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Space technology for the marine mammal research and conservation in the Arctic



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Space technology for the marine mammal research and conservation in the Arctic

RESULTS OF THE PILOT PROJECT
TO DEVELOP METHODS OF FINDING WALRUSES
ON SATELLITE IMAGES

Moscow
2012

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With support of WWF-Russia and Council on Marine Mammals Research and development center ScanEx carried out a project to perfect decoding of satellite images of walrus locations in the south-east Barents. The quality of acquired images let define locations of animal groups as well as count approximate number. Lack of knowledge of Atlantic walrus is a serious obstacle for measure development to reduce negative impact on animals from developing oil and gas extraction. The given brochure is intended for specialists, teachers and university students.

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INTRODUCTION

Yearly the world's supply of hydrocarbons on land continues to run low, and to that end during the last decade growing activity of shelf deposit absorption has been observed.

Today in Russia the amount of shelf oil extracting isn't as high as in other countries, however experts forecast its prominent growth in the upcoming decades. It's already growing in the Caspian, Baltic and Okhotsk Seas. In 2011 oil extracting began in the Arctic Sea, and in the Pechora Sea an oil platform "fault line" was installed.

All shelf projects bring a definite ecological risk connected to the possibility of an oil spill in an icy area and threatening key inhabited locations of rare animals.

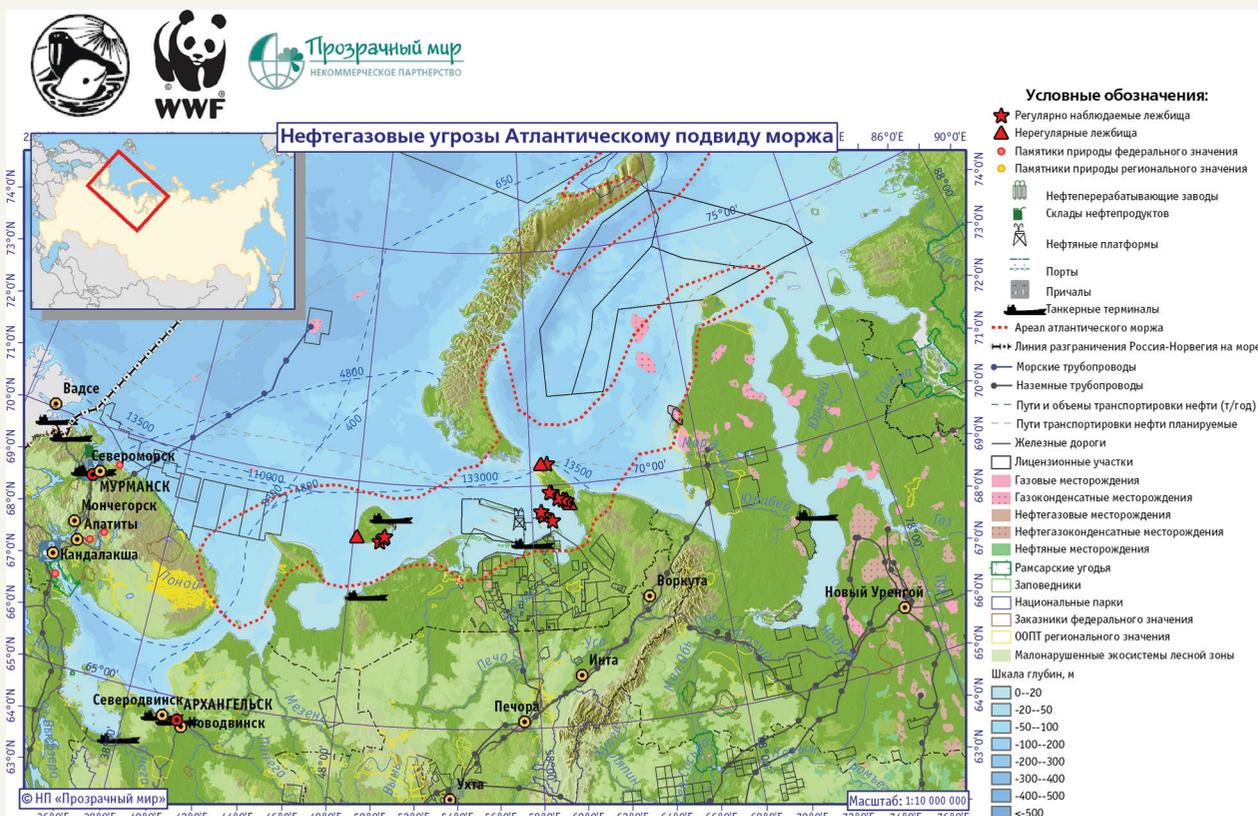
Intensive commercial absorption of the south-eastern parts of the Barents Sea (Picture 1), which consists of installing extracting platforms, growth of shipping and development of coastal infrastructures, has a high impact on the ecosystem of the region and especially on the walrus, which is one of the most fragile of the northern components.

