# Flow of Pacific water in the Chukchi Sea: Results from RUSALCA expeditions


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K. Iken, E.A. Ershova, J.M. Grebmeier,
B.A. Bluhm, L.W. Cooper, R.R. Hopcroft,
D.J. Torres, G.W.K. Moore,
T.E. Whitledge, H. Hu, J. Wang,
C.J. Ashjian, K.N. Kosobokova

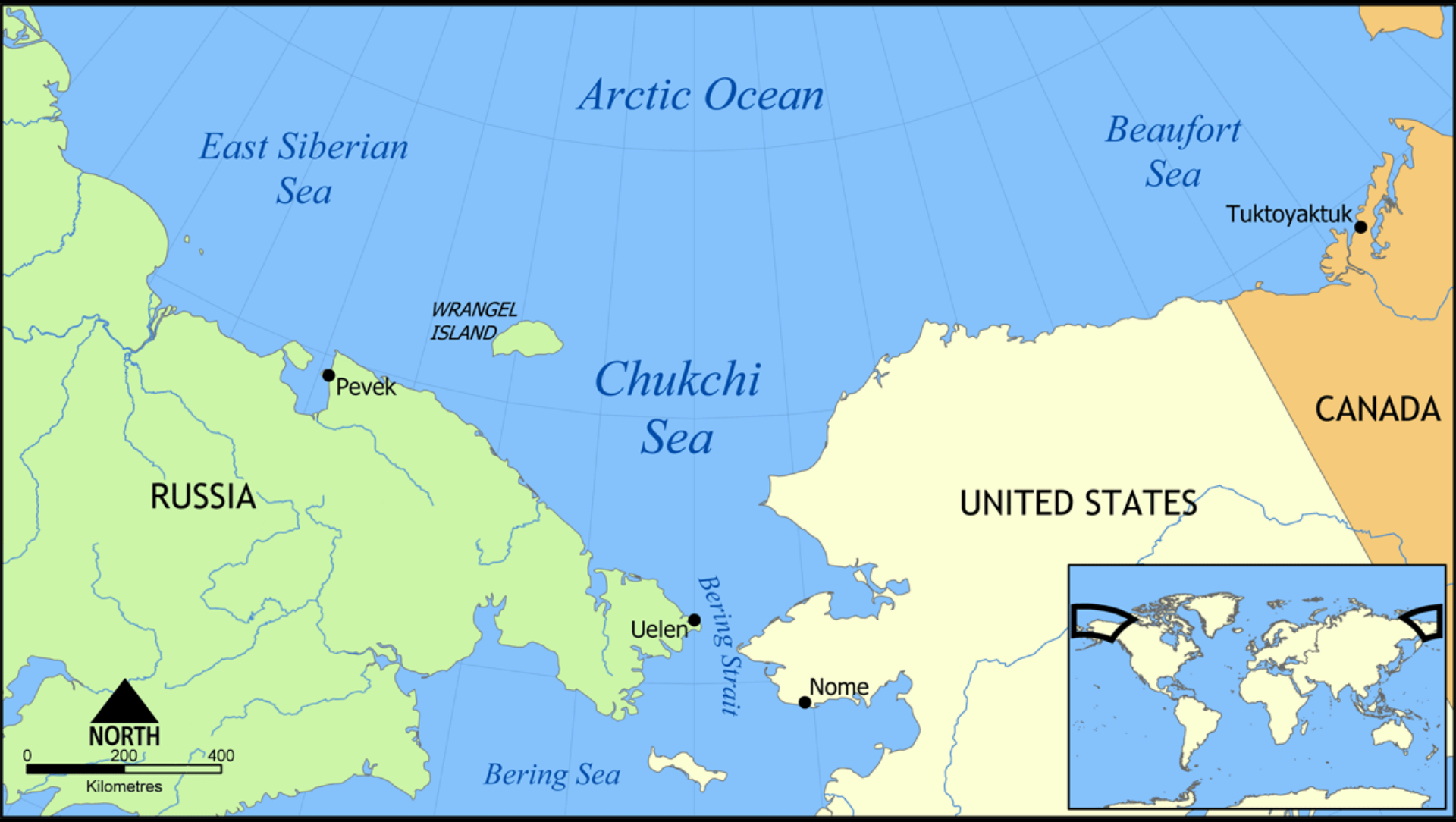

Photo credit: IRAS – NOAA, RUSALCA 2009


*September 2017, PICES, Vladivostok*

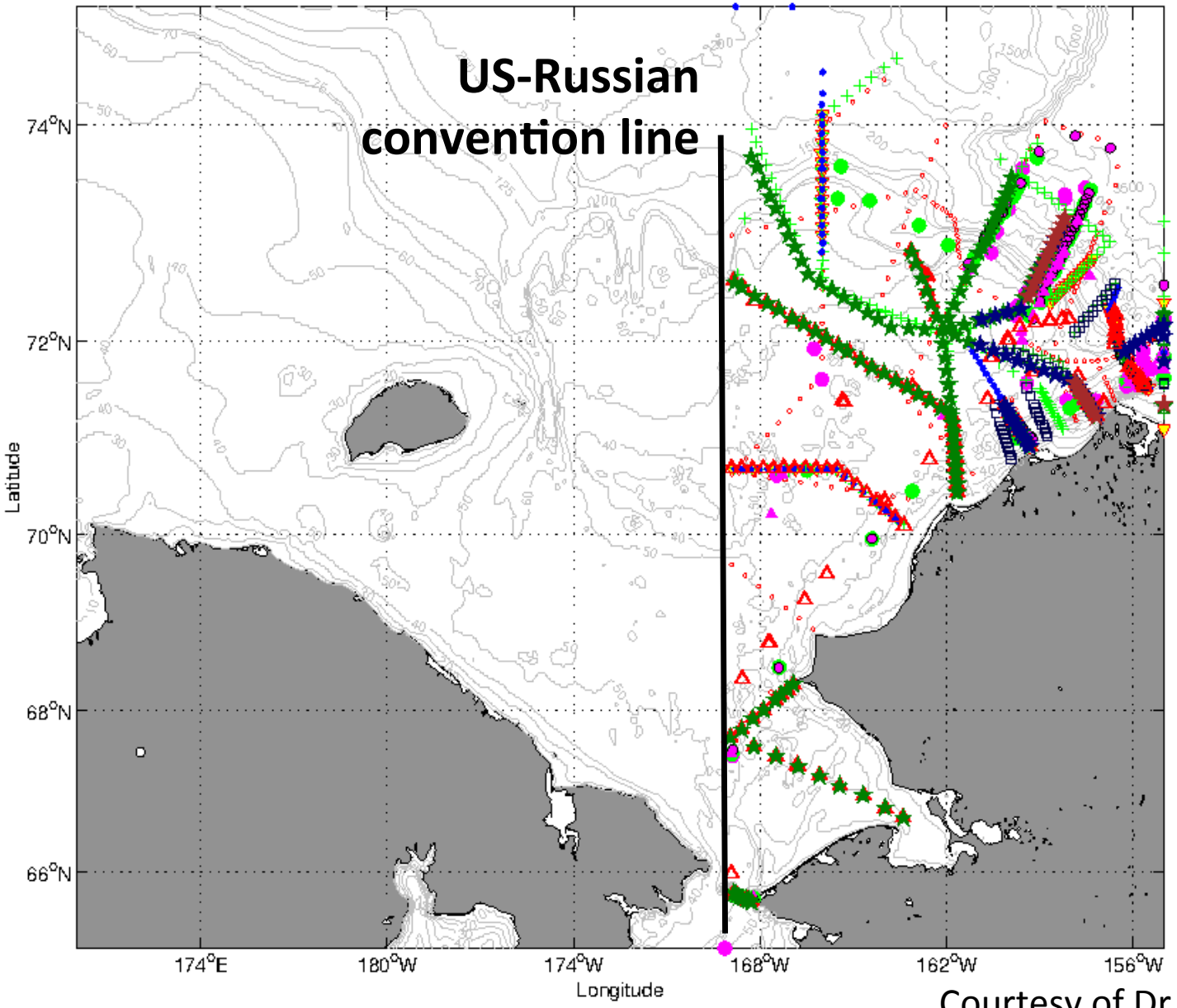
**Outline**

- Introduction. RUSALCA program
- Chukchi Sea circulation
- Atmospheric forcing
- Water masses of the Chukchi Sea, their variability
- Conditions in Bering Strait in 2009
- Current state of RUSALCA program

