northern abalone scenarios are of potentially closed populations (e.g., perhaps Kunghit Island populations are separated from Langara Island populations) and limited distance larval dispersal (e.g., connectivity between Houston Stewart Channel and SGaang Gwaii populations). Recruitment of red sea urchins in northern California has now been linked to relaxation of winds that induce upwelling (Morgan *et al.* 2000). This enabled larval delivery from offshore areas to coastal areas back across the continental shelf. There are insufficient data to link this process driving spatial recruitment patterns to fishable adult abundance (Morgan *et al.* 2000), but this will come.

The fecundity of all species in Table 30 is great. Females of all species except prawns and crabs produce eggs by the million each season and most have the high-risk strategy of external fertilization of broadcasted gametes in the water column. For example, a female northern abalone of 135 mm shell length was estimated capable of producing 7.8 million eggs annually (Campbell *et al.* 1992). Female geoduck have a dramatic fecundity, producing hundreds of millions of eggs over an active reproductive life perhaps exceeding a century. There is, therefore, likely no shortage of juveniles of these species, but few larvae survive to successfully settle, because larvae "…. *lead transitory lives of great risk and grave uncertainty*" (Rumrill 1990).

Concerns of ecosystem-related effects of harvest of dense shellfish populations are beginning to contribute to management decision-making. For example, a potential goose barnacle fishery has set a precedent as the first species to be closed by DFO Pacific coast-wide (in 1999), solely for reasons of potential ecosystem impacts of harvesting. The concern was that harvesting the barnacle clumps, along with California mussel – the other community dominant, could damage the essential microhabitat that goose barnacles and California mussels provide for ≈300 other species (Jamieson *et al.* 1999; Schmidt 1999; Jamieson and Levings 2001). This is a manifestation of a broadening fisheries mandate for conservation beyond the well-being of single species. Further, this underscores the need for ecosystem (not species) reference points for evaluating what are acceptable levels of ecosystem impacts of fisheries (Jamieson and Levings 2001). Ecosystem-based fisheries management will be an increasing influence in regional marine conservation and an opportunity for deepening inter-agency cooperation.

Case Study: Northern Abalone

Northern abalone cannot currently be fished legally by anyone, and the species' cultural, species-at-risk and political profile is high (Neis *et al.* 2000). Further, there is high black market value stimulating poaching (Campbell 2000). The Gwaii Haanas area is a major stronghold for this "threatened" species and, therefore, a strategic opportunity is at hand to work with partners in using Gwaii Haanas for long-term northern abalone restoration in keeping with Parks Canada policy (Parks Canada 1994, subsection 3.1.2). Provided that there is consensus and clarity on the population objectives for northern abalone, the species is well suited for inclusion in marine area protection (Jamieson 2000).

The model of local, sub-populations linked by larval dispersal into genetically distinct metapopulations is robust for abalone species (Keesing and Baker 1998). Northern abalone (and red sea urchin) are exemplary in their spatially persistent clumping. Abalone restoration is certainly amenable to a range of refugia-based strategies (Davis 2000). Understanding the dynamics of clump size, density and between-clump proximity and connectivity will be central to sustainable management (Quinn *et al.* 1993; Shepherd and Brown 1993). Further, being a kelp forest-associated species, northern abalone is a useful surrogate for exploring implementation of area-based conservation. Finally, we already know that northern abalone respond well to area protection by increasing in density, average body size and reproductive output in British Columbia refugia (Wallace 1999).

Abalone can be affected by other shellfish species where there are ecological or behavioural interactions between them. In their worldwide review, Andrew and MacDiarmid (1999) reported that high densities of sea urchins may have a negative effect on abalone populations. This may be related to two species competing for the same sea weed food supplies. Perhaps a fishery for one species could make more food available for adults of the other species? However, in both California (Rogers-Bennett and Pearse 2001) and South Africa (Mayfield and Branch 2000), the spine canopies of adult sea urchins provide a refuge for young abalone. The California study suggested that red sea urchin fishing could decrease important hiding habitat for abalone species. The South African study suggested that a lobster (sea urchin predator) fishery would decrease predation pressure on the sea urchins, thus increasing the amount of hiding (sea urchin spine canopy) habitat for abalone. In other words, abalone can be involved in cascading effects between different shellfish species according to which species is locally fished. The multispecies ecosystem approach, therefore, needs to be used in both fisheries and marine area management.

Numerous studies are now available demonstrating the benefits to shellfish populations provided by protected areas mentioned previously. A report on the genetic characteristics of Haida Gwaii northern abalone populations collected from sites throughout the archipelago is in preparation (R. Withler, DFO, *personal communication*). Such information can reveal the distinctiveness of abalone populations (Withler 2000). Local information could provide insights on the appropriate spatial scale for northern abalone stock rebuilding and area conservation efforts. The application of genetic knowledge to marine area-ecosystem conservation and fishery management is underutilized (Policansky and Magnuson 1998). Clearly, genetics studies have tremendous potential in future marine area conservation science.

The following are examples of topics on northern abalone that could be explored:

- *would protecting northern abalone habitat areas lead to enhanced larval settlement in adjacent (fishable) areas*? – The issue of net export of recruits from protected areas to adjacent areas is the key unanswered science question in marine area conservation. Science has not yet demonstrated this potential benefit (NRC 2001) and this will be very important in consultations with the fishery sector (Jamieson and Levings 2001);

- *can fisheries biology reference points be applied to northern abalone population restoration?* – for example, this could relate to comparing total egg production of a population of individuals permitted to grow to their full potential size with that of the proportion of a population fished (theoretically) above the old legal size limit [100 mm shell length for northern abalone pre-1990 closure] and asking how does this relate to differences in recruitment success? (Shepherd and Baker 1998);

- *what is the spatial scale of larval source/sink dynamics of northern abalone metapopulations*? – this relates to refugia sizes [sufficient densities to maintain adequate fertilization, larval production and recruitment], shapes [in order to maximize kelp forest habitat inclusion], locations [species' optimal habitat criteria and distance between sub-populations] and connectedness [sub-population linkage by larval transport by nearshore oceanographic processes and according to different larval residence times in the plankton] (Tegner 1993);

- *can northern abalone genetic studies provide insight into the connectedness between sub-populations in Haida Gwaii or Gwaii Haanas*? - this could enable spacing no-take northern abalone areas within Gwaii Haanas based on known genetic connectivity between those sub-populations; and

- *do the spine canopies of red sea urchins provide important hiding spaces for young northern abalone*? - this could link abalone well-being to red sea urchin fisheries effects.

<u>Case Study: Geoduck Clam</u>

Geoduck have great commercial importance in Gwaii Haanas and will be a key linking species between the fishery sector and all other stakeholders. There is increasing focus on the engagement of the British Columbia fishery sector into marine area conservation (Burrows 2000; Symington and Jessen 2001). Undisturbed geoduck populations consist of dense populations of old clams whose beds are presumably stable over long periods and whose biomass likely dominates the infauna of these sand bed ecosystems. Because this species is so important commercially, and because its life-history (excluding stock assessment) is not well understood for the Haida Gwaii region, geoduck are an important conservation area science target for better biological understanding.

The following are relevant topic areas in early geoduck life-history applicable to Haida Gwaii conservation-related science:

- *would protecting geoduck habitat areas lead to enhanced larval settlement in adjacent (fishable) areas?*

- *what is the spatial scale of larval source/sink dynamics between geoduck sub-populations within their regional metapopulation?*

- *how does fishing affect the diversity and abundance of other species in the fished area?*

- *what are the impacts of fishing on juvenile geoduck?* – relates fishing impacts to unearthed larvae or juveniles being eaten by opportunistic predators (not unlike predation following gray whale (*Eschrichtius robustus*) bottom-feeding (Oliver and Slattery 1985)) and exacerbated by the possibility that geoduck larvae are alleged to settle near (attracted to?) adults;

- *what is the importance of the refuge for geoduck that live below safe, compressed air diving depths (>30 m) to maintaining populations at fishable depths?* – relates to whether shallow-water refugia are needed if there already are refugia (at depth) for the unfishable proportion of the population; and

- *does fishing improve larval geoduck settlement opportunities in crowded clam beds?* – relates to the issue of whether beds thinned by fishing could provide better (less cannibalism of larvae?)

settlement opportunities compared to crowded (unfished) beds.

Case Study: Sea Otter–Shellfish Interactions

Sea otters were heavily hunted in the immediate post-contact era of ≈1790s to 1840s (Gough 1989; Gibson 1992; Robinson 1996). By the early 20th century, they were considered effectively extirpated from the Haida Gwaii region (Watson *et al.* 1997). They have been internationally protected since the 1911 Northern Fur Seal Treaty signed by the U.K. (for Canada), U.S., Japan and Russia. They are protected federally under the *Fisheries Act* and provincially under the *British Columbia Wildlife Act*. Finally, they are listed as "*threatened*" in the EC species-at-risk database and *red*-listed ("*endangered – threatened*") at the Conservation Data Centre, Victoria, British Columbia.

There have been three published sightings in Haida Gwaii, all from the Gwaii Haanas area, between 1972 and 2001 (Table 31). All were of single individuals, likely free-ranging males. There is another report (no photographs) by Patche (1922) who mentioned a sea otter skull from a cabin near Rose Spit plus one killed in 1921 and 27 taken in one day in ≈1890 by Old Massett villagers. Recently there have been anecdotal reports. These could be mistaken identity with the river otter (*Lutra canadensis*), which is common in Haida Gwaii. There is as yet no indication of sea otters establishing breeding populations in the Haida Gwaii region.

The removal of sea otters from Haida Gwaii has undoubtedly effected kelp forest-associated species such as northern abalone and red sea urchin. The intense predation effects of sea otters on shellfish species in the Northeast Pacific are well known and these effects are mentioned for each of the species discussed above. Watson and Smith (1996) and Watson (2000) speculated that the absence of sea otters allowed some invertebrate stocks, such as northern abalone and red sea urchin, to accumulate to unnaturally high levels. Further, there likely was widespread decline in kelp abundance after release of red sea urchin populations from sea otter predation pressure in Haida Gwaii.

The possibility that commercial red sea urchin fishing could have similar effects of increasing kelp abundance as predation on red sea urchins by sea otters seems unlikely. One reason is that divers fish only certain areas. They select areas for highest potential roe yield such as red sea urchin feeding front aggregations ("*feed lines*").

Kelp forest expansion would contribute increased amounts of organic material (food) cycling through nearshore ecosystems with an attendant "*trophic cascade*" (Sala *et al.* 1998) for species groups benefiting from the increased food into the system. In Gwaii Haanas, reestablished sea otter populations would likely lead to kelp population increases with a related trophic cascade, but also decreased northern abalone, red sea urchin and intertidal clam populations. In the north and east Graham Island areas, there could also be decreases to the commercial Dungeness crab stocks by sea otters.

In summary, there are two possibilities for the return of breeding sea otters populations. Firstly, breeding populations of sea otters could reasonably be expected to reestablish in Gwaii Haanas naturally. Expanding populations, perhaps originally from northwest Vancouver Island where they were reintroduced, could have been the source of free-ranging males into the Haida Gwaii area over the last 30 years. Sea otters are physiologically capable of swimming from the mainland coast directly across Hecate Strait (from the Goose Island group into which they are now known to have expanded from the south) or across Dixon Entrance from southeast Alaska. Reestablished sea otters populations in Gwaii Haanas would be actively protected by Parks Canada as part of its ecosystem restoration mandate described below. We should, therefore, anticipate eventual expansion throughout Haida Gwaii as, elsewhere in British Columbia and Alaska, once reintroduced to areas from which they were extirpated, populations can expand at a rate exceeding 18% annually (Watson and Smith 1996; Woodby *et al.* 2000). Secondly, sea otters could be repatriated to Haida Gwaii or Gwaii Haanas by humans. This introduction would likely be accompanied by a vigorous population expansion to the whole archipelago. There is precedent in British Columbia with the successful introduction of 89 Alaskan (Aleutian Islands) sea otters to Checleset Bay on the northeast coast of Vancouver Island by the province of British Columbia and DFO between 1969 to 1972 (Watson *et al.* 1997). This stimulated a Haida Gwaii NGO of the day (Islands Protection Society) to promote an introduction into Haida Gwaii (Anonymous 1976). In 1987 the province of British Columbia formally proposed to DFO an introduction of Alaskan stock to Haida Gwaii (preferred sites of SGaang Gwaii and Hippa Island; alternate sites of Englefield Bay and Skincuttle Inlet). There was a public meeting in Masset in January, 1988 at which both opposition and support was expressed (M. Hearne, Masset, *personal communication*). The introduction was not done.

Parks Canada policy does allow for active marine ecosystem restoration (Parks Canada 1994). In sub-section 3.1.4 of the policy's "Ecosystem Management" section, restoration of extirpated species is supported in principle provided that "*….research has shown that reintroduction is likely to succeed and that its probable effects are acceptable within the conservation area and the surrounding region*." In either case of natural or human-influenced return of sea otters, it would be imperative to consult all stakeholders to enable an understanding of anticipated ecosystem and shellfishery outcomes.

Table 31. Published sea otter (*Enhydra lutris*) sightings reported from the Haida Gwaii region; all are from the southern Gwaii Haanas area.

Date	Location	Notes	Reference
July 25, 1972	Cape St. James, 51° 55'N, 131° 00'W adjacent to the sea lion rookery	Reported by a sea lion researcher – a 35 mm slide was taken and put on file with the RBCM [1]	Edie (1973)
August 30, 1976	Flamingo Inlet, 52° 12'N, 131°20'40"W opposite Sperm Bay	Reported by scientists on a botanical and anthropological expedition – no photograph taken	Taylor and Gough (1977)
July 11, 2001	SGaang Gwaii (Anthony Island), 52° 04'58"N, 131° 13' 49"W beside a sea lion haulout on an islet south of the main island	Reported by Alaska Department of Fish and Game and Parks Canada warden staff while on a sea lion survey – photographs taken	Raum-Suryan *et al.* (*in preparation*) - Digital photos on file at Gwaii Haanas (Parks Canada) office

[1] a copy of the original slide taken by A.G. Edie was provided courtesy of M. McNall, Royal British Columbia Museum (RBCM) and is on file at Gwaii Haanas office

CONCLUSIONS AND RECOMMENDATIONS

"*Conservation is a positive experience of skill and insight, not merely a negative exercise of abstinence and caution*" (Aldo Leopold, from Callicott 1992)

"*But if I had to name the single most frightening and dangerous threat to the health of the oceans, the one that stands alone yet is at the base of all others is ignorance: lack of understanding, failure to relate our destiny to that of the sea, or to make the connection between the health of coral reefs and our own health, between the fate of the great whales and the future of humankind.*" (Earle 1995)

"*The long-term survival of most species and ecosystems also requires large and interacting populations to ensure diverse genetics, health and reproductive success, and large areas to provide habitats and nourishment. This further supports the need for partnerships to protect and manage biodiversity.*" (Industry Canada - IC 2000)

The wisdom of Aldo Leopold resonates with us, but ignorance of regional marine biodiversity, biogeography and ecosystem function necessitates the precautionary approach. In the long term, however, using skill and insight are the operational ideals. As E.O. Wilson has said: "*There is an implicit principle of human behavior important to conservation: the better an ecosystem is known, the less likely it will be destroyed.*"

Gwaii Haanas is a great opportunity for Canadian innovation in marine area conservation. This report will have succeeded if readers find it facilitates discussion of technical issues during public consultation towards establishing Gwaii Haanas marine area under a consultative, knowledge- and ecosystem-based partnership.

Invertebrates are fundamental to local marine ecosystem structure and function, yet we know so little about them. Invertebrates are important culturally and economically. Finally, invertebrates have intrinsic value and the ethical right to coexist with us. Appreciating the breadth of invertebrates' importance and our moral obligations to them is progress. But, further progress can only be made through new thinking about applying ecosystem-based science to marine area conservation, better ways to involve the public, new attitudes about interagency - stakeholder consultation and full exploitation of computer-based technologies such as GIS.

We recommend the following:

- **document traditional Haida knowledge and usage of marine invertebrates**

Considering that marine invertebrates were likely important to the survival of indigenous people for ≈10,000 years in the Haida Gwaii region, we have only a small published knowledge-base. Much more documentation of Haida oral history, traditional knowledge and archaeology is required. Some has been published, but we expect that much knowledge has already been lost. This issue is important in its own right as well as in view of the Canada-Haida cooperative management partnership currently underpinning Gwaii Haanas' land management.

The passing of Elders, who had relatively traditional rearing, represent particularly significant losses of traditional knowledge if their stories are not recorded. Some unexamined audio-tapes of deceased Elders do exist. These must be fully evaluated along with interviews with living Elders. Currently, Gwaii Haanas' is working with the Skidegate Haida Language Authority for GIS mapping of traditional knowledge (names, songs, stories) associated with locations in southern Haida Gwaii. Also, an intensive archaeological study of pre-contact Haida diets from coastal habitation sites has begun that likely will reveal much more on historic marine invertebrate usage (D. Fedje, Parks Canada, *personal communication*).

