CHUKCHI SEA COASTAL STUDIES: COASTAL GEOMORPHOLOGY, ENVIRONMENTAL SENSITIVITY, AND PERSISTENCE OF SPILLED OIL

PART II. COASTAL RESOURCE INVENTORY AND SPILL SENSITIVITY INDEX MAPS

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1.0
INTRODUCTION

This volume contains the 84 Chukchi Sea coastal resource maps with corresponding oil spill index maps that display the Oil Residence Indices (ORI), Biological Sensitivity Indices (BSI), and Human Use Indices (HUI). The coastal resource maps present the physical, biological, and human use resources of the shore zone in a simple format. The formatis directly useable by managers and other decision-makers for the usual coastal zone planning activities as well as by the on-scene coordinator during oil spill training sessions or actual oil spill events. More detail on the type, seasonality, distribution, and abundance of the physical, biological, or human use resources is presented in the main text (Part I) orin the Coastal Resource Tables (Part III).

2.1 GENERAL

This section describes how to use the maps and the information displayed on the maps. It also provides a brief description of the mapping methods as a basis for interpreting the maps.

The coastal resource maps only include the shore-zone resources; that is, those resources normally found between the low water line to the prominent storm surge line, typically about 2 meters above normal water level. The exceptions are the human uses and some of the biological resources in the major passes through the barrier islands and the human uses of the major lagoon systems. The physical, biological and human use characteristics of the nearshore and offshore open water areas were explicitly not included in this study (though they may be affected by an oil spill and be equally or more important then the shore-zone ones).

2.2 USE OF MAPS

The volume is organized so that it can be laid on a flat surface and the user can fold out the last page, the Index to Maps. The user can then identify the map number(s) of interest and open the map section at the approximate resource/index map pair(s). The 84 map pairs are numbered beginning at Pt. Barrow in the north and ending at Cape Thompson in the south.

The user can open the Coastal Resource Legend foldout to the left and the Coastal Sensitivity Legend foldout to the right for easy reference. This eliminates having to flip back and forth between the map pairs and the legends to interpret the information on the maps. With the Index to Maps foldout also opened out, the user need only lift the Coastal Sensitivity Legend to use the Index to Maps.

2.3 MAPPING METHOD

The mapping methods are described in detail in Part I but are described briefly here to facilitate understanding of how the unit identifiers are obtained and how to use the Coastal Resource Maps. The unit identifiers on the Coastal Resource Maps correspond to the unit identifiers listed in the left-hand column of the Coastal Resource Tables (Part III).

The general shore-zone types as well as the location of important biological and human use resources were identified from existing information (topographic charts, maps, aerial photography, published literature, personal communication with other experts, and previous experience). Additional *information* required to map these characteristics in sufficient detail was obtained from low-level, oblique aerial videotape and photographic coverage of the entire study area. A limited ground-truth survey (Figure 2-1) was conducted to verify or correct aerial interpretations.

The mapping method defines a series of shoreline units that are physically homogeneous along a section of coast (Figure 2-2). These units or shore-zone types represent a set of shore-zone components that occur repeatedly in the same combination throughout the study area. The across-shore components are based on geomorphological and/or textural characteristics that are homogeneous both across-shore and alongshore. These physical shore-zone components are described in Section 2.4.

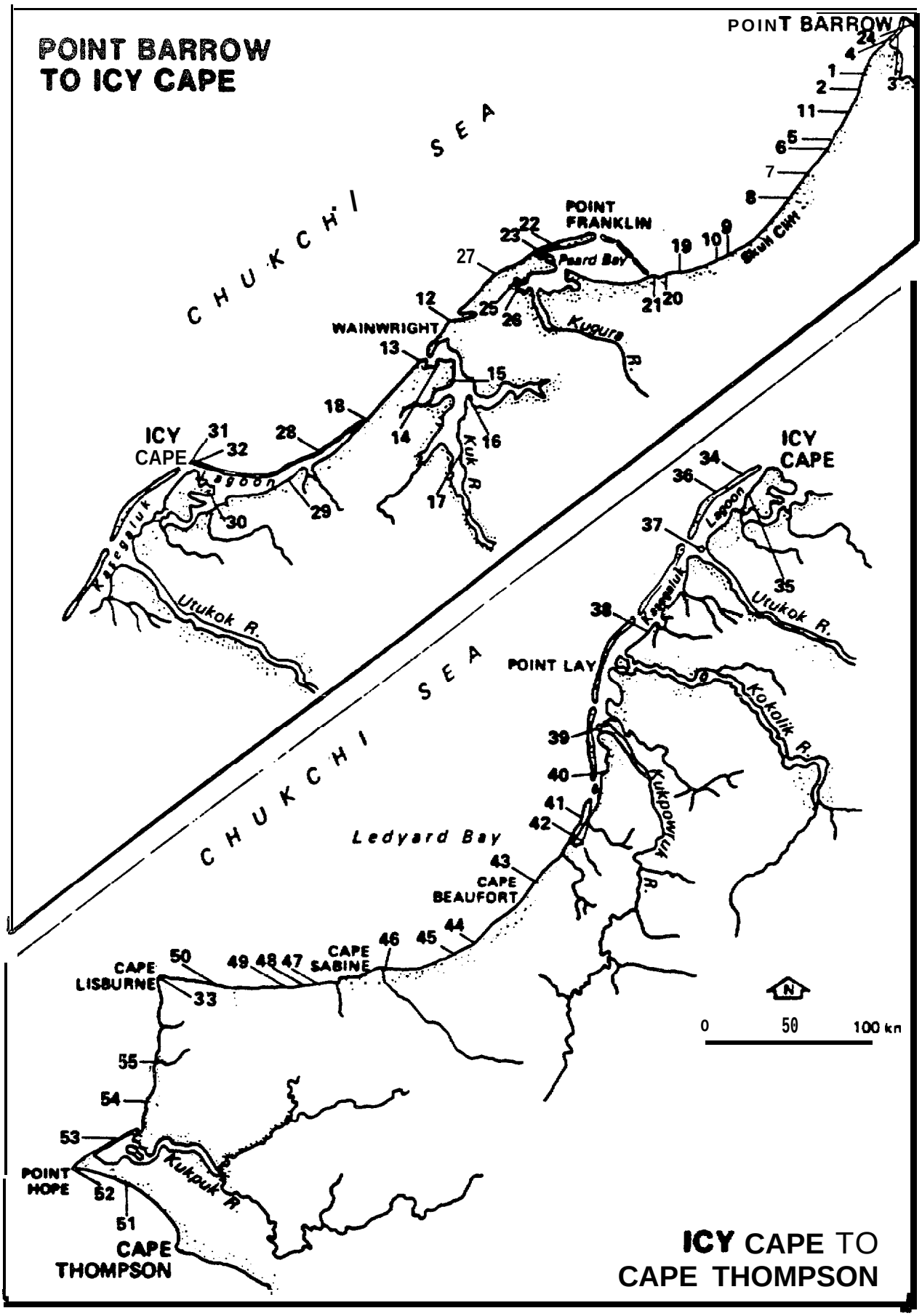


Figure 2-1. LOCATION OF GROUND TRUTH STATIONS

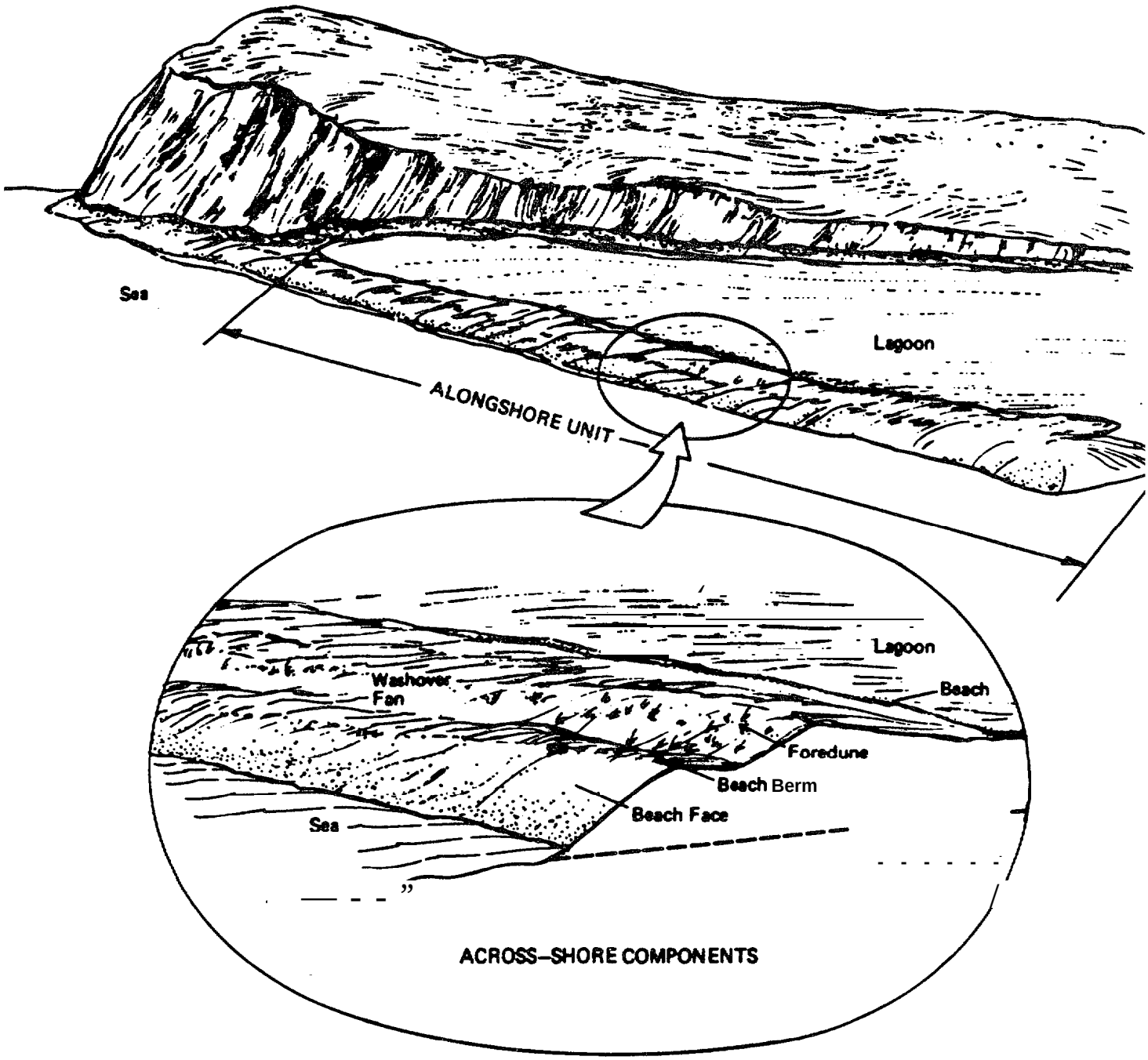


Figure 2-2. ILLUSTRATION OF THE MAPPING APPROACH

The map format identifies the boundaries of units longer than 0.25 km in two ways: (a) change in the distinct graphic pattern used for each shore-zone type (Figure 2-3) and (b) lines perpendicular to the shoreline at each end of the unit (Figure 2-4).

Each shore-zone unit on a map is uniquely identified for that map with a capital letter. Units identified by a letter followed by a superscript "prime" are located on the lagoon shoreline while letters without a *'prime*' are located on the open Chukchi Sea coast. Water bodies (e.g., lagoons, passes, bays, inlets) are identified by name. Where the same shore-zone type is present on both the lagoon and the Chukchi Sea sides of a barrier island or spit, the shore-zone is considered two separate units and each is given a unique unit identifier. The perpendicular line dividing them on the map is arbitrarily placed at the tip of the island or spit where maximum fetch and wave exposure changes.

The unit identifiers (i.e., the capital letters) are applied to the shore-zone units in a generally north to south direction. Where there are exposed or open as well as lagoon coasts, the unit identifiers are applied (a) first to the open coast side of the barrier island or spit, (b) next to the lagoon side of the barrier island or spit and (c) finally the mainland shore. Only one unit will be identified with a letter (which may be further modified with a *'prime*' sign) so ideally each letter would appear only once on each map. However, on some maps, it is easier to label the unit several times. Figure 2.4 illustrates the unit identifier labelling scheme.

Note that the unit identifiers are simply that. They uniquely identify the unit(s) on each map and in the tables. There is no explicit or implied relationship or similarity between units on different maps labelled with the same unit identifier. For example, the unit labelled D in Figure 2-4 is a sandy gravel beach while unit D on the adjacent map is a permanent inlet (Figure 2-5).

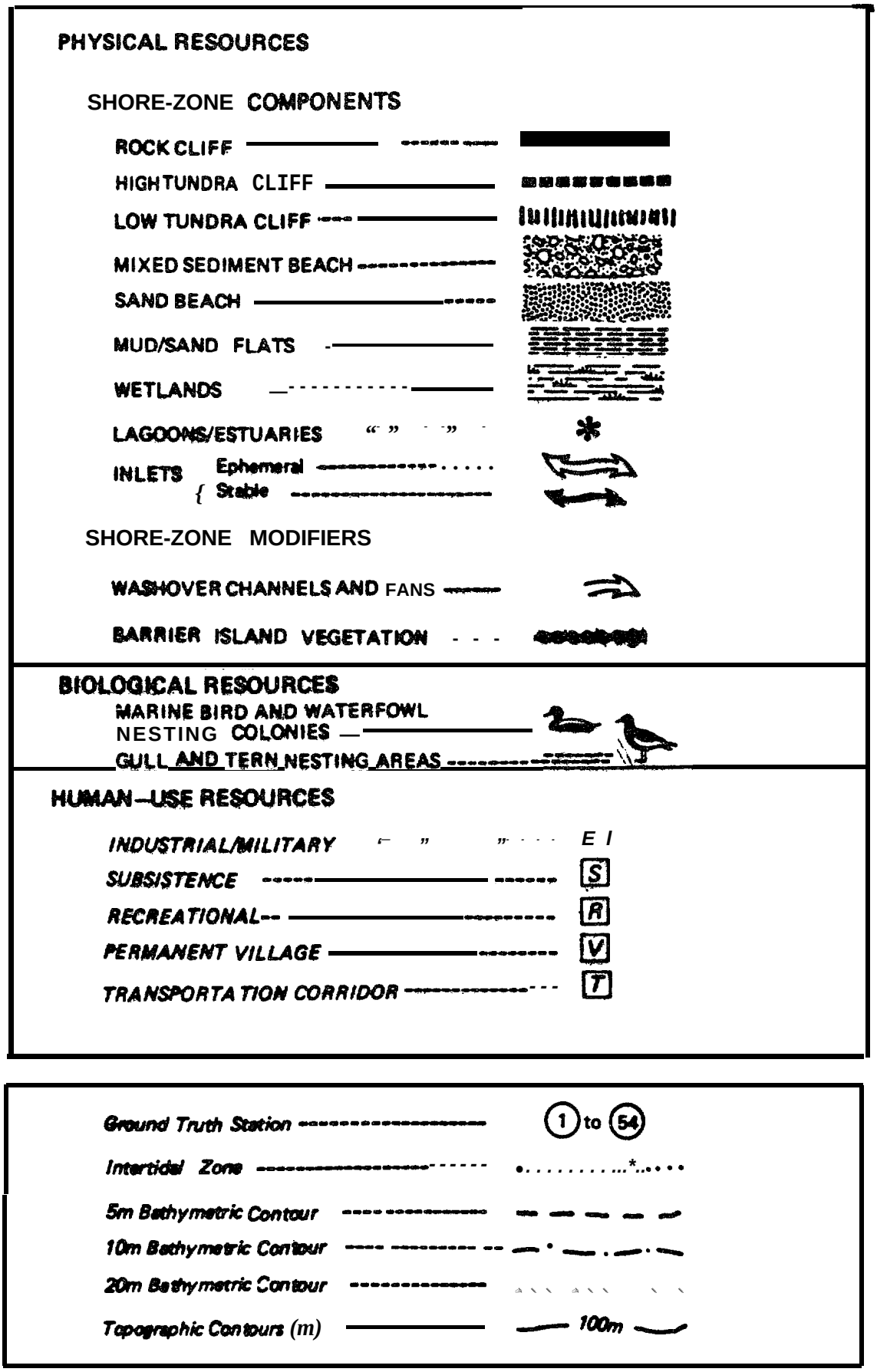


Figure 2-3. MAPPING PATTERNS USED FOR SHORE-ZONE COMPONENTS

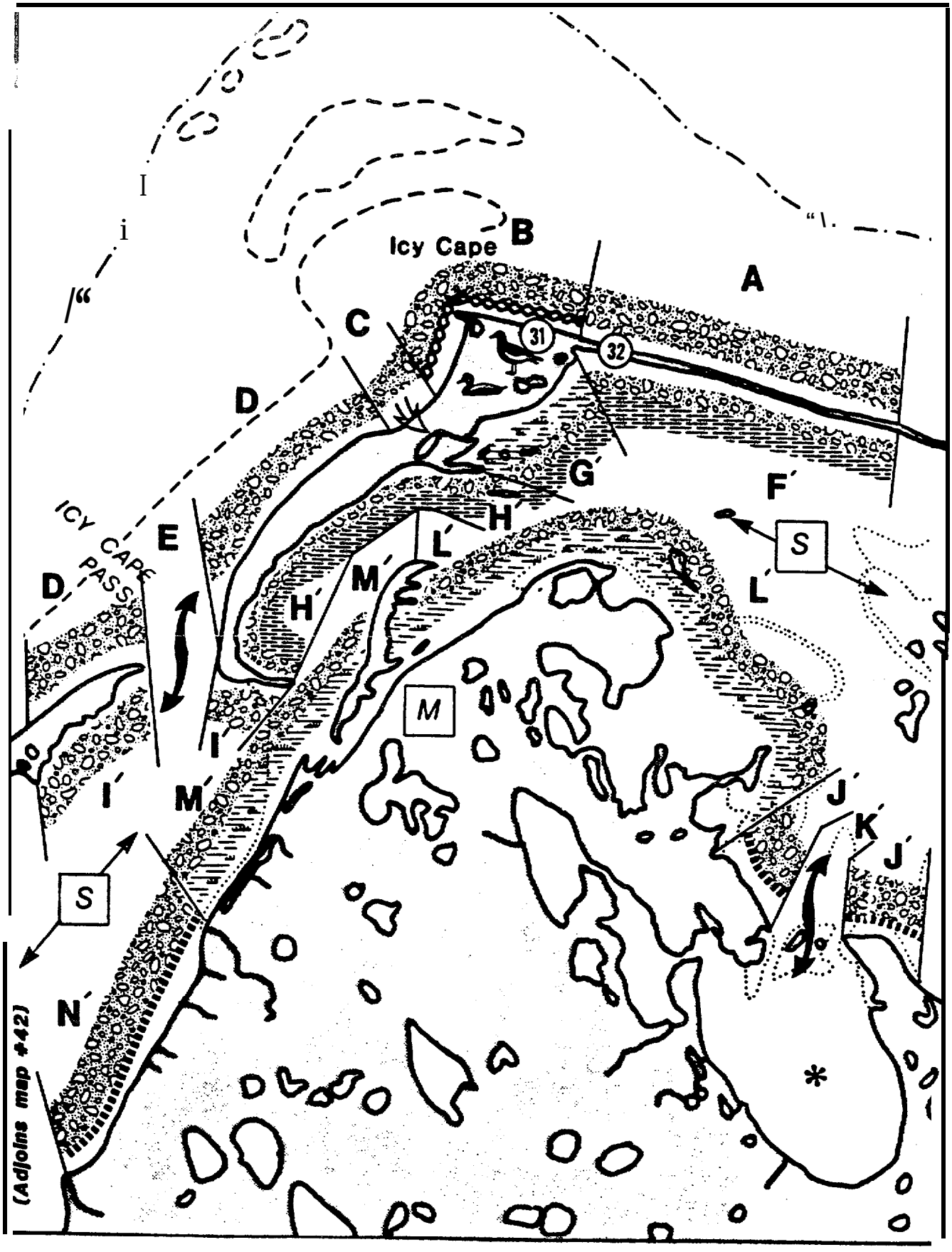


Figure 2-4. EXAMPLE OF COASTAL RESOURCE MAP FROM PART II

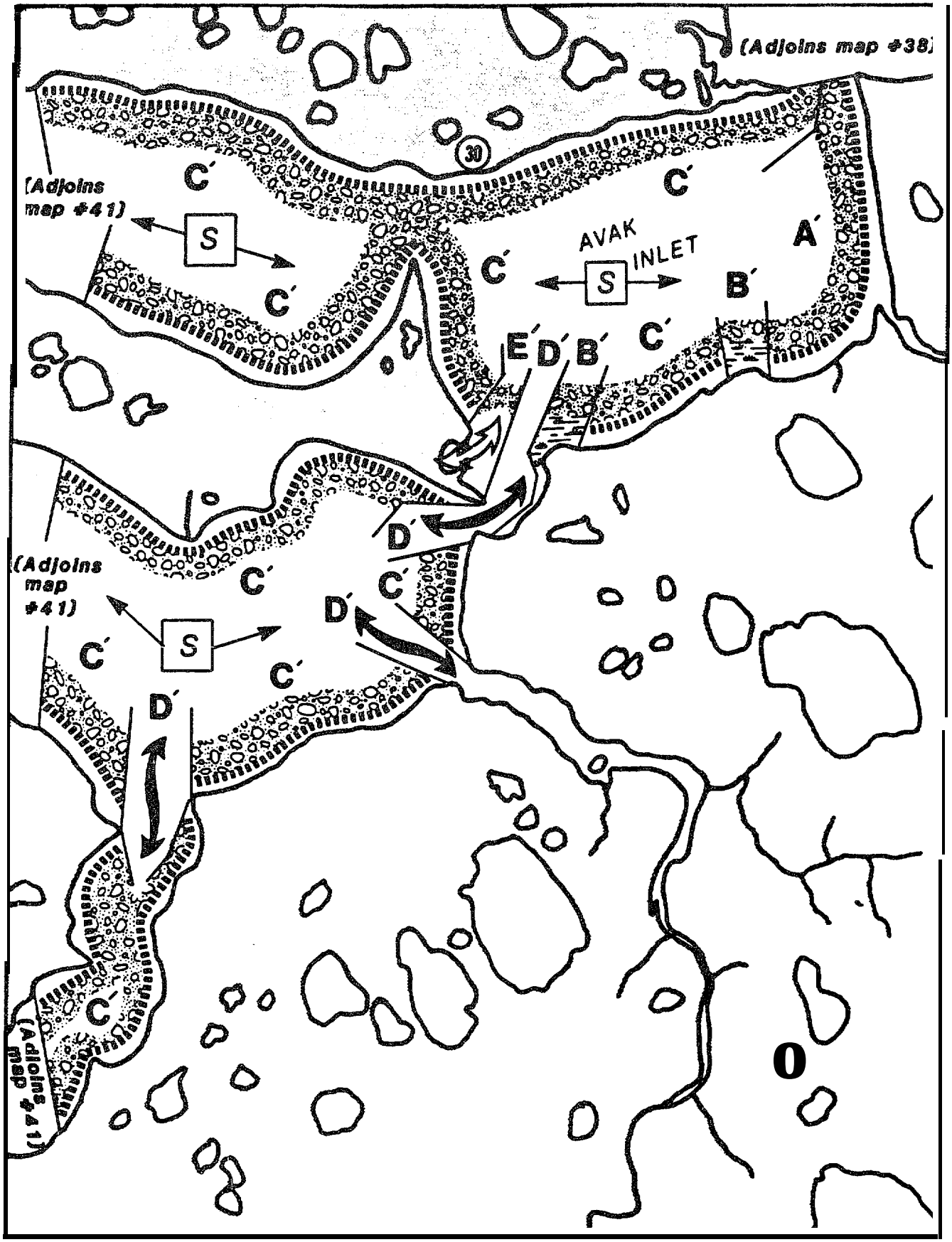


Figure 2"5. EXAMPLE OF COASTAL RESOURCE MAP FROM PART II

The location or boundaries for the biological and human use resources may not coincide with the physical shore-zone type boundaries. The wetlands, a biological resource, are also a physical shore-zone type. The boundaries in either category will generally be the same along the lagoon and bay shores. However, bird nesting areas or seabird colonies are typically much smaller than the physical unit. The human use resources which can be mapped as discrete sites, principally villages, military areas and archeological sites are typically less areally extensive than the adjacent shore-zone type(s) with which they are associated. Also, these resources are typically above the storm surge line and thus out of the shore-zone as defined in this study. Transportation corridors subsistence and recreational areas can not be as precisely defined. They are shown on the Coastal Resource Maps by arrows indicating their approximate extent which typically includes several physical shore-zone units, often over several consecutive maps.

2.4 EXPANDED COASTAL RESOURCE LEGEND

2.4.1 Physical Resources

Repetitive shore-zone components are used as a combined representation of morphology and substrate types in mapping the shore-zone character of the Chukchi Sea coast. Each repetitive component is indicated by a distinctive pattern (Figure 2-3) on the coastal resource maps. A detailed description of each repeatable component, illustrated by a series of photographs, is presented in Part I.

More than one repetitive shore-zone component may occur within a shore-zone unit. The repetitive components are not necessarily mutually exclusive, and by combining two or more within a unit, a composite picture of the shore-zone character is established. However, not all components can be combined (e.g., rock cliffs and tundra cliffs cannot occur within the same unit). Washover fans are used as a modifying symbol within some units. These shore-zone modifiers differ from shore-zone components in that they cannot be used alone to represent a unit.

The expanded legend (Table 2.1) provides a concise summary of shore-zone components and modifiers which are used on the maps.

2.4.2 Biological Resources

In the Chukchi Sea shore-zone area, there are a number of species and habitats of direct. concern in an oil spill. They include spotted seals, several species each of seabirds, waterfowl, and shorebirds as well as the wetland and protected lagoon habitats. Most of these are subsistence species. They are mostly migratory species, arriving around breakup and leaving by freezeup. They *tend* to concentrate in certain areas to feed, breed, raise their young, and rest prior to migrating out of the area.

Oil spill counter-measures should focus on those activities that are predictable in the spatial context and that are essential for the survival *of* the population. For most of these species, the breeding and nesting areas are the main spatial or **real-estate oriented" aspect of their activities in the arctic that are predictable from year to year, through the exact site on the barrier islands where eiders or terns nest might vary somewhat. These nest sites or seabird colonies can therefore be the focus of counter-measure planning a priori. The nesting areas, seabird colonies and immediately adjacent intensely-used water areas are also small enough (in most cases) for effective counter-measure implementation. Of course, most of the actual nest sites and colonies are above the storm surge line so that spilled oil probably would not directly impact them. However, oiled adult birds will contaminate their nests, eggs and chicks. Also, the shoreline protection and cleanup activities are likely to disturb the nesting birds.

The exact location(s) of areas that are used for feeding, molting, staging, etc. are usually less predictable due to weather, sea-ice presence, oceanographic conditions, location 'of prey, etc. Oil spill counter-measure planning and implementation for these areas, most of which are not directly associated with the shore-zone, is better done at the time ofthespill. Otherwise, as an example a biological resource

Table 2.1. EXPANDED LEGEND OF PHYSICAL SHORE-ZONE COMPONENTS

SHORE-Z(MR COMPONENTS

Rock Cliffs - primary morphology is that of a steep cliff cut by waves into the bedrock substrate. Cliff slopes are typically steep (greater than 45°) and fringing beaches are rare. Pocket beaches of gravel sized material may occur in small indentations along the base of the cliffs. Bedrock types include sedimentary sandstones in the northern portion of the study area (Skull Cliff, Peard Bay, Kuk River) to meta sedimentary and igneous in the southern portion of the study area (Cape Sabine, Cape Lisburne, Cape Thompson).

High Tundra Cliffs - wave-cut cliffs formed in unconsolidated Quaternary sediments. Relief from cliff base to cliff edge is greater than 5 m (approximately 15 ft). Cliff sediments are bonded by permafrost and are usually 'ice-poor", although massive ice beds do occur locally. Slopes are usually less than 45° and are dominated by surface wash and debris slide mass-wasting processes. Coastal retreat rates, where documented, are less than 1 m/yr. Fringing gravel beaches typically occur at the cliff base.

Low Tundra Cliffs - wave-cut cliffs formed in unconsolidated Quaternary sediments. Relief from cliff base to cliff edge is less than 5 m (approximately 15 ft). Cliff sediments are bonded by permafrost and are usually **ice rich." These cliffs are most common in lagoons and near open-coast river mouths. Coastal retreat con be rapid (> 1m/yr) on some cliffs (usually steep slopes, >45°, indicate rapidly retreating cliffs), although most cliffs appeared retreating only slowly in comparison with those of the Beaufort Sea coast. Narrow fringing sand or gravel beaches are typically associated with these cliff types.

Mixed Sediment Beaches - the vast majority of beaches along the Chukchi Sea coast are comprised of a mixture of sand and gravel-sized sediment. Mixed-sediment beaches are widely distributed and are associated with both/barrier islands and tundra cliffs. Additional detail on size composition of sediment within the unit is provided in the resource tables. (Mote: gravel includes sediment greater than 2 mm in diameter; sand includes sediments with diameters of 0.06 to 2.0 mm).

Sand Beaches - sand beaches occur at the distal ends of some barrier spits (the eastern Peard Bay spit, for example). Sand-sized material comprises more than 80 percent of the total sediment mass. Sand beaches may occur locally along the lagoon shores as well.

Table 2.1. EXPANDED LEGEND OF PHYSICAL SHORE-ZONE COMPONENTS (continued)

SHORE-ZONE COMPONENTS

Mud/Sand Flats - wide (>100 m or .300 ft) intertidal flats occur within the lagoon systems of the Chukchi Sea coast. These flats are typically associated with river deltas, flood-tidal deltas on the seaward side of the lagoon, with washover fans on the barrier islands and with other smaller scale coastal features along the mainland coast. Sediment texture on the flats usually grades from sand-sized material in the upper portion of the shore zone to mud-sized material in the lower shore-zone.

Wetlands - low *elevation,* generally flat areas with standing water for most of the snow or ice-free season. They are subject to occasional storm inundation but are generally not covered by the normal astronomical tides. Vegetation is salt-tolerant and dominated by the grass, Puccinella spp. Wetlands are low energy environments primarily on borders of small estuaries, deltas and the lagoon side of barrier islands.

Lagoons/Estuaries - protected embayments such as small lagoons or estuaries, which are too small to map separately are delineated by a site symbol. Lagoons and estuaries typically encompass low-energy coastal features such as mudflats or wetlands, which can not be shown on the map due to the small scale of the feature. Lagoons and estuaries are necessarily connected to marine water areas by either a washover channel, or an inlet.

Inlets - inlet provide a critical water exchange link between protected lagoons, estuaries or bays. Inlet widths vary, although most are less than 1.5 km (approximately 0.25 mi) in width (with the exception of the Peard Bay inlets]. Inlets which have been permanently open for the past few years are mapped as stable inlets. Inlets which are only open seasonally, such as during spring freshet or during storm-surges or which open and close on a year-to-year basis are mapped as ephemeral.

SHORE-ZONE MODIFIERS

Washover Channels and Fans - washover fans and channels are activated during storm surges and provide an *important* water exchange conduit during storm surges. Water exchange is in only one direction, landward-directed (return flow occurs through inlets or through ground-water seepage. Washover channel and -fans are found on low, usually unvegetated, barrier islands and on small baymouth bars enclosing lagoons and estuaries.

Table 2.1. EXPANDED LEGEND OF PHYSICAL SHORE-ZONE COMPONENTS (concluded)

SHORE-ZONE COMPONENTS	
Barrier Island Vegetation	- barrier island vegetation is mapped as a shore-zone modifier for open coast barrier islands where significant densities of vegetation occur. Vegetation on the Chukchi Sea side of the barrier islands is primarily dune grass (Elymus arenarius mollis). On the lagoon side, the vegetation is typically one for more species of grass, primarily Puccinella Spp . The presence of vegetation usually indicates a greater barrier island stability (i.e., stable or accretional) and less frequent over-topping during storm surges.

such as oldsquaw or eider molting and staging area would be mapped on almost every map in Kasegaluk Lagoon (Map Nos. 33-59). This defeats the purpose of identifying important areas that are of a size that is amenable to oil spill counter-measure planning and implementation.

The other "real-estate oriented*' biological resource considered important in the sensitivity analysis is wetlands, both salt-tolerant ones and freshwater wetlands below the prominent storm surge line. These areas could be inundated with oil especially during a storm. The salt marshes and adjacent mudflats are especially important to black brant and shorebirds. Brant use the coastal salt marshes, particularly those in the vicinity of Icy Cape and Peard Bay, between early June and late September. They are particularly abundant there as spring migrants in June (-37,000 birds) and again in late August and September as fall migrants (70,000-80,000 birds). In these staging habitats, they feed on salt marsh vegetation (grasses, sedges). The distribution of staging shorebirds is dictated by the presence of saltmarsh and mudflat habitats in which the birds feed. The most extensive of these habitats are in the northern part of Kasegaluk Lagoon, especially near Icy Cape. Less extensive habitats occur on the spits and mainland shores of Peard Bay.

The waterfowl, gull, and tern nesting areas, and the marine bird colonies are identified on the maps with appropriate symbols (Figure 2-3) . The number of breeding pairs of each species (if reported in the literature) is presented in the Coastal Resource Tables (Part III).

Wetlands are identified with a distinctive pattern (Figure 2-3) as part of the physical characterization of the shore-zone. However, on the maps, no distinction is made between large and small wetlands or sparse and lush vegetation (except for the length of the shore-zone unit). The known or expected use of each wetland is identified in the Coastal Resource Tables (Part III).

Other biological resources such as spotted seals, beluga whales, waterfowl and shorebirds that may utilize a section of the shoreline or adjacent water body (lagoon, bay, pass) are also identified in the Coastal Resource Tables (Part III). However, as described previously, they are not depicted on the Coastal Resource Maps because their temporal and spatial distribution is unpredictable except in a very general way.

2.4.3 Human Use Resources

Human use resources include resources (i.e., property, public facilities, subsistence resources, cultural resources), and shoreline uses (transportation, fishing sites, boat storage). Many human use patterns of the coastline can be identified with individual communities (i.e., Barrow, Wainwright, Point Lay, and Point Hope), although the patterns also reflect traditional uses that preceded the formation of permanent communities. Activities are intense in the immediate vicinity of each village, and include subsistence hunting and gathering, transportation (boat traffic and storage on the beach, three-wheeler traffic along the shoreline, airstrips with daily schedule traffic) and excursions to traditional use sites. However, local residents travel extensively outside their communities to harvest subsistence resources so village use areas extend tens of miles from the permanent communities.

Other human resources are less identifiable with individual communities. The general cultural resources sites is high, and density increases in areas there the distribution of subsistence resources is concentrated. Distant Early Warning (DEW) Line Sites also constitute a human resource; several are located in the study area. Active sites generate air traffic in support of their mission; inactive sites are often used to support research or resource exploration teams and can be used during emergencies.

Some human uses resources are predictable and obvious in terms of location (e.g., villages, boat storage areas, airstrips, DEW Line stations, cultural resource and archaeological sites). They are shown on

the maps with the appropriate symbol at the site. More detail is presented in the Coastal Resource Tables (Part III).

Other human uses are not as predictable in the spatial or temporal context. For example, subsistence hunting and fishing may be very predictable in the case of egg collecting at the Cape Lisburne or Cape Thompson bird colonies, but quite unpredictable in the case of waterfowl, beluga or spotted seal hunting. Also, transportation along the beach by three-wheelers or nearshore by boat may be generally predictable, but the actual routes *will* depend on a large number of variable circumstances.

In these cases, the appropriate symbol for subsistence, recreational or transportation activities is presented in the map with arrows indicating the general directions in which the activities take place.

3.1 INTRODUCTION

A primary objective of this study is to provide an evaluation of the sensitivity of shore-zone resources which in turn will provide a partial basis for determining oil spill counter-measure priorities. The sensitivity evaluation must be necessarily general because of the regional nature of the study yet must be of sufficient detail to be of use for contingency planning. For these reasons, we developed a three level index (primary, secondary and tertiary levels of concern) to illustrate sensitivities for (a) potential oil residence, (b) biological sensitivity and (c) human-use sensitivity.

While the use of three levels of concern for the three resource types is relatively simple, and therefore useful to resource managers, there are 27 possible combinations possible. As such, the approach provides planners with sufficient detail to develop priorities for the oil spill contingency plan. The development of the oil residence, biological and human-use sensitivity indices is discussed in detail in Part I.

3.2 DEFINITION OF INDICES

3.2.1 Oil Residence Index (ORI)

The Oil Residence Index indicates how long oil that reaches the shoreline might be expected to persist. This is important because short persistence on residence times may reduce the need for (or even the possibility of) shoreline protection on cleanup counter-measures, and

short *residence* times may reduce impacts on biological or human use resources. Expected long residence times, however, may require some counter-measure actions.

Potential *oil residence* is determined by:

- wave exposure
- substrate type
- sedimentation processes
- oil type
- spill volume
- oil form at impact zone.

Many of these parameters cannot be determined until the time of the spill so any a priori index must be necessarily general. Wave exposure, substrate type and sedimentation processes can be evaluated prior to a spill, however, and provide a basis for developing the Oil Residence Index (Table 3.1).

The wave exposure is the primary process influencing potential residence of oil. It should be emphasized, however, that wave exposure refers only to the open-water season. From approximately October through June, ice cover is continuous in the Chukchi Sea and there is no wave activity at the shore. Areas of low wave exposure, such as lagoons and estuaries, are likely to have lengthy oil residence periods. Most outer coast areas are comparatively exposed, with wave fetch distance exceeding 500 km during most open-water seasons. Wave exposure is lower in the northern portion of the study area, near Point Barrow, as a result of (a) the shorter open-water season and (b) shorter fetches during the open water season due to the normal proximity of pack ice.

Substrate type may influence potential residence (Table 3.1). Coarse sediment beaches allow penetration of the oil into the substrate where it is no longer exposed to mechanical wave action. For beaches of equal

Table 3.1. RATIONALE FOR ESTIMATING POTENTIAL OIL PERSISTENCE IN THE SHORE ZONE

Shore-Zone Type	Wave Exposure[1]	Substrate Type[2]	Coastal Stability	Level of Concern
Open Coast				
Rock Cliffs	High	Rock	Erosional	Tertiary
Tundra Cliff	Moderate	Sandy gravel	Erosional	Tertiary
Barrier Island	High	Gravelly sand	Stable to erosional	Tertiary
Barrier Island with Vegetation	High	Gravelly sand	Stable to accretional	Secondary to tertiary
Lagoon Coast				
Tundra Cliffs	Low	Sandy gravel	Erosional	Primary to secondary
Barrier Island	Low	Gravelly sand	Stable	Primary
Deltas	Low	Muddy sand, vegetation	Accretional	Primary to secondary
Wetlands	Low	Mud, peat, vegetation	Stable	Primary

[1] Exposure based on maximum open-water fetch lengths
High - fetch > 100 km
Moderate - fetch 10 to 100 km
Low - fetch <10 km

[2] Terminology of Folk, 1968

wave exposure, persistence will be greater on coarse-sediment beaches than fine-sediment beaches. Similarly, mudflats often have short oil residence periods because the fine sediments and the associated high water content of the sediments prevent the oil from penetrating or adhering to the substrate.

Coastal stability and its effect on coastal sedimentation patterns will influence potential oil residence periods. Eroding coastal areas, by nature, will have short potential oil residence periods due to the coastal retreat, particularly since retreat rates of 1 m/yr are not uncommon. Oil residence may be *increased,* however, on accretional shorelines, where there is potential for oil burial, hence removal from exposure to wave action.

3.2.2 Biological Sensitivity Index (BSI)

The Biological Sensitivity Index (BSI) is a guideline for identifying which sections of the shoreline may be considered sensitive to oil spills because of the biological resources potentially present. The BSI levels of concern are defined on the basis of (a) the potential population-level effect an oil spill could have upon a sensitive "target** population or biological resource described in Volume 1 and (b) the Potential recovery time. The BSI is not based on the potential effects to individual organisms (i.e., the *"body count" impact assessment approach) although the effect on the population is obviously related to the effects on individuals. The BSI does not include elements of "risk" (i.e., probability that an oil spill will occur and the oil will reach the area occupied by the biological resource) or the effectiveness of countermeasure response and implementation. It also does not include the human-perceived sensitivity (i.e., all "cute" mammals and birds are more sensitive than worms or snails.)

The BSI levels of concern reflect the assessment of the vulnerability and biological sensitivity of the particular population or community of concern. Vulnerability is the likelihood that some portion of the

biological resource will actively or passively come into contact with oil if the oil is in the same area as the resource. Vulnerability of a resource or likelihood of contact involves a qualitative judgment based on abundance, distribution and behavior of the biological resource in the area and on the spill characteristics as well as weather and oceanographic conditions. The low, moderate and high levels of vulnerability reflect the increasing proportion of the population/community that could come into contact with oil and the potential increase in the portion of the population/community potentially lost. For example, clumped resources such as nesting seabirds or molting oldsquaw are considered more vulnerable than those with relatively non-clumped distributions such as gulls, terns, cormorants, or spotted seals. Birds that dive for their food (alcids) are more vulnerable than those that do not (shorebirds). Animals that move through an area quickly (whales or migrating waterfowl) are less vulnerable than slow-moving (molting waterfowl) or stationary (wetlands) resources.

Sensitivity is the expected impact on and response of the biotic resource following contact with oil. Response is evaluated in terms of potential morality or diminished reproductive capacity and of the resilience of the potentially affected population/community (i.e., how quickly it is likely to recover from the oil spill impacts). For example, seals and whales are not likely to suffer any substantial impacts and their sensitivity is rated low. Seabirds such as murres at Cape Lisburne may experience substantial direct adult, juvenile and egg mortality plus reduced reproductive ability for one or more years, thus resulting in a substantial population level impact requiring several years for recovery.

3.2.3 Human Use Index

The Human Use Index (HUI) explicitly includes peoples* perceptions and importance values in the evaluation of sensitivity and thus to the level of concern applied to each coastal resource or area. The human

use sensitivity evaluation is similar in many ways to the biological sensitivity evaluation because many of the human uses of the Chukchi Sea shoreline are directly or indirectly based on biological resources.

The sensitivity of human resources to an oil spill is a function of (a) spill characteristics, (b) vulnerability or risk that the resource will be impacted and (c) the importance of the resource.

Development of the human use sensitivity index incorporates the following human use criteria:

- frequency of human use and presence
- relative distribution and abundance of the resource
- proximity of the resource to communities
- importance of the resource to local residents (cultural significance, contribution to diet)
- characteristics of the oil spill (e.g., size, type Of oil, location *of* spill, etc.) .

While large areas associated with each village are utilized, certain areas are more important than others. '*Importance*' depends on proximity to the village(s), use or harvest levels, and uniqueness of the human resources. In areas close to communities or of importance to local residents, perceptions of potential impact may actually exceed real impact.

The HUI has been developed for the following human resources of the Chukchi Sea coastal environment: (a) residential (communities), (b) transportations, (c) recreation (special use), (d) subsistence, and (e) cultural resources. The first three resources are relatively fixed in location, and, once established, the levels of concern or sensitivity values for these uses (e.g., presence of a house) should not vary much over time or on a seasonal basis.

However, the location and harvest of subsistence resources and the importance of their contribution to the community varies significantly on a month-to-month basis and from year to year. This variation and limitations to available data require some subjectivity in developing sensitivity classifications. Cultural resources are also fixed at specific areas. However, the importance of the same resource in different areas can vary widely, and the specific location can influence sensitivity to spill persistence and cleanup activities.

The vulnerability of resources and uses to oil spill impact is an important aspect of sensitivity. Some of the human uses are directly vulnerable to oil spill impacts; i.e., spilled oil could directly contact the resource or interfere with the activities of interest to people. These uses include most of the subsistence hunting and fishing activities, recreation where it depends on shoreline use or access, and transportation. The recreation and transportation uses are most likely to be affected during the containment and cleanup which may involve an increase in people and vehicle activities and thus interference with these uses. The subsistence hunting and fishing activity may be directly affected because oil could ruin nets, foul boats, and generally be unpleasant to work around; however, few of the resources except waterfowl themselves are likely to be directly affected. Increased activity associated with spill cleanup may also cause subsistence resources to avoid the area.

Some human uses are not likely to be directly affected (vulnerable); i.e., oil on the water or shoreline is not likely to directly contact villages, military operations, most cultural resources, or even many recreation or transportation uses. However, the oil spill cleanup operations may have a major impact on these human uses, especially if large amounts of equipment and number of people are moved into the area.

3.3 LEVELS OF CONCERN

3.3.1 Background

The significance of the potential effects of an oil spill on shore-zone and coastal resources is expressed as three general levels of concern, labelled primary, secondary, and tertiary or high, moderate and low, respectively. This three level system is simple, unlike most other oil spill sensitivity indices that employ four or more sensitivity levels (see Part I). The three-level system combines information of varying quality into easily understood categories typically used by decision-makers, especially in actual oil spill events.

In practical terms, the three levels of concern, regarding any of the components of the three resource categories, can be described in the context of an actual oil spill. The Primary (or High) category has high visibility with the public, government agencies, and other concerned groups . There will be considerable public and official pressure to implement protective or cleanup counter-measures without regard to cost or practicality. The majority of knowledgeable sources will agree that there will be (or is perceived to be) a significant impact to the resource if oil contacts it. The Tertiary (or low) category attracts very little attention. There is little pressure from any knowledgeable source to take counter-measure actions because there is general agreement that the resources will not be affected. The Secondary (or moderate) category, however, includes those situations where there is considerable debate in the media and among knowledgeable sources about the importance of the resource, 'the cost-effectiveness of counter-measures and the likely impact of oil contacting the resource.

In most cases, decisions about the need to take counter-measure actions in areas assigned Primary or Tertiary Levels of Concern will be straight-forward (although the actual implementation may not be) and can be planned for on an a priori basis. However, decisions in areas assigned a Secondary Level of Concern are probably best made at the time of the spill though some planning can take place on an a priori basis.

Not uncommonly, the level of concern is influenced or even established by policy makers, government regulatory bodies, or the public on the basis of perceived sensitivity of the biological or human use to oil spills. This perceived sensitivity and usually high level of concern may not reflect the real ecological or human use sensitivity. That is, the species, habitat or human activities may not be substantially affected by the oil and, on a strictly ecological or economic basis, should be assigned a lower level of concern. For example, there is very little evidence from past oil spills that pinnipeds or whales in open water situations are adversely affected by oil spills, so long as the pinnipeds or whales are allowed to move about on their own accord. Yet pinnipeds and their haulout or shoreline rookery areas and whale intensive-use areas are often assigned a high level of concern by decision-makers and the lay public based on a perceived sensitivity.

Estimation of the level of concern is necessarily subjective due to the large amount of uncertainty about the physical, biological and human use conditions at the time of an actual spill and about the characteristics of the spill itself. The indices or levels of concern do not include an estimate of the likelihood of an oil spill occurring. The levels of concern presented on the maps are based on the experience and professional judgment of the authors and on the pertinent literature on the short and long-term effects of spilled oil on shore-zone resources. Here accurate estimates of the level of concern, especially for Secondary categories, can be made at the time of the spill when the numerous variables affecting the level of impact can be evaluated in real time.

3.3.2 Use of Coastal Sensitivity

For each Coastal Resource Map, there are three Coastal Sensitivity Maps which display the levels of concern for the indices. These maps only display the spatial distribution of the ORI, BSI and HUI. They do not indicate the seasonal distribution of the level of concern; that is displayed on the "Seasonal Variability of Indices" table (discussed later).

The criteria for each level of concern used for each of the three indices are shown in the Coastal Sensitivity Legend (Figure 3-1). Each level of concern is depicted on the maps and the "Seasonal Variability of Indices" table with a distinctive pattern:

- Primary - solid black stripe
- Secondary - black and white candy stripe
- Tertiary - clear stripe

For the shore-zone resources and uses, the longshore bounds over which each level of *concern is* applicable is indicated by perpendicular lines from the shoreline to the level of concern stripe (Figure 3-2).

For the biological or human use resources associated with the lagoons or bays, the primary or secondary level of concern is shown as a box around the identifier (Figure 3.2). The biological or human use resources in the lagoons and bays at a tertiary level of concern are not shown .

There may be different shore-zone types affecting the oil residence time (ORI) or biological (BSI) or human use (HUI) resources on a single map (Figure 3-2). Each component is assigned a unique identifier ("R" for ORI, "B" for BSI, and *'H" for HUI) so that the seasonal variability of each component can be described in the "Seasonal Variability of Indices table (Figure 3-2).

Occasionally, there will be *more* than one resource in the same shore-zone section, and one will be assigned a secondary level of concern while the other is assigned a primary level of concern. On the map, this will appear as a solid black line to indicate the higher priority concern. However, in the '*Seasonal Variability of Indices" table, all resources within the identified section of shore-zone will be shown along with the seasonal distribution of the level of concern. Figure 3-3 provides an example where the BSI identifier B1 includes a primary level

COASTAL SENSITIVITY LEGEND

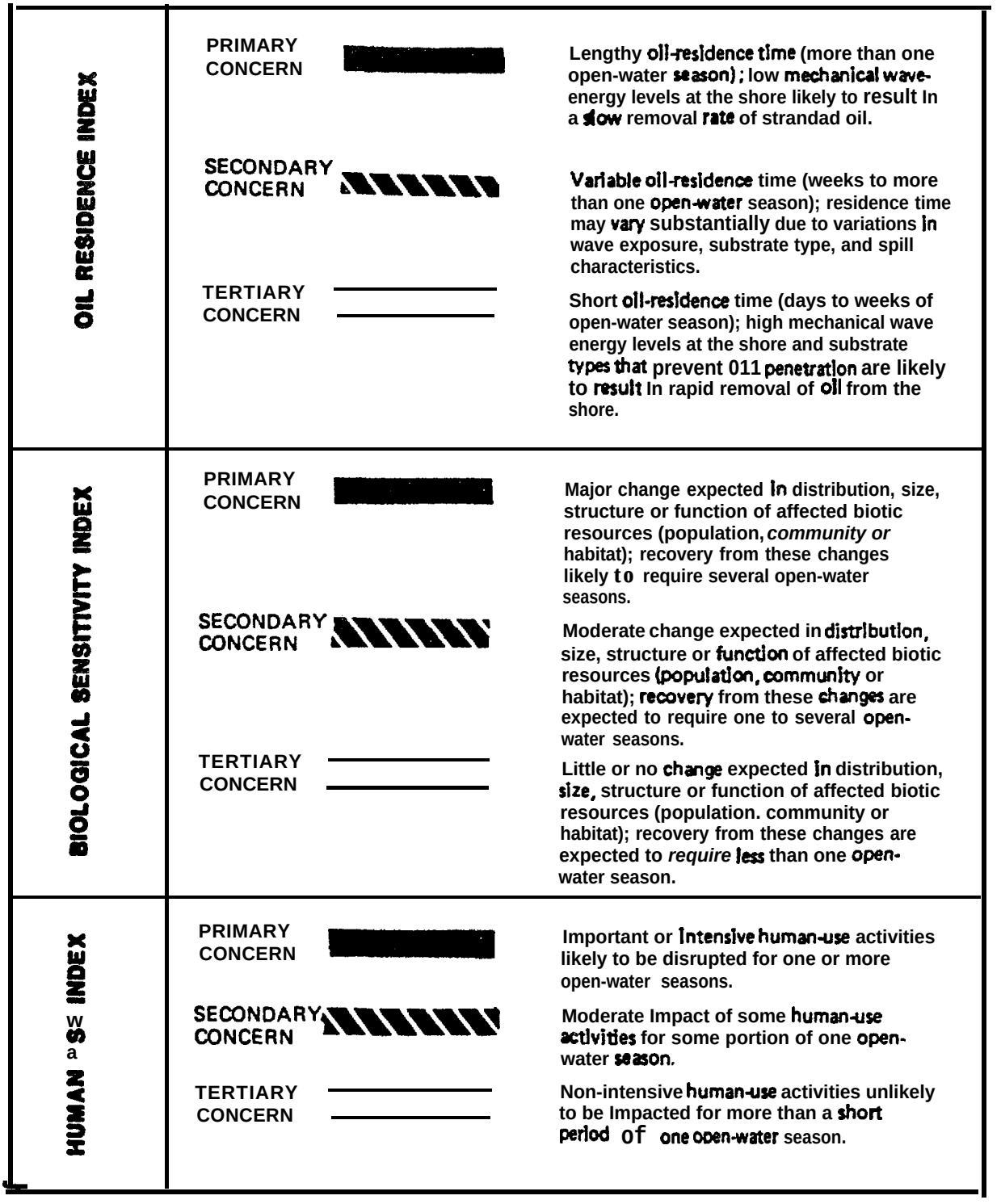
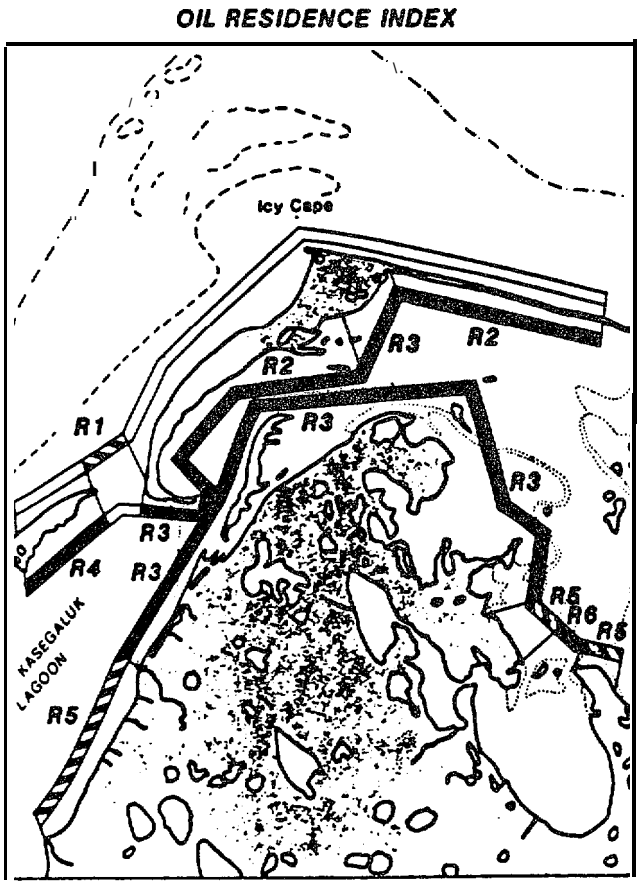
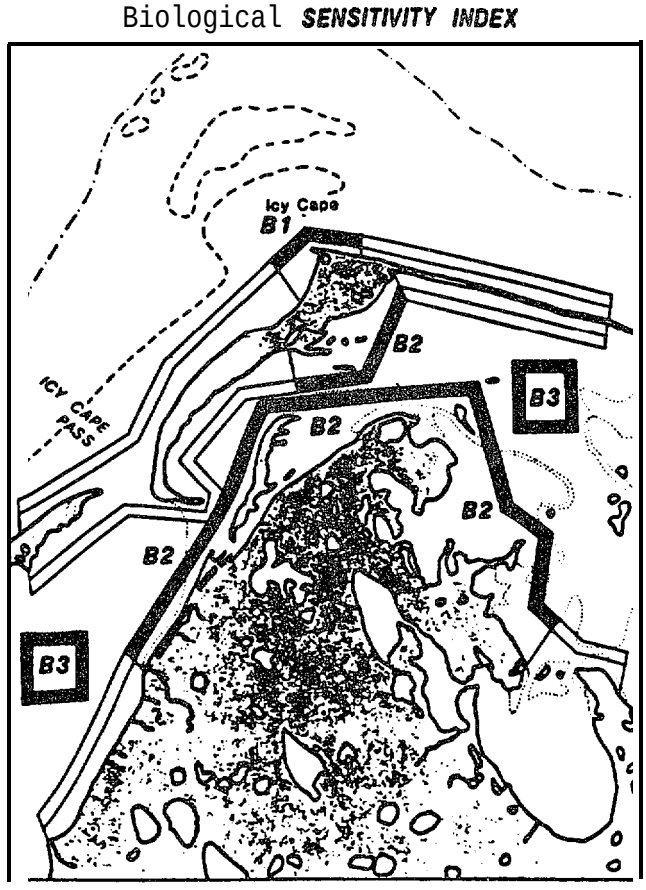
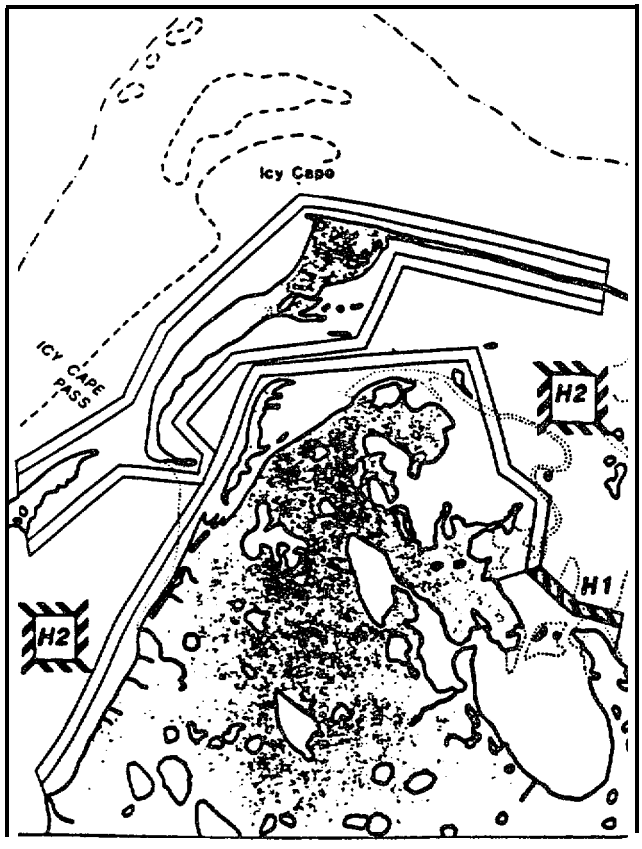


Figure 3-1. CRITERIA FOR ASSIGNING LEVEL OF CONCERN FOR EACH INDEX







Seasonal Variability of Indices

Identifier	RESOURCE
R1	Stable inlet; recurve spits
R2	Low energy beach; mudflat
R3	Low energy beach; mudflat; wetland
R4	Low energy beach
R5	Protected tundra cliff
R6	Stable inlet; lagoon
R7	Low energy beach; Wetland
B1	Eider (62 pr), gull (2 pr) and arctic tern (6 pr) nesting
B2	Extensive mudflats and wetlands
B3	Kasegaluk Lagoon (Icy Capa area) Extensive mudflats and wetland
H1	Fishing
H2	Beluga whale hunting Spotted seal hunting Fishing

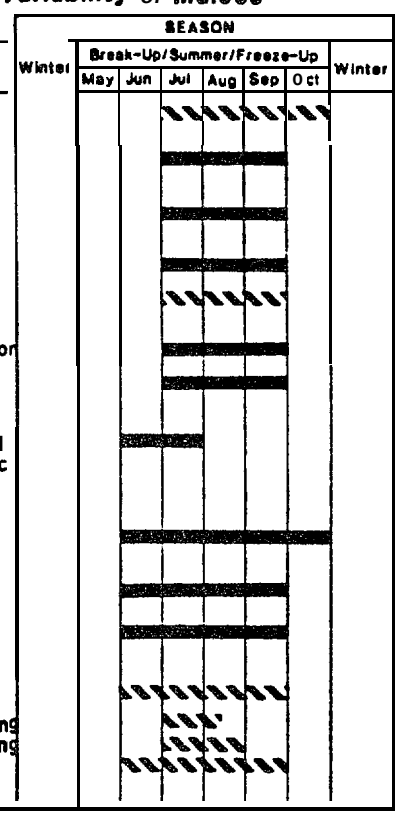
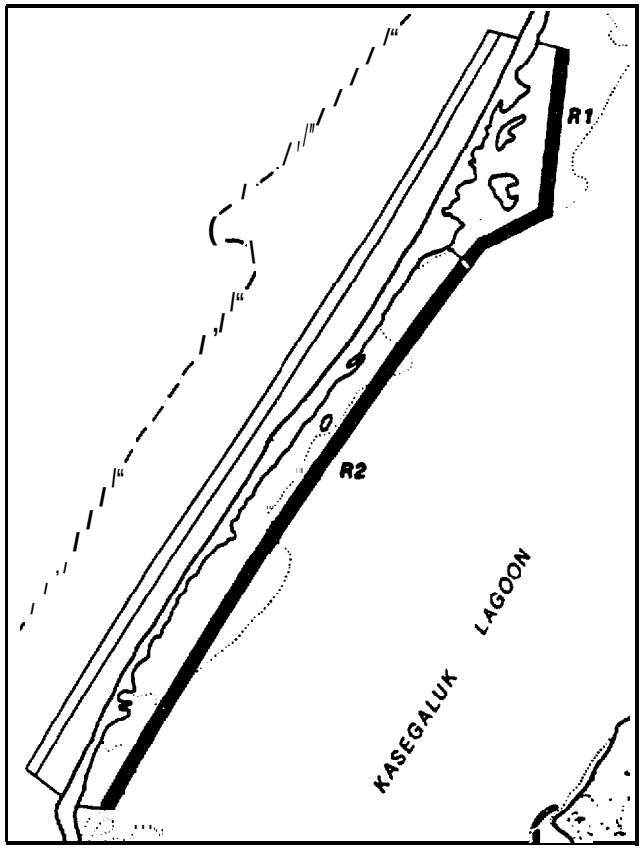
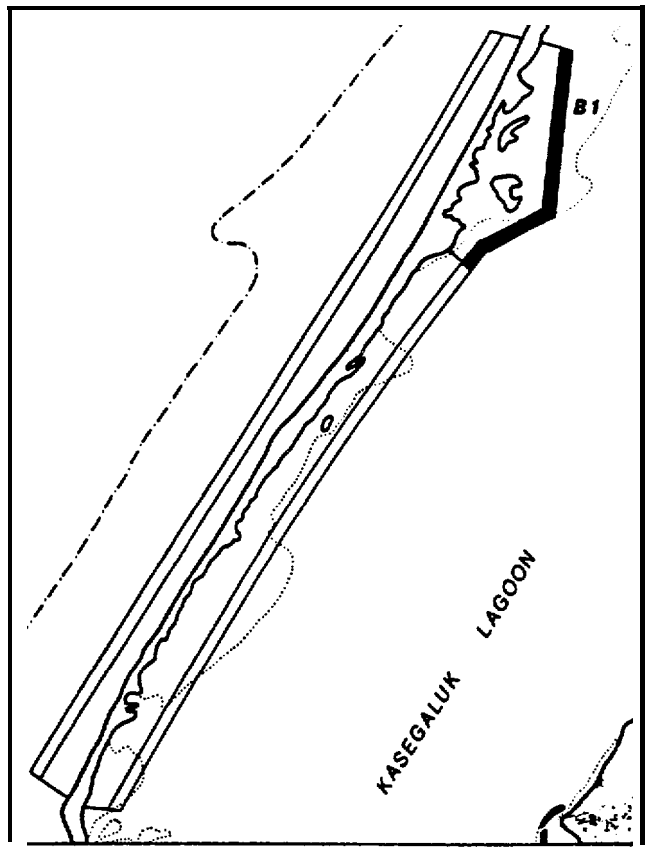


Figure 3-2. EXAMPLE OF SENSITIVITY INDEX MAPS AND TABLE

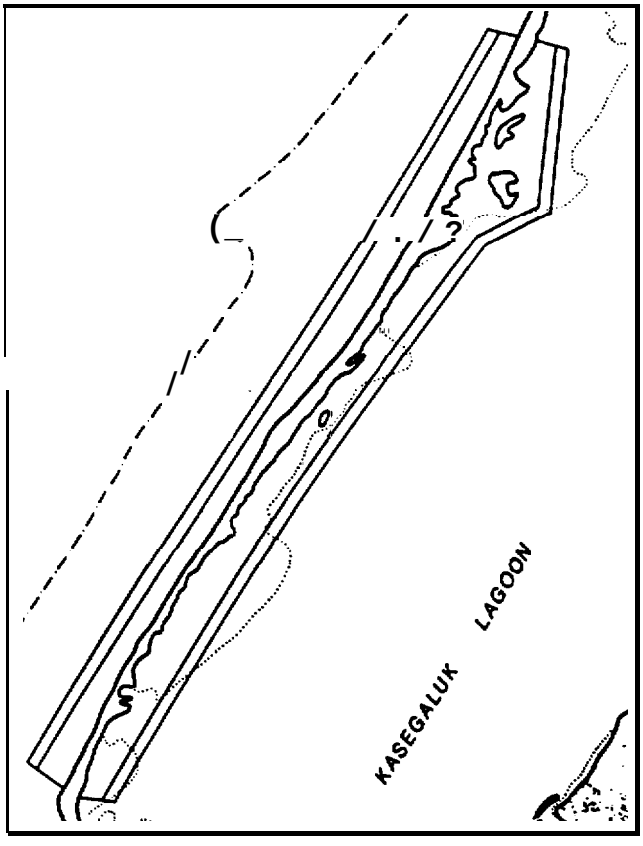
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



HUMAN USE INDEX



Seasonal Variability of Indices

Identifier	RESOURCE	SEASON: Winter	Break-Up/Summer/Freeze-Up: May	Jun	Jul	Aug	Sep	Oct	Winter
R1	Mudflat; Wetland			■	■	■	■		
R2	Mudflat; Low energy beach			■	■	■	■		
B1	Wetland Eider (22 pr), arctic tern (16 pr) and brant (4 pr) nesting			■	▨	▨	■		

Figure 3-3. EXAMPLE OF MORE THAN ONE RESOURCE IN THE SAME SECTION OF SHORE ZONE

of concern for wetlands but only a secondary level of concern for waterfowl and tern nesting areas.

3.4 SEASONAL VARIABILITY OF INDICES

The temporal or seasonal variability of oil persistence, or biological and human use resource sensitivity levels cannot be shown on the maps easily without cluttering them. However, the seasonal distribution of resources and activities may be very significant in oil spill counter-measure planning or implementation. For example, there is no need to plan for or to implement counter-measures at a waterfowl nesting area in early September because the birds will have left the area weeks before. That information would not be readily apparent from the maps, however.

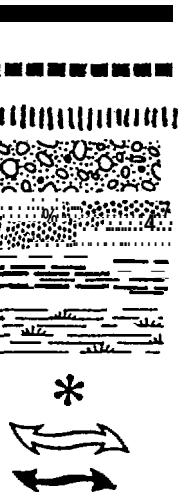
Along with the maps, we include a table showing the seasonal variability of the primary and secondary levels of concern for each identified component for each index (Figure 3-2 and 3-3). Tertiary levels of concern are not shown. only the open water season is included because it is unlikely oil will reach the shore-zone during the winter when sea ice covers the nearshore-shoreline area.

COASTAL RESOURCE LEGEND

PHYSICAL RESOURCES

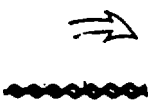
SHORE-ZONE COMPONENTS

- ROCK CLIFF
- HIGH TUNDRA CLIFF
- LOW TUNDRA CLIFF
- MIXED SEDIMENT BEACH
- SAND BEACH
- MUD/SAND FLATS
- WETLANDS
- LAGOONS/ESTUARIES
- INLETS
  - Ephemeral
  - Stable



SHORE-ZONE MODIFIERS

- WASHOVER CHANNELS AN D FANS
- BARRIER ISLAND VEGETATION

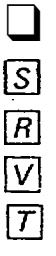


BIOLOGICAL RESOU RCES

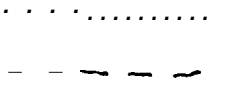
- MARINE BIRD AND WATERFOWL NESTING COLONIES
- GULL AND TERN NESTING AREAS

HUMAN-USE RESOURCES

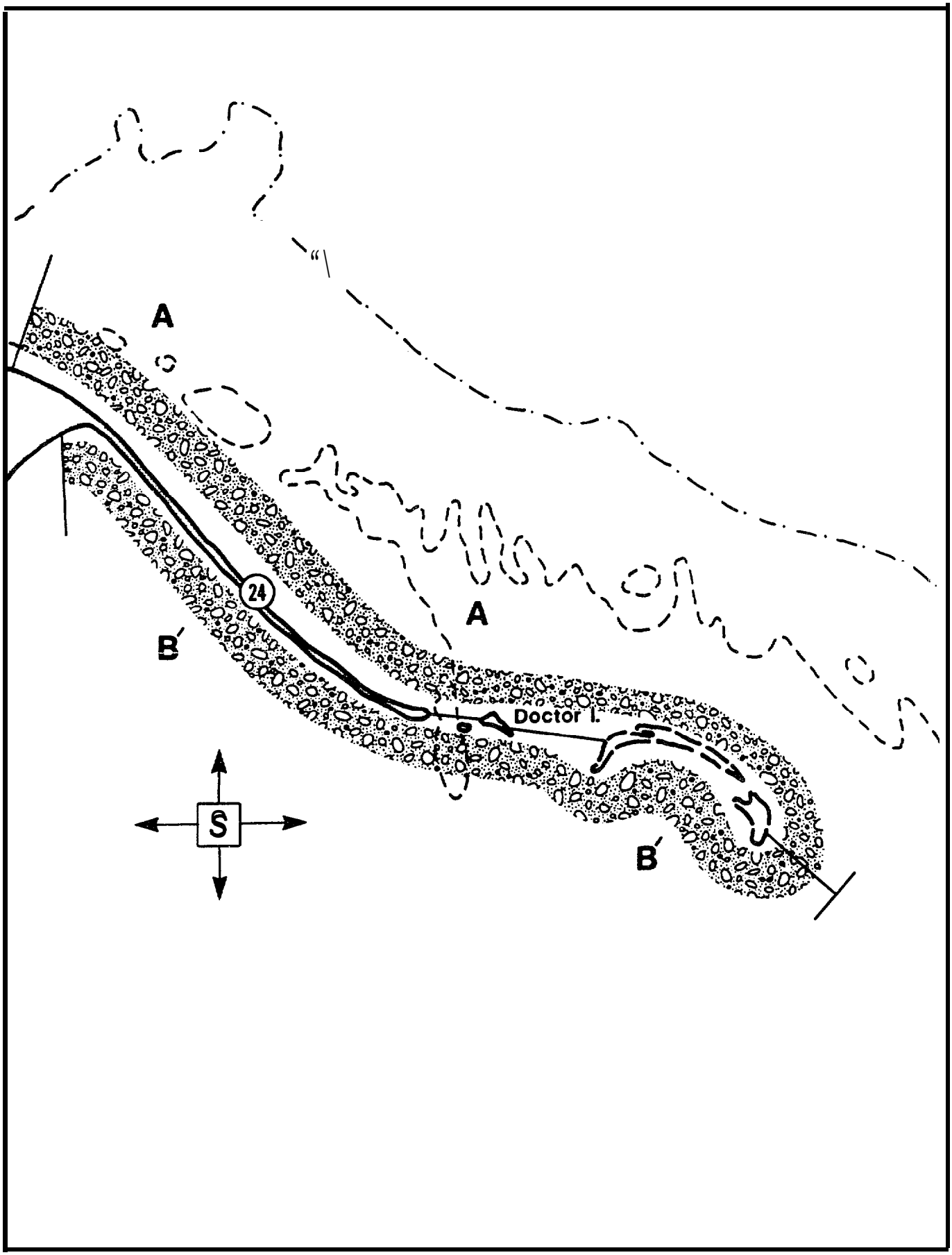
- *industrial/%IILITARY*
- *SUBSISTENCE* — S
- *RECREATIONAL* — R
- *PERMANENT VILLAGE* — V
- *TRANSPORTATION CORRIDOR* — T



- *Ground Truth Station* — (1) to (54)
- *Intertidal Zone*
- *5m Bathymetric Contour*
- *10m Bathymetric Contour*
- *20m Bathymetric Contour*
- *Topographic Contours (m)* — *100m*



Scale 1:50,000 — 0 — *1km*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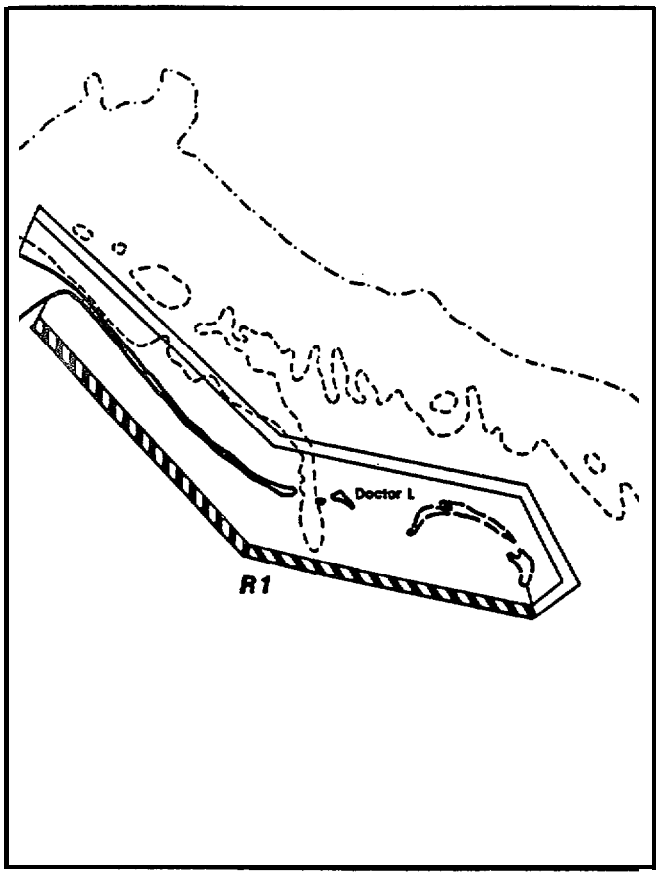
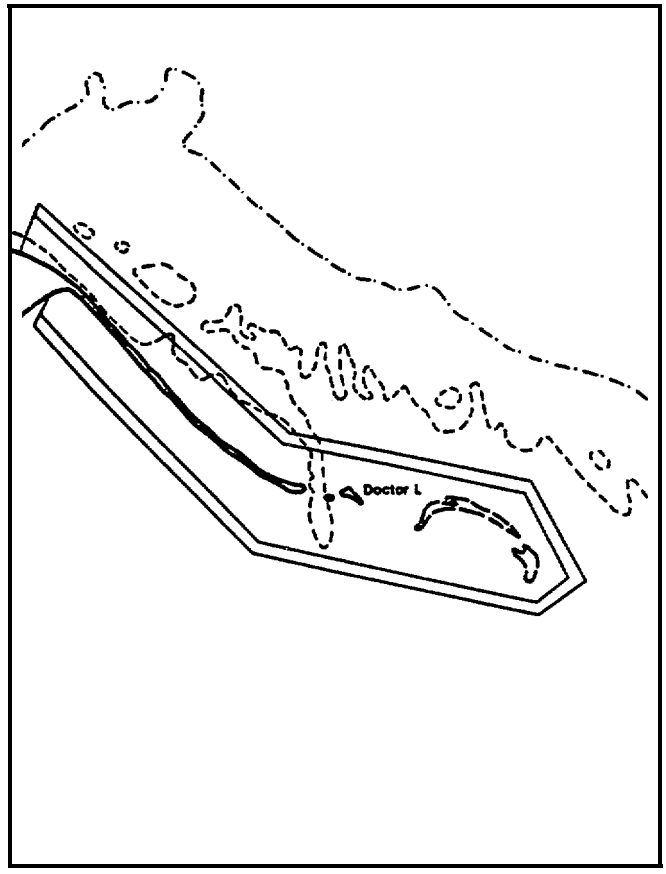
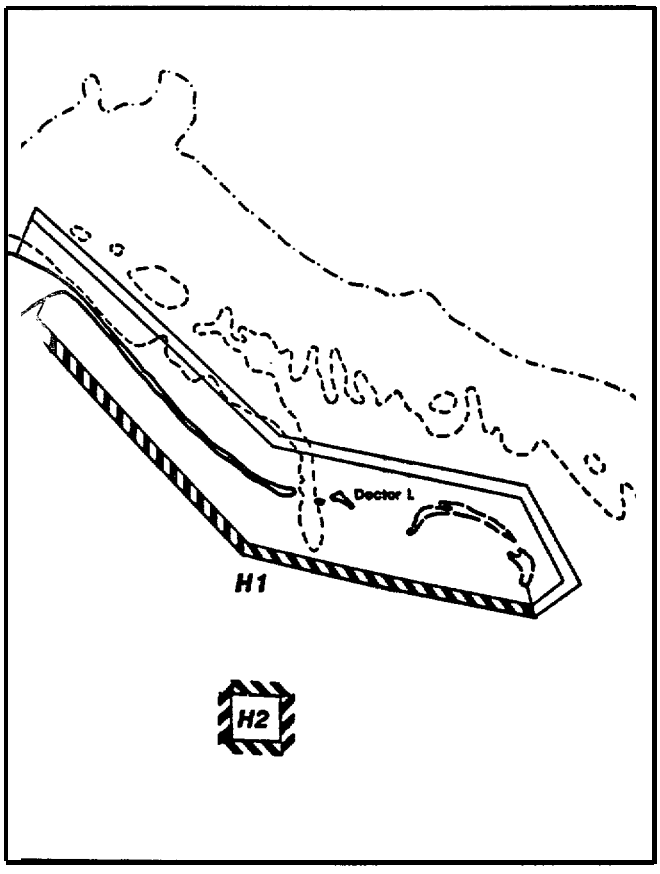
OIL RESIDENCE ***INDEX***



BIOLOGICAL ***SENSITIVITY*** *INDEX*



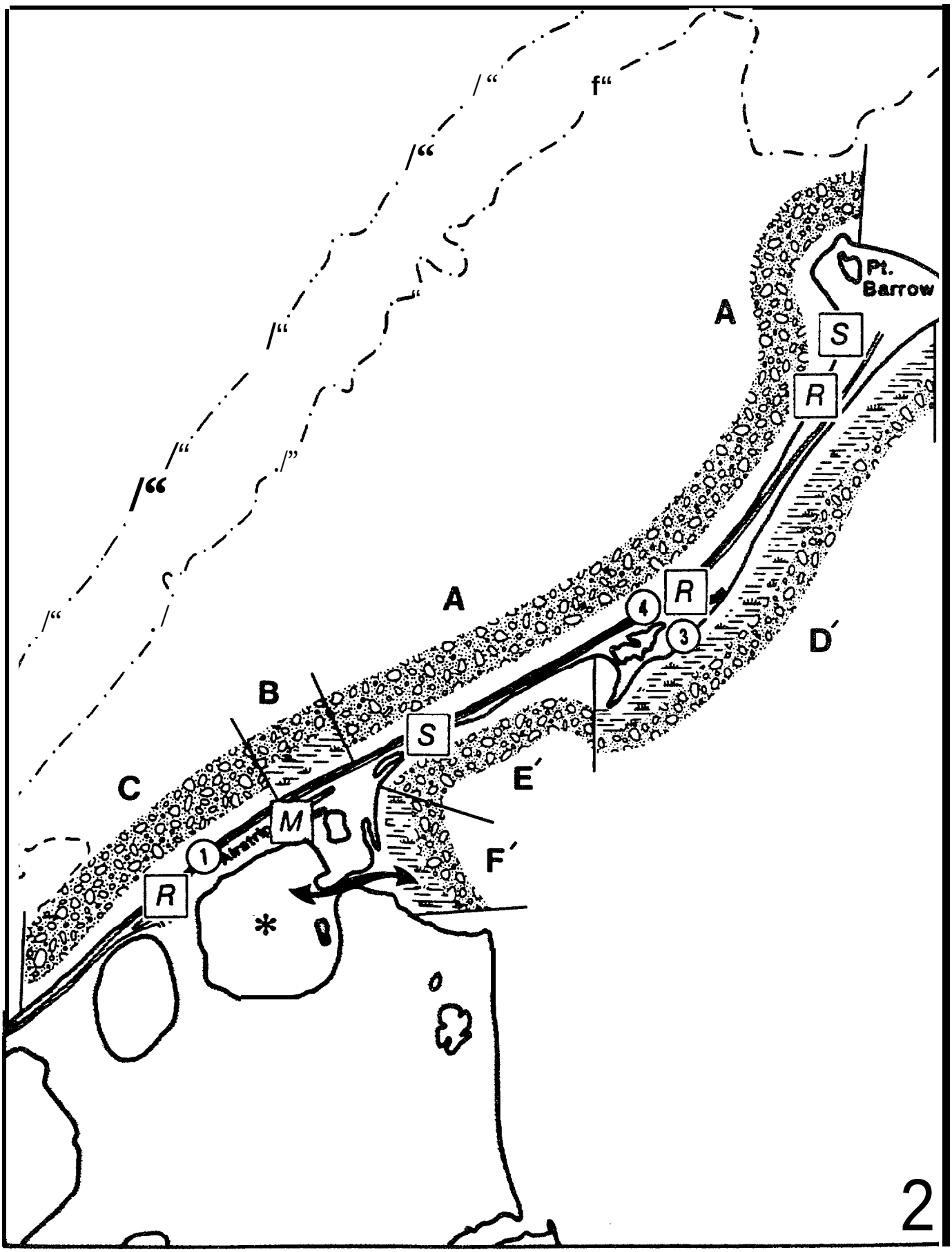
HUMAN USE INDEX



Seasonal Variability of ***Indices***

Identifier	RESOURCE	SEASON							
		Winter	Break-Up/Summer/Freeze-Up						Winter
			May	Jun	Jul	Aug	Sep	Oct	
R1	Lou energy beach				▬	▬	▬		
H1	Waterfowl hunting			▬	▬	▬	▬		
H2	Fishing					▬	▬	▬	

1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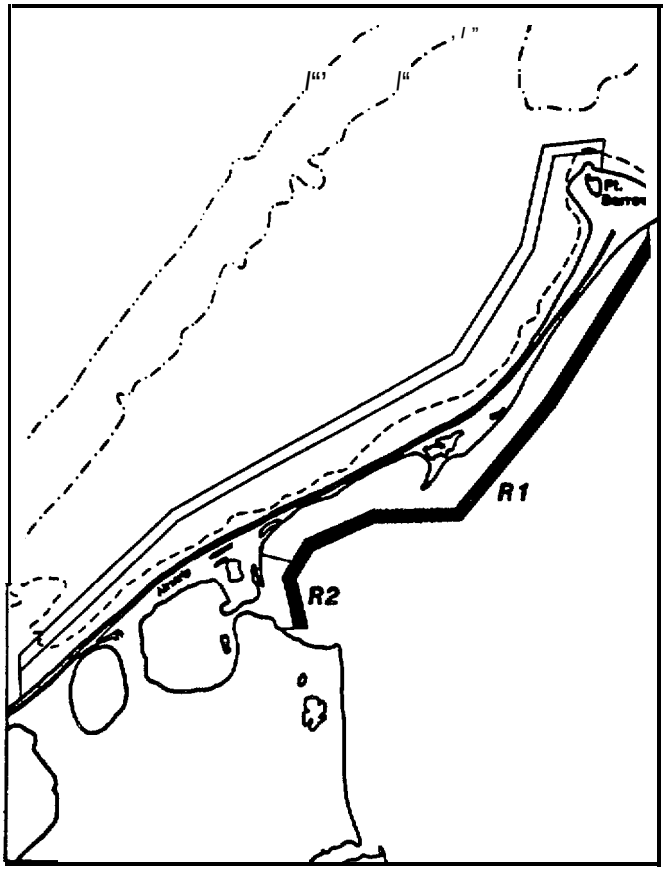
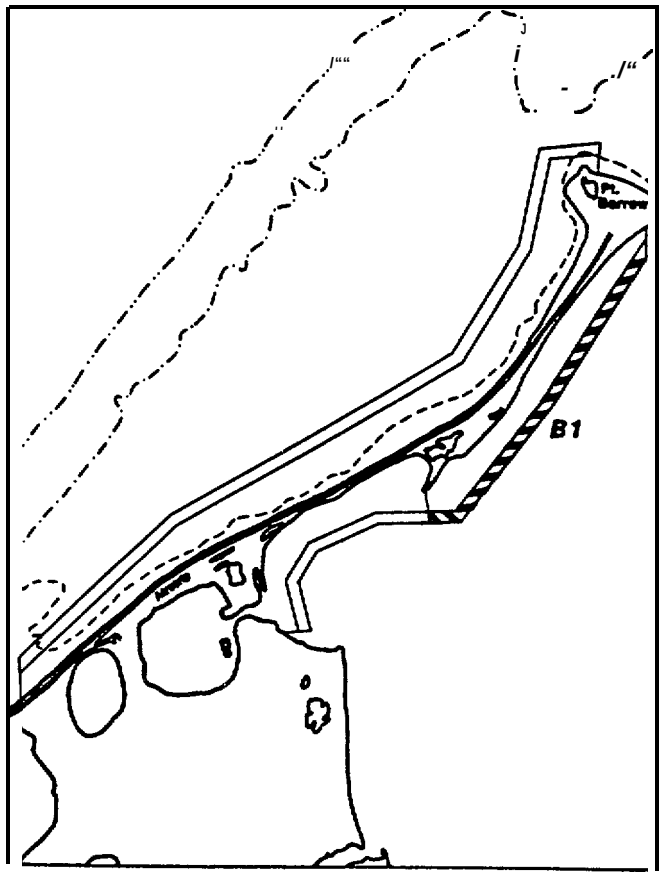
2

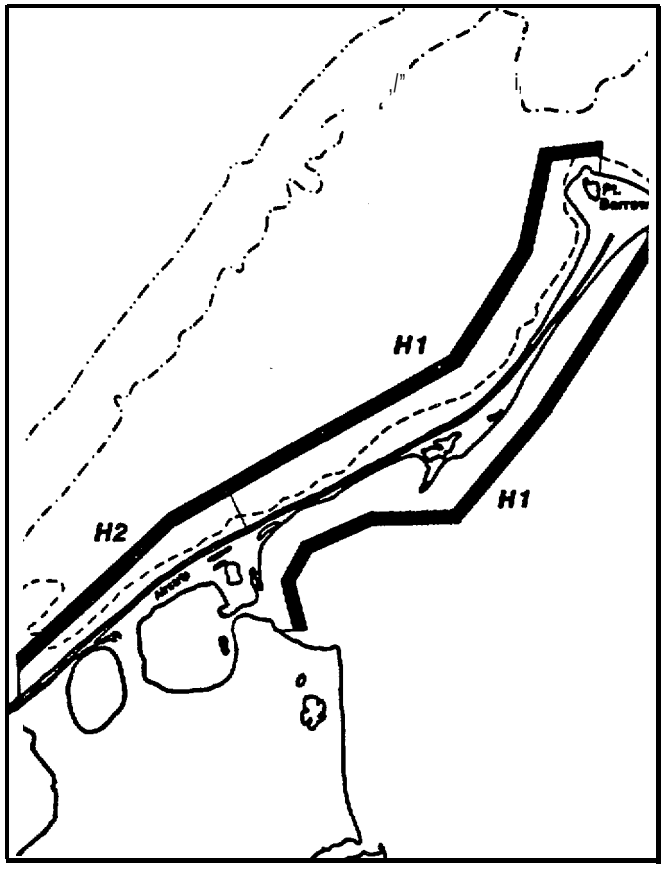
OIL RESIDENCE INDEX



*B1OLOOICA1 SENSITIVITY **INDEX***



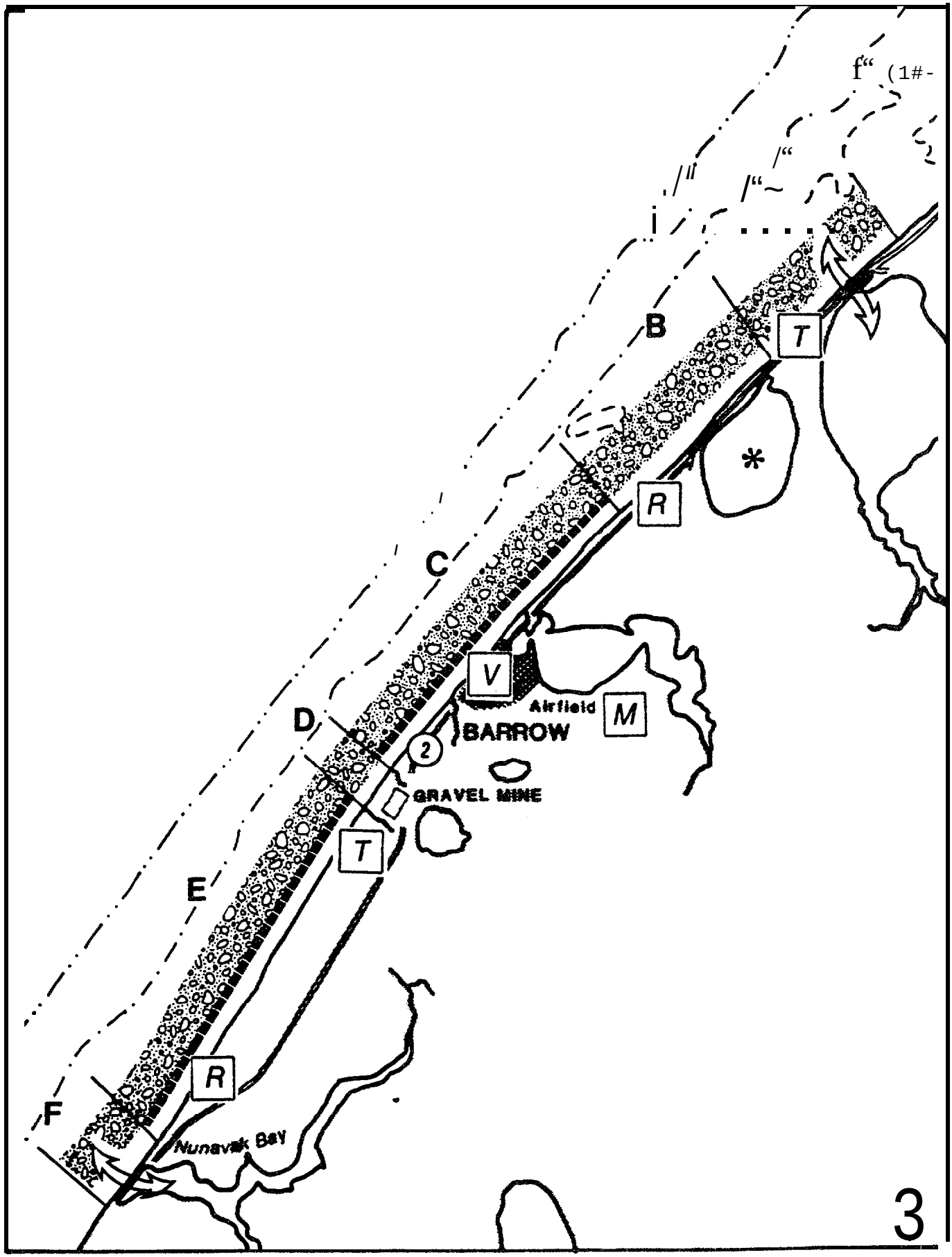
HUMAN USE INDEX



Seasonal Variability** of **Indices

Identifier	RESOURCE	Winter	Break-Up/Summer/Freeze-Up						Winter
			May	Jun	Jul	Aug	Sep	Oct	
R1	Low energy beach								
R2	Low energy beach; Lagoon								
B1	Wetland Marine bird, shorebird, waterfowl use								
H1	Waterfowl hunting Subsistence access Resident recreation								
H2	Subsistence access Resident recreation								

2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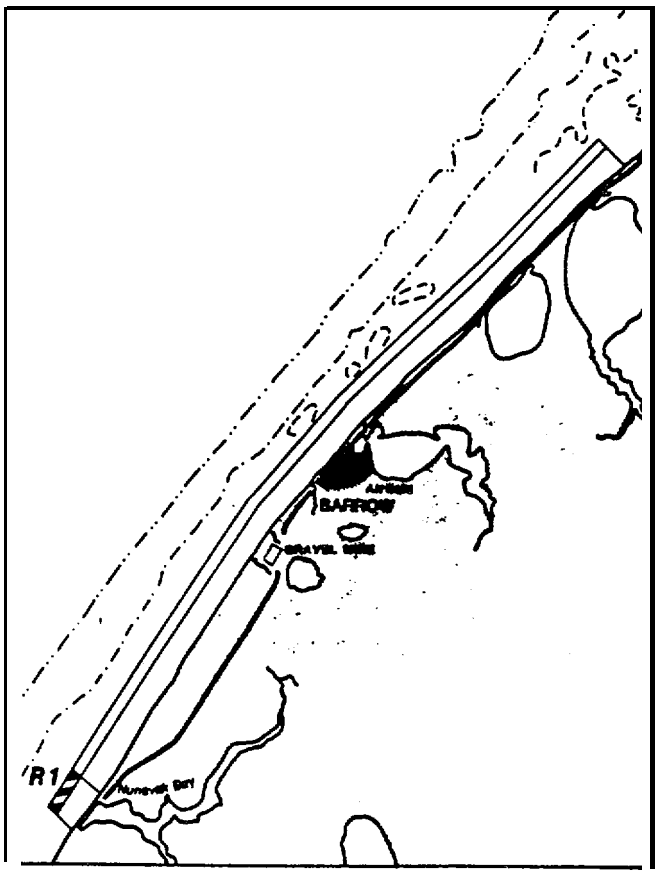
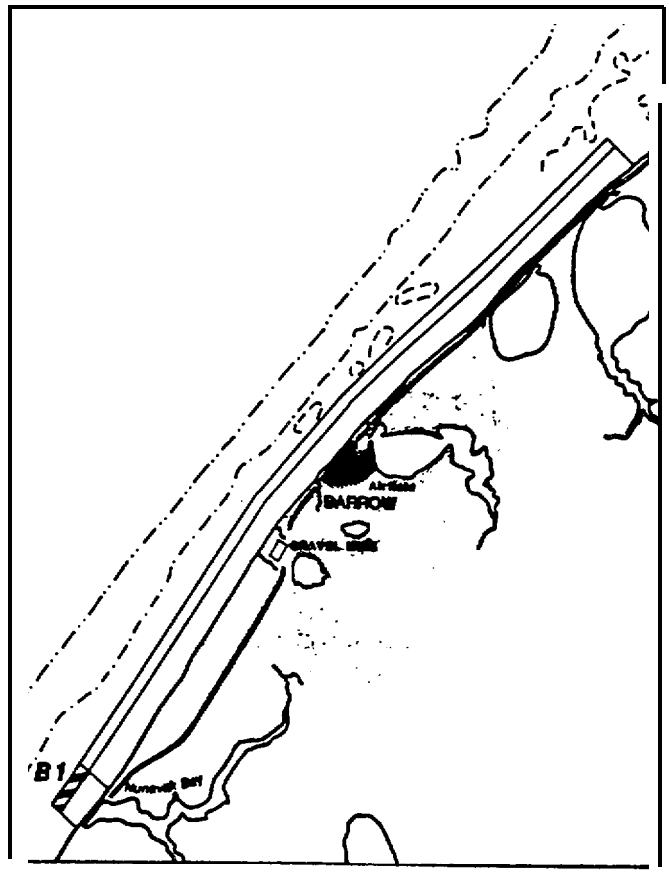
BARROW
GRAVEL MINE
Nunavak Bay
3

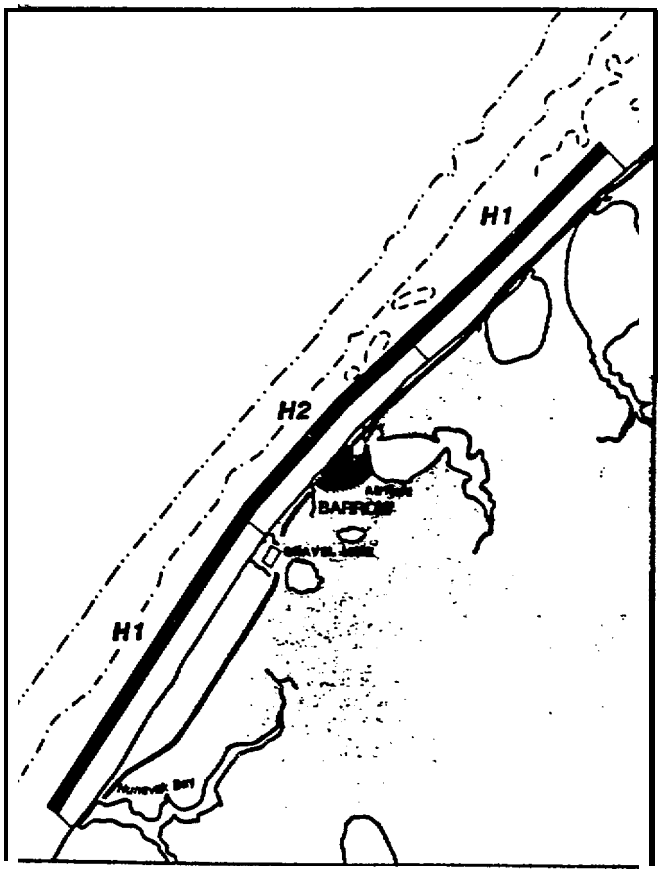
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX

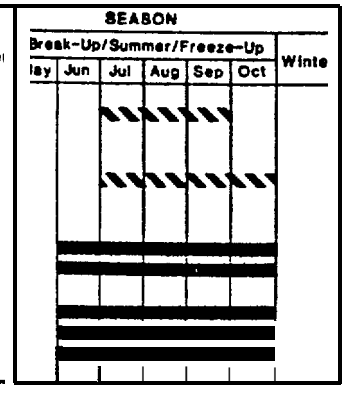


HUMAN USE INDEX



Seasonal Variability of Indices

dentifier	RESOURCE	Inter
RI	Lagoon	
B1	Lagoon	
H1	Subsistence access Resident recreatio	
H2	Village of Barrow Subsistence access Resident recreatio	



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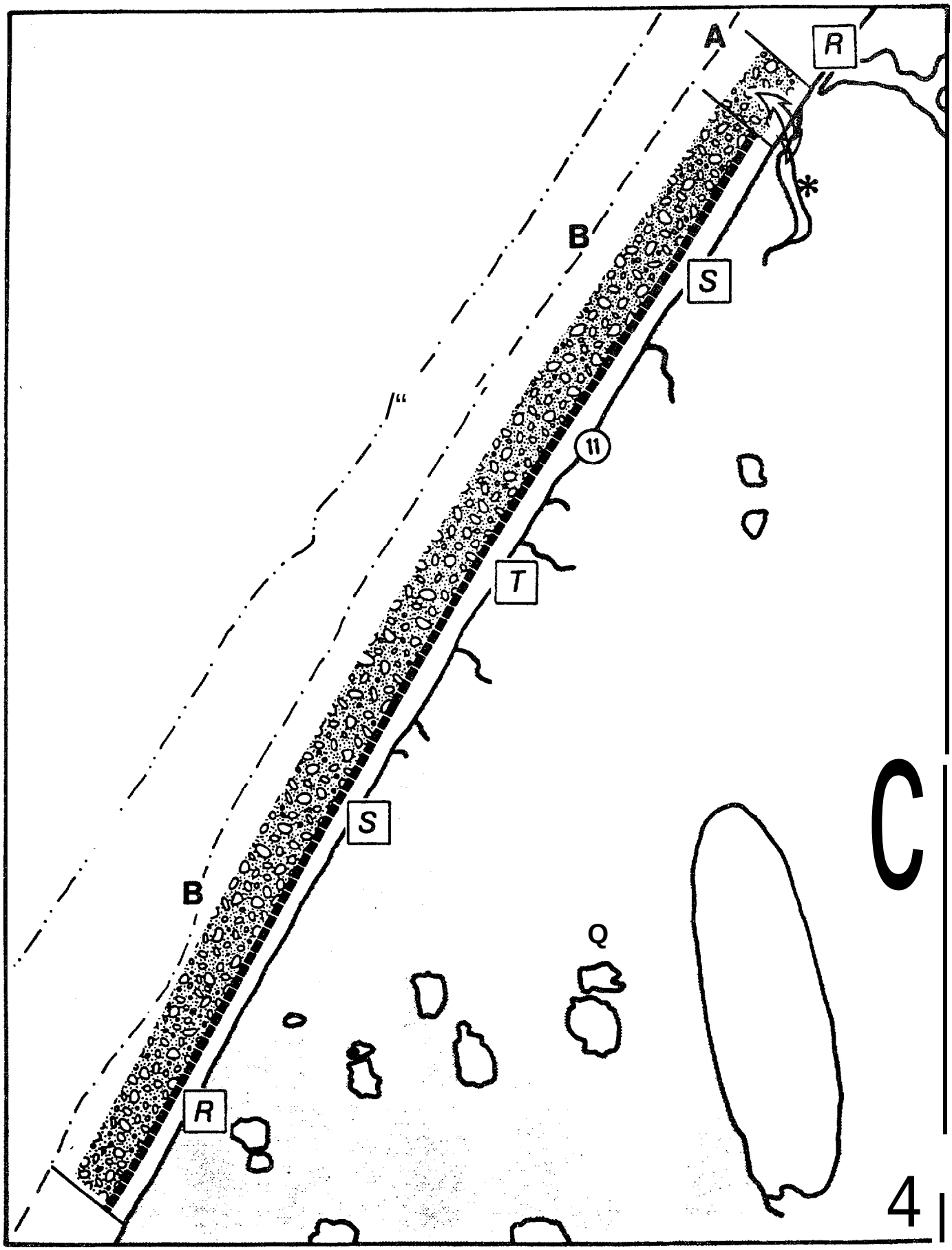
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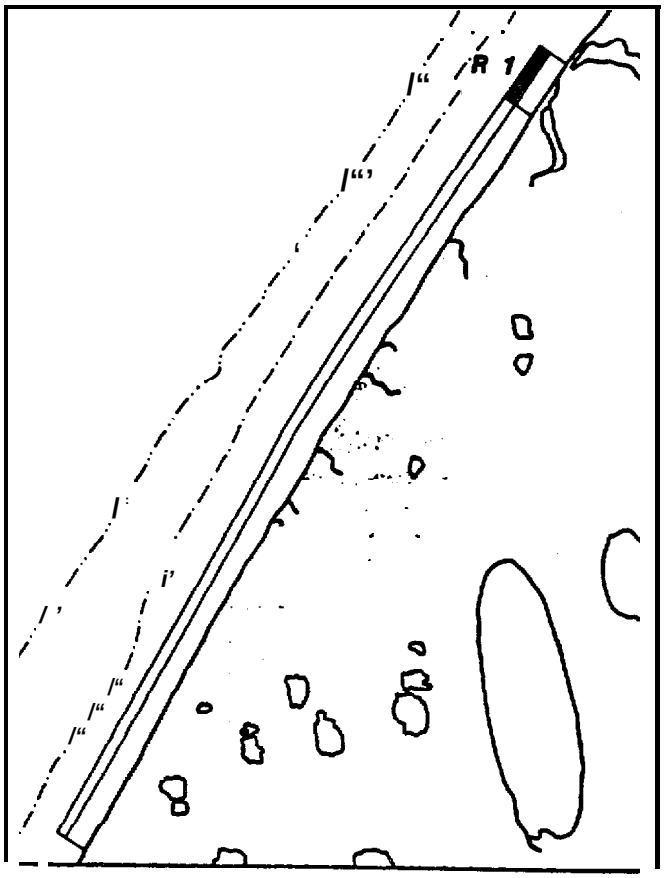
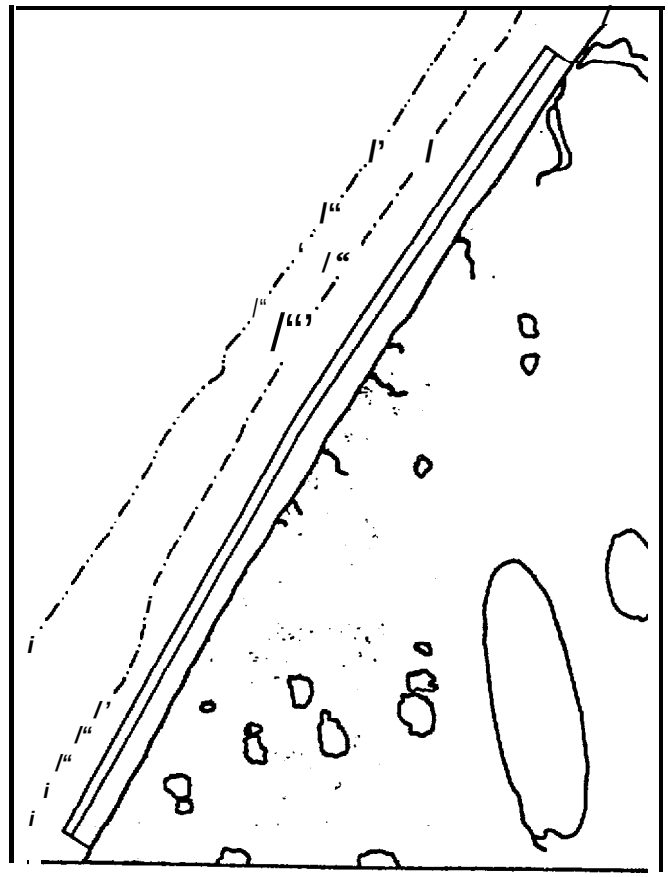
OIL RESIDENCE INDEX



*BIOLOGICAL SENSITIVITY **INDEX***



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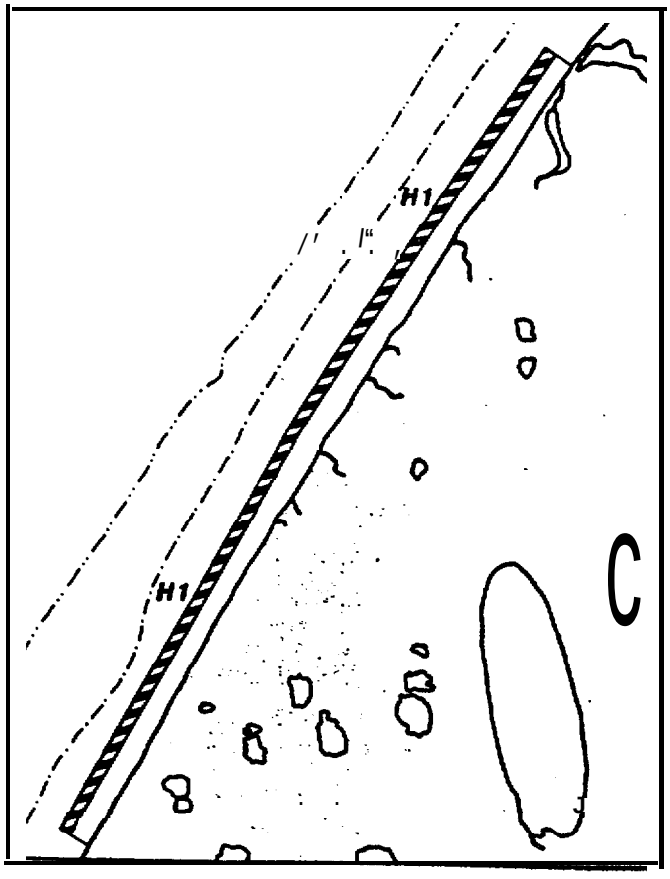
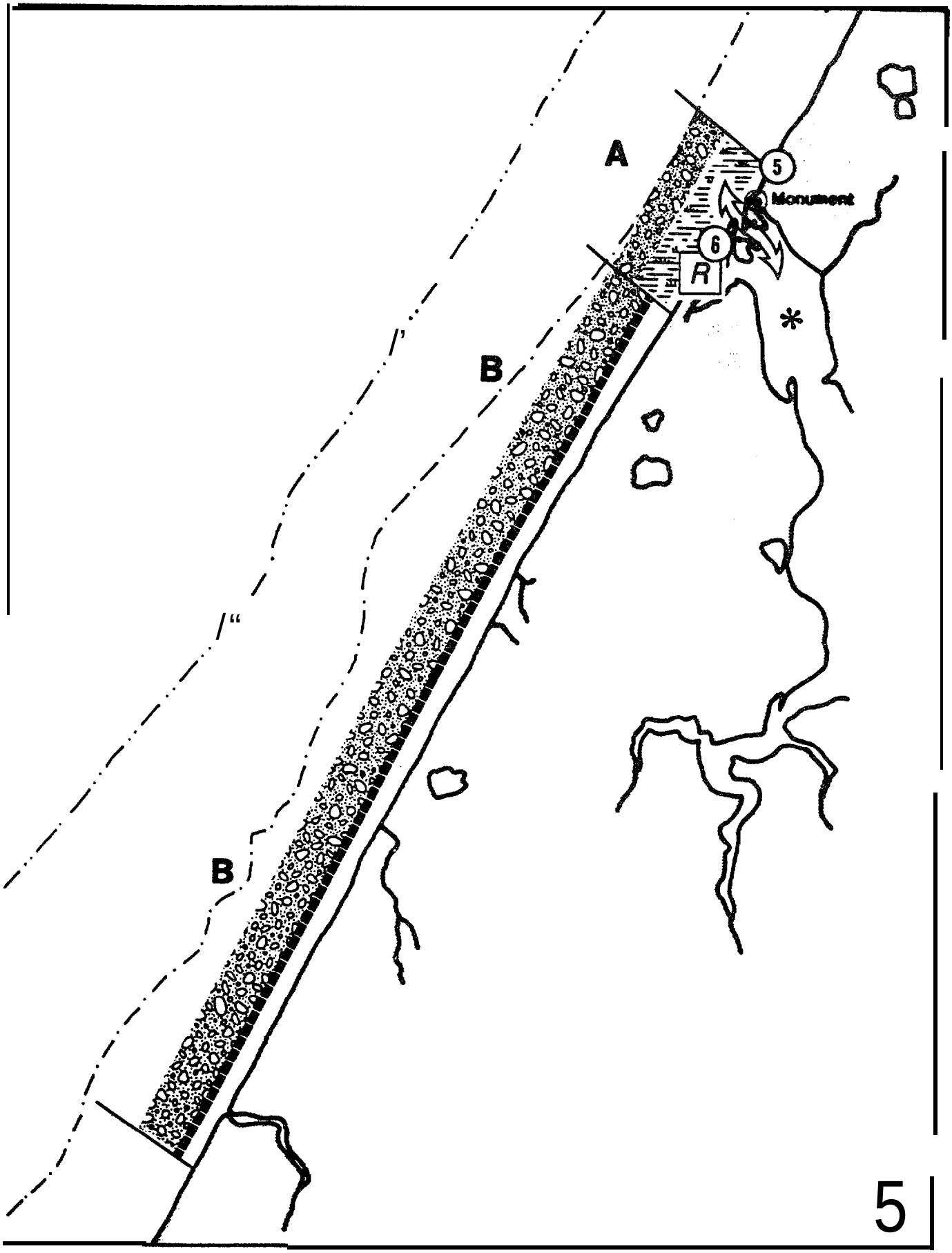