# Chukchi sea – an important transition zone for Pacific water



# Station occupations of the SBI and ICESCAPE programs (2002-2011)



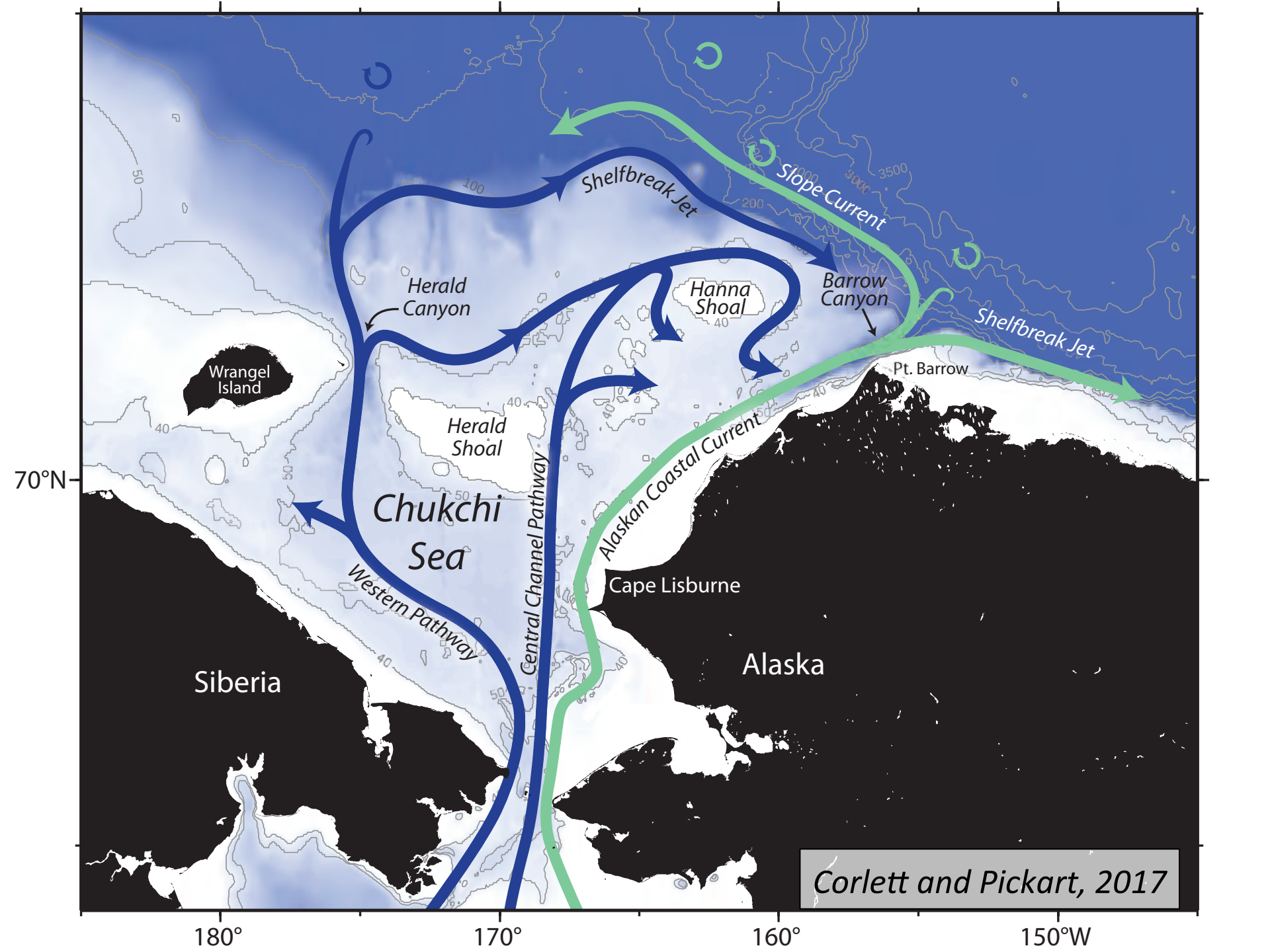

Courtesy of Dr. R.S. Pickart

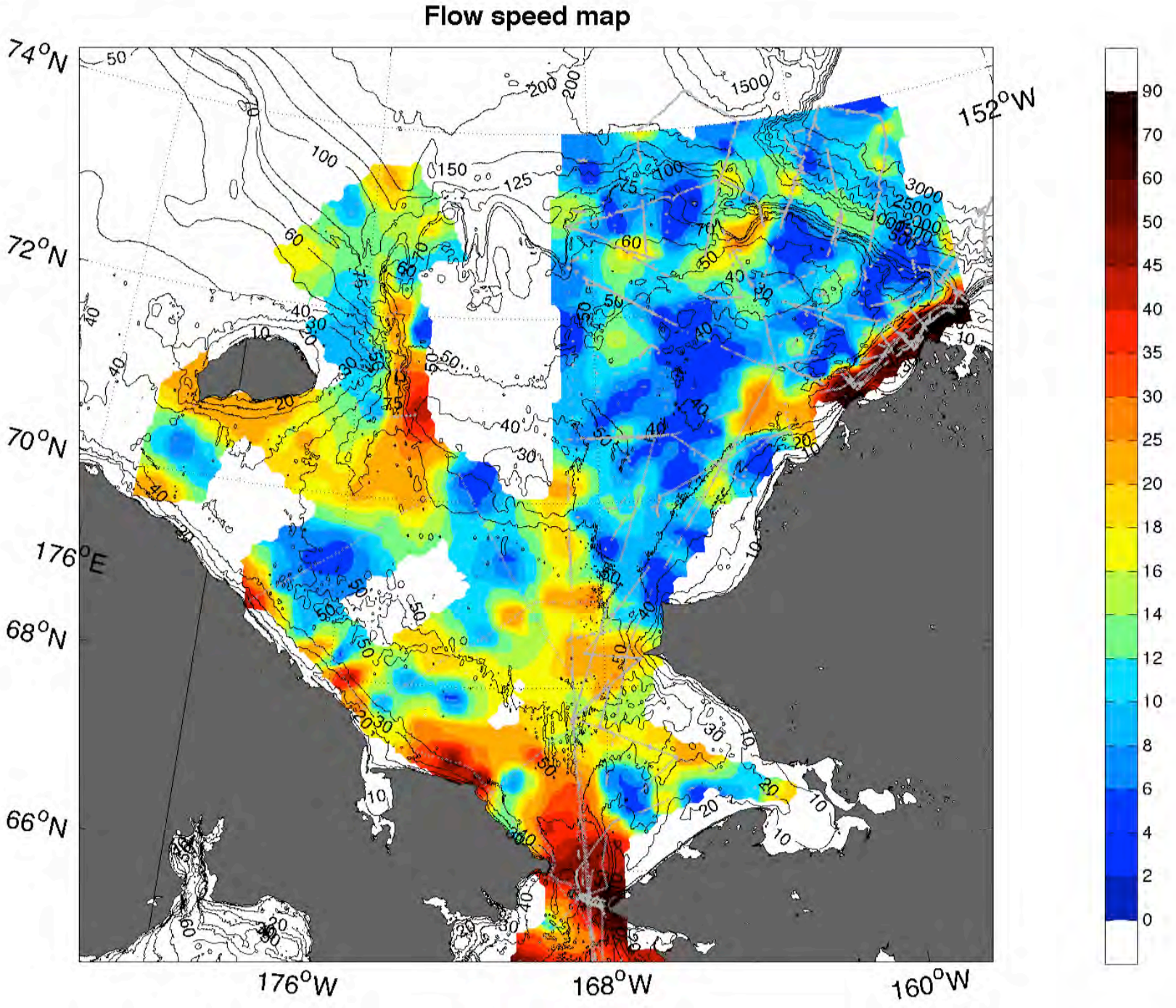
# Russian-American Long-term Census of the Arctic (RUSALCA)

(funded by NOAA)

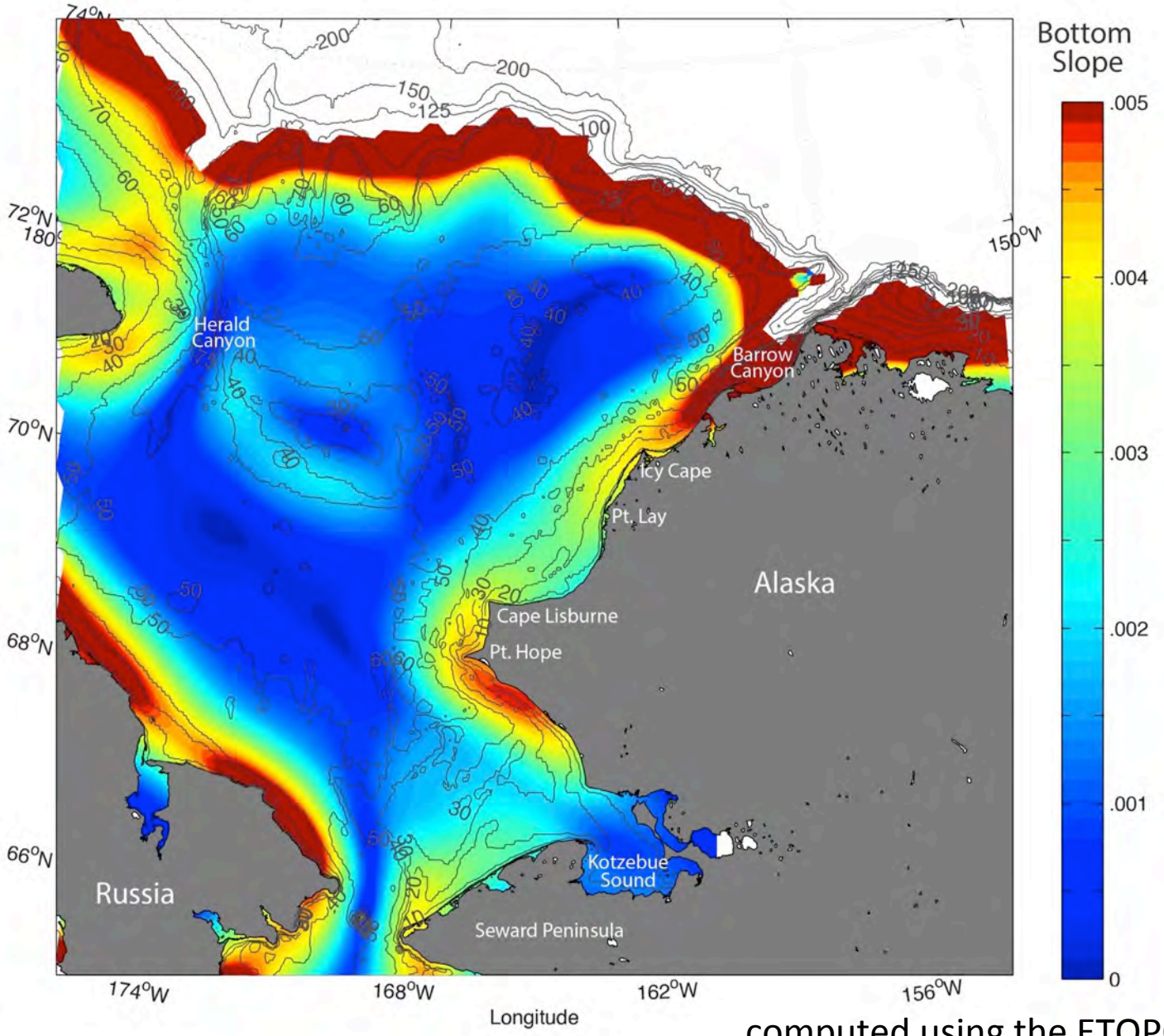
Since 2004
12 bio-physical and mooring cruises has been conducted by RUSALCA.

