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FISHERIES AND OCEANS ACTIVITIES IN THE NORTH 1979 - 80

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Fisheries and Oceans

Activities In the North

1979-80

INTRODUCTION

The growing economic importance of Canada's northern regions, particularly as a source for oil and gas and mineral exploitation, has meant a dramatic increase in the responsibilities and activities of the Department of Fisheries and Oceans in these areas.

Not only must the department take action to ensure that fish and marine mammal resources of the North are protected from the various forms of industrial encroachment and are not over-exploited, but it also has a responsibility for producing adequate marine navigation charts for northern waters as well as acquiring the necessary marine science expertise to advise industry and other government departments in many critical areas.

The following pages provide a summary of DFO's activities north of 60° during the fiscal year 1979-80, and preview activities for 1980-81. This text will appear as part of the annual publication "Government Activities in the North", produced by the Advisory Committee on Northern Development.

GOVERNMENT ACTIVITIES IN THE NORTH - 1979-80

Department of Fisheries and Oceans

Responsibilities

The department is responsible for fisheries research and management throughout the Canadian North, drawing its authority from several acts, including the significant Fisheries Act. The department implements oceanographic and hydrographic programs and coordinates ocean policies and programs of the federal government.

Organization and responsibilities with respect to Fisheries

Arctic fisheries management occurs under two regions, the Pacific (Yukon) and the Western (NWT). Enforcement and inspection programs, and to a limited extent management functions, are performed by Fishery Officers located in the Territories in both districts (e.g. Whitehorse, YT and Yellowknife, NWT) and sub-district offices (e.g. Haines Junction, YT, and Inuvik, Frobisher Bay, NWT). Professional assistance for fisheries and fish habitat management is supplied through regional headquarters in Vancouver and Winnipeg.

The Arctic Biological Station operates outside the network, reporting through the Quebec Region, adding a marine biological research capability to the fisheries northern programs.

Information has been gathered under three headings: Fisheries Resources, Fish Habitat Management and Industry Services. Fisheries Resources comprises the conservation and protection of fish stocks,

including both management and enhancement plus associated research. Fish Habitat Management comprises evaluation of effects of industrial developments on fish resources and habitats: research on the ability of northern ecosystems to respond to adverse impacts: departmental input to the Federal Environmental Assessment and Review Process (EARP); and the development of terms and conditions for licences issued by other government departments. Industry Services comprises the monitoring of processing plants to ensure adherence to operating standards: provision of advice in handling, processing, transportation, storage and distribution of fish products; laboratory analyses for contaminants in domestic and improved fish products, water and ice samples; inspection of freshwater species and fishing vessels; administration of grant assistance programs to fishermen for new vessels, and the fishing vessel insurance coverage programs; provision of advice and guidance to industry on developmental programs with respect to fishing gear, equipment and process development.

Yukon Territory

Fisheries Resources

Review 1979-80

Fishery officers sampled stocked lakes to determine success of stocking programs.

A new sub-district office was opened in Haines Junction to improve coverage in the Western section of the Yukon.

The Klukshu River salmon counting fence was operated for the fourth successive year. The fence, located about 100 yards upstream from the mouth of the river, enumerates adult migrating salmon as an aid to managing the sport and Indian food fisheries. An active sport fishery is concentrated just below the weir and the confluence of the Klukshu and Tatshenshini Rivers and an Indian food fishing trap is located upstream from the weir at the mouth of Klukshu Lake. In addition to information on salmon abundance and migrations timing, baseline biological information (sex, age, length) was collected as a biological basis for management.

The numbers of fish of each species counted through the fence in 1979 were as follows: sockeye 12,292, chinook 4,404 and coho 175, well below the 1976-78 averages (sockeye 21,783, chinook 2,466 and coho 1,453). A report is presently being prepared on the results of the 1979 program.

Wellesley Lake, renowned for the exceptionally large lake trout available to anglers and given "trophy lake status" in 1977, was sampled in 1979 to assess the size of catches and numbers of fish released. This consisted of three three-day trips to the lake to interview anglers. Because of the superficial nature of this investigation it was impossible to draw any definite conclusion regarding the seasonal catch and numbers released. A more intensive program is required to determine this basic information and to assess catch and release mortality.

The commercial salmon fishery in the Yukon River at Dawson was sampled in 1979 to collect basic biological information on chinook salmon (lengths, sex, age). This information may be of value in longterm management of the fishery.

Plans for 1980-81

Further development of Yukon salmon fisheries is proposed and ongoing negotiations with the U.S. will address the matter of equitable harvests to Canadians from Yukon river stocks.

Additional data on fish stocks in Yukon streams will be obtained and fisheries development in the Beaufort Sea area investigated.

