

**DEPARTMENT OF FISHERIES AND OCEANS
CONTRIBUTION TO THE DEVELOPMENT
OF THE MACKENZIE DELTA-BEAUFORT SEA
REGIONAL LAND USE PLAN**

**INTERNAL WORKING PAPER
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OF THE MACKENZIE DELTA-BEAUFORT SEA
REGIONAL LAND USE PLAN**

**ARCTIC OFFSHORE DEVELOPMENT COMMITTEE
DEPARTMENT OF FISHERIES AND OCEANS**

May 1992

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Part 1. Department of Fisheries and Oceans. Contribution to the Development of the Mackenzie Delta - Beaufort Sea Regional Land Use Plan.

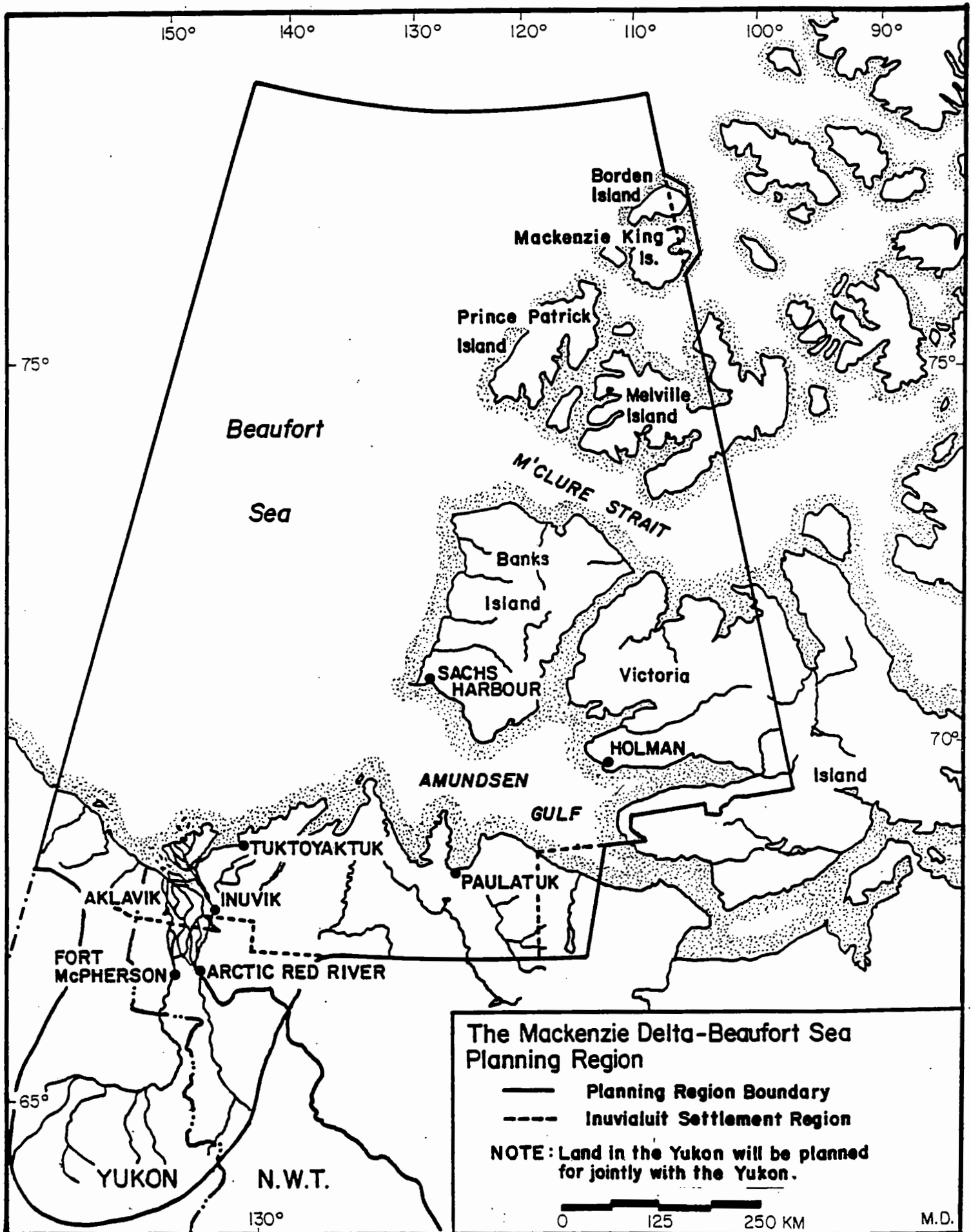
Part 2. Fishery Resource Maps for the Mackenzie Delta - Beaufort Sea Planning Region.

INTRODUCTION

As part of the northern land use planning process in the Northwest Territories, the Mackenzie Delta - Beaufort Sea Regional Land Use Planning Commission was established in June, 1987, to prepare a land use plan for the Mackenzie Delta - Beaufort Sea Planning Region. The area covered by this Region is shown in the map on the next page. The land use plan will address the use of land and waters and their resources.

The Regional Commission established community working groups, identified land use planning issues and concerns, and held workshops and meetings with community, industry, government and interest groups. The Department of Fisheries and Oceans (DFO) prepared a Contribution and fishery resource maps for the Commission, participated in various sectoral and general workshops and meetings, and reviewed documents. This work was conducted in conjunction with the Fisheries Joint Management Committee.

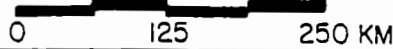
This ARCOD Working Paper contains the information that was provided by DFO to the Commission. The first part outlines the department's position and suggestions on issues that should be addressed in the land use plan for the region, and a proposal for implementation of the plan. The second part contains the maps of fishery resources.



The Mackenzie Delta-Beaufort Sea Planning Region

- Planning Region Boundary
- - - Inuvialuit Settlement Region

NOTE: Land in the Yukon will be planned for jointly with the Yukon.



M.D.

**Part 1. Department of Fisheries and Oceans. Contribution to the
Development of the Mackenzie Delta - Beaufort Sea
Regional Land Use Plan.**

DEPARTMENT OF FISHERIES AND OCEANS

CONTRIBUTION TO THE
DEVELOPMENT OF THE MACKENZIE DELTA BEAUFORT SEA
REGIONAL LAND USE PLAN

Prepared for
THE MACKENZIE DELTA BEAUFORT SEA REGIONAL PLANNING COMMISSION

MAY 1989

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BACKGROUND

The Department of Fisheries and Oceans (DFO) is pleased to provide the following statement to the Mackenzie Delta Beaufort Sea Regional Planning Commission. The statement outlines the department's position and suggestions on issues that should be addressed in the land use plan for the region and a proposal for implementation of the plan. It proposes a classification of the region based on the importance of different areas to fish and marine mammals, and proposes protection requirements for each category of the classification. It identifies some general requirements for various types of development in the region, and for research. It also contains annexes outlining the department's responsibilities (Annex 1), and an overview of the mapped information provided to the Regional Commission (Annexes 2 and 3). The department recognizes that the Regional Commission is receiving this and other contributions from communities and other groups, all of which have to be integrated into the land use plan.

The Mackenzie Delta Beaufort Sea Planning Region is vast and varies significantly in its physical and biological characteristics. Not only does the marine component of the planning area contrast to the freshwater environment, dominated by the Mackenzie River and its large and complex delta, but the physiography of the Mackenzie River valley and the Delta contrasts sharply with the Arctic and Interior Coastal Plains and the Western Cordillera of the Mackenzie, Richardson and British mountains. The many and varied aquatic environments produced by the interaction of physiography, hydrology and hydrography have resulted in the development of a rich assemblage of fish and marine mammal populations.

The marine area of the eastern and southern Beaufort Sea supports during the summer open water period a population of approximately 11,500 beluga whale belonging to the Eastern Beaufort stock and approximately 7,800 bowhead whale belonging to the Bering Sea stock. In addition, there are significant numbers of ringed seal and lesser numbers of bearded seal in the marine portion of the Planning Region. The Mackenzie River and coastal waters support large populations of anadromous coregonids such as broad and humpback whitefish and Arctic and least cisco. As well, the Mackenzie River supports many non-anadromous species such as inconnu, northern pike and burbot. Anadromous or non-anadromous Arctic charr occur in many river systems; anadromous Arctic charr migrate to the sea to feed in the adjacent marine waters and return to fresh water to spawn and overwinter, while non-anadromous (resident) Arctic charr remain continuously in fresh water. The marine and estuarine waters also contain large populations of Arctic cod, Pacific herring and smelt which in turn provide food for the seals, beluga and Arctic charr.

These resources are of the utmost importance to the Dene and to the Inuvialuit both culturally and as a source of food. Beluga are harvested each summer primarily from the Mackenzie River estuary. Seals are hunted primarily during the winter and spring. Anadromous Arctic charr are harvested during both the downstream and upstream migrations and both anadromous and non-anadromous charr are harvested through the ice. Large numbers of coregonids are netted predominantly during the upstream spawning and downstream post-spawning migrations and at overwintering sites.

Fishery knowledge for the planning region varies. Over the past 15 years, the department has collected a considerable amount of data concerning the life history and ecological relationships of fish in the Mackenzie Delta and the lower portion of the river. Considerable data have been amassed concerning the various Arctic charr populations in the area, and studies of marine fish have been conducted intermittently over the past 28 years. Very little information exists with respect to the inland fisheries to the east of the Mackenzie River. Beluga have been the object of much study in the past fifteen years. However, despite this effort, there is still much to learn with respect to the population dynamics and certain ecological requirements of these species. The size of the portion of the Bering Sea stock of bowhead whale that summers in the Eastern Beaufort Sea is not precisely known nor are its overall ecological requirements. There is incomplete knowledge of many aspects of the functioning of the marine ecosystem, for instance the food of marine mammals, and relatively little understanding of the long-term impacts of industrial activities, both within and outside the planning region, on the fish and marine mammal populations.

Many people and organizations consider that conservation and protection of the renewable resources should be the primary goal of any land use plan for the region. Such an approach must be balanced with the continued use of the fish and marine mammal resources by the Inuvialuit and the Dene residents, and with other possible uses such as hydrocarbon development and shipping. Also, an increase in the human population of the region may increase local pollution, disturbance and harvesting pressure on the renewable resources which may be unable to withstand these impacts. Major issues such as the meaningful participation by local people in planning and decision making and the potentially unequal distribution of social costs and benefits from development are considerations in the integration of these divergent interests.

The Department of Fisheries and Oceans is responsible for the management and protection of the fish and marine mammal resources which are of such great importance in the Mackenzie Delta Beaufort Sea Planning Region. A major feature of fishery management in much of the region is the existence of cooperative management between the Inuvialuit and the Department through the Fisheries Joint Management Committee which was established under the Inuvialuit Final Agreement. In addition, the department has a mandate to coordinate the policies and programs of the Government of Canada respecting oceans, including the Arctic seas. The department recognizes the importance of Northern Land Use Planning in developing a blueprint for integrated conservation and management which will promote the protection, management and development of fishery resources as well as in implementing aspects of the Arctic Marine Conservation Strategy, DFO's fish habitat management policy and other legislative responsibilities (see Annex 1).

OVERALL PRIORITIES

Based on its responsibilities, the Department of Fisheries and Oceans has three priorities for planning, management and development in the Mackenzie Delta/Beaufort Sea Planning Region.

1. **DFO's first priority is the conservation and management of fish and marine mammal resources and their habitats. The land use plan should reflect the special areas important to fish and marine mammals identified by DFO.**

An integral part of land use planning is the protection, as required, of important habitats and populations for use by current and future generations of Canadians on a sustained basis. Because of the biological and physiographical limits to productivity in the region and international sharing of populations, conservation must be carried out over large areas, the entire range of species and processes upon which they depend, in order to be effective. Setting aside conservation areas with varying degrees of protection is compatible with DFO objectives.

2. **DFO's second priority, subject to the overriding priority of conservation, is the sustained use of fish and marine mammal resources by northerners. Non-consumptive uses and new harvesting opportunities could be developed where they do not conflict with existing uses or with conservation requirements.**

Hunting, fishing and trapping continue to be important sources of income and food in all communities in the region. These activities not only provide the maintenance of a high protein country food diet but are equally important to the cultural and social survival of the Inuvialuit and the Dene. Consideration must be accorded to the growing northern tourism industry and to commercialization of renewable resource harvesting.

3. **DFO's third priority, subject to the priorities of conservation and renewable resource utilization, is to ensure that other activities such as the development of non-renewable resources and shipping proceed with minimal effects on fish and marine mammal resources, their habitats and harvesting.**

There is national interest in the exploration for and development of non-renewable resources in the region particularly in attaining domestic energy resources. However uncontrolled development without consideration of critical habitats and renewable resources could change migration patterns and population sizes of animals and affect their harvesting by local people. In most areas, compatibility between conservation of renewable resources and non-renewable resource development and shipping may be achieved by recognition of spatial, temporal and other constraints, but in some areas development may not be compatible with conservation.

APPLICATION TO THE MACKENZIE DELTA BEAUFORT SEA PLANNING REGION

Because of the planning region's extent and its biological and physio-graphical diversity, the department proposes that its three overall priorities be applied on an area by area basis. To this end the department has classified the region into four categories reflecting relative importance to fish, marine mammals and harvesting and associated protection requirements. It is stressed that:

- the classification is based on existing information and so might change as new information becomes available;
- boundaries between areas are the best estimate as to where such a line should be drawn, but spatial importance usually changes gradually;
- even within areas, importance may vary from site to site, from season to season and from year to year.

Information on the following topics was used in developing the classification system: distribution and abundance of harvested and ecologically important species; status of fish and marine mammal stocks; susceptibility of stocks to human activities; importance and susceptibility of habitats to human activities; location of harvesting; and extent of knowledge. In particular, the following generalizations related to susceptibility were incorporated. Marine mammals, the larger terminal predators and grazers of the Arctic marine ecosystem, are thought to be the species most at risk from overharvesting or environmental change, and, in general, the longer-lived whales are more at risk than the shorter-lived seals. Species that aggregate, such as beluga and Arctic charr, or follow a defined migration pattern, such as whitefish and ciscoes, are more at risk than those that do not. Stocks whose current abundance are at low levels, such as some Arctic charr stocks, are more at risk than stocks whose levels are not reduced. Freshwater and shallow coastal habitats are more at risk than habitats in other waters. Important habitats also occur under ice or in polynyas.

The resultant criteria used in classifying areas into categories are presented in Table 1. In applying the criteria to Mackenzie Delta Beaufort Sea Planning Region information was used for Arctic charr, anadromous coregonids (whitefish and ciscoes), harvested freshwater fishes (coregonids, lake trout etc.), Pacific herring, whales and seals. In general, insufficient information exists for other marine fish and marine invertebrates to use in the classification, and walrus only occurs rarely in the region.

Table 1 also presents the general protection requirements for each of the four categories. Current harvesting of fish and marine mammals should continue in areas of all four categories subject to the requirements of resource conservation. New subsistence, commercial or recreational fisheries could be developed in all areas, again subject to the requirements of resource conservation. Also, whale-watching and other non-consumptive uses of fish and marine mammals could be developed in all areas subject to requirements such as no disturbance of whales, if compatible with existing or proposed activities, and subject to the requirements of resource conservation.

Table 1. Criteria for Priority Area Classification and Associated Protection Requirements.

Importance and Protection Requirement	Priority 1	Priority 2	Priority 3	Priority 4
<u>Importance to Fish and Marine Mammals</u>	Critical	High	Moderate	Limited
<u>Criteria</u>				
Anadromous Fish	Spawning, nursery and overwintering areas of harvested, rare, endangered or ecologically important species or stocks	Coastal (0-10 km) and freshwater feeding areas and migration routes of harvested, rare, endangered or ecologically important species or stocks	Offshore areas used regularly by harvested, rare, endangered or ecologically important species or stocks	Areas used by other species and occasionally by harvested, rare, endangered or ecologically important species or stocks
Freshwater Fish	Spawning, nursery and overwintering areas of harvested, rare, endangered or ecologically important species or stocks	Feeding areas and migration routes of harvested, rare, endangered or ecologically important species or stocks		Areas used by other species and occasionally by harvested, rare, endangered or ecologically important species or stocks
Marine Fish and Invertebrates	Coastal (0-10 km) spawning, nursery and overwintering areas of harvested, rare, endangered or ecologically important species or stocks	Offshore spawning, nursery, and overwintering areas or coastal (0-10 km) feeding areas and migration routes of harvested, rare, endangered or ecologically important species or stocks	Offshore feeding areas and migration routes used by harvested, rare, endangered or ecologically important species or stocks	Areas used by other species and occasionally by harvested, rare, endangered or ecologically important species or stocks
Whales	Estuaries and coastal areas used by high concentrations	Coastal (0-10 km) feeding areas and migration routes	Offshore areas used regularly	Areas used occasionally
Walrus	Haulouts and adjacent 10 km areas	Coastal (0-10 km) feeding areas and migration routes	Offshore areas used regularly	Areas used occasionally

Table 1. Continued.

Importance and Protection Requirement	Priority 1	Priority 2	Priority 3	Priority 4
Seals		Areas used by concentrations of harvested stocks	Areas used by harvested stocks	Areas used by non-harvested stocks
Unique Areas	Some areas with a combination of two or more Priority 2 characteristics or other unique features	Some areas with a combination of two or more Priority 3 characteristics or other unique features		
Harvesting	Harvesting may occur regularly	Harvesting may occur regularly	Harvesting may occur regularly	Harvesting may occur occasionally
Knowledge	Species, stock and habitat importance known	Species, stock and habitat importance known or suspected	Species, stock and habitat importance known or suspected	Species, stock and habitat importance known or suspected
<u>Protection Requirements</u>	Maximum protection	Stringent protection	Enhanced protection	Basic protection
Harvesting and Non-consumptive Uses of Fish and Marine Mammals	Harvesting and non-consumptive uses of fish and marine mammals may occur subject to conservation requirements	Harvesting and non-consumptive uses of fish and marine mammals may occur subject to conservation requirements	Harvesting and non-consumptive uses of fish and marine mammals may occur subject to conservation requirements	Harvesting and non-consumptive uses of fish and marine mammals may occur subject to conservation requirements



Table 1. Continued.

Importance and Protection Requirement	Priority 1	Priority 2	Priority 3	Priority 4
Constraints on Non-renewable Resource Development and Shipping	No development is acceptable. Possible exceptions are for special cases where it is proven there will be no adverse effects on species or their habitats	Some developments are acceptable. Spatial and temporal constraints and other specific protection requirements probably are required. Some developments may warrant a cautious phased approach. Some development adjacent to priority 1 areas may not be permitted	Most developments are acceptable. Spatial and temporal constraints and other specific requirements possibly are required. Some developments may warrant a cautious phased approach	Most developments are acceptable. Basic protection requirements probably are sufficient
Protected Area Status	Most areas are candidates for inclusion in a system of protected areas	Some areas are possible candidates for inclusion in system of protected areas		
Pre-development Studies	Studies may be required to confirm that the special case development is acceptable	Studies may be required to confirm the Priority 2 ranking of the area and to confirm that the development is acceptable	Studies may be required to confirm the Priority 3 ranking of the area and to confirm that the development is acceptable	Studies may be required to confirm the Priority 4 ranking of the area and to confirm that the development is acceptable
Monitoring Developments	For the special cases, monitoring to demonstrate no adverse effects will be required	Most developments warrant monitoring to demonstrate safety and minimal effects	All developments warrant routine monitoring requirements. Some developments may warrant monitoring to demonstrate safety and acceptable effects	All developments warrant routine monitoring requirements

In contrast to harvesting and whale-watching, other human activities, such as non-renewable resource development, construction and operation of facilities and shipping should be managed so that they do not affect renewable resources and their harvesting in the region. The categories have different basic requirements for protecting fish and marine mammals from such activities; these are outlined in Table 1 and the following description of priority areas, and in more detail in the Non-Renewable Resource Development and Shipping section.

Priority 1 Areas

These areas are the most critical, being of greatest importance to fish and marine mammals and/or most susceptible to disturbance. They include: freshwater and coastal spawning, overwintering and nursery areas of harvested, rare, endangered or ecologically important freshwater, anadromous and marine fish species; and estuarine and coastal areas used by high concentrations of whales. Species, stock and habitat importance of these areas is known. Harvesting may occur regularly in these areas. These areas constitute less than 1% of the planning region.

Because of their importance, these areas should be afforded maximum protection. Most areas are candidates for inclusion in a network of protected areas. The department recommends that no non-renewable resource or shipping development be permitted in or adjacent to these areas. Possible exceptions could occur if it is proven there will be no adverse effects on fish and marine mammals or their habitats; such exceptions would be subject to temporal, spatial or other restrictions as required.

The Priority 1 areas in the planning region are listed in Table 2 and shown on the attached maps. A brief description of their importance is given in Annex 3. All fresh waters containing Priority 1 areas are depicted on the maps as though all the water bodies are classified as Priority 1 although some parts may be Priority 2 or Priority 4.

Priority 2 Areas

These areas are of high importance. They include: coastal and freshwater feeding areas and migration routes of harvested, rare, endangered or ecologically important anadromous, freshwater and marine fish; offshore nursery, spawning and overwintering areas of harvested, rare, endangered or ecologically important marine fish; coastal feeding areas and migration routes of whales; and areas used by concentrations of harvested seals. Species, stock, or habitat importance of these areas is known or suspected. Harvesting may occur regularly in these areas.

These areas require stringent protection. Some non-renewable resource development, facilities and shipping could be permitted if it is shown that there would be no long-term adverse effects on fish, marine mammals, their habitats or their harvesting. Stringent spatial, temporal and other constraints probably would be applied to any proposed development.

Table 2. Application of the Priority Area Classification to Areas in the Mackenzie Delta Beaufort Sea Planning Region.

	Priority 1	Priority 2	Priority 3	Priority 4
Protection Requirement	Maximum	Stringent	Enhanced	Basic
Marine and Estuarine Areas	Shallow Bay/Niakunak Bay Central Mackenzie Estuary including Kendall Island, Mallik Bay, and embayments of N.E. Richards Island including Mason Bay Kugmallit Bay Whitefish Bay Tuktoyaktuk Harbour "Fingers" area of Liverpool Bay	North Slope Yukon coastal (0-10 km) zone Tuktoyaktuk Peninsula coastal (0-10 km) zone Liverpool Bay coastal (0-10 km) zone Wood Bay/Baillie Islands coastal (0-10 km) zone Parry Peninsula/Franklin Bay/Darnley Bay coastal (0-10 km) zone Southwest Victoria Island coastal (0-10 km) zone including Prince Albert Sound and Minto Inlet Sachs Harbour coastal (0-10 km) zone Mercy Bay/Castel Bay coastal (0-10 km) zone Bar Harbour coastal (0-10 km) zone Banks Island coastal (0-10 km) zone in northern Prince of Wales Strait	Beaufort Sea transition zone Amundsen Gulf Southern Prince of Wales Strait	Beaufort Sea permanent polar pack M'Clure Strait Northern Prince of Wales Strait
Freshwater Areas	Mackenzie Delta channels and some lakes to confluence of Arctic Red R. Some Tuktoyaktuk Peninsula streams and lakes <u>Known</u> spawning, and overwintering and nursery areas for harvested anadromous and freshwater fish including areas on:	<u>Known or suspected</u> feeding areas and migration routes and <u>suspected</u> spawning overwintering and nursery areas used by harvested, rare, endangered or ecologically important freshwater and anadromous fish including: Feeding areas and migration routes on rivers listed under Priority 1 Some Mackenzie Delta Lakes		Freshwaters containing no harvested, rare, endangered or ecologically important species including: Some streams, rivers and lakes of the mainland Streams, rivers and lakes of

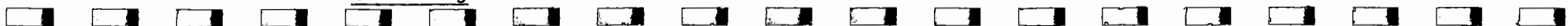


Table 2. Continued.

Priority 1	Priority 2	Priority 3	Priority 4
Firth R. Babbage R. Big Fish R. Hornaday R. Bluenose L. Quunnguq L. Kuuk R. Tahiryuak L. Kuujjua R.	Some Tuktoyaktuk Peninsula streams and lakes Most other mainland streams, rivers and lakes Most streams, rivers and lakes of central west Victoria Island Some streams, rivers and lakes of Banks Island including: Big R. Thomsen R. Muskox R.		north west Victoria Island Some streams, rivers and lakes of Banks Island Streams, rivers and lakes of the Queen Elizabeth Islands

Although the department does not specifically propose these areas as candidates for inclusion in a system of protected areas, the department would support such proposals.

The Priority 2 areas in the planning region are listed in Table 2 and shown on the attached maps. A brief description of their importance is given in Annex 3. The freshwater Priority 2 areas depicted in the maps contain some Priority 1 and Priority 4 water bodies or locations.

Priority 3 Areas

These areas are of moderate importance. They include: offshore feeding areas and migration routes used regularly by harvested, rare, endangered or ecologically important species of anadromous or marine fish; offshore areas used regularly by whales; and areas used by harvested seals. Species, stock or habitat importance of these areas are known or suspected. Harvesting may occur regularly in these areas.

These areas may require enhanced protection. Most non-renewable resource development, facilities and shipping could be permitted, but spatial, temporal and other specific requirements possibly would be applied to any proposed development.

The Priority 3 areas in the planning region are listed in Table 2 and shown on the attached maps. A brief description of their importance is provided in Annex 3.

Priority 4 Areas

These areas are of limited importance. They include: freshwater, coastal and offshore marine areas used occasionally by harvested, rare, endangered or ecologically important fish or used by other fish species; areas used occasionally by whales; and areas used by non-harvested stocks of seals. Species, stock or habitat importance of these areas is known or suspected. Harvesting may occur occasionally in these areas.

The Priority 4 areas require basic protection to conserve fish and marine mammals and to protect the overall quality of marine and freshwater habitats.

The Priority 4 areas in the planning region are listed in Table 2 and shown on the attached maps. Priority 4 freshwater areas also may occur in the water bodies or locations depicted in the maps as Priority 1 or Priority 2.

NON-RENEWABLE RESOURCE DEVELOPMENT AND SHIPPING

The previous section outlines the department's basic land use planning requirements for protecting fish and marine mammals from non-renewable resource development and shipping in the region. This section provides additional information related to oil and gas development, mineral development and dredging, shipping and upstream development, all of which are actual or potential major uses of the region or may affect the region.

The general requirements of the department are:

- the development of onshore and offshore facilities, ports and shore-bases is unacceptable in areas used by year-round or high seasonal concentrations of fish and marine mammals and which are considered habitats critical to the continued productivity and well-being of such populations;
- development elsewhere should occur at a rate commensurate with the demonstration of safety, reliability and environmental acceptability;
- the sensitivity of fish, marine mammals and their habitats and harvesting should be reflected in the location, design, construction and operation of facilities;
- any proposed development would be subject to the requirements of the land use plan, environmental impact assessment and regulatory processes;
- stringent protective measures, including spatial and temporal constraints, may be imposed on activities to ensure the conservation of fish and marine mammal resources, their habitats and their harvesting;
- research and monitoring may be required to identify specific important habitats, vulnerable species, protection requirements and any effects of a development.

OIL AND GAS DEVELOPMENT

Hydrocarbon exploration has been ongoing within the confines of the planning region for the past 30 years. Reserves are being confirmed and hearings are in progress that would see initial production of hydrocarbons from the Taglu and Amauligak structures by about 1996. DFO has been an active player in the ongoing regulation and monitoring of exploration operations and has intervened at the EARP hearings on the Beaufort Sea Hydrocarbon Production Transportation Proposal and on the Norman Wells Oilfield Development and Pipeline Project.

Overall Position

DFO's overall position is:

- frontier area hydrocarbon development may proceed at a rate commensurate with the demonstration of safety, reliability and environmental acceptability;
- the construction and operation of on land production facilities and a Mackenzie Valley Pipeline may proceed subject to the requirements of regional land use plans, environmental assessment of specific projects, the regulatory process, and research and monitoring;
- only cautious phased development of subsea pipelines, offshore production facilities and year-round marine transportation of hydrocarbons may proceed at this time, and these should be subject to the requirements of regional land use plans, environmental assessment of specific projects, the regulatory process, and research and monitoring;
- expansion of offshore production and transportation should be considered only after the demonstration of safety, reliability and environmental acceptability;
- any expansion would be subject to the requirements of regional land use plans, environmental assessment of specific projects, the regulatory process, and research and monitoring.

An on land focus for the production and transportation of Beaufort Sea hydrocarbons would cause less difficulty for the department because for on land developments there are better management capability, better scientific data and understanding, proven technology and experience, reduced and more localized risks of spills, and better capability for detection, containment and clean-up of spills.

The development of offshore hydrocarbon resources along these proposed lines would lead to improved understanding of potential impacts, and give time to prepare a sound management strategy. The experience gained would be useful in planning expansion of offshore hydrocarbon production and transportation.

On Land Production Facilities

DFO expects that the impacts on aquatic resources from the development of on land facilities would be acceptable under the following conditions:

- the sensitivity and importance of fish, marine mammals and their habitat have been reflected in the location, design, construction and operation and abandonment of the facilities;
- any proposal for on land production facilities has been subject to an environmental review;
- sites should not be in or immediately adjacent to Priority 1 areas;

- where necessary, stringent conditions to protect fish, marine mammals and fish habitat have been met.

The types of environmental impacts associated with land-based production and transportation of hydrocarbons are known at this time. Acceptable mitigative techniques have been developed, so that appropriate safeguards can now be built into the design and construction of such facilities.

Offshore Production Facilities

Until such time as a definite production proposal is brought forward, DFO is unable to determine the acceptability of the construction and operation of offshore production facilities. The integrity of any system to withstand the extremes of the Arctic offshore environment needs to be proven, and considerable uncertainty exists respecting the effects of offshore development and production on fish, marine mammals and their habitats.

Recognizing these uncertainties DFO would be prepared to accept the cautious phased development of offshore production facilities under the following conditions:

- sites chosen would not be in or immediately adjacent to Priority 1 areas;
- projects would have an appropriate research and monitoring program associated with them;
- an environmentally sound regional strategy for the disposal of wastes from offshore facilities has been implemented;
- discharge standards have been established and implemented for all wastes associated with offshore production activities; this requirement should also be applied to appropriate shore-based activities;
- plans for abandonment of offshore production facilities have been approved.

Offshore production platforms are subject to a variety of physical hazards, such as collision, pile-up, ride-up and scour by sea ice; erosion and flooding from storm surges; and erosion from ocean waves and currents. These oceanic parameters need to be predicted accurately from existing data to ensure structural integrity and operational safety. Failure could result in major oil spills with consequent impacts on fish and marine mammals. Associated activities, such as dredging, may also impact upon fish and benthic biota, but the synergistic and cumulative effects are unknown. In addition, development will involve the routine discharge of a variety of waste products in large volumes. In addition to various chemical wastes, there are major concerns respecting the projected large discharges of oily water.

Shorebases

DFO's position on shorebases is:

- the development of new shorebases or ports is not acceptable in or immediately adjacent to Priority 1 areas;
- DFO strongly discourages new harbour development west of Kay Point because of the productive fish habitat along the coast;
- DFO expects that impacts from the development of new ports or shorebases elsewhere along the Beaufort Sea Coast would be acceptable under the following conditions:
 - the sensitivity and importance of fish, marine mammals and their habitats have been reflected in the location, design, construction and operation of the facilities;
 - harvesting activities will not be detrimentally affected;
 - questions relating to the safety of the proposed site or facilities have been resolved in relation to the hazards posed by sea ice, ocean currents, coastal processes, navigational hazards, waves and water levels;
 - the overall plan for development of a new port site and other facilities along the Beaufort Sea coast should be considered in the regional planning process prior to further development;
 - any specific proposal has undergone a detailed environmental review.

Subsea Pipelines

DFO is unable to determine the acceptability of the construction of subsea pipelines since the ability to detect and clean up oil spilled under the ice from a ruptured pipeline has not been demonstrated. The feasibility, safety and environmental acceptability of subsea pipelines in the Beaufort Sea needs to be demonstrated. Such a demonstration would be acceptable under the following conditions:

- the demonstration should not be located in or immediately adjacent to Priority 1 areas;
- adequate contingency plans and countermeasures have been put in place for detecting and cleaning up oil spills, with particular reference to the protection of fish, marine mammals and their habitat;
- an environmental assessment of the proposed demonstration project has been conducted;
- an appropriate research and monitoring program has been instituted for the project.

The risk of damage exists for subsea pipelines in the Beaufort Sea. Uncertainties and difficulties exist in the ability to detect damaged pipelines immediately, to repair the damage under all ice conditions, and to contain and clean up an oil spill. An oil spill could result in major adverse effects on fish, marine mammals or their habitats, or the fisheries which they support.

Overland Pipelines

The construction of an overland pipeline in the Mackenzie Valley would be acceptable under the following conditions:

- the loss of fishery resources and their habitats should be avoided through proper design, construction and operating conditions, and, if appropriate, the provision of suitable compensatory measures;
- a pipeline should avoid Priority 1 areas or affecting Priority 1 areas;
- any proposal for a pipeline should undergo environmental review, and as a consequence, a pipeline may be subject to special design, spill detection and other mitigative measures to protect fish and fish habitat.

Although a pipeline through the Mackenzie Delta and Mackenzie Valley has the potential for many impacts on aquatic resources, the department concluded at previous hearings on Mackenzie Valley pipelines that the ability exists to construct and operate a pipeline in a safe and environmentally acceptable manner provided appropriate attention is given to the protection of fish and fish habitat. Environmentally acceptable techniques for pipeline construction have been developed and proven in the field. The design and construction of a Mackenzie Valley pipeline can, therefore, be satisfactorily undertaken provided that current state of the technology and techniques are utilized in all phases of the project.

MINERAL DEVELOPMENT AND DREDGING

At the present time there are no known mineral development prospects within the planning region. However, iron ore exists in the Snake River area on the NWT/Yukon border, and coal exists near Aklavik.

There will be a tremendous need for granular material should development of the area's hydrocarbon resources proceed. Granular material can be obtained by dredging of offshore deposits or from deposits on land. Dredging of offshore granular materials poses a direct threat to bottom dwelling plants and animals by either destruction of the habitat or entrainment within the dredging equipment.

In general, the department has concluded:

- potential mineral developments and dredging are compatible with the conservation of fish and marine mammals if they avoid Priority 1 areas and if they adhere to good environmental operating practices established through environmental impact assessment and the regulatory process.

In addition, for dredging operations:

- investigation may be required of possible impact on benthos, fish and marine mammals, including consideration of the distribution and ecological role of benthos and the potential impacts of resuspended contaminated materials;
- spatial, temporal and other constraints may be required;
- entrainment of fish in dredging equipment should be minimized; and
- a monitoring program may be required.

On land, the removal of granular material from upland sites is preferred over removal of granular material from within the flood plain or from the stream channel. Gravel removal from stream channels can cause large scale damage. The most severe damage results when gravel is removed from an area utilized by fish for spawning. Stream bed alterations resulting from gravel removal can also cause obstruction or entrapment of migrating fish and increases in the levels of suspended sediment.

Gravel removal operations should be limited to areas above the design flood high water stage and no closer than 90 m (300 ft) from any active river channel. If and when DFO is satisfied that a stream does not support or have the potential to support significant fish populations then permission may be given for excavation and removal of riverbed material. Such permission will be dependent on removal operations being conducted in a controlled manner and subject to the approval of DFO.

SHIPPING

For the most part, shipping in the Mackenzie Delta Beaufort Sea Planning Region has been restricted to the open water season and has centred around support for local industrial development activities, community resupply, and research. Tourist ships have begun traversing the region, and Canada is building the Polar 8 icebreaker. Several scenarios for the transport of oil and gas from the Beaufort Sea have been proposed which include year round shipping either eastward through the Northwest Passage or westward around Point Barrow and through Bering Strait. A number of issues related to the interaction of shipping with fish and marine mammals have been identified:

- vessels may affect animals inhabiting close pack ice or fast ice, such as the ringed seal, through collisions or the destruction of birth lairs;
- ship noise may disturb marine mammals which might result in detrimental changes in behavior, and may increase the ambient noise level masking marine mammal vocalizations or interfering with communication and echolocation;
- icebreaking may change distribution patterns of marine mammals, affect hunting success, endanger hunters on the ice, make travel more difficult or result in the loss of hunting equipment; and

- spills of pollutants from vessels may alter the movements and migrations of fish and marine mammals or result in physiological effects or tainting.

Based on its general requirements and assessment of the biological importance of areas, the department has concluded:

- shipping should avoid Priority 1 areas if possible;
- spatial, temporal or other restrictions may be required for shipping;
- only cautious, phased development of year-round marine transportation of hydrocarbons may proceed at this time;
- projects involving operation of ice-strengthened tankers in medium to heavy summer ice conditions should incorporate appropriate research and monitoring programs to ensure that the project is managed well, risks and possible impacts are minimized, and maximum experience is gained for application to future large scale projects;
- initial projects to demonstrate acceptability of year-round marine transportation should begin with ships carrying non-polluting cargoes;
- expansion of marine transportation should be considered only after demonstration of safety, reliability and environmental acceptability;
- studies may be required to further identify areas of critical fish and marine mammal habitat which could be affected by shipping activities associated with specific projects, and to assess aspects of sound production by vessels operating in the Arctic marine environment and the effects these sounds may have on marine mammal acoustics and biology;
- specific shipping projects may be required to develop adequate oil spill scenarios, spill impact assessments, contingency plans, clean-up procedures and compensation policies.

UPSTREAM DEVELOPMENTS ON THE MACKENZIE RIVER

Developments in the Mackenzie River Basin outside of the Planning Region have the potential to affect fish and marine mammal resources and habitat within the Planning Region. Of particular concern is the construction and operation of hydroelectric power dams.

In addition to its general requirements, the department has concluded:

- the planning of such developments should include assessment of effects within the Planning Region;
- construction and operation of such developments should occur only if the integrity of the Mackenzie Delta ecosystem and the nearshore waters of the Beaufort Sea can be assured.

RESEARCH

Considerable knowledge of the marine and freshwater areas and their resources encompassed by the Mackenzie Delta-Beaufort Sea Planning Region have been amassed by the continuing science programs conducted by DFO, other agencies and industry. Although the current knowledge base is sufficient to permit informed judgements, further scientific investigations and continued monitoring are required for the production of accurate models and sound scientific advice for the prediction of impacts and management plans necessary for the conservation of the ecosystems and their resources. However, the immensity and diversity of the area present logistic restraints which impede the gathering of adequate knowledge of the biological, physical and chemical components and their interactions in the ecosystems.

Investigations are required on the Arctic freshwater, estuarine, coastal and marine ecosystems and food-chain relationships to provide advice for the management and conservation of the ecosystems and their fish and marine mammal resources. Further investigations are required on marine mammal distribution, abundance and dynamics, and interactions with development and transportation. Studies also are required on important anadromous and marine fish, and invertebrate species, and detailed biological information is required from animals taken in native harvests.

Physical and chemical studies are required for definition of local systems and their importance to Arctic and global systems. Studies on sea ice formation, decay and movement are fundamental to the safe and efficient movement of shipping in the Arctic. The long range transport of toxic contaminants in relation to the Arctic ecosystems is another area which requires investigation.

Although a transportation corridor, 18 km wide, has been surveyed from the Beaufort Sea through the Northwest Passage, the Arctic in general is only 20% surveyed to modern standards. Since several proposed developments in the region would involve marine transportation, considerably more hydrographic surveying to a greater level of detail is needed.

Such studies are required but it should be stressed that they are expensive and will take time. For instance, in responding to the Beaufort Sea Environmental Assessment Panel's report, the department estimated that the research proposals addressed to the department would require 100 people, \$150 million and up to 15 years.

In addition, some developments in the Planning Region will require pre-development studies to confirm the importance of areas to fish and marine mammals, to elucidate potential impacts and to identify protection requirements. Also, developments may require monitoring studies in order to demonstrate their safety or their predicted impacts on fish, marine mammals and their habitats.

The Regional Commission should recognize the inadequacies in the existing knowledge base, and take these into account in preparation of the plan. The plan should identify and reflect areas of deficiency, and should advocate and facilitate the gathering of additional information. As it becomes available, such information should be incorporated in revisions to the plan.

IMPLEMENTATION

The process for implementing the land use plan should be kept as simple as possible, should recognize existing responsibilities and should, whenever possible, use existing mechanisms. The main requirement of the process should be the commitment of the planning partners, the resource management agencies and other groups to implement the plan.

Specific project proposals should be subject to the requirements of environmental impact assessment and of the regulatory process, but these would be conducted and decisions made within the context of the regional land use plan.

Existing mechanisms should be used as far as possible. For example, the Environmental Advisory Committee on Arctic Marine Transportation should continue to advise the Arctic Shipping Control Authority on shipping proposals and environmental issues related to shipping.