*Seasonal **Variability** of **Indices***

Identifier	RESOURCE	Winter
R1	Lagoon	
H1	Subsistence access Resident recreation	

4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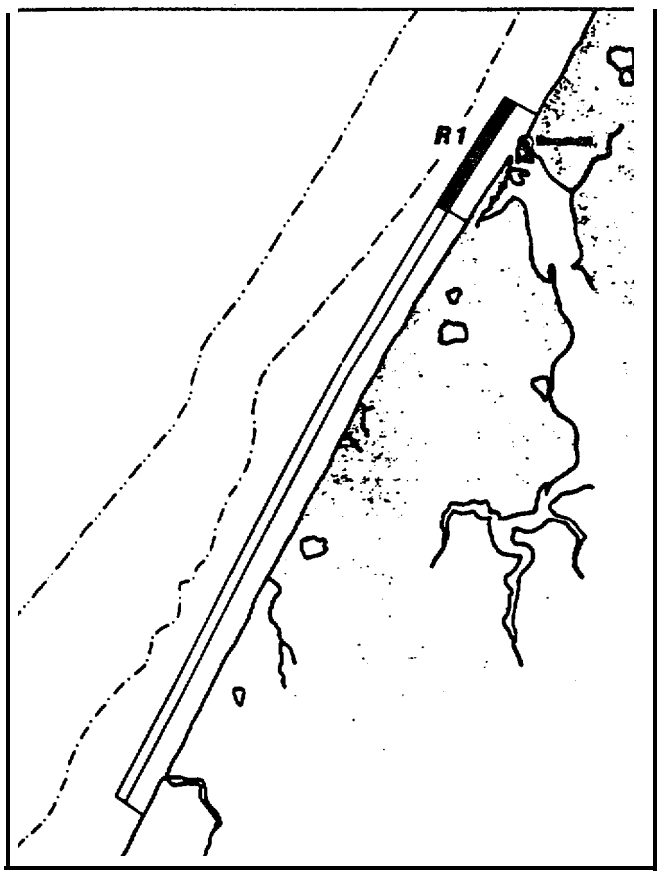
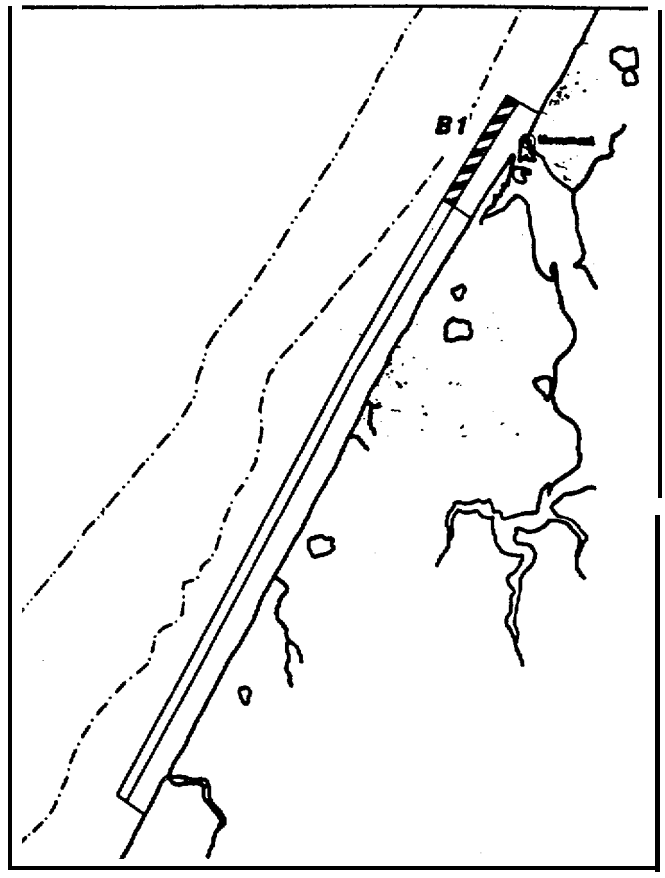
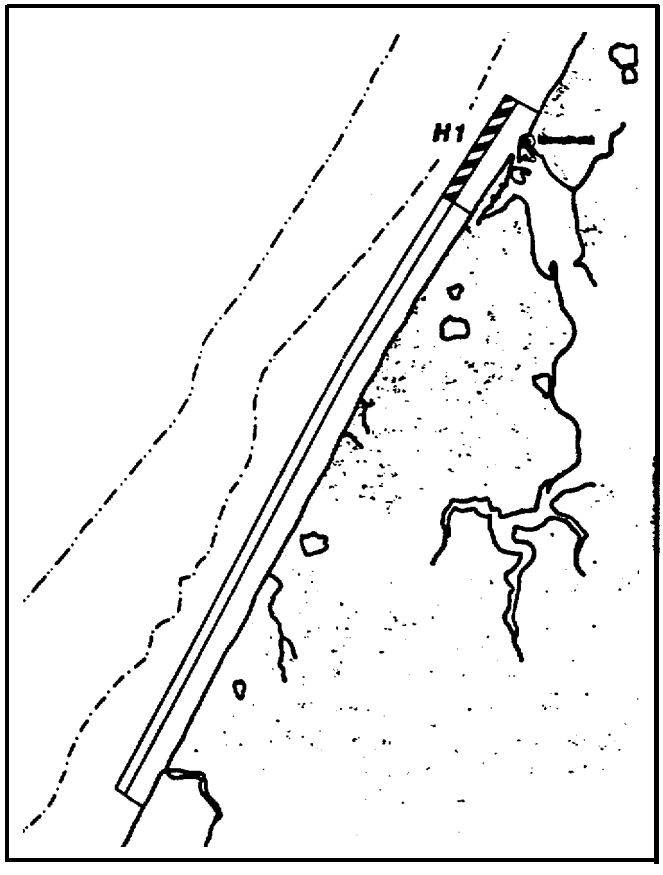
OIL RESIDENCE *INDEX*



BIOLOGICAL *SENSITIVITY* **INDEX**



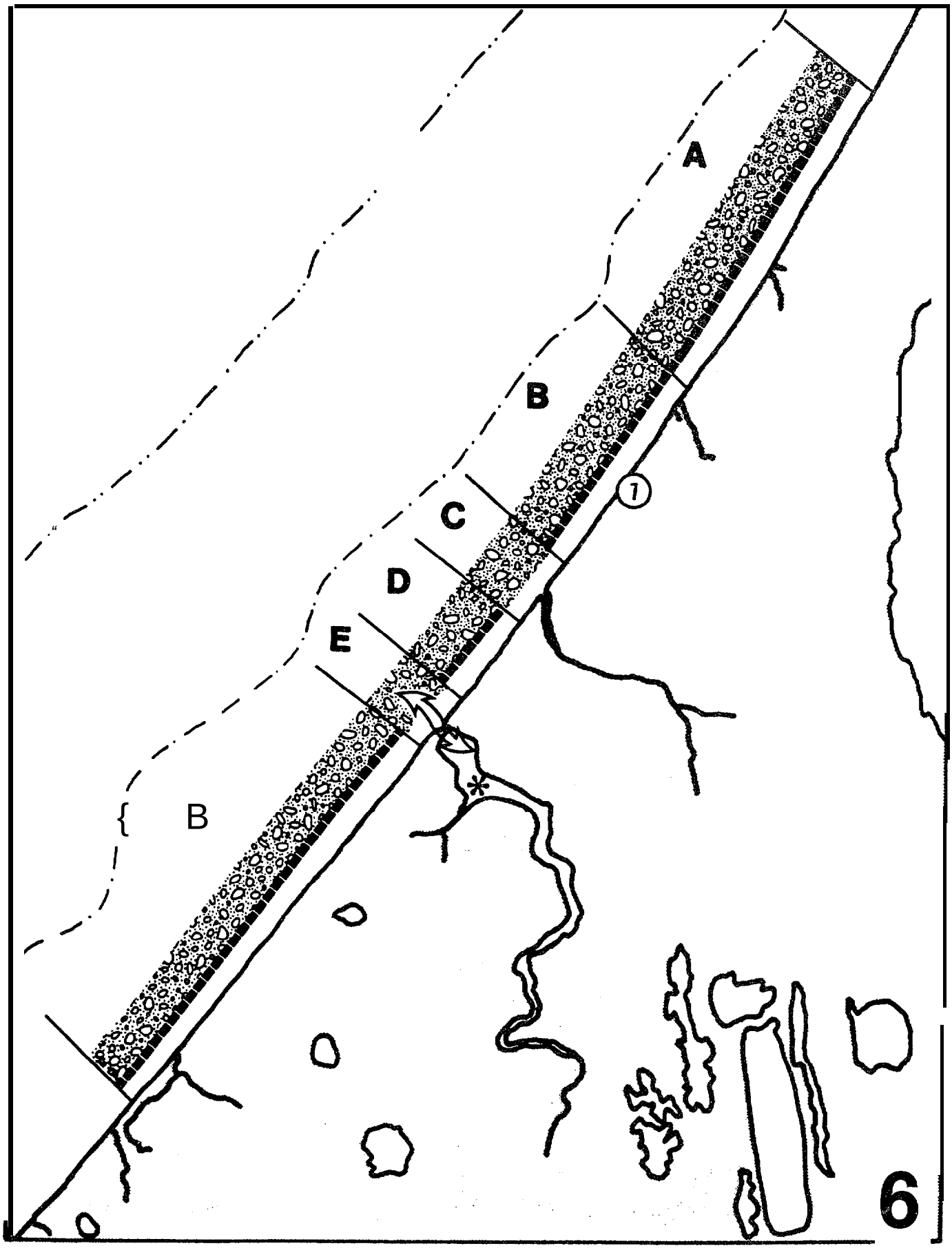
HUMAN USE INDEX



Seasonal ***Variability*** *of Indices*

Identifier	RESOURCE	SEASON						
		Winter	Bre	t-Up/Summer/Freeze-Up				Winter
			May	Jun	Jul	Aug	Sep	Oct	
R1	Lagoon				■	■	■		
B1	Lagoon				▨	▨	▨	▨	
H1	Residential recreation			▨	▨	▨	▨	▨	

5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B
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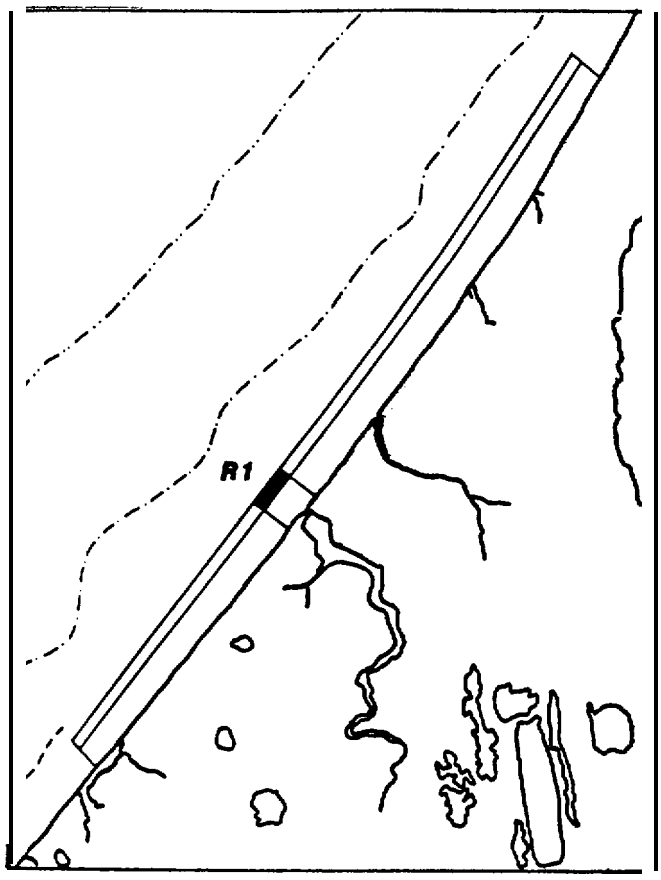
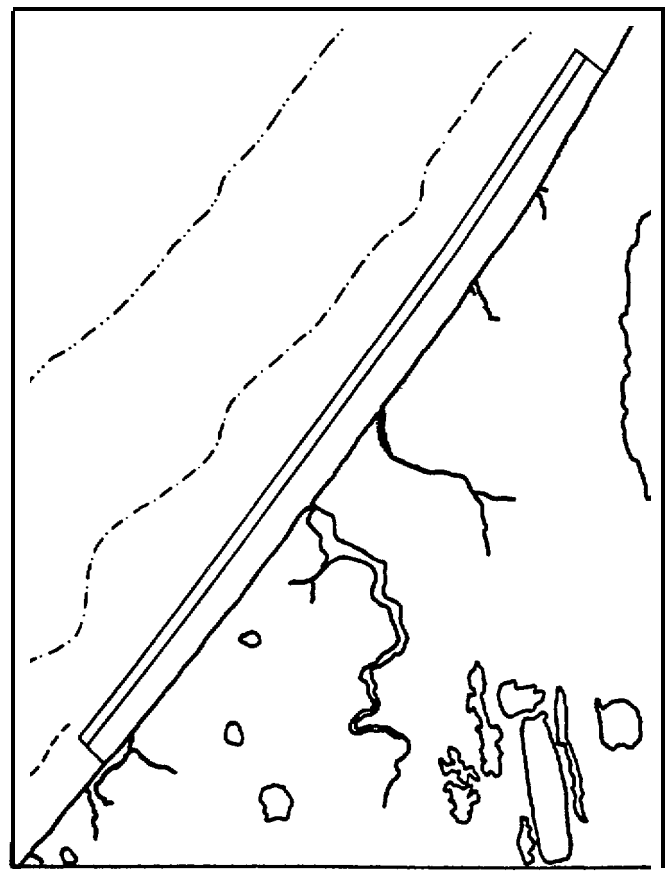
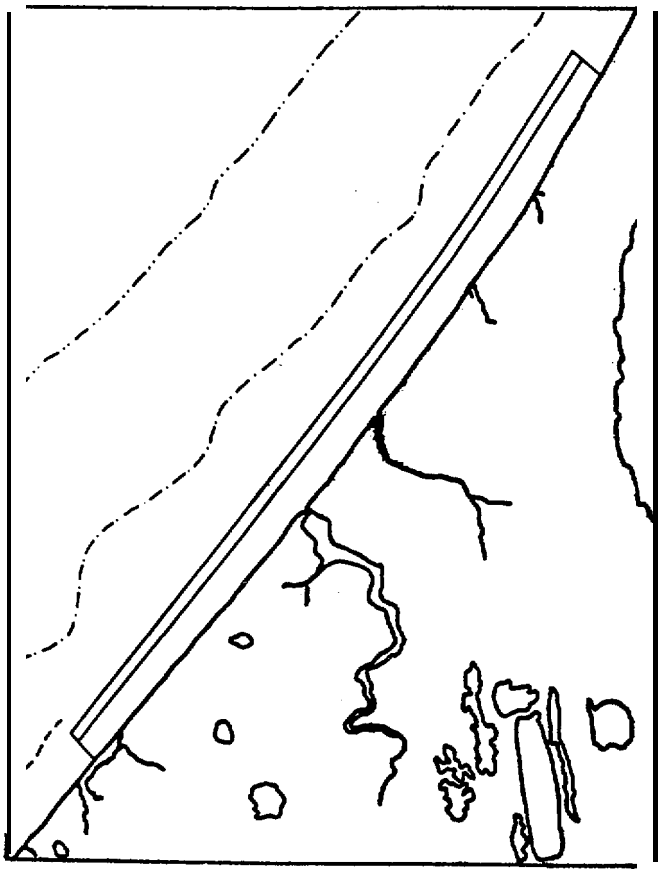
*016 RESIDENCE **INDEX***



BIOLOGICAL *SENSITIVITY INDEX*



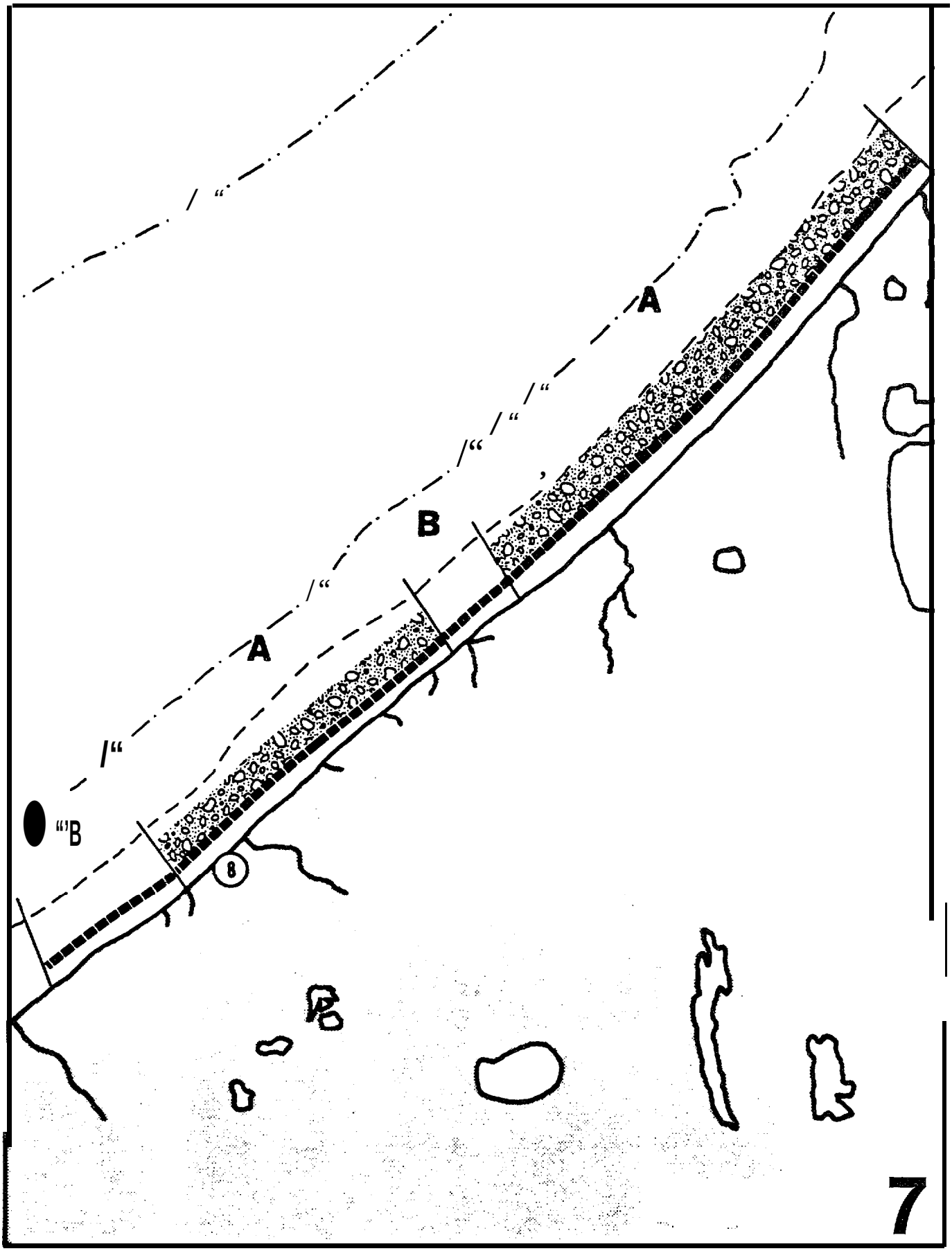
*HUMAN USE **INDEX***



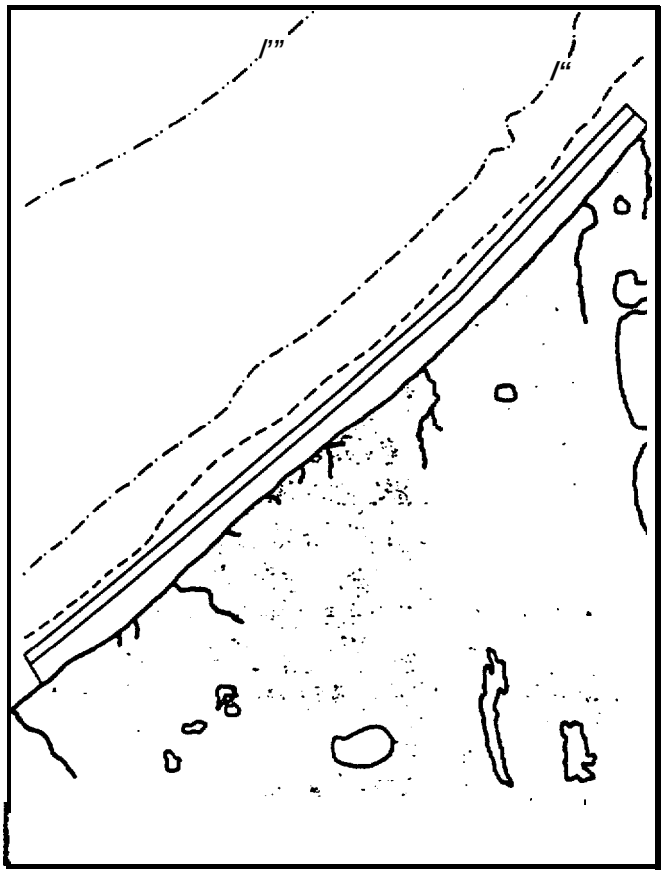
*Seasonal **Variability** of Indices*

Identifier	RESOURCE	SEASON						
		Winter	Break-Up/Summer/Freeze-Up					Winter
			May	Jun	Jul	Aug	Sep	Oct	
R1	Lagoon				■	■	■		

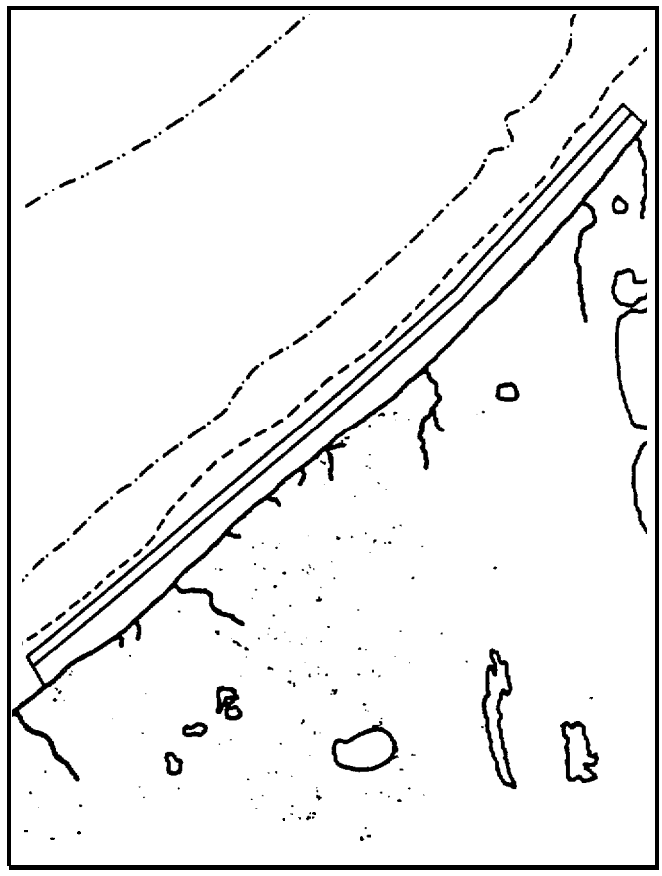
6


A
B
A
"B
7

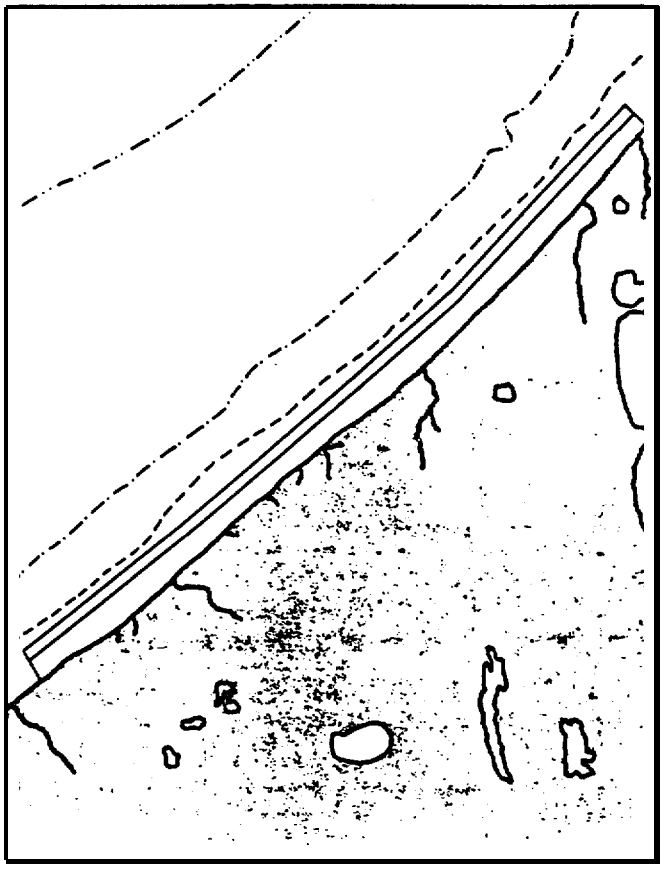
***OIL RESIDENCE** INDEX*



***BIOLOGICAL** SENSITIVITY INDEX*



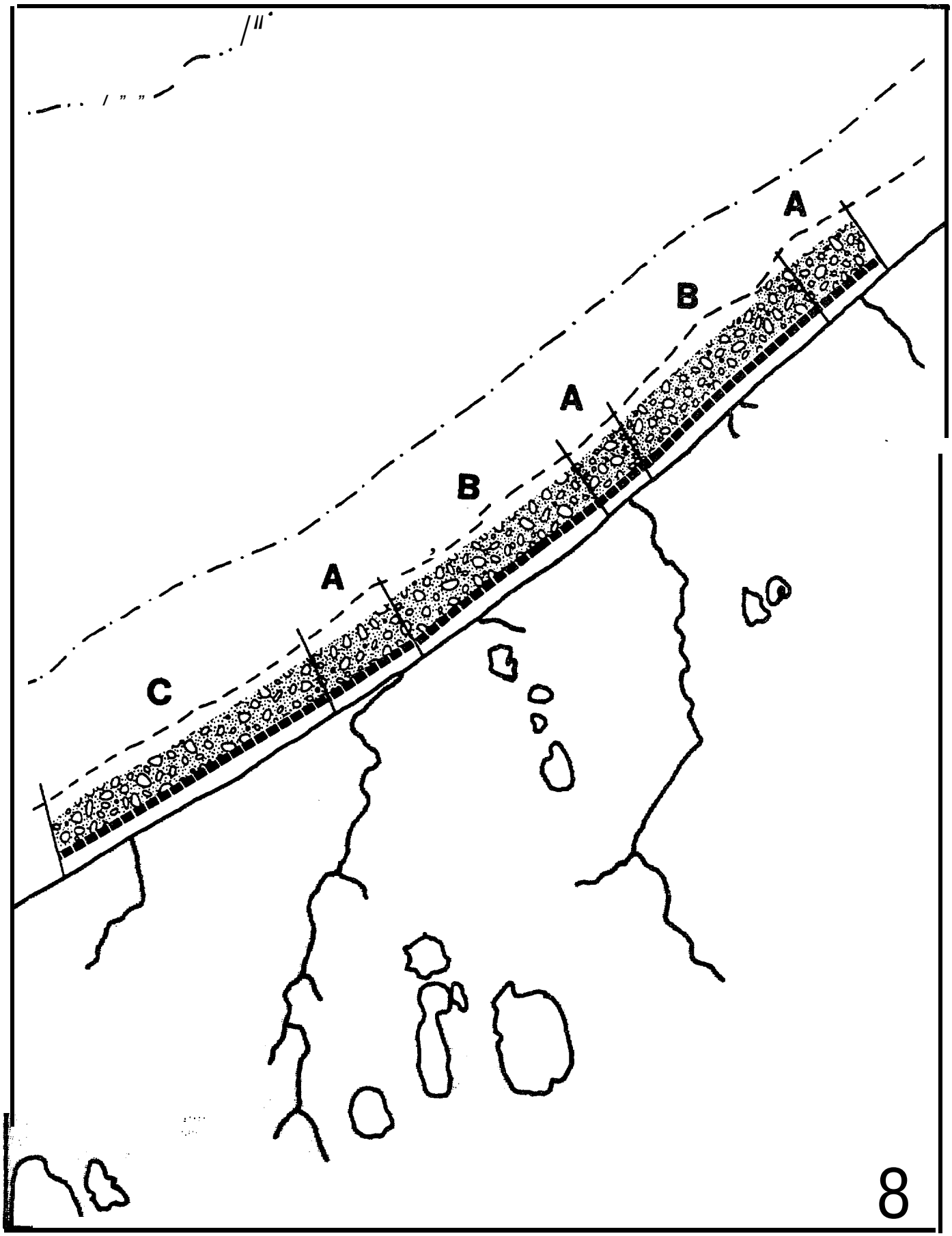
HUMAN USE INDEX



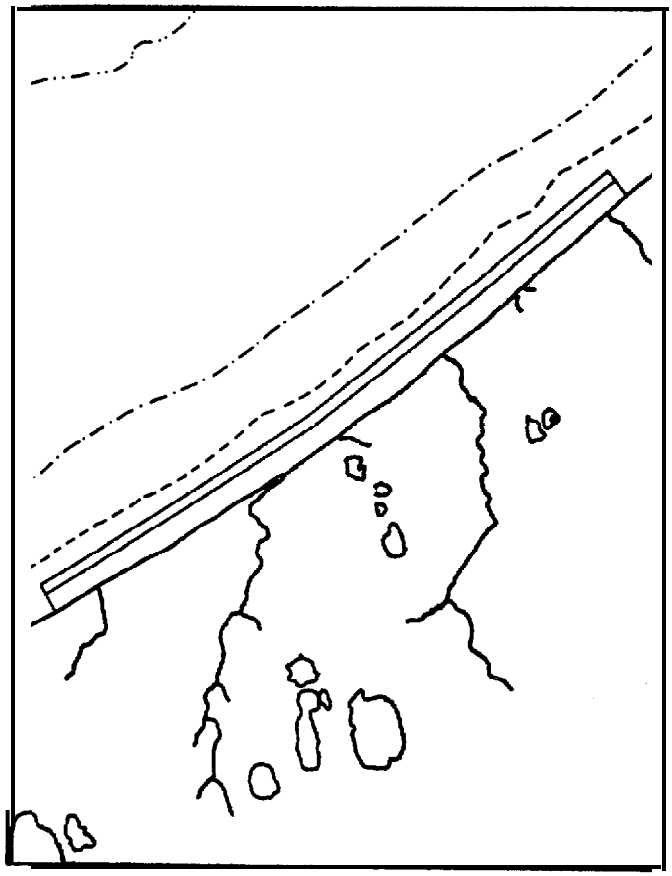
Seasonal Variability of Indices

Identifier	RESOURCE	SEASON							
		Winter	Break-Up/Summer/Freeze-Up						Winter
			May	Jun	Jul	Aug	Sep	Oct	
	NO PRIMARY OR SECONDARY SENSITIVITIES								

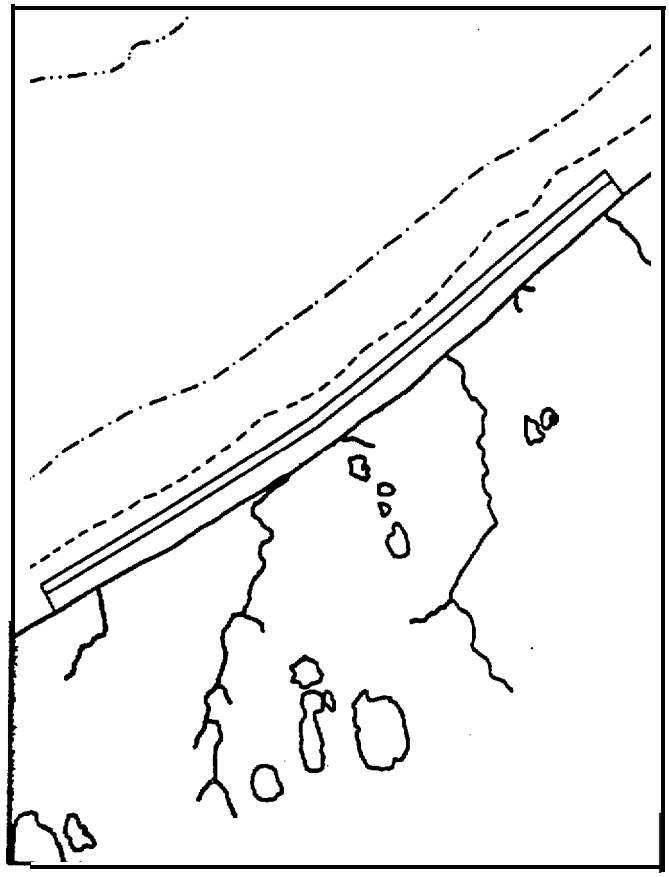
7


A
B
A
B
A
C
8

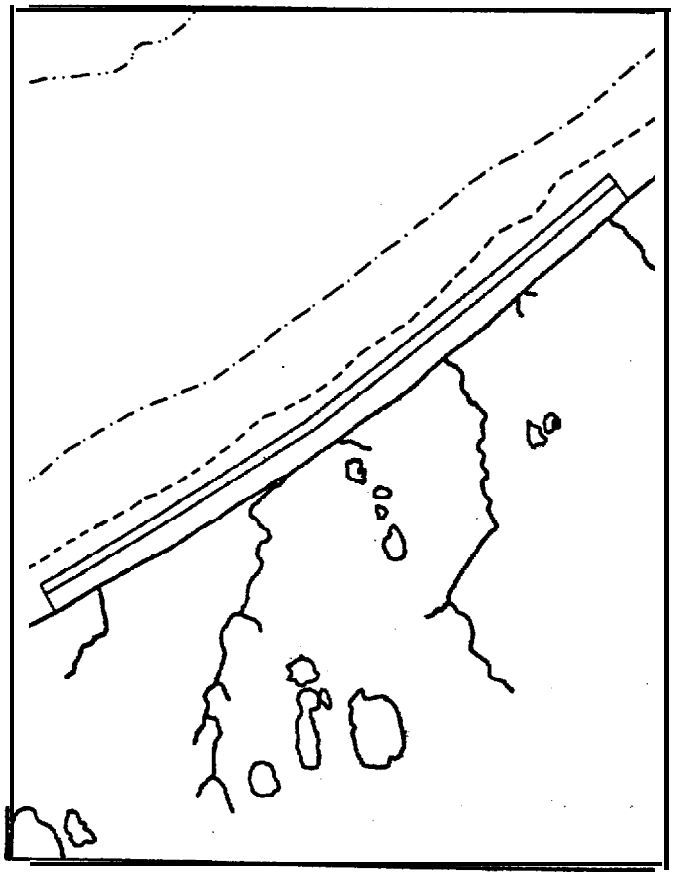
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



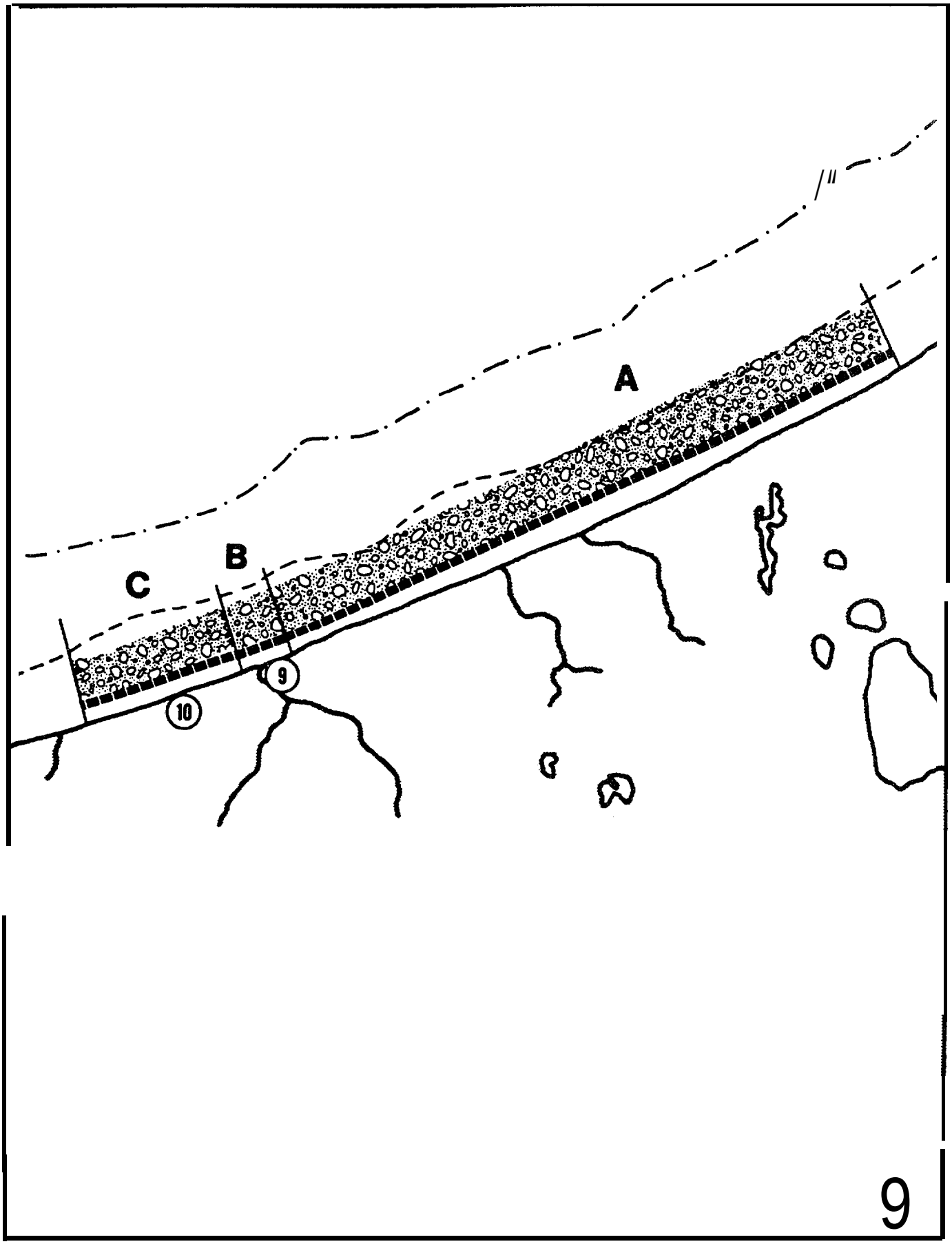
HUMAN USE INDEX



Seasonal Variability of Indices

Identifier	RESOURCE	SEASON						
		Winter	Break-Up/Summer/Freeze-Up					Winter
			May	Jun	Jul	Aug	Sep	Oct	
	NO PRIMARY OR SECONDARY SENSITIVITIES								

8



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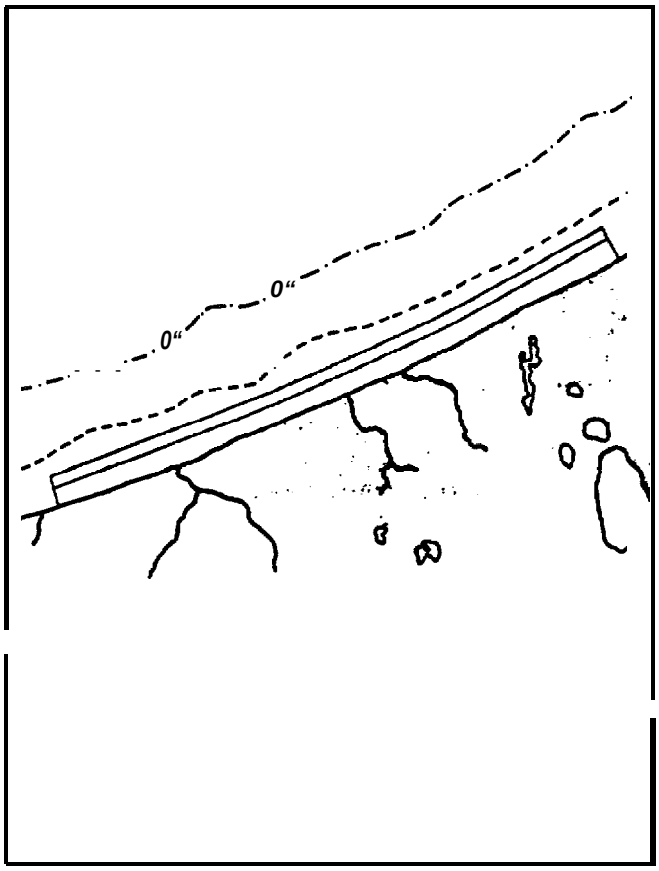
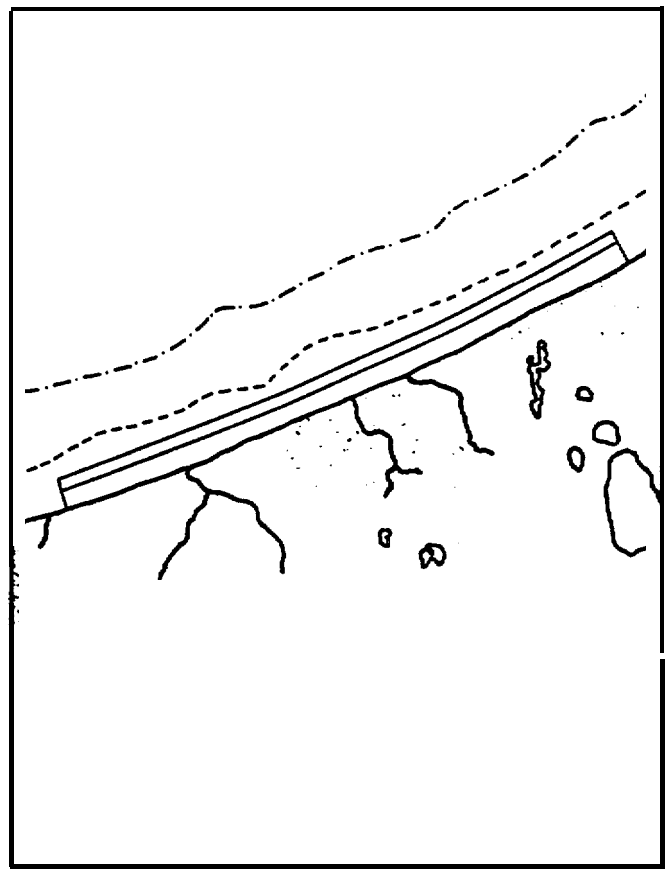
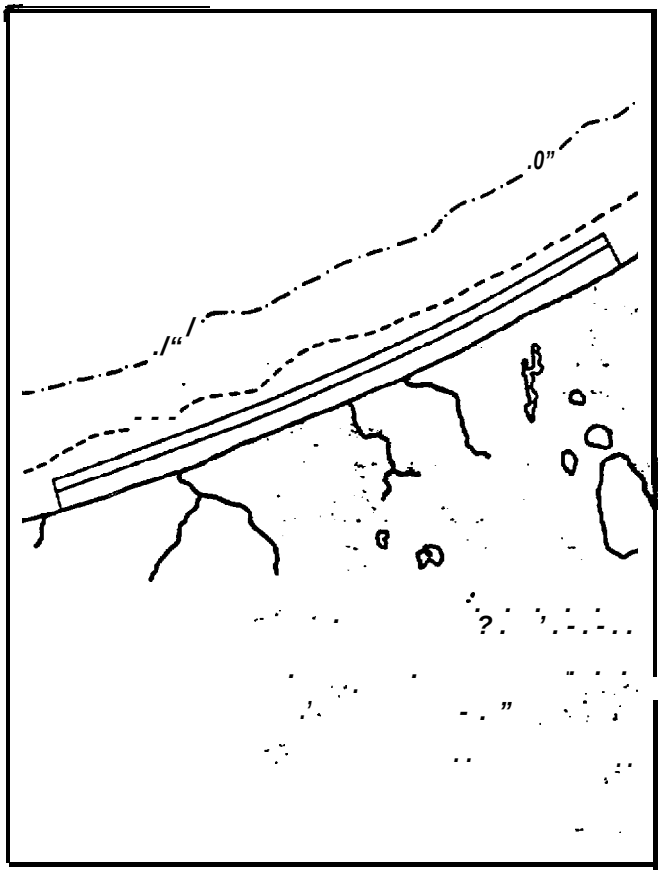
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



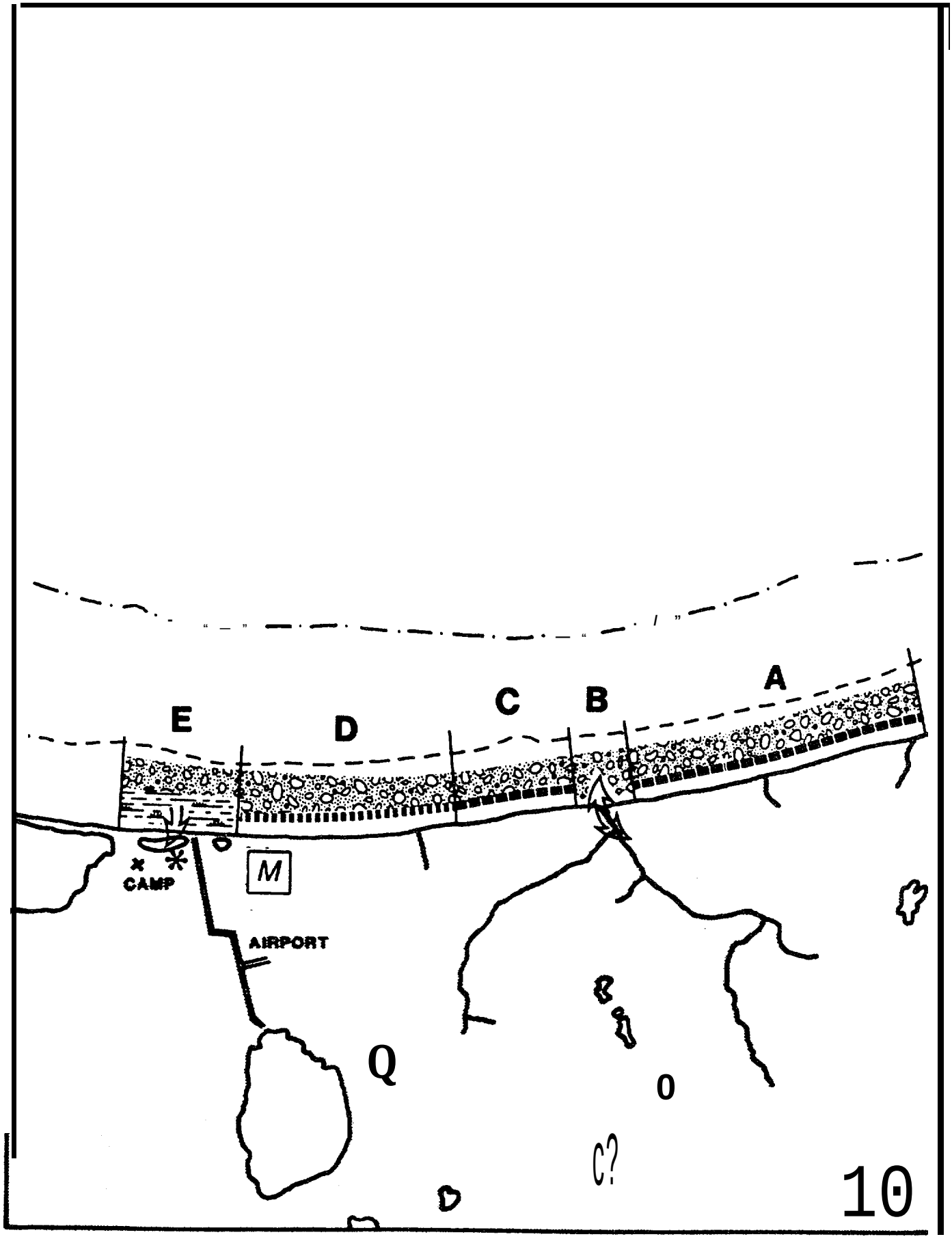
HUMAN USE INDEX



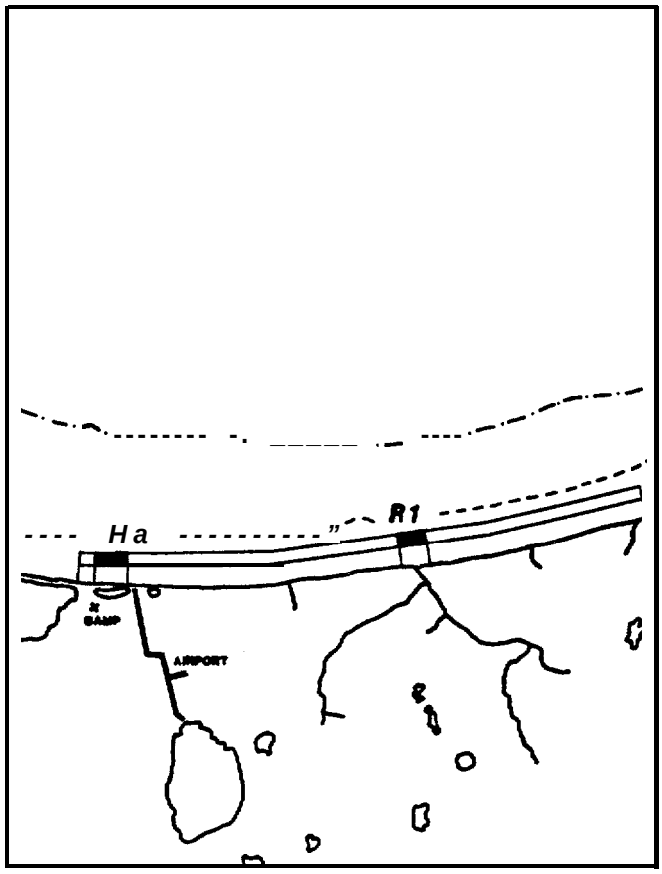
Seasonal Variability of Indices

Identifier	RESOURCE	SEASON						
		Winter	Break-Up/Summer/Freeze-Up					Winter
			May	Jun	Jul	Aug	Sep	Oct
	NO PRIMARY OR SECONDARY SENSITIVITIES							

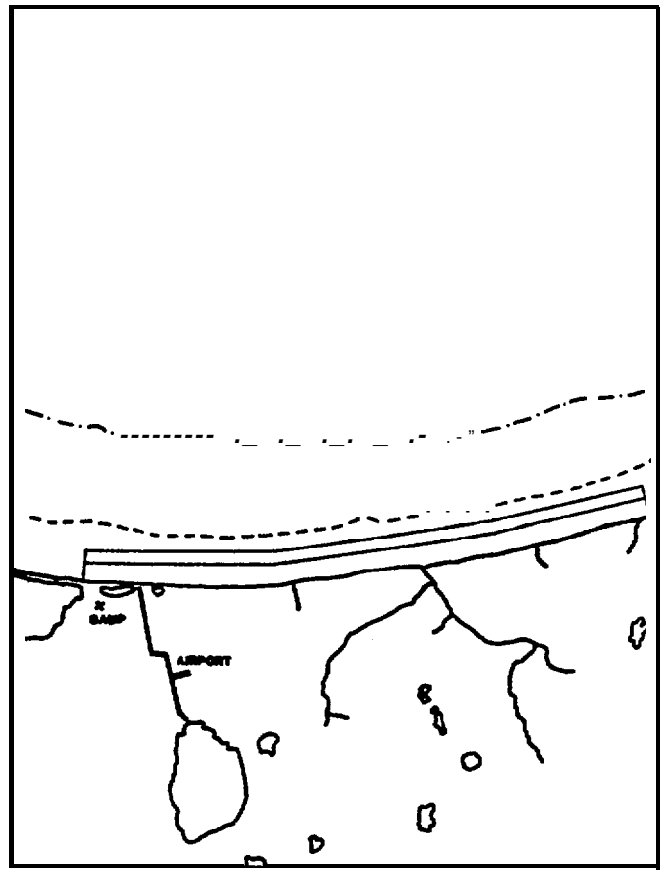
9


E
D
C
B
A
CAMP
M
AIRPORT
Q
10

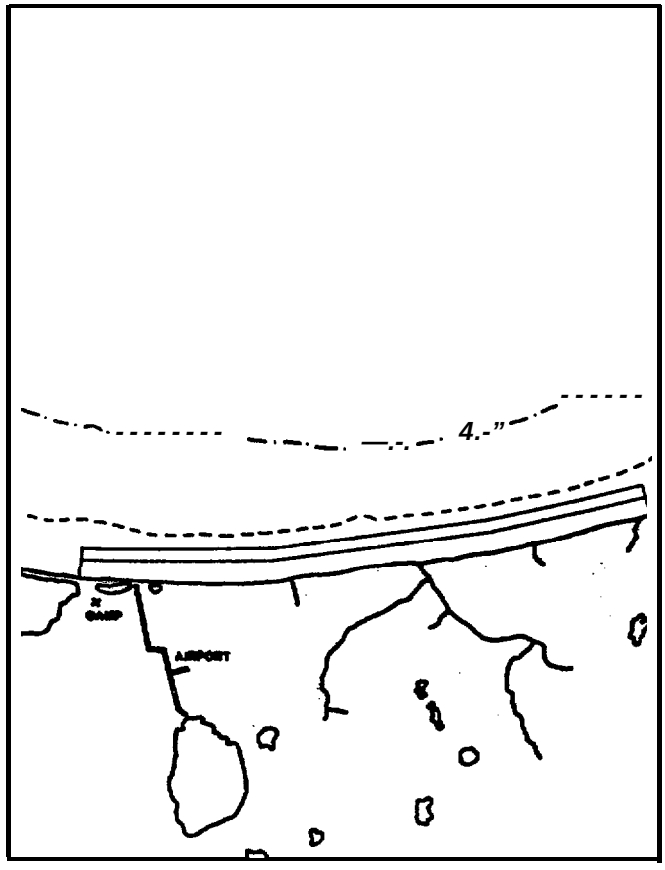
*OIL **RESIDENCE** INDEX*



BIOLOGICAL SENSITIVITY INDEX



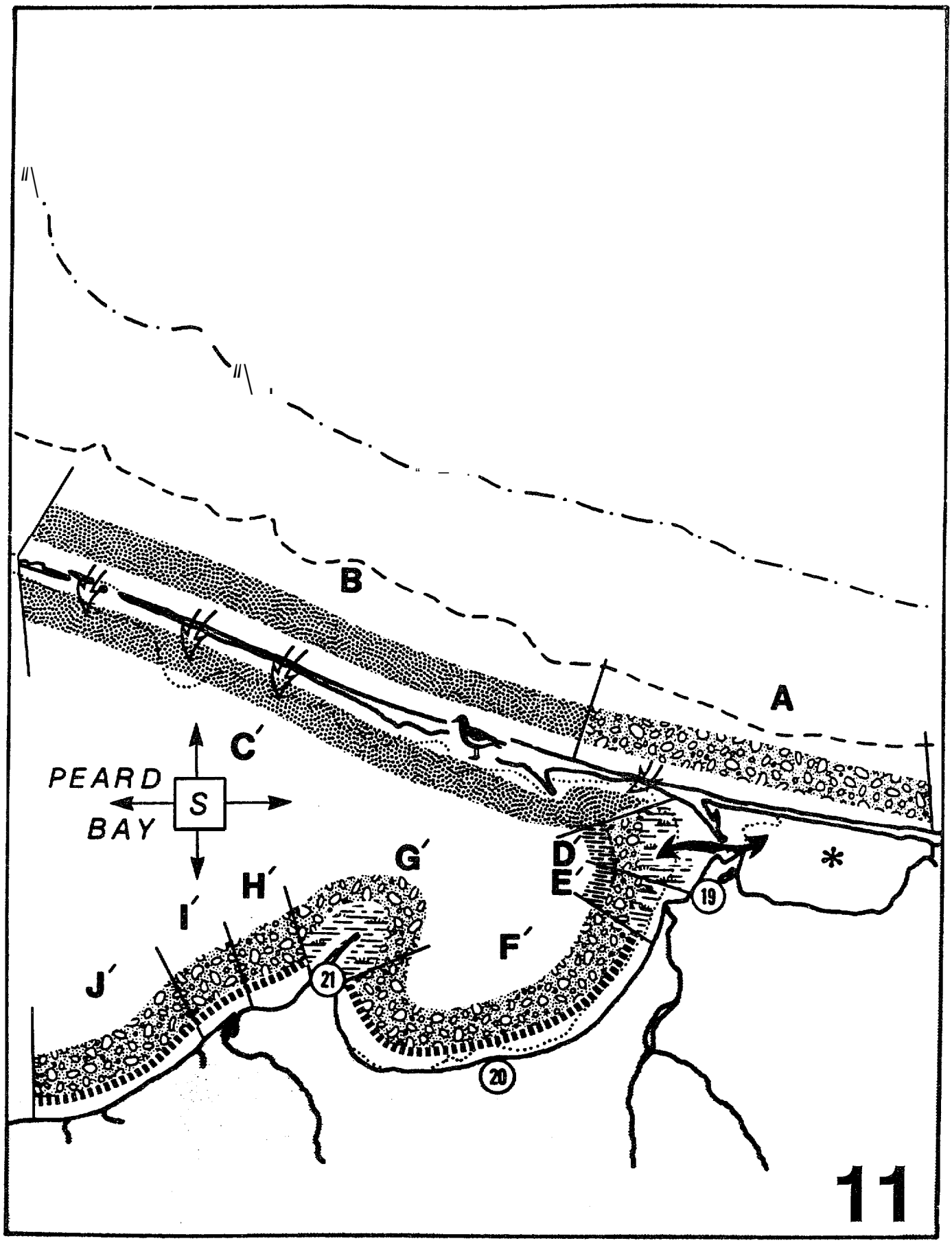
HUMAN USE INDEX



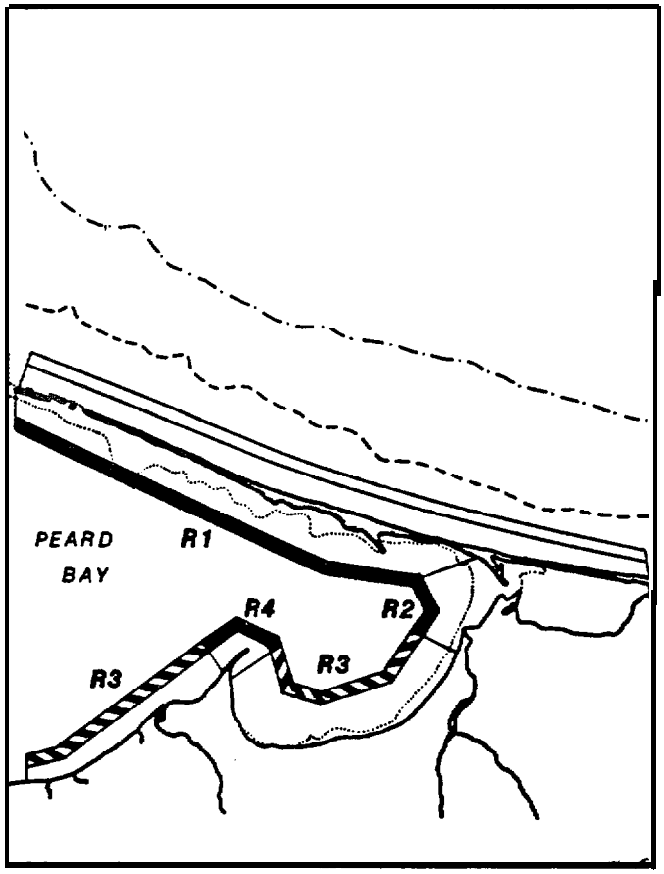
***Seasonal** Variability of Indices*

Identifier	RESOURCE	SEASON							
		Winter	Break-Up/Summer/Freeze-Up						winter
			May	Jun	Jul	Aug	Sep	Oct	
R1	Lagoon				■	■	■		
R2	Washover channel; Wetland				■	■	■		

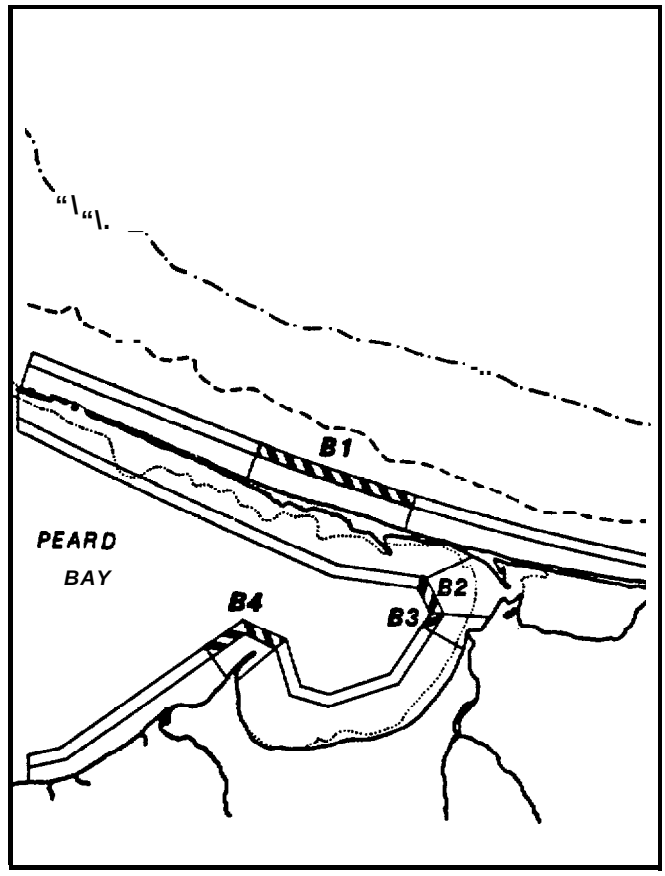
10


B
A
C´
PEARD
BAY
S
G´
H´
I´
J´
D´
E´
F´
19
20
21
*
11

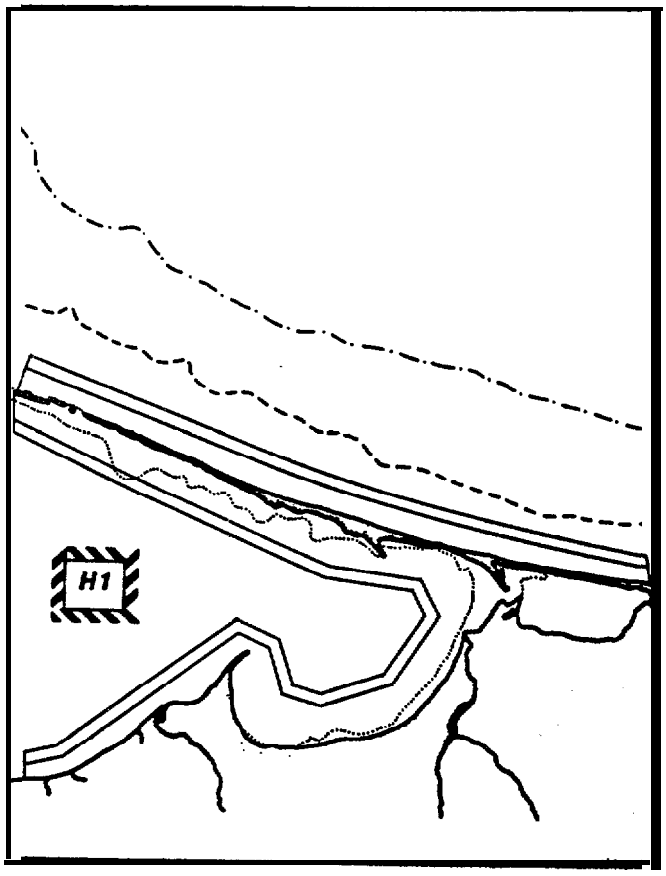
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



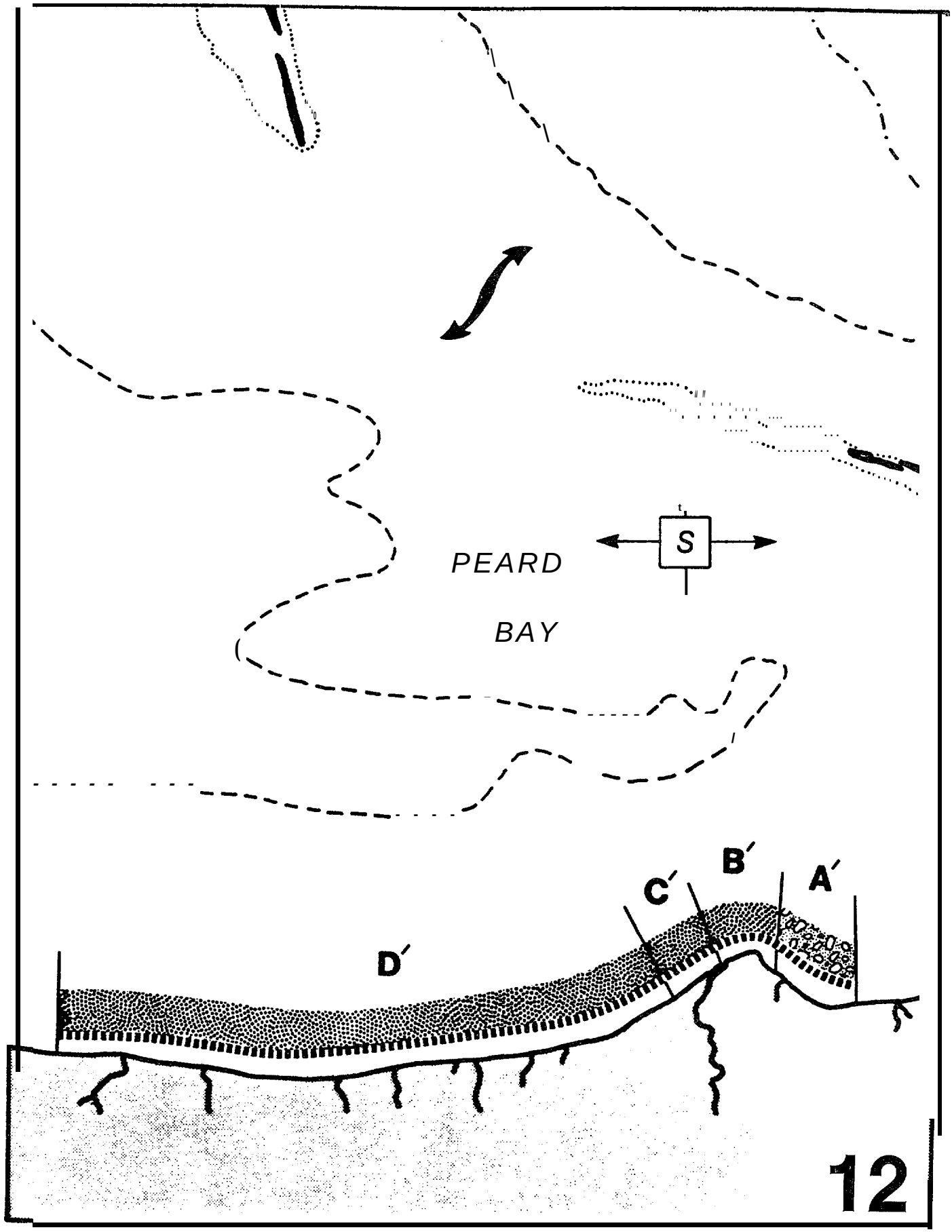
HUMAN USE INDEX



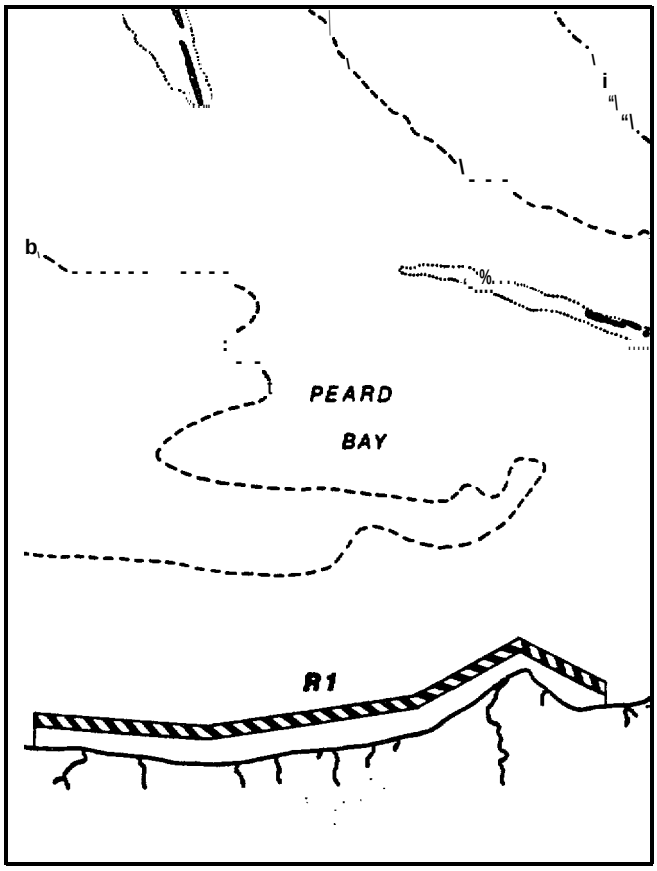
Seasonal Variability of Indices

Identifier	RESOURCE	SEASON							
		Winter	Break-Up/Summer/Freeze-Up						Winter
			May	Jun	Jul	Aug	Sep	Oct	
R1	Low energy beach				■	■	■		
R2	Lagoon				■	■	■		
R3	Protected tundra cliff				▨	▨	▨		
R4	Low energy beach; Wetland				■	■	■		
B1	Arctic tern nesting (25 pr)			▨	▨				
B2	Lagoon				▨	▨	▨		
B3	Wetland			▨	▨	▨	▨	▨	▨
B4	Wetland				▨	▨	▨		
H1	Beluga whale huntin				▨	▨			

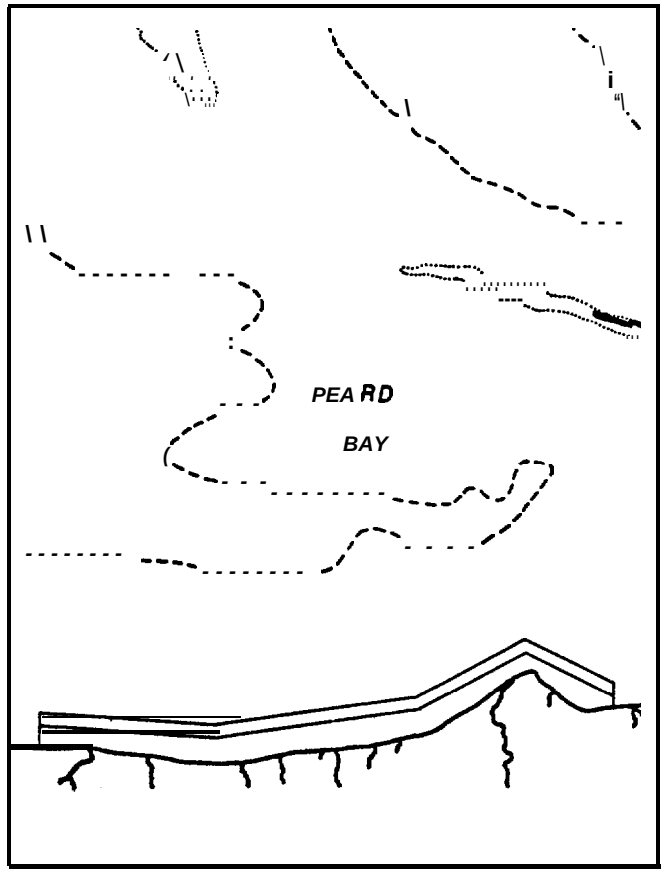
11


PEARD
BAY
S
A´
B´
C´
D´
12

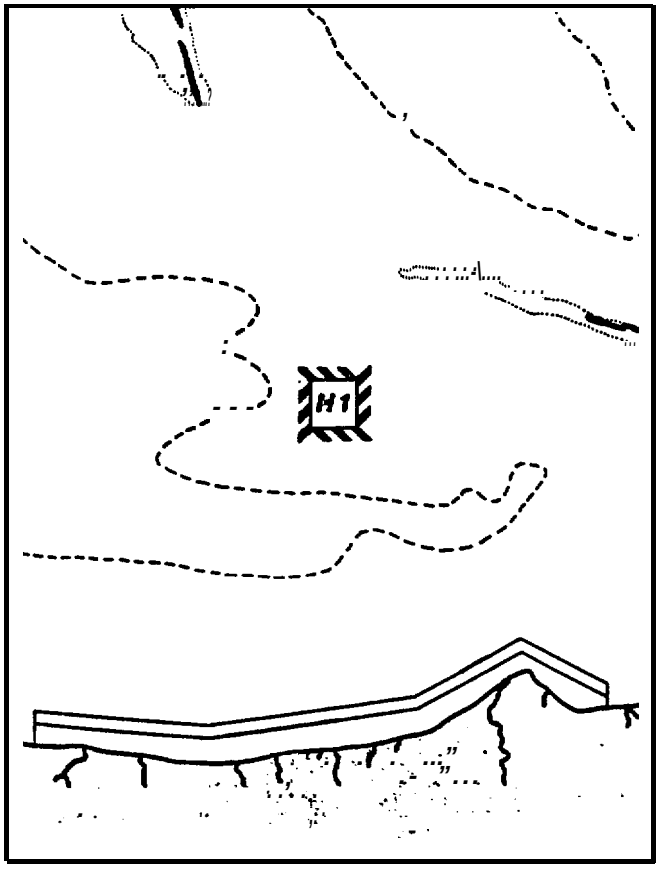
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



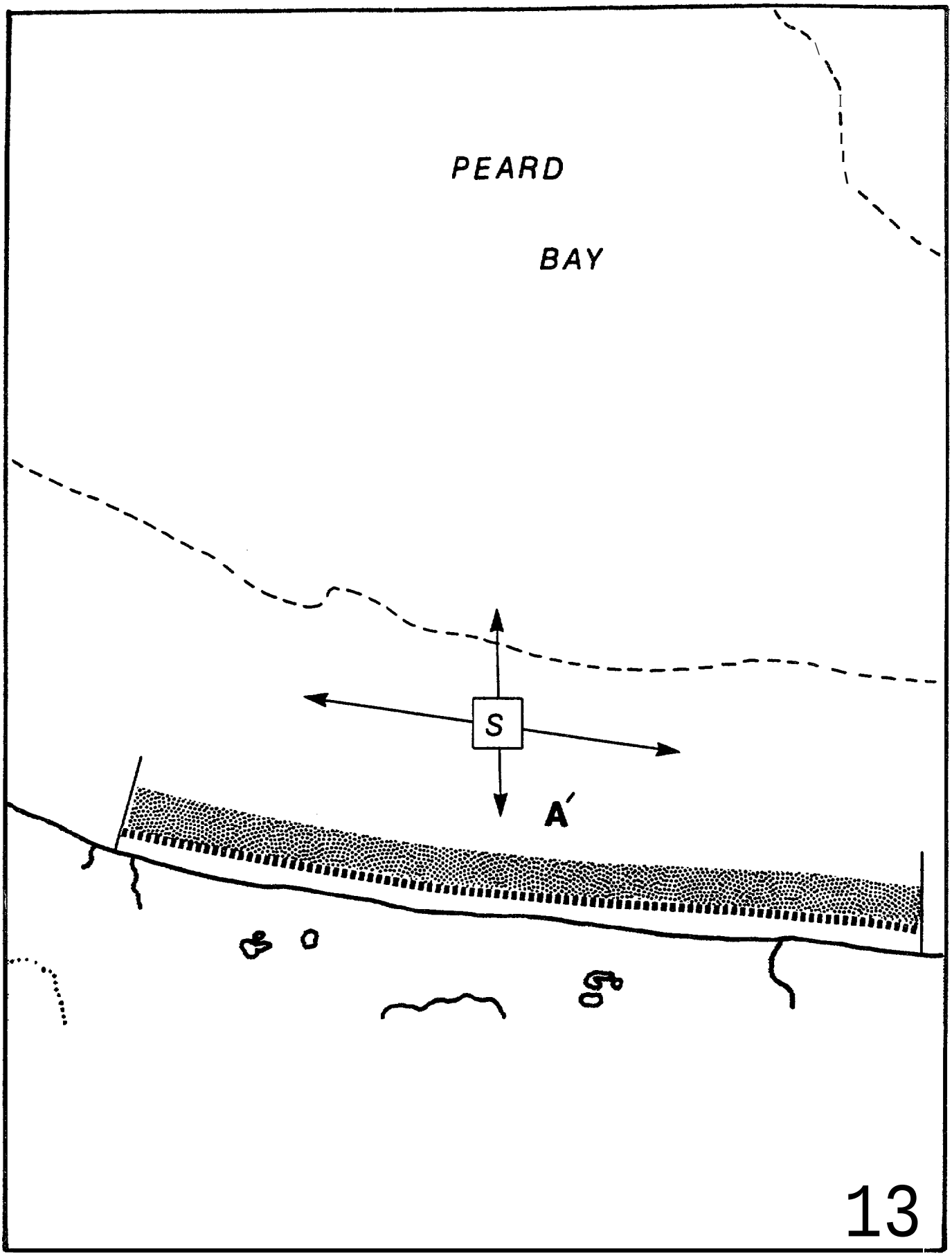
HUMAN USE INDEX



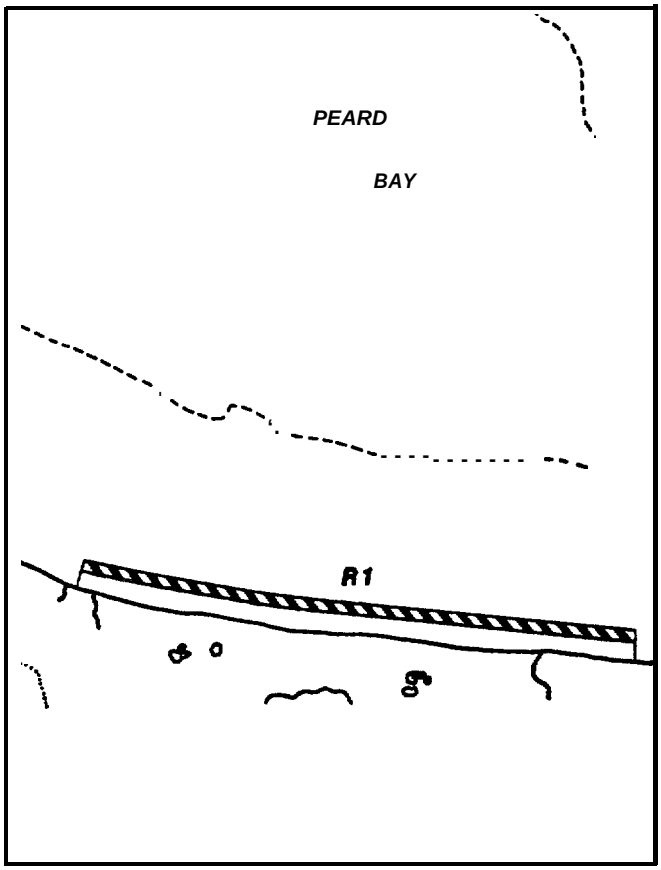
Seasonal Variability of Indices

Identifier	RESOURCE	SEASON							
		Winter	Break-Up/Summer/Freeze-Up						Winter
			May	Jun	Jul	Aug	Sep	Oct	
R1	Protected tundra cliff				▨	▨	▨		
H1	Beluga whale huntin				▨				

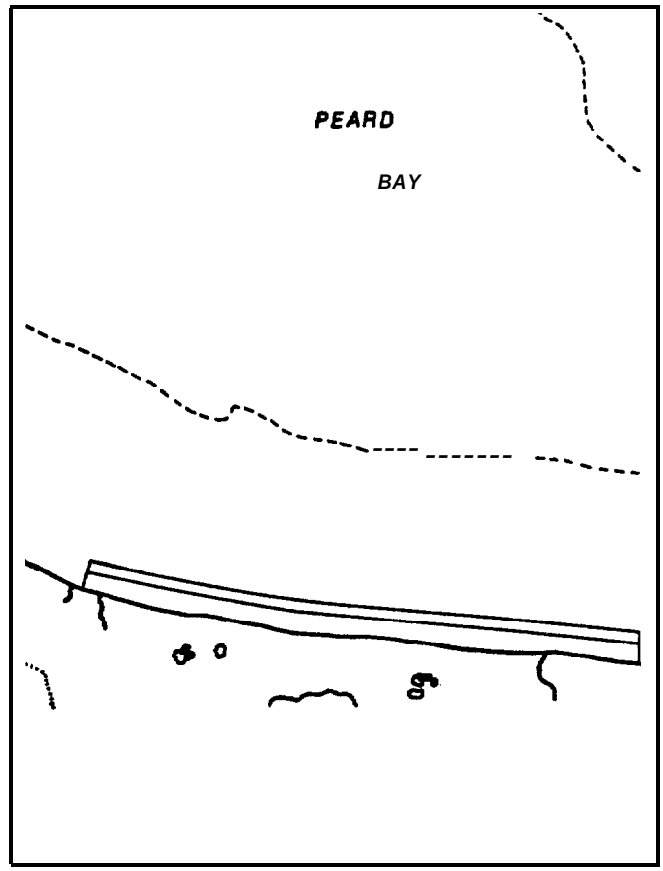
12


PEARD
BAY
S
A´
13

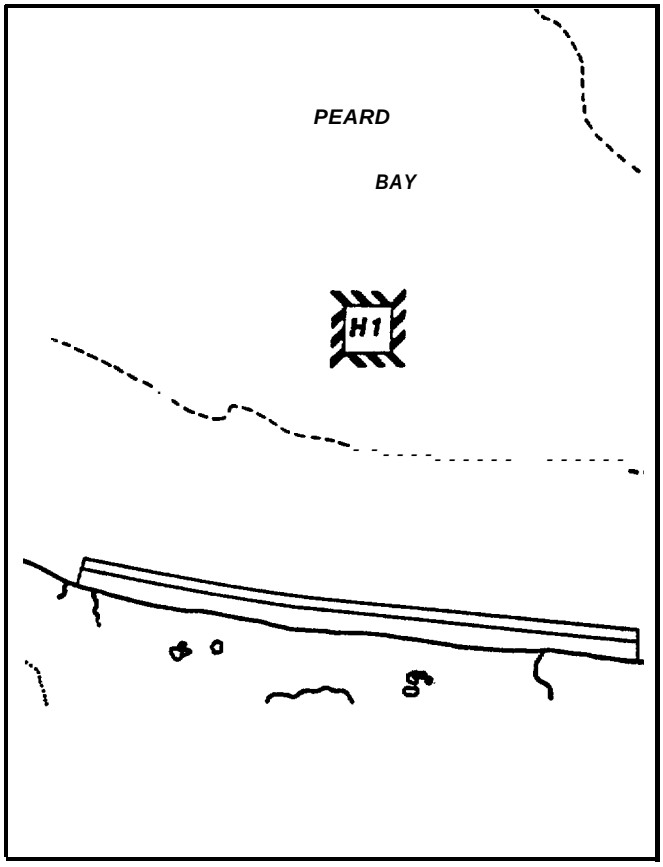
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



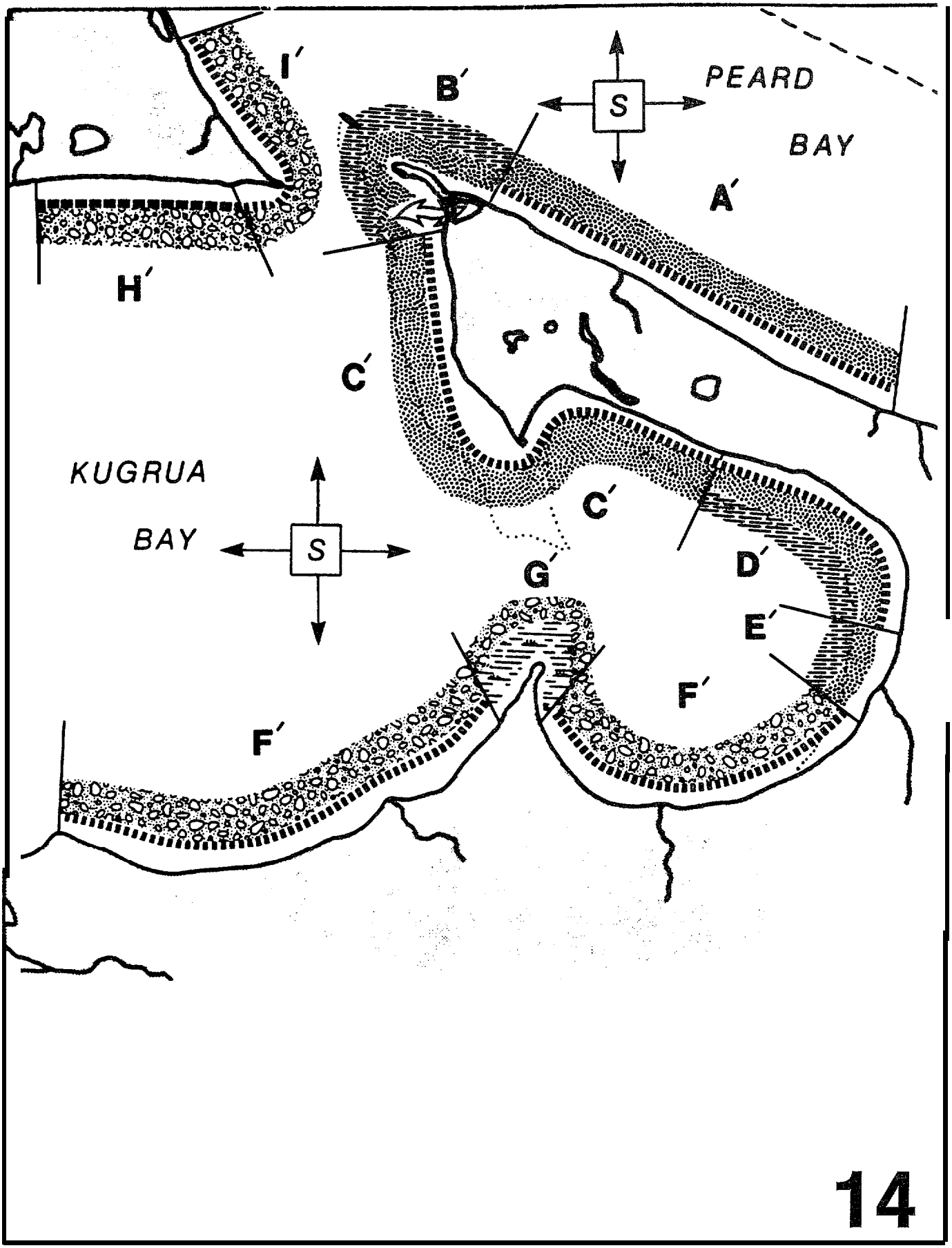
HUMAN USE INDEX



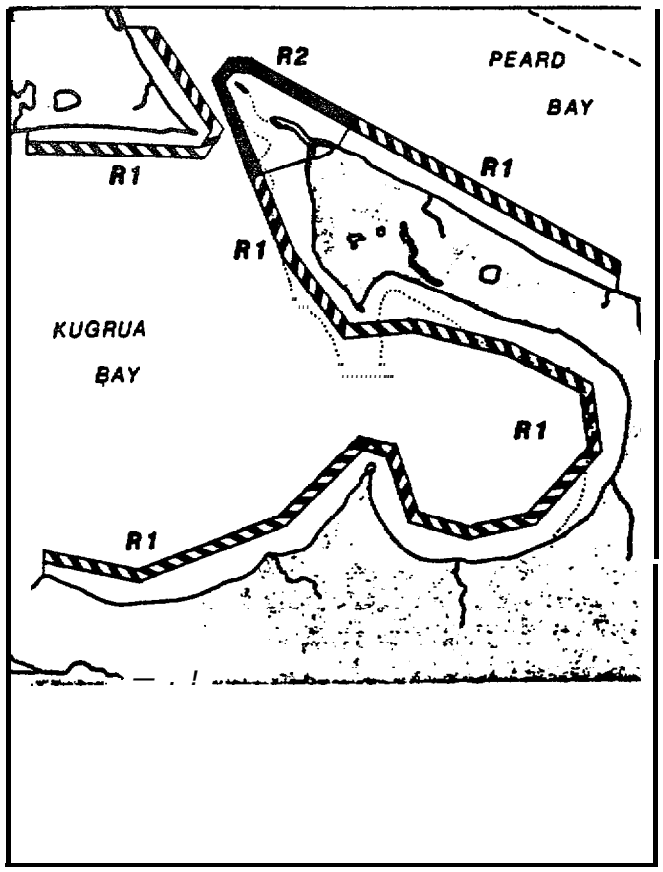
Seasonal* Variability *of Indices

Identifier	RESOURCE	Winter	SEASON: Break-Up/Summer/Freeze-Up May	Jun	Jul	Aug	Sep	Oct	Winter
R1	Protected tundra cliff				▨	▨	▨		
H1	Beluga whale hunting				▨	▨			

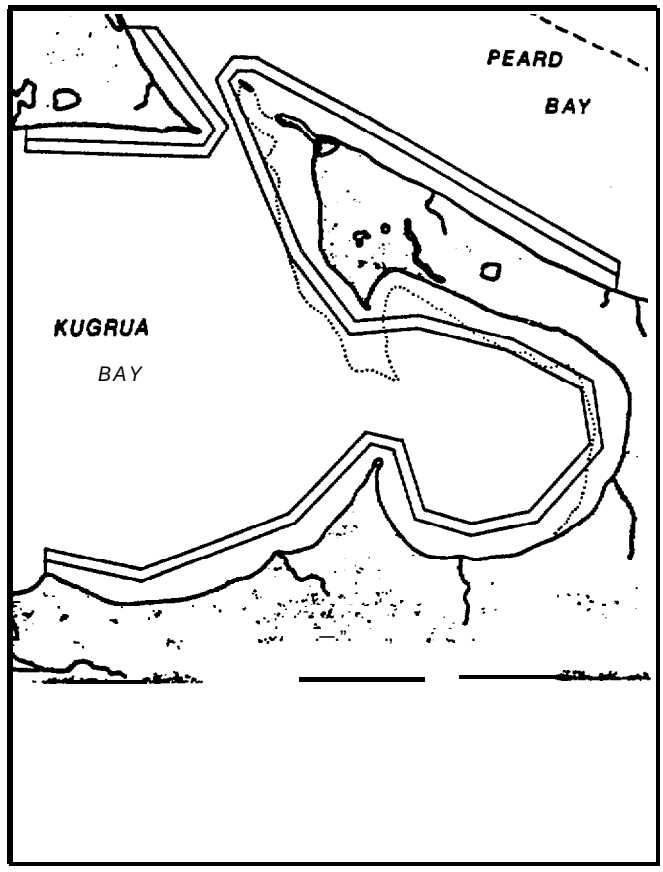
13


I´
B´
PEARD
BAY
A´
H´
C´
KUGRUA
BAY
C´
G´
D´
E´
F´
F´
14

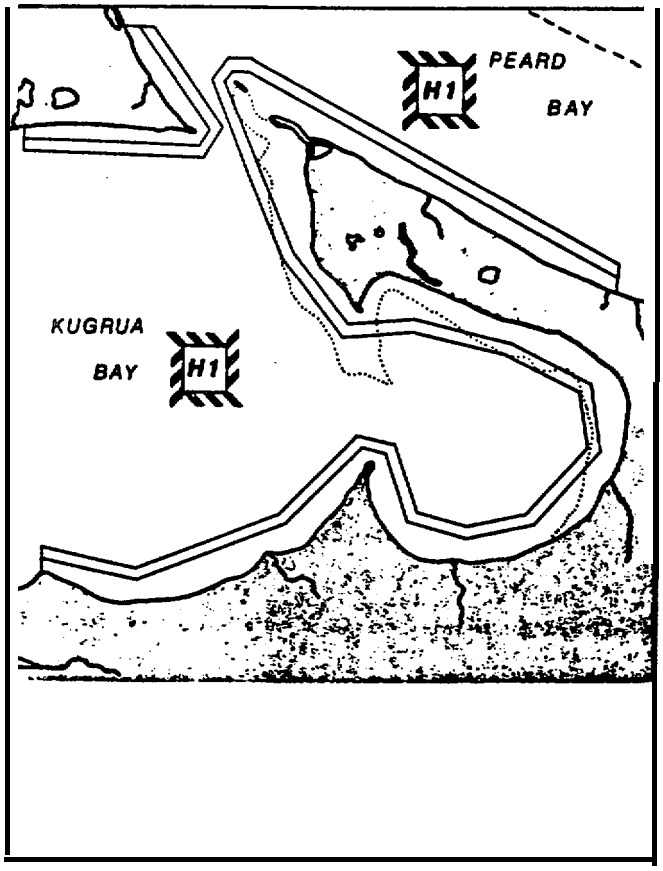
Oil. RESIDENCE INDEX



Biological ***SENSITIVITY*** *INDEX*

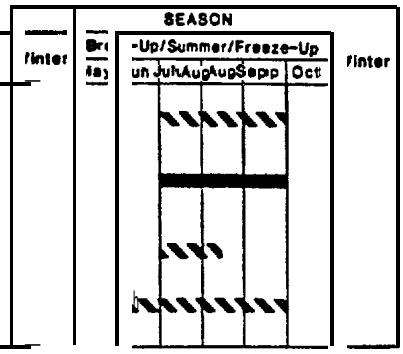


HUMAN USE INDEX

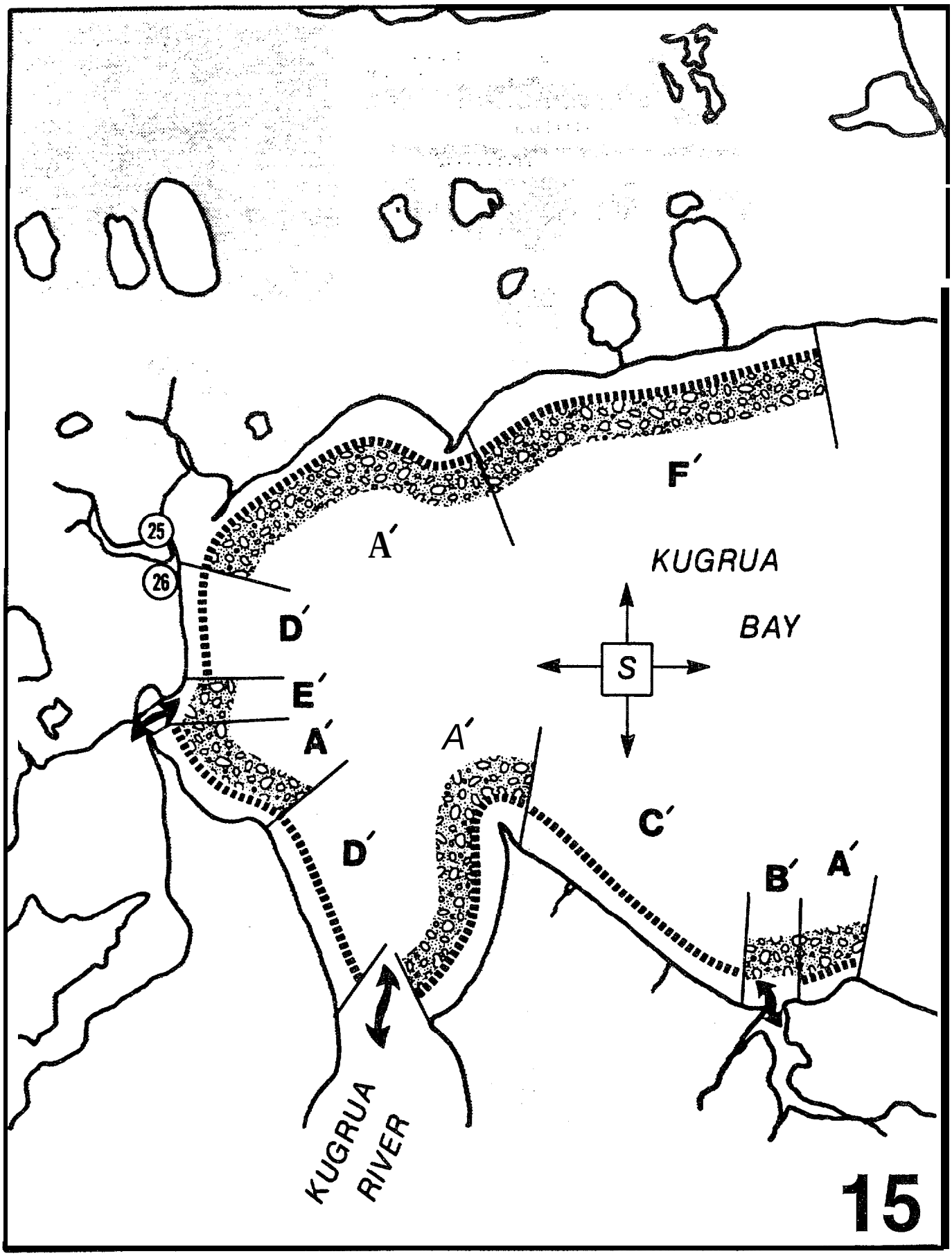


Seasonal Variability **of** ***Indices***

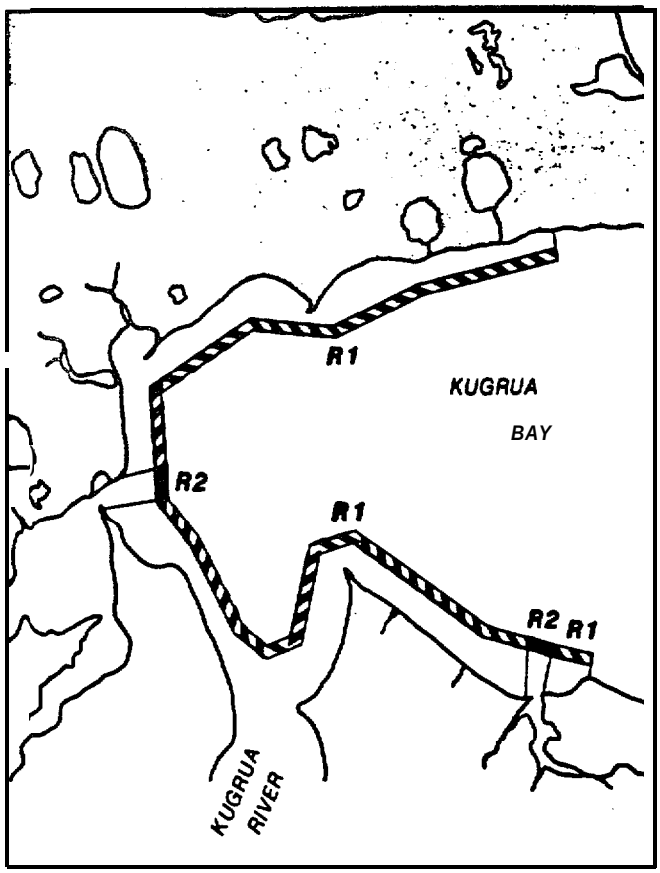
Identifier	RESOURCE
R1	Protected tundra cliff
R2	Low energy beach
HI	Beluga whale hunting
	Fishing



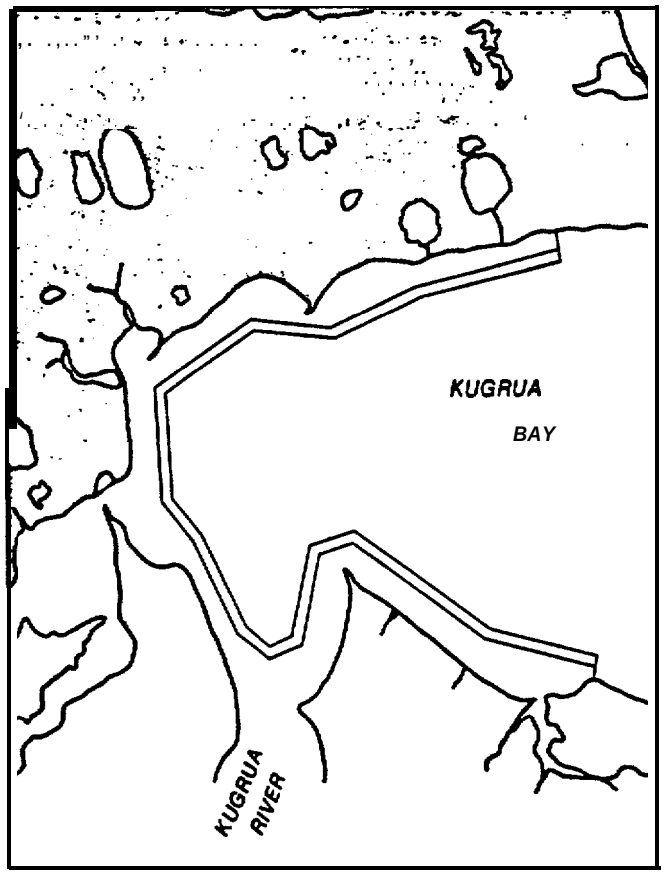
14


25
26
A´
F´
KUGRUA
BAY
S
D´
E´
A´
A´
C´
D´
B´
A´
KUGRUA
RIVER
15

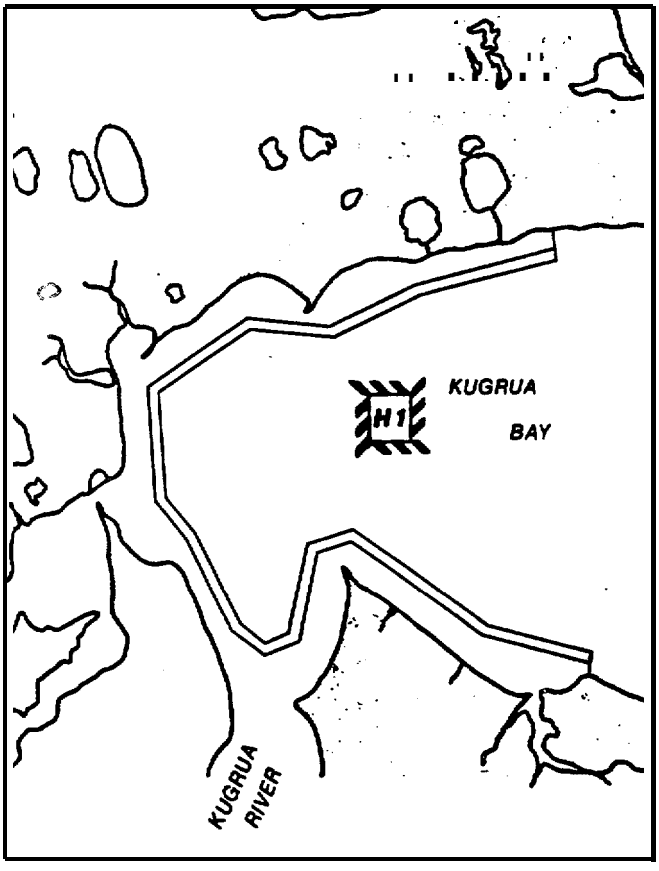
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



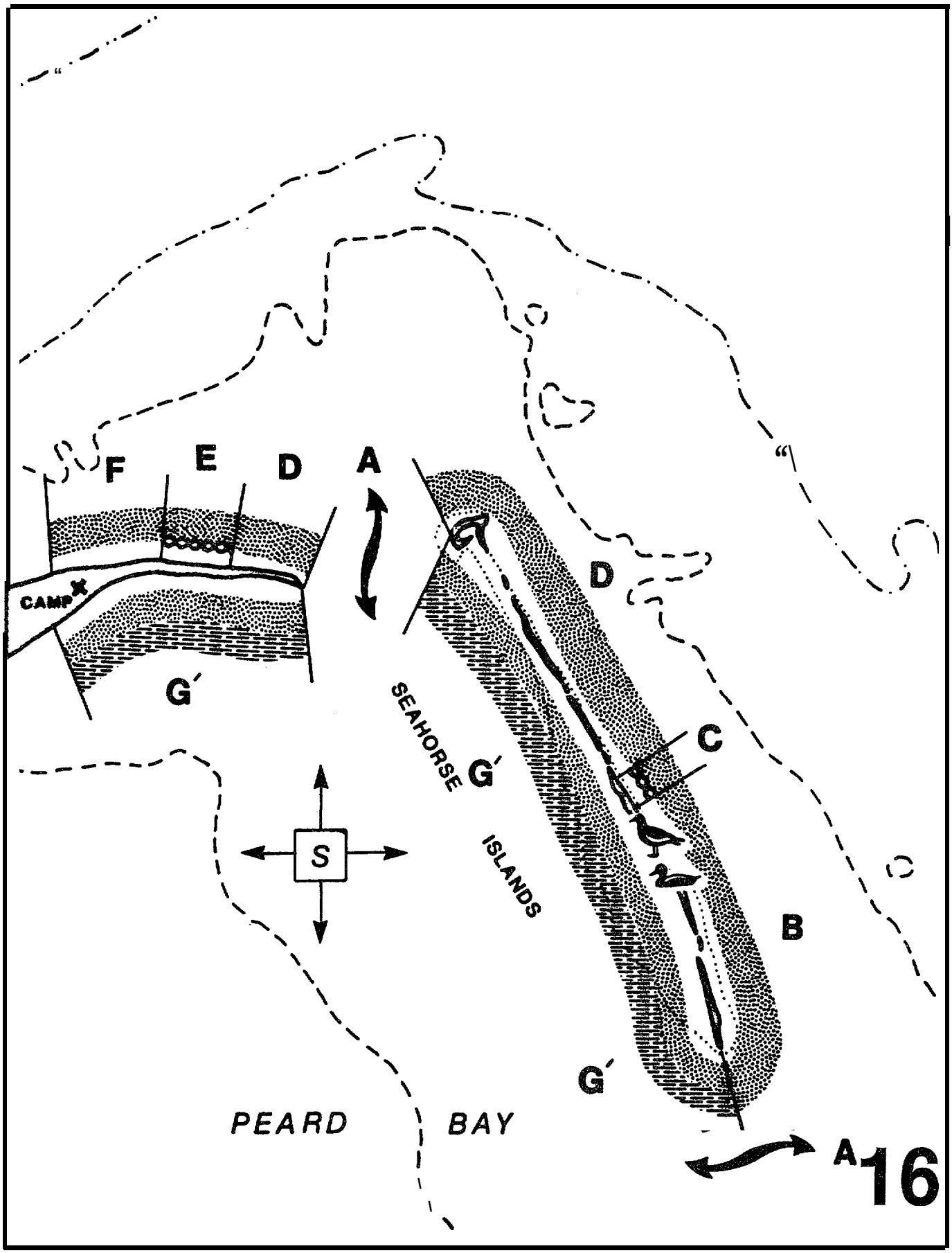
HUMAN USE INDEX



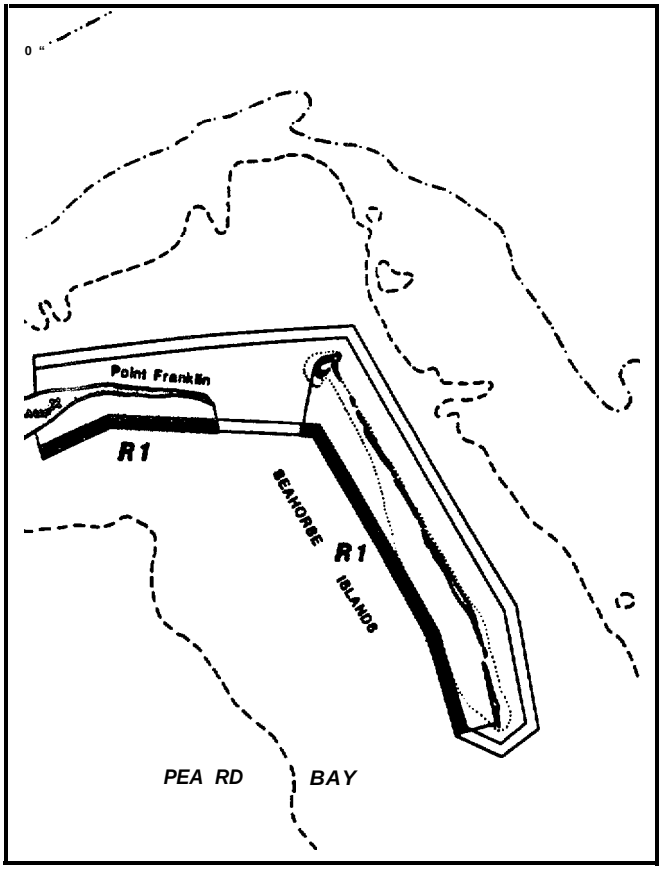
*Seasonal **Variability** of Indices*

Identifier	RESOURCE	SEASON							
		Winter	Break-Up/Summer/Freeze-Up						Winter
			May	Jun	Jul	Aug	Sep	Oct	
R1	Protected tundra cliff				▨	▨	▨		
R2	Low energy beach				■	■	■		
H1	Spotted seal hunting Fishing				▨	▨	▨		

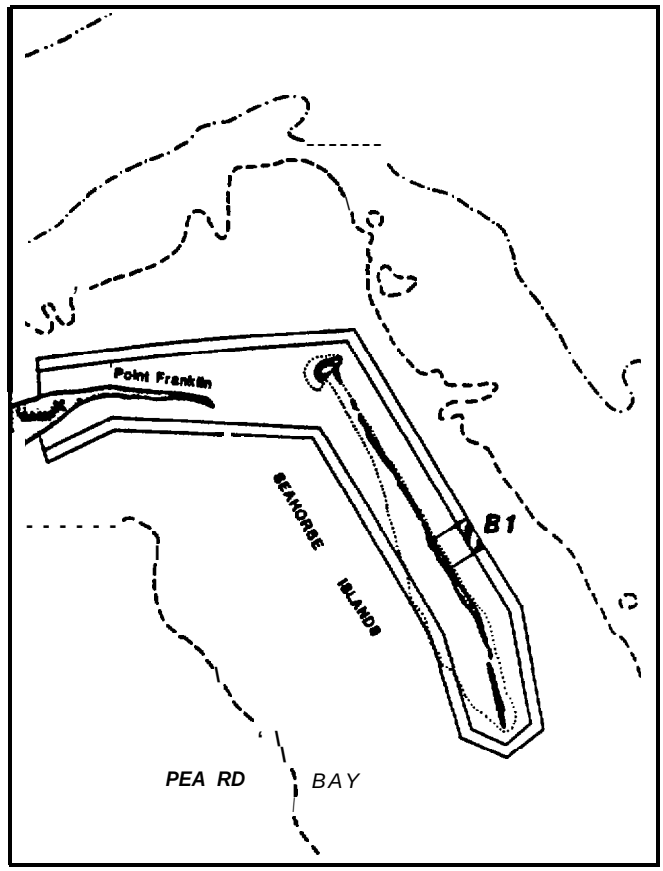
15


F
E
D
A
CAMP
G´
SEAHORSE
G´
ISLANDS
S
D
C
B
G´
PEARD
BAY
A
16

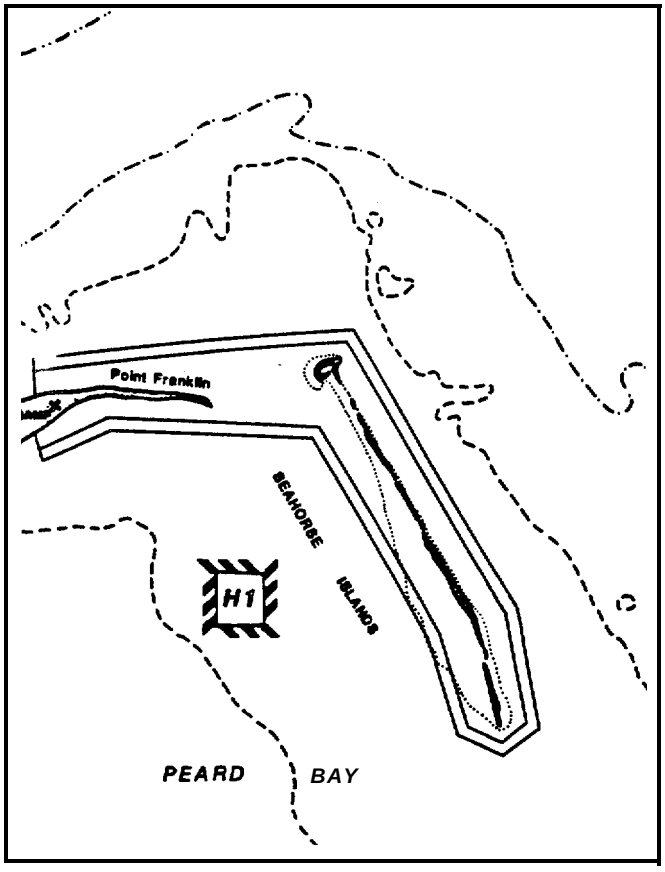
***OIL** RESIDENCE INDEX*



***BIOLOGICAL SENSITIVITY** INDEX*



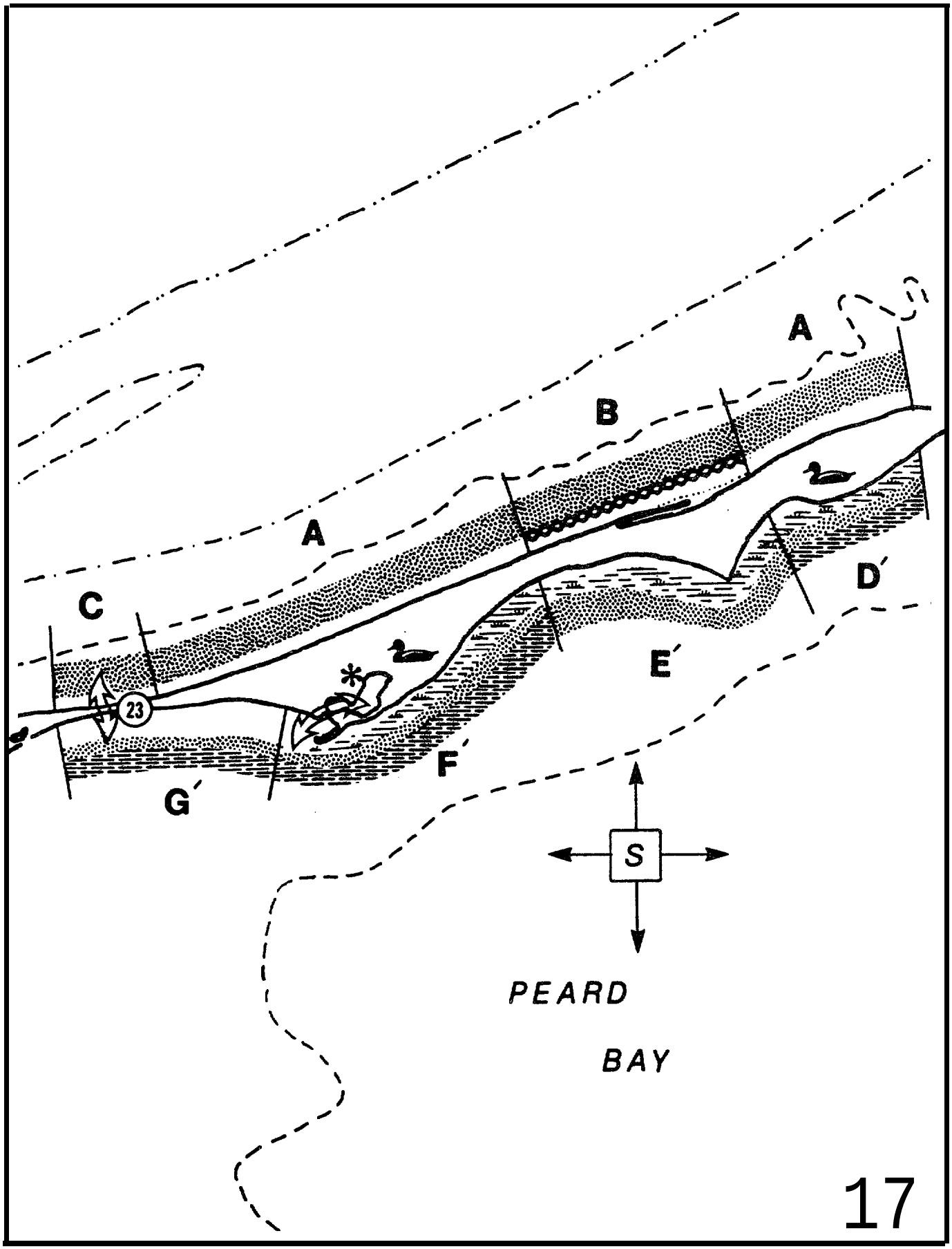
HUMAN USE INDEX



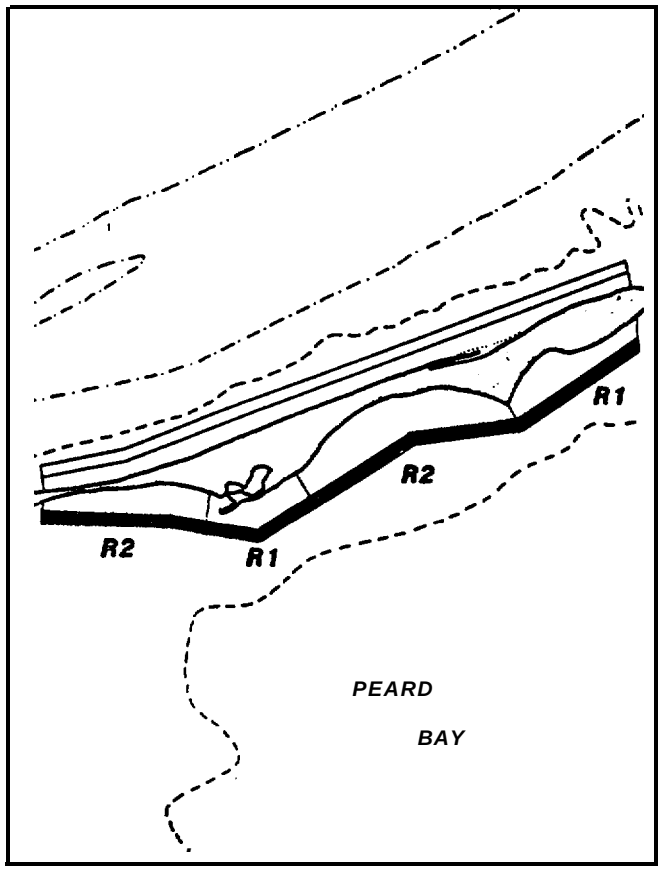
*Seasonal **Variability of Indices***

Identifier	RESOURCE	SEASON						
		Winter	Break-Up/Summer/Freeze-Up					Winter
			May	Jun	Jul	Aug	Sep	Oct	
R1	Low energy beach				■	■	■		
B1	Black guillemot (20 pr), eider and arctic tern (20 pr) nesting			▨	▨	▨	▨		
HI	Beluga whale hunting				▨	▨			

