

An Overview of Key Conservation, Recreation and Cultural Heritage Values in British Columbia's Marine Environment

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Having expressed these acknowledgements, it is especially important to stress that the views, interpretations and "judgement calls" in this report in no way represent a consensus among those consulted nor necessarily reflect their individual or collective viewpoints. Such responsibility lies solely with the lead author.

Executive Summary

The British Columbia marine environment is truly a marine region of superlatives, both by comparison within Canada and for many of its features, at the global scale. Few other coasts on earth are so complexly indented, with innumerable embayments, archipelagos and channels, estimated at more than 29,500 km in total length. This environmental diversity translates into marine biodiversity and to a historic and continuing role in nurturing the human communities and society who live beside, derive their living from, and enjoy BC's marine environment. The high importance of and pressures on the marine environment have made it imperative to consider modern approaches to protection and management. A key initiative has been the evolution of a co-operative Marine Protected Areas Strategy between the governments of Canada and British Columbia. The present study seeks to inform the development of that strategy by addressing the question: What is it we value in BC's marine environment enough to justify substantial protection through a program of establishing Marine Protected Areas?

The response to this question takes the form of an overview of key marine values in three broad categories: conservation (i.e. natural environment), recreational and cultural-heritage. The overview is based on a detailed and multi-disciplinary literature review, internal discussions within the project team with experts in marine sciences, recreation and cultural-heritage; selected unstructured interviews and discussions with knowledgeable individuals; and a series of small group workshops focused on each of the three broad categories.

For greatest clarity and the distinction among other usages of the term "value," the principal unit of analysis used in the report is valued marine environments and/or features, abbreviated as "VMEFs." So as to set the stage for the approach used in the present overview, a brief review is made of results from previous and ongoing Canadian and international initiatives in the area of marine protection and value identification. What emerges is that values to be taken into account in the selection and evaluation of Marine Protected Areas generally comprise a very long list. While conservation concerns remain pre-eminent the other categories of value are now inevitably factored in. This greater inclusiveness leads to widespread value conflict when MPA planning is undertaken and this has serious implications for the present study and its use.

The over view of conservation values led to the identification of 27 overlapping VMEFs organized under four headings:

- Major Intertidal and Marine Environments of BC
- Specific Habitats Generally Deemed to Be of Especially High Ecological Significance
- Areas Significant to Especially Valued / Familiar Groups or Taxa
- Areas of Special Scientific Interest

The conservation VMEFs were:

Major Intertidal and Marine Environments of BC
• Open waters -plankton based ecosystems
• Archipelagos and their environs
• Intertidal areas (foreshore) & adjacent backshore
• Inland seas
• Major embayments
• Fjords
• Passages: straits, channels, passes, sounds and narrows
• Estuaries
• Continental margin (shelf, slope, & rise)
• Ocean Basin: ridges, abyssal plains etc.
Specific Habitats Generally Deemed to Be of Especially High Ecological Significance
• Salt marshes
• Tidal flats

• Sea Grass beds
• Kelp beds
• Reefs and their environs
• Seamounts and their environs
• Hydrothermal vents and their environs
• Localized upwelling environments
• Other Special Marine Environments
Areas Significant to Especially Valued / Familiar Groups or Taxa
• Significant finfish habitat A. Spawning areas
• Significant finfish habitat B. Juvenile nursery areas
• Significant invertebrate concentration areas
• Significant habitats for marine birds including colonies & environments on which they rely
• Significant marine habitat for waterfowl & shorebirds
• Significant marine mammal habitats (colonies/haul-outs/breeding grounds etc.)
• Sites significant to rare or endangered species (those not covered by previous categories)

Areas of Special Scientific Interest

- Areas with a substantial record of prior marine research and data gathering

The overview of recreation values was divided into two distinct approaches. The main thrust in identification of recreation VMEFs was on the basis of six principal marine-dependent recreational activities: sports fishing; coastal cruising (power and sail); sea kayaking; SCUBA diving; marine nature observation; and shore-based but marine-dependent recreation. It was recognized that many of the already identified 27 conservation VMEFs were important to one or more of these activities. Additionally, a set of 12 more specific recreation VMEFs was derived by examining the specific marine attributes significant to each marine-dependent activity.

• Shoreline configuration (i.e. islet clusters, bays, narrow channels)
• Shoreline type
• Sea conditions
• Aquatic visibility and transparency
• Water temperature
• Marine life (harvestable)
• Marine life (for observation)
• Natural coastal features (waterfalls, tidals, hotsprings, beaches, coastal trails, etc.)
• Native heritage areas, presence of archaeological or historical resources
• Coastal scenery
• Subsea surface topography
• Anchorages (protection from waves, wind, adequate depth, suitable substrate)

The second approach to identifying what matters most for marine recreation (broadly defined) was to consider, suggestively rather than systematically, more difficult-to-measure values that have made BC's marine environment so enchanting and stimulating. A published list including such "hard-case" qualities is used strictly to stimulate (and legitimise) future discussion of these invaluable if intangible dimensions of the marine experience. Its elements were:

<ul style="list-style-type: none"> • Life: place of our ancestral beginnings...sense of continuing creation, vitality, sea as the 'pulse of the cosmos,' rhythm...
<ul style="list-style-type: none"> • Time, or timelessness: sense of the ancient, eternal...
<ul style="list-style-type: none"> • Space and distance; endlessness, openness, infinity, scope, wilderness, frontier, the sense of great distances travelled...
<ul style="list-style-type: none"> • Imperviousness to man and man's actions; impersonality; anonymity, erases and covers man's intrusions, untamed...
<ul style="list-style-type: none"> • Energy, conflict, and contrast: battle and/or contrast between land and water..
<ul style="list-style-type: none"> • Mystery and spirituality: enchanted, holy, magical.

The overview of cultural-heritage values began with recognition of two distinct subsets: First Nations' and "Eurasio-Canadian." In considering the challenge of identifying First Nations' marine cultural-heritage VMEFs, a conclusion was reached that it was inappropriate and likely to be ineffective to create a framework list as was done for conservation and recreation values. For while the world-famous "Northwest Native Culture" may be seen as alike to outsiders, First Nations' knowledge and valuing of the marine environment is highly specific to local environments and features to which outsiders would be oblivious. This militates against relying on generic frameworks. Instead a "starting point" framework is proffered strictly for beginning dialogue with First Nations and comprising ten categories of valued marine-related features. These are derived from existing frameworks for traditional use studies.

Archaeological sites — places where relics of ancestral activity are found;
Ceremonial and Religious Sites — a location vital to the performance of important ceremonies
Commercial — a place where commerce is or has been transacted;
Cross-cultural interaction — a place significant to the interaction of two or more cultures

(e.g. first contact sites, locations of conflict);
Cultural landforms/seaforms — features used to mark location for travel, cross-cultural boundaries etc.
Food harvesting — places significant in the harvesting of marine foods
Material harvesting — a place where important non-food marine items are gathered (e.g. dentalia shells);
Traditional management areas — (e.g. clam and cockle beds where rock removal was practised to encourage better growth);
Recreation — a location where traditional and current marine-based recreation is pursued
Supernatural beings — a place associated with the past and present occurrence and activity of beings whose existence is not recorded by western science or others from outside the culture

Some of the same concerns over generic frameworks for cultural-heritage values may eventually apply to all marine-related cultural heritage, especially for long-established rural coastal communities. For now, this study briefly identifies 5 broad categories of VMEFs central to current understandings of Eurasio-Canadian marine culture.

<ul style="list-style-type: none"> • Relics — shipwrecks, airplane wrecks, remnants of early industrial activities
<ul style="list-style-type: none"> • Locations of special historic significance — points of early contact with First Nations
<ul style="list-style-type: none"> • Areas associated with earlier / problematic marine resource use
<ul style="list-style-type: none"> • Sites and structures related to marine heritage activities — old whaling stations, lighthouses, rescue stations and canneries
<ul style="list-style-type: none"> • Complete coastal communities with clear marine heritage identity

Overall, then, 60 valued marine environments and features are named and tabulated in this overview. It is to be expected, for a summary of so complex a reality as the "BC marine environment", that others will see things differently. They will want to critically review, challenge and change our "version" of a framework. This is appropriate, indeed essential. The best use we can envision for this study is as a place to start a well-planned ongoing dialogue about the bases for choosing MPAs, a dialogue involving those who live by, from and, even for, the superlative values of BC's marine environment.

I saunter by the shore and lose myself

*In the blue water, stretching on, and on
Beyond the low lying headland dark with woods,
And on to the green waste of sea, content
To be alone — but I am not alone...*

From "A Hymn to the Sea" by William Stoddard

The marine environment of Canada's west coast continues to fill us with awe for its rich biological and topographic diversity, its mystery, and, so many times, its raw power. For British Columbians and for others who visit here in body or in mind, the incredible range of shores and species, remnants of history, legendary places, dramatic coastal scenery, quiet coves and raging surf are of unimaginable value: together they define what BC is. It is not surprising then that protecting these values has become a social and governmental priority. As in many other parts of the world, effort has increased rapidly in recent years to set aside areas of the marine environment as Marine Protected Areas. To choose "MPAs" wisely, we must first know what we value. And we would also need to think of how much we value the attributes of sea and coastline.

Answering "What matters?" and "How much?" were the reasons for this study. As will be seen the focus of the work became very much the former rather than the latter. But prior to responding to these questions, this report examines the concept and vocabulary of values (Section 2.1) as these apply to Marine Protected Areas context. To reduce the ambiguity around the multifaceted concept of and multiple meanings of the term "value," longer phrases are introduced focusing attention on that which is valued (i.e. valued marine environments, features and sites). A brief review of programmes and literature about values, benefits and criteria relevant to Marine Protected Area identification is then presented (Section 2.2).

To answer the question "what is it we value?" this report presents an overview of the specific environments, features and sites relevant to the identification and evaluation of potential Marine Protected Areas. The overview comprises the identification of key marine attributes from a conservation and recreation perspective and a discussion primarily of the problems to doing the same for cultural-heritage attributes. For conservation (Section 3.1), 27 separate environments or features (of a wide range of scales) are identified and described.

A different approach is taken for recreation (Section 3.2), one primarily centred on marine recreational activities — sport fishing; coastal cruising (power and sail); sea kayaking; scuba diving; marine nature observation; and such shore-based but marine-dependent activities as beachcombing, coastal hiking, shellfish digging etc. The question is then put: what marine environmental attributes are most valued for each activity? The detailed response is given in a series of summary statements organized around the

activities but focusing on what each activity values. From these and subjective judgement, a set of 12 "recreational VMEFs" is proposed.

The treatment of cultural heritage values (Section 3.3) is necessarily distinct. It is argued that the intrinsic nature of culture and the particular sensitivity surrounding its interpretation (especially by those who are not from the culture) militates against setting firm frameworks and evaluation methodologies. This is particularly the case for the coastal First Nations whose culture is so famous and, in historical context, predominant along the BC coast. It is argued, a protocol for the "negotiation" of answers to the questions, "what matters?" and "how much" is needed as a prerequisite to incorporating cultural heritage values in the Marine Protected Areas Strategy. A framework is provided for consideration of "Eurasio-Canadian" * marine cultural heritage values, with the proviso, however, that these too may need to be broadened as coastal communities develop a stronger agenda of "cultural survival."

We conclude (Section 4) that while an overview of each category of marine value can be tentatively made, these should not be seen as definitive checklists for future MPA planning. Instead they are starting points for dialogue within which the "real" business of strategic assessment must occur.

1. Introduction

1.1 The Superlative Marine Environment of Canada's West Coast: An Overview

Before we become immersed in the considerable detail of features of the British Columbia marine environment it may be helpful to stand back and consider a "bigger picture" of the broad forms and processes that make this environment so enormously important and interesting. For this is truly a marine region of superlatives, both by comparison within Canada and for many features, at the global scale. Canada has the longest linear coastline of any single nation and no Canadian province comes close to BC in the extent of its shores. A quick glance at a map of the coastline reveals why this is so. Few other coasts on earth are so complexly indented, appearing from the air much like a massive vascular system made up of innumerable embayments, archipelagos and channels. The coastline is estimated at more than 29,500 km in total length when all indentations and islands are accounted for (Zacharias & Howes in press). Given the richness and productivity of littoral and nearshore life this translates in an almost unimaginable diversity and scale of marine living communities.

The marine waters and coastal ecosystems off British Columbia have been shaped by enormous physical forces. The region is one of the world's most active geological zones in terms of the great movements of tectonic plates and, as a result, of volcanism and uplift creating mountains (Clague et al 1982, Riddihough 1988).¹ British Columbia's coast and nearshore geology is most directly shaped by the meeting of the massive tectonic plates underlying the Pacific and the North American continent. Two smaller plates, Juan de

Fuca and Explorer Plates further mould the submarine topography. This geological activity has also created some extraordinarily interesting offshore environments including the vents where volcanically heated waters escape from the sea bottom ("hydrothermal vents") and numerous seamounts. Both features add significantly to the marine biodiversity of the region.

A second major shaping force has been the history of extensive glaciation. Advancing and retreating glaciers from four different episodes of glaciation over the past million years, sculpted the fjords and , in concert with the active uplifting of mountains have left behind the incredible maze of inlets, coves and passes that gives rise to the great linear extent of the coast.

The oceanography and climate off the BC coast is affected by ocean currents originating far across the world's largest ocean (Thomson 1981). The North Pacific Drift originates off the coast of Japan and moves slowly and steadily across the ocean where it divides into north and south flowing portions as it approaches the North American coastline. These cool waters account for the moderate summer temperatures experienced in the region.

Strong prevailing winds especially in summer lead to upwellings of cold nutrient-rich water from the depths off the west coast of Vancouver Island. This phenomenon fertilizes the microscopic plants of surface waters contributing to the production of life upwards in the marine food chain. The intermittent disruption of this pattern by El Niño demonstrates just how important the normal ocean dynamics are for marine life and fisheries (Thomson 1983). Weakening of the prevailing easterly winds as a result of El Niño have been associated with drastic reductions in marine plant productivity and a cascade of secondary effects on the fauna dependent on the plankton. While the tidal range of the Northeast Pacific is described as moderate (3–5 metres in amplitude) interaction with the many differently shaped basins and passages can lead to extraordinarily rapid tidal currents. Several areas of the coast are especially renowned for the flow rates due to the tides, including Masset Inlet, Active Pass, Seymour Narrows (at Discovery Pass) and Skookumchuck Narrows.

The marine environment off Canada's west coast is also affected by the flow of several large and numerous smaller rivers. By far the largest in drainage area and flow is the Fraser River. The effects of its estimated mean annual discharge of 3800 cubic metres per second (and several times greater during peak periods of precipitation and spring thaw) can be seen well out into the Strait of Georgia in terms of freshwater dilution and massive glacial silt loads. Smaller but still significant influence on marine waters results from the outflows of the major northern systems, the Stikine, the Nass and the Skeena.

The biological consequences of these great physical forces are seen in communities of extreme diversity and variability. Just as the province of British Columbia is unquestionably the most biogeographically diverse in Canada, similarly its marine systems display a wide range of characteristics that have attracted world recognition. Major features include the massive complex of coastal wetlands in the vicinity of the

Fraser River estuary; rich and productive canopy kelp beds; unique and diverse assemblages of invertebrates around such features as biological reefs, rich seaweed beds, high current channels and, offshore, the recently discovered hydrothermal vents near oceanic ridges. Lambert (1994) reports that there are over 6000 known marine invertebrate species alone. This is in addition to BC being "blessed with one of the richest and most diverse marine floras in the world" (Hawkes 1994, p.113) and more than respectable numbers of marine mammal, finfish and sea bird species (Lambert 1994, Tunnicliffe 1991). Among these there is no shortage of impressive superlatives as Lambert (1994) well describes:

"I can usually impress an audience with a list of marine invertebrates from the west coast that Guinness would envy — the largest chiton in the world, the largest octopus, the largest sea slug, the heaviest sea star, the biggest barnacle. I can also boast 68 species of sea stars, over 600 amphipod crustaceans, 75 sea anemones and their relatives, 478 species of polychaete sea worms, 111 species of nudibranchs, and the list goes on."

(Lambert 1994, p.58)

There is probably no clearer example of how marine resources enable social and cultural development than in the history of humans on Canada's Pacific shores. The original peoples of the region are unique in the complexity and richness of their cultural achievements and this is generally attributed to the economic surpluses made possible by the endowment of marine resources (Drucker 1965, Ames 1994). Home-migrating salmon were the leading species for food, ceremonial and trade purposes but marine species such as shellfish, halibut and the eulachon also joined in underwriting the indigenous economy of the coast. Nowhere in the world have non-agricultural societies created so intricate and productive a social order. Their history as well as modern activity creates a legacy of cultural heritage resources that are renowned internationally. As a secondary result, BC's coastal First Nations' cultures have been among the most researched of any human societies.

After an initial early visit by the Spaniard Juan de Fuca in the late 1500s, two centuries passed before a brief but intense period of British and Spanish exploration led to direct contact with indigenous peoples. These explorers left behind increasingly accurate maps of the complex coastline, with ample opportunity taken to name numberless coves, passages and embayments after themselves and their royal patrons. As non-indigenous peoples came to stay longer in what is now British Columbia, marine-related activity predominated. Indeed, the initial period of contact between Natives and Europeans centred on maritime trade in both marine and terrestrially produced goods. Later, the coast of British Columbia was the setting for a boom of canneries and cannery-dependent communities all reliant on seemingly — and illusorily — inexhaustible salmon resources. It is said that in the early part of the 20th century, a typical steamship run from Vancouver to the Nass River near Alaska, could have up to 65 stops (Warriner 1987). This is no longer the case and now, coastal communities, both Native and non-Native

struggle in the face of what can seem to be inexorable economic trends of centralization. Yet most of the modern human population of British Columbia remains strongly linked to the sea. Today, fishing and coastal forestry remain economically and socio-culturally important if beleaguered sectors. Meanwhile nature-based tourism and maritime trade across the Pacific Rim grow rapidly in importance. Those who promote and/or enjoy the recreational amenities of BC's marine environment show no hesitation in repeatedly rating this region as the world's best in almost every recreational category - the best temperate SCUBA diving destinations, sports fishing capital(s) of the world, most dramatically scenic beaches, unequalled kayaking and, simply and eloquently, according to one sailor, "the last great place" (Nash, in Douglass & Hemingway-Douglass 1997). All these attributions reflect in different ways the continuing high capability of BC's marine environment to nurture the livelihoods, lifestyles and the spirit of human communities, large and small.

1.2 Purpose of this Study

The basic purpose of this overview is to answer a deceptively simple-seeming question:

What is it we value in BC's marine environment enough to justify substantial protection through a program of establishing Marine Protected Areas ?

The Federal Government and the Province of British Columbia are, in fact, in the process of developing a Marine Protected Areas Strategy for the Pacific Coast of Canada (see BC Parks et al 1997 for background on this work). While each jurisdiction has pursued for some time individual efforts related to setting aside special marine sites for conservation and related purposes, a full-fledged intergovernmental co-operative effort is comparatively recent. This high level co-operation is leading directly to a change in the way that Marine Protected Areas are identified and evaluated. By and large in the recent past identification and evaluation occurred in a primarily ad hoc manner. A government agency or a private group or organization would direct its attention to the protection of one or at most, a few restricted marine areas deemed to be special in some way (presumably, related to the mandate, objectives or values of the proposing body). Inevitably, because protection worthy of the name involves some change in current human activity, the proposal would encounter opposition and the proponent would shift to some technique of attempting to prevail whether by dint of political influence or tactful persuasion.

The net result has not been a very effective or quantitatively productive increase in the number or scale of marine areas under truly meaningful protection.² One advocacy group, the Marine Life Sanctuaries Society, concluded that there are 106 MPAs on the west coast of Canada, by standards of the International Union for the Conservation of Nature and Natural Resources. In this organization's view, however, "90% of them provide little or no ecosystem protection... these MPAs were not designed to conserve marine ecosystems as a whole" (Marine Life Sanctuaries Society, n.d., p. 13). Researchers from Westwater Research Centre concluded that "Most British Columbia provincial marine parks have been selected unsystematically and primarily for the benefit

of special interest groups such as yachting clubs." (Westwater Research Centre 1992, p.8). Moreover, creation of new and more protective MPAs occurs inside a virtual policy vacuum where the rules and criteria must be made up in an ad hoc fashion, is proving to be enormously costly to proponents and opponents alike.

The high costs and uncertainties of success associated with ad hoc MPA identification are but one problem: equally if not more serious is the possibility that the limited resources of agency or interest groups' time and money might actually better be spent on some other site(s) which surpass the proposed one in meeting conservation and other objectives. Yet without some larger picture of what precisely we are trying to protect in BC through Marine Protected Areas, this danger can neither be assessed nor, therefore, avoided.

With the recent onset of broader intergovernmental initiatives, an immediate priority has been to put the process of finding high quality MPA "Areas of Interest" on a more systematic footing. The present study is one contribution to doing this. Our formal terms of reference define the purpose of the work as follows:

1. identify and describe those conservation, recreation and cultural heritage values that are characteristic of or unique to British Columbia's Pacific Coast and that can make a significant contribution to provincial, national and international systems of coastal and marine protected areas; and
2. develop criteria to identify and rank the conservation, recreation and cultural heritage values from most to least significant based on provincial, national and international scales.

These two purposes constitute respectively what is meant by "an overview" and "a strategic assessment." We have, however, seen the need for doing more by way of "overviewing" than providing the category names and descriptions of valued environments, features and sites. In a broader sense an overview scans the issues, general and specific that need to be reflected upon before and during use that may be made of such lists. Especially in light of the circumspection we encountered in discussion with marine specialists and non-specialists alike, there is definitely this need for providing some cautionary even self-critical background to our value lists.

For reasons that will become apparent in later sections of this report, accomplishing the latter — rigorously ascribing provincial, national and international significance to each subcategory of valued feature, environment or site — has not proven to be feasible. In short, this was because most of the informants with whom we talked and our own expert team, supported by the literature we studied, saw the quest for criteria that could objectively rank key values "from most to least significant" as neither achievable nor desirable. A wide variety of concerns were raised with trying to do so, in particular the following:

- that, relative to the terrestrial information base, marine area information is so massively incomplete that assignments of which areas are most representative, most special or most by any other criterion would be at best conjectural and at worst contributory to a misappropriation of MPA resources;
- that present knowledge of marine areas within BC was very imbalanced towards the southern and more populated regions and that this could lead to misleading and poorly based high rankings of "provincial significance" for features in these as opposed to northern remote regions
- that scales of provincial, national and international significance tended to be highly subjective yet, dangerously cloaked in the guise of pseudo-objectivity; and
- that reliance on such scales tends to devalue that which may be locally or regionally significant at a time when the active co-operation of local interests is increasingly seen as vital to the success of MPA programming;

These and other related concerns about the feasibility of a "strategic assessment" have led to a shift in emphasis. In particular, we have tried, in discussing each category of value (i.e. conservation, recreation and cultural-heritage), to raise and clarify issues that affect the ability to be strategic, which, to repeat, in this context, means being systematically selective in choosing MPAs. Thus, there are selected comments about features and environments of obvious national or international significance, in Section 3, these are brief and no attempt is made to discuss "provincial significance" at all.

1.3 Methods

Information for this project was gathered and analysed using the following methods:

- compilation and analysis of an extensive literature relevant to understanding BC's marine environment and its component features;
- compilation and study of selective general references on all three categories of value, i.e. literature about the ecology and natural processes and characteristics of marine environments; literature (much of it in report form rather than published books and articles) about marine recreation; and historical and cultural anthropological information focusing on the Northwest coast indigenous and Eurasio-Canadian cultures;
- selective review of Marine Protected Areas literature in regard to approaches used for identifying key values and assessment approaches;

- repeated one-on-one dialogues within the expert team assembled for this project (i.e. Brian Emmett and John Harper re: "conservation" values; Julie Paul re recreation and Jim Haggarty re cultural heritage);
- a full-day workshop among the project expert team to develop and compare approaches for overview and strategic assessment among the three categories;
- informal interviews with several other experts in the three value categories and on the general topic of Marine Protected Areas; and
- four small group workshops, two for conservation and one for each of recreation and cultural-heritage with selected experts from the relevant fields.

The Project Manager, Norman Dale, also participated in and facilitated break-out groups at the two Marine Protected Area Forums held in March 1997 by the federal and provincial agencies who make up the Marine Protected Areas Working Group. This experience and the opportunity to hear commentary at the plenary, small group and individual conversation level has helped to shape the subject of this report.

It is to be emphasized that due to difficulties experienced in developing a workable and comprehensible framework early in the study process, most of the conclusions and much of the framework emerged only late in the writing. Therefore they represent primarily the author's views and inferences and not necessarily those of any or all interviewees and workshop participants with whom much earlier meetings had been held.

1.4 Organization of the Report

This opening section has provided a general overview of BC's "superlative" marine environment (Section 1.1); introduced the formal and emergent purposes of the report and project (Section 1.2) and identified the principal means by which information was gathered and analysed (Section 1.3). Section 2 concerns the scope of the key functional term in the study — values. We begin in Section 2.1 with a brief discussion of terminology to clarify how the word "value" is used. In so doing we introduce the longer but less ambiguous phrase "Valued Marine Environments and Features" which will be used throughout this report. There follows in Section 2.2, a brief and selective review of the categories and subcategories that leading Canadian and international sources have used when talking about marine values. These sources, supported by discussions held during the project, influence the scope of features, environments and sites included in the overview.

Section 3 comprises the overview itself. It begins with a brief consideration of the scope and inter-relationships of the main value categories (conservation, recreation and cultural-heritage), after which each category becomes the focus for separate discussion. Section

3.1 deals with so-called "conservation values," 3.2 with recreation values, and 3.3 with cultural-heritage.

Each of these large subsections follow a roughly similar format. They open with definition of what is included in the category of value and then move to an outline of the specific structure and approach used in classifying features, environments or sites. An important subsection of each describes some of the particular challenges surrounding the "naming and rating" of values within the category. The largest part of the study then follows with detailed discussion of the valued features and environments important to conservation, recreation and cultural heritage respectively. The format, however, differs considerably among these three categories, especially for the cultural heritage section where, for reasons that will be given there, no attempt was made to categorically list what the relevant values are.

We conclude in Section 4 with general observations on the use of this overview within the further strategy development and planning of the Marine Protected Areas programme on the Pacific coast of Canada.

2. Values in Marine Protection: Terms and Uses

2.1 Terminology

"The word 'value' is the victim of arrogance from economists, obfuscation from philosophers, and rhetoric from politicians..."

(Ashby 1978, p. 6)

Because the term "values" is used in several very different ways in literature concerning marine and other resource protection, it is important to briefly consider and propose specific terminology. After all, over the next few years, British Columbians from many walks of life, cultures, levels of expertise, qualities of marine experience and disciplinary backgrounds will be working to choose MPAs. Substantive issues are going to be difficult enough by themselves; there should be no room left for debates rooted in semantic confusions over values and valued features. Yet the literature on MPAs, and protected areas more generally, is rife with confusion and multiple usages about "values." At least three usages are encountered — sometimes two or more from the same source:

- values as benefits (especially economic ones) as when we ask questions such as "what value is there in providing a particular recreational opportunity?";
- values as the broad reasons for why something is considered valuable — the basic underlying rationale for caring about an attribute of the environment; and
- values as the things we value (which is closest to the intended subject of this overview).

Values as Economic Benefits

The first of these is most often seen in the way that economists discuss Marine Protected Areas and their rationale. A good review of economic evaluation techniques applied to the selection and justification of MPAs is presented by Hoagland et al (1995).

It is common to speak of qualities such as uniqueness, representativeness or high biodiversity spoken of simply as "values." This is the second usage referred to above and is probably the one closest to the meaning of "value" one encounters in everyday conversation. But here and in much of the MPA literature such "values" are seen more as criteria useful for rating that which that we value.

