

Welcome

ARCUS Arctic Research Seminar Series

Community Science in Arctic Research and Observing – Past, Present, and Future

10 April 2019



Elena
Sparrow



Marilyn
Sigman



Michael Køie
Poulsen



Ted
Cheeseman

Presenters:

- Elena Sparrow (UAF, GLOBE, Winterberry Project)
- Marilyn Sigman (Alaska Sea Grant),
- Michael Køie Poulsen (NORDECO, INTAROS), and
- Ted Cheeseman (Polar Citizen Science Collective)



#ARCUSwebinar

Thank You!

- ❖ International Arctic Science Committee (IASC) for co-hosting today's seminar
- ❖ University of Alaska Fairbanks and the International Arctic Research Center for providing our venue for today's in-person seminar
- ❖ National Science Foundation Office of Polar Programs for financial support to ARCUS and this seminar series



Elena Sparrow

Engaging Youth and Community Members in Scientific Investigations and Civic Action Through Citizen Science

- Education Outreach Director and Research Professor
- International Arctic Research Center, University of Alaska Fairbanks
- GLOBE
- Winterberry Project



Engaging Youth and Community Members in Scientific Investigations and Civic Action Through Citizen Science



Elena B. Sparrow, Ph. D.
Education Outreach Director, Research Professor

Katie V. Spellman, PH.D.
Research Assistant Professor



What is Citizen Science?

- Scientific work undertaken by members of the general public, often in collaboration with or under the direction of professional scientists and scientific institutions. (Oxford English Dictionary)
- Other names for partnerships between scientists and non-scientists to conduct scientific research
 - Community science
 - Community-based monitoring
 - Voluntary biological/physical monitoring
 - Participatory Research
 - Public Participation in Scientific Research



Citizen Science Program Spectrum

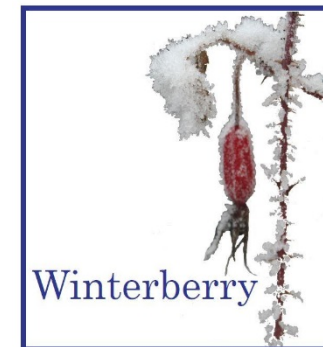


Question	Researcher	Citizens
Methods Design	Researcher	Citizens with researcher assist.
Data collection	Citizens	Citizens
Data Analysis	Researcher	Researcher with citizen assist.
Use of findings	Researcher & Citizens	Citizens & Researcher

Citizen Science in Alaska, the Arctic and Worldwide



<https://www.globe.gov>



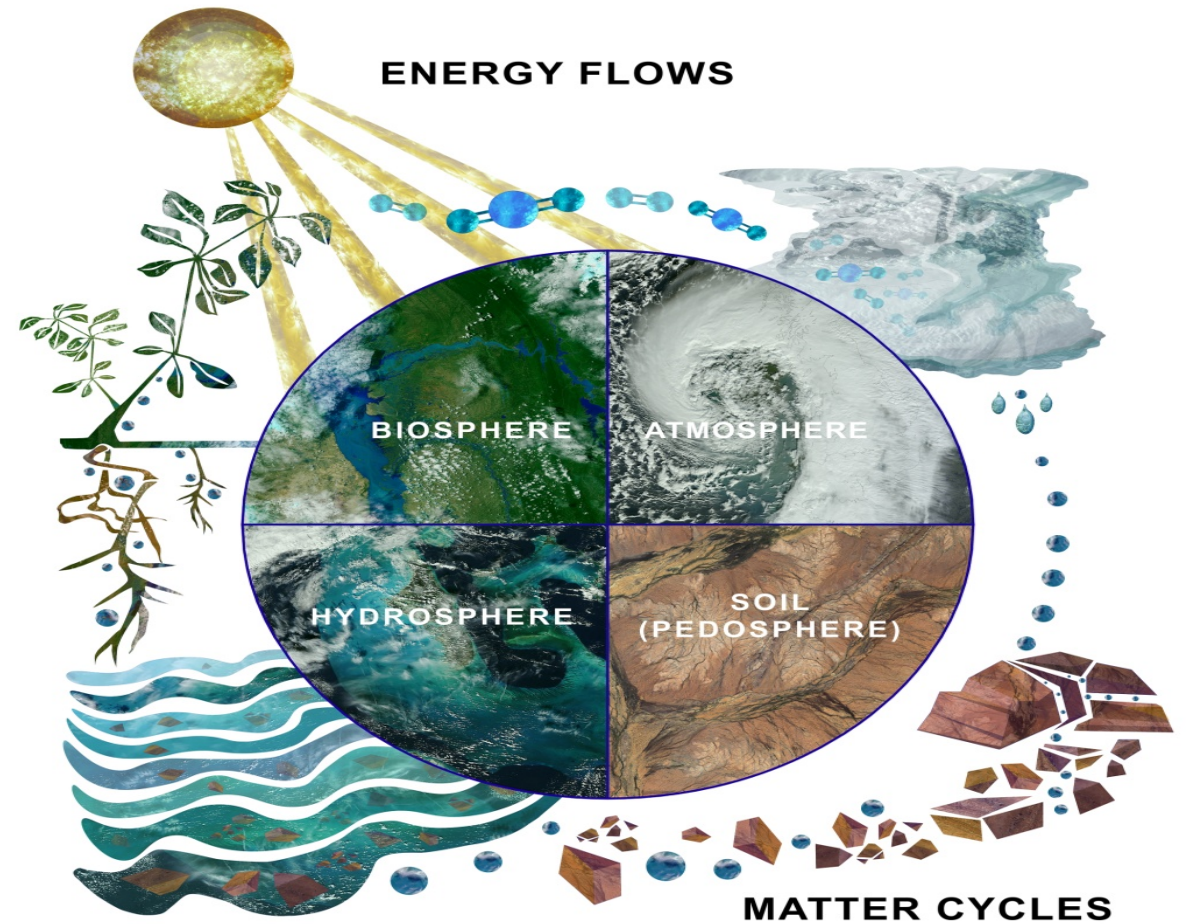
GLOBE Science Investigation Areas

Atmosphere-Air

Hydrosphere-Water

Biosphere- Life

Pedosphere-Soil



GLOBE Basic Protocols



Atmosphere/Climate

- Cloud
- Temperature
- Precipitation

Hydrosphere

Hydrology

- Transparency
- Temperature
- pH
- Conductivity
- Salinity

Pedosphere

Soil

- Field Characterization
- Bulk Density
- pH
- Temperature
- Gravimetric Moisture
- Frost Tube

Biosphere



Land Cover / Biology

- MUC
- Qualitative Land Cover Sampling
- Quantitative Land Cover Sampling
- Manual Mapping



Phenology

Green-up/green-down



GLOBE
Observer

Choose your protocol:



GLOBE
clouds



GLOBE
mosquito
habitat
mapper



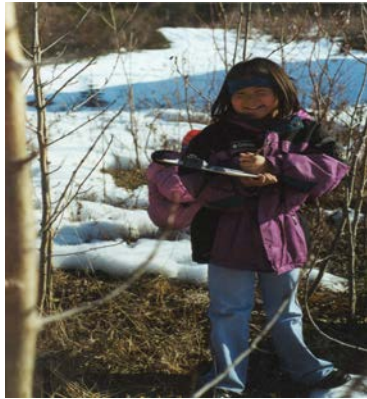
GLOBE
Land Cover
Adopt a Pixel



GLOBE
Trees

Phenological Investigations

Green-up



Observe



Measure



Green-down



Record data



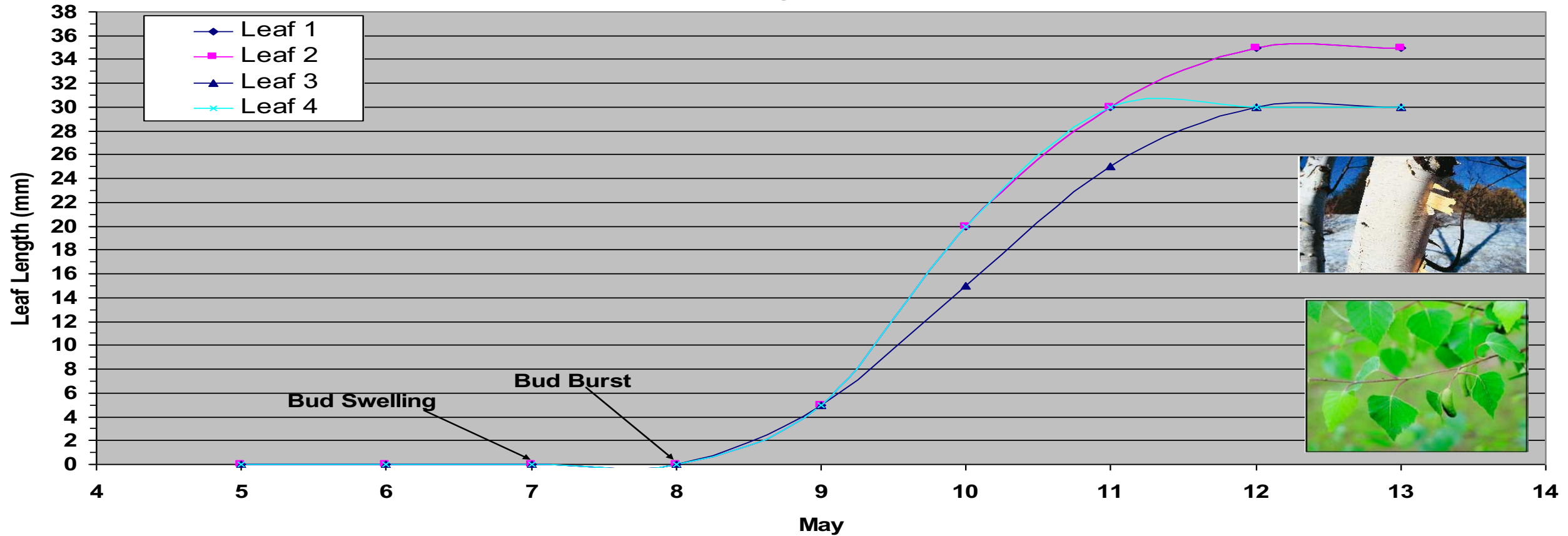
Enter data

Green-up Cards learning activity



Looking at the Data

Green-Up of *Betula Papyrifera*
Innoko River School, Shageluk, AK, US
Spring, 2005





Greenup & Greendown Annual Site Profile

OSAKA PREFECTURAL HIGASHISUMIYOSHI TECHNICAL HIGH SCHO

2002: GRN-02 PHN-GUGD2

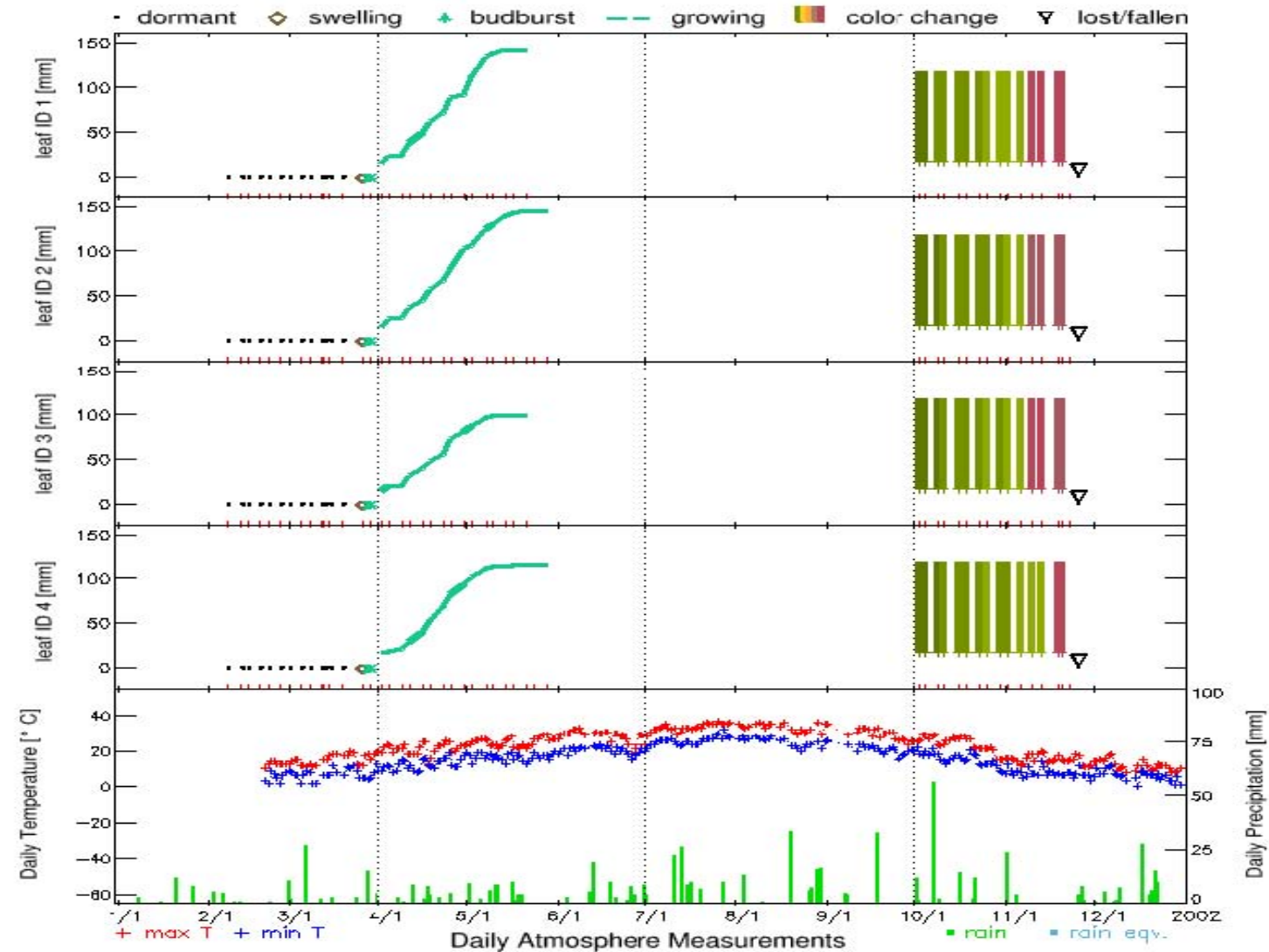
135.5437°E, 34.6133°N, 5.2 m, site type LCB,