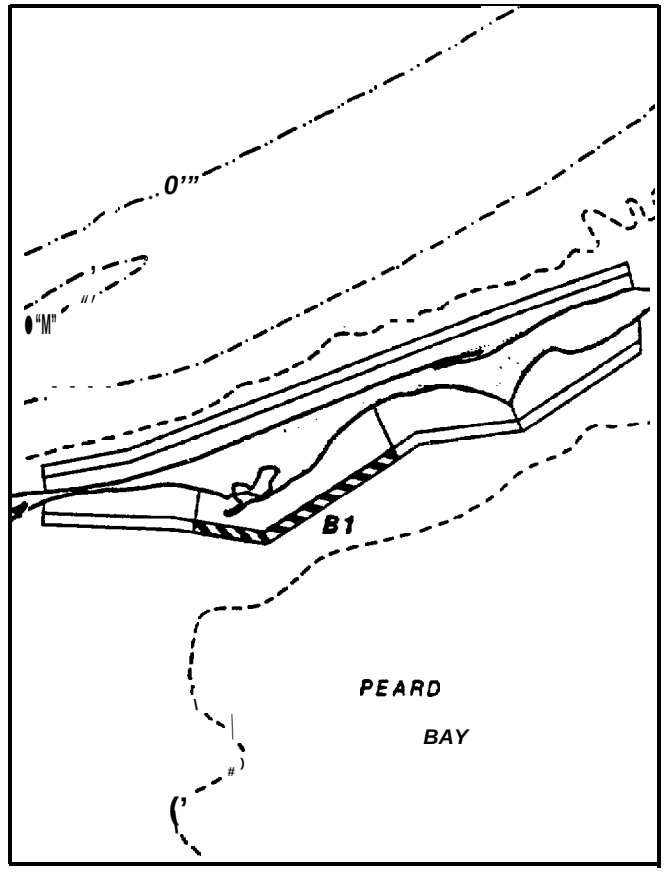
16


A
B
A
C
D´
E´
23
F´
G´
S
PEARD
BAY
17

OIL RESIDENCE INDEX



***BIOLOGICAL* SENSITIVITY INDEX**



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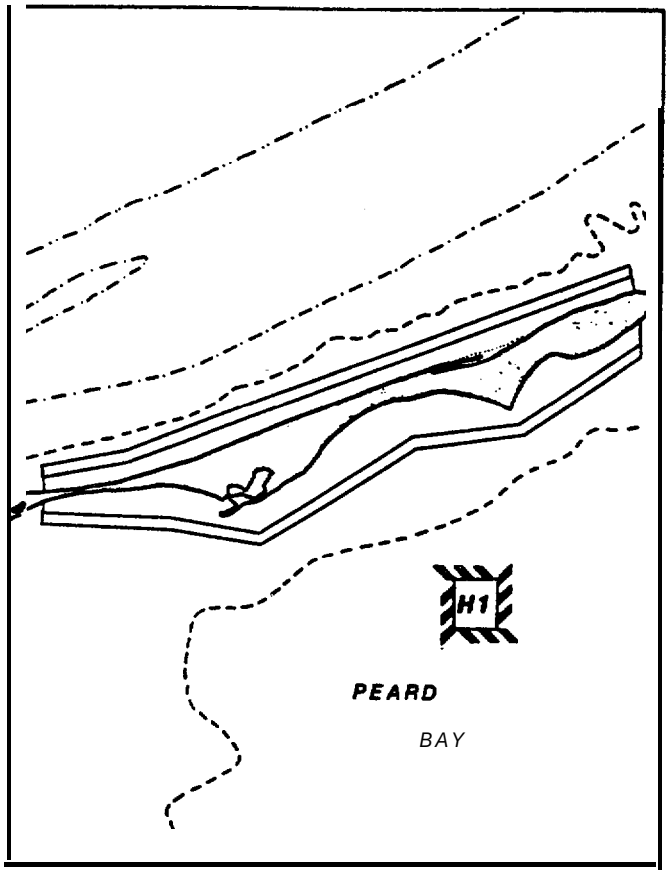
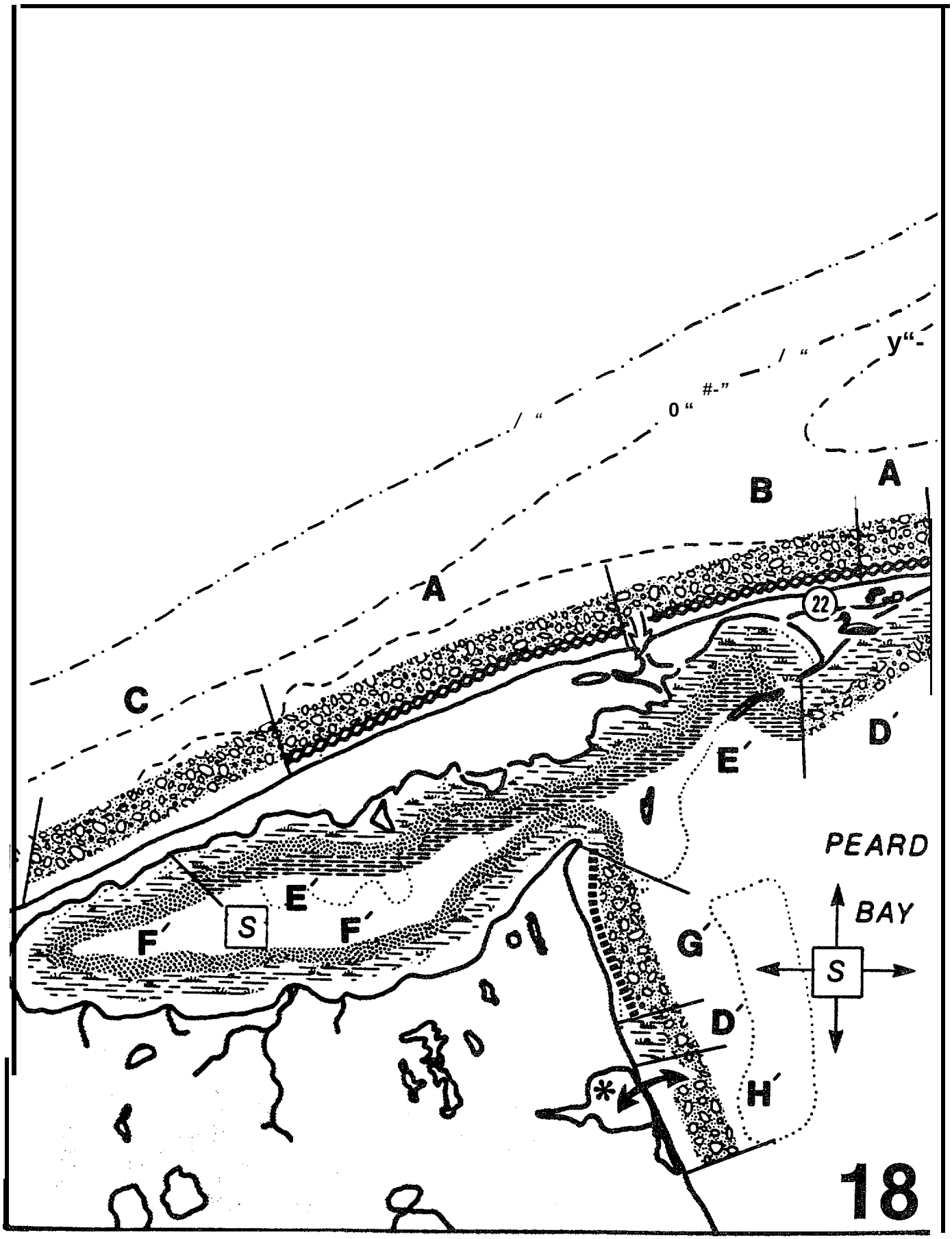


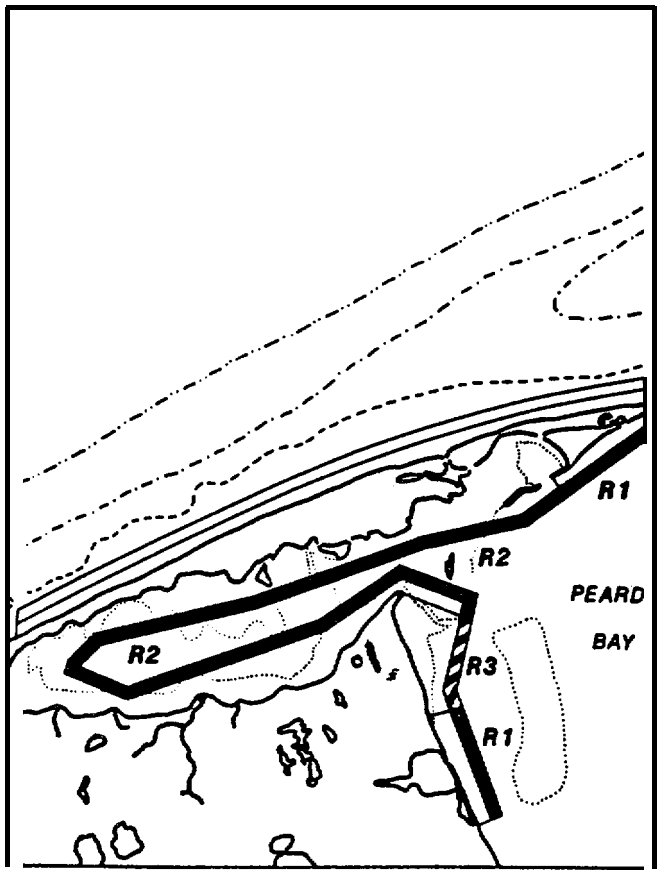
Seasonal Variability of Indices

dentifier	RESOURCE	Winter	SEASON: May	Jun	Jul	Aug	Sep	Oct	Winter
R1	Low energy beach; Wetland				■	■	■		
R2	Low energy beach				■	■	■		
B1	Wetland and eider nesting			▨	▨	▨	▨	▨	
H1	Beluga whale hunting				▨				

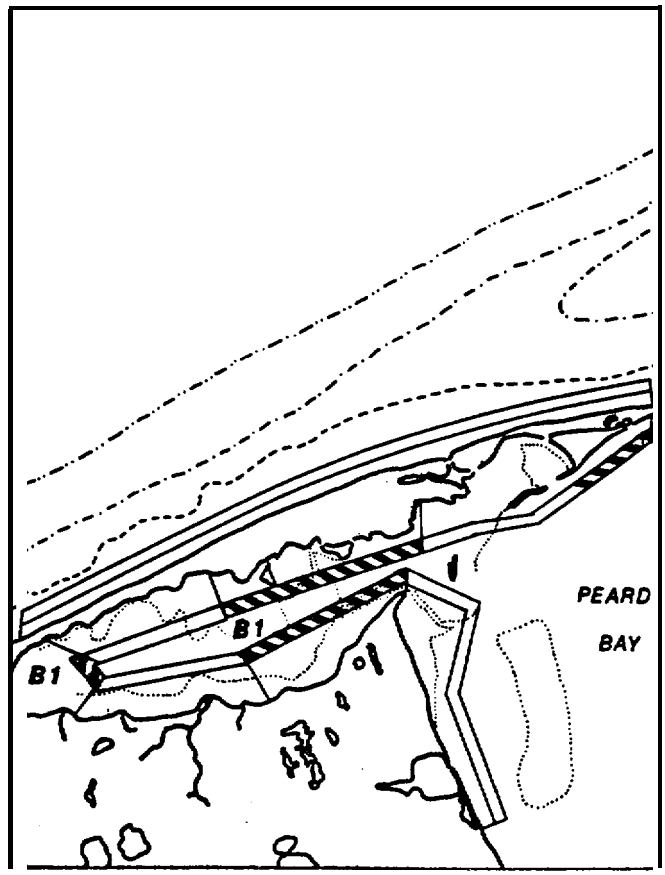
17


A
B
A
C
D´
E´
22
PEARD
BAY
E´
F´
S
F´
G´
S
D´
H´
*
18

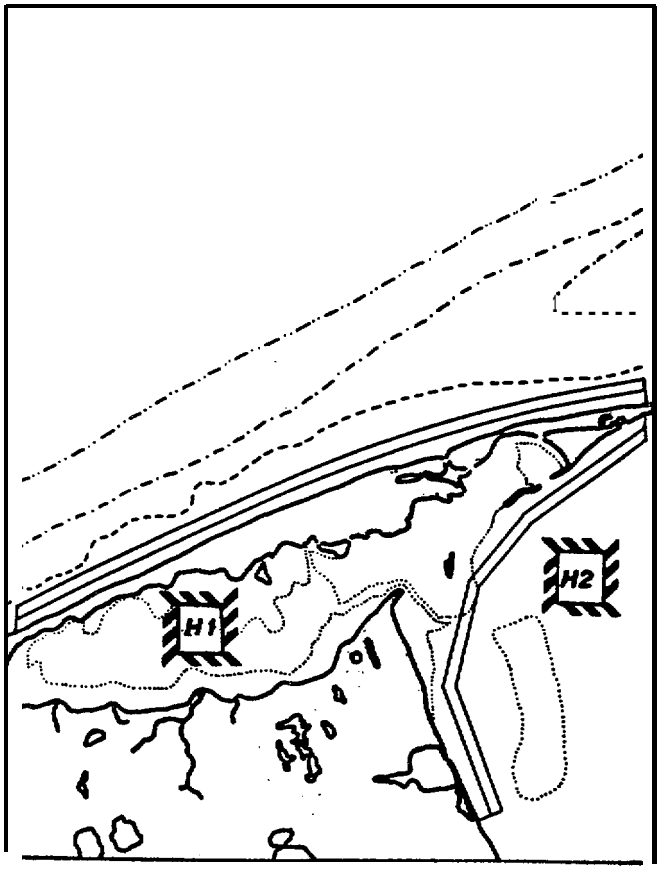
OIL *RESIDENCE INDEX*



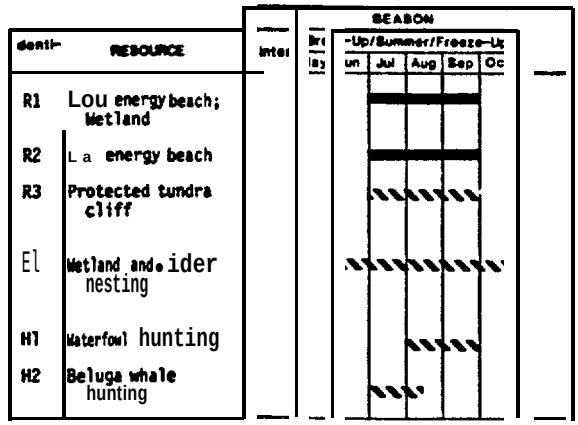
Biological SENSITIVITY INDEX



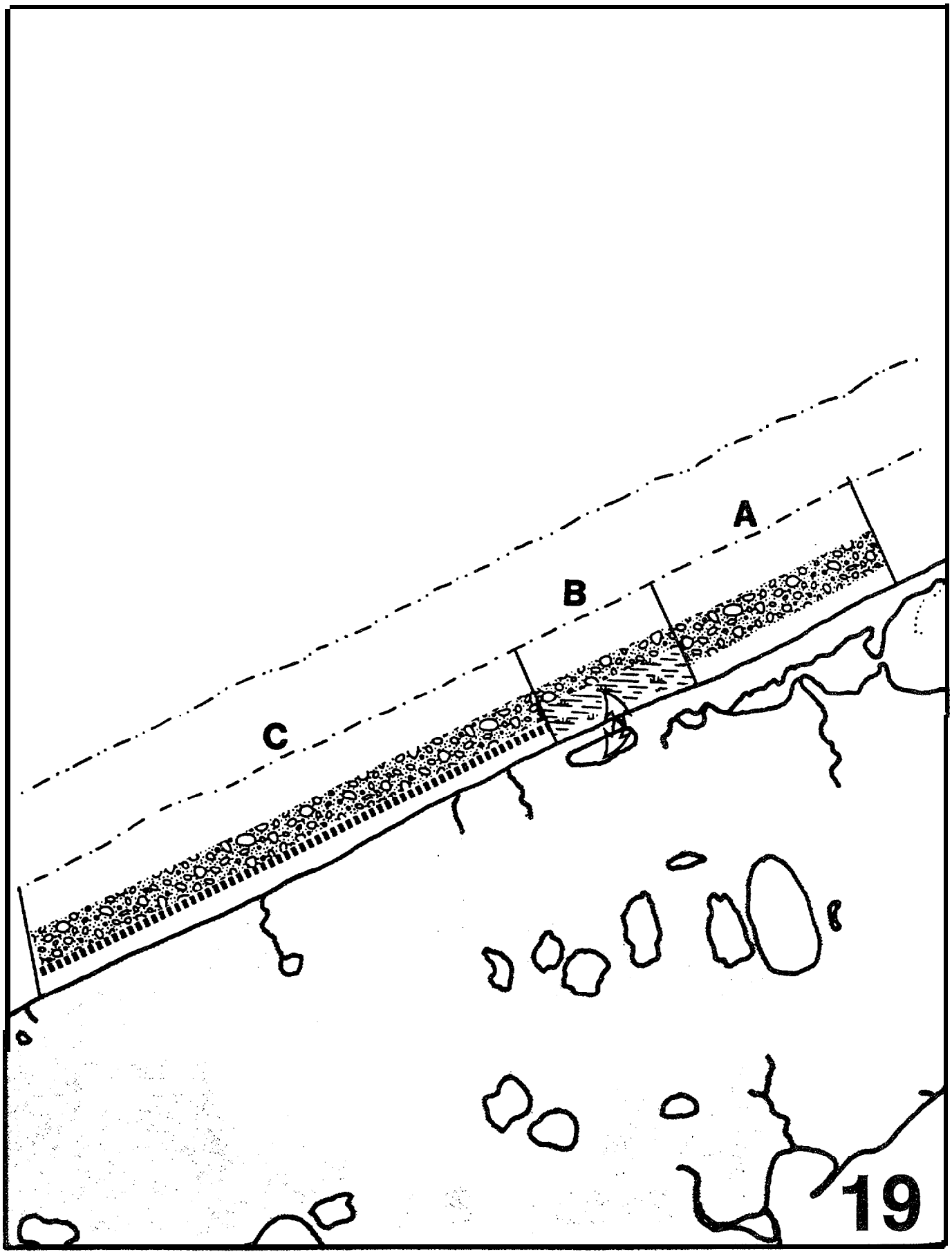
HUMAN USE INDEX



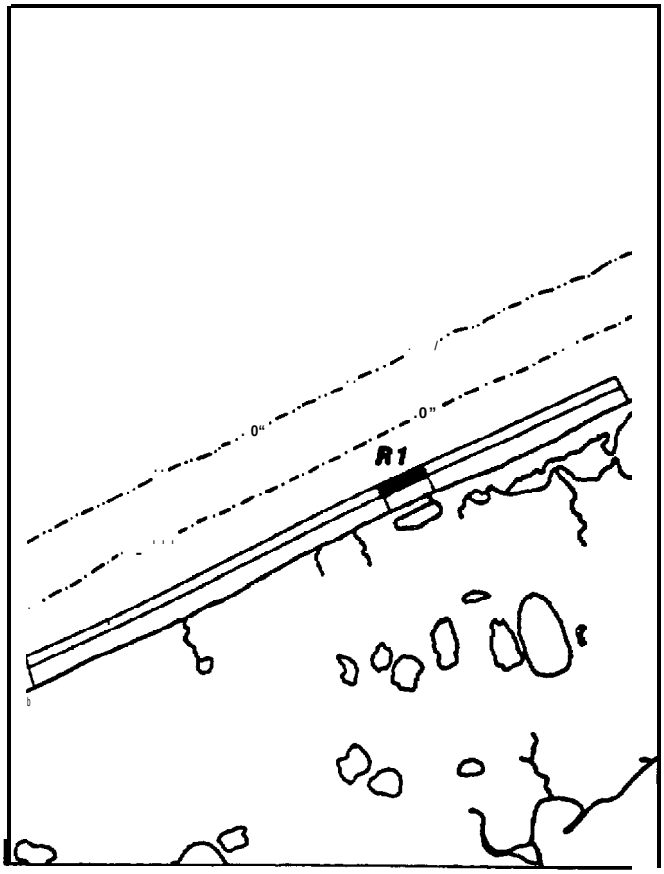
Seasonal ***Variability*** *of* ***Indices***



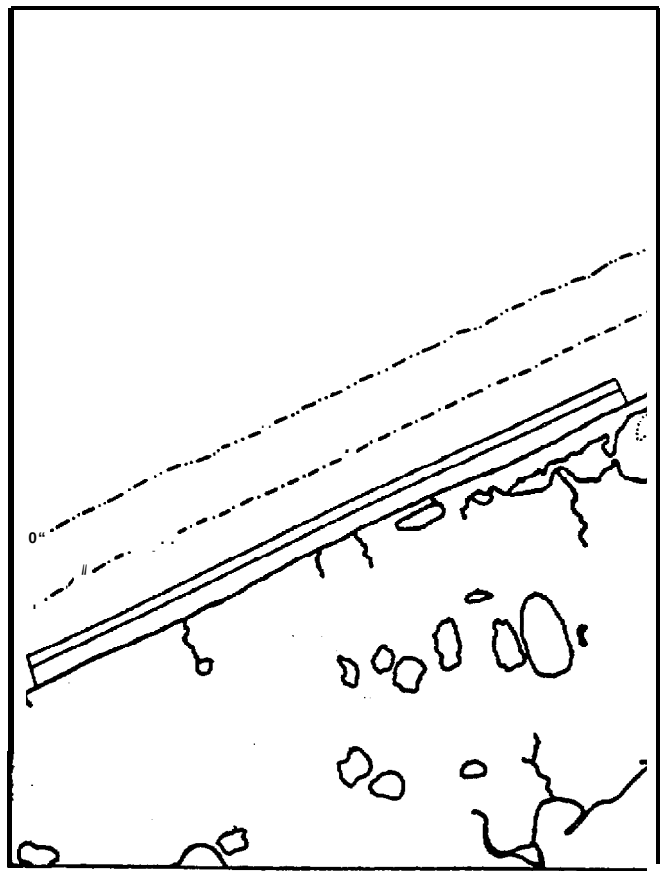
18


A
B
C
19

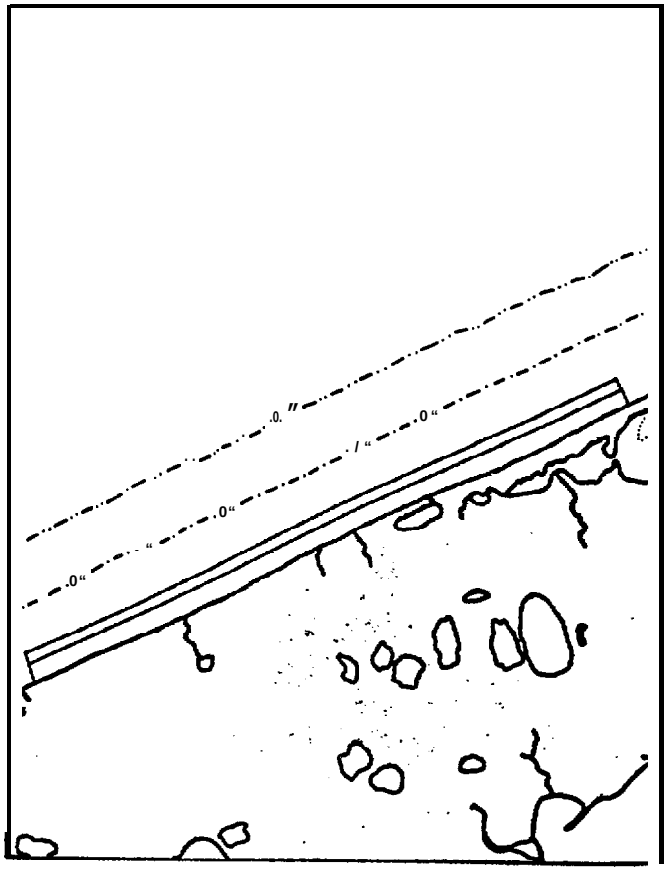
OIL RESIDENCE INDEX



BIOLOGICAL *SENSITIVITY INDEX*



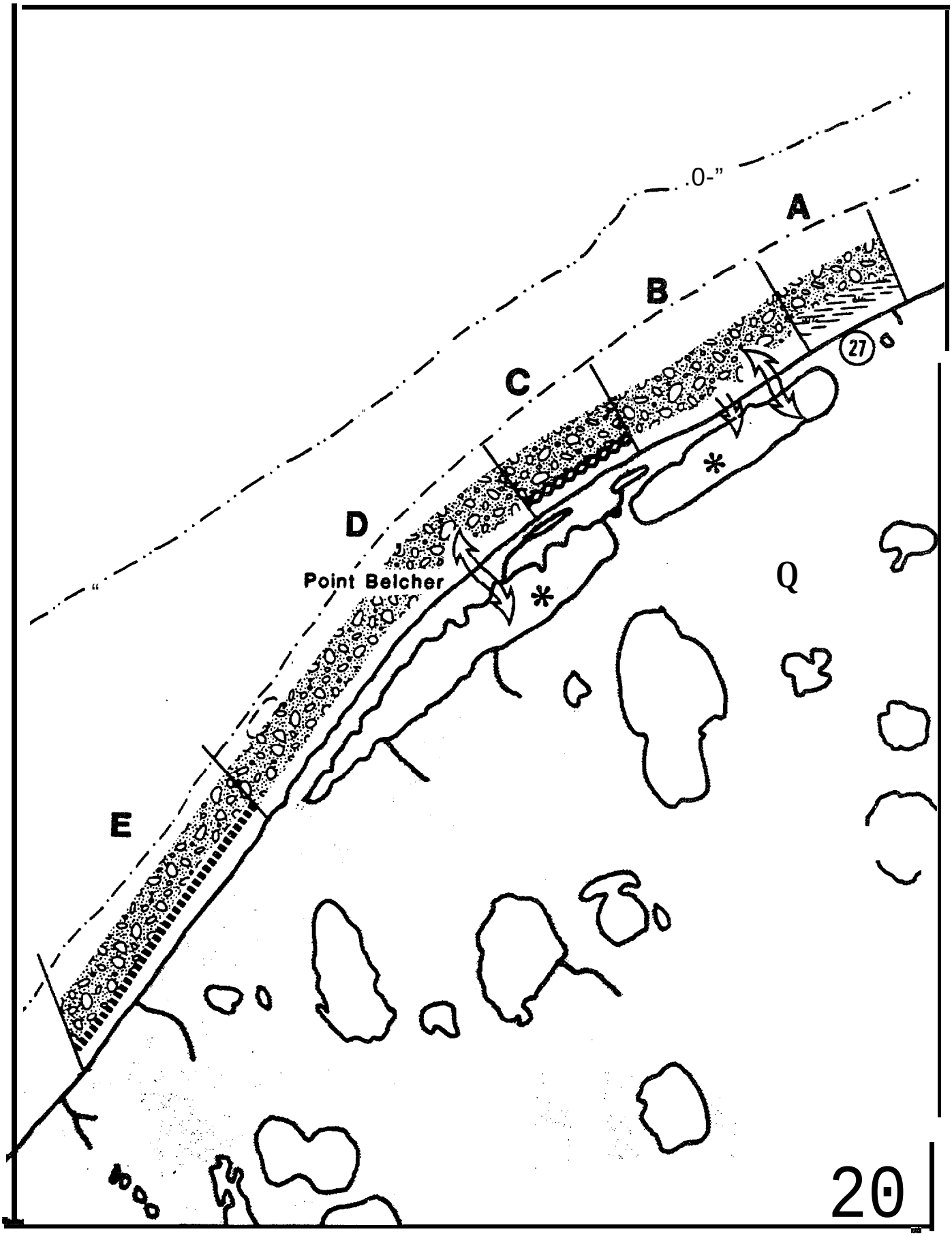
HUMAN USE INDEX



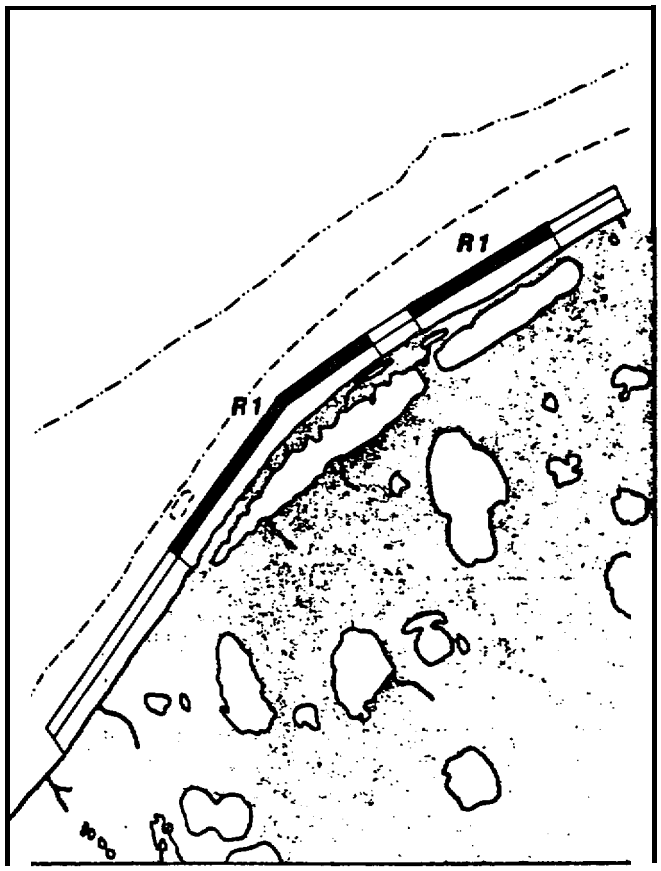
Seasonal ***Variability of Indices***

Identifier	RESOURCE	SEASON						
		Winter	Break-Up/Summer/Freeze-Up					Winter
			May	Jun	Jul	Aug	Sep	Oct	
R1	Ephemeral inlet; Lagoon					■	■		

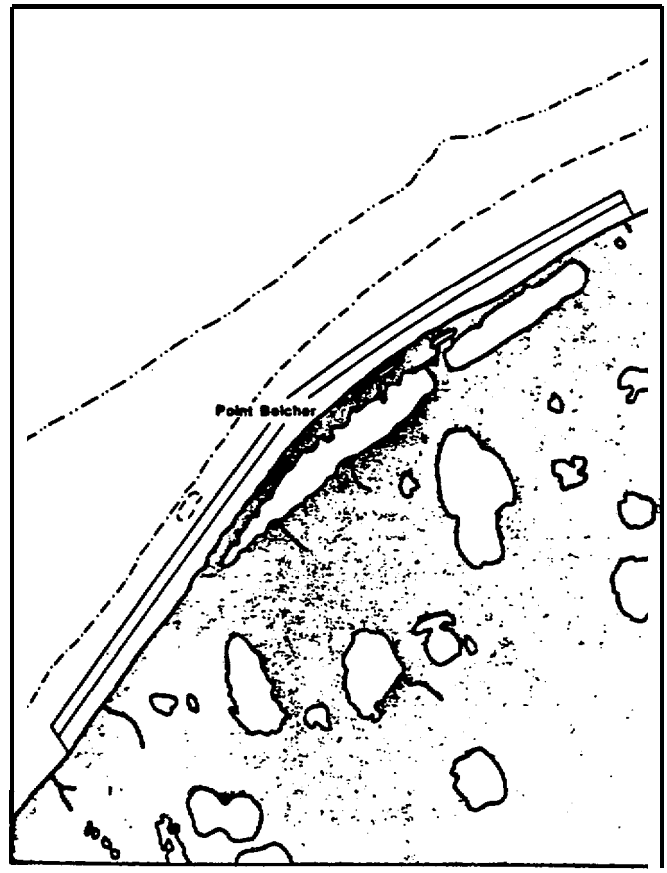
19


.0-"
A
B
C
D
E
Point Belcher
27
Q
20

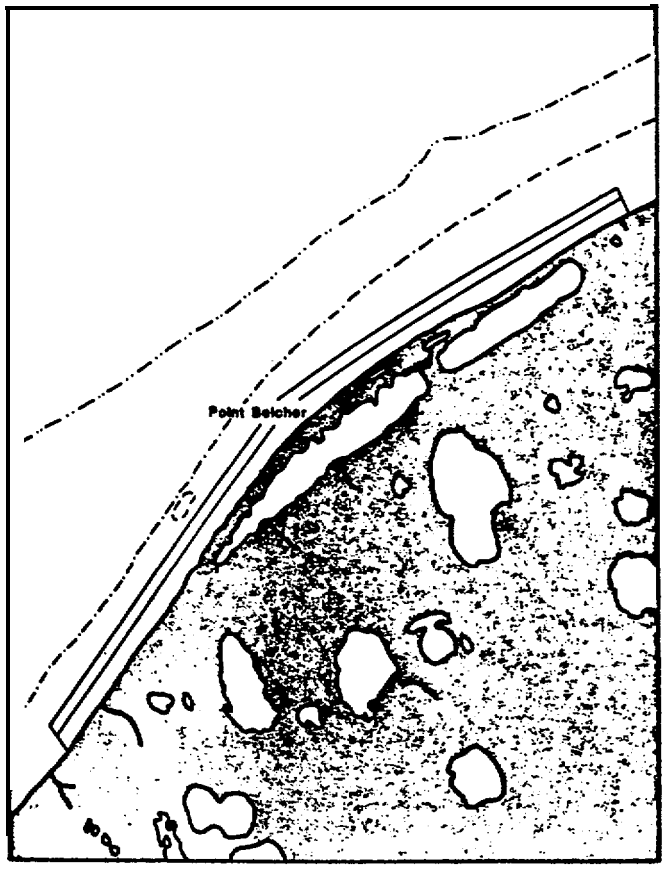
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



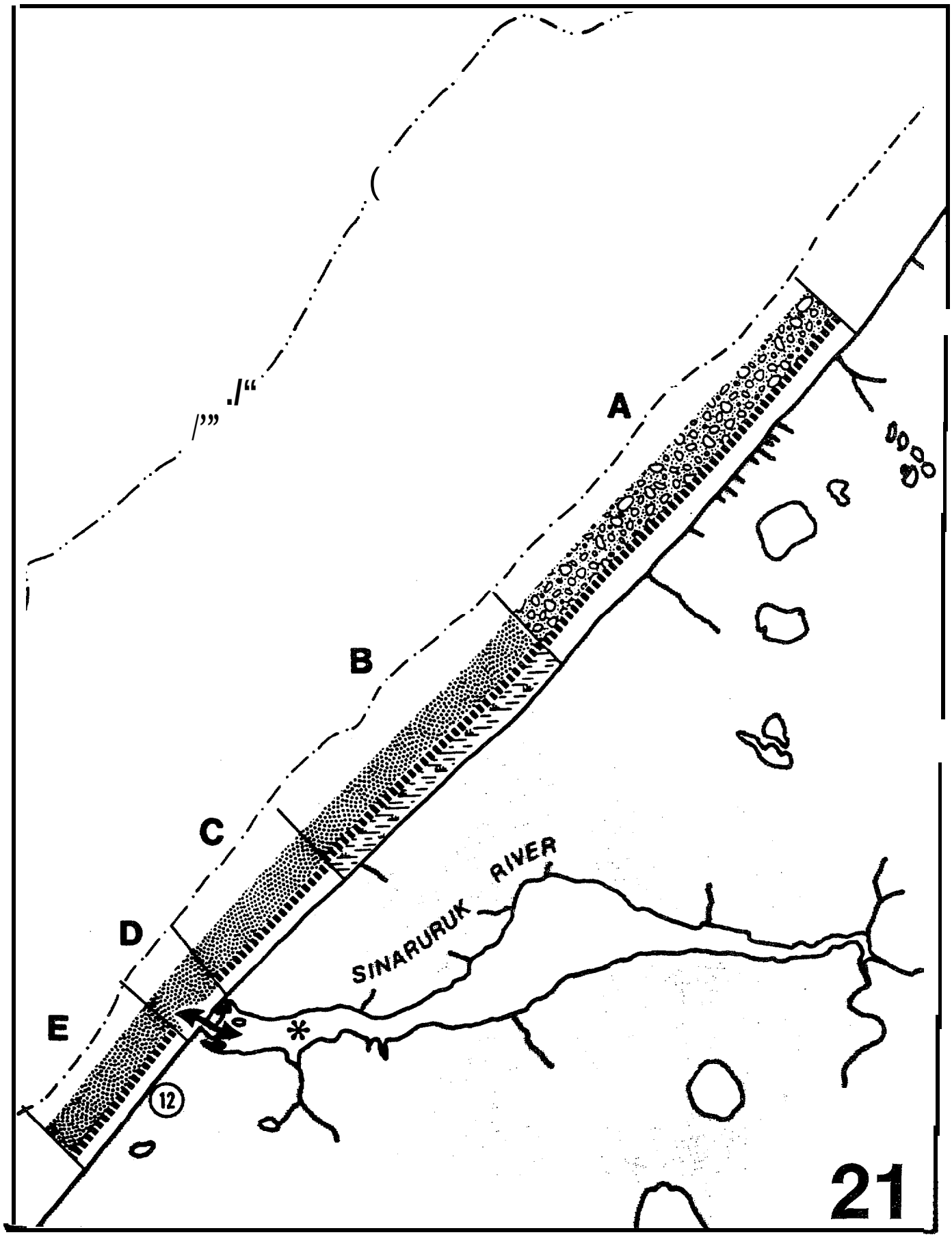
HUMAN USE INDEX



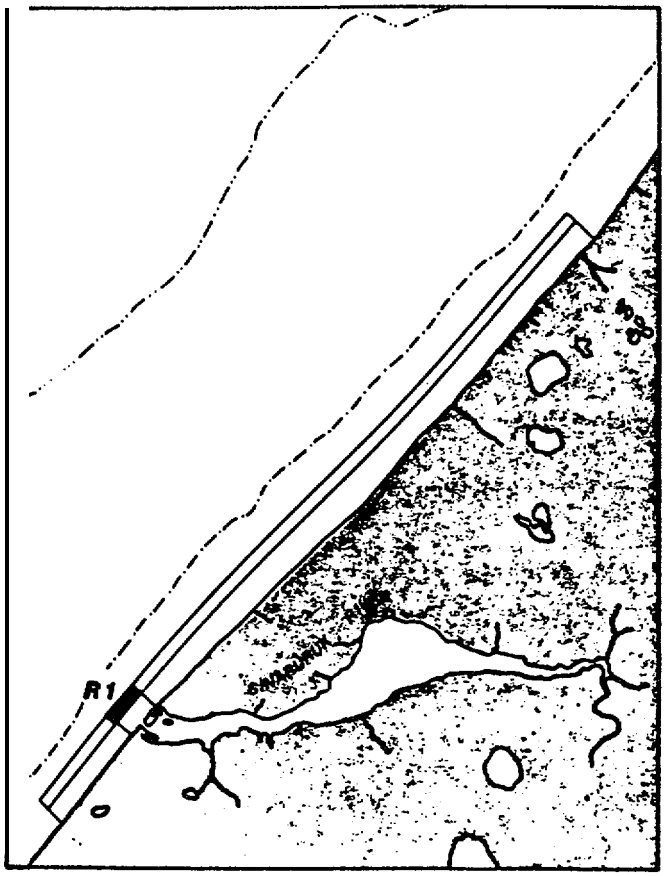
Seasonal Variability of Indices

Identifier	RESOURCE	SEASON							
		Winter	Break-Up/Summer/Freeze-Up						Winter
			May	Jun	Jul	Aug	Sep	Oct	
R1	Ephemeral inlet; Lagoon				I-HI				

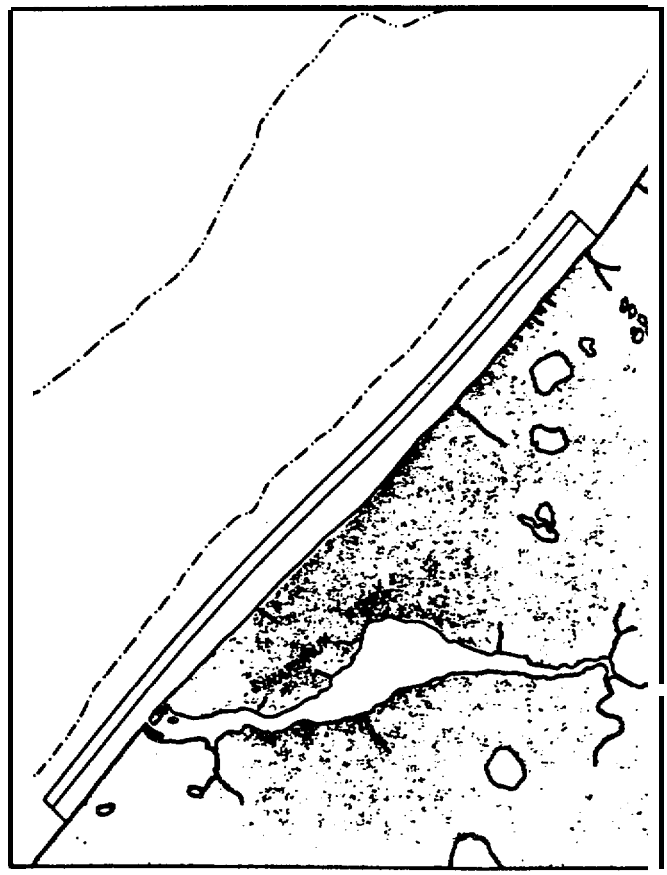
20


A
B
C
D
E
SINARURUK RIVER
12
21

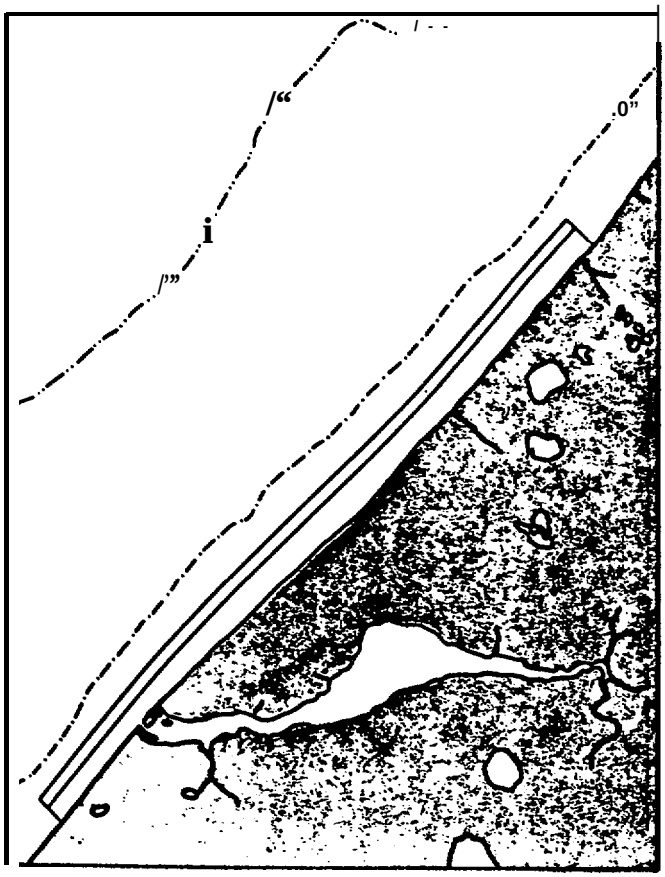
***OIL RESIDENCE* INDEX**



BIOLOGICAL SENSITIVITY INDEX



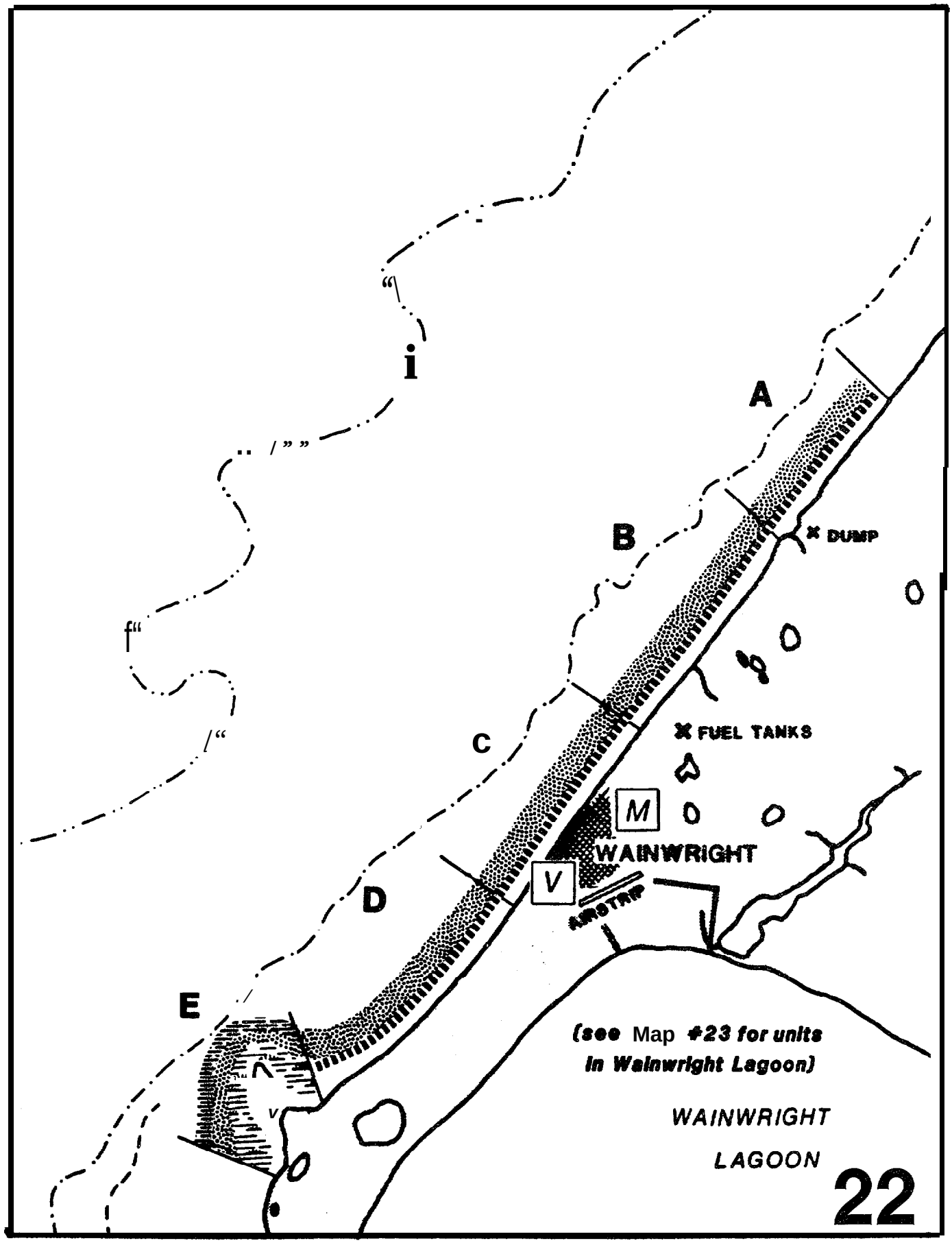
HUMAN USE INDEX



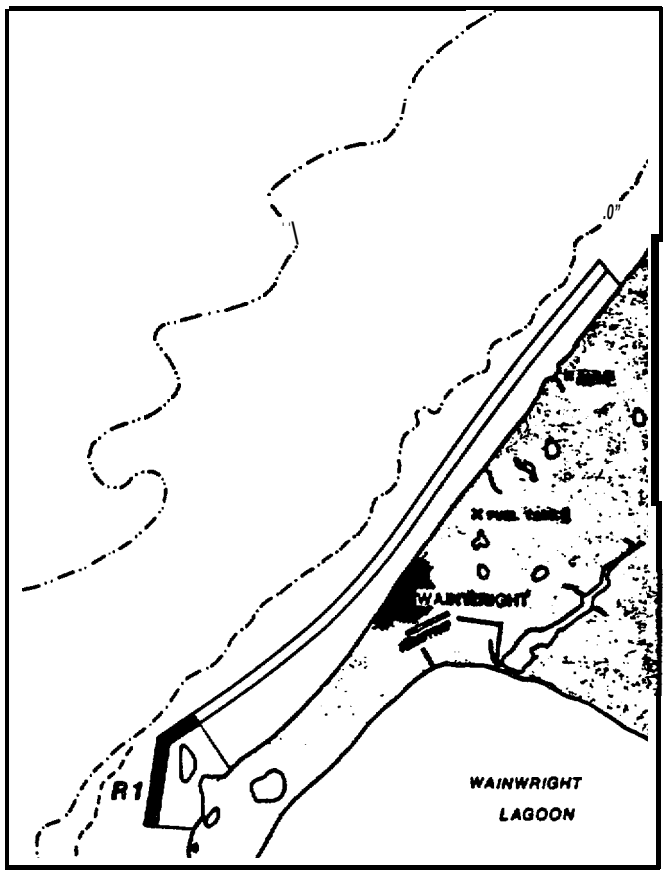
Seasonal Variability of Indices

Identifier	RESOURCE	SEASON							
		Winter	Break-Up/Summer/Freeze-Up						W inter
			May	Jun	Jul	Aug	Sep	Ott	
R1	Permanent inlet; Lagoon					■	■		

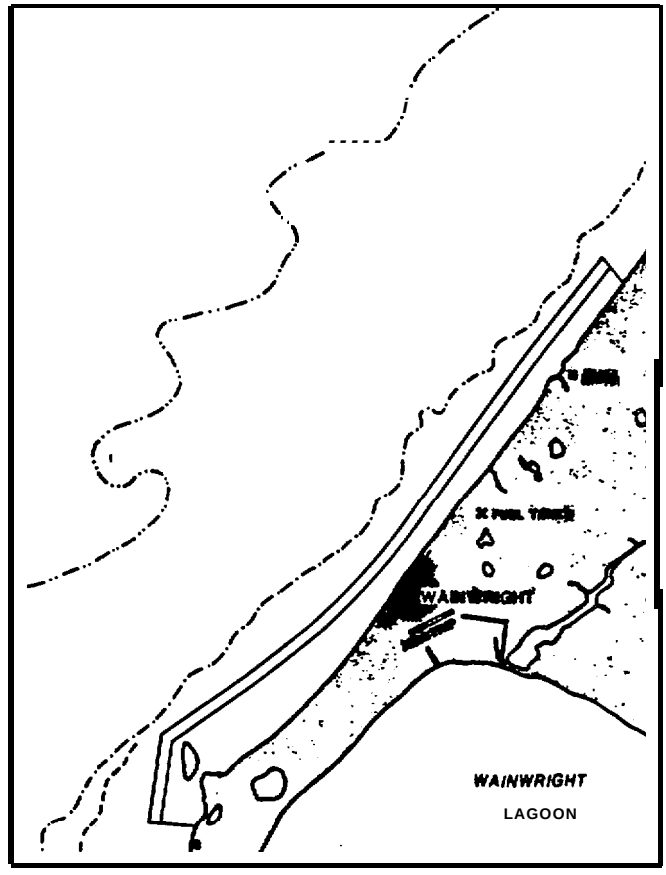
21


A
B
C
D
E
DUMP
FUEL TANKS
M
WAINWRIGHT
V
AIRSTRIP
(see Map #23 for units in Wainwright Lagoon)
WAINWRIGHT
LAGOON
22

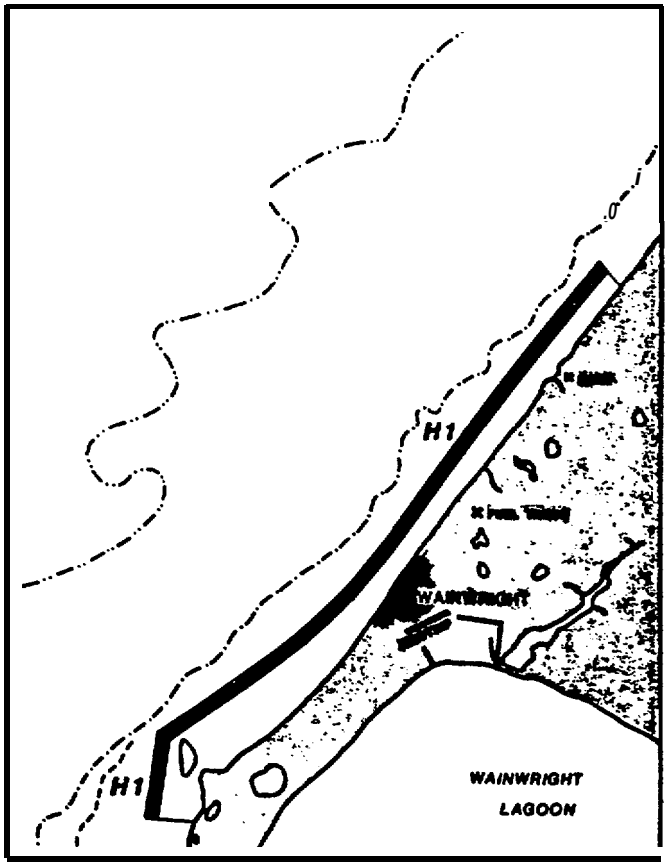
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



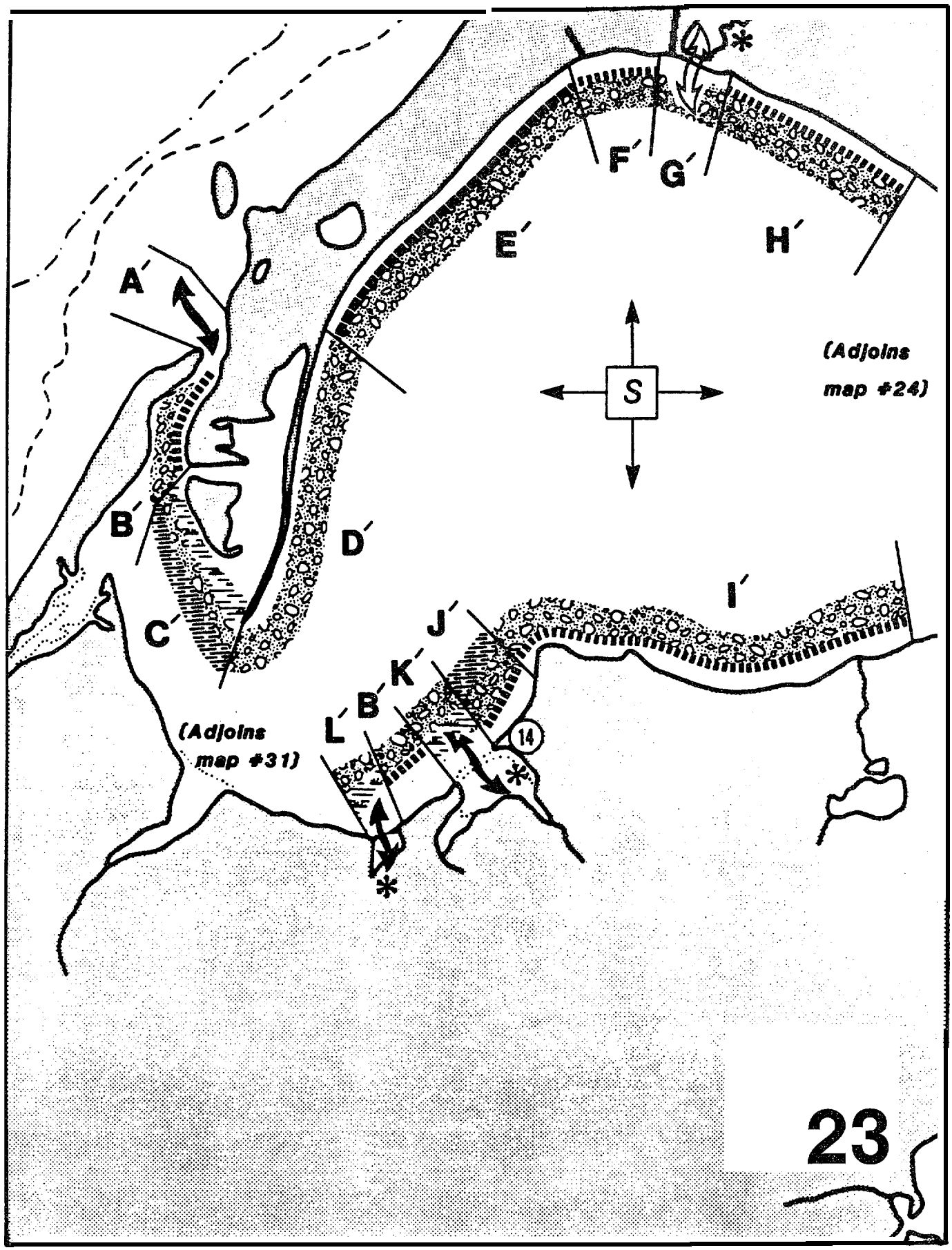
HUMAN USE INDEX



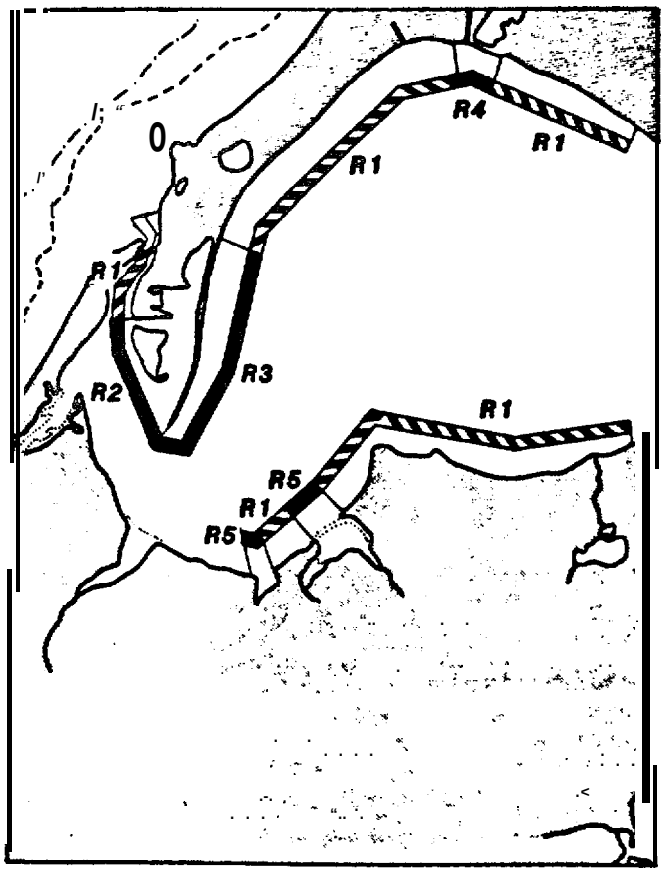
Seasonal Variability of Indices

Identifier	RESOURCE	Winter	SEASON: Break-Up/Summer/Freeze-Up May	Jun	Jul	Aug	Sep	Oct	Winter
R1	Wetland				■	■	■	■	
H1	Community of Wainwright			■	■	■	■	■	
	Subsistence access			■	■	■	■	■	
	Resident recreation			■	■	■	■	■	

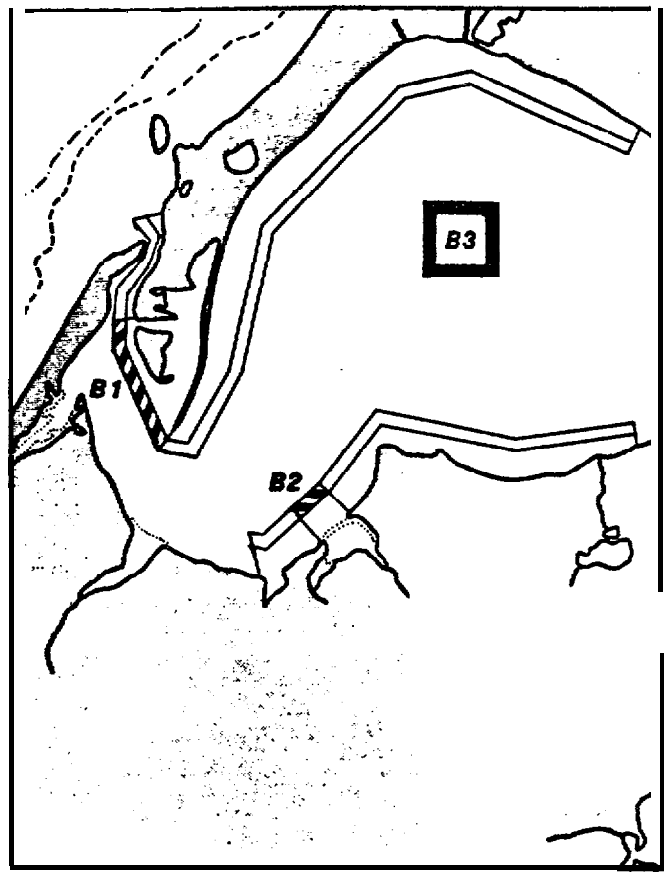
22


A´
B´
C´
D´
E´
F´
G´
H´
I´
J´
K´
L´
B´
S
(Adjoins map #24)
(Adjoins map #31)
14
23

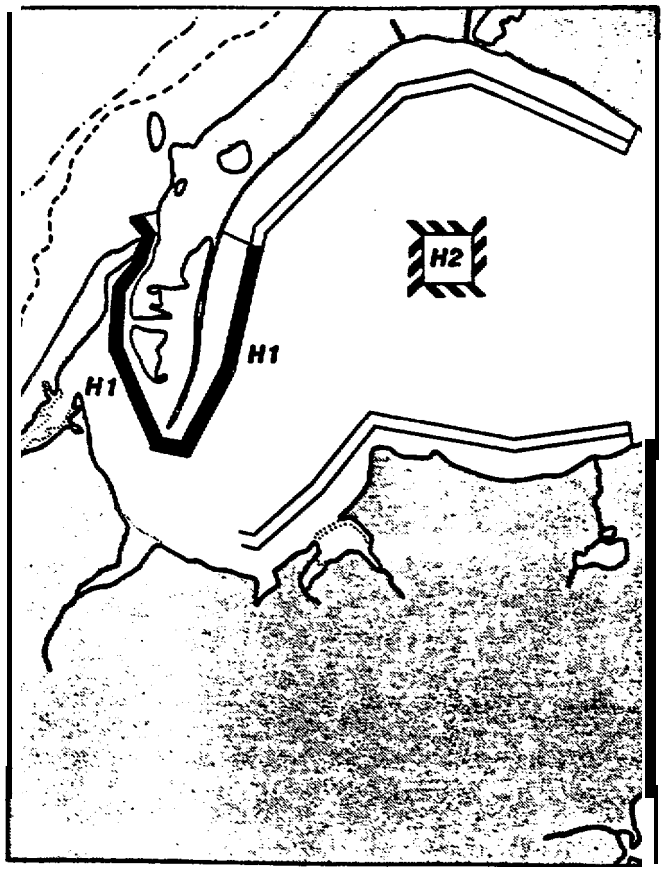
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX

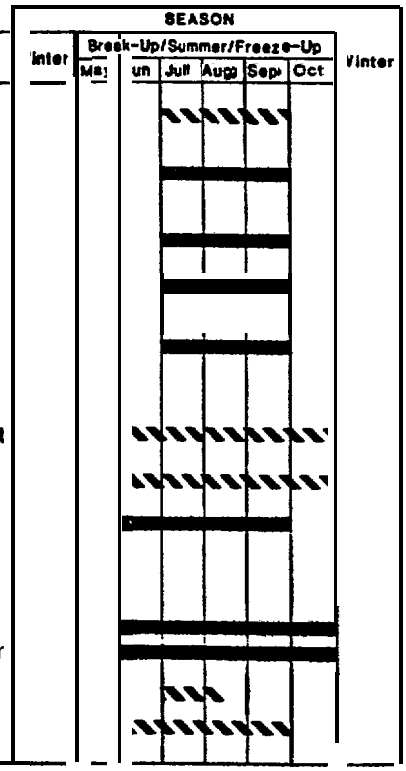


HUMAN USE INDEX

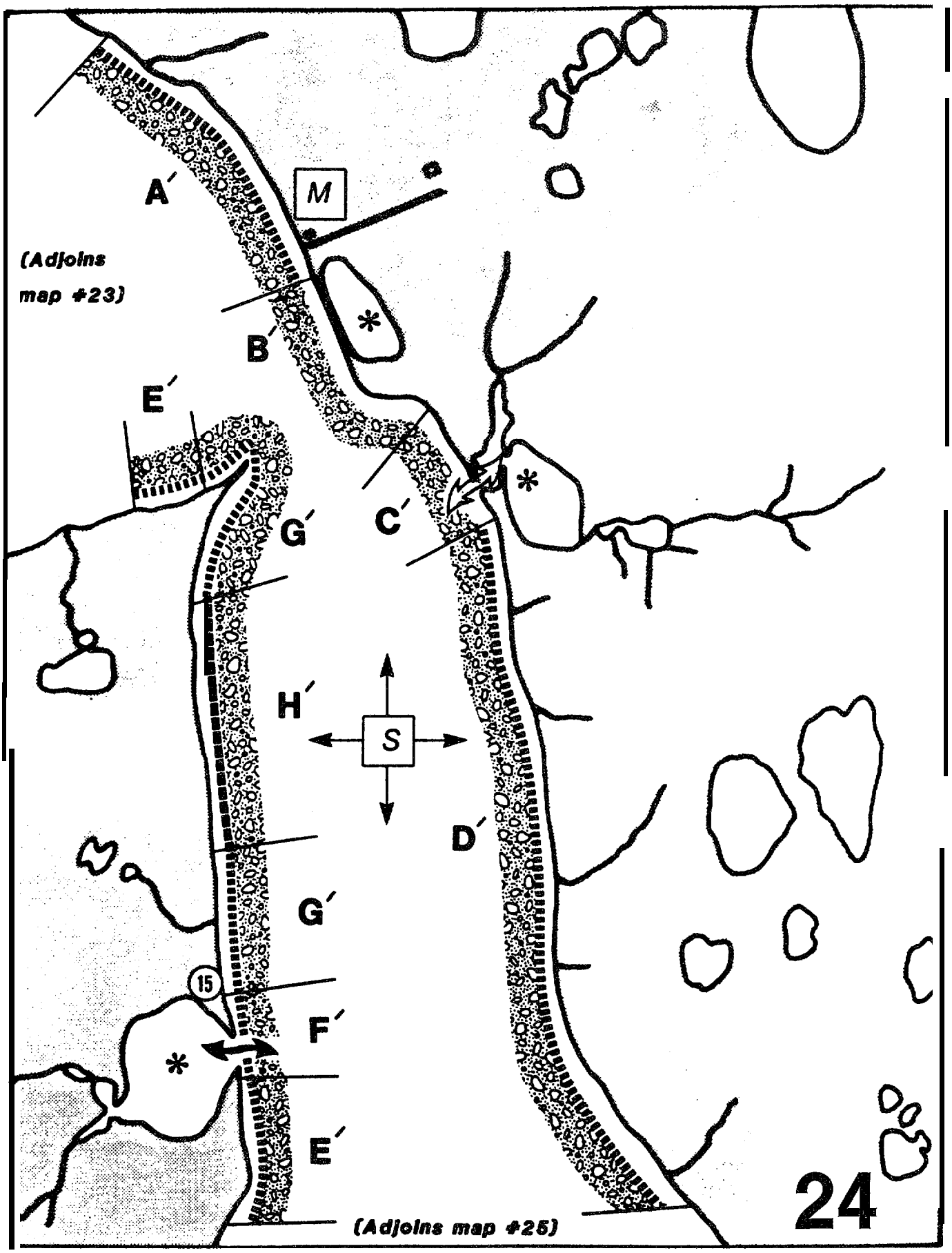


Seasonal *Variability of* ***Indices***

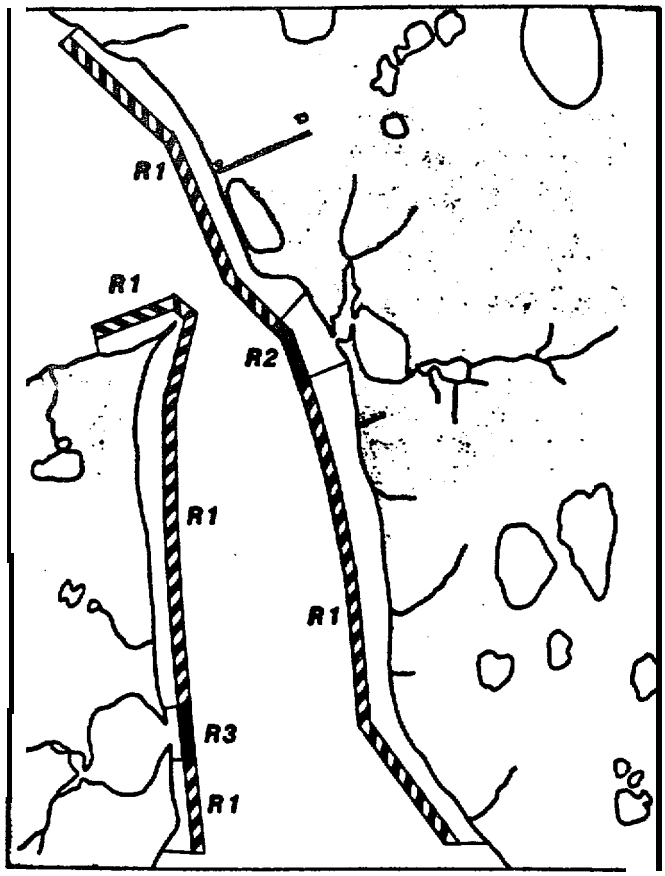
Identifier	RESOURCE
R1	Protected tundra cliff
R2	Low energy beach; Wetland
R3	Low energy beach
R4	Ephemeral inlet; Lagoon
R5	Permanent inlet; Lagoon
B1	Wetland and mudflat
B2	Wetland and lagoon
B3	Wainwright Inlet Whales, seals, Fish
H1	Subsistence access Resident recreator
H2	Beluga whale hunting Fishing



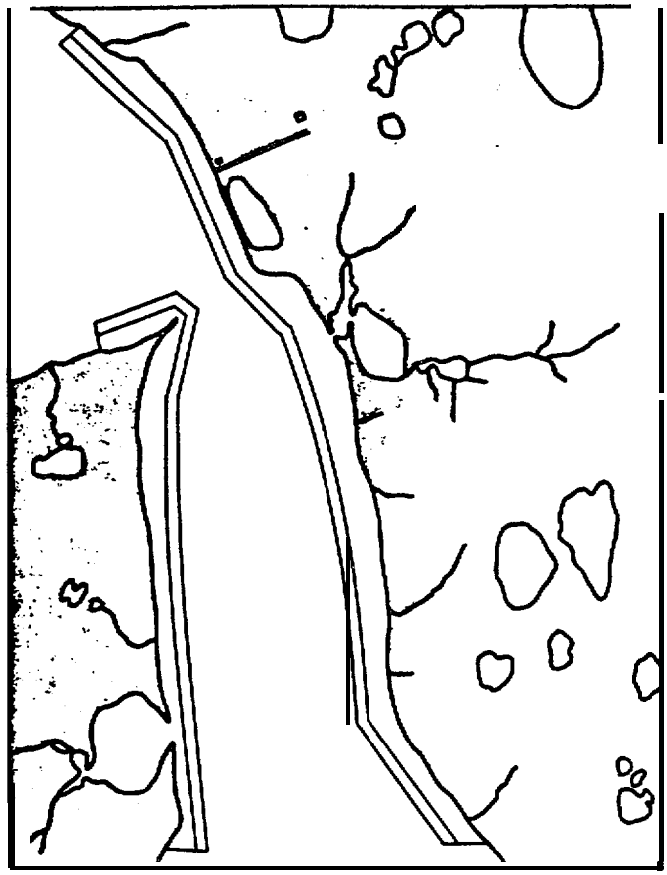
23


A´
M
(Adjoins
map #23)
B´
E´
G´
C´
H´
S
D´
G´
15
F´
E´
(Adjoins map #25)
24

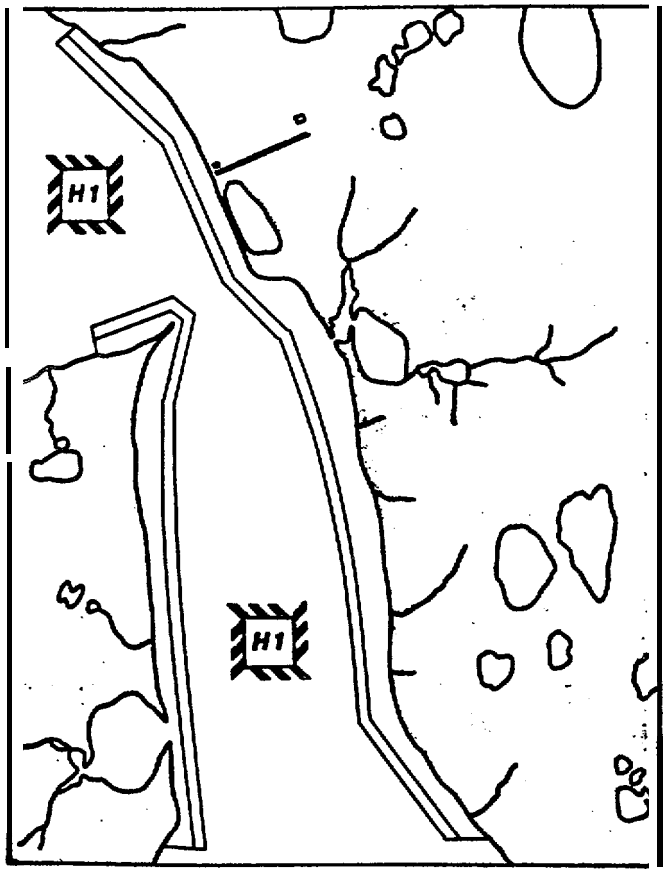
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX

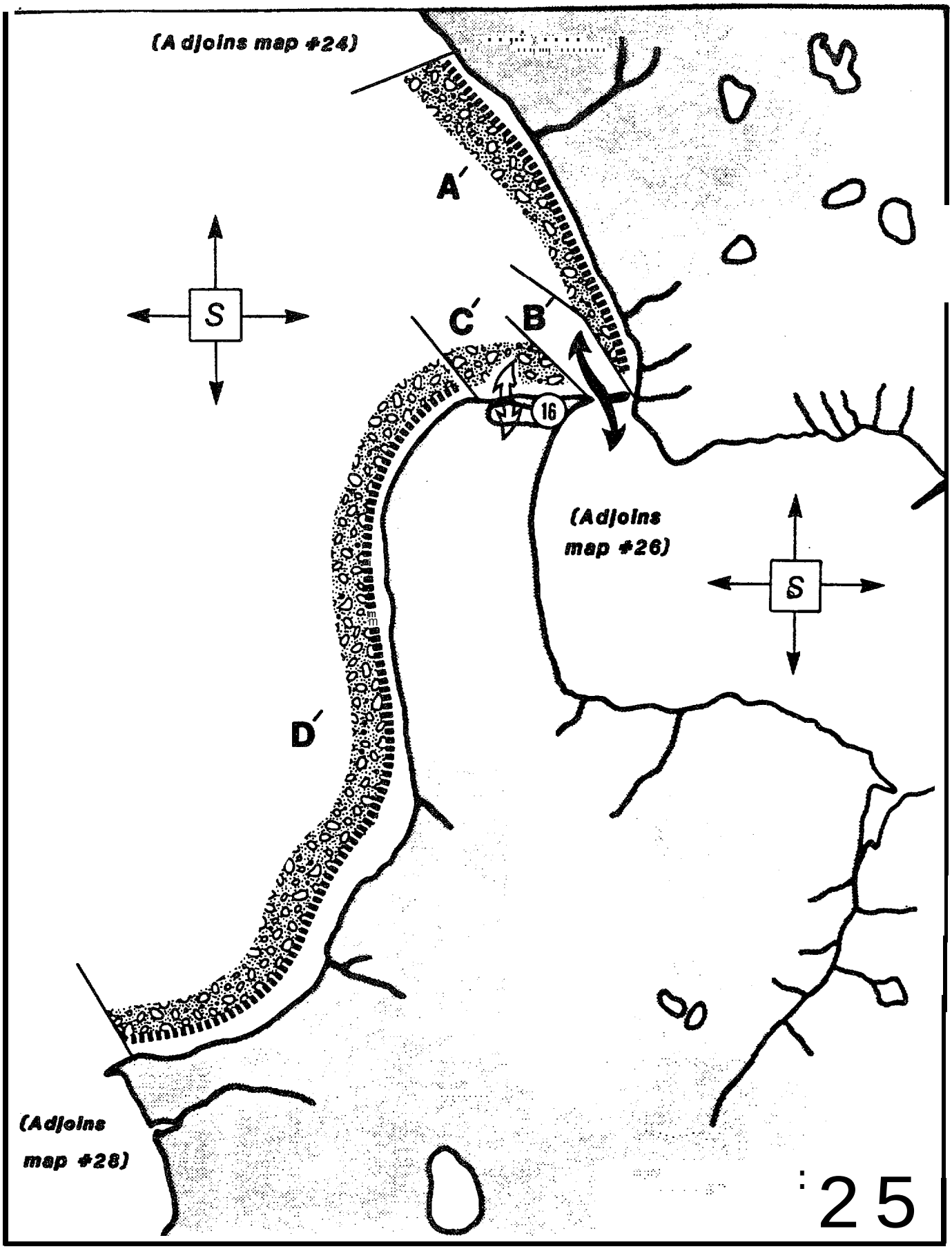


HUMAN USE INDEX

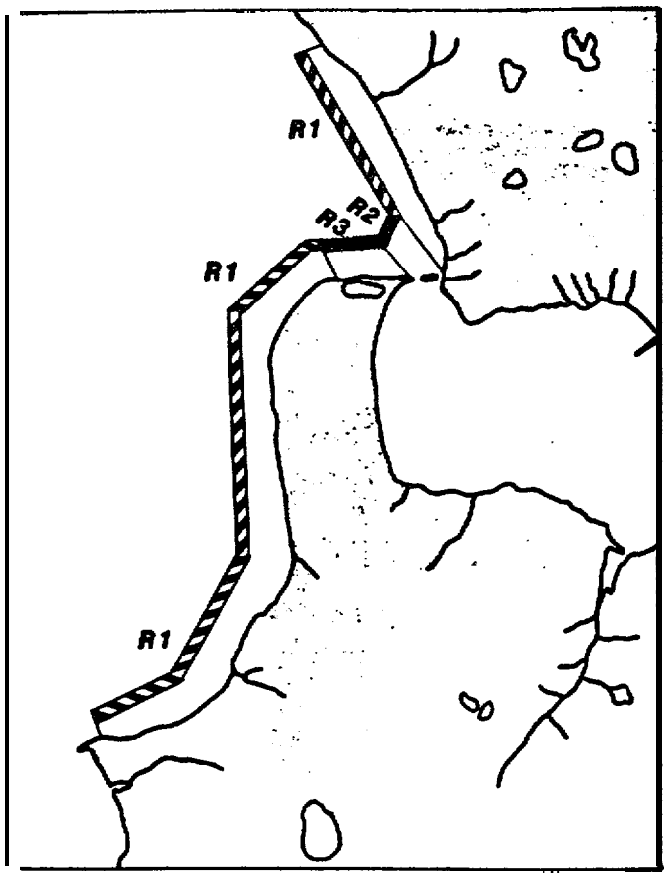


*Seasonal **Variability** of Indices*

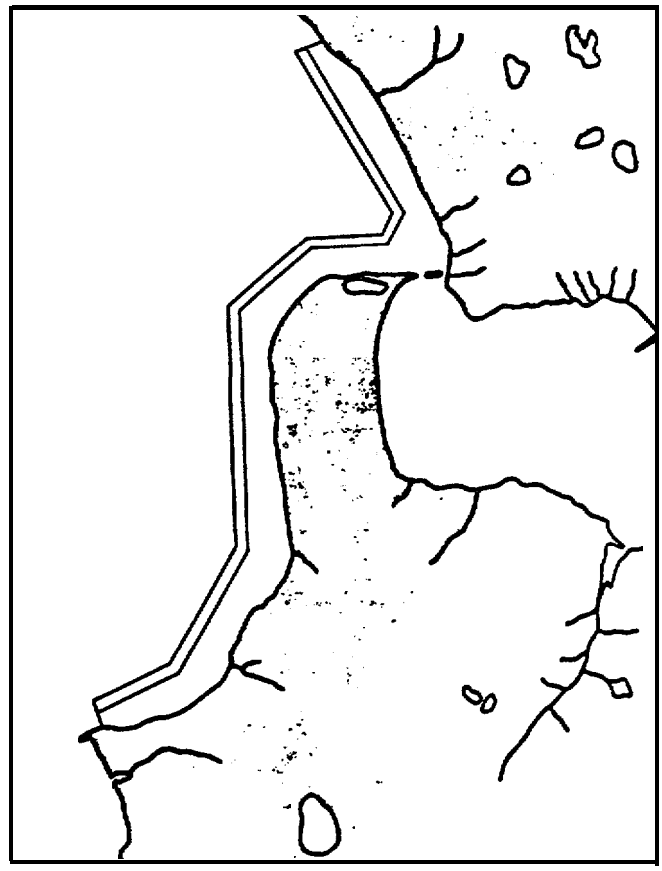
Identifier	RESOURCE	Winter	Spring	Summer/Freeze-Up				Winter
			May	Jun	Jul	Aug	Sep	Oct	
R1	Protected tundra cliff				▨	▨	▨		
R2	Ephemeral inlet; Lagoon				■	■	■		
R3	Permanent inlet; Lagoon				■	■	■		
H1	Fishing				▨	▨	▨	▨	


(Adjoins map #24)
A´
S
C´
B´
16
(Adjoins map #26)
S
D´
(Adjoins map #28)
25

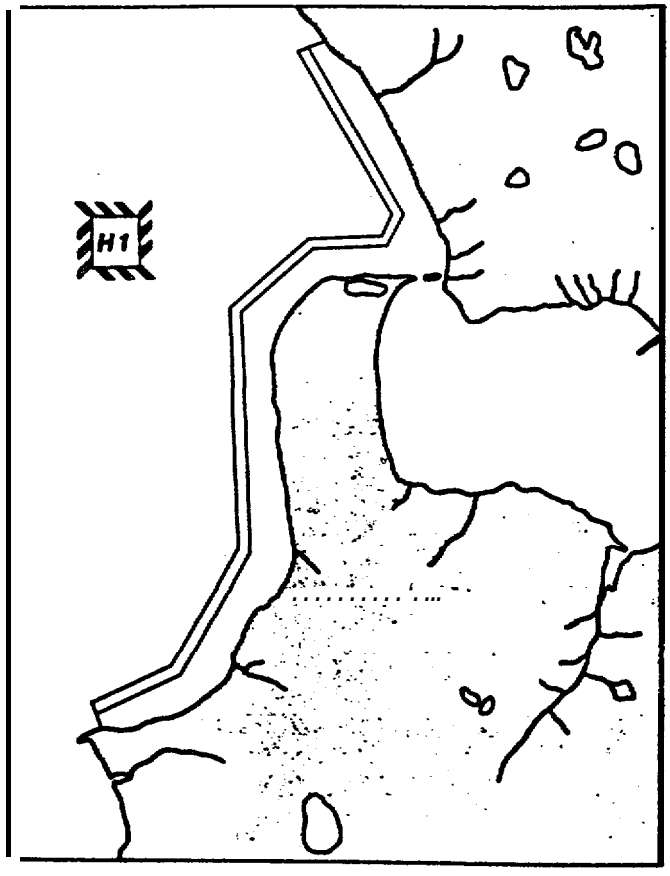
OIL RESIDENCE INDEX



*BIOLOGICAL **SENSITIVITY** INDEX*



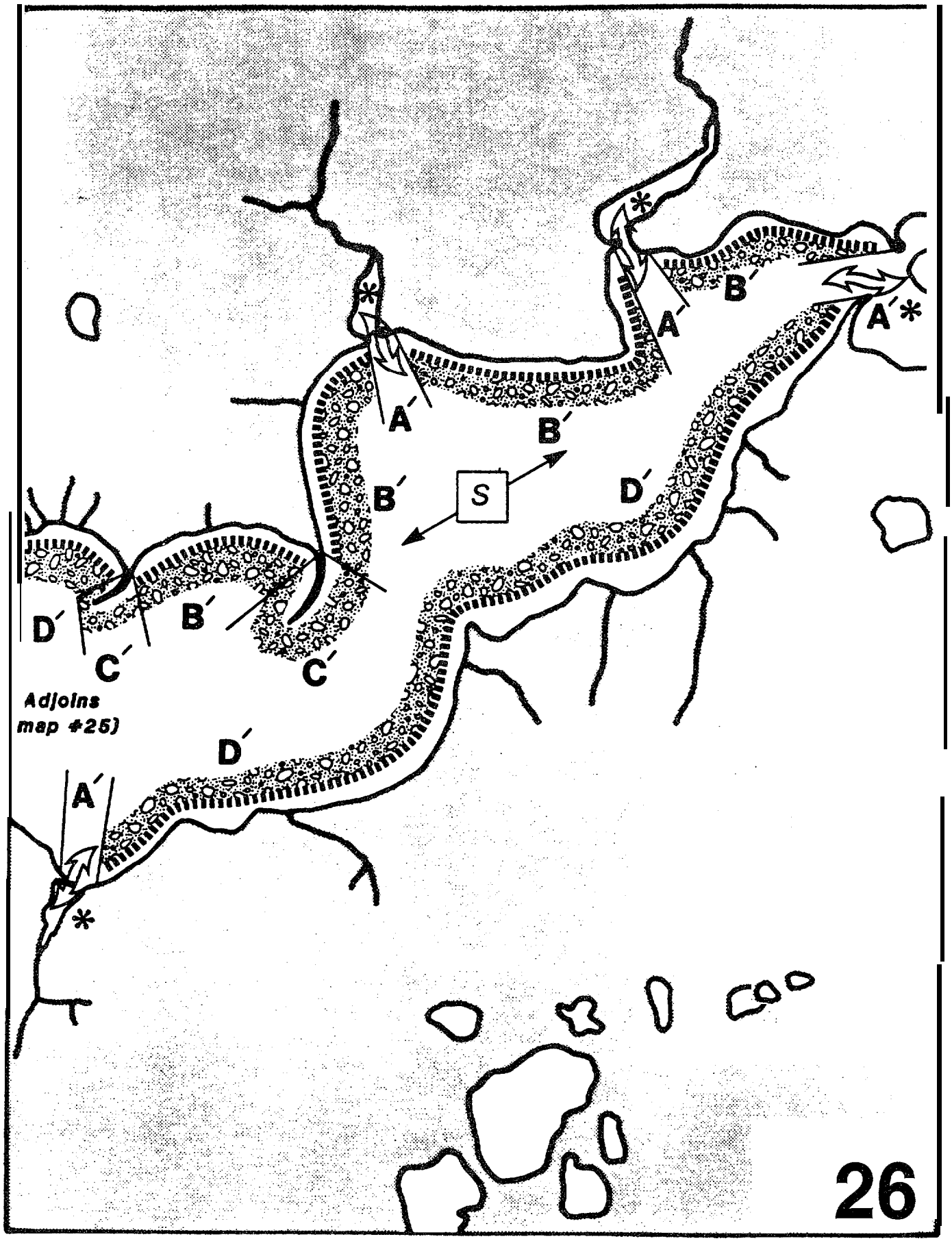
HUMAN USE INDEX



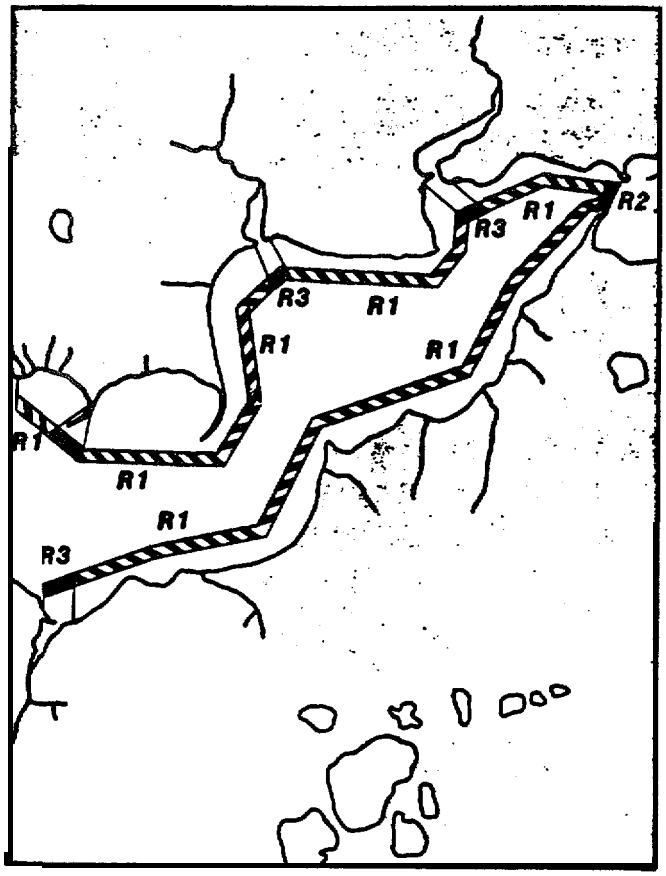
*Seasonal **Variability** of Indices*

Identifier	RESOURCE	SEASON: Break-Up/Summer/Freeze-Up — May	Jun	Jul	Aug	Sep	Oct	Inter
R1	Protected tundra cliff			▨	▨	▨		
R2	Penaanent inlet; Lagoon			■	■	■		
R3	Ephemeral inlet; Lagoon			■	■	■		
Ill	Fishing	—		▨	▨	▨		

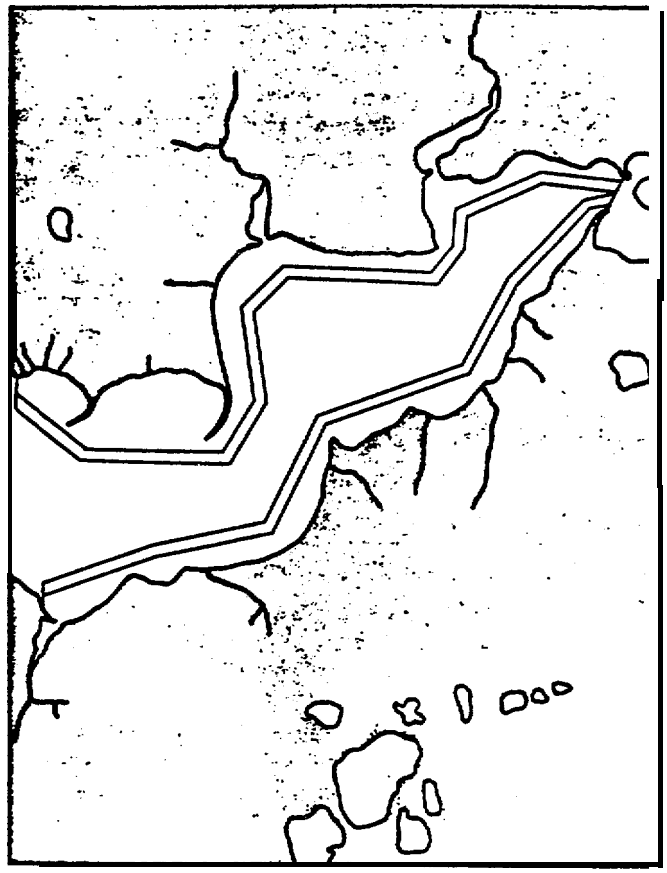
25


A´
B´
A´
B´
A´
B´
S
D´
B´
D´
C´
B´
C´
Adjoins
map #25)
D´
A´
26

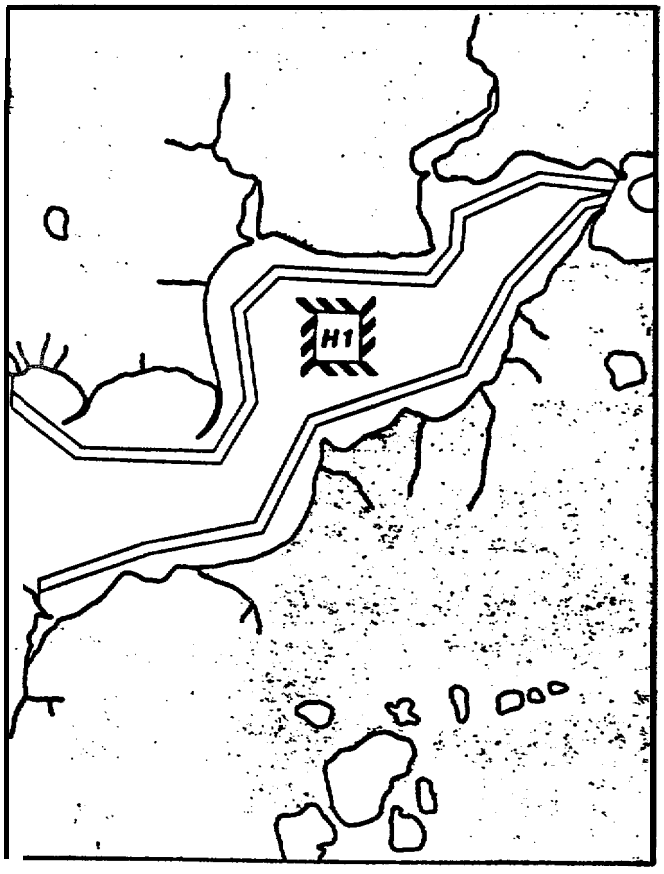
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



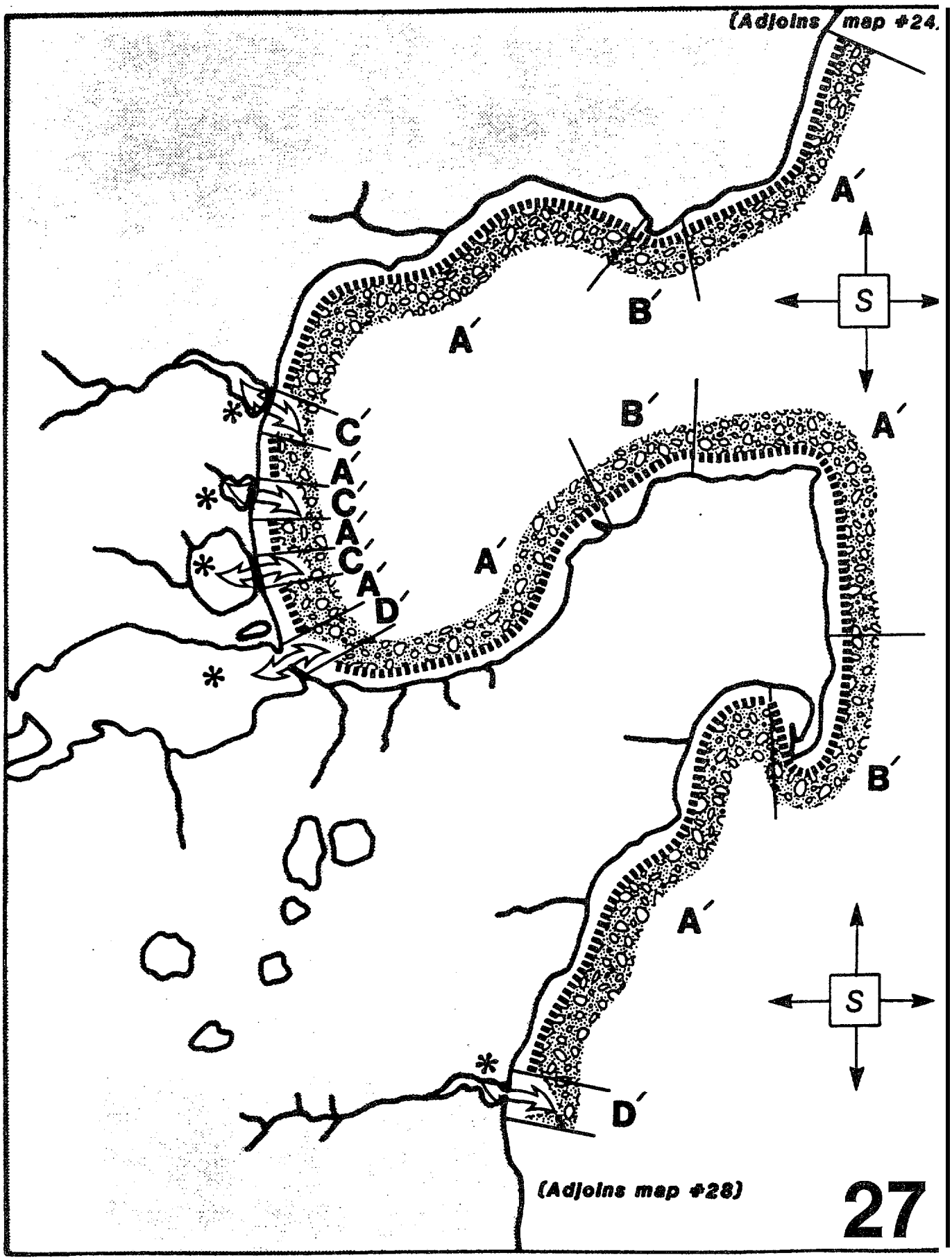
HUMAN USE INDEX



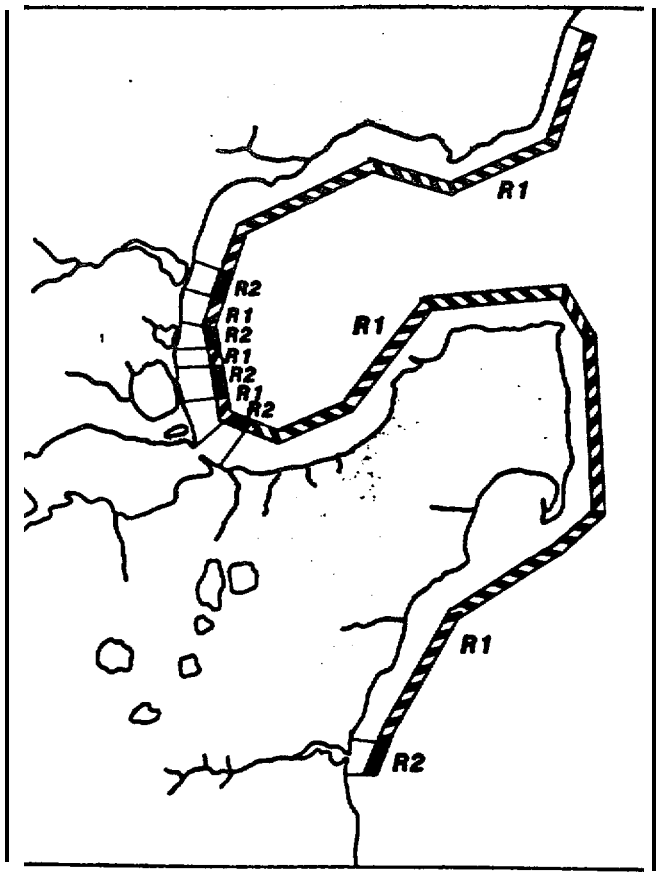
Seasonal Variability of Indices

Identifier	RESOURCE	Winter	Spring	SEASON -Up/Summer/Freeze-Up Jun	Jul	Aug	Sep	Oct
RI	Ephemeral inlet; Lagoon							
R2	Protected tundra cliff							
R3	Low energy beach							
H1	Fishing							

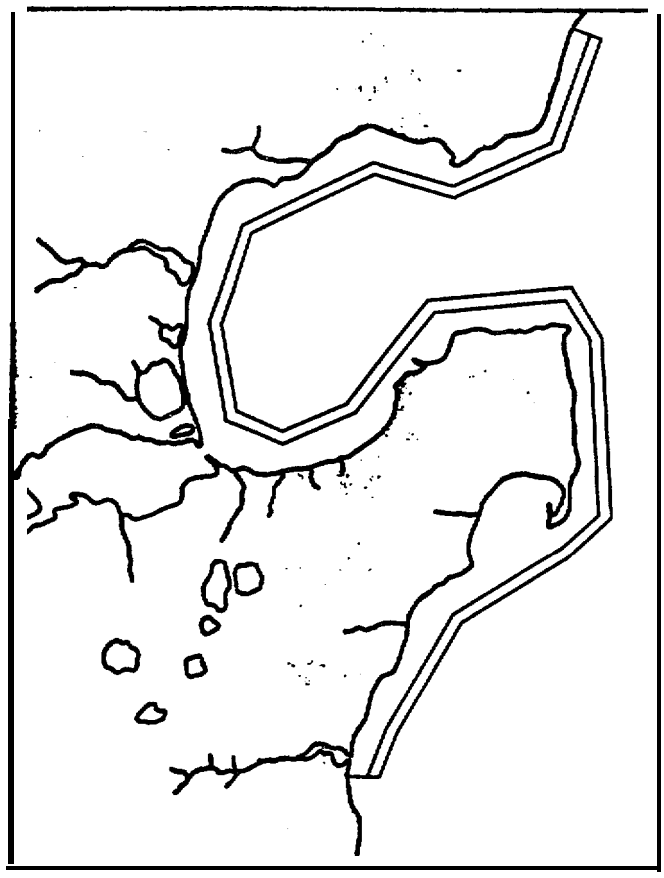
26


(Adjoins map #24
A´
B´
A´
S
B´
A´
C´
A´
C´
A´
C´
A´
D´
A´
B´
A´
S
D´
(Adjoins map #28)
27

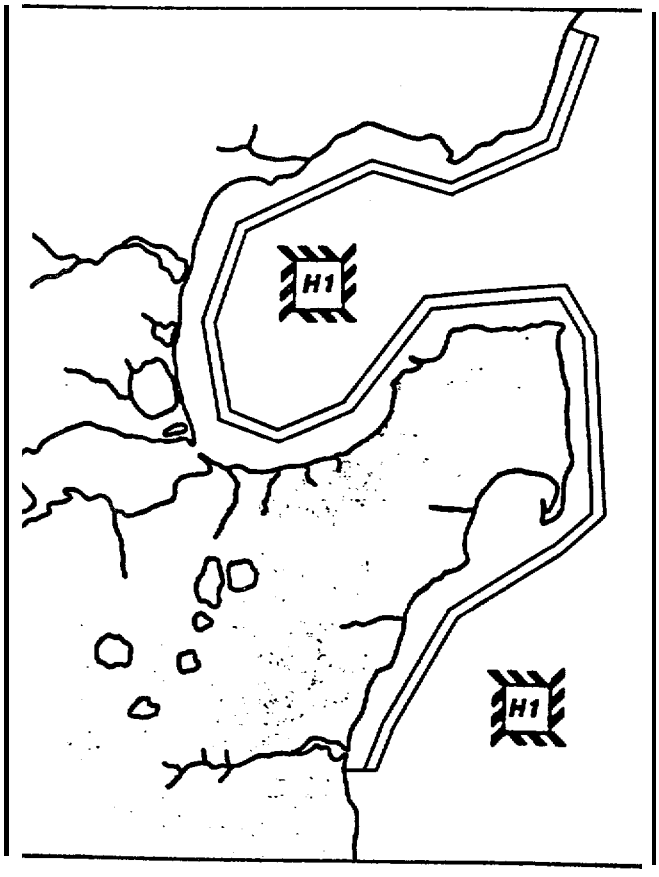
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



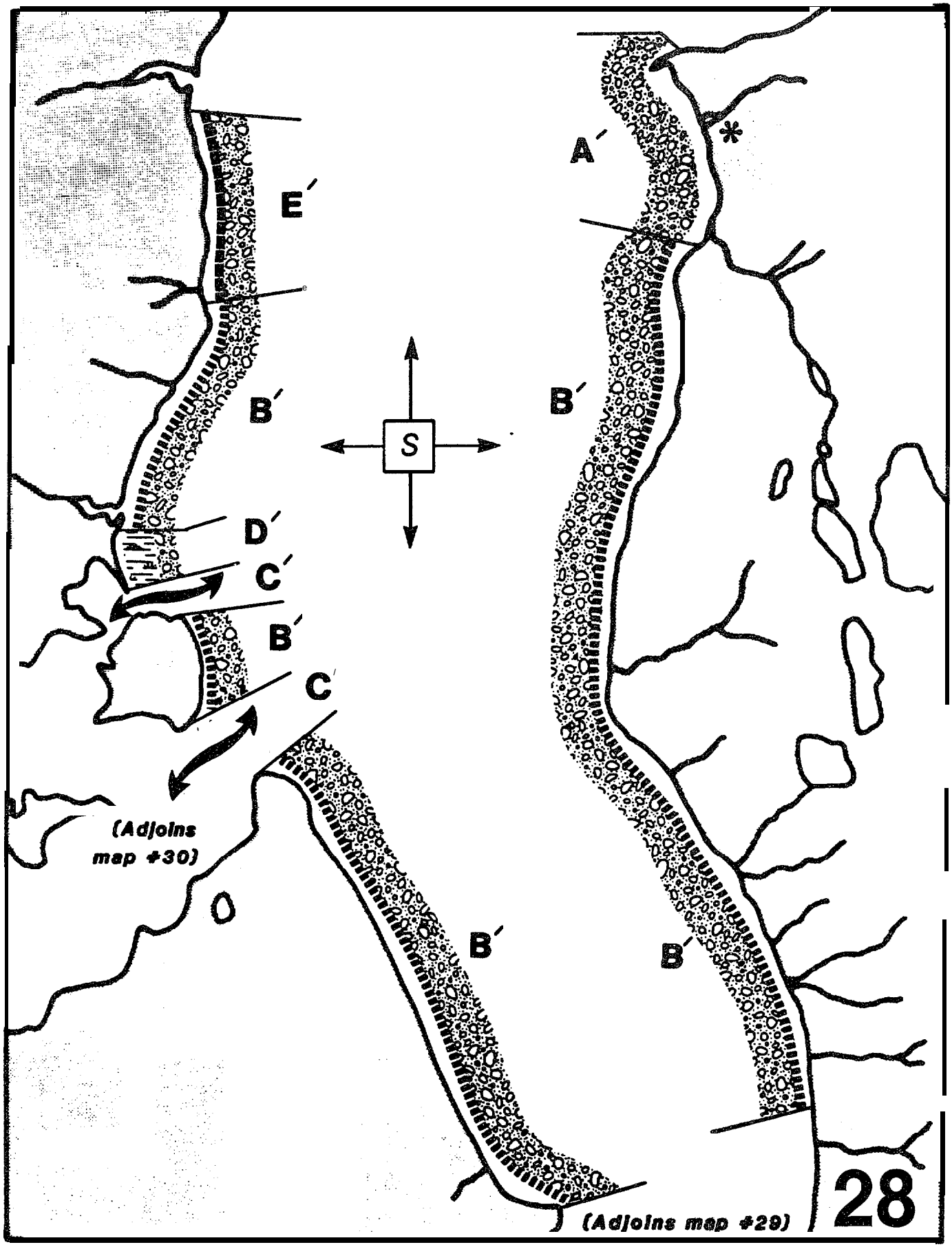
HUMAN USE INDEX



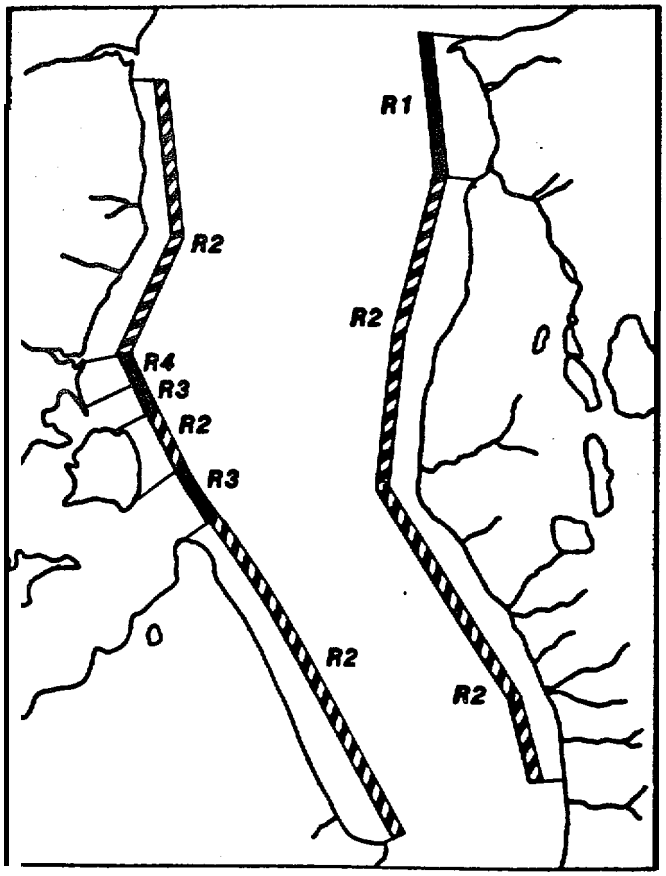
Seasonal Variability of Indices

Identifier	RESOURCE	Winter	Break-Up/Summer/Freeze-Up					Winter
			Jun	Jul	Aug	Sep	Oct	
R1	Protected tundra cliff							
R2	Ephemeral inlet; Lagoon							
H1	Fishing							