There is an emerging discussion on uses of traditional information along with western science information within an overarching approach to conservation (Mauro and Hardison 2000). Such an approach should have a role in managing spatial marine conservation in Gwaii Haanas. A way to give respect to this process would be to use indigenous knowledge (and other local experiential knowledge) to make hypotheses that could be scientifically tested and then applied in an adaptive conservation management regime (Sloan 2002). Further, traditional knowledge systems themselves may already possess analogies to the adaptive management approach (Berkes *et al.* 2000).

- **improve regional physical and biological oceanographic knowledge**

Productivity studies of plankton and currents, especially in the nearshore, are crucial. We need to understand the connectivity (energy, nutrients, larvae) between different areas of Haida Gwaii and between inshore and offshore. Currently we have no notion of appropriate scale and linkages for effective marine area conservation, as determined by invertebrate larval source-sink dynamics in the Haida Gwaii region. Where planktonic larvae go and how they survive is key information for the scale of eventual zoning such as location of fishing sites, refugium size and distances between refugia. We also need to identify those species with larvae residing only a short time in the plankton as well as those species with only benthic larvae or no larvae. Oceanography, particularly at smaller than conventional spatial scales, has a core role in understanding recruitment processes leading to spatial patterns in adult populations (Bradbury and Snelgrove 2001). Seasonal plankton phenomena and upwelling events influence local invertebrate well-being in ways we do not understand. This whole topic area is a missing building block for knowing the roles of invertebrates in local marine ecosystems.

- **chart the west coast of Gwaii Haanas**

The west side of Gwaii Haanas north of Nagas Point to Tasu Sound being largely unsurveyed (for depth, substrate type, bottom topography) is not in keeping with the need for long-term, knowledge-based conservation. The only charted area within this coastline is Gowgaia Bay. The west side of Gwaii Haanas is the largest stretch of British Columbia coastline that remains uncharted.

Charting should be done through interagency cooperation led by the Canadian Hydrographic Service (DFO). Without this, we lack core data on the mosaic of habitats (determined by depth, bottom relief and substrate) that would underpin an understanding of benthic invertebrate-habitat relationships and ecosystem function for most of the west coast of Gwaii Haanas.

- **work up Haida Gwaii material in key Canadian museum collections**

Considering just deep-sea benthic invertebrate species, Poore and Wilson (1993) estimated that the ratio of known to total faunas might be as high as 1:20 – which forms part of their world-wide estimate of ≈5 million species. This is bracketed by previous estimates of ≈10 million (Grassle and Maciolek 1992) to ≈500,000 species (May 1992). That the experts should have such wide-ranging estimates reveals the depth of our ignorance! Clearly, there are many more marine invertebrate species out there than are in databases, and the Gwaii Haanas region is no exception.

Possible initiatives are firstly to examine the unsorted/unidentified material as a low-cost way to expand our species biodiversity inventory and secondly to have all the identified material checked by specialists group-by-group. Likely most collections are in museums, but some are maintained by individual specialists and some are in marine stations and universities. Checking identifications is a long-term proposition given the small number (»120) of specialists world-wide with direct interests in Canadian marine life (Austin *et al.* 1997). Moreover, this does not include the description of new taxa found during the checking process. Clearly, support is needed for training both taxonomists and parataxonomists and for the time consuming identification and description processes. Such a systematic assessment must be an international effort for specialists to access the collections.

- **collect in poorly represented habitat types to fill egregious database gaps**

In keeping with the reality that so little has been done in this region, many large gaps in invertebrate species biodiversity knowledge exist. These should be addressed because knowledge about all habitats and ecosystem types will be needed for long-term, ecosystem-based management. A few examples of underrepresented areas in our basic invertebrate biodiversity knowledge are: estuaries (see below), deep-water, rock-dwelling corals and other species not easily sampled by dredges or grabs, the meiofauna (intertidal and subtidal), rocky bottom/kelp forest benthos, highly exposed intertidal shores and continental shelf/slope sediments.

- **focus on invertebrates of estuaries as critical land-sea linkage habitats**

The protected and relatively undisturbed uplands of Gwaii Haanas are a key regional attribute that will enable long-term studies of land-sea interactions on the scale of small coastal watersheds. Estuaries are the spaces where the transition area between terrestrial to marine species biodiversity is the most marked and the most amenable to mapping. Gwaii Haanas estuaries are, however, not well enough understood ecosystems, although they are critical to high-profile salmonid and wildlife (e.g., black bear [*Ursus americanus carlottae*] and shore bird) populations. A vegetation-based classification is currently underway (complimentary to provincial guidelines – Howes *et al.* 1999) and this should be matched by studies of invertebrates associated with the plant communities. A start has been made in that intertidal invertebrates of some estuaries was assessed in 1992 with respect to elevation (Harper *et al.* 1994). Further, the estuarine intertidal is a useful candidate areas towards reconciling the terrestrial-marine conventions for basic elevation data and vertical datum reference levels.

- **start mapping the marine biodiversity of Gwaii Haanas**

Mapping can greatly increase the utility of biodiversity information. Key to spatial management of Gwaii Haanas will be mapping patterns of invertebrate species and communities according to benthic habitats. Invertebrates constitute key components of food webs as they account for ≈90% of the marine animal species. Ideally, we will eventually understand the factors causing those mapped patterns. Future marine invertebrate biodiversity work in this region should, therefore, connect invertebrate species to definable places, habitats and associations. For example, there may be an opportunity to link with the forthcoming multi-agency (DFO, NRCan, National Defense)/ industry/academia Seabed Resource Mapping Program (SeaMap) to map Canada's submerged features (T. Tomascik, Parks Canada, *personal communication*). Marine surveillance technologies are developing rapidly and marine conservation areas could benefit.

- **monitor the marine area using Parks Canada's Warden Service**

Gwaii Haanas should be a reference site for regional marine environment/ecosystem well-being. Wardens spend more time travelling in this isolated region than any other technical agency staff. The Warden Service, with science direction and subsequent evaluation by a multi-agency (Parks Canada, DFO, EC, NRCan) group, could implement marine monitoring. This could be a core science task for the Warden Service and embedded within Gwaii Haanas' long-term operating budgets. At a minimum, wardens would cover the proposed Gwaii Haanas marine conservation area within the whole Haida Gwaii region. The data would be shared through the World Wide Web.

- **commit to long-term ecosystem-based Hecate Strait studies**

A good opportunity is at hand for Gwaii Haanas to help coalesce different interests in the Hecate Strait towards knowledge-based regional marine conservation. Firstly, there is the on-going (since 1982) DFO commitment to multi-species groundfish research (Perry *et al.* 1994); secondly, the sponge bioherm work (Conway *et al.* 2001); thirdly, the oceanographic knowledge (Crawford 2000); fourthly, the geology research of the Queen Charlotte Basin (Woodsworth 1991); and fifthly, benthic invertebrate studies (e.g., Bernard 1979; Burd and Brinkhurst 1987).

Further, Hecate Strait's productive waters will become topical if the oil and gas exploration moratoria are lifted. This would create a pressing need for an altogether better Hecate Strait marine environmental baseline inventory and stimulate more science on the Strait's ecosystem structure and function. Gwaii Haanas should be among the cooperating stakeholders within this key regional marine ecosystem issue.

- **support declaration of the sponge bioherms as DFO Marine Protected Areas**

The sponge bioherm areas of Hecate Strait and Queen Charlotte Sound are an ideal candidate group for area-specific declaration as Marine Protected Areas under DFO's *Oceans Act* mandate. Sufficient science has been published to characterize these unique marine invertebrate-structured areas. In keeping with Parks Canada's broader regional view of marine conservation, we should support declaration of the bioherms' protected status by DFO before further bottom-trawling damage occurs.

- **use shellfish species to help address spatial scale within Gwaii Haanas**

Among the invertebrates, edible species (traditional Haida foods, commercial and recreational) naturally receive more human interest than other marine invertebrates. Therefore, we should wisely use this interest and what we know about these species' life histories (particularly those with spatially explicit adult populations), to initiate discussions on scale and connectedness within Gwaii Haanas. For example, such discussions concerning red sea urchin, geoduck or northern abalone would help delineate zoning networks of connected no-take zones within Gwaii Haanas' future multiple-use matrix. The scale of these spaces should be determined by our knowledge of their connections through larval replenishment processes and the need for having stock available for our commitment to commercial fishing. In other words, setting aside source populations both as examples of local ecosystems and as sources of recruits for sustainable nearby fisheries. However, we should remember that the less well known, non-edible species also receive protection.

- **understand the socioeconomics of Haida Gwaii shellfisheries**

Knowing who pays for and who benefits from marine conservation is essential. Understanding the impacts to communities of marine area conservation is a core component of public consultation (NRC 2001). Our shellfishery overview requires a complimentary study of the social and economic importance of shellfisheries at the individual community, regional and provincial scales. We must listen carefully to the fisheries sector (fishers, processors, associations). Jentoft (1998) emphasizes that social science is usually absent from fisheries management decision-making. Further, agency commitments to public consultation in marine conservation compel us to look deeply into the human consequences of protecting marine spaces. Therefore, Jentoft's two major roles of social science in fisheries; (1) design of management institutions, and (2) provision of feedback to the management process - are important to consider. For example, the impacts to the industry of future marine zoning in Gwaii Haanas, including no-take areas, must be understood if it will be accepted within the public consultation process. Other issues include the ripple effects of sea otter protection within Gwaii Haanas to all regional Haida Gwaii shellfisheries.

- **acquire fishers' experiential knowledge of invertebrates**

Working with fishers to learn from their experiences with invertebrates is a point of engagement for relationship-building, besides an important source of technical information. In the long-term, the fisheries sector must be engaged as a key partner in Gwaii Haanas' future. As an example of their knowledge, finfish long-liners know the locations of deep-water coral groves on current-swept, rocky continental slope areas along the west side of Gwaii Haanas. Fishers were a key information source for inventory of Nova Scotia's deep-water coral groves (Breeze *et al.* 1997). Recognizing the fisheries sector as a participant in the future of Gwaii Haanas is imperative. But, we will need to build trust that the outcomes of their knowledge-sharing will not feed-back negatively on the fisheries economy.

- **federal agencies must cooperate more for marine conservation science progress**

" … effective application of ecological integrity principles will require collaboration and partnerships among federal science-based departments and agencies, and between the government and its non-federal partners."
(Industry Canada - IC 2000)

A reality-check is warranted because of the size and complexity of the challenge. To begin understanding regional marine ecosystems, all the key federal agencies (Parks Canada, DFO, EC, NRCan) must cooperate more closely than ever and partner with other entities (NGOs, First Nations, universities, fishery sector, coastal communities). Core to such cooperation is DFO - the agency with the most capacity and regional marine science history. The *Oceans Act's* preamble contains a clear DFO commitment to marine ecosystems, as follows:

- "*Canada promotes the understanding of oceans, ocean processes, marine resources and marine ecosystems to foster the sustainable development of the oceans and their resources*;" and

- "*Canada holds that conservation, based on an ecosystem approach, is of fundamental importance to maintaining biological diversity and productivity in the marine environment.*"

Accordingly, DFO should, in addressing its *Oceans Act* mandate, return part of its science thrust to its roots in basic ecological and biodiversity research. That means building upon overlooked traditions of the Pacific Biological Station's basic research in the Haida Gwaii region (e.g., C.M. Fraser in the 1930s and D.B. Quayle and F.R. Bernard in the 1950s to 1970s) and integrating that ethic with the capacity of the Institute of Ocean Sciences, Sidney (e.g., Thomson 1989; Crawford 2000). An enlightened research commitment, beyond stock assessment into fundamental issues of marine biodiversity and ecosystem structure and function, is needed.

Fishing is central to the long-term future of Gwaii Haanas. To enable ecosystem-based management of human activities, there must be access to the full information base for the management partnership. This means access to both fishery-dependent and fishery-independent data with attendant confidentiality to protect the interests of individual fishers and maintain trust among the partners. An example is finding the balance between serving the public good with access to information on continental shelf bottom trawl tracks and serving the industry good by protecting appropriate portions of such data. All information sources are relevant and all should be shared. The strategic step of partners' consensus on information policy would solidify future working relationships.

- **increase public awareness and understanding of marine invertebrates and associated habitats**

Awareness and understanding are key to fostering stewardship and support for marine conservation. Agencies such as DFO and Parks Canada must continue to work with NGOs that promote marine conservation. Also, government agencies mounting their own initiatives should ensure that these compliment, not overshadow, NGO efforts.

Both NGOs and government organizations should collaborate in working with the media to promote awareness and understanding through magazines such as Canadian Geographic, Beautiful British Columbia, television documentary programs such as Discovery Channel, Knowledge Network, newspapers and even stamps (e.g., the Canada Post "Canadian corals" stamp to be issued in 2002).

The NGOs played a key role in the establishment of Gwaii Haanas National Park Reserve / Haida Heritage Site. Particularly in a remote region such as Haida Gwaii, NGO support must be nurtured and acknowledged. The remoteness of Haida Gwaii limits the number of people who can directly experience its marine ecosystems. However, most of the same species and habitats occur in more accessible regions of southern British Columbia. Experiential programs in the field (e.g., DFO Shorekeepers, Hecate Strait Streamkeepers, Laskeek Bay Conservation Society, Haida Gwaii Marine Resources Group Association, Georgia Strait Alliance Straitkeepers), entities explicitly promoting marine conservation (e.g., World Wildlife Fund-Canada Marine Program, Living Oceans Society, Sierra Club, David Suzuki Foundation, Canadian Parks and Wilderness Society), and coastal facilities (e.g., Bamfield Marine Station, Marine Ecology Station, Vancouver Aquarium) foster understanding and participation in marine conservation coast-wide.

- **increase science cooperation with Naikoon Provincial Park**

Gwaii Haanas represents the rocky shores of Haida Gwaii well, but not the sandy shores typical of Naikoon Provincial Park within the Queen Charlotte Lowlands (the Argonaut Plain) in the archipelago's northeast corner (Figure 1). Although the province of British Columbia has had an important role in the establishment of Gwaii Haanas (e.g., the *South Moresby Agreement* [1988] and the transfer of jurisdiction of the proposed marine area's seabed [2001]), Parks Canada has been little involved with Naikoon. This is not in keeping with the spirit of Parks Canada's marine policy of regional concern outside park boundaries and given the inherent ecosystem value, and invertebrate populations, of Naikoon's incomparable sandy beaches.

Naikoon Provincial Park was established in 1973 and is managed by British Columbia Parks (under the *British Columbia Park Act*) within the British Columbia Ministry of Water, Land and Air Protection. The park protects the relatively level, boggy coastal forests on glacial deposits and marine-derived sand dune systems. Naikoon has ≈724 km^2 of land and ≈108 km of mostly sandy shoreline comprising ≈2.16 km^2 of park "foreshore" – an intertidal band whose width is ≈200 m seaward of the high tide line. Naikoon has no subtidal marine area, i.e., no sea space. With the exception of two rocky promontories (Yakan Point and Tow Hill), the shoreline consists almost entirely of sand beaches exposed to high wave energy. There is some cobble-boulder shoreline near Tlell in the park's southeastern corner.

Naikoon's sand beaches are Pacific Canada's largest and most dramatic. North and South Beaches represent ≈21 km and ≈12 km respectively of continuous sand beaches (≈1 km wide intertidal zone) facing northward into McIntyre Bay, Dixon Entrance. The sands come from offshore and their net onshore movement is speculated to be due to recent uplift of the offshore platform (Harper 1980). East Beach, facing eastward into northern Hecate Strait, extends south from Rose Point as a continuous sandy shore for ≈75 km before merging into the cobble-boulder shoreline near Tlell. The intertidal of East Beach is narrower (<0.5 km) and tends to have more cobble in the lower intertidal than South and North Beaches. For comparison, Long Beach, Wickaninnish Bay within the Long Beach unit of Pacific Rim National Park is ≈11.4 km long and the unit's other major sand beach (in Florencia Bay) is ≈6.4 km long. North Beach and Naikoon's offshore sandy areas are the centre of Haida Gwaii's razor clam and Dungeness crab fisheries.

Naikoon has a year-round staff of one and one seasonal (four-month) ranger. Gwaii Haanas has ≈40 year-round staff. Naikoon is less funded than Gwaii Haanas and it relies on remote technical services, such as GIS, from an off-island British Columbia Parks regional office (in Smithers). Naikoon management performs a science permitting process particularly aimed at the park's two Ecological Reserves (Tow Hill and Rose Spit), but the park has no sustained internal science process in support of management. Ecological Reserves are separately managed by British Columbia Parks under the *Ecological*

Reserves Act. Given the complementation of Gwaii Haanas' rocky shores and Naikoon's sandy shores within Haida Gwaii, there should be more regional ecosystem-based, technical cooperation between these coastal parks.

