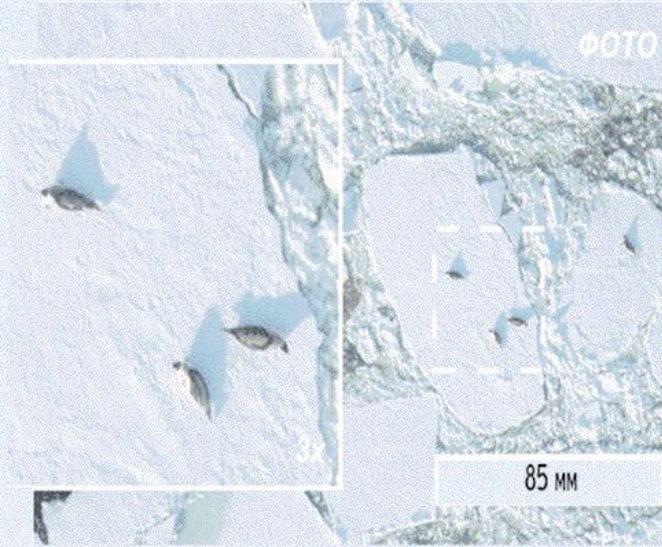




# PINRO AIRBORNE RESEARCH ON STUDY OF THE WHITE SEA HARP SEAL PUP PRODUCTION ABUNDANCE



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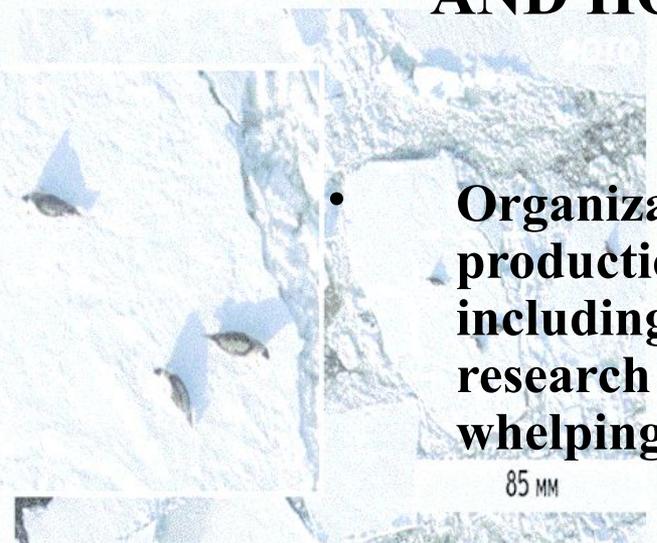
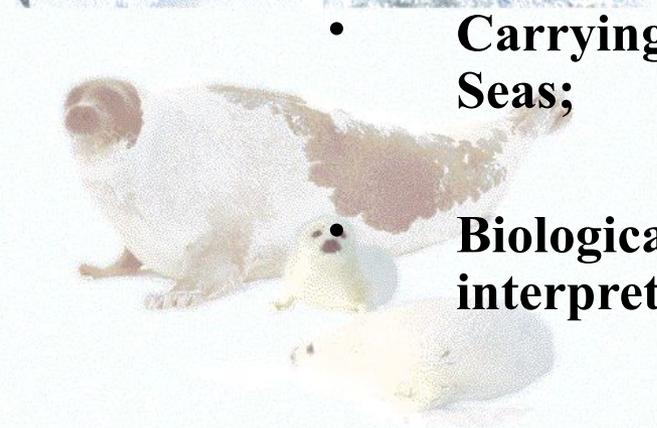




Harp Seal Adult Female With Pup Among the White Sea Ices on Whelping Patch



# **PRINCIPAL GENERALIZED RECOMMENDATIONS FOR THE WHITE/BARENTS SEAS HARP SEAL POPULATION RESEARCH (UNDER JOINT ICES/NAFO WG ON HARP AND HOODED SEALS - WGHARP)**

- 
- **Organization, preparing and carrying out of harp seal pup production aerial accounted survey in the White Sea including ice conditions monitoring here with additional research on search of correlation between ice situation and whelping patches distribution;**
  - **Carrying out of satellite tagging in the White or Barents Seas;**
  - **Biological materials collection, processing, analyze, interpretation and generalization including genetic analyses.**
- 



**Appearance of  
Research Aircraft  
Antonov-26 (AN-26)  
«Arktika» and its  
Main Technical  
Specification**

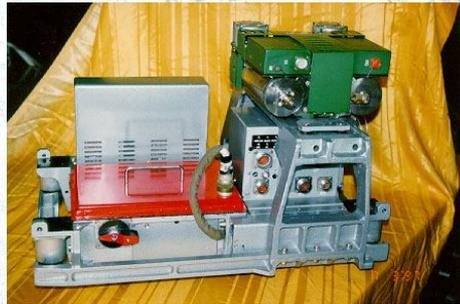
Maximum flight distance, km	3200
Maximum flight duration, hr	8-9
Number of board measuring complex	max. 14 (harp seal-8)
Number of places for board operators	8
Height of flight, m	100-6000
Speed range, km/h	250-400

# RUSSIAN RESEARCH AIRCRAFT AN-26 “ARKTIKA” REMOTE SENSING EQUIPMENT TECHNICAL SPECIFICATIONS FOR MULTISPECTRAL AERIAL SURVEYS



## Digital Camera «Nikon D1X»

1.	Image Size, pic.	3008x1960
2.	Die Size, pic.	5,470,000
3.	Sensitivity, ISO	125-800
4.	Exposure, s	30 – 1/16000
5.	Focus Distance, mm	28 – 80



## IR-scanner “Malakhit”

1.	Horizontal Resolution, mrad	1.55
2.	Field of View, °	120
3.	Sensitivity, °C	0.1
4.	Maximum Scan Rate, Hz	125
5.	Dynamic Range, bits	12

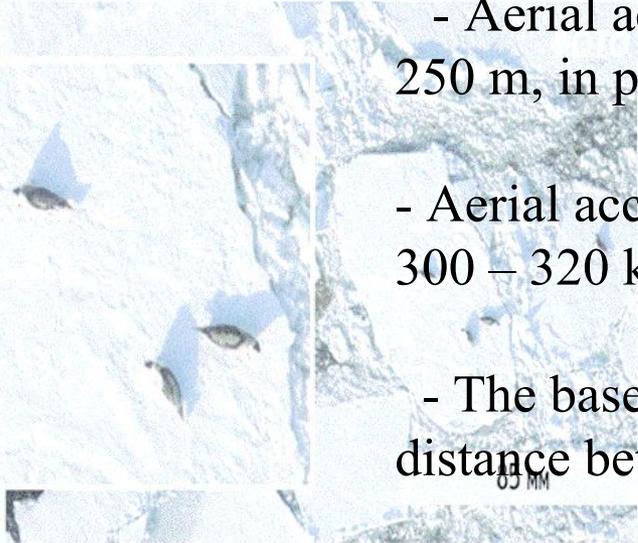


## Video System «Panasonic»

1.	Die Size, pic.	1,080,000
2.	Standard Illumination, lux	1400
3.	Exposure Range, s	1/50 – 1/8000
4.	Focus Distance, mm	3.55 – 35.5