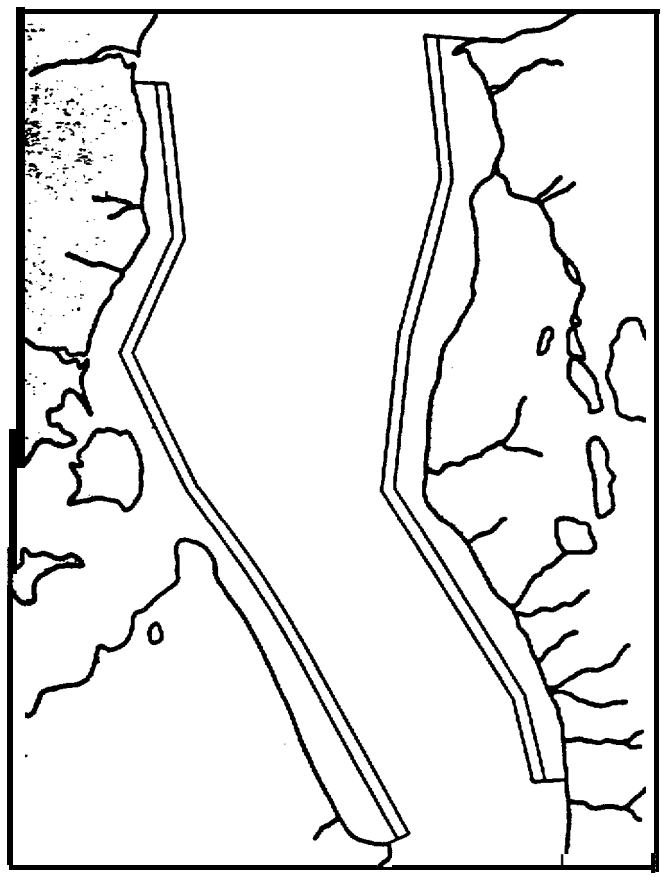
27


A´
E´
B´
B´
D´
C´
B´
C´
S
*
(Adjoins map #30)
B´
B´
(Adjoins map #29)
28

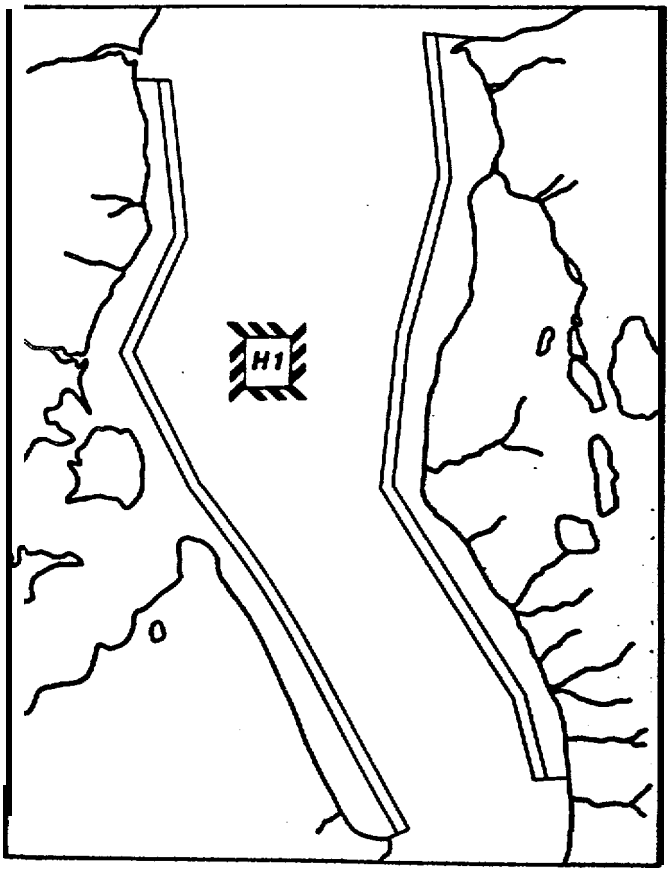
***OIL** RESIDENCE INDEX*



BIOLOGICAL SENSITIVITY INDEX

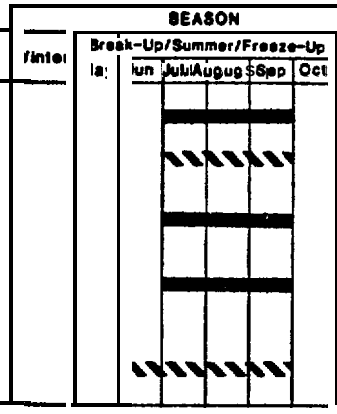


HUMAN** USE **INDEX

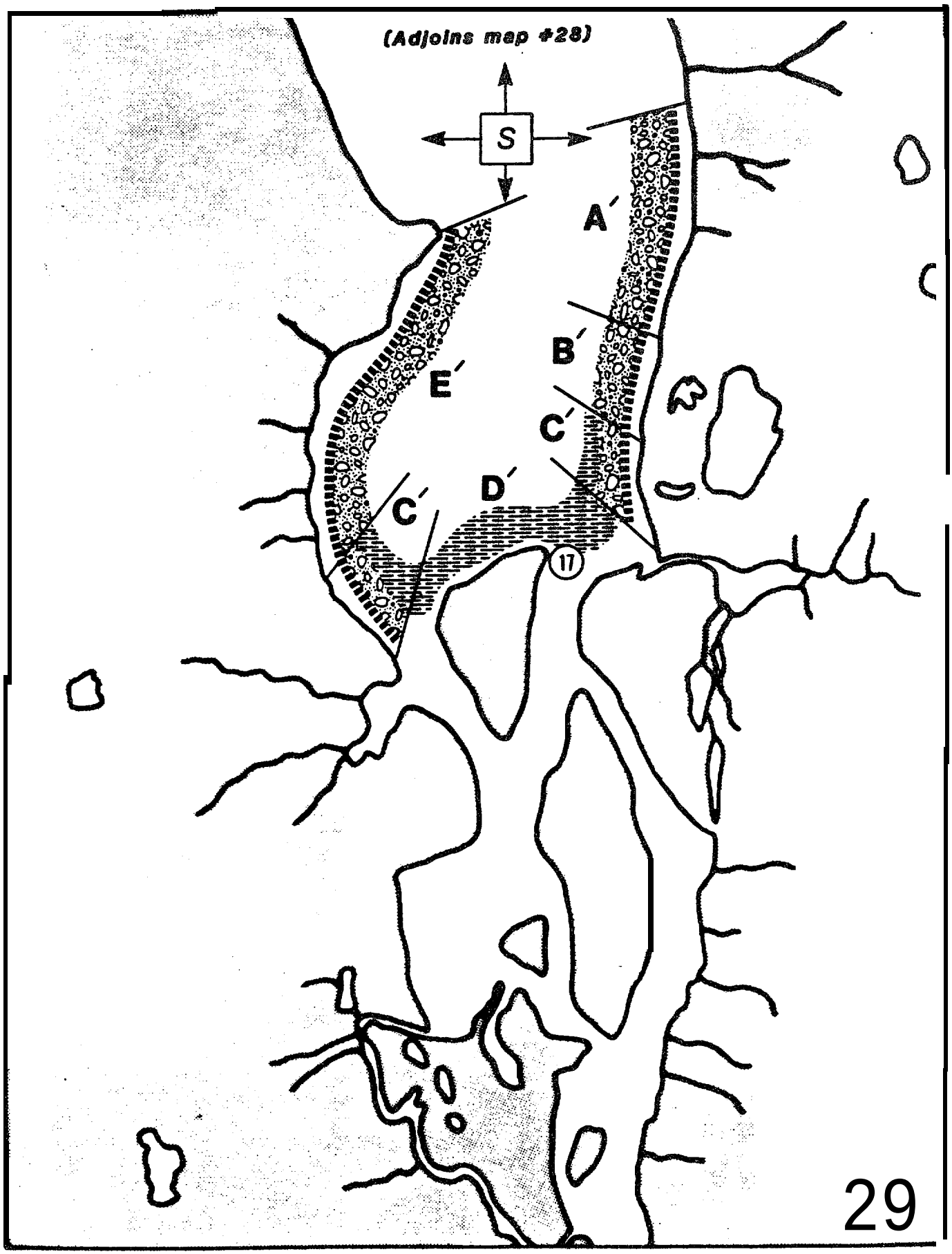


***Seasonal Variability** of Indices*

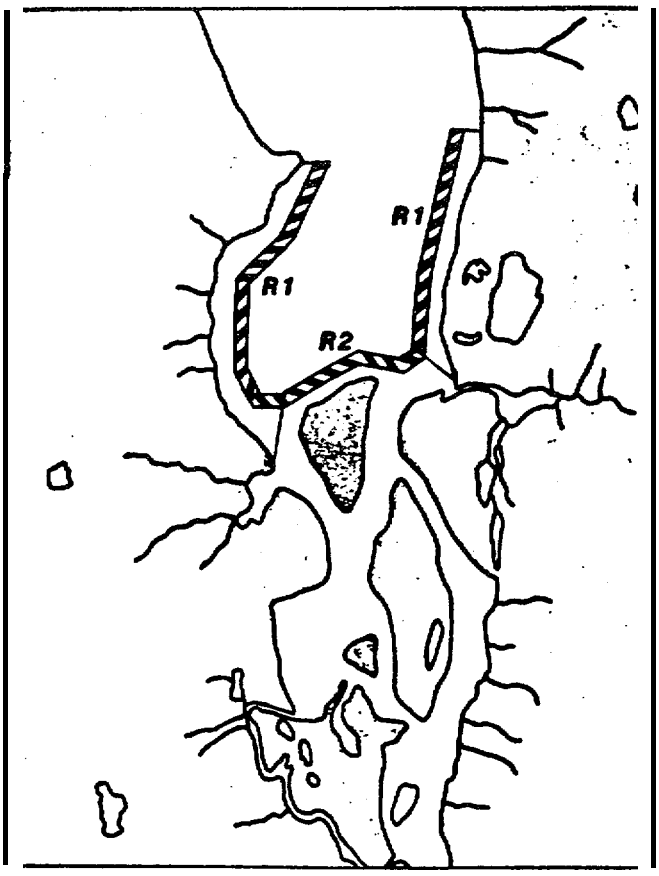
Identifier	RESOURCE
R1	Low energy beach
R2	Protected tundra cliff
R3	Permanent Inlet; Lagoon
R4	Low energy beach; Wetland
H1	Fishing



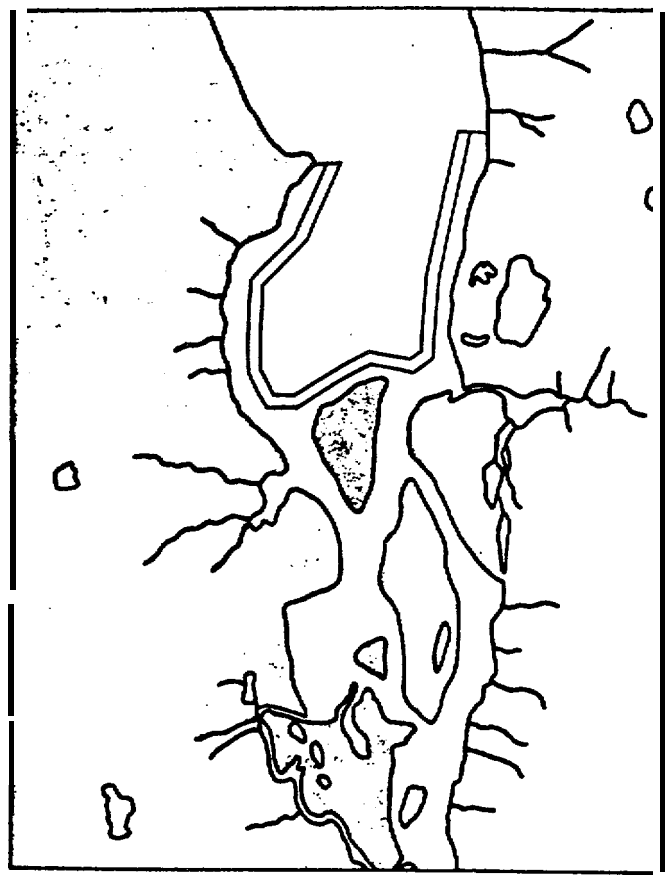
28


(Adjoins map #28)
S
A´
B´
C´
D´
E´
C´
17
29

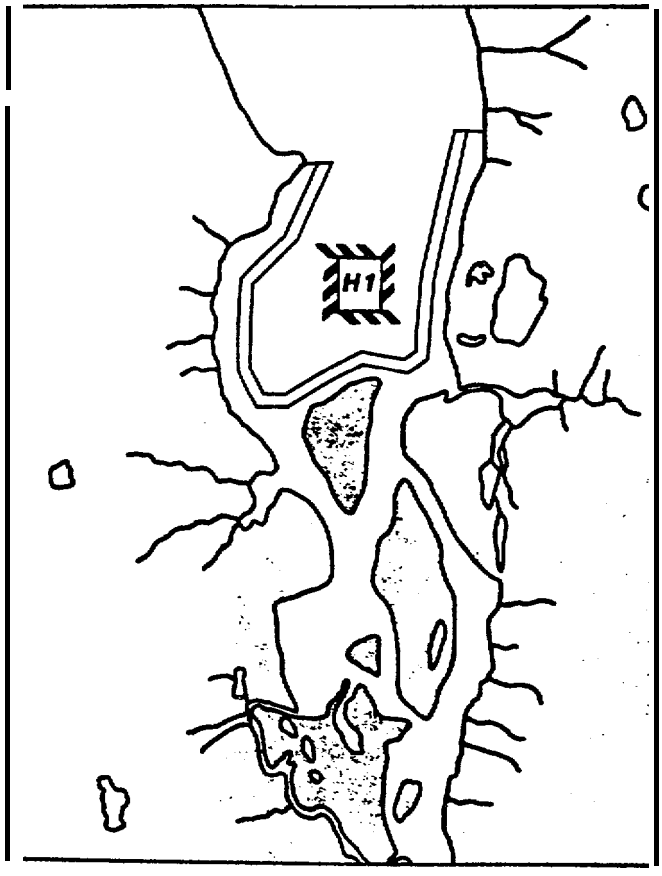
*OIL RESIDENCE **INDEX***



*BIOLOGICAL **SENSITIVITY** INDEX*



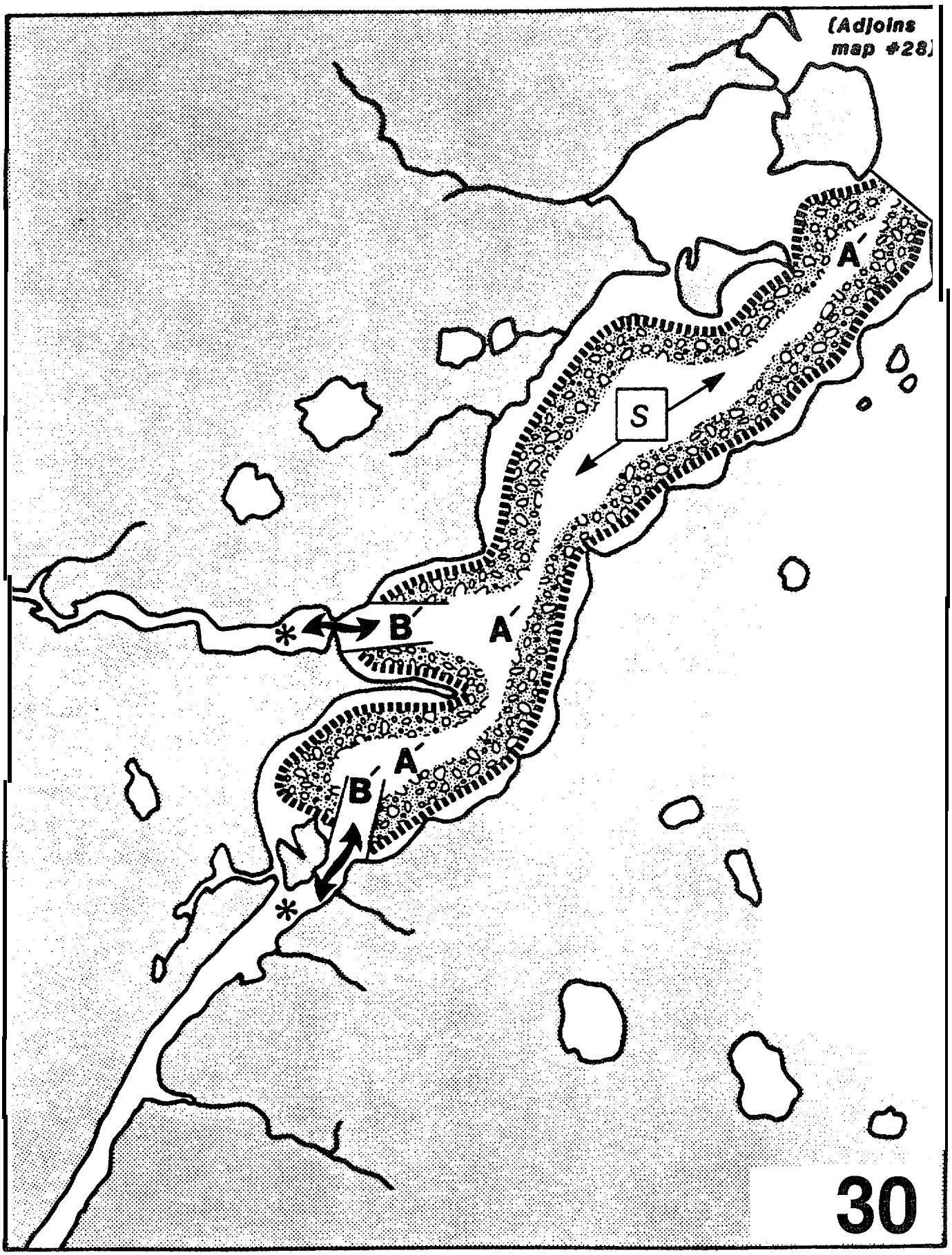
HUMAN USE INDEX



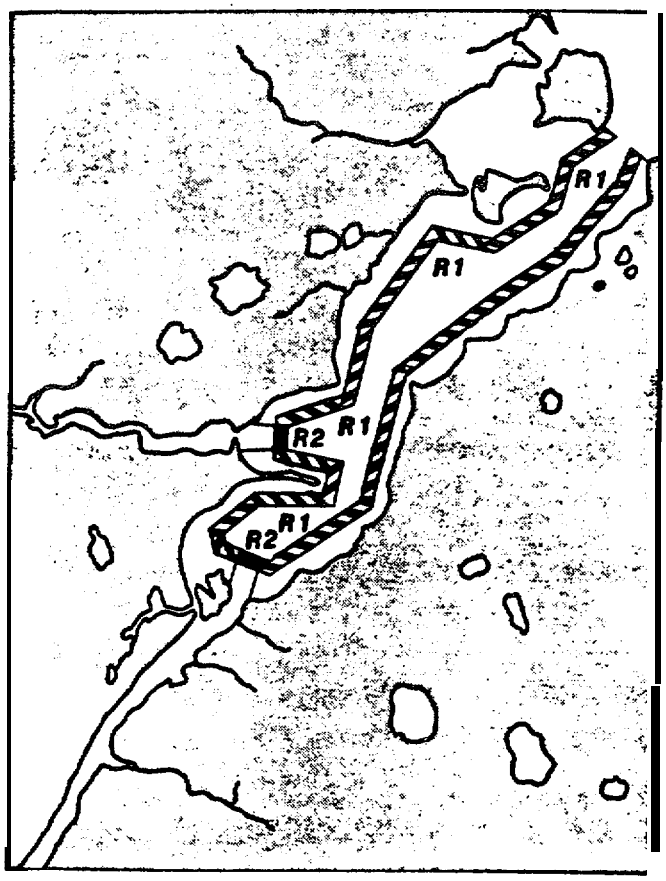
***Seasonal Variability** of* Indices

Identifier	RESOURCE	SEASON							
		Winter	Break-Up/Summer/Freeze-Up						Winter
			May	Jun	Jul	Aug	Sep	Ott	
R1	Protected tundra cliff								
R2	Delta flats								
H1	Fishing								

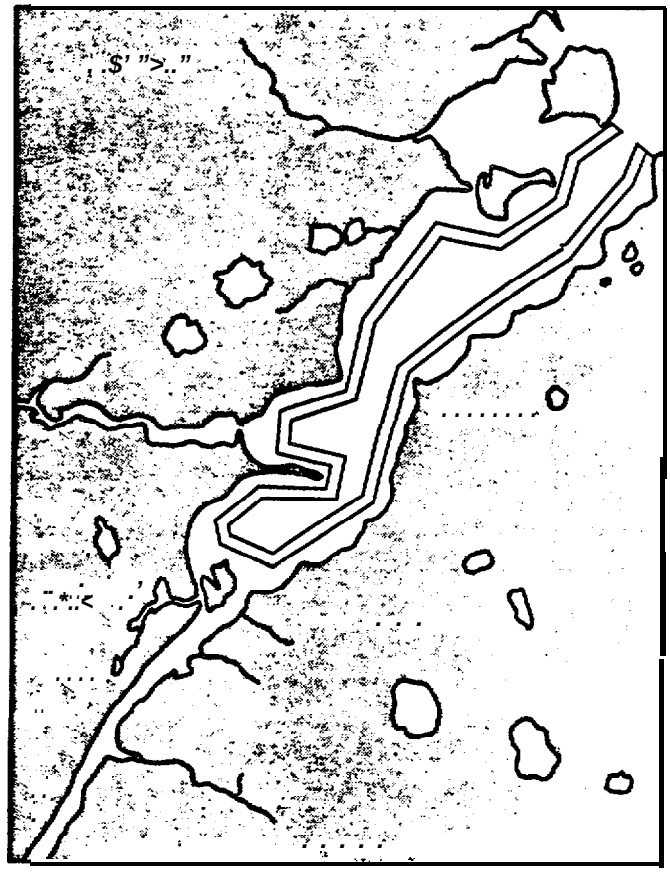
29


(Adjoins
map #28)
A´
S
B´
A´
B´
A´
30

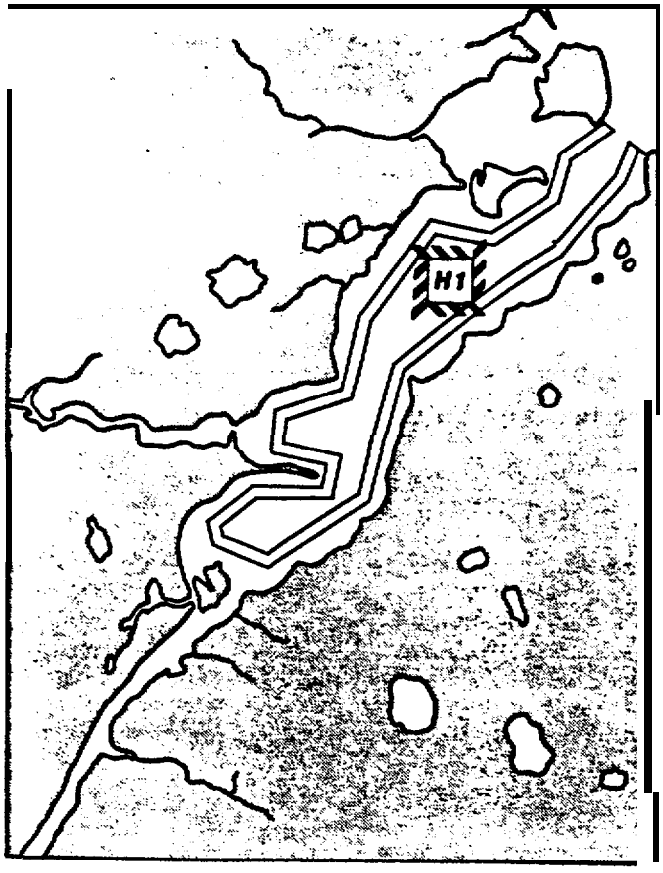
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



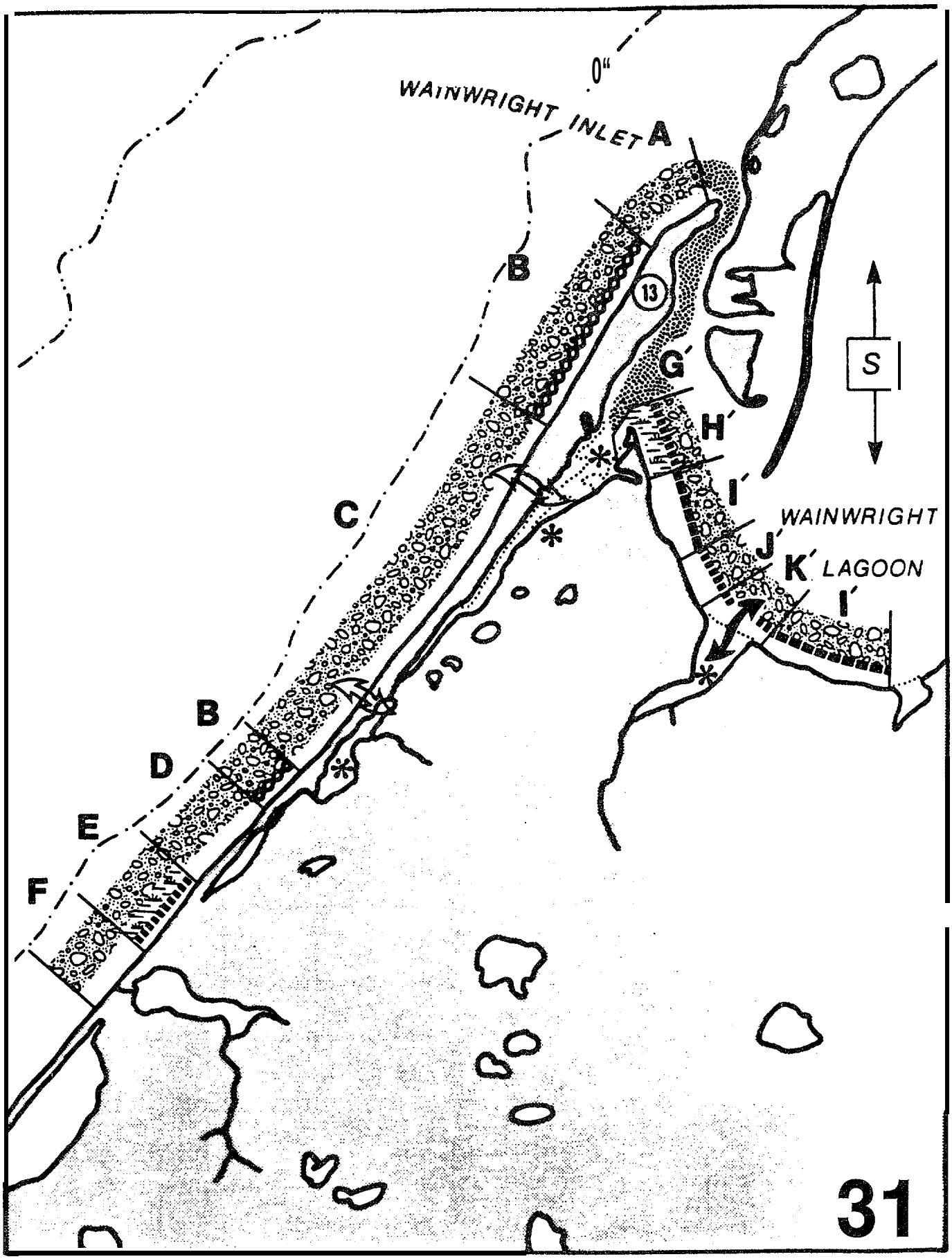
HUMAN USE INDEX



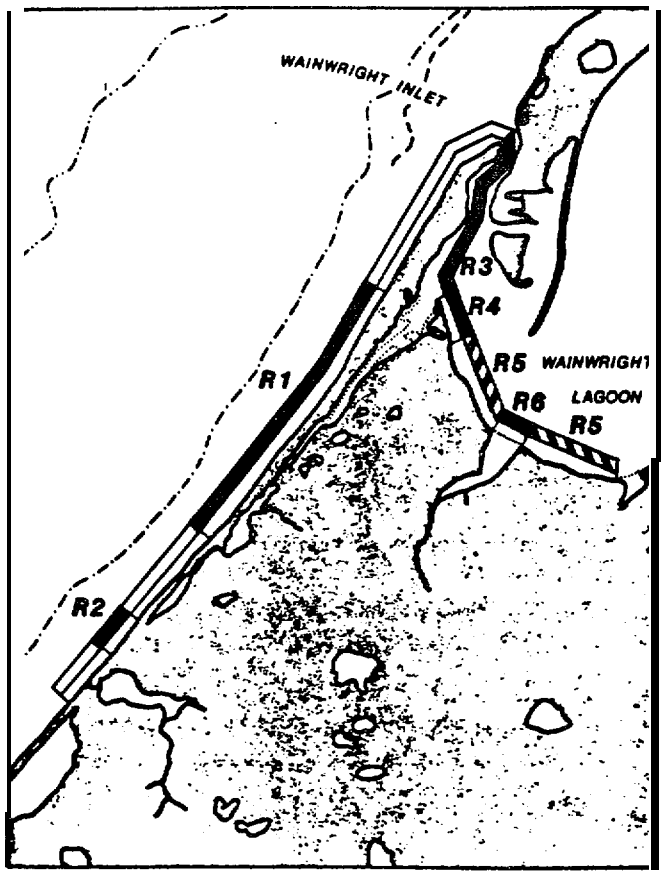
Seasonal Variability of Indices

Identifier	RESOURCE	SEASON						
		Winter	Break-Up/Summer/Freeze-Up					Winter
			May	Jun	Jul	Aug	Sep	Oct
R1	Protected tundra cliff				▨	▨	▨	
R2	Stable Inlet; Estuary				■	■	■	
H1	Fishing			▨	▨	▨	▨	

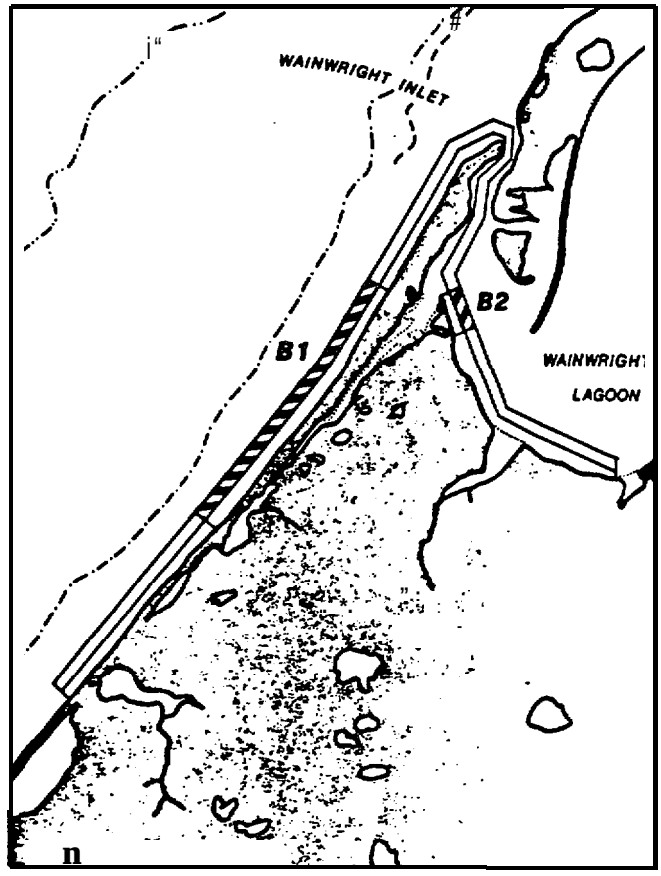
30


0"
WAINWRIGHT INLET
A
B
13
G'
H'
I'
WAINWRIGHT
J'
K'
LAGOON
I'
S
C
B
D
E
F
31

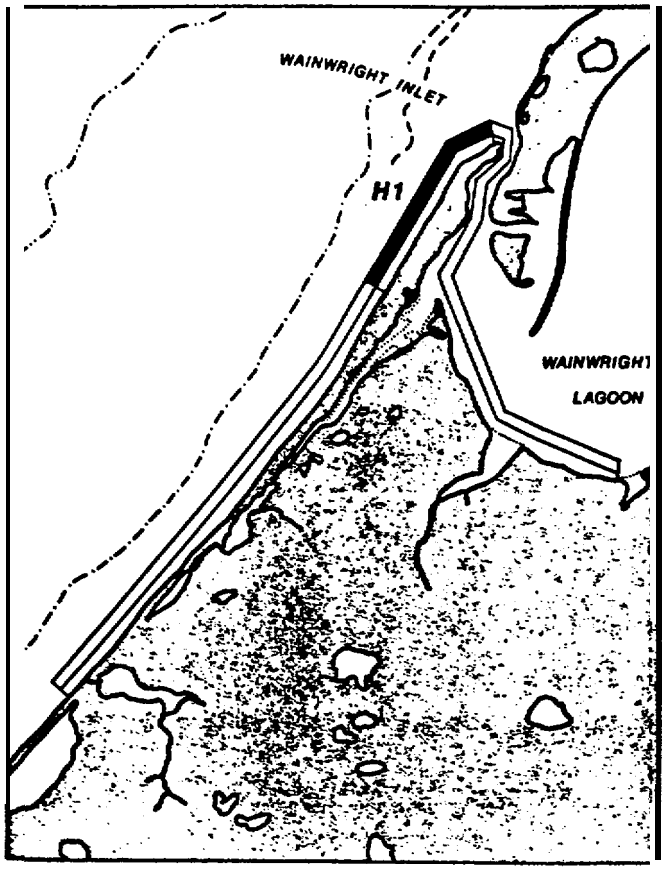
OIL RESIDENCE INDEX



B1OLOGICAL SENSITIVITY INDEX



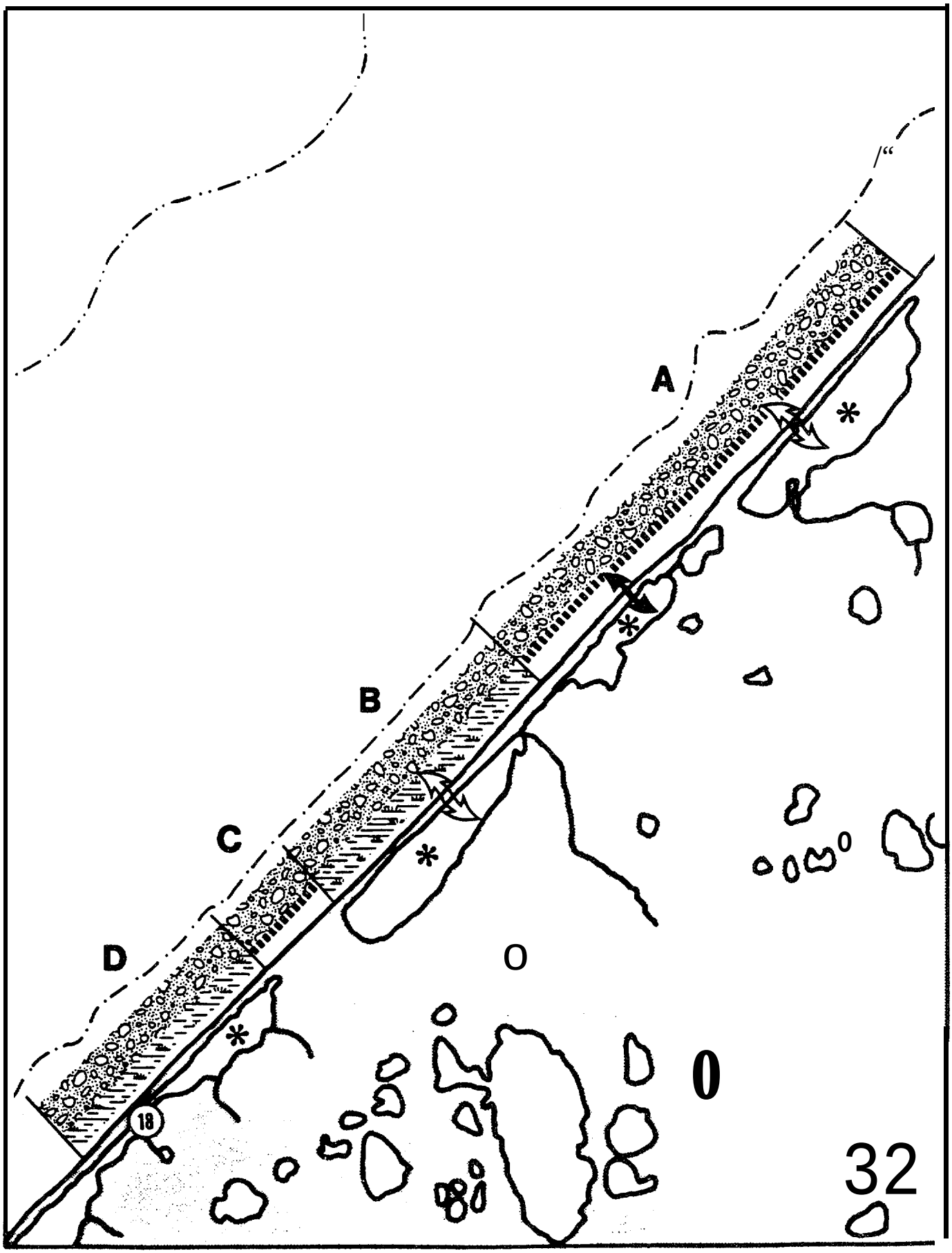
HUMAN USE INDEX



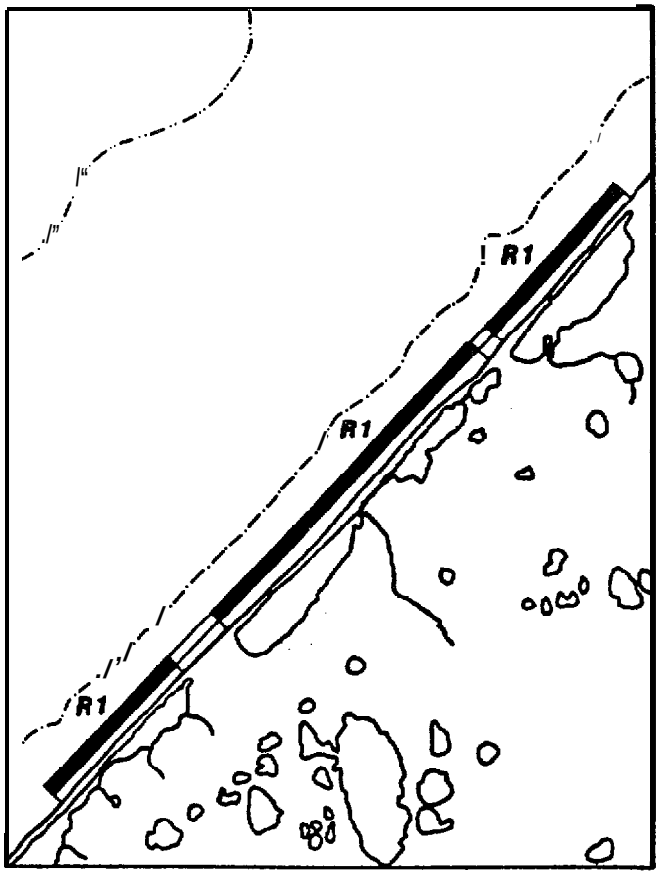
***Seasonal Variability** of Indices*

Identifier	RESOURCE	Winter	Spring	Summer	Fall	Winter
				Jun	Jul Aug Sep Oct	
RI	Washover channels; Lagoon				■ ■ ■ ■	
R2	Wetland				■ ■ ■ ■	
R3	Lou energy beach				■ ■ ■	
R4	Low energy beach; Wetland				■ ■ ■	
R5	Protected tundra cliff				▨ ▨ ▨ ▨	
R6	Stable inlet; Estuary				■ ■ ■	
B1	Wetland and lagoon			▨	▨ ▨ ▨ ▨ ▨	
B2	Wetland			▨	▨ ▨ ▨ ▨ ▨	
H1	Egg gathering Waterfowl hunting			■	■ ■	

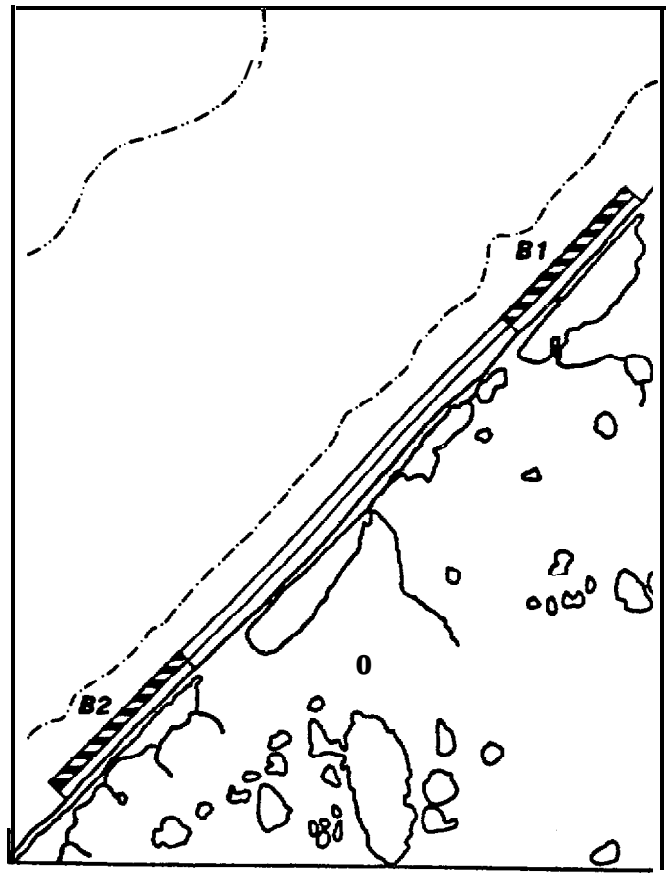
31


A
B
C
D
18
32

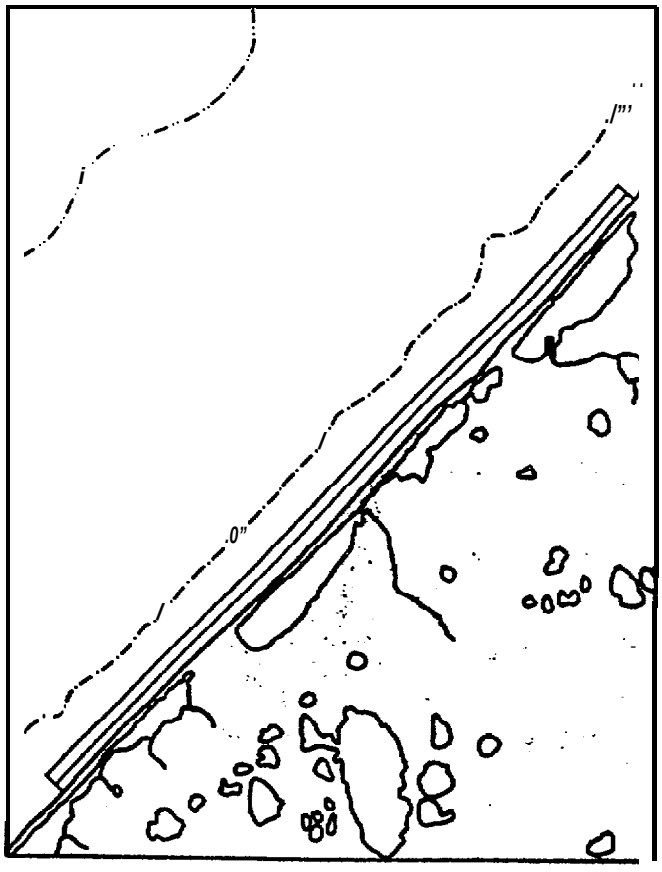
OIL RESIDENCE **INDEX**



BIOLOGICAL **SENSITIVITY** INDEX

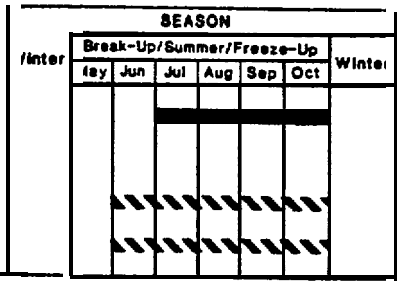


HUMAN USE INDEX

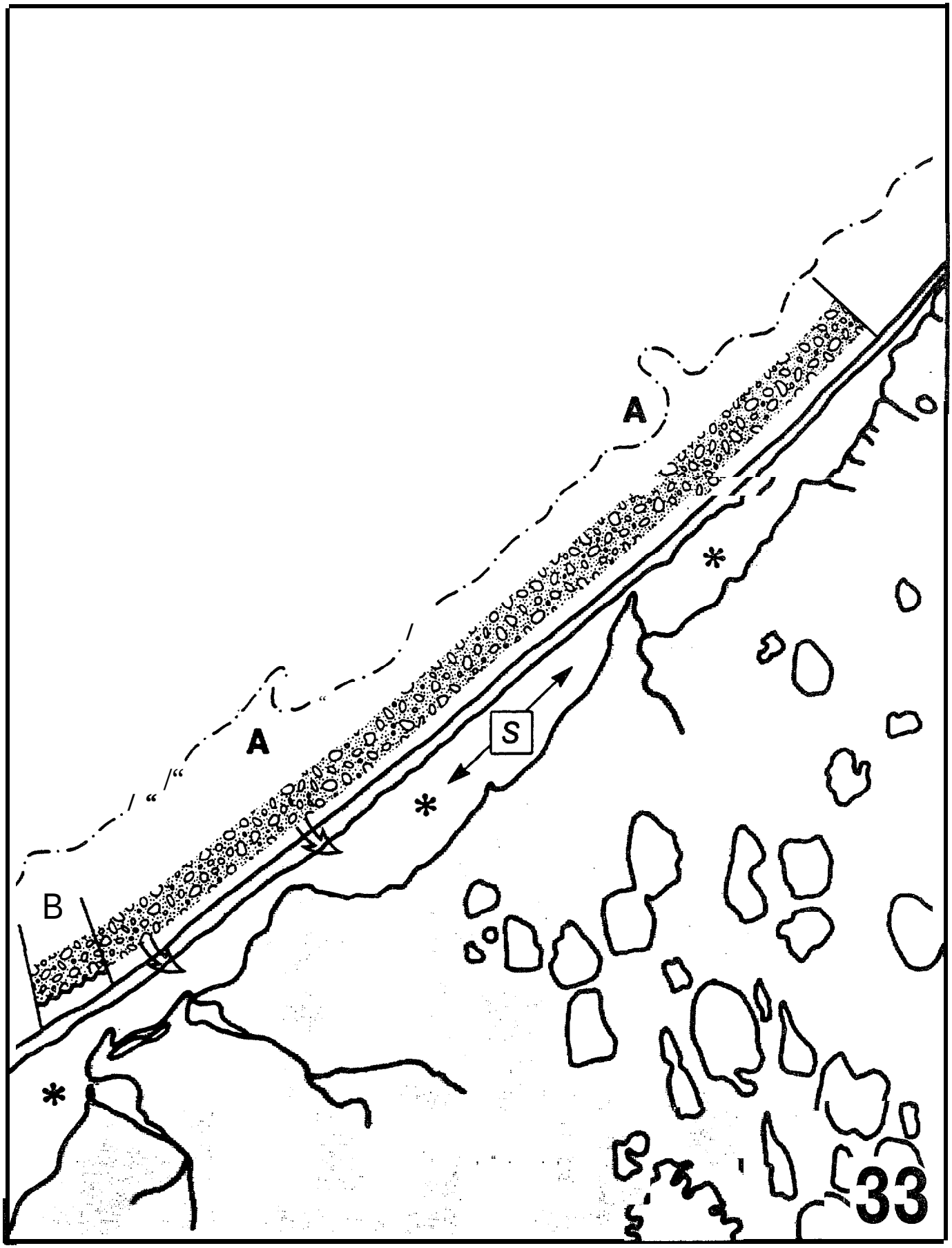


Seasonal **Variability** of Indices

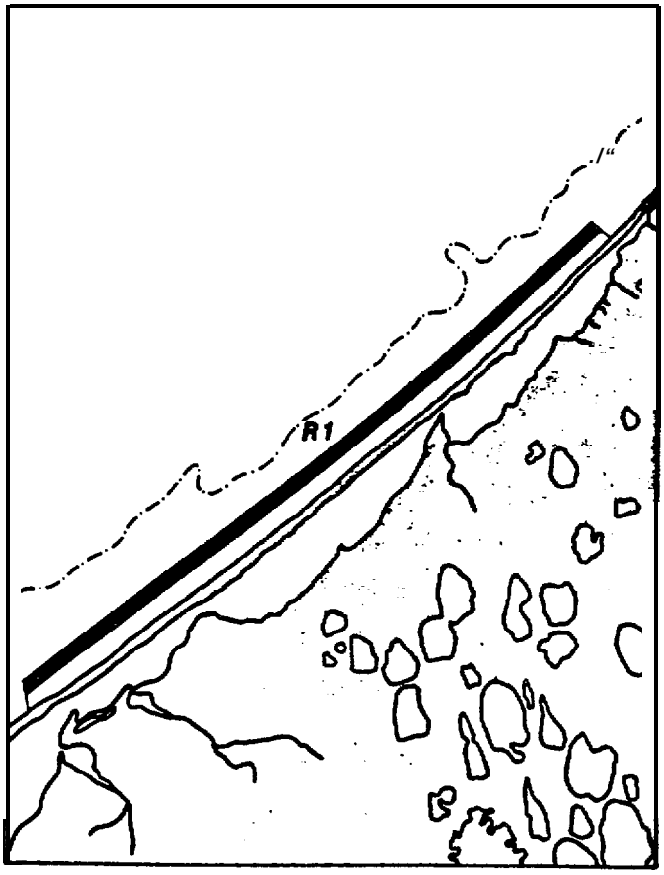
Identifier	RESOURCE
R1	Washover fan or inlet; estuary
B1	Lagoon and wetland
B2	Lagoon and wetland



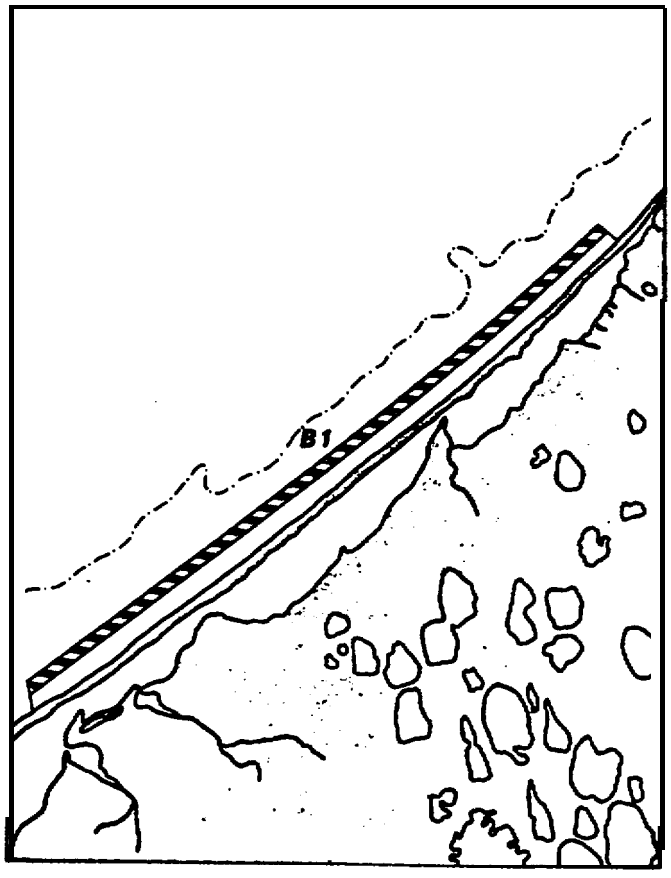
32


A
A
S
B
33

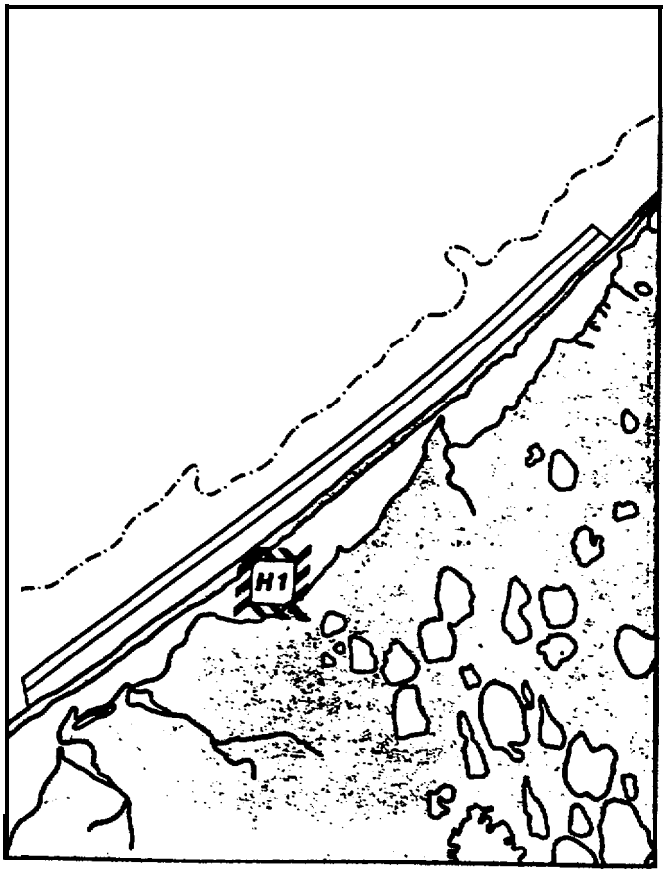
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



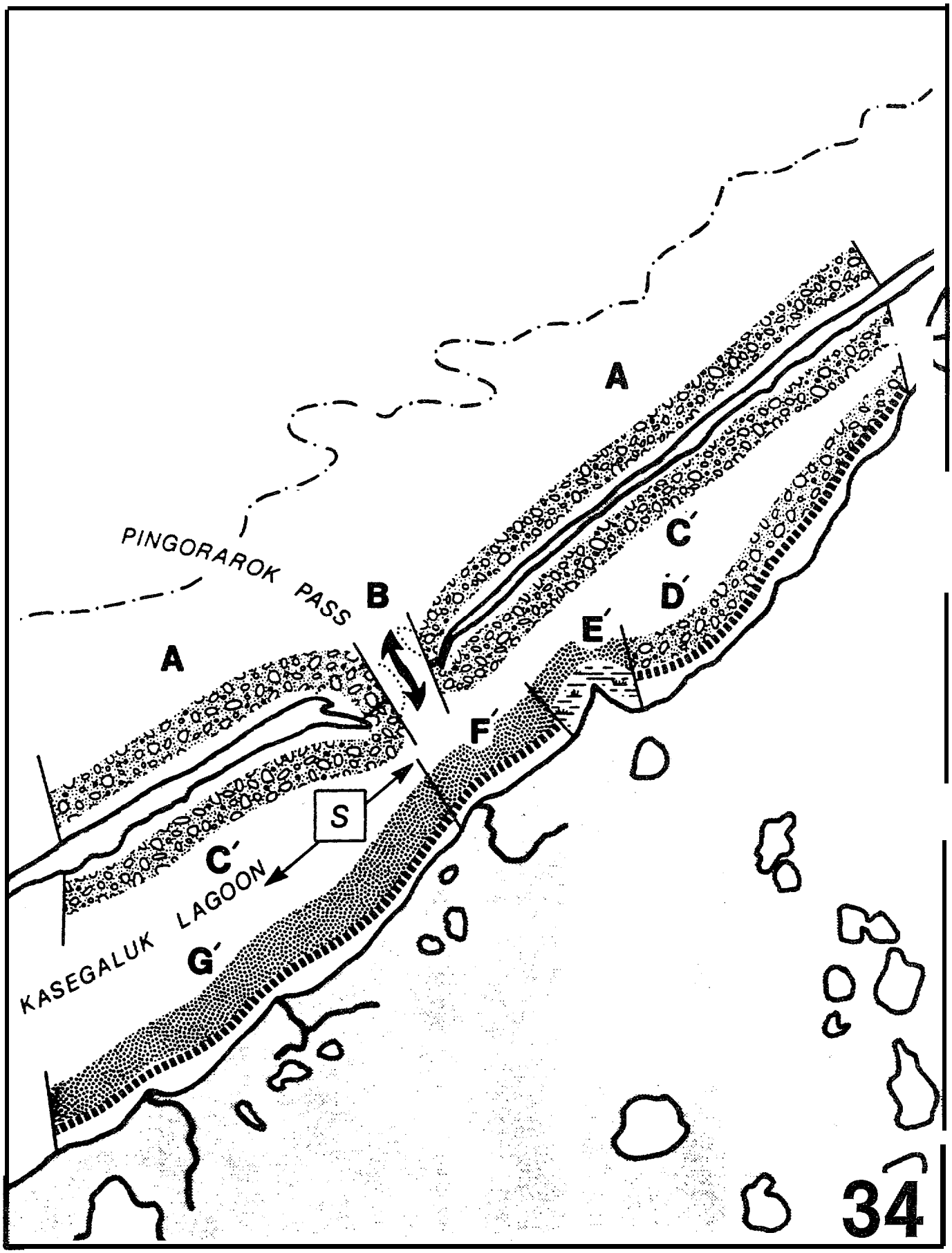
HUMAN USE INDEX



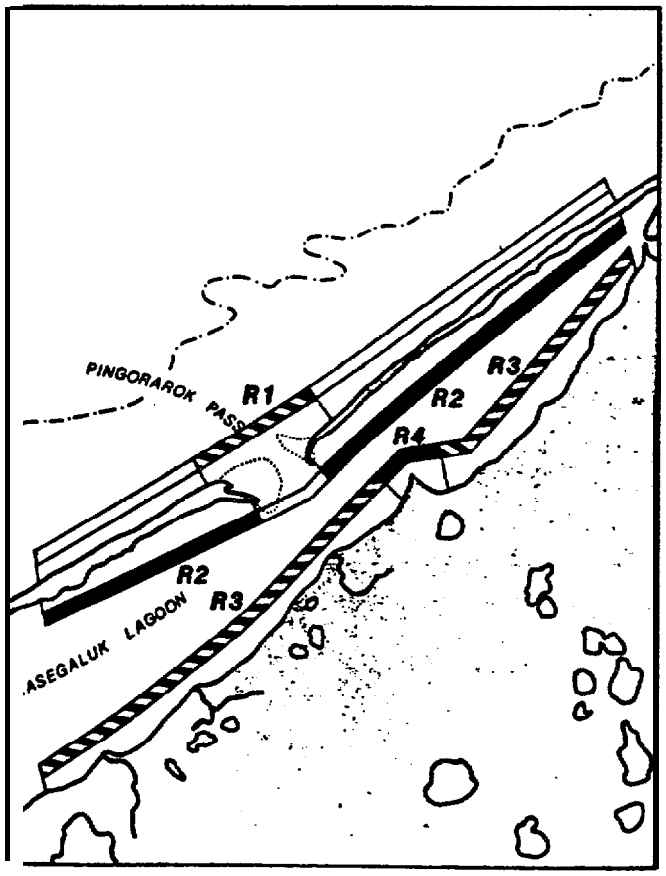
Seasonal ***Variability*** *of* ***Indices***

Identifier	RESOURCE	Winter	SEASON: Break-Up/Summer/Freeze-Up May	Jun	Jul	Aug	Sep	Oct	Winter
R1	Washover fan; lagoon				■	■	■	■	
B1	Lagoon and wetland			▨	▨	▨	▨	▨	
H1	Beluga whale hunting				▨	▨			
	Spotted seal hunting				▨	▨			

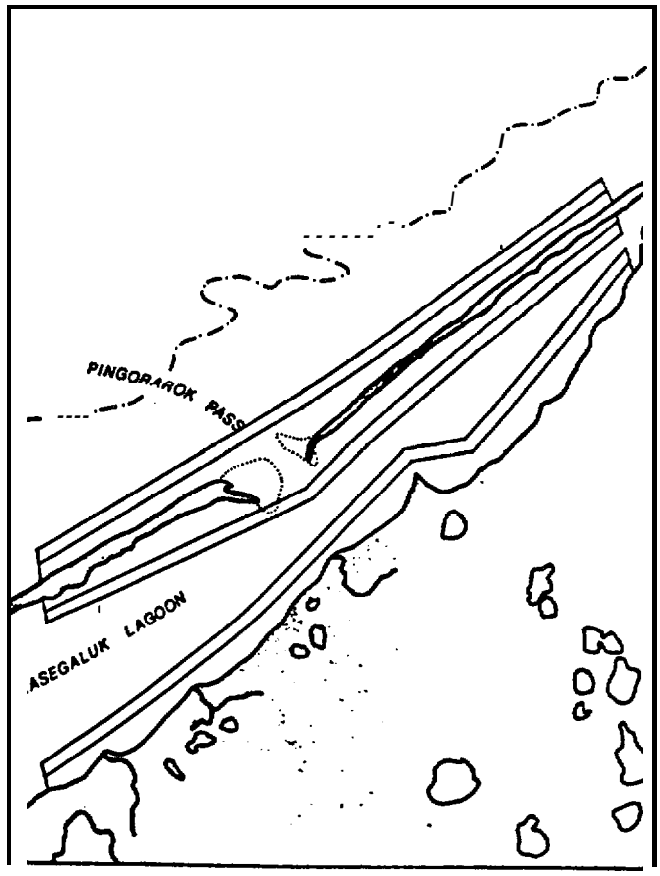
33


A
PINGORAROK PASS
B
A
C´
D´
E´
F´
S
C´
KASEGALUK LAGOON
G´
34

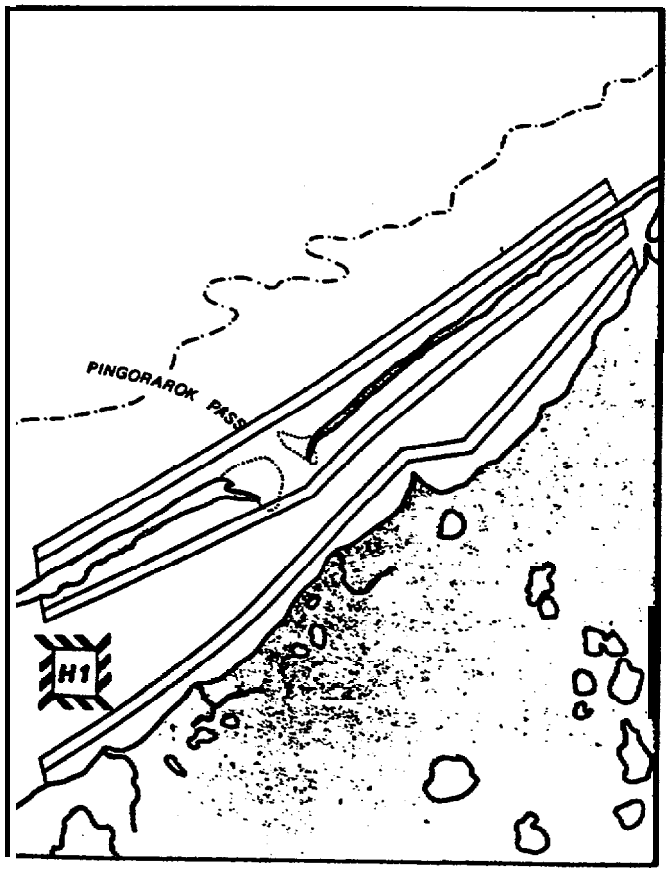
OIL RESIDENCE *INDEX*



BIOLOGICAL SENSITIVITY *INDEX*



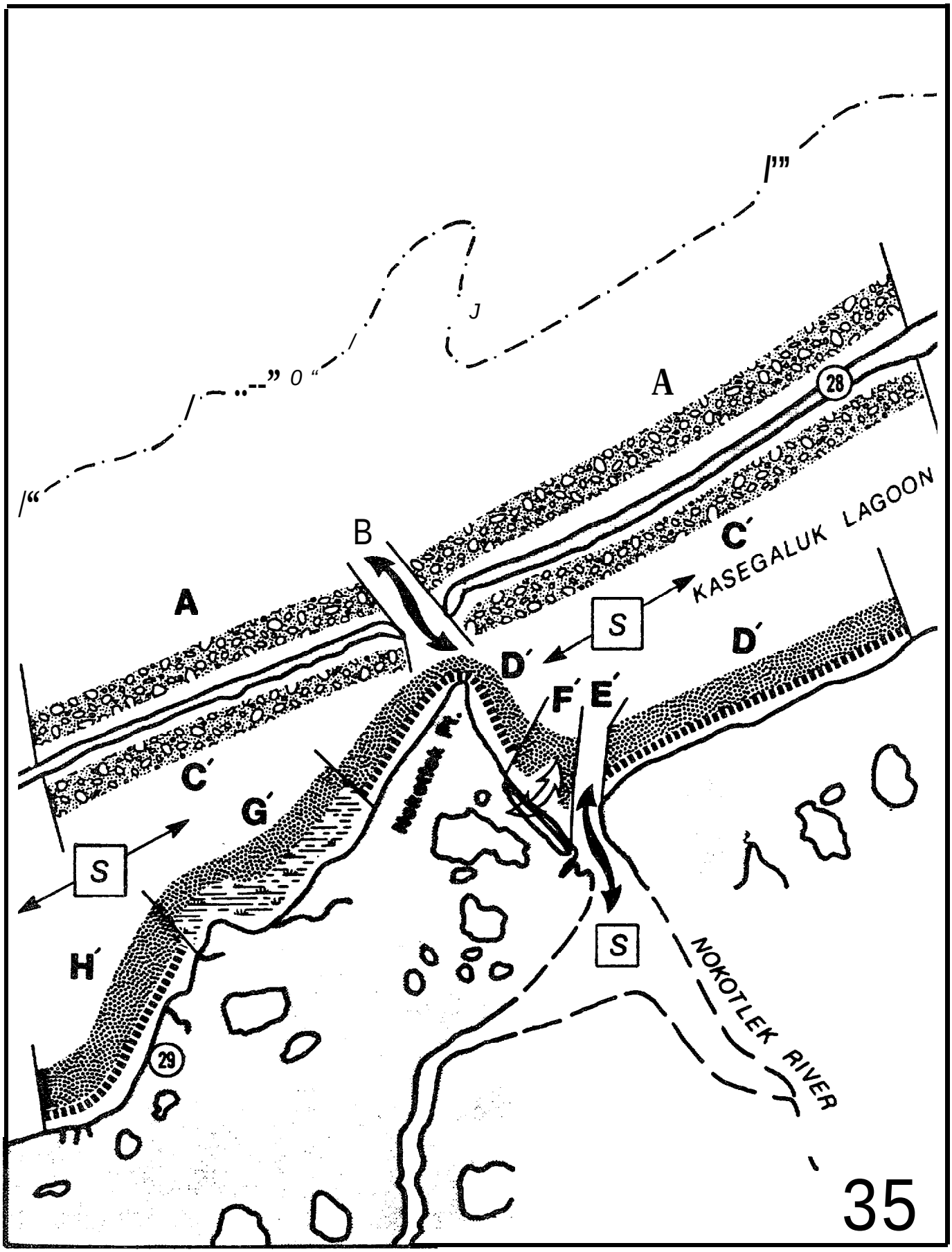
HUMAN USE INDEX



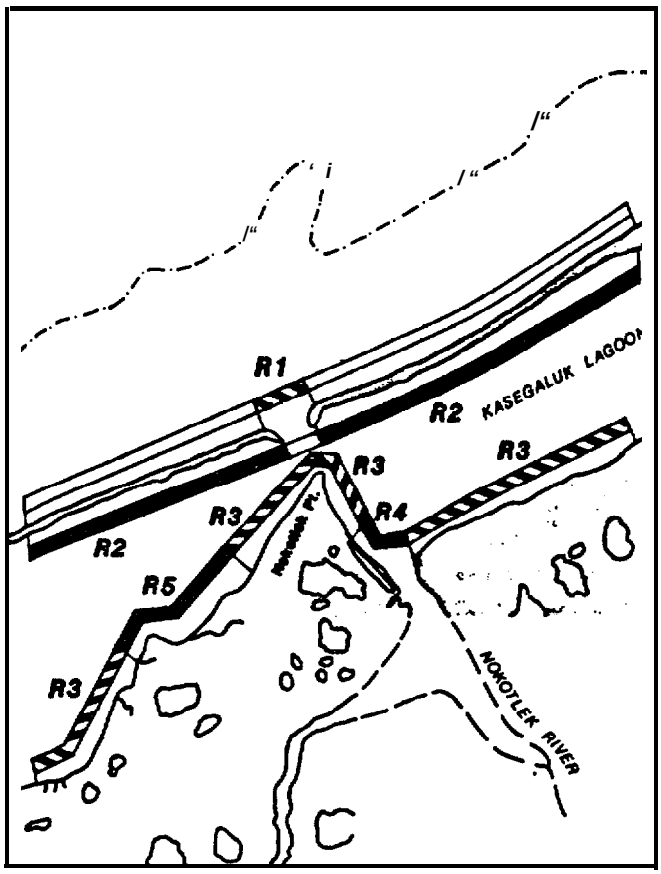
Seasonal ***Variability*** *of Indices*

Identifier	RESOURCE	SEASON							
		Winter	Break-Up/Summer/Freeze-Up						Winter
			May	Jun	Jul	Aug	Sep	Oct	
R1	Stable inlet; Recurve spits								
R2	Low energy beach								
R3	Protected tundra cliff								
R4	Low energy beach; Wetland								
H1	Beluga whale hunting								
	Spotted seal hunting								

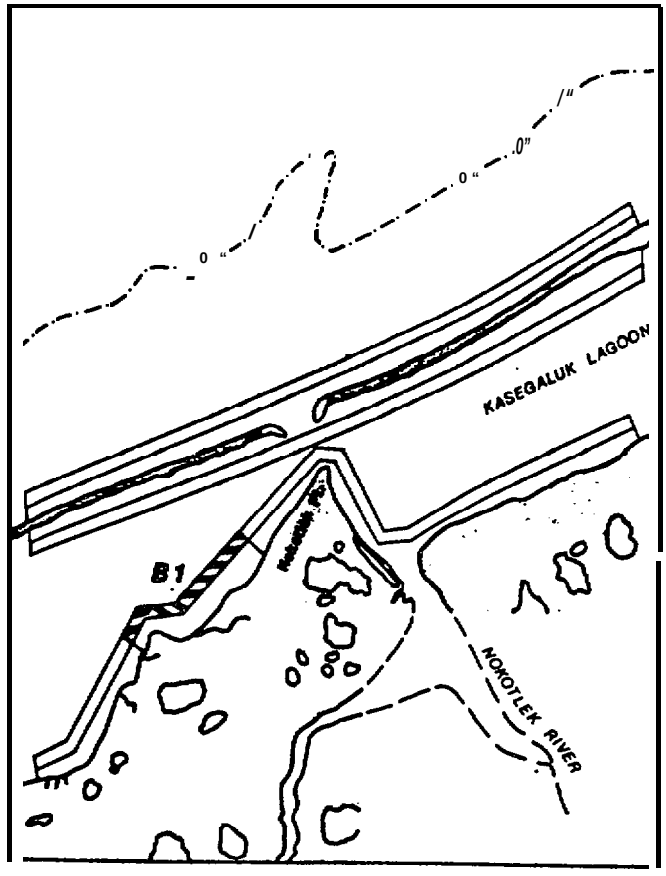
34


A
B
C
D
E
F
G
H
S
28
29
KASEGALUK LAGOON
NOKOTLEK RIVER
35

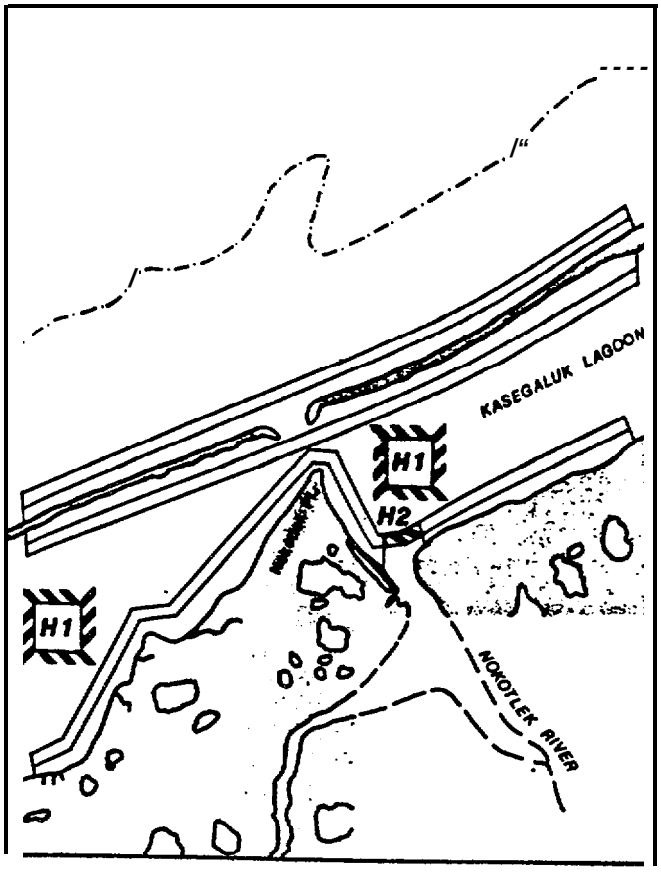
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



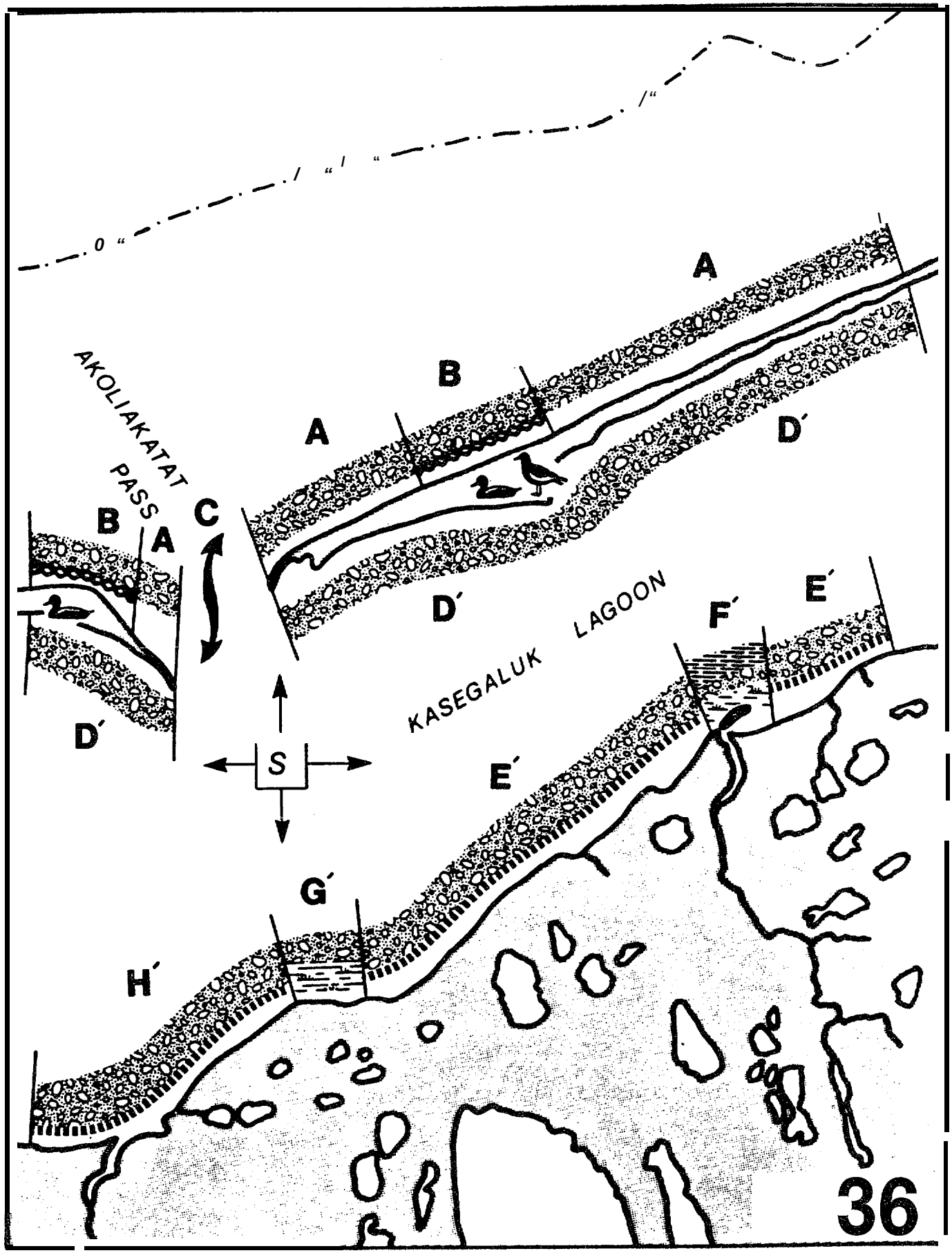
HUMAN USE INDEX



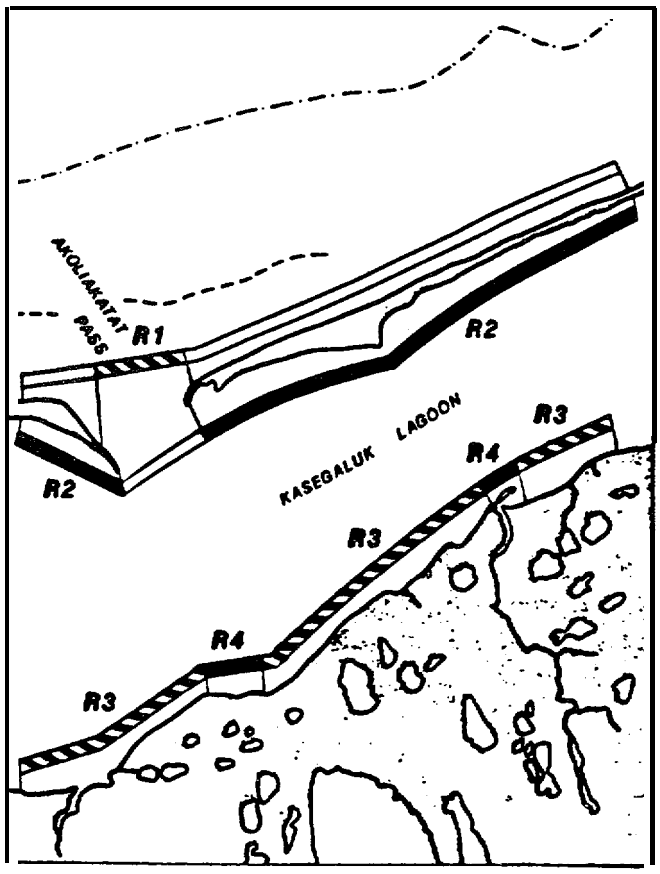
Seasonal Variability of Indices

Identifier	RESOURCE	SEASON: Winter	Break-Up/Summer/Freeze-Up: May	Jun	Jul	Aug	Sep	Oct	Winter
R1	Stable inlet; Recurve spits								
R2	Low energy beach								
R3	Protected tundra cliff								
R4	Inlets; lagoon/ river								
R5	Low energy beach; Wetland								
B1	Wetland								
H1	Beluga whale hunting								
	Spotted seal hunting								
H2	Fishing								

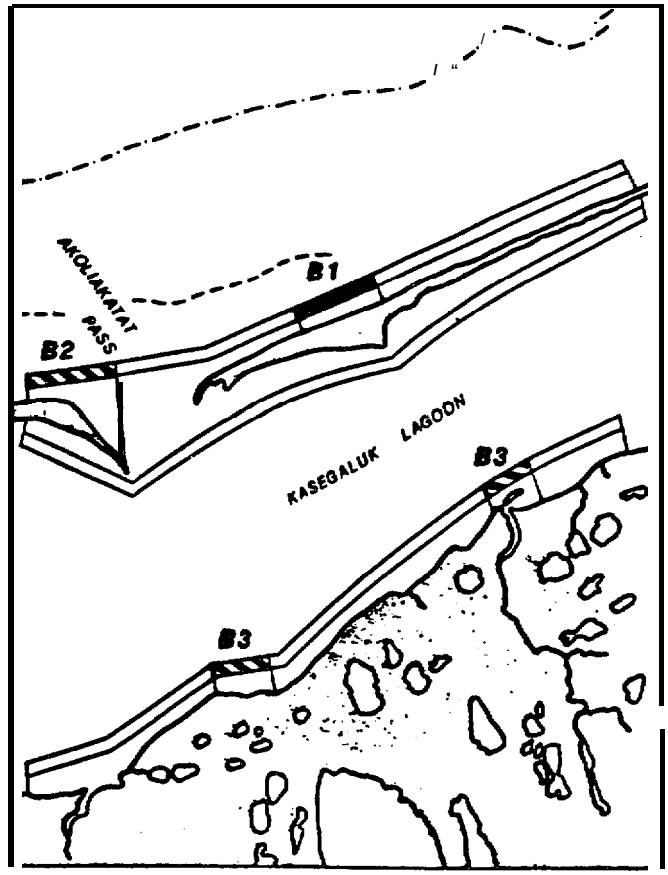
35


AKOLIAKATAT PASS
KASEGALUK LAGOON
A
B
C
D´
E´
F´
G´
H´
S
36

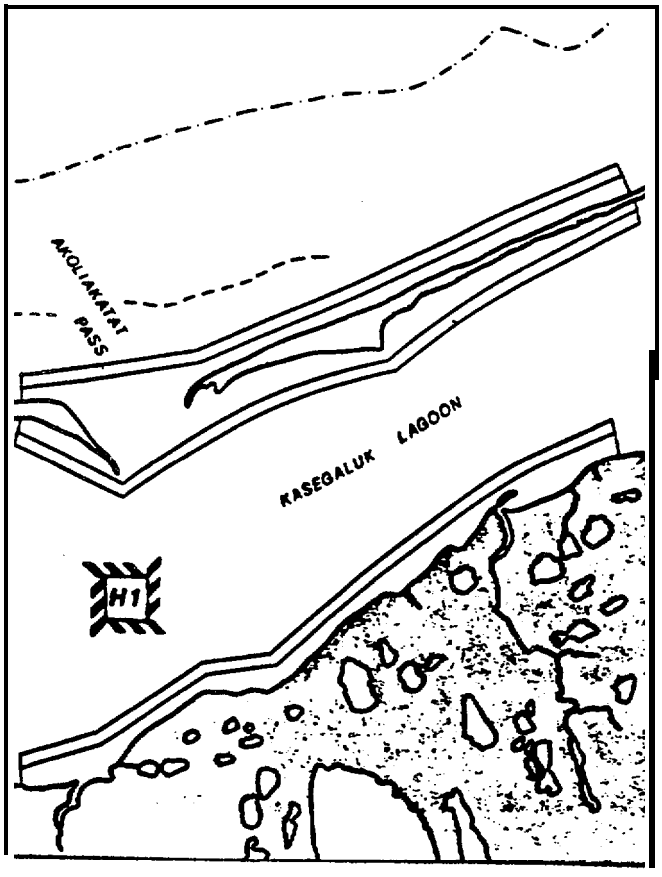
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



HUMAN USE INDEX



Seasonal Variability of Indices

Identifier	RESOURCE	SEASON: Winter	Break-Up/Summer/Freeze-Up: May	Jun	Jul	Aug	Sep	Oct	Winter
R1	Stable inlet; Recurve spits				▨	▨	▨	▨	
R2	Low ● nergy beach				■	■	■		
R3	Protected tundra cliff				▨	▨	▨		
R4	Inlets; lagoon/ river				■	■	■		
B1	Eider (450 pr), gull (10 pr) and arctic tern (42 pr) nesting			■	■				
B2	Eider nesting			▨	▨				
B3	Wetland			▨	▨	▨	▨	▨	
H1	Beluga whale hunting				▨				
	Spotted seal hunting				▨	▨	▨		
	Fishing			▨	▨	▨	▨	▨	

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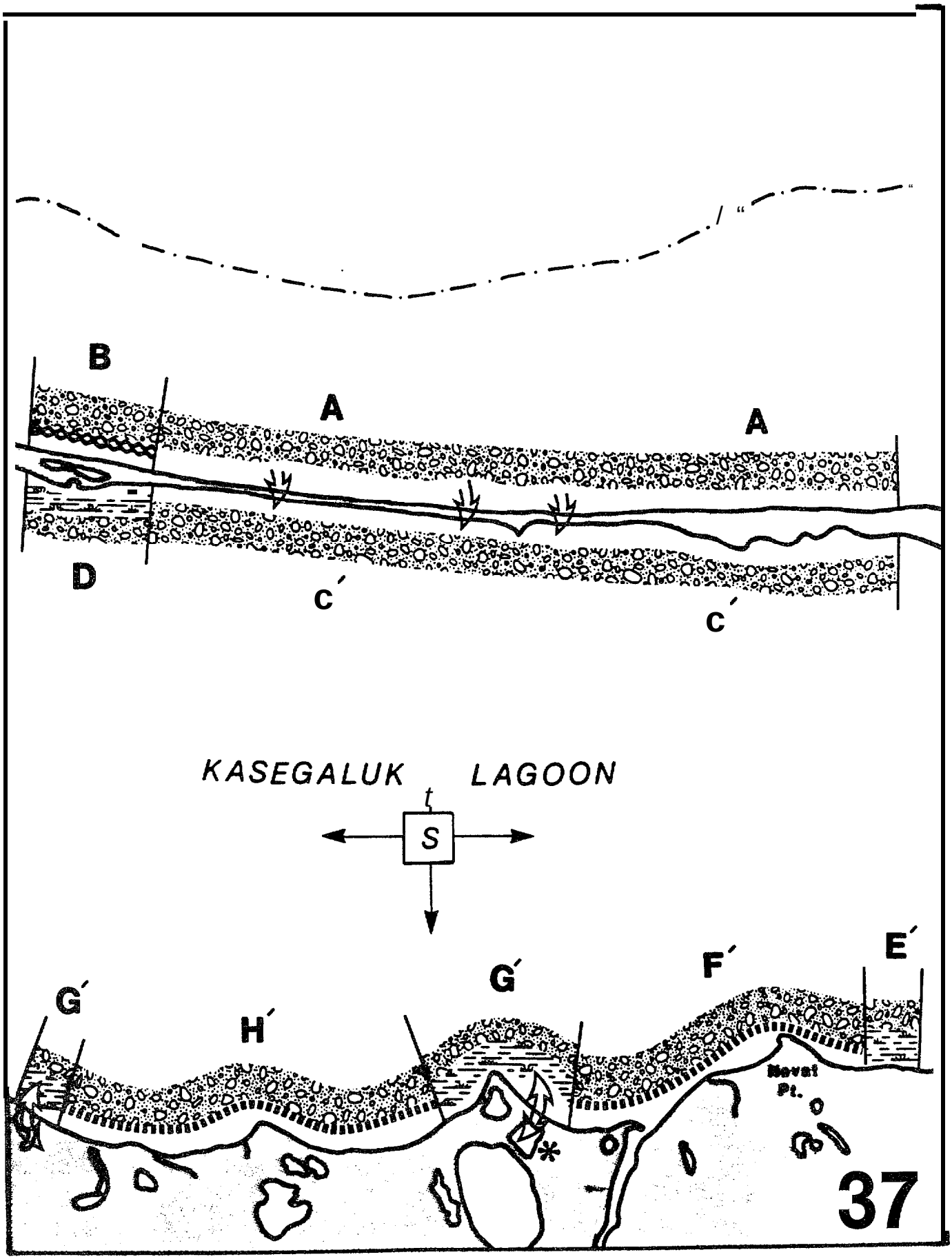
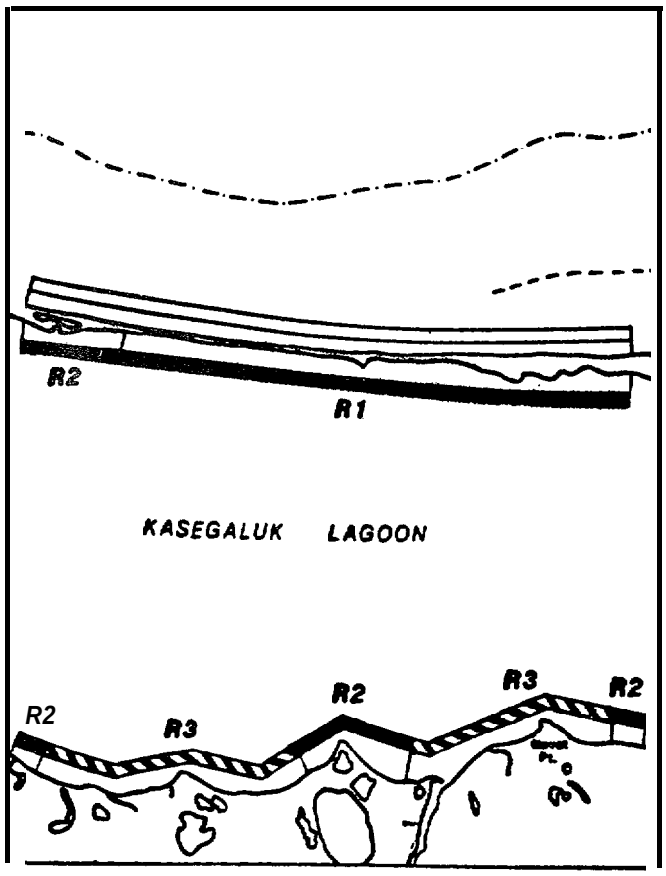
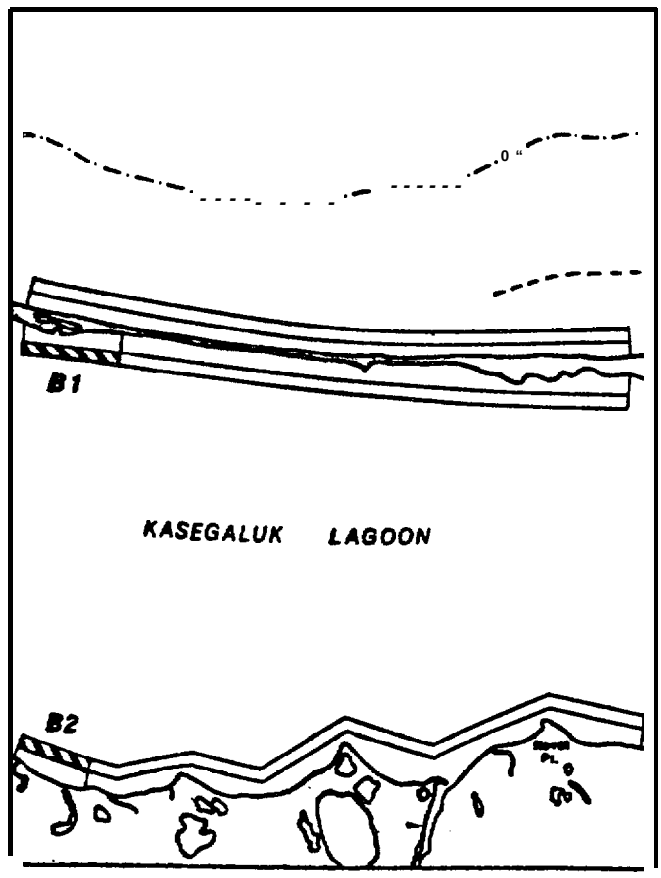

B
A
A
D
C´
C´
KASEGALUK LAGOON
t
S
G´
H´
G´
F´
E´
Navai Pt.
37

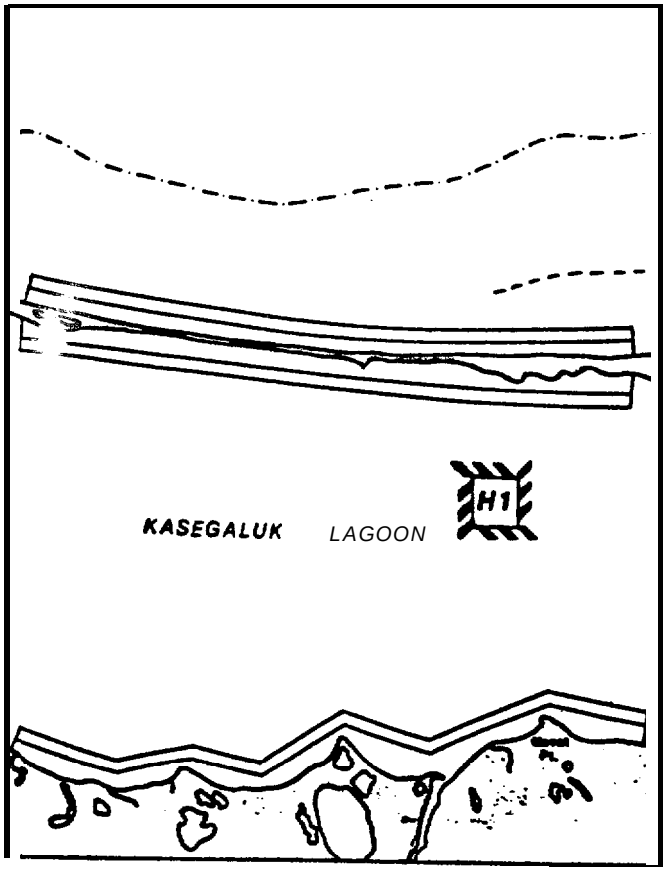
OIL *RESIDENCE INDEX*



BIOLOGICAL SENSITIVITY **INDEX**



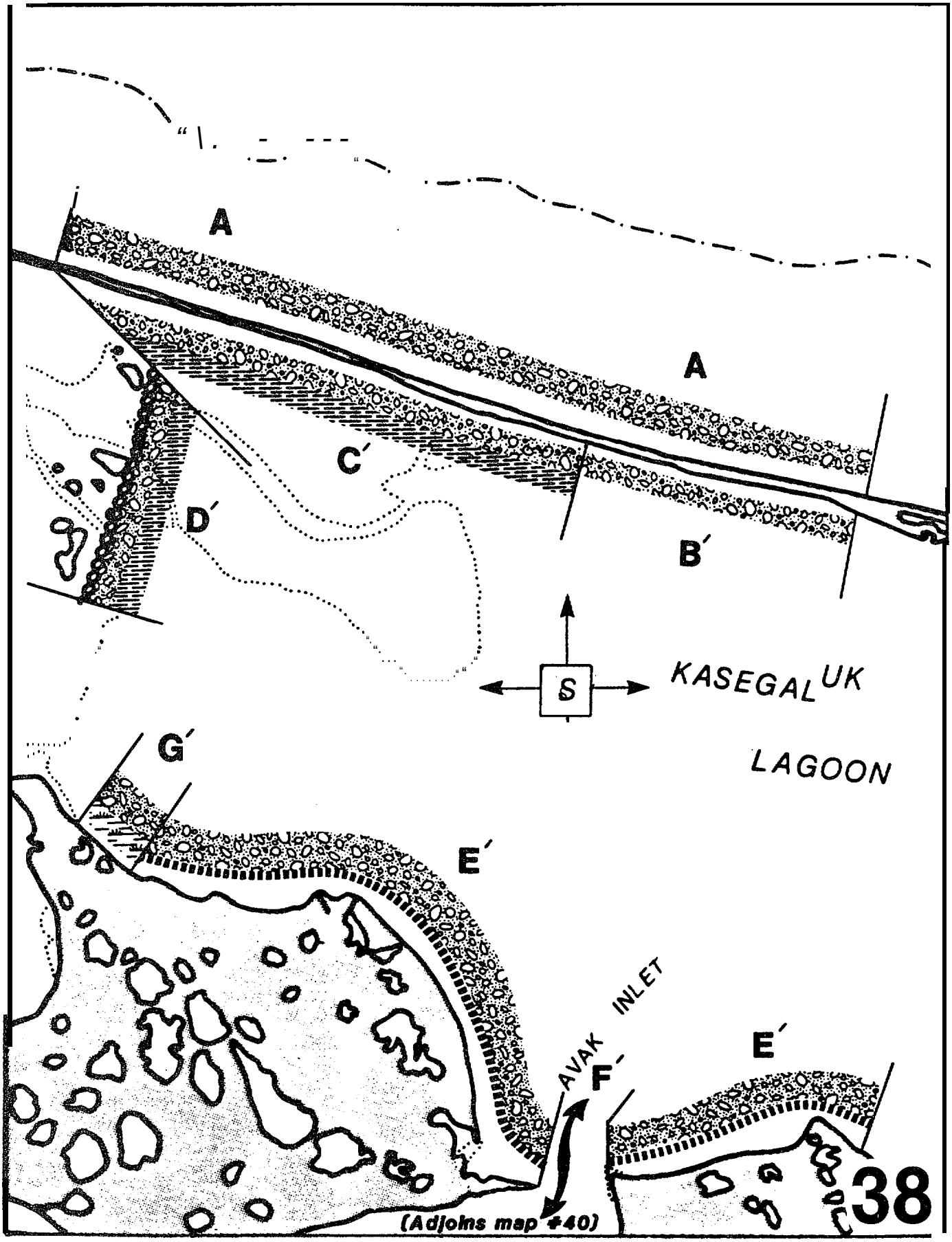
HUMAN USE INDEX



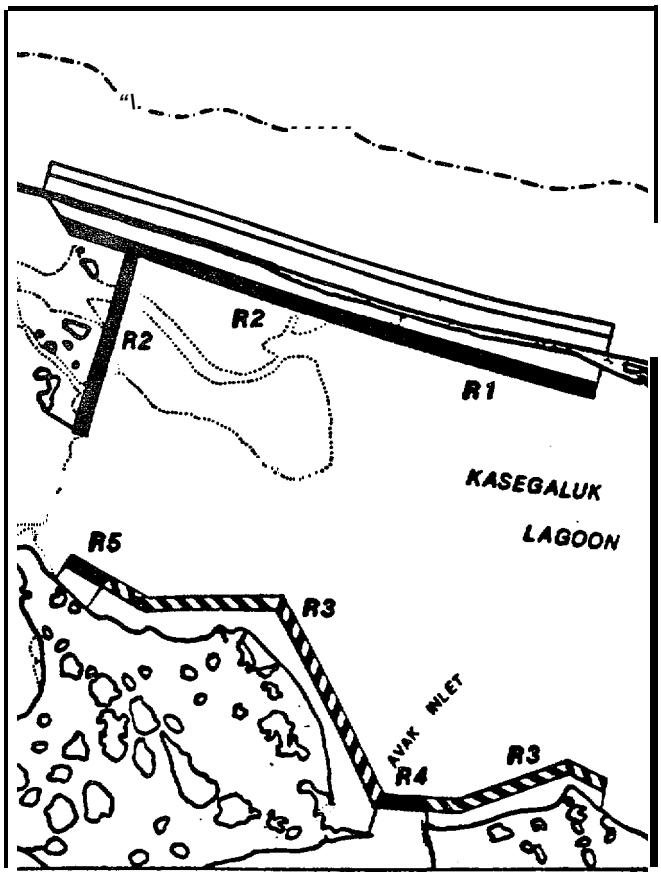
Seasonal ***Variability of Indices***

Identifier	RESOURCE	Winter	Spring	Summer	Fall
			May	Jun Jul Aug Sep Oct	
R1	Low energy beach			■ ■ ■	
R2	Low energy beach; Wetland			■ ■ ■	
R3	Protected tundra cliff			▨ ▨ ▨ ▨	
B1	Wetland use by brant			▨ ▨ ▨ ▨ ▨ ▨	
B2	Wetland and mudflat			▨ ▨ ▨ ▨ ▨ ▨	
H1	Beluga whale hunting			▨ ▨	
	Spotted seal hunting			▨ ▨ ▨	

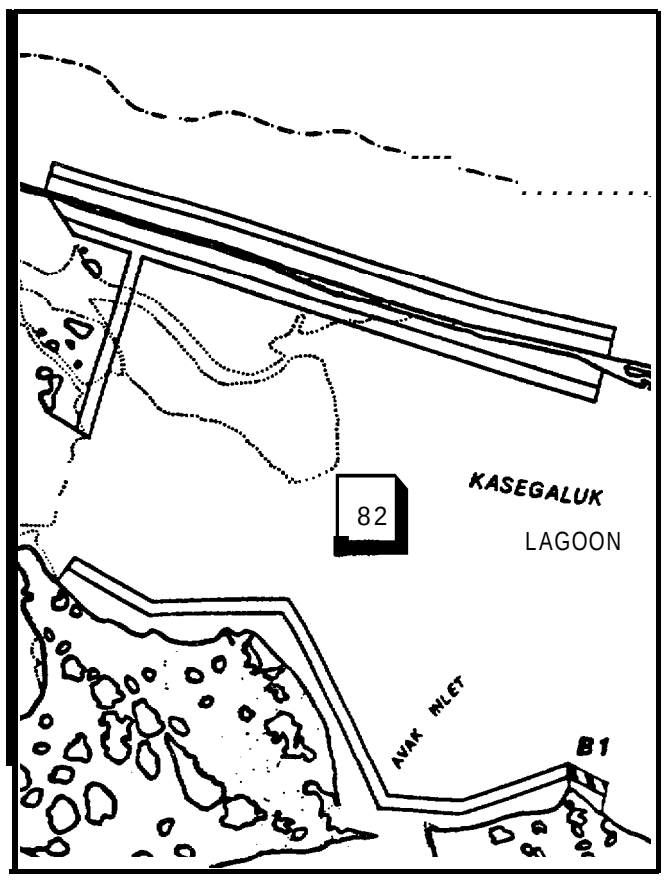
37


A
A
C´
D´
B´
S
KASEGAL UK
LAGOON
G´
E´
AVAK INLET
F´
E´
38
(Adjoins map #40)

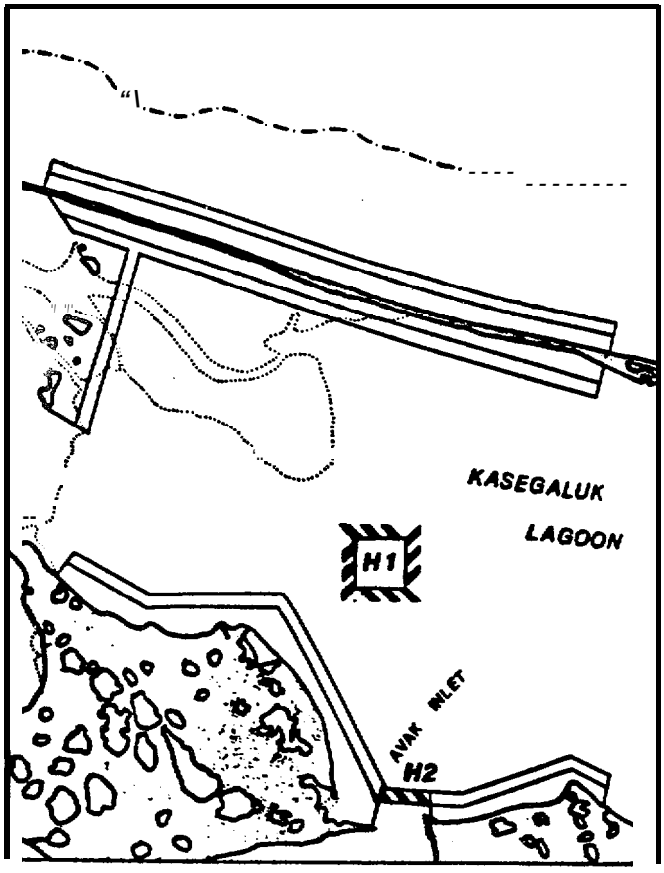
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



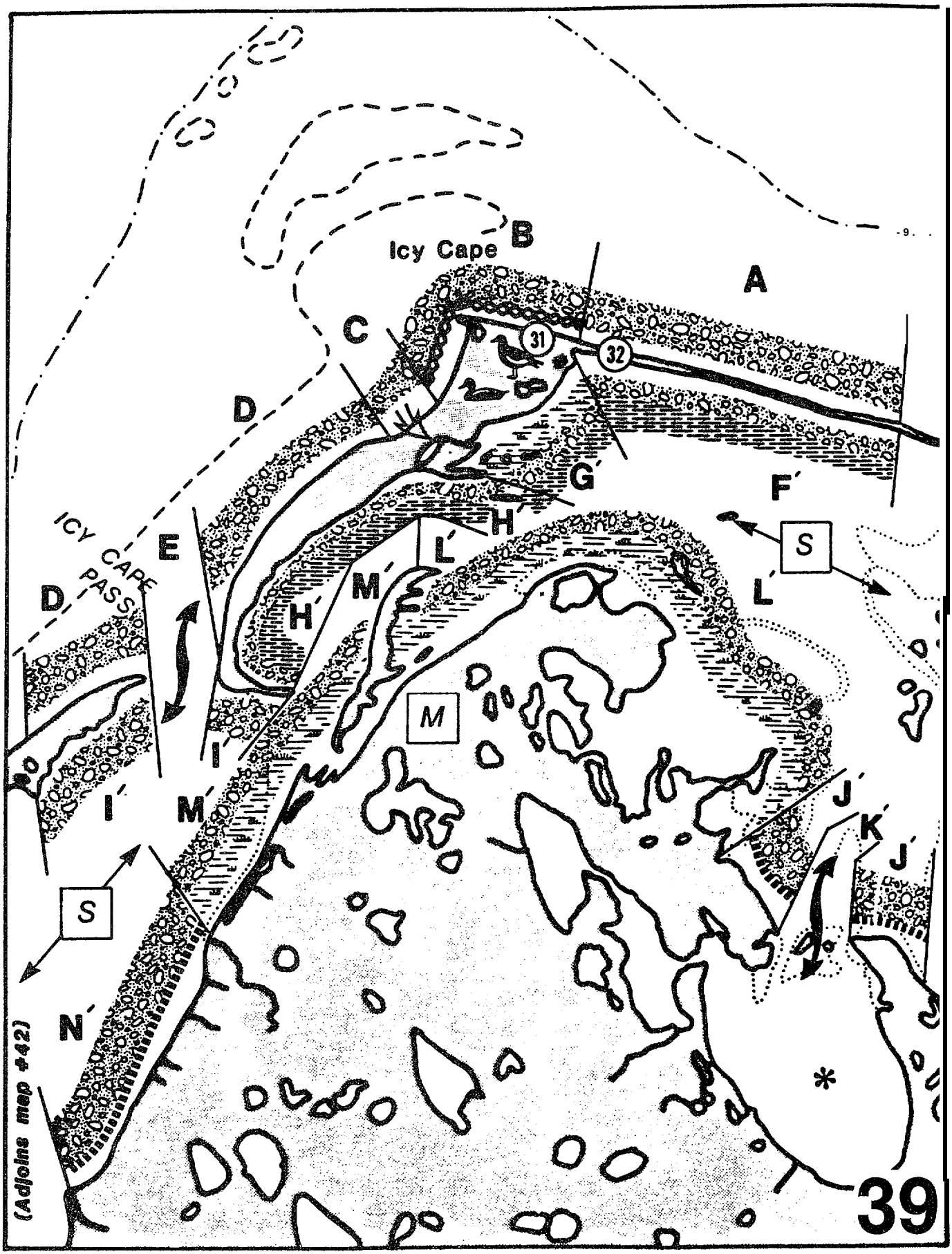
HUMAN **USE INDEX**



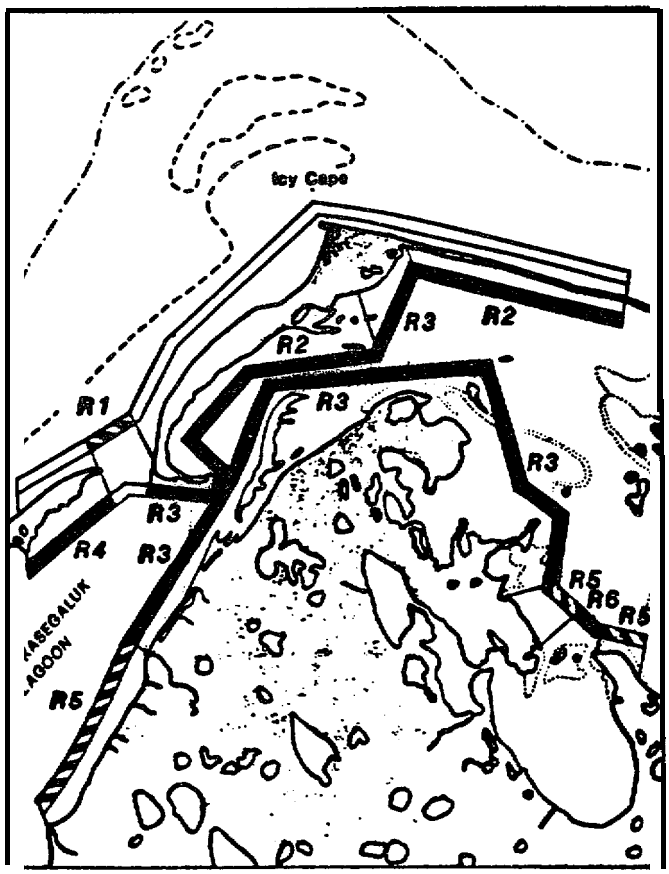
Seasonal Variability of Indices

Identifier	RESOURCE	Winter	SEASON: Break-Up/Summer/Freeze-Up				
		May	Jun	Jul	Aug	Sep	Oct
R1	Low energy beach			■	■	■	
R2	Low energy beach; Mudflats			■	■	■	
R3	Protected tundra cliff			▨	▨	▨	
R4	Stable inlet and estuary			■	■	■	
R5	Low energy beach; Wetland			■	■	■	
B1	Wetland and mudflats		▨	▨	▨	▨	▨
B2	Kasegaluk Lagoon; (Icy Cape Area) Extensive mudflats and wetland		■	■	■	■	
H1	Beluga whale hunting Spotted seal hunting			▨	▨		
H2	Fishing		▨	▨	▨	▨	▨

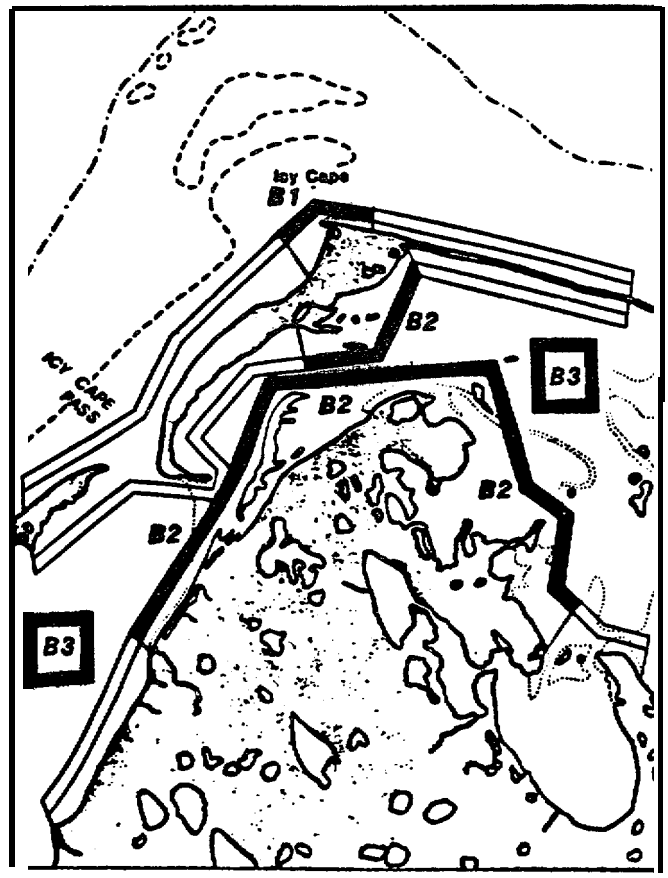
38


Icy Cape
B
A
C
31
32
D
G
F
H
E
L
S
ICY CAPE PASS
D
M
H
L
M
I
I
M
J
K
J
S
N
(Adjoins map #42)
*
39

