SP.222

DRAFT REPORT

A SOCIO-ECONOMIC OVERVIEW OF RACE ROCKS: A PILOT MARINE PROTECTED AREA OFF THE WEST COAST OF CANADA

Prepared for:

Marc Pakenham
Community Advisor
Oceans Directorate – South Coast
25 Huron Street
Victoria, B.C., V8V 4V9
Tel: (250) 480-2794

by

AXYS Environmental Consulting Ltd.
P.O. Box 2219 – 2045 Mills Road
Sidney, B.C., V8V 3S8
Contact: Marcy J. Sangret
Tel: (604) 264-7698

December 1999

Table of Contents

List of Figures

List of Tables

1. INTRODUCTION AND OBJECTIVES

1.1 Introduction

Fisheries and Oceans Canada, in co-operation with the government of British Columbia and public interest groups, has recently identified five[1] pilot areas under consideration for inclusion in a national system of Marine Protected Areas (MPAs). Among these five is Race Rocks, a grouping of nine small islets located off the southern tip of Vancouver Island. Its proposed designation was prompted by a variety of factors, including:

Sea lions at Race Rocks - Pearson College

- an extraordinary tidal flow, one of the strongest on the west coast, that results from the combined influence of location and sea conditions;
- the abundant sub-tidal marine flora and the diversity of underwater organisms mainly attributed to the constant supply of plankton and nutrients swept into the area by tides and currents;
- the exceptional variety of marine life including sea lions, seals, river otters, porpoises, orcas, gray whales, octopi, sponges, corals, giant barnacles and sea grasses; and
- the role of the islets as nesting colonies for many species of sea birds, and as important stopover areas for some migratory birds.

The majority of the terrestrial and all of the sub-tidal lands (to the 36.6 metre contour) were designated a provincial ecological reserve in 1980 to protect the significant marine ecological features and values. Although not as thoroughly understood, the social and economic values of Race Rocks are also significant, and are the subject of this report.

The area has historical and cultural values for a number of First Nations groups who include Race Rocks in their traditional territories and who once used the site as a location for fishing and food gathering. Race Rocks' prominent location south of Vancouver Island has contributed to its historic and present-day role in navigation. A Coast Guard lighthouse, one of the oldest in Western Canada, is still operational on Great Race Rock, the largest of the islets. The lighthouse has been recognized nationally by the Canadian Coast Guard as one of Canada's 'top ten light stations' for its historical values and its contribution to the development of the City of Victoria and of British Columbia.

The concentrations and variety of marine species and habitats provide an exceptional opportunity for scientific study and marine education. A few modest facilities in the vicinity of the lighthouse have been maintained primarily for use by researchers and students. Recreational diving and

1 Four of the five pilot areas are found off the west coast of British Columbia (Race Rocks, Gabriola Passage, Bowie Seamount and the Endeavor Hot Vents); the other, the Gully on the Scotian Shelf, is located off Canada's east coast.

boating occur in the surrounding marine area and commercial tourism operators use the site for wildlife viewing and sightseeing excursions. There has been a total closure on commercial fisheries and a partial closure on recreational fisheries in the waters surrounding the existing ecological reserve since 1990. Other activities known to occur in the area including Coast Guard activities, sea vessel traffic and use by the Canadian military.

The status, timing and locations of these and other types of human activities in the Race Rocks area were investigated as part of the Socio-Economic Overview.

1.2 Study Purpose and Rationale

According to Canada's *Oceans Act* (Canada 1997), MPAs are legally designated areas designed and managed to conserve and protect the ecological integrity of marine ecosystems, species and habitats. To accomplish this broad goal, the state of existing knowledge for each candidate MPA must be assessed to identify requirements for further research and to plan and manage human pressures.

The importance of examining the social and economic aspects of potential marine protected areas cannot be overstated. In addition to ecological factors, the International Union for the Conservation of Nature (IUCN) considers social, economic and scientific values important criteria for MPA selection (Kelleher and Kenchington 1992, Kelleher et al. 1997). In Canada, like most coastal countries, there is a long history of human use of coastal and marine resources for subsistence and commercial harvesting, exploration, research, transportation and recreation. According to IUCN guidelines, the continuation of such activities within and adjacent to MPAs should be considered where such activities can be managed to meet conservation principles and the objectives of sustainable development.

Strategies to manage human use within a MPA can take many forms, but generally include some level of restriction or limitation on the types, timing, locations and scope of activities (Crosby 1994). If an area is to receive protected status, it is therefore imperative that its historical, present and potential values and uses are clearly understood to determine the feasibility of various management alternatives, and the degree to which each alternative might positively or adversely affect human populations.

The pilot MPA at Race Rocks represents an excellent opportunity to engage in a 'learn by doing' approach to marine protected area planning and management. The principal objective of the Socio-Economic Overview is to provide a comprehensive, descriptive review of the social and economic knowledge and values for Race Rocks and the immediate surrounding area to complement the extensive body of ecological information that already exists. Together, this information will serve to:

- assist managers towards defining objectives for the pilot area;
- provide a sound basis for delineating boundaries of a potential MPA;
- identify research priorities and monitoring requirements;
- address management and enforcement challenges; and
- communicate information to the public and other agencies.

1.3 Format of the Socio-Economic Overview

Following the introductory Section (Section 1), the Socio-Economic Overview is comprised of the following sections:

Section 2 Study Area
This section briefly describes the geographic, socio-economic and management context of Race Rocks.

Section 3 Study Methodology
Section 3 provides an overview of the collection methods and sources of information used to prepare the Socio-Economic Overview.

Section 4 Historical and Cultural Values
This section concisely outlines the historical and cultural values and uses of Race Rocks.

Section 5 Commercial and Industrial Values
Section 5 describes the types, levels and locations of use on or near Race Rocks for commercial fisheries, mining, oil and gas activities, shipping, Coast Guard and military purposes.

Section 6 Tourism and Recreation Values
This section outlines the types, levels and locations of use on or near Race Rocks for boating, diving, marine wildlife viewing and sport fishing.

Section 7 Research and Educational Values
This section outlines the past, present and proposed research and educational uses of Race Rocks.

Section 8 Stakeholder Perspectives
Key stakeholder groups who have an interest in Race Rocks are identified in this section.

Section 9 Management Implications
From a socio-economic perspective, this section describes issues and implications related to the potential establishment of Race Rocks as a Marine Protected Area.

Section 10 Information and Knowledge Gaps
This section highlights areas in which data were unavailable at the time of reporting either due to their non-existence, or because of the inability of researchers to contact key sources.

Section 11 Summary and Conclusions
Section 11 provides an overview of the key findings of the report.

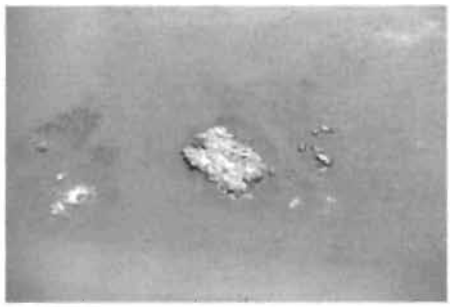
Section 12 Bibliography and Personal Communications
A list of literature and personal communications relevant to Race Rocks is presented.

2. STUDY AREA

2.1 Location and Geographic Setting

Race Rocks is located 17 km south west of Victoria at 123° 31.85'W latitude and 48° 17.95'N longitude (Figure 1). It is 1.5 km off Rocky Point, the extreme southern tip of Vancouver Island, at the eastern end of the Juan de Fuca Strait. Race Rocks is the most southerly part of Canada on the Pacific Coast.

The area considered for the Socio-Economic Overview includes the nine islets that comprise Race Rocks, the area encompassed in the provincial ecological reserve and the marine area surrounding the ecological reserve. As a guide to assist in data gathering, an arbitrary study boundary was drawn around Race Rocks to a radius of about three kilometres. However, when information was identified for an area outside this boundary, if it was felt to be relevant to future MPA planning and management, it was also included in the report.



Overhead View of Race Rocks - Andreas Pakenham

2.2 Race Rocks Ecological Reserve

Much of the underwater and above water ecosystems at Race Rocks are currently protected in an ecological reserve. In British Columbia, ecological reserves are designated to preserve unique or representative ecosystems in the province. Unlike provincial parks, which have a mandate to provide recreational opportunities, ecological reserves were intended primarily to provide opportunities for research and education and to serve as baseline areas for monitoring ecological changes.

Efforts to designate the area an ecological reserve were spearheaded by faculty and students from Lester B. Pearson College, who had been using the reserve for research and field studies since 1974. They were assisted in their efforts by representatives from the Royal British Columbia Museum, the University of Victoria, the Pacific Biological Station and the then Ministry of Parks. The Race Rocks Ecological Reserve was proclaimed in March of 1980 *"to protect a unique small rocky island system, inter-tidal areas, and high current sub-tidal area in the eastern entrance of the Strait of Juan de Fuca"* (BC Parks 1998a).

Added protection for all groundfish species except halibut (*Hippoglossus stenolepis*) was obtained in 1990 through an official enforceable Fisheries and Oceans Canada regulation (F&OC 1999). This regulation granted closure on all commercial fishing, including fin and shellfish, and all sport fishing except for migratory salmon (*Oncorhynchus* spp.) and halibut within the 20 fathom (36.6 metre) bathymetry line. This was the first marine reserve fishery closure on the West Coast ever granted by federal fisheries (Pearson College 1999).

Race Rocks
Pilot Marine Protected Area

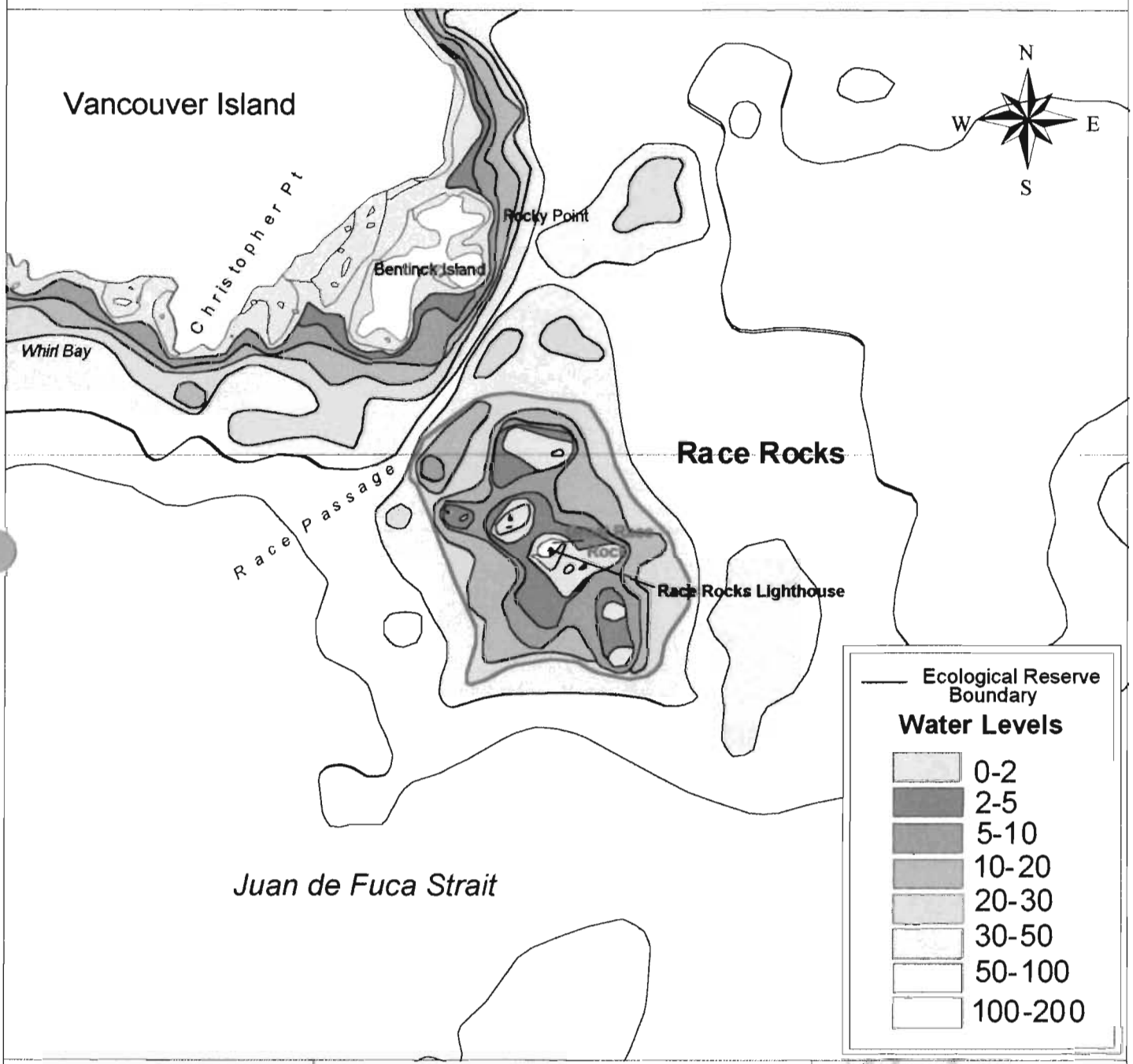


Figure 1
Location of Pilot Marine Protected Area

1000 0 1000 2000 3000

Meters

Fisheries and Oceans Canada

Printed from digital files by
Canadian Coast Guard-GIS Services

The Race Rocks Ecological Reserve is administered under the authority of BC Parks with the assistance of Pearson College, which manages the island facilities as part of a lease agreement. The reserve covers 220 hectares and includes areas of ocean, rocks and reefs bounded by the 36.6 metre (20 fathom) contour. The present boundary was determined by the standard limits of SCUBA diving and the contour lines of nautical charts. The ecological reserve includes nine islets, but does not include the land area of Great Race Rock beyond the high water mark[2]. The reserve is almost entirely sub-tidal and the nine islets comprise less than one hectare. The islets are characterized by a rugged topography and their substrates are made up of continuous rock cliffs, chasms, benches and surge channels.

A draft management plan for the ecological reserve was prepared in 1998. The management plan states that *"Race Rocks Ecological Reserve will be managed to protect the rich inter-tidal communities and to encourage educational and research benefits while minimizing impacts"* (BC Parks 1998a).

2.3 Surrounding Marine Area

The surrounding marine area experiences high water flows and current movements that result from tidal flow in and out of the Juan de Fuca Strait, the Strait of Georgia, Puget Sound and adjoining waters. These currents bring vast amounts of plankton to Race Rocks that support thousands of invertebrate species. Located in a transition zone between the inner coastal waters and the open ocean, Race Rocks is also influenced by the daily ebb and flood tides. The ebb tide brings nutrient-rich waters that have entered the sea from coastal rivers and streams, while the flood tide delivers upwelled waters from deep in the Pacific Ocean. These combined factors contribute to the exceptional variety of marine life that can be found in this area.

Given its proximity to the City of Victoria and other coastal communities, the marine waters experience relatively high levels of activity. Commercial fishing, marine traffic, military activities and various forms of recreation and tourism all occur in the regional marine area.

2.4 Current Administrative and Management Context

Jurisdictional responsibility for the management of the marine environment and marine resources at Race Rocks is currently shared between federal and provincial governments:

- Fisheries and Oceans Canada is responsible for navigable waters, organisms in the water column, and for managing marine resources under the *Fisheries Act* and the *Oceans Act*[3];
- the Canadian Coast Guard is responsible for the management of Great Race Rock and the light station; and
- the Province of British Columbia (under BC Parks) has jurisdiction over the other islands and the sea bed.

---

[2] Great Race Rock is owned by BC Lands and Assets and a small portion of it is leased to Fisheries and Oceans Canada who administers the lighthouse station.

[3] The *Oceans Act*, enacted in January 1997, also gives Fisheries and Oceans Canada the authority to establish Marine Protected Areas for a number of purposes.

The ecological reserve is protected under the provincial *Ecological Reserve Act* and the Ecological Reserve Regulations and is subject to penalty provisions under the *Park Act.* The lighthouse has been designated a heritage site under the *Heritage Conservation Act*. Also under the *Heritage Conservation Act*, shipwrecks in the area that are more than two years old are protected from the unauthorized removal of artifacts.

The lighthouse on Great Race Rock has recently been automated and the federal government has returned the surplus land to the provincial government, although the lighthouse tower will continue to be administered by the Canadian Coast Guard (C. Kissinger, pers. comm.).

The District of Metchosin may also play a role in management of a MPA. The District has administrative authority over much of area inland from Race Rocks. The Department of National Defence (DND) also owns lands in the region and maintains an interest in offshore areas that are used for military purposes.

Students and teachers at Pearson College volunteer time and resources and take an active role in the management and stewardship of Race Rocks. They assist BC Parks in a number of ways including data collection, enforcement of regulations, and review of permit applications for use of the reserve. The college has a two-year agreement with the Canadian Coast Guard to occupy the site at Great Race Rock and to run a research station from the outbuildings. They have also been financing the presence of resident guardians through internal fundraising since March of 1997 (A. Mathews 1998). The agreement with the Coast Guard expires in 1999 and the probability of renewal will likely depend on funding availability.

3. STUDY METHODOLOGY

3.1 Scope of the Socio-Economic Overview

A detailed investigation of the current state of socio-economic information and knowledge for Race Rocks was conducted as part of this study. Results are presented in Sections 4, 5 and 6. The study area centred upon Race Rocks, but also encompassed the immediate marine environment and, where applicable, the regional marine environment.

The scope of the Socio-Economic Overview included an assessment of the importance of Race Rocks to:

A) society, including
- heritage,
- history,
- culture,
- recreation,
- aesthetics, and
- aboriginal interests;

B) the economy, by way of its current and historical uses, and potential values for
- subsistence and commercial fishing,
- harvest refuge,
- oil and gas exploration,
- mining,
- military exercises, and
- transportation and shipping;

C) science and education, including
- research,
- monitoring,
- educational curriculum, and
- outreach programs.

3.2 Data Collection

As part of a broadly-based review of existing information on Race Rocks, the following sources were consulted where available:

- inventories and original data;
- scientific and academic reports;
- compilations and reviews of existing socio-economic data;
- archives and holdings;
- reports, publications and articles;
- bibliographies;

- multi-media and Internet sources; and
- maps and photographic inventories.

Lester B. Pearson College maintains an extensive library of information regarding Race Rocks. While the majority of these holdings relate to ecological components, the college proved a useful source of information on the socio-economic uses and significance of the site.

By far the most useful approach to gathering socio-economic data was through personal communications with knowledgeable individuals. Those contacted included government agencies and interested stakeholders in academia, industry, non-government organizations (NGOs), special interest groups and the public (Table 1).

Table 1. Stakeholder Contacts for the Race Rocks Socio-Economic Overview

Agency / Organization	Information Requested for Race Rocks
Fisheries and Oceans Canada	fishing licenses, research permits, other known uses or values
Natural Resources Canada and BC Energy, Mines and Resources	known energy reserves, resource extraction licenses or permits, future interests
Department of National Defence	military activities and interests in the area
Canadian and U.S. Coast Guards	locations of shipping routes, traffic density, search and rescue, other Coast Guard activities and interests
BC Parks, Canadian Wildlife Service	protected area interests and links to other types of marine protected areas
Industry representatives (oil and gas, mining, commercial fishing)	historical, current and potential uses, economic values, thoughts on a MPA designation
Lester B. Pearson College	library holdings, administration of the Race Rocks and college research activities
Researchers and academic institutions	past or planned research activities, value of the study area for research and education
Tourism operators and recreation clubs	levels of use for private and commercial recreation including diving, fishing and nature tours
Non-government organizations with an interest in marine protected areas	knowledge of socio-economic values and interests, thoughts on a MPA designation

A complete list of individuals contacted through the course of this research is provided in Section 12.2. A detailed overview of the traditional and present-day values of Race Rocks to First Nations was beyond the scope of this study and for the purpose of this report First Nations were not consulted. It is recognized that First Nations interests are subject to treaty negotiations at this time and this report has been prepared without prejudice to these rights or claims. Traditional use studies or other data related to First Nations values or uses of the Race Rocks area may be appended at a later time should these become available. Some of these studies are currently underway, for example, Pearson College has been contracted to further develop First Nations educational initiatives at Race Rocks.

4. HISTORICAL AND CULTURAL VALUES

Section 4 summarizes the known historical and cultural values of Race Rocks. The main values considered were cultural values and traditional uses of Race Rocks by First Nations and historical values of the Race Rocks lighthouse.

4.1 First Nations

The area has historical and cultural values for a number of First Nations groups[4], who include Race Rocks in their traditional territories and who once used the site for fishing and food gathering (Pearson College 1999). The collection of islands are known by local First Nations as 'Qhuqyingh', which in the Clalum language means "*area of swift waters*". The more well-known name 'Race Rocks' was later provided by the Hudson's Bay Company.