# DATA ON RESEARCH AIRCRAFT AN-26 “ARKTIKA” EXPLOITATION IN AERIAL SURVEYS OF HARP SEALS WHELPING PATCHES



- Aerial accounted multispectral surveys altitude was 200 – 250 m, in principal – 250 m;

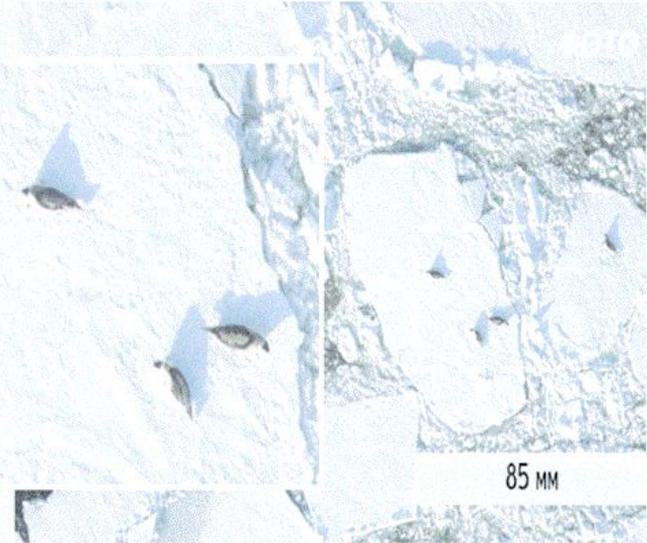
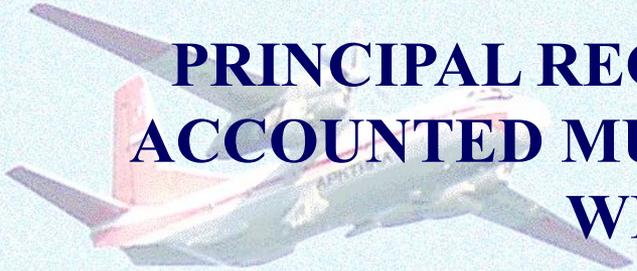
- Aerial accounted multispectral surveys flight speed was 300 – 320 km/h;

- The base accounted tracks were oriented along longitudes with distance between its 7,5 km, i.e. about 10' between longitudes;



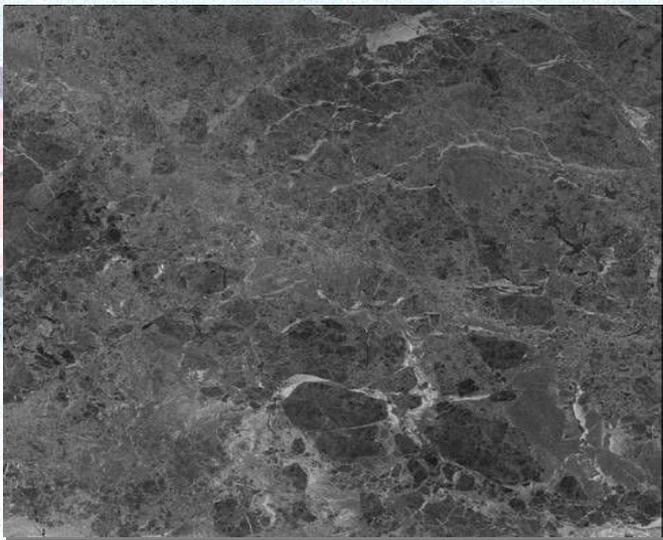
- Remote sensing equipments switched on when ice edge was crossed from open water and switched off when research aircraft reached coast or crossed ice edge again from ice to open water

# PRINCIPAL REQUIREMENTS FOR HIGH QUALITY ACCOUNTED MULTISPECTRAL AERIAL SURVEY ON WEATHER CONDITIONS

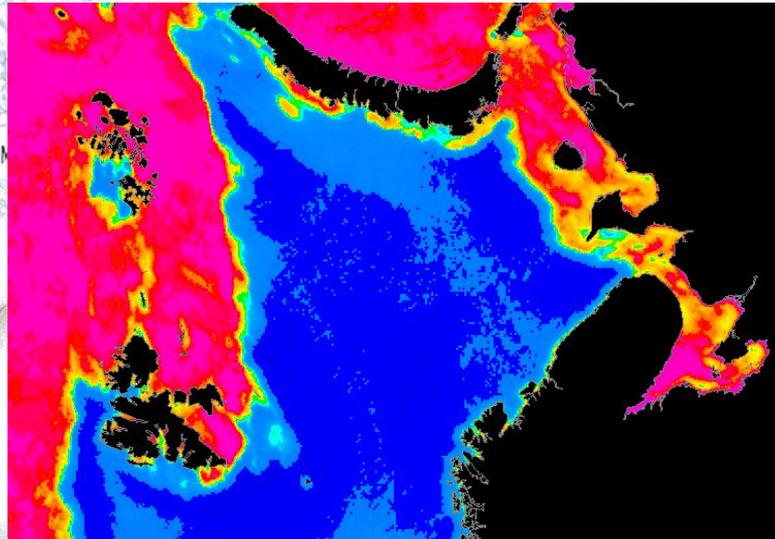


- **Wind speed – no more than 10 m/s;**
- **Absolute absent of precipitations, fogs, haze and other atmospheric phenomenon;**
- **Clouds low edge – higher than 250 m.**  
**Its meteorological conditions should observe in area more than 75% of aerial survey area simultaneously.**

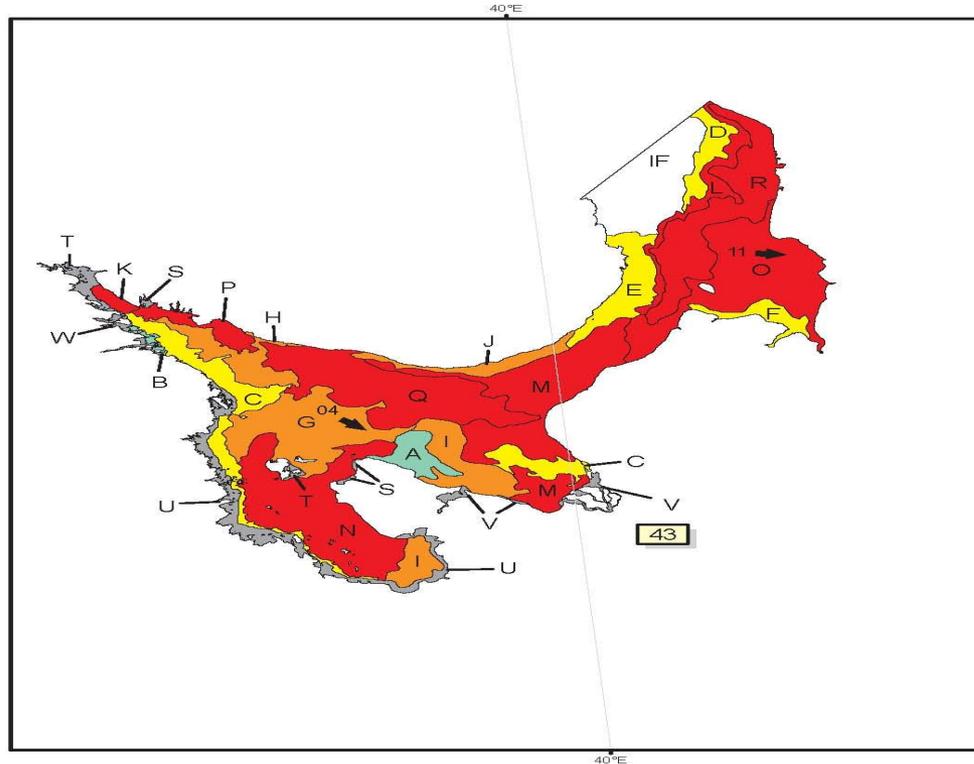
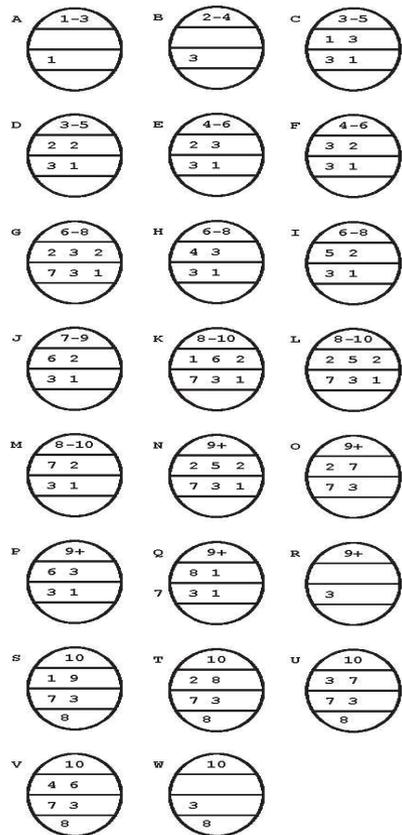