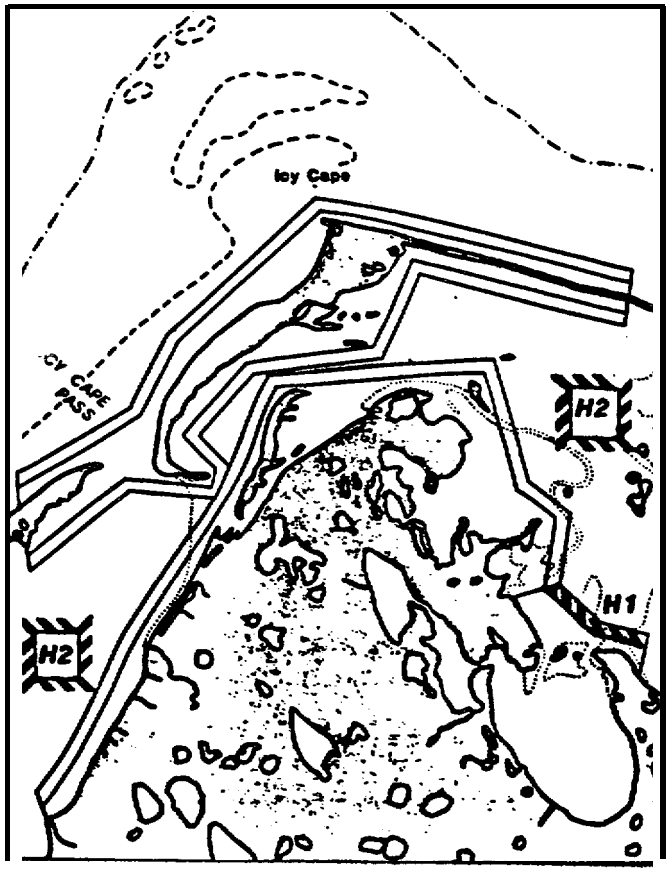
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



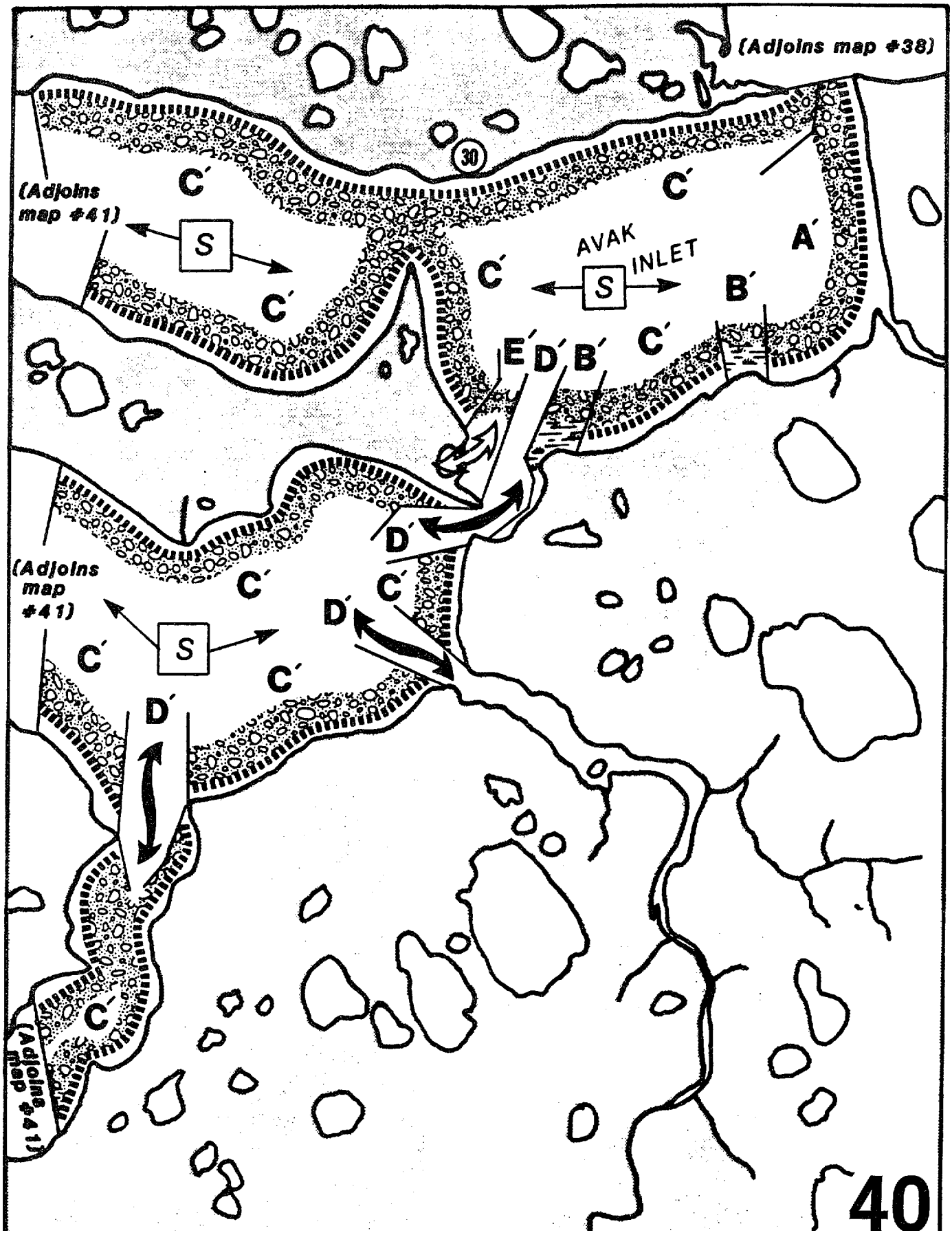
HUMAN USE INDEX



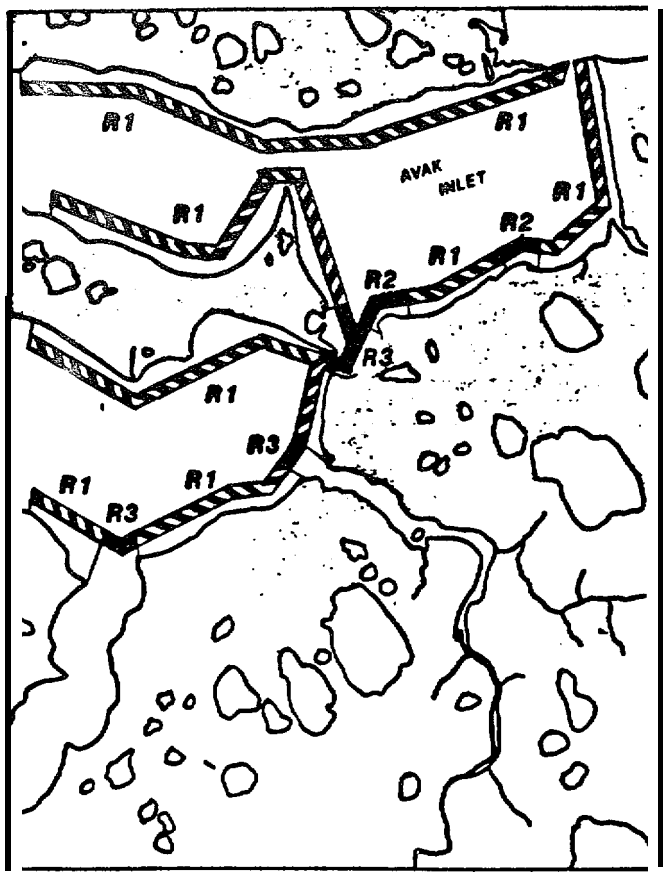
Seasonal Variability of Indices

Identifier	Resource	Season: Winter	Break-Up/Summer/Freeze-Up: May	Jun	Jul	Aug	Sep	Oct	Winter
R1	Stable inlet; recurve spits				▨	▨	▨	▨	
R2	Low energy beach; mudflat				■	■	■		
R3	Low energy beach; mudflat; wetland				■	■	■		
R4	Low energy beach				■	■	■		
R5	Protected tundra cliff				▨	▨	▨		
R6	Stable inlet; lagoon				■	■	■		
R7	Low energy beach; Wetland				■	■	■		
B1	Eider (62 pr), gull (2 pr) and arctic tern (6 pr) nesting			■	■				
B2	Extensive mudflats and wetlands			■	■	■	■	■	
B3	Kasegaluk Lagoon (Icy Cape area) Extensive mudflats and wetland			■	■	■	■		
H1	Fishing			▨	▨	▨	▨	▨	
H2	Beluga whale hunting Spotted seal hunting Fishing			▨	▨	▨	▨	▨	

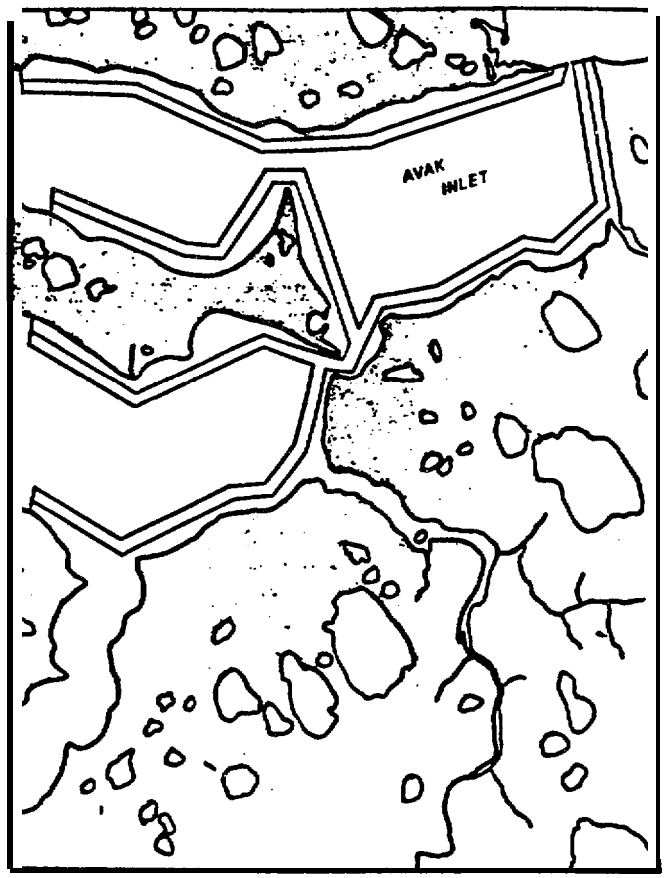
39


(Adjoins map #38)
30
(Adjoins map #41)
C´
S
C´
AVAK INLET
S
A´
B´
C´
E´
D´
B´
C´
D´
(Adjoins map #41)
C´
C´
D´
C´
S
C´
C´
D´
C´
(Adjoins map #41)
40

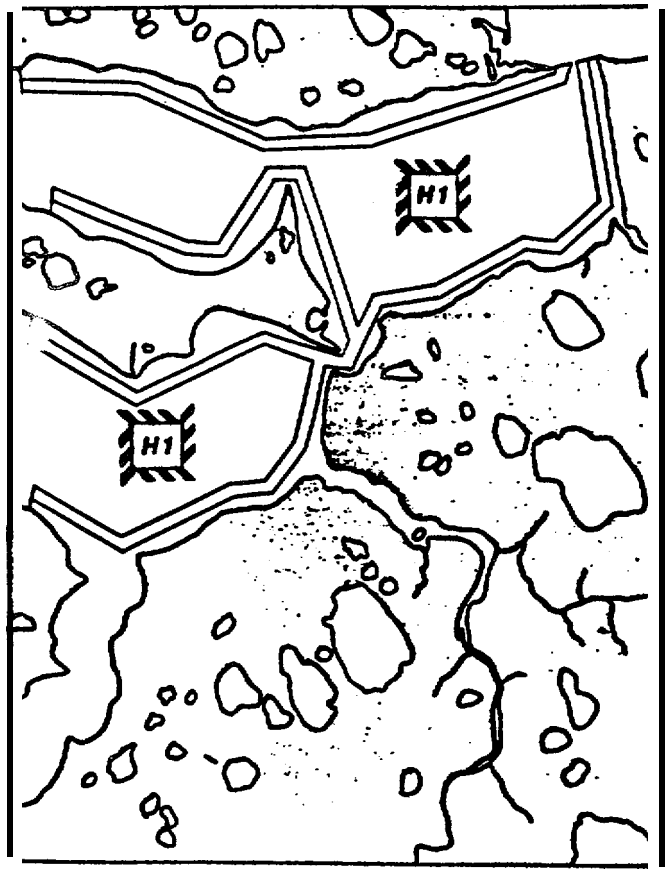
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



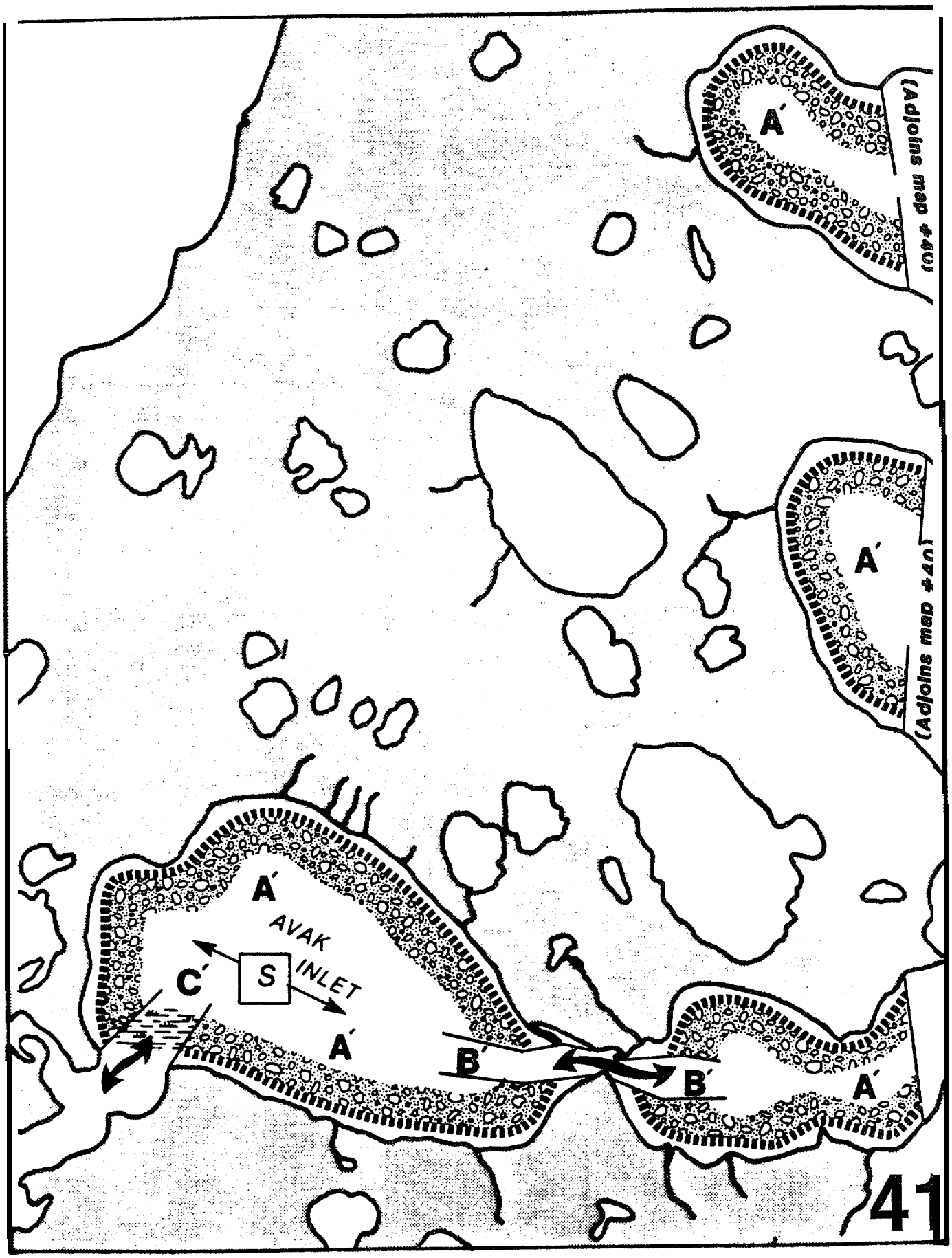
HUMAN USE INDEX



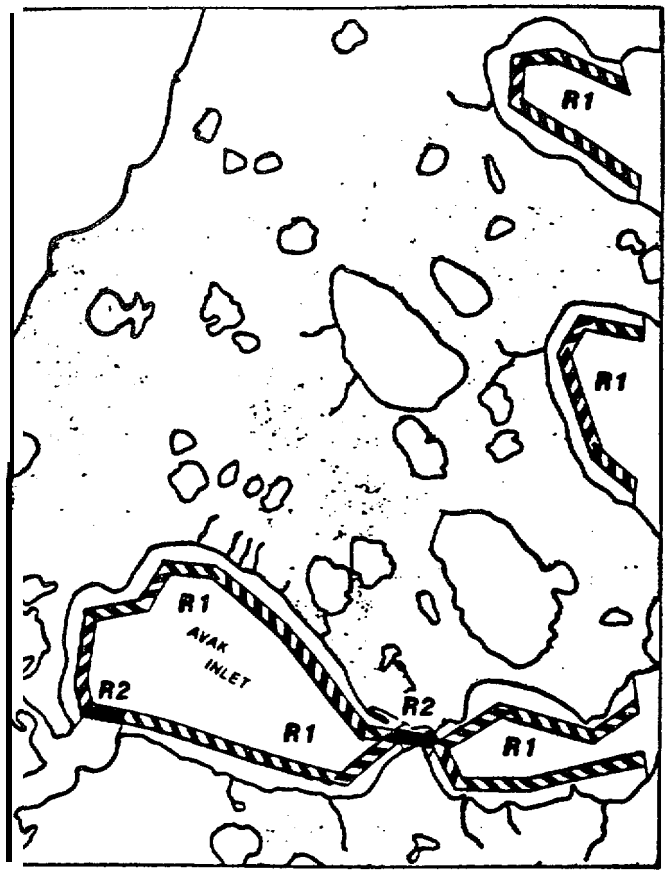
Seasonal Variability of Indices

Identifier	RESOURCE	Winter	Br	SEASON -Up/Summer/Freeze-Up Jun	Jul	Aug	Sep	Oct	Winter
R1	Protected tundra cliff								
R2	Low energy beach; Wetland								
R3	Inlet; lagoon/ estuary								
H1	Spotted seal hunting Fishing								

40

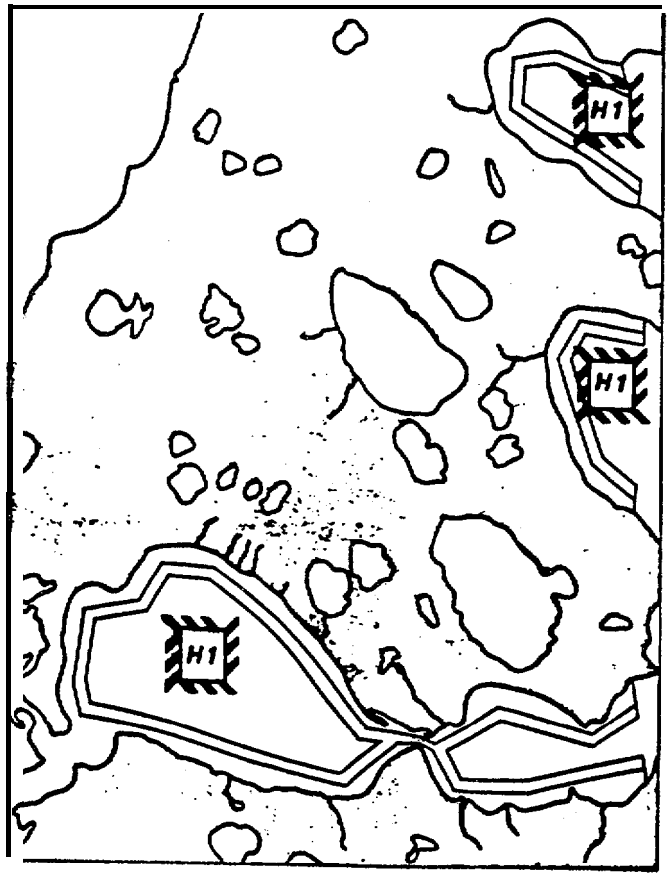

A´
(Adjoins map #40)
A´
(Adjoins map #40)
A´
AVAK
INLET
S
C´
A´
B´
B´
A´
41

OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX

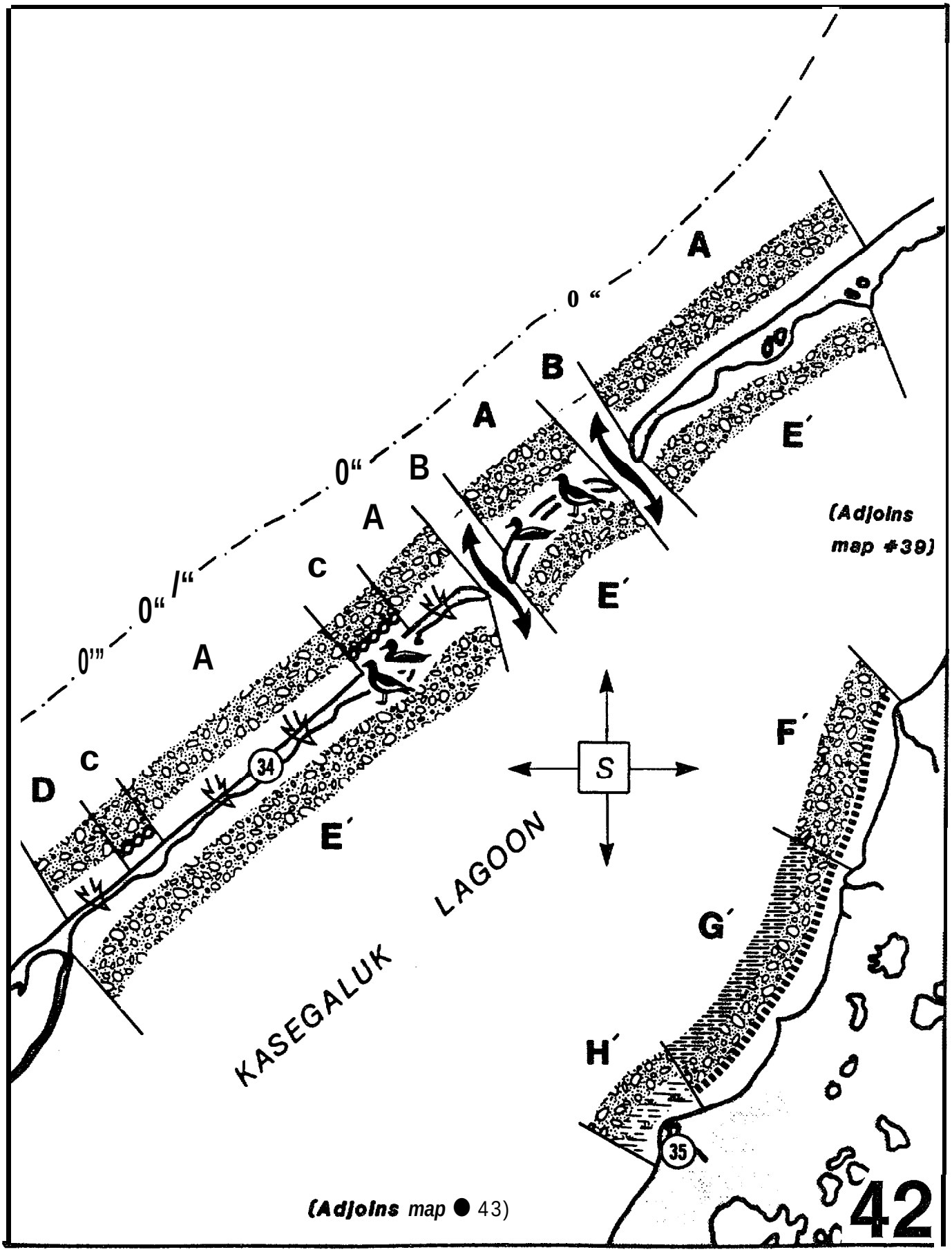
HUMAN USE INDEX



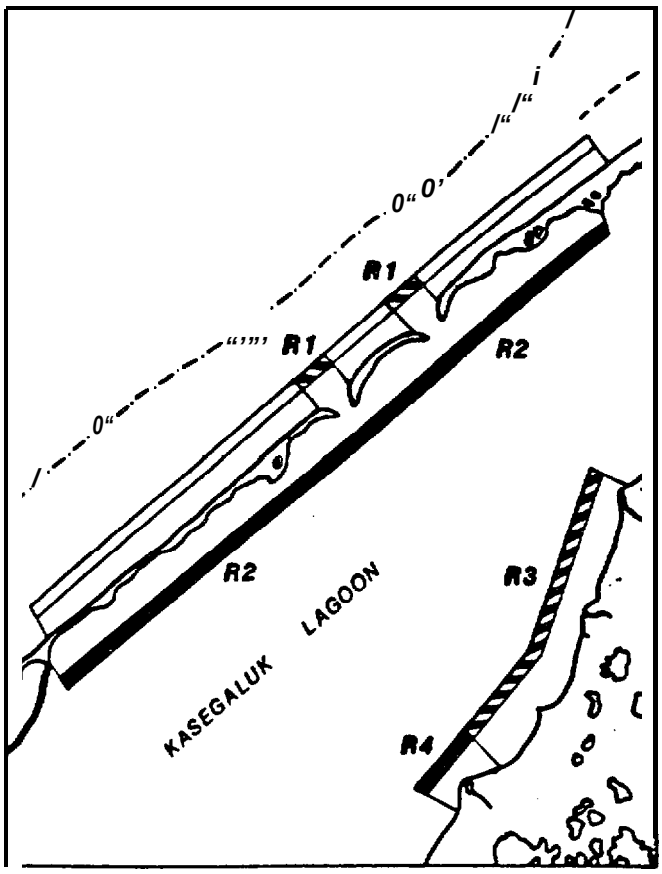
Seasonal Variability of indices

Identifier	RESOURCE	Winter	SEASON: Break-Up/Summer/Freeze-Up					
				Jun	Jul	Aug	Sep	Oct
R1	Protected tundra cliff							
R2	Inlet; estuary							
H1	Subsistence hunting Fishing							

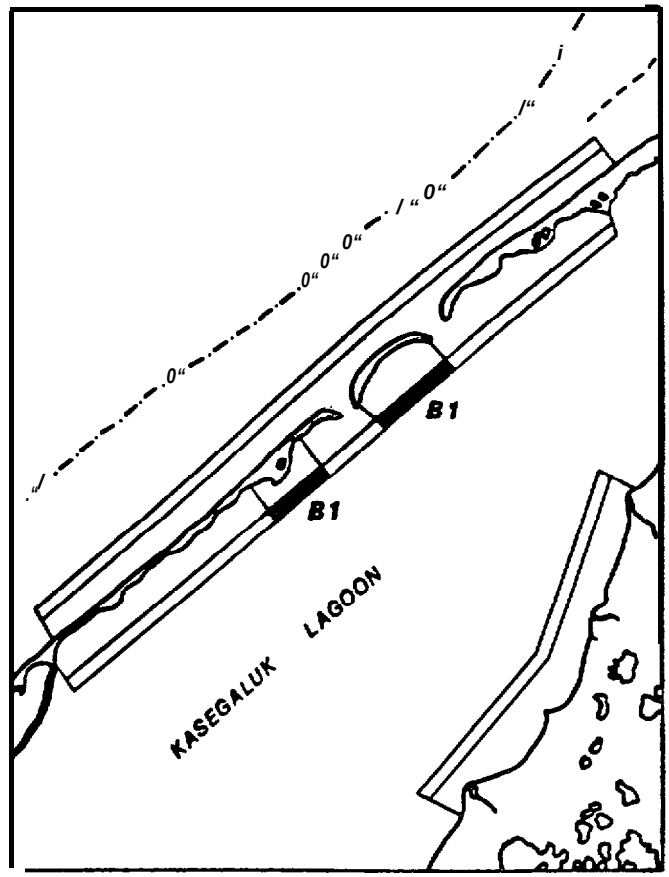
41


0"
0"
0"
0"'
A
B
A
B
A
C
C
D
E´
E´
E´
F´
G´
H´
34
35
S
KASEGALUK LAGOON
(Adjoins map #39)
(Adjoins map ● 43)
42

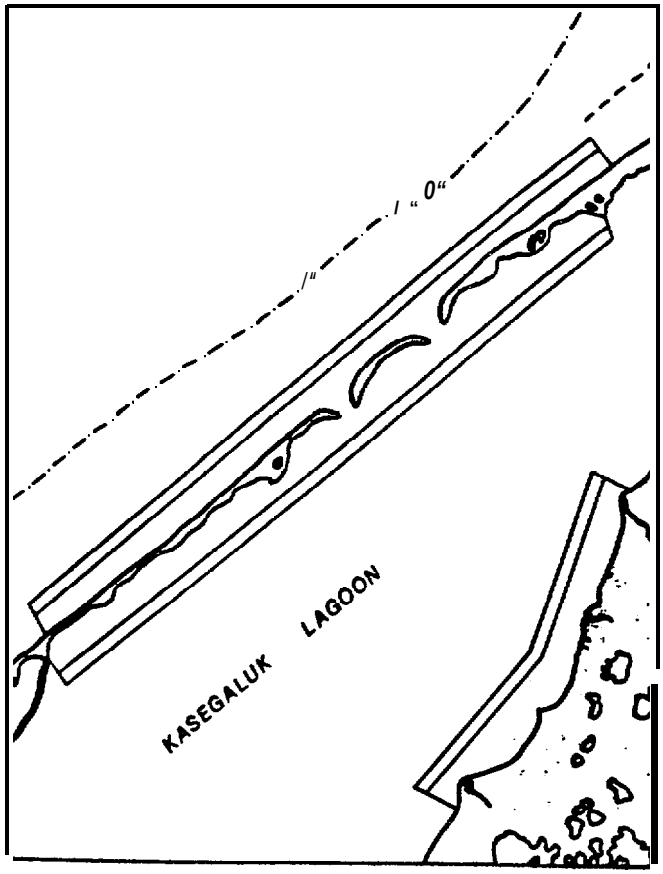
OIL RESIDENCE INDEX



*BIOLOGICAL **SENSITIVITY INDEX***



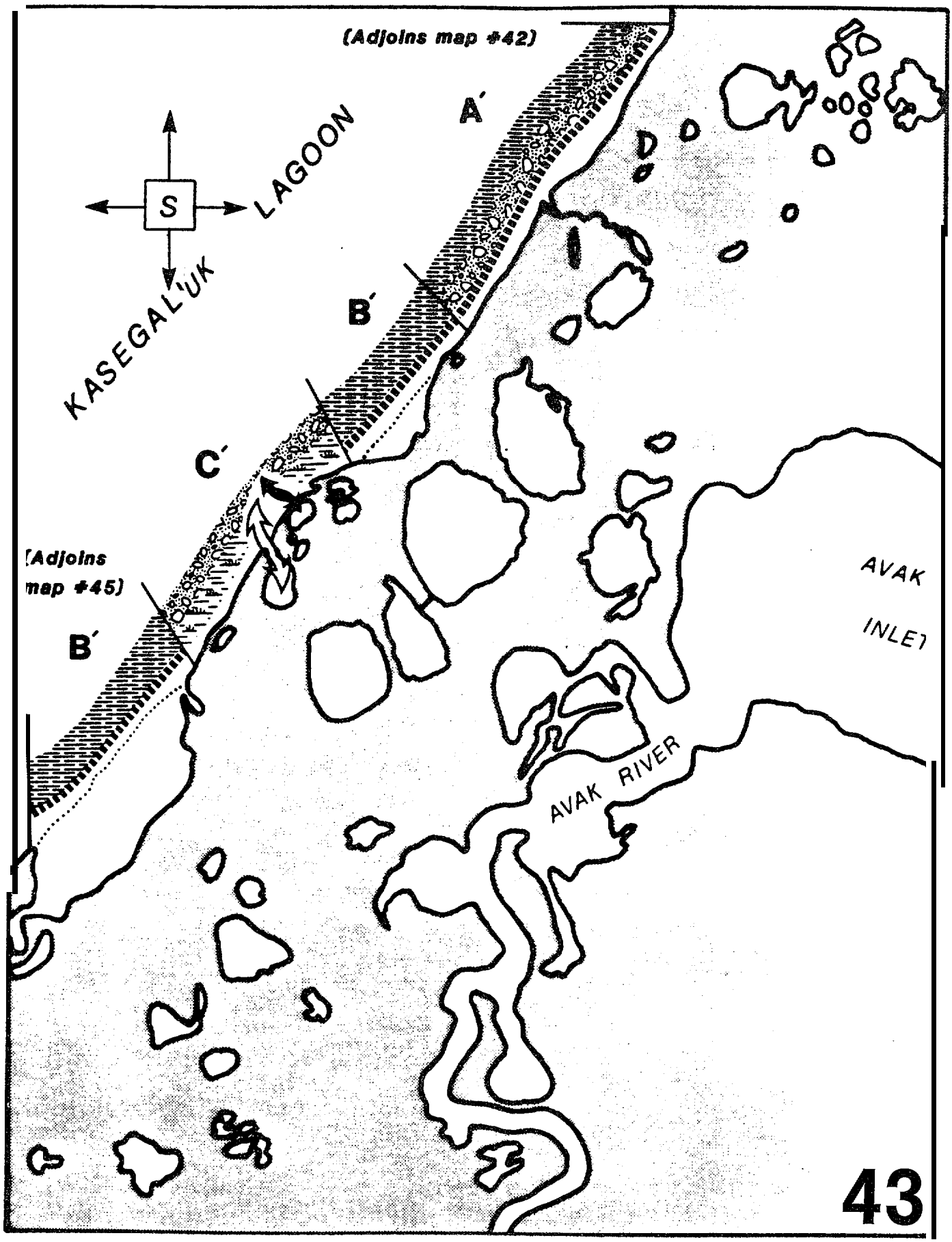
*HUMAN USE **INDEX***



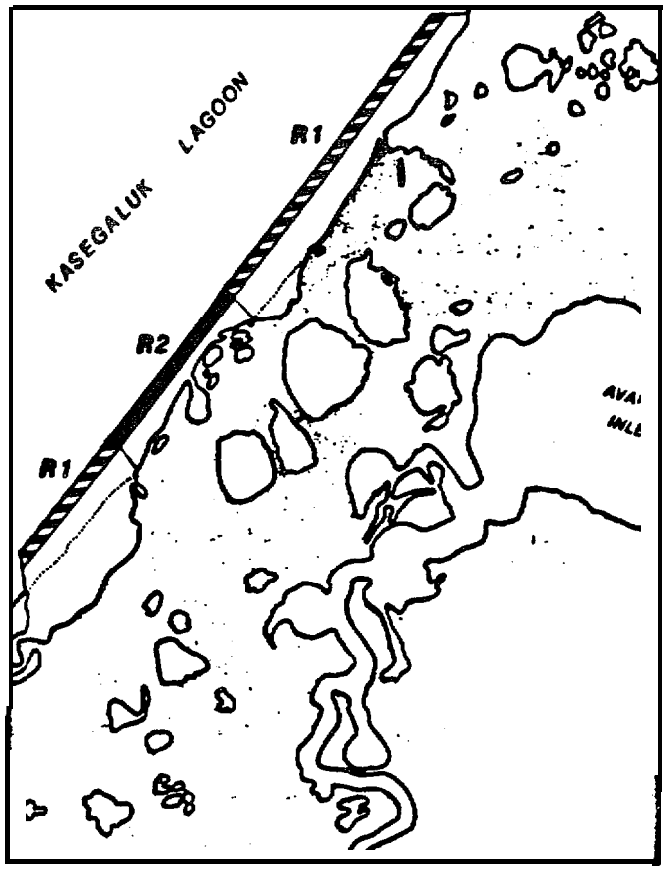
Seasonal** Variability of **Indices

Identifier	RESOURCE	BEASON: Winter	Break-U91Summ*rlFr**z9-lb: May	Jun	Jul	Aug	Sep	Ott	w inter
R1	Stable inlet; Recurve spits				▚	▚	▚	▚	
R2	Low energy bath				■	■	■		
R3	Proofed tundra				▚	▚	▚		
R4	Wetland				■	■	■		
B1	Eider (3S0 pr), gull (15 pr) and arctic tern (20 pr) nesting			■	■				

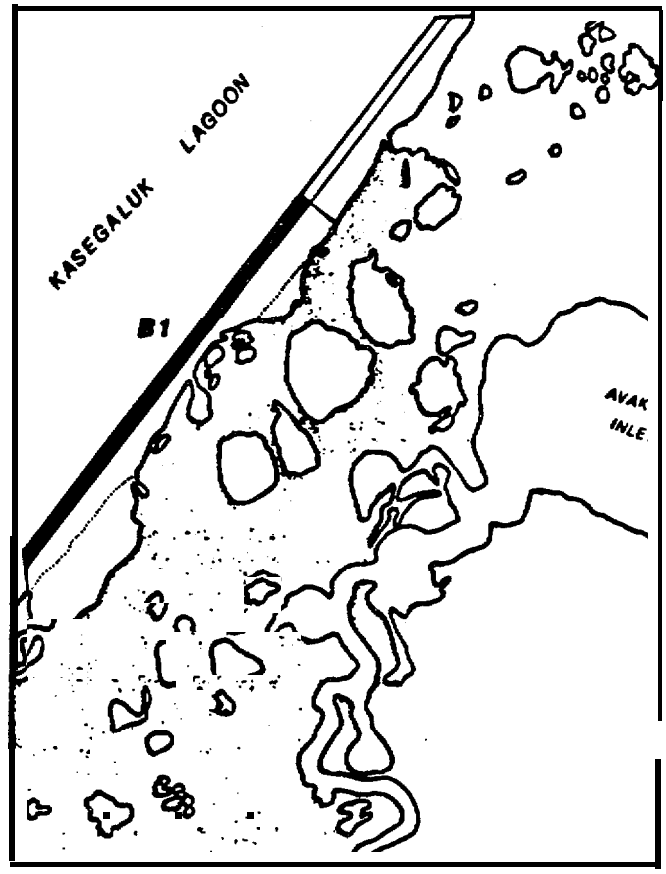
42


(Adjoins map #42)
A´
S
LAGOON
KASEGAL'UK
B´
C´
(Adjoins
map #45)
B´
AVAK
INLET
AVAK RIVER
43

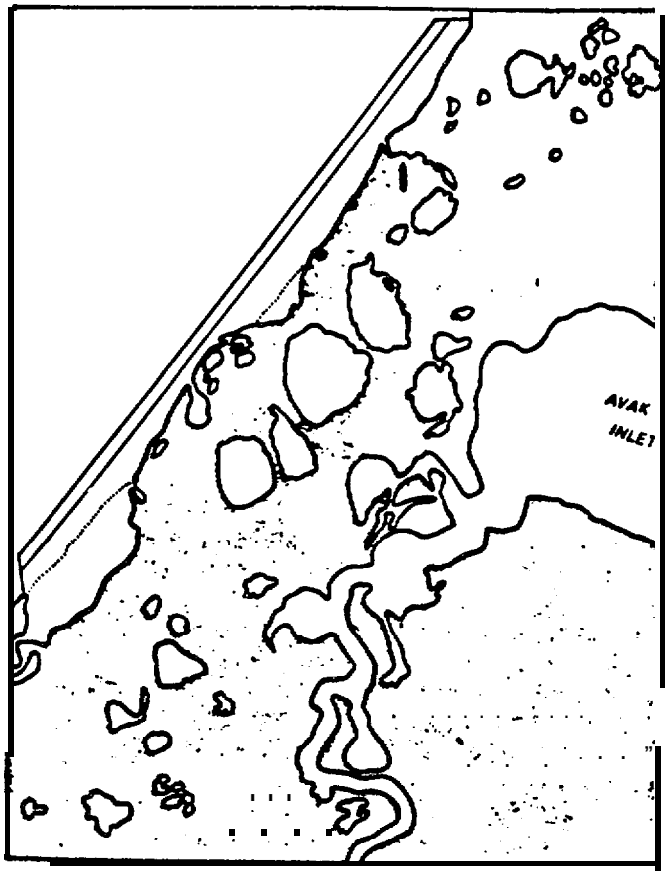
OIL RESIDENCE ***INDEX***



BIOLOGICAL *SENSITIVITY INDEX*

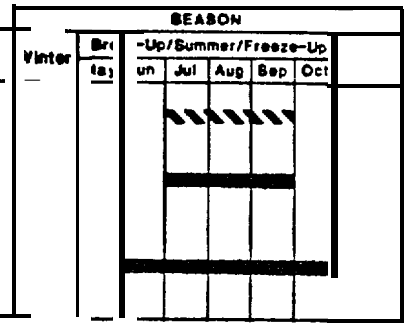


HUMAN USE ***INDEX***

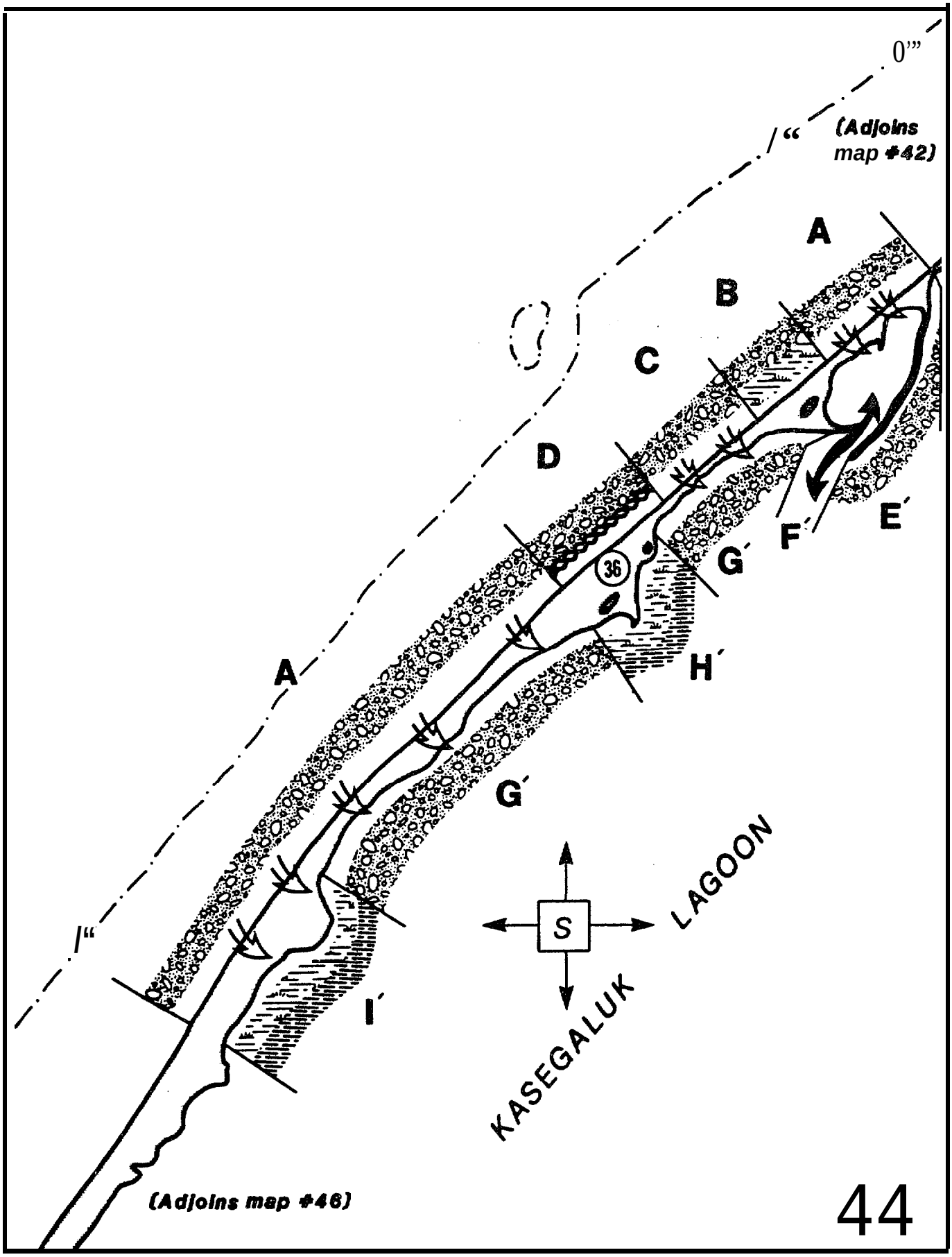


Seasonal *Variability* ***of Indices***

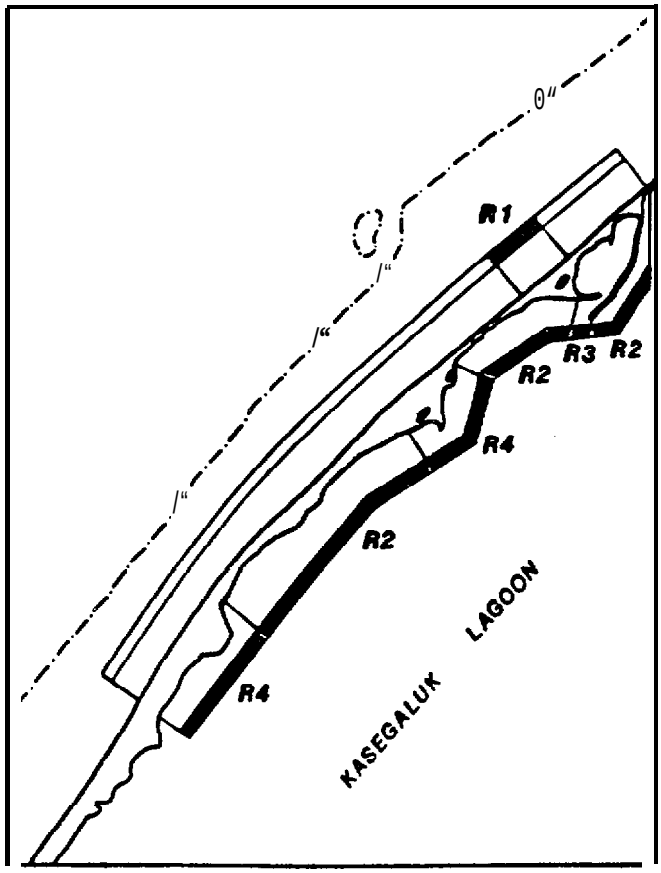
Identifier	RESOURCE
R1	Protected tundra cliff
R2	Low energy beach; Inlets; wetland
B1	Wetlands and mudflats



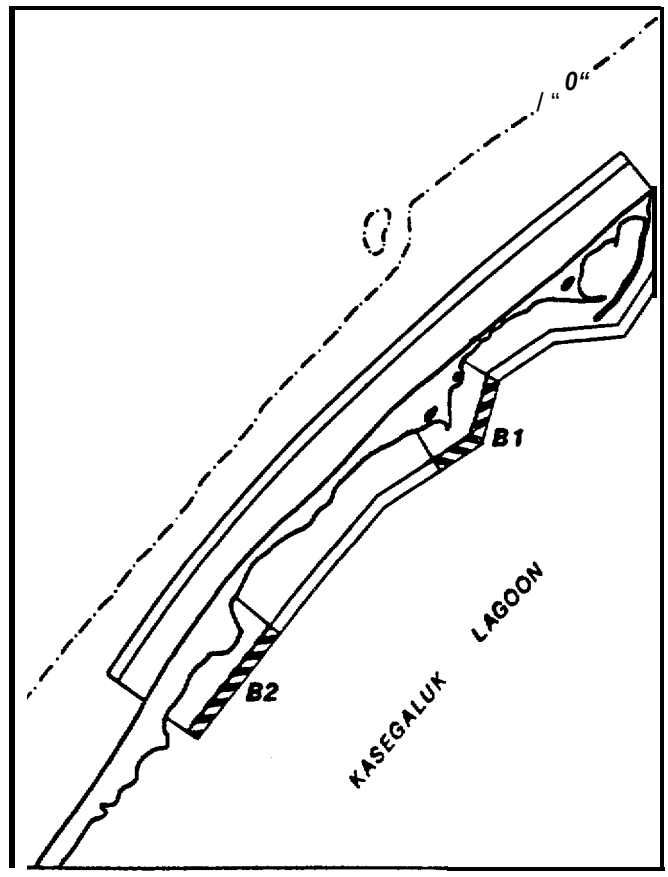
43


0'"
/"
(Adjoins map #42)
A
B
C
D
E´
F´
G´
H´
36
A
G´
I´
/"
S
LAGOON
KASEGALUK
(Adjoins map #46)
44

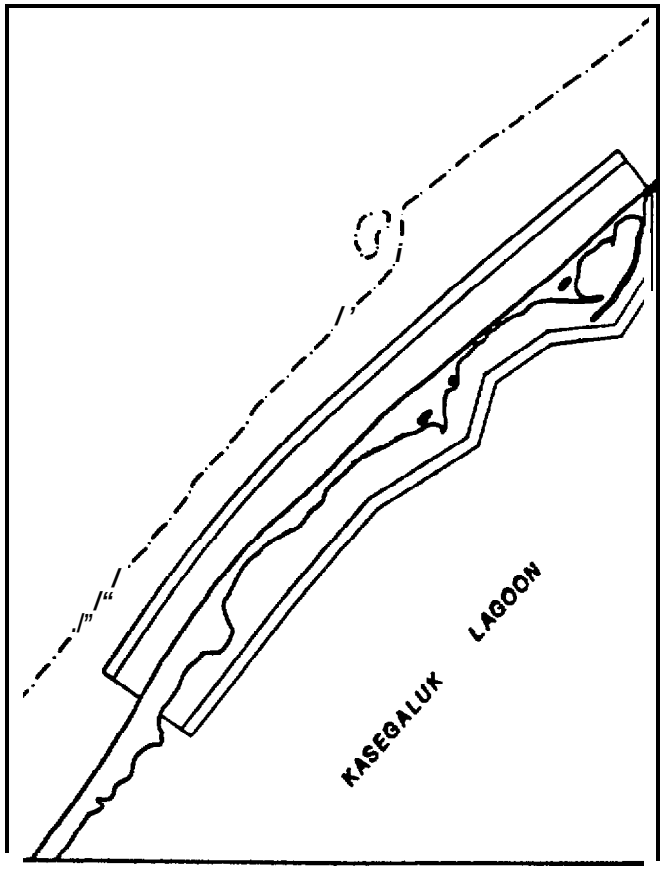
OIL RESIDENCE INDEX



***BIOLOGICAL** SENSITIVITY INDEX*

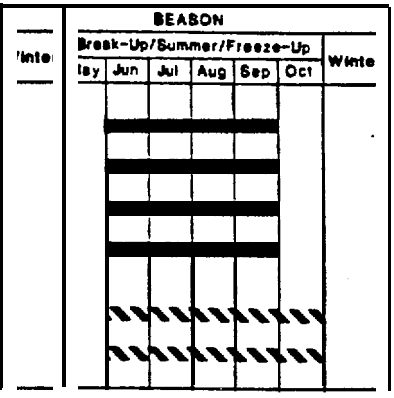


***HUMAN** USE INDEX*

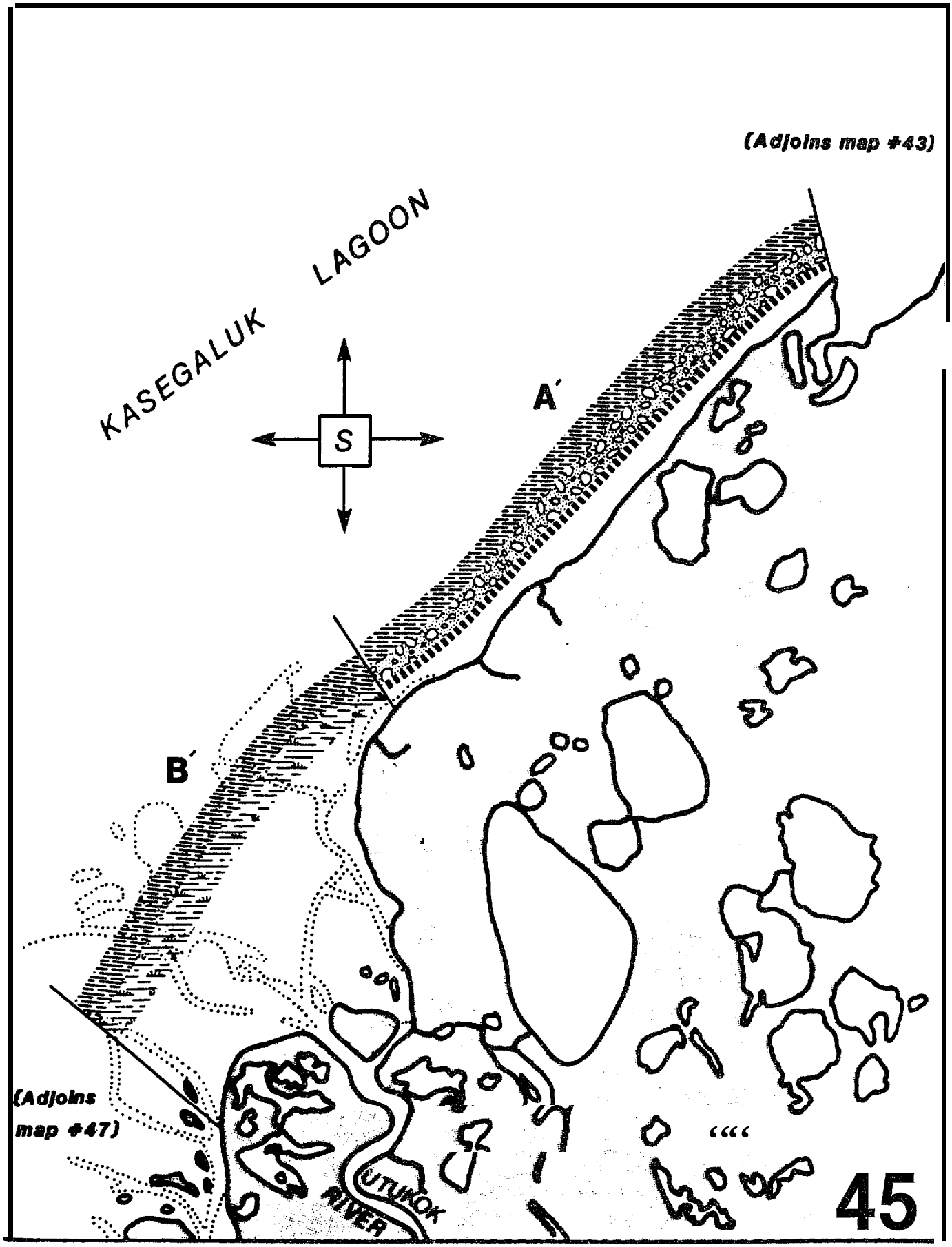


***Seasonal Variability** of Indices*

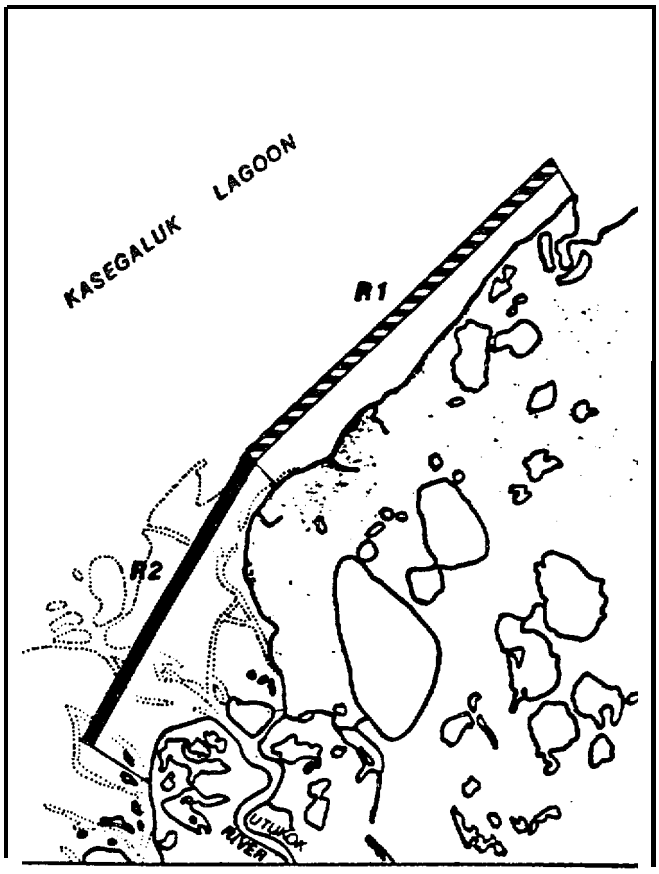
Identifier	RESOURCE
R1	Wetland
R2	Low energy beach
R3	Inlet; lagoon
R4	Mudflat; wetland
B1	Wetland
B2	Wetland



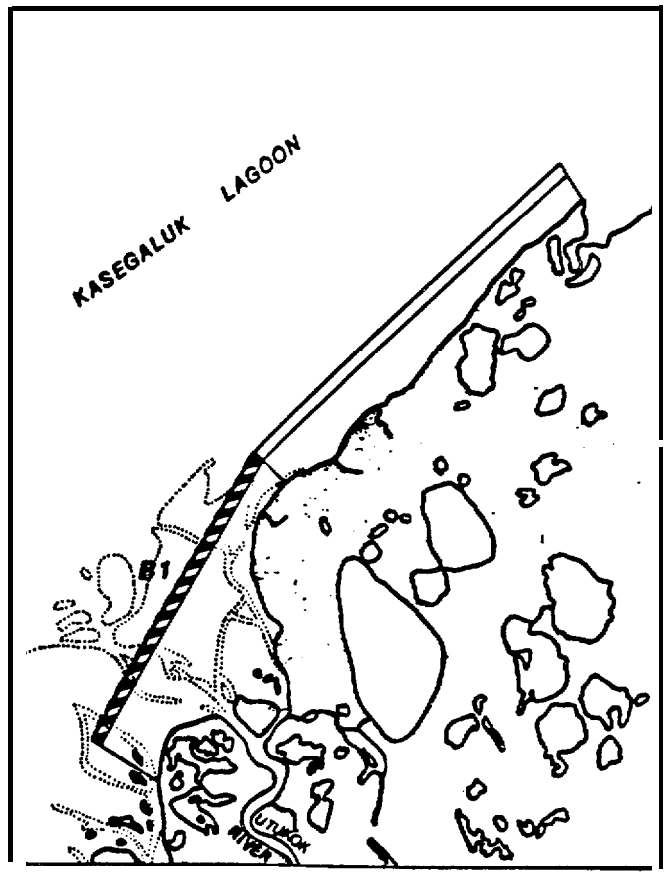
44


(Adjoins map #43)
KASEGALUK LAGOON
A´
B´
S
(Adjoins map #47)
UTUKOK RIVER
45

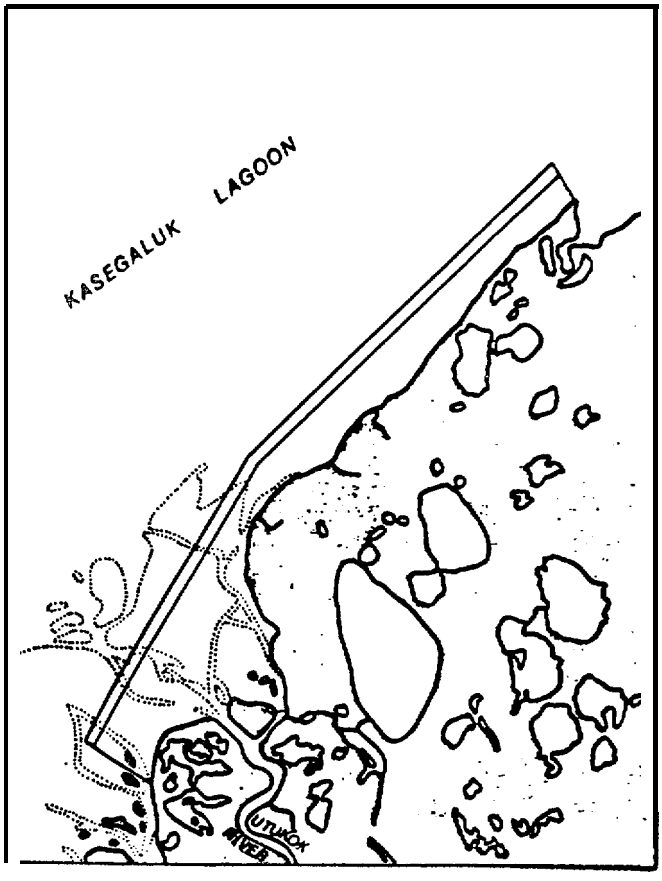
OIL RESIDENCE INDEX



BIOLOGICAL ***SENSITIVITY*** *INDEX*

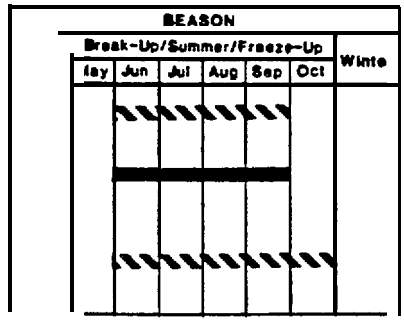


HUMAN USE INDEX

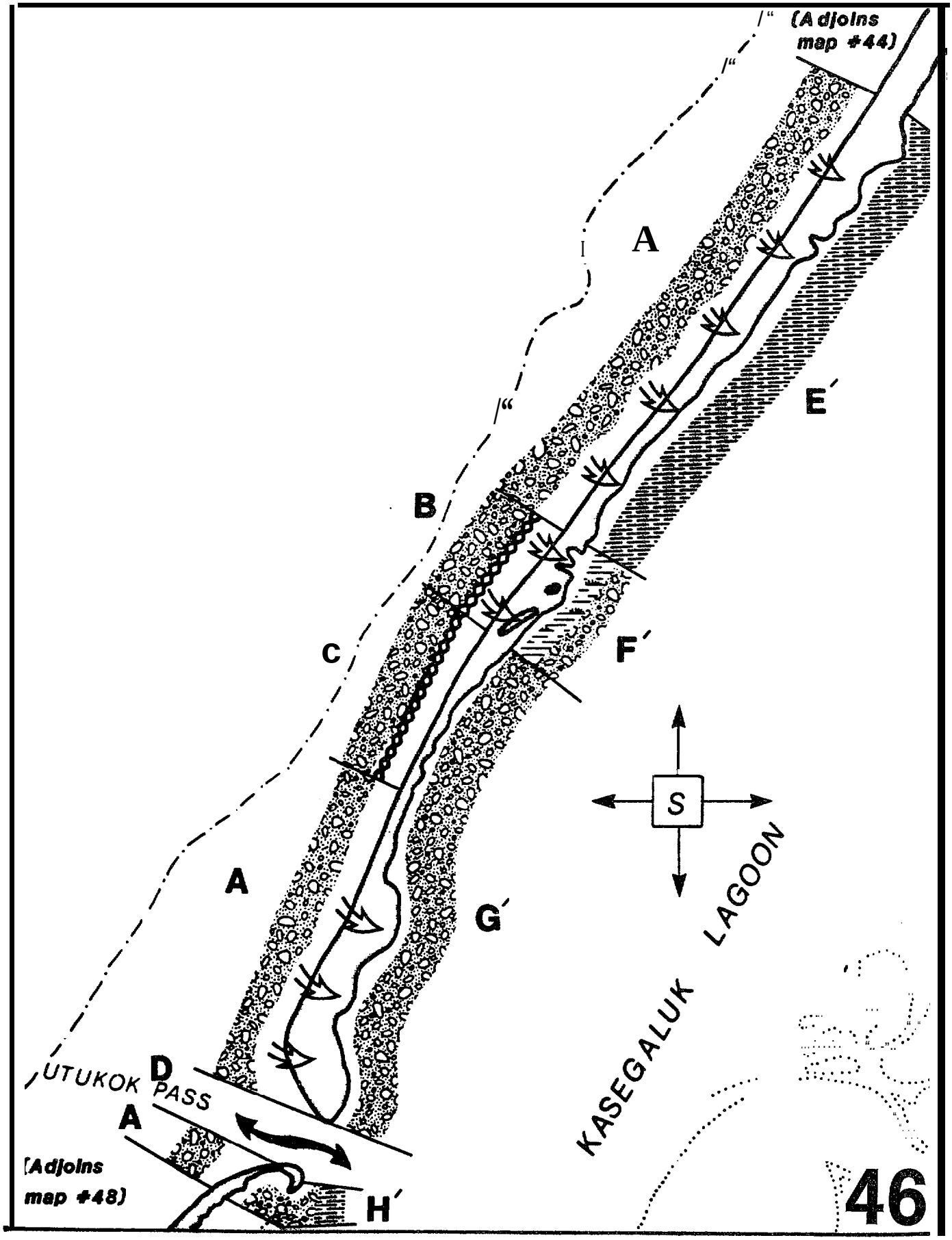


Seasonal Variability *of Indices*

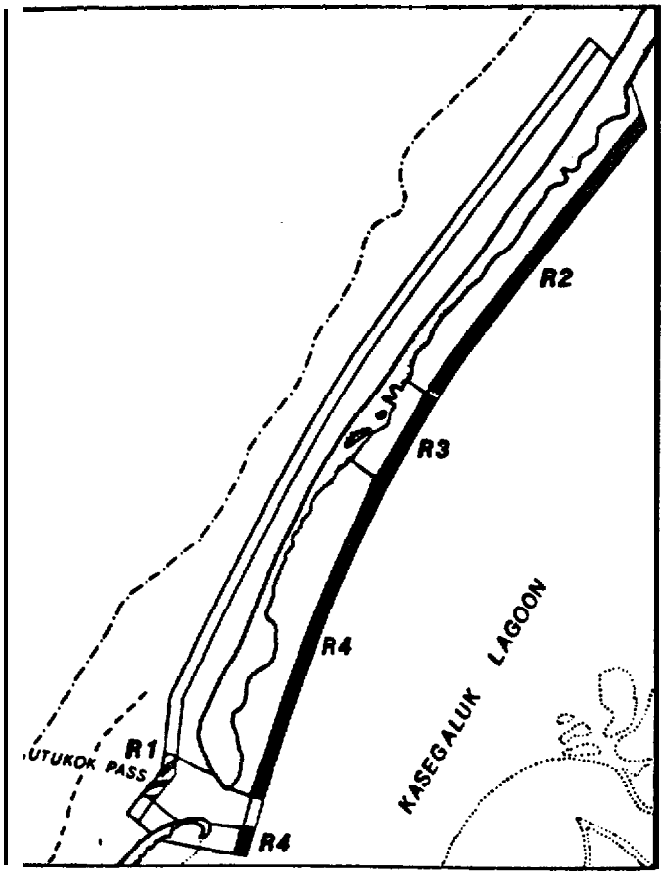
dentifier	RESOURCE
R1	Protected tundra cliff
R2	Delta flats; Wetland
B1	Wetland and mudflats



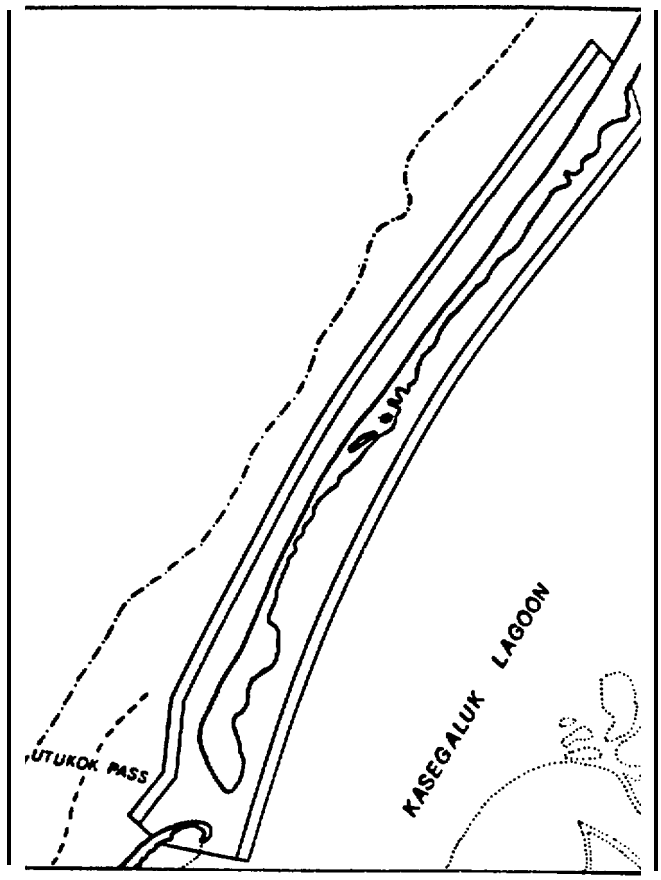
45


(Adjoins map #44)
A
B
C
E´
F´
G´
A
A
D
UTUKOK PASS
(Adjoins map #48)
H´
S
KASEGALUK LAGOON
46

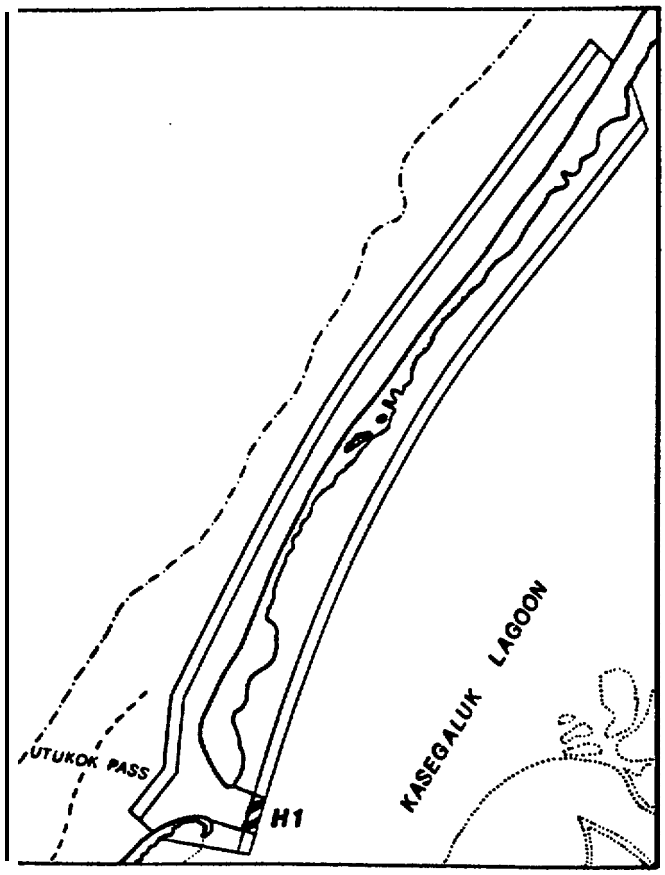
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX

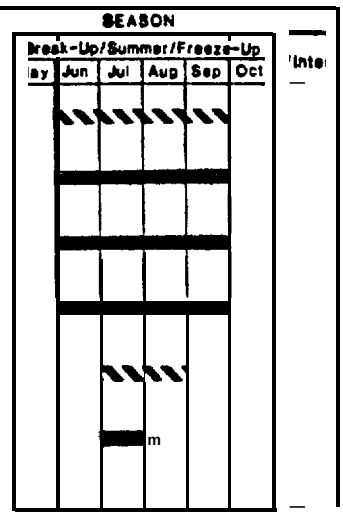


HUMAN USE INDEX

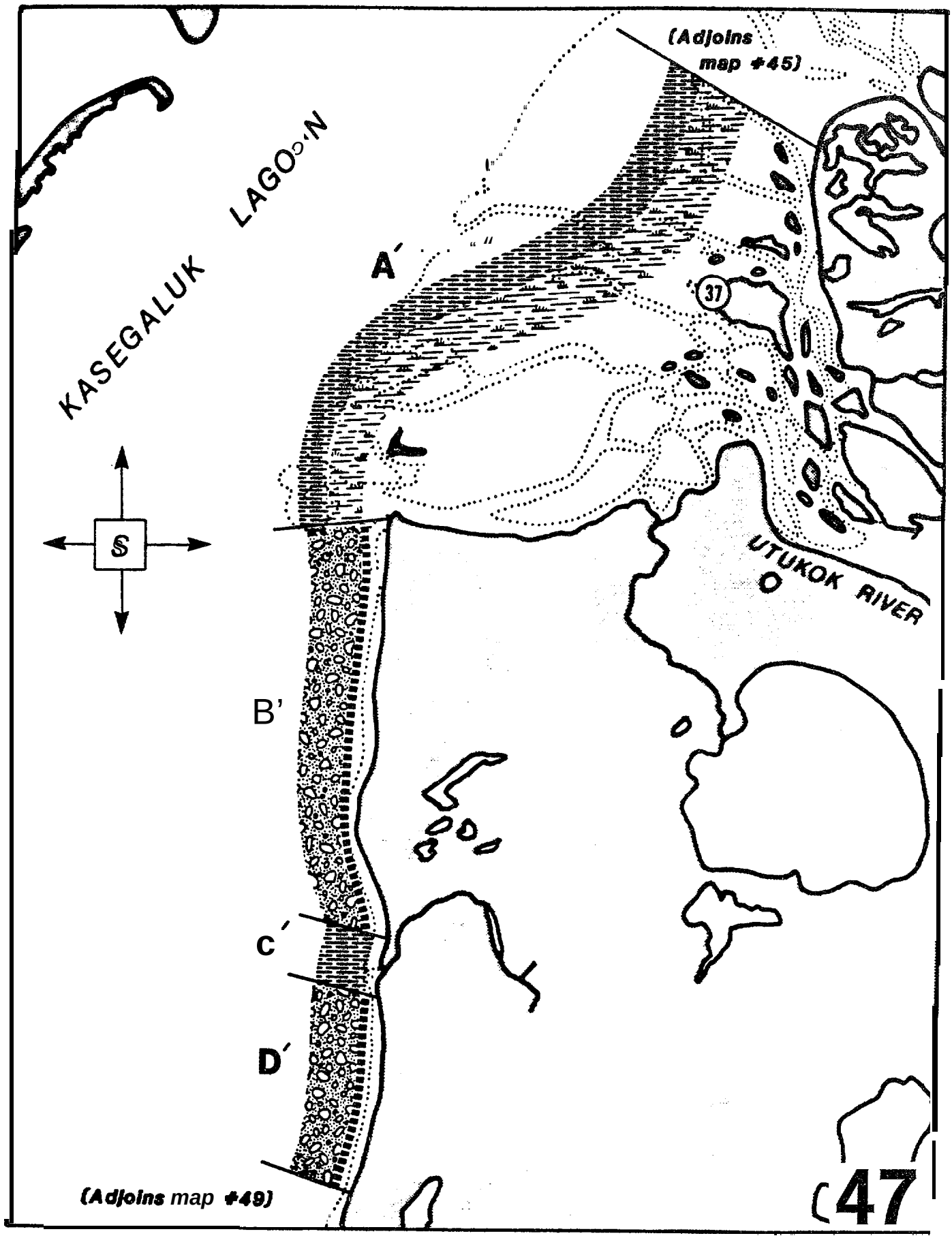


Seasonal Variability* of *Indices

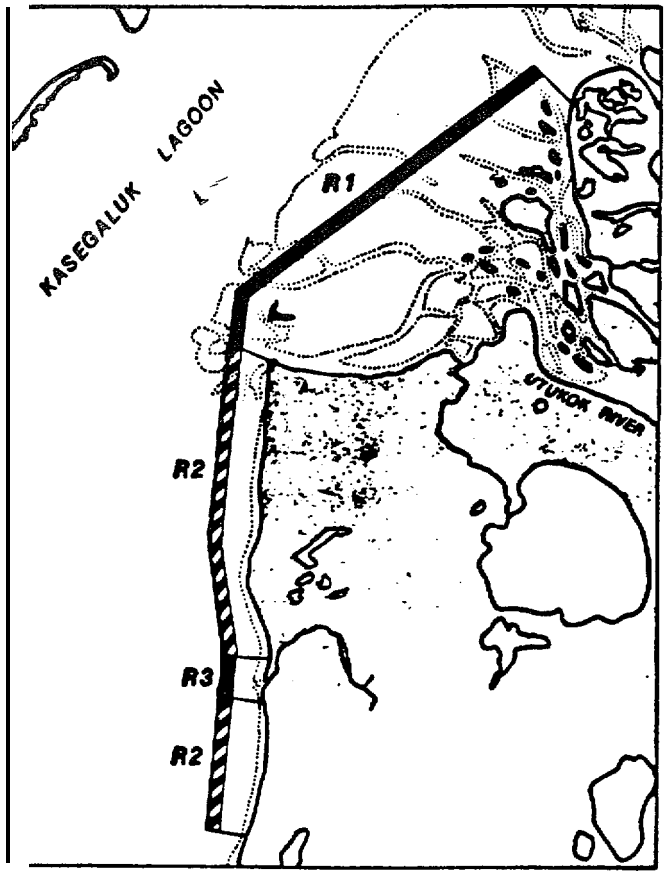
Identifier	RESOURCE
R1	Stable inlet; Recurve spits
R2	Low energy beach and mudflats
R3	Low ● ntrgy beach; Wetland
R4	Low energy beach
H1	Spotted seal hunting
	Beluga whale hunting



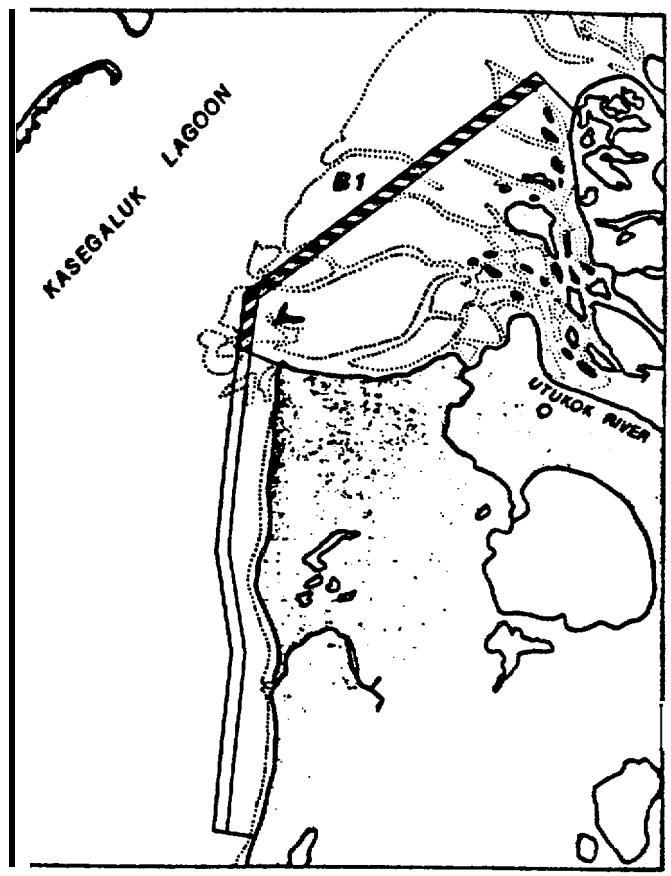
46


(Adjoins map #45)
KASEGALUK LAGOON
A´
37
S
UTUKOK RIVER
B'
C´
D´
(Adjoins map #49)
47

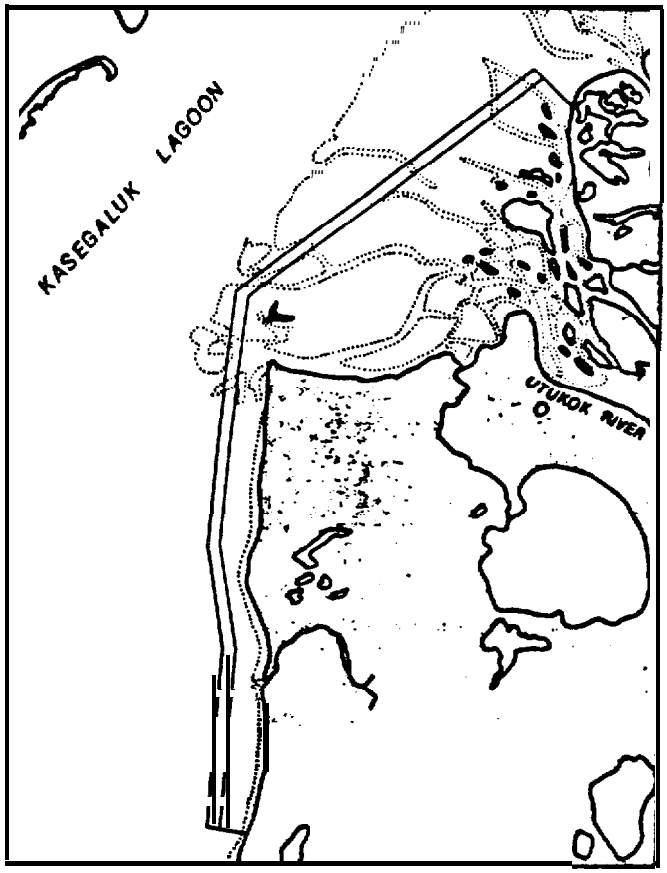
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



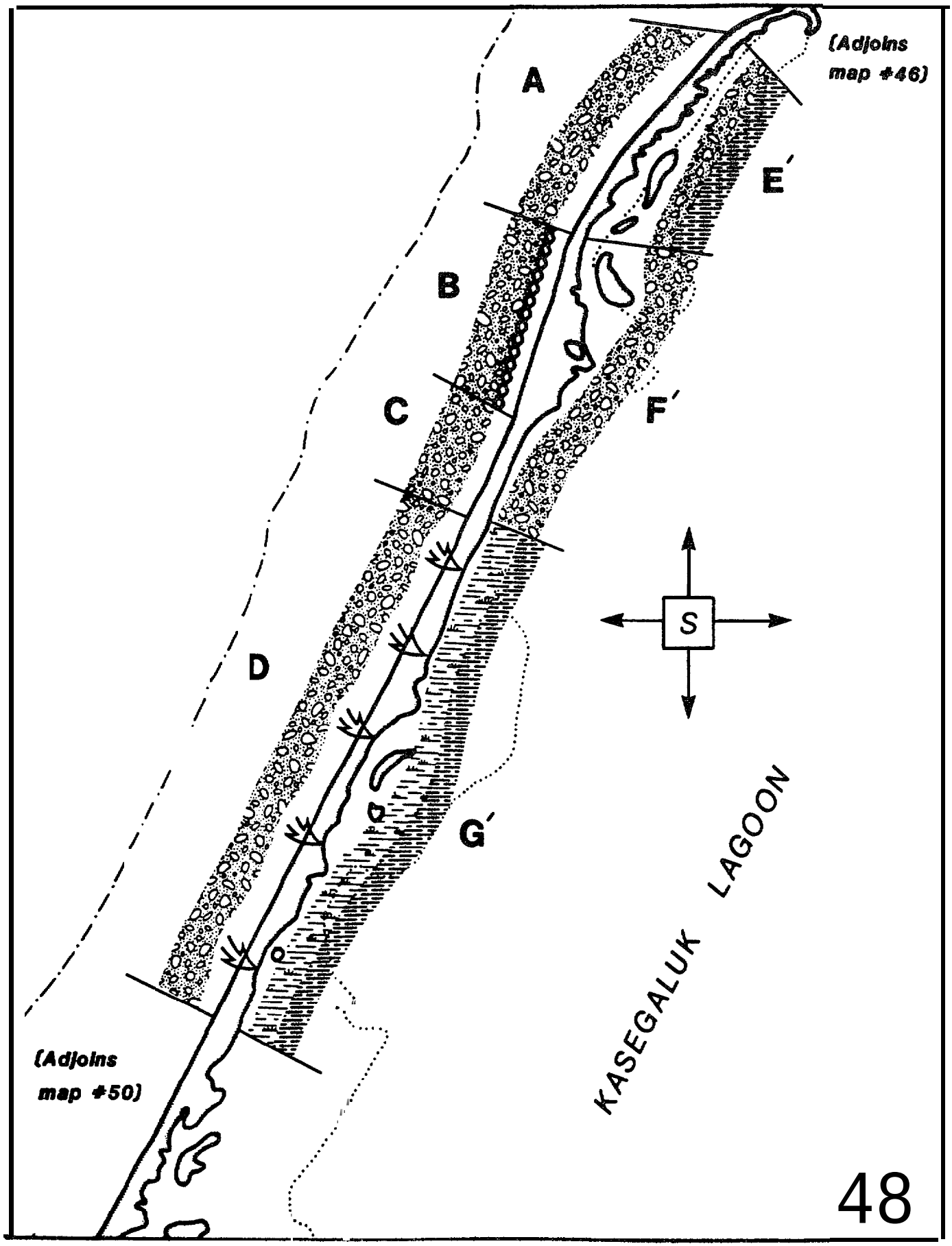
HUMAN USE INDEX



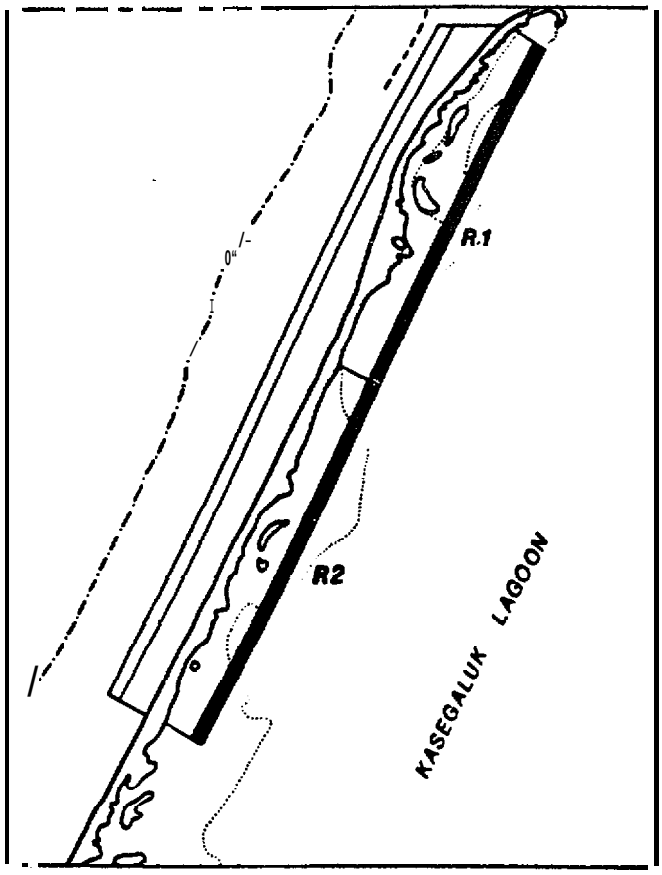
Seasonal Variability of Indices

Identifier	RESOURCE	SEASON: Break-Up/Summer/Freeze-Up May	Jun	Jul	Aug	Sep	Oct	Winter
R1	Delta flats; Wetland							
R2	Protected tundra cliff							
R3	Mudflat; Estuary							
B1	Wetland and mudflats							

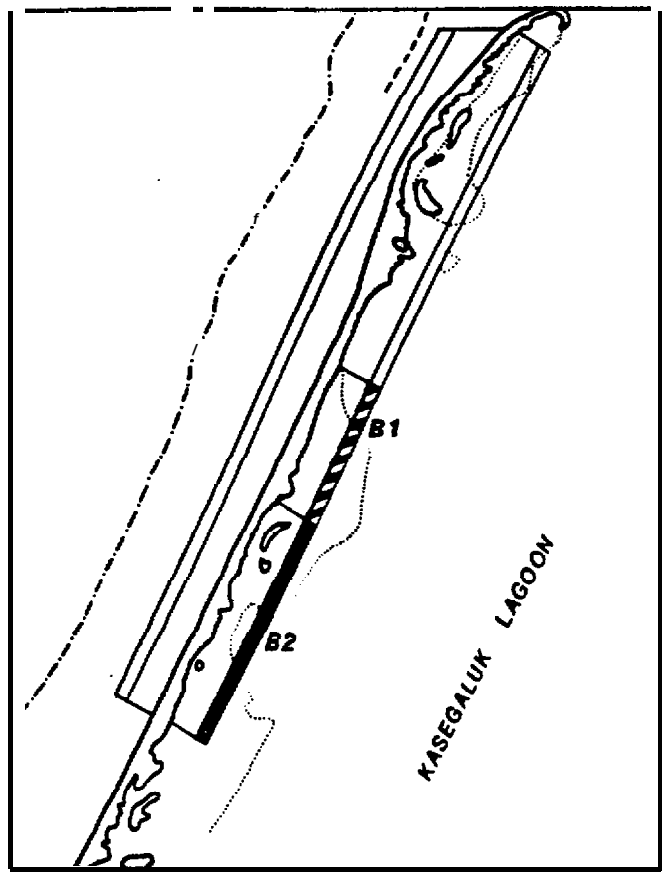
47


(Adjoins map #46)
A
B
C
D
E´
F´
G´
S
KASEGALUK LAGOON
(Adjoins map #50)
48

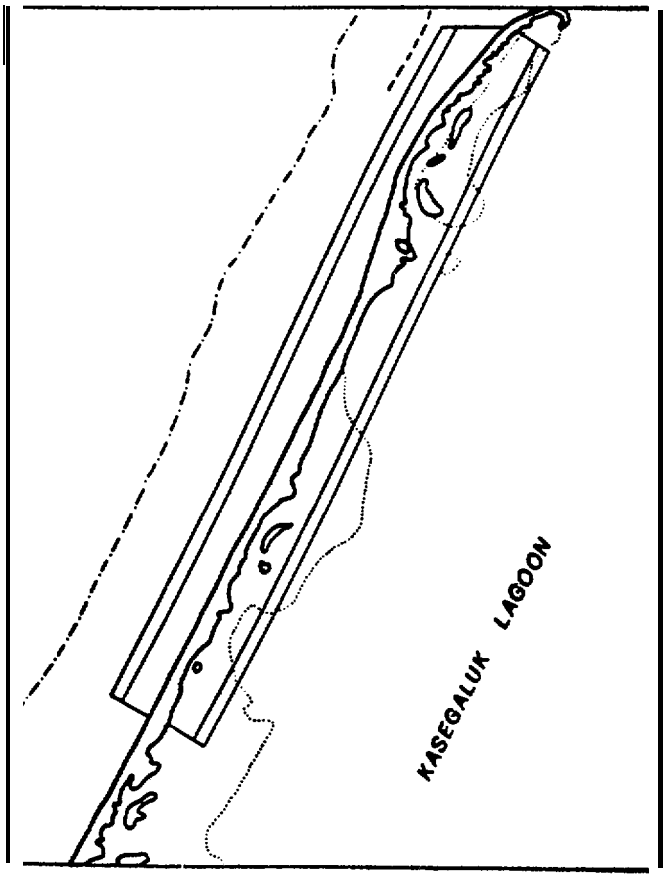
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



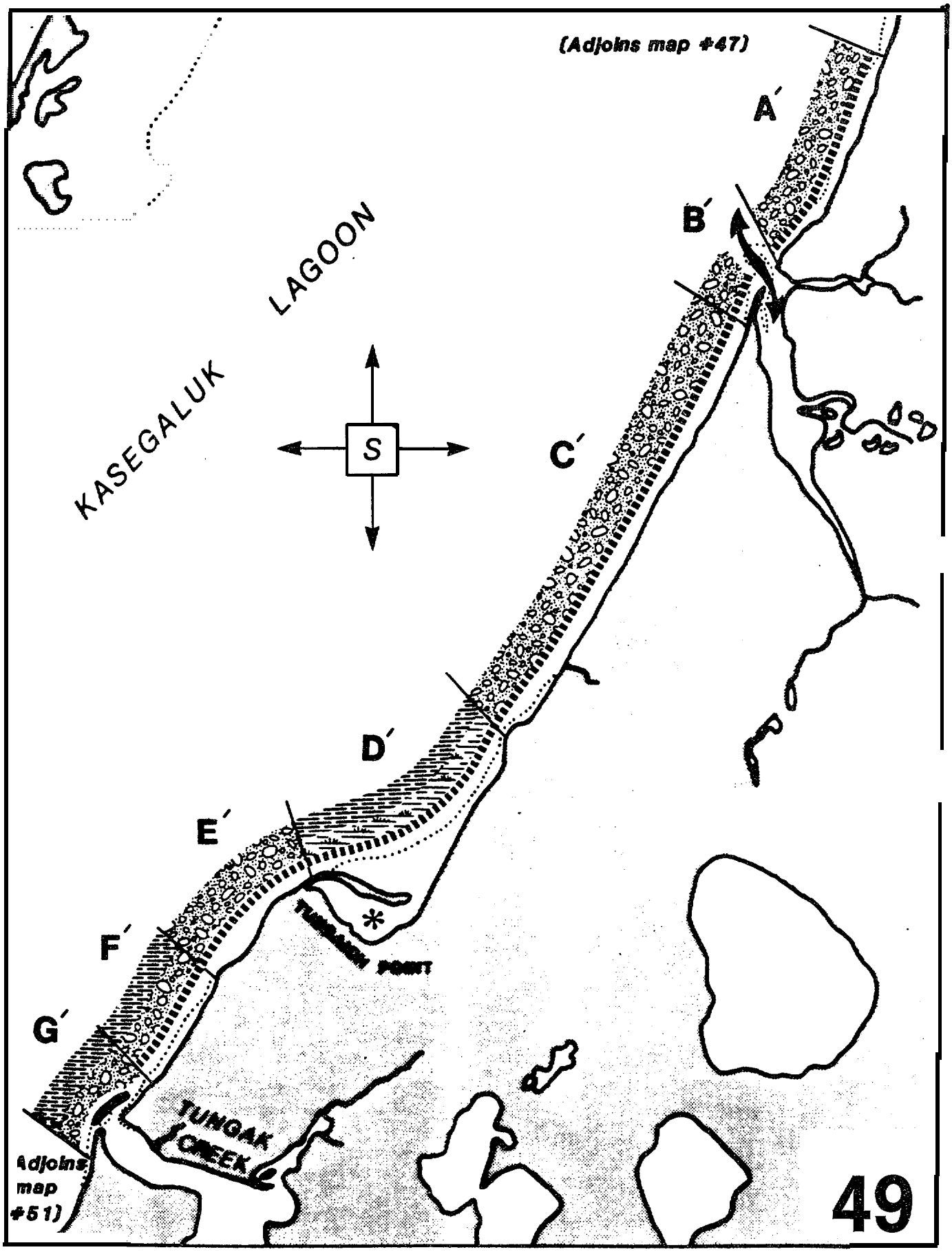
HUMAN USE INDEX



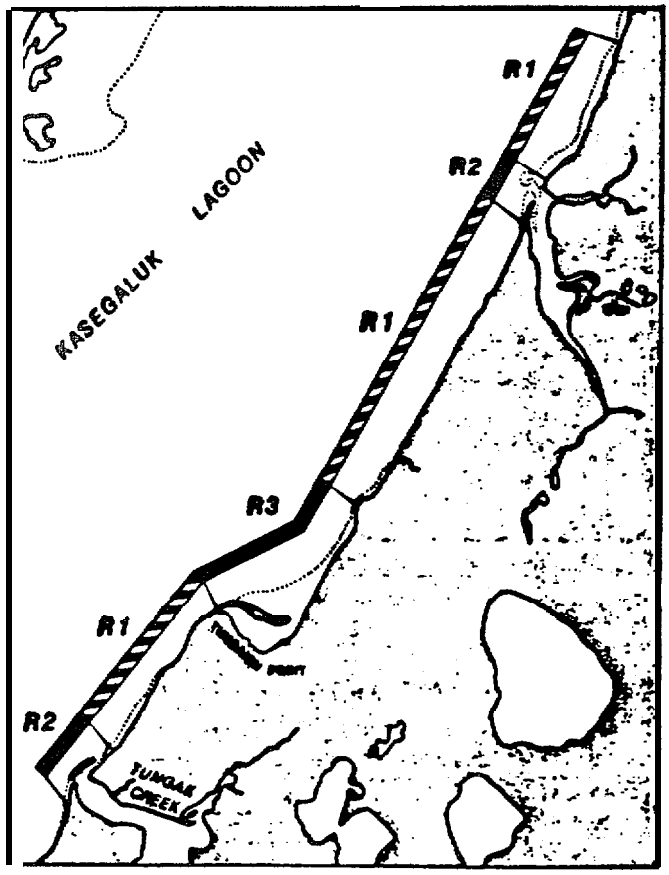
Seasonal Variability of Indices

Identifier	RESOURCE	Winter	SEASON: Break-Up/Summer/Freeze-Up						Winter
			May	Jun	Jul	Aug	Sep	Oct	
R1	Low energy beach			■	■	■	■		
R2	Low energy beach; Wetland			■	■	■	■		
B1	Wetland			▨	▨	▨	▨	▨	
B2	Wetland; Brant and shorebird staging			■	■	■	■	■	

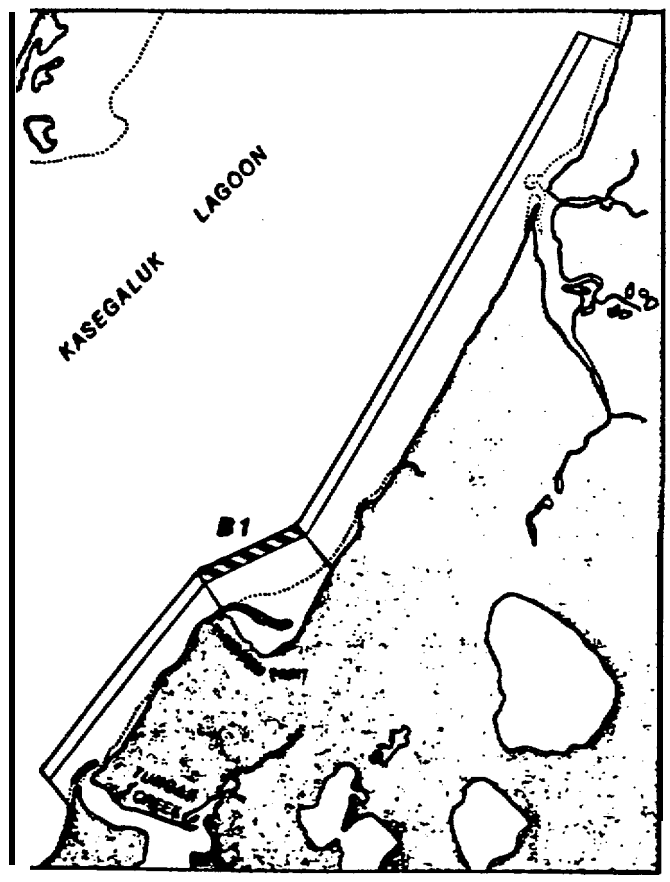
48


(Adjoins map #47)
A´
B´
C´
D´
E´
F´
G´
KASEGALUK LAGOON
S
TUNGAK CREEK
(Adjoins map #51)
49

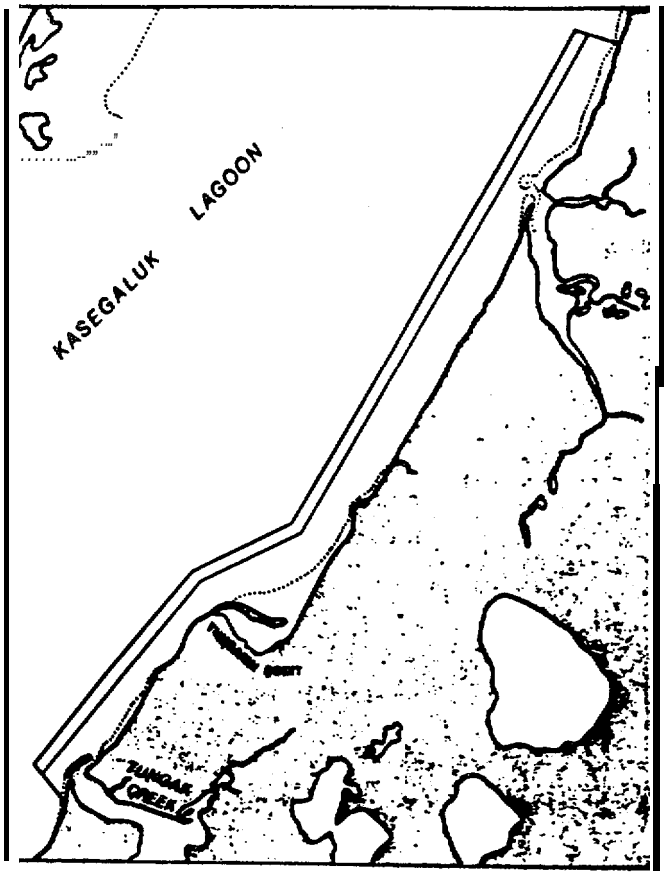
*OIL RESIDENCE **INDEX***



BIOLOGICAL SENSITIVITY INDEX

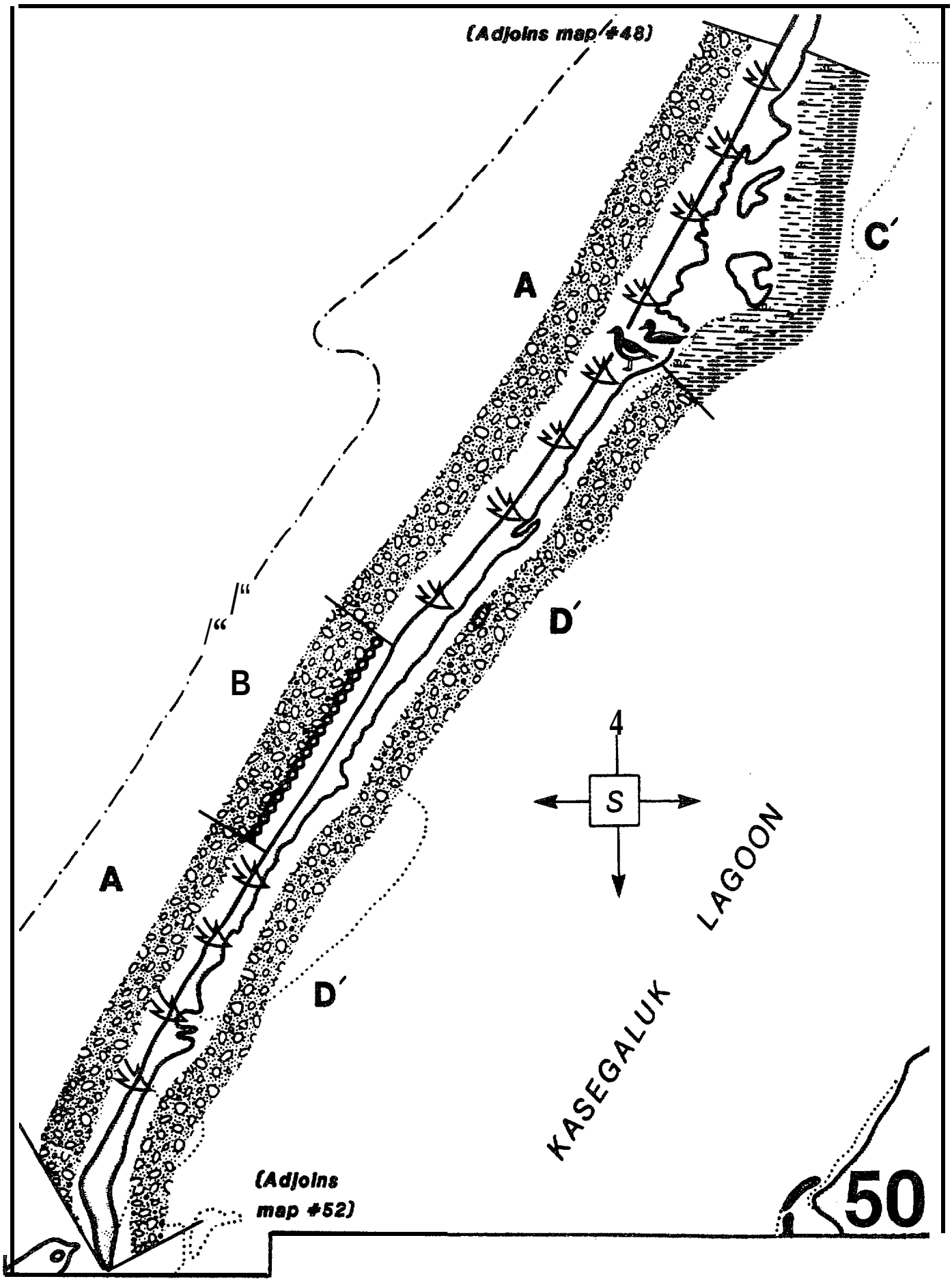


HUMAN USE INDEX

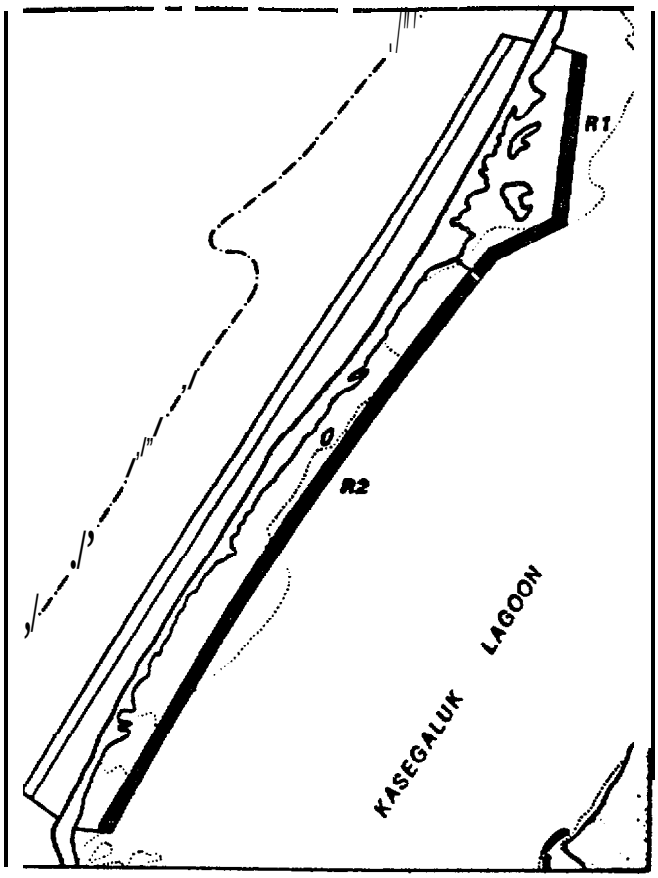


***Seasonal Variability** of* Indices

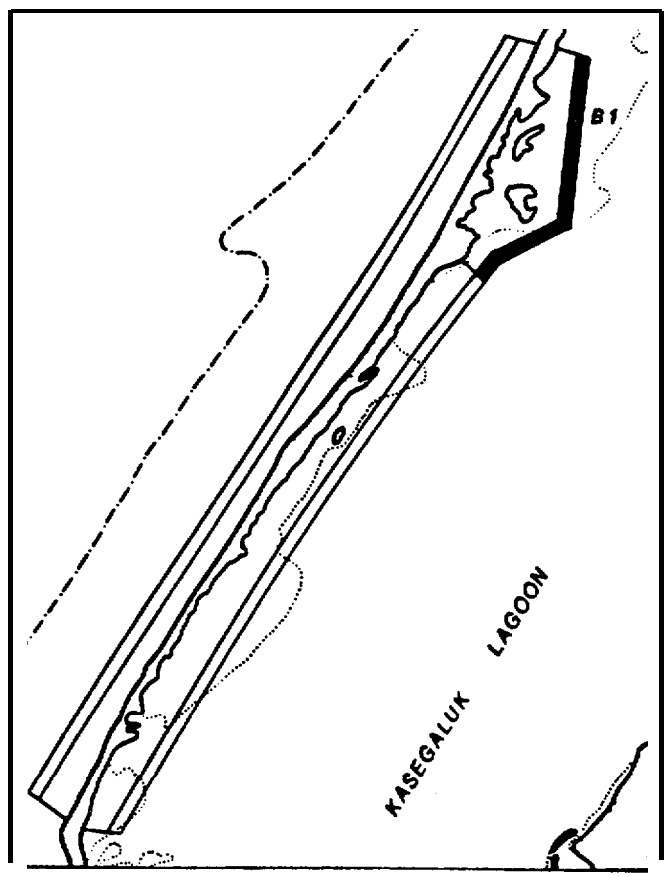
Identifier	RESOURCE	SEASON							
		Winter	Break-Up/Summer/Freeze-Up						Winter
			May	Jun	Jul	Aug	Sep	Oct	
R1	Protected tundra cliff								
R2	Stable Inlet; Estuary								
R3	Lagoon								
B1	Wetland, mudflats and ponds								