The latter is the usage closest to our subject matter: for example, orcas and the environments they rely on are values in this third sense, as are tidal flats, good anchorages, shellfish beds and mythologically significant places.

All of these usages (and a few others) have been made of the word "value" in the literature of coastal management and MPAs. This becomes a problem in a work aimed at developing a list of some thing's called "values" for groups planning MPAs. One ends up with some values being used as ways to evaluate values! In order to avoid this, we have adopted the following terms.

First of all there are the broad value categories which appear in the title of this project — conservation, recreation and cultural-heritage. The meaning attached to each of these is briefly defined in relevant parts of Section 3. Within each category are generic features and/or environments of the things that matter and that should be inventoried and assessed in MPA identification. These are the "units of analysis" for purposes of this study. For conservation and recreation categories, we refer to these units as Valued Marine Environments and Features or, for brevity, VMEFs. This phrase is used to allow for identifying either specific features or larger environmental systems whose protection as a whole is likely to be considered. The phrase does not quite work for cultural-heritage values where the focus is generally on sites. Nonetheless, for consistency we use the phrase "Cultural-Heritage VMEFs" in that part of the discussion.

2.2 A Selective Review of How Values are Considered in Protected Areas Initiatives and Literature

Over the next few years systematic planning will begin for the identification of candidate Marine Protected Areas (MPAs) in British Columbia, and thence, to their designation. This will not be accomplished easily, no more than has been the case in the first several years of the primarily terrestrially oriented Protected Areas Strategy. Clarity on values is essential if consensus is to be reached in the various regions of the BC coast and at the

provincial level. In this section, as background to identifying the things that matter most about BC's marine environment, we examine briefly how others have identified guiding values for marine area protection and, more generally, for protected areas initiatives. The intent is not to be comprehensive but rather to give a representative sampling of how the same challenges to program development have been addressed in other contexts. It is of interest, therefore, to scan influential and innovative thinking concerning any of these as they are used to create the rationale for marine protection or other protected areas.

First, closest to home, let us briefly review the primary rationale for the BC Protected Areas Strategy. An explicit statement was made in the policy document regarding the value of protected areas — and it is a very encompassing one.

Protecting areas of land and water offers a multitude of ecological, scientific, social, cultural and economic benefits and values (which)...

- contribute to the preservation of our natural and biological diversity and the maintenance of essential ecological processes and life-support systems;
- provide natural benchmarks for long-term scientific research, the results of which can be used to monitor regional and global environmental changes and to evaluate and improve resource management practices outside protected areas;
- serve as a reservoir of genetic information for a variety of disciplines and industries such as agriculture, medicine and forestry;
- contribute to the preservation and understanding of our cultural heritage, including places of special spiritual significance, which promote cultural well-being;
- support Aboriginal peoples' rights to continue their traditional use of the land and spiritual relationship with the land;
- provide outdoor classrooms for British Columbia residents, visitors, students and specialists. Through visitation, viewing opportunities, and educational and interpretative programs, protected areas offer a heightened awareness of common environmental concerns and respect for the rights of other life-forms to exist;
- provide opportunities for the public to experience, appreciate and enjoy nature and open spaces, including a distinctive range of outdoor recreation facilities and services from enhancing the major travel routes along highways, coast and lake systems to ensuring access to wilderness settings and experiences. Outdoor recreation provides immeasurable value to the physical and mental well-being of the individual and family; and
- contribute to the long-term viability and growth of the tourism industry and the diversification of the provincial economy.

(A Protected Areas Strategy for British Columbia 1993, p.1-2)

This impressive breadth is circumscribed, however, by a later clear statement of what takes priority:

The first priority in the use and management of protected areas is to protect their ecological viability and integrity.

Recreational activities, facilities, services and cultural heritage policies in protected areas must be compatible with each area's objectives and the long-term protection of ecological viability and integrity, while enhancing the public's experience of the natural and cultural heritage of the province.

(Ibid, p. 5)

At the level of explicit goals, the Protected Areas Strategy focuses on two qualities (which readily become criteria) of highest importance:

Goal 1: Representativeness

To protect viable, representative examples of the natural diversity of the province, representative of the major terrestrial, marine and freshwater ecosystems, the characteristic habitats, hydrology and land, forms, and the characteristic backcountry recreational and cultural heritage values of each ecosection.

Wherever possible, protected areas should combine natural, cultural heritage and recreational values. Where it is not possible to combine these in a common area, they may be represented separately. Where it is not possible to represent all values, the natural values will be given priority.

Goal 2: Special Features

To protect the special natural, cultural heritage and recreational features of the province, including rare and endangered species and critical habitats, outstanding or unique botanical, zoological, geological and paleontological features, outstanding or fragile cultural heritage features, and outstanding outdoor recreational features such as trails.

Many protected areas will be set aside primarily to protect rare or vulnerable features. Others will combine protection with giving people the opportunity to appreciate and enjoy the intrinsic values of the areas. Others will be protected to attract people to experience and appreciate their natural or cultural heritage."

(Ibid, p. 6, emphasis added)

What stands out from these broad ranging ideas about values, priorities and program goals is that while a very wide range of values can be served in protected area

programming, conservation is to take priority. Other needs (i.e. other values) will be accommodated as possible without losing sight of that top priority.

A number of federal agencies have also been pursuing initiatives related to what are now called MPAs. Probably the most long-standing of such initiatives are those associated with Canada's National Parks system, under the management of Parks Canada (now within the Department of Canadian Heritage). The early history of policy development in this area has been well summarized by Mondor (1985). More recently a National Marine Conservation Areas (NMCAs) Policy has been adopted and provides specific guidance regarding the considerations that are to underlie the identification of candidate NMCAs.

In selecting potential national marine conservation areas, consideration will be given to a wide range of factors including:

- i) the extent to which the area represents the ecosystem diversity of the marine region;
- ii) the degree to which the area contributes to the maintenance of essential ecological processes and life support systems for downstream areas (e.g. the protection of nursery or juvenile rearing areas);
- iii) the importance of the area in maintaining biodiversity and protecting critical habitats of rare, threatened or endangered species;
- iv) the occurrence of exceptional natural phenomena and cultural resources;
- v) the existing or potential value of the area for ecological research and monitoring;
- vi) opportunities for public understanding; education and enjoyment;
- vii) possible threats to the long-term sustainability of the area's marine ecosystems as well as those of the surrounding lands;
- viii) minimizing conflict with existing or probable marine resource uses such as significant commercial fishing areas, mineral or energy resources, navigation routes or defence exercise areas;
- ix) complementarity with the objectives of existing or planned protected marine or coastal areas of other jurisdictions in the marine region;
- x) the potential of establishing an adjacent national park or national park reserve representative of its natural region;
- xi) the potential to cooperatively manage existing and potential uses of the marine resources within and adjacent to the potential marine conservation area on

sustainable basis, compatible with the objective of protecting its biotic resources and other park values; and

xii) the implications of comprehensive land claims and treaties with Aboriginal peoples.

*From National Marine Conservation Areas Policy,
Section 1.2.2, (in Parks Canada, 1994)*

Thus, the National Marine Conservation Areas Policy, like BC's provincial Protected Areas aims to protect or enhance a wide array of values but with priority assigned to several long-standing priorities of the National Parks system. In particular, National Parks planning in Canada has put strong emphasis on the idea of representativeness — securing within protected status sites that typify larger ecological zones or regions.

A more recently consolidated federal agency perspective on Marine Protected Areas has been issued by Fisheries and Oceans Canada, titled *An Approach to the Establishment and Management of Marine Protected Areas under the Oceans Act: A Discussion Paper*. This document deals with the question of values most explicitly when discussing "Overall Purposes for MPAs." These of course are necessarily related to the mandate of the Fisheries and Oceans Canada which is predominantly about the protection of fish and fish habitat. Thus the purposes from which motivating values can be adduced are:

- conservation of commercial and non-commercial fisheries resources;
- conservation of endangered or threatened species;
- conservation of unique habitats;
- conservation of productive ecosystems and biodiversity; and
- conservation of other marine resources and habitats to fulfil the mandate of the Minister of Fisheries and Oceans.

Understandably, given the agency's mandate, the word "Conservation" resounds in all these statements of purpose. Elsewhere in the discussion paper, particularly in the consideration of "Area Evaluation and Selection" (p.21-22), these purposes are seen to be the source of criteria for choosing MPAs. Note is also made of the importance of considering other values — social and economic, ecological fragility, scientific importance and educational — as well as regional, national and international significance.

At the international level, the most influential source of guidance on the values that are to count comes from the publication *Guidelines for Establishing Marine Protected Areas* (Kelleher and Kenchington 1991). This study has become foundational for a number of national and regional Marine Protected Areas programmes and is used as the basis for probably the most ambitious compilation of such programmes, the four volume set, A

Global Representative System of Marine Protected Areas. Kelleher and Kenchington posit the following primary reasons for creating" MPAs:

- to maintain essential ecological processes and life support systems;
- to ensure the sustainable utilization of species and ecosystems; and
- to preserve biotic diversity.

Thereafter they provide a brief but interesting discussion of how this ecological case for protection may be modified when the physical or economic survival of traditional marine-based activities are potentially impacted by creating MPAs.

It follows from ...humanitarian, economic and pragmatic considerations that where there is a choice of ecologically suitable areas, as there often is in the sea, the dominant criteria for selection of MPA locations, boundaries and management systems will commonly be socio-economic.

Clearly, where there are few, if any alternative sites, ecological criteria should be critical and decisive.

(Kelleher and Kenchington 1991, p.14)

The authors of this seminal report go on to identify eight factors or criteria that can be used in deciding whether an area should be included in an MPA. These are:

- naturalness
- biogeographic importance
- ecological importance
- economic importance
- social importance
- scientific importance
- international or national significance
- practicality/feasibility

Each, except perhaps the last, can be easily translated back to the values which one aims to protect and enhance through the creation of MPAs. That is, at a general level an MPA planning team would look for places that are especially "natural" or of highest "scientific importance."

A helpful review has more recently been completed on the kinds of objectives associated with marine nature reserves on a world-wide basis. Jones (1994) discovered little consensus among numerous authors of papers and technical reports on marine protection. In all he identified six scientific, five economic, three cultural and one ethical reason(s) for the establishment of marine nature reserves.

More specifically these were:

Scientific

1. Maintain genetic diversity/species diversity
2. Promote research
3. Education/training areas
4. Conserve habitat and biota
5. Baseline monitoring areas
6. Protect rare/important species

Economic

7. Promote/control tourism/recreation
8. Promote sustainable development
9. Recolonize exploited areas
10. Coastal protection
11. Alternative environmental economic arguments

Cultural

12. Aesthetic value
13. Protect historical/cultural sites
14. Political reasons

Ethical

15. Intrinsic absolute value

The "last word" here, on values and value categories relevant to MPAs, is left to the ongoing initiative between Canada and British Columbia for Marine Protected Areas — an initiative of which the present work is but one input. In March 1997, the Canada/BC Steering Committee on MPAs convened public workshops in Parksville and Prince Rupert to discuss emerging concepts for MPAs.³ A background discussion paper contains several sections illustrative of current federal and provincial thinking on values. A brief section entitled "What are the Values of the Pacific Coast Marine Environment We Need to Protect?" (BC Parks et al 1997, p.7-8) focuses mainly on (a) "superlatives" attributable to the environment such as "80% of the world's population of Cassin's auklet" or "the largest sea slug"; and (b) biodiversity, with citation of published estimates of numbers of species in different taxonomic categories.

Subsequently, the discussion paper outlines the benefits of marine protected areas, which can be re-interpreted as enhancements of that which is valued. In that section of the paper (*ibid.*, p.10-11), the benefits are considered under five headings:

1. Protect Biodiversity and Ecosystem Structure, Function and Integrity

2. Improve Fishery Yields
3. Expand Knowledge and Understanding of Marine Ecosystems
4. Provide Recreation and Tourism Opportunities
5. Provide Socio-Economic Benefits for Coastal Communities

From these, it follows that the value categories of relevance are marine biodiversity; intact, functioning marine ecosystems; fish stocks for commercial and recreational purposes, the opportunities to learn from, relax and enjoy marine environments and the socio-economic sustainability of coastal communities.

In the final section of the paper an eight step process for an MPA strategy is outlined. The first step involves the "identification of key marine values" (ibid., p.25). Here the authors become quite specific, naming four "broad types of marine values, attributes and features to be captured by the MPA system: conservation(biophysical), recreation, cultural heritage and fisheries" (ibid., p.25). The text continues with examples "...representative ecosystems to unique habitats, seabird foraging areas, species refugia, scenic beaches, kayak routes and safe anchorages" (ibid., p.25). Naturally, these concepts and ideas have influenced the way that values are considered in the present report.⁴

There are strong implications of this ubiquitous value conflict for what we are trying to accomplish in this study especially in regard to the feasibility of objective and strategic assessment. Strategic assessment, generally speaking, implies selectivity. In the context of MPA programming, it involves establishing a hierarchy of what is valued, what will most influence the choice of MPA sites, in a systematic way, as open as possible to the understanding and informed criticism of others. But what does it mean to be "strategic" when increasingly, almost "anything goes" in lists drawn up as the value-based rationale for creating marine protected areas. That is, if almost any imaginable value is a good enough one to be factored into candidate area selection, and if the values are based ultimately on a mix of objective facts and subjective preferences, is being strategic anything more than being politically astute?

Our overview and "strategic assessment" must, therefore, stop short of making comparisons between different kinds of values or valued marine environments and features. We can legitimately lists of "VMEFs" and report, to the extent possible, widely shared attributions about just how significant particular environments or features are. But in doing so, we must try, above all, to set the stage for the detailed planning when dialogue among scientific experts, resource users, community spokespeople and many others will be the prime determinant of how particular values influence the identification and evaluation of MPAs.

3. An Overview of Valued Marine Environments and Features

In this section of the report, an overview of valued marine features and environments is presented, the main purpose of which is to furnish lists that may be useful in Marine Protected Area Planning. The central question is "what kinds of attributes are so valued that they should form the basis for identifying candidate MPA sites?" In accordance with the framework that was provided in the Terms of Reference to this study, the present section is organized into three categories: 1) conservation; 2) recreation; and 3) cultural-heritage. The goal, to repeat, under each heading is to break down the broad category into lists meaningful in the terms specific to each category.

Each of the following three sections is organized in a roughly similar manner. They begin with a consideration of what is meant by the category heading and thereby, what sorts of valued features or environments are included. We then turn, in each of the three sections, to brief but important remarks about the special difficulties or challenges faced in identifying important values for each category. It will be seen that in each case there are important reasons to be hesitant rather than definitive about what values ought to count.

We then get down, as much as possible, to the specifics of the overview — what the values (VMEFs) are and how, if at all, their significance might be assessed. The original plan was to develop a single framework for describing each valued feature, site and environment, applicable across all three categories. This did not prove to be possible nor to best capture the essence of what must be considered in MPA planning that incorporates each value category. Conservation-related attributes, we found, could be reviewed in a fairly systematic manner. The discussion of recreation-related values, on the other hand, was better understood and organized in terms of the principal recreation activities and, in less detail, in terms of harder-to-assess qualities, often termed "intangibles" by rigorous analysts. Finally, we concluded that attributes most significant from a cultural-heritage viewpoint could not be placed in a compelling general framework at all. The reasons for this will be fully discussed in Section 3.3. It should not be surprising that these categories turned out to be fundamentally distinct from one another. So-called conservation values are firmly anchored in natural sciences. They entail such qualities as biodiversity, rare species and habitats, genetic endowments etc., all of which are, at least in principle, measurable using tools that professionals such as ecologists, geologists and physical oceanographers routinely apply. Despite best efforts and some agile methodologies, recreation is simply not subject to comparably systematic and scientific analysis. Thus, for example, in considering conservation values, it is (again in principle) possible to show that site A has a higher biotic diversity than site B or that site C is more heavily used by some endangered marine species than site D. On the recreation side, superlatives abound such as BC's two "salmon capitals of the world," or Goletas Channel is among the ten top dive sites anywhere, or the entire Inside Passage being among the best cruising destinations globally. But confirming such assertions proves elusive, unless one accepts — and experts in the field of recreation generally do not — that the most intensely used locations are ipso facto the most significant. It adds to the non-comparability of recreation and conservation values that most of the attributes which are valued from a recreational standpoint, are very largely "covered" in inventories of conservation and cultural-heritage values. The long-standing conventional way of thinking about cultural-heritage sites — that is, as limited to those with physical evidence

or well-documented written histories — would make our third category of values amenable to scientific documentation and evaluation, in somewhat the same way as conservation values. However, especially in light of the significance of First Nations within BC's "cultural heritage milieu," this conventional way of thinking about this category is rapidly giving way. Replacing it is an understanding of "cultural importance" that is far less amenable to Western-style scientific assessment. As noted in Section 1.2, a key part of the assignment was "strategic assessment," a means to be systematically, transparently selective. From the perspective of the present study's Terms of Reference, a large part of this work was to have been identifying attributes of provincial, national or even global significance. However, as noted, neither we nor the people we consulted in the research felt that such attributions could be rigorously and objectively made. In lieu of such determinations, we do offer a commentary in each section about the challenge of making such judgements and where feasible offer some indication of valued marine environments and features that appear incontrovertibly to be of such high level significance.

3.1 Conservation VMEFs

Scope: What is included Under "Conservation"?

The term "conservation" has become a widely used descriptor of a critical set of values basic to the rationale of setting aside protected areas. Given the highly controversial history of the term, this is surprising. Conservation has very often been used to mean wise extractive use of renewable resources. This common usage may not fit very well as a "label" within a program that is likely to involve creation of areas where "no take" and even "no go" are the policies. Notwithstanding, conservation is taken in this study to imply nothing about how or whether areas are used but rather as equivalent to what might most simply be called "the natural" — biological, biogeographical, geological and chemical — features of the marine environment. So to look for that which is valuable from a conservation viewpoint is to examine the natural features at different scales.

Structuring the Overview and Strategic Assessment of Conservation VMEFs

Thinking about conservation values in protected area planning has generally focused on two major objectives: 1) achieving representativeness and; 2) protecting unique or otherwise special natural features. The Protected Areas Strategy for BC is a prime example of this way of defining objectives. Lewis (1991) similarly uses these two objectives to distinguish the motivation for ecological reserves. In this section we divide conservation-related "valued environments and features" somewhat along these lines.

Our first subcategory, "(A) Major Intertidal and Marine Environments of BC" is intended to be as inclusive as possible of the major kinds of marine and coastal environments that are distinguishable and which, in many cases, distinguish the BC coast. The idea is that a Marine Protected Area system ought to represent all such environments by having at least one good example, protected sufficiently that its constituent species, communities and

abiotic features can be sustainable. This, as we have noted earlier, has been probably the prime consideration in parks system planning in Canada and in the quarter century of initiatives to establish specially protected marine areas. For example, Howard Paish & Associates (1970) undertook a reconnaissance regarding marine parks for the Vancouver Island - Mainland Coast "inland sea" in which the organizing question was what themes required representation in selecting suitable sites. Later studies have continued to examine ways of incorporating areas representative of the ecoregions of the BC coast into an overall system (Searing and English 1983; Parks Canada 1993).

The second main heading we use for this overview of conservation values reflects the other principal objective that most protected areas strategies comprise: special attention to that which is rare, unique or, more generally, that stand out because of significant contribution to marine biodiversity. This has several dimensions. There are VMEFs which are rare in terms relative to the broad expanse of the BC coast, because of limited natural distribution. Formative geological processes may simply have led to there not being very many examples, at least here, of a particular structure which may have uncommon or unique biotic communities associated with it. A good example would be the hydrothermal vents which have only recently been discovered around oceanic ridges off the coast of Vancouver Island (Tunncliffe 1991a). These rare or in other ways especially significant habitats most of which make important general contributions to marine biodiversity are placed in a second category "(B) Specific Habitats Generally Deemed to Be of Especially High Ecological Significance."

The third category consists of habitats important to highly valued species or assemblages of related species, generically referred to as taxa (plural of taxon). The category is titled, "(C) Areas Significant to Especially Valued / Familiar Groups or Taxa." It is believed, for example, that the only remaining overwintering population of Black Brant geese (*Bernicla bernicla nigra*) is in the vicinity of Skidegate Inlet on the Queen Charlotte Islands (ESL Environmental Ltd. et al 1991). Habitat of these unusually marine-dependent waterfowl is therefore an example of the kind of VMEF likely to be deemed significant to the identification and evaluation of MPA areas of interest.

A fourth category with a single "member" has been added for the special consideration that MPA planners may wish to give to areas for which particularly strong baseline information exists. As noted in section 2.2., one of the frequently cited reasons given for marine protection is to have sites which are functioning in a more or less natural way and which can therefore be used in the future as a "control" and a source understanding. Places where good data is already available are of value in relation to this objective.

Based on this framework under the four broad categories we have identified 27 Valued Marine Environments and Features (VMEFs), knowledge of the distribution of which should be an important guide in identifying potential MPAs. A common format has been used in describing these VMEFs (although it must be stressed that very unequal levels of information are available among these VMEFs):

1. Definition – briefly, what is meant by and included under the title;

2. Explanation as to why the VMEF is important — statement as to the basis for considering the VMEF to be important; Note that for the major environments of category A, their importance is implicit in their making up a significant proportion of the overall marine area of BC. Representing such major environments, consistent with the general purposes associated with protected area designation (see Section 2.2), is the primary rationale for their inclusion and significance.

3. Subcategories (if any) — given that for almost every category, finer grained sub-classification is not only possible but would be necessary for organizing a systematic identification of valued features, we attempt to indicate what further distinctions may have to be made;

4. Distribution and Illustrative Examples in British Columbia — where possible, comments are made on how widely the VMEF is distributed along the BC coast and one or more examples are given purely to illustrate the kind of environment or feature. It must be stressed that the inclusion of the example is not meant to imply any judgement on whether it is of special significance compared to other sites;

5. Status of Information about this VMEF in BC – brief comments on the extent to which knowledge or information is available that would enable a planning group to readily determine the regional occurrence and extent of the VMEF.

6. Comments re Provincial, National or Global Significance — where possible commentary is made on any rationale for considering each VMEF to be significant at provincial, national or global levels. Note that doing this in a rigorous manner, as had been anticipated at the outset of this work, was not deemed to be feasible or desirable (see Section 1.2).

7. Selected References — if useful literature specifically about the VMEF have been located, the references within the final bibliography are given.

Each VMEF is numbered (the "C" before the numeral indicating a conservation-related value). To be clear, the order of presentation has nothing to do with rank or importance.

Note that in the cases of three kinds of VMEFs which were considered important in the literature and/or our workshops, minimal information was available and so only summary paragraphs have been prepared (VMEFs C18,19,26). The intent was to draw attention to and name categories which appear to be worth considering in future MPA planning but for which information is sparse.

Conservation VMEFs: Category (A): Major Intertidal and Marine Environments of BC

Several existing frameworks for considering needs for achieving representativeness were considered in developing the framework of "major intertidal and marine environments." On a national level Parks Canada has identified 29 marine regions of Canada including 5 for the Pacific Coast. This is not a fine enough breakdown for our purposes of overviewing what is valued. Other much more detailed approaches have been developed in BC, including work undertaken for Environment Canada (Harper et al 1993) and, more recently, for the BC Corporate Information Services (Howes et al. 1996). This British Columbia Marine Ecological Classification (BCMEC) involves a hierarchical classification delineating the whole marine area of BC into Ecozones, Ecoprovinces, Ecoregions and Ecosections.

An even finer set of distinctions were developed called ecounits, essentially subareas defined by multivariate geographic information analysis using five criteria: wave exposure, depth, subsurface relief, seabed substrate and current regimes (see Howes et al 1996). These frameworks are likely to prove of use in cross-checking the adequacy of representation of different environments within a Marine Protected Areas system (see Zacharias & Howes, in press). However, the resulting array of ecounits is not easily related to the subject of what is valued. For purposes of this overview, the approach we have taken here is not so much regional nor statistical as feature-based. That is, we have identified the main marine and coastal environments which can be readily recognized, even directly experienced by lay people as well as experts, as intuitively distinct environments in British Columbia. Some are seen as distinguishing characteristics of Canada's Pacific coast and ocean environment, the things that make this region remarkable overall in comparison to other Canadian and global marine waters and coastal zones. These "VMEFs" are defined primarily in terms of geological and physical attributes but their biological significance, is also enormous.

Most of these environments are divided into three subcategories just for clarity and organizational purposes. These are: Shoreline & littoral — those that are close to land or even span the boundary between marine and terrestrial environments; Coastal water bodies - the plethora of channels and embayments of unimaginable variation in shape and size those from the Strait of Georgia inland sea to the small innumerable inlets, named and nameless along the entire coast; and Offshore environments, including the distinctive geomorphologic features of the shelf and sea bottom. The first VMEF considered is one that literally overlays most of the others - the pelagic waters-plankton based ecosystems whose productivity is so significant for marine food chains and humans relying on them.

We will deal with key distinctions within each class in the discussions of each VMEF that follow the full listing. It is important to reiterate that these are not exclusive categories. Some VMEFs overlap with or may be, in many cases, found within others. For reasons described earlier, at this point we are less worried about any redundancy in the framework than with the possibility of missing one or more important types of marine system.

C1 Open waters -plankton based ecosystems
<i>Shoreline & littoral</i>
C2 Archipelagos and their environs
C3 Intertidal areas (foreshore) & adjacent backshore
<i>Coastal Water Bodies</i>
C4 Inland seas
C5 Major embayments
C6 Fjords
C7 Passages: straits, channels, passes & narrows
C8 Estuaries
<i>Offshore Environments</i>
C9 Continental margin (shelf, slope, & rise)
C10 Ocean Basin: ridges, abyssal plains etc.

VMEF C1 PELAGIC WATERS - PLANKTON BASED ECOSYSTEMS

1. Definition:

"Pelagic" refers to open waters, often contrasted with environments that are enclosed (e.g. estuaries, lagoons) and also with those on or in the seabed (benthic). Most of the pelagic environments of interest in a BC context would be further classified as "neritic" meaning close to shore, generally over the continental shelf and slope. For discussion purposes here, we use the term pelagic in reference to the water column whether that be of the more enclosed subtidal waters (inland seas, embayments etc.) or of the true "open seas" 6. Within the water column itself exist complex and very changeable communities of organisms intimately related to physical and chemical properties that also vary widely in time and space. The biological communities - "the plankton" - comprise microscopic plants (phytoplankton), very small species of animal (zooplankton) larval stages of larger fish and invertebrate species which later in their life cycle may either be attached to or within the bottom communities (benthos). Also found within plankton communities are floating organisms visible to the naked eye (e.g. jellyfish) and, of course, fish which unlike the permanent plankton "maintain their position and (can) move against local currents" (Parsons & Takahashi , 1973. p. 1). The latter are sometimes referred to

collectively as the "nekton" but may be considered as part of the overall plankton dominated communities of pelagic environments.

2. Explanation as to why the VMEF is important:

On a volume basis, this environment is by far the predominant one of BC's marine areas. Encompassed are open water ecosystems found from the Alaska border to Juan de Fuca strait. It may seem almost absurd to even ponder why so high a proportion of the overall environment is worthy of attention ! But there are conceptual and practical difficulties in trying to find ways to relate these very important plankton communities to the tools of an MPA system. By definition these are organisms and groups of organisms whose "movement is weak in comparison with the prevailing movement of the water" (Parsons & Takahashi , 1973. p. 1).

3. Subcategories (if any):

See the discussion within the "definition" regarding the components of pelagic ecosystems. Several efforts have been made to characterize and classify the different open water areas of the BC marine environment. Parks Canada's National Marine Conservation Areas System Plan (Mercier and Mondor 1995) names five broad marine regions on the Pacific coast and within these divisions, makes note of distinctions in the marine environment although not primarily in terms of the oceanography of the pelagic zones. The British Columbia Marine Ecological Classification which divides the entire coast into "Ecozones, Ecoprovinces, etc." based on 1:2,000,000 scale information, may at its highest levels of aggregation, serve as a more analytical basis (or cross-check) for ensuring representation of the main pelagic environments.

