

**2001 FARO Meeting**  
**Iqaluit, Nunavut, Canada - Participants**

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## FORUM OF ARCTIC RESEARCH OPERATORS FARO

### Terms of Reference

#### MISSION

The Forum of Arctic Research Operators (FARO) aims to encourage and facilitate logistics and operational support for scientific research in the Arctic, through international collaboration for all those involved in Arctic research.

#### The objectives of FARO are:

- ◆ To provide a **forum** for discussion and review, exchange of operational information and experience, and to seek solutions to common operational issues.
- ◆ To review proposed programmes requiring major international collaboration on operations/logistics
- ◆ To advise the Arctic science community on operational matters, and to respond to requests for information and advice
- ◆ To serve as contact with COMNAP on behalf of Arctic research operators, and to encourage and facilitate exchanges of Arctic and Antarctic operational knowledge and experience.

#### Terms of Office

- ◆ The FARO Executive is elected for a period of 3 years.
- ◆ Members can be re-elected for a second term.
- ◆ The main task for the FARO Executive is to discuss, develop and prepare FARO issues between main meetings.

#### Membership

- ◆ FARO consists of a representative from each member country.
- ◆ A member country should have active research programmes in the Arctic.
- ◆ Members will be responsible for communicating with their own national communities as required.
- ◆ Members will serve as information links between the FARO and operators within their own countries.



# FARO

## The Forum of Arctic Research Operators

Mission

Membership

Brief History

Arctic Research Operators

Arctic Observatories and Research Stations

Arctic Research Vessels

Links

Back to IASC

### BRIEF HISTORY

The idea for such a Forum has been considered for some time. An initial meeting was held in August 1998 attended by 24 operators from 11 countries. They agreed to initiate the Forum, appointed a small group to draft terms of reference, and had an initial discussion about tasks.

The second meeting, held during the Arctic Science Summit Week in April 1999, was also well attended by operators.

They started the discussions on the terms of reference, membership and tasks - and some useful clarifications were made.

**The FARO Executive** was also elected, and their main task will be to plan the development of FARO.

<b>Bonni Hrycyk</b>	<b>Canada (Chair)</b>
<b>Anders Karlqvist</b>	<b>Sweden</b>
<b>Olav Orheim</b>	<b>Norway</b>
<b>Tom Pyle</b>	<b>USA</b>

### TASKS

The following tasks are being discussed:

- Circumarctic network of environmental observatories
- Technology:
  - Satellite observations
  - Seminars on Arctic technology
- Database for logistical information

## MEMBERSHIP

- Each country interested nominates a national representative (focal point), preferably a major Arctic operator with a national network to other operators.
- If needed, each national representative can attend meetings with a maximum of 2-3 observers, but the total number of members of the Forum should not exceed 30.

**USA**

<http://www.nsf.gov/od/opp/arctic/start.htm>



## Arctic Research Vessels

The intention of this list is to provide basic information about Arctic research vessels, doing so by creating links to relevant web sites.

If you have relevant web site addresses, please inform the IASC Secretariat: e-mail: [iasc@iasc.no](mailto:iasc@iasc.no)

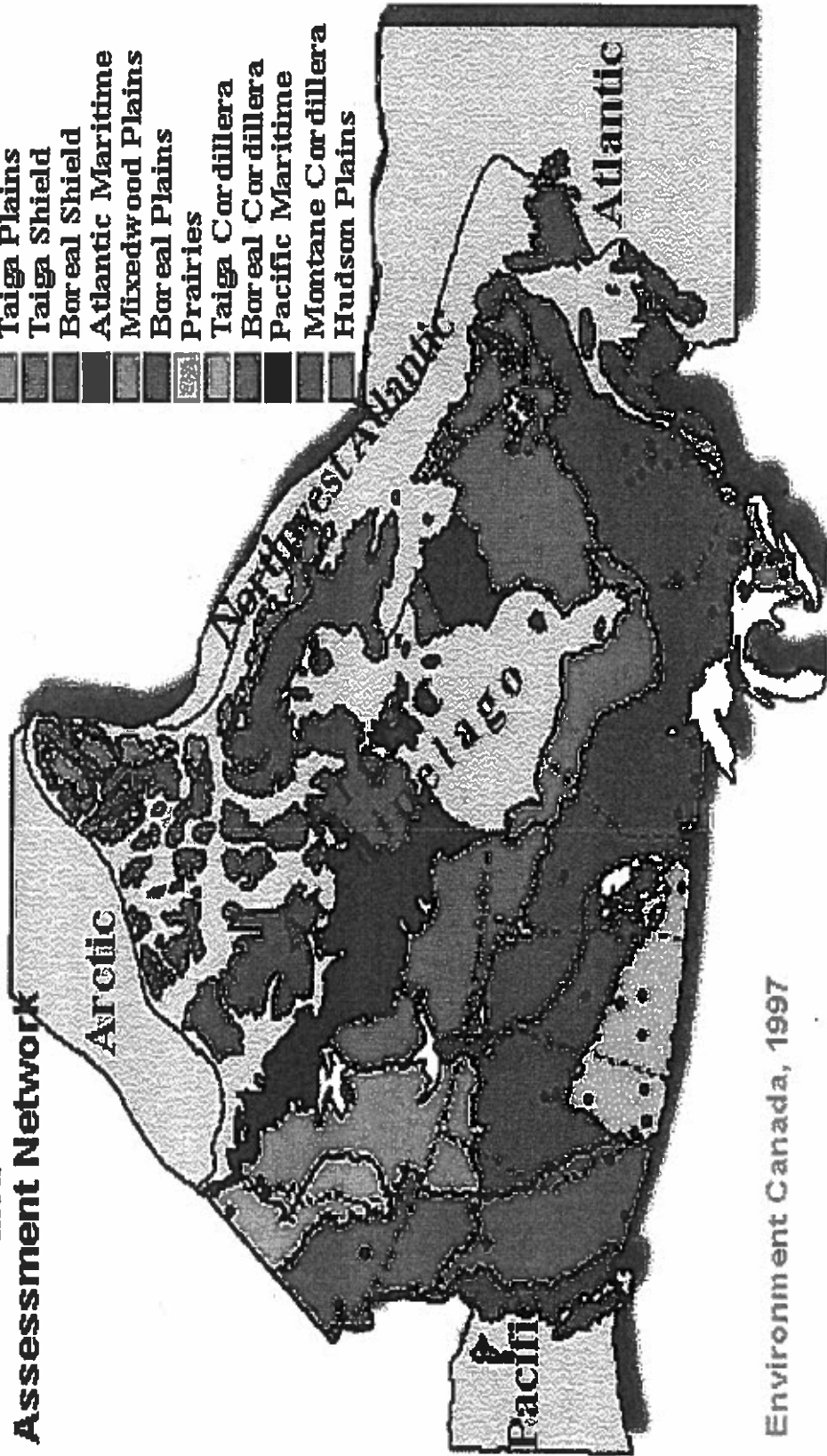
Canada	<a href="http://polar.nrcan.gc.ca/NorthernFacilities_e.html">http://polar.nrcan.gc.ca/NorthernFacilities_e.html</a>
Finland	<a href="http://www2.fimr.fi/aranda/aranda2.htm">http://www2.fimr.fi/aranda/aranda2.htm</a>
Germany	<a href="http://www.awi-bremerhaven.de/Polar/polarstern.html">http://www.awi-bremerhaven.de/Polar/polarstern.html</a>
Netherlands	<a href="http://www.nioz.nl/en/facilities/vessels">http://www.nioz.nl/en/facilities/vessels</a>
Norway	<a href="http://www.nilu.no/avd/troms/nncpr/">http://www.nilu.no/avd/troms/nncpr/</a>
United Kingdom	The BAS fleet of polar ships: <a href="http://www.antarctica.ac.uk/Living/Transport/Ships/Ships.html">http://www.antarctica.ac.uk/Living/Transport/Ships/Ships.html</a>
United States of America	<a href="http://oceanic.cms.udel.edu/ships/default.htm">http://oceanic.cms.udel.edu/ships/default.htm</a> <i>This site also includes information on vessels from other countries.</i>



