Toxic Algal Blooms in the Arctic…*REALLY?!?*

ATCEM 2019

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&
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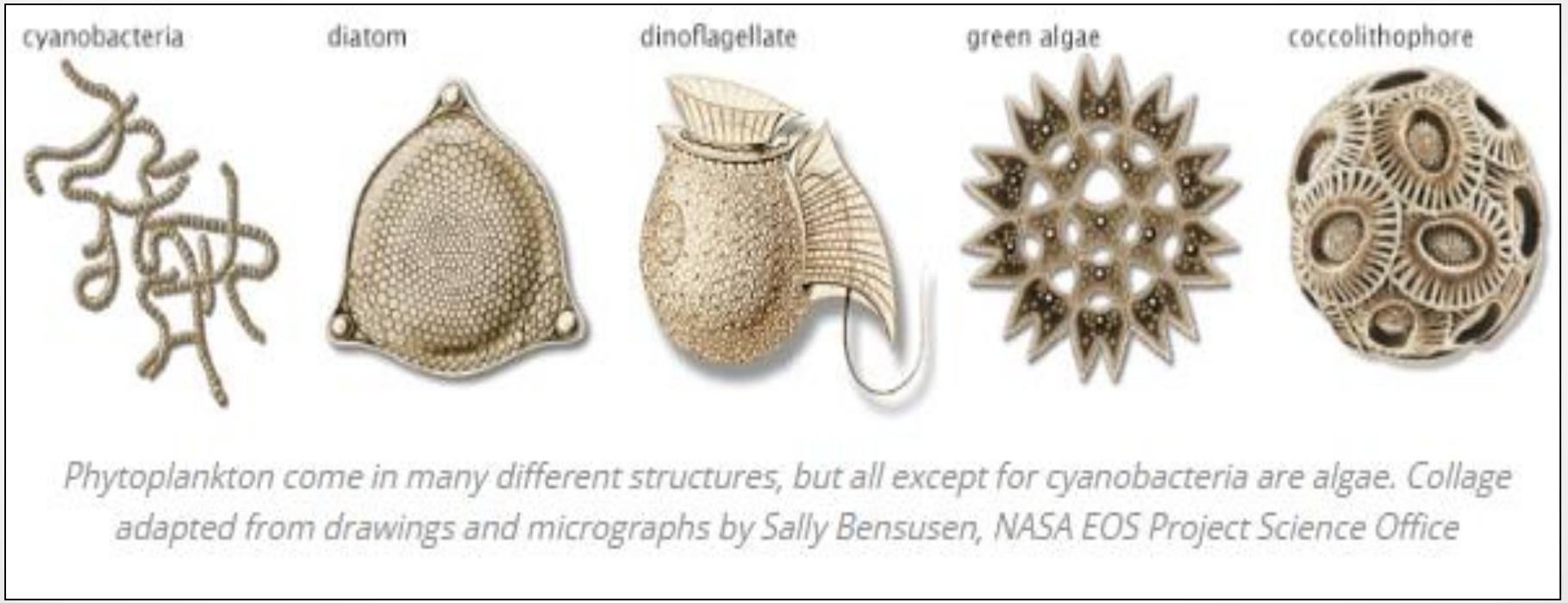
Algae or Phytoplankton??



Phytoplankton come in many different structures, but all except for cyanobacteria are algae. Collage adapted from drawings and micrographs by Sally Bensusen, NASA EOS Project Science Office

https://www.fondriest.com/environmental-measurements/parameters/water-quality/algae-phytoplankton-and-chlorophyll

