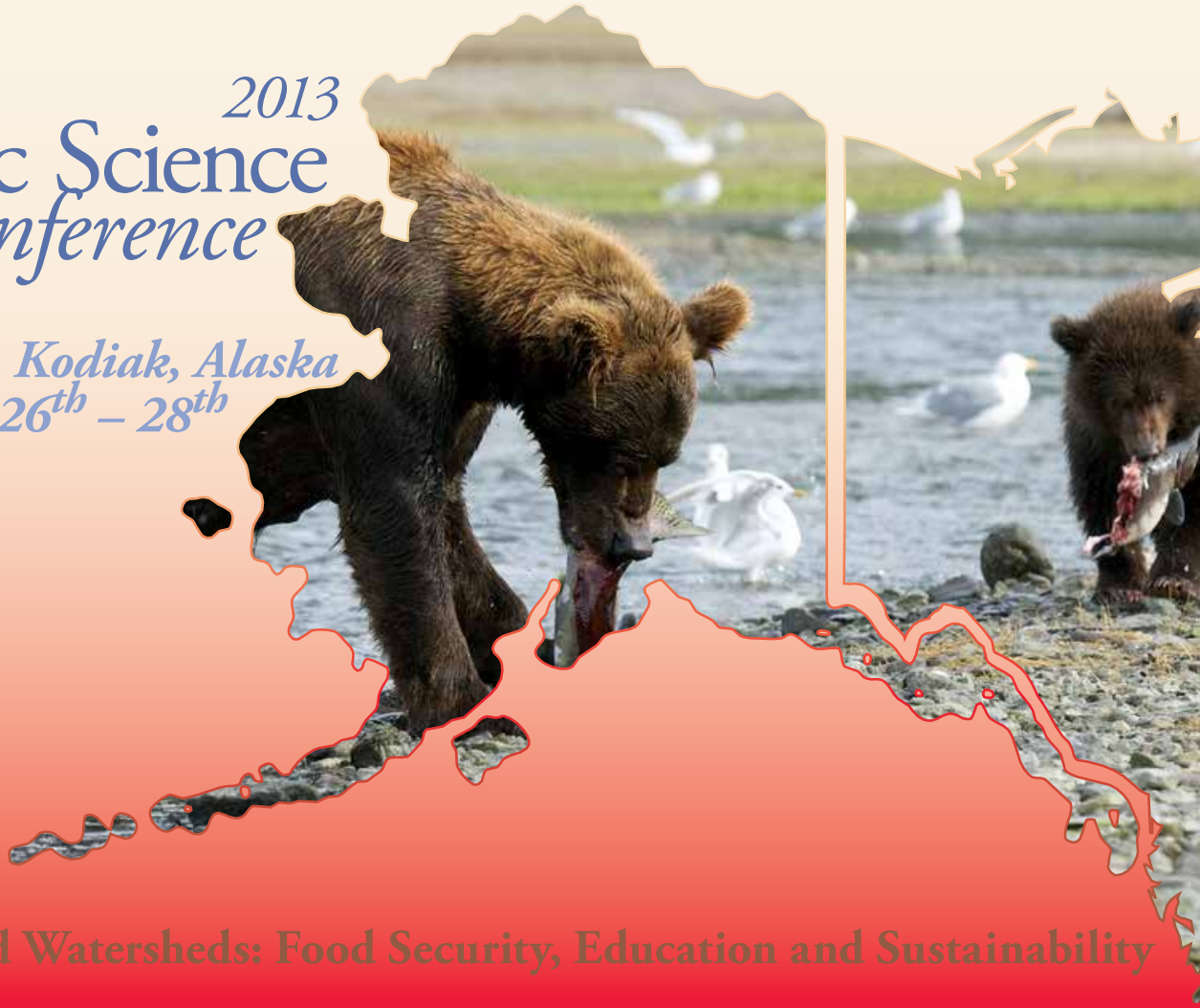
2013 Arctic Science Conference

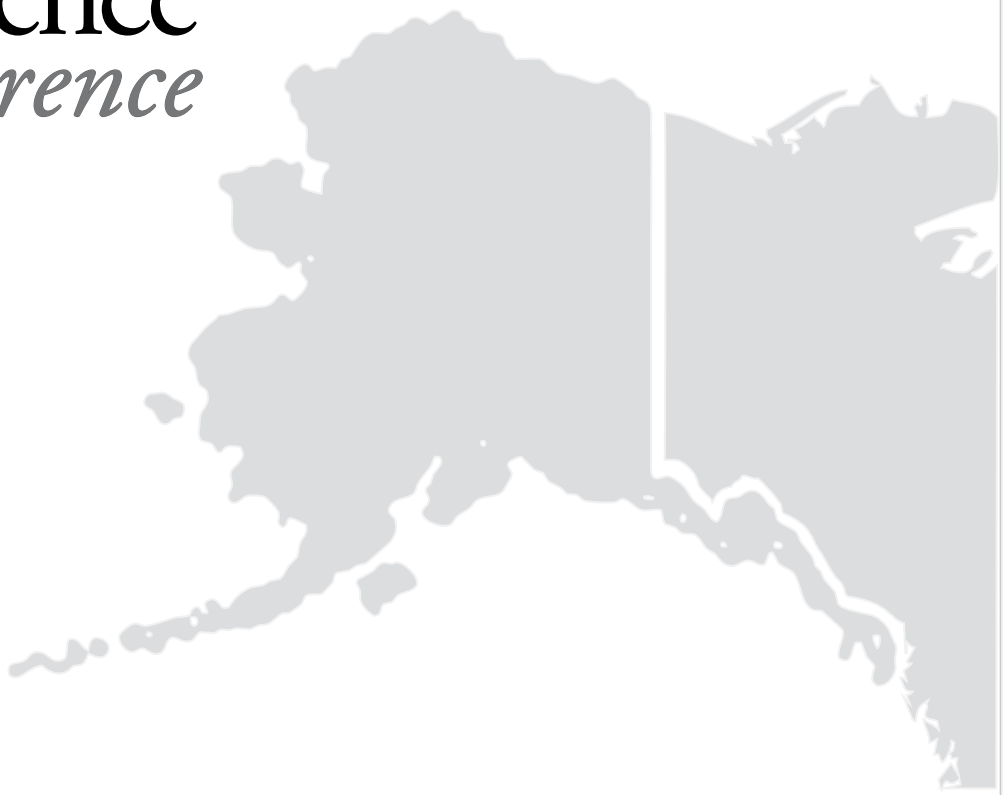
Kodiak, Alaska

September 26th – 28th



Fisheries and Watersheds: Food Security, Education and Sustainability

2013 Arctic Science Conference



Fisheries and Watersheds: Food Security, Education and Sustainability

Kodiak, Alaska
September 26th – 28th, 2013

Cover photograph information: "Katmai Alaska 1797" by Patrick Moody.

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The Arctic Science Conference is an annual meeting that is organized and supported by the Arctic Division of the American Association for the Advancement of Science (AAAS). The locations and themes of the conference vary from year to year, although the themes and locations are always related to the Arctic and the scientific endeavors of the Arctic Division AAAS members and their colleagues. It is a continuing goal of this conference that it be open and accessible to all scientific scholars who are working on Arctic, Alaskan, Canadian, northern or Antarctic issues, and to communicate their interests and discoveries at the event. This year's conference was organized by:

Conference Organizers

Conference Chair
Brian Himelbloom
School of Fisheries and Ocean Sciences, University of Alaska Fairbanks (UAF), Kodiak, Alaska

Conference Coordinator
Alaska Sea Grant/University of Alaska

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General Information

Registration Desk
The Arctic Division AAAS registration staff will provide assistance with program information, audio and visual aids for sessions, and other administrative needs. The registration desk will be open:

Wednesday, Sept. 25th:	5:00 p.m. to 6:00 p.m.
Thursday, Sept. 26th:	8:00 a.m. to 5:00 p.m.
Friday, Sept. 27th:	8:00 a.m. to 5:00 p.m.
Saturday, Sept. 28th:	8:00 a.m. to 10:00 a.m.

Conference Fees

Full Conference:	$200
Single Day:	$75
Student – Full Conference:	$90
Student – Single Day:	$30

Badges
Each participant should obtain a badge at the registration desk prior to attending any of the sessions.

Coffee and Registration Area
Coffee will be available inside the session meeting rooms.

List of Participants
A list of pre-registered conference participants will be available at registration.

Poster Sessions
Posters will be on display according to the following schedule:

Thursday, Sept. 26th from 5:00 p.m. to 6:30 p.m.

Authors are requested to be present to discuss their material at 5:00 p.m. on Thursday or designate another time when they will be available.

