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The Role of the Biosphere Designation in Promoting Sustainable Fisheries and Aquaculture in Clayoquot Sound

Designated as a UNESCO Biosphere Reserve in 2000, Clayoquot Sound is an area that has a long history of resource extraction from the marine environment -historically through fishing, and more recently through shellfish and finfish aquaculture. The Biosphere Reserve' role of promoting sustainability and requiring protected areas makes it an ideal tool for supporting the long-term viability of fisheries and aquaculture in Clayoquot Sound. It can do so by supporting ecosystem-based management, supporting creation of marine protected areas, promoting sustainable aquaculture through polyculture, promoting better management practices in fisheries –practices the not only help sustain, but help rebuild fisheries- as well as including stakeholders through various forms of co-management.

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Executive Summary

Understanding how the UNESCO Biosphere Reserve Designation of Clayoquot Sound can promote sustainable fisheries and aquaculture requires taking several steps back and looking at some fairly large concepts. First, understanding the current state of world fisheries and aquaculture, as well as a brief insight into its history, is required. Then, the concept of sustainability must be established for both industries since, although related, fisheries can be described as declining while aquaculture is increasing; therefore, it can be said that we want to rebuild fisheries and develop aquaculture if it is already increasing, why does aquaculture need development. Perhaps you mean manage aquaculture?. A key component to marine resource management is the establishment of marine protected areas, combined with sustainable, long-term fisheries management practices. This is followed by a look at ecosystem-based management and involving stakeholders in co-management of marine resources to promote viable resource extraction from the marine environment.

With this background in mind, there is a consideration of UNESCO Biosphere Reserves and what that designation means in terms of protection and management for the marine environment and the designation's ability to work towards sustainability in extremely complicated bioregions. To exemplify this there is an example from Columbia's Seaflower Biosphere Reserve.

Finally, with a better understanding of fisheries and aquaculture, marine protected areas, ecosystem-based management and the role of biosphere reserves, Clayoquot Sound and its ability the sound as a geographical region has no "ability" to do anything to

promote the rebuilding of fisheries and sustainable aquaculture is considered in the context of its biosphere designation and the Clayoquot Biosphere Trust.

Introduction

Considering the state of the world's declining fisheries and the increase in aquaculture production, Biosphere Reserves can be used as a tool to achieve sustainability. Biosphere Reserves are designed to deal with one of the most important questions the world faces today: How can we reconcile conservation of biodiversity and biological resources with their sustainable use supporting references? In the marine environment, Biosphere Reserve designations provide an ideal framework for ecosystem based management reference? Ecosystem-based management often involves the establishment of marine protected areas and stakeholder involvement, often through co-management schemes for fisheries and aquaculture.

Clayoquot Sound is in a unique position in that it has an endowment fund to work with, which means they who is this "they"? The people of the Sound? CBT? have guaranteed funding. Clayoquot Sound is also an area renowned for its remarkable ecosystems as well as its socially and environmentally conscious populace are they? Supporting references. For these reasons I believe that the UNESCO Biosphere designation of Clayoquot Sound can promote sustainable fisheries and aquaculture.

Thesis?

State of the World's Fisheries

Fisheries are the last major world industry exploiting wild natural resources for food (Jacquet and Pauly 2007). Fishing is an important activity for the livelihoods of 200 million people, providing in excess of 100 million tonnes of fish and fish products annually for which over a billion people are dependent for their protein, cultural and social needs (Fletcher et al. 2005). According to recent studies, the maximum production potential of marine fisheries worldwide was reached at least two decades ago; since then, due to widespread development of excess harvesting capacity, there has been an increase in the proportion of marine fish stocks which are exploited beyond levels at which they can produce their maximum sustainable yields (Martinet et al. 2007). The world is now eating down marine food webs. Invertebrates and low-trophic level fish are replacing piscivorous species such as cod and swordfish (Jacquet and Pauly 2007). It is estimated that about 20 percent of global catches (about 20 million tonnes annually) constitutes unwanted by-catch, and is discarded (Sinclair et al. 2002).

The Blue Revolution

While landings by global fisheries have leveled off, and many fish stocks have essentially collapsed, demand for seafood has been rising steadily, leading to the fast expansion of aquaculture (Neori et al. 2007). World aquaculture on land or at sea (in all water types) has been approaching parity with fisheries; more than 38 percent of the entire global seafood market was supplied by aquaculture in 2004 (FAO 2006), a figure the FAO expects will approach 50% by 2030 (Tidwell and Allen, 2001). While nearly 90 percent of the world mariculture (marine aquaculture) production consists of fairly environmentally benign algae and molluscs, intensive carnivore finfish monocultures

(which constitutes less than 9 percent of the world's total mariculture production) has remained at the center of policymakers' attention and planning (Neori et al. 2007). As I asked previously on your draft: Why has it remained at the center? The economic success of the intensive monoculture approach has much to do with the fact that the nutrification do you mean eutrophication? of the environment involves little monetary cost to the growers, that is to say that marine aquaculture does not have to internalize the cost of water treatment (Neori et al 2007). What of the other associated problems such as the spread of diseases to wild stocks? Awareness from scientists, industry, the public and politicians is such that technologies with uncontrolled impact on the environment are no longer considered sustainable (Neori et al 2007).