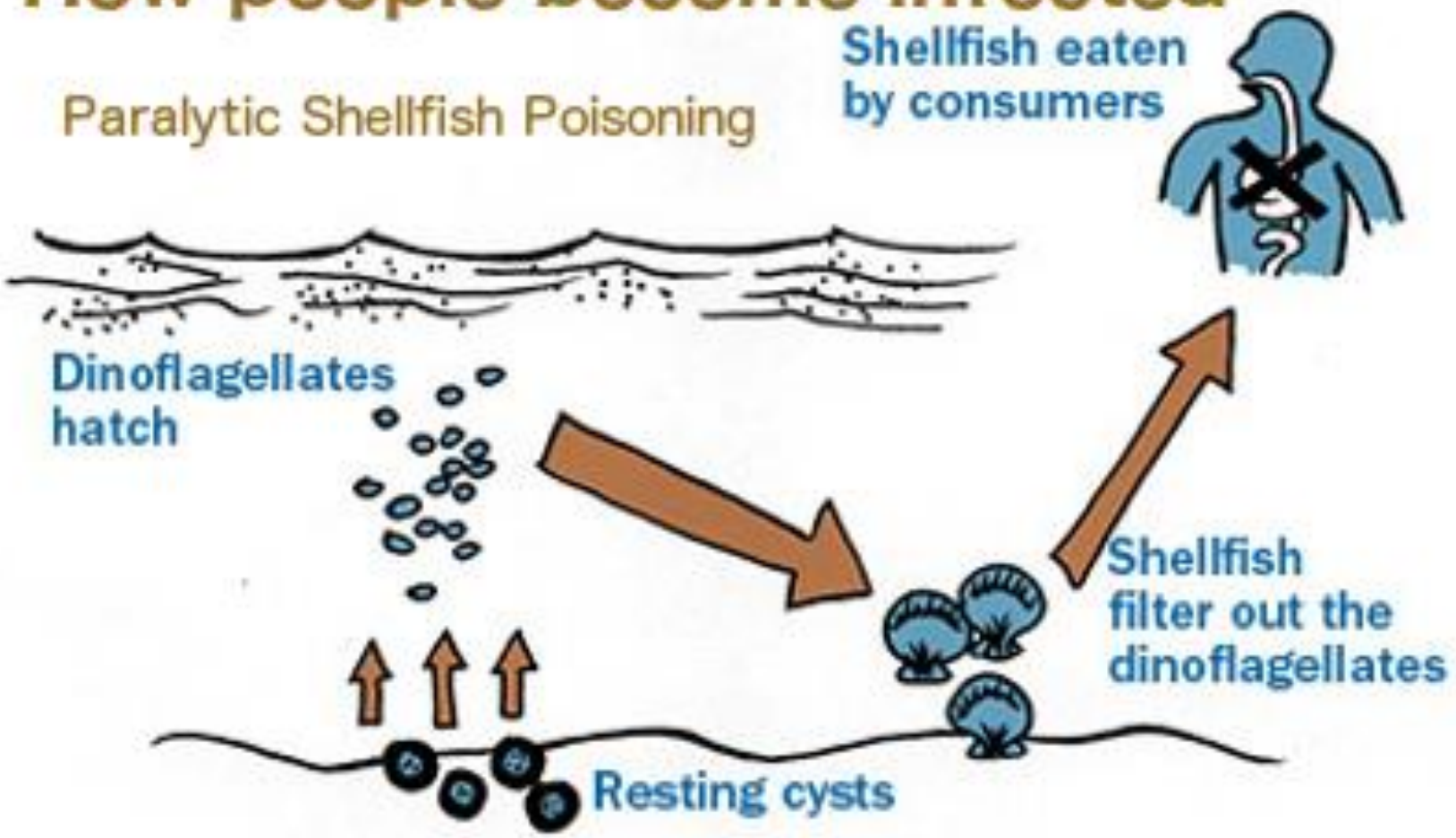
Harmful Algal Blooms

- Harmful Algal Bloom (HAB) – when tiny algae *grow out of control* …while producing toxins
- Saxitoxin: Naturally produced toxin, can impact the nervous system
- Domoic Acid and Cyanotoxin**
- Can impact people, marine mammals, seabirds, etc.

Harmful Algal Blooms

- Clams = vacuum cleaners of the ocean
- Eating shellfish contaminated with high dose of saxitoxin can cause Paralytic Shellfish Poisoning (PSP)
- Federal seafood safety limit for human consumption of shellfish = 800 Nano grams saxitoxin/gm shellfish

How people become infected



How do we know?