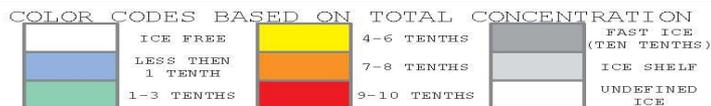
Examples of RARARSAT Image from ScanEX (here is March 15, 2009, right – full Image, left – part of it - increased)



Example of SSM/I Image from DTU (here is March 14, 2009)

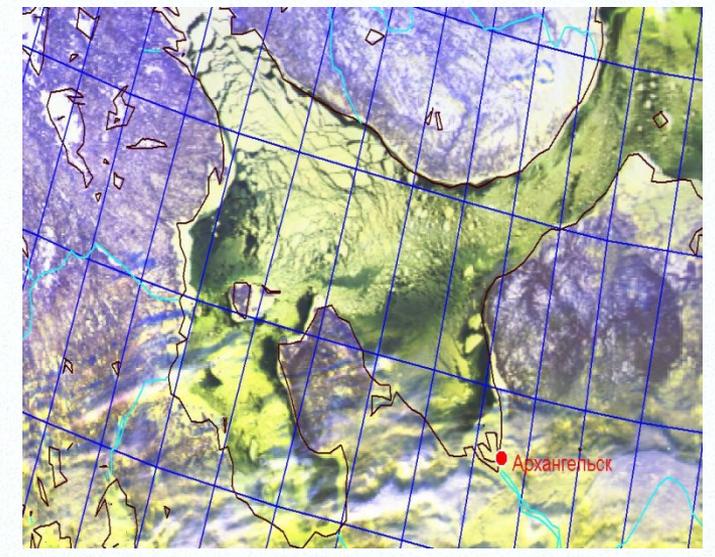
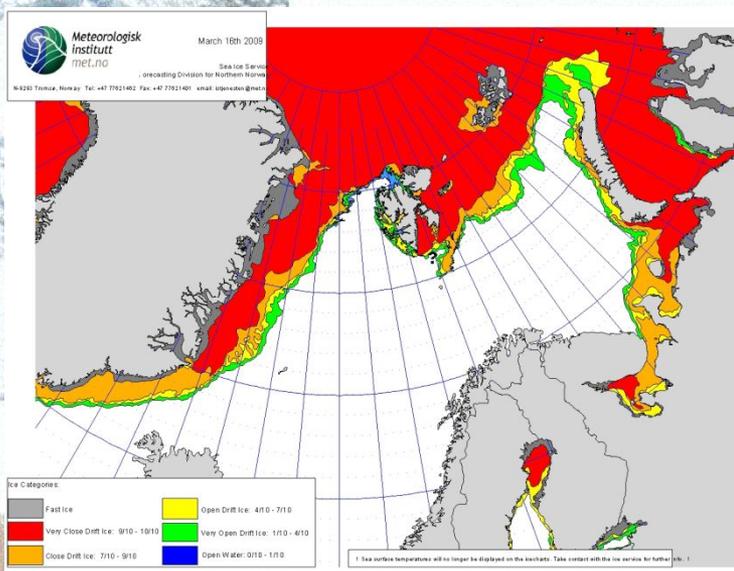
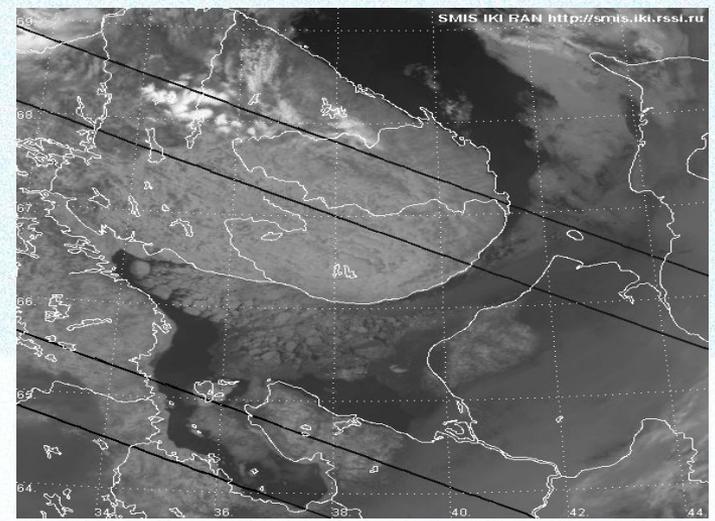
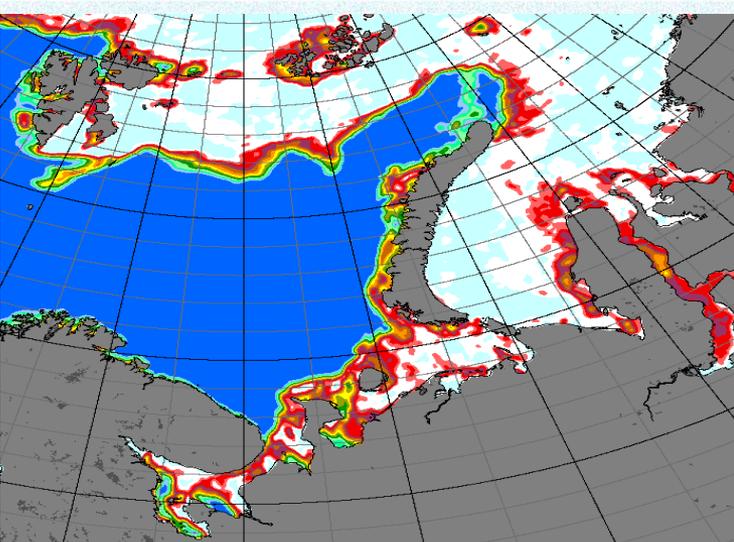


