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Science Advisory Report 2012/075

EVALUATION OF PROPOSED ECOLOGICALLY AND BIOLOGICALLY SIGNIFICANT AREAS IN MARINE WATERS OF BRITISH COLUMBIA

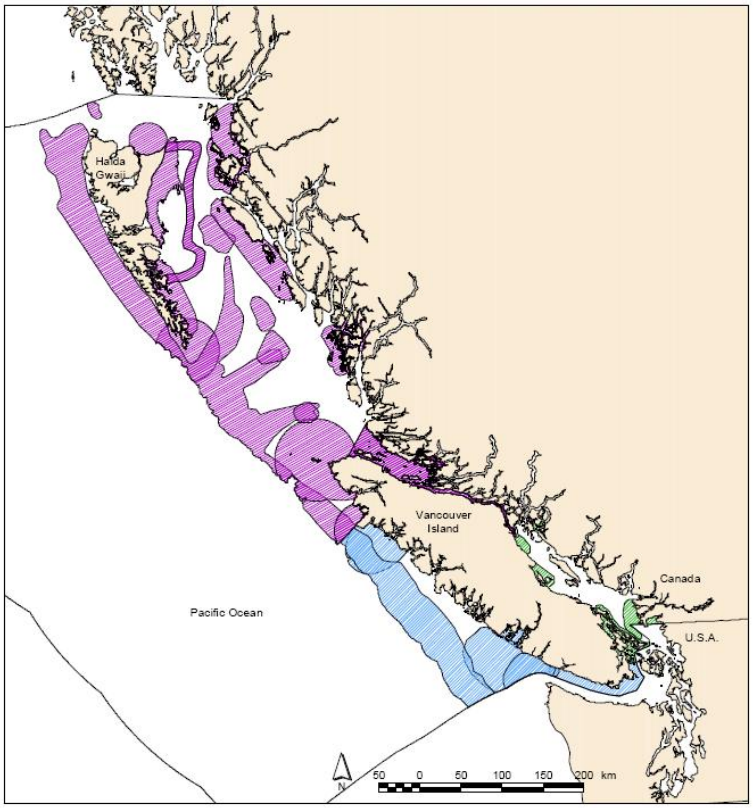

Figure 1: Canadian Pacific marine waters, illustrating the proposed ecologically and biologically significant areas (EBSAs). Purple shading represents those EBSAs in the Northern shelf ecoregion, blue in the Southern shelf ecoregion, and green in the Strait of Georgia ecoregion. In addition, note that at the scale of the B.C. coast, the entire Strait of Georgia is proposed as an EBSA (Ian Murfitt kindly provided technical support in producing the maps).

Context :

Canada's Oceans Act provides the legislative framework for an integrated ecosystem approach to management in Canadian oceans, particularly in areas considered ecologically or biologically significant. DFO has developed general guidance for the identification of ecologically or biologically significant areas. The criteria for defining such areas include uniqueness, aggregation, fitness consequences, resilience, and naturalness. This science advisory process identifies proposed ecologically and biologically significant areas (EBSAs) in Canadian Pacific marine waters, specifically in the Strait of Georgia, along the west coast of Vancouver Island (southern shelf ecoregion), and in the Pacific North Coast Integrated Management Area (PNCIMA, northern shelf ecoregion).

This Science Advisory Report is from the February 7-8, 2012 Pacific Regional Advisory Process on Evaluation of Proposed Ecologically and Biologically Significant Areas in Marine Waters of British Columbia. Additional publications from this process will be posted as they become available on the Fisheries and Oceans Canada Science Advisory Schedule at www.dfo-mpo.gc.ca/csas-sccs/index-eng.htm.

SUMMARY

- Using the DFO criteria for defining ecologically and biologically significant areas (EBSAs), 18 EBSAs are proposed in the northern shelf ecoregion (Pacific North Coast Integrated Management Area; PNCIMA), 7 EBSAs are proposed in the southern shelf ecoregion (west coast of Vancouver Island), and 8 EBSAs are proposed in the Strait of Georgia. On the spatial scale of the British Columbia coast, the entire Strait of Georgia is proposed as a single EBSA.
- Identifying areas which are important for species or groups of species based on uniqueness, aggregation, fitness consequences, resilience, and naturalness ("Important Areas") is a key step in the EBSA identification process. The use of physical oceanographic features, geographic bottlenecks, and unique areas that overlap with species-specific Important Areas is an acceptable approach to identifying EBSAs in Canada's Pacific marine waters. Any physical oceanographic features or geographic bottlenecks that are not associated with species' Important Areas are not considered as EBSAs.
- Information on species' Important Areas must be retained in an available and accessible form. This information may be important for some management and spatial planning issues. Updates on information related to Important Areas or physiographic features may also lead to future updates in the EBSAs which reflect these Important Areas and physiographic features.
- Guidance is needed for marine resource managers on how best to use EBSAs in management decisions. Such guidance should include how to deal with the uncertainty surrounding the exact location of boundaries of the identified EBSAs.
- The process of identifying ecologically significant species (ESSs) should be completed to provide complementary information to spatially-explicit EBSAs.
- EBSAs in any one ecoregion should be re-evaluated and updated with new information approximately every 5 years.
- Significant aspects for improvement in the process for identifying EBSAs in Pacific Region include expanding the fish species considered beyond those of primarily commercial interest, expanding the range of experts surveyed to identify species' Important Areas (and expanding the use of literature sources when available), and improving the consideration of nearshore areas (e.g. estuaries, river mouths, beaches and other shallow subtidal areas). At present, all estuaries and river mouths supporting anadromous species have been defined as EBSAs, although they are not mapped due to their small spatial scales.

