

Arctic Ocean Diversity (ArcOD)

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<http://www.zin.ru/projects/arccoml/eng/index.html>

1. 2006 ACCOMPLISHMENTS & SCIENTIFIC HIGHLIGHTS

1) *Proposals funded and pending*

Title	Organizations involved	Status and agency	Duration
The Chukchi Borderland: sea ice, zooplankton, benthos, fish, physical-chemical environment	UAF, Texas A&M, RAS, Pt. Stephens Research, MPC (US, Russia)	Pending NOAA OE	2007-2009
Frozen treasures - the life in Antarctic sea ice	UAF, ACE CRC (US, Australia)	Pending NOAA OE	2007-2008
Frozen Jello: exploration of gelatinous zooplankton in the Antarctic	UAF, MPI, JAMSTEC, ICM (US, Japan, Spain)	Pending NOAA OE	2007-2008
Beaufort Sea fish survey	AFSC, UAF (USA)	Pending MMS	2007-2009
Collaborating IPY projects ranging from sea ice to mammals, across the Arctic (ca. 20 projects)	Many (pan-Arctic)	Pending w/ various agencies	2007-2009
Arctic Ocean Diversity Census of Marine Life project	UAF, ZIN, IORAS, Moscow State Univ. (US, Russia)	Funded Sloan Foundation	2006-2009
Molecular phylogeny and population	IPOE, IFM (Germany)	Funded,	2007-2008

genetics of polar brittle stars of the genus <i>Ophiecten</i> (Echinodermata: Ophiuroidea)		German Science Foundation	
Russian-American Long-term Census of the Arctic: Pelagic, benthic and fish communities	UAF, Pt. Stephens Research, Univ. Texas, RAS (ZIN, Shirshov) (US, Russia)	Funded NOAA ARO (\$\$ not announced yet)	2007-2012
Hidden Ocean phase II: sea ice, plankton, benthos, physical-chemical environment	UAF, Texas A&M, HBOI, CA State Univ., ZIN, Shirshov, PRI China (US, Russia, China)	Funded NOAA OE	2005-2007
Arctic Ocean synthesis: Analysis of Climate Change impacts in the Chukchi and Beaufort Seas with strategies for future research	Univ. of Alaska (organizers); about 35 participants (US, Canada, Russia, Japan)	Funded NPRB	2005-2006
Bering Sea Ecosystem Study – sea ice, zooplankton	UAF, NOAA (US)	Rejected, but likely resubmission in 2007	2008-2012?

All projects and proposals contribute to increased assessment of biodiversity, many in understudied regions, or for understudied groups.

2) Workshops

Three workshops/meetings were held in 2006:

An Arctic Synthesis workshop was funded by the North Pacific Research Board. The workshop was held February 16-17, 2006, in Coconut Island Hawaii, consisting of 8 of the ten working groups (35 participants), with two working groups meeting later. The goal of this effort was directed at summarizing the current state of knowledge and then identifying: (1) the most crucial information gaps, (2) ‘pulse points’ in the biological/physical environment that require monitoring, and (3) how climate change might impact biota through its influence on: sea ice extent/characteristics, shelf currents and transport through Bering Strait, coastal currents along Alaska’s north coast and their relationship to various biological processes and life histories. This workshop resulted in a comprehensive report submitted to NPRB in September 2006. This report will hopefully guide future Announcements of Opportunity with regard to Arctic research funding by the NPRB.

ArcOD held its second SSG meeting Feb 19-20, 2006 in Honolulu, Hawaii in association with the Ocean Sciences Meeting. Agenda items included status reports, IPY opportunities and plans, mini-grant format etc. During this meeting we made good progress on defining the scope and format of our mini-grant program and discussed ArcOD’s role during IPY.

The third workshop was held in St. Petersburg and Moscow, Russia, May 18-23, 2006. Participants included ArcOD collaborators from the Fairbanks office and data base team and the Zoological Institute, Shirshov Institute and Moscow State University. On the agenda were progress updates, data base work and problems, co-ordination issues as well as informative tours of the hosting institutions and their enormous sample collections. The meeting was hosted by Dr. Igor Smirnov and colleagues at the Zoological Institute in St. Petersburg, and by Dr. Andrey Gebruk and colleagues at the Shirshov Institute in Moscow.

3) IPY preparations

ArcOD, with the support of their SSG and PIs of collaborating Expressions of Intent (EoI), submitted their full International Polar Year (IPY) proposal to the International Council for Science (ICSU) for the January 31 2006 deadline and received IPY endorsement from the Joint Committee in March 2006. The proposal along with a list of EoIs interested in collaborating was assigned the activity ID# 333 and can be viewed at <http://www.ipy.org/development/eoi/proposal-details.php?id=333>. The proposal brings together 20 EoIs (pending funding) that focus on Arctic biodiversity questions. The IPY approval stamp *per se* does not come with any funding, but several nations required the approval to be able to submit IPY-related proposals to their national funding agencies. The duration of IPY will be March 2007-March 2009. Goals and objectives of IPY can be found at www.ipy.org. A final list of funded projects will be presented on the new ArcOD web site. IPY will help ArcOD go pan-Arctic and will make the collaborating network larger.