- Can't smell it or taste it. Often can't see it!
- Can't depend on the animals to tell us
- Cooking or freezing won't lessen the effects
- Testing/Monitoring**
  - Southeast Alaska Tribal Ocean Research, Sitka Tribe
  - State Lab
  - Researchers

Medical Info

- Neurological toxin
- Tingling of lips, face…paralysis of lungs (saxitoxin)
- **Variable with each algae species and each toxin produced.**
- No antidote
- Need medical care **immediately**!

Saxitoxin

Table 6. Classification of the symptoms.

Category of Symptoms	Symptoms
1	Headache
1	Paresthesia (abnormal sensation such as tingling, pricking, numbness)
1	Dizziness (impairment in spatial perception and stability)
1	Nausea, vomiting
1	Vertigo
2	Incoherent speech
2	Nystagmus (involuntary eye movement)
2	Rapid pulse
2	Ataxia (lack of voluntary coordination of muscle movements)
2	Dyspnea (shortness of breath)
2	Backache
3	Dysarthria (motor speech disorder)
3	Dysphagia (difficulty in swallowing)
3	Apnea (suspension of breathing)
3	Weakness of arms and legs
3	Pronounced respiratory difficulties
3	Muscular paralysis
3	Respiratory arrest (without death)
4	Death

Why now?

- **Not new to Alaska**
  - 1993-2014 had 117 cases (confirmed)
  - 54% were Alaska Native
- Global increase in Harmful Algal Blooms
- Climate Change?

Local Knowledge

IÉUPIAQ PLACE-NAMES, LOCALITIES, AND SITE DESCRIPTIONS FOR THE SEWARD PENINSULA, ALASKA Susan Fair and Edgar Ningeulook, National Park Service, 2013

41. **Ipnauraq** (Bering Strait); translation: "Small bluff," "Rocky wall," or "Little bank" Gideon Barr: This is an old site near the mouth of the Serpentine River which has igloo houses, older cabins, and modern fall fishing cabins. It is used as a site for fishing herring and formed just before freeze-up. Edgar Ningeulook: ***Ningeulook states that Ipnauraq was the location of a red tide at one time which caused many deaths.*** Today, dog races are run from Shishmaref to Ipnauraq and back.

Western Science

Possible spreading of toxic *Alexandrium tamarense* blooms on the Chukchi Sea shelf with the inflow of Pacific summer water due to climatic warming

Masafumi Natsuike[a,*], Kohei Matsuno[b], Toru Hirawake[a], Atsushi Yamaguchi[a], Shigeto Nishino[c], Ichiro Imai[a]

Evidence of increased toxic *Alexandrium tamarense* dinoflagellate blooms in the eastern Bering Sea in the summers of 2004 and 2005

Masafumi Natsuike[1☐a]*, Rui Saito[2☺], Amane Fujiwara[3☺], Kohei Matsuno[1], Atsushi Yamaguchi[1], Naonobu Shiga[1☐b], Toru Hirawake[1], Takashi Kikuchi[3], Shigeto Nishino[3], Ichiro Imai[1]

Prevalence of algal toxins in Alaskan marine mammals foraging in a changing arctic and subarctic environment

Kathi A. Lefebvre[a,*], Lori Quakenbush[b], Elizabeth Frame[a,1], Kathy Burek Huntington[c], Gay Sheffield[d], Raphaela Stimmelmayr[e], Anna Bryan[b], Preston Kendrick[a], Heather Ziel[f], Tracey Goldstein[g], Jonathan A. Snyder[h], Tom Gelatt[f], Frances Gulland[i], Bobette Dickerson[f], Verena Gill[h,2]

Why now?