Inhabited in the touched region is a few of an Atlantic subspecies of walruses, which in the Endangered Species List of the Russian Fed., and they are possibly mostly stranded from its main population the "southern" group.

In order to produce means for these animals' preservation, it's necessary to complete a modern scientific research on their biology and ecology.

One of the methods for such a research is through satellite observation. In June of 2011, through the initiative and support of the Engineering-Technological Center

Pic.1
Oil and Gas development
in the Barents Sea sector
of the Polar Region



“Scanex” (ITC “Scanex”), the World Wide Wildlife Fund (WWF) and the Marine Mammals Council (MMC), a project was launched for the production of methods to locate the walrus and their coastal rookeries in the south-eastern parts of the Barents Sea.

In this brochure a description of the stated methods and its first summation results are given.

CHOOSING THE REGION AND PERIOD FOR THE OBSERVATION

Regardless that the walrus is a sea mammal, they still cannot constantly reside in water. They must have a platform for rest and breeding. Sea ice is used as such a platform, and in the period of its absence in the inhabited regions (July- December) islands and continent shorelines are used. However ice is the preferred option for a walrus. It is far safer, but due to the global climate changes the duration of ice in the researched areas has been reduced, which increases the importance of the

shoreline in a walrus's life.

Within the frames of the expert advisory groups for the study and preservation walrus in the south-eastern Barents Sea and the adjoining water zones, functioning by the initiative of the WWF Russia and the SMM from the 20th of May 2009, the major regions for the walrus's shoreline rookeries were singled out to the islands of Kolguev, Dolgy, Matveyeva and Vaigach. From May to September of 2011 operative orbital monitoring of walrus shoreline rookeries were conducted in the singled out regions (Pic.2).

Pic.2
The regions
for the operative
orbital monitoring
of walrus rookeries



THE TECHNICAL CHARACTERISTICS OF THE SYSTEM'S SURVEY

The survey was done by an independent commercial company ETC “Scanex”, providing a complex of possibilities from receiving to thematic processing of images of earth from space.

In the process of surveying the rookeries, the satellite EROS B (Earth Resources Observation System) was used for its high maneuverability and its ability to quickly reprogram the target of survey.

Today it is the only program of extra-high (0.7 m) authorized, providing the possibility to receive data directly on paper in the territory of Russia on a real time basis.

The size of the scene (the territory, shown on the satellite in one shot) consists of 7x7 km.

The possibility to repeat the shooting is every 3 to 4 days.

RESULTS OF THE SATELLITE MONITORING OF WALRUS SHORELINE ROOKERIES

Results of the Matveyeva Island survey

The possibilities of the satellite allowed us to shoot the entire territory of Matveyeva Is., which is a part of the state nature reserve “Nentsy”.

An assembly of walrus was found on the south-eastern shore of the island (*Pic.3*). For the certification of the fact of this animal being located in this shot, from the amount of pixels their size was defined to be 2.5 m.

There was also a comparison to the archive shot (*Pic.4*), upon which similar objects were not found. This proves the presence of animals and not static objects.

The detailed authorized satellite survey and the shot's low angle of slope not only allowed us to see the animals but also to count their numbers (*Chart 1*).

The shots of Matveyeva Is. were repeated three times. On all three shots (*Pic. 5,6,7*) animal assemblies were noticed. At the same time, to fully value the numbers only one picture was used (*Pic.5*), another allowed only approximate numbers (*Pic. 7*) and due to poor quality the numbers of the last shot were impossible to define (*Pic.6*).