**CM** = THEORETICAL ICE THICKNESS IN CENTIMETERS  
**NM** = 168HR ANAL DRIFT VECTORS IN NAUTICAL MILES  
**IF** = ICE FREE



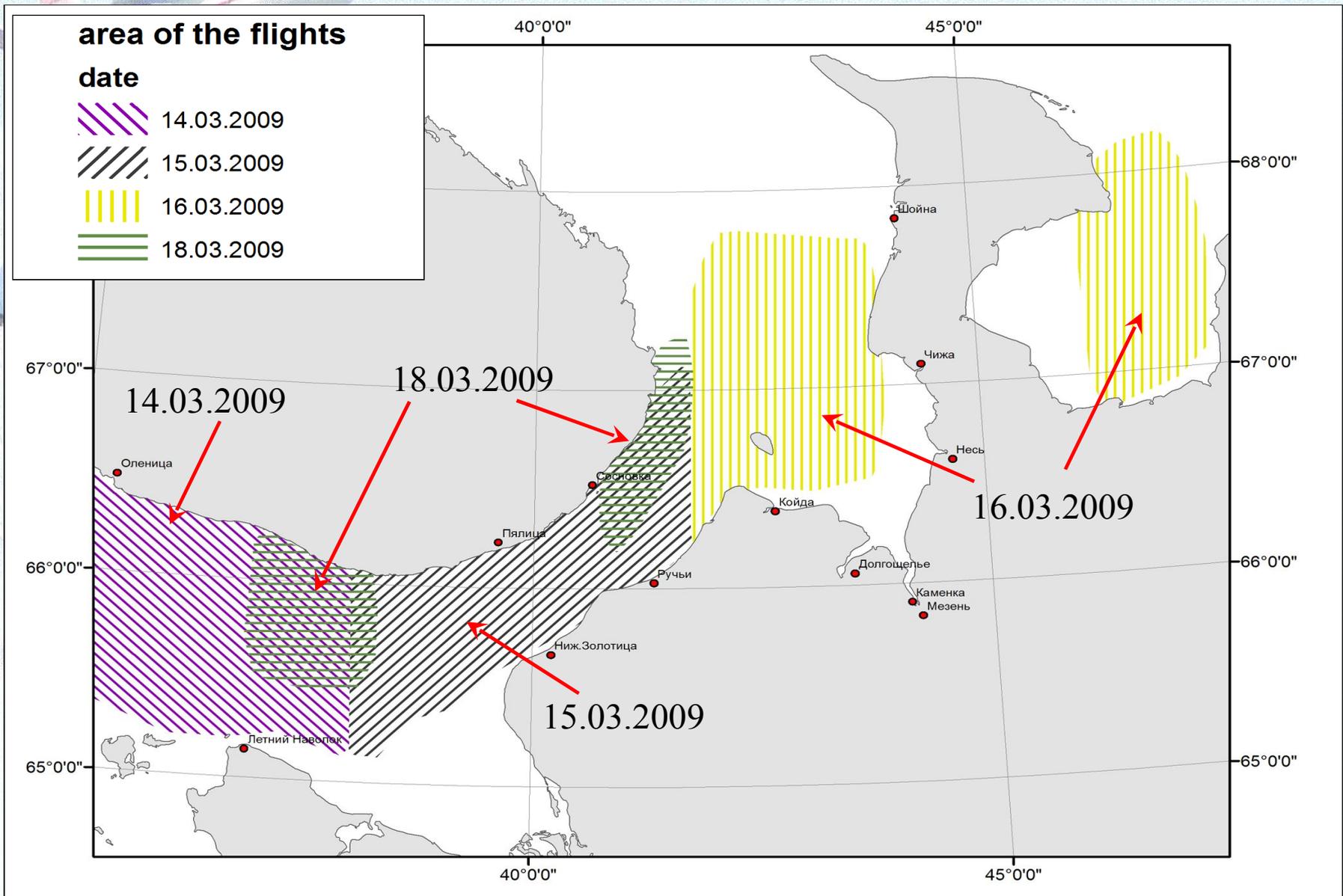
**ICE ANALYSIS**  
**White Sea**  
**NATIONAL/NAVAL ICE CENTER**  
 Analysis Week 02 - 06 Feb 2009  
 Data Sources                      Date  
 RADARSAT.....01 Feb  
 ENVISAT/GMM.....01 Feb  
 Analysts: Holmes, Georgette (NAVY CIV)  
**UNCLASSIFIED**

Example Complex Ice Map from NOAA National Ice Center  
 (here is time 02 – 06 February, 2009)