Lunch
The conference has a scheduled lunch break on each day at which time each attendee can eat lunch.

Wednesday, September 25th, 2013

5:00 p.m. – 6:00 p.m.	**Registration**
6:00 p.m. – 8:00 p.m.	**Arctic AAAS Social (Kodiak Convention Center)**

Thursday, September 26th, 2013

8:00 a.m. – 8:30 a.m.	**Registration and Continental Breakfast**
8:45 a.m.	**Conference Welcome (Borough/City Mayor)**
9:00 a.m. – 9:45 a.m.	**Keynote Address** "Marine Arctic 2020: At the Intersection of Science, Education, Policy and Environment" Mike Castellini, Dean, School of Fisheries and Ocean Sciences (SFOS), UAF
9:40 a.m. – 10:00 a.m.	**Break**
10:00 a.m. – 10:45 a.m.	**Plenary Talk** "A Field Guide to the Age of Ecological Innocence: Lessons from Martha Brae, Palliser's Triangle, and Bristol Bay" Todd Radenbaugh, UAF Bristol Bay Campus
10:45 a.m. – 11:45 a.m.	**Technical Session** **Marine Biology** Chair: Bree Witteveen, Alaska Sea Grant Marine Advisory Program – Kodiak Presenters: Douglas Causey, Maribeth Murray, Gregg Rosenkranz, and Ric Shepard
11:45 a.m. – 1:30 p.m.	**Lunch (on your own)**
1:30 p.m. – 2:30 p.m.	**Technical Session** **Fisheries** Chair: Andy Seitz, SFOS – Fisheries Division Presenters: Bill Morris, Allyson Olds, Megan McPhee, and Andrew C. Seitz
2:30 p.m. – 3:20 p.m.	**Break**
3:20 p.m. – 4:00 p.m.	**Technical Session** **Fisheries (continued)** Chair: Andy Seitz, SFOS – Fisheries Division Presenters: Marcus Gho, Courtney Carothers, and Jesse Coleman
4:00 p.m. – 4:40 p.m.	**Technical Session** **Seafood Science** Chair: Brennan Smith, SFOS – Kodiak Seafood and Marine Science Center Presenters: Thomas J. Farrugia, and Veronica M. Padula
4:40 p.m. – 6:00 p.m.	**Poster Session and light refreshments**
6:00 p.m.	**Dinner (on your own)**
6:30 p.m. – 8:00 p.m.	**Workshop** "Are You Really Communicating Your Science?" Marilyn Sigman and Robin Dublin, Center for Ocean Sciences Education Excellence – Alaska

Friday, September 27th, 2013

8:00 a.m. – 8:30 a.m.	**Registration and Continental Breakfast**
8:30 a.m. – 9:20 a.m.	**Plenary Talk** "Bioeconomic Control Rules for Sustainable Management of Fisheries in a Nonstationary Environment" Keith Criddle, SFOS Fisheries Division Director
9:20 a.m. – 10:00 a.m.	**Technical Session** **Sustainability** Chair: Todd Radenbaugh, Bristol Bay Campus Presenters: William C. Leighty, and Sarah Wanderse
10:00 a.m. – 10:30 a.m.	**Break**
10:30 a.m. – 11:30 a.m.	**Technical Session** **Sustainability (continued)** Chair: Todd Radenbaugh, Bristol Bay Campus Presenters: Tom Marsik, Kristin Donaldson, and Davin Holen
11:30 a.m. – 1:00 p.m.	**Lunch (on your own)**
1:00 p.m. – 3:00 p.m.	**Technical Session** **Interdisciplinary, General and Applied Science** Chair: Cindy Trussell, UAA – Kodiak College Presenters: Meredith Marchioni, Lisa Wirth, Karen A. Murphy, Joel H. Reynolds, and Tom Moran
3:00 p.m. – 3:30 p.m.	**Break**
3:30 p.m. – 5:00 p.m.	**Technical Session** **Science Education** Chair: Marilyn Sigman, Alaska Center for Ocean Sciences Education Excellence Presenters: Cindy Trussell, Linda Himelbloom, Douglas Causey, Mike Mueller, and Jessica Cherry
5:00 p.m.	**Student Awards**
After 5:30 p.m.	**Brewery Visit and Dinner (on your own)**

Saturday, September 28th, 2013

8:00 a.m. – 8:30 a.m.	**Registration and Continental Breakfast**
8:30 – 9:00 a.m.	**Plenary Talk** "Seafood: Health Risks vs. Benefits" Charles Santerre, Purdue University
9:00 – 9:45 a.m.	**Plenary Talk** "Can preschool children consume more fish to improve diet quality and DHA intake?" Sibylle Kranz, Purdue University
9:45 a.m. – 10:15 a.m.	**Break**
10:15 a.m. – 12:00 p.m.	**Open discussion on needs for Community Science, K-12 Interactions, Teacher Training**
Afternoon	**Tours, hikes and/or fishing (see Discover Kodiak at http://www.kodiak.org/)**

• *Arctic Division AAAS Meeting History* •

The Arctic Division of the American Association for the Advancement of Science (AAAS) has a long and illustrious history. Founded in 1951 as the Alaska Division, the Arctic Division was established to foster scientific communication in the then rather isolated Arctic territory. The name was changed to Arctic Division in 1982 to reflect the membership's growing interest in high latitudes outside of Alaska. Most of the Division members reside in Alaska and Canada's Yukon, Northwest Territory, and Nunavut, but any AAAS member who has an interest in the Arctic or Antartic may join. More information about the Arctic Division AAAS can be found online at www.arctic.aaas.org.

Previous Arctic Division AAAS Meetings

No.	Dates	Year	Location	Chair	Theme
1	Nov. 9 - 11	1950	Washington, D.C.	John C. Reed	Science in Alaska
2	Sept. 4 - 8	1951	Mt. McKinley National Park	Laurence Irving, UA Biology Dept.	Science in Alaska
3	Sept. 22 - 27	1952	Mt. McKinley National Park	Laurence Irving, UA Biology Dept.	Science in Alaska
4	Sept. 28 - Oct. 3	1953	Juneau	Christian T. Elvey, UA Geophysical Inst.	Science in Alaska
5	Sept. 7 - 10	1954	Anchorage	Hugh A. Johnson, US Dept. of Agriculture	Science in Alaska
6	Jun. 1 - 4	1955	College	Neil W. Hosley, Univ. of Alaska	Science in Alaska
7	Sept. 27 - 30	1956	Juneau	Troy L. Pewe, US Geological Survey	Science in Alaska
8	Sept. 10 - 13	1957	Anchorage	Victor P. Hessler, Univ. of Alaska	Science in Alaska
9	Sept. 2 - 5	1958	College	Robert L. Rausch, Arctic Health Res. Cntr., US Public Health Svc.	Science in Alaska
10	Aug. 25 - 28	1959	Juneau	Norman J. Wilimovsky, Univ. of British Columbia	Science in Alaska
11	Aug. 30 - Sept. 2	1960	Anchorage	Roger R. Robinson, US Bureau Land Mgmt.	Science in Alaska
12	Aug. 28 - Sept. 1	1961	College	John P. Hannon, Arctic Aeromedical Lab	Science in Alaska
13	Aug. 22 - 26	1962	Juneau	James W. Brooks, AK Dept. of Fish and Game	Science in Alaska
14	Aug. 22 - 30	1963	Anchorage	Allan H. Mick, AK Agricultural Exp. Sta.	Science in Alaska
15	Aug. 31 - Sept. 4	1964	College	Charles J. Eagan, Arctic Aeromedical Lab	Science in Alaska
16	Aug. 30 - Sept. 1	1965	Juneau	Richard M. Hurd, Inst. Northern Forestry	Science in Alaska
17	Aug. 29 - Sept. 2	1966	Anchorage	William Davis, Alaska Methodist Univ.	Science in Alaska
18	Aug. 28 - Sept. 1	1967	College	Peter R. Morrison, UA Inst. of Arctic Biology	Science in Alaska
19	Aug. 26 - 30	1968	Whitehorse	Richard Hill, Dept. of Indian Affairs	Science in Alaska & Northern Development
20	Aug. 24 - 27	1969	College	Victor Fisher, UA Inst. Social & Econ. Res.	Change in the North: People, Petroleum & Environment
21	Aug. 16 - 19	1970	College	T. Neil Davis, UA Geophysical Inst.	Change in the North: UA Physical Environment
22	Aug. 17 - 19	1971	College	Laurence Irving, UA Inst. of Arctic Biology	Adaptation for Northern Life
23	Aug. 15 - 17	1972	Fairbanks	Gordon S. Harrison, UA Inst. of Social & Econ. Res.	Science and Policy in the North
24	Aug. 15 - 17	1973	Fairbanks	Gunter E. Weller, UA Geophysical Inst.	Climate of the Arctic
25	Oct. 18 - 20	1974	Anchorage	William Davis, Alaska Methodist Univ.	Behavioral Sciences in the North
26	Aug. 11 - 15	1975	Fairbanks*	Donald W. Hood, UAF Inst. of Marine Science	Third International Conference on Port & Ocean Engineering Under Arctic Conditions (POAC)
27	Aug. 4 - 7	1976	Fairbanks	George C. West, UAF Inst. of Arctic Biology	Resource Development: Processes and Problems
28	Sept. 22 - 24	1977	Anchorage	David M. Hickok, UA Arctic Environ. Info. & Data Center	Science Information Exchange in Alaska
29	Aug. 15 - 17	1978	Fairbanks	Donald H. Rosenberg, UA Alaska Sea Grant	Alaska Fisheries: 200 Years & 200 Miles of Change
30	Sept. 19 - 21	1979	Fairbanks	Daniel B. Hawkins, UAF Geophysical Inst.	Science for Alaska
31	Sept. 17 - 19	1980	Anchorage	E. Lee Gorsuch, UAA Inst. od Social and Econ. Res.	Agenda 80S
32	Aug. 25 - 27	1981	Fairbanks	John Bligh, UAF Inst. of Arctic Biology	Life Sciences in the Service of Alaska
33	Sept. 16 - 18	1982	Fairbanks	Vera Alexander, UAF Inst. of Marine Science	Science in the North
34	Sept. 28 - Oct. 1	1983	Whitehorse	Arthur Pearson, Rampart Dev. Corp.	Alaska/Canada North: Neighbours in Science
35	Oct. 2 - 5	1984	Anchorage	John Davies, UAF Geophysical Inst.	Science in Public Policy
36	Sept. 27 - 29	1985	Fairbanks	Robert G. White, UAF Inst. of Arctic Biology	Technology and the Scientist
37	Jun. 8 - 13	1986	Vancouver**	Richard Bushey, Yellowknife, NWT	All Disciplines

