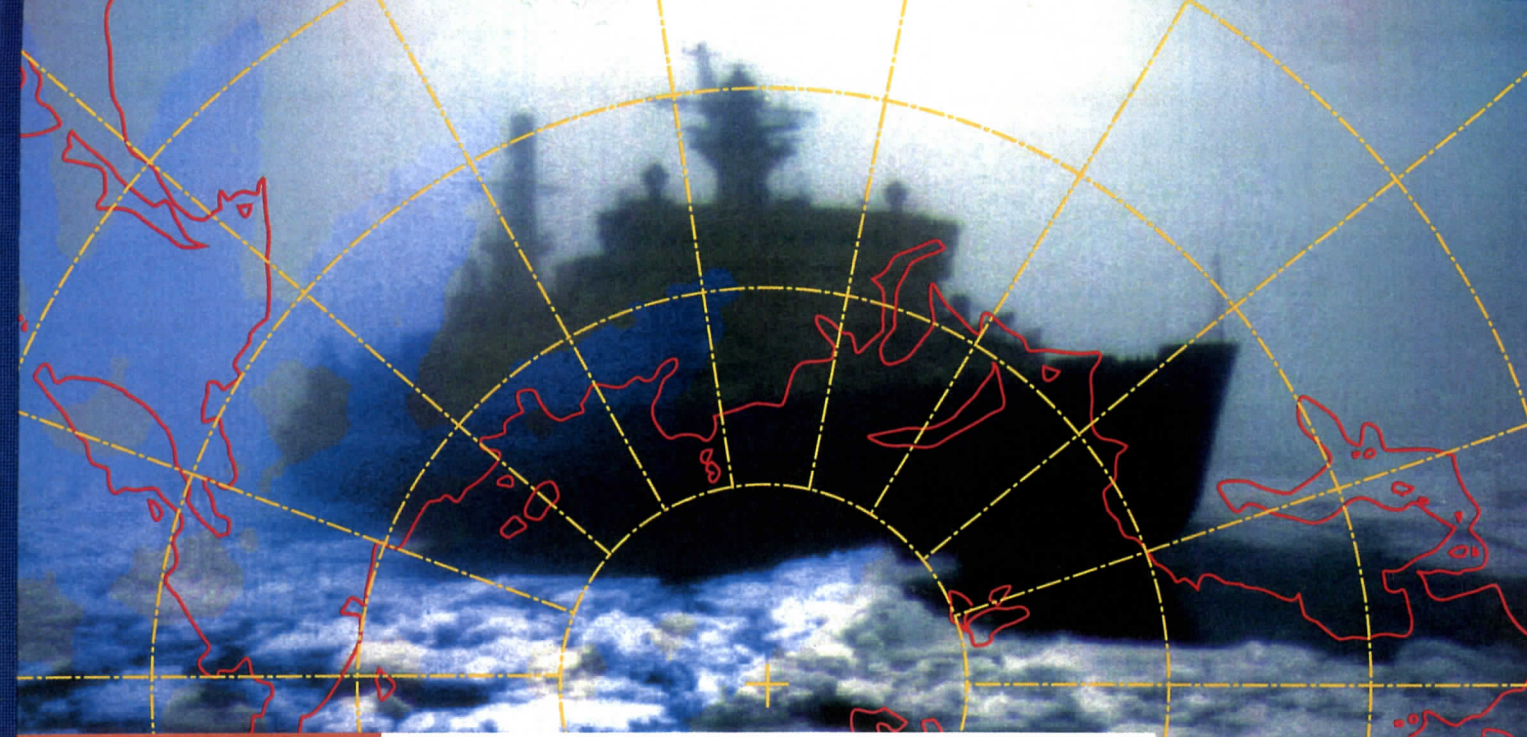
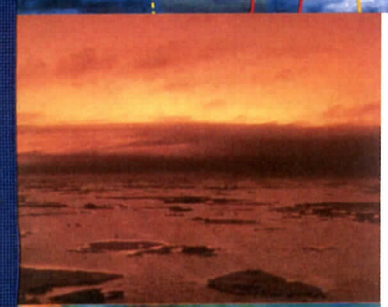
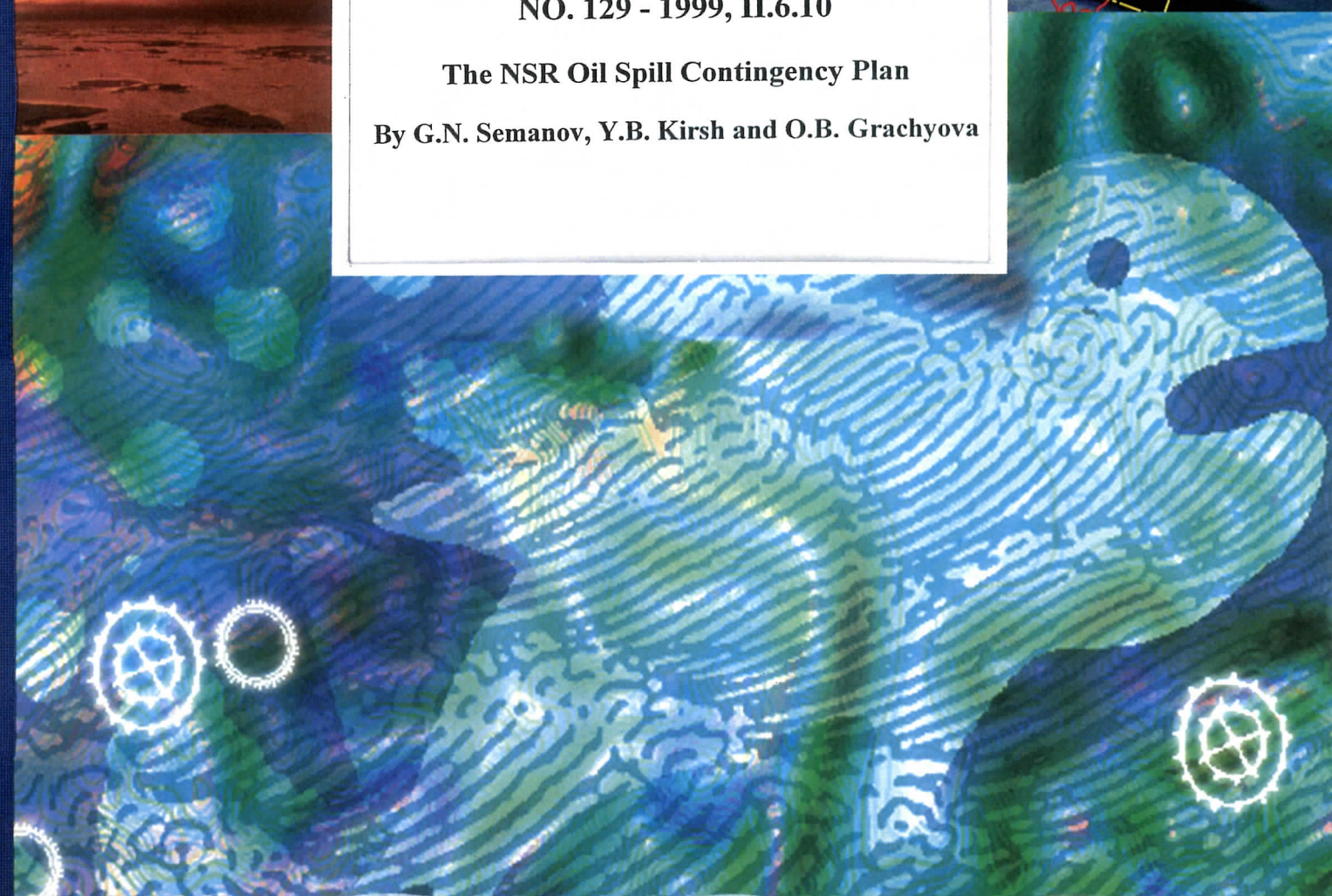




INSROP WORKING PAPER NO. 129 - 1999, II.6.10

The NSR Oil Spill Contingency Plan

By G.N. Semanov, Y.B. Kirsh and O.B. Grachyova



INSROP International Northern Sea Route Programme

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Sub-Programme II: Environmental Factors

Project II.6.10: Coastal Oil Spill Contingency Plan

Supervisor: Gennady N. Semanov, CNIIMF

Title: **The NSR Oil Spill Contingency Plan**

Authors: **G.N. Semanov, Y.B. Kirsh and O.B. Grachyova**

Address: Central Marine Research and Design Institute (CNIIMF)
6 Kavalergardskaya Street
193015 St.Petersburg
RUSSIA

Date: 21 January 1999

Reviewed by: Regional Director Victor M. Santos-Pedro, Marine, Prairie & Northern Region, Transport Canada, Toronto, CANADA.

What is an INSROP Working Paper and how to handle it:

FOREWORD - INSROP WORKING PAPER

INSROP is a five-year multidisciplinary and multilateral research programme, the main phase of which commenced in June 1993. The three principal cooperating partners are **Central Marine Research & Design Institute (CNIIMF)**, St. Petersburg, Russia; **Ship and Ocean Foundation (SOF)**, Tokyo, Japan; and **Fridtjof Nansen Institute (FNI)**, Lysaker, Norway. The INSROP Secretariat is shared between CNIIMF and FNI and is located at FNI.

INSROP is split into four main projects: 1) Natural Conditions and Ice Navigation; 2) Environmental Factors; 3) Trade and Commercial Shipping Aspects of the NSR; and 4) Political, Legal and Strategic Factors. The aim of INSROP is to build up a knowledge base adequate to provide a foundation for long-term planning and decision-making by state agencies as well as private companies etc., for purposes of promoting rational decisionmaking concerning the use of the Northern Sea Route for transit and regional development.

INSROP is a direct result of the normalization of the international situation and the Murmansk initiatives of the former Soviet Union in 1987, when the readiness of the USSR to open the NSR for international shipping was officially declared. The Murmansk Initiatives enabled the continuation, expansion and intensification of traditional collaboration between the states in the Arctic, including safety and efficiency of shipping. Russia, being the successor state to the USSR, supports the Murmansk Initiatives. The initiatives stimulated contact and cooperation between CNIIMF and FNI in 1988 and resulted in a pilot study of the NSR in 1991. In 1992 SOF entered INSROP as a third partner on an equal basis with CNIIMF and FNI.

The complete series of publications may be obtained from the Fridtjof Nansen Institute.

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PROGRAMME COORDINATORS

- **Yuri Ivanov, CNIIMF**

Kavalergardskaya Str.6
St. Petersburg 193015, Russia
Tel: 7 812 271 5633
Fax: 7 812 274 3864
E-mail: cniimf@neva.spb.ru

- **Willy Østreng, FNI**

P.O. Box 326
N-1324 Lysaker, Norway
Tel: 47 67 11 19 00
Fax: 47 67 11 19 10
E-mail: sentralbord@fni.no

- **Hiroyasu Kawai, SOF**

Senpaku Shinko Building
15-16 Toranomon 1-chome
Minato-ku, Tokyo 105-0001, Japan
Tel: 81 3 3502 2371
Fax: 81 3 3502 2033
E-mail: sofkawa@blue.ocn.ne.jp

Executors

The present report has been prepared by the following executors:

Semanov G.N.	- Dr., Head of the CNIIMF Laboratory, supervisor of project
Kirsh Y.B.	- Scientific Worker of the CNIIMF
Grachyova O.B.	- Engineer of the CNIIMF

Summary

The Northern Sea Route oil spill contingency plan (hereinafter "the NSR Plan") is a constituent part of the territorial and functional sub-system of the Single Russian system of ensuring preparedness and response to emergency situations. With regard for the Arctic conditions the NSR Plan consists of two regional parts: for the Western and Eastern sectors of the Arctic. Its main purpose is to ensure preparedness and response to oil spillages in the Arctic seas as well as coordination of interaction of Operations Control Headquarters (OCHq) established on a permanent basis in all Russian Federation subjects within whose limits lies the NSR (Yamal-Nenets, Dolgano-Nenets and Chukotskiy autonomous areas and the Republic of Sakha (Yakutia). The Headquarters is headed by the Chief of the Administration of the autonomous area/republic or by his Deputy. The Director of the Murmansk Regional Department is the Deputy Chief of the OCHq in the Yamal-Nenets and Dolgano-Nenets autonomous areas, while the Director of the Far East Regional Department is the Deputy Chief of the OCHq in the Chukotskiy autonomous area and in the Republic of Sakha (Yakutia). Besides, the representatives of the Emercom – the main coordinating body when dealing with any emergencies – are also the Deputy Chiefs of the OCHq.

The OCHq include representatives of large companies (shipping, oil prospecting, oil producing and fishery ones), navy, frontier service, bodies monitoring the environment quality. The owners of facilities where accidents occurred are engaged in the work of the OCHq. The plan describes in detail the distribution of the rights, duties and responsibilities of the OCHq officials. The main work on OSC rests on the RegDpt, the owner of the main bulk of the OSC equipment. The function of the on-scene commander of operations lies with the RegDpt or its representative.

When dealing with an oil spill the task of the OCHq includes the ensurance of proper cooperation of all forces and means for OSC, preparation of a final report on the results of OSC operation. If it is impossible to deal with a spill by own forces the OCHq asks for the assistance of the OCHq of the neighbouring Federation subjects, submits proposals to the SMPCSRA on establishing a federal OCHq and/or on rendering assistance from contiguous states. In the first place consideration is given to the variant of asking for the assistance from the countries with which Russia has appropriate agreements (Norway and Finland – the Western sector of the Arctic, the USA and Canada – the Eastern sector of the Arctic). At the usual time the OCHq arranges exercises and drills in actions connected with emergencies.

OSC operations are impossible without appropriate information support. In the first turn this applies to the contents of required information, its volume, order of receiving and transmitting. Therefore, the plan gives the diagram of notification, transmittance and reception of the information. Its contents and volume shall meet the requirements of the OPRC and Russian legislation.

The plan contains recommendations on the algorithm of taking a decision about the beginning of operations, the order of their documentation, gives a brief description of OSC technologies feasible in the conditions of the NSR.

Expenses for OSC including compensation for damages are reimbursed at the cost of the person responsible for reimbursement of a damage in the case of an accident connected with oil spillage. If, due to some reasons, this is impossible the operations are to be financed from territorial or federal ecological funds, from the reserve of financial and material resources of the Federation subjects within whose area of responsibility a spillage took place. At the Govern-

ment's decision the above-mentioned expenses are reimbursed from the federal budget. Forces and means involved in the OSC operations are paid from the reserve fund of the Administration of the Federation subject.

Diagram of communication and notification about oil spill, example of taking decision on oil spill combating, composition and structure of Operations Control Headquarters, technical means for combating the oil spills on NSR, inventory of floating facilities and aircraft means for combating the oil spills at sea, the information about volumes and directions of oil transportation over the NSR, the calculation of the probable amount of oil outflow, brief description of the behavior of spilled oil on open water and in ice conditions, detailed description of natural and hydrometeorological characteristics of areas of probable oil spillages are given in the plan as Annexes to it. The plan is approved and adopted by response organizations.

ABBREVIATIONS

CD and ES Hq	Civil Defense and Emergency Situations Headquarters which are territorial bodies of Emercom attached to subjects of the Russian Federation.
CES	Commission for Emergency Situations. A special body of the Russian Federation subjects which has been established to perform operations on dealing with emergency situations on the territory of a subject of the Russian Federation including operations for cleaning-up the shoreline and coastal zone from oil pollutions.
DM	Defense Ministry of the Russian Federation
Emercom	Ministry of the Russian Federation for Civil Defense, Emergency Management and Natural Disaster Response (Emercom of Russia). A body of power of the Russian Federation responsible for coordination of activities of departmental services while dealing with emergency situations.
Emercom RC	The Emercom Regional Centre. A body coordinating the work of the territorial CD and ES Hq
FERegDpt	The Far East Regional Departments of SMPCSRA
FFS	Federal Frontier Service of the Russian Federation.
INSROP	International Northern Sea Route programme
MOHq	Marine Operations Headquarters. Special navigational services of the Murmansk and Far East Shipping Companies directly performing ice operations at sea along the Northern Sea Route. Two MOHq have been set up – the Eastern and Western ones to direct operations in the Eastern (the port of Pevek) and Western (the port of Murmansk) sectors of the Russian part of the Arctic respectively.
MRegDpt	The Murmansk Regional Departments of SMPCSRA
NSR	The Northern Sea Route
NSRA	The Administration of the North Sea Route
OCHq	Operations Control Headquarters. A special coordinating and managing body of a subject of the Russian Federation established on a permanent basis to direct operations on combating oil spills at sea.
OSC	Oil spill combating (clean-up).
OSCO	On scene commander of operations
OSCP	Oil spill contingency plan

RCC (RCSC)	Rescue Coordination Centre (Sub-Centre) – territorial subdivisions of the SMPCSRA.
RegDpt	Regional Departments of the SMPCSRA in marine basins (for the NSR these are the Murmansk and Far East Regional Departments).
ROSCP	Regional oil spill contingency plan
SMI	Special Marine Inspection of the State Committee for Nature Protection and Natural Resources Conservation and Hydrometeorology (The State Committee for environment Protection)
SMPCSRA	State Marine Pollution Control Salvage and Rescue Administration of the Russian Federation

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1. GENERAL

1.1. To enforce the Federal Law "On Protection of Population and Territories Against Extraordinary Situations of Natural and Technical Character" the Government of the Russian Federation by its Decree No. 1113 of 05.11.95 has approved the Regulations on an Unified State System of Preventing and Combating Emergency the Situations (RSES).

Among the main tasks of the RSES are:

- maintaining permanent preparedness for the actions to be performed by the managerial bodies, forces and means intended for preventing and combating the emergency situations;
- creating reserves of financial and material resources for combating the emergency situations;
- combating the emergency situations.

The RSES integrates managerial bodies, forces and means of the Federal bodies of executive power, executive bodies of the RF subjects, local self-government institutions which authority covers settlement of the matters concerning protection of population and territories against extraordinary situations.

1.2.According to the Decree of the USSR's Council of Ministers No. 48 of 15.01.91 performance of oil spill response operations (OSR) in sea basins was entrusted to the State Marine Pollution Control Salvage and Rescue-Coordination Administration of the Russian Federation (Gosmorspassluzhba) consisting of the Head Office (HO) and Regional Department (RegDpt), with utilization of the forces and means of the co-operating organizations, ministries and departments of Russia as well as other states being involved in these operations on the international contractual basis.

On the NSR seaways the OSR operations are performed by the Murmansk (Western Arctic Sector) and Far-Eastern (eastern Arctic sector) Regional Departments.

1.3. The OSR operations in the water areas of ports, organizations and other economic facilities shall be performed by the relevant owners in conformity with their plans involving RegDpt in these operations on contractual terms.

In case of oil spill (oil slick movement) in the coastal sea area being under jurisdiction of the direct subject of the RF or loral executive bodies (city, settlement, etc) the OSR operations are to be performed by RegDpt only on the depths limited by the navigational and technical capabilities of the craft and equipment available for OSR (craft draft, depth of slick bar and oil recovery facilities, etc).

In case of where the coastal shallow and difficult to access sea areas as well as the coastline have bean polluted by oil the OSR operations shall be performed by the Commissions for Emergency Situations of the territorial executive bodies involving forces and means of organizations within their technical capabilities.

1.4. To organize the OSR operation in sea, co-ordinate the forces and means, ensure permanent preparedness and response to oil spills in sea each Federation subject is to be provided with Operations Control Headquarters (OCHq) (Annex 7). In case where a coastal strip has been polluted management of its clean-up operations is to be carried out by the Commission for Emergency Situations of the executive bodies of the Federation Subjects (CES).

1.5. The OSR operations are to commence immediately after the OCHq chief has made a decision to this effect based on the official oil spill notification or request from the owner of the object from which oil had flowed out.

1.6. Inopportune combating the oil spill in sea results eventually in the pollution of coastal strip of the adjoining territories, irreparable damage to flora and fauna. Expenses for manual and mechanical clean-up of coastlines of the polluted territories are incommensurably heavy (10-20 times higher than expenses for operations in open sea) and require vast manpower and financial resources.

1.7. The present regional Plan for Combating Oil Spills on the NSR (hereinafter referred to as the Plan) has been drawn up in compliance with the requirements of the International Convention on Oil Pollution Preparedness, Response and Cooperation, 1990 (OPRC-90) and with consideration for the Decree of the RF Government No. 924 of 03.08.96 "On Forces and Means of the Unified State System of Preventing and Combating the Emergency Situations".

1.8. The Plan is intended for ensuring preparedness and organization of the main OSR operations by the RegDpt forces and means with involvement of the co-operating organizations, coordination of activities carried out by the OCHq of the Federation Subjects.

1.9. Within the framework of the aim set forth the Plan stipulates the following main tasks:

- establishment of the basic principles of OSR organization;
- determination of composition of the facilities available at RegDpt and other organizations to be involved in the operations;
- coordination of activities when organizing the OSR operations;
- conducting of training and exercises, control over preparedness of the personnel and facilities.

2. THE RESPONSE AREA AND RISK ESTIMATION

2.1. The response area

A traditional practice of ensuring the shipping safety is a conventional subdivision of the NSR into two parts, eastern and western, with the 1250E frontier in between. With this in mind, it is reasonably to accept the same line to divide the response area in the OSCP plan. The western part of the Russian Arctic is under control of the MRegDpt and the eastern part under control of the FERegDpt. In view of a close relationship between the Barents Sea and the NSR's seas, the contingency plan for the NSR should cover not only the Laptev Sea, the Kara Sea, the East Siberian Sea and the Chuckchee Sea, but the Barents Sea as well. Such a need is understandable from the fact that major oil traffics and the off-shore production of oil, hence potential sources of larger emergency oil spills, are situated in the Barents Sea and the Pechora Bay. Then the boundary of the MRegDpt response area will go through the next points:

(A) 69047'N, 3005O'E;
(B) 69051'N, 31006'E;
(C) 70003'N, 32000'E;
(D) 74000'N, 32000'E;
(E) 74000'N, 33030'E;
(F) 73018'N, 33030'E;
(G) 73010'N, 34024'E;
(H) 73003'N, 36000'E;
(I) 72014'N, 40030 E;
(J) 73006'N, 40042'E;
(K) 73044'N, 41015'E;
(L) 74000'N, 41036'E;
(M) 74052'N, 41045'E;
(N) 75025'N, 43012'E;
(O) 76000'N, 43030'E;
(P) 76044'N, 44042'E;
(Q) 76053'N, 43005'E;
(R) 77045'N, 45015'E

and further along the boundary of the RF polar domain up to the point of crossing with a conventional line of the minimal ice extent (in July-October), then eastward, along this minimal line, up to the point of crossing with the 1250E meridian, then southward, along the 1250E, up to the coast line. As a whole, this boundary is the western limit for the FERegDpt response area. The eastern limit will be the state boundary between the Russian Federation and the United States, passing through the Chuckchee Sea and the Bering Strait.

2.2. Risk estimation

Based on the number of voyages and transported volumes (Annex 1) the statistically probable amount of spills per year is 0,02. The average expected size of oil spill on the NSR equals to 163 t by the year, the probable oil outflow from the "Samotlor" type tanker is 503 t and from the "Ventspils" type tanker is 207 t (Annex 2).

3. OPERATION CONTROL HEADQUARTER

In execution of the Federal law "Protection of population and territories against emergency situations of the natural and technogenic character" the Government of the Russian Federation by its Enactment No 1113 of 05.11.95 approved "Regulations on the single state system of warning and eliminating emergency situations". The system consists of territorial and functional sub-systems and has a few levels: a federal, regional, territorial, local and object one.

At each Federation subject the Operations Control Headquarters (OCHq) is established to arrange OSC operations at sea, to coordinate forces and means, to ensure preparedness and to respond to oil spillages at sea. In the case of shore-line pollution the management on its clean-up is effected by the Commission for Emergency Situations (CES) of the bodies of executive power of the Russian Federation subjects.
As applied to the Northern Sea Route OCHq are established in the Yamal-Nenets, Dolgano-Nenets and Chukotski autonomous areas and the Republic of Sakha (Yakutia). Coordination of interaction of the Headquarters is carried out within the Regional oil spill contingency plans

The OCHq are established on a permanent basis and summoned in the case of combating oil spills of more than 100 t or if it is impossible, due to some reasons, to deal with any oil spills by forces and means of the Basin marine pollution salvage departments (RegDpts). Proposals on summoning OCHq are made by the chief of the RegDpt, a territorial or regional body of Emercom. OCHq shall coordinate their action with the MOHq.

3.1. The tasks of the OCHq.

The task of the OCHq is organization of work on combating oil spills at sea and coordination of actions of the agencies taking part in the operations.

To fulfil the task set, the OCHq:

- collects and analyses the information about a spillage;
- prepares proposals on strategy and tactics of OSC;
- performs notification in accordance with the Diagram of messages passage (see Annex 8);
- assesses the need for involving forces and means for OSC including the means of co-operating agencies, and arranges their delivery to the area of spillage, appoints the on-scene commander of the operation, approves the Incident Action Plan.
- prepares the information about a spill, about taken and planned
- measures on its combating, studies the problem of shoreline pollution threat and sends all the information to the local authorities in whose waters a spillage took place as well as to the SMPCSRA and media; and also to the relevant services of the contiguous states in the case of a possible pollution threat to their waters or territory;
- takes decisions about the beginning, temporary cessation, resumption
- and termination of OSC operations;
- ensures control and execution of the announced pattern of the top-priority actions and approved Incident Action Plan of OSC;
- takes the decision on appealing to the higher level Commissions and SMPCSRA for assistance;
- executes operational management and coordination of actions by RegDpt strike team, divisions and services of cooperating agencies of other departments on OSC problems;
- maintains communication with the on-scene commander of the operations, with all participants in OSC operations and supervising agencies;

- systematically monitors the emergency situation and the progress of work in the area of spillage;
- keeps a record log in which are entered all instructions, reports from the area of spillage, reports to the SMPCSRA to the authorities of the area under threat as well as the results achieved;
- settles the problems related to the use of chemical and biochemical substances for combating oil spills;
- keeps the record of expenditures for spill clean-up, does not allow ungrounded involvement of personnel and equipment of cooperating agencies in OSC operations;
- invites, if necessary, experts (advisers) on problems related to OSC operations;
- after completion of an operation prepares a technical report, organizes the analysis of the way the OSC operation was conducted, conduct the final briefing and send the information to the appropriate organizations;
- arranges headquarters exercises in communication, takes part in marine exercises in oil spill combating, drills coordination and interaction, submits proposals on correction and perfection of the regional oil spill contingency plan.

On completing the operations the OCHq draws up a report about the work on oil spill combating which has been done.

3.2. Composition and structure of the OCHq

The composition and structure of OCHq are established in accordance with the diagram of Annex 7 and approved by the Central Department of the Marine Pollution Salvage Administration of Russia as well as by the appropriate Administrations of the Federation subjects located in the area which is covered by the Plans.

The OCHq includes: the Head or Deputy Head of the Administration of the Russian Federation subject in whose waters oil spillage took place, the Chief of the appropriate RegDpt (the Murmansk RegDpt – for the western sector of the NSR and the Far East RegDpt – for the eastern sector of the NSR), public information representative of Russian Federation subject, representatives of the CD and ES Hq of the Federation subject, of the Navy, the Federal Frontier Service, the ports of Murmansk and Nahodka (the areas of RegDpts basing), of shipping companies, of the special marine inspection of the State Committee for Environment Protection. Distribution of rights, duties and responsibilities among OCHq officials is given in Table 1.

Notification, procedure of work or summoning of OCHq members are performed on the instructions of the Head of the Administration (or the person acting for him) by dispatcher services and by men on duty from cooperating organizations. The place of muster and work of the OCHq is established there.

The Chief of the OCHq appoints a public relations officer to inform the public about the progress of the work conducted, his/her duties are shown in Annex 11.

In the case of absence of an OCHq permanent member (he may be on leave, on a business trip, ill, etc.) his duties are fulfilled by a person who acts for him in office.

Table 1

Distribution of the duties of OCHq members depending upon the sector of the Arctic

Participant in operation Position held	Duties
Chief of the Federation subject OCHq Head of the Administration of the territory in whose sea waters a spillage took place	He executes general management. Takes the decision on summoning the OCHq, on the beginning of the work related to spill combating, ensures interaction with ports, shipping companies, ship owners and other agencies. Carries out the work on providing OSC operations with required finances, transport, materials and technical facilities. Approves an Incident Action Plan of spill combating. Establishes and maintains communication with the OCHq nearest to the spillage area, with the SMPCSRA, with the public. If necessary, submits his proposal on summoning the CES. Organizes the work of the OCHq. Renders assistance in oil spill combating in areas of responsibility of other OCHq stated in the Plan. Upon agreement with the bodies of the State Committee for Environment Protection takes the decision about termination of the OSC operations. Coordinate their action with the MOHq.
Deputy Chief of OCHq Head of RegDpt	Carries out operative management in the port related to ensuring the fulfillment of the announced pattern of top-priority actions and of the approved plan by RegDpt divisions as well as by interacting divisions, obtains more precise information about the spill, determines requirements in additional technical means, works out and submits an Incident Action Plan to the Chief of the OCHq for his approval. If necessary, he executes direct management of the operation on the scene of the spillage. Ensures delivery of the personnel and equipment of the RegDpt to the area of spillage. Arranges preparation of the report on the progress and results of the operation conducted. Collects documents to assess expenditures on OSC, provides the OCHq with required legal and technical documentation.
Deputy Chief of OCHq Chief of CD and ES Hq of Federation subject or Emercom RC	Establishes and maintains communication with the authority of a coastal area under threat. Exercises coordination of actions of the OCHq and CES of coastal areas. Participates in assessment of a spill. Ensures assignment and delivery to the spill area of forces and means of Emercom, FFS, Navy and exercises coordination of their activities. Takes part in working out the Incident Action Plan.
Permanent Member of OCHq Chief of RCC or RCSC	Establishes the coordinates of the accident. Provides communication between a ship casualty and ships taking part in an OSC operation. Ensures collection of information about the area and conditions of spillage, the source of spillage; arranges communication of the OCHq with the on-scene commander on the site of the spill. Takes part in considering the Incident Action Plan.
Permanent member of OCHq Plenipotentiaries of shipping companies	Carries out operational management on execution of the announced pattern of top-priority actions and of the approved Incident Action Plan by services and divisions of shipping companies. Ensures sending ships to the area of spill which are designated for resolving concrete problems related to OSC. Takes part in considering the Incident Action Plan.
Permanent member of OCHq Deputy Chief of RegDpt	Takes part in working out and considering the Incident Action Plan. Carries out operational management on execution of the announced pattern of actions and of the approved plan by the RegDpt services. Organizes preparation of the report about the progress and results of the conducted operation. Collects documentation for estimating expenditures on OSC, provides the OCHq with legal and technical documentation.