BACKGROUND

Canada's Oceans Act states that "conservation, based on an ecosystem approach, is of fundamental importance to maintaining biological diversity and productivity in the marine environment". This act provides the legislative framework for an integrated ecosystem approach to management in Canadian oceans, particularly in areas considered ecologically or biologically significant. DFO has developed guidance for the identification of ecologically or biologically significant areas (EBSA) (DFO 2004, 2011), and has endorsed the scientific criteria of the Convention on Biological Diversity (CBD) for identifying ecologically or biologically significant marine areas as defined in Annex I of Decision IX/20 of its 9th Conference of Parties (UNEP/CBD, 2008).

The identification of EBSAs in the Canadian Pacific Region will serve as a key component of the knowledge base for: i) regional development activities and marine use planning; ii) the development of Canada's network of marine protected areas (MPAs) under the Oceans Act; and iii) facilitating the implementation of DFO's sustainable fisheries framework (http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/overview-cadre-eng.htm) under the Fisheries Act. In addition, this information will be of value to other federal departments and the province of British Columbia who are responsible for the management of marine activities in this region (e.g. resource extraction, marine shipping, ocean dumping, spill response, cable laying, land use planning, etc.).

INTRODUCTION

This Science Advisory Report identifies the consensus ecologically and biologically significant areas (EBSAs) in Canadian Pacific marine waters, specifically the northern shelf (Pacific North Coast Integrated Management Area; PNCIMA), the southern shelf (west coast of Vancouver Island), and the Strait of Georgia ecoregions. This report does not review the specific methods for identifying ecologically and biological significant areas; these have been reviewed as part of national DFO advisory processes (DFO, 2004; 2011). The report provides recommendations for EBSAs and potential next steps to improve the identification of EBSAs in Canadian Pacific marine waters.

Ecologically and biologically significant areas are a tool for management; they are intended to identify areas in need of enhanced management that supercede the management needs of individual species. The process for identifying EBSAs involves assessing proposed areas in terms of three core criteria and two supplemental criteria (DFO 2004). The core criteria are (a) uniqueness: unique, rare, distinct features; (b) aggregation, including areas where most individuals of a species are aggregated for some part the year; and (c) fitness consequences: defined as areas that are used by species for life history activity(ies) and that make a significant contribution to the fitness of individuals of those species. An EBSA would meet one or more of these three core criteria. The supplemental criteria are (d) resilience, defined to include areas where the habitat structures or species are highly sensitive, easily perturbed, and slow to recover and areas where the habitat structures or species are robust, resistant to perturbation, or readily return to the pre-perturbation state; and (e) naturalness, being areas which are pristine and characterised by (predominantly) native species. Resilience and naturalness should be considered in the context of potential future developments in the application of an ecosystem approach.

ANALYSIS

The approach to identify ecologically and biologically significant areas (EBSAs) in Pacific marine waters focused on Pacific continental shelf regions, i.e. excluding the deep offshelf areas (with seafloor depths greater than 500 m) and most nearshore areas (defined as 0.25 to 0.5 km from the coastline). These shelf regions were divided into three ecoregions (DFO 2009): northern shelf (convergent with the Pacific North Coast Integrated Management Area, PNCIMA), southern shelf (west coast of Vancouver Island), and the Strait of Georgia.

Identification of EBSAs in each of these regions followed a two step process. In step 1, a "Delphic process" was used in which species experts were canvassed for their recommendations on 'Important Areas' (IA's) for individual species (or in some cases, groups of related species) based on the EBSA criteria (defined above). The result was that all marine waters in Pacific Canada were identified as important for at least one species or group of species. A process was needed, therefore, to synthesize these species-specific Important Areas

into a smaller number of spatially distinct EBSAs. Three sets of physiographic features were used to identify the EBSAs: physical oceanographic features (such as gyres and eddies, fronts, upwelling regions, etc.), geographic bottlenecks (e.g. estuaries, river mouths, narrow passages such as Discovery Passage at the northern boundary of the Strait of Georgia), and unique areas (such as the hexactinellid sponge reefs). Thus in the Pacific Region, IAs are identified on the basis of expert knowledge about the biology of individual species or groups of species, while EBSAs are primarily identified on the basis of expert knowledge about physiographic features which include important areas for at least one species or species group. Several considerations concerning this process are important to note:

Species

This approach of using expert opinion in Step 1 tends to bias the identification of EBSAs towards species for which more information is available, i.e. those of commercial or 'charismatic' (e.g. hexactinellid sponge reefs, marine mammals) interest. Detailed information was not available for some species, so they have been considered at a higher level of taxonomic aggregation (e.g. marine birds, whales). In addition, Important Areas were not identified for all life history stages of each species or group of species. Some species that were not considered in this EBSA process (e.g. kelps) will be considered in the process to identify ecologically significant species (DFO 2006).

Experts

Experts contacted for this process were largely resident in British Columbia, and most were affiliated with Fisheries and Oceans Canada. Typically, one expert was consulted for each species or group of species.

Boundaries

The boundaries for the identified EBSAs were based on expert knowledge and are presented as solid lines on maps. In practice, these should be considered as dynamic and uncertain (fuzzy) boundaries which depend on the characteristics of the constituent species and the underlying oceanographic features. As a result of the fuzzy nature of these boundaries, there may be overlaps between adjacent EBSAs in some cases. Nearshore features such as river mouths and estuaries are difficult to delineate. They are potential EBSAs because they are geographical bottlenecks which are important for migrating salmon and other anadromous species, but their small geographic extent and dynamic nature make them difficult to represent on coarse scale maps. In this analysis, all river mouths and estuaries of importance to salmon populations and other anadromous species (e.g. eulachon) have been identified as EBSAs, but are not represented on maps of EBSAs in this report.

It is also important to note that ecological boundaries (i.e. of an EBSA) may not be consistent with political boundaries, such that the EBSA may in fact extend into another political jurisdiction. A principal example is the Juan de Fuca eddy EBSA in the southern shelf region which, ecologically, extends into U.S. territorial waters.

Proposed Ecologically and Biologically Significant Areas

This process identified 18 EBSAs in the northern shelf (PNCIMA) ecoregion, 7 in the southern shelf (west coast of Vancouver Island) ecoregion, and 8 in the Strait of Georgia ecoregion, including one EBSA that comprises the entire Strait of Georgia.

Northern shelf ecoregion

The EBSAs identified for the northern shelf (PNCIMA) region are summarised in Table 1 and presented in Figure 2. They are largely based on information that is more than five years old. New information is now available for several species. However, the more recent information was not presented or evaluated in this scientific advisory process in a uniform manner. Suggestions for updating species' Important Areas and re-evaluating identified EBSAs are provided later in this document.

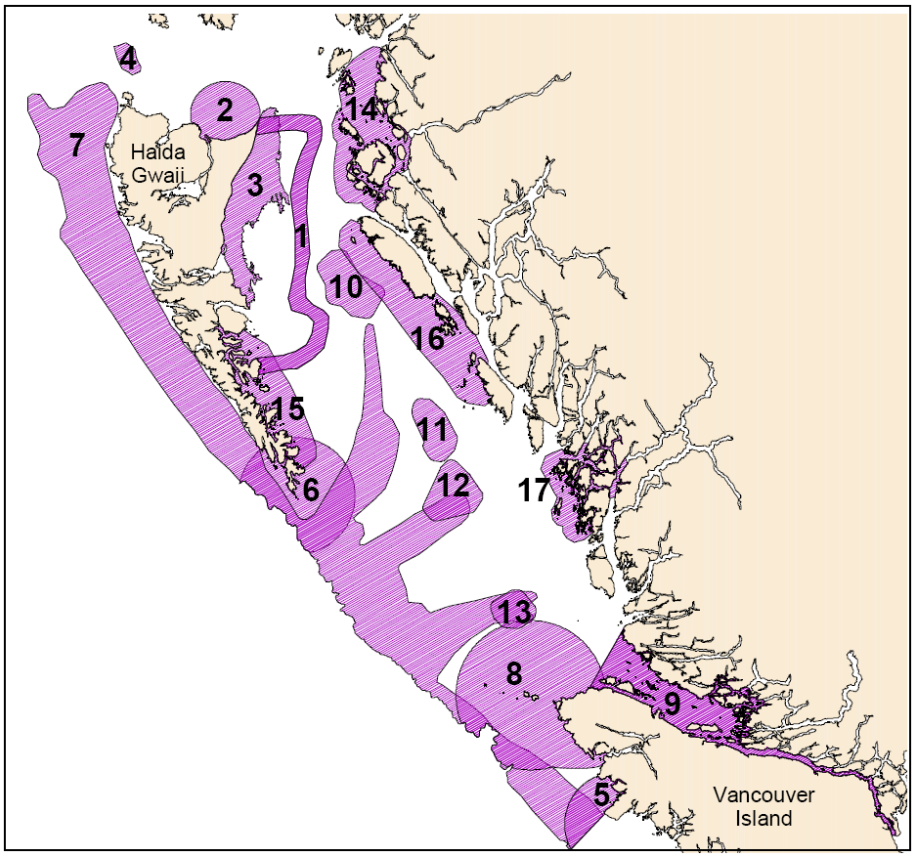

Figure 2. Proposed ecologically and biologically significant areas (EBSAs) for the B.C. Northern Shelf Region (Pacific North Coast Integrated Management Area; PNCIMA). Numbers correspond to the EBSAs defined in Table 2.