4) Data base work (OBIS liaisons Huettmann, Cermak; Russian contact: Igor Smirnov, ZIN)

In 2006 we were able to register ArcOD as a node with OBIS and GBIF (<http://www.gbif.org/DataProviders/resourceslist>, OBIS currently changing web design). The first test data sets are served now through the Alaska Ocean Observing System AOOS (<http://ak.aos.org/op/data.php?region=AK&type=b&name=arcod>) and are part of OBIS and of GBIF, and can be seen there by the public. AOOS staff member Rob Cermak contributes part of his time to maintain the site and post new data sets. We have begun creating metadata and online data for a series of new data sets, partly from the ongoing minigrant program. Details can be seen in the OBIS report template.

Efforts are ongoing to make the comprehensive database of >10,000 records compiled by our Russian counterparts compatible to OBIS formats. At this time, the Russian ArcOD database can be viewed at <http://www.zin.ru/projects/arccoml/eng/dbases.htm>. In addition to species records, a database containing Russian references is posted on this web site and currently contains >800 entries.

In order to achieve our goals, we communicated with data owners, reviewed data sets and metadata, held progress meetings among ArcOD members, and – by email - with collaborators (depending on access and availability). Additional meetings were held with AOOS.

5) Mini-grant program

ArcOD's first minigrant program is now in full swing. 11 small grants were awarded to researchers from six nations (Canada, Germany, Poland, Norway, Russia, US) with two additional grants in progress. Geographic areas investigated range from the Barents to the Beaufort Sea and topics cover zooplankton, benthic and sea ice biodiversity questions. A strong focus is on fostering data compilations for the Arctic node of OBIS as well as enhancing taxonomic resolution of existing samples. Several new species have already been found as a result of this effort. The following table lists the ongoing minigrant projects.

Title	Geographic area	Taxonomic focus	Primary product(s)	PI(s)
Western Arctic marine fish museum voucher database	Western Arctic	Fish	Data base, species IDs	Mecklenburg, Chernova, Sheiko
Compilation of species abundance data sets from sympagic, pelagic and benthic biota in Arctic Seas	Eurasian Arctic	Benthos, plankton, ice biota	Data sets	Piepenburg, Spindler
Mesozooplankton community structure and diversity in the southeastern Beaufort Sea	Beaufort Sea	Zooplankton	Species IDs, data set	Fortier
Taxonomic biodiversity of benthic boundary layer zooplankton from the Beaufort Sea shelf	Beaufort Sea	Zooplankton	Species IDs, data set	Deibel, Connelly
Benthic Copepoda Harpacticoida from Kongsfjorden, Spitsbergen and succession of Arctic meiofauna communities	Kongsfjord / Svalbard	Benthic harpacticoids	Species IDs, data sets, species descriptions	Veit-Koehler
Zooplankton species and stages from the Barents Sea MIZ & Amundsen & Nansen Basins	Barents, Eurasian Basin	Zooplankton	Species IDs, data set	Wassman, Arashkevitch, Pasternak
Phytoplankton and ice algae species from the White Sea, Barents Sea & Amundsen & Nansen Basins	White, Barents, Eurasian Basin	Phytoplankton / ice algae	Species IDs, data set	Wassman, Ratkova
Permanent archiving for specimens, notes and photographs from NARL	Beaufort Sea	Macro-benthos	Species IDs, data set	Foster, MacDonald
Epibenthic biodiversity in Arctic nearshore boulder communities	Beaufort Sea	Macro/mega-benthos	Species IDs, data sets	Iken, Schonberg
Abundance and diversity of the Amphipoda (Crustacea) of the Greenlandic shelf	Greenland Sea	benthic amphipods	Species IDs, data sets	Brandt, Stransky
Macrophytes from Hornsund Fjord - check list, species gallery and distribution map for web	Hornsund, Svalbard	Macroalgae	Check list, maps, imagery	Wiktor

6) ArcOD-related presentations at scientific meetings

Bluhm BA, Iken K, Dunton KH, Sirenko B, Gagaev S (2006) Chukchi Sea food web structure and epibenthic community composition. Alaska Marine Science Symposium. Anchorage, Jan 23-26, 2006 (talk)

Bluhm BA, Iken K, Dunton KH, Sirenko B, Gagaev S (2006) Chukchi Sea food web structure and epibenthic community composition. Eos Trans. AGU, 87(36), Ocean Sci. Meet. Suppl., Abstract OS35P-14 (poster)

Gradinger R, Bluhm B, Eicken H, Iken K (2006) Primary production and diversity of Arctic ice communities – relations to the environment. Ocean Science Meeting Honolulu Hawaii, Feb 20-24, 2006 (talk)

Gradinger R, Hopcroft RR, Bluhm BA (2006) Arctic Ocean Diversity Census of Marine Life project. Ocean Science Meeting Honolulu Hawaii, Feb 20-24, 2006 (poster)