No.	Dates	Year	Location	Chair	Theme
38	Sept. 24 - 26	1987	Anchorage	Thomas Morehouse, UA Inst. of Social and Econ. Res.	Alaska's Resources, Alaska's Future
39	Oct. 7 - 10	1988	Fairbanks	Neal B. Brown, UAF Geophysical Inst.	Science Education
40	Sept. 14 - 16	1989	Fairbanks	Francis Williamson, UAF Inst. of Arctic Biology	Global Change
41	Oct. 8 - 10	1990	Anchorage	Thomas Newbury, US Minerals Mgmt. Svc.	Circumpolar Perspectives
42	May 16 - 18	1991	Fairbanks***	Neal B. Brown, UAF Geophysical Inst.	Circumploar Modeling of Climate Change
43	Sept. 8 - 12	1992	Valdez	Kenneson Dean, UAF Geophysical Inst.	Environmental Change: Natural and Man-Made
44	Sept. 15 - 18	1993	Whitehorse	Arthur Pearson, Rampart Dev. Corp.	Circumpolar Information Exchange: Shrinking the Circumpolar Community
45	Aug. 25 - 27 Aug. 29 - Sept. 2	1994	Anchorage Vladivostok	Rosa Meehan, US Fish and Wildlife Serv.	Bridges of Science Between North America and the Russia Far East
46	Sept. 19 - 21	1995	Fairbanks	Robert G. White, UAF Inst. of Arctic Biology	Landscapes
47	Sept. 19 - 21	1996	Girdwood	Jack Kruse, UA Inst. of Social and Econ. Res.	Shaping an Unpredictable Future: Science and Communities
48	Sept. 24 - 27	1997	Valdez	R. Ted Cooney, UAF Inst. of Marine Science	Arctic Science and Resource Management: Exploring the Issues
49	Oct. 25 - 28	1998	Fairbanks	Syun-ichi Akasofu, UAF Geophysical Inst.	International Cooperation in Arctic Research: Detecting Global Change and its Impacts in the Western Arctic
50	Sept. 19 - 22	1999	Denali National Park & Reserve	Claus-M.Naske, UAF History Dept.	Science in the North: 50 Years of Change
51	Sept. 21 - 24	2000	Whitehorse	Joan Eamer, Yukon Science Inst.	Science and Community Crossing Borders - Arctic Science 2000
52	Sept. 12 - 15	2001	Anchorage****	Don Spalinger, AK Dept. of Fish and Game	2001 Arctic Science Odyssey: Exploring New Technologies and Methodologies for Arctic Science Management
53	Sept. 18 - 21	2002	Fairbanks	Terry Whitledge, UAF Inst. of Marine Science	Connectivity in Northern Water: Arctic Ocean, Bering Sea, and Gulf of Alaska Interrelationship
54	Sept. 21 - 24	2003	Fairbanks	John C. Eichelberger, UAF Geophysical Inst.	Extreme Events: Understanding Perturbations to the Physical and Biological Environment
55	Sept. 14 - 16 Sept. 26 - Oct. 1	2004	Vladivostok - 1 Anchorage - 2	Craig E. Dorman, VP Research UA Statewide System	1 - Bridges of Science 2 - Human Dimensions of the Arctic Environment
56	Sept. 27 - 29	2005	Kodiak	Scott Smiley, Fishery Industrial Technology Center, UAF	Consequences of Arctic and Sub-Arctic Environmental Variation
57	Oct. 2 - 4	2006	Fairbanks	John Walsh, Center for Global Change and Arctic Systems Research, UAF	State of the Arctic: Current State of the Arctic Observations and Evaluations of Arctic Change
58	Sept. 24 - 26	2007	Anchorage	John Kelley, School of Fisheries and Ocean Sciences, UAF	Partnering for Northern Futures: Science, Policy, Education, and Learning in the International Polar Year
59	Sept. 15-17	2008	Fairbanks	S. Craig Gerlach, UAF Anthroplogy Dept.	Growing Sustainability Science in the North: Science • Policy • Education • Legacy In the International Polar Year
60	Sept. 14-16	2009	Juneau	Brian Edmonds, UAF Dept. of Chemistry and Biochemistry	Impact of Environment on Human Health: Interdisciplinary Science and Education
61	Sept. 13-15	2010	Anchorage	Lillian Alessa, Chair, UAA Resilience and Adaptive Management Group	Water: Integrating Health, Habitat and Economy
62	Sept. 21-24	2011	Dillingham	Todd Radenbaugh, Director Bristol Bay Environmental Science Lab, UAF Bristol Bay Campus	Ecosystems: Understanding the Cycles.
63	Aug. 5-10	2012	Fairbanks	*Held jointly with the International Congress on Circumploar Health's 15th annual meeting	Circumpolar Health
64	Sept. 26-28	2013	Kodiak	Brian Himelbloom School of Fisheries and Ocean Sciences UAF	Fisheries and Watersheds: Food Security, Education and Sustainability

*Arctic Division co-sponsored the International Port and Ocean Engineering Under Arctic Conditions (POAC) Conference
**Joint with the Pacific Division
***Yukon College cancelled; conference moved to Fairbanks
****Not held due to the tragic events of Sept. 11, 2001 at the World Trade Center and the Pentagon

2013 Arctic Science Conference Abstracts

Abstracts are listed alphabetically according to presenter.

1. Fisheries Privatization, Social Transitions, and Well-Being in Kodiak's Fisheries

Courtney Carothers, University of Alaska Fairbanks, Anchorage, AK, clcarothers@alaska.edu; Jesse Coleman, University of Alaska Fairbanks, School of Fisheries and Ocean Sciences, Fairbanks, AK, jmcoleman2@alaska.edu

Scholars and fishermen alike view the privatization of fishing rights as a fundamental driver of change in fishing livelihoods and communities. Expanding upon ethnographic research conducted in rural fishing communities in the Gulf of Alaska, this project explores the social and cultural shifts linked to the privatization of fishing rights in the diverse fishing community of Kodiak, Alaska. We examine how the privatization of fishing rights has been experienced across diverse participants, explore the relative importance of impacts of fisheries privatization compared with other drivers of change, and assess relationships between social and cultural shifts linked to fishery privatization and individual and community well-being.