Participant in operation Position held	Duties
Permanent member of OCHq Representative of the Department of hydrometeorology and environment monitoring	Ensures oil slick movement surveillance. Appraises the incoming information about the spill. Forecasts movement of the oil slick. Ensures issue of the information about the current hydrometeorological situation, short-term and long-term weather forecasts.
Permanent member of OCHq Representative of Special Marine Inspection of Federation subject and State Committee for Environment Protection	Exercises control over bringing the information about the oil spill to the notice of all organizations concerned. Controls effectiveness of conducting OSC operations. Appraises the threat of polluting areas under environment protection. Establishes communication with environment protection bodies, fish protection and sanitary inspection bodies. Takes decision about ceasing the work on OSC. Takes part in assessment of expenditures related to oil spill.
Permanent member of OCHq Public information officer (representative of RF subject)	Lead manager of OCHq for all spill related public information activities according Annex 11.
Permanent member of OCHq Chief of RegDpt strike team	Develops the working plan of the OSC operation, resolves the problems on the techniques of the work on OSC. He is the on-scene commander of operations at the place of spillage. On arrival at the area of the OSC operation, he deploys technical means and manages the work on OSC; coordinates actions of forces and means involved in the operation; establishes operational communication with the means of aerial and marine reconnaissance.
Permanent member of OCHq Representative of large oil-extracting or/and fishery companies	At the OCHq's inquiry he ensures allotment and delivery of technical means of his organizations to the place of oil spill; predicts a possible extent of spills.
Invited member of OCHq Dispatcher on duty from RegDpt	Arranges assembly (summoning) of the personnel of the strike teams and emergency party. Gives instructions to the captains of duty ships (cutters) on preparation for the work on OSC. Maintains communication with cooperating organizations.
Invited member of OCHq Representatives of Navy	Allots aircraft and helicopters and places them at the disposal of the OCHq for delivery of the personnel and OSC equipment to the air-field nearest to the place of the spill, and also for carrying out visual surveillance.
Invited member of OCHq Chief of Staff of FFS Arctic Group	Ensuring special regime measures. Rendering technical assistance in reconnaissance in the area of oil spill.
Invited member of OCHq Heads of sea port administrations in the zone of OCHq activities: as a rule, only the heads of ports nearest to the area of spillage are invited to the work of OCHq	Resolves the problems related to loading or unloading of technical means and equipment for OSC from depots onto ships' and automobiles, allotting ships to ensure the work on OSC. Ensures control and execution of the announced pattern of actions, the Incident Action Plan and instructions by the on-scene commander by the assigned ships and technical means of ports. In the case of a threat of polluting the waters of the ports under their responsibility they issue instructions on getting the port pollution contingency plans ready.

Participant in operation Position held	Duties
Invited member of OCHq Representative of Air Transport Department	Ensures allotting aircraft and their sending to the port of loading of OSC equipment with its subsequent delivery to the airfield nearest to the area of spillage.
Invited member of OCHq Clerk	Records the minutes of sittings and keeps all the documentation related to the work on OSC, including that of the OCHq.

3.3. On-scene commander of operations

For direct management of the work on OSC in the area of the spillage the Chief of the OCHq appoints the on-scene commander of the operation. Depending upon the extent of the spill and concrete conditions the commander can be the chief of the RegDpt or the head of the strike team. On arrival at the place of the spill the commander of the operation:

- carries out direct management of all the work at the place of the spill;
- proceeding from the specified situation determines and requests the necessary additional technical means and equipment;
- organizes maintaining the documentation related to the work on oil-spill clean-up;
- reports to the Chief of the OCHq about the progress of work on the containment and clean-up of the spill.

3.4. OCHq documentation

The OCHq is in good time provided with the following documents:

a) the regional oil spill contingency plan;
b) the International Conventions, the legislative acts of Russia, orders of the Ministry of Transport of the Russian Federation (or their set) on the problems of preventing and combating marine pollution;
c) manuals, instructions and regulations on organization of oil spill combating at sea;
d) the list of organizations and offices which can give a qualified consultation on the problems related to combating oil pollution of the sea (with the indication of telephone numbers, post and telegraph addresses);
e) the list of dispersants and other chemical substances permitted for use in the zone of responsibility of the OCHq;
f) the list of motor transport companies and organizations which can detail required means for transportation of the personnel and equipment to be used for OSC (with the indication of load-carrying and passenger capacity of such means).

3.5. Operations documenting, reporting

The whole chronology of events from the moment of the receipt of the message till the time of the return of the ships, waterborne and technical facilities to their permanent location shall be reflected in the log books of the ships participating in OSC and in the record-book of the OCHq.

In the working group of the OCHq there must be a responsible executor who will register the dates of events and messages, information about weather conditions and expenditures borne, description of operations and other data required for the further analysis and assessment of the results of OSC operations.

In order to determine the expenditures connected with the oil spillage and spill clean-up it is necessary to draw up and collect the documentation that should include, at a minimum:

- information about the source and circumstances of oil spillage with the indication of the degree of its reliability;
- information about the offenders or suspected offenders responsible for oil spillage (if possible);
- description and assessment of actions of the offender (suspected offender) responsible for oil spillage;
- description of the effect (potential effect) of the oil spillage consequences on the health of people, their well-being, environment and economic activities;
- list of all forces and means involved in the OSC operation with the indication of time of their employment in the course of the operation, including the time that was required for their delivery from the permanent location and back;
- generalized information concerning all expenses borne in the course of the OSC operation.

Collecting and keeping the above-mentioned documentation is done by the on-scene commander in the course of the OSC operation. Documentation collected is submitted by him to the OCHq.

The documentation collected by the on-scene commander should be readily accessible for the representatives of the State environment protection bodies.

An important point in OSC is taking samples of all types of oil that is on the casualty object, as well as the samples of the spilled oil. When taking samples it is essential to determine their authenticity. Therefore, the samples taken should be witnessed, and the containers with the samples should be properly sealed and labeled. Samples shall be taken by the representatives of hydrometeorological service or by authorized persons.

Within 30 days after the completion of the OSC operation (or in a shorter time) the OCHq is to prepare a report on the progress and results of the OSC operation carried out. The report shall be submitted to the territorial organ of executive power, to the SMPCSRA.

The report shall contain the following particulars:

- the source, circumstances and causes of spillage;
- the amount and type of oil products spilled, the character of pollution;
- the amount of oil recovered;
- the data of the analyses;
- the duration of separate stages and the OSC operation on the whole;
- information concerning the composition of technical means and personnel involved in the OSC operation, the extent of their employment;
- hydrometeorological and other conditions effecting the carrying out of the operation;
- assessment of operation of technical means, the revealed drawbacks of the serving personnel's qualification being mentioned;
- information about all material costs of the OSC operation and the character of the damage due to the spillage;
- considerations as to the effect of the spillage on the natural resources, recreation zones and installations with the evaluation of the damage, if possible;
- assessment of the instructions and recommendations by the OCHq and promptness of response to the inquiries of the on-scene commander of the operations;

- assessment of the promptness of summoning the OCHq members, working groups members and experts and of their activities during the whole course of the operation;
- assessment of the execution of the missions set by the OCHq and responses to the OCHq inquiries by the cooperating parties at the place of the spillage, as well as the assessment of their activities;
- assessment of completeness and timeliness of deploying forces and means determined by regional OSC plans, all cases of non-conformity to the established readiness being stated;
- assessment of the condition of communication with all cooperating bodies from the moment of the spillage signal passage up to the complete termination of the OSC operations;
- description and assessment of participation of public organizations and citizens in the actions on the OSC;
- description and assessment of coverage of the OSC progress by mass media;
- cases of non-fulfillment or incomplete fulfillment of the OCHq's missions by cooperating organizations at the place of the spillage with the indication of ecological, economic, social and other damage relating to these cases;
- conclusions, including recommendations on the prevention of recurrent oil spillages, improvement of carrying out OSC operations, corrections of the Plan, elimination of shortcomings and perfection of technical means.

4. APPOINTMENT AND INVITATION OF EXPERTS

In the case of oil spillages experts are invited for the work of the OCHq and for rendering assistance in the course of OSC operations.

The candidatures of the experts are appointed beforehand, in the procedure of implementation of oil spill contingency plans, and are approved by the Chief of the OCHq. The number and specialization of the experts are determined by the Chief of the OCHq or by the on-scene commander of the operation depending upon the extent or conditions of the accident.

Each of the experts in accordance with his specialization shall study home and foreign information and be in the know of the OSC problems requiring qualified and prompt decision on the spot.

When combating oil spills experts in the following fields may be needed (Table 2).

Table 2

Sphere of expertise	Names of organizations
– marine salvage;	MRegDpt, Murmansk, Vladivostok
– navigation;	MOHq, Murmansk, Pevek
– OSC techniques;	CNIIMF, St.Petersburg
– hydrometeorology and oceanology;	State Oceanographic Institute, Moscow
– environment protection;	Murmansk Biological Institute, Murmansk
– fish protection;	Polar VNIRO, Murmansk
– marine oil and natural gas prospecting;	Arcticmorneft, Murmansk
– aerial surveillance;	Local airlines
– civil engineering;	Emercom RC, St.Petersburg
– jurisdiction;	State Marine Institute, Moscow
– international law;	State Marine Institute, Moscow
– economics;	CNIIMF, St.Petersburg
– ecology;	Murmansk Biological Institute, Murmansk
– fishery;	Polar VNIRO, Murmansk
– use of booms;	CNIIMF, St.Petersburg
– use of oil-skimming equipment, dispersants, sorbents, bio-compounds, burning of oil at the place of spillage;	CNIIMF, St.Petersburg
– hydrometeorology, weather forecasting;	AART, St.Petersburg, MOHq, Murmansk, Pevek
– oil slick spreading and movement, taking samples and their express analyses;	State Oceanographic Institute (Moscow), Murmansk Biological Institute (Murmansk)
– shore-line protection;	Emercom RC
– destruction and disposal of non-recyclable oily materials.	Emercom RC

5. ORGANIZATION OF RECEIVING AND TRANSMITTING INFORMATION

The procedure of transmitting the information about pollution incidents is determined by the "Instructions on the procedure of transmitting messages about marine environment pollution" approved by the Deputy Minister of Protection of Environment and Natural Resources of the Russian Federation, by the Deputy Minister of Transport of the Russian Federation and the Deputy Chairman of the RF Fishery Committee in 1994, the Instructions being registered by the Ministry of Justice of the Russian Federation, No 598 of June 14, 1994.

The general principle of pollution messages transmission lies in the commitment of the masters of sea-going ships and other waterborne craft, civil aircraft commanders, executives fulfilling work on artificial islands and installations, the masters of foreign sea-going ships and other waterborne craft which are in inner sea and territorial waters of the Russian Federation as well as in the economic zone of Russia to notify about marine environment pollution in the following cases:

- incident with a ship or other object which has resulted or may result in discharge of oil and other noxious substances;
- detection of discharge of oil and other noxious substances from another ship or object in violation of the international and national regulations applied;
- spotting a spill of oil or other noxious substances.

The procedure of transmitting pollution messages from ships is also determined by the "Shipboard oil pollution emergency plan" which must be available on board a ship in compliance with the requirements of Regulation 26 of Annex I to the International Convention MARPOL-73/78.

The pollution messages are transmitted to the Rescue Coordination Centre (RCC) or the Rescue Coordination Sub-Centre (RCSC) in the marine basin.

The pollution message from ships is also transmitted to the organizations concerned with the ship, i.e. the shipowner, charterer, P & I Club.

The pollution messages from civil aircraft are transmitted to the air traffic controller.

To transmit a message about an oil spill at sea a standard format of such a message from the source (object) of effecting (or detecting) an oil spill has been introduced which includes, as far as possible, the following data.

For shipmasters:

- discharge or the possibility of discharge of oil as a result of damage of a ship or of its equipment;
- time of detection of the oil spill and its coordinates;
- weather conditions in the area of the oil spill (sea state, direction and speed of wind, visibility);
- character of the pollution and its extent (area);
- suspected source of the spill.

For the persons who are in charge of the work carried out on the artificial islands, installations and structures:

- location of the artificial island, installation or structure (coordinates);
- time of the incident;
- data about the installation, etc.;

- description of the incident;
- amount and concentration of the harmful substance discharged into the sea;
- weather conditions in the area of the incident;
- assistance required;
- measures taken on combating the pollution.

The man on duty of the RCC (RCSC) and the air traffic controller immediately notify the Administration of the Russian Federation subject, the RegDpt dispatcher (in compliance with the Order by the Department of the Merchant Marine, Ministry of Transport of the Russian Federation No 1 of January 10, 1994), the specialized marine inspection of the State Committee for Environment Protection and the SMPCSRA about the message received according to the pattern of notification presented in Annex 8.

The dispatcher on duty at the RegDpt after receiving the specified information about the spill transmits it to the Chief of the RegDpt for taking decisions, and also to the Hydrometeorological Service for taking operational measures on obtaining more specific information about the oil spill, surveillance and forecasting of the oil slick movement (research ships, aircraft, computer programmes).

In the case of an extensive oil spill at sea and the necessity to conduct OSC operations the Chief of the RegDpt informs the MPSA and proposes the Chief of the OCHq to summon the Headquarters members and gives orders about the beginning of OSC operations. In the case of the shore-line pollution threat he informs the local Administration, the territorial CD and ES Hq and transmits the necessary data to the bodies of the State Committee for Environment Protection.

The messages about the progress of the OSC operation are transmitted by the Chief of the RegDpt to the SMPCSRA, as a rule, once in 24 hours.

Urgent messages are transmitted as required.

At a minimum, the above messages shall contain the following information:

- amount of recovered or spread oil;
- data about the state of oil (fresh oil, water-in-oil, approximate thickness of oil film, sizes of oil slicks, direction of their drift);
- data about the quantity of waterborne craft, special equipment and personnel involved in the OSC operation;
- data about the hydrometeorological conditions in the area of spillage;
- data about the necessity to involve personnel and equipment from cooperating enterprises and organizations.

The messages about the termination of the OSC operations are transmitted to the SMPCSRA by the Chief of the RegDpt and shall contain the information about the results of the operation conducted, including:

- amount of recovered oil;
- reason for termination of the OSC operations.

All messages about oil spillages at sea shall be transmitted to the persons and organizations concerned without delay.

All notifications and information about an oil spillage at sea received by any divisions of interacting organizations are transmitted to the RegDpt without delay.

To ensure conducting OSC operations the following means and systems are used:

- departmental system of radio communication in the radio-telegraphy mode with the urgency mark "Oil-emergency";
- regional information-control centres;
- subscriber's points of the CD and ES Hq;
- inter-port wire communication of the Ministry of Transport;
- telephone and telegraph networks of the Ministry of Communication: town and trunk ones with the use of the code word "Distress", as well as special ones (the list of telephones, faxes, telexes is given in the form of tables with the cooperating organizations enumerated);
- VHF communication of aircraft and helicopters with ships on frequency 130.0 MHz.

All radio stations of ships participating in an OSC operation are operationally subordinate to the radio station of the "Headquarters ship" or "Support ship" and terminate the work at the instructions by the on-scene commander.

6. OIL SPILL COMBATING ON THE NORTHERN SEA ROUTE

6.1. Preliminary assessment of the situation and the beginning of the OSC operations

On the receipt of the information about oil spillage that occurred or was detected it is advisable to study it with the purpose of determining the type and amount of the pollutant, the source of spillage, threat to people and environment, possibilities of the spill clean-up.

The preliminary consideration may show that the situation can be assessed as follows:

1) The spill is small (less than 1 t) and can be properly dealt with by the responsible party, then the RegDpt should establish contacts with this party in order to render assistance, if necessary.
2) The spill is small but cannot be properly dealt with, then the RegDpt shall:
   - make prompt efforts for preventing further pollution and remove the pollution that has already taken place and is taking place;
   - jointly with the State Marine Inspection, inform the polluter about his liability for oil spillage consequences envisaged by the existing legislation. This liability shall include both the cost of the damage done and recovery of damaged natural resources, and all the expenses borne in connection with carrying out oil spill clean-up operations;
   - depending on a concrete situation, submit proposals to the Chief of the OCHq on the necessity of summoning the OCHq members.
3) The medium (about 50 t) and major (more than 50 t) spills cannot be dealt with at the local level or through the Contingency Plans available at the source of spillage, then it is necessary to summon the OCHq members, appoint the on-scene commander of the operation and to start the implementation of the Plan by full or partial deployment of personnel and equipment for the OSC.
4) Major spill (more then 1000 t) cannot be dealt with through implementation of the regional Plan, then it is necessary to raise the question before the SMPCSRA about involving additional personnel and equipment for the OSC, putting into effect the Federal Plan of OSC, applying for help to the states contiguous with Russia, in the first turn, to those with which Russia has agreements on OSC cooperation (Norway and Finland – the Western sector of the Arctic, the USA and Canada – the Eastern sector of the Arctic).

In the case of oil spillage threatening the coastal objects, the OCHq issues the proposal about summoning the CES whose task includes the clean-up of the shore-line.

For clarifying the characteristics of the spillage it is essential to organize the operational survey of the spillage area with the involvement of the personnel and equipment of cooperating organizations, as well as the inspection carried out by the on-scene commander at the place of spillage. The survey of the area shall be documented (with the minutes, facsimile and other maps, diagrams, photographs, etc.). The documents are to be presented to the OCHq for planning the operation and their use in the work on OSC.

The OCHq inquires of the hydrometeorological service centre nearby the oil spillage area about the actual weather and the forecast of the weather in the oil spillage area for the next 6, 12, 24, 48 hours.

After analyzing the information and weather forecast, as well as the forecast of spreading and movement of the oil slick, the OCHq makes a decision on the start of the OSC operation about which they inform the cooperating and concerned organizations.

In view of the fact that the most important factor determining the success of the OSC operation is the factor of time, the promptness of taking well-grounded decisions on involving the available personnel and technical means becomes of paramount importance. It is especially important to establish priorities for OSC operations and to choose the variant of organization and technology that may be optimal in the given conditions.

An exemplary algorithm of making a decision on oil spill clean-up and an algorithm of making a decision on carrying out OSC operations in coastal waters are given in Annex 9.

The most important and top-priority action in OSC at the place of the incident is the stoppage or confinement of the oil outflow from the spillage source (vessel, oilrig, etc.). Organization of these actions should be carried out in contact with the nearest Headquarters of Marine Operations, with the administration of the spillage source acting in accordance with their plans, in particular, "Shipboard oil pollution contingency plans". In case the ship is within a convoy, the master of the leading ice-breaker is in charge of these operations.

Immediately, after the receipt of the message about the spillage, the system of forecasting the spread of oil shall be engaged for evaluating the necessity to protect the shores and zones of priority protection the list and coordinates of which are given in the "Ecological Atlas of the NSR" and on Annex 4.

Simultaneously, right after the receipt of the message about the spillage, the means of the "first strike" shall be sent to the place of spillage as oil spreads so fast that the least delay may sharply reduce the effect of all further actions in OSC.

6.2. Containment, skimming and delivery of recovered oil

As the members of the OCHq are summoned and the schedule of top priority actions is adopted, the OCHq shall start the organization of the OSC work according to the duties and responsibilities of the officials (see section 3).

The main measures on the containment and clean-up of the spill are:

1) taking samples for determining the properties of the spilled substance;
2) prevention of further outflow;
3) installing defenses that prevent spreading of discharged substance and contamination of areas sensitive to pollution;
4) diverting the spilled substance or casualty into the zone suitable for carrying out OSC operations;
5) skimming the spilled substance from the water surface;
6) delivery of recovered pollutants to the shore;
7) dealing with the spill by means of physical and chemical methods.

To make a right decision it is necessary to take a sample of spilled oil to determine viscosity, density, chilling and kindling temperatures.

Depending upon the physical and chemical properties of oil the main methods of combating the spillages are the following;

- mechanical removal of floating oil from the sea surface with the help of oil-skimming systems or by absorbents;
- burning of floating oil;
- oil dispersion in water with the help of dispersants.

The choice of methods of spill containment and clean-up is made proceeding from the spillage conditions and existing possibilities which depend on the personnel and equipment at the disposal of the OCHq, as well as on the local conditions connected with permission of employing dispersants in the area of particular environmental significance.

The patterns of actions in dealing (the Incident Action Plan) with oil spills at sea provide for the following:

a) in case of an accident with a ship on the NSR that is sailing within a convoy, the first operations on fencing the place of spillage and skimming the spilled oil are carried out by the leading ice-breaker which, according to the Regulations of Navigation on the NSR, shall have on board a complete set of booms, skimmers and pumps for pumping oil out of damaged tanks. These operations are carried out according to "Shipboard oil pollution contingency plan";
b) the plan of delivery of the personnel and technical means of the strike team to the place of spillage (aircraft, types of ships and the time of flight and/or passage to the area of spillage with favorable weather forecast are to be mentioned);
c) ensuring operation of technical means for OSC (types of ships that will ensure the operation of technical means for OSC and time of their passage to the place of spillage are to be given);
d) ensuring fire safety in the area of oil spillage (the required ships that will ensure fire safety and time of their passage to the place of spillage are to be stated).

The description of shipboard and technical means of RegDpt and organizations involved, which can be used on the NSR, is given in Tables of Annex 5 and 6. Personnel and equipment involved in the OSC within the framework of other states' assistance are placed at the disposal of the OCHq on terms specified by the SMPCSRA.

All work on the deployment of technical means for OSC is carried out in conformity with the manufacturer's instructions or "Standard technologies for OSC at sea" (No 9364-000-001, developed by the Southern Research Institute of Merchant Marine, 1988), and "Field Guide for Oil Spill Response in Arctic Waters" AEPS/EPPR, 1998.

For installing booms that are kept on the hydraulically driven winches specialized boom deployment ships are required. Medium freezer trawlers and large freezer trawlers that have stern slips may be used for these purposes. Self-propelled scows with a bow ramp or type "Slavyanka" self-propelled barges may be used for installing defenses in shallow waters.

During the fulfillment of work connected with installing booms and oil-skimming by the ships in the order, it is necessary to clearly know the hydrometeorological conditions of the given area (Annex 10). For this purpose the on-scene commander and masters of participating ships should be provided with large-scale navigational and hydrometeorological charts and tables.

Oil (water-oily mixture) collected from the water surface by oil skimming ships shall be transferred to the shore reception - purification facilities. In case of carrying out an OSC operation at a certain distance from the shore, the oil (oily mixture) is to be pumped into a tanker, bunkering ship or lighter that are assigned for this purpose in order to deliver it to the nearest shore reception-purification facility. Ships with the tank heating system should be selected in case of skimming viscous oil products.

In case of skimming highly viscous wastes mixed with seaweeds or small size rubbish it is advisable to provide for their delivery to a vessel of the technical fleet (a sludge-removal barge, a suction dredger with an open hold, etc.). These craft should be discharged with the help of vacuum suction trucks, grabs (into additionally equipped dump-trucks). The materials that cannot be pumped are to be delivered by the municipal motor transport to the storing areas allotted by the local administration.

If the recovered materials require heating for their possible pumping, then use is made of a mobile steam generator, a steam-powered tug, a steam locomotive, etc. Steam supply can be arranged from the boiler house of the port, ship-repair yard or from a ship staying in the port, or hot water can be supplied from the city heating system.

Taking into account the possible demand for additional hoses to pump high viscosity oil in steam (hot water) too, OCHq (CES) shall have a list of sources for obtaining oil and steam hoses, mud engine-driven pumps, vacuum suction tank trucks (sewage disposal ones included), wheel-mounted compressors (for feeding pneumatic ejectors).

It is recommended to provide for containers designed for receiving oily water mixture containing approximately 10% of oil and 90% of water, that is in the case of 1000 t oil spill it is advisable to provide for a tanker, etc. with the total capacity of not less than 10000 t.

In view of possible large-scale operations in the zone of ports, beaches, berths, etc. the OCHq (CES) shall possess lists of metal containers with the indication of telephone numbers of the responsible persons and the location of technical means that can be mobilized for OSC operations (dustbins, grain containers, railway tanks, etc.) according to the Port Contingency Plan.

At present out of all OSC technical means, with which the strike teams are equipped, the majority of these are ineffective, and in some cases they cannot be practically used in ice conditions as they were designed for the use in ice-free waters. Therefore, ensuring the preparedness for OSC even at the end of the summer period of navigation (when the permanent ice has set in) is not practicable.

The strength of boom defenses is not so sufficient as to resist the pressure created by the ice-drift.

For confining the spreading of oil on the water surface it is recommended to use ice itself as a means of defenses with its additional freezing, if needed in some cases.*

Oil-skimmers of threshold, vortex and suction principles of operation can be used in ice conditions in very limited cases, when there are iceleads, clear waters and proper meteorological conditions. Ice easily blocks such oil-skimming devices, clogs the reception member.

Application of oleophilic skimmers is effective in the case of floating oil on the surface of the water, their employment in ice conditions being ineffective.

The use of absorption materials in ice conditions is limited due to higher oil viscosity, however, this is one of the few methods applicable in these conditions.

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* EPPR Working Group, 1998. Field Guide for Oil Spill Response in Arctic Waters. Arctic Environmental Protection Strategy, Emergency Prevention, Preparadness, and Response Working Group, Environment Canada, Yellowknife, NWT, xxx pages.

Oil burning in ice conditions is feasible when the oil layer gets very thick (for crude oil – 5 mm). This thickness ensures good stability of burning. In order to reduce the cooling effect of the water it is advisable to use initiators (peat, sawdust, wood-shavings, etc). Burning is effective only for eliminating newly-spilled oil.

Application of biological methods for OSC in ice conditions does not produce any noticeable effect as the activity of bacteria at low temperature is insignificant.

Collecting spilled oil in ice conditions (pieces of mazut-contaminated ice, sludge ice mixed with floating oil) or viscous oil (approximately 7000 centistokes) that has lost its fluidity due to the low temperature of the water and ambient air can be performed only with a grab that grips pieces of mazut-contaminated ice, sludge ice mixed with oil and discharges them into the hold.

However, this method involves the solution of further difficult problems, as when the mazut-contaminated ice is discharged into the hold of a dredger or a sludge-removal barge it is necessary to ensure ice melting, skimming and pumping out the oil or emulsion into the shore reception facilities.

When oil has been spilled over crushed ice it is practicable to use a trawl and to empty its bag into open reception facilities.

Oil can also be recovered through sinking the ice with a perforated sheet or net. As a result, the oil will come to surface and is recovered with the help of one of practicable methods. Naturally, such a method of recovery can be applied only on small areas sheltered from the wind and heavy seas.

It should be noted that at present none of the facilities and methods being available and used can ensure quite effective recovery of spilled oil in ice.

7. MEASURES ON ENSURING SAFETY

When OSC operations are being organized and carried out, the requirements of normative documents on ensuring safety of navigation, safety precautions and fire-prevention measures should be observed.

Besides, it is necessary to observe a number of additional requirements that depend on the specific character of OSC work on the NSR (cold temperatures, snow, ice and remoteness).

The responsibility for the observance of the requirements at the site of the OSC work lies with the captains of ships and water-borne craft involved in it and with the heads of specialized emergency oil spill teams.

For ensuring safety of navigation when carrying out an OSC operation it is required that:

- the shipmaster at all stages of the operation should keep a better surveillance of the surroundings, ensure high degree of preparedness of the crews and shipboard technical means for damage control actions, ensure reliable radio-communication with the OCHq or on-scene commander participating in the operation;
- the captain of the "base" ship that is carrying out OSC operations should organize and exercise control over the traffic in the area of the operation in progress preventing the passing ships from dangerously close approach;
- the captain of the nearest seaport should timely issue a notification directly or through the hydrographic service about the closing of the area of the OSC operation for navigation, and also intensify control over the traffic in this area.

For ensuring safety when performing OSC work it is required that:

- conditions must be safe if cleanup is to be attempted;
- the waterborne craft of RegDpt participating in the operations should have a device for measuring the hydrocarbons concentration level. In the course of the operation the condition of the air in the area of the personnel's work and adjacent premises should be constantly monitored. Other ships directly involved in OSC operations should be equipped with appropriate facilities in advance, and the personnel should take the required course of training;
- manoeuvring on the booms deployment and oil recovery should be performed in such a way that air pollution on the ship by oil vapours could be minimized;
- the ship participating in OSC operations should have aids for protecting respiratory organs from hydrocarbons vapours and a set of first-aid remedies for those who suffered from inhaling these vapours. The work of the personnel without protective equipment in the area with hydrocarbons concentrations dangerous for health is prohibited;
- before the beginning of the operations, it is necessary to check up whether sanitary norms, measures on fire and explosion prevention in conformity with the instructions in force are ensured on board the ship participating in OSC. The results of this checkup should be stated in the certificate or entered into the ship's log book;
- due to high risk of traumatism during the work on slippery decks, the ships participating in the operations should have an additional supply of sand not less than 0.2 cu m (1 barrel).

For ensuring fire safety when carrying out OSC operations the following additional requirements should be observed on the ships:

- portholes of all spaces located in two lower tiers of the superstructure should be tightly closed;

- in order to avoid the penetration of hydrocarbons vapours into the living compartments of the ship, into all spaces located at the height of 6 m from the water line of floatation and into the engine-room, they should have forced ventilation;
- hydrocarbons concentration in the air on the working deck, in the engine-room and in the spaces of the first tier of rooms should be monitored continuously (at least every hour). Concentration of oil products is measured only on the ships participating in oil recovery;
- before the beginning of the operations all systems of fire extinguishing should be inspected and put into complete readiness;
- the crews of the ships participating in the operation should be briefed at the working place on safety precautions and fire prevention measures in the OSC conditions with relevant entries in the appropriate register books with signatures of the persons briefed.

The regime of fire danger is imposed on the territory adjacent to the spillage area, all the persons who are not taking part in the OSC work are removed, the coastal area under threat is controlled by the militia forces. The established regime of fire danger is maintained up to the complete elimination of the fire threat.

8. PLAN EFFECTIVENESS CHECK, TRAINING, EXERCISES

8.1. Revision and update requirements

The Plan will be reviewed annually and revised as necessary by CNIIMF in consultation with the CD MPCSA and RF subjects. Proposed changes should be submitted directly to CNIIMF.

CNIIMF, in consultation with appropriate OCHq, will prepare, annually review and revise the Plan as necessary. Any part of this Plan may be changed as conditions warrant.

All changes to the Plan must be noted on the record of changes page.

8.2. Exercises and drills

Activities of the RegDpt, other enterprises and organizations which facilities and personnel, under the present Plan, participate in the OSR operation in sea, are to be assessed by the technical condition of the facilities, speed and efficiency of combating oil spills, their preparedness for the OSR, which is to be checked by training, exercises, inspections.

The chief of the RegDpt is responsible for arrangement for and participation in practical OSR excercises and training to be conducted locally to ensure effective implementation of the Plan.

The RegDpt team of specialists is to include: the OSR group leader, manager of the salvage and rescue operations department, shop's masters involved in the OSR operations in sea.

The composition of specialists from other enterprises and departments which facilities and personnel participate in the OSR operations under the Plan, is to be determined by the managers of the co-operating enterprises.

The OCHq will, in its discretion, conduct announced and unannounced exercises to assure that an oil discharge prevention and contingency plan is adequate in content and execution. No more than two exercises will be required in each twelve-month period, unless an exercise demonstrates a plan holder's failure to effectively implement the plan.

Execution of the plan during a exercise will be considered inadequate if the readiness for response and response performance stated in the plan are significantly deficient due to inadequate mobilization or performance of personnel, equipment, other resources, or other factors, including the mobilization or performance of a response action contractor identified under Plan.

If a RegDpt cannot adequately execute the plan during an exercise, the OCHq will, in its discretion, require additional exercises until it is satisfied that plan execution is adequate, or take other appropriate action as described in the Plan.

The OCHq will consider a regularly scheduled training exercise initiated by a RegDpt as a exercise if the OCHq monitors, evaluates, or participates in the exercise and concurs that it is equivalent to a exercise conducted by the OCHq. A RegDpt shall notify the OCHq in advance of the exercise and shall provide an opportunity for an OCHq representative to be present and participate.

The HOCHq shall periodically (annually at a minimum) conduct scheduled or no notice oil pollution response drills to assess the effectiveness of this Plan.

The RegDpt will be responsible for coordinating a joint evaluation team and issuing a single report that evaluates the overall exercise performance. The single evaluation report should be released within 45 days after completion of the exercise.

Drill types include notification, table-top and field exercises.