# EMAN

## Ecological Monitoring and Assessment Network

- Arctic Cordillera
- Northern Arctic
- Southern Arctic
- Taiga Plains
- Taiga Shield
- Boreal Shield
- Atlantic Maritime
- Mixedwood Plains
- Boreal Plains
- Prairies
- Taiga Cordillera
- Boreal Cordillera
- Pacific Maritime
- Montane Cordillera
- Hudson Plains



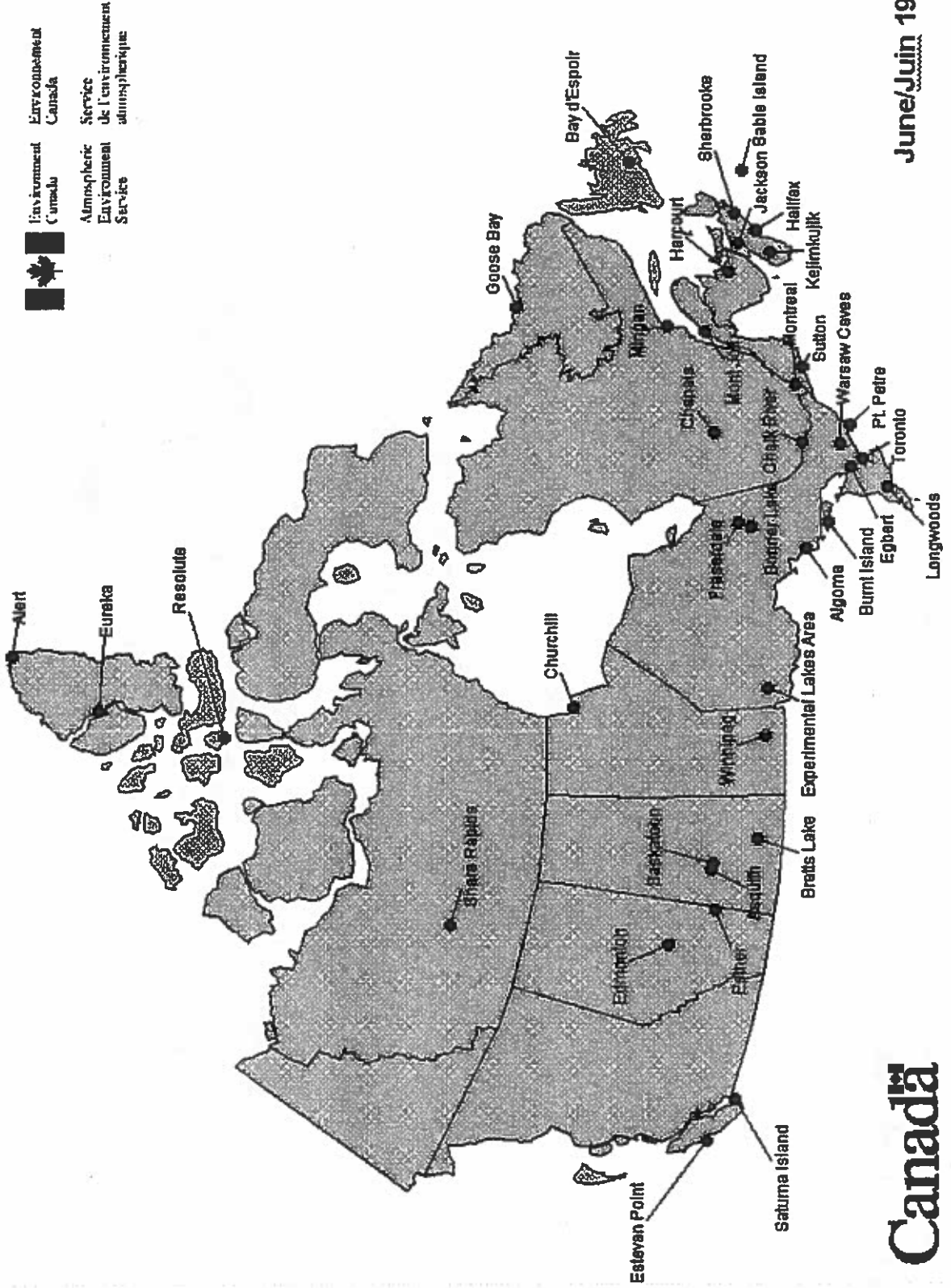
Environment Canada, 1997



# Sites by Lead Agency

• Universities	28
• Parks Canada	18
• Provincial (incl. Conservation Agencies)	17
• Environment Canada	8
• Biosphere Reserves	6
• Agriculture Canada	6
• Natural Resources Canada	3
• Dept. Indian and Northern Affairs	3
• DFO	2
• CFS	1
• National Defense	1
• <b>Total</b>	<b>93</b>

• **Estimated \$20-30M of ecosystem monitoring and research annually (does not include info from other networks, Departments, Regions)**