EPILOGUE

Clark (1993) called current conservation professionals: "…. *the last generation that can prevent the extinction of large numbers of species and the disruption of large scale ecosystem processes*." In other words, this is the time to act. It is acknowledged world-wide, however, that marine conservation lags behind terrestrial conservation technically, intellectually and politically (NRC 2001).

The Gwaii Haanas marine area is being considered during the most exciting and dynamic era in marine conservation history. Tremendous advances in computer-based tools for marine map and database processing are on-going. Fundamental technical and political progress is being made in the United States on conserving marine spaces (NRC 2001). Canadian agencies (EC – Zurbrigg 1996; interagency – Anonymous 1998; DFO – Jamieson and Levings 2001) and environmental NGOs (Day and Roff 2000; Wallace and Boyd 2000) are also embracing habitat- and ecosystem-based ideas for conserving marine spaces. As well, there are many recent, science-based books for the lay public underscoring that fundamental change is needed in human-ocean relations based upon fisheries' spectacular failures and negative ecosystem effects (Earl 1995; Berrill 1997; Safina 1997; Harris 1999; Dobbs 2000; Glavin 2000; Woodward 2000; Helvarg 2001).

Invertebrates are vital to assembling the information tools for future marine conservation. However, science moves too slowly for the critical near-term decision-making we need. We need the wisdom of a precautionary approach to offset uncertainties and the flexibility of adaptive management to chart our course. We need vision to fulfil Gwaii Haanas' promise through new partnerships and forthcoming public consultation. Finally, we need to be humble but bold in confronting our ignorance as we prepare Gwaii Haanas for unborn generations to use, enjoy and cherish.

LITERATURE CITED

Acheson, S.R. 1995. In the wake of the Iron People: a case for changing settlement strategies among the Kunghit Haida. Journal of the Royal Anthropological Institute (New Series) 1: 273-299.

Acheson, S.R. 1998. In the wake of the *ya'aats' xaatgaay* ["Iron People"]: a study of changing settlement strategies among the Kunghit Haida. British Archaeological Reports International Series 711: 209 p.

Ackerman, R.E. 1996. Early maritime culture complexes of the northern Northwest Coast. p. 123-132. In: Early human occupation of British Columbia. R.L. Carlson, and L. Dalla Bona (eds.). University of British Columbia Press, Vancouver, B.C.

Addessi, L. 1994. Human disturbance and long-term changes on a rocky intertidal community. Ecological Applications 4: 786-797.

Adkins, B.D. 1977. A biological and oceanographic analysis of the Queen Charlotte Sound Marine Natural Region. Report prepared for Parks Canada, Hull, P.Q. by Lee and Adkins Ltd., Lantzville, B.C. 103 p.

Agardy, M.T. 1993. Accommodating ecotourism in multiple use planning of coastal and marine protected areas. Ocean and Coastal Management 20: 219-239.

Ahmed, F.E. (ed.). 1991. Seafood safety – Committee on evaluation of the safety of fishery products. National Academy Press, Washington, D.C. 432 p.

Allison, G.W., J. Lubchenco, and M.H. Carr. 1998. Marine reserves are necessary but not sufficient for marine conservation. Ecological Applications 8(Supplement): S79-S92.

AMR (Archipelago Marine Research Ltd.). 1997. An environmental assessment of a floating operations station in Rose Harbour, Gwaii Haanas. Report prepared for Gwaii Haanas National Park Reserve, Queen Charlotte, B.C. by Archipelago Marine Research Ltd., Victoria, B.C. 39 p.

Andrew, N.L., and A.B. MacDiarmid. 1999. Sea urchin fisheries and potential ecological interactions with a *kina* fishery in Fiordland. Conservation Advisory Science Notes 266: 12 p. (Department of Conservation, New Zealand)

Anderson, J.T. 2001. Monitoring pelagic marine cold water ecosystems. Canadian Science Advisory Secretariat Research Document 2001/076: 15 p.

Angel, M.V. 1997. Pelagic biodiversity. p. 35-68. In: Marine biodiversity patterns and processes. R.F.G. Ormond, J.D. Gage, and M.V Angel (eds.). Cambridge University Press, Cambridge, U.K.

Angermeier, P.L., and I.J. Schlosser. 1995. Conserving aquatic biodiversity: beyond species and populations. American Fisheries Society Symposium 17: 402-412.

Anonymous 1976. Returning keystone species: the sea otter. All Alone Stone III: p. 35 only. Islands Protection Society, Masset, B.C.

Anonymous. 1982. Initial environmental evaluation of renewed petroleum exploration in Hecate Strait and Queen Charlotte Sound. Chevron Canada Resources Ltd., Calgary, AB. 2 volumes.

Anonymous. 1983. Offshore Queen Charlotte Islands: Initial environmental evaluation. Petro-Canada Inc., Calgary, AB. 3 volumes.

Anonymous. 1995. Crossroads of life, site of exchanges, wellspring of riches - management plan. Report prepared for Saguenay-St.Lawrence Marine Park, Tadoussac, PQ. Parcs Canada – Ministere de l'Environnement et de la Faune. 69 p.

Anonymous 1998. Marine protected areas - a strategy for Canada's Pacific coast. Fisheries and Oceans Canada, Pacific Region, Vancouver, B.C. and British Columbia Land Use Coordination Office [*now Client Services Branch, Business Information Services Division, Ministry of Sustainable Resource Management*], Victoria, B.C. 27 p.

AS-USSR (Academy of Sciences of the Union of the Soviet Socialist Republics) 1973. Complex investigations of the continental slope in the Gulf of Alaska region based on the 45th cruise of the R/V *Vityaz*. P.P. Shirshov Institute of Oceanology Proceedings No. 91. Nauka Publishing House, Moscow.

Austin, W.C. 1984. Underwater bird watching. Canadian Technical Report of Hydrography and Ocean Sciences 38: 83-92.

Austin, W.C. 1985. An annotated checklist of marine invertebrates in the cold temperate Northeast Pacific. Khoyatan Marine Laboratory, Cowichan Bay, B.C. 3 Volumes: 682 p.

Austin, W.C. 1999 a. Field notes: biota assessment of sponge bioherms in the Haida Gwaii Marine Area. Unpublished data, Khoyatan Marine Laboratory, Cowichan Bay, B.C.

Austin, W.C. 1999 b. The relationship of silicate levels to the swallow water distribution of hexactinellids in British Columbia. Memoirs of the Queensland Museum 44: 44 only.

Austin, W.C. 2000. Rare and endangered marine invertebrates in British Columbia. p. 57-66. In: Proceedings of a conference on the biology and management of species and habitats at risk. Volume 1. L.M. Darling (ed.). British Columbia Ministry of Environment, Lands and Parks, Victoria, B.C. and University College of the Cariboo, Kamloops, B.C.

Austin, W.C., M. Hawkes, A. Peden, J.C. Watson, A. Burger, N. McDaniel, and J. Harper. 1997. Marine inventory requirements in British Columbia. Report on file with the Conservation Data Centre, British Columbia Ministry of Environment, Lands and Parks, Victoria, B.C.

Austin, W.C. and M.P. Haylock. 1973. British Columbia marine faunistic survey reports: ophiuroids from the northeast Pacific. Fisheries Research Board of Canada Technical Report 426: 33 p.

Baker, H.R. 1982. Two new Phallodriline genera of marine Oligochaeta (Annelida: Tubificidae) from the Pacific Northeast. Canadian Journal of Zoology 60: 2487-2500.

Ballantine, W.J. 1995. Networks of "no-take" marine reserves are practical and necessary. p. 13-20. In: Marine protected areas and sustainable fisheries. Shackell, N.L., and J.H.M. Willison, (eds.). Science and Management of Protected Areas Association, Wolfville, NS.

Ballantine, W.J. 1997 a. Design principles for systems of "no-take" marine reserves. In: The design and monitoring of marine reserves. T.J. Pitcher (ed.). Fisheries Centre Research Reports 5(1): 4-5. University of British Columbia, Vancouver, B.C.

Ballantine, W.J. 1997 b. "No-take" marine reserve networks support fisheries. p. 702-706. In: Developing and sustaining world fishery resources: the state and management. D.A. Hancock, D.C. Smith, A. Grant, and J.P. Beumer (eds.). Proceedings of the 2nd World Fisheries Congress, CSIRO, Brisbane, Australia.

Bally, R., and C.L. Griffiths. 1989. Effects of human trampling on an exposed rocky shore. International Journal of Environmental Studies 34: 115-125.

Banner, A.H. 1948. A taxonomic study of the Mysidacea and Euphausiacea (Crustacea) of the Northeastern Pacific. II. Mysidacea from tribe Mysini through subfamily Mysidellinae. Transactions of the Royal Canadian Institute 27: 65-118.

Barber, F.G. 1983. Lobster transplant to Masset Inlet. Canadian Technical Report of Fisheries and Aquatic Sciences 1181: 6 p.

Barnard, J.L. 1964. Some bathyl Pacific amphipoda collected by by the *U.S.S. Albatross*. Pacific Science 18: 315-335.

Barrie, J.V., and K.W. Conway. 1996. Sedimentary processes and surficial geology of the Pacific margin of the Queen Charlotte Islands, British Columbia. Current Research 1996-E, Geological Survey of Canada. 6 p.

Bartsch, P. 1912. A zoogeographic study based on the Pyramidellid mollusks of the west coast of North America. Proceedings of the United States National Museum 42: 297-349.

Bartsch, P. 1916. The recent and fossil mollusks of the genus *Rissoina* from the west coast of America. Proceedings of the United States National Museum 49: 33-62.

Bartsch, P. 1921. New marine mollusks from the west coast of America. Proceedings of the Biological Society, Washington, D.C. 34: 33-40.

Basset, Y., V. Novotny, S.E. Miller, and R. Pyle. 2000. Quantifying biodiversity: experience with parataxonomists and digital photography in Papua New Guinea and Guyana. BioScience 50: 899-908.

Bax, N., J.T. Carlton, A. Mathews-Amos, R.L. Haedrich, F.G. Howarth, J.E. Purcell, A. Rieser, and A. Gray. 2001. The control of biological invasions in the world's oceans. Conservation Biology 15: 1234-1246.

BC (British Columbia Ministry of Agriculture, Fisheries and Food). 1990. Federal and Provincial Transplant Regulations. Aquaculture Factsheet Bulletin (Aquaculture and Commercial Fisheries Branch) 8-1: 3 p.

Beach, H. 1988. The Resources of Kouchibougac National Park - Resource Description and Analysis. Report prepared for Kouchibouguac National Park, NB. 323 p.

Bendell-Young, L.I., and R.C. Ydenberg. 2001. Ecological implications of the shellfishery; a case study on the west coast of British Columbia, Canada. p. 57-70. In: Waters in Peril. R. Gallaugher, and L.I. Bendell-Young (eds.). Kluwer Academic Publishers, Norwell, MA.

Berkeley, E., and C. Berkeley. 1942. North Pacific Polychaeta, chiefly from the west coast of Vancouver Island, Alaska, and Bering Sea. Canadian Journal of Research 20(Sec. D, No. 7): 183-208.

Berkes, F., J. Colding, and C. Folke. 2000. Rediscovery of traditional ecological knowledge as adaptive management. Ecological Applications 10: 1251-1262.

Bernard, F.R. 1967 a. British Columbia marine faunistic survey. Numerical codes for mollusca. Fisheries Research Board of Canada Manuscript Report 914: 30 p.

Bernard, F. R. 1967 b. Prodrome for a distributional check-list and bibliography of the recent marine mollusca of the west coast of Canada. Fisheries Research Board of Canada Technical Report 2: 261 p.

Bernard, F.R. 1968. *Cyclopecten carlottensis*, a new species of Pectinidae from the northeastern Pacific. Journal of the Fisheries Research Board of Canada 25: 1509-1510.

Bernard, F.R. 1971. British Columbia marine faunistic survey report on the Brachiopoda. Fisheries Research Board of Canada Technical Report 268:10 p.

Bernard, F.R. 1979. The food of Hecate Strait crabs August 1977. Fisheries and Marine Service Manuscript Report 1464: 23 p.

Bernard, F.R. 1980. Preliminary report on the potential commercial squid of British Columbia. Canadian Technical Report of Fisheries and Aquatic Sciences 942: 51 p.

Bernard, F.R. 1981. The food of Hecate Strait crabs June 1978. Fisheries and Marine Service Manuscript Report 1612: 9 p.

Bernard, F.R. 1988. Potential fishery for the gooseneck barnacle *Pollicipes polymerus* (Sowerby, 1833) in British Columbia. Fisheries Research 6: 287-298.

Bernard, F.R., N. Bourne, and D.B. Quayle. 1967. British Columbia faunistic survey. A summary of dredging activities in western Canada, 1878-1966. Fisheries Research Board of Canada Manuscript Report 920: 61 p.

Bernard, F.R., N. Bourne, and D.B. Quayle. 1968. British Columbia faunistic survey. A summary of dredging activities 1966-1967. Fisheries Research Board of Canada Manuscript Report 975: 6 p.

Bernard, F.R., N. Bourne, and D.B. Quayle. 1970. British Columbia faunistic survey. A summary of dredging activities 1967-1969. Fisheries Research Board of Canada Manuscript Report 1082: 7 p.

Bernard, F.R., S.M. McKinnell, and G.S. Jamieson. 1991. Distribution and zoogegraphy of the Bivalvia of the eastern Pacific Ocean. Canadian Special Report of Fisheries and Aquatic Sciences 112: 60 p.

Bernard, F.R., and D.B. Quayle. 1973. British Columbia faunistic survey. A summary of dredging activities 1970-1972. Fisheries Research Board of Canada Manuscript Report 1240: 11 p.

Berrill, M. 1997. The plundered seas - can the world's fish be saved? Greystone Books, Vancouver. 208 p.

Beveridge, M.C.M., L.G. Ross, and J.A. Stewart. 1997. The development of mariculture and its implications for biodiversity. p. 372-393. In: Marine biodiversity patterns and processes. R.F.G. Ormond, J.D. Gage, and M.V Angel (eds.). Cambridge University Press, Cambridge, U.K.

Bigelow, H.B. 1913. Medusa and Siphonophora collected by the U.S. Fisheries Steamer '*Albatross*' in the Northwest Pacific, 1906. Proceedings of the United States National Museum 44: 1-119.

Blackman, M.B. 1976. Northern Haida ecology: a preliminary discussion. Draft notes prepared for a Northwest Coast Studies Conference, May 1976, Vancouver, B.C. Report on file, Cultural Resource Services, Western Canada Service Centre-Parks Canada, Victoria, B.C.

Blackman, M.B. 1979. Northern Haida land and resource utilization. p. 43-55. In: Tales of the Queen Charlotte Islands. Senior Citizens of the Queen Charlotte Islands, Masset, B.C.

Blackman, M.B. 1990. Haida: traditional culture. p. 240-260. In: Handbook of North American Indians. Vol. 7. W. Suttles (ed.). Smithsonian Institution, Washington, D.C.

Bondrup-Nielsen, S., and T.B. Herman. 1995. Long-term monitoring of the environment: panacea or placebo! p. 22-26. In: Ecosystem monitoring and protected areas. T.B. Herman *et al.* (eds.) Science and Management of Protected Areas Association, Wolfville, NS.

Booth, J., D.E. Hay, and J. Truscott. 1996. Standard methods for sampling resources and habitats in coastal subtidal regions of British Columbia: Part 1: review of mapping with preliminary recommendations. Canadian Technical Report of Fisheries and Aquatic Sciences 2118: 53 p.

Booth, J.D. 1994. *Jasus edwardsii* larval recruitment off the east coast of New Zealand. Crustaceana 66: 295-317.

Booth, J.D., and B.F. Phillips. 1994. Early life history of spiny lobster. Crustaceana 66: 271-294.

Botsford, L.W., C.L. Moloney, A, Hastings, J.L. Largier, T.M. Powell, K. Higgins, and J.F. Quinn. 1994. The influence of spatially and temporally varying oceanographic conditions on meroplanktonic populations. Deep-Sea Research II 41: 107-145.

Botsford, L.W., J.C. Castilla, and C.H. Peterson. 1997. The management of fisheries and marine ecosystems. Science 277: 509-515.

Botsford, L.W., C.L. Moloney, J.L. Largier, and A. Hastings. 1998. Metapopulation dynamics of meroplanktonic invertebrates: the Dungeness crab (*Cancer magister*) as an example. In: Proceedings of the North Pacific Symposium on Invertebrate Stock Assessment and Management. G.S. Jamieson, and A. Campbell (eds.) Canadian Special Publication of Fisheries and Aquatic Sciences 125: 295-306.