Quest for Sustainable Fisheries and Aquaculture: laws, policies, approaches

Fishery resources stand challenged by factors acting on a global scale throughout the world's water bodies: progressive and high-variance climate change; innovative, potent and overcapitalized catching technology; massive, mounting and unprecedented excess of demand over supply; and unparalleled social pressure for jobs, recreation, and sectoral equality in allocation, recreation, and the restoration of indigenous people's rights (Pitcher 2001). Over the past decade, various UN organizations have worked on sustainable development issues [in fisheries] (Fletcher et al 2005). These have resulted in a Code of Conduct for Responsible Fisheries (FAO 1995), to which Canada is a signatory, and a set of guidelines to support this Code to and facilitate its implementation (FAO 1999). Closer to home, the release of the Ocean's Act in 1997 saw Canada committing to marine management based on sustainable development, integrated

management, and ~~the~~ an ecosystem approach ~~and~~ including the precautionary principal (Tank 2004). In Canadian policy, this is now referred to as 'integrated coastal-zone management'. The Ocean's Act, however, is simply 'enabling' legislation and does not force agencies to comply with the concepts outlined therein (Tank 2004).

One of the more recent theories in fisheries management -developed by D. Pauly, a UBC professor- is the 'Back to the Future Model'. This approach is based on the premise that 'rebuilding' rather than 'sustaining' is the correct goal for fisheries management (Pitcher and Pauly 1998). This rebuilding policy strategy is distinguished from that of sustaining current catches and biomass since the baseline for sustainability is often based on present or recent biomass levels (Pitcher 2001), levels which are but a small fraction of their pre-industrial scale fishing levels (Pauly et al. 2002). Sustaining and rebuilding fisheries is no small task and includes reducing bycatch (Pauly et al. 2002), adopting a precautionary approach (Caddy and Cochrane 2001), decreasing fleet capacity (Pauly et al. 2002, Caddy and Cochrane 2001), protecting habitat (Pauly et al 1998, Pauly et al. 2002, Caddy and Cochrane 2001), involving local communities (Caddy and Cochrane 2001, Grafton 2005, Wiber et al 2004), and conducting more research and monitoring (Clark 1996).

Sustainability in aquaculture requires, wherever possible, a shift towards lower trophic level species and adopting methods of polyculture. Integrated farming -or polyculture- can be generally defined as occurring when an output from one subsystem in an integrated farming system, which otherwise may have been wasted, becomes input into another subsystem resulting in a greater efficiency of output of desired products from the area under a farmer's control (Neori et al 2005) and less wastes accumulating in water

column and on sediment. Kautsky and Folke (1991) introduced the concept of “integrated open sea aquaculture”, in which coastal waters, made eutrophic by fish net pens, agricultural runoff and sewage, ~~and~~ are used to supply cultured seaweed with dissolved nutrients and shellfish with plankton. Are polyculture, integrated farming and integrated open sea aquaculture related? If so, take time to more carefully define this terms and show their relationship to each other.

It is a prerequisite that a successful sustainable integrated farming system mimics, as much as possible, the way a natural ecosystem functions (Faulk and Kautsky, 1992). The concept of integrated aquaculture constitutes an essential element in coastal zone management, aimed at reducing, in an economically and socially beneficial manner, the adverse environmental impacts of aquaculture on the coastal environment (Neori et al 2004).

The ideas in this section have not be adequately developed nor linked to each other or to the thesis.

Marine Protected Areas

Marine reserves –or marine protected areas (MPAs)- are now strongly advocated by many managers and biologists because reserves may offer a type of protection not offered by other management strategies: special protection of critical areas, intrinsic prevention of overfishing, and even enhancement of fisheries (Allison et al 1998). Under Canada’s Oceans Act, MPAs can be internally zoned to include a range of restrictions, from controls on specific activities to the establishment of no-take reserves (O’Boyle et al 2006).

Probably the most important biological use of marine reserves is as a refuge from fishing pressure for some or all species in an area. By releasing a population from fishing pressure, that population becomes structured by natural mortality instead of fishing mortality (Allison et al 1998). Because larger, older individuals are typically much more important to reproduction in a population than small individuals, this change in the population structure can drastically increase the reproductive output of the population protected in the reserve (Bohnsack 1992). Therefore, reserves could potentially enhance fisheries by acting as centers of dispersal of propagules and adults into the areas surrounding the reserves (Allison et al 1998). As well, MPAs can serve as a buffer against management errors and recruitment failure; protect non-target species thus promoting functional food webs; provide sites for research to advance understanding of marine systems; and provide ecological benchmarks against which anthropological perturbations can be measured, and finally, marine reserves offer important educational, recreational and economic opportunities (Ballantine 1991, Agardy 1994)

Marine reserves are essential to marine conservation; however, their efficacy can be greatly enhanced if their design and implementation are scientifically sound, but their potential effectiveness is limited by large-scale processes that must be explicitly addressed by conservation measures outside as well as inside the reserve (Allison et al 1998). MPAs cannot be expected to act on their own. If fishing effort displaced by the reserve concentrates into surrounding areas, or seeks new targets to harvest, advantages will be compromised (Pitcher 2001). Therefore, marine reserves have to be put in place in conjunction with fishery management devices (Pitcher 2001) which include prohibitions on certain activities or harvesting methods; the use of closed seasons for

particular activities; input controls on the amount of regulated activities (ex: fishing effort); output controls on natural resources extracted from the ecosystem (quotas); and many other measures (Murawski 2007). Like reserves on land, setting aside areas helps conserve biodiversity but will not solve all of humanity's problems. They are necessary, but are only part of the solution (Allison et al. 1998, Roberts et al. 2005).

