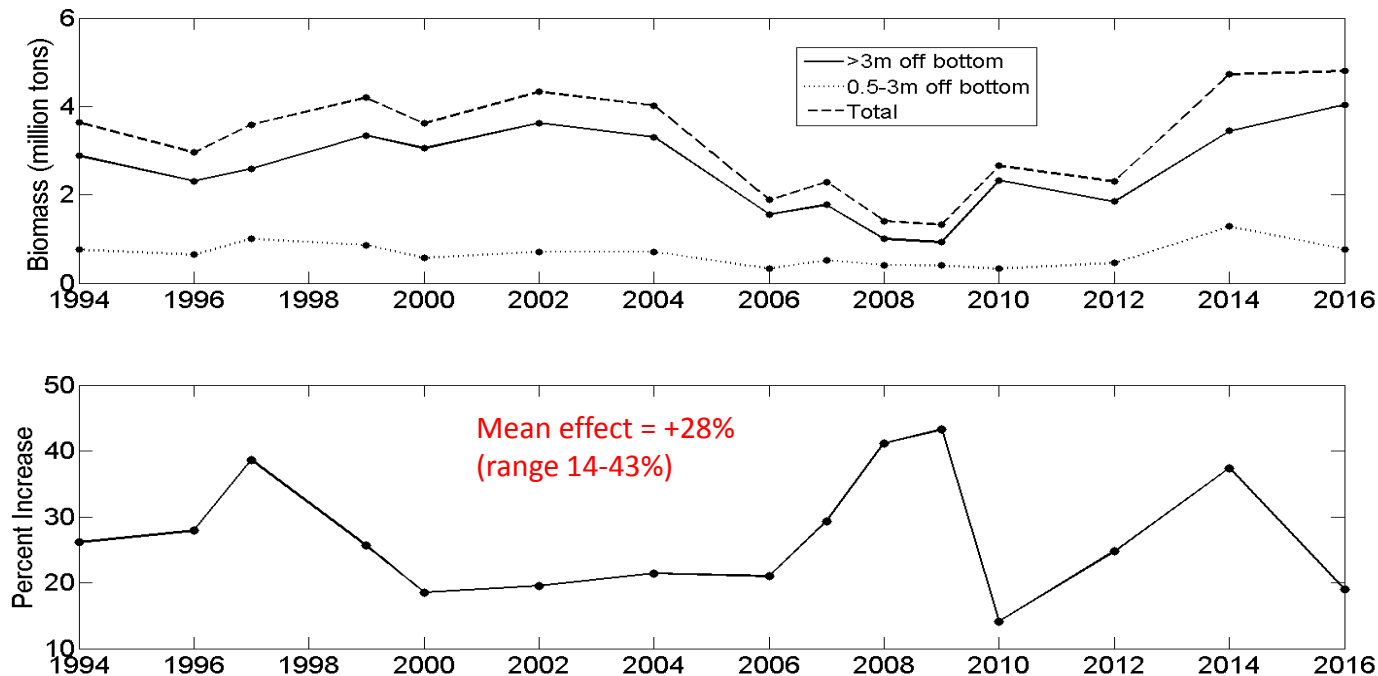
Pollock is around 85% of the backscatter on average