**http://www.arctic.noaa.gov/rusalca/**


Shelfbreak Jet
Slope Current
Herald Canyon
Hanna Shoal
Barrow Canyon
Shelfbreak Jet
Pt. Barrow
Wrangel Island
Herald Shoal
Chukchi Sea
Alaskan Coastal Current
Central Channel Pathway
Western Pathway
Cape Lisburne
Siberia
Alaska
70°N
180°
170°
160°
150°W
Corlett and Pickart, 2017


Flow speed map
74°N
72°N
70°N
68°N
66°N
176°E
176°W
168°W
160°W
152°W
90
70
60
50
45
40
35
30
25
20
18
16
14
12
10
8
6
4
2
0

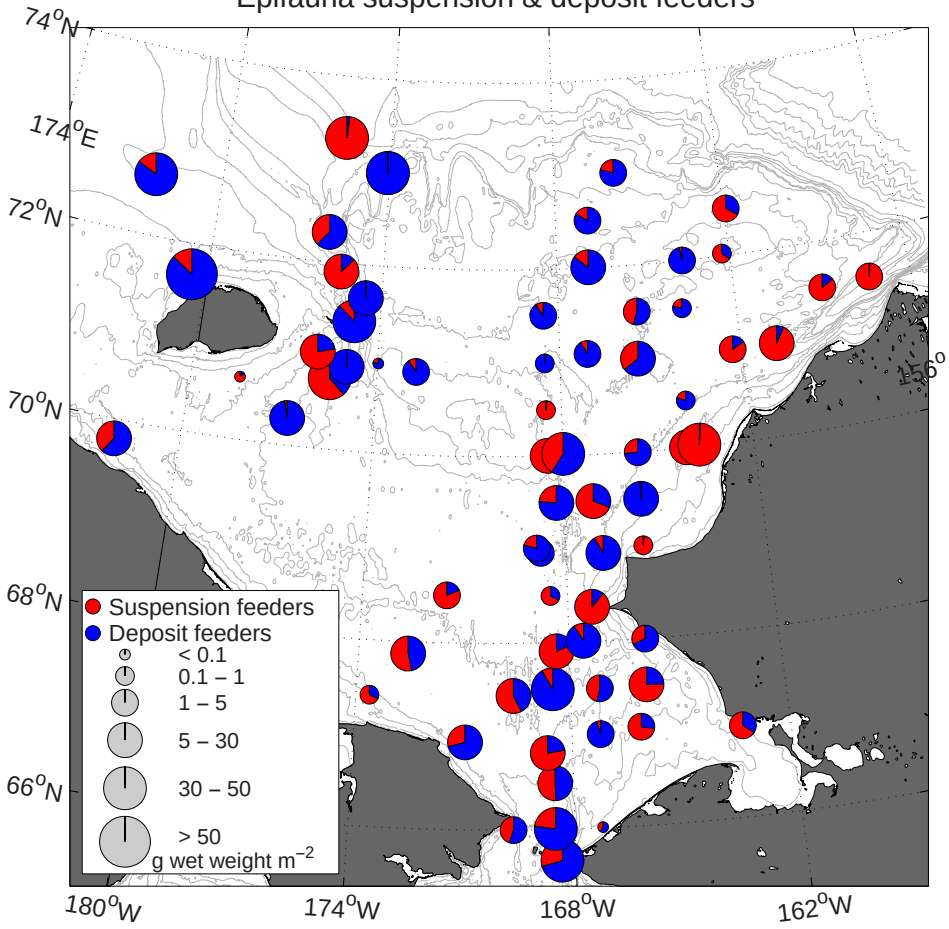
# Map of the bottom slope gradient on the Chukchi Shelf



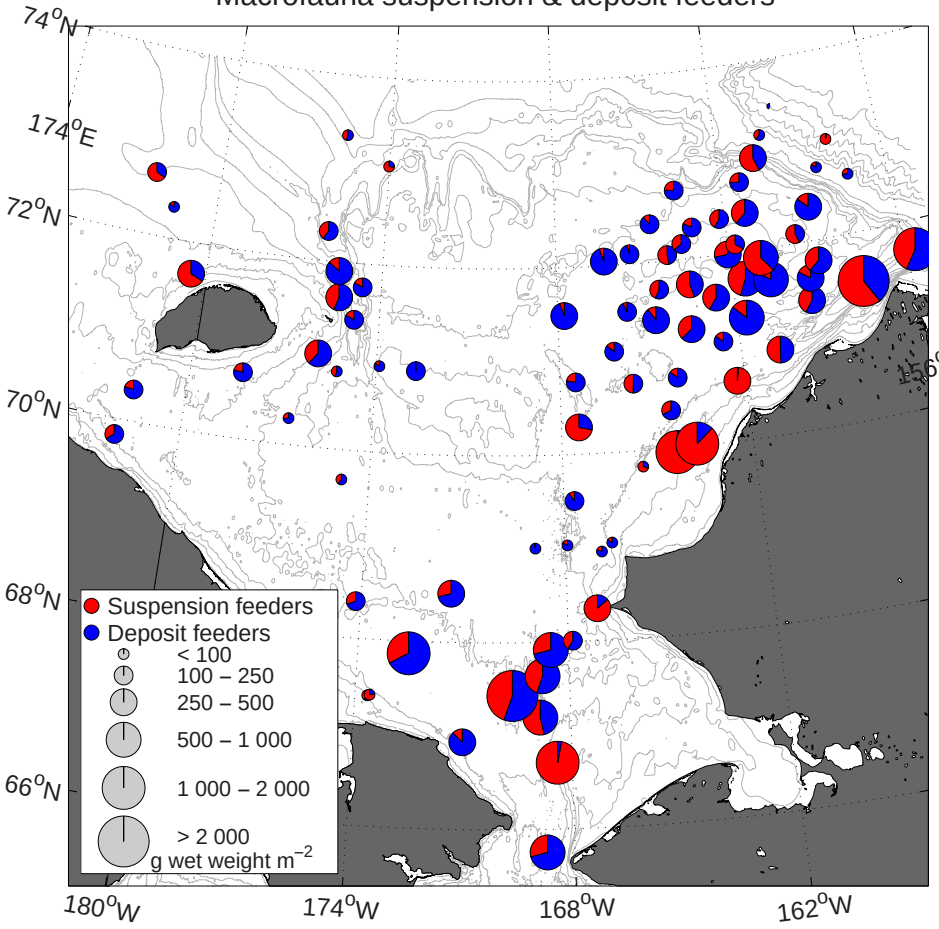

computed using the ETOPO2 bathymetry

# The feeding mode of benthic fauna is related to the strength of the currents.

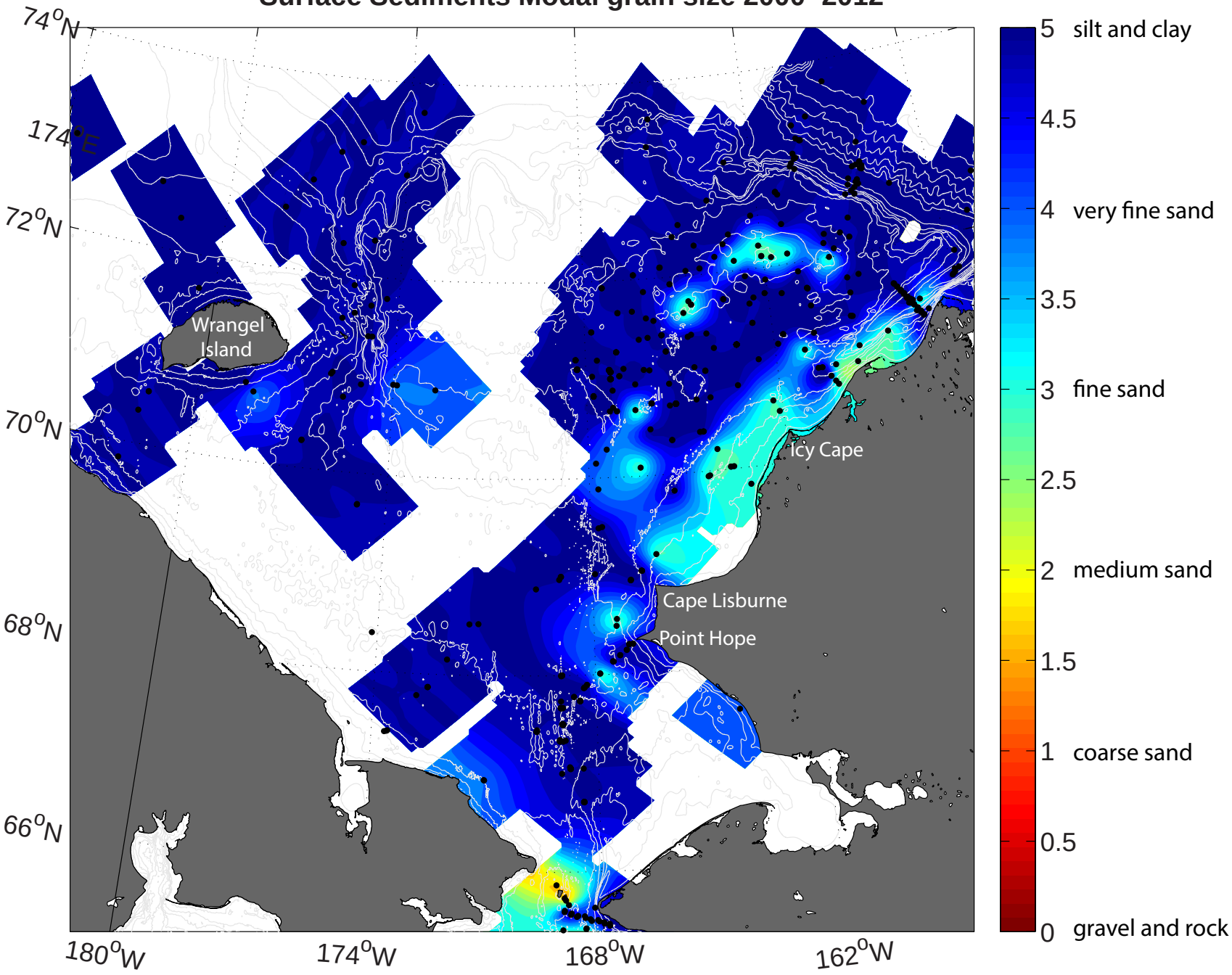
Epifauna suspension & deposit feeders




Macrofauna suspension & deposit feeders

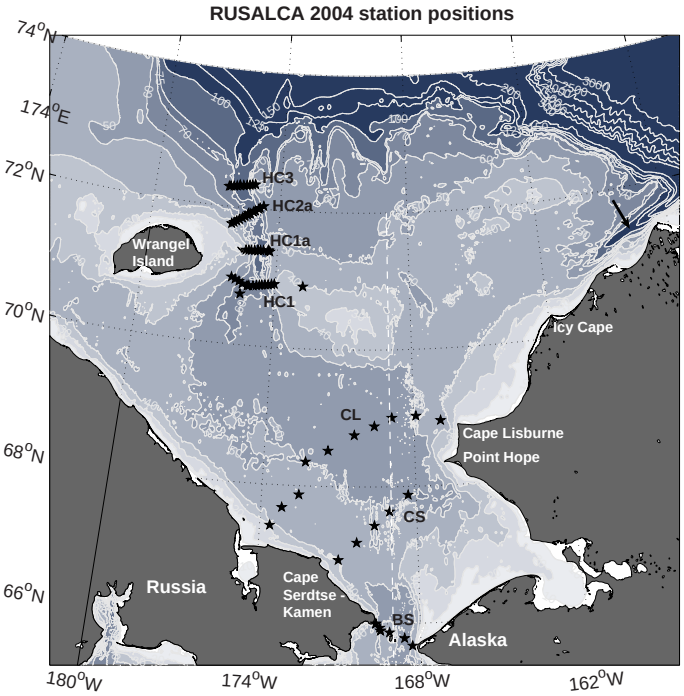


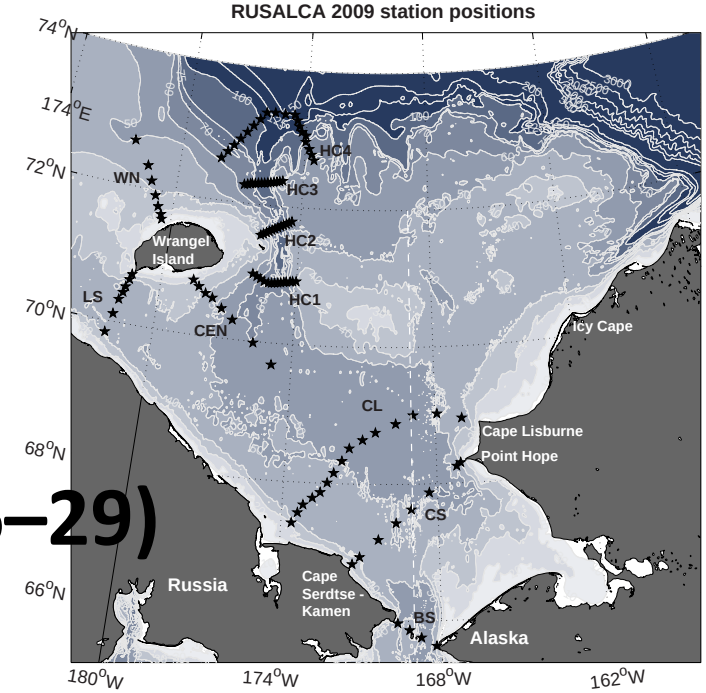
# Surface Sediments Modal grain size 2000–2012