Bourne, N. 1997. Invertebrate fisheries and possible conflicts with marine birds in the Queen Charlotte Islands. In: The ecology, status, and conservation of marine and shoreline birds of the Queen Charlotte Islands. Canadian Wildlife Service Occasional Paper 93: 29-35.

Bousfield, E.L. 1958. Ecological investigations on shore invertebrates of the Pacific coast of Canada, 1955. National Museum of Canada, Bulletin No. 147: 104-115 (Annual Report for Fiscal Year 1955-56).

Bousfield, E.L. 1963. Investigations on shore invertebrates of the Pacific coast of Canada, 1957 and 1959. I. Station List. National Museum of Canada, Bulletin No. 185: 72-89. (Paper No. 6 in Contributions to Zoology, 1963).

Bousfield, E.L. 2001. An updated commentary on phyletic classification of the amphipod Crustacea and its application to the North American fauna. Amphipacifica 3: 49-119.

Bousfield, E.L., and E.A. Hendrycks. 1995. The amphipod superfamily Eusiroidea in the North American Pacific region. I. Family Eusiridae: systematics and distributional ecology. Amphipacifica 1(4): 3-59.

Bousfield, E.L., and P.M. Hoover. 1997. The amphipod superfamily *Corophioidea* on the Pacific coast of North America. Part V. Family *Corophidae*. *Corophiinea*, new subfamily. Systematics and distributional ecology. Amphipacifica 2(3): 67-139.

Bousfield, E.L., and N.E Jarrett. 1981. Station lists of marine biological expeditions of the National Museum of Natural Sciences in the North American Pacific coastal region, 1966 to 1980. Syllogeus 34: 66 p.

Boutillier, J.A., J.A. Bond, and H. Nguyen. 1999. Evaluation of a new assessment and management framework for west coast shrimp stocks. Canadian Stock Assessment Secretariat Research Document 99/124: 28 p.

Boutillier, J.A., T.H. Butler, J. Bond, I. Winther, and A Phillips. 1998 a. Assessment of the Areas A crab (*Cancer magister*) fishery in British Columbia. Canadian Stock Assessment Secretariat Research Document 98/86: 52 p.

Boutillier, J.A., A. Campbell, R.Harbo and S. Neifer. 1998 b. Scientific advice for the management of the sea cucumber (*Parastichopus californicus*) fishery in British Columbia. Canadian Technical Report of Fisheries and Aquatic Sciences 2221: 309-340.

Boutillier, J.A., and M. Joyce. 1998. Assessing the inshore shrimp fisheries: data status, model requirements and problems. Canadian Technical Report of Fisheries and Aquatic Sciences 2221: 187-219.

Boutillier, J.A., and H. Nguyen. 1999. *Pandalus hypsinotus*, humpback shrimp: a review of the biology and a recommended assessment framework for a directed fishery. Canadian Stock Assessment Secretariat Research Document 99/067: 25 p.

Bower, S.M., S.E. McGladdery, and I.M. Price. 1994. Synopsis of infectious diseases and parasites of commercially exploited shellfish. Annual Review of Fish Diseases 4: 1-199.

Bowker, G.C. 2000. Mapping biodiversity. International Journal of Geographical Information Science 14: 739-754.

Bradbury, I.R., and P.V.R. Snelgrove. 2001. Contrasting larval transport in demersal fish and benthic invertebrates: the roles of behaviour and advective processes in determining spatial pattern. Canadian Journal of Fisheries and Aquatic Sciences 58: 811-823.

Breen, P.A., and B. E. Adkins. 1975. A survey of abalone populations on the east coast of the Queen Charlotte Islands, August 1978. Fisheries and Marine Service Manuscript Report 1490: 125 p.

Breen, P.A., T.A. Carson, J.B. Foster, and E.A. Stewart. 1982. Changes in subtidal community structure associated with British Columbia sea otter transplants. Marine Ecology Progress Series 7: 13-20.

Breeze, H., D.S. Davis, M. Butler, and V. Kostylev. 1997. Distribution and status of deep sea corals off Nova Scotia. Ecology Action Centre (Halifax, NS), Marine Issues Committee Special Publication 1: 58 p.

Briggs, J.C. 1974. Marine zoogeography. McGraw Hill, New York. 475 p.

Brinckmann-Voss, A., and M.N. Arai. 1998. Further notes on Leptolida (Hydrozoa: Cnidaria) from Canadian Pacific waters. Zoologische Verhandelinger (Leiden) 323: 37-68.

Brinckmann-Voss, A. 1974. British Columbia marine faunistic report on the Hydrozoa. Part I. Medusae. Candian Technical Report of Fisheries and Aquatic Sciences 492: 21 p.

Brinckmann-Voss, A. 1983. British Columbia marine faunistic report on the Hydrozoa Part II. Hydroids. Canadian Technical Report of Fisheries and Aquatic Sciences 1185: 20 p.

Brinkhurst, R.O. 1985. Museum collections and aquatic invertebrate environmental research. In: Museum collections: their role and future in biological research. E.H. Miller (ed.). British Columbia Provincial Museum Occasional Paper Series 25: 163-168.

Brosnan, D.M. 1993. The effects of human trampling on biodiversity of rocky shores: monitoring and management strategies. Recent Advances in Marine Science and Technology 92: 333-341.

Brosnan, D.M., and L.L.Crumrine. 1994. Effects of human trampling on marine rocky shore communities. Journal of Experimental Marine Biology and Ecology 177: 79-97.

Brothers, D.E. 1978. Marine environmental assessment of Tasu Sound, British Columbia, June, 1977. Fisheries and Environment Canada, Environmental Protection Service Regional Program Report 78-12: 33 p.

Brown, S.C. 1998. Native visions – evolution in northwest coast art from the eighteenth through twentieth century. Douglas and McIntyre, Vancouver, B.C. 216 p.

Bureau, D., N.W.Surry, C.M. Hand, G. Dovey, and W. Hajas. *in preparation*. Age, size structure and growth parameters of geoducks (*Panope abrupta,* Conrad 1849) from 34 locations in British Columbia sampled from 1993 to 2000. Canadian Technical Report of Fisheries and Aquatic Sciences.

Brunel, P., L. Bosse, and G. Lamarche. 1998. Catalogue of the marine invertebrates of the estuary and Gulf of Saint Lawrence. Canadian Special Publication of Fisheries and Aquatic Sciences 126: 405 p.

Burd, B.J., and R.O. Brinkhurst. 1987. Macrobenthic infauna from Hecate Strait, British Columbia. Canadian Technical Report of Hydrography and Ocean Sciences 88: 123 p.

Burd, B.J., and G.S. Jamieson. 1991. Survey of larval stages of commercial species in the area and time of the 1988 seismic survey in Queen Charlotte Sound and Hecate Strait. In: Evolution and Hydrocarbon Potential of the Queen Charlotte Basin, British Columbia. Geological Survey of Canada, Paper 90-10: 513-544.

Burrows, B. 2000. The living oceans society – perspective on marine protected areas. The Westcoast Fisherman 15(August): 21-23.

Butler, T.H. 1964. Records of shrimp (Order Decapoda) from British Columbia. Journal of the Fisheries Research Board of Canada 21: 419-421.

Butler, T.H. 1980. Shrimps of the Pacific coast of Canada. Canadian Bulletin of Fisheries and Aquatic Sciences 202: 280 p.

Byun, A.S., B. Koop, and T.E. Reimchen. 1999. Coastal refugia and postglacial recolonization routes: a reply to Demboski, Stone, and Cook. Evolution 53: 2013-2015.

Caley, M.J., M.H. Carr, M.A. Hixon, T.P. Hughes, G.P. Jones, and B.A. Menge. 1996. Recruitment and the local dynamics of open marine populations. Annual Reviews in Ecology and Systematics 27: 477-500.

Callicott, J.B. 1992. Principal traditions in American environmental ethics: a survey of moral values for framing an American ocean policy. Ocean and Coastal Management 17: 299-325. [he quotes Aldo Leopold (1939) The farmer as a conservationist. American Forests 45: 294-299, 316, 323, 495.]

Cameron, F.E. 1957. Some factors influencing the distribution of pelagic copepods in the Queen Charlotte Islands. Journal of the Fisheries Research Board of Canada 14: 165-202.

Campbell, A. 1996. An evaluation of abalone surveys off southern Queen Charlotte Islands. Canadian Technical Report of Fisheries and Aquatic Sciences 2098: 111-131.

Campbell, A. 1998. Catch, effort and quota estimates for the red sea urchin fishery in British Columbia. Canadian Technical Report of Fisheries and Aquatic Sciences 2215: 83-109.

Campbell, A. 2000. Review of northern abalone, *Haliotis kamtschatkana*, stock status in British Columbia. Canadian Special Publication of Fisheries and Aquatic Sciences 131: 41-50.

Campbell, A., W. Hajas, and D. Bureau. 1999. Quota options for the red sea urchin fishery in British Columbia for fishing season 2000/2001. Canadian Stock Assessment Secretariat Research Document 99/201: 67 p.

Campbell, A., and R.M. Harbo. 1991. The sea urchin fisheries in British Columbia, Canada. p. 191-199. In: Biology of echinodermata. N. Yanagisawa *et al.* (eds.). A.A. Balkema, Rotternam.

Campbell, A., R.M. Harbo, and C.M. Hand. 1998. Harvesting and distribution of Pacific geoduck clams, *Panope abrupta*, in British Columbia. Canadian Special Publication of Fisheries and Aquatic Sciences 125: 349-358.

Campbell, A., I. Manely, and W. Carolsfeld. 1992. Size at maturity and fecundity of the abalone, *Haliotis kamtschatkana* (Jonas), in northern British Columbia. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2169: 47-65.

Carefoot, T. 1977. Pacific seashores a guide to intertidal ecology. J.J. Douglas, Vancouver, B.C. 208 p.

Carl, G.C., and C.J. Guiguet. 1958. Alien animals in British Columbia. British Columbia Provincial Museum Handbook 14: 94 p.

Carr, M.H., and D.C. Reed. 1993. Conceptual issues relevant to marine harvest refuges: examples from temperate reef fish. Canadian Journal of Fisheries and Aquatic Sciences 50: 2019-2028.

Carlton, J.T. 1979. History, biogeography, and ecology of the introduced marine and estuarine invertebrates of the Pacific coast of North America. Ph.D. dissertation, University of California, Davis, CA. 903 p.

Carlton, J.T. 1992. Introduced marine and estuarine mollusks of North America: an end-of-century perspective. Journal of Shellfish Research 11: 489-505.

Castilla, J.C. 1999. Coastal marine communities: trends and perspectives from human-exclusion experiments. Trends in Ecology and Evolution 14: 280-283.

Castilla, J.C., and M. Fernandez. 1998. Small-scale benthic fisheries in Chile: on co-management and sustainable use of benthic invertebrates. Ecological Applications. 8(Supplement): S124-S132.

Cattrall, C.P., and I.R. Poiner. 1987. The potential impact of human gathering on shellfish populations, with reference to some NE Australian intertidal flats. Oikos 50: 114-122.

CFIA (Canadian Food Inspection Agency) 1999. Guidelines for the construction of a fish processing plant. CFIA, Western Area Programs, Fish, Seafood and Production Division, Vancouver, B.C. 17 p.

Chittenden, N. H. 1884. Official report of the exploration of the Queen Charlotte Islands. [reprinted - 1984 as: Exploration of the Queen Charlotte Islands. Gordon Soules Book Publishing, Ltd., Vancouver, B.C.]

Clark, T.W. 1993. Creating and using knowledge for species and ecosystem conservation: science, organisations and policy. Perspectives in Biology and Medicine 36: 497-525.

Clarke, A., and J.A. Crame. 1997. Diversity, latitude and time: patterns in the shallow sea. p. 122-147. In: Marine biodiversity patterns and processes. R.F.G. Ormond, J.D. Gage, and M.V Angel (eds.). Cambridge University Press, Cambridge, U.K.

Clemens, W.A. 1933. A check list of the marine fauna and flora of the Canadian Pacific coast. National Research Council of Canada, Ottawa. 88 p.

Coan, E.V. 1971. The northwest American Tellinidae. Veliger 14(supplement): 1-63.

Coan, E.V., P.V. Scott, and F.R. Bernard. 2000. Bivalve seashells of western North America - Marine Bivalve Mollusks from Arctic Alaska to Baja California. Santa Barbara Museum of Natural History Monographs 2: 764 p.

Coates, K.A. 1983. New records of marine *Marionina* (Oligochaeta, Enchytraeidae) from the Pacific Northwest, with a description of *Marionina klaskisharum* sp. nov. Canadian Journal of Zoology 61: 822-831.

Cole, D., and B. Lockner (eds.). 1989. The journals of George M. Dawson: British Columbia, 1875-1878. University of British Columbia Press, Vancouver, B.C. 2 Volumes, 611 p.

Conand, C., and N.A. Sloan. 1989. World fisheries for echinoderms. p. 647-663. In: Marine invertebrate fisheries: their assessment and management. J.F. Caddy (ed.). J.Wiley and Sons, New York.

Conway, K.W. 1999. Hexactinellid sponge reefs on the British Columbia continental shelf: geological and biological structure with a perspective on their role in the shelf ecosystem. Canadian Stock Assessment Secretariat Research Document 99/192: 21 p.

Conway, K.W., J.V. Barrie, W.C. Austin, and J.L. Luternauer. 1991. Holocene sponge bioherms on the western Canadian continental shelf. Continental Shelf Research 11: 771-790.

Conway, K.W., M. Krautter, J.V. Barrie, and M. Neuweiler. 2001. Hexactinellid sponge reefs on the Canadian continental shelf: a unique "living fossil." Geoscience Canada 28(2): 71-78.

Costello, M.J. 1998. To know, research, manage and conserve marine biodiversity. Océanis 24(4): 25-49.

Costello, M.J. 2000. Developing species information systems: the European Register of Marine Species (ERMS). Oceanography 13: 48-55.

CPAWS (Canadian Parks and Wilderness Society). 2000. Wildwaters - marine conservation in British Columbia, protecting the hidden realm. CPAWS, Vancouver, B.C. 28 p.

Crawford, W.R. 2000. Oceans of the Queen Charlotte Islands and Gwaii Haanas National Marine conservation Area Reserve. CD-ROM. Fisheries and Oceans Canada, Canadian Hydrographic Service, Institute of Ocean Sciences, Sidney, B.C.

Crawford, W.R., and G.S. Jamieson. 1996. Modeling advection of Dungeness crab (*Cancer magister*) in Dixon Entrance and northern Hecate Strait, British Columbia. In: High latitude crabs: biology, management and economics. Alaska Sea Grant College Program AK-SG-96-02: 498-506.

CRMSW (Coastal Research and Monitoring Strategy Workgroup). 2000. Clean water action plan: coastal research and monitoring strategy. U.S. EPA / NOAA / USDA / USGS 34 p. [http://www.cleanwater.gov]

Dall, W.H. 1897. Notice of some new or interesting species of shells from British Columbia, and the adjacent region. Papers and Communications of the Natural History Society of British Columbia, Victoria 2(1): 1-18.

Dall, W.H. 1921. Summary of the marine shellbearing mollusks of the Northwest coast of North America, from San Diego, California, to the Polar Sea, mostly contained in the collection of the of the U.S. National Museum with illustrations of hitherto unfigured species. Bulletin of the United States National Museum 112: 1-217.

Dall, W.H., and P. Bartsch. 1907. The pyramidellid mollusks of the Oregonian faunal area. Proceedings of the United States National Museum. 33(1574): 491-534.

Dalzell, K.E. 1968. The Queen Charlotte Islands. Volume 1. 1774-1966. Bill Ellis, Publisher, Queen Charlotte City, B.C. 340 p.

Dalzell, K.E. 1973. The Queen Charlotte Islands. Volume 2. Places and names. Bill Ellis Publisher, Queen Charlotte City, B.C. 472 p.

Dame, R.F. 1996. Ecology of marine bivalves: an ecosystem approach. CRC Press, Inc., Boca Raton, FL 310 p.

Davis, G.E. 1993. Design elements for monitoring programs: the necessary ingredients for success. Environmental Monitoring and Assessment 26: 99-105.

Davis, G.E. 1995. Recruitment of juvenile abalone (*Haliotis* spp.) measured in artificial habitats. Marine and Freshwater Research 46: 549-554.

Davis, G.E. 2000. Refigia-based strategies to restore and sustain abalone (*Haliotis* spp.) populations in Southern California. Canadian Special Publication of Fisheries and Aquatic Sciences 130: 133-138.