Site comments:

Nearest ATM site: ATM-01 ATM-1

135.5469°E, 34.6097°N, 5.2 m, at distance 0.0 m, in direction N

T GENUS/SPECIES: Cornus/florida, Dogwood



Student Outcomes

Phenology Studies



Mat-Su Career & Technical H. S. students helped U.S. Fish and Wildlife Service scientists



Collaborative Budburst Study



Students from two schools for the deaf Presented at a GLOBE Learning Expedition In South Africa

Scientific Publications

- Gazal, R., White, M., Gillies, R., Rodemaker, E., Sparrow, E. and Gordon, L. 2008. GLOBE students, teachers, and scientists demonstrate variable differences between urban and rural leaf phenology along a multi-continent bioclimatic gradient. *Global Change Biology*, 14, 1-13, doi:10.1111/j.1365-2486.2008.01602.x.
- Robin, J.H., Dubaya, R., Sparrow, E., and Levine, E. 2007. Monitoring start of season in Alaska with GLOBE, AVHRR and MODIS data. *Journal of Geophysical Research – Biogeosciences*. 113, G01017, doi:10.1029/2007JG000407.

Citizen Science Program Design



	“Contributory”	“Co-Created”
Question	Researcher	Citizens
Methods Design	Researcher	Citizens with researcher assist.
Data collection	Citizens	Citizens
Data Analysis	Researcher	Researcher with citizen assist.
Use of findings	Researcher & Citizens	Citizens & Researcher



Designing for outcomes across scales: A hybrid model

Personalized, facilitated match making starting with local needs and priorities

Theoretical or generalizable needs

Local community needs

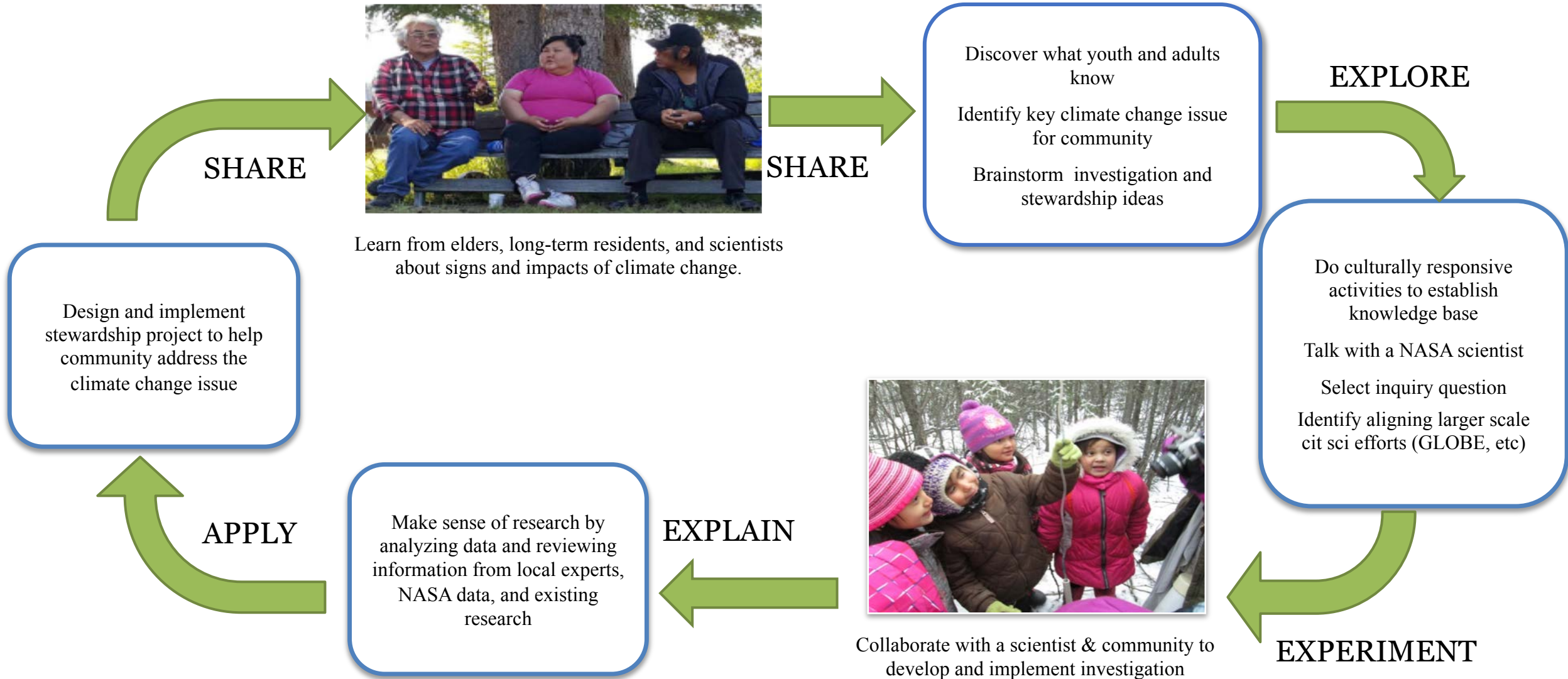
Community investigations and stewardship action projects on local climate change issue co-identified by youth, elders, educators, and scientists aligned with large-scale citizen science project (GLOBE, etc.)

Publishable dataset,
Fill gaps in large scale dataset,
Large scale policy impact

Individual learning,
Critical data now,
Local policy impact

Learning and data at multiple scales

Designing for generational and cultural diversity: culturally responsive learning framework





Design Elements

Social-Ecological Resilience

- Data collection using GLOBE protocols – local problem, global data
- Explicit expectation of a stewardship project

Diversity

- 3 generations of participation, team approach
- Key Project partner (Association of Interior Native Educators, Tribal Resilience Program)
- Intensive participant training on weaving indigenous culture and GLOBE
- Culturally-based curriculum supports



Ket'acik & Aapalluk Memorial School students, teacher Whitney Spiehler, elder and teacher Pauline Morris used GLOBE soil protocols to address erosion in Kwethluk, AK.

Program Evaluation Insights

Learning goal	Change pre-post
Knowledge of local climate change issues	++
Knowledge of personal connection to climate change	+++
Knowledge of how to braid Alaska Native knowledge & Western Science in a project	+++
Knowledge of connections and feedbacks between components of earth system	+
Confidence in designing an inquiry project	++
Knowledge of how to guide youth in investigating and addressing a climate change issue.	++



Designing for outcomes across scales: Needs and priorities alignment



Ecological Research Question:

- How do shifts in climate affect the fate of ripe berries and timing of berry loss from plants in fall and winter across Alaska?

Local Question:

- Why are our berries changing?

Cit Sci Research Questions:

- Can the contributory model of citizen science be supplemented to increase diversity of participation and social-ecological resilience outcomes?

Designing for personal relationships and alternative learning frameworks

Winterberry - Arctic Harvest Study Design



Basic

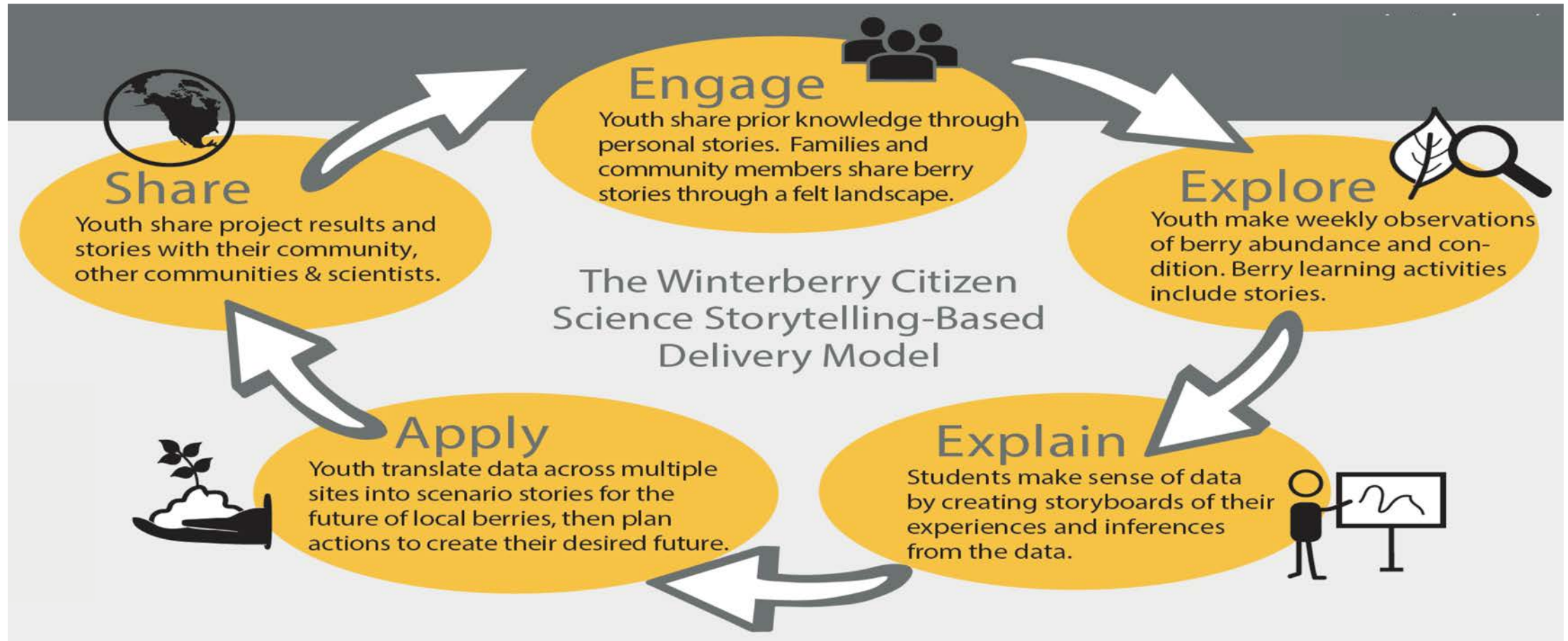


Highly Supported



**Highly Supported &
Storytelling**

Designing for diverse learners: Storytelling-based citizen science learning



Measuring resilience-related outcomes across scales

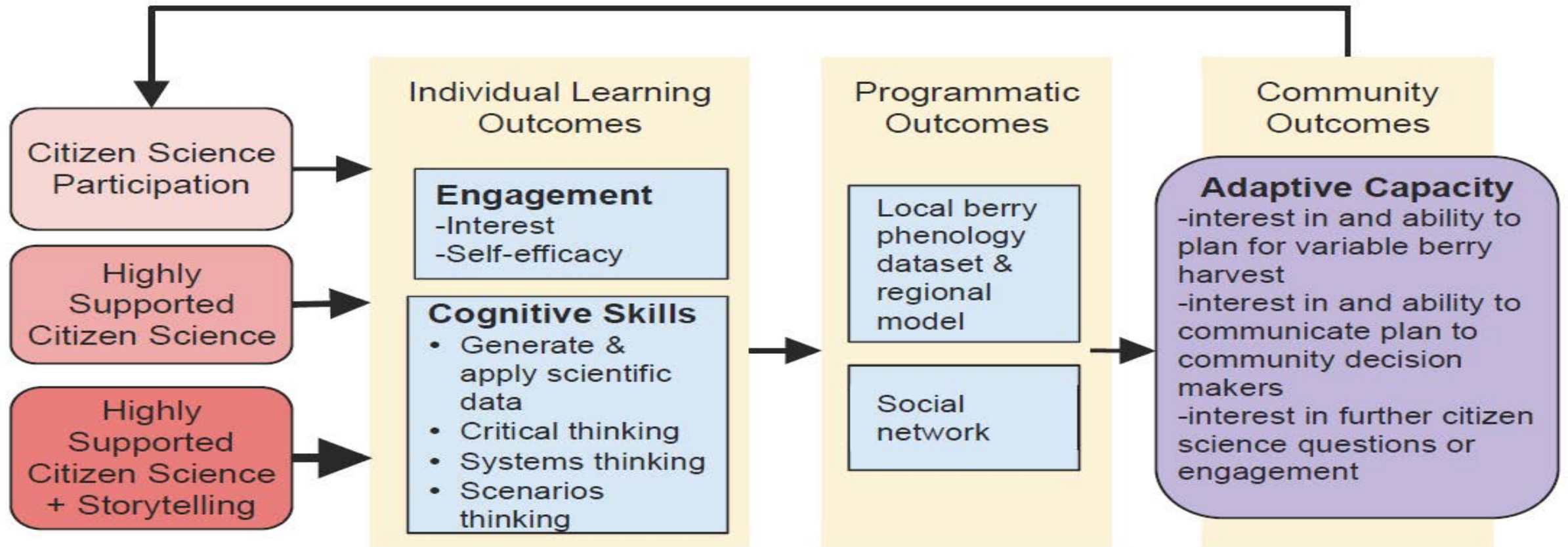


Figure 2. Research framework for determining the impact of three Winterberry citizen science delivery methods (left) on learning outcomes at individual, programmatic and community scales that are expected to influence social-ecological system resilience (adapted from Jordan et al. 2012). Bolded individual and community outcomes are the focal response variables for our proposed research, and larger arrow size indicated larger hypothesized effect on these response variables.