Chart.1

Date of Survey	Region of Survey	Number of Animals Found	Quality of Photograph
04.07.2010 (archive)	Matveyeva Is.	None	high ¹
28.07.2011	Matveyeva Is.	around 200	high ¹
28.08.2011	Matveyeva Is.	Impossible to estimate	low ³ (high angle shot)
04.09.2011	Matveyeva Is.	from 100 to 200	medium ² (high angle shot)

* Approximate quality of shots in the Appendix (p. 12)

Pic. 3
EROS B, 28.08.2011,
0.7 m/pixels,
Imagesat Int.,
SCANEX, 2011



© IMAGESAT, LLC "SCANEX"

Pic.4
GeoEye, 04.07.2010,
0.7 m/pixels,
Imagesat Int.,
SCANEX, 2010



© GEOEYE, ИТЦ «СКАНЭКС»

Pic.5
EROS B, 28.07.2011,
0.7 m/pixels,
Imagesat Int.,
SCANEX, 2011



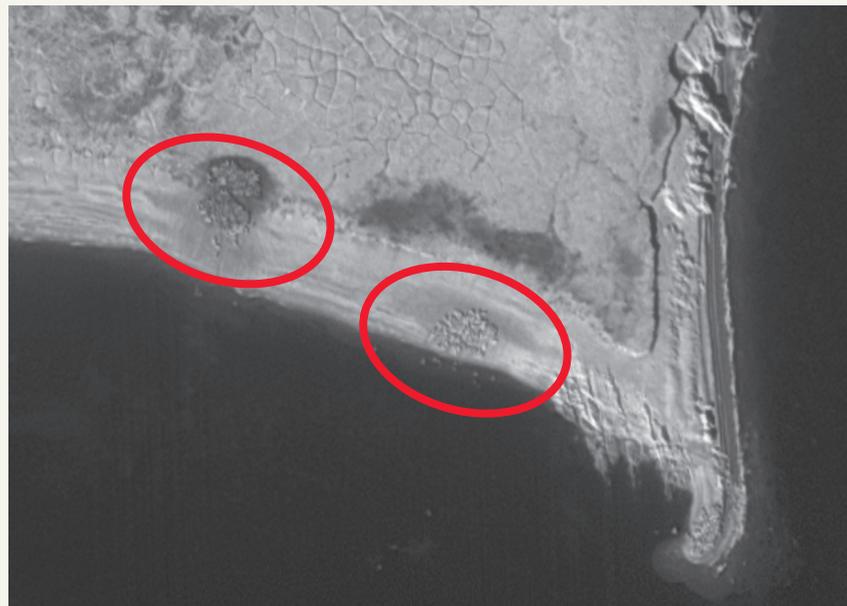
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Pic.6
EROS B, 28.08.2011,
0.7 m/pixels,
Imagesat Int.,
SCANEX, 2011



© IMAGESAT, ITC 'SCANEX'

Pic.7
EROS B, 04.09.2011,
0.7 m/pixels,
Imagesat Int.,
SCANEX, 2011



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Results of the Vaigach Is. survey

The orbital survey of Vaigach Is. was conducted on the southern coast of the peninsula Lyamchin (Pic.8). A walrus shore rookery was found on the western Cape of Lyamchin Nose.

The quality of the shot allowed us to estimate that at the moment of the shot their assembly consisted of around 400 animal units (see Chart.2).

Chart.2

Date of Survey	Region of Survey	Number of Animals Found	Quality of Photograph
28.08.2011	Vaigach Is., Cape of Lyamchin Nose	Impossible to estimate	low ^{*3} (cloudy shot)
04.09.2011	Vaigach Is., Cape of Lyamchin Nose	around 400	high ^{*1}

* Approximate quality of shots in the Appendix (p. 12)

Due to the results of the survey of walrus we were able to confirm the ground photographs, which were done months earlier in the process of the scientific-touristic expedition. On July 14th in the same place (the western Cape of Lyamchin Nose) members of the expedition photographed (Pic.9) rookeries of walrus and numbered them to be approximately 150 animals.

The satellite shots along with the other photographs done became the first facts that confirmed the forming of shoreline walrus rookeries on Vaigach Is., which singles out its importance for the grouping of the Atlantic walrus in the summer-autumn period.

Pic. 8
EROS B, 04.09.2011,
0.7 m/pixels,
Imagesat Int.,
SCANEX, 2011



Pic.9
Walrus rookery
on Vaigach Is.,
Cape of Lyamchin Nose
14.07.2011



© WWF-RUSSIA / VICTOR MASLOV

Results of the Kolguey Is., Dolgy Is. and Golets Is. surveys

Chart.3

Date of Survey	Region of Survey	Number of Animals Found	Quality of Photograph
30.05.2011	Kolguey Is. southern region	None	high ¹
10.06.2011	Kolguey Is. southern region	None	low ³ (very cloudy)
08.07.2011	Kolguey Is. Western Flat Trolley	None	high ¹
20.07.2011	Kolguey Is. Western Flat Trolley	None	medium ² (partly cloudy)
07.08.2011	Dolgy Is., Golets Is.	None	high ¹
05.09.2011	Dolgy Is., Golets Is.	None	medium ² (high angle shot)

* Approximate quality of shots in the Appendix (p. 12)

The orbital survey was conducted on the southern shore of Kolguey Is., the northern ends of Dolgy Is. and Golets Is. Walrus were not found in these regions.