AT estimates between 0.5 and 3 meters off bottom

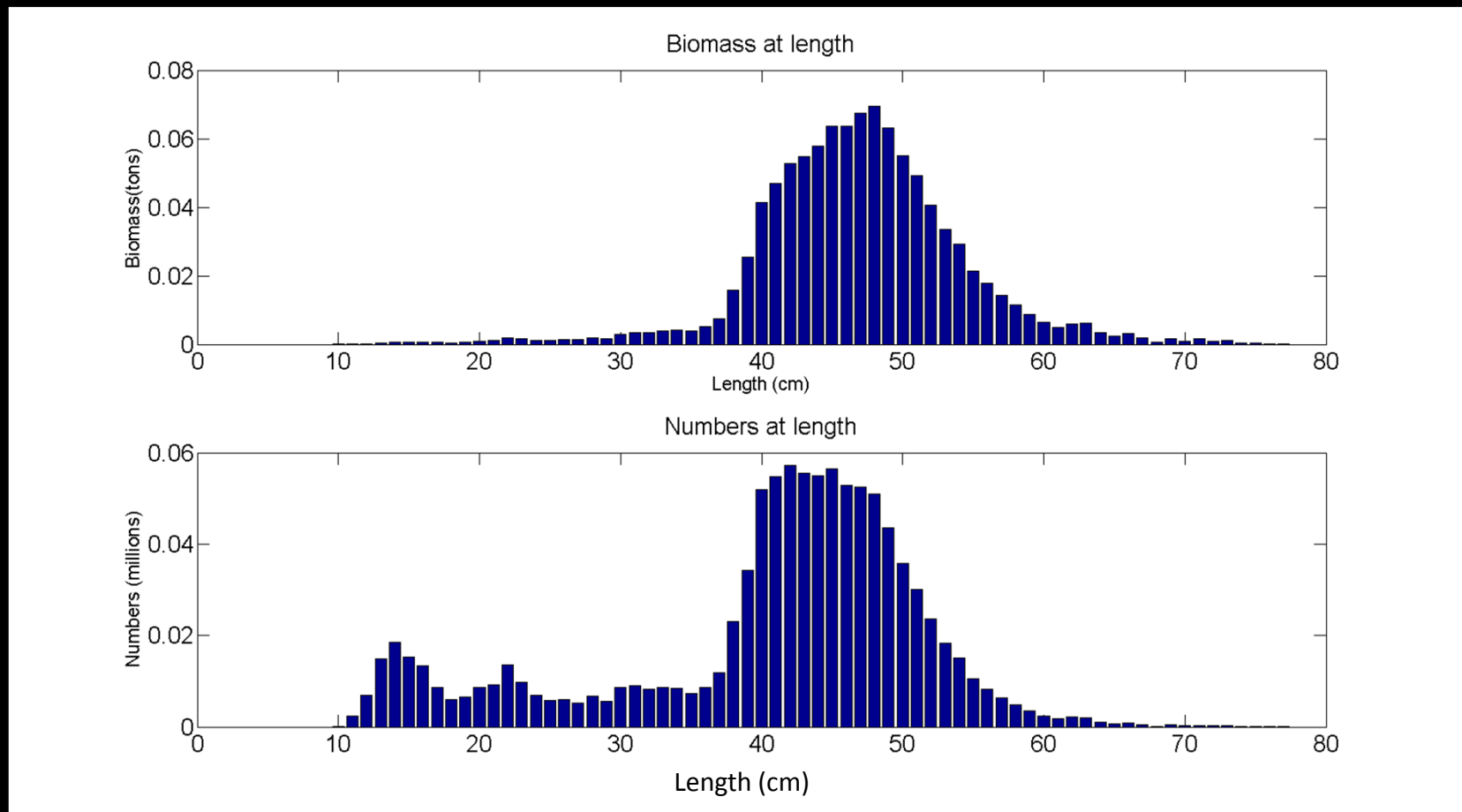
Method for applying correction back in time, 2016, and the future:

- Find catch from closest bottom trawl stations for each EDSU
Within a max range of 25 nmi, weighted by $1/R$ distance
- Find proportion of backscatter that is from pollock using fitted coefficient values for each species and catch data
- Use proportion to scale backscatter between 0.5 and 3 meters



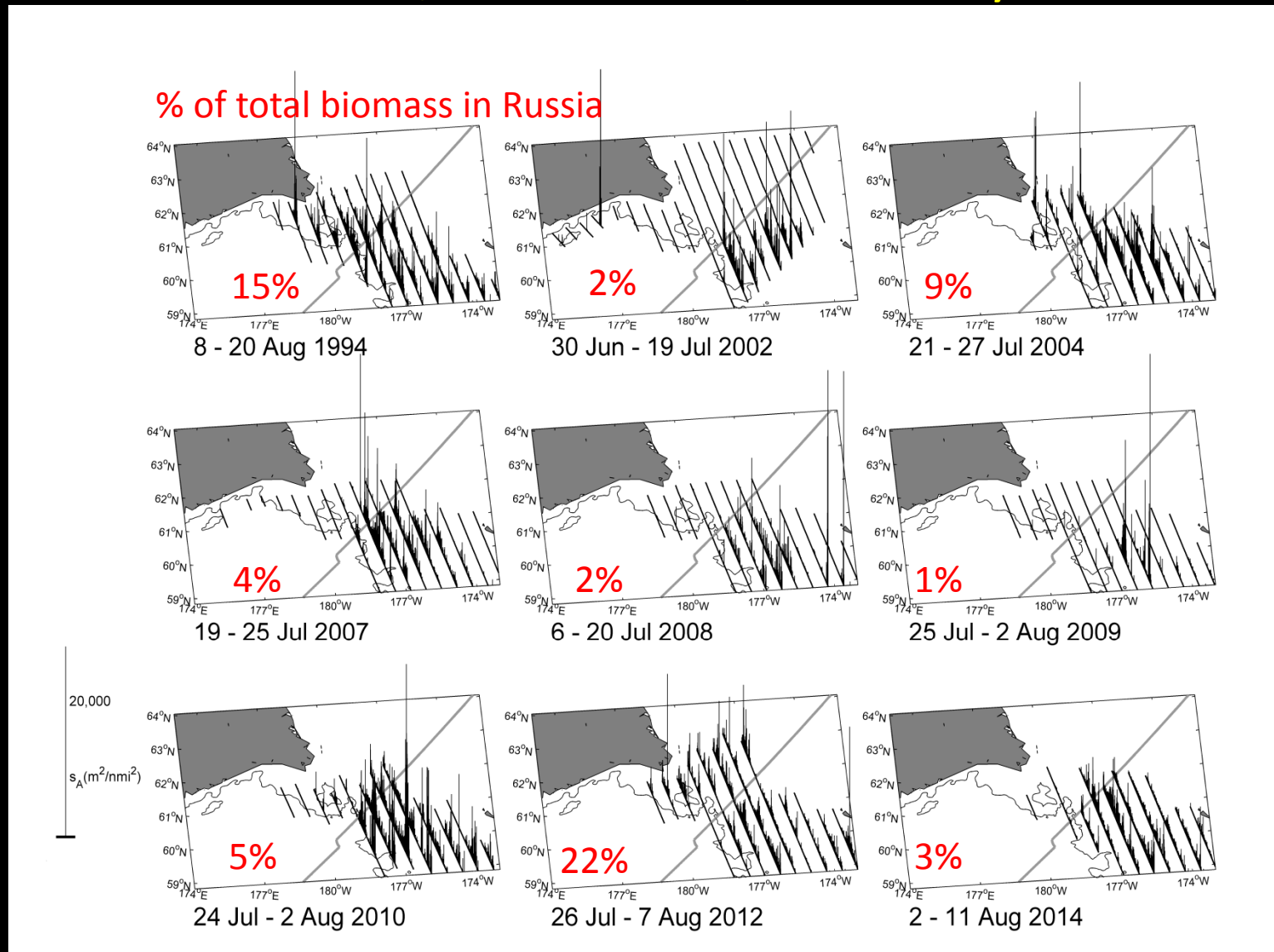


2016 AT survey estimates between 0.5 and 3 meters off bottom





EBS shelf, Russian EEZ, AT surveys



Walleye pollock acoustic backscatter (s_A) from acoustic-trawl surveys near Cape Navarin, Russia. The United States conducted all surveys except 2002 which Russia conducted.