Legislation should not be developed to implement the plan in general, although legislation would be required to implement specific aspects of the plan such as the establishment of protected areas. For example, a marine component of the Northern Yukon National Park could be established under legislation.

Because the conservation of the renewable resources of the region cannot be assured based solely on actions and decisions within the region, cooperation and joint efforts are required with neighbouring planning regions, provincial governments, Alaska/United States and on a global scale. Industrial projects and harvesting activities in neighbouring land use planning regions and throughout the Mackenzie River basin could affect renewable resources within the Mackenzie Delta Beaufort Sea Planning Region. Marine mammals, anadromous fish and possibly marine fish stocks migrate between Canadian and Alaskan waters where many of these stocks may be harvested, so cooperation is required between Canada and the United States to prevent overharvesting or adverse effects from other human activities. International cooperation is required to resolve global problems such as the long range transport of pollutants and man-induced climatic changes. All these requirements should be incorporated into the implementation process.

Once the land use plan is finalized, an action plan should be developed which clearly identifies the responsibilities of the various groups in implementing the plan, identifies specific actions that they should take, and the timing of the actions.

The department and the Fisheries Joint Management Committee (FJMC) will be involved closely in the implementation both through their direct actions and through the advice they provide to other agencies and groups. One action the department and the FJMC will undertake is the development of fishery management plans for stocks of fish and marine mammals in the region; these plans will integrate present management, fishery development, habitat protection and research requirements. These plans will reflect the land use plan to the extent possible.

MONITORING

Once implementation of the plan has begun, it will be necessary to ensure that each action has been implemented properly, expediently and with resolution of unforeseen problems. Therefore, it should be ensured that the responsible groups are undertaking the actions properly, and should report annually on this information to senior representatives of the Native, non-government and government organizations with interests in the region. This could involve the use of outside experts to resolve any implementation problems and to undertake any other appropriate actions to improve the implementation of the plan.

In addition to ensuring that the plan is implemented properly, it is necessary to ensure periodically that the plan is achieving its objectives. This requires a procedure which would culminate in the preparation of a report every five years outlining whether goals are being achieved, and identifying any problems encountered. Subsequently, any issues identified through the process would be resolved.

REVISION

The regional land use plan must evolve over time. Thus the plan should be modified whenever necessary. This could occur when new knowledge becomes available, through the monitoring or audit processes, or as a result of other developments.

ANNEX 1

DFO MANDATE AND RESPONSIBILITIES

DEPARTMENTAL OBJECTIVE

The objective of the Department of Fisheries and Oceans is: to undertake policies and programs in support of Canada's economic, ecological and scientific interests in the oceans and inland waters, and to provide for the conservation, development and sustained economic utilization of Canada's fisheries resources in marine and inland waters for those who derive their livelihood or benefit from these resources; and to coordinate the policies and programs of the Government of Canada respecting oceans.

MANDATE

The Department of Fisheries and Oceans' mandate is derived from the Constitution Act, 1867, and the Department of Fisheries and Oceans Act, 1979. Section 91 (12) of the Constitution Act, 1867, gives the Government of Canada exclusive legislative responsibility for sea coast and inland fisheries. The Department of Fisheries and Oceans Act, 1979, defines the Minister's powers as extending to and including:

- a) all matters over which the Parliament of Canada has jurisdiction, not by law assigned to any other department, board or agency of the Government of Canada, relating to:
 - (i) sea coast and inland fisheries,
 - (ii) fishing and recreational harbours,
 - (iii) hydrography and marine sciences, and
 - (iv) the coordination of the policies and programs of the Government of Canada respecting oceans; and
- b) such other matters over which the Parliament of Canada has jurisdiction relating to oceans as are by law assigned to the Minister.

The department's responsibility to manage fisheries includes that for marine mammals and shellfish as well as for fish. The specific legislative basis for the management and protection of fish and marine mammals and their habitats is the Fisheries Act which contains provisions to control the harvesting of various species and to protect them and their habitats from the effects of human disturbances (see section on Departmental Legislation). In fulfilling its responsibility for fisheries, the distribution and abundance of fisheries resources are studied, their habitats identified, research is undertaken on their biology, on ecological processes and on environmental impacts, biological requirements for the protection and sustained usage of fisheries resources are stipulated, the effects of industrial developments are monitored, and the Fisheries Act and its regulations are enforced. Economic research is undertaken and various forms of assistance, including financial and marketing assistance, are provided to the fishing industry.

The department's ocean science mandate is derived from the Department of Fisheries and Oceans Act, 1979 and the Resources and Technical Surveys Act (Government Organization Act, 1966). The department acts primarily as a service and advisory agency applying oceanographic knowledge, data and information to the solution of a variety of marine problems including those arising from the exploitation, regulation and management of arctic hydrocarbon resources and shipping. It undertakes long-term or sustained (and often large-scale) process-oriented research and thereby provides the context within which industry undertakes site-specific and/or problem-oriented investigations. A major function is the provision of ocean information and advisory services to the regulatory agencies. It has been making significant progress in operating on ice-covered waters. As well, the department has an important support function with respect to environmental emergencies.

The department, has the national responsibility for the provision of hydrographic charts and related nautical productions. The Charts and Publications Regulations of the Canada Shipping Act require that ships navigating in Canadian waters have the latest edition of appropriate hydrographic charts. Adequate chart coverage is a prerequisite to the provision of navigational aid systems by Transport Canada. It has the responsibility for the publication of Tide and Current Tables and of Sailing Directions.

DEPARTMENTAL LEGISLATION

The department administers several statutes of which the Fisheries Act is most relevant. It is the main statute for the management and protection of fish and marine mammal resources and their habitats. Fish and marine mammal resources are managed primarily in accordance with the provisions of section 43 of the Fisheries Act, under which various regulations have been made to control harvesting of different species. The harvesting of fish in the Northwest Territories (NWT) and the Yukon is controlled under the Northwest Territories Fishery Regulations and the Yukon Territory Fishery Regulations. The harvesting of beluga, narwhal, seals, walrus and bowhead whale is controlled under the Beluga Protection Regulations, the Narwhal Protection Regulations, the Seal Protection Regulations, the Walrus Protection Regulations and the Cetacean Protection Regulations respectively.

Sections 43 and 57 of the Act can be used to protect spawning and breeding areas of fish and marine mammals.

Fish and marine mammal resources and their habitats are protected from the effects of man-made disturbances primarily in accordance with sections 20, 30, 32, 35 and 36 of the Fisheries Act. Specifically, obstruction of fish passage in streams is controlled under section 20 and the Fishway Obstructions Removal Regulations; the need for fish guards on water intakes under section 30; the destruction of fish and marine mammal habitat under section 35; and the deposit of deleterious substances in waters frequented by fish and marine mammals under section 36. This last section is administered in part by the Department of the Environment, but the Minister of Fisheries and Oceans remains accountable to Parliament for the entire Act.

The use of explosives in water is controlled under both the Northwest Territories and Yukon Territory Fishery Regulations. The department has prepared guidelines to assist prospective applicants in preparing requests for authorizations to use explosives in water.

Under section 37 of the Fisheries Act the Minister of Fisheries and Oceans may require specific information from anyone who is carrying on, or proposes to carry on, any work or undertaking that results in or is likely to result in (a) the deposit of a deleterious substance in water frequented by fish or (b) the alteration, disruption or destruction of fish habitat. This may include plans, specifications, studies, procedures, analyses or other information related to the work. Also, under section 4, the Minister may authorize scientific studies to be carried out by people other than DFO staff.

The department administers sixteen other statutes. One of these is the Fish Inspection Act. The Fish Inspection Regulations under the Act provides for control of the quality of fish products for inter-provincial trade and export. This Act does not apply to marine mammals.

FISHERIES JOINT MANAGEMENT COMMITTEE

The Fisheries Joint Management Committee was established under the Inuvialuit Final Agreement and advises the Minister of Fisheries and Oceans. It is responsible for the cooperative management of fish and marine mammal resources within the Inuvialuit Settlement Region. Its specific responsibilities include the identification of the fishery resources available, determination of the type and present level of utilization, and the provision of recommendations on the allocation and use of these resources in response to the interests and concerns of both the Inuvialuit and the appropriate management agencies. Cooperative management of stocks of mutual interest to the Inupiat of Alaska, the Dene/Metis of the Mackenzie Basin and the Indians of Yukon requires the development of contact mechanisms to address management of these stocks.

Its basic objectives are:

- to implement the terms and conditions of the Inuvialuit Final Agreement in relation to the conservation and management of fishery resources in the Inuvialuit Settlement Region
- to develop a management entity capable of assembling the needs of the resource users, assessing the capability of stocks to sustain these needs, and providing recommendations on the actions required to regulate, maintain and protect the fish and marine mammal stocks in the Inuvialuit Settlement Region; and
- to assist and cooperate with government agencies both internal and external to the Inuvialuit Settlement Region, other native groups and private industry in developing short term and long term management objectives and policies for fishery resource use in the Western Arctic (stock management plans, fishing plans).

Also, it recommends investigative programs to assist in the assessment of fishery resources in the Western Arctic.

POLICY AND FISHERY MANAGEMENT INITIATIVES

Three initiatives are clarifying how the department discharges its responsibilities in the Arctic. After comprehensive discussions, the department released the Policy for the Management of Fish Habitat. The overall objective of the policy is to increase the natural productive capacity of fish habitat. This will be achieved through the conservation, restoration and development of fish habitat, described as the goals of the policy. The principle of "no net loss" is fundamental to the conservation goal. Under this principle, the department will strive to balance unavoidable habitat losses through habitat replacement on a project-by-project basis. The policy also places greater emphasis on integrated resource planning, such as Northern Land Use Planning, to reconcile interests of sectors competing for the use of an area of fish habitat, on public involvement in the decision-making process and on public consultation for major issues.

The department is preparing an explicit statement on the way it manages Arctic fisheries. The proposal will recognize many current initiatives such as increased participation of resource users in the management of the fishery resources, development of fishery management plans, the importance of fisheries development, and consultation with affected clients, and non-DFO initiatives such as land claims and Northern Land Use Planning. Departmental clients will be consulted on the proposed policy before it is finalized.

The department is leading the development of an Arctic Marine Conservation Strategy for Canada. Considerable consultation has occurred with interested groups and consensus has been reached on the purpose and ten principles which form the basis of the draft strategy. The Minister released the draft strategy as a discussion paper in December 1987. The draft proposes several strategies necessary for conserving Canada's Arctic marine environment and its resources including: establishment of shared management processes; integrated resource planning and management; sustainable development of renewable resources; protection of the quality of the Arctic marine environment; establishment of a system of marine protected areas; the need for research; exchange of information; and provision of relevant education and training. The draft strategy recognizes the importance of Northern Land Use Planning for its implementation.

The Fisheries Joint Management Committee, with assistance from the department, is developing a management strategy for Beaufort Sea beluga. The strategy addresses harvest levels, regulation, protected areas and times, guidelines and advice for industry, and research. It is expected that the strategy will be finalized in 1989/90.

ANNEX 2

FISH AND MARINE MAMMALS OF THE MACKENZIE DELTA BEAUFORT SEA PLANNING REGION

The department is providing the Regional Commission with maps of the distribution of important fish and marine mammals within the planning region. This Annex supplements the information depicted on the maps.

BOWHEAD

The bowhead was found throughout northern polar waters. Of the five world-wide stocks that are recognized to have existed, one is now extinct and three others are now composed of very small numbers. The western Arctic stock currently numbers approximately 7 800 whales and contains the majority of the world's bowheads. Prior to the onset of commercial whaling in the western Arctic it has been estimated that bowheads numbered between 14 000 and 20 000, most likely nearer the high end of the range. Between 1848 and 1915, some 16 600 bowhead whales were harvested and another 2 050 were killed but lost for a total kill of 18 650 bowhead.

Bowhead overwinter in the pack ice of the Bering Sea and move northward through the Bering Strait, following lead systems in the ice along the northwestern Alaska coast. They pass Point Barrow from about mid-April to early June. Early migrants travel through an extensive system of far offshore leads to the northwest of Banks Island and then south along the shore lead west of Banks Island arriving in the Cape Bathurst polynya as early as mid-May. Over the course of the summer, there is a gradual westward expansion of their range with bowhead arriving north of the Mackenzie Delta in late July and early August. Most data suggest the seaward boundary of their summer range to be approximately the 50 m depth contour with 10 m as the landward boundary. Bowhead appear near the Yukon coast in the latter part of August and commence their out-migration sometime after mid-September. Most bowhead have departed the Beaufort by mid-October. The out-migration occurs in a corridor bounded by the 20 and 50 m depth contour. Bowhead continue westward through the Chukchi Sea to about Wrangel Island and then follow the Siberian coast south through to the Bering Sea wintering grounds, arriving between November and January.

BELUGA

Substantial numbers of beluga summer in Amundsen Gulf and the southern portion of the Beaufort Sea. This stock has been estimated to contain at least 11 500 animals. The beluga leave their suspected wintering areas in the Bering Sea in March and April, pass through the Chukchi Sea in mid to late April and migrate along the northwest coast of Alaska from late April to mid-June. East of Point Barrow, early migrants move northeast through an extensive lead system in the pack ice and reach the major shore lead that develops west of Banks Island in May. The beluga then travel south arriving in suspected feeding grounds in Amundsen Gulf in mid-May. Later migrants travel directly to Amundsen Gulf along a more southerly route. During late June many whales leave Amundsen Gulf and follow the expanding shore lead and land fast ice edge along the Tuktoyaktuk Peninsula to the Mackenzie River estuary. Arrival in the estuary is dependent upon ice conditions but usually occurs in late June or early July.

Beluga utilize three concentration areas within the Mackenzie estuary complex: Shallow Bay/Niakunak Bay on the west; Kugmallit Bay on the east; and the waters surrounding Garry, Kendall and Pelly islands. The number of beluga using each of these areas is dependent upon ice conditions. In those years when fast ice blocks access to Kugmallit Bay for westward migrating whales, Niakunak Bay is used by larger numbers of whales. The third area is used later in the season and by fewer whales than the other two areas.

Although the reasons for occupation of these areas is unclear, the importance of them is evident. The present, most widely accepted theory is that the warm estuarine waters provide a thermal advantage, particularly to neonates. Feeding apparently is not the principal reason for beluga being in the concentration areas since whales harvested in these area usually have empty stomachs. Feeding most likely occurs in the offshore waters and in Amundsen Gulf.

Most whales leave the estuary by early August. However, the distribution of the population outside of the estuary during the months of June, July and August is poorly understood. It is suspected that many beluga may move eastward into Amundsen Gulf. The area along the Tuktoyaktuk Peninsula serves as an important travel route and perhaps as a feeding area.

A westward migration to overwintering areas commences in the later part of August and in September. The routes used are not well known. Available data suggest that most whales migrate along the ice edge rather than along the shore and that the animals reach overwintering areas by late November.

Inuvialuit from Aklavik, Inuvik and Tuktoyaktuk harvest beluga from the Mackenzie River estuary each June, July and August. The harvest comes primarily from beluga concentration areas in Kugmallit Bay, near Kendall Island, and along the Yukon coast between Tent Island and King Point. Beluga are harvested occasionally by Inuvialuit from Paulatuk and Holman Island near these communities. Beluga from this population are also harvested by the Inupiat of Alaska.

RINGED SEAL

Ringed seal is the most abundant and widespread marine mammal in the Canadian Arctic. While no estimate of the stock size within the Planning Region is available, ringed seal numbers are thought to be stable and one estimate suggests a total population of several million in the Canadian Arctic.

Good birth-lair habitat for ringed seal exists in Prince Albert Sound, Minto Inlet and northern Coronation Gulf. These areas are also used for moulting in May and June. Large numbers of ringed seal are also present in the Cape Kellet and de Salis Bay areas of Banks Island and in the southern portion of Prince of Wales Strait. Breeding adults maintain breathing holes in the land-fast ice along the Tuktoyaktuk Peninsula. Pupping occurs in subnivean lairs on the hummocky land-fast ice during March and early April.

Sub-adults and nonbreeding adults concentrate in leads and areas of thin ice in the transition zone during winter and spring and make extensive use of the Cape Bathurst Polynya during the winter months. Little use is made of the

pack ice by ringed seal. High densities of hauled-out ringed seal have been observed during the spring haul-out and moult period in the fast ice along the Yukon coast.

The distribution of ringed seals during the open water season is not well documented.

Ringed seal are harvested extensively in the Planning Region. They are a principal source of food, an important source of dog food, and the skin is used in a variety of clothing and handicraft items. The number of ringed seals harvested in the Planning Region is unknown.

BEARDED SEAL

Most of the Beaufort Sea is considered to be marginal winter habitat for bearded seal as they tend to avoid land-fast ice and close pack ice and are associated more with the shear zone. Their preferred water depths are in the range of 25 to 75 metres. The area north of Cape Dalhousie and Cape Bathurst contains the highest density of bearded seal in the Beaufort Sea. The Cape Kellet area of Banks Island is another area with a relatively high density of bearded seal. Bearded seal pup on the moving pack ice in late April and early May and haul-out to moult on ice floes in June.

There is little information available on the numbers and distribution of bearded seal in the Beaufort Sea during the open water period. Multi-year pack ice retreats beyond the depth of waters preferred by bearded seals and consequently good summer habitat is not available. Bearded seal frequent certain nearshore areas near Herschel Island during the summer.

Bearded seal are harvested on an opportunistic basis. There are few data available as to numbers of bearded seal harvested annually in the Planning Region.

ARCTIC CHARR

Arctic charr are widely distributed throughout the region and are utilized in subsistence, commercial and sport fisheries. Information on the range of individual populations is minimal. It appears that Arctic charr cannot withstand heavy exploitation. Overexploitation can result from the simultaneous use of a single stock for subsistence, commercial and/or sport fisheries.

Rivers to the west of the Mackenzie Delta support the western form of Arctic charr, while the rivers east of the Mackenzie Delta support the eastern form. The western form completes its life cycle more rapidly than the eastern form and is somewhat smaller than the eastern form. Both anadromous and non-anadromous (resident/land-locked) Arctic charr occur within the Planning Region.

Arctic charr overwinter and spawn in deep pools, spring-fed areas or lakes of many rivers. The non-spawning segment of anadromous stocks migrates to the sea at or just prior to spring breakup to feed, and returns to overwintering areas commencing in late August and early September.

Distinct stocks of the western form of Arctic charr are found in the Firth and Babbage rivers draining the Yukon North Slope and in the Big Fish and Rat rivers draining into the western side of the Mackenzie Delta. Little is known as to the stock size or response to exploitation of the Yukon North Slope populations. The stocks in the Rat and Big Fish rivers are harvested by the residents of Aklavik and Ft. McPherson, and are thought to be over exploited. The streams and rivers draining into Amundsen Gulf that provide adequate overwintering habitat support stocks of the eastern form of Arctic charr. Many stocks are subjected to extensive domestic fisheries and some, such as the Hornaday River stock, are overexploited. Some of the streams and lakes on Banks Island support small populations of anadromous and non-anadromous Arctic charr.

COREGONIDS

By far the most dominant group of anadromous and freshwater fish within the Planning Region are the coregonids (whitefishes, ciscoes, inconnu). The Mackenzie Delta and nearshore areas of the Beaufort Sea support large and important populations of anadromous coregonids. Throughout the summer and autumn, large numbers of mature coregonids pass through the Delta, migrating upstream from summer feeding areas to spawning areas located throughout the Mackenzie system. Extensive coregonid movements also occur along the coast of the Tuktoyaktuk Peninsula as fish migrate back and forth between overwintering locations and summer feeding areas. For broad whitefish, the peak time of migrations in both directions varies with length class so that during the short summer season there may be some overlap of eastward and westward migrations along the Tuktoyaktuk Peninsula coast. For some species, such as Arctic cisco and least cisco, major feeding and rearing areas are located in bays and lagoons along the coastal margin. For others, such as broad whitefish, lake whitefish and least cisco, the brackish inshore zone serves as an access corridor to rich feeding areas located in freshwater lake systems along the Tuktoyaktuk Peninsula. These freshwater systems also are important nursery and overwintering areas for young-of-the-year and juvenile whitefish. After being flushed out of the Mackenzie River at breakup, large numbers of young-of-the-year migrate up Tuktoyaktuk Peninsula streams to feed and reside in the lakes for up to four years before joining the older juveniles that migrate in and out of the systems annually. Some of the drainages, such as Canyon Creek, contain resident populations of least cisco that move between overwintering, feeding and spawning habitats among its network of interconnected lakes. The large, deep embayments and lagoons along the coast, such as Tuktoyaktuk Harbour, Whitefish Bay, Mason Bay and Mallik Bay, the deep channels of the Mackenzie Delta and the freshwater inner estuary of the Mackenzie River (Shallow Bay and south Kugmallit Bay) serve as important overwintering areas for many coregonids. Along their migration routes the anadromous coregonids are harvested in domestic fisheries.

LAKE TROUT

Lake trout are found in deep lakes and, occasionally, in rivers throughout the Planning Region. Lake trout seldom venture into the turbid, brackish water of the Mackenzie Estuary. The Eskimo (Husky) lakes contain stocks of lake trout.

Lake trout appear to reproduce no more frequently than in alternate years. The absence of observed spawning migrations leads to the conclusion that lake trout spawn in the lakes in which they reside. There is little movement from one watershed to another. Lake trout are opportunistic feeders, their diet varying with the lake and the size of the fish. The prey species utilized become progressively larger as the fish grow. Fish may be the predominant food item of larger, mature fish. Lake trout are harvested incidentally in domestic fisheries for whitefish. Few reliable data are available concerning the domestic harvest of lake trout in the Planning Region.

NORTHERN PIKE

Northern pike are common in the lakes and streams throughout the mainland section of the Planning Region. Northern pike seldom enter brackish water and are rarely caught at locations where lake trout occur. Northern pike are generally non-migratory, but do undertake limited seasonal movements. They generally overwinter in deep channels and lakes and remain in warm inshore water in the summer. Northern pike feed on a wide variety of prey species depending on availability. Domestic and recreational harvest of northern pike is greatest in the Mackenzie Delta area. Lakes and streams outside this area may have harvestable pike populations but access is generally poor. Northern pike are utilized most often as dog food by domestic fishermen. They are occasionally eaten by humans.

BURBOT

Burbot distribution is similar to that of lake trout within the Planning Region, with the exception that burbot also frequent the mainstem of the Mackenzie River, its major tributaries, and, especially during winter and spring, fresh or brackish waters of Kugmallit Bay's coastal embayments including Tuktoyaktuk Harbour. Spawning occurs in late winter to early spring under ice. Food consists of fish, augmented by other aquatic invertebrates.

Burbot are utilized at all times but a special winter fishery exists with jigging the main method of harvest. The liver is the prized portion of the catch and is very high in vitamin D.

ARCTIC GRAYLING

Arctic grayling have a similar mainland distribution as lake trout within the Planning Region. Arctic grayling occur rarely in the lakes and streams of Tuktoyaktuk Peninsula and Richards Island. Despite its wide distribution, very few data are available as to growth, reproduction and food habits of Arctic grayling within the Planning Region, although information is available from other parts of the Northwest Territories. Grayling are used to a limited extent by domestic fishermen for human consumption and dog food. No specific fisheries for grayling exist but they are caught incidentally while fishing for whitefish.

MARINE FISH

Scanty information exists on the marine fish of the region. However, the Arctic cod is an extremely important link in the Arctic marine food chain, being eaten by birds, marine mammals and Arctic charr. Its importance is due

to its role in energy transfer from copepods and amphipods to the larger predators. Arctic cod is very abundant in areas of the offshore and in the periphery of the Mackenzie estuary. It is seldom used by Inuvialuit. Arctic cod spawn in nonspecific nearshore and offshore areas during the winter, but it is unknown whether Arctic cod spawn in the Planning Region.

Pacific herring occurs in relatively nearshore waters, showing a preference for brackish-to-marine waters. It is considerably more abundant in the coastal embayments of north-east Richards Island and along the coast further east than along the Yukon coast. Tuktoyaktuk Harbour, the deeper embayments of the Tuktoyaktuk Peninsula, Liverpool Bay, Husky Lakes, the Baillie Island/Cape Bathurst area and the Parry Peninsula coast all provide important habitat from fall to early summer. Pacific herring are known to spawn, just prior to breakup in mid to late June, in Tuktoyaktuk Harbour and locations in Liverpool Bay.

Greenland cod occur in Liverpool Bay and, more generally, east of Cape Bathurst. Its distribution is more widespread and its abundance greater in the coastal waters of Parry Peninsula and in areas of the south coast of Banks Island.

There are relatively few data available with respect to other marine species inhabiting the southern Beaufort Sea. This is primarily due to the nearshore emphasis placed on most studies in the area and the degree of difficulty associated with offshore marine fish surveys. Available data suggest that many marine species utilize inshore areas, primarily for feeding during the summer months and for overwintering. Copepods and epibenthic invertebrates are the favoured prey species. As summer progresses and the flow of fresh water from the Mackenzie River decreases there appears to be an increase in the abundance of marine species in inshore areas.

Spawning habitat requirements for most marine species are unknown. Some species such as fourhorn sculpin and snailfish may spawn in nearshore waters of depth greater than two metres. Sculpin and snailfish spawn under ice cover.

ANNEX 3

PRIORITY AREAS FOR FISH AND MARINE MAMMALS

The department has classified areas of the Mackenzie Delta Beaufort Sea Planning Region into four categories based on their importance to fish and marine mammals, their habitats and their harvesting. The main text describes the criteria for placing areas into each category, identifies their general protection requirements, and lists the areas assigned to each category. This Annex provides specific information on the importance of the Priority 1 and Priority 2, Priority 3 and Priority 4 areas to fish and marine mammals.

PRIORITY 1 AREAS

Criteria for Selection

- Freshwater and coastal spawning, overwintering and nursery areas for harvested, rare, endangered or ecologically important species or stocks of freshwater, anadromous and marine fish.
- Estuaries and coastal areas used by high concentrations of whales.
- Species, stocks and habitat importance known.
- Harvesting may occur regularly in these areas.

Fresh waters containing priority 1 areas are identified below even though only spawning, overwintering and nursery areas and areas used by overharvested stocks are given priority 1 classification.

Shallow Bay/Niakunak Bay

The inner portion of Shallow Bay is an overwintering area for many anadromous coregonids and a feeding and nursery area for young fish. The outer portion of Shallow Bay (Niakunak Bay) is extensively used as a concentration area for a major portion of the Beaufort Sea beluga population during late June, July and early August.

Central Mackenzie Estuary

The area between Garry, Kendall and Pelly islands is a concentration area for beluga during July and early August. Several beluga hunting camps are located here. Beluga use the coastal zone of the outer Delta as a transit corridor between concentration areas in Niakunak and Kugmallit bays. The coastal zone of the outer Delta is used extensively for feeding by anadromous coregonids. The deep embayments of the outer Delta, such as Mason and Mallik bays, serve as major overwintering and nursery areas for a variety of marine and anadromous fish. The area north-east of Richards Island is overwintering and spawning habitat for fish including Pacific herring.

Kugmallit Bay

There is a major concentration area for beluga south of Summer Island and south and west of Hendrickson Island during late June, July and early August. This is one main area for hunting beluga. The southern part of Kugmallit Bay is an overwintering area for anadromous coregonids. As winter progresses, the freshwater zone expands and more fish use this area. The coastal area is important feeding and nursery habitat for coregonids and Pacific herring, and is a major migrations corridor for coregonids. Harvesting occurs here.

Whitefish Bay

This coastal inlet is a known overwintering site for immature broad whitefish from at least four Tuktoyaktuk Peninsula drainages. Post-spawning broad whitefish migrate from spawning sites in the Mackenzie River to overwinter in several areas of the East Channel and Whitefish Bay.

Tuktoyaktuk Harbour

Tuktoyaktuk Harbour is very important fish habitat. Pacific herring spawn in Tuktoyaktuk Harbour and several other species of marine fish probably also spawn in the Harbour. The Harbour is an important overwintering area for Pacific herring and anadromous Arctic cisco. Several species of coregonids utilize the area during their migrations. The streams entering the harbour may be important nursery areas for broad whitefish and lake whitefish.

Liverpool Bay Fingers Area

The "Fingers" area of Liverpool Bay is an important spawning area for Pacific herring.

Firth River

The Firth River supports anadromous and non-anadromous stocks of the western form of Arctic charr. An aerial survey in 1972 estimated the population as roughly 32 000. No current estimate is available. Spawning and overwintering areas are known.

Babbage River

The Babbage River and its major tributary, Fish Hole Creek (Canoe Creek), contain stocks of the western form of Arctic charr and two non-anadromous stocks. The main overwintering and spawning area is in Fish Hole Creek. Falls on the Babbage River prevent the anadromous stock utilizing the whole river. No estimate of the population size is available.

Big Fish River

The Big Fish River arises in the Richardson Mountains and flows northeastwards discharging into Moose Channel of the Mackenzie Delta. Anadromous and non-anadromous Arctic charr of the western form inhabit this drainage. One tributary, Cache Creek, has suitable overwintering and spawning areas. The current estimate of the population is approximately 9 100 fish.

This stock probably feeds in nearshore coastal areas west to Shingle Point and possibly to King Point and Kay Point. The stock has been heavily exploited by the residents of Aklavik. The fishery was closed in 1987.

Mackenzie Delta Channels and Lakes

The myriad of minor channels and lakes in the Delta serve as important nursery areas for many larval coregonids and smelt. The channels provide migration routes for anadromous Arctic charr and coregonids. Throughout the summer and fall large numbers of mature coregonids pass through the Delta, migrating upstream to spawning areas located throughout the Mackenzie River system. Some species, such as the least cisco, are thought to spawn in the Peel and Husky channels. Following spawning, spent fish migrate downstream to overwintering areas in the deep channels of the lower estuary and in the deeper embayments of the outer Delta. Upon emerging from spawning beds in the spring young fish are flushed by the current to nursery areas in the Delta lakes and minor channels. Not all Delta lakes warrant Priority 1 classification.

Tuktuyaktuk Peninsula

Some small lake-stream systems draining the Tuktuyaktuk Peninsula are critical nursery and overwintering areas for young-of-the-year and juvenile Mackenzie River broad whitefish. Some drainages offer sufficient overwintering, spawning and feeding habitat to support large resident populations of least cisco. Also they are utilized heavily as summer feeding areas and to a certain extent as overwintering areas for broad whitefish, lake whitefish and least cisco.

Hornaday River

The lower 45 km of the Hornaday River used by the eastern form of anadromous Arctic charr. A 23 m waterfall prevents further upstream passage of anadromous fish. The lower portion of the river contains spawning, nursery and overwintering areas. The current size of the population is 11 000-16 000 Arctic charr. The stock is fished for domestic purposes by the residents of Paulatuk and was commercially fished between 1968 and 1987. Catches have declined since the early 1980's and the stock shows signs of serious overexploitation. The anadromous fish feed in Darnley Bay. A non-anadromous stock is present above the falls, but little is known of this stock.

Croker River and Bluenose Lake

Arctic charr are present in Bluenose Lake. These may or may not be anadromous fish.

Kagluk River - Quunnguq Lake

The anadromous eastern form Arctic charr stock in this system supports a test commercial fishery by the Inuvialuit Development Corporation.

Kuuk River - Tahiryuak Lake

The system supports an anadromous Arctic charr stock which is fished domestically by Holman residents.

Kuujuua River - Minto Inlet

Freshwater lakes are overwintering and spawning habitat for anadromous Arctic charr.

PRIORITY 2 AREAS

Criteria For Selection

- Coastal and freshwater feeding areas and migration routes of harvested, rare, endangered or ecologically important anadromous, freshwater and marine fish.
- Offshore spawning, nursery and overwintering areas of harvested, rare, endangered or ecologically important marine fish;
- Coastal feeding areas and migration routes of whales.
- Areas used by concentrations of harvested seals.
- Species, stock or habitat importance of these areas is known or suspected.
- Harvesting may occur regularly in these areas.

Many specific fresh waters containing feeding areas and migration routes of harvested Arctic charr, anadromous coregonids and other fish species are described under priority 1 areas although feeding areas and migration routes are given a priority 2 classification.

North Slope Yukon Coastal Zone

The coastal zone is a major feeding area for Arctic charr originating in the Firth, Babbage, Rat and Big Fish rivers and for several species of coregonids originating in the Mackenzie River. The coastal zone is a major migration route for Arctic cisco from spawning areas in the Mackenzie River system to nursery, feeding and overwintering areas in the Colville River, Alaska. During some years, areas along the coast may be important to bowhead.

Tuktoyaktuk Peninsula Coastal Zone

Extensive movements of coregonids occur along the coast of the Tuktoyaktuk Peninsula as fish migrate between overwintering locations and summer feeding areas throughout the summer and fall. For some species, such as Arctic cisco, least cisco and rainbow smelt, major feeding and rearing areas are located in bays and lagoons along the coastal margin. For others, such as broad whitefish, lake whitefish and some least cisco stocks, the brackish inshore zone serves as an access corridor to rich feeding areas located in freshwater lake systems along the Peninsula. McKinley Bay may be a spawning area for Pacific herring. Beluga may feed in this area.

Liverpool Bay Coastal Zone

The "Fingers" area is given a Priority 1 classification. The remainder of the Liverpool Bay coastal zone is suspected of being spawning habitat for Pacific herring.

Wood Bay/Baillie Islands Coastal Zone

The area is important for both anadromous and marine fish. Wood Bay appears to serve the same habitat functions for fish as Shallow and Kugmallit bays. Pacific herring are thought to utilize the Baillie Islands area as a spawning and nursery area.

The Parry Peninsula/Franklin Bay/Darnley Bay Coastal Zone

Arctic cod are ubiquitous through this area. Greenland cod have been reported in large numbers in the vicinity of Cape Parry. Franklin Bay and Darnley Bay support large numbers of Pacific herring. These are an important source of food for ringed seals, beluga and Arctic charr. Darnley Bay is an important marine feeding area for anadromous Arctic charr populations from the Hornaday and Brock rivers. Beluga frequent these waters, feeding on the rich forage fish base.

Southwest Victoria Island Coastal Zone

The coastal zone around Southwest Victoria Island, including Prince Albert Sound and Minto Inlet, is used by feeding Arctic charr from streams and rivers of the area. The Safety Channel area of Prince Albert Sound is fished by Holman Island residents. Ringed seal use the good birth-lair habitat in Prince Albert Sound and Minto Inlet, and these areas are used for moulting during May and June.

Sachs Harbour Coastal Zone

The coastal zone around Sachs Harbour and the west coast of Banks Island is used by feeding Arctic charr. The Sachs River estuary may provide seasonally important habitat for Greenland cod.

Mercy Bay/Castel Bay Coastal Zone

The coastal zone around Mercy Bay and Castel Bay is used by feeding Arctic charr from the Thomsen River and Muskox River.

Mackenzie Delta Lakes

Some Mackenzie Delta lakes have a Priority 1 classification. Others have a Priority 2 classification since they are feeding areas or are only suspected spawning, nursery and overwintering areas for coregonids and other fish.

Tuktoyaktuk Peninsula

Some freshwater systems draining the Tuktoyaktuk Peninsula have a Priority 1 classification. Others have a Priority 2 classification since they

are feeding areas and migration routes for coregonids or are only suspected spawning, nursery or overwintering areas for coregonids.

Mainland

Many small systems on the Yukon North Slope are occupied by resident coregonids and grayling. Other freshwater areas of the mainland support resident populations of coregonids, burbot, lake trout, northern pike, and in some instances, Arctic grayling. While not as important as the anadromous coregonids of the mainstem Mackenzie and its major tributaries, these systems are none-the-less important fish habitat. These water bodies contain Priority 1 areas. Some of these water bodies are:

Anderson River

The Anderson River estuary is suspected to be important habitat for anadromous coregonids. There may be a small population of the eastern form of Arctic charr in this river.

Brock River

Paulatuk residents report an upstream migration of anadromous Arctic charr in the Brock River. Arctic charr have been taken in lakes in the system. No information is available as to spawning or overwintering areas or population parameters.

Roscoe River

The lower 20-25 km of the river may contain anadromous Arctic charr. A series of rapids and falls present a barrier to upstream migrants. The head water lakes support a non-anadromous stock of charr.

Inman, Hoppner rivers

The residents of Coppermine report that these rivers both contain Arctic charr. The entire rivers are accessible to upstream migrants.

Victoria Island

Many streams, rivers and lakes of central west Victoria Island support anadromous or non-anadromous Arctic charr stocks. The location of spawning, overwintering and nursery areas are not known except for those water bodies described in Priority 1. The migration routes and feeding areas of the Priority 1 water bodies and other water bodies supporting Arctic charr have a Priority 2 classification including:

Wollaston Peninsula Streams

The streams and lakes contain anadromous Arctic charr stocks. These are fished for domestic purposes by Coppermine residents.

Diamond Jenness Peninsula

Test fisheries in the Safety Channel area in July and August suggest that the streams draining the Diamond Jenness Peninsula have anadromous Arctic charr stocks.

Naloagyok River

Test fisheries indicate the presence of anadromous Arctic charr.

Banks Island

Some streams, rivers and lakes of Banks Island support anadromous or non-anadromous Arctic charr stocks, but the location of spawning, overwintering and nursery areas is not known. Adjacent marine areas are used for feeding by anadromous Arctic charr. These waterbodies include:

Sandhill River

It is possible that the Arctic charr stock in the headwater lakes is anadromous although the river in mid July of 1976 appeared difficult for fish to ascend.

DeSalis River

The water of Windrum Lagoon is slightly brackish and very turbid. It is not known whether the Arctic charr stock in the headwater lake is anadromous. The lake is accessible to fish migrating from DeSalis Bay.

Sachs River - Raddi Lake

There is a small anadromous Arctic charr stock in the system which is fished domestically by Sachs Harbour residents. It is suspected that the stock in Raddi Lake is anadromous as the river does not have any barriers to migration.

Kellett River

Due to the small discharge of the outlet stream of the lake at 71° 53'N and 123° 52'W, it seems unlikely that the Arctic charr in that lake are anadromous but the possibility of migrations exists within the Kellett River.

Sik Sik Lake and River

The lake is deep and clear. It contains Arctic charr but it is not known if they are anadromous or non-anadromous. The lake also contains a stock of lake trout.

Big River

It is not known whether the Arctic charr in this system are anadromous or non-anadromous. The large headwater lakes are generally deep with gravel or rock shorelines. The river bed is generally of gravel or pebbles and the

water for the most part is clear. The lake trout found in the lake at 71° 47'N and 121° 16'W spawn on gravel shoals near the inlet stream.

Bar Harbour Creek

The headwater lakes of this small system contain Arctic charr. The size of the stock and the type (anadromous/non-anadromous) is not known.

Thomsen River - Muskox River

The Thomsen River provides a migration route and spawning, nursery and overwintering habitat for anadromous Arctic charr and ciscoes. These fish also occupy the major tributary, the Muskox River. Headwater lakes in the system contain Arctic charr, ciscoes and lake trout. It is not known whether these are anadromous, but no barrier to migration is present in the system.

Mercy Bay West River

The Arctic charr in this system could be anadromous.

"Bow Lake"

This lake and several near-by lakes, draining east to Prince of Wales Strait, contain Arctic charr and lake trout. It is not known whether the Arctic charr is anadromous or non-anadromous.

Lake "305"

This is the largest lake on Banks Island and is relatively deep. Several other lakes drain to it. Anadromous charr migrate between the lake and Prince of Wales Strait. A suspected spawning area has been identified.

Johnson Point - Headwater Lake

Many large adult lake trout and/or Arctic charr were observed from the air.

PRIORITY 3 AREAS

Criteria for Selection

- Offshore feeding areas and migration routes used regularly by harvested, rare or ecologically important species of anadromous or marine fish.
- Offshore areas used regularly by whales.
- Areas used by harvested seals.
- Species, stock or habitat importance known or suspected.
- Harvesting may occur regularly in these areas.

Beaufort Sea Transition Zone

The Beaufort Sea transition zone extends from the 10 km coastal zone to the permanent polar pack. During the summer, beluga may disperse to the more landward portion of the transition zone and feed after leaving the concentration areas in the Mackenzie estuary. Bowhead whales also utilize this area, travelling from east to west as the summer progresses. Each year a fracture zone forms extending from Point Barrow to the shore lead that develops from Prince Patrick Island to Cape Bathurst. This lead system is an important migration route for bowhead and beluga travelling from overwintering areas in the Bering Sea to summering areas in Amundsen Gulf and the Beaufort Sea. Adult ringed seal are relatively abundant on the land fast ice of western Banks Island. During the winter bearded seal and immature ringed seal occupy the area. The area is general marine fish habitat.