This ethnographic study, employing mixed methods of interviews, surveys, participant observation, and archival research, provides rich qualitative and systematic quantitative data to assess how regulatory and related changes affect the social and cultural dimensions of fishery systems and fishing communities. The research framework joins scholarship in political ecology, social-ecological systems, and the anthropology of fishing communities to provide analytical insights into the relationship between the enclosure of resources and changing nature-society relationships. The research findings have broad applicability to understanding transitions in fishing communities in the Gulf of Alaska, Bering Sea, and throughout the Circumpolar North.

2. Marine Arctic 2020: At the Intersection of Science, Education, Policy, and Environment

Michael Castellini, University of Alaska Fairbanks, School of Fisheries and Ocean Sciences, Fairbanks, AK, macastellini@alaska.edu

In modern human history, we have never experienced a “new ocean” opening up on Earth. By 2020, the Arctic Ocean will be ice-free enough during the summer that shipping, commercial exploration, tourism, international boundaries, military needs, and scientific research will be issues we will need to understand and balance. Well over four million people will be living above the Arctic Circle by 2020, and the rest of the world will be pushing to utilize this region. How do we design the tools of science, education, policy, and environment now, so that they successfully meet 10 years from now in the North? An essential element to this balance will be the awareness of those who live outside of the Arctic to the unique characteristics of the northern regions. Demonstrating the importance of the Arctic to those who live there is easy; demonstrating that same significance to the vast majority who don’t live there, but have significant roles in setting research, education, and marine policy that impact the North, is not.

Dr. Castellini will discuss not only the need for us to look toward the future Arctic, but also what lessons we have already learned in northern and southern polar regions. For example, the world united to change our use of refrigerants that were the primary cause of the ozone hole over the Antarctic. Are there similar global perspectives that are applicable to the North? We will have a new ocean available in the north—the question is, are we prepared for it?

3. Community-Infused STEM Collaborative of Alaska’s Professionals and Educators (C-SCAPE)

Douglas Causey, University of Alaska Anchorage, Department of Biological Sciences, Anchorage, AK, dcausey@uaa.alaska.edu; Mike Mueller, University of Alaska Anchorage, Department of Teaching and Learning, Anchorage, AK, mmueller4@uaa.alaska.edu

The C-SCAPE project will transform elementary science education in a rural district through inquiry-based science that taps into the local science and cultural communities. C-SCAPE will engage grade 3-8 children on Alaska’s Kodiak Island in science that is embedded in the local fisheries industry, related environmental issues, and the cultural practices of the diverse community—known as socio-scientific issues. A core premise of the grant is that while entry points to science are abundant on Kodiak Island, they are elusive to most elementary students and their teachers, who lack a background in inquiry-driven science. C-SCAPE will open science entry points to teachers and students by strengthening and creating sustainable relationships with the rich, existing community-based knowledge network. Teachers will develop the elements of socio-scientific reasoning so they can embed these in inquiry-based instruction for students. C-SCAPE will make extensive use of innovative rich media technology, extending the district’s current technology resources that enrich education in town and remote village schools. We have three overarching goals: (1) to increase the quality and quantity of elementary school teachers engaged in transformative science research, teaching and learning; (2) to create online and in-person hybrid communities of practice anchored in environmental

monitoring, socio-scientific issues, and reasoning; and (3) to develop distributed leadership and partnership infrastructure to support systemic change and policies necessary to sustain and scale the project.

4. Trophic Ecology of Marine Birds of the Far Western Aleutian Islands

Douglas Causey, University of Alaska Anchorage, Department of Biological Sciences, Anchorage, AK, dcausey@alaska.edu; Veronica M. Padula, University of Alaska Fairbanks, School of Fisheries and Ocean Sciences, Fairbanks, AK, vmpadula@alaska.edu

Research over two decades indicates that seabird populations are decreasing in the most western group of islands in the Aleutians (the Near Islands), while they are relatively stable in all of the other regions of the Aleutians. Gyral currents, like the one found in this region, tend to create a distinct oceanographic ecosystem with its own marine fauna, upper?water food web, and ecological dynamics. Climate change has dramatically affected the direction, strength, and biological oceanography of Aleutian currents over time, and it appears that these changes continue to strengthen. We predict that diet analysis will provide evidence that Near Island seabirds are ecologically decoupled from the other Aleutian populations. Results from ?15N and ?13C stable isotope analysis allows a multidimensional and temporally discrete look at the proxies determining the dynamics of trophic ecology of seabird diets.

5. Sustainability in Alaska?A Postmodern, Low-Carbon Future?

Izetta Chambers, University of Alaska Fairbanks, Alaska Sea Grant Marine Advisory Program, Dillingham, AK

The proposed oral presentation aims to highlight some of the big-picture issues associated with sustainability in Alaska, such as food, housing, water, technology, and economics. This presentation will lay the groundwork for the more detailed presentations to follow on many of these topics, and will include information on where participants can find more information on the broader topics. The presenter will discuss one or two examples of what is being done in Alaska to combat the rising cost of fuel, a shrinking economy, and food insecurity around the state.

Here is a short synopsis of the main points that will be discussed at the presentation:

- Overview of indicators that point to a postmodern, low-carbon future.
- Discussion of past, present, and future life in Alaska?what will that look like?
- Case studies on how resourceful Alaskans are tackling these projects now.
- Interesting trends and projects happening around the world and their application in Alaska.
- Where to find more information on sustainability efforts around the state and around the world.

6. Waterways: A Film about Water, Language, and a Changing Way of Life

Jessica Cherry, University of Alaska Fairbanks, International Arctic Research Center and Institute of Northern Engineering, Fairbanks, AK, jcherry@iarc.uaf.edu; Olga Lovick, First Nations University, Regina, Canada, Olga@lithophile.com; Patrick Harman, Harman Media, Fairbanks, AK, Kandokoro@yahoo.com

In this talk, we report on an interdisciplinary film project involving a hydrologist, a linguist, and a media designer, to document the ways in which water has shaped and continues to shape the way of life for the Tetlin people, including food systems.

The old settlement of Last Tetlin lies among numerous lakes and small rivers near the origin of the Tanana River in eastern interior Alaska. The traditional language of the Tetlin people is the Tetlin dialect of Upper Tanana Athabascan, but today only a few handfuls of speakers remain. Water and its changes through the seasons and across decades form the matrix in which this culture has functioned for thousands of years. Water provides both resources (fish) and travel-ways (via boat and winter trail network) to access these and other resources, leading to a seminomadic lifestyle. Many of the old-time stories tell of the peoples' interactions with their land, as can be seen in a collection of Tetlin narratives by David (2011).

In “Waterways,” we present three short story segments illustrating the relationship between the Tetlin people and their waterscape using the original (Upper Tanana Athabascan) audio, animated text, and, following every Athabascan line, a spoken English translation. Enriching this material with maps, airborne images of hydrologic features, archival imagery, and new video footage of the Tetlin area, we created an educational, museum-quality exhibit suitable for anyone with an interest in the changing way of life of an interior Alaska Athabascan group.

David, Cora. 2011. Teedl!y t'iin naholndak niign: Stories by the Tetlin people. Edited by Olga Lovick. Fairbanks: Alaska Native Language Center.

7. Bioeconomic Control Rules for Sustainable Management of Fisheries in a Nonstationary Environment

Keith R. Criddle, University of Alaska Fairbanks, Fisheries Division, Juneau, AK, keith.criddle@alaska.com

The harvest control rules specified for groundfish and crab fisheries off Alaska are simple mathematical expressions keyed to critical values. The Overfishing Limit (OFL) is set to zero when the current stock level is estimated to be below a critical lower bound. The OFL is set to a biologically determined maximum when biomass is above a critical upper bound. For intermediate biomass levels, the OFL is set proportionate to a ratio of current biomass and the sustainable yield maximizing biomass. The Acceptable Biological Catch (ABC) is set as a fraction of the OFL and the Total Allowable Catch (TAC) also known as the Annual Catch Limit (ACL) is set as a fraction of the ABC. At present, neither critical value reflects economic or social considerations. This paper presents a bioeconomic basis for specification of the critical values and for curvature of the harvest control rule at intermediate biomass levels.

8. Ascension: Exploring the Art and Science of Denali through Education and Exhibition

Annie Duffy, University of Alaska Fairbanks, Fairbanks, AK, aduffy@alaska.edu

In 2009, the University of Alaska Museum of the North created an original traveling exhibition entitled "Ascension: Exploring the Art of Denali." The exhibit consisted of artwork from the Denali Artist-in-Residence program, interpretive statements from University of Alaska Fairbanks science faculty from multiple disciplines, and educational materials developed by educational professionals from the University of Alaska Museum of the North, the Fairbanks North Star Borough School District, and the Denali Borough School District. "Ascension" was a result of partnerships between Alaska Geographic, Denali National Park and Preserve, the Murie Science and Learning Center, the University of Alaska Fairbanks, and the University of Alaska Museum of the North.