Notification exercises merely test call-out plans and communications systems. Table-top exercises entail gathering responders in one or several locations to test their ability to respond to scenarios. Field exercises entail actually moving personnel and equipment into the field to practice containment and cleanup. Logic dictates that drills progress over time from telephone to field. Once the system performs adequately during announced drills, the OCHq may conduct unannounced spill drills in order to improve readiness among government personnel. The benefits of frequent exercising have to be weighed against the costs.

The primary purpose of the area exercises is to activate and observe the response infrastructure in the area, and the ability of the entire response community to effectively conduct a spill response. The focus should be on the interaction between the responsible party and the federal and local government to exercise Regional Contingency Plan. An adequate level of response equipment will be deployed, consistent with the scenario.

Additionally, over a three-year cycle, the exercise program should exercise the 15 core components of the response plans. The 15 core components are:

Organization Design
1) Notifications
2) Staff Mobilization
3) Ability to Operate within the Response Management System described in the Plan

Operational Response
4) Discharge Control
5) Assessment of Discharge
6) Containment of Discharge
7) Recovery of Spilled Material
8) Protection of Sensitive Areas
9) Disposal of Recovered Material and Contaminated Debris

Response Support
10) Communications
11) Transportation
12) Personnel Support
13) Equipment Maintenance and Support
14) Procurement
15) Documentation

9. PROCEDURE OF RECORDING THE COSTS AND THEIR RECOVERY

For ecological offences, i.e. for causing damage to the environment, the offenders bear disciplinary, criminal and civil liability under the law on environment protection and other legislative acts of the Russian Federation.

When determining the expenditures connected with the oil spill and its clean-up, the following particulars should be taken into account:

- damage caused by the oil spill to the health of people, their well-being and environment. It is determined according to the "Methods of assessment of damage caused to the state due to violation of the water resources protection laws" and "Basic standards of compensation for ejections, discharges of pollutants into the environment and wastes placement" approved by Enactment of Russia's Government No 632 of 28.08.92, as well as according to the Order of the Ministry for Nature Protection No 200 of 27.06.94 "On the approval of Provisional procedure of assessment and compensation for the damage to the environment as a result of an accident, and according to the normative standards (indices) established annually by the State Committee for Environment Protection;
- cost of the employment of all forces and means involved in the OSC operation with regard to profit lost (if it is potentially available);
- documented expenditures borne by all the participants in the OSC operation, related to it but not mentioned above.

One of the main tasks of the RegDpt in case of oil spillage is the control over the expenditures incurred for the clean-up and preventive measures aimed at minimizing the damage from oil pollution of the sea.

Expenditures connected with the oil spill and clean-up shall be estimated by experts appointed on the proposal of the OCHq and with the participation of the OCHq members – representatives of the State Marine Inspection of the State Committee for Environment Protection of the Russian Federation.

In compliance with the legislation of the Russian Federation enterprises, institutions, organizations and citizens that have caused damage to environment are to indemnify for it in full. Expenses on OSC are to be reimbursed at the account of the person who is responsible for reimbursement for damage in the case of an incident related to oil spillage.

If the legal party that caused the oil spill has not been identified or is financially incapable to meet their obligations, and also if the oil spillage occurred as a result of force majeure, reimbursement for the damage and financing OSC work are refunded from the territorial or federal ecological funds and from the reserves of financial and material resources of the Federation subject in whose zone of responsibility the accident occurred.

If required, at the Government's decision the compensation for the above mentioned expenditures can be made at the expense of the Federation budget.

OSC work is financed in accordance with Enactment of the RF Government No 989 of 28.08.94 "On the procedure of financing the measures on preventing and eliminating consequences of emergency situations at industrial enterprises, in building industry and on transport" and Enactment of the RF Government No 1113 of 05.11.95 "On the single state system of preventing and eliminating emergency situations" (items 2, 20, 21, 22, 24 of the Regulation). Oil spill clean-up work is financed from the ecological fund and the reserve of financial

and material resources of the Administrations of territories in whose waters the oil spillage occurred, or from the federal budget.

The involved transport (dry cargo) ships, tankers, tugs participating in the OSC operation are paid promptly after the termination of the OSC operation, with regard to the time required for the passage of the vessel to the homeport, from the reserve fund of the Administration of the Federation subject.

Expenditures for the removal of cargo from a tanker casualty should be stated separately from the expenditures for oil spill clean-up.

Special attention should be paid to the fact that the compensation will be eventually paid if the claim is properly documented. It is essential that comprehensive records are kept detailing all actions and expenses for OSC operations. A daily work sheet should include description of the operations in progress, the equipment in use, where and how it is being used, the number of the personnel employed, where and how they are deployed and the materials consumed. The major expenditures usually result from the involvement of aircraft, vessels, specialized equipment, heavy machinery, trucks and personnel.

ANNEX 1

Current state of oil transportation in the Arctic region

Oil products for consumers on the Arctic coast are brought in by sea and river tankers in the periods of summer and winter navigation. Larger volumes are observed in the summer season, from late June to mid September. There are several distribution points in the Arctic basin [1], the major ones being: Murmansk, Archangel, Nahodka and the river ports on the Ob, the Enisei, and the Lena.

The major operators for the oil transportation in the Russian Arctic are the Russian Ministry of Transport (sea and river shipping companies), and private enterprises.

In the recent years - since 1985 - the volume of the Arctic oil transportation have demonstrated a stable tendency to decrease (Fig. 1).

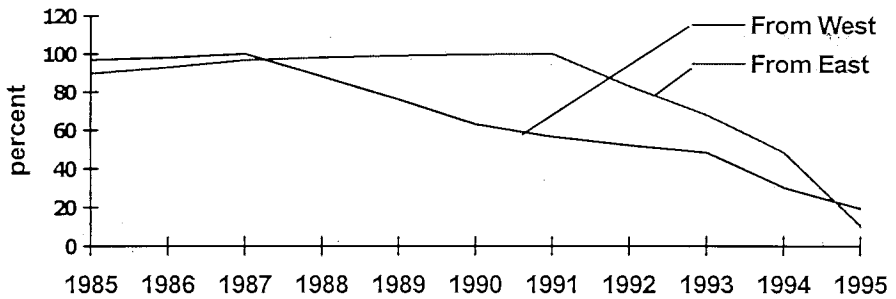

Fig. 1. Changes in volumes for oil transportation by sea to the Arctic ports.

In 1994, 500,000 t oil was delivered from Murmansk, whereof 350,000 t was exported to Europe, and the remaining amount was delivered to consumers in the Russian Arctic.

Oil is delivered in Archangel from the oil storage facility, operated by "Roskomnefteproduct". In 1994, 500,000 t was shipped for export and 14,000 t was delivered to consumers in the Russian Arctic.

From island Kolguev 40,000 t crude oil was dispatched for export.

The shallow ports of the Eastern Arctic region get their oil supplied from Nahodka (225,000 t), and from larger ports (Providenie and Vladivostok). The consumers at Tiksi and Pevek are supplied with oil by means of reloading sea tankers onto river or sea tankers. These operations are undertaken by the Arctic Shipping Company. The winter diesel fuel, arctic fuel, petrol and kerosene (Fig. 2), are the largest part of oil transportation.

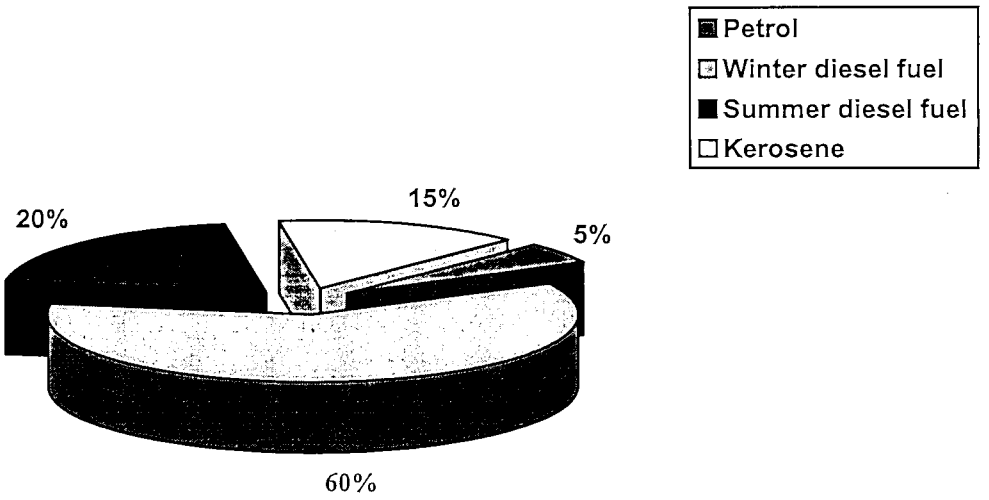

Fig.2. Composition of oil transport.

Oil transportation in the Arctic region (Fig.3) bears most hardships at the time being in comparison to other schemes of transportation applied in the region.

Until 1991 the following stable scheme and technologies for oil supply was in place:

The port of Archangel (in bulk) - Dudinka, tankers of the "Samotlor" or "Ventspils" type.

Severodvinsk (lubricants in tare) - polar stations on Arctic islands and coasts, or to river bases. Cargo is carried on the "Unyi Partizan" type. The way delivery is unusual, as the casks are loaded in the open road to the ships or other floating facilities, including the self-propelled.

The port of Archangel (in bulk) - Hatanga on "Samotlor" type tankers reload onto "Oleg Koshevoy" type (5,000 dwt tankers or river 600 dwt ships). NB: the latter are not equipped with double sides, hence - this type presents high level of danger for ecological safety.

The port of Archangel - mouths of the Yana and the Kolyma rivers on "Samotlor" type tankers reloaded onto "Lenaneft" type river ships.

The port of Archangel - Amderma on "Nefterudovoz" type (5,000 dwt) river ships operated by "Volgatanker".

The port of Archangel - Tiksi on "Samotlor" type tankers.

The port of Krasnoyarsk - Dudinka on "Lenaneft" type tankers.

In recent years this scheme of delivery is undergoing an alteration. First of all, considerable volumes of oil are delivered to Arctic points from Murmansk and Nahodka. Volumes and directions of the 1994 oil traffic are presented in Figs. 4-1, 4-2, and 4-3.

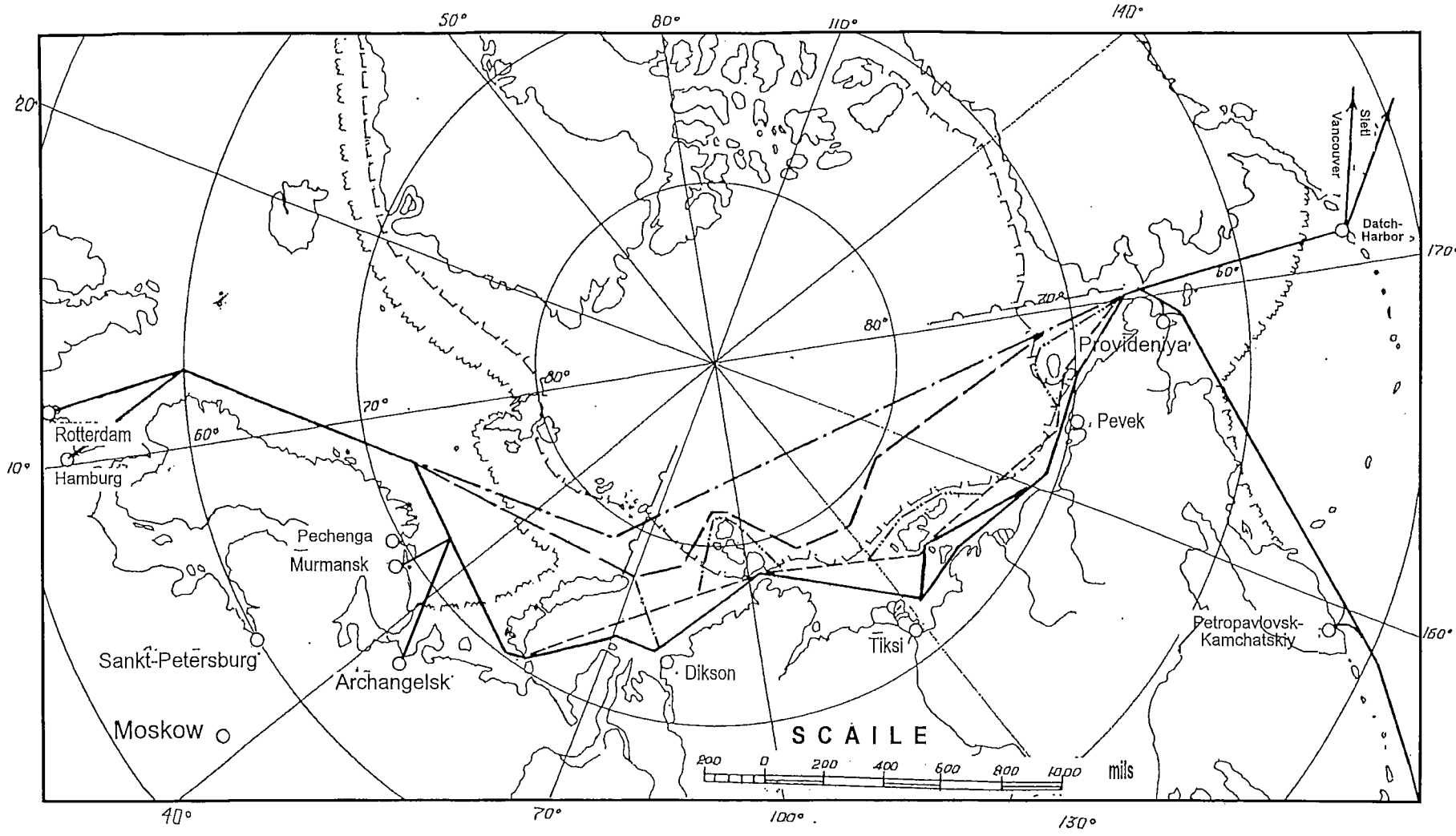

Fig.3 Versions of cargo transport
(distance Murmansk - Bering strait).

——— - The South route - 3500 ml
——— - The Central route - 3340 ml
——— - The High altitude part of Central route
---------- - The High altitude route - 2890 ml
---------- - The North Pole route - 2700 ml
—⌒— - The NSR boundary
⋀⋀ - Everage maximum ice boundary
⌴⌴ - Everage minimum ice boundary

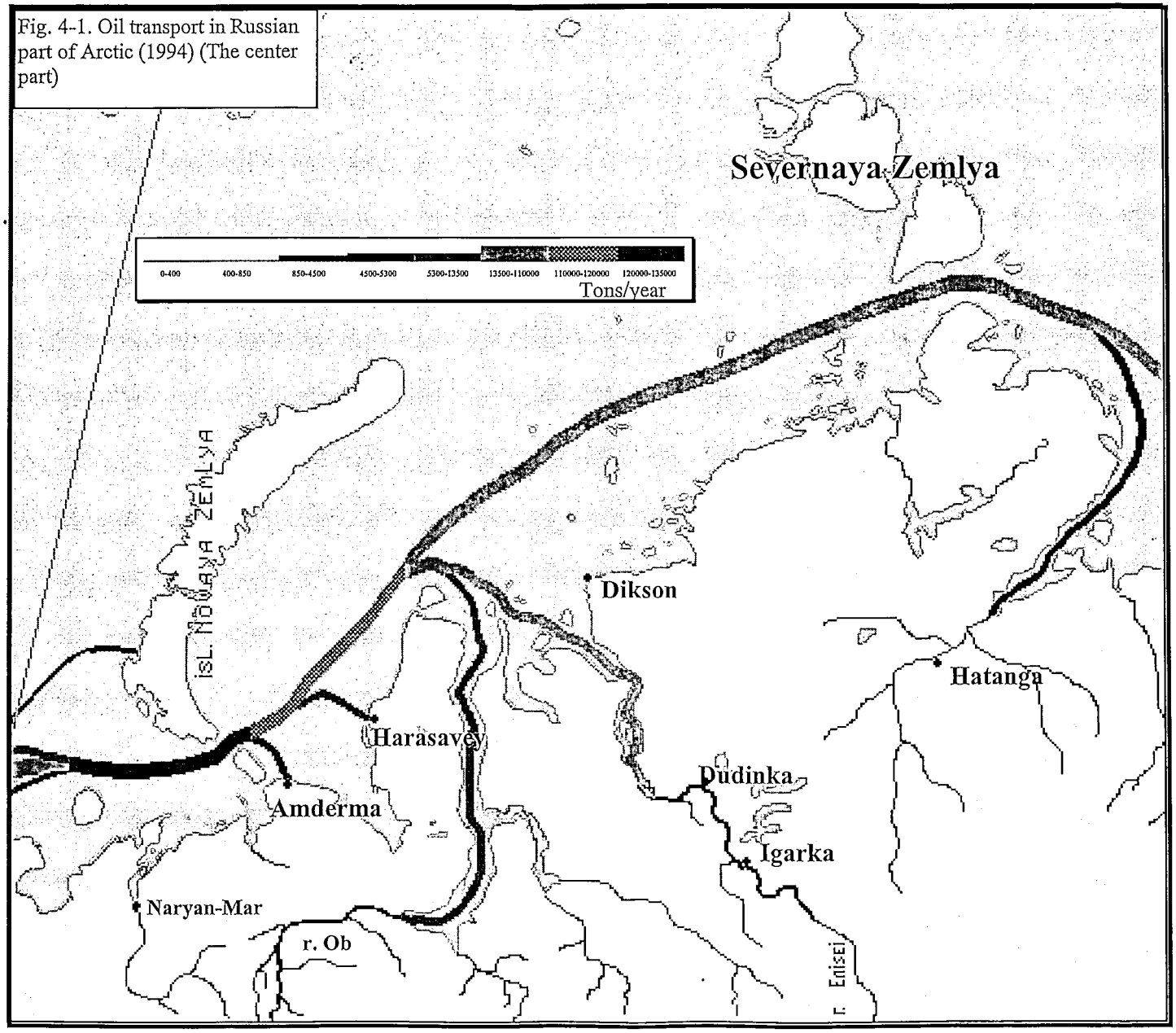

Fig. 4-1. Oil transport in Russian part of Arctic (1994) (The center part)

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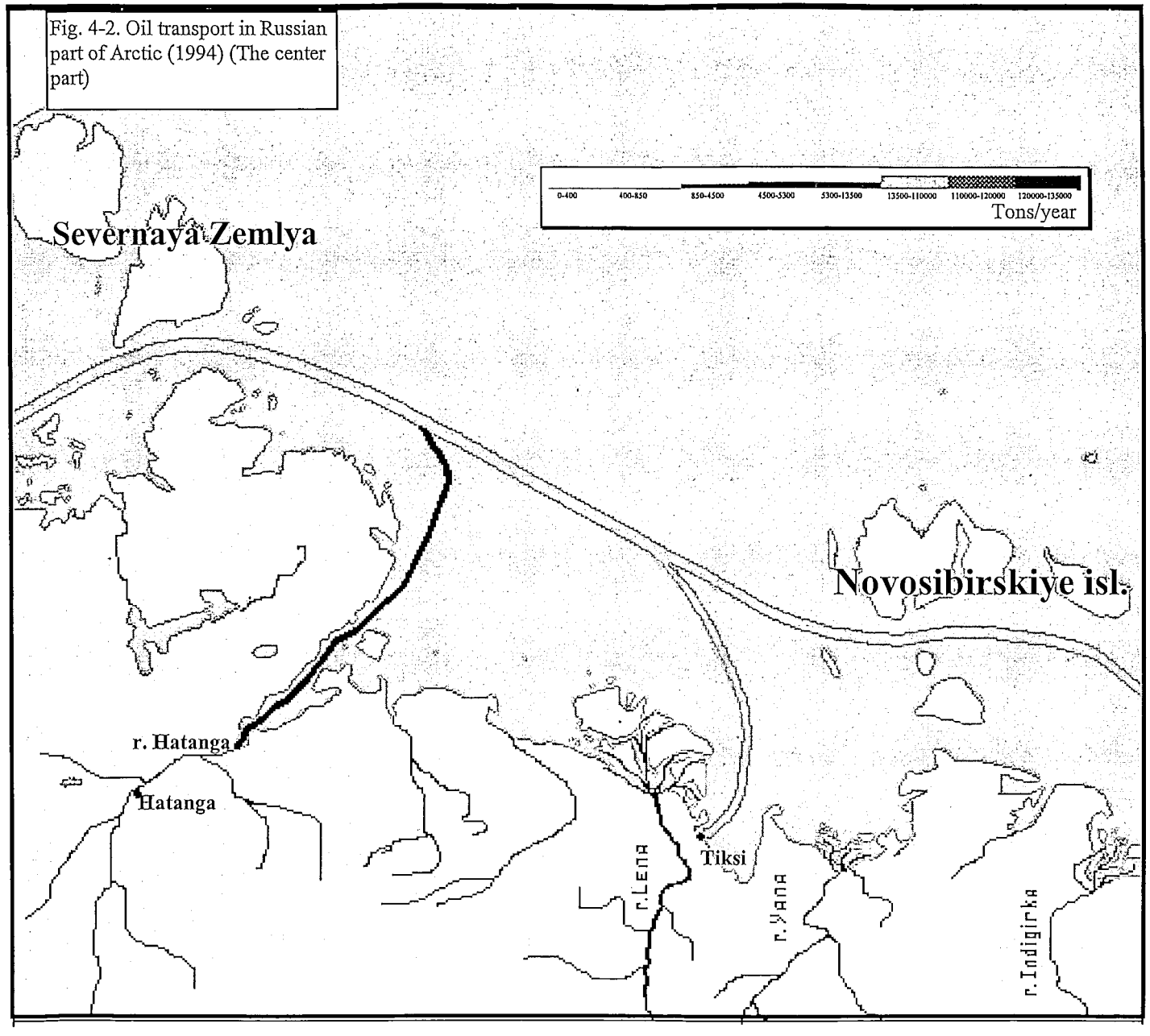
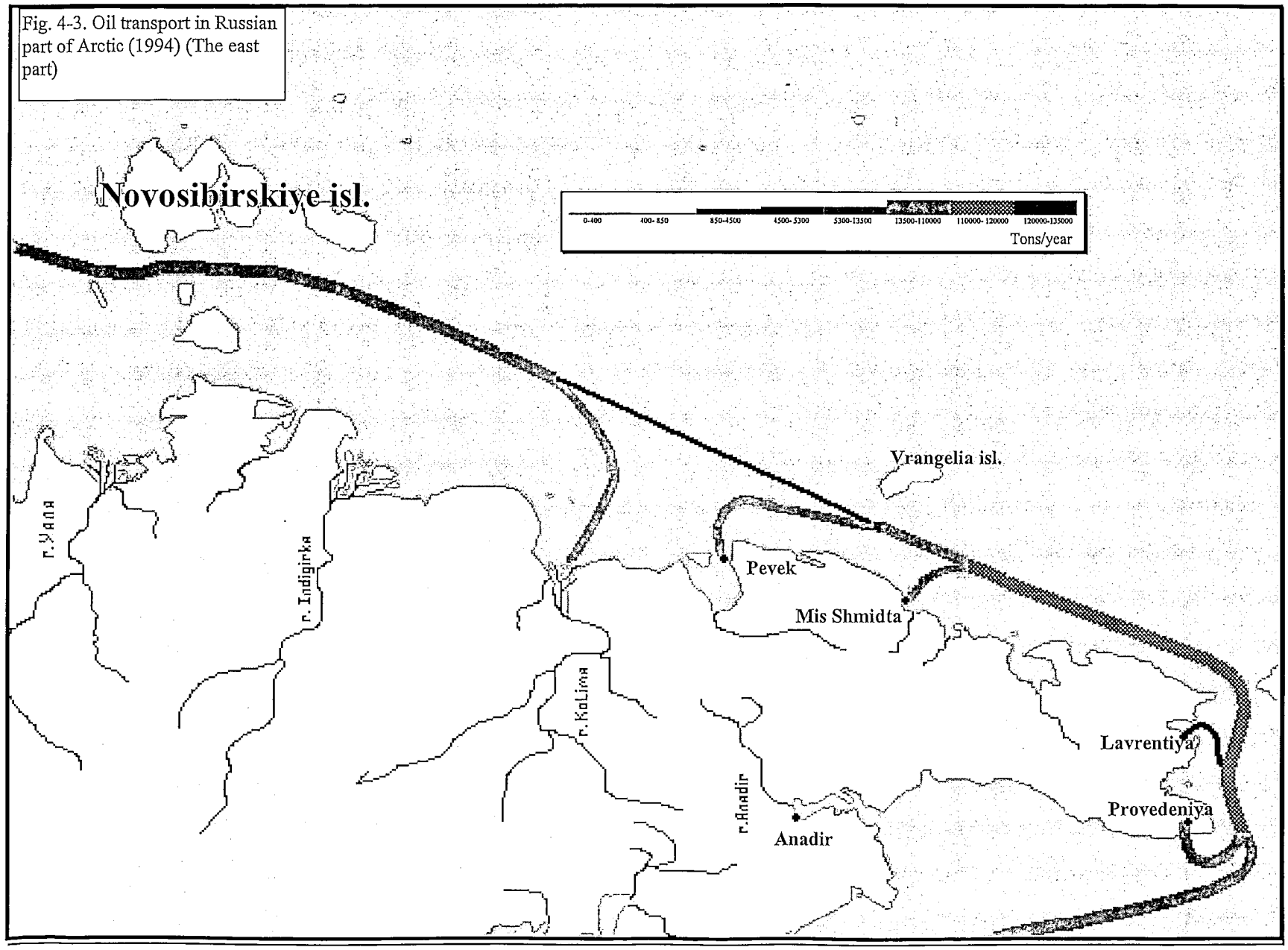


Fig. 4-2. Oil transport in Russian part of Arctic (1994) (The center part)

Fig. 4-3. Oil transport in Russian part of Arctic (1994) (The east part)



ANNEX 2

Risk estimation

No oil spills involving tankers were registered in the Arctic, as mentioned above. I therefore used the IMO data for the purposes of this chapter. On Fig. 5 and 6 histograms for grave accidents involving tankers are presented, based on the tankers' capacities and age. According to the statistical data on a world-wide basis, the average annual frequency for accidents involving tankers of intermediate and large capacity (6,000 RT and more) is:

- due to collision - 0,31 and
- due to stranding 0,41.

The concept of collision, for the purposes of this report, encompass collisions of a ship with another ship, as well as collision with ice. Very strict qualification requirements are imposed on Arctic crew members. Most tankers used in the Arctic are equipped with the double sides and double bottoms. The navigation is being carried out on the routes, defined on beforehand. Taking all these factors into account, I believe, that the low probability for accidents with tankers in the Arctic region will be even lower in the future.

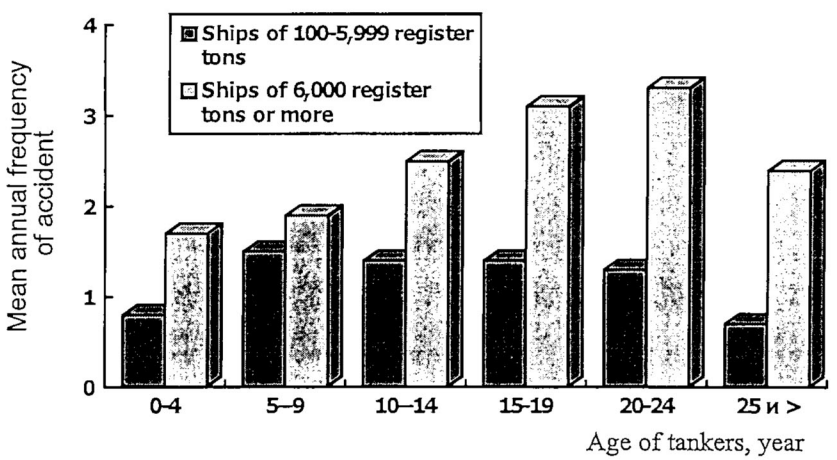


Fig.1. Frequencies of tanker accidents as a function of the ship age.

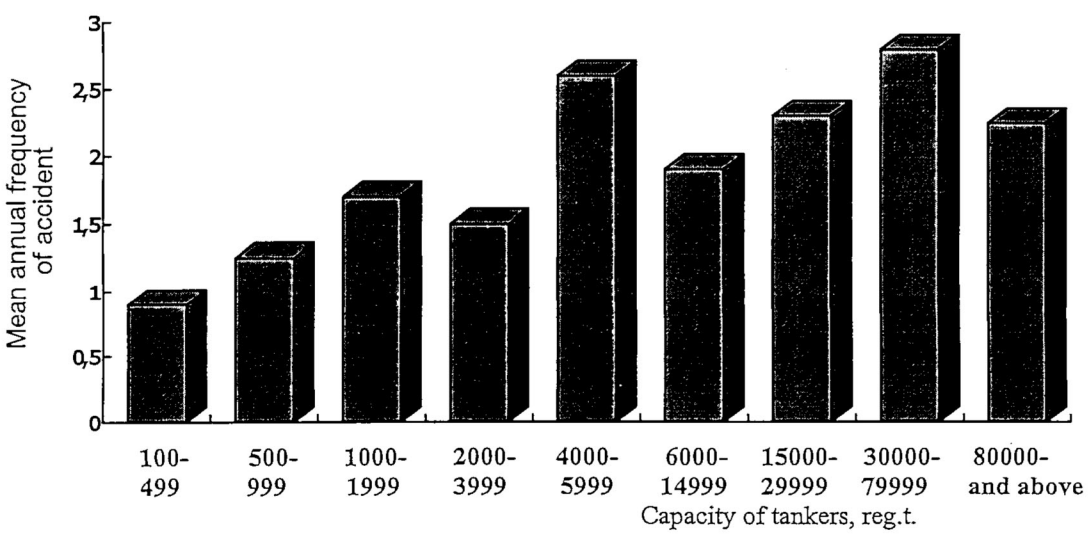


Fig.2. Frequencies of tanker accidents as a function of the ship size.

Probability of a ship accident followed by cargo outflow depends on many factors. The most important of them being construction of a ship, conditions of navigation, intensity of traffic and the volume of oil transported. The majority of accidents involving ships followed by oil outflow occur due to collisions and strandings.

These parameters vary significantly in different parts of the Arctic. The most intensive navigation is observed in the Barents Sea and in the West part of the Arctic, where most oil transportation is carried out at the present time. The volume of transported oil will increase significantly in the future due to deliveries of crude oil from the drilling platforms of the "Prirazlomnoye" field and from the Ob' Bay. The value of accident's probability cannot be calculated exactly, as the statistical data on accidents with oil spills is unknown for this region (no oils spills occurred). Therefore, the Helcom method was used here as a basis with accident's probability at 0,4 per 1,000 voyages. Spill probability for this area is may be thus set to 0,05 per 1,000 voyages when in the areas close to ports and oil terminals. Taking into account a possible frequency of accidents due to strandings or collisions, and low level of probability for a loss of a tanker (1 per 300,000), the size of an average oil spill may be estimated as 1/48-th of transported volume.

Based on the number of voyages and transported volumes (presented in the earlier sections), as well as on the risk factors, mentioned above, the statistically probable amount of spills per annum will be 1,73 by the year 2000, and 1.14 in 1995. The average expected size of oil spill equals to 104 t by the year 2000, and 14 t in 1995, at the probable oil outflow from the "Samotlor" type tanker is 374 t and from a large-capacity tanker - 2,800 t.

For comparison, Table 8 gives estimates for a probable cargo release in case of a side or bottom break at collision or stranding. The estimates are calculated, based on the CNIIMF probabilistic method for tankers with double structure. This technique uses the IMO statistical data on locations and size of damage due to collision or stranding. The probability of having cargo on board at the time of accident is assumed to be 0.5. Then probabilities of collisions or strandings followed by cargo spills are 0.03, and 0.04, respectively for service life of a ship. The data in Table 1 shows, that the expected cargo outflow at collision an order of magnitude more than at stranding, due to better structural protection of bottoms and an incomplete outflow of cargo in accidents of this type.