Ecosystem-Based Management

Part of the challenge in fisheries management is that, at present, no general theory of the functioning of marine ecosystems is available (Sinclair et al. 2002). This lack of explanatory power within marine ecology imposes severe limits on ~~theor~~ ability to explain (let alone predict) the impacts of fishing of different species on the structure and function of marine ecosystems. It follows that fisheries management is -and will continue to be- fraught with uncertainty (Sinclair et al. 2002).

In the face of this uncertainty, virtually every contemporary review of ocean and living marine resource management now includes a paean to ecosystem approaches or ecosystem-based management (EBM) (Murawski 2007). According to Murawski (2007) EBM is differentiated from more narrowly focused management approaches by the following defining characteristics: (1) adaptive in its development over time as new information becomes available or as circumstances change, (2) takes into account ecosystem knowledge and uncertainties, (3) recognizes that multiple simultaneous factors may influence the outcomes of management (particularly those external to the ecosystem), and (4) strives to balance diverse societal objectives that result from resource decision making and allocation. Additionally, because of its complexity and emphasis on

stakeholder involvement, the process of implementing EBM needs to be (5)
collaborative, meaning stakeholders are involved. Because of stakeholder involvement, stakeholders need to be involved???

Canada's Oceans Act, and the implementation of "integrated coastal-zone management" (ICZM) which is essentially another term for EBM, changed the legislative basis for the management of coastal zones but above you state that the Act is only an "enabling" piece of legislation. Most current ocean governance regimes (ex: national fisheries laws, pollution abatement, and coastal development) are based on issue specific management objectives (Murawski 2007). ICZM has Canada moving away from a focus on commercially exploited species and their habitats -which was grounded in the Fisheries Act- to a focus that now requires consideration of the impacts of all human activities on Canada's marine ecosystems and is rooted in the more recent Oceans Act (O'Boyle et al 2006). In contrast to individual species or single issue management, EBM/ICZM considers a wider range of relevant ecological, environmental, and human factors (Murawski 2007) which all affect the marine environment in different ways. However, EBM/ICZM is generally applied to ecological boundaries, which may or may not coincide with jurisdictional boundaries (Murawski 2007). Country, state, or local jurisdictional boundaries may be embedded within a larger set of ecological boundaries, which then require multi-jurisdictional cooperation in science and management activities to be effective (Murawski 2007). Part of this increased cooperation requires commonly defined and accepted management goals (O'Boyle et al 2006), which is where the bBiosphere rReserve mandate can come into play since goals are outlined for each reserve???. Also, as EBM/ICZM is an extension of present ocean management

activities, the current suite of regulatory tools used by managers will continue to be utilized, but ideally in a more coordinated fashion (O'Boyle et al 2006). A somewhat convoluted paragraph – ideas are not adequately developed or linked

A common component to EBM/ICZM is participatory governance and co-management of resources. The international importance accorded to participatory approaches was exemplified in the outcomes of the Earth Summit in Rio de Janeiro in 1992 when 178 states, including Canada, signed Agenda 21, a document stating that “broad public participation in decision making was a fundamental prerequisite for the achievement of sustainable development” (Kearney et al 2007). Canada explicitly confirmed its commitment to Agenda 21 in 2002 when it declared that its Oceans Strategy was a concerted effort to implement principles of Agenda 21 (Kearney et al 2007). The government noted that an important principle of integrated management is inclusive and collaborative ocean governance structures and processes (p.11) (Kearney et al 2007). In a key section on governance (p.19), the Oceans Strategy states: quote is out

The governance model proposed for Integrated Management is one of collaboration. It involves ocean management decisions based on shared information, on consultation with stakeholders, and on their advisory or management participation in the planning process. It is also based on institutional arrangements that bring together all stakeholders. Participants take an active part in designing, implementing and monitoring the effectiveness of coastal and ocean management plans, and partners enter into agreements on ocean management plans with specific responsibilities, powers and obligations. It is also recognized that in specific cases, Integrated Management and planning may be achieved through co-management.

of order.

Co-management involves bringing previously excluded, disenfranchised and sometimes alienated user groups and stakeholders into the management decision-making

process (Jentoft 2005). The degree of legitimacy of a management regime will directly influence the degree of compliance by participants (Willman and Insull 1993). A regime which is widely perceived as inequitable, or ineffective, will generate lower compliance or lack of voluntary commitment (Willman and Insull 1993). In this situation, the cost of enforcement may make it impossible to implement management measures, particularly when there are a large number of resource users. Alternatively, a regime based on a wide level of acceptance and, therefore, with the power of moral persuasion from within the group of participants, is possibly the only way to manage widely dispersed marine resources (Willman and Insull 1993).

Increasingly, fishers and regulators are developing forms of “co-management” that requires co-operative behavior among fishers, and between fishers and regulators and government agencies (Grafton 2005) as I mentioned in my comments on your draft, the term “co-management” typically conveys binding, legal obligations. You need to define this term drawing on the relevant literature to back up which definition you’ll be using. These arrangements include, but are not limited to, fishers acting in an advisory role to managers, consultative decision making between fishers and managers and assistance by fishers in stock assessment, monitoring and enforcement (Grafton 2005). A common characteristic of fisheries that are both sustainably managed and generate substantial and on-going benefits is that fishers have (individually and collectively) a decision-making role more specifics on the nature of this role are needed in fisheries management, especially in terms of the nature of fisheries regulations (Grafton 2005). Having good working relationships between fishers and managers promotes the sharing of knowledge and information about the resource (Grafton 2005). Such knowledge exchange can

reduce regulatory costs and improve management outcomes (Grafton 2005). For example, with effective interchange of ideas fishers become better aware of the consequences of their collective actions on the resource, while managers benefit from timely feedback about local changes in the stock and environmental conditions (Grafton 2005). [More details on what co-management means, especially with regards to actual management practices is needed.](#)