Citizen Science Program Design



	“Contributory”	“Co-Created”
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Use of findings	Researcher & Citizens	Citizens & Researcher

**Publishable dataset,
Large scale policy impact,
Slower timescale**

**Individual learning,
Local policy impact,
Rapid timescale**

Thank You

Alaska GLOBE

Collaborators: E. Sparrow, K. Spellman, C Buffington, C. Keill, GLOBE Implementation Office at UCAR, Alaska School Districts, Alaska Schools,

Funding: NASA, NSF, Arctic and Earth SIGNs, Winterberry, Bonanza Creek LTER, Alaska EPSCoR, The International Arctic Research Center

Winterberry

Collaborators: K. Spellman, C. Mulder, E. Sparrow, J. Shaw, D. Cost, S. Stanley, C. Villano, L. Parkinson, C. Buffington, 409 citizen/community scientists

Funding: NSF Advancing Informal Science Learning

Arctic and Earth SIGNs

Collaborators: Elena Sparrow, Malinda Chase, K. Spellman, et al. University of Alaska Fairbanks; Association of Interior Native Educators; GLOBE Implementation Office; NASA Langley Research Center Office of Education; NASA Goddard Space Flight Center Cryosphere Branch; North Slope Borough School District and other school districts; Kenaitze Indian Tribe; 4-H Alaska; Santa Ana Community College MESA; Goldstream Group; NASA Science Mission Directorate STEM Activation Collective, 345 community/citizen scientists

Funding: NASA Science Mission Directorate



Marilyn Sigman

Alaska CoastWatch Project: Using Citizen Science to Engage Alaskan Youth in Strengthening Community Resilience

- Marine Education Specialist, UAF Alaska Sea Grant - Homer, Alaska
- Associate Professor, UAF
- Editor of a “best practices” handbook for
- Community-based monitoring of Alaska’s
- Coastal and ocean environments



Alaska CoastWatch for Action

Citizen Science Strategies to Engage Youth
in Strengthening Community Resilience



Arctic Research Seminar
April 10, 2019

Marilyn Sigman

Community-Based Coastal Erosion Monitoring



“Stakes for Stakeholders” Bristol Bay Region



Providing Data for Storm Surge Modeling, Utqiagvik



Research

We are charged by Congress to conduct scientific research that enhances the wise use and conservation of our coastal and marine resources.



Marine Advisory

Our outreach and technical assistance programs help Alaskans wisely use, conserve, and enjoy Alaska's marine and coastal resources.



Education

Resources and professional development for K-12 educators. Public education and training in coastal communities. College student awards and fellowships.

Alaska HAB Network



HAB monitoring Kodiak and Bering Strait



PlateWatch Project, Unalaska

Overview: Encountering Environmental Hazards on Alaska's Coasts



Preparing for oil dispersant testing at Quayle Beach, Smith Island (Prince William Sound), after the *Exxon Valdez* oil spill in 1989. *Public domain from the [EVOS ARLIS reference](#)*

Climate change and other forces are altering the environment of Alaska's coast and waterways. If you have encountered an unusual event on the coast, this site can help. It provides information on several issues Alaska coastal communities are facing, and what to do and whom to contact if you experience one of them.

Report Unusual Coastal Events
or Hazards

Navigate topics

[Home/Overview](#)

[Aquatic Invasive Species in Alaska](#)

[Earthquakes and Tsunamis in Alaska](#)

[Flooding and Erosion in Alaska](#)

[Harmful Algal Blooms in Alaska](#)

[Marine Mammal Strandings in Alaska](#)

[Ocean Acidification in Alaska](#)

[Oil and Hazardous Spills and Wildlife in Alaska](#)

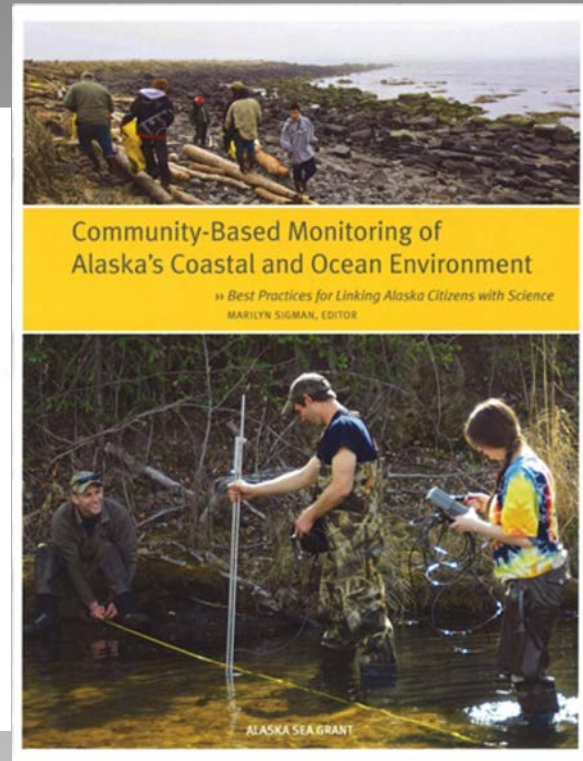
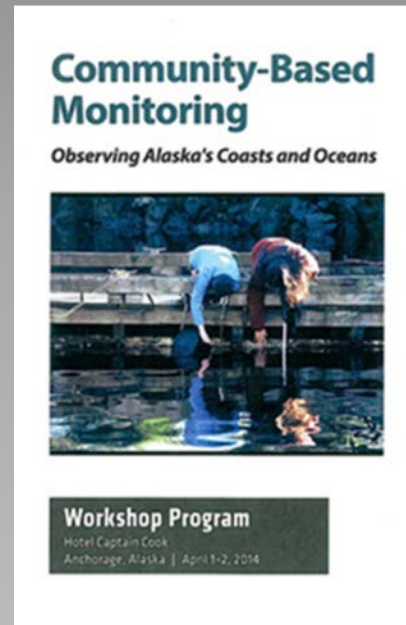
[Paralytic Shellfish Poisoning in Alaska](#)

[Sea Ice and Rising Ocean Temperatures in Alaska](#)

[Seabird Mortality in Alaska](#)



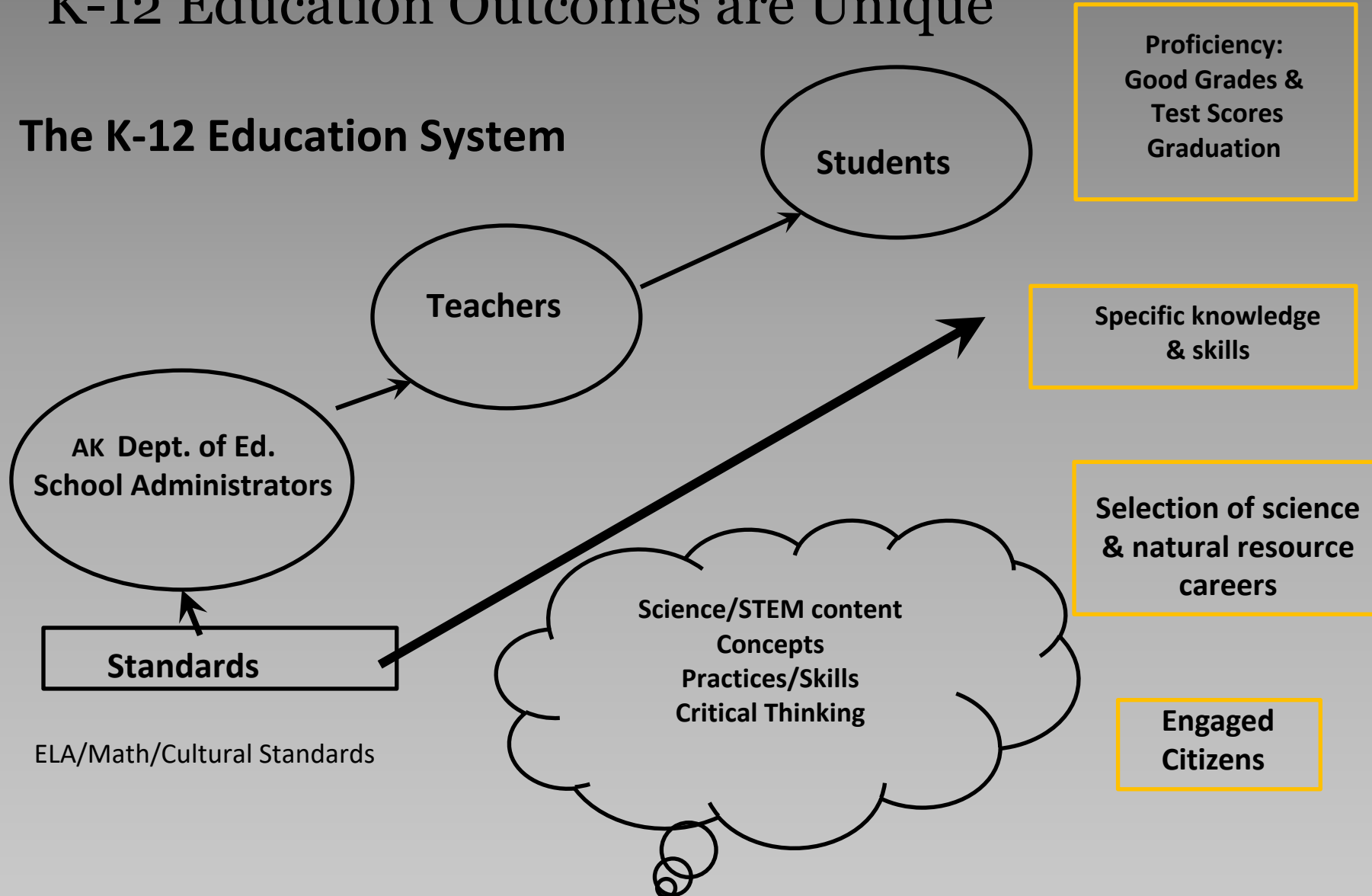
Alaska Coastal Communities Want Their Youth Engaged in Community-Based Efforts



2014 Statewide "Best Practices" Workshop

K-12 Education Outcomes are Unique

The K-12 Education System



Promoting Resilience *and* Adaptation in Coastal Arctic Alaska



**2018 Regional Workshops:
Nome, King Salmon, Dutch Harbor,
Dillingham**

Alaska Communities Want Relevant and Timely Climate Change Education for Their Youth that isn't Politicized or Scary



