A Svalbard perspective on global change

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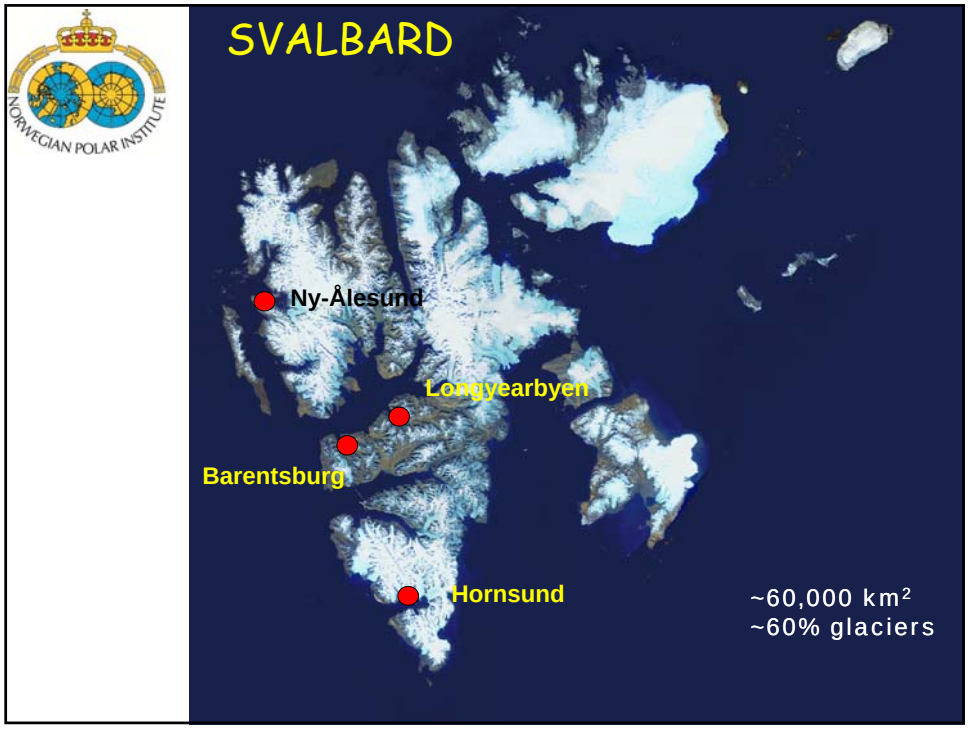
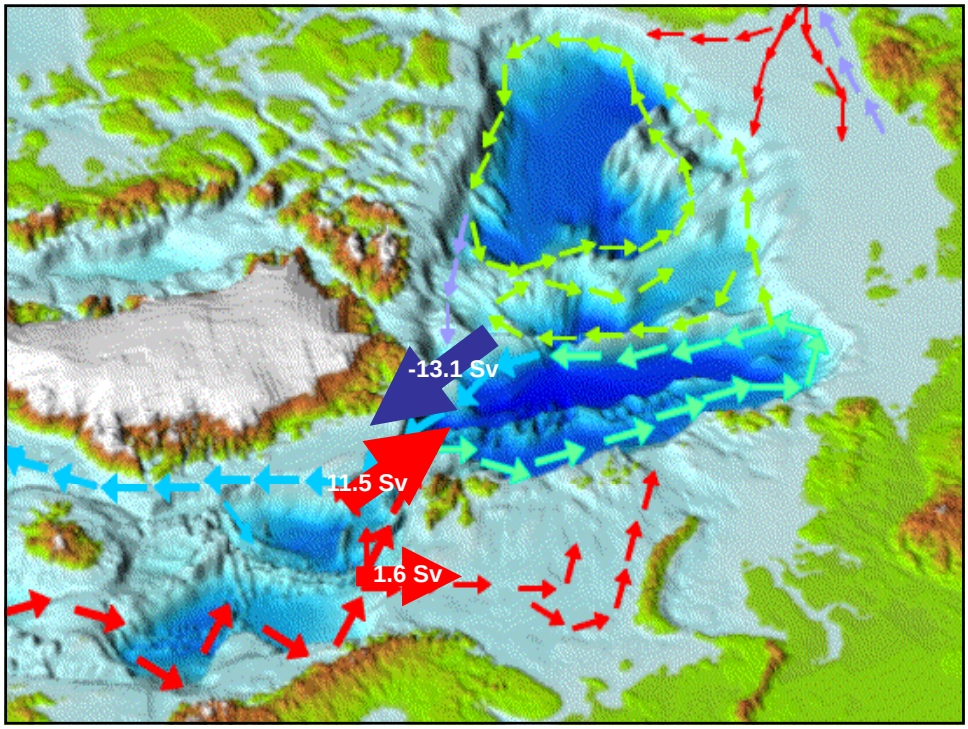
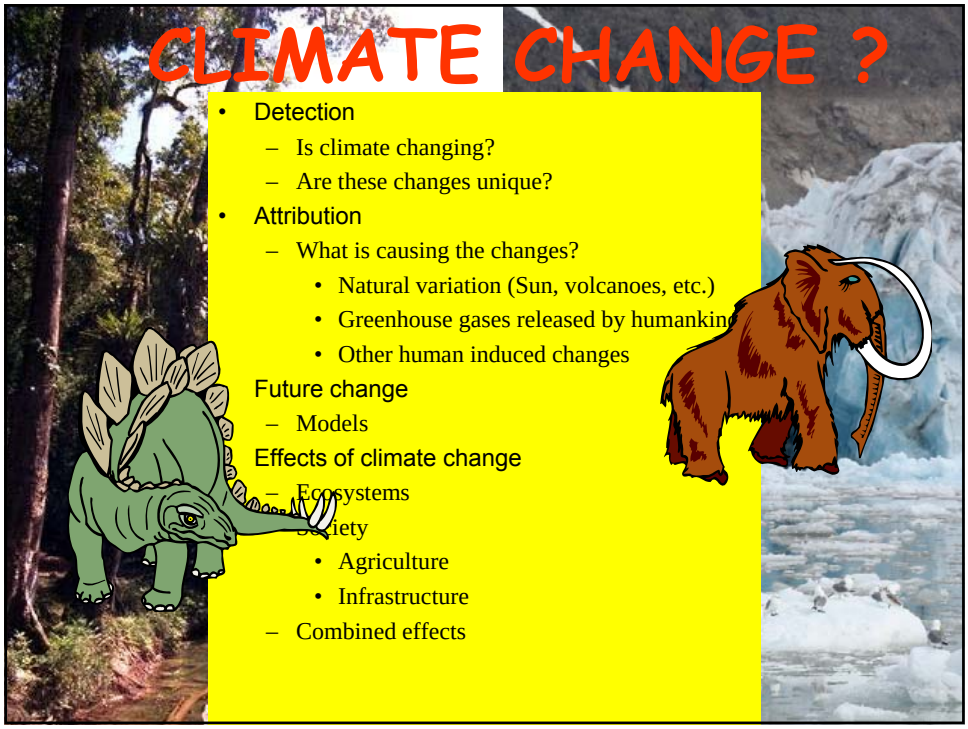
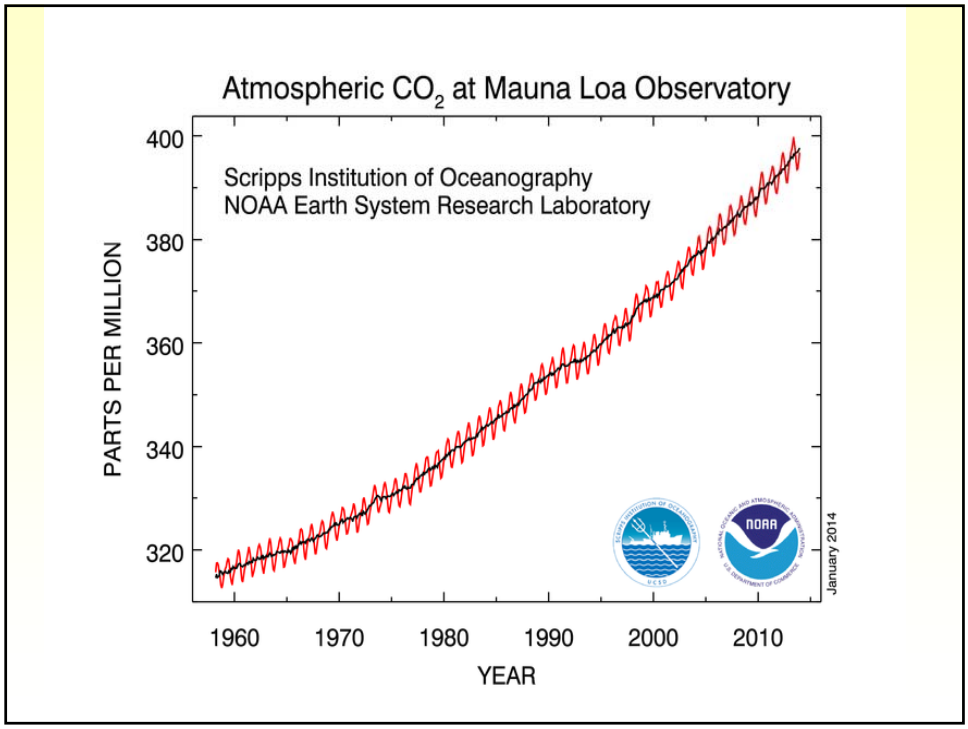
Svalbard:

Norwegian Arctic


SVALBARD
NORWEGIAN POLAR INSTITUTE
Ny-Ålesund
Longyearbyen
Barentsburg
Hornsund
~60,000 km²
~60% glaciers

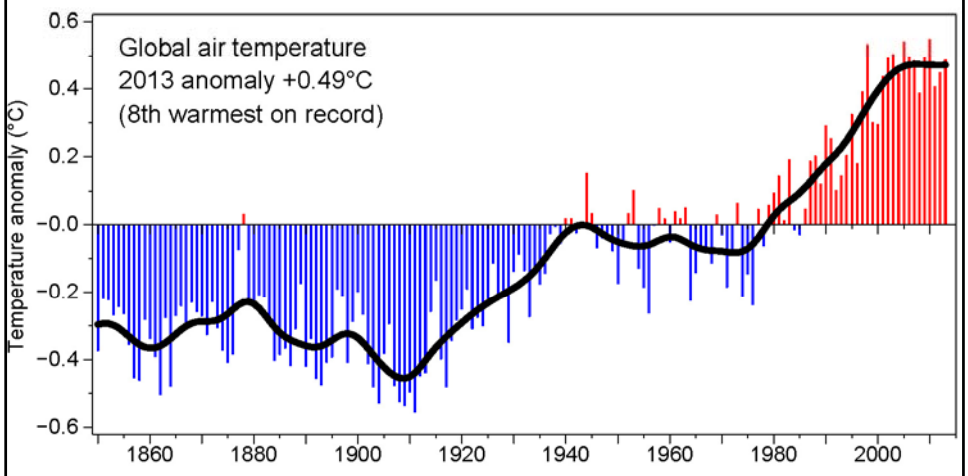

-13.1 Sv
11.5 Sv
1.6 Sv


CLIMATE CHANGE ?
• Detection
– Is climate changing?
– Are these changes unique?
• Attribution
– What is causing the changes?
• Natural variation (Sun, volcanoes, etc.)
• Greenhouse gases released by humankind
• Other human induced changes
Future change
– Models
Effects of climate change
– Ecosystems
– Society
• Agriculture
• Infrastructure
– Combined effects


Atmospheric CO2 at Mauna Loa Observatory
Scripps Institution of Oceanography
NOAA Earth System Research Laboratory
PARTS PER MILLION
400
380
360
340
320
1960
1970
1980
1990
2000
2010
YEAR
January 2014