The West Coast Vancouver Island Aquatic Management Board exemplifies co-management under an ecosystem-based management scheme. The board acts in an area with 360 km of coastline and involves a complex set of stakeholders, including: four levels of government (federal, provincial, regional district, and tribal council) and seven stakeholder groups (sport, commercial, environmental, aboriginal, aquaculture, labor, processor) (Kearney et al 2007). The Board plays the following roles: as a creator of new modes of regulating local fisheries that were unmanageable under conventional regimes [why would this be?](#); as a creator of synthesized databases and atlases of information about the region; a convenor and facilitator of processes among various stakeholders within and outside its region—connecting them to one another and to the vision of ecosystem management; and as a sponsor of specific projects within the region that would not otherwise happen because of failure to mobilize financial and human resources (Kearney et al 2007). Through the Board, governments have been able to explore a different, more “integrated”, way of operating than the standard sectoral advisory process, and to seek solutions to the puzzle of how to recognize the constitutionally protected rights of aboriginal people, without creating even more conflict ~~without creating even more conflict~~ with other stakeholders (Kearney et al 2007).

The West Coast Vancouver Island Aquatic Management Board helped to ensure the compatibility of goals whose goals? by facilitating federal/provincial/local communication in the creation of the 2003 provincially led Kyuquot Coastal Use Plan, which identified and prioritized potential uses of provincial foreshore and nearshore areas in the inlets and waterways of Kyuquot Sound (Kearney et al 2007). The plan attempted to integrate use by balancing development and environmental protection in high conflict areas, through advisory committee participation with the Kyuquot/Checkleset First Nation, industry, environmental, and recreation organizations (Kearney et al 2007). The Board applied its ecosystem management principles to identify gaps in information, planning, and monitoring, eventually submitting a lengthy and comprehensive commentary on the plan (Kearney et al 2007) I'm confused as to the exact nature of the Board's involvement with the plan. This section needed further work for clarity. Importantly, it praised provincial efforts on 10 points, but also asserted that the plan was merely a first necessary step, and outlined 5 major next steps needed and the importance of being consistent with 5 principles of the Oceans Strategy and the Board's integrated ecosystem principles (Kearney et al 2007) what were the 10 points, 5 major next steps and 5 principles? Be more specific. It helped identify and initiate three follow-up activities which were?, working closely with the local First Nation (Kearney et al. 2007). In this way, the Board acted as a watchdog on provincial initiatives?, and by implication federal what?, implementation of integrated planning processes (Kearney et al. 2007). awkward

Co-management involves incorporating traditional knowledge in a systematic manner; supporting decision-making bodies or advisory boards that include local fishers and community members (like the WCVIAMB); developing processes for dispute resolution; and providing assurance of long-term rights and tenure to the fisheries (Grafton 2005). Co-management means that fishers have both rights and responsibilities to be effective partners in ensuring sustainable fisheries (Grafton 2005). These rights and responsibilities need to be discussed, as do those of the relevant government agencies, especially with regard to power-sharing.

EBM is a management method that looks at fisheries and aquaculture management with a more holistic approach, rather than considering only commercially viable stocks and their habitat. ~~EBM~~ It considers multi-trophic food webs and all associated habitat as well as socio-economic factors. It functions by including stakeholders, promoting co-management and participatory approaches and often includes creating marine protected areas. Awkward closing paragraph to this section. Transition to next section also needed.

UNESCO Biosphere Reserves

Biosphere Reserves are designed to deal with one of the most important questions the world faces today: How can we reconcile conservation of biodiversity and biological resources with their sustainable use (Seville incorrect citation 1995). The concept of biosphere reserves was initiated by a Task Force of UNESCO's Man and the Biosphere (MAB) Program in 1974 (Seville 1995). The reserve network is a key component in MAB's objective for achieving a sustainable balance between the sometimes conflicting goals of conserving biological diversity, promoting economic development and

maintaining associated cultural values. Biosphere reserves are sites where this objective is tested, refined, demonstrated and implemented (Seville 1995).

Biosphere reserves are areas of terrestrial and coastal/marine ecosystems or a combination thereof, which are internationally recognized with the framework of UNESCO's Statutory Framework of the World Network of Biosphere Reserves (Seville [as mentioned above, incorrect citation](#)1995). Each reserve is intended to fulfill three complementary functions; a conservation function, to preserve genetic resources, species, ecosystems and landscapes; a development function, to foster sustainable economic and human development, and a logistic support function, to support demonstration projects, environmental education and training, and research and sustainable development (Seville 1995).

Physically, each reserve must contain three elements: one or more core areas, which are securely protected sites for conserving biological diversity, monitoring minimally disturbed ecosystems, and undertaking non-destructive research and other low-impact uses; a clearly identified buffer zone, which usually surrounds or adjoins the core areas, and is used for cooperative activities compatible with sound ecological practices, including environmental education, recreation, eco-tourism and applied basic research; and a flexible transition area, or zone of cooperation, which may contain a variety of agricultural activities, settlements and other uses in which local communities and stakeholders work together to manage and sustainably develop the area's resources (Seville 1995).