Fish Habitat Management

Review 1979-80

Field studies and discussions have been undertaken with DPW to assess fisheries impacts and arrange mitigative action respecting the Shakwak Highway Project and the proposed route realignment in the paving of the Alaska Highway from the BC/Yukon border at Watson Lake to Haines Junction.

Briefs were presented at several public hearings under the auspices of the Yukon Territorial Water Board for the purpose of developing

"Interim Guidelines for Issuance of Authorizations to Use Water for the Purpose of Placer Mining in the Yukon Territory".

The rapid expansion of placer mining has required DFO interventions at several water license application hearings.

Contributions were made to the development of the Terms and Conditions respecting construction of the Alaska Highway Gas Pipeline and a brief presented to EARP hearings in Whitehorse in April, 1979. A Yukon pipeline crossing schedule is being prepared in cooperation with Foothills Pipeline Company.

A field reconnaissance, along the Alaska Highway Gas Pipeline route and Dempster Lateral route, was conducted.

Negotiations have been undertaken with the Northern Canada Power Commission with respect to the modification of the fish passage facilities in the event proposed expansion takes place, and provision of a mini-hatchery aimed to offset turbine mortalities of juvenile salmon which have resulted from the existing operation and which would be aggravated by expansion.

A radio-tagging study of adult chinook salmon was undertaken in the vicinity of the Whitehorse Rapids powerhouse in August, 1979 to determine the period of delay, and the effectiveness of the fish

passage facilities. It was established that salmon were not attracted to the powerhouse tailrace and that the fishway and barrier dam are functioning properly.

An update on the probable impact on the fisheries resource from a proposed diversion into Aishihik Lake for hydro-electric purposes was made. Estimation of possible effects on the resource of erosion of new watercourses, changed lake morphometry and other broad environmental effects were considered essential before the diversions, and associated lake poisoning programs to prevent parasite transfer, could be undertaken.

Habitat Protection personnel also contributed to a Yukon River Basin Preplanning Study initiated by the Inland Waters Directorate of the Department of Environment. The purpose was to determine the state of knowledge about the Yukon system and on the basis of this to determine what information must be gathered before a Water Management Plan can be developed. It was concluded that if a full management plan was developed a considerable increase in fisheries resource information would be required.

Staff reviewed consultants' preliminary and final reports on Cyprus Anvil Mine's proposed tailings pond expansion, contributed to a joint DFO/DOE brief to the Y.T. Water Board public hearing on the Cyprus Anvil Mines water licence renewal, and reviewed Whitehorse Copper and United Keno Hill Mines Water Use Licence Renewal applications.

1980/81 Programs

Habitat Protection staff will participate in an inter-agency resource inventory and impact research program associated with the placer mining industry, and review "conventional" mine developments and pesticide application programs. Negotiations will continue with Northern Canada Power Commission re proposed expansion of the Whitehorse Rapids facility and the Aishihik diversion.

Northwest Territories

Review 1979-80

Fisheries Resources

The research station at Nauyak Lake on the Kent Peninsula continued its work on Arctic char. Results to date indicate that its life history is extremely complex with considerable interchange between the various stocks. In spite of the existence of large stocks annual production levels are very low. The information being gathered will be essential to the planning of efficient management strategies. The station will terminate the present phase of operations in 1981.

The program on Experimental Whitefish exploitation centered on Chitty Lake, north of Yellowknife, is now in its ninth year of operation. Sampling was at a relatively low level, as the recovery is adjudged to be complete and a new program of exploitation at levels and under

conditions comparable with those of a commercial operation will be inaugurated.

Activities in fishery management included the continuing creel census, biological sampling and tagging studies on lake trout in Great Bear and Great Slave (east arm) lakes. The reduced possession limits resulted in these two lakes being managed as "trophy sport fisheries". Monitoring of the other inland sport fisheries was carried out in the Hay River (for walleye), Kakisa River (for Arctic grayling), Mackenzie River - Brabant Is. (for Arctic grayling), Yellowknife (for lake trout, walleye, N. Pike, whitefish) and Keewatin - e.g. Kasba Lake (for lake trout and N. pike). The growth of stocked rainbow trout in Polar Lake was studied. A questionnaire survey of sport fishing in the Yellowknife and Hay River areas was carried out.

A program on monitoring the subsistence (domestic) fishery (primarily whitefish) was initiated on Great Slave Lake. The unusually high presence of chum salmon in the Liard, Mackenzie and Slave rivers and on Great Slave Lake was studied during late fall.

Monitoring of the commercial fishing on Great Slave Lake continued to measure the effects of a reduced gillnet mesh size on the whitefish stock(s). In addition, a tagging biochemical genetic study was initiated to differentiate possible populations and/or sub-populations of whitefish in Great Slave Lake. The inconnu commercial fishery at

Buffalo River - Great Slave Lake was monitored, and a fisheries gillnetting survey was done on Tathlina Lake.

