EMODnet
European Marine Observation and Data Network

EMODnet Sea-basin Checkpoints
Tender no MARE/2014/09 (lot 1 Arctic)

EMODNET Oil Platform Leak Bulletin

Date: 12/05/2016

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European Commission

Executive Summary

At 10:27 (BST) on 10/05/2016, OSRL and SINTEF were alerted to the fact that an explosion had occured at 08:15 (CET) on the Prirazlomnaya Platform, 60km off the coast in the Pechora Sea (figure 1). Currently, oil is leaking subsurface, at a rate of 800m³/day: this is expected to be reduced to 500 m³/day following emergency repairs with 24 hours, with the leak being stopped completly within 72 hours.

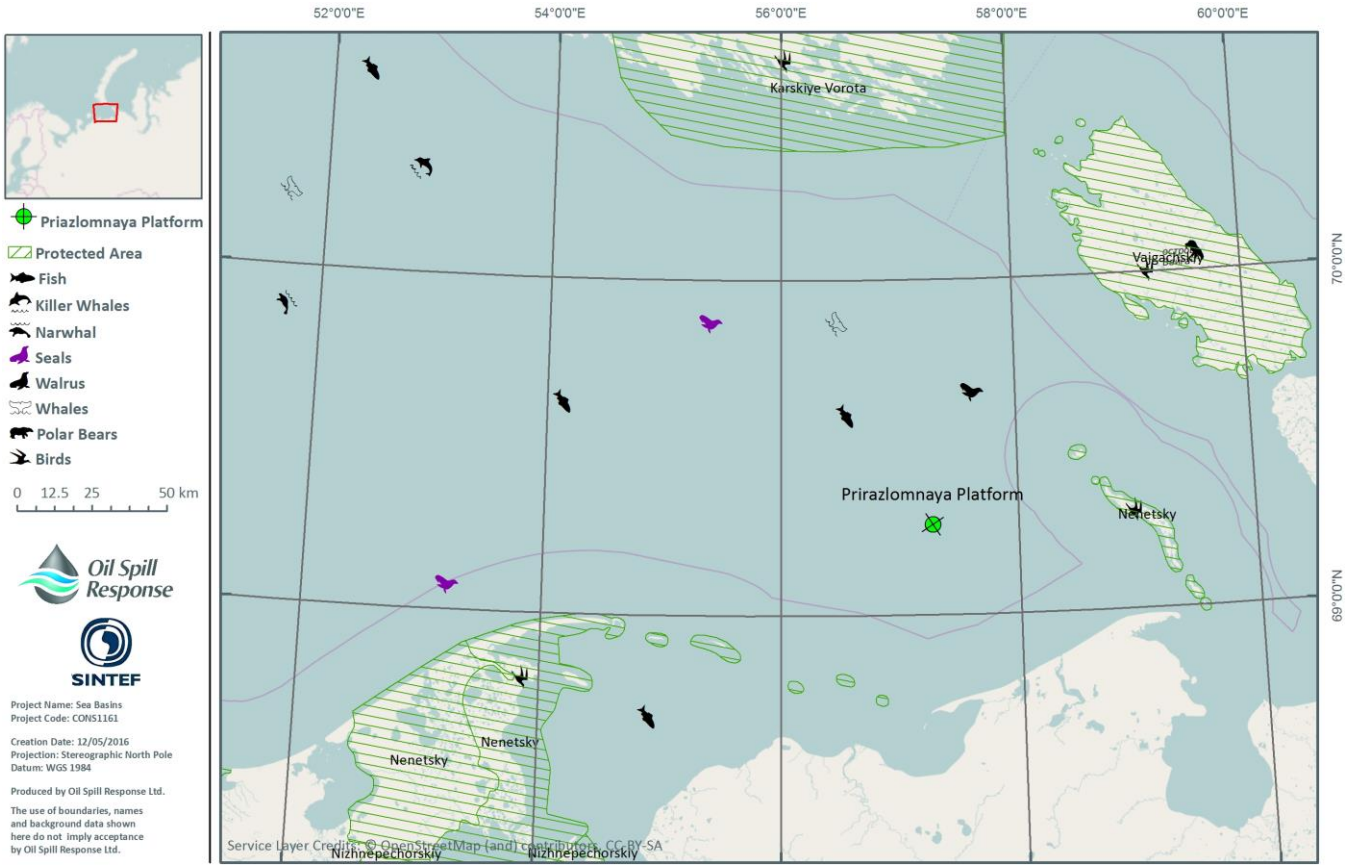
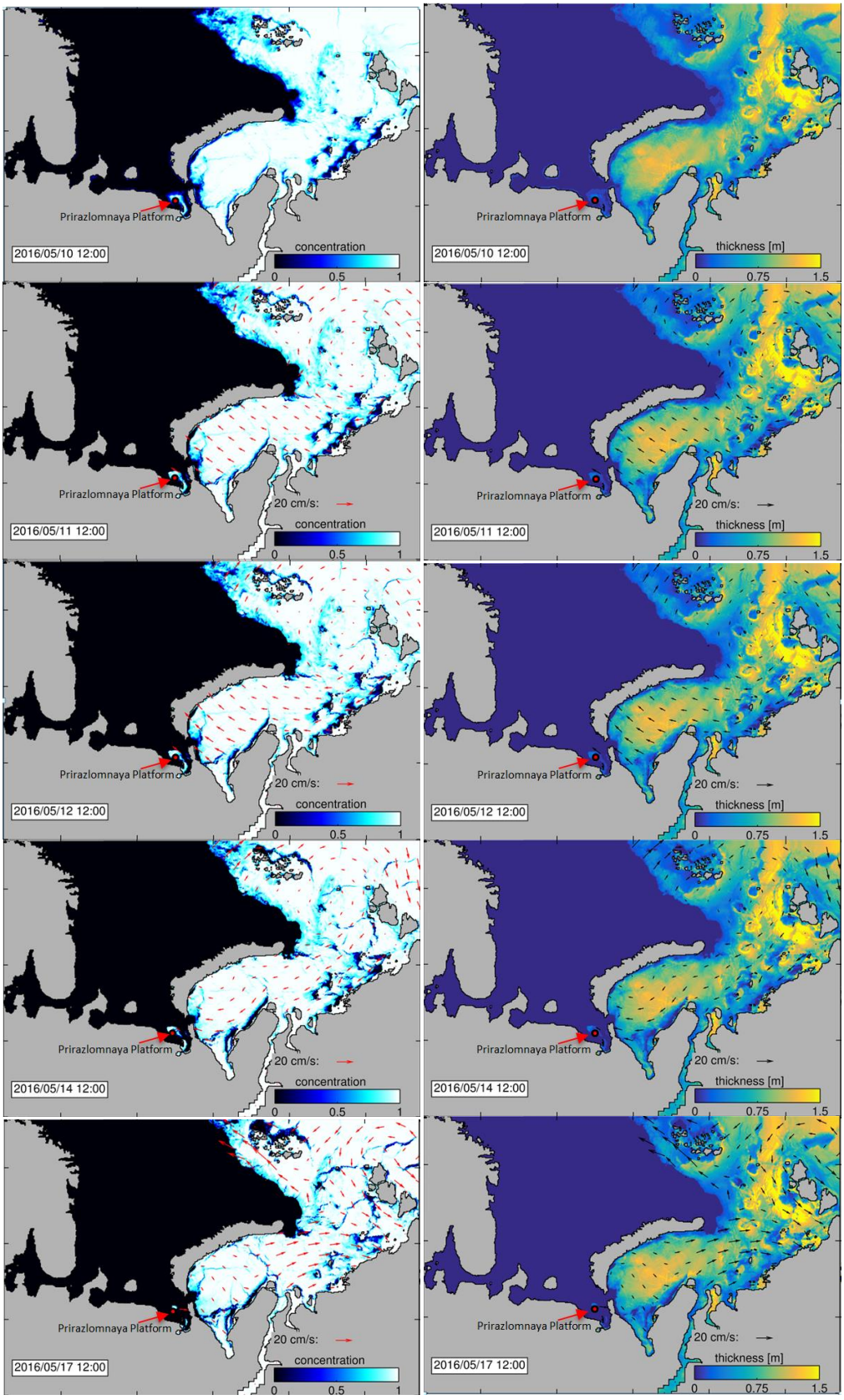


Figure 1:Location of the spill with local environmental sensitivities

The Pechora sea area is characterised by extremely low temperatures; annual average is -4˚C, and being ice-free for only 110 days a year. Wind strength reaches up to 40m/s and wave heights can be as much as 12m. The weather and ice forecast for 10/05/2016 are shown below:

Variable	10-May 06:00	10-May 09:00	10-May 12:00	10-May 15:00	10-May 18:00	10-May 21:00	10-May 00:00	11-May 06:00	11-May 12:00	11-May 18:00	11-May 00:00	12-May 12:00	12-May 00:00	13-May 12:00	13-May 00:00
Wind Speed, knots	16	14	14	12	10	10	10	10	11	12	13	15	16	11	5
Wind From Direction, °	63	55	47	50	54	50	50	55	54	72	77	66	60	58	152
Wind Gust, knots	17	15	14	13	11	10	11	10	11	13	14	16	17	12	6
Sig. Wave Height, m	1.2	1	0.9	0.8	0.8	0.7	0.7	0.6	0.5	0.6	0.7	1.1	1.2	1.1	0.7
Cloud Cover, %	95	95	97	97	98	100	100	98	95	92	98	93	95	86	50
Air Temperature, °C	-4	-4	-4	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
Precipitation, mm/h	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0

The Prirazlomnaya Platform is the main pre-development facility of the Prirazlomnoye oil field. It is used for all production operations, and has been designed so that it can still operate in the extreme conditions.