Climate Research Unit, University of East Anglia

http://www.cru.uea.ac.uk/cru/info/warming/



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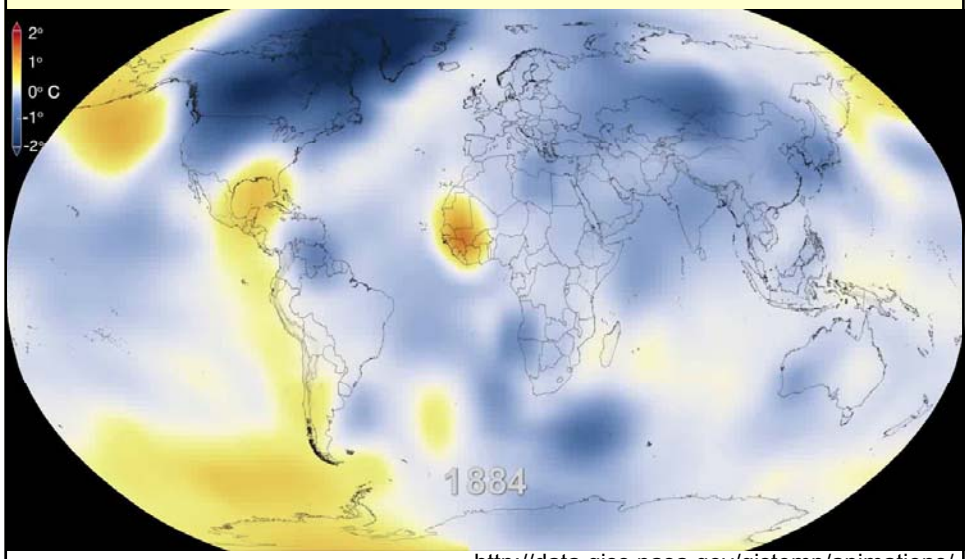
National Aeronautics and Space Administration
Goddard Institute for Space Studies



http://data.giss.nasa.gov/gistemp/animations/

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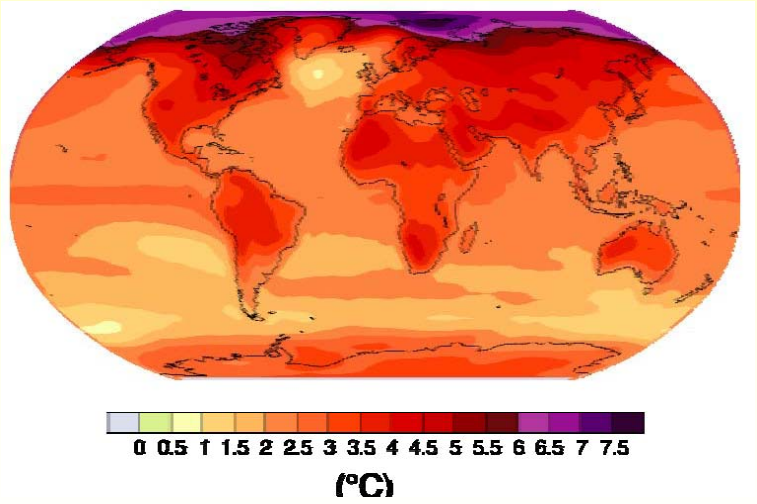
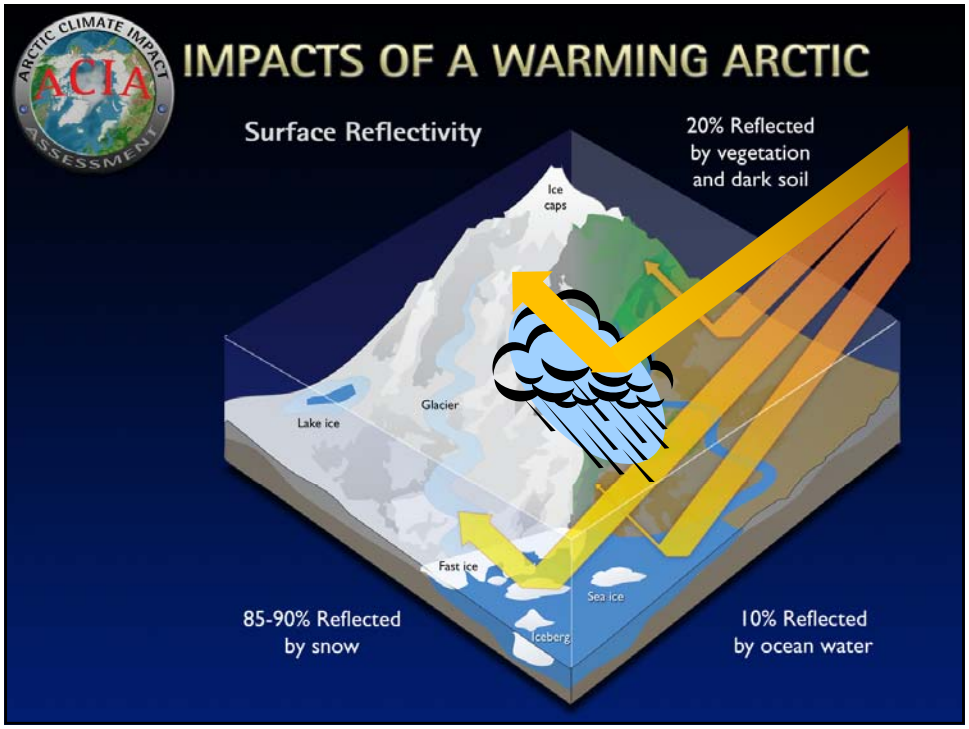
Geographical pattern of surface warming



Projected surface temperature changes for the late 21st century (2090-2099). The map shows the multi-AOGCM average projection for the A1B SRES scenario. All temperatures are relative to the period 1980-1999.



NOVEMBER, 1922. MONTHLY WEATHER REVIEW.

Deviation from the normal course Aigué explains as usually due to the presence not far away of another typhoon. However, there is record of a hurricane in Fiji which recurved so sharply on its course that its center passed twice over the city of Levuka, and yet no other disturbance was known to be anywhere near. Furthermore, this hurricane traveled northwest from Levuka after its first passage over that city, the opposite direction from that which tropical cyclones normally take in that latitude in the southern hemisphere."

Bifurcation of cyclones.—Sometimes it happens that a well-developed cyclone apparently divides into two independent, comparable storms, each of which henceforth

The oceanographic observations have, however, been even more interesting. Ice conditions were exceptional. In fact, so little ice has never before been noted. The expedition all but established a record, sailing as far north as 81° 29' in ice-free water. This is the farthest north ever reached with modern oceanographic apparatus.

The character of the waters of the great polar basin has heretofore been practically unknown. Dr. Hoel reports that he made a section of the Gulf Stream at 81° north latitude and took soundings to a depth of 3,100 meters. These show the Gulf Stream very warm, and it could be traced as a surface current till beyond the 81st parallel. The warmth of the waters makes it probable

THE CHANGING ARCTIC.

By GEORGE NICOLAS IFFT.

[Under date of October 10, 1922, the American consul at Bergen, Norway, submitted the following report to the State Department, Washington, D. C.]