Monitoring of the Arctic char commercial fishery on the major rivers in the Cambridge Bay area checked catch, age and growth of the populations. A fish fence (Aug. - Sept.) at the Elalluk River (Wellington Bay) accounted for more than 180,000 anadromous char moving into the system. The domestic-commercial Arctic char fishery at Paulatuk was monitored. The two-year preliminary assessment study on Arctic char in the Gjoa-Haven-Pelly Bay area was initiated in conjunction with the N.W.T. Government. The Keewatin coastal Arctic char domestic/commercial fisheries were monitored with assistance from the N.W.T. Government.

On Baffin Island the test fishery program for Arctic char, in conjunction with the N.W.T. wildlife officers continued. Studies on the domestic (Salmon River - Pond Inlet) and sport (Koluktoo Bay-Robertson River) fisheries were initiated with assistance from PetroCanada.

The live-capture at Churchill of six beluga whales by Sea World was supervised. Funding was provided for a brief survey of the beluga stocks in the Cumberland Sound area.

Thirty-one scientific permits (under Section 4 of Fisheries Act) for studies on fish and marine mammals in the Northwest Territories were processed.

Plans for 1980-81

Inland sport fisheries will be monitored in the Hay River, Kakisa River, Yellowknife area, Great Bear and Great Slave lakes and Keewatin (N. Henik Lake) area. Studies to assess the sport fishery potential along the Liard and Dempster Highways will be initiated.

Stock assessment studies on Great Slave Lake will continue. A fisheries survey will be carried out on Gordon Lake.

The assessment of Arctic char stocks and monitoring of the Cambridge Bay area commercial fishery will continue. The domestic/commercial Arctic char fisheries will be monitored in the Mackenzie Delta (Aklavik area) and Keewatin coast (Rankin Inlet). The second year of the two-year assessment for potential Arctic char fisheries in the Gjoa Haven - Pelly Bay areas will be carried out.

On Baffin Island, assessments of the sport fishery at Koluktoo Bay and domestic fishery on the Salmon River, both in the Pond Inlet area, will continue.

The Arctic char project on the Kent Peninsula and the experimental whitefish exploitation studies will continue.

Fish Habitat Management

Review 1979-80

The Liard Highway study completed the second of a three year program to evaluate the effects of culvert construction on the fish resources of several small streams crossed by the highway. The project included studies on the effects of construction on hydrologic conditions, fish habitats and on the effectiveness of crossing design in permitting fish passage.

The Beaufort Sea-Mackenzie Delta project completed its second year. Fish resources and migrations along the Tuktoyaktuk Peninsula were monitored and an extensive study of a coastal embayment and its freshwater drainage system was undertaken. Approximately 1.3 million fish passed through a monitoring fence to upstream lakes.

At the Saqvaqjuac research study area, north of Chesterfield Inlet, phosphorus and nitrogen were added to selected lakes to determine if Arctic systems respond to increased nutrient loadings in the same manner as do more temperate systems. The effects on nutrient budgets, primary productivity, benthos, zooplankton and fish were monitored.

The second year of a three year study of the Slave River Delta was completed. Objectives of the project were to monitor macronutrients and to evaluate the spawning potential of river reaches above the Delta.

Arctic Land Use mapping surveys of approximately 260,000 sq. km. of the Back Lowlands were undertaken in 1979. Maps have been prepared and a report describing survey techniques, characteristics of the water-sheds and detailed catch information has been issued.

Personnel participated in the review of several major industrial developments in the region in the past year. These included: offshore drilling in northern and southern Davis Strait; the Arctic Pilot Project for the transport of liquified natural gas from the Arctic Islands; the release of offshore drilling acreage in Hudson Bay; dredging for harbour development in the Beaufort Sea; the Polar Gas Pipeline project; and the development of draft guidelines for the production of oil and gas from the Beaufort Sea. In addition, the section played a leading role in the development of the government's Green Paper for Lancaster Sound.

Plans for 1980-81

Studies of the fish resources of Tuktoyaktuk Harbour, the coastal areas from Tuktoyaktuk to Richards Island and of anadromous fish in

outer Mackenzie Delta will be included in the Beaufort Sea-Mackenzie Delta project for the coming year.

At Saqvaqjuac, the study of eutrophication processes and effects in Arctic systems will be continued.

Study of the Slave River Delta to investigate the significance of fish resources and the potential for disturbance, through changes in water quality and quantity will enter the third of a three year program.

Arctic Land Use mapping surveys of the watersheds of northern Baffin and Devon islands will be undertaken in 1980.