Ice Forecast (left = Ice Concentration, right = Ice Thickness)

Method

The oil spill forecast was done using SINTEF's OSCAR model. The information provided in the initial email was used for the setup:

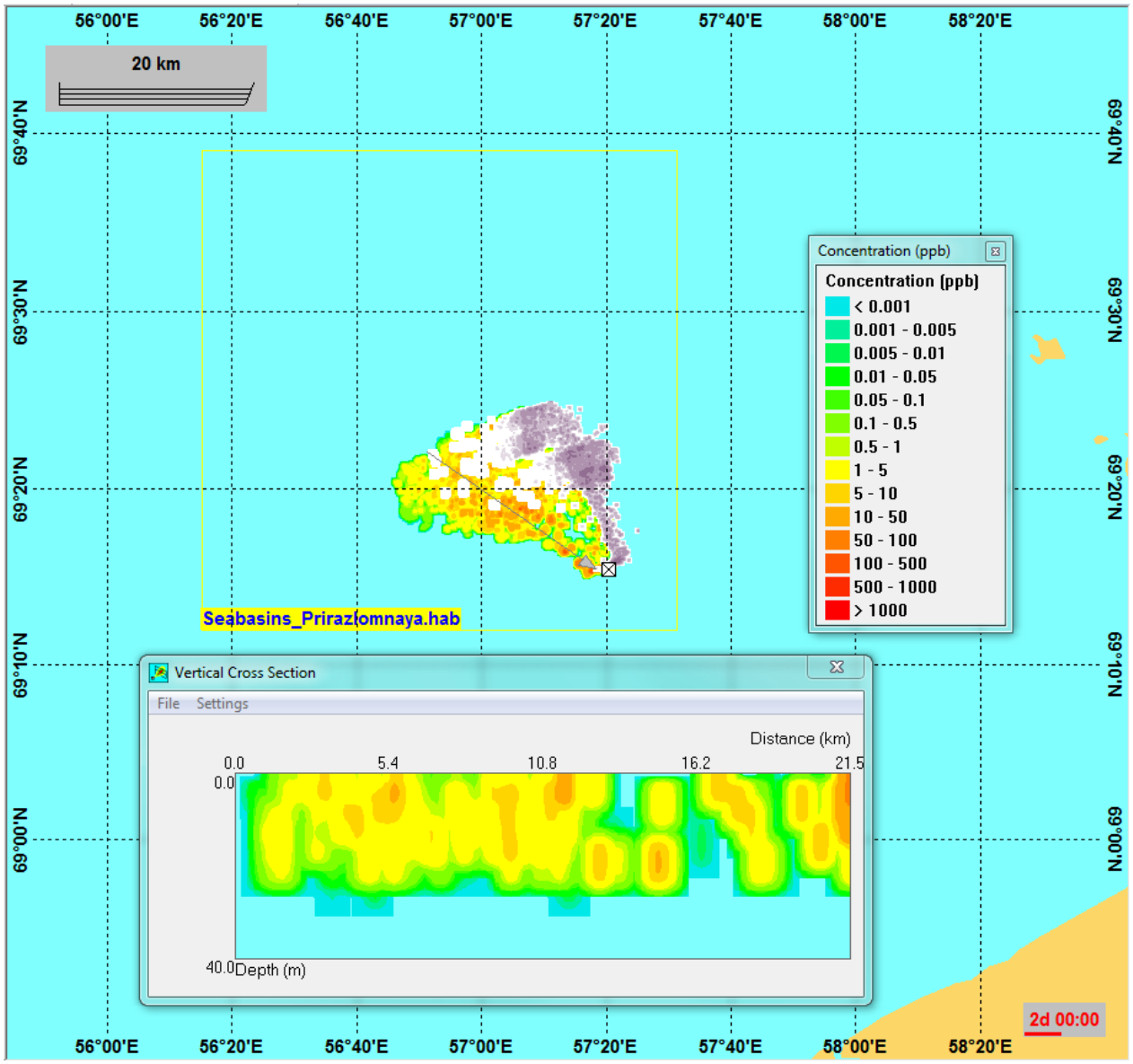
Model Setup	
Release Date	11-May-2016
Release Time	08:15 (GMT+1)
Latitude	69° 16' 04.44" N
Longitude	057° 16' 50.48" E
Release Rate	800 m^3/day (0 – 24 hrs) 500 m^3/day (24 – 72 hrs)
Total Volume Spilt	1800 m^3
Model Duration	4 days

Assumption

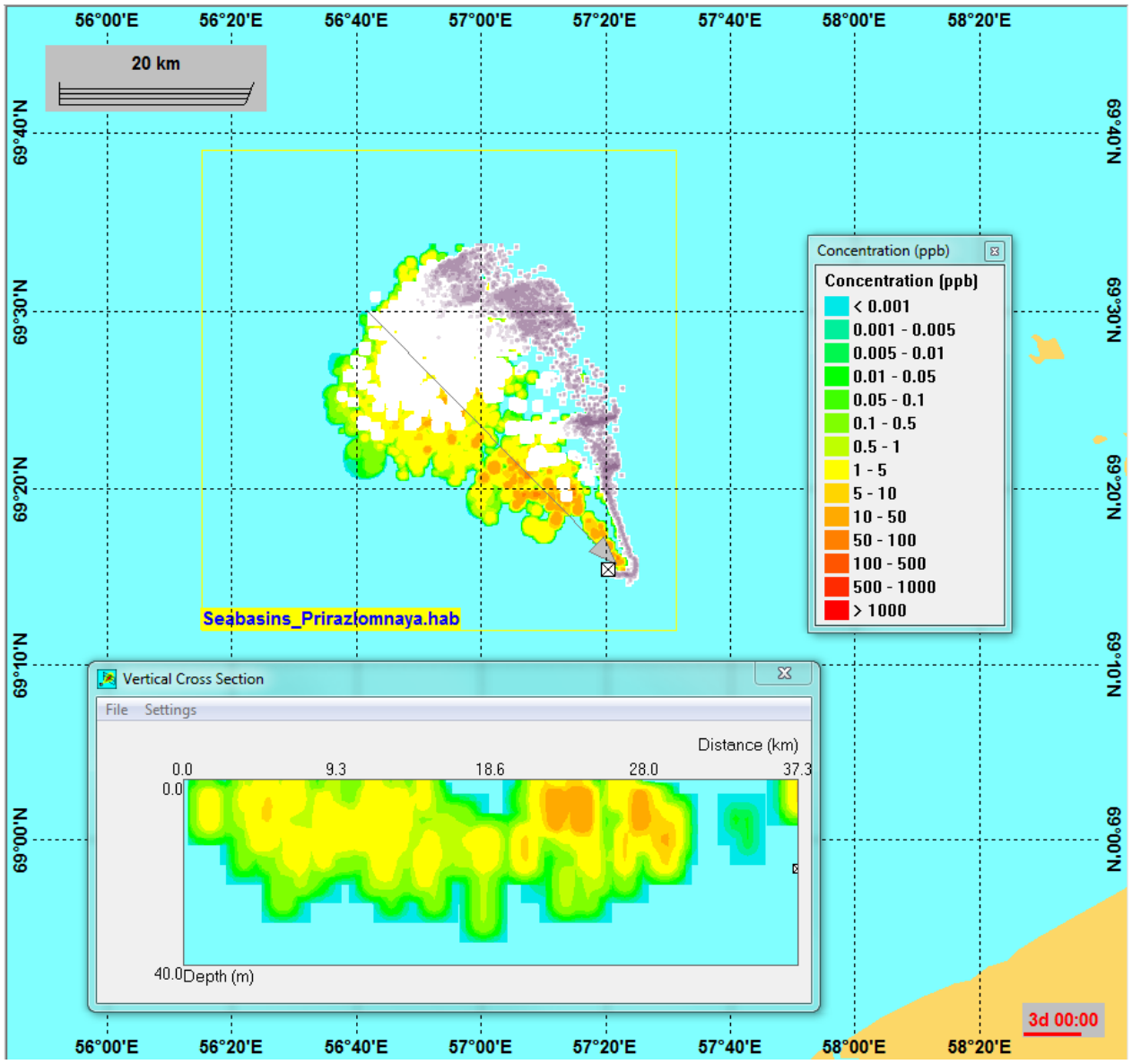
The following assumptions were made in order to create a oil spill forecast:

- The oil type is a heavy Group 3 Oil (0.910 kg/m^3) with increased concentration of sulfur and low paraffin content. Information about oil groups can be found here http://www.itopf.com/fileadmin/data/Documents/TIPS%20TAPS/TIP2FateofMarineOilSpills.pdf
- The exact location of the platform is 69°16'4.44"N, 057°16'50.48"E in 19 m to 20 m of water.