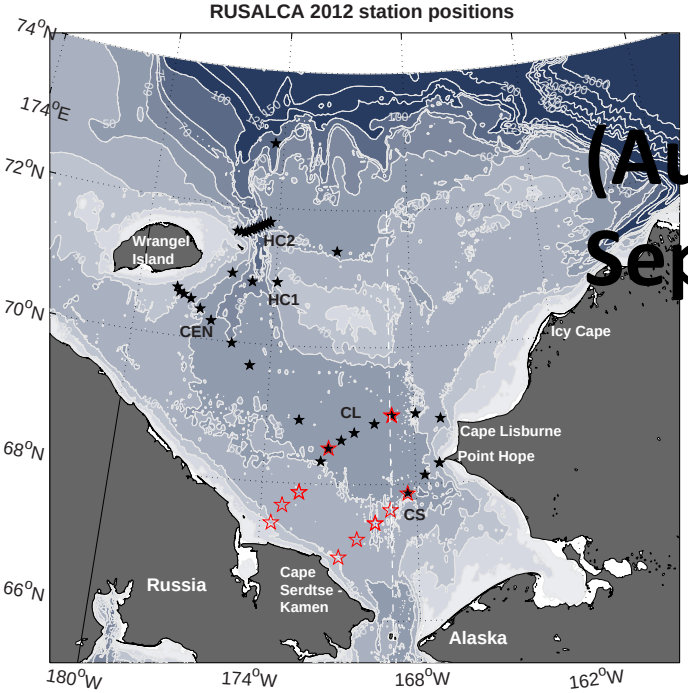
# 2004 (Aug 10–22)