Personnel will participate in the public hearings for the Arctic Pilot Project and the Lancaster Sound Green Paper and will develop a statement of DFO concerns for EARP with respect to the planned hydro development of the Slave River and proposed oil pipeline from Norman Wells to northern Alberta.

Industry Services

Review 1979-80

The monitoring of certified processing plants ensured that construction and operating requirements were maintained. Advice and guidance was provided to packing plant operators to upgrade their operating procedures.

A study of contaminants from various locations in the Northwest Territories continued, with approximately 1,000 samples yielding over 5,000 analyses being completed. Collection of end-of-line samples for analyses and inplant surveys and inspection were continued.

The Fishing Vessel Insurance Plan continues to provide low cost insurance to 45 commercial fishing vessels in the Northwest Territories. Four N.W.T. vessels were added to the 13 already approved for assistance under the Fishing Vessel Assistance Plan.

Whitefish roe harvesting and processing continued this year with over 25,000 pounds being produced at ten locations including two sites in the N.W.T.

Plans for 1980-81

The Branch will continue to carry out regulatory inspection of fish products, processing plants, vessels and transportation conveyances. The Fishing Vessel Insurance Plan will still be available, as will subsidies under the Fishing Vessel Assistance Plan.

A pulse fishing strategy is being proposed for a number of smaller northern lakes which allows heavy exploitation for one season followed by a moratorium on the lake of sufficient length to allow the fish population to recover.

Further development and evaluation of automated winter fishing equipment is planned. The sonar scanner, heated mobile shed and hydraulically operated net reel and winches are intended to improve fish quality, improve working conditions and to increase productivity.

Some technological innovations are proposed to assist in improving fish quality. A small portable blast freezer for use in remote fish processing plants is being designed. The equipment should result in lower freezing costs plus a smaller initial capital investment for these plants. Also, containers with modified controlled atmospheres will be evaluated to determine benefits for holding and shipping fresh fish from remote locations.

To increase the market value of freshwater fish, the Branch is proposing a number of initiatives that will increase the use of species by-products, increase sales of exploited species, as well as increase the use of under-utilized species. The initiatives include constructing a pilot fish fertilizer operation, evaluating the development of whole salt cured Northern pike and tullibee ovaries, and by continuing to overcome the problems in utilizing species such as burbot, parasitized whitefish and mullet as a human food source.

The Arctic Biological Station

Review 1979-80

The Station continued to provide important information on Canada's northern marine environment, with emphasis on the distribution and abundance of marine mammals and fishes, the ecological factors that control production and the reaction of plants and animals to environmental stress.

Aerial surveys of migrating marine mammals, particularly the narwhal, were carried out in Lancaster Sound and Prince Regent Inlet in collaboration with personnel of LGL Ltd. (environmental consultants), using aircraft supplied by the Polar Continental Shelf Project. The aerial surveys were supported by more detailed observations of the inshore migration from a camp on the cliffs at Cape Hay, northern Bylot Island.

The white whale population in Cumberland Sound was resurveyed from the ground with the assistance of two Inuk hunters from Pangnirtung. The situation was later reviewed with local Inuit at a meeting of the Hunters and Trappers Association in Pangnirtung.

A survey of the breeding habitat of ringed seals and a study of their behaviour during the spring haul-out period were carried out in southeastern Baffin Island from mid-March to early June as part of the

EAMES program. Other EAMES studies included participation by microbiological staff in collecting at a proposed drill-rig site in southern Davis Strait and in an oceanographic cruise in northern Baffin Bay. Further involvement in the EAMES program was centred on M.V. Calanus which was used as a platform for a marine ecology study at Brevoort Island, the logistics centre for the oil companies' drilling program in Davis Strait. Good use was made of the facilities of the Ikaluit Research Laboratory at Frobisher Bay.

Plans for 1980-81

A reassessment will be made of the population of white whales in Cunningham Inlet, Somerset Island, following two years of unusually late break-up of ice. Animals will also be tagged to see if they are the same whales that spend the winter and spring months along the coasts of western Greenland.

A detailed study of the Arctic fox will be made at Holman Island in the western Arctic in its role as an important predator of the ringed seal.

In Frobisher Bay, studies will continue on the seasonal distribution and abundance of bacteria, production and growth of phytoplankton and seaweeds, and the population structure and biochemical features of macrozooplankton. Further bacterial studies will be carried out under

the Arctic Marine Oilspill Program (AMOP) at the proposed experimental site at Cape Hatt, Pond Inlet.

Canadian Hydrographic Service

Responsibilities

The Service conducts hydrographic surveys in northern waters and produces, distributes and maintains up-to-date nautical charts, sailing directions and tide tables of northern regions.