Gradinger R, Hopcroft RR, Bluhm BA (2006) Arctic Ocean Diversity Census of Marine Life project. Alaska Marine Science Symposium. Anchorage, Jan 23-26, 2006 (poster)

Hopcroft R (2006) RUSALCA: Zooplankton. Arctic Science Summit Week, Potsdam, Germany. Mar 2006 (invited talk)

- Hopcroft R (2006) The consequences of climate change on Alaskan marine life. Alaska Forum, Anchorage, AK. Feb 2006 (talk)
- Hopcroft RR, Raskoff KA, Purcell JE, Youngbluth MJ (2006) Species discovery in the Arctic Ocean: the 2005 Hidden Ocean expedition. Eos Trans. AGU, 87(36), Ocean Sci. Meet. Suppl., Abstract OS43M-04 (talk)
- Iken K, Bluhm B (2006) Effects of climate change on benthic populations in the Arctic. Helge Ingstad Memorial Symposium, Fairbanks, Sep 7-9, 2006 (invited talk, both authors spoke)
- Kosobokova KN, Hirche H-J, Hopcroft RR (2006) Egg Production of Deep-water Calanoid Copepods in the Arctic Ocean. Eos Trans. AGU, 87(36), Ocean Sci. Meet. Suppl., Abstract OS35N-02
- Raskoff KA, Hopcroft R, Purcell R, Youngbluth MJ (2006) Deep-sea Gelatinous Zooplankton of the Arctic Ocean: Surprising Results From the 2005 Hidden Ocean Expedition. Eos Trans. AGU, 87(36), Ocean Sci. Meet. Suppl., Abstract OS33G-03 (talk)
- Sirenko B, Bluhm BA, Iken K (2006) New evidence of invertebrate invasion in the Chukchi Sea from the Northern Pacific. Eos Trans. AGU, 87(36), Ocean Sci. Meet. Suppl., Abstract OS35N-03 (poster)
- Bluhm BA, Gradinger R, Hopcroft RR (2005) Arctic Ocean Diversity Census of Marine Life project. International Arctic Research Planning Conference II, Copenhagen, Nov 11-13, 2005 (poster)
- Bluhm BA, Iken K, Dunton K, Sirenko BI, Gagaev S (2005) Chukchi Sea food web and epibenthic community structure. RUSALCA Joint US-Russian Arctic workshop, Kotor, Montenegro. Oct 2005
- Gradinger R, Hopcroft RR, Bluhm BA (2005). Arctic Ocean Diversity (ArcOD), a Census of Marine Life project – status report. Census of Marine Life All Program Meeting, Frankfurt, November 4-5, 2005 (talk)
- Hopcroft RR, Kosobokova K (2005) Chukchi Sea zooplankton community patterns. RUSALCA Joint US-Russian Arctic workshop, Kotor, Montenegro. Oct 2005 (talk)
- Hopcroft RR (2005) An Overview of Arctic Ocean Ecosystems. Marine Mammal Commission meeting. Anchorage, AK. Oct 2005 (talk)
- Hopcroft RR, Gradinger RG, Bluhm BB (2005) The Arctic Ocean Diversity project. Circumpolar Biodiversity Monitor Program workshop, Circumpolar Arctic Flora and Fauna (CAFF) program. Cambridge, UK. Sept 2005 (talk)
- MacDonald IR, Bluhm B, Iken K, Gagaev S and Robinson S (2005). Benthic community composition and seabed features of a Beaufort Sea pockmark. AGU Meeting, December 2005, St. Francisco (poster)

Data base-related presentations (all talks) with ArcOD connection

- Breton A, et al. (co-author Huettmann F) (2006) On the crucial Importance of using Databases to Manage Ecological Data: Seabird Case Studies from Kodiak Island and the Gulf Of Maine. Pacific Seabird Group (PSG) meeting, 16-19 February 2006.
- Oehlers S, Huettmann F (2006) Quantifying the Absolute Abundance of Coastal Murrelets in Yakutat Bay, SE Alaska: A Digital Template for Making Field Survey Data Globally Available to the Research Management Community Following ISO Standards. Pacific Seabird Group (PSG) meeting, 16-19 February 2006.
- Huettmann F (2006) The Global Biodiversity Facility GBIF. International Polar Year (IPY) Meeting on Data Policy in Cambridge, 3-4 March 2006
- Huettmann F (2006) The Avian Experience Monitoring Wildlife for Biodiversity Inventories: Reviewing Why, What, How, and an Outlook. Alaska Bird Conference, Juneau-Alaska, March 2006

- Huettmann F (2006) Automatized Methods for finding the best Algorithm Setting for Modeling Biodiversity Data in A Spatial GIS-Setting: Mars (Multivariate Adaptive Regression Splines) and beyond. Salford Systems Software Ltd Meeting, San Diego, 28-29 March 2006
- Huettmann F (2006) Linking data in ArcOD and OBIS: An overview. ArcOD workshop, St. Petersburg and Moscow, Russia. May 2006
- Huettmann F (2006) The International Polar Year (IPY) and Metadata: Why, What and How it links to Sustainable Ocean Management and Beyond. Metadata Conference, Dept. of Fisheries and Oceans, Dartmouth, Canada, 13-14 June 2006
- Huettmann F (2005) Alaska as an international leader in Natural Resource Management based on high quality Digital Data: Where we are, where to go and why. The Wildlife Society (TWS) Alaska Chapter, Fairbanks, 22-23 April 2005

All presentations communicated progress on Arctic Biodiversity questions and ArcOD itself.