(Adjoins map #48)
A
C
B
D
A
D
4
S
KASEGALUK LAGOON
(Adjoins map #52)
50

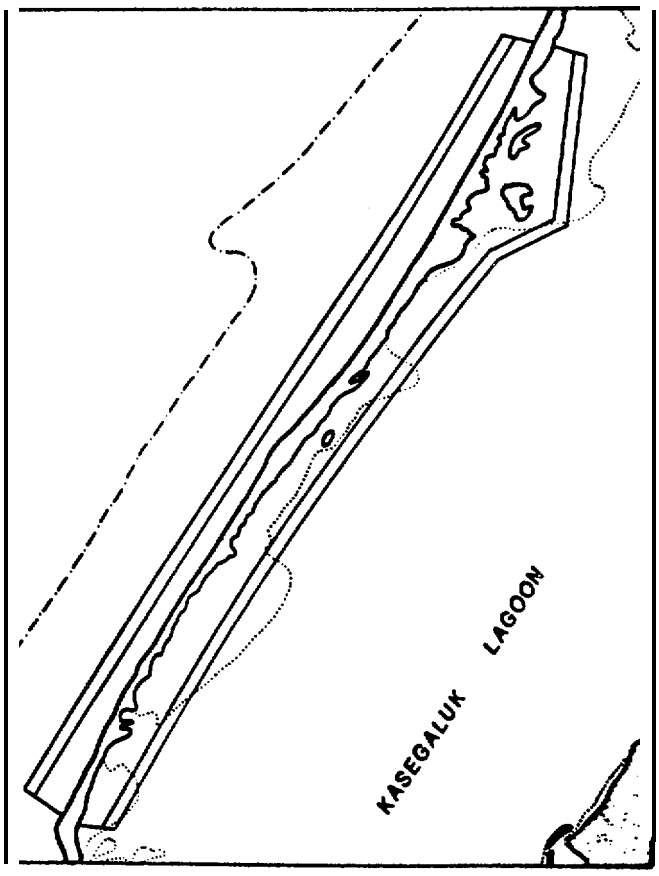
OIL RESIDENCE *INDEX*



BIOLOGICAL SENSITIVITY *INDEX*



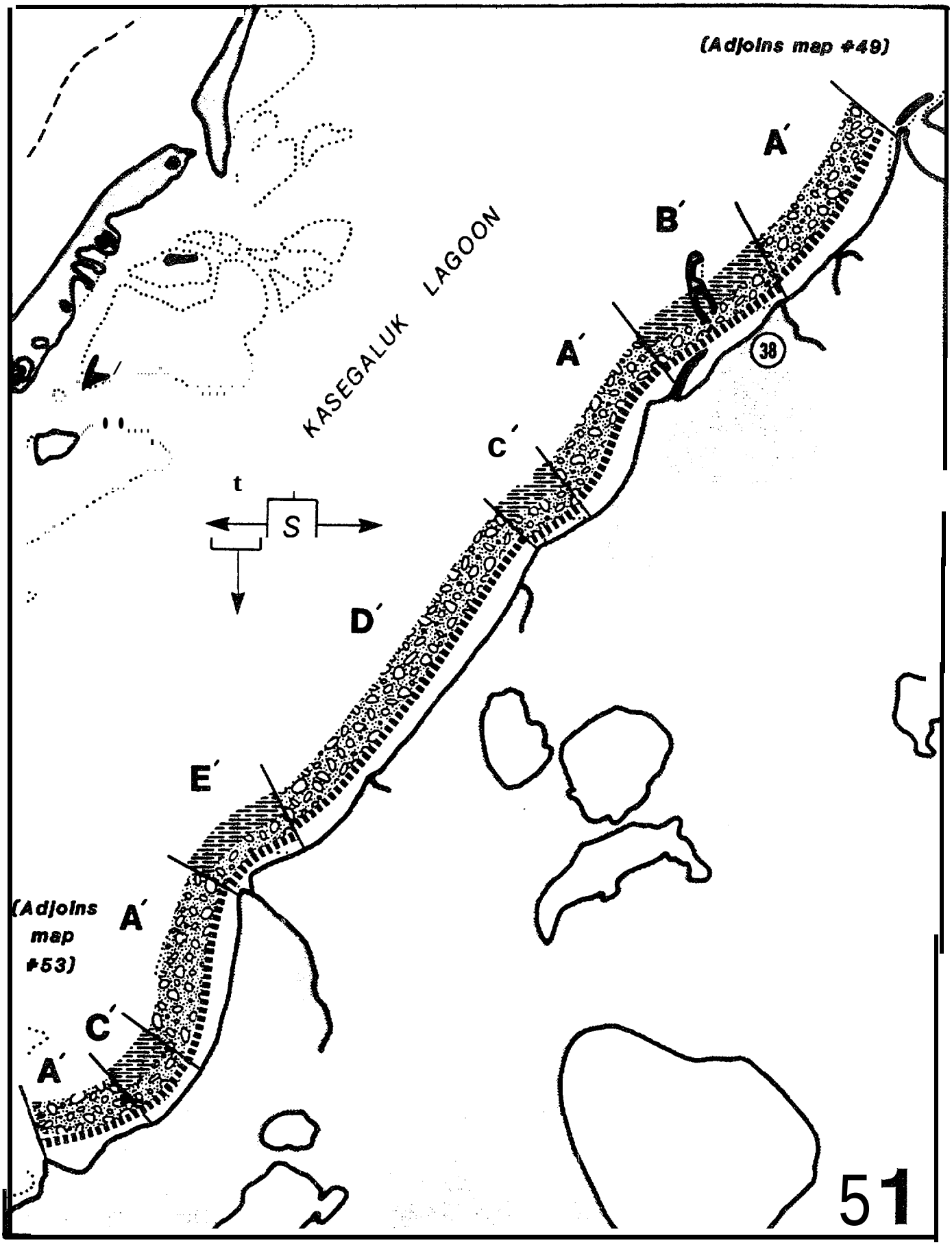
HUMAN USE ***INDEX***



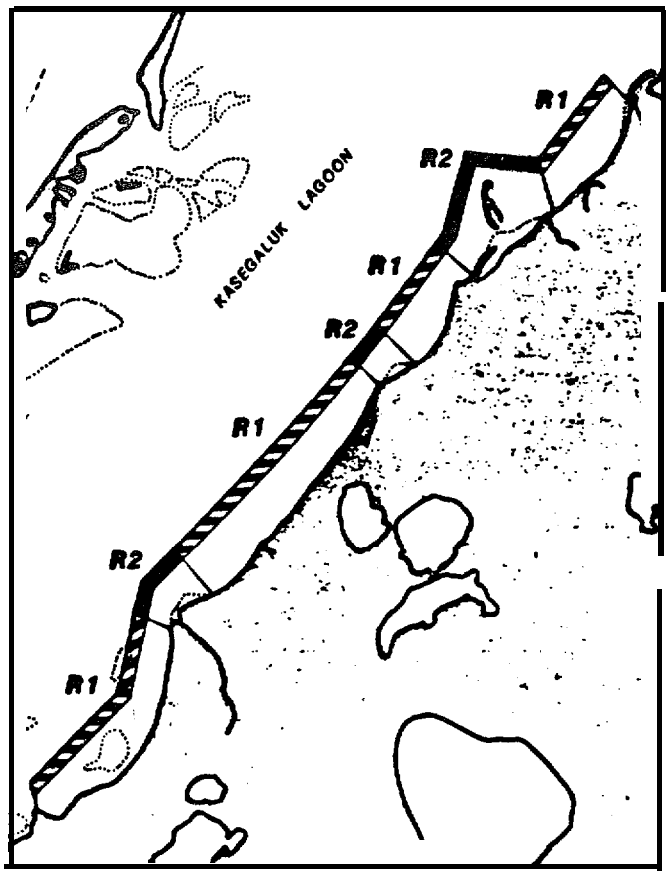
Seasonal ***Variability*** *of* ***Indices***

Identifier	RESOURCE	Winter	SEASON: Break-Up/Summer/Freeze-Up May	Jun	Jul	Aug	Sep	Oct	Winter
R1	Mudflat; Wetland			■	■	■	■		
R2	Mudflat; Low energy beach			■	■	■	■		
B1	Wetland Eider (22 pr), ● rctic tern (16 Pr) ● nd brant (4 pr) nesting			■	■	■	■		

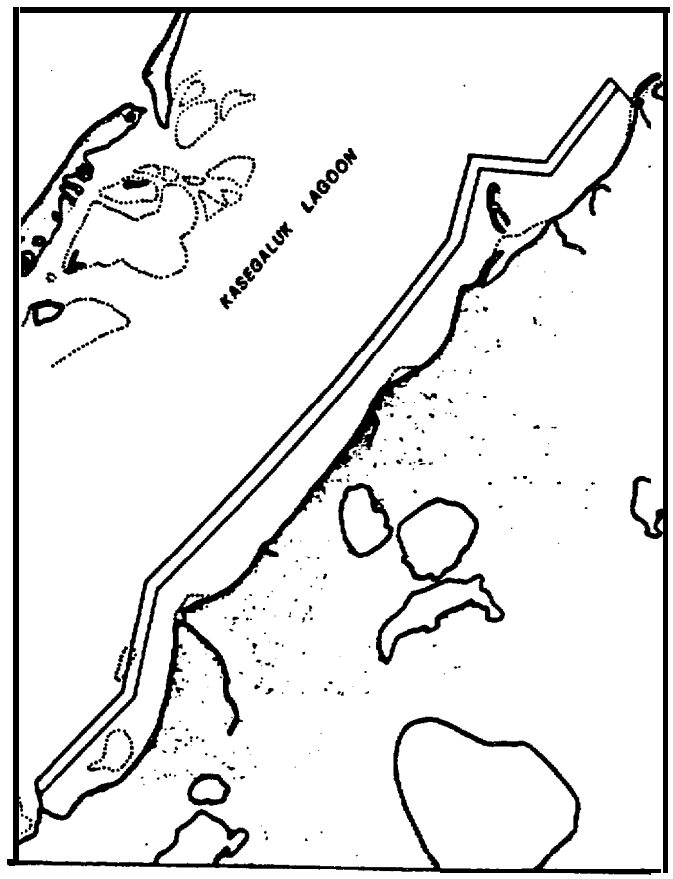
50


(Adjoins map #49)
KASEGALUK LAGOON
A´
B´
A´
C´
D´
E´
A´
C´
A´
38
t
S
(Adjoins map #53)
51

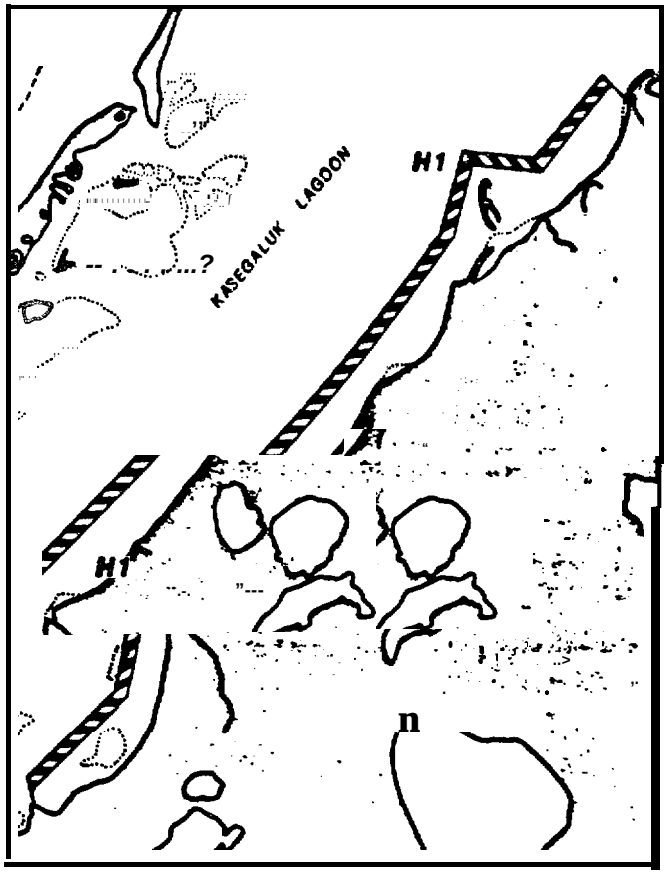
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



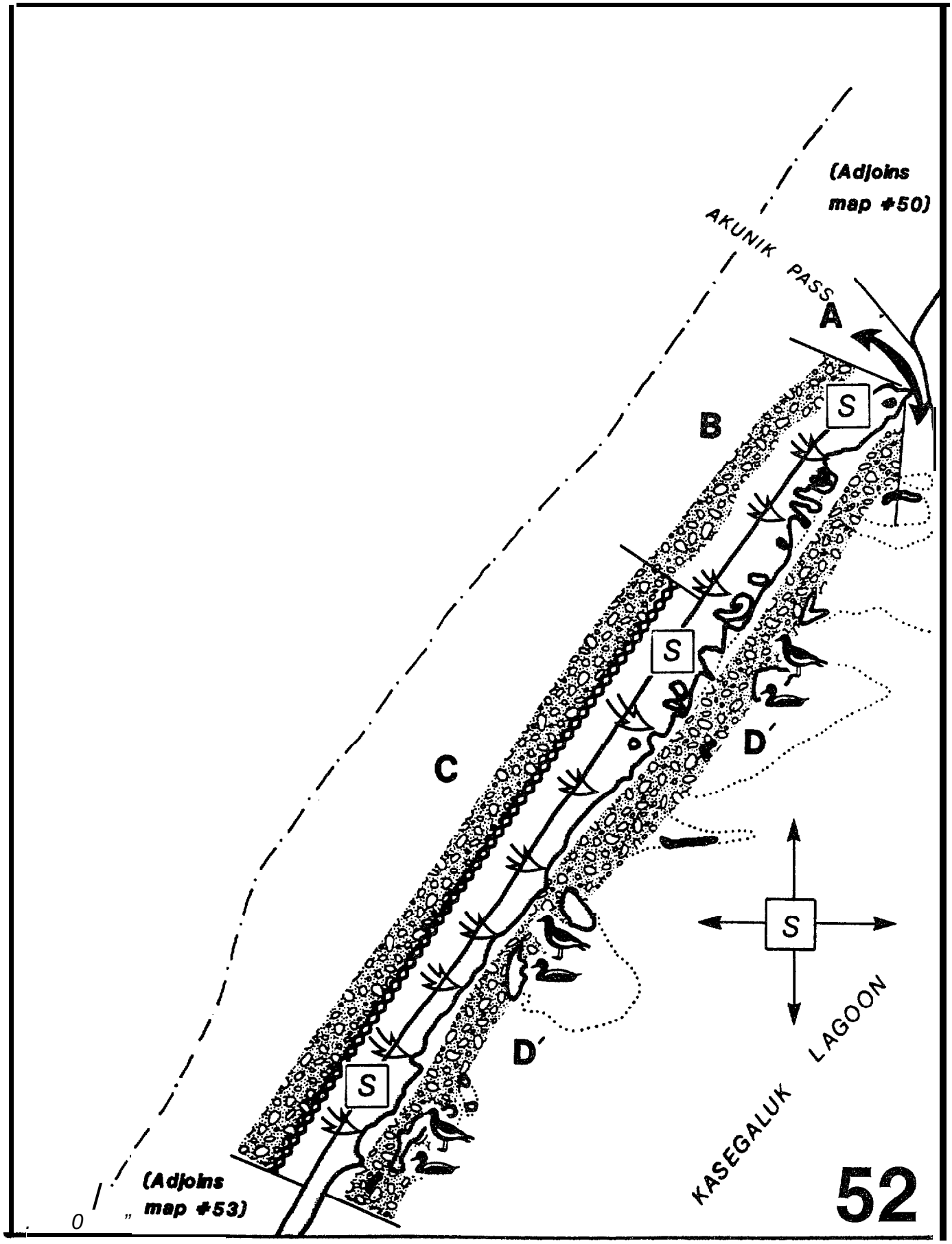
HUMAN USE INDEX



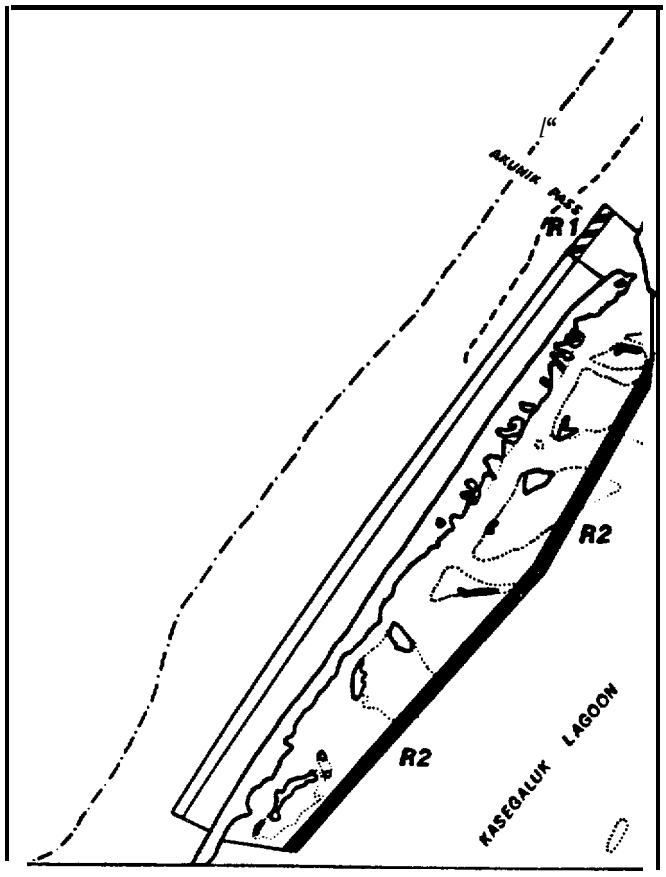
Seasonal Variability of Indices

Identifier	RESOURCE	Winter	SEASON: Break-Up/Summer/Freeze-Up May	Jun	Jul	Aug	Sep	Oct	Winter
R1	Proofed tundra								
R2	Mudflat; lagoon/ estuary								
H1	Waterfowl hunting								

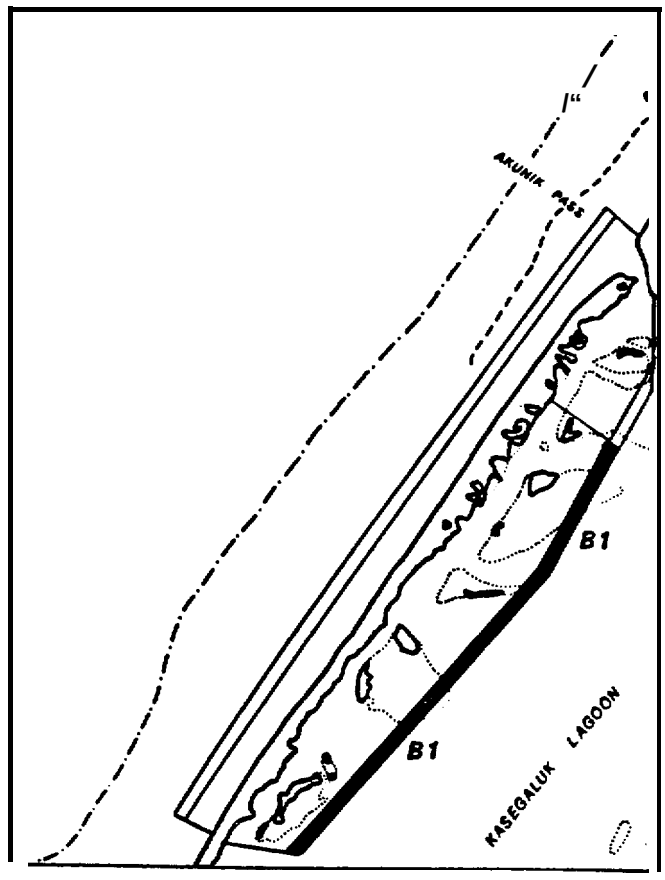
51


(Adjoins
map #50)
AKUNIK PASS
A
B
S
S
C
D´
D´
S
S
KASEGALUK LAGOON
(Adjoins
map #53)
0
52

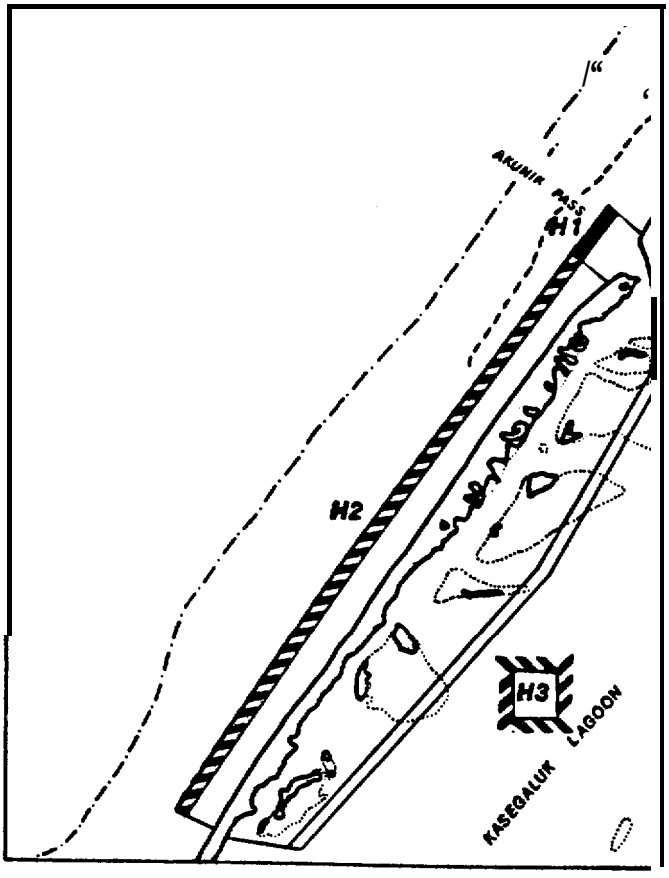
OIL *RESIDENCE INDEX*



BIOLOGICAL SENSITIVITY **INDEX**

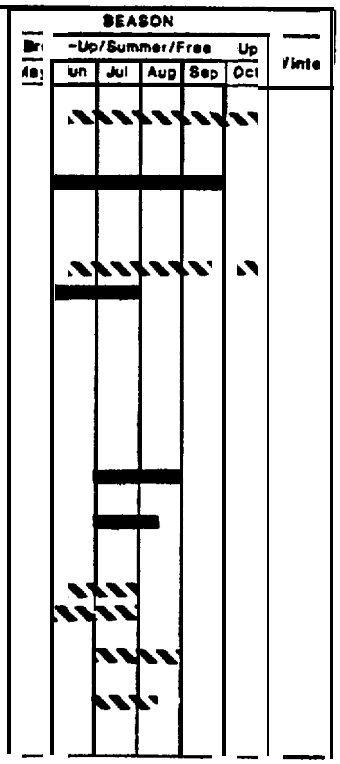


HUMAN USE **INDEX**

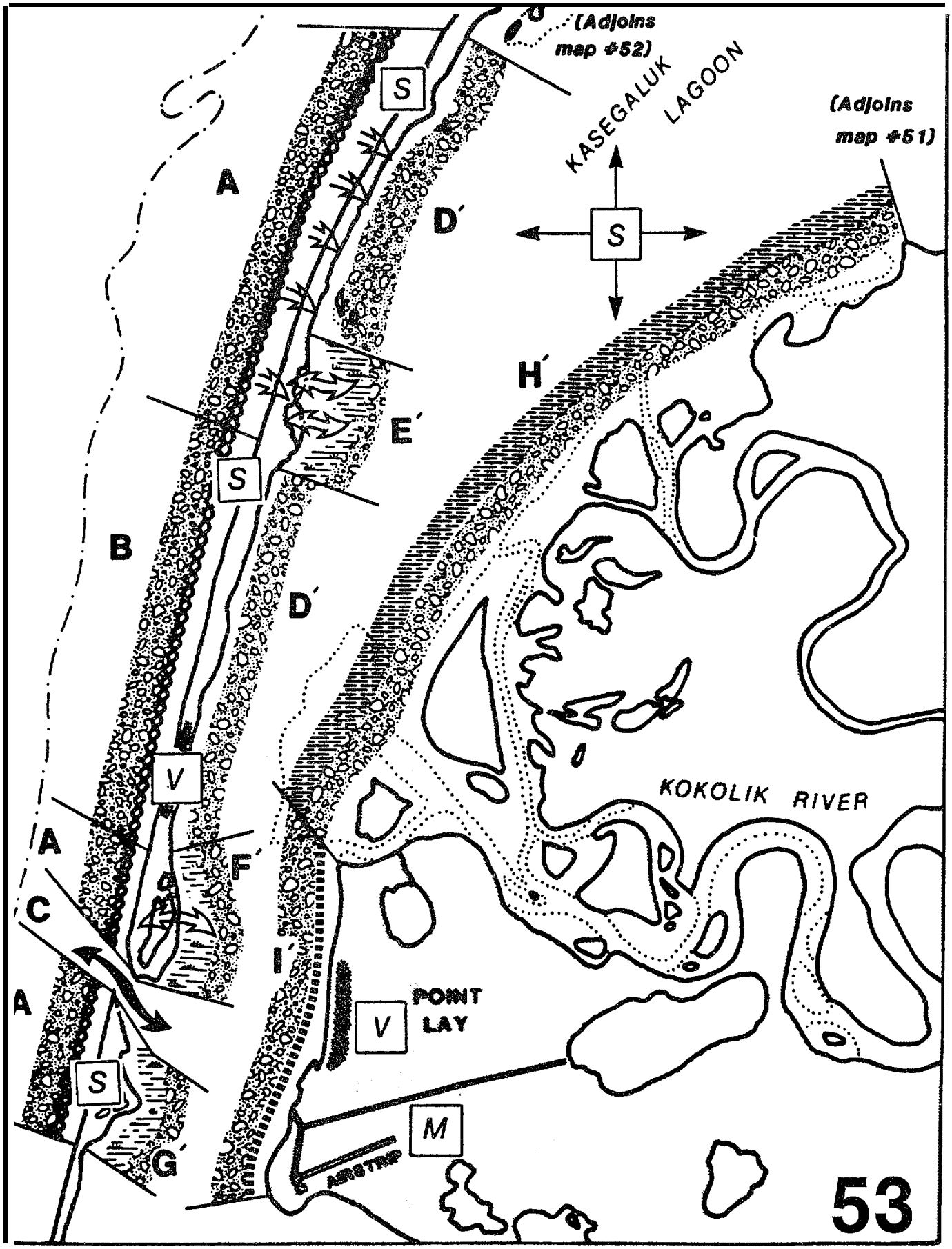


Seasonal Variability *of Indices*

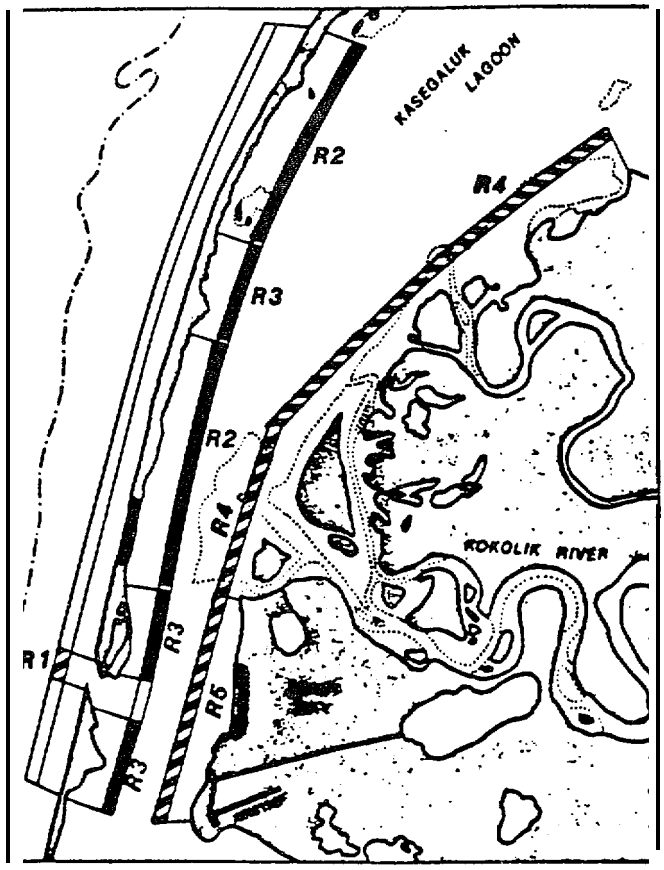
Sensitivity	RESOURCE
R1	Permanent inlet; Recurve spits
R2	Low energy beach; Some wetlands
B1	Wetland Eider (28 pr), arctic tam (S4 pr), gull (4 w), brant (4 pr), oldsquaw (6 pr) nesting on islands
H1	Spotted seal hunting Beluga whale hunting
H2	Waterfowl hunting Egg gathering
H3	Spotted seal hunting Beluga whale hunting



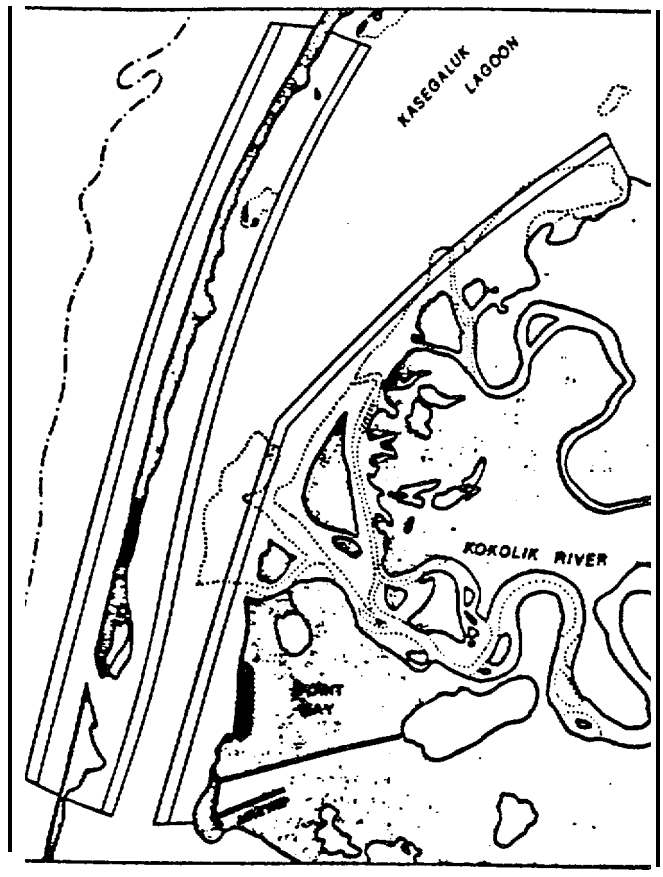
52


(Adjoins map #52)
KASEGALUK LAGOON
(Adjoins map #51)
S
A
D´
S
E´
H´
S
B
D´
V
KOKOLIK RIVER
A
F´
C
I´
A
POINT LAY
V
S
M
G´
AIRSTRIP
53

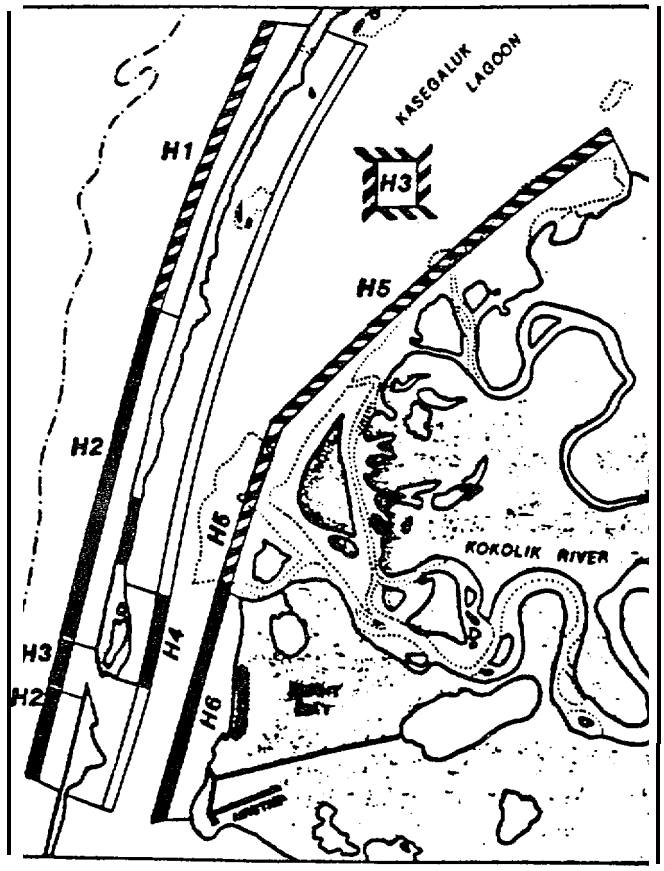
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



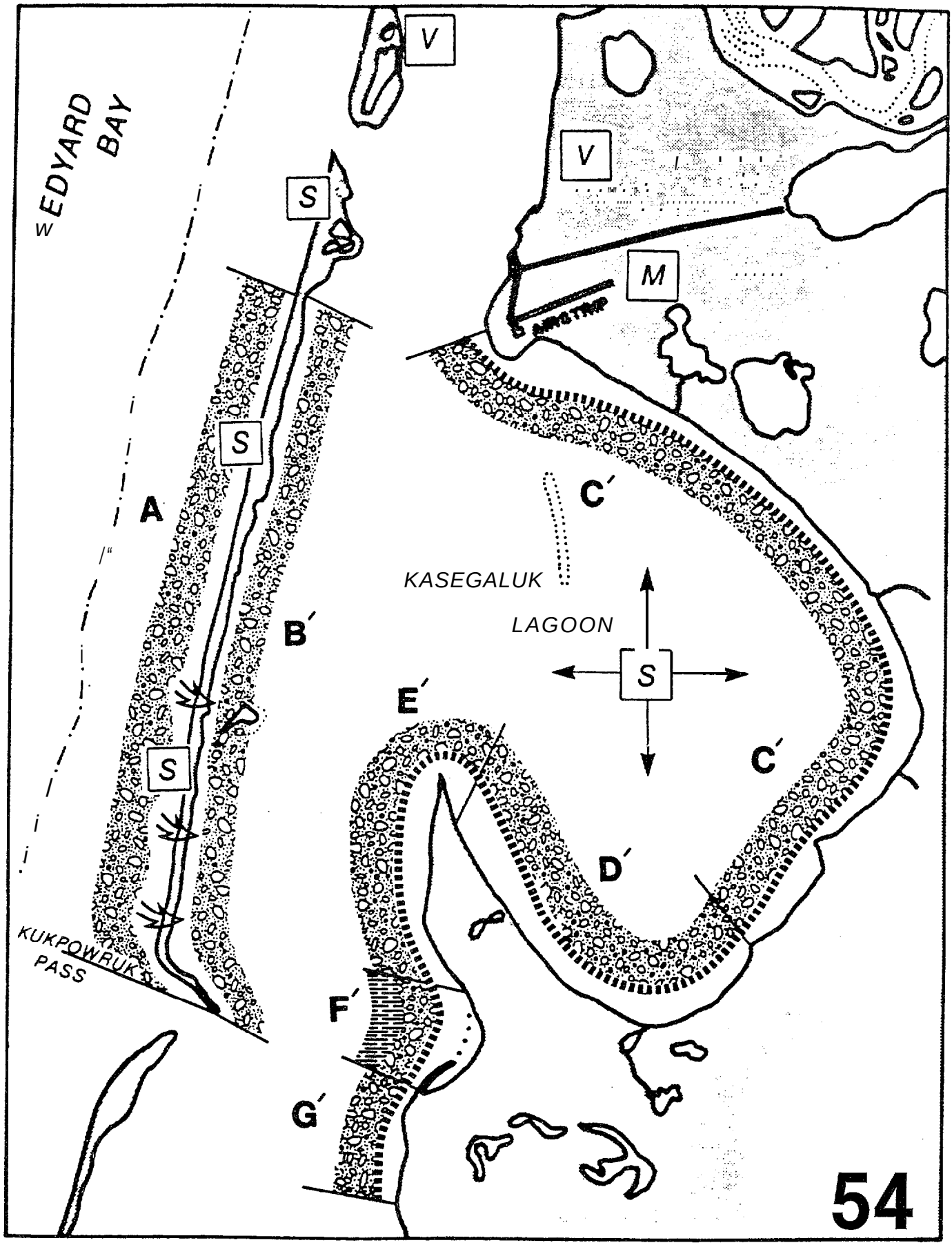
HUMAN USE INDEX



Seasonal Variability of Indices

Identifier	RESOURCE	Winter	SEASON: Break-Up/Summer/Freeze-Up May	Jun	Jul	Aug	Sep	Oct	Winter
R1	Permanent inlet; Recurve spits								
R2	Low energy beach								
R3	Low energy beach; Wetland								
R4	Delta front; Wetland								
R5	Protected tundra cliff								
H1	Waterfowl hunting Egg gathering								
H2	Seasonal village Subsistence access Waterfowl hunting Egg gathering								
H3	Beluga whale hunting Spotted seal *hunting*								
H4	Beluga landing and harvesting area								
H5	Waterfowl hunting Fishing								
H6	Village of Point Lay Subsistence access								

53


EDYARD BAY
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M
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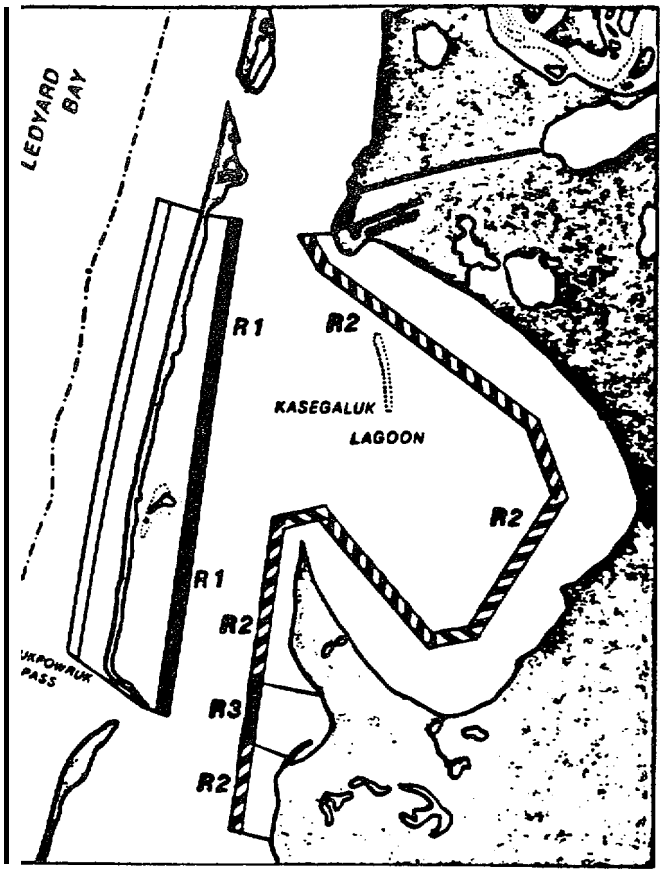
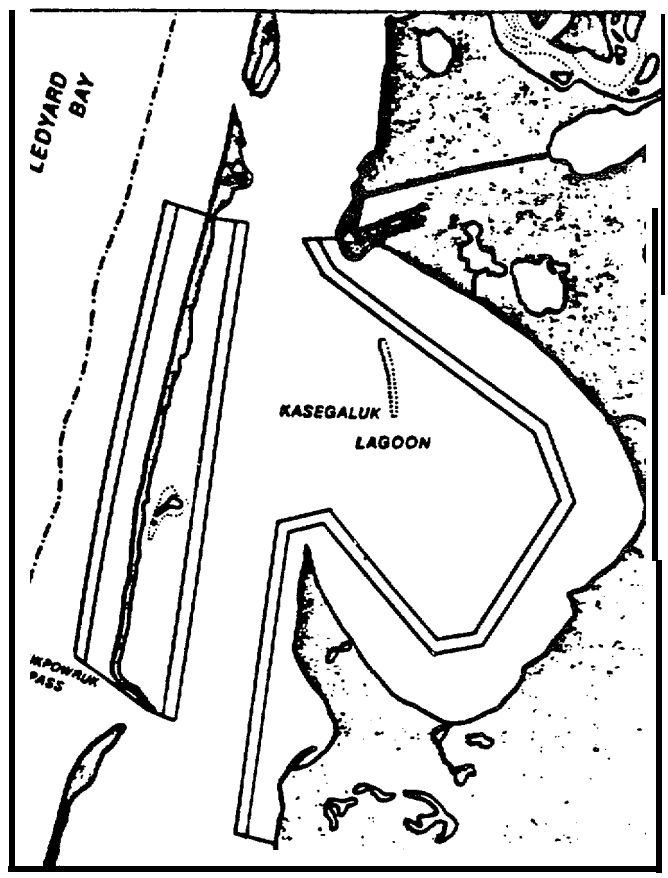
C´
C´
D´
E´
F´
G´
KASEGALUK
LAGOON
KUKPOWRUK
PASS
54

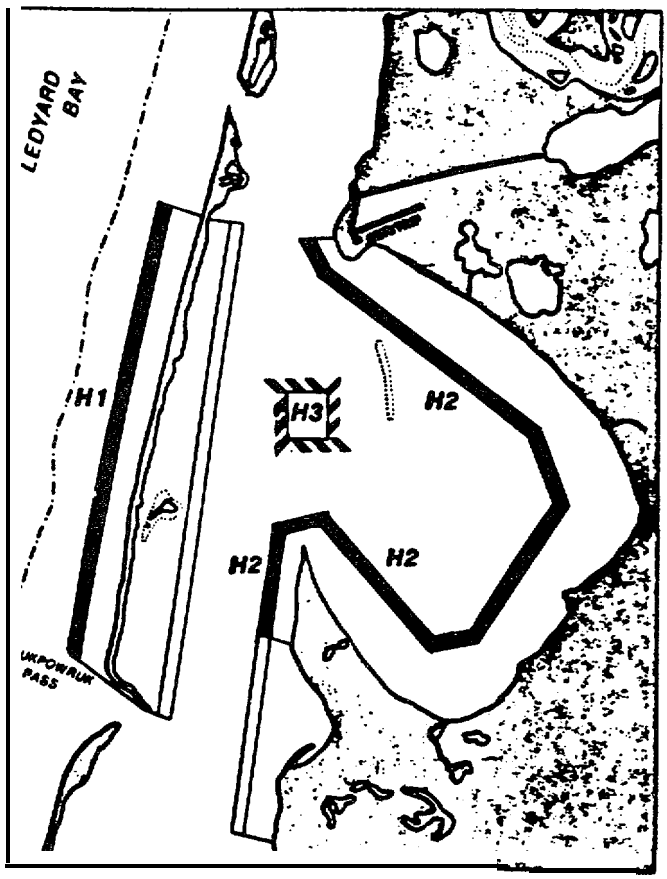
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



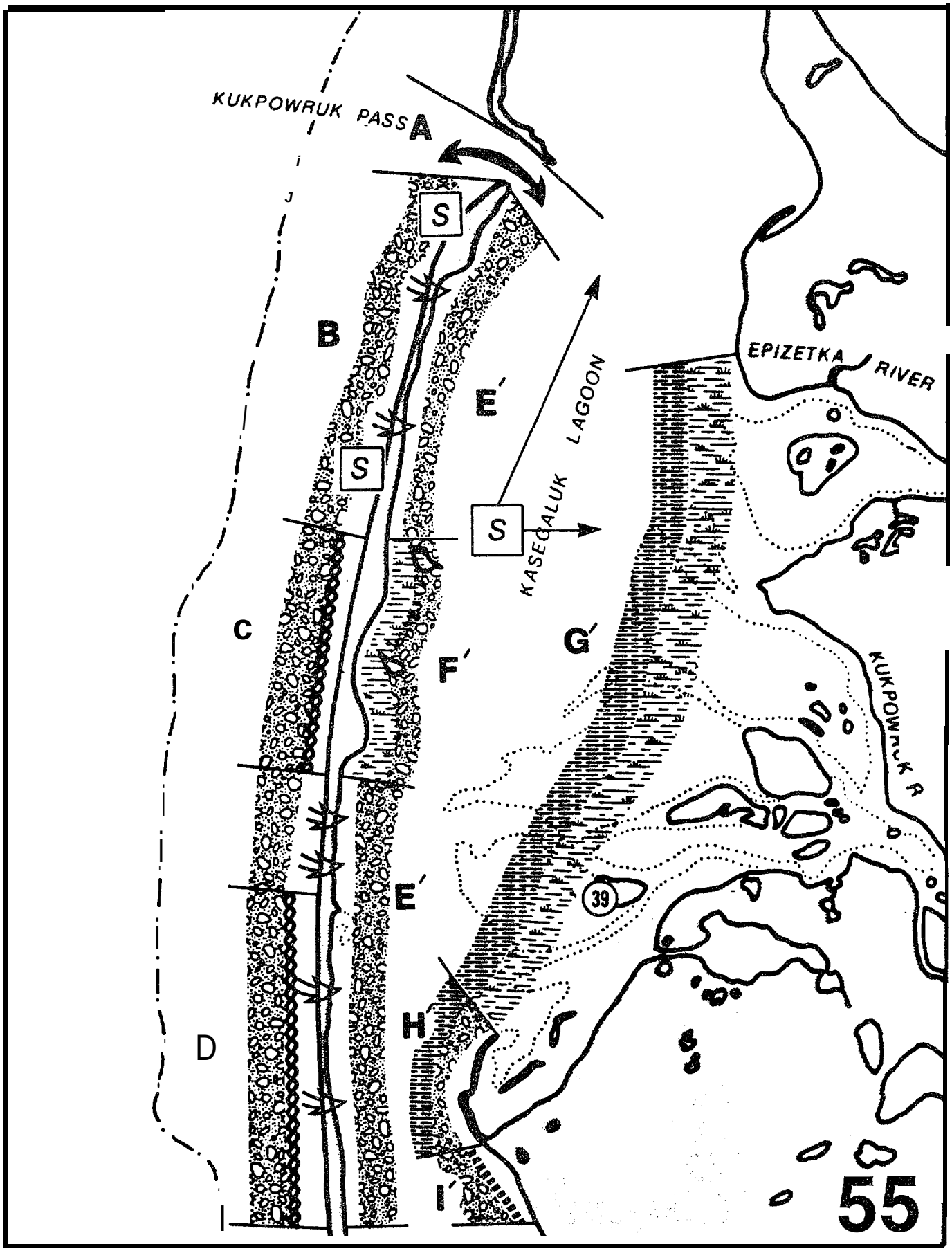
HUMAN USE INDEX



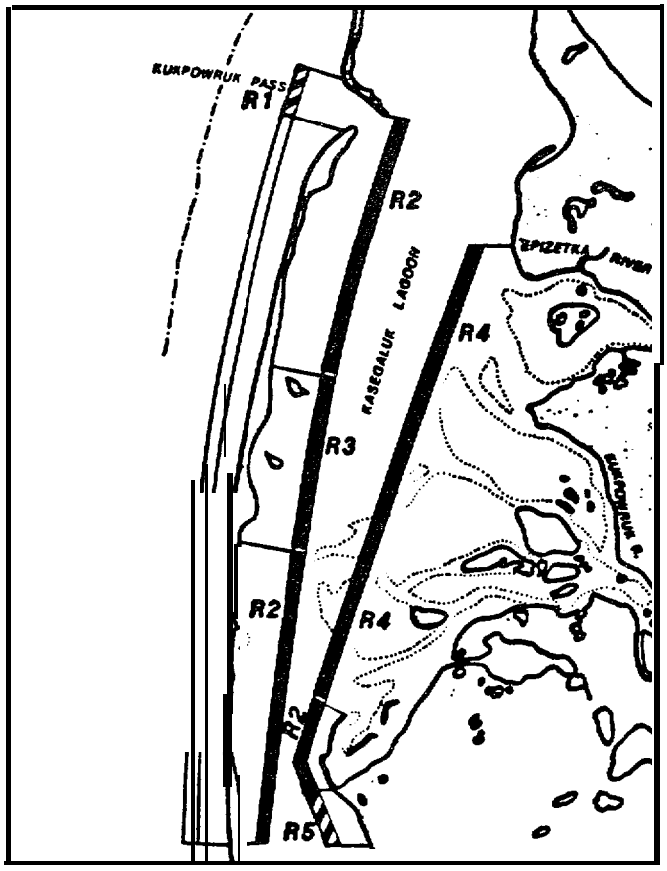
*Seasonal **Variability** of Indices*

flor	RESOURCE	Winter	SEASON: Break-Up/Summer/Freeze-Up May	Jun	Jul	Aug	Sep	Oct	Winte
R1	Lou energy beach								
R2	Protected tundra cliff								
R3	Small lagoon								
H1	Egg gathering								
H2	Waterfowl hunting								
H3	Fishing								

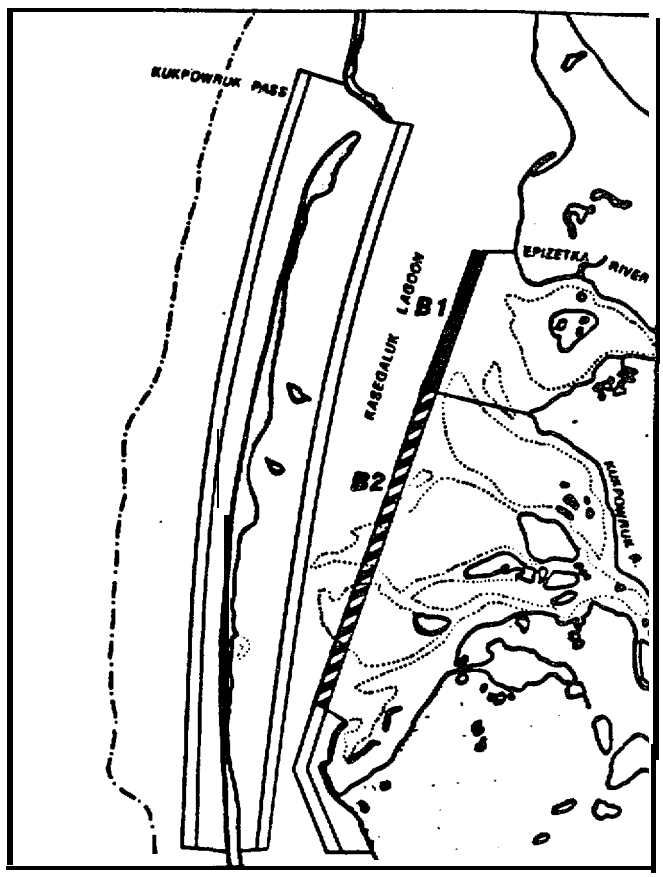
54


KUKPOWRUK PASS
A
S
B
E´
S
KASEGALUK LAGOON
S
EPIZETKA RIVER
C
F´
G´
KUKPOWRUK R
E´
39
H
D
I´
55

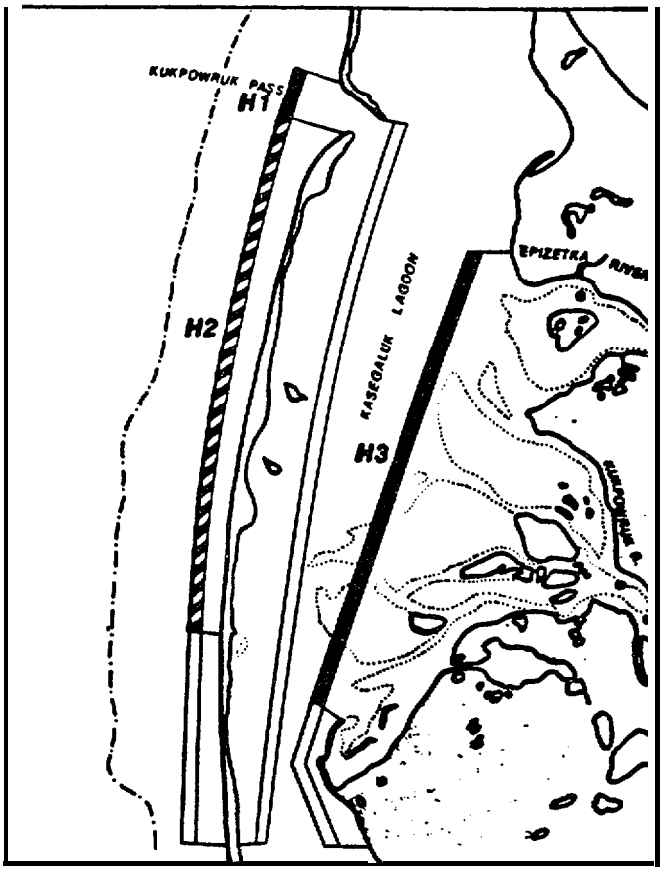
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



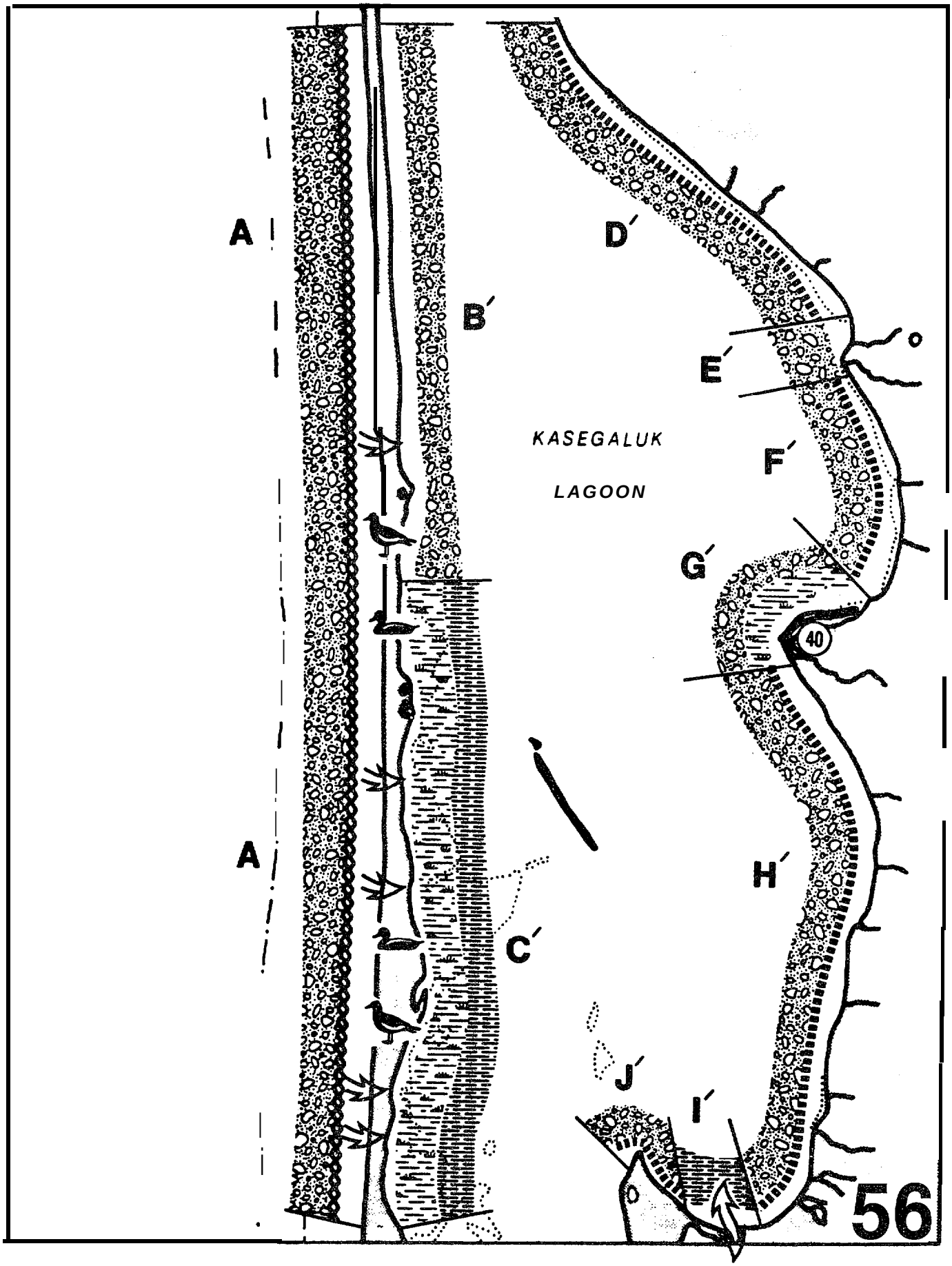
HUMAN USE INDEX



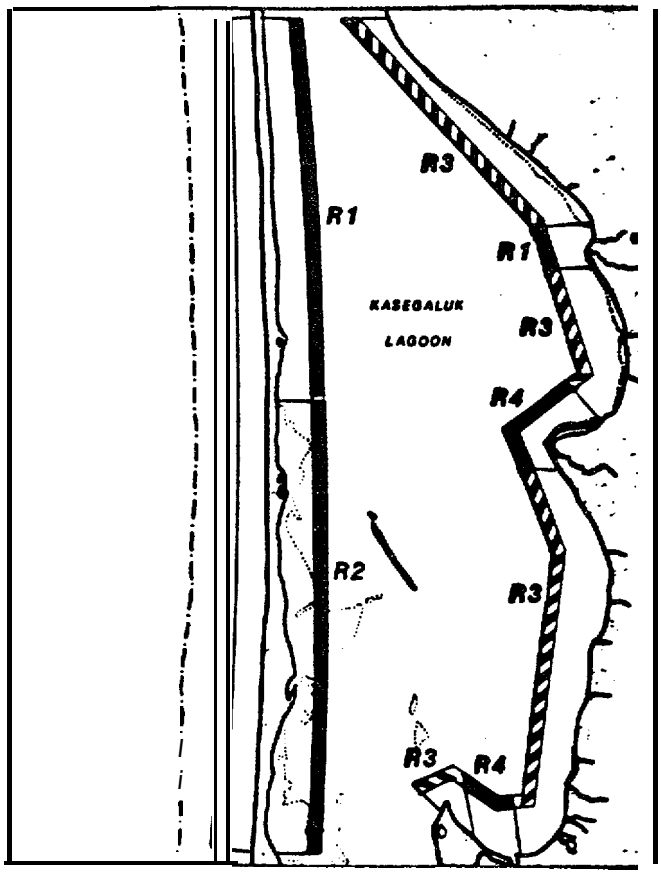
Seasonal Variability of Indices

Identifier	RESOURCE	Winter	SEASON: Break-Up/Summer/Freeze-Up (May Jun Jul Aug Sep Oct)
R1	Stable Inlet; Recurve spits		
R2	Low energy bath		
R3	Low energy beach; Wetland		
R4	Tidal flats; delta wetlands		
R5	Protected tundra cliff		
B1	Wetland and mudflats		
B2	Mudflats with some wetland		
H1	Beluga whale hunting; Spotted seal hunting		
H2	Egg gathering		
H3	Waterfowl hunting		

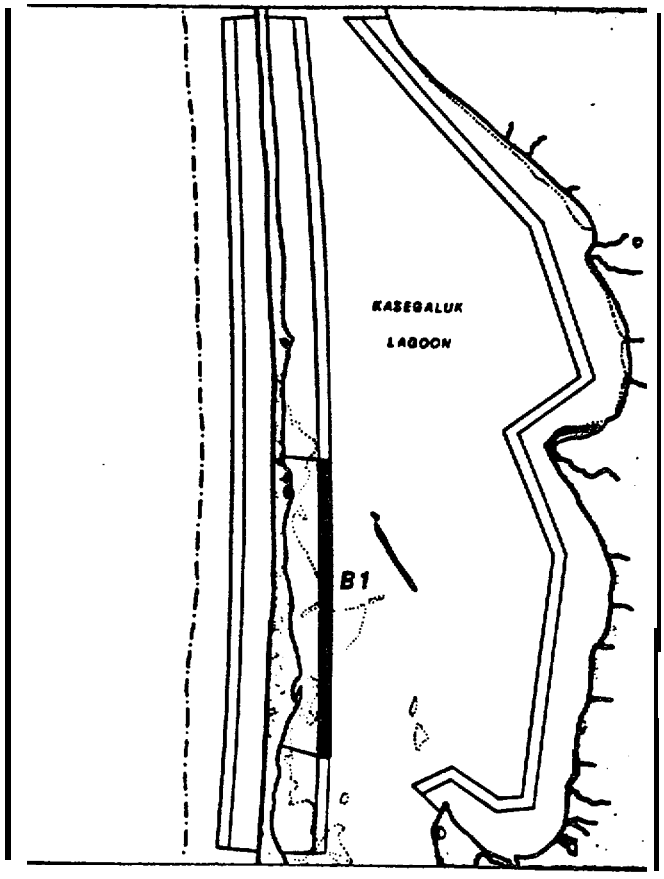
55


A
A
B´
C´
D´
E´
F´
G´
H´
I´
J´
KASEGALUK
LAGOON
40
56

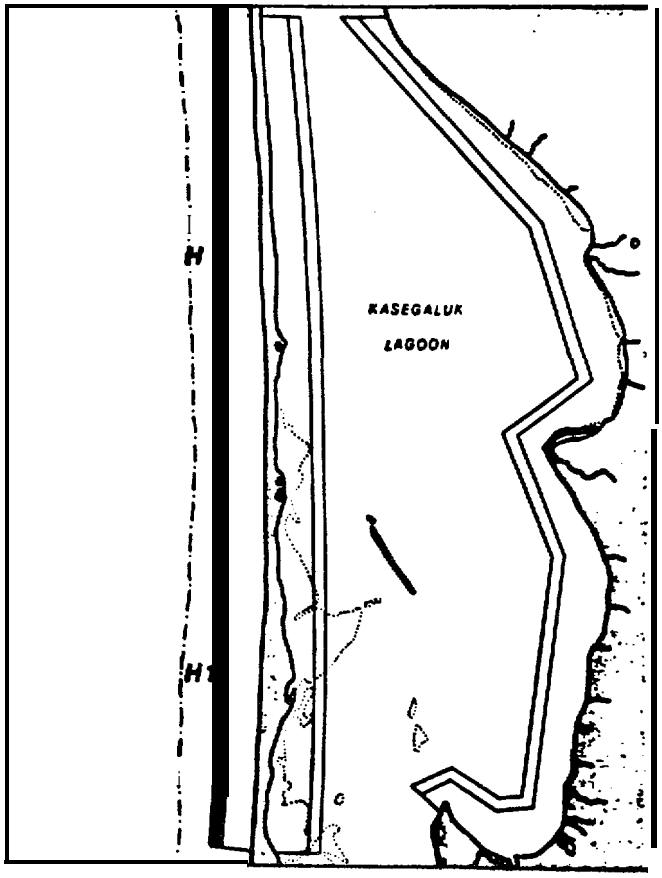
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



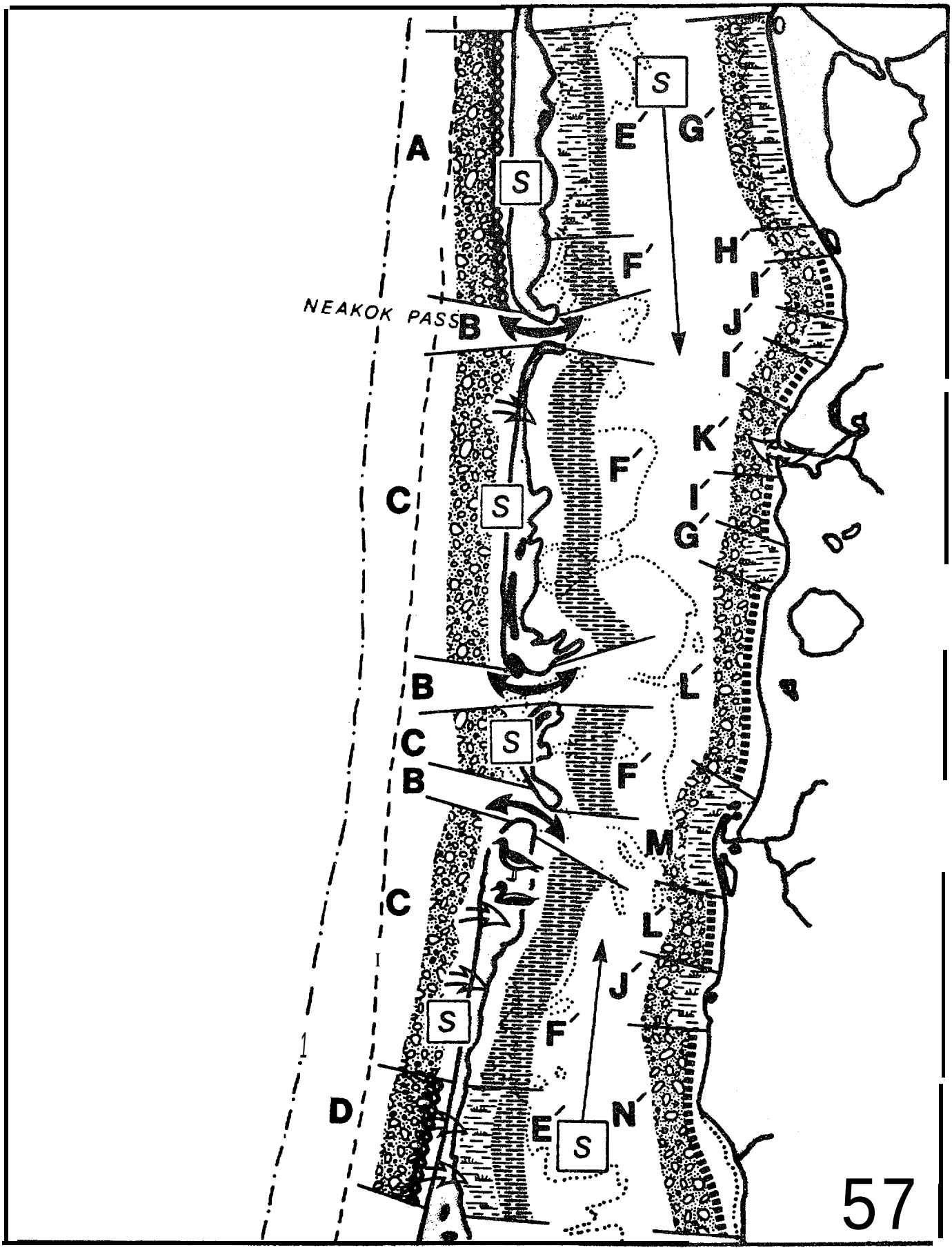
HUMAN USE INDEX



Seasonal Variability of Indices

Identifier	RESOURCE	BEAUFORT Winter	Break-Up/Summer/Freeze-Up May	Jun	Jul	Aug	Sep	Oct	Winter
R1	Low Energy beach								
R2	Tidal flats; Wetland								
R3	Protected tundra cliff								
R4	Tidal flats; Ephemeral Inlet; Lagoon								
B1	Wetland Eider (8 pr), arctic tern (28 pr), oldsquaw (2 pr) nesting								
H1	Beluga whale hunting Spotted seal hunting Fishing								

56


NEAKOK PASS
A
B
C
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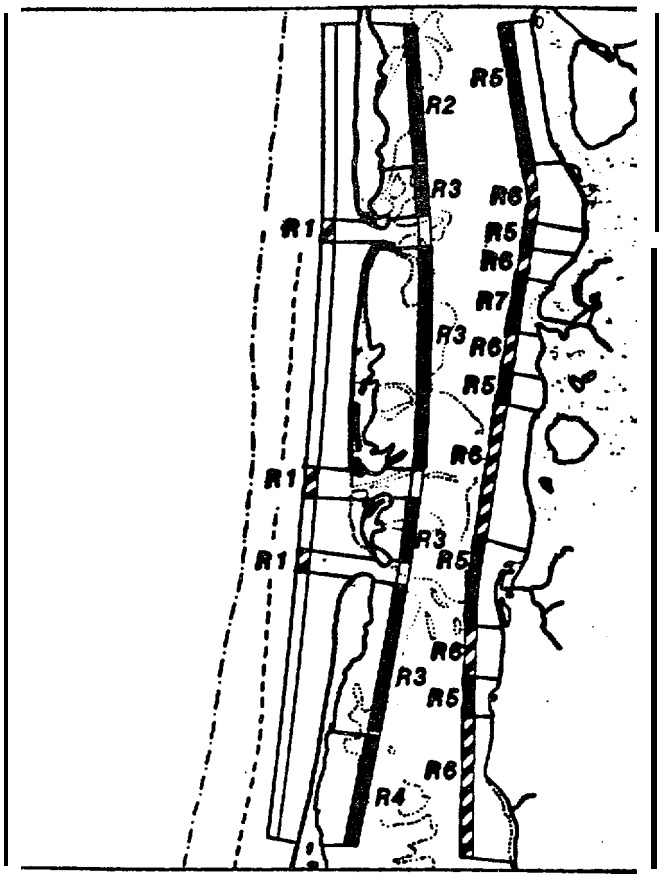
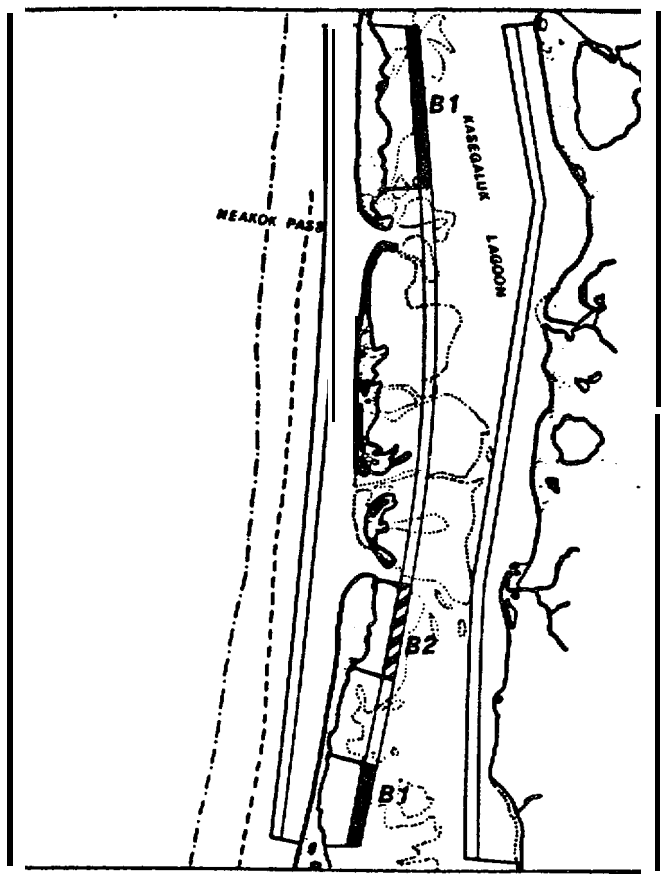
G
H
I
J
K
L
M
N
S
57

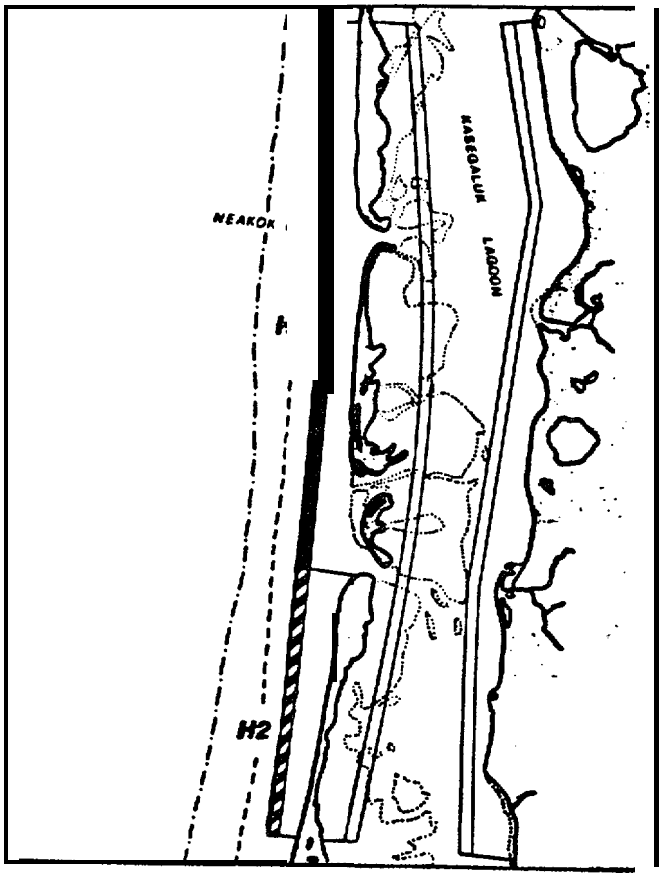
*OIL **RESIDENCE** INDEX*



*BIOLOGICAL **SENSITIVITY INDEX***

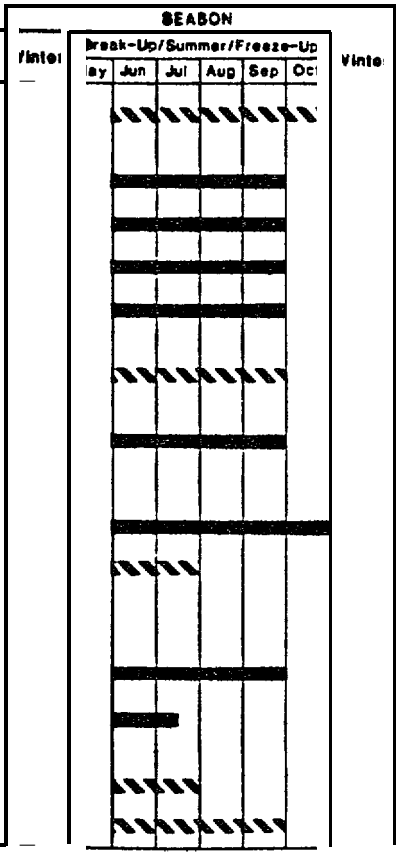


HUMAN USE INDEX

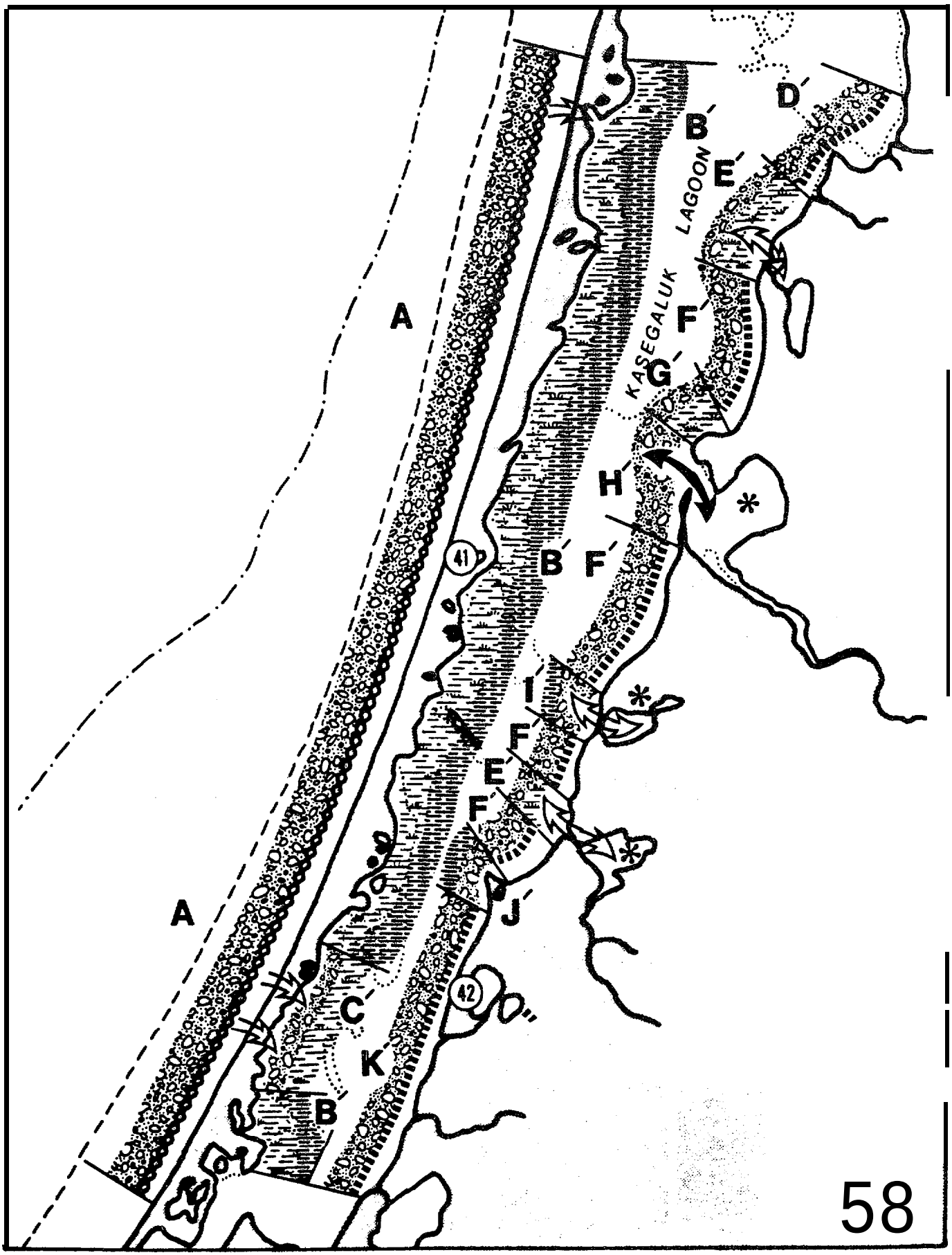


***Seasonal Variability** of indices*

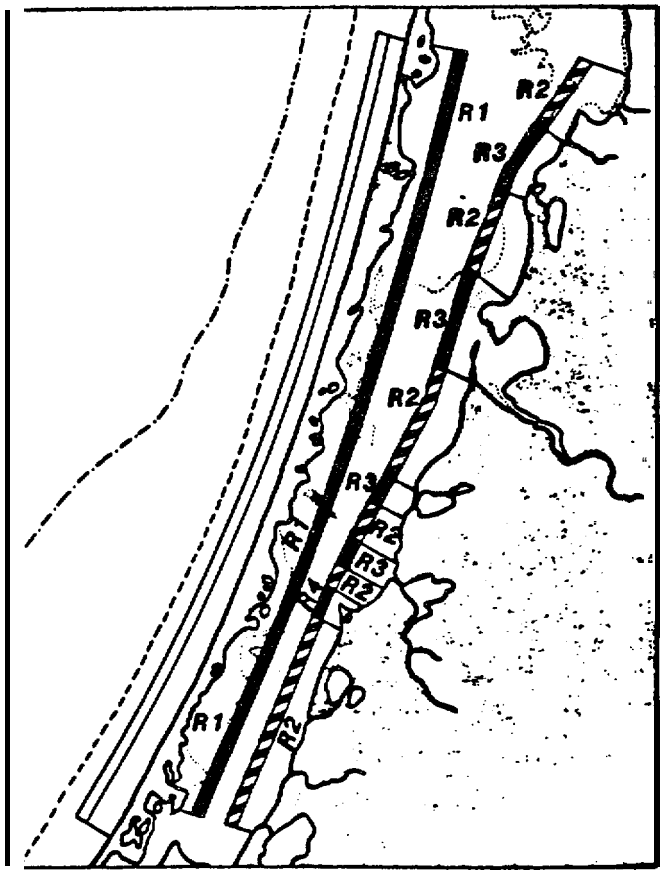
Identifier	RESOURCE
R1	Stable inlet; Recurve spits
R2	Wetland
R3	Tidal flats
R4	Tidal flat; wetlanc
R5	Low energy beach; Wetland
R6	Protected tundra cliff
R7	Ephemeral inlet; Estuary
B1	Wetland
B2	Eider (6 pr), ● nd ● rctic tern (2 pr) nesting
H1	Fishing Beluga whale hunting
H2	Spotted seal hunt ing Fishing



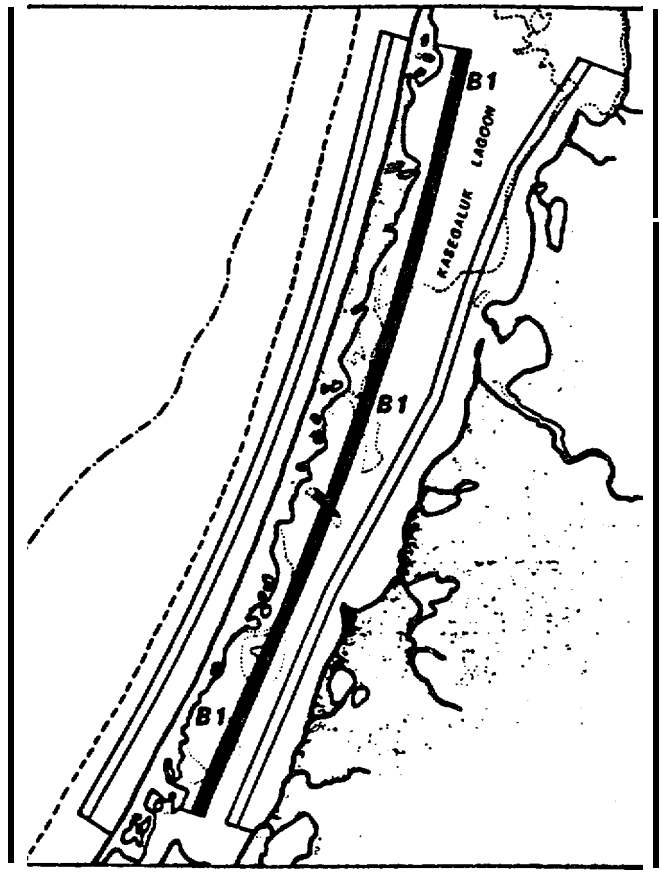
57


A
A
B
C
K
B
B
F
E
F
I
F
H
G
F
B
E
D
KASEGALUK LAGOON
J
41
42
58

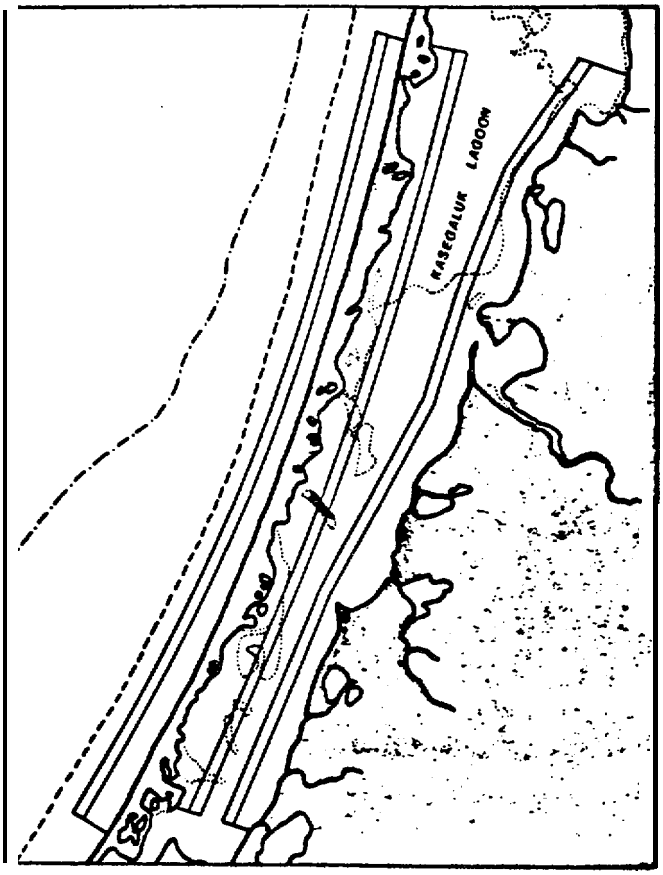
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



HUMAN USE INDEX



Seasonal Variability of Indices

Identifier	RESOURCE	SEASON: Winter	Break-Up/Summer/Freeze-Up: May	Jun	Jul	Aug	Sep	Oct	Winter
R1	Tidal flats; Wetland								
R2	Proofed tundra								
R3	Wetland; inlet; Lagoon								
R4	Tidal flat; low energy beach								
B1	Wetland								

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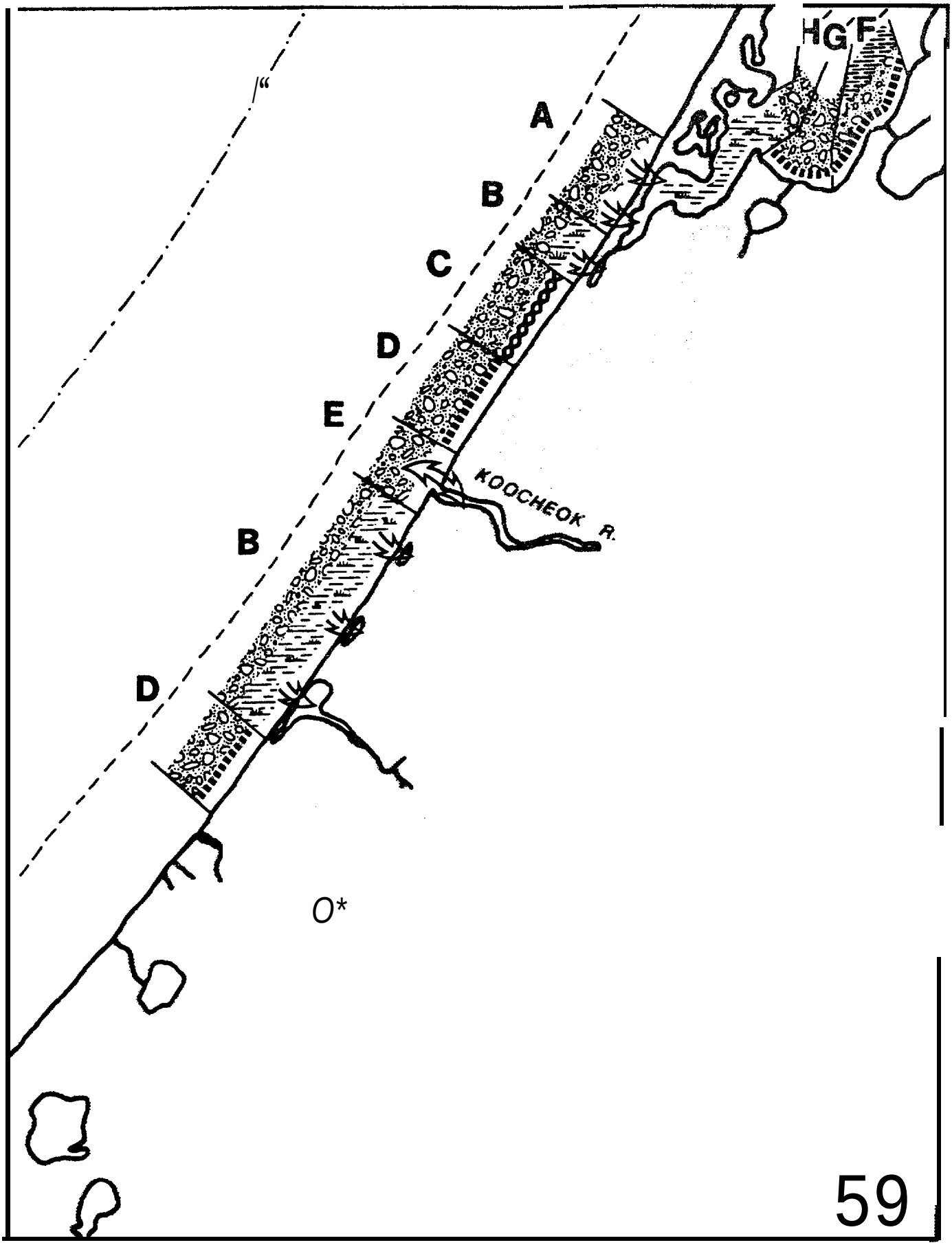
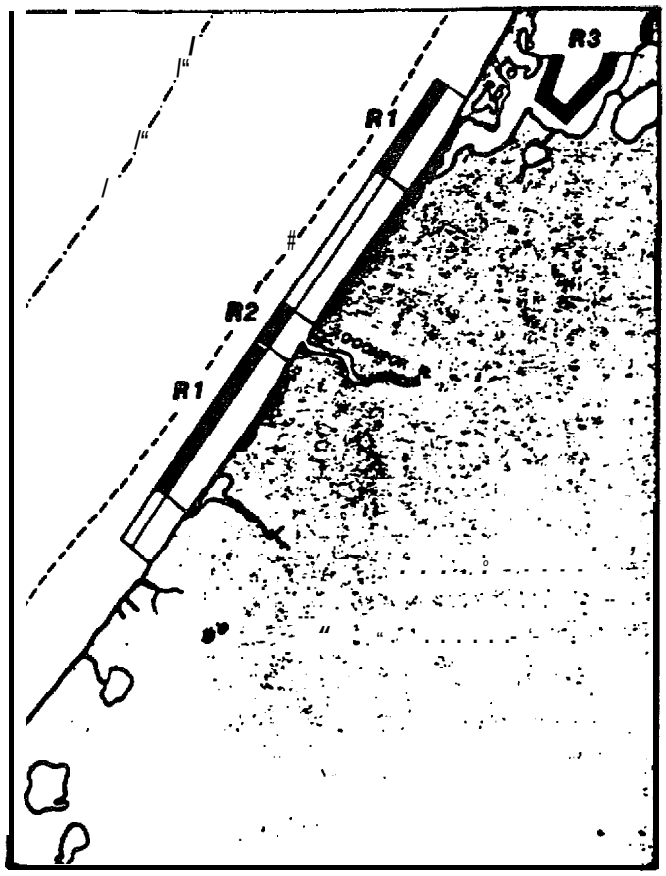
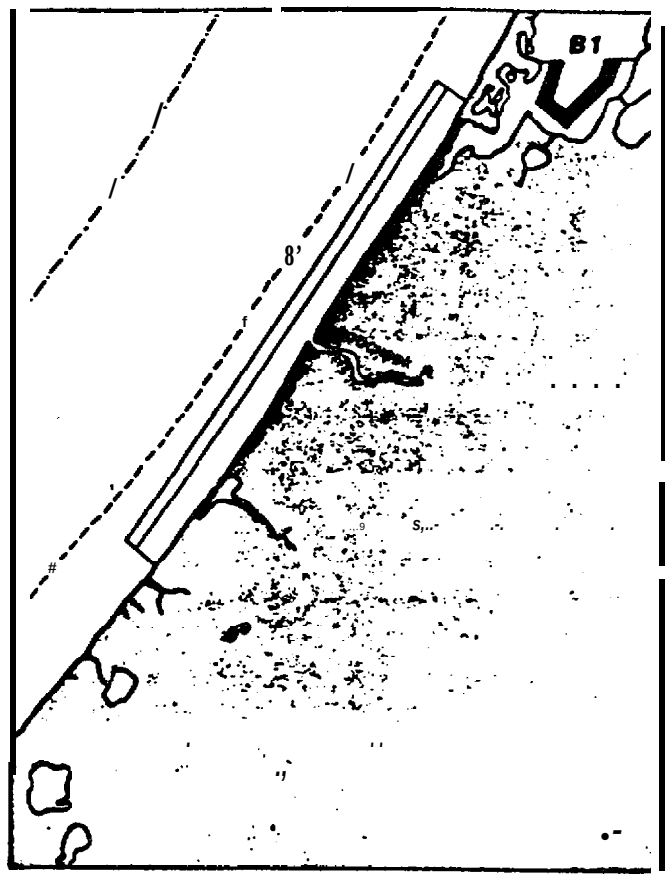

HGF
A
B
C
D
E
B
D
KOOCHEOK R.
59

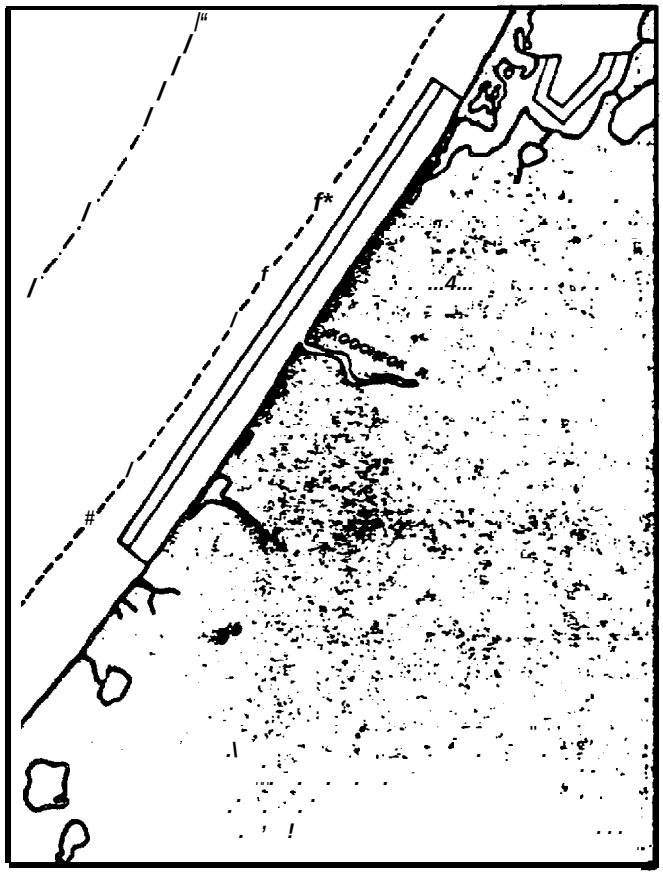
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



HUMAN USE INDEX



Seasonal Variability of Indices

Identifier	RESOURCE	SEASON							
		Winter	Break-Up/Summer/Freeze-Up						Winter
			May	Jun	Jul	Aug	Sep	Oct	
R1	Washover channels; Wetland				■	■	■	■	
R2	Ephemeral inlet; Estuary				■	■	■	■	
R3	Low energy beaches; Wetlands			■	■	■	■		
B1	Wetland			■	■	■	■	■	

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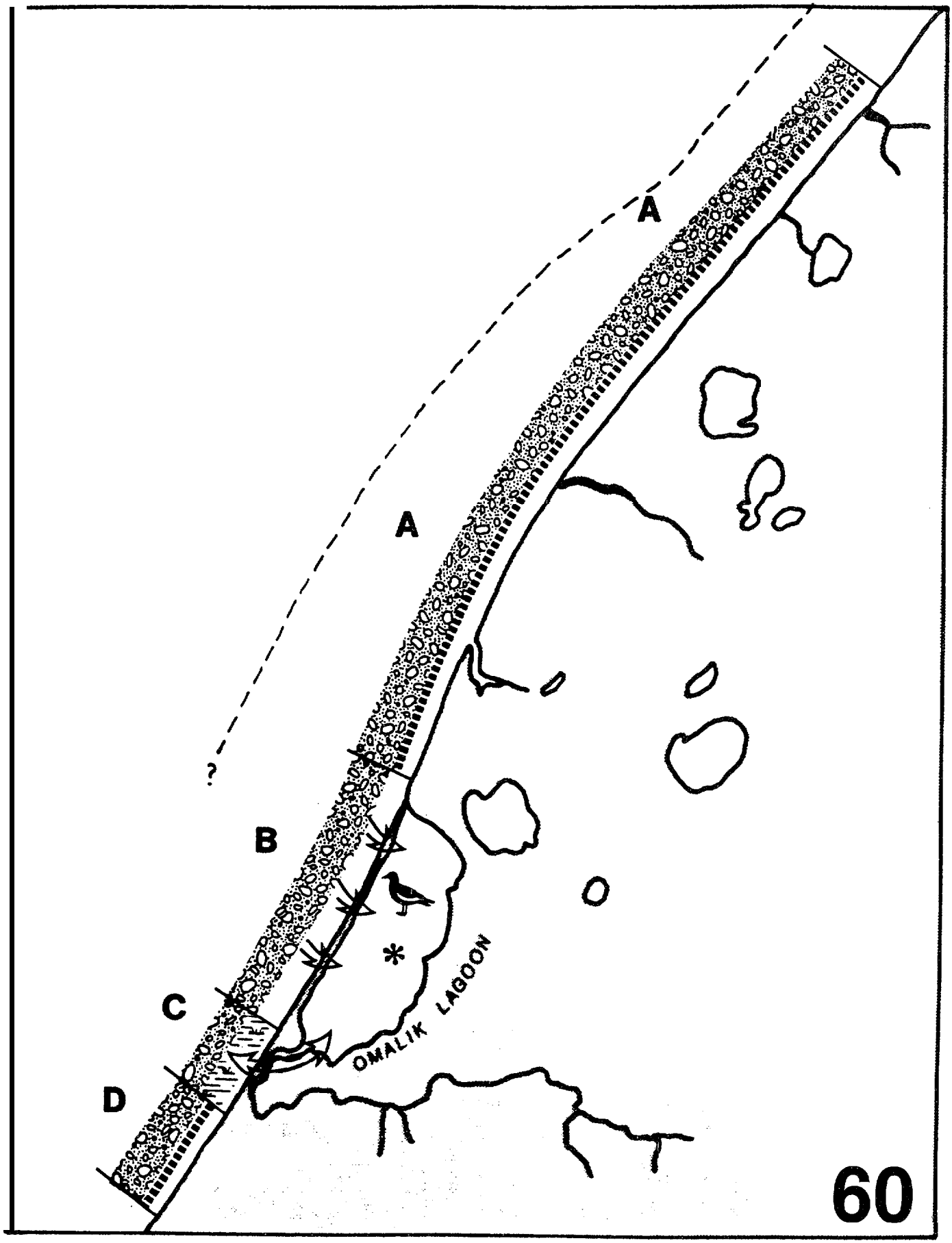
A
A
?
B
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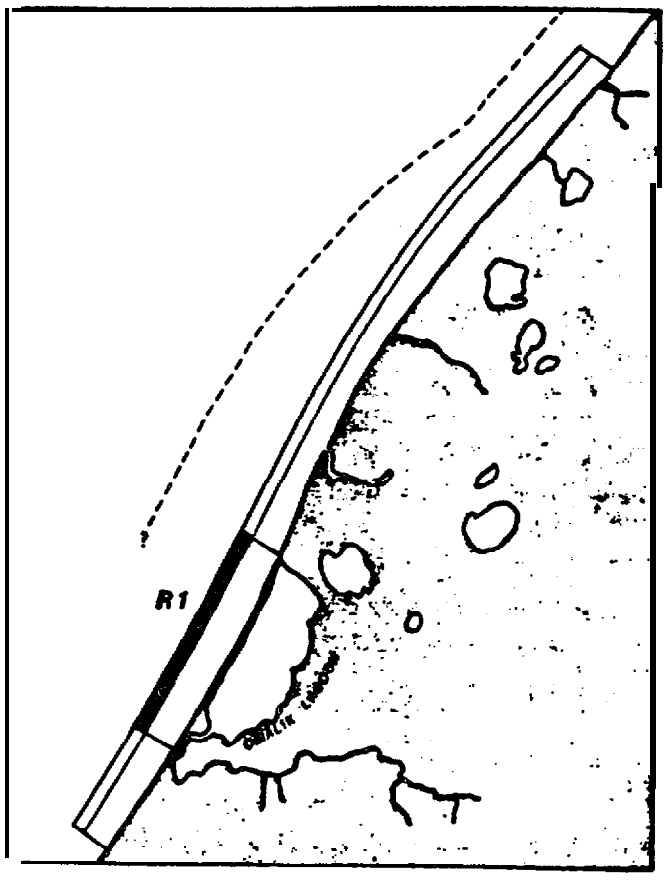
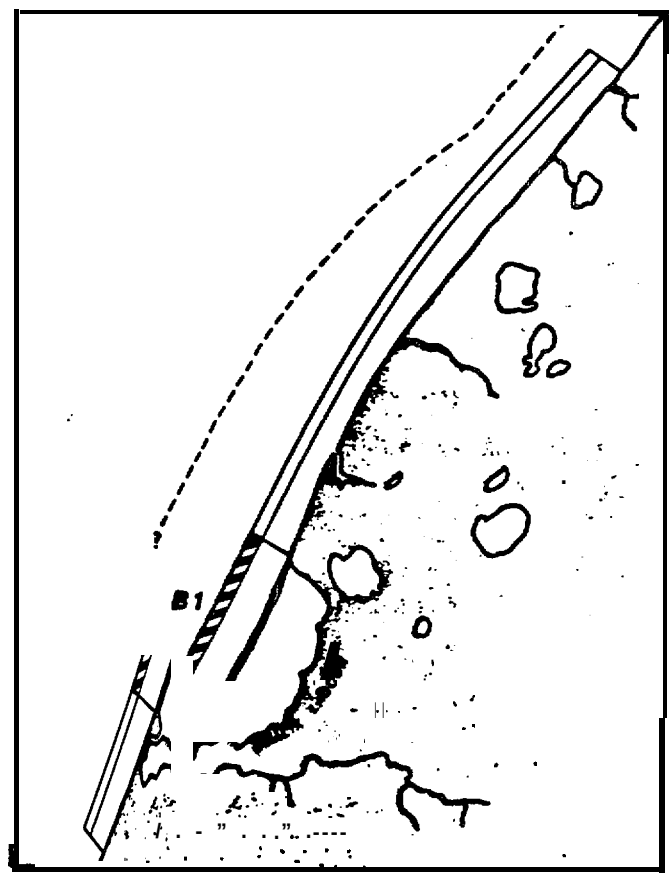
D
OMALIK LAGOON
60

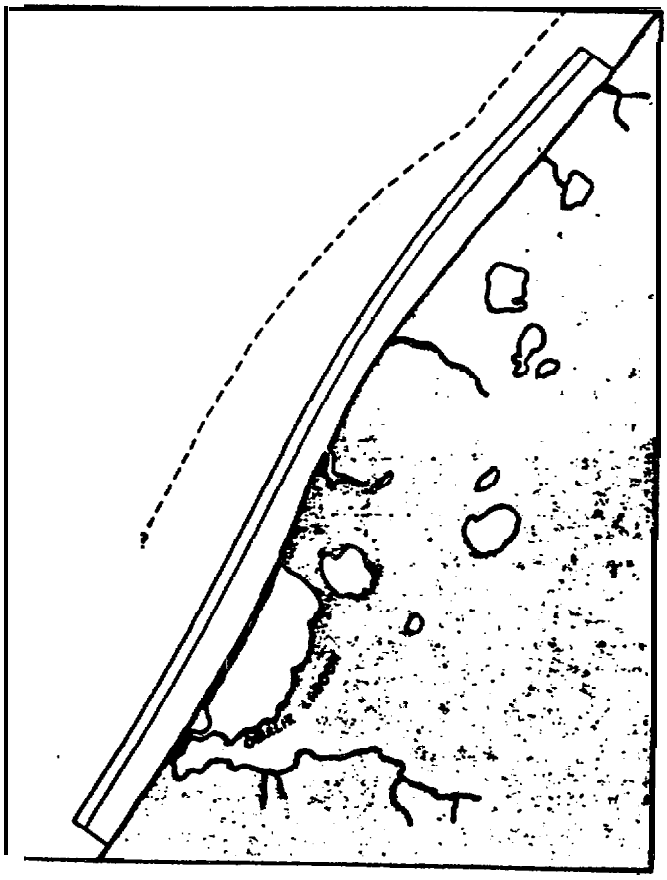
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



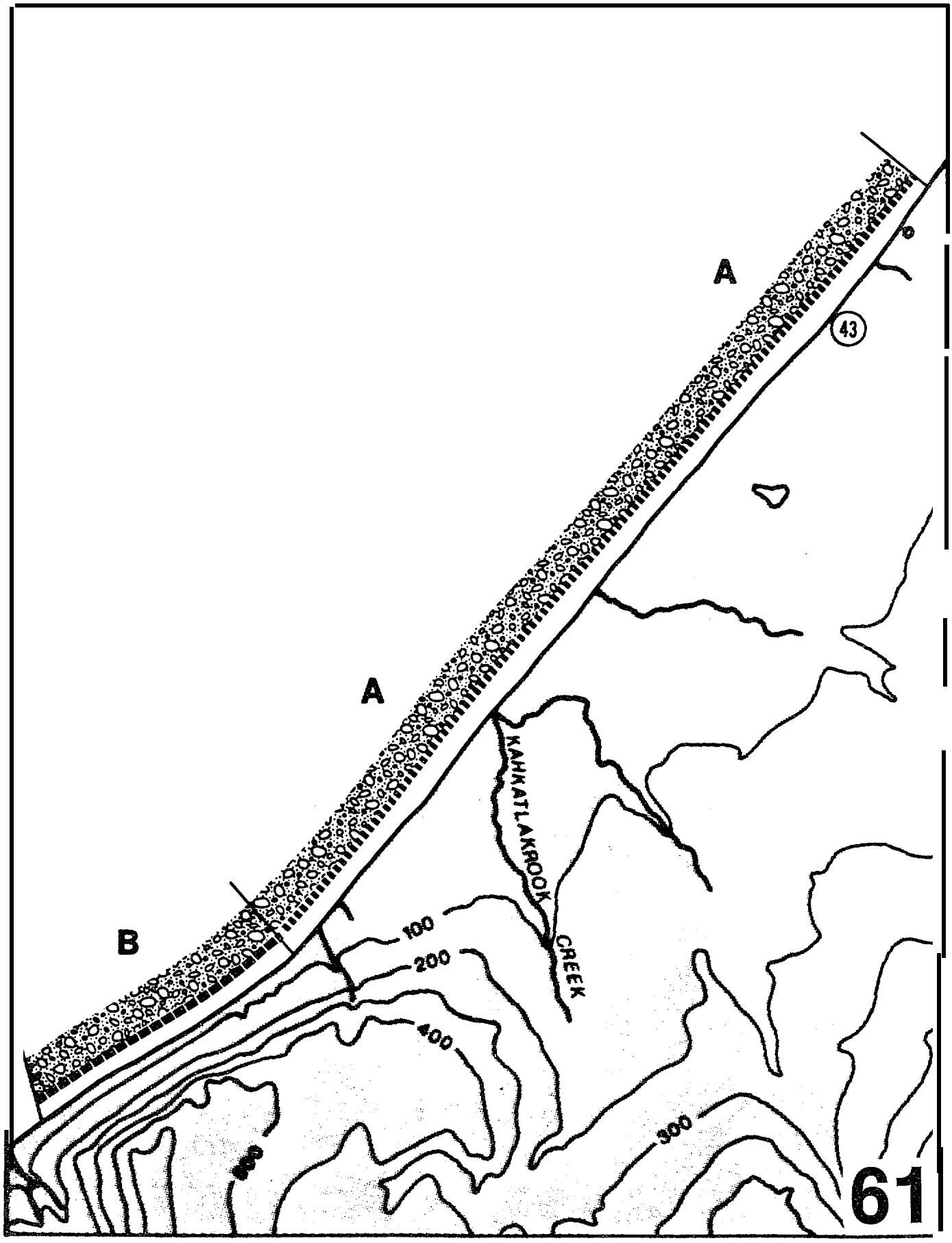
HUMAN USE INDEX



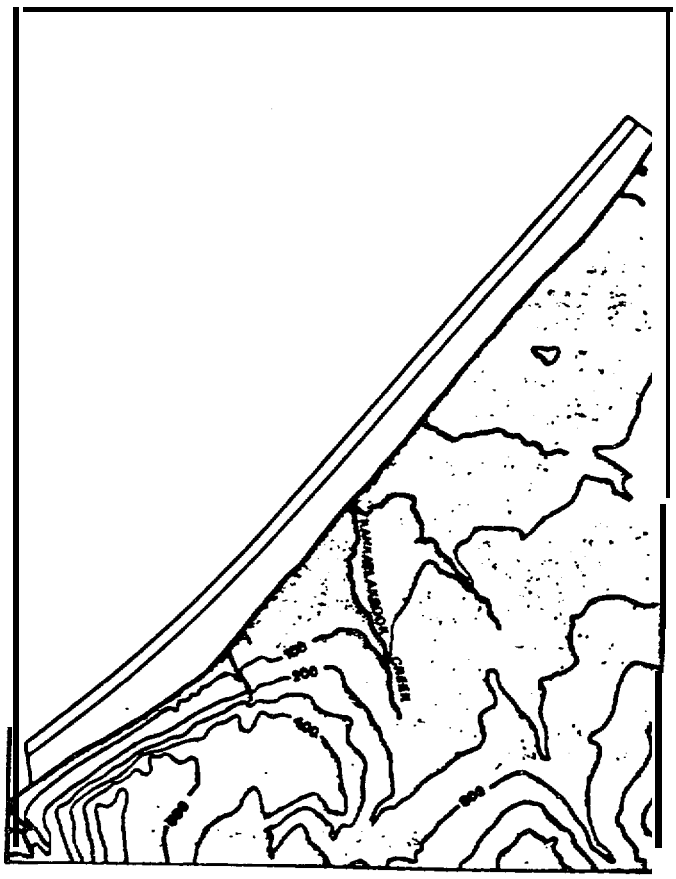
Seasonal Variability of Indices

Identifier	RESOURCE	SEASON							
		Winter	Break-Up/Summer/Freeze-Up						Winter
			May	Jun	Jul	Aug	Sep	Oct	
R1	Washover channels; inlet; lagoon				■	■	■	■	
B1	Lagoon and wetland Arctic tern (10 pr) nesting			▨	▨	▨	▨	▨	

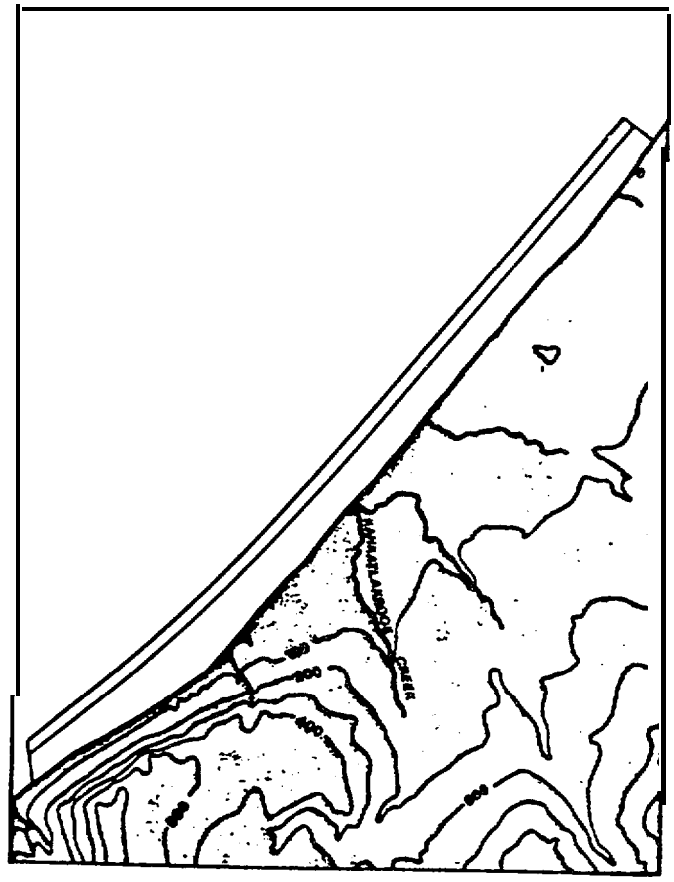
60


A
A
B
43
KAHKATLAKROOK
CREEK
100
200
400
300
61

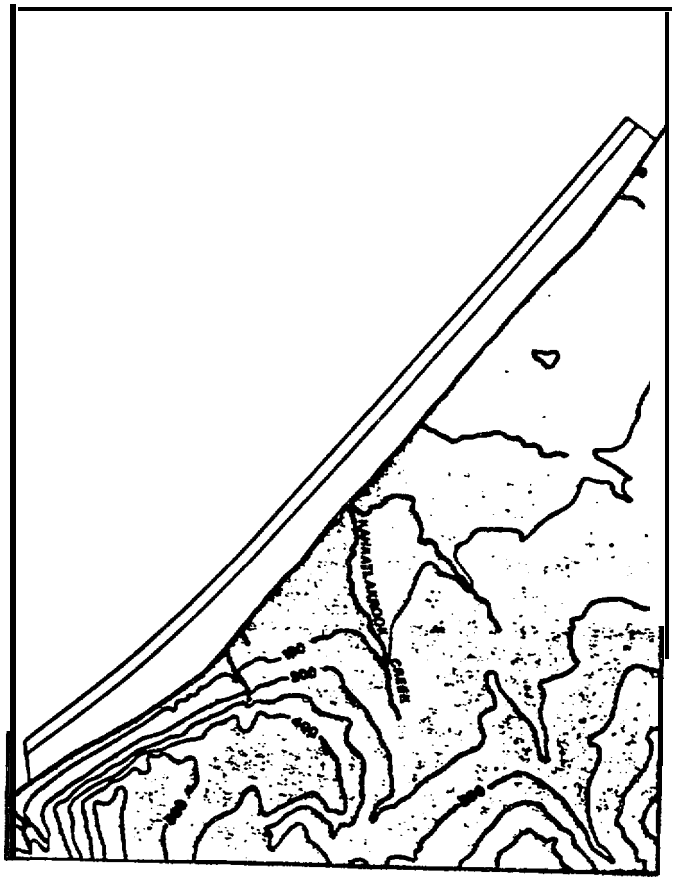
OIL RESIDENCE INDEX



B1OLO(3ICAL SENSITIVITY INDEX



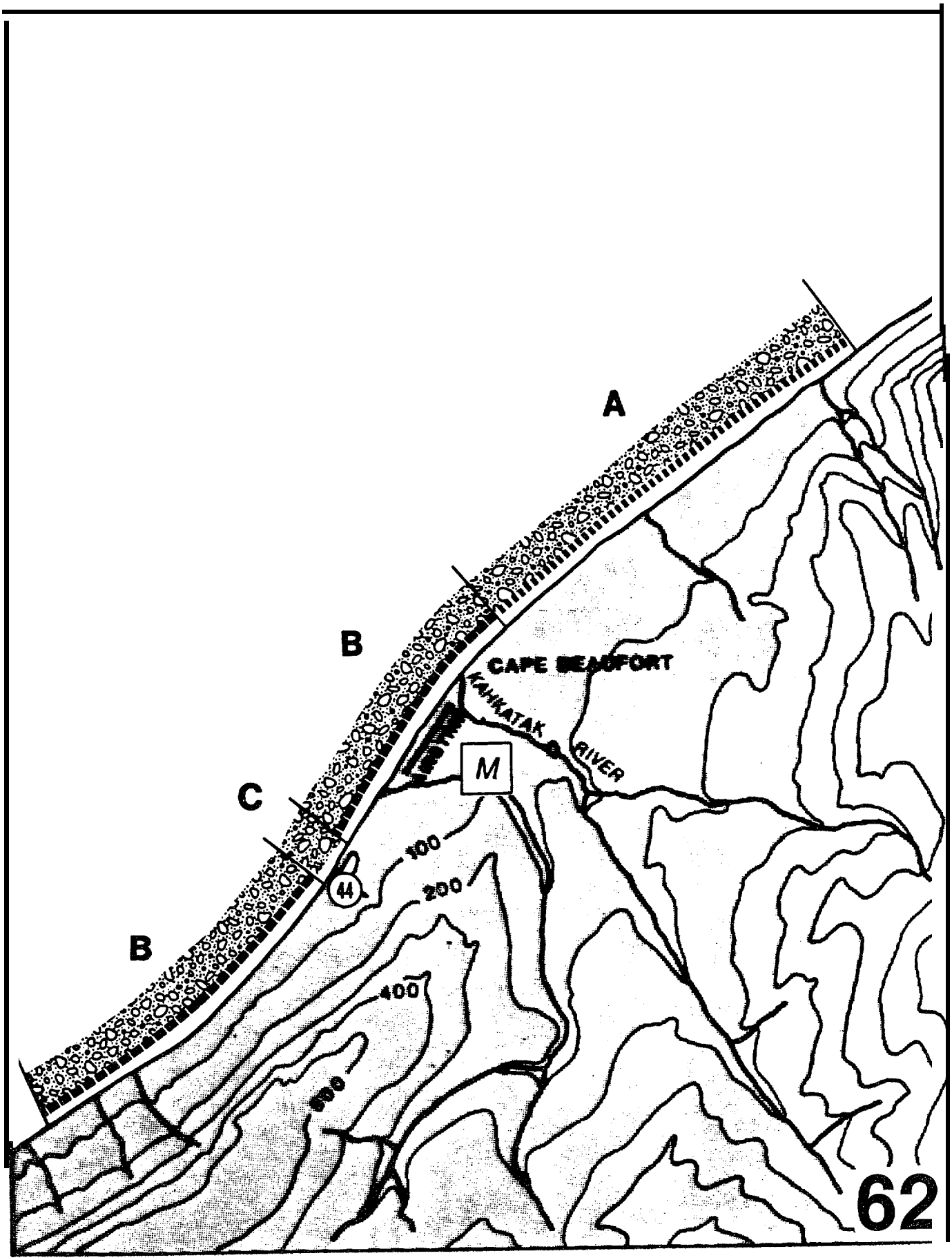
HUMAN USE INDEX



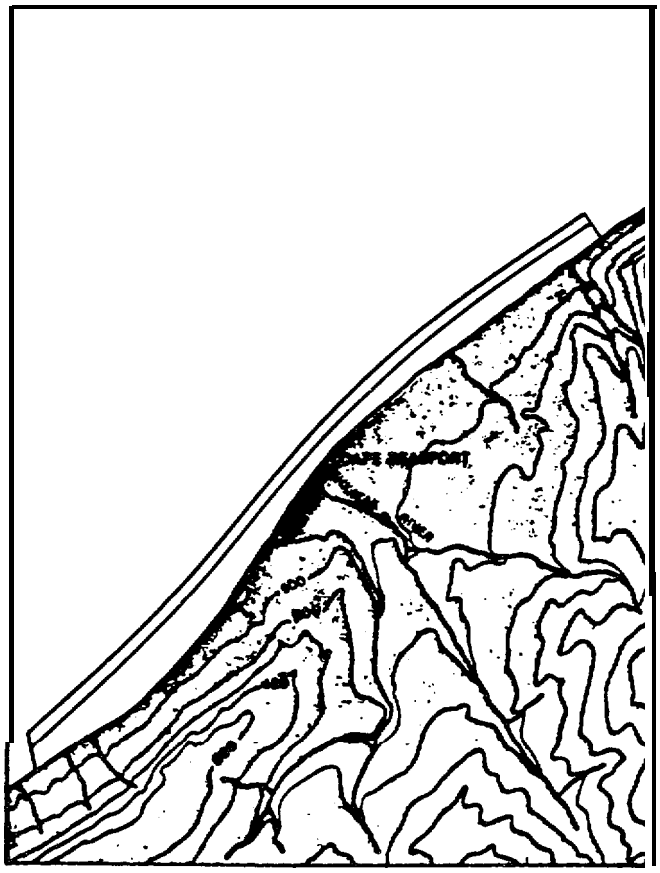
Seasonal Variability of **Indices**

Identifier	RESOURCE	SEASON						
		Winter	Break-Up/Summer/Freeze-Up					Winter
			May	Jun	Jul	Aug	Sep	Oct	
	NO PRIMARY OR SECONDARY SENSITIVITIES								