Review 1979-80

CSS Baffin continued charting in Ungava Bay (commenced in 1978) and completed a coastal mapping project along the Labrador Coast from Cape White Handkerchief to Button Islands. This latter project was required in order to compile new shoreline plots for the precise determination of baselines from which to draw offshore boundaries. In the Eastern Arctic, eight hydrographers and four survey launches were assigned to three large Coast Guard icebreakers; however as 1979 was one of the worst ice years on record for the Eastern Arctic little hydrographic work was accomplished.

In association with the Polar Continental Shelf Project a through-the-ice survey was carried out in Penny Strait, Queen's

Channel and Wellington Channel. Three helicopters and one tracked vehicles were used on this project, which covered an area of 27,500 square kilometres.

The charter vessel Radium Express had a productive season on the Mackenzie River and the survey of the main route from Hay River to Tuktoyaktuk is now complete and up to date. With support from the Coast Guard and Canmar, surveys were completed in Wise Bay and in the eastern and western approaches to Summers Harbour. A detailed survey was made of the approach channel to Tuktoyaktuk and reconnaissance work was done in Prince Albert Sound. Surveillance of the artificial islands in the Beaufort Sea was again carried out.

In the development field, research work continued on the "spiked" ice-coupled transducers at Resolute. The Marine Arctic Route Reconnaissance System (MARRS), in modified form, was evaluated in Bedford Basin and the results proved to be of sufficient quality to warrant further trials in an Arctic environment. A major problem encountered during Arctic surveys is the supply of suitable electric power for portable positioning systems. Marine electronic systems technicians of CHS Central Region, R & D Division, have solved this problem by developing a solar power system. An investigation of the reception characteristics of Omega and Loran-C in the Western Arctic was also undertaken.

Two trial surveys were carried out in the Western Arctic in 1979. In the early part of the year three tide gauges were installed in Peel and Franklin Straits and Prince Regent Inlet and in mid-August an extensive tidal survey of Coronation Gulf, St. Roch Basin and connecting waterways was begun. A number of Aanderaa pressure gauges were deployed through the ice for a month-long period in Sverdrup Basin, Queens Channel and Wellington Channel.

More than 40 new editions of existing charts were published and two new charts - a general chart of the Arctic and a large scale chart of Bridport Inlet - have been put in production.

GEBCO (General Bathymetric Chart of the Oceans) 5.17 of the Arctic was produced and 1:250,000 maps were interpreted and drawn for areas of Amundsen Gulf and the Labrador Shelf.

Work also commenced on Volume II of the Arctic Sailing Directions.

Plans for 1980-81

CSS Baffin will continue work on the Labrador Coast and in Ungava Bay. Later in the year, Baffin will work with CSS Hudson on a multi-parameter survey of Davis Strait. Dependent upon the availability of Coast Guard vessels, surveys will be carried out in Prince of Wales Strait and in high priority areas in the Eastern

Arctic. The co-operative program with Earth Physics Branch of EMR will resume in McClintock Channel and Peel Sound and surveys will be conducted in the Western Arctic, as well as Loran-C transmission tests.

The Arctic tide-gauging program will continue in 1980 with the deployment of Aanderaa instruments during the winter survey in the McClintock Channel and Peel Sound areas.

There is also a possibility of staging an aerial hydrography project in the Western Arctic, aimed at obtaining bathymetry by means of air photo interpretation.

Ocean and Aquatic Sciences (OAS)

Oceanography

Oceanographic investigations in the Arctic relate directly to legislative responsibilities in accordance with the Arctic Waters Pollution Prevention Act and Ocean Dumping Control Act regulations. The main difficulties relate to the adequacy of oceanographic information in defining operating conditions and assessing the consequences of non-compliance or accidents. Even though industry

must take a large responsibility for environmental observations, the regulatory function requires government officials to have both knowledge and expertise relevant to Arctic oceanography. This includes the major responsibility for determining physical oceanographic conditions in relation to drilling permits in the Arctic.

OAS provides oceanographic information and advice to agencies such as DINA, EMR and DOE in support of the regulatory process, the review of industry proposals and related environmental studies, and participates in the conduct and/or management of government/industry marine environmental programs.

Institute of Ocean Sciences, Patricia Bay, B.C. (Pacific Region, OAS)
Review of 1979/80

IOS Arctic activities included extensive field and committee work, administration of Arctic Ocean Dumping Control Act research studies, input into preparation of a Lancaster Sound Green Paper, attempted recovery of moorings deployed by the former Arctic Marine Sciences Section, work-up of a back log of chemical oceanographic data and samples, and remote sensing of chlorophyll.