Amundsen Gulf

The Cape Bathurst polynya is the dominant oceanographic feature in this area. The polynya appears to be an area of enhanced marine productivity caused by the upwelling of nutrients and the enhanced light regime brought about by early breakup. This in turn stimulates primary and secondary productivity. The area may be a prime feeding area for bowhead, which feed upon the abundant zooplankton, and for beluga, which feed on Arctic cod and Pacific herring during spring before departing for concentration areas in the Mackenzie estuary. Following dispersal from concentration areas in the Mackenzie estuary in early August, many beluga return to this area. Since beluga arrive in the concentration areas with calves, calving may occur in Amundsen Gulf.

Sub-adult ringed sea and adult bearded seal make extensive use of the Cape Bathurst polynya during the winter. The reliable occurrence of open water and new ice provides excellent habitat. The shore lead adjoining the polynya is a pupping area for bearded seal. Large numbers of ringed seal are present in the Cape Kellett and DeSalis Bay area of Banks Island.

The shore lead which develops seaward of the land fast ice of Banks Island is an important access route for beluga and bowhead. Bearded seal also frequent this area. The greatest concentration of bearded seal occurs in the vicinity of Cape Kellett to Haswell Point. Bearded seal feed primarily on benthic and epibenthic invertebrates and prefer water depths in the 25m to 75m depth range. Sub-adult ringed seal are excluded from the land fast ice by the breeding population and utilize the offshore lead system.

Southern Prince of Wales Strait

The southern portion of Prince of Wales Strait supports ringed seals.

PRIORITY 4 AREAS

Criteria for Selection

- Freshwater, coastal and offshore marine areas used occasionally by harvested, rare, endangered or ecologically important fish, or used by other fish species.
- Areas used occasionally by whales.
- Areas used by non-harvested stocks of seals.
- Species, stock or habitat importance of these areas is known or suspected.
- Harvesting may occur occasionally in these areas.

Beaufort Sea Permanent Polar Pack

This area is covered by the permanent polar pack and excludes the transition zone. There is little known use of this area by marine mammals, and very little is known of the fish resources of the area.

M'Clure Strait

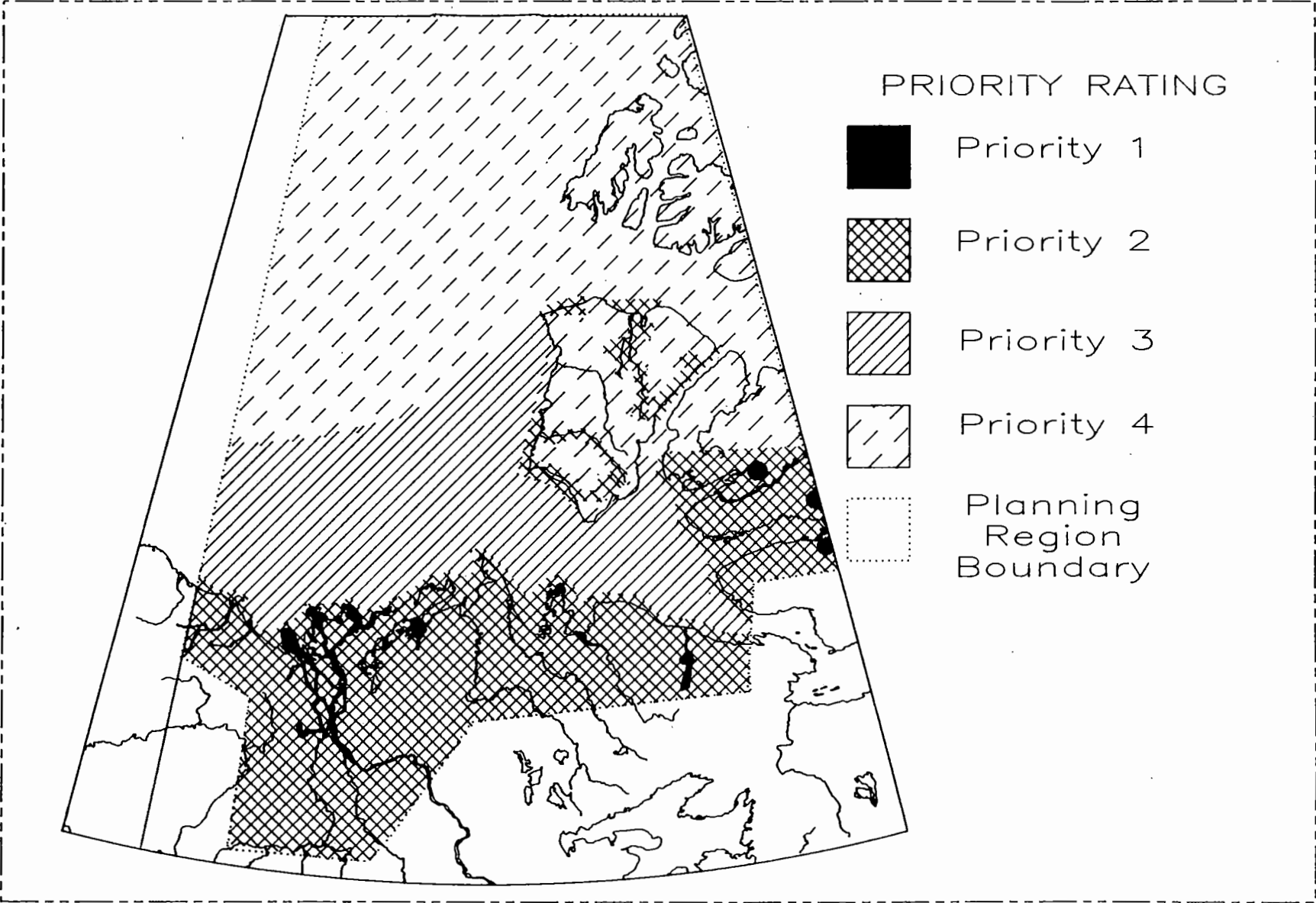
Some beluga enter waters of M'Clure Strait in some years but the area is relatively unimportant as marine habitat.

Northern Prince of Wales Strait

Northern Prince of Wales Strait is not known to support regularly whales or harvested stocks of seals. Little is known of the marine fish of the area.

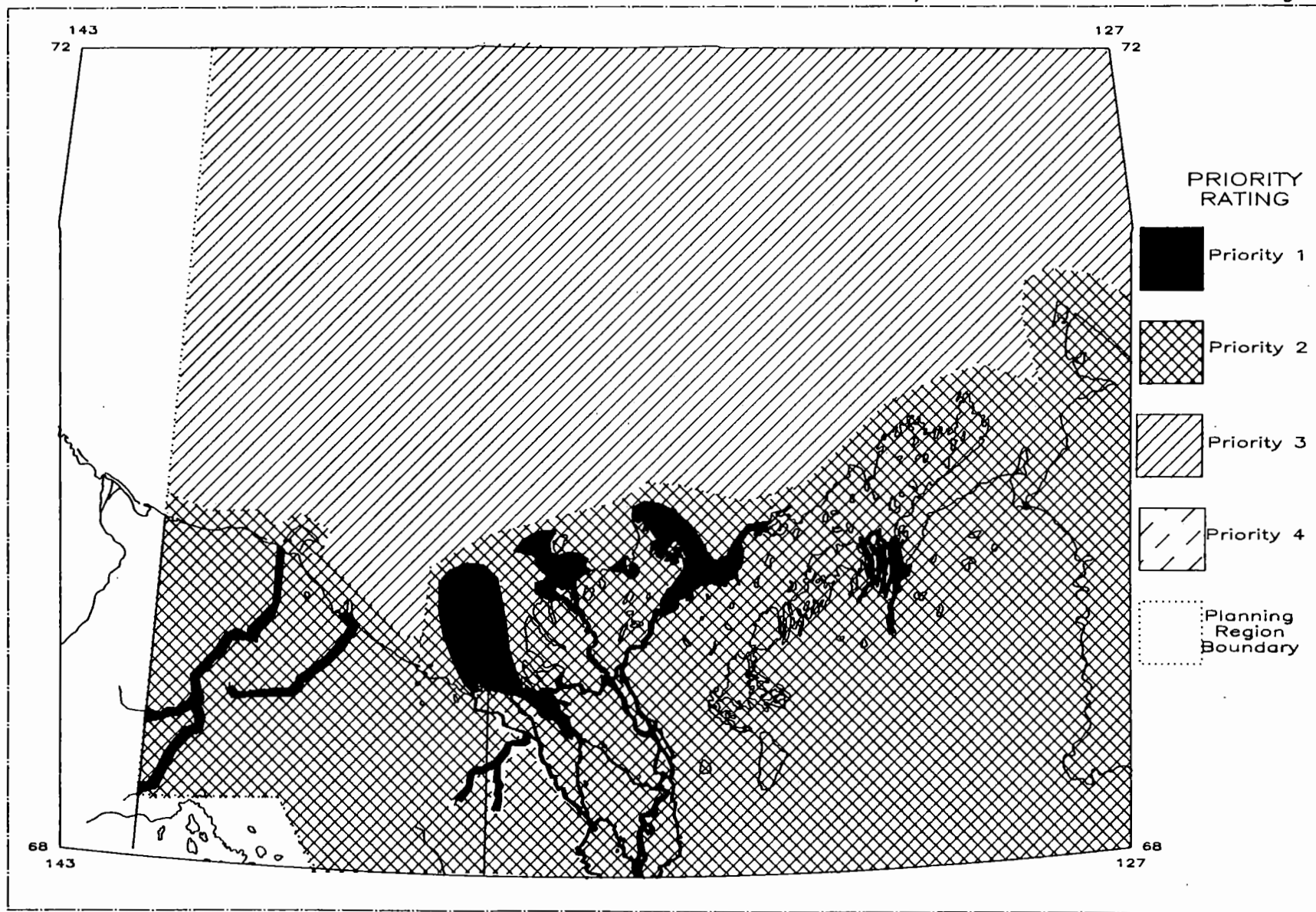
Fresh Waters

All fresh waters of the Queen Elizabeth Islands, and some fresh waters of Banks Island, Victoria Island and the mainland are not known to support harvested, rare, endangered or ecologically important species of fish.



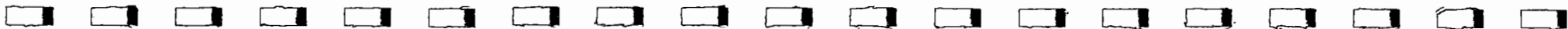
DFO Priority Areas

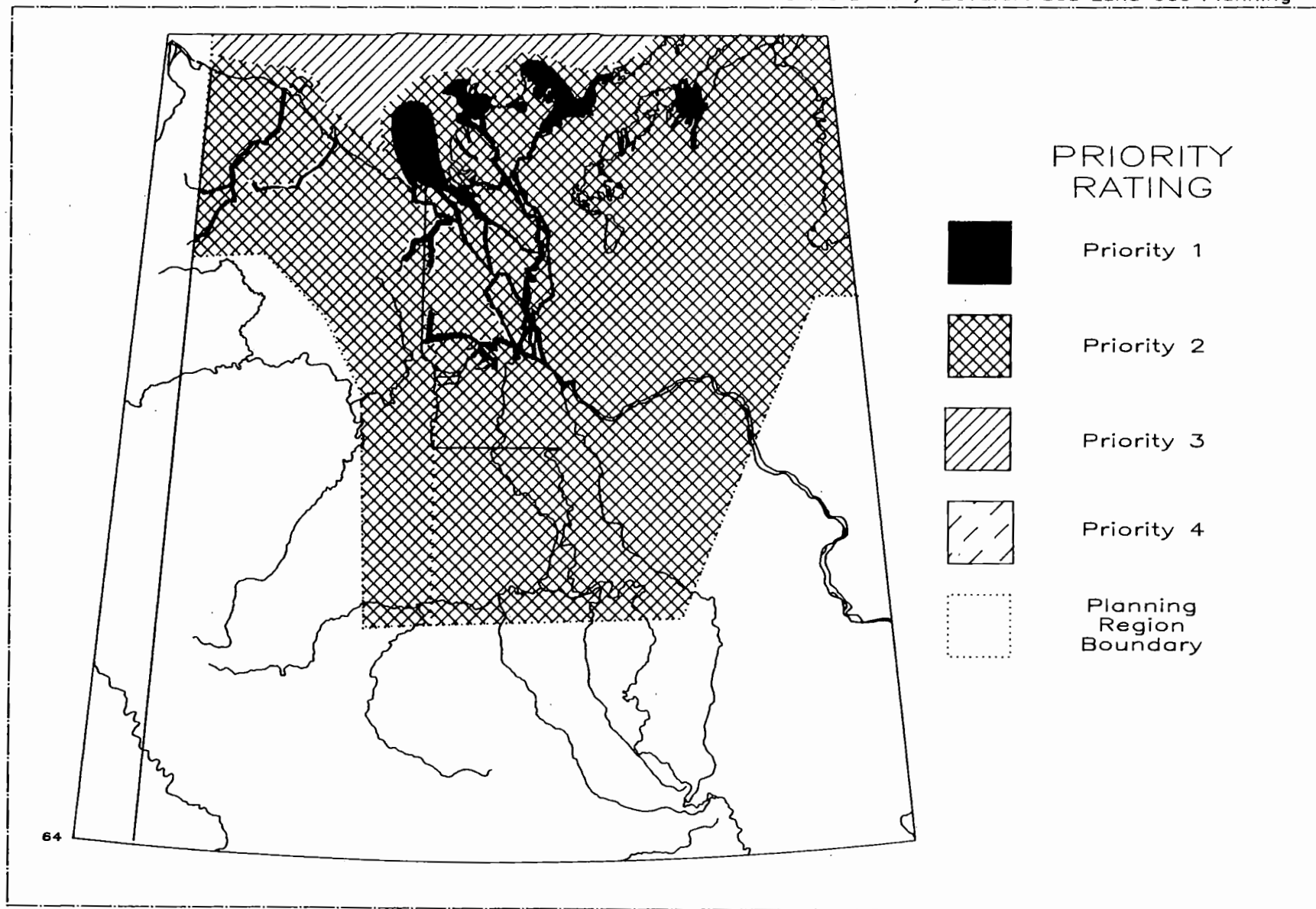
Total Planning Region



DFO PRIORITY AREAS

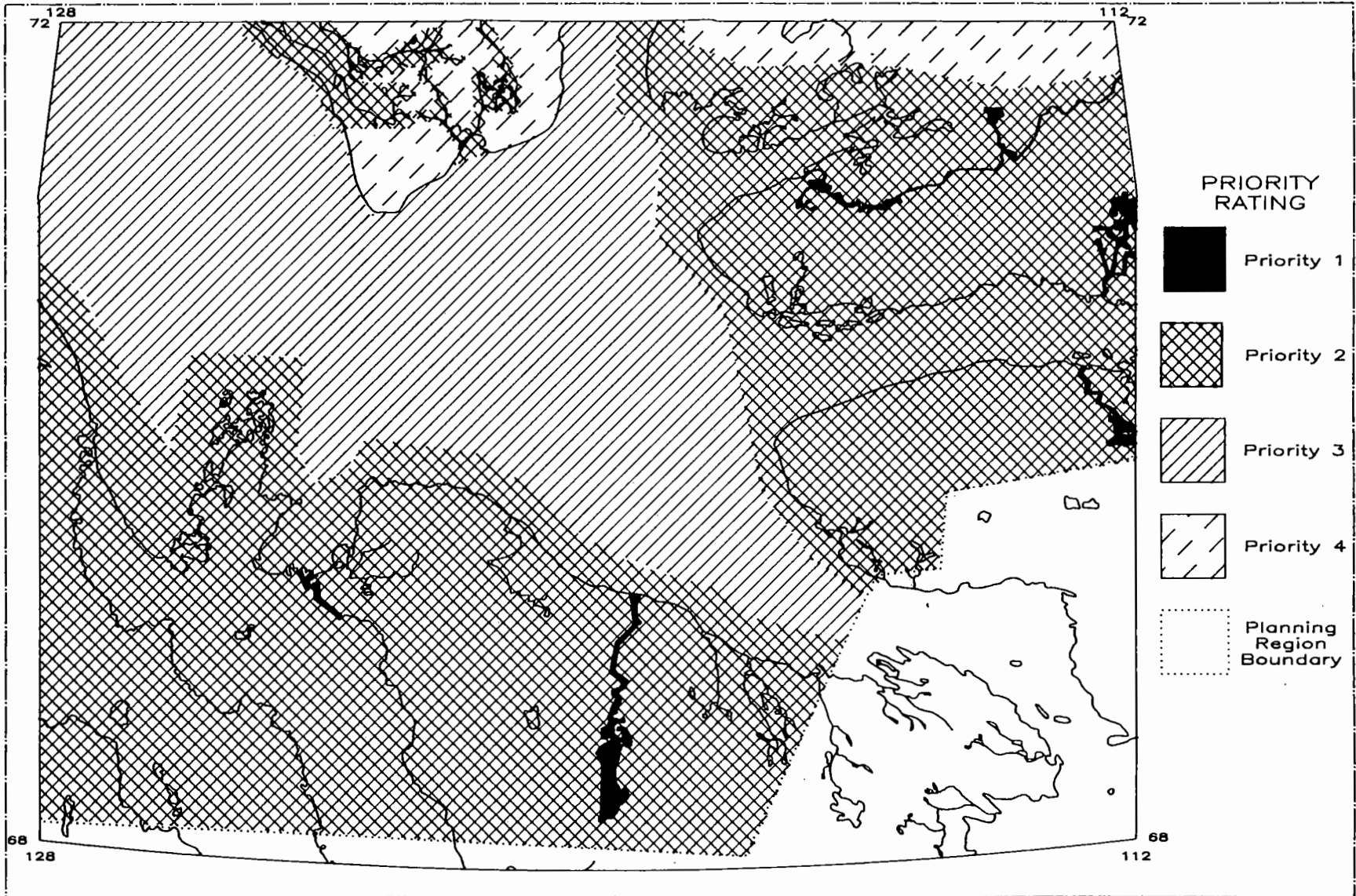
Firth River





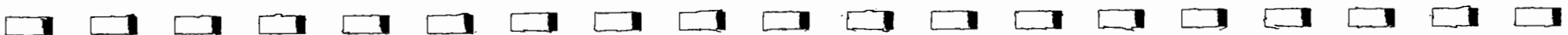
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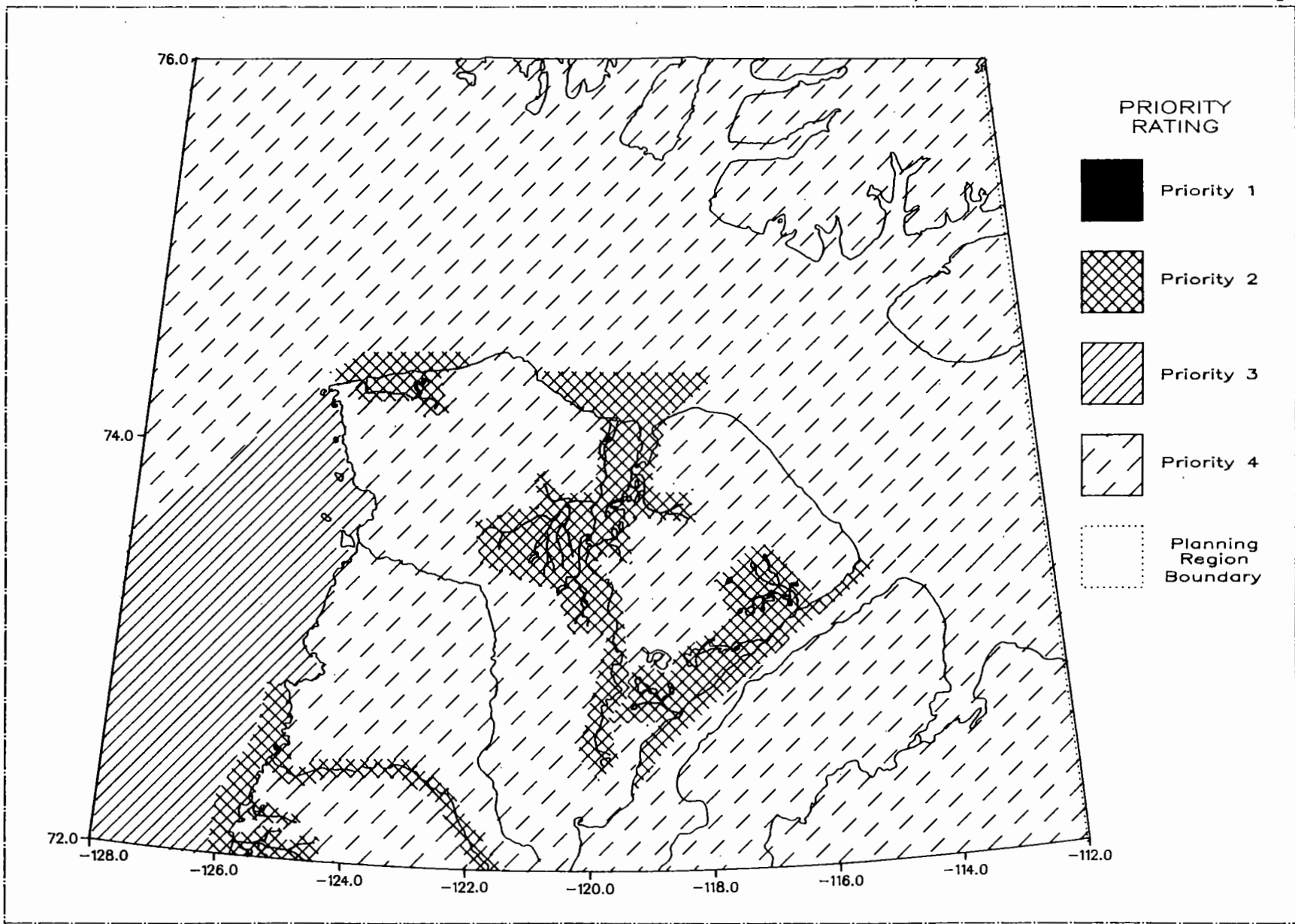
Peel River / Delta



DFO PRIORITY AREAS

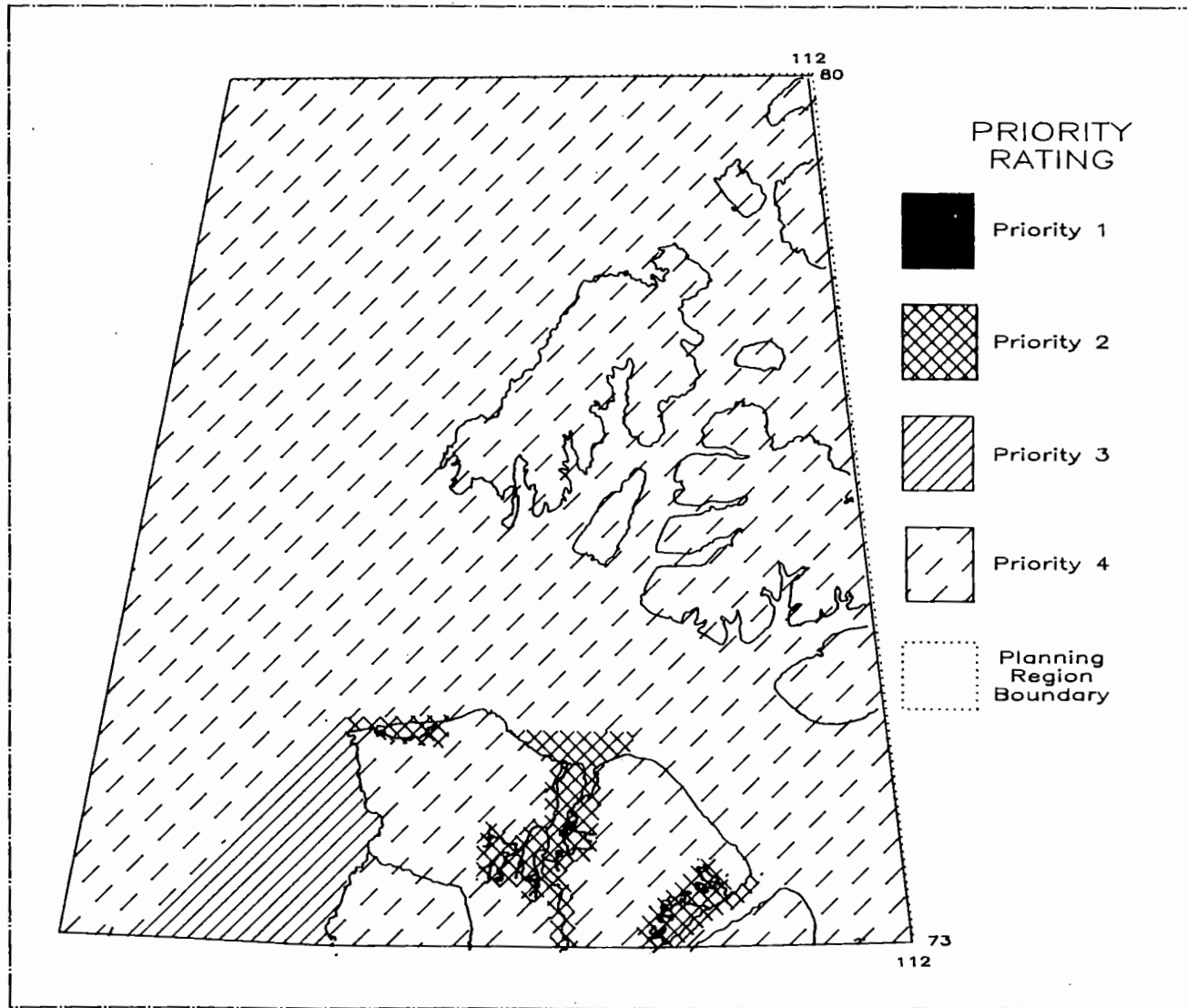
Horton River





DFO PRIORITY AREAS

Thomsen River



DFO PRIORITY
AREAS

Prince Patrick



**Part 2. Fishery Resource Maps for the Mackenzie
Delta - Beaufort Sea Planning Region.**

**Fishery Resource Maps
for the Mackenzie Delta - Beaufort Sea Planning Region**

<u>Species</u>	<u>Map Sheets/Topics</u>
Pacific herring	Firth River; Horton River
Arctic charr	Firth River; Peel River; Horton River; Thomsen River
Arctic cisco	Firth River: feeding areas; migration; nursery areas; overwintering areas. Peer River: feeding areas; spawning areas and migration; nursery areas; overwintering areas.
Least cisco	Firth River: feeding areas; migration; nursery areas; overwintering areas. Peel River: feeding areas; spawning areas and migration; nursery areas; overwintering areas.
Broad whitefish	Firth River: feeding areas; migration; nursery areas; overwintering areas. Peel River: feeding areas; spawning areas and migration; nursery areas; overwintering areas.
Lake whitefish	Firth River: feeding areas; migration; nursery areas; overwintering areas. Peel River: feeding areas; spawning areas and migration; nursery areas; overwintering areas.
Capelin	Firth River
Rainbow smelt	Firth River
Arctic cod	Horton River
Saffron cod	Firth River; Horton River
Greenland cod (Ogac)	Firth River; Horton River
Arctic flounder	Firth River; Horton River

Species

Map Sheets/Topics

Starry flounder

Firth River; Horton River

Ichthyoplankton

Firth River

Bowhead

Firth River; Horton River

Beluga

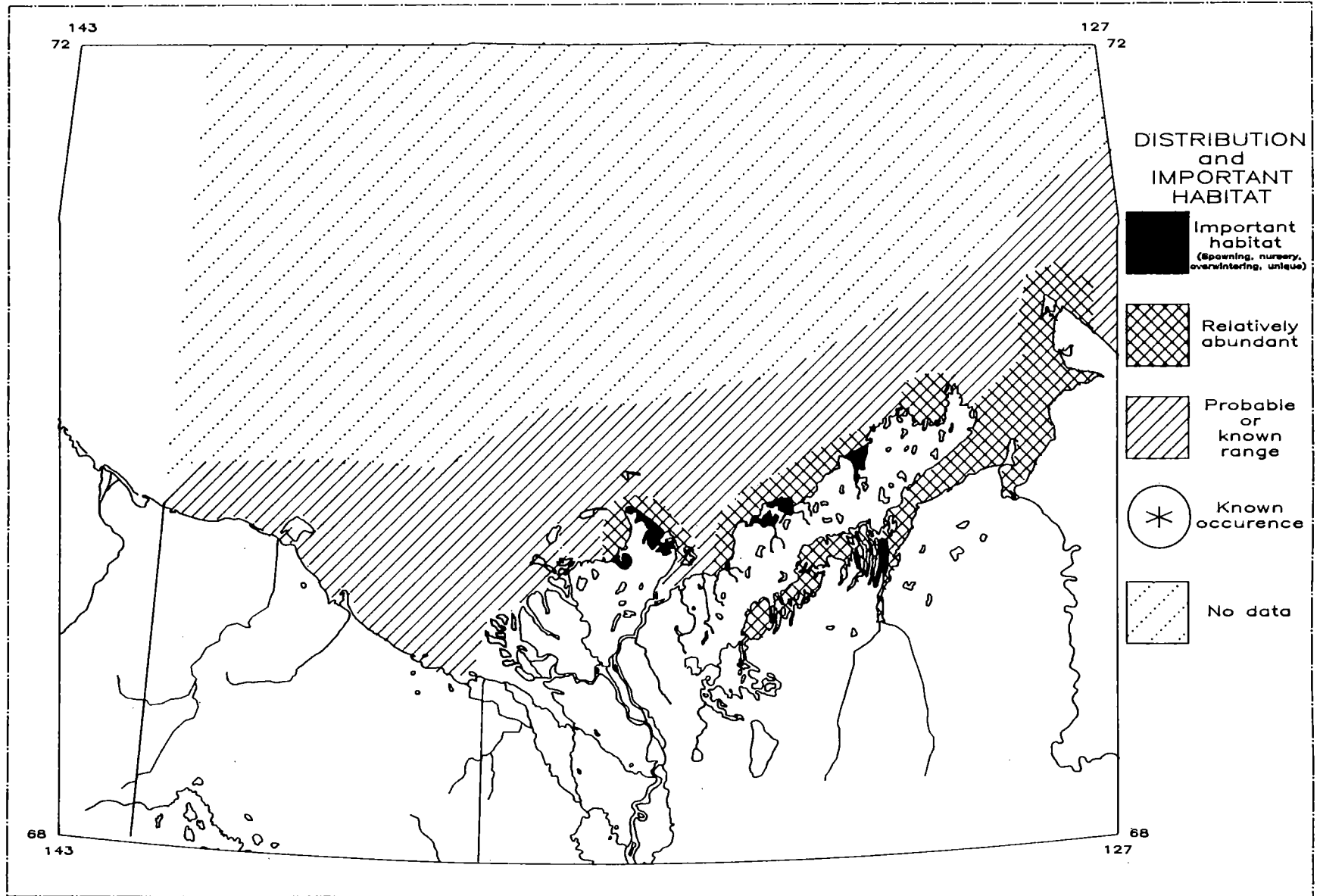
Firth River; Horton River; Thomsen River

Ringed seal

Firth River; Horton River; Thomsen River

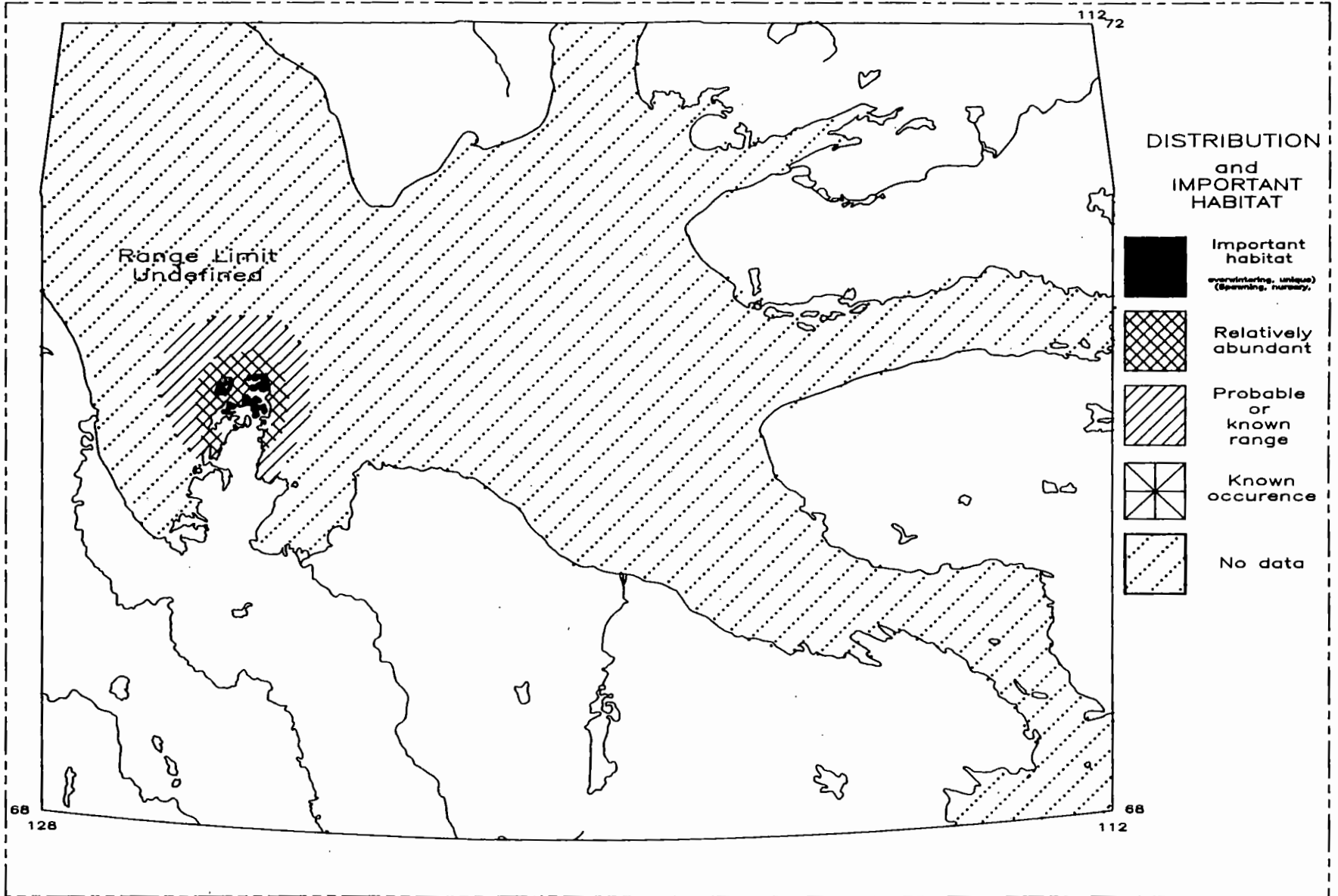
Bearded seal

Firth River; Horton River; Thomsen River



Pacific Herring
(*Clupea harengus*)

Firth River



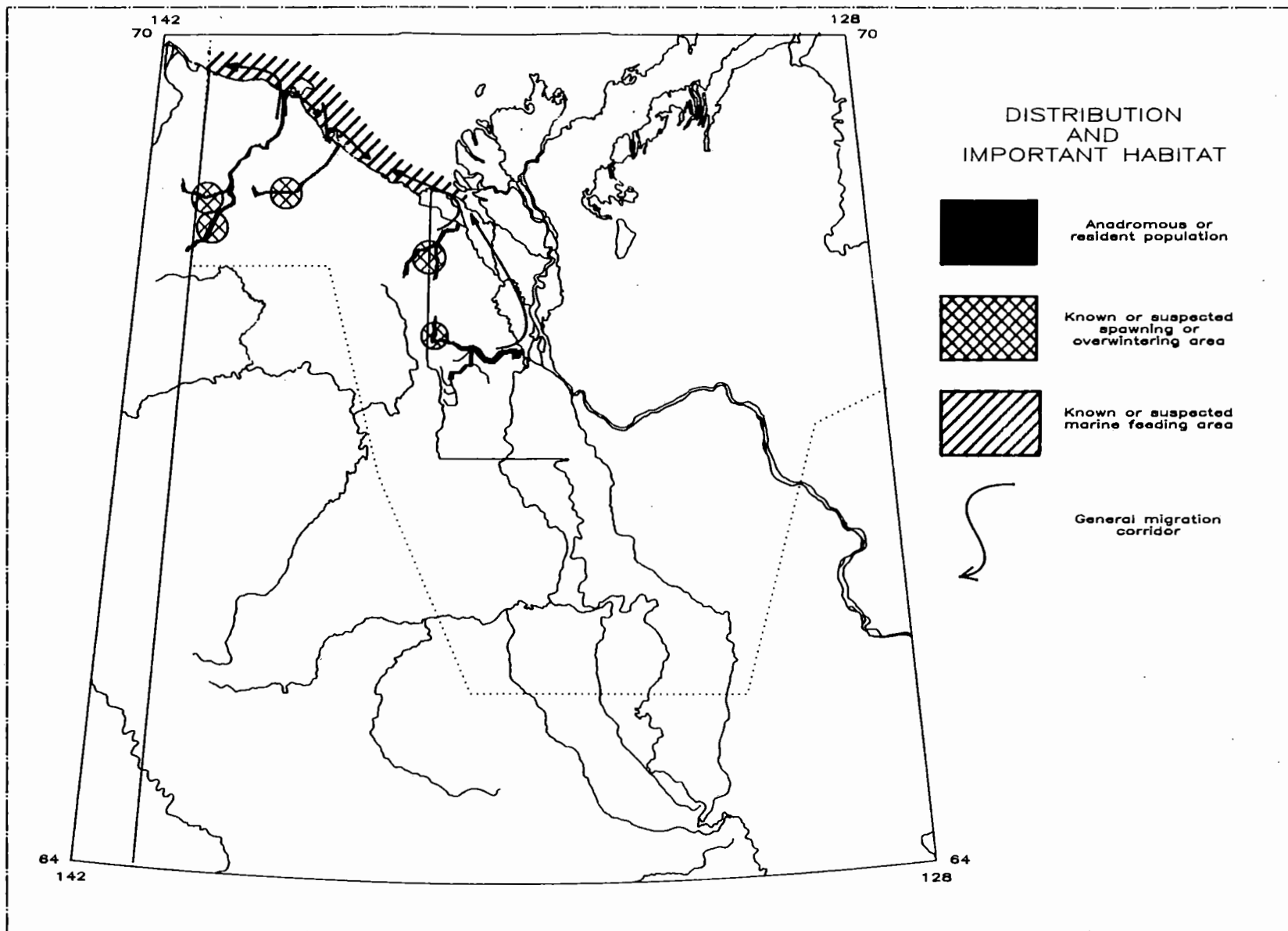
PACIFIC HERRING
(*Clupea harengus pallasii*)

Horton River



ARCTIC CHARR
(*Salvelinus alpinus*)

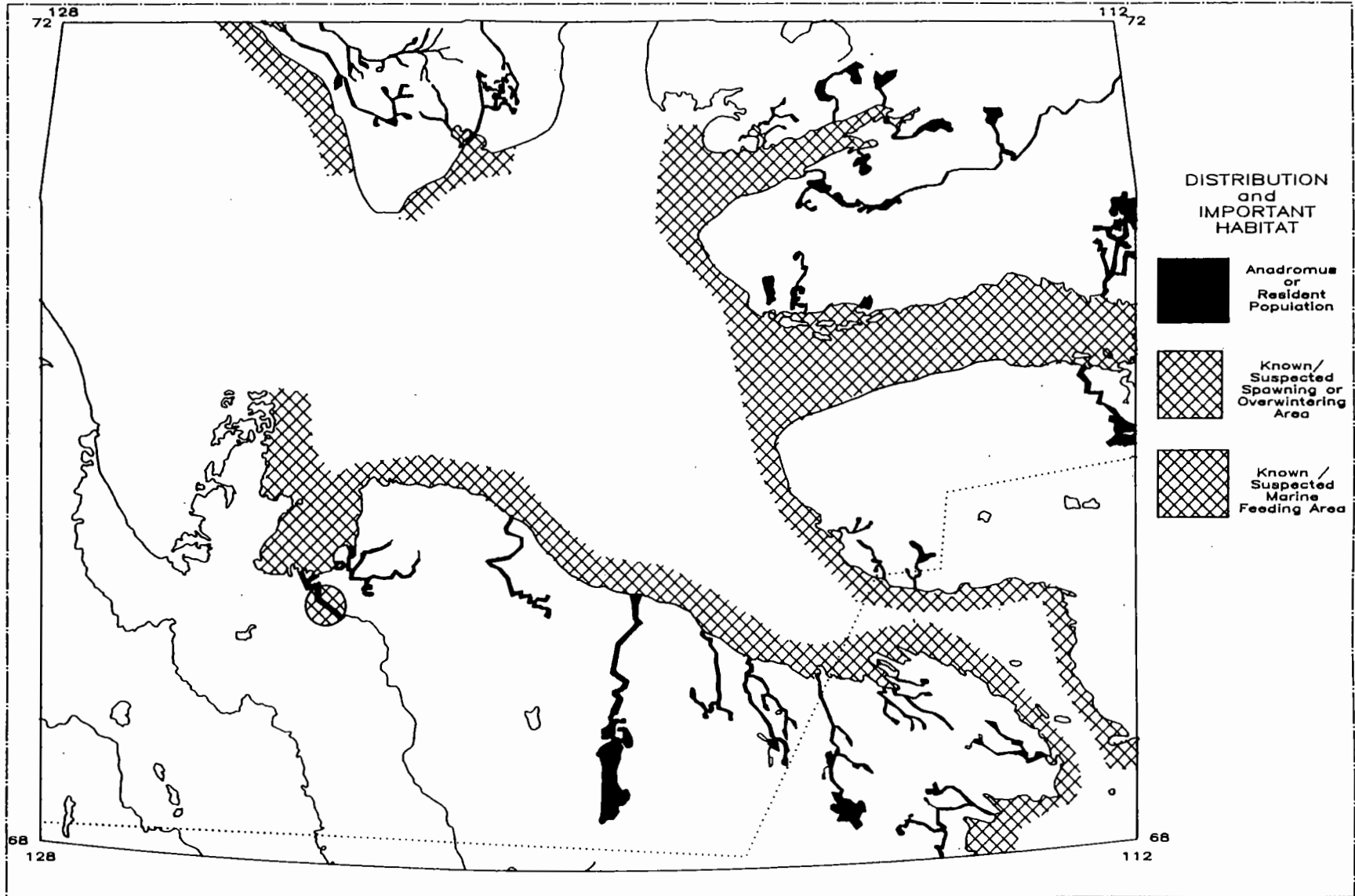
Firth River



ARCTIC CHARR
(*Salvelinus alpinus*)