First Nation interests and traditional uses of Race Rocks have not been documented. The First Nations that claim a traditional territory that includes Race Rocks are the Beecher Bay and T'Souke First Nations. It is known that First Nations peoples have lived and worked as an integral part of the coastal ecosystems of southern Vancouver Island and the Juan de Fuca Strait for centuries. The area from Pedder Bay to Beecher Bay, inland from Race Rocks, was a community that had been totally dependent on the coastal resources well into the twentieth century. The vast area provided a wealth of standard marine resources for the First Nations that were used locally and sometimes traded or sold. Although access to Race Rocks is difficult even today given rough sea conditions and unpredictable weather, some elders recall its early use. Race Rocks was known as a place where one could get any kind of food they wanted. It was used as a location for the collection of gull eggs and for fishing for lingcod, which was then sold to buyers in Pedder Bay (Pearson College 1999).

Representatives from Pearson College (Angus Matthews and Garry Fletcher) have initiated consultation with members of various First Nations groups both to understand the historical uses and values of Race Rocks, and to better understand the importance of the coastal areas to First Nations peoples and cultures of BC. One objective of Pearson College is to involve First Nations more prominently in their educational programs for Race Rocks. The Pearson College library contains tape recordings of the Clalum language with the original pronunciations of place names around Race Rocks. Their database also contains a directory of contacts made with First Nations, and a listing of individuals from First Nations communities who have knowledge of the area. The college is also interested in including some of the stories of how First Nations traditionally used the coastal resources of this area into their elementary schools programs.

BC Parks has little information about First Nations uses or values associated with the ecological reserve (C. Kissinger, pers. comm.). However, the collection of information on First Nations values, and the building of stronger relationships with First Nations are objectives for the future management of the ecological reserve, as outlined in the Draft Management Plan (BC Parks 1998a).

4 As part of the MPA initiative, Fisheries and Oceans Canada and other government agencies have been working with local First Nations such as the Esquimalt, T'Souke, and Beecher Bay Bands.

4.2 The Race Rocks Lighthouse Station

The following account is summarized from the report "History of the Race Rocks Light Station", prepared by Lester B. Pearson College (Pearson College 1999) and from "Keepers of the Light" (Graham 1985).

The need for a light station on Race Rocks became evident in the early 1850s. The City of Victoria was emerging as an important economic centre and the booming timber business and excellent harbours at both Victoria and Esquimalt resulted in a significant increase in shipping. At the same time, marine traffic in the area was increasing as a result of the large number of immigrants arriving by ship to participate in the Fraser River Gold Rush.

Race Rocks Lighthouse - Pearson College

About this time, a light had been placed at Cape Flattery to mark the southern shore of the entrance to Juan de Fuca Strait. While the Cape Flattery light proved invaluable for ships entering the strait, once in the strait itself, mariners found themselves traversing the dark inland waterway with little guidance. To complicate matters, the strait was subject to strong and variable winds and challenging tidal conditions. Of particular concern for large ships was the area surrounding Race Rocks, located at the narrowest point in Juan de Fuca Strait. It was here that ships had to be wary not only of the strong tides and currents, but the surging waves of the Pacific Ocean as well. Navigators reported that attempting to enter Victoria Harbour after dark was almost impossible. In response to these concerns, the British Admiralty decided to construct the first lighthouses on the west coast at Fisgard (at the entrance to Esquimalt Harbour) and at Race Rocks, which were constructed within two months of each other.

Three days before the new light was lit, the *Nanette*, a 385 tonne cargo ship ran aground on Race Rocks. While the crew found shelter on Race Rocks and were rescued the next day, the ship's cargo was strewn across the rocks. This attracted many eager locals from the mainland trying to salvage the cargo for themselves. One overly ambitious crew perished when their over-loaded canoe capsized off Albert Head. In the wake of the wreck of the *Nanette*, the Race Rocks light station was lit for the first time on Boxing Day, 1860. Soon after the light went into service however, it became obvious that the tower was difficult to see by day when approaching from the west. Distinctive black and white stripes were painted on the tower by the first light keeper to improve its visibility against the shoreline. These markings remain a distinctive feature on the lighthouse today.

On clear nights the light was visible for 18 miles. However, the hazards of Race Rocks were still very real in fog, which shrouded the islets up to 45 days a year. With only the station bell for a keeper to sound in the fog, the treacherous waters around Race Rocks continued to claim ships and their unsuspecting crews. Known shipwrecks include:

- The *SS Nichola Biddle,* January 5, 1867;
- The *Swordfish*, November 6, 1877 ;

- The *SS Rosedale*, December 12, 1882; and
- The *Barnard Castle*, a coal freighter en route from Nanaimo to San Francisco, struck Race Rocks on November 2, 1886, but made it to nearby Bentinck Island, where it now lies.

In 1892, a steam plant and two compressed air foghorns were installed at Race Rocks. Despite the addition of the powerful horns, tragedies continued to occur. In 1896 the *S.S. Tees* crashed ashore followed by the *Prince Victor* in January 1901. The worst disaster occurred on March 24, 1911 when the ferry *Sechelt*, bound for Sooke from Victoria, capsized and sank in Race Passage killing her crew and 50 passengers.

Although the light keepers worked diligently to maintain and operate the foghorns, complaints were filed reporting that the horns were not always being sounded in foggy conditions. In July of 1923 the liner *Siberian Prince* went aground within a mile of the lighthouse without hearing the horn, which was being sounded at the time of the incident. On November 2, 1925 the Holland America liner *Eemdijk* ran aground in almost the same location again reporting they did not hear the foghorns. In 1927, Race Rocks was the first lighthouse on Canada's west coast to be fitted with a radio beacon, which dramatically reduced the number of incidents. In 1929, the Hydrographic Survey ship *Lilloet* conducted an investigation of the reported 'silent zone'. The expedition proved that an unusual deflection of sound, as a result of the location of the horns, was the cause of the problem and the horns were moved to a separate tower. The lighthouse was staffed and operational for the many decades that followed. In the 1990s, after several years of experimental testing, the Race Rocks light station became fully automated in March of 1997.

As part of a co-operative agreement with the Coast Guard, Pearson College undertook the operation of the surplus lighthouse facilities as an education and research centre. They also raised funds to cover the salary costs for the light keepers to temporarily remain on Race Rocks as caretakers of the reserve. Several other projects initiated in the past two years by Pearson College have been directed at preserving some of the unique marine heritage of Race Rocks. As part of their efforts, the weather station room has been converted into a museum where historic photos of the island are on display and two outdoor areas have been renovated to preserve past artifacts.

The Race Rocks lighthouse has been designated a heritage site under the BC *Heritage Conservation Act*. Also protected under this Act are artifacts from some of the numerous shipwrecks. Although most have been salvaged and removed, remnants of at least two wrecks (the *Idaho* and *Nanette*), remain as legacies to the province's early maritime history.

At a national level, the Race Rocks light station is considered one of Canada's 'top ten light stations' as designated by the Canadian Coast Guard. The primary reason is its status as the oldest staffed light station in Western Canada. Secondary reasons include the aesthetic qualities of the tower and its unique construction materials, rare among lighthouse towers in Canada. It is the only example of a tall, pre-Confederation, unsheathed stone masonry tower built outside of Ontario. It is also listed as significant because of its linkage to the development of the City of Victoria, Esquimalt (as a major naval base on the West Coast), and consequently, British Columbia (CCG web page).

5. COMMERCIAL AND INDUSTRIAL VALUES

Section 5 summarizes the known economic and social uses of Race Rocks for industrial, military and Coast Guard activities including past, current and potential future uses of Race Rocks and the surrounding marine environment. Where available, information is included on the scale, scope, duration and status of these activities.

5.1 Commercial Fisheries

Currently, there are no commercial fisheries for salmon, groundfish, molluscs (i.e., geoducks, clams, oysters), crabs or urchins at the Race Rocks site (A. Mathews, pers. comm., W. Shaw, pers. comm.). The following information is included to provide a regional picture of the commercial fishery in the Race Rocks area, and is not necessarily indicative of commercial fishing adjacent to the ecological reserve. Recreational fisheries at Race Rocks are discussed under Section 6.5 in the context of tourism and recreation values.

Race Rocks is located in Fisheries and Oceans Statistical Areas 19 and 20, at the southern tip of Vancouver Island. Both of these Statistical Areas cover an extensive marine area. Statistical Area 19 includes waters of Saanich Inlet, and from approximately Sidney on the eastside of the Saanich Peninsula around to a line drawn through Race Rocks from Albert Head to the Canada-United States border. Statistical Area 20 includes waters of the Strait of Juan de Fuca from the Albert Head-Race Rocks boundary, west to approximately Pachena Point. Specifically Race Rocks lies in Statistical sub-areas 19-3 and 20-5 (Fisheries and Oceans Canada 1999b).

5.1.1 Finfish

Species found within Statistical Areas 19 and 20 include all species of anadromous salmon: pink (*O. gorbusha*), coho, chinook (*O. tshawytscha*), sockeye and chum (*O. keta*). Additionally, resident groundfish such as lingcod (*Ophiodon elongatus*), greenling (*Hexagrammus sp.*) and a variety of rockfish (*Sebastes* spp.) species have been documented.

Historically, commercial fishing may have included herring, salmon and groundfish in and around the Race Rocks. No commercial fisheries for salmon or groundfish are allowed in the Race Rocks Ecological Reserve, although the location of Race Rocks in the Strait of Juan de Fuca places it proximal to commercial fishing activities. Statistical Areas 19 and 20 show a significantly wide range of historical species captures overall. This catch diversity is demonstrated in Table 2 and is based on combined harvest volumes for 1994 to 1998. Harvest data for sub-areas 19-3 and 20-5 are not available, thus Table 2 represents only a potential species list for the Race Rocks area based on commercially harvested species in Statistical Areas 19 and 20. The cut-off for inclusion on this harvest list was set at 20 kg over the five-year duration. Additional fish species were harvested but these occurred at such low levels that they were deemed insignificant for this assessment.

Table 2. Summary of Commercially Harvested Finfish Species and Harvest Weights for Fisheries and Oceans Canada Statistical Areas 19 and 20 for 1994 to 1998

Species (common name)	Species (scientific name)	1994 (kg)	1995 (kg)	1996 (kg)	1997 (kg)	1998 (kg)	Total (kg)
Hake	*Merluccius productus*	6,449,220	5,842,658				12,291,878
Dogfish	*Scualus acanthias*	568,772	350,946	333,168	310,482	232,922	1,796,290
Albacore tuna	*Thunnus alalunga*			318,683			318,683
Pacific cod	*Gadus macrocephalus*	75,400	21,685		145	655	97,885
Dover sole		43,946	5428				49,374
Skate	*Raja binoculata*	11,027	12,060	8414	5403	7060	43,964
Lemon sole	*Parophrys vetulus*	29,260	13,204				42,464
Pacific herring- bait	*Clupea harengus*		38,579				38,579
other rockfish	*Sebastes spp.*	16,644	12,752				29,396
Greenie (yellowtail)	*Sebastes flavidus*	9461	3886	59			13,406
Mackerel	*Scomber japonicus*	27	12,343				12,370
Lingcod	*Ophiodon elongatus*	4661	1566	27			6254
Pacific halibut	*Hippoglosssus stenolepis*	3523			688		4211
Mink feed	*Atheresthes stomias*	3767	317				4084
Red snapper	*Sebastes ruberrimus*	1832	766	40	136	138	2912
Turbot	*Atheresthes stomias*	1387	488				1875
Brill sole	*Eopsetta jordani*	1249	321				1570
Rex Sole	*Glyptocephalus zachirus*	1006	511				1517
Walleye pollock	*Theragra chalcogramma*	991					991
Rock sole	*Lepidopsetta bilineata*	209	682				891
Pacific herring-unspecified	*Clupea harengus*	454					454
Silver perch	*Cymatogaster aggregata*	338	115				453
Mixed sole species		304	30				334
Idiot fish	*Sebastelobes spp.*	140					140
Sablefish	*Apoplopoma fibria*	51					51
P.O. perch	*Sebastes alutus*	24					24
Yellowmouth rockfish	*Sebastes reedi*	23					23

Statistical Area 19 data are based on figures for 1994 and 1995 only. Species harvests reflect all gear types and some species have been combined for simplicity.

The Pacific Biological Station has conducted some research related to the hook and line fishery in the area. Fisheries resources harvested through the hook and line rockfish fishery (ZN licenses) were used to estimate resources in the two sub-areas surrounding Race Rocks. These data provide a more focused perspective on the fisheries than can be gained from Statistical Area data. The catch data include mostly targeted rockfish species but also include any by-catch weight of halibut, dogfish, and lingcod. Relative species harvests within each year were not broken out of the data (Yamanaka 1999), and three years of data (1990 to 1992) were not included. These data provide total harvests of rockfish near Race Rocks in 1988, 1989, 1993, 1994 and 1995, with harvest amounts of 1.6 tonnes, 10.2 tonnes, 12.6 tonnes, 1.3 tonnes and 0.1 tonnes, respectively.

5.1.1.1 Herring

Historical herring fisheries may have occurred on a minimal basis at Race Rocks, however, no spawn records exist for the area between 1930 and present (Hay 1999). The closest herring spawn locations as indicated by the Fisheries and Oceans Herring Spawn CD-ROM are in Sooke Harbour to the west and Esquimalt Lagoon to the east, where spawning has been recorded between 1950 and 1970 (Hay 1999). No roe herring fisheries have occurred at Race Rocks between 1980 and 1998 (F&OC 1999a). However, Hardie *et al.* (1975) suggested that herring were fished on a commercial basis during designated seasons from Albert Head to Race Rocks prior to 1975.

Spawning for herring may be difficult due to the heavy tides and the large waves that occur at Race Rocks (D. Chalmers, pers. comm.). Additionally, herring spawn locations are extremely variable and unpredictable, and are likely influenced by such factors as water quality and human disturbance. Future changes in spawn locations cannot be predicted and the possibility of a large spawn area and subsequent fisheries interest in the Race Rocks area does exist (D. Chalmers, pers. comm.).

5.1.1.2 Economic Value of Finfish Fishery

Since market values are based on species, seasonal timing and fisheries supply and demand, it is difficult to assign an economic value to the rockfish fishery in the vicinity of Race Rocks (Yamanaka 1999). Nonetheless, an attempt to quantify the economic contribution of commercial fisheries harvests in the Race Rocks area was made based on Statistical Area data obtained from the Catch Data Unit of Fisheries and Oceans (Davidson 1999). Annual harvest totals were extracted for each species and combined with the average value per kilogram (taken as the average annual price per kg). Annual harvest values were then calculated and a cumulative revenue total for the years 1994 through 1998 (1999 data was too preliminary) was determined (Table 3). These values are based on harvest data from Statistical Areas as opposed to sub-areas, which would have provided a more refined analysis if these data were available.

Table 3. Relative Commercial Harvest Revenues for Finfish Species in Fisheries and Oceans Canada Statistical Areas 19 and 20 for 1994 to 1998

Species (common name)	Species (scientific name)	1994 ($)	1995 ($)	1996 ($)	1997 ($)	1998 ($)	Total Revenue
Hake	*Merluccius productus*	838,399	835,500				$1,673,899
Albacore tuna	*Thunnus alalunga*			916,532			$916,532
Dogfish	*Scualus acanthias*	217,840	135,114	146,261	130,713	97,128	$727,056
Other rockfish	*Sebastes spp.*	93,656	58,646				$152,302
Pacific herring- bait	*Clupea harengus*						$127,581
Pacific cod	*Gadus macrocephalus*	52,403	22,336		115	638	$75,492
Dover sole		32,696	4853				$37,548
Pacific halibut	*Hippoglosssus stenolepis*	29,382			5418		$34,800
Lemon sole	*Parophrys vetulus*	21,828	12,385				$34,213
Skate	*Raja binoculata*	2591	4088	2600	1680	2393	$13,353
Greenie (yellowtail)	*Sebastes flavidus*	6254	3505	132			$9,891
Lingcod	*Ophiodon elongatus*	4894	2692	30			$7,616
Red snapper	*Sebastes ruberrimus*	3999	2781	51	136	168	$7,135
Brill sole	*Eopsetta jordani*	2885	662				$3,547
Mackerel	*Scomber japonicus*	10	3135				$3,145
Pacific herring-unspec.	*Clupea harengus*	1500					$1,500
Rex Sole	*Glyptocephalus zachirus*	644	442				$1,085
Rock sole	*Lepidopsetta bilineata*	171	682				$853
Mink feed	*Atheresthes stomias*	580	9				$589
Silver perch	*Cymatogaster aggregata*	372	128				$500
Turbot	*Atheresthes stomias*	295	123				$418
Walleye pollock	*Theragra chalcogramma*	319					$319
Mixed sole species		209	40				$248
Idiot fish	*Sebastelobes spp.*	212					$212
Sablefish	*Apoplopoma fibria*	129					$129
P.O. perch	*Sebastes alutus*	17					$17
Yellowmouth rockfish	*Sebastes reedi*	12					$12

Statistical Area 19 data are based on figures for 1994 and 1995 only. Species harvests reflect all gear types and some species have been combined for simplicity.

Other commercial species were harvested in Statistical Areas 19 and 20 but contributed less than $1000 revenue over the five-year time period. Although these species were relatively less important than those shown for the given time period in Table 3, these finfish species may have been important in previous years and are shown in Table 4.

Table 4. Finfish Species Harvested in Fisheries and Oceans Canada Statistical Areas 19 and 20 with Minimal Contribution to Fisheries Revenues between 1994 and 1998

Species (common name)	Species (Scientific name)	Total Revenue
Rock sole	*Lepidopsetta bilineata*	$853
Mink feed	*Atheresthes stomias*	$589
Silver perch	*Cymatogaster aggregata*	$500
Turbot	*Atheresthes stomias*	$418
Walleye pollock	*Theragra chalcogramma*	$319
Mixed sole species		$248
Idiot fish	*Sebastelobes spp.*	$212
Sablefish	*Apoplopoma fibria*	$129
P.O. perch	*Sebastes alutus*	$17
Yellowmouth rockfish	*Sebastes reedi*	$12

Statistical Area 19 data are based on figures for 1994 and 1995 only.
Species harvests reflect all gear types and some species have been combined for simplicity.

Hake, albacore tuna and dogfish contributed the most to revenue totals for Statistical Areas 19 and 20, in which Race Rocks is located. Revenue derived from these three species over the five-year period was approximately $3.20 million, representing more than all other species revenues combined. Economic spin-off from the sale of these fish would be felt in the home communities of these fishers through payment of crew wages, equipment repairs, fuel, moorage and supplies.

5.1.2 Shellfish and Other Species

Shellfish and other species, particularly crab, octopus and urchin are harvested commercially at considerable volumes throughout Statistical Areas 19 and 20, but not within the Race Rocks Ecological Reserve. A search of the Commercial Fisheries Landings database was performed as part of this study although these data are only attributable to catches throughout the statistical areas under consideration, and are not specific to sub-areas or precise locations such as Race Rocks (Davidson 1999). Mr. Raymond Lauzier was able to provide commercial harvest data for Statistical sub-areas 19-3 and 20-5, which are more specific to the Race Rocks study area (Lauzier 1999a). Using these two sources, a preliminary list of shellfish and other species potentially found in the Race Rocks area is included in Table 5.

5.1.2.1 Economic Value of Shellfish and Other Fisheries

Annual per unit (i.e., per pound) values from Statistical Sub-areas 19-3 and 20-5 were used to determine the value of each fishery. These data have been compiled to develop the harvest values shown in Table 5.

Table 5. Harvest Revenues for Species other than Finfish for 1994 to 1998, in Fisheries and Oceans Canada Statistical Sub-Areas 19-3 and 20-5, Race Rocks Area

Species* (common name)	Species (scientific name)	1994 ($)	1995 ($)	1996 ($)	1997 ($)	1998 ($)	Total Revenue
Dungeness crab	*Cancer magister*	75,800	50,100	162,750	218,920	203,480	$711,100
Geoduck	*Panope generosa*	HIST					N/a
Green sea urchin	*Strongylocentrotus drobachiensis*	159,200	56,570	58,850	76,730	13,725	$365,100
Octopus – dive	*Octopus dofleini*	28,610	17,670	35,680	67,400	22,960	$172,300
Octopus – trap	*Octopus dofleini*	NRL	NRL	NRL	Conf.	Conf.	N/a
Sea cucumber	*Cucamaria miniata*	HIST					N/a
Shrimp - trawl	*Pandalus jordani*	NRL	Conf.	NRL	Conf.	$3520	$3520
Prawn – trap	*Pandalus platyceros*	NRL	Conf.	Conf.	NRL	Conf.	N/a

Data adapted from (Lauzier 1999b). Sub-area data have been combined to satisfy confidentiality rules
Conf. = less than three fishers harvesting, NRL = no reported landings, HIST = geoduck and sea cucumber historic landings 1986 -1991. Crab est. at $2.00 per piece.

Dungeness crab, green sea urchin and octopus harvested through the dive fishery have been the main economic contributors in these two sub-areas. However, in years when the harvest data is deemed confidential because of less than three fishers harvests could be equally as high and cannot be discounted. This does not apply to geoduck and sea cucumber harvests that only ran from 1986 to 1991. It is not known why these fisheries have been curtailed.