7) *IPY post-doc awarded*

Sarah Mincks, previously University of Hawaii at Manoa, currently Natural History Museum London, has been awarded a UAF presidential International Polar Year post doc fellowship for 2007-2009. Sarah will be working under the auspices of ArcOD with B. Bluhm and K. Iken (ArcOD, NaGISA) at the School of Fisheries and Ocean Sciences at the University of Alaska Fairbanks and will, thereby, contribute to ArcOD and IPY goals.

8) *Publications see 8a. Community database*

9) *Science tidbits*

Update: New species and range extensions: At least 23 new species and 31 species range extensions have been recorded as a result of ArcOD-related work. This is likely an underestimate.

Taxon	Common name	# of species	Region
NEW SPECIES			
Cnidaria	Jelly fish	1	Canada Basin
Ctenophora	Comb jellies	3	Canada Basin
Polychaeta	Bristle worms	3	Canada Basin
Copepoda	Copepods	7	Canada Basin, Beaufort Sea
Ostracoda	Ostracod	1	Canada Basin
Cumacea	Cumaceans	1	Canada Basin
Isopoda	Isopods	4	Canada Basin
Amphipoda	Amphipod	1	Greenland Sea
Larvacea	Larvaceans	2	Canada Basin
		23	
RANGE EXTENSIONS			
Cnidaria	Jelly fish and polyps	7	Canada Basin, Chukchi Sea
Ctenophora	Comb jellies	2	Canada Basin
Nemertini	Nemerteans	1	Canada Basin
Polychaeta	Bristle worms	6	Canada Basin
Bivalvia	Bivalve	1	Chukchi Sea
Cephalopoda	Octopus	1	Canada Basin
Copepoda	Copepod	6	Canada Basin

Cumacea	Cumacean	1	Canada Basin
Decapoda	Crabs	2	Chukchi Sea
Ophiuroidea	Brittle stars	1	Canada Basin
Pisces	Fish	3	Canada Basin, Chukchi Sea
		31	

Highlight: Zooplankton

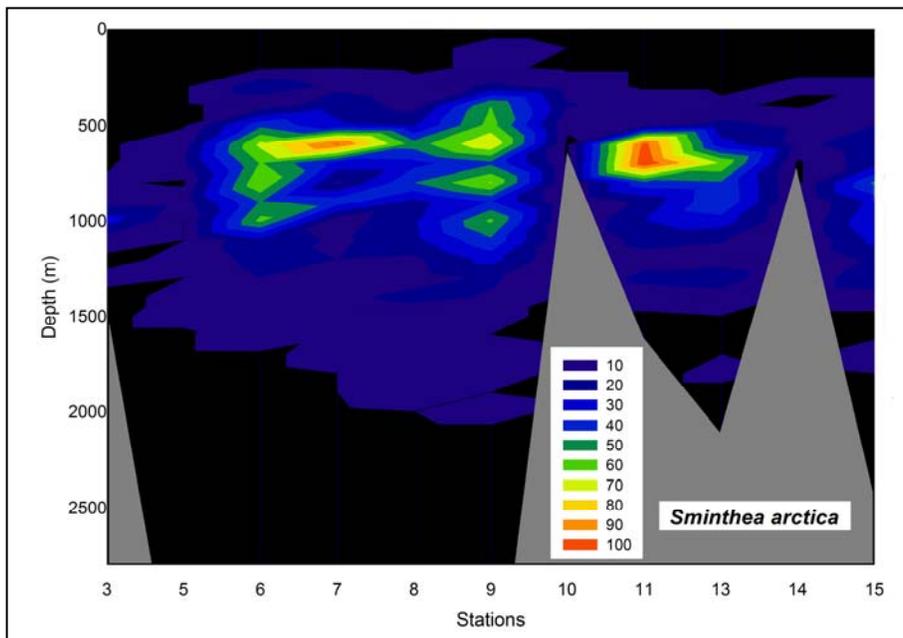


Figure 1: With a body about the size of sewing thimble, the hydromedusea *Sminthea arctica* was the most abundant soft-bodied zooplankter observed from the ROV in 2005. Data has been grouped into 50m depth strata and standardized to number of observations per hour, and reveals a preferred depth range of 500-1000 m. The topographic feature on the right hand side is the Northwind Ridge at about 75°N and 160°W (Figure by K. Raskoff, MPI).