Davis, G.E., K.R. Faulkner, and W.L. Halvorson. 1994. Ecological monitoring in Channel Islands National Park, California. p. 465-482. In: The Fourth California Islands Symposium: update on the status of resources. W.L. Halvorson, and G.J. Maender (eds.). Santa Barbara Museum of Natural History, Santa Barbara, CA.

Davis, G.E., P.L. Haacker, and D.V. Richards. 1998. The perilous condition of the white abalone *Haliotis sorenseni*, Bartsch, 1940. Journal of Shellfish Research 17: 871-875.

Davis, G.E., D. Kushner, J. Mondragon, J. Morgan, D. Lerma, and D. Richards. 1997. Kelp forest monitoring handbook. Volume 1: Sampling protocol. Channel Islands National Park, U.S. National Park Service, Ventura, CA. 55 p.

Dawson, G.M. 1880. Report on the Queen Charlotte Islands 1878. Geological Survey of Canada, Ottawa and Dawson Brothers, Montreal. 239 p. [Appendix A. On the Haida Indians of the Queen Charlotte Islands. p. 103-175.]

Day, J.C., and J.C. Roff. 2000. Planning for representative marine protected areas – a framework for Canada's oceans. World Wildlife Fund Canada. Toronto, ON. 147 p.

Dayton, P.K. 1998. Reversal of the burden of proof in fisheries management. Science 279: 821-822.

Dayton, P.K., E. Sala, M.J. Tegner, and S. Thrush. 2000. Marine reserves: parks, baselines and fishery enhancement. Bulletin of Marine Science 66: 617-634.

Dayton, P.K., M.J. Tegner, P.B. Edwards, and K.L. Riser. 1998. Sliding baselines, ghosts, and reduced expectations in kelp forest communities. Ecological Applications 8: 309-322.

Denning, D. 1984. Life on the rocks. p. 73-94. In: Islands at the Edge - preserving the Queen Charlotte Islands wilderness. Islands Protection Society, Douglas and McIntyre, Vancouver. 160 p.

Dethier, M.N. 1997. Handbook of monitoring protocols for intertidal resources of Olympic National Park. Report prepared for U.S. National Park Service, Olympic National Park, WA by Friday Harbor Laboratories, Friday Harbor, WA. 21 p.

Dethier, M.N., D.O. Duggins, and T.F. Mumford. 1989. Harvesting of non-traditional marine resources in Washington State: trends and concerns. The Northwest Environmental Journal 5: 71-87.

Dietrich, J.R. 1995. Petroleum resource potential of the Queen Charlotte Basin and environs, west coast Canada. Bulletin of Canadian Petroleum Geology 43: 20-34.

Dietrich, J.R., G.R. Morrell, and M.C. Fortier. 1992. Petroleum resource potential in the proposed area of Gwaii Haanas/South Moresby National Marine Park, British Columbia. Geological Survey of Canada Open File: 17 p.

DFO (Fisheries and Oceans Canada) 2000 a. Marine environmental quality – together, towards healthy oceans. Fisheries and Oceans Canada, Marine Ecosystems Conservation Branch, Ottawa, ON. (Looseleaf)

DFO (Fisheries and Oceans Canada) 2000 b. Hexactinellid sponge reefs on the British Columbia continental shelf: geological and biological structure. DFO Pacific Region Habitat Status Report 2000/02: 4 p.

Dobbs, D. 2000. The great gulf – fishermen, scientists, and the struggle to revive the world's greatest fishery. Island Press, Washington, D.C. 206 p.

Donald, L. 1997. Aboriginal slavery on the Northwest coast of North America. University of California Press, Berkeley, CA. 379 p.

Druehl, L.D., and C.T.J. Elliott. 1996. Parks Canada Barkley Sound kelp distribution. Part 1 – Introduction and species distribution. / Part 2 – Parks Canada kelp distribution. / Part 3 – Description of the physical environment. Reports prepared for Parks Canada [contract No. K3489-3-0006] by Bamfield Marine Station, Bamfield, B.C.

Dugan, J.E., and G.E. Davis. 1993 a. Introduction to the international symposium on marine harvest refugia. Canadian Journal of Fisheries and Aquatic Sciences 50: 1991-1992.

Dugan, J.E., and G.E. Davis. 1993 b. Applications of marine refugia to coastal fisheries management. Canadian Journal of Fisheries and Aquatic Sciences 50: 2029-2042.

Dugan, J.E., D.M. Hubbard, and G.E. Davis. 1990. Sand beach and coastal lagoon monitoring handbook. Channel Islands National Park, U.S. National Park Service, Ventura, CA. 34 p.

Dye L.C. 1997. Data and information management at Channel Islands National Park. In: Making protection work. p. 397-400. Proceedings of the 9th Conference on Research and Resource Management in Parks and Public Lands. D. Harmon (ed.). The 1997 George Wright Society Biennial Conference, Hancock, MI.

Earle, S.A. 1995. Sea change a massage of the oceans. Fawcett Columbine, New York. 361 p.

EC (Environment Canada) 1997. New directions in delivery of water quality monitoring requirements in support of the Canadian Shellfish Sanitation Program discussion document. Marine Environment Division, Environment Protection Service, Environment Canada, Ottawa, ON. 18 p.

Edgar, G.J., and N.S. Barrett. 1997. Short term monitoring of biotic change in Tasmanian marine reserves. Journal of Experimental Marine Biology and Ecology 213: 261-279.

Edgar, G.J., and N.S. Barrett. 1999. Effects of the declaration of marine reserves on Tasmanian reef fishes, invertebrates and plants. Journal of Experimental Marine Biology and Ecology 242: 107-144.

Edie, A.G. 1973. Sea otter sighting at Cape St. James, British Columbia. Syesis 6: 265 only.

Ellis, D.V. 1969. Ecologically significant species in coastal marine sediments of southern British Columbia. Syesis 2: 171-182.

Ellis, D.W., and L. Swan. 1981. Teachings of the tides – uses of marine invertebrates by the Manhousat people. Theytus Books, Nanaimo, B.C. 118 p.

Ellis, D.W., and S. Wilson. 1981. The knowledge and usage of marine invertebrates by the Skidegate Haida people of the Queen Charlotte Islands. Queen Charlotte Islands Museum Monograph Series No. 1: 42 p. Queen Charlotte Islands Museum Society, Skidegate, B.C.

Engle, J.M., and G.E. Davis. 1996. Rocky intertidal monitoring handbook Cabrillo National Monument, Point Loma, San Diego, California. Cabrillo National Monument, U.S. National Park Service, San Diego, CA. 38 p.

Engstrand, I.H.W. 2000. Of fish and men: Spanish marine science during the late eighteenth century. Pacific Historical Review 69: 3-30.

Enrico, J. 1989. The Haida language. p. 223-247. In: The Outer Shores. G.G.E. Scudder, and N. Gessler (eds.). Queen Charlotte Islands Museum Press, Skidegate, B.C.

Estes, J.A., and D.O. Duggins. 1995. Sea otters and kelp forests in Alaska: generality and variation in - a community ecological paradigm. Ecological Monographs 65: 75-100.

Fairweather, P.G. 1991. Implications of "supply side" ecology for environmental assessment and management. Trends in Ecology and Evolution 6: 60-63.

Fedje, D.W., and T. Christensen. 1999. Modeling paleoshorelines and locating early Holocene coastal sites in Haida Gwaii. American Antiquity 64: 635-652.

Fedje, D.W., and H. Josenhans. 2000. Drowned forests and archaeology on the continental shelf of British Columbia, Canada. Geology 28: 99-102.

Fedje, D.W., and R. Mathewes (eds.). *in preparation.* Haida Gwaii, prehistory and post-glacial environments. University of British Columbia Press, Vancouver, B.C.

Fedje, D.W., I.D. Sumpter, and J. Morton. 2001 a. Gwaii Haanas archaeological resource description and analysis. Report prepared for Gwaii Haanas National Park Reserve, Queen Charlotte, B.C. by Parks Canada: Cultural Resource Services, Western Canada Service Centre, Calgary, AB. 128 p.

Fedje, D.W., R.J. Wigen, Q. Mackie, C.R. Lake, and I.D. Sumpter. 2001 b. Preliminary results from investigations at Kilgii Gwaay: an early Holocene archaeological site on Ellen Island, Haida Gwaii, British Columbia. Canadian Journal of Archaeology 25 (*in press*).

Fitzhugh, W.W., and A. Crowell. (1988). Crossroads of continents – cultures of Siberia and Alaska. Smithsonian Institution Press, Washington, D.C. 360 p.

Fladmark, K.R. 1975. A paleoecological model for Northwest coast prehistory. Archaeological Survey of Canada Mercury Series Paper 43: 319 p.

Fladmark, K.R. 1989. The native culture history of the Queen Charlotte Islands. p.199-221. In: The Outer Shores. G.G.E. Scudder, and N. Gessler (eds.). Queen Charlotte Islands Museum Press, Skidegate, B.C.

Foster, J.B. 1989. Conservation on the Queen Charlotte Islands. p. 281-301. In: The Outer Shores. G.G.E. Scudder, and N. Gessler (eds.). Queen Charlotte Islands Museum Press, Skidegate, B.C.

Foster, M.S., and D.R. Schiel. 1985. The ecology of giant kelp forests in California: a community profile. U.S. Fish and Wildlife Service Biological Report 85(7.2): 152 p.

Fraser, C.M. 1911. The hydroids of the west coast of North America with special reference to those of the Vancouver Island region. Bulletin of the Laboratory of Natural History, State University of Iowa, New Series 28, 6(1): 1-91.

Fraser, C.M. 1930. The razor clam, *Siliqua patula* (Dixon), of Graham Island, Queen Charlotte group. Transactions of the Royal Society of Canada 24(Section V): 141-154.

Fraser, C.M. 1936 a. Hydroids from the Queen Charlotte Islands. Journal of the Biological Board of Canada 1: 503-507.

Fraser, C.M. 1936 b. Hydroid distribution in the vicinity of the Queen Charlotte Islands. The Canadian Field-Naturalist 50: 122-126.

Fraser, C.M. 1938. The relation of the marine fauna to the physiography of the west coast of the Queen Charlotte Islands. Canadian Field-Naturalist 52: 88-93.

Fraser, C. M. 1942 a. Marine zoology in the north-east Pacific. Transactions of the Royal Society of Canada. 36(5): 1-18.

Fraser, C. M. 1942 b. The collecting of marine zoological material in British Columbia waters. Canadian Field-Naturalist 56: 115-120.

Gaines, S.D., and M.D. Bertness. 1992. Dispersal of juveniles and variable recruitment in sessile marine species. Nature 360: 579-580.

Gajda, A. 1999. Gwaii Haanas backcountry management plan. Report prepared for Archipelago Management Board, Gwaii Haanas National Park Reserve, Queen Charlotte, B.C. 42 p.

Garcia, S.M. 1996. The precautionary approach to fisheries and its implications for fisheries research, technology and management: an updated review. FAO (Food and Agricultural Organization of the United Nations) Fisheries Technical Paper 350/2: 75 p.

Gardner, G.A. 1982 a. Biological and hydrological evidence for Pacific equatorial water on the continental shelf north of Vancouver Island, British Columbia. Canadian Journal of Fisheries and Aquatic Sciences 39: 660-667.

Gardner, G.A. 1982 b. Patterns in the distribution and abundance of selected zooplankton species from the coast of British Columbia. Biological Oceanography 1: 255-270.

Gardner, G.A., and I. Szabo. 1982. British Columbia pelagic marine copepoda: an identification manual and annotated bibliography. Canadian Special Publication of Fisheries and Aquatic Sciences 62: 536 p.

Gauthier, D., and D.A. Steel. 1998. A synopsis of the Canadian situation regarding ship-transported ballast water. ICES (International Council for the Exploration of the Sea) Cooperative Research Report 224: 91-101.

Gessler, N., and T. Gessler. *no date, but in the 1970s*. A European history of Kiusta as compiled from the early chronicles. The Charlottes: A Journal of the Queen Charlotte Islands 3: 17-32. Queen Charlotte Islands Museum Society, Skidegate, B.C.

Ghelardi, R.J., and C.T. Shoop. 1972. Lobster (*Homarus americanus*) production in British Columbia. Fisheries Research Board of Canada Manuscript Report 1176: 31 p.

Gibbs, J.P., S. Droege, and P. Eagle. 1998. Monitoring populations of plants and animals. BioScience 48: 935-940.

Gibson, J.R. 1992. Otter skins, Boston ships, and China goods - The maritime fur trade of the Northwest coast *1785-1841*. McGill-Queen's University Press, Montreal, PQ. and Kingston, ON. 422 p.

Gillespie, G.E. 1997. Review of biology, fisheries and assessment of oceanic squids, particularly *Ommastrephes bartrami*, *Onychoteuthis borealijaponica*, *Gonatopsis borealis* and *Berryteuthis magister*. Canadian Stock Assessment Secretariat Research Document 97/143: 36 p.

Gillespie, G.E., and N.F. Bourne. 1998. Exploratory intertidal clam surveys in British Columbia – 1997. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2465: 43 p.

Gillespie, G.E., G. Parker, and J. Morrison. 1998. Fisheries biology of the giant Pacific octopus (*Octopus dofleini*) (Wulker, 1910), with a discussion of octopus fisheries in British Columbia. Canadian Stock Assessment Secretariat Research Document 98/87: 41 p.

Glavin, T. 2000. The last great sea – a voyage through the human and natural history of the North Pacific Ocean. Douglas and McIntyre, Vancouver, B.C. 244 p.

Golumbia, T. 2001. Classification of plant communities in Gwaii Haanas National Park Reserve and Haida Heritage site. M.Sc. thesis, Department of Forest Sciences, University of British Columbia, Vancouver, B.C. 173 p.

Goodwin, C.L., and B.C. Pease. 1991. Geoduck, *Panope abrupta* (Conrad, 1849), size, density, and quality as related to various environmental parameters in Puget Sound, Washington. Journal of Shellfish Research 10: 65-77.

Gough, B. 1971. The Royal navy and the northwest coast of North America 1810-1914. University of British Columbia Press, Vancouver, B.C. 294 p.

Gough, B. 1989. The Haida-European encounter, 1774-1900: the Queen Charlotte Islands in transition. p. 249-260. In: The Outer Shores. G.G.E. Scudder, and N. Gessler (eds.). Queen Charlotte Islands Museum Press, Skidegate, B.C.

Grassle, J.F., P. Lasserre, A.D. McIntyre, and G.C. Ray. 1991. Marine biodiversity and ecosystem function – a proposal for an international programme of research. Biology International Special Issue No. 23: 1-19.

Grassle, J.F., and N.J. Maciolek. 1992. Deep-sea species richness: regional and local diversity estimates from quantitative bottom samples. American Naturalist 139: 313-341.

Green, R.H., and K. Klinka. 1994. A field guide to site identification and interpretation for the Vancouver Forest Region. British Columbia Ministry of Forests Research Branch, Victoria, B.C. 285 p.

Greenwood, B., and R.D.G. Davidson-Arnott. 1977. An interpretation study of coastal processes. Report prepared for Kouchibouguac National Park, NB. 398 p.

Grosholz, E.D. 2000. The impacts of a nonindigenous marine predator in a California bay. Ecology 81: 1206-1224.

Guenette, S., T. Lauck, and C. Clark. 1998. Marine reserves: from Beverton and Holt to the present. Reviews in Fish Biology and Fisheries 8: 251-272.

Ham, L.C. 1990. The Cohoe Creek site: a late Moresby Tradition shell midden. Canadian Journal of Archaeology 14: 199-221.

Hand, C.M., and D. Bureau. 2000. Quota options for the geoduck clam (*Panope abrupta*) fishery in British Columbia for 2001 and 2002. Canadian Stock Assessment Secretariat Research Document 00/163: 52 p.

Hand, C.M., and J. Rogers. 1999. Sea cucumber phase 1 progress report. Canadian Stock Assessment Secretariat Research Document 99/141: 32 p.

Hankin, D.G., T.H. Butler, P.W. Wild, and Q. Xue. 1997. Does intense fishing on males impair mating success of female Dungeness crabs? Canadian Journal of Fisheries and Aquatic Sciences 54: 655-669.

Harbo, R. 1997. Abalone dive fishery (closed). In: Pacific commercial fishery updates for invertebrate resources (1994). Canadian Manuscript Report of Fisheries and Aquatic Sciences 2369: 86-92.

Harbo, R. 1998. New directions in invertebrate fisheries management in British Columbia, Canada. In: Proceedings of the North Pacific Symposium on Invertebrate Stock Assessment and Management. G.S. Jamieson, and A. Campbell (eds.). Canadian Special Publication of Fisheries and Aquatic Sciences 125: 429-437.

Harris, M. 1999. Lament for an ocean - the collapse of the Atlantic cod fishery: a true crime story. McClelland and Stewart, Toronto. 389 p. (updated paperback edition).