The Arctic seems to be warming up. Reports from fishermen, seal hunters, and explorers who sail the seas about Spitzbergen and the eastern Arctic, all point to a radical change in climatic conditions, and hitherto unheard-of high temperatures in that part of the earth's surface.

In August, 1922, the Norwegian Department of Commerce sent an expedition to Spitzbergen and Bear Island under the leadership of Dr. Adolf Hoel, lecturer on geology at the University of Christiania. Its purpose was to survey and chart the lands adjacent to the Norwegian mines on those islands, take soundings of the adjacent waters, and make other oceanographic investigations.

Dr. Hoel, who has just returned, reports the location of hitherto unknown coal deposits on the eastern shores of Advent Bay—deposits of vast extent and superior quality. This is regarded as of first importance, as so far most of the coal mined by the Norwegian companies on those islands has not been of the best quality.

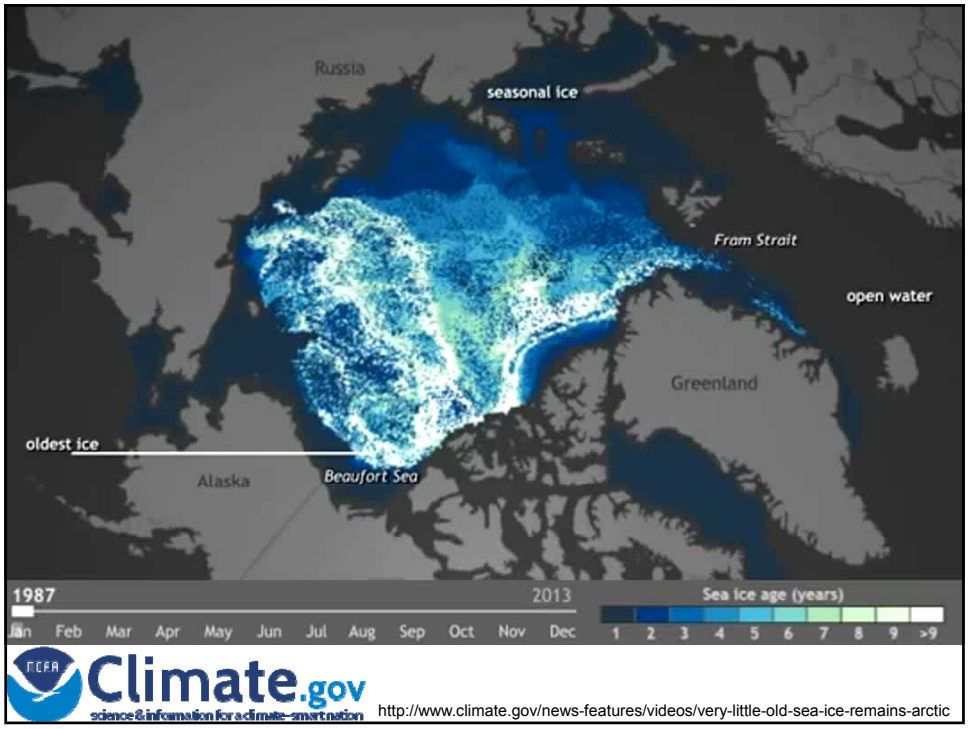
* R. L. Haines: Quart. Journ., Royal Meteorol. Soc., January, 1905.

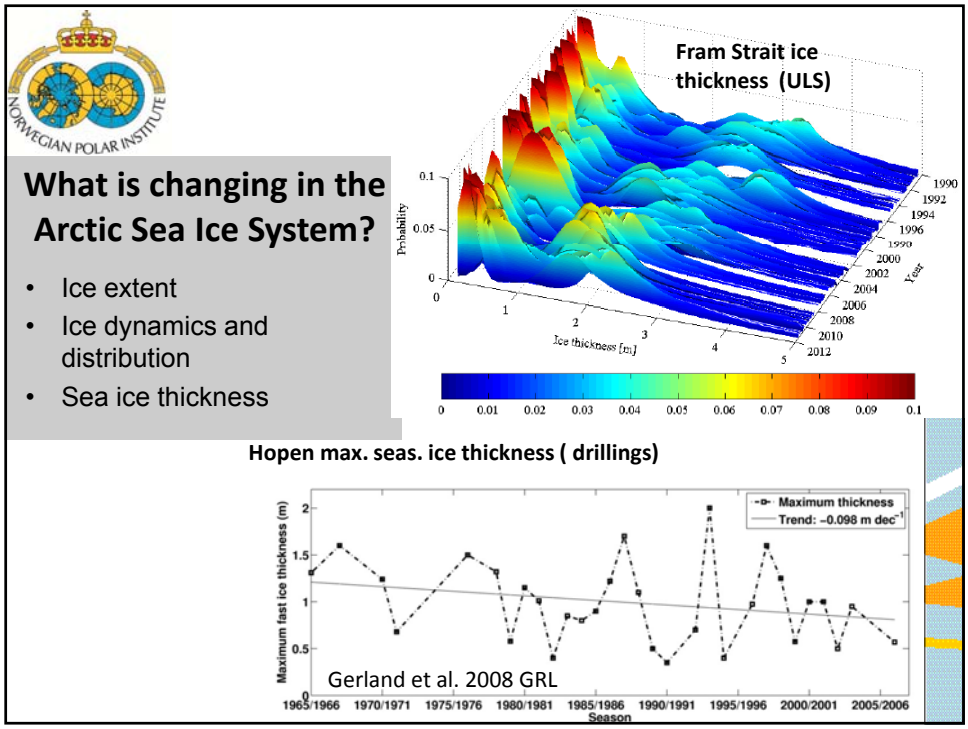
[Weather Bureau, Washington, D. C., Dec. 10, 1922.]

An interesting memorandum was recently received by the Weather Bureau in connection with a marine weather report from Mr. W. Scott, fifth officer of the American S. S. *Manchuria*. It deals with the appearance of several varieties of small land birds a considerable distance at sea on the 27th to 29th of October, 1922, during a voyage from New York to Hamburg, and is presented here, with an inclusion of the list of observed bird varieties, for the scientific interest involved.