Biosphere [r](#)Reserves are intended to serve as models of sustainability through community focused ecosystem-based ecosystem management (Mendis 2004). As

communities outside the biosphere reserve's official boundary can sometimes contribute to its functioning, the biosphere reserve 'region' may be considered as a broader 'community' (Mendis 2004)[this point is not clear](#). Biosphere reserves have the potential to address some the issues raised by Agenda 21 at the 1992 United Nations conference on Environment and Development in Rio de Janeiro such as: integrating environmental issues into decision making, protecting fragile ecosystems (including all forms of marine environments) and promoting education, public awareness and training (UN 2004). They do so by being places to explore means of balancing human needs and desires with protecting the environment, an important purpose in a world facing such issues as increasing population pressures (Mendis 2004) and associated demands on resources.

In terms of biosphere reserves and marine environments, the UN Law of the Sea (UNCLOS) agreements have given each coastal nation responsibilities for resource conservation within its exclusive economic zone (EEZ), out to 200 nautical miles from shore, an area that previously was a commons. These zones together comprise approximately 30 percent of the Earth's surface (40 percent of the ocean) (Carleton and Gregg 1991). A functional global network of coastal-marine biosphere reserves would help coastal states coordinate their efforts to promote sustainability within their EEZ (Carleton and Gregg 1991). [How so?](#)

Biosphere ~~r~~eserves are ideally suited for coastal-marine areas where human uses and ecosystem processes are so often in strong conflict (Carleton and Gregg 1991). The designation allows for a focus on community involvement which is critical in healthy fisheries and aquaculture management. They also garner support for ecosystem-wide conservation and protection mandates.[This section seems weak with respect to advancing](#)

your thesis.

Transition?

Seaflower Biosphere Reserve

The Archipelago of San Andres, Old Providence, and Santa Catalina, Colombia, in the Western Caribbean (see figure 1)—a UNESCO Biosphere Reserve since November 2000—relies heavily on its coastal and marine resources, which are important for fisheries, tourism, as habitats, and for their traditional cultural value (Mow et al 2007). However, as economic and subsistence importance has increased so have incidences of conflict over resource use and threats to ecosystem health (Mow et al 2007). This area is an interesting and relevant case study involving the creation of multiple-zoning MPAs that were developed through stakeholder involvement within a UNESCO Biosphere Reserve. somewhat awkward and disjointed introductory paragraph

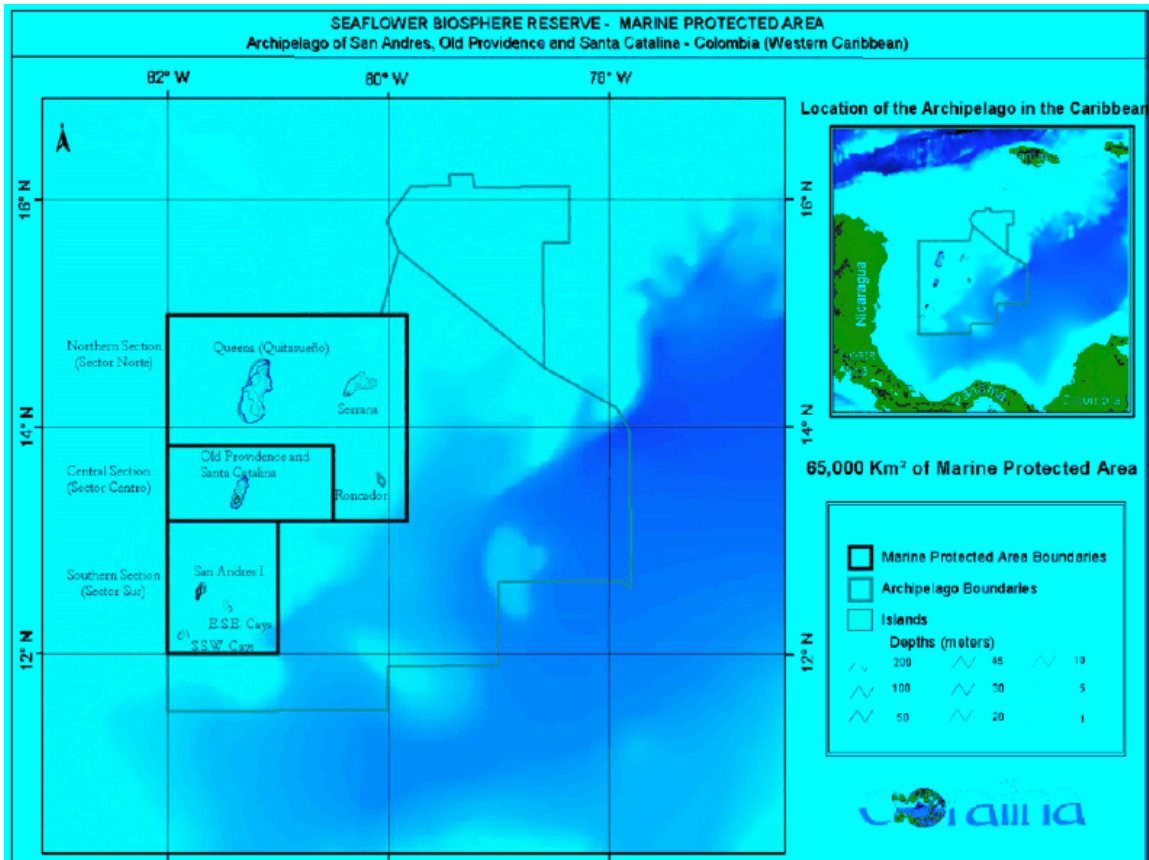


Figure 1: The Seaflower Biosphere Reserve boundaries (Mow et al 2007).

