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SEALS SURVEY BY IL-18 DORR PLANE

by

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#### ABSTRACT

To estimate seal stocks in the Greenland Sea in 1986-1991 the plane IL-18 DORR was used. The following equipment was used while estimating the seal stock with the help of this plane: handicam DXC-1800 CK (changeable focal distance 11-70 mm), VHS VO-4800 PS, monitor PVM-9000 ME, TV thermal device 780 produced in Sweden by the company of AGA. This device records the image by digital tape-recorder or the VHS. The visual angle of the scanner is 7 degrees and 20 degrees. The following equipment was also used: the plane camera PA-39, multizone plane camera MSK-4 and other equipment, including a computer on board the plane.

The results of aerial surveying concerning seals with the help of equipment mentioned above vary a lot, but as a whole they represent a multiform quantitative and qualitative characteristic of the object photographed.

## INTRODUCTION

To estimate the seal stock the Soviet scientists use the method of black and white photographing the seals, lying on the ice-floes and the method of visual counting of seals from planes, vessels, cutters, bikes, snow-tractors etc. The main difficulty in determining the number of seals of the Greenland Sea is the remoteness of this sea from sea-ports and air-ports. Yet in 50-60 years of this century both Soviet and Norwegian scientists made attempts of seal aerial photographing in the Greenland Sea. Beginning from 1986 the Soviet scientists have began to use four-engines aircraft IL-18 DORR for this purpose. This air-craft has the following qualities:

- maximum flight distance: 6 500 km
- maximum flight time: 12 hours
- flight speed ( altitude of 6 000-8 000 m ): 630 km/h
- flight when photographing: 350 km/h
- operating altitude diapason: 100-2 000 m

## TYPES OF AERIAL PHOTOGRAPHING OF SEAL STOCKS

In 1986-1991 the scientists on board IL-18 DORR the aerial photographing of harp seals and hooded seals on pup and moulting grounds and also pups aggregations of both species has been carried out. The optimum speed and altitude when photographing was determined by taking into consideration the seal stocks of the White Sea and during experimental photographing the harp seal pups in the enclosures located on the sea-coast of Koida peninsula.

The aerial photographing has been carried out with the help of the following equipment:

- VHS complex
- Thermal device complex
- AFA PA - 39, MSK - 4
- Devices of seal visual counting according to the " ANIMAL " program

## SHOOTING A VIDEOFILM OF SEAL STOCKS

A VHS of Japan company SONY ( a handi-cam DXC-1800 SK with a changeable focal distance 11 to 70 mm, video tape-recorder VO-4800PS with a power supply unit AS-340 CE, a monitor PUM-9000 ME ) was installed on board the plane.

The process of shooting a film was being organized in a way the seals could be seen on the display of the monitor and at the same time the maximum width of the sea area was in the focus. Good results of aerial photographing were received under following conditions:

Flight altitude, m	Lens focal distance, mm	Width of the sea area shot
250 - 350	15	137 - 164
400 - 500	30	110 - 137
550 - 900	70	64 - 100

After the experimental shooting a video film had been carried out the following results were received:

- no difference noticed in the results of shooting a videofilm when the flight speed was changing
- the optimum altitude of photographing with the use of translocator of 40 mm. is: harp seal pups at the age of "ragged jackets" - 200-300 m., hooded seal pups - 300 m., adult harp seals and hooded seals - 400 m.

When increasing the flight altitude the number of seals estimated was less than the true one. Thus, when shooting a film with a 15-mm translocator at the altitude of 400 m the number of "ragged jackets" was 10-50 % less than the true one, the 40-mm translocator - 0-50 %, 70-mm translocator - 0-15 %. The error started showing up when shooting a film at the altitude of more than 600 m.

#### THERMAL SEAL AERIAL PHOTOGRAPHING

The fact seals are the warm-blooded animals gives an opportunity to photograph them in the infra-red part of the spectrum with the help of thermal-vision devices. The thermal complex on board the plane represented by thermal-vision set (model 780, AGA, Sweden), which records the image through the digital tape-recorder, video tape-recorder. The visual angle of the scanner is 7 degrees and 20 degrees. The results of shooting a film are recorded on the audio and video tapes through digital image recording. The seals are represented by flickering dots on the display. The thermal aerial photographing data are processed by means of the apparatuses. To look through the films and to estimate seal stock the equipment mentioned above is used (thermal image recording equipment)

The quality of the aerial photographing depends upon the flight altitude and the lens visual angle. Good results are received when 7 deg. visual angle at the altitude of 100-800 m was used. The width of the sea area photographed was:

altitude 100 m -	12.3 m
400 m -	49.1 m
800 m -	98.2 m

The experimental photographing showed the flight speed doesn't influence the process of photographing. The optimum altitude to photographing the adult harp seals and hooded seals is 400-600 m, the pups - 100-300 m. Good results of estimation the stock by means of thermal method were received when the thinned out seal pup aggregations and the pups lying on the pack ice and dirty ice-floes were photographed.

The thermal device can't be widely used because of its low quality and relatively small sea area while estimating the adult seal stock, but when estimating pups stocks the use of this device gives fair effects

#### BLACK AND WHITE AERIAL PHOTOGRAPHING OF SEAL GROUNDS

A camera AFA-PA-39 is installed on board the plane. The qualities of the lens are following:

- focal distance: 100 mm
- visual angle: 54 deg.

- shot size: 7 x 8 cm
- exposure of curtain shutter: 1/700, 1/1400, 1/1800

Due to these exposures and good lens abilities the image displacement is not taken into consideration that makes possible to photograph when the flight speed is high and flight altitude is low. The harp seal pup grounds photographing shows that when the altitude of photographing is 270 m and higher seal pups photoes are rather distinct. The size of the pups photographed at the altitude of 250-270 m is 1.0-1.5 mm, adult seals - upto 3 mm (the photoes were enlarged x 2)

#### MULTI-ZONE AERIAL PHOTOGRAPHING

Multi-zone plane camera MSK-4 is a complex, consisting of an electronic unit, control unit and camera unit (camera). Due to this complex 4-channel negatives of 480 to 840 nm spectrum diapason can be received (in case changeable stripe light filters are available). The number of shots is 600 (film thickness - 0.18 mm), and 1200 (film thickness - 0.09 mm) in each of the 4 channels.

Not perforated aerial photographing film is used in MSK-4 (the width of the film - 70 mm). The useful square of the shot is 55 x 80 mm. Due to the lens of "PINATAR 4/125" type, a unit of image displacement correcting, a unit of angle displacement correcting an information is of high precision and capacity at the altitude of 2000-6000 m. It's possible to photograph using the degree of overlapping equal to 20, 60, 80 %

The photo-chemical processing of the film is done in labs. The shots are joint chronologically (according to the cross and longitudinal sections). Then the seal stock of all the ground is estimated.

#### ESTIMATION OF SEAL STOCK ACCORDING TO "ANIMAL" PROGRAM

For approximate estimation of seal stock by plane the program of "ANIMAL" is used. The estimation is carried out by scientists on board the plane along the route, the width of which is equal to 1/3 of the flight altitude. The width of the route (the angle of observing) is recorded through a blister and is controlled by means of goniometer.

During the experimental photographing the scientists on board the plane register not only the frequency of seals met, but also some other characteristics concerning stock, distribution and behaviour of seals. The registered information is input into the computer according to the "ANIMAL" program. At the same time the following information is input: time, co-ordinates in certain periods of time, flight altitude and speed, weather condition.