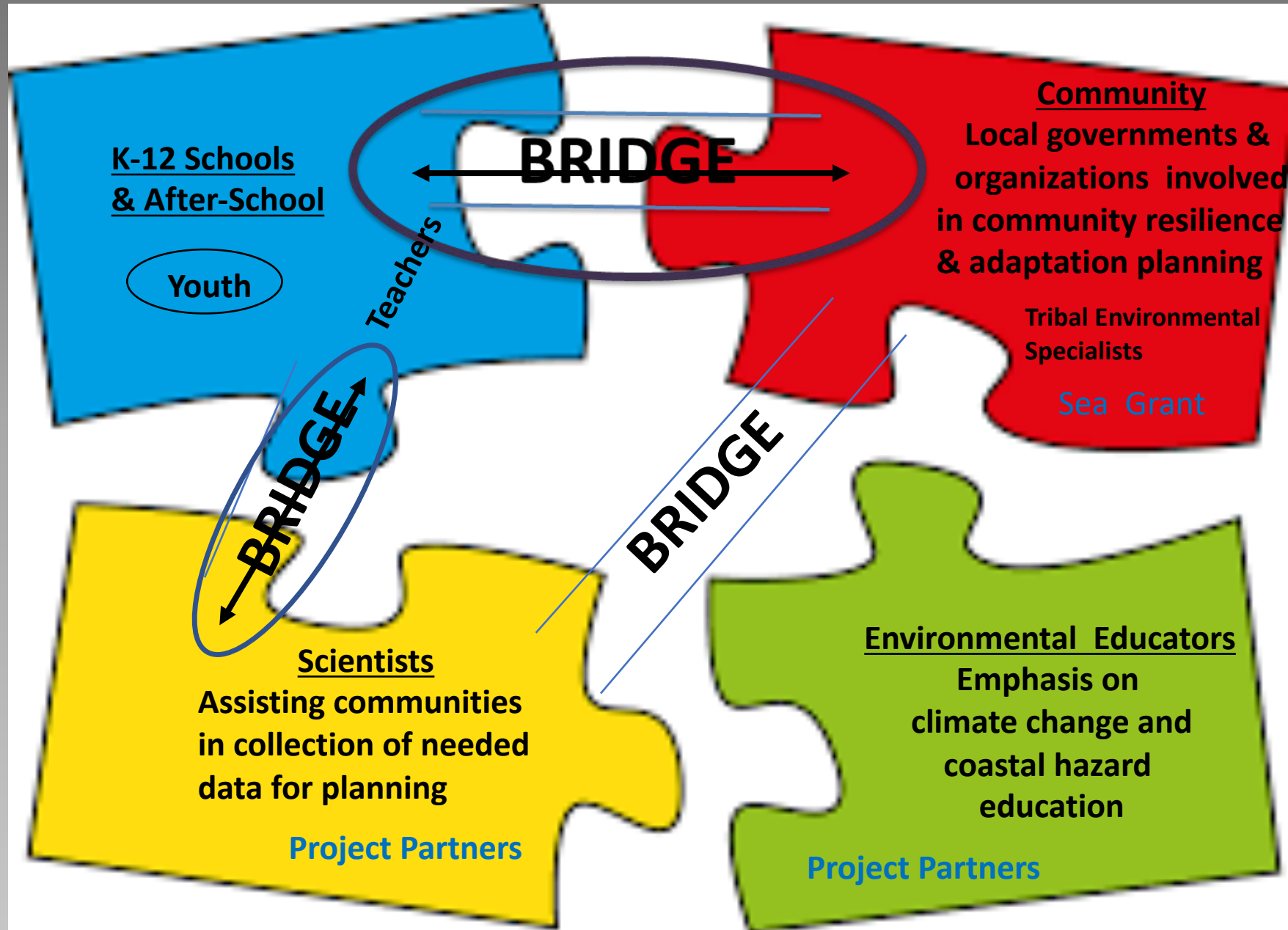


Utqiagvik



Anchorage

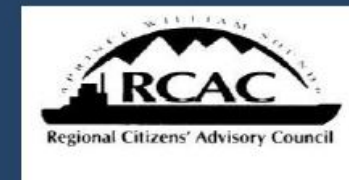
Focus of Alaska CoastWatch Project



A Funding Source Provided the Coastal Hazard Focus



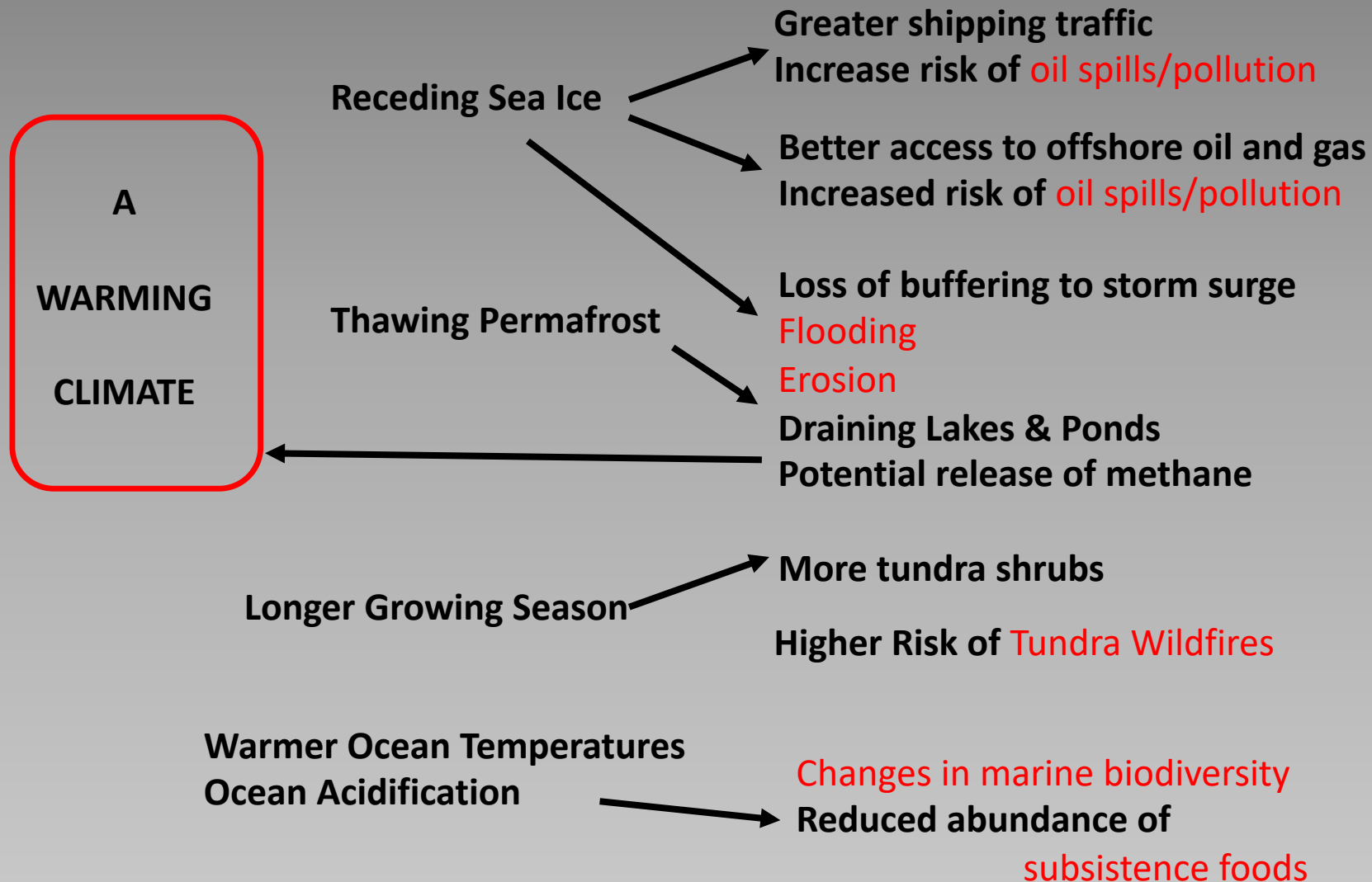
**Community
Preparedness
& Response
to Coastal
Hazards**



Educational Goals

- **Connecting teachers and community educators to environmental hazard issues** relevant to their students and their communities.
- **Supporting them with the resources and tools** to teach about the consequences of climate change and engage their students in making observations, collecting data, and problem-solving.
- Ultimate goal of **sustaining the educational approach** in the school district curriculum and the community

An Educational Framework for Climate Change Education



Based on the National Climate Assessment

Key Messages


- Arctic summer sea ice is receding (faster than expected) and is expected to virtually disappear before mid-century. This is altering marine ecosystems and leading to greater ship access (potential for pollution), offshore development (potential for oil spills) opportunity, and increased community vulnerability to coastal erosion.
- Permafrost temperatures in Alaska are rising, a thawing trend that is expected to continue, causing multiple vulnerabilities through drier landscapes, more wildfire, altered wildlife habitat, increased cost of maintaining infrastructure, and the release of heat-trapping gases that increase climate warming.
- Current and projected increases in Alaska's ocean temperatures and changes in ocean chemistry are expected to alter the distribution and productivity of Alaska's marine fisheries, which lead the U.S. in commercial value (and are the focus of subsistence harvests).
- The cumulative effects of climate change in Alaska strongly affect Native communities, which are highly vulnerable to these rapid changes but have a deep cultural history of adapting to change.

Alignment with Next Generation Science Standards

Storms & Other Forms of Severe Weather; Changing Weather Patterns			
HIGH SCHOOL	MIDDLE SCHOOL	GRADES 3-5	GRADES K-2
<p>Construct an explanation based on evidence how the availability of natural resources, occurrence of natural hazards, and changes to climate have influenced human activity.</p> <p>HS-ESS3-1 Examples of natural hazards can be from . . . severe weather (such as floods). Examples of the results of changes in climate that can affect populations or drive mass migrations include . . . regional patterns of temperature and precipitation.</p>	<p>Conceptual Foundations: Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.</p> <p>MS-ESS2-5</p>	<p>Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change. 3-LS4-4</p> <p>Examples include changes in . . . temperature.</p>	<p>Use and share observations of local weather and patterns over time.</p> <p>K-ESS2-1 (foundational)</p>
<p>Analyze geoscience data and results from global climate models to make an evidence-based forecast of the current rate of regional climate change and associated future impacts to Earth systems. HS-ESS3-5</p> <p>Examples of evidence, for both data and climate model outputs, are for climate changes (such as precipitation and temperature) . . .</p>	<p>Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.</p> <p>MS-ESS3-2 Emphasis is on how some natural hazards, such as severe weather, are preceded by phenomena that allow for reliable predictions, . . . Examples of natural hazards can be taken from . . . severe weather events.</p>	<p>Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.</p> <p>3-ESS3-1</p> <p>Examples: wind-resistant roofs.</p>	<p>Ask questions to obtain information about the purpose of weather forecasting to prepare for, respond to severe weather.</p> <p>K-ESS3-2</p>
	<p>Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.</p> <p>MS-ESS3-3</p>		

Teacher Trainings Support for Curriculum Development

**Project-Based
Learning**



North Slope Borough School District
Biology


North Slope Borough School District > High School > Science > Biology (Unit) > Week 1

Monitoring Changing Weather Patterns

North Slope Borough School District > High School > Science > North Slope Science (Unit) > Wee

North Slope Science: Erosion Project

Collaboration



**Teacher
Workshops
With
Community
Experts**



**Connections to Culture, Citizen Science
and CBM Efforts**

Making Educational Resources and Tools Available on AdaptAlaska.org

Visualize Change

Projects

Stories

Resources

ADAPTAlaska

About What's Changing? How Can We Adapt? Visualize Change Projects Stories Resources

Promoting Resilience and Adaptation in Coastal Arctic Alaska

A Synthesis from Four Regional Workshops in the Alaskan Arctic with individual workshop summaries.

What is Changing?

How Can We Adapt?

Opportunity to Share Teacher & Student Success Stories



**High School Students
Erosion Monitoring Project
Goodnews Bay**



**Old Harbor 6th Grader
PSP Monitoring Project
Winner of two science fair awards**

Michael Køie Poulsen

Enhancing Community-Based Observing Programs in the Arctic

- Biologist
- Nordic Foundation for Development and Ecology (NORDECO)
- Integrated Arctic Observation System (INTAROS)



Enhancing community-based observing programs in the Arctic

ARCUS and IASC seminar/webinar -
Civic Participation in Arctic Research and
Observing: Where We Are and Where
We're Going - 10 April 2019

Michael Køie Poulsen

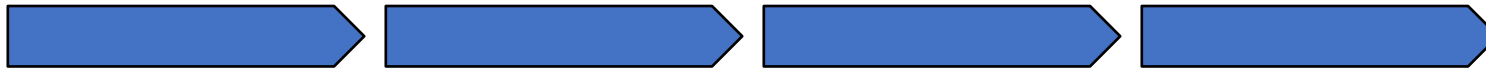
NORDECO - INTAROS

mkp@nordeco.dk

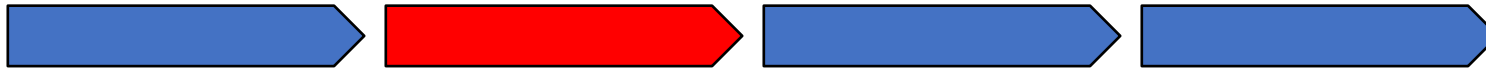




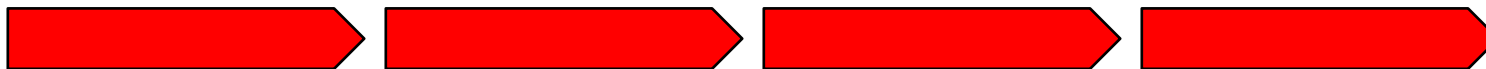
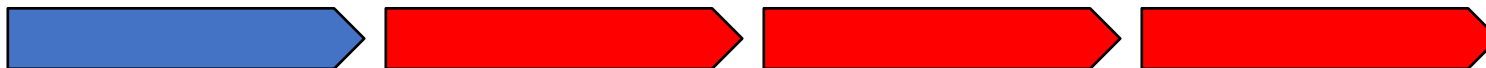
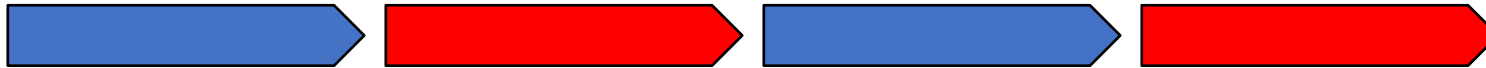
Scientist-executed



Citizen Science (Contributory)



Approaches with even more involvement of community members



PISUNA

Focus Group Discussion (FGD) approach

- Qualitative research method.
- Documents Indigenous and local knowledge.
- Increases coverage





PISUNA

Piniakkanik Sumiiffinni Nalunaarsuineq 'Opening Doors to Native Knowledge'