Table 1 Proposed ecologically and biologically significant areas (EBSAs) for the British Columbia northern shelf ecoregion (Pacific North Coast Integrated Management Area: PNCIMA).

EBSA		Physical Features	Uniqueness	Aggregation	Fitness Consequences	Level of Confidence
1	Hecate Strait front	• spring to fall tidal front		• zooplankton		Insufficient information in report to assign confidence
2	McIntyre Bay	• gyre – retains plankton		• zooplankton • marine birds • eulachon • razor clams • Dungeness crabs • Weathervane scallops	• halibut rearing • herring foraging • northern killer whales (summer) • humpback whale feeding	High
3	Dogfish Bank	• large bank with soft sediments	• largest shallow area in region	• marine birds • Dungeness crabs	• larval rearing area for many invertebrate species • Pacific cod rearing • flatfish rearing	High (more info is now available, in particular for marine mammals – reinforces high confidence)
4	Learmonth Bank	• isolated bank concentrates plankton	• locally-unique feature		• marine bird foraging area	High (recent information indicates large aggregations of corals and fin whales)
5	Brooks Peninsula	• narrow continental shelf • strong offshore flowing currents • north/south species 'boundary'		• sea otters • green sturgeon • Olympia oysters	• marine bird breeding and rearing • lingcod spawning and rearing	High
6	Cape St. James	• formation of offshore eddies • strong currents connecting Hecate Strait and offshore regions	• formation of offshore eddies • strong currents connecting Hecate Strait and offshore regions	• halibut • corals	• Steller sea lion pupping and foraging • Humpback whales	High (species missing from original report include: blue, sei, fin whale aggregations, rockfish, marine bird foraging areas)
7	Shelf break	• circulation features and plankton aggregations		• Pacific hake (in warmer years) • corals	• marine bird colonies and foraging area • humpback whale foraging	High

				• sponges • high Tanner crab bycatch	• Sperm, fin, blue, sei whale feeding and migrations • fur seal foraging • eulachon foraging • sablefish spawning • dover sole spawning • rockfish (Pacific Ocean perch, Yellowtail, Yellowmouth) spawning	
8	Scott islands	• upwelling and strong tidal mixing drives high plankton productivity		• sea otters	• key breeding area for marine birds • gray whale foraging and migrations • humpback whale feeding • Steller sea lion breeding • Pacific cod spawning and rearing • Lingcod spawning and rearing • Sablefish spawning • Pacific hake foraging (warm years) • Herring foraging (summer)	High (recent info suggests may be important for spawning of sand lance and widow rockfish)
9	North Island Straits	• migration corridors and bottleneck areas	• Resident killer whale foraging (summer-fall)	• Humpback whales • salmon migrations • herring migrations • high shrimp catches • green sea urchins • sea otters	• marine bird breeding locations • gray whale foraging • resident killer whale foraging (summer-fall)	High (recent information indicates this area is important habitat for resident killer whales)
10-13	Sponge reefs		• reef-building hexactinelid sponges			High

			(globally unique)			
14	Chatham Sound	• major river outflow region with strong tidal mixing • high phytoplankton biomass and productivity		• staging areas for black and white winged scoters during migrations • green sea urchins (Prince Rupert area) • Dungeness crab • High shrimp aggregations and species diversity	• herring spawning • northern resident killer whale feeding (summer) • humpback whale feeding (summer-fall)	High (recent information indicates significant fishing grounds for several invertebrate benthic species)
15	Haida Gwaii nearshore	• intertidal and nearshore areas • tidal mixing • tidal fronts • high productivity		• fin, humpback whales • red urchins and sea cucumber	• herring spawning • marine birds (Sooty shearwaters) • pacific cod foraging	High (new information indicates this area is important for steller sea lion pupping and northern abalone aggregations)
16	Central mainland	• strong tidal mixing • tidal fronts • freshwater plumes		• sea otters	• Steller sea lion rookery • marine bird (sooty shearwaters) moulting and sheltering areas • northern killer whale feeding • fin, humpback whale feeding	Medium for nearshore species; high for offshore (important for gray whale migrations and several benthic invert species not included in report; also important for rockfish)
17	Bella Bella nearshore	• intertidal and nearshore • tidal mixing and fronts • plankton concentrations		• sea otters • geoducks • red urchins and sea cucumber • manila clams • shrimp (3 spp) • northern killer whales	• herring spawning and rearing	Medium for nearshore species; high for offshore
18	River mouths and estuaries	• estuarine regions as bottlenecks for anadromous species		• salmon • eulachon		High