The maximum cargo outflow for navigational accidents with collisions or strandings is close to he capacity of a cargo tank. Two adjacent tanks may be damaged however in collision with perforation of double side.

Table 1

Cargo outflow estimates for tanker accidents

Description	Type of tanker			
	Ventspils	Samotlor	Perspective	
			Var.1	Var.2
Deadweight, t	6,297	17,200	81,200	112,350
Length between perpendiculars, m	105.3	148	247	247
Breadth, m	18.3	23	40	40
Depth, m	8.5	12.9	21	28
Draught, m	7.2	9.2	15	20
Net cargo-carrying capacity, cu.m	5,943	17,937	94,500	135,000
Displacement, t	9,400	24,570	113,900	151,900
Outflow, only collision, cu.m	428	1,107	4,955	7,336
Outflow, only stranding, cu.m	41	116	994	1,272
Outflow at accident, cu.m	207	503	2,690	3,444
Outflow at accident probability for ultimate life of ship, cu.m	16	39	187	240

Comparison of estimates achieved by Helcom and CNIIMF methods produces quite a difference in values for probable maximum outflow. Therefore, for the purposes of further calculations to ensure preparedness and response for COS, the CNIIMF estimates are used.

Time estimate for cargo outflow from surface displacement of a damaged tank is about 20 sec, with assumptions for cargo density at 0,83 kg/cm^3, cargo viscosity 50 x 10^{-6} m^2 at 5°C, and size of hole set at 2m, in proximity of midship bulkhead on 5 m depth, with capacity of midship tank set at 5,000 m^3. Oil will be expelled by inflowing seawater from underwater displacement of damaged tanks. The outflow time will be the same under assumptions mentioned above. When double bottom is perforated due to stranding, oil will be escaping as long as internal and outer hydrostatic pressures are equal. Further, the oil outflow will go on for a lengthy period of time, sometimes for days. Thus, outflow time for a principal portion escaping through holes in side or bottom is measured in seconds and minutes. This cannot be accounted for, when computing the spreading time.

ANNEX 3

Behavior of oil on sea

1. Behavior of oil on ice-free water

Oil which has escaped as a result of an accident quickly spreads over the sea surface forming oil films:

- on the calm open water, if there is no wind and current, oil spreads uniformly in all directions thus forming a circle the radius of which changes with time;
- if there is wind and current, an oil slick acquires an alongated shape in the direction of the aggregate vector of the wind and current speeds.

While planning measures on OSC it is very important to know beforehand the main parameters of the oil slick and the rate of its forming.

Table 2 shows the data on oil slick forming presented by the State Oceanographic Research Institute.

Table 3 shows the characteristics of the formed oil slick for different amounts of oil spilled.

Table 1

Pre-assigned radius of slick, R_n, m	Rated area of slick, $S_n \times (10^4)$, m^2	Rated speed of spreading, Up, cm/sec	Rated time of reaching pre-assigned radius, t_p, hr	Rated thickness of oil products film, $h \times (10^{-4})$ cm	Rated value of oil concentration in water layer 10 cm $Q \times (10^{-3})$ mg/cm^3
50	0,785	3,66	0,36	1270	2490
100	3,14	2,30	1,2	318	786,6
150	7,06	2,04	2,0	142	377,0
200	12,56	1,80	3,1	79	204,0
250	19,62	1,59	4,3	51	122,3
300	28,56	1,50	5,6	35	85,0
350	38,46	1,35	7,1	26	61,2
400	50,24	1,24	9,6	20	37
450	63,58	1,19	10,4	15,7	30,0
500	78,50	1,10	12,6	12,7	22,0
550	94,98	1,09	14,0	10,5	18,3
600	113,04	1,04	16,0	8,6	14,0
650	132,66	1,01	17,8	7,5	12,1
700	153,86	0,97	19,4	6,5	10,0
750	176,62	0,948	21,9	5,6	8,4
800	200,96	0,92	25,0	5,0	6,7
850	226,86	0,894	26,4	4,4	6,0
900	254,334	0,87	27,8	3,9	5,1
950	283,38	0,849	31,1	3,5	4,5
1000	314,00	0,83	34,7	3,2	3,8
1050	343,28	0,812	35,8	2,9	3,6
1100	379,94	0,795	38,3	2,6	3,1
1150	415,26	0,782	40,8	2,4	2,8
1200	452,16	0,765	43,6	2,2	2,2
1250	490,62	0,751	46,1	2,0	2,2

Initial data for calculations:

spill mass M = 10 t; initial radius of spill R_0 = 3 m;
layer thickness h < 10 cm; spill radius increment = 50 m.

Table 2

Mass of oil spilled, t	Time of forming, hr	Area of ultimate spreading, thousand sq. m	Slick sizes, m (along current) (across current)
0,3	6-7	282,6	1300 / 200
1	6-8	392,5	1500 / 250
10	7-8	410	1600 / 260
300	7-8	550	1800 / 300
1000	7-9	785	2200 / 350
10000	10-14	1538,6	3000 / 500

Oil spilled on the water surface moves in the same direction and at the same speed as the superficial layer of water. The main factors that determine movement of an oil slick are current and wind.

As a rule, an oil slick moves at a speed equal on the average to 3% of wind speed. The direction of oil slick movement is determined by the vectorial expression:

$$\overline{V_n} = 0{,}03\overline{V_b} + \overline{V_t} \quad ,$$

where $\overline{V_n}$ – vector of oil slick movement speed;

$\overline{V_b}$ – wind speed vector;

$\overline{V_t}$ – current speed vector.

For appropriate assessment of sea pollution use can be made of the scale of visual evaluation of water surface pollution with oil products in the open sea, bays and gulfs which is employed by the State Committee for environment protection (Tables 3 and 4).

Table 3

Pollution degree	Verbal characteristics of pollution degree	Characteristic signs	Indirect disclosing signs	Additional features for aerial surveillance
0	Clear water	There are no films and slicks on water surface.		
1	Oil pollution of a very low degree	There are separate slicks , a very thin grey film of oil pro- ducts imparting to water surface a whitish appearance, a slightly oily tinge, brighter due to greater reflecting power of the film as compared with clear surface. In the area of a patch of sunlight the film hue changes: in the centre of the patch the water surface covered with the film reflects sun rays like a mirror while on the edges the surface is noticeably darker than neigh- bouring parts which are not	The film smoothes the ripples. On parts of water free of the film the shape of waves is revealed more clearly.	The film is seen most clearly from the shadowed side of a helicopter if it faces the wind at an angle of 45 to 70 deg from the vertical. On parts of clear water one can see point-like radiant-sparkling patches of sun- light, while in the places of the oil film these patches can be seen

Pollution degree	Verbal characteristics of pollution degree	Characteristic signs	Indirect disclosing signs	Additional features for aerial surveillance
		covered with the film. By the light separate stripes of the film are formed which are stretched strictly in the wind direction.		in the form of spots of different sizes.
2	Oil pollution of a low degree	There are slicks and iridescent (with various tints) films of oil products on water surface. The film is whitish-grey, with a weak oily gleam. At a close look one can notice heterogeneity of the film. Narrow curved stripes (patches of clear water) cut it into separate cells. Under the influence of wind the oil film forms round-shape spots. On the lee side of these spots long beards form which, with strengthening of wind, stretch and break, thus forming a sys- tem of stripes oriented strictly in the wind direction. With the wind speed of 5 to 6 m/sec there appear narrow broken stripes of soap-like foam.	The film subdues the ripples noticeably and smoothes the wave surface.	The film is seen most clearly from the shadowed side of a helicopter if it faces the wind at an angle of 40 to 70 deg from the vertical.
3	Oil pollution of a medium degree	There is a continuous bright, from bluish-steel to greyish-brown film, through which it is impossible to see water even at angle of view close to the vertical. Such slicks do not have "windows" (patches of clear water) or they are very few. Under the influence of wind the film breaks up forming round-shape spots stretching with strengthening of wind. On their lee side beards form that are transformed in a sys- tem of stripes stretched in the wind direction. Soap-like foam forms within these stripes which is preserved steadily while the wind blows.	The film subdues the ripples. Wave crests do not form. The ship's wake in such a slick closes quickly.	At angles of view greater than 60 deg from the vertical the slicks in clear weather acquire the appearance of bright, mirror-like surface.
4	Oil pollution of a high degree	There are newly formed dense slicks of oil products of a lilac-violet colour and in the case of pure oil or mazut pollution – of a brown colour with a greenish tint. On the periphery of the slicks a belt of the film of a grey-steel colour is formed that corresponds to the pollution degree of 3. If there is a wind the slicks begin to break up and stretch thus forming a system of stripes stretched in the wind direction. With seas soap-like foam forms on the windward side of the slicks.	The film subdues the ripples, smoothes the wave surface. Wave crests do not form. The ship's wake is closed with the oil film at once.	The above- mentioned colour characteristics of the slicks are clearly seen from a helicopter at angles of view less than 60 deg. At large angles the slicks in clear weather have the appearance of a bright mirror-like surface.
5	Oil pollution of a very high degree	There are relatively massive traces of oil products on water surface that have a bright- brown colour with various tints (brownish, etc.).	The film subdues the ripples, prevents the development of seas.	

Oil mass on 1 sq. m of water surface with different outward appearance of oil film is shown in Table 4.

Table 4

Outward signs of oil film	Oil mass (grams) on water surface of 1 sq. m
Clear water surface without any signs of opalescence (absence of signs of colour under various conditions of illuminance).	0
Lack of a film and slicks, separate iridescent stripes observed under the most favourable conditions of illuminance and calm state of water surface.	0,1
Separate slicks and grey films of a silvery hue on water surface observed in the case of a calm state of water surface, appearance of first signs of colour.	0,2
Slicks and films with bright coloured stripes observed in the case of smooth sea state.	0,4
Oil in the form of slicks and film covering considerable parts of water surface that is not broken up in the case of seas, the colour becoming muddy-brown.	1,2
Water surface is covered with a solid layer of oil that can be seen in the case of seas, the colour being dark or dark-brown.	2,4

Destruction of oil film occurs mainly due to evaporation and emulsification. With sea force 5, after only 12 hours about 15 per cent of oil emulsifies.

Most part of oil distributed in water is in the form of "oil-in-water" emulsion. In the case of oil spillages "water-in-oil" emulsion is formed as well. The formation of "oil-in-water" emulsion may result in disappearance of oil slick from water surface. However, with the change of the conditions the oil slick can restore. "Water-in-oil" emulsion is notable for its high resistance. It is typical of the mixture of water and viscous oil and contains from 50 to 80 per cent of free water. Outwardly it looks like pure oil. Sometimes it is called "chocolate mousse". The rate of evaporation depends on the type of oil spilled and wind speed. Up to 20% of oil can disappear due to evaporation.

2. Behavior of oil in ice conditions

Oil spilled on water surface is subject to the influence of different processes that change its state. Under the influence of outer natural factors, in the conditions of ice cover, spreading of oil in the case of spillage, its drift and degradation processes have their own peculiar features.

The process of spreading is greatly effected by the ambient temperature depending on which oil properties (its viscosity, density, surface tension) change as well as the direction, force of current and wind do.

Oil, when getting on the restricted water surface with floating ice, finds itself under ice, on ice surface and in ice (being absorbed by ice).

Oil gets under ice mainly under the influence of density of an oil product. At the temperature of 0^0C the density of most heavy oils is higher than the density of ice. This difference increases with degradation of oil. In this case it looks as if ice crawls over oil.

Light grade oil gets under ice under the influence of current and wind. Observations have shown that with the wind speed of 12 m/sec and current velocity of 0.5 m/sec and with ice thickness of 15 to 45 cm oil is easily driven under ice.

Oil can remain under ice for a long time. In this case oil drifts together with ice or moves in relation to ice under the influence of current. The speed of movement is effected by the current velocity, roughness of the lower surface of ice, its sponginess as well as by density and viscosity of oil. Oil drift is greatly influenced by wind, while ice drift is influenced by current. Consequently, there can be cases when oil and ice are moving in opposite directions which is to be taken into account while taking decisions on measures and methods of OSC. Oil can move under ice only when a certain speed of water current, so-called "maximum speed", is exceeded. For example, it has been established that for crude oil which is under ice with significant roughness of its lower surface the value of the maximum speed of current is about 0.3 m/sec, i.e. with the current speed of less than 0.3 m/sec oil will not move in relation to ice but will drift together with ice.

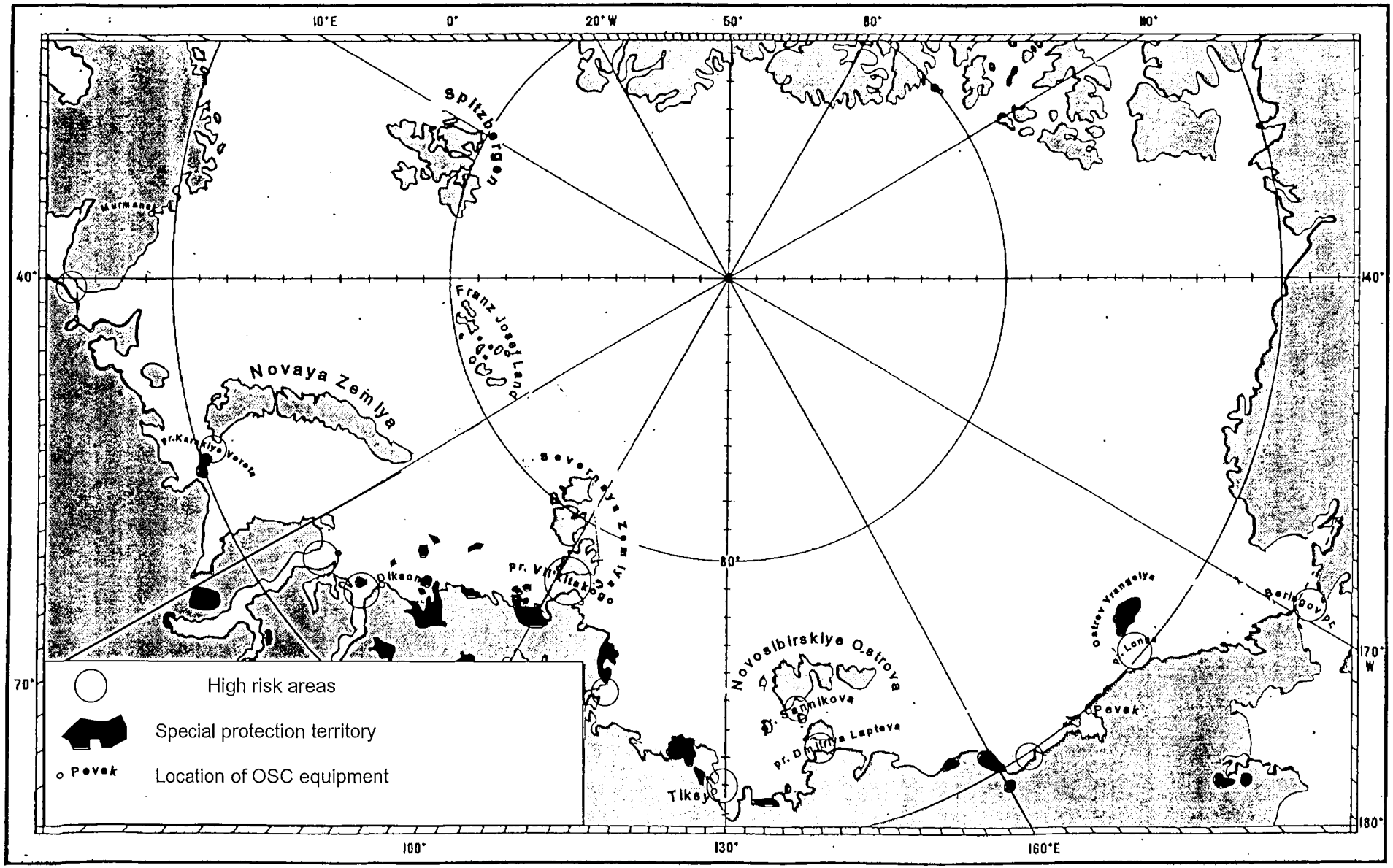
With the even surface of ice cover the maximum speed for light grades of oil is about 0.035 m/sec.

The sponginess of the ice's lower surface and its roughness are conditioned by the availability and thickness of the snow cover. In the case of its uneven distribution on the surface and different thickness of layer the insulating effect of snow is also uneven which results in different growth of ice thickness. Such roughness on ice lower surface presents excellent cavities for accumulation and storage of oil under ice.

Oil gets on ice surface: directly from the source of spillage penetrating through the pores and cracks of spongy ice, being thrown on ice when ice-floes rock on heavy seas relative to each other. The process of sticking-on sharply develops in case snow cover is available on ice surface, with which oil forms viscous slush which makes the process of clean-up and recovery of oil much more difficult.

Buoyant oil under ice will migrate to the underside of a floating ice sheet which, typically, has an uneven surface. Oil will tend to migrate to pockets on the underside unless lateral movement is stopped by ice ridges or keels. Ice forms by freezing at the ice-water interface. Oil at that interface can become frozen into the ice sheet. As the ice melts on the upper surface and continues to form on the underside, oil will move up through the ice sheet and eventually appear on the upper surface. Oil also can migrate upwards through brine channels or cracks in the ice.

If the oil finds a break in the ice sheet, such as a lead or a seal hole, it will flow into the open-water and may spill over onto the surface on the ice. Oil in broken ice will tend to collect in leads, unless lateral movement is prevented on the underside of an ice floe. During freeze-up, new ice can form on the underside of a slick.



High risk areas, protected areas (resources at the risk) and place of location of OSC equipment

ANNEX 5

Technical means for combating the oil spills on NSR

While establishing the Maritime Pollution Control and Salvage Administration, the State made large bargains of technical equipment and floating facilities for OSCP, which were distributed among sea basins. As to the NSR, places for disposition of the oil spill combating equipment were chosen in the base ports of Murmansk and Nahodka. On account of the great stretch of the response areas, parts of equipment destined to the FERegDpt and to the MRegDpt were correspondingly arranged in Pevek and Dikson

In the immediate region of the NSR, in Pevek, there are two sets of boom RO-BOOM in amount of 1000 m, the RO-CLEAN system for washing the booms and a set of transferring pumps FRAMO TK-5/TK-8. A main body of the technical means is located in the ports of Murmansk and Nahodka (Table 1) and is in possession of MRegDpt and FERtgDpt.

Table 1

Technical means for combating the oil spills

Item Nos.	Description	Amt	Specifications	Note
1	Emergency oil pumping system FRAMO	2	1st container: Weight 2200 kg Dim. 2400 x 1300 x 1850 2nd container: Weight 1100 kg Dim. 2500 x 1750 x 1800 3rd container: Weight 2000 kg Dim. 2800 x 2260 x 1800 Capacity of pumps: TK-8 up to 1000 m^3/h TK-5 up to 450 m^3/h	
2	Skimmer VALOSEP W-2	2	Capacity 45 m^3/h Power plant: Weight 1100 kg Dim. 1650 x 1100 x 1065 Skimmer: Weight 400 kg Dim. 2000 x 2000 x 1900	
3	Skimmer DESMI-250	2	Capacity 70 m^3/h Container: Weight 3145 kg Dim. 2440 x 2900 x 2440	
4	Skimmer TRANSREC-250	1	Capacity 45 m^3/h Power plant: Weight 1900 kg Dim. 2300 x 920 x 1650 Hoisting winch: Weight 7200 kg Dim. 2500 x 1915 x 2800 Skimmer: Weight 410 kg	

Item Nos.	Description	Amt	Specifications	Note
5	Skimmer FOXTEIL VAB 2-6	1	Capacity 9 m^3/h Container: Weight 475 kg Dim. 2100 x 1400 x 1400 Power plant: Weight 585 kg Dim. 1500 x 800 x 1100	
6	Skimmer FOXTEIL VAB 4-9	1	Capacity 30 m^3/h Container: Weight 750 kg Dim. 2250 x 1950 x 1700	
7	Submersible electric pump FLUGHT	2	Capacity 100 m^3/h Weight 48 kg Dim. 415 x 335 x 505	
8	Suspended boom trap RO-SWEEP	1	Stationary onboard unit. Effective performance at waves under 3 m Weight 980 kg Length 35 m	
9	Oil sweep PL-1000	1	Breadth of opening 26 m Effective performance at waves under 3 m Winch: Weight 750 kg Dim. 2250 x 1950 x 1700 Length 1000 m (4 x 250)	
10	Boom OCEAN-2000	2	1st container: Weight 6400 kg Dim. 2800 x 2200 x 2200 2nd container: Weight 6400 kg Dim. 2800 x 2250 x 2200 3rd container: Weight 2300 kg Dim. 2800 x 2200 x 2200	
11	Boom EXPANDEE	1	Length 432 m Weight 2700 kg Dim. 1900 x 1900 x 1700	
12	Washing unit RO-CLEAN	1	Washing of boom defense on transport frame. Weight 4850 kg Dim. 5200 x 2500 x 2400	
13	Tank-separator RO-SET	1	With pneumatic pump and power plant Weight 2700 kg Dim. 4700 x 2440 x 2400	
14	Inflatable boat ACHIL-LES	2	Weight capacity 3210 kg Weight 360 kg Dim. 4800 x 210	

Item Nos.	Description	Amt	Specifications	Note
15	Outboard motor TOHATSU	2	Power 40 HP Weight 60 kg	
16	Boat MOB-20	1	Engine power 174 HP Carrying capacity 3075 t Crew up to 9 men Max passenger capacity 22 men Weight 2400 kg Dim. 6250 x 2600 x 2280	
17	Boom, type RO-BOOM, for containment and collection of oil from sea surface	2	Length 2 x 250 m Height 2,0 m Wind velocity up to 20 m/s Wave height up to 3 m Towing speed up to 1 knot Air temperature from -40^0 to $+60^0$C Two containers with booms on hydraulic winches: Weight 6400 kg Dim. 2800 x 2200 x 2200 Container with power plant, wire cables, etc.: Weight 2300 kg Dim. 2800 x 2200 x 2200	
18	Boom, type HF-11, for containment and collection of oil from sea surface	1	Length 2 x 200 m Height 4,0 m Wind velocity up to 12 m/s Wave height up to 6 m Towing speed up to 1,5 knots Air temperature from -20^0 to $+70^0$C Hydraulic winch with booms: Weight 14400 kg Dim. 3900 x 3300 x 4100 Container with buoys and rig: Weight 1300 kg Dim. 1900 x 1500 x 1400	Power unit for winch is required. The unit from pump system FRAMO fits.
19	Boom, type KL-8D, for containment and collection of oil from sea surface		Length 2 x 200 m, joint Total height 3,35 m Wind velocity up to 10 m/s Wave height up to 5 m Towing speed up to 1,5 knots Air temperature from -20^0 to $+70^0$C Hydraulic winch with booms: Weight 8500 kg Dim. 3700 x 3300 x 3930 Container with buoys and rig: Weight 5000 kg Dim. 2440 x 2300 x 2250 Container with compressor: Weight 1300 kg Dim. 1900 x 1500 x 1400	Power unit required for winch. The unit from pump system FRAMO or ORS-1000 fits.

Item Nos.	Description	Amt	Specifications	Note
20	FRAMO system for pumping oil from tanks	2	Capacity: Submersible pump TK-5: 180 m^3/h at head of 70 m Submersible pump TK-8: 700 m^3/h at head of 31 m Container with pumps TK-5 (2 items) and TK-8 (1 item): Weight 110 kg Dim. 2500 x 1750 x 1800 Container with hoses: Weight 1600 kg Dim. 2800 x 2260 x 1800	
21	Oil sweeper PL-1000/35 with guide boom HF-11 for collecting oil from sea surface	1	Working length 35 m Total height 2,2 m Capture width 25 m Expansion angle 35 deg. Guide boom length 20 m Wind velocity up to 12 m/s Wave height up to 3 m Towing speed up to 1,5 knots Air temperature from -20^0 to $+70^0$C Hydraulic winch with coiled sweeper and boom: Weight 6800 kg Dim. 3700 x 2750 x 3530	Power plant for winch and compressor for inflating HF-11 boom required.
22	Onboard mounted oil-collecting system RO-SWEEP for collection of oil from sea surface	1	Total boom height 2,0 m Capture width from two boards 2 x 15 m Wind velocity up to 20 m/s Wave height up to 3 m Pay-out speed up to 1,0 knot Air temperature from -40^0 to $+60^0$C Hydraulic winch with coiled sweepers: Weight 2800 kg Dim. 2700 x 2000 x 1800 Two beams with floats in a box: Weight 1600 kg Dim. 5200 x 1600 x 1200 Compressor with hydraulic drive in a box: Weight 100 kg Dim. 900 x 700 x 700	Power plant to drive winch and compressor required. The unit from DESMI-250 fits.
23	System DESMI-250 for collection and pumping oil from sea surface	4	Capacity up to 60 t/h Wind velocity up to 20 m/s Wave height up to 3 m Pay-out speed up to 1,5 knots Air temperature from -40^0 to $+60^0$C The set consists of: hydrocompressor with hydraulic drive, collecting head, hoses, portable control unit, packed up in a special container: Weight 3000 kg	

Item Nos.	Description	Amt	Specifications	Note
			Dim. 3000 x 2440 x 2440	
24	System TRANSPEC for collection and pumping oil from sea surface	1	Capacity up to 250 m^3/h Wind velocity up to 20 m/s Wave height up to 3 m Pay-out speed up to 2 knots Air temperature from -20^0 to $+50^0$C Standard container of 20 ft with built-in hydraulic crane, drum with hose, collecting head and diesel-hydraulic compressor: Weight 3000 kg Dim. 3000 x 2440 x 2440	
25	System VALOSEP-1 for collection and pumping oil from sea surface	2	Capacity up to 40 m^3/h Wind velocity up to 15 m/s Wave height up to 3 m Pat-out speed up to 1,5 knots Air temperature from -20^0 to $+50^0$C The system includes: Collecting head Weight 100 kg Dim. 1410 x 1100 x 870 Power plant Weight 600 kg Dim. 1650 x 1100 x 1000	
26	System VALOSEP-2 for collection and pumping oil from sea surface		Capacity up to 45 m^3/h Wind velocity up to 15 m/s Wave height up to 3 m Pay-out speed up to 1,5 knots Air temperature from -20^0 to $+50^0$C The system includes: Collecting head Weight 400 kg Dim. 2000 x 2000 x 1900 Hoses 100 kg Power plant Weight 900 kg Dim. 1650 x 1100 x 1000	
27	Oil-collecting system FOXTEIL 2-6	1	Capacity 9 m^3/h 2 absorbing arms Arm length 10 m Containers for storing skimmer: Weight 475 kg Dim. 2000 x 1250 x 1075	
28	Sprayer for dispergent URD-2	2	Dispergent is fed to URD-2 from barrels	Based on s/s IRBIS
29	System RO-CLEAN for washing of booms	1		

ANNEX 6

Inventory of floating facilities and aircraft means for combating the oil spills at sea

To ensure the operations of the OSCP technical means and to pursue the collection of the spilled oil, in the northern basin there are rescue tugs, specialized ships and more other floating facilities equipped with water-draining, oil-pumping and oil-collecting units, aids for containment of the spilled oil, and some other accessory equipment.

