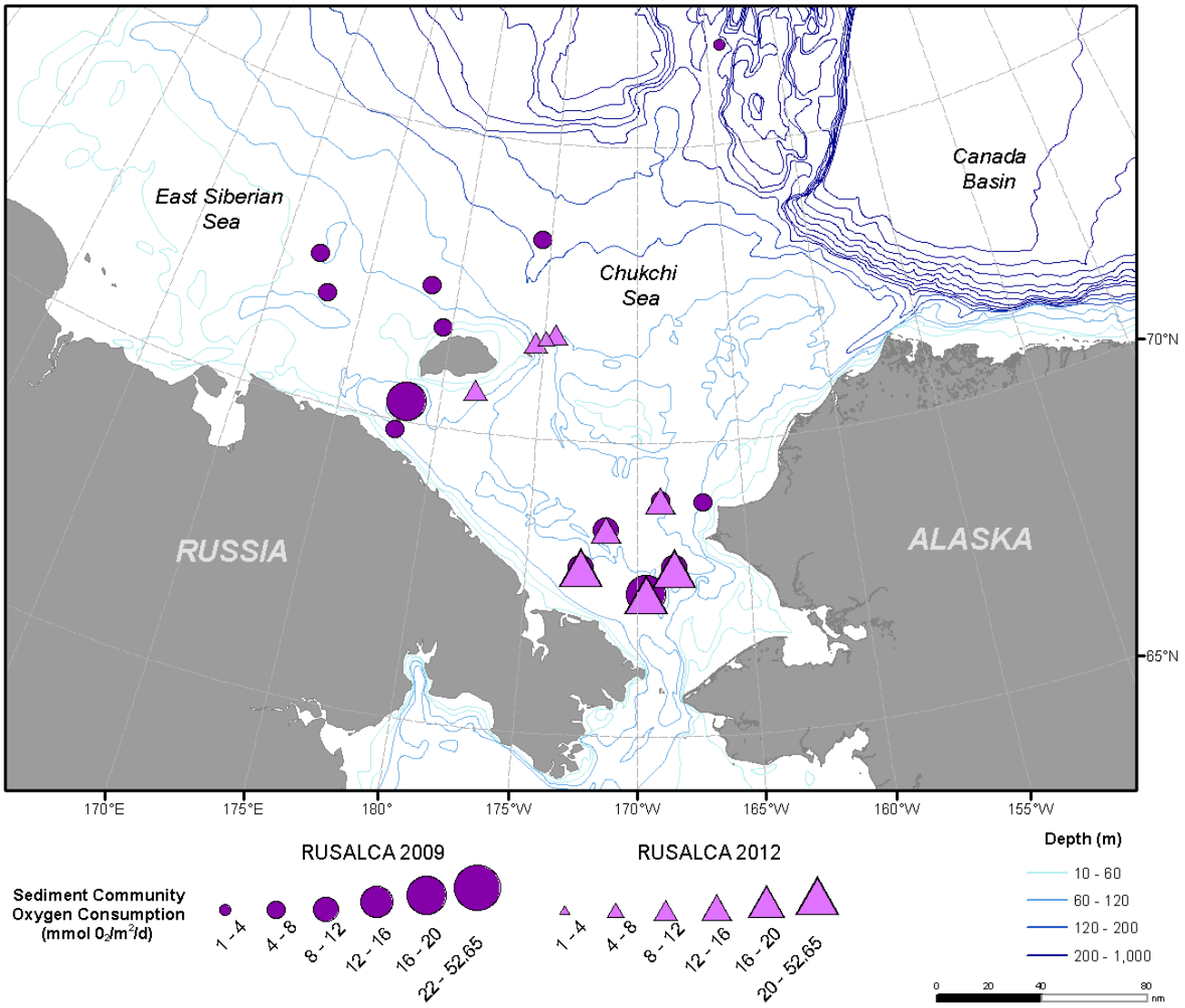
SEAFLOOR-OCEAN FLUXES: BASELINES AND OBSERVATIONS OF CHANGE

LEE COOPER, ALEXANDER SAVVICHEV AND JACKIE GREBMEIER

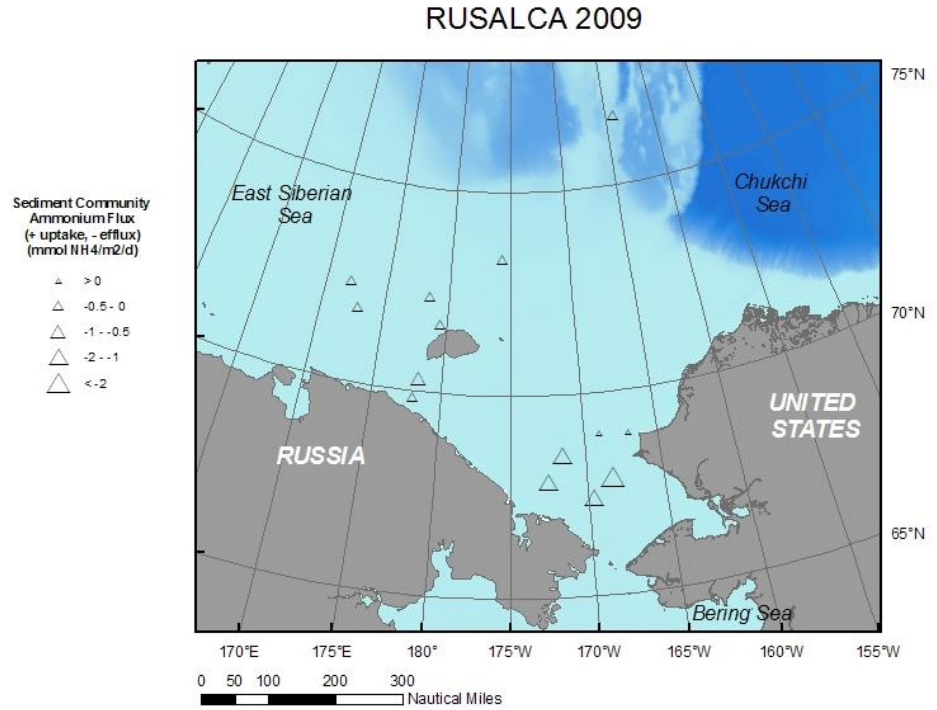
Sediment Community Oxygen Consumption RUSALCA 2009 and 2012