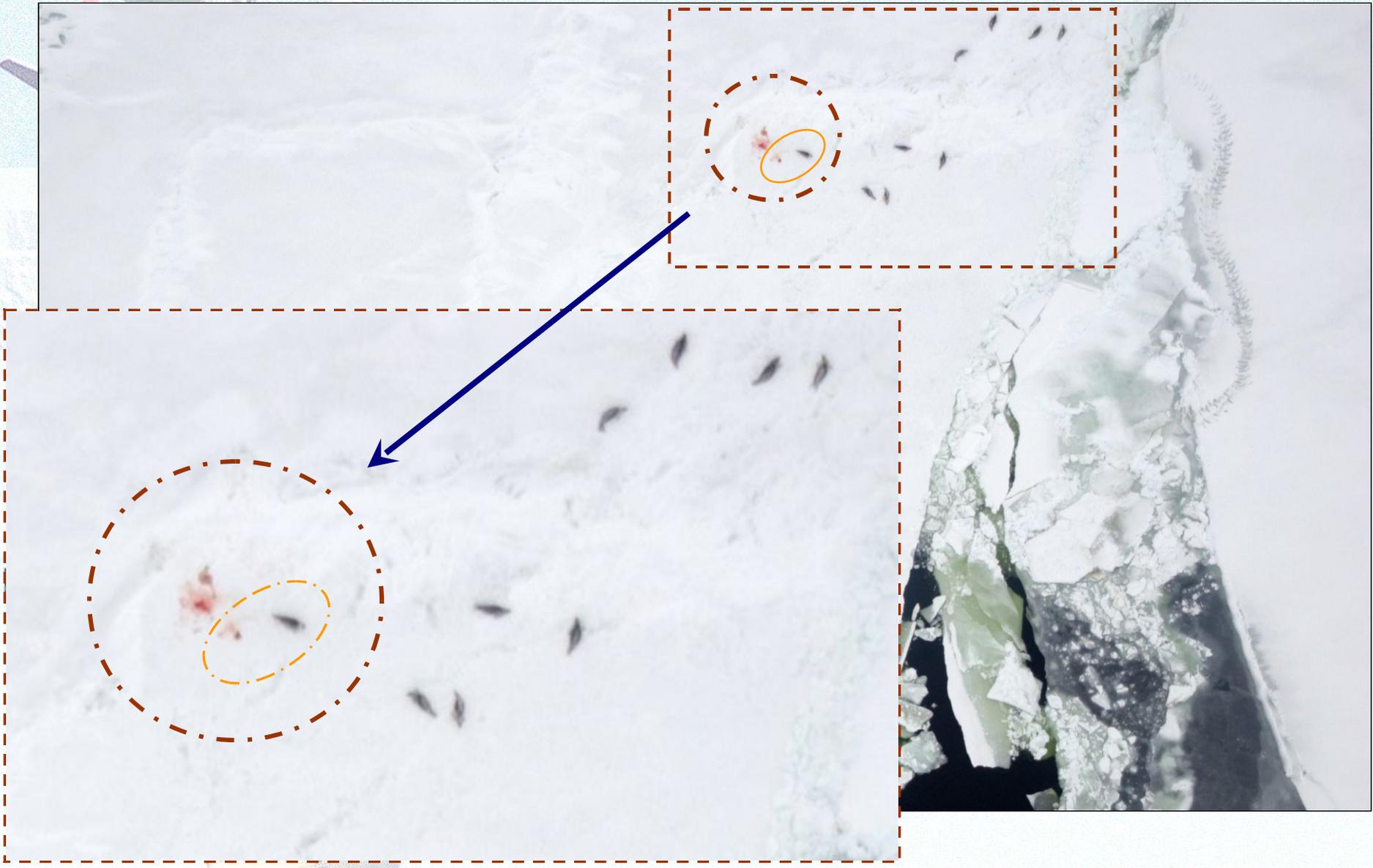


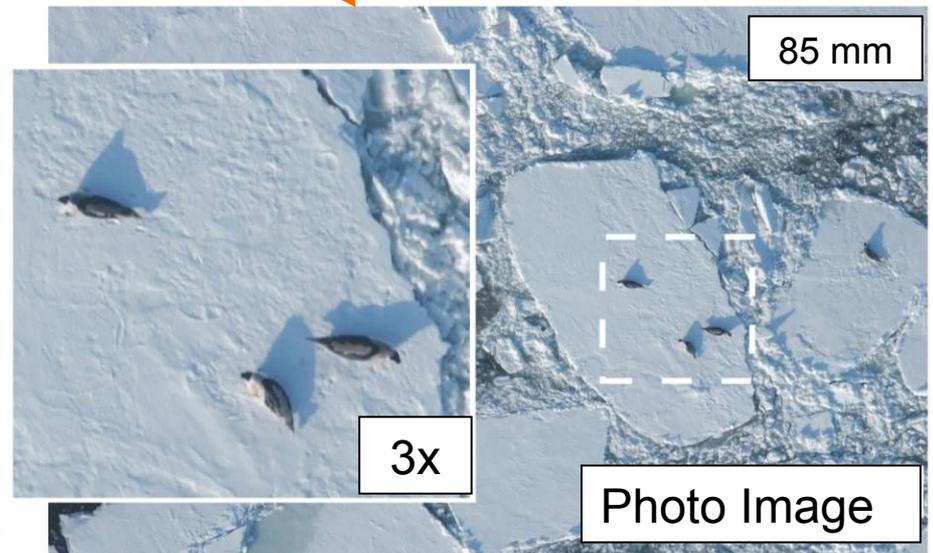
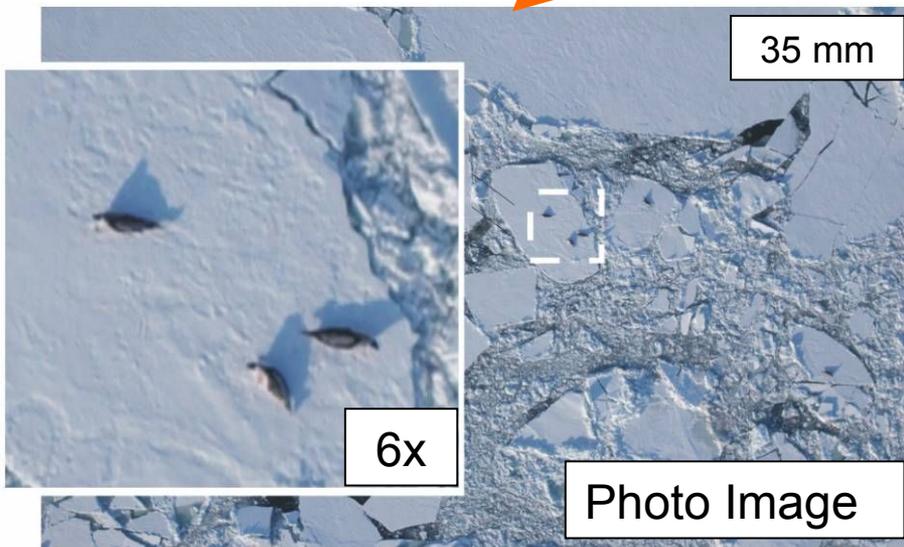
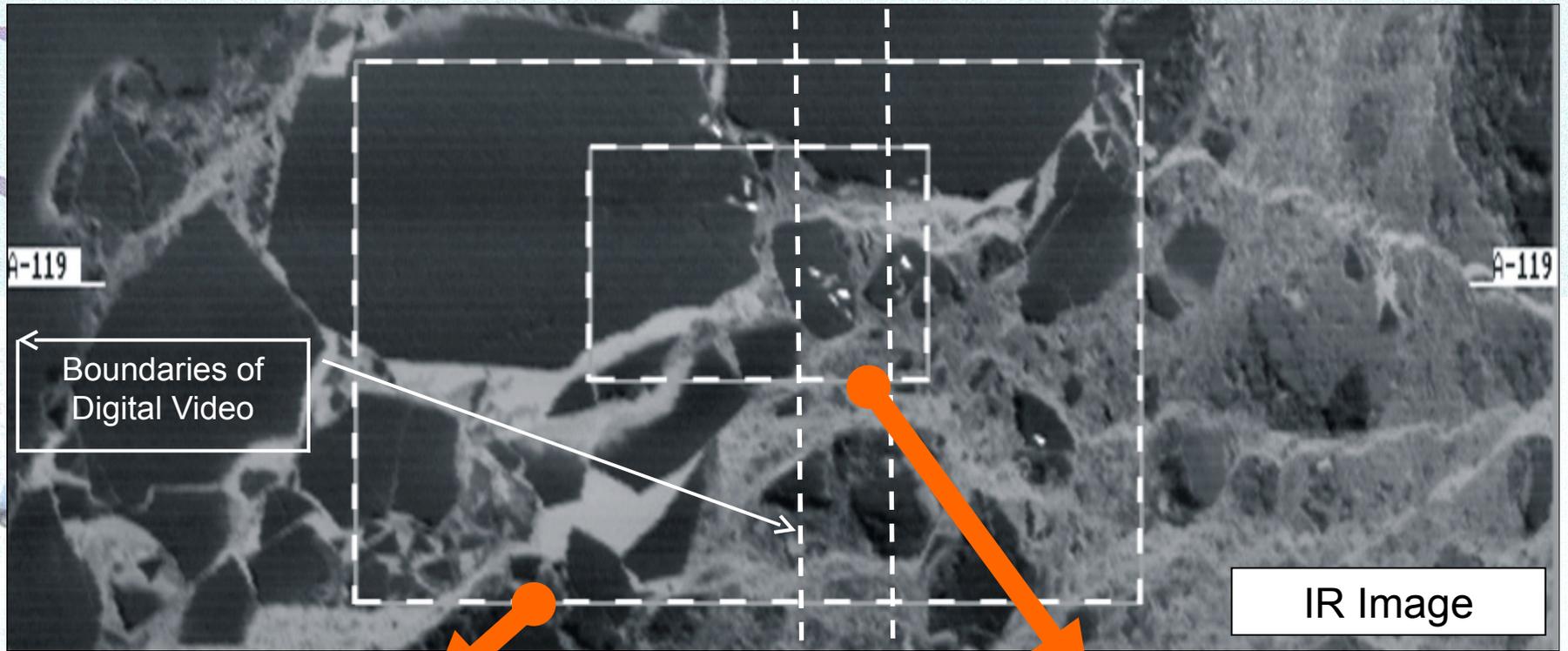
Examples with Ice Conditions Images, 1. Top: Left – AARI (March 17, 2009), Right – Russian Hydrometeorological Center (March 18, 2009); 2. Bottom: Left – NMI (March 16, 2009), Right – NHMC (March 11, 2009)