Table 1

Inventory of floating facilities and aircraft means for primary actions in combating the oil spills at sea

Item Nos.	Description and type	Major specifications	Owner, location	Amt
1	Specialized ship (project V-92)	Length 81,16 m Width 15,3 m Hull height 7,2 m Draft 4,75 m Power 2 x 3600 HP Speed 15,0 knots Thrust on hook 82 t Gear: stern boom 12,5 t Outboard sweep of boom 5,0 m 2-4 blade controllable-pitch propeller Forward maneuvering unit Navigation area unlimited	FERegDpt Peter the Great Bay	1
2	Sea diving boat (project 535 M)	Length 41,0 m Width 8,0 m Hull height 3,6 m Draft 2,1 m Power 2 x 300 HP Speed 12,0 knots Thrust on hook 5 t Gear: stern boom 2,5 t Outboard sweep of boom 5,0 m 2-4 blade controllable-pitch propeller Forward maneuvering unit Navigation area limited I, under 200 miles from refuge base	FERegDpt pt Vladivostok	1
3	Ocean rescue ship (project 1453)	Length 92,8 m Width 15,62 m Hull height 7,7 m Draft 5,9 m Power 2 x 4500 HP Speed 18,7 knots Thrust on hook 98 t Gear: bow booms 2 x 2 t 2-4 blade controllable-pitch propeller Forward maneuvering unit Navigation area unlimited	FERegDpt	1

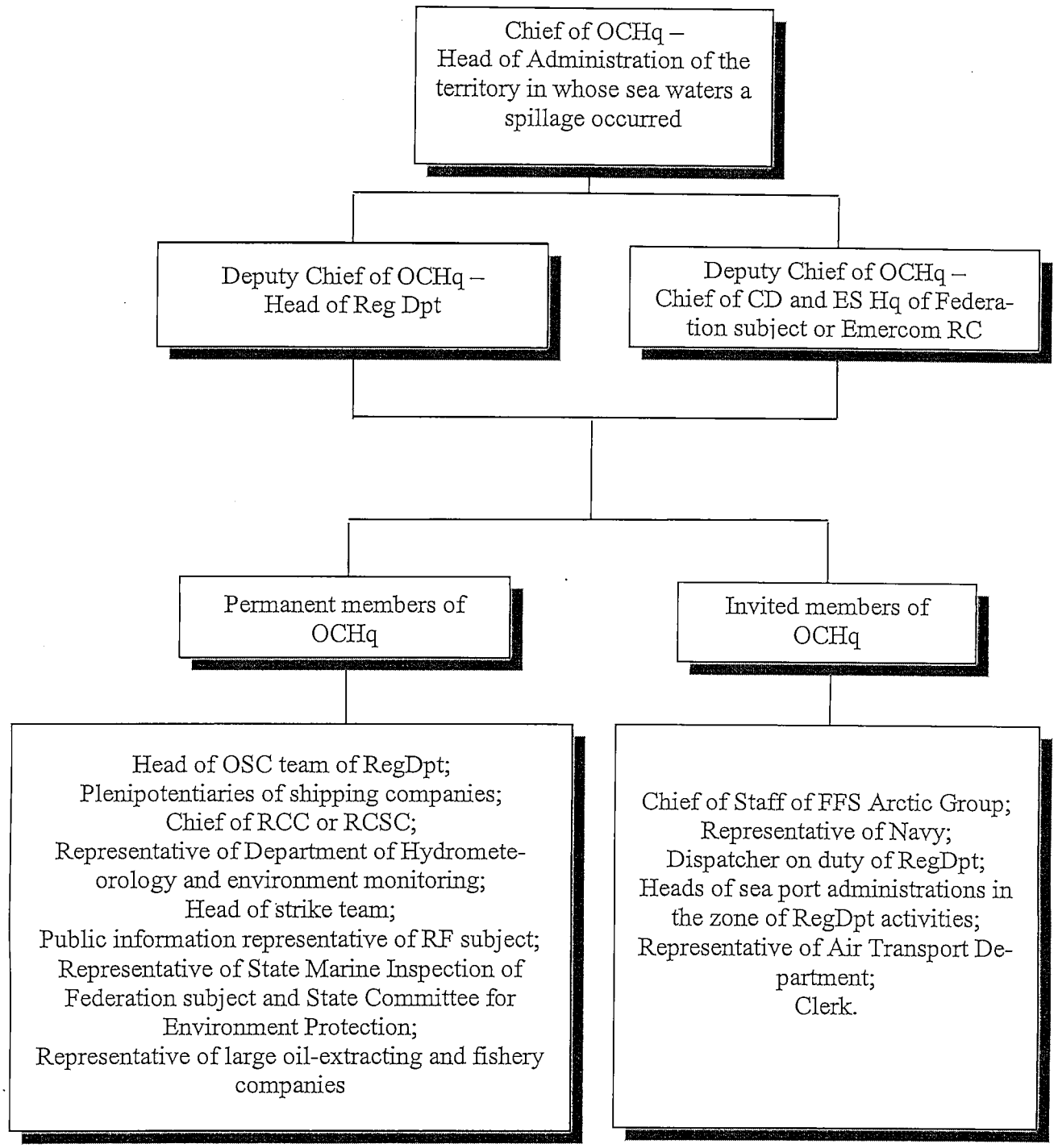
Item Nos.	Description and type	Major specifications	Owner, location	Amt
4	Rescue tug (project 1454	Length 58,3 m Width 12,6 m Hull height 5,9 m Draft 4,7 m Power 2 x 1500 HP Speed 12,5 knots Thrust on hook 3,7 t Gear: stern boom 5,0 t Outboard sweep of boom 5,0 m 1-4 blade controllable-pitch propeller Forward maneuvering unit Navigation area unlimited	FERegDpt pt Vladivostok AC DALRYBA pt Vladivostok Kam BED pt Petropavlovsk- Kamchatski	1 1 1
5	Rescue tug STROPTIVYI (project 1124)	Length 74,41 m Width 18,32 m Hull height 9,02 m Draft 6,7 m Power 2 x 2868 kW Speed 15,0 knots Gear: two 3t cranes, two 5t cranes Outboard sweep of boom 5,0 m 2-4 blade controllable-pitch propeller Navigation area unlimited	AC DALRYBA pt Vladivostok	3
6	M/s UMKA	Staff ship. Trawling and collection of oil by sweeper, booms and skimmer. Pumping of oil from damaged ships	MRegDpt pt Murmansk	
7	M/s SVETLOMOR	Boom deployment, sweeping of oil spills, reception of collected oil from other ships. Pumping of oil from damaged ship. Collection of oil. Provision of operations of smaller floating facilities.	MRegDpt pt Murmansk	
8	R/B MARKAB	Fast boom deployer	MRegDpt pt Murmansk	
9	S/s AGAT	Transportation of OSC tech. facilities, working in order, towing of non-self-propelled oil skimmers.	MRegDpt pt Murmansk	
10	Rescue tug, type DIOKL (Holland)	Length 72,5 m Width 13,6 m Hull height 7,2 m Draft 5,96 m Power 2 x 2500 kW Speed 16,3 knots Gear: one 5t crane 1-4 blade controllable-pitch propeller Navigation area unlimited	AC DALRYBA pt Vladivostok	1
11	Transport ship	Cargo gear 10 t and more	FEMSC pt Vladivostok, pt Nahodka AMSC pt Tiksi	

Item Nos.	Description and type	Major specifications	Owner, location	Amt
12	Transport ship	Cargo gear 40 t and more	FEMSC pt Anadyr pt Pevek pt Tiksi	 1 1 1
13	Self-propelled barge with bow type SLAVYANKSA (project 20150)	Length 21,9 m Width 5,8 m Hull height 1,5 m Draft 1,1 m Power 2 x 235 HP Thrust on hook 4,0 t Speed 9,5 knots 1-4 blade controllable-pitch propeller Navigation area limited III, under 5 miles from a service ship	Marine commercial pt Anadyr Marine commercial pt Providenye pt Pevek AMSC pt Tiksi	1 1 1
14	Tanker, type PARTIZANSK	Tonnage 1500 t Loaded draft 4,8 m Speed 13,2 knots Gear: two booms x 0,65 t Navigation area unlimited	PMSC pt Nahodka	2
15	Tanker, type VENTSPILS	Tonnage 4500 t Loaded draft 6,1 m Light draft 4,35 m Speed 14,3 knots Gear: hydraulic crane 1 t Navigation area unlimited	PMSC pt Nahodka	1
16	Tanker, type SAMOTLOR	Tonnage 16000 t Loaded draft 9,2 m Speed 15,7 knots Gear: 4 booms x 5 t Navigation area unlimited	PMSC pt Nahodka	1
17	Tanker, (project 1577)	Tonnage 5000 t Loaded draft 3,6 m Navigation area: pt Tiksi to Jana R. mouth, under 50 miles from refuge points	LORSC pt Tiksi	1
18	Tanker, (project P77)	Tonnage 2150 t Loaded draft 2,5 m Navigation area: pt Tiksi to Kolyma R. mouth	LORSC pt Tiksi	1
19	Cargo airplane IL-76	Cargo capacity: 40 t in range under 3000 km, 22 t in range under 5000 km Size of cargo room 18,5 x 3,25 x 3,15 Cargo-handling system: electric hoists 4 x 2,5 t Flight speed 900 km/h	Regional UVT of Magadan City	2
20	Airplane AN-12	Cargo cabin: Length 13,5 m Width 3,0 m Height 2,4 m	Vladivostok Habarovsk	1 1

Item Nos.	Description and type	Major specifications	Owner, location	Amt
		Cargo hatch: Width 2,95 m Height 2,4 m Cargo winch capacity 2,0 t Cargo capacity 10,0 t Speed 550 km/h 10t load in range of 2200 km	Regional UVT of Magadan City	1
21	Transport helicopter, type RF-32	Weight on outer suspension up to 5,0 t Flight speed 230 km/h Max flight range 800 km Max flight time 4,5 hs Landing on solid ground on a spot 50 x 50 m in any area of Scheme 1 Refueling points: Ternei, Dalnegorsk, Kovalevo, Artem	United aviation detachment of Vladivostok, Artem City	2
22	Transport helicopter, type MI-8	Weight on outer suspension up to 3,0 t Flight speed 200 km/h Max flight range 600 km Max flight time 4,0 hs Landing on solid ground on a spot 50 x 50 m in any area of Scheme 1 Refueling points: Ternei, Dalnegorsk, Kovalevo, Artem	United aviation detachment of Vladivostok, Artem City	3
23	TBS, type NEFTEGAS	Delivery of OSC facilities, working in order	PO Arctikmorneftegasrazvedka	4
24	SB-523; SB-38	Universal OSC ship, working in order	Vladivostok	2
25	S/s KARABAH	Provision of OPE operations	Vladivostok	1
26	S/s PURGA	Provision of OPE operations	Association SEVRYBA	4
27	Tanker	Reserve for reception and transportation of collected oil	Association SEVRYBA	

ANNEX 7

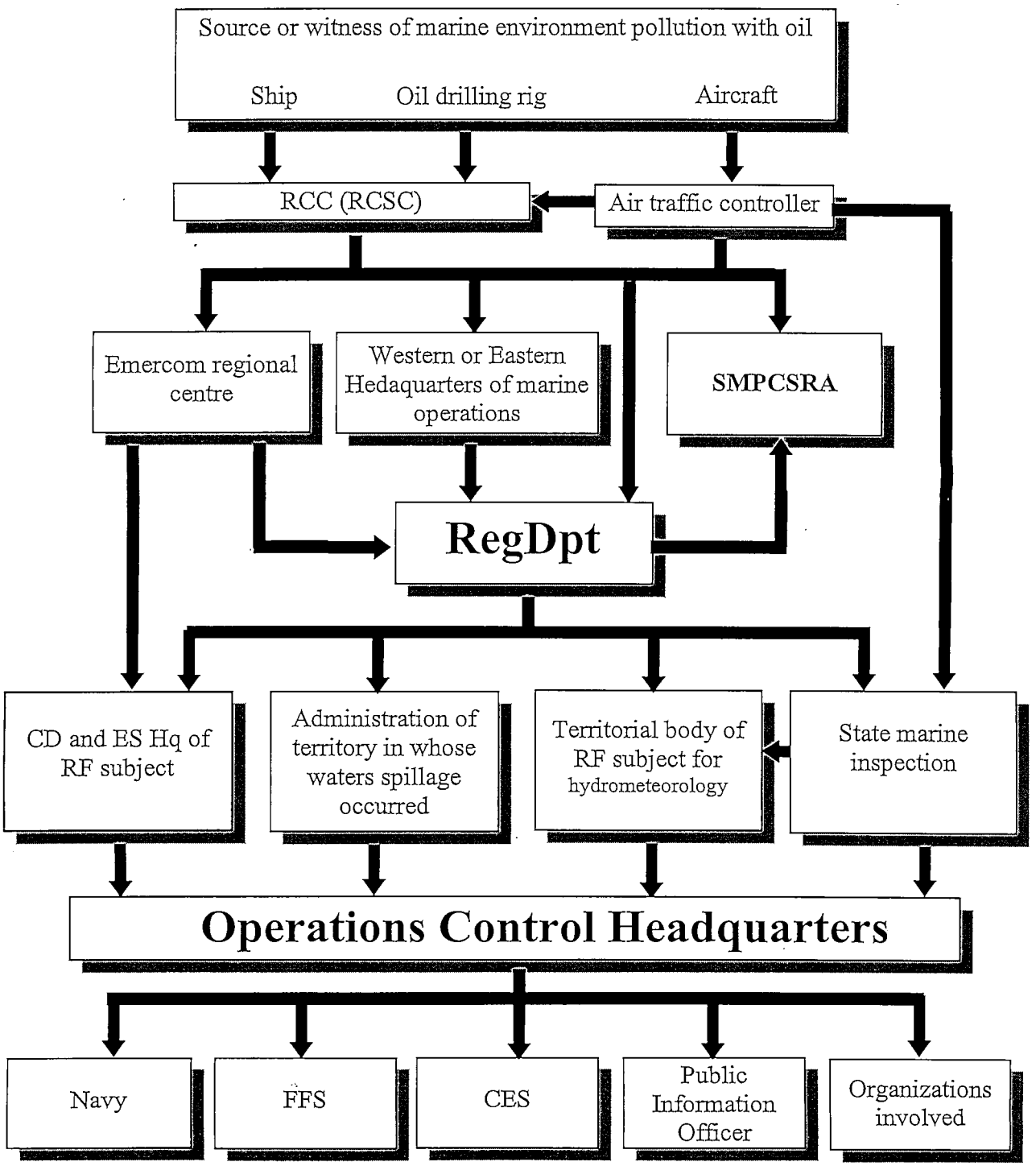
Composition and structure of Operations Control Headquarters



ANNEX 8

Diagram of communication and notification about oil spill
(number of telephones, faxes, telexes as well as radio frequencies are listed for each concrete OCHq in the form of the supplementary table to this Appendix)

a: For spill more then 100 t



b: For spill less then 100 t

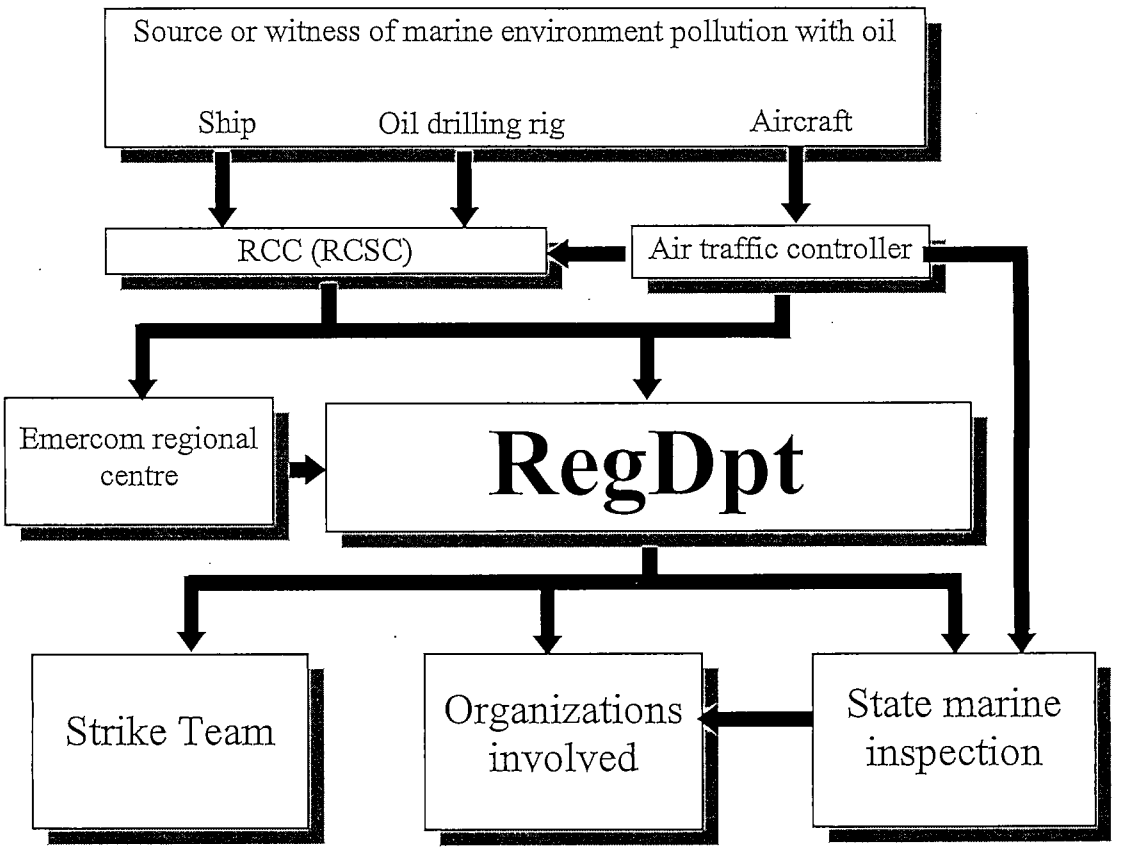


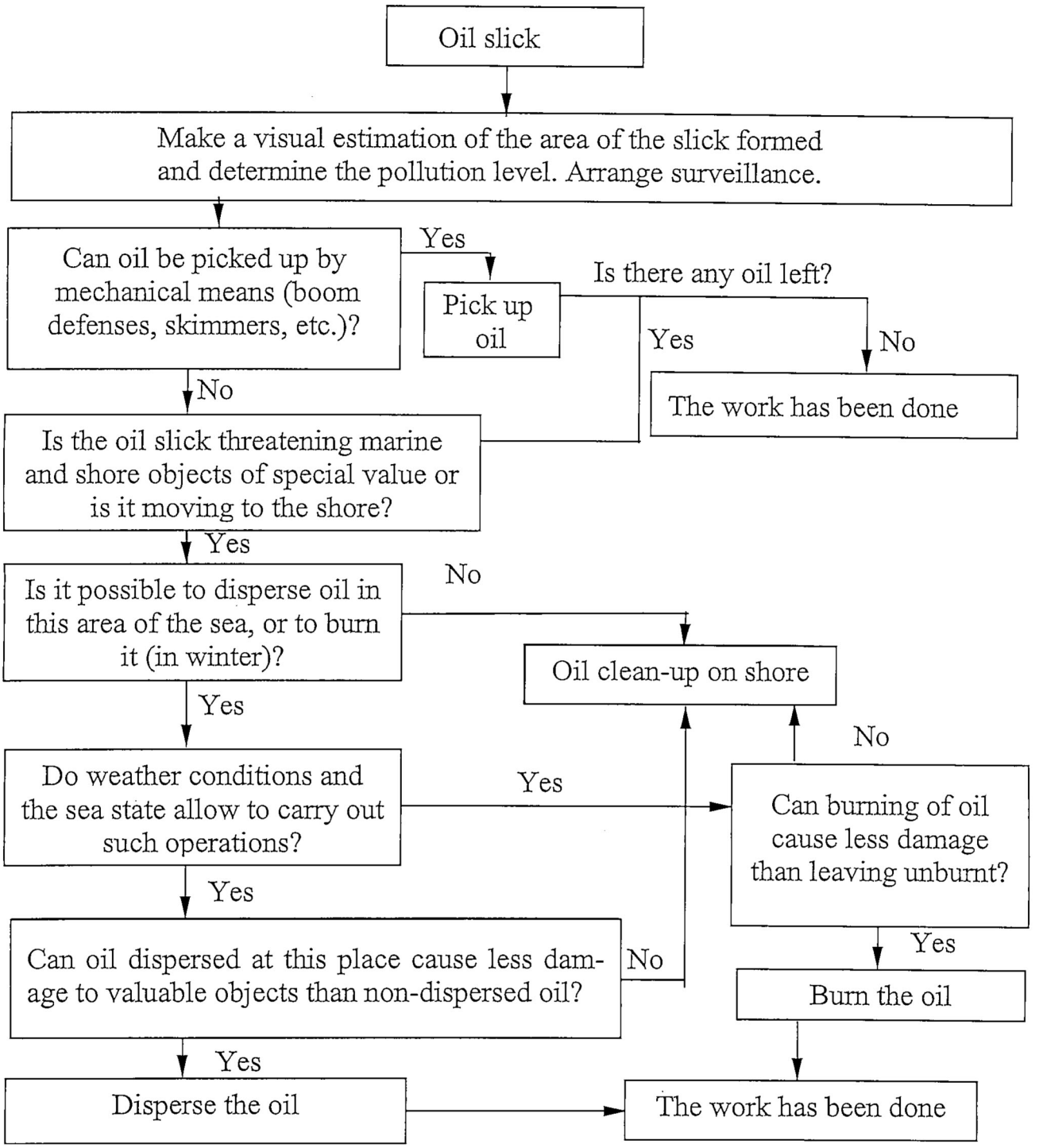
Table 1.

Points of contact

Organization	Tel, fax
1. SMPCSRA	tel. 926-93-02, fax. 926-91-28
2. Administration of Taymir (Dolgano-Nenetskiy) a/o	tel. 2-11-60
3. Administration of Yamalo-Nenetskiy a/o	tel. 4-66-02
4. Murmansk Reg.Dpt.	tel. 57-29-82, fax 57-32-69
5. Northern Shipping Company	tel. 44-74-00, fax 43-83-10
6. Murmansk Shipping Company	tel. 52-61-07, fax 55-23-93
7. Murmansk Sea Port	tel. 52-26-44, fax 52-51-95
8. Arcticmorneftegazrazvedka	tel. 56-45-19, fax 56-47-15
9. Special Marine Inspection of Yamalo-Nenetskiy Regional Environment Committee	tel. 21-45, 20-64
10. Special Marine Inspection of Krasnoyarskiy Region State Ecological Committee	tel. 24-22-83
11. Taymir Department of State Meteorological Committee	tel. 2-55-83
12. Yamalo-Nenetskiy Department of State Meteorological Committee	tel. 4-01-92, 2-38-14
13. Yamalo-Nenetskiy Department of Emercom	tel. 4-94-13; 4-85-80, fax 4-94-15
14. Taymir Department of Emercom	tel. 2-24-60, 5-64-15
15. NE Regional Center of Emercom	tel. 540-59-83
16. Regional Center of Uralskiy Emercom	tel. 62-39-45
17. Regional Center of East-Siberian Emercom	tel. 27-34-30; 23-68-16 fax 23-68-16
18. Navy	tel. 33-23-09
19. Murmansk RCC	tel. 55-50-65
20. Vladivostok RCC	tel. (423-22)22-27-25
21. Special Marine Inspection of Primorskiy Region State Ecological Committee	tel. 25-22-68
22. Dispatcher of Far-East Reg.Dpt.	tel. 27-89-14
23. Administration of Chukotskiy o.	tel. 4-25-49
24. Administration of Sakha Republic (Yakutiya)	tel. 2-50-05
25. Environmental Protection Committee of Chukotskiy a/o	tel. 4-47-77
26. Far-East Regional Center of Emercom	tel. (42-12)33-13-99
27. Primorsk Shipping Company	tel. (423-66)5-71-18
28. Arctic Shipping Company	tel. 5-35-23
29. Nahodka Sea Port	tel. (423-66)4-18-16

ANNEX 9

Example of taking decision on oil spill combating



ANNEX 10

Hydrometeorological conditions on the NSR

1. General meteorological description.

Main factors influencing arctic seas meteorological conditions are, as follows:

1) specific character of solar radiation (polar day and polar night);
2) character of atmospheric circulation:
3) inhomogeneous underlying surface, which is caused by the presence of inland and drift ice, by the influence of warm waters from the Atlantic and Pacific Oceans, by the water inflow from Siberian rivers, and by topography.

The NSR crosses three climatic areas, as follows:

1. Atlantic Area (Barents Sea, western part of the Kara Sea and part of the Arctic Ocean extending to the N of them). High occurrence rate of atmospheric low and disturbed weather in winter, and dull weather with frequent fogs and precipitation in summer, are characteristic for this area.

2. Siberian Area (the eastern Kara Sea, Laptev Sea, western part of the East Siberian Sea). This area is influenced by the Siberian Low in winter. Winter air temperature is lower than in surrounding areas and is almost the same through the whole area. In summer air temperature rises considerably in the southern part of the area, especially near the continental coast, while in the northern part of the area air temperature remains low.

3. Pacific Area (eastern part of the East Siberian Sea and the Chukchi Sea). It is strongly influenced by Pacific depressions in winter. Air temperature is higher, and wind strength and amount of precipitation are greater in this area than in the surrounding areas. Summer is marked by the highest for the NSR occurrence rate of atmospheric low, and by considerable air temperature amplitudes. In the southern part of the area fog occurs more frequently than in adjacent regions.

Wind, visibility and air temperature are meteorological factors directly affecting the navigation. Polar stations are the main regular data source on wind, visibility and air temperature.

1.1. Air temperature.

Snow and ice thawing in summer results in that the temperature remains close to 0°C. Large and abrupt air temperature variations are not common for the NSR zone. Number of days with air temperature above 0°C is almost the same along the parallel 75^0 N, and makes approximately 40 days. Closer to the North Pale positive temperature occurs usually in the second half of July during only 10 to 15 days. Maximum temperature in the open sea does not exceed +5°C. (Table 1)

Air temperature in the Arctic depends much on wind direction. Air temperature on the coast is 7 to 10°C higher during continental wind than during inshore wind. On islands 25 to 50 miles offshore this difference is 2 to 4°C and between the parallels 80° - 85°N it is 1°C. Air temperature also depends on the average wind speed.

In the SW part of the Kara Sea, and in the southern parts of the Laptev Sea and East Siberian Sea air temperature transition to mainly positive values occurs in the second half of June. In the northern parts of almost all arctic seas, except for the Chukchi Sea, temperature transition to mainly positive meanings occurs by the end of the 1st decade/beginning of the 2nd decade of July. However, even in July temperature below freezing can occur in any region of the Arctic. (Table 2)

In the similar way, in autumn air temperature transition to stable below freezing values takes place in different regions at different time. In northern parts of the Kara Sea and Laptev Sea, and in the central East Siberian Sea, it occurs in the 3rd decade of August. In the central parts of the Kara and Laptev seas, in the northern parts of the Barents Sea and Chukchi Sea, and in the coastal area of the East Siberian Sea such transition occurs in the 3rd decade of September. Positive air temperature holds longer in the southern parts of the Kara and Chukchi seas, as a result of an inflow of, warmer waters from the adjacent seas.

Table 1

Average monthly air temperature (A), air temperature absolute maximum (B), and absolute minimum (C), °C.

Areas	Area numbers	Temper. symbol: "A","B","C"	June	July	August	September
Proliv Karskiye Vorota and Proliv Yugorskiy Shar	2, 6	A	1	6	6	3
		B	28	30	29	20
		C	-14	-4	-4	-11
Around Mys Zhelaniya	3	A	-1	2	3	1
		B	13	21	21	15
		C	-20	-13	-5	-16
Proliv Vilkitskogo and western approaches	5, 11	A	-2	2	3	-2
		B	12	24	20	13
		C	-13	-6	11	19
Laptev Sea, W part	12, 14	A	2	4	5	2
		B	30	30	29	20
		C	-12	-5	-4	-20
Novosibirskiye Ostrova and straits	15, 16	A	0	3	3	2
		B	19	22	22	12
		C	-13	-4	-6	-18
East Siberian Sea, western part	16, 17	A	1	3	3	0
		B	30	33	28	20
		C	-11	-5	-10	-16
East Siberian Sea, eastern part	18, 19	A	1	3	3	0
		B	28	29	25	16
		C	-11	-4	-7	-21
Proliv Longa and eastern approaches	21, 22	A	1	4	5	3
		B	25	30	26	17
		C	-12	-5	-7	-18

Table 2

Dates of the air temperature changing to stable above the 0 ^{0}C, or below the 0^{0}C

Area	Spring	Autumn
Proliv Karskiye Vorota and Proliv Yugorskiy Shar	6–8.VI	2–4.X
Around Mys Zhelaniya	21–26.VI	31.VIII–18.IX
Proliv Vilkitskogo and western approaches	12–21.VI	25.VIII–16.IX
Laptev Sea, W part	6–17.VI	1–21.IX
Novosibirskiye Ostrova and straits	14–16.VI	6–12.IX
East Siberian Sea, western part	4–8.VI	11–17.IX
East Siberian Sea, eastern part	3–7.VI	13–15.IX
Proliv Longa and eastern approaches	1–6.VI	14.IX–4.X

1.2. Fogs

In summer visibility in arctic seas can be reduced by precipitation, especially in the areas of atmospheric fronts, but more frequently it is reduced by fogs. In summer occurrence rate of fog is high. Fogs mainly are caused by an influx of relatively warm and moist air from the Atlantic and Pacific Oceans. Ice thawing in summer also leads to forming of a stable fog and low clouds. Fogs are most frequent not near the shore, but near the edge of close ice. Maximum number of days with fog, 24 to 29 days per month, occurs in July and August. On small islands lying within the NSR area the number of such days is somewhat less, 22 to 24 days per month. The average number of days with fog is 14 to 17 days per month on the continental shore and on the coasts of large islands, and 8 to 10 days per month in gulfs and bays.

At a distance of over 250 miles offshore, and in the absence of ice, fogs occur 10 more frequently during the 5 winds, and at a distance of 50 to 73 miles offshore fogs are observed more frequently during the N winds. In the presence of ice fogs are equally frequent both during the S and the N winds. Fogs occur more frequently when air temperature is 0°C to +5°C, but they are also observed when the temperature is below 0°C (up to -5°C).

Fog by "charges", when duration of a "charge" is less than I hour, is observed rather frequently. Normally fogs are formed during gentle and moderate winds. Fogs occurring during the winds with speed of more than 8 In/sec, make 25 to 30% of the total number of fogs.

Table 3

Average and maximum number of days with fog

(Maximum number of days with fog is given in parentheses)

Area	Area numbers	June	July	August	Septmber
Proliv Karskiye Vorota and Proliv Yugorskiy Shar	2, 6	9(16)	7(17)	8(19)	8(16)
Around Mys Zhelaniya	3	12(14)	17(23)	17(29)	9(18)
Proliv Vil'kitskogo and western approaches	5, 11	11(19)	17(24)	13(23)	4(15)
Laptev Sea, W part	12, 14	12(18)	14(18)	14(21)	9(14)
Novosibirskiye Ostrova and straits	15, 16	17(20)	23(24)	18(22)	7(10)
East Siberian Sea, western part	16, 17	13(24)	17(24)	17(22)	7(12)
East Siberian Sea, eastern part	18, 19	15(20)	19(23)	19(22)	9(17)
Proliv Longa and eastern approaches	21, 22, 22	11(19)	17(24)	13(23)	4(15)

1.3. Winds.

Wind direction, speed and persistence have direct influence on navigation. In the presence of ice in the area of NSR wind is an important factor affecting ice conditions, as wind drift of ice prevails in the arctic seas.

By their influence on drift ice winds can be divided into "pushing-off" and "pushing-to" winds. Pushing-off winds are these favoring better ice conditions, i.e. they weaken, or remove pressure in the close ice, and pushing-to winds influence the ice inversely.

Along practically the whole of the NSR. except for certain areas, unfavorable (pushing-to) winds are these blowing from the northern quarters.

In the western part of the NSR occurrence rate of the pushing-to winds ranges from 60 - 70% in June to 33 - 35 % in August.

In the eastern part of the NSR (eastern East Siberian Sea and Chukchi Sea) occurrence rate of the pushing-to winds increases towards the end of navigation period.

In the central part of the NSR (Laptev Sea) occurrence rate of the pushing-to winds accounts for about 50%.

Occurrence of the pushing-to winds considerably changes from year to year. For instance, in August 1975 it was 39% in the area to the W of Proliv Vil'kitskogo, and in August 1976 it was 81%. In the area of Novosibirskiye Ostrova occurrence of the pushing-to winds was 20% in August 1979, and in August of 1980 and 1981 it was, respectively, 64% and 68%.

Pushing-to winds usually are followed by pushing-off winds, or by gentle winds lasting normally for 3 days; sometimes they last for 8 days, and for more than 15 days in the areas to the west and east of Proliv Vil'kitskogo and in the vicinity of Novosibirskiye Ostrova.

The greatest duration of pushing-to winds (32 days) has been observed in the W part of the Laptev Sea and in the area to the west of Proliv Vil'kitskogo.

Occurrence rate of winds with speed less than 12 m/sec, (up to 15 m/sec, in gusts) is the greatest in the northernmost stretches of the NSR, especially at the end of the navigation season. In the rest of the NSR, occurrence rate of winds with speed up to 12 m/sec, is 10 to 19%.

Strong winds normally last for 1 - 3 days, although they can last up to 6 days in some sections.

Gales with wind speed 20 m/sec and more normally last for 1 day. The westernmost part of the NSR is the exception, where gales can last for up to 4 days.

In the area to the east of Proliv Vil'kitskogo and up to Proliv Longa duration of gales with wind speed 20 m/sec and mole did not exceed 2 days during navigation period. In the western East Siberian Sea such winds very rarely last for 1 day.