The Corporation for the Sustainable Development of the Archipelago of San Andres, Old Providence and Santa Catalina (CORALINA), is the environmental management agency for the archipelago (Friedlander et al 2003). This agency has extensive authority to manage natural resources and direct the regional planning process for land and marine use (Baine et al 2007). It was CORALINA that submitted the application for biosphere reserve status to UNESCO’s MAB program (Baine et al 2007). As a result, the San Andres Archipelago Seaflower Reserve joined the World Network of Biosphere Reserves on 10 November 2000 (Baine et al 2007). Local islanders in the San Andres Archipelago have placed themselves squarely behind plans for **bBiosphere**

Reserve designation and are willing to participate proactively in its planning and regulation, including the establishment of a system of use zones and MPAs (Baine et al 2007).problems with structure and flow within this paragraph

With its small population and limited tourism, the most frequent user conflict is among artisanal fishers over the use of illegal gear or nontraditional methods (Baine et al 2007)needs more of an explanation. What is meant by the term “artisanal”? The major conflict, at present time,artisanal fishing more frequent source of conflicts, but industrial fishing the major conflict? Needs some explanation. however, centers on industrial fishing by outsiders and takes place primarily in the area of the northern cays ??? (Freidlander et al 1993). Major issues that have resulted from this situation are the increasing difficulty of access to collective fishing grounds by artisanal fishers, failure to respect or acknowledge traditional rights and sea tenures, demands for local autonomy in licensing and management, lack of benefit to the island community, severe overfishing of some species including exploitation of threatened and endangered species, and neglecting to enforce existing fishing regulations that include gear restrictions and closed seasons (Freidlander et al 1993) Many of these points need some explanation. Related consequences are a decline in local income generated from fishing, food shortages of fish, and rising seafood prices (Baine et al 2007). Try to avoid presenting long lists of points without providing commentary or analysis

To facilitate stakeholder consultations on fisheries management, committees of artisanal fishers, known as the Artisanal Fishers Working Groups, were set up on both islands as part of the present project (Baine et al 2007) what present project? The objective of these groups was to promote sustainable fisheries through the development

of management strategies and protection of the rights of traditional artisanal fishers (Baine et al 2007). Needs further explanation. How are they set up? How are their objectives to be achieved? Etc.

During the course of the European Union-funded project examining appropriate marine resource management and conflict resolution techniques for the archipelago this project needed to be properly introduced and explained earlier in this section. (1998–2002), CORALINA engaged local stakeholders in a participatory process specifics of the process? aimed at identifying and meeting management challenges faced by the archipelago's inhabitants (Mow et al 2007). A stakeholder consultation structure specifics? was set up to work on coastal and marine resource issues (Mow et al 2007).

Information about distribution of resources, use patterns, and values was gathered from stakeholders through surveys, interviews, and social mapping exercises (Mow et al 2007). Working groups also produced maps with their preferred allocation of zones based on their knowledge, needs, and use (Mow et al 2007). Early in the planning process, the following MPA objectives were developed in collaboration with stakeholders (Mow et al 2007):

- preservation, recovery, and long-term maintenance of species, biodiversity, ecosystems, and other natural values including special habitats;
- promotion of sound management practices to ensure long-term sustainable use of coastal and marine resources;
- equitable distribution of economic and social benefits to enhance local development;
- protection of the rights pertaining to historical use; and
- education to promote stewardship and community involvement in planning and

management. These points should be single spaced. Also, provide some commentary to ensure reader understands why these points are relevant.

To realize these objectives, five zone types were defined (Mow et al 2007): (1) no-entry, with use restricted to research and monitoring; (2) no-take, allowing a variety of non-extractive uses; (3) artisanal fishing, for use by traditional fishers only; (4) special use, for specific uses like shipping lanes, anchorage, ports, and marinas or uses with the potential to generate conflict like heavily used watersports areas; and (5) general use, where minimal restrictions apply to preserve MPA integrity. Stakeholder groups previously in conflict over resource use began to work together in defining boundaries, zoning and management options for the MPA (Mow et al 2007). So among the artisanal fishers and between them and the industrial fishers? Who was involved is not clear

Since working together in resource management planning was a new experience for all stakeholders, CORALINA began a process of capacity building through public and private environmental education initiatives specifics needed targeting all ages, levels, and groups of the community (Mow et al 2007). In addition to the island-wide outreach program, achievements included developing and implementing an accredited technical degree program in coastal and marine resource management at a local university, introducing island-specific curricula for local schools, and stakeholder training in topics like water quality, MPA management, and coastal and marine ecosystems. (Mow et al 2007). Commentary needed to explain how these initiatives were helpful

Based on the information gathered, CORALINA and the community, together, chose their preferred marine management alternative—the establishment of multiple-use

MPAs (Baine et al 2007). So far the participatory process to plan and manage the Seaflower MPA has succeeded in joining national and local government together with the archipelago community, private sector, and international partners to begin a journey that, if it continues on course, will advance sustainable development, improve environmental justice, and acknowledge rights of tenure to coastal and marine resources (Mow et al 2007).

What role the biosphere reserve designation played is not adequately drawn out.

Summary

Biosphere reserves can provide a mechanism to achieve three main goals pertaining to marine regions. The designation can put pressure of management bodies; to change aquaculture and fishery management ~~practices~~ practices; and to create functional marine protected areas; and to foster co-management/collaborative management. UNESCO Biosphere Reserves allow for the sustainability mandate to be adapted to suite the particular needs of the area. Management of natural resources requires building a broader framework for evaluating competing and conflicting agendas and harmonizing the institutions responsible for advancing them (Murawski 2007). Within a sector, tunnel vision may have been acceptable in the past as it provided short-term fixes, but society is now taking a broader, longer term view of decisions affecting the quality of the environment and human life, and no single entity is in charge (Murawski 2007). Hence, the increasing important of the broad, cooperative stakeholder engagement aspects of EBM is becoming paramount (Murawski 2007).

1999). Marine currents, tides and wave action combine in meeting the nutrient-laden waters of the inland and coastal environment, leading to a rich marine habitat and a diverse mosaic of ecosystems (CBT 1999).

Figure 2: Clayoquot Sound Biosphere Reserve (CBT website). out of order

There are 8 communities in the Clayoquot Sound area: Hot Springs Cove/Hesquit Ahousat, Tofino, Opitsaht, Esowista, Ucluelet, Ittatsoo, and Machoah (CBT 1999). The total population of the sound is less than 5000 (CBT 1999). The area has experienced a shift in recent decades from a primary reliance on logging and fishing to economic diversification (Mendis 2004). Tourism is growing and increasingly catering to high-end resorts, while also spawning eco-tourism operations (Mendis 2004). Aquaculture is another growing industry but is being met with opposition and controversy (Mendis 2004).

Existing parks and protected areas within the core area conserve a wide range of habitats and landscapes (see figure 3), covering approximately 90,412 hectares in the terrestrial component (34% of terrestrial area of 265,705 hectares) and 19,869 hectares in the marine component (24% of marine area of 84,242 hectares) (CBT 1999). The marine component of the reserve is managed to ensure that development, fisheries and resource

uses- including tourism- occur within the context of sustainability and conservation through a wide range of statues and management plans (CBT 1999).

Marine resources are managed under several government agencies and multiple pieces of legislation (see appendices for more details) but predominantly feature the Department of Fisheries and Oceans (DFO) and the Fisheries Act (first enacted in 1857) and the Oceans Act. While periodically revised (most recently in 1991) the focus of the Fisheries Act has been the conservation and protection of commercially exploited species and their habitats (O’Boyle 2007). Responding to both international legislative changes, as well as concerns for the impacts of human activities on its marine ecosystems, Canada enacted the Oceans Act in 1997 (O’Boyle 2007). While fishery management plans under the Fisheries Act continue to focus on target species, the Oceans Act changes the legislative basis for management and now requires consideration of the impacts of all human activities on Canada’s ecosystems in marine management plans (O’Boyle 2007). However, the Oceans Act is enabling legislation, it has no strict requirements, it just suggests a direction of action. The implications of this need to be developed much further, especially with respect to the Fisheries Act.

Marine Core Areas (in hectares)	
Pacific Rim National Park Reserve (Long Beach Unit)	6,763
Vargas Island Provincial Park	4,039
Fiores Island Provincial Park	2,969
Sulphur Passage Provincial Park	1,943
Maquinna Provincial Marine Park	1,398
Hesquiat Peninsula Provincial Park	1,210
Sydney Inlet Provincial Park	691
Strathcona Provincial Park	513
Epper Passage Provincial Park	251

Dawley Passage Provincial Park	92
Upland component of Tofino Mudflats Wildlife Management	420

Marine Buffer Zone Components (in hectares)	
Intertidal component of Tofino Mudflats Wildlife Management	1680
(Further marine buffer zones could be established through future planning processes)	

Marine Transition Zone Components (in hectares)	
All non-core and non-buffer marine areas	62,693

Figure 3: Marine Protected Areas in Clayoquot Sound (CBT 1999) Why is this table relevant?

This section needed to include discussion that draws together fisheries management and biosphere reserves.

Fisheries and Aquaculture in Clayoquot Sound

Historically, the local fishing industry was dominated by activity related to the harvesting and processing of wild salmon (WCVIAMB provide full name first time used date unknown). The sockeye fishery in Clayoquot Sound was once the largest on the coast (WCVIAMB date unknown). This fishery disappeared in the 1970s as a result of over-harvest and habitat loss. Other species accounted for a relatively small share of the industry's output (WCVIAMB date unknown). Today, few commercial fishing vessels (estimated to be less than 50) remain in the region and continue to fish for at least part of each season (WCVIAMB date unknown). However, without access to the few lucrative fisheries that remain (halibut, black cod, herring) why is access an issue? Deserves brief

explanation., the small boat fleet may eventually be financially squeezed out of the industry (WCVIAMB date unknown). More recently, the emphasis of the industry has been on diversification, placing an increased emphasis on species other than salmon (WCVIAMB date unknown) such as halibut, black cod, herring???. It is now recognized that the value of each fishery needs to be maximized through onshore processing, niche market development and value-added product development (WCVIAMB date unknown).

How does value maximization address underlying issues of sustainability?

Shellfish harvesting has formed a consistent component of the region's economy for generations (FOCS again, provide full name first time used 1995). Wild harvest of clams and oysters has traditionally been a staple of the First Nations economy, wild harvest of geoducks, sea cucumber and urchin an important part of their food, social and ceremonial system and the farming of Pacific oysters has been growing steadily since the 1960's (FOCS 1995) run-on sentence. There are currently 68 shellfish tenures in Clayoquot and Barkley Sounds, held by 47 individuals or companies (FOCS 1995). Leases occupy approximately 293 hectares of the marine and foreshore area which total how much? What's the proportion?. At present, Pacific oysters (principally for the shuck market but increasingly for the ??? shell market) are the predominate species grown, with Manila clams a distant second (FOCS 1995).

In Clayoquot Sound, there are 21 salmon farm tenures (see figure 4), the majority of which are owned by Mainstream/Cermaq and Creative Salmon Company (FOCS 1995). Salmon farming is a very contentious issue in the region because of possible impacts on wild stocks and the marine environment some mention needs to be made of

the farmed species being different from wild stocks. However, it can also provide employment for the region how much? Is it significant? Needs more explanation/discussion. The aquaculture industry may also provide opportunities for secondary industries including net cleaning and storage (WCVIAMB date unknown).

Weak section. Much greater discussion was needed to draw out salient points



Figure 4: Salmon tenure sites in Clayoquot Sound (FOCS 2006)

Discussion/Analysis

Sustainable use of the marine environment requires a more holistic approach than what has been done in the past. Ecosystem based management (EBM) is widely regarded

as the new wave in resource management. When considering all of Clayoquot Sound in terms of long term use of the marine environment- and all other uses as well- changes in management need to be made to guarantee ecosystem health and sustainability. Much of the policy and legislation framework already exists but has yet to be acted on or implemented in most cases. Not adequately demonstrated

Considering the previous literature review and the example from Columbia's Seaflower Biosphere Reserve, there are four main components to sustainable fisheries and aquaculture, these include: changing current fisheries management practices, aquaculture trends, creating functional marine protected areas and having a greater level of community/co-management of resources.

Culturing lower trophic level species requires less inputs –mainly fishmeal- and usually has less of impact on the surrounding environment and biodiversity neither discussed nor supported with references. Also, polyculture means less wastes are diffused to the marine environment. An example of this is the Pacific SEA-lab initiative, which is based in Clayoquot Sound, north of Clayoquot. There, they are working on culturing sablefish with sea cucumbers below the cages to decrease the impact on the sea floor, as well as oysters, scallops and kelp to filter out the nutrients released by the fish into the water column (SEA-lab 2007).

MPAs are needed, but are only part of the solution. Like reserves on land, setting aside areas helps conserve biodiversity but will not solve all of humanity's problems. They are necessary, but are only part of the solution. MPAs can take many forms including no-take reserves, but also seasonal fisheries closures. In Clayoquot Sound,

there are several rockfish closures. Rockfish are a species that are slow growing and fairly sedentary therefore those species respond well to MPAs. [Supporting references?](#)

As recognized by several pieces of legislation from both Canada and abroad, fisheries management needs to be more holistic in terms of ecosystem based management and stakeholder involvement. A perfect example of this type of cooperation [at least in theory. There was no critical analysis of how well the board is functioning.](#) is the West Coast Vancouver Island Aquatic Management Board (WCVIAMB), which has Clayoquot Sound within its jurisdiction. On the board are representatives from governments, First Nations, fisherman and community members and they have been mandated by DFO to work together to make fishery management decisions (WCVIAMB date unknown). The objective of the Board is to lead and facilitate the development and implementation of a strategy for the integrated management of aquatic ecosystems in the management area, in a manner consistent with statutory authorities, policies, standards, and processes, which will: protect, maintain and rehabilitate aquatic resources, manage aquatic resources on an ecosystem basis, respect and protect First Nations' food, social and ceremonial requirements and treaty obligations (WCVIAMB date unknown). Part of the vision of the board is to manage aquatic resources on an ecosystem basis, which is consistent with the principles of Hishukish Ts'awalk (everything is one) and Isaak (respect) (WCVIAMB date unknown). The belief underlying these two principles is that the goal in interacting with others is not to maximize personal benefit, but to produce mutually beneficial outcomes (WCVIAMB date unknown). These outcomes arise from understanding and respecting the needs of other people or species, and recognizing an essential 'oneness' or

interconnection with all people and species (WCVIAMB date unknown). All of this information should have been included under the section above dealing with the Board.

A Biosphere reserve designation can provide a venue for all stakeholders to be involved in working towards the common, mutually beneficial goal of sustainability. The biosphere reserve and the CBT can promote better communication between stakeholders who might otherwise never deal directly with one another. Because the goals what goals? are agreed upon -or at least outlined for all to see- the biosphere designation can circumvent some of the jurisdictional complexity involved in managing marine ecosystems. The ability to work on a level-playing field where decisions are not just top-down and government initiated can allow stakeholders to move beyond the mistrust they may have for the government, which is seen so often in fisheries management and marine protected area establishment. The points raised in this paragraph needed to be much better developed.

The Biosphere Reserve can increase community and stakeholder awareness of the issues at a local level how so?, but also on an international level because it is an international designation and thus promotes a certain level of 'global citizenship'. It also can promotes support for international initiatives such as the FAO Code of Conduct for Responsible Fisheries, to which Canada is a signatory.

Finally, the bBiosphere reserve designation in its very nature promotes more research –in both science and social science- which is mandated in the Ocean's Act. More research and monitoring will help in all aspects of marine resource management and the promotion of sustainability.

Another weak section. Presents critical points that are inadequately discussed. Little critical analysis evident.

Conclusion

The Clayoquot Biosphere Trust can play a key role in promoting sustainable fisheries and aquaculture by improving stakeholder involvement and co-management, providing funding community education and research into fisheries and aquaculture and supporting marine protected areas. Valid points but deserve further discussion

Clayoquot Sound is in a unique position within Canadian biosphere reserves, as well as globally, in that it they is blessed with have access to consistent financial resources to fund projects the work towards sustainability. A large body of research has been done in the fields of marine resource management and ecosystem based management. What is required now is acting on all the legislation and policy through community-wide initiatives that are collaborative and transparent to all stakeholders.

Weak conclusion.

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[Excellent references. Solid research.](#)