The intended aims of this exhibition were threefold. First, to examine and document the long-standing connection between scientific research and art within the Denali National Park and Preserve. Second, to create associated educational materials that could be used as part of both science and art courses that would discuss both how artists are inspired by scientific research being conducted in the park and how art can be a useful tool to help communicate scientific concepts, e.g., climate change–related phenomena within the park. Third, to communicate to the public and other interested individuals outside of the interior Alaska region about the unique relationship art and science have enjoyed in Denali and how Denali's programs may serve as a models for other national parks and public lands in their efforts to better understand these environments and their significance.

9. The Harvest of Herring Spawn-on-Kelp in Togiak, Alaska

Sarah Evans, Alaska Department of Fish and Game, Subsistence Division, Dillingham, AK, sarah.evans@alaska.gov

The Alaska Division of Subsistence is working with the residents of Togiak, Alaska, to collect harvest and use data including harvest locations for herring spawn-on-kelp for subsistence use. This information is useful in determining areas that are important for the harvest of herring spawn-on-kelp by residents of Togiak. Before this project took place, little was understood about the amount of herring spawn-on-kelp that was harvested by Togiak residents, the areas where the harvest took place, and the reasons that residents encountered difficulty harvesting enough herring spawn-on-kelp for subsistence. Data collected as part of this project could inform managers of important harvest areas for subsistence uses of herring spawn-on-kelp.

10. Nutritional and Contaminant Analyses of Skates in the Gulf of Alaska: Shaping Future Skate Demand

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Skates are in growing demand worldwide, specifically in European and Asian markets, and there is increasing economic pressure to develop directed fisheries for them in Alaska. Big skates (Raja binoculata) and longnose skates (Raja rhina) are the largest and most frequently landed skates in the Gulf of Alaska (GOA), yet very few studies have been done on their nutritional value or contaminant load. Currently only the wings are retained from GOA skates; the livers are being discarded but they could be an important source of high quality fish oil. Seafood is recognized as an important source of proteins, amino acids,

and long-chain omega-3 fatty acids. However, one of the primary concerns is the level of heavy metals, particularly mercury, present in fish tissues, which may influence the demand of certain fishery products.

Understanding the protein, lipid, moisture, and omega-3 content of skate products, as well as the concentrations of contaminants, could be critical to determining the long-term demand for skate products from the GOA. To address this lack of knowledge, I collected 10 big and 10 longnose skates near Kodiak and Cordova, Alaska, sampled muscle and liver tissue from each individual, and analyzed nutritional content (protein, moisture and lipid content, and fatty acid profiles) and heavy metal load (mercury, arsenic, selenium, cadmium, lead). These data will be shared with the fishing industry and will be integrated into a bioeconomic model developed to determine the most profitable and sustainable harvest strategy for skates in the GOA.

11. CFEC Salmon Set Gillnet Permits and DNR Shore Fishery Leases in Prince William Sound, Cook Inlet, Kodiak, Alaska Peninsula, and Bristol Bay, 1975-2012

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The Research Unit completes many tasks in support of the Alaska Commercial Fisheries Entry Commission (CFEC). One task is to build data sets that allow us to report on topics of interest to the commissioners. This paper documents a recently completed project that linked Department of Natural Resource (DNR) shore fishery lease data with CFEC permit files and the Alaska Department of Fish and Game (ADFG) fish tickets.

Many CFEC set gillnet permit holders in Prince William Sound, Cook Inlet, Kodiak, Alaska Peninsula, and Bristol Bay also hold shore fishery leases with DNR. A DNR shore fishery lease allows CFEC permit holders the ability to exclude others from fishing at sites secured through the DNR lease. This report documents the number of leases, breaking out the figures into five residency classes in each year from 1975 through 2012. The residency classes are combinations of urban/rural, local/nonlocal, and nonresident. This paper also identifies the level of benefit from securing a lease in terms of real dollars by combining data from CFEC and DNR databases.

12. Integrating Alaska-Themed Environmental Topics into an Online Science Course

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We focus on Alaska environmental issues using science systems and processes to introduce and understand interrelationships of air, water, ocean, and soil. A variety of platforms link students to this Alaska-based course: case studies, student-generated questions for an Alaska panel discussion, and Alaska and arctic connections with selected readings. We use regional examples to cover the topics of ecology, climate change, resource development, and natural hazards. This regional focus assists students in formulating powerful links to a changing world.

We selected case studies that highlight northern regions: lake water quality, air quality, and sea mammal studies. For panel discussions on development in Alaska students generated questions and synchronously listened and responded to representatives from academic, government, nonprofit, and other organizations.

13.The Praxis of Fisheries as Culture: Successful Fishing Communities in Rural Alaska

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In rural Alaska a fishing community is a social-ecological system incorporating ecological boundaries and fishers who have an interest in ensuring the continuity of both the subsistence and commercial fisheries in their region. This research project is investigating the long-term viability of rural fishing communities in Alaska by understanding how commercial and subsistence fisheries create and maintain culture and community. This project focuses on internal sociocultural factors such as culture change, kinship-based social networks, and local-level politics that shape contemporary commercial and subsistence fisheries in Alaska. This paper will present some of the findings and discuss what constitutes a successful fishing community from the community perspective.

14. What the Heck Is Permaculture?

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Permaculture is, at its core, a decision-making tool that permeates each part of life, so that we can decide how we want to be and/or live as a sustainable member of the ecosystem on this planet and specifically in Alaska. How did our Alaskan forefathers/mothers understand permanent culture (permaculture)? How do we want to become?

This sounds a little like sustainability, which is a popular buzzword these days, but have you noticed no one tells you how do you really do it? This talk will allow the participants to grasp the idea of how a permanent culture might be able to work in Alaska.

15. Can Preschool Children Consume More Fish to Improve Diet Quality and DHA Intake?

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Preschoolers tend to eat the foods they are accustomed to. For many children, this translates into low, if any, fish intake other than the occasional heavily breaded and deep-fried fish shapes. Although one might assume that this intake pattern is reflected in low EPA/DHA intakes, other sources of these two fatty acids may mask the lack of DHA from fish. DHA is a critical nutrient, especially during the rapid growth phase during the preschool years (ages 2-5 years old) and as per the Dietary Guidelines for Americans 2010 (DGA) the consumption of two servings of fish per week is recommended for all Americans two years and older.

More than 60% of U.S. children attend childcare centers full-time, yet due to the low acceptance of fish most childcare centers don't offer fish dishes, especially not the odor-rich varieties, such as salmon. We examined the possibility of improving children's diet quality by incorporating at least two servings of fish into the diet of (n = 45) preschoolers attending a local childcare center by substituting chicken-based lunches with similar salmon-based dishes. Each substitution was served to the children twice, to calculate average food intake. A plate-waste method was used to measure the grams of food consumed and estimate the average total energy and DHA intake for both the chicken-based dishes and the fish-based dishes. Results showed that the children accepted some, but not all, of the substitutions into their diet. However, even for the foods that were not as well accepted and therefore consumed at significantly lower levels, DHA intakes significantly increased on the days when the fish-based dishes were served compared to the days when the chicken-based lunch was served (p-value <0.05).

The results of this community-based prospective controlled nutrition intervention study indicate that preschoolers would very likely meet the DGA for fish intake, thus improving overall diet quality and increasing their diet variety, if fish-based dishes were served for lunch in the childcare centers. Further research to identify the predictors of fish acceptance, such as ethnic and income group, as well as other venues to make fish-based dishes available to the American youth, are urgently needed to support better diet quality and therefore optimal development in children.

16. Protecting the Arctic by Running the World on Renewables: Alternatives for Transmission and Low-Cost Firming Storage of Stranded Renewables Such as Hydrogen and Ammonia Fuels

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Rapid climate change, ocean acidification, and eventual depletion of fossil fuels require that we must soon "run the world on renewables," but we cannot, and should not, try to accomplish this entirely with electricity transmission. We will need more transmission and storage capacity than electricity can provide. We need to supply all energy, not just electricity, from diverse renewable energy (RE) resources, both distributed and centralized, where the world's richest RE resources of large geographic extent and high intensity are stranded?in high latitudes and in many places worldwide, far from end-users with inadequate or nonexistent gathering and transmission systems to deliver the energy. Electricity energy storage cannot affordably firm large, intermittent renewables at annual scale, while carbon-free gaseous hydrogen (GH2) and liquid anhydrous ammonia (NH3) fuels can: GH2 in large solution-mined salt caverns, NH3 in surface tanks, both pressurized and refrigerated.