On the islands of Dolgy, Golets and Kolguey an experimental **stereo-survey** was conducted. It consisted of receiving two shots of exactly the same regions divided by a short period of time (several minutes). This principle could allow us to define moving objects (such as animals) from the unmovable (such as plants, ice, rocks and etc.).

Periodical results of the south-eastern Barents Sea orbital survey

Chart.4

Region of survey	Period of survey	Number of shots	Cloudy shots	Shots of animal	Stereo Shots
Kolguey Is.	13.05-20.07	9	1	0	1
Matveyeva Is.	28.07-04.09	3	0	3	0
Dolgy Is. And Golets Is.	30.07-05.09	5	2	0	2
Vaigach Is.	28.08-04.09	2	1	1	0
Total:	13.05-05.09	19	4	4	3

THE FIRST CONCLUSIONS OF USING ORBITAL SURVEY TO MONITOR SHORELINE WALRUS ROOKERIES

From the results of the conducted work, a conclusion of using orbital survey to monitor shoreline walrus rookeries in the south-eastern Barents sea can be made.

The advantages of this method	Ограничения метода
<ul style="list-style-type: none">• It allows the receiving of operative information on the location and placement of walrus rookeries and with a high quality shot give the approximate number of animals in an assembly.• Relative low cost shots that allow monitoring the dynamic of the animals' numbers in arduous rookeries.• Using the given method could be a helpful element in field ground research and in air reports.	<ul style="list-style-type: none">• The possibility of high quality shots are only clear cloudless weather.• The quality of the shot also depends on the angle of the shot.• To receive higher authenticity to identify the objects it's preferable to use stereo photography and/or air, ground research.

CONCLUSION

Orbital survey was for the first time used to find walrus assemblies and evaluate their numbers during the important summer-autumn period.

Success from monitoring the walruses through orbital survey alongside ground research will allow environment-orientated and scientific organizations to operatively receive basic information on the placement and numbers of walruses in the regions that are difficult to monitor through other ways, and also this will help to take adequate measures for the preservation of the stated group of walruses under the conditions of the “boom” of economic development in those regions.

Thus using the high authorized data is a perspective method to research this species of sea mammal.

With reference to the success of the first pilot project to develop methods for the locating of walruses in orbital shots, and the locations most likely used for shoreline rookeries, the WWF Russia is planning to expand the region of monitoring walrus rookeries and receive shots of the Barents, Kara, Laptev and East-Siberian seas.



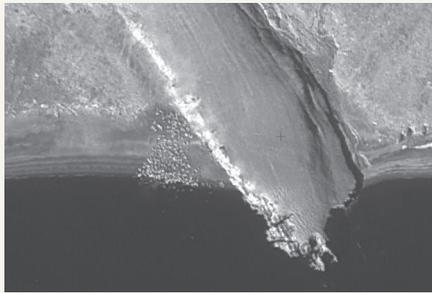
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APPENDIX

Examples of the photograph's quality

*1

HIGH QUALITY



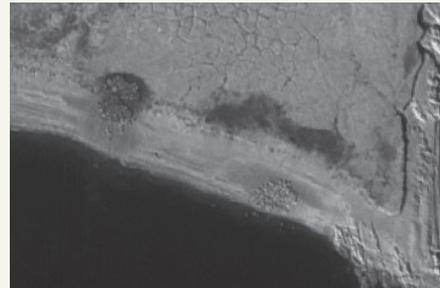
Accurate shot (it's possible to count the walruses)

*2

MEDIUM QUALITY



Partly cloudy shot



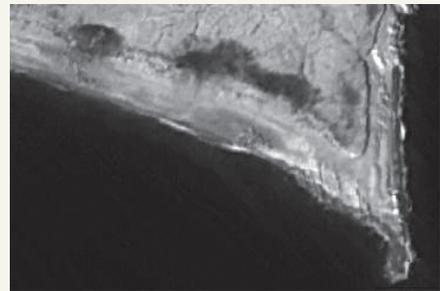
High angle shot (it's more difficult to count the walruses)

*3

LOW QUALITY



Highly cloudy shot



Very high angle shot (it's possible to see the presence of walruses yet impossible to count)