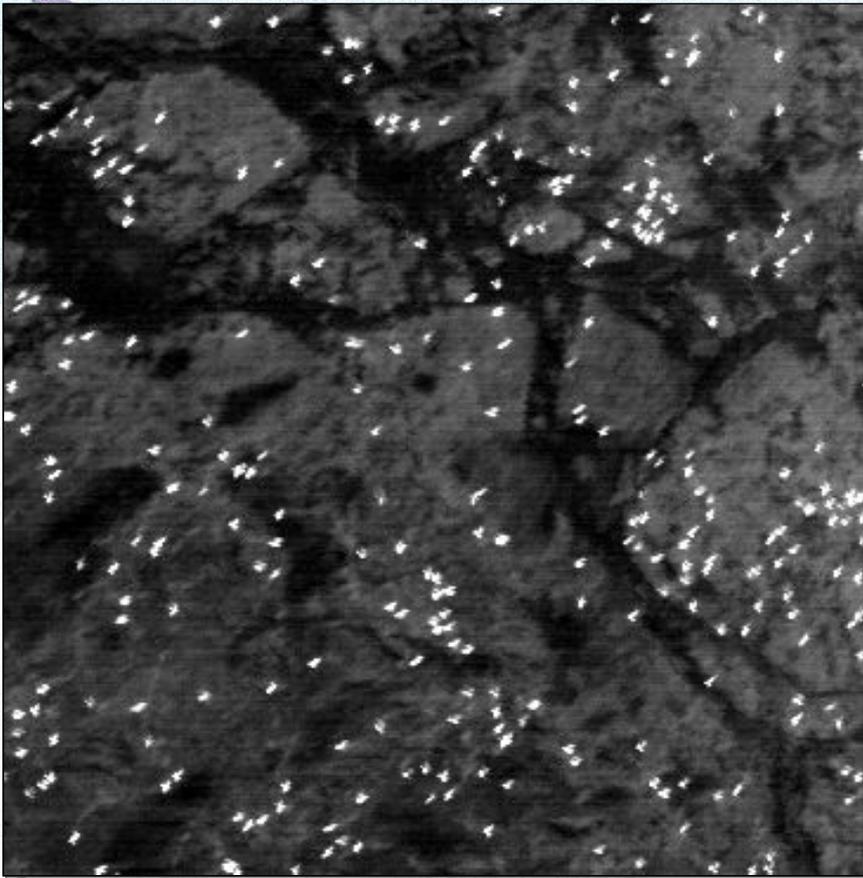
# DATES AND AREA OF ACCOUNTED MULTISPECTRAL AERIAL SURVEYS



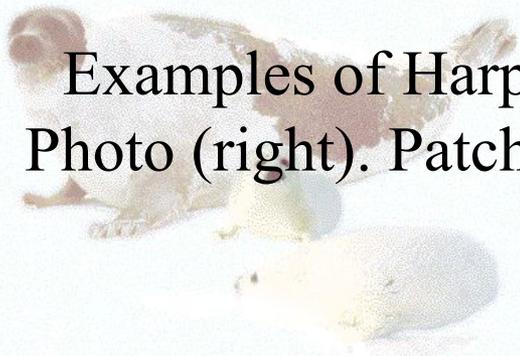
# EXAMPLE OF HARP SEALS WHELPING PATCHES



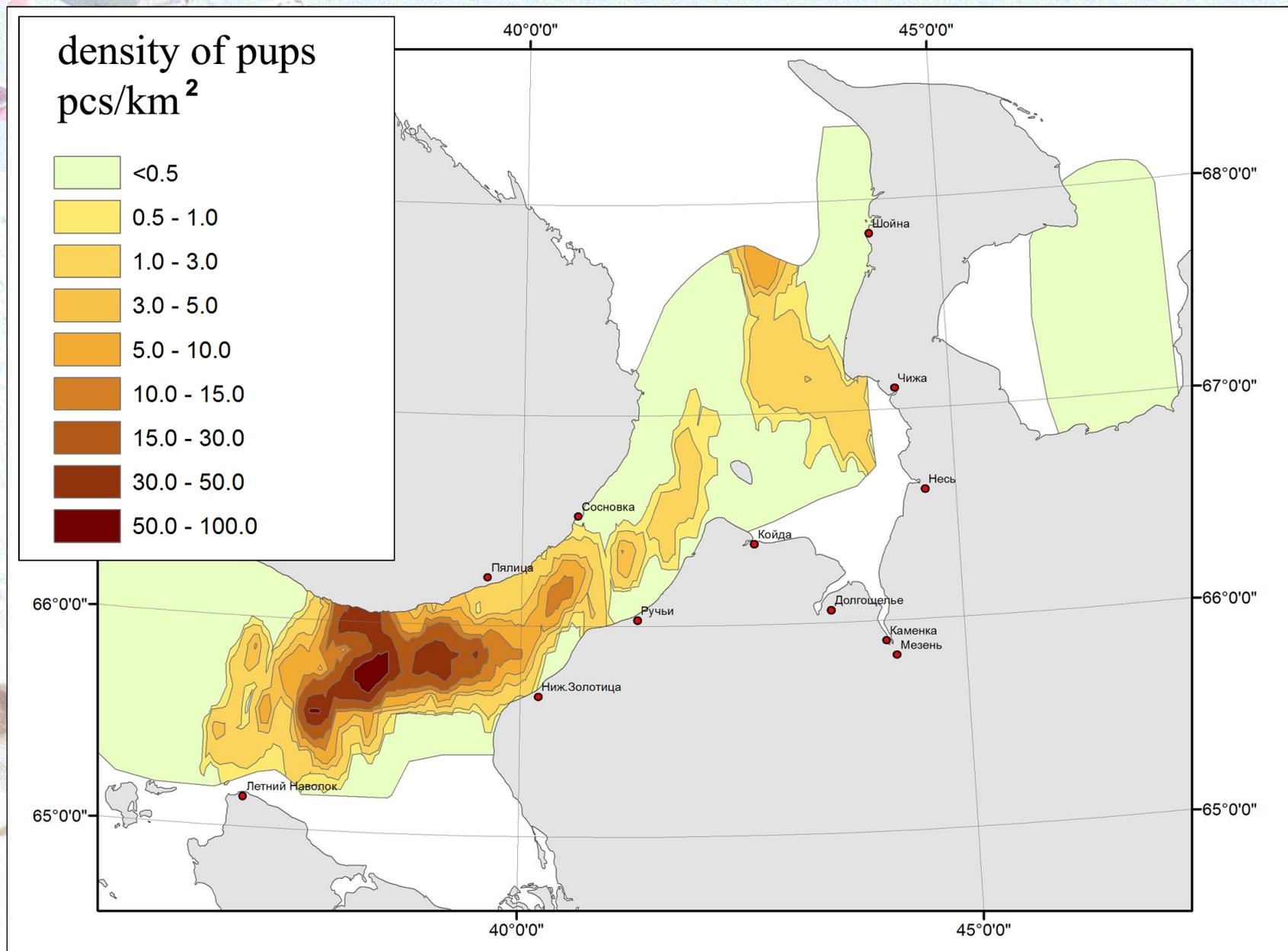




Examples of Harp Seal Whelping Patches on IR-image (left) and Photo (right). Patches on IR-image is High Density, and on Photo is Middle