Harper, J.R. 1980. Coastal processes on Graham Island, Queen Charlotte Islands, British Columbia. Current Research, Part A, Geological Survey of Canada Paper 80-1A: 13-18.

Harper, J.R., W.C. Austin, M. Morris, P.D. Reimer, and R. Reitmeier. 1994. Ecological Classification of Gwaii Haanas - Biophysical Inventory of Coastal Resources. Report prepared for Parks Canada, Calgary, AB by Coastal & Ocean Resources Ltd., Sidney, B.C. 115 p.

Harrold, C., S. Lisin, K.H. Light, and S. Tudor. 1991. Isolating settlement from recruitment of sea urchins. Journal of Experimental Marine Biology and Ecology 147: 81-94.

Hart, J.F.L. 1940. Reptant decapod crustacea of the west coast of Vancouver and Queen Charlotte Islands, British Columbia. Canadian Journal of Research 18(D): 86-105.

Hart, J.F.L. 1953. Northern extension of range of some reptant decapod Crustacea of British Columbia. Canadian Field-Naturalist 67: 139-140.

Hartwick, B. 1983. *Octopus dofleini*. In: Cephalopod life cycles. Volume I: 277-291. Academic Press, London.

Hastings, A., and L.W. Botsford. 1999. Equivalence in yield from marine reserves and traditional fisheries management. Science 284: 1537-1538.

Hawkes, M.W. 1994. Conserving marine ecosystems: are British Columbia's marine protected areas adequate? p. 393-410. In: Biodiversity in British Columbia: our changing environment. L.E. Harding and E. McCullum (eds.). Environment Canada, Ottawa, ON.

Hawkes, M.W., C.E. Tanner, and P.A. Lebednik. 1978. The benthic marine algae of northern British Columbia. Syesis 11: 81-115.

Hawkes, S. 1996. The Gwaii Haanas agreement: from conflict to cooperation. Environments 23: 87-93.

Hawkins, J.P., and C.M. Roberts. 1993. Effects of recreational scuba diving on coral reefs: trampling on reef-flat communities. Journal of Applied Ecology 30: 25-30.

Hebda, R., and S.G. Frederick. 1990. History of marine resources of the Northeast Pacific since the last glaciation. Transactions of the Royal Society of Canada, Series I 1: 319-342.

Hedgpeth, J.W. (ed.). 1978. The outer shores. Part 1. Ed Ricketts and John Steinbeck explore the Pacific coast. Mad River Press, Eureka, CA. 128 p.

Hedgpeth, J.W., R.J. Menzies, C.H. Hand, and M.D. Burkenroad. 1953. On certain problems of taxonomists. Science 117: 17-18.

Helvarg, D. 2001. Blue frontier saving America's seas. W.H. Freeman and Co., New York. 299 p.

Heron, G.A., and D.M. Damkaer. 1969. Five species of deep-water cyclopoid copepods from the plankton of the Gulf of Alaska. Smithsonian Contributions to Zoology 20: 24 p.

Heusser, C.J. 1989. North Pacific coastal refugia – the Queen Charlotte Islands in perspective. p. 91-106. In: The Outer Shores. G.G.E. Scudder, and N. Gessler (eds.). Queen Charlotte Islands Museum Press, Skidegate, B.C.

Hilborn, R., J-J. Macguire, A.M. Parma, and A.A. Rosenberg. 2001. The Precautionary Approach and risk management: can they increase the probability of successes in fishery management? Canadian Journal of Fisheries and Aquatic Sciences 58: 99-107.

Hincks, T. 1884. Report on the Polyzoa of the Queen Charlotte Islands. Geological and Natural History Survey of Canada. MacLean, Roger and Co., Ottawa, 44 p. [reprinted from papers published in the Annals and Magazine of Natural History Vol. 5, London – 1882, 1883, 1884]

Hiscock, K. 1987. Subtidal rock and shallow sediments using diving. p. 198-237. In: Biological surveys of estuaries and coasts. J.M. Baker, and W.J. Wolff (eds.). Cambridge University Press, Cambridge, UK.

Hixon, M.A., P.D. Boersma, M.L. Hunter, F. Micheli, E.A. Norse, H.P. Possingham, and P.V.R. Snelgrove. 2001. Oceans at risk - research priorities in marine conservation biology. p. 125-154. In: Conservation biology research priorities for the next decade. M.E. Soulé, and G.H. Orians (eds.). Island Press, Washington, D.C.

Hobson, K.D., and K. Banse. 1981. Sedentariate and archiannelid polychaetes of British Columbia and Washington. Canadian Bulletin of Fisheries and Aquatic Sciences 209: 35 p.

Holmes, H. 1999. Alternative methods for shoreline monitoring in Pacific Rim National Park Reserve. Research Links (Parks Canada) 7(2): 8 only.

Holmquist, C. 1979. *Mysis costata* Holmes, 1900, and its relations (Crustacea, Mysidacea). Zoologisch Jahrbucher Abteilung fur Systamatik, Okologie und Geographic der Tiere 106: 471-499.

Howes, D.E., M. Morris, and M. Zacharias. 1999. British Columbia estuary mapping system. Report prepared for Resources Inventory Committee by the Land Use Coordination Office, Victoria, B.C. 61 p.

Howorth, P.C. 1978. The abalone book. Naturegraph Publishers, Happy Camp, CA. 80 p.

Hunt, H.L., and R.E. Scheibling. 1997. Role of early post-settlement mortality in recruitment on benthic marine invertebrates. Marine Ecology Progress Series. 155: 269-301.

Huntsman, A.G. 1912. Holosomatous ascidians from the coast of western Canada. Contributions to Canadian Biology 1906-1910: 103-185.

IC (Industry Canada). 2000. Forging ahead: a report on science and technology – 1999. Industry Canada, Ottawa. 69 p. [http://strategis.gc.ca/S-Tinfo]

Irvine, G.V. 1998. Development of coastal monitoring protocols and process-based studies to address landscape-scale variation in coastal communities of Glacier Bay National Park and Preserve, Katmai National Park and Preserve, and Wrangell-St. Elias National Park and

Preserve. Phase II: Development and testing of monitoring protocols for selected intertidal habitats and assemblages. Annual Report NRPP Project. U.S. Geological Survey, Biological Resources Division, Alaska Biological Science Center, Anchorage, AK. 62 p.

Ivanov, A.V. 1962. New pogonophores from the eastern part of the Pacific Ocean. II. *Heptabrachia ctenophora* sp. n. and *H. canadensis* sp. n. Zoologicheskii Zhurnal 41: 893-900. (in Russian with English summary)

Jacksom, J.B.C., M.X. Kirby, W.H. Berger, K.A. Bjorndal, L.W. Botsford, B.J. Bourque, R.W. Bradbury, R. Cooke, J. Erlandson, J.A. Estes, T.P. Hughes, S. Kidwell, C.B. Lange, H.S. Lenihan, J.M. Pandolfi, C.H. Peterson, R.S. Steneck, M.J. Tegner, and R.W. Warner. 2001. Historical overfishing and the recent collapse of coastal ecosystems. Science 293: 629-638.

James, M.K., I.J. Dight, and J.C. Day. 1990. Application of larval dispersal models to zoning of the Great Barrier Reef Marine Park. Proceedings of the PACON Meeting, Tokyo, July 1990. p. 140-145.

Jamieson, G.S. 1999. Review of status of northern, or pinto, abalone, *Haliotis kamtschatkana*, in Canada. Canadian Stock Assessment Secretariat Research Document 99/190: 22 p.

Jamieson, G.S. 2000. Marine protected areas and their relevance to abalone conservation in British Columbia. Canadian Special Publication of Fisheries and Aquatic Sciences 131: 139-147.

Jamieson, G.S., and A. Campbell. 1995. Red sea urchins and kelp in northern British Columbia. p. 537-547. In: Ecology of fjords and coastal waters. H.R. Skjoldal, C. Hopkins, K.E. Erikstad, and H.P. Lrinaas (eds.). Elsevier Science, Amsterdam.

Jamieson, G.S., R. Lauzier, and G. Gillespie. 1999. Phase 1 framework for undertaking an ecological assessment of the outer rocky intertidal zone. Canadian Stock Assessment Secretariat Research Document 99/209: 33 p.

Jamieson, G.S., and J. Lessard. 2000. Marine protected areas and fishery closures in British Columbia. Canadian Special Publication of Fisheries and Aquatic Sciences 131: 414 p.

Jamieson, G.S., and C.D. Levings. 1998. Marine protected areas: connectivity considerations. p. 151-160. In: Linking protected areas with working landscapes conserving biodiversity. N.W.P. Munro and J.H.M. Willison (eds.). Wolfville, NS: Science and Management of Protected Areas Association.

Jamieson, G.S., and C.D. Levings. 2001. Marine protected areas in Canada – implications for both conservation and fisheries management. Canadian Journal of Fisheries and Aquatic Sciences 58: 138-156.

Jamieson, G.S., C.D. Levings, B.C. Mason, and B.D. Smiley. 1999. The shorekeepers' guide for monitoring intertidal habitats of Canada's Pacific waters. Fisheries and Oceans Canada, Pacific Region, Vancouver, B.C. 3 Modules (Looseleaf).

Jamieson, G.S., and N.A. Sloan. 1985. King crabs in British Columbia. Proceedings of the International King Crab Symposium. Alaska Sea Grant Report 85-12: 49-68.

Jarrett, N., and E.L. Bousfield. 1994. The amphipod superfamily Phoxocephaloidea on the Pacific coast of North America. Family Phoxocephalidae. Part I. Metharpiniinae, new subfamily. Amphipacifica 1(1): 58-140.

Jeffrey, C. 1973. Biological nomenclature. Edward Arnold, London. 69 p.

Jenkins, B.W., and I. Britt. 1972. Seaweed inventory of two Queen Charlotte inlets. Unpublished report - Department of Environment, Fisheries Service, Vancouver, BC. 44 p.

Jentoft, S. 1998. Social science in fisheries management: a risk assessment. p. 177-184. In: Reinventing fisheries management. T.J. Pitcher, P.J.B. Hart, and D. Pauly (eds.). Kluwer Academic Publishers, London, UK.

Johnstone, K. 1977. The aquatic explorers: a history of the Fisheries Research Board of Canada. University of Toronto Press, Toronto, ON. 342 p.

Jonaitis, A. 1988. From the land of the totem poles. – the northwest coast indian collection of the American Museum of Natural History. Douglas and McIntyre, Vancouver, B.C. 269 p.

Jonaitis, A. (ed.) 1991. Chiefly feasts – the enduring Kwakiutl potlatch. Douglas and McIntyre, Vancouver, B.C. 300 p.

Jones, P.J.S. 1994. A review and analysis of the objectives of marine nature reserves. Ocean and Coastal Management 24: 149-179.

Jones, R.R., and D.A. Garza. 1998. Co-management of the razor clam fishery (*Siliqua patula*) at Haida Gwaii, British Columbia, Canada. In: Proceedings of the North Pacific Symposium on Invertebrate Stock Assessment and Management G.S. Jamieson, and A. Campbel (eds.). Canadian Special Publication of Fisheries and Aquatic Sciences 125: 385-391.

Jones, R.R., and W. Lefeaux-Valentine. 1991. Gwaii Haanas South Moresby National Park Reserve review of invertebrate fishery resources. Report prepared for Gwaii Haanas National Park Reserve, Queen Charlotte, B.C. 186 p.

Jones, R.R., C. Schwartz, and L. Lee. 1998. Intertidal population estimate of razor clams (*Siliqua patula*) at beaches near Masset, Haida Gwaii/Queen Charlotte Islands. In: Proceedings of the North Pacific Symposium on Invertebrate Stock Assessment and Management G.S. Jamieson, and A. Campbel (eds.). Canadian Special Publication of Fisheries and Aquatic Sciences 125: 199-211.

Josenhans, H.W., D.W. Fedje, K.W. Conway, and J.V. Barrie. 1995. Post glacial sea levels on the western Canadian continental shelf: evidence of rapid change, extensive subaerial exposure, and early human habitation. Marine Geology 125: 73-94.

Josenhans, H., D. Fedje, R. Pienitz, and J. Southon. 1997. Early humans and rapidly changing Holocene sea levels in the Queen Charlotte Islands – Hecate Strait, British Columbia, Canada. Science 277: 71-74.

Kavanaugh, D.H. 1992. Carabid beetles (Insecta: Coleoptera: Carabidae) of the Queen Charlotte Islands, British Columbia. Memoirs of the California Academy of Sciences 16: 113 p.

Kavanaugh, D.H. 1989. The ground-beetle (Coleoptera: Carabidae) fauna of the Queen Charlotte Islands: its composition, affinities, and origins. p. 131-146. In: The Outer Shores. G.G.E. Scudder, and N. Gessler (eds.). Queen Charlotte Islands Museum Press, Skidegate, B.C.

Kavanaugh, D.H. 1984. Studies on Nebriini (Coleoptera: Carabidae). V. new nearctic nebria taxa and changes in nomenclature. Proceedings of the California Academy of Sciences 43(12): 159-177.

Keen, J.H. 1895. List of Coleoptera collected at Masset, Queen Charlotte Islands, B.C. The Canadian Entomologist 27(7): 165-172, 217-220.

Keen, S. 1990. Shellfish faunal analyses from sixteen archaeological sites in the southern Queen Charlotte Islands. Report prepared for British Columbia Heritage Trust, Victoria, B.C. 119 p.

Keesing, J.K., and J.L. Baker. 1998. The benefits of catch and effort data to a fine spatial scale in the South Australian abalone (*Haliotis laevigata* and *H. rubra*) fishery. In: Proceedings of the North Pacific Symposium on Invertebrate Stock Assessment and Management. G.S. Jamieson, and A. Campbell (eds.). Canadian Special Publication of Fisheries and Aquatic Sciences 125: 179-186.

Kelly, S., D. Scott, A.B. MacDiarmid, and R.C. Babcock. 2000. Spiny lobster, *Jasus edwardsii*, recovery in New Zealand reserves. Biological Conservation 92: 359-369.

Keough, M.J., and G.P. Quinn. 1991. Causality and the choice of measurements for detecting human impacts in marine environments. Australian Journal of Marine and Freshwater Research 42: 539-554.

Keough, M.J., and G.P. Quinn. 1998. Effects of periodic disturbance from trampling on rocky intertidal algal beds. Ecological Applications 8: 141-161.

Kingsford, M.J., and C. Battershill. (eds.). 1998. Studying temperate marine environments – a handbook for ecologists. Canterbury University Press, Christchurch, NZ. 335 p.

Kingsford, M.J., A.J. Underwood, and S.J. Kennelly. 1991. Humans as predators on rocky reefs in New South Wales, Australia. Marine Ecology Progress Series 72: 1-14.

Kirkendale, L., and P. Lambert. 1995. *Cucumaria pallida*, a new species of sea cucumber from the northeast Pacific Ocean (Echinodermata, Holothuroidea). Canadian Journal of Zoology 73: 542-551.

Kozloff, E.N. 1996. Marine invertebrates of the Pacific Northwest (with additions and corrections). University of Washingtom Press, Seattle, WA. 539 p.

Kramer, K.J.M. (ed.). 1994. Biomonitoring of coastal waters and estuaries. CRC Press, Inc., Boca Raton, FL. 340 p.

Krautter, M., K.W. Conway, J.V. Barrie, and M. Neuweiler. 2001. Discovery of a "living dinosaur": globally unique modern hexactinellid sponge reefs off British Columbia, Canada. Facies 44: 265-282.

Kyle, R., W.D. Robertson, and S.L. Birnie. 1997. Subsistence shellfish harvesting in the Maputaland Marine Reserve in Northern Kwazulu-Natal, South Africa: sandy beach organisms. Biological Conservation 82: 173-182.

Lambe, L.M. 1893. On some sponges from the Pacific coast of Canada and Behring Sea. Transactions of the Royal Society of Canada Section IV(1892): 67-78.

Lambe, L.M. 1894. III. Sponges from the Pacific coast of Canada. Transactions of the Royal Society of Canada Section IV(1893): 25-43.

Lambert, P. 1978. British Columbia marine faunistic survey report: asteroids from the northeast Pacific. Fisheries and Marine Service Technical Report 773: 23 p.

Lambert, P. 1984. British Columbia marine faunistic survey report: holothuroids from the northeast Pacific. Canadian Technical Report of Fisheries and Aquatic Sciences 1234: 30 p.

Lambert, P. 1986. Northeast Pacific holothurians of the genus *Parastichopus* with a description of a new species *Parastichopus leukothele* (Echinodermata). Canadian Journal of Zoology 64: 2266-2272.

Lambert, P. 1994. Biodiversity of marine invertebrates in British Columbia. p. 57-69. In: Biodiversity in British Columbia: our changing environment. L.E. Harding, and E. McCullum (eds.). Environment Canada, Ottawa, ON.