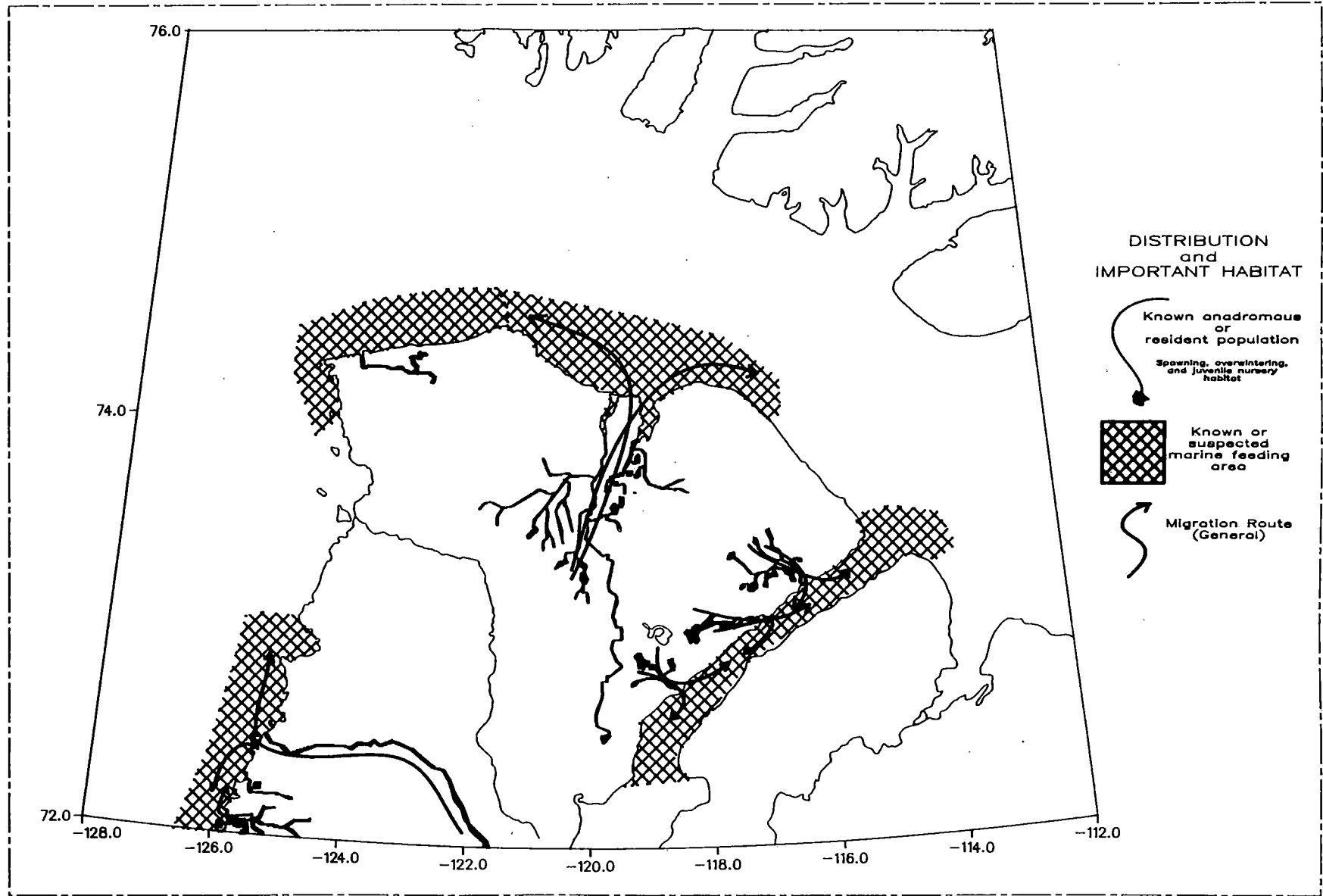
Peel River/Delta





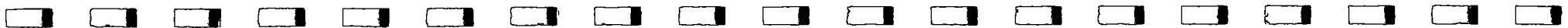
ARCTIC CHARR
(*Salvelinus alpinus*)

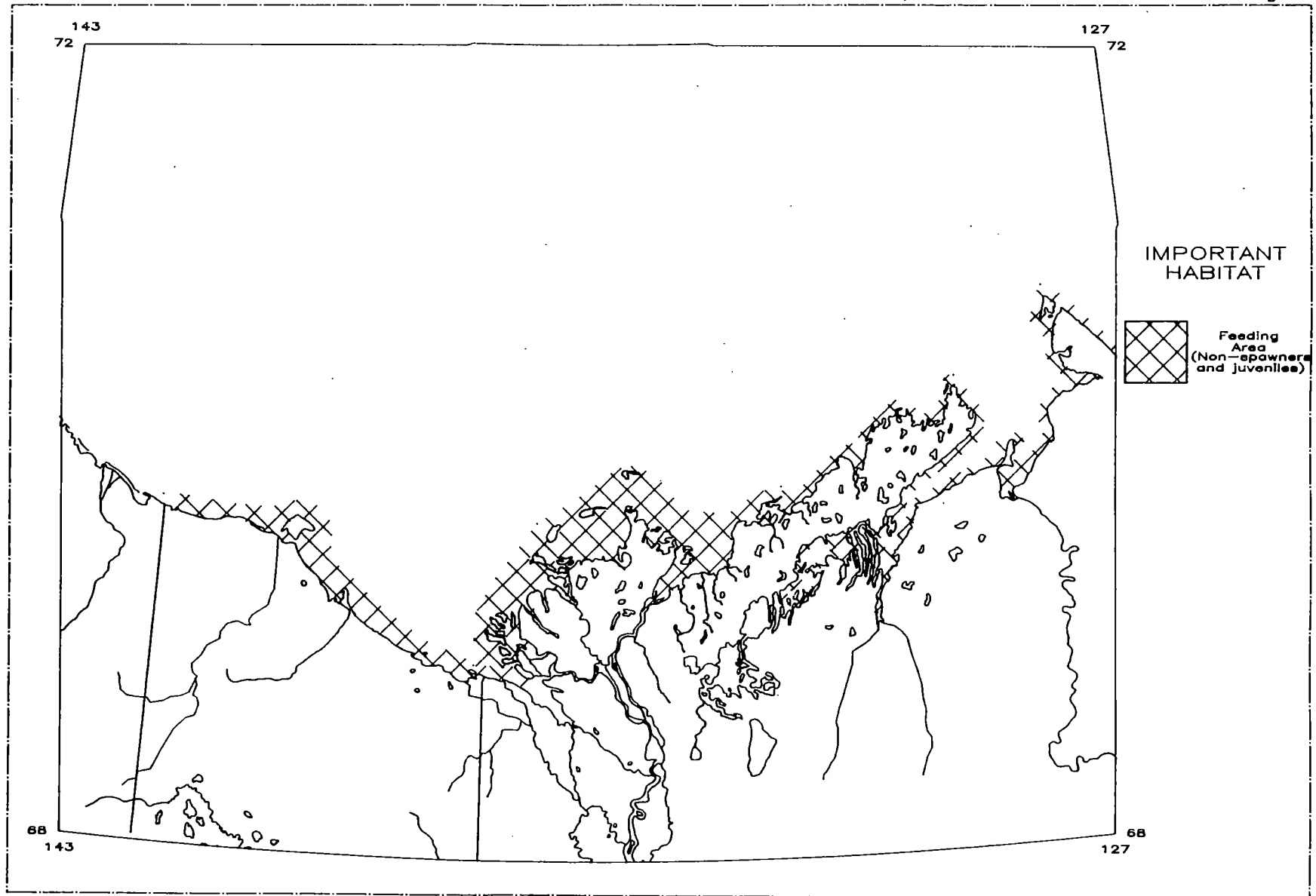
Horton River



ARCTIC CHARR
(Salvelinus alpinus)

Thomsen River





ARCTIC CISCO
(*Coregonus autumnalis*)

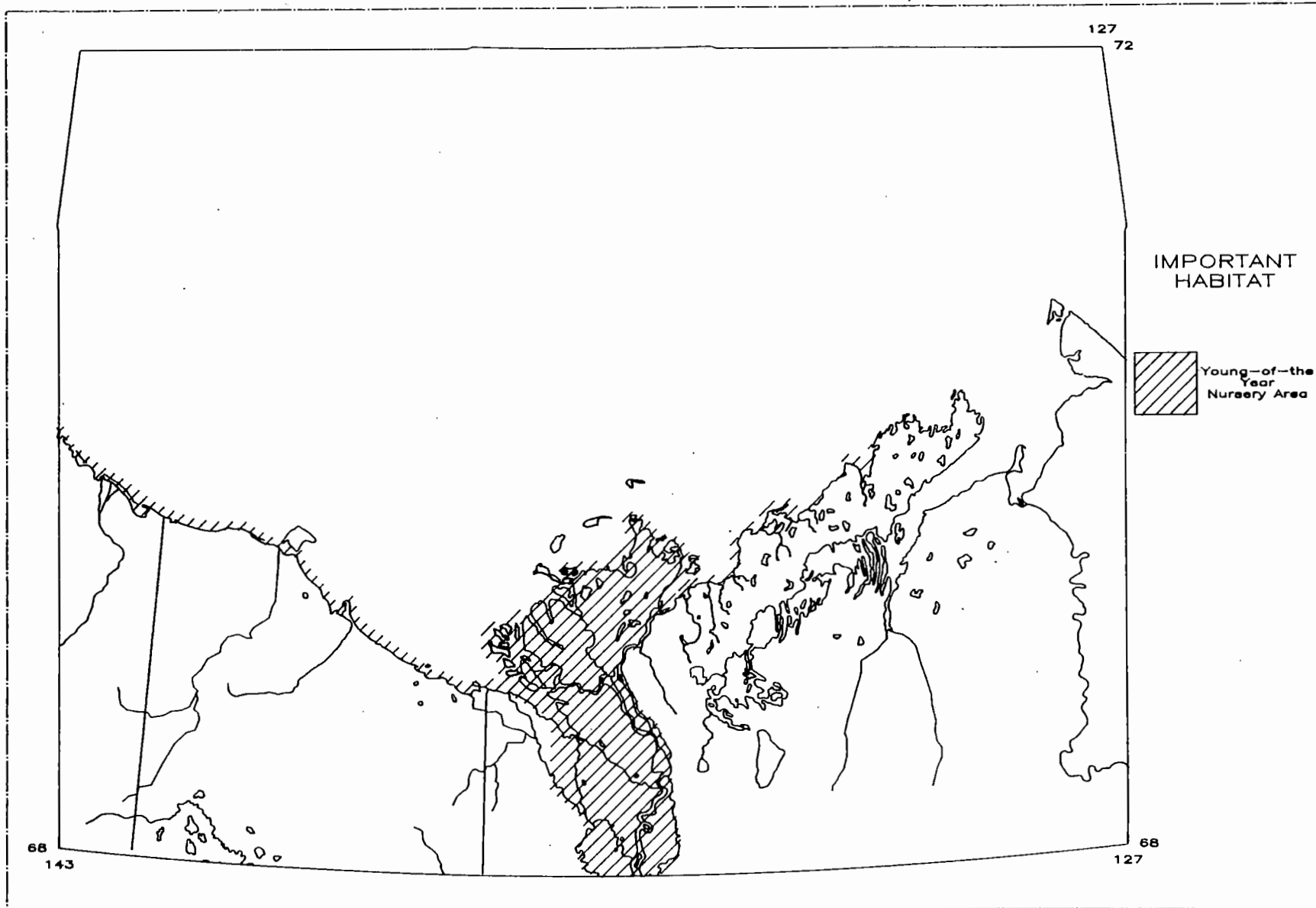
Firth River



ARCTIC CISCO
(*Coregonus autumnalis*)

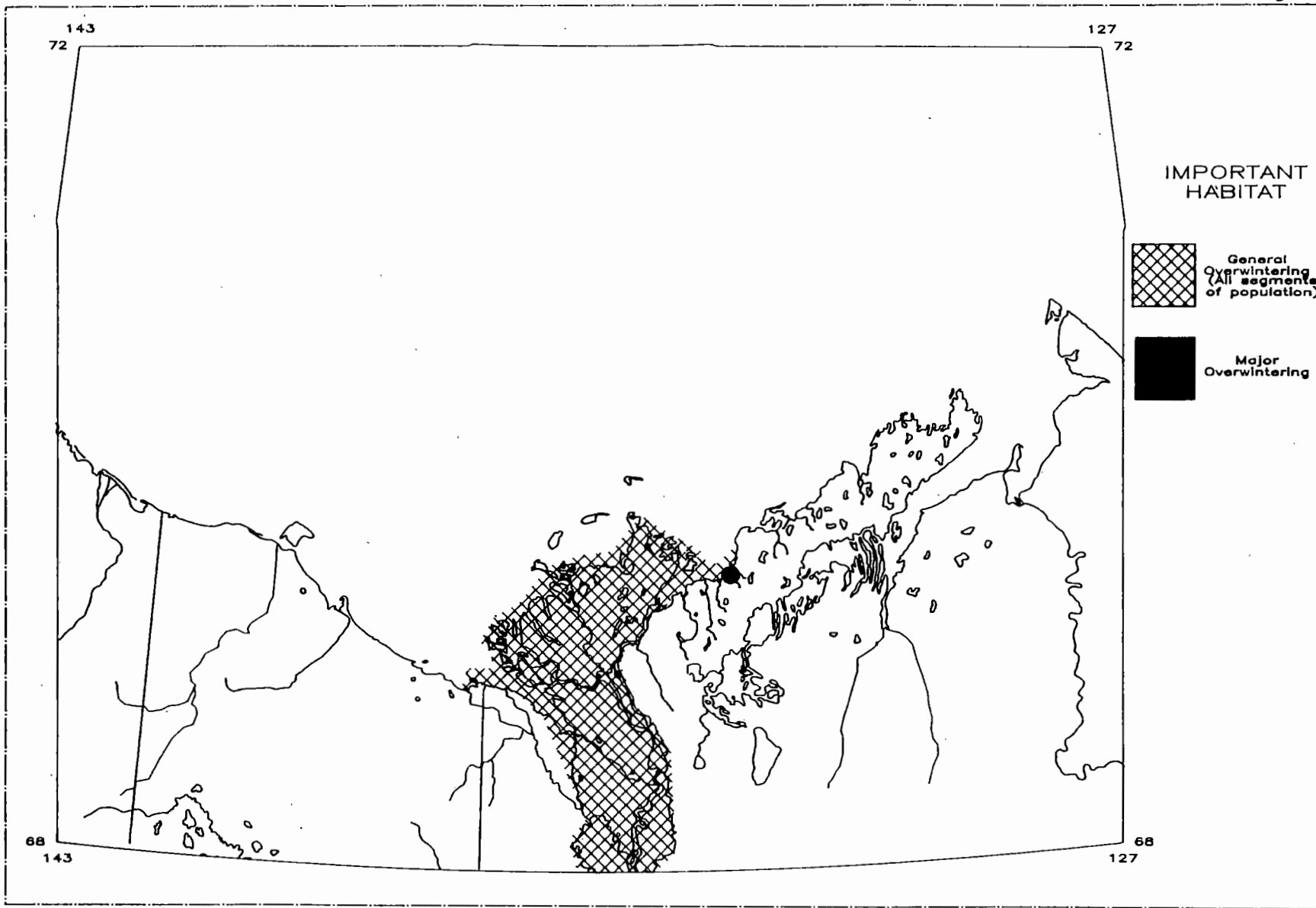
Firth River





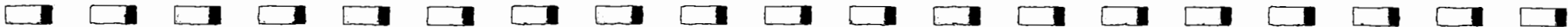
ARCTIC CISCO
(Coregonus autumnalis)

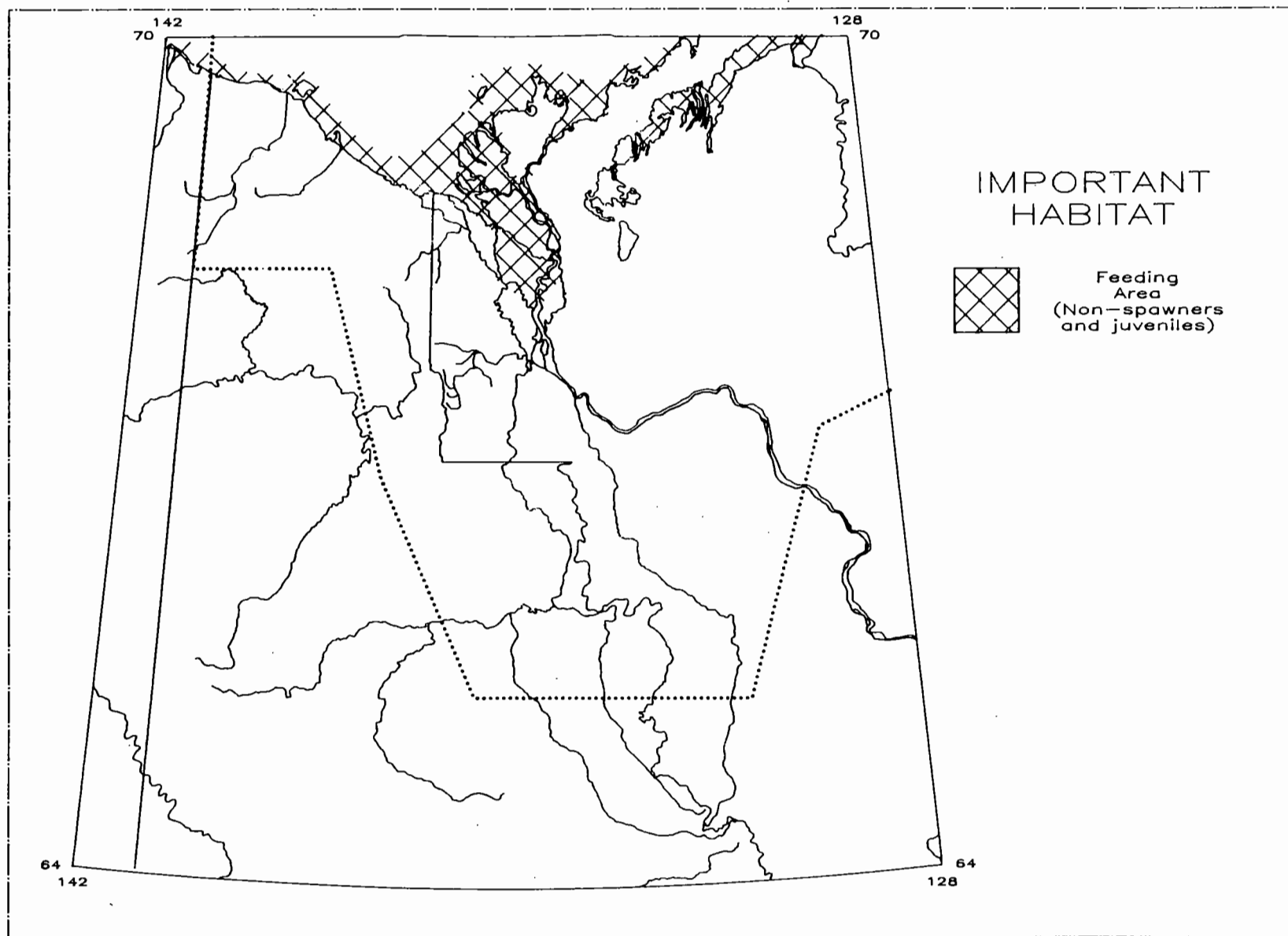
Firth River



ARCTIC CISCO
(*Coregonus autumnalis*)

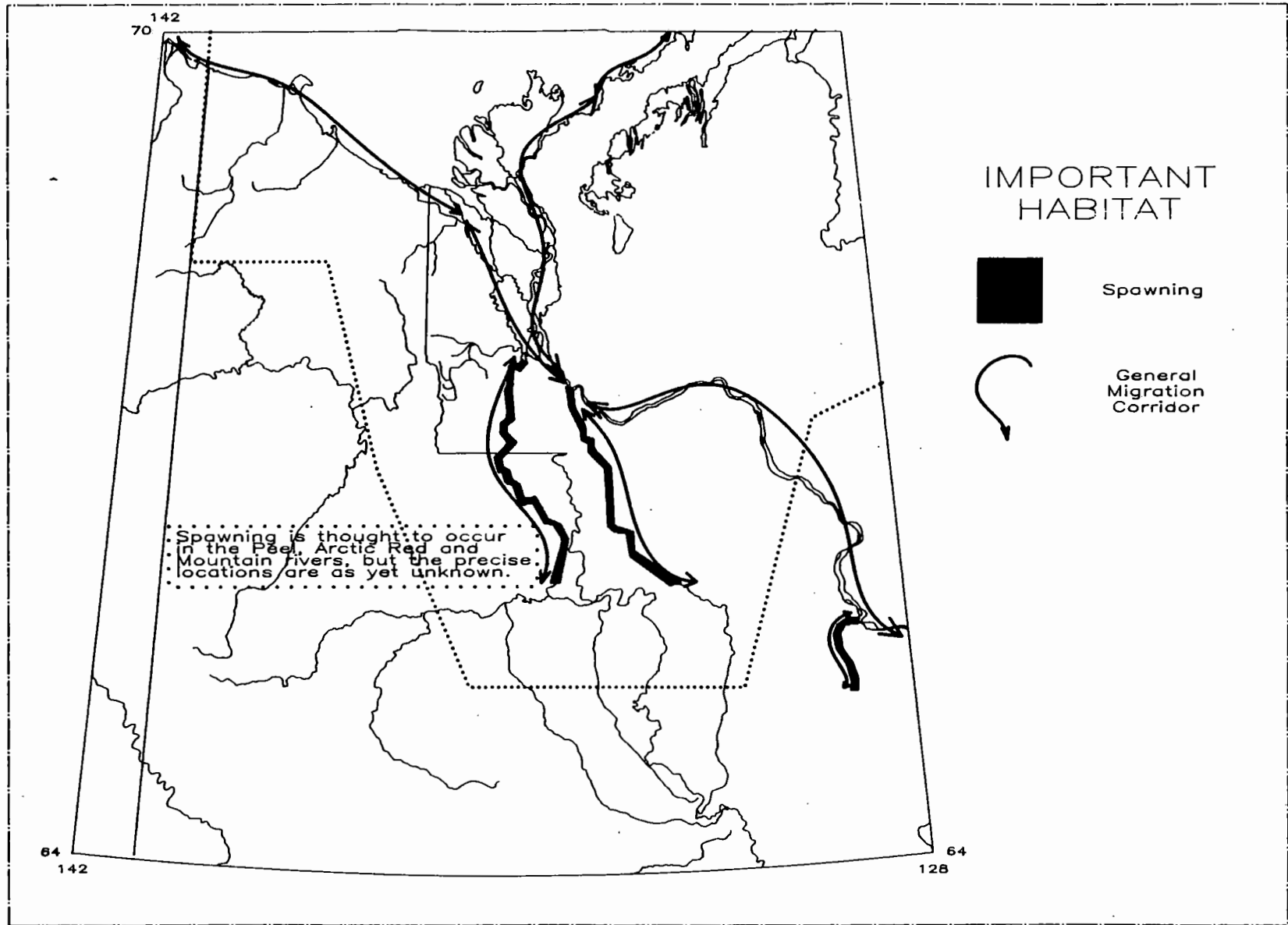
Firth River





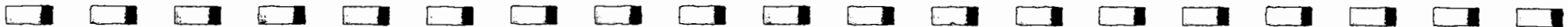
ARCTIC CISCO
(*Coregonus autumnalis*)

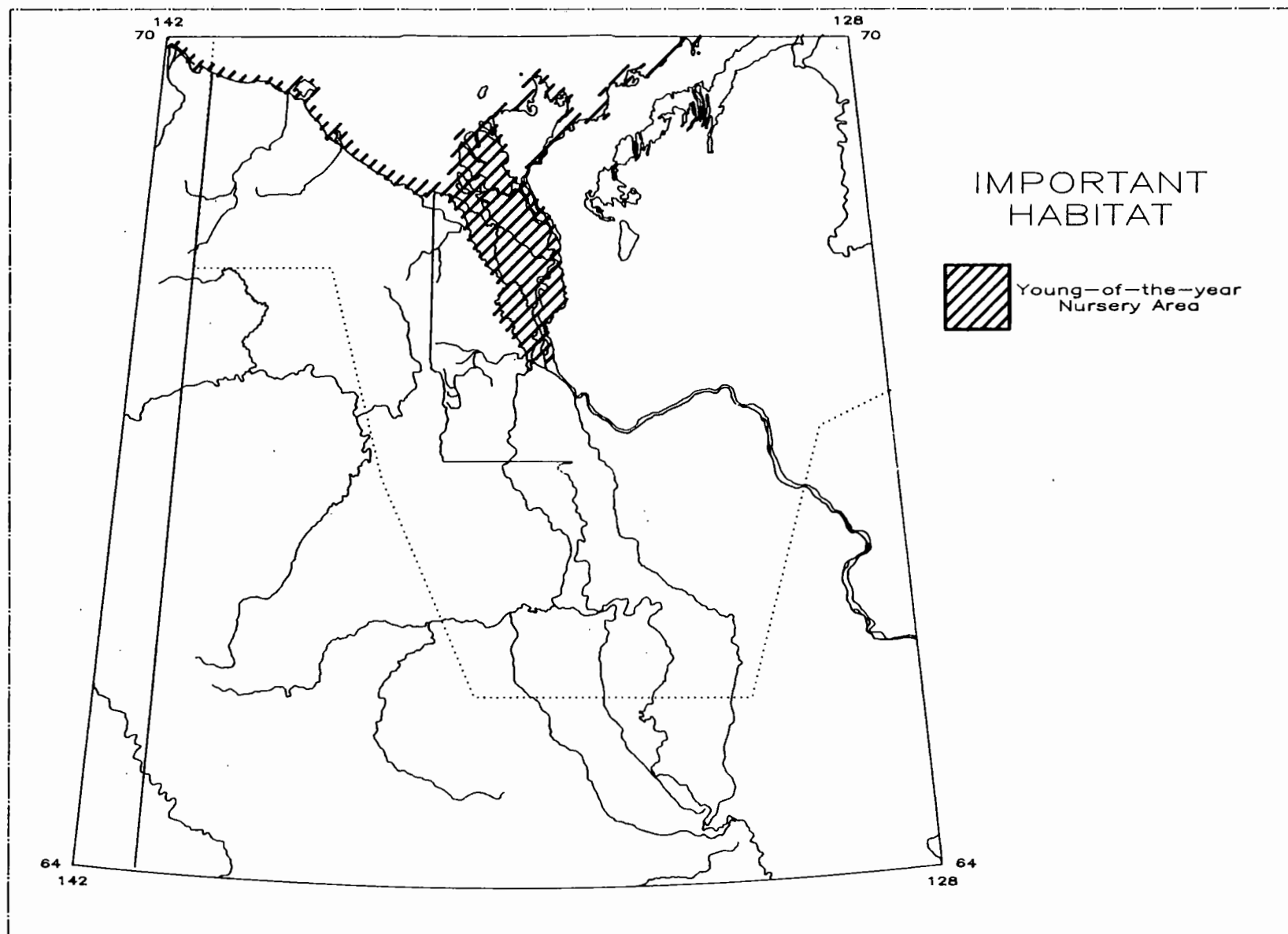
PEEL RIVER



ARCTIC CISCO
(*Coregonus autumnalis*)

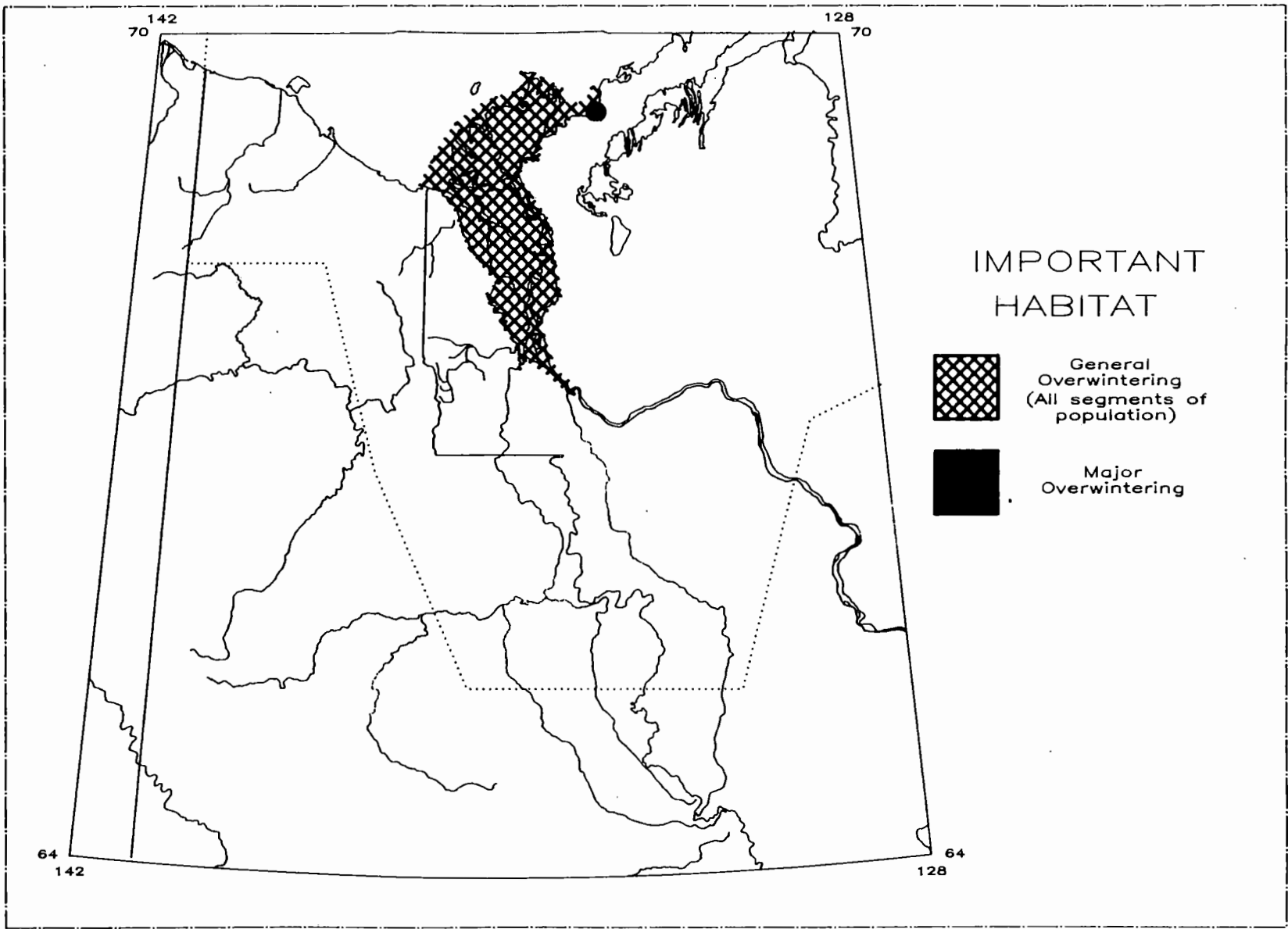
PEEL RIVER







ARCTIC CISCO
(*Coregonus autumnalis*)

PEEL RIVER

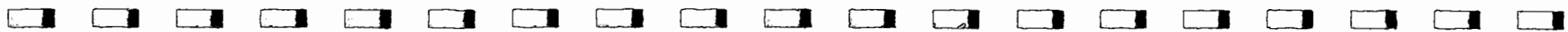


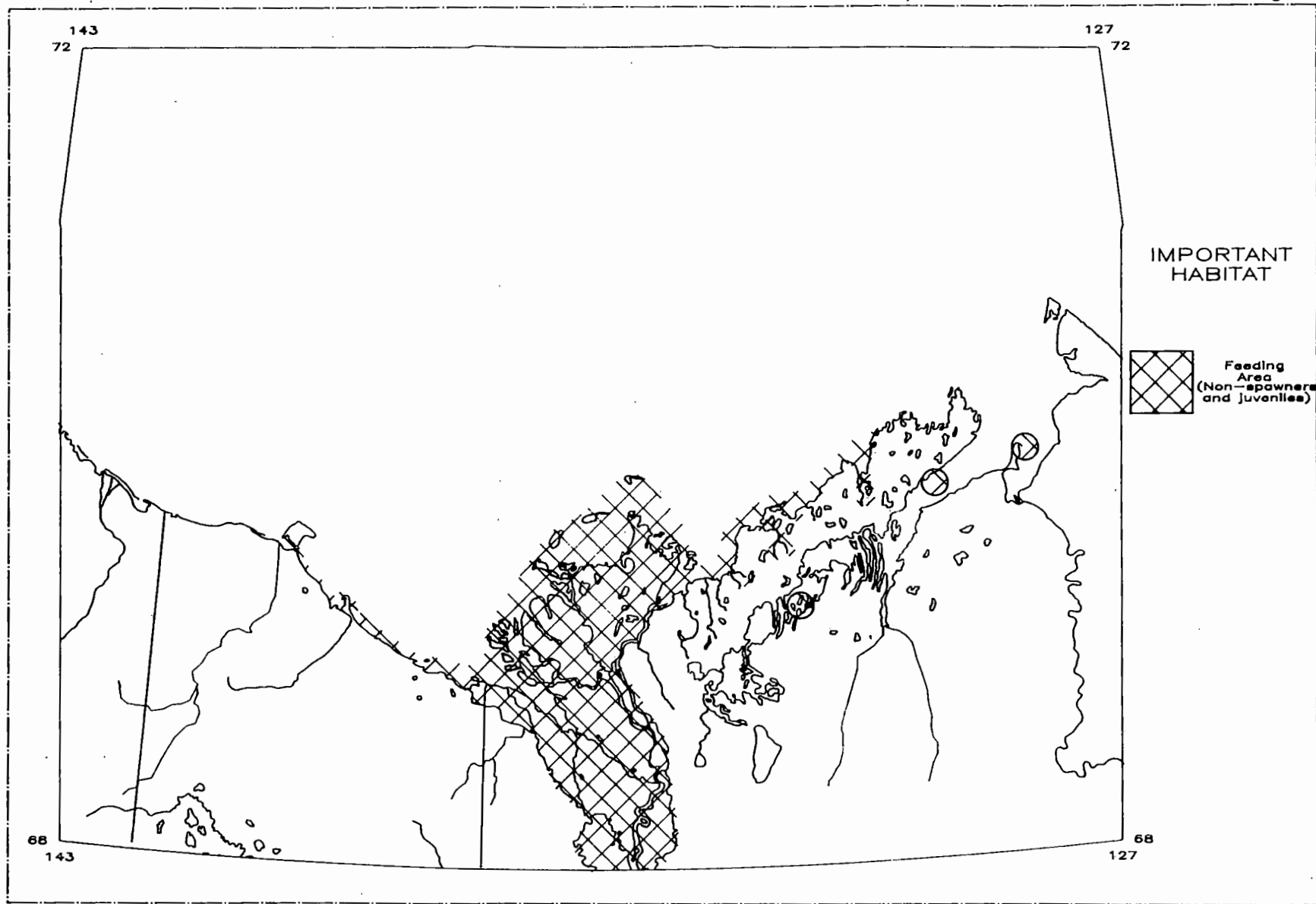
IMPORTANT HABITAT

-  General Overwintering (All segments of population)
-  Major Overwintering

ARCTIC CISCO
(*Coregonus autumnalis*)

PEEL RIVER





LEAST CISCO (Anadromous Type)
(*Coregonus sardinella*)

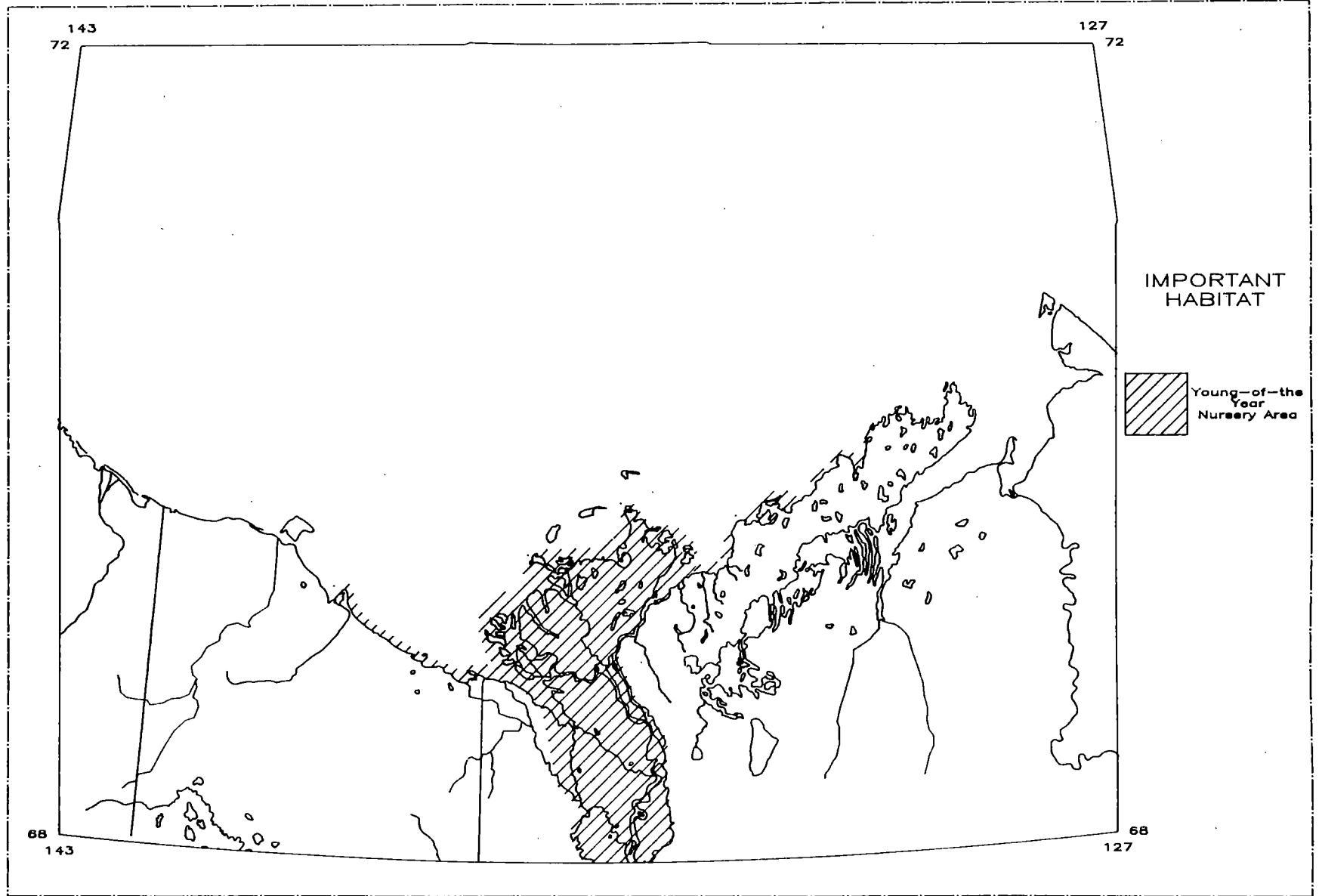
Firth River



LEAST CISCO (Anadromous Type)
(*Coregonus sardinella*)