Southern shelf ecoregion

The EBSAs identified for the southern shelf ecoregion are summarised in Table 2 and presented in Figure 3. The EBSA identified for the Juan de Fuca eddy (EBSA #22) is completely subsumed within the EBSA identified on the continental shelf west of Barkley Sound (EBSA #21). This was done to recognize the importance of the Juan de Fuca eddy as a distinct feature in the larger context of this shelf area. The nearshore areas along the west coast of Vancouver Island are important for local species and for feeding by migrating grey whales, but were inadequately characterised and represented in this EBSA process. They should be considered in a future EBSA identification process which is focused on the nearshore areas.

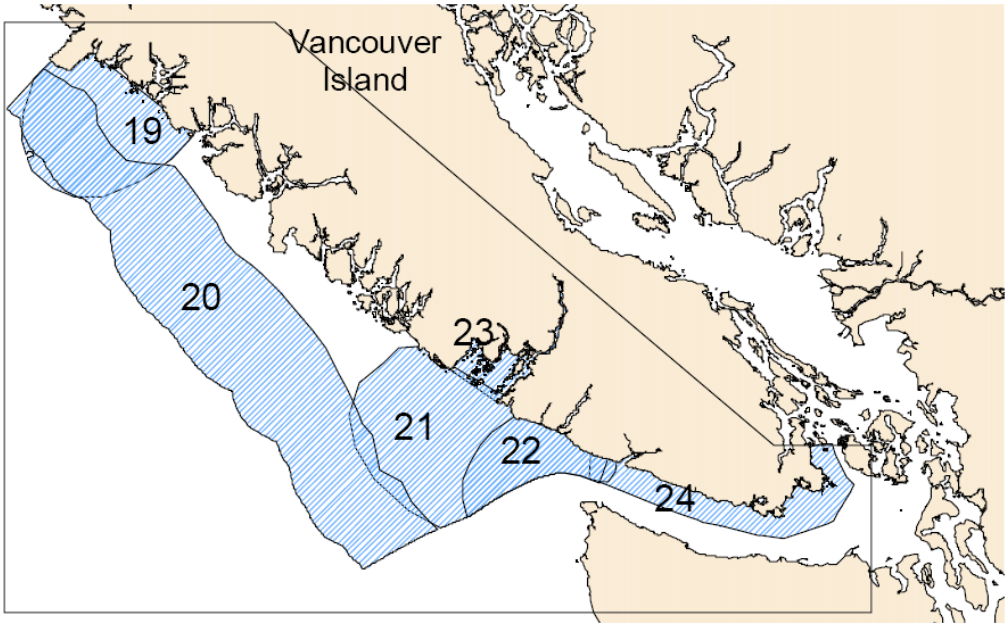

Figure 3. Proposed ecologically and biologically significant areas (EBSAs) for the B.C. Southern Shelf ecoregion (west coast of Vancouver Island). Numbers correspond to the EBSAs defined in Table 2.

Table 2 Proposed ecologically and biologically significant areas (EBSAs) for the British Columbia southern shelf ecoregion (west coast of Vancouver Island).

EBSA		Physical Features	Uniqueness	Aggregation	Fitness Consequences	Level of Confidence
19	Brooks Peninsula (adjoins EBSA #5 in the Northern shelf ecoregion)	• circulation jets • high plankton productivity • bottleneck area between Brooks Peninsula and shelf break	• Halibut distributions	• marine birds • Blue, sperm, sei, fin, humpback, gray whale migrations • sea otters • Green sturgeon migration route • sardine foraging and migration route • Pacific hake migrations • high bycatch of corals and sponges • Tanner crab distributed along shelf break • smooth pink shrimp aggregations	• marine bird foraging • Steller sea lion foraging and haul-out sites • migration and foraging areas for juvenile salmon • adult herring spawning and rearing • juvenile herring rearing • Petrale sole winter spawning and summer distributions	High
20	Shelf break	• high productivity • high aggregation of plankton • site of strong trophic transfers	• Pacific sleeper sharks	• sardine migration and foraging • Basking shark sightings • major distributions of big skate, longnose skate, and sandpaper skate • Pacific hake migrations • English sole distributions • high coral and sponge bycatch • smooth pink shrimp • habitat for slope rockfish spp	• marine bird foraging areas • Blue, sei, sperm, and fin whale foraging • fur seal foraging • important feeding area of humpback whales • Steller sea lion foraging • juvenile salmon migration and foraging • juvenile and adult herring feeding • eulachon feeding • Dover sole spawning (winter) • Petrale sole spawning (winter)	High
21	Continental shelf off of Barkley Sound	• highly productive submarine banks due to convergent circulation and shallow depths		• Gray whale migration route and summer feeding • Green sturgeon • Dungeness crab • shrimp (5 species)	• pelagic marine birds foraging • Humpback whale foraging • Southern resident killer whale foraging • Harbour porpoise foraging (summer) • Northern fur seal foraging • Steller sea lion foraging and haul-	High