4. Distribution and Illustrative Examples in British Columbia:

See discussion above.

5. Status of Information about this VMEF:

The physical, chemical and biological oceanography and perhaps most advanced, the meteorology and climatology of the various portions of the pelagic environment have been studied for many years although some areas for reasons of intrinsic interest and/or convenience for survey work are far more thoroughly understood. Obviously, a massive area is comprised but also, one expects that mixing associated with the pelagic environment means much less place-to-place variation than would be encountered in equivalent extent of terrestrial or estuarine environments.

6. Comments re National or Global Significance:

7. Selected References:

Regarding physical and chemical dynamics see Thomson (1981) and Crawford and Thomson (1991); on the biological communities and processes, see Parsons and Takahashi (1973).

VMEF C2 ARCHIPELAGOS AND THEIR ENVIRONS

1. Definition:

Clusters of numerous islands varying in size from tiny islets to larger islands of many hectares and the marine area encompassing such clusters.

2. Explanation as to why the VMEF is important:

Archipelagos are diverse physically and biologically. They are characterized by high physiographic diversity leading to significant biodiversity. Thus, for example, in all of Pacific Rim Park on the west coast of Vancouver Island, the Broken Group Islands are deemed to lead in marine community diversity (Environment Canada 1991, p. 19). Typically the member islands and islets are separated by channels and passes of varying widths which implies a variety of hydrographic conditions including high velocity currents as tidestreams pass through constricted channels. The bathymetry is similarly diverse. Often the presence of smaller islands uninhabited and unused by humans or other potential predators, allows for the development of significant breeding colonies of ocean-dependent birds. Thus some of the most significant of such colonies in terms of overall bird numbers, species diversity and presence of rare species, are on BC archipelagos.

The complex clusters of islands seen in all of the main ecoregions of the BC marine environment are often seen as a defining regional feature.

3. Subcategories (if any):

None

4. Distribution and Illustrative Examples in British Columbia:

The impressive length of the British Columbia coastline, to a large degree, is due to the seemingly innumerable islands that dot the shoreline, many of which are clustered into archipelagos. Close examination of the entire coastline reveals that at the mouth of almost every embayment, large or small, are such clusters. This is true from the from Portland Canal in the north where the Dundas Island group is located to the small Race Rocks system and Gulf islands/San Juan Islands complex separating Georgia Strait from the Strait of Juan de Fuca. The following are some of the best known archipelagos: Broken Group (in Barkley Sound) Scott Islands Blackfish (Broughton) Archipelago Goletas Channel islands (Nigei, Hope etc.) South Moresby/Gwaii Haanas Hakai Recreational Area (which includes the Goose Group) The Race Rocks Ecological Reserve near Victoria is a good example of a cluster of islets (a mini-archipelago) whose biodiversity

within, above and below the intertidal zone became the justification for marine area protection.

5. Status of Information about this VMEF:

The incidence of physical archipelagos is readily determinable from maps and marine charts. Some BC archipelagos have been subject to quite detailed biological inventories (e.g. South Moresby/Gwaii Haanas, see Harper et al 1994) while others, notably the complexes on the central and North coasts from Cape Caution north are far less well known in terms of their specific physical and oceanographic conditions and the significance of their biological communities. An exception for which a detailed biological inventory has been prepared is the Goose Group (Emmett et al 1995).

6. Comments re National or Global Significance:

The sheer number of archipelagos along BC's coast is unparalleled in Canada (outside the Arctic) and in much of the rest of the world. The South Moresby/Gwaii Haanas archipelago has already been the focus of international attention and, in part as a result of this, obtained protected status through the Canada: BC South Moresby Agreement and the Gwaii Haanas Agreement between Canada and the Council of the Haida Nation.

7. Selected References:

As noted one of the best known BC archipelagos is Gwaii Haanas/South Moresby about which increasing numbers of specific ecological studies continue to add to the earlier more descriptive literature prepared by advocates of protection (e.g. Islands Protection Society 1984). Emmett et al's (1995) inventory of the Goose Group in the Hakai Pass Recreational Area provides a useful overview of the marine diversity, biological and physical of one important archipelago of the Central Coast while Harper et al (1993) delineate the great biological and physiographic diversity of the archipelago of Gwaii Haanas National Park Reserve.

VMEF C3 INTERTIDAL AREAS (FORESHORE) & ADJACENT BACKSHORE

1. Definition:

Area between high and low water marks that is alternately wet and dry according to the flow of the tide. The backshore is the adjacent area above the tide but which is directly and conspicuously influenced by marine environment to the extent that a characteristic biota and physical environment has evolved (e.g. dune systems, "spray zones" on cliffs, high salt marshes). Frequently, the popular collective term "seashore" is applied across both zones.

2. Explanation as to why the VMEF is important:

This is an extraordinarily diverse (see below) and critical area as it is the place where humans most frequently are able to access and affect the marine environment. In Gwaii Haanas National Park Reserve, for example, there are over 500 intertidal species not including microorganisms (Harper et al 1994). These nearshore areas also provide critical spawning and rearing habitat for many fish and feeding environments essential to shore birds and waterfowl. As already noted, there are also important and specialized environments immediately adjacent to the intertidal zone and which are strongly associated (physically and in people's minds) with the marine environment. Such systems as extensive sand dunes and long sand spits and cusps are shaped by marine forces and can also strongly affect adjacent intertidal environments. These are often highly unstable environments fragile to the impacts of human activity.

3. Subcategories (if any):

There are numerous classifications that are widely used for shores. The BC Corporate Information Services has undertaken shore zone classification systems which include intertidal as well as backshore and offshore areas. ARA et al (1992) found it useful to summarize a wider literature on shore classification into sixteen categories. King (1972) reviews 7 different ways of classifying the seashore ranging from systems based on how the area was formed geologically, to ecological to substrate. For preliminary planning purposes a simple approach as for example is used in Ricketts et al's (1985) classic *Between Pacific Tides*, is probably a good start for discussion purposes here: 7

Open Coast	Open Coast	Protected Outer Coast	Outer Bays & Estuaries	Rocky
Rocky Shores	Open Coast	Coast Rocky Shores	Outer Shores of Bays & Estuaries	
Sandy Beaches		Coast Sandy Beaches	Tidal Flats	

As MPA planning advances to detailed inventory, use should be made of more detailed and rigorous classification systems as prepared by Howes et al (1994).

4. Distribution and Illustrative Examples in British Columbia:

While some regions of British Columbia are obviously dominated by particular shore types, all of the above subcategories can be found along BC's 29,500 km coastline. BC is usually seen to be dominated by rocky shores although the extent of other forms is also considerable.

5. Status of Information about this VMEF:

Extensive work has been completed on coastal inventory and classification for some major portions of the BC shoreline. Romaine et al (1981, 1983) have prepared coastal folios that provide fairly small scale folios of coastal characteristics. Other helpful background material has been compiled in relation to environmental impact assessments, especially in relation to proposed offshore petroleum exploration. Concern over oil spills and public sector capability to respond to any such emergency lay behind some of the

initial work undertaken to gather systematic information for large stretches of the coast (e.g. Howes & Wainright 1983). This effort has continued with broader purposes in mind under the leadership of the BC Corporate Information Services. Another related initiative undertaken in the 1980s were the series of Coastal Resource Inventory Studies (CRIS) carried out in relation to the advent of fish farming. All of these provide a great deal of information on the characteristics of BC intertidal and nearshore areas.

6. Comments re National or Global Significance:

BC's extensive fjord cut and predominantly rocky coastline is unquestionably unique in extent and diversity of form in southern Canada. Some portions of the Nova Scotian and Newfoundland/Labrador coastlines are broadly similar in general form. In the Canadian Arctic, extensive systems of fjords are seen, notably on Baffin and Ellesmere Islands. Overall, BC's coastal zone probably most closely resembles other temperate fjord-dominated regions such as Norway, Chile and New Zealand.

7. Selected References:

In addition to the above mentioned technical inventory work, the classic text by Ricketts et al (1985) is an excellent and detailed overview of Pacific intertidal features. Kozloff (1983) is the recognized authoritative text on intertidal biology for the west coast while Snively (1978) and Harbo (1988) are in popular guide format.

VMEF C4 INLAND SEAS

1. Definition:

Large marine areas, generally comprising a range of medium scale environments such as estuaries, fjords and broad pelagic areas, yet with very constricted passages to the open sea. Note that this is not a precise term but rather a category used descriptively, a mid level between the open ocean and more specific environments.

2. Explanation as to why the VMEF is important:

While it is important to protect special localized environments and features, rarely are there entire ecosystems that capture the range of dynamics that typify coastal British Columbia. Increasingly there is recognition that protecting biodiversity and related values requires relatively large regional approaches and that there is value in establishing management regimes at the wider level. British Columbia's clear example of an Inland Sea is the Strait of Georgia. For many years it has been proposed for special study and protection because of its enormous significance to the major population centres of the province and its related vulnerability to human influence (Howard Paish & Associates, 1970; Interdepartmental Task Force on National Marine Parks, Technical Working Group 1971 a,b,c).

3. Subcategories (if any):

Only one coastal embayment of British Columbia is usually thought of as an Inland Sea – the Strait of Georgia. Probably the only other system arguably in the category although significantly smaller and relatively less enclosed is Queen Charlotte Strait.

4. Distribution and Illustrative Examples in British Columbia:

The most frequently mentioned and studied "inland sea" in western Canada has been the Strait of Georgia.

5. Status of Information about this VMEF:

The Strait of Georgia is one of the most extensively studied marine ecosystems in the world. This reflects both its importance and the location of numerous research institutions at its "doorstep." A bibliography of all marine scientific research completed on the Strait of Georgia would run to many pages (see below).

6. Comments re National or Global Significance:

The Strait of Georgia is probably one of the most studied of large marine regions in the world. Within Canada, only the Gulf of St. Lawrence and, possibly, Lancaster Sound are comparably well researched. The adjacent Puget Sound area (which is frequently, along with the Strait of Juan de Fuca) considered to be "one system" with the Strait of Georgia, provides an intriguing and close example for comparison.

7. Selected References:

For an early assessment of marine reserve potential, see Howard Paish and Associates (1970). For a bibliography (albeit now somewhat dated) of the ecology of the Strait of Georgia, see Harrison (1984). Waldichuk (1957) wrote an early but still useful scientific description of the physical oceanography of the Strait of Georgia. Marine and shore bird ecology for the Strait of Georgia has been described in a collection of papers edited by Vermeer & Butler (1989) Included in this volume are several chapters dealing with other aspects of the Strait including its the physical (LeBlond 1989). Other worthwhile sources with multiple disciplinary perspectives on the Strait include British Columbia / Washington Marine Science Panel(1994) and Wilson et al (1994). For a diverse array of papers centred on environmental concerns about the Strait of Georgia, see Save Georgia Strait Alliance (1991).

VMEF C5 MAJOR EMBAYMENTS

1. Definition:

Large marine areas complexes which generally subdivide into smaller but still significant passages, fjords and estuaries. Like "inland seas" this is not a precisely definable category. It is broken out separately in recognition of there being large named systems in

BC that are not single fjords or inlets and are studied and thought of as "entities." Hopefully, the examples given below will clarify what is meant. Note that most of these systems are called "sounds" as, confusingly, are a few other marine areas which are very different including Queen Charlotte Sound and Baynes Sound.

2. Explanation as to why the VMEF is important:

Size and complexity of the major BC embayments is such that they include very diverse habitats and are home to many valued species and features. Above all, they are known publicly and scientifically, defining in a sense the way the marine environment is perceived.

3. Subcategories (if any):

none

4. Distribution and Illustrative Examples in British Columbia:

Because of their size and manageable number, the major embayments of BC can be listed. To repeat we are not listing single fjords but rather the more complex and named embayment systems, comprising fjords, passages, archipelagos etc. These are listed in approximately north to south order:

Chatham Sound	Masset Inlet	Caamano Sound
Milbanke Sound	Queen Charlotte Strait	Quatsino Sound
Kyuquot Sound	Nootka Sound	Desolation Sound
Clayoquot Sound	Barkley Sound	

It should be emphasized that there is no clear scientifically defensible cut-off between the sounds just listed and numerous, slightly smaller and perhaps less well known adjacent systems which share similar features.

5. Status of Information about this VMEF:

Several of these major embayments have been subject to quite extensive study. Notable in this regard is Barkely Sound, long a favoured location for professional marine analyses (e.g. Austin et al 1982, . The proximity of the Bamfield Marine Station has made this highly intriguing large embayment a natural "laboratory" for generations of field work. Recent intense interest in conservation of the whole Clayoquot Sound area while initially focused on land-based activities, has also led to

6. Comments re National or Global Significance:

Several of the large embayments of the BC coast are well known at least by name on a national basis. Arguably, Clayoquot Sound's familiarity is a function more of land-based user conflicts than of the significance of its rich marine subsystems. As noted, Barkley

Sound is probably the best known from a viewpoint of marine life. Its richness in benthic invertebrates – 1500 species according to Austin et al 1982), diverse seaweeds and the presence of six-gilled and basking sharks give it a presumptive status of at least national significance. This is subject, of course, to the caveat of how little is known of other comparably sized marine embayments which under closer inspection may well prove to be of comparable significance.

7. Selected References:

See references for Barkley Sound above. A search of the data base for publications and manuscripts completed by scientists at Fisheries and Oceans Canada west coast research establishment reveals an extensive literature of work carried out in a number of the above mentioned major embayments.

VMEF C6 FJORDS

1. Definition:

Fjords are narrow, deep coastal inlets with very steep shorelines, formed by glacial erosion and subsequent inundation. They are characterized by having relatively little exposure and wind-driven circulation, with the tides and tidal currents predominating in moving waters through them. In British Columbia many fjords are part of larger complexes of fjords, channels and coves frequently although not always called "sounds" as for example with Clayoquot Sound and Barkley Sound (see VMEF C5). Note that the term "sound" is also applied to less obviously circumscribed areas such as Queen Charlotte Sound northeast off Vancouver Island. In this description, focus is on the fjords themselves.

2. Explanation as to why the VMEF is important:

Fjords are often seen (as with archipelagos) as definitive of the BC coastline. Indeed, the entire BC coast has been placed within the category "West Coast Fjords Province," Dietrich's (1963) biogeographic classification scheme. Few areas of the world (Norway, Chile and New Zealand) have such an abundance of fjords. Many of BC's fjords are large, exceeding 100 km in length. These generally comprise many habitats, including several which are of special importance to a variety of well-valued species. Note that BC estuaries, which are treated separately here, are largely coterminous with, indeed a part of, fjords.

Within fjords there are a number of distinctive habitats. Many fjords, especially in southern BC have extensive mudflats at their upper reaches. Depths can reach more than 500 metres, far deeper than adjacent outside waters. At the seaward openings of fjords are sills, flattened shallower platforms over which tidal exchange occurs. Where these sills are relatively narrow, shallow or both, very high current speeds are reached and unusual biological communities may evolve. In the vicinity of sills, there is opportunity for filter feeding animals to do extraordinarily well — Lambert (1994) reports unusually large

sponges and sea fans from such habitat. He also notes that species reminiscent of deep sea forms are also to be encountered in the depths of fjords. Because of the depth, low oxygen levels and in some cases slow exchange rates with open seas, fjords are quite vulnerable to pollution impacts. Fjords also generally have steep vertical walls the fauna of which may be rich and perhaps frequently endemic (Tunncliffe 1991). Finally, because of the great depth and limited exchange of bottom water due to sills, oxygen free (anoxic) environments can occur with a very limited but interesting fauna.

3. Subcategories (if any):

Fjords are often subclassified in terms of the shallowness and narrowness of their sills, i.e. very shallow, shallow, moderate, low and no sill fjords. Distinctions in terms of water temperature are also very relevant to species composition.

4. Distribution and Illustrative Examples in British Columbia:

As noted, fjords extend along the entire coast of British Columbia. Some of the best known are: Howe Sound because of its proximity to Vancouver; Bute and Toba Inlets, Knights' Inlet, Douglas Channel and Saanich Inlet.

5. Status of Information about this VMEF:

These large features are readily listed: but their variety and the difficulty of conducting research in such deep and frequently low transparency waters means that we are largely ignorant of the fine details of the geology, hydrodynamics and biology of all but a very few BC fjords. Nonetheless several surveys have been undertaken of components of fjord ecology, especially in the southern Strait of Georgia region (e.g. Burd and Brinkhurst 1992, Levings et al. 1983).

6. Comments re National or Global Significance:

As noted, coastlines so dominated by fjords are quite rare globally. Elsewhere in Canada, there are several comparably extensive fjord-dominated coasts - Labrador, Newfoundland and large Arctic islands (e.g. Baffin) come to mind. Prevailing climactic conditions make fjords there quite different from BC's ecologically.

7. Selected References:

Regionally, see Burd and Brinkhurst (1992) and Levings et al. (1983). More generally see Syvitski et al (1987).

VMEF C7 MARINE PASSAGES: CHANNELS, NARROWs & PASSES

1. Definition:

Named in a variety of often inconstant ways, these are marine water bodies, open at both ends and where land significantly constricts the passage of marine waters leading, in many cases, to relatively fast moving currents. They are almost invariably well mixed and unstratified. Note that a few of the major systems referred to as "straits" or are large distinct water bodies that are not so readily characterized as long, narrow and constricted passages. The large straits – Georgia, Hecate, Juan de Fuca, and Queen Charlotte are so large that they cannot be usefully placed in the same category as the almost innumerable much smaller passages of various nomenclature that give the coastline of BC its remarkably complex appearance.

2. Explanation as to why the VMEF is important:

These are the features which, along with the islands they so often surround make BC's coastline of such enormous linear extent. As noted the characteristic physical result of a narrowing of passages through which marine waters move, is in the high degree of tidal current. This in turn has highly significant biological consequences. High densities and diversity of attached organisms benefit from the large volumes of water both in terms of ample supply of food and of well-aerated waters. Not surprisingly several of the first candidate areas that have been seriously considered for MPA designation are passages — Gabriola near Nanaimo and parts of Goletas Channel at the northeast corner of Vancouver island have been of great interest to groups working to establish MPAs.

3. Subcategories (if any):

As indicated above, the names used for constricted marine passages are quite varied and have no consistent geological or biogeographical meaning. The most common terms are channels and passes but there is no consistently meaningful distinction between these or other terms such as sounds (e.g. Darwin Sound between Lyell and Moresby Island on Haida Gwaii), "reaches (e.g. McKay-Fraser-Graham Reaches on the Inside Passage) etc.

4. Distribution and Illustrative Examples in British Columbia:

Different sizes and endlessly varied configurations of marine passages are located along the entire mainland coast and the west coast of Vancouver Island. Well known and important passages of note include: Johnstone Strait- Discovery Pass, site of some of the largest commercial fishing effort; Baynes Sound, a significant shellfish and herring spawn area; Grenville Channel, the almost straight-line protected passage used by vessels from gillnetters to cruise ships in journeys northward; and Masset Sound, the fast-flowing connection between Dixon Entrance and the ecologically unique Masset Inlet on Graham Island in the Queen Charlottes. Several channels with very high tidal current flow are Burnaby Narrows in the Gwaii Haanas National Park Reserve; Skookumchuck Narrows on the Sunshine Coast and Nakwakto Rapids on the Central Coast. These, it must be emphasized, are but a small fraction of the many biologically rich and culturally important passages along the BC coast.

5. Status of Information about this VMEF:

Ecological and oceanographic information about a few particular passages has been gathered especially for Johnstone Strait because of its high significance to fisheries and orcas. A few smaller passages such as Gabriola and Active Pass attract attention from those who are interested in sessile (attached or non-mobile) marine invertebrates which can be especially rich in areas of high flows and water exchange. As Lambert (1994) and Tunnicliffe (1991), report marine biodiversity and unique organisms are but two of the values that attract both research and recreational diving to passages. Generally, however, the high numbers and great collective length of BC's many marine passages mean that knowledge of the biology and physical characteristics is very limited. What is known is that almost any concerted effort to study new sites of this kind yields community assemblages and even species hitherto unseen in the region (Lambert 1994, W. C. Austin pers. comm., April, 1997).

6. Comments re National or Global Significance:

The "Inside Passage" of British Columbia which subsumes many named straits, channels, passes etc. from the Strait of Georgia to Prince Rupert is undoubtedly world renowned although this is probably more from its recreational than for its "conservation" values. What is probably most noteworthy is the very large number of all such marine passages which collectively contribute so much to the marine biodiversity of BC, Canada and the world.

7. Selected References:

There does not appear to be any literature that deals with general ecology of marine passages although some particular locations are exceptions (e.g. salmon assessments on Johnstone Strait). Emmett et al's (1995) inventory of the Goose Group is indicative of the environmental diversity that occurs within an area rich in small passes and surge channels. Good general descriptions of many of BC's marine passages, including casual observations on larger wildlife, fish, weather and currents, etc., can be found in BC sailing compendia such as Douglass & Hemingway- Douglass (1996, 1997) and Wolferstan (1993).

VMEF C8 ESTUARIES

1. Definition:

Estuaries are coastal embayments where freshwater flowing from the land mixes with marine saltwater.

2. Explanation as to why the VMEF is important:

Appreciation for the high production of organic matter in estuaries has grown in the past three decades. Inputs of rich nutrient sources (natural and, increasingly, from human settlements) support very productive growth of large marine plants (saltmarsh grasses,

seagrasses and seaweeds) and of microscopic plants (phytoplankton and surface-living photosynthetic microorganisms). In turn this production supports estuarine food chains and, through export of organic matter on the tides, marine food chains. Estuaries often contain a number of habitats that have special significance to important commercial species as well as to waterfowl and shorebirds. These habitats include saltmarshes, sea grass beds and tidal flats. In some estuarine reaches of large river systems like the Fraser, "sloughs" are a significant habitat for many species including juvenile salmon.

3. Subcategories (if any):

Estuarine experts have devised several kinds of estuary classification systems based on the kind and extent of mixing dynamics between the fresh and salt water components (see Dyer 1973).

4. Distribution and Illustrative Examples in British Columbia:

Estuaries make up only a small fraction of the coastline of BC but cannot be considered uncommon. Most of the fjords that indent much of the coastline from Portland Inlet to the Strait of Georgia have estuaries at the head of the inlet. Two very significant sub-boreal estuaries, those of the Taku and Stikine are in fact well north of the BC/Alaska border.

The Fraser estuary is the largest⁸ and unquestionably most studied of BC's estuaries and is already subject to various protective regimes, albeit not for its entirety. A number of other BC estuaries have been the subject of management planning including basic inventory work. An ambitious programme, to compile all existing information for 18 estuaries began in 1974 as the Special Estuaries Series. These were "chosen" on the basis of living resource potential and threat from development." (Leaney and Carter 1979, p. 1). The original 18 were: the Fraser, Squamish, Skeena, Kitimat, Indian Arm, Homathko, Wannock, Bella Coola, Cowichan, Chemainus, Nanaimo, Campbell, Courtenay, Somass, Quatse, Gold, and Nimpkish. Choice of these study areas appears to have been motivated more by actual or imminent environmental degradation rather than because the systems necessarily have unique or highly representative features.

The Pacific Estuary Conservation Program is a more recent initiative focused on co-operation between non-government environmental organizations, government agencies and the owners of lands adjacent to estuaries. While attempting to get away from piece meal protection, this program has been primarily opportunistic, rather than based on a systematic setting of priorities among estuaries. Between 1987 and 1995, land acquisition occurred on ten estuarine areas (Nanaimo, Marble, Baynes Sound, Millard Creek, Salmon, Asseek, Bella Coola, Kumdis, Fraser, Englishman and Cowichan). Other BC estuarine systems that are provincially well known include the Klinaklini, a holding area for spawning eulachon, and the Yakoun and Delkatla estuaries which are part of the larger Masset Inlet and famous as shorebird and waterfowl congregation areas.

5. Status of Information about this VM EF:

As for most other VMEFs the detailed knowledge of biology and other properties of these estuaries is very uneven. The Fraser River estuary is the largest and no doubt most productive of BC estuaries in terms of marine food chains. As noted the Special Estuary Series compiled detailed information for a number of critical estuaries (but was terminated before all 18 could be finished). Several estuaries have also been subject to a good deal of continuing study, some through estuary planning processes that were launched as early as the mid 1970s. Examples are Cowichan, Squamish, Comox and Campbell River. There is much less information available on most of the more remote central and northern coast estuaries. A different and focused series of reports on waterfowl and other bird use of selected estuaries has been undertaken by the Canadian Wildlife Service.

6. Comments re National or Global Significance:

Several BC estuaries are home (or stopover) to nationally and globally significant populations of migratory waterfowl. The Comox River estuary's uniquely large population of wintering Trumpeter swans is a prime example. The Fraser Estuary is, as stated, BC's largest and most diverse estuarine complex. Several subareas of the Fraser estuary are recognized as uncommonly important for fish and bird species, including the sloughs of the lower reaches and the Reifel Bird Sanctuary. The Skeena estuarine complex is also of high significance although far less general ecological knowledge of the area is available.

7. Selected References:

For general science of estuaries, see Dyer (1973), Mann (1982) and Kennish (1986); re BC "special estuary series" see Leaney and Carter (1979); re the Pacific Estuary Conservation Program, see Kelsey (1995). Kistritz (1992) provides a very readable introduction to the ecology and environmental management of the Fraser estuary.

VMEF C CONTINENTAL MARGIN (SHELF, SLOPE, RISE)

1. Definition:

The continental margin is a term used inclusively for the continental shelf, continental slope and continental rise, the vast area separating the coast from the deep ocean basin. In addition to these wide subareas of the margin, there are numerous morphologic features (see below) which characterize this major area. For purposes here, we distinguish this area from the nearshore features and environments which, nonetheless are contiguous with the margin, i.e. inland seas and major fjordal embayments.

2. Explanation as to why the VMEF is important:

Areal extent and the diversity of sub-environments on the continental margin qualifies this as one of the major zones. Generally speaking the continental shelf is much narrower than off the east coast of Canada.

3. Subcategories (if any):

The continental margin, as noted, is an inclusive term for several zones – defined primarily by slope and elevation – and numerous important large features each one of which may be as extensive as some of the nearshore features described elsewhere in this report. For the purposes of MPA planning, proposed designations advanced to insure representativeness should be chosen so as to include a full array of the subareas and primary features of the overall continental margin. The following would be a minimal set for such a cross-section:

CONTINENTAL MARGIN	Continental Shelf	Banks, Troughs
	Continental Slope & Rise	Canyons, Ridges, Troughs,

4. Distribution and Illustrative Examples in British Columbia:

The continental margin, including the shelf and slope, varies considerably in width along the coast of British Columbia. Off the west coast of the Queen Charlottes there is almost no shelf but instead an abrupt slope leading to depths of over 2500 metres a mere 30 km offshore. Between the Queen Charlottes and Alaska to the north, the mainland to the east and Vancouver Island to the south are more extensive shelf areas respectively under Dixon Entrance, Hecate Strait and Queen Charlotte Sound. Off the west coast of Vancouver Island the shelf width varies from 20 km in the north to 80 km in the south. Three troughs of three hundred metres or more in depth intrude into Queen Charlotte Sound while much of the length of Dixon Entrance is underlain by a trough. There is very little of a true continental rise (i.e. a wide and, compared to the slope, gradual rise from the sea floor) off the coast of BC although fans of sediment usually associated with the continental rise have been identified at the seaward end of canyons west of Juan de Fuca Strait and Queen Charlotte Sound.

5. Status of Information about this VMEF

Several key sources of information exist about characteristics of the continental margin. First, in the pursuit of data pertinent to the general study of tectonic activity, the BC offshore has been an especially important location. Riddihough (1988) summarizes this research. Second, high interest in offshore hydrocarbon development also led several major corporations to conduct detailed mapping of seismic and sedimentary patterns relevant to exploration. Some of this information, however, remains proprietary.