Local documentation and management of living resources



Central
Government



**National
decisions**



Local
Authority



**Local authority
decisions**



Village
Committee



Natural
Resource
Council



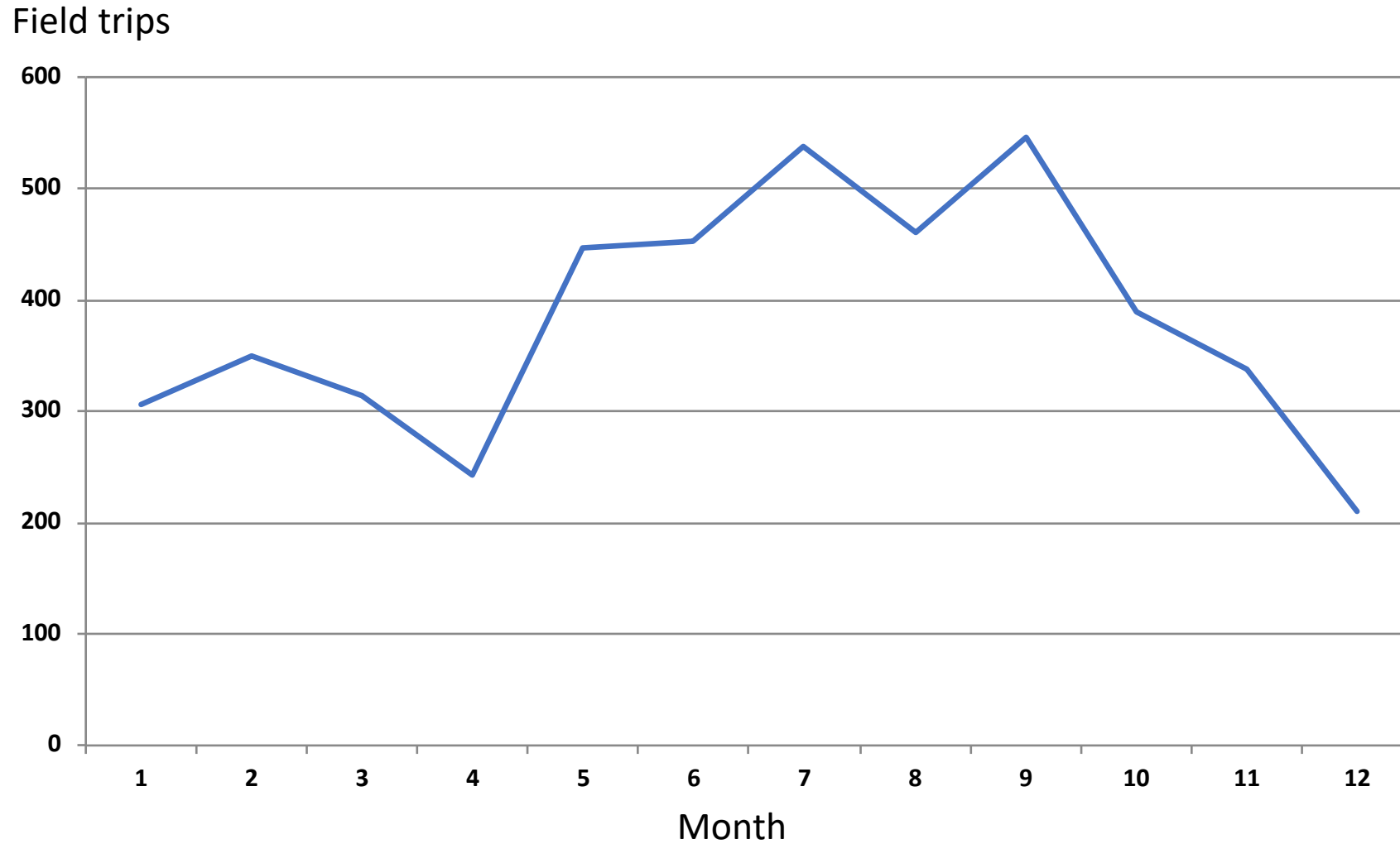
Natural Resource Council meeting



Example of PISUNA quarterly summary form .
 Expressing concern for Musk Ox at Lersletten.
 Stable but too small population. Could
 increase if illegal hunting is reduced.
 Recommends outsider' help with law
 enforcement and change in license system.

Risup atia:		Per Ole Frederiksen.					Ukioq aggornerlu:				2015. 3.KVARTAL. JULI - AUGUST - SEPTEMBER		
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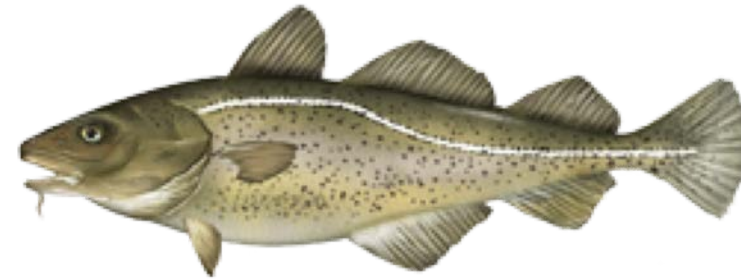
PISUNA field activity through the year



Fishers proving that there are cods – Akunnaaq 2010



Atlantic Cod



Most PISUNA communities report regularly on Atlantic Cod.

Numbers increasing.
Spreading northward.



Attu – in PISUNA since 2013 – Awarded Nordic Environmental Prize 2018



NUUNOQ FROM GREENLAND NOMINATED FOR THE NCM 2018 PRIZE, REPRESENTS ATTU IN FINLAND

Posted on October 5, 2018 by Tero Mustonen





Pisuna.org

The Program
Communities
Documents
Data
Links
Contact
Facebook

Fishermen, hunters and other environmentally-interested people participate in a program of Greenland's Government on the management of living resources. The program aims to establish locally-based documentation and resource management. It takes place in select villages and towns from Disko Bay and northwards in North West Greenland.

"After our hunting and fishing trips, we often discuss between us what we have seen. Some species are disappearing. Some species are coming back after having been away for a long time. And some species are turning up in larger numbers than before..."

Lars Olsen, Akunnaaq.



"The extent of sea ice is rapidly changing. This has an impact on almost everything we do. During our hunting and fishing trips we see a lot of birds and seals and other resources. We write down what we see and we discuss what it means. We hope our records and knowledge can help the Government make wise decisions..."

Karl Tobiassen, Qaarsut.





Search the observations catalog:



Search for:

AND:

AND:

AND:

Date range: to

[View All](#)

Search for Atlantic Cod

The PISUNA-net Observation Database is a collaboration between the Greenland Meteorological Institute and the National Snow and Ice Data Center.



Version 1.3.1
Rails version: 4.1.16, Rails environment: staging

CURRENT SEARCH
Keyword(s):
Date(s): 2009-05 - 2016-09-01
Community: All
Coordinator: All
Living Resources: Atlantic Cod
[Refine Search](#)

Search Results
Showing comments 1 - 20 of 72
20 per page Go to Page: 1 of 4
Sort by:

Date	Coordinator	Community	Additional elements noted (legend)	Transcript	Edit
2016-09	Karl S Marcussen	Attu		Transcript	Edit
2016-09	Tom Mølgård	Kitsuarsuit		Transcript	Edit
2016-08	Karl S Marcussen	Attu		Transcript	Edit
2016-08	Tom Mølgård	Kitsuarsuit		Transcript	Edit
2016-07	Karl S Marcussen	Attu		Transcript	Edit
2016-07	Tom Mølgård	Kitsuarsuit		Transcript	Edit
2016-06	Edvard I. Kristiansen	Kangersuatsiaq		Transcript	Edit
2016-06	Karl S Marcussen	Attu		Transcript	Edit
2016-05	Edvard I. Kristiansen	Kangersuatsiaq		Transcript	Edit

Search for details

Observation ID: KANKR160301_4
Recorder: pisuna admin
Coordinator: Edvard I. Kristiansen (Kangersuatsiaq)
Date: 2016-03
Observation area: Kangersuatsiaq

Observation Details

Total trips: 30
Quantity caught: 0
Trend: Increasing

Comment:

Increasing numbers are observed and most are of medium size. There are only few large individuals

Importance

Long lines for Atlantic Cods are now placed for no longer than one hour as there are so many Atlantic Cods

Suggested Action

We recommend that the Atlantic Cod surveys carried out up here in the north, also near Kangersuatsiaq, to also clarify the options here.



Some recommended sites:

www.pisuna.org

<https://eloka-arctic.org/pisuna-net/>

<https://mkp28.wixsite.com/cbm-best-practice>

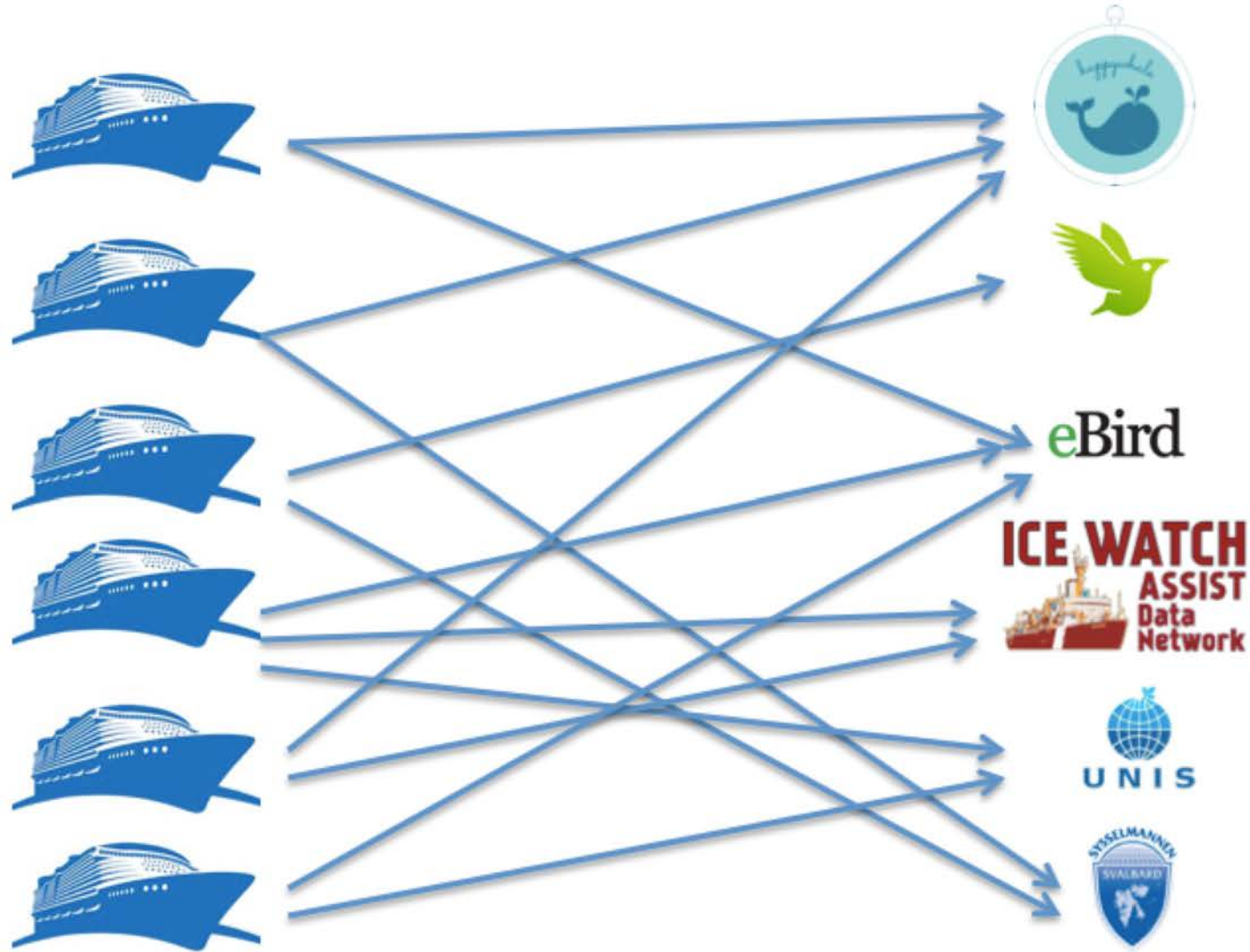
www.monitoringmatters.org





**Cruise Expedition Monitoring Workshop
Longyearbyen 7 March 2019**

Situation today

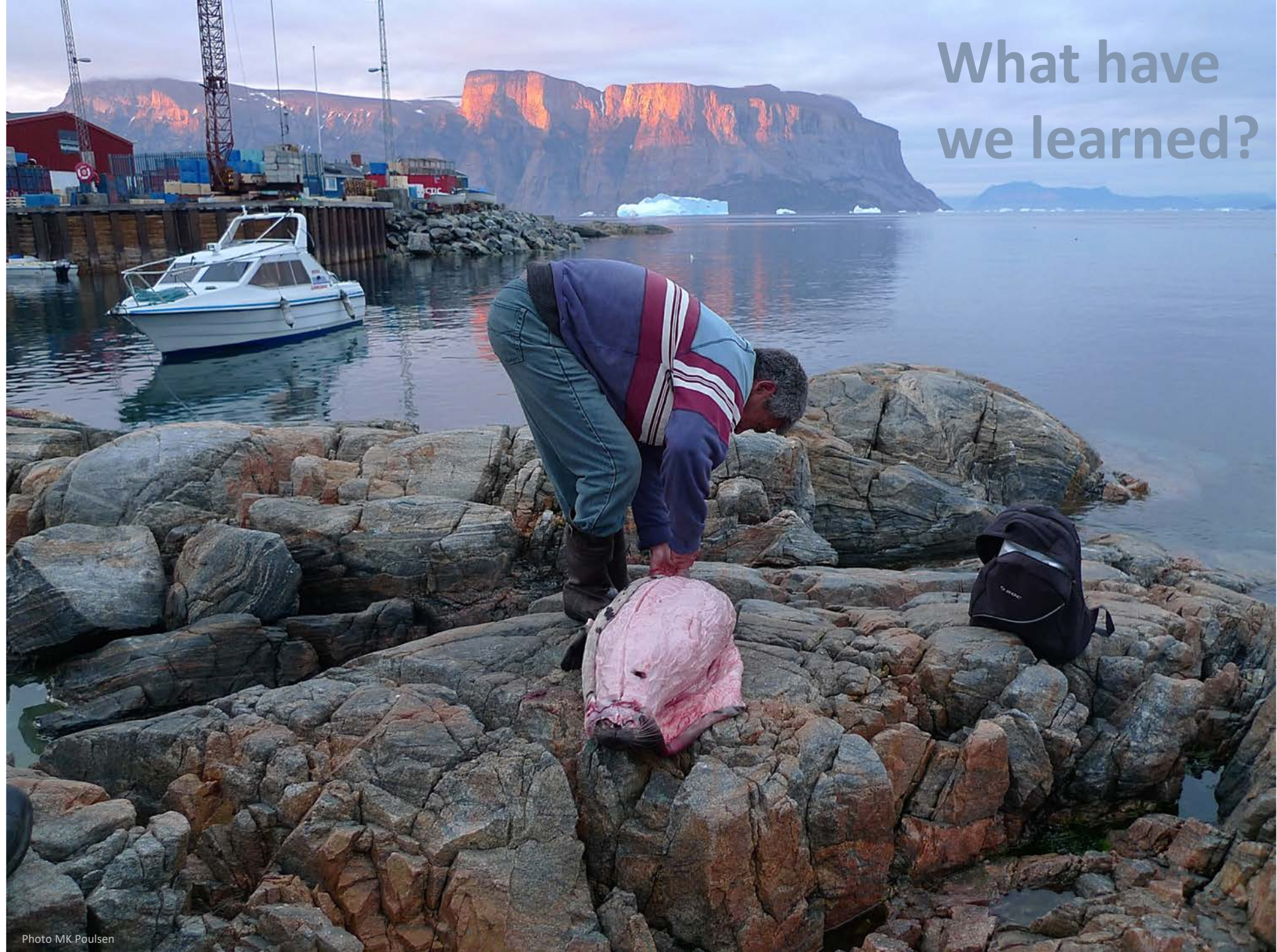


Cruise Expedition Monitoring Workshop - 7 March 2019

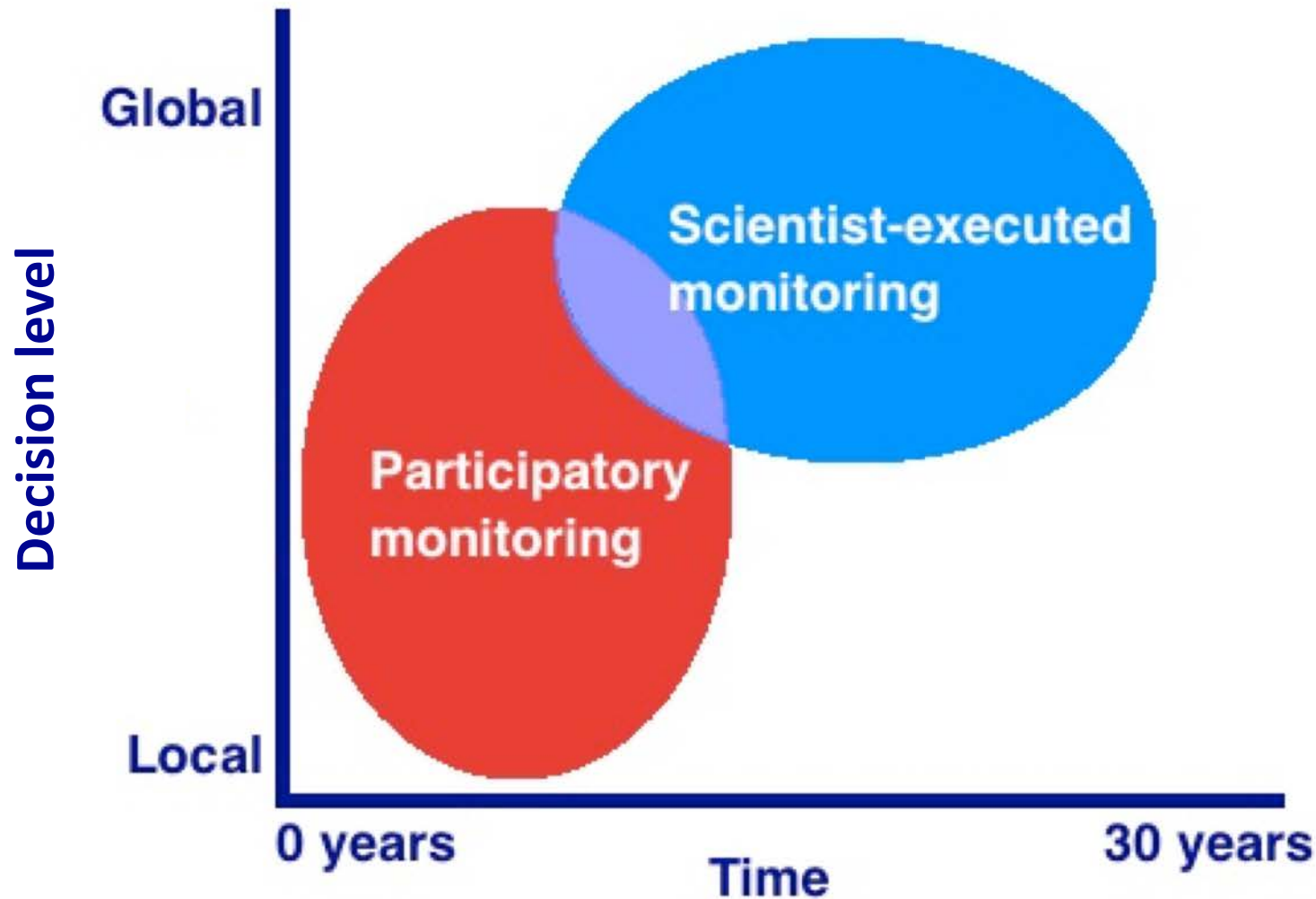
Preliminary conclusions

- Citizen science is already undertaken but large unexplored potential.
- Geo-physical, biological, environmental, cultural topics.
- Immediate feedback needed.
- Builds trust between scientists and people.
- Broad interest in further cooperation, incl. pilot program in 2019.
- Next step: Test existing c.5 CS initiatives. Evaluate.

What have
we learned?



Time from data gathering to management decision



only gather data for researchers

Community-based monitoring should also:

- Make sure that communication reaches decision-makers and leads to management action.
- Provide users a 'voice'. Express how they see the challenges and solutions.
- Raise environmental awareness among users.

Ted Cheeseman

Creating Polar Ambassadors through Citizen Science

- Senior polar expedition guide, Polar Citizen Science Collective
- Co-founder of Happywhale, a marine mammal photo ID citizen science web platform

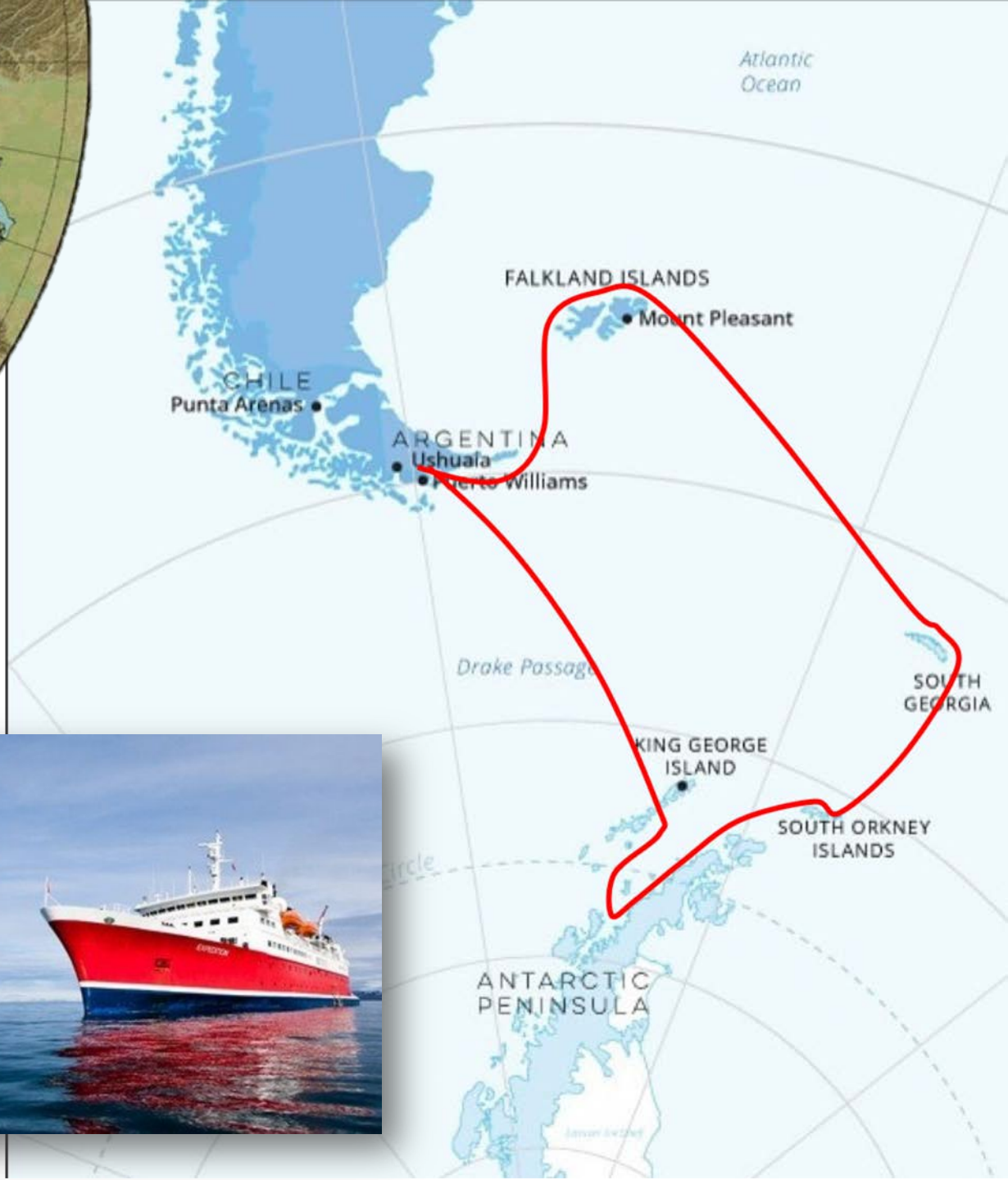
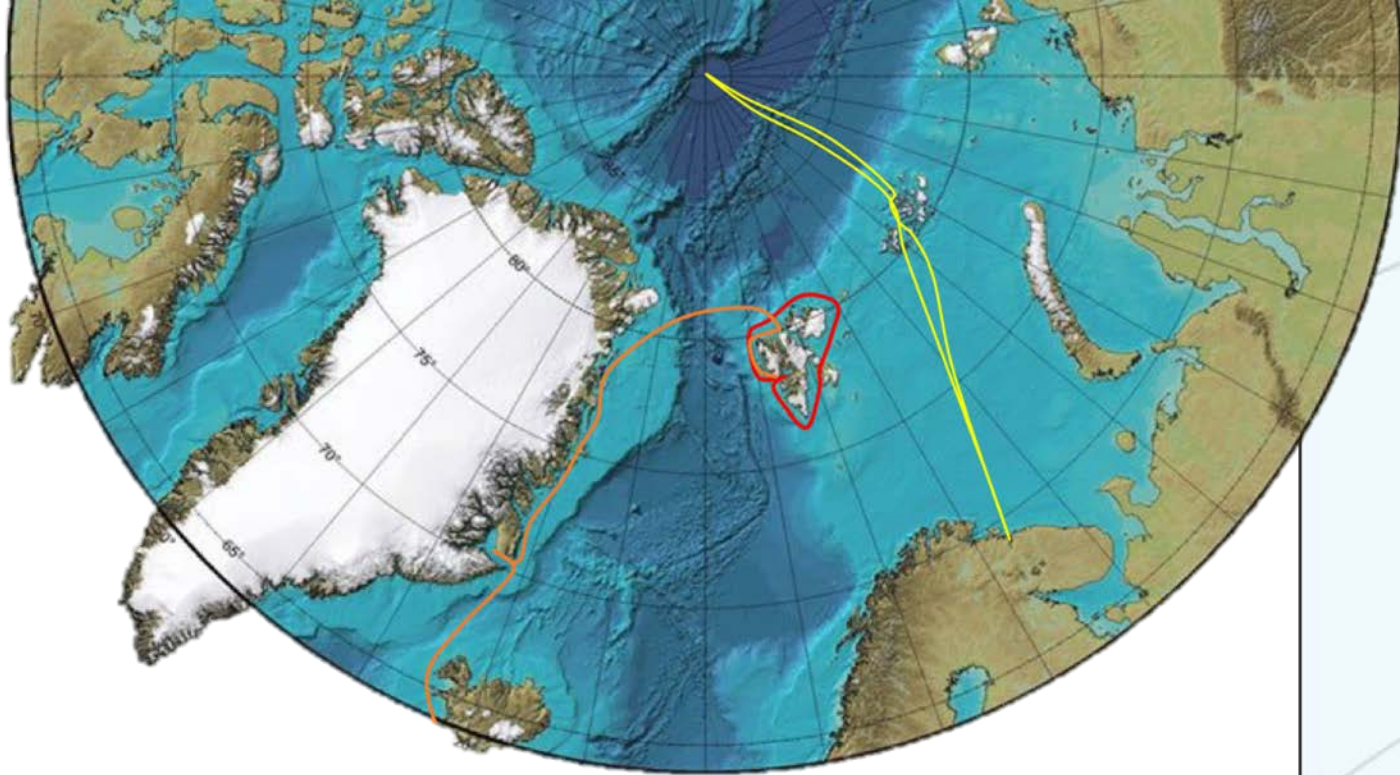