During 1979 the Frozen Sea Research Group (FSRG) made field trips concerned with the oceanography of Bridport Inlet on the southern slope of Melville Island; tested measurement techniques used

to determine the heat flow from polynyas (areas of open water within growing sea ice); joined with other agencies in acquiring field data aimed at the development of a computer model for sea ice motion in the Beaufort Sea nearshore; and acquired data at the sill of a polluted Greenland fjord from instruments deployed in 1978. Work continued on the physics of underwater oilwell blowouts, on instrument development, in particular a "salinity sucker" which is a device for detecting ice crystals in water, and on the new "Practical Salinity Scale 1978".

Bridport Inlet is the proposed northern terminal for the Arctic Pilot Project whereby liquid natural gas would be transported via LNG tanker from the gas fields of the Sverdrup Basin to southern markets year-round. Physical oceanographic studies continued in March, including current metering and recovering and redeployment of tide gauges. An ultrasonic current meter was used in conjunction with a prototype conductivity-temperature (CT) chain to investigate internal waves. Observed complex currents and internal wave packets are being utilized in ongoing IOS modelling of residual flow within the inlet.

The second stage of the joint IOS/AES/BIO Polynya Project to test techniques and make preliminary heat flux measurements was undertaken despite adverse conditions. The radio-controlled model aircraft used for temperature observations in combination with mean air temperature profiles from a 4-metre mast detected a major temperature drop within one metre of the water surface. Current meter moorings indicated

that, over a 10-day period, tidal flows from the north, i.e. from areas of thin or broken ice, were consistently cooler than flows from the south, the direction of unbroken ice cover.

In the second half of 1979, FSRG became involved in the Beaufort Sea Winter Ice Experiment, a joint government/industry study aimed at the development of a computer model to predict the motion of sea ice. Such prediction requires an understanding of the combined effects of winds, ocean currents, the earth's rotation and the strength of ice on the ultimate speed and direction of ice drift. To provide data to test the models being developed, a coordinated survey of temperature and salinity to a depth of 400 metres, together with ice and atmospheric conditions, was conducted over an area of 100,000 square kilometres in southeastern Beaufort Sea in November and December. Data analysis and modelling continue.

Installation of a current meter on the sill of the Agfaidikovsa Fjord in Greenland showed that relatively high currents could occur during flushing events, resulting from dense water spilling over the sill. This confirmed the expectation that polluted water, derived from mine tailings disposal in the fjord, were being raised over the level of the sill and being transported out of the system.

Laboratory studies of gas hydrate formation and outgassing of oil drops over a decreasing pressure range from 1300-300 psi were

completed under a contract to the University of Calgary. The results suggest that, in a blowout at depths greater than 500 metres, all the gas would be converted to solid hydrate. In the absence of hydrate particles, dissolved gas of gas-saturated oil drops diffused directly in the water column. However, with hydrate particles present, the oil drops became coated with hydrate which decomposed under simulated rise conditions. At no time did out-gassing result in fragmentation of the oil drops.

A "salinity sucker", capable of measuring the conductivity and temperature of water while collecting entrained ice crystals on a filter, has been constructed to understand in-situ ice formation and growth, and apparent super-cooling of waters beneath growing ice. Work also continued in providing the definition for the "Practical Salinity Scale 1978" including fitting a new and more accurate data set to a set of empirical equations over the entire oceanographic range of variables. The equations and the definition of salinity were accepted by the IAPSO (International Association for the Physical Sciences of the Ocean) in December 1979.

Provision of physical oceanographic advice to committees concerned with Arctic industrial development has become a major task requiring substantial IOS effort. An IOS Arctic scientist devoted several months contributing to the Lancaster Sound Green Paper and other Arctic environmental impact assessments and reviews. Another of

the Beaufort Sea Overview report series -- "Crude Oil in Cold Water" -- was published in 1979.

An attempt to recover current meters deployed by the former Arctic Marine Sciences Section from Lancaster Sound and Wellington Sill using the submersible PISCES IV was unsuccessful due to ice conditions and vessel malfunctions.

Remote sensing of chlorophyll at the sea surface was successfully undertaken over Lancaster Sound and northern Baffin Bay during the summer in cooperation with the University of Paris, Petro-Canada and EMR. Ground truth measurements were made from the MV Theron.

No Arctic chemical oceanographic field work was undertaken in 1979 although lead-210 dating of marine sediments in cores previously collected in Amundsen Gulf were processed. Beaufort Sea nutrient and chemical oceanographic data were processed into reports, and salinity and dissolved reactive silicate were used to determine the origin and composition of surface water in the southern Beaufort Sea.