6. Comments re National or Global Significance:

As noted, research on the BC offshore has played a major role in the development of plate tectonic theory. Thus from a scientific point of view the area is of special significance.

7. Selected References:

Riddihough (1988) is a useful overview for both the continental margin and its features and the deeper ocean floor of the Northeast Pacific. There is also some limited but clearly written discussion in Thomson's (1981) monograph which, despite its title, is much more than a "physical oceanography" of the region.

VMEF C10 OCEAN BASIN

1. Definition:

The deep ocean basin refers to the areas beyond the continental margin.

2. Explanation as to why the VMEF is important:

Because of the relatively narrow continental shelf off the coast of BC substantial areas still within Canada's 200 mile jurisdiction fall within this category. Decades ago protecting such vast and deep reaches would have seemed unnecessary. Now capabilities and incentives to disturb this still largely unknown frontier make its representation within a complete MPA system a necessity. Of special concern may be the unique features found within the larger offshore basins (see below).

Subcategories (if any):

Significant deep sea topographic features off Canada's west coast include:

- Abyssal plains (note that there are no true abyssal plains off BC within the 200 mile jurisdictional limit)
- Ridges (where sea spreading occurs)
- Seamounts
- Offshore banks (e.g. Perouse Bank)

Quite recently a new and very special environment associated with tectonically created ridges was discovered. These are the hydrothermal vents where super-heated waters rich in sulphates seep into the ocean water. Discussion of these features and also of seamounts is taken up later in this section of the report under Category B Conservation VMEFs.

4. Distribution and Illustrative Examples in British Columbia:

Thomson (1981) states that the "outer edge of the continental slope is delineated remarkably well by the 1800- m (1000 fa) contour whose distance from the land varies from about 90 km off the southeast coast of Vancouver Island to less than 45 km off the Northern tip of the Island. (Thomson 1981, p. 13). Off the Queen Charlotte islands/Haida Gwaii, the ocean basin lies even closer. In terms of recognized management authority (i.e. the 200 mile or 322 km zone), this leaves a huge expanse almost 1000 km long and up to 300 km wide, by far the largest component by area of the overall marine environment.

5. Status of Information about this VMEF

Generally speaking the difficulties associated with deep sea research leave ocean basins far less surveyed or understood than nearshore marine environments. One of the lessons derived from the recent discovery of hydrothermal vents was of how very little humans know of this most inaccessible environment. Nonetheless as noted, there has been considerable geophysical research in the Northeast Pacific focusing on data informative to the study of plate tectonics. Whether this approaches what might be needed to select "representative areas" for marine protection is open to discussion when such planning is initiated.

6. Comments re National or Global Significance:

As noted, the offshore area of BC has been extraordinarily important in the development of plate tectonics because of its high activity in terms of sea floor spreading. Riddihough (1988) describes this region as "an almost unique laboratory for the application of the principle that the present is the key to the past." The oceanic ridges of the Northeast Pacific are unusually close to the coastline compared with other such ridges elsewhere in the world's oceans. This makes them especially amenable to research, future enjoyment, and also influences from land-based activity. Finally, this vast area is also of major biological significance given its huge areal extent and the diversity of large special physical features as noted above. The north Pacific basin is especially well known as the area within which the famous and valuable Pacific salmon species spend the longest part of their life cycle.

7. Selected References:

Riddihough (1988) is the best current survey of the general features of the Northeast Pacific Ocean basin and associated features.

Conservation VMEFs (B): Specific Habitats Generally Deemed to be of Especially High Ecological Significance

The types of habitat or site in this subcategory are, of course, found within the fully inclusive broader VMEFs from the preceding list. But the VMEFs listed immediately below are what could be called special subareas or subclasses of the broad zones of the coast. While interest in protecting such areas or including them within MPAs will in part be based on aiming to insure representation of key ecosystem components, these habitats are deemed to be special because they are likely to be significant to many different taxa of organisms — indeed, one major reason for these being significant is their contribution to biodiversity and, in some cases, their unique biological community structure (e.g. hydrothermal vents). They also tend not only to be more diverse but also to be higher in productivity (producing organic matter at different trophic levels) than their surroundings.

- 11 Salt marshes
 - 12 Tidal flats
 - 13 Sea Grass beds
 - 14 Canopy kelp beds
 - 15 Reefs and their environs
 - 16 Seamounts and their environs
 - 17 Hydrothermal vents and their environs
 - 18 *Localized upwelling environments (summary only)
 - 19 *Other Special Marine Environments (summary only)
-

VMEF C11 SALT MARSHES

1. Definition:

Wetlands in well sheltered intertidal areas, including the highest portions colonized by salt tolerant grasses.

2. Explanation as to why the VMEF is important:

Over the past two decades there has been increasing recognition of the ecological significance of salt marshes in supporting marine food chains. Marshes can have very high rates of primary production much of which enters what is often called the "detritus or decomposer food chain." Bacterial decomposition and mechanical breakdown of dead marsh grasses provides foods for many specialised invertebrates which are, in turn, consumed by larger invertebrates, fish and shorebirds. Microscopic algae living on the surface of mud and sand-flats also can be very productive. These ecosystems play other roles including significant contributions to major mineral cycling and the trapping of sediments and pollutants originating on adjacent lands or flowing in from rivers. While the fauna and flora that reside in marshes are not especially diverse because of the special adaptations required for intertidal life, they are quite specialised and in the cases of some small invertebrates are endemic to these systems. Historically, because of the ease with which these nearshore marine areas can be filled, marshes have been filled, drained, ditched and impounded to create agricultural or development lands. False Creek, right in the heart of Vancouver, is a prime example of a small, undoubtedly once productive marsh area which has been severely altered and polluted.

3. Subcategories (if any):

The most visibly distinguishing characteristic are the different species of salt-tolerant grasses and sedges which make up the community. This, in turn, depends on physico-chemical conditions and in particular salinity. Hutchinson et al (1989) classify salt marshes into three general categories related to the salinity: saline marshes, brackish marshes and fjord head marshes.

4. Distribution and Illustrative Examples in British Columbia:

Salt marshes which form in well protected areas of inlets and estuaries are of quite limited distribution in British Columbia compared to the extent of rocky intertidal shores that typify the region. Their development tends to occur in one of three specialised environments: high foreshores of semi-protected coastline such as along the landward edges of deltas; in confined upper reaches of fjords; and behind barrier beaches and spits. The most extensive BC salt marshes are part of the Fraser River complex but other significant marshes which have been subject to both study and protection include the Cowichan estuary marshes, the Campbell River estuary marshes and the Courtenay area marshes. Another marsh that was subject to a lengthy and successful effort to restore adequate marine water flows was the Delkatla Slough on the Northern Queen Charlotte islands/Haida Gwaii. In most cases the marshes that we know best are those that have been substantially disturbed. By comparison the small but numerous marshlands at the heads of fjords along the central mainland coast are poorly documented.

5. Status of Information about this VMEF:

The best known and studied marsh ecosystems, unfortunately, are those that have been substantially disturbed. By comparison the small but numerous marshlands at the heads of fjords along the central and northern mainland coast and much of the west coast of Vancouver Island are poorly documented.

6. Comments re National or Global Significance:

It would be probably difficult to make the case that BC's salt marshes and tidal flats have national significance in comparison to extensive Atlantic coast equivalents. An exception would perhaps be the marsh and the extensive tidal flat systems in and around the mouth of the Fraser, including Boundary Bay. Of course, the rather obvious point is readily made that British Columbia's are Canada's only Pacific coast examples and should therefore attain some representation in national marine protected area planning.

7. Selected References:

Regarding west coast salt marshes, see Hutchison et al (1989) and Hutchison (1986). Long & Mason (1983) have written a thorough text on salt marshes generally, while John and Mildred Teal 's (1969) *Life and Death of the Salt Marsh* remains among the most enjoyable introductions to the ecology and alteration of any marine ecosystems. Levings & Thom in Wilson et al (1994) provide a discussion of the historic changes in marsh areas on the Fraser estuary. The annotated bibliography by Morgan (1980) is now somewhat dated but contains still useful general information.

1. Definition:

For purposes here, tidal flats are the often extensive intertidal areas composed primarily of sediments and which are not substantially covered with macro-vegetation such as sea grasses. Note that many publications treat sea grass beds and salt marshes as part of the same continuous complex inclusive of mud and sand-flats.

2. Explanation as to why the VMEF is important:

Muddy intertidal flats as defined have few if any large prominent fauna and flora as permanent residents. Thus they can easily be seen as not especially interesting to casual nature watching, in comparison for example with the rich algal communities of rocky shores and tide pools. But closer observation reveals an extraordinarily rich and productive ecosystem comprising microscopic plants and animals living on the surface of flats (the epibenthos) and an even wider array of organisms living within the sediments (the "infauna"). These communities attract larger and more conspicuous organisms such as wading birds and, when tides cover the flats, macro-invertebrates and finfish which feed on smaller organisms. Sedimentary ecosystems not only nourish marine food chains but also play vital roles in major nutrient and mineral cycling. Especially in finer grained flats, an oxygen-free "ecosystem" exists below the sediment surface where sulphate reduction occurs leading to the characteristic hydrogen sulphide (rotten-egg) aroma. One of the main reasons for concern sufficient to provide protection for these tidal flats systems is the very fact that the life upon and within them is so unseen and therefore under-appreciated. For example, single celled protozoans may number up to 20 million per square metre and larger but still microscopic nematode worms, up to 5 million (Lambert 1994). Rarity is also an important consideration: compared to other marine substrates in BC, tidal flats are very scarce. In studies of the west coast of Vancouver Island and the Gwaii Haanas area of the Queen Charlottes (Haida Gwaii), it was found that only 3% and 1% of all marine substrate occurred as tidal flats (Harper et al 1994, 1996). Thus this habitat is both scarce and enormously valuable to a diversity of species.

3. Subcategories (if any):

The main distinctions to be drawn among tidal flats relate to their sediment size distribution, i.e. the characteristic range of sediment particles of different sizes that make up the flats. At the extremes there are sandy flats (mean particle sizes) parts of which may reach gravel sizes and, true silts. In turn, particle size distributions reflect largely the degree of exposure to wave and current action.

4. Distribution and Illustrative Examples in British Columbia:

Small stretches of intertidal mud- or sand flats are to be found in the more sheltered reaches of most BC coastal inlets. By far the best known and largest flats are within the Fraser estuarine complex where there are an estimated 14,000 hectares comprising the Sturgeon and Roberts Banks. Boundary Bay, at or near the former mouth of the Fraser, is also richly endowed with extensive mud and sand-flats.

5. Status of Information about this VMEF:

Intertidal flats are readily observable from aerial photography and satellite imaging. Ecological analysis has been conducted on some of the large flats in and around the

Fraser delta but this is quite limited in comparison to studies of much larger organisms which, yet, may rely heavily on the biota of the flats. Outside the lower mainland there is virtually no information on the ecology of tidal flats.

6. Comments re National or Global Significance:

The Fraser and Boundary Bay tidal flats are among the most extensive examples of such systems in Canada. Their importance to juvenile fish and a rich array of wading birds and migratory waterfowl also qualifies these areas to be deemed of national and international significance.

7. Selected References:

Consideration of the role of intertidal flats appears within Mann's (1982) survey of coastal ecosystems. There is some data on the Fraser estuarine and several other intertidal mud and sand flats in Levings et al (1983) and, briefly, in Lambert (1994).

VMEF C13 SEA GRASS BEDS

1. Definition:

Low intertidal and high subtidal habitats dominated by species of the marine grasses. The dominant sea grasses in British Columbia are two species from the genus *Zostera*, one native (*Z. marina*) and one that was accidentally introduced (*Z. japonica*). Another genus of sea grasses, *Phyllospadix* spp. grows in exposed rocky habitat but does not form characteristic "meadows."

2. Explanation as to why the VMEF is important:

Sea grasses generally have rapid rates of organic production, rivalling and even exceeding the productivity of first class agricultural lands (Mann 1982). While relatively few species can consume live sea grasses, as the plants die and decompose they form the basis for a food chain of marine organisms and bird species. Because eelgrass substantially alters local current regimes, their beds promote sedimentation and the building of the foreshore. Within habitats so created, live a variety of permanent residents with special characteristics as well as numerous juvenile finfish. Eelgrass is directly consumed by a limited number of larger organisms, a notable case being Brant geese (*Branta bernicla nigra*). The ability of eelgrass beds to remove suspended sediments may in some cases be a significant if under appreciated "resource" for navigation, reducing the need for dredging and channel stabilization works. Unfortunately, the location of sea grass beds puts them in jeopardy from a variety of marine and coastal engineering projects including harbours, breakwaters, etc. Concern over the disruption of eelgrass habitat has been a major topic in several environmental impact assessments in BC as has the developing "science" of recreating new eelgrass habitat in compensation for areas lost due to development.

3. Subcategories (if any):

A distinction could be made between different species of sea grasses but the predominant ones in BC are the two previously mentioned *Zostera* species. A case should be made for

protection of native *Zostera marina* in preference to introduced *Z. japonica*, consistent with the general aims and philosophy of MPA programming.

4. Distribution and Illustrative Examples in British Columbia:

Eel grass is widely distributed in the high subtidal zone of inlets all along the coast of BC. However, the ecological significance of eelgrass beds may vary considerably. One of the most well-known and extensive eel grass areas occurs in Boundary Bay south of Vancouver. Surveys of the extent of utilization for food and protection by rare or endangered species such as the Brant geese should help in identifying beds that may be especially worthy of protection. In the course of environmental impact studies related to a small craft harbour proposal in Skidegate Inlet on the Queen Charlottes it was discovered that Brant had a strong preference for one particular area where special conditions permitted eelgrass to grow at higher levels on the foreshore than is usually the case. This high elevation allowed waterfowl, including the sole known remaining population of over-wintering Brant in BC, to feed for longer periods of time than would otherwise have been the case. In turn, this made the area of special importance to these species (see ESL Environmental Sciences Ltd. et al 1991)

5. Status of Information about this VMEF:

As with many other specific VMEFs, information has been best developed in (a) the Strait of Georgia region and (b) where proposed development projects have necessitated environmental impact studies. Knowledge of other areas especially on the central and north coasts is almost non-existent. It should be noted, however, that the ecological dynamics and significance of eelgrass has been well studied for particular locations and that there is good reason to believe that eelgrass beds in other locations would be found to have similar kinds of value.

6. Comments re National or Global Significance:

Sea grass beds, including eelgrass are a feature of world-wide distribution. Although some of the species within Pacific coast eelgrass beds from the Baja California to Alaska contain some endemic invertebrates, there is probably no case to be made for these features being generally of national or international significance in and of themselves. As already noted, the dependence of the last over-wintering populations of Brant geese in Canada on certain Skidegate Inlet eelgrass beds would qualify the latter as being of at least national importance.

7. Selected References:

Phillips & McRoy (1980) is a detailed scientific compendium of the worldwide ecology and biology of sea grasses. Mann (1982) also covers some of the most important aspects of eelgrass contributions to marine food chains.

VMEF C14 CANOPY KELP BEDS

1. Definition:

Areas containing extensive "forests" or "canopies" of large brown seaweeds and associated biological species that live all or part of their lives within the area. The two

principal canopy-forming algae in BC are the bull kelp, *Nereocystis luetkeana* and the perennial kelp *Macrocystis integrifolia*.

2. Explanation as to why the VMEF is important:

Kelp beds are widely recognized as among the most biologically productive areas of any on the planet, rivalling, by some estimates, tropical rainforests and intensive agriculture (Mann 1982). Associated with these "forests" are a high diversity and abundance of marine animals some of which are found only in kelp beds. The extent and nature of the dependency of animals living in kelp canopy forests is, however, a matter of continuing investigation (Leaman 1990). Perhaps the most well known "associate" of the kelp forests historically has been the sea otter (*Enhydra lutris*) whose predation on sea urchins critically affects the overall abundance and relative success of kelps on which the urchins graze (Stewart et al. 1982). Considerable interest exists in BC in commercial harvest of kelps for a wide variety of end uses. Divergent views exist on whether this would put key marine food chains and biodiversity at unacceptable risk (e.g. Hawkes 1991, 1994) or a proven practice unlikely to significantly affect kelp regeneration or the long term success of fish species found within kelp beds provided sound management principles are applied (e.g. Coon 1982, Lewis 1985).

3. Subcategories (if any):

There are several species of brown algae which can be the dominants in formation of kelp canopies. A basic distinction exists between kelps which are "annuals" (*Nereocystis*, the bull kelp) and those which are perennials, including *Macrocystis integrifolia*. The former are by definition more transitory in location and opportunistic in their growth. Nonetheless, *Nereocystis* canopies may be found in generally the same location for periods of many years. The longer-lived *Macrocystis* also shows dramatic seasonal variation in standing crops but because plants can live for a few or even many years, locational variability is less pronounced. This has obvious implications for the ease with which the two principal canopy forming kelps in BC could be "protected" within an MPA. There are also some canopy kelp beds which comprise a mixture of both species.

4. Distribution and Illustrative Examples in British Columbia:

Both of the key canopy forming kelp species are widely distributed through much of the BC coast. *Macrocystis* canopies are not, however, found within the Strait of Georgia. Based on fairly extensive survey work carried out since the late 1970s, several areas have been of particular interest either because of very high standing crop of kelp or because of the significance in rebuilding populations of sea otters. A great deal of commercial interest has focused on kelps in the vicinity of Malcolm Island in Queen Charlotte Strait. Other areas where biomass is large and quantitative assessments have been completed include the north end of Vancouver island, Juan de Fuca Strait, Nootka Sound and Hesquiaht peninsula on the west coast of Vancouver Island; the Estevan Group and the Hakai pass to Bardswell groups on the central coast; the Dundas Group and the Goschen Island area on the north coast; and most of the north end of Graham Island (Haida Gwaii/the Queen Charlottes (see Coon 1990). While these are believed to be the most potentially important commercial areas, other locations stand out for having already been subject to sufficient study that some reasonable understanding exists of the ecology of

their kelp forests. Barkley Sound is a noteworthy case in this regard (see Druehl & Wheeler 1986).

5. Status of Information about this VMEF

Stimulated largely by the prospect for a viable kelp harvesting industry the provincial government has undertaken extensive kelp surveys of large portions of the BC coast. While detailed information on and analysis of the whole ecosystems associated with kelp forests is not available, there is a relatively good comprehension of where both key canopy kelp species are concentrated.

6. Comments re National or Global Significance

Kelp beds are well distributed around the world. The particular key species (*Nereocystis luetkeana* and *Macrocystis integrifolia*) and associated biological communities in British Columbia, while well distributed along the whole east Pacific coast will differ somewhat from other areas in terms of their dominance. Both species occur, for example, down into California, but, there, another kelp, *Macrocystis pyrifera* is a highly important ecologically and economically. Significant kelp beds elsewhere in Canada are also made up primarily of distinct species. For example, in Nova Scotia, species from the genus *Laminaria* are the most important kelps in terms of overall biomass and productivity (Sharp 1990). It follows that, at least at the species or genus level, BC's kelp canopy forests can be considered of at least national significance. This is especially the case for those along the west coast of Vancouver Island where the sea otter populations are rebuilding.

7. Selected References

Regarding the general significance of large brown algae in marine ecosystems, see Mann(1982). Many specific studies and surveys have been published about kelp species and their forests in BC: Druehl & Wheeler (1986); Stewart et al (1982), Coon (1982, 1990), Wheeler (1990). As noted above, Hawkes (1993) has made cautionary remarks about commercial harvesting of kelps and these should be considered in reflections in the consideration of canopy kelps within MPA selection.

VMEF C15 REEFS AND THEIR ENVIRONS

1. Definition:

A relatively shallow marine physical structure and the community developing on and around it. This includes widespread rock reefs as well as ones created by biological activity. While corals are by far the best known bio-reef builders, numerous other marine invertebrates can also lay down reefs. These include sponges, mollusks, polychaete worms and bryozoans. Related structures that combine biologically deposited materials with non-biological sediments are called bioherms.

2. Explanation as to why the VMEF is important:

Reefs of all kinds generally offer unusual opportunities to marine organisms. The complex topography, localized alteration in flow regimes (leading to diverse sub-environments including high flow areas amenable to filter feeding animals) and relative

shallowness (allowing development of attached marine plants) all contribute to making these very special environments. High relief rocky reefs are favoured habitat for a wide variety of rockfish, some of which are uncommon and others of which support significant commercial and sports fisheries in BC. Indeed, the value of temperate reefs in conserving mature, spawning populations of long-lived rockfish and lingcod has made them a primary focus for marine protection. Biologically formed reefs and bioherms are intriguing in part because they are among the few substantial physical environments created primarily by biological rather than geological processes.

3. Subcategories (if any):

Reefs can be separated according to whether they are primarily of geological or biological origin, i.e. rock reefs and biological reefs. Biological reefs may then be subclassified in terms of the taxa of the main organisms that build the structure – corals, sponges, sabellid worms etc. It should also be noted that there is increasing interest in and popularity of creating artificial reefs which emulate some of the features of natural ones. A favoured approach of late has been the creation of reefs by intentionally sinking old military vessels. This was done, for example, in June 1997 off Nanaimo with the HMCS Saskatchewan.

4. Distribution and Illustrative Examples in British Columbia:

There is rich localized knowledge among sport and commercial fishermen throughout BC of the location of rock reefs significant to rockfish populations. This knowledge is not frequently shared. Survey and analysis of biologically formed reefs in BC is at a quite preliminary stage. Many intriguing examples have been discovered in the recent past but we are largely in ignorance of just how widely distributed these features are, given the minute fraction of areas surveyed compared to the vast expanse of those yet unseen.

5. Status of Information about this VMEF

See above - widespread for reefs used by rockfish but not synoptic information on the full ecosystems of rocky reefs. Knowledge of biologically formed reefs in BC is very limited.

7. Comments re National or Global Significance

Given the small number of known biologically-formed reefs in British Columbia, all must at this point be seen as potentially very significant. Rockfish reefs in BC's marine environment are broadly similar to those in adjacent US waters although the distribution of individual species varies somewhat.

8. Selected References

Conway et al (1989)

VMEF C16 SEAMOUNTS AND THEIR ENVIRONS

1. Definition:

Terrain rises of 1000 metres or more in height rising from the ocean basin usually due to volcanic activity.

2. Explanation as to why the VMEF is important:

Seamounts are features which have long been of interest to geologists studying the activity of sea floor dynamics. They are part of the sea surface geology that contributed to the original development of plate tectonics theory (Riddihough 1988). Seamounts have been described as "oases of life in mid ocean deserts" (e.g. Mercier and Mondor 1995, p.22). Their biological productivity is a result of the unusual physical oceanography they create around them. In essence a localized upwelling is created by seamounts which brings not only nutrients to the surface waters but also organisms that can be fed upon by birds and larger fish (Dower et al 1992, Dower 1994). Because they are essentially undersea "islands" they can have special fauna that have evolved along unique lines due to isolation (Parker & Tunnicliffe 1994). "Seamount effects" on the biology of nearby pelagic and benthic environments may extend many kilometres from the actual terrain rise.

3. Subcategories (if any):

None

4. Distribution and Illustrative Examples in British Columbia:

The Northeast Pacific comprises several chains and ridges associated with volcanic activity. The Bowie seamount, 220 km west of the Queen Charlotte Islands, rises to within 37 m of the sea surface and is characterized by a high biomass although relatively low diversity of biological communities. The Cobb seamount is located 500 km southwest of Vancouver Island and rises to within 24 m. of the sea surface. Canadian Hydrographic Service research from a manned submersible were able to observe features such as grass on the top of Cobb seamount, ancient beaches and copious yellow eye rockfish and sea perch (Thomson 1981). A third example is the Union seamount, located about 100 km west of mid-Vancouver Island and rising to within 300 metres of the sea surface. Two other seamounts off BC with deeper pinnacles are the Dellwood and Warwick features. Current-topography interactions near shallow seamounts often result in complex flow phenomena. Interaction between these phenomena and local biological communities produce numerous "seamount effects." Between 1990-1994 the Cobb Seamount Experiment (CSEX) explored these various physical-biological linkages around this seamount.

5. Status of Information about this VMEF:

As noted the Cobb seamount has been subject to a great deal of recent research undertaken within several disciplines. The Cobb Seamount Experiment between 1990 and 1994 examined biological-physical interactions. Oceanography and ecology of other seamounts off the coast have been far less well documented.

6. Comments re National or Global Significance:

Seamounts are relatively common globally occurring in all regions of active subsea volcanic activity. The ridges along the Pacific Coast are Canada's "contribution" to the world inventory of such features.

7. Selected References:

Regarding the specialized biological conditions on and above seamounts, see Dower (1994), Dower et al (1992), and Parker & Tunnicliffe (1994).

VMEF C17 HYDROTHERMAL VENTS AND THEIR ENVIRONS

1. Definition:

Vents are formations found only where sea floor spreading occurs and where water superheated by in the crust of the earth emerges creating unique chemical and physical conditions. These give rise to mineral formations and to biological communities specially adapted to the unique physico-chemical environment.

2. Explanation as to why the VMEF is important:

Hydrothermal vents and the communities associated with them have only been known since the late 1970s. The geological phenomena is intriguing in its own right but even more unusual are the organisms and species assemblages that have evolved in the immediate environment of the vents. It has been estimated that more than 90% of the fauna are endemic (found only in those environments) and were new to science. Furthermore, taxonomists have deemed some of these life forms to be so different from other animals that a whole new phylum (the highest order classification of fauna) has been identified — the Vestimentifera. It has been speculated that life on earth may have originated in the unique hydrothermal vent environment (see Tunnicliffe 1991 for the pros and cons of such arguments).

3. Subcategories (if any):

While the sciences of marine geology, biology and chemistry continue to improve understanding of differences among vents and vent communities (e.g. based on temperature of the released water), it is too early and unnecessary to use emerging distinctions in MPA planning.

4. Distribution and Illustrative Examples in British Columbia:

There are three sets of ridges off the northwest coast of North America where numerous individual vent sites have been discovered. Two of these are relatively close to the BC coast (the Juan de Fuca and Explorer ridges). The Juan de Fuca ridge contains several main as well as many smaller hydrothermal fields that have been more thoroughly examined than the Explorer ridge.

5. Status of Information about this VMEF:

In light of how recent the discovery of hydrothermal vents is, there has actually been an impressive amount of information compiled on distribution and biological characteristics. However, the science of these phenomena has barely begun. Enough is known to make this VMEF an unquestionable candidate for special consideration. At this point in knowledge of the distribution of hydrothermal vents, each site must be seen as special and as yet not well enough known to be "rated" as of anything less than very high significance. Ultimately, as understanding grows, vent communities may be compared in terms of representativeness of emerging "kinds of vents," or by the extent to which the fauna are unique and endemic. It is to be noted that biological sampling from the much

less well-studied Explorer ridge has already indicated the presence of species undetected in the Juan de Fuca ridge. The implication is that because of the scattered non continuous distribution of vents, further analysis is likely to show that many if not most sites will have unique fauna in comparison to others.

6. Comments re National or Global Significance:

Scientists are very excited about the discovery of this phenomenon which has been called "the most extraordinary environment on earth" (Cone 1991). Some lower temperature vents have been discovered off the Newfoundland coast. Globally, geologists consider it likely that all active areas of seafloor spreading will eventually be shown to contain hydrothermal vents. As of the early 1990s, Tunnicliffe (1991) considered 13 sites world-wide to have been examined biologically.

7. Selected References

See Tunnicliffe (1991) for a scientific account including her own work offshore of BC. Cone (1991) is a more general reference accessible to lay readers.