Our future global energy planning should be based on optimizing, technically and economically, complete renewable-source energy systems?from photons and moving air and water molecules to delivered energy services. It should not be based on trying to stuff a square peg into a round hole, as we now are by inventing costly and sophisticated adjunct equipment to be dispersed upon the "grid."

We now need pilot plants to discover and demonstrate whether these alternatives to electricity systems may allow us to affordably and dependably "run the world on renewables," including from arctic resources, as we eventually must. This will

help protect other arctic resources.

17. Conceptualizing Subsistence: How Differing Beliefs about the Concept of Subsistence Could Be Creating Misconceptions within Management Forums

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The people of the City of Kodiak, while diverse in ethnic background, origin, occupation, and interests, have a common link in their appreciation of the outdoors and their involvement in subsistence activities. Whether they are fishing for sockeye salmon with a gillnet, fishing for silver salmon with a rod and reel, picking berries, hunting for deer, or eating a slice of wild blueberry pie at their neighbor's house, each resident of Kodiak has some involvement in subsistence activities. However, while they may be subsisting from the land in one form or another, they are not all perceiving and valuing the concept of subsistence in the same way. Many sociocultural variables contribute to why different people living in the same island community value subsistence activities and perceive the concept of subsistence in different ways. An individual using a rod and reel to harvest silver salmon in the Buskin River for their family's dinner is using that fish to subsist from the land. Some residents of the City of Kodiak consider this activity to be sport fishing by regulation and therefore do not consider themselves subsistence harvesters or users. Correlations between sociocultural variables and perceptions and valuations of subsistence can be used both to determine people's behaviors and beliefs regarding subsistence activities and to plan for future education surrounding resource management. Moving toward a cohesive idea of the concept of subsistence could make it easier to assess how much value all members of a community place on it and therefor how best to manage it.

18. Net Zero Energy-Ready Home in Dillingham, Alaska

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Despite increases in the energy efficiency of homes, the total energy used in the residential sector in the USA continues to rise. As shown in the residential statistics of the U.S. Department of Energy for the period of 1985-2004, the average energy usage per square foot decreased by about 10%, but at the same time, the average square footage of a household increased by almost 20%. If society acknowledges the importance of reducing energy consumption, a logical question to ask is: What good does it do to increase the energy efficiency of homes if it is outweighed by escalations in their size?

The question is addressed by the project described in this presentation. The house built in this project has the following energy features:

- Small size (2 bedrooms, 1 bathroom)
- 28 inch thick walls
- Extremely tight building envelope (0.05 ACH50; official world record for the tightest residential building)
- Majority of needed heat comes from internal heat gains (byproduct heat from lighting and appliances, body heat, passive solar gain)
- Heat that needs to be supplied from a heat source corresponds to about 35 gallons of heating oil annually

A one-year data collection period was recently completed and it was successfully demonstrated that by combining super-efficient construction technology with small house size, an extremely low energy home can be achieved. More information is available at http://energy-alaska.wikidot.com/nzer-dillingham.

19. Alaska EPSCoR: Statewide, Place-Based Research into Community Adaptive Capacity

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Alaska EPSCoR is a National Science Foundation and state-funded effort to improve Alaska's scientific capacity by engaging in statewide research endeavors. Alaska EPSCoR is currently in year 2 of a 5-year project entitled "Alaska Adapting to Changing Environments (Alaska ACE)," which examines the mechanisms by which communities adapt to environmental and social change. The project encompasses all three main University of Alaska campuses as well as rural campuses and involves faculty and students at various levels representing a number of different disciplines.

Alaska ACE is organized around "test cases" that use sensor networks, social surveys, and modeling approaches to study adaptive capacity in different areas of the state: the North Slope/Interior, the Kenai Peninsula, and the Juneau area. These

projects are linked via a statewide Coordination, Integration and Synthesis (CIS) Group that works across the test cases to reach larger conclusions about adaptation, as well as by an Education, Outreach and Diversity (EOD) Group that conducts educational events and shares EPSCoR findings with the public.

20. Kuk and Kugra River Fish and Aquatic Habitat Surveying

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The Kuk and Kugrua rivers are two of the largest rivers that flow into the Chukchi Sea (north of the Brooks Range), yet systematic sampling of these drainages has not been conducted to any level adequate to make fish or fish habitat management determinations or an evaluation as to the drainage's significance to fish. These rivers are likely to be crossed by pipelines connecting any Chukchi development to the Trans-Alaska Pipeline System (TAPS) and are in the area identified for placement of Chukchi Sea offshore development–related onshore facilities. This project was designed to collect fish presence and population structure data as well as aquatic habitat data to begin to characterize fish use of the systems and their habitats. Fish sampling began in 2010 in the Ivisaruk River, a tributary to the Kuk River, followed by the Kungok River in 2011, the upper Kuk River in 2012, and the Kugrua River in 2013. Sampling involved using fyke nets, hoops traps, seines, and gillnets from mid-June to late August. Basic fish data were collected including relative abundance by species, age/weight, age structure, and age at maturity data for non-salmon species. Catches in the Kuk drainage were dominated by least cisco, arctic flounder, arctic grayling, ninespine stickleback, and fourhorn sculpin. Pink salmon, chum salmon, Chinook salmon, burbot, and arctic grayling were implanted with radio tags and tracked via fixed-wing aircraft to determine important habitats. Preliminary results from the Kugrua River suggest the system is predominately used by ninespine and threespine stickleback, rainbow smelt, and arctic flounder.

21. Science Education for Generation R (Responsibility)

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How do we as science educators respond to increasing global environmental challenges, as well as complex personal and social challenges, faced by youth today? These issues are addressed in a new book, Assessing Schools for Generation R (Responsibility): A Guide for Legislation and School Policy in Science Education (Springer, 2013), which includes perspectives from top experts in the fields of science and environmental education, ecology, experiential education, education philosophy, policy, and history. This book begins by explaining the need for more durable and meaningful indicators of science learning, derived and envisioned from cultural studies, local literacies, experiential education, digital technology, civic responsibility, thinking responsibly, ecological modeling, community partnerships, and global relationships. It includes theories, research, and practices for envisioning how science and environmental education can promote personal, social, and civic responsibility. This book is cutting-edge in terms of beginning a conversation of how to develop assessments for newly envisioned indicators of how school influences and educational experiences shape national and Alaska community and ecology. We anticipate this work will be used to inform funding strategies and school policy for a citizenry of responsibility.

22. From Reach to Region: Core Steps to Advancing Our Ability to Assess Climate Change Impacts on Freshwater Systems

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The Western Alaska Landscape Conservation Cooperative (LCC) is a partnership designed to provide improved tools and knowledge related to climate change to benefit conservation in western Alaska. The LCC geography spans from the Kotzebue Lowlands to Unimak Island and includes the Kodiak archipelago. One of the highest priority, shared science needs identified by the LCC is related to supporting healthy freshwater systems capable of supporting robust populations of naturally occurring species and ecosystem services. For the next two funding years, the LCC will be focusing on freshwater systems with the specific topic of "changes in freshwater temperatures and its impacts." Through this focus we hope to make progress in establishing a voluntary participation water temperature monitoring network for Alaska. We will look for studies that provide greater information about the cause and effect relationships between water temperature changes and impacts on species and decisions in western Alaska. In September 2013 we released a request for proposals (see http://WesternAlaskaLCC.org) to initiate the voluntary water temperature monitoring network and address the water temperature impact questions. We also recently secured national funds to establish a statewide framework for improving hydrography mapping and stewardship

in Alaska through creation of a system that will make digital mapping data updates accessible and affordable. This will allow agencies and organizations to greatly improve their hydrography mapping data, and make use of project level hydrography data that would not otherwise be incorporated.

23. Evidence of Climate Change Impacts on the Mercury Levels in Kodiak Sea Otters

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The increasing mobility and bioavailability of toxic metals like mercury in the ecosystem is commonly proposed to be a potential impact of climate change. Present-day changes in high latitude marine ecosystems must be placed in the context of past natural variability. The possibility of using mercury concentrations in bone tissue as an indicator of past exposure to mercury was tested in ancient sea otter bones. Mercury concentrations in preserved sea otter bone from archaeological deposits in Shelikof Strait were analyzed and compared to samples from modern otter bones. Mercury concentrations appear to fluctuate with major climate-driven events such as sea level rise in Beringia around 4-5,000 years before present, to name but one example.

The project was funded by NSF grant 0525275. We also acknowledge the contribution of S. Craig Gerlach's insightful discussions.