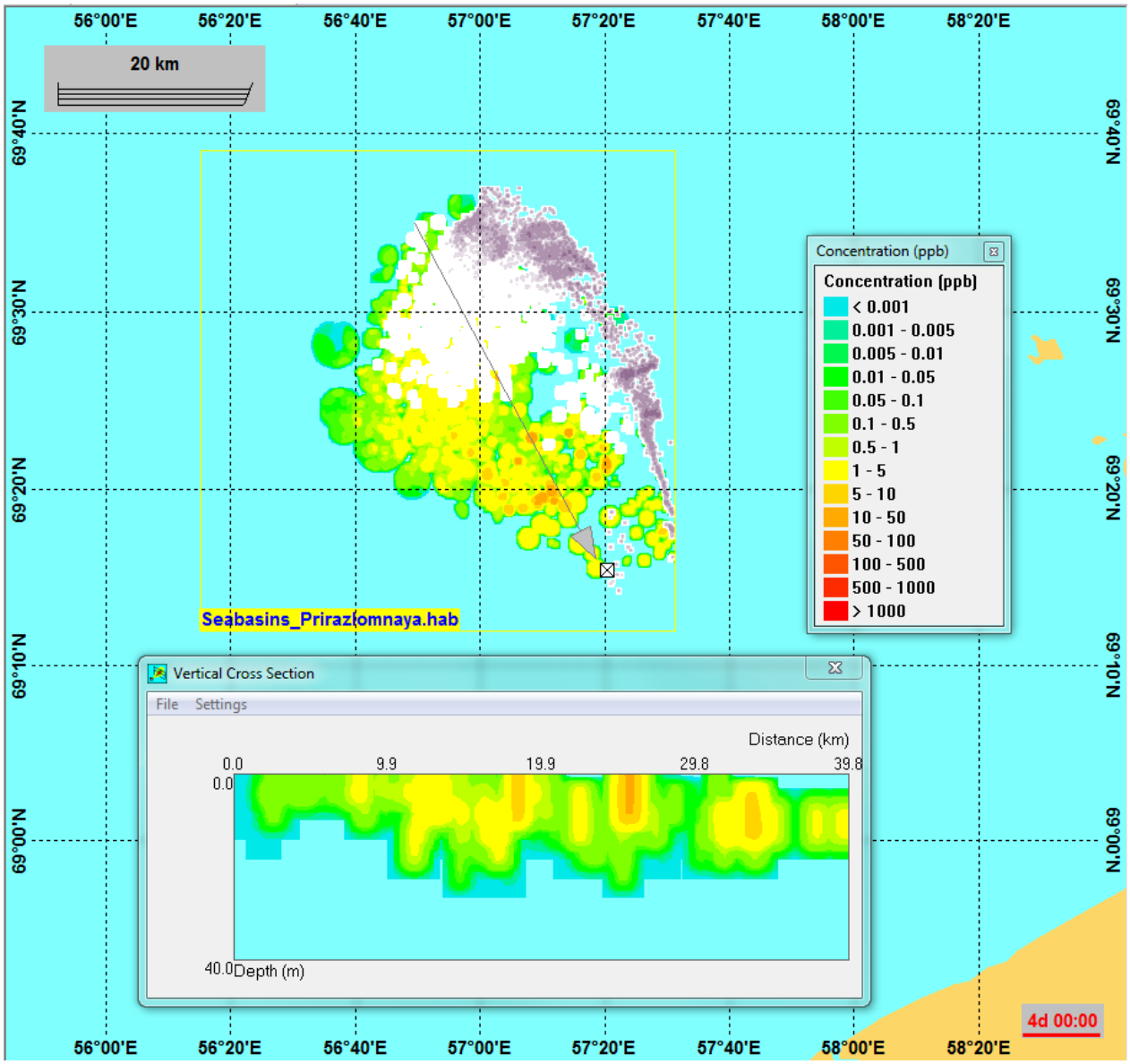
Results



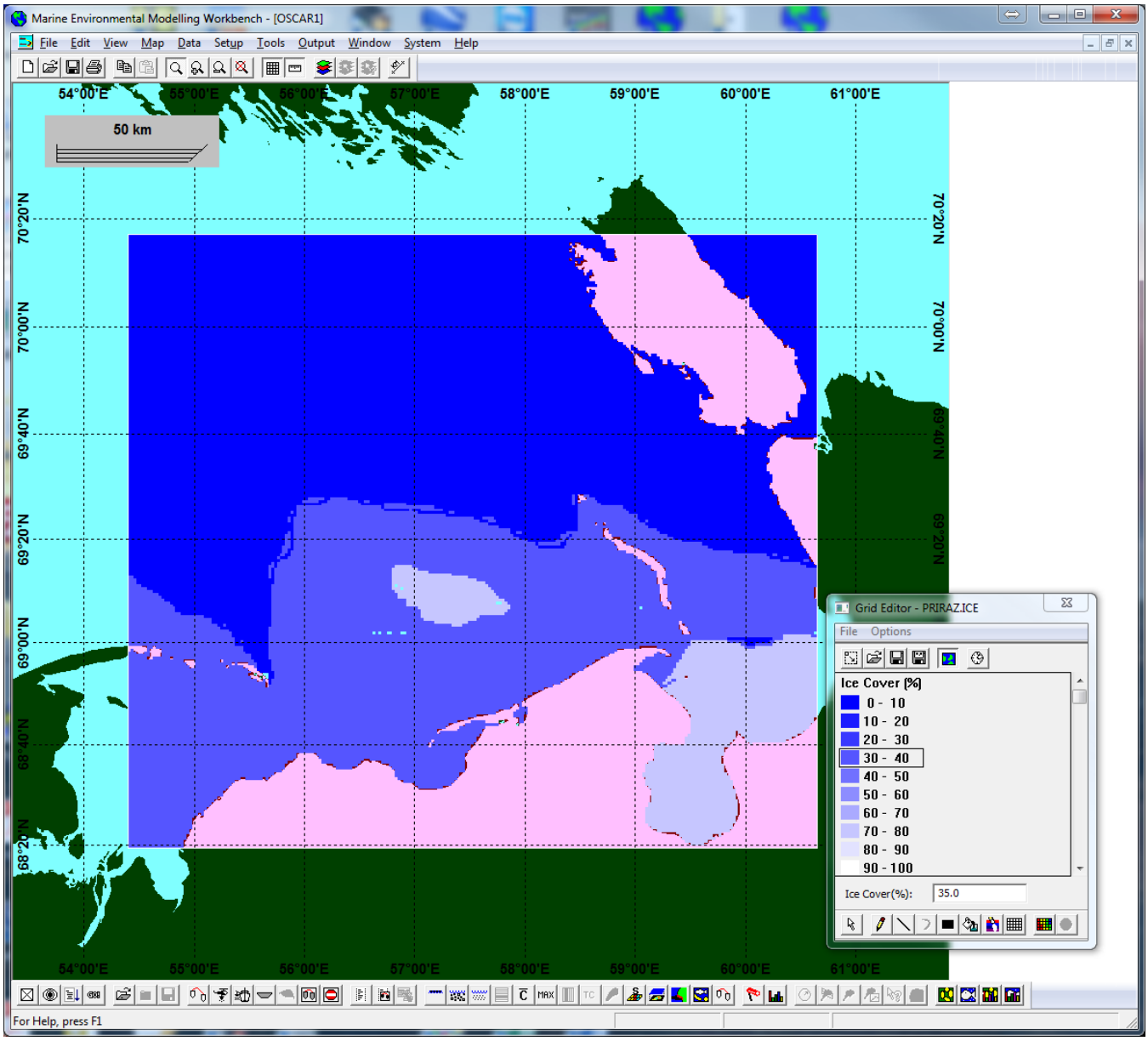
Day 2 (12-May-2016 08:15 CET). Surface oil shown overlaid with a plot of maximum subsurface concentrations and a cross section of subsurface oil concentration at end of Day 2, oil release rate decreasing. (SINTEF OSCAR model, output updated 12 May 2016 1100)



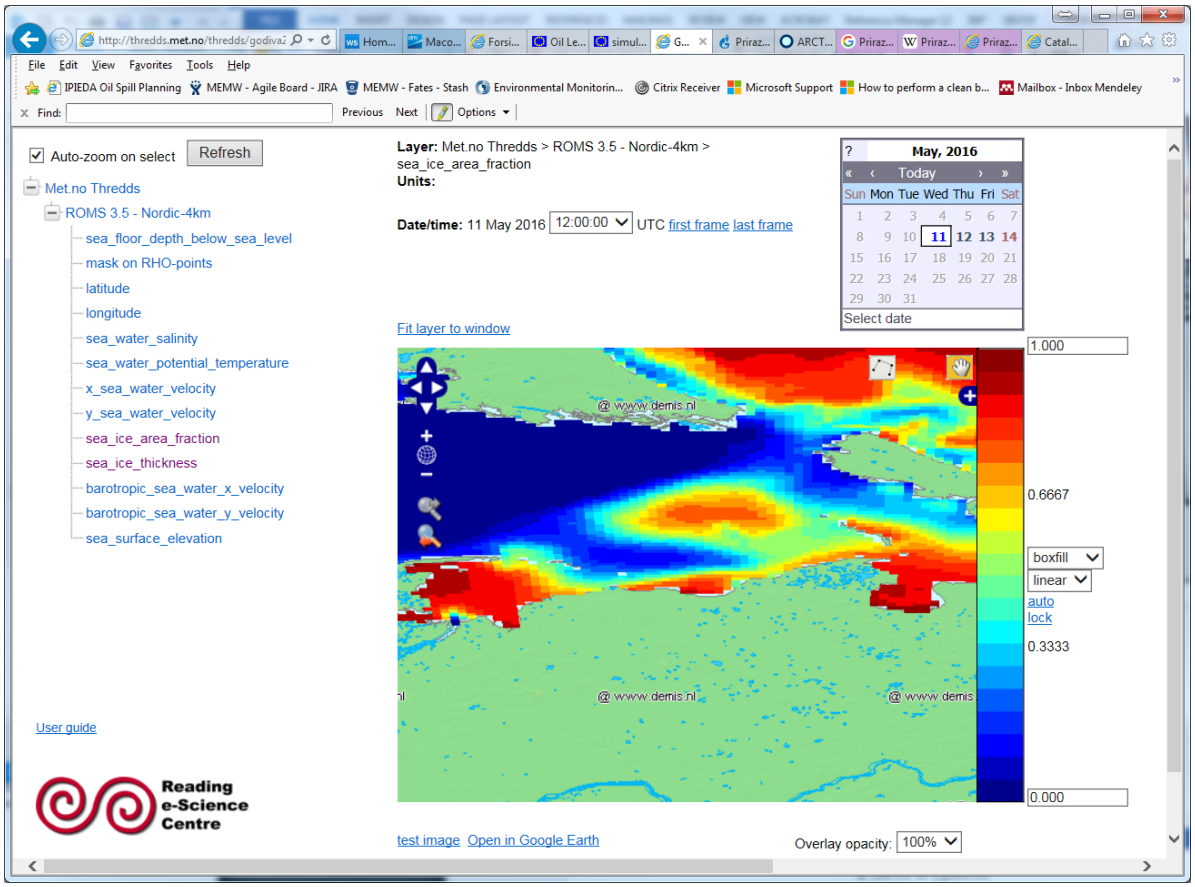
Day 3 (13-May-2016 08:15 CET). Surface oil shown overlaid with a plot of maximum subsurface concentrations and a cross section of subsurface oil concentration at end of f Day 3. Cross section is for arrow shown on map. (SINTEF OSCAR model, output updated 1100 12 May2016)