Lambert, P. 1997. Sea cucumbers of British Columbia, Southeast Alaska and Puget Sound. Royal British Columbia Museum Handbook. University of British Columbia Press, Vancouver, B.C. 165 p.

Lambert, P. 2000. Sea stars of British Columbia, Southeast Alaska and Puget Sound. Royal British Columbia Museum Handbook. University of British Columbia Press, Vancouver, B.C. 186 p.

Lankester, E.R. 1885. *Golfingia MacIntoshii*, a new sipunculid from the coast of Scotland. Transactions of the Linnean Society of London (Zoology) (Series 2) 2: 469-474.

Lasiak, T. 1998. Multivariate comparisons of rocky infratidal macrofaunal assemblages from replicate exploited and non-exploited localities on the Transkei coast of South Africa. Marine Ecology Progress Series 167: 15-23.

Laubitz, D.R. 1970. Studies on the Caprellidae (Crustacea, Amphipoda) of the American north Pacific. National Museums of Canada, Publications in Biological Oceanography 1: 89 p.

Lauck, T., C.W. Clark, M. Mangel, and G.R. Munro. 1998. Implementing the precautionary principle in fisheries management through marine reserves. Ecological Applications 8(Supplement): S72-S78.

Lauzier, R.B. 1999 a. A review of the biology of the goose neck barnacle (*Pollicipes polymerus* Sowerby, 1833). Canadian Stock Assessment Secretariat Research Document 99/111: 30 p.

Lauzier, R.B. 1999 b. Framework for goose barnacle (*Pollicipes polymerus* Sowerby, 1833) fishery in waters off the westcoast of Canada. Canadian Stock Assessment Secretariat Research Document 99/198: 27 p.

Lauzier, R.B., C.M. Hand, A. Campbell, and S. Heizer. 1998. A review of the biology and fisheries of horse clams (*Tresus capax* and *Tresus nuttallii*). Canadian Stock Assessment Secretariat Research Document 98/88: 43 p.

Lee, J.C., and N. Bourne. 1973. Marine bibliographical and review study of Pacific Rim National Park. Fisheries Research Board of Canada Manuscript Report 1276: 121 p.

Lee, J.C., and N. Bourne. 1976. Marine resource inventory of Pacific Rim National Park. Fisheries Research Board of Canada Manuscript Report 1389: 236 p.

Lee, J.C., and N. Bourne. 1977. Marine resource inventory of Pacific Rim National Park - 1976. Fisheries and Marine Service Manuscript Report 1436: 375 p.

Lee, J.C., and N. Bourne. 1978. Marine resource inventory of Pacific Rim National Park - 1977. Fisheries and Marine Service Manuscript Report 1467: 198 p.

Lee, J.C., and N. Bourne. 1979. Marine biophysical inventory of Pacific Rim National Park - 1978. Fisheries and Marine Service Manuscript Report 1514: 194 p.

Lee, J.C., B.L. Yoshida, and N. Bourne. 1982. Ecological (biophysical) coastal classification of Pacific Rim National Park. Report on File at Pacific Biological Station Library (DFO), Nanaimo, B.C. 211 p.

Levings, C.D. 1999. Review of current practises to reduce the risk of introducing non-indigenous species into Pacific region via ballast water. Canadian Stock Assessment Secretariat Research Document 99/211: 13 p.

Levings, C.D., R.E. Foreman, and V.J. Tunnicliffe. 1983. Review of the benthos of the Strait of Georgia and contiguous fjords. Canadian Journal of Fisheries and Aquatic Sciences 40: 1120-1141.

Levings, C.D., and G.S. Jamieson. 1999. Evaluation of ecological criteria for selecting MPAs in Pacific Region: a proposed semi-quantitative approach. Canadian Stock Assessment Secretariat Research Document 99/210: 30 p.

Levings, C.D., J.D. Pringle, and F. Aitkens (eds.). 1998. Approaches to marine ecosystem delineation in the Strait of Georgia: proceedings of a D.F.O. workshop, Sidney, B.C., 4-5 November 1997. Canadian Technical Report of Fisheries and Aquatic Sciences 2247: 165 p.

Lewis, J.R., and D.B. Quayle. 1972. Some aspects of the littoral ecology of British Columbia. Fisheries Research Board of Canada Manuscript Report 1213: 23 p.

Liddle, M.J. 1991. Recreation ecology: effects of trampling on plants and corals. Trends in Ecology and Evolution 6: 13-17.

Lindberg, D.R. 1992. Evolution, distribution and systematics of Haliotidae. p. 3-18. In: Abalone of the world biology, fisheries and culture. S.A. Shepherd, M.J. Tegner, and S.A. Guzman del Proo (eds.). Fishing News Books, Oxford, UK.

Lowey, L.F., and J.S. Pearse. 1973. Abalones and sea urchins in an area inhabited by sea otters. Marine Biology 23: 213-219.

LUCO (Land Use Coordination Office) 2001. British Columbia Marine Ecological Classification update final report. Report prepared for the British Columbia Land Use Coordination Office, Victoria, B.C. by AXYS Environmental Consulting Ltd., Sidney, B.C. [report on file at LUCO – now renamed, *Client Services Branch, Business Information Services Division, British Columbia Ministry of Sustainable Resource Management*]

Ludwig, D., R. Hilborn, and C. Walters. 1993. Uncertainty, resource exploitation and conservation: lessons from history. Science 260: 17 and 36.

Lungalv, T. 1986. Detection of long-term trends in rocky sublittoral communities: representativeness of fixed sites. p. 329-345. In: Ecology of rocky coasts. P. Moore, and R. Seed (eds.). Columbia University Press, New York.

MacDonald, G.F. 1994 (paperback reprint). Haida monumental art – villages of the Queen Charlotte Islands. University of British Columbia Press, Vancouver, BC. 218 p.

Macdonald, R.W., and T.F. Pedersen. 1991. Geochemistry of sediments of the western Canadian continental shelf. Continental Shelf Research 11: 717-735.

MacLaren Plansearch. 1987. Queen Charlotte Islands coastal zone mapping – digital mapping and linked data base system, final report. Report prepared for Environmental Studies Revolving Fund, Canada Oil and Gas Lands Administration by MacLaren Plansearch Corp./ Lavalin. 87 p.

Malakoff, D. 2000. Grants kick off ambitious count of all ocean life. Science 288: 1575-1576.

Mandryk, C.A.S., H. Josenhans, D.W. Fedje, and R.W. Mathewes. 2001. Late quaternary paleoenvironments of Northwestern North America: implications for inland versus coastal migration routes. Quaternary Science Reviews 20: 301-314.

Marliave, J.B., and M. Roth. 1995. *Agarum* kelp beds as nursery habitat of spot prawns, *Pandalus platyceros* Brandt, 1851 (Decapoda, Caridea). Crustaceana 68: 27-37.

Martin, J. 1994 (reprinted). Red tides. Underwater World series, Fisheries and Oceans Canada, Ottawa, ON. 11 p.

Martin, M., and B.J. Richardson. 1991. Long term contaminant biomonitoring: views from southern and northern hemisphere perspectives. Marine Pollution Bulletin 22: 533-537.

Mauro, F., and P.D. Hardison. 2000. Traditional knowledge of indigenous and local communities: international debate and policy initiatives. Ecological Applications 10: 1263-1269.

May, R.M. 1992. Bottoms up for the oceans. Nature 357: 278-279.

Mayer, E. 1969. Principles of systematic zoology. McGraw-Hill, New York. 428 p.

Mayfield, S., and G.M. Branch. 2000. Interrelations among rock lobsters, sea urchins, and juvenile abalone: implications for community management. Canadian Journal of Fisheries and Aquatic Sciences 57: 2175-2185.

McCrone, A. 2001. Visitor impacts on marine protected areas in New Zealand. Science for Conservation 173: 68 p. (Department of Conservation, New Zealand)

McDonald, T.E. 2001. A preliminary list of parasites of marine fishes from the Queen Charlotte Islands area. Report prepared for Gwaii Haanas National park Reserve, Queen Charlotte, B.C. by Worms 'n Us Parasite Identification Service, Nanaimo, B.C. 25 p.

McLean, J.H. 1987. Taxonomic descriptions of cocculinid limpets (Mollusca, Archaeogastropoda): two new species and three rediscovered species. Zoologica Scripta 16: 325-333.

McTaggart Cowan, I. 1964. New information on the distribution of marine Mollusca on the coast of British Columbia. Veliger 7:110-113.

McTaggart Cowan, I. 1969. A new species of Gastropod (Fissurelidae, Fissurisepta) from the eastern North Pacific Ocean. Veliger 12: 24-26.

Menge, B.A., and G.M. Branch. 2001. Rocky intertidal communities. p. 221-251. In: Marine community ecology. M.D. Bertness, S.D. Gaines, and M.E. Hay (eds.). Sinauer Associates, Sunderland, MA.

Mercier, F., and C. Mondor. 1995. Sea to sea to sea – Canada's National Marine Conservation Areas system plan. Parks Canada, Hull, P.Q. 106 p.

Monterey Bay National Marine Sanctuary. 1999. Ecosystem observations for the Monterey Bay National Marine Sanctuary 1998. Annual Report, National Oceanic and Atmospheric Administration (NOAA), Monterey Bay National Marine Sanctuary, Monterey, CA. 27 p.

Monterey Bay National Marine Sanctuary. 2000. Ecosystem observations for the Monterey Bay National Marine Sanctuary 1999. Annual Report, National Oceanic and Atmospheric Administration (NOAA), Monterey Bay National Marine Sanctuary, Monterey, CA. 27 p.

Morgan, L.E., S.R. Wing, L.W. Botsford, C.J. Lundquist, and J.M. Diehl. 2000. Spatial variability in red sea urchin (*Strongylocentrotus franciscanus*) recruitment in northern California. Fisheries Oceanography 9: 83-98.

Morris, R.H., D.P. Abbott, and E.C. Haderlie. 1980. Intertidal invertebrates of California. Stanford University Press, Stanford, CA. 690 p.

Morton, J. 1992. Homeland to hinterland: the southern archipelago of the Queen Charlotte Islands since European contact. Parks Canada, Victoria, B.C. 211 p.

Murina, V.V. 1973. New species of sipunculids in the Pacific Ocean. Zoologicheskii Zhurnal 52: 942-945. (in Russian with English summary)

Murray, S.N., R. Ambrose, and M.N. Dethier. *in press*. A handbook for designing, monitoring and injury assessment programs for rocky intertidal organisms. California Sea Grant College Program. University of California, La Jolla, CA.

Murray, S.N., R.F. Ambrose, J.A. Bohnsack, L.W. Botsford, M.H. Carr, G.E. Davis, P.K. Dayton, D. Gotshall, D.R. Gunderson, M.A. Hixon, J. Lubchenco, M.Mangel, A. McCall, D.A. McArdle, J.C. Ogden, J. Roughgarden, R.M. Starr, M.J. Tegner, and M.M. Yoklavich. 1999. No-take reserve networks: sustaining fishery populations and marine ecosystems. Fisheries 24(11): 11-25.

Neis, B., R. Jones, and R. Ommer. 2000. Food security, food self-sufficiency, and ethical fisheries management. p. 154-173. In: H. Coward, R. Ommer, and T. Pitcher (eds.). Just fish - ethics and Canadian marine fisheries. Social and Economic Papers No. 23, Institute of Social and Economic Research, St. John's' NF.

New, T.R. 1995. Introduction to invertebrate conservation biology. Oxford University Press, Oxford, U.K. 194 p.

New, T.R. 1998. Invertebrate surveys for conservation. Oxford University Press, Oxford, U.K. 240 p.

Newcombe, C.F. 1891. Report on the marine shells of British Columbia. Papers and Communications of the Natural History Society of British Columbia, Victoria 1(1): 31-72.

Nichol, L., and K. Heise. 1992. The historical occurrence of large whales off the Queen Charlotte Islands. Report prepared for Gwaii Haanas National Park Reserve, Queen Charlotte, B.C. by Vancouver Public Aquarium, Vancouver, B.C. 68 p.

Nichol, L.M., P.F. Wainwright, P.F. Olesiuk, and B.D. Smiley. 1993. West coast data inventory and appraisal. Volume 4. Dixon Entrance, Hecate Strait, Queen Charlotte Sound and adjoining B.C. coastal waters: biological oceanography – marine mammals. Canadian Data Report of Hydrography and Ocean Sciences 37: 321 p.

Noakes, D.J., and A. Campbell. 1992. Use of geoduck clams to indicate changes in the marine environment of Ladysmith Harbour. Environmetrics 3: 81-97.

Norse, E.A. (ed.). 1993. Global Marine Biological Diversity, a Strategy for Building Conservation into Decision-making. Island Press, Washington, D.C. 383 p.

Noss, R.F. 1990. Indicators for monitoring biodiversity: a hierarchical approach. Conservation Biology 4: 355-364.

NRC (National Research Council). 1995. Understanding marine biodiversity a research agenda for the nation. National Academy Press, Washington, D.C. 114 p.

NRC (National Research Council). 1999. Sustaining marine fisheries. National Academy Press, Washington, D.C. 164 p.

NRC (National Research Council). 2001. Marine Protected Areas: Tools for Sustaining Ocean Ecosystems. National Academy Press, Washington, D.C. 272 p.

Observer. 2001 (July 26). Oil and gas plan out soon - minister promises action next week. Queen Charlotte Islands Observer, Queen Chatlotte, B.C.

O'Clair, R.M., and C.E. O'Clair. 1998. Southeast Alaska's rocky shores animals. Plant Press, Auke Bay, AK. 561 p.

Ogden, J.C. 1997. Marine managers look upstream for connections. Science 278: 1414-1415.

Oliver, I., and A.J. Beattie. 1996. Designing a cost-effective invertebrate survey: a test of methods for rapid assessment of biodiversity. Ecological Applications 6: 594-607.

Oliver, J.S., and P.N. Slattery. 1985. Destruction and opportunity on the sea floor: effects of grey whale feeding. Ecology 66: 1965-1975.

Orensanz, J.M., R. Hilborn, and A.M. Parma. 2000. Harvesting Methuselah's clams – is the geoduck fishery sustainable, or just apparently so? Canadian Stock Assessment Secretariat Research Document 00/175: 68 p.

Orensanz, J.M., and G.S. Jamieson. 1998. The assessment and management of spatially structured stocks: an overview of the North Pacific symposium on invertebrate stock assessment and management. In: Proceedings of the North Pacific Symposium on Invertebrate Stock Assessment and Management G.S. Jamieson, and A. Campbell (eds.). Canadian Special Publication of Fisheries and Aquatic Sciences 125: 441-459.

Parks Canada. 1994. Guiding principles and operational policies. Parks Canada, Hull, P.Q. 125 p.

Parks Canada Agency. 2000. Unimpaired for future generations? Protecting ecological integrity with Canada's national parks. Volume I. A call to action. Volume II. Setting a new direction for Canada's national parks. Report of the Panel on the Ecological Integrity of Canada's National Parks. Ottawa, ON: Parks Canada Agency.

Parizeau, H.D. 1929. Hydrographic survey of the northwest coast of British North America, from the earliest discoveries to the present time. Report and Proceedings of the British Columbia Historical Association 4: 10-19.

Parma, A.M., and NCEAS Working Group on Population Management. 1998. What can adaptive management do for our fish, forests, food and biodiversity? Integrative Biology 1: 16-26.

Patche, C.A. 1922. A biological reconnaissance on Graham Island of the Queen Charlotte group. Canadian Field-Naturalist 36: 101-105, 133-136.

Partinquin, D.O., and C.R. Butler. 1976. Marine resources of Kouchibouguac National Park. Report prepared for Kouchibouguac National Park, NB. 423 p.

Pauly, D., L. Palomares, R. Froese, P. Sa-a, M. Vakily, D. Preikshot, and S. Wallace. 2001. Fishing down Canadian aquatic food webs. Canadian Journal of Fisheries and Aquatic Sciences 58: 51-62.

Peden, A.E., and D.E. Wilson. 1976. Distribution of intertidal fishes of northern British Columbia and southeastern Alaska. Syesis 9: 221-248.

Perry, R.I. 1999. Scientific concepts for ecosystem-based management of marine invertebrates on Canada's Pacific coast. Canadian Stock Assessment Secretariat Research Document 99/123: 24 p.

Perry, R.I., M. Stocker, and J. Fargo. 1994. Environmental effects on the distribution of groundfish in Hecate Strait, British Columbia. Canadian Journal of Fisheries and Aquatic Sciences 51: 1401-1409.

Perry, R.I., C.J. Walters, and J.A. Boutillier. 1999. A framework for providing scientific advice for the management of new and developing invertebrate fisheries. Reviews in Fish Biology and Fisheries 9: 125-150.