VMEF C18 Localized upwelling areas

Summary Only

One of the most important factors in high biological productivity in coastal waters is the phenomenon of upwelling. The large scale upwelling processes offshore, caused by prevailing westerlies especially during summer, is known to enhance nutrient supply of surface waters and thereby primary production by microscopic algae. There are however almost innumerable places within the waters nearer shore where a combination of currents, winds and bottom topography can have the same effect in miniature. Perhaps the best known examples are the environments in the vicinity of sills at the openings of most BC fjords (Lambert 1994). Farther offshore significant localized upwelling occurs as a result of seamounts (e.g. Freeland & Denman 1982) See also the description of seamounts in regard to the special hydrographic conditions they create.

VMEF C19 OTHER SPECIAL MARINE ENVIRONMENTS

Summary Only

In this course of the present study, several other quite small and specialized marine environments were identified about which there is limited information but which, in part because of their unique character and restricted distribution, may contain species or biotic communities not seen elsewhere. Moreover, in light of the limited knowledge we still have of the intricacies of the marine world, there will no doubt be others of these environments and features discovered in time. The experience with hydrothermal vents illustrates how this can happen (see above). This category, then, is primarily to name a few such specialized marine environments, known or suspected to be present in the coastal and offshore waters and to leave room for future discoveries.

Include here as contributors of rare or unique species and communities are:

- sea caves
- nearshore subtidal hot springs
- natural petroleum "seeps" marine communities primarily associated with human activity and development (e.g. fauna and flora of breakwaters, piers and marine structures, artificial reefs, eutrophic marine waters, etc.)

In regard to the last example, there is no intention to suggest that an MPA system ought to benignly include the low diversity benthic communities associated with outflows from sewage systems or industrial facilities. But consideration may be given to some specialized environments which have either high diversity or from which lessons about marine ecosystem recovery may be obtained. An excellent example of marine biological community of impressive diversity and which developed on a human-created surface is that at Ogden Point in Victoria.

Conservation VMEFs (C): Areas Significant to Especially Valued / Familiar Groups or Taxa

The third subset are areas of significance organized in explicit reference to highly valued or noteworthy groups or taxa of organisms. Here it is very important to note that such lists are very much biased to (a) larger organisms and (b) those that have for one reason (size, unusualness, economic significance) come to be of special interest to humans. They stand in comparison to other usually smaller and even microscopic organisms whose ecological role may be no less and indeed in many cases may exceed the more visible, "charismatic" species. These neglected and so easily "neglectable" groups include:

- micro-plankton communities (plant and animal);
- organisms living within bottom sediments, including in highly specialised environments such as sulphureta (oxygen free environments based on sulphur reduction) basins, and in interstitial waters within the sediment);
- micro-organisms living on surfaces such as seaweeds, sediment particles, etc.

Given the greater difficulty involved in ecology and systematics of these categories, it is almost certain that numerous as yet undescribed and endemic species exist within such communities.⁹ This would suggest that if biodiversity and unique ecological processes are really to count in MPA planning, these biological groups will eventually have to be more seriously considered.

The VMEFs proposed on the basis of the more familiar, currently valued and charismatic organisms are:

<p>C20 Significant finfish habitat (A) spawning grounds C21 Significant finfish habitat (B) juvenile nursery areas C22 Significant invertebrate areas C23 Significant habitats for marine birds including seabird colonies & the marine environments on which they rely</p>
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C24 Significant marine habitat for shorebirds & waterfowl C25 Significant marine mammal habitat C26 Sites significant to rare or endangered species

VMEF C20 SIGNIFICANT FINFISH HABITAT(A): SPAWNING GROUNDS

1. Definition:

Areas in which marine finfish reproduce or which are critical staging areas for reproduction.

2. Explanation as to why the VMEF is important:

Some, although not all, marine finfish spawn in relatively restricted "preferred" areas. Over time the exact locations are likely to change but the broad regions in which spawning takes place are more stable through time (except for species which are in notable decline). Other marine locations may play an important role in the spawning biology of anadromous fish such as salmon and eulachon as they serve as temporary concentration areas pending suitable river flows.

3. Subcategories (if any):

Subcategories would logically be drawn first on a species-by-species basis and then, as needed, stock-by-stock.

4. Distribution and Illustrative Examples in British Columbia:

One of the best known prime spawning grounds is Lambert Channel (between Hornby and Denman Islands) for Pacific herring. Pacific cod spawning is known to occur in several important locations — off Amphitrite Point near Ucluelet, White Rock, Bonilla Rock area of Hecate Strait. The Strait of Georgia hake heavily use the basins south of Texada Island and east of Gabriola Island. Staging areas at the mouths of spawning rivers are also widely important for salmonids. Hay (1995) estimates that there are 15 BC rivers with eulachon runs and puzzles over their total absence from Vancouver Island. Some of the most important and best known areas where spawning eulachon are harvested for the production of "grease" by First Nations are: the Nass River (Nisga'a First Nation); the Skeena (Tsimshian); the Kitimat River (Haisla), Bella Coola and Kimsquit (Nuxalk); and the head of Knight Inlet (Tanakteuk & related Kwakwaka'waxw First Nations).

5. Status of Information about this VMEF:

Annual compilations of the herring spawn fishery are undertaken by the Department of Fisheries & Oceans. A summary of, analysis and classification of herring spawning areas was prepared by Hay et al. (1989). Because of the interaction of subregional year-to-year variation, longer trend changes in overall population abundance and the large number of

species, extensive coastal waters and the high costs of inventory, comprehensive awareness of locations of prime spawning and related concentration areas are far from precise. This applies especially to species other than salmonids and herring.

6. Comments re National or Global Significance:

Since many of the species found in the Pacific do not occur in other parts of Canada, areas significant to them are clearly "unique" nationally. The scale of the Pacific herring spawn in places like Lambert Channel and Barkley Sound is among the most dramatic such events anywhere. Eulachon do not occur anywhere else in Canada. The unique relationship between this species and First Nations, captured best by an early spring visit to the "eulachon camps" such as at the head of Knight Inlet, is undoubtedly a globally unique phenomenon.

7. Selected References:

See Hay et al (1989) and Chalmers (1993) re herring; Hay (1995) re eulachon generally and Stewart (1982) in regard to native use of the eulachon.

VMEF C21 SIGNIFICANT FINFISH HABITAT (B) - JUVENILE NURSERY AREAS

1. Definition:

Areas where concentrations of young fish spend a critical period of the life cycle.

2. Explanation as to why the VMEF is important:

Young fish of all species are significantly more vulnerable to mortality, through exposure to such as other fish as well as birds and marine mammals. Juvenile salmon in the process of making the demanding physiological shift from fresh to salt water ("smoltification") may be particularly vulnerable.

3. Subcategories (if any):

There are more than 200 species of marine and anadromous fish along the BC coast (Hart 1973). While it would be unrealistic to expect that for purposes of MPA planning, areas significant to each must be treated independently, interspecific variations in needs and preference are enormous. Even among the salmonids, the location and duration of stay for nursery areas varies significantly.

4. Distribution and Illustrative Examples in British Columbia:

Probably the species whose juvenile habitat requirements are best understood and studied are the salmonids. Smolt of the seven species (including steelhead and cut-throat) differ significantly in their use of estuarine and marine juvenile rearing areas. Healey (1980,

1982) has summarized the state of knowledge about the distribution of juvenile salmonids in southern BC marine waters.

5. Status of Information about this VMEF

There is a widespread acknowledgement of the role that estuaries, eelgrass beds, and intertidal flats play as nursery grounds. Juvenile chum and chinook appear to make the most extensive and protracted use of nearshore marine areas. Coho stay less time and sockeye and pink move quickly offshore. Unfortunately site specific knowledge of the most important nursery areas within BC's nearshore marine waters is quite limited. That is, fisheries scientists would have difficulty naming the most important nursery areas on a comparative basis for most subareas of the coastal zone (Healey pers. comm., June, 1997).

6. Comments re National or Global Significance

To the extent that particular fish species are themselves of national or global significance, it follows that any area important to them at critical stages of the life cycle would be of like significance. Unfortunately, as noted, site specific knowledge of where such places are is generally lacking. The exception would be the estuarine reaches of major salmon rivers such as the Fraser and the Skeena which are known to be heavily used by juvenile salmon.

7. Selected References

For juvenile salmon, see Healey (1980, 1982) and Hartt & Dell (1986).

VMEF C22 SIGNIFICANT INVERTEBRATE AREAS

1. Definition:

Localized concentrations of invertebrate species or taxa.

2. Explanation as to why the VMEF is important:

Marine biodiversity of invertebrates in BC as a whole is noteworthy. It is estimated that there over 400 species just of bivalves (Webb & Marcus 1996), which are only one component of mollusks, which are but one phylum within the whole array of BC's marine invertebrates. In total, one estimate, made in 1985, of the overall numbers of species of invertebrates is 6,555 (Austin 1985). This is many times greater than the numbers of vertebrate marine species (Lambert 1994). Invertebrates play a significant role in linking the huge production of detritus from marine and marsh plants to higher level consumers including important fish, birds and mammals (Levings et al 1983). As well, direct commercial harvesting of many invertebrate species is pursued along the BC coast. Commonly, over-exploitation has tended to occur leading to a diminution of breeding stock and ability to naturally recover, Some once-common species have been reduced

either due to overfishing (e.g. abalone, razor clam) or other factors which may include competition with introduced species (e.g. the native oyster, *Ostrea lurida*). Although linkages to other parts of the marine food chains are not well understood, it must be assumed that direct and indirect issues related to biodiversity are raised in respect to the management and protection of these areas.

3. Subcategories (if any):

By species of invertebrate — this is essential at the stage of MPA identification/inventory because the various species are very distinct from one another in terms of geographic locations and preferred environments.

4. Distribution and Illustrative Examples in British Columbia:

With the enormous numbers of different species of invertebrate, comes an equally impressive ubiquity: almost every conceivable habitat of BC's marine environment has been colonized by and is now important to an invertebrate fauna. One of the more thoroughly inventoried areas in BC is Barkley Sound from which nearly 1500 invertebrate species were identified (Austin et al. 1982). Another well known area of high invertebrate and seaweed diversity is Burnaby Narrows within Gwaii Haanas National Park Reserve (Harper et al 1994). Shellfish resources are widely dispersed along the BC coast, especially given all different species. Some are more than locally known either because they are no longer commonly encountered (e.g. razor clam, *Siliqua patula*, at Long Beach, Vancouver Island and North Beach on the Charlottes) or because of high productivity of certain locations (e.g. Savary Island for manila clams).

5. Status of Information about this VMEF:

The huge numbers and apparently ubiquitous distribution of marine invertebrates means that knowledge of which organisms are where is relatively minimal. Unfortunately complete taxonomic inventories seem to be affordable primarily when environmental damage is imminent or has already occurred. Otherwise, even the most expert invertebrate biologists will readily admit that there is far too little known to make useful coastwide generalizations about which particular habitats are outstanding in their significance to marine invertebrates. Even subregional assessments as may be undertaken in connection with MPA identification are bound to suffer from scarce knowledge of all but the commercial species. The distribution of commercially valuable intertidal species is well known in a generalized way although the exact locations and biology of individual shellfish beds are less well surveyed. Subtidal shellfish populations tend to be familiar most to commercial and recreational divers. Recently, efforts have been made by commercial divers to systematically compile such information.

6. Comments re National or Global Significance:

As noted the overall marine invertebrate biodiversity off the west coast is generally deemed to be of high significance (e.g. Lambert 1994). As the painstaking task of

inventorying particular areas occurs, finding species either new to the region or even previously unrecorded is almost an expectation. Austin (1985, pers. comm. March 1997) has described a number of these "finds" which indicate that there is likely to continue to be a steady increase in the number of such undescribed species appear as good inventory and taxonomic work continues. So, as much in expectation of what may be found as what is known, the marine invertebrate fauna of BC should be considered minimally a national treasure.

7. Selected References:

Austin (1985); Austin et al (1982); Harbo (1988, 1997); Jamieson & Francis (1986); Lambert (1994), Levings et al (1983); Tunnicliffe (1991b)

VMEF C23 SIGNIFICANT HABITATS FOR MARINE BIRDS, 10 INCLUDING SEABIRD COLONIES & THE MARINE ENVIRONMENTS ON WHICH THEY RELY

1. Definition:

Descriptions of the ecology of marine birds usually focus on three kinds of area-based features: where they breed, where they feed and where they rest. Colonial aggregations of marine-dependent birds, usually on smaller rocky islands or islets along the BC coast are probably the most specific sites associated with various species' ecological requirements. Many of the species are members of the Alcidae family the auks, including murre, puffins and guillemots. But not all of the birds which are usually called "marine" are necessarily colonial. Vermeer & Ydenberg (1989) place several non-colonial species within their definition of marine birds, including loons and sea ducks. It is important to stress that this VMEF must contain key parts of the marine environment per se in addition to the rocky islands where birds nest and roost. Many of the existing BC seabird colonies protected under regimes such as ecological reserves do not comprise this essential feeding habitat.

2. Explanation as to why the VMEF is important:

Seabirds are among the most "charismatic" and sensitive categories of organisms associated with BC's marine environment. Because of their high position within food chains they are vulnerable to marine-borne pollutants and to major changes in the abundance of other organisms that constitute their prey. Humans tend to be fascinated by these organisms especially the remote colonies found on offshore islets. Most of the major forms of marine-based recreation in BC place a high value on the opportunity to observe seabirds (ARA et al 1992). This both adds to their importance and raises the concern that disturbance will interfere with breeding success and population sustainability.

3. Subcategories (if any):

Burger et al (1997) divide critical areas (known or potential) under two headings: seabird colonies and "important foraging and staging areas at sea". Finer subcategories would logically be drawn first on a species-by-species basis within which it would be useful to be clear about each species' nesting, feeding and resting habitat. It needs to be repeated for emphasis that protecting only one of these is unlikely to accomplish the overall goal of sustaining seabird populations.

4. Distribution and Illustrative Examples in British Columbia:

BC's complex coastline would appear to include a very large number of potential seabird sites. Surveys conducted over the past decade suggest, however, that the required combination of suitable nesting habitat and adjacent waters productive in seabird foods is not so common. This leads to concentration within regions — for example surveys of the entire northern coast approximately from Cape Caution to the Alaskan border suggested that upwards of 85% of colonial seabirds nested off the west coast of Aristazabel Island (Rodway & Lemon 1991). A total of 10 ecological reserves in BC have been established specifically to recognize and protect valuable seabird concentrations. The Scott Islands off the northwest corner of Vancouver Island enclose the largest seabird colonies in the province. In all, Burger et al (1997) listed 82 separate locations deemed to be of known or "suspected" importance to marine and shoreline birds combined.

5. Status of Information about this VMEF:

The Canadian Wildlife Service recently undertook a seabird colony inventory along much of the BC coast (e.g. Rodway & Lemon 1991) Some concentrated survey works has been undertaken in relation to environmental assessments, as for example, on Chatham Sound (Canadian Wildlife Service 1980). The coverage for purposes of MPA planning therefore, in comparison to a number of other VMEFs is quite good. On the other hand, locations and relative importance of critical foraging and staging areas is "still poorly known" (Burger et al 1997, p.6).

6. Comments re National or Global Significance:

Colonial seabird concentrations are one of the most widely cited special features of the BC coast, based on national and international comparisons. For example 80% of the world population of Cassin's Auklets are believed to nest in BC.

7. Selected References:

The most current compilation of knowledge regarding sites important to seabirds is Burger et al (1997). Collected papers in Vermeer & Butler (1989) and Vermeer et al. (1992) provide very detailed information on ecology and feeding habitats. Rodway (1991) gives a useful overview of the status of seabirds in BC. Campbell et al (1990)'s *Birds of British Columbia, Volume 1*, is an excellent source of information on the distribution of seabirds as well as other avian species. .

VMEF C24 SIGNIFICANT MARINE HABITAT FOR SHOREBIRDS & WATERFOWL

1. Definition:

In addition to the true seabirds discussed in the immediately preceding "VMEF", a large number of well known bird species depend on shallow marine waters and intertidal for feeding and resting¹¹. These include many species of migratory waterfowl (geese, swans and ducks) as well as those most commonly referred to as shorebirds – sandpipers, oystercatchers, plovers, herons, etc. The same habitat is often significant to other species that are not generally thought of as shorebirds such as eagles and crows.

2. Explanation as to why the VMEF is important:

Shorebirds are among the most accessible species for humans to observe. The habitat they generally use has been discussed earlier in this report under several VMEF discussions, particularly Intertidal Areas (VMEF C3); Estuaries (VMEF C8), Salt Marshes (VMEF C11), Tidal Flats (VMEF C12) and Sea Grass beds (VMEF C13). These should be consulted for specific consideration of distribution and significance.

3. Subcategories (if any):

none

4. Distribution and Illustrative Examples in British Columbia:

Some of the best known sites associated with shorebirds of BC include:

- Fraser estuarine complex including Boundary Bay - overwintering, nesting & feeding for a large number of all categories of shorebirds;
- Courtenay River Estuary - highest concentration of Trumpeter swans in North America;
- Parksville-Qualicum beaches - stopover area for northerly migrating Brant geese;
- Skidegate Inlet - possibly the only overwintering area for Brant geese in Canada;
- Shoal Harbour (Saanich Peninsula) - overwintering area;
- Esquimalt Lagoon - feeding & nesting site within urban area.
- Rosewall Creek (east Vancouver Island) - overwintering area

5. Status of Information about this VMEF

The very high public interest in and ease of observation of waterfowl and other shorebirds virtually guarantees that general knowledge of the whereabouts of significant habitat is substantial at least in comparison to other groups of species and their habitat. The nature of the importance of intertidal and nearshore habitat has been well documented in a number of books and articles although more detailed analysis of the dependency on particular sites in BC is available only fragmentarily (Verbeek & Butler

1989). As with many of the other VMEFs proximity of habitat to the large human population centres and research institutes of southwestern BC has meant far better information than is the case for more remote but equally significant sites.

6. Comments re National or Global Significance

The Fraser estuary-Boundary Bay complex is truly one of the most productive waterfowl and shorebird areas in Canada and the world. Several of the other sites mentioned above are already recognized through the creation of Federal migratory bird sanctuaries (e.g. Esquimalt Lagoon) or national wildlife areas (e.g. Rosewall Creek)

7. Selected References

Regarding the ecology of waterfowl (ducks, geese & swans) generally, see Owen & Black (1990) and for shorebirds and their use of the marine environment, Pitelka (1979). Verbeek & Butler (1989) review the feeding ecology of shorebirds in the Strait of Georgia. There are numerous other more specific studies focusing on particular species and/or particular sites important to shorebirds within BC. Campbell et al (1990) contains detailed discussions on the distribution and distinguishing characteristics of BC's shorebirds and waterfowl.

VMEF C25 SIGNIFICANT MARINE MAMMAL HABITAT

1. Definition:

In British Columbia there are estimated to be 28 species of marine mammals include 20 cetaceans (whales, porpoises), 5 pinnipeds (seals and sea lions) and the sea otter (Darling 1991). These species differ greatly in the geographic range of their life cycles but all require and use relatively specific areas for feeding and for the birth of their young. Some have other habitat uses of restricted areal extent such as the "haul-outs" used by seals and sea lions and the "rubbing beaches" of the orca (*Orcinus orca*).

2. Explanation as to why the VMEF is important:

Marine mammals are sometimes described as "charismatic species" because of the high levels of interest humans have in them. As the occupants of the highest levels of marine food chains, they are among the most sensitive of species to effects of human activities. They can exert significant influence on the abundance and ecology of organisms at lower levels as best illustrated in the now famous change in seaweed ecosystems after the depletion of sea otters for furs led to a rapid increase in sea urchins which denuded kelp beds (Stewart et al 1982, Watson 1993).

3. Subcategories (if any):

As noted there are nearly 30 different species. Some grouping may be possible but in general what characterizes a species is its distinctive life history and ecological niche.

Thus a comprehensive representative system of MPAs would aim to include habitat significant to most if not all marine mammal species.

4. Distribution and Illustrative Examples in British Columbia:

Taken as a group, marine mammals are seen throughout the coast of BC. At the species level, each is likely to be associated most strongly with particular places. For some species such as the harbour seal, there are many year round and seasonal locations that are known. Others, such as haul-outs and rookeries for sea lions, benthic feeding areas for gray whales, breeding grounds for cetaceans, and the unique "rubbing rocks" for orcas, may be very limited in the numbers and distribution of suitable sites. Some examples of what are believed to be especially significant and/or unique marine mammal sites include: Checleset Bay (prime sea otter area, now an Ecological Reserve); Robson Bight (famed orca rubbing beaches, also an Ecological Reserve), Triangle Island (sea lion rookery, also an Ecological Reserve), West Cracroft Island in Johnston Strait (calving grounds for Dall's porpoise); and the west coast of Vancouver Island and Calvert Island summer feeding grounds of gray whales.

5. Status of Information about this VMEF

The larger size of marine mammals and keen human interest in them, compared to other marine species, has meant that many and detailed observations have been made coast-wide on the various species. While knowledge of the dynamics and reasons for dependence on specific geographic areas is not fully understood in many cases there is a fair degree of information about marine mammals.

6. Comments re National or Global Significance

British Columbia contains several sites that are already recognized as being of national or global significance. Robson Bight particularly but also other locations in the Gulf Islands and Blackfish Archipelago are among the most well known and relatively accessible orca locations anywhere. Robson Bight with its famous "rubbing beaches is especially significant. Overall, the largest concentration of orcas in the world are found on the BC coast and the northern Johnston Strait area is described as a "hot spot" for their pods (Rennie 1982). Kyuquot Sound and, possibly, Calvert Island are the only remaining locations in Canada of sea otter populations. Other marine mammals with larger ranges along the entire eastern Pacific, are also very well represented on the BC coast and particular places are unusual if not unique – e.g. gray whale feeding areas off the west coast of Vancouver Island; sea lion colonies on Triangle Island.

7. Selected References

See: Bigg (1969) and Olesiuk et al (1990) re seals; Bigg (1985) re sea lion; Campbell (1987) re elephant seals; , Darling (1976) re gray whales; Darling (1991) re general status of marine mammals; Jefferson (1990) re porpoises; Watson (1993) re sea otters.

VMEF C26 SITES SIGNIFICANT TO RARE OR ENDANGERED SPECIES

Summary Only

Marine biodiversity generally and the contribution to it of rare and endangered species has suffered relative neglect in comparison to terrestrial equivalents (see Lambert 1994 for discussion). Among the reasons for this is the general belief that the relative lack of barriers to dispersal in the marine environment and large number of species with easily dispersed microscopic life stages makes marine extirpation or extinction improbable – see, for example, Kelleher & Kenchington (1991), p.6. Yet marine extirpation or extinction is not an unheard of phenomenon. Because of their low reproductive rate, marine mammal populations are potentially vulnerable to catastrophic decline and extirpation. The disappearance of sea otters (*Enhydra lutris*) and the consequences for kelp-based marine ecosystems, stands as one of the best known examples of how losing a "keystone" marine species can have profound repercussions on the whole environment (see Stewart et al 1982, Watson 1993).

This category is included, then, more to leave room for the strong possibility that new highly specialised and presently poorly understood environments may come to be recognized, in the course of detailed MPA planning, as crucial to marine and marine-related species which are rare or endangered. The status of knowledge about marine endangered species (see below) is such that we need to be open to new information about (a) hitherto undescribed species in the marine environment (b) new information on status of species that would place them on "rare and endangered" lists; and (c) new understandings of the habitat dependencies of such species. It is generally found that when professional marine biologists have the resources to look in less well studied parts of BC's marine environment, new findings are inevitable (Lambert 1994, Austin pers. comm., April 1997; Marliave, pers. comm., June 1997).

An ongoing project, undertaken by the Khoyatan Marine Laboratory of Cowichan Bay, on behalf of the BC Conservation Data Centre should clarify the extent to which marine species fall into one of categories associated with rarity and endangerment (W.C. Austin, pers. comm., April 1997).

Conservation VMEFs (D): Areas of Special Scientific Interest

VMEF C27 AREAS WITH A SUBSTANTIAL RECORD OF PRIOR MARINE RESEARCH AND DATA GATHERING

As noted, basic and applied marine science is likely to be keenly interested in most if not all of the VMEFs listed above. It seems worthwhile, however, to give some added weight to the consideration of what is valuable enough to be protected to sites which, for whatever reason, already have been subject to considerable scientific study. Proximity of sites to research centres may well be the prime reason why concentrated scientific research has been targeted on some areas. Arguably, we know somewhat more about Saanich Inlet than many other BC fjords because the Institute of Ocean Sciences is

located on its shores; the biology and oceanography of the area around Gabriola Island may, again arguably, be better known than in areas comparable in their "ecological values," because of the neighbouring long-term presence of the Pacific Biological Station. In the course of our interviews it was suggested more than once that a good start to a sound MPA system might be made by aiming to establish one MPA everywhere along the BC coast where there are nearby marine research establishments (e.g. Saanich Inlet, Gabriola Pass, Cowichan Bay, Barkley Sound). Another marine area that has been well studied by marine researchers and their students from Victoria-area learning institutions is the Race Rocks Ecological Reserve (Cribb 1981).

The basic rationale relates to the argument, common in the MPA literature, that one important benefit in establishing protected areas is to provide "controls" for continuing understanding of what comparatively undisturbed marine environments are like. One of the frustrations of environmental management and assessment is that there are so few places where natural variability can be understood in isolation, by and large from human influence. This often leaves scientists and managers unable to ascribe causal relations between human action and biological response. MPAs chosen on the basis of having such baseline data in place would facilitate the understanding of the effects of development and exploitation on other marine ecosystems.

3.2 Recreation VMEFs

Scope: What is Included Under "Recreation?"

The second category of Valued Marine Environments and Features (VMEFs) to be considered are those whose value relates to recreation. As with conservation, let us begin by considering what is included under this heading. Recreation is often equated with leisure-time activities — doing things for fun and relaxation. But as Graham (1985b) asserts, recreation is not just an activity but the interaction of activities, with environmental settings and specific opportunities. This understanding of recreation as part of the environmental setting in which it takes place underlies the logic used here to identify VMEFs primarily on an activity-by-activity basis.

There is, however, also a need somewhere within a Marine Protected Areas strategy of taking account of values which transcend overt recreational activity, existing as much in the way people think as in how they act. These values include ones as delineated by Blomberg (1982) in terms of "senses of life and continuing creation, time and timelessness, space and distance, imperviousness to man and man's actions, energy and conflict and mystery and spirituality." (Blomberg 1982, p.53). These add to and complement one "intangible" quality which, more so than others, has been rendered less intangible over the past two decades — the dimension of scenic or visual quality (see Cats-Baril and Gibson 1984 generally re measuring scenic quality and, for BC coastal applications: Catherine Berris and Associates 1993; Miller 1984).

Thus, in thinking about the values to be considered in identifying and evaluating potential Marine Protected Areas, we need a very broad definition of recreation. A bit of

etymology helps: the word comes from the Latin *recreatus* which means to restore, refresh or create anew. As such recreation includes not only activities but passive enjoyment, reflection, contemplation and even the rewards of knowing that something exists (i.e. what some economists call "existence value"). Unquestionably it will be easier in identifying and evaluating marine sites as to their value as MPAs to focus on primary marine activities and the sorts of resource features important to pursuing those activities. Yet, explicit consideration of other non-activity kinds of values should be included if a robust representation of what is really valued about BC's marine environment is to be achieved.

Challenges and Structuring of Overview and Strategic Assessment of Recreation VMEFs

The category of recreation presents some difficulties not encountered in either of the other two value categories dealt with in this work. In the case of conservation values one is dealing directly, for the most part, with the features which marine protected areas are created for — diverse environments, assemblages of unique or endangered organisms etc.. But it is much more difficult to be "scientific" in ascribing recreational significance. Recreational resources are defined in terms of human leisure activity rather than by experts from such established scientific disciplines of biology, geology, history or archaeology. This means that there is a much higher subjective in trying to answer the core question "what is valuable?."

