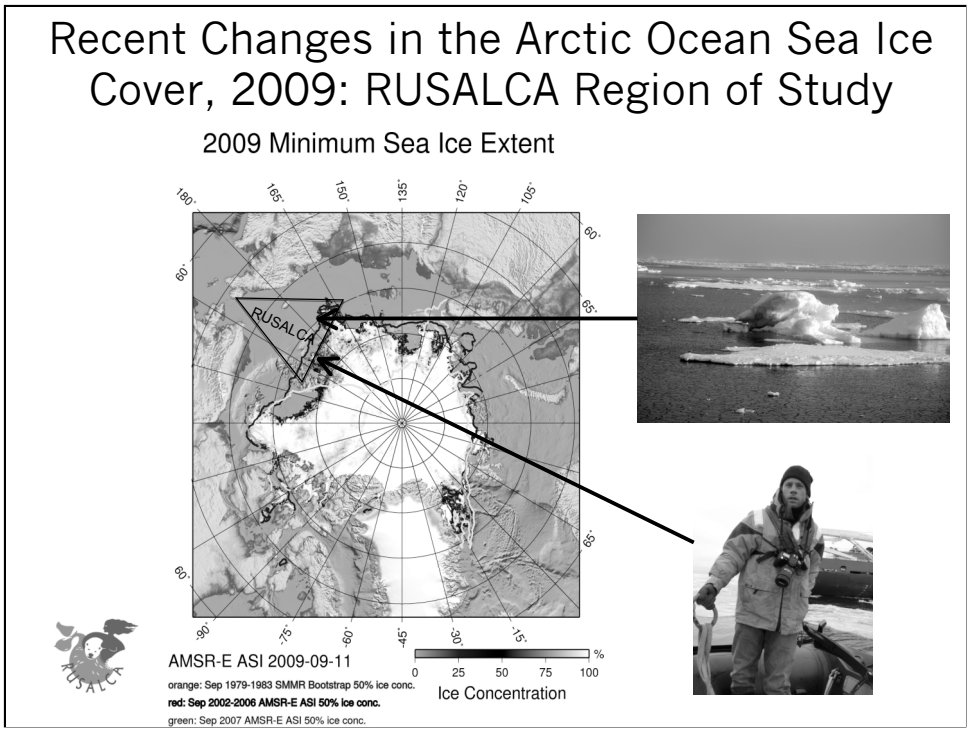
HIGHLIGHTS FROM RUSALCA 2009

RUSSIAN-AMERICAN LONG-TERM CENSUS OF THE ARCTIC

Kathleen Crane, Arctic Research Program, CPO NOAA, USA U.S. Oversight for RUSALCA
Aleksey Ostrovskiy, Group Alliance, Russia, Russian Federation Oversight for RUSALCA

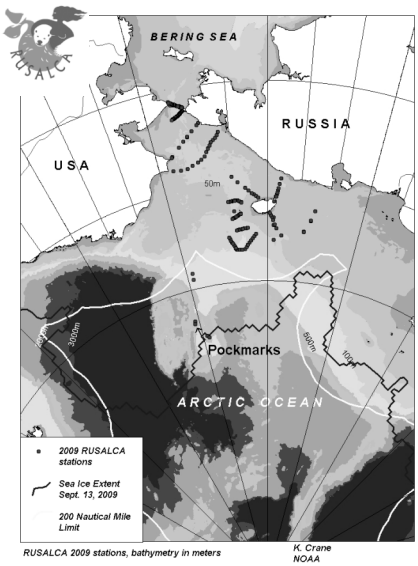


Left multi year ice (thickness and age change) Ron Kwok (JPL)

Right sea ice extent reduction. NSIDC

Ice coverage this year in september;

2009 STATION LOCATIONS



RUSALCA 2009 stations, bathymetry in meters

K. Crane
NOAA

Photos Courtesy of A. Ostrovskiy

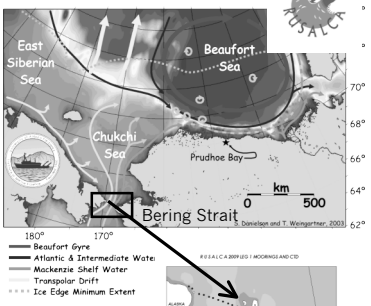
It shows the highlights of the 2009 RUSALCA program (Russian American Longterm Census of the Arctic). Next year in 2010 will continue to use the R/V Khromov to service the Bering Strait moorings.

Got up to the pock marks this year. No evidence of methane.