# DENSITIS OF PUP PRODUCTION SPATIAL DISTRIBUTION



# THE WHITE/BARENTS SEAS HARP SEAL POPULATION PUP PRODUCTION ESTIMATED NUMBERS

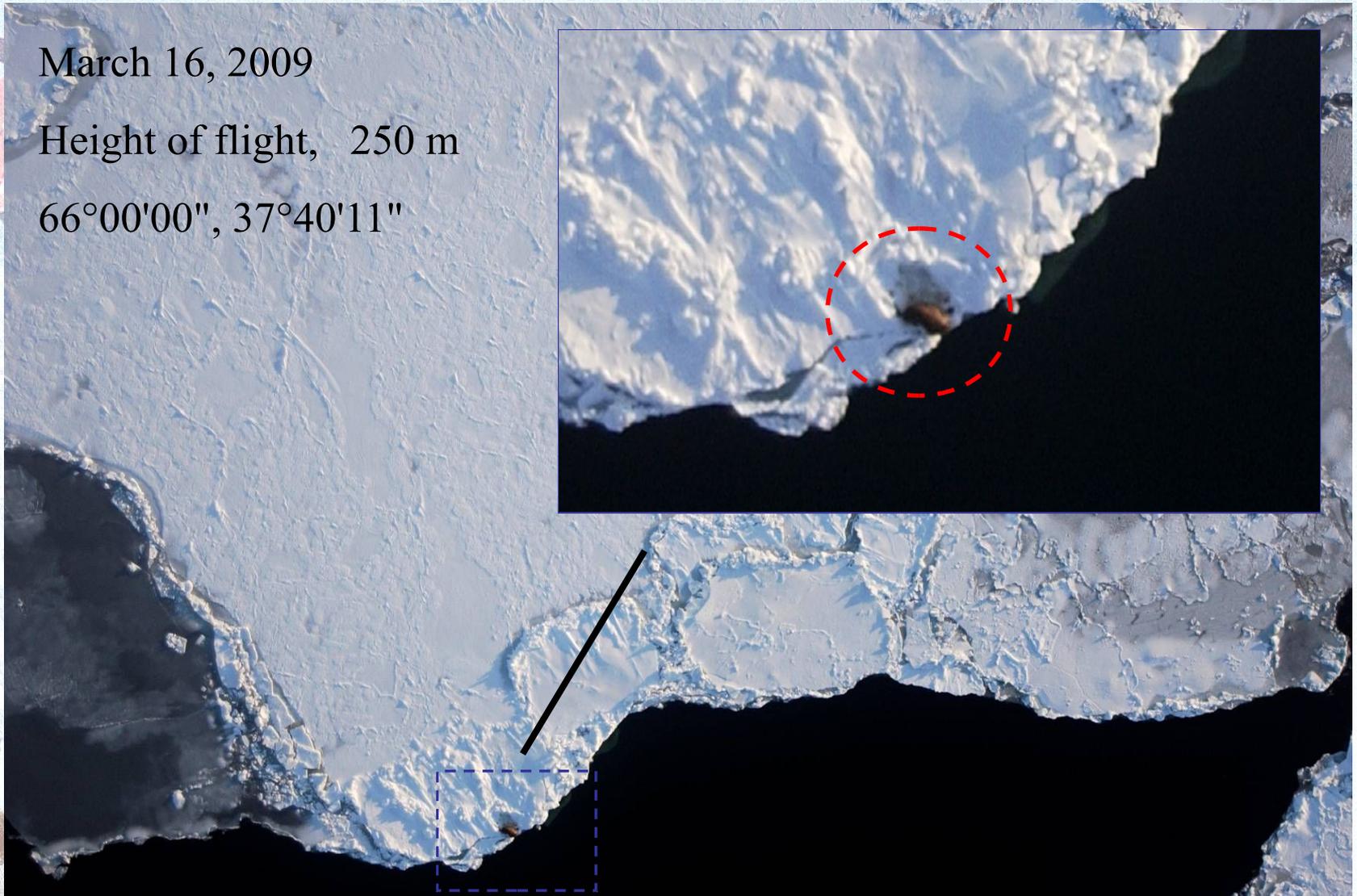
Year	Numbers of Harp Seal Pup Production (on M. Kingsly) Including Commercial Catches / Error (Pieces)
1998	286 260 / 43 000
2000	339 710 / 30 000
2002	330 000 / 45 000
2003 85 MM	327 000 / 41 000
2004	239 000 / 36 000
2005	122 658 / 19 900
2008	123 104 / 28 341
2009	157 000 / 17 000