5.2 Mining

According to the Ministry of Energy and Mines MINFILE database on provincial mineral rights, there are no past, current or proposed tenures in the vicinity of Race Rocks and the general area has been given a low mineral potential rating (MINFILE 1999). The nearest provincial mineral tenures are located on the south end of Vancouver Island.

5.3 Oil and Gas Activities

The geological composition of the area surrounding Race Rocks is indicative of good oil and gas potential, however, there has been no exploration or issuance of tenures in the area to date. It is doubtful, considering its existing Ecological Reserve status and proposed Marine Protected Area status, that any exploration will be conducted in this area (M. Hayes, pers. comm.).

Race Rocks lies at the eastern extreme of the Juan de Fuca sub-basin within the Tofino Basin. Four petroleum wells have been drilled onshore of the Olympic Peninsula with one minor gas show in Tertiary sandstone (Hannigan 1998). In addition, three surface gas seeps have also been

reported in the area, most probably thermogenically-sourced, from underlying Tertiary sediments. The majority of exploration activity in the Tofino Basin has taken place in areas well removed from Race Rocks and, while the overall potential for the entire Tofino Basin is estimated at 9.4 trillion cubic feet, Race Rocks is an area that will likely see little or no exploration activity in the foreseeable future (M. Hayes, pers. comm.).

5.4 Commercial Shipping

Juan de Fuca Strait is a very busy route for marine traffic as it provides the major lane for traffic in to and out of both Vancouver and Seattle. Oil tankers from Alaska and freighters from Europe and Japan, with industrial goods ranging from cars to forest products, must bypass Race Rocks. Large oil and cargo vessels that transit Juan de Fuca Strait are required to follow the established shipping lanes outlined on the Canadian Hydrographic Service (CHS) chart #3606 (M. Jourdenis, pers. comm.), which are well to the south and east of Race Rocks. There is a northbound lane for vessels travelling into the Pilot Station, a southbound lane for vessels travelling out of the Pilot Station, and a Traffic Separation Zone that was established as a safety zone between these two lanes. At one time, ships came within half a mile of Race Rocks, but since designation of the Traffic Separation Lanes, they pass further away.

The Port of Vancouver implemented the "Ballast Water Exchange Program" in 1998 to minimize the potential of introducing non-indigneous species into Canadian waters and to protect the environment. These regulations require that vessels destined to arrive in the port in ballast condition carry out mid-ocean ballast exchange prior to entering Canadian waters (Vancouver Port Authority website). Although the exact location where ballast exchange occurs could not be determined, it can be assumed that Race Rocks is far enough into Canadian waters not to be effected by these activities. The tidal regime and high volume water exchange that occurs at Race Rocks would also minimize any influence that deballasting could potentially have on the area. There are no current deballasting regulation for the Victoria Harbour, however the Canadian Coast Guard has proposed federal pleasure craft sewage pollution prevention regulations be implemented in the Victoria Harbour area, including waters from Ogden and Macaulay points inland to the Gorge Waterway and Portage Inlet (Victoria Harbour website).

5.4.1 Oil Tankers

The Trans Alaska Pipeline System (TAPS), that runs from Prudhoe Bay to Valdez, Alaska, was completed in June 1977. Since that time, tankers varying in size from 50,000 to 250,000 DWT, have been transporting crude oil from Valdez to the U.S. west coast ports. On average, there is one loaded tanker entering Juan de Fuca Strait everyday and conversely, a tanker, in ballast, exiting the strait for Alaska (D. Alpen, pers. comm.). Many of these tankers will pass Race Rocks on their transit, but, as indicated above, they follow the shipping lanes for Juan de Fuca Strait that lie well outside the study area.

There have not been any significant oil spills in the vicinity of Race Rocks for more than ten years (T. Severup, pers. comm.), and there have been several initiatives implemented that greatly assist in continuing this trend. An international organization called INTERTANKO, Interational Association of Independent Tanker Owners, claims that operational pollution from shipping contributes a higher proportion of oil entering the sea than major spills from large tankers.

Sources of operational oil pollution includes discharge from dirty ballast tanks, engine room waste and slop. INTERTANKO has been developing guidelines for port waste facilities to reduce open ocean oil discharge (INTERTANKO website). The United States *Oil Spill Pollution Act* of 1990 has taken steps toward reducing the amount of oil entering the ocean by requiring all oil tankers to be double-hulled by the year 2015. There is also a US/BC Oil Spill Task Force, established in 1989, that have made 46 recommendations for oil spill prevention and response, of which a large proportion have been incorporated into either the US *Oil Spill Act* or the Canadian *Shipping Act.*

5.4.2 Cargo Vessels

Freighters and deep-sea tugs are a common sight through the Juan de Fuca Strait as they travel to the main ports of Vancouver and Seattle from Japan and Europe, and vice versa. These vessels carry a wide range of industrial cargo, including cars, coal and forest products. The Port of Vancouver is the largest port in Canada and received a total of 72 million tonnes in traffic for 1998. Port operations were estimated to contribute $1.68 billion to the Canadian economy and generated 17,300 jobs (Transport Canada website). The taxes generated by activities and related indirect businesses by the port totalled $520 million (Vancouver Port Authority website).[5]

Table 6 summarizes the total annual transits, by vessel type, moving in and out of the Port of Seattle, via Juan de Fuca Strait, for 1998. Large vessels are required to notify the Port of Seattle when they enter or exit the port. These movements are recorded, by vessel type, and summarized on an annual basis. A majority of these vessels will pass Race Rocks on route to their final destinations. The results of this summary indicate that there could be over 600 vessels travelling past Race Rocks on any given day.[6] The total numbers depicted in this table do not indicate the total number of individual vessels entering the Port of Seattle, but rather reflect the number of transits. For example, there are not 178,374 individual ferries entering the port every year, but more likely 6 individual ferries making 29,729 transits into and out of the port.

Table 6: Annual Transits by Vessel Type for the Port of Seattle in 1998

Vessel Type	Total Annual Transits	Average No. Transits per day*
Government Vessels	3,083	8.4
Freighters	16,888	46.3
Tankers	2,205	6.0
Tug Boats	25,878	70.9
Ferries	178,374	488.7
Other	1,677	4.6
TOTAL	**228,105**	**624.9**

* total transits/365 days per year

[5] There is very little oil and cargo traffic that enters the Victoria Harbour and therefore there is little direct economic benefit to the Victoria area other than through pilotage. Pilotage is compulsory in all coastal waters of BC. There are 44 BC Coast Pilots (BCCP) employed in Victoria that operate under the Pacific Pilot Authority from the pilot boarding station located at Brotchie Legde (Chamber of Shipping website).

[6] A formal information request has been submitted to the Port of Seattle on the value of cargo and the amount of oil entering and exiting the port. This may be appended to the Socio-Economic Overview at a later time.

5.4.3 Other Marine Traffic

Smaller and slower vessels than the oil and cargo vessels (such as smaller tugs and tows) can transit closer to Race Rocks as they are not required to follow established shipping routes (J. Peschel, pers. comm.). However, given their likely destinations, there appears to be no reason for these vessels to travel close to the islets except in the event of an emergency.

5.5 Coast Guard Activities

Both the Canadian and United States Coast Guards have some interest in Race Rocks as part of their involvement in the Co-operative Vessel Traffic Service (CVTS). The CVTS acts much the same way that air traffic control operators monitor aircraft; the focus is to improve safety and efficiency of traffic management. Race Rocks coincides with the BC Pilot boarding station for Victoria/Vancouver near Constance Bank, but vessels simply bypass Race Rocks as a 'check-in' location when either in or outbound (J. Peschel, pers. comm.).

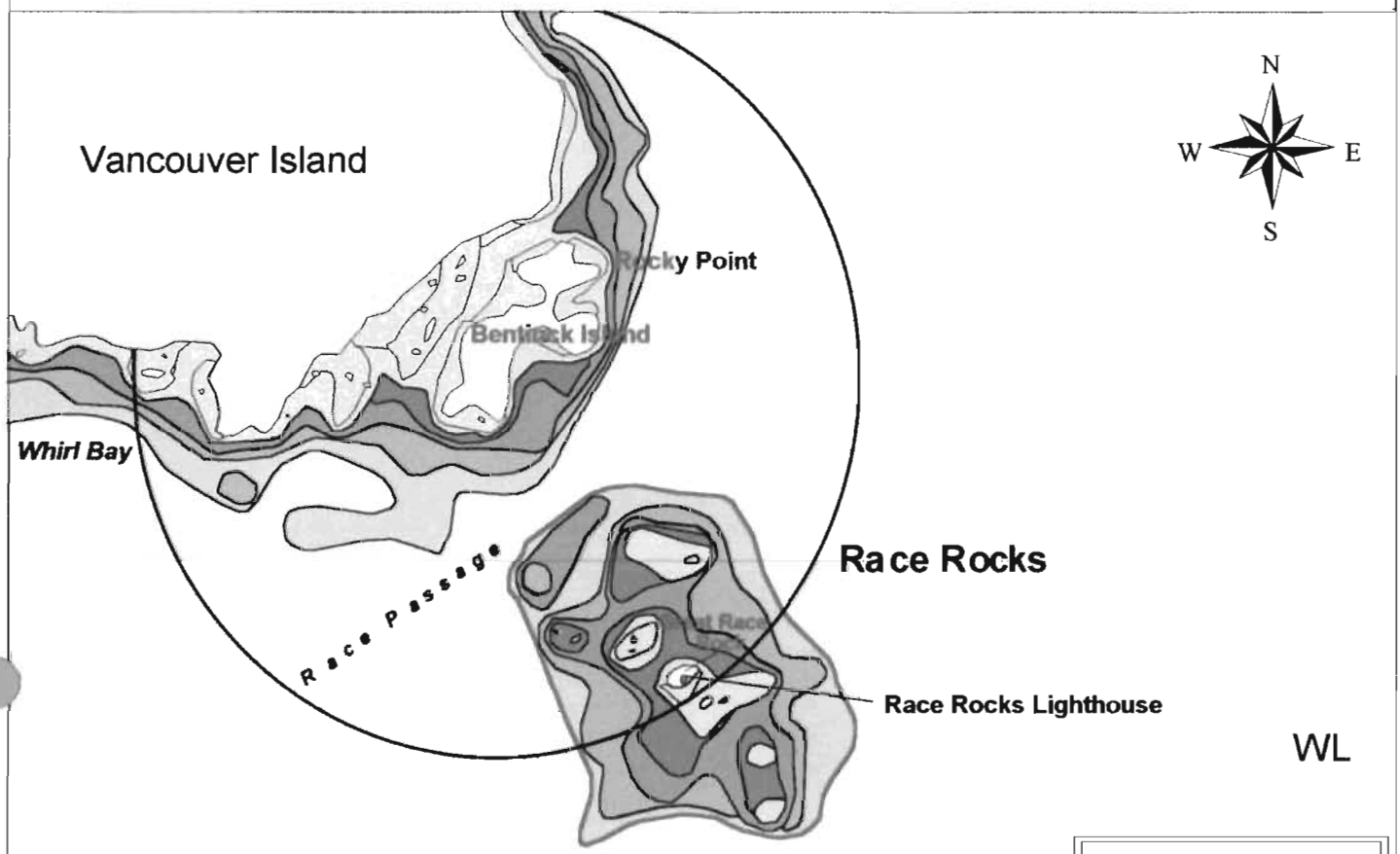
The Canadian Coast Guard (CCG) was originally responsible for the light station situated on Great Race Rock and for semi-annual transportation of fuel and supplies to the station. The CCG is still responsible for the station, after it was decommissioned in 1997, and continues to make occasional trips to the station for maintenance (G. Hamilton, pers. comm.). While there is a helicopter pad on Great Race Rock, it is no longer used. An environmental study was conducted in 1998that concluded that helicopter landings were interfering with certain rookeries and therefore all helicopter activity was abandoned and the elevated concrete pathway leading to and from the pad was demolished earlier this year. All Coast Guard facilities are now concentrated on the southwest side of Great Race Rock (G. Hamilton, pers. comm.). From a public safety perspective, it is within the CCG's mandate to respond to any marine vessel emergency in the area. Since 1994, the CCG has responded to 28 marine emergencies and assisted over 80 people.

The United States Coast Guard has only a limited interest in Race Rocks as part of their involvement in the CVTS (J. Peschel, pers. comm.).

5.6 Military Activities

The Race Rocks Ecological Reserve is partially within the Department of National Defence (DND) military buffer zone (see CHS chart 3641) which is used extensively by the Canadian Forces for a variety of purposes. The three main areas utilised are Rocky Point, Bentinck Island and Whirl Bay (Figure 2). The DND owns both Bentinck Island and a 2500 ha parcel of land at Rocky Point. This was crown provincial land and DND now holds a provincial Order in Council for these properties. Bentinck Island was originally a leper colony, after which no one was interested in the land. The only existing feature on the island is a small, inactive cemetery. DND is also the controlling agency for Whirl Bay. Any party, including the Coast Guard, that is interested in obtaining access to any of these areas is required to obtain a clearance permit from DND (D. Beamish and G. Smith, pers. comm.).

Race Rocks
Pilot Marine Protected Area



WL Military Exercise

Military Buffer Zone

Ecological Reserve Boundary

Water Levels

- 0-2
- 2-5
- 5-10
- 10-20
- 20-30
- 30-200

Figure 2
Areas of Principal Department of National Defense Activity Near Race Rocks

1000 0 1000 2000 3000

Meters

Fisheries and Oceans Canada

Printed from digital files by
Canadian Coast Guard-GIS Services

Rocky Point serves as a permanent ammunition depot for the military. On average, the military makes about one trip per week to Rocky Point for depositing and collecting ammunition. The DND is sometimes contacted by citizens who have been collecting world war vintage ammunition and are now concerned about the safety of possessing these items. These trips are included in the once per week estimate.

Inland from Race Rocks is Bentinck Island that is used as a land-based demolition range, while Whirl Bay, located west of Race Rocks, is the main diver training and underwater demolition area used by the military for training purposes. Both of these areas are typically used several times per month for training exercises, however, seasonally, they can be inactive for several months. Supplemental training sessions are also conducted at these two locations, which can extend for a period of one to two weeks, during which time blasting may occur daily (Major Norris, pers. comm.). Concerns have been raised by Pearson College and marine tourism operators that noise from the demolitions causes disturbance to marine wildlife and potentially underwater life as well. It has been reported that during periods of blasting, sealions are observed leaving their resting ground on Great Race to seek protection in the water.

An additional 'WL' military exercise area is located to the south and east of Race Rocks in the Juan de Fuca Strait (Figure 2). The DND has control over the area but it receives little to no use, and there are no restrictions on use of this are by other vessels.

With respect to marine traffic, the Race Rocks area is used infrequently by the Canadian Navy. Navy ships will pass by Race Rocks on route to Pedder Bay where they dock at the Rocky Point jetty for access the ammunition dump. This activity occurs, on average, at a frequency of once per week. The strong tidal currents common to the area generally negate any extensive use of these waters by naval vessels. In the region, the Canadian Navy also utilizes an exercise area at William Head, well to the west of Race Rocks, and both the U.S. and Canadian Navies utilize the waters in the vicinity of Hind Bank which lies significantly to the east.

6. TOURISM AND RECREATION VALUES

Section 6 summarizes the known recreation and tourism values of Race Rocks and describes the levels of frequency of use for such activities as boating, diving, sport fishing and marine wildlife viewing. Where information is available, the economic significance of recreation and tourism activities at Race Rocks is also discussed.

Although activity- and site-specific data are difficult to obtain, it bears mention that the economic benefits of marine tourism, including private trips by individuals, are significant at a provincial level and in the Greater Victoria region. A province-wide study, conducted for 1989, estimated the value of BC's marine tourism industry to be in the order of $222 million dollars, with nearly 800 marine-based tourism businesses in operation (ARA Consulting Group 1991). A more recent report concludes that one in every three dollars spent on tourism in BC goes toward marine or marine-related activities (F&OC and LUCO 1998). At a regional level, over 5.5 million visitors traveled to the City of Victoria in 1998 generating roughly $7.5 billion in revenue; and of those who visited from outside the province, 16% participated in marine-based activities such as boating, sport fishing and whale watching (Tourism British Columbia 1998). Direct economic benefits of such activities include job creation and user expenditures for necessities such as licenses, guides, charters, equipment and supplies. Indirect benefits include economic 'spin-offs' created in the local or regional area.

6.1 Access and Activities

Commercial and non-commercial recreation activities such as wildlife viewing, diving, boating and nature appreciation occur in the vicinity of Race Rocks, both in the water and on land. In the immediate area of Race Rocks, and including the Race Rocks Ecological Reserve, there are several categories of visitors (BC Parks 1998b):

1. private and commercial boaters who are primarily observing the marine life around the rocks, particularly marine mammals;
2. boaters who come ashore, usually to visit the lighthouse facilities;
3. divers who dive either from shore or from boats; and
4. recreational fishers who fish within (for migratory species) and outside of the ecological reserve boundary.

Visitation to the waters surrounding Race Rocks has been increasing since the 1980s (BC Parks 1998a). Given the proximity of the site to Victoria and the interest in these types of activities, commercial and recreation use is expected to continue to grow.

Access to Race Rocks is limited to boat users and only seaworthy vessels are able to approach the islets given the extreme sea conditions and lack of sheltered moorage. Anchoring is not permitted in the ecological reserve except during emergencies due to the fragile nature of the underwater features and ecological communities. Some boats, for example dive boats, land at the docks on Great Race Rock. There are no other temporary mooring facilities in the area. Pearson College has signs and brochures that encourage all users of the docks to get permission from the resident light keeper before going ashore and to sign a visitor book. Entry onto any of the small islands is by permit only and there are no public facilities available on shore.

As per the Ecological Reserve Regulations, all commercial operators who land at Race Rocks are required to have a permit from BC Parks for their activities. Operators who merely enter the waters of the ecological reserve to view wildlife or for diving or fishing charters, are not required to obtain a permit (D. Biffard, pers. comm.).

6.2 Boating

The Race Rocks area is conveniently located within easy access to Greater Victoria, which makes it an attractive destination for pleasure boaters. Additionally, both private and commercial tourism vessels frequently pass near or through Race Passage (mainly tender, wildlife-viewing and fishing boats from Vancouver and Victoria) on their way to or from the salmon, herring and whale-watching grounds in the Pacific. The tourist season, primarily from June to September, is one of the most popular times of year for all types of boating activities.

Commercial whale-watching companies and other marine charter operators (e.g., diving) out of Victoria and Washington have contributed to a significant increase in boat traffic in the Race Rocks area in recent years (see Sections 6.3 and 6.4). In the area immediately surrounding Race Rocks, fishing for salmon and halibut occurs although much of the halibut recreational fishery takes place in deep waters beyond the immediate vicinity of Race Rocks (see Section 6.5). Sea kayaking also occurs at Race Rocks on a limited basis. Rough sea conditions and strong currents mean that most paddlers avoid the area. However, as sea kayaking is an activity that is growing in popularity, it may be necessary to consider this as a potential future use of the site for a limited market of experienced kayakers.

Log books are used by resident caretakers to record boat activity in the ecological reserve. According to the 1997 records, 44 boats entered the ecological reserve between the months of March and August. Seventeen were engaged in fishing activities, four were tour boats, and the remainder were unclassified (data recorded by Carol Slater, as presented in Murgatroyd 1999). While this seems low when compared with the number of vessels that transit the area, Race Rocks is likely to see an increase in boat traffic in the future, a trend that may be exacerbated if the area is designed a MPA. Various information sources indicate the boating industry in BC is strong. For example, a BC Parks study reported that in 1991, some 28% of British Columbians participated in powerboating, 9% participated in sailing and 20% participated in canoeing and kayaking (BC Parks 1991). This is in addition to the 46% of British Columbians who participated in fishing activities. According to the Canadian Allied Boating Association there are approximately 408,000 recreational boats in British Columbia, most of them outboard powerboats (MTABC no date). Additionally, more than 50,000 visiting U.S. boaters cruise BC waters annually, a figure that increases every year.

6.2.1 Economic Significance of Boating

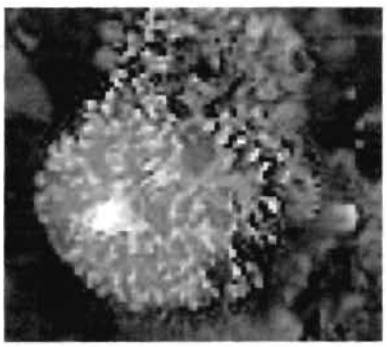
Boating has the potential to bring considerable economic benefits to local economies through direct expenditures on moorage, insurance, fuel, supplies, club memberships, maintenance and repairs. In 1989, marinas alone generated over $101 million in revenues through the provision of moorage, gas, launching facilities and supplies to both resident and non-resident boaters (MTABC no date). Unquantified indirect expenditures from boating might include food, park use

fees or costs associated with related recreational pursuits such as diving or fishing. In terms of employment, the Marine Trades Association of BC (no date) has estimated that recreational boating activities generated at least 22,000 person-years of total direct and indirect employment in 1989, not including jobs created in the related sport fishing sector (see Section 6.5).