# RUSALCA Stations positions



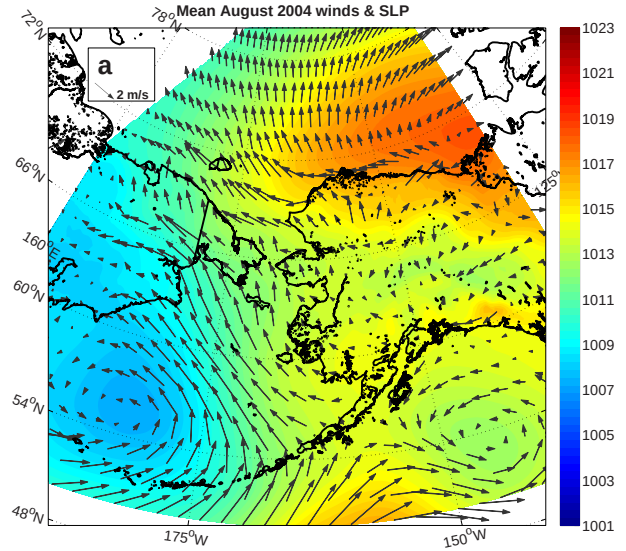

# 2009 (Sep 6–29)

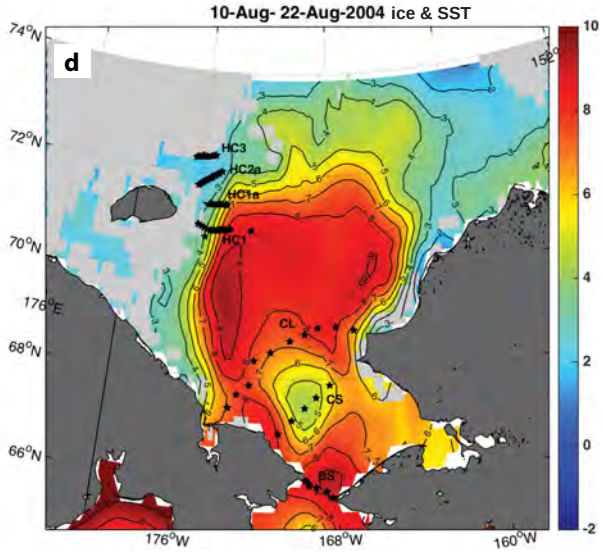



# 2012 (Aug 30–Sep 16)

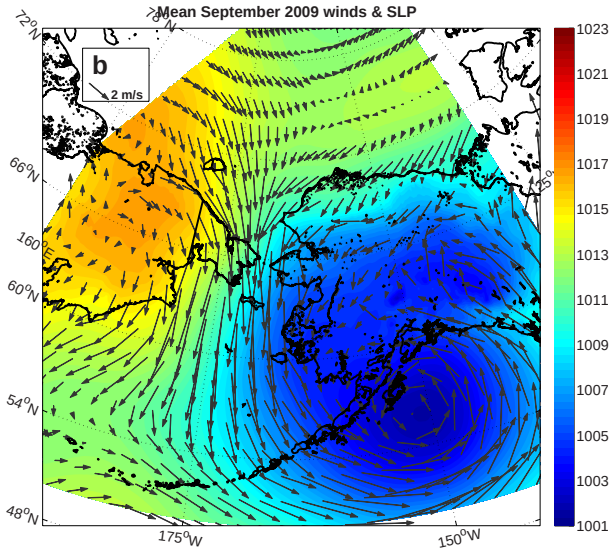
# Atmospheric situation

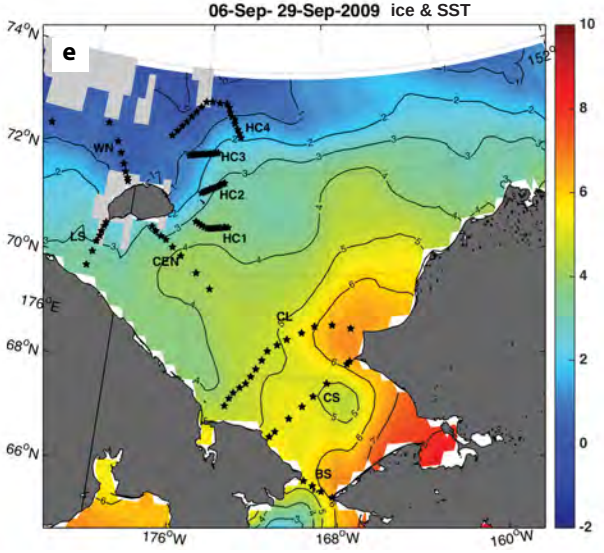
## 2004



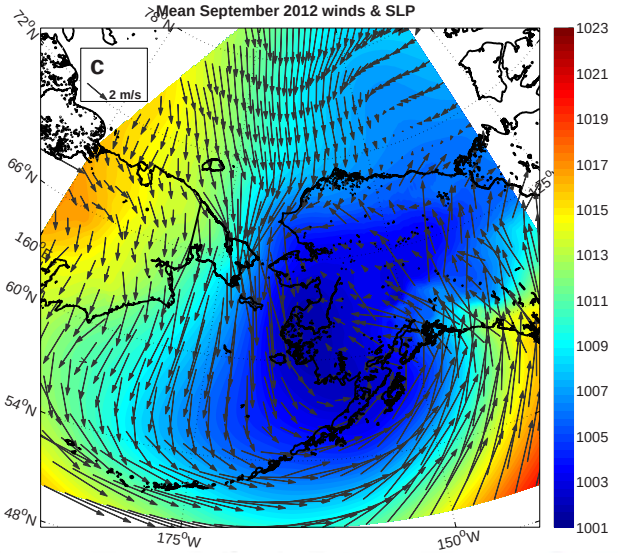



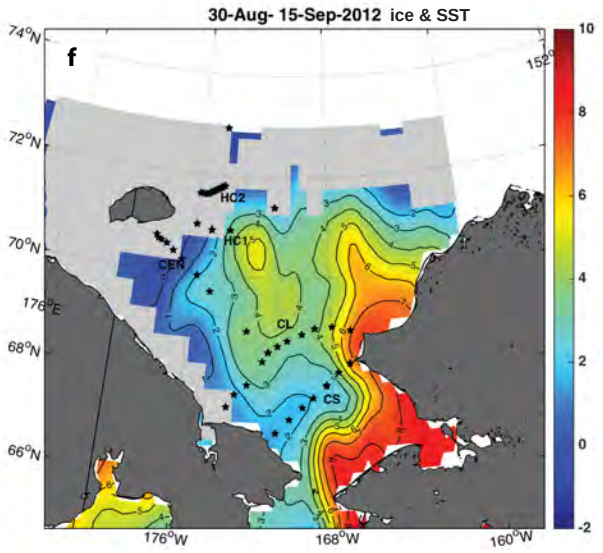

## 2009



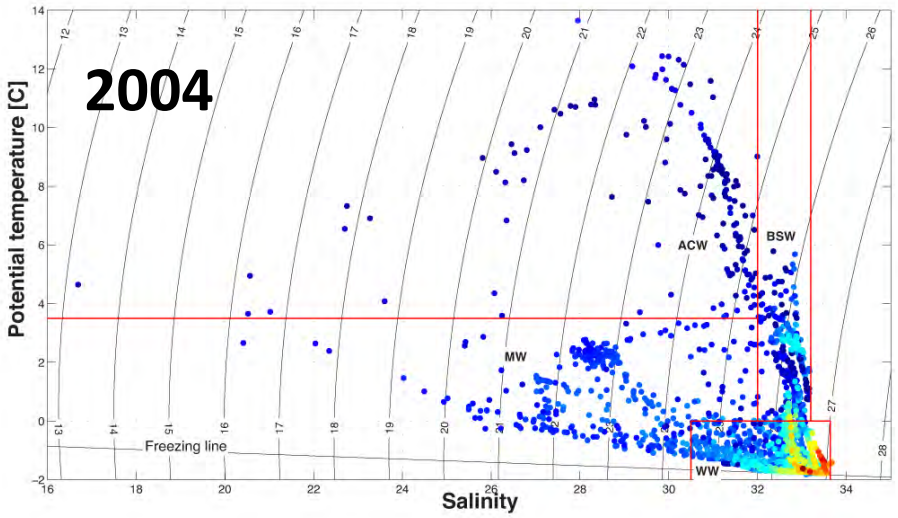



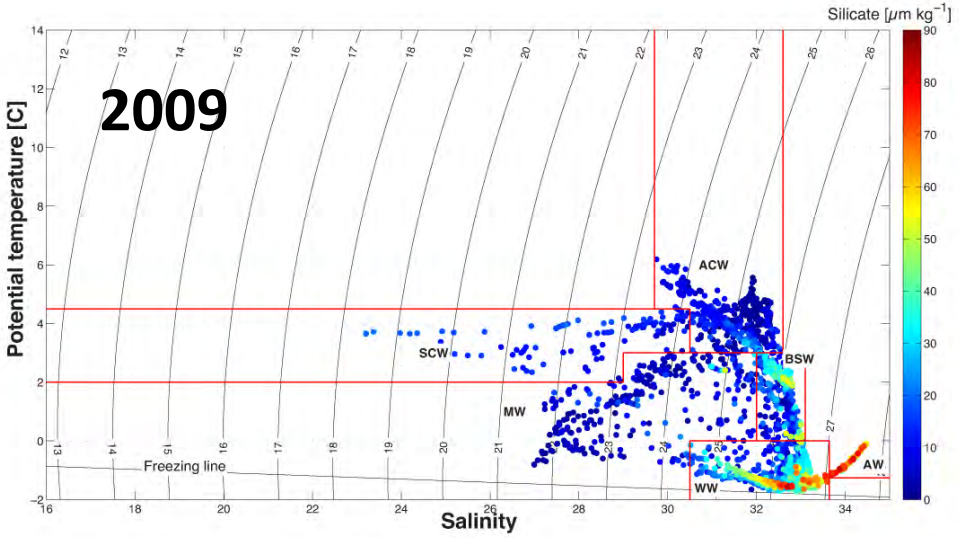

## 2012

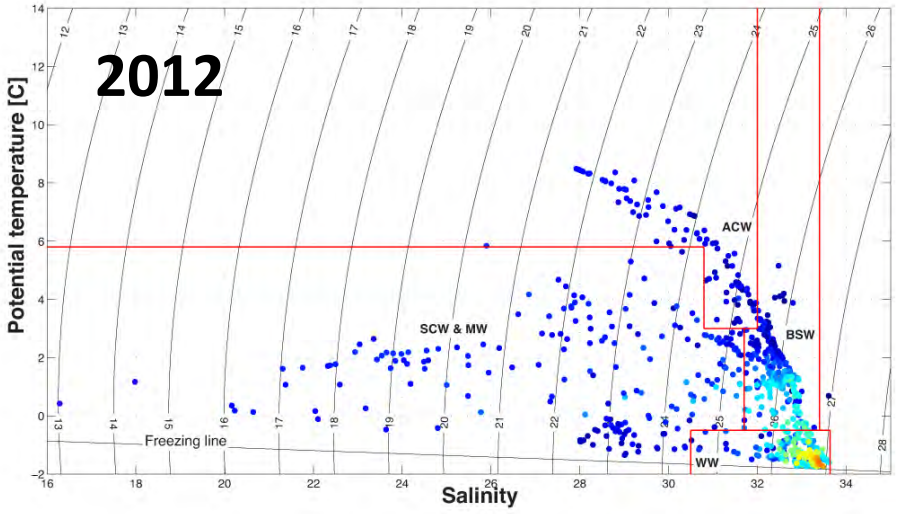


# Water masses of the Chukchi Sea. Silicate data are shown with color.



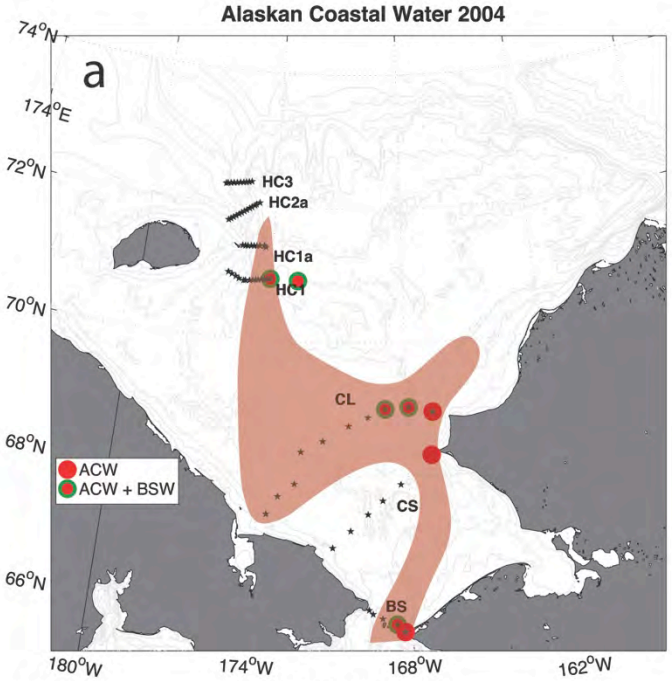



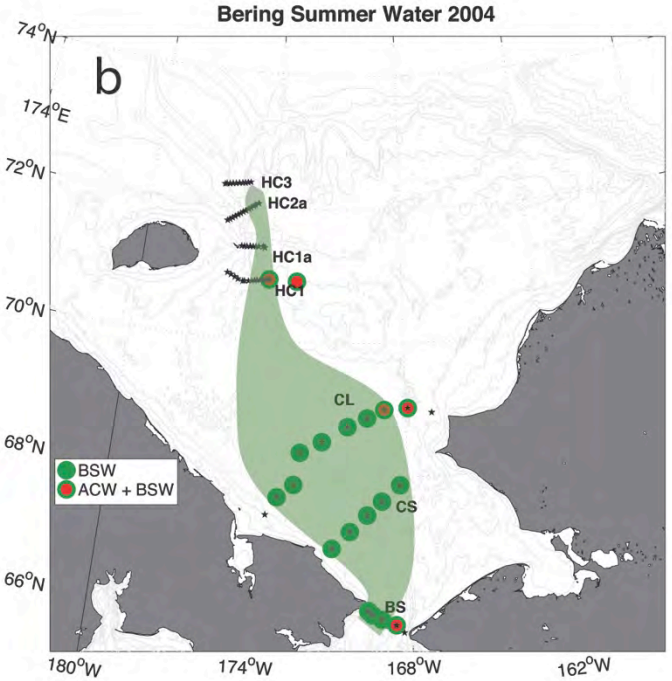




**<u>Pacific origin water masses are:</u>**

**ACW** – Alaskan Coastal Water
**BSW** – Bering Sea Water
**PWW** – Pacific Winter Water
**RWW** – Remnant Pacific Winter Water