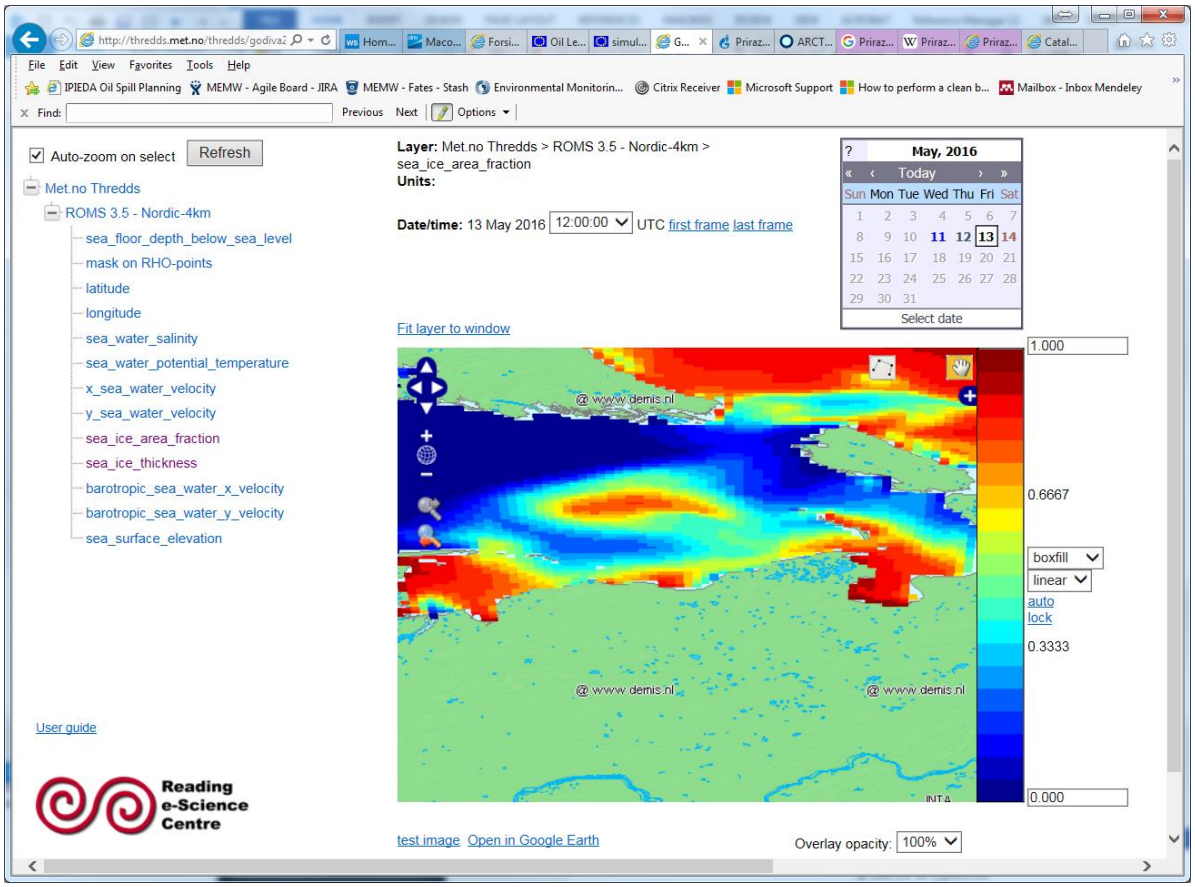
Day 4 (14-May-2016 08:15 CET). Surface oil shown overlaid with a plot of maximum subsurface concentrations and a cross section of subsurface oil concentration at end of Day 4. Cross section is for arrow shown on map. (SINTEF OSCAR model, output updated 1100 12 May2016)



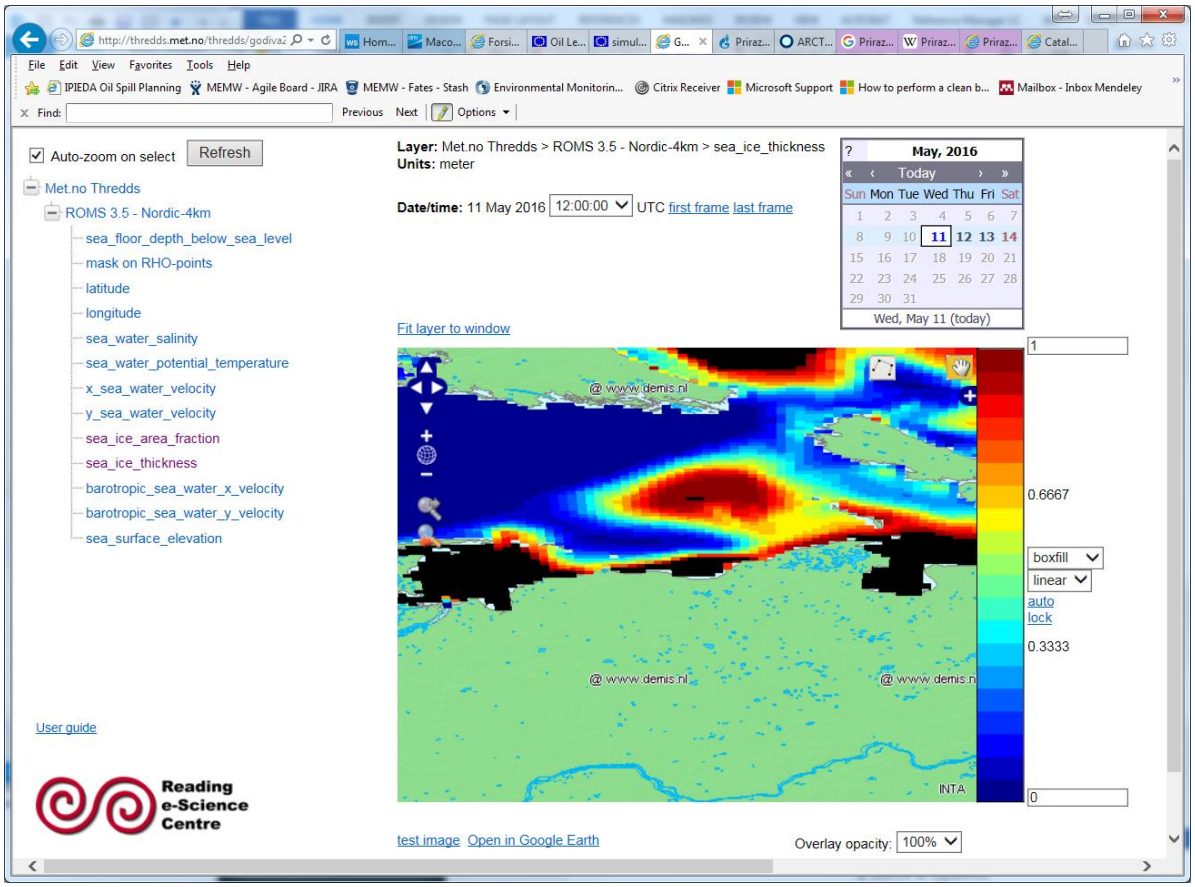
Day 2. Sea ice coverage in SINTEF OSCAR, on the 12 May 2016 (24hrs after release).



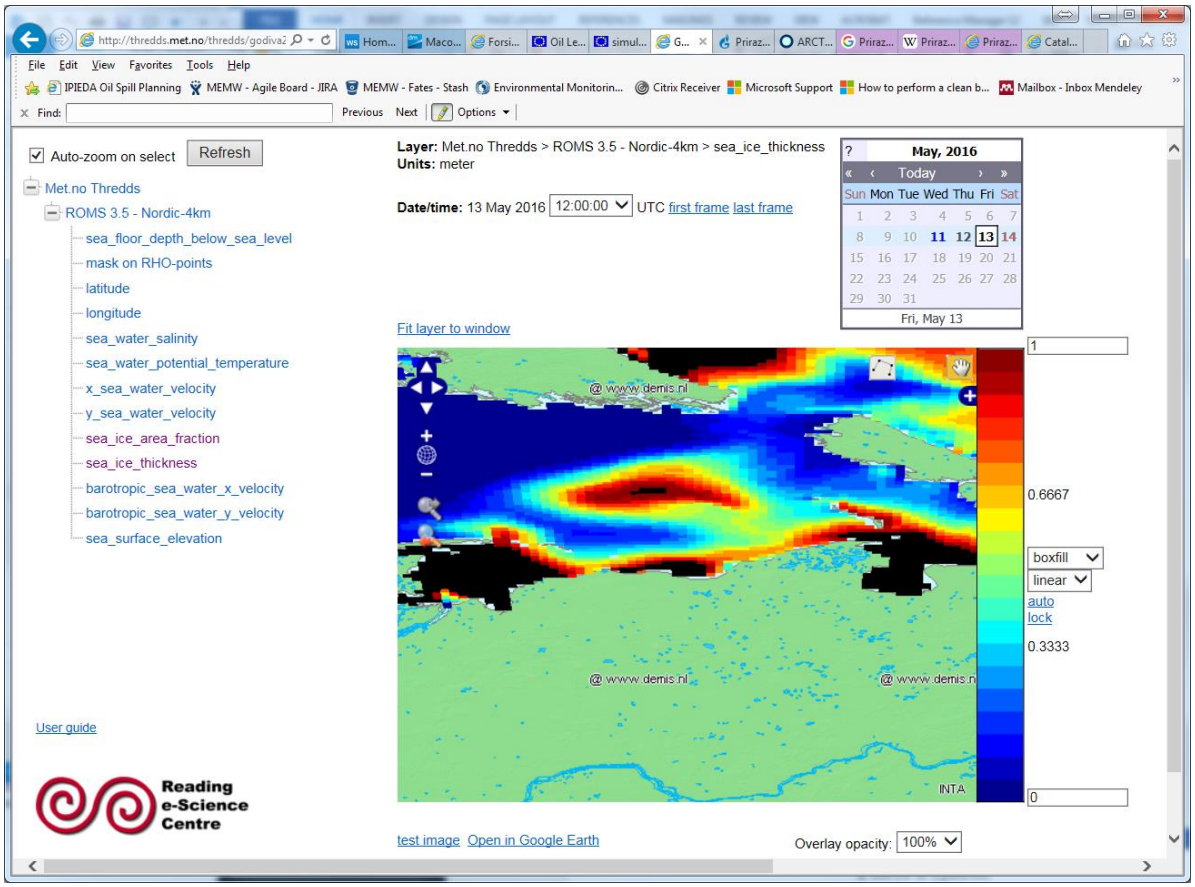
Sea ice fraction from data assimilation 2016-05-11



Sea ice fraction forecast 2016-05-13



Sea ice thickness from data assimilation 2016-05-11



Sea ice thickness from forecast 2016-05-13

Ecological Impacts

The oil slick is not predicted to impact protected areas within the next 6 days, but could affect local wildlife including seabirds, fish and marine mammals. Marine mammals likely to be present in the spill area are:

- Seals: bearded, harp and ringed
- Whales: beluga, bowhead, humpback and minke;
- Narwhal;
- Killer whales;
- Walrus.