6.3 Diving

The lack of winter ice in the Juan de Fuca Strait allows for year-round diving and boating in certain areas of the Strait, however extreme weather and cool water temperatures around Race Rocks typically restrict diving to warmer months. Fair weather diving occurs from July through October at Race Rocks when water temperatures are high. During warm years, divers may use Race Rocks for longer periods of time but will rarely use it for more than six months of the year (A. Bradley, pers. comm.). Along with the weather, currents are a determining factor in dive planning. Most diving can only be done during slack water, which will occur at most twice a day, leaving only a narrow window of opportunity for divers (from 30 minutes to one-hour until currents shift). Inexperienced divers and those on introductory certification dives are discouraged from diving in this area without an experienced guide. As anchoring is prohibited in the ecological reserve, dives are usually done with a live[7] boat, or from the dock on Great Race Rock.

Diver at Race Rocks - Pearson College



Hydrocorals at Race Rocks - Pearson College

6.3.1 Values and Dive Sites

The underwater features at Race Rocks make it a highly-valued dive for intermediate and experienced divers. One dive charter company describes it as *"the premiere diving location in the southern half of Vancouver Island"* and others have described it as among the best dives in BC because of the diversity and intensity of marine life (R. Glazner, pers. comm., K.Cleemput, pers. comm.). Divers have the opportunity to view species such as wolf eel (*Anarrhichthys ocellatus*), kelp greenling, several species of rockfish, sculpin (family *Cottidae*), and occasionally lingcod. Large populations of invertebrate species are also found including sponges, sea anemones, over 65 species of hydroids, bright pink hydrocoral and soft coral , bryozoans, molluscs, giant barnacles, a variety of colonial tunicates, three species of sea urchin, sea cucumbers and basket stars (Pearson College 1999).

Divers utilize a number of sites around Race Rocks (K. Van Cleemput, pers. comm., A. Bradley, pers. comm.). The following descriptions were provided by *Shallon* Charters and are posted on their Internet web page. According to the company, each of these sites is distinct from the others,

[7] The term 'live' boat refers to the use of a vessel that drops divers off at one location and picks them up where they surface.

and it takes a diver several visits to each site to get a true feel for the diversity within and between each site.

The most popular of the Race Rocks dives is Great Race Rock, which is used by both private and commercial users. This dive is preformed in the pass on the north side of Great Race. It is popular because it is the easiest dive in the area and can be accomplished by all levels of divers, if supervised. Light currents make navigation easy and most divers stay above depths of 50 feet. Divers wishing to observe sea lions, which are most prevalent during November and December, also use the West Race islet. This site is suitable for most divers, while the 'West Race Wall' is a more advanced dive due to slightly higher currents and deeper depth (down to 100 feet). However, this is an excellent site to see various species of sponges and barnacles. The West Race North dive is a shallow dive sometimes used by charter companies as a shorter duration dive. The area is found within a kelp forest and is subject to slower currents.

Charter companies sometime dive along the Rosedale Reef, which extends from Great Race to the south-south-east. The currents here are less predictable and the area is dotted with shallow rocks, making it a more advanced dive. The reef is a series of rocky ridges, between which live an abundance of marine life. Here, divers may also see evidence of the numerous wrecks that have occurred in the area, in particular, the machinery from the *Idaho*. A dive site at Central Race Rock is popular for viewing red sea urchins and corals that have been described as "reminiscent of the Caribbean". This is one of the best places at Race Rocks to find harbour seals, and is a popular location for snorkelling with seals and sea lions. The North Race offers a drift dive that is for advanced divers only, as it requires more skills for maneouvering through a variety of depths and unpredictable currents.

Nearby dive sites that are also used along with Race Rocks include Swordfish Island and Bentnick Island, where the wreck of the *Barnard Castle* can be found.

6.3.2 Levels of Use by Divers

Much of the diver use is conducted through charter companies although private users do frequent the area. The vast majority of trips occur during the summer months. Three companies (*Shallon* Charters, Doug Wilson Dive Charters and Ogden Point Dive Centre) make up the majority of commercial users of Race Rocks. While the actual number of diver days varies with weather conditions and market demand, use of Race Rocks by charter companies is estimated at between two and three trips per week on average, with each trip comprising between five and ten clients. The Odgen Point Dive Centre, the closest charter operator to Race Rocks, take an estimated 500 divers to Race Rocks each year (Murgatroyd 1999). The Sidney-based *Shallon Charters* once used Race Rocks exclusively, running between three and four trips per week in previous years. However, their use of Race Rocks has dropped considerably and in 1999 they ran only two trips to the site (K. Van Kleemput, pers. comm.).

The CFB Esquimalt Dive Club is a regular user of Race Rocks (R. Glazner, pers.comm.). The club's boat takes ten to twelve divers out to Race Rocks between twelve and fourteen times per year. The most frequently dived site by club members is the southern side of West Race Wall in the channel between Great and West Race Rocks. Similar to charter operators, a live boat is

generally used unless novice divers are aboard, in which case the boat will dock at Great Race and the group will dive from shore.

Due to tidal conditions, diving can only occur during intervals of slack water and most dives do not last longer than one-hour (A. Bradley, pers. comm.). However, some companies spend up to three hours at the site diving and viewing marine wildlife. Additional information on private dive use may be gleaned from incidental observations recorded in logbooks that are kept by the reserve guardians. These logbooks are currently the only records of use of Race Rocks by both private and commercial divers. In 1995, roughly 1300 divers signed the guest book kept on the dock of Great Race Rocks (Grant 1996), however, as many dive boats do not dock on the island, this value is conservative at best.

6.3.3 Economic Significance of Diving

There are some 265,000 active[8] divers in Canada with concentrations in BC and Ontario, and some 2.8 million active divers in the United States (Economic Planning Group *et al.* 1997). Participation in diving is rising, with some 30,000 new divers being certified each year and some 600,000 new certifications annually in the United States. New certifications are expected to continue to grow at 15% per year for the next several years (Economic Planning Group *et al.* 1997). BC is recognized nationally and internationally as an excellent dive destination, and the activity has seen a high participation rate among BC residents. According to one report, the industry was valued at $4 million dollars in 1993 (Eggen 1997).

Both private divers and commercial dive operators incur costs associated with diving and these dollars ultimately filter into the local economies. The costs of diving include equipment (a $2500 - $6000 initial cost), air and compressor costs ($5 - $6 per tank), and costs associated with chartering or owning a vessel (e.g., insurance, fuel, maintenance and repairs). Some of these economic benefits are substantial, such as moorage costs that can run between $1500 - $3500 per year depending upon vessel size. Boat insurance, liability insurance and general maintenance and repairs on vessels and equipment may also equate to thousands of dollars per year. Charter operators may spend $100 - $250 daily on fuel and another $5 - $6 per tank for air, in addition to capital costs of equipment and wages for crew and instructors. Hence dive operators change an average of $75 - $80 per person per day for charters, which generally include two dives and all related equipment. With approximately 80 trips to Race Rocks in 1999, and an average of seven clients per trip, the commercial dive industry grossed approximately $45,000.

Indirect costs such as food, accommodation and miscellaneous spending can add up to thousands of dollars spent in the local dive area. For charter operators that offer full-day or multi-day packages, other local businesses are often sought to provide catering services and/or overnight accommodation. Additionally, for well-known dive locations, divers may also require airfares or ground transportation to the nearest centre from which they depart for their dive excursion. While no exact figures are available for BC, one survey of out-of-province divers who visited Nova Scotia found that the average person spent $475 on dive-related activities during their trip and an average total of $1400 in the province (Economic Planning Group *et al.* 1997).

[8] An 'active' diver is defined as one who makes more than two dives per year.

Since diving is a year-round sport, with the best underwater visibility in the winter months, diving can potentially bring money into a community during the off-season for other types of tourism activities (G. Dennison, pers. comm.). Furthermore, the literature suggests that dive operators tend to reinvest substantially in their businesses to keep up to the demand for diving tourism (Dixon et al 1993).

6.4 Whale Watching and Marine Wildlife Viewing

The regional study area is a prime viewing area for marine wildlife primarily for orca whales (*Orcinus orca*), and other species of whales, that can be found in Haro Strait. Although whales do visit the immediate Race Rocks area, the islets and surrounding waters are better known for viewing other types of marine wildlife. California sea lions (*Zalophus californianus*) and northern sea lions (*Eumetopias jubata*) haul out on Race Rocks between the months of September and May in numbers often well over one thousand. Several hundred harbour seals (*Phoca vitulina*) reside on the islets year round, bearing their young in June and July. A small number of elephant seals (*Mirounga angustirostris*) and a family of river otters (*Lutra canadensis*) have recently been observed in the reserve and there has been the occasional sighting of a lone Alaskan fur seal (*Callorhinus ursinus*). Dall's porpoises (*Phocoenoides dalli*) and gray whales (*Eschrishtius robustus*) are also seen in the local waters on rare occasions (Pearson College 1999).

Harlequin Duck - Pearson College

The islands serve as nesting colonies for about 500 sea birds and as a stopover during migration. Glaucous-winged gulls (*Larus glaucescens*) and pelagic cormorants (*Phalacrocorax pelagicus*) are the most abundant nesting birds in the months of June and July. Pigeon guillemots (*Cepphus columba*) nest in rock crevasses on the central island and up to 10 pairs of black oyster-catchers (*Haematopus bachmani)* also nest in the area. Bald eagles (*Haliaeetus leucocephalus*) frequent the area, with groups of up to 50 birds recorded on the rocks in the winter months. Harlequin ducks (*Histrionicus histrionicus*), black turnstones (*Arenaria melanocephala*), surf birds (*Aphriza virgata*), and rock sandpiper (*Calidris ptilocnemiscan*) can be observed occasionally, especially in the winter months In the local waters of Race Passage common murres (*Uria aalge*), rhinoceros auklet (*Cerorhinca monocerata*), ancient murrelet (*Synthliboramphus antiquus*), and marbled murrelet (*Brachyramphus marmoratus*) are occasional visitors In the fall and winter, the most abundant birds are the glaucous-winged gulls and Brandt's cormorants (*P. penicillatus*) on the islands, and common murres on the surrounding waters (Pearson College 1999).

6.4.1 Marine Wildlife and Whale Watching Charters

Visitation by tourist charter boats to Race Rocks has been increasing, particularly those engaged in whale watching and marine wildlife viewing. An estimated 85 commercial whale watching boats (about 50% from Canada and 50% from Washington) carry about 140,000 passengers per year to the shared inland waters around Haro Strait (Pynn 1999). Private vessels also engage in whale watching activities in this area (See Section 6.2).

The high-season for the industry is April to October where tourists have a 90% chance of seeing whales in Haro Strait (highest in June-August). During this period, few operators go to Race Rocks as a first choice as whales are more likely to been seen elsewhere, particularly around the Gulf Islands and the San Juan Islands. However, Race Rocks is used as 'Plan B' on the itineraries of many commercial whale watching companies. This means that on occasions when whales are not found, operators will take clients to Race Rocks where they are guaranteed to see a variety of other types of marine life.

One company estimates their use of Race Rocks between April and October as only about two or three days out of the month (when whales cannot be found elsewhere), however during those days, they may run four to five trips per day to Race Rocks. Some of the larger companies may run eight or nine trips per day and one company runs 18 trips per day from Victoria Harbour during the peak season. Thus when whales are not found, all of these boats may potentially head to Race Rocks. However, several companies indicated they nearly always take clients east towards the San Juan Islands, even when whales are not found. For these companies, Race Rocks is an out-of-the-way destination that is rarely visited in the summer. The largest marine wildlife viewing company, Prince of Whales, stopped at Race Rocks about 20 days between May and September of 1999 (A. Allen, pers. comm.).

Race Rocks is used more frequently during the whale watching shoulder season (i.e., April and October) when the chance of seeing whales decreases, and it is used by some companies as a main destination during the whale watching off-season (i.e., November to March) along with sites such as Whirl Bay. The latter trips are marketed as 'nature tours' or 'marine wildlife tours' as opposed to whale watching excursions. The prime draws are stellar and California sea lions, Elephant harbour seals, porpoises, seabirds, and occasionally humback whales. These off-season marine wildlife trips are usually about two- to three- hours long and most visit Race Rocks for at least part, if not all, of that time. Companies may run several of these trips per day (on average two to three) during the shoulder season when tourist volumes are still relatively high. Operators visit Race Racks less frequently during the winter due to lower tourist demand and poor weather conditions.

One operator estimates that about twelve boats per week from his outfit go to Race Rocks during the off-season (D. Kukat, pers. comm.). Another operator advertises daily tours to Race Rocks from mid-October to March although the exact number of trips depends on tourist demand. On average, this company may run four to five trips per week to Race Rocks from October to November dropping to one or two trips per week from December to March (D. Cooper, pers. comm.). If Race Rocks is the main destination, a typical tour group will spend 35 to 45 minutes there. If Race Rocks is not the main destination, but a side-trip or part of a package tour, a tour group may spend as little as 15 minutes there.

6.4.2 Economic Significance of Marine Wildlife Viewing

While there are no exact figures on the economic benefits of Race Rocks for wildlife viewing, some inferences can be made. A 1999 article in the *Vancouver Sun* estimated that the number of operators in the Victoria area had grown to 45, many of whom own multiple boats (Pyne 1999), and other estimates appear consistent with this. However, data on the total number of passengers varies. According to one source, 81,000 tourists from BC and Washington engaged

in commercial whale watching in Haro and Juan de Fuca straits in 1997 (Obee 1998). For the same area, another source states that the BC-based whale watching industry accounted for approximately half of an estimated 140,000 whale watching clients in 1998, a 73% increase from the 1997 estimate. If this is true, then BC operators served 70,000 passengers in 1998. At an average cost of $60 per person, these operators collected $4.2 million in ticket sales alone. When combined with other tourist expenditures, the industry is likely worth far more[9].

Shoulder-and off-season trips exclusively to Race Rocks for marine wildlife viewing are similarly priced at around $60 per person, although volumes are much lower. Considering October and November when use of Race Rocks is highest, a hypothetical company that averages twelve clients per trip and three trips per week, could generate direct revenues of over $17,000 during this eight-week period. While not all companies run marine wildlife tours that focus on Race Rocks, if each of the 45 companies ran only one trip to Race Rocks per week the economic benefits would still be significant. It is clear that the Race Rocks site brings in economic revenues to Victoria tourism operators and spin-off benefits to others in BC.

6.5 Recreational Fishing

The coastal areas off southern Vancouver Island are among the most productive recreational salmon sport fishing waters in British Columbia and sport fishing is a popular activity in the immediate waters off Race Rocks. In 1990, the Department of Fisheries and Oceans closed these waters to the commercial harvest of fin and shellfish and to recreational harvest of shellfish, lingcod, and rockfish. Recreational fishing of salmon and halibut is still permitted. Collecting in the reserve and any kind of harvesting, including shellfish and seaweed is prohibited under Ecological Reserve Regulations.

6.5.1 Fishing Values

Extreme currents and resultant nutrient upwellings create ideal fishery conditions at Race Rocks. The nutrient-rich waters swept up from the ocean floor provide excellent forage for migratory salmon species and resident groundfish such as lingcod (*Ophiodon elongatus*), halibut and a variety of rockfish (*Sebastes* spp.) species. The ecosystems supported in the tidal and sub-tidal areas demonstrate species richness, diversity and abundance characteristic of only the most nutrient-enhanced of locations (Hardie and Mondor 1975, Pearson College 1999)

In comparison to other areas in the Strait of Juan de Fuca, the Race Rocks location is a desirable area to fish, attracting people from Sooke, Pedder Bay, Victoria and Washington for sport fishing purposes (W. Bond, pers. comm., D. Kukat, pers. comm.). Additionally, due to increasing sport fishery closures elsewhere, Race Rocks has become one of the main places to fish on the southern end of Vancouver Island (S. Moore, pers. comm.). Sport fishing boats are observed both inside (fishing for salmon and halibut) and outside the reserve boundary (fishing for groundfish and salmon).

[9] Although not specific to the Race Rocks area, Ed Lochbaum of Fisheries and Oceans Canada has estimated that whale watching, including watching gray whales on the west coast of Vancouver Island, generates $100 million a year in direct and spin-off benefits in BC (Pyne 1999).

Fishers are limited to a certain extent by the exposed nature of the Race Rocks area, and the tendency for high winds, surface swells and large tidal exchanges. This combination of effects often limits the number of fishers that can access the area at any given time, especially in the winter months. In an average month, it has been estimated that recreational fishing boats can safely access the area only 12 days (W. Bond, pers. comm.). However, Race Rocks provides some protection from heavy tidal waters and prevailing winds and allows safer access to waters that contain high food availability for fish. The pinnacled type of underwater terrain of Race Rocks is favoured habitat of halibut, the most sought after species of charter groups (W. Bond, pers. comm., D. Kukat, pers. comm.).

6.5.2 Regulations and Enforcement

The Race Rocks Ecological Reserve is an area of provincial jurisdiction that protects the ocean floor around the Race Rock islands and pinnacles. The governing regulations of the reserve prevent the harvesting of ocean floor resources, but do not prevent the harvest of fish from the water column.

In 1990, regulations implemented by Fisheries and Oceans Canada prevented the fishing of species with slow reproductive biology, namely rockfish and lingcod. The regulations prevented the capture or intent to capture rockfish or lingcod within the 20 fathom (36.6 metre) area surrounding Race Rocks. This regulation allows resident or non-migratory fish to maintain a refugium, which possibly provides strength to surrounding populations and maintains species richness in the ecological reserve. Salmon and halibut, both migratory species, are allowed to be angled within the 20 fathom area, however, any by-catch of groundfish other than halibut must be released according to Fisheries and Oceans regulations.

Due to limited enforcement budgets within Fisheries and Oceans Canada, many of the charter operators informally police the 20 fathom boundary. Sport fishers or other operators are also informed of the regulations restricting the fishing of rockfish and lingcod within the ecological reserve by the reserve guardians who reside at the lighthouse site on Great Race Rock (C. Slater, pers. comm.). These guardians are former lighthouse keepers and are on temporary salary with Pearson College to maintain a presence at the reserve (A. Mathews, pers. comm.).

6.5.3 Recreational Fishing Activities

The waters surrounding the Great Race Rock and associated islands is a preferred fishing location for local sport fishers and area charter operators (R. Waters, pers. comm., L. MacBride, pers. comm., W. Bond, pers. comm., S. Moore, pers. comm.). The recreational fishing regulations currently restrict the harvest of rockfish and lingcod for conservation purposes at Great Race Rock, North Race Rock, West Race Rock and Rosedale Rock within the 20 fathom depth contour (F&OC 1999). However, within this 20 fathom area fishing can still occur for other species such as salmon and halibut. In fact, Race Rocks is currently within on of two allowable salmon fishing locations in Fisheries Area 20 (F&OC 1999a). Fishing at Race Rocks is a good location for all species of anadromous salmon including pink (*O. gorbusha*), coho (*O. kisutch*), chinook (*O. tshawytscha*), sockeye (*O. nerka*) and chum (*O. keta*). All are available to the sport fisher at various times of the year.

Race Passage is one of the favoured locations for salmon trolling in the Race Rocks area. Trolling is sometimes accomplished without motor assistance as strong currents keep the fishers entirely outside of the ecological reserve. Depending on the tidal currents (i.e., ebb or flood), salmon are also fished to the east or to the west of Great Race in eddies where food becomes concentrated (Waters, pers. comm.). These two areas are within the ecological reserve and provide very good salmon fishing, second only to Race Passage.

Halibut fishing generally occurs outside of the current ecological reserve on pinnacled areas where the fish come to feed. One prime location, known as Eleven Fathom Rock, is located to the north of the reserve and often has ten to fifteen boats on its flanks (R. Waters, pers. comm). Additionally, excellent halibut potential can be found near the Rosedale can-buoy where many boats have been known to raft up to the buoy to fish. It must be noted that tying to a navigational aid is to be discouraged as it is against the law (C. Slater, pers. comm.). Finally, good halibut fishing can be found to the east and to the west of the ecological reserve and boats commonly use these areas when space gets limited in other locations.

On an average day, approximately four to five boats may be in the water around Race Rocks at any given time depending on weather, and tidal direction and strength (C. Slater, pers. comm.). Charter operators report that twelve to fifteen boats per day is an average in the winter (comprising private, charter and rental boats), whereas use in the summer months is generally much higher (W. Bond, pers. comm.). The local conditions tend to create the effect of 'forced conservation'. When bad weather prevails, most fishers tend to stay closer to shore or do not go out at all. It can be inferred that if Race Rocks were in a calmer area with comparative fishery resources, it would have a higher fishing pressure.