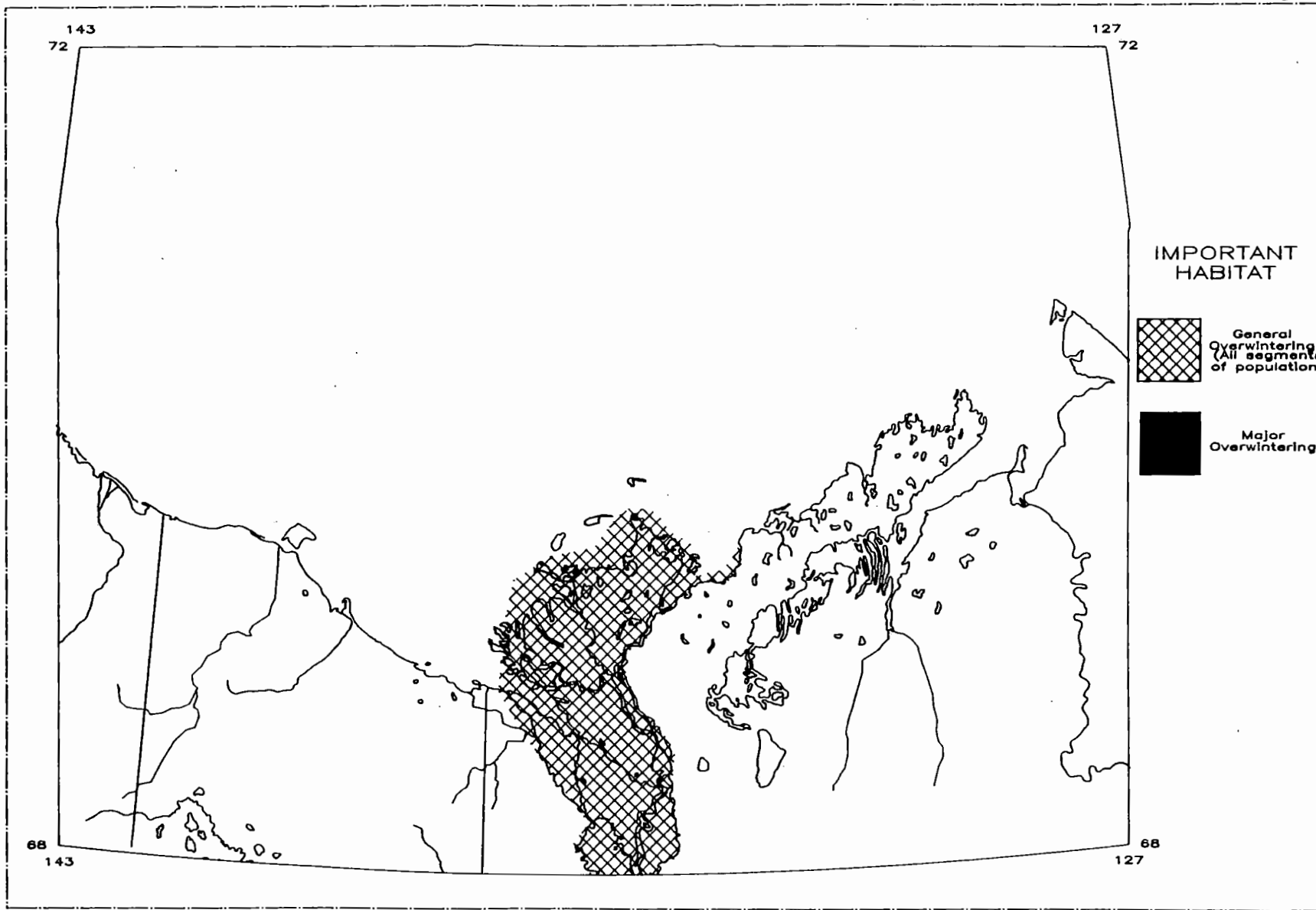
Firth River





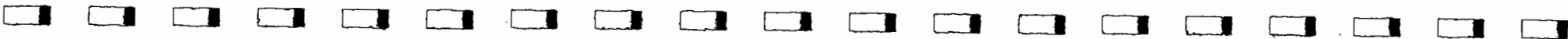
LEAST CISCO (Anadromous Type)
(*Coregonus sardinella*)

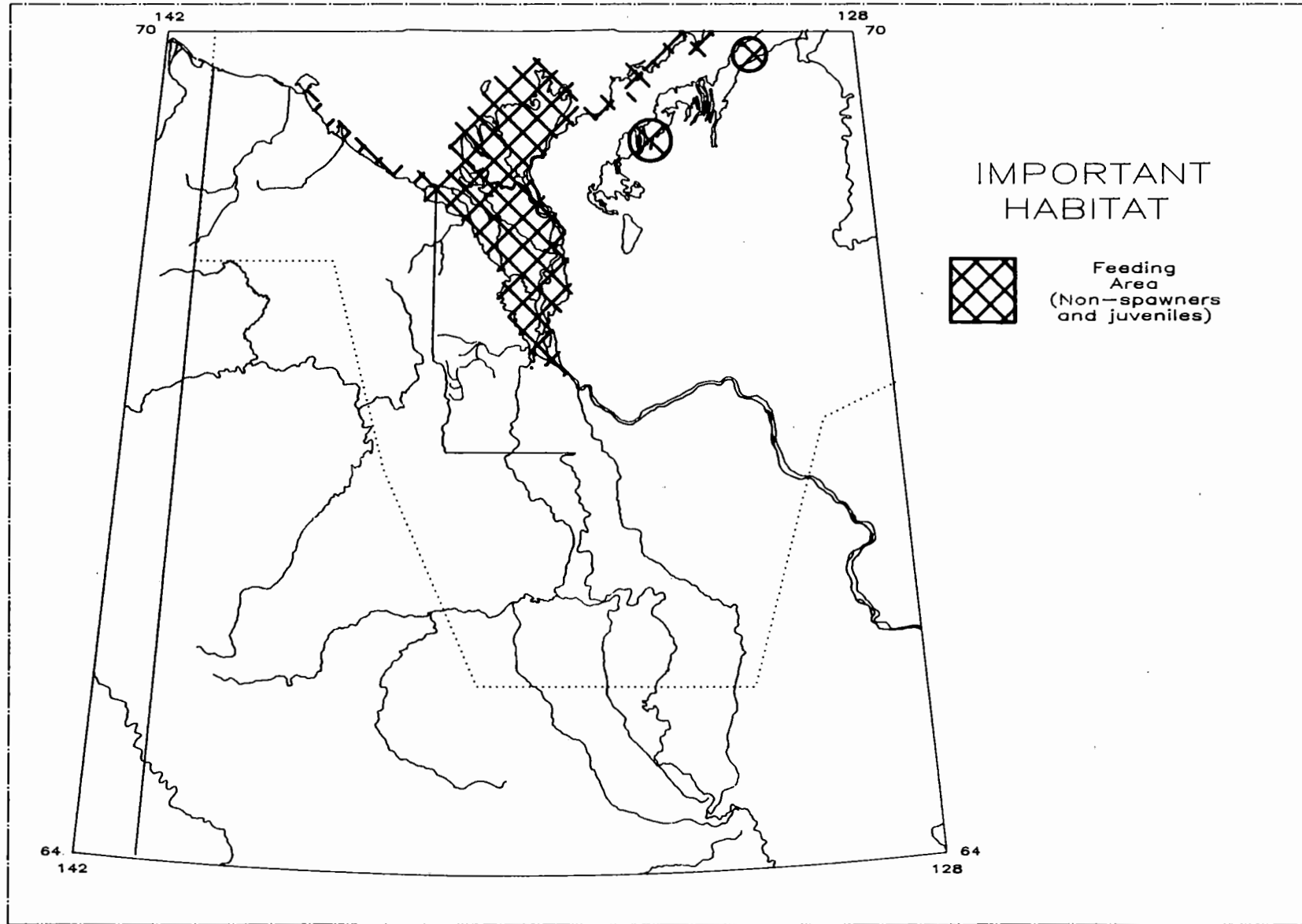
Firth River



LEAST CISCO (Anadromous Type)
(*Coregonus sardinella*)

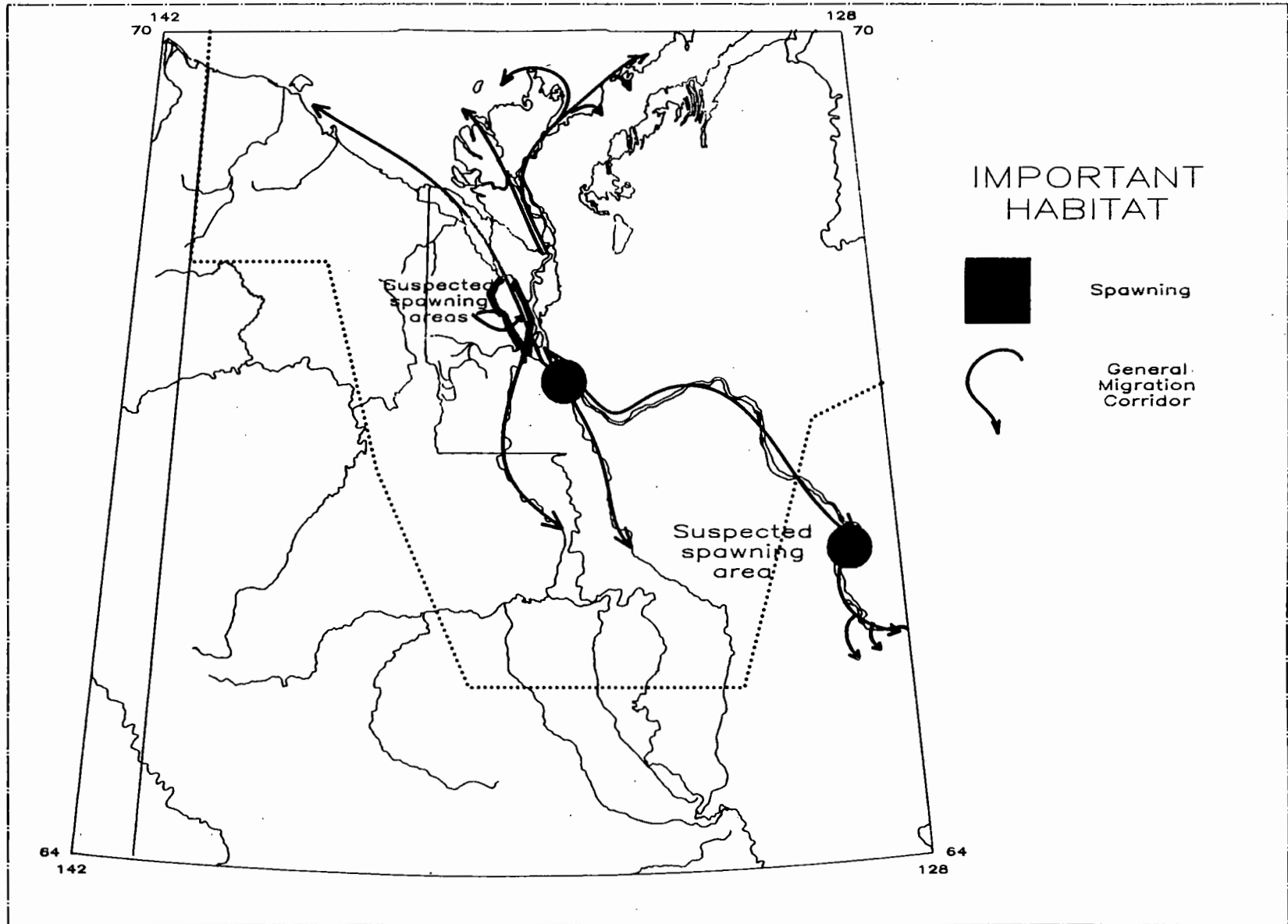
Firth River





LEAST CISCO
(*Coregonus sardinella*)

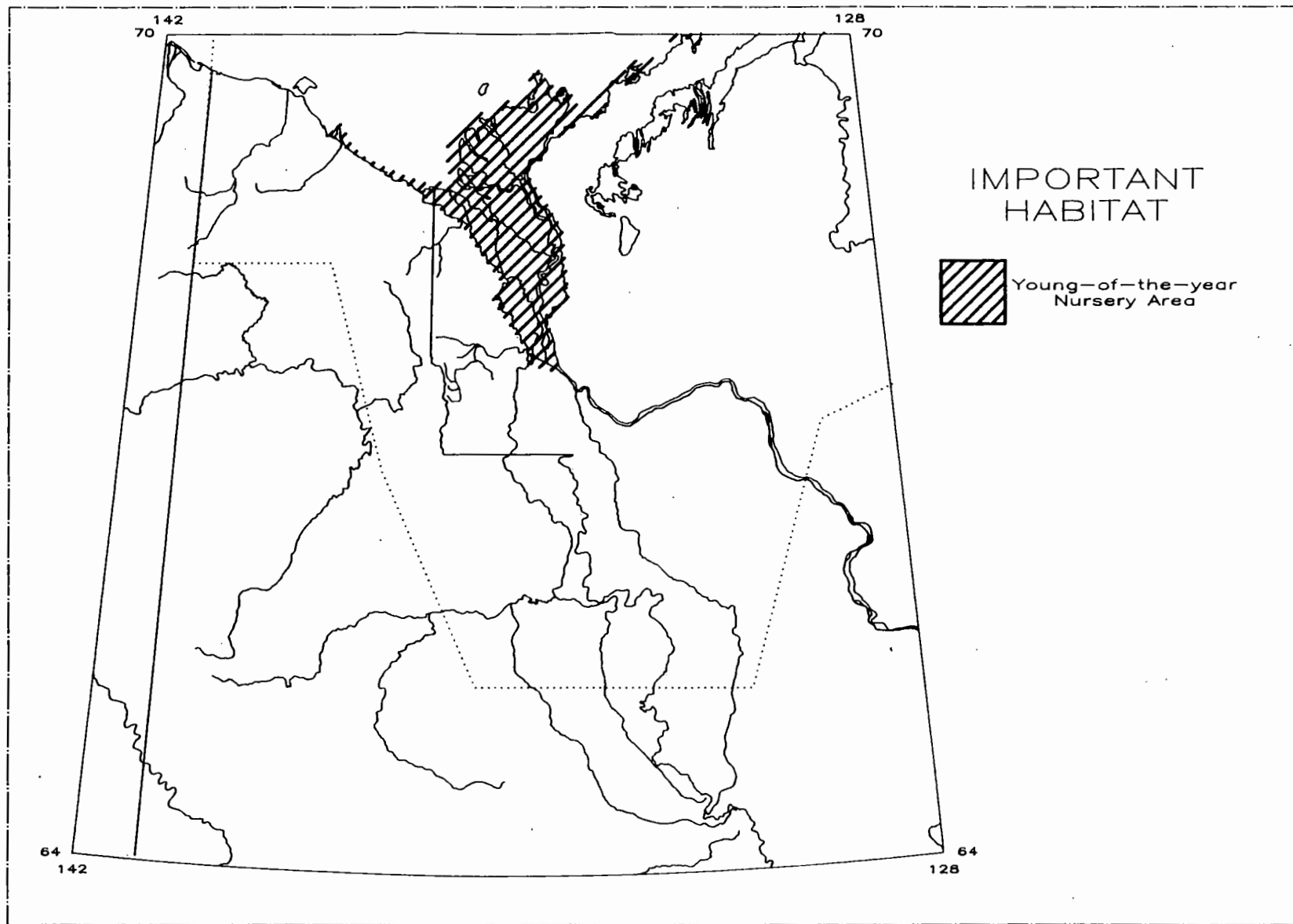
PEEL RIVER



LEAST CISCO
(*Coregonus sardinella*)

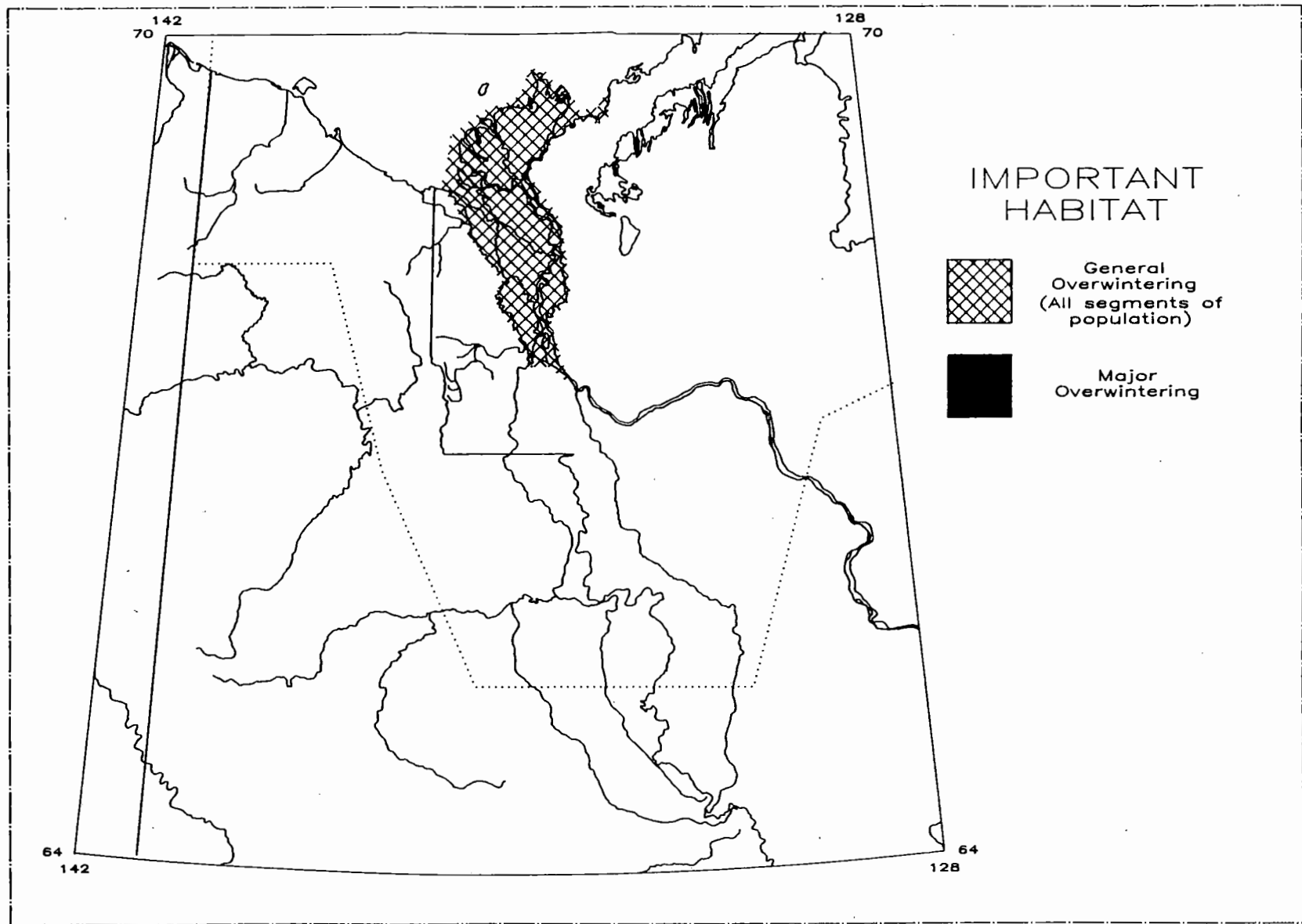
PEEL RIVER





LEAST CISCO
(*Coregonus sardinella*)

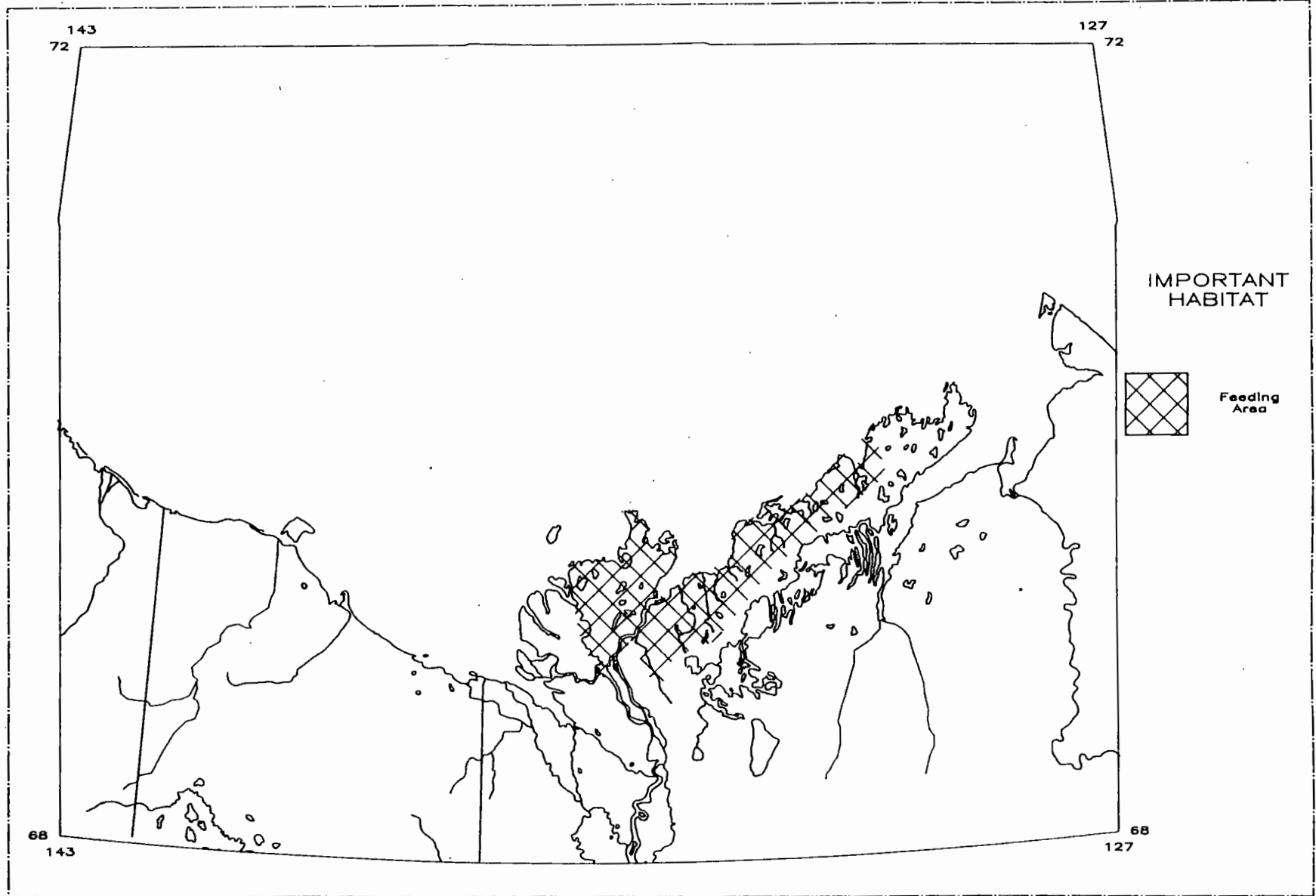
PEEL RIVER



LEAST CISCO
(*Coregonus sardinella*)

PEEL RIVER





BROAD WHITEFISH
(*Coregonus nasus*)

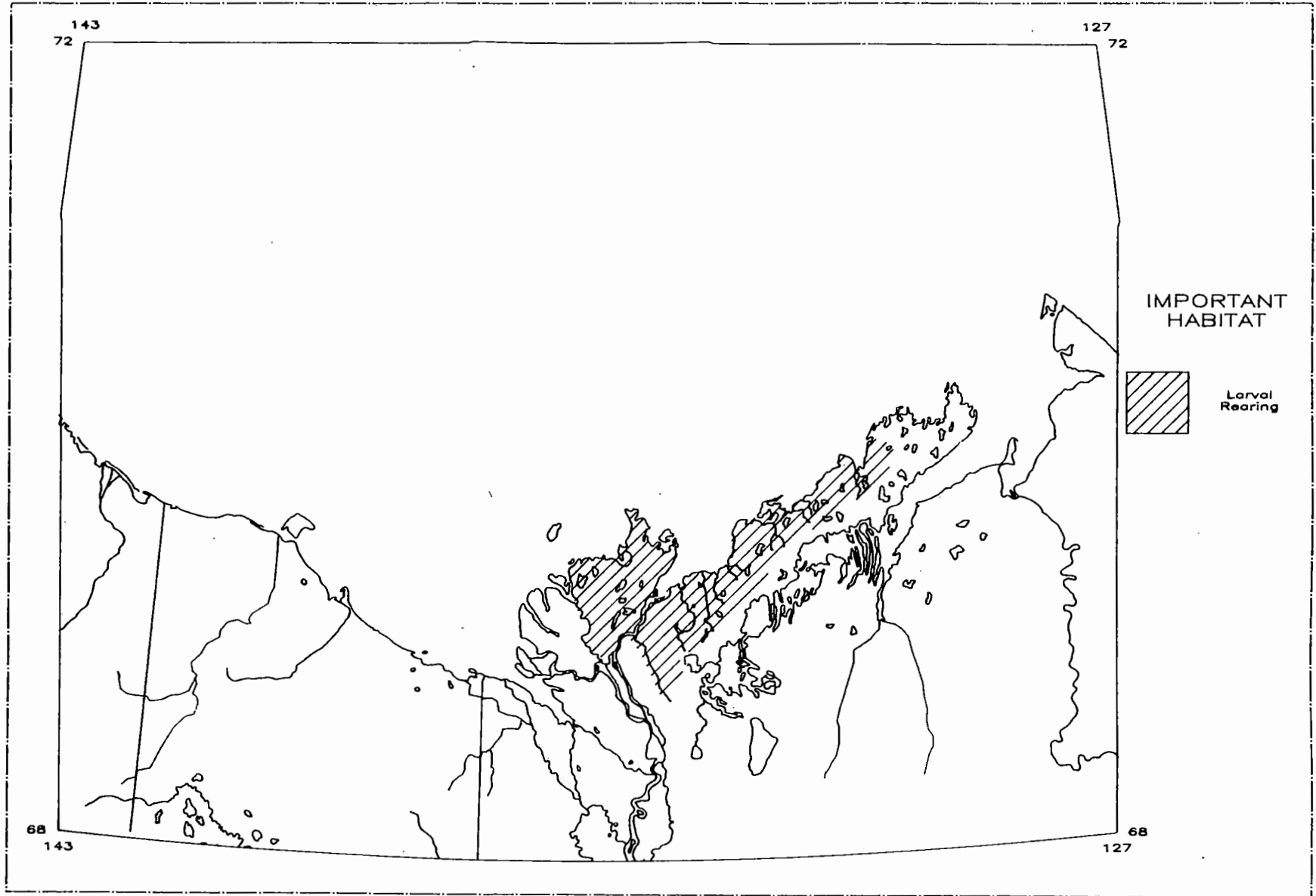
Firth River



BROAD WHITEFISH
(*Coregonus nasus*)

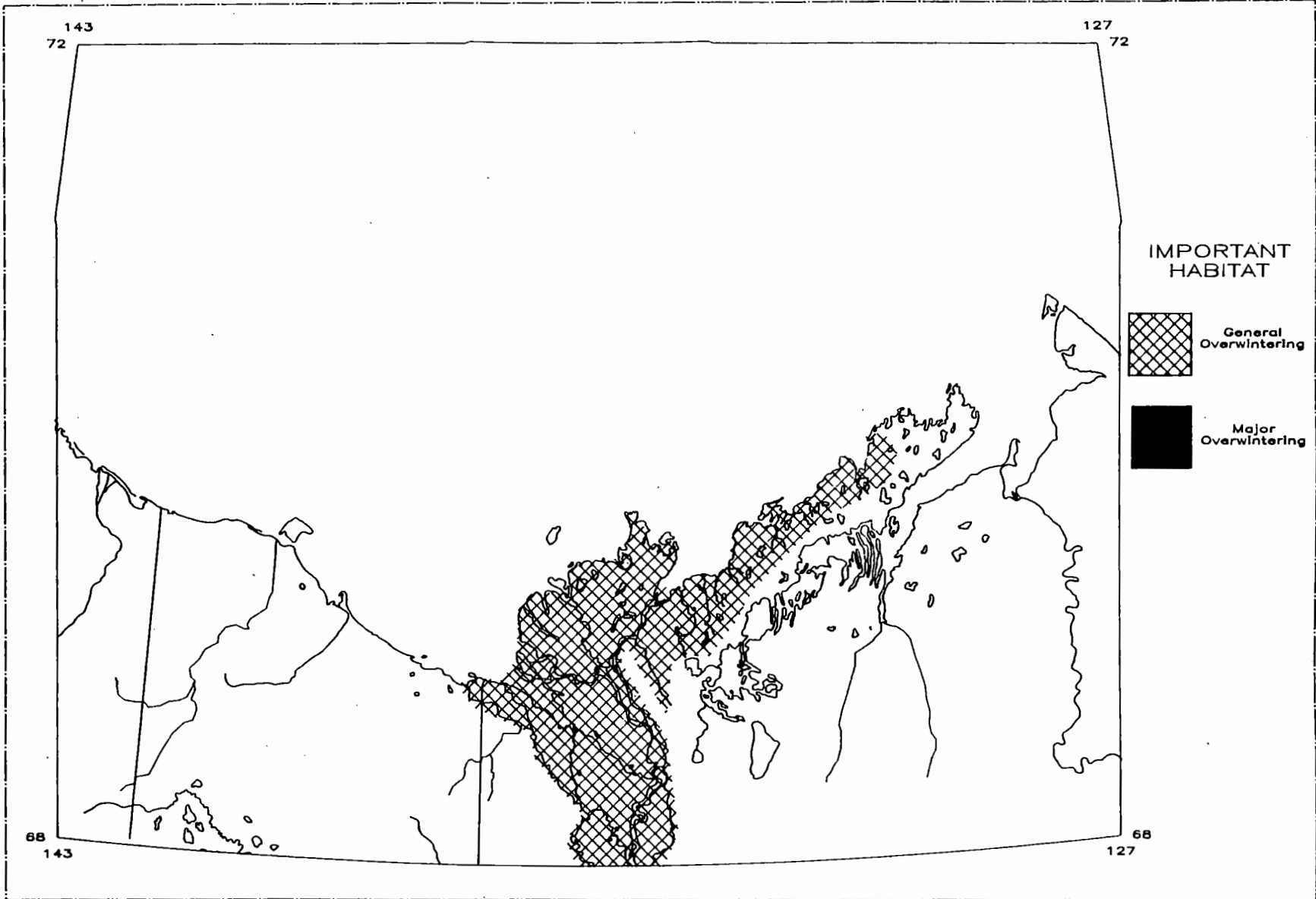
Firth River





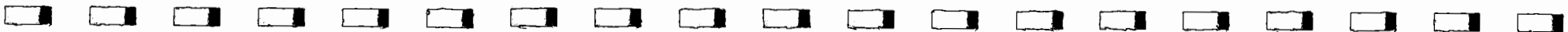
BROAD WHITEFISH
(*Coregonus nasus*)

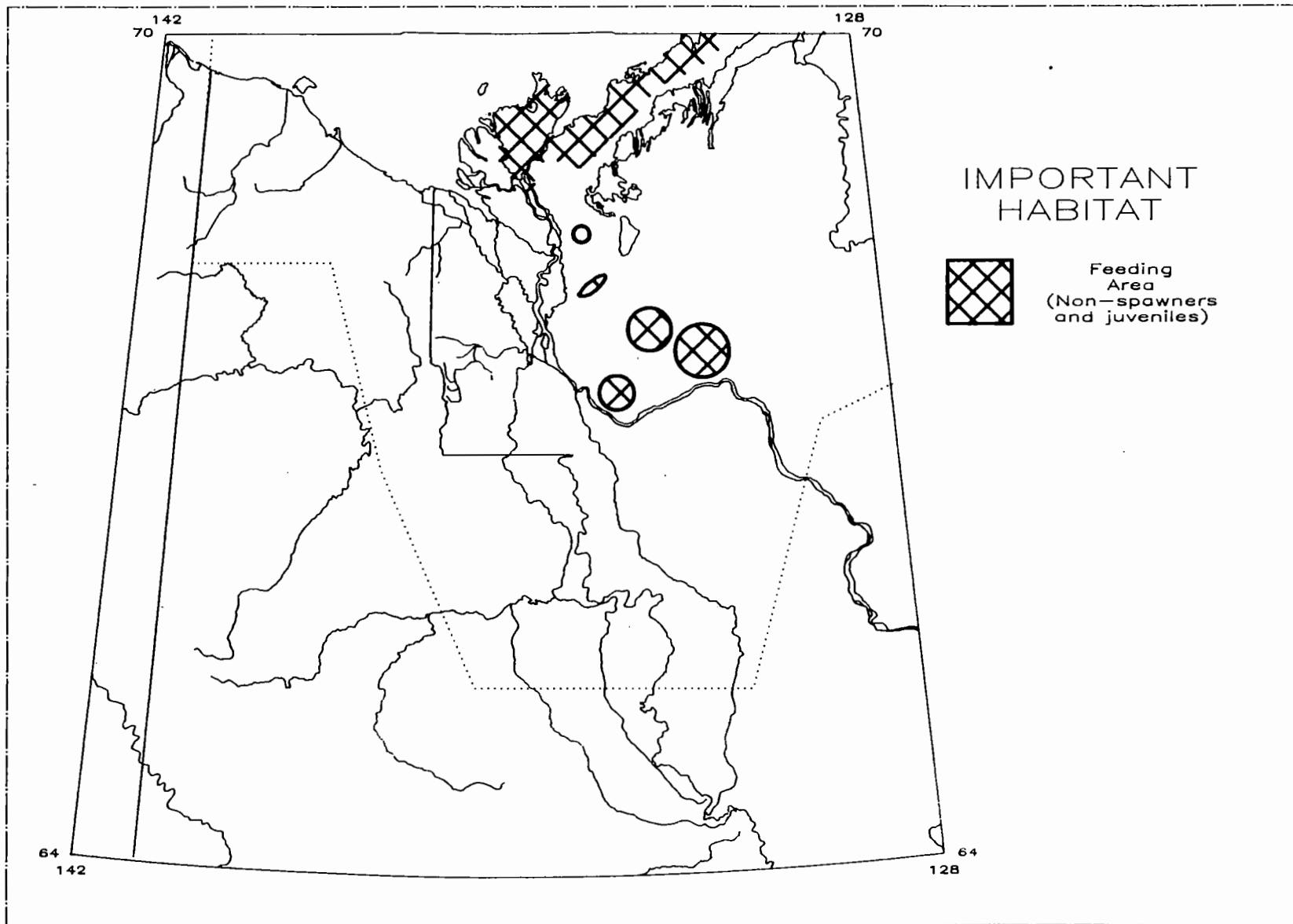
Firth River



BROAD WHITEFISH
(*Coregonus nasus*)

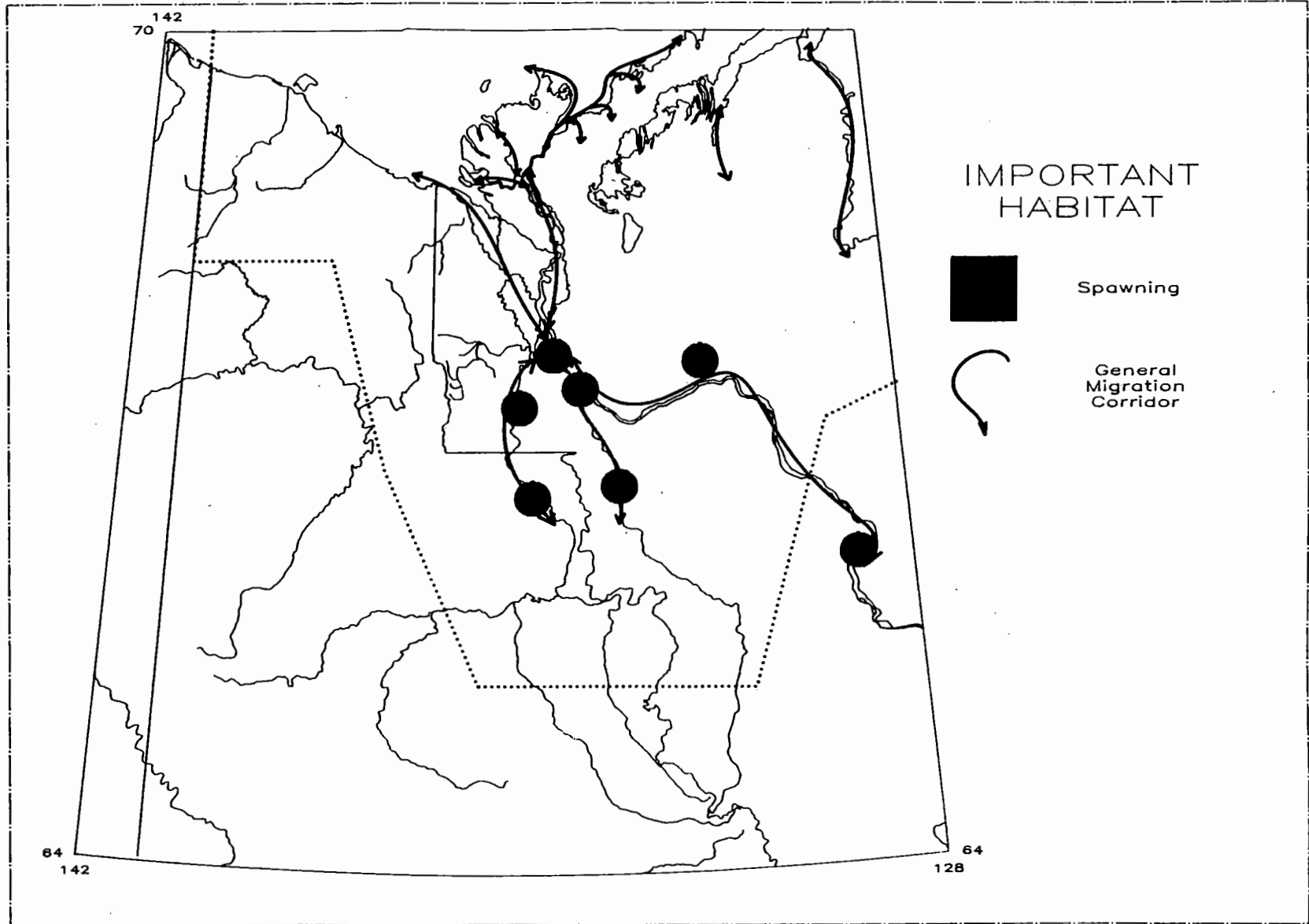
Firth River





BROAD WHITEFISH
(Coregonus nasus)