Polar bears have also been seen in the area, but limited data are available. Annex A shows the important ecological areas and the spread and concentration of certain species.

Socio-economic

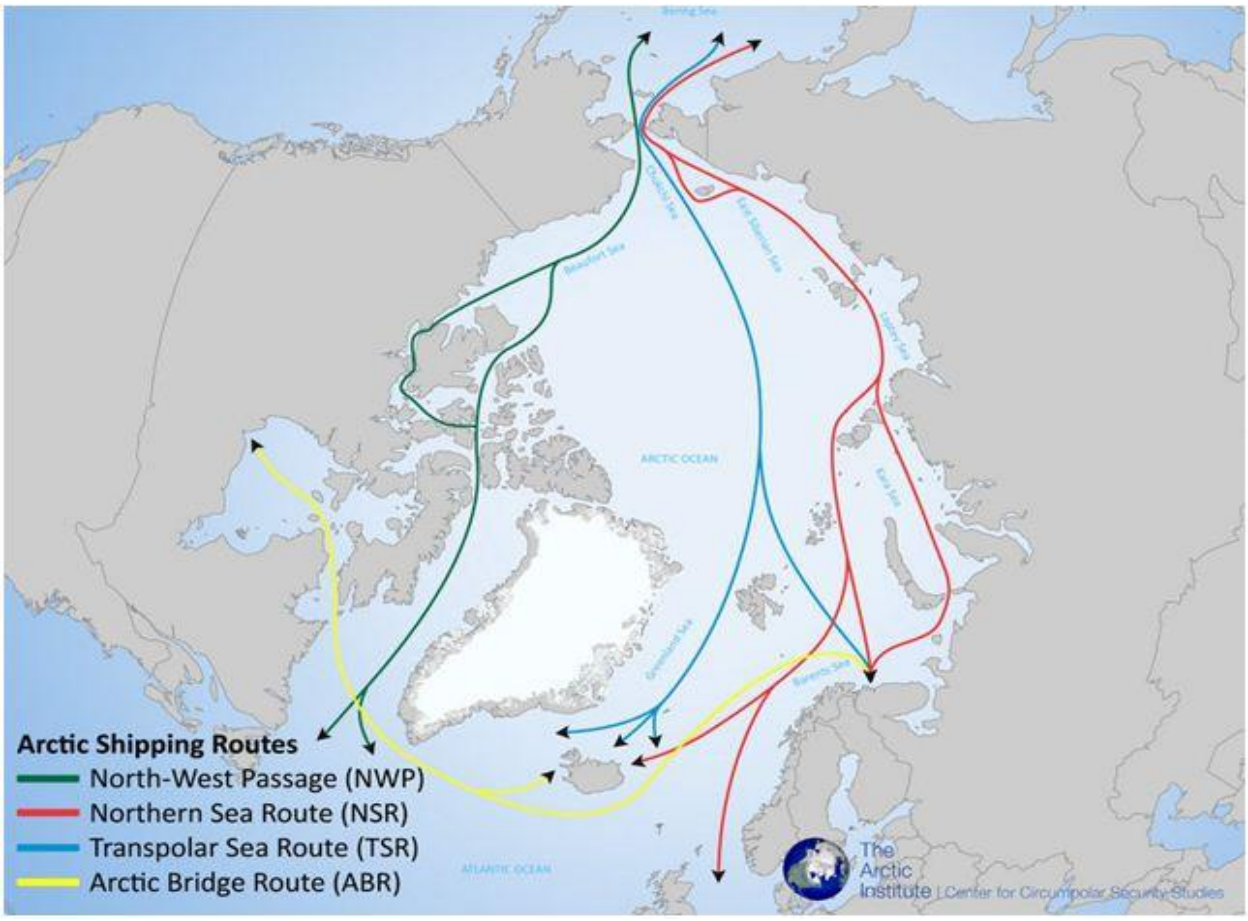


Figure 2: Arctic Shipping Routes

The Prirazlomnaya Platform lies within close proximity to the Northern Sea Route (NSR). The NSR connects trade between Asia and Northern Europe. The NSR is NOT currently open, but is typically navigable between July and November.".

Response Options

Taking into consideration the thickness of the ice sheet, and the current location of the spill, it would be difficult for OSRL to man a traditional response. The ideal option would be to monitor and evaluate the situation, using forecast modelling, preferably stochastic, to predict the movement and weathering effects on the oil. This would help us to be prepared to act once the ice has started to melt making the oil accessible. Some attempts to locate the oil under the ice and cut trenches for skimmers could be made, but this would depend on the availability of response vessels, and their ability to get through the ice, meaning containment options would be limited. In situ burning could be considered, although accelerants would have to be used.

Remarks

The Copernicus Marine Services data is much coarser resolution than what is available through Met.no and NERSC directly. For responders, high quality high resolution forecasts are key to mobilizing response equipment and personnel rapidly to needed areas.

Rapid acquisition and inspection of ocean current and wind data is important in order to evaluate and use data sources for oil spill simulations. The ocean current data must be of a high temporal and spatial resolution to capture tidal effects that greatly affects the transport of oil. Myocean data sets for this region are given on a coarse spatial resolution using daily mean. This is too coarse for accurate predictions of oil spill trajectories with OSCAR. Met.no produces data sets that are on a 1h temporal resolution and 4k spatial resolution. This will give significantly more accurate simulations, however the acquisition, inspection and usage of this data demonstrates that it does not conform to netCDF CF 1.6, which introduces difficulties to use the data without performing significant adaptations. This introduces a risk regarding whether the adaptations are correct and whether the data sets are fully self-describing which must be checked.

In order to perform this operation rapidly and fail-safe, we recommend that high resolution data sets with the purpose accurately modelling oil spills are collected on a data server, including sufficient meta-data to unambiguously describe the data sets and the projections/grids used. We further recommend that data sets conform to the netCDF format and CF 1.6 (or newer) convention. Furthermore, to reduce the risk of data being interpreted wrongly in the oil spill model, vector maps of the ocean current directions and magnitude should be provided for some time intervals. This makes it easy to rapidly check that the data is being used correctly.

The Met.no website has 4 km and 800 m forecast data for ocean winds and currents and runs the TOPAZ sea ice model at coarse resolution.

The International Oil and Gas Producers has funded a project to add capability to major oil spill models, such as the SINTEF Oil Spill Contingency And Response (OSCAR) model, to use the Nansen Environmental and Remote Sensing Center (NERSC) neXtSIM-F model, which is a high resolution elasto-brittle rheology to improve sea ice dynamics.

The NERSC neXtSIM-F 3 km coupled ice ocean model forecast model is available here

https://www.nersc.no/data/nextsim-f

Images of the NERSC neXtSIM-F can be found here

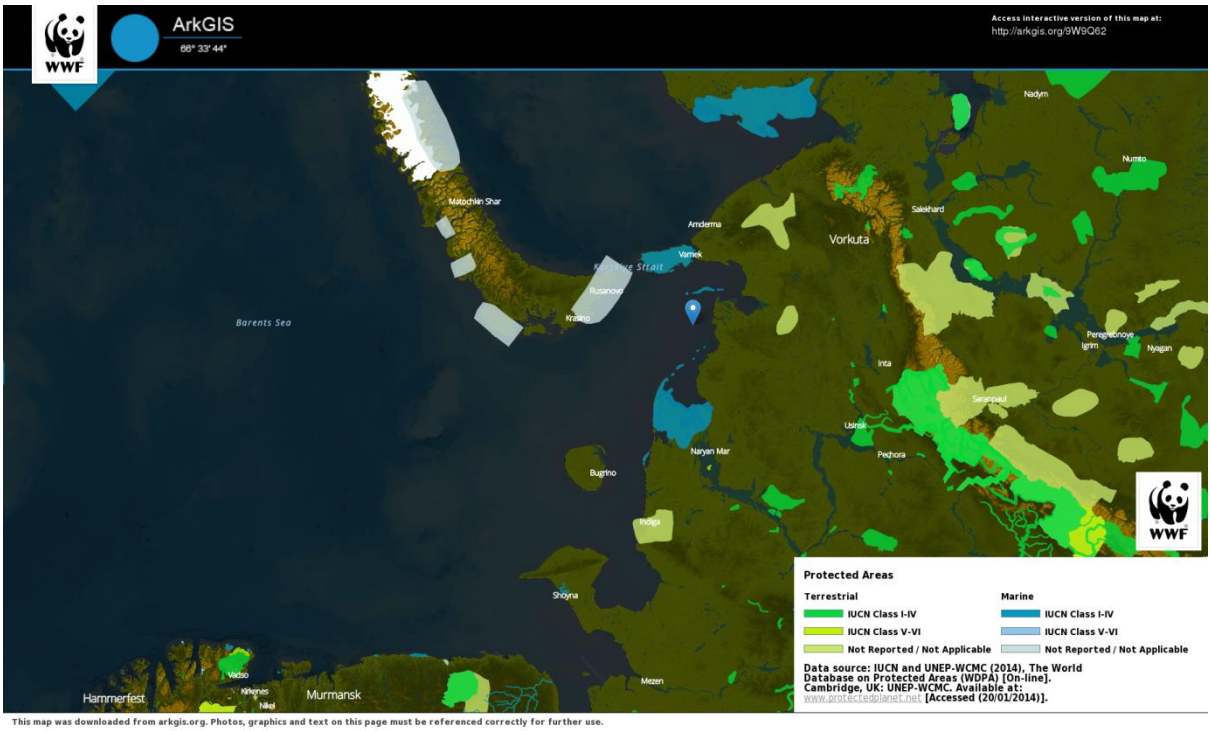
ftp://ftp.nersc.no/pub/Philipp/forecasts/plots_20160510_lowres.png