6.5.4 Charter and Guided Fishing

There are approximately 50 fishing charter operators that use the Race Rocks as a productive, accessible, year-round fishing location for halibut and salmon (W. Bond, pers. comm., S. Moore, pers. comm., R. Waters, pers. comm.). Both of these species are migratory, as opposed to resident groundfish species such as lingcod, rockfish and kelp greenling (*Hexagrammos decagrammus*). Groundfish catch restrictions, excluding halibut, currently apply within the Race Rocks Ecological Reserve to the 20 fathom bathymetric line and this regulation is respected by charter operators who frequent the area.

Occasionally, fishers accidentally cross the reserve boundary with fishing gear targeting groundfish (i.e., jigging gear for rockfish or lingcod) and are advised by fellow guides or the reserve guardians of the regulations and boundary location. In order to prevent any confusion, the boat rental operation at Pedder Bay Marina provides all clients with Race Rocks Ecological Reserve maps designating the reserve as a restricted area. The occasional rental boat crosses into the reserve prompting a call to Pedder Bay by the reserve guardians and a prompt 'clarification' trip by a Pedder Bay representative to warn those involved (S. Moore, pers. comm., C. Slater, pers. comm.). This demonstrates the commitment that the Pedder Bay Marina has in maintaining the resident fish population of the reserve. These types of self-policing of the sport fishing guide industry demonstrates a keen interest in abiding by fisheries regulations.

6.5.5 Economic Significance of Sport Fishing

Various attempts have been made to quantify the economic value of sport fishing. Sport fishing is the most popular marine-based activity in BC, generating the greatest amount of revenue with the largest number of operators (ARA Consulting 1991). In a 1995 national sport fishery survey, approximately 200,000 angler days per year were recorded for the Victoria area, generating between $30 and $50 million dollars in associated expenditures (T. Gjemes, pers. comm. as cited in Murgatroyd 1999). The sport fishing industry in BC generates an estimated 17,500 person-years of employment including direct and indirect impacts (MTABC no date).

The average cost of halibut charter to Race Rocks is about $500 per day of fishing per group (generally four persons). There are approximately twelve 'safe weather' days per month to be on the water at Race Rocks, and an average of five trips per day can generally be anticipated. Thus, charter operators run approximately 720 charters per year to the Race Rocks area fishing for halibut predominately, and to a lesser extent migratory salmon (W. Bond, pers. comm.). Additionally, some charter companies run trips to Race Rocks on a daily basis (W. Bond, pers. comm., D. Kukat, pers. comm., Moore, pers. comm.). Based on these figures, annual revenue within the Victoria-area sport fishing guiding industry is calculated at approximately $360,000 per year, and many of these operators utilize Race Rocks to varying degrees (W. Bond, pers. comm.).

Additionally, ARA Consulting (1991) compiled a report showing that 30 anglers per day go out to the Race Rocks area in private boats. Based on twelve fishing days per month, Race Rocks experiences a total of 4320 private sport fishing trips per year. These individuals pay for moorage or boat launching, fuel, tackle and repair services at various marinas and facilities throughout the Greater Victoria Region.

Fishing derbies are a secondary source of sport fishing dollars each year but can have a large economic impact. However, based on tides, currents and unpredictable weather conditions, derbies may be restricted from using the Race Rocks area (W. Bond, pers. comm.).
In addition to economic benefits, sport fishing provides important social benefits including recreation and education. Fishing education has also become quite popular on the local fishing scene. Mr. Ward Bond has taught halibut fishing courses to approximately 960 fishers per year over the past four years, each of whom pays a small registration fee to learn proven fishing techniques and fishing ethics (W. Bond, pers. comm.). Classes are held at local fishing supply shops and are generally organized based on demand. No definite financial characteristics were obtained for this type of activity.

Thousands of local and international fishers benefit from the opportunity to fish in BC waters. However, the current recreational fishery is slowly declining, and with it the social pleasures of the sport. This is evidenced in declining boat sales, vacant marinas, and a reduction in the number of fishing charters and boat rentals (S. Moore, pers. comm., R. Waters, pers. comm.). In the wake of this decline, Race Rocks is still seen by fishers as a productive and relatively accessible fishing location.

7. RESEARCH AND EDUCATION VALUES

Section 7 summarizes the known science and research values of Race Rocks. Past, current and potential future research activities are described along with the values of Race Rocks as a regional focus for marine education. Although much of the information gathered by research activities at Race Rocks has not been converted into report formats (often due to financial restrictions), the following summary demonstrates the interest that the scientific and educational communities have in Race Rocks.

7.1 Science and Research Activities at Race Rocks

7.1.1 Baseline Data

Due to its proximity to the cosmopolitan areas of southern Vancouver Island, Race Rocks has commanded a moderate amount of research interest. Oceanographic data for temperature and salinity have been gathered at Race Rocks since 1923 and 1934 respectively[10], and Stevenson and Stevenson (1961, as found in Seabrocky 1975) have assembled all surface water temperature and salinity data gathered at Race Rocks between 1948 and 1957. In the regional area, Herlinveaux and Tully (1961) characterized the waters throughout Juan de Fuca Strait to be relatively rich in nutrients as a result of the mixture of deep, cold ocean waters and warm brackish waters (through coastal freshwater inputs) from the Strait of Georgia (Herlinveaux and Tully 1961). The Race Rocks area was considered to be a unique entity even in 1975 when Dobrocky SEATECH Ltd. was contracted to study inter-tidal and sub-tidal flora and fauna for the proposed national marine park in Juan de Fuca Strait (Dobrocky Seatech 1975).

According to the Institute of Ocean Sciences (IOS), there have been a number of IOS research vessels in the Race Rocks area between 1951 and 1982. Seven separate research events occurred within the Race Rocks area in 1951 and 1952 to gather temperature and salinity data by bottle samples. In 1978 there were two sampling efforts to gather temperature and salinity data by CTD unit. Additionally, there were four 'CM' sampling sessions near Race Rocks in 1981 and 1982.

Since 1974, Pearson College has been the principal research agency at Race Rocks and has worked co-operatively with other researchers to gather and document scientific information. For example, in 1986 Dr. Anita Brinkmann-Voss collected hydroid specimens with the assistance of Pearson College staff and students and identified over 60 species of hydroids, including one new species. Through the years, the college has developed a library of information on the biophysical values of Race Rocks. They have also collected a considerable amount of historical information. As a component of the Ecological Overview for Race Rocks (part of the MPA pilot program), a comprehensive database has been developed by Mr. Garry Fletcher of Pearson College for cataloguing literature relating to Race Rocks. The database can be searched by topic, and includes socio-economic categories such as:

[10] Currently, these data are being collected regularly by the Pearson College staff (Mike and Carol Slater), who live onsite as reserve guardians.

- nautical archaeology;
- oil-spill impacts;
- marine protected areas;
- historical;
- First Nations;
- socio-economic;
- marine education; and
- light station.

The database currently resides in the Race Rocks collection at the Pearson College library and with Fisheries and Oceans Canada. It is a dynamic resource, which will continue to grow in both digital and hardcopy formats.

7.1.2 Recent Research Efforts

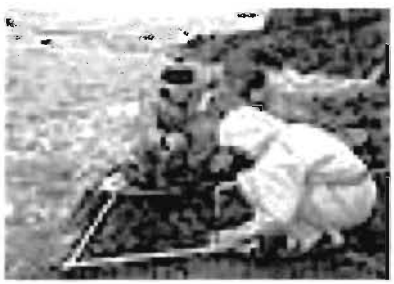
7.1.2.1 Permits and Facilities

Most research that has been conducted to date has occurred within the ecological reserve boundaries. As required by the Ecological Reserve Regulations, those interested in conducting research or undertaking projects within the ecological reserve must obtain a permit from BC Parks. Research proposals are subjected to a systematic review process, which may include a preliminary screening for environmental impacts. The data collected are required to be made available and shared with the scientific community.

Since automation of the light station, Pearson College has pursued options to use the decommissioned lighthouse buildings as a research and education facility and guardian base for their own use and for use by others (Pearson College 1999). Under a two-year agreement with the Coast Guard, the college has used some of the on-site buildings at Race Rocks for research purposes, however, this agreement expires in 1999. Regulations for the use of these facilities are presented in Appendix 1. Other than the surplus light station buildings, there are no other research facilities on the islands.

7.1.2.2 Pearson College

Research at Race Rocks by students and instructors at Pearson College has been ongoing since the establishment of the Race Rocks Ecological Reserve. Since little outside research has been done and little is planned, student research and monitoring efforts play a valuable role in maintaining baseline information for Race Rocks. Since creation of the ecological reserve, there has been a continuous monitoring of underwater and inter-tidal life in various parts of the reserve by science students and the diving faculty of Pearson College, along with assistance by members of the diving community. In addition, the installation of an electronic



Data Collection at Race Rocks - Pearson College

temperature monitoring station underwater, to be serviced by the Pearson College divers, will lead to more refined physical data from the reserve. The development of the Race Rocks web site and Ecological Database (see Section 7.2.4) has provided a unique forum for Pearson College to share this information with the public, other researchers and educators. Specific projects by students of Pearson College are discussed in Section 7.2.1 and 7.2.2 in relation to educational uses.

The economic values of research conducted by Pearson College is difficult to quantify by has likely been worth several hundred thousand dollars over the years they have been performing research at Race Rocks. Since automation of the lighthouse, the college has allocated approximately $100,000 per year to their Race Rocks program. Much of this money has come from grants and fundraising efforts by students and faculty and has gone towards equipment, maintenance of facilities, transportation to and from the islets, educational programs and salaries for the resident caretakers.

The ability to obtain this level of funding from year to year is often tenuous, however, this year the college has received a grant that will substantially assist them in continuing their programs at Race Rocks. The college, in partnership with BC Telephone (now 'Telus'), the Royal British Columbia Museum, the BC Ministry of Environment, Nuytco and the Vancouver Aquarium Marine Research Centre submitted a proposal to the Canada Millennium Partnership Program to develop environmental appreciation through the internet. Referred to as the 'Race Rocks.com' project, the grant will facilitate the placement of robotic cameras, both underwater and above ground, which will transmit live internet images of the marine environment at Race Rocks. The final budget funding of $210,021 was approved on 25 October 1999, and is a significant component of the estimated $838,940 total project budget (Canada Millennium Partnership Program 1999).

7.1.2.3 Fisheries and Oceans Canada

Dr. Jane Watson of Fisheries and Oceans Canada is currently involved in assisting Pearson College students in setting up a long-term monitoring station at Race Rocks with permanently installed underwater pegs. Additionally, the installation of an underwater electronic temperature monitoring station, serviceable by Pearson College divers, will gather highly refined physical data from the reserve (Pearson College 1999).

7.1.2.4 Canadian Hydrographic Service

The Canadian Hydrographic Service (CHS) has conducted research in the Race Rocks area during February and March of 1999 (J. Galloway, pers. comm.). Their work included: multi-beam bathymetry; seafloor mapping to a depth of 100 m; seabed classification survey; bottom grab sampling at 40 locations for ground truthing; and the creation of a near-shore video survey to a depth of 20 m. Currently, Triton Resource Consultants are developing a modeling survey of peak and flood waters from this data, and Coastal Ocean Resources Inc. is classifying the flora species recorded on the video survey. The entire project accounted for a total of ten to twelve vessel weeks of work for the crews and scientists of the CHS. Out of this, the multi-beam sonar research consumed the largest time period (approximately eight weeks). Mr. Jim Galloway has presented the results of these efforts several times to government and private sector interests (J. Galloway, pers. comm.). Although the data collected are currently being analyzed, there are no plans (or budget) to perform additional oceanographic research at Race Rocks.

7.1.2.5 Simon Fraser University

Significant scientific research was performed by Mr. Robin Baird as partial completion of his Ph.D. Thesis on the foraging behaviour of transient killer whales. He found the area to be an extremely important feeding site for the whales but is also cognizant of the importance of Race Rocks to many other species (Baird 1994).

Data was collected between 1986 and 1994 on the haulouts of sea lions and elephant seals at the Race group for provision to Fisheries and Oceans Canada. Additionally, data pertaining to tagged seal lions was provided to the National Marine Fisheries Service in Seattle for analysis. Mr. Baird is currently composing a manuscript on the elephant seals at Race Rocks for release in the near future.

7.1.2.6 University of British Columbia

Mr. Scott Wallace used the Race Rocks venue in his Ph.D. studies on marine refugia and abalone populations. His comparison site was on William Head where he found abalone populations to be significantly less developed than those at Race Rocks, which had been protected from harvest since 1990 (C. Slater, pers. comm.).

7.1.2.7 Royal Roads University

Royal Roads University, a relatively new post-secondary institution, has taken an interest in Race Rocks as a learning site for inter-tidal and sub-tidal topics. They have on at least two occasions chartered boats and instructors from Pearson College to take their classes out for ecological interpretive sessions.

7.1.2.8 Diver Research

Divers have, at various times over the past twenty years, provided some underwater transect records. Although these records are intermittent, some of them provide useful baseline information. Recording this information on the north side of Race Rocks is possible only in the late winter months before kelp growth covers the area. The raw data from these records are stored in the Race Rocks collection at the Pearson College library. A number of dive clubs and affiliations across the province have spearheaded efforts to develop a constituency of volunteer researchers to conduct inventories and assist with other research initiatives as needed (Murgatroyd 1999, R. Mulder, pers. comm.).

Diver research - Pearson College

7.1.2.9 Royal BC Museum

In the fall of 1992 the Royal British Columbia Museum embarked on the live production of 24 one-hour television shows from the Race Rocks Ecological Reserve. The Canadian Underwater Safari production involved 13 divers and several faculty from Pearson College. These ecology programs

were broadcast live by satellite to down-link sites in eastern and western Canada and in the eastern US. Since then, they have been re-broadcast by cable stations throughout the country and have been seen by at an estimated 2 million viewers (Pearson College 1999).

7.1.2.10 Rocky Point Bird Observatory

Located on the naval ground at Rocky Point, the Rocky Point Bird Observatory was initiated in 1994 by the Canadian Wildlife Service. Researchers and volunteers have been continually gathering data for migratory birds. During 1998 and 1999, Mr. Dan Derbeshire has also operated a banding facility at the observatory. Songbird banding is conducted daily in the early morning hours and evening seabird watches are conducted at dusk each evening and the species list includes 240 individual species (M. Setterington, pers. comm.).

Night radar-tracking data have been collected during the past three years and currently comprise the basis of a Ph.D. thesis by Ms. Rhonda Millikin, Royal Roads University. These data and those collected by the banding facility may not be specific to Race Rocks, but they do give an index of species richness, airspace use and habitat potential for stopover of migratory species in the vicinity.

7.1.2.11 Rare Species Monitoring

A request was made to the Conservation Data Centre to determine if there had been any rare species observations on the Race Rocks. The CDC does not maintain a list of marine invertebrates or sub-tidal plants but does list mammals and terrestrial plants on a tracking list (Table 7).

Table 7. Rare Species Observations at Race Rocks for Mammals and Terrestrial Plants

Common Name	Scientific Name	Provincial Status
Northern sea lion	Eumetopias jubatus	Red
Pelagic cormorant	Phalacrocorax pelagicus	Yellow
Brandt's cormorant	Phalacrocorax penicillatus	Red
Arctic cookie star	Ceramaster arcticus	Red
Erect pigmyweed	Crassula connata, var connata	Red
Seaside bird's-foot trefoil	Lotus formosissimus	Red
Western pearlwort	Sagina decumbens, ssp occide	Blue
Snake-root	Sanicula arctopoides	Red

Source: CDC 1999. See Appendix 2 for definitions of Provincial listings for rare species.

The Sensitive Ecosystems Inventory (SEI) of southern and eastern portions of Vancouver Island was checked for potential coverage of the Race Rocks group of islands. However, the SEI only includes polygonal coverage terrestrial habitats of Vancouver Island and the larger of the Gulf Islands. Race Rocks was not covered in this survey.

7.1.3 Future Research Opportunities

Pearson College has depleted its funds available for use on the Race Rocks guardianship. Thus future data collection (especially the temperature, salinity and weather data currently collected by Mike and Carol Slater) may continue only on a very irregular basis unless additional funding is found (G. Fletcher, pers. comm., A. Mathews, pers. comm.). The college has submitted a research proposal in search of funding from the Millenium Partnership Program. The goal is to develop a real time monitoring and data-gathering station that can be viewed via the Internet. This facility would minimize the amount of human disturbance that currently occurs on the island while allowing continuous monitoring of biophysical resources at Race Rocks. The Internet would provide an ideal medium for monitoring remote cameras and electronic data-logging equipment.

In 1998, the Underwater Council of BC (UCBC) took part in the Reef Environmental Education Foundation's (REEF) Pacific Northwest Pilot Project. REEF trains recreational divers to identify fish species and collect data while diving using slates and underwater paper. The data are later transferred into a computer database maintained by REEF. While no specific REEF surveys have been conducted at Race Rocks, more than 100 BC divers have received this training and some REEF surveys have been conducted in other areas of the province as part of the UCBC's mooring buoy program. Additionally, the UCBC mooring buoy team, in association with BC Parks, is planning to conduct surveys of dive sites that would benefit from a UCBC Mooring buoy. At this time, the buoy surveys have not begun and may take up to six months to complete (G. Dennison, pers. comm.).

Although not directed at Race Rocks specifically, marine wildlife operators running tours in Haro and Juan de Fuca straits have contributed $14,000 for research on local marine life (Obee 1998). These operators may be willing to focus a portion of their research funds on the Race Rocks area in the future.

7.2 Education and Outreach

Education is an objective of ecological reserves in British Columbia and of many marine protected areas worldwide. Given the proximity of an urban centre, Race Rocks provides excellent educational opportunities as described below.

7.2.1 School Curriculum

Since the late 1970s, Pearson College has been using Race Rocks as an outdoor classroom and educational facility for students from both the college and local schools. They also serve as volunteer wardens of the ecological reserve. Mr. Garry Fletcher, Environmental Instructor, has very actively incorporated Race Rocks into the curriculum at Pearson College, which has resulted in a plethora of data that otherwise would not have been collected. For example, since the reserve's inception in 1980, there has been continuous monitoring of underwater and inter-tidal life for educational purposes.

The research facility at Race Rocks is used to a great extent to further marine education of Pearson College students. To date, nine extended essays have been completed on Race Rocks

by students in the biological and environmental sciences and over 800 students of biology, marine science, and environmental systems programs have participated on field trips to Race Rocks. Beach walks, inter-tidal surveys and sub-tidal dive surveys by biological professionals and students have been used to highlight the need for conservation and the reduction of ecological impacts in the reserve. One student also put together a herbarium collection of the marine algae from the reserve (Pearson College 1999).

7.2.2 Outdoor Classroom

Since the mid-1980s, students from Pearson College have been escorting elementary school children from the local school district to the reserve for ecology visits. As part of these ecology tours, several hundred students visit the reserve each year between late February and the end of April. The children are exposed to the complexities of marine ecosystems and are able to appreciate the magnitude of human impacts on that marine environment and implications for organisms that live there. Two saltwater tanks are maintained on Great Race Rock containing a sampling of the underwater life found within the ecological reserve (Murgatroyd 1999).

Education Programs at Race Rocks - Pearson College

The instructors from Pearson College have, on numerous occasions, provided tours and interpretive sessions to students from other post-secondary institutions such as Royal Roads College. This allows for the dissemination of information to a greater audience and instills an appreciation for BC's marine environments. The economic spin-off from these activities are minimal, barely covering the fuel, boat rental and instructors time, but their social value is truly immeasurable.

Students from other universities, such as University of Victoria, have also used Race Rocks as part of their own educational programs. For example, Geography students at the University of Victoria use Race Rocks as a field location from September to November each year (depending on weather). Senior students and faculty take three groups of students out once per week to Constance Bank and to Race Rocks as part of a class project (C. Malcolm, pers. com.). Another student, working with Fisheries and Oceans Canada as part of a Co-operative Education Program, is currently reporting on field work performed at Race Rocks in the summer of 1999. The main goal of her work was to document activity levels (boats) within the ecological reserve (G. Fletcher, pers. comm., A. Mathews, pers. comm.).

7.2.3 Educational Tours

Public education and awareness-building through interpretation programs are among the most important aspects of protected area management for areas where visitation is permitted. The benefits of education, including generating support for conservation efforts, are accrued not only to the visitor, but to local communities, tour operators and other stakeholders (Murgatroyd 1999). The Race Rocks Ecological Reserve provides an excellent location for interpretation of ecosystem components in the terrestrial, inter-tidal and sub-tidal strata. Pearson College has

conducted guided ecology tours for over 150 grade seven students from the local community each year since the mid1980s. Ecological tour operators from Victoria and surrounding area, through such organizations as the Victoria Naturalist Society, Friends of Ecological Reserves, and commercial tours operators, also offer educational nature tours of the ecological reserve.

Land-based activities are strictly regulated by permit to minimize disturbance intensity in the terrestrial areas of the reserve. Commercial tour operators that run marine nature tours to Race Rocks to view wildlife are not required to obtain a permit unless they intend to go ashore.