PEEL RIVER

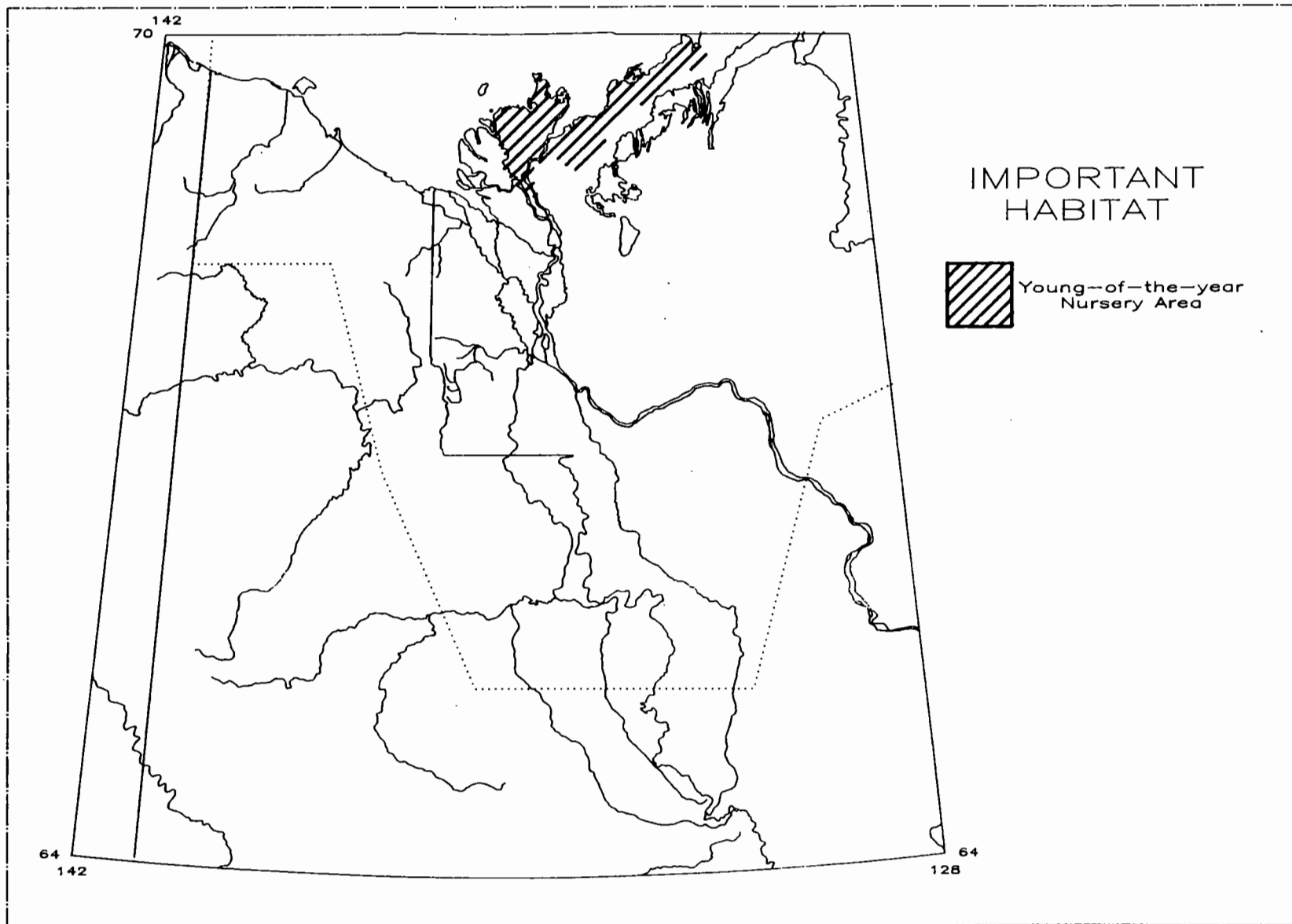


BROAD WHITEFISH
(*Coregonus nasus*)

PEEL RIVER

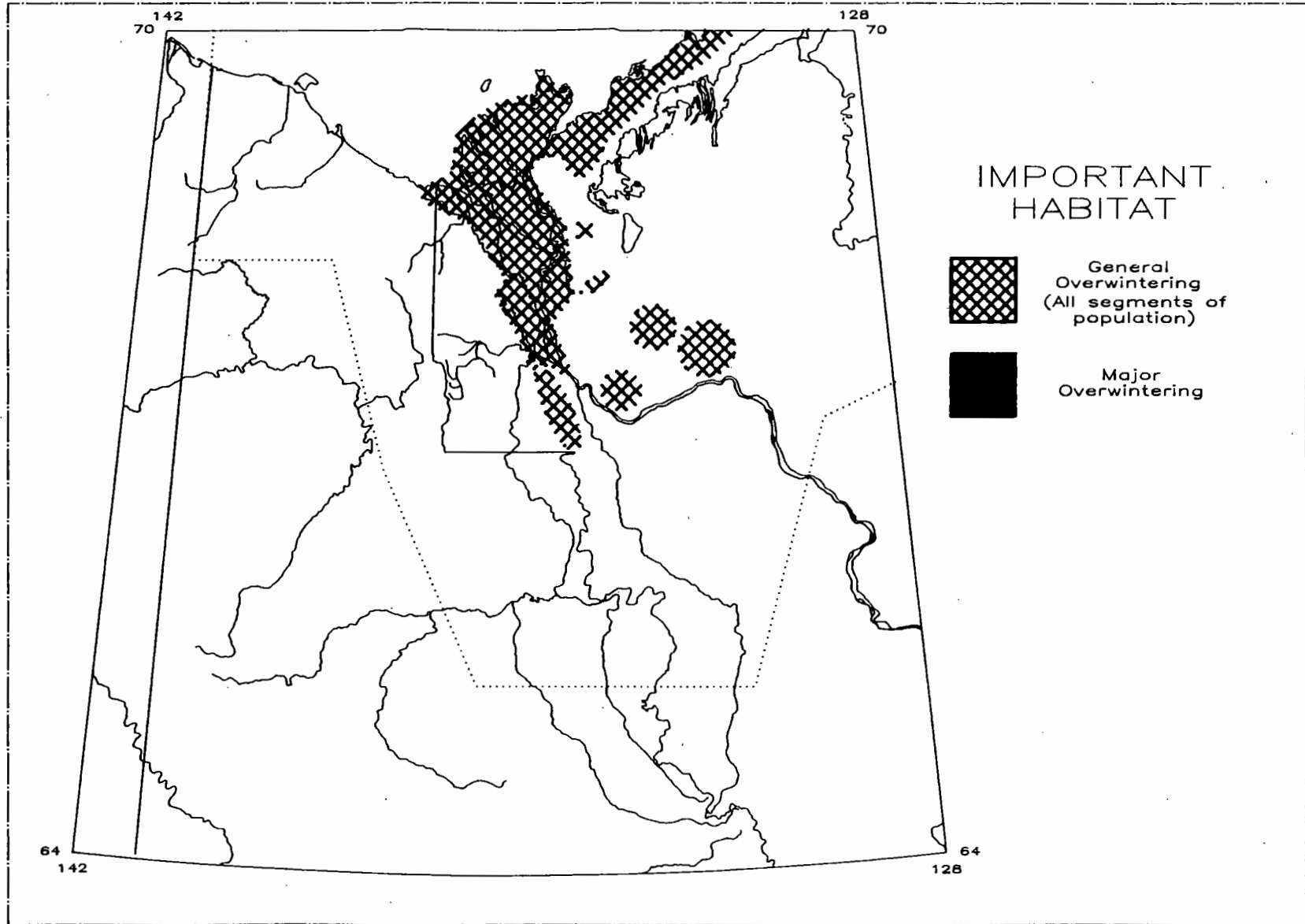


BDWT Nursery Areas



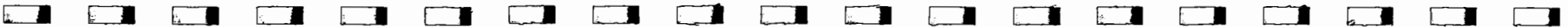
BROAD WHITEFISH
(Coregonus nasus)

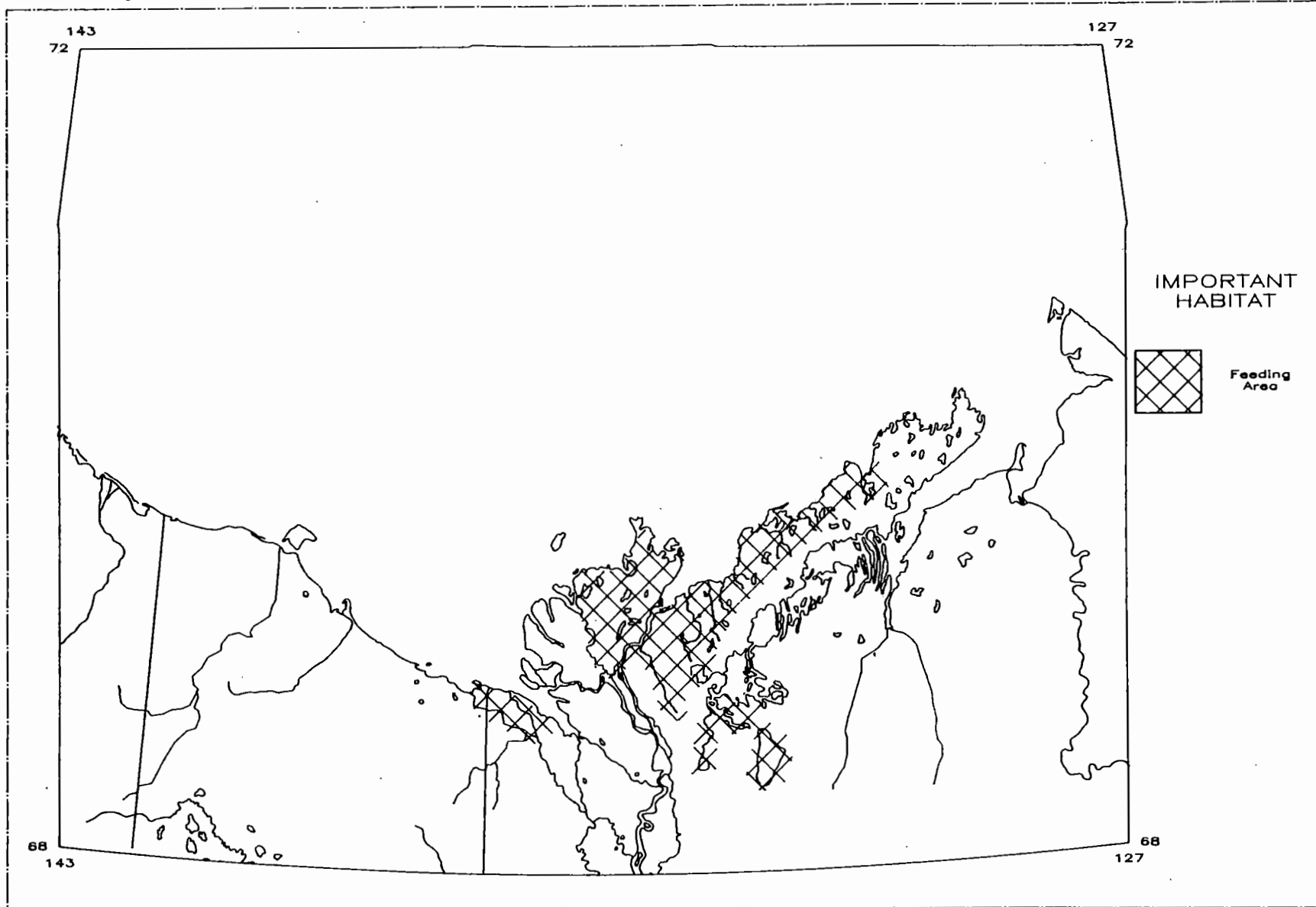
PEEL RIVER



BROAD WHITEFISH
(*Coregonus nasus*)

PEEL RIVER





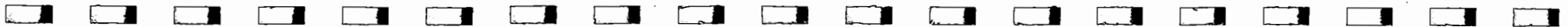
LAKE WHITEFISH
(*Coregonus clupeaformis*)

Firth River



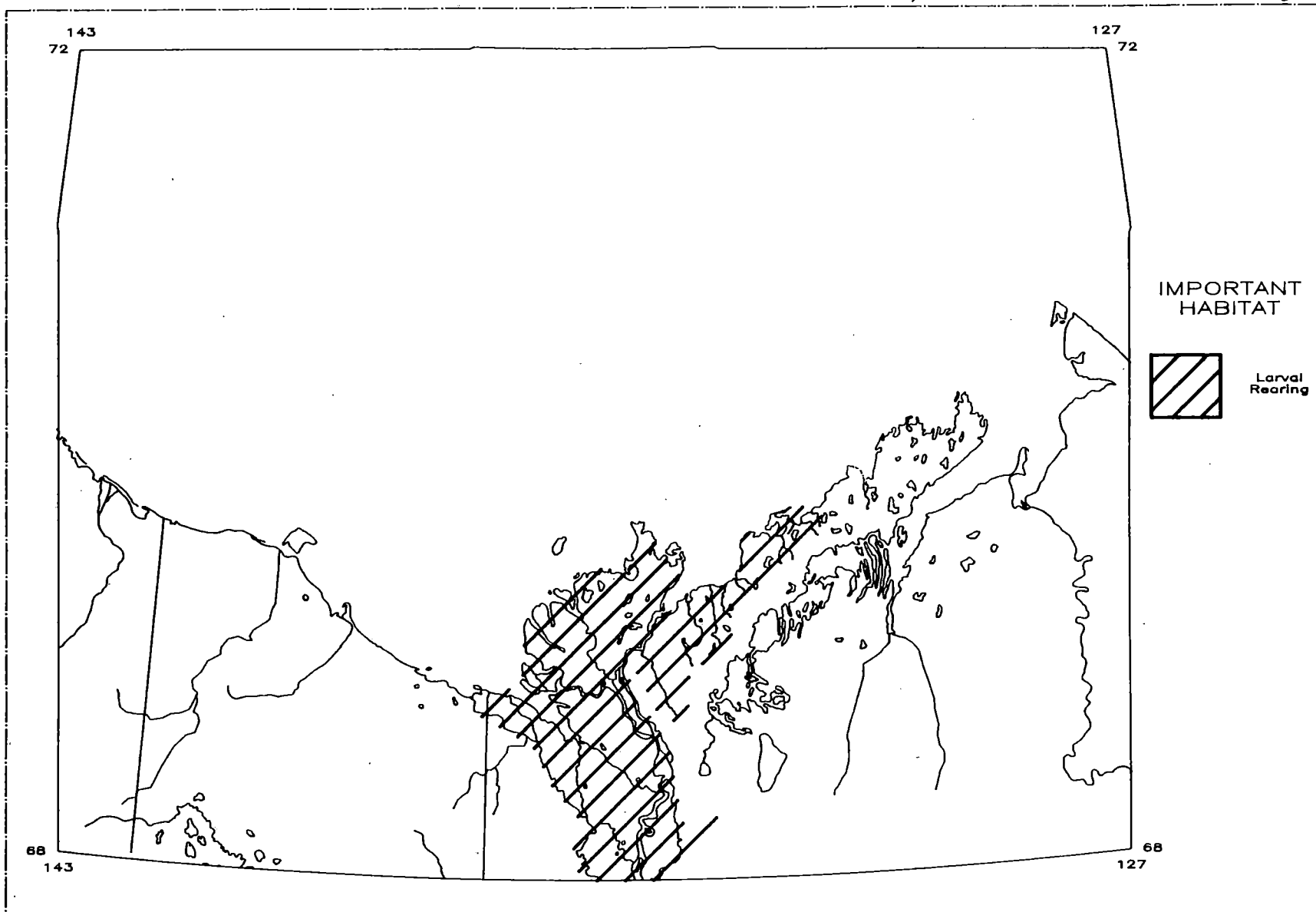
LAKE WHITEFISH
(*Coregonus clupeaformis*)

Firth River



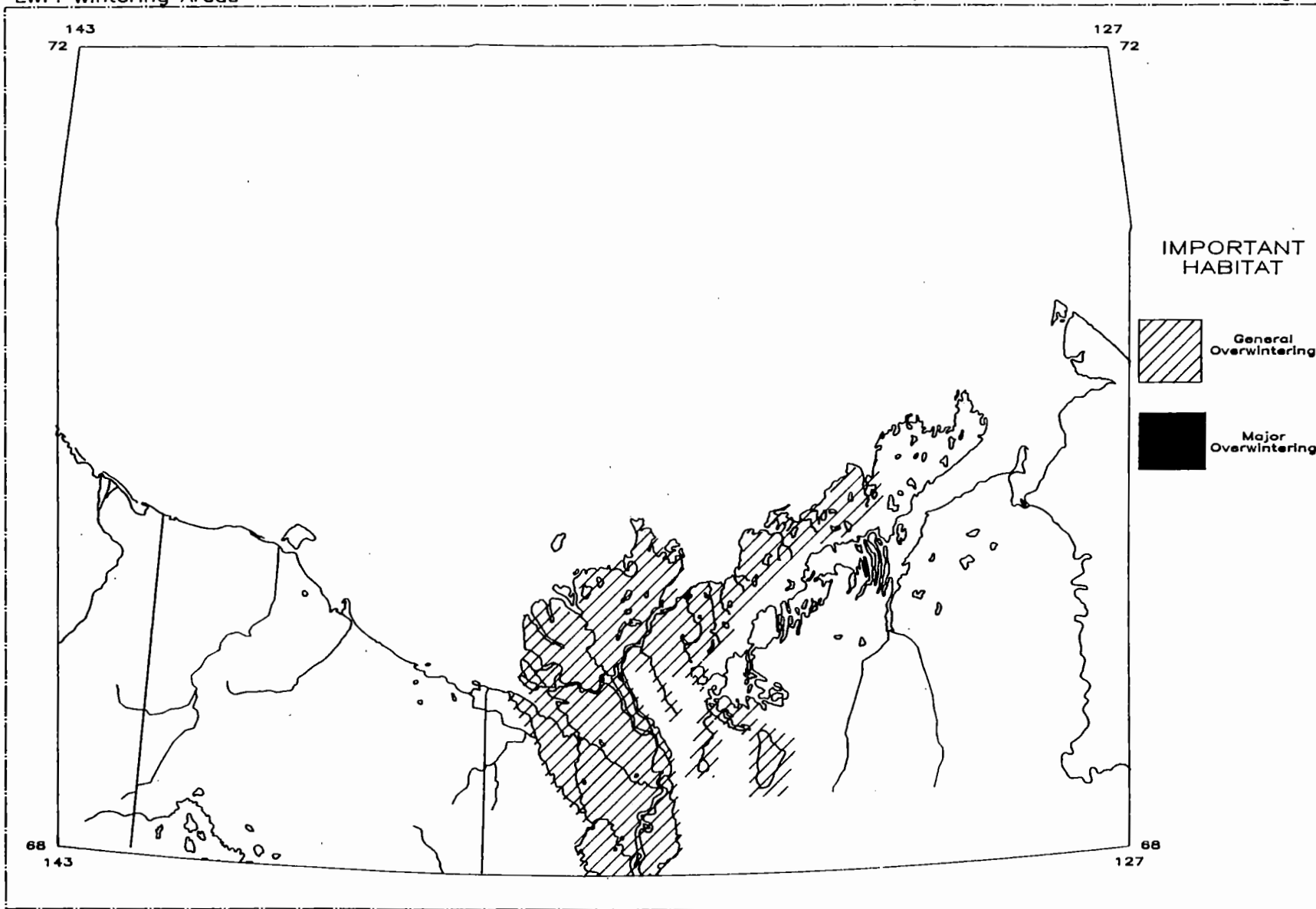
LWF: Larval Areas

Mackenzie Delta / Beaufort Sea Land Use Planning



LAKE WHITEFISH
(*Coregonus clupeaformis*)

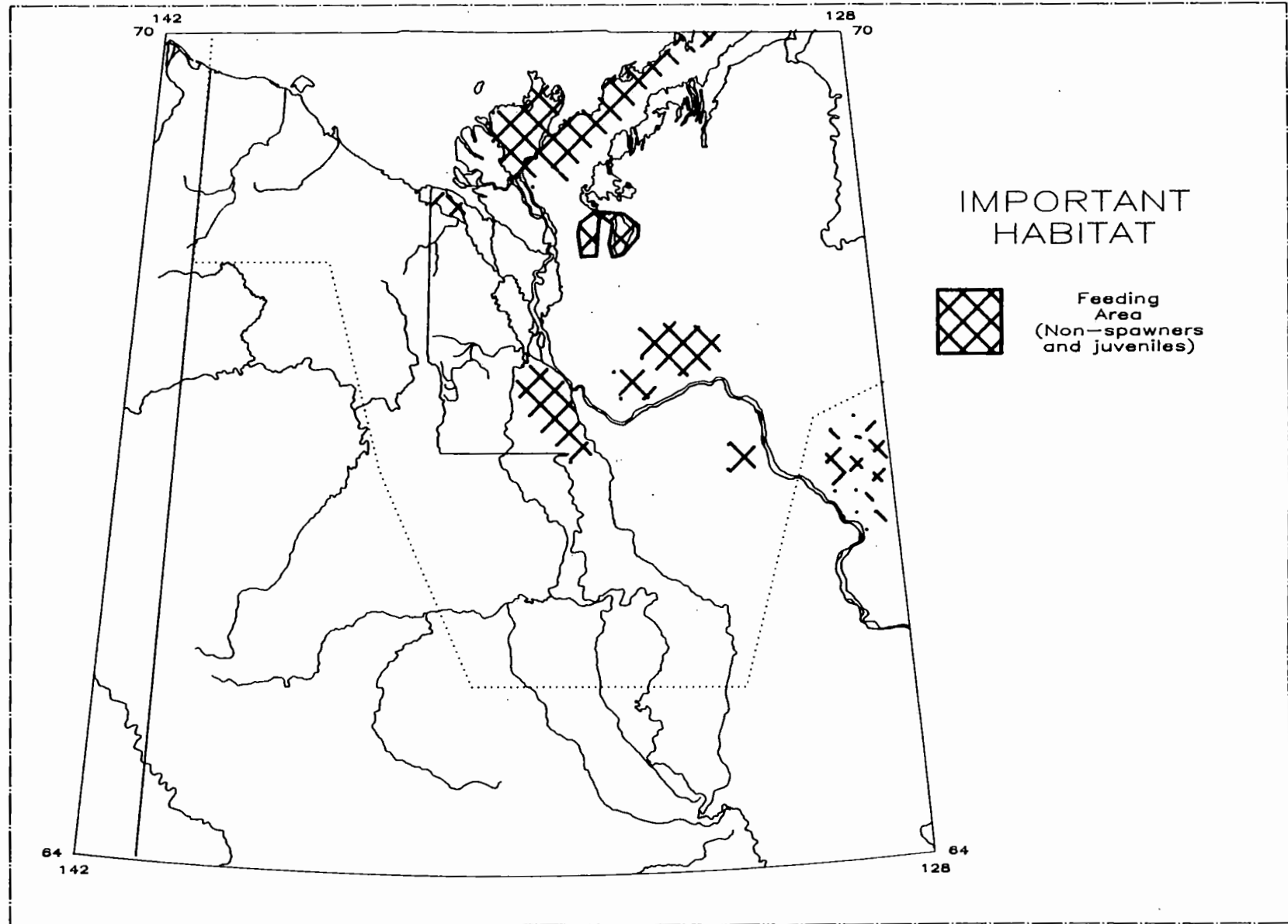
Firth River



LAKE WHITEFISH
(*Coregonus clupeaformis*)

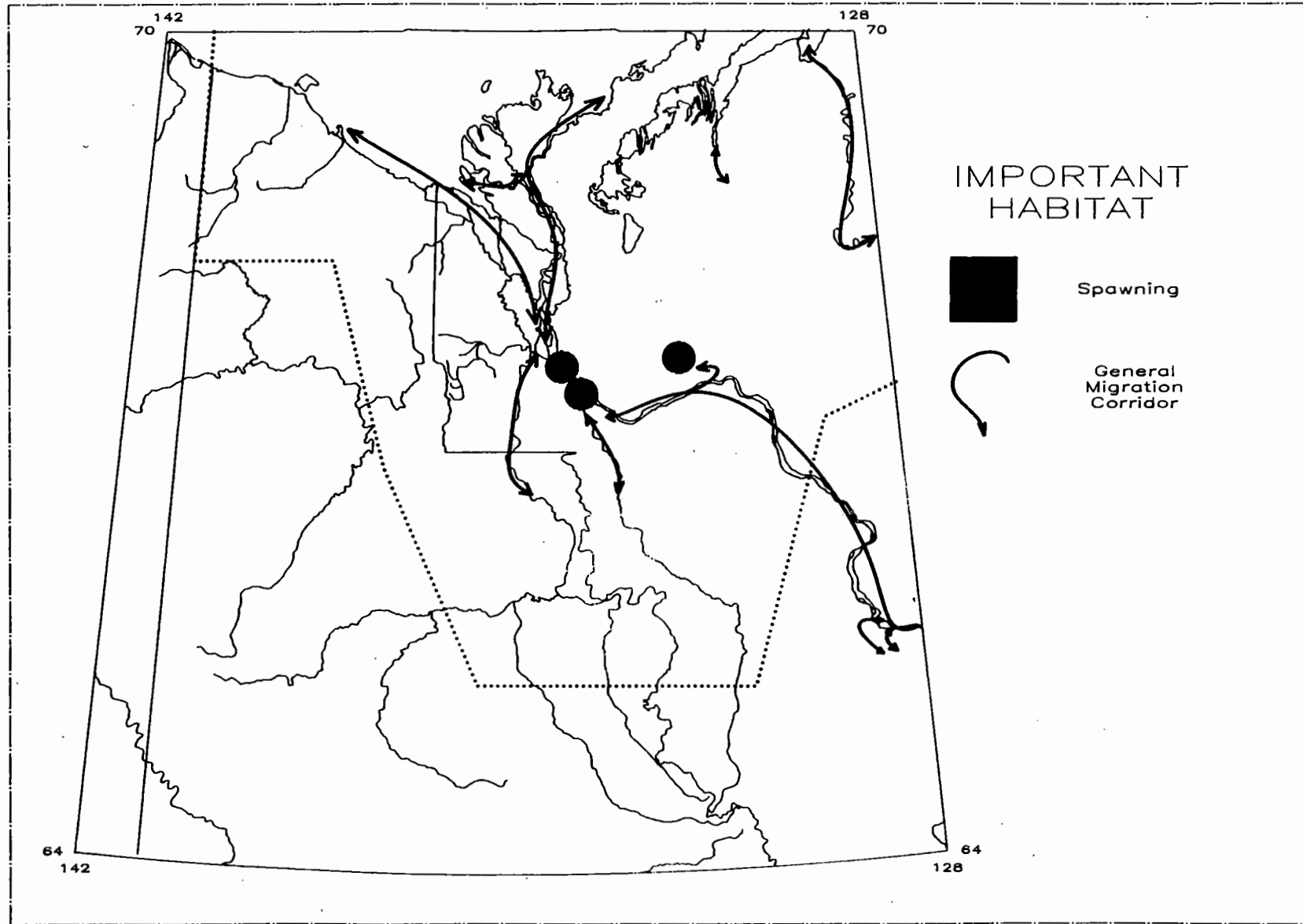
Firth River





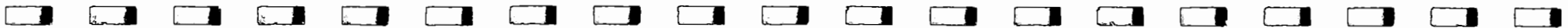
LAKE WHITEFISH
(*Coregonus clupeaformis*)

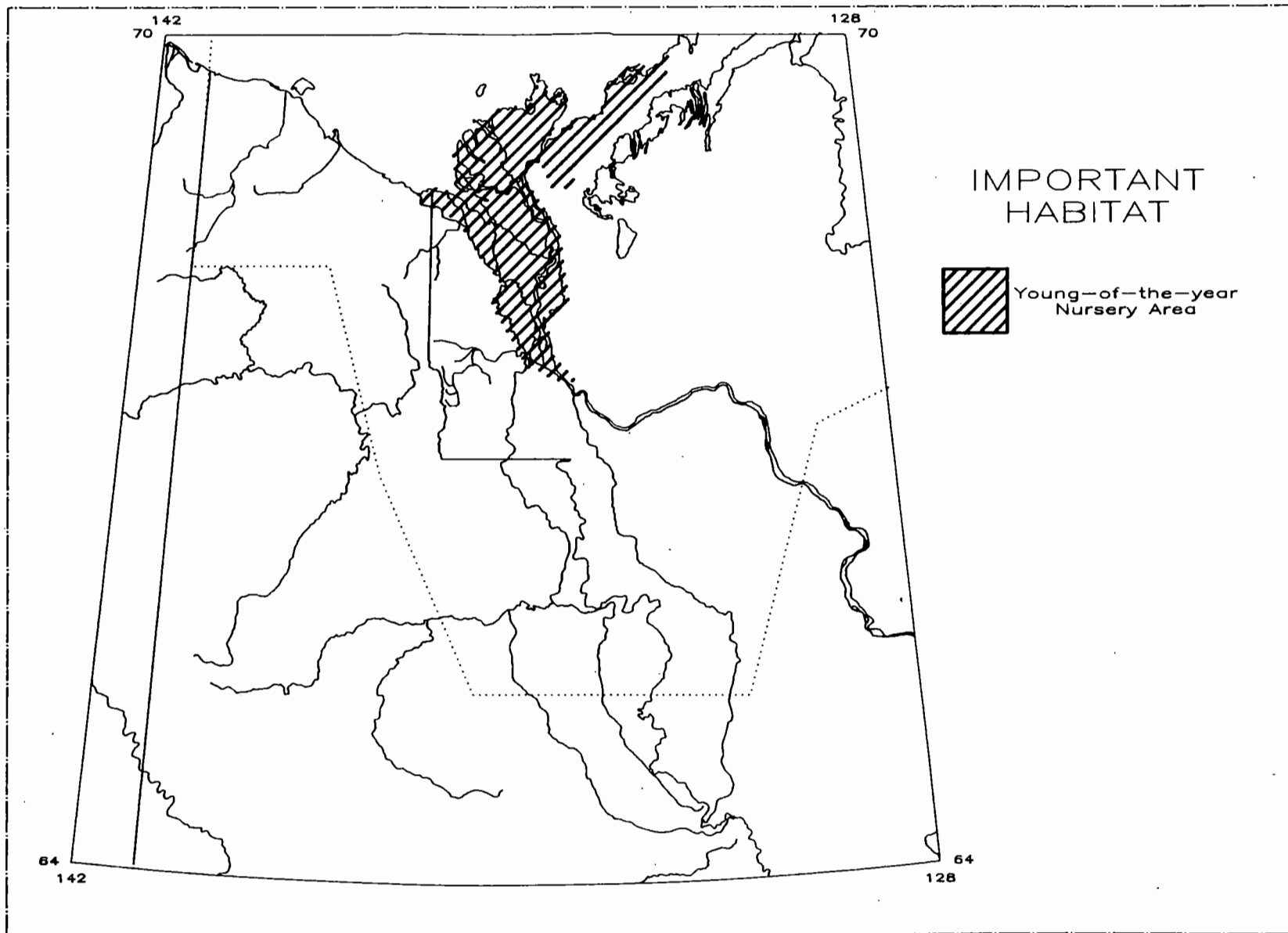
PEEL RIVER



LAKE WHITEFISH
(*Coregonus clupeaformis*)

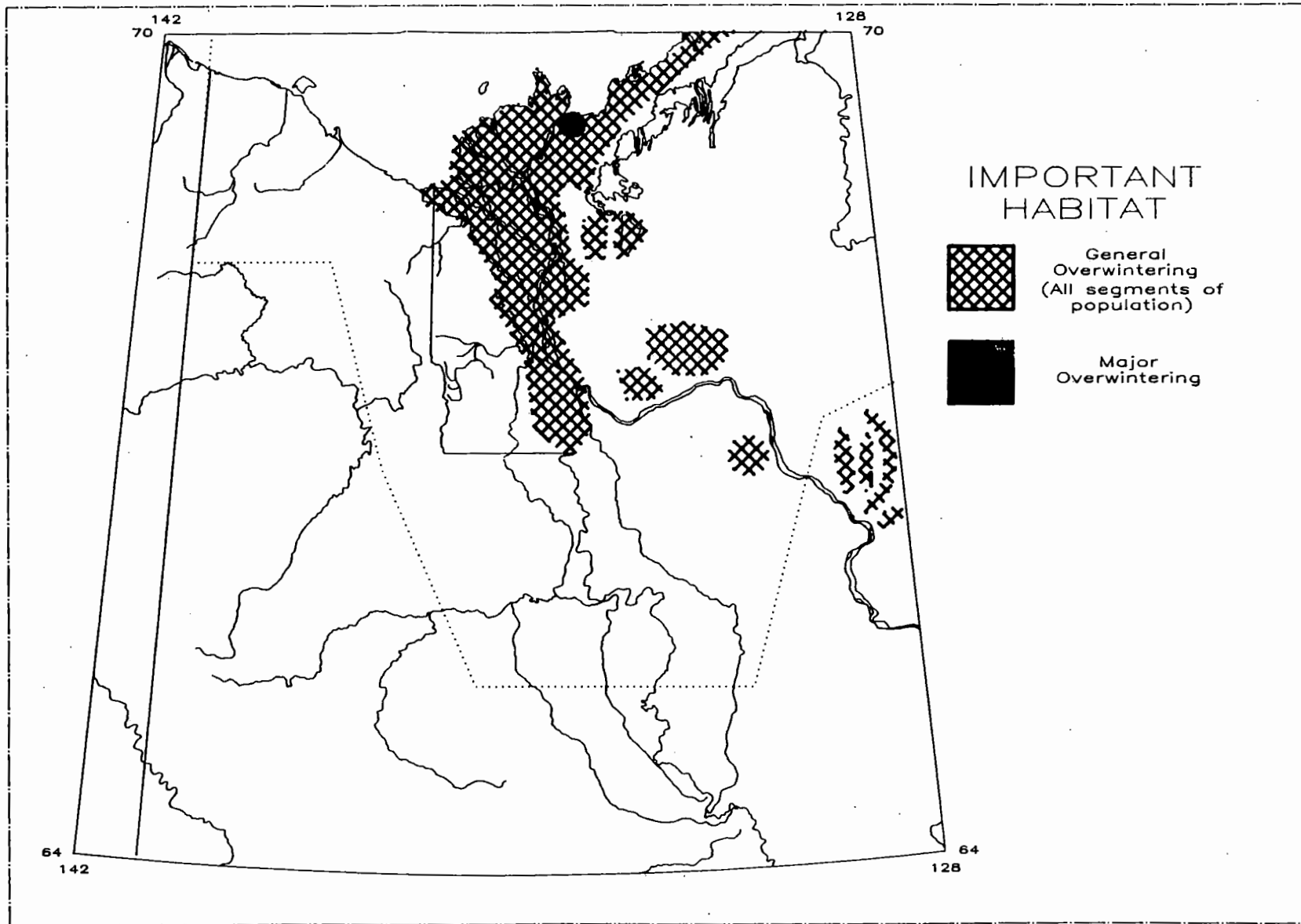
PEEL RIVER





LAKE WHITEFISH
(*Coregonus clupeaformis*)

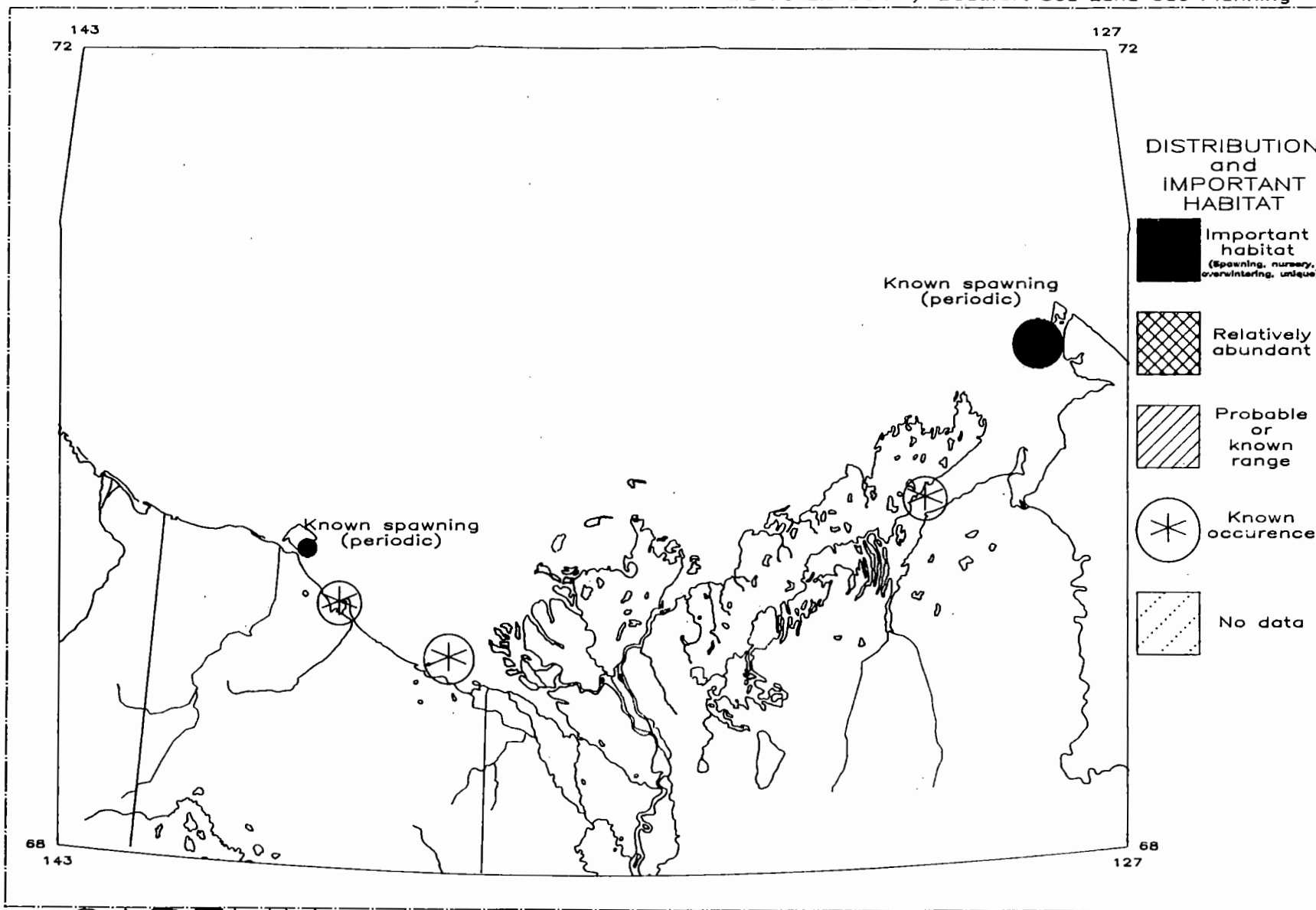
PEEL RIVER



LAKE WHITEFISH
(*Coregonus clupeaformis*)

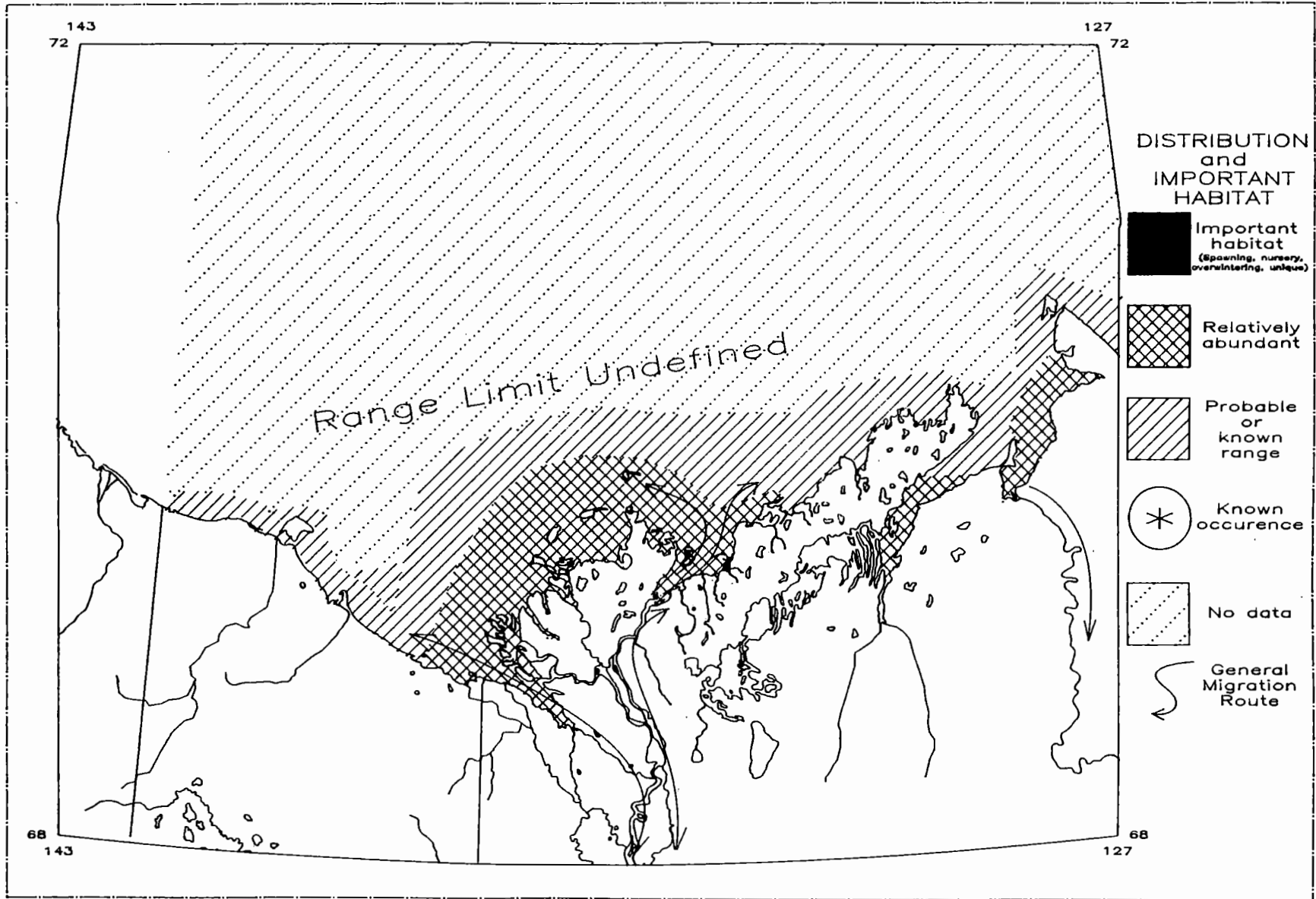
PEEL RIVER





CAPELIN
(*Mallotus villosus*)