Plans for 1980-81

The Frozen Sea Research Group will conduct the final major field operation (including a biological component) in the study of ocean/atmosphere heat exchange from a polynya in cooperation with AES

and BIO, and will continue data analysis and interpretation. Further observations will be made in Bridport Inlet to test a model of the circulation. Beaufort Sea Ice Research Project studies and modelling in cooperation with Dome/Canmar will continue into 1980.

Planning and preparation for an Eurasian Basin Experiment with a survey scheduled for April, 1981, will involve scientists from Canada (FSRG), the U.S. and Norway. The project is recommended by SCOR Working Group 58 on the "Arctic Ocean Heat Budget" and has the purpose of studying the heat transport and fate of water cooled on the Siberian Shelf. Field operations are proposed for the study of currents in the major channels of the Sverdrup Islands and the transport of water through the archipelago southwards from the Arctic Ocean. These studies would possibly be allied with the continental shelf moorings for investigation of deep convecting processes and other large-scale variations affecting current fluctuations in the Arctic channels. Work will continue on refinement of sonically oriented current meters, salinity chains and the "salinity sucker".

IOS will continue to administer Arctic RODAC* research proposals, including oil spill experiments. Dew line site cleanup,

* Regional Ocean Dumping Advisory Committee

coal dust on ice for early breakout, oilwell blowout surveillance, harbour development (dredging), and provide advice for ocean dumping permits.

Contingent upon a major vessel cruise primarily for Arctic hydrography in 1981, chemical oceanography may be conducted relating to sedimentation, carbon dioxide, trace metals and hydrocarbon chemical variability and physical oceanography related to water transport through the archipelago. IOS will continue to contribute to Arctic ocean climate and oceanographic research initiatives planning and implementation.

Atlantic Region, OAS (Bedford Institute of Oceanography,
Dartmouth, N.S.)

Review of 1979/80

The Labrador Sea has been studied by Atlantic region physical oceanographers for many years and continues to receive much attention. The array of current meters on Hamilton Bank, which was set in October 1978, was recovered in August 1979; the data obtained are being analyzed and the moorings have since been reset. The object of this particular project is to obtain a long time-series (about 10

years) of water velocity data in order to investigate the seasonal and yearly changes in the Labrador current. The analysis, interpretation, and publication of data obtained in the Labrador Sea during earlier years continues.

Work on a wave climate for east coast coastal waters, including Davis Strait into Baffin Bay, continued. Coastal waters comprise the nearshore, the continental shelves, and the marginal seas. The data base for this climate is being expanded from one to three years.

Work towards the provision of an improved ocean geoid (mean sea-level service) for Hudson Bay continued. Altimetry data have been obtained from NASA's GEOS-3 satellite and a computer program is being developed to merge these data with other data and gravity and tide models in order to produce a geoid map of the region.

A joint experiment with Ocean and Aquatic Sciences Pacific and the Atmospheric Environment Service to evaluate the heat budget of an Arctic polynya was postponed when the open water froze over. Since the participants were already on site extensive testing of the equipment was undertaken in preparation for carrying out the experiment during a subsequent field season.

The region participated in the Lomonosov Ridge Experiment, undertaken in the vicinity of the North Pole to study the nature of this undersea

ridge. A major responsibility was the provision of positioning data to all experimenters. The region's involvement will enhance its capability in polar satellite positioning techniques.

In theoretical studies pertaining to the Arctic, a model of the Bering Sea was developed that includes horizontal transport processes. This work was done in collaboration with the Lamont Geological Observatory, U.S.A.

In Arctic chemical oceanographic research, particular attention has been paid to those regions off N.E. Baffin Island thought to be receiving inputs of hydrocarbons from seeps in the underlying sediments, e.g. Scott Inlet. Mapping of the hydrocarbons in the sediments and water was used to identify seep "hot-spots".

Gas chromatograph/mass spectrometry analyses of organic material in sediments demonstrated the presence of components of crude petroleum, biogenic hydrocarbons and possibly products of high temperature combustion.

Surveys of the incidence of organohalogenes (polychlorinated biphenyls and DDT derivatives) in sediments have been carried out in the eastern Arctic. No detectable quantities were found.

The interpretation of trace metal data from Arctic water samples collected by the region has been completed. Metal levels in Baffin

Bay and the Canadian Arctic Archipelago are lower than in most coastal waters, and in the centre of Baffin Bay are comparable with pelagic levels. Water in Jones and Lancaster Sounds shows the influence of run-off. On the other hand little influence of biological processes in Baffin Bay can be detected. A budget for trace metals in Baffin Bay has been constructed.

Oxygen isotope studies of the upper waters of Baffin Bay, Lancaster Sound, Jones Sound, and Smith Sound were undertaken in order to define the extent of sea ice meltwater penetration and to estimate the annual cycle of sea ice formation and melt.