7.2.4 Media Exposure and Commercial Productions

Race Rocks has received considerable attention in the local and regional print media with respect to the natural features of the area, its status as an ecological reserve and the automation of the lighthouse (Murgatroyd 1999). Films and live televised programs assist in developing an appreciation of the biodiversity of the area. Approval for filming within the ecological reserve must be provided through a permit. The approval process will take into account the purpose of the filming and the type of footage in relation to the purpose of the ecological reserve and the current inventory of 'stock' footage available.

Pink tipped surf anemone - Charlie Gibbs

Several photographic and film shoots have taken place on Race Rocks. A National Geographic Explorer television production called "The Silence of the Sea Lions" was partially filmed on Race Rocks in the early 1990s (K. Van Cleemput, pers. comm.). Around the same time, an ABC television special on octopi was filmed but never aired. In the fall of 1992, Pearson College and the Royal British Columbia Museum assisted with a live production of 24 one-hour television shows from the Race Rocks Ecological Reserve, a Canadian Underwater Safari Production (see Section 6.1.10.). A still photography book by Jeff Rottman features underwater images of sea life around Race Rocks.

7.2.5 The Internet

The Internet is another means of education and broader exposure. With the proliferation of web-based learning, the faculty at Pearson College found a way to distribute ecological information to a very wide audience. In 1995, Pearson College established a Race Rocks web page with information on the ecological reserve, an ecological reserve publications list, and inter-tidal photographic transects (Pearson College 1999). The site has expanded to include additional research data, profiles of organisms, tidepool survey results and a historical account of the area. The use of the Internet to promote no-impact visitation will be enhanced using robotic onsite cameras to broadcast live images from Race Rocks as proposed by Pearson College and numerous project supporters. This will be the result of recent funding approval for the 'Race Rocks.com' project by the Canada Millennium Partnership Program (Canada Millennium Partnership Program 1999). Global awareness, one of the goals of these efforts, will assist others in comparative studies of other similar types of ecological reserves.

7.2.6 Potential Future Use

Education benefits will continue at Race Rocks, regardless of MPA status, but the issue of intensity of use will have to be formally addressed to minimize disturbance to sensitive ecosystem components. Through a permitting system, access to the reserve could be monitored, temporarily stopped or deferred, depending on the stages of nesting, birthing and nurturing of the resident animals.

The closing down of the lighthouse operation and use of automated equipment has brought the opportunity to develop a historical museum with a lighthouse theme. The use of this display may be limited to certain spatial and temporal windows depending on the group size, type and timing.

Great Race Rock, and other islets as required, would provide an excellent project site for ecological restoration (C. Slater, pers. comm.). Students of the Restoration of Natural Systems program at the University of Victoria could use this locale for a number of long-term restoration projects once the Coast Guard transfers the remainder of the island to the province. It would provide an excellent opportunity to exercise planning, mitigation and low disturbance skills in the restoration of native plant species and removal of outbuildings.

7.3 Socio-Economic Significance of Science and Education

From a social perspective, the values of research and education are largely immeasurable but undeniably significant. Increasingly, the public is demanding that government managers work with researchers, academia and volunteer stewardship groups to gather biological and socio-economic information useful for the development of 'best management' policies and practices. Marine protected areas provide an environment that is particularly conducive to research and education by way of their inherent values and regulated use. These efforts provide invaluable information that is not only relevant at a local scale, but applicable to other areas that experience similar characteristics, uses or issues. The resulting data lends to a sense of confidence in management decisions and a greater understanding of the steps that must be accomplished in order to maintain ecological integrity into the future.

The direct economic value of research and educational projects can be quantified to a certain extent in terms of budgets allocated and dollars paid under various programs and/or contracts. These dollars are ultimately transferred back into the economy by way of salaries, procurement of equipment and supplies, transportation costs and so on. While some dollar amounts are provided in this report, many researchers were reluctant to divulge this information. A less tangible economic consequence of research activities is the resulting effects these projects have on public or private sector operations or policies. For example, research that concludes an area has high values for a particular activity (e.g., fisheries, transportation, tourism), may result in subsequent investment in that activity and further spin-off benefits. This economic effect is far more difficult to quantify yet is probably among the more important economic attributes of scientific programs.

8. GOVERNMENT AND STAKEHOLDER PERSPECTIVES

Given the jurisdictional complexities of the Race Rocks area, co-operation among stakeholders will by an important step in the MPA planning process. This section summarizes the interests and perspectives of key stakeholder groups that have an identified interest in Race Rocks.

8.1 Federal and Provincial Governments

In Canada, federally designated protected areas are intended to complement provincial and community-based conservation strategies. The National Strategy for Oceans Management (as defined under the *Oceans Act*) will include development and implementation of an overall federal MPA program under the joint responsibility of three federal agencies representing a range of MPA types:

- Fisheries and Oceans Canada (Marine Protected Areas);
- Canadian Heritage (National Marine Conservation Areas); and
- Environment Canada (National Wildlife Areas, Marine Wildlife Areas, and Migratory Bird Sanctuaries).

Together, these agencies are assisting Canada in meeting its international obligations to protect marine areas of significant ecological and socio-economic values. To ensure a co-ordinated effort, all three groups should be involved in all stages of MPA planning for Race Rocks.

8.1.1 Federal Government

In addition to Fisheries and Oceans Canada's interest in fisheries-related activities and the overall management of Race Rocks as a MPA, several other federal agencies have expressed an interest in the area:

- Natural Resources Canada – potential source of minerals or energy resources;
- Canadian Coast Guard and the Canadian Hydrographic Service currently have an interest in the Race Rocks area – research and public safety;
- Department of National Defence – three DND properties in the vicinity of Race Rocks; and
- Canadian Forces - land-based and underwater demolition training activities and for ammunition storage.

8.1.2 Provincial Government

The provincial government maintains a high level of interest in Race Rocks. Agencies include BC Parks, which has jurisdiction over the existing ecological reserve, and the Land Use Co-ordination Office, which is the co-ordinating agency for the BC Marine Protected Areas Strategy. Through their participation in matters related to the various pilot areas, these agencies have expressed a strong interest and commitment in the implementation of a federal MPA program that complements provincial efforts.

In particular, BC Parks is interested in retaining management jurisdiction over Race Rocks Ecological Reserve and in working co-operatively with Fisheries and Oceans Canada to ensure consistent management of the water column and the land base of Race Rocks. In their draft management plan for Race Rocks Ecological Reserve (1998), BC Parks has outlined a number of action items that relate to the future management of Race Rocks, and which require a co-ordinated effort between BC Parks, Fisheries and Oceans Canada, and stakeholders. These include:

- pursue the addition of the land component of Great Race Rock to the ecological reserve;
- investigate opportunities to expand the ecological reserve boundary from the existing 36.5 m (20 fathom) contour to the 50 m contour; and
- investigate the implications and feasibility of implementing full recreational harvesting closures in Race Rocks either under the Federal *Fisheries Act* or via designation as a Marine Protected Area under the *Oceans Act.*

8.2 First Nations

Further consultation between governments is required to confirm the significance of Race Rocks to the Beecher Bay and T'Souke First Nations, and to discuss implications of managing the site as a marine protected area.

8.3 Lester B. Pearson College

Lester B. Pearson College was instrumental in the establishment of the ecological reserve and faculty and students of the college have been long-time volunteer wardens of the site. They remain actively involved in research and education activities at Race Rocks and provide an important monitoring function. In addition to raising funds to keep the former lighthouse keepers residing on Race Rocks as guardians, Pearson College has covered the costs of maintenance (e.g., paint, grounds maintenance), boat use and fuel since the Coast Guard automated the light station in 1997. The total amount allocated by Pearson College has been approximately $100,000 per year but this funding will likely be exhausted by the end of 1999 (G. Fletcher, pers. comm., A. Mathews, pers. comm.). The college is concerned about the long-term maintenance and management of the reserve in absence of these funds.

Additionally, Pearson College faculty and students aim to maintain the size of the ecological reserve at the 20 fathom depth contour and to provide fishers with visual landmarks to prevent accidental boundary crossings. Their feeling is quite strong that a 'no-take' classification within this zone is *"essential to maintaining groundfish populations and providing migratory species with a refuge"*. The no-take designation would also allow enforcement efforts to be more effective and directed at any fishers in the reserve.

8.4 Industry

A formal MPA designation will likely have some influence on current and future options for industrial uses in the vicinity of Race Rocks. While this research did not uncover any current significant interest in the area surrounding Race Rocks, industry representatives should be given

an opportunity to participate in early planning, particularly from the perspective of future oil and gas exploration. Regulations set forth to manage Race Rocks as a MPA may also affect commercial fisheries harvesting by potentially restricting fishing activity in a wider area.

8.5 Researchers and Educators

Given the relative proximity of Race Rocks to several major academic institutions, high research interest is expected to continue. In addition, the continued interests of scientific researchers to study the area will be an important mechanism to gather needed information for the future planning, management and monitoring of the area. The main interest groups from a research perspective are: Fisheries and Oceans Canada, Canadian Hydrographic Service, BC Parks, Pearson College, University of Victoria and the Royal British Columbia Museum.

8.6 Tourism Operators

Many marine tourism operators "rely heavily" on Race Rocks as an area to take clients in the off-season for whales. Race Rocks is viewed as an excellent location to view marine birds and mammals and to present tourists with educational information that operators feel is compatible with the objectives of MPAs. One operator has stated that "*during the off-season for whales, there is no comparable site to Race Rocks for viewing marine wildlife and any restrictions on this use will adversely affect many operators who depend on this area for their off-season incomes".* There is a fear that fees, licenses or access restrictions could result in a loss of a spectacular viewing and educational opportunity for visitors, as well as a loss of economic benefits to operators.

The concept of a larger ecological reserve is not a favourable one to many in the sport fishing industry. With the continued tightening of regulations and fewer places to fish, groups such as the Sport Fishing Advisory Board (SFAB) find themselves pressured into fighting hard for the fishing locations that remain. They are not opposed to the ecological reserve concept or to the current groundfish conservation regulations. However, the SFAB and other sport fishers are opposed to additional fishing closures and/or any enlargement of the reserve area. In their opinion, *"the excellent halibut fishing to the west, southeast and east of the reserve and salmon fishing west of the Rosedale Rock buoy and in Race Passage must stay accessible to guide fishing and private boats"*. They feel that the establishment of a 'no fishing' zone around Race Rocks would "*significantly reduce revenues for many local fishing charter operators, and would severely affect the potential for these businesses, and for private fishers, to access close, productive and 'wild' sites"*. Additionally, some charter operators and industry participants feel that a total ban on fishing in the Race Rocks area is "*not supported by biological reasoning, since targeted halibut and salmon are migratory species*". They suggest that "*the concept of fisheries refugia is more applicable to resident species such as rockfish and lingcod, which are already protected under current Fisheries and Oceans regulations* ".

8.6.1 Non-Government and Public Interest

A number of non-governmental organizations (NGOs) maintain an interest in marine protected areas. These include the Canadian Parks and Wilderness Society (CPAWS), the Marine Life Sanctuaries Society, the Georgia Strait Alliance, and the Living Oceans Society among others.

Race Rocks has a relatively high public profile due to its history, its proximity to human populations, and its proliferation of use. Currently, public knowledge of and interest in Race Rocks is high relative to the other four lesser-known MPA pilot areas. Announcement of the pilot MPA has further increased public awareness and there has been some publicity surrounding the site, mainly by local media and NGOs interested in the MPA program.

9. SOCIO-ECONOMIC MANAGEMENT IMPLICATIONS

The Race Rocks Pilot MPA provides a venue for the consideration of a number of management issues (Murgatroyd 1999). Section 9 presents a summary of some of the preliminary management issues identified for Race Rocks as they relate to the socio-economic uses and values discussed in the above sections of this report.

9.1 Boundary Delineation

Establishing boundaries around protected areas is a difficult task in all environments but is especially problematic given the fluidity and three-dimensional characteristics of marine areas. One problem is the establishment of useable and visible marine 'markers' to inform people that they are within a MPA. The present boundaries of the provincial ecological reserve were determined by the standard limits of SCUBA diving and were based on the contours of the nautical charts of the time. However, the boundary is currently not well defined and the more common use of metric charts has made the boundary, which is described in terms of 'fathoms', more difficult to determine (BC Parks 1998a).

Some stakeholders have expressed concerns that a preliminary or working boundary for the MPA has not been determined by Fisheries and Oceans Canada. Some have even put forward their own suggestions for a boundary in relation to the existing ecological reserve boundary and restricted fishing area. For example, BC Parks has expressed an interest in expanding the boundary from the 36.5 m contour to the 50 m contour and establishing global position system co-ordinates for identification. It has been suggested by Jim Galloway and other members of CHS that have worked on Race Rocks, that a logical boundary for the reserve is at the limit of the rock margin of the island. This would represent a significant increase in size, which would have implications for the kinds of activities such as anchoring, fishing or shellfish harvesting. Members of the Sport Fishing Advisory Board, on the other hand, would prefer that either the current boundary remain or that it actually becomes smaller with stronger fishing restrictions (i.e., a no-take zone).

Once determined, it would be useful and beneficial to delineate the MPA boundaries on all standard navigational charts. This would serve to increasing public awareness of the area as well as assisting with the problem of visible, marine 'markers', as most boaters travel with navigational charts.

9.2 Management of Recreational Users

Marine protected areas provide an attractive venue for recreation and tourism activities. However, while recreation and tourism have the potential to provide economic benefits to local communities as well as social and educational benefits to clients and users, these activities may potentially result in impacts that degrade the very values for which the areas were set aside. Recreational and tourist activities around Race Rocks have grown considerably over the past decade (Murgatroyd 1999), particularly as activities such as diving and marine wildlife viewing have gained popularity. Due to the distinctive marine ecosystem at Race Rocks, and its sensitivity to human disturbance, uncontrolled and/or excessive use of Race Rocks for recreation and tourism has been identified as an issue of concern. Furthermore, the granting of protected area status at

Race Rocks may make the area better known and easier to promote, thus resulting in even higher use in the future (Davis and Tisdell 1996).

Although regulations and informal guidelines exists to control some aspects of visitation, uneducated visitors can easily damage the delicate underwater communities by anchoring, or cause adverse impacts to marine mammals and sea birds (e.g., behavioural changes, physical injury or mortality). Disruption by boaters can seriously interfere with sea bird nesting between May and September. In the fall and winter, boaters can disturb resting sea lions and seals by landing or passing too close to the islets. Other concerns include poaching and the incidence of boats coming into contact with marine animals.

Concerns are also being raised about the affects of visitation on whales and the degree to which noise and movement of boats, particularly uncontrolled and unrestrained pursuit, interferes with foraging activities (Sandborn 1999, BC Parks 1998b). To address these concerns, the Whale Watching Operators Association Northwest, which represents Greater Victoria and the San Juan Islands, has issued voluntary whale watching guidelines that discourage operators from engaging in behaviours believed to be harmful to whales (see Appendix 3).

There is a considerable body of literature regarding the impacts of recreational use on marine ecosystems, although much of this research has emphasized impacts to coral reef communities. As the management of recreational users will prove to be one of the more significant issues facing MPA managers, efforts should be made to acquire more site-specific data regarding the impacts of recreational use on the Race Rocks ecosystem.

9.3 Military Activities

Further research should be conducted to determine the impacts of explosives testing on marine life and subsurface communities, and to establish mitigation measures. Part of such a study was contracted by the military in 1998 (Demarchi et al. 1998). According to the study, the high-energy shock pulses and sound waves that result from explosions can disturb, injure or kill animals. The purpose of the study was to assess the significance of the individual and cumulative effects on marine organisms and recommended mitigation strategies to minimize the harmful effects of the exercises on local populations of fish, birds, pinnipeds and cetaceans.

9.4 Oil Spills

Its location, combined with the volume of marine traffic in the area, make Race Rocks susceptible to oil spills. However, no evidence of past oil spills near Race Rocks has been found. The establishment of the Traffic Separation Zone was a positive step in the movement to improve marine safety. Oil spills in the Juan de Fuca Strait could potentially be detrimental to the sensitive inter-tidal communities, marine mammal and bird populations of Race Rocks. This area likely has a relatively short self-cleansing period given its location in a high current zone with high energy exposure from both easterly and westerly winds in the Juan de Fuca Strait and its geomorphologic makeup. Options for the protection of this area in the event of an oil spill, however, should be investigated. The US/BC Task Force on Oil Spill has taken a co-operative and positive approach to protecting the west coast marine environment from oil spills and minimizing the impacts of an oil spill through response mechanisms.

9.5 Enforcement

Despite efforts that have been made to raise awareness about Race Rocks and educate user groups about this sensitive environment, infractions of anchoring and fishing regulations continue to be reported along with incidents of speeding boats and harassment of wildlife (C. Slater, pers. comm., Murgatroyd 1999. Many of the fishing charter operators informally police the 20 fathom boundary. Visitors to the area are also informed about regulations by the reserve guardians. These guardians are former lighthouse keepers and are on temporary salary with Pearson College to maintain a presence at the reserve. However, without further funding these guardians will be removed leaving Race Rocks without an enforcement presence.

BC Parks has been addressing enforcement issues in Robson Bight Ecological Reserve, a marine area used extensively by private and commercial boaters for the viewing of gray and killer whales. With the support of operators, they implemented a summer patrol program where volunteers and co-op students patrol the waters informing all visitors that they are in an ecological reserve, and providing guidelines for approaching and viewing marine mammals. Perhaps a similar program could be considered for Race Rocks.

10. INFORMATION AND KNOWLEDGE GAPS

A comprehensive list of individuals within relevant government, industry and public sectors that may have a potential interest in Race Rocks have been contacted for this study. Nevertheless, in some instances, information gaps remain. It is recommended that further research and follow-ups be conducted in the following areas.

First Nations

Little is known about the historical use of Race Rocks by First Nations or about their present-day interests in the area. Pearson College has established an archive of relevant historical information and has undertaken preliminary consultations with First Nations. However, data on this important topic remain sparse.

Canadian Shipping

The Vancouver Traffic Centre can provide detailed data relating to shipping traffic along much of the south coast of BC, and including Gabriola Passage. Shipping density data are available by vessel type in database format. However, these data require substantial interpretation to make them applicable to Gabriola Passage and useable for planning purposes.

U.S. Interests (Military, Shipping)

Information has been requested from the U.S. Navy regarding military uses of the Race Rocks area. When available, this information will be included in the final Socio-Economic Overview. It is likely that a majority of the U.S. military activity will be on the American side of the Juan de Fuca Strait and, therefore have little influence on the Race Rocks area, however, this hypothesis should be confirmed.

Marine Species Lists

Additional data should be sought about an unknown marine biologist who is currently initiating surveys to develop a marine (inter-tidal and sub-tidal) species list for the Conservation Data Centre (CDC). This will allow the CDC to process marine species data requests since only terrestrial and freshwater components have been catalogued to date.

11. SUMMARY AND CONCLUSIONS

11.1 Socio-Economic Values of MPAs

Humans have long accepted the important benefits provided by terrestrial reserves, but have only recently discovered the benefits afforded by marine reserves. Some of these benefits include biodiversity conservation, ecosystem protection, improved fisheries, enhanced recreation, and expanded knowledge and understanding of marine systems (Table 8).

Table 8. Summary of Benefits and Costs of Marine Protected Areas

Benefits	Costs
• Enhance commercial and recreational fishing ⇒ Build and maintain healthy fisheries ⇒ Provide insurance against uncertainty ⇒ Minimize regulations on fishing ground ⇒ Improve traditional management • Simply enforcement ⇒ Violations easily detected ⇒ Easier for the public to understand • Improve fairness and equity • Preserve biodiversity through habitat protection • Reduce direct and indirect fishing mortality • Maintain wilderness areas for viewing natural ecosystems • Enhance opportunities for the dive and tourism industries • Provide educational opportunities • Provide scientific research opportunities	• Foregone fishing opportunities • Potential for higher costs • Fishing-related benefits difficult to predict ⇒ Lag time before benefits are achieved ⇒ Increased pressure on fishing grounds ⇒ Not appropriate for all fisheries ⇒ Difficult to site ⇒ Difficult to design ⇒ Cannot provide foolproof protection ⇒ Benefits may not accumulate • Will not eliminate other fishery regulations • Uncertainty of outcome • Increased enforcement complexities ⇒ Direct enforcement necessary ⇒ Incentive for poaching created ⇒ Complexities may be created

Source: Gulf Council 1999

Documented examples of social and economic impacts and benefits of marine protected areas are scarce. Much of what can be found exists from studies conducted in tropical 'marine parks' with an emphasis on coastal tourism and recreational diving. In addition, while some of the ecological benefits of MPAs for fisheries have been well-documented in the scientific literature (see Appendix 5 for examples), the potential socio-economic benefits arising from healthy, sustainable fisheries have not. One likely explanation for the lack of attention paid to social and economic components of MPAs is the inherent difficulties in quantifying benefits such as ecological health, education, recreation and future use and existence values.