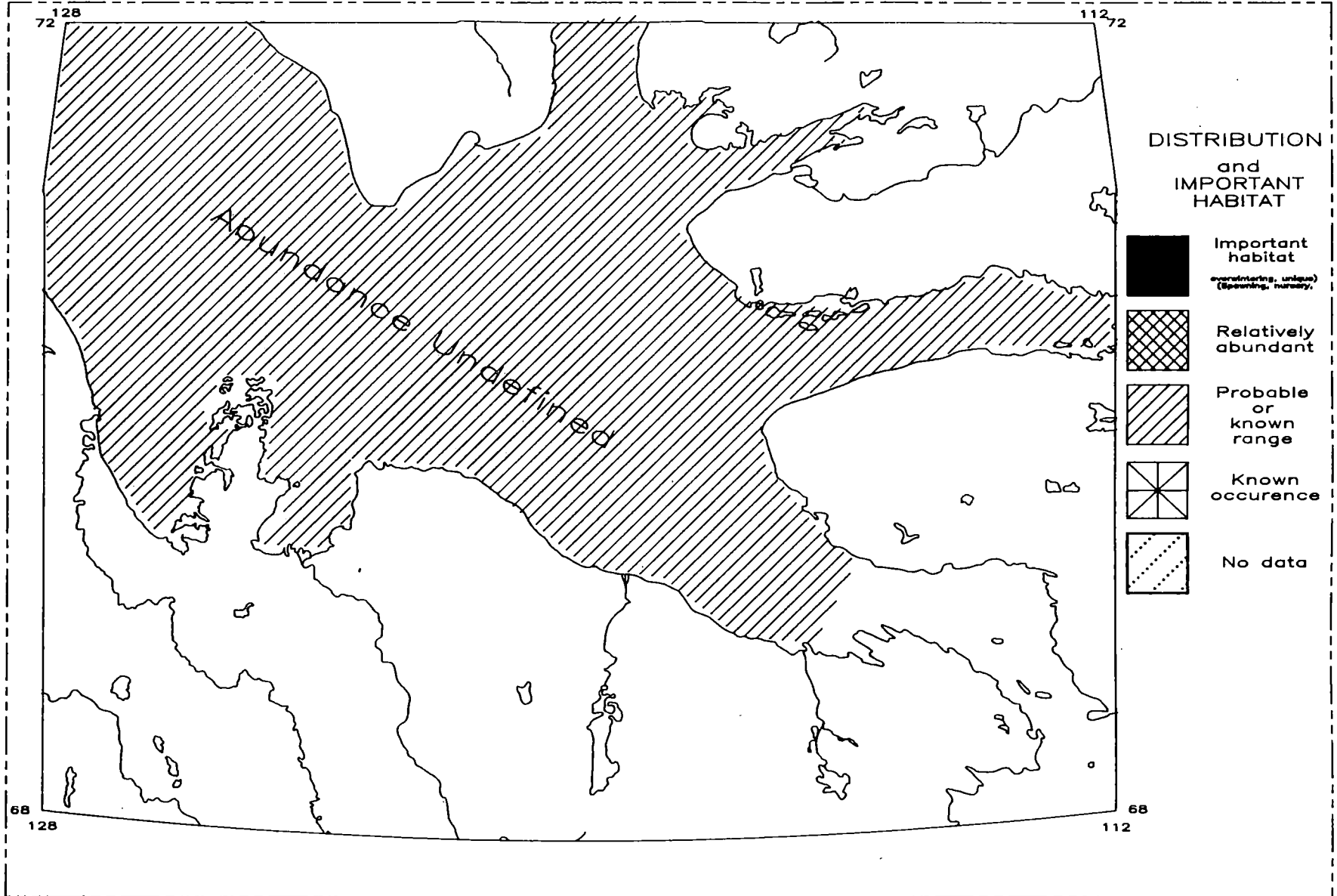
Firth River



RAINBOW SMELT
(*Osmerus mordax*)

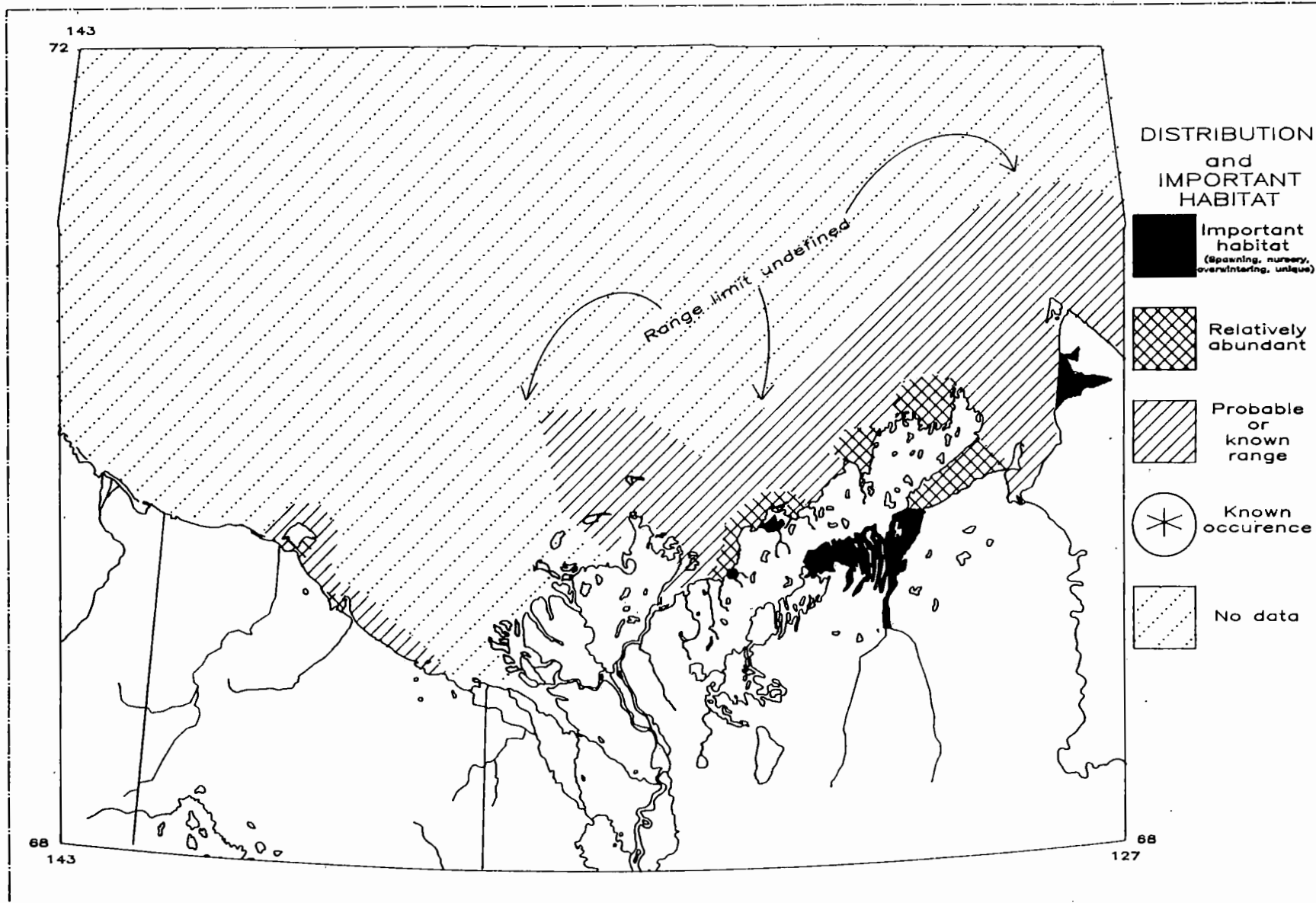
Firth River





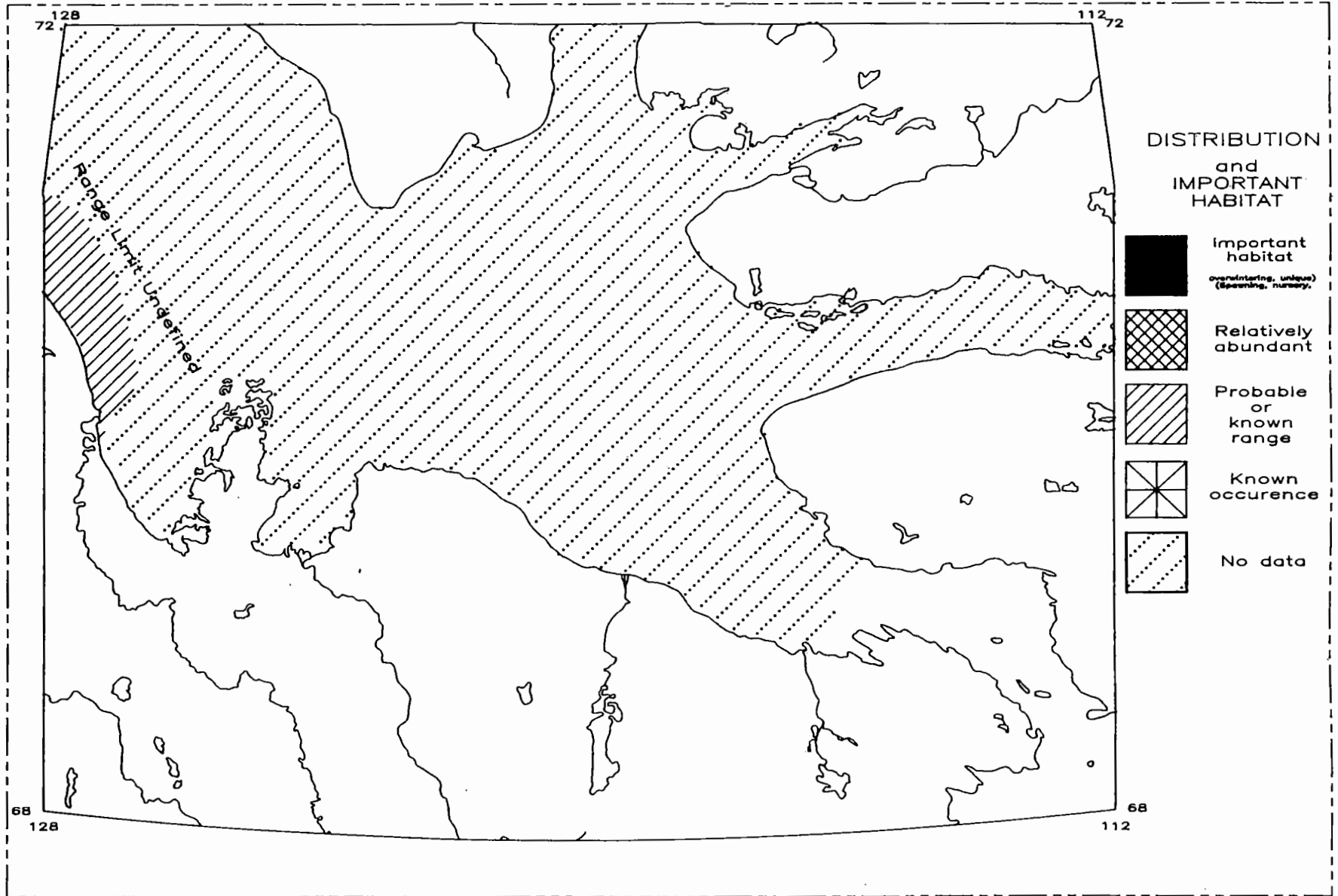
ARCTIC COD
(*Boreogadus saida*)

Horton River



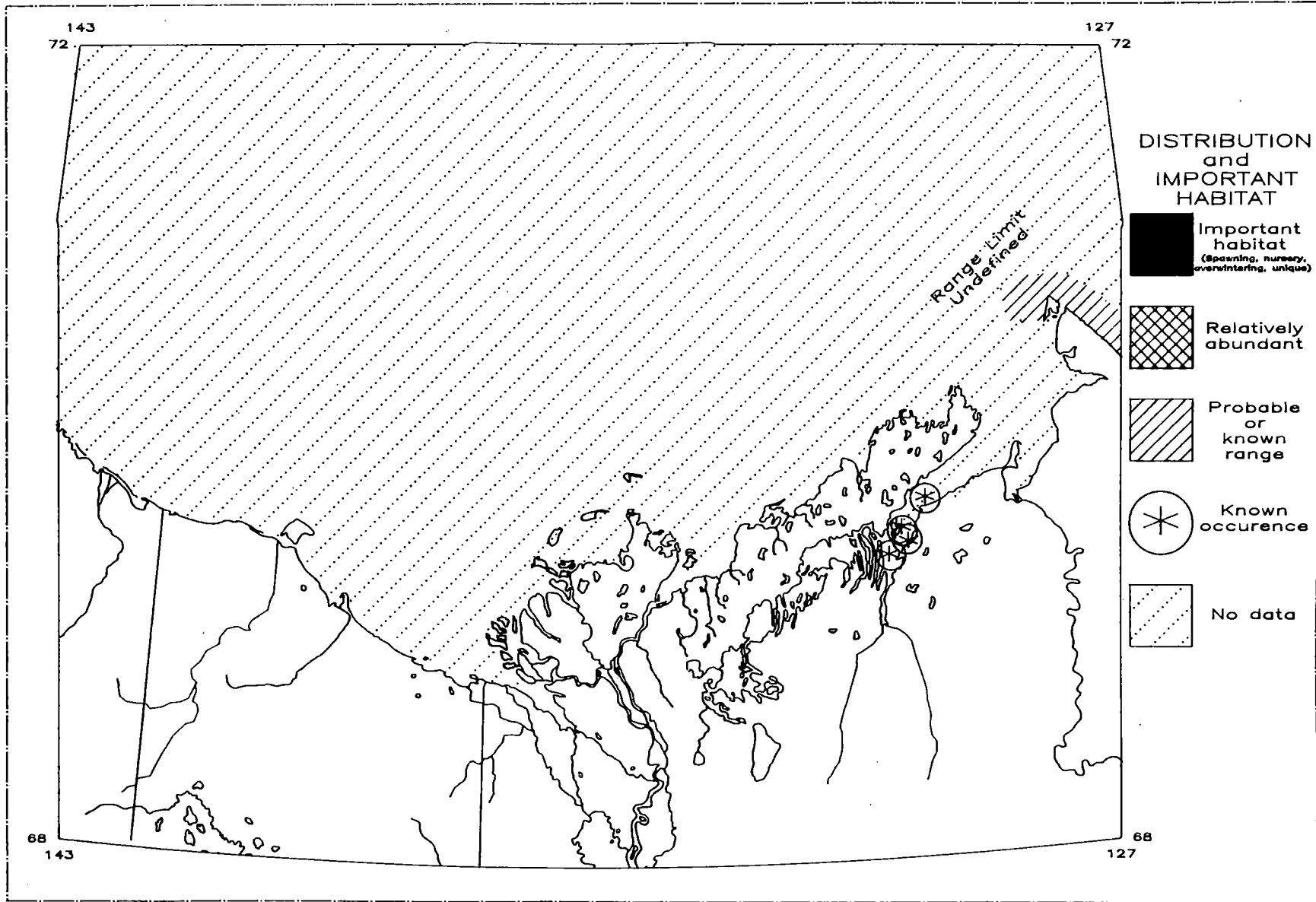
SAFFRON COD
(*Eliginus glacialis*)

Firth River



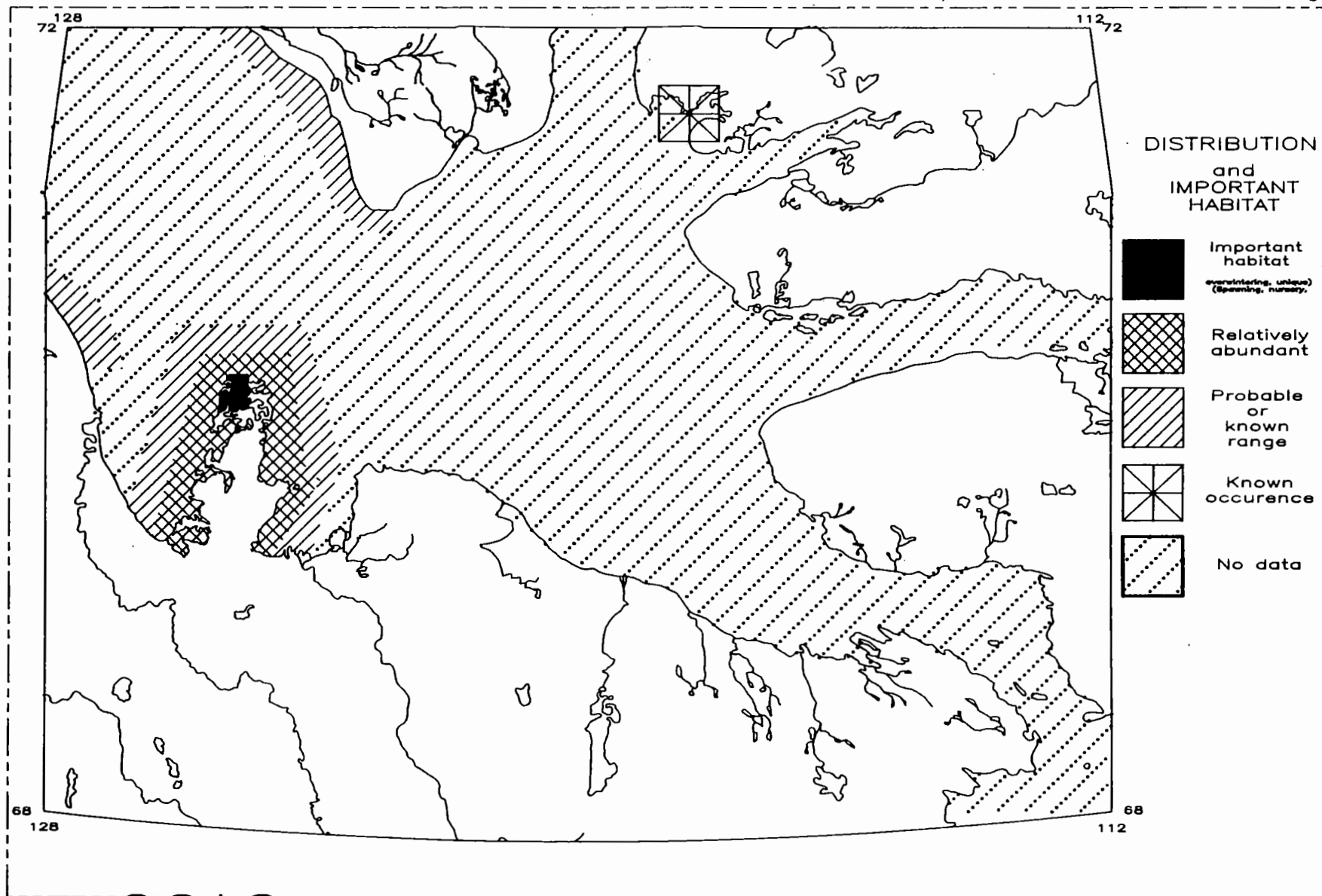
Saffron Cod
Eliginus glacialis

Horton River



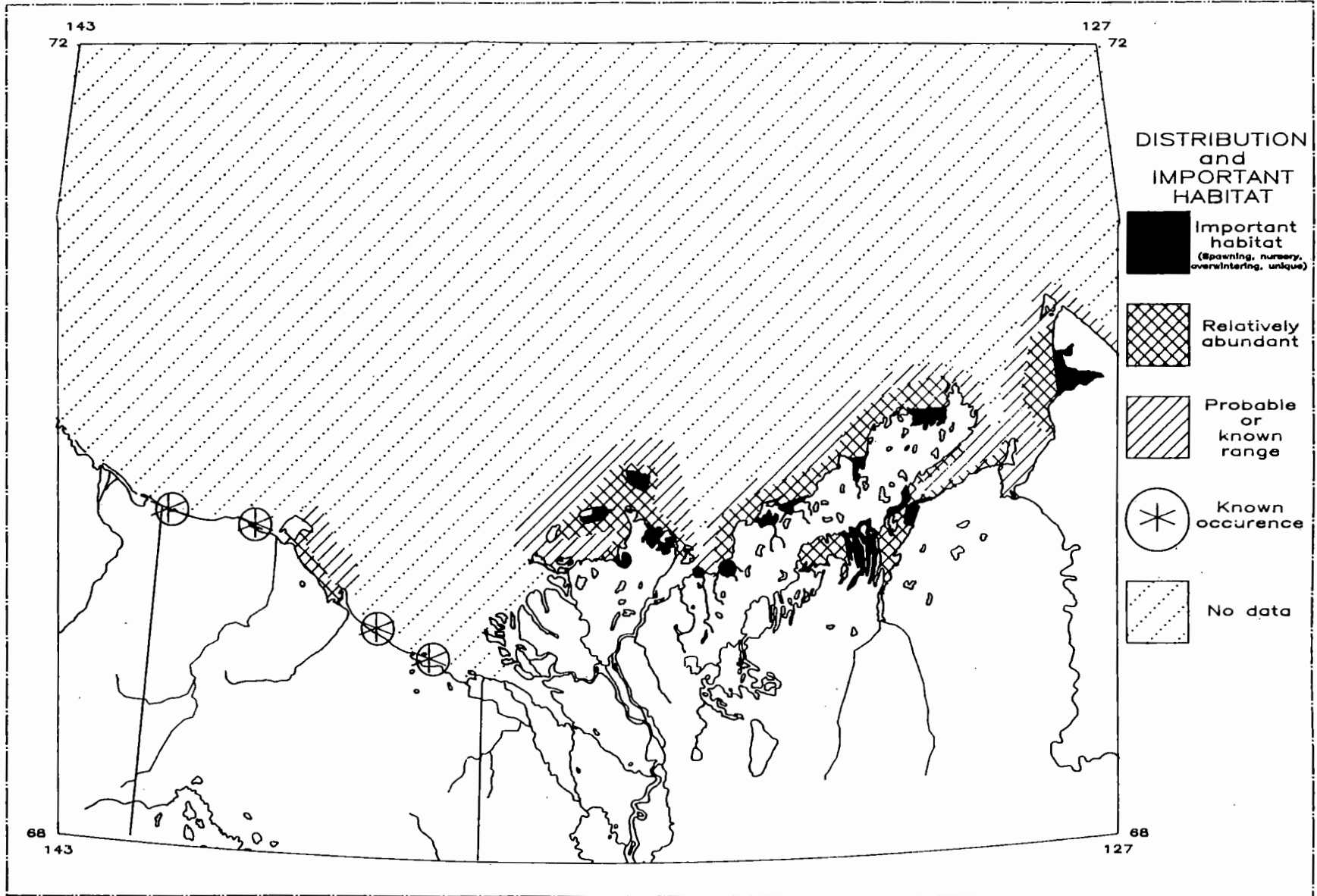
OGAC
(*Gadus ogac*)

Firth River



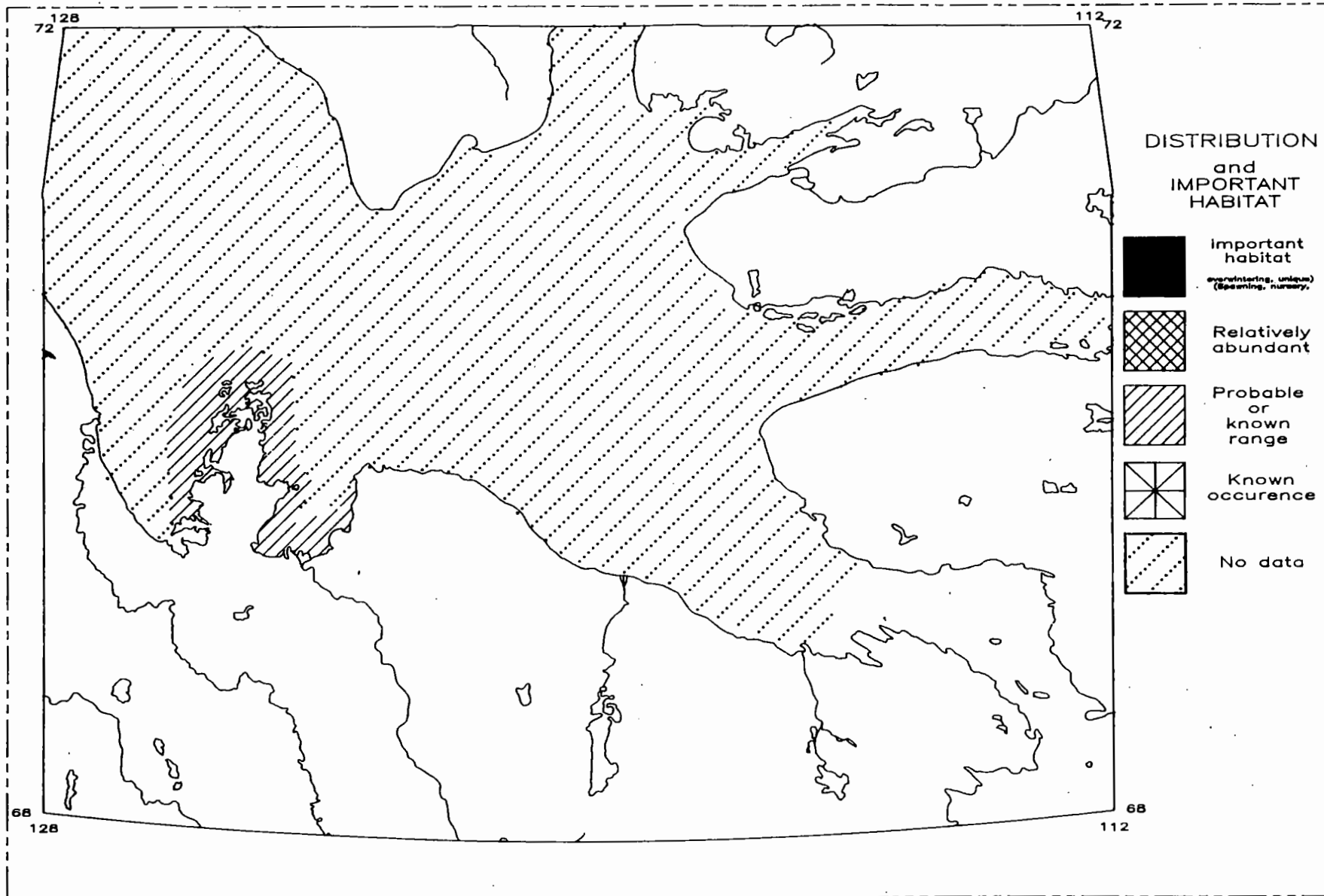
OGAC
(*Gadus ogac*)

Horton River








ARCTIC FLOUNDER
(*Liopsetta glacialis*)

Firth River

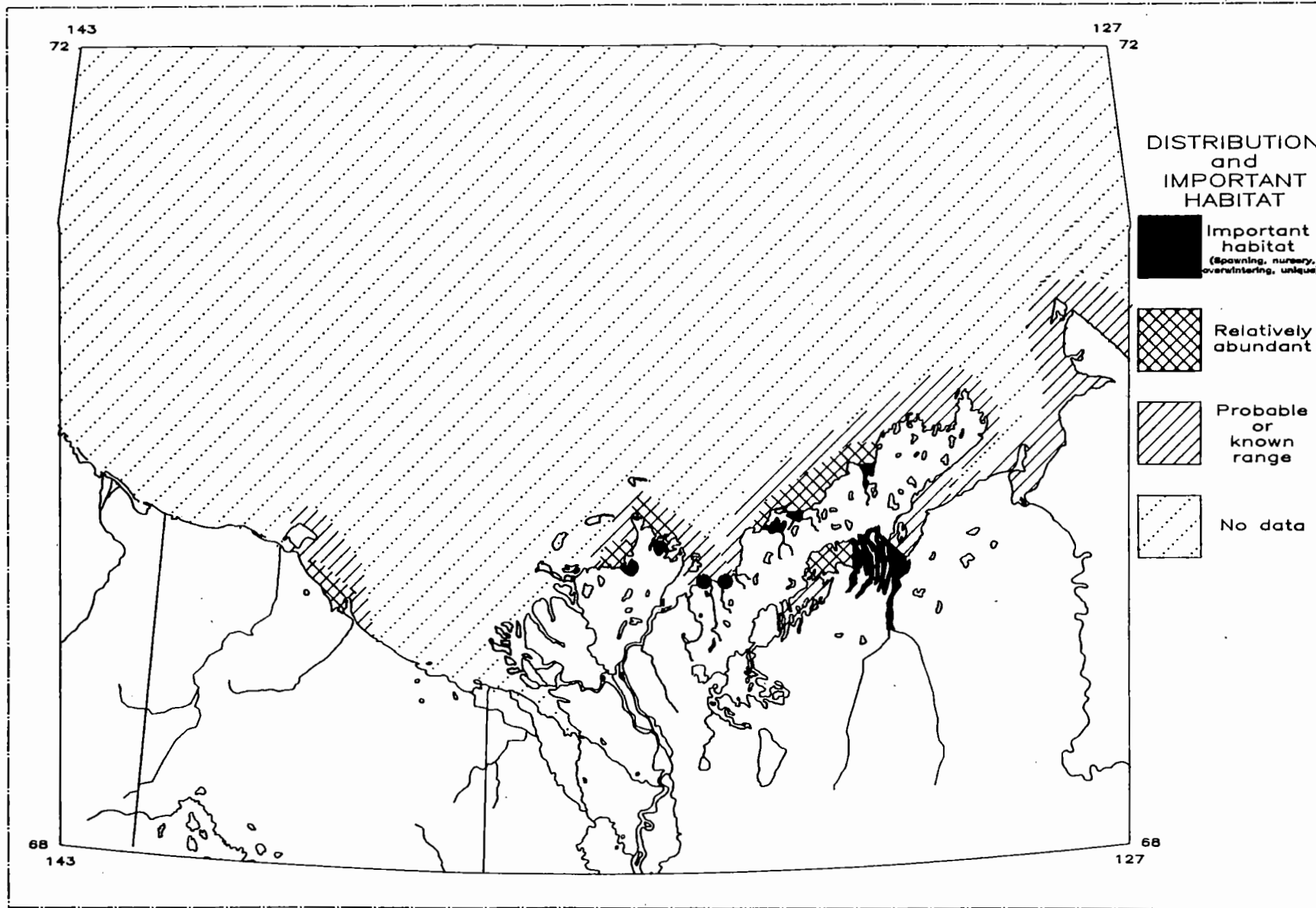


DISTRIBUTION
and
IMPORTANT
HABITAT

-  Important habitat
overwintering, unique
(Spawning, nursery)
-  Relatively abundant
-  Probable or known range
-  Known occurrence
-  No data

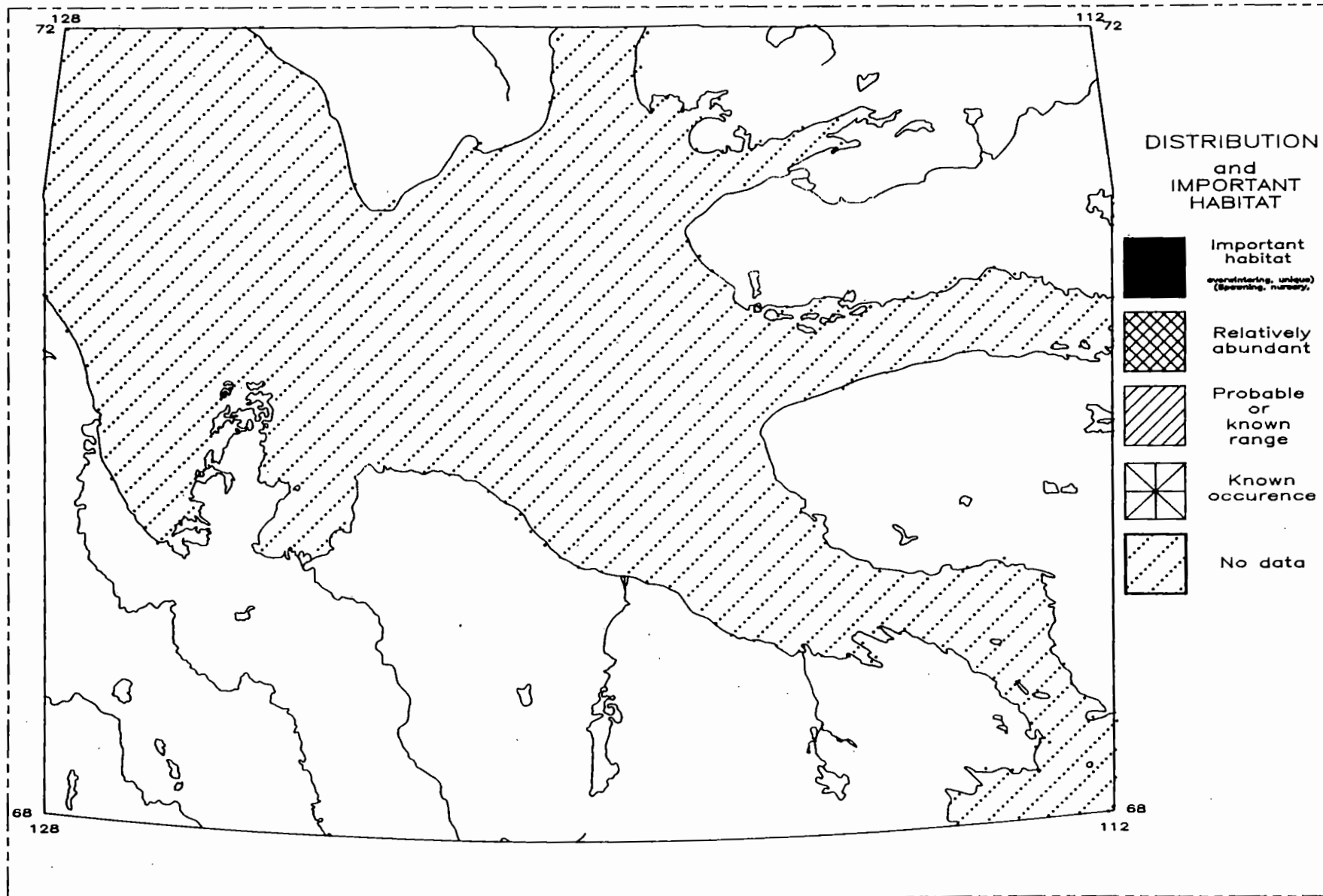
ARCTIC FLOUNDER
(*Liopsetta glacialis*)

Horton River








STARRY FLOUNDER
(Platichthys stellatus)

Firth River

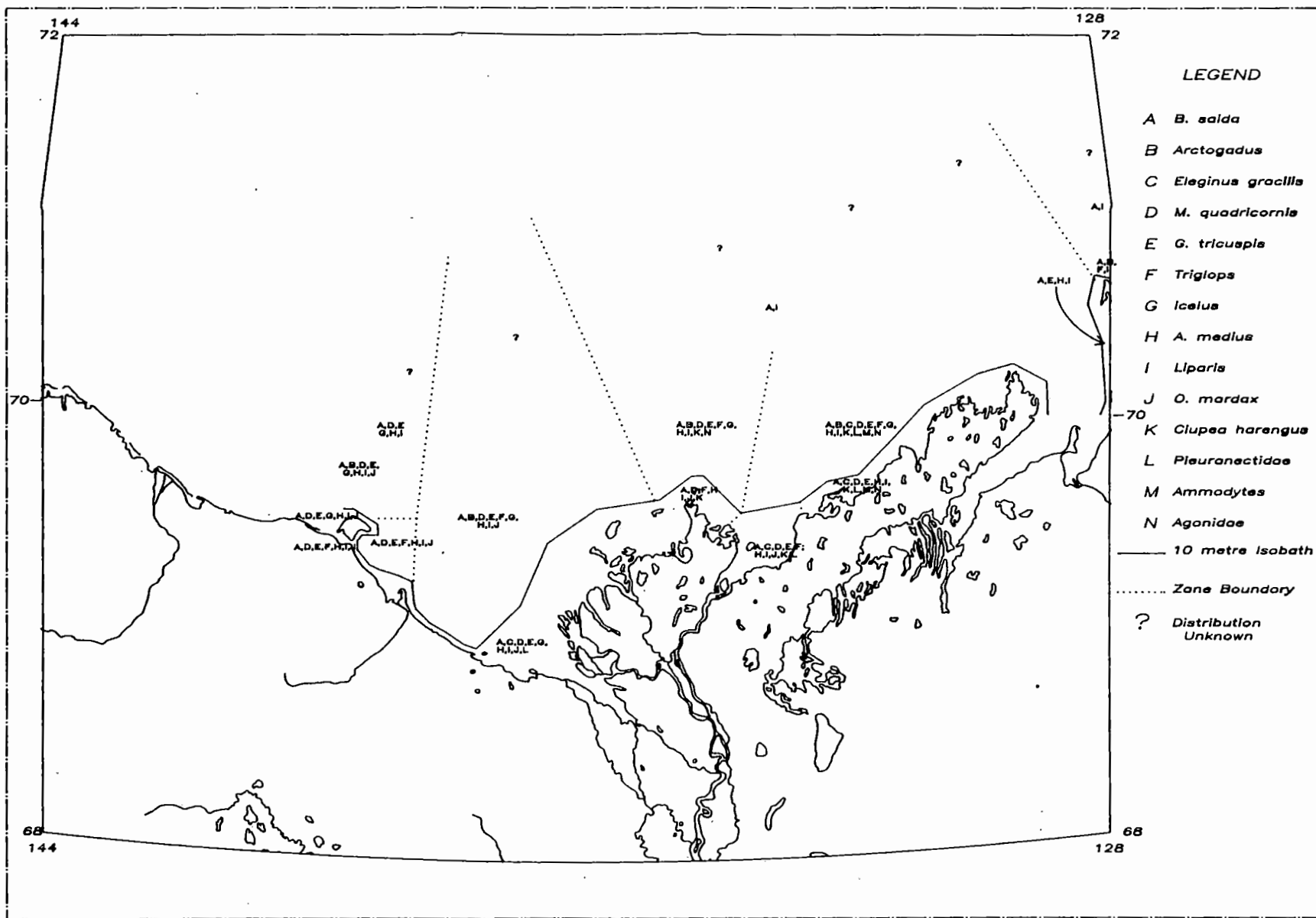


DISTRIBUTION
and
IMPORTANT
HABITAT

-  Important habitat
(overwintering, unique)
(Spawning, nursery)
-  Relatively abundant
-  Probable or known range
-  Known occurrence
-  No data

STARRY FLOUNDER
(*Platichthys stellatus*)