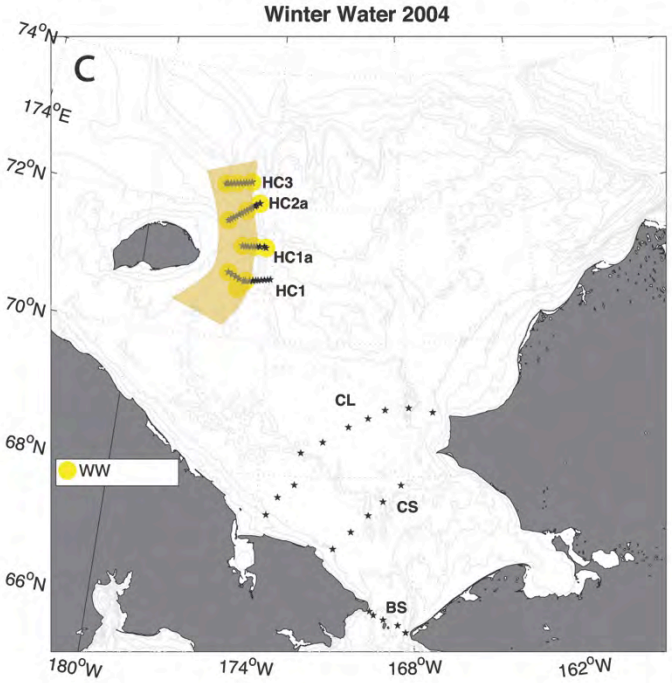
ACW




BSW

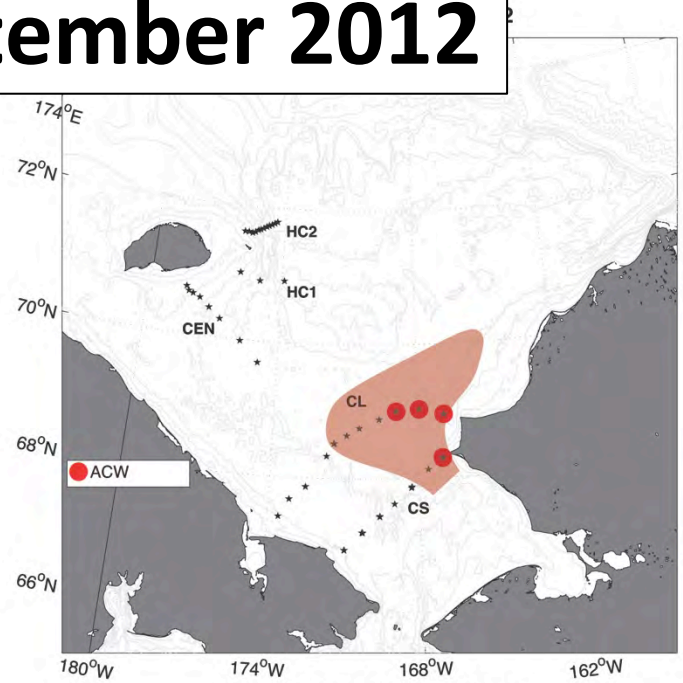
WW

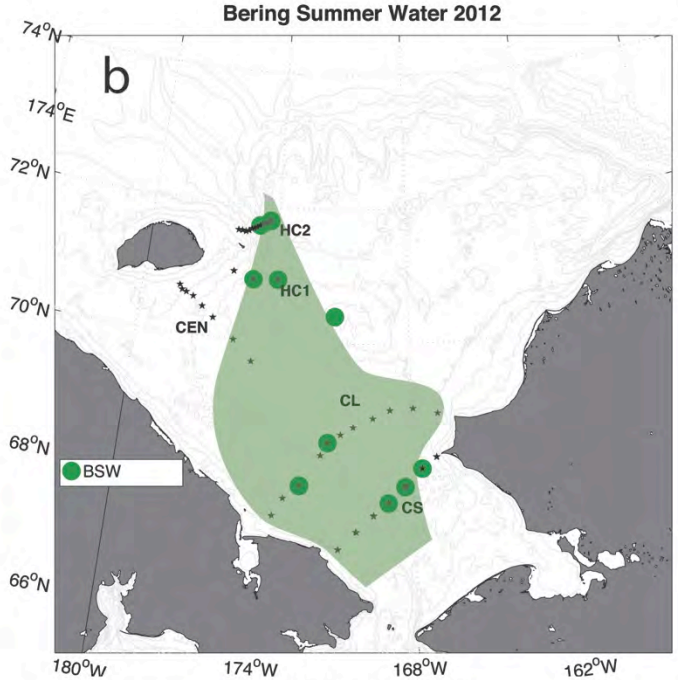



**August 2004**

# September 2012

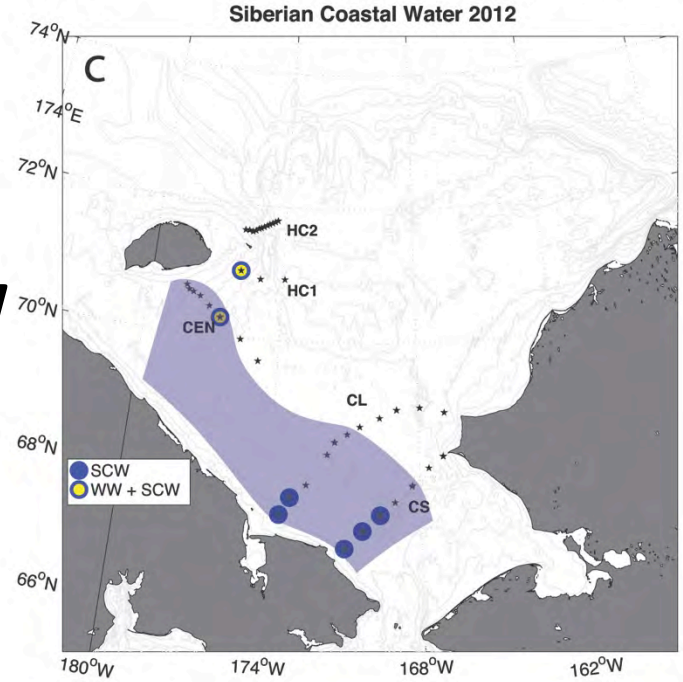
ACW

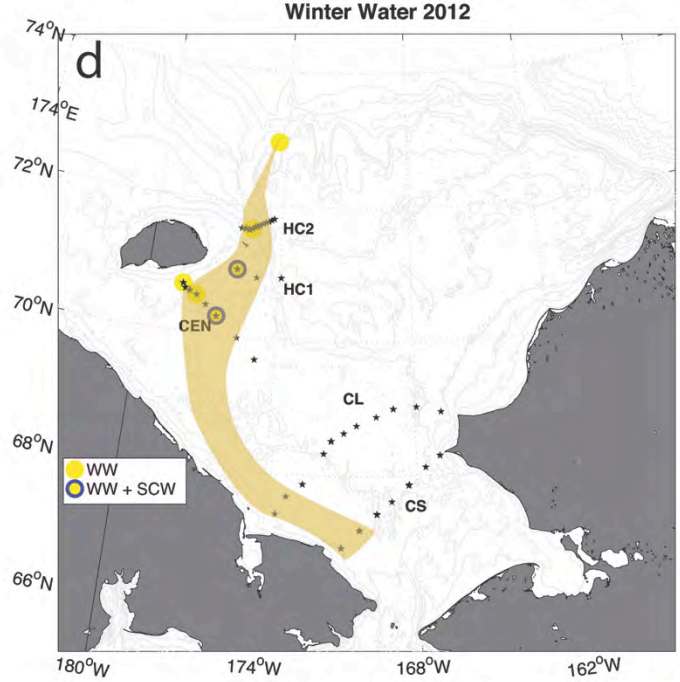



BSW

SCW

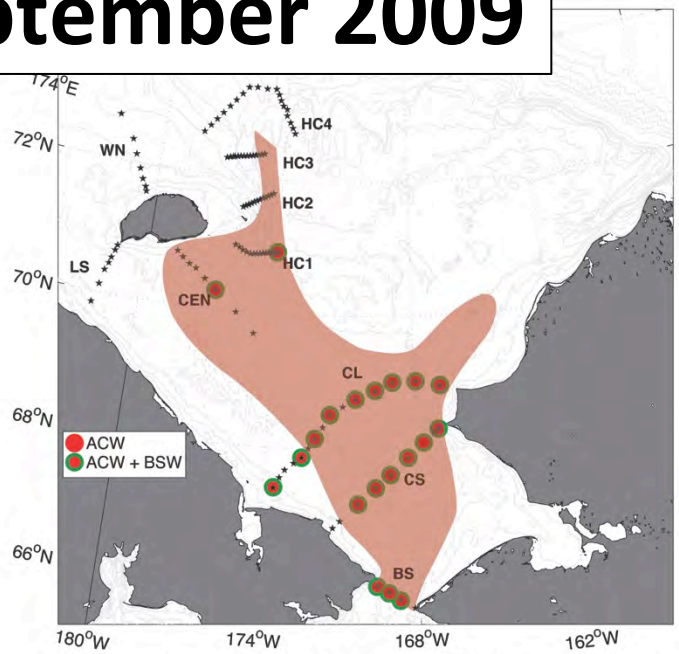


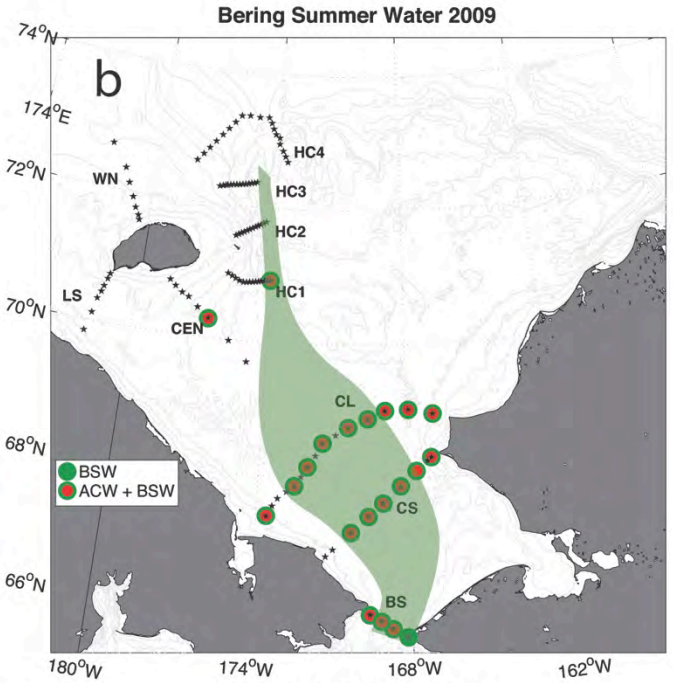

RWW

# September 2009

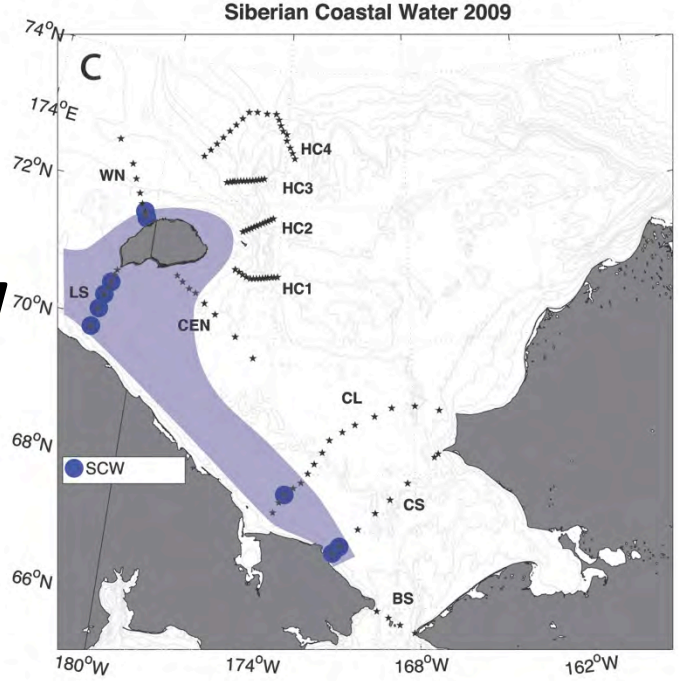
ACW



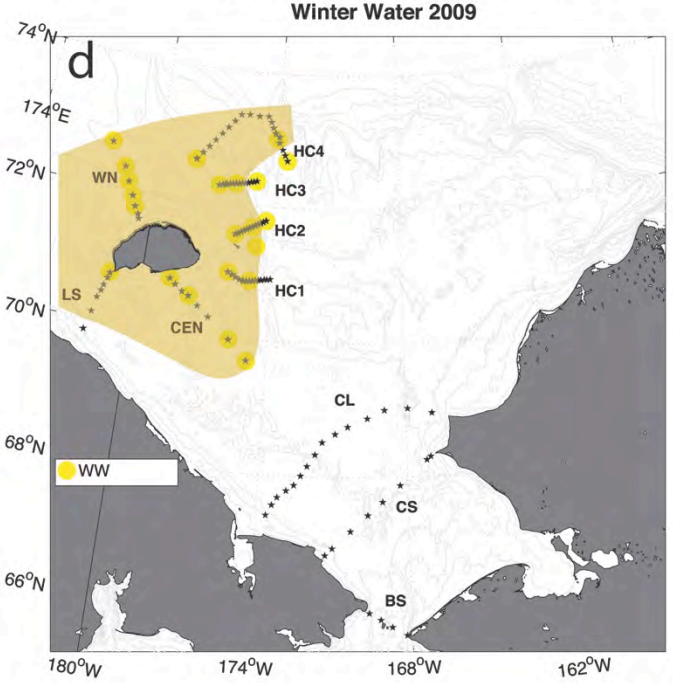

BSW



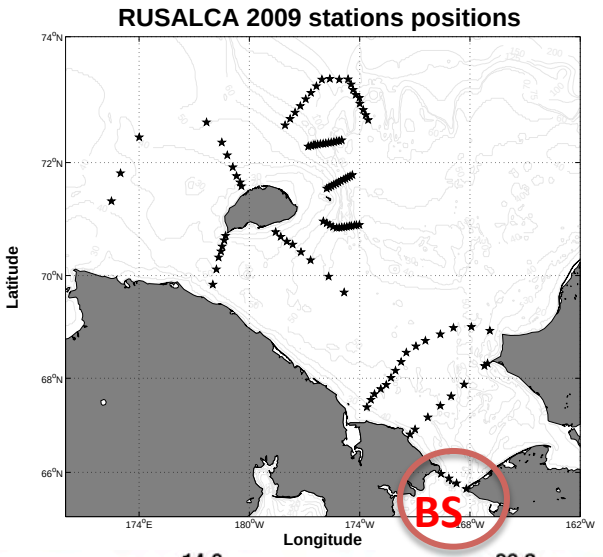

SCW

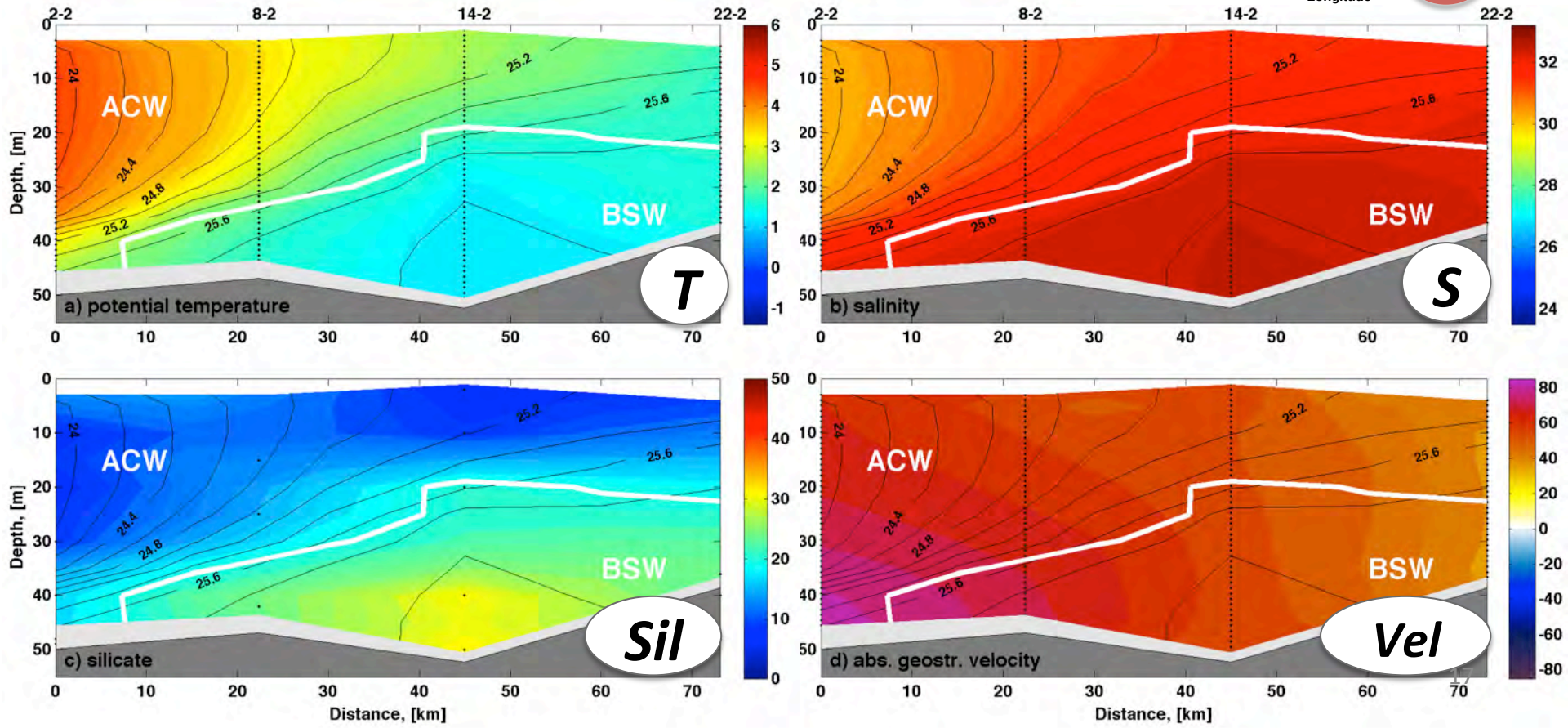



RWW

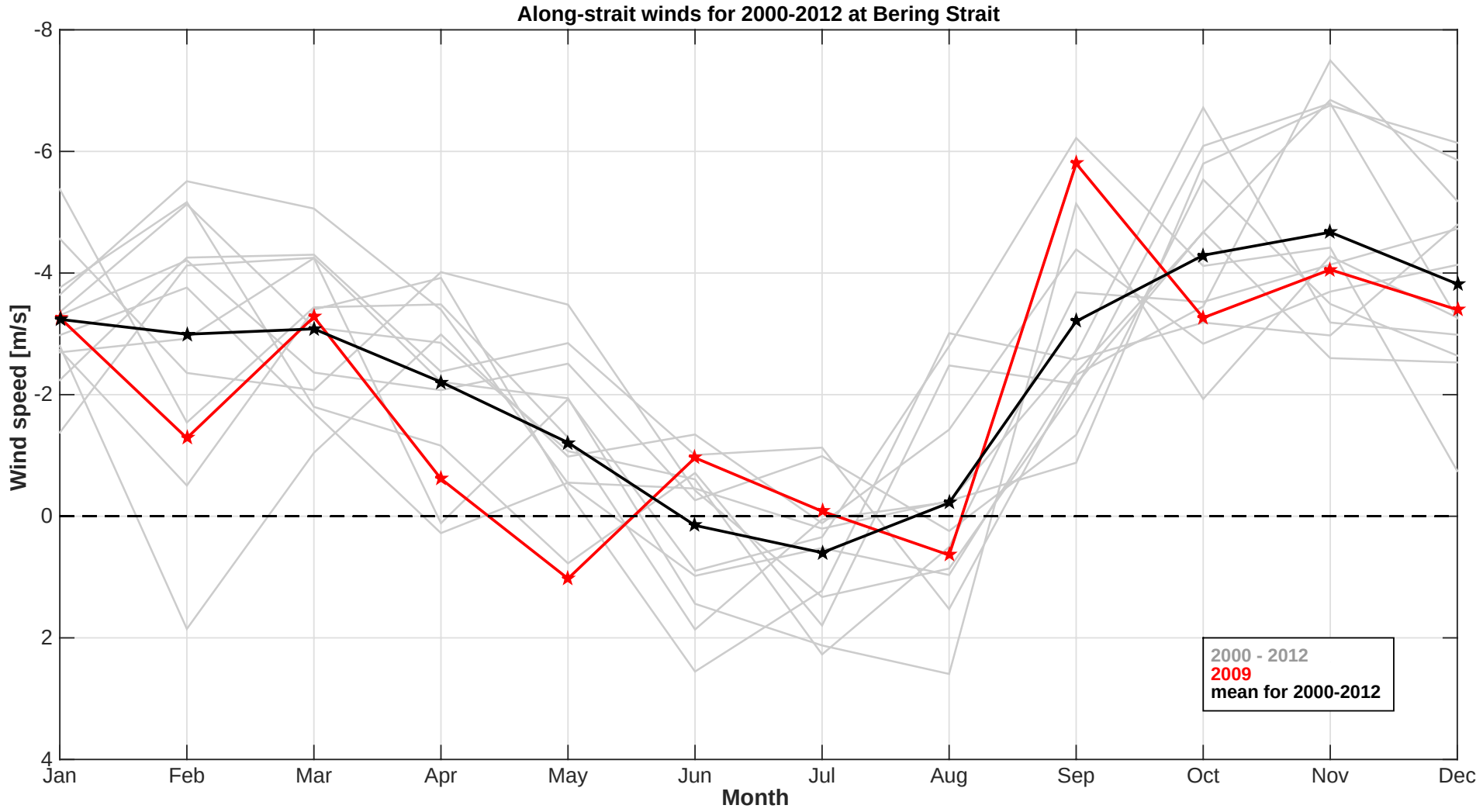


# Bering strait transect
## *September 2009*



# Northerly winds were anomalously strong during September 2009.

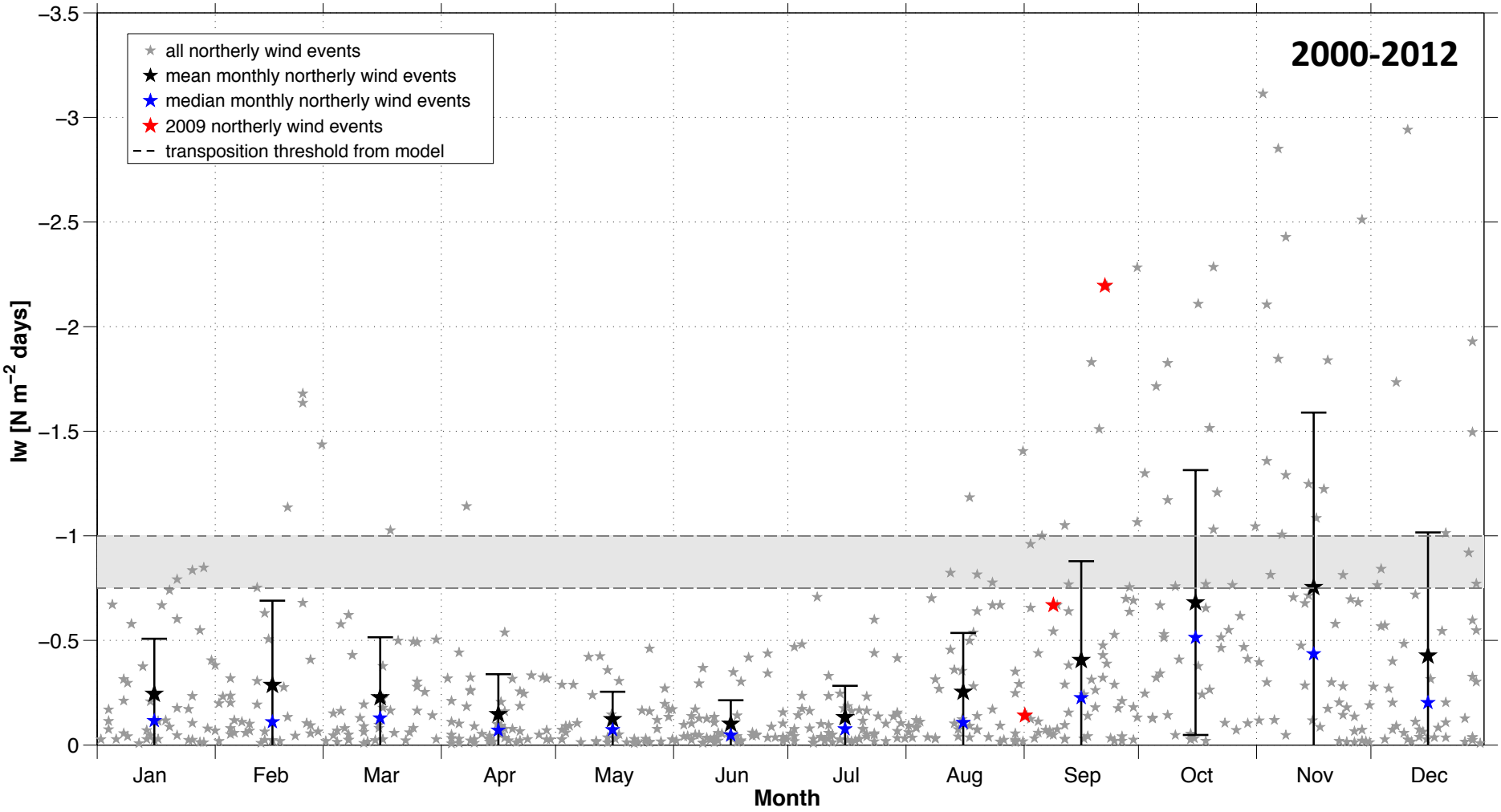


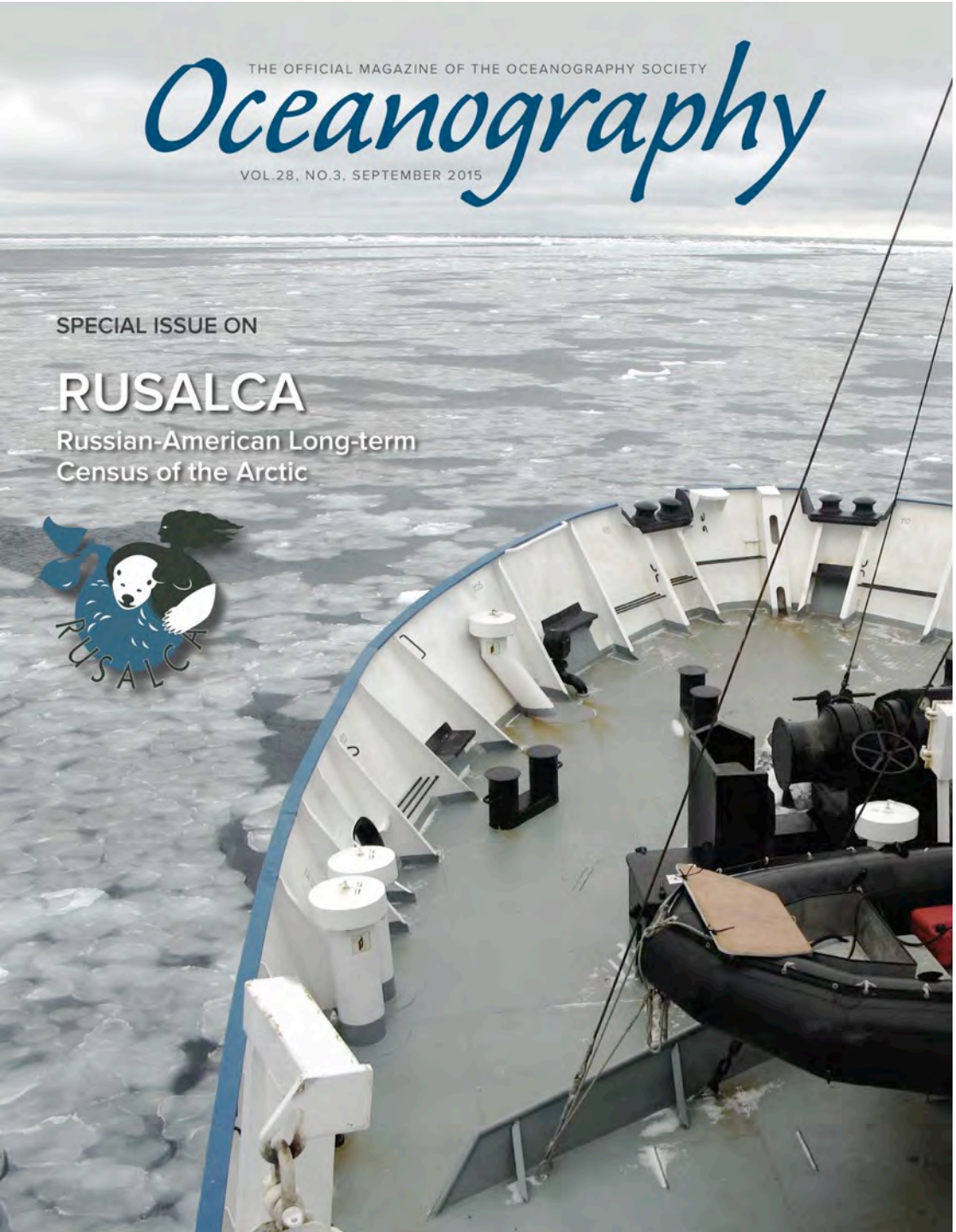
# Time integral of the windstress over a northerly wind event

$$Iw = \int_{t1}^{t2} \tau_a(t)dt$$