# AIR QUALITY RESEARCH BRANCH DIRECTION DE LA RECHERCHE SUR LA QUALITE DE L'AIR




 Environnement  
Canada  

 Service  
de l'environnement  
atmosphérique

June/Juin 1998



# Diagnostique

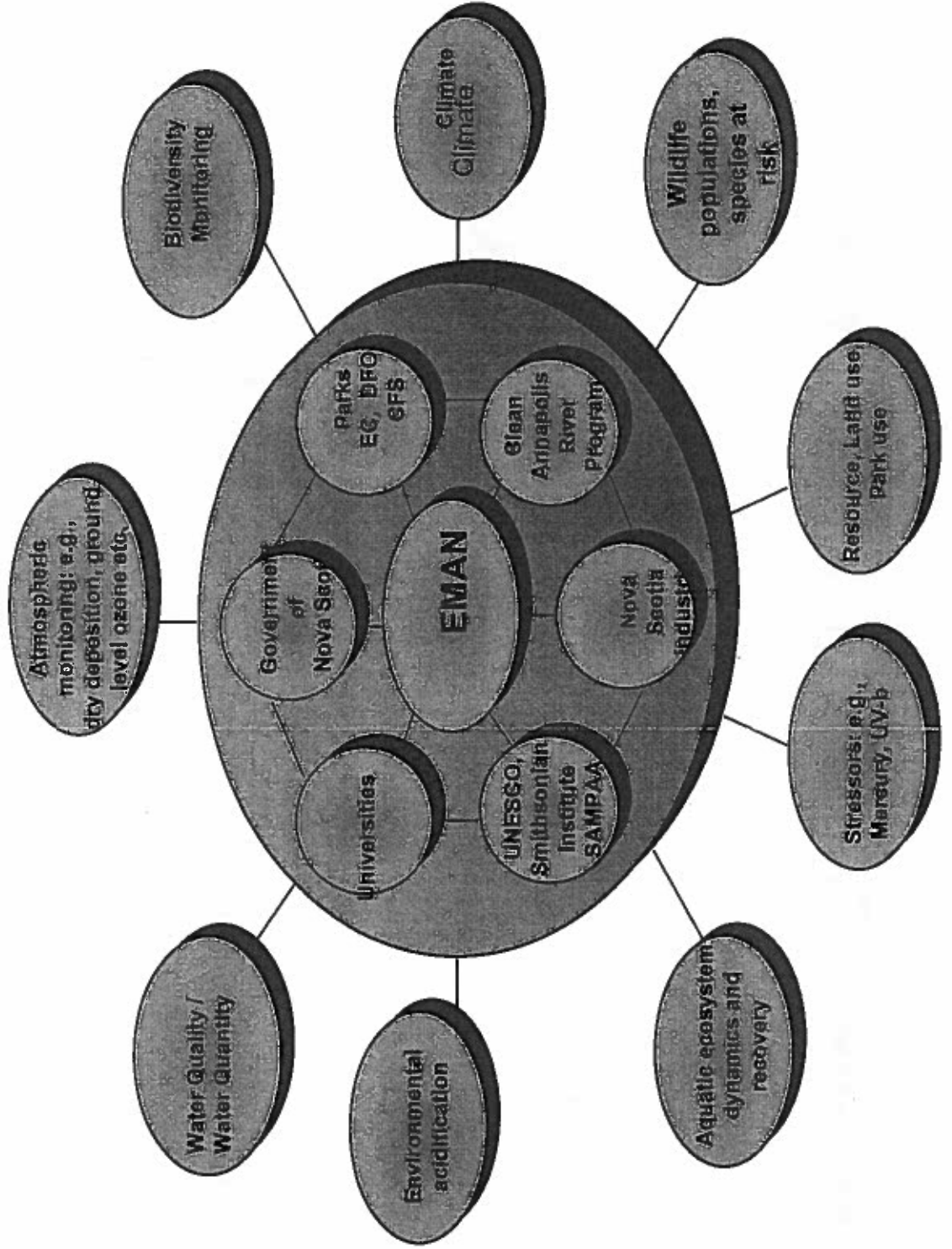
- ⇒ Monitoring in Canada is spatially and temporally fragmented and dispersed
- ⇒ Monitoring knowledge gaps are widespread and affecting our ability to make informed decisions
- ⇒ Inadequate use of data and information generated by monitoring activities - not integrated for assessment and decision-making
- ⇒ Monitoring practitioners are expanding (gov'ts, industry, communities, volunteers, universities, ENGOs, etc.)

*Result: Inability to provide Canadians with a comprehensive, integrated picture of national/regional environmental status and trends*