Nonetheless, some studies have attempted to address socio-economic aspects of MPAs. For example, in a study of the economic benefits of the Bonaire Marine Park found that economic activities associated with park use, primarily diving, produced yearly gross revenues of over $23

million (US), or over half of Bonaire's entire income (Dixon 1993). A 1991 study conducted in Virgin Island National Park found economic benefits generated by the park to be over ten times its annual operating cost. Elsewhere in the Caribbean, Saba Marine Park in the Netherlands Antilles, was found to be self-sufficient within five years of establishment due to revenues generated from user fees, product sales and donations. Most of these studies looked at the direct economic benefits of the MPA. However, in addition these direct benefits, MPAs also produce spin-off benefits such as job creation; private sector revenues collected by hotels, dive operators and guides; government revenues such as income taxes, business taxes and taxes levied on tourists; and even increased land value in adjacent areas (Dixon 1993).

While the economic value of recreation and tourism at some MPAs is substantial, not all economic benefits are associated with these activities. The Great Barrier Reef Marine Authority, which manages the world's largest marine protected area, has become financially self-sufficient through revenues generated by extemal consulting whereby they share their research results and management experiences. Economic values and benefits can also be attributed to extractive uses of marine resources, where permitted, for activities such as sport fishing, or from industrial activities such as commercial shipping (as occurs in California's Monterey Bay National Marine Sanctuary) or commercial harvesting (such as longline fishing for tuna which is permitted over Tasmanian Seamounts proposed MPA).

Additionally, not all benefits are economic. Much human history is associated with the oceans of the world and in Canada, like most coastal countries, there is a long history of human use of coastal, inter-tidal and marine resources for subsistence and commercial harvesting, exploration, research, transportation and recreation. Marine protected areas have been established to protect significant shipwrecks, cultural artifacts or treasures. Of course, science and research are among the most important socio-economic activities in many MPAs. In order to study long-term effects of fishing and other human uses of the marine environment, it is necessary to have a baseline with which to compare results from other areas that are not protected. In addition, there is increasing interest and need to study long-term environmental changes (either natural viabilities or human-induced changes such as global warming) and their implications on marine systems. Some MPAs, such as Leigh Marine Reserve in New Zealand, have been established for the express purpose of providing for marine studies in an undisturbed environment. These MPAs act as natural laboratories for marine research and have values associated with marine education and training. In this regard, MPAs can serve both as research areas for marine science students and as a focus for public information and education on the marine environment.

11.2 Summary of Results for Race Rocks

It is concluded from the information presented in the Socio-Economic Overview that Race Rocks is an area of high social and economic significance for many diverse user groups. Each of these groups will be affected to varying degrees by the establishment and management of a Race Rocks Marine Protected Area. The main human uses occurring at Race Rocks are summarized in Table 9 along with a brief assessment of potential management implications.

Negative socio-economic outcomes of the proposed MPA are difficult to quantify since a boundary has not been determined and no proposed regulations have yet been put forward by government. However, it can be surmised that some adverse social or economic impacts may

result from lost opportunities should regulations be implemented that precluded present or future economic activities from occurring. Of particular relevance at this time are sport fishing for salmon and halibut and other forms of recreational boating that may have impacts on sensitive marine features and wildlife. It is clear these activities have economic as well as social benefits that need to be considered during the public consultation and planning process.

The potential positive socio-economic outcomes of a MPA designation at Race Rocks are considerable. The site offers high recreation and research values, and exceptional opportunities for marine education programs. Examples of Marine Protected Areas elsewhere have shown that visitors and local populations alike benefit socially and economically from MPAs as a result of enhanced fisheries, increased tourism revenues, and directed research and education programs that promote conservation and stewardship - the benefits of which are immeasurable.

Table 9. Summary of Human Activities on and around Race Rocks

Activity	Historical & Current Uses and Interests	Future & Continued Uses and Interests	Management Implications
Commercial Fishing	There are references to historical commercial fishing up until 1980, at which time Fisheries and Oceans implemented a 'no-take' zone for commercial harvesting.	None.	Enforcement should ensure that commercial harvesters in the vicinity of Race Rocks are aware of the MPA boundary and respect established regulations.
Sport fishing	Fishing at/near Race Rocks is a productive activity. Sport fishers are allowed to fish inside the ecological reserve boundary for migratory species and outside the boundary for all species (including rockfish) based on Fisheries and Oceans regulations.	The sport fishing community will remain very interested in maintaining their ability to continue fishing at Race Rocks. Most fishers see the need to limit harvesting of rockfish and respect the regulations. The possibility of enlarging the reserve is not looked at favourably.	The sport fishing community would like to be extensively involved in all public meetings and negotiations regarding a MPA boundary and potential regulations. With the possible removal of the current reserve guardians, other options for enforcement of sport fishing regulations should be considered, particularly to maintain rockfish populations.
Research & Education	Race Rocks has been/is used extensively as an outdoor classroom to students of all ages and for various forms of marine research. Pearson College is the prime user in this category.	Interest in research and educational uses of Race Rocks is high. BC Parks has been supportive of these types of activities provided impacts to sensitive species, are minimized i.e., nesting birds and pupping sealions.	All activities should continue to be screened through an application and impact assessment process to determine their appropriateness and timing.
Oil & Gas	Little or no past or current interest identified for Race Rocks. No exploration tenures have been issued to date.	There is relatively good oil and gas potential in the area, but no proposals for exploration have been received.	If desired, restriction may be sought to ensure that no exploration or development is conducted within the boundaries of the MPA.
Mining	No past or current mining tenures have been identified in the area.	The area has low potential for mining.	If desired, restriction could be put sought to ensure that no future mining is conducted within the boundaries of the MPA.

Activity	Historical & Current Uses and Interests	Future & Continued Uses and Interests	Management Implications
Shipping & Transportation	Race Rocks is within a major shipping lane for local, national and international marine traffic.	Current levels of use will likely remain the same or increase in the future.	Marine shipping safety measures should continue to be implemented and regulated. Oil spill response strategies should be further researched to increase emergency response preparedness.
Military	There is substantial interest and use of the area by the military. DND owns or is the controlling agency for three areas surrounding Race Rocks.	All indications suggest that this use of the area will continue into the future.	Cessation or restrictions regarding demolition activities may be desirable if it is determined that this activity is resulting in negative impacts on marine mammals or underwater communities. Any restrictions on the timing or intensity of demolition activities will have to be negotiated with DND.
Recreation & Tourism	Recreational use has been increasing at Race Rocks over the last ten years. Although no data are available, it is believe that the largest user groups are marine tourism operators and divers within the existing ecological reserve, and sport fishers outside of the reserve boundary.	Use of Race Rocks as an area for recreation and tourism is likely to remain constant or increase in future years. To a high degree, the amount and frequency of use by tourism operators and charter companies will depend on other trends, such as the tourism industry, the presence of whales, and fisheries trends, all of which are difficult to predict.	Recreation and tourism activities are often permitted in MPAs, provided regulations are in place to manage these activities and minimize their impacts. Given the ecological sensitivity of the area, formal measures should be taken to control and regulated these activities. Alternative management options should be development and discussed with prime user groups.
First Nations traditional use	Unknown.	At least two First Nations groups, the T'Souke and Beecher Bay First Nations, have claimed Race Rocks as part of their traditional territory.	Government to Government negotiations/discussions should be undertaken to clarify the traditional uses and current interests of First Nations, and to determine management implications of establishing a MPA at Race Rocks.

12. BIBLIOGRAPHY

12.1 Literature

Anderson, David. 1998. Statement by the Honourable David Anderson, Minister of Fisheries and Oceans. Announcement on offshore marine protected areas. Vancouver, BC. Monday, 7 December 1998.

ARA Consulting Group. 1991. Marine Tourism in British Columbia: Opportunity Analysis. Rep. prep. for Industry, Science and Technology Canada and British Columbia Ministry of Regional and Economic Development. Vancouver, BC.

ARA Consulting Group Inc. 1996. The economic value of salmon. Chinook and coho in British Columbia. Rep. prep. for Canada Dept. of Fisheries and Oceans, BC Min. of Agriculture, BC Min. Env. Lands and Parks and BC Min. of Small Business, Tourism and Culture, February 1996, 16 pp.

Baird, R. W. 1994. Foraging behaviour and ecology of transient killer whales (*Orcinus orca*). Rep. prep. for Ph.D. Thesis, Simon Fraser University, Burnaby, B.C., Pp. 159 pp.

Ballantine, W.J. 1989. Marine reserves: Lessons from New Zealand. Progress in Underwater Science 13:1-14.

Ballentine, W. J. 1991. Marine reserves for New Zealand. University of Auckland Bulletin No. 25.

Bohnsack, J.A. 1993. Marine reserves: They enhance fisheries, reduce conflicts, and protect resources. Oceanus 36(3): 63-71.

BC Parks. 1991. Recent Trends in Outdoor Recreation Participation by British Columbians, November 1991.

Brown, R. 1999. Results of a search of the IOS database for an area surrounding Race Rocks, near the southern tip of Vancouver Island. Rep. prep. for Darren Bennett, AXYS Environmental Consulting Ltd., 20 August 1999.

Canada. 1997. *Canada Ocean Act*. Statutes of Canada.

Canada Millennium Partnership Program. Fletcher, M. G. 1999. Canada Millennium Partnership Program website at www.millennium.gc.ca/cgi-bin/mill_srch.cgi?view_record_e&689

CCG (Canadian Coast Guard). Web page on historic lighthouses in Canada wwwccg-gcc.gc.ca/iala-aism/main.htm

CDC (Conservation Data Centre). 1999. Results of a search of the CDC database for an area surrounding Race Rocks, near the southern tip of Vancouver Island. Rep. prep. for Darren Bennett, AXYS Environmental Consulting Ltd., 24 August 1999.

Chamber of Shipping website: www.chamber-of-shipping.com/portterm/pilotage.htm

Crosby, Michael P. 1994. A Proposed Approach for Studying Ecological and Socio-Economic Impacts of Alternative Access Management Strategies for Marine Protected Areas. In: D. Brunckhorst (ed.). *Marine Protected Areas and Biosphere Reserves: Towards a New Paradigm*. Proceedings of a workshop hosted by the Australian Nature Conservation Agency and supported by UNESCO. Canberra, Australia.

Davidson, J. 1999. Search results for commercial fishery catches within Statistical Areas 17 and 29, with particular interest in historical records for Gabriola Passage pilot marine protected area on the eastern side of Vancouver Island. Rep. prep. for Darren Bennett, AXYS Environmental Consulting Ltd., by Catch Statistics Unit, Fisheries and Oceans Canada. 22 September 1999, 100 pp.

Davis, D. and C. Tisdell. 1996. Economic Management of Recreational SCUBA Diving and the Environment. *Journal of Environmental Management* 48: 229-248.

DeMarchi, M.W., W.B. Griffiths, D. Hannay, R. Racca and S. Carr. 1998. Effects of military demolitions and ordinance disposal on selected marine life near Rocky Point, southern Vancouver Island. Rep. prep. for the Department of National Defence, Canadian Forces Base Esquimalt. 113 pp.

Dixon, J. A., L. F. Scura, and T. van't Hof. 1993. Meeting ecological and economic goals: marine parks in the Caribbean. *Ambio* 22(2-3):117-125.

Dobrocky Seatech, L. 1975. The inter-tidal and sub-tidal macroflora and macrofauna in the proposed Race Rocks Marine Park near Victoria, BC. Rep. prep. for National Parks Branch, May 1975.

Economic Planning Group of Canada, McQuinn and Company Marketing and Corporate Research Associates Inc. 1997. Nova Scotia Marine Tourism Study Final Report. December.

Eggen, M. 1997. That sinking feeling: do artificial reefs in BC waters increase biodiversity or waste? *Alternatives Journal* 23 (1): 7.

F&OC. 1999a. Pacific Region - 1999 Integrated Management Plan - Roe Herring. 18 + append.

F&OC (Fisheries and Oceans Canada). 1999b. Sport Fishing Guide, British Columbia Tidal Waters - 1999-2000. Fisheries and Oceans Canada, 120 pp.

F&OC and LUCO (Land Use Co-ordination Office). 1998. Marine Protected Areas: A Strategy for Canada's Pacific Coast. Discussion Paper.

Graham, Donald. 1985. Keepers of the Light. Harbour Publishing.

Grant, Peter. 1996. Race Rocks B&B? *Friends of Ecological Reserves Newsletter.* Fall 1996.

Hannigan D.K. 1998. GSC Open File 3629. Petroleum Resource Potential of Sedimentary Basins on the Pacific Margin of Canada.

Hardie, D. and C. Mondor. 1975. Race Rocks National Marine Park - a preliminary proposal. No. 10 726R1. February 1976.

Hay, D. 1999. Database of herring spawn locations and tagging results for the British Columbia Coast, from 1938 to the present. CD-ROM. Fisheries and Oceans Canada.

Herlinveaux, R. H. and H. P. Tully. 1961. Some oceanographic features of Juan de Fuca Strait. Journal of the Fisheries Board of Canada 16:

Hume, Stephen. 1999. Scraping Bottom. *Vancouver Sun.* Saturday, 20 March 1998. p. H1, H4.

INTERTANKO website: www.intertanko.com

Kelleher, G. and R. Kenchington. 1992. *Guidelines for Establishing Marine Protected Areas: A Marine Conservation and Development Report.* IUCN, Gland, Switzerland. 79 pp.

Kelleher, G., R. Kenchington and C. Bleakley. 1997. *IUCN-CNPPA Marine Protected Areas Programme: Identification of Priority Areas for the Establishment and Management of Marine Protected Areas.* Prepared for the IUCN and the Great Barrier Reef Marine Park Authority. Canberra, Australia.

Mathews, A. 1998. Letter to Mr. Dan Kukat, dated 30 April 1998, regarding fisheries and boundary issues and the pilot MPA at Race Rocks near the southern tip of Vancouver Island.

MINFILE database. 1999. www.em.gov.bc.ca/mining/geolsurv/minfile/default.htm

MTABC (Marine Trades Association of BC). no date. The Recreational Boating Industry in British Columbia: Selected Statistics. Rep. prep. by Price Waterhouse for the MTABC.

Murgatroyd, Louise. 1999. Managing Tourism and Recreational Activities in Canada's Marine Protected Areas: the Pilot Project at Race Rocks, British Columbia. Unpublished graduate research project. Dalhousie University, Halifax.

Obee, Bruce. 1998. Eco-tourism boom: how much can wildlife take? *Beautiful British Columbia* 40 (1): 6-17.

Pearson College. multiple authors. 1999. Race Rocks web site at www.racerocks.com.

Pynn, Larry. 1999. Whale-watching: Is protection taking a backseat to profits? *Vancouver Sun*, Saturday, Aug 7, 1999

Sandborne, Calvin. Are we loving whales to death? In *The Vancouver Sun*. Saturday, August 28, 1999.

Tourism British Columbia. 1998. British Columbia Visitor Study – The Victoria Visitor Report. Vancouver.

Transport Canada website: www.tc.gc.ca/en/mediaroom.vancouver.htm

Vancouver Port Authority website: www.portvancouver.com/frames/community/i2_2.html

Victoria Harbour website: http://www.pacific.ccg-gcc.gc.ca/epages/offboat/rias/sites/vti_cnf/victoria_harbour.htm

Yamanaka, L. 1999. Estimate of resources surrounding MPA pilot projects. 10 September 1998, 1 pp.

12.2 Personal Communications

Allan, Andria. Manager, Prince of Whales (Whale Watching Tours). Regarding use of Race Rocks for marine tourism excursions. 24 September, 1999.

Alpen, Douglas. Assistant Regional Program Specialist, (FWODE), Marine Communications & Traffic Services, Pacific Region, Canadian Coast Guard. Regarding marine traffic in the vicinity of Race Rocks.

Beamish, D. Property Resource Officer. Department of National Defence.

Biffard, Doug. Marine Ecosystem Specialist, BC Parks Headquarters. Regarding information sources and BC Parks' interests in Race Rocks. 06 August, 1999.

Bond, Ward. Island Outfitters and Chairman of the Sport Fishing Advisory Board. Discussions of charter boat operations and the proposed MPA at Race Rocks. 06 August, 1999.

Bradley, Aaron. Owner, Odgen Point Diver Centre, Victoria. Regarding levels of diver use and dive charter tours at Race Rocks. 23 September, 1999.

Cooper, Dale. SeaFun Safari Tours. Regarding use of Race Rocks for marine tourism excursions. 20 September, 1999.

CUDA Marine Adventures, Victoria. Regarding use of Race Rocks for marine tourism excursions. 23 September, 1999.

Davidson, J. Data Analyst, Fisheries and Oceans Canada. Discussions of commercial fisheries within management areas 19 and 20, with particular interest in historical records for Race Rocks pilot marine protected area at the southern tip of Vancouver Island. 20 August, 1999.

Fletcher, Garry. Biology Instructor, Lester B. Pearson College. Discussions of fisheries, whale watching, military and First Nations issues at Race Rocks, and the proposed MPA. 14 September, 1999.

Freedom of Information Act Officer, US Coast Guard, Vessel Traffic Service, Seattle, WA.

Galloway, J. Research Scientist, Canadian Hydrographic Service. Discussions of oceanography work that has been performed at the Race Rocks pilot marine protected area near the southern tip of Vancouver Island. 19 August, 1999.

Gernais, T. Recreational Sportfishing Co-ordinator, Pacific Biological Research Station. Discussions of fisheries issues and the pilot MPA at Race Rocks and Gabriola Passage. 03 August 1999.

Glazner, Richard. Member of Aquarius (CFB Esquimalt) Dive Club. Regarding club activities at Race Rocks. 23 September, 1999.

Hamilton, Gary. Navigational Aids Division, Pacific Region, Canadian Coast Guard.

Hayes, Mark. Senior Petroleum Geologist. Petroleum Lands Branch, B.C. Ministry of Energy and Mines.

Hellicar, Adam. Ocean Explorations (marine tours). Regarding use of Race Rocks for marine tourism excursions. 23 September, 1999.

Jourdenis, Michael. Navigational Aids Division, Pacific Region, Canadian Coast Guard.

Kissinger, Chris. Resource Officer, BC Parks South Vancouver Island District. Regarding information sources, First Nations uses, and MPA proposal for Race Rocks. 26 August, 1999.

Kukat, D. Springtide Charters and Chairman of MPA sub-committee of the Sport Fishing Advisory Board. Discussions of fishing and wildlife viewing charter boat operations and the proposed MPA at Race Rocks. 05 August 1999.

Malcolm, Chris. SpringTide Marine Tours and University of Victoria Ph.D. student conducting research on whale waters in the Greater Victoria area. Regarding use of Race Rocks for marine tours and results of Ph.D. research. 22 September, 1999.

Mathews, Angus. Instructor, Lester B. Pearson College. Discussions of fisheries, whale watching, military and First nations issues and the proposed MPA at Race Rocks at the southern tip of Vancouver Island. 14 September, 1999.

McBride, L. Sportfishing Advisory Board (past-chairman). Discussions of fishing charter boat operations and the pilot MPA at Race Rocks near the southern tip of Vancouver Island. 06 August 1999

McGowin, Grant. MCTS Programmer. Pacific Region, Canadian Coast Guard.

Moore, S. Manager, Pedder Bay Marina. Discussions of marina economics, charter fishing boat operations and the pilot MPA at Race Rocks at the southern tip of Vancouver Island. 22 September, 1999.

Mulder, Roy. Environment Director, Underwater Council of BC. Regarding dive use, diver perspectives on MPA and other stakeholders worth contacting. 25 October, 1999.

Norris, Major. Operations Duty Officer, Operations Support Centre Pacific, Marpac Operations, Department of National Defence.

Peschel, James E. 13th District Marine Safety Division. Pacific Northwest Region, U.S. Coast Guard.

Ted Severup. Canadian Coast Guard, Pacific Region. Vancouver, B.C.

Setterington, M. Wildlife Biologist and Bird Specialist, AXYS Environmental Consulting. Discussions of the operation of the Rocky Point Bird Banding Facility located on the Department of National Defence base, Metchosin, BC. 27 September 1999.

Slater, Carol. Reserve Guardian and former light keeper at Race Rocks. Discussions of fisheries, whale watching, and military issues and the proposed MPA at Race Rocks. 22 September, 1999.

Shaw, William. Pacific Biological Station, Nanaimo. Regarding commercial fisheries in Race Rocks area.

Smiley, John. Manger, Big Creek Ecological Reserve, California. Regarding definition, legal status and management objectives for Big Creek Ecological Reserve. 16 August, 1999.

Smith, Graham. Environmental Risk Management Officer. Department of National Defence.

Stephenson, Bevin. Statistics Clerk. Pacific Region, RCC Victoria. Canadian Coast Guard.

Van Cleemput, Kevin. Owner, *Shallon* Charters. Regarding diver use and dive charters at Race Rocks. 24 September, 1999.

Waters, R. Fisheries columnist and former manager of Pedder Bay Marina. Discussions of charter fishing boat operations and the proposed MPA at Race Rocks. 21 September, 1999.

APPENDIX 1 – REGULATIONS FOR USING THE RACE ROCKS RESEARCH CENTRE

This information is available from the Race Rocks web page maintained by Pearson College and also available as a brochure.