24. Ecology and Genetics of Newly Discovered Populations of Chinook and Other Salmonids in Portage Valley, Alaska

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Salmon are a vital component to southcentral Alaska's freshwater and marine ecosystems, and are the basis of active commercial, sport, and subsistence fishing lifestyles of many Alaskans. Population declines in recent decades of coho (–45%) and chinook (–85%) salmon in upper Cook Inlet may indicate that these and other salmonids are ecologically unstable. We predicted that marginal populations in glacier-dominated drainages were less impacted than other more accessible populations, and began a survey in the Three Rivers region of upper Turnagain Arm. This complex drainage system comprises Portage, Placer, and Twentymile watersheds, which all drain into Turnagain Arm and Cook Inlet. During fall and winter of 2012-2013, we made the first discovery of juvenile chinook salmon in Portage Valley, and documented significant populations of coho salmon, dolly Varden, and other salmonids. Groundwater and active glacier streams proved to be important factors for juvenile rearing, but the specifics of habitat use by individuals and species is complex and still under study. Population and landscape genetic analysis using SNPs is helping provide greater insight into the relationships, migration, and evolution of the Three Rivers salmonid populations. These observational studies and genetic analyses will help form better conservation plans and management of this newly discovered fisheries resource.

25. Mercury Accumulation in the Food Webs and Sportfish of Benka Lake, Alaska

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Large, top fish predators are primarily targeted in sport and subsistence lake fisheries. In some cases, these fish are hatchery reared and fed a fishmeal composite diet prior to their release into aquatic systems. This diet may be a source of anthropogenic mercury (Hg) in lake food webs. I will collect samples during the summer of 2013 and will then utilize stable isotopes of carbon and nitrogen to interpret dietary pathways and trophic patterns of Hg accumulation in freshwater sportfish in Benka Lake, Alaska. I will measure Hg and stable isotopes in arctic char (Salvelinus alpinus), rainbow trout (Onchorhyncus mykiss; both recently stocked juveniles and lake-reared adults), and other food web constituents. These data will allow for the evaluation of Hg accumulation in sportfish and food webs, and will provide insights into the pathways by which humans can be exposed to Hg. Studies such as this which analyze the Hg concentration in subarctic lakes and their food webs are necessary for

ensuring human health for the future, especially given the biomagnification previously observed in these systems, extensive recreational use of sportfish, and the profound dependence of Native communities on subsistence fish harvest.

26. Eulachon of the Chilkat and Chilkoot Rivers: Roles in Local and Indigenous Cultures

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Eulachon, Thaleichthys pacificus, is an anadromous smelt of the Pacific Northwest, ranging from northern California to southwest Alaska. In the southern portion of its geographic range, population declines have led to federal protection of eulachon for California, Oregon, Washington, and British Columbia. The cause and extent of the declines remain unidentified, as eulachon are poorly understood and data are limited.

To coastal indigenous groups and local peoples, the eulachon serves as a cultural, economical, and nutritional source. In southeast Alaska, indigenous and local residents of the Haines-Klukwan area harvest eulachon from the Chilkat and Chilkoot rivers. Eulachon is also an important food source to many predators, including marine animals, birds, and terrestrial mammals. The declines threaten the roles of eulachon for many human and animal communities.

To understand past and present roles of eulachon of the Chilkat and Chilkoot rivers, I seek local and traditional knowledge from residents of Klukwan and Haines. Guided by an interview protocol, I am conducting semi-structured interviews in an ongoing study about trends in eulachon runs of the Chilkat and Chilkoot rivers. Data will be extracted from the transcribed interviews. These data will be supplemented with scientific literature and other published sources to summarize the roles of eulachon of the Chilkat and Chilkoot rivers in the local and indigenous cultures of the area.

27. Orca Skeletal Articulation: A STEM Collaboration for Southwest Alaska

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Skeleton articulation projects offer students an interesting hands-on opportunity to learn science. A large skeleton articulation project, involving both an adult and fetal Orca skeleton, is under way in Dillingham, Alaska. In October 2011, a pod of three killer whales (Orcinus orca) perished after traveling an unprecedented distance up and spending an extended time in the Nushagak River in southwest Alaska. Following a necropsy by a team of scientists headed by the National Oceanic and Atmospheric Administration, it was determined that one of the whales was a pregnant female. The Dillingham City School District received an educational permit for the adult and fetal skeletal remains. Thus far, the fetal skeleton has been cleaned and is being prepared for articulation, and the adult skeleton is awaiting the cleaning process. A collaborative effort between the Dillingham City School District, University of Alaska Fairbanks Bristol Bay Campus, and Nunamta Aulukestai has developed to advance the Orca Articulation Project for the purpose of local STEM education. The goal of the project is to generate interest in science through the involvement of students from Dillingham in the unique attempt to articulate and display both skeletons together. The collaboration has resulted in the offering of courses in small skeleton articulation to high school students and community members in preparation for the large articulation project. Future plans include integration with technology education and development of curricular materials that will maximize student involvement throughout the school district.

28. Phthalate and PCB Contamination in Seabirds from the Western Aleutian Islands

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Seabird populations have been decreasing in the western Aleutian Islands over the last two decades, raising questions about the underlying mechanisms for these declines. One mechanism may be negative health effects associated with contaminant exposure. Rising levels of contaminants in marine ecosystems are of concern as they are transported to arctic and subarctic regions through atmospheric processes, oceanic currents, and riverine input from industrialized regions. A growing body of research shows that seabirds from the central and eastern Aleutian Islands have been exposed to contaminants, but little information exists for western Aleutian populations. The contaminant groups of interest in our study are phthalates and PCBs. Phthalates, the additive chemicals in plastics, have been used since the 1930s. They impart flexibility, pliability, and elasticity to plastic polymers. The endocrine-disrupting properties of phthalates are associated with adverse effects on reproductive health and outcomes. Small plastic particles were found in stomach contents of seabirds collected from the western Aleutian Islands. Phthalates could potentially leach off these particles and be incorporated into their tissues. Additionally, plastic particles tend to accumulate persistent, bioaccumulating, and toxic contaminants such as PCBs, which are also associated with adverse health effects. We will present the results from phthalate and PCB analyses of liver and muscle tissues collected from tufted puffins (Fratercula cirrhata) collected in the western Aleutian Islands. Quantifying harmful contaminants in seabirds will help in finding underlying mechanisms for population declines, and will help us better understand the extent and types of pollution in these subarctic regions.

29. A Field Guide to the Age of Ecological Innocence: Lessons from Martha Brae, Palliser Triangle, and Bristol Bay

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Since the industrial revolution, many segments of our society have perpetuated an age of ecological innocence that denotes Earth processes are cursory to the wealth generated by human endeavors. This contrived notion has allowed many to justify significant alteration of Earth's ecosystems that reduces the important services provided by the world's major ecosystems. The environmental movement of the 1950s and 60s established some the first significant organized campaigns using science to investigate the important functional role of ecosystems. By 1987 the global realizations of our ecological innocence led the United Nations and the Brundtland Commission to generate the Report of the World Commission on Environment and Development: Our Common Future. This report predicted that the human future is threatened and called for a sustainable international economy that did not alter the health of impending generations. Then in a 1997 issue of Nature, Vitoisek et al. declared that human alteration of global processes is substantial and escalating, with half of the land surface being significantly exploited by society. Also in 1997, Costanza et al. calculated the value the world's ecosystem services and natural capital at over $33 trillion per year, or three times the annual value of the society's global gross national product. The continual growth of the human population and their influences on ecosystem function inspired the Geological Society of America in 2008 to deliberate if human alteration to Earth's geographical and ecological functions merits a new geological Epoch or Anthropocene. There are growing data concerning the losses of ecosystem function and the services provided to society.

This paper takes an interdisciplinary case study approach to discuss ecosystems services. It starts with a paleo-ecological perspective to view Earth as a hierarchy of evolving complex units. At a broad level, the processes of evolution and escalation have changed the structure and function of paleo-ecosystems, often an accelerated rate in times of rapid ecological change (i.e., coordinated stasis). Ecosystems become restructured after resilience is lost as new species evolve and innovate to adapt to changing conditions. The changes in broad-scale ecological structure can be analyzed using functional groups or guilds, and throughout the Phanerozoic major ecological faunas have changed due to major evolutionary innovation.

Given the overwhelming influences that modern society has on ecosystem function, have human drivers altered the evolutional track of the planet? To discuss this, two case studies at different scales are used to investigate how humans have influenced ecosystem level processes. The studies include the Martha Brae River Estuary on the north coast of Jamaica and Palliser Triangle in Great Plains of Canada. Next the lessons learned from these case studies are applied to the relatively pristine Bristol Bay watershed in southwest Alaska. Research in the Bristol Bay watershed has shown that ecosystem function is one of the most valuable contributions to the health of society in terms of food security, coastal erosion, wastewater treatment, and nutrient cycling. The interdisciplinary approach suggests that ecosystem dynamics (i.e., feedback and interactions) are often complex and difficult to accurately model. This suggests that regions such as the Bristol Bay are important to preserve and study as they are among the last ecosystem remnant that can teach us how healthy ecosystems function.