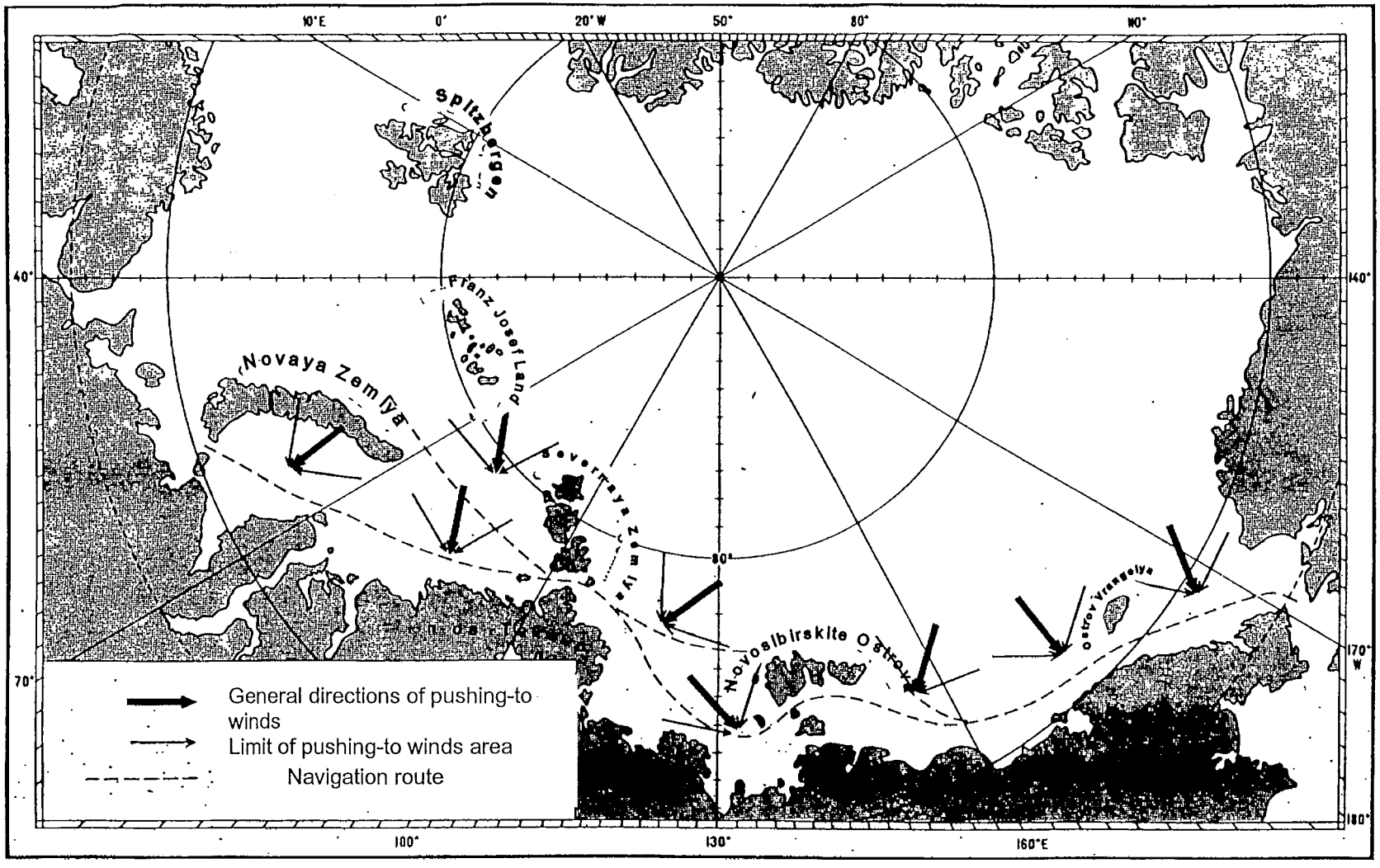


Fig. 1. Scheme of general directions of pushing-to winds

1.4. Currents.

Summary currents in arctic seas are composed of constant, wind- induced and tidal currents. The scheme of the constant currents is calculated by using indirect method based on water density distribution, and provides an idea on water circulation in the arctic seas.

In the Kara Sea, East Siberian Sea and Chukchi Sea (Fig.2) constant currents are formed as a result of the fresh water inflow from rivers, water exchange with adjacent seas, including the Arctic Basin. Schemes of constant currents in the above mentioned seas give an idea on currents direction and speed in the surface layer in summer, in the absence of wind and in the presence of gentle wind.

Rate of the constant currents in the larger part of the NSR area is 0.1-0.3 knot. Only in some areas, mainly in straits and in the areas adjoining mouths of large rivers, the speed of the constant current is 0.4-1.2 knots.

Cold current sets from the N to the NW part of the Kara Sea through the wide passage between Franz Josef Land and Ostrov Ushakova.

Warm Novozemel'skoye (of Novaya Zemlya) current goes to the Kara Sea from the Barents Sea rounding Mys Zhelaniya. It sets SW along eastern coasts of Ostrova Novaya Zemlya. The speed of the current is 0.1-0.2 knots.

In Proliv Karskiye Vorota constant current with a speed 0.4 knot goes along Ostrov Vaygach shore from the Barents Sea to the Kara Sea, and near the southern coast of Ostrova Novaya Zemlya there is constant current with a speed 0.2 knot, 3 which goes in the opposite direction. In Proliv Yugorskiy Shar constant current is directed from the Barents Sea to the Kara Sea. In the middle of the strait its speed is 1.2 knots.

In the SW part of the Kara Sea constant current setting from Barents Sea through Proliv Karskiye Vorota and Yugorskiy Shar, goes to the NE; its speed is 0.2 knot.

Waters from river Ob' and river Yenisey spread in the Kara Sea in the fan pattern. Part of these waters form counter-clockwise rotating current in the SW part of the sea. Other part goes northward and north-eastward, with a speed 0.1-0.3 knot, towards Proliv Vil'kitskogo. In the Matisena strait constant current with a speed 0.2-0.3 knot is directed to the E and NE. In Proliv Lenina constant current of the same speed goes to the SE. Vostochno-Taymyrskoye (of the eastern Taymyr) current goes from the N to S along the eastern shores of Ostrova Severnaya Zemlya and near the shores of Poluostrov Taymyr with a speed 0.2 to 0.3 knot. Part of this current then sets through Proliv Shokal'skogo and the N part of Proliv Vil'kitskogo to the Kara Sea, and its main blanch continues to the S and gets strengthened by waters coming from the Kara Sea through the southern part of Proliv Vil'kitskogo; its speed is 0.5 knot. Approximately at the latitude of Bukhta Pronchishchevoy this current meets with a flow of freshened waters from Khatangskiy Zaliv, mixes with it and continues to the E with a speed 0.2 knot.

In the SE part of Laptev Sea, under the influence of an inflow from rivers Lena and Yana, constant E and NE current forms. Further it merges with currents setting W from Proliv Dmitriya Lapteva and Proliv Sannikova and continues to the N and NW: its speed is 0.2 to 0.3 knot.

In the East Siberian Sea constant W and NW currents prevail. Only in coastal area current is of the cast-north-eastern direction. To the W of Ostrov Vrangelya constant current sets NW: it is an extension of the constant current coming from the Chukchi Sea through Proliv Longa; its speed is 0.1 to 0.2 knot.

In Proliv Dmitriya Lapteva and Proliv Sannikova constant currents are W-going their speed is 0.2 to 0.3 knot. In the N part of Proliv Longa constant current sets W 9 and in the S part it sets E: their speed is 0.2 knot.

Indigirskoye (of Indigirka) current caused by the water inflow from rivers Indigirka and Alazeya is N and NE-going. River Kolyma waters form in the sea two branches of constant current, one sets N and another sets ENE; their speed is 0.3 knot.

Constant currents in the Chukchi Sea are conditioned mainly by an influx of Pacific waters through the Bering Strait (Beringovomorskoye current), and by an influx of the East Siberian Sea waters through Proliv Longa. Speed of the current in the Bering Strait is about 1 knot. In the Chukchi Sea Beringovomorskoye current divides into 3 main branches: Alaskan, Herald and of Proliv Longa. Alaskan branch 3 goes to the NE from Point Hope along the shore of Alaska: its speed ranges from 0.5 knot at the parallel of Point Hope to 0.2 knot at the parallel of Point Barrow.

Herald branch goes to the N through the central part of the sea, rounding Ostrov Gerard (Herald) on both sides; speed of the current ranges between 0.3 knot in the central Chukchi Sea and 0.1-0.2 knot in its N part.

A branch of Proliv Longa current gets separated from the main flow approximately in the area of the parallel 68°N and goes NW into Proliv Longa: speed of the current is 0.2 knot.

Chukotskoye current goes from Proliv Longa to the SE, along the coast of Chukotskiy Poluostrov. Its speed in Proliv Longa is 0.2 knot, and on the meridian of Kolyuchinskaya Guba it is 0.1 knot. This current does not usually reach Bering Strait and in the vicinity of Kolyuchinskaya Guba merges with the current setting WNW.

Schemes of wind-driven currents in the surface layer of arctic seas for steady (i.e. lasting for not less than 12 hours) NE, SE, SW and NW winds with a speed 10 m/sec, are given in this Guide.

In coastal areas with complicated shoreline configuration, currents direction may both coincide with the wind direction and decline from it.

NE wind with a speed .10 m/sec, induces in the larger part of arctic seas currents setting W and NW at 0.4 to 0.8 knot.

SE wind with a speed 10 m/sec, induces in the Laptev, East Siberian and Chukchi seas a current setting mainly NW at 0.4-0.8 knot. In the Kara Sea similar wind induces a current setting mainly NE at 0.4-0.8 knot.

In Proliv Dmitriya Lapteva, Proliv Sannikova and Proliv Longa currents are W- going, and in Proliv Karskiye Vorota and in the Bering Strait they are NE-going. Their speed reaches 1.2 knots in the Bering Strait. In Proliv Vil'kitskogo SE wind induces currents setting E and NE at 1.3 knots.

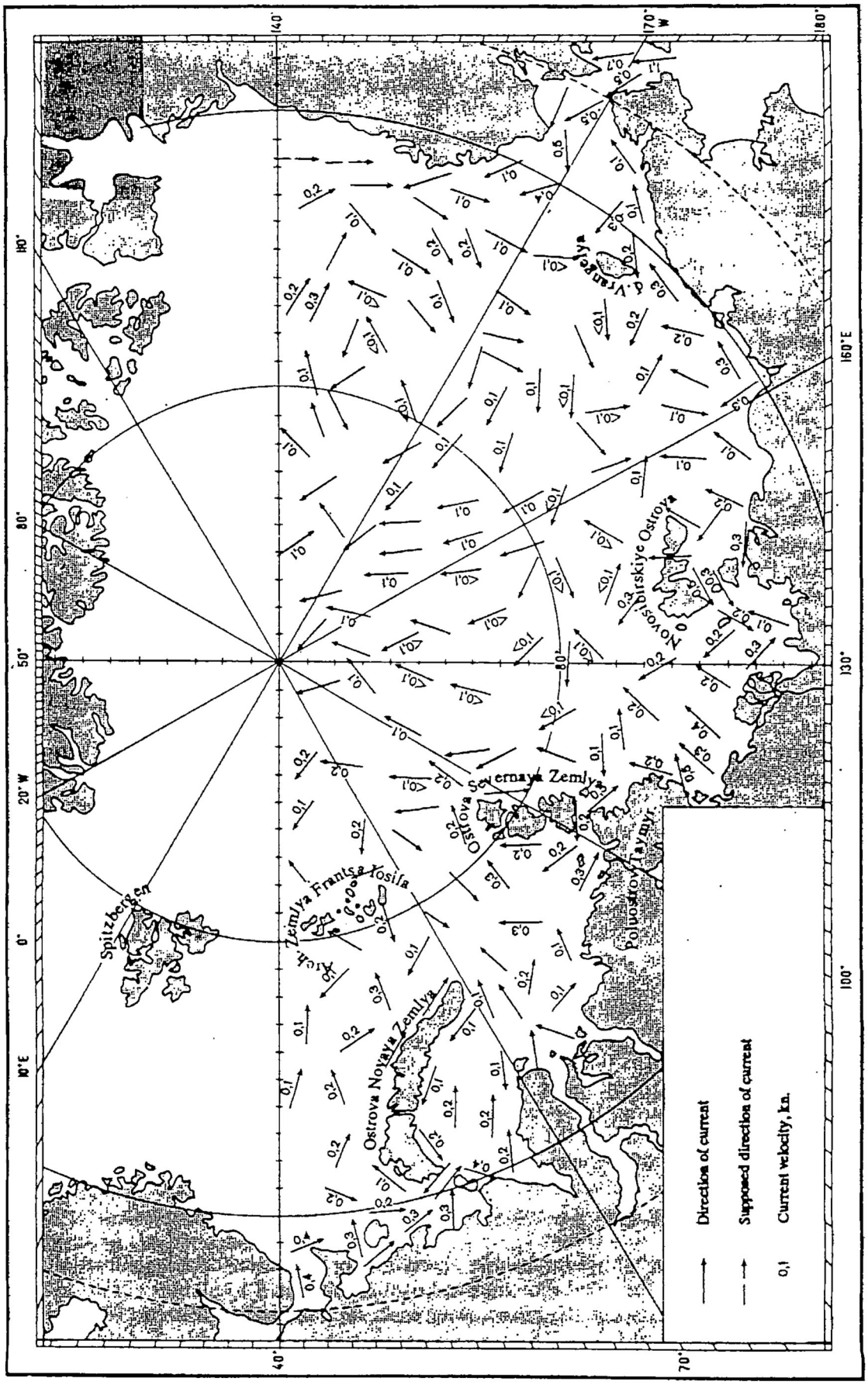


Fig. 2 Scheme of constant currents in the 0-10 m. Layer during the period of navigation

SW wind with a speed 10 m/sec. induces in arctic seas and straits currents setting predominantly E and NE. Their speed in the open sea is 0.3 to 0.8 knot, in the Bering Strait 1.7 knots, in Proliv Sannikova 2.1 knots, in Proliv Yugorskiy Shar 2 knots. In Proliv Vil'kitskogo this wind induces a current going to the E at 1.3 knots.

NW wind with a speed 10 m/sec, induces in the Laptev, East Siberian and Chukchi seas currents going SE at 0.4 to 0.6 knot. In the Kara Sea similar wind induces currents going to the S and SW in 0.2 to 0.5 knot.

Current is S-going in Bering Straits its speed reaches 1.1 knots.

In Proliv Matisena during winds from the SE - W current is mainly NE-going. Its speed during 10 m/sec. winds from the W and SW is 1.3 to 1.6 knots, and it decreases to 0.5 knot during SE wind.

Maximum speeder the wind currents (Fig.7) is generally 1.5-2 knots, in some places 2.5 to 3 knots, and even 5 to 6 knots in Proliv Matochkin Shar, Proliv Yugorskiy Shar and Proliv Matisena. Currents of such speed are possible mainly during winds of 20 m/sec, and greater.

Tidal streams in the Arctic Basin and arctic seas are mainly semidiurnal. They are reversing in coastal waters, in narrow passages and in not wide bays, but in the open parts of arctic seas they are rotary.

Reversing tidal streams change very quickly from flood stream to ebb stream and vice versa; flood stream direction is opposite to that of the ebb stream. Currents go along the shore, or along the axes of passages.

Rotary tidal streams change their direction gradually and in majority of regions clockwise.

The strongest are spring tide currents, which are observed 2.5 to 3 days after the new moon and full moon. Weak neap tide currents occur 2.5 to 3 days after the first and third quarters of the Moon. The spring currents are 2 to 2.5 times stronger than the neap currents.

In the open Kara Sea and in the W part of the Laptev Sea prevailing speed of the spring current (Fig.8) is 0.4 to 0.8 knot, in the E part of the Laptev Sea and in the East Siberian Sea it is 0.2 to 0.4 knot, and in the Chukchi Sea it is 0.4 to 0.6 knot.

In the area to the N of Ostrov Belyy speed of the spring current reaches 1.8 knots, and in Proliv Karskiye Vorota and Proliv Yugorskiy Shar 2.8 knots. 3 In Proliv Vil'kitskogo Hood stream goes from the Laptev Sea to the Kara Sea, and ebb stream has an opposite direction. Spring currents speed is 0.2 to 0.6 knot in the E part of the strait.

In Proliv Sannikova and Proliv Dmitriya Lapteva tidal stream goes from the East Siberian Sea to the Laptev Sea: its speed does not exceed 0.2 to 0.3 knot.

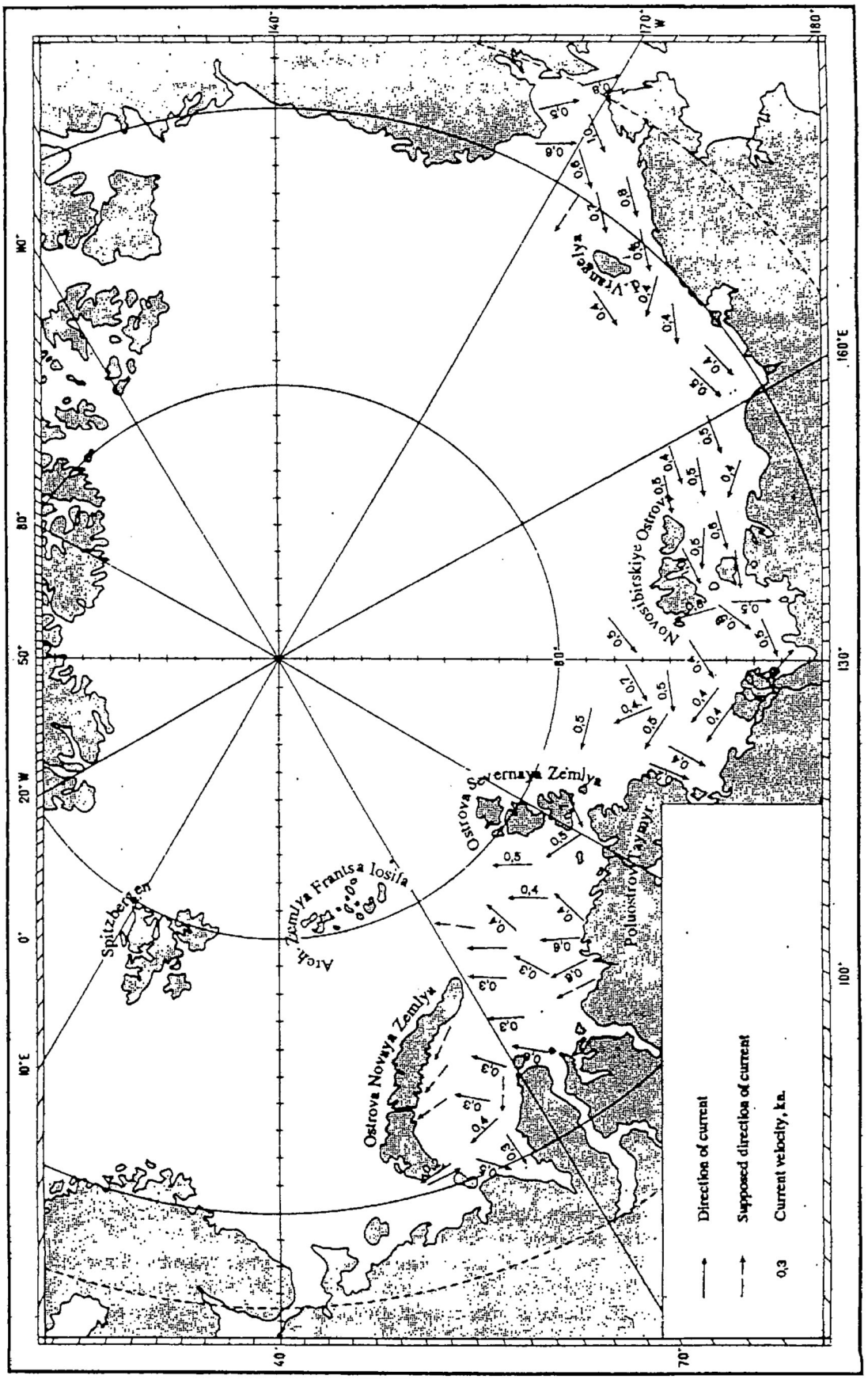


Fig.3. Scheme of currents in the 0-10 m. Layer during 10 m/sec. NE wind

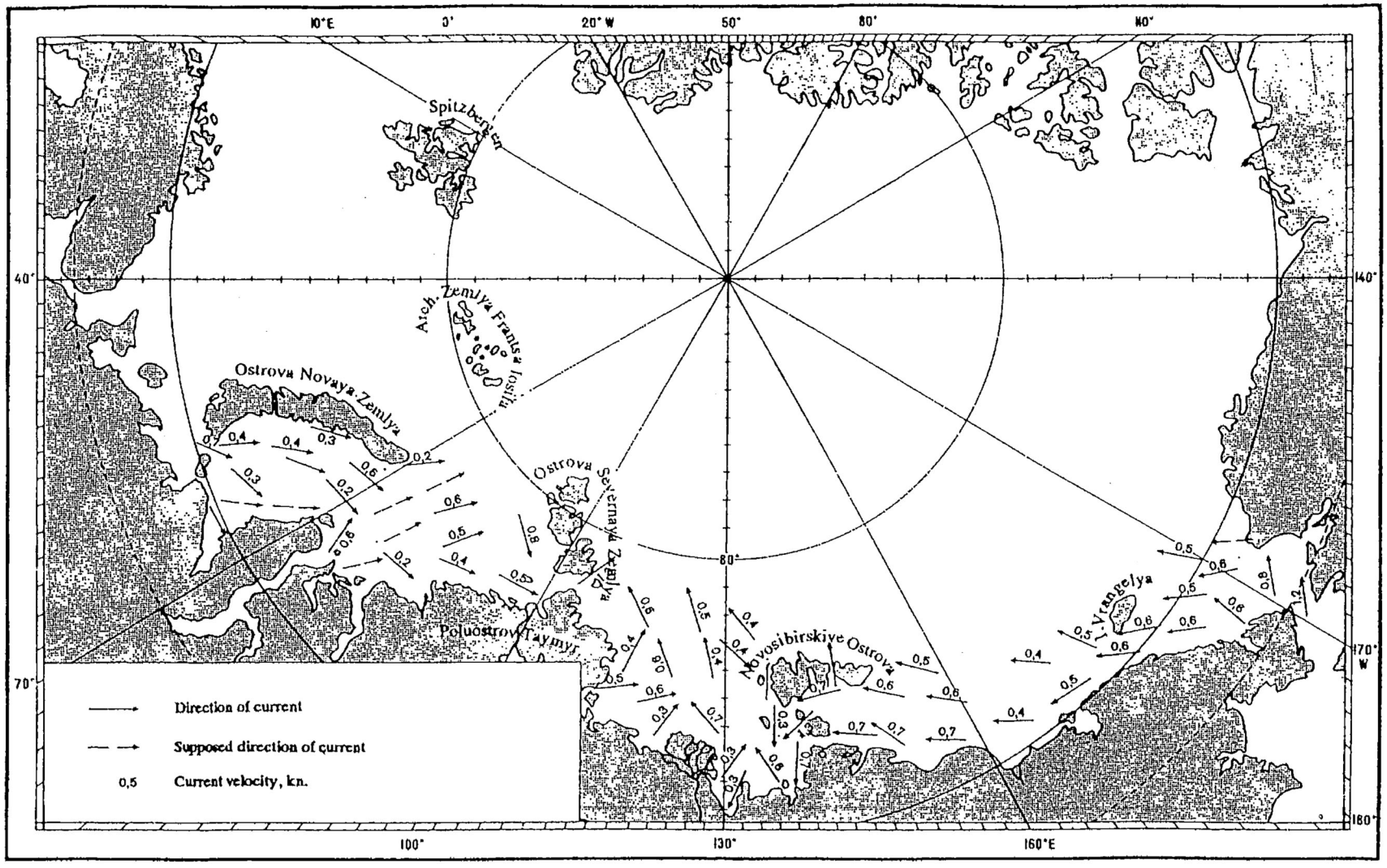


Fig.4. Scheme of currents in the 0-10 m. Layer during 10 m/sec. SE wind

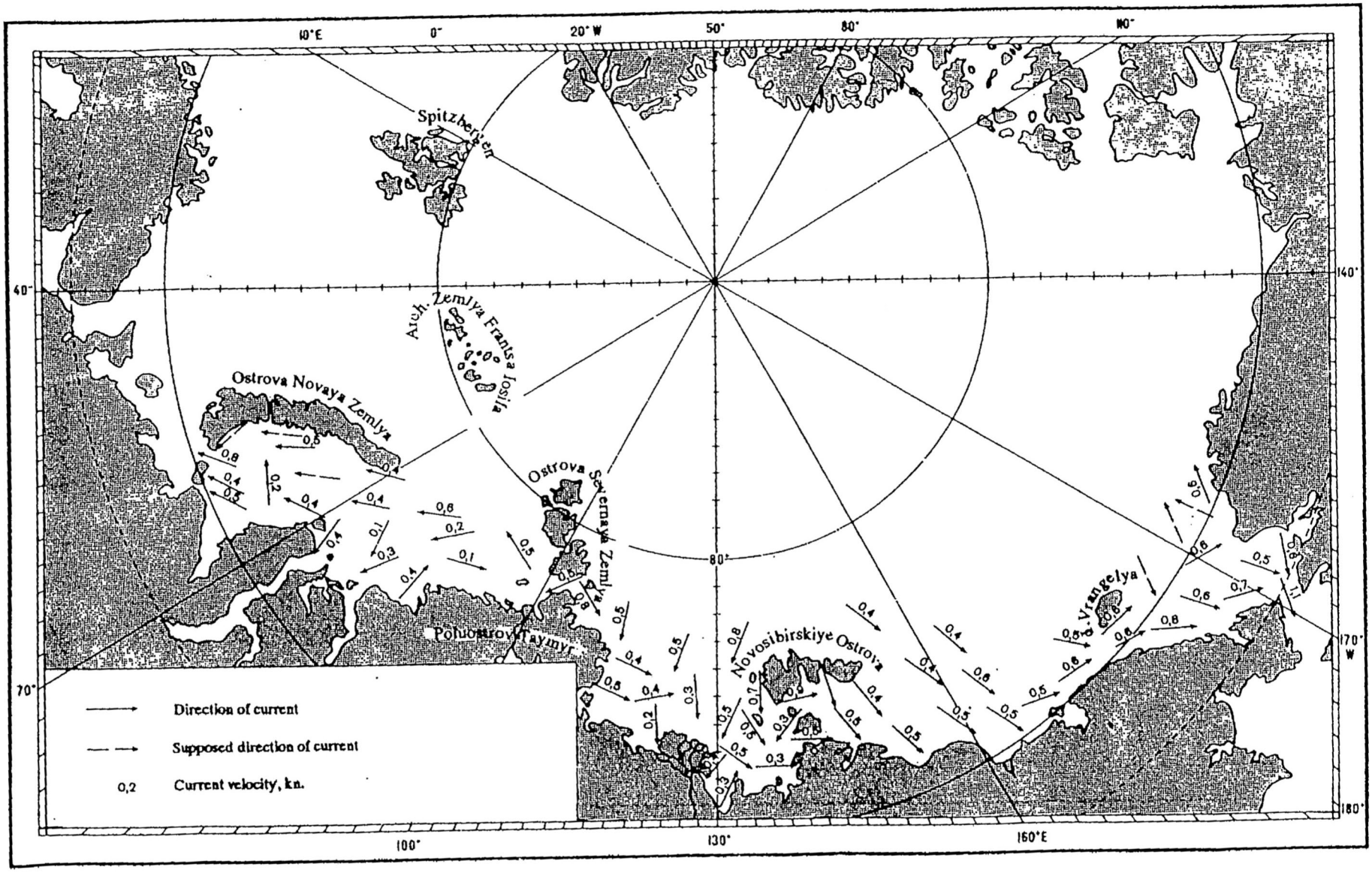


Fig. 5. Scheme of currents in the 0-10 m. Layer during 10 m/sec. wind

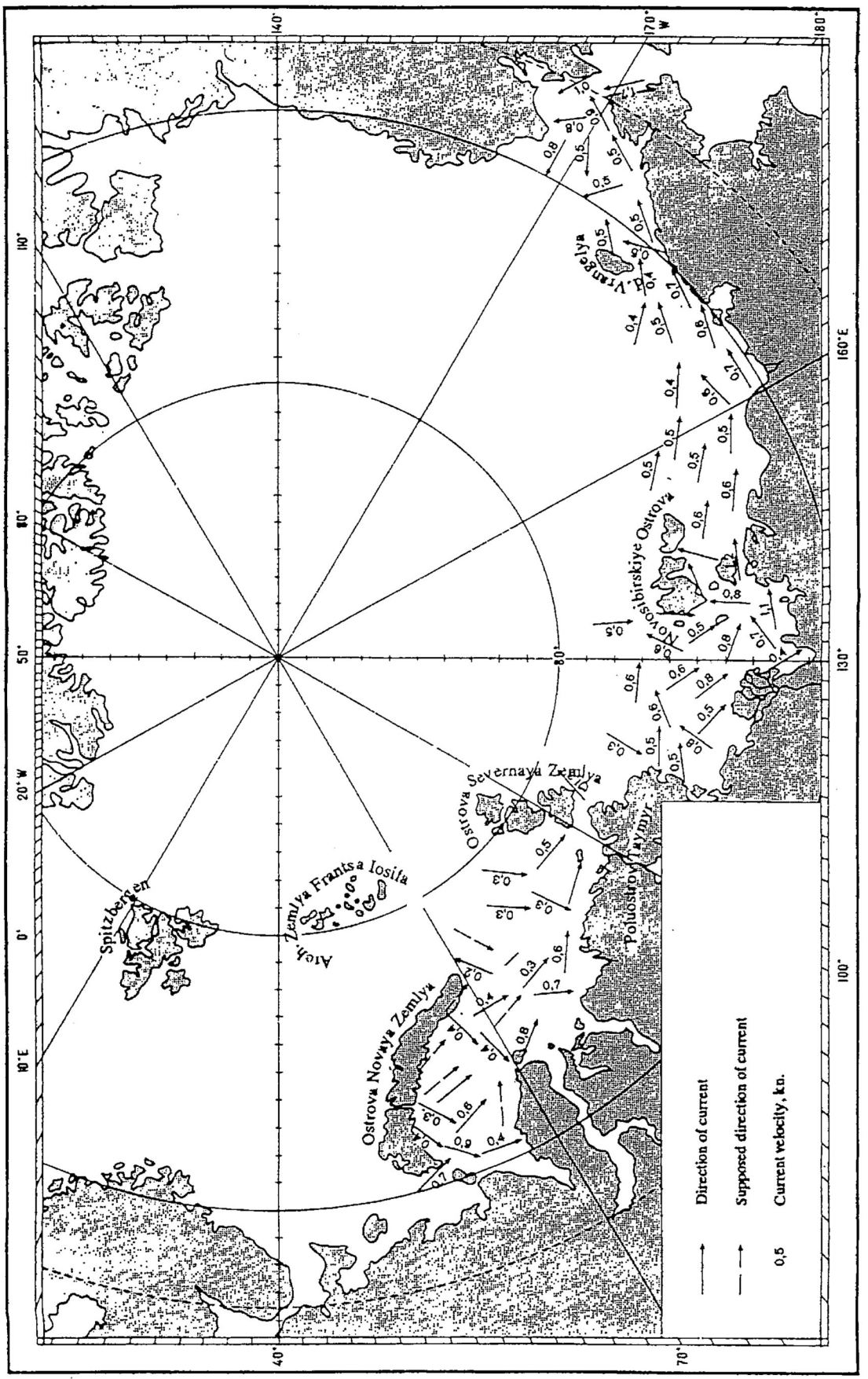


Fig. 6. Scheme of currents in the 0-10 m. Layer during 10 m/sec. SW wind

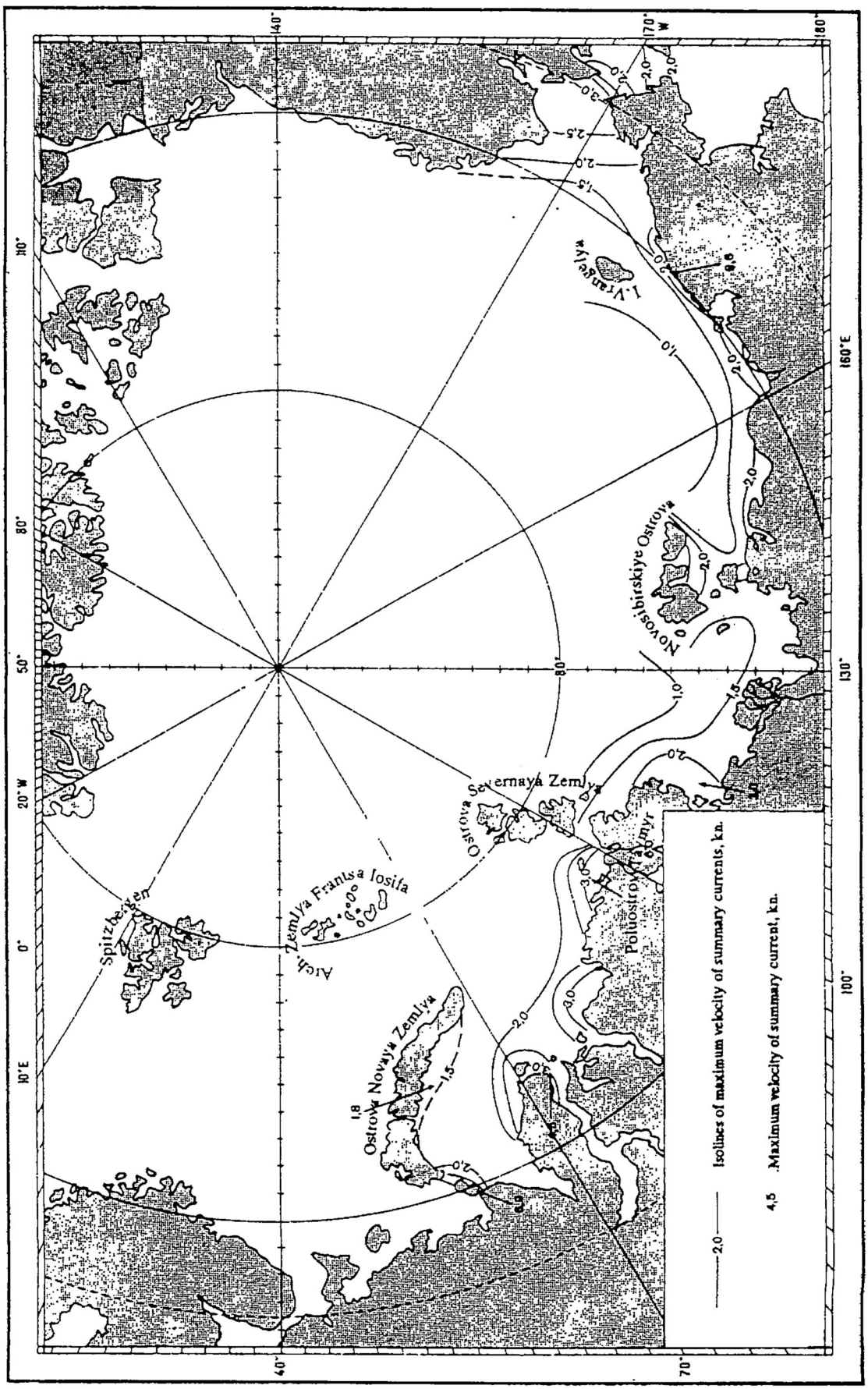


Fig. 7. Maximum velocity of summary currents in the 0-10 m. Layer during the period of navigation

