

Citizen Science and Arctic Observing: Using the Internet and Simple Technologies to Improve Understanding of Arctic Ecosystem Change

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Citizen science (CS), one of many forms of Public Participation in Scientific Research (PPSR) is the collection of information for scientific and often educational purposes by citizen volunteers (Bonney, et al. 2009; Silvertown 2009). CS need not be Community-Based Observing/Monitoring (CBO/M) as defined in AOS white papers by Alessa et al., (2013) and Johnson et al. (2013), although CS can include CBO/M efforts, and certainly it may integrate community needs for information, community directed research, and local and/or traditional knowledge. CS as described here offers **all** interested individuals the opportunity to participate in the research process with the express purpose of collecting data to address a specific problem or set of problems regardless of permanent physical location of the observer, the expertise of the observer, or the level of observer engagement in research problem formulation. Citizen scientists engaged in arctic observing may be residents of arctic communities, but they may also be other individuals who have particular opportunities to collect information of relevance to arctic observing needs and arctic research. Members of the northern fishing fleets who reside part of the year outside of the arctic but still spend a significant amount of time on arctic waters, members of the dog mushing community who may spend substantial time each year traveling on the land, seasonal workers in northern industries, sportsmen visiting from other regions, and tourists are just a few examples of those who can be engaged in arctic observing. CS observing projects may be short-term or they may be longer-term. In the case of the latter, CS can approximate CBO/M efforts, but will include a more geographically dispersed observer community collecting data that might be more temporally or seasonally bounded than that collected through CBO/M efforts. A CS project that involves collection of observations **in** the Arctic should be informed by the engagement of local people from the outset, even though they may or may not choose to participate in the collection of the observations themselves.

Web-based and GPS technologies are powerful tools for engaging citizen scientists in arctic observing. Use of GPS can be similar to that pioneered in the Igliniit project to record information on a whole host of environmental variables (Gearheard, et al. 2011), or focused on locating observations of very specific phenomena such as a single species. When partnered with an online reporting system that generates maps displaying the collected data the potential for generation of and access to information is great. *BioMap Alaska* (Murray et al. 2013) is an internet accessible, iterative, multilingual, GIS and Google Maps-based tool for collecting observations on marine species that is useful for management, research and education. At present, information on 11 species is available in both English and Iñupiat, and the system allows people to volunteer their observations through a simple web form. Participants can also submit photographs, and are asked for information on location, weather and environmental conditions at the time of observation. In addition observers can contribute information that may differ from that which is requested but which is meaningful to them (i.e. TEK/LEK or other). Interaction

between observers and researchers is both possible and encouraged. Thus *BioMap* enables the co-production of knowledge (Gibbons, et al. 1994), even as the community of knowledge producers is connected largely through cyberspace. Future versions of *BioMap* will integrate with social media in order to strengthen the virtual community component.

Information/observations are accumulated in the *BioMap* database, vetted by experts on regional fauna, and made publicly available in a standardized data format for researchers, managers, educators and the general public. *BioMap* is designed to improve monitoring of marine species and may provide information on changing conditions including species range extensions and introduced species using a consistent yet flexible format. *BioMap* objectives overlap and complement similar initiatives, including those of the Circumpolar Biodiversity Monitoring Program. At a minimum, the goal is to improve baseline information on coastal marine resources in the Chukchi/Beaufort sea region and to facilitate a forum for continuous exchange and communication among scientists, resources managers and stakeholders using the internet and incorporating local knowledge and diverse user observations. However, technological improvements can simplify the input of observations such that contributions could be made from around the pan-Arctic. Similarly standardized reporting of certain variables can be enabled. For example through collaboration and cooperation with entities such as those that manage and monitor weather stations the input of GPS coordinates and time of observation can automatically link to weather data.

An *Arctic BioMap* should be developed and implemented in partnership with regional, national, and international programs engaged in similar observing activities. Minimal efforts at coordination and some sharing of resources would allow expansion beyond Alaska and potentially enable a citizen science effort for arctic ecosystem observing that could equal the success of programs such as Old Weather (www.oldweather.org). Ultimately the goal is to build a citizen science platform for arctic ecosystem observing that is pan-arctic in coverage, that is open to the collection of observations on much larger number of species than the 11 which are currently being observed and that includes all participants who have the interest in and opportunity to contribute.

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SPECIES OF INTEREST

PACIFIC WALRUS

The Pacific walrus can be found off the coasts of the Bering and Chuckchi Seas hauled out on sea ice, the shore, or diving for food nearby. The walrus is the largest pinniped species in Alaska. It can rotate its hind flippers or uses its tusks to help drag its body across land and ice. They are often found in large groups and have strong social bonds with one another.

VIEW SIGHTINGS

REPORT SIGHTING

What is BioMap Alaska?

BioMap Alaska requests the assistance from citizens of Alaska in tracking the movement of species of interest across the state. Citizens use this website to Report Sightings and the reports are directly verified by the BioMap Alaska team and their network of Scientists. Confirmed sightings are added to the BioMap which can be viewed on this website.

[View BioMap](#)
[Download BioMap Data](#)

Project Partners

How to Get Involved

HOW TO GET INVOLVED
Help track Species of Interest within Alaska. [Learn More](#)

CALLING ALL SCIENTISTS
BioMap Alaska is seeking qualified scientists to assist in confirming sightings. [Learn More](#)

Report a Sighting

If you have seen one of the animals of interest, please share it with us. Your information will be invaluable to help us track the movements of these animals within the state. [Report A Sighting](#)

[Download Sighting Form](#)

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Figure 1. BioMap Alaska homepage.

Iñuusiala: Uukakpak Alaskami paqinnaqtut Ualiġm (Bering) taġiuġani suli Uġalim qikiqtaġinini (Aleutian islands), iġaġi inuġiakilhat Sallim (Gulf of Alaska) taġiuġani paqinamiut. Paqinaguurut imam qaaquraġani, itiqpaġitchuami taġiumi suvaiqsisaqamik unii niġiniaqamiġ, immasuli tallimat tlimakipiatun taġium ititiniġani. Uukakpait iġlausuurut nunam siññanun upingaami suvaiqsinaqsikamik nagga niġiniaqamik aasii itiruamun nuulutik ukiagmauġ. Katitpaguumiut atautchimun tasamma iñuġiaksiqaklutik.

Iñuġiaktilaani: Iñuġiaktilaaniat tasamma tamatkua nayuqtit iqalluġniagniq pisigivlugu naamanigaaat iqalliqikpagnigraġat. suli aġiniqtauruġ iqalluktaapayaurani USġum iqalliqirinisa nalunaigmaruġ. Naipiqtuġmatigik uukakpait qilamik nausukpiuraqtut taġiullaani. Isumalaagutit suli siquminniniġa taġium natqani iñuuviatni ihuaqsiaġat pitquratigun nayuqtiqaqluġi govamam savaktiġniġnik aglaan qaunaksraagiktusraurut taikuġasugruk kavyanaiqsimmaalugi.



Photo: NOAA AK Fisheries Science Center

Irrusiġi: Uuktuunmi aktiaaqaqtut sisamakipiaq qulit atausik CM, qivliqtut amii aasii qaana maġauraqtuq suli qivliaqtaaguruk narraak, irikpaqaqtut, taqsraqtaqaanik pitusigauratun qupaqaqtut, suli piġasut suluutit, maġuk sipik, suli maġuk ataani aġuutiġi.

Aġnasalut irrusia: Qiññaniġ allagiipaġitchuġ aglaan aġiuralhaaqtut aġusaluniñ.

Aġusalut irrusia: Qiññaniġ allagiipaġitchuġ aglaan mikiuraqtuq aġnasaluniñ.

Piayaaniġa irrusia: Suvaġniñ anniqamiat aktillaqaqtut itchaksrat mm tun suli immam qaaquraani puumitчуurut, suli taġium siññaaniitчуurut.

Niqiġi taġiumi: Aġiruut uukat niġisuurut naulagnat, iqaluit, uukakuluuraniglu, mikiruut uukat aglianiġaitchuatlu niġisuurut iġliġauranik, iġliganik suli qupilgunik

Iñuġuqniġat: Aġnasalutlut suvaiqsisuurut ukiutuagman, isuani Siqinñaaugruum- Suvluġvigmun aglaan, itiqpaġitchuami taġiumi, maġuġnik-tallimanik ukiuniġmata. aasii taima suvaiksisaġmata maġuk kavluutik kavluutinik suvaiksillarut maġuġi akunniksaagni.

Niqigilatukaġat: iqaluit, taġium nigrutai (ulghaat niqigilatupiksuagai natchiaġruulu) suli, suli taġium tinmiġit.

Iqalluutiqatiġiit: Uugaġruaq, uugaq, uugaq, Iqalugaq.

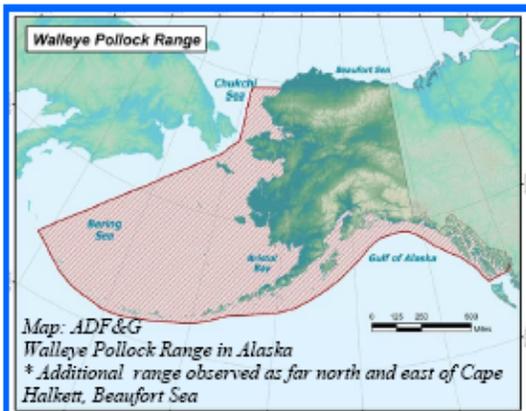


Figure 2. Species field guide – Walleye Pollock, Iñupiat text.

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