Furthermore, in a sense, recreation values are "second-order" or what might be called "derived" in that very largely they depend on natural or cultural heritage features. Consider, for example, the goal set for the BC Ministry of Tourism's 1992 Coastal Tourism Resource Inventory is to "Ensure that outstanding natural, cultural and heritage resources which are important to British Columbia's tourism industry are identified and documented for use in coast tourism planning" (ARA et al. 1992, p.1-3). The implication is that coastal tourism values (which in large measure are equivalent to values for marine recreational activities) are largely, if not wholly, a subset of natural and/or cultural-heritage values that contribute to recreational enjoyment. If this is so, "recreation VMEFs" in our terminology, are primarily to be derived by understanding the weight recreationalists attach to conservation and cultural-heritage values. It should be possible then to represent recreational values in MPA identification and selection mainly by putting an appropriate amount of added emphasis on conservation and cultural-heritage values that also are highly significant from a recreational perspective.

Fortunately, this kind of assessment of what each of the main marine recreational activities needs, in terms of conservation and cultural-heritage features has already been undertaken in the aforementioned Coastal Tourism Resources Inventory (ARA et al. 1992). One of the analytical steps in that inventory involved determining "tourism capability" by identifying the primary and secondary attributes important to each recreational activity. The way that this analysis incorporates these primary and secondary attributes into an overall assessment of the capability for each marine recreational activity may prove to be of interest, value and applicability in MPA identification and evaluation. The details are beyond the scope of our study but what is immediately useful in this

overview is that such attributes are a systematic first cut at answering the question: what is valuable in BC's marine environment from a recreational standpoint?

Finally, in discussing the challenges of considering recreational values, a difficulty which pervades the consideration of recreational values in MPA planning is the "site particularity" of individual preferences. By this we mean that for each of the main activities, recreational users individually tend to have very specific preferred sites which, from their perspective, are the best and which might well not be identified in a highly systematic capability analysis. Preferred fishing holes or sailing "gunkholes" or beaches to get away, are very difficult to identify for any large geographic area. Perhaps personal history, perhaps some of the "hard case intangibles" discussed elsewhere in this section, or perhaps information which is not available to broad systematic survey work, accounts for these preferences. Whatever the reason, people simply may not come forward with information about what is most valued – until they perceive a threat to their continued use and enjoyment of the area. This and the dearth of biological and physical information for much of the marine area of BC dictates that MPA planning will need to build on and incorporate local public preferences as much or more than systematic surveys if and when recreational values are to be brought into site selection.

Working Catalogue of Recreation VMEFs

To organize recreational VMEFs we have used a framework based on the principal marine dependent recreational activities. Six broad kinds of activity are used:

1. Sport Fishing
2. Coastal Cruising (sail & power)
3. Sea Kayaking
4. Scuba Diving
5. Marine Nature Observation
6. Shore-based Marine-Dependent Recreation

It is to be emphasized for clarity: these are not the "VMEFs" themselves, but rather provide a framework for identifying what is valuable from a recreational standpoint. Under the heading of each of these activities, the first and most important step is to address the question: what features and environments enable people to pursue the activity? For completeness this section concludes with reflections on identifying sites or features based on those least tangible (from an analytical point-of-view) sorts of values as noted above, i.e. Aesthetics, Wonder, Spirituality, Sense of Place and Time and related "Intangibles" as recreation values.

In considering the valued marine environments and features on which major marine recreational activities depend, a first step is to recognize the significance of the Conservation VMEFs already identified and discussed. As noted, marine recreational experiences depend to a considerable degree on natural features and environments. As a starting point, Table 3.2.1 has been prepared to give some a priori reasonable assessments

of the relative importance of conservation VMEFs to the six major kinds of marine recreational activity.

Table 3.2-1: Subjective overview of importance of conservation VMEFs to marine recreational activities

(H=High importance; M=Medium; L=Low; U=Unclear)

CONSERVATION VMEF (from section 3.1)	sports Fishing	coastal cruising	scuba diving	sea kayaking	nature observat.	shore-based rec.
1. Pelagic waters-plankton based ecosystems	L	M	L	L	L	L
Archipelagos and their environs	H	H	H	H	H	L
Intertidal areas (foreshore) & adjacent backshore	M	L	L	M	H	H
Inland seas	H	H	H	H	M	M
Major embayments	H	H	H	H	M	M
Fjords	H	H	H	H	H	L
Passages: Straits, channels, passes, sounds and narrows	H	H	H	H	H	L
Estuaries	M	M	M	M	H	M
Continental margin	L	L	L	L	L	L
Ocean basin	L	L	L	L	L	L
Salt marshes	M	L	L	L	H	M
Tidal flats	M	L	L	M	H	M
Sea grass beds	H	L	L	L	M	L
Kelp beds	L	L	M	M	M	L
Reefs and their environs	H	M	H	M	M	L
Seamounts and their environs	L	L	L	L	L	L
Hydrothermal vents and their environs	L	L	L	L	L	L
Localized upwelling areas	H	L	L	L	H	L
Other special marine environments	M	L	H	M	H	M
Significant finfish habitat A. Spawning	H	L	L	L	M	L

areas						
Significant finfish habitat B. Juvenile nursery areas	H	L	L	L	L	L
Significant invertebrate concentration areas	M	M	H	M	H	H
Significant habitat for marine birds	L	M	L	M	H	L
Significant marine habitat -waterfowl & shorebirds	L	L	L	M	H	M
Significant marine mammal habitats	L	H	M	H	H	M
Sites significant to rare or endangered species	L	L	M	M	H	M
Areas with substantial prior marine research/data base	L	L	L	L	M	L

This table was derived most subjectively after consideration of several information sources: informal discussions with individuals and groups who study, participate in or make a living from these activities; the ARA et al (1992) report which identified key "tourism resources" associated with different activities and from reading the primarily popular literature about each of the activities as pursued in British Columbia. No claim is made that this is a definitive determination of the importance of conservation VMEFs. In fact, a more thorough and ecologically-minded assessment would undoubtedly score many of the features and environments more highly in recognition of the indirect but significant connections between recreational use of resources and the intricate relations among environments. The "connection" between conservation VMEFs and recreational activity is assessed in terms of direct utilization rather than tracing the indirect yet undoubtedly important dependence of almost all activities ultimately on marine ecosystem integrity. Moreover, the table is somewhat static in that it is conceivable that as technology advances, remote but intriguing "VMEFs" such as seamounts and hydrothermal vents may become destinations for marine recreationalists. This table then is advanced only to give a general sense of which VMEFs may be especially valued in current patterns of recreational activity.

In principle, it would also be possible to devise a similar table relating cultural-heritage resources to recreational activities. Certainly, all six of the recreational categories place some degree of value, on such resources. The ARA et al's (1992) Coastal Tourism Resources Inventory reports that all focus groups of people involved in marine recreation

businesses identified the "opportunity to include interpretation of native heritage and culture tourism activities" as important to their sector (ARA et al 1992, p.2-52).

In addition to conservation and cultural-heritage related values, each of the six main marine-dependent recreational activities has other needs, some of which may be construed as "recreational" VMEFs. It is to be noted that among these needs are also infrastructure of varying kinds which, for purposes of this study, are not seen as values that ought to be used in MPA designation. Thus, for example, marinas, roads, supply centres etc. are unquestionably important to most sports fishing and some coastal cruising. Roads for access are especially important to shore-based marine recreation. Ferry services such as the recently initiated "Discovery Coast Passage" are likewise of major importance in expanding access by sea kayakers to previously remote parts of the coast. But to begin to inventory and assess the importance of all these factors would lead this study well away from the notion of values significant to the identification of MPAs and into more of a needs assessment for the recreational activities. For this reason, focus is on aspects of the natural environment as opposed to human-created infrastructure.

The discussion of each activity and derivation of VMEFs critical to it, uses the following common framework

- Brief description of the activity
- Marine Features & Environments (VMEFs) of Importance to the Activity, including a summary list of such main recreational VMEFs
- Specific areas important to the activity in British Columbia - Examples of sites important to the activity in British Columbia — the geographic extent especially of high or very high capability areas and a sampling of noteworthy sites frequently mentioned in recreational trade literature.
- Comments re Provincial, National or Global Significance of Sites Used by Activity
- Further Reading re Distribution of Activity- further reading about the extent, importance and general nature of the activity in BC's marine environment.

Several VMEFs recur among two or more of the activities. After the discussion of all six categories of marine dependent recreational activity, a summary table of the VMEFs is presented, integrating the key recreational VMEFs with a brief description of what is known of their distribution in BC at present. A table is also given showing the presumptive relationship between the 6 recreational activities and the conservation VMEFs derived in section 3.1.

SPORT FISHING and its VMEFs

1. Brief description of the activity:

Sport fishing in British Columbia entails a very wide range of recreational activities - from individual low cost fishing either from small boats or from the shore (including wharves and piers) to large enterprises with very large vessels or floating lodges. It is estimated that over one half million individuals participate in one form or another of tidal sports fishing in BC.

2. Marine Features & Environments (VMEFs) of Importance to the Activity:

It has become a truism that what recreational sports fishers seek is not only fish, perhaps not even primarily fish. The point has often been made (e.g. Kenchington 1993, Laventhol & Horwath Management Consultants 1987) that so long as there is some measurable likelihood of catching fish, sports fishers are seeking the opportunity (some would say "excuse") to be on the water in a pleasant perhaps even scenic locale without major congestion. Even the latter "criterion, i.e. relative low density of competing fishers, would appear from casual observation of activity in places such as Discovery Passage, to be quite a flexible one. Laventhol & Horwath Management Consultants (1987,p.5) concluded, "Recent research conducted both in BC and throughout the US indicates that most anglers consistently regarded the elements of the natural environment, escapism, and being with others as more important to their overall satisfaction in a fishing trip than either the size or number of fish caught."

The authors did not explain what was meant by "elements of the natural environment." Presumably the reference is to easily observable features such as scenery, conspicuous and interesting marine wildlife such as the larger mammals, eagles, In the ARA et al (1992) Coastal Tourism Resource Inventory focus group sessions identified several other attributes unrelated to fish abundance, , including cultural resources, as influential in their choice of fishing destinations

Despite this, it is reasonable to argue that adequate stocks of target species are among the more important "VMEFs" associated with sports fishing. While other features – many of which are basically infrastructural rather natural such as marinas, supply stores, fuel stations etc. – undoubtedly influence the choice of sports fishing destinations, there must be a threshold of target fish abundance below which willingness to visit drops off.

In addition to the ecological connections between sports fishing (particularly the abundance of fish) and our conservation VMEFs as seen in Table 3.2-1 the following general categories of values appear to be most important:

- areas where there is a reasonable prospect of fishing success (related complexly to the proximity of productive salmon streams, rockfish habitat etc.);
- coastline scenery; and
- other marine attractions that can be observed incidentally to fishing (marine mammals, Native heritage sites).

As accessibility becomes less and less of a problem (given the mobility of sports fishing charter operations), and as stocks decline at least in some of the most heavily used

traditional sports fishing grounds, the reasonable prospect of catching one or more fish will become more and more important. In turn this means that all of the critical habitats of such valued species (spawning grounds, nursery areas etc.) will become highly significant features for MPA planning related to this recreational activity.

3. Specific areas important to the activity in British Columbia:

Sports fishers have favoured locations along the entire length of the BC coast. A strong trend in the last fifteen years has been tremendous growth in the numbers and geographic spread of charter operations located in the most remote inlets and bays. Indeed remoteness and thereby access to stocks which will be harder for others to use, is one of the primary "selling features" for some of the best known charter operations in BC. Places such as Langara Island off the northwest tip of Haida Gwaii / the Queen Charlottes and the Hakai Pass on the central coast are but two of the remote locations that have come to be very well known in sports fishing circles.

It is not possible, in a study such as the present one to say much more on the detailed distribution and relative significance of different subareas of the coast for sport fishing. Competition among the many coastal communities with significant sport fishing sectors to their economies, virtually guarantees that province-wide or regional groups like tourism associations or fish and game clubs will refrain from asserting that one place is superior to another.

To illustrate, ARA et al (1992) made a reasonable attempt at ascribing "capability for multi-day sport fishing"¹² based on estimates of fish resources, local statistics for salmon escapement and, secondarily, scenery and opportunities for ancillary wildlife viewing. This analysis led to ascription of "high" capability to a very large proportion of the south coast of BC - for example, the entire Johnstone and Queen Charlotte Strait areas, and all of Barkely and Clayoquot and Quatsino Sounds. Interestingly, the only coastal area receiving these analysts' rating of "very high" capability were South Moresby and western Graham Island on Haida Gwaii / the Queen Charlottes.

In sum, given the eccentricities of patterns of reporting favoured saltwater angling opportunities and the continuing predominance of the highly mobile salmon as the target species of preference, it will remain quite difficult for MPA planning to factor sports fishing values into the general search for Areas of Interest. On the other hand, once a section of the coast becomes the focus for MPA planning, the abundance and coastwide distribution of individual sport fishers and of "rod and game" associations etc., means that it will be both feasible and essential to include these interests in detailed planning.

4. Comments re Provincial, National or Global Significance of Sites Used by Activity:

As noted, British Columbia is generally reputed to be a world class sport fishing destination and certain locales are unquestionably world renowned even if, within BC, catch statistics no longer put them at the top. The Campbell River/Discovery Passage area

is probably the world's most famous salmon fishing destination, earning by reputation alone its title as "salmon fishing capital of the world." Rival destinations with national and international reputations include Rivers Inlet on the central coast, Barkley and Clayoquot Sounds on the west coast of Vancouver Island and much of Haida Gwaii/the Queen Charlottes.

5. Further Reading re Distribution of Activity:

The periodical BC Outdoors carries an annual review of "where, when and what to catch in BC" which gives a good lay overview of the sector and places currently important to it. Popular books on salt water fishing in British Columbia are very numerous. A widely read popular celebration of BC's fishing (saltwater and fresh) is Haig-Brown's (1964) *Fishermen's Fall*.

COASTAL CRUISING (POWER & SAIL) and its VMEFS

1. Brief description of the activity:

Recreational touring by marine vessel including both propulsion by sail and engine. Each year many different kinds of vessel cruise the coastline of British Columbia some on short day junkets to nearby destinations, others taking up the challenge of travelling substantial portions or even all of the lengthy shoreline.

2. Marine Features & Environments (VMEFs) of Importance to the Activity:

Sailing and yachting are recreational activities in and of themselves but also serve as a transportation mode and staging for diverse other activities including all of the other marine recreation categories used in this report. Thus, in addition to their being certain attributes of unique or specific importance to this use group, all of the other VMEFs noted under sports fishing, diving, sea kayaking, marine wildlife viewing and shore-based activity, will also, for significant numbers of pleasure boaters, be significant. This is especially so for those recreational boaters who are not merely traversing the BC coast but who stop for one or more days to anchor and enjoy the amenities of many way points.

Because so wide an array of attributes can matter to those engaged in coastal cruising, no summary statement can be made about the state of knowledge concerning VMEFs significant to this activity. Nonetheless there is probably no other marine recreational activity for which so many thorough compilations of information have been prepared. The series of guides by Wolferstan focusing primarily on the south coast and the more recent coastwide documentation by Douglas and Hemingway-Douglas (1996, 1997) are rich and important sources for generally understanding what relevant attributes occur where. As well each issue of the periodical *Pacific Yachting* includes detailed maps and descriptions of particular stretches of coast as well as informative brief articles on so-called "gunkholes" (relatively shallow water coves and passages that are usually less

well-known and therefore appeal to those who seek "off-the-beaten-track" experiences). Generally, ARA et al (1992) identified the following as features important to coastal cruising:

- scenery (naturalness/degree of alteration, layering, specific features)
- wildlife viewing (marine mammals, seabirds etc.)
- Native heritage areas
- shoreline configuration (i.e. islet clusters, bays, narrow channels)
- coastal features (waterfalls, tidal rapids, hot springs, superior beaches, readily accessible coastal trails)
- areas of high availability especially of coho and chinook salmon
- adjacent mature forest
- excellent to good anchorages

3. Specific areas important to the activity in British Columbia:

The entire coast of BC has now become a destination or significant stopover for rapidly increasing numbers of recreational boaters. By its nature this activity is spatially extensive – it is moving from place to place and experiencing a variety of conditions rather than being in one outstanding location that is most important. Thus, for example, the ARA et al (1992) Map Folio for the Coastal Tourism Inventory portrays many 100s of kilometres of high or very high capability coast for multi-day cruising -- one day only cruising, naturally, is less widespread as it is limited in area by the range of recreational vessels based at a shore accessible a marina or small craft harbour. In terms of popularity certain areas of the coast are clear leaders. These include the Gulf Islands, Desolation Sound and the Sunshine Coast. This high ranking is, of course, as much or more a function of proximity to human population concentrations and related services as it is to the presence of the VMEFs and natural attributes listed above.

Despite the large size of areas important to this recreational activity, there are several ways in which users tend to identify more localized and special places and features. One would be any place that rates high in the combination of quality scenery, shore-based features, wildlife viewing etc. A second more spatially limited category of valued environment comprises so-called "safe anchorages."¹³ ARA et al (1992) notes that the BC Council of Yacht Clubs maintains a data base on anchorages, based on accessibility, protection, water depth, suitability of the bottom for anchoring and on access to fresh water. There is also great detail on and descriptions of good anchoring sites in the recent coastwide two volume set by Douglas and Hemingway-Douglas (1996, 1997).

4. Comments re Provincial, National or Global Significance of Sites Used by Activity:

As with other marine -related recreational activities, BC is increasingly described as being overall one of the best destinations world-wide, a place where both wildness and relatively safe and well serviced cruising can take place. In Nash's succinct phrasing, it is the "last best place" (in Douglass & Hemingway-Douglas 1997). As noted, certain

subareas of the coast that are relatively close to population centres are especially attractive; it would follow logically that these favoured places in a globally exceptional region are themselves of national or international level significance.

5. Further Reading re Distribution of Activity:

Wolferstan (1991) and Douglas and Hemingway-Douglas (1996, 1997) provide coastwide detailed descriptions of the nature of BC's marine environments from a coastal cruising perspective. The periodical, *Pacific Yachting* which focuses on cruising on the BC coast, carries articles often with vivid sub regional accounts of particular routes. Anne Vipond's occasional rating of "best features" are quite useful in visualizing coastal features such as beaches or trails from a sailing perspective. (Hill 1985, 1994) provides a light-hearted account of experiences sailing the south and north coasts of BC which includes a wealth of descriptions of specific and favoured sites.

SEA KAYAKING AND ITS VMEFS

1. Brief description of the activity:

Sea kayaking has grown to be one of the most popular recreational activities in BC over the past two decades (ARA Consulting Group Inc. 1991). The kayak's light weight, ease of handling, sea worthiness and virtually zero draught, make it an ideal vessel for exploration of the widest range of BC marine environments.

2. Marine Features & Environments (VMEFs) of Importance to the Activity:

Because sea kayaks can navigate in areas inaccessible to almost any other means of conveyance, users in this category have a range of valued features and environments of interest and importance, unparalleled among marine recreational activities. Kayakers are also quite demanding and discerning in regard to environmental quality seeking in particular natural, undisturbed shorelines, quiet and solitude. As with coastal cruising and distinct from the other marine recreational activities here, it must be kept in mind that the activity is inherently about "moving around." This means that in addition to site specific features that may serve as stopovers or even destinations, corridors or routes which may be many tens or even hundreds of kilometres long, are equally sought. For this reason some of the prime kayaking "sites," including ones already protected from extractive activity (see below) are relatively large subregions of the BC coast. It should be noted that a major distinction between multi-day coastal cruising and kayaking is that the latter requires suitable places to bring the "vessel" safely ashore and to camp. This means that many of the steep-sided sections of BC's numerous fjords do not work as prime destinations for kayakers. Dependency on and enjoyment of terrestrially based amenities is obviously higher for kayakers than for sailors.

Another implication of the mobile nature of this activity for the subject of the present study is that one of the overarching "values" sought on a journey is variety of experience. This makes it inappropriate to state categorically that certain kinds of locale are most

favoured or that kayakers seek sheltered anchorages and passages etc. Experienced paddlers appreciate times of easy sheltered travel but also welcome the challenges of more turbulent and even unpredictable settings. As a result, "...virtually no waters along the coast are off-limits to a capable sea kayaker" (Ince & Kottner 1982, p.17).

The following, then, are the valued marine environments and features important to sea kayaking, based on ARA et al (1992) and on popular writings about the sport (e.g. Ince & Kottner 1982).

- variable and distinct shoreline configuration & type;
- variable sea conditions, ranging from challenging to calm
- sites for landing/camping (preferably with fresh water at hand);
- diverse and changing flora and fauna;
- natural shoreline features (waterfalls, hot springs, trailheads, superior beaches, tidal falls & rapids)
- presence of archaeological or historical resources;
- natural-appearing & unaltered scenery
- mature forest along routes (especially, absence of conspicuous logging)

3. Specific areas important to the activity in British Columbia:

A few well known single site destinations are famously attractive to kayakers particularly if access by other means is difficult and therefore the numbers of visitors at any one time are kept small. Examples of such sites are Ninistints (Anthony Island) near the southern tip of Haida Gwaii (the Queen Charlottes); and the geothermal hot springs, notably the several sites on the fjords and passages leading to Kitimat; Hot Springs Cove on Clayoquot Sound and Hot Spring Island in Gwaii Haanas National Park Reserve.

But in general discussion of prime kayaking locations refers more to broader areas where a journey rather than a single destination is the object. In recent years, sea kayaking has expanded such that most areas of the coastline are visited relatively frequently. Several of the areas most favoured over time have become part of large scale protected areas: Gwaii Haanas on Haida Gwaii, the Broken Group islands, now within Pacific Rim National Park and the Hakai and Fiordland Recreational Areas on the Central Coast are the most noteworthy examples of large protected zones where perhaps the prime recreational activity is multi-day sea kayaking. Because of the ease of reaching them from BC's major human population centres, the Gulf Islands probably continue to be the most frequent destination for day or short multi-day kayaking trips.

4. Comments re Provincial, National or Global Significance of Sites Used by Activity:

British Columbia's coast is one of the prime destinations for kayakers in Canada and North America because of the diversity of shoreline and experiences and the year-round ice free conditions.

5. Further Reading re Distribution of Activity:

Ince & Kottner (1982) remains the principal work about sea kayaking covering the entire coast of BC. Several periodicals include Wave-Length and Sea Kayaking publish articles with detailed accounts of particular itineraries and the features and amenities along the way.

SCUBA DIVING and its VMEFS

1. Brief description of the activity:

SCUBA (Self contained underwater breathing apparatus) diving is among the fastest growing recreational activities world-wide and in British Columbia. It allows for the uninterrupted opportunities to observe natural as well as human-made features of the underwater environment. As such it is the recreational activity with the most intimate direct contact with the marine environment per se - note that other categories tend to be as much or more reliant on coastal land-based features and environments as on marine ones.

2. Marine Features & Environments (VMEFs) of Importance to the Activity:

Recreational divers can be separately or simultaneously seeking several different kinds of experience. Nonetheless, the quality of the diving experience (and therefore the relationship between what is valued and what a potential MPA offers) can be understood in terms of several main motivations - spear fishing, observation of marine life and natural geological features (caves, sea arches), and "wreck diving" are among the most common.

In addition to important factors which are not germane to the selection of MPAs (e.g. proximity of sources of air for refilling tanks), there are several key attributes valued by most recreational divers and which make one site preferred to others. These include:

- outstanding marine life (see table below);
- high aquatic visibility and transparency;
- presence of diverse sea surface topography such as underwater caves, lava tubes and arches;
- relatively calm surface waters;
- presence of archaeological or historical resources (shipwrecks being the most popular);
- appealing scenery en route to the dive site.

3. Specific areas important to the activity in British Columbia:

A number of different compilations have been made of the high quality dive sites of British Columbia. Obviously these change through time. Ernst and Whinney et al. (1980) included no premier BC dive sites north of Bute Inlet. Today some of the best diving in the world is said to be on Northern Vancouver Island and the Central Coast. Bearing in mind the highly subjective nature of such list, Tourism BC (1997) cites a compilation prepared by Diver Magazine which included the following:

Site	Key Features
Browning Wall (Queen Charlotte Strait) The Coral (Agamemnon Channel) Discovery Passage (Campbell River)	soft pink coral wall with high visibility gorgonian corals at 50 m. depth large boulders w. strawberry anemones and other diverse invertebrates
Dodd Narrows (Northumberland Channel)	kelp canopy, abundant rockfish, sea bass, corals and sponges
Hunt Rock (Queen Charlotte Strait)	abundant protected sea life and seals, sea lions
Race Rocks (Juan de Fuca Strait)	large area encompassing many diverse habitats and species
Gwaii Haanas Park Reserve	terraced ledges, pink & plumose anemones, corals, orcas nearby
Stubbs Island (Johnston Strait) Tyler Rock (Barkley Sound)	six-gill sharks at undersea pinnacle, black plumose anemones
Whytecliff Park (Howe Sound)	very diverse rockfish and invertebrate communities
Broken Group (Barkley Sound)	many different sites with rich marine life and wrecks
Porteau Cove (Howe Sound)	enhanced reefs and wrecks, intentionally sunk vessels, MPA
Saltery Bay (Powell River)	diverse marine life, bronze statue of mermaid (!)

4. Comments re Provincial, National or Global Significance of Sites Used by Activity:

Frequent reference is made to the coastal waters of BC as being among the world's best for SCUBA diving. As with similar comments about other marine related recreation opportunities the statements appear to have some validity but are difficult to substantiate in any rigorous manner.

5. Further Reading re Distribution of Activity:

Ernst & Whinney et al (1980)'s assessment of tourism potential related to diving is now somewhat dated in terms of extent of activity in BC but still useful on the basic criteria sought by divers. Diver Magazine (published in Vancouver) carries many detailed

description of particular destinations along the coast. Similar qualitative information appears in such books as Frame (1989), Pratt-Johnson (1994, 1995).

MARINE NATURE OBSERVATION

1. Brief description of the activity:

Marine nature observation refers to the purposeful activity of finding and observing species that are either wholly marine or which by virtue of being significantly dependent on marine habitat, are observed in marine environments. For purposes of classification, we suggest that the term be used inclusively for all recreational observation of all living species including, in addition to mammals and birds, organisms such as seaweeds, intertidal invertebrates etc. In some cases the focus of attention may be non-biological, such as particular geologic formations or viewing of dramatic physical processes such as tidal rapids.

Potential for growth in this area of recreation is enormous especially in light of the steady increase in eco-tourism in BC. There are now at least two communities that host annual festivals based on the presence of marine waterfowl - Parksville-Qualicum with its Brant festival celebrating the stopover of thousands of these geese; and the Trumpeter swan festival in Courtenay.

It should be noted that the distinction between recreational observation and scientific study is never a sharp one and is being intentionally "blurred" by initiatives such as the UBC-based "Coastal Ecosystems Research Foundation" 14 which attracts paying eco-tourist participants for cetacean studies on the Central Coast of BC. Further it is also to be noted that all of the other recreational categories used in this report, attach some degree of importance to the opportunity to see marine organisms. We treat it as a separate category primarily because of the growth in recreation specifically focused on nature observation .

2. Marine Features & Environments (VMEFs) of Importance to the Activity:

Nature observation depends on the continuing thriving of the preferred species and these in turn depend on habitats and combinations of the right environmental factors which are specific to each kind of organism. This is to say there are as many such combinations as there are species. It is not possible therefore to speak at the aggregate level about the kinds of habitat features that each of the above categories are associated with and which therefore would be looked for in marine protected area identification. At this point, it is probably sufficient to conclude that the values and interests of those engaged in marine nature observation would be adequately met by sufficient attention to conservation values as outlined in section 3.1. For this reason, we do not break out a separate list of VMEFs in connection with this recreational activity. In later stages of a strategy, especially when boundaries and zones are delineated, a more explicit account would need to be taken of requirements and preferences from a nature observation perspective.

The following table outlines the principal groups, communities or features currently attracting targeted nature observation.