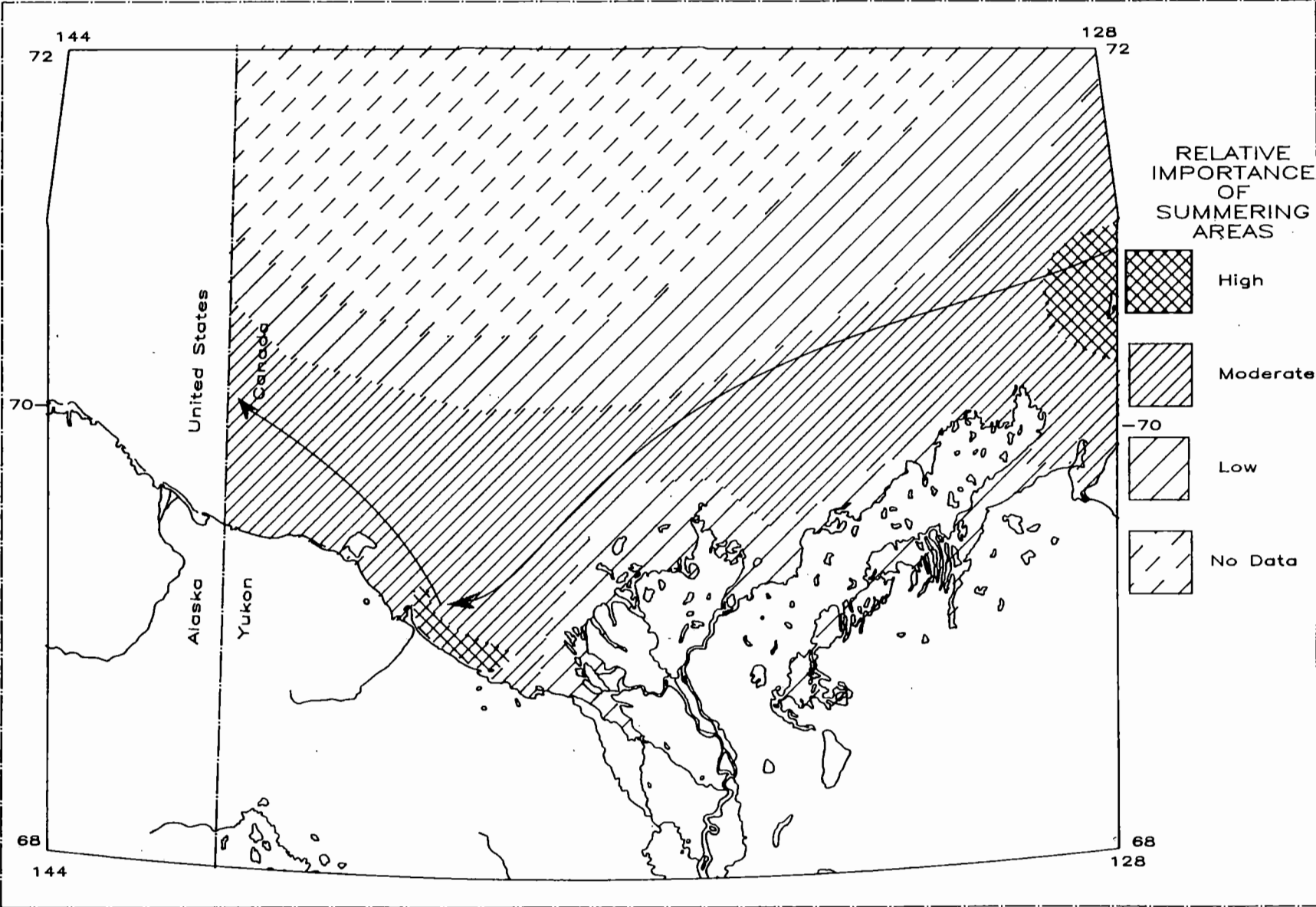
Horton River



Ichthyoplankton Distribution (Presence/absence data)

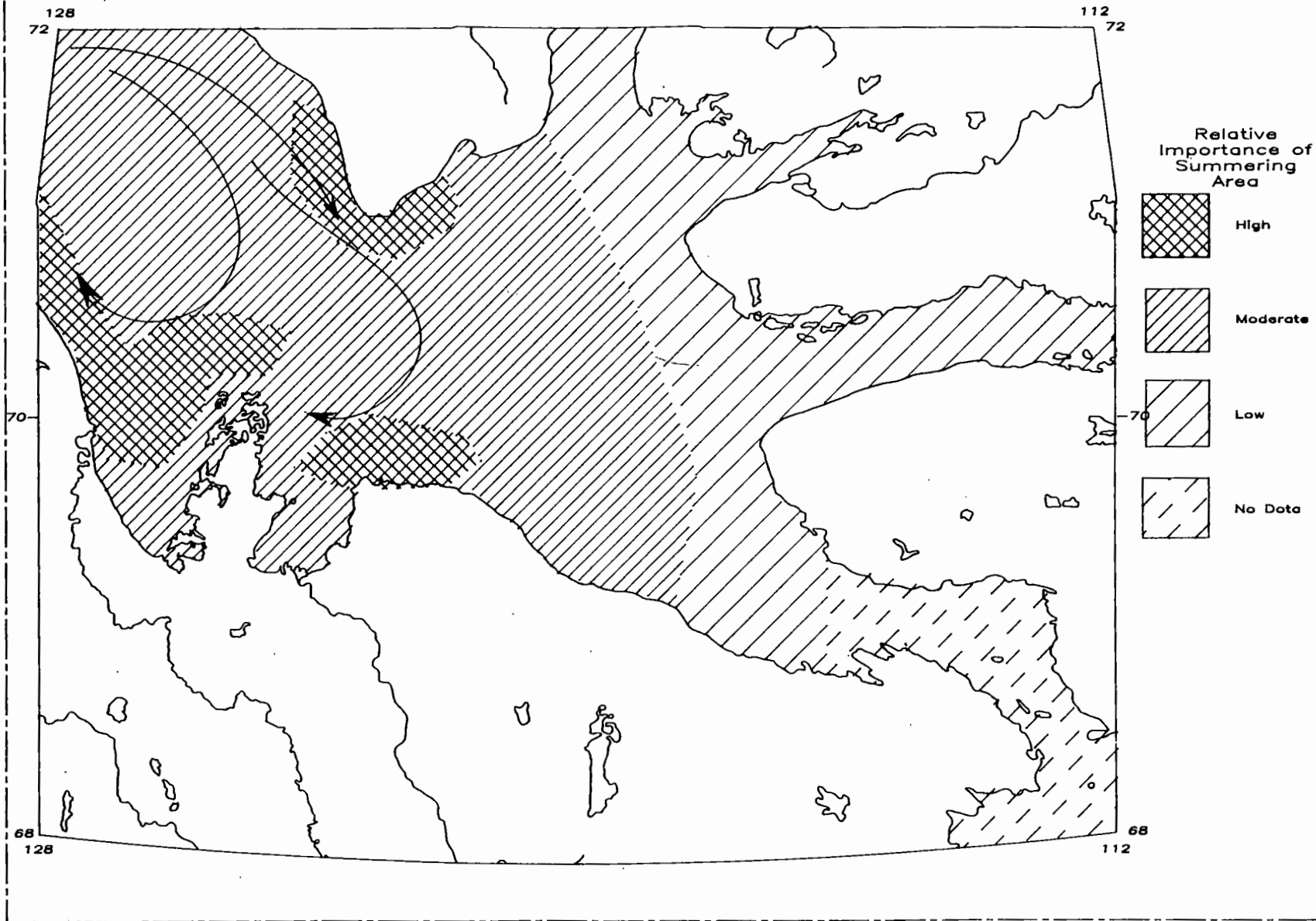
Firth River





BOWHEAD WHALE
(*Balaena mysticetus*)

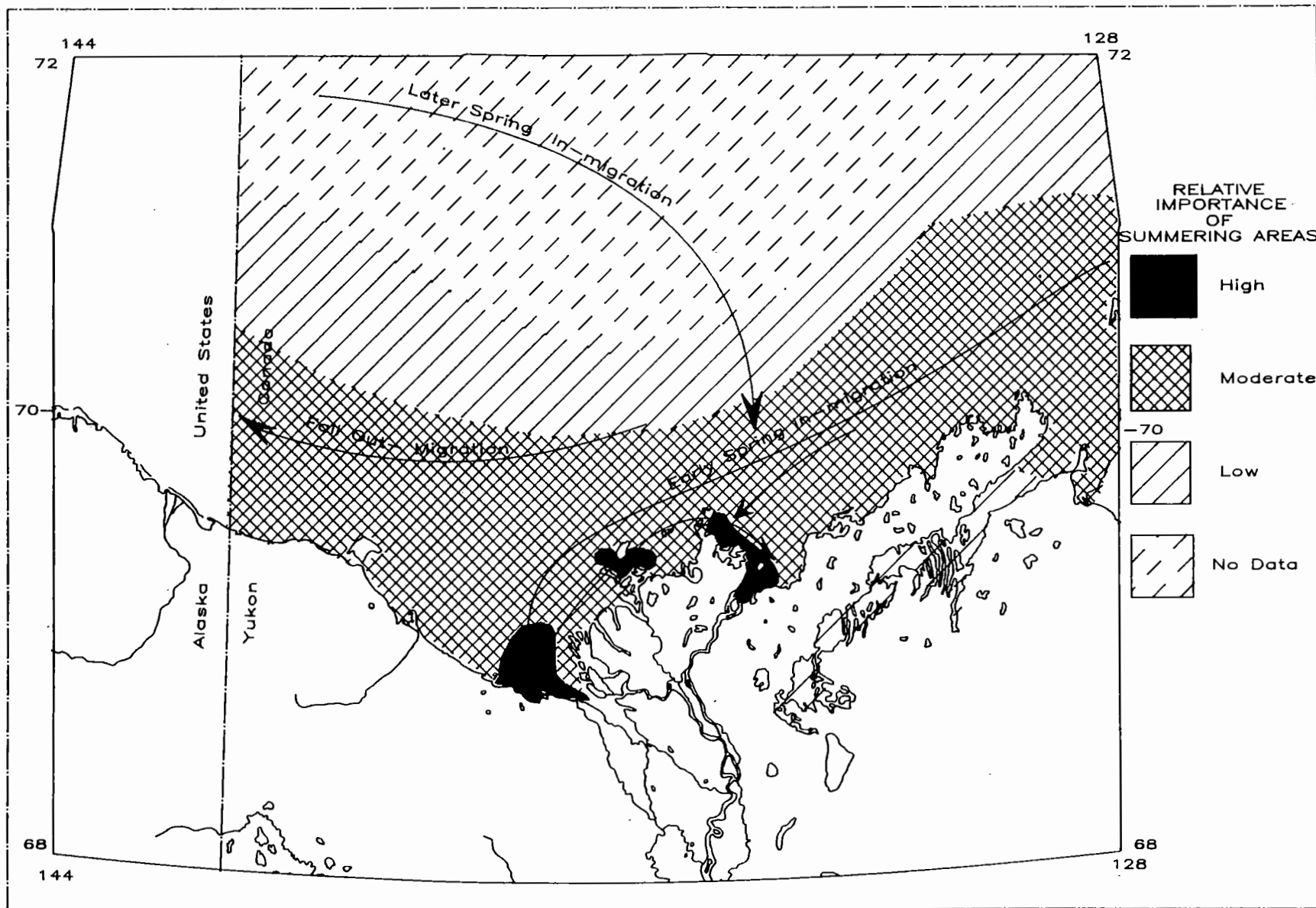
FIRTH RIVER



BOWHEAD WHALE
(*Balaena mysticetus*)

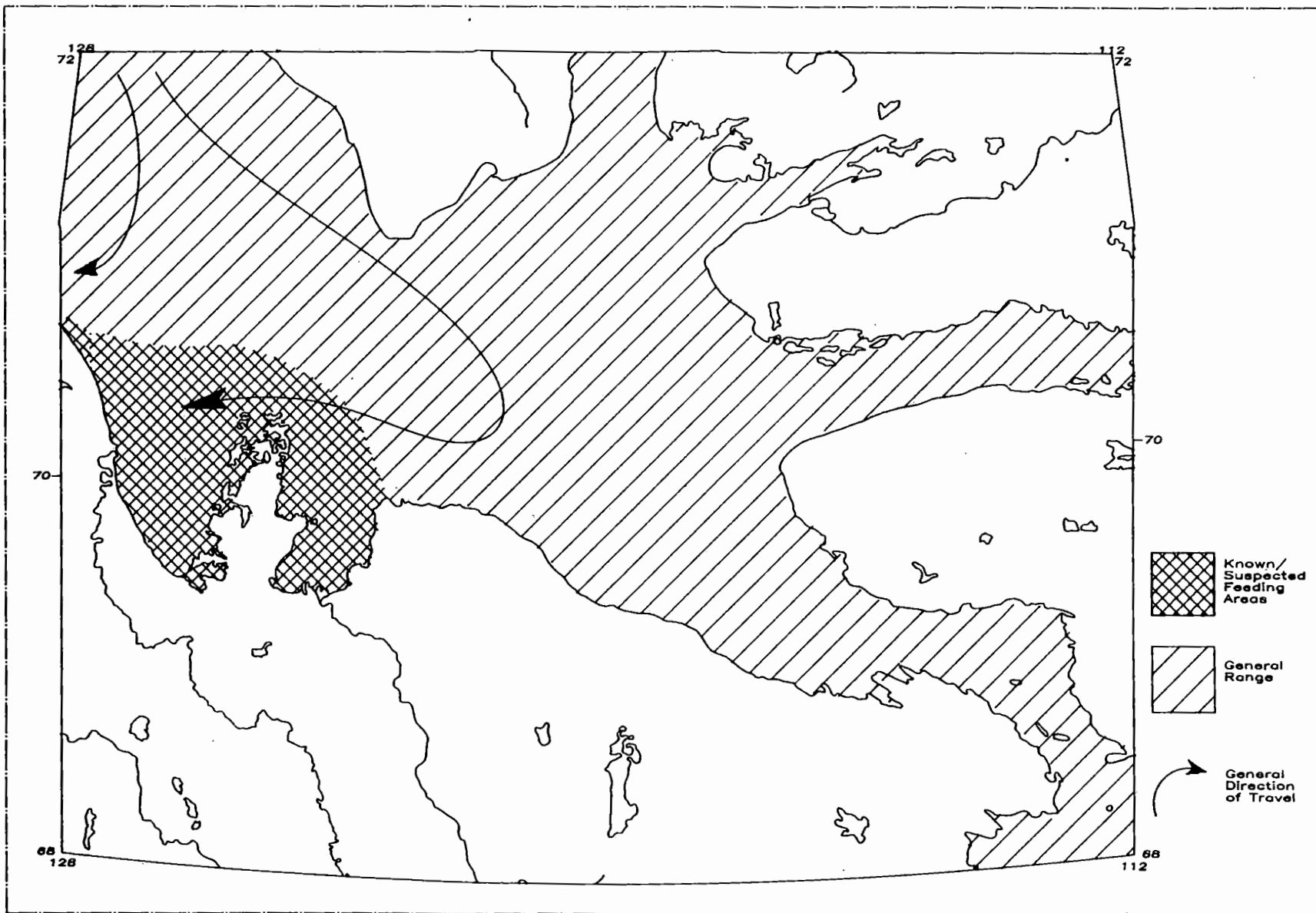
Horton River





BELUGA WHALE
(*Delphinapterus leucas*)

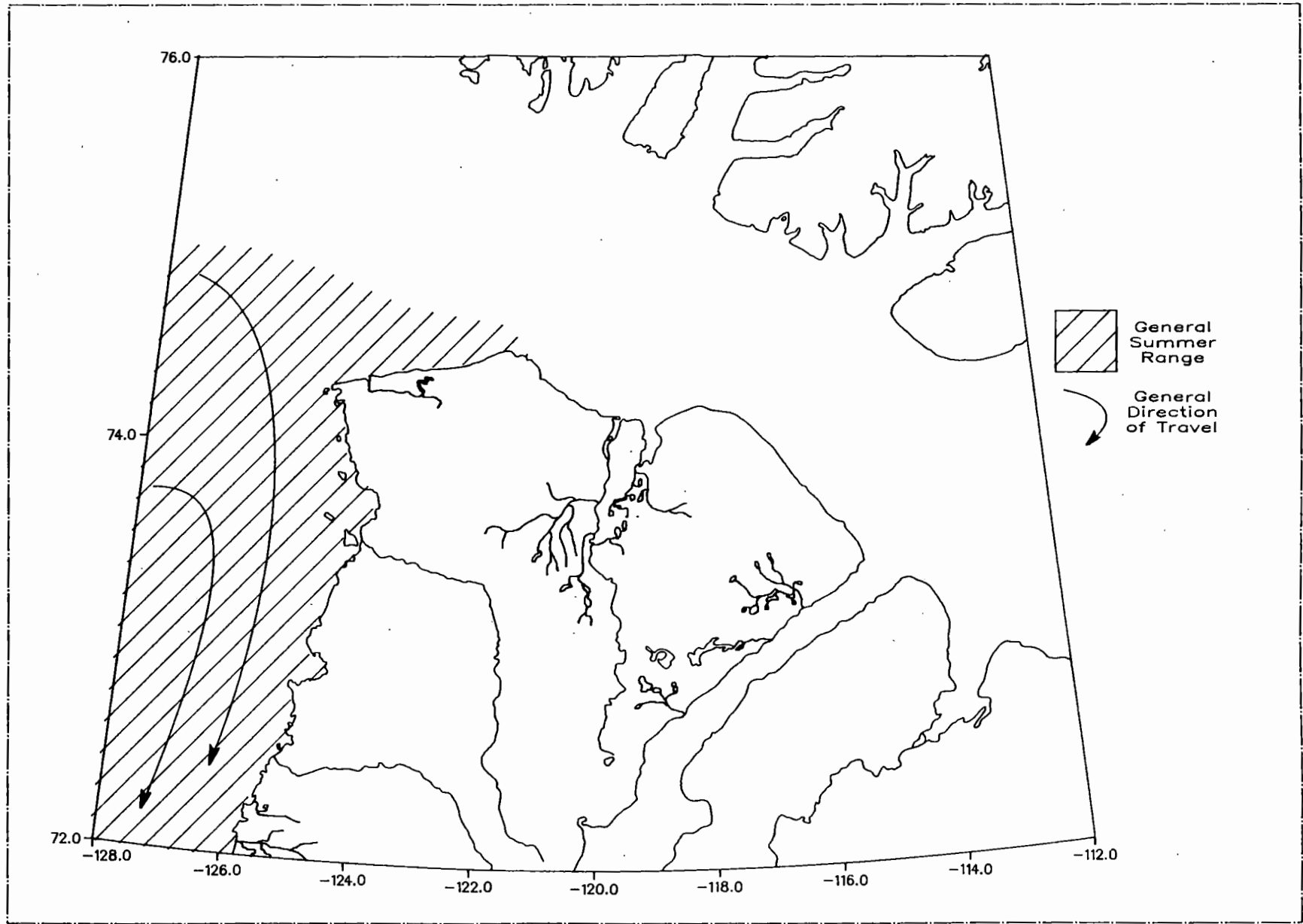
FIRTH RIVER



BELUGA WHALE
(*Delphinapterus leucas*)

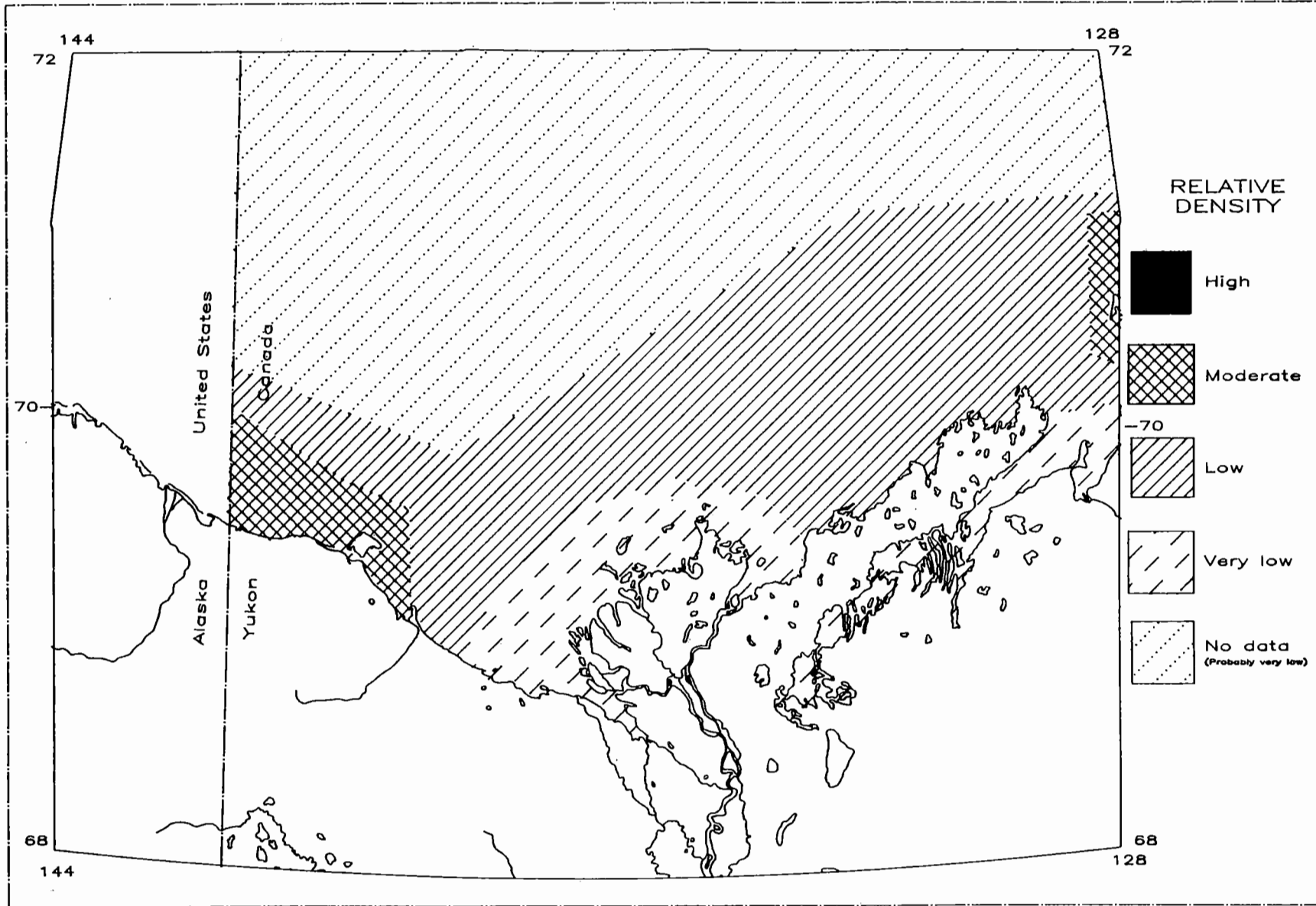
Horton River





BELUGA WHALE
(*Delphinapterus leucas*)

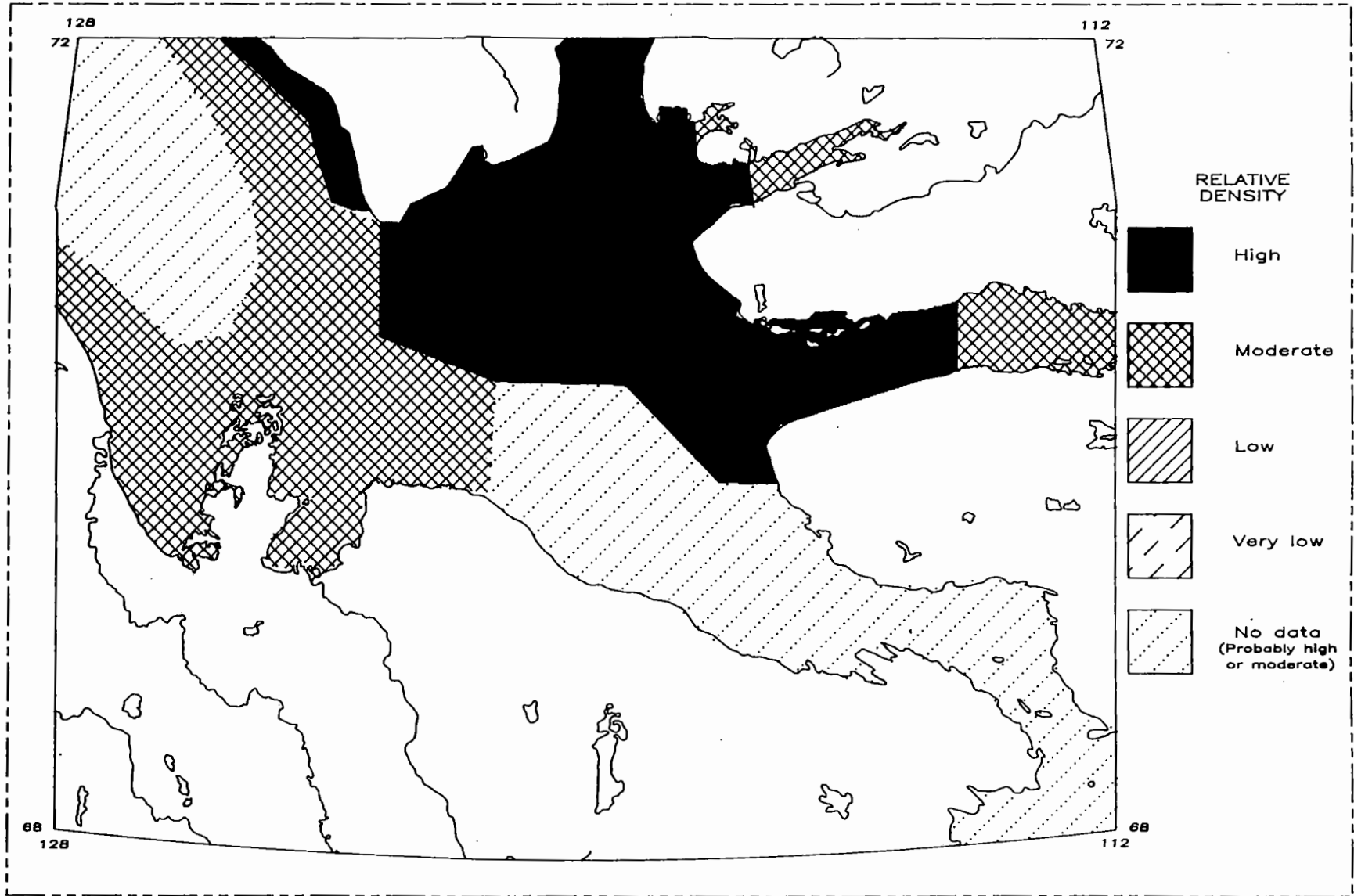
Thomsen River



Ringed Seal
(*Phoca hispida*)

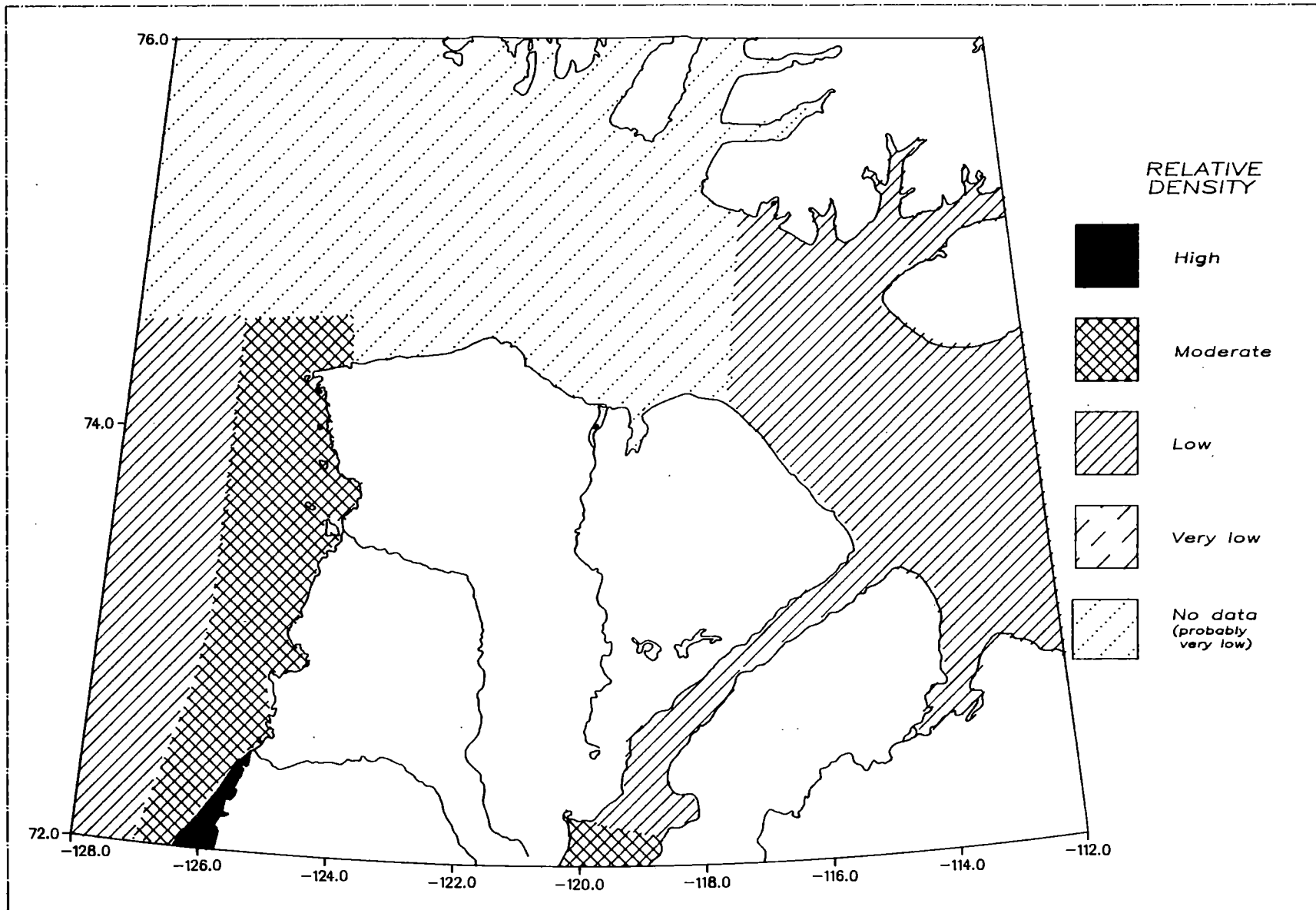
FIRTH RIVER





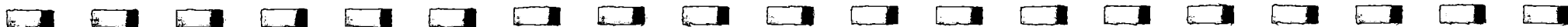
RINGED SEAL
(*Phoca hispida*)

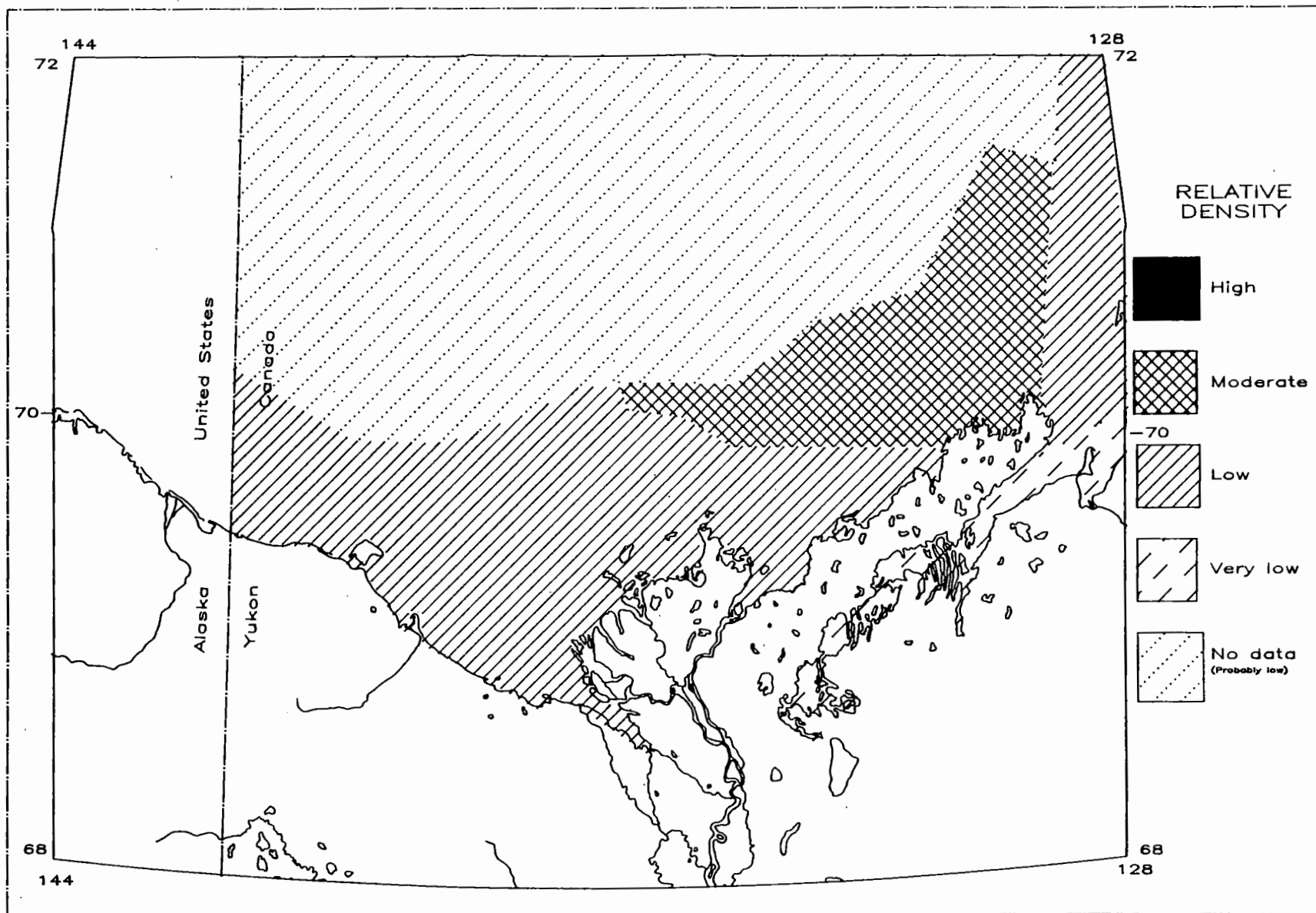
Horton River



RINGED SEAL
(*Phoca hispida*)

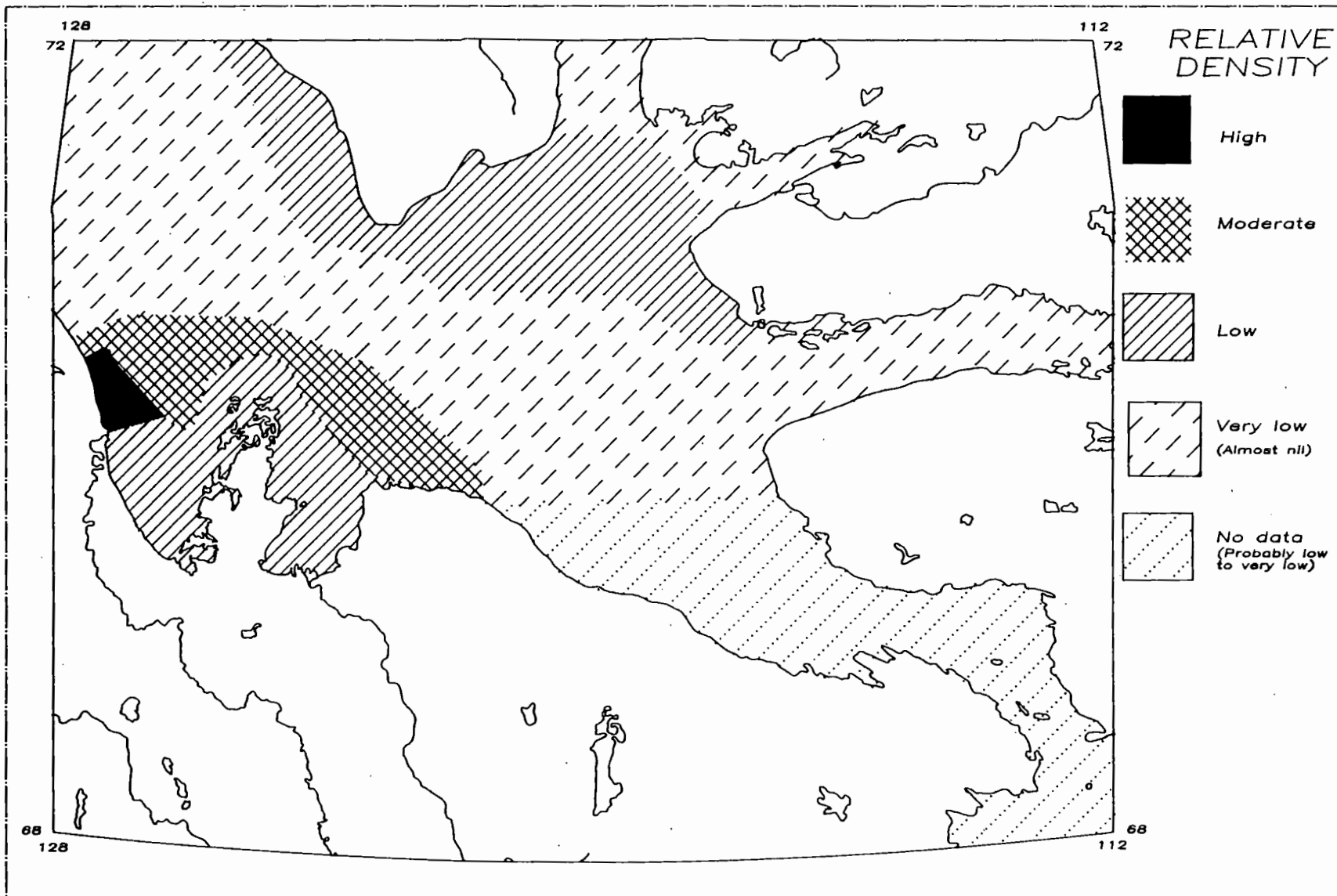
Thomsen River





Bearded Seal
(*Erignathus barbatus*)

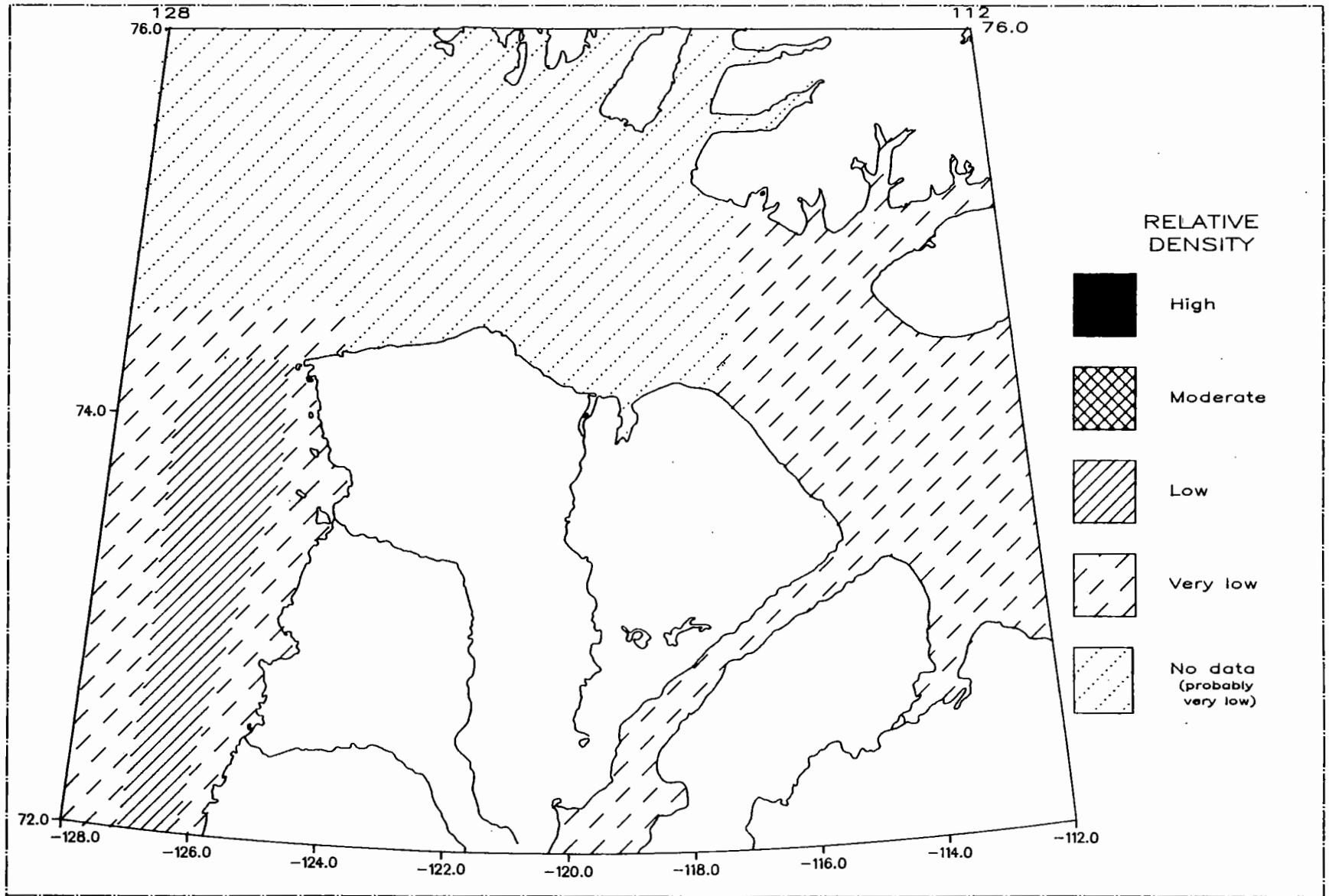
FIRTH RIVER



BEARDED SEAL
(*Erignathus barbatus*)

Horton River





BEARDED SEAL
(*Erignathus barbatus*)

Thomsen River