Perry, R.I., and B.J. Waddell. 1999. Review of the fishery and assessment of the green sea urchin stocks in British Columbia, with quota recommendations for 1999/2000. Canadian Stock Assessment Secretariat Research Document 99/113: 43 p.

Phillips, A.C., and J.A. Boutillier. 1998. Stock assessment and quota options for the sea cucumber fishery. Canadian Technical Report of Fisheries and Aquatic Sciences 2215: 147-169.

Pocklington, P., and P.G. Wells. 1992. Polychaetes, key taxa for marine environmental quality monitoring. Marine Pollution Bulletin 24: 593-598.

Policansky, D., and J.J. Magnuson. 1998. Genetics, metapopulations, and ecosystem management of fisheries. Ecological Applications 8(Supplement): S119-S123.

Poole, F. 1872. Queen Charlotte Islands: A narrative of discovery and adventure in the North Pacific. J.W. Lyndon (ed.). Hurst and Blackett, London, U.K.

Poore, G.C.B., and G.D.F. Wilson. 1992. Marine species richness. Nature 361: 597-598.

Probert, P.K. 1999. Seamounts, sanctuaries and sustainability: moving towards deep-sea conservation. Aquatic Conservation: Marine and Freshwater Ecosystems 9: 601-605.

Puotinen, M.L. 1994. Designing effective baseline monitoring programs for the Great Barrier Reef Marine Park, Queensland, Australia. Coastal Management 22: 391-398.

Quayle, D.B. 1969. Paralytic Shellfish Poisoning in British Columbia. Bulletin of the Fisheries Research Board of Canada 168: 68 p.

Quayle, D.B. 1988. Pacific oyster culture in British Columbia. Canadian Bulletin of Fisheries and Aquatic Sciences 218: 241 p.

Quayle, D.B. 1992. Marine wood borers in British Columbia. Canadian Special Publication of Fisheries and Aquatic Sciences 115: 55 p.

Quayle, D.B., and N. Bourne. 1972. The clam fisheries of British Columbia. Bulletin of the Fisheries Research Board of Canada 179: 70 p.

Quinn, J.F., S.R. Wing, and L.W. Botsford. 1993. Harvest refugia in marine invertebrate fisheries: models and applications to the red sea urchin, *Strongylocentrotus franciscanus*. American Zoologist 33: 537-550.

Rafi, F., and D.R. Laubitz. 1990. The Idoteidae (Crustacea: Valvifera) of the shallow waters of the northeastern North Pacific Ocean. Canadian Journal of Zoology 68: 2649-2687.

Rainbow, P.S., and D.W. Phillips. 1993. Cosmopolitan biomonitors of trace metals. Marine Pollution Bulletin 26: 593-601.

RaLonde, R. 1996. Paralytic Shellfish Poisoning: the Alaska problem. Alaska's Marine Resources [Marine Advisory Program, University of Alaska] 8(2): 20 p.

Raum-Suryan, K., R. Lamy, and K. Pitcher. *in preparation.* First documented sea otter (*Enhydra lutris*) sighting off the Queen Charlotte Islands British Columbia in more than 25 years. Marine Mammal Science.

Ray, G.C. 1996. Coastal-marine discontinuities and synergisims: implications for biodiversity conservation. Biodiversity and Conservation 5: 1095-1108.

Ray, G.C., B.P. Hayden, M.G. McCormick-Ray, and T.M. Smith. 1997. Land-seascape diversity of the USA east coast coastal zone with particular reference to estuaries. p. 337-371. In: Marine biodiversity patterns and processes. R.F.G. Ormond, J.D. Gage, and M.V Angel (eds.). Cambridge University Press, Cambridge, U.K.

Redford, K.H., and B.D. Richter. 1999. Conservation of biodiversity in a world of use. Conservation Biology 13: 1246-1256.

Reimchen, T.E. 1984. Distribution and abundance of dominant intertidal taxa from select localities on the Queen Charlotte Islands. Report prepared for Islands Protection Society, Queen Charlotte, B.C. (*dissolved in the early 1990s*) by Islands Ecological Research, Queen Charlotte, B.C. 92 p.

Reimchen, T.E. 1994. Further studies of predator and scavenger use of chum salmon in stream and estuarine habitats at Bag Harbour, Gwaii Haanas. Report prepared for Gwaii Haanas National Park Reserve, Queen Charlotte, B.C. by Islands Ecological Research, Queen Charlotte, B.C. 58 p.

Reimchen, T.E. 2000. Some ecological and evolutionary aspects of bear-salmon interactions in coastal British Columbia. Canadian Journal of Zoology 78: 448-457.

Richards, D.V., and G.E. Davis. 1988. Rocky intertidal communities monitoring handbook. Channel Islands National Park, U.S. National Park Service, Ventura, CA. 15 p.

Richards, L.J., and J-J. Maguire. 1998. Recent international agreements and the precautionary approach: new directions for fisheries management science. Canadian Journal of Fisheries and Aquatic Sciences 55: 1545-1552.

Richardson, J. 1873. Report on the coal-fields of Vancouver and Queen Charlotte Islands. Geological Survey of Canada Report of Progress for 1872-1873: 32-65.

Richardson, M., and B. Green. 1989. The fisheries co-management initiative in Haida Gwaii. p. 249-261. In: Co-operative management of local fisheries – new directions for improved management and community development. E. Pinkerton (ed.). University of British Columbia Press, Vancouver, B.C.

Risk, M.J., D.E. McAllister, and L. Behnken. 1998. Conservation of cold- and warm-water seafans: threatened ancient gorgonian groves. Sea Wind 12(1): 2-21.

Roberts, C.M. 1998. Sources, sinks and the design of marine reserve networks. Fisheries 23(7): 16-19.

Roberts, C.M. 2000. Selecting marine reserve locations: optamility versus optimism. Bulletin of Marine Science 66: 581-592.

Roberts, C.M., B. Halpern, S.R. Palumbi, and R.R. Warner. 2001. Designing marine reserve networks. Conservation Biology in Practise 2(3): 10-17.

Robinson, C.L.K. 2001. Monitoring the ocean climate of coastal regions adjacent to Pacific Rim and Gwaii Haanas National Park Reserves. In: Managing Protected Areas in a Changing World. Proceedings of the Fourth International Conference on Science and Management of Protected Areas, May, 2000. S. Bodrup-Nielsen, and N.W.P. Munro (eds.). Wolfville, N.S., Science and Management of Protected Areas Association. (*in press*)

Robinson, C.L.K., R. Douglas, and D.M. Ware. 1999. A synthesis of oceanographic and biological information for Gwaii Haanas NMCA continental shelf ecosystems. Report prepared for Gwaii Haanas National Park Reserve, Queen Charlotte, B.C. by Northwest Ecosystem Institute, Lantzville, BC. 122p.

Robinson, C.L.K., D.E. Hay, J. Booth, and J. Truscott. 1996. Standard methods for sampling resources and habitats in coastal subtidal regions of British Columbia: Part 2: review of sampling with preliminary recommendations. Canadian Technical Report of Fisheries and Aquatic Sciences 2119: 113 p.

Robinson, M.P. 1996. Sea otter chiefs. Bayeux Arts, Calgary, AB. 94 p.

Rogers-Burnett, L., and J.S. Pearse. 2001. Indirect benefits of marine protected areas for juvenile abalone. Conservation Biology 15: 642-647.

Roughgarden, J., T. Pennington, and S. Alexander. 1994. Dynamics of the rocky intertidal zone with remarks on generalization in ecology. Philosophical Transactions of the Royal Society of London B 343: 79-85.

Rouse, G.W., and K. Fauchald. 1997. Cladistics and polychaetes. Zoologica Scripta 26: 139-204.

Rowe, A., W. Redhead, and D. Dobell (eds.). 1999. Pacific Rim National Park Reserve proceedings of a workshop on assessing ecological status, October 1998. Ucluelet, B.C.: Pacific Rim National Park Reserve. 67 p.

Rumrill, S.S. 1990. Natural mortality of marine invertebrate larvae. Ophelia 32: 163-198.

Safina, C. 1997. Song for the blue ocean - encounters along the world's coasts and beneath the seas. Henry Holt & Co., New York. 458 p.

Sala, E., C.F. Boudouresque, and M. Harmelin-Vivien. 1998. Fishing, trophic cascades, and the structure of algal assemblages: evaluation of an old but untested paradigm. Oikos 82: 425-439.

Salm, R.V. 1985. Integrating marine conservation and tourism. International Journal of Environmental Studies 25: 229-238.

Salomon, A.K., J.L. Ruesink, B.X. Semmens, and R.T. Paine. 2001. Incorporating human and ecological communities in marine conservation: an alternative to Zacharias and Roff. Conservation Biology 15: 1452-1455.

Scagel, R.F., P.W. Gabrielson, D.J. Garbary, L. Golden, M.W. Hawkes, S.C. Lindstrom, J.C. Oliveira, and T.B. Widdowson. 1993. (reprinted with minor changes, corrections, footnotes and references). A synopsis of the benthic marine algae of British Columbia, Southeast Alaska, Washington and Oregon. University of British Columbia Phycological Contribution No. 3: 535 p. University of British Columbia, Vancouver, B.C.

Scheltema, R.S. 1986. On dispersal and planktonic larvae of benthic invertebrates: an eclectic overview and summary of problems. Bulletin of Marine Science 39: 290-322.

Schmidt, D. 1999. A review of California mussel (*Mytilus californianus*) fisheries biology and fisheries programs. Canadian Stock Assessment Secretariat Research Document 99/187: 32 p.

Schmitt, R.J., and C.W. Osenberg (eds.). 1996. Detecting ecological impacts - concepts and applications in coastal habitats. Academic Press, San Diego, CA. 401 p.

Schroeter, S.C., J.D. Dixon, T.A. Ebert, and J.V. Rankin. 1996. Effects of kelp forest *Macrocystis pyrifera* on the larval distribution and settlement of red and purple sea urchins *Strongylocentrotus franciscanus* and *S. purpuratus.* Marine Ecology Progress Series 133: 125-134.

Schroeter, S.C., D.C. Reed, D.J. Kushner, J.A. Estes, and D.S. Ono. 2001. The use of marine reserves in evaluating the dive fishery for the warty sea cucumber (*Parastichopus parvimensis*) in California, U.S.A. Canadian Journal of Fisheries and Aquatic Sciences 58: 1773-1781.

Scudder, G.G.E. 1996. Terrestrial and freshwater invertebrates of British Columbia: priorities for inventory and descriptive research. Research Branch, British Columbia Ministry of Forests and Wildlife Branch, British Columbia Ministry of Environment, Lands and Parks, Victoria, B.C. Working Paper 09/1966: 206 p.

Seaman, H. 1951. Trapping crabs off the Queen Charlottes. Canadian Geographical Journal 43(2): 76-83.

Searing, G.F. 1987. A proposed national marine park in the southern Moresby Island area, Queen charlotte Islands: Marine resources and issues. Report prepared for Environment Canada-Parks, Ottawa by LGL Ltd., Sidney, B.C. 36 p.

Searing, G.F., and K.K. English. 1983. A comparative analysis of three natural areas of Canadian significance in Queen Charlotte Sound for their potential as marine national parks. Report prepared for Environment Canada-Parks, Ottawa by LGL Ltd., Sidney, B.C.

Searing, G.F., and H.R. Frith. 1995. B.C. British Columbia shore-zone mapping system. Report prepared for Resources Inventory Committee by LGL Ltd., Sidney, B.C. and the Land Use Coordination Office, Victoria, B.C. 46 p.

Severs, P.D.S. 1974 a. Archaeological investigations at Blue Jackets Creek, FlUa-4, Queen Charlotte Islands, British Columbia, 1973. Canadian Archaeological Association Bulletin 6: 165-205.

Severs, P.D.S. 1974 b. Preliminary report on archaeological investigations at Tow Hill, GaTw-5, in Naikoon Park, Queen Charlotte Islands. Report on file, Cultural Resource Services, Parks Canada, Victoria, B.C.

Shafer, C.S., and D. Benzaken. 1998. User perceptions about marine wilderness of Australia's Great Barrier Reef. Coastal Management 26: 79-91.

Shakespear, N. 1999. Bruce Chatwin. Harvill Press with Jonathan Cape, London, UK. 550 p.

Shepherd, S.A., and J.L. Baker. 1998. Biological reference points in an abalone (*Haliotis laevigata*) fishery. In: Proceedings of the North Pacific Symposium on Invertebrate Stock Assessment and Management G.S. Jamieson, and A. Campbell (eds.). Canadian Special Publication of Fisheries and Aquatic Sciences 125: 235-245.

Shepherd, S.A., and L.D. Brown. 1993. What is an abalone stock: implications for the role of refugia in conservation. Canadian Journal of Fisheries and Aquatic Sciences 50: 2001-2009.

Shepherd, S.A., M.J. Tegner, and S.A. Guzman del Proo. (eds.). 1992. Abalone fisheries of the world – biology, fisheries and culture. Fishing News Books, London. 608 p.

Sherman, K. 1994. Sustainability, biomass yields, and health of coastal ecosystems: an ecological perspective. Marine Ecology Progress Series 112: 277-301.

Sherman, K., and A.M. Duda. 1999. Large marine ecosystems: an emerging paradigm for fishery sustainability. Fisheries 24(12): 15-26.

SHIP (Skidegate Haida Language Authority, Skidegate Haida Immersion Program). 2001. Update of southern Haida place names and words for marine invertebrates. Information supplied by the Skidegate Haida Immersion Program, Skidegate, B.C. to Gwaii Haanas National Park Reserve, Queen Charlotte, B.C.

Siddall, M.E., D.S. Martin, D. Bridge, S.S. Desser, and D.K. Cone. 1995. The demise of a phylum of protists: phylogeny of Myxozoa and other parasitic Cnidaria. Journal of Parasitology 81: 961-967.

Simberloff, D. 2000. No reserve is an island: marine reserves and nonindigenous species. Bulletin of Marine Science 66: 567-580.

Simpson, G. 1961. Principles of animal taxonomy. Columbia University Press, New York. 247 p.

Sinclair, M., R. O'Boyle, L. Burke, and S.D. D'Etrement. 1999. Incorporating ecosystem objectives within fisheries management plans within the Maritimes region of Atlantic Canada. ICES (International Council for the Exploration of the Sea) CM 1999/Z:03: 20 p.

Sloan, N.A. 1991. Experimental fishing for the flying squid, *Ommastrephes bartrami* (Lesueur, 1821), off British Columbia. Journal of Shellfish Research 10: 373-377.

Sloan, N.A. 1999. Oil impacts on cold-water marine resources: a review relevant to Parks Canada's evolving marine mandate. Parks Canada - National Parks Occasional Paper 11: 67 p. [http://www.parkscanada.gc.ca/library/DownloadDocuments/]

Sloan, N.A. 2002. History and application of the wilderness concept in marine conservation. Conservation Biology 16 (*in press*).

Sloan, N.A., and P.A. Breen. 1988. Northern abalone, *Haliotis kamtschatkana*, in British Columbia: fisheries and synopsis of life history information. Canadian Special Publication of Fisheries and Aquatic Sciences 103: 46 p.

Sloan, N.A., and P.M. Bartier. 2000. Living marine legacy of Gwaii Haanas. I. Marine plant baseline to 1999 and plant-related management issues. Parks Canada – Technical Reports in Ecosystem Science 27: 104 p.

Sloan, N.A., and P.M. Bartier. 2001. Taking stock: ideas about inventory for Parks Canada's Marine Conservation Areas. In: Managing Protected Areas in a Changing World. Proceedings of the Fourth International Conference on Science and Management of Protected Areas, May, 2000. S. Bodrup-Nielsen, and N.W.P. Munro (eds.). Wolfville, N.S., Science and Management of Protected Areas Association. (*in press*)

Smiley, B., D. Thomas, W. Duvall, and A. Eade. 1998. Selecting indicators for marine ecosystem health: a conceptual framework and an operational procedure. State of the Environment Reporting Occasional Paper Series 9: 33 p. Prepared for the National Marine Indicators Working Group (Environment Canada and Fisheries and Oceans Canada), Ottawa.

Smith, S.I. 1880. Notes on crustacea collected by Dr. G.M. Dawson at Vancouver and the Queen Charlotte Islands. Appendix D, p. 206B-218B. In: G.M. Dawson 1880. Report on the Queen Charlotte Islands 1878. Geological Survey of Canada, Ottawa and Dawson Brothers, Montreal.

Snow, N., and P.L. Keating. 1999. Relevance of specimen citations to conservation. Conservation Biology 13: 943-944.

Sobel, J. 1996. Marine reserves: necessary tools for biodiversity conservation? Global Biodiversity 6: 8-18. 1996.

Southerland Brown, A. 1968. Geology of the Queen Charlotte Islands. British Columbia Department of Mines and Petroleum Resources Bulletin 54: 226 p.