- spatial patterns indicative of the amount of carbon reaching the sediments

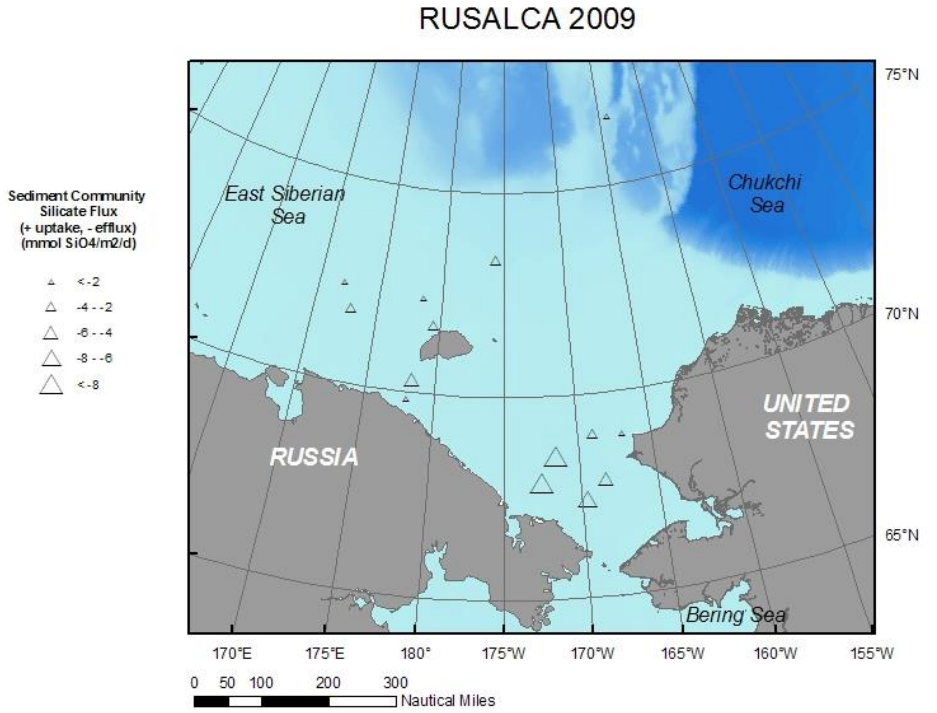


High nutrient efflux from sediments with high organic carbon deposition during RUSALCA 2009 (same 2012)

Sediment Community
Ammonium flux (mM/m^2/d)

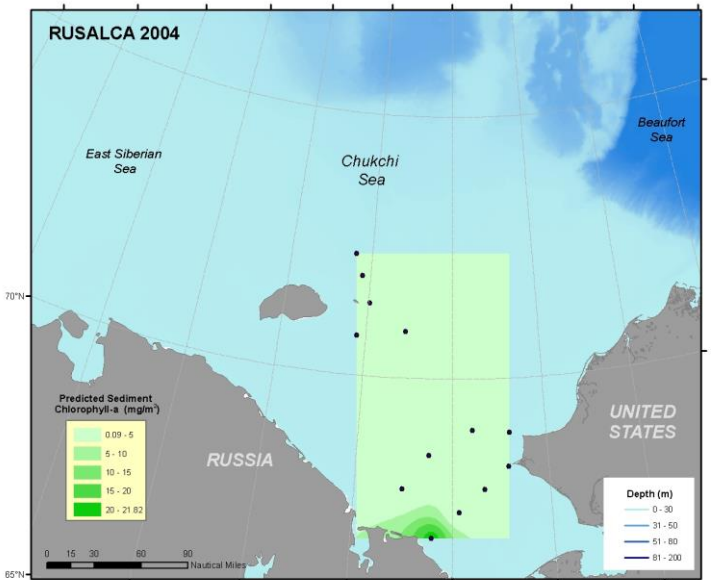


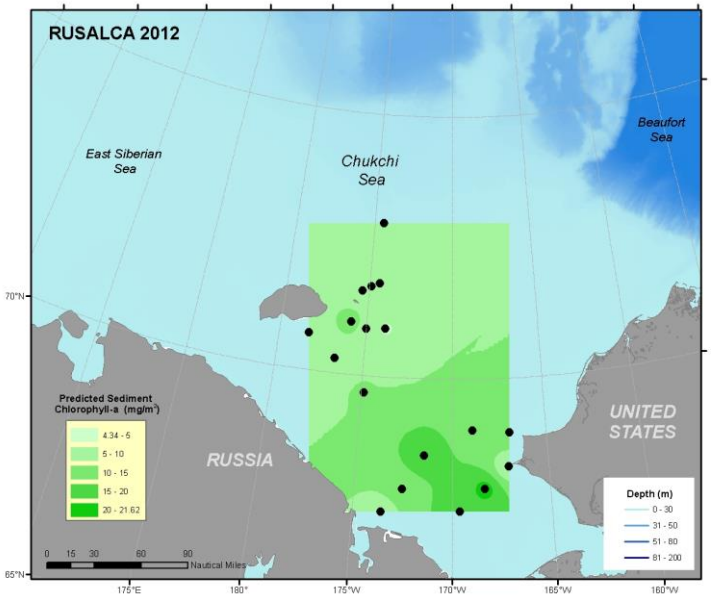
Sediment Community
Silicate flux (mM/m^2/d)

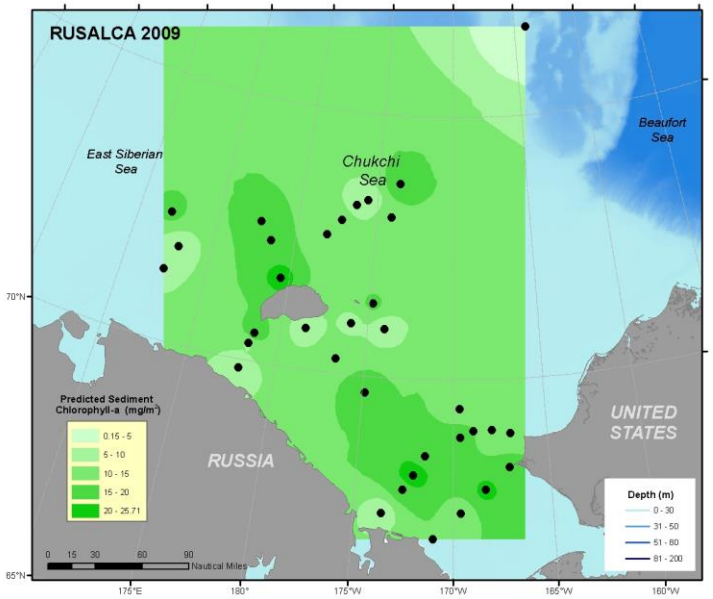


- highest outflux nutrients in SE Chukchi Sea “hotspot” where highest carbon export and benthic infaunal biomass
- lowest outflux nutrients in offshore East Siberian Sea and north of Pt. Hope off Alaska

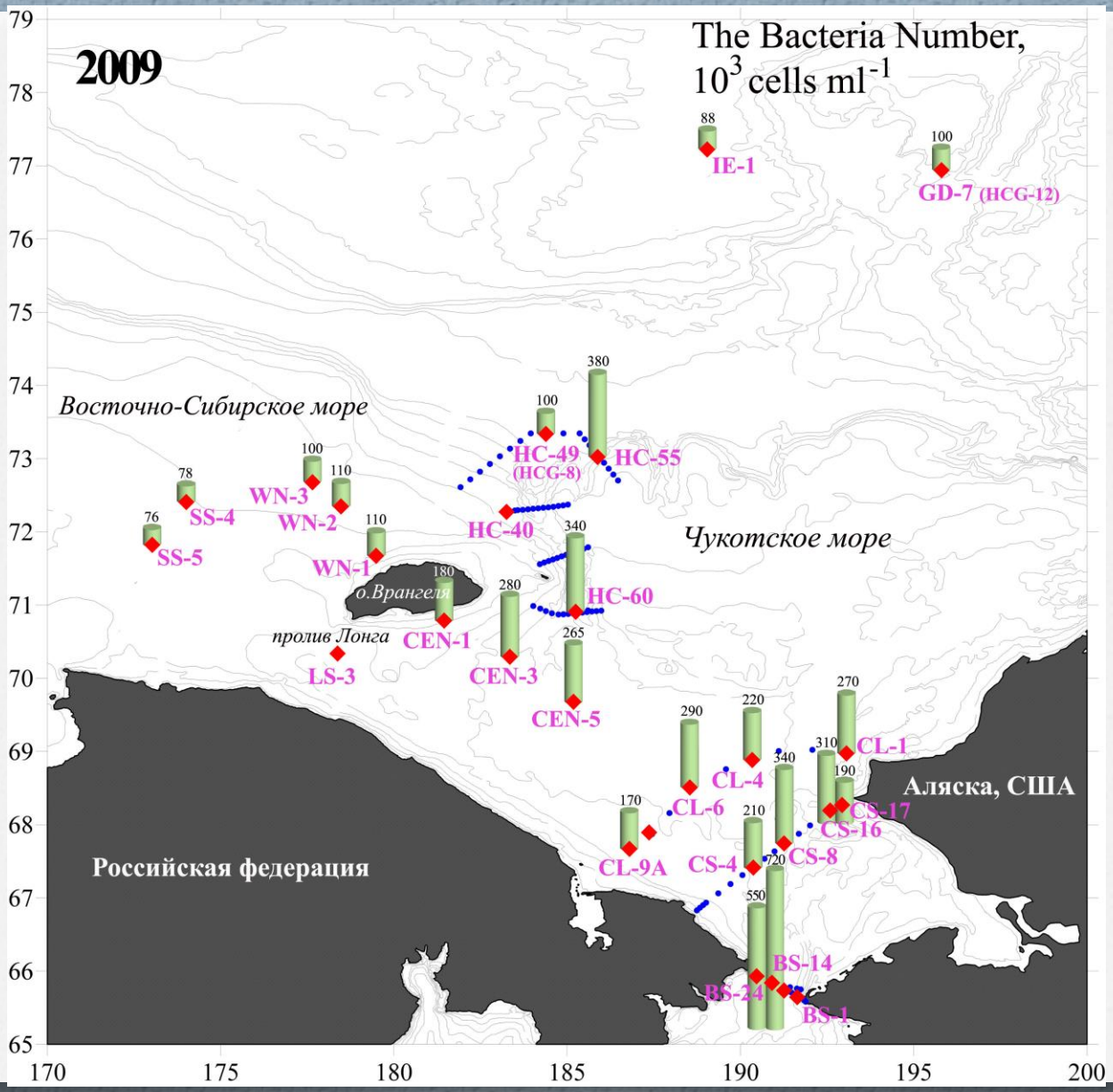
Sediment Chlorophyll a (mg/m^2) as short-term indicator of carbon supply to benthos







- Depends on overlying water column production on a seasonal basis
- Patterns of highest values in upper Herald Valley (SE Chukchi Sea)


2009
The Bacteria Number,
10^3 cells ml^-1
Восточно-Сибирское море
Чукотское море
Аляска, США
Российская федерация
о.Врангеля
пролив Лонга
IE-1
GD-7 (HCG-12)
HC-49 (HCG-8)
HC-55
HC-40
HC-60
WN-3
WN-2
WN-1
SS-4
SS-5
CEN-1
CEN-3
CEN-5
LS-3
CL-1
CL-4
CL-6
CL-9A
CS-17
CS-16
CS-8
CS-4
BS-14
BS-24
BS-1
79
78
77
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73
72
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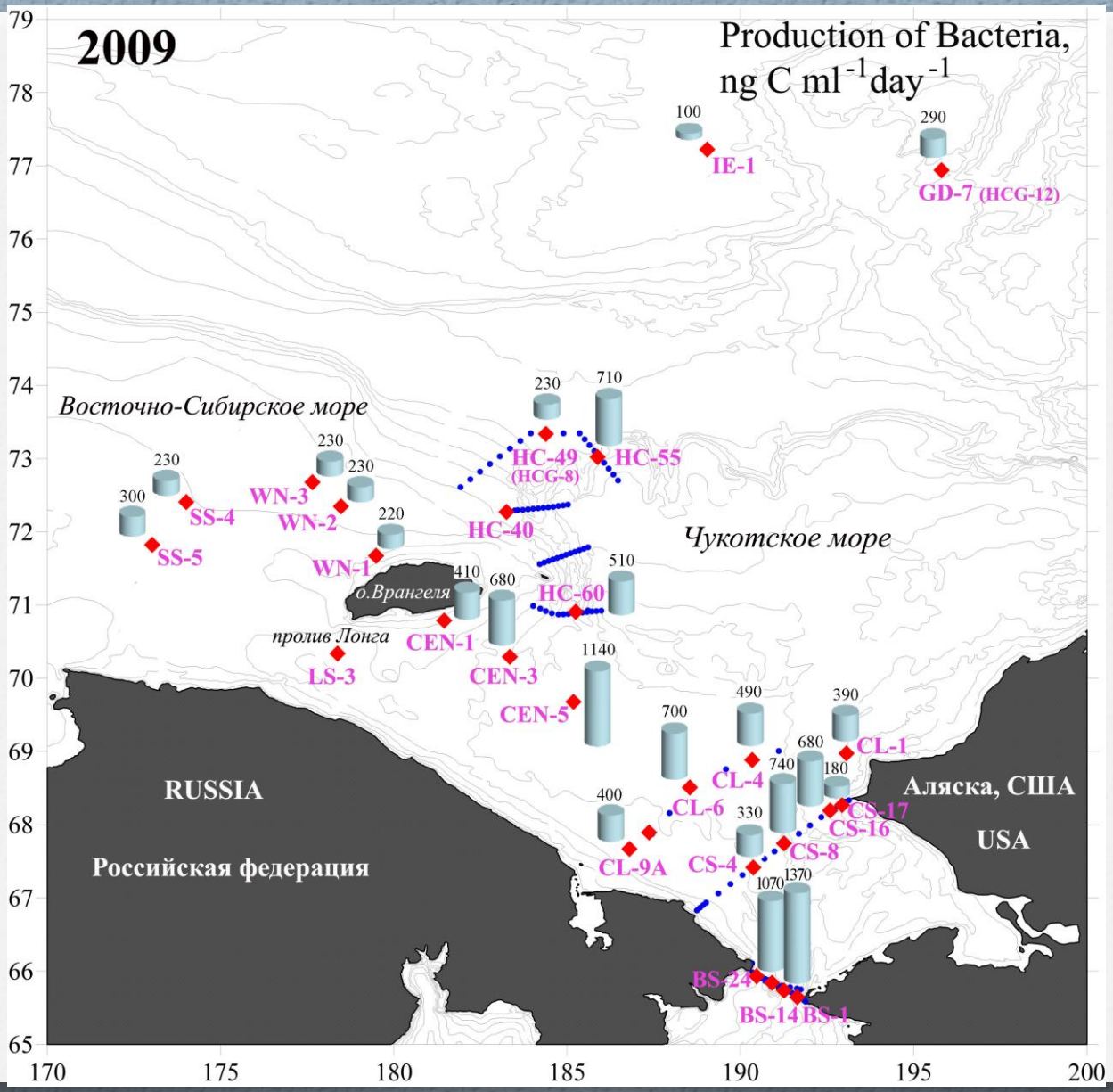
67
66
65
170
175
180
185
190
195
200


2009
Production of Bacteria,
ng C ml -1 day -1
Восточно-Сибирское море
Чукотское море
о.Врангеля
пролив Лонга
RUSSIA
Российская федерация
Аляска, США
USA
IE-1
GD-7 (HCG-12)
HC-49
(HCG-8)
HC-55
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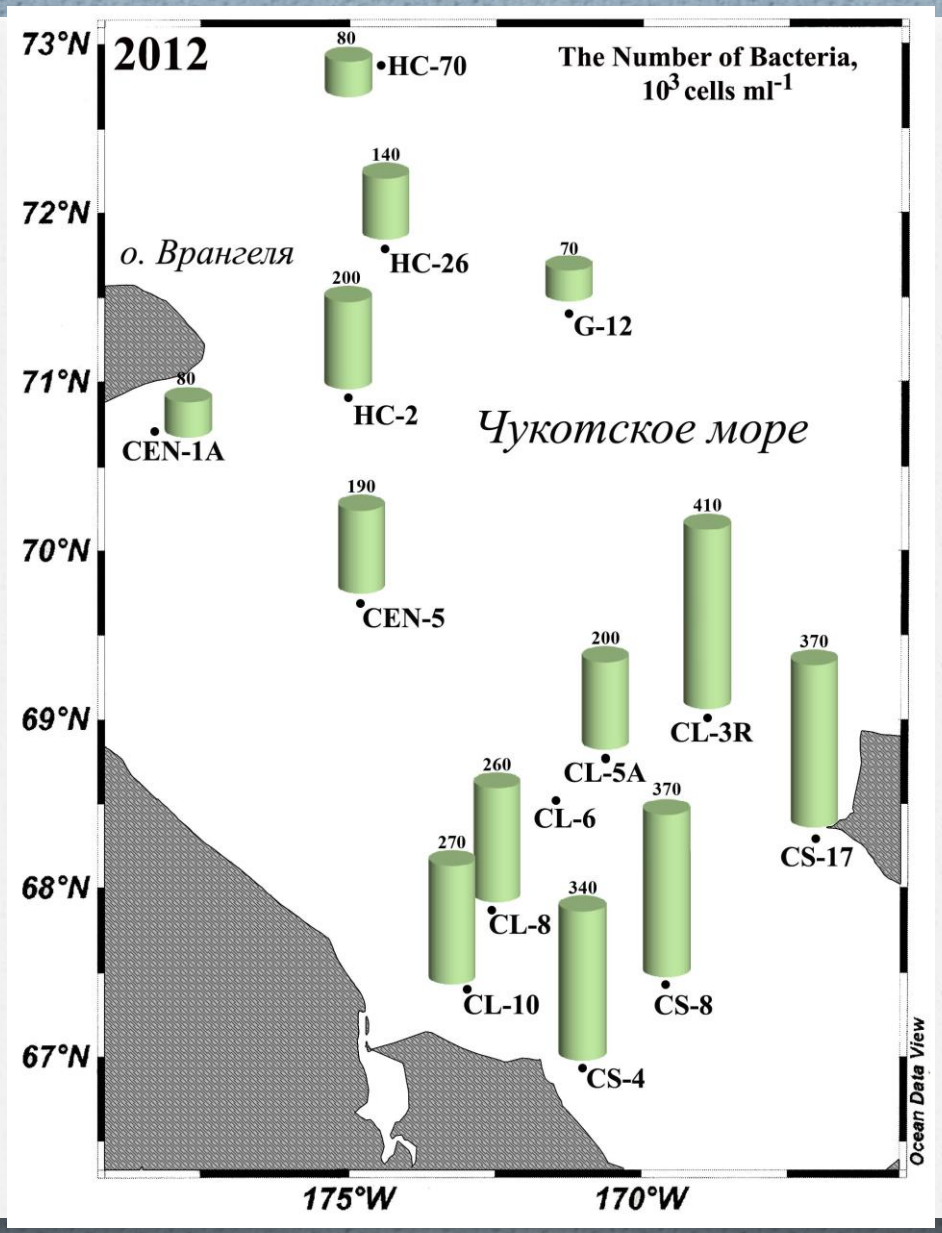
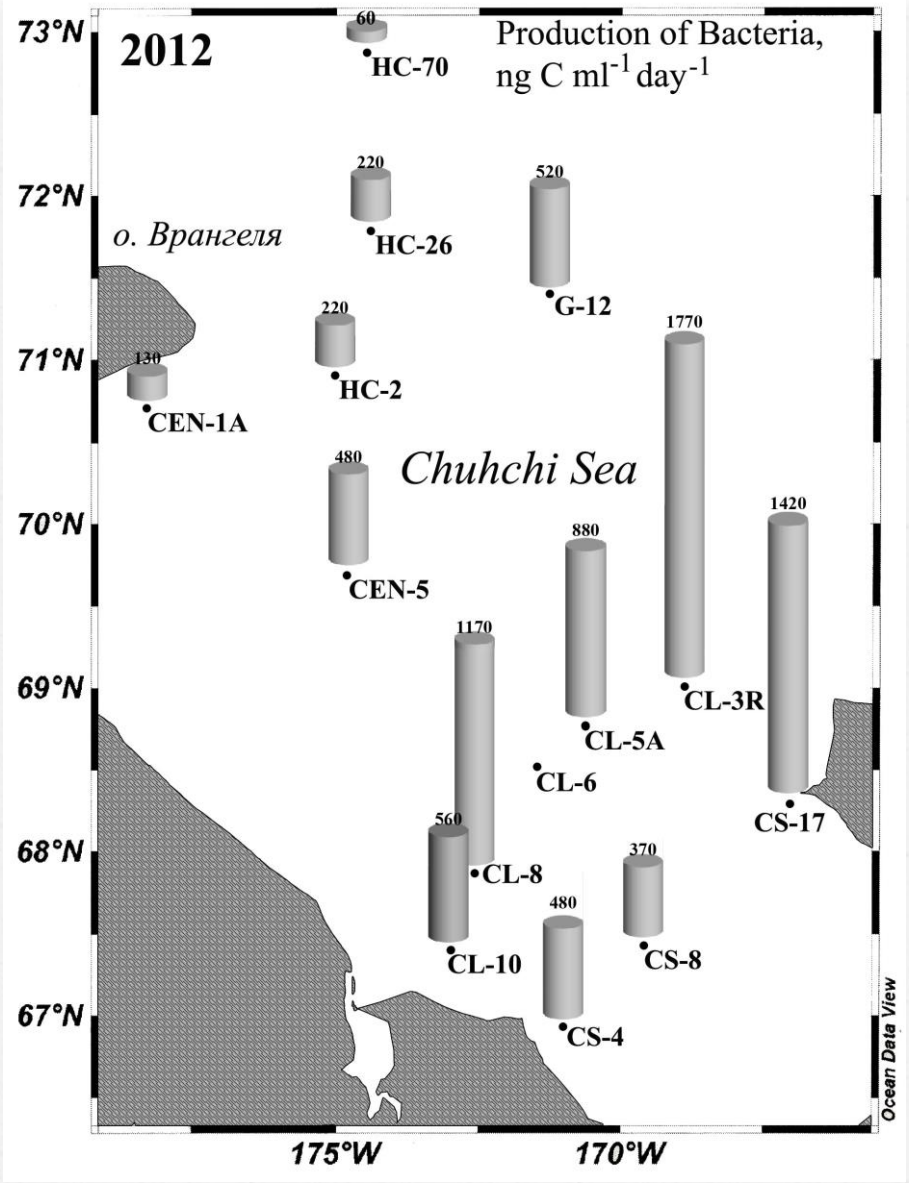
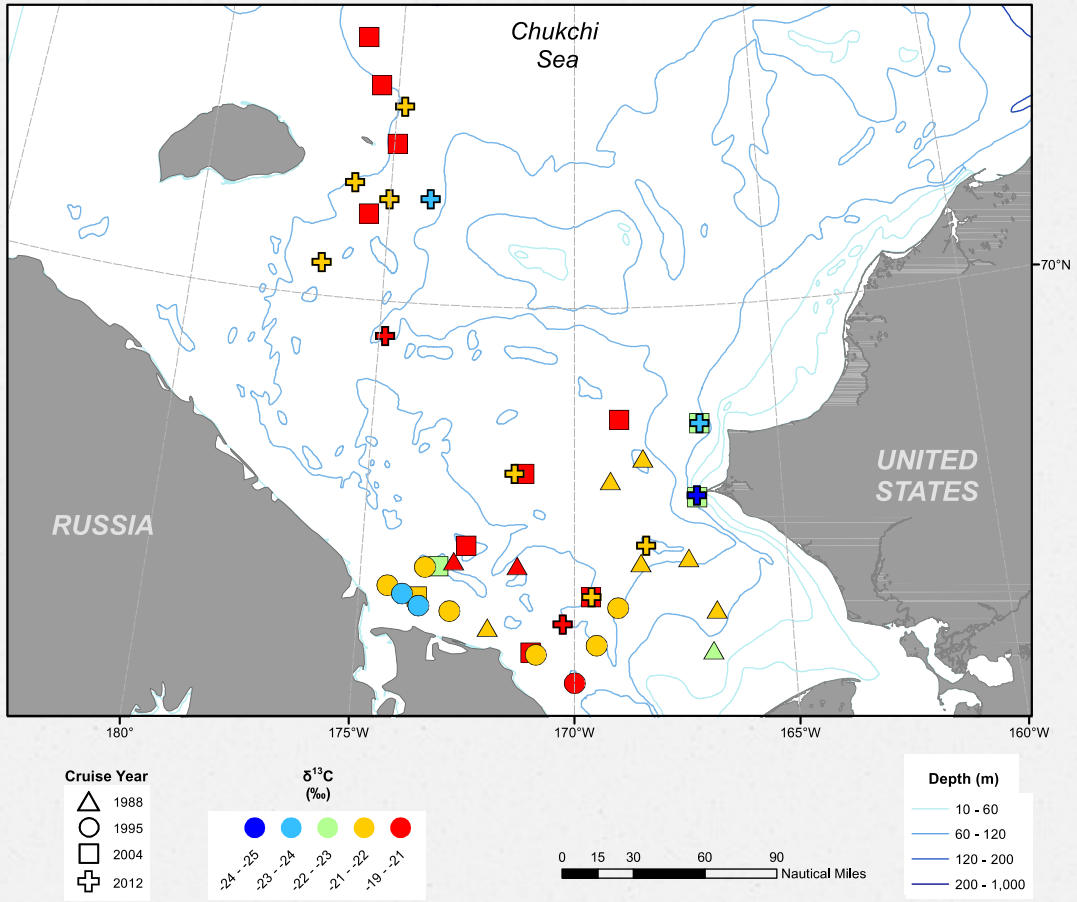
WN-3
WN-2
WN-1
SS-4
SS-5
CEN-1
CEN-3
CEN-5
LS-3
CL-1
CL-4
CL-6
CL-9A
CS-17
CS-16
CS-8
CS-4
BS-24
BS-14
BS-1
100
290
230
710
230
230
230
300
220
410
680
510
1140
700
490
390
680
740
180
400
330
1070
1370
79
78
77
76
75
74
73
72
71
70
69
68
67
66
65
170
175
180
185
190
195
200

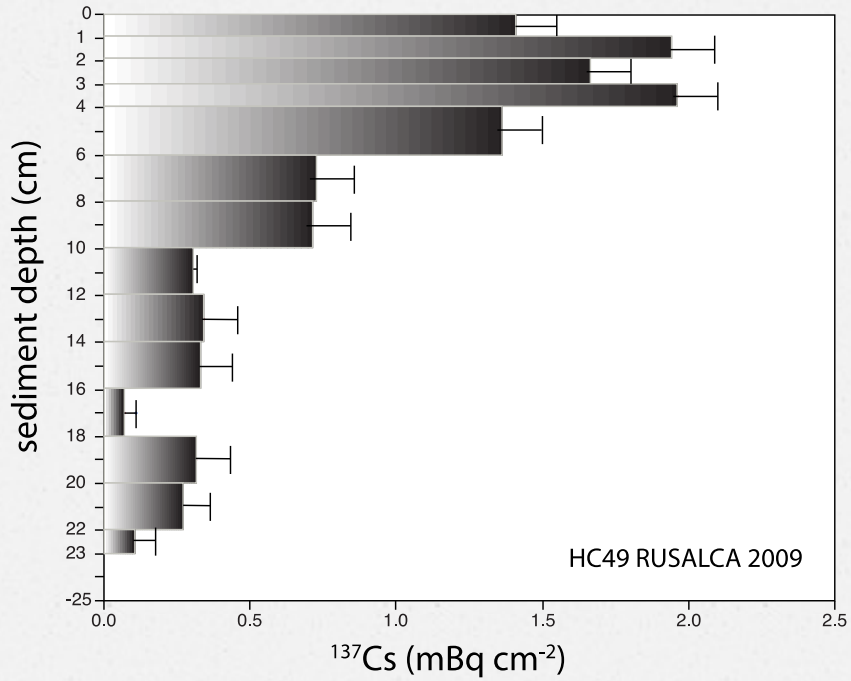

2012
The Number of Bacteria,
10^3 cells ml^-1
73°N
72°N
71°N
70°N
69°N
68°N
67°N
175°W
170°W
о. Врангеля
Чукотское море
80
HC-70
140
HC-26
70
G-12
200
HC-2
80
CEN-1A
190
CEN-5
410
CL-3R
200
CL-5A
370
CS-17
260
CL-6
370
CS-8
270
CL-8
340
CS-4
CL-10
Ocean Data View


2012
Production of Bacteria,
ng C ml-1 day-1
о. Врангеля
Chuhchi Sea
60
HC-70
220
HC-26
520
G-12
220
HC-2
130
CEN-1A
480
CEN-5
1770
CL-3R
1420
CS-17
880
CL-5A
CL-6
1170
CL-8
560
CL-10
370
CS-8
480
CS-4
73°N
72°N
71°N
70°N
69°N
68°N
67°N
175°W
170°W
Ocean Data View

Changes in $\delta^{13}C$ of organic carbon, surface sediments, 1988-2012, isotopically heaviest in 2004

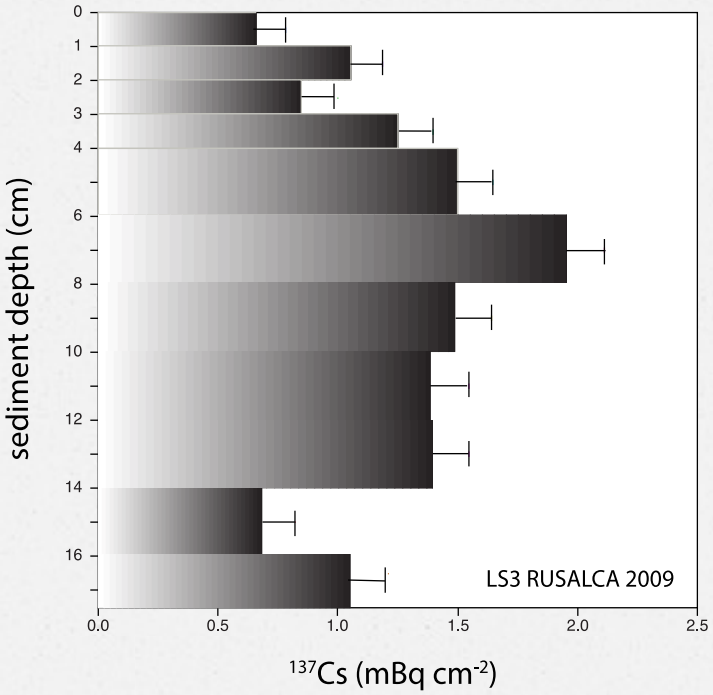


Herald Canyon 49



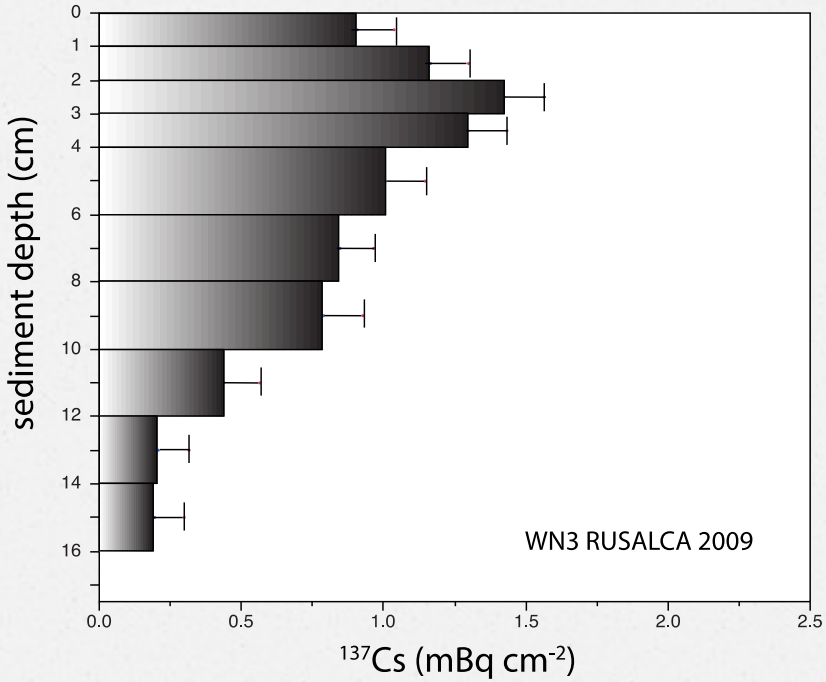
Low depositional environment, i.e. higher current flow; modest bioturbation

Long Strait 3



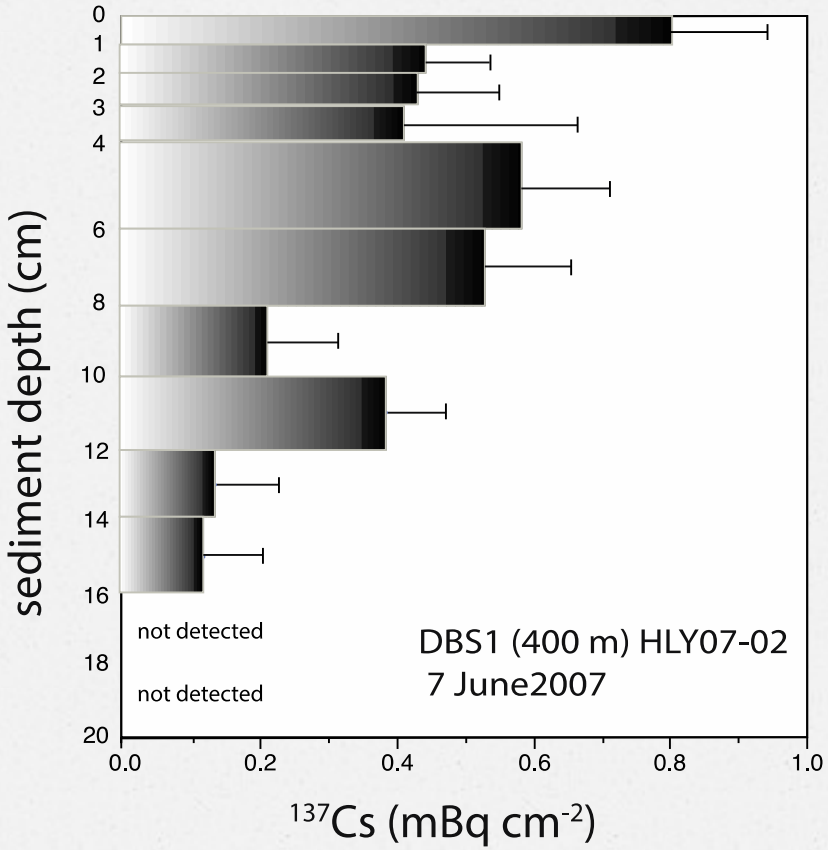
More depositional system, implying lower currents than in Herald Canyon; radiocesium present to bottom of core due to bioturbation; maximum deposition at 6-8 cm (~1964 bomb fallout peak)

WN 3 (East Siberian Sea)

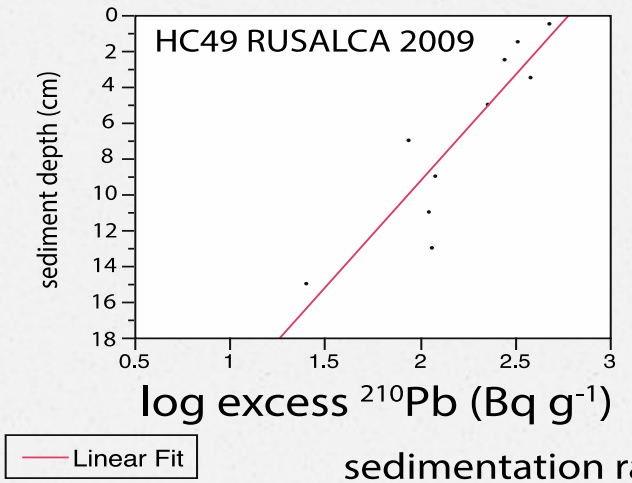


Lower sedimentation (apparent bomb fallout peak at 3 cm); lower bioturbation; well preserved profile suggests lower current flow

Bering Sea, 400 m



^{210}Pb example Herald Canyon



log ^{210}Pb = 2.678 + 0.068 (depth)

r^2= 0.81

sedimentation rate = ~0.2 cm yr^{-1}
decay coefficient for ^{210}Pb (-0.0132 yr^{-1}) /slope of line(-0.068)

^{210}Pb dating suitable for a sub-set of cores; challenges include bioturbation; sedimentation rate of 0.20 cm year^{-1} higher than independently estimated from ^{137}Cs ~0.10 cm year^{-1}

SYNTHESIS PAPER #1: COOPER, SAVVECHIV, GREBMEIER

- Carbon as currency and cycling: production and destruction
- Bacterial populations: composition, abundance and heterotrophic bacterial production
- Stable isotope carbon analyses and C-14 method to evaluate transformations of carbon in water and sediments
- Compare surface sediment stable C isotope with bottom water suspended load-indicates bacterial activity at sediment-water interface
- Role bacterial and infauna in sediment metabolism
- Sediment oxygen and nutrient fluxes
- Sedimentation rates: Cs-137 and Pb-210, downcore
- Savvichev, Cooper, Grebmeier, others?