EBSA		Physical Features	Uniqueness	Aggregation	Fitness Consequences	Level of Confidence
		• plankton aggregations • high trophic transfer			out sites • eulachon migration route and offshore feeding • herring spawning and rearing • sand lance spawning • sardine foraging and migrations • Pacific hake foraging • Pacific cod spawning and foraging	
22	Juan de Fuca eddy	• high productivity • retention area • temporally dynamic feature • bottleneck	• Unique eddy feature within WCVI EBSA #21 (higher temporal variability)	• Harbour porpoise • Gray whale • Northern fur seal • Green sturgeon migrations • Basking shark • Dover sole • Petrale sole • shrimp (2 spp)	• marine bird foraging • Southern resident killer whale foraging • Humpback whale foraging • Steller sea lion foraging and haul-out sites • juvenile salmon migration and foraging • eulachon foraging • sardine foraging • sand lance spawning • Pacific hake foraging • herring foraging	High (subsumed into EBSA #21)
23	Barkley Sound and Alberni Inlet	• geographic bottleneck	• Pacific hake (resident) inshore stocks	• Pacific loons and duck wintering • pelagic seabirds (pigeon guillemots, marbled murrelets) • Green sturgeon migrations • Basking shark historical concentrations • Olympia oyster • Pacific oyster • shrimp (2 spp)	• Surf scoters wintering and foraging • Gull and pelagic cormorants nesting • Resident gray whale foraging • Humpback whale foraging • Harbour seal foraging • Steller sea lion foraging • adult and juvenile salmon foraging and migrations • herring spawning and foraging • juvenile eulachon rearing • sardine foraging • flatfish nearshore juvenile rearing	High
24	Juan de Fuca Strait	• geographic bottleneck	• Southern resident	• Harbour porpoise • eulachon migrations	• Resident gray whale foraging • juvenile and adult Pacific salmon	High

EBSA		Physical Features	Uniqueness	Aggregation	Fitness Consequences	Level of Confidence
			killer whale critical habitat	• Dover sole (summer) • Pacific hake • green sea urchins • Dungeness crabs	foraging and migrations • herring spawning and migration corridor	
25	River mouths and estuaries (WCVI)	• estuarine regions as bottlenecks for anadromous species			• salmon • marine birds	High confidence for anadromous species; medium confidence with other species (e.g. crabs)

Strait of Georgia ecoregion

The EBSAs identified for the Strait of Georgia ecoregion are summarised in Table 3 and presented in Fig. 4. The Strait of Georgia is the smallest ecoregion in Canadian Pacific marine waters (and the smallest among all of Canada's marine ecoregions, DFO 2006). The approach of using physiographic features to identify EBSAs is problematic for the Strait of Georgia. It is a physically complex area, and much of the Strait can be considered as being near shore. Some physical oceanographic features which are used to define EBSAs in other Pacific regions, such as areas of strong vertical stratification or mixing, can occur throughout the entire Strait of Georgia, suggesting that the entire Strait could be defined as an EBSA. In addition, the entire Strait is important for several species of fish, notably anadromous salmonids which rear in the Strait and undertake migrations to and from other coastal and oceanic regions in the Pacific Ocean through Johnstone Strait and Juan de Fuca Strait. There are also distinct areas within the Strait of Georgia which are important for several species (e.g. river mouths, Baynes Sound, Southern Gulf Islands, hexactinellid sponge reefs). Thus, the entire Strait of Georgia is identified as an EBSA along with smaller areas within the Strait of Georgia (e.g. the Gulf Islands, Fraser River estuary, etc.), as listed in Table 3. Other spatial management tools should be examined along with EBSAs for managing appropriate issues within the Strait of Georgia.