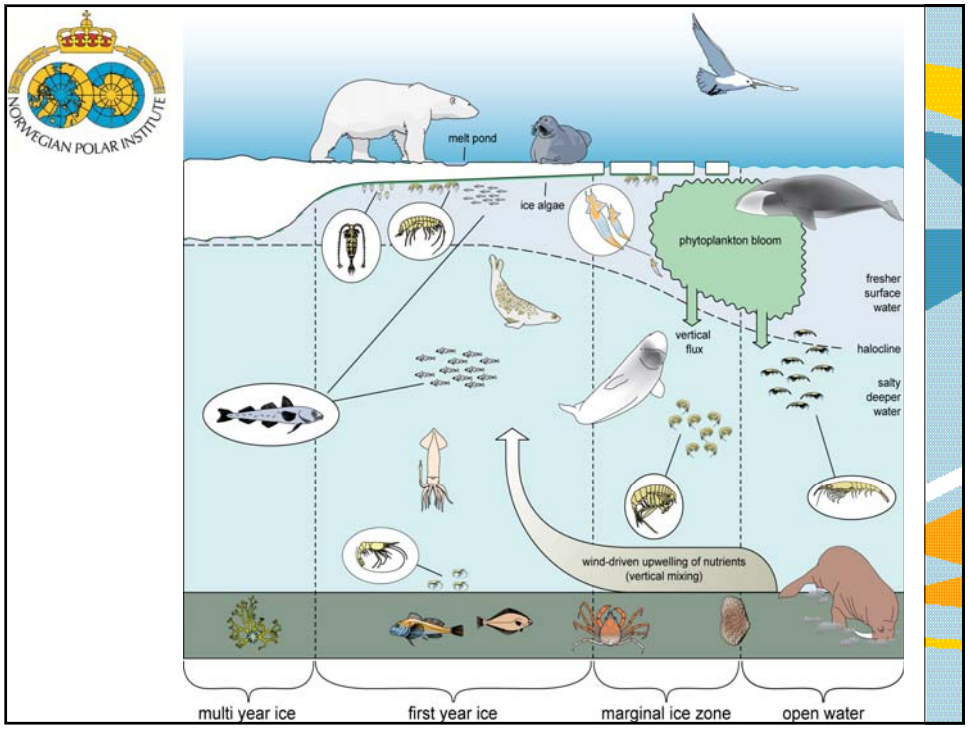
S. S. *Manchuria*,
Voyage 50—N. Y.-Hamburg,
October 28, 1922.

It may be of some interest to the Department of Plants and Animals or to the Smithsonian Institution to note that on October 27, latitude 40° 30', longitude 68°, to noon 28th, latitude 41° 45', longitude 68° 27',


Russia
seasonal ice
Fram Strait
open water
Greenland
oldest ice
Alaska
Beaufort Sea
1987
2013
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Sea ice age (years)
1 2 3 4 5 6 7 8 9 >9
Climate.gov
science & information for a climate-smart nation
http://www.climate.gov/news-features/videos/very-little-old-sea-ice-remains-arctic


NORWEGIAN POLAR INSTITUTE
What is changing in the Arctic Sea Ice System?
• Ice extent
• Ice dynamics and distribution
• Sea ice thickness
Fram Strait ice thickness (ULS)
Probability
Ice thickness [m]
Year
Hopen max. seas. ice thickness (drillings)
Maximum thickness
Trend: −0.098 m dec⁻¹
Maximum fast ice thickness (m)
Season
1965/1966 1970/1971 1975/1976 1980/1981 1985/1986 1990/1991 1995/1996 2000/2001 2005/2006
Gerland et al. 2008 GRL


POLAR BEAR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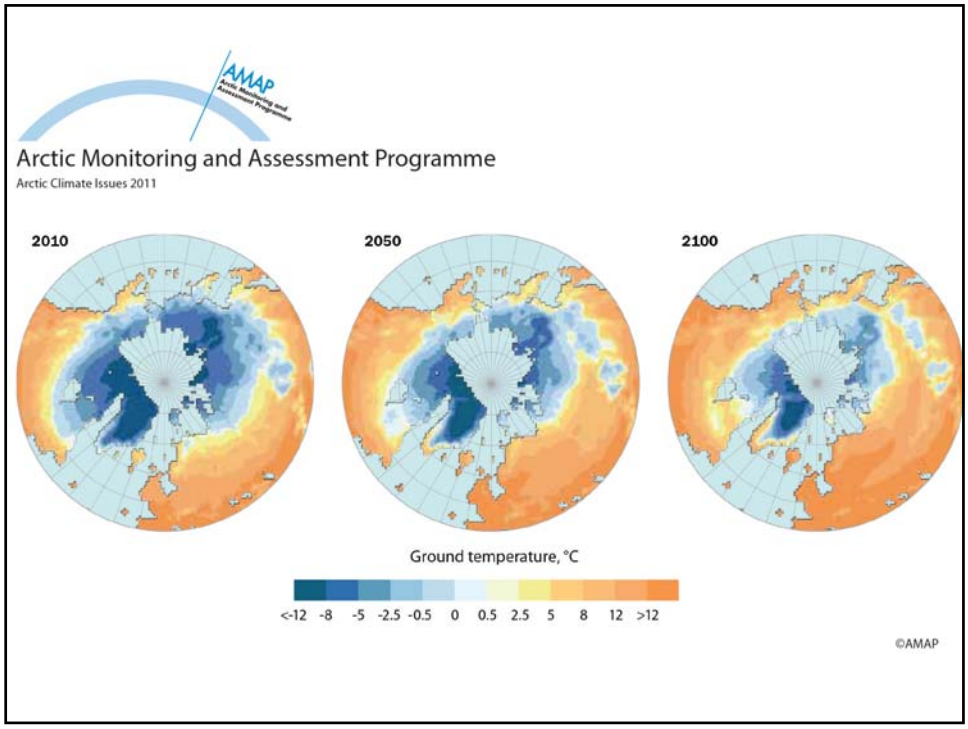
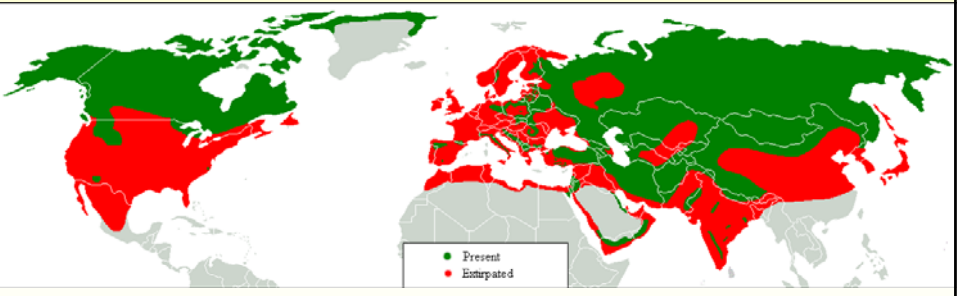
melt pond
ice algae
phytoplankton bloom
fresher surface water
halocline
salty deeper water
vertical flux
wind-driven upwelling of nutrients (vertical mixing)
multi year ice
first year ice
marginal ice zone
open water

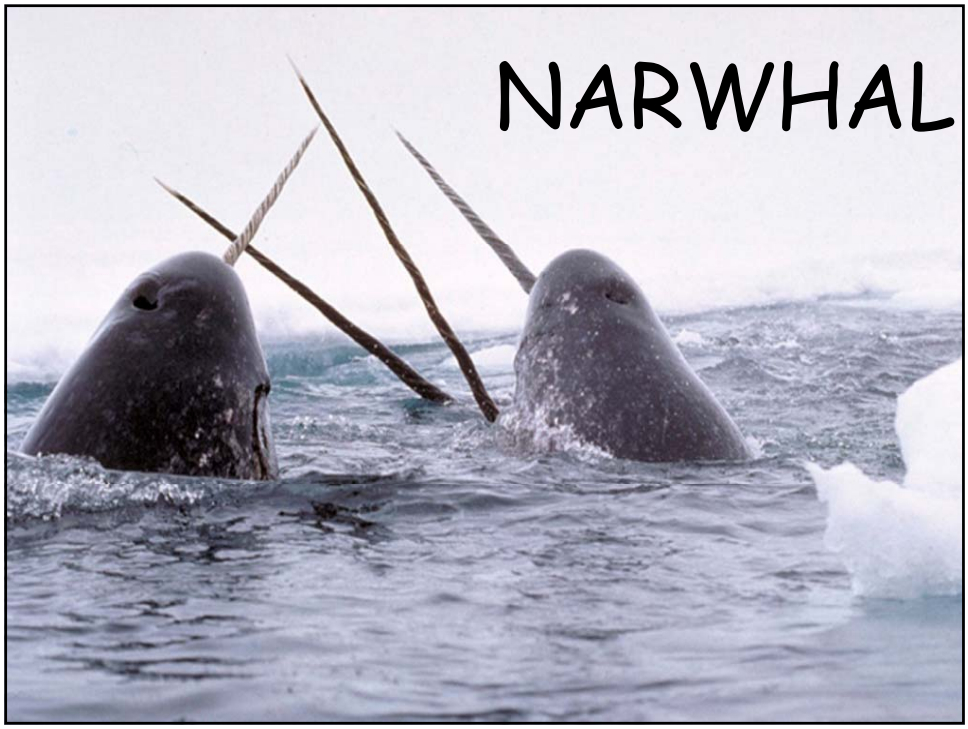

Arctic Monitoring and Assessment Programme
Arctic Climate Issues 2011
2010
2050
2100
Ground temperature, °C
<-12 -8 -5 -2.5 -0.5 0 0.5 2.5 5 8 12 >12
©AMAP


WOLF

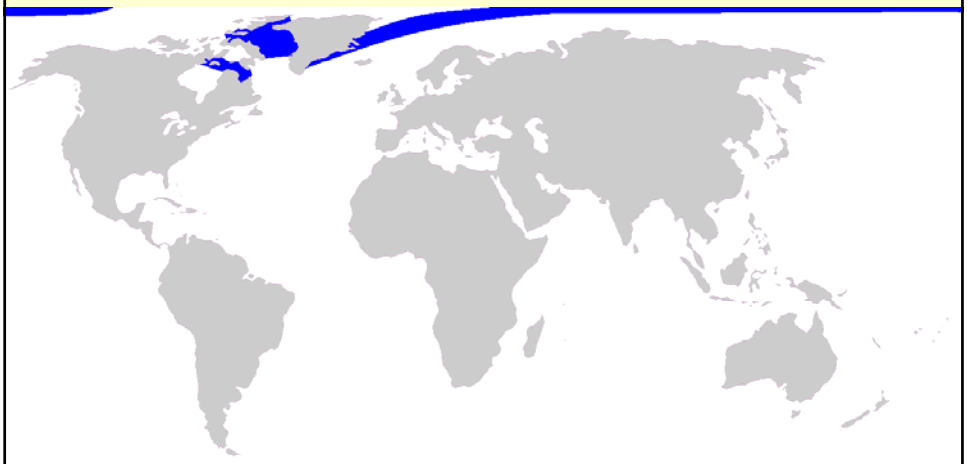
Grey Wolf



Wikimedia commons



Narwhal



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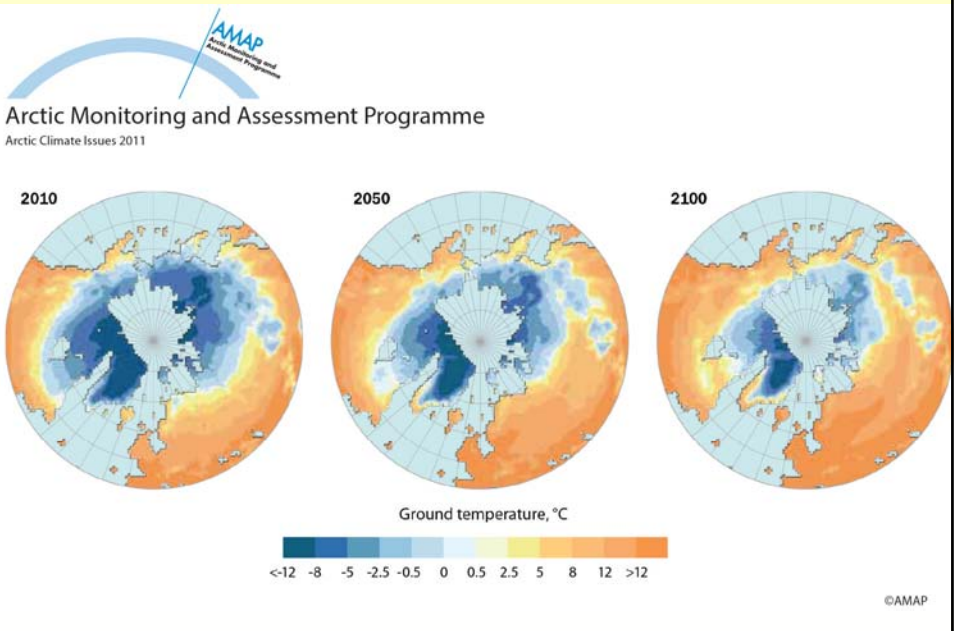

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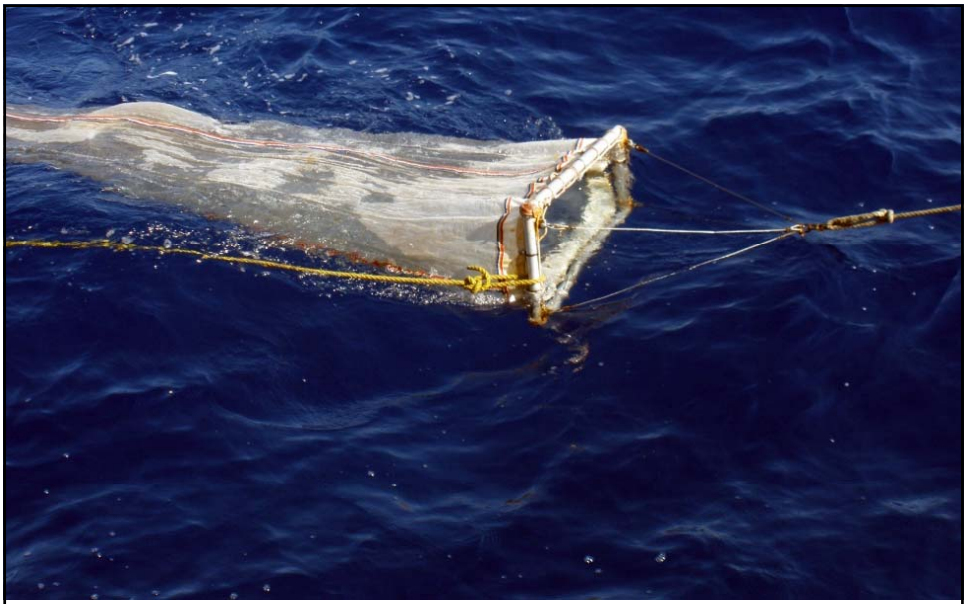
Other drivers…

Turist-Norge gror igjen

Aftenposten, January 19, 2013

Photo: Ann-Christine Engvall



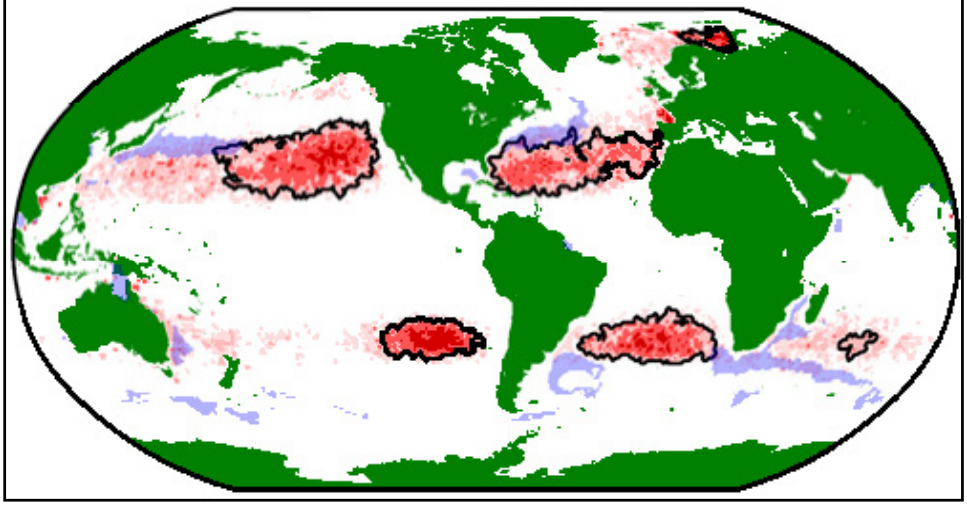
A plankton net (neuston net) that is towed at the air-sea interface to collect biological organisms and floating debris. The net has a 1-m x 0.5 m mouth, 335-µm mesh, and is towed for 30 minutes, typically sampling 1.8 km of the sea surface (equivalent to filtering ~2000 bathtubs of surface water).

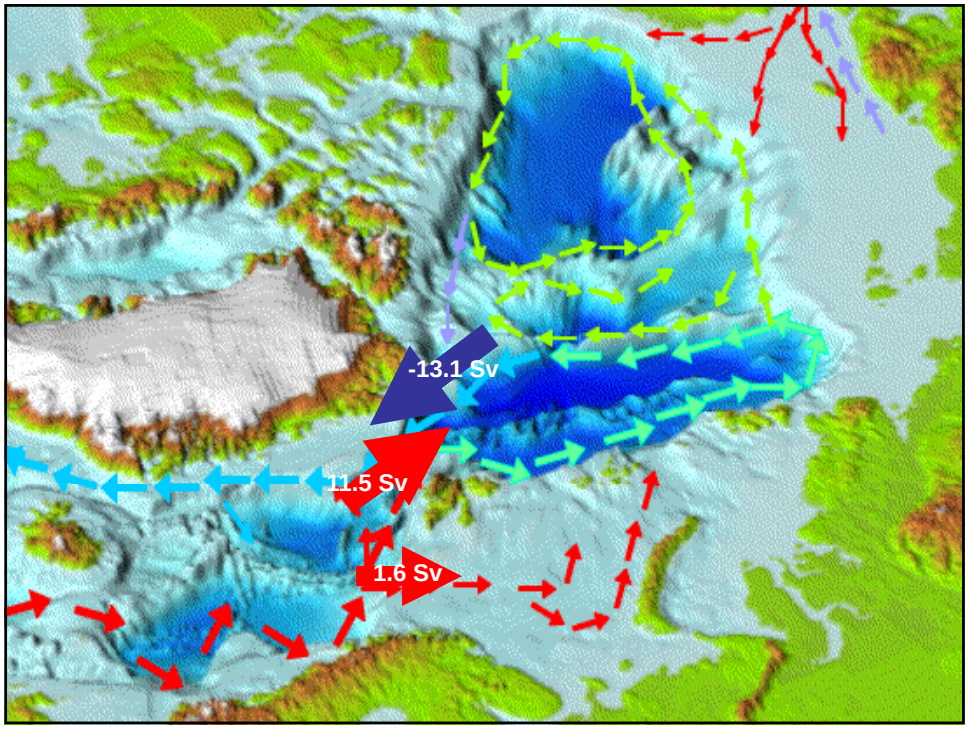
Plastic bits collected at sea.
Photo Credit: M. Maglione/SEA.

Origin, dynamics and evolution of ocean garbage patches from observed surface drifters

Erik van Sebille[1,3], Matthew H England[1] and Gary Froyland[2] GRL, 2012

e Tracer accumulation factor after 100 years



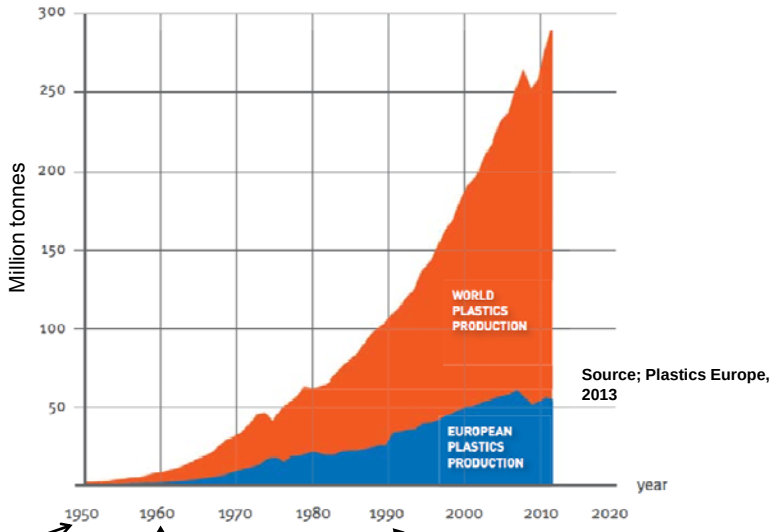

-13.1 Sv
11.5 Sv
1.6 Sv


FULMAR

Plastic in 20% of Svalbard fulmars in the early 80ies.

We found plastic in 90% of Svalbard fulmars in 2013.

Global Plastic Production



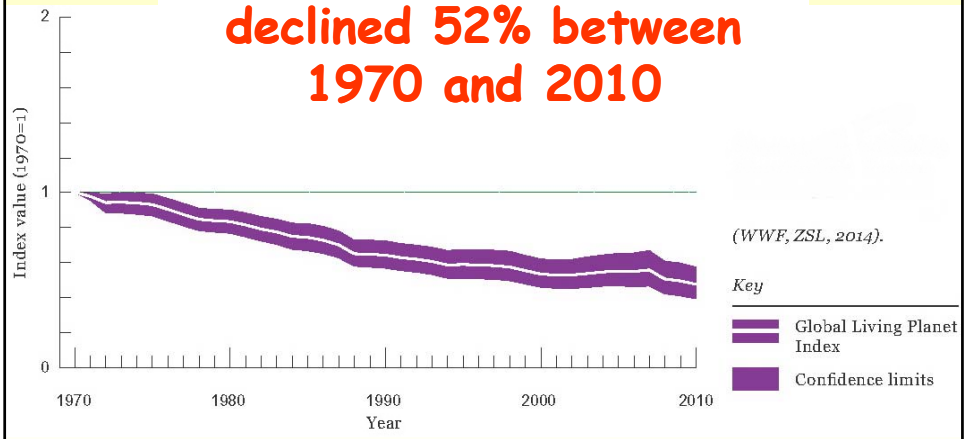
Source; Plastics Europe, 2013

First plastic production

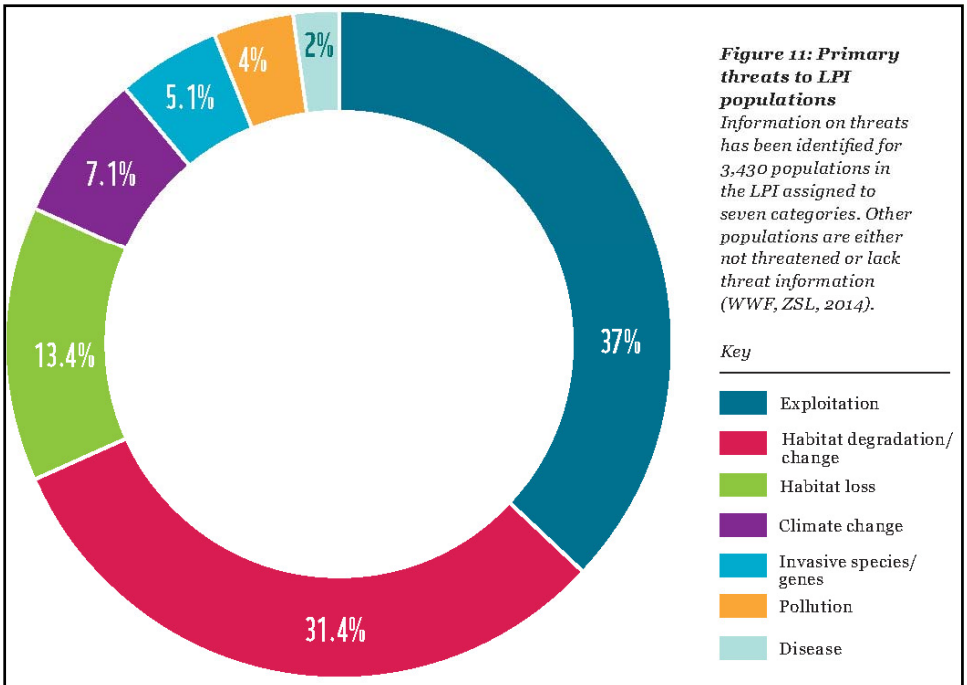
First report of plastic in the marine food chain

Ban against dumping of plastic in sea

Global Living Planet Index declined 52% between 1970 and 2010



The Global Living Planet Index is calculated using trends in 10,380 populations of over 3,038 vertebrate species (fishes, amphibians, reptiles, birds and mammals).



Humanity is big

- Land-use
- Altering nature
- Resource use
- Waste production
- Climate change

BIG comes with responsibility