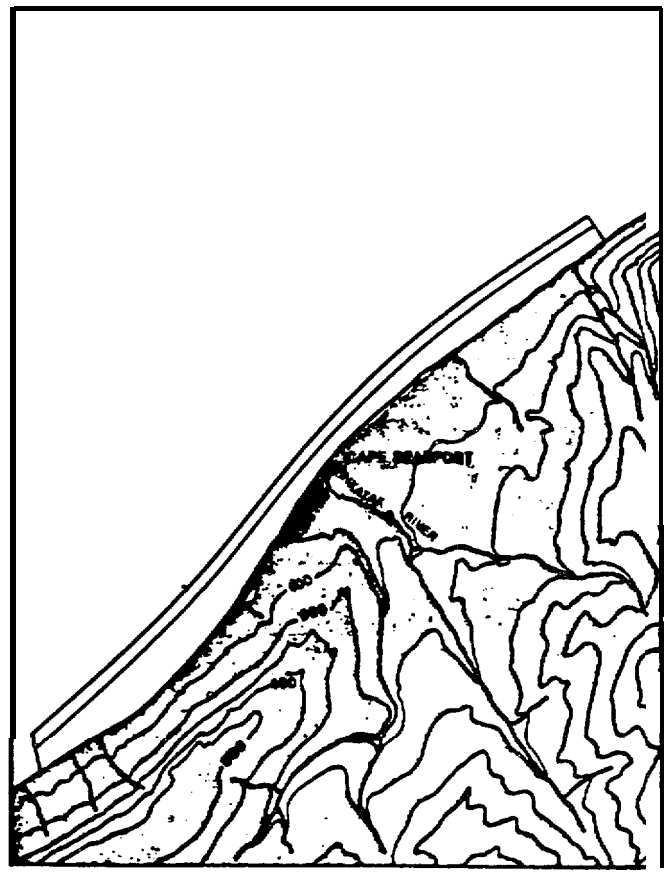
61


A
B
B
C
B
CAPE BEAUFORT
KAHKATAK
RIVER
M
44
100
200
400
500
62

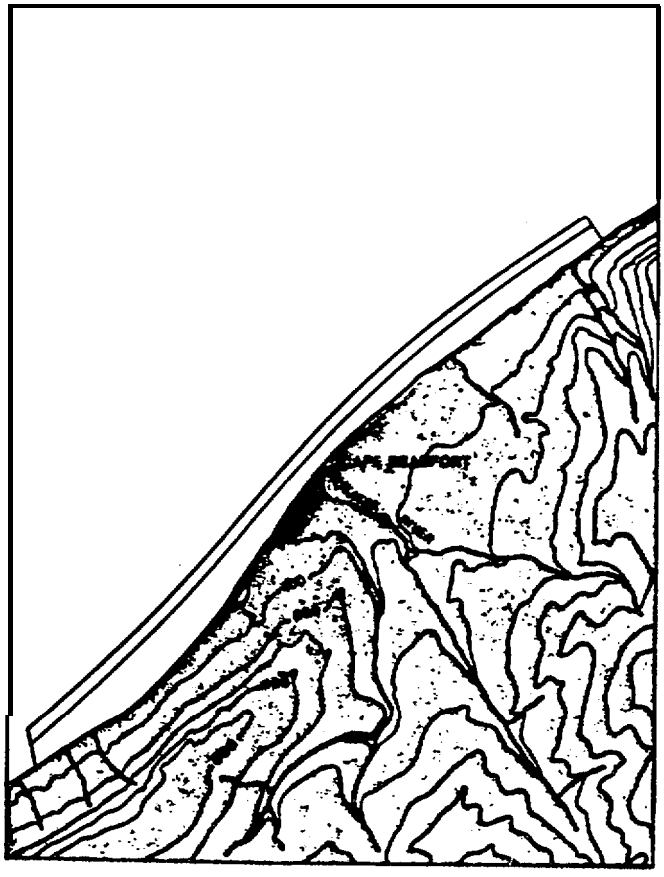
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



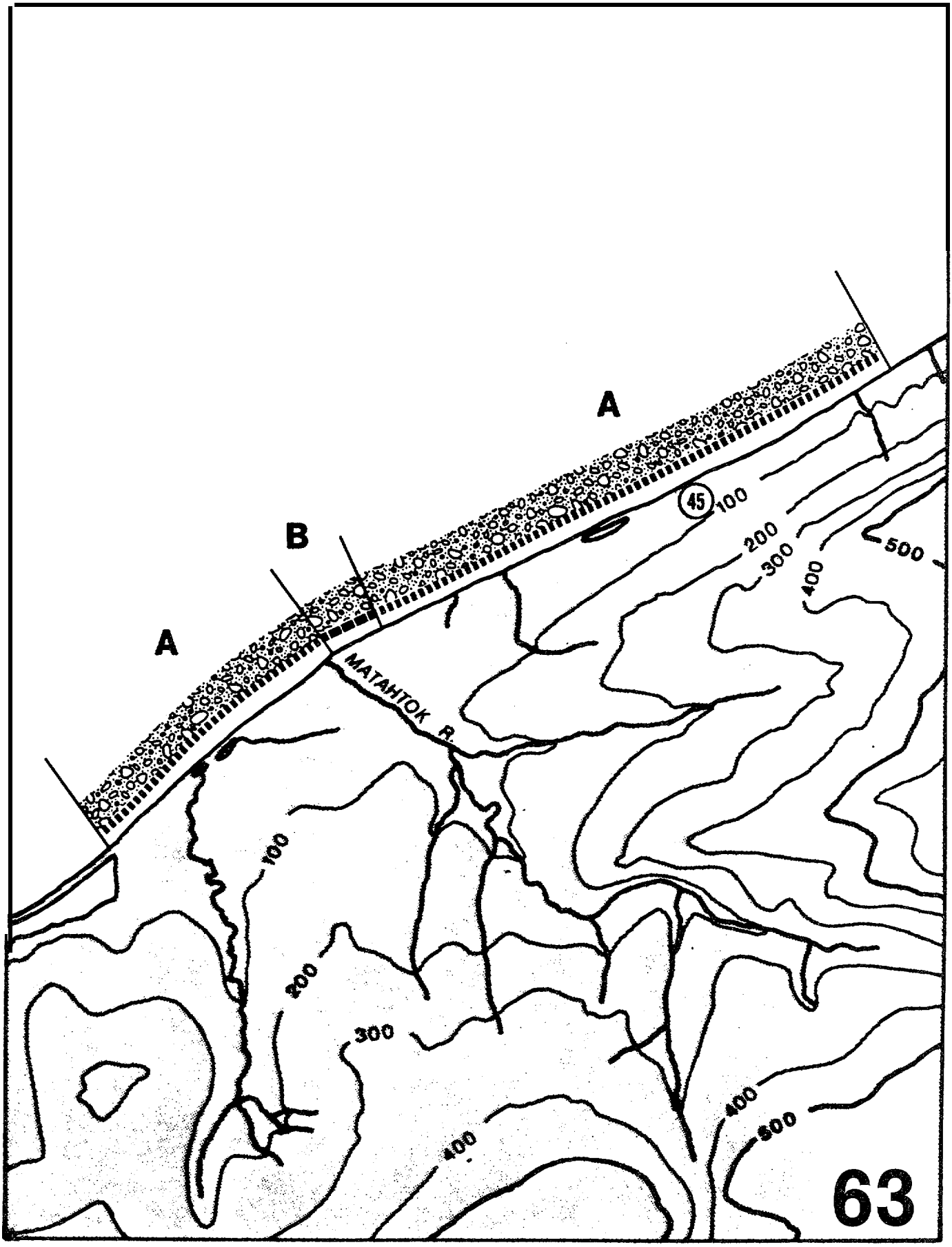
HUMAN USE INDEX



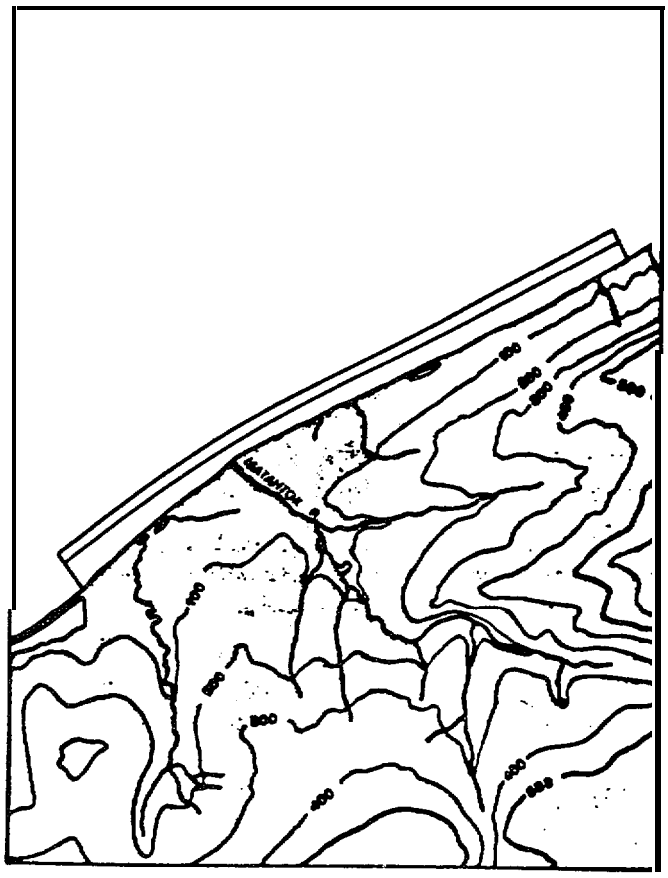
*Seasonal **Variability** of **Indices***

Identifier	RESOURCE	SEASON						
		Winter	Break-Up/Summer/Freeze-Up					Winter
			May	Jun	Jul	Aug	Sep	Oct
	NO PRIMARY OR SECONDARY SENSITIVITIES							

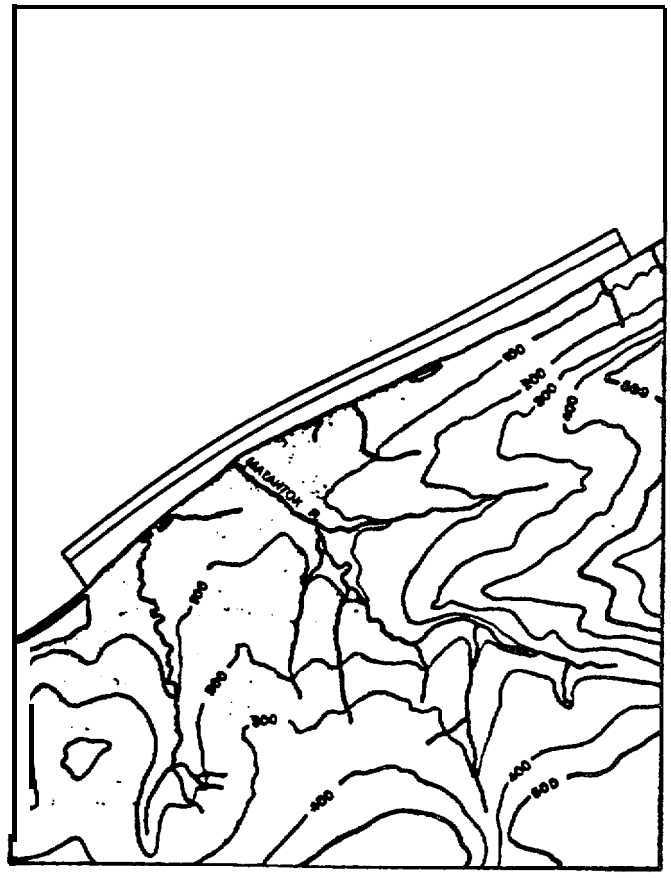
62


A
B
A
45
100
200
300
400
500
MATAHTOK R.
100
200
300
400
400
500
63

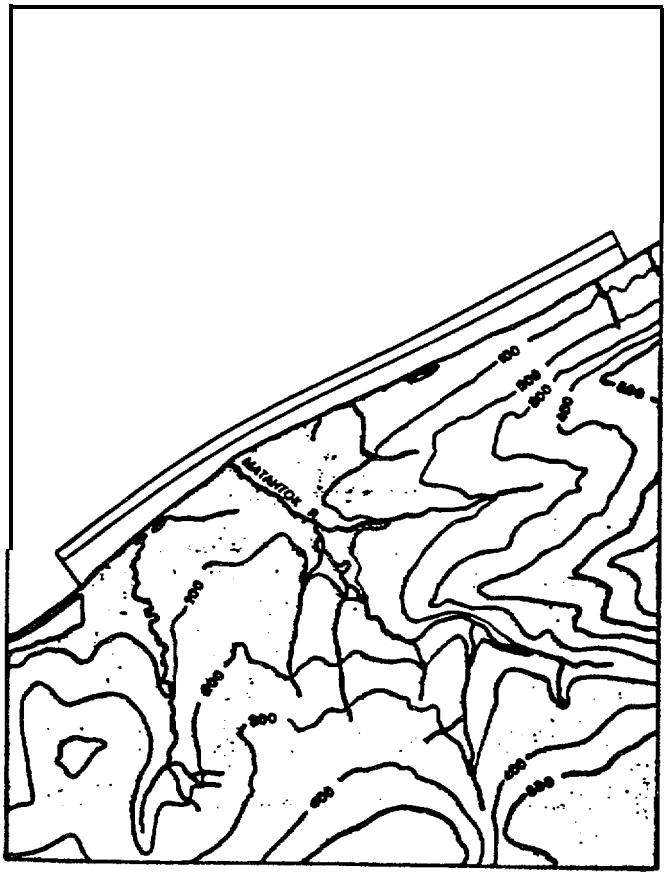
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



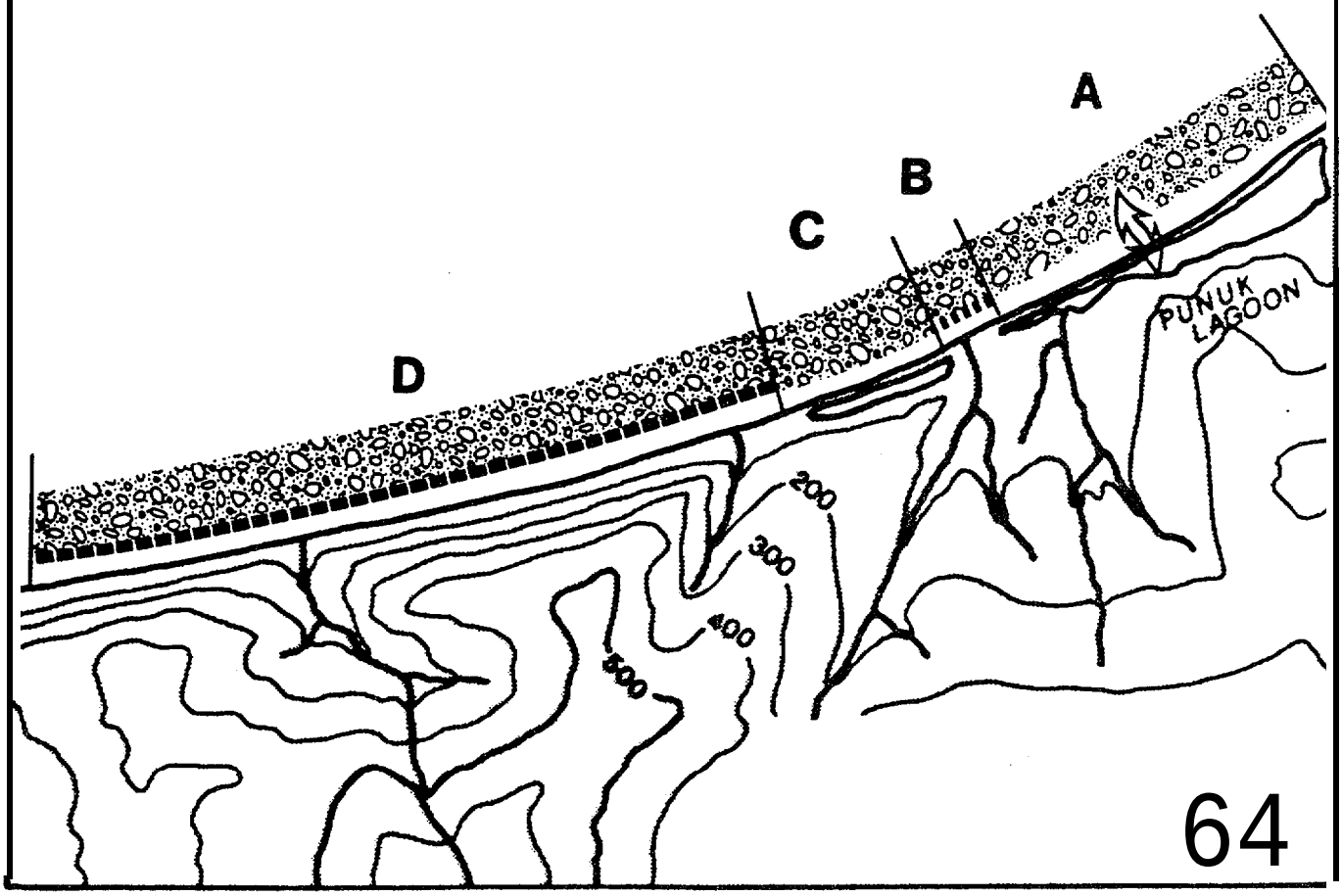
HUMAN USE INDEX



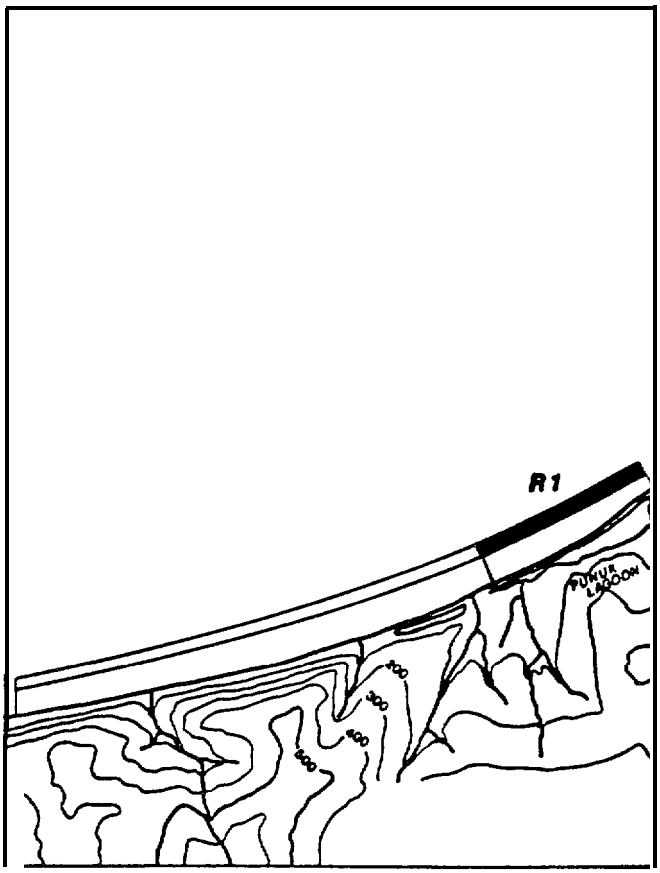
Seasonal Variability of Indices

Identifier	RESOURCE	● EA80N						
		Winter	Break-Up/Summer/Freeze-Up					Winter
			May	Jun	Jul	Aug	Sep	Oct	
	NO PRIMARY OR SECONDARY SENSITIVITIES								

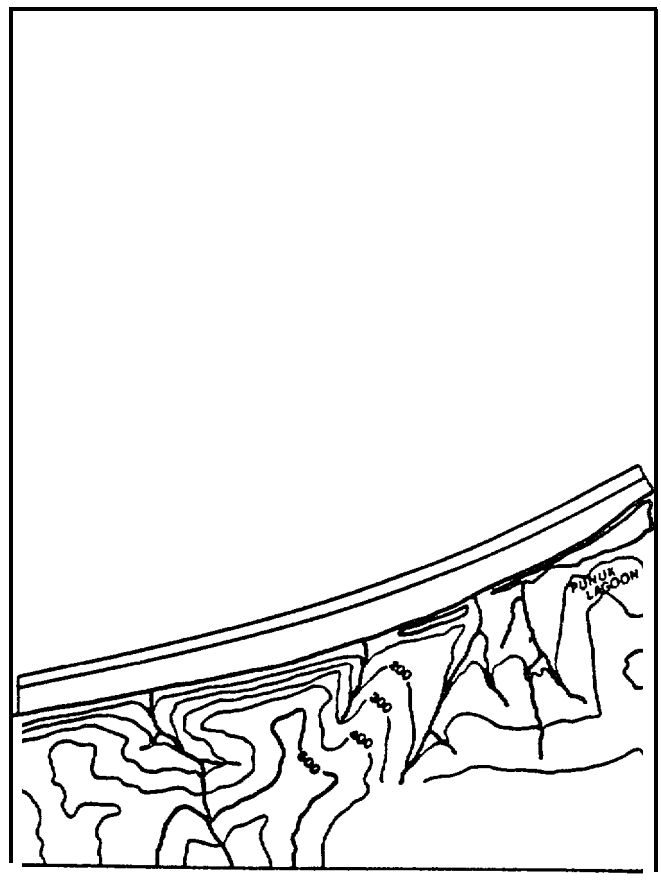
63


A
B
C
D
PUNUK
LAGOON
200
300
400
500
64

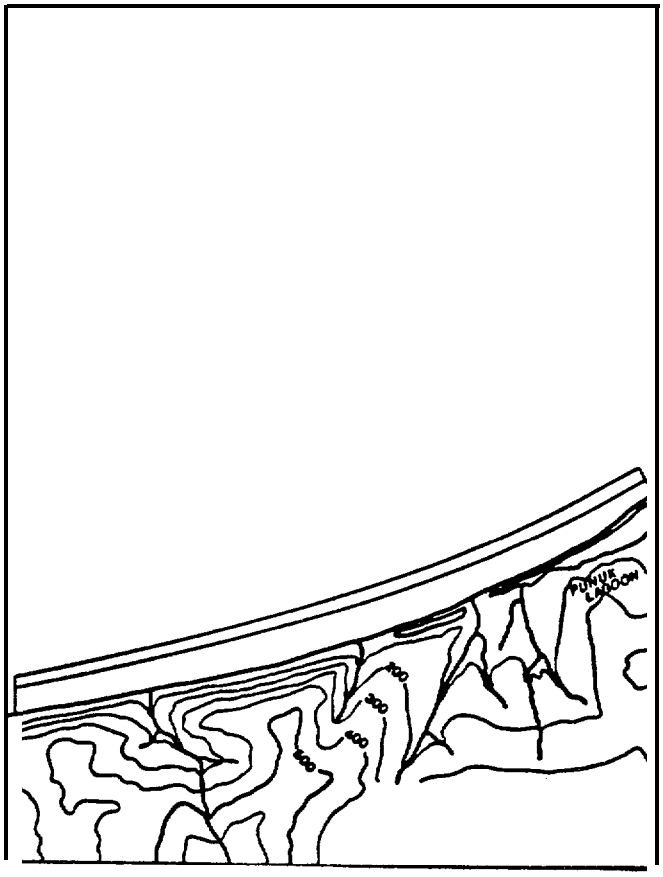
OIL RESIDENCE INDEX



***BIOLOGICAL SENSITIVITY* INDEX**



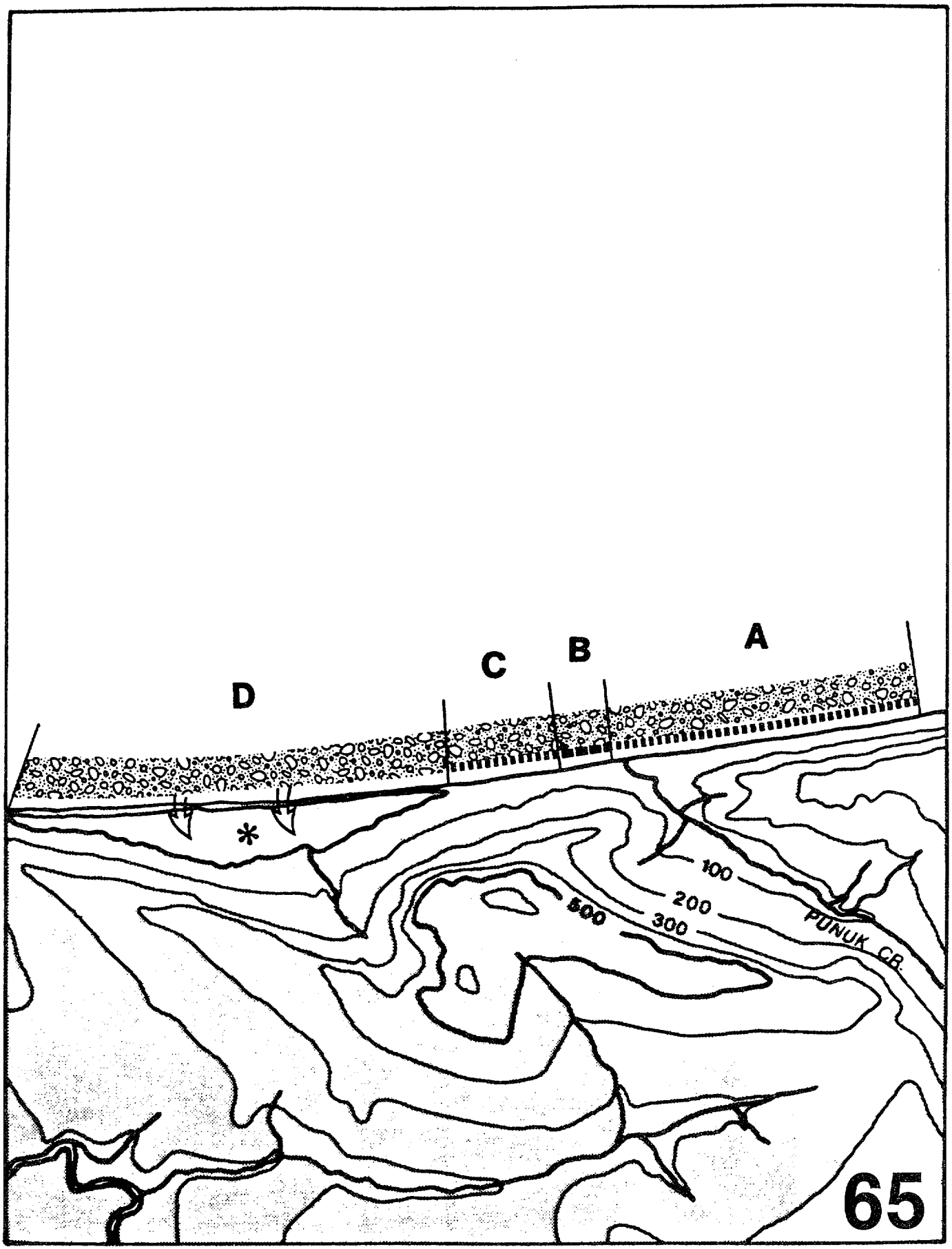
HUMAN USE INDEX



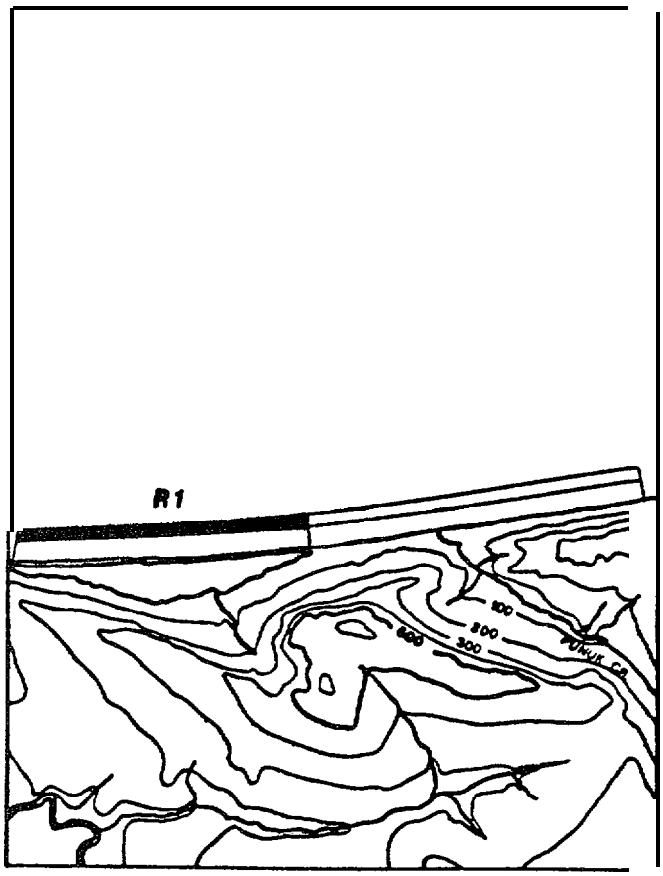
Seasonal ***Variability of Indices***

Identifier	REBOURCE	SEASON							
		Winter	Break-Up/Summer/Freeze-Up						Winter
			May	Jun	Jul	Aug	Sep	Ott	
R1	Ephemeral inlet; Lagoon								

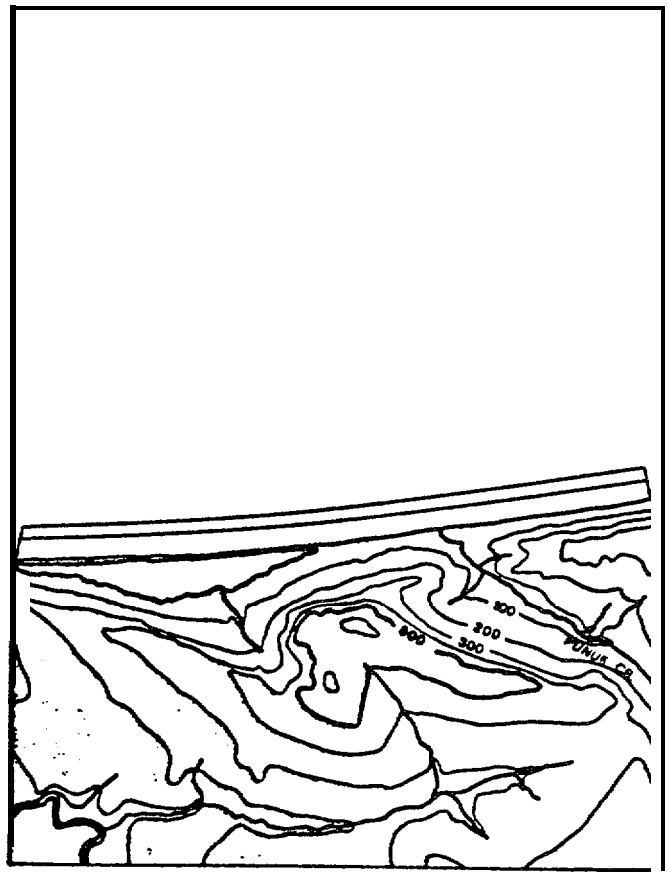
64


D
C
B
A
100
200
300
500
PUNUK CR.
65

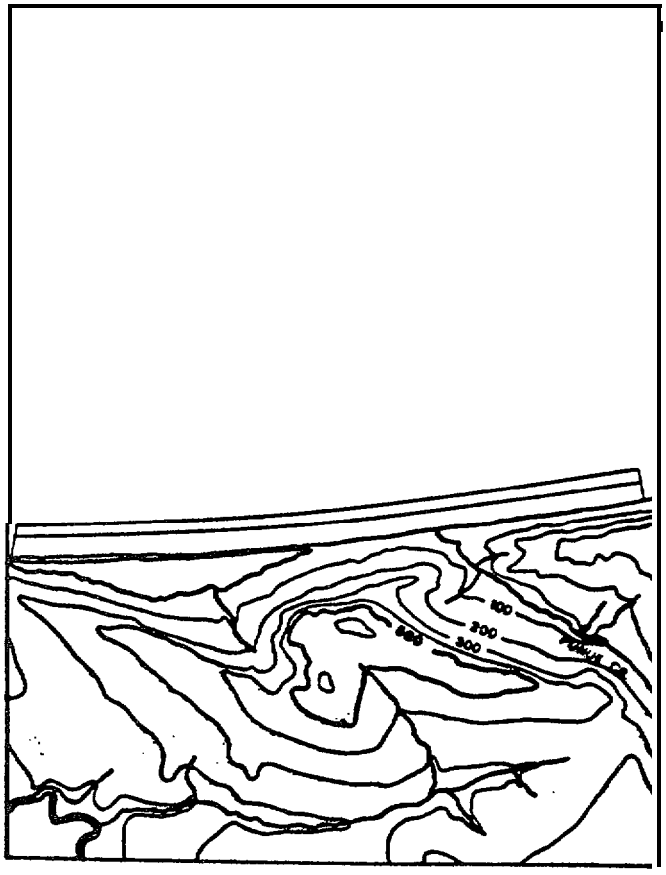
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



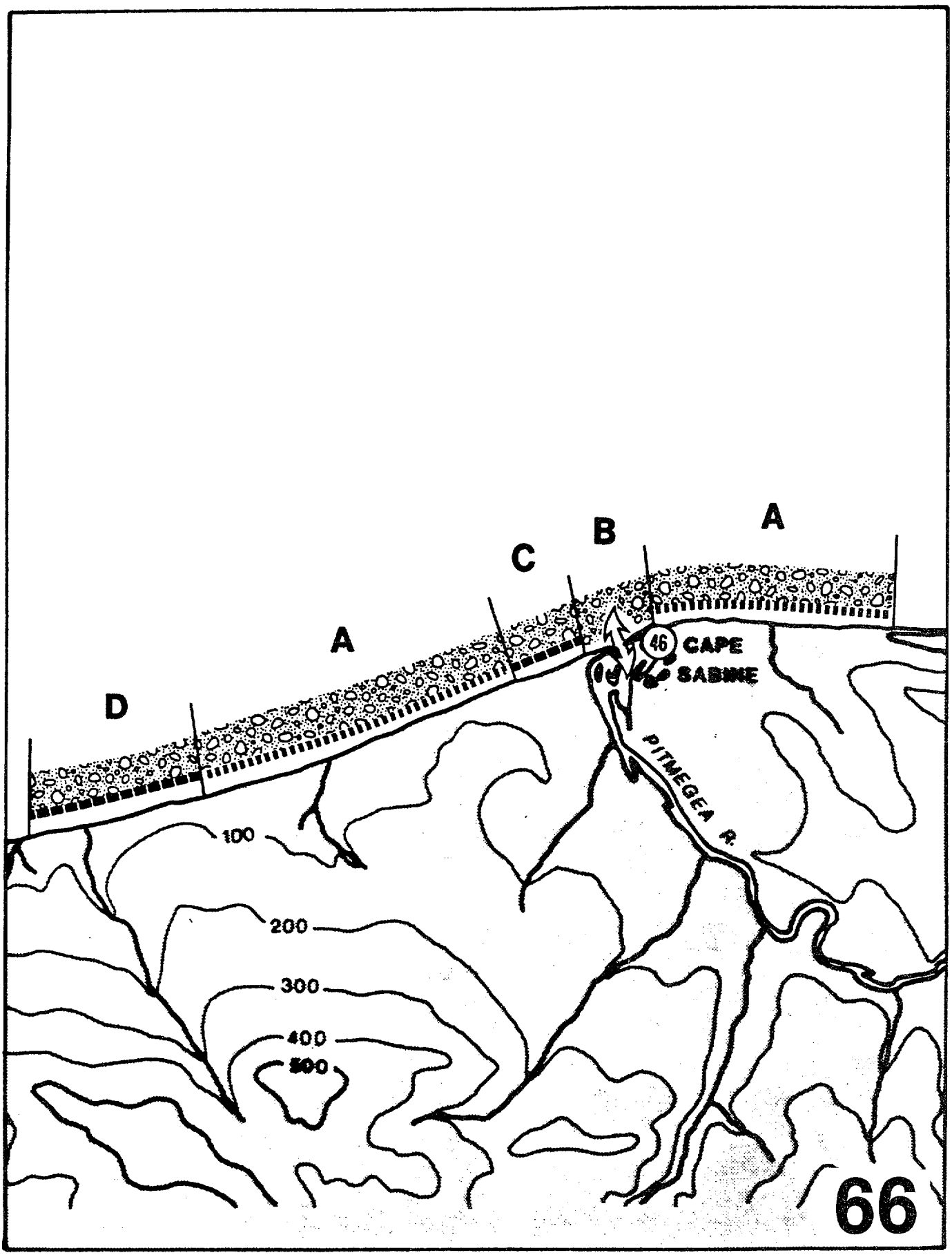
HUMAN USE INDEX



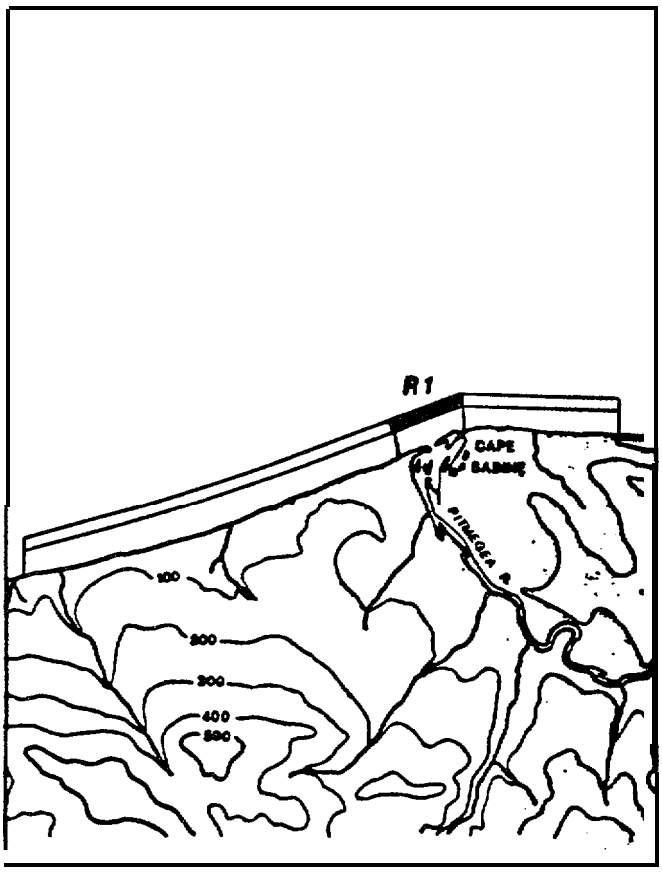
Seasonal Variability of Indices

Identifier	RESOURCE	SEASON							
		Winter	Break-Up/Summer/Freeze-Up						Winter
			May	Jun	Jul	Aug	Sep	Oct	
RI	Washover channels; Lagoon				■	■	■	■	

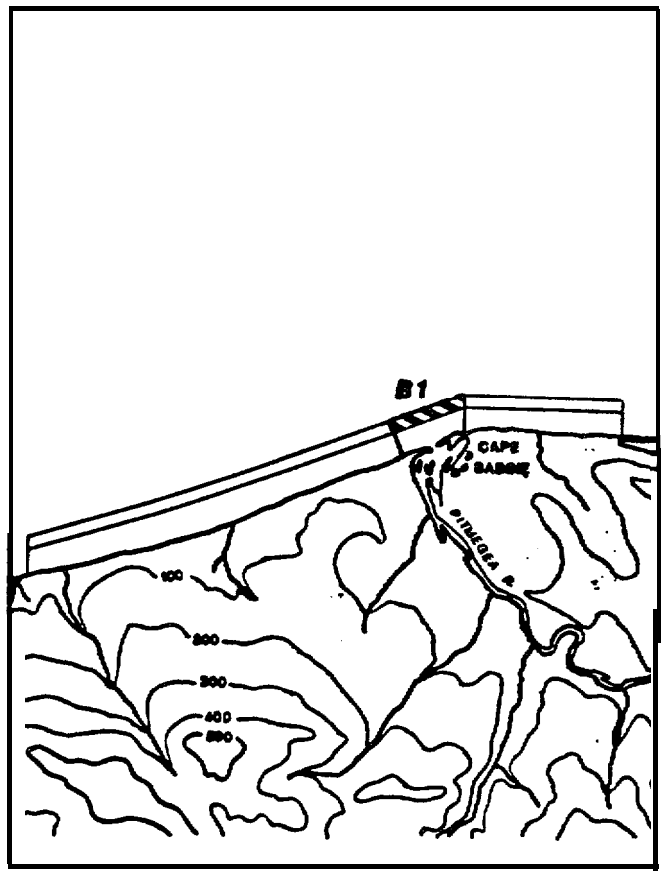
65


A
B
C
A
D
46
CAPE
SABINE
PITMEGEA R.
100
200
300
400
500
66

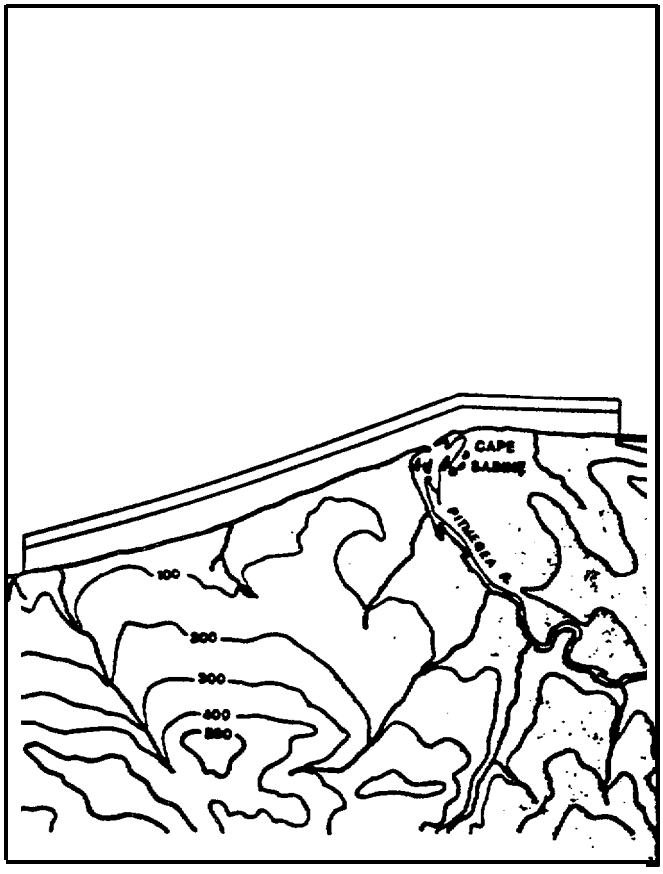
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



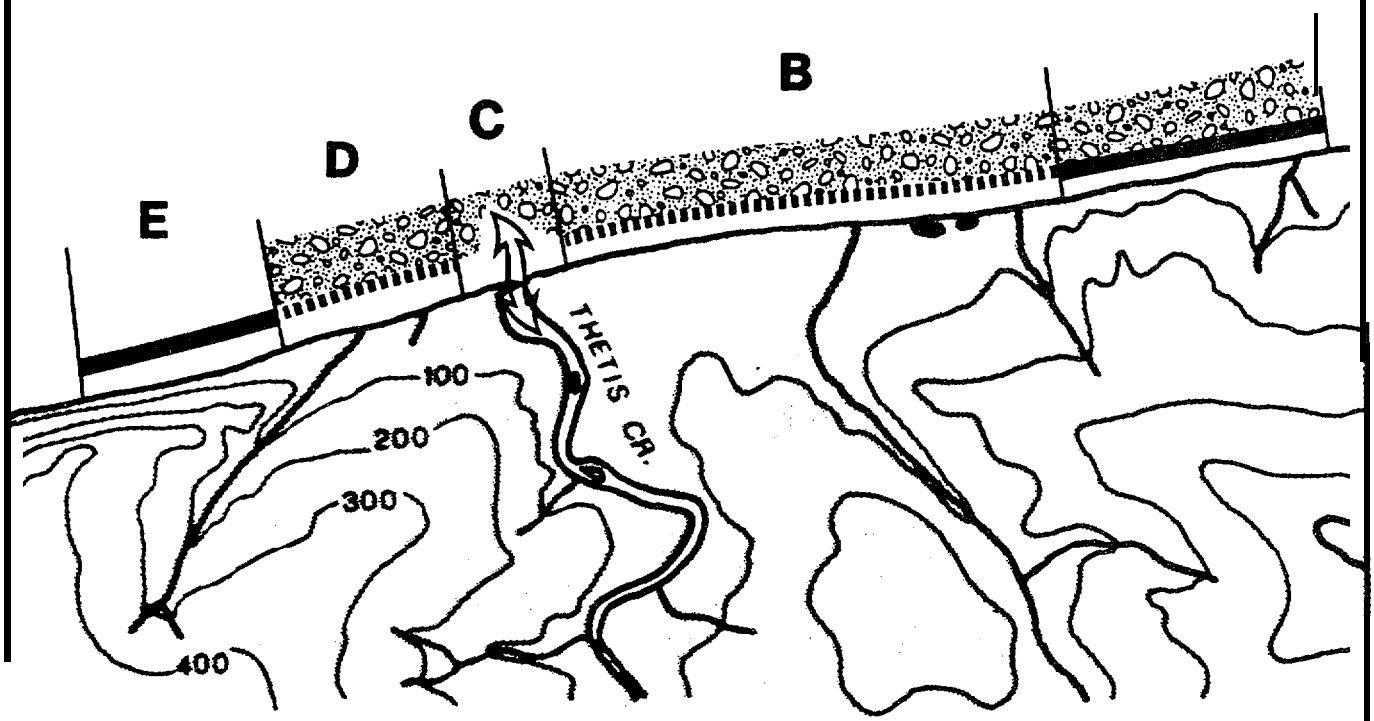
HUMAN USE INDEX



Seasonal Variability of Indices

Identifier	RESOURCE	Winter	SEASON: Break-Up/Summer/Freeze-Up						Winter
			May	Jun	Jul	Aug	Sep	Oct	
R1	Ephemeral inlet; Estuary				■	■	■	■	
B1	Estuary			▨	▨	▨	▨	▨	

66



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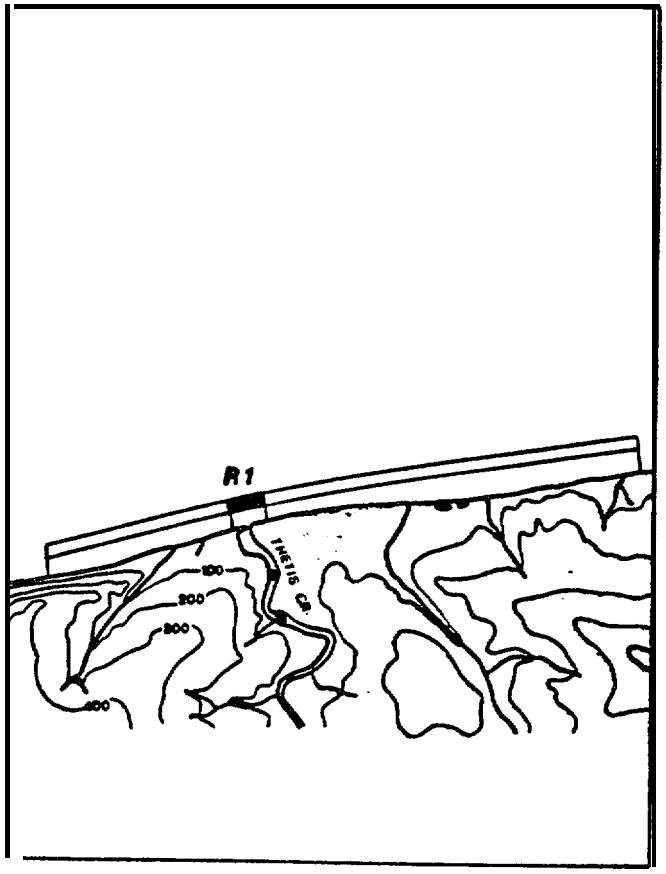
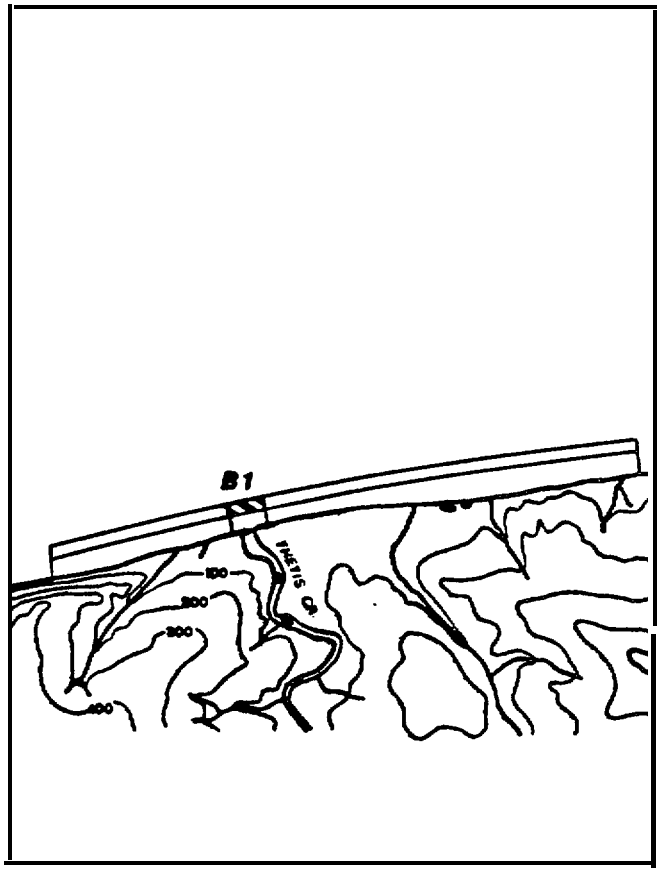
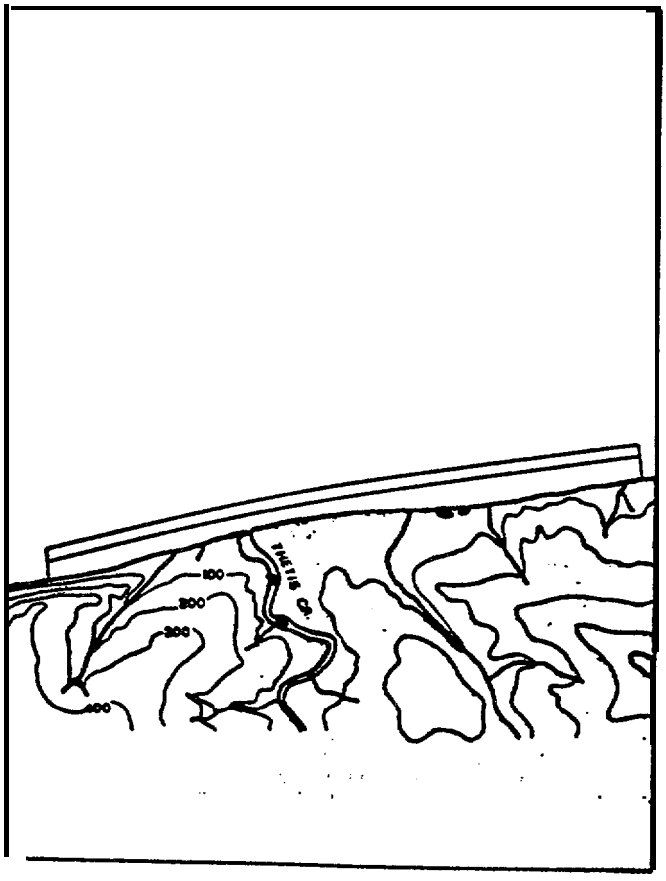
***OIL* RESIDENCE INDEX**



BIOLOGICAL SENSITIVITY INDEX



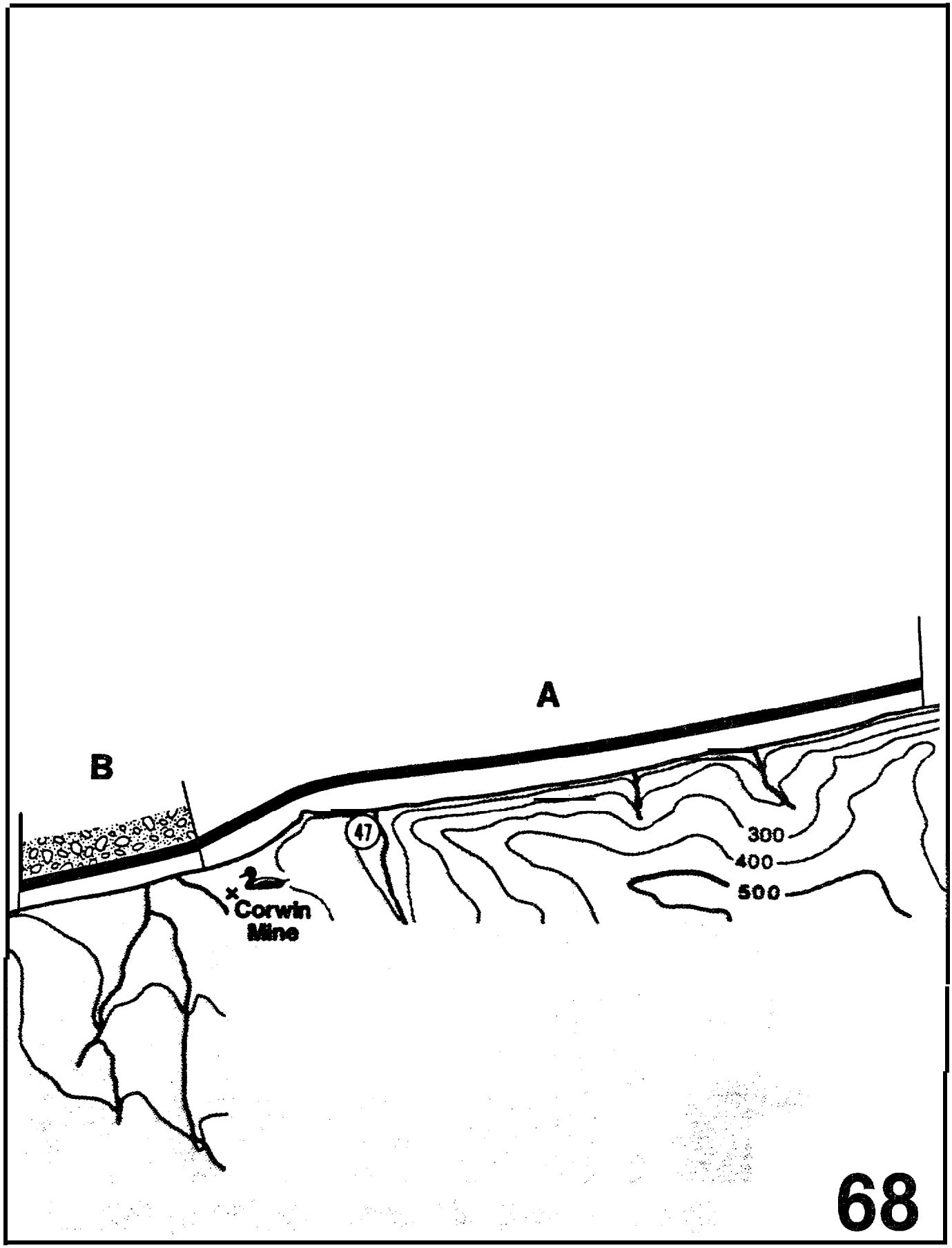
HUMAN USE INDEX



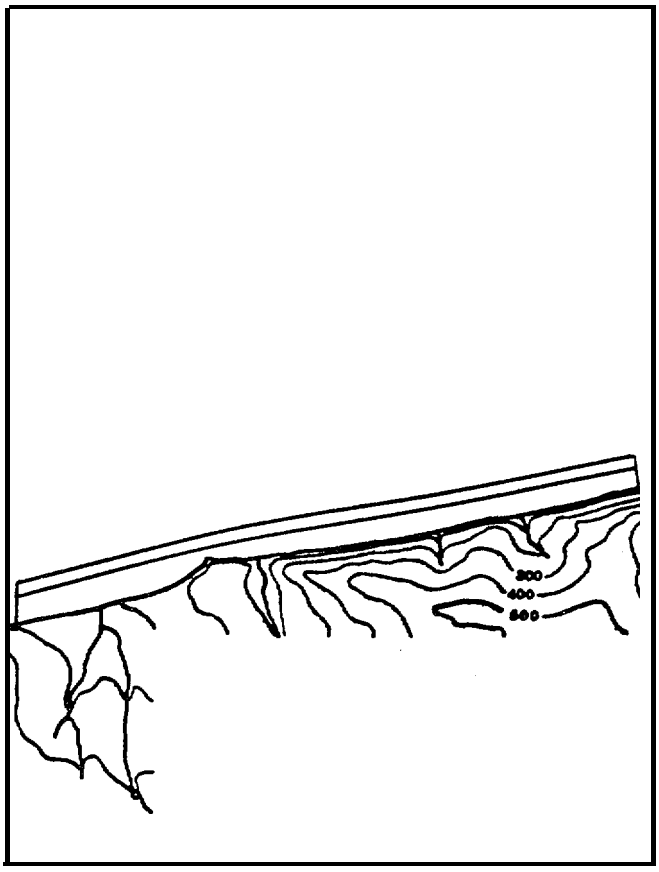
Seasonal ***Variability*** of ***Indices***

Identifier	RESOURCE	Winter	SEASON: Break-Up/Summer/Freeze-Up May	Jun	Jul	Aug	Sep	Oct	Winter
R1	Ephemerall inlet; Estuary				■	■	■	■	
B1	Estuary		▨	▨	▨	▨	▨	▨	

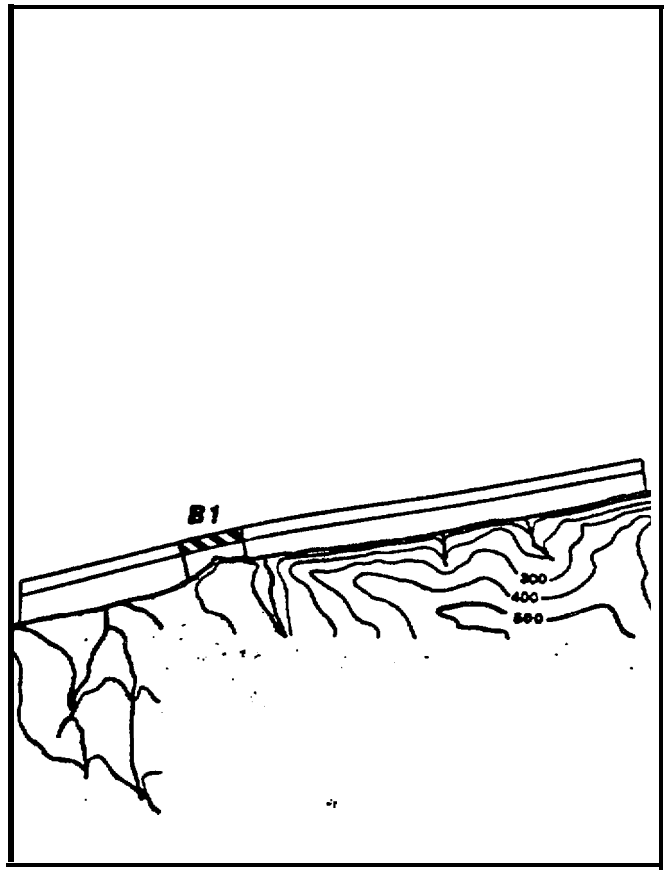
67


A
B
47
300
400
500
Corwin
Mine
68

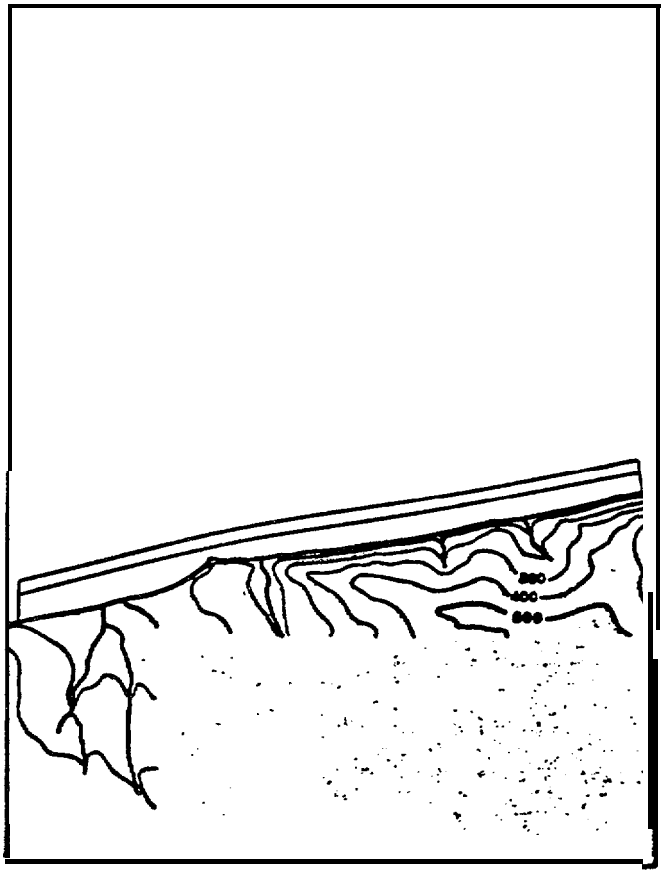
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



HUMAN USE INDEX



Seasonal Variability of Indices

Identifier	RESOURCE	SEASON						
		Winter	Break-Up/Summer/Freeze-Up					Winter
			May	Jun	Jul	Aug	Sep	Oct	
B1	Seabird colony; cormorants (33 pr), tufted puffin (3 pr)								

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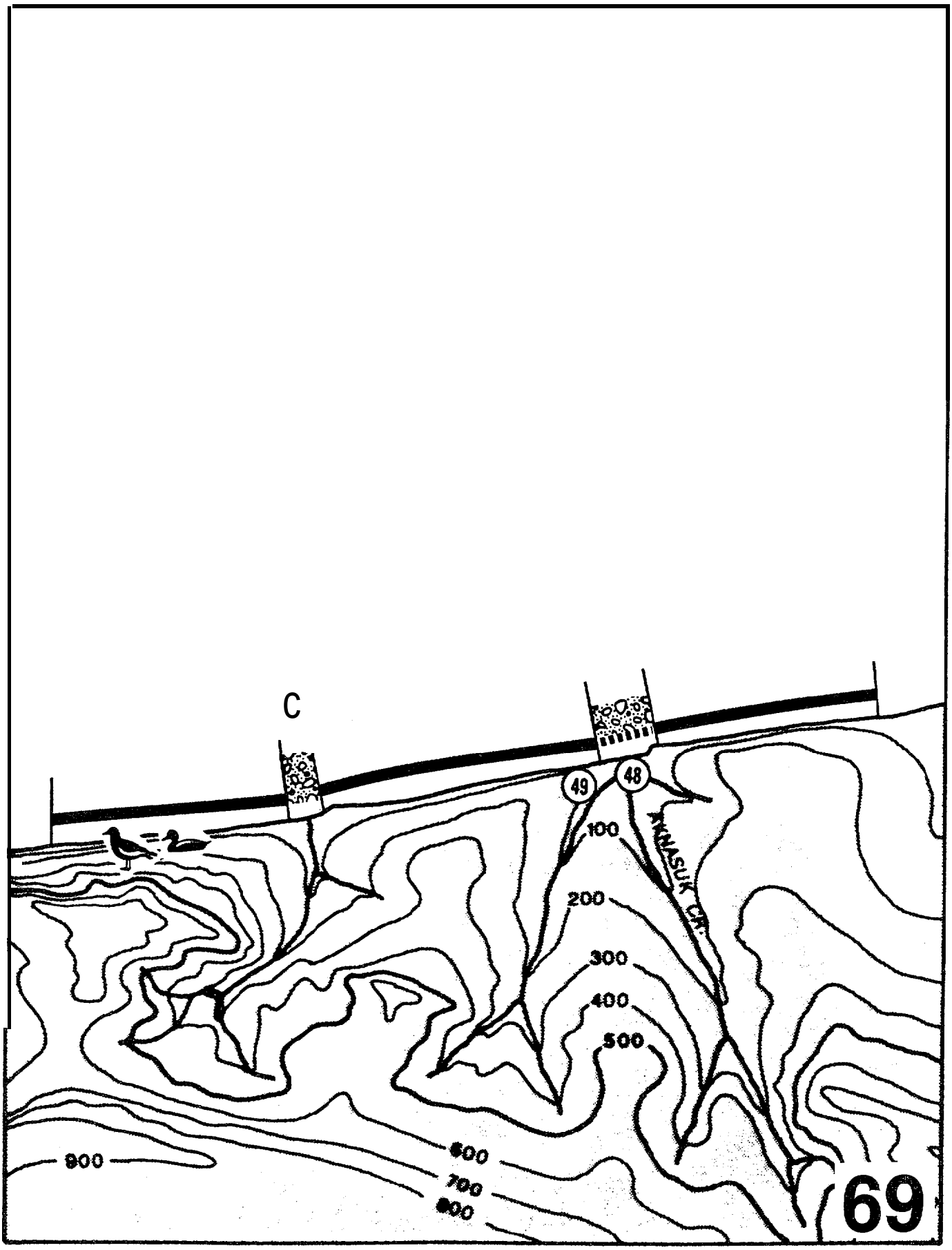
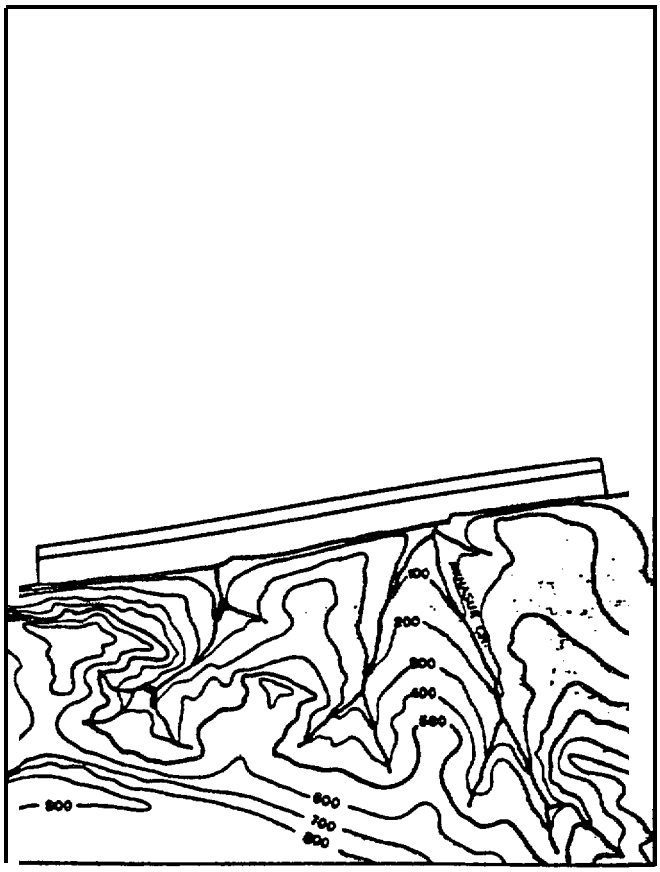
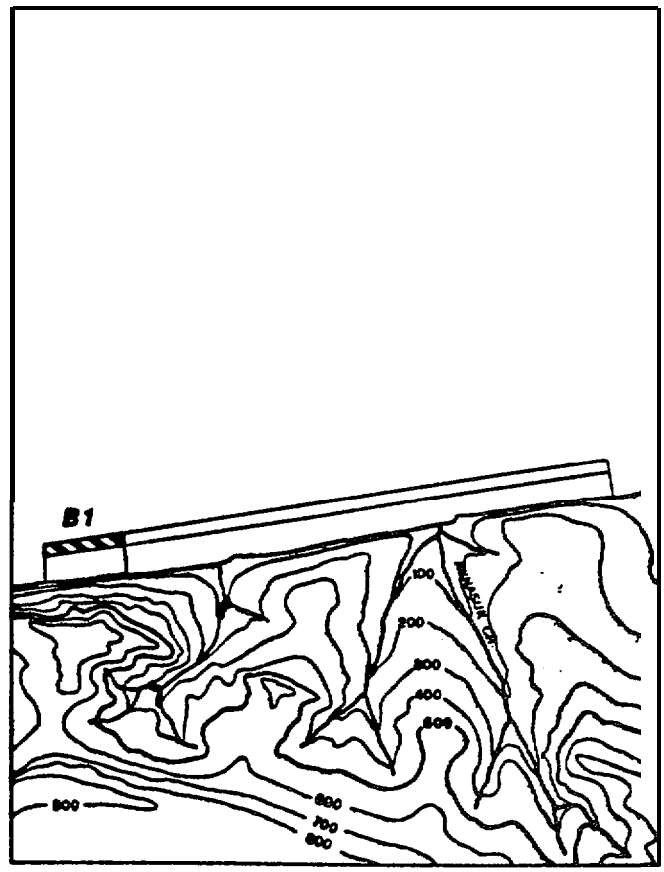

C
49
48
100
200
300
400
500
600
700
800
900
AKWASUK CR.
69

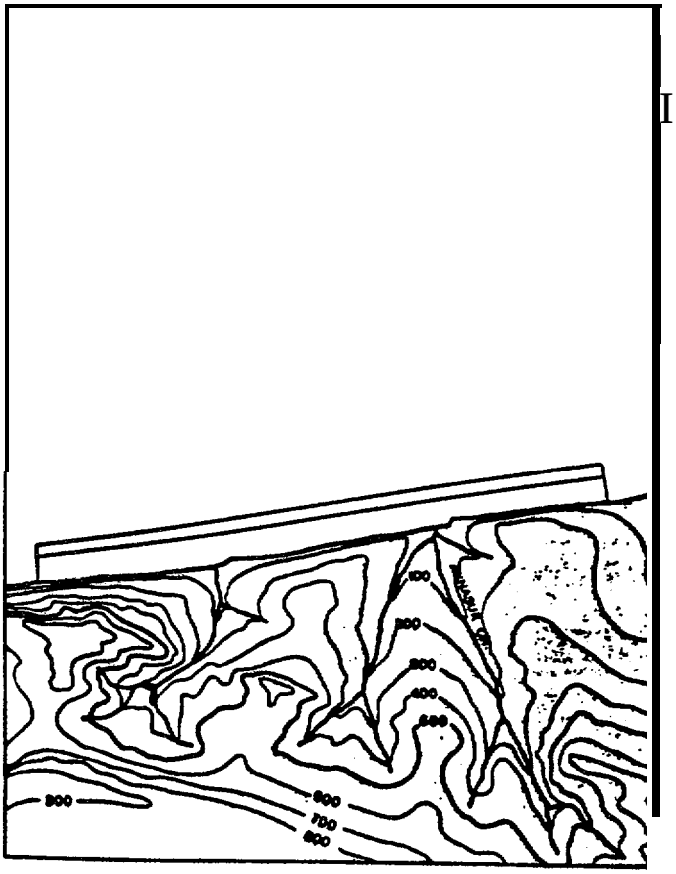
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX

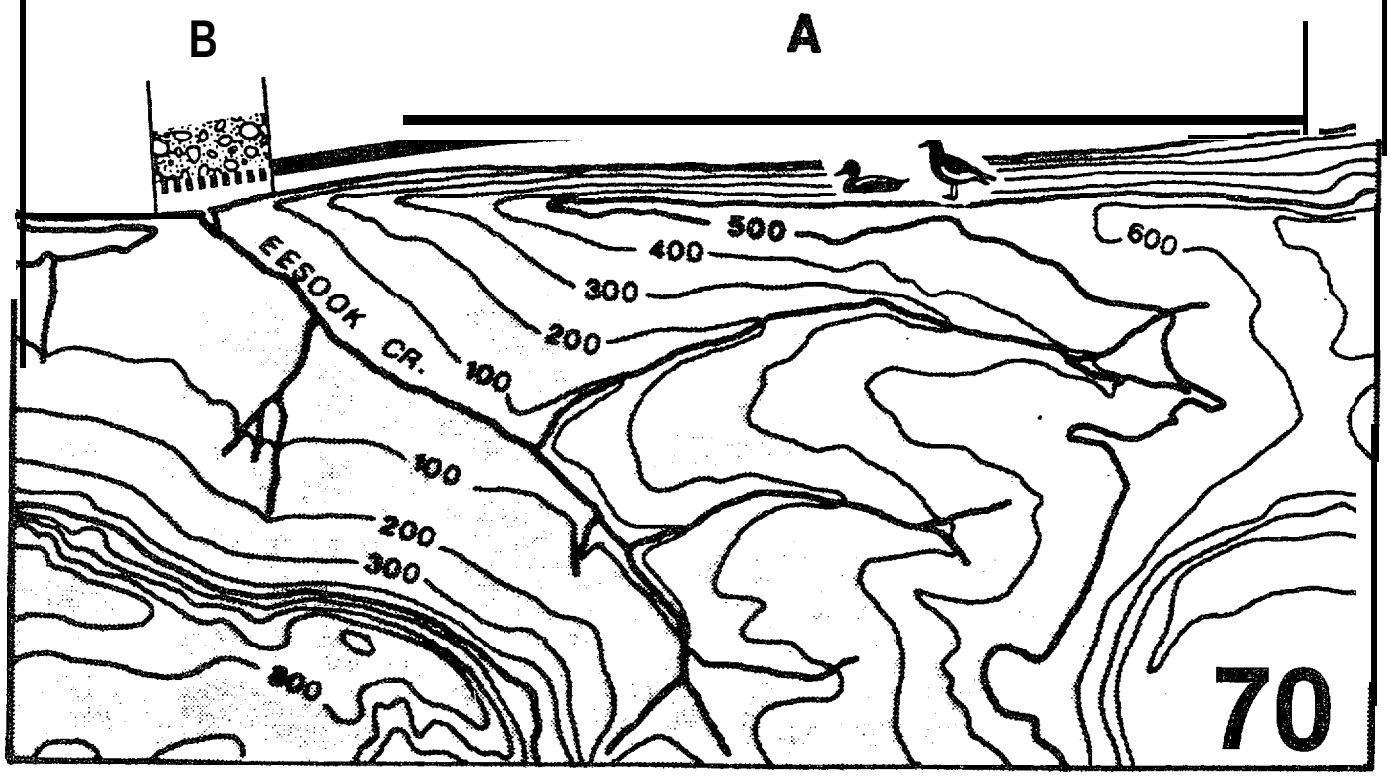


HUMAN USE INDEX

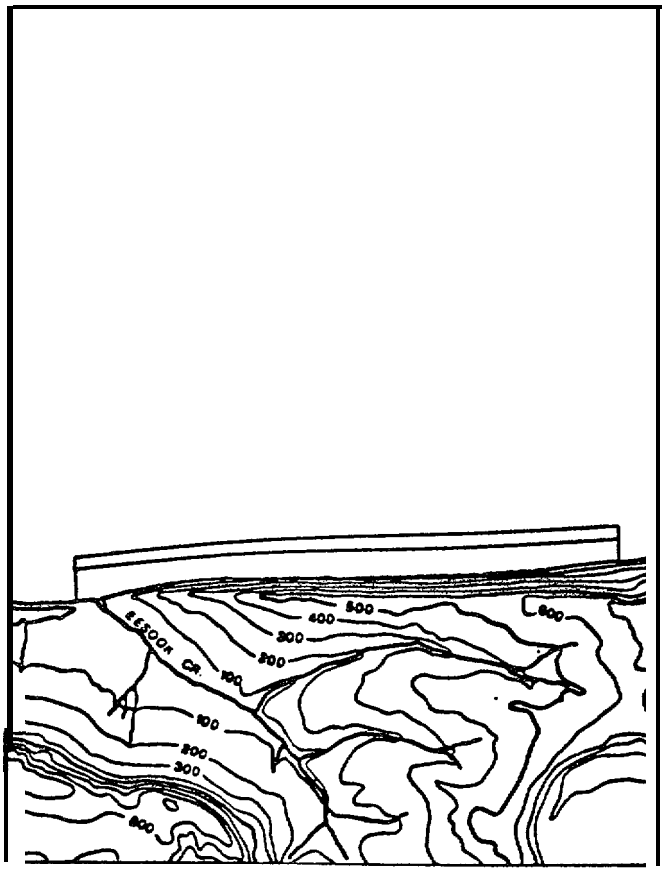


Seasonal Variability of Indices

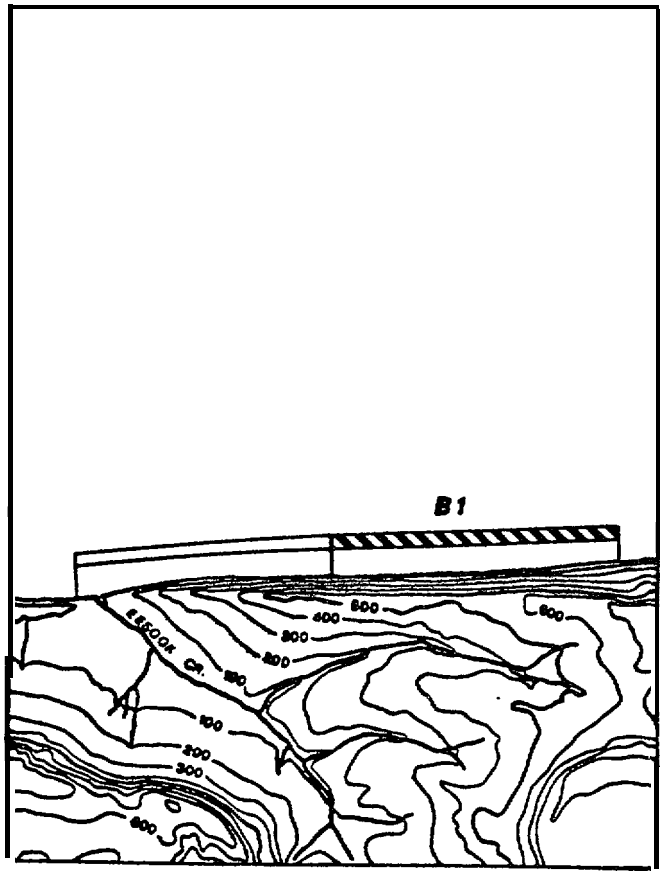
Identifier	RESOURCE	SE Winter	SE Break-Up/Summer/Freeze-Up May	Jun	Jul	Aug	Sep	Oct	SE Winter
B1	Seabird colony; gulls (40 pr), black guillemot (9 pr)								


B
A
500
400
300
200
EESOOK CR.
100
600
100
200
300
400
70

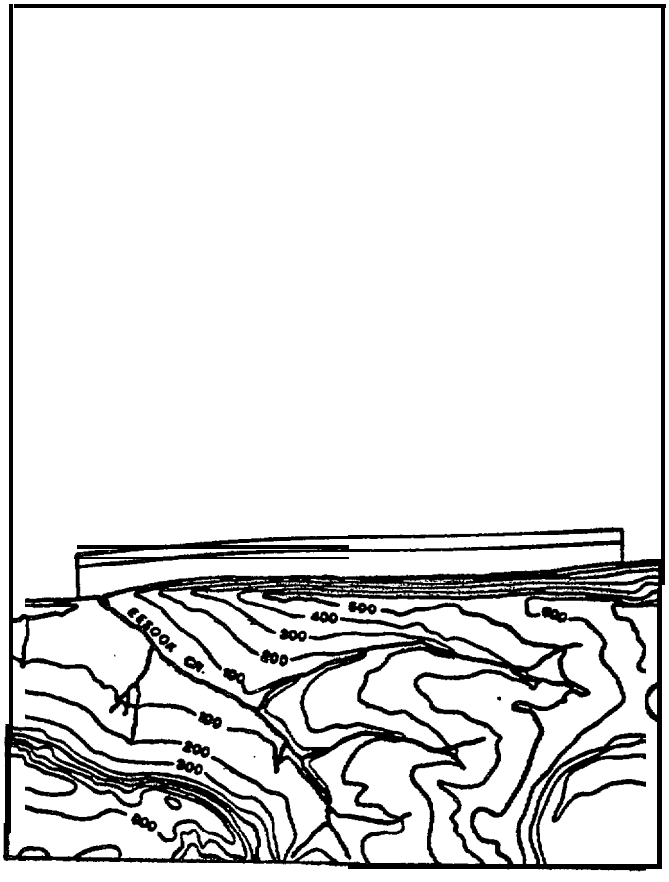
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



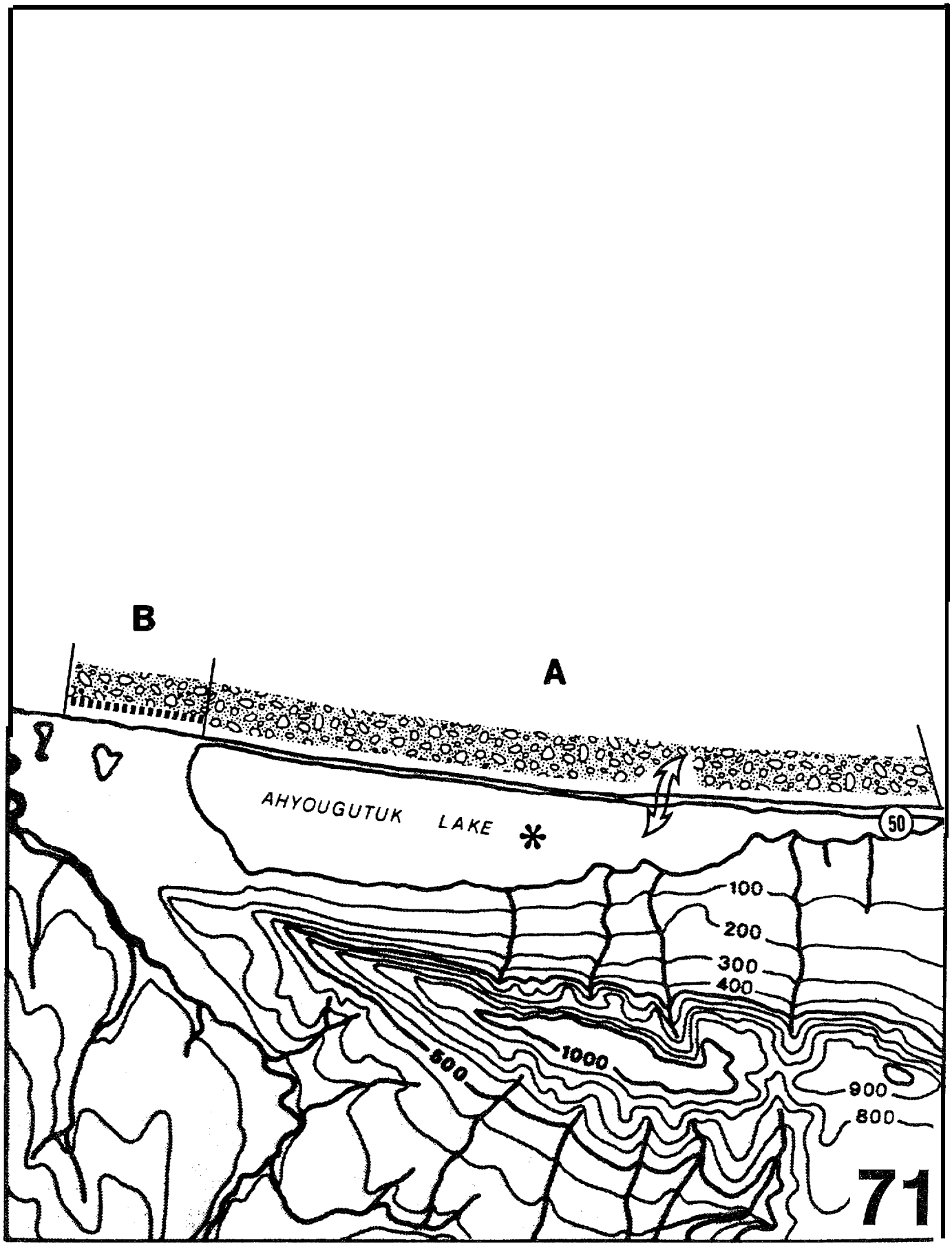
HUMAN USE INDEX



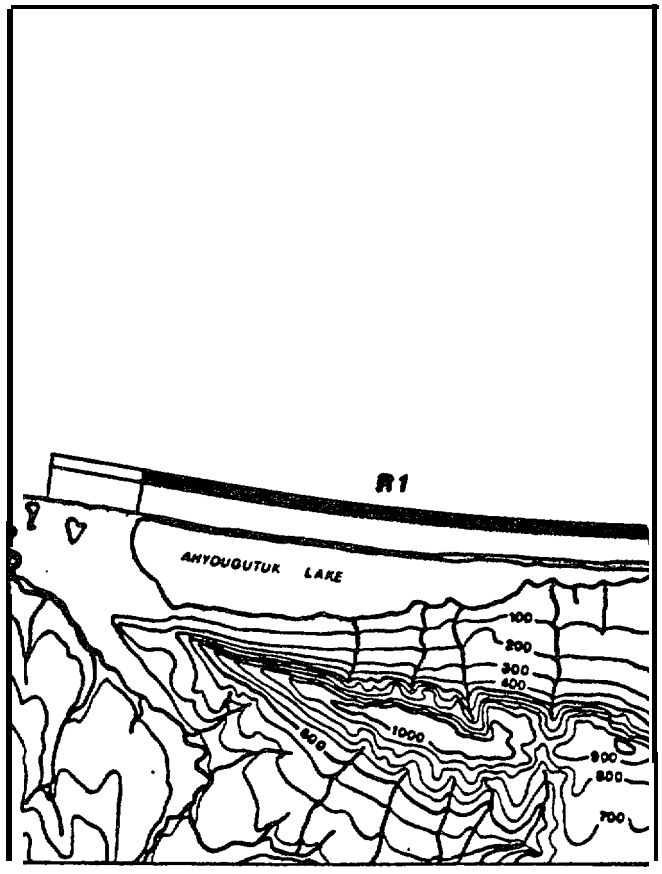
Seasonal Variability** of **Indices

Identifier	RESOURCE	SEASON							
		Winter	May	Jun	Jul	Aug	Sep	Oct	Winter
B1	Seabird colony; gulls (40 pr), black guillemot (9 pr)		▨	▨	▨	▨	▨		

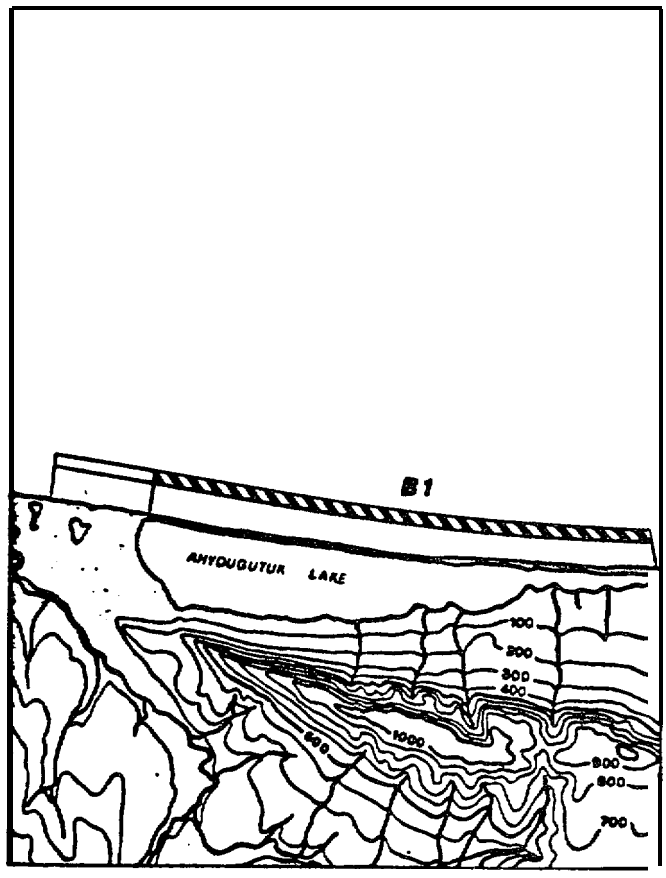
70


B
A
AHYOUGUTUK LAKE
50
100
200
300
400
500
1000
900
800
71

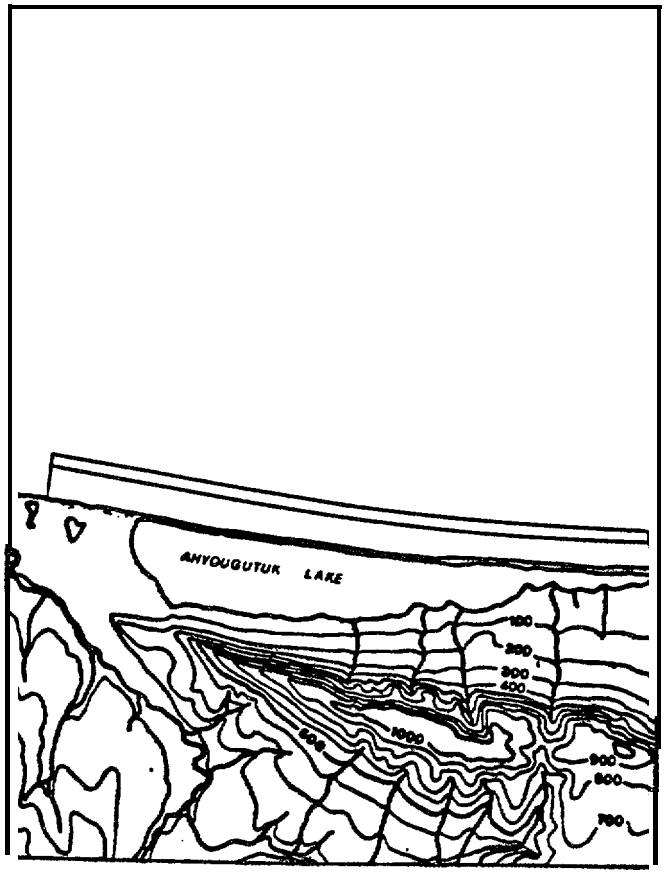
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



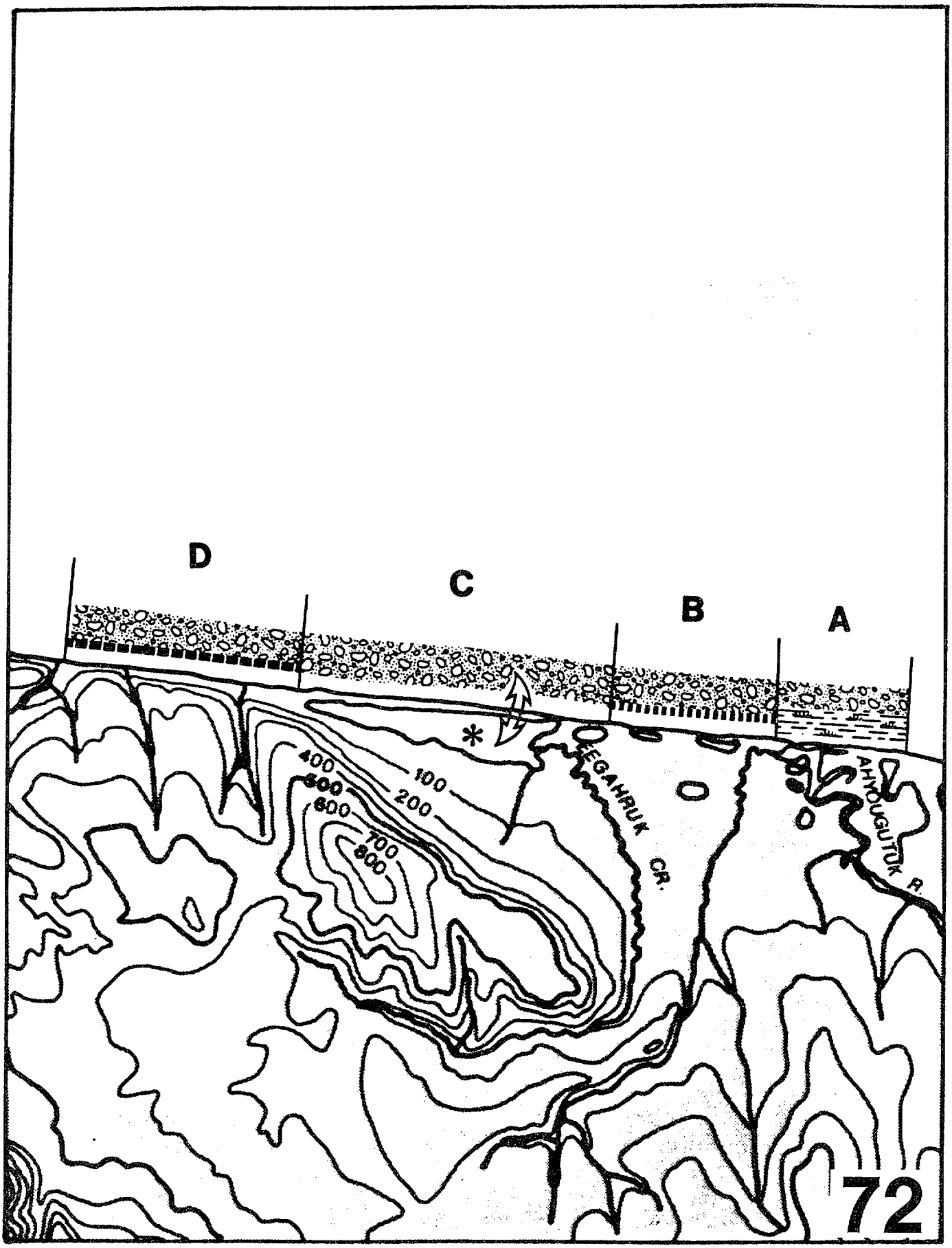
HUMAN USE INDEX



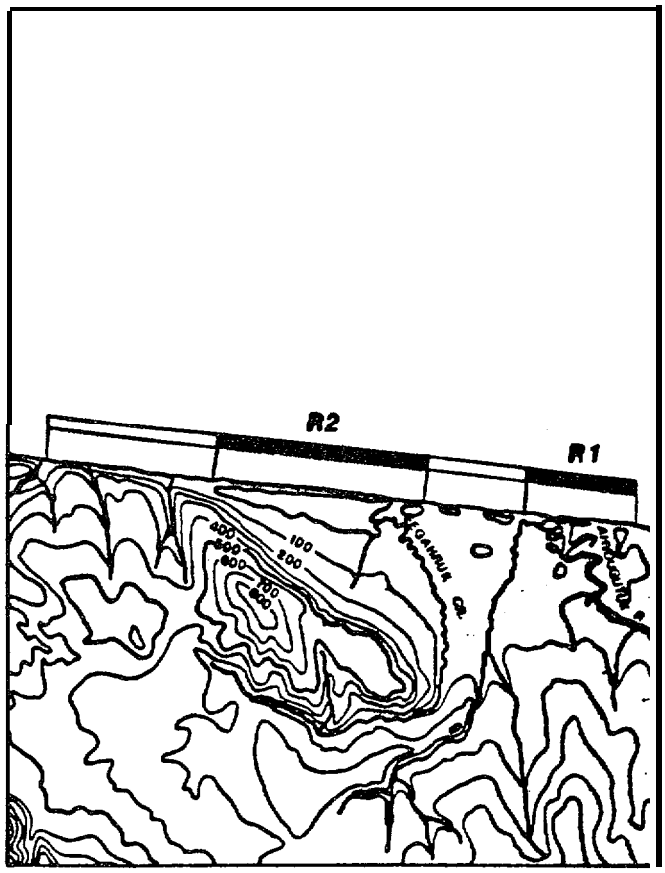
Seasonal **Variability** of **Indices**

Identifier	RESOURCE	SEASON						
		Winter	Break-Up/Summer/Freeze-Up					Winter
			May	Jun	Jul	Aug	Sep	Oct	
R1	Ephemeral inlet; Lagoon				■	■	■	■	
B1	Lagoon with wetland		▨	▨	▨	▨	▨		

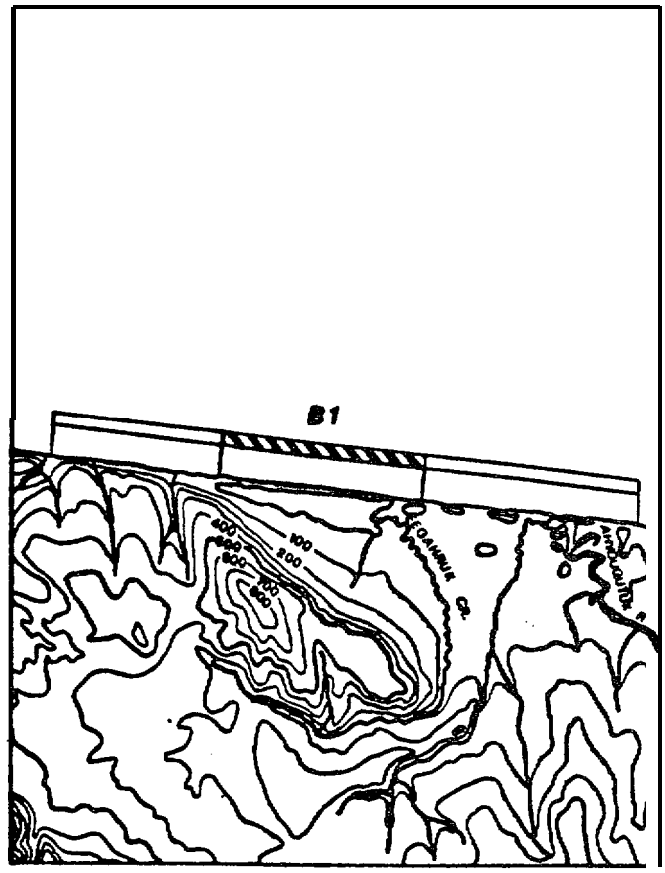
71


D
C
B
A
400
300
600
100
200
700
800
EGAHRUK CR.
AHYOUGUTÜK R.
72

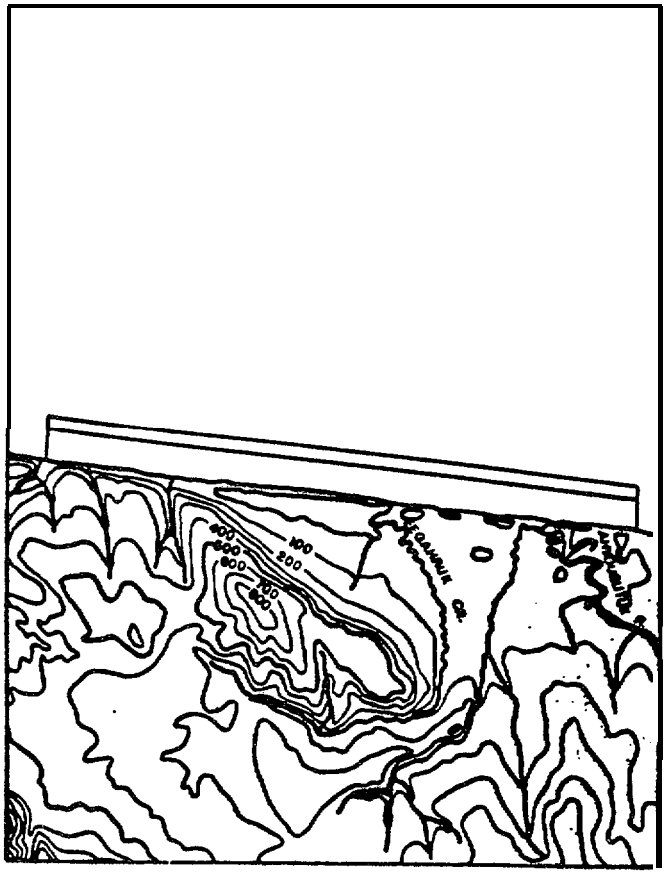
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



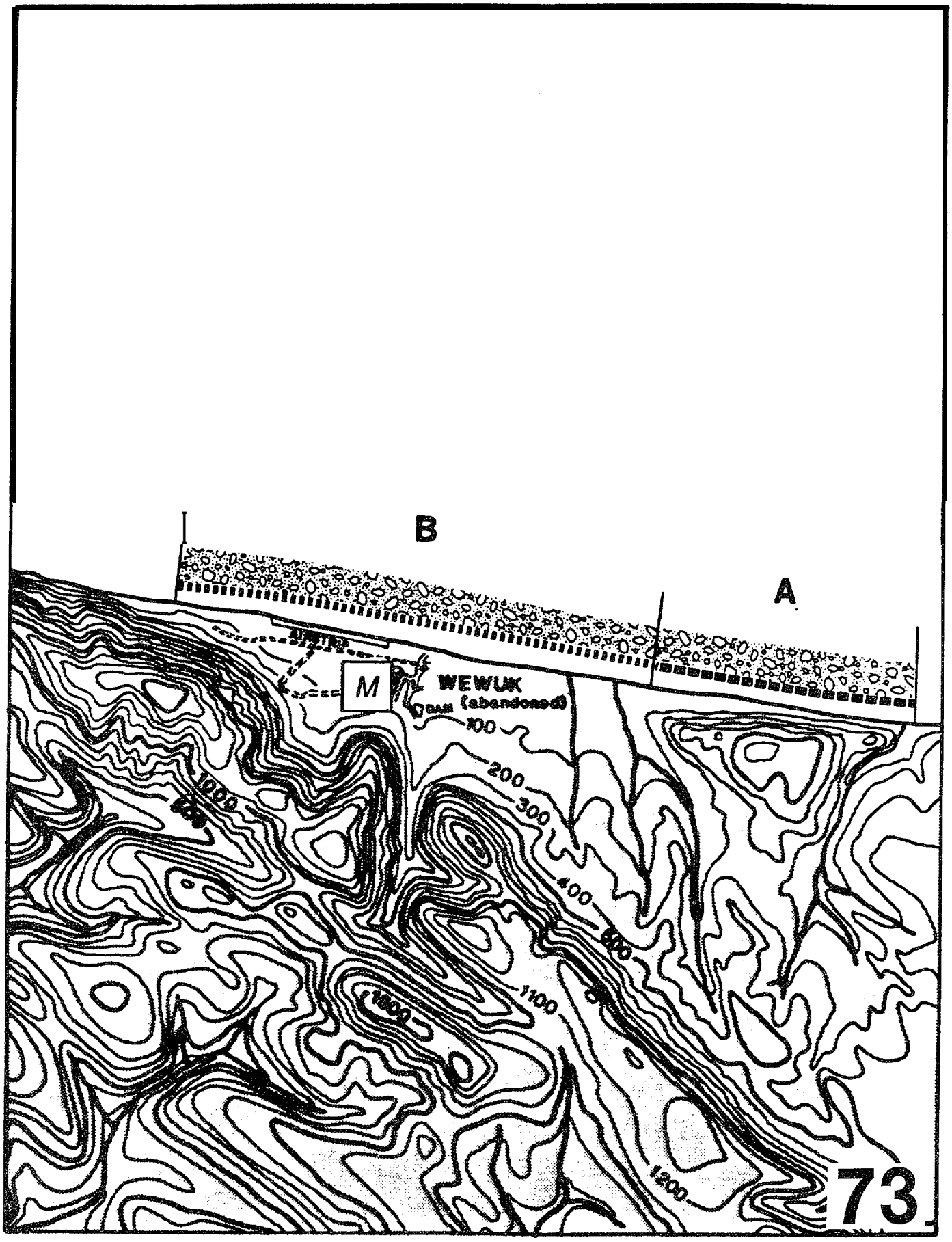
HUMAN USE INDEX



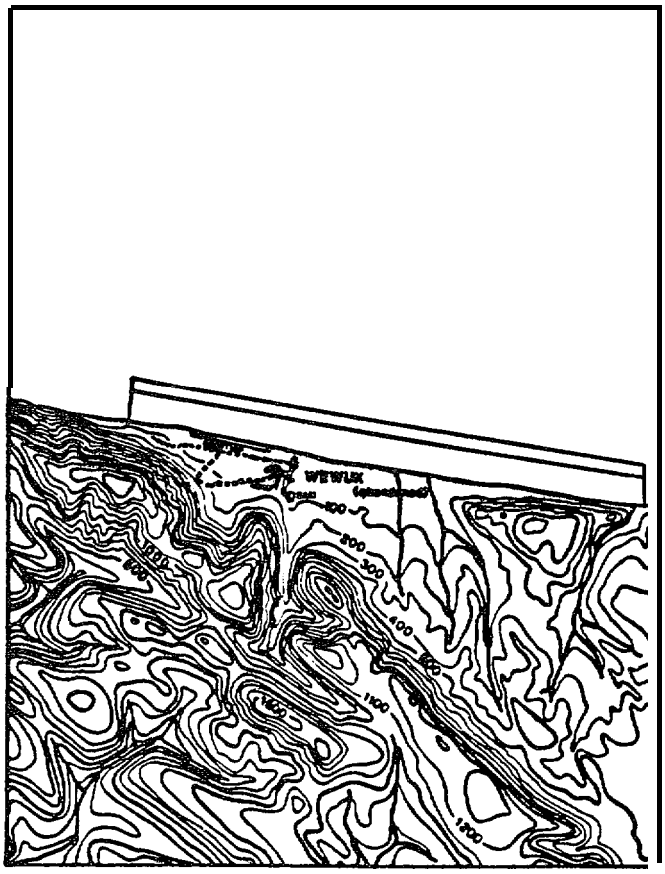
Seasonal Variability of Indices

Identifier	RESOURCE	REASON: Winter	Break-Up/Summer/Freeze-Up: May	Jun	Jul	Aug	Sep	Oct	Winter
R1	Estuary				■	■	■	■	
R2	Ephemeral Inlet; Lagoon				■	■	■	■	
B1	Lagoon		▨	▨	▨	▨	▨	▨	

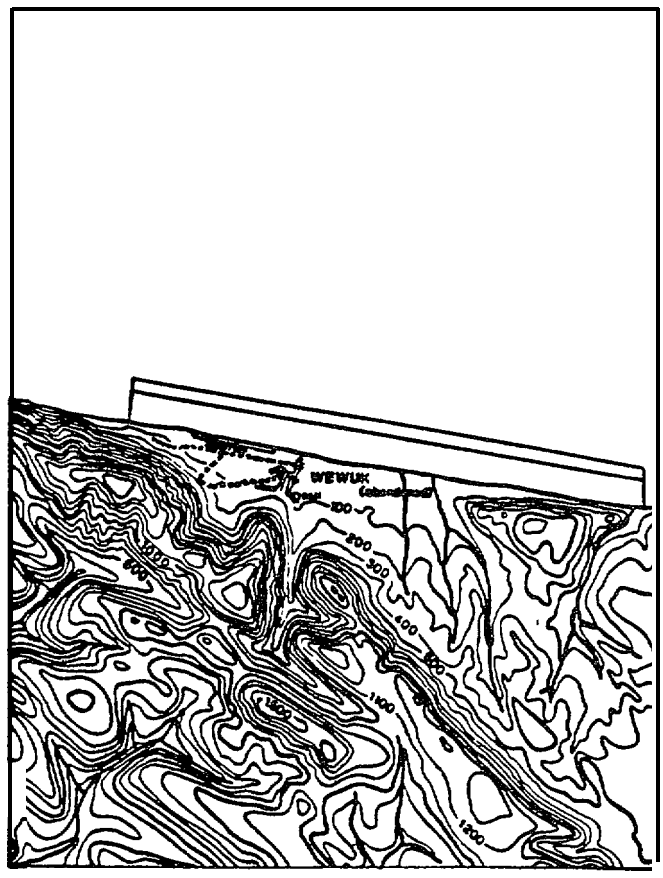
72


B
A
M
WEWUK
DAM (abandoned)
100
200
300
400
1000
1100
1200
73

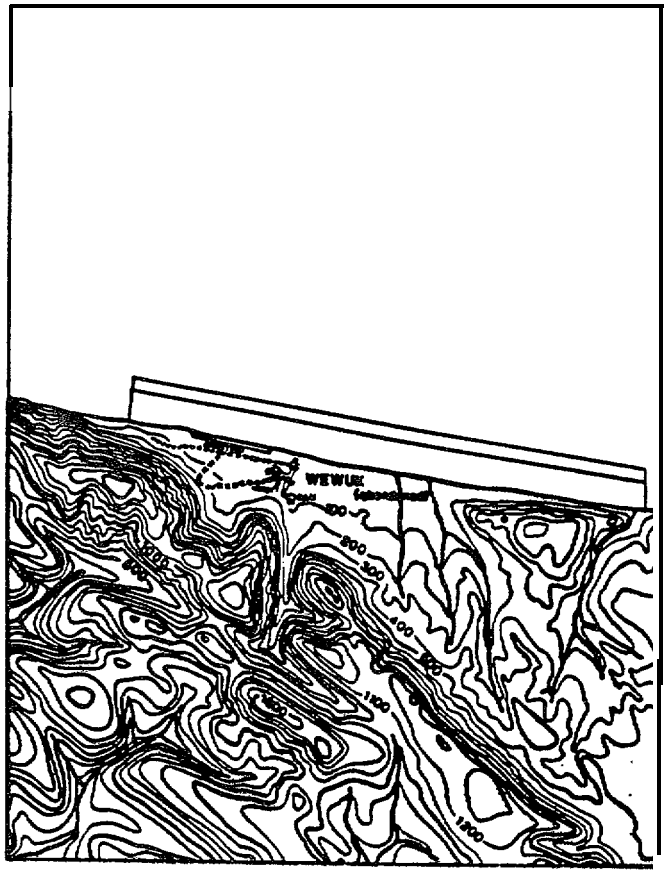
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