[*CET = Iw/f*; Huyer et al., 1977]

*where t1 and t2 are the time frame of a northerly wind event and* $\tau_a$ *is the along-strait component of the windstress*





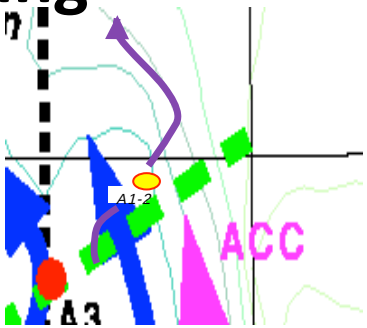

# *These results are published*

Pisareva, M.N., R.S. Pickart, M.A. Spall, C. Nobre, D.J. Torres, G.W.K. Moore, and T.E. Whitledge, 2015. Flow of Pacific water in the western Chukchi Sea: Results from the 2009 RUSALCA expedition. Deep Sea Research Part I 105:53–73.

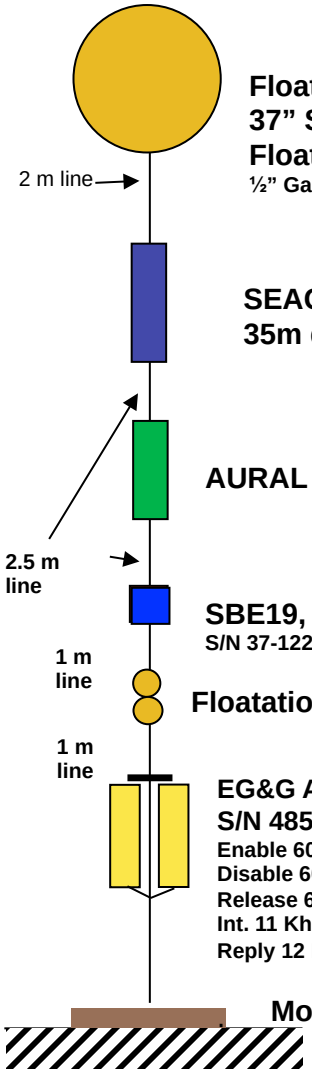
Pisareva, M.N., R.S. Pickart, K. Iken, E.A. Ershova, J.M. Grebmeier, L.W. Cooper, B.A. Bluhm, C. Nobre, R.R. Hopcroft, H. Hu, J. Wang, C.J. Ashjian, K.N. Kosobokova, and T.E. Whitledge, 2015. The relationship between patterns of benthic fauna and zooplankton in the Chukchi Sea and physical forcing. Oceanography 28(3):60–75.

# RUSALCA 2014 mooring

A1-2 – RUSSIAN EEZ