Lester B. Pearson College manages the island facilities as part of a Lease Agreement with BC Parks. The light tower and immediately adjacent area are leased by Fisheries and Oceans for the operation of the automated aids to navigation.

GENERAL REQUIREMENTS FOR USE:

Pearson College manages the island and operates the facilities with the primary objective of:

A. protecting the ecological values of the island and surrounding ecological reserve;
B. maximizing educational opportunities; and
C. facilitating research.

All activities at Race Rocks are subject to review and approval by the Race Rocks Operating Committee. Research or commercial activity in the ecological reserve also requires a permit for Research and Commercial Use

Students and staff from Pearson College (including the resident Island Managers) are available at most times to assist in projects. Special consideration will be given to projects that include a component of student involvement.

All research, print material, film, video and other results from activities at Race Rocks must be made available as public information for education and research. Where possible, the information must be provided in electronic form. Pearson College will receive and maintain all information and materials for use on the Race Rocks web-site or at the Pearson College library. All information will be made available for this purpose without cost or copyright restriction.

SEASONAL CONSIDERATIONS:

At various times during the year, the marine bird and mammal populations of Great Race Rocks and the surrounding Ecological Reserve will be sensitive to human disturbance. Movement on the island may be severely restricted throughout the seal birthing and bird nesting season as the population may be heavily impacted by visitors. This season varies in length, but generally it is from late May to late August. Visitors must co-operate with the guidelines as laid down at the time by the Island Managers.

ACCOMMODATION:

The Ecoscience Centre residence is the building that formerly housed the assistant light keeper

at Race Rocks. It is equipped with a kitchen with fridge and stove, basic eating and cooking utensils, a deep freeze, mattresses for sleeping 6, vacuum cleaner, cleaning supplies, and basic furniture. Visitors must supply their own bedding and towels, washer and dryer are not available. There is limited water use; showers are not available. There is a basement for drying wet suits. There is no smoking permitted on the island.

All facilities must be left in an acceptably cleaned state.

If SCUBA diving is to be done, arrangements may be made with the operating committee for the provision of compressed air for diving at a cost of $8.00 per tank. Special safety precautions will be required as it is a high current area; a boat tender must be available for emergency pick up.

GARBAGE:

All waste generated on the island has to be removed from the island for recycling. Proper sorting and management of waste is the responsibility of those using the facility. A composting toilet is available in the basement of the Ecoscience Centre residence.

COSTS ASSOCIATED WITH MANAGING THE ISLAND:

Since March of 1997, Lester B. Pearson College has provided for a human presence for protection of the Ecological Reserve and buildings at Race Rocks. It is therefore necessary to charge fees for the use of the island in order to help defray these ongoing expenses.

All electricity for the houses is generated by diesel generators. There is a limited amount of energy available.

Phone service is by cellular phone.

The water supply for the houses on the island is an electric desalinator. Sea water has to be pumped to a reservoir and then fresh water is produced at a limited rate. Visitors should bring their own drinking water, there is not enough water for showers.

Transportation to Race Rocks is by Pearson College boats. Docking privileges may be extended to other boats only at the discretion of the Island Manager. It must be understood that transportation is entirely weather dependent. High winds can make the island totally inaccessible at times so users should allow some flexibility in their timetable.

The station boat is available for emergencies, and the use of the Island Managers.
Salaries of Island Managers are paid by the College.

All operating costs on the leased part of the island and part of the capital maintenance costs are paid by the college.

FEES FOR USING THE ISLAND FACILITIES:

A. For Research Use

Requests for use of the facilities will be accompanied by a proposal outlining the purpose of the visit. There is a charge of $100.00 for return transportation to the island (weather permitting) and use of the research residence for up to four individuals for one night. Additional individuals will be charged at the rate of $25.00 per person.

Reduced rates may be negotiated in special circumstances

B. For Commercial Use

Authorization and arrangements for any commercial use involving the facilities on Great Race Rocks will be made with the Race Rocks Operating Committee at Lester Pearson College. Requests for use of the facilities will be accompanied by a proposal outlining the purpose of the visit. If the ecological reserve is involved, a permit will be required from BC Parks. The Operating Committee will supply forms for a permit on request.

Uses that may be considered: Television filming on the island, photography, interviews with college and Ecoscience Center personnel.

There is a charge of $200.00 per day for use of the available facilities for a 24-hour period (up to 4 individuals). This provides return transportation (when available) to the island (weather permitting).

All payments will be made to: Lester B. Pearson College, Race Rocks Operating Fund,

RACE ROCKS OPERATING COMMITTEE

Ecological Reserve Warden (LBPC Biology Faculty): Garry Fletcher
Transportation, Diving Co-ordination: Chris Blondeau
College Administrator: Angus Matthews
Island Managers: Mike and Carol Slater (in residence at Race Rocks.)

Telephone: 250-391-2411
Fax: 250-391-2412

APPENDIX 2 – LISTED SPECIES DEFINITIONS

PROVINCIAL LIST STATUS AND CDC RANKS
as taken from (CDC 1999)

All rare entities tracked by the BC Conservation Data Centre have been assigned provincial and global rarity ranks. Most entities also have a designation on the Ministry of Environment's Red or Blue list. Definitions of the Ministry's Red and Blue lists, and the relationship between list status and the CDC provincial rarity rank ('S' rank) are explained below.

I. PROVINCIAL LIST STATUS

RED LIST:
Includes any indigenous species or subspecies (taxa) considered to be Extirpated, Endangered, or Threatened in British Columbia. Extirpated taxa no longer exist in the wild in British Columbia, but do occur elsewhere. Endangered taxa are facing imminent extirpation or extinction. Threatened taxa are likely to become endangered if limiting factors are not reversed. Red-listed taxa include those that have been, or are being, evaluated for these designations.

BLUE LIST:
Includes any indigenous species or subspecies (taxa) considered to be Vulnerable in British Columbia. Vulnerable taxa are of special concern because of characteristics that make them particularly sensitive to human activities or natural events. Blue-listed taxa are at risk, but are not extirpated, endangered or threatened.

YELLOW LIST:
Any indigenous species or subspecies (taxa) which is not at risk in British Columbia. The CDC tracks some Yellow listed taxa that are vulnerable during times of seasonal concentration (e.g., breeding colonies).

EXCLUDED TAXA:
Marine reptiles and marine mammals are not within the Ministry of Environment's mandate, but CDC does track rare taxa in these groups. They are assigned global and provincial rarity ranks, and their List status appears in CDC reports as 'N/A' (not applicable).

WWOANW Guidelines
6/99

Preamble

The whale watching and marine wildlife tour industry has recently experienced tremendous growth. A significant increase in the number of vessels engaged in wildlife viewing and the uninformed conduct of new operators have resulted in some negative press, negative public opinion and tensions between vessel operators on the water. The Whale Watching Operators Association NW has agreed upon the following guidelines for the conduct of commercial vessels around marine wildlife in order to safeguard the animals that we are out there to observe, ameliorate some of the difficulties associated with the industry's growth and assure the public that we can act responsibly as an industry association to self-regulate. These guidelines should be reviewed by returning vessel operators and studied by operators new to the whale watching and wildlife viewing industry.

Operation of vessels around whales

- Member companies shall ensure that their vessel operators are thoroughly familiar with the U.S. Marine Mammal Protection Act and the Canadian Federal Fisheries Act. Member companies shall ensure that their vessel operators comply with the above legislation as well as the current WWOANW whale watching guidelines.

- Member vessels shall approach an area of known whale activity with extreme care. Vessels should slow down and approach cautiously from at least ½ mile from the whales (or from whale watching vessels if whales cannot be seen from a ½ mile position). Vessel operators should take time to survey the layout of vessels and distribution of whales as they approach.

When approaching a whale or a group of whales:

a) **From ahead**: STOP and allow the whales to travel toward you
b) **From behind**: Move to the outside of the nearest group of whales or boats and head in a direction parallel to the direction the whales are traveling.
c) **From the side**: Slowly maneuver until heading in a direction parallel to the direction the whales are travelling.

- Member vessels should endeavor to stay to the outside of the group of whales they are watching.

At all times

- Vessels should travel in a direction parallel to the direction the whales are travelling.
- Vessels speed should be the same as the whale's speed or slower.

Member vessels shall avoid:

- Making high speed runs trough the middle of a group of whales or boats.
- Cutting across the direction of travel of the whales.
- Taking a position between the whales and shore when the whales are within ½ mile of shore.
- Approaching whales that are obviously foraging.
- Approaching resting whales closer than 100 yards/meters. When whales are resting, no vessel should approach from ahead and/or stop in front of the group. Member companies will ensure that their vessel operators can recognize resting behavior.

- When leaving a group of whales, vessels should travel slowly until they are at least ¼ mile away from all whales and whale watching vessels.

- It is not uncommon for a number of vessels to arrive in an area where there is whale activity simultaneously. Member companies shall work together to limit the number of vessels with the whales by watching them in rotation and positioning themselves accordingly.

- Newly arrived vessels should wait on the outskirts and if possible, locate a group of whales that are not already with vessels.
- Vessels in more favorable positions should limit their time in that position to 15 minutes.
- When multiple vessels are watching a single group of whales, they should all be positioned on the same side of the whales, travelling in a line (bow-to-stern) or spread out behind the whales. There should not be a line of vessels on both sides of the whales.
- Vessels should limit the amount of time spent with whales on days when there are a large number of vessels with the animals. On these occasions vessels should spend some of their whale watching trip observing other marine wildlife (birds, porpoises, seals, etc.) in other locations.

- Member vessels shall respect the perspective of any shore-based whale watcher, especially those at Limekiln State Park and on the West Side of San Juan Island between Kellet Bluff and Eagle Point. This should be done by maintaining a position seaward of the whales and not venturing close to shore. The area within a ¼ mile of the shore between Kellet Bluff and Eagle Point and the area within a ½ mile radius from the Limekiln light shall be a boat-free zone.

- Member vessels shall not reposition themselves using the leapfrog method.

Operation of vessels around Pinnipeds

1. When approaching pinniped haul-outs, vessels should slow down from at least 100 yards/meters away and approach slowly. At the first sign of disturbance (sea lions sitting up and shifting position or harbor seals bouncing on their bellies) vessels should slowly back away. The vessel and its passengers should refrain from making loud noises or sudden rapid movements. Particular caution should be exercised during pupping season (July/August).

Operation of vessels around birds

1. Caution should be exercised when approaching birds on land or on the water. Approach slowly, watch for signs of agitation and leave slowly. Birds on the water should be given as wide a berth as is practical. Disturbance while fishing is probably more detrimental than disturbance while resting on land. There is a great deal of variation in how different species respond to marine traffic. Cormorants are particularly sensitive to disturbances when nesting although all nesting birds should be avoided. Extra caution should be exercised from nesting through fledging (beginning of May to the end of August). Vessels should approach very slowly and remain at least 100 yards/meters from rookeries. All operators should be aware of areas designated as refuges and remain 200 yards/meters away.

Operation of vessels around porpoises

1. All operators should be able to distinguish harbor porpoise from Dall's porpoise.

2. When harbor porpoise are encountered, vessels should either (1) leave them alone or (2) if they wish to observe them, either (a) reduce speed as low as possible and maintain their course to their next destination or (b) STOP with engine off or in neutral and observe.

Under no circumstances should vessels attempt to engage harbor porpoise in bow riding.

3. When Dall's porpoise are encountered vessels should either (a) continue their course and speed or (b) STOP and observe. If the porpoises decide to bow-ride vessels should continue their course and adjust their speed accordingly. *Vessels should not repeatedly drive through groups of Dall's porpoise in order to encourage them to bow-ride. If no porpoises are interested in bow riding after 2 passes, either continue on your way or stop to observe. Avoid circling.*

4. When more than one vessel is with the same group of Dall's porpoise who are actively bow riding, they should communicate and/or have one of the vessels parallel at a safe distance so that passengers can observe the bow riding on the other vessel.

5. Vessels should avoid congregating in a small area when looking for Dall's porpoise.

Radio Etiquette

1. US Channel 09 should be monitored when on site and used for all communication on the water. Channel 16 should also be monitored at all times.
2. All operators should remember that customers in other boats and in dispatch offices are often able to hear conversations. Transmissions should be courteous and helpful, and use appropriate language.

Guiding/Naturalist Services

1. Member companies shall ensure that the services of an educated/trained naturalist are available to passengers aboard their vessels.

2. Member companies shall ensure that passengers aboard their vessels are informed of whale-watch guidelines and association standards concerning marine wildlife viewing.

3. Operators should keep a logbook of sightings of all types including birds, cetaceans, pinnipeds and anything else of interest.

Hydrophone etiquette

1. A vessel with a hydrophone down should, if possible, fly a hydrophone flag (letter 'R' International system). Any vessel showing the hydrophone flag should be on US Channel 09. Vessels approaching a stationary vessel (or one flying the 'R' flag) should establish communications move to a position indicated by the stationary vessel as quickly as possible and then shut off their engine. A vessel departing should communicate their intention to the vessel listening with the hydrophone.

Vessel Operation

1. *SHOW RESPECT FOR OTHER OPERATORS!* Remember: do unto others, as you would have them do unto you.

2. Do not travel between a boat and the animals its passengers are observing or between a boat and the shoreline.

3. Do not accelerate or pass near other boats at cruising speed.

4. Do no operate loudspeakers near shore – especially in residential areas – or when boats are closely grouped.

5. If you have a complaint about the conduct of a fellow operator, do not voice it over the VHF radio. Offer a helpful suggestion in a courteous manner or discuss the issue in person, by phone, or using a courtesy reminder after the incident. Do not criticize an operator in front of his/her customers.

Research and Education

1. Association members should support local whale research by providing written records of sighting information to bona fide research groups and through association approved financial support of selected research activity.

2. In the interest of good public relations and general good will, association members shall, as occasion warrants, adopt a friendly and educational (rather than punitive) approach with recreational boaters operating in flagrant violation of guidelines.

3. The association shall endeavor to collaborate with and secure the support of the US and Canadian Coast Guards and Fisheries enforcement authorities as well as concerned island residents. A collaborative and cooperative approach has much more to offer than a distant, threatening or defensive one.

APPENDIX 4 – SELECTED EXAMPLES OF RESEARCH STUDIES RELATING TO THE BENEFITS OF MARINE PROTECTED AREAS

The following examples have been summarized and compiled from various sources, as listed at the conclusion of this appendix.

- The density of adults rock lobsters in a New Zealand marine reserve is ten times higher within the reserve than on the surrounding coast. Lobsters living in the reserve are much larger than those found outside of it (Ballantine 1987).

- In a study of the economic benefits of the Bonaire Marine Park, it was found that economic activities associated with use of the Park waters produced yearly gross revenues of over $23 million (US), or over half of Bonaire's entire income (Dixon 1993).

- The Sumilon Reserve, located in the Philippines, contained significantly more individuals for most families of fish than either a limited protection area or a no protection area. The Catch Per Unit Effort (CPUE) rates, or how hard a fisherman must work to catch a certain quantity of fish, were higher during a year of protection than a year of no protection, for all three types of fishing gear used (Alcala 1988).

- In the Mediterranean, more fish species were observed at marine reserve sites than non-reserve sites of the same depth. The additional species at reserve sites were from families of fish that were vulnerable to spearfishing, amateur angling or commercial gill netting. Furthermore, most of the 'vulnerable' species were observed in higher densities at the reserve site. The 'non-vulnerable' fish species also had higher densities at protected reserve sites (Bell 1983).

- Following the establishment of the De Hoop marine reserve in South Africa, the fish species targeted most by anglers increased. The six fish species for which Catch Per Unit Effort (CPUE) rates improved comprised the most important angling species in the area (Bennett and Attwood 1991).

- In the Saba Marine Park in the Caribbean, they learned that there was a strong incentive to provide protection to marine resources given the growth in dive tourism after implementation of the Park (Dixon 1993).

- Hol Chan, a very small but popular marine reserve in Belize, contains a higher biomass of fishes per unit area of reef than has been seen anywhere else in the world. The reserve also contained seven more species of commercial fishes than adjacent areas subject to fishing (Roberts and Polunin 1994).

- Coral-reef fish communities in Saba Marine Park (Netherlands Antilles) and Hol Chan Marine Reserve (Ambergris Caye, Belize) in the Caribbean were studied to assess differences between them and adjacent ecologically similar sites after four years of protection from fishing. Forty-five percent of target species commonly recorded in visual censuses in Belize

(23% of all recorded target species), and 59% at Saba (22%), showed greater abundance, size or biomass in shallow protected sites. In both protected areas the local stock of visible demersal target fishes was 1.9 to 2.0 times greater in biomass and 2.2 to 3.5 times greater in commercial value than in fished sites (Polunin and Roberts 1993).

- Four Philippine projects to increase fish yields by creating inviolate replenishment zones, or reserves were compared with one project in the United States to protect an intensively used coral reef for ecological, tourist and fishery purposes. In all cases, a marked increase in desirable species was observed after strict protection was applied (Clark, Causey and Bohnsack 1989).

- In the Florida Keys National Marine Sanctuary, the relative abundance of spiny lobster (catch per trap) within the Western Sambo Ecological Reserve was greater than in adjacent fished areas. The average size of lobsters within the Reserve was also significantly larger than outside the Reserve.

- Visual surveys conducted in shallow-water (<10 m depth) reef habitats were used to compare juvenile epinepheline grouper density, size distribution, and diversity in the Exuma Cays Land and Sea Park (ECLSP), Bahamas and in the northern region of the Florida Keys National Marine Sanctuary (FKNMS). The community of juvenile groupers in an area closed to fishing (ECLSP) and in an area with extensive fisheries exploitation (FKNMS) were contrasted for specific reef habitats. Across habitats, the mean density of groupers was three times higher in the ECLSP compared to the FKNMS (Sluka et al. 1994).

- At Apo Islands Marine Reserve in the Philippines, scientists determined that, after approximately nine years of protection and build-up of important species, local fishing grounds adjacent to the reserve began to be replenished (Russ and Alcala 1996b)

References

Alcala, A.C. 1988. Effects of protective management of marine reserves on fish abundance and fish yields in the Philippines. Ambio. 17:194-199.

Ballantine, W.J. 1987. New Zealand's course for marine reserves. New Scientist. 1563:54-55.

BC Parks. 1993. Ecological Reserves in British Columbia. Brochure.

Bell, J.D. 1983. Effects of depth and marine reserve fishing restrictions on the structure of a rocky reef fish assemblage in the north-western Mediterranean Sea. J. Applied Ecol. 20:357-369.

Bennett, B.A. and C.G. Attwood. 1991. Evidence for recovery of a surf-zone fish assemblage following the establishment of a marine reserve on the southern coast of South Africa. Mar. Ecol. Prog. Ser. 75:173-181.

Clark, J.R., B. Causey, and J.A. Bohnsack. 1989. Benefits from coral reef protection: Looe Key

Reef, Florida. Pages 3076-3086 in O. T. Magoon, H. Converse, D. Miner, L. T. Tobin, and D. Clark (editors). Proceedings of Sixth Symposium on Coastal and Ocean Management: Volume 4, Coastal Zone '89

Dixon, J. A., L. F. Scura, and T. van't Hof. 1993. Meeting ecological and economic goals: marine parks in the Caribbean. *Ambio* 22(2-3):117-125.

Gulf Council (Gulf of Mexico Fishery Management Council). 1999. Marine Reserves Technical Document: A Scoping Document for the Gulf of Mexico. July 1999.

McGarvey, R. and J.H. Martin Willison. 1995. Rationale for a marine protected area along the international boundary between U.S. and Canadian waters in the Gulf of Maine. Pages 74-81 in N.L. Shackell and J.H. Martin Willison (editors). Marine Protected Areas and Sustainable Fisheries. Published by Science and Management of Protected Areas Association.

Polunin, N. V. C. and C. M. Roberts. 1993. Greater Biomass and Value of Target Coral-Reef Fishes in Two Small Caribbean Marine Reserves Marine Ecology Progress Series, Vol. 100: 167-176, 1993, Published October 5.

Roberts, C.M. and N.V.C. Polunin. 1994. Hol Chan: demonstrating that marine reserves can be remarkably effective. Coral Reefs. 13: 90.

Rowley, R. J. 1992. Impacts of marine reserves on fisheries: A report and review of the literature. Science and Research Series Number 51: 1-50. Available from New Zealand Department of Conservation, Post Office Box 10-420, Wellington, New Zealand.

Russ, G.R. and A.C. Alcala. 1996. Do marine reserves export adult fish biomass? Evidence from Apo Isalnd, Central Philippines. Marine Ecology Progress Series. 132:1-9.

Sluka, R., M. Chiappone, and K.M. Sullivan. 1994. Comparison of juvenile grouper populations in southern Florida and the central Bahamas. Bulletin of Marine Science 54(3): 871-880.

South Atlantic Council Reef Fish Plan Development Team. 1990. The potential of marine fishery reserves for reef fish management in the U.S. southern Atlantic. NOAA Technical Memorandum NMFS-SEFC-261. 40 pages.