Marine Mammals	<ul style="list-style-type: none">• cetaceans (killer whales, porpoises, gray and other baleen whale species)• Pinnipeds (seals, sea lions)• Sea otters
Seabirds	<ul style="list-style-type: none">• alcid (puffins, murre, guillemots, auklets, murrelets) colonies• bald eagle concentrations (e.g. at herring spawn locations)• summer concentrations of moulting sea ducks, other pelagic birds of many varieties
Waterfowl and Shorebirds	<ul style="list-style-type: none">• concentrations of migratory waterfowl• intertidal areas with high concentrations of wading and shorebirds
Mixed Shorelife	<ul style="list-style-type: none">• including tide pools and areas rich in macro algae
Non-biological structures & phenomena	<ul style="list-style-type: none">• Unique geologic formations, high current tidal rapids

3. Specific areas important to the activity in British Columbia:

Simple aggregate statements cannot be made with any confidence about the distribution of the above taxa or other natural features. Efforts have been made to identify highest ranking sites for nature observation: Ethos Consulting et al. (1988) included interviews with numerous stakeholders. On this basis the authors derived a list of 51 "choice sites" for all of BC including 10 where the major attractions listed were marine or marine-dependent organisms. These were (listed alphabetically):

- Blackfish Sound in the Broughton Archipelago (orcas)
- Boundary Bay (sea birds and wintering migratory waterfowl)
- Bunsby Islands (sea birds and seals)
- Courtenay River estuary (waterfowl, notably Trumpeter swans)
- Pacific Rim National Park (marine mammals, seabirds, shorebirds, intertidal life)
- Parksville-Qualicum (for migratory Brant geese)
- Reifel Bird Sanctuary (migratory waterfowl & shorebirds)
- Rose Spit (sea and shore birds)
- Sea Island/Iona Island (seals, seabirds, shorebirds, waterfowl)
- South Moresby (Gwaii Haanas) national park Reserve (marine mammals, seabirds, shorebirds, intertidal life)

- Squamish Estuary (seals, seabirds, waterfowl & shorebirds)

Other well known concentration areas for nature observation include the Scott Islands for sea bird colonies and sea lions; Race Rocks near Victoria and Mitlenatch Island in the northern Strait of Georgia, both with a wealth of diverse marine mammals and shorebirds; and Botanical Beach, west of Victoria home to an accessible and diverse array of intertidal life. Annual herring spawns in several locations on the Strait of Georgia and its fjords attract large numbers of "charismatic" predators such as eagles and pinnipeds and, so, are increasingly drawing human observers.

4. Comments re Provincial, National or Global Significance of Sites Used by Activity:

See comments regarding national and international significance in the relevant conservation VMEF - seabirds (VMEF#22) shorebirds and waterfowl (VMEF#23, and marine mammals (VMEF#24).

5. Further Reading re Distribution of Activity:

See Ethos Consultants et al. (1988) regarding recreational potential associated with marine and other nature observation sites; see also references under Conservation VMEFs, especially #s16 - 24.

SHORE-BASED MARINE DEPENDENT RECREATION AND ITS VMEFS

1. Brief description of the activity:

In addition to the preceding 5 activities which are pursued primarily on or in the water, a number of important activities that take place along the shore depend primarily on marine attributes. Obvious examples within this "catch-all" category include beach day use for sunbathing, swimming, sand-castle building festivals, snorkelling, surfing etc.; recreational clam-digging; beach-combing for both natural objects such as shells and for intriguing human-made objects such as the stray glass floats once used by Japanese high seas fishing fleet so prized by beachcombers in exposed areas such as the west coast of Vancouver Island and North Beach on the Queen Charlotte Islands / Haida Gwaii. There is no sharp boundary to be drawn between such primarily marine-dependent recreational activities and ones for which the proximity of the sea is appreciated but not fully essential to the recreational experience (e.g. hiking coastal trails which provide frequent seascapes en route, as well as some of the above opportunities if hikers so choose. 15 Nature observation (which has been separated out and which can be pursued on the shore or on the water) is also an important activity as seen in the use (sometimes excessively) of especially rich areas such as Botanical Beach west of Victoria. Finally, shore based sports fishing is a very popular activity on many wharves and waterfronts but its marine environmental values are best considered in sports fishing generally.

2. Marine Features & Environments (VMEFs) of Importance to the Activity:

These are as varied as the activities themselves. Coastal hiking (the least truly marine dependent of these shore-based activities) in principal can be pursued virtually in any part of BC's 29,500 km shoreline. This is to say that all of the major shoreline types can be locations for trails in whole or in part. The other marine dependent shore based recreational activities occur preferentially on areas of the coast where a reasonably wide foreshore and intertidal zone exist. Beaches with substantial sand content are the preferred areas for day use activities such as sunbathing, swimming and surfing. Substrate, for these activities, is important in making the activity a comfortable one. Water temperature is also a significant variable for recreational swimming in particular (some beaches that have quite cold water are nonetheless used by many people who stay on the foreshore. Key to clam digging is the availability of target species (butter clams, manila, littleneck and razor being the most commonly sought after), a function both of substrate and of the pressures on the resource from other recreational as well as commercial diggers. A major locational factor for the activity ion BC is the presence in the water column of naturally occurring toxin producing micro-organisms ("red tides") and of sewage pollution .

Activity

Beach day use (sunbathing, swimming, snorkelling, surfing, opportunistic nature appreciation)

VMEFs of Importance

- Shoreline type (sand-sized materials best)
- Scenery
- Readily observable marine & shore life
- Water temperature (warm favoured)
- Exposure (different degrees favoured by different uses)

Beachcombing

- Shoreline type (beaches as opposed to rocky shores or cliffs)
- Exposure (generally the more, the better)
- Scenery

Coastal hiking

- Diverse shoreline configuration
- Shoreline features (waterfalls, tidal rapids etc.)

Recreational shellfish-digging

- Shellfish in suitable concentrations, accessibility, acceptable water quality

3. Specific areas important to the activity in British Columbia:

Because of the diversity of activities actually subsumed under the current heading it is, again, best to provide examples of important sites in a tabular manner, separating out each main shore-based activity:

Activity	Well known examples of important sites for activity
Beach Day Use	Greater Vancouver area urban beaches (e.g. Jericho, Wreck, Kits Point, White Rock, Crescent Beach at White Rock) Greater Victoria (Mount Douglas, Cordova Bay, Island View) Parksville-Qualicum Long Beach (Pacific Rim/Tofino area) North Beach (Masset - Rose Spit)
Beachcombing	Long Beach(Pacific Rim/Tofino area) Queen Charlotte Islands - North Beach, Tlell, Rennell Sound, Naikoon)
Coastal Hiking	West Coast Trail (Port Renfrew area - Bamfield) Juan de Fuca Trail (south Vancouver Island) East Beach (Naikoon Park) Cape Scott Trail (northwest Vancouver Island)
Recreational shellfish-digging	Savary Island (n. Strait of Georgia), Baynes Sound (but note frequent recent closures re contamination) North Beach of Graham Island for razor clams (Haida Gwaii)

4. Comments re Provincial, National or Global Significance of Sites Used by Activity:

Several of the shore-based marine recreational sites noted above are certainly known well outside of BC. Perhaps the most famous is Long Beach within Pacific Rim National Park but the extensive recreational beaches sites in Vancouver are also widely known. The West Coast Trail is an internationally known challenge for hikers attracting visitors so widely and numerous that a quota system has had to be implemented.

5. Further Reading re Distribution of Activity:

A good general overview of all varieties of recreational activity in BC is Nanton & Simpson (1996). It includes much more than shore based marine recreation but is strong on such features. Gill (1995) is authoritative regarding the West Coast Trail while Obee (1986) covers well the diverse recreational amenities of the whole Pacific Rim National Park and vicinity. Snively (1978) and Harbo (1988) guide readers to the many biological features of shore exploration although with far more reference to species than sites.

Summarizing Marine Recreational Values

The above discussions of 6 categories of marine-dependent recreation together yield a wide array of valued environments and features. Table 3.2-2 encapsulates the lists of such VMEFs from all activities without any attempt to eliminate duplicates or similar items. We have not taken this overview the next step of attempting to determine how widely distributed each feature is nor how instances of each could be rated. Some work in this direction was undertaken by ARA et al (1992). Their Coastal Tourism Resources Inventory used extensive focus group sessions with representatives from major coastal tourism sector to identify 12 "resources":

- depth
- shoreline configuration
- marine birds
- scenic resources
- exposure
- shoreline features
- marine mammals
- native heritage
- shoreline type
- fish resources
- mature forest
- Eurasio-Canadian heritage

Approaches were then developed to select representative parameters for which data could be found, and thereby to prepare base maps and Geographic Information System (GIS) structures to allow ready access and updating/improvement of information. A similar procedure can be undertaken for the marine recreational VMEFs identified here since many of them are like or even identical to those referred to as "resources" in the ARA et al work.

The following tables are used to display and, then, condense (removing repeats) the VMEFs that have been identified as most important to the six principal marine related recreational activities discussed here. It should be noted that while these were intended to be the VMEFs not explicitly covered already in our discussion of conservation values (section 3.1), there are some which are obviously closely related to such values. As elsewhere in this report, there is much less concern for redundancy than accidental omission of important categories of value.

The first table (3.2.2) is in disaggregated form, simply reproducing in one place the summary of important VMEFs within each recreational activity description.

The second table (3.2.3) condenses all such VMEFs within one list without repeats. An effort has been made to put basically identical as well as very similar valued environments together. This like any "aggregating step" sacrifices some information and detail (Alexander 1964) but it does make for a somewhat more manageable set of VMEFs that can be a start, at least, for the recreational component of identifying and selecting MPAs.

Table 3.2-2: Listing of recreational VMEFS by activity.

Sport Fishing

- Areas where there is a reasonable prospect of fishing success (related complexly to the proximity of productive salmon streams, rockfish habitat etc.)
- Coastline scenery
- Other marine attractions that can be observed incidentally to fishing (marine mammals, Native heritage sites)

Coastal Cruising (power & sail)

- Scenery (naturalness/degree of alteration, layering, specific features)
- Wildlife viewing (marine mammals, seabirds etc.)
- Native heritage areas
- Shoreline configuration (i.e. islet clusters, bays, narrow channels)
- Coastal features *waterfalls, tidal rapids, hot springs, superior beaches, readily accessible coastal trails)
- Areas of high availability especially of Coho and Chinook salmon
- Adjacent mature forest
- Excellent to good anchorages

Sea Kayaking

- Variable and distinct shoreline configuration & type;
- Variable sea conditions, ranging from challenging to calm
- Sites for landing/camping (preferably with fresh water at hand);
- Diverse and changing flora and fauna;
- Natural shoreline features (waterfalls, hot springs, trailheads, superior beaches, tidal falls & rapids)
- Presence of archaeological or historical resources;
- Natural-appearing & unaltered scenery
- Mature forest along routes (especially, absence of conspicuous logging)

Scuba Diving

- Outstanding marine life (see table below);
- High aquatic visibility and transparency;
- Presence of diverse subsea surface topography such as underwater caves, lava tubes and arches;
- Relatively calm surface waters;
- Presence of archaeological or historical resources (shipwrecks being the most popular);
- Appealing scenery en route to the dive site.

Marine Nature Observation

- Marine mammals
- Seabirds
- Waterfowl concentrations
- Mixed shore life including tide pools and areas rich in seaweeds
- Non-biological natural features & unique formations - e.g. high current tidal rapids

Shore-Based Marine-Dependent Recreation

- Shoreline type
- Scenery
- Readily observable marine & shore life
- Water temperature (warm favoured)
- Exposure (different degrees favoured by different uses)
- Diverse shoreline configuration
- Shoreline features (waterfalls, tidal rapids etc.)
- Shellfish in suitable concentrations, accessibility, acceptable water quality

Table 3.2-3: Condensed listing of marine recreational VMEFS.

Note: The following VMEFs were developed from the list of activity-specific environments and features of importance as presented in Table 3.2.2. This "amalgamation" is necessarily a judgmental step rather than one that can be described as technical-analytical. See Bacow (1980) and Elliot (1981) for excellent reviews of the distinctions between technical and judgmental approaches, including when each is feasible and necessary.

-
1. Shoreline configuration (i.e. islet clusters, bays, narrow channels)
 2. Shoreline type (including sites suitable for kayak landing/camping (preferably with fresh water at hand)
 3. Sea conditions -Variable sea ranging from challenging to calm, relatively calm surface waters for diving
 4. High aquatic visibility and transparency
 5. Water temperature (of direct significance primarily for swimming, surfing)
 6. Marine life (harvestable) -areas where there is a reasonable prospect of fishing success (related complexly to the proximity of productive salmon streams, rockfish habitat, clam beds etc.)
 7. Marine life (for observation) - diverse and changing flora and fauna; wildlife viewing opportunities (marine mammals, seabirds etc.), rich, colourful benthic life (for diving)
 8. Natural coastal features (waterfalls, tidal rapids, hot springs, superior beaches, readily accessible coastal trails,)
 9. Native heritage areas, presence of archaeological or historical resources

10. Coastal scenery - natural-appearing & unaltered coastline, naturalness/degree of alteration, layering, specific features) mature forest along routes (especially, absence of conspicuous logging)
 11. Interesting subsea surface topography such as underwater caves, lava tubes and arches
 12. Good Anchorages (which depend for quality on a combination of protection from waves, wind, adequate depth, suitable substrate for anchoring)
-

The following are some very brief annotations regarding the condensed list of "recreation VMEFs" derived in this report. Even more so than for the Conservation VMEFs, it must be stressed that there is no objective "scientifically defensible" basis on which this list can be said to be definitive or final. In the final section of this report, some discussion will follow regarding the primarily heuristic role of this compilation of recreation VMEFs.

1. Shoreline configuration (i.e. islet clusters, bays, narrow channels)

Shoreline configuration refers to the extent of indentation and shaping along the coast. ARA et al (1992) provide a suitable classification scheme for consideration. More extensive work on shoreline mapping by Harper et al (in press) provides further detail that could be used to categorize shorelines during

2. Shoreline type

This refers primarily to the substrate - i.e. rocky shores, sand beaches, mudflats etc. See outline in Conservation VMEF# 3. ARA et al (1992) have developed a detailed classification system for coastal tourism and discuss the availability of data. More recent ongoing work by Harper et al (1993, 1994, 1996, in press) should be used in MPA planning.

3. Sea conditions

Sea conditions usually refer to the prevailing range of exposure to winds of varying directions, waves, currents and interactions among these. Obviously such sea conditions are quite variable but gross distinctions can of course be made among areas. ARA et al. Data on winds, wave heights, tides etc. are regularly gathered and reported by Coast Guard Canada on the basis of approximately a dozen recording buoys and upwards of 20 manned lighthouse stations. More fine-grained information on sea conditions in the almost innumerable passages and inlets of the coast can only be gained from locally knowledgeable mariners although coastal cruising guides provide extensive if anecdotal discussions of local conditions in many areas.

4. High aquatic visibility and transparency

The penetration of light to considerable depths is a major factor for SCUBA diving. While transparency at any location varies with time, there are clearly some locations which are well known for unusually good visibility at depths of 60m or more (e.g. Goletas Channel off northeast Vancouver Island). We are unaware of any coastwide efforts to rate something like an average transparency for different water bodies.

5. Water temperature

From a recreational standpoint, water temperature is primarily of interest to swimmers and surfers. Much of BC's marine environment even in summer is only marginally bearable without diving suits. This means that the relatively few locations which have higher temperatures such as some areas in the northern Strait of Georgia (e.g. Savary Island) will have special appeal for shore-based recreation.

6. Marine life (harvestable)

Areas where there is a reasonable prospect of fishing success (related complexly to the proximity of productive salmon streams, rockfish habitat, clam beds etc.) See comments under the section on sports fishing above. In aggregate, a great deal of resource-specific information is regularly compiled by Fisheries and Oceans Canada on the many vertebrate and invertebrate species which are recreationally (as well as commercially) harvested in BC.

7. Marine life (for observation)

Included here are diverse and changing flora and fauna; wildlife viewing opportunities (marine mammals, seabirds etc.), rich, colourful benthic life (for diving). The opportunity to view interesting marine life is, by definition, the core of "marine nature observation" but is also reported as important if ancillary by most other marine-related forms of recreation (ARA et al 1992). Discussion of the availability of information about the different categories of key marine organisms appears in Conservation VMEFs C23 to C26.

8. Natural coastal features

These include waterfalls, tidal rapids, hot springs, superior beaches, and readily accessible coastal trails. Note that most of these features important to several marine recreational activities are not marine per se but rather located on adjacent coastal lands (the exceptions being intertidal portions of beaches and phenomena such as high velocity tidal rapids as seen at Skookumchuck and Seymour Narrows). ARA et al (1992) have documented the availability of and access to information on the distribution of these principal coastal features.

9. Native heritage areas, presence of archaeological or historical resources

From recreationalists' perspective, interesting native heritage includes old village sites, sites where there are one or more remaining totem poles, shell middens and other relatively visible physical remnants of Native culture. Most such sites are well known and many are protected as archaeological sites. It is essential to refer here to the discussion below in section 3.3. regarding the very different and far broader Native interpretation of what is significant.

10. Coastal scenery

High quality scenery is an aggregate property involving such factors as natural-appearing & unaltered coastline, naturalness/degree of alteration, layering, specific features, mature forest along routes (especially, absence of conspicuous logging). As with coastal features,

it is to be noted that scenery is very much about the character and configuration of lands adjacent to marine water bodies (except for divers). It is the combination of interesting and natural-appearing topography, forests, waterfalls etc. which renders some locations of special importance in terms of scenery. Inventories of the condition of the scenery along marine travel routes have been compiled (e.g. Catherine Berris & Associates) 1993 although no coastwide survey exists.

11. Interesting subsea surface topography

In addition to water transparency and readily observable marine life, the conformation of the bed of coastal water bodies and especially the presence of relatively rare geologic forms - such as underwater caves, lava tubes and arches - are of high importance in dive site preferences. Many of the prime diving areas in BC have been described in popular literature (e.g. Frame 1989, Pratt-Johnson 1994, 1995) where reference is to any remarkable subsea surface topographical features. There remains, of course, a vast subsea area nearshore and farther out, for which no such descriptions or information are available.

12. Good anchorages

A good, safe place to moor recreational vessels is defined in terms of several factors including protection from prevailing and storm waves and winds, adequate depth, and suitable substrate for anchoring. There are several very detailed guides to coastal cruising in BC (Douglass & Hemingway-Douglass 1996, 1997; Wolferstan 1991) which describe where anchorages of differing characteristics and overall quality are to be found. The Council of BC Yacht Clubs also keeps information on the location of safe anchorages. Recently an initiative involving the Council has been undertaken in cooperation with the provincial government to identify "safe havens" along the coast. The focus is on single-day cruising, i.e. within 40 km of usual launching harbours and incorporates the above factors as criteria. Approximately 125 such havens have been listed so far (Judy Stanley, Council of BC Yacht Clubs, pers. comm.).

"Hard Case" Intangible "Recreational" Values

For completeness, let us now briefly consider not so much what the less tangible VMEFs are in the BC context but rather how to think about them within a future MPA identification and selection process. As noted already, there has been much recent attention to and widening acceptance and use of techniques for objective scenery or visual quality assessment of the coastal zone (Miller 1984, Catherine Berris & Associates 1993). But there remain many ways that humans value the marine environment that resist objective, professional assessment. They are frequently called intangibles, a misleading term because, the roots of this word mean literally that which cannot be touched, implying a less than direct experiencing. What is no doubt meant is that these kinds of value are "incalculables" or "immeasurables" since there is really no difficulty in directly sensing their importance. Consider these words of appreciation for the Strait of Georgia, penned by the well-known BC author and journalist Arthur Mayse:

What has it done for me? Well it has given me any number of sunsets. Sunsets when the seas were painted, and the mountains were purple. It has also given me

a few sunrises, but I cannot say I am much of an early riser. Fishing: I am sure I have had some of the best fishing in the world from the Strait's salmon, cod and flounder... One night off Porlier Pass my son, Ron, hooked into a heavy spring salmon. He played it while the moon was rising over the side hills, and the moon was high over us when we finally got it in the boat. It was his birthright, and it had a profound influence on my son, because he grew up to love fishing and the outdoors. I am grateful for the many gifts we have received.

(Mayse 1991, p. 17-18).

Few people who have lived by or spent significant times at sea would find Mayse's tribute hard to grasp. Hard to measure ? Probably, but we would miss a very significant dimension of that which is valued if we neglected the consideration in planning of these feelings, ones on which the struggle to create MPAs will continue to rely.

As noted, one so-called "intangible" has actually become subject to quite rigorous and sometimes even quantified analysis over the past several decades - we refer here to the scenic qualities associated with marine and coastal areas. Respectably reproducible results can now be obtained by systematic analysis of land and seascapes in and around potential protected areas. This can be as much a management tool in insuring that which justifies treating a site specially does not disappear. An excellent example of use of such tools appears in Catherine Berris and Associates (1993) draft plan for scenic corridors in and around Clayoquot Sound. Miller (1984) provides other cases and reflections on alternative methodologies for visual assessment approaches. While arguments would likely abound if one was to start asking where the most scenic, perhaps internationally significantly scenic marine areas of BC are, these techniques should be added to the multi-variate assessment of potential areas of interest for MPAs on a routine basis.

When we move to the other and still very much hard case intangibles, it becomes far less clear how these are to be understood and applied for MPA selection. It could even be quite difficult to establish consensus on what these things are. Mention has already been made of Blomberg's (1982) typology of coastal values which she adduced from a selective reading of poetry and prose, works "which relied most heavily on or seemed most deeply influenced by the coastal environment." (Blomberg 1982, p.57). From that reading she came up with the following groupings of "the common threads in perceptions of and values found at the coast:"

1. Life: place of our ancestral beginnings...sense of continuing creation, vitality, sea as the 'pulse of the cosmos,' rhythm...
2. Time, or timelessness: sense of the ancient, eternal...
3. Space and distance; endlessness, openness, infinity, scope, wilderness, frontier, the sense of great distances travelled..
4. Imperviousness to man and man's actions; impersonality; anonymity, erases and covers man's intrusions, untamed...
5. Energy, conflict, and contrast: battle and/or contrast between land and water...
6. Mystery and spirituality: enchanted, holy, magical.

Blomberg's discussion and side comments indicate how hard a time she had in developing this framework and she makes no claim that it is an exhaustive list for that which cannot be measured yet is so intensely felt. It would not be surprising if another author, and much more so a collection of MPA planning team members, was unable to reach easy agreement on the list and then its application to particular cases. Yet, we feel strongly that it is essential to grapple with the identification of such values so that the whole exercise of MPA planning does not completely lose sight of those harder to talk about reasons why individuals and groups become committed to and enthusiastic about protecting marine areas. For it may well be that the public's energy and motivation comes from, and is maintained more by those "hard case" intangibles than by many of the other sorts of rational and systematic information gathered and analysed in marine area protection. Individual thinking and dialogue about the values that really move people could be structured in British Columbia not necessarily around a published framework like Blomberg's (although reviewing her article might be stimulating of new ideas for a MPA planning team); instead, we would suggest that there already exists a substantial literature of biographies, journals, museful travelogues, fiction and poetry specific to the BC marine environment (e.g. Hill 1994, Iglauer 1988, Raincoast Historical Society 1984, Steltzer & Kerr 1979). Reading and reflecting upon these kinds of literature in conjunction with a framework such as Blomberg's could enable MPA planning team members to creatively develop their own ways of incorporating critical but difficult values associated with individual and collective meanings, subjectivity, spirituality, sense of place and the like.

3.3 Cultural Heritage Valued Marine Environments and Features

Scope: What is included under "Cultural-Heritage?"

In the past fifteen years the scope of what is included in a survey of cultural heritage has been undergoing major change. Until quite recently it meant looking at the physical relics of the past and also recognizing sites for which there was solid archival evidence of important events or historic periods. This included archaeological features which in North America mean the remnants of pre-contact Aboriginal cultures - middens, old village sites etc. - and post-contact features such as historic sites, routes, ghost towns and trade routes. An example of this constrained definition and one quite relevant to the subject of this study is the definition used in the draft Buenos Aires Draft Convention on the Protection of the Underwater Cultural Heritage:

"For the purposes of this Convention:

1. "Underwater cultural heritage" means all underwater traces of human existence including:

(a) sites, structures, buildings, artifacts and human remains, together with their archaeological and natural contexts; and

(b) wreck such as a vessel, aircraft, other vehicle or any part thereof, its cargo or other contents, together with its archaeological and natural context."

These kinds of cultural heritage resources remain a focus for much work but there is now wider recognition for sites whose significance has others foundations - oral histories, culturally important stories and "myths," as well as resource use and ceremonial locations used in the past and into the present. The recent report on "First Nations' Perspectives of the Scientific Panel for Sustainable Forest Practices in Clayoquot Sound, provides an excellent review of this broader "canvas" of cultural heritage values (Clayoquot Sound Scientific Panel 1995, see especially chapter 4). Included in addition to the usual cultural heritage resources associated with archaeological and historic sites are sacred areas, and a more broadly defined "historic areas" comprehensive of what are now called "Traditional Use Sites" (see also BC Ministry of Forests 1996).

It should be noted that a distinction appears to remain between this more inclusive framework for cultural heritage now widely used in relation to First Nations versus a still quite constrained view of what is a cultural heritage value for non-indigenous British Columbians. We have not tried here to change this but would argue that with the increasing importance now being attached to the survival of long-standing non-Native coastal communities, Marine Protected Area planning will have in due course to recognize a wider suite of values related to such communities. Eurasio-Canadian marine cultural heritage is more than shipwrecks, involving, as indigenous culture does the web of stories, meanings and customary use patterns that constitute a culture. Elsewhere traditional but non-Native coastal villages have come to be recognized as highly valuable cultural resources - the recent designation of Lunenburg, Nova Scotia as a World Heritage Site is a strong indicator of this.

A final but important note should also be made about the extent to which land-based coastal cultural heritage values are to be included in a survey of "marine values." Rather obviously most humans spend most of their lives on land and for this reason, and also because marine locations traditionally were usually "fixed" in relation to points on the land, marine cultural heritage is taken to include places on the coast that have a strong marine connection.

Challenges of Overview and Strategic Assessment of Valued Marine Cultural-Heritage Environments and Features

While MPA programs usually have been initiated primarily to address conservation concerns there is now widespread recognition, if not consensus, that protecting places and resources of high cultural-heritage significance should be an integral part of MPA system development. There are pragmatic and substantive arguments in support of this. Winning the support of the public and especially of communities near candidate MPA sites depends on planning that takes into account what is culturally significant. This works two ways: 1) on the positive side, it means that the MPA strategy where possible ought to afford protection as needed to that which is culturally valuable; and 2) it also means that

consideration must be carefully given to the possibility that the establishment of an MPA could conflict with traditional and ongoing cultural practices. The fact of such potential conflict should not be seen as creating an either/or choice but rather as an incentive to collaborative planning which, as far as possible, results in a consensus on siting and management of MPAs meeting both ecological and cultural objectives.

A. First Nations "Starting Point Framework" of Valued Marine Cultural Heritage

Meeting the expectations of this study for this category has, however, been especially difficult. Our assignment was to identify what mattered most in this, as in the previous two main value categories, especially insofar as features could be considered of high-level significance (i.e. provincial, national and/or global). In British Columbia, the predominant cultural-heritage attributes, at least in terms of longevity, relate to First Nations. There are political and conceptual difficulties which we believe pre-empt any external assignment of such levels of significance to the features of the Northwest cultural complex. Let us try to be clear on the source of the dilemma.