Latitude 65* 55,994'N
Longitude -169* 36.990'W
Depth 51 m.




**What's next?..**




**Floatation**
**37" Syntactic Float**
**½" Galv. Shackle**

**SEAGUARD RCM Blue Current Meter**
**35m depth, S/N 5450 64**

**AURAL Recorder 38m depth, S/N 00247LF**

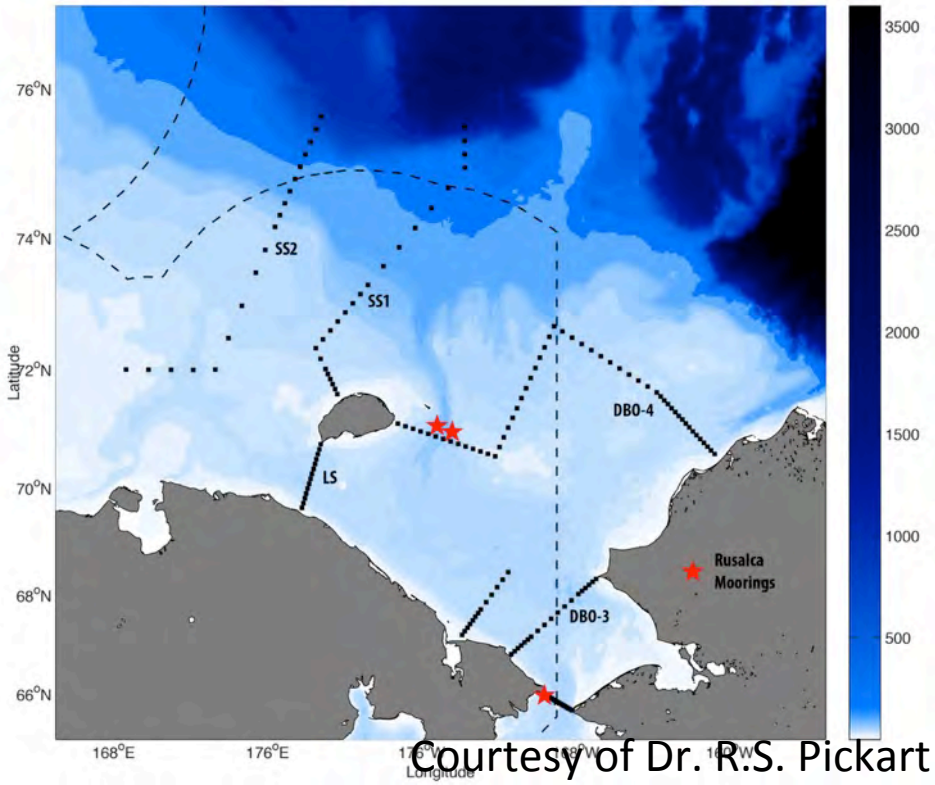
**SBE19, 43 depth**
**S/N 37-12278, no cage !**

**Floatation**

**EG&G ACOUSTIC RELEASE**
**S/N 48597**
**Enable 602113**
**Disable 602130**
**Release 623721**
**Int. 11 Khz**
**Reply 12 Khz**

**Mooring Anchor**
Bottom Depth 51 m.
Anchor Dry Wt.= 2220 lbs

# RUSALCA 2016 tentative plan – didn't happen




Courtesy of Dr. R.S. Pickart

**Data and papers available on:**

https://www.pmel.noaa.gov/rusalca/

https://workspace.aoos.org/

http://rpickart.whoi.edu/ - Dr. Robert S. Pickart's page

http://psc.apl.washington.edu/HLD/Bstrait/bstrait.html

Etc.


Thank you!
Photo credit: RAS – NOAA, RUSALCA 2004