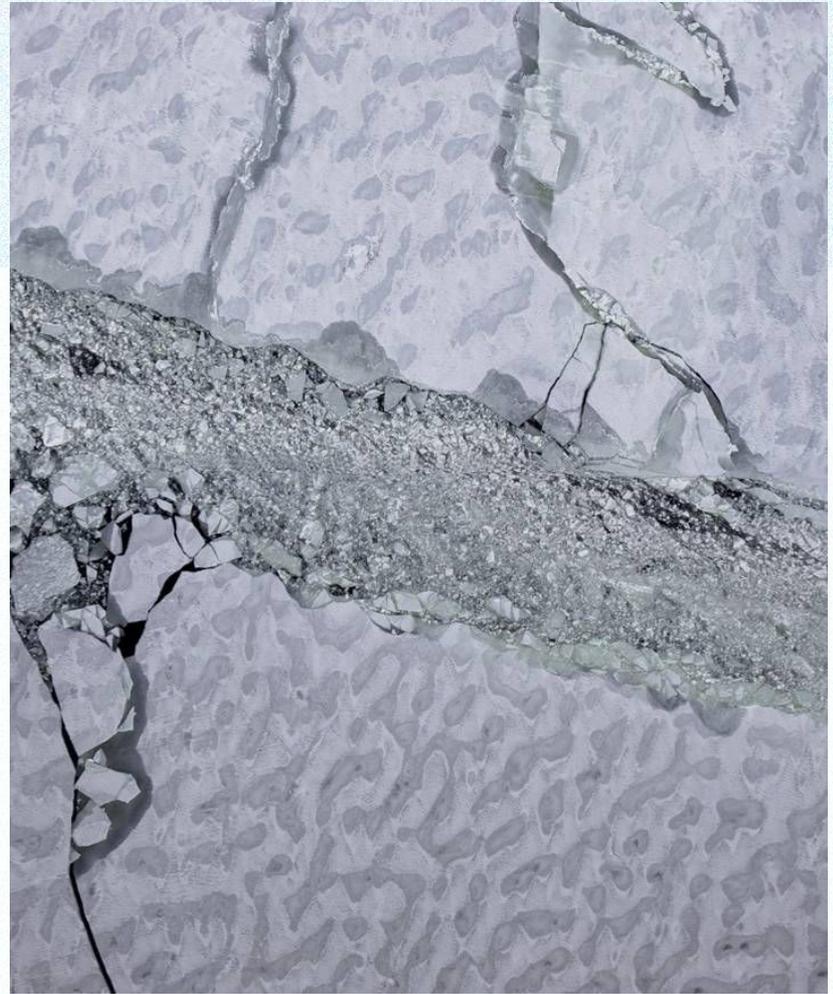
March 16, 2009

Height of flight, 250 m

66°00'00", 37°40'11"



Walrus Inside of the White Sea “Gorlo” South Part

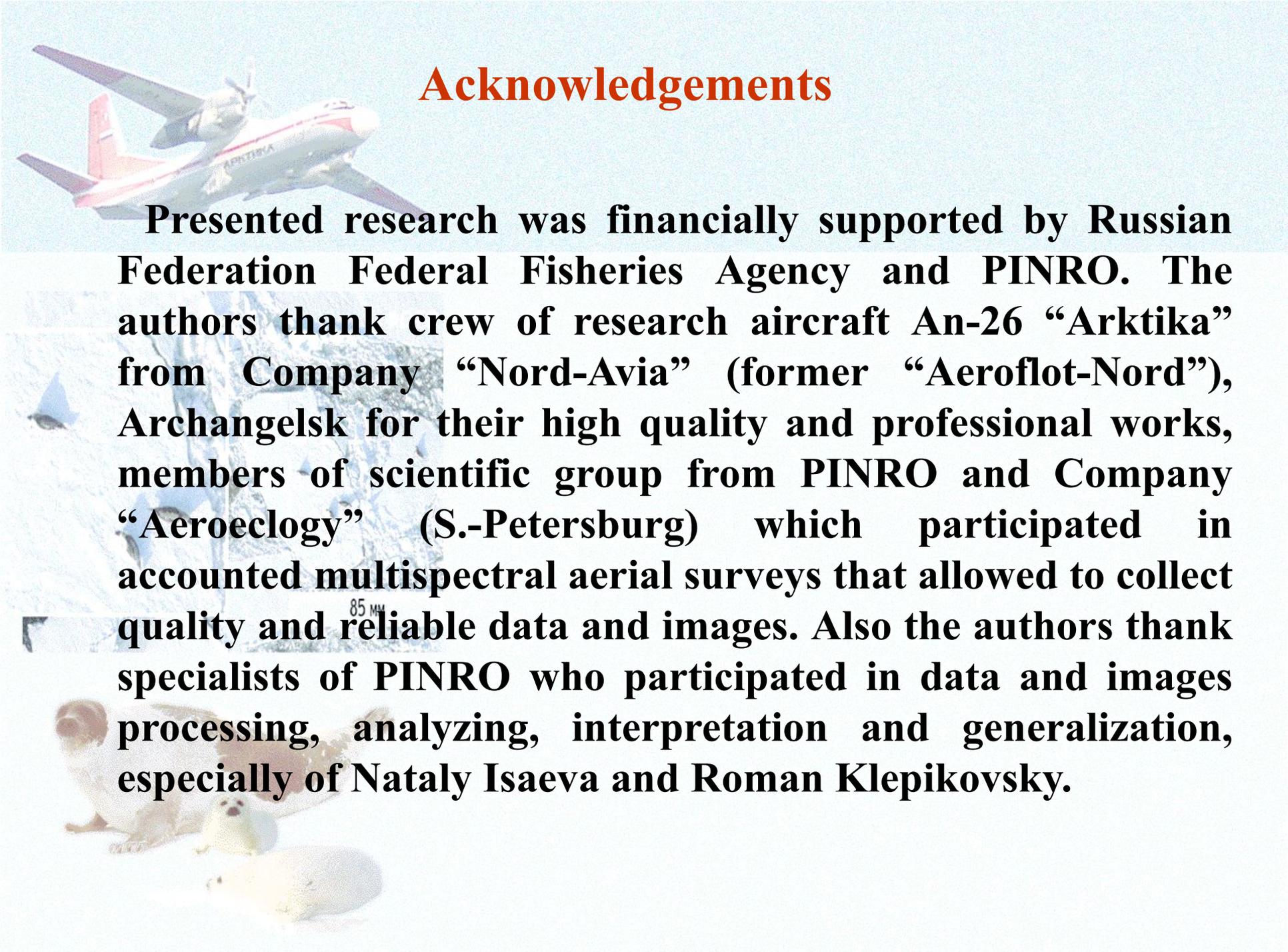


Example of Icebreaker Route



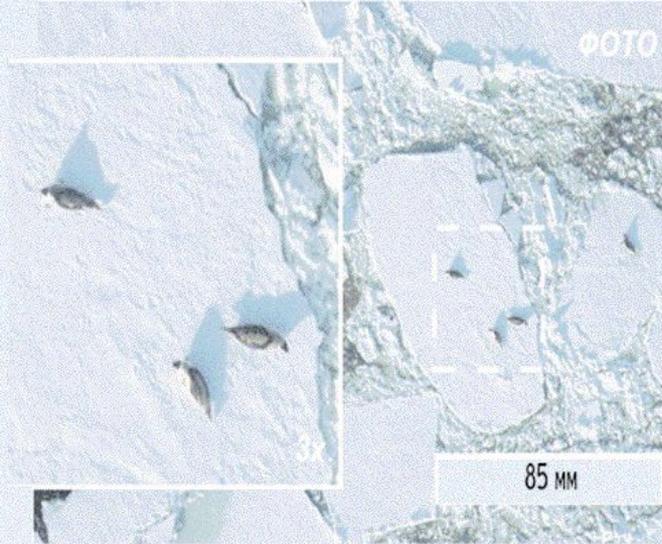


**Harp Seal Adult Female With Pup Among the White Sea Ices  
on Whelping Patch**

An-26 aircraft flying over a snowy landscape. The aircraft is white with red and blue stripes and has "ARKTIKA" written on its side. The background shows a snowy, mountainous terrain under a clear sky.

## Acknowledgements

Presented research was financially supported by Russian Federation Federal Fisheries Agency and PINRO. The authors thank crew of research aircraft An-26 “Arktika” from Company “Nord-Avia” (former “Aeroflot-Nord”), Archangelsk for their high quality and professional works, members of scientific group from PINRO and Company “Aeroeclogy” (S.-Petersburg) which participated in accounted multispectral aerial surveys that allowed to collect quality and reliable data and images. Also the authors thank specialists of PINRO who participated in data and images processing, analyzing, interpretation and generalization, especially of Nataly Isaeva and Roman Klepikovsky.



THANK YOU VERY  
MUCH FOR YOUR  
ATTENTION!