# Kejimikujik National Park Ecological Monitoring and Research Centre:

*Baseline knowledge contributing to ecozone management*





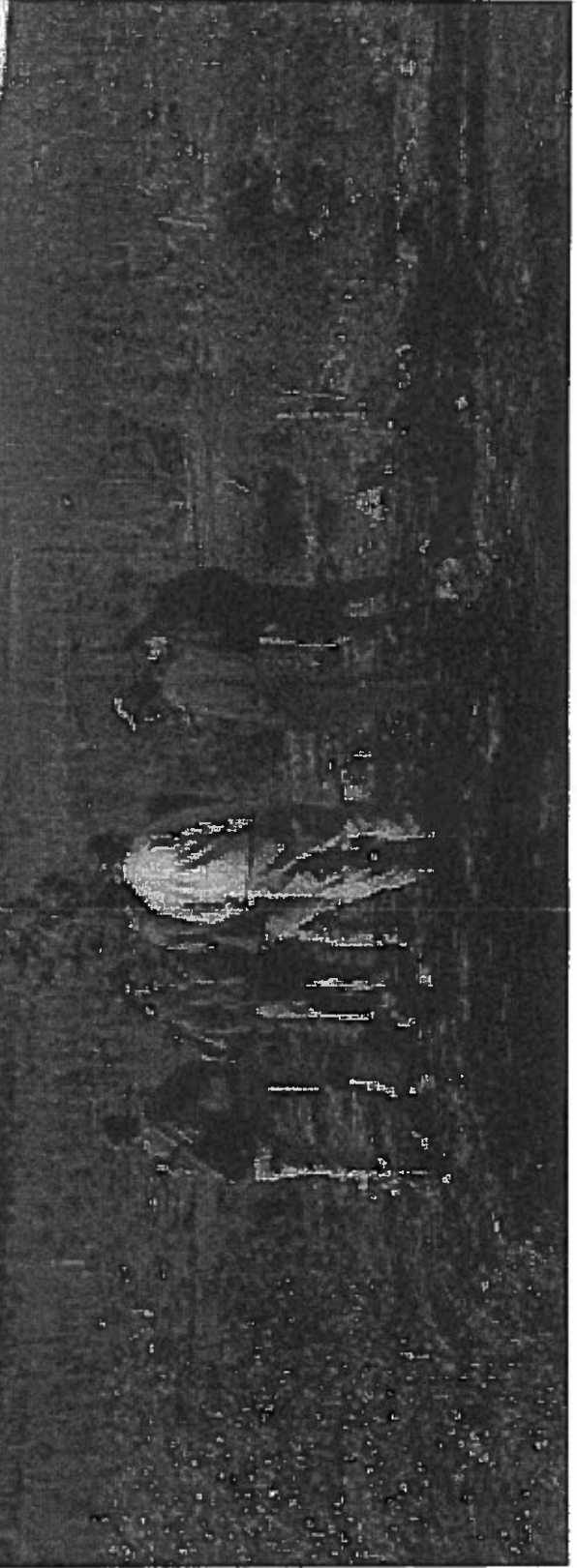


# EMAN-North

Coordinating and reporting on ecological  
monitoring in Northern Canada

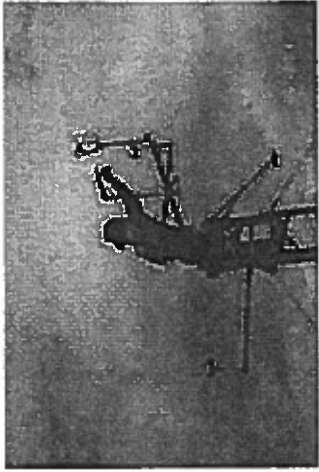
# Next Two Years

- Funding through Northern Ecosystem Initiative
- Focus is on impacts of climate change and development on northern ecosystems



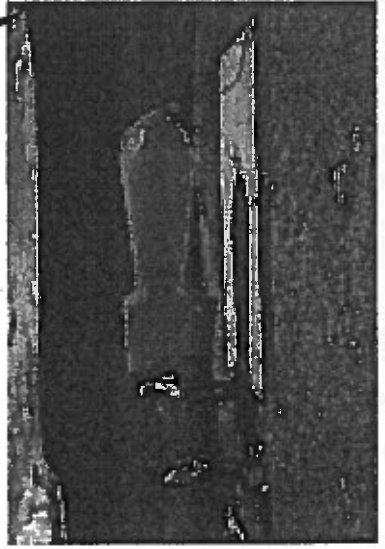
## **Activities**

- Establish web-based coordination and reporting system
- Synthesize results of Canadian ITEX studies (tundra research and monitoring)
- Improve and adapt ecological monitoring protocols and make more accessible for non-expert use
- Share methods and results and expand programs for community-based monitoring



# Integrated, multi-disciplinary research and monitoring – addressing development and climate change issues

- e.g. Wolf Creek Research Basin  
(Yukon), Yellowknife EMAN Site  
and Daring Lake Research Station  
(NWT)



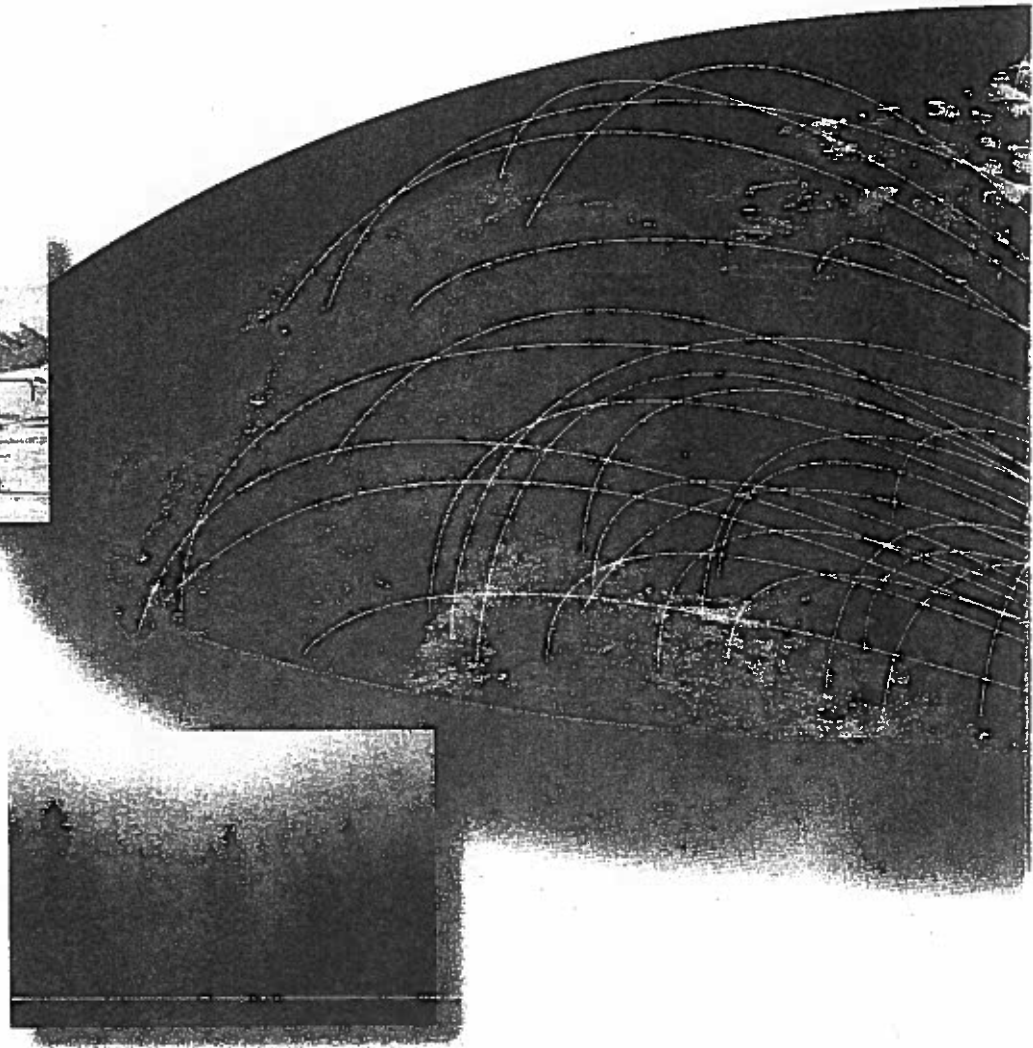
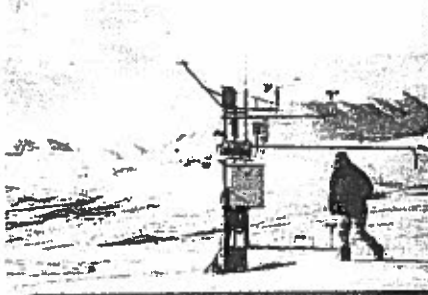
# The Arctic Borderlands Coop