During the 1979 summer field season ecological studies were carried out from the Coast Guard vessel Louis St. Laurent in the Lancaster Sound region and from CSS Baffin in Ungava Bay. These investigations were preliminaries to a planned major Arctic cruise in 1980 (see below) and concentrated on physiology and photosynthesis in cold water phytoplankton populations.

Plans for 1980/81

Most of the work described above is on-going and will continue during 1980/81, including the requirement to analyze and interpret the data collected during earlier years.

Major cruises during 1980/81 include: CSS Hudson to the Labrador Sea in connection with the long-term mooring program on Hamilton Bank; CSS Hudson to Baffin Bay, Melville Bay, Kane Basin, Jones Sound, Lancaster Sound, etc., to conduct marine ecosystem investigations; and CSS Hudson to the Baffin Island shelf to determine the chemical nature of substances released from seeps.

New projects during 1980/81 include an investigation of the influence of atmospheric fallout on the background levels of organic material in the Arctic and other marine environments.

Central Region, OAS (Canada Centre for Inland Waters,
Burlington, Ont.

Review of 1979/80

Continuing the program in support of Transport Canada's Energy R&D program on marine transportation of energy commodities, the 1979 Arctic oceanography project concentrated on the Sverdrup Basin. While the primary objective of this project was the collection of current and salinity/temperature data during a representative period of solid ice cover (March-May), the ultimate aim is to design specific dynamics-related experiments with other agencies (notably AES and industry groups such as APOA and AIEG) to examine motion and deformation in consolidated pack ice. Other applications arising from

the studies include: (1) the provision of baseline data which could assist industry in the planning, design and operation of facilities for the exploration and production of hydrocarbon and perhaps mineral finds in the Arctic; (2) the direct use of the baseline data in providing the Department with the knowledge for reviewing environmental impact statements; and (3) planning and advising on contingency measures.

The field project was greatly assisted by logistics support from the Polar Continental Shelf Project, and through the generous cooperation of Panarctic Oils Ltd. in permitting operations from their camp.

Fourteen current meters were moored on transects from Ellef Ringnes Island to Sabine Peninsula (Melville Island) and between Loughed Island and Cameron Island. The currents are tidally-dominated and are higher in Danish Strait (between Ellef Ringnes and King Christian Islands) and Desbarats Strait (between Loughed and Cameron Islands), attaining speeds up to 24 and 22 cm sec^{-1} , respectively. Although the general flow is towards the southeast, northwesterly means were observed between Loughed Island and King Christian Island. Salinity and temperature data showed a relatively high degree of mixing around Loughed Island and over several sills.

Experiments were carried out at Resolute to use solar panels to power or assist in powering various electrical loads under Arctic

conditions. A compact portable solar panel/battery system capable of supplying the power requirements of a microwave survey transponder for a three-week period was built and successfully tested. This would meet the needs of a transponder used in a typical survey. Work is progressing well on a larger system capable of supplying a survey or navigational transponder (or similar load) for a ten-month or one-year period.

Plans for 1980/81

The major portion of this fiscal year will be spent on building and testing a profiling current meter/CTD system for Arctic applications. Current sensing will likely rely on acoustic methods while a small gyro compass will be used to detect direction. The system will be tested in the Sverdrup Basin where a field project is planned for the spring of 1981.

Solar power experiments will continue through 1980/81. Plans call for monitoring the state of the solar panel/battery systems between March and October and the development of long-term solar power systems, battery technology and battery enclosures.

Marine Sciences and Information Directorate (MSID)

Responsibilities

The Directorate participates in policy formulation for OAS Arctic involvement, provides OAS headquarters representation on a number of interdepartmental committees related to northern development and Arctic marine science, archives oceanographic data collected in the Canadian north, and disseminates northern oceanographic data in processed form on request. It is also responsible for publishing the Canadian Journal of Fisheries and Aquatic Sciences and other publications containing specific papers and technical reports on Arctic marine science.

Review 1979/80

MSID staff provided the secretariat for the Canadian Committee on Oceanography (CCO) Panel on Ice and the interdepartmental Panel on Ocean Management and served on panels established to carry out Environmental Assessment and Review Process (EARP) hearings on offshore drilling in Lancaster Sound and Davis Strait. The Directorate was responsible for formulating a program to collect iceberg data in Lancaster Sound, using a radar installation located on Bylot Island; supported a major initiative to develop an operational model for Beaufort Sea ice dynamics and provided direct funding for the Centre for Cold Ocean Resources Engineering (C-CORE) in Newfoundland.

Plans for 1980/81

The Directorate will be placing increased emphasis on OAS policy development for northern marine research. It will continue to participate in interdepartmental committees addressing northern marine issues and will provide staff to the EARP hearings on the Arctic Pilot Project.