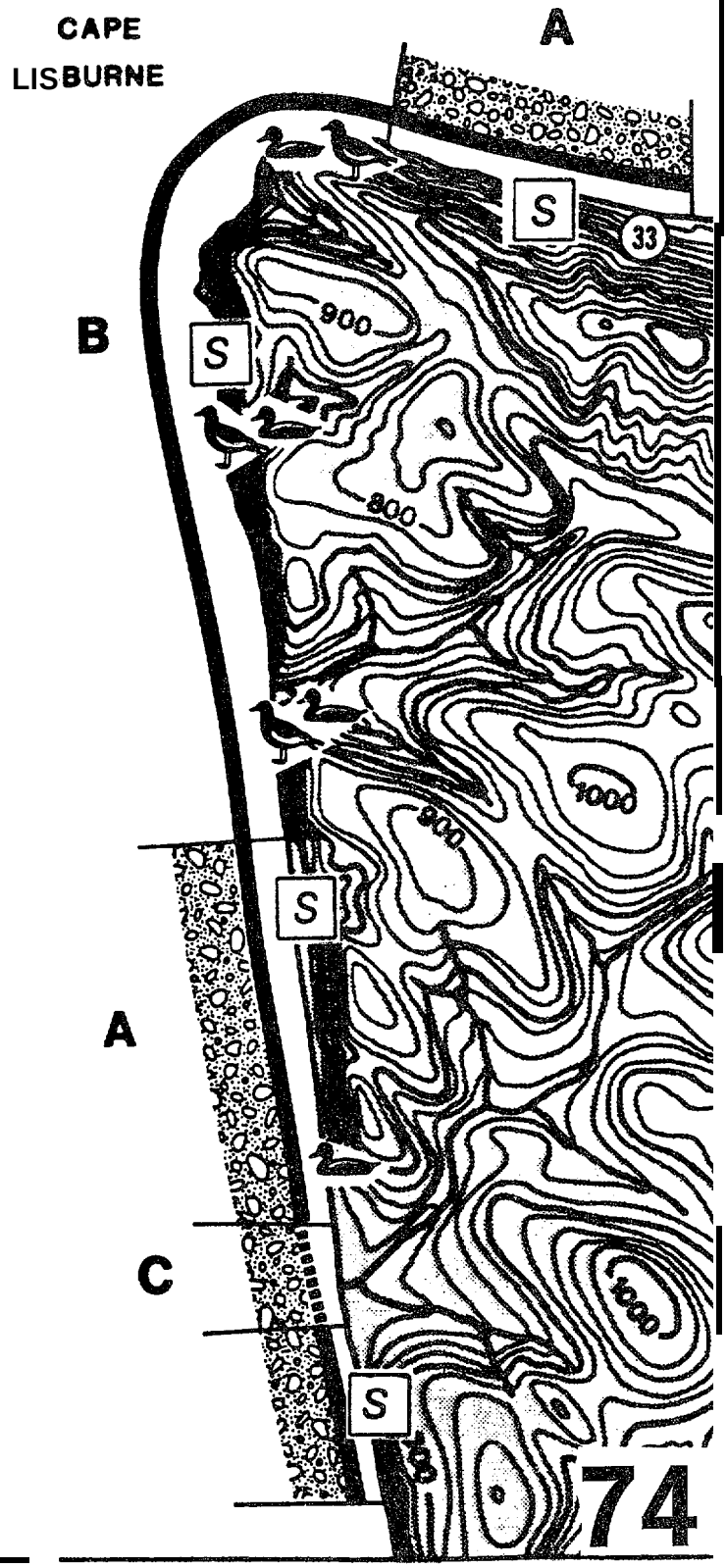
HUMAN USE INDEX



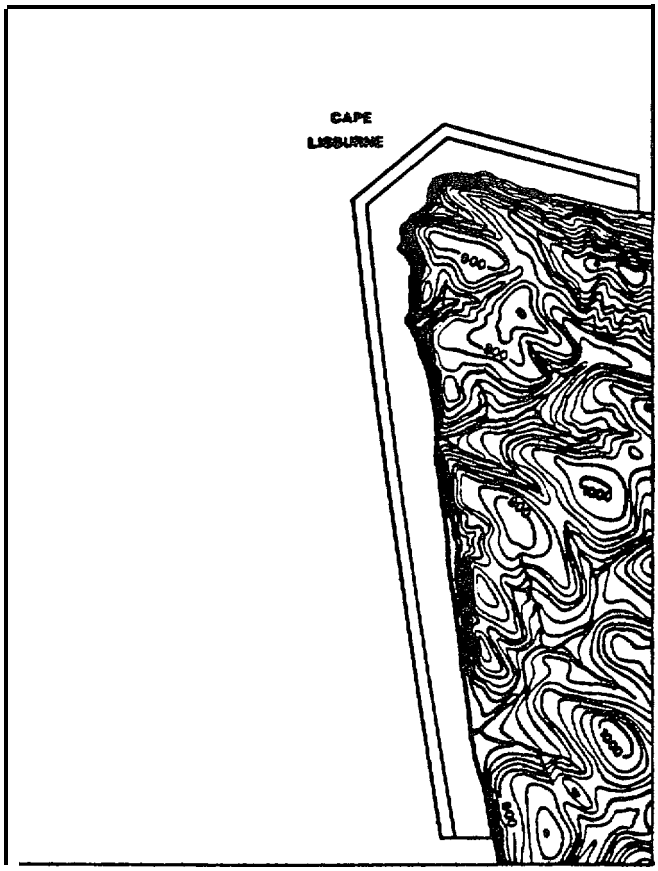
Seasonal Variability of Indices

Identifier	RESOURCE	SEASON						
		Winter	Break-Up/Summer/Freeze-Up					Winter
			May	Jun	Jul	Aug	Sep	Oct	
	MO PRIMARY OR SECONDARY SENSITIVITIES								

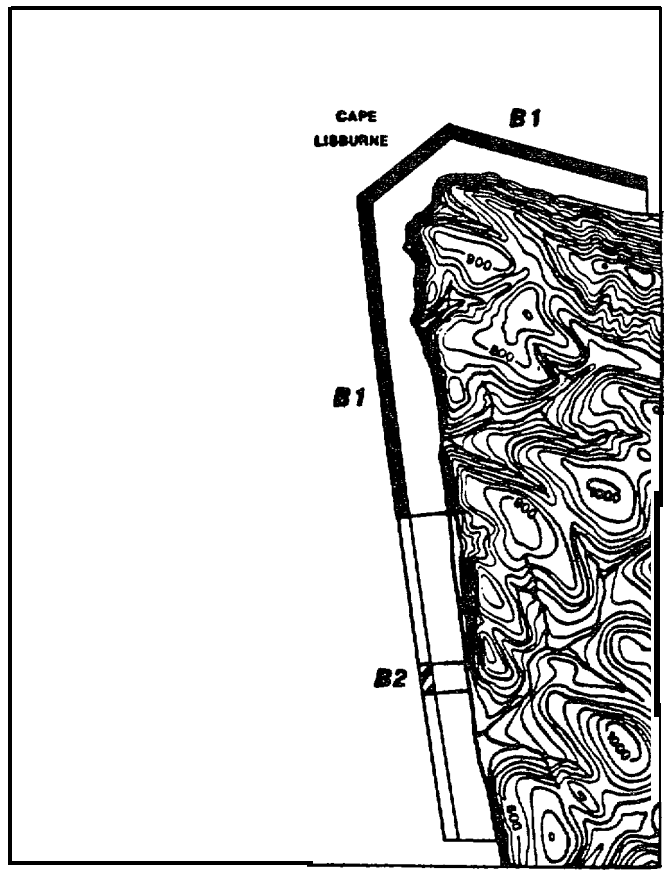
73


CAPE
LISBURNE
A
S
33
B
S
900
800
S
A
C
S
74

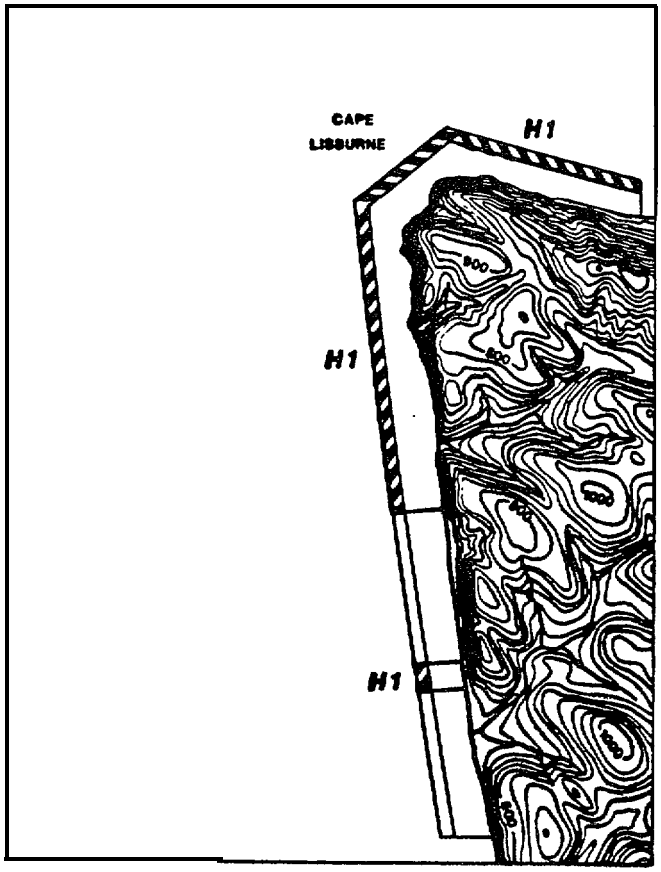
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



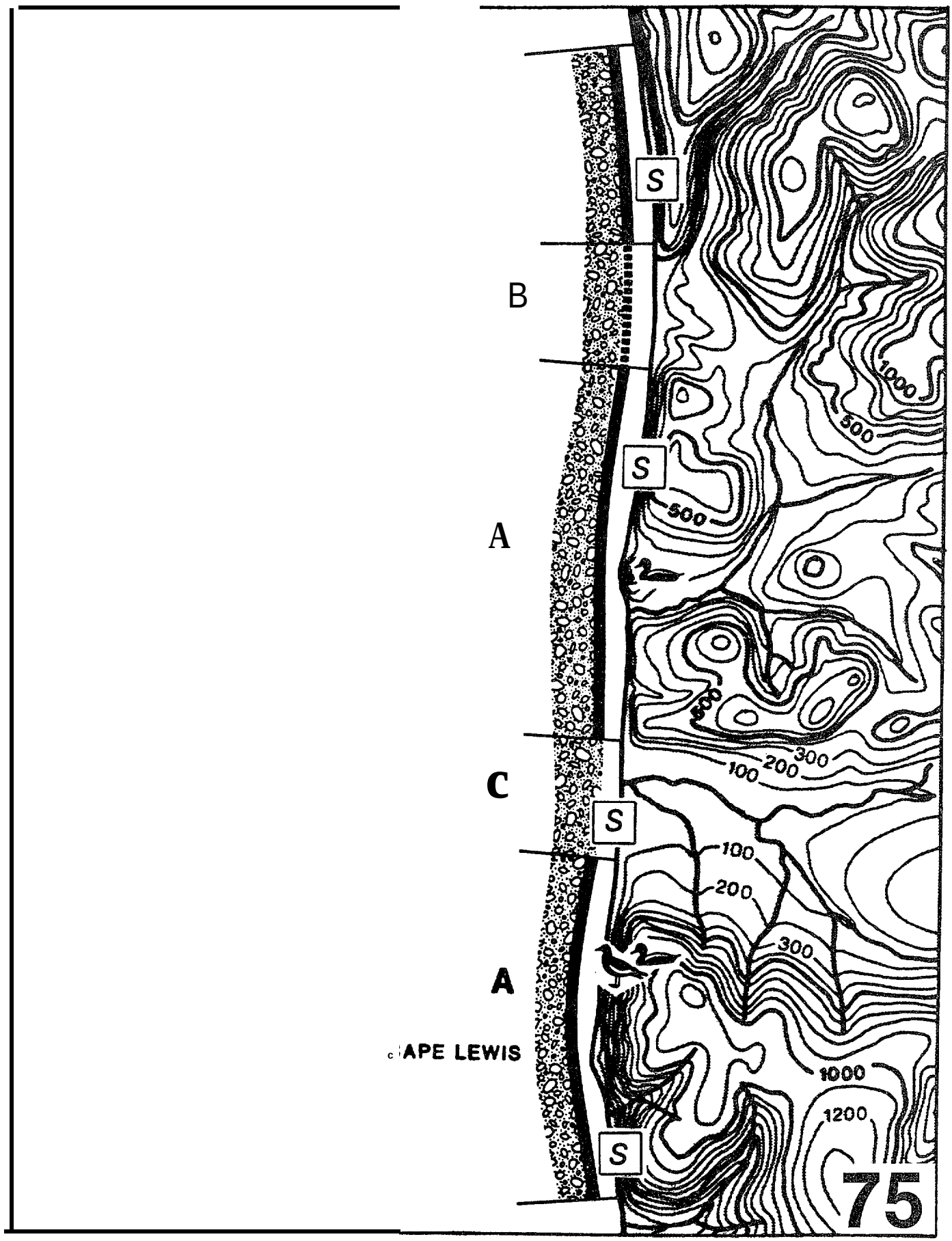
HUMAN USE INDEX



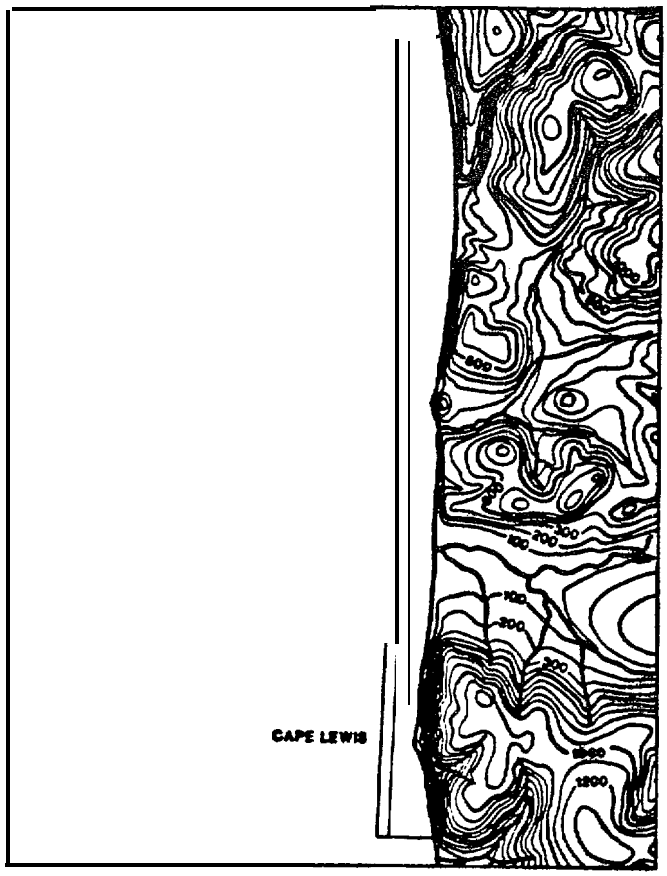
Seasonal Variability of Indices

Identifier	RESOURCE	Winter	SEASON						Winter
			Apr	May	Jun	Jul	Aug	Sep	Oct
B1	● abird colony; common murre (70,000 pr), thick-billed murre (30,000 pr) kittiwake (25,000 *v), horned* puffin (1,450 pr), others (540 pr)		■	■	■	■	■	■	
B2	Pelagic cormorant (6 pr) nesting		◪	◪	◪	◪	◪	◪	
H1	gg gathering				◪	◪			

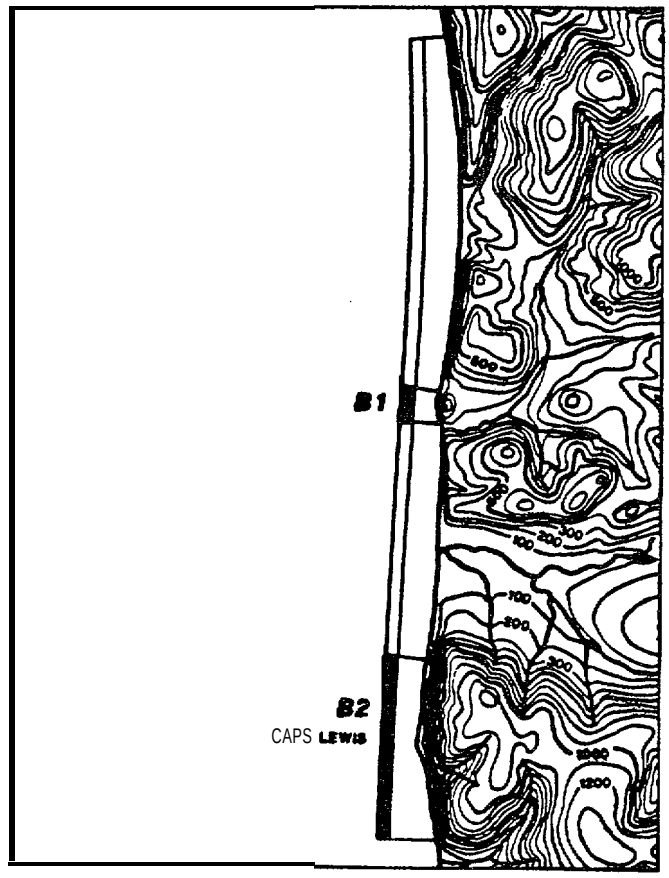
74


S
B
S
A
C
S
A
S
APE LEWIS
1000
500
500
100
200
300
100
200
300
1000
1200
75

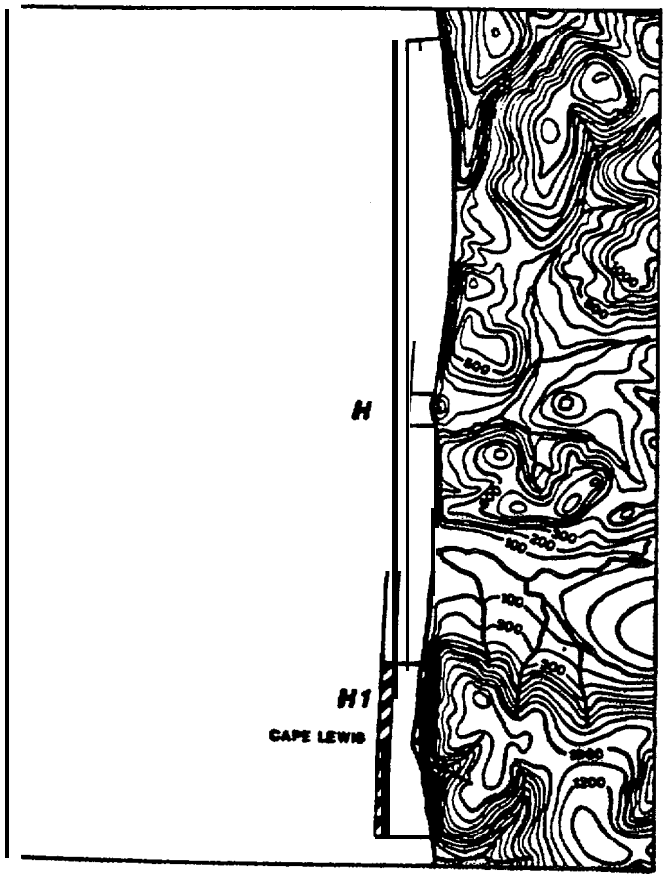
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



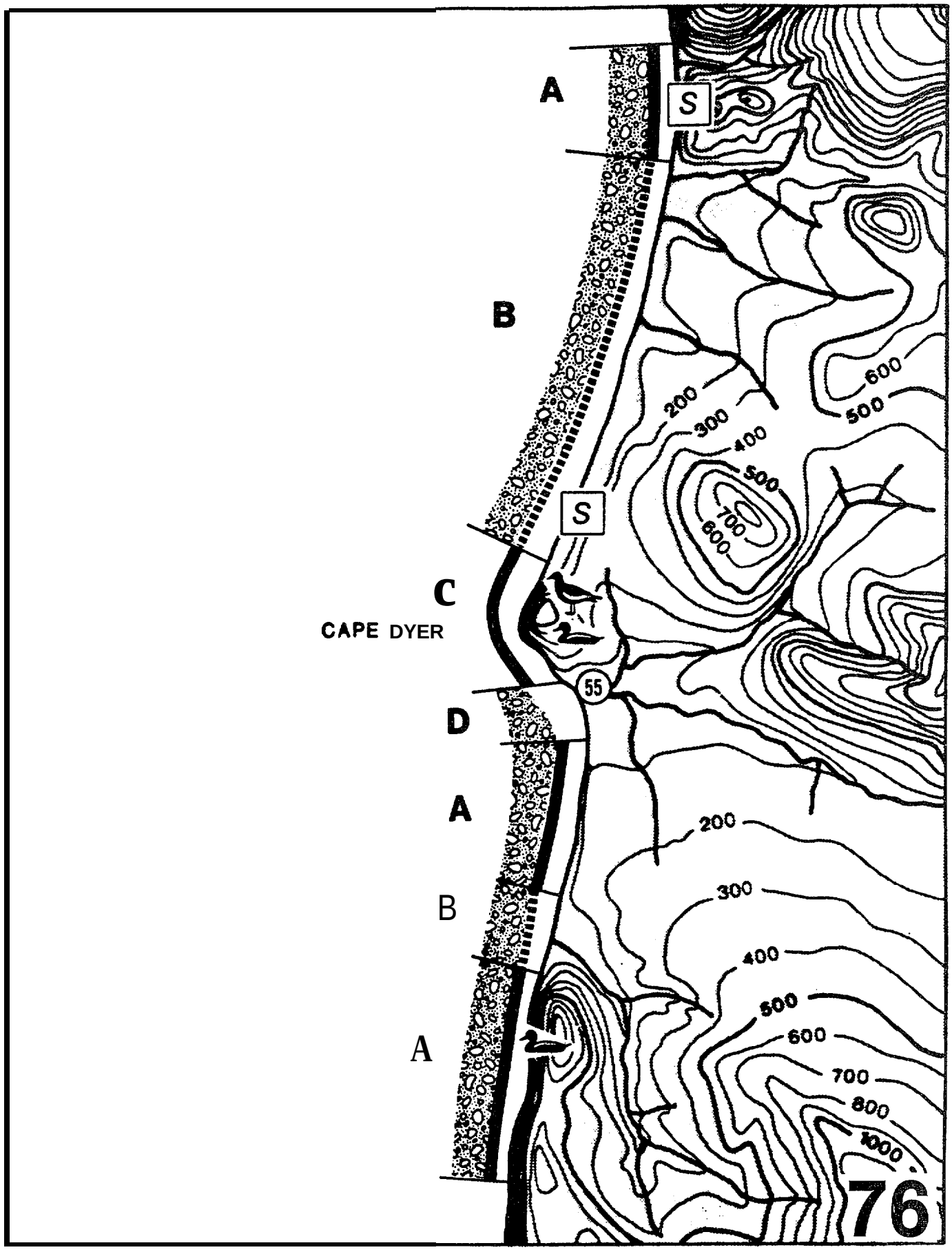
HUMAN USE INDEX



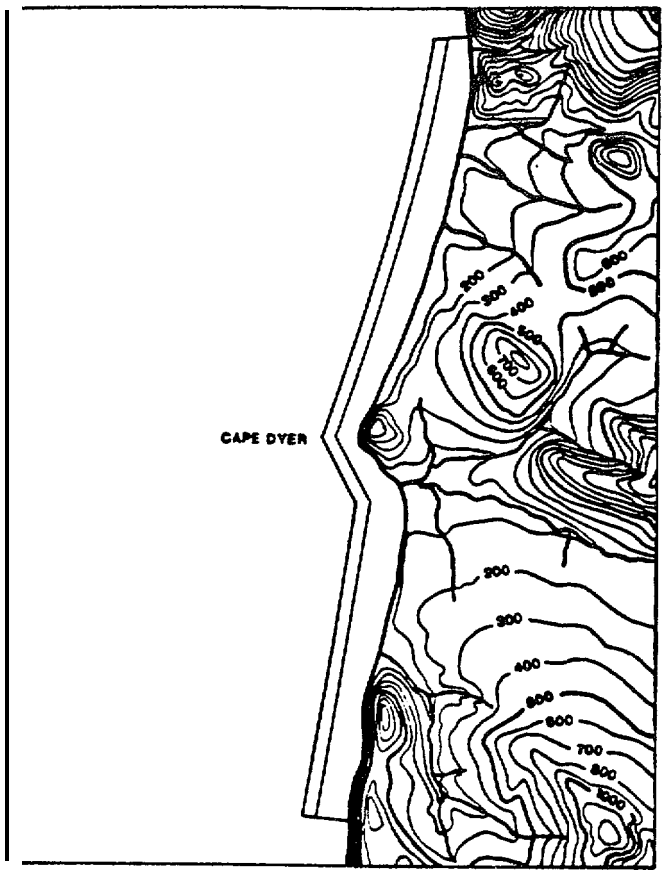
Seasonal Variability of Indices

Month ber	RESOURCE	BE ON May	Jun	Jul	Aug	Sep	Oct	Winter
al	eabird colony; horned and tufte puffins (50 pr), murres (20 pr), cormorants (9 pr							
S2	eabird colony; murres (25,000 pr), Kittiwakes (3.000 pr), puffins (300 pr) Others (1S0 pr)							
HI	gg gathering							

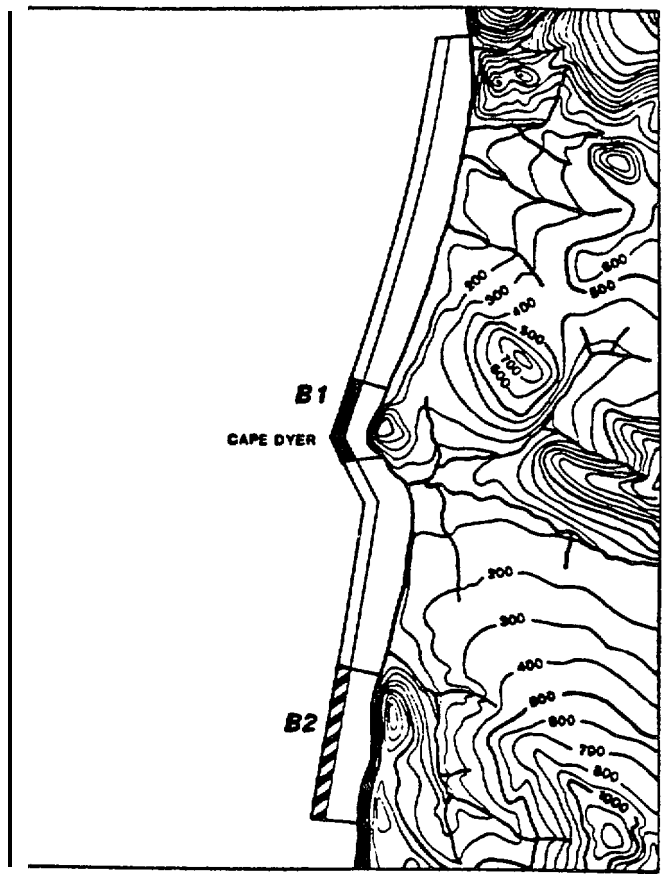
75


A
S
B
200
300
400
500
600
700
600
500
S
C
CAPE DYER
55
D
A
B
A
200
300
400
500
600
700
800
1000
76

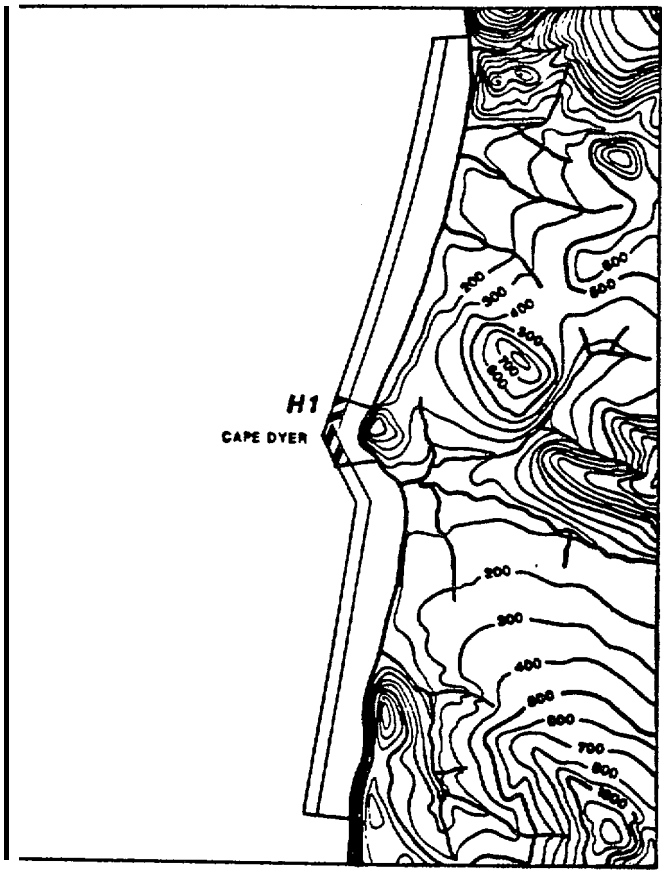
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



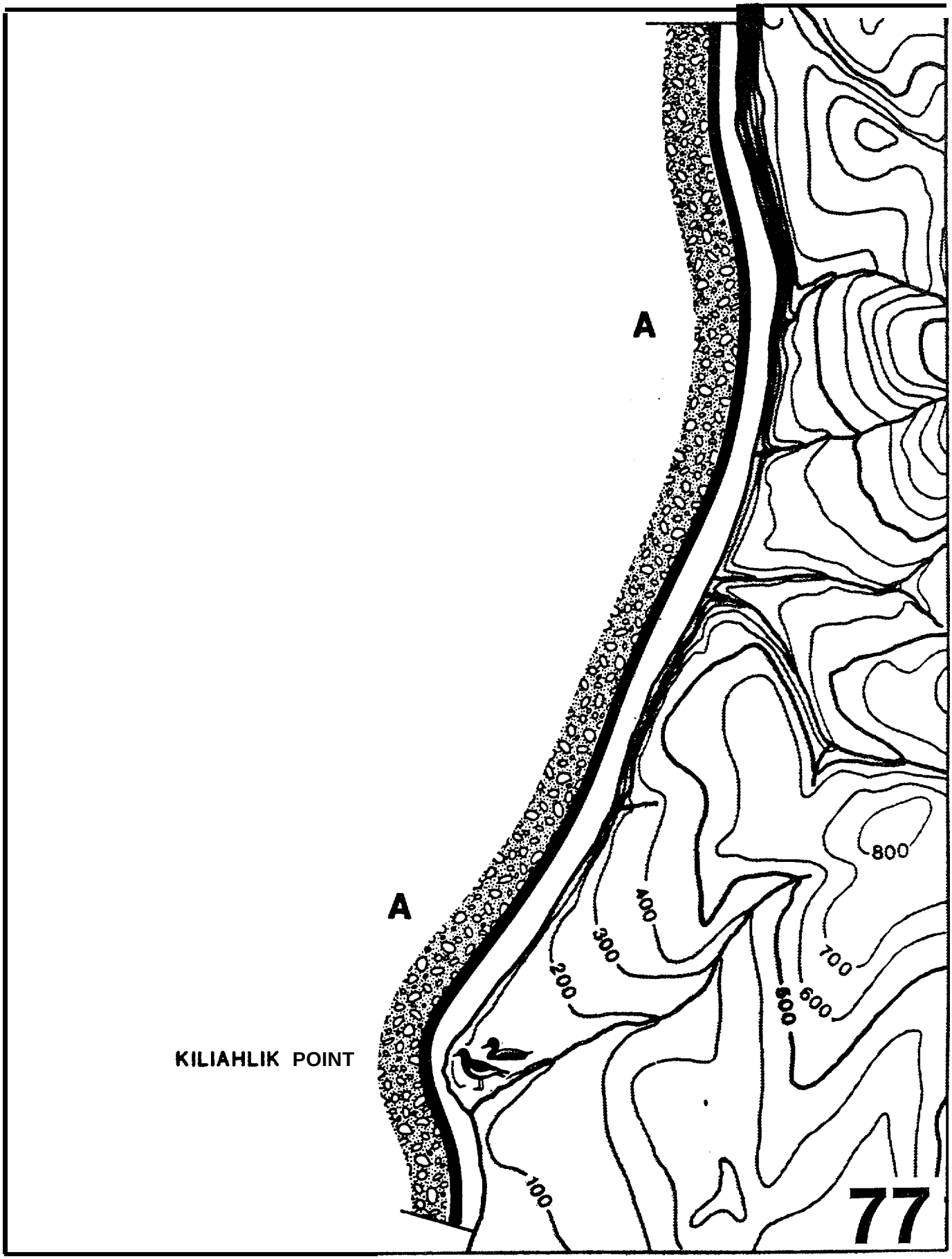
HUMAN USE INDEX



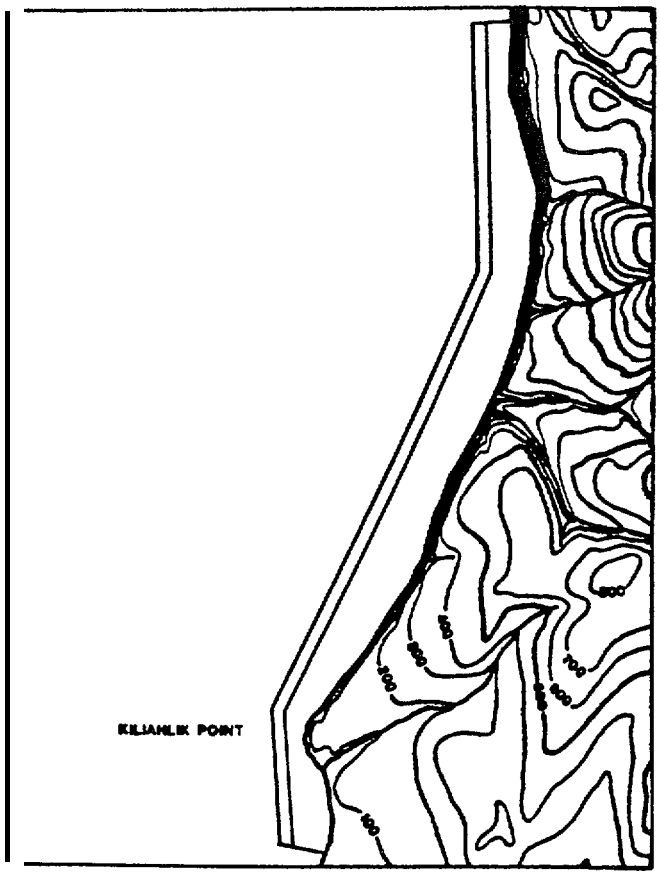
Seasonal Variability of Indices

Identifier	RESOURCE	Winter	Break-Up/Summer/Freeze Up					
			May	Jun	Jul	Aug	Sep	Oct
B1	Seabird colony; gulls (48 pr), puffins (28 pr), cormorant (26 pr)		■	■	■	■	■	
B2	Murre colony (20 pr)		▨	▨	▨	▨	▨	
H1	Egg gathering			▨	▨	▨		

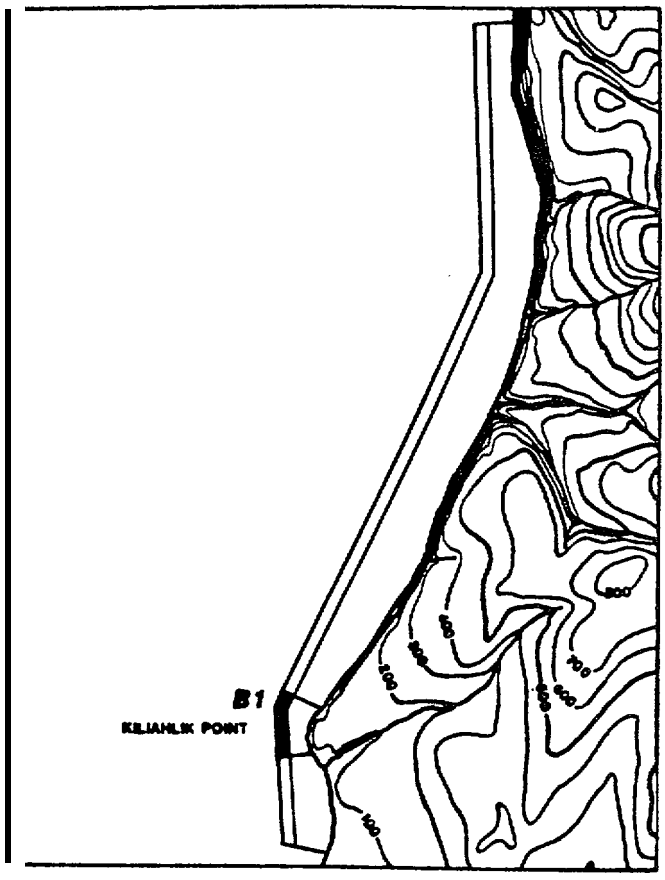
76


A
A
800
400
300
200
700
600
500
100
KILIAHLIK POINT
77

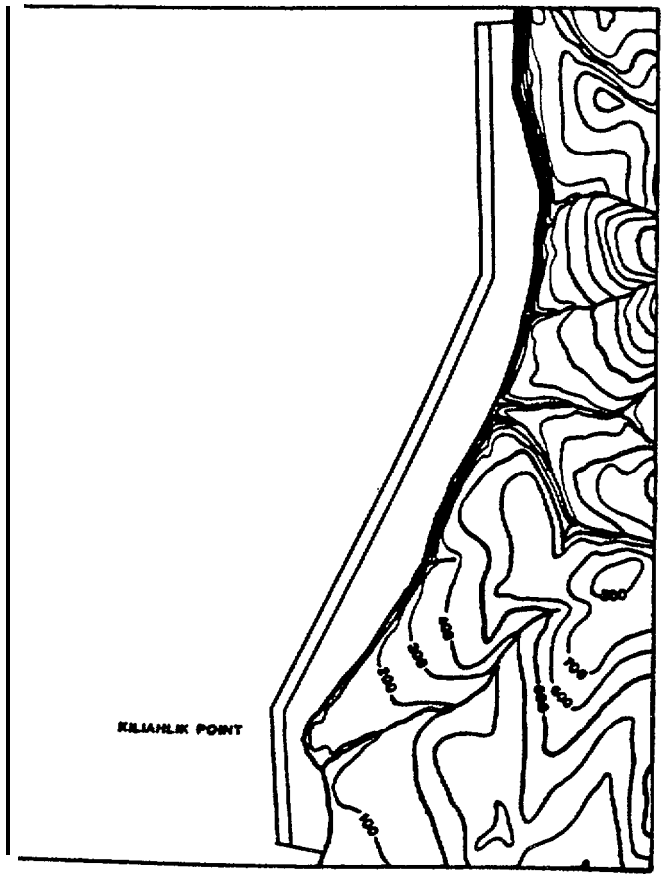
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



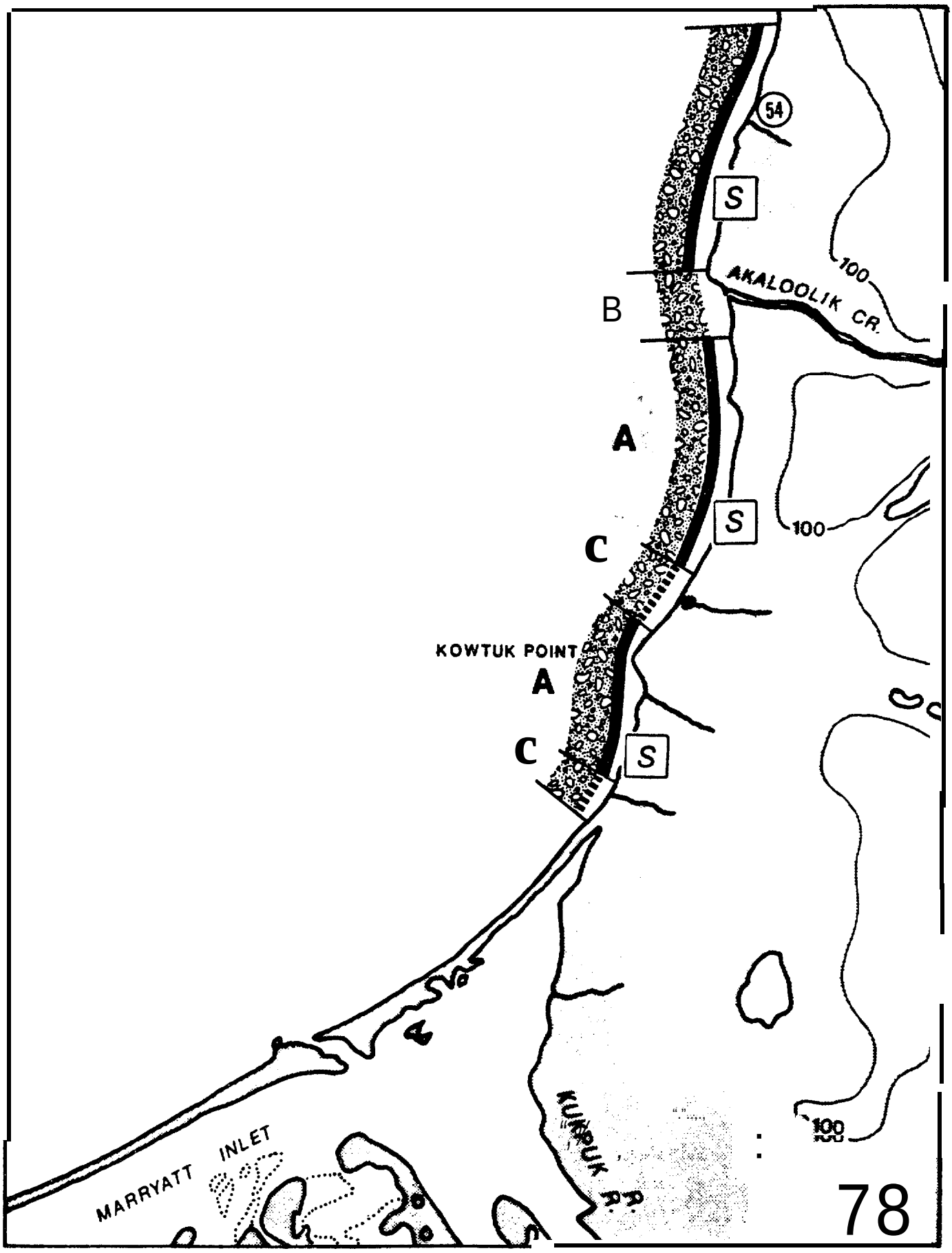
HUMAN USE INDEX



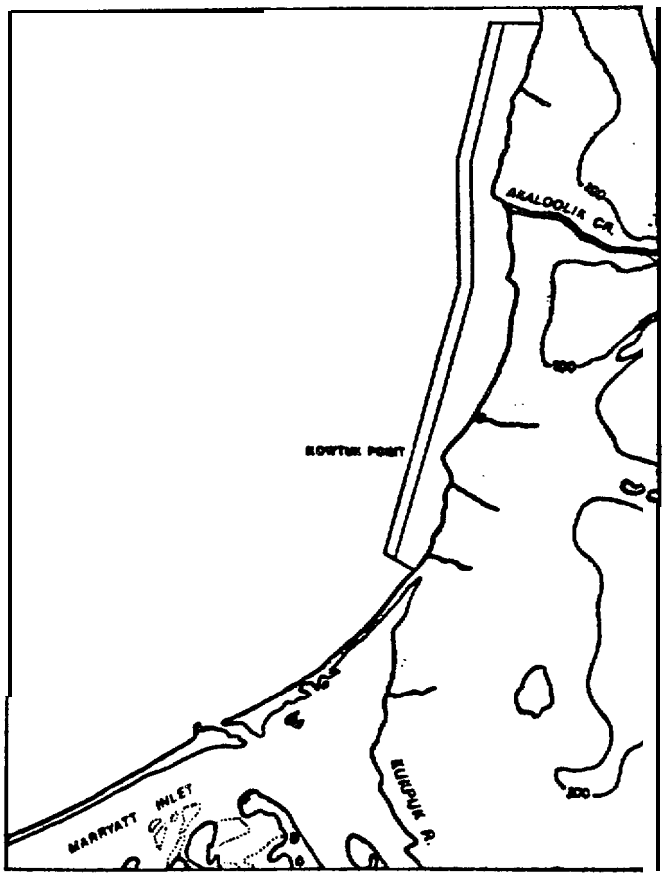
Seasonal Variability of Indices

Identifier	RESOURCE	SEASON							
		Winter	Break-Up/Summer/Freeze-Up						Winter
			May	Jun	Jul	Aug	Sep	Oct	
B1	Seabird colony; cormorants (100 pr), gulls (40 pr)		■	■	■	■	■		

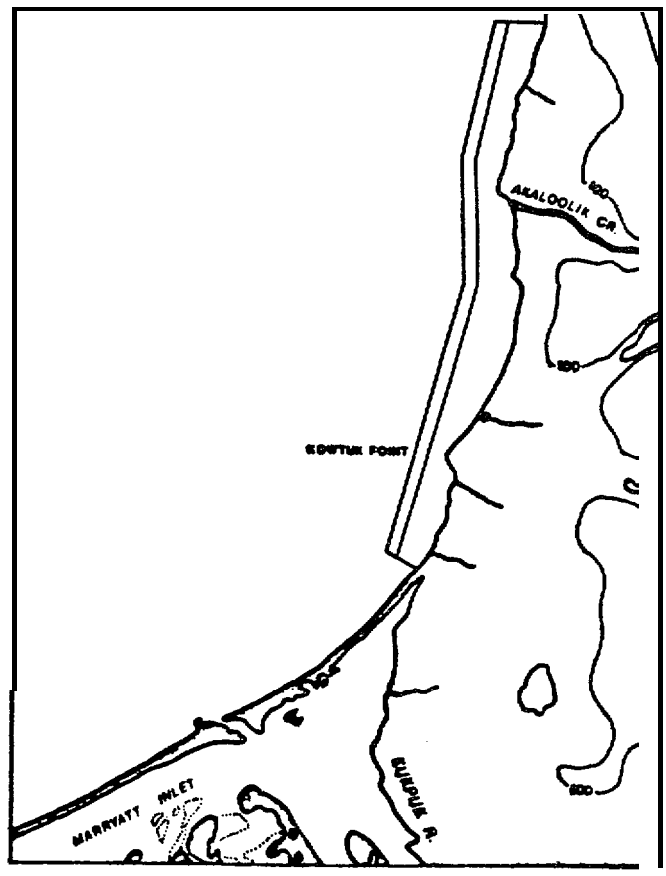
77


54
S
AKALOOLIK CR.
100
B
A
S
100
C
KOWTUK POINT
A
C
S
MARRYATT INLET
KUKPUK R.
100
78

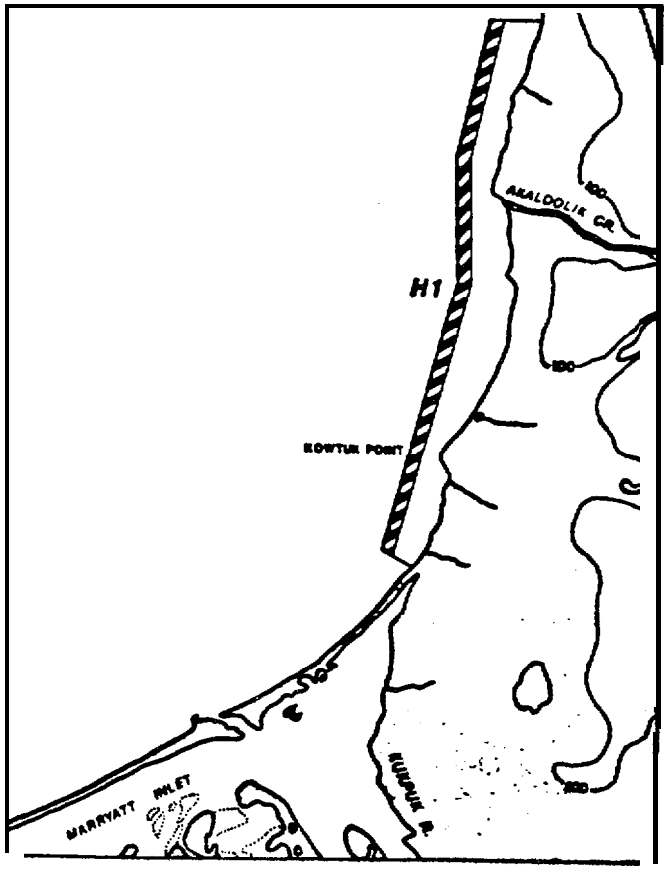
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



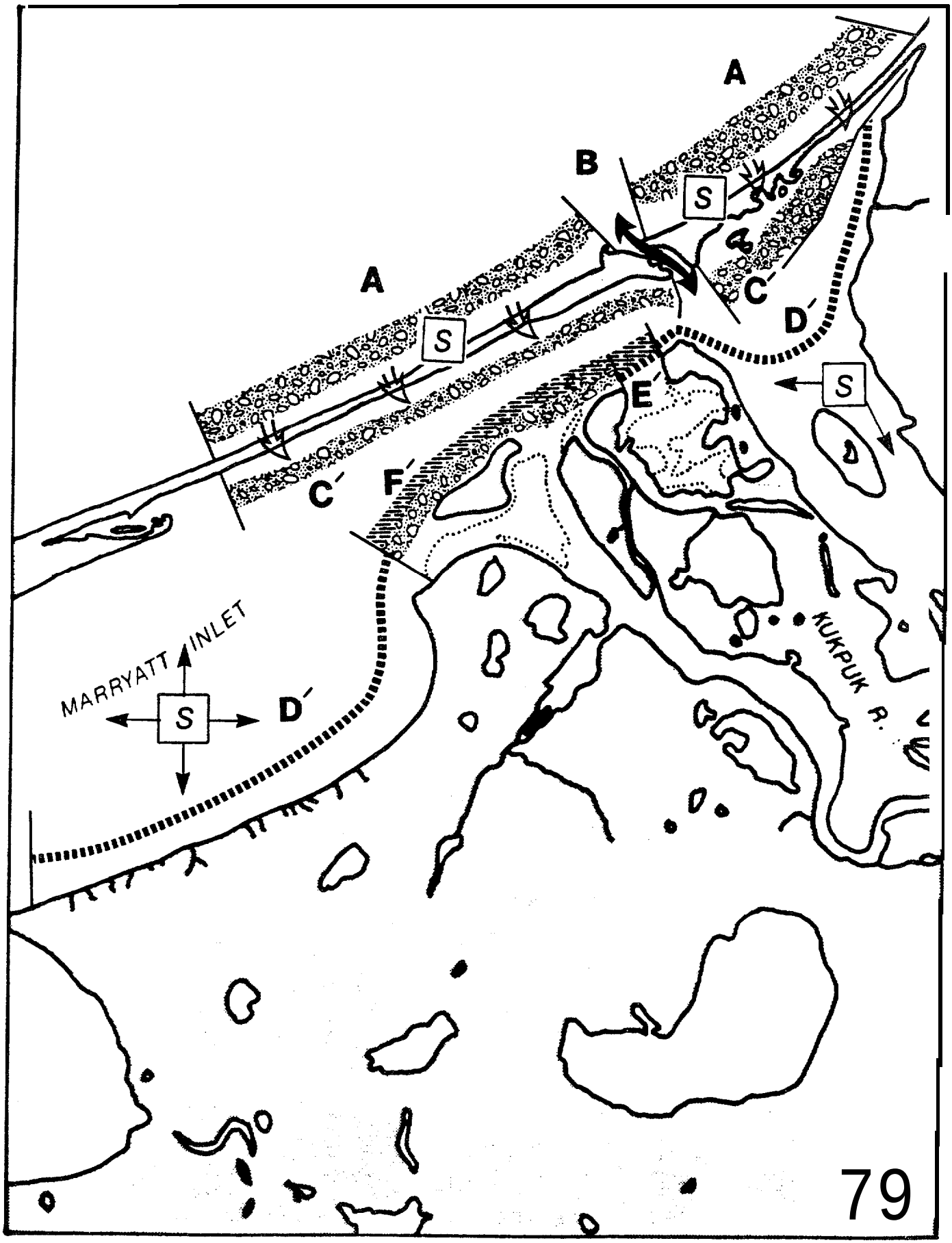
HUMAN USE INDEX



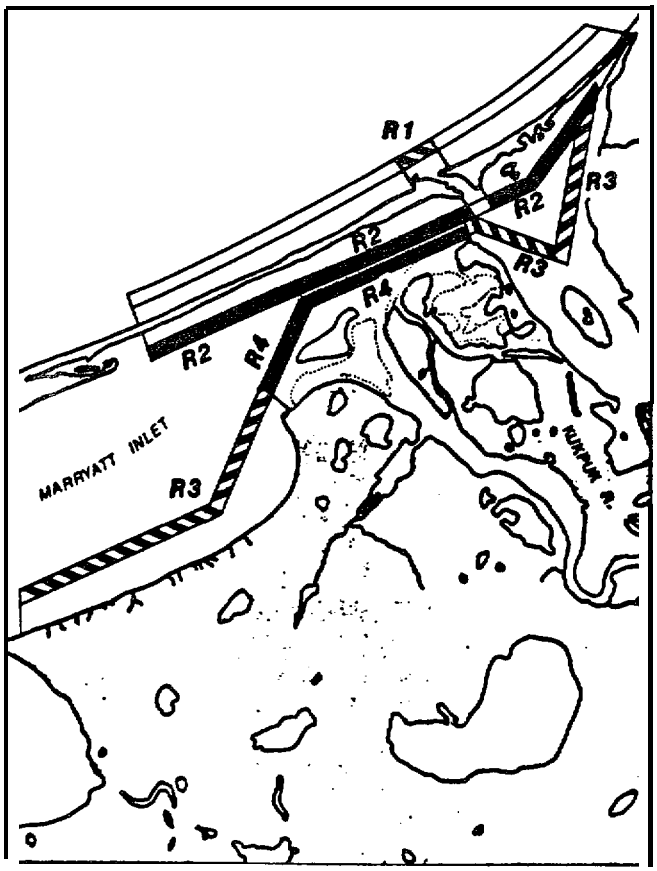
Seasonal Variability of Indices

Identifier	RESOURCE	SEASON							
		Winter	Break-Up/Summer/Freeze-Up						Winter
			May	Jun	Jul	Aug	Sep	Oct	
H1	Fishing			▨	▨	▨	▨		

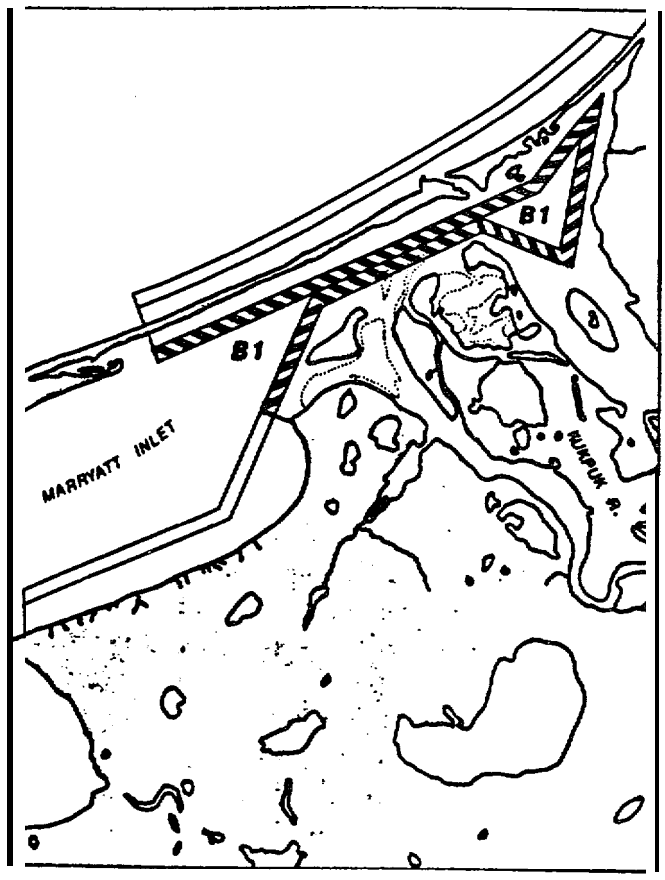
78


A
B
S
A
S
C´
D´
E´
S
C´
F´
MARRYATT INLET
S
D´
KUKPUK R.
79

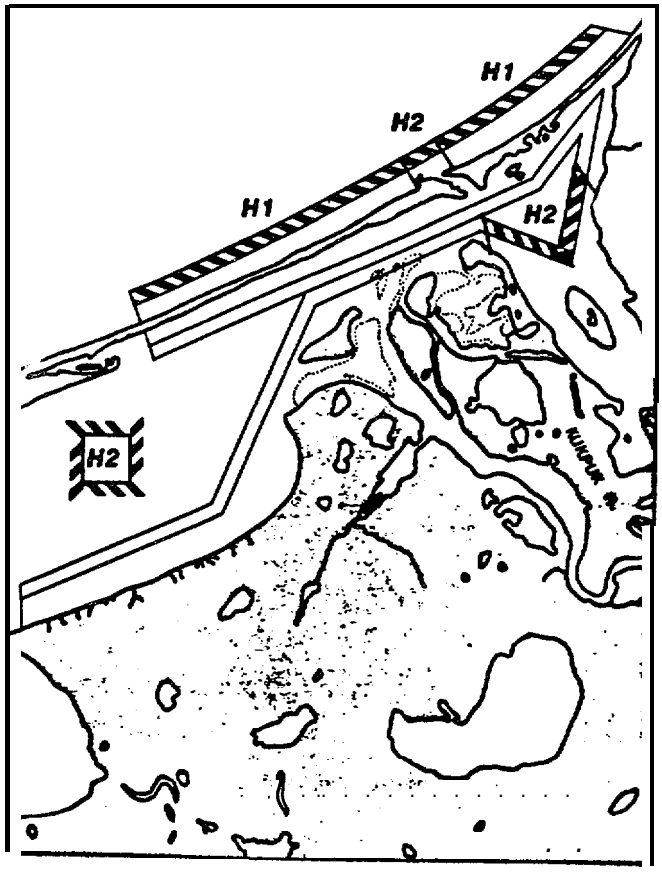
OIL RESIDENCE ***INDEX***



BIOLOGICAL SENSITIVITY INDEX



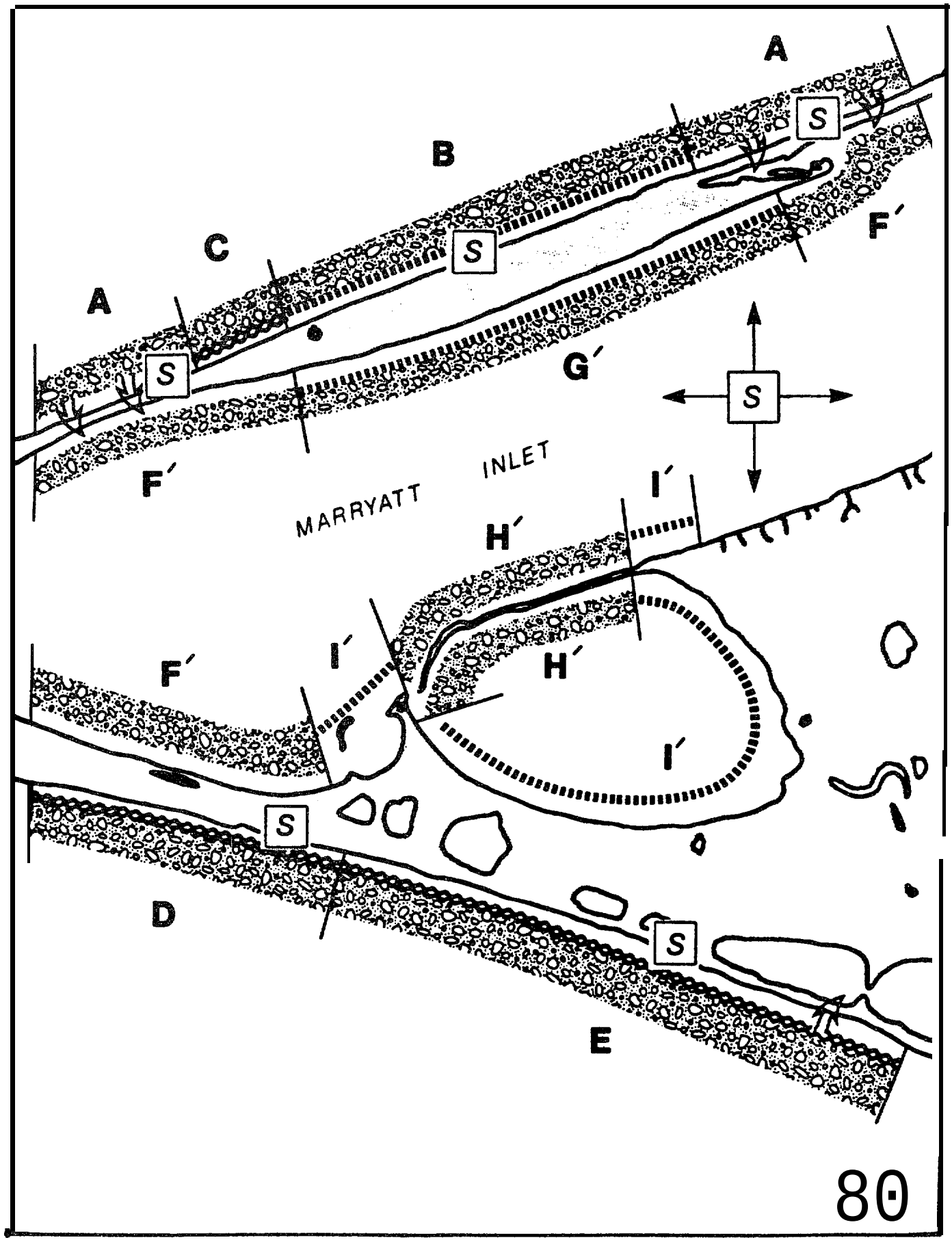
HUMAN USE INDEX



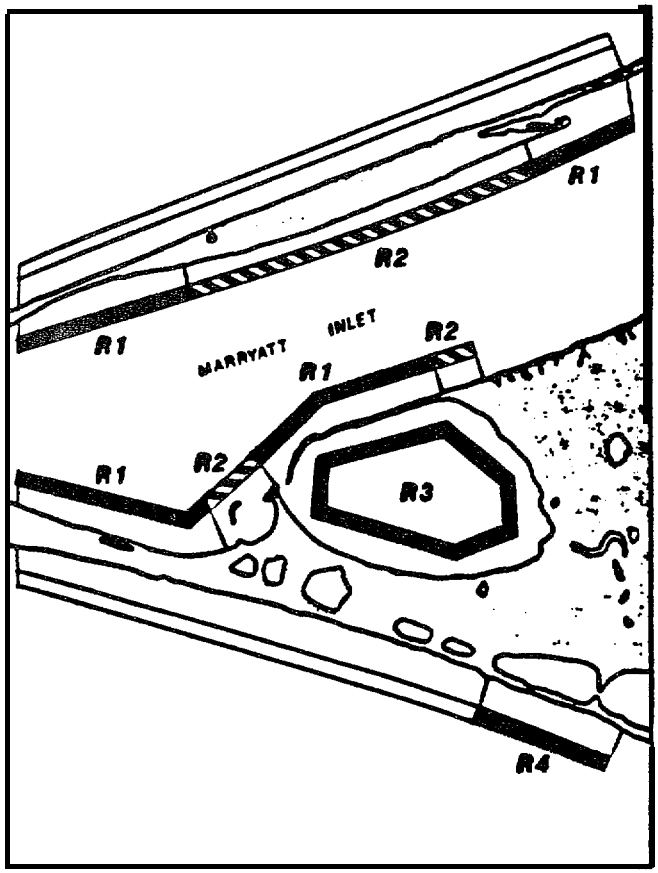
Seasonal Variability ***of Indices***

dentifier	RESOURCE	Winter	Break-Up/Summer/Freeze-Up						Winte
			May	Jun	Jul	Aug	Sep	Oct	
R1	Permanent 1 nltt; Recurve spits								
R2	Lou energy beach								
R3	Protected tundra cliff								
R4	Tidal flats; delta f rent								
B1	Shorebirds migration; staging								
	Waterfowl migrat ion; staging								
H1	Fishing								
H2	Beluga whale hunting								
	Fishing								

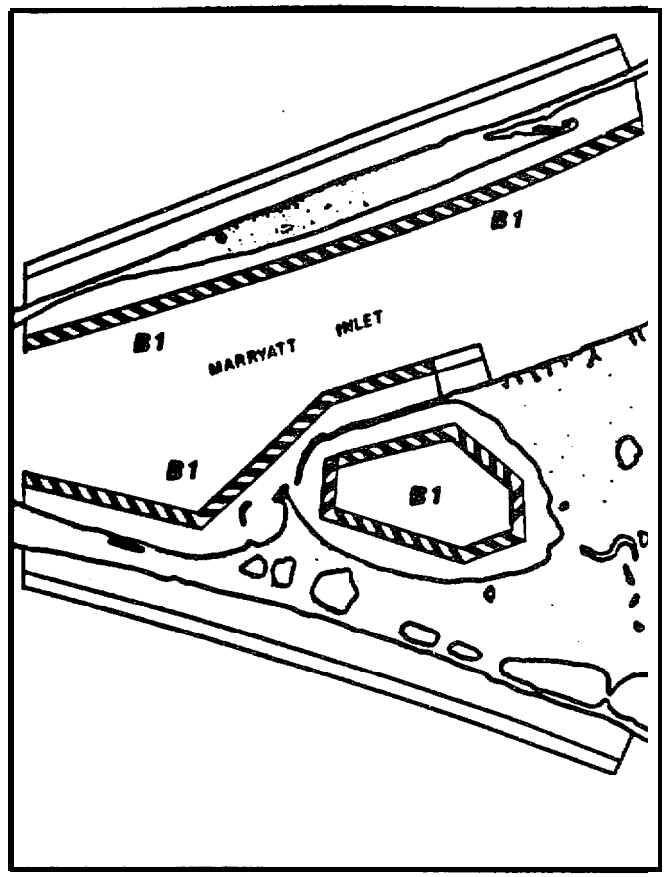
79


A
B
C
A
S
S
S
S
F´
G´
F´
MARRYATT INLET
I´
H´
F´
I´
H´
I´
S
S
D
E
80

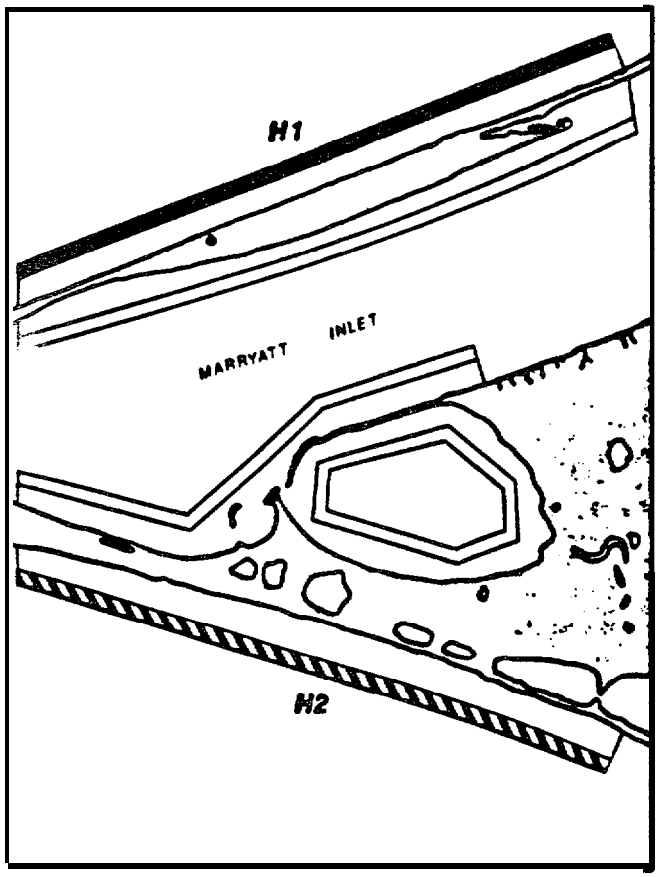
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



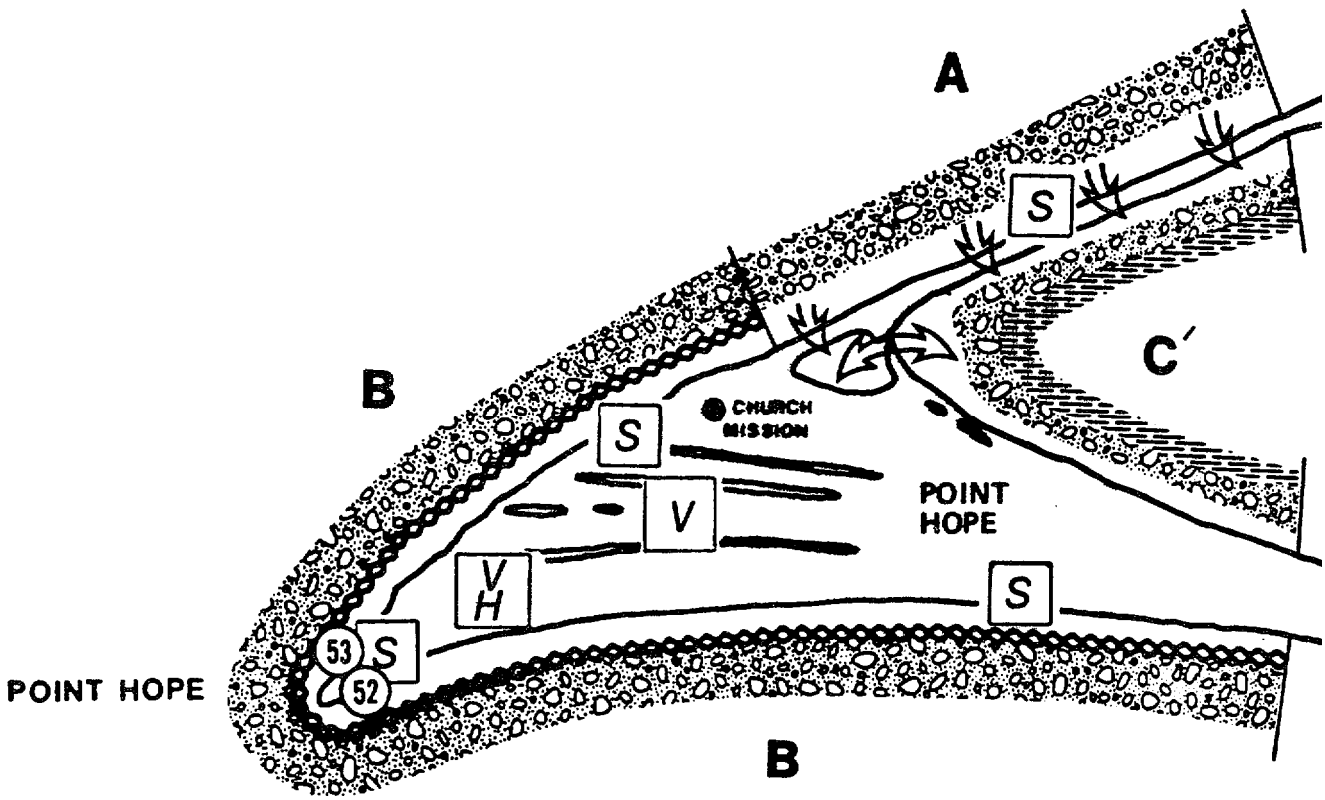
HUMAN USE INDEX



Seasonal Variability of Indices

Identifier	RESOURCE	Winter	Break-Up/Summer/Freeze-Up						Winter
			May	Jun	Jul	Aug	Sep	Oct	
R1	Low energy beach			■	■	■	■		
R2	Protected tundra cliff			▨	▨	▨	▨		
R3	Very protected tundra cliff; Beach			■	■	■	■		
R4	Washover channel; Lagoon			■	■	■	■		
B1	Shorebirds migration; staging				▨	▨			
	Waterfowl migration; staging			▨	▨	▨	▨	▨	
H1	Waterfowl hunting			■	■				
	Fishing			▨	▨	▨	▨	▨	
H2	Fishing			▨	▨	▨	▨	▨	

80



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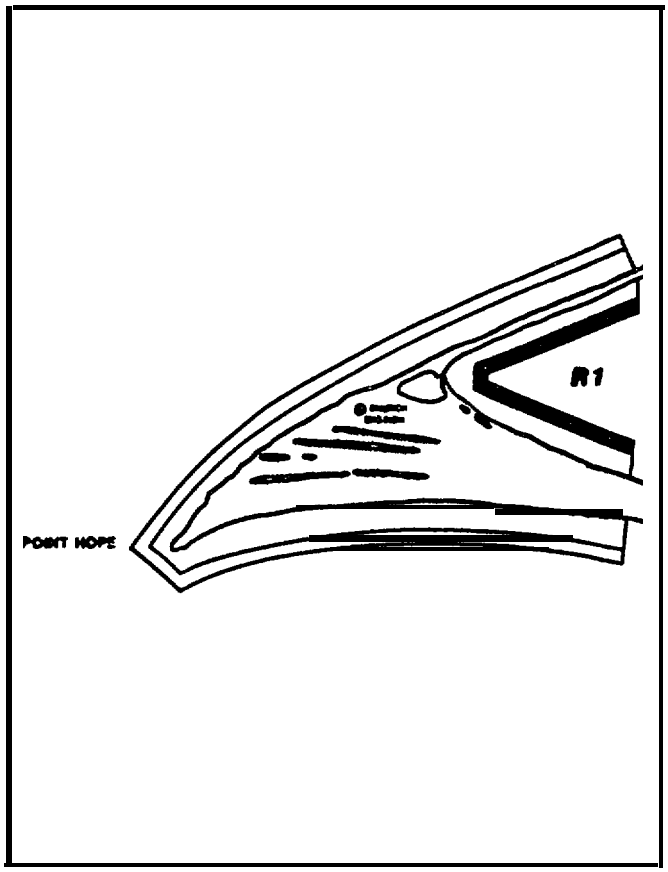
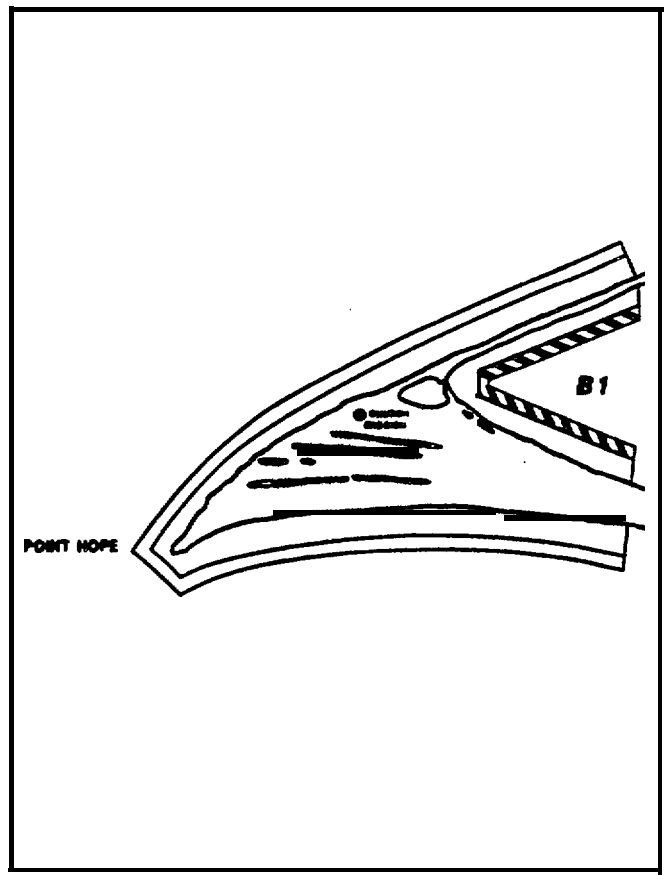
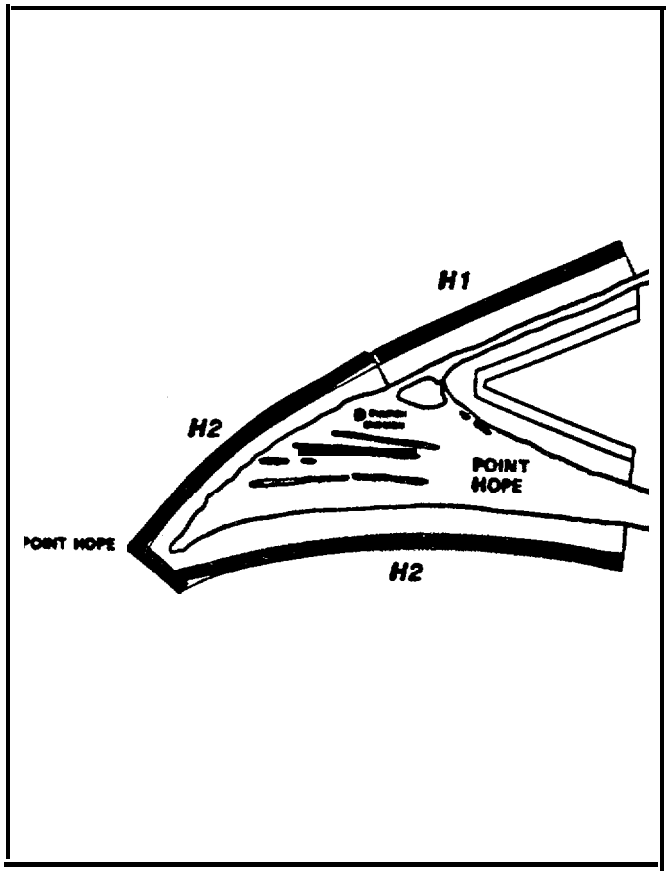
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



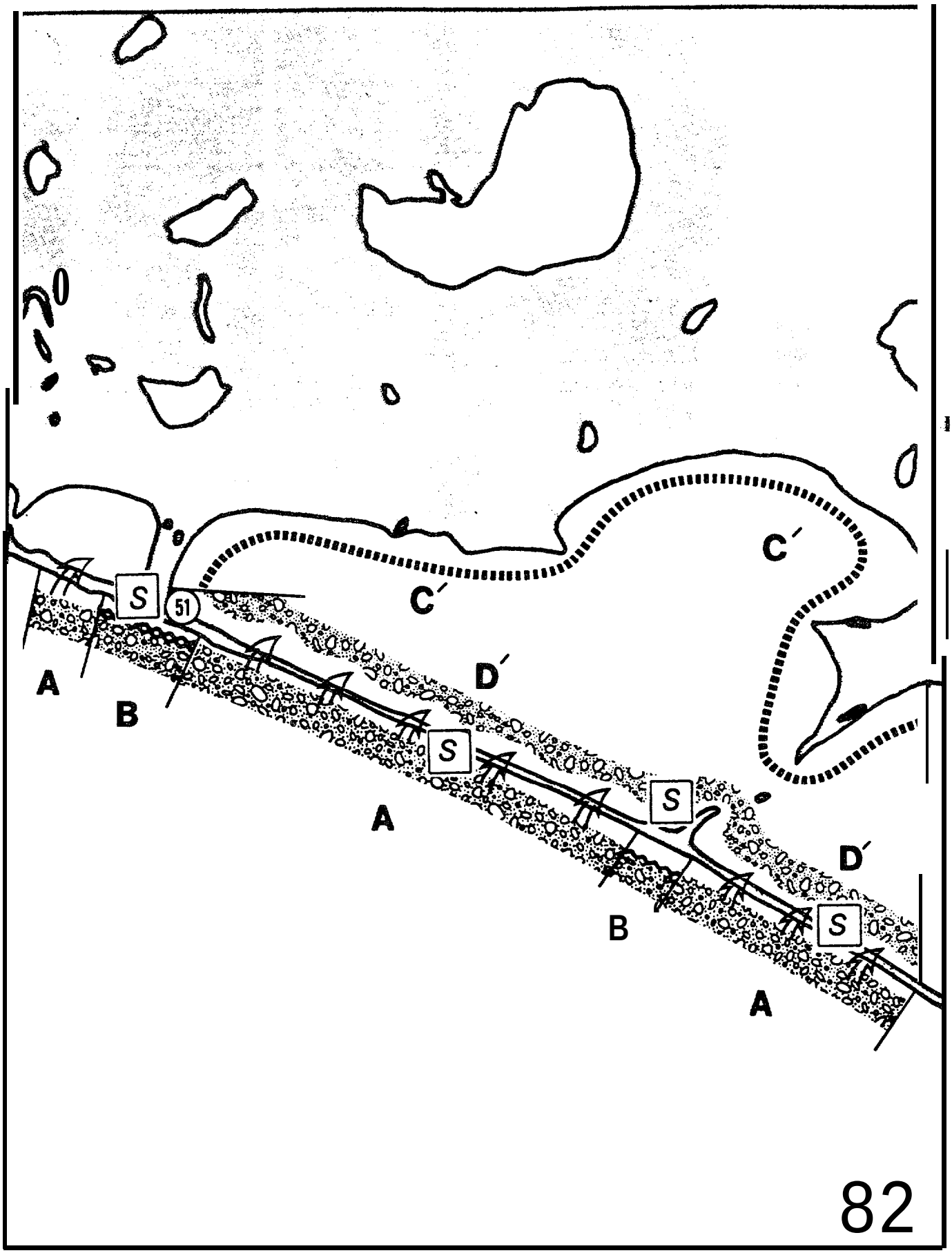
HUMAN USE INDEX



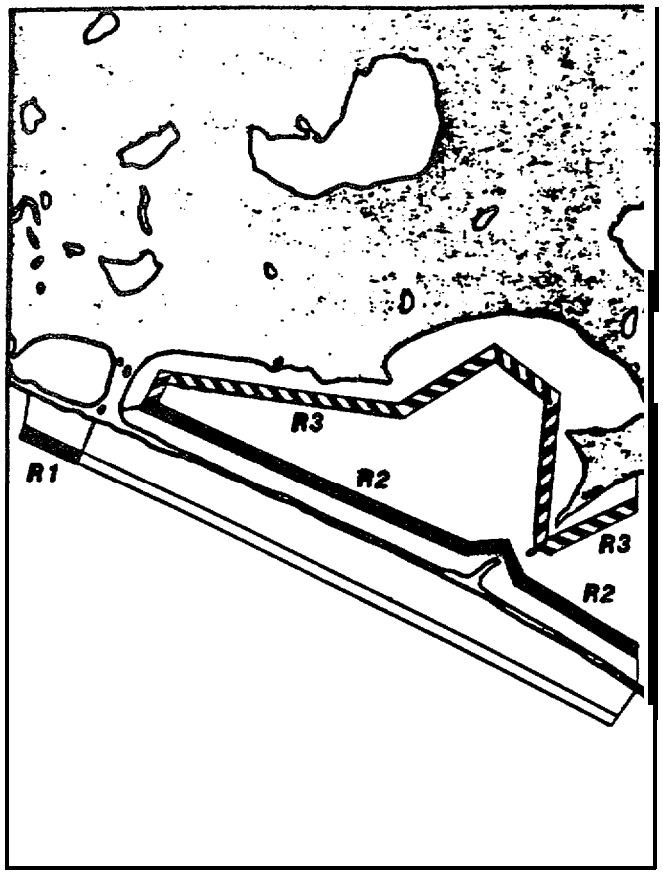
Seasonal Variability of Indices

Identifier	RESOURCE	Winter	SEASON: Break-Up/Summer/Freeze-Up						Winter
			May	Jun	Jul	Aug	Sep	Oct	
RI	Lou energy beach								
B1	shorebirds migration; staging								
	Waterfowl ● igration; staging								
	Fishing								
	Subsistence access								
	Resident recitation								
	Village of Point Hope								
	Subsistence access								
	Resident recreation								
	Fishing								

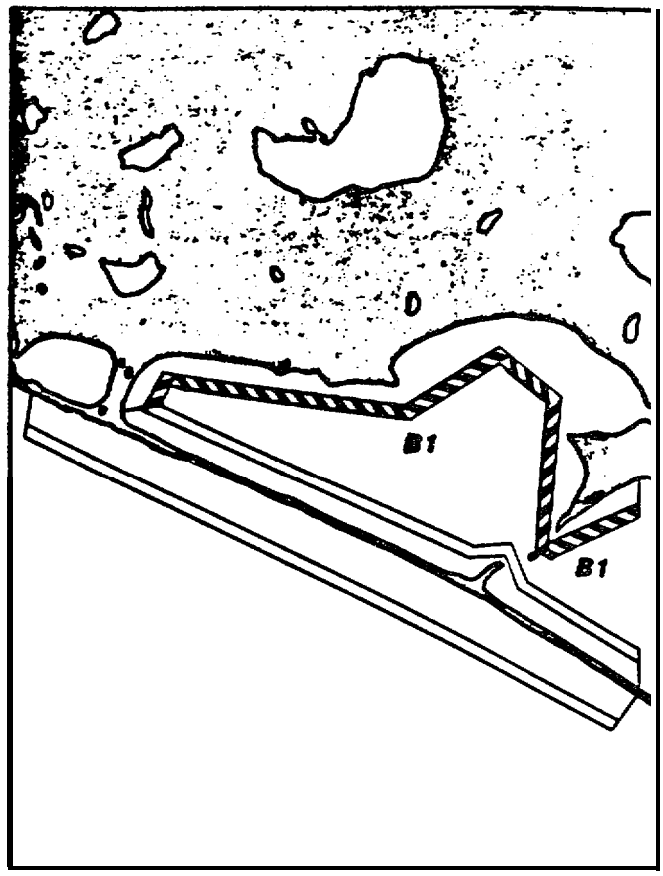
81


S
51
C´
C´
D´
A
B
S
A
S
D´
B
S
A
82

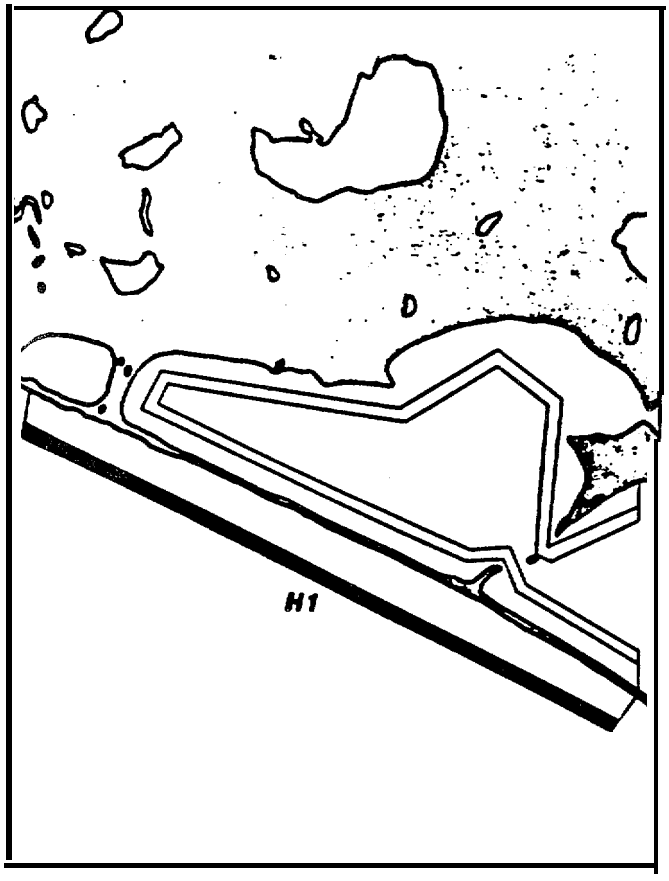
OIL ***RESIDENCE INDEX***



BIOLOGICAL ***SENSITIVITY INDEX***



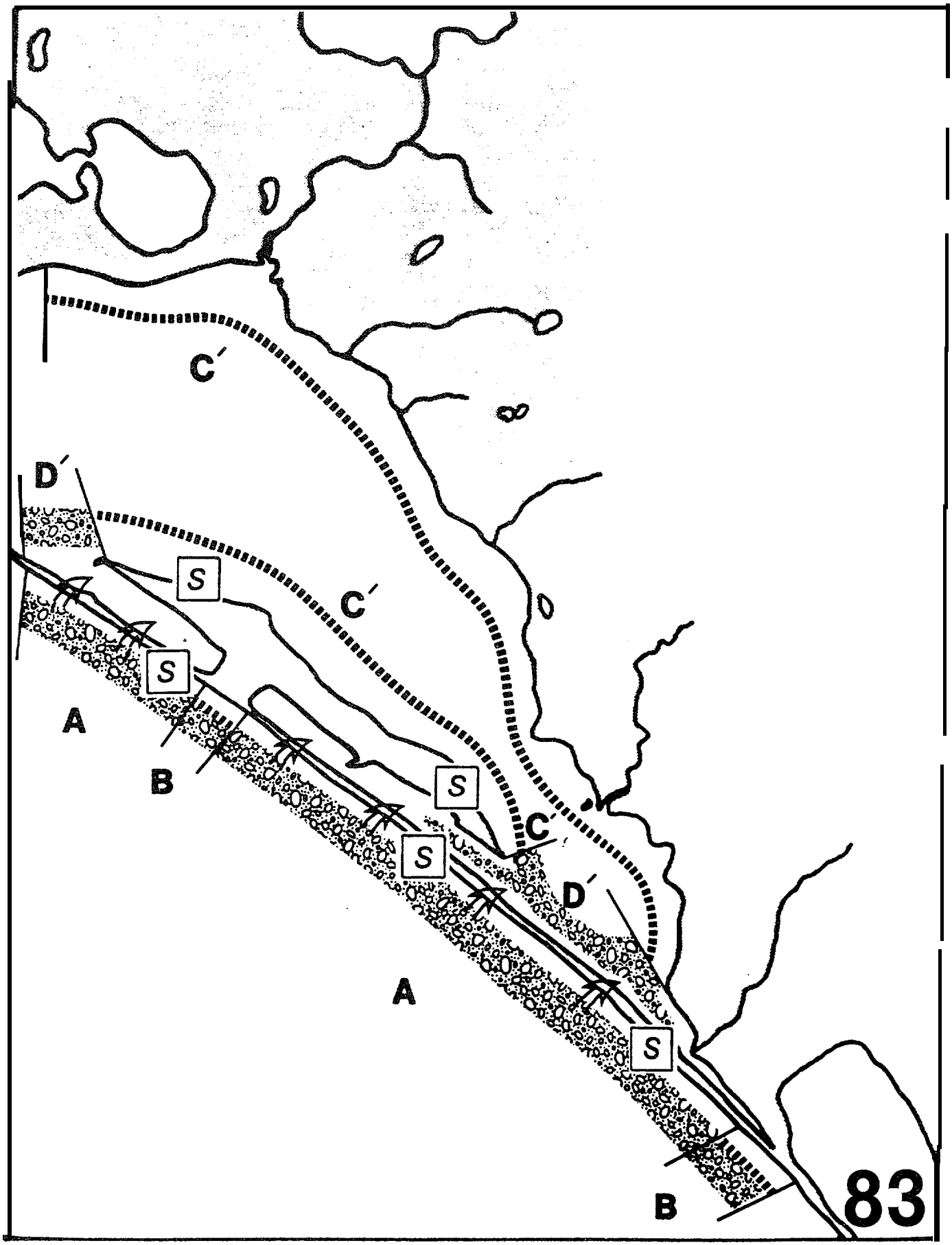
HUMAN USE INDEX



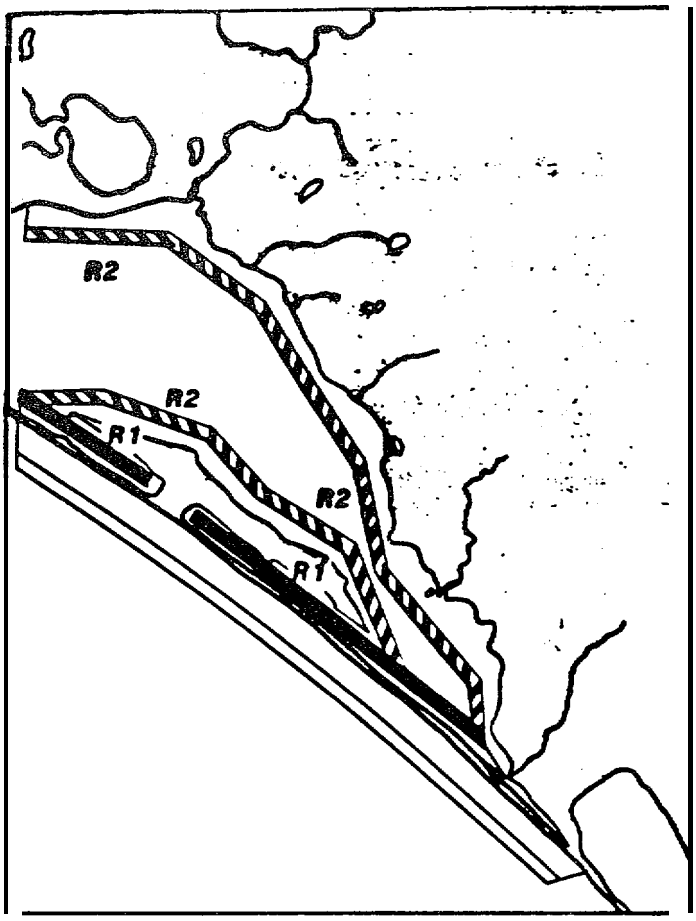
Seasonal Variability of ***Indices***

Identifier	RESOURCE	Winter	SEASON: Break-Up/Summer/Freeze-Up May	Jun	Jul	Aug	Sep	Oct
RI	Washover chenntls; Lagoon							
R2	Low energy beach							
R3	Protected tundra cliff							
B1	Shorebirds ● igration; staging Waterfowl ● igration; staging							
H1	Waterfowl hunting Fishing							

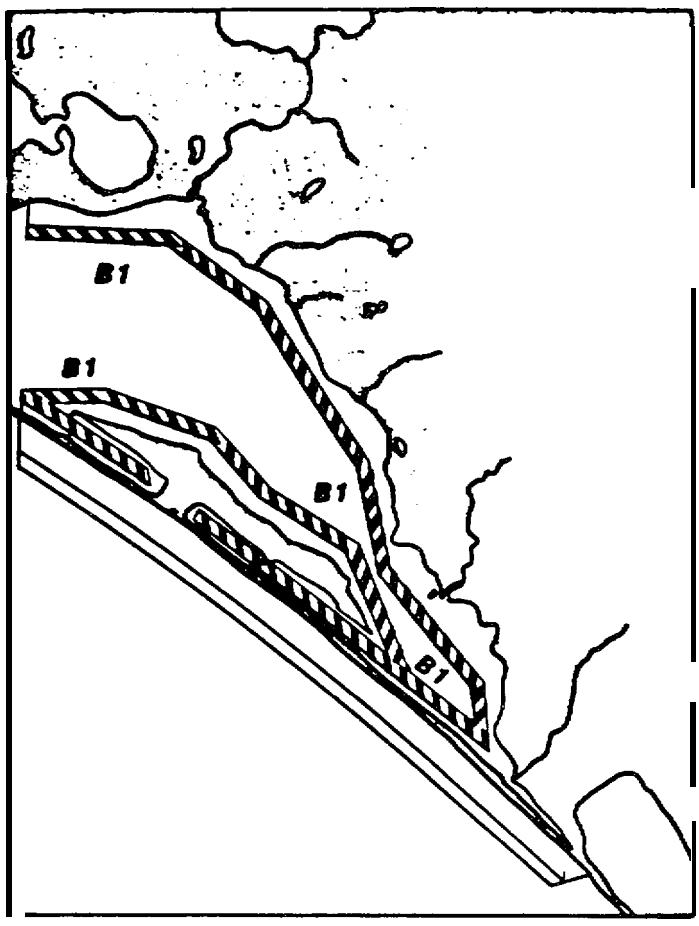
82


C´
D´
S
C´
S
A
B
S
C´
S
D´
A
S
B
83

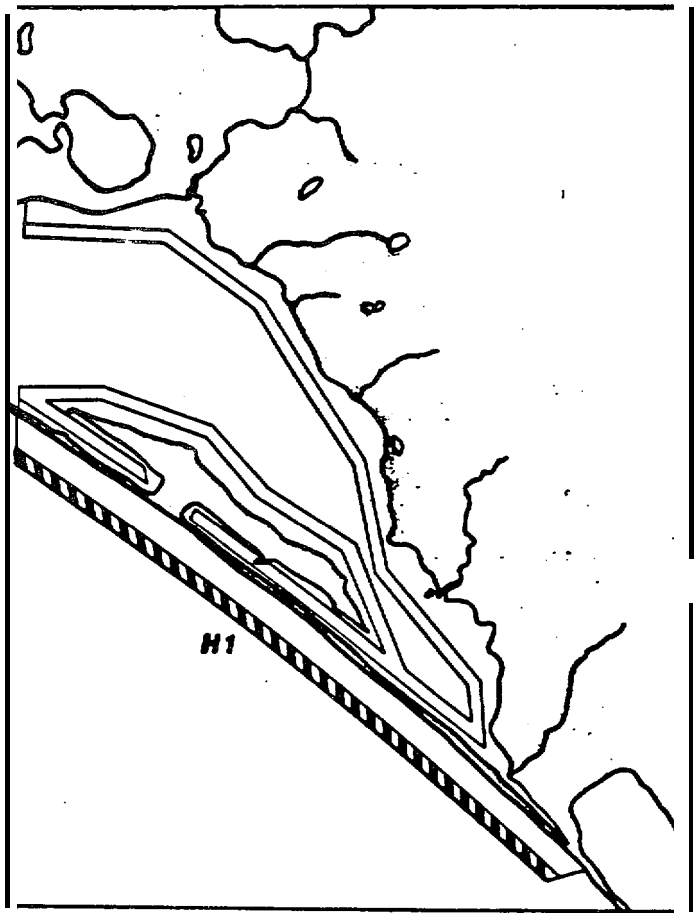
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX



HUMAN USE INDEX



Seasonal ***Variability of Indices***

Identifier	RESOURCE	SEASON: Winter	Break-Up/Summer/Freeze-Up: May	Jun	Jul	Aug	Sep	Oct	Winter
R1	Low ● nergy beach			■	■	■	■		
R2	Protected tundra cliff			▨	▨	▨	▨	▨	
B1	Shorebirds migration; staging				▨	▨	▨		
	Waterf owl migration; staging			▨	▨	▨	▨	▨	
ml	Waterfowl hunting			▨	▨				
	Fishing			▨	▨	▨	▨	▨	

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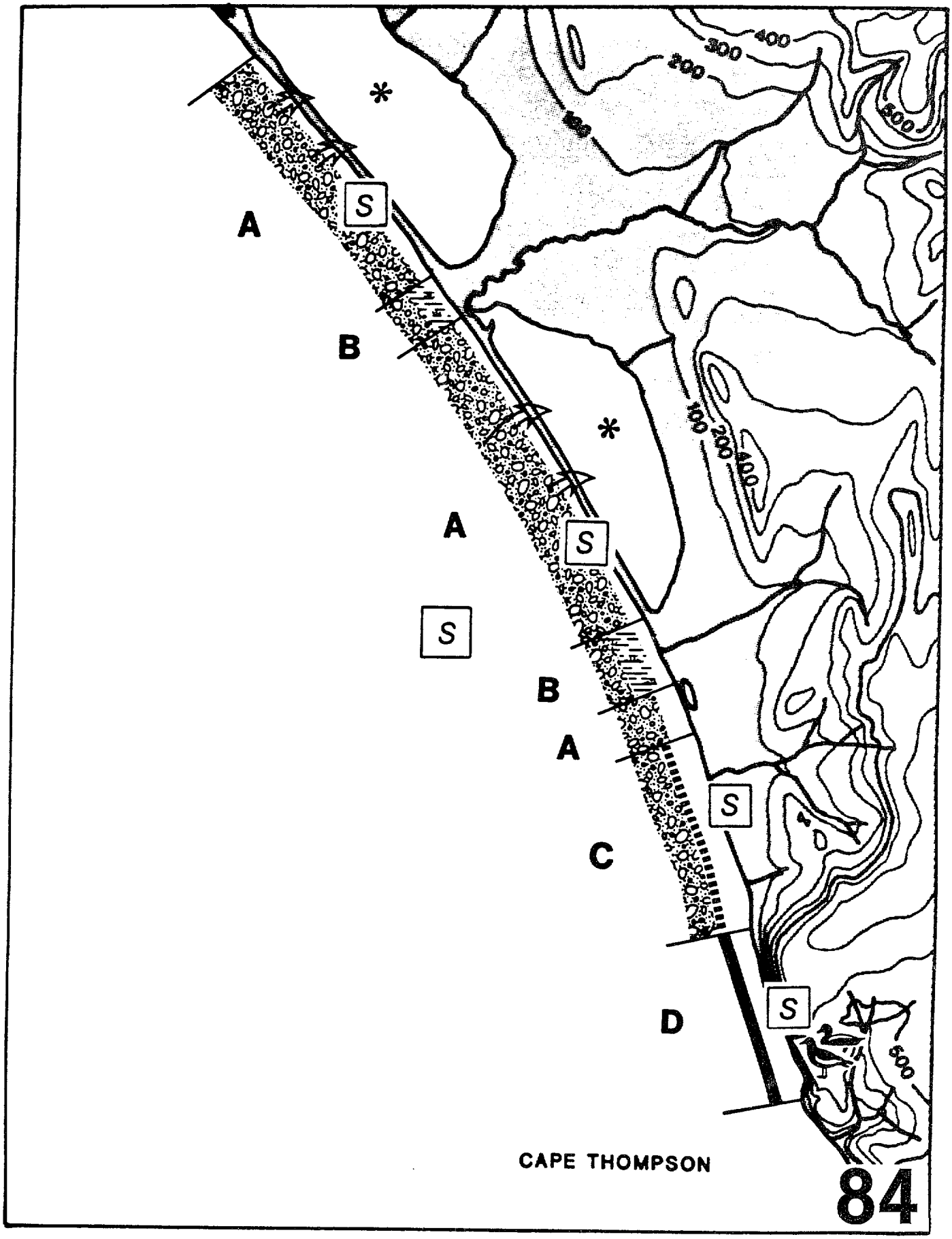
400
300
200
100
500
S
A
B
A
S
B
A
S
C
S
D
S
600
CAPE THOMPSON
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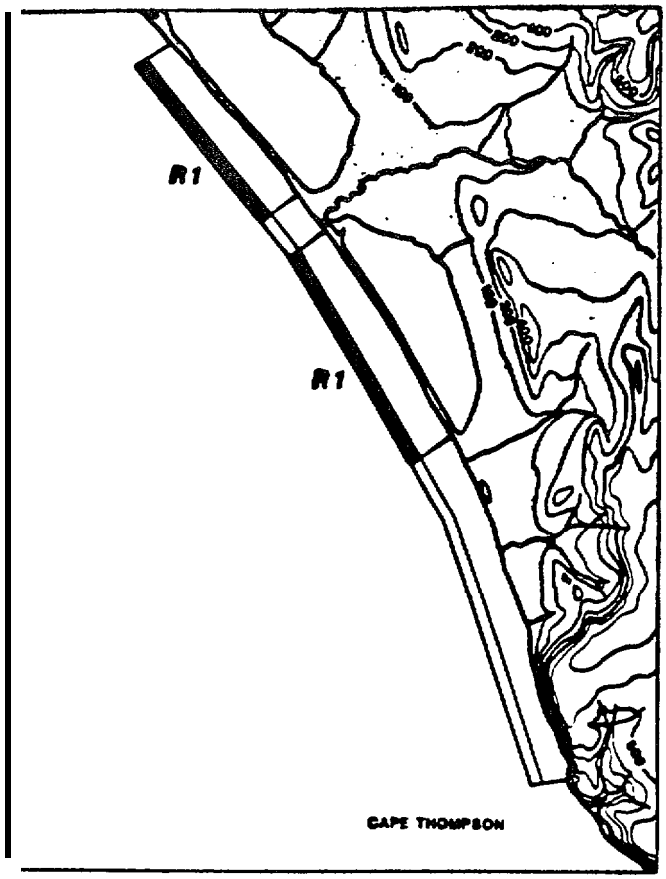
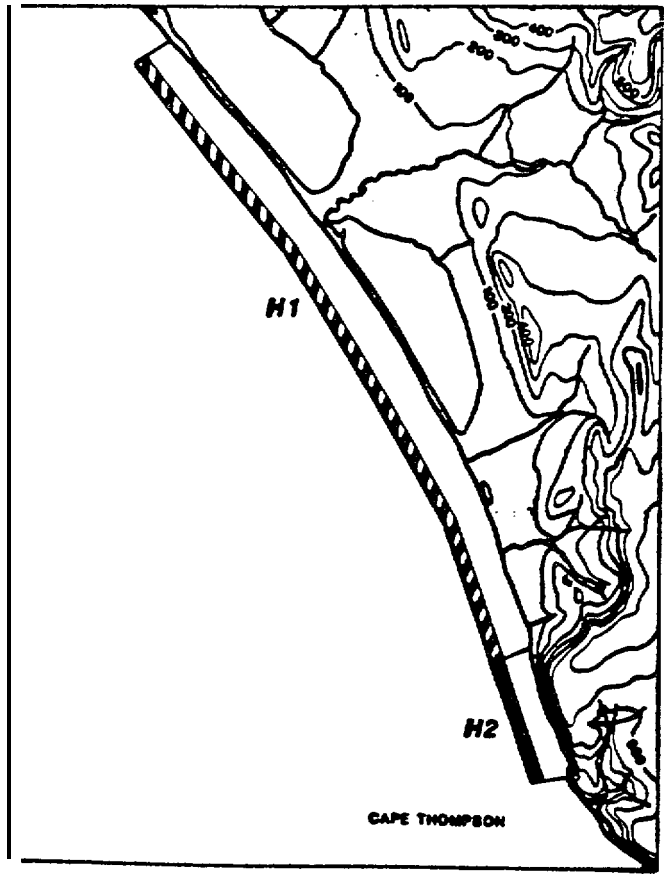
OIL RESIDENCE INDEX



BIOLOGICAL SENSITIVITY INDEX

HUMAN USE INDEX



Seasonal Variability of Indices

Sensitivity	RESOURCE	Winter	SEASON: Break-Up/Summer/Freeze-Up May	Jun	Jul	Aug	Sep	Oct	Winter
R1	Washover channels; Lagoon			■	■	■	■		
B1	Seabird colony murres (217,000 pr), kittiwake [10,200 pr), puffins (700 pr), others (100 pr)		■	■	■	■	■		
H1	Waterfowl hunting			▨	▨	▨	▨		
	Fishing			▨	▨	▨	▨	▨	
H2	Egg gathering			■	■				

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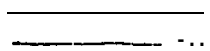
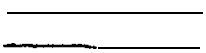
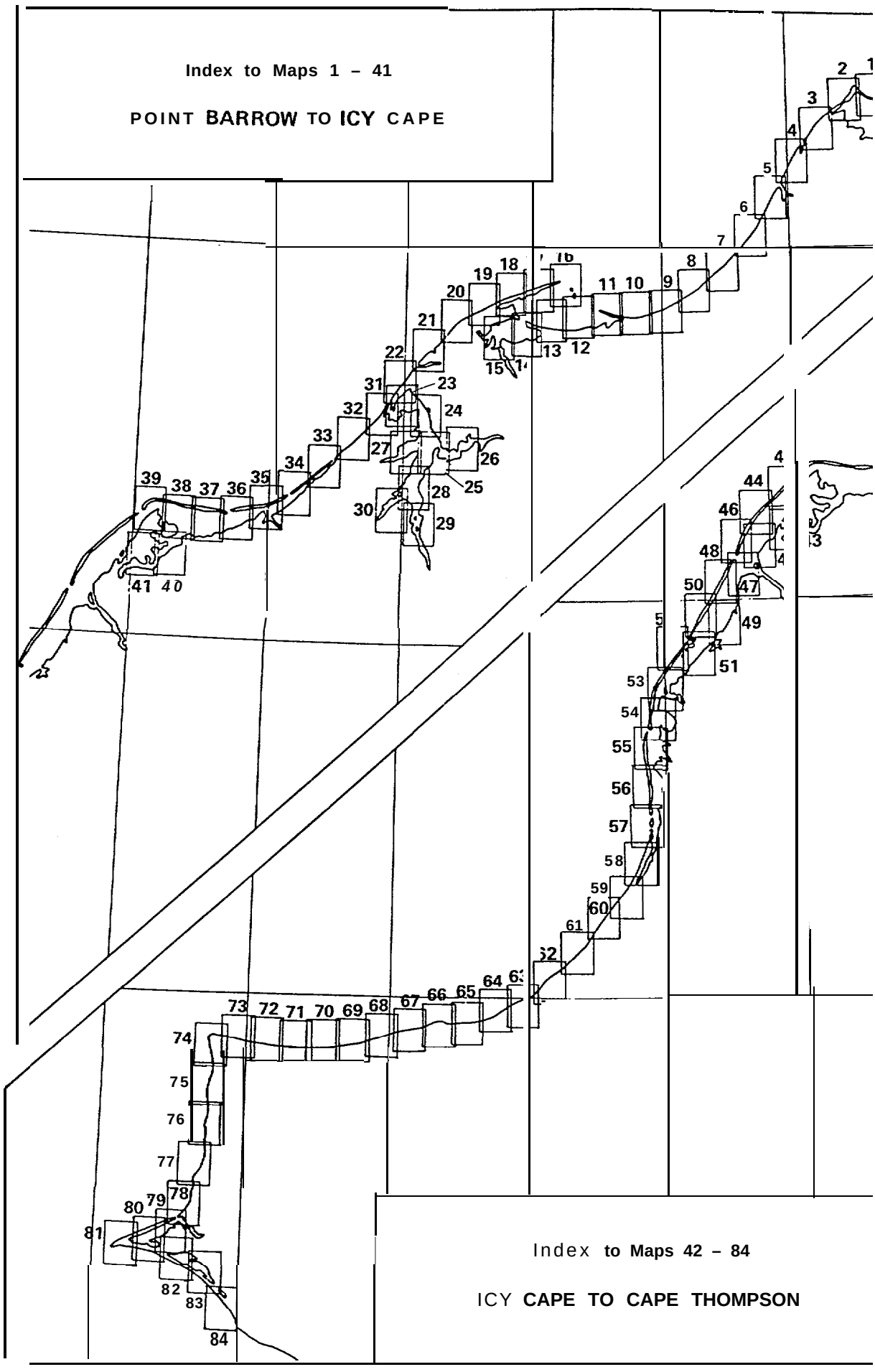
. COASTAL Sensitivity LEGEND

OIL RESIDENCE INDEX	**PRIMARY CONCERN** 	Lengthy oil-residence time (more than one open-water season); low mechanical wave-energy levels at the shore likely to result in a slow removal rate of stranded oil.
	SECONDARY CONCERN 	Variable oil-residence time {weeks to more than one open-water season); residence time may vary substantially due to variations in wave exposure, substrate type, and spill characteristics.
	TERTIARY CONCERN 	Short oil-residence time (days to weeks of open-water season); high mechanical wave energy levels at the shore and substrate types that prevent oil Penetration are likely to result in rapid removal of oil from the shore.
BIOLOGICAL SENSITIVITY INDEX	**PRIMARY CONCERN** 	Major change expected in distribution, size, structure or function of affected biotic resources (population, community or habitat); recovery from these changes likely to require several open-water seasons.
	SECONDARY CONCERN 	Moderate change expected in distribution, size, structure or function of affected biotic resources (population, community or habitat); recovery from these changes are expected to require one to several open-water seasons.
	TERTIARY CONCERN 	'Little or no change expected in distribution, size, structure or function of affected biotic resources (population. community or habitat); recovery from these changes are expected to require less than one open-water season.
HUMAN USE INDEX	**PRIMARY CONCERN** 	Important or intensive human-use activities likely to be disrupted for one or more open-water seasons.
	SECONDARY CONCERN 	Moderate impact of some human-use activities for some portion of one open-water season,
	TERTIARY CONCERN	Non-intensive human-use activities unlikely to be impacted for more than a short period of one open-water season.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POINT BARROW TO ICY CAPE
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ICY CAPE TO CAPE THOMPSON