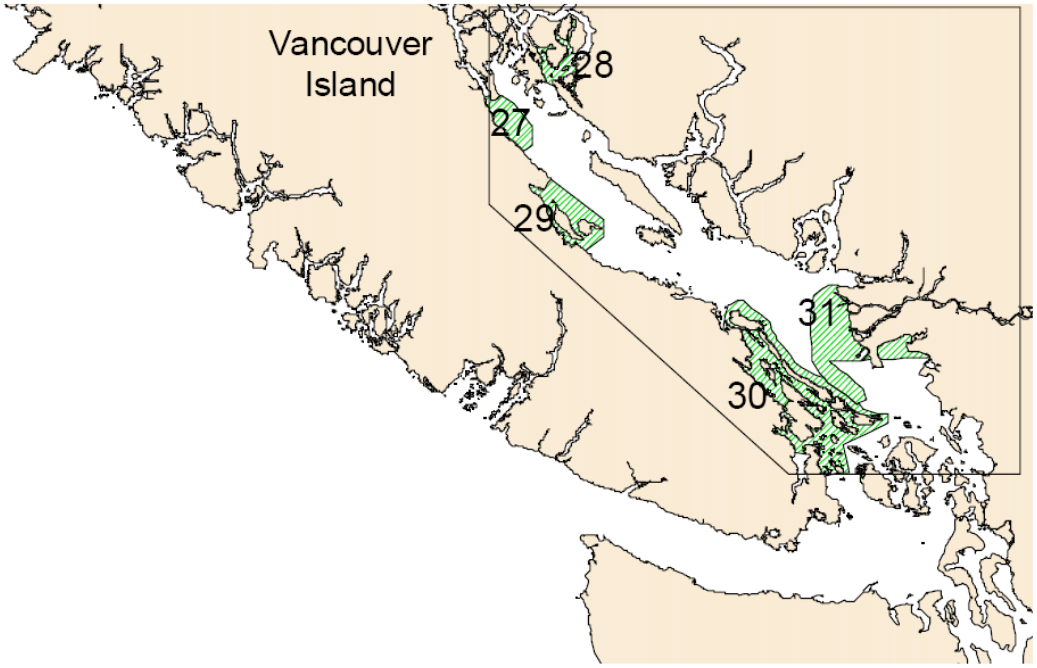

Figure 4. Proposed ecologically and biologically significant areas (EBSAs) for the Strait of Georgia. Numbers correspond to the EBSAs defined in Table 3.

Table 3. Proposed ecologically and biologically significant areas (EBSAs) for the Strait of Georgia ecoregion, British Columbia.

EBSA		Physical feature	Uniqueness	Aggregation	Fitness consequences	Level of confidence
26	Strait of Georgia	• entire Strait		• migratory bottleneck for juvenile and adult salmonids	• rearing for juvenile salmonids	Medium
27	Discovery Passage (adjoins EBSA #9 in the Northern shelf ecoregion)	• geographic bottleneck; • biological front; • mixed waters via tidal currents		• high densities of green urchin and spiny and pink scallops	• foraging area for harbour seals; • haul out site for harbour seals; • rearing and spawning site for herring (and possibly sand lance) • salmon migration route	Low - Medium
28	Desolation Sound and Pendrell Sound	• thermally stratified waters; rocky substrate • low tidal exchange		• Purple-hinged rock scallop	• wintering habitat for surf scoters; • used by breeding marbled murrelets; • migration routes through inlets for juvenile and adult salmon; • rearing and spawning sites for herring; • hake foraging area; • Pacific oyster recruitment;	High
29	Baynes Sound	• thermally stratified waters; • soft substrate; • biological fronts	• key location for marine birds	• high density of butter clam	• staging area for marine birds (e.g. brant, harlequin ducks); • foraging area and haul out for Steller sea lion; • spawning and rearing area for herring	High
30	Southern Gulf Islands	• vertically mixed waters via tidal currents; • some stratified sections; • biological fronts inside some passages (Porlier, Active; Saanich Inlet)	• seven glass sponge reef complexes	• high harbour porpoise abundance during summer; • high densities of green sea urchin, pink and spiny scallops, and Tanner crab; • aggregations of Dungeness crabs	• critical habitat for southern resident killer whales; • foraging and haul out sites for harbour seals; • rearing areas for juvenile salmon, herring, and possibly eulachon • herring spawning area; • potential spawning and burrowing habitat for sand lance • structural habitat formed by sponge reefs	High
31	Fraser River Estuary and Boundary	• salinity driven stratified water; • biological front;	• glass sponge reef	• high abundance of harbour porpoise; • aggregations of	• Boundary Bay is an important marine bird wintering ground (e.g. Trumpeter swans, snow geese, ducks, Western sandpipers);	High

EBSA		Physical feature	Uniqueness	Aggregation	Fitness consequences	Level of confidence
	Bay	• extensive intertidal area		Dungeness crab and shrimp; • aggregations of anadromous species; • important migratory bottleneck for anadromous species	• critical habitat for southern resident killer whales; • foraging and haul out sites for harbour seals; • juvenile salmon and eulachon rearing; • juvenile rearing and spawning for herring; spawning area for walleye Pollock; • habitat structure created by sponge reef	
32	Sponge Reefs	• 16 glass sponge reef complexes have been identified in the Strait of Georgia; they are important habitat forming features in soft bottom regions				High (see Table 4 for locations)
33	All River Mouths and Estuaries	• all waters off river mouths and associated estuaries • geographic bottlenecks		• aggregations of anadromous species	• staging and migration routes for anadromous species (salmon, eulachon) • foraging areas for marine birds and mammals	High (for those with anadromous species; medium confidence for those without anadromous species)

Table 4. Nominal locations of hexactinellid sponge reefs in the Strait of Georgia ecoregion (proposed as EBSA #32).