In the historical past, the time which is the source of a large part of what is equated with "cultural-heritage values," First Nations of BC were organized into hundreds if not thousands of village-level cultures. To the outsider then, as now, the spiritual, communal and economic life of these villages seemed quite similar: but to those who lived in these places and to their descendants, the distinctions were, and are, highly significant. The "old people" lived by different priorities and, more obviously, the places that mattered to each group, including marine sites, varied in a complex way which is most difficult to appreciate today, especially in light of post-contact decimation of the original population and, therefore, of the traditional knowledge base of each distinct group. It should be emphasized that this highly specific local perspective so characteristic of First Nations world views, runs contrary to the priority placed in MPA selection on values that are deemed to be nationally or internationally significant. In other words, an integral aspect of cultural-heritage values is precisely their non-global, non-national ascriptions of what is significant.

From a political standpoint, today in BC it is simply "not on" to have outsiders determine the categories and the significance of that which is valued by First Nations. While there has been co-operation between First Nations and others on the designation of a few sites, these cases are quite limited and, from a Native standpoint, have been largely driven by what non-Native experts such as archaeologists and anthropologists value. Thus the major initiatives for naming and protecting cultural-heritage sites have been for places where there is physical evidence or written archival materials to provide a rationale for protection. This "limiting concept" (Clayoquot Scientific Panel 1995, p.26) is no longer acceptable as delimiting what is valued culturally by First Nations. We will return to some discussion of how cultural valuation is being expanded below. The point here is that there are two related and very strong trends, which we believe will gain momentum at treaty processes advance, which powerfully affect the identification and evaluation of "cultural-heritage values" as originally aimed for in the present study. These are:

- the necessity of having cultural values primarily defined by those whose culture it is (with the corollary that there will potentially be as many attributions of what is significant as there are enduring First Nations);and
- the ever growing expansion of the concept of "cultural heritage sites" from the physical / archivally recorded to a wider range of categories embracing dimensions such as the spiritual, oral historical, supernatural as well as the continuing exercise and evolution of traditional cultures.

In light of this we do not propose to advance a set of VMEFs as a basis for then providing a BC wide overview. It is more appropriate to put forward what could be called "process criteria" for the representation of cultural heritage category of VMEFs. That is, we are responding to the question "What are the key cultural heritage values" by saying how, within a marine protected areas strategy, to answer the question, and not by trying to provide the answer ourselves.

This does not mean that we say nothing in this section about relevant VMEF subcategories. Rather, we offer a "Starting Point Framework" in point form as one part of the recommended protocol for the consideration of cultural heritage values in Marine Protected Area identification and evaluation.

Significant Valued Marine Cultural Heritage Environments and Features: Towards Protocols for Identification and Evaluation

In lieu of advancing a list or catalogue as was done in the previous suggestion, we provide an outline of the steps that would be needed to develop and use such lists in the context of MPA identification and evaluation for subareas of the BC coast. Part (but only part) of this is a "Starting Point" Framework of Valued Marine Cultural Heritage Sites and Features - basically a worksheet from which co-operating First Nations, agencies and stakeholders could develop the cultural heritage component of MPA identification/evaluation. First let us say something about the necessary context within which such a tool could be used. We have referred to this as a Protocol on Marine Protected Areas.

Delineating the details of how such a Protocol could be achieved with voluntarily co-operating First Nations, is not within the scope of this work and here we need only outline the key elements. It should be noted that these ideas are not unfamiliar ones. The logic and underlying principles are becoming well established as First Nations and public governments develop and use the BC treaty process and forge Interim Measures Agreements such as the one between the Province and the Nuu-cha-nulth establishing the Central Region Board. The core elements needed are:

1. Hold direct meetings individually with coastal First Nations (or with collectivities depending on the willingness of groups of First Nations to work in that manner) to explore government and First Nation individual and mutual interests that could be served through Marine Protected Areas planning - this

should not await the point at which governments are urgently moving to initiate MPA planning.

2. Provided the meeting results in willingness by all parties to proceed, negotiate the terms and conditions under which co-operative designation of Marine Protected Areas can occur. Of prime importance will be agreement on:

- the objective(s) for marine protected area planning (which governs, among other things, the kind of information that would be gathered and selection criteria);
- any voluntarily entered curtailment of current actions or activities that could negatively effect the prospects for creating MPAs; and
- the kinds of information that are to be collected and the extent to which this information is to be public.

3. Stemming from the agreed upon objective, define the scope of valued attributes to be considered in identifying candidate MPAs and the process whereby decisions would be made based on those attributes.

The "Starting Point Framework" outlined immediately below would be a tool potentially useful in starting discussions about the kinds of data that would be needed from the participating First Nation(s)' perspective to adequately incorporate their sense of what is culturally valuable.

A. Starting Point Framework for Considering First Nations' Marine Cultural Heritage Values

The following is an outline, based closely on Traditional Use Study Program Guidelines (BC Ministry of Forests 1996) and, to a lesser extent, on the Clayoquot Sound Scientific Panel's report on First Nations' perspectives (Clayoquot Sound Scientific Panel 1995, section 4). It should be modified and used on a case-by-case basis in the identification of significant marine-related cultural-heritage values:

1. Archaeological sites - places where relics of ancestral activity are found;
2. Ceremonial and Religious Sites - a location vital to the performance of important ceremonies (e.g. "First salmon," purification site for whalers) or rites of passage, spirit quests etc.;
3. Commercial - a place where commerce is or has been transacted;
4. Cross-cultural interaction - a place significant to the interaction of two or more cultures (e.g. first contact sites, locations of conflict);
5. Cultural landforms/seaforms - features used to mark location for travel, cross-cultural boundaries, or named places significant to a group's mental map, collective stories(e.g. Rose Spit on Haida Gwaii as place where humans emerged from clam shell) etc.;

6. Food harvesting - a place of significance in the harvesting of marine foods (e.g. fishing sites, roe harvesting, clam and mussel beds, sources for chitons, abalone and seaweeds);
7. Material harvesting - a place where important non-food marine items are gathered (e.g. dentalia shells);
8. Traditional management areas - (e.g. clam and cockle beds where rock removal was practised to encourage better growth);
9. Recreation - a location where traditional and current marine-based recreation is pursued; and
10. Supernatural beings - a place associated with the past and present occurrence and activity of beings whose existence is not recorded by western science or others form outside the culture - the Haida's Wasgo and the Kwa'kwaka'wakw's Sisiutl are but two of the many sea monsters dwelling in this realm and often associated with particular places.

B. Eurasio-Canadian Marine Cultural Heritage Environments and Features

It was noted above that while the interpretation of what is included under "cultural heritage" has been rapidly expanding for First Nations, there appears to be no strong equivalent movement in regards to Eurasio-Canadian history and heritage. On the marine side proper, this yields a rather short list of potentially valued sites or features. Basically, the coastal and nearshore underwater cultural heritage resources are seen to consist mainly of:

- relics - shipwrecks, a few air plane crash sites and miscellaneous other remains of early industrial activities which happen to have become submerged;
- locations of special historic significance - points of early contact with First Nations (e.g. Yuquot or Friendly Cove on Nootka Sound) and also of early conflict (e.g. site of the attack on the American vessel Boston, also on Nootka Sound)
- areas associated with earlier and problematic marine resource use - prime examples are portions of the coast (e.g. west coast of Vancouver Island, Queen Charlottes where excessive exploitation of sea otters for the maritime fur trade led to extirpation of the species); and
- sites and structures related to marine heritage activities - old whaling stations, lighthouses, rescue stations and canneries.
- complete coastal communities that maintain a clear marine heritage identity

Knowledge regarding some of these features is coastwide. Wrecks - both shipwrecks and aviation disasters are well documented and officially protected. Their high appeal to divers and, where accessible, to hikers (as is the case at several West Coast Trail wrecks) virtually guarantees this. Descriptive popular literature describes both the location and significance of shipwrecks (Rogers 1973, 1992). Similar coverage exists for lighthouses (Graham 1985a).

In addition to sites with one focal source of interest or importance, there are also more or less complete coastal communities that maintain a clear marine heritage identity whether by design or good fortune. Good examples of existing communities (other than ones that are almost entirely Aboriginal in population of which there are many) which have this conspicuous and distinct marine heritage ambience include Bamfield, Esperanza and Winter Harbour along the west coast of Vancouver Island, and Sointula and Alert Bay off the east coast of Vancouver Island.

Ultimately with the currently increasing commitment of these communities to explicitly advance the cause of their survival through collective political action (e.g. through the Coastal Communities Network based in Ucluelet), it seems inevitable that a broader set of their cultural-heritage values will be advocated as ones deserving of attention in MPA selection. To an extent such values may begin to merge with some of the "hard case" intangibles discussed above - those most fundamental reasons why some British Columbians choose to live along the sea's edge.

4. Using the Overview Strategically — and Sensibly — in the Identification and Evaluation of MPA Sites

Summary of Findings

The preceding analysis has brought forward a set of lists each related to the question we posed in Section 1.2:

What is it we value in BC's marine environment enough to justify substantial protection through a program of establishing Marine Protected Areas ?

The nature of the response has been necessarily different for each of the three broad value categories with which we began, i.e. conservation, recreation and cultural-heritage. These differences reflect the distinct challenges in conducting an overview for each category.

For conservation, naming all the major subsystems of the ABC marine environment" so that representativeness can be tackled, and also naming a reasonable but not unmanageable set of particularly valued specific features, requires a great deal of thinking about appropriate categories. Our workshops with experts from this field well exemplified the problem of different disciplinary and individual perspectives leading to many more or less equally good ways of classifying "valued marine environments and features." There was, and can be, no closure on the one right classification. Moreover, as will be readily apparent on a glance at the list we eventually settled on, there is substantial overlap or redundancy. Estuaries (VMEF C8) usually can contain intertidal flats (VMEF C12) and are themselves important contiguous "subsystems" of "inland seas" (VMEF C4) wherein flow "pelagic waters (VMEF C1)." To continue, those intertidal flats may be among the most important "Significant Areas for shorebirds & waterfowl" (VMEF C24) because of the presence of juvenile fish (VMEF C22) and so on !

During one of our workshops when one commentator worried that the overall conservation list "mixed apples and oranges," a reply came: "no, it mixes apples and orchards"! But in the end, we considered that it was more worrisome to achieve a neat well bounded set of subcategories and possibly miss something, than to be redundant and as explicit as possible about what was valued. For the diversity of views among experts will be recapitulated in the process of identifying MPAs and it will be important to have headings in the starting "catalogue" that reflect the many different perceptions that will be brought to the planning table about what marine attributes really matter.

Defining recreation-related values faces different sorts of problems. One is that much of what is valued from a recreational standpoint is likely to fall into the conservation or the cultural heritage sets of values. Again, the problem of redundancy. Perhaps more serious is that when one looks at each recreational activity and sets standards of what makes a quality area, misgivings arise over the compatibility of at least some of the activities (and the values they seek) with key conservation, cultural-heritage and even other recreational values. "Safe anchorages" for pleasure craft is a good case in point. Indeed, this "VMEF" has been frequently used to illustrate the kind of recreational value that ought to be factored in to MPA planning. But at what point in the overall process? While it seems more than reasonable to take account of the incidence of safe anchorages when examining the pros and cons of particular MPA candidates, it is more debatable whether an initial inventory of potential sites should be factoring in "safe anchorages" in the same way as, say, seabird colonies or kelp forests are being accounted for.

Finally, with cultural-heritage values, especially as these relate to Aboriginal peoples, a different and perhaps more difficult issue arises. It arises from the separate cultural identity which each First Nation is uniquely situated to claim and interpret. Anthropologists have long struggled with the limits of understanding and describing someone else's culture. They draw distinctions between descriptions made directly by the members of a culture's way (emic) versus informed objective outsider accounts (etic) (Rosaldo 1989). The dilemma pervades the attempt here to specify the kinds of values or valued attributes that ought to count as key "cultural heritage" attributes in MPA identification. For this reason, we very hesitatingly advance a framework based closely on value categories used in traditional use studies (BC Ministry of Forests 1996) strictly as a starting point rather than a required checklist for considering First Nations' marine cultural heritage values.

In regard to Eurasio-Canadian cultural-heritage, a more limited set of historic sites and marine related shore based attributes is listed. To repeat, it seems likely that coastal communities will begin to insist on a broader definition of what constitutes their marine cultural-heritage values in the near future. This will arise primarily from ongoing struggles they experience over changes in the marine resource policies, including the advent of MPAs.

Keeping in mind the considerable differences in what these lists represent, the overview of key conservation and recreation values (or VMEFs) is presented in Table 4.1, Part A. The continuation of Table 4.1, as part B, summarizes two sets of marine related values

which, for reasons discussed in the text cannot, indeed must not, be seen in any way as definitive. They are advanced strictly to give a sense of the kinds of values that might arise from a sound process of deliberation involving the people in the best position to know what about the marine environment really matters to them.

Table 4.1 Part A: BC Marine Conservation & Recreation Values (VMEFs).

<p>CONSERVATION</p> <ol style="list-style-type: none"> 1. Open waters -plankton based ecosystems 2. Archipelagos and their environs 3. Intertidal areas (foreshore) & adjacent backshore 4. Inland seas 5. Major embayments 6. Fjords 7. Passages: straits, channels, passes, sounds and narrows 8. Estuaries 9. Continental margin (shelf, slope, & rise) 10. Ocean Basin: ridges, abyssal plains etc. 11. Salt marshes 12. Tidal flats 13. Sea Grass beds 14. Kelp beds 15. Reefs and their environs 16. Seamounts and their environs 17. Hydrothermal vents and their environs 18. *Localized upwelling environments (summary only) 19. *Other Special Marine Environments (summary only) 20. Significant finfish habitat A. Spawning areas 21. Significant finfish habitat B. Juvenile nursery areas 22. Significant invertebrate concentration areas 23. Significant habitats for marine birds including seabird colonies and marine environments on which they rely 24. Significant marine habitat for waterfowl & shorebirds 25. Significant marine mammal habitats (colonies/haul-outs/breeding grounds/concentration areas) 26. *Sites significant to rare or endangered species (those not covered by previous categories) summary only 27. Areas with a substantial record of prior marine research and data gathering
<p>RECREATION - based on main marine -dependent activities</p> <ol style="list-style-type: none"> 1. Shoreline configuration (i.e. islet clusters, bays, narrow channels) 2. Shoreline type 3. Sea conditions 4. Aquatic visibility and transparency 5. Water temperature

6. Marine life (harvestable)
7. Marine life (for observation)
8. Natural coastal features (waterfalls, tidal rapids, hot springs, superior beaches, readily accessible coastal trails,)
9. Native heritage areas, presence of archaeological or historical resources
10. Coastal scenery
11. Subsea surface topography
12. Anchorages (protection from waves, wind, adequate depth, suitable substrate)

Table 4.1, Part B: Examples of "hard case" intangibles & cultural-heritage VMEFs.

Note: These are not to be construed as objectively derived VMEFs but rather as "starting points" for dialogue with those in the best position to define intangible/cultural -heritage values that matter.

RECREATION - "Hard-case intangibles"(HCI)

1. Life: place of our ancestral beginnings...sense of continuing creation, vitality, sea as the 'pulse of the cosmos,' rhythm...
2. Time, or timelessness: sense of the ancient, eternal...
3. Space and distance; endlessness, openness, infinity, scope, wilderness, frontier, the sense of great distances travelled...
4. Imperviousness to man and man's actions; impersonality; anonymity, erases and covers man's intrusions, untamed...
5. Energy, conflict, and contrast: battle and/or contrast between land and water.
6. Mystery and spirituality: enchanted, holy, magical.

CULTURAL-HERITAGE

A. First Nations' Cultural Heritage VMEFs (for initial discussion purposes only)

1. Archaeological sites — places where relics of ancestral activity are found;
2. Ceremonial and Religious Sites — a location vital to the performance of important ceremonies
3. Commercial — a place where commerce is or has been transacted;
4. Cross-cultural interaction — a place significant to the interaction of two or more cultures (e.g. first contact sites, locations of conflict)
5. Cultural landforms/seaforms — features used to mark location for travel, cross-cultural boundaries etc.
6. Food harvesting — places significant in the harvesting of marine foods
7. Material harvesting — a place where important non-food marine items are gathered (e.g. dentalia shells);
8. Traditional management areas — (e.g. clam and cockle beds where rock removal was practised to encourage better growth);
9. Recreation — a location where traditional and current marine-based recreation is pursued
10. Supernatural beings — a place associated with the past and present occurrence and activity of beings whose existence is not recorded by western science or

others from outside the culture

B. Eurasio-Canadian Marine Cultural Heritage VMEFs

1. Relics — shipwrecks, airplane wrecks, remnants of early industrial activities
2. Locations of special historic significance — points of early contact with First Nations
3. Areas associated with earlier / problematic marine resource use
4. Sites and structures related to marine heritage activities — old whaling stations, lighthouses, rescue stations and canneries
5. Complete coastal communities with clear marine heritage identity

Using the Overview

When this study began, "strategic assessment" was seen as the natural step to follow directly from an overview of key marine values. That would have meant developing criteria for comparison and an objective scheme for rating the significance of what we have called VMEFs. In the course of the work, several good arguments arose for not taking the step into criteria-setting and ranking schema (see section 1.2).

But what use, then, is a stand-alone overview ? How are the lists, descriptions, examples, and inferences of Section 3 to be relevant to the early stages of systematic MPA planning now at hand in BC ? It is our considered view that there is a different way to think about being "strategic."

First, it may be of help to briefly encapsulate the current stage of such MPA planning is and where it is thought to be going as of late 1997. Prior to workshops held in March, 1997, a draft strategy was circulated for discussion purposes (BC Parks et al 1997). It laid out a "Proposed Process for Marine Protected Area Identification, Establishment (Making Decisions), Designation and Management" (ibid., p.24-32). The process was envisioned as comprising three general phases within which were eight steps as follows:

Identification Phase

1. Identification of Key Marine Values and Confirmation of MPA System Goals and Objectives
2. Identification of Areas of Interest

Evaluation Phase

3. Technical Evaluation of Areas of Interest
4. Identification of Socio-economic Issues and Concerns Associated with Areas of Interest
5. Selection of Candidate Areas for Any Special Interim Management Measures

Decision Phase

6. Making Recommendations to Protect Areas through Planning Processes
7. Formal Designation of New MPAs
8. Management of MPAs

The present overview is mentioned in connection with steps 1 and 3. Step 1, the identification of key marine values, has been the principal focus of our work.

The Conservation VMEFs can be used in several ways in the envisioned process of moving on to the Identification of Areas of Interest (Step 2). For first category of Conservation VMEFs, "Major Intertidal and Marine Environments of BC" , the key practical challenge will be to map boundaries of these environments as precisely as possible. Indeed, this kind of work is well underway as part of the development of marine ecosystem classification (J. Harper pers. comm.). A clear map of where these major environments occur will provide those who are undertaking detailed MPA planning, with an overlay to determine the extent to which potential MPA sites and boundary configurations advance the goal of representation. Thus, for example, as specific alternatives are developed for potential MPAs, information will be available to say the extent to which each alternative includes a representative archipelago and its environs (VMEF C2), or encloses a representative sample of continental shelf features (VMEF C9).

The more specific Conservation VMEFs (#s CH11 through CH27) can be used initially as a checklist. Those who are to be involved in MPA planning should first become acquainted with the nature of all these valued environments and features. The mainly one page descriptions provided in section 3.1 will be "old hat" for any one involved in MPA planning who has a strong background in marine studies. For others, these outlines are but the start of what must be a learning process about each of the VMEFs. Only through such learning can valid participation be expected. As the participants become acquainted with the nature of these VMEFs, information should also be assembled on the distribution and, where data permits, the characteristics of such features within a planning area. Our list of Conservation VMEFs can be used to direct attention to the data requirements of MPA planning. It is beyond the scope of the present work to comment on the kinds of information handling and display most appropriate to these VMEFs. Presumably a GIS-based approach can be developed for recording and portraying the occurrence and characteristics of many of the Conservation VMEFs. This would enable MPA planning teams to examine the extent to which different candidate sites (Areas of Interest as per BC Parks et al 1997) and different boundary configurations around alternative sites can enclose significant conservation values.

For Recreation VMEFs, the task of recording these in formats amenable to spatial representation has already begun at least for most of the 12 identified here. The ARA et al Coastal Tourism Resources Inventory is very much directed towards supporting a GIS data base for the resources most valuable to coastal recreation. As should be clear, the same study has strongly influenced the way that Recreation VMEFs are tabulated here. It will be necessary, however, for recreational interests involved in MPA planning to cross check, critique and change as needed the lists provided above in Tables 3.2.1, 3.2.2 and

3.2.3. It must be repeated (a) all VMEFs suggested here must be subject to both review and updating as detailed MPA planning proceeds; and (b) that especially in the categories other than conservation, judgement not objective analysis has been the predominant means by which lists were generated. Thus, before much effort is expended finding out where the VMEFs associated with recreational activities occur within a planning area, people knowledgeable about these recreational activities and their needs should take time to reflect, discuss and revise our list. The best hope is that these lists give them a place to start this critical work.

The same needs to be said, even more resolutely in regard to the identification and evaluation of marine cultural heritage sites and resources. We can only reiterate briefly what was said in section 3.3: cultural values (including heritage values) cannot be determined by objective analysis especially by expert outsiders. Only a process of dialogue within the culture or communities whose values are being elucidated, can produce a list that really gets at the most important marine sites and attributes. For this reason, the lists appearing in Table 4.1, Part B should be, even more than with those in Table 4.1 Part C, seen as mere starting points for dialogue.

The upshot of these remarks is that the present overview would not serve well as a definitive catalogue of what MPA planning teams are to look for as they move into the second step envisioned in the present draft strategy process (BC Parks et al 1997). Rather, all categories we have come up with should be seen for what they are: a limited attempt by a handful of people to make sense out of the incredible array of very different values associated with BC's marine environment. In the end, a study such as the present one could never have hoped to capture the breadth as well as the nuances of how people (i.e. British Columbians, Canadians, visitors, etc.) value the superlative marine environment off Canada's west coastline. In the course of the writing of this report, numerous successive versions of the various lists were tried and internal debate continued almost to the final printing. We see this continual dialogue as indicative of several very important if obvious seeming conclusions:

1. Values are subjective and multiple views and valid differences on what should count as important, are an absolute certainty, especially in a field of consideration so vast and multi-faceted as "BC's marine environment";
2. Knowledge of BC's marine environment (and pretty well any other marine environment in the world) is so incomplete as to make it impossible and ill-advised to determine generically what is significant. That applies to all but the most obvious or trivial observations on what is nationally or globally significant.
3. The sole route to strategic — and sensible — determination of the best sites based on what is valuable, is dialogue, abetted but not pre-empted in any way by lists of the kind developed in this overview.

Here, dialogue is not used simply as a synonym for "conversation:" nor are we equating with the burgeoning use of multi-stakeholder consensus processes. We speak here of something more than mere talk or negotiation: a concerted well planned effort to use group discussion as a way of bringing unlike (although not necessarily conflicting) ideas up against each other and, from this, exploring new ways of understanding complex sets of information and situations. The techniques needed to create such dialogue are only beginning to emerge (Bohm 1985, Schon & Rein 1994) but what is clear is that dialogue needs a place for work to start. Just as the construction of a house requires temporary and adaptable scaffolding from which workers can operate, a process of establishing MPAs needs a structure, however rough-hewn it may be, on which the planning team can initially "stand." This is the appropriate role for the lists and framework of VMEFs developed here

Strategic assessment should not be seen as a set of criteria and methodologies the application of which will yield definitive and objective "answers" on where the best MPA sites are. It is better seen as the process and the outcome of well structured dialogue among governments, communities, stakeholders and marine experts (all of which categories, by the way, necessarily include First Nations). The contribution of the overview developed here will be best judged in terms of its effects on the quality of such dialogue.

Footnotes

* Present Address: Oweekeno-Kitasoo-Nuxalk Tribal Council, Box 760, Bella Coola, BC, V0T 1C0.

* This admittedly awkward term, following the usage in ARA et al's (1992) Coastal Tourism Resource Inventory, is used in reference to inhabitants of BC who came to the region for the first time in the 18th century and after. It is used in preference to such common but, for some, objectionable terms such as "European" or "whites" (which neglects the substantial cultural and historical influence of early and continuing immigration from Asian countries); and "non-Native" (or non-Aboriginal or non-indigenous) which defines the majority of the current population of BC in negative terms, i.e. what they are not.

1 An excellent introductory overview of the tectonics and geomorphology of the coast as well as other general features of the marine environment appears in Cannings & Cannings (1996).

2 See Zacharias & Howes (in press) for a helpful discussion of the meaning of "protected area" generally and as defined by the International Union for the Conservation of Nature (IUCN)

3 See Salasan Associates (1997) for a summary of the workshops.

4 It should be pointed out, however, that, unlike the Discussion Draft, the Terms of Reference for the present study had only three broad value categories, not four. "Fisheries" was the major category not separately identified in our Terms of Reference.

5 Unquestionably, identifying such VMEFs will overlap significantly with the previous categories. That is, when one inventories habitat significant to shore birds (VMEF # 24) , one is going to identify on tidal flats (VMEF #11) which will often occur in estuaries (VMEF # 6) and which are, by definition, the same as VMEF #2. Why retrace the same steps ? The reason is that ours is intended to be an overview of values and there is no reason one would expect that values to fall neatly into exclusive categories or elaborate hierarchical classifications. Wholes are valued, as are parts, as are parts of parts and so on.

6 This usage is not universal since pelagic is also used in exclusive reference to the water column above the true sea floor rather than coastal waters.

7 This system, which was geared to descriptions of intertidal fauna and flora also included wharf pilings.

8 Although it comprises many estuaries and is not at all typical in shape and mixing characteristics, the Strait of Georgia (and adjacent Puget Sound) are sometimes considered a modified estuary - see Croom et al. (1995) at p. 64).

9 Fenchel (1992) provides an excellent short essay on the world under a single square centimeter of sediment in a shallow marine bay, emphasizing protozoan/bacterial interactions.

10 Note: A distinction is used in this and in VMEF # 21 (Critical Marine Habitat for Shoreline Birds) between marine and shoreline birds, following the usages found in Part 2 of Vermeer and Butler (1989)'s collection regarding birds of the Strait of Georgia. A chapter on feeding ecology of marine birds somewhat loosely defines marine birds as ones that "feed extensively in waters of the Strait of Georgia" versus shorebirds which "feed only to a limited extent in the marine habitat." (Vermeer & Ydenberg 1989, p. 62). In the immediately following paper by Verbeek & Butler, "shoreline birds" are those that "regularly feed in tidal marshes, mudflats, seashores, and nearshore shallow waters..." (p.74). While the basis for categorization is imprecise, there is unquestionably a practical distinction to be drawn between species which spend most of their lives at sea except for nesting typically in colonies on islets versus those which primarily frequent intertidal and shallow subtidal areas. As for any somewhat arbitrary distinction, there are problematic "border" cases as with the Black brant (*Branta bernicla nigra*) whose feeding is almost exclusively on eelgrass, an unquestionably marine plant (Ogilvie 1978) ; or the marbled murrelet which, unlike most other alcids, nests not on rocky island colonies but solitarily in coastal habitat such as old growth forests (Sealy & Carter 1984).

11 See the footnote in the preceding VMEF for the distinction between seabirds and shorebirds.

12 The same study made a similar determination for "capability for day sport fishing" which, of course, differs from multi-day fishing primarily because of the necessary limitation of being within 25 km of a serviced facility.

13 But see report text in Section 4.0 regarding appropriateness of these as explicit "values" for to be accounted for in Marine Protected Areas identification.

14 See World Wide Web Site: <http://www.bcu.ubc.ca/~megill/cerf/index.html>)

15 Lines are always blurred between what is essential and what is secondary. One of BC's most famous hikes is the West Coast Trail between Port Renfrew and Bamfield. Its history begins as a life saving trail because of the proximity of waters in which shipwrecks were common . Today its attractiveness is partly a result of the marine-related features (bits of shipwrecks, wide swimming beaches) but is also based on non-marine attributes such as old-growth forests, waterfalls and challenging stream crossings. The extent to which a Marine Protected Area in the vicinity would enhance the "values" of the overall West Coast Trail experience is arguable.