- Area: Northern Yukon, western Mackenzie Delta, Northeastern Alaska (communities of Fort McPherson, Aklavik, Old Crow, Arctic Village, with interest from Kaktovik)
- Run as a non-profit society; Environment Canada leads co-ordination with help from co-management organizations and others
- Components:
  - Indicators of ecological change
  - Community-based monitoring program based on annual interviews with hunters, fishers, Elders
  - Annual gathering (6<sup>th</sup> was in Aklavik, March/01)
  - Special projects and information clearing house

[www.taiga.net/coop](http://www.taiga.net/coop)



# THE POWER OF



WHEN IT COMES TO THE ENVIRONMENT, THE ECOLOGICAL MONITORING AND ASSESSMENT NETWORK IS DESIGNED TO HELP CANADIANS SEE THE BIG PICTURE

*By Mark Stabb*

**E**urekas don't come easy in ecology, so people tend to remember them. They recall the excitement, the satisfaction and the ripple effects in science, conservation and even political circles. Tom Brydges experienced such a defining moment in the study of acid rain. The epiphany, as it were, helped set the stage for 13 years of negotiations with the Americans to reduce sulphur dioxide emissions. Decades later, the event also inspired him when he helped build a national science network to monitor and assess Canada's ecosystems.

It was 1975. Eutrophication was the big pollution issue of the day. A few years earlier, the media had declared Lake Erie — artificially fertilized and oxygen-depleted — to be "dead." Tom Brydges, a veteran of water quality studies in the Sudbury area, was managing the limnology and toxicity group within the Ontario Ministry of the Environment. This group was deeply immersed in multidisciplinary eutrophication studies in the Muskoka region about 250 kilometres north of Toronto. Staff at the Dorset Research Centre had around

two dozen watersheds and 20 Canadian Shield lakes under close observation.

Peter Dillon, his senior ecologist at the time, came into Brydges' Toronto office to discuss the readings from some spanking new air monitoring equipment. "We have a problem," the researcher said, handing his boss a half-page sheet of data. Brydges' response was somewhat more pungent than "Oh no." The state-of-the-art devices had detected disturbingly high levels of sulphur deposition into their lakes, far beyond the reach of notorious

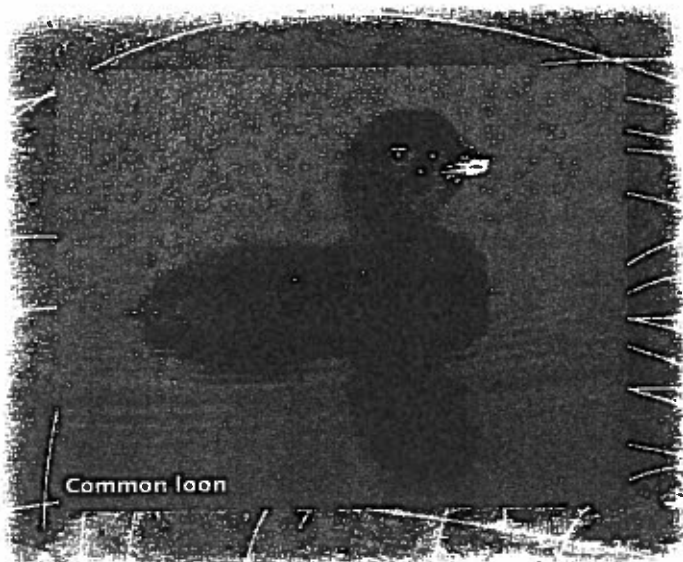
studying the natural world. EMAN staff, for example, are now working with the Canadian Nature Federation to promote volunteer-based, "citizen science" programs such as Frogwatch, Plantwatch and (get ready for this) Wormwatch across the country. There is even a fledgling Lichenwatch in the works.

"EMAN is a grease-and-glue operation," says current director Hague Vaughan, who acts as an ambassador for partnerships between different political jurisdictions, government agencies and scientific disciplines. "[Society and governments] have divided the ecosystem into manageable parts. The only way we can address ecosystem questions like biodiversity, long-range transport of air pollutants and UV-B [ultraviolet radiation] is through partnerships."

So far EMAN has rallied together a network of almost 100 ecological "case study sites" into landscape-based research collectives in each of Canada's 15 natural ecozones. EMAN helps the networks grow, spread and work effectively. Rather than recreating the wheel, it is promoting value-added benefits from existing work — a strategy with taxpayer-appeal.

It is a simple idea, really, but one that must negotiate a multi-tiered labyrinth of government agencies, universities, research institutions and other collaborators if it is going to work. And EMAN seems to be working.

A Who's Who of Canadian field stations and research sites now fly the EMAN flag. The network includes scientifically strategic sites such as the University of British Columbia Research Forest, the Kluane Lake Research Station, the sub-arctic research station at Schefferville in northern Quebec



Common loon

AT KEJIMKUJIK NATIONAL  
PARK, RESEARCHERS  
DISCOVERED THE  
HIGHEST MERCURY  
CONCENTRATIONS  
EVER FOUND IN  
LOON TISSUES  
IN NORTH AMERICA.

(a pioneer in inland taiga research), the Nunavut Research Institute site at Iqaluit, the Huntsman Marine Science Centre and the St. Andrews Biological Station in New Brunswick, the University of Saskatchewan's native prairie research site at Matador, the Lethbridge Agricultural Research Centre, Delta Marsh in Manitoba, the Experimental Lakes Area in northwestern Ontario and the Swan Lake Forest Research Reserve in Algonquin Park. EMAN is also at the core of ecological monitoring schemes in most of Canada's eight United Nations-recognized biosphere reserves.

Although Hague Vaughan and the EMAN staff are boosters of long-term research, they recognize the realities of government funding for ecological studies. "Fully 80 percent of all papers published in ecological journals are based on studies that last less than

three years," remarks Vaughan. "Roughly 75 percent cover only one or two species; and most are based on studies that use one square metre of ground as a typical sampling unit. Long-term studies are absolutely essential, but we cannot afford to conduct research for its own sake. It must help us find scientifically defensible rationales for

issues such as pollution control and resource management."