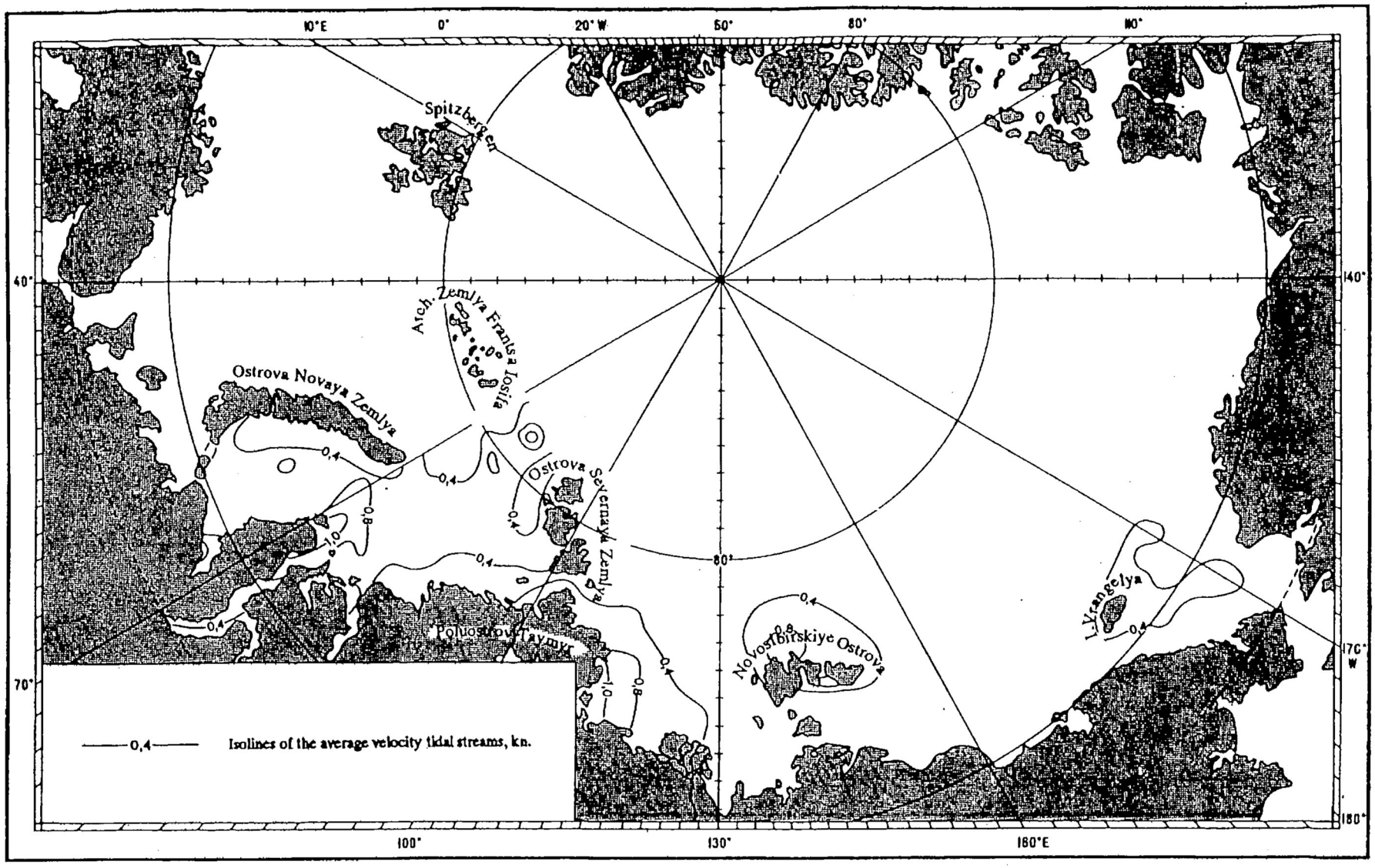


Fig. 8. Average velocity of spring tidal streams

1.5. Waves.

Development or waves in the arctic seas depends on wind speed and direction, on presence and character of distribution of ice, and on the sea depth. Strong winds are relatively rare in July and August, and sea areas clear of ice are small, which binders waves development. Waves of maximum magnitude develop in September and October. In November arctic seas are almost completely ice-covered, due to which waves are small, or there are no waves at all. The S part of the Chukchi Sea is the exception, where in some years wave height can reach 4 to 5 m in November.

In the Kara Sea in July and August waves more frequently come from the NE. Occurrence of waves 3 m high and greater is 3-6% in July and August, and 6-16% in September and October. Their high occurrence rate is observed in the NW part of the Kara Sea. In the deep SW part of the sea ice rarely prevents waves development, due to which wave height can reach 8 to 9 m in this area. In this area heavy sea from any direction is possible.

In the Laptev Sea the heaviest sea develops, when there is no ice in the central part and near the W shores.

As the shipping route passes through shallow waters in the Laptev Sea, the wave height along it normally does not exceed 2 m. However, in some areas waves can be steep and dangerous for small craft during strong N winds. In the central part of the sea during E gales the height of waves can reach 4 to 5 m in July and August. In the SE part of the sea the height of waves does not exceed 4 m even during wind with a speed of 12 to 20 m/sec., due to shallow water.

Wave height reaches 6 m in September and October. The maximum wave height does not exceed 4 m on the shipping route in the Laptev Sea in this period, and only near the shores of Poluostrov Taymyr it can reach 5 m.

Occurrence rate of wave height of 3 m and greater is 4 to 6% in July and August, and 6 to 8% in September and October.

The East Siberian Sea is rather smooth, if compared to other arctic sea, due to its highly developed ice coverage and shallow waters.

In the W part of the sea in the middle of August the wave height reaches 4 to 5 m during the NW wind with speed up to 20 m/sec. The wave height in this area does not exceed 2.5 m during the NE wind. It can reach 5 m in September.

In coastal waters maximum wave height is 2.5 to 3 m. However, even waves with height less than 2.5 m become steeper there.

Occurrence of wave height of 3 m and greater makes 3 to 5% in August and Septembers; in July and October the sea is covered by ice, as a rule.

In the Chukchi Sea waves are not high in July and August, only in the SE part of the sea maximum wave height can reach 5 m.

Wave height reaches 5 to 7 m in September and October. The highest waves are observed in the central part of the sea and along the shores of Chukotskiy Poluostrov lying to the E of Mys Serdtse-Kamen'. Maximum wave height observed in the Chukchi Sea is 9 m. Wave

height decreases towards the end of November, when forming of ice cover intensities. However, wave heights of 4 to 5 m occur in November in the vicinity of Mys Uelen.

Along the coastal shipping route of the Chukchi Sea wave height can reach 6 m during the northern gales.

In the coastal zone of the Chukchi Sea (the vicinity of Mys Otto Shmidta) an infrequent but dangerous phenomenon called the "ice storm" is observed, i.e. storm in the presence of ice. The "ice storm" was observed in the vicinity of Mys Otto Shmidta in 1969, 1972, 1980, 1984 and 1985. This phenomenon occurs when there is about 27 miles wide strip of 2 to 6 points close brash ice blocking the coast. Waves consolidate ice up to 10 points and drive it to the shore. Width of ice strip decreases to 3-4 cables. Waves approaching the shore break down, and the surf forms. Up to 3 m high waves swing, ice blocs and throw them down on the shore damaging piers, wharves and other constructions.

Under the same conditions the "ice storm" may also occur in other parts of arctic seas.

1.6. Water temperature.

Water temperature in the surface layer of the arctic seas in winter is mainly close to the freezing point. Mean water temperature in the NW part of the Kara Sea is -1.85°C, in the Chukchi Sea -1.8°C, and -1°C near the mouths of large rivers.

Large part of the Kara Sea clears of ice in the third decade of July, and water temperature reaches 3°C in the coastal zone. The N part of the sea remains covered by ice and water temperature in the 5 m surface layer is negative (-1...-1.5°C).

In the S part of the Laptev Sea water warms up to 1-2°C at this time, and its N part normally is covered by ice, with water temperature about -1°C.

East Siberian Sea is almost completely covered by ice in July, and water temperature in 5 m surface layer is about -1°C. In the coastal area water temperature is about 0°C in the end of July.

Large part of the Chukchi Sea clears of ice in the 3rd decade of July on the average, according to the multiyear observations. In the SE part of the sea water temperature reaches 7°C in this time, and in the NW part it is -1°C and below.

Maximum temperature in the surface layer of the arctic seas is observed in August. At this time, water temperature reaches $+6^0$C in the coastal areas of the Kara Sea. Towards the N water temperature gradually decreases and is about -1°C in the N part of the sea.

In the northern Laptev Sea water temperature is -0.5...-1°C, and in the coastal areas +4 to $+6^0$C. The East Siberian Sea waters warm up in August to +1 +3°C along the continental coast, and in the northern part water temperature does not exceed -0.5...-1°C.

In the SE part of the Chukchi Sea water temperature rises In August to +8 +9°C. It docs not exceed 0...-1°C in the NW part of the sea.

Water surface layer begins to cool in September in the arctic seas. In the SW Kara Sea and in the Ob'-Yenisey region average multiyear water temperature in September is +3 - +4°C; in the northern part of the sea water temperature -1°C (Fig.9).

In the S part or the Laptev Sea water temperature docs not exceed +3 - +4°C in ' September. and it is about -l°C in the NE part of the sea.

In the western part of the East Siberian Sea water temperature is above freezing in September, reaching +l to +2"C near the continental coast. In the northern part of the sea water temperature does not exceed -l°C.

In the SE part of the Chukchi Sea water temperature is +5 to +6°C. due to the influx of warm waters from the Bering Sea. In the western and northern parts of the sea water temperature is 0 - +l°C.

In October intensive cooling of the surface layer and freeze-up take place. In the first decade of December above freezing water temperature persists only in the south' western Kara Sea (+l - +2°C), in the south-eastern Laptev Sea (up to +l°C), and in the south-eastern Chukchi Sea (+2 to +4°C).

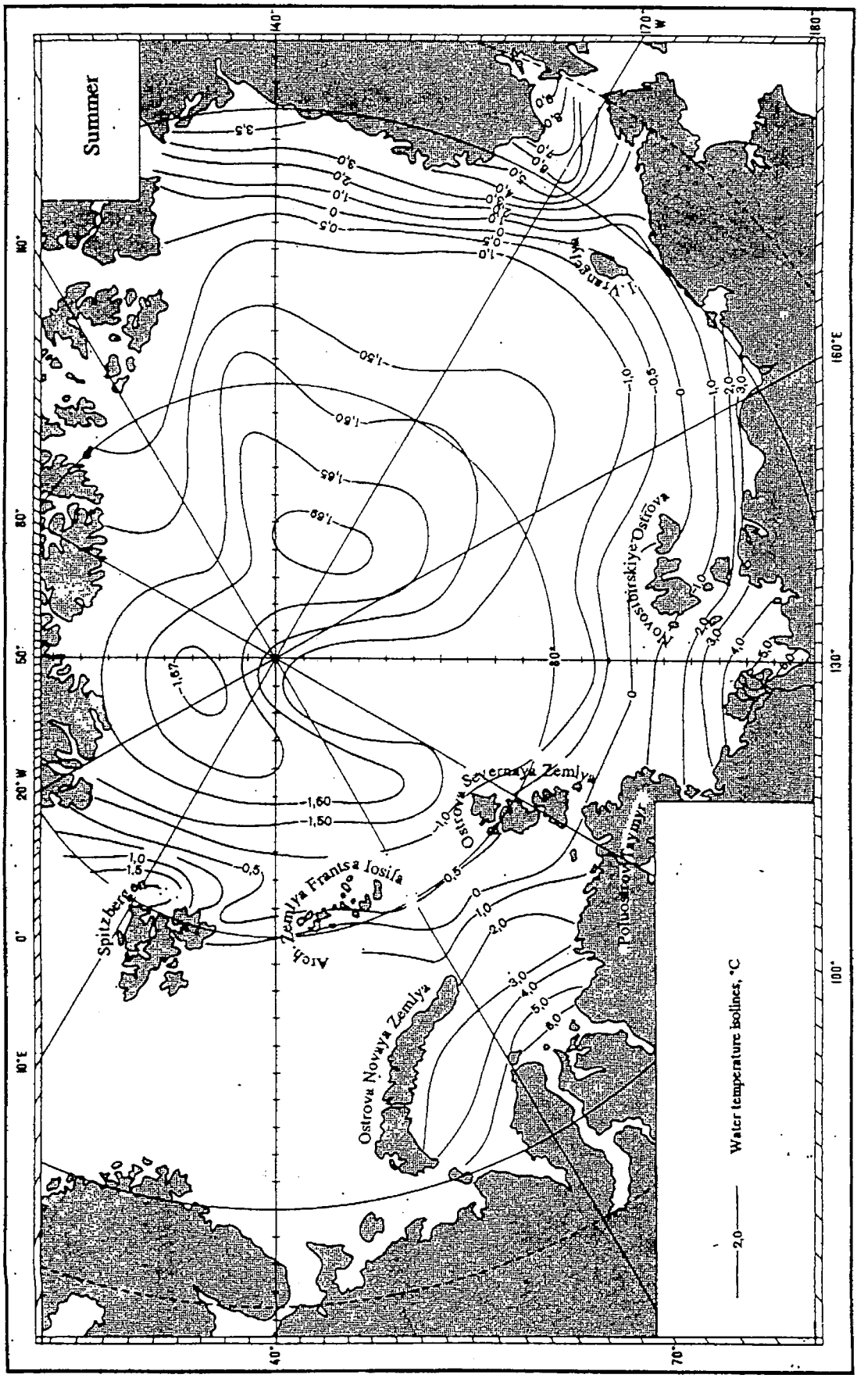


Fig. 9. Surface water layer temperature

2. Seas and High risk areas on the NSR descriptions

2.1. Kara Sea

Kara Sea is one of the marginal seas of the Arctic Ocean and covers an area of 883000 km^2 (including islands 893000 km^2). In the West, the Kara Sea is bounded by Ostrov Vaygach and Ostrova Novaya Zemlya and is connected with Barents Sea by Proliv Yugorskiy Shar, Proliv Karskiye Vorota and Proliv Matochkin Shar. In the NW, the Kara Sea merges with Barents Sea and in the N opens widely to the Arctic Basin (Central Polar Basin) of the Arctic Ocean. In the East, the sea is bounded by Ostrova Severnaya Zemlya and Poluostrov Taymyr and is connected with Laptev Sea by Proliv Vil'kitskogo, Proliv Shokal'skogo and Proliv Krasnoy Armii.

Navigational conditions for ships are complicated. The main reasons impeding navigation are the following: great number of submarine dangers, frequent fogs, almost constant presence of ice and insufficient knowledge of currents.

Route option in coastal zone is determined by existence of ice and depths dangerous for navigation. In the open sea areas, where depths dangerous for navigation do not exist, route option depends on ice concentration.

The Kara Sea coasts are of different structure, but mostly they have comparatively smooth relief and low height. Shores are abrupt, stony, composed of bedrock in 3 places.

The Kara Sea coast is covered with tundra vegetation and is of monotonous yellowish- brown colour.
Of many rivers falling into the Kara Sea only Ob', Yenisey, Pyasina and Taymyra are important inland waterways. Other rivers are shallow or short, and only some of them can be used by small crafts.

The most important for navigation are Proliv Yugorskiy Shar and Proliv Karskiye Vorota connecting Kara Sea with Barents Sea, and Proliv Vil'kitskogo connecting Kara Sea with Laptev Sea.

Kara Sea is situated within continental shelf, so I that depths less than 400 In prevail. Continental slope starts N of the line connecting Franz Josef Land with Ostrova Novaya Zemlya.

The deepest is the W part of the sea where Novozemerskaya Vpadina with depths 200 to 400 m lies along Ostrov Vaygach and Ostrova Novaya Zemlya.

The most dangerous zone for navigation in the Kara Sea, because of bottom irregularity, is its coastal part between Pyasinslay Zaliv and Taymyrskiy Zaliv lying within 50 m contour line.

2.1.1. Proliv Yugorskiy Shar and Proliv Karskiye Vorota

Ostrov Vaygach, Proliv Yugorskiy Shar and Proliv Karskiye Vorota are at the W boundary of the NSR between Barents Sea and Kara Sea. Proliv Yugorskiy Shar and Proliv Karskiye Vorota are the main routes leading to the NSR from W.

Proliv Yugorskiy Shar separates Ostrov Vaygach from the continent and is the most southern of the straits connecting Kara Sea and Barents Sea- The SW limit of the strait passes along the line connecting Mys Sokoliy and Mys Belyy.

The coast in the vicinity of Proliv Yugorskiy Shar is of a smooth contour slightly elevating inland. In places the coast consists of the short stretches of rocky precipices 4 to 16 m high alternating with marshy low lands fringed with drying shoals.

Bottom relief, hydrometeorological and ice conditions in this strait are well studied.

Water depths are of 13 to 15 m are in the W part of Proliv Yugorskiy Shar: and 16 to 30 m in its E part: in the central part within depths of 13 to 17 m there are deeps of 27 to 42 m.

Dangers, such as small stony shoals, lie mainly in the W part of Proliv Yugorskiy Shar, some of them are close to a fairway. Dangerous sand banks lie in the central and E parts of the strait; stony shoals are encountered only at the shores and near Ostrov Sokoliy.

The tides are semidiurnal in Proliv Yugorskiy Shar. The spring range reaches 0.6 m and the neap range is 0.2 m. The range of non- periodical sea level variations reaches 1.4 m.

Constant currents, tidal streams and wind-driven flows are experienced in Proliv Yugorskiy Shar. Constant current, with a direction from Barents to Kara Sea, has a speed of 0.2 to 0.5 knots in Proliv Yugorskiy Shar.

In winter Proliv Yugorskiy Shar almost always is covered with landfast ice. Settled freeze-up in the strait begins on the average between 4th and 71h of November, the earliest date is 5th of October and the latest - lst of December.

The break-up of ice in the strait occurs on 26th to 30th of June on the average. The earliest date is 7th of June, and the latest is 21st of July.

The strait completely clears of ice on 20th to 30th of July, on the average, the latest date is about 20th of September.

Proliv Karskiye Vorota passes between Ostrov Vaygach and Ostrov Yuzhnyy (Novaya Zemlya) and is the main shipping channel connecting Barents Sea and Kara Sea.

The SW border of the strait passes along the line connecting Mys Rogatyy and Mys Kusov Nos. The NE border passes along the line connecting Mys Bolvanskiy Nos and Mys Menshikova. The strait is suitable to deep draught vessels. ' Bottom topography, oceanographic, meteorological and ice conditions in Proliv Karskiye Vorota are studied sufficiently; navigation in the strait is possible only in compliance with recommendations given below. The least width of the safe channel in the strait is 13 miles, between Banka Persey and Ostrov Chirachiy. Navigation in the strait is difficult because of strong currents, frequent fogs, existence of drifting ice) and a great number of navigational hazards, though the latter are located mainly near the shores. It is almost impossible to anchor in the strait due to deep depths, and heaving to is also unsafe, as currents may carry a vessel towards the banks.

The shores of Proliv Karskiye Vorota are of skerries nature.

Depths are deep and irregular in Proliv Karskiye Vorota. Within depths 100 m and more there are numerous bottom rises up to 15 17'm, especially on the Barents Sea side.

Many dangers lie near the strait shores, so it is not recommended to approach them. Navigable part of the strait passes between 50 m contour lines. Banka Prokof'yeva and Banka Persey are the most outlying off the shores or the strait, being in the SW part of the strait.

The bottom is grey mud in Proliv Karskiye Vorota. Grey sandy silt with sparse inclusions of shingle and boulders is deposited In the approaches to the strait from the Barents Sea side the bottom is grey sandy silt with sparse inclusions of shingle and boulders, and in the approaches to the strait from the Kara Sea the bottom is brown and grey silt. Grey sandy silt and silty sand prevail along the coasts of Ostrova Novaya Zemlya.

The bottom on banks is mainly stone covered with mud.

Winds. NE, E. W and SW winds are the most frequent during navigation period in Proliv Karskiye Vorota. The strongest gales occur from October to January (wind speed averages 7 to 10 In/sec monthly). Wind weakens from June to August (on the average to 5 to 7 m/sec). Storm gales are observed frequently from November to January.

During navigation period fogs are more frequent in Proliv Karskiye Vorota than In the other areas of the SW Kara Sea. It averages 16 fog days a month.

Sea level fluctuations and tides. Tides are semidiurnal in Proliv Karskiye Vorota. The spring range reaches 0.6 m and that of the neap tide reaches 0.2 m.

Non-periodical level fluctuations range is 1.4 m.

Constant current, tidal streams and wind-driven flows are observed in Proliv Karskiye Vorota. Constant current sets along Ostrov Yuzhnyy (Novaya Zemlya) from Kara to Barents Sea, and current of opposite direction goes along the coast of Ostrov Vaygach. The current speed docs not exceed 0.6 kn.

In Proliv Karskiye Vorota ice can be encountered all the year round. In winter the strait is covered with drifting ice. In summer ice usually drifts from Kara Sea to Barents sea, predominantly along the W coast of the strait. On the average solid ice begins to form in the strait on 25th to 30th of November; early freeze-up is observed from 15th to 201h of November, and late one occurs at the end of December.

The strait completely clears of ice during the period from the end of June to the end of September: the average date is early August.

2.1.2. Proliv Vil'kitskogo and west approach

Proliv Vil'kitskogo running between Poluostrov Taymyr and Ostrova Severnaya Zemlya is the most important section of the Northern Sea Route connecting Kara Sea and Laptev Sea. The W border of the strait passes from Mys Poluostrovnoy (77°20'N. 102°06'E) to Mys Neupokoyeva, the SW extremity of Ostrov Bol'shevik; and the E border from Mys Pronchisheheva (77°33'N, 105°56'E) to Mys Yevgenova, the SE extremity of the same island.

In the middle of the entrance to he strait from W lies a group of stony islands which are called Ostrova Geyberga, and in the approaches to it from SW lies a group of islands which are called Ostrova Firnleya.

The shores of the strait covered by tundra vegetation and rocky deposits are mainly high: the N shore is higher than the S one. There are many rivers on the coast, but by the start of navigation they all become very shallow and have no practical value.

The bottom in Proliv Vil'kitskogo is comparatively even, the only exception being the area of Ostrova Geyberga and especially SW approaches to the strait. Prevailing depths are 100 to 200 m. In approaches to the strait from W they are somewhat less. The bottom is mainly sandy mud; near the shores - gravel, shingle and clay.

Submarine dangers in Proliv Vil'kitskogo lie near the shores and are concentrated mainly in its E part near Mys Pronchishcheva. Ostrovok Lishniy and Ostrovok Morislyy, steep-to, lying on the approaches to the strait from the W, present great danger.

Tides in the approaches to Proliv Vil'kitskogo from W are semi-diurnal. Mean spring range is 0.5m.

Constant current sets eastward at 0.2 to 0.3 knots near the S shore of the strait and westward at about 0.2 knots near its N shore.

Wind currents are especially strong in S winds. During S winds of 11 m/sec the summary current flowing eastward reaches 2 knots in places. The W wind of 11 m/sec causes a current flowing eastward at a speed of 1 knot. At the S shore of Ostrov Bol'shevik, where the constant current sets westward, during W wind of 11 m/sec the summary current flowing eastward at a speed of 0.8 knots is observed.

During N and E winds of 11 m/sec a current flowing from Laptev Sea into Kara Sea at a speed of about 1 knot in the narrowest part of the strait is observed.

The possibility of navigation in Proliv Vil'kitskogo mainly depends on ice conditions in its W and E approaches.

During the period of navigation ice conditions in Proliv Vil'kitskogo sometimes change abruptly in the course of one day. Ice conditions in the strait may be different 41 its S and N show.

Settled W winds make ice conditions in the approaches to Proliv Vil'kitskogo from W worse and reduce considerably the speed of vessel's guiding in this area.

Winds from other directions, even during great concentrations of ice in the NE part of Kara Sea and in the approach's to Proliv Vil'kitskogo, are more favorable.

If winds from the E prevail before the spring break-up of the landfast ice, this usually results in forming a leeward polyn'ya (water opening) between pack and landfast ice, which allows to start navigation around Ostrov Russkiy to Proliv Vil'kitskogo, approaching it in the vicinity of Ostrova Geyberga, or Ostrova Firnleya, tnd to pass the strait in the middle, or along its S coast. Ice drift in Proliv Vil'kitskogo is caused mainly by wind, the direction of ice drift being well in conformity to the direction of the wind and shoreline contours. Ice drift speed during W winds is greater than during E winds, which is a result of induced by W winds surge. In the area of Proliv Vil'kitskogo W and E winds prevail during the period of navigation.

Time limit of removing of vessels from the Laptev Sea through Proliv Vil'kitskogo into the Kara Sea is determined taking into account the possibility of old ice freezing together, which

sometimes Is observed in this area at the end of September, as well as taking into account the thickness of young ice in autumn.

2.2. Laptev Sea

The Laptev Sea, one of the Arctic; Ocean seas, is situated between Kara and East Siberian Seas.

The eastern shores of Ostrova Severnaya Zemlya are the western borders of the Laptev Sea. In the east the area is limited by the mainland shore from Mys Pronchishcheva to Mys Svyatoy Nos. The western shores of Novosibirskiye Ostrova are the eastern borderline.

Navigational conditions in the Laptev Sea are difficult. The S coast of the sea is shelving, therefore the sea vessels navigate in this area generally out of sight of the shore. Severe ice conditions, especially in the W part of the sea (Taymyrskiy ice massif), create difficulties for vessels navigating along the recommended routes and often force them to go far offshore, or on the contrary to pass along the coast where scant depths restrict maneuvering abilities of sea vessels.

Mariners should bear in mind that icebergs and their fragments are encountered at sea not only in the vicinity of glaciers near Ostrova Severnaya Zemlya. Drifting with Vostochno-Taymyrskoye (East Taymyr) current they get into the E entrance to Proliv Vil'kitskogo, and sometimes as far southward as Ostrova Komsomol'skoy Pravdy and Ostrov Andreya.

The coast character of the Laptev Sea is rather various. The E shores of Ostrova Severnaya Zemlya are mountainous. In some places mountains come close to the shoreline forming steep rocky precipices of up to 400 m high, in some places they recede inland: on such stretches of the coast the shore descends to the water in broad terraces sloping down gradually. These shores are shelving, cut by bays.

The N and E shores of Poluostrov Taymyr are greatly indented, precipitous in places. Precipitous stretches of the coast are 15 to 22 m high. The height gradually increases inland and 7 miles from the shoreline it is KM to 250 m.

The S coast of the Laptev Sea presents a number of not high mountainous spurs alternating with plains typical for north Siberia tundra. The spurs are not more than 300 m high; only on some stretches their slopes come to the shore.

Vast deltas of Reka Lena mil Reka Yana, where on large sections the shores hardly attain 1 to 2 m in height, are characteristic peculiarity of the S coast of the Laptev Sea.
The E coast of the sea is formed mainly by smooth slopes of coastal hills, only in some places high rocky steeps are encountered.

The shores of the Laptev Sea are considerably indented almost throughout, however, the majority of the bights are shallow: the number of sheltered anchorages is limited.

Vegetation of the Laptev Sea coast is monotonous. Tundra comes close to the shoreline in places, where sand and solid bedrock do not come out to the land surface and where glaciers recede. In low places tundra is usually swamped.

Depths are not great in the most part of he Laptev Sea and only on the continental slope near the N borders of the sea they increase abruptly up to the ocean depths of the Arctic Basin.

In the S part of the sea, up to the 100 m depth line, the bottom presents a submarine plain with small rises. Bottom gradients are very small. The plain is cut by several not deep troughs running in meridian direction and presenting the submarine extension of the valleys of the rivers Khatanga, Anabar, Olenek, Lena and Yana.

Vast Semenovskoye Melkovod'ye (shallow water) situated W of Ostrov Stolbovoy a peculiarity of the SE part of the sea.

Ground in the Laptev Sea is mainly silty and sandy sediments. Pure silt or sand is comparatively rare, more often their mixtures in which this or other component revails are encountered (sandy silt, or silty sand).

Land adjoining the Laptev Sea coast between Anabarskiy Zaliv and Reka Lena delta is mountainous.

Reka Lena delta occupies a vast space between Olenekskiy Zaliv and Bukhta Tiksi. Mountains in this area are at 90 miles from the shoreline.

The shore is rather greatly indented. Apart from the large bays of Anabarskiy Zaliv and Olenekskiy Zaliv, which are accessible for sea vessels, there are many shallow bays in the seaward part of Reka Lena delta.

Far offshore, two small islands of alluvial origin lie: Ostrov Peschanyy opposite the Anabarskiy Zaliv, and Ostrov Leykina N of Olenekskiy Zaliv.

Few settlements there are on the coast. There are several polar stations, small villages and hunters huts.

Reka Lena delta occupies a vast space near the S coast of the Laptev Sea between Olenekskiy Zaliv and Bukhta Tiksi. Many small low islands are situated in the E pan of the delta. Only on some of them hills of 10 to 35 m high are encountered. Almost all the islands of the delta are very marshy and abound the lakes.

Among delta branches of Reka Lena the most important is Protoka Bykovskaya ($72^0$10'N, 128°20'E): Bykovskiy Farvater leading into it is accessible for vessels with 3 to 4 m draft depending on the water level on the bar.