Fluxes Through the Bering Strait: Leg 1

Rebecca Woodgate, UW, Chief Scientist
Elena Bondareva, AARI mooring head

- **moorings in Bering Strait show decrease salinity, increase freshwater flux, and temperature**
- **revised Bering Strait FW influx upwards from 1989**
- **Bering Strait is the largest Arctic ''river'' (~40% of freshwater)**
- **10% of earth's freshwater flows into the smallest ocean with the highest proportion of shelf**
- **currently 7 joint US-Russian moorings part of RUSALCA**
- **2009 Eastern Strait fresher & cooler… waiting for Western data**

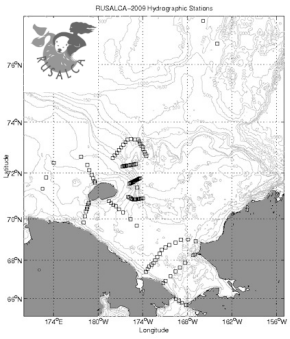


Photos courtesy of A. Ostrovskiy and K. Crane

Main task is monitoring fluxes through Strait; need to do that w/ Russia; service moorings everyyear. Temps have been increasing and salinities decreasing in last several years. Gateway; anticipate enhanced cooperation.

Changes in Hydrography: Leg 2

R.S. Pickart, H.N. Swartz and D.J. Torres, Woods Hole Oceanographic Institution
E. Bondareva, Arctic and Antarctic Research Institute



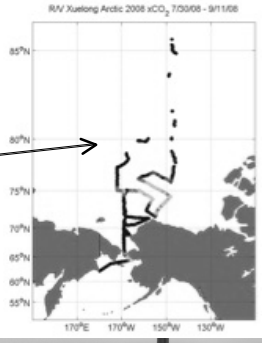
◆134 CTD stations during Leg 2
◆WHOI provided rosette mounted with 21 10-liter bottles, Sea-Bird model SBE 911 + CTD profiler, upward and downward looking RDI Workshorse300 kHz ADCP, and a SeaScan Video Plankton Recorder
◆High speed survey of the Herald Canyon was carried out, investigation of the area around Wrangel Island, in the East Siberian Sea and above the Chukchi Plateau.
◆Hydrographic conditions were greatly different from 2004 (Maybe a seasonal effect).
◆Water masses on the western side of Herald Canyon were warmer than in 2004. On the eastern side of the canyon, the summer water reached farther north than in 2004
◆The Siberian Coastal Current extended more than 70 km offshore in 2009. It was not present during the 2004 expedition.

Photo courtesy of RAS-NOAA, RUSALCA 2009

WHOI and Russian team – illustrates physical hydrography conducted in 2009 mostly in canyon waters; trying to get a handle on quantifying flux rate from Pacific to Arctic through the Bering strait.

Ecosystem-CO_2 Variability in the Region of Extreme Sea Ice Change

- In 2008 NOAA funded the PCO_2 sampling in the Arctic Ocean using the Chinese Vessel Xue Long. The results showed: a **very large CO_2 sink < 380 ppm** in the entire region, including in the ice



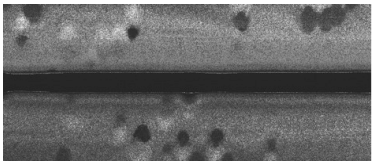
- In 2009 Nick Bates carried out CO_2 studies during RUSALCA Leg 2 north to 77°30'N.

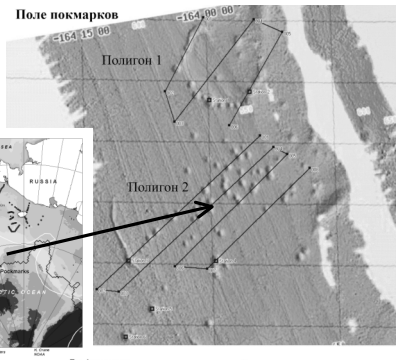
Photo Courtesy of Dan Torres

Started ocean acidification. First put instruments on Chinese vessel; discovered a huge CO2 sink under the ice. This year we're doing the sampling on the Russian ship. First two years to look at the changing CO2 in upper ocean of arctic in areas of sea icea nd where ice just disappeared for the first time. We think sea ice has a major impact on preventing CO2 into the ocean.

PACIFIC-ARCTIC SEAFLOOR FLUX OBSERVATIONS : Tatiana Matveeva and Liza Logvina P.Is

- Objective is to determine the magnitude and distribution of the flux of methane from submarine permafrost into the Arctic Ocean
- Instrumentation is supplied from VNIIOkeangeologia, Russia,: A SONIC deep-water side-looking sonar 30Khz and sub-bottom profiler were used for the investigations.
- Investigations took place along the Herald Canyon and above a pockmark field located on the Chukchi Plateau. To date, no evidence of present day methane fluxes have been located





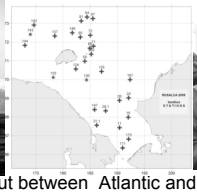
Multibeam sonar map from Healy, 2003, 76.5°N

Bottom right: US multibeam map from Healy in 2003. w/Sidescan from Russia. Top is 30Khz sonar w/o nav. Illustrates sonar imagery. Looking for venting but found none but took cores. Nothing found in the water column.

Climate Change Impacts On Benthic Life

Zoological Institute of RAS S. Denisenko, P. Strelkov, D. Petrova,
UAF S. MIncks J. Weems (Iken and Bluhm), UMD, J. Grebmeier, L. Cooper

INITIAL RESULTS:29 Van Veen Grabs; 270 Tissue Samples from Trawl



Photos RAS-NOAA RUSALCA 2009

•Genetic Relational Studies to be carried out between Atlantic and Pacific Arctic Species
.

•Zoobenthic biomass to NW of Wrangel is much higher in 2009 than in previous years. High density of large isopods.

•Highest infaunal biomass at the head of Herald Valley: hotspot of *Macoma* bivalves

•Pockmark site lowest observed biomass

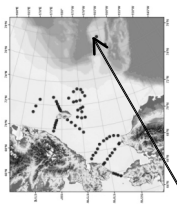
•Oxygen uptake highest under Anadyr water and East Siberian Sea and Long Strait. Large isopods

•Video imagery illustrated that benthic biomass is heavily underestimated by Van Veen sampling.

Team of zoologists from ST. Pt and US (large team); goals to revisit sites that are sentinel sites in Russia and US to look for benthic changes related to physical changes; mostly shallow waters (50-100m). Were able to take some stations in deeper waters.

Impacts: Probable Migration of Fish Northward

Surveys west to the East Siberian Sea and North to 77°30



Principal Investigators

Natalia Chernova, Daria Petrova, Catherine Mecklenburg, Brenda Holladay, Christine Gleason, Morgan Busby, Brenda Norcross

25 stations.
The most northerly trawl ever taken in the Pacific Arctic region.
22 species were collected; many species are rare to science.

14 additional Species were collected during RUSALCA 2009

Photos courtesy of Dan Torres

IF ASKED: Any vessel can go and sample at a particular place.

Shows tracking migration of fish north. Mixture of CPO and OER to look for what species are there, which are new, range extensions, trying to track migration with changes in current and temps. These species are shared all over the world. Took the most northerly fishing trawl ever taken (arrow) Pacific Arctic region. Mid-water trawl. Found many rare to science species.

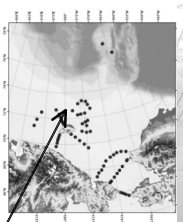
Cite NOAA Arctic plan

Know a lot about southern BS, but not northern BS, Chukchi, Beaufort

Deciphering Biodiversity Changes in the Water Column: Zooplankton

Principal Investigators:

Ksenia Kosobokova, Shirshov, Russ Hopcroft UAF



- 63 stations for species identification
- To assess the health of the zooplankton
- Population egg production experiments were carried out.
- Strong across-shelf differences occurred in the northern domain and strong east-west gradients in the southern Chukchi Sea.
- Small jelly fish were common in the NW region near Wrangle Island
- Alaska Coastal Current pteropods were common.
- Compared to 2004, meroplankton and larvacean were less abundant. in the region.

Photo courtesy of RAS-NOAA, RUSALCA 2009

Zooplankton: can reach full water depth. Russians, Alaskan and German team – biodiversity; OER co-funded. Try to track genetics across the arctic; e.g., invasions from species from Atlantic to Pacific. Looking at evolution of species across the arctic.

Fate of Ice and Non-ice Dependent Marine Mammals

RUSALCA Point of Contact, Sue Moore, NMFS, NOAA

Locations Vs Ice edge and regions of high productivity

- Rare opportunity to search for marine mammals in East Siberian Sea and Far north
- 7 species of marine mammals were observed; bowhead, gray and humpback whales, walrus, ringed and bearded seals and polar bears
- >100 gray whales spotted over the benthic hot spot
- 67-67.5°N and 169.33-169.666 W
- Gray whales spotted north of Wrangel Island- may be a northern range record for this species.
- Probably bowheads observed in Herald Canyon.
- 80 walrus hauled out on narrow sliver of ice north of Wrangel Island.

Photos Courtesy of RAS-NOAA, RUSALCA, 2009

Had people on board trying to track marine mammals. Great opp for mm folks b/c mammals move all around this area; spend most of their yearly cycle on the Russian side. Political issue with not having people on vessels; spotted grays north of Wrangel island (new to American scientists). Happy to expand across political border. No passive acoustics.

Changes in Nutrients and Productivity

- Quantify the range of nutrients, phytoplankton biomass and productivity in water masses
- Establish physical and chemical factors that are conducive to large rates of primary production
- Compare contemporary rates under warm conditions with those from the previous decade
- 8 productivity bottle experiments
- 49 stations

P.I.'s Terry Whitledge, Sang Lee, Hyoung Min Joo and Mike Kong

Photo courtesy of RAS-NOAA, RUSALCA 2009

Three country – Russia, US, Korea. Look at info from moorings (productivity) and insitu sampling over 40 days of expedition. Remind them that Korea has an ice breaker coming online this year and will be offering positions to US scientists; looking for suggested sampling site programs. Vessel will have sidescan.

Changes in Microbiological and Biogeochemical Aspects of the Carbon and Sulfur Cycles

P.I. A.S. Savvichev, E.E. Zakharova, Vinogradsky Institute of Microbiology, RAS

- A warming of the Arctic climate is expected, which can cause a substantially increase in microbial methane production; the quantitative characterization of this process is therefore important. Increased methane production may lead to elevated concentrations of this greenhouse gas in the atmosphere and therefore to further warming.

As a whole, preliminary results of researches specify rather high activity of microorganisms determining substantially modern processes of diagenesis of deposits of Chukchi Sea.

Major investigation took place in the Herald Canyon and on the Chukchi Plateau at the Pockmark site.

Photo courtesy of RAS-NOAA, RUSALCA 2009

Microbiology – showing chemical carbon cycles; Russans taking lead on methane. Looking at variability acros whole region. Oil companies have big interests in these groups (east siberian sea).

Future Opportunity for PAG Participation: Suggested Stations

Critical hydrographic Stations

Latitude	Longitude W
71.305	-157.41
71.457	-157.714
70.908	-174.311
70.893	-175.474
71.42	-152.04
73.5	-166

Critical fish stations

Latitutde	Longitude
70.283333	-176.666667
69.683333	-174.833333
69.836667	178.016667
71.666667	179.500000
71.400000	-174.780000
68.949867	-166.912117
69.006200	-168.894767
68.522417	-171.461867
67.870283	-172.550900
67.408217	-173.602817
66.934600	-170.990150
67.432250	-169.597283
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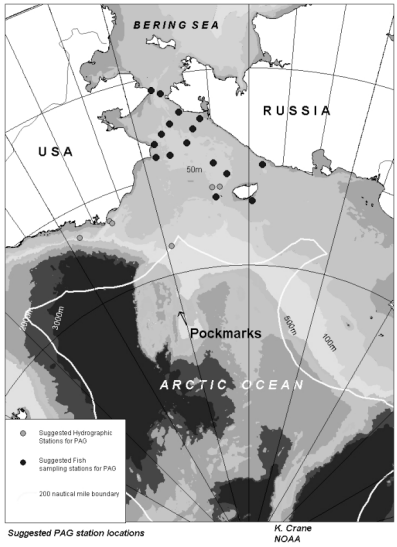
65.624667	-168.177167



Suggested PAG station locations

K. Crane NOAA

Sites suggested for PAG (Pacific Arctic Group) sites for people to go to for opportunistic sampling and sharing with other scientists doing similar work. Sentinel monitoring. Really difficult to get into the Russian side w/o Russian participation. To be revised. Chinese and Koreans have both stated they will put this into their sampling logs. More monitoring than exploration of interest to climate groups (changes).

Another program: Polar Sea to look at ice ridges (OER) – John may have some slides. Diving under ice. Don't know results. Hopefully John has some info b/c it is a US ice breaker.

ARP relies on Arctic Ice Center.

NSF

FUTURE GOALS/OBJECTIVES: Have plans in past and hope in future, would like to do a multiplatform expedition to expand RUSALCA with other vessels, US, Canadian, etc. (PAG) to do a much larger set of coordinated expeditions in pacific Arctic. Right now only 1 vessel. Would require additional coordination. Goal is to sample at the same time the state of the arctic in multiple geographies to see what is happening over a month. Optimistic. Have talked with Russia recently about doing joint bathymetry further north. Craig McLean was discussing with Russian Admiral (Russian Hydro Survey office) north of Chukchi. They don't have the multibeam. Interested in working with multiple agencies.