ROV-based observations and collections have revealed a variety of gelatinous species never reported from the Arctic Ocean, or new to science. For example, our 2005 OE cruise doubled the number of known Arctic ctenophores species from 5 to 10, and showed siphonophores and medusae to be the most abundant “larger” zooplankton throughout the water column (e.g., Figure 1). During OE 2005 in the Northwind Ridge area specifically, 2 undescribed species of larvaceans, and one undescribed

ctenophore species (specialized for a novel epibenthic lifestyle) were collected, plus we noted range extensions on several species of epibenthic medusae. Cirrate octopods and squid were common, although virtually no records of their occurrence in this specific region exist.

Highlight: Sea ice

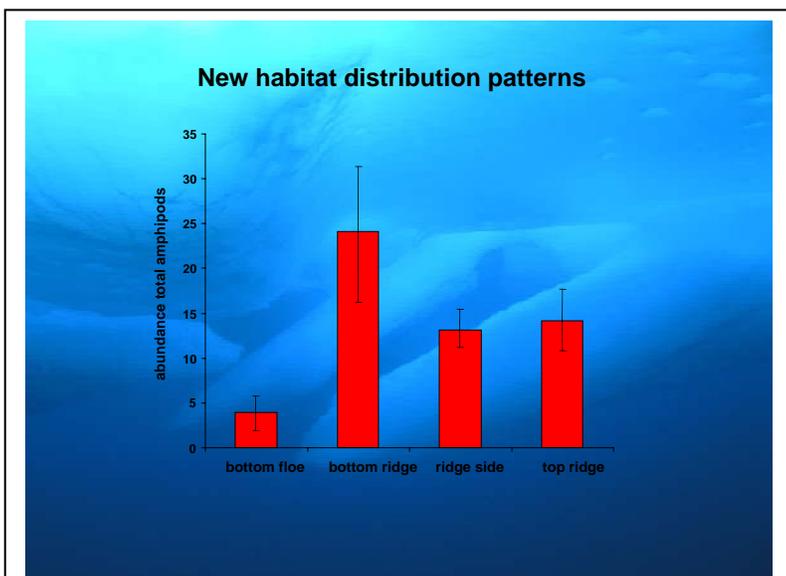


Figure 2: Abundance (animals/0.25m²) of sea ice amphipods along pressure ridges and the bottom of level sea ice floes (results from OE *Hidden Ocean* 2005 cruise). (Figure by K. Iken, UAF).

The heterogeneous structure and enormous thickness of sea ice pressure ridges cause difficulty in sampling with normal ice coring techniques, resulting in very little published data.

Observations by divers in the Barents

Sea provided first evidence for the algal distribution patterns in this environment. During OE *Hidden Ocean* 2005, we observed that the 3-dimensional structure of pressure ridges provided complex habitat for copepods, amphipods and fish to hide in, and presumably avoid predation. Preliminary data analysis showed that pressure ridges had indeed higher amphipod abundances than level sea ice. These observations are of relevance to evaluate the impact of enhanced sea ice melt in summer and winter on the species composition of the Arctic ice biota. Potentially, reduced surface water salinities will increase the importance of deep-reaching pressure ridges as refuges for true marine sea ice fauna.

The collected material from the Canada Basin is currently compared to data from the nearshore regions of the Chukchi/Beaufort Seas (Barrow, Alaska), and from Bering Strait. Shallow water sea ice fauna has specific faunal components (like polychaete larvae and juveniles) that are not found in the offshore pack ice which in turn houses sea-ice endemic fauna such as the above described under-ice amphipods.

Highlight: Benthos

During our *Hidden Ocean* 2005 cruise we were able to biologically explore a potential pockmark in the Chukchi Borderland area. This feature had a maximum water depth of approximately 940m, was 1200m in maximum width, and was depressed approximately 40m below the surrounding seabed. We used an ROV to collect benthic epifauna and imagery during a 6h transit; we also collected >800 seabed images and 3 box core samples. Although benthic fauna were significantly more abundant