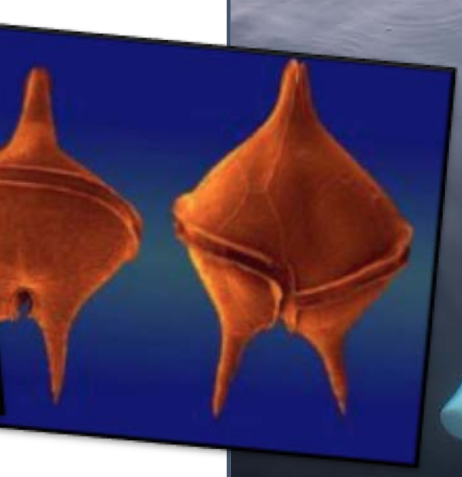
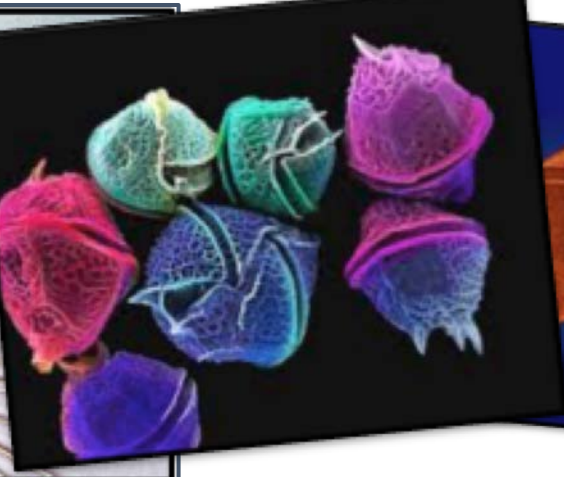
THE POLAR CITIZEN SCIENCE COLLECTIVE

*Creating polar
ambassadors through
citizen science*





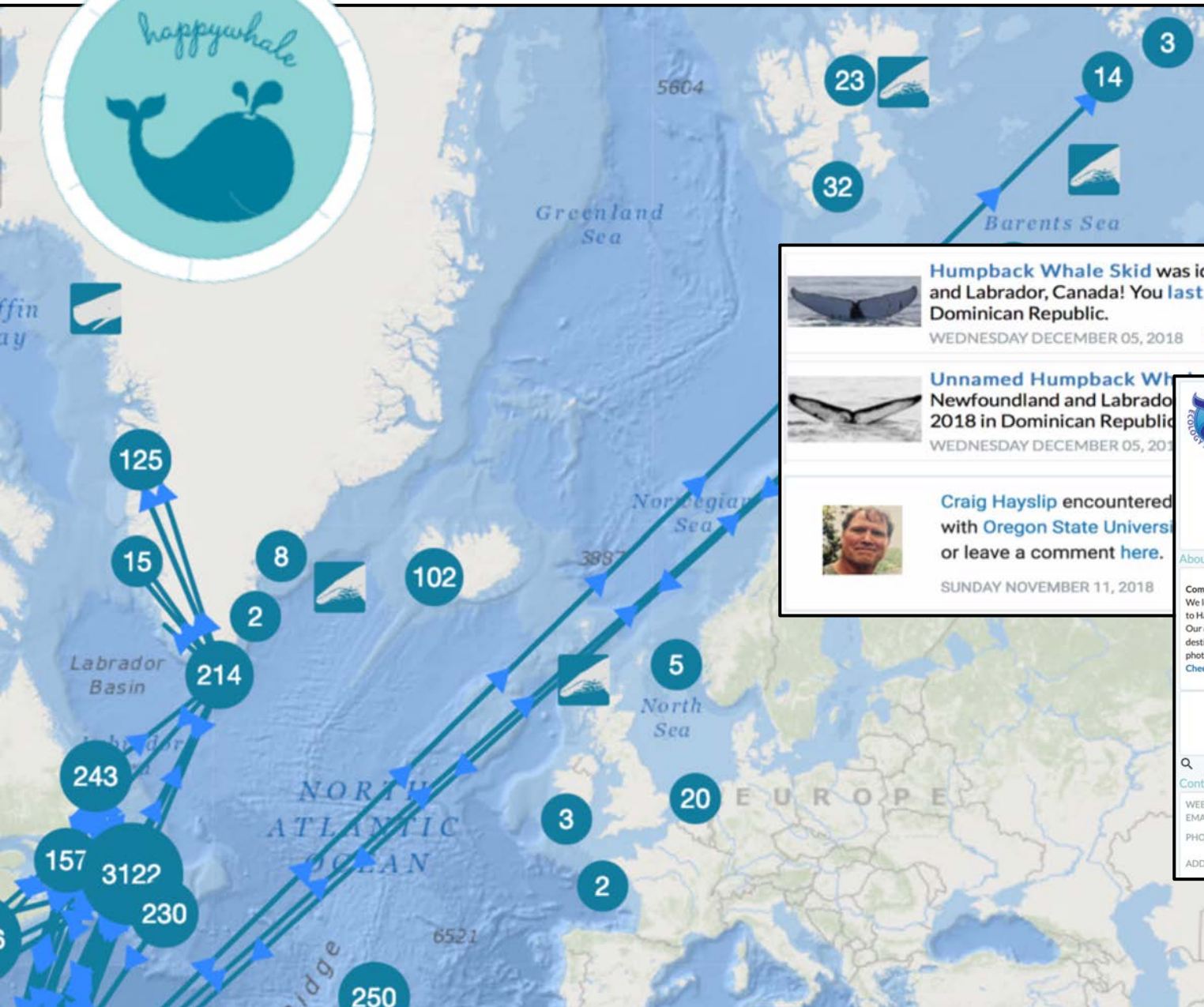
Phytoplankton Sampling



Happywhale: Tracking the Whales of the Southern Ocean



Feedback delivered to contributor



Humpback Whale Skid was identified in an encounter on Saturday June 09, 2012 in Newfoundland and Labrador, Canada! You last encountered this individual on Friday February 06, 2015 in Samaná, Dominican Republic.
WEDNESDAY DECEMBER 05, 2018 VIEW

Unnamed Humpback Whale encountered in Newfoundland and Labrador 2018 in Dominican Republic
WEDNESDAY DECEMBER 05, 2018

Craig Hayslip encountered with Oregon State University or leave a comment here.
SUNDAY NOVEMBER 11, 2018

Cheesemans' Ecology Safaris
Los Gatos, California, United States

Voyages	74	Encounters	538	Individuals	386
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Log My Trip

Followers 6 Unfollow

About

Come watch whales and all wildlife with us! We love whales and are excited to contribute to Happywhale making citizen science fun :) Our distinctive worldwide tours travel to destinations unique for abundant and photogenic wildlife and nature. Visit us at Cheesemans.com or call us at (800) 527-5330.

Total	Encounters	Visible
32	Encounters	32
4	Individuals	4
2	Species	2

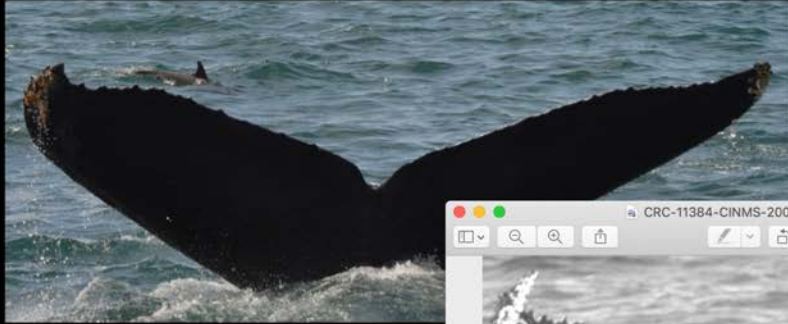
Contact

WEBSITE: www.cheesemans.com
EMAIL: info@cheesemans.com
PHONE: 800-527-5330 or 408-741-5330
ADDRESS: 555 North Santa Cruz Ave. Los Gatos, CA 95030

Cheesemans' Ecology Safaris
Feb 18th - Mar 4th, 2019
VESSEL Akademik Ioffe
Sightings 32

Voyage tracks with geolocated encounters

Happywhale: Automated Image Recognition of Individual Whale ID



2019-04-03-Ti...gpx export_encount...zip

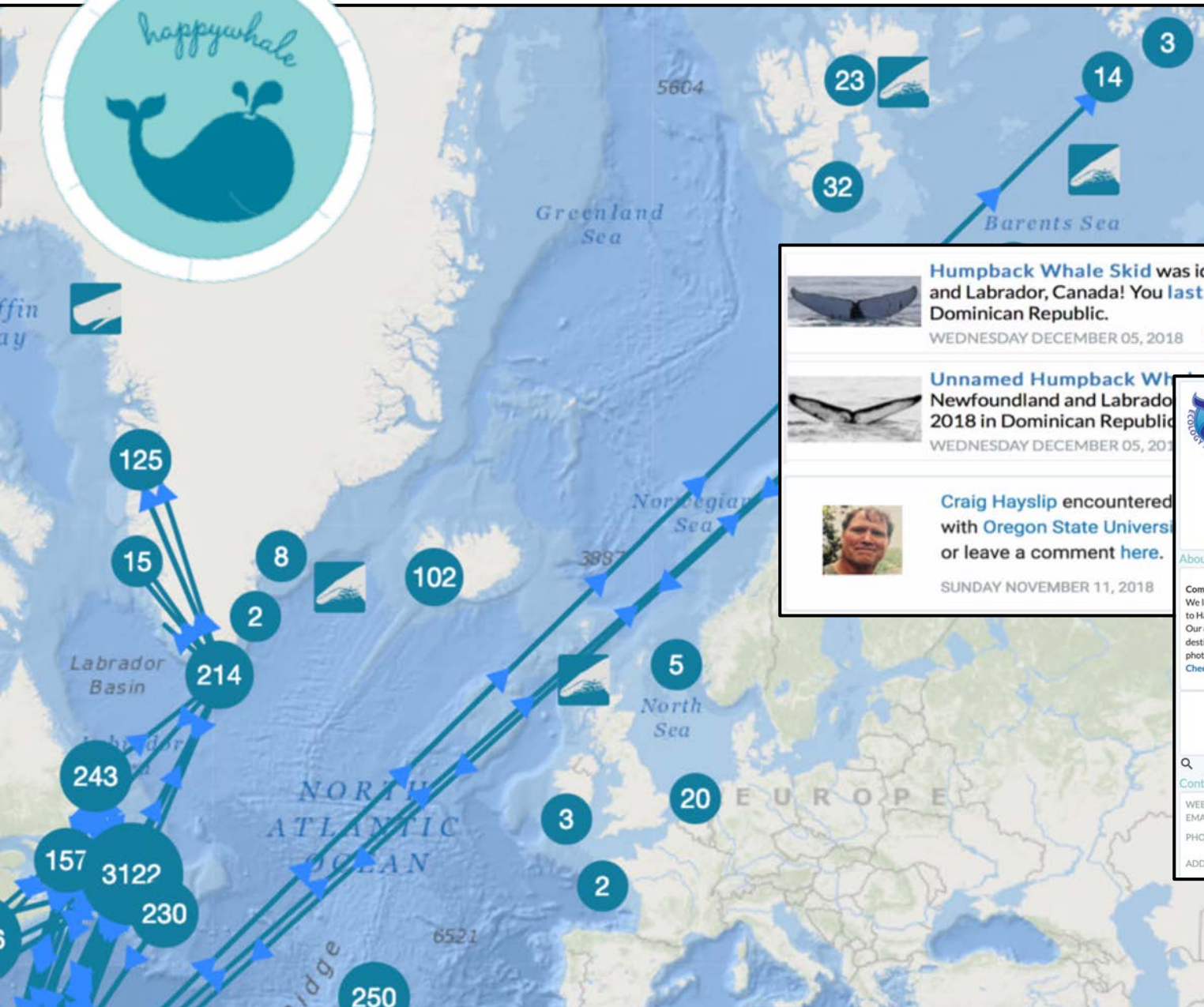


**Computer vision enabling
powerful citizen science**

Happywhale: Tracking the Whales of the Southern Ocean



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Sightings 32

Voyage tracks with geolocated encounters



IAATO is supporting Science

Travelling to Antarctica on board an IAATO vessel gives you operators as well as our guests the time, access and resources to participate in citizen science and to contribute valuable information to the scientific community for a better understanding and protection of the Southern Ocean and Antarctica.

What is citizen science and why should we participate?

Citizen science is scientific research conducted (in part) by non-professional scientists. It is a way to utilize the power of thousands of travelers around the globe to observe, record, and report on natural phenomena. This is particularly important in remote and difficult to access destinations, like the Southern Ocean and Antarctica. Research in these areas is extremely expensive and limited by its remoteness and seasonal accessibility. The scientific community studying these regions is therefore often facing data scarcity. The Antarctic Peninsula, which is the main operating area for the majority of operators, is also considered a hotspot of climate change, putting the polar tourism industry in a unique position: our expedition vessels make fantastic platforms for science. With extended access to these remote regions and expedition teams often equipped with research backgrounds, we have the potential to participate and engage our guests in citizen science projects and to provide valuable data to the scientific community.