Number (in chronological order of discovery)	Nominal location	Reference
1	Fraser River (in EBSA #31)	Conway et al. 2005
2 - 4	McCall Bank	Conway et al. 2007
5	Parksville	Conway et al. 2007
6	Nanaimo (in Gulf Islands EBSA #30)	Conway et al. 2007
7 – 12	Active Pass (in Gulf Islands EBSA #30)	Conway et al. 2007
13	Coulee Bank	Conway et al. 2007, Cook et al., 2008
14	Howe Sound (Passage Island)	Cook et al, 2008
15	Howe Sound (Defence Islands)	Marliave et al., 2009
16	Ajax Bank	K. Conway (Natural Resources Canada, unpublished data)

Sources of Uncertainties

This section describes some of the major (known) sources of uncertainty relating to the identification of ecologically and biologically significant areas (EBSAs) in Pacific Region. Some of these are noted above, including the selection of species, aggregation of species into groups, fuzzy boundaries, variable data quality, the selection of experts, and the reliance on expert knowledge as opposed to the published literature. Experts were not asked to identify species-specific Important Areas for a particular time period. Therefore this information is likely integrated over different time periods for different species. The Delphic approach used to compile expert knowledge in this process makes it difficult to assess the suitability of EBSAs to potential future changes in environmental conditions.

Information for the northern shelf ecoregion (i.e. PNCIMA) is at least 5 years out of date, because the review focused on information in Clarke and Jamieson (2006a,b). More recent data are available for species in the northern shelf ecoregion and other areas that should be reviewed and applied (e.g. Crawford and Irvine 2011; Irvine and Crawford 2011) to update the identified EBSAs, as necessary.

Nearshore areas, including estuaries, river mouths, beaches, inlets, fjords, and other shallow subtidal areas are not adequately represented in the current EBSA identification process as conducted in Pacific region. This is in part due to a lack of information and a lack of consistency as to how the limited information that was available could be applied in each ecoregion.

In the southern shelf ecoregion, the Vancouver Island Coastal Current is an important physical feature for some taxa, as is the nearshore region along the west coast of Vancouver Island (e.g. for feeding by grey whales during their migrations, and as sea otter habitat). Neither of these features was defined as EBSAs in this process but this should be re-considered at the next evaluation. This ecoregion also contains political boundaries, which may not be consistent with ecological boundaries and with identified EBSAs (e.g. the Juan de Fuca eddy).

Evaluation of the performance of EBSAs that are identified based largely on their importance to highly migratory species (such as whales, salmon) may be difficult considering the potential for high spatial variability in migration routes which are influenced by variable ocean conditions.

The Strait of Georgia presented difficulties with identifying EBSAs using the step-wise process of defining species' Important Areas and EBSAs based on physical oceanographic features, geographic bottlenecks, and unique areas. The small spatial scale of this ecoregion (some of the EBSAs identified elsewhere in Canada are larger than the Strait of Georgia) made it difficult to use the expert-derived physical oceanographic template, because some of these physical features occurred throughout the entire Strait. A two-level solution is proposed, with the entire Strait being considered as an EBSA but which contains within it smaller distinct areas also identified as ESBAs.

CONCLUSIONS AND ADVICE

- Identifying areas which are important for species or groups of species based on uniqueness, aggregation, fitness consequences, resilience, and naturalness ("Important Areas") is a key step in the EBSA identification process. The use of physical oceanographic features, geographic bottlenecks, and unique areas that overlap with species-specific Important Areas is an acceptable approach to identifying EBSAs in Canada's Pacific marine waters. Any physical oceanographic features or geographic bottlenecks that are not associated with species' Important Areas are not considered as EBSAs.
- Recognize 18 areas in the northern shelf ecoregion (PNCIMA), 7 areas in the southern shelf ecoregion (west of Vancouver Island), and the Strait of Georgia, along with its 7 nested EBSAs, as proposed EBSAs (see Tables 1-3).
- For the Strait of Georgia, two spatial scales need to be considered. On a coastwide spatial scale, the entire Strait of Georgia should be considered as an EBSA, noting that the entire Strait is smaller than EBSAs identified elsewhere in Canada. Within the spatial scale of the Strait of Georgia, there are smaller areas which are identified as EBSAs. For example, the entire Strait is important for salmon and several species of groundfish, but local areas are important for several other species, including unique reef building hexactinellid sponges.
- Information on species' Important Areas must be documented and retained in an available and accessible form, in such a way as to facilitate evaluation and updating with new information when available. This information may be important for some management issues (i.e. it is species and location specific whereas EBSAs are based on physiographic and biological information and are important for multiple species). Important Areas used as a basis for assessing EBSAs identified in this report may be as informative as the EBSAs themselves in marine spatial planning analyses. Updