



EASTERN BERING SEA ECOSYSTEM STATUS REPORT

Elizabeth Siddon and Stephani Zador
NOAA Alaska Fisheries Science Center

November 2018

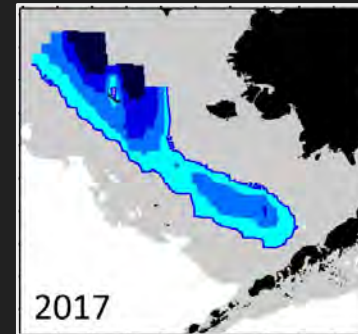
With contributions from:

Brandon Ahmasuk, Alex Andrews, Kerim Aydin, John Bengtson, Jennifer Boldt, Nick Bond, Gregory Buck, Hillary Burgess, Kristin Ciecziel, Curry Cunningham, Elizabeth Dawson, Alison Deary, Sherri Dressel, Anne Marie Eich, Lisa Eisner, Ed Farley, Nissa Ferm, Benjamin Fissel, Shannon Fitzgerald, Robert Foy, Corey Fugate, Sarah Gaichas, Sabrina Garcia, Andrew Gray, Kristen Gruenthal, Chuck Guthrie, Jeffrey Guyon, Colleen Harpold, Lorenz Hauser, Jordan Head, Ron Heintz, Jerry Hoff, Anne Hollowed, Kirstin Holsman, Kathrine Howard, Jim Ianelli, Tayler Jarvis, Timothy Jones, Robb Kaler, Steve Kasperski, David Kimmel, Christine Kondzela, Kathy Kuletz, Liz Labunski, Carol Ladd, Jesse Lamb, Christie Lang, Geoff Lang, Robert Lauth, Anna Lavoie, Jean Lee, Daniel Lew, Michael Litzow, Todd Miller, Jennifer Mondragon, Franz Mueter, Jim Murphy, Hanhvan Nguyen, John Olson, Jim Overland, Julia Parish, Steve Porter, Rolf Ream, Heather Renner, Patrick Ressler, Jon Richar, Lauren Rogers, Marc Romano, Chris Rooper, Sarah Schoen, Katie Sechrist, Gay Sheffield, Elizabeth Siddon, Kim Sparks, Ingrid Spies, Phyllis Stabeno, Jeremy Sterling, Duane Stevenson, Marysia Szymkowiak, Carolyn Tarpey, Grant Thompson, Rod Towell, Caroline Van Hemert, Muyin Wang, Jordan Watson, George Whitehouse, Alex Whiting, Jacqueline Whittle, Tom Wilderbuer, Sharon Wildes, Michael Williams, Sarah Wise, Ellen Yasumiishi, and Stephani Zador.

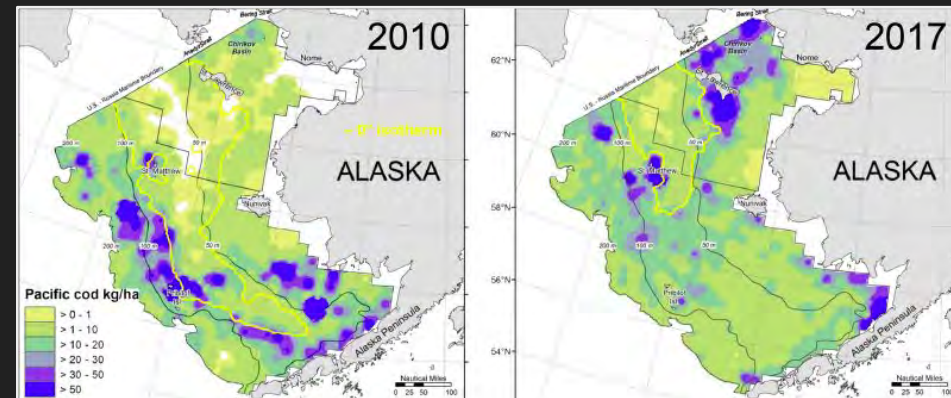
With contributions from (in alphabetical order): Steve Barbeaux, Peter Boveng, Lyle Britt, Catie Bursch, Lauren Divine, Martin Dorn, Janet Duffy-Anderson, Lisa Eisner, Anne Hollowed, Kirstin Holsman, Jim Ianelli, Chad Jay, Dave Kimmel, Sasha Kitaysky, Bob Lauth, Kathi Lefebvre, Paul Lehman, Maggie Mooney-Seus, Carina Nichols, Emily Osborne, Jim Overland, Heather Renner, Patrick Ressler, Gay Sheffield, Phyllis Stabeno, Jeremy Sterling, Grant Thompson, Jim Thorson, and Andy Whitehouse.

2017 HIGHLIGHT REEL

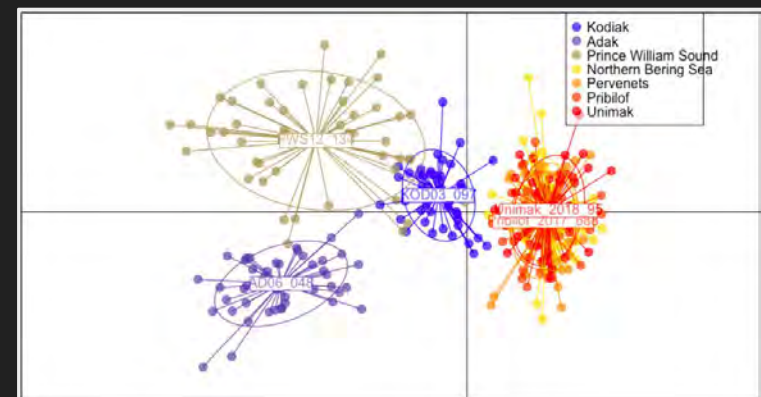
Extensive, but narrow cold pool.
Middle domain = cold
Inner domain = warm corridor



Cod and Pollock in NBS

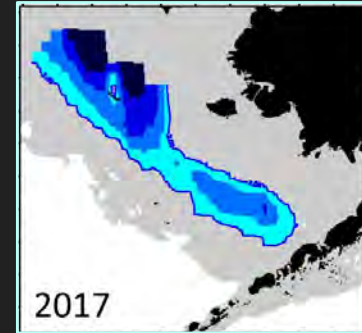


Genetic work shows population coherence with EBS.

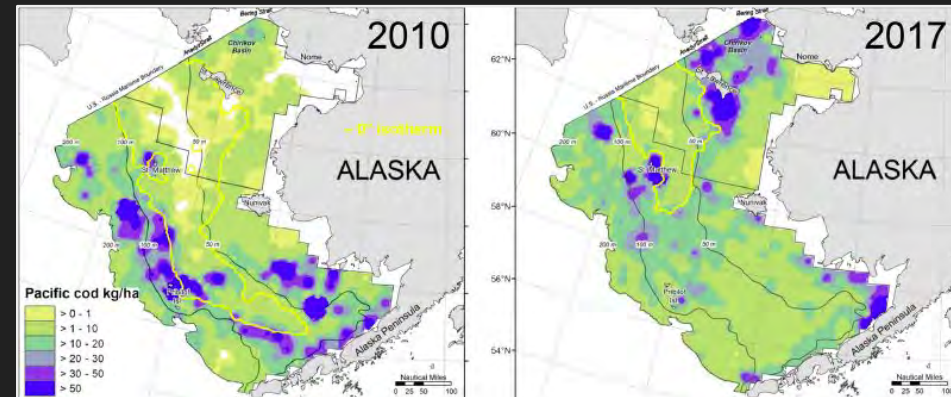


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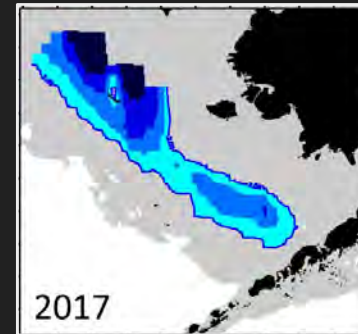


Productivity increased with latitude

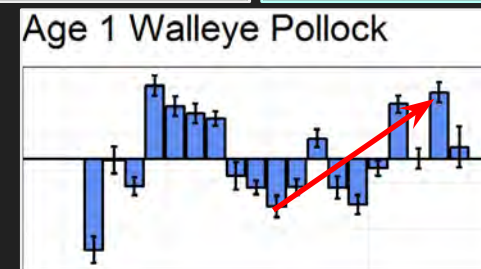
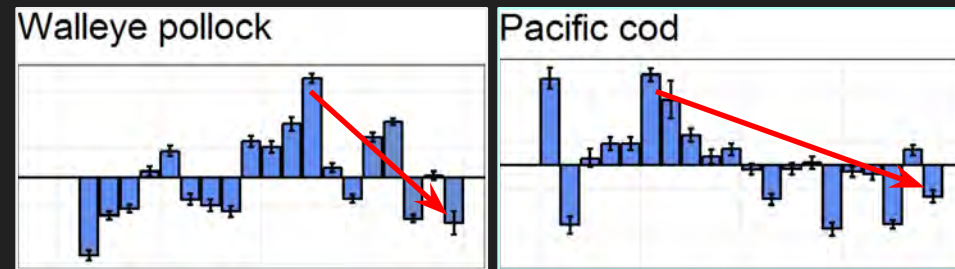


2017 HIGHLIGHT REEL

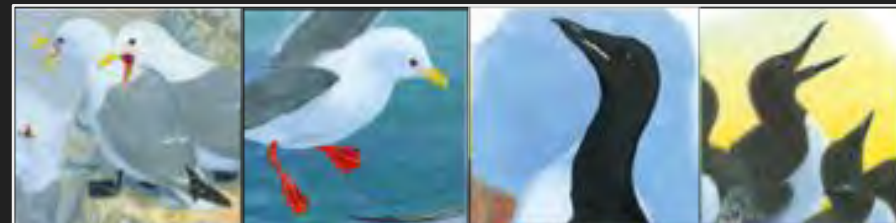
Extensive, but narrow cold pool
Middle domain = cold
Inner domain = warm corridor



Fish condition negative for adults; increasing trend for juveniles.



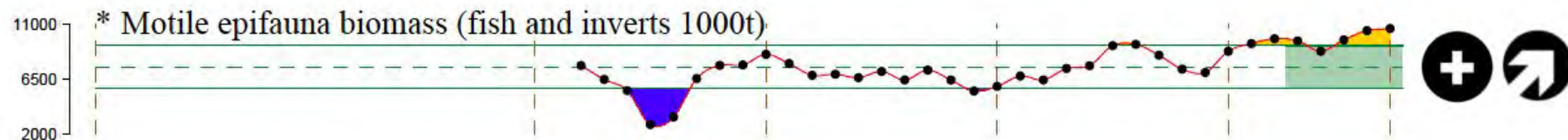
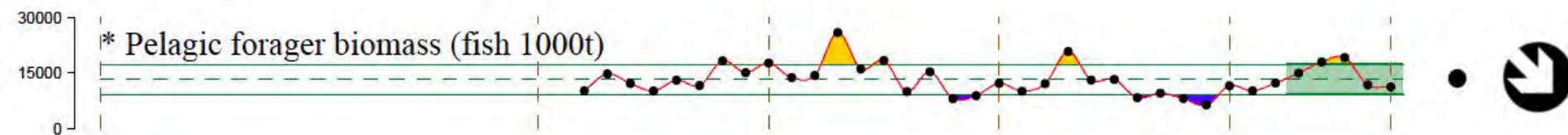
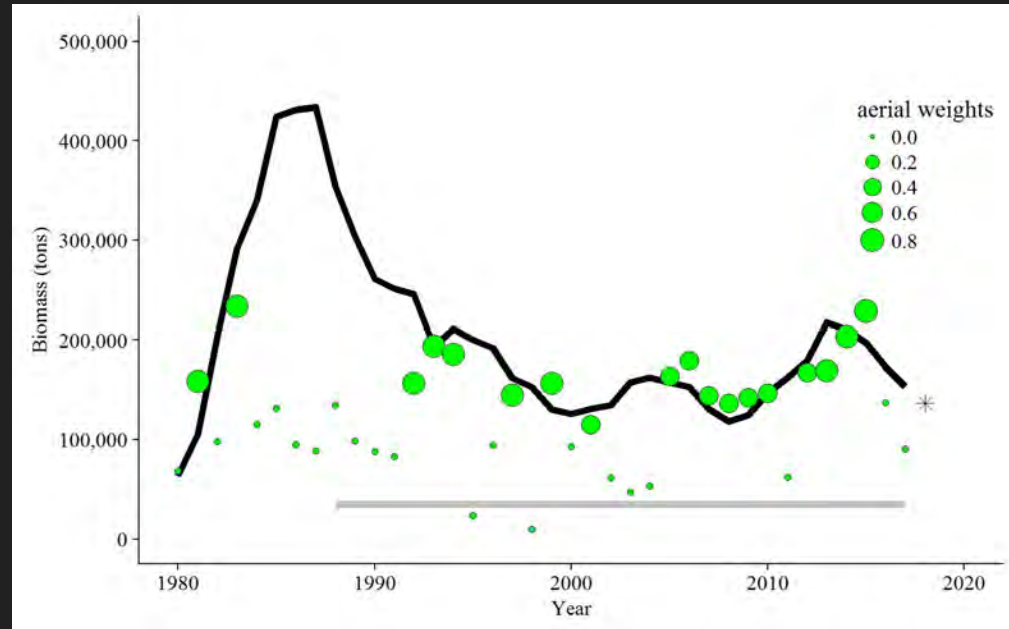
Poor seabird reproductive success at the Pribilof Islands for murre and kittiwakes.



2017 HIGHLIGHT REEL

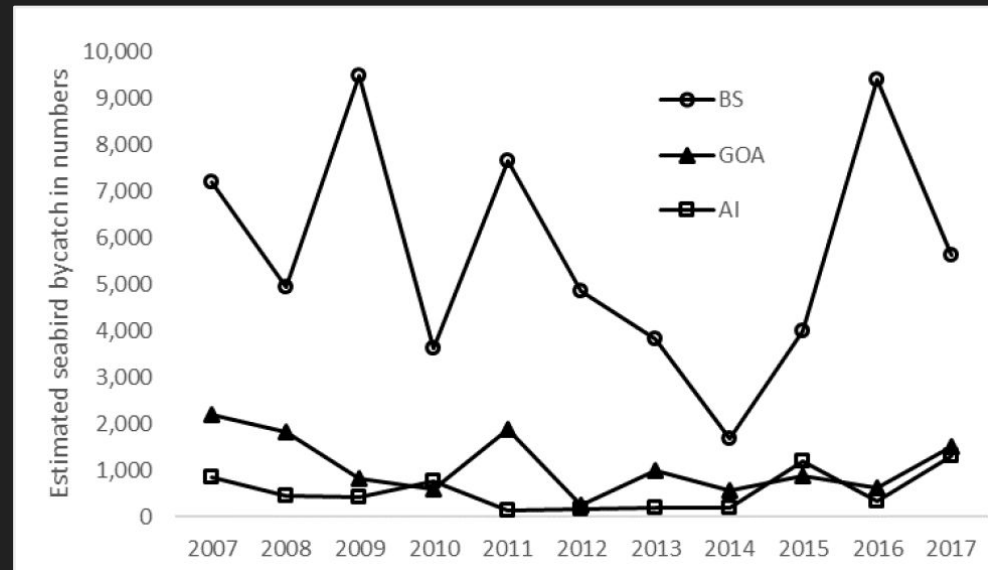
Extensive, but narrow cold pool
Middle domain = cold
Inner domain = warm corridor

2017 Togiak herring 'healthy and sustainable'.



2017 HIGHLIGHT REEL

Seabird bycatch rates back down to historical average.



2017 HIGHLIGHT REEL

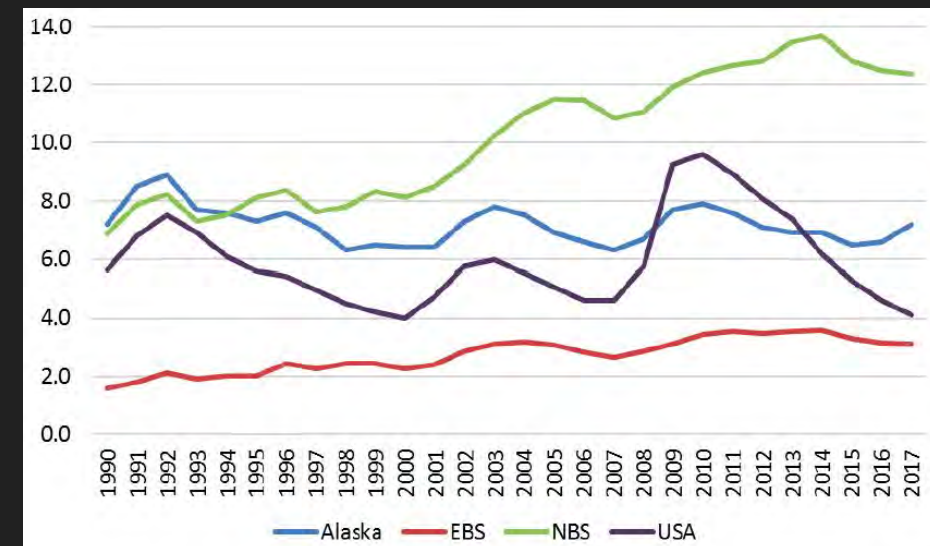
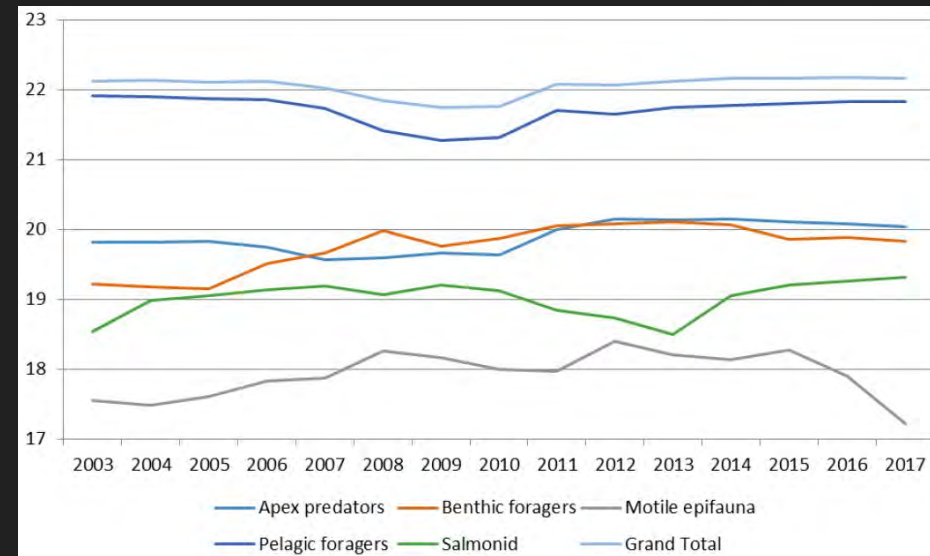
Landings: most functional groups stable; decrease in crab landings in 2017.

Ex-vessel value generally tracks landings.

Unemployment dropping in US, but rising slightly in AK; EBS lower than state/US and NBS higher.

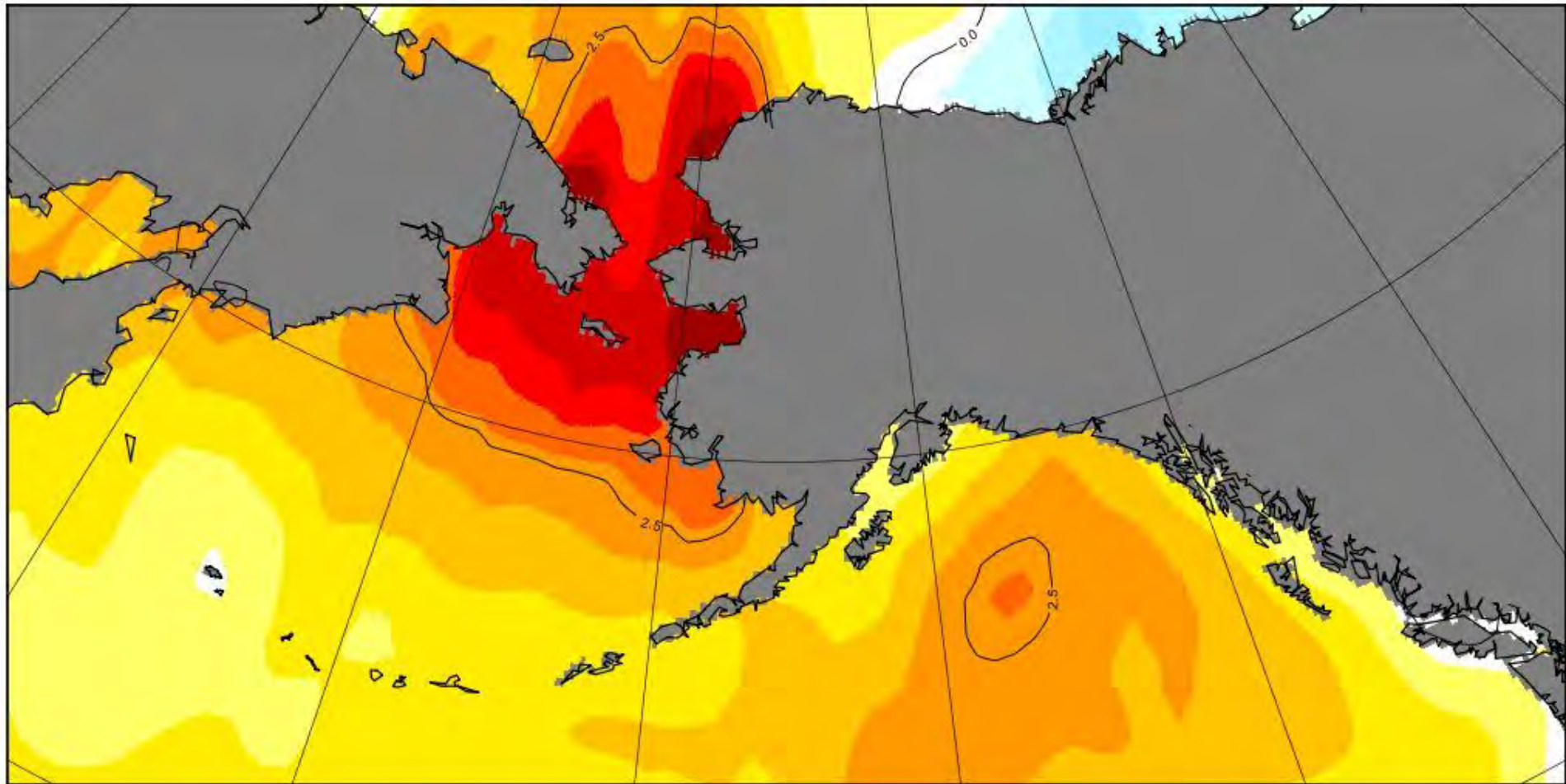
Population stable (SEBS) or increasing (NBS).

School enrollment decreasing (SEBS) and increasing (NBS).

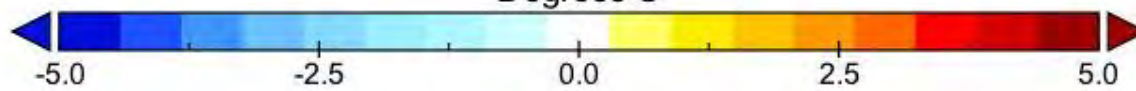


Sea Surface Temperature Departure from Normal

October 2018

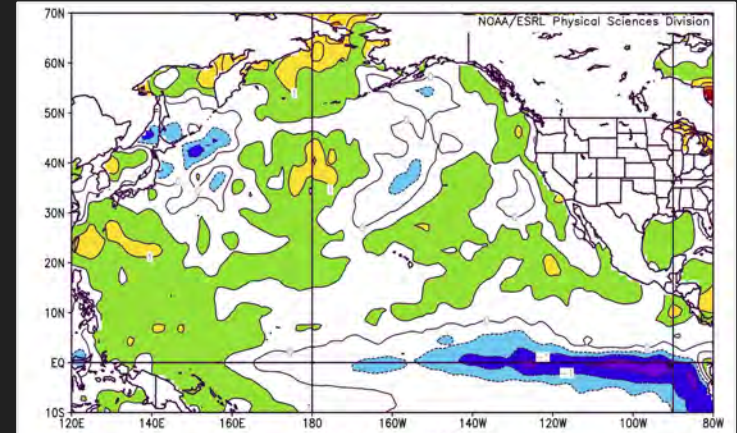


Degrees C

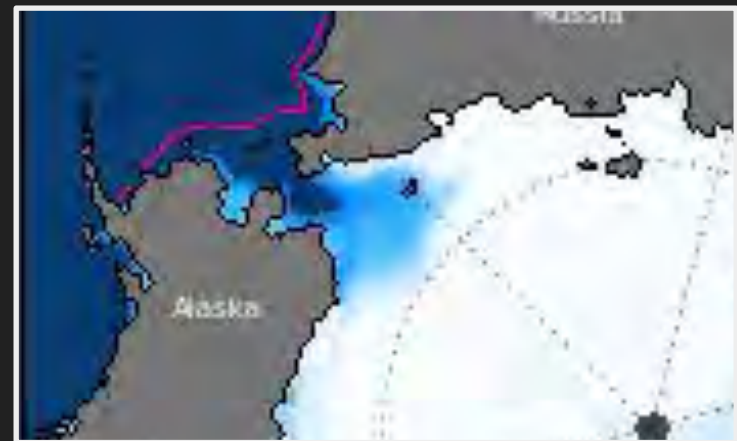


Unprecedented lack of sea ice: what caused it?

Residual heat in the system
- delayed onset of sea ice



Autumn 2017

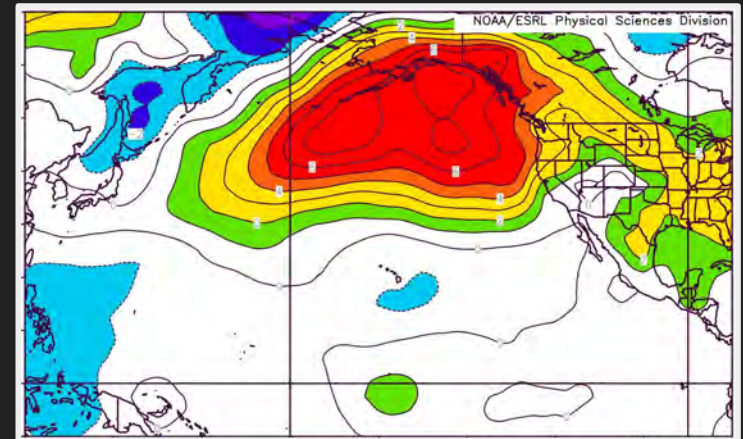


December 2017

Unprecedented lack of sea ice: what caused it?

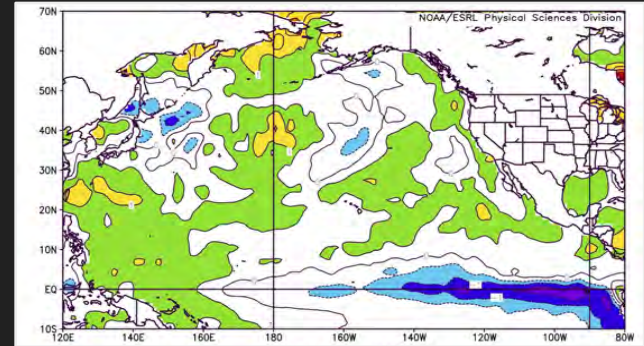
Residual heat in the system

Persistent high pressure system
- pushed ALPS over Siberia

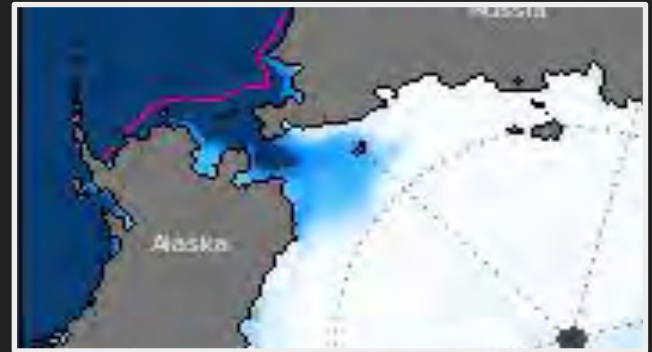


Unprecedented lack of sea ice: what caused it?

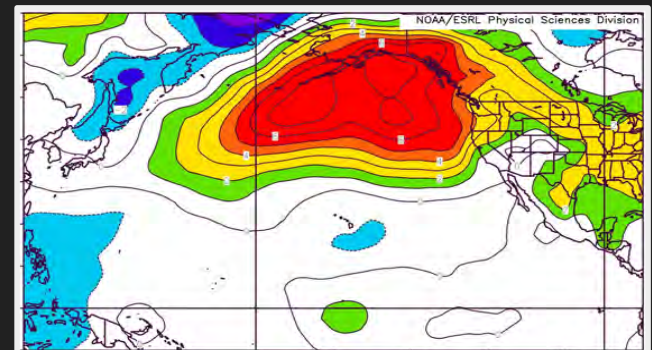
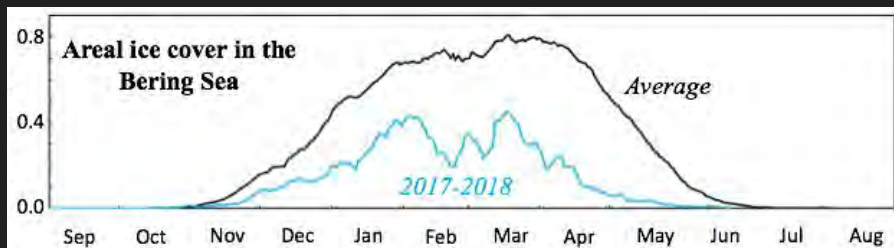
Residual heat in the system



Persistent high pressure system



Anomalous winds from the south



Consequences of no sea ice



No freshwater lens after ice melt.

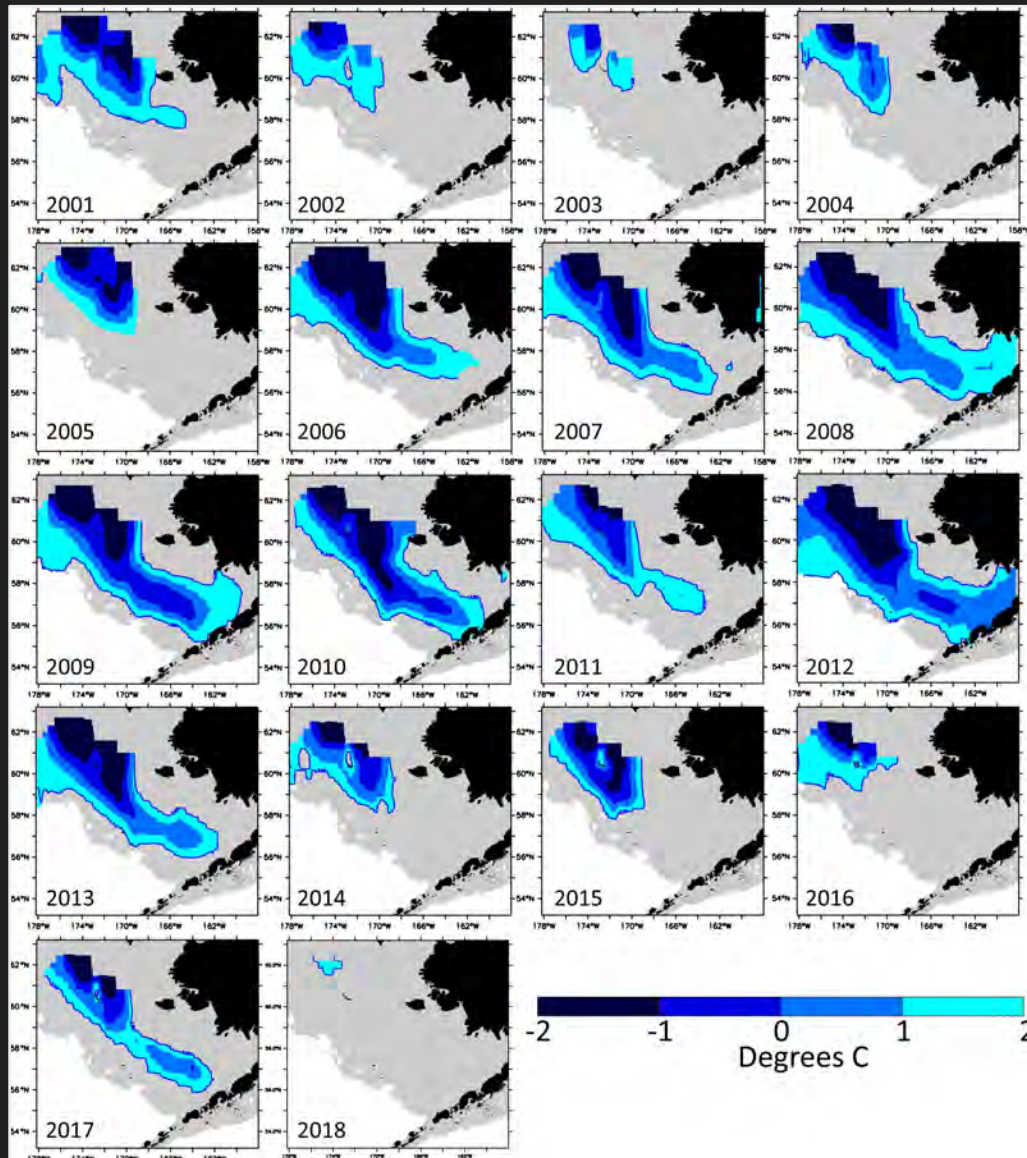
No salinity stratification.

Well-mixed water column.

Water column will cool more rapidly.

No cold pool.

Cold pool dynamics



Low ice years = 'warm'

High ice years = 'cold'

2002-2005 = warm stanza

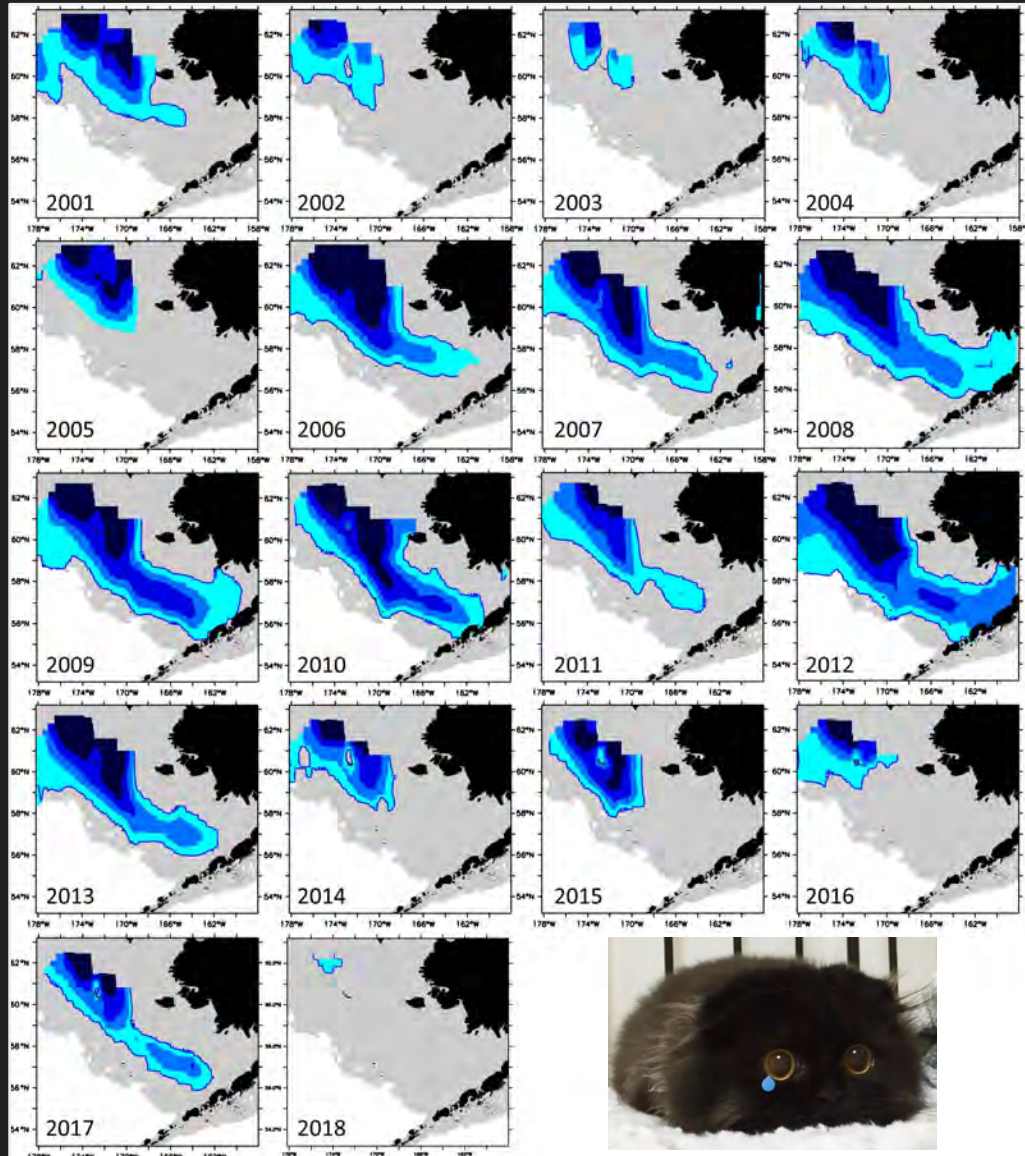
2007-2012 = cold stanza

2014-2016 = warm stanza

2017 = narrow, but
extensive

2018 = cold pool 'teardrop'

Cold pool dynamics



Low ice years = 'warm'

High ice years = 'cold'

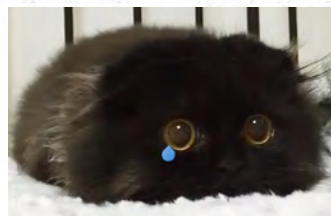
2002-2005 = warm stanza

2007-2012 = cold stanza

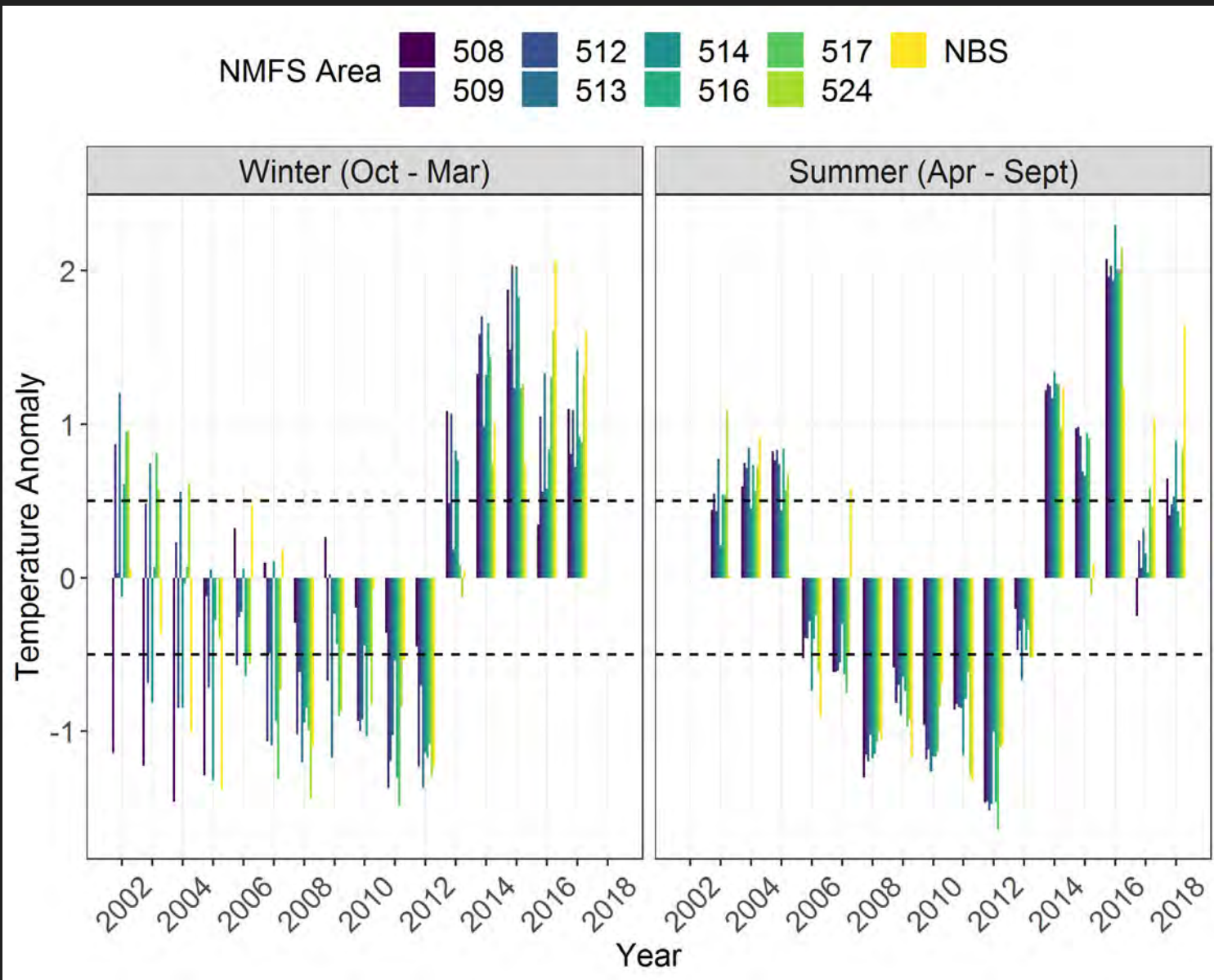
2014-2016 = warm stanza

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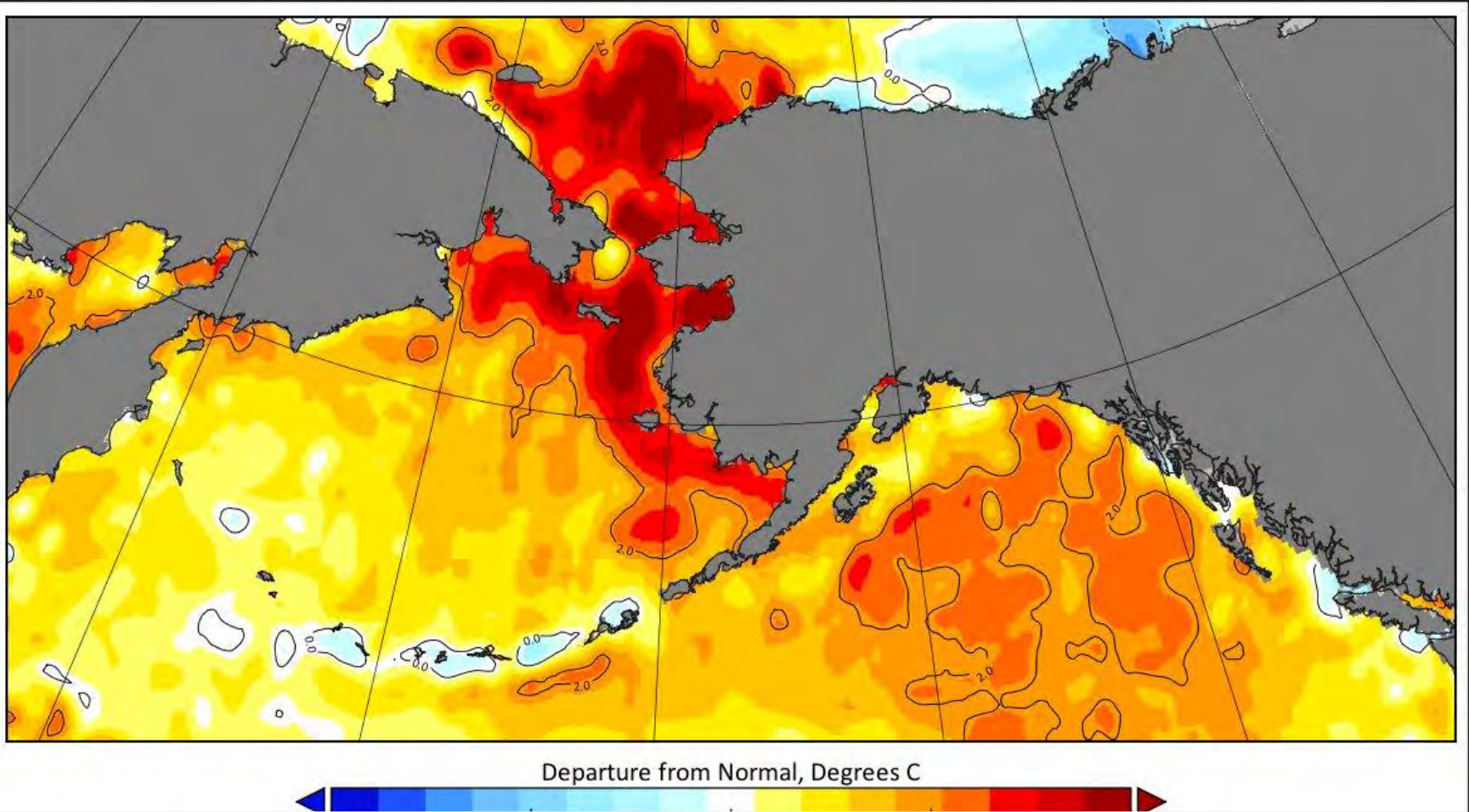
2018 = cold pool 'teardrop'



SST Anomalies

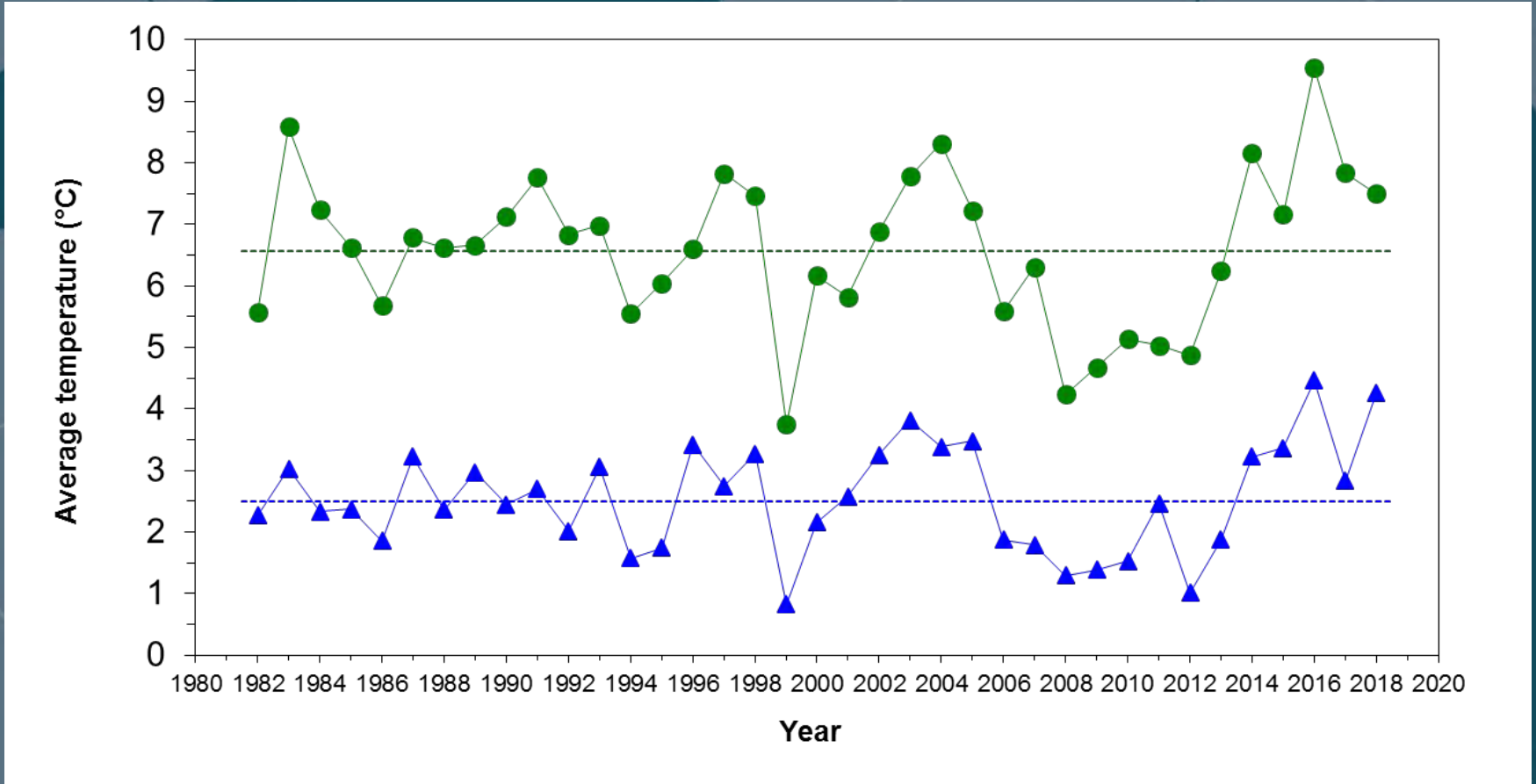


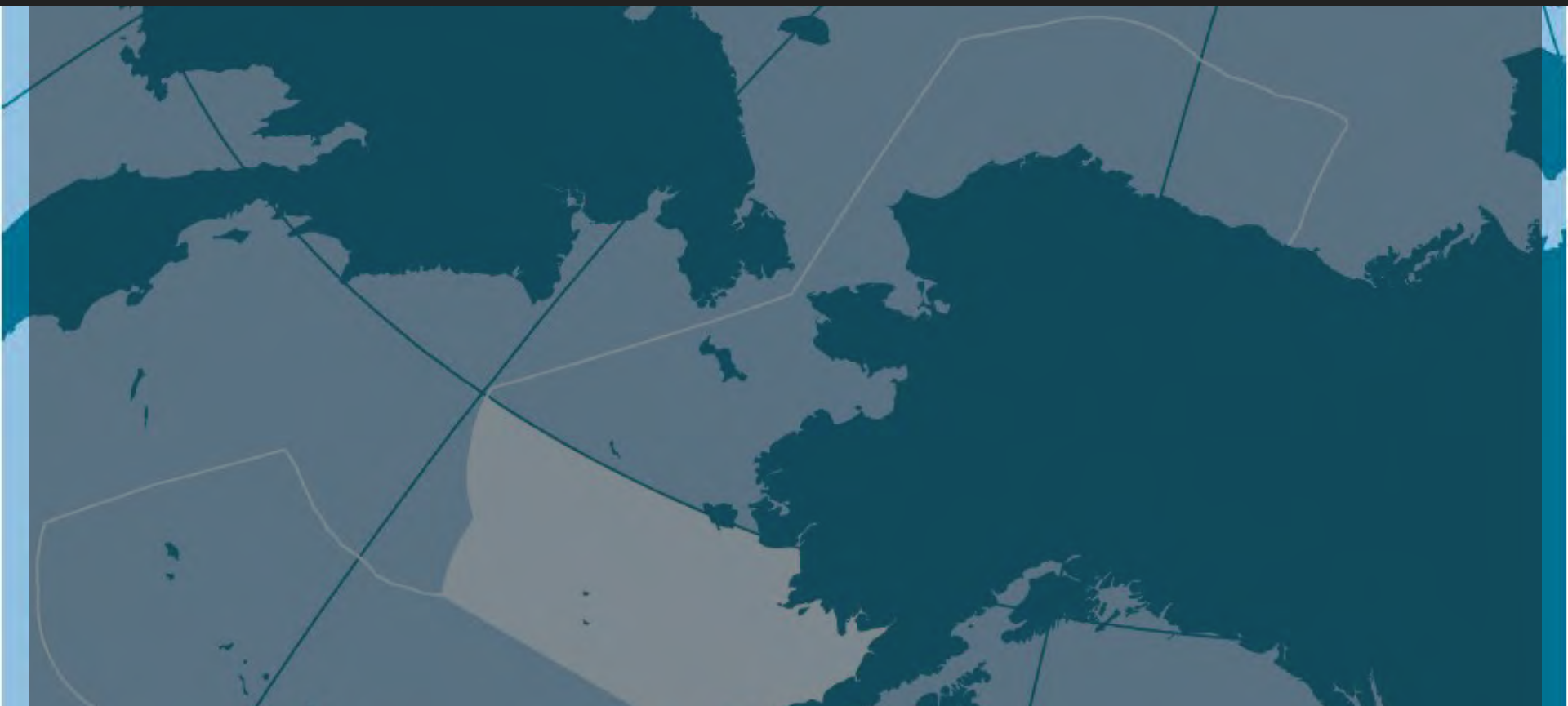
How did the ecosystem respond?

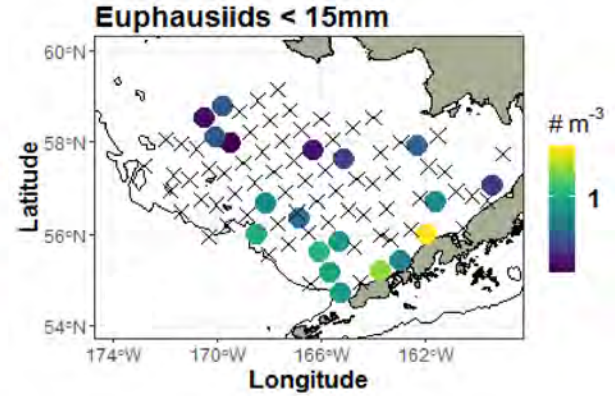
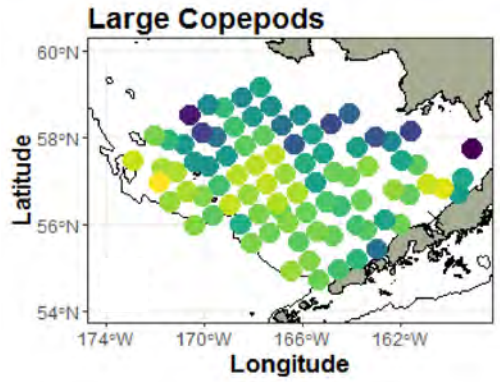
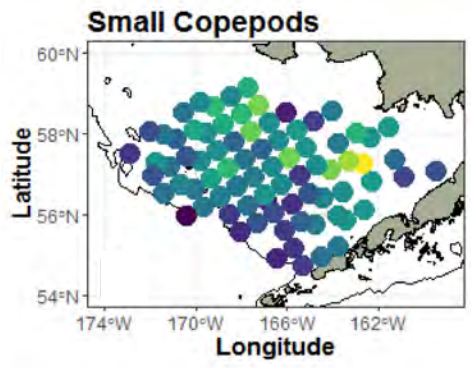
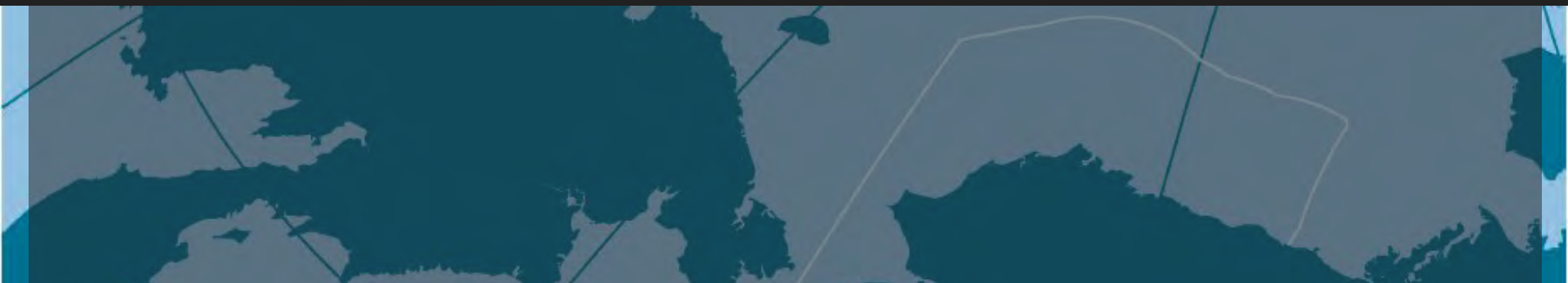


Southeastern Bering Sea

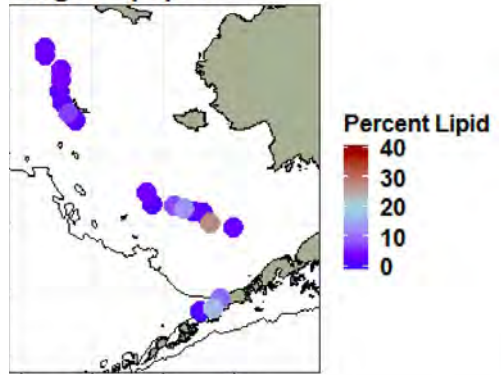




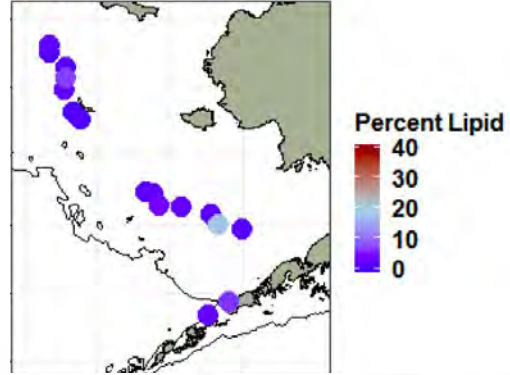




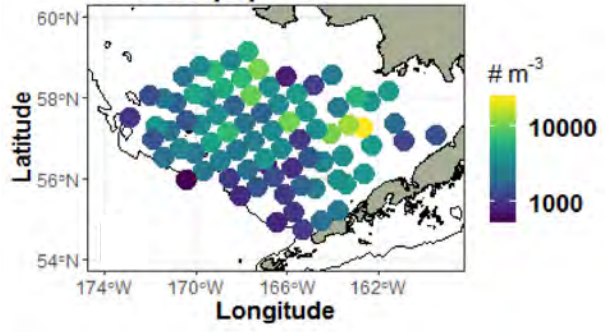
Large Copepods



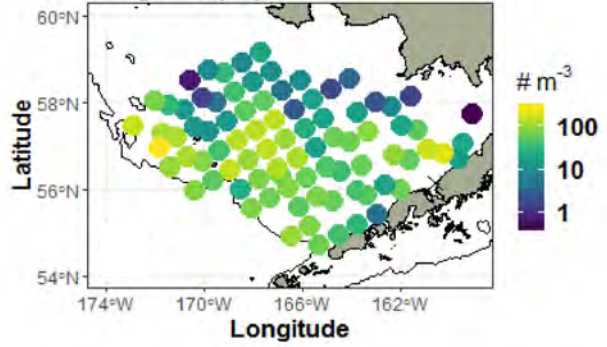
Euphausiids < 15 mm



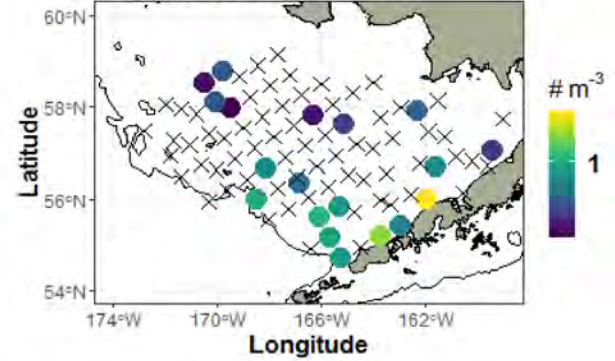
Small Copepods

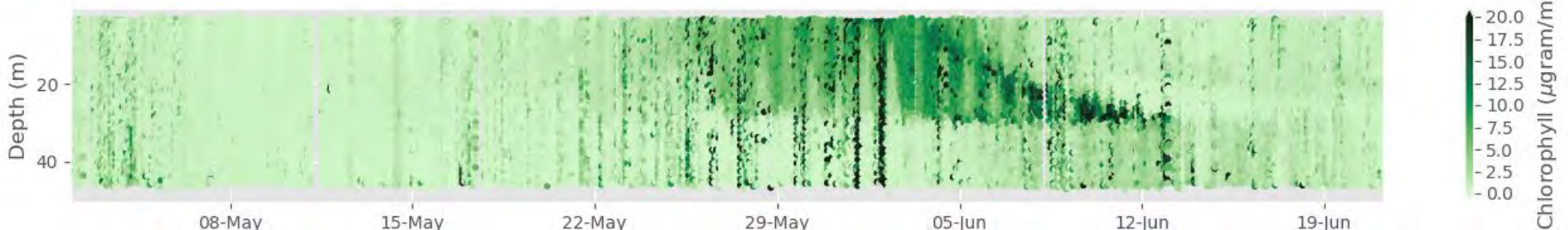
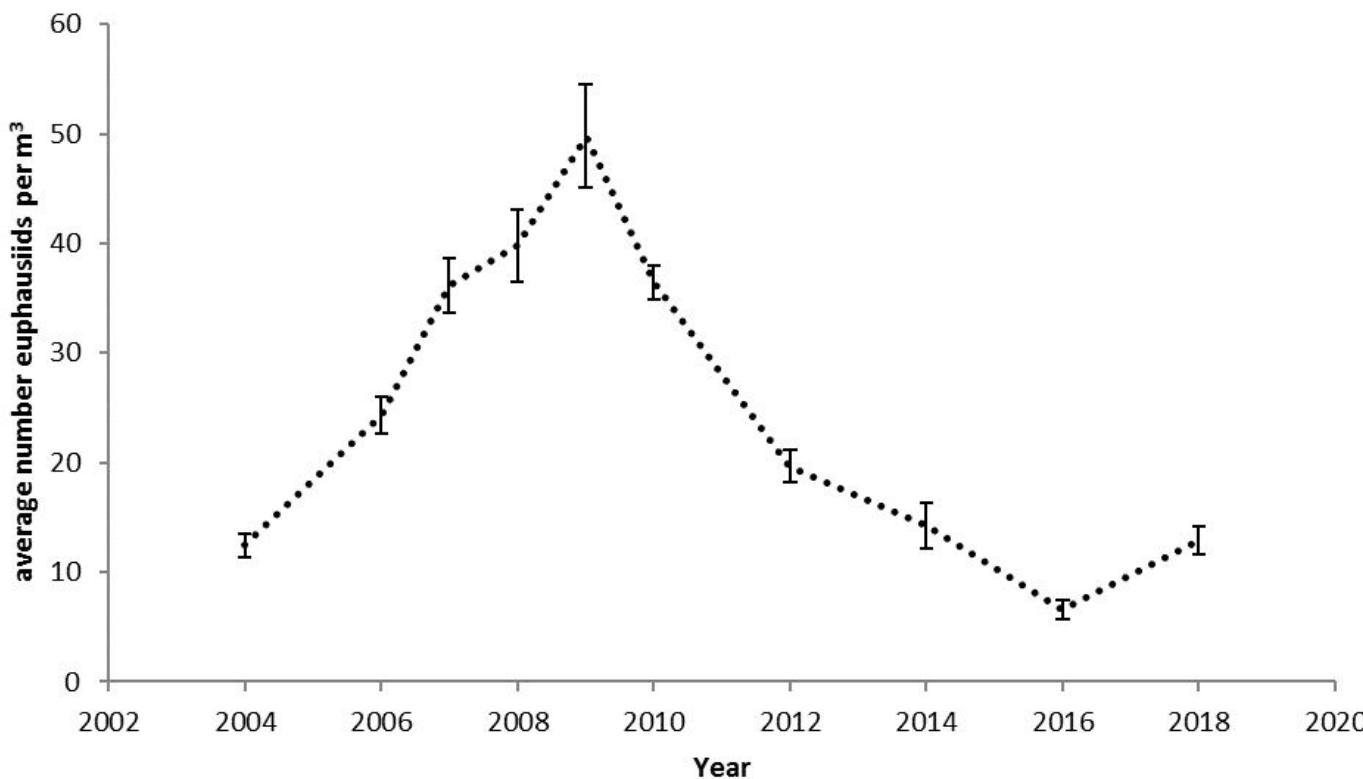


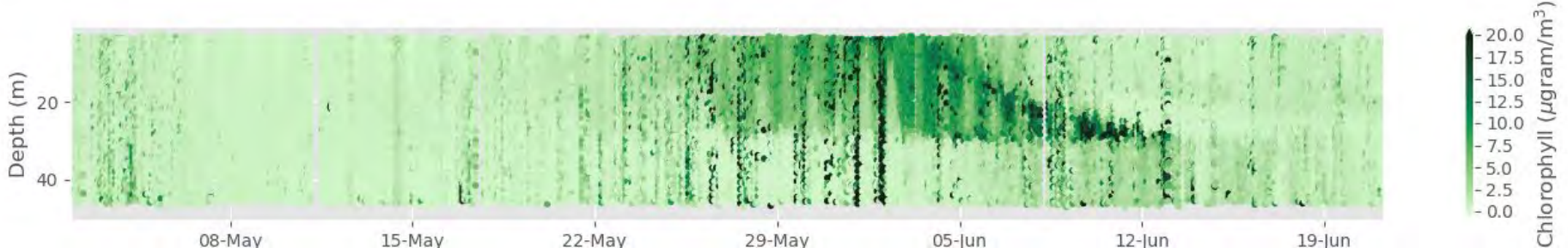
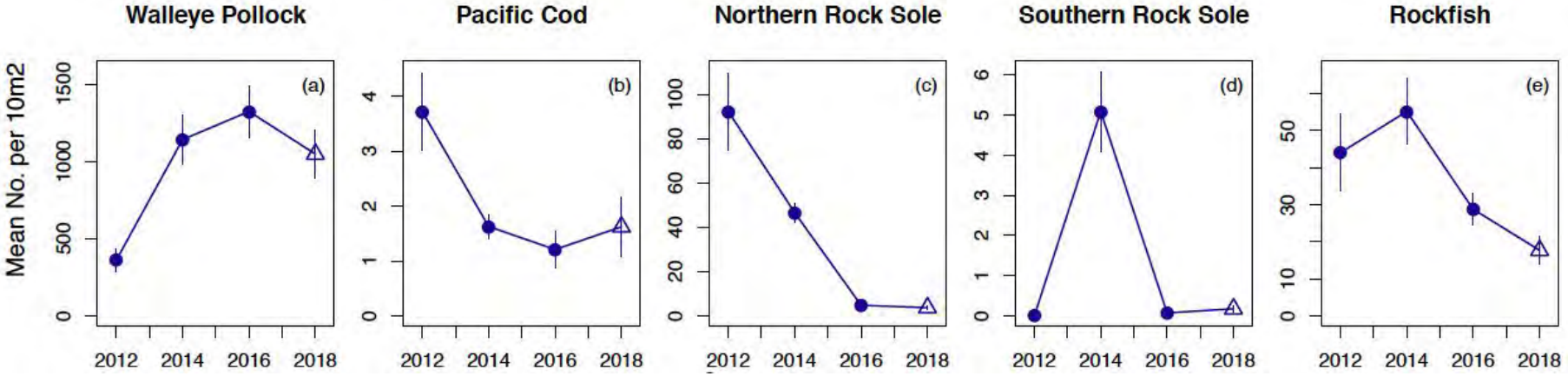
Large Copepods



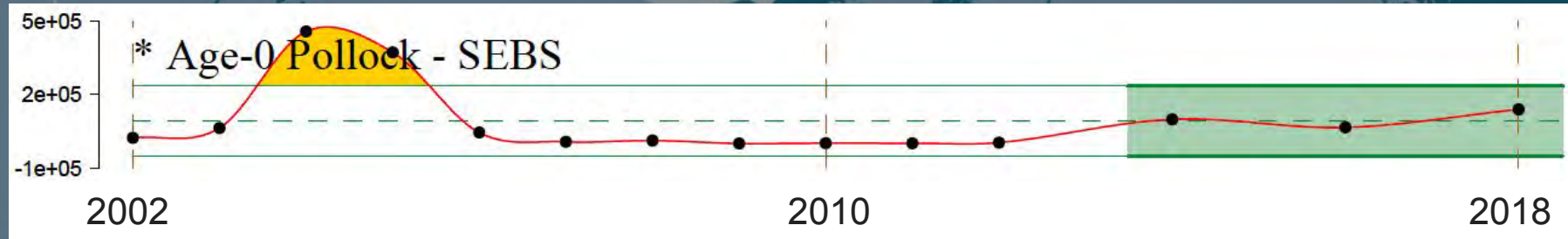
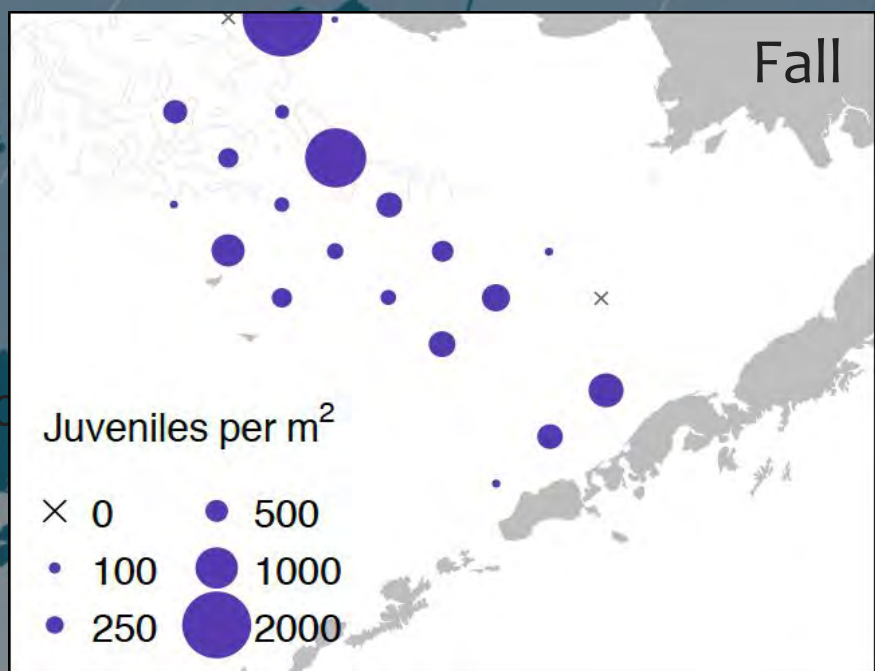
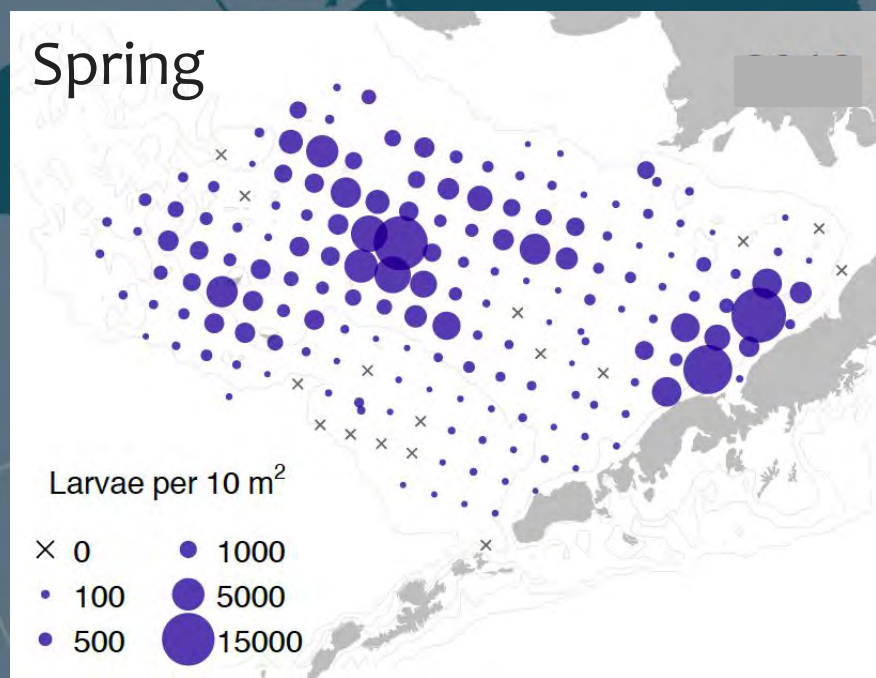
Euphausiids < 15mm



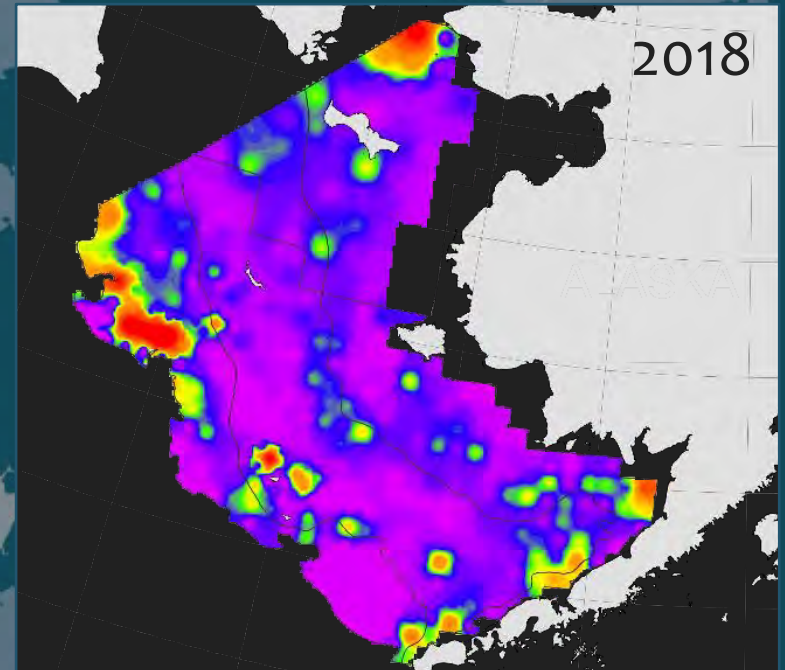
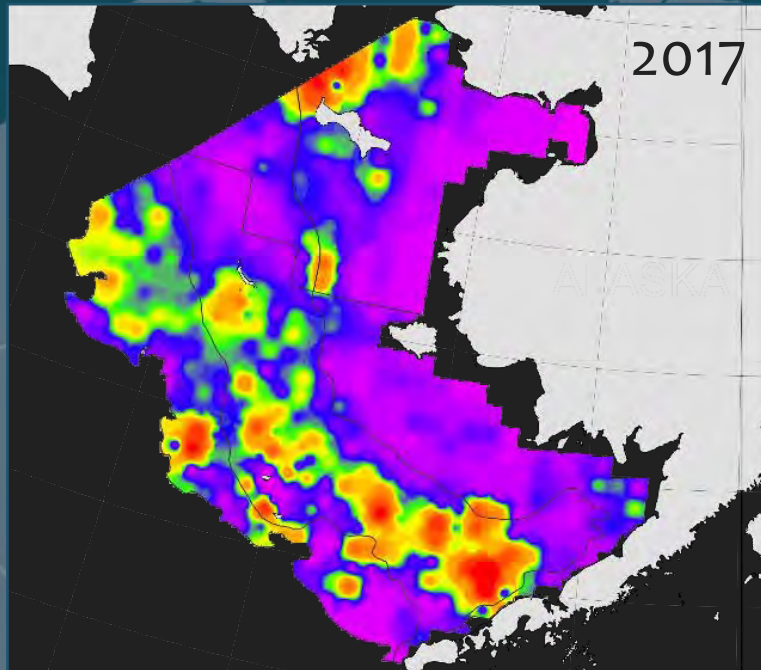


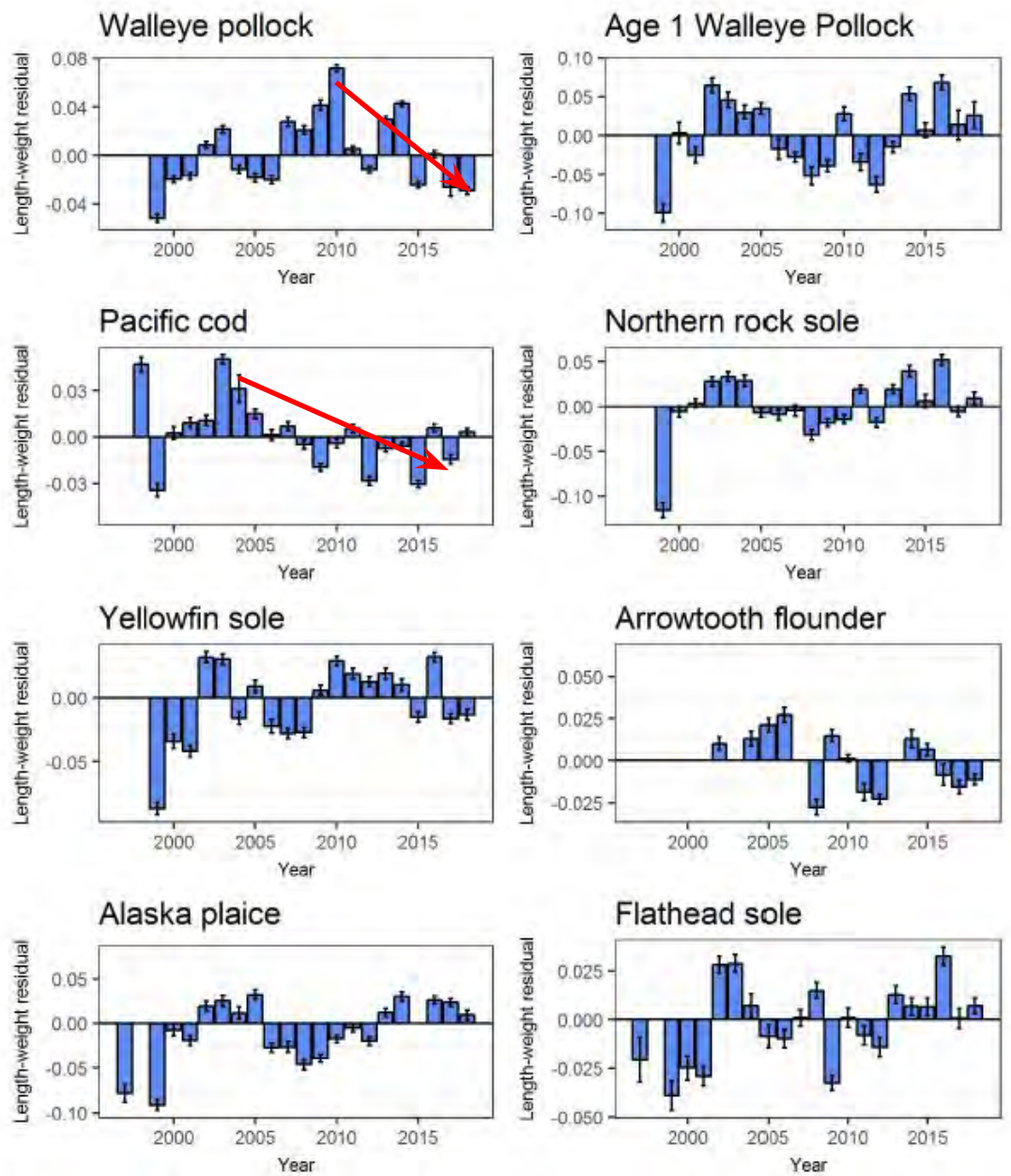


Walleye pollock



Walleye pollock



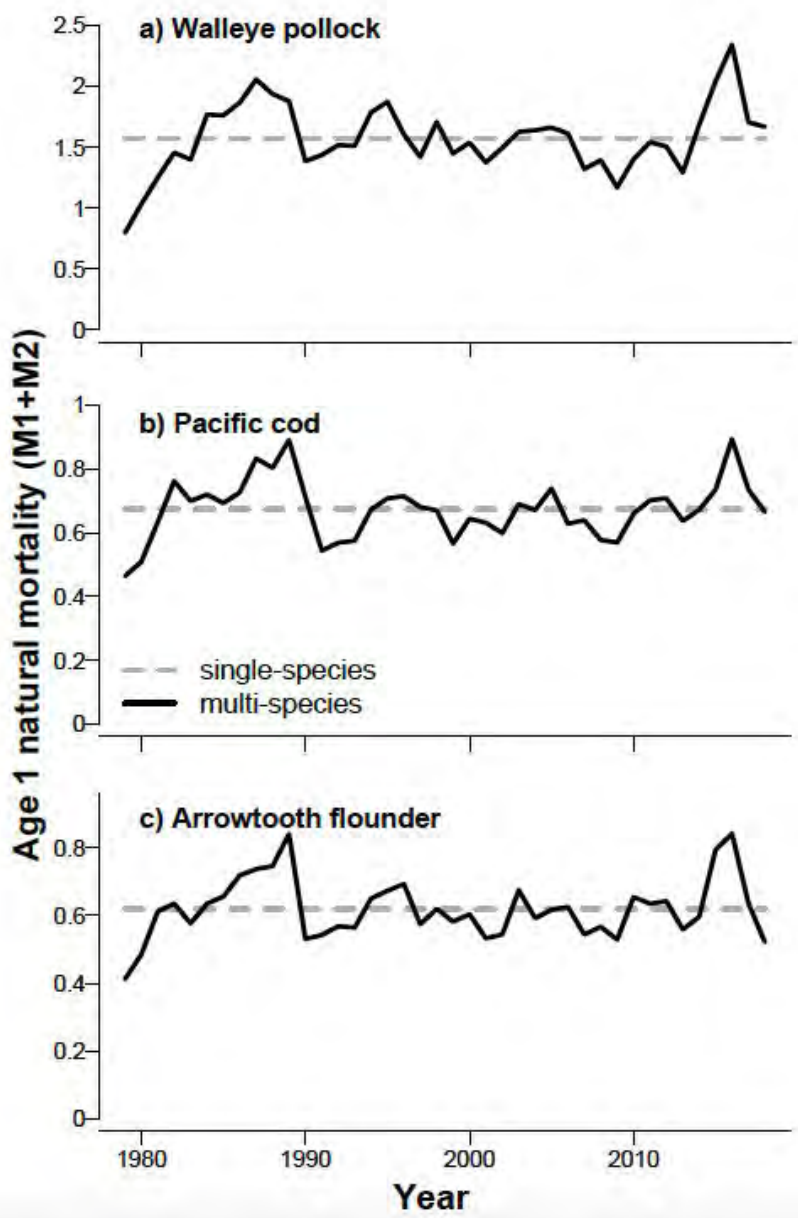


Adult pollock was the 2nd lowest on record and continued a decreasing trend.

Negative trend in Pacific cod since 2003.

Length-weight residuals for most species were the same or increased from 2017 to 2018.

The exceptions were adult pollock and Alaska plaice, which had lower condition in 2018 relative to 2017.

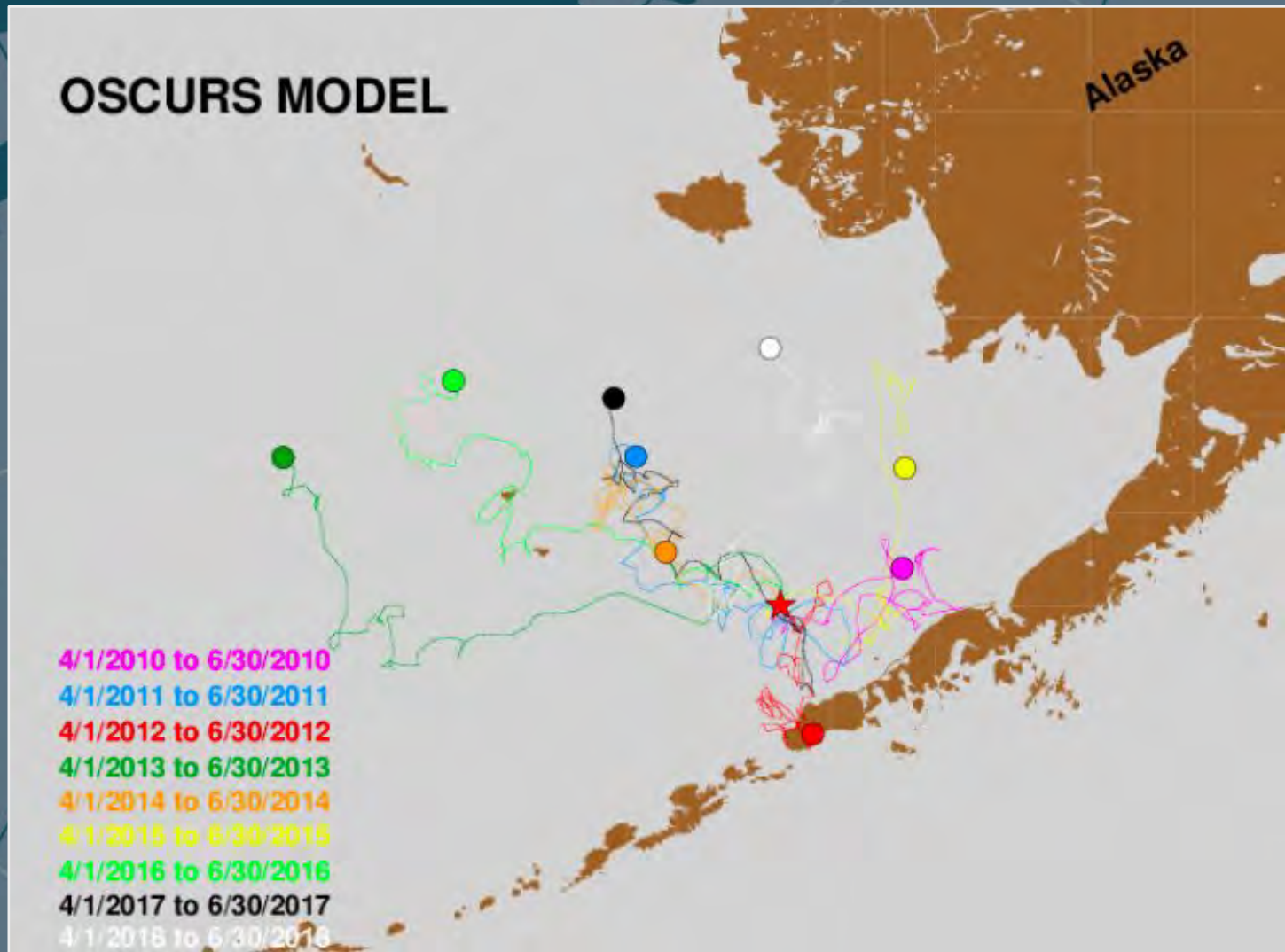


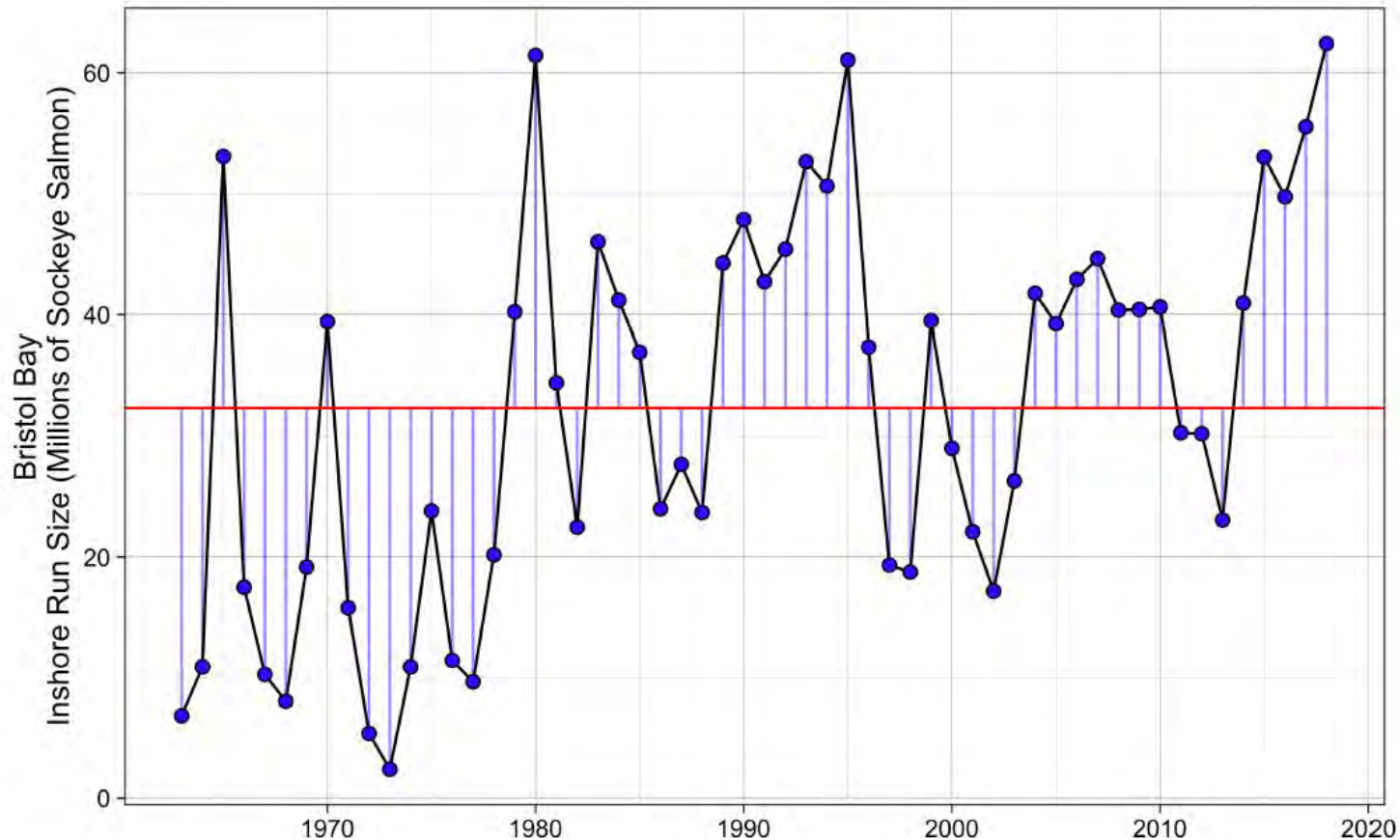
Estimated age-1 natural mortality for Pollock, Pacific cod, and Arrowtooth flounder peaked in 2016.

In 2018, Pollock natural mortality remained above the long-term mean (4th consecutive year).

Pacific cod and Arrowtooth flounder mortality were at and below the long-term mean, respectively.

May reflect higher metabolic demand of predators under warm conditions, combined with maturing 2010-2012 age classes of Pollock and Pacific cod.





- ◆ 2018 Bristol Bay inshore run of sockeye was largest on record since 1963, especially to Nushagak District.
- ◆ Indicates positive ocean conditions in summer 2015/16 and winter 2016/17.

Bristol Bay Pollock

Catie Bursch

Naturalist/Commercial fisherman

“Traditionally, it is unusual to see Pollock in the salmon season in Bristol Bay.”

- Catie Bursch

5/27/18

Just south of Pilot Point
Over past 3 years, seen Pollock
dead on beach in late May. In
2018 observed many, many
more than other springs.

Tyler Sterling

Seasonal salmon fisherman

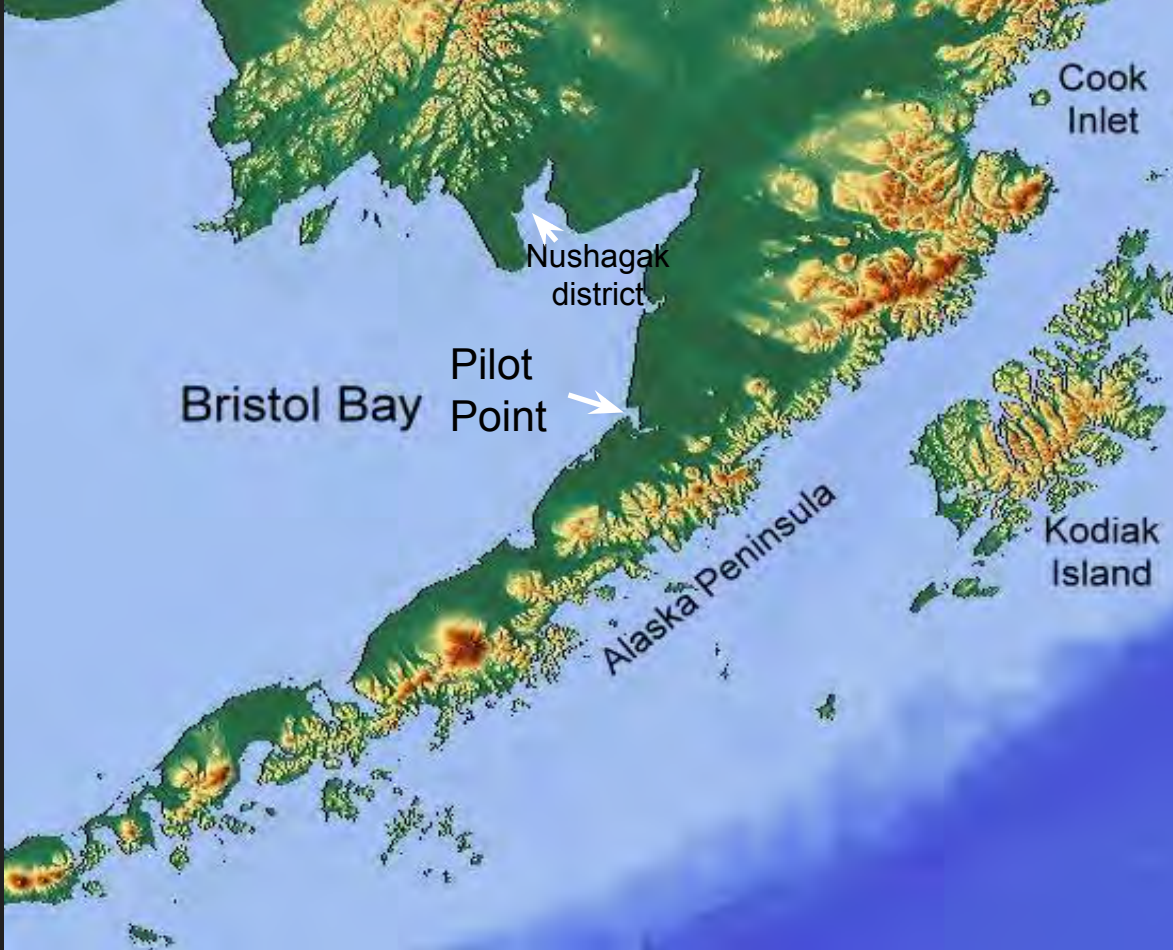


6/30/18

North of Ugashik River mouth.
Pollock floating belly up, dying.
Saw Pollock multiple days in a
row, 2-3 pollock at a time.

Chris Osbekoff

Seasonal salmon fisherman



Bristol Bay Pollock Calls from fishermen

July 6
Ugashik river mouth
Belly up, but alive
Floating at the surface

July 16
James Wheeler aboard the F/V *Bad Whiskey*
Nushagak district
½ swimming, ½ floating
“Odd”



Sample processing:

Length/weight

- “Definitely skinny!” compared to average weights by year/size from the BT survey (B. Lauth)

Stomach content IDs

- Caridea shrimp, gammarid amphipods, other fish
- “Diet seems pretty typical for Bristol Bay” (K. Aydin)

Toxin/HABs (Kathi Lefebvre – NWFSC)

- Low but detectable levels of PSP, exposure risk was present in the food web.
- Toxins could have role in unusual behaviors & mortalities
- Levels were well below seafood safety reg. limit

Isotope & condition samples

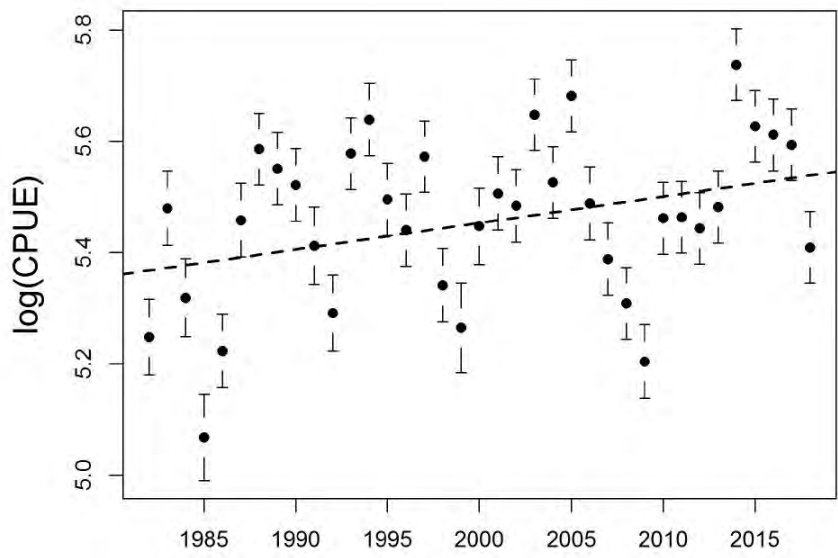
- Processing not yet completed

Otoliths collected

July 19
Sherry O’Connor
Comm. set net fisherman
3 pollock caught

July 25 (email)
Carina Nichols, Comm. fisher
Coast between Ugashik and Egegik
“...dead pollock dried up everywhere
along the beach.”

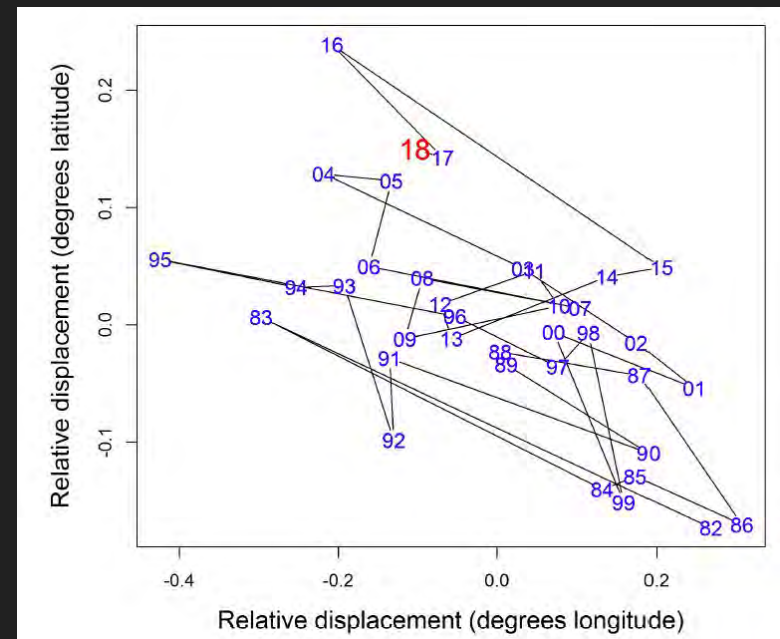
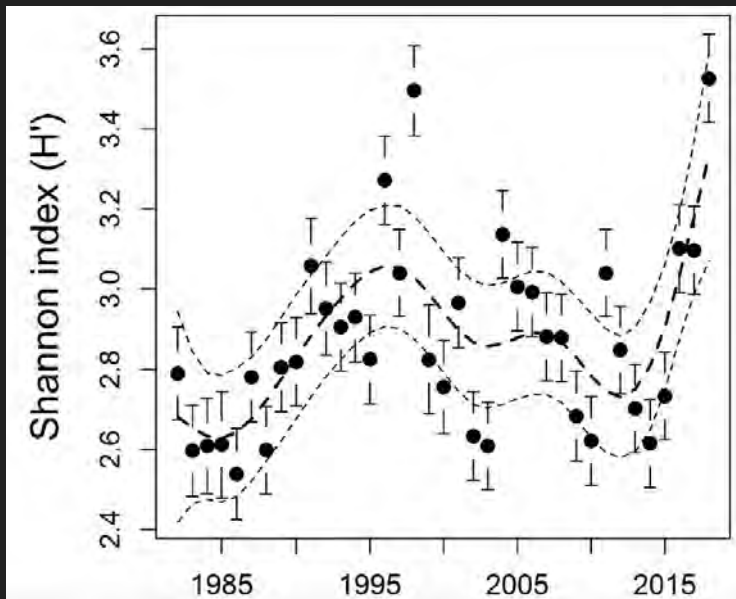
Southeastern Bering Sea

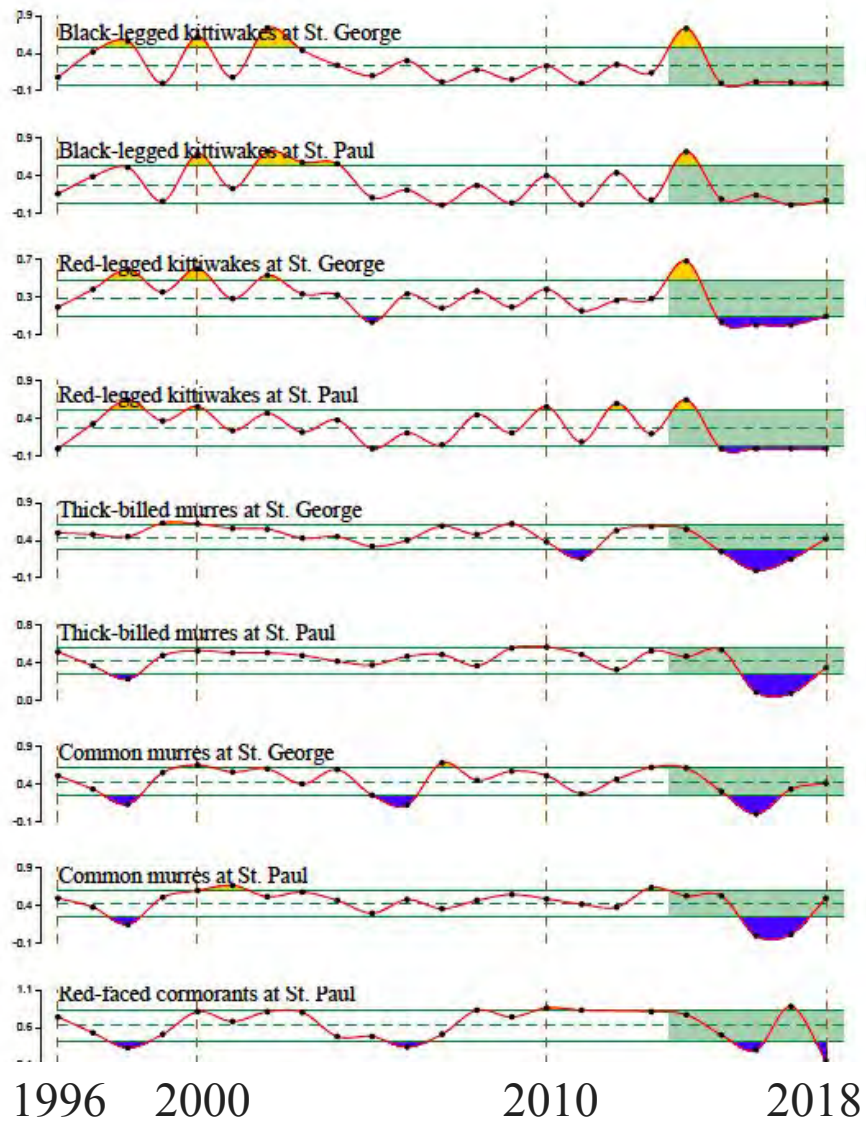


Total CPUE peaked in 2014 and dropped sharply between 2017 and 2018.

Species diversity has increased since 2014, with a particularly large increase in 2018.

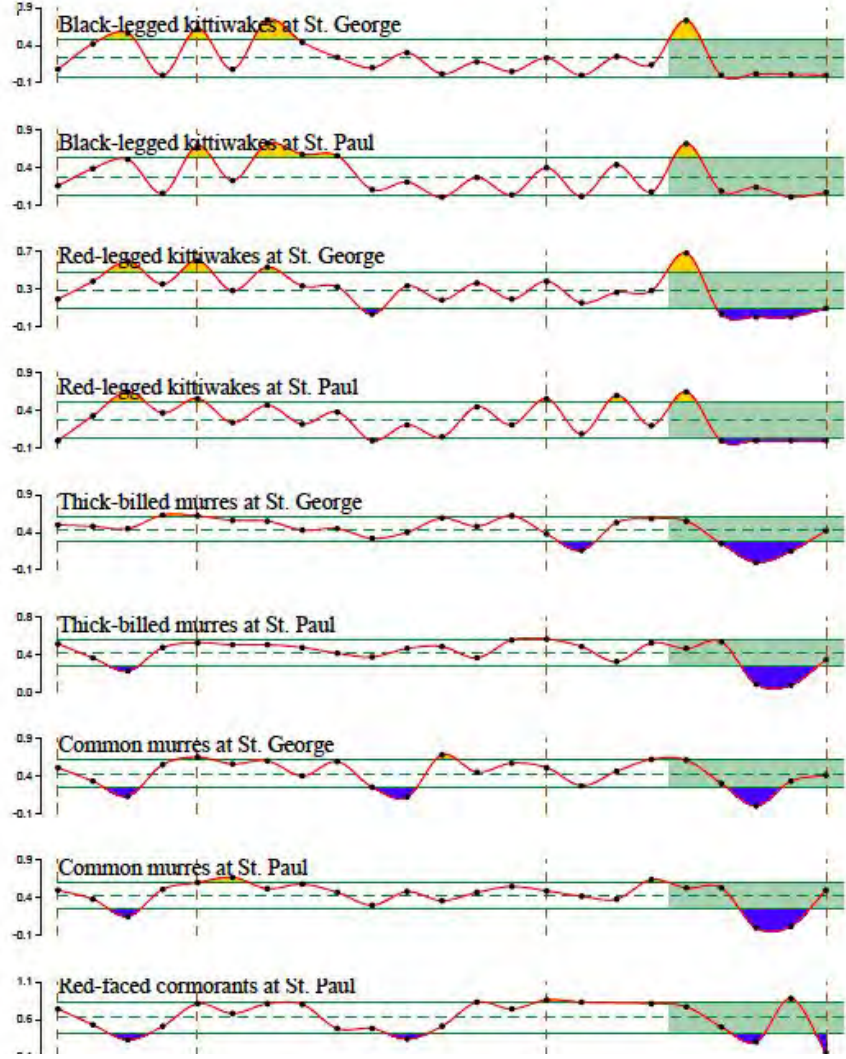
Center of gravity shifted northwest in 2016 then back south in 2017 and 2018; remains farther north than any year besides 2016.





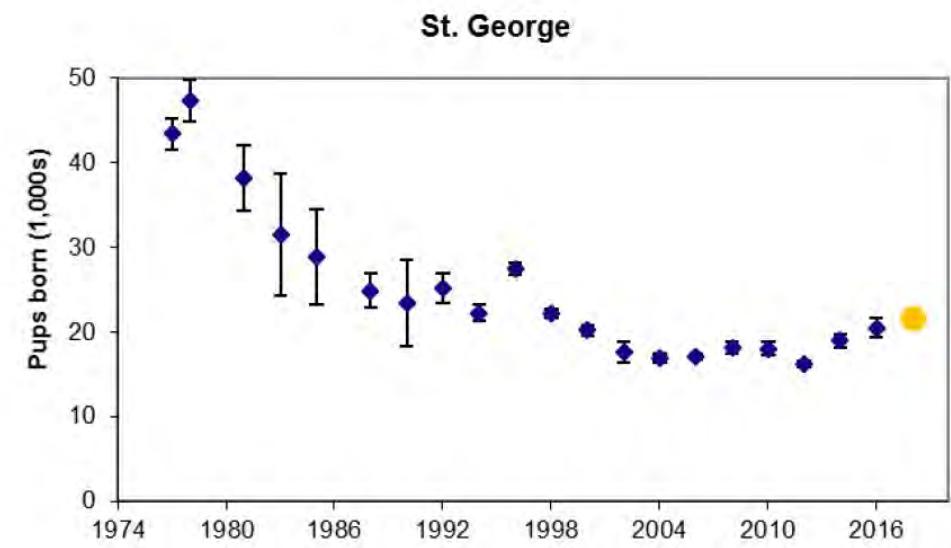
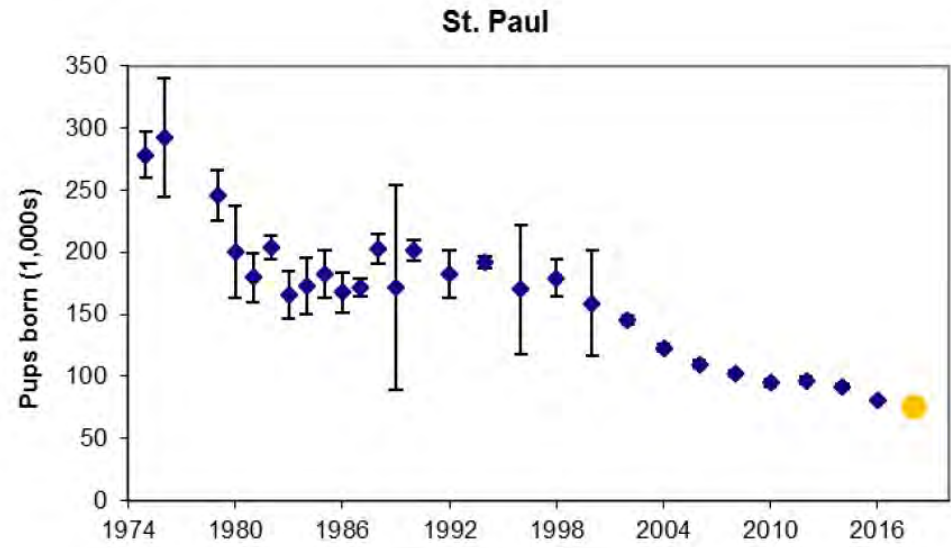
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1996 2000 2010 2018

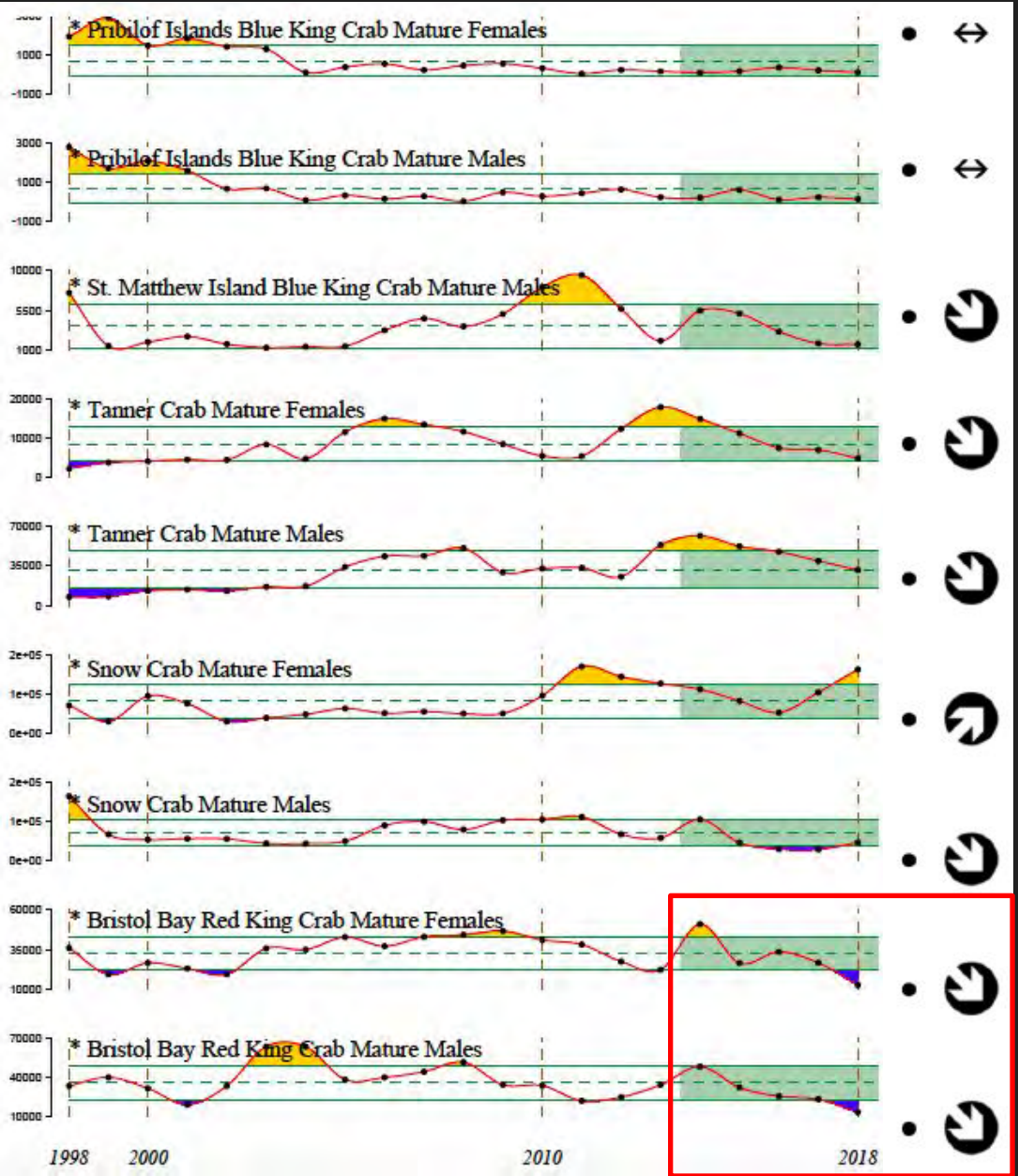




2018 estimated fur seal pup production for St. Paul is ~6% less than 2016. The St. George estimate is ~5% greater than 2016.

This indicates a continued decline in pup production on St. Paul and a leveling / slightly increasing trend on St. George.

Using estimates for 2018, pup production has been declining since 1998 at an approximate annual rate of 4.0% on St. Paul. No significant trend on St. George over the same time period.



Decrease in biomass and abundance in blue king crab, Tanner crab, and red king crab stocks in 2018.

Bristol Bay red king crab at 35- and 22-year lows (M and F, respectively).

St. Matthew BKC at all-time low.

Snow crab biomass (60% increase in both M/F). The stock had declined to all-time low in 2016. Increased recruitment means trend is expected to continue.

Better Off Dead

The Pribilof Islands support a significant concentration of breeding seabirds; a rat prevention program safeguards against potentially catastrophic impacts.



A rat was detected on St. Paul Island in August 2018 and seen again in September. A USFWS strike team was deployed. As of Nov. 12, the rat has remained elusive to trapping attempts...they've brought in dead rats to lure it.



SUMMARY

No cold pool over the southeastern shelf.

Reduced stratification.

Weak, delayed bloom.

Low abundance and quality of zooplankton.

Larval fish production high; juv. survival predicted low due to poor prey quantity/quality.

Adult pollock biomass decreased from 2017; condition low; natural mortality remains high.

Drift trajectory favorable for winter-spawning flatfish.

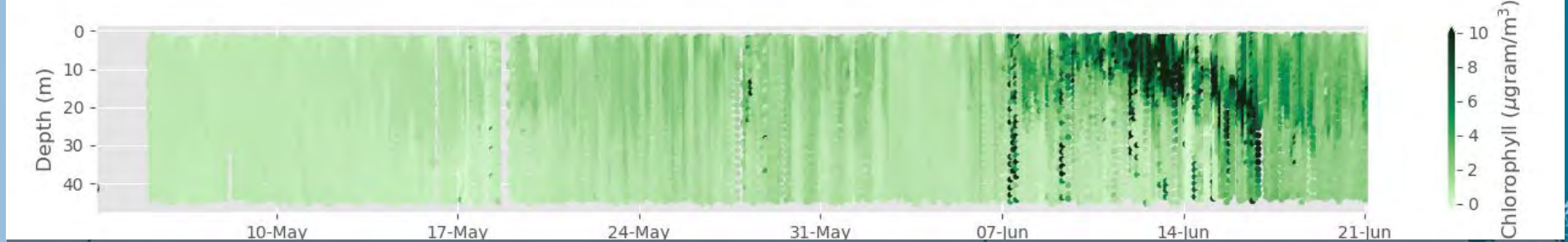
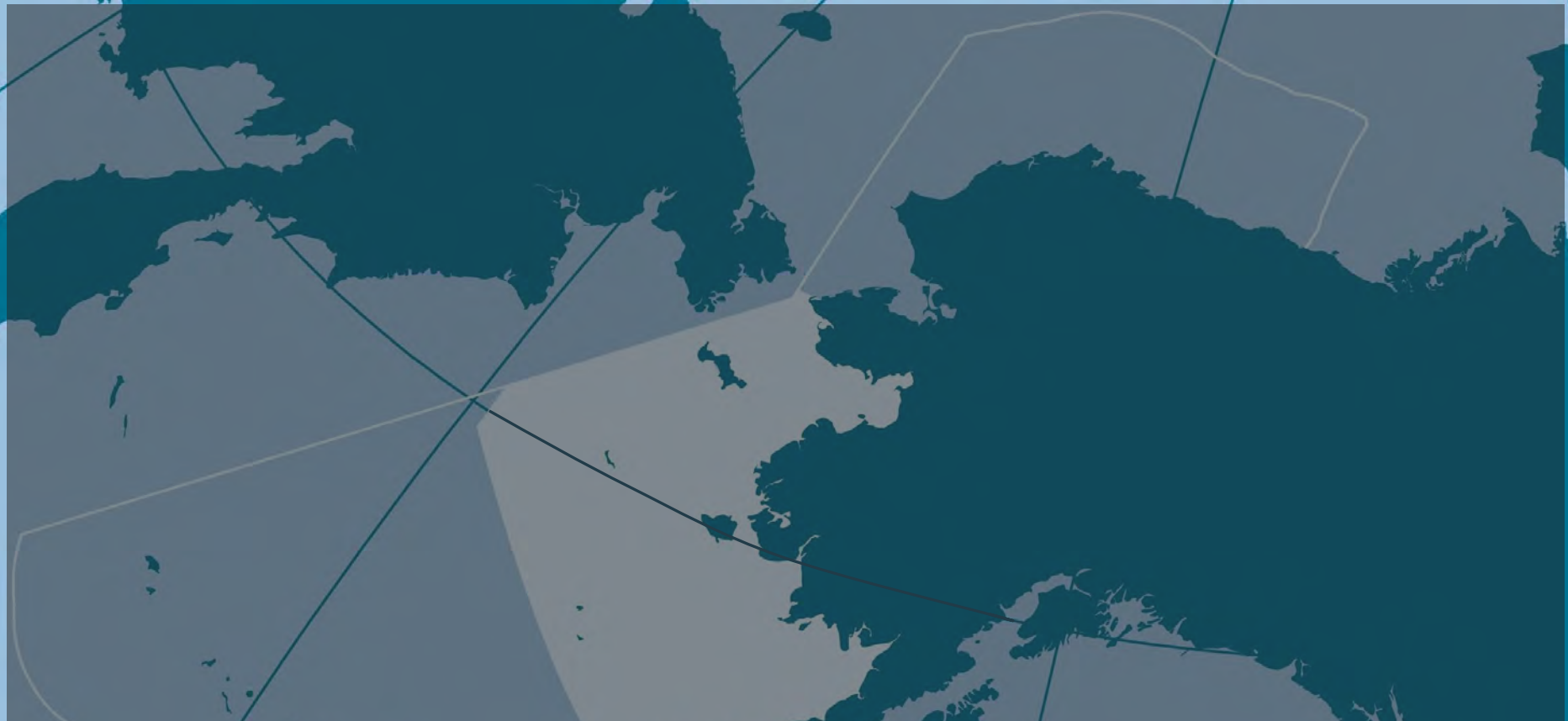
Poor reproductive success for seabirds at Pribilof Islands.

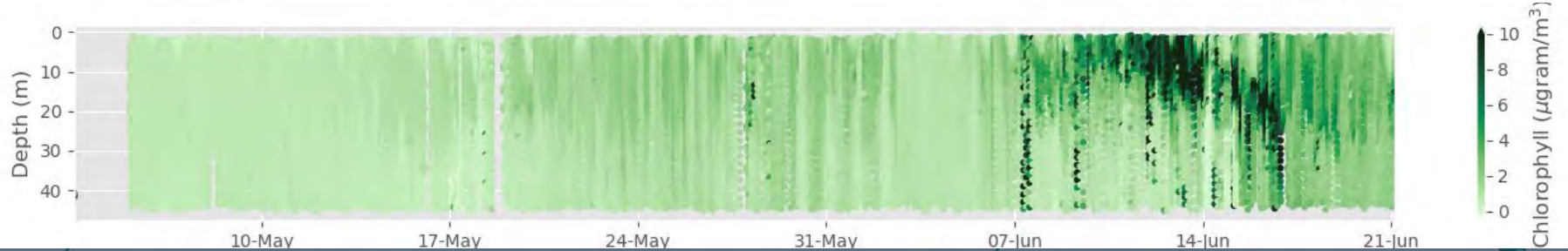
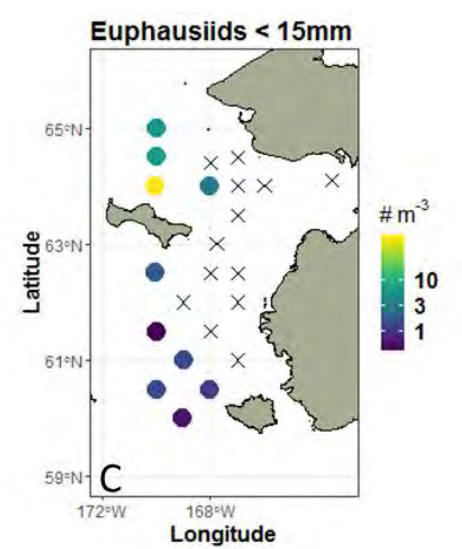
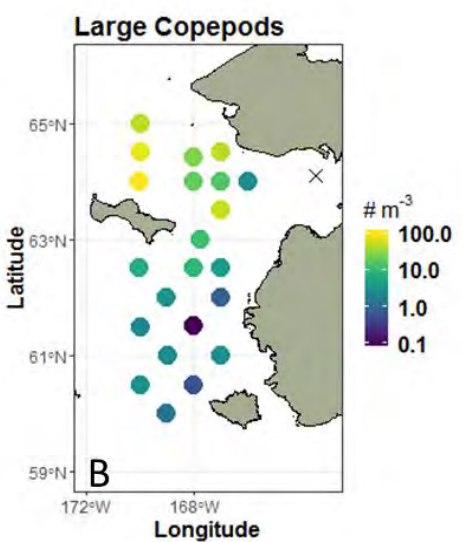
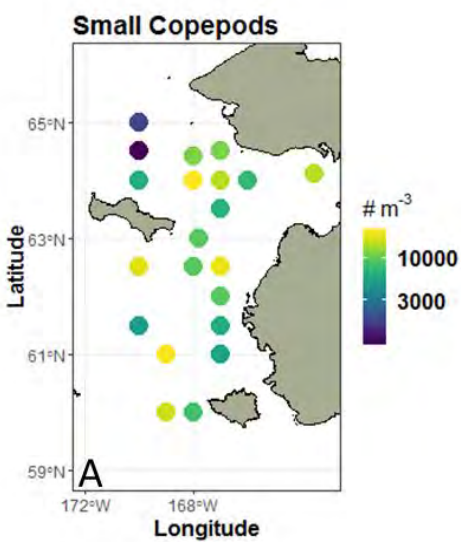
Fur seal pup production down at St. Paul; up at St. George.

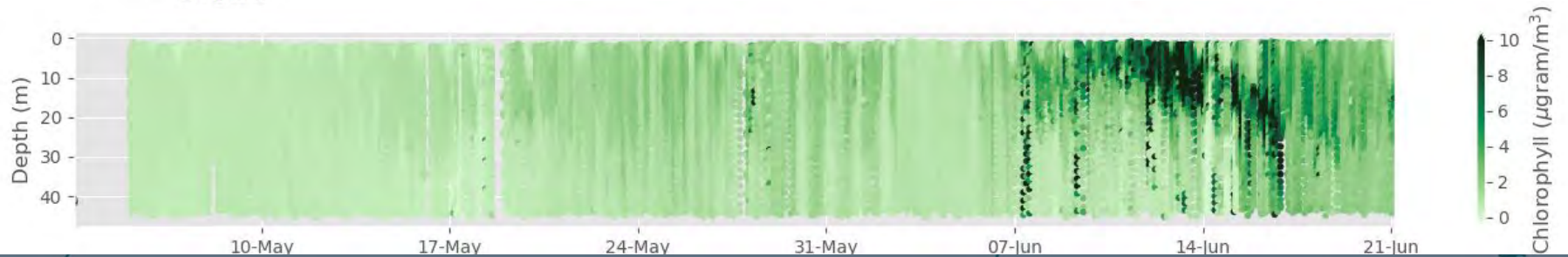
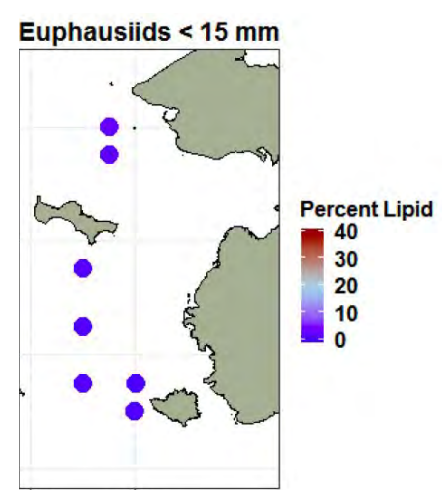
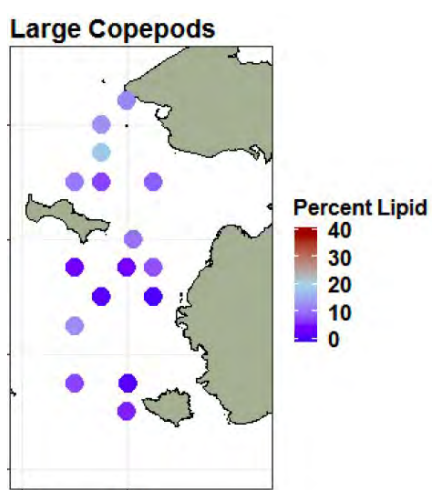
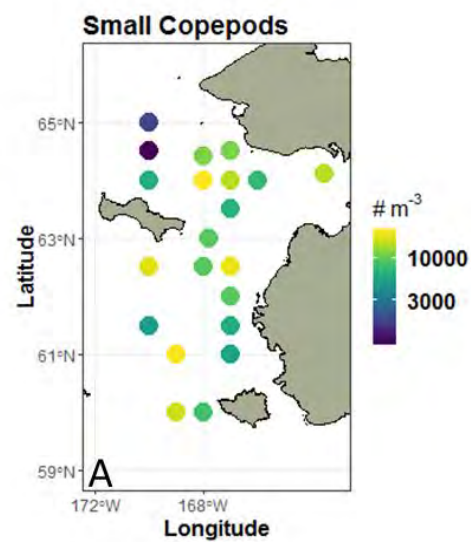
Decrease in RKC, BKC, and Tanner; increase in snow crab

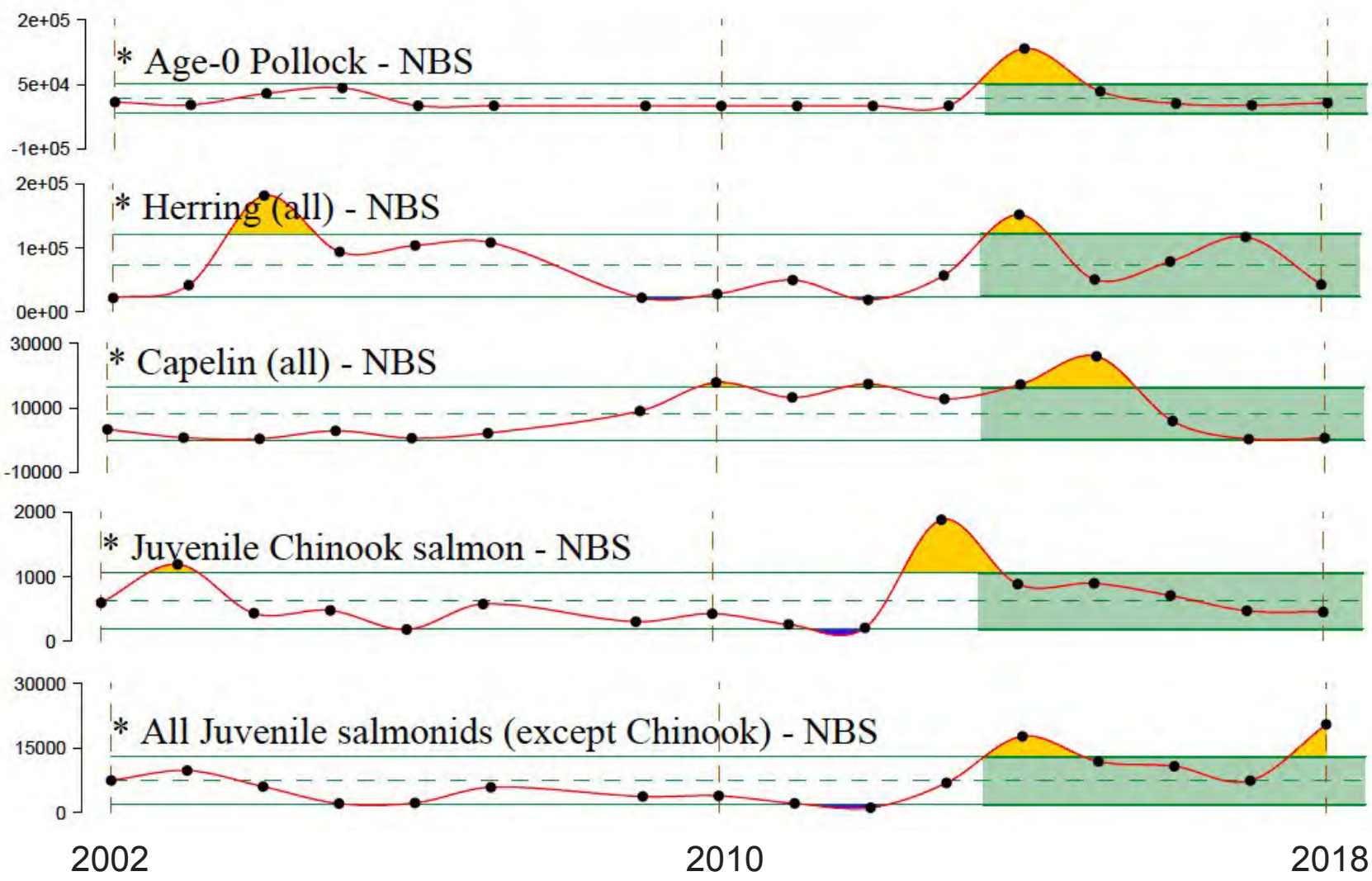
Northern Bering Sea



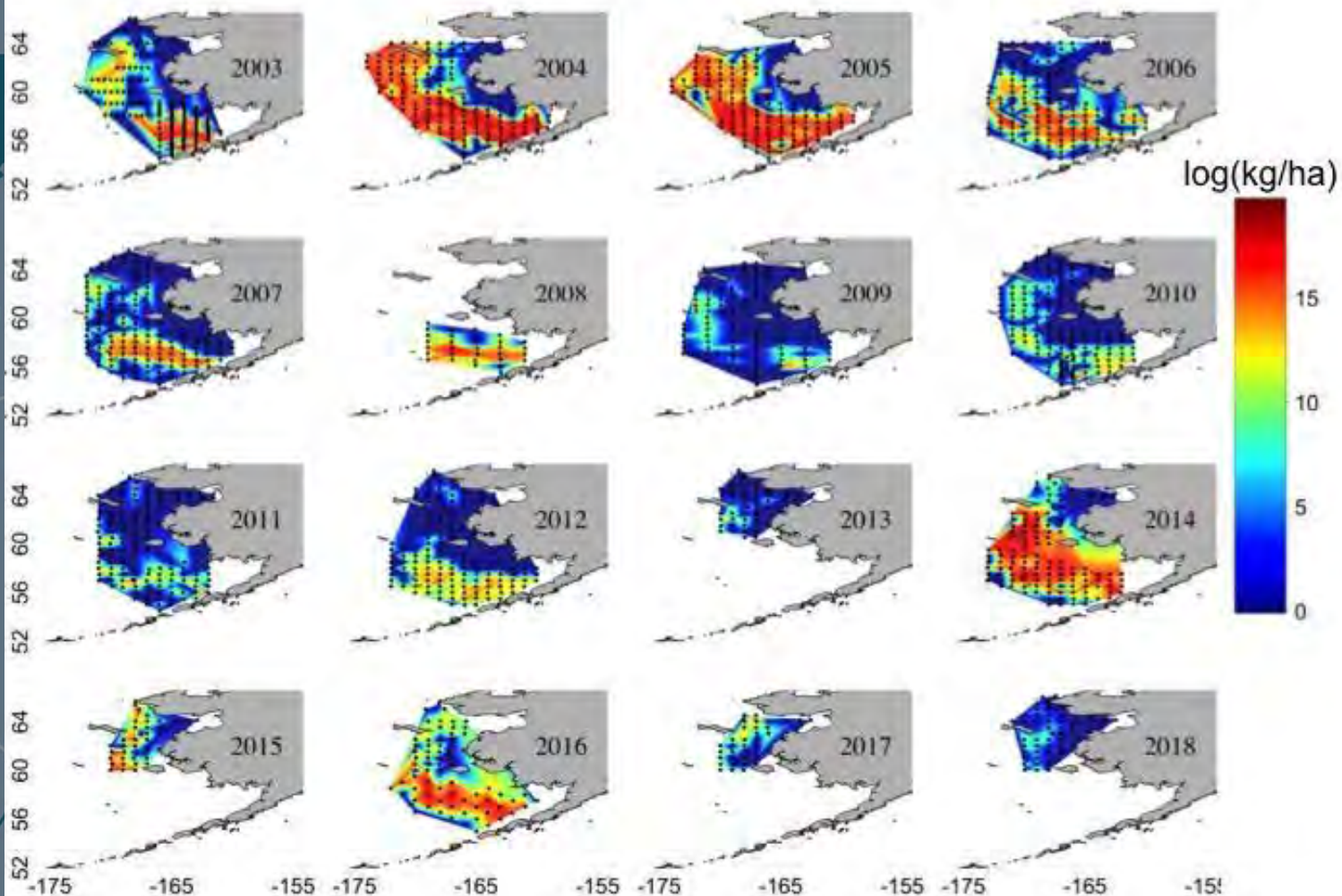


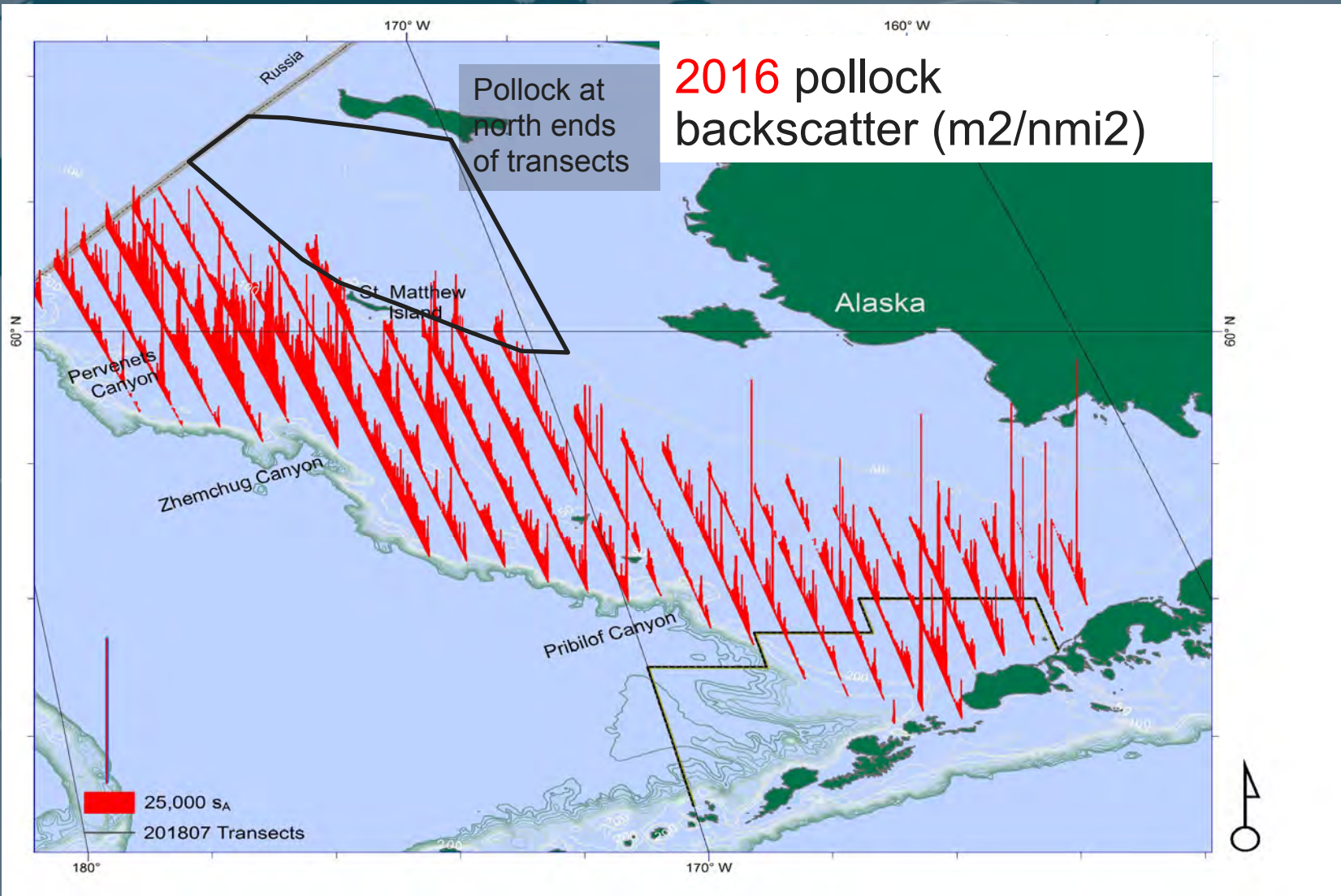




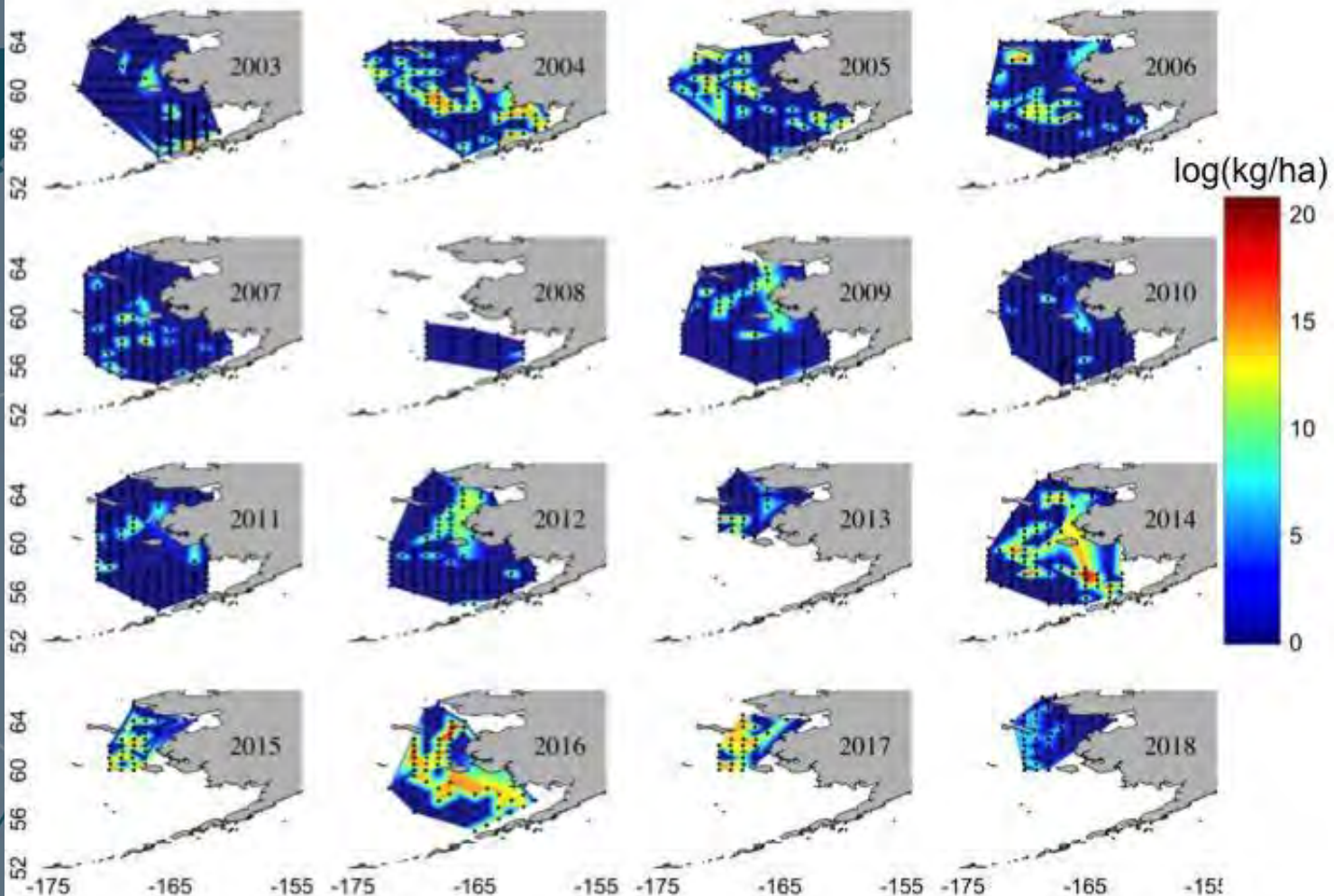


Juvenile (age-0) Pollock

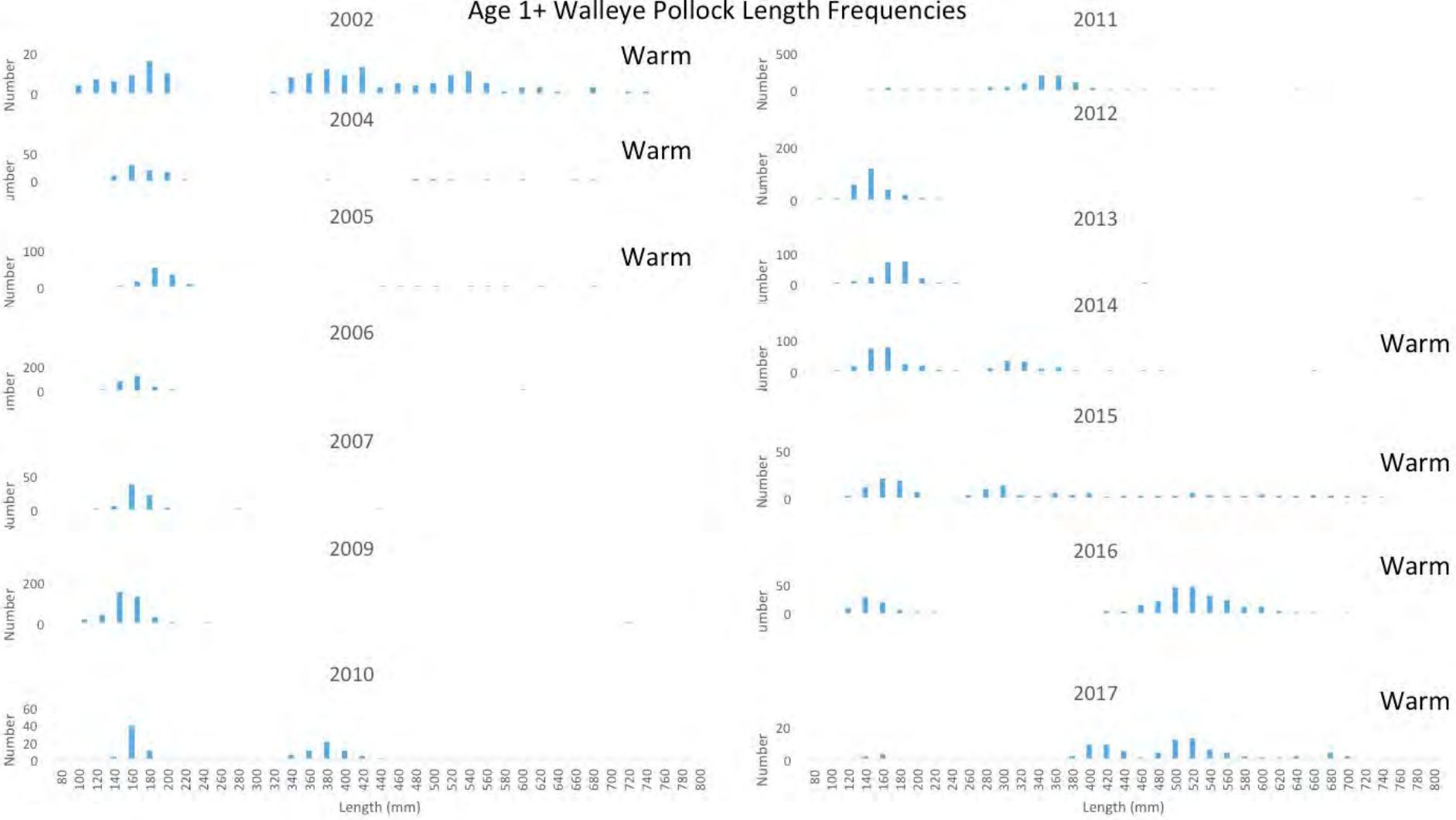


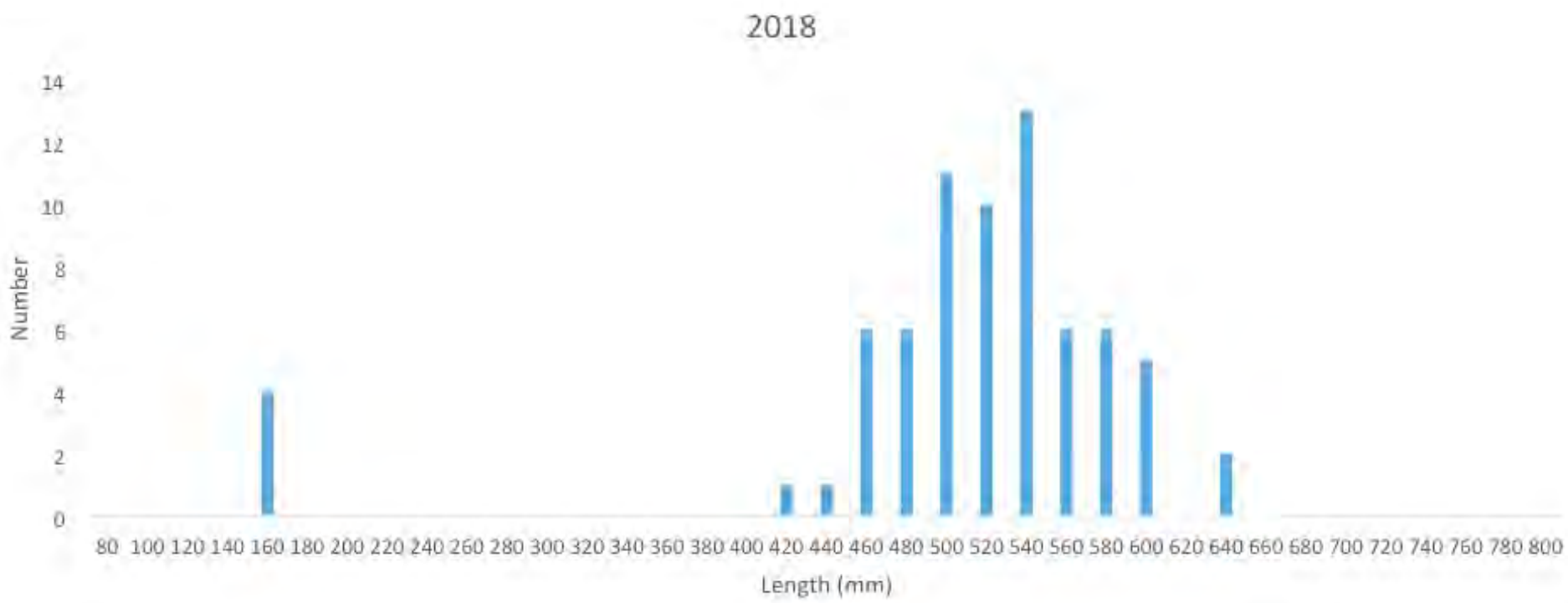


Adult (age-1+) Pollock

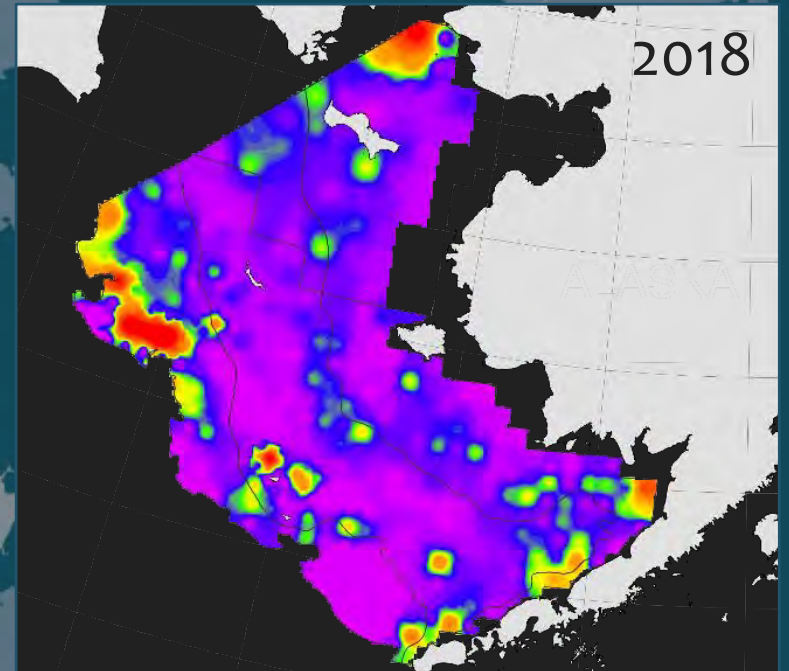
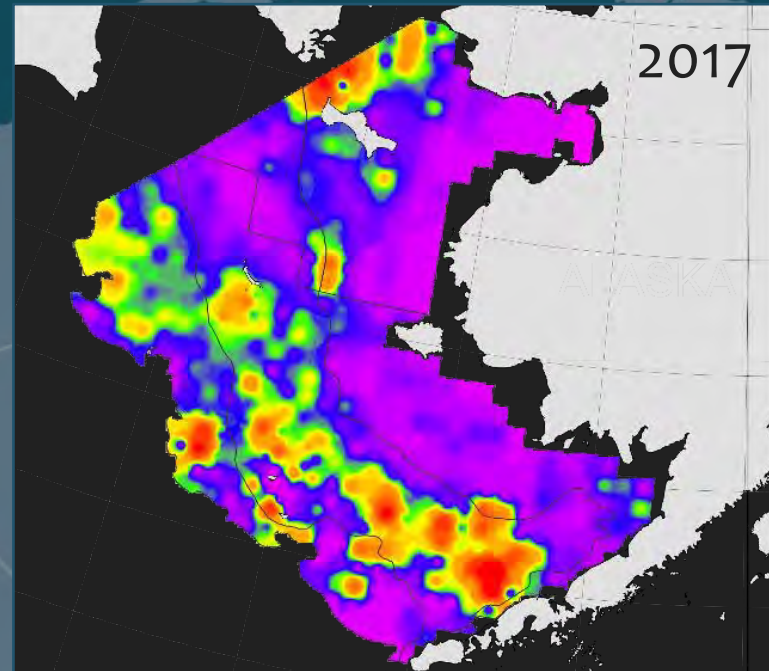


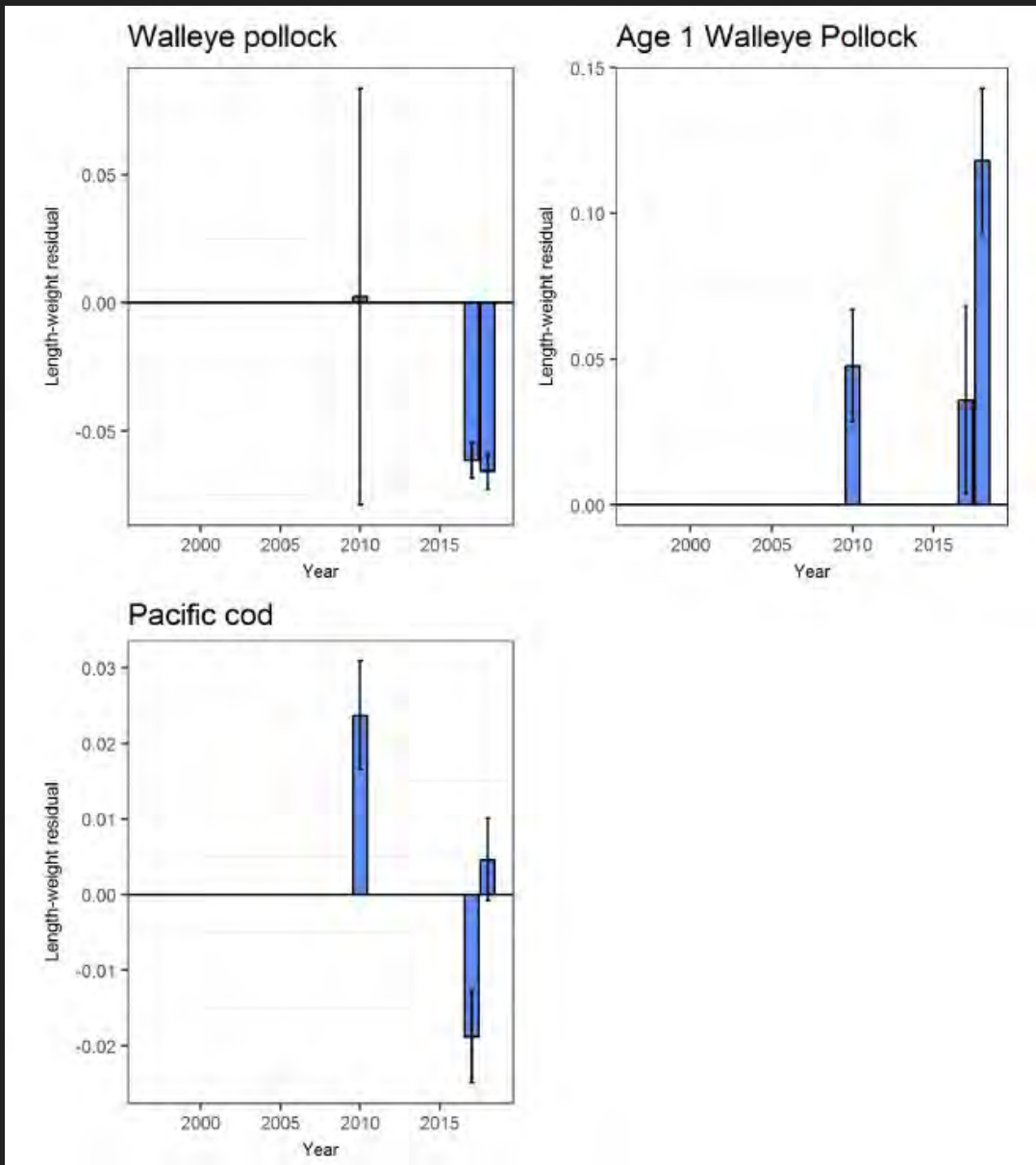
Age 1+ Walleye Pollock Length Frequencies





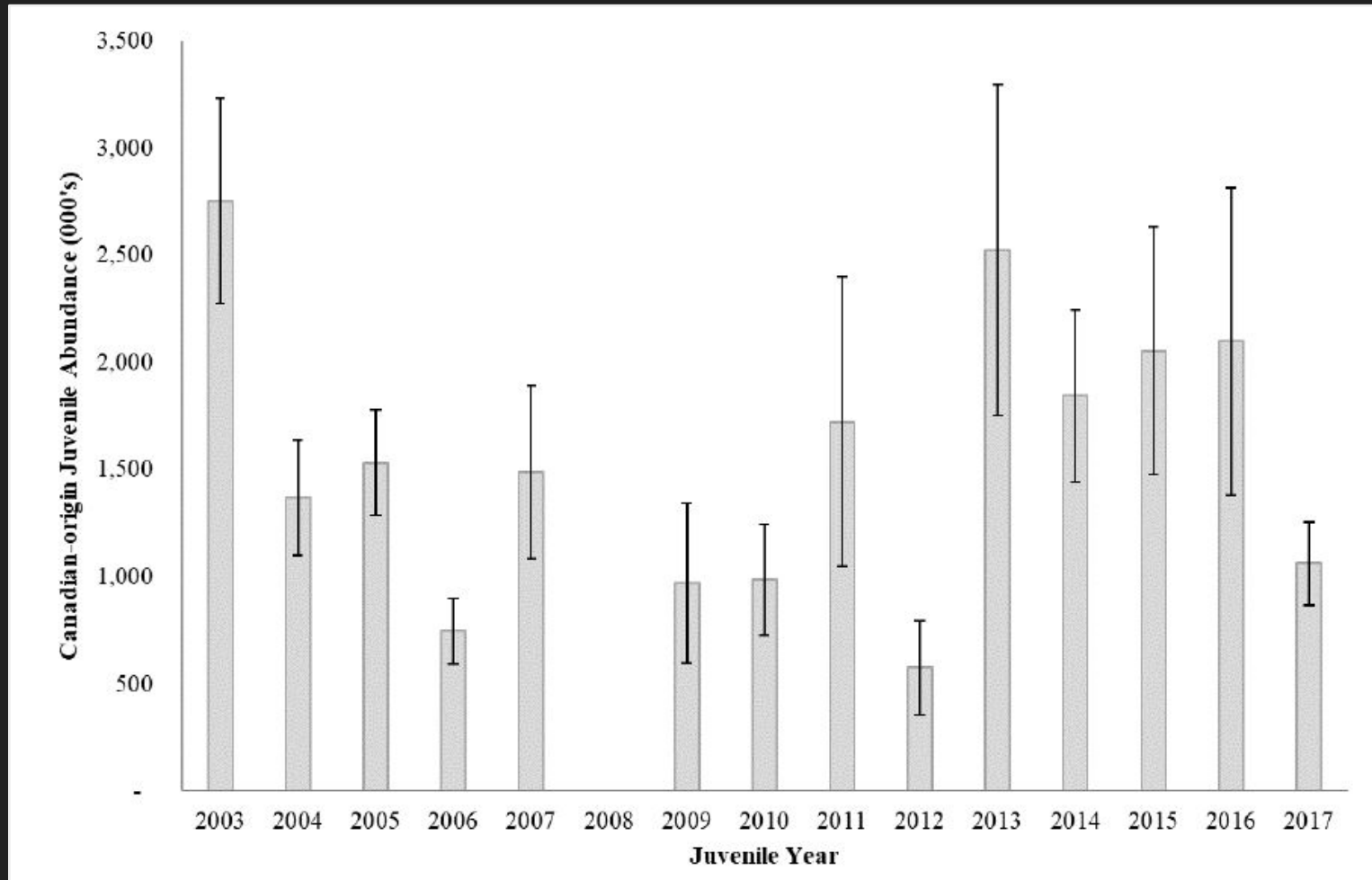
Walleye pollock



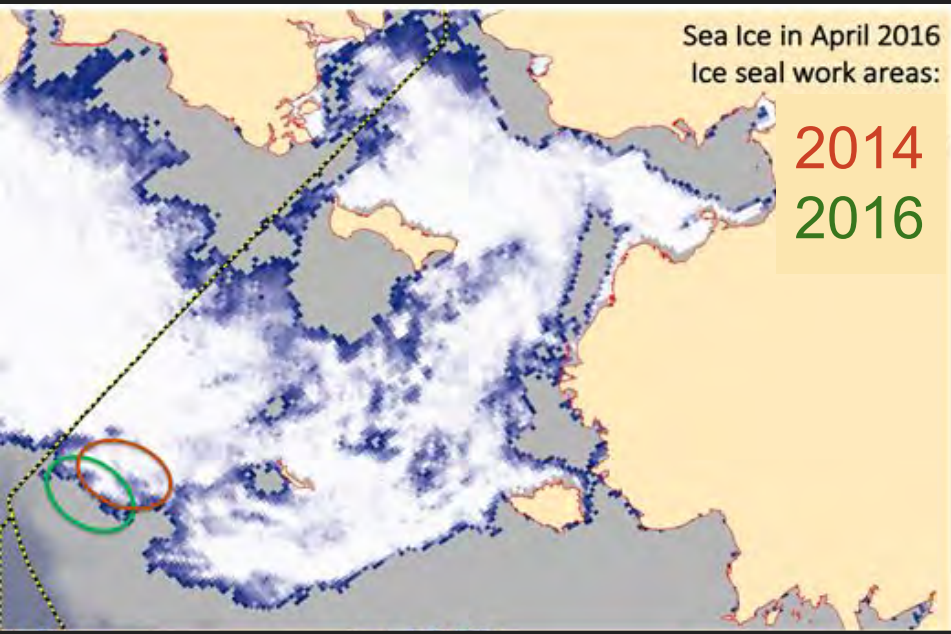


Adult pollock had below average condition, consistent with the rest of the eastern Bering Sea.

Juvenile pollock and Pacific cod had above average condition (relative to the entire Bering Sea population).



- ◆ 2018 juvenile Chinook were among lowest observed since 2003.
- ◆ Below average for 2nd consecutive year.
- ◆ Juvenile abundance has important implications for bycatch caps in pollock fishery.



Sea Ice in April 2016
Ice seal work areas:

2014
2016

Sea Ice in April 2018
Ice seal work areas:

2014
2016

April 2018
cruise track

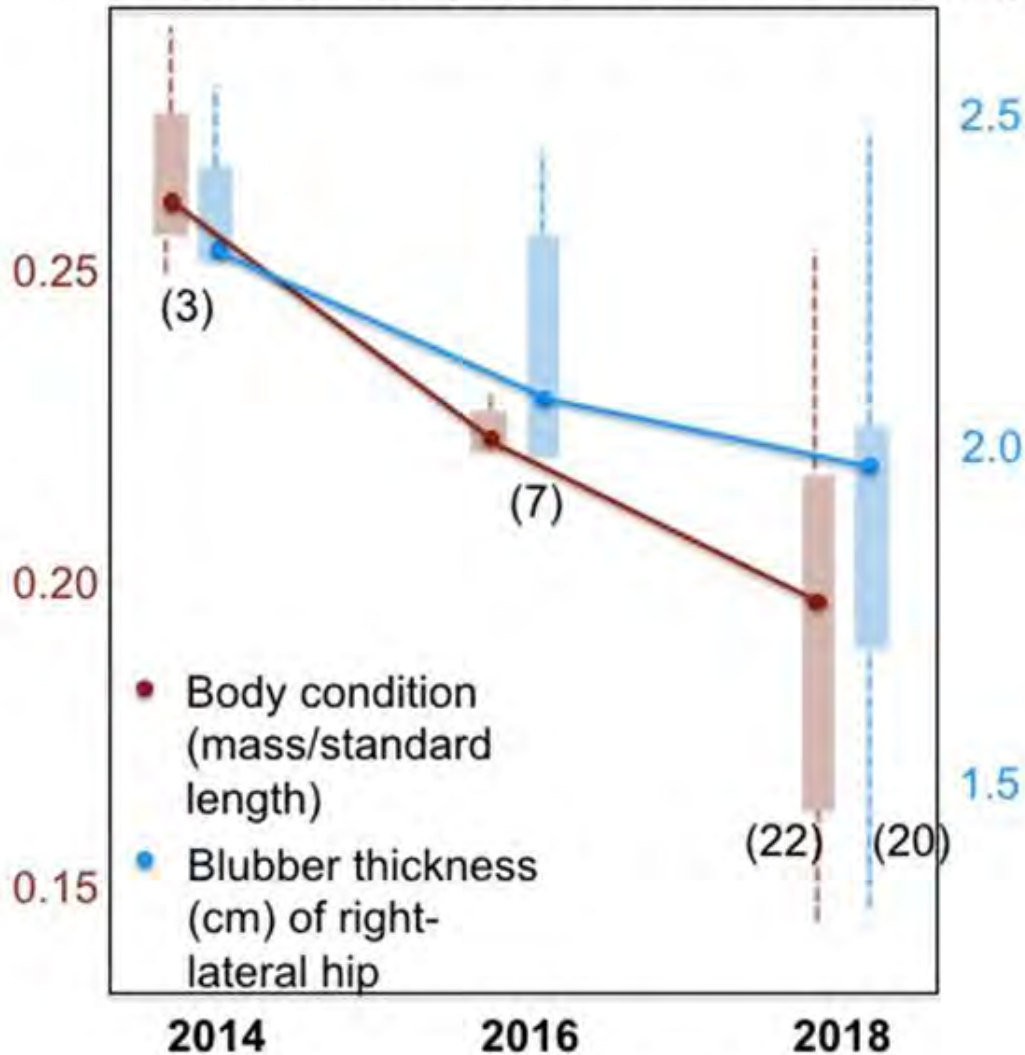
Ice seals scarce.

Pupping areas on ice were displaced north.

Seal strandings reported at Wales and St Lawrence.

In July, exceptionally large numbers of humpbacks north of St. Lawrence.

Spotted seal pups in April and early-May



Preliminary data *suggest* spotted seal pups had poor body condition relative to earlier years.

Seabird breeding success observations 2018 – Alaska Maritime NWR

| Colony | Murres | Kittiwakes | Cormorants | Auklets | Notes |
|-----------------|--------|------------|------------|-------------|-------------------------------------------------------------------------------------------|
| Cape Lisburne | | ? | ? | Not present | Kittiwakes either failed or late (sitting tight) |
| Cape Thompson | | | Few noted | Not present | no chicks observed, only 1 egg |
| Cape Lewis | | | ? | Not present | |
| Puffin/Chamisso | | ? | ? | Not present | Murres observed attending cliffs on Puffin, not Chamisso Poor weather, brief look only |
| Sledge | | | | Not present | 8% of kittiwakes had chicks |
| Bluff | | | | Not present | 10% of kittiwakes had chicks |
| St. Matthew | ? | ? | ? | ? | Red-legged kittiwakes breeding for first time |
| Nunivak | | | ? | Not present | Poor weather, brief look only |
| St. Paul | | | | | Murres initiated very late |
| St. George | | | | | Murres initiated very late |

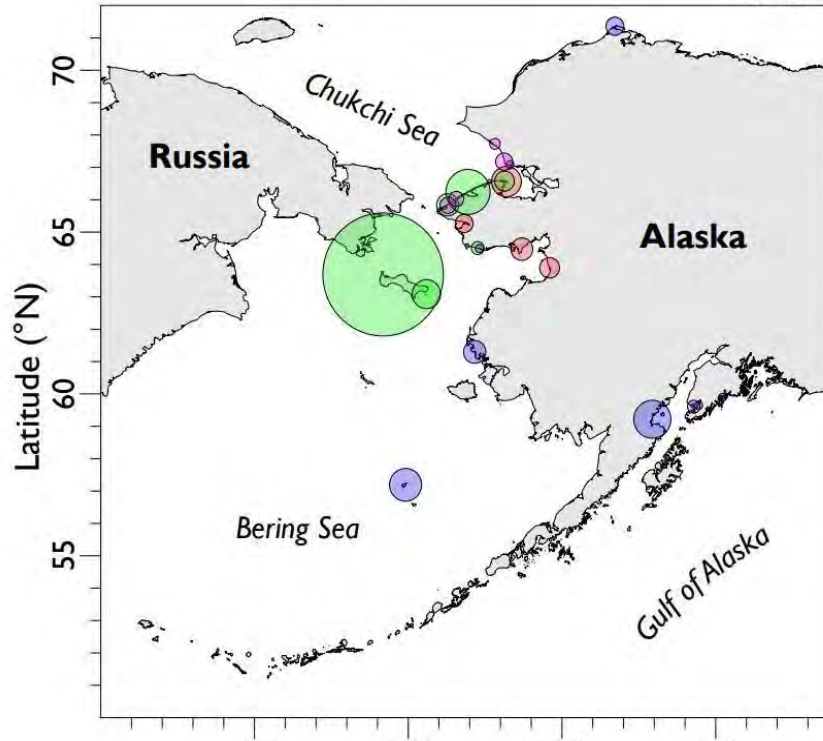
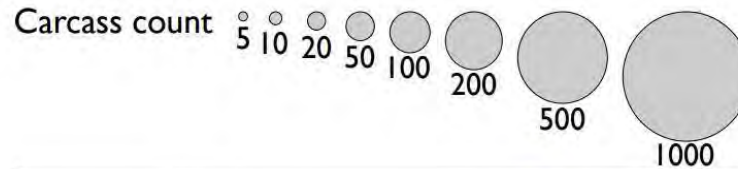
Zero production Low production Average to above average

Seabird breeding success observations 2018 – Alaska Maritime NWR

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Zero production Low production Average to above average

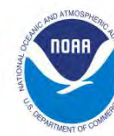
Kuletz, Labunski, Kaler (USFWS); Parrish, Jones, Burgess (COASST)
 Sheffield (UA-Nome); Ahmasuk (Kawerak, Inc.); Schoen (USGS)



Month

- May (N = 133)
 95% TBMU/COMU
- June (N = 1140)
 94% TBMU/COMU
 1% BLKI
- July (N = 206)
 11% TBMU/COMU
 30% STSH
 19% NOFU
 29% FTSP
- August (N = 67)
 28% BLKI
 28% STSH
 10% NOFU
 10% TBMU/COMU

Contributing Partners:



Large Pacific cod were caught in crab pots.

Unusual occurrence of king salmon caught on rods from the beach.

Record returns of pink and silver salmon; came in strong and early.

Halibut fishing off Savoonga was “really great”.

Subsistence hunters for auklet fledglings struggled to find live birds.

An Elder on St. Lawrence Island: “when there is no dirty ice, there is less food for the krill, and consequently, no food for the birds”.

Dead and emaciated murre, shearwaters, and crested auklets in Nome and on St. Lawrence Island.

SUMMARY

Lack of sea ice (unprecedented).

Weak stratification.

Well-mixed water column.

Zooplankton abundance increased with latitude, but overall low.

Large copepods dominated by *Eucalanus bungii* (not lipid-rich).

Juvenile forage fish abundance low.

Adult pollock biomass decreased from 2017, condition low.

Juvenile Chinook preliminary abundance estimate low; bycatch implications.

Ice seals scarce; pup condition poor.

Seabird reproductive failures and die-off event (unprecedented).

IMPLICATIONS

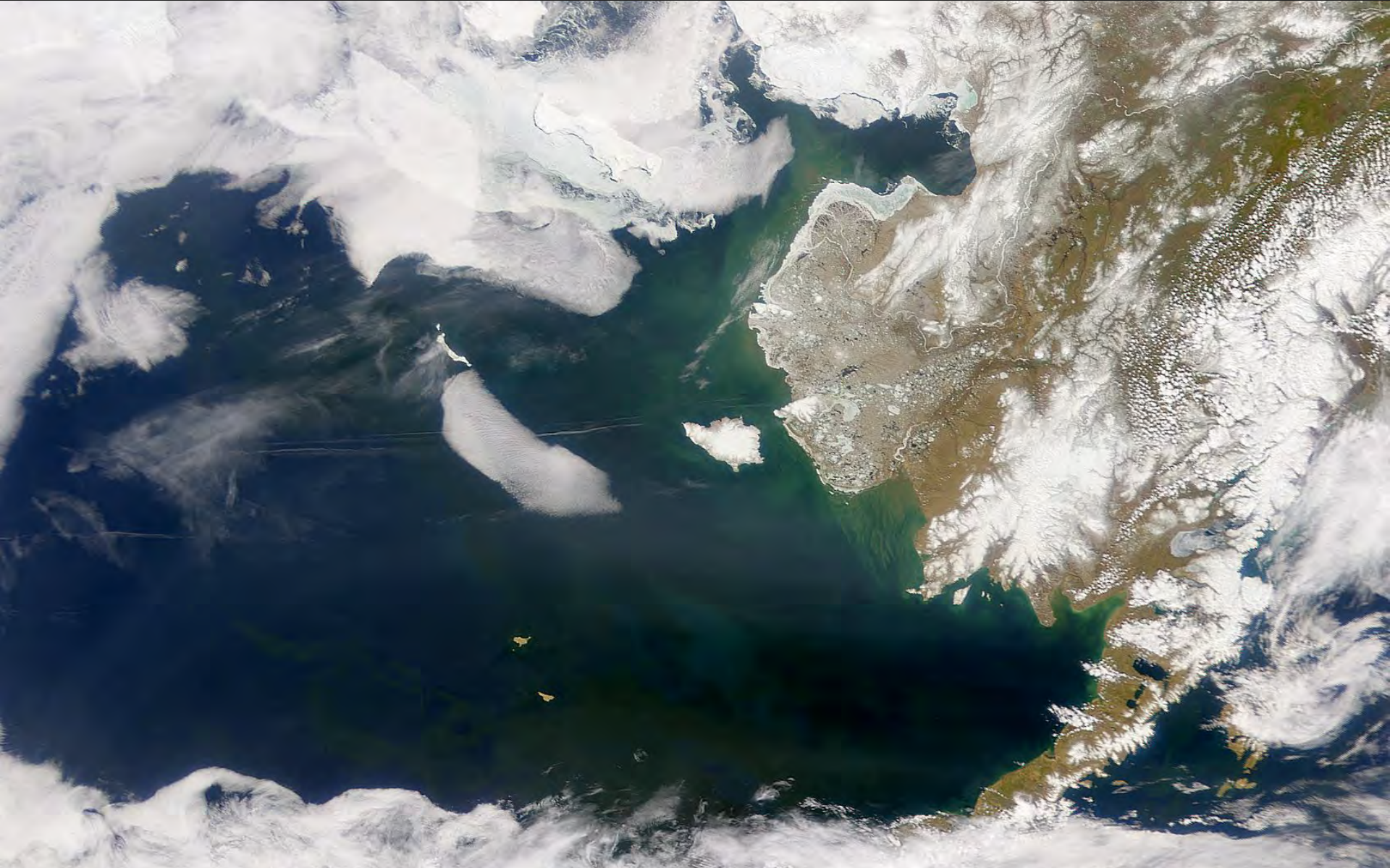
Did fish overwinter in the northern Bering Sea last winter (2017/18)?

- If so, what impact did they have on prey resources?
- Did their presence shift the food web balance?

Ecosystem indicators suggest poor productivity and lack of a sufficient prey base.

Will fish overwinter in the northern Bering Sea this winter (2018/19)?

Eastern Bering Sea



Stock Differences in Pacific Herring



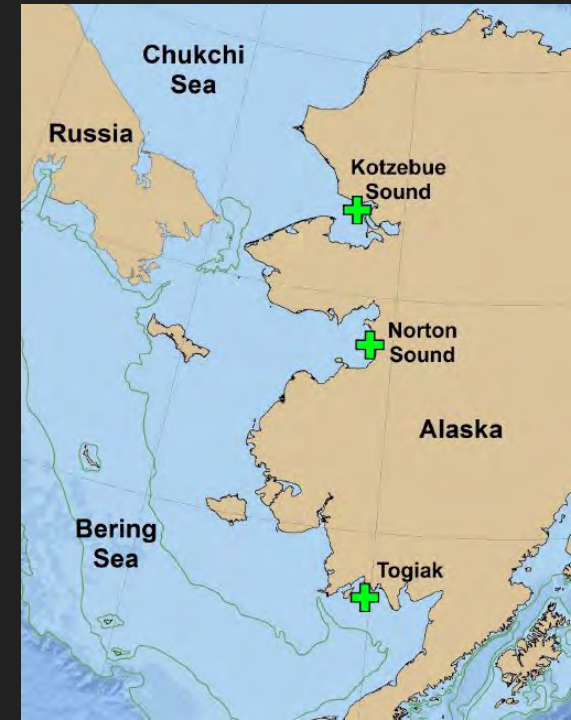
Alex Whiting
Native Village of Kotzebue

Largest spawning biomass is from Togiak, but largest sampled biomass is from the NBS (BASIS).

Is the NBS (i.e., Norton Sound) an important nursery area for EBS herring populations?

Togiak and Norton Sound were genetically similar; both differ from Kotzebue.

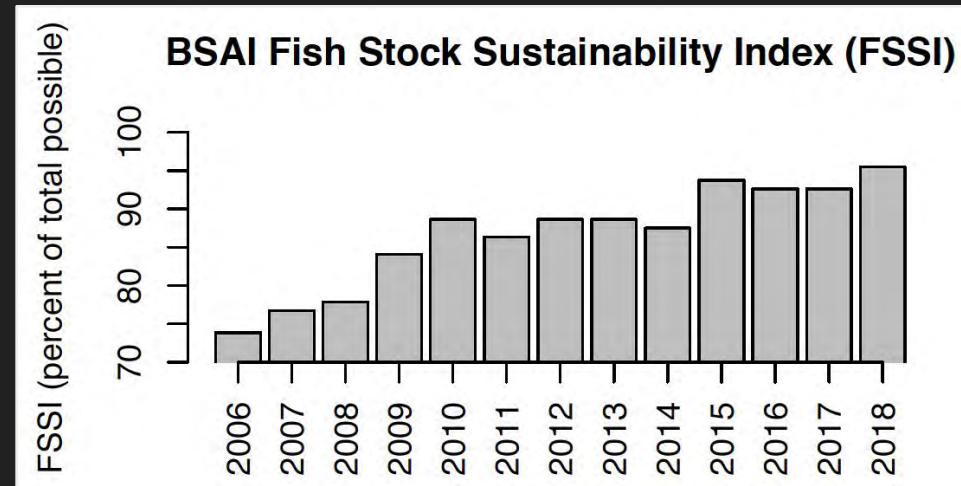
Isotopic results and otolith analyses underway.



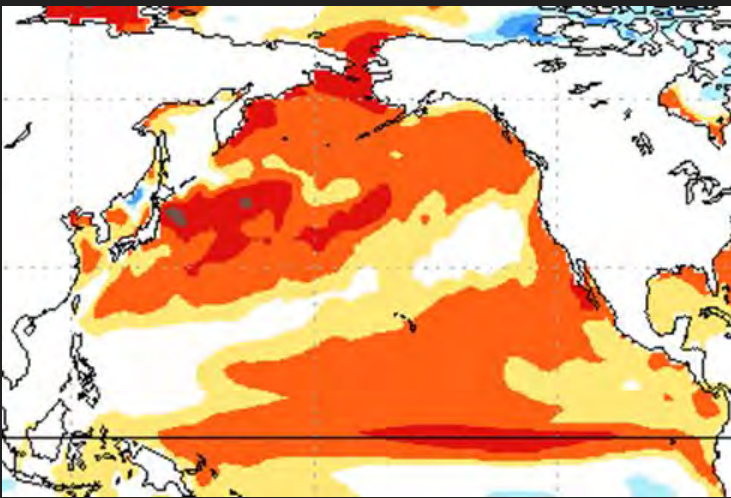
No groundfish stock/complex is subjected to overfishing, considered overfished, or approaching an overfished condition.

Pribilof Islands BKC considered overfished, but not subject to overfishing. In year 4 of rebuilding plan.

St. Matthew BKC...



Oct - Dec 2018



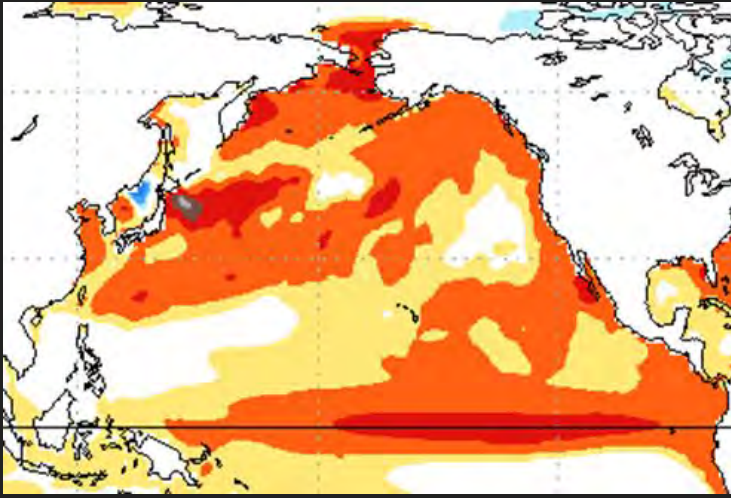
Warm conditions across the North Pacific through December.

Positive anomalies ($>1^{\circ}\text{C}$) greatest in NBS.

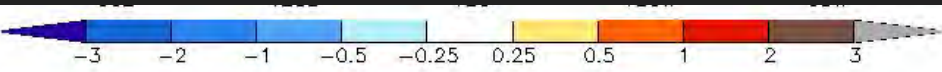
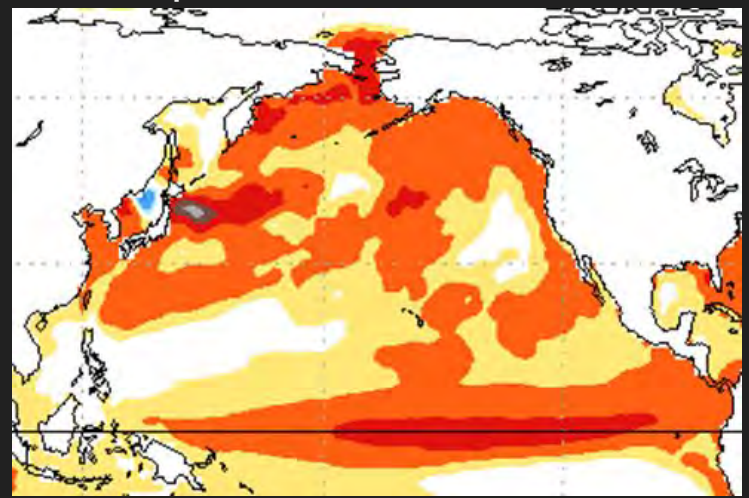
ALPS deeper than normal in late winter of 2018/19 = warm weather for Alaska enhanced by warm waters.

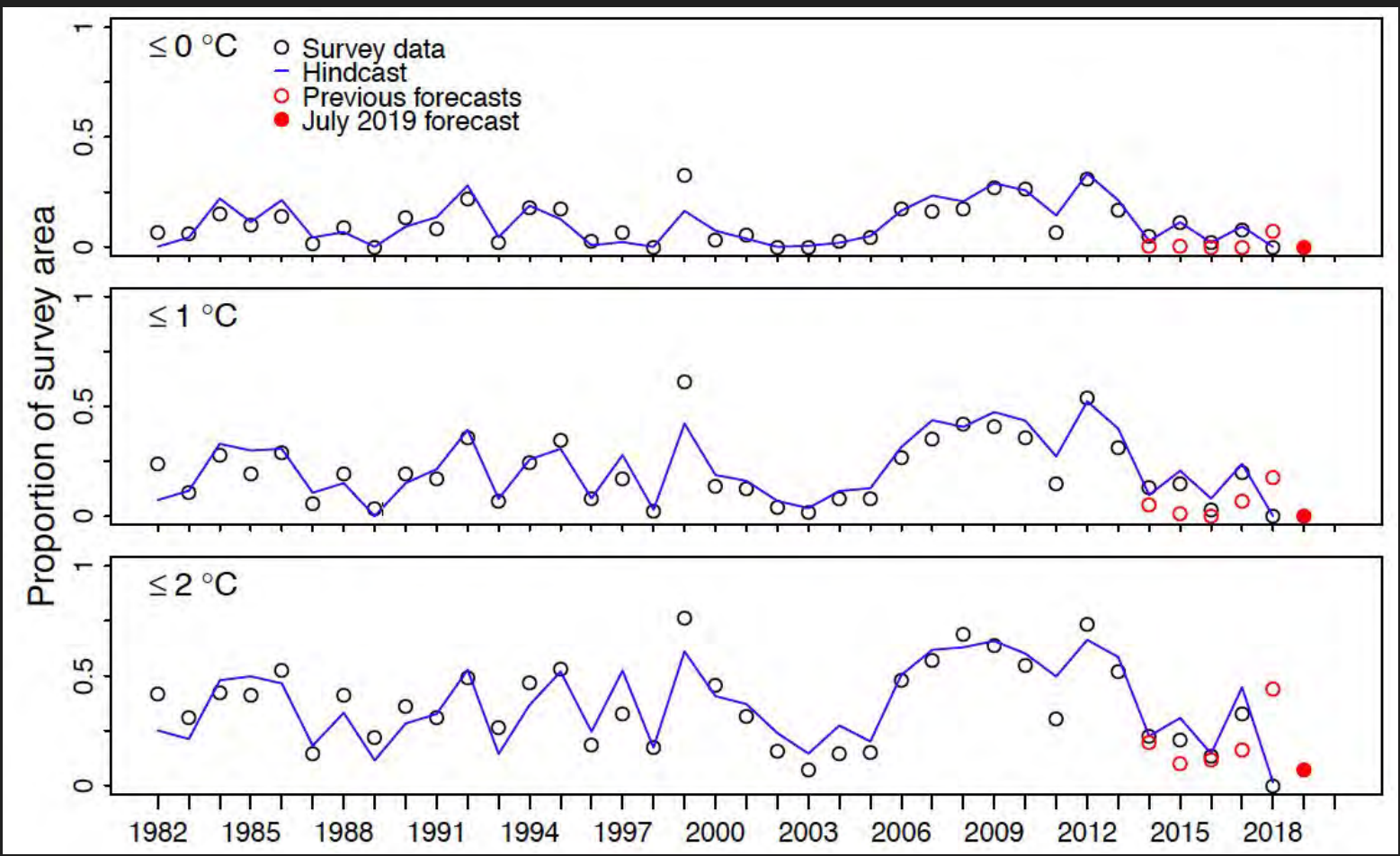
No typical PDO pattern in North Pacific (warm everywhere).

Dec 2018 - Feb 2019



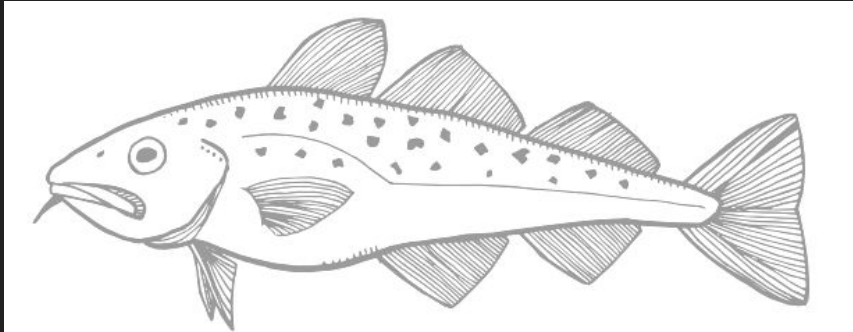
Feb - April 2019





The predictions for summer 2019 are for continued warm conditions substantially similar to 2014 - 2018.

Forecasts and Predictions



Pacific cod

Probability of the **2016** year class being above average is 56% (but the associated error is largest in the time series.)

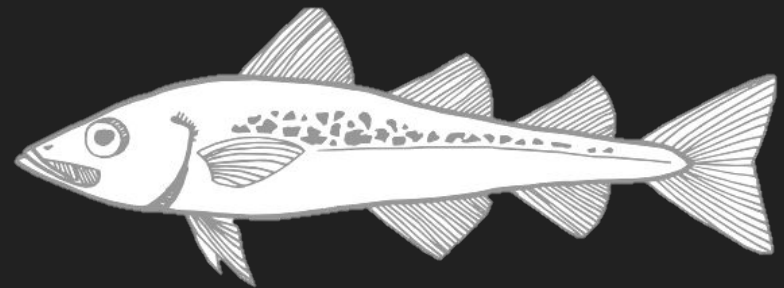
Walleye pollock

2016 year class appears below average.

- Temp change index ✓
- Large copepod abundance ✓
- Energy density ≈

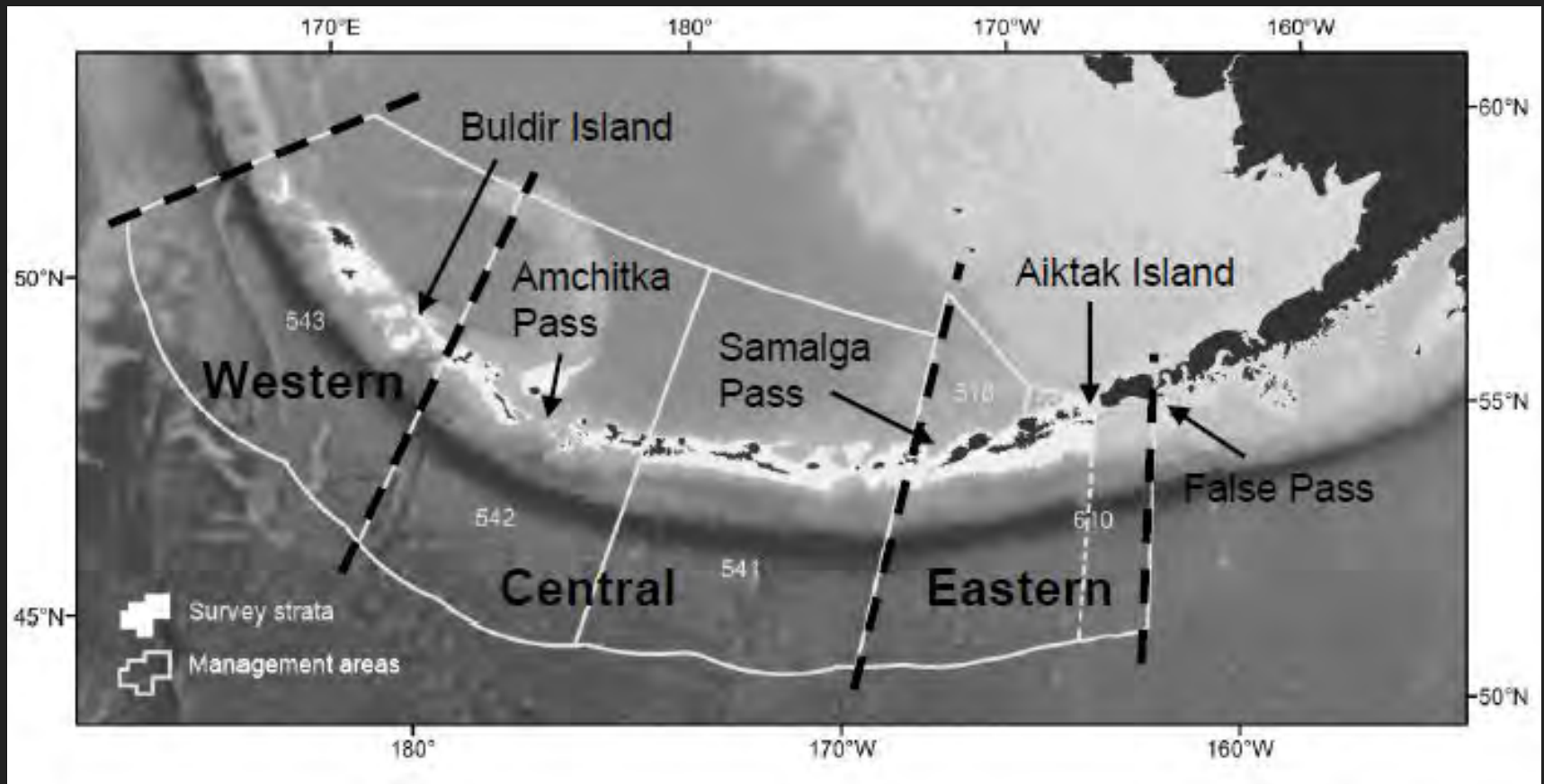
2017 year class

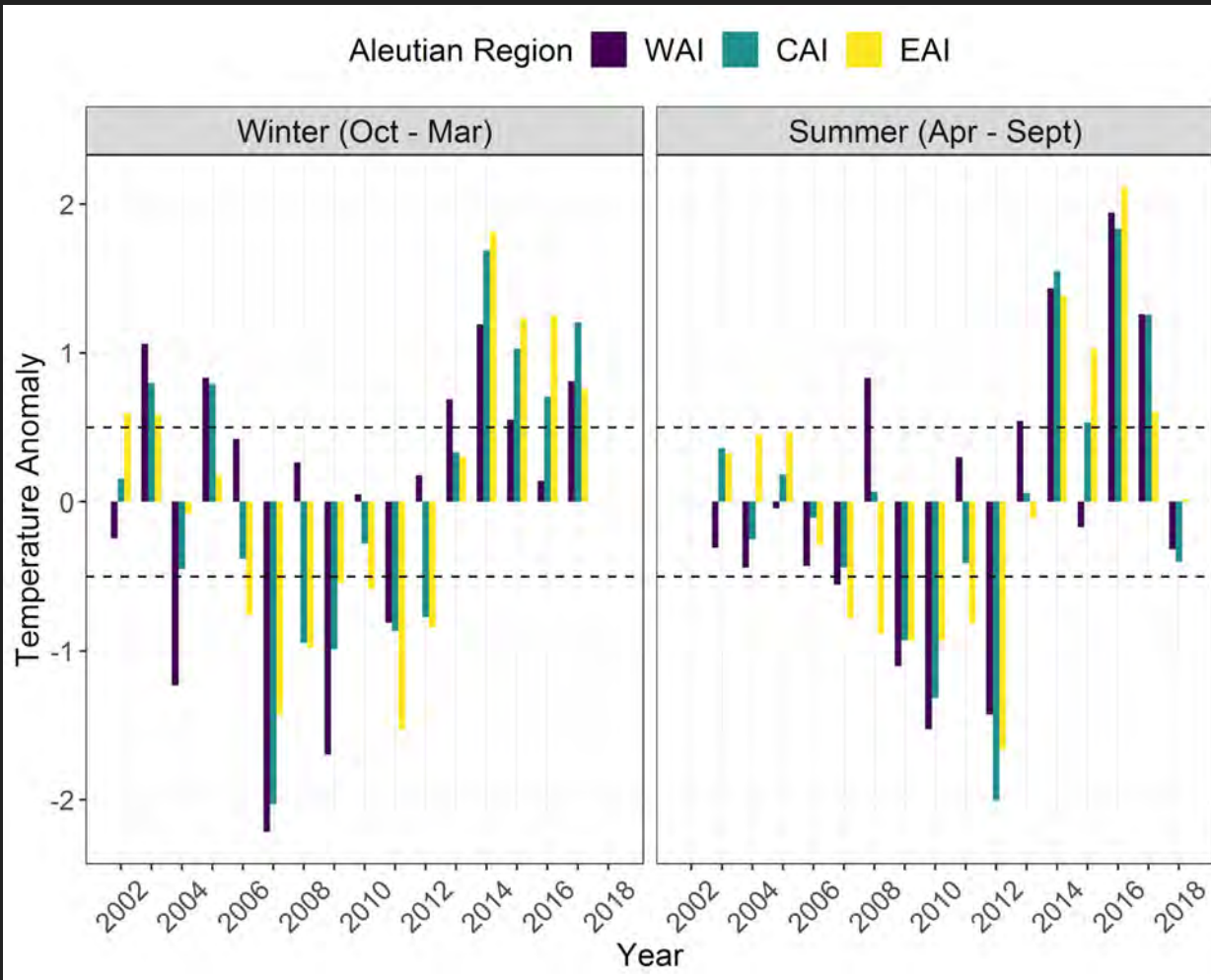
- Temp change index ≈
- Energy density ≈



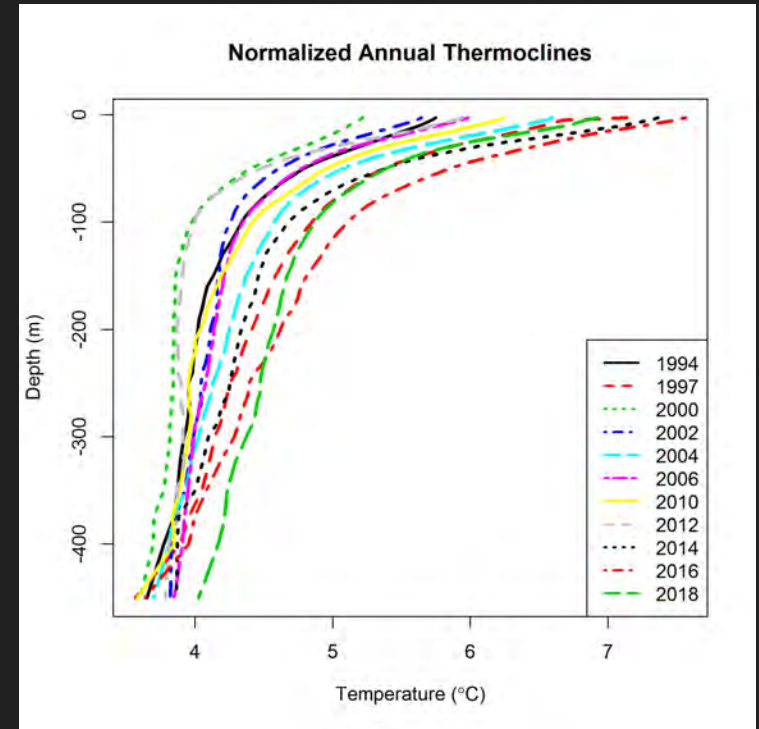
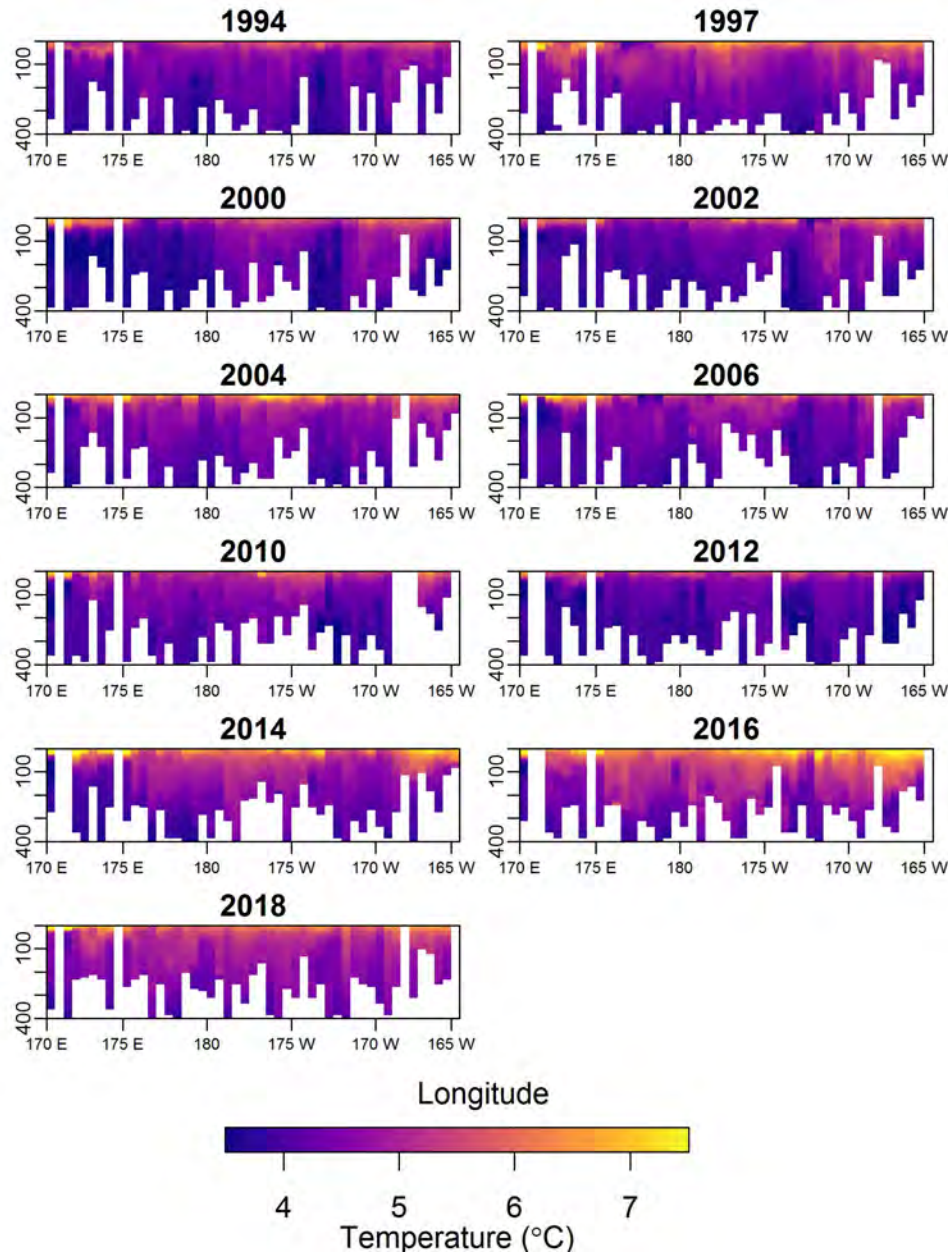


Aleutian Islands Ecoregions

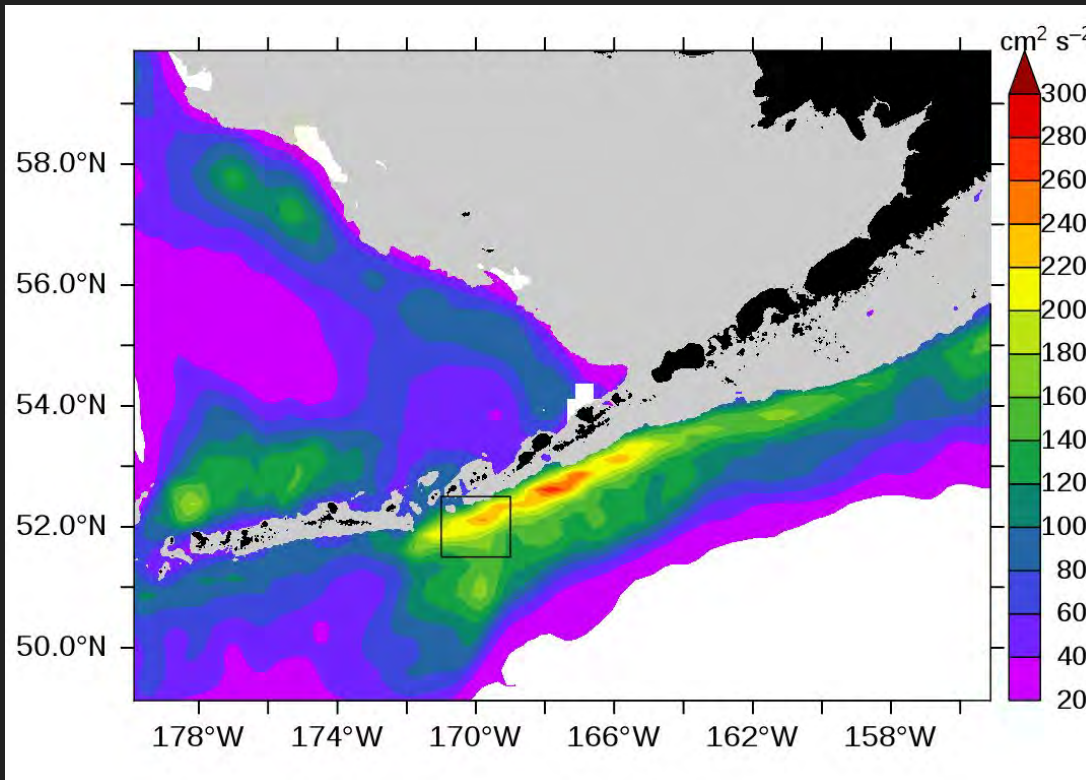




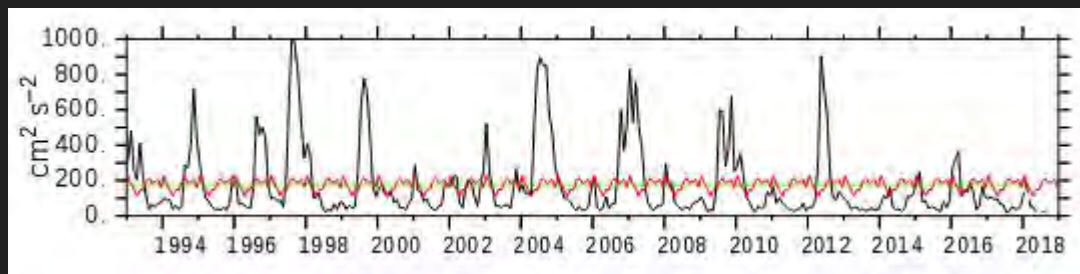
- Warm from 2013–2017
- Cooled to normal during summer 2018
- Western AI mostly likely to diverge from Central and Eastern

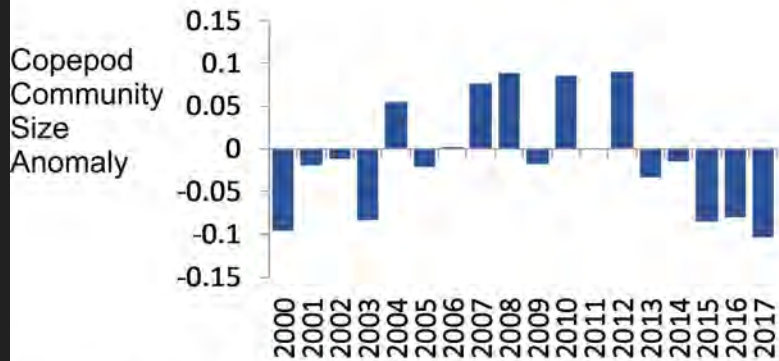
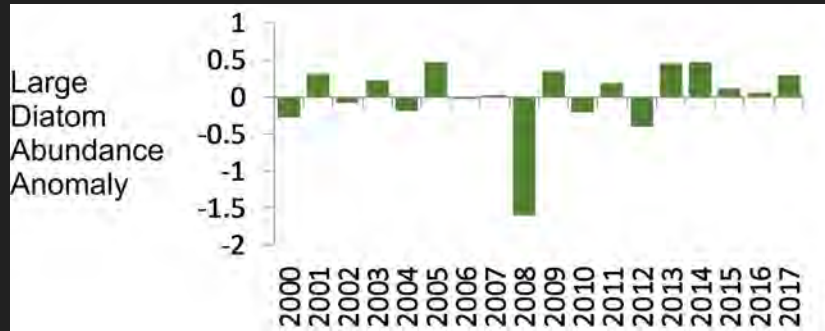
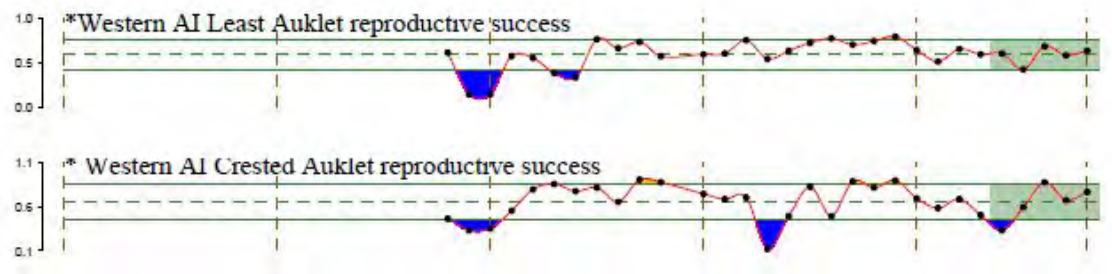


- Surface temperatures cooled relative to 2016
- Warmth remained at depth

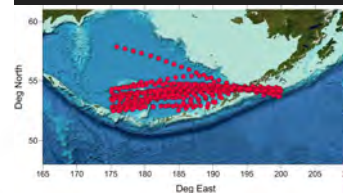


- Eddy kinetic energy at Amutka Pass has been low since 2013
- Diffuse Alaska Stream in 2018

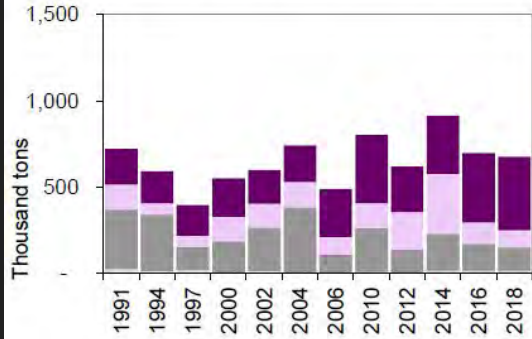




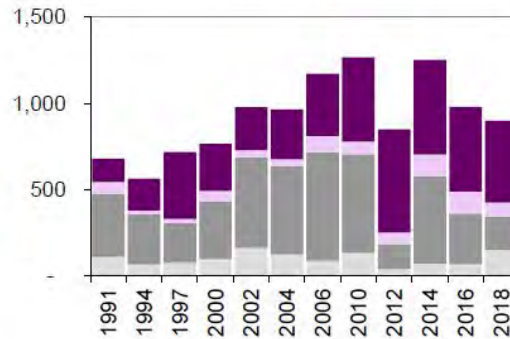
- Auklet reproductive success mostly good during warm years = sufficient zooplankton to raise chicks
- Zoops sampled by Continuous Plankton Recorder, mostly north of AI
- Copepod taxa have been small 2013–2017
- Biomass average to above-average 2015–2017



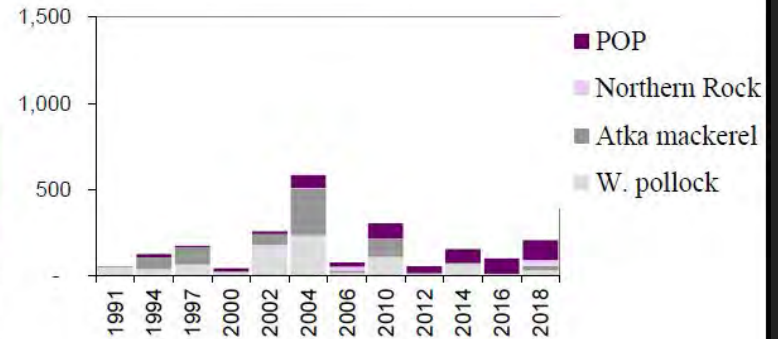
Pelagic Foragers: Western AI



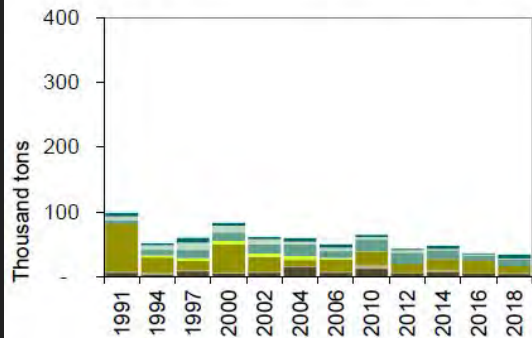
Central AI



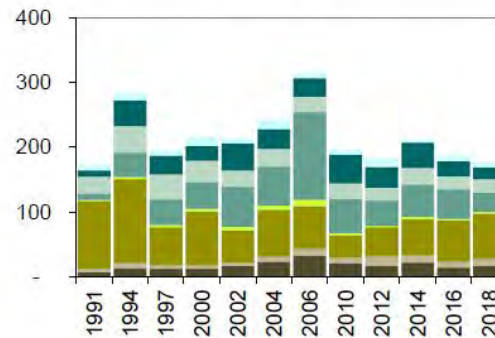
Eastern AI



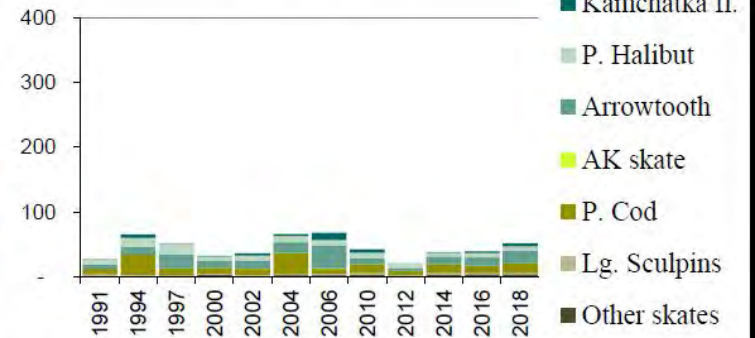
Apex Predators: Western AI



Central AI

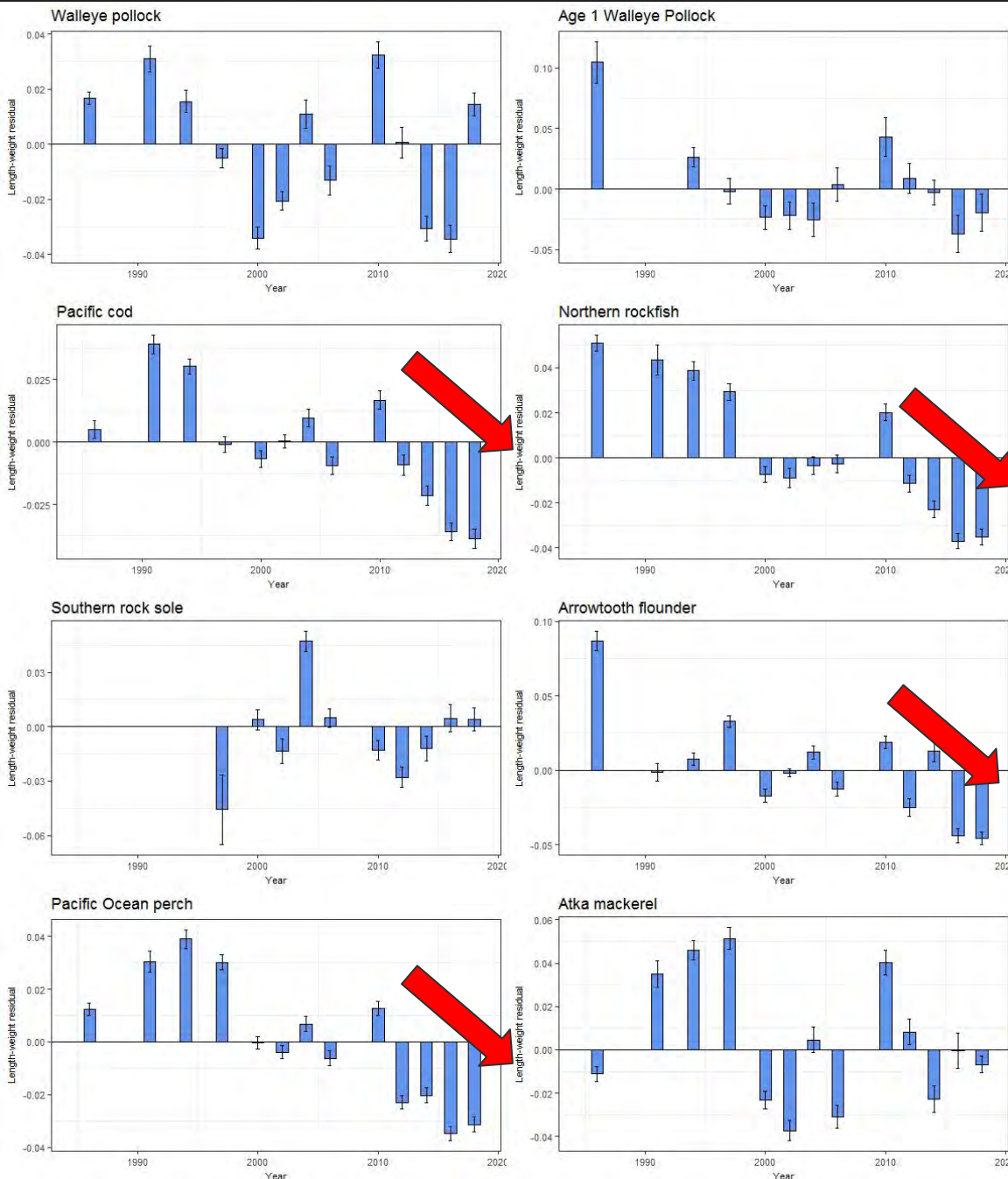


Eastern AI



Groundfish Condition

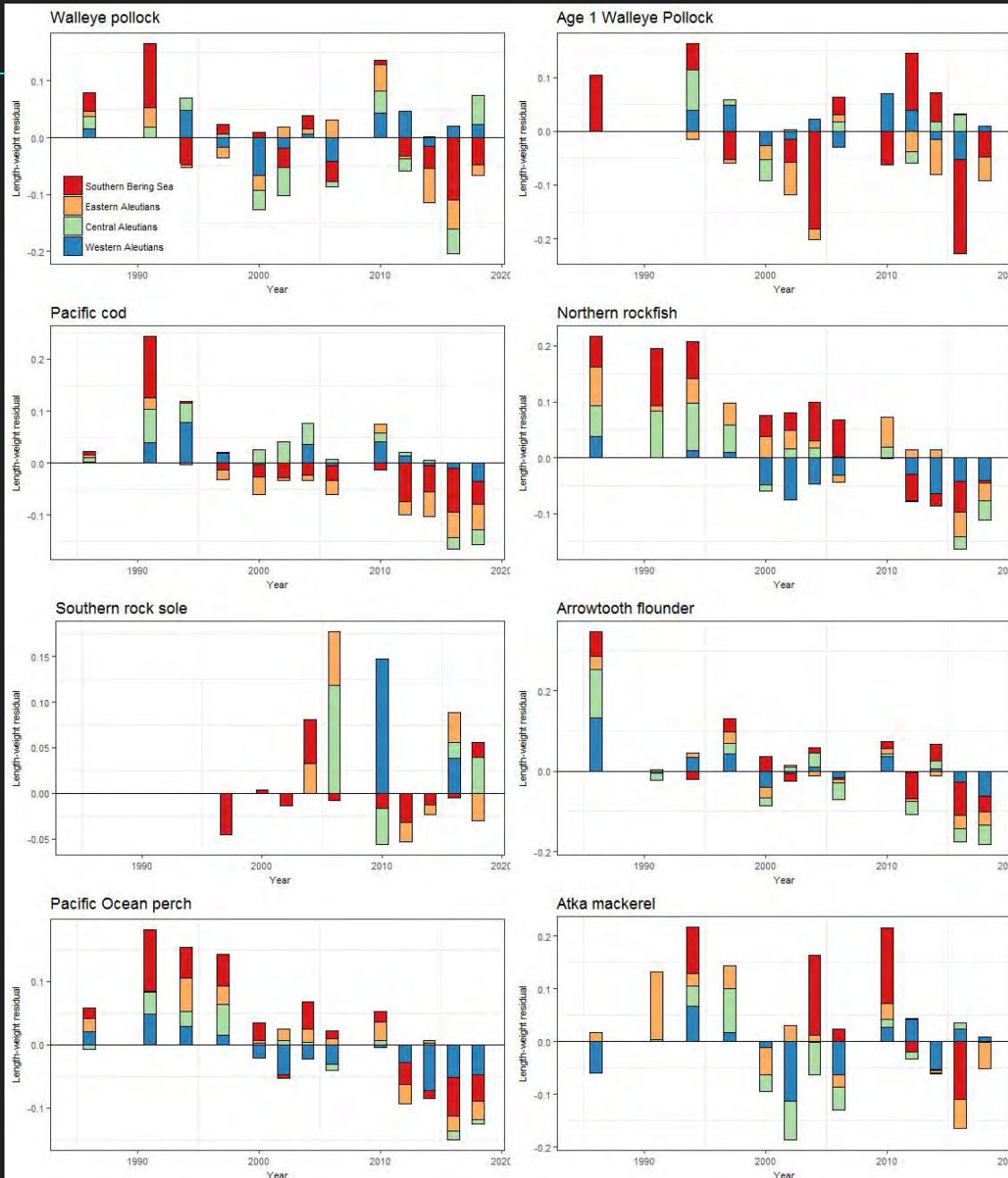
Rooper, Boldt et al



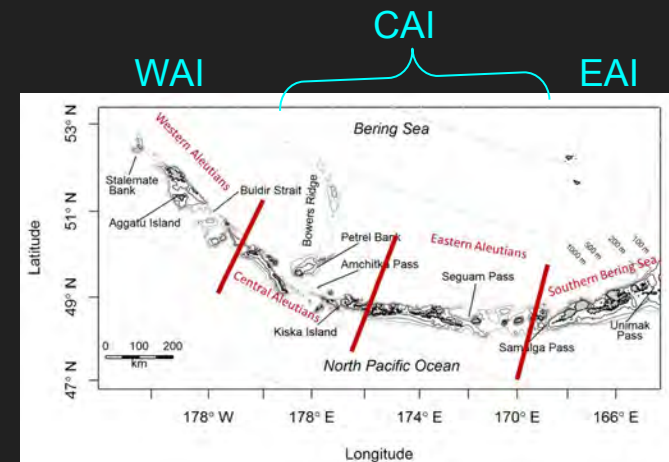
- Weight-length residuals across the AI
- Continued overall negative conditions indicators since 2010
- Cod, northern rockfish, ATF, POP strongly negative in 2018
- Atka slightly negative across AT

Groundfish Condition

Rooper, Boldt et al



- Weight-length residuals by management unit
- Atka slightly positive in the Western ecoregion, but
- Atka “skinny” in eastern part of the Central ecoregion (“eastern AI”)



Alaska Maritime National Wildlife Refuge

2018 Seabird Report Card



| Region | Annual monitoring site | Red-faced cormorants | Glaucous-winged gulls | Common murre | Thick-billed murre | Horned puffin | Tufted puffin | Red-legged kittiwakes | Black-legged kittiwakes | Northern fulmar | Fork-tailed storm-petrels | Leach's storm-petrels | Parakeet auklets | Least auklets |
|------------------|------------------------|----------------------|-----------------------|--------------------|--------------------|--------------------|--------------------|-----------------------|-------------------------|-----------------|---------------------------|-----------------------|--------------------|--------------------|
| Chukchi Sea | Cape Lisburne | | | Complete failure | Complete failure | | | | Average | | | | | |
| Bering Sea | St. Paul | Below average | | Average | Below average | | | Complete failure | Below average | | Complete failure | | | Below average |
| | St. George | Average | | Average | Below average | | | Complete failure | Below average | | Complete failure | | | Below average |
| Aleutian Islands | Buldir | | Average | Complete failure | Below average | Average | Complete failure | Average | Average | | Way above average! | Way above average! | Way above average! | Way above average! |
| | Aiktak | | Below average | Complete failure | Complete failure | Below average | Way above average! | | | | Below average | Way above average! | | |
| Alaska Penin. | Chowiet | Average | Average | Way above average! | Way above average! | Way above average! | Way above average! | | Way above average! | Below average | | | Below average | |
| Gulf of Alaska | East Amatuli | | Below average | Below average | | | Average | | Below average | | Way above average! | | | |
| | St. Lazaria | | Below average | Way above average! | Way above average! | | | | | | Way above average! | Way above average! | | |



Eggs represent overall productivity relative to the long-term average. White eggs indicate productivity derived from monitoring data; colored eggs indicate productivity based on anecdotal observations.

Way above average! Average Below average Complete failure

- Planktivorous seabirds did well reproductively in both W and E AI in 2018

West AI
East AI

Alaska Maritime National Wildlife Refuge

2018 Seabird Report Card



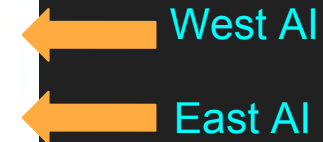
| Region | Annual monitoring site | Red-faced cormorants | Glaucous-winged gulls | Common murre | Thick-billed murre | Horned puffin | Tufted puffin | Red-legged kittiwakes | Black-legged kittiwakes | Northern fulmar | Fork-tailed storm-petrels | Leach's storm-petrels | Parakeet auklets | Least auklets |
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| | St. George | Average | | Average | Below average | | | Complete failure | Below average | | Complete failure | | | Below average |
| Aleutian Islands | Buldir | | Average | Complete failure | Below average | Average | Complete failure | Below average | Average | | Average | Way above average! | Way above average! | Average |
| | Aiktak | | Below average | Complete failure | Complete failure | Below average | Way above average! | | | | Below average | Way above average! | | |
| Alaska Penin. | Chowiet | Average | Average | Way above average! | Way above average! | Way above average! | Way above average! | | Way above average! | Below average | | | Below average | |
| Gulf of Alaska | East Amatuli | | Below average | Below average | | | Average | | Below average | | Below average | | | |
| | St. Lazaria | | Below average | Way above average! | Way above average! | | | | | | Way above average! | Way above average! | | |

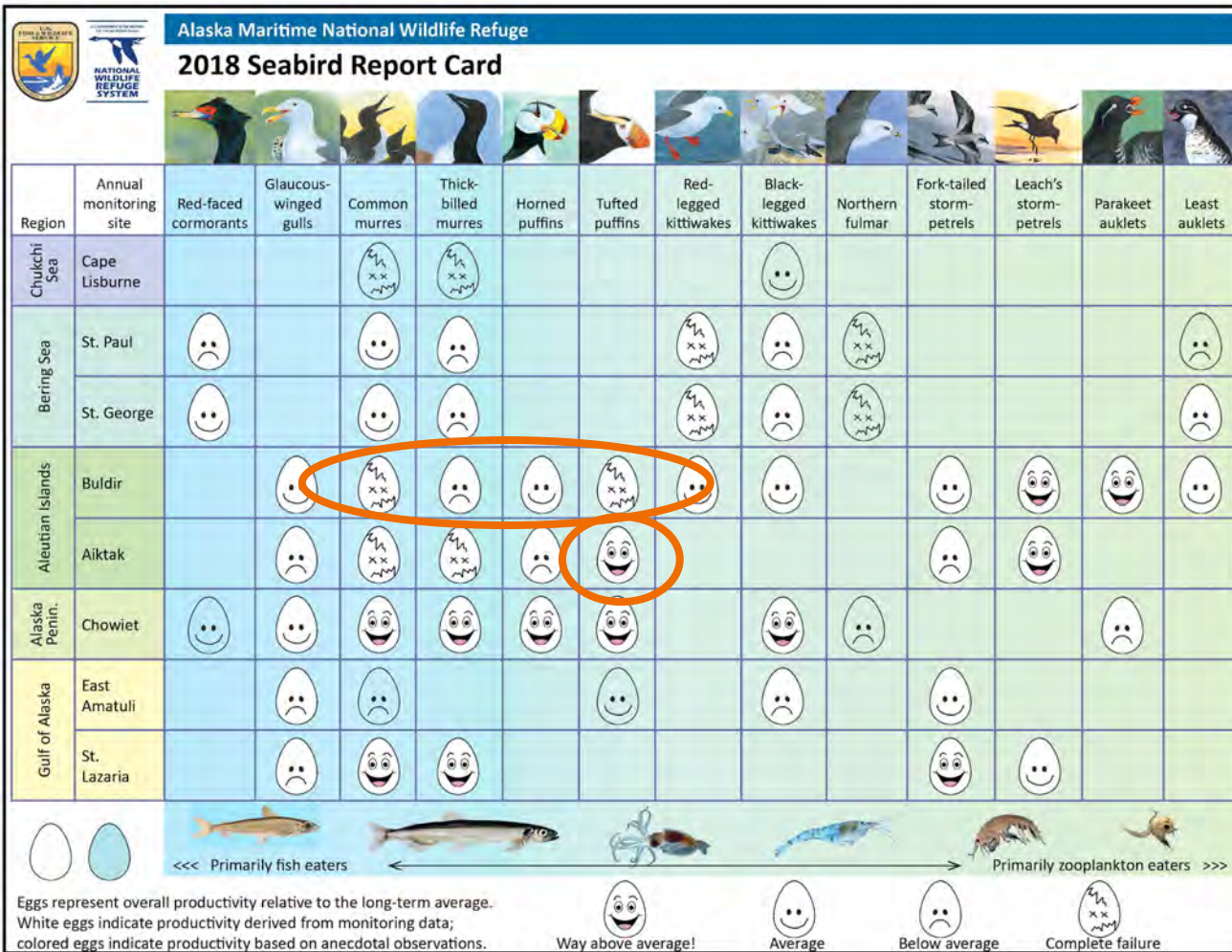


Eggs represent overall productivity relative to the long-term average. White eggs indicate productivity derived from monitoring data; colored eggs indicate productivity based on anecdotal observations.

Way above average! Average Below average Complete failure

- Piscivorous seabirds failed reproductively in W AI in 2018





- But tufted puffins (piscivorous seabirds) did well reproductively in E AI in 2018
- Corresponds with good reproduction of piscivorous seabirds in W GOA (Chowiet)

Aleutian Islands Summary

- As usual, data-poor relative to EBS and GOA
- Water has been warm; eddy activity low
- Overall, ecosystem response to recent warm conditions seem similar to that in the GOA
- Indicators suggest zooplankton abundant but small during warm years
- Piscivorous predators less successful during warm years
- Some longer term negative trends (SSL, fish condition)

Contributors

Sonia Batten, Jennifer Boldt, Nick Bond, Anne Marie Eich, Ben Fissel, Shannon Fitzgerald, Sarah Gaichas, Jerry Hoff, Steve Kasperski, Carol Ladd, Ned Laman, Geoffrey Lang, Jean Lee, Jennifer Mondragon, John Olson, Ivonne Ortiz, Wayne Palsson, Heather Renner, Nora Rojek, Chris Rooper, Kim Sparks, Michelle St Martin, Jordan Watson, George A. Whitehouse, Sarah Wise, and Stephani Zador

Thank you!