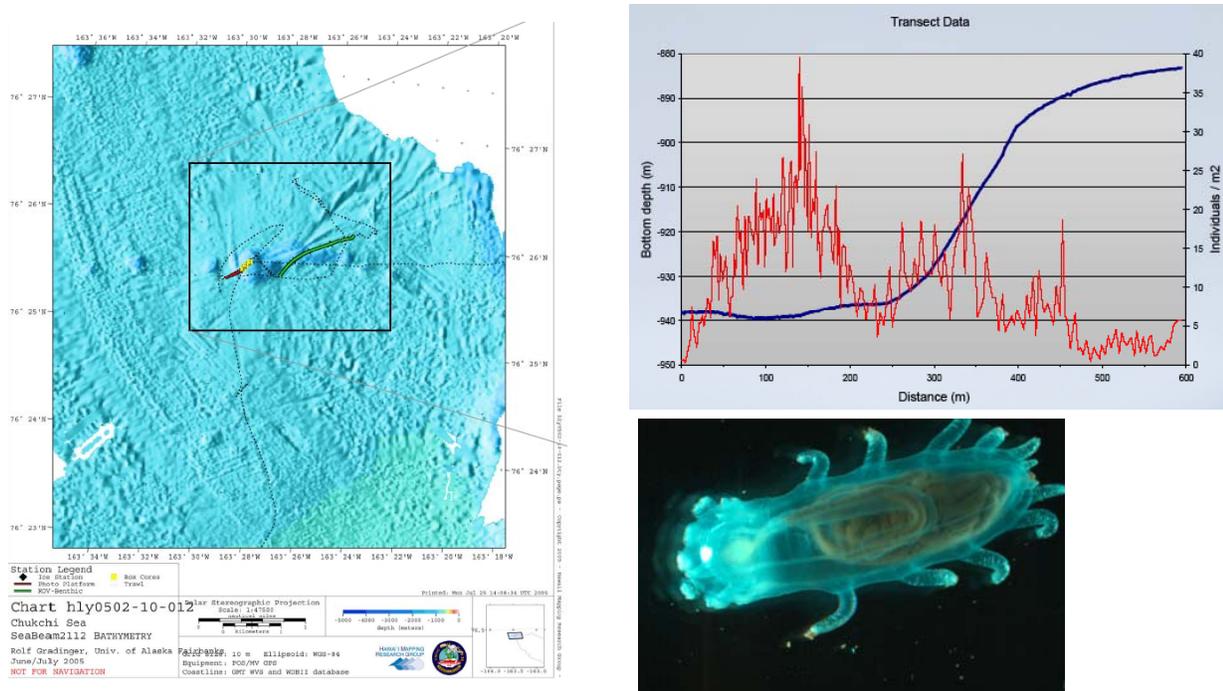


Figure 3: Pockmark-like features in Chukchi Borderland area. Left: Bathymetric map with investigated potential pockmark marked by rectangle. (May by Edwards, Univ. Hawaii). Top right: Abundance of epifauna per image (red line) in suspected pockmark. Abundance was high in the feature's center (left part of graph) where water depth (blue line) was maximal. Abundance dropped towards the western edge of the pockmark-like feature and outside the pockmark (right part of graph). (Graph by MacDonald, Texas A&M). Bottom right: Epibenthic sea cucumber (*Kolga hyalina*), which was very abundant at potential pockmark site in CBL area (Photo by Bluhm, UAF).

within the pockmark than on the periphery, our investigations did not provide any direct evidence for gas or fluid flux through the seabed of this feature neither did we see any secondary indications of

methane flux such as authigenic carbonate precipitates or bacterial mats. The investigated pockmark-like formation appeared to have been rather old based on the undefined edge contours and heavy sediment fill in the central region. Increasing patch age or ceased seep activity often leads to a decline in chemosynthetic primary producers and increasing importance of phytoplankton-based food webs and higher trophic level consumers as well as non-seep-endemic species. Especially noteworthy about the investigated pockmark-like feature, however, was the high abundance of benthic epifauna that was unrivaled by any other station investigated. Holothurians (*Kolga hyalina*) were the single most abundant group in densities of >50 individuals m^{-2} . We also observed brittle stars, various types of anemones, shrimps, eelpouts, stalked crinoids, a benthic ctenophore (likely new species), gooseneck barnacles, and mysids as well as burrows and mounds of unidentified origin. Such dense assemblages of holothurians and other epifauna have been reported from other old pockmarks with ceased seepage. Hence, the CBL 'pockmark' could be a feature generated by gas or fluid flow, and/or the depression could function as a 'collection bowl' for nutritious organic material coming off the Chukchi shelves. The exploration of more, especially newer and well-defined suspected pockmarks is essential to elucidate the nature of these peculiar and apparently abundant features, and a proposal has been submitted suggesting additional investigation.

2. SOCIETAL BENEFITS, IMPACT & APPLICATIONS

- 1) Background info for rapidly increasing oil and gas development in the Arctic
- 2) Baseline for future opening of shipping routes due to climate change-related sea ice retreat (invasive species, other impacts)
- 3) Baselines for climate change assessments
- 4) Baseline for subsistence and potential commercial species distributions (as they move north outside current survey areas of state / federal agencies)
- 5) Baseline of prey distribution for endangered / threatened / listed species (e.g. mammals, sea birds)

3. WORK PLANNED FOR 2007

- 1) Field work / expedition planning
 - 5 field trips Barrow: sea ice sampling (Dec 2006-Jun 2007)
 - planning for RUSALCA icebreaker expedition (likely Aug or Sep 2008)
 - planning for IPY expeditions (pending funding; beginning summer 2007)
 - planning for Chukchi Borderland icebreaker expedition (pending funding: summer/fall 2008)
 - 5 field trips Barrow: whale fall project (pending funding: fall 2007 to spring 2009)
- 2) IPY activities
 - Work on ArcOD IPY coordination tasks (need guidelines from IPY Joint Committee and collaborating projects)
 - Organize IPY planning meeting of ArcOD led cluster
 - IPY post-doc will begin work at UAF
- 3) Mini-grant program
 - results coming in from first round of mini-grants
 - streamline process for next call