All the branches have bars which as a rule are situated far offshore from where the low shores are not visible.

2.3. East Siberian Sea

The East Siberian Sea, one of the seas of the Arctic Ocean, washes the eastern part of the Russian Arctic coast. In the west the sea is bordered by Novosibirskiye Ostrova; Proliv Dmitriya Lapteva and Proliv Sannikova join it with the Laptev Sea. In the north, the East Siberian Sea adjoins the Arctic Basin of the Arctic Ocean. In the east the sea is bordered by Ostrov Vrangelya and the Proliv Longa joins it with the western part of the Chukchi Sea.

Sailing conditions for vessels in the East Siberian Sea are complicated by shallow depths, scant surveying (apart from the coastal area), frequent fogs in summer months and almost continuous presence of close ice.

The choice of the route in the coastal zone depends on the presence of ice and depths dangerous to navigation, and in the areas of open sea in depends on ice concentration and existence of depths dangerous to navigation.

The East Siberian Sea coast can be divided into two types. In the W part of the sea the shores of Novosibirskiye Ostrova and the mainland shore to the mouth of Reka Kolyma are low in general, being mainly composed of sandy and clay sediments.

In the E part of the sea the mainland coast from the mouth of Reka Kolyma to Mys Yakan is mountainous. Small low areas are in general in the river mouths. High shores are mainly steep-to and almost throughout are suitable for visual and radar orientation.

A number of large rivers fall into the East Siberian Sea. Of navigation importance are only Reka Indigirka (used by river vessels) and Reka Kolyma suitable for sea vessels as well.
Straits and islands: Main straits present are the Proliv Dmitriya Lapteva and the Proliv Sannikova, which join the East Siberian Sea with the Laptev Sea, and Proliv Longa connecting the East Siberian Sea with the Chukchi Sea.

Straits between islands are of secondary navigation importance.

There are many islands, lying mainly in groups, in the coastal strip of the East Siberian Sea. Novosibirskiye Ostrova (75°N, IW'E), bordering the sea from W, are the most outlying, numerous, and large in size of all island groups. Islands lie also in the approach to Reka Kolyma from N, at the entrance to Chaunskaya Guba and at the entrance to Zaliv Aachim.

The East Siberian Sea is shallow, being located within Siberian mainland shoal. According to the bottom topography it can be divided into two parts: the W part is shallow and the E is deep-water. The bottom of the East Siberian Sea is Hat and hits a gentle SE slope. However, there are dangers in different areas of the sea.

Ground in the East Siberian Sea is mainly mud. In the coastal zone, approximately within the 10 m depth line, ground is sand almost throughout. In the E part of the sea clayey mud prevails in places.

2.3.1. Proliv Dmitriya Lapteva

Proliv Dmitriya Lapteva separates Ostrov Bol'shoy Lyakhovskiy from the mainland. The shores of the strait are elevated, almost throughout steep-to, cut by ravines. In places they are fringed for a long distance by sandy and muddy, or shingle beaches. Good landmarks in the strait are the mountains situated on Mys Svyatoy Nos, on Poluostrov Kigilyakh and on the S side of Ostrov Bol'shoy Lyakhovskiy.

Depths in Proliv Dmitriya Lapteva are regular: depths of 12 to 15 m, lying as a band of 14 to 18 miles wide along the axis of the strait, prevail. In places the depths increase up to 16 to 17 m but there are small banks with depths of 6.6 to 9.8 m.

In front of the entrance to Proliv Dmitriya Lapteva from the E there is a vast area with depths of 8 to 10 m.

The bottom in the strait is mud and sand, holds anchors poorly.

During the navigation period (late July -September) the weather is mainly foggy, but relatively calm. In the W part of the strait during this period of time E, SE and NW winds prevail, and in the E part E and W winds prevail. The most settled are the E winds, which sometimes last for 1 to 10 days. The mean wind speed is 3 10 8 m/sec, hut in separate years it can roach 14 m/sec. In the W part of the strait the number of stormy days attain on the average 3 to 4 days per month and in the E part 1 to 2 days per month. In separate years in the W part or the strait up to 14 stormy days per month can occur. The maximum wind speed is 30 m/see.

In July and August on the average 15 to 19 foggy days per month are observed, in September the number of such days decreases to 7 days. Occurrence of t (nod visibility at 13.00 in July and August constitutes about 70% and in September 80%.

Sea level fluctuations and tides. Tidal level fluctuations in the strait are small. The value of spring tide is 0.1 to 0.2 m at the mainland shore and 0.3 m at Ostrov Bol'shoy Lyakhovskiy. The tide is of semi-diurnal character.

Surge exceeds the value of tidal fluctuations several times and reaches 2.4 m at Poluostrov Kigilyakh. 1.8 m at the mainland shore and 2.5 m at Mys Shalaurova. High level of the surge is caused by NW winds and low level of the surge is caused by E winds.

Currents in Proliv Dmitriya Lapteva set in general along its axis and are mainly f conditioned by winds blowing in the adjacent areas. During prolonged S and E winds the current sets W and during N and W winds it sets E. Its speed varies from 0.2 to 1.3 knots, and the change of the current direction happens quickly when the wind changes.

During W wind with a speed more than 29 m/sec the E-setting current with a speed of 4.5 knots is observed in the strait, during the wind of the same direction and speed varying from 15 to 22 m/sec, the speed of the current is 2.5 to 3 knots.

During calm weather constant current in the strait is setting to W with a speed of 0.1 to 0.3 knots. Spring tidal currents are of the same speed.

Ice break-up in Proliv Dmitriya Lapteva begins in mid-July and goes slowly. The final clearance of ice appears to occur in the second half of August, however, in some cases the strait happened to be blocked by ice during the whole period of navigation and no vessel could pass through it without icebreaker assistance. In general, freeze-up in the strait begins in the first decade of October, sometimes at the end of September and nearly always takes place when there is no old ice. At the beginning of November the strait begins to get covered by compact landfast ice.

2.3.2. Proliv Sannikova

Proliv Sannikova separates Ostrova Lyakhovskiye from Ostrova Anjou. The W limit of the strait follows the line joining Mys Vaygach (Ostrov Malyy Lyakhovskiy) and Mys Medvezhiy (74°38'N. 139°05'E), and the E limit follows the line joining Mys Shalaurova (Ostrov Bol'shoy Lyakhovskiy) and Mys Nadezhnyy (74°44'N. 149°46'E).

The shores of Proliv Sannikova are low and not conspicuous. Only in the western ' part of the strait Ostrov Malyy Lyakhovskiy and Ostrov Kotel'nyy are seen from the median line of the strait. In good visibility Cora Gavrisha-Tas (73"48'N, 141"29'E), 226 m high, on Ostrov Bol'shoy Lyakhovskiy, and 374 m high mountain (74"52'N, 138°46'E) on the Ostrov

Kotel'nyy are seen from afar. As reduced visibility prevails in the strait, mariners often have to resort to the assistance of radar.

When approaching Proliv Sannikova from E and navigating in the strait itself, mariners should keep the recommended courses, systematically fixing vessel's position.

Due to severe ice conditions often mariners have to deviate from the recommended course and proceed in limiting depths. In such cases deviation to N is f more dangerous due to presence of many banks there. Therefore, when navigating through Proliv Sannikova in both directions great caution should be exercised.

Permanent settlements on the shores of the strait are the polar station Proliv Sannikova (74°40'N. 138°55'E) and the polar station Zemlya Bunge (74°53'·N, 142°06'E). There are hunters' log huts in some places.

Depths in the W part or Proliv Sannikova attain 33 m; decreasing gradually up to 11 15 m eastward. A 16 to 18 miles wide passage leads through Proliv Sannikova: depths in the passage are more than 13 m. Beyond this passage close to the shores are banks, with depths of 4 to 10 m. In the E part of the strait an extensive shoal, with depths of 8 to 9.8 m, extends from the passage along its axis. There are many hanks in the form of separate ridges in the strip up 15 miles wide at the S side of Ostrov Novaya Sibir. An extensive shoal, with depths of less than 5 m, extends from Ostrov Bol'shoy Lyakhovskiy for 35 miles E of it. Near the E exit of the strait depths are 13 to 15 m. The ground in the strait is mud and silty sand.

Most favorable navigation conditions in the strait are in September. Freeze-up begins in the first decade of October. In years, when storms are frequent, ice in the strait periodically breaks up and forms into hummocks. The definitive freezing of the strait occurs in the second half of October.

From late October to mid-July steady landfast ice keeps in the strait. Break-up of landfast ice occur, on average, on 21st July, being accelerated in the period of strong E winds which favor ice clearance of the strait. Winds of western directions usually bring into the strait much ice from the Laptev Sea. The dates of final clearing of ice depend on ice conditions in the W part of the East Siberian Sea; they vary between the first decade of August and the third decade of September. In unfavorable years the strait docs not entirely clear of ice.

2.4. Chukchi Sea

The Chukchi Sea, a marginal sea or the Arctic Ocean, being entirely located on the mainland shoal in the N of Asia and America, washes the shores of Russia and the United States.

Shores or the W part of the Chukchi Sea are formed by spurs of Chukotskiy, or Anadyrskiy, Khrebet (mountainous range). The central part of this ridge, which is 80 to 100 miles inland, is 200 m high; coastal mountains are 300 to 700 m high.

Almost uninterrupted chain of lagoons extends along the coast. The lagoons are separated from the sea by low shingle and sand spits. Rectilinear character of this coast, excluding the area of Kolyuchinskaya Guba, is slightly broken by precipitous capes Mys Otto Shmidta, Mys Vankarem, Mys Dzhenretlen. Mys Onman and Mys Serdtse-Kamen' projecting into the sea.

The Chukchi Sea is located within the mainland shoal with a little slope to the N. In the central part of the sea and in Proliv Longa depths of 40 to 50 m prevail, to the N depths gradually increase to 200 m.

Ground in the coastal parts of the Chukchi Sea consists mainly of sand, silty sand, gravel and shingle sediments: stones are found near high rocky coasts.

Population of the mainland mast and the islands of the Chukchi Sea is scanty. Chukchi and Russians make up the majority of the population. Eskimos are few.

Settlements are located along the whole length of the coast. In general, settlements consist of 50 to 80 small buildings, among which one-story wooden dwelling houses and official buildings of polar stations are distinguishable. The largest ones are the Mys Shmidta settlement and the Uelen village.

There are polar stations near Mys Otto Shmidta in Bukhta Rodzhers (Ostrov Vrangelya), near Mys Vankarem, Mys Netten and in Uelen village.

ANNEX 11

Public Affairs

Oil spills generate a great deal of public attention and media coverage, particularly if a spill is large or the substance spilled is extremely hazardous. This attention, reflecting legitimate public concern, may be local or even national or international in scope. The Public Information Officer of the OCHq serves as the lead manager for all spill-related public information activities conducted on behalf of the OCHq. The Public Information Officer maintains a OCHq's public information office, as needed, which is directed by the Head of OCHq. The following information provides general guidance regarding public affairs and media relations during spill response operations.

GENERAL RULER FOR MEDIA INTERACTION, COMMUNITY RELATIONS AND INTERNAL INFORMATION

1. Public Information Tools:

1.1. Staying Ahead of Changing Events: One of the information officer's precepts for day-to-day effectiveness is to stay ahead of the "information curve." During a rapidly changing emergency this will become one of his or her most exacting challenges. Not only must this person assemble information quickly, arrange interviews and assist reporters, but also must maintain close contact with the OCHq and spill team members to anticipate as much as possible each major development in the spill response that will generate the next wave of public concern or media interest.

These events may come in the form of escalated response actions, the release of new water sample data or wildlife mortality figures, a formal decision delivered by a member of the OCHq, or others serving in an official capacity. When events such as these can be anticipated, press information can be prepared to enable the OCHq to maintain his/her role as the primary, responsible spokesperson for the incident. Additionally, the information officer must work within media deadlines as much as possible.

To stay ahead of changing events and to meet deadlines, the information officer must assimilate a mass of information by coordinating with local government officials and Federal public information staff, attending staff meetings, reading situation reports and asking many questions. All of this consumes time. Sufficient staff support and resources in the spill information office or Joint Information Center (JIC) is essential for answering phones, writing and dispensing bulletins, and hosting the press. Obtaining staff resources is thus one of the information officer's first duties upon arrival at a spill site.

1.2. Staff and Resources: Experienced crisis managers know that when information officers are needed, the need can be critical, and the OCHq's effectiveness with the media and public is often in direct proportion to the public information staff's experience and training in complex environmental emergencies. Effective communication with the public is indispensable to a successful spill response.

Arriving at a spill site, the information officer must ensure that a recorder is assigned from the professional spill response staff to assist in recording and transmitting written information. The staff person is responsible for writing a "spill bulletin" summarizing salient facts and information about the incident. The bulletin is transmitted, on a frequent basis and usually by Fax to Administration of RF subject, communities, Native groups, resource organizations, the

media, and federal agencies (as appropriate). The information contained is also of obvious usefulness to the information officer.

Additional information officers and clerical staff should be added to handle the workload, as should photographic services, both still and video. An advance agreement should be made with the OCHq that photos and video footage shot for public information may be used for that purpose, without delay or restriction for legal reviews.

Other resources required for the spill information office include suitable maps of the impacted area, up-to-date media and community contact lists, dedicated phone lines, portable phones or beepers if available, PCs for all writers on staff, and a Fax machine.

2. Media interaction

2.1. General: The general public's opinion of response efforts is not always based upon what action has been taken, but upon what information they have received. Supplying information to the media is a critical component of spill response and is a primary function of the OCHq. Early and accurate news releases serve to minimize public apprehension and to enhance their faith in the response community's ability to deal with oil and hazardous substance contingencies.

To ensure an accurate flow of information, a single point of contact or pool of public affairs personnel should be established for media relations. The number of people needed to respond to inquiries will vary depending on the size of the incident and the media interest involved. The OCHq has many resources available to assist with the media

The following general guidelines are also provided:

a. Fast and accurate information must be provided to protect public health and obtain public cooperation, and to assist in guarding against further environmental damage.

b. Clear communication by spill response authorities is essential for the delivery of accurate information to avert misinformation or rumors sometimes engendered by an emergency.

c. The OCHq must immediately establish and maintain his/her position as chief articulator of an incident. As statutory guardian of public health and resources, it is the Regional OCHq's role - not the role of the spiller or others - to deliver public statements regarding the effects of a spill, including evaluations of a spill's size, extent, nature, dangers to public health or resources, details of the response plan, the OCHq's expectations for response plan implementation, degree of success or lack of success of a spill response, and the anticipated long-term effects of a spill.

d. When a spill occurs the OCHq must immediately open communications with local government officials of affected communities, conveying facts needed by residents for their own response activities and protection of public health and resources. Initial phone calls to establish communication channels with local governments and appropriate organizations, such as fishermen and Native groups, should be followed by regular updates through spill bulletins, press releases, and briefings.

Credibility with the press and the public is the best foundation for an effective public information effort, and the efficient delivery of accurate information is the key to credibility.

2.2. Media Access: The question of media access to spill sites may arise during emergencies, usually because of one of three issues: safety; potential interference with response activities; or admission to private property.

In general, it should be the OCHq's policy to allow free access for the media where public resources are concerned, with reasonable guidelines to protect personal safety and preclude interference with response activities. The information officer must work through and seek permission from the OCHq before allowing media access to the emergency scene. If conditions will not accommodate crowds of reporters, "pool" reporting may be necessary on a temporary basis In regard to private property (a spill, for instance, on the grounds of a privately-owned refinery or storage facility) reporters or their companies must negotiate their own access. The information officer should obtain permission and legal counsel before releasing photos or video footage on private property, both for purposes of conserving legal evidence and potential violation of owners' rights.

2.3. The Daily Press Briefing: during a significant spill with a rapidly developing situation and the presence of a large number of reporters, a briefing held daily at a pre-established time (8:00 am or 8.30 am is recommended) is one of the most useful means of delivering information. This is an opportunity for the OCHq and other spokespersons to brief the press and answer their questions, and for other key staff members to follow up with important data. For example, if applicable, OCHq should present information on wildlife and fisheries impacts, or public health authorities may offer their findings on contamination of local subsistence foods. It is the information officer's duty to work with the OCHq to prioritize the information according to importance, point out backup factual material and other sources, provide written information for distribution and conduct the press briefing

Early morning is the best part of the day for the information officer to coordinate the day's press activities and ensure that everyone receives written information and background facts

These press briefings may relieve the OCHq and other spokespersons of some of the pressure of interviews throughout the remainder of the day, as well as free reporters to proceed with field work.

2.4. News Releases, Fact Sheets, Background Papers: News releases should be reserved for announcements of major decisions, policy changes, or new developments. They must report on items that are actually news, should summarize issues clearly, and provide quotes from decision-makers that encapsulate and clarify the OCHq's position. Distribution should be to affected communities and all response agencies in addition to the media

Fact sheets should be prepared and updated regularly to present key data needed by the press or the public, such as amounts of oil or hazardous substance spilled or cleaned up or wildlife mortalities. Background papers should be written to amplify and clarify complex issues and the OCHq's related actions and policies.

Desktop publishing technology should be utilized in the public information office from the outset of the spill for rapid reproduction of documents that communicate effectively

2.5. The Spill Bulletin: This simple but essential publication is one of the key vehicles for conveying information about the spill response. It is produced several times daily by the liaison officer/recorder, a staff member with technical spill and environmental expertise who works closely with both the information officer and the spill management team. The liaison officer keeps track of the changing status of the response and records the information in brief,

summarized informational "bullets". The bulletin is Faxed to communities, other response agencies, the Administration of subject of Federation, Federal agencies, and others who require the information. With OCHq approval the bulletin may also be made available to the media through the information officer.

2.6. Mapping: Oil often present increasing dangers to resources and public health because of their tendency to move after being released into the environment. The location of the spill, and the changes in location are thus essential pieces of information for local residents, communities and the media. The spill information office should obtain maps from agency technical mapping teams and make them available on a continuing basis they can also be attached to the Spill Bulletin.

2.7. Designation of Spokesperson: At the local level the designated spokesperson is normally the OCHq. He or she will articulate the RF subject's key policy positions and provide continuity of spokesmanship throughout the spill response. The spokesperson should have experience in media interviews and be capable of delivering clear and frequent explanations of the Federal's actions during a rapidly changing emergency.

All information regarding Federal involvement at the spill site will be documented by staff to the OCHq either at the scene or through his/her regional office, and the Public information officer will disseminate the information appropriate for release.

The Public information officer will work closely with the OCHq, reiterating the Federal's positions and policies, delivering them in writing or verbally to the news media and affected communities, and arranging appropriate interviews and press briefings to facilitate the flow of information.

Other agencies outside RF subject; such as representative of large oil-extracting and fishery companies, and local government officials may be important media sources depending upon the severity and location of an incident and the type of response required.

The Public Information Officer should contact the Goskomsanepidnadzor of the Russian Federation and/or the regional Emercom Center in the earliest stages of any incident that may impact public health. Goskomsanepidnadzor will provide a flow of accurate and timely information to public health personnel in the field and will provide information on public health issues and policy to Public's information officer.

The company responsible for the spill or the company's contractor may choose to inform the media of its actions in the spill response, but should defer to the OCHq for statements about public health, dangers to resources, extent of the spill, or other issues within local or Federal jurisdiction. Before releasing scientific data or other information that bear upon public concerns about the extent and nature of the spill, the spiller should first submit the information to the OCHq for assessment of its scientific accuracy.

3. Community relations

Providing information directly to members of the impacted community, free of the filtering and potentially distorting effect of the media is critical to public understanding of the incident response. Community relations may include scheduling of public meetings, preparing speeches, and coordinating public activities with public officials and protocol personnel.

In order to ensure that important constituencies are not overlooked or slighted during a major response, it is important that a Public Information Officer/Liaison Officer coordinate closely with the public affairs element. (Under no circumstances should community relations be a collateral duty of the media relations officer during a major incident).

Additionally, public information officers should contact local government officials and have them offer information and comments on the situation. Federal and local governments should coordinate their responses/press releases to the media.

4. Internal information

Informing the members of the response community of the status of the response is vital if consistent and accurate information is to be conveyed to all interested parties. Internal information is the process of informing our own people of the status of our activities.

At a minimum, all personnel assigned to response duties should be provided with access to the daily fact sheet prepared by the media relations officer. This will help ensure a consistent and accurate flow of information.

5. General logistical concerns for press conferences and news briefs

Pollution incidents that generate significant media interest normally require press conferences or news briefs. These media gatherings provide an opportunity to film and ask questions of senior response officials. People arranging conferences and briefings should ensure that top officials are available and up-to-speed on any special interest areas. It is beneficial to provide a press release, statement, or press packet prior to conducting a press conference. The spokesperson (s) should approach the conference with a clear idea of the specific points to be discussed and anticipate questions that may be posed. Charts, diagrams and other visual aids serve to facilitate presentations and clarify response actions.

A schedule of the times and locations for press conferences should be published and made available to the media well in advance, whenever possible. This can be accomplished with a news advisory. It may be beneficial to conduct press conferences near the site of a pollution incident. This presents a challenging scenario to the Public Affairs personnel.

Public buildings in the area which could handle the expected media representatives should be quickly identified. This may include local Federal, Regional, or community facilities, fire stations, police stations, or other state and local government buildings.

One alternative is to conduct a conference or briefing on scene or alongside a mobile command post. On scene conferences or briefings must be carefully coordinated to ensure efforts to control the spill are not disrupted. For press briefings, efforts should be made to find a location which provides convenient access for federal, regional, and local officials and which is large enough to accommodate the anticipated number of media personnel.

Some members of the media will request access to the spill site for photo opportunities. Direct access to private property such as facilities, vessels, or barges will remain under the control of the owner. It may be advantageous to have a OCHq vessel available to tour the affected area from the waterside. When media interest exceeds the capacity of the OCHq vessel, it will be necessary to form a press pool. The selection of participants is best left to members of the media, the media may also obtain their own vessel or aircraft with which to view the spill site. They will continue to be governed by a Security or Safety Zone that may be in effect unless granted specific access by appropriate authority.

Transport Canada - AMNS
Prairie & Northern Region - Marine
330 Sparks Street,
Ottawa, Ontario
K1A 0N5

Transports Canada - AMNS
Région des Prairies et du Nord - Marine
330, rue Sparks
Ottawa, Ontario
K1A 0N5

Our file Notre réference
AMNS 8103-70

October 20, 1998

Mr. Claes Lykke Ragner
Deputy Head, INSROP Secretariat
P.O. Box 326
Fridtjof, Nansens vei 17
Lysaker, Norway
N-1324

Re: The NSR Contingency Plan
Technical Review of Report

The authors are to be congratulated on a very comprehensive report of the many components of the Northern Sea Route Oil Spill Contingency Plan.

The quick, well organized response to any emergency depends heavily on communications, training, and equipment. In this respect, here are some comments in relation to this report.

* The "public relations officer" (sec. 2.2) has an important role whose duties could be included in Table 6.

* The official role of providing information (which may be done by various people depending on the stage of an emergency) needs to be integrated in the organization chart.

* Scheduling of press conferences with general guidance on who conducts, participates, and when held, would make the report even more useful.

* The description in Section 3 regarding the flow of information and the corresponding Appendix 2 may need further clarification:

  – The diagram shows a separate path of information when received from aircraft.

  – as minor spills may be dealt with at the Regional Department level perhaps indicating the minor/major spill split in the diagram would make the path connections clear.

  – consider including the flow of communications once the on-scene commander is appointed, who is not from the Regional Department.

Telephone (613) 991-6004 Facsimile (613) 991-4818

October 20, 1998

* There are references throughout the report to investigation (collecting of samples) and security measures which perhaps could be better, and fully described under separate headings. (Sec. 2.1)

* Training and exercises are mentioned for individual organizations but there's no sense of the overall responsibility and level of commitment - frequency and updates of plans. A separate heading for this important aspect may be useful for users of this report.

* The shortcomings of oil recovery equipment in ice infested waters is recognized in Sec. 4.2 with the recommendation to use "ice itself" as a means of defence. Two points: reference should be made to an inventory of existing equipment and the contingency plan could have the means to keep up-to-date and promote (?) on-going research on the issue.

* Because of the importance of lessons learned, the report on completion of operations by OCHQ (Sec. 2.1) could be expanded to include debriefing meetings, etc.

This is an extremely useful report as reference material for putting in place the NSR Contingency Plan(s) - West and East. The existing regulations on "the single state system" are aptly named in the pursuit of seamless application of plans where too many organizations are involved. It remains to be seen through training that it will work.

Thank you for the opportunity to review this report.

V.M. Santos-Pedro
Regional Director, Marine
Prairie & Northern Region
Transport Canada

ANNEX 13

Author's Answers

15 November 1998

To: V.M. Santos-Pedro, Regional Director, Marine
Prairie & Northern Region Transport Canada

Dear V.M. Santos-Pedro,

Thank you for your comments of the paper of INSROP Project II.6.10 "The NSR Contingency plan".

The comments serve the very useful purpose of confirming some of weaknesses of the paper.

Our replies to your comments may be summarized as follows:

1. Comment: *"The "public relations officer" (sec. 2.2) has an important role whose duties could be included in Table 6".*

This recommendation is taken into consideration in section 3.5 of Plan and Public relations officer is included in OCHq (Table 6):

Participant in operation Position held	Duties
Permanent member of OCHq Public information officer (representative of RF subject)	Lead manager of OCHq for all spill related public information activities according Annex 11.

2. Comment: *"The official role of providing information (which may be done by various people depending on the stage of an emergency) needs to be integrated in the organization chart".*

Public relations officer is integrated in "Diagram of communication and notification about oil spill" (Annex 8).

3. Comment: *" Scheduling of press conferences with general guidance on who conducts, participates, and when held, would make the report even more useful".*

The recommendation is conceded in new Annex 11 where present general aspects of duties of the Public information officer is presented.

4. Comment: *"The description in Section 3 regarding the flow of information and the corresponding Appendix 2 may need further clarification".*

a) The Diagram of communication and notification about oil spill is corrected (Annex 8)

b) Enclosed new Diagram of communications by minor spill (less 100 t) for Regional Department level.

5. Comment: *"There are references throughout the report to investigation (collecting of samples) and security measures which perhaps could be better, and fully described under separate headings. (Sec. 2.1)".*

This recommendation is taken into account in full. In corresponding part of Plan is made supplements.

6. Comment: *"Training and exercises are mentioned for Individual organizations but there's no sense of the overall responsibility and level of commitment - frequency and updates of plans. A separate heading for this important aspect may be useful for users of this report".*

This recommend is taken into account in new section 8 "Plan effectiveness check, training, exercises".

7. Comment: *"The shortcomings of oil recovery equipment in ice infested waters is recognized in Sec. 4.2 with the recommendation to use "ice itself' as a means of defense. Two points: reference should be made to an inventory of existing equipment and the contingency plan could have the means to keep up-to-date and promote (?) on-going research on the issue".*

In corresponding part of section 6.2 reference on Field Guide for Oil Spill Response in Arctic Waters of EPPR Working Group, 1998 is included.

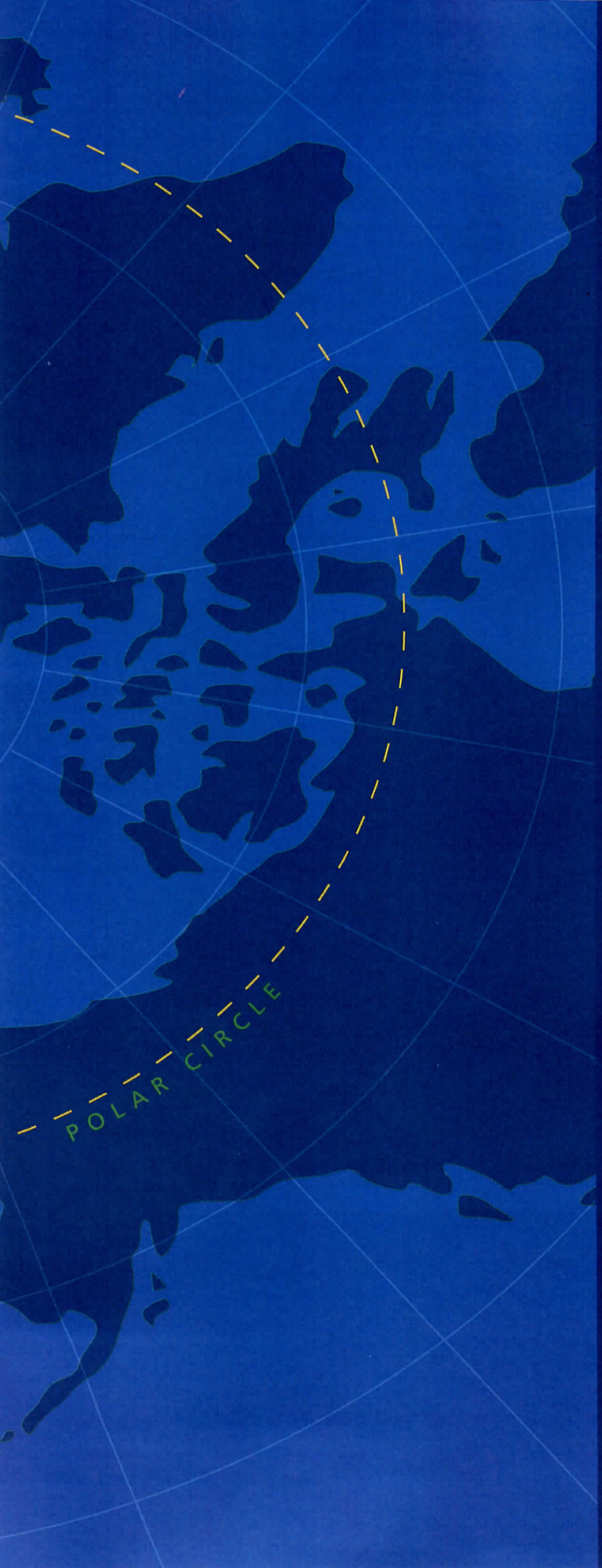
8. Comment: *"Because of the importance of lessons learned, the report on completion of operations by OCHq (Sec. 2. 1) could be expanded to include debriefing meetings, etc.".*

In corresponding part of section 3.1 words "... conduct the final briefing and send the information to the appropriate organizations" is added

Sincerely yours

G. Semanov

Supervisor of project



The three main cooperating institutions of INSROP

Ship & Ocean Foundation (SOF), Tokyo, Japan.
SOF was established in 1975 as a non-profit organization to advance modernization and rationalization of Japan's shipbuilding and related industries, and to give assistance to non-profit organizations associated with these industries. SOF is provided with operation funds by the Nippon Foundation, the world's largest foundation operated with revenue from motorboat racing. An integral part of SOF, the Tsukuba Institute, carries out experimental research into ocean environment protection and ocean development.

Central Marine Research & Design Institute (CNIIMF), St. Petersburg, Russia.
CNIIMF was founded in 1929. The institute's research focus is applied and technological with four main goals: the improvment of merchant fleet efficiency; shipping safety; technical development of the merchant fleet; and design support for future fleet development. CNIIMF was a Russian state institution up to 1993, when it was converted into a stock-holding company.

The Fridtjof Nansen Institute (FNI), Lysaker, Norway.
FNI was founded in 1958 and is based at Polhøgda, the home of Fridtjof Nansen, famous Norwegian polar explorer, scientist, humanist and statesman. The institute spesializes in applied social science research, with special focus on international resource and environmental management. In addition to INSROP, the research is organized in six integrated programmes. Typical of FNI research is a multi-disciplinary approach, entailing extensive cooperation with other research institutions both at home and abroad. The INSROP Secretariat is located at FNI.