Running for decades or more in some cases, long-term studies are stalwarts of ecology. Although usually designed to answer specific questions — What happens to ecosystems in the long run when you clear-cut a watershed? — they also let the land (and water) tell its own story. The work can uncover long-term trends in environmental quality and can produce important short-term discoveries.

Cliff Drysdale of Kejimikujik National Park — the first formally identified EMAN site and a candidate biosphere reserve — has seen the value-added benefits of long-term, integrated research. Hired as an in-park ecologist in the 1970s — the first in the national parks system — Drysdale was charged with delivering on Parks Canada's mandate to assess and monitor the health of national park lands. He started with a park inventory.

Not content with a catalogue of bears, birds and bullfrogs, Drysdale set out to study all the living and non-living parts of the park that he could, including air, soils and water quality. With good baseline data and a commitment to monitoring, Kejimikujik soon became a regional magnet for field researchers from government agencies, colleges and universities.

The park, for example, became an acid rain station in the LRTAP



Wolf Creek, Kejimikujik, Dorset and more than 90 other sites have adopted the EMAN label. Every site has its own history, its own collection of partners, and its own set of eureka's to boast about. But more to the point, each has bought into the concept of collectively working on ecological science.


With a healthy mix of raincoats and lab coats, and pure and applied research, EMAN sites are dedicated to understanding Canadian ecosystems and putting data to work to solve ecological problems. Acid rain showed us how ecological research can be a tool to protect Canadian ecosystems. Global issues such as

ozone depletion and climate change will surely drive us to our arsenal of long-term studies once again.

"From 1978 to 1991, we were in a pitched battle with the Americans over acid rain," says Tom Brydges. "The Reagan administration did not want controls put on their industries, and pulled out all the stops to challenge us. There was tremendous pressure to discredit the Canadian scientific case. It was like scientific hand-to-hand combat."

Brydges worked closely with researchers in Dorset, the Experimental Lakes Area near Kenora, the Turkey Lakes area north of Sault Ste. Marie, Kejimikujik

National Park and scores of other lakes downwind of American industry. "We could not understand acid rain by only looking at one site. This did not tell us what was happening across Eastern Canada. We had to examine 15 acid rain sites over a number of years. As a result, our scientific evidence was rock-solid."

The rock that slew the Goliath of American indifference to acid rain was the public's response to data collected from a network of long-term ecological studies. This realization is at the heart of EMAN. It is a new millennium-friendly adage: there is strength in numbers, but there is power in networks. 

## EMAN WITH A MISSION

Co-ordinated by Environment Canada, EMAN began as an alliance of biologists, ecologists, soil scientists, hydrologists, climatologists and other researchers who share a common commitment to long-term ecological studies in Canada. The network is a sort of franchise operation that recognizes and gives a national identity to existing ecological research operations, and strives to foster a national approach to such studies. Since its inception in 1984, EMAN has remained mostly a "virtual" entity, co-ordinated by a skeleton staff out of the Canada Centre for Inland Waters in Burlington, Ontario. Recently, however, the "skeleton" has put some meat on its bones.

With limited funds and resources, EMAN has turned to the public for help in gathering data to study the health of the Canadian environment. To ensure that information is useful to the scientists working at monitoring sites across the country, it has created a core set of environmental variables — the ecological equivalents of our temperature, pulse and blood pressure. By tracking key species, the program hopes to help monitor environmental trends and build a national early warning system of ecosystem change that may threaten the well-being of Canadians.

This "watchdog" aspect of EMAN has already attracted provincial partners across the country. Programs such as the Metro Toronto Zoo's Frogwatch Ontario and the University of Alberta's Devonian Botanic Garden's Plantwatch are part of this monitoring exercise. To expand the program nationally, however, the network's creators turned to the Canadian Nature Federation (CNF).

The success of the CNF's Lady Beetle Survey convinced them the non-profit conservation group would be the ideal partner for this science-based, community oriented initiative. CNF executive director



Bullfrog

June Gelfand agreed. She says, "Many of our supporters are naturalists who are both committed to, and knowledgeable about, the natural world. When EMAN approached us about this project, we were very excited about the opportunity to participate." As a non-profit group, the Canadian Nature Federation was also in a position to find sponsors — something the money-strapped federal program was prohibited from doing.

When CNF went to the corporate community looking for help in launching Frogwatch (the first in this national series of volunteer monitoring projects), Petro-Canada was quick to respond. Greta Raymond, the company's senior director of environment, health and safety, says, "The Frogwatch program captured our attention because it is a very good fit with Petro-Canada's social vision theme — 'the development of Canadian talent, innovation and expertise through education.'

"The environment is a top-of-mind issue with Canadians, and Frogwatch will provide an excellent opportunity for children and adults alike to learn more about our collective environment in a very hands-on way," says Raymond. She adds, "environment is also top-of-mind with our employees, and we hope to get a number of them involved in the program across the country. We're very pleased to partner with such a well-respected organization as the Canadian Nature Federation on this exciting educational project."

To find out how you can participate in Frogwatch, read the brochure enclosed with this article (opposite page). Extra copies of the Frogwatch brochure and survey form are also available by contacting the Canadian Nature Federation, 1 Nicholas St., Ste. 606, Ottawa, ON, K1N 7B7; telephone (613) 562-3447; fax (613) 562-3371; e-mail cnf@cnf.ca.



**The run-up phase of the Arctic-Subarctic Ocean Flux (ASOF) Program.**

ASOF has thus far developed in four main steps.

1. In May 1999, the AOSB announced plans to study the two-way oceanic exchanges that link the Arctic Ocean with subarctic seas; under this plan, a circum-Arctic deployment of a long term Arctic-Subarctic Ocean Flux (ASOF) Array would provide the measurements that coupled climate models need to understand the role of the Arctic in abrupt climate change.
2. On 6 April 2000 in Cambridge UK, as a joint initiative of the AOSB and IASC, a discussion meeting on the Sustained Monitoring of Arctic Fluxes was held during Arctic Science Summit Week to discuss the palaeo- and modelling evidence that THC slowdown or shutdown has happened in the past, to begin to define the system of critical measurements that will be needed to understand the role of the high-latitude oceans in decadal to centennial climate variability, and to discuss ways of achieving the necessary stamina in our funding to implement such a system across all the main gateways to/from the Arctic Ocean for a period of a decade or more.
3. The scientific planning of ASOF was later advanced by means of a second discussion meeting and workshop, held at the Norsk Polarinstitutt, Tromsø on 21-24 September 2000, in conjunction with the H. U. Sverdrup Symposium. The Tromsø workshop had the aim of providing a more complete description of the required observing system, with preliminary costs, and with some results in support
4. The design of an ASOF array was further refined at a National Academy of Sciences Workshop on Abrupt Climate Change: Science and Public Policy, held at Lamont Doherty Earth Observatory, Palisades NY, on October 30-31 2000.