- 4) Data base work
 - Further integrate Russian and US ArcOD data bases
 - Integrate mini-grant data files into ArcOD data base
- 5) Web page redesign
- 6) Arctic Invertebrate Identification Guide
 - Produce first volumes of Arctic Invertebrate Identification Guide
 - Identify funding for translation (Russian-English) and printing cost
- 7) Begin GIS modeling of ArcOD data
 - Student project Arctic zooplankton (Huettmann, Hopcroft)
- 8) Methodology handbook for sea ice research
- 9) Arctic Biodiversity session in Sept 2007 AAAS Conference in Anchorage, Alaska.
 - Chair: R. Gradinger (per invitation by chairperson of meeting)

4. EDUCATION & OUTREACH

- 1) *Presentations to public audiences*
 - Gradinger, Jul 21, 2006. Exploration of the diversity of life in Arctic Seas. UAF Summer Research Academy. Fairbanks; audience: ca. 60 (high school students)
 - Hopcroft, Jun 7, 2006. Visualization in the Census of Marine Life. Capital Hill Ocean Week, Washington, DC. Arctic Ocean Exploration. Capitol Hills Week; audience: ca. 50
 - Gradinger, Apr 12, 2006. Arctic Ocean Diversity and Arctic exploration. Fairbanks Aurora Borealis Rotaract Club; audience: ca. 15
 - Bluhm, Gradinger, Mar 18, 2006. Invertebrate Life Cycles Associated with Arctic Sea ice. Barrow UIC Science Center, NSF Schoolyard Seminar series and demonstration; audience: ca. 30 (Barrow villagers)
 - Raskoff K, March 29, 2006. Hidden Ocean cruise 2005. French Embassy, Washington DC
 - Gradinger, Jan 9, 2006. Arctic Ocean Diversity and Arctic exploration. Fairbanks College Rotary Club; audience: ca. 80 (upper middle class business people and academics)
 - Bluhm, Hopcroft (both speaking), Nov 28, 2005. Arctic Ocean Diversity and Arctic exploration in the Canada Basin. Lathrop Highschool. Fairbanks Highschool Science Seminar Series; audience: ca. 80 (high school students, teachers, parents)

All presentations brought the message across that Arctic Exploration is exciting, challenging, and promises novel discoveries. All audiences showed significant interest and asked a wide range of questions.

- 2) *Brochure*: In collaboration with SFOS public information office Carin Bailey, the ArcOD office designed an ArcOD brochure, which we hand out to potential collaborators, at public and scientific meetings, etc. The brochure summarizes the general goals and questions of ArcOD and gives contact information and suggestions on how to contribute.
- 3) *Classroom activities*
 - Gradinger. Chemistry and biodiversity lesson on sea ice. Barrow Highschool, contact Tim Buckley, Mar 17, 2006; audience: 25 (mostly native) high school students

- Hopcroft, Grading, Bluhm. College of Exploration, <http://www.coexploration.org/>; 45 min interview with Peter Tuddenham; 1 week of keynote and Q&A, Oct 2005; audience: ca. 20 formal and informal teachers

4) *Photo loans*

Pictures and movie sequences are widely used in the press and by colleagues. The list gives just some recent examples:

- Nile Mueller, preparation of 2006 UAF President's report on science activities, Aug 2006, Grading, Bluhm, Hopcroft
- Dave Partee, Alaska Sea Grant strategic plan, *Ophiura sarsi* by Bluhm, Jul 2006
- Adam Goff, Picture Editor, New Scientist, acidification article, pteropod image Hopcroft, Jul 2006
- Tom Vormelker, Bildredaktion / picture desk, SZ und SZ Wissen, Süddeutsche Zeitung GmbH, Hopcroft, Jul 2006
- Vivienne Clark. Graphic Designer for Clontech Laboratories in Palo Alto, CA, commercial use, *Metridia longa*, Hopcroft, Jul 2006
- John Uscian, book about Alaska SeaLife Center, online and in CD-Rom format, *Serripes groenlandicus*, Bluhm / Iken, Jul 2006
- Several images for Canadian IPY stamps (to come out in spring 2007), 2006

The continuous flow of photo requests shows the interest of a broad audience in Arctic imagery as well as the success of ArcOD's and CoML's webpages (although ArcOD's require a major overhaul).

5) *Magazine Articles*

- National Geographic Magazine (planned for 3/2007)
- Witness the Arctic (7/2006)
- Know News, The science magazine for curious kids (1-2/2006)
- LaRecherche (12/2005)
- Alaska Magazine (12/ 2005)
- Seed Magazine (11/2005)
- Strange New Species (Maple Tree Press) (11/2005)
- Canadian Geographic (11/2005)

The large number of magazine articles printed in the last 12 months is largely a consequence of the July 2005 Canada Basin Hidden Ocean expedition which was efficiently publicized by the CoML URI media team and NOAA Ocean Exploration. These articles, in turn, generate further interest in the readers and other magazines.

6) *TV and Radio*

- featured on NPR Sept 2005 (contact: Richard Harris)
- on ABC television Sep 2005 (contact: Clayton Sandell)

5. GEOGRAPHIC EXPANSION

The focus of ArcOD is the Arctic; there are no plans to change this focus. However, the Arctic is comprised of several shelf seas (the Barents, Kara, Laptev, East Siberian, Chukchi, Beaufort Seas and

Canadian Archipelago), the Eurasian and Amerasian deep basins and sub-Arctic Seas (Bering Sea, Norwegian and Greenland Seas, part of Barents Sea).