Annex A

List in annex if you wish to provide any additional information

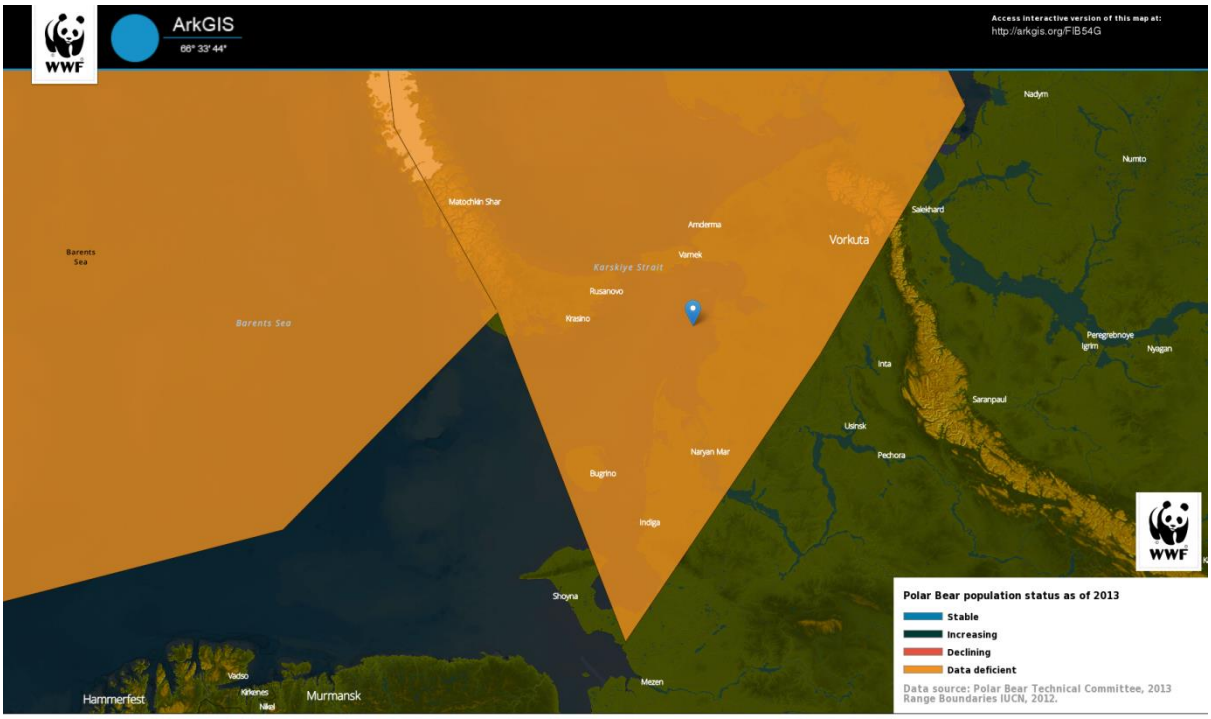
Important ecological areas in the Arctic:

Protected areas



Beluga whale distribution

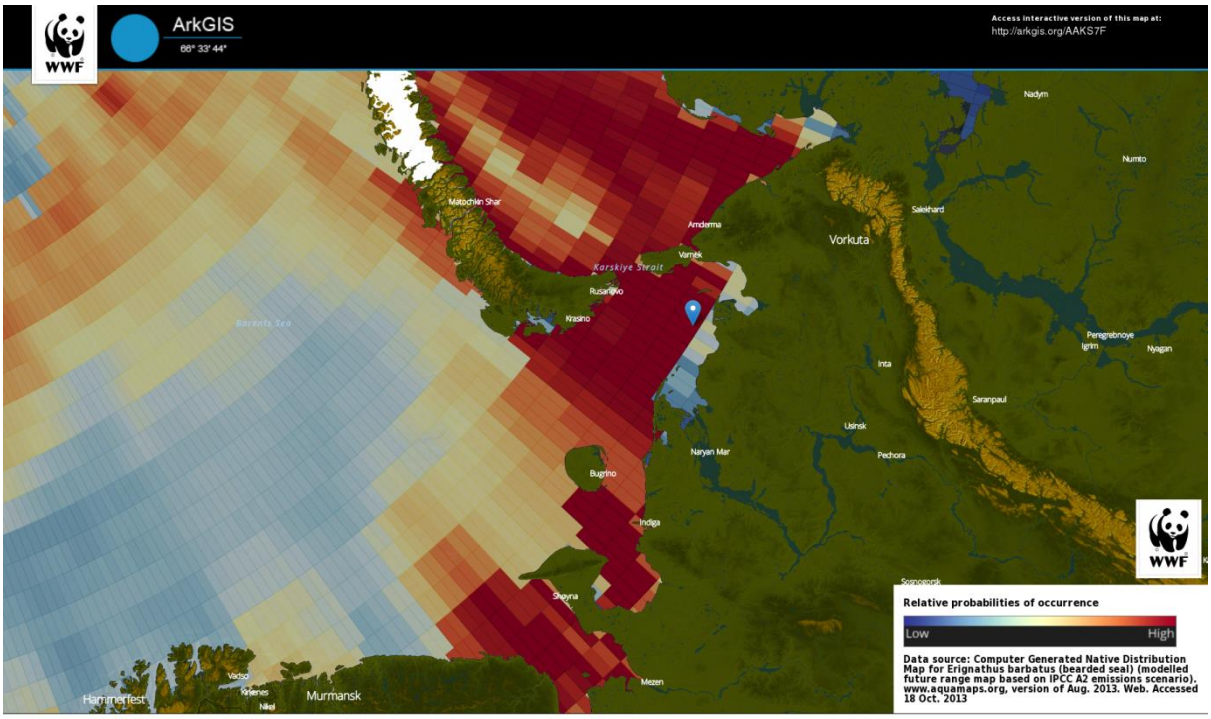
Polar bear distribution (data deficient)