With the active encouragement of the NSF, NOAA, the Norsk Polarinstitutt (NPI), and the University of Washington SEARCH\* Program (in many ways the parent body of ASOF), plans have now advanced to the point of designing a prototype array and establishing an ISSG, chaired by RRD, to carry the concept through to implementation.

**The rationale and draft science plan for ASOF** can be found on NPI and SEARCH\* websites [\*SEARCH = Study of Environmental Arctic Change]: [<http://asof.npolar.no> and <http://psc.apl.washington.edu/search/ASOF.html>], and the dialogue over its implementation can be found at [www.ocean.washington.edu/research/gfd/asof.html](http://www.ocean.washington.edu/research/gfd/asof.html).

The basic aim remains one of establishing a coordinated, circum-Arctic system of ocean flux measurements with decadal 'stamina' to cover all of the gateways that connect the Arctic Ocean with subarctic seas. At least initially,

The ASOF Chair and the Deputy Chair ASOF-West met in Iqaluit during ASSW in April 2001 to plan and prioritise the mix of design studies and equipment trials that will form the business of the full ISSG until implementation, progress the ASOF Science Plan and develop links to ongoing and upcoming national programmes. Similar discussions are underway to plan and prioritise the tasks of ASOF-East.

The initial questions and tasks which will form the business of ASOF ISSG until implementation will shortly be posted on the ASOF websites. The broadest possible range of comments on these tasks are sought and welcome.

Bob Dickson, CEFAS, Lowestoft, Chair  
8 May 2001



# Arctic Logistics - Canada



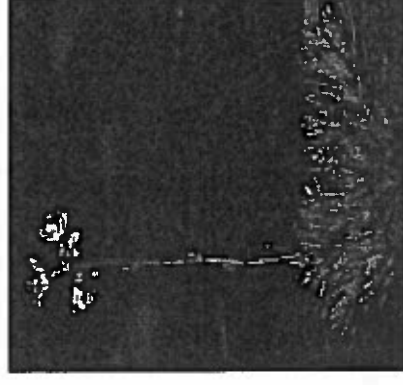
 Natural Resources  
Canada

 Ressources naturelles  
Canada

## ...partnerships....2

### ■ Collaborations with

- Nunavut Research Institute
- Aurora Research Institute (NWT)
- Environment Canada Arctic operations
- Canadian Coast Guard
- National Defence - Search and Rescue
- Communities (medevacs, search and rescues)
- International research & logistics community (*Northern Dimension of Canada's Foreign Policy*)