The first two major ArcOD initiatives targeted the Chukchi Sea (RUSALCA 2004, likely 2008) and the Canada Basin (Hidden Ocean 2002 and 2005).

In 2006, ArcOD expanded geographically through its newly established mini-grant program. Currently, mini-grant projects are ongoing in the western Arctic, Beaufort Sea, Barents Sea, Greenland Sea, Svalbard area, Eurasian Basin and several Russian Arctic Seas (see 1. Accomplishments 2006).

Expansions are planned for the International Polar Year 2007/8 through collaborative projects within the IPY-endorsed Arctic Biodiversity cluster. Final funding decisions for IPY projects are expected by late 2006-early 2007.

6. PARTNERSHIPS & COLLABORATION

a. Partnerships

Organization Name	Point-of-Contact (Name)	Nature of Relationship
NOAA Office of Ocean Exploration	Jeremy Potter	Funded two 'Hidden Ocean' expeditions & part of RUSALCA; marine inventories in mission; OBIS is accepted species data repository
NOAA Office of Arctic Research Office	Kathleen Crane	Funding RUSALCA & int'l collaborators; partial overlap in mission with CoML
ACBio (Arctic Coastal Biodiversity)	Christopher Cogan, Alfred-Wegener-Institute	Bluhm on SSG
Alaska Ocean Observing System	Rob Cermak, Univ. of Alaska Fairbanks	Maintenance of ArcOD OBIS/GBIF node
NMFS "COPEPOD" database	Todd O'Brian, NMFS Silver Springs	Data exchange, co-ordination of data rescue efforts
IPY data base working group	Falk Huettmann, UAF	Part of data policy discussions

b. Links to Other CoML Ocean Realm Projects

Project Name	Cross-Over Person(s)	Nature of Relationship
CAML	Hopcroft	Co-ordination with CAML; Hopcroft is on CAML SSG, will spend 6 months in Hobart in 2007; Hopcroft, Gradinger and Bluhm all submitted OE proposal to collaborate on Antarctic research
CMarZ	Hopcroft	Hopcroft is on CMarZ SSG; provides Arctic zooplankton for barcoding; participated in Sargasso Sea cruise
NaGISA	Iken, Konar	Collaboration on Arctic component of NaGISA; Iken is part of ArcOD projects including minigrant; Bluhm and Iken co-advise student ArcOD project

ChESS	MacDonald	Bluhm (ArcOD), Iken (NaGISA) and MacDonald (ChESS) have joint pock mark (seep) proposal pending
CeDAMAR	Martinez-Arbizu Smith	SSG member in ArcOD Bluhm, Gradinger (both ArcOD), Iken (NaGISA) and Smith (CeDAMAR & ChESS) have joint Arctic whale fall proposal pending
MarECO	Youngbluth	Same taxonomic focus in MarECO and ArcOD areas

c. Links to CoML National and Regional Implementation Committees (NRICs)

NRIC	Liaison or Cross-over personnel	Nature of Relationship
Australia	Victoria Wadley	Communication regarding potential collaborations, exchange of experiences, Hopcroft on CAML SSG
Canada	Conny Lovejoy, Paul Snelgrove, Don Deibel	Communication regarding IPY (Deibel, Lovejoy) and framework report (Snelgrove)
Caribbean	N/A	
China	(Contacts to Chinese scientists exist outside CoML as Gradinger is representative for NOAA US/ Chinese collaboration)	
Europe	Bhavani Narayanaswamy	Potential collaborations with EuroCoML
Indian Ocean	N/A	
Japan	N/A	
South America	N/A	
Sub-Saharan Africa	N/A	
USA	Vera Alexander (liaison)	Advice, exchange, project updates

d. Liaisons to CoML Cross-Cutting Groups

Project Name	Liaison Name & Institution (all UAF)	Nature of the Relationship
OBIS	Falk Huettmann, Rob Cermak	Operations and maintenance of Arctic OBIS node at AOOS, links to GBIF, metadata management etc.
HMAP	Rolf Gradinger	Communication
FMAP	Bodil Bluhm	Participation in planned workshop?
SCOR Tech Panel	Russ Hopcroft	Communication
E&O	Bodil Bluhm	Email communication with URI team and other liaisons, attending E&O meetings etc.
Barcoding	Russ Hopcroft	Supplying Arctic zooplankton samples

e. Effectiveness of the Partnerships and collaborations

- Effective communication / exchange: e.g., CAML, CMarZ, Barcoding (through contribution to CMarZ), E&O
- Emerging relationships: e.g., HMAP, FMAP, EuroCoML, Canada NRIC
- No relationship: e.g., NRICs outside focus area, CoML realm projects with no overlap

Several relationships will become increasingly important during the synthesis phase of ArcOD / CoML in 2009/2010.