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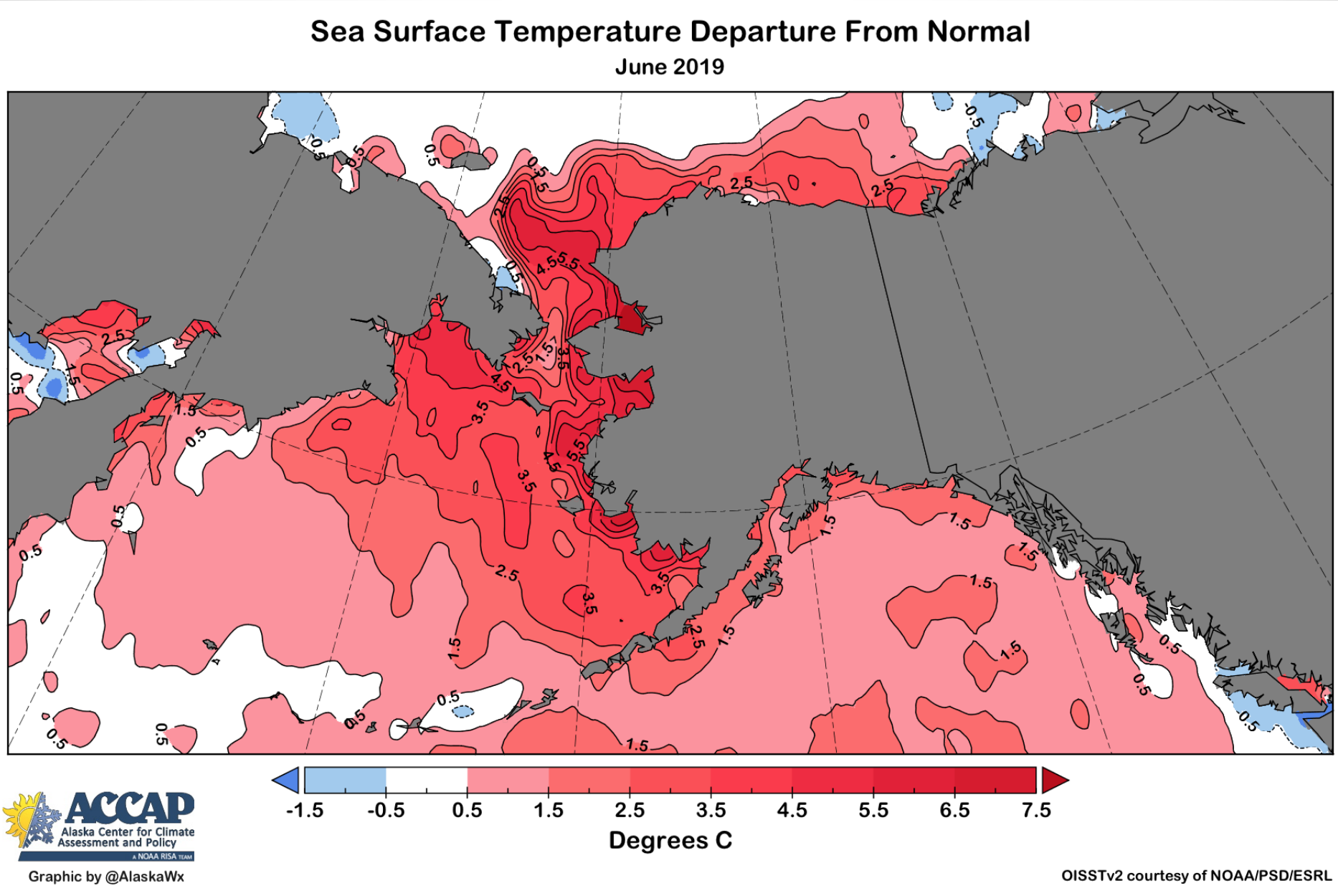
- **Global increase in Harmful Algal Blooms**
- **Climate Change?**

WARMING OCEAN TEMPERATURES



Bering Sea (east of 180W)
Average Sea Surface Temperature
May through October, 1900 to 2019

Degrees C

9
8
7
6
5
4

1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010

Avg SST in area 54-66N, 180-160W

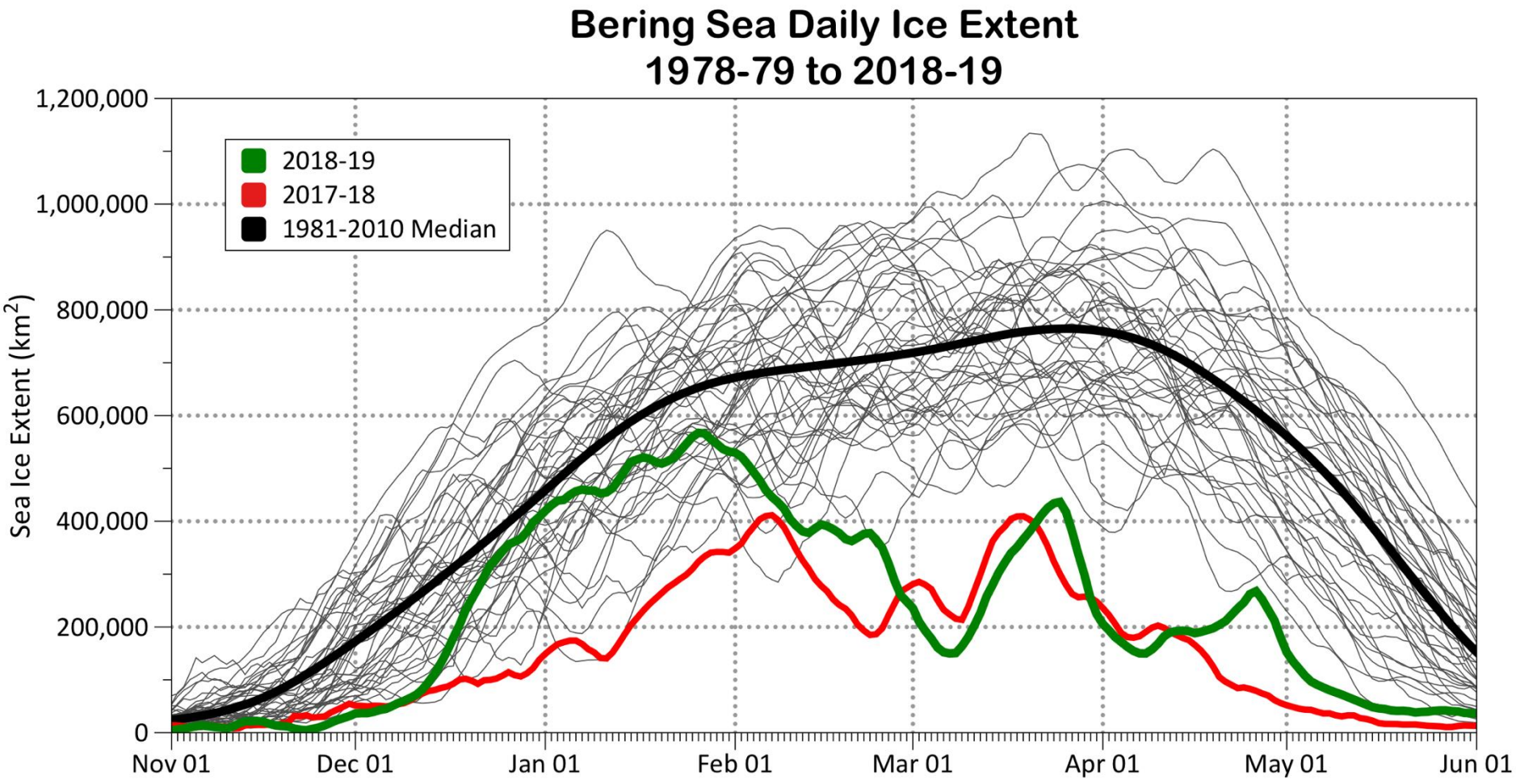
ACCAP
Alaska Center for Climate Assessment and Policy
A NOAA RISA TEAM

Ten Warmest
Ten Coldest
Smoothed Average

Data sources: NOAA/ERSSTv5
UAF/B. Brettschneider

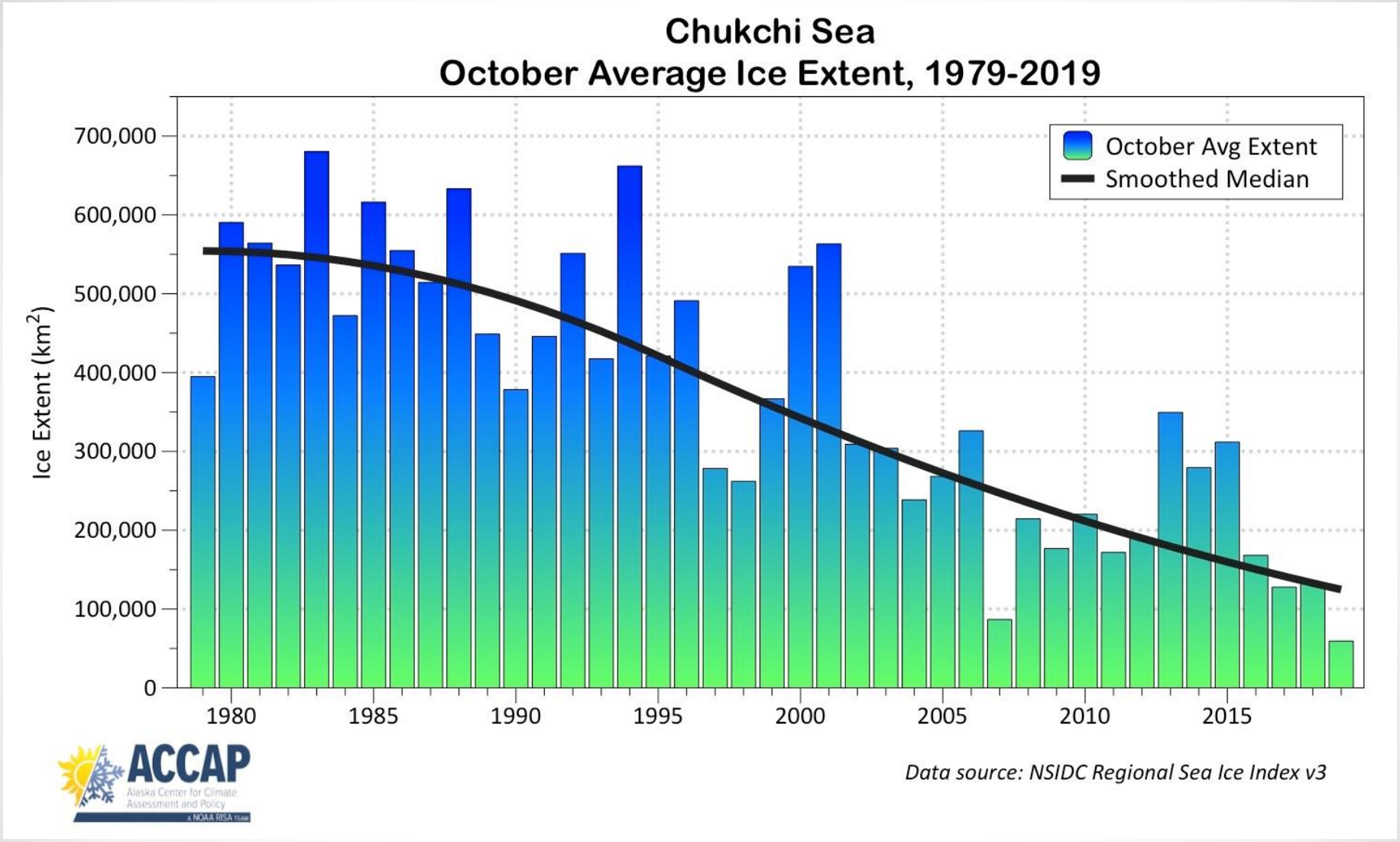
https://uaf-accap.org/sea-surface-temperature/

LOSS OF SEA ICE



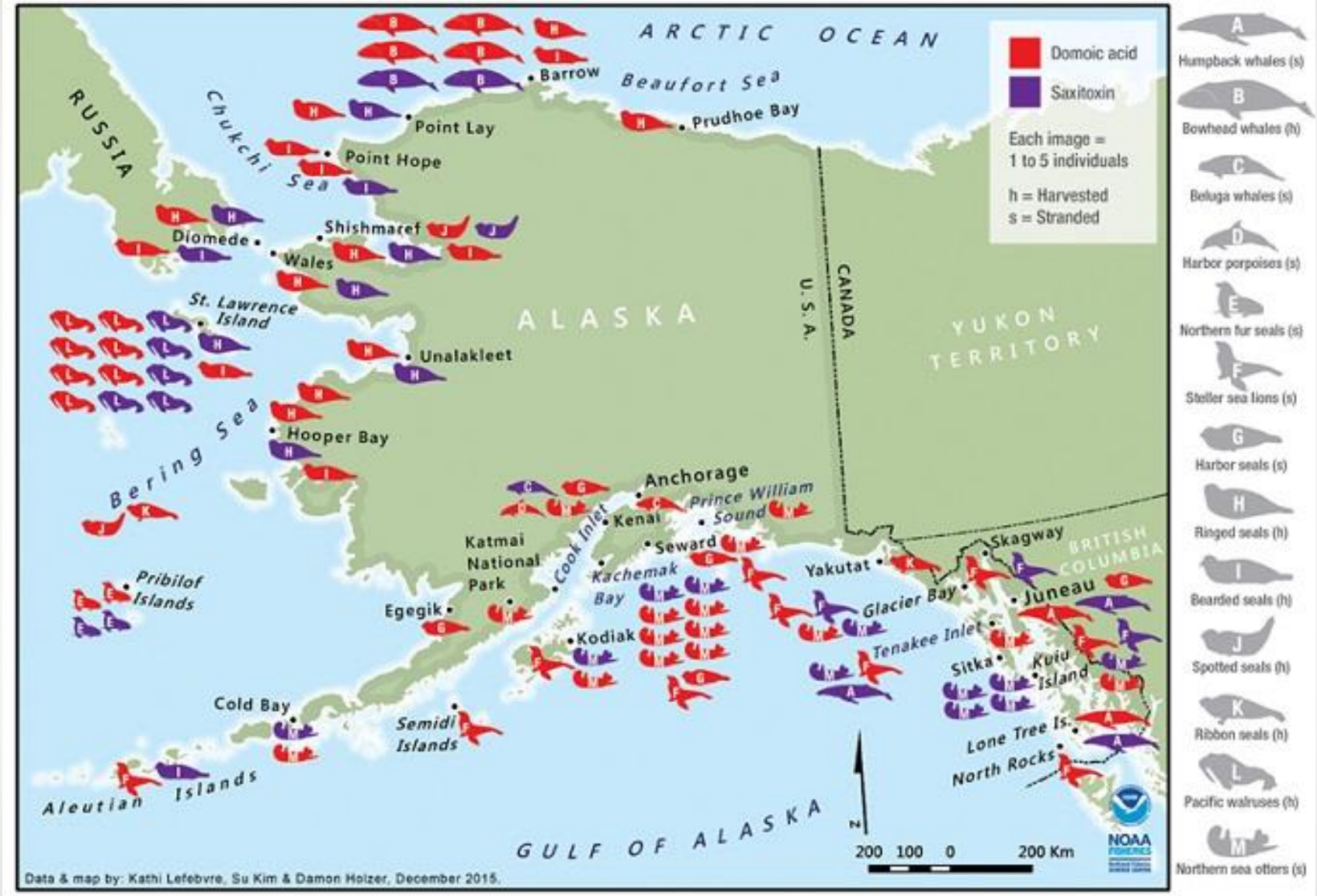
ACCAP
Alaska Center for Climate Assessment and Policy
A NOAA RISA TEAM

Data source: NSIDC Sea Ice Index, Version 3
Graphic by Rick Thoman, @AlaskaWx
Updated through June 01, 2019



https://uaf-accap.org/sea-ice/

Algal toxins were detected in 13 species marine mammals from Southeast Alaska to the Arctic Ocean during 2004 to 2013



https://www.nwfsc.noaa.gov/news/features/algal_blooms_in_arctic_waters/index.cfm

Regional Data

- 2017 Walrus Stranding Event (39)
- Diomede & Shishmaref (4)
  - 100%
  - 5 times higher than FDA's "safe level"

- 2018 and 2019 HEALY, Coast Guard Icebreaker
  - Confirmed Harmful Algal Blooms
  - Aug. 2019: clams at 2 locations had HIGH saxitoxin levels
    - 50 miles north of Cape Lisburne and 70 miles north of Saint Lawrence Island

Subsistence harvest is essential

Photo of bowhead whale skin/blubber, muscle, kidney, and intestine utilized as food…

What now? Baby steps..

- No human health impacts yet…right?
- Get the information out to people!
  - Subsistence community
  - Best practices**
  - Health Care Staff
  - Update eCHAM (crab butter)
- Continue working with researchers
  - Harming animals or birds??
  - Quick testing method??

Bering strait, image taken by MODIS satellite. https://www.rsmas.miami.edu

Bering Strait

Algal Toxin Workshop

July 16, 9 am – 4:30 pm (open to public)
July 17, 8 am – 12 pm (health care professionals only)
UAF Northwest Campus Education Center Grand Hall, Nome

This workshop, cosponsored by Alaska Sea Grant and the Alaska Ocean Observing System, will provide an introduction to algal toxins, harmful algal blooms and the effect these have on western Alaska's marine resources. The two-day workshop will also cover identification, impacts and monitoring techniques and results. Other topics will include a presentation on the changing environmental conditions in the Bering Strait region and the role of the state in a public health response to a person poisoned by algal toxins.

The first day of the workshop is intended for anyone interested in learning about algal toxins, harmful algal bloom (HAB) events, results of toxin tests on Bering Strait/Western Alaska marine wildlife, and monitoring efforts. There will also be a Strait Science series presentation that evening. The second day will be targeted to health care professionals.

Sea Grant Alaska

AOOS Alaska Ocean Observing System

Registration is free. For more information, call Gay Sheffield at 907-443-2397 or visit:

alaskaseagrant.org/workshops

Recommendations

- Enhance participation with existing regional networks: Local partnerships strengthen awareness
- Regional / Community-based Surveillance and Response Training: Quicker response times, more collaboration, better communications
- Address health / safety concerns: HABs are a serious food security / health concern for communities that rely on non-commercial resources for nutritional, cultural, and economic well being.

Recommendations

- Continue learning
- Remain vigilant! Communicate when something is not right with our marine wildlife. Call:
  - **Gay Sheffield: (907) 434-1149**
  - **Brandon Ahmasuk: (907) 443-4265**
- Monitoring efforts

Recommendations??

- Feedback would be very appreciated!!
  - ?
  - ?
  - ?

Acknowledgements

- Without the efforts and support of the coastal communities of northern and western Alaska we would not have the current information on harmful algal events or saxitoxin in marine mammals from these regions.

- NOAA Fisheries: Wildlife Algal-toxin Research and Response Network, North Slope Borough Dept. of Wildlife Management, Woods Hole Oceanographic Institute, Alaska Ocean Observing System, SOA-Section of Epidemiology

Resources

- Alaska Sea Grant, UAF. https://alaskaseagrant.org/
- Kawerak, Subsistence Resources. https://kawerak.org/natural-resources/subsistence-resources/
- State of Alaska, Section of Epidemiology. http://dhss.alaska.gov/dph/Epi/Pages/default.aspx
- Southeast Alaska Tribal Ocean Research, Sitka Tribe. http://www.seator.org/Resources
- U.S. National Office for Harmful Algal Blooms. Woods Hole Oceanographic Institute, Harmful Algae. 27 Nov. 2017. https://www.whoi.edu/website/redtide/photos/blooms/
- NOAA. Northwest Fisheries Science Center. https://www.nwfsc.noaa.gov/news/features/algal_blooms_in_arctic_waters/index.cfm
- Alaska Harmful Algal Bloom Network. https://aoos.org/alaska-hab-network/
- USEPA. https://www.epa.gov/cyanohabs