| For more information: <http://polar.nrcan.gc.ca>

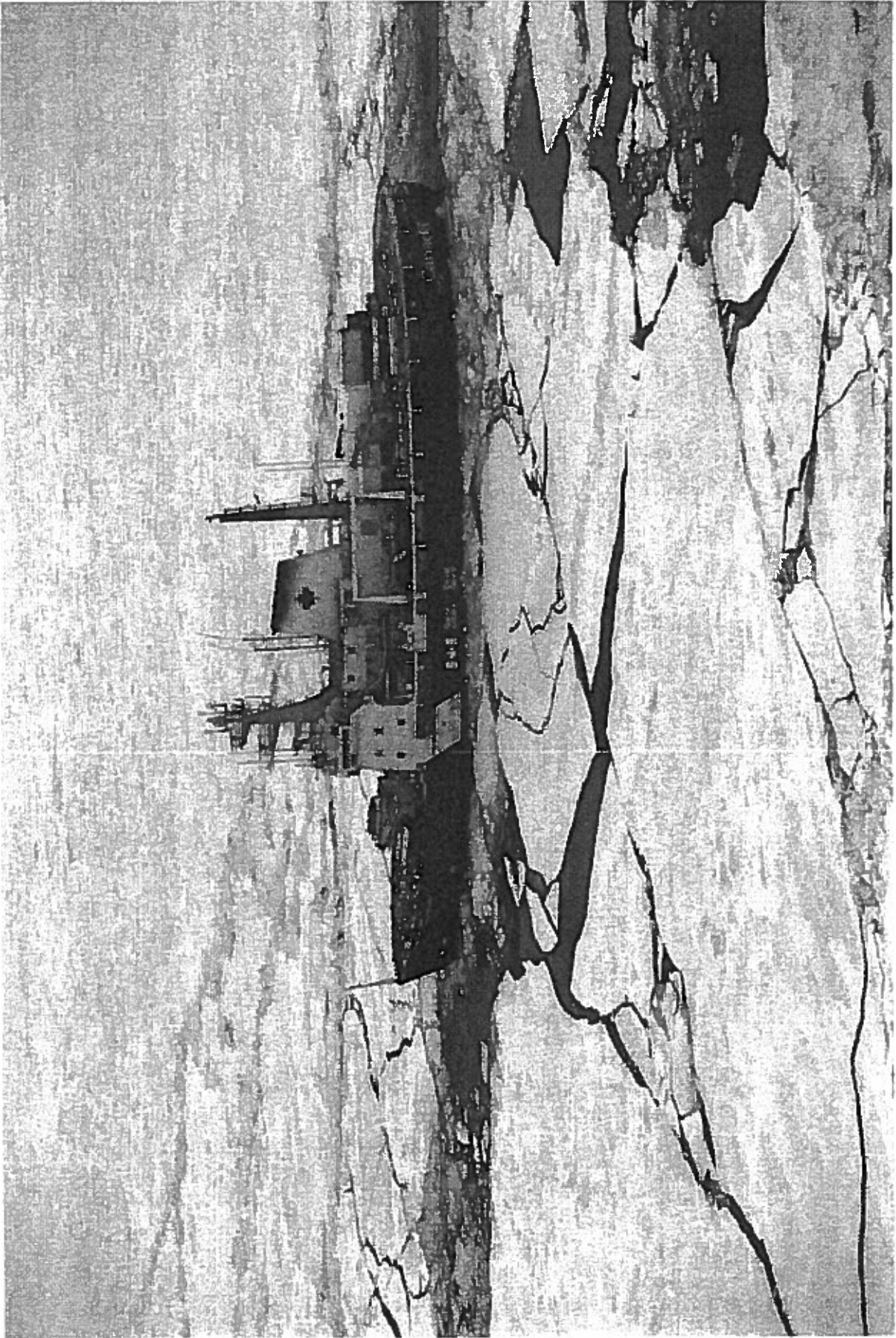


Natural Resources  
Canada

Ressources naturelles  
Canada







Canada

Fishes of Oceans  
Carpiats

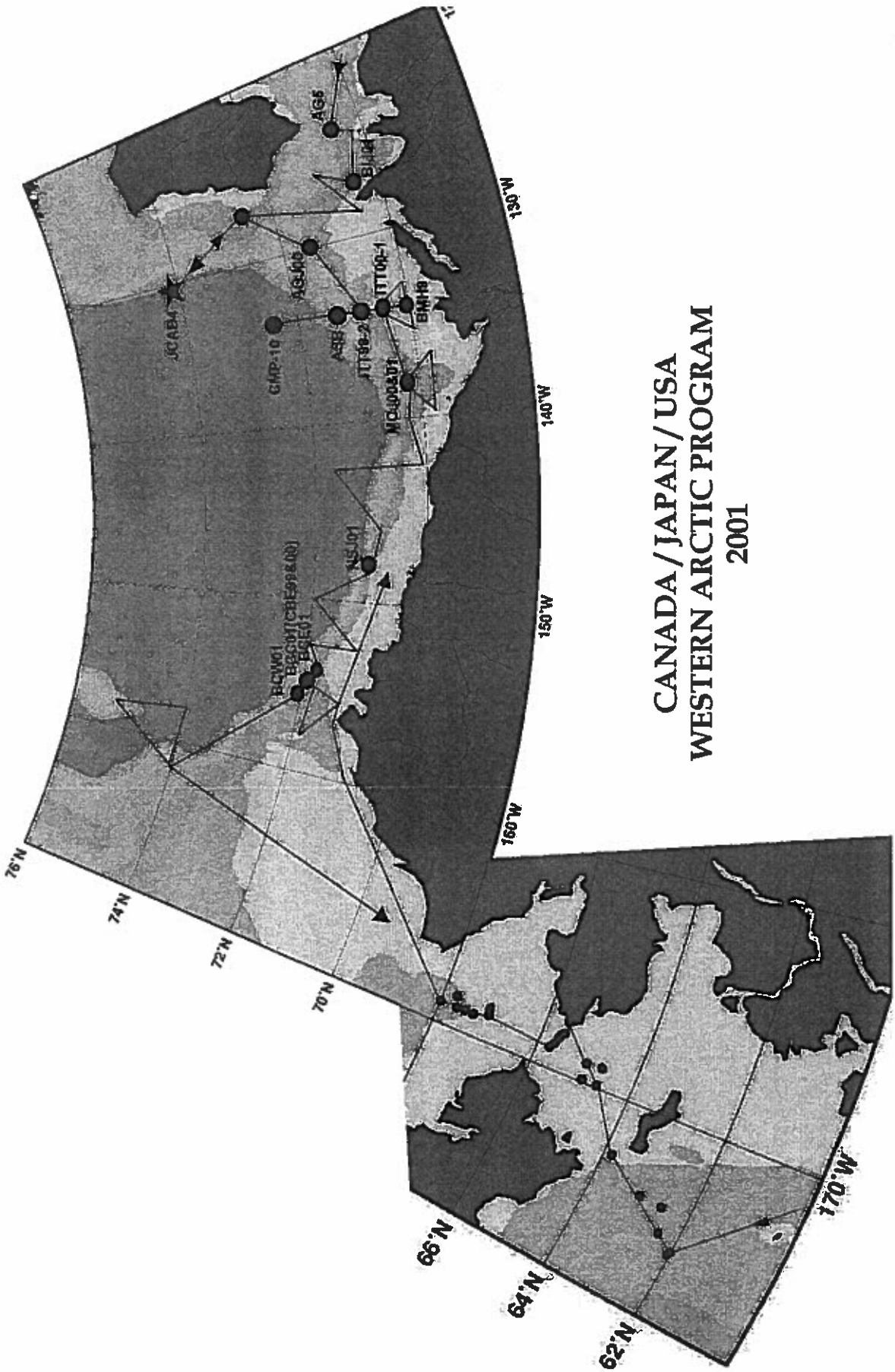
Fishes and Oceans  
Canada



# Nares Strait Program

- Germany-NRCan led program - Aug, 2001
- 3+ years of planning
- Acoustic arrays; seismic gear
- CTD/Rosette program
- 35 researchers - Germany, Canada, Denmark
- CCGS Louis S. St-Laurent





**CANADA / JAPAN / USA  
WESTERN ARCTIC PROGRAM  
2001**

# Ship costs (\$CDN)

- Laurier - ~13K/day
- 1200 - ~16K to 18K/day
- Louis - ~25-35K/day
- Nahidik - ~10K/day
- Helicopter - ~\$1K/h





FARO Meeting  
April 2001, Iqaluit, Canada

## GERMAN ARCTIC RESEARCH AND OPERATIONS

Alfred Wegener Institute for Marine and Polar Research

Co-ordination of research activities  
Operation of main research facilities

### TERRESTRIAL ACTIVITIES

#### *Koldewey Station (Ny-Ålesund-Svalbard) since 1991*

- Member of Ny-Ålesund science community, EU-Large Scale Facility, permanently occupied,
- Atmospheric sciences, biology, chemistry, geophysics, hydrology
- Network primary site, validation site, EBV, NET, NDR, GAW, BRU
- Long-term observations on climatic, biological, hydrological, and environmental issues

#### *Siberian field expeditions since 1993*

bilateral co-operation with Russia, project: System Laptev Sea 2000  
paleoclimatic, periglacialology, glaciology, geochemistry/soil science

### RESEARCH AND SUPPLY VESSEL "POLARSTERN"

#### *Arctic voyages since 1983*

17<sup>th</sup> expedition in 2001

multidisciplinary program: biology, geology, oceanography,

#### *coordinated operations*

ARK XVII/2: RV Polarstern and USSG Healy  
geophysical and geological conditions in the area Gakkel Ridge

### INITIATIVES FOR NEW MARINE RESEARCH FACILITIES

#### *Aurora Borealis*

new Arctic research icebreaker with a deep ocean drilling capacity