Society is slowly awakening from its ecological innocence, while realizing how naive we have been as components in complex systems. Through the study complex researchers documented a long history of significant human influences such as the mass tourism Martha Brae River Estuary or agriculture in sensitive landscapes like Palliser Triangle. However such studies tell us only part of the story. More research needs to be done in places with low human influences like Bristol Bay, where we can better see natural connections between society and the Earth. By doing this we might better restore segments of highly altered

systems restore needed ecosystem services. To end the age of ecological innocence society needs adopt a global environmental ethic that embraces the science of ecosystem health and stewardship.

30. Alaska CamSled: High Resolution Benthic Imaging

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Alaska CamSled is a towed, open-framed, bottom-tending optical imaging system developed by Alaska Department of Fish and Game for weathervane scallop and benthic habitat research in coastal waters. The system was designed for deployment at depths less than 250 m from commercial fishing or research vessels 20 m or greater in length. Built primarily with commercial off-the-shelf components from the computer vision industry, CamSled acquires an overlapping stream of megapixel digital images of the seafloor while towing up to 9.0 km per hr. Images and auxiliary data are telemetered in real time via gigabit ethernet from the sled to the tow vessel over an armored fiber optic tow cable that also contains electrical conductors that power CamSled lights and electronics. We present a system overview and demonstrate review software developed by project engineer Ric Shepard that features image correction, zoom, and database connectivity for storage of results. We highlight system capability with images from St. Lawrence Island and other Bering Sea locales collected during a 2008 cruise.

31. Using Google Apps for Education, Mobile Devices, and Kodiak College's Remote Environmental Learning Stations for Enhancing Online Science Labs

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This talk discusses three lab activities in a newly developed online environmental science lab. In the first activity, an inventory and comparison of two local study sites, students use their smartphones to collect field data (audio, photo, and video). In addition, they record their 1 km tracks using mobile apps (e.g., MotionX or MyTracks) to gather latitude, longitude, and altitude of each site. All of these data are imported into Google Earth to better visualize the differences. In the second activity, students investigate differences in weather conditions between three locations on Kodiak Island using data collected from Kodiak College's Remote Environmental Learning Stations. In the third activity students use Google Earth and data from the National Snow and Ice Data Set to measure sea ice from the north coast of Alaska. Students enter data into Google spreadsheets to determine and graph the mean and standard deviation for each 10 year period over the past 30 years. We developed these activities to teach basic science skills often utilized in the field of environmental science.

32. **Seafood: Health Risks vs. Benefits**

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There is a strong and growing body of evidence that supports the health benefits from eating seafood. Many nutritionists contend that seafood provides benefits that far outweigh the risks from pollutants. However, in recent years a number of concerns have been raised about the safety of consuming fish. Environmental pollutants that accumulate in selected seafood products have caused some to believe that these chemicals are dangerous for fetuses, nursing infants, and young children. In this presentation, we will discuss the health benefits of eating seafood and the risks from two environmental pollutants (mercury and PCBs) that are found in fish. In addition, we will look at strategies for fish consumption advisories that can help sensitive populations make informed decisions and maximize the benefits while minimizing the risks from eating seafood. We will also highlight our wallet card, apps, and website (www.fish4health.net).

33. Dispersal of Adult Dolly Varden from the Wulik River, Alaska, Evaluated Using Satellite Telemetry

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In northwest Alaska near the Chukchi Sea, Dolly Varden is highly valued as a subsistence fish and local residents harvest thousands of these fish each year. In the Pacific Ocean, Dolly Varden is broadly distributed during annual summer feeding migrations, but its distribution in the Chukchi Sea is unknown. Because the Chukchi Sea is biologically productive in the summer,

I hypothesized that Dolly Varden inhabit this sea during the summer, which may expose them to human activities. Therefore, we attached Pop-up Satellite Archival Transmitting tags to Dolly Varden in the Wulik River, which flows into the Chukchi Sea, to examine their dispersal and behavior. Several of the fish provided the first documented northwesterly offshore dispersal to the Russian Chukchi Sea. While at sea, they dispersed up to 60 km per day and frequently occupied relatively shallow water (less than 15 m). Other dispersal types were demonstrated, including Wulik River residency, southerly alongshore dispersal, and movement to other rivers. Because of its ability to rapidly transit broad areas of the Chukchi Sea, in addition to its frequent occupation of shallow water, Dolly Varden may be impacted by emerging human activities, such as hydrocarbon development and shipping.

34. Pebble Watch: An Educational and Fact-Based Initiative

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In 2010, the Bristol Bay Native Corporation developed Pebble Watch, an informational print and web resource to inform shareholders and the public about the science and public process involved in the permitting of a large copper-gold-molybdenum mine project proposed for the Bristol Bay region. More than 85% of the people in the region are opposed to the mine, particularly because of risks to salmon and other natural resources that are very important to the local subsistence-based communities.

Amid this environment, Pebble Watch distinguishes itself by striving to remain objective, fact-based, educational, and topical—an approach that has served shareholders and helped to engage multiple stakeholders. Flexibility with subject matter and format has enabled Pebble Watch to remain relevant for multiple audiences and needs, with topics ranging from salmon biodiversity to the EPA Bristol Bay Watershed Assessment. Formats currently include in-person outreach visits, an e-newsletter, a website, social media, and a 52-page printed "Guidebook."

The role of Pebble Watch has matured from being solely a shareholder communication resource to becoming a tool enabling engagement on many levels with multiple stakeholders, from BBNC shareholders to federal and state agency representatives. Over time, the program has seen additional benefits, including opportunities to provide real-time feedback to agencies and other stakeholder correspondence, invitations to provide input on public engagement, and inroads to participate in science education. The tool has helped build trust and enabled communication with multiple stakeholders, including shareholders, EPA, the Pebble Mine developers, environmental conservation organizations, media, and the Anchorage School District.

35. Alaska Adapting to Changing Environments: Approaching Social-Ecological Dynamics on the Kenai Peninsula

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The impacts of environmental change on ecological processes and resources may be serious but are not well understood, particularly on a local level in dynamic settings. Alaskans are dependent on natural resources in a plethora of ways and exhibit diverse sets of responses to change. Responses may vary not only based on state policies but also local histories, social capital, and values. It is vitally important to better understand the linkages between local resource users, communities, and land/water change in order to approach current dynamics and plan for a sustainable future. The Alaska Adapting to Changing Environments (ACE) project approaches the various drivers of social-ecological change in three main test cases. This presentation highlights the Southcentral test case. This test case looks at environmental and social changes on the Kenai Peninsula, with a focus on interactions and connections to adaptation. Major issues addressed include climate dynamics, tourism and recreation, fisheries, changing forests and wetlands, development, and resource use. We present the test case approach, explain its integration with the overall project, discuss current progress and challenges, and detail future plans.

36. Remote Sensing Imagery Resources for Multi-Decadal Change Detection Analysis

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Historical remote sensing data is a valuable tool for change detection. Considerable skill and attention to detail is necessary to create map products from historical aerial and satellite collections that can be inter-compared for valid change detection analysis. The NSF EPSCoR research capacity building program is sponsoring the Adapting to a Changing Environment (EPSCoR-ACE) project in Alaska; this project conducts biological, physical, and social research into the adaptive capacity of Alaska communities; that is, the mechanisms that enable communities to effectively respond to environmental and social changes. Change detection is a key component of the EPSCoR ACE research at each of the project's three Test Case sites, in the North near Nuiqsut, Southcentral on the Kenai Peninsula, and in Southeast near Juneau.

To provide a common platform for change detection and historical comparison of each test case, University of Alaska Fairbanks GINA and the UAF Alaska Satellite Facility are providing the researchers orthorectified historical imagery base layers of three vintages: 1950s era USGS aerial imagery, 1980s Alaska High Altitude Photography (AHAP) color infrared aerial imagery, and 2010s Alaska SPOT5 Statewide Orthomosaic satellite imagery. Very recent, high resolution commercial satellite imagery is also available to the ACE researchers through a partnership with the University of Minnesota's Polar Geospatial Center.

Results from the test cases are used by a statewide Coordination, Integration and Synthesis Working Group to answer larger scientific questions about adaptation and to create decision-support tools for land and resource managers.

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