By having guests participate in these programs and by using citizen science projects to educate guests about the Antarctic ecosystem, they gain a greater understanding of the region in which they travel. This heightened level of understanding can invoke the desire to become Antarctic Ambassadors, returning home to champion for the protection of one of our planet's most fragile ecosystems.

In these following pages you will find information gathered by the Polar Citizen Science Collective on how to run a successful citizen science program on board, as well as a selection of a multitude of projects from different disciplines that have been proven to work well on board. The Polar Citizen Science Collective www.polarcollective.org is a non-profit that works collaboratively with the industry and the scientific community to develop and implement citizen science projects on board tour vessels.

Everyone is invited to participate – it is fun, engaging and educational. Let's make a difference together.

IMPORTANT NOTE: None of the projects listed in this document require special permitting; if you are considering a citizen science project that involves collection of any specimen, be sure to check special permitting requirements prior to initiating the program on board.

How to make citizen science successful on board

Citizen science works well when it is considered as an activity in the same way as kayaking or camping and incorporated into the company's program. It is recommended to assign one expedition staff member to act as "Citizen Science Coordinator/Science Nerd" for each cruise. His/her primary duties would be to:

- Oversee and coordinate the citizen science program;
- To discuss the project scheduling with the Expedition Leader;
- Assign "Project Leads" to the individual citizen science projects;
- Ensure data collection protocols are met and data are delivered to respective scientific partners; and
- Serve as the go-to expedition staff member for guests interested in participating.

Here are a few tips on how to make citizen science successful during your voyage:

- Consider an introductory power point presentation to introduce the citizen science program you offer on board (many projects listed in the following provide power point material).
- Consider creating a citizen science voyage plan; some projects are excellent for sea days, others for in the field, some are site specific, and some can be done throughout the entire voyage.
- Create a citizen science notice board, where you post information/flyers about each project (additionally other relevant information from the scientific community).
- Post citizen science activities in the daily program.
- Mention citizen science activities/findings at the daily recap.
- Invite guests to an end of trip citizen science recap where you summarize the projects you ran during the trip, show preliminary results, and discuss the concept of being an Antarctic Ambassador.
- Include citizen science information in the post-trip information package that guests receive, such as information about the projects you offered including important project websites, or about science projects guests can participate in when back at home (e.g. www.penguinwatch.org).

Project overview

In the following you will find a brief description of the various projects supported by IAATO and the Polar Citizen Science Collective. For detailed information about each project please refer to the downloadable resources provided via IAATO (specific links are mentioned in each project description).



Happywhale – Marine Mammal Photo Identification



Background

Happywhale <https://happywhale.com> is a platform for gathering marine mammal photos from citizen scientists from all over the world, serving the research community as a data source for photo identification (photo ID) studies of many whale and seal species. Photo ID has been used for decades by scientists, where unique individually identifiable markings on animals allow them to be tracked through time and space. Photographs from citizen scientists can become high-value data if the image is of good quality and has a verifiably correct date and location. We are able to track individuals over lifetimes working with researchers and citizen scientists around the world. This helps scientists study important ecological questions, such as lifespan and survival, population health, migration patterns, and even social dynamics like family structure.

In the Southern Ocean, large whale species such as the blue, fin and humpback whale were hunted down to just a few thousand, for some species even a few hundred individuals by 20th century commercial whaling. Most commercial whaling ended in the 1980s and the great news is that the majority of whale populations are recovering. But science is starved for good data from Antarctic waters.

We have a unique opportunity to change this through collecting photos of species of interest during our voyages: humpback, blue, sei, fin, southern right whale, killer whale, rare whales, Weddell seals and leopard seals and submitting them to Happywhale. Images are then shared with scientific organizations engaged in photo ID studies. For humpback whales, Happywhale will attempt to identify your whales; the best part is that all contributors can follow individuals, like a social media platform for your favorite whales.

Participate?

Fun and very engaging throughout the entire trip. It's the underside of a whale and saddle patches of fin/sei whales, etc. (see

WHALE CATALOG



MAKE WHALE PHOTOS



- Photograph the identifiable features on marine mammal species that you see, being sure to follow responsible marine mammal watching guidelines (do not disturb wildlife to obtain ID photos).
- Upload photos to <https://happywhale.com> or deliver them electronically to project director Ted Cheeseman (see contact info below). The project is most successful when there is a way to gather images aboard; despite the best of intentions, guests often fail to upload photographs after they disembark.

Make sure your company has its own Happywhale page. If not, contact Ted to have this set up. All sightings from your company will be connected to that page and you can then share this page with your guests. Non-photographing guests can participate as well, through "following" the voyage, or individual whales. Both options can be selected via the company's Happywhale website, to receive identification notifications.



Optional: Name a whale to fundraise and engage passengers! For high quality images of humpback whales sent by expedition staff, we try to keep a rapid feedback cycle, with notification within 48 hours from image submission to notification of a match found or confirmation that a whale is new to science. You may name an unnamed matched whale or a whale confirmed to be new to science if used in a fundraising context, such as the voyage auction following certain naming guidelines. If you are interested in naming a humpback whale, please contact Ted.

- Make sure cameras are set to Antarctic local date and time (ship's time) and use on/in camera GPS if available. Happywhale will use GPS data either directly from the camera or from the time stamp that is attached in the metadata of each photo to derive location (each IAATO vessel is continuously sending its position, so if the time stamp is right, Happywhale will know where the photo was taken).

Note for expedition staff: Remind guests to adjust camera times during South Georgia trips when time changes are occurring.



Training and equipment required

Participation is easy, requiring a decent quality camera/smartphone and basic internet navigation skills. No other training is required.

- The equipment needed for this project includes
 - Camera/smartphone with decent camera function

Expected results/feedback

Participating in science can be rewarding! Happywhale will notify every participant of what we find in their photographs, both by email notification and on the website <https://happywhale.com>. Notifications will tell contributors

what the sighting that their animal is new to identified in the future, and that animal will get a station - finding out for graphed has migrated to years before - reminds experience and keeps the or science, these studies the mammal populations, whaling and responding genetic findings and results <https://www.facebook.com/>

It has already all humpback whales years apart and tracked inds of miles. Where will

ence as well as on board enloaded via the

son

ale.com or

Scientific project partners

Data are shared with a wide collaboration of research groups, depending on species. A major goal of Happywhale is to make data available for sound management and protection of remote polar regions. By sharing your photos (more info about each project is available via the resource material):

Antarctic Killer Whale Photo Identification Catalog

The Antarctic Peninsula may be home to the world's most diverse assemblage of killer whale ecotypes, possibly different species! Photos of the dorsal fin and saddle patch (the pale area just below and behind the dorsal fin) are requested by researchers Robert Pitman, John Durban and Holly Fearbach from NOAA's Southwest Fisheries Science Center to help understand pod structure and population health.

Antarctic Humpback Whale Catalog

Humpback Whales are showing a very strong recovery after the end of commercial whaling. Photos of the underside of the tail are requested to understand their population recovery and migration patterns. This research project at Allied Whale, College of the Atlantic now spans more than two decades and has documented over 8000 individual whales.

WHALE-SWIM Project – Southern Right Whales in South Georgia

Southern Right Whales were one of the first whales hunted in the Southern Ocean whaling era, but we know very little about their recovery. Photos of the head, particularly viewed from above to show the "callosity" patterns are requested. The WHALE-SWIM project is the first ever survey of southern right whales in South Georgia waters, their primary feeding grounds.

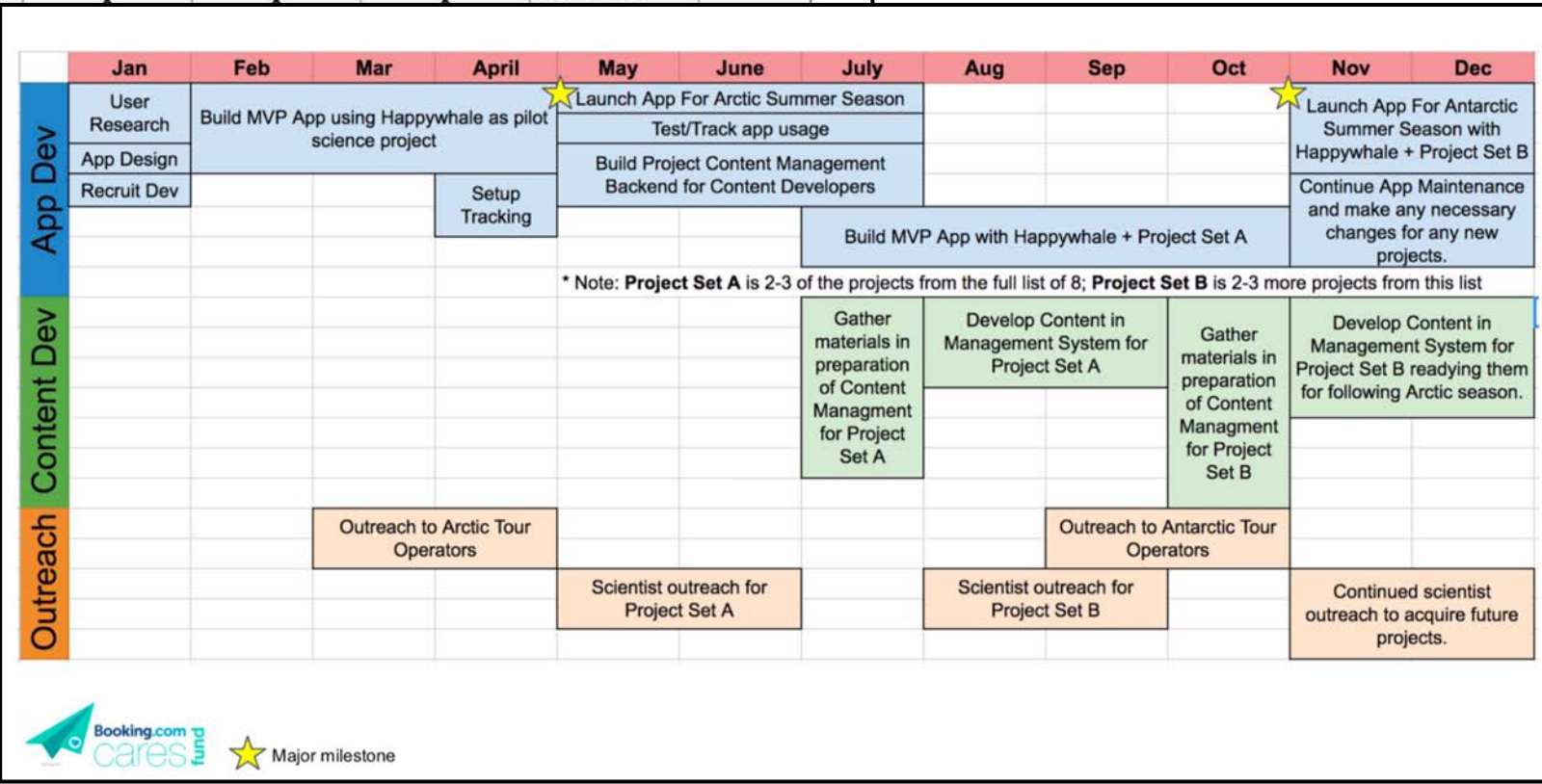
WE NEED YOUR HELP



In Development: Polar Collective Mobile App for Citizen Science

The Polar Citizen Science Collective currently operates 8 projects that will be implemented into the app using common modular building blocks. This programming efficiency dramatically reduces development time and cost, and invites perpetual scalability

Project	Description	Modular app building blocks	Replace data sheets	Connect to existing app	Date/time/location tracking	User management	Outreach / follow-up engagement	Data sharing to global databases
Antarctic Travel Experience: Bucknell University	Pre-and post-trip traveler surveys studying the impact of the travel experience				X	X	X	
Bird Surveys: Stony Brook University	Counting seabirds during ocean crossings for population monitoring		X		X	X	X	eBird
FjordPhyto: Scripps Institution of Oceanography	Impact of increased glacial meltwater from climate change on phytoplankton		X		X	X	X	iNaturalist
Happywhale	Individual ID of whales worldwide				X	X	X	OBIS/Seamap
Historic Site Inventory: UK Antarctic Heritage Trust	Monitoring status of remote Heroic Age historic sites		X					
Cloud Observation: NASA	Linking satellite overpass images with ground truthed atmosphere observations for climate modeling			X				
Sea Ice Observation: International Arctic Research Center	Measuring sea ice type and distribution to correlate with satellite observations		X					
Secchi Disk: Secchi Disk Foundation	Measuring plankton concentrations globally to understand ocean productivity			X				



Roadmap and Timeline





polarcollective.org
info.polarcollective@gmail.com



Thank You!



Thank You!

❖ The next Arctic Research Seminar will be:

- 3 May 2019, 8:00-9:00 a.m. AKDT (12:00 p.m. EDT) in Washington, D.C. featuring Larry Hamilton (UNH): *What People Know – Asking About the Arctic on US General-Public Surveys*

❖ Please visit ARCUS online to find:

- ARCUS Seminar recordings:
<https://www.arcus.org/research-seminar-series/archive>
- Information on how to become an ARCUS member:
<https://www.arcus.org/arcus/member-information>



#ARCUSwebinar

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Please help us improve the Arctic Research Seminar Series by taking our short seminar evaluation survey at:

<https://goo.gl/YZ3QsT>

- This link is available for webinar participants in the chat window
- This link will also be included in the follow-up email you will receive once the seminar video recording has been posted online.



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