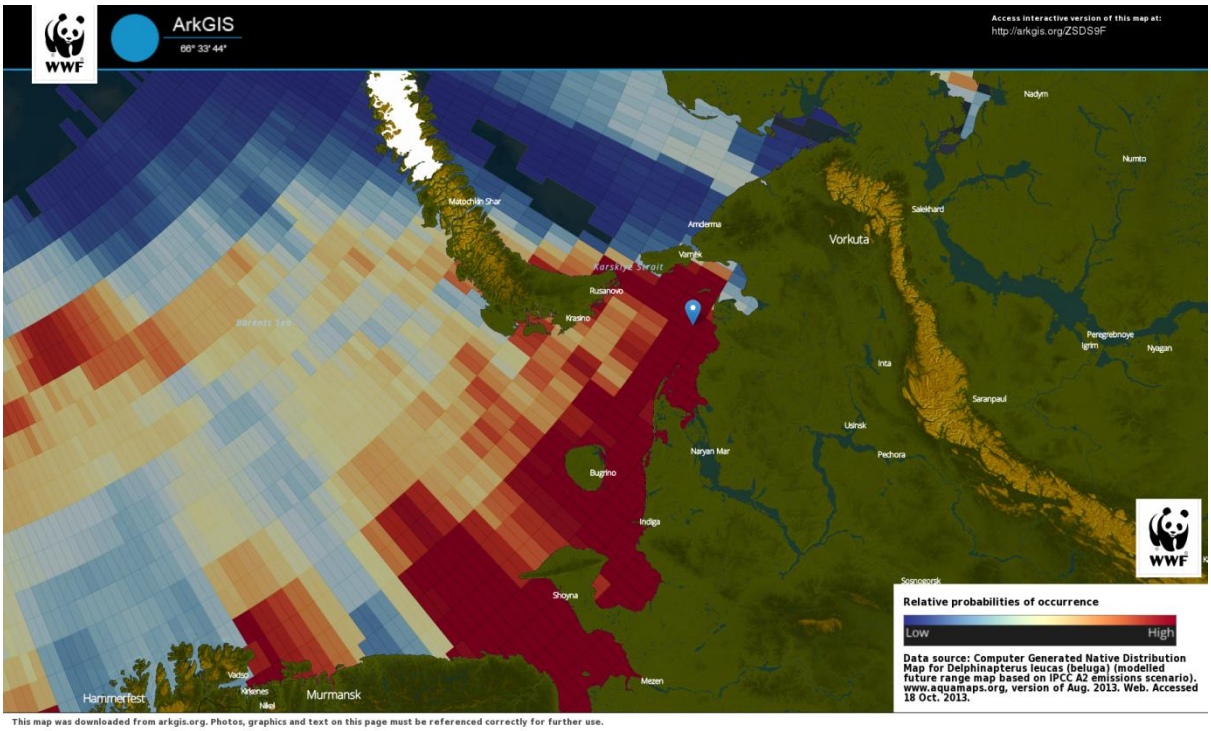
Walrus distribution

Relative probability of occurrence of marine mammals in the region

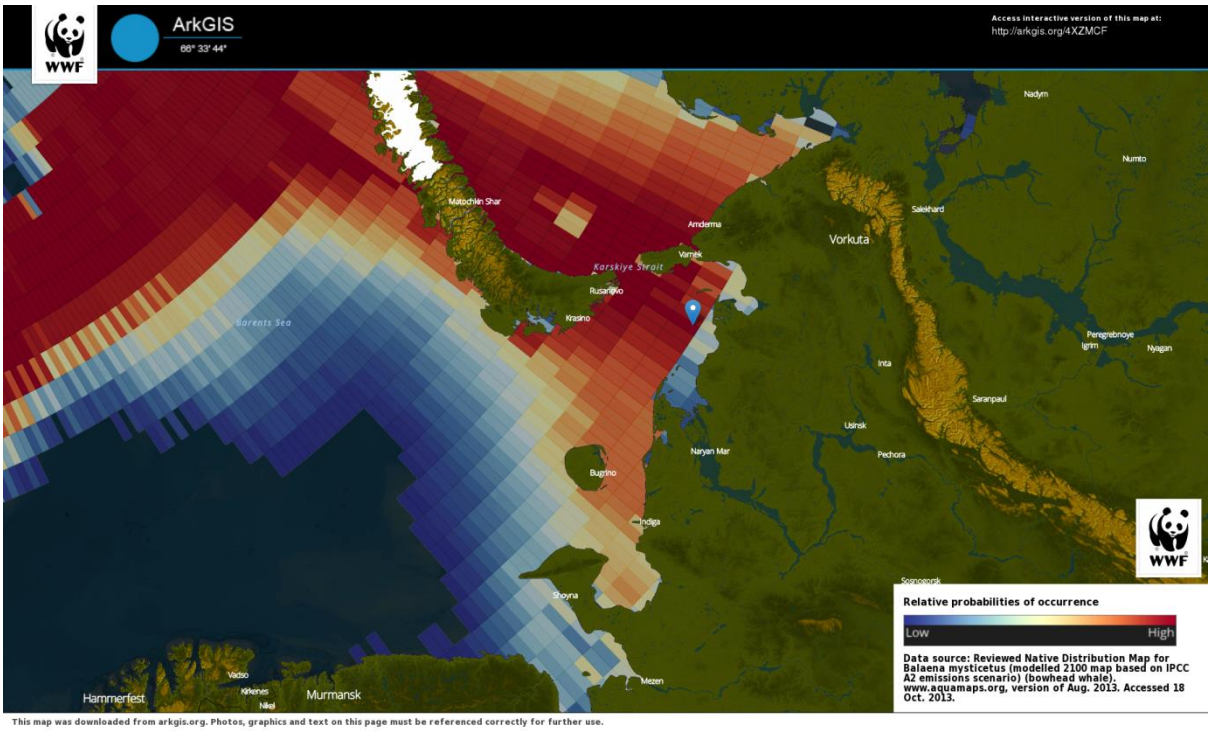
Bearded seal



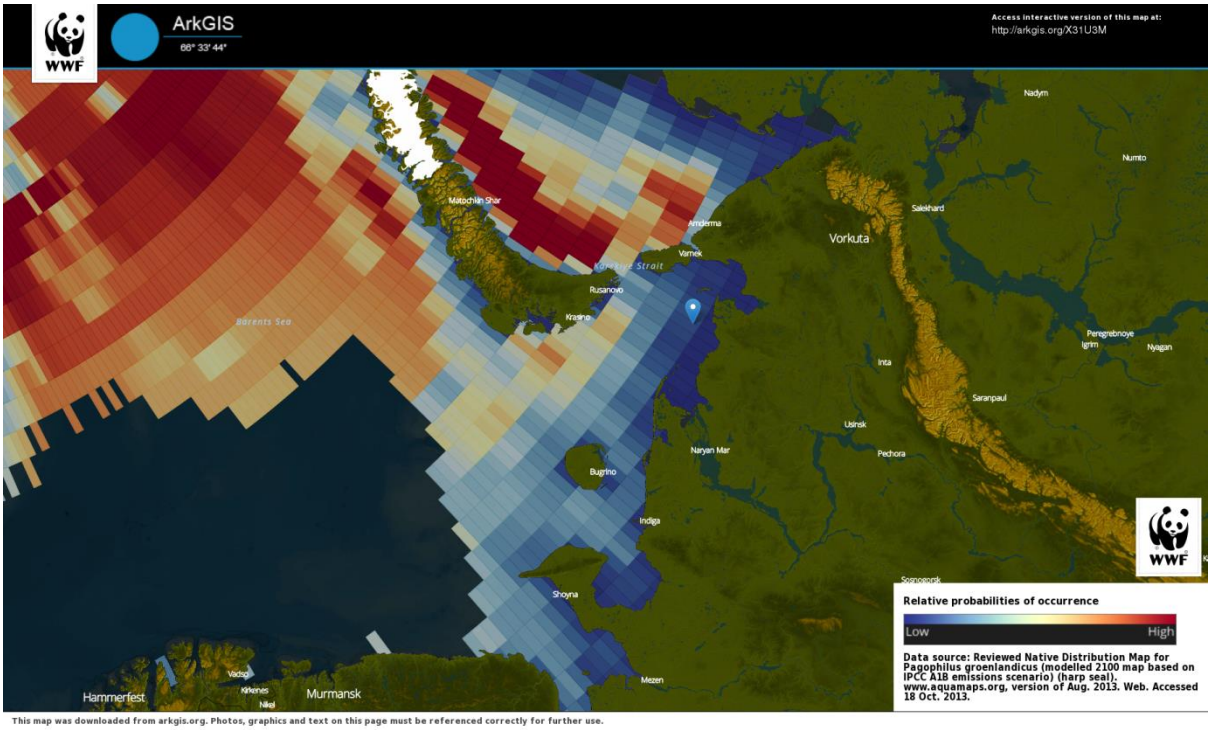
Beluga whale



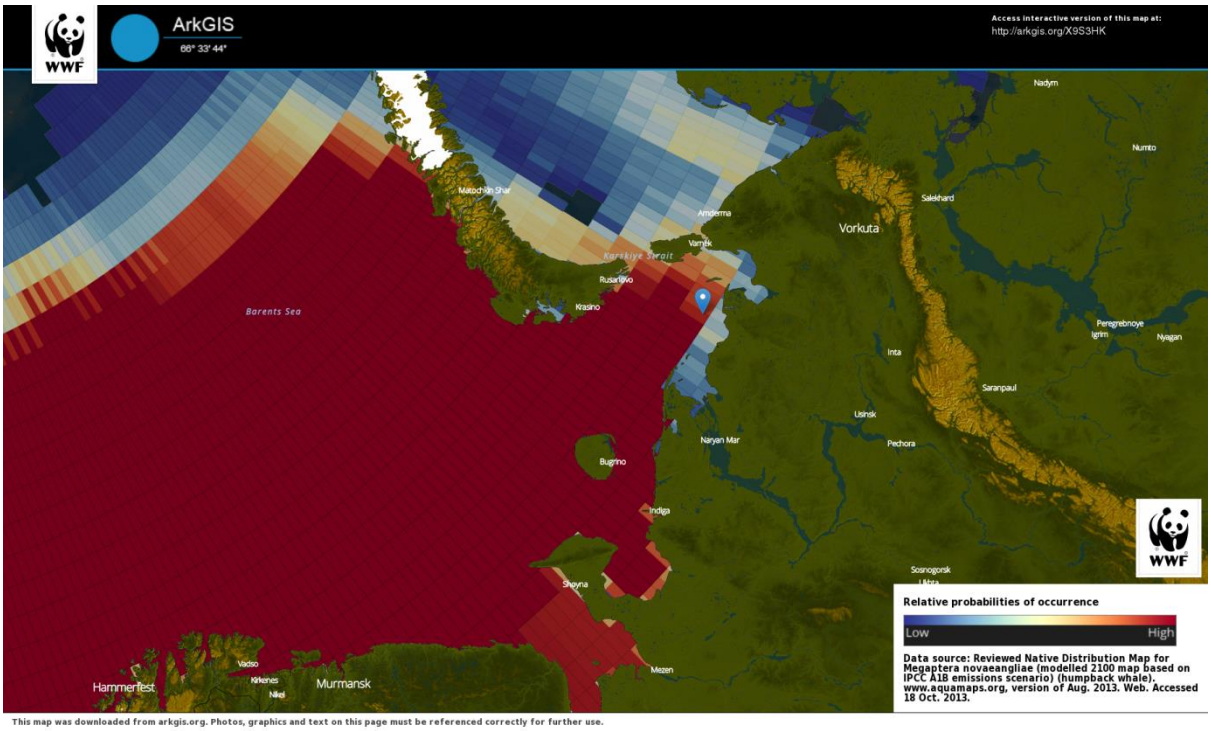
Bowhead whale



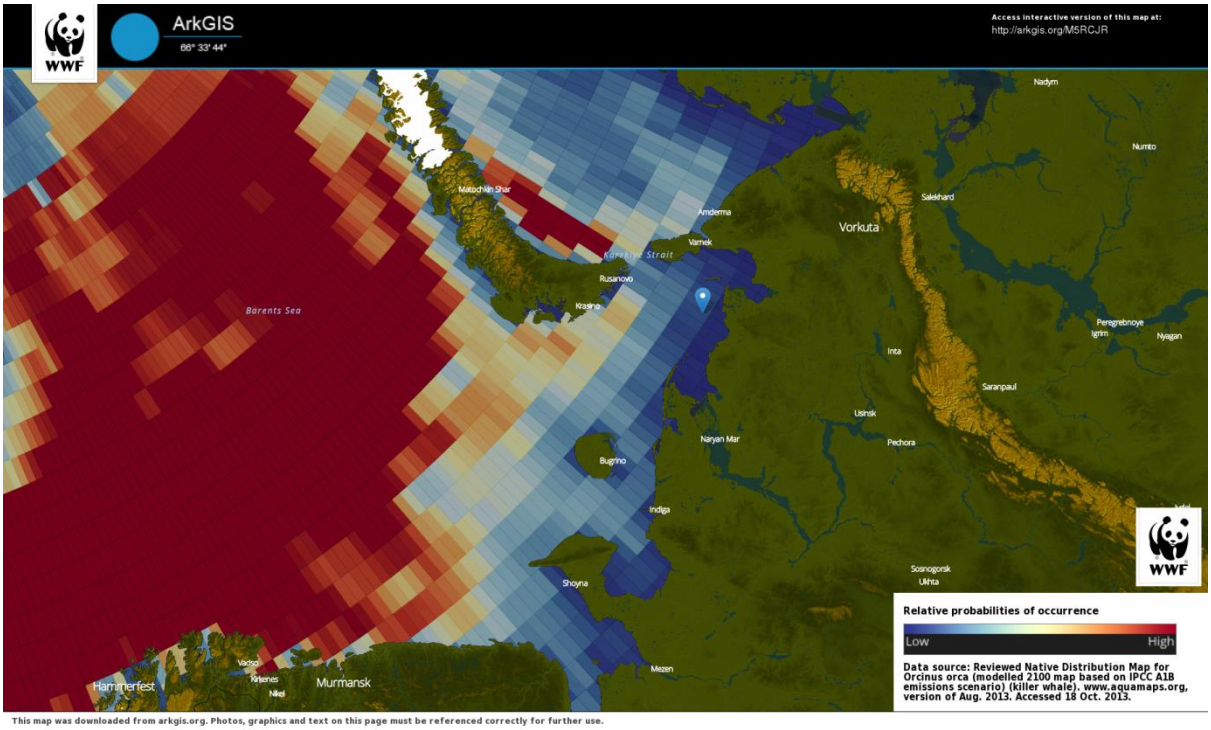
Harp seal



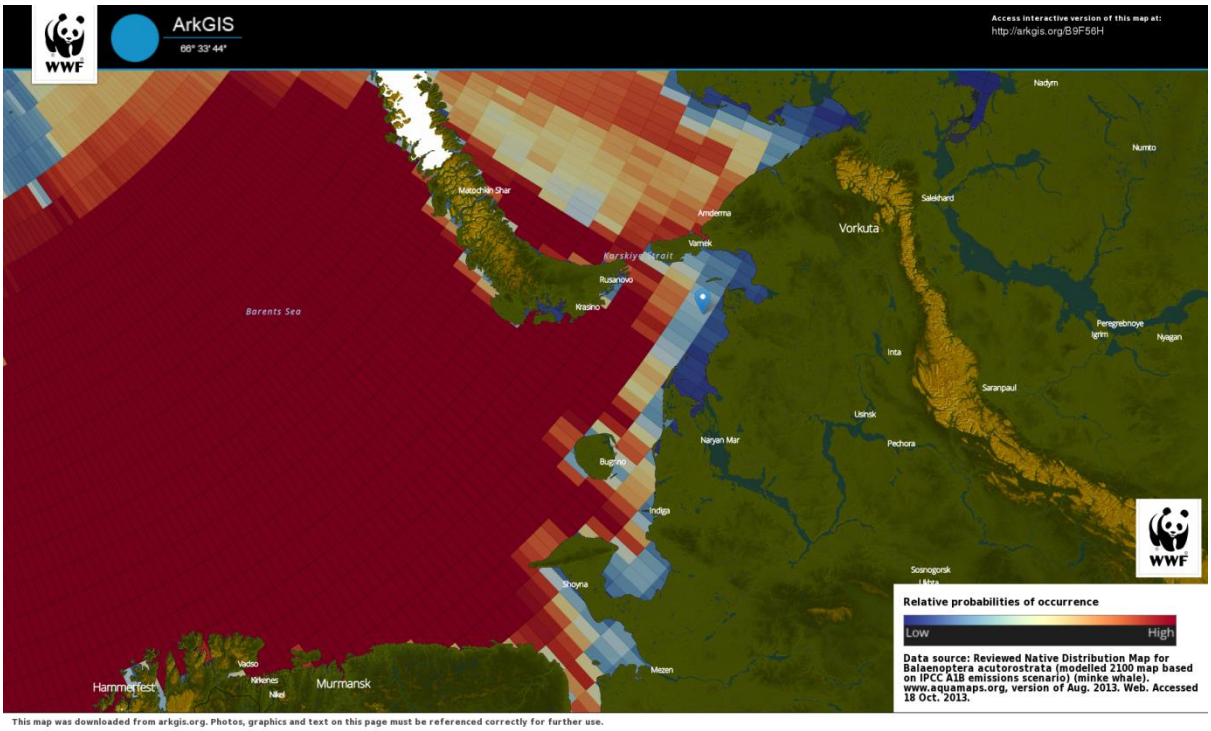
Humpback whale



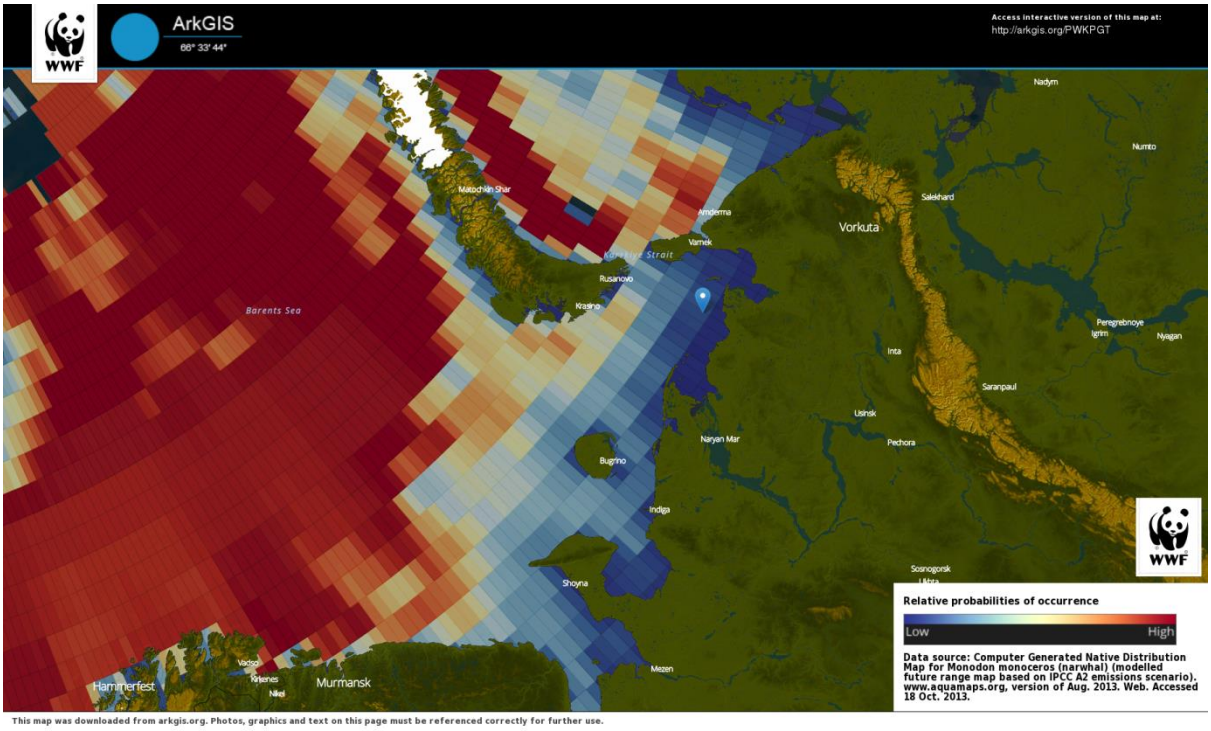
Killer whale



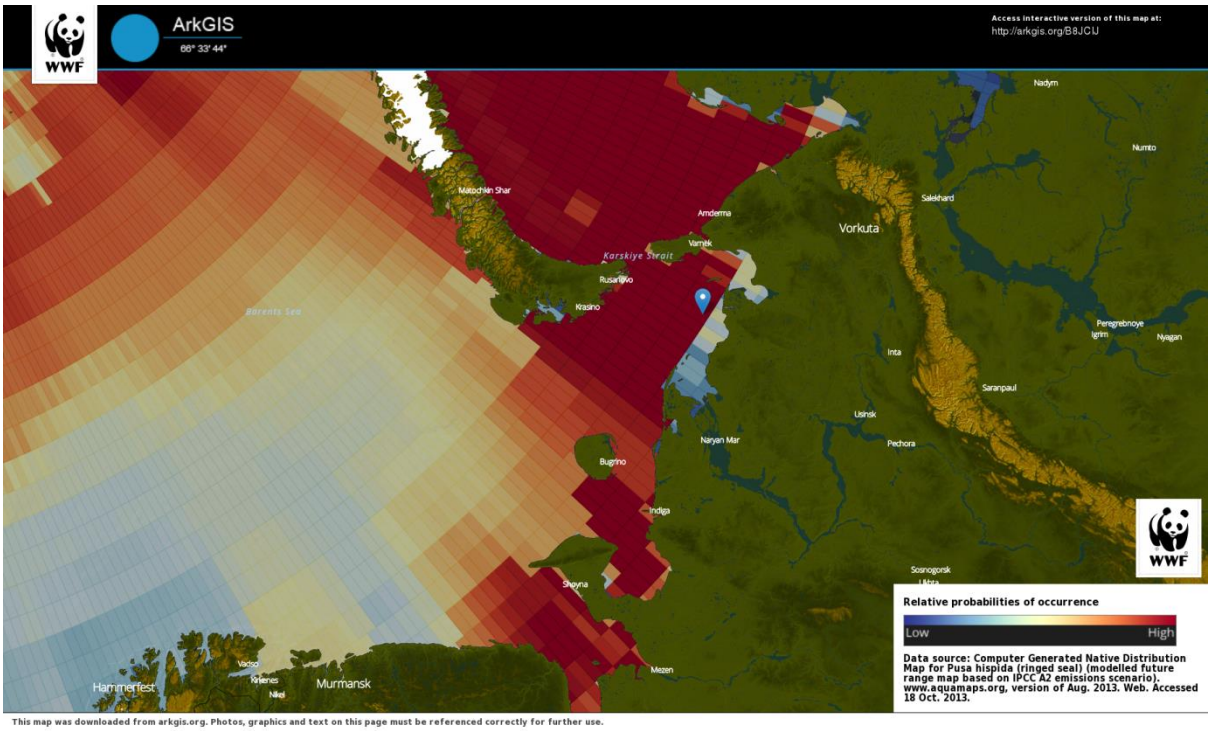
Minke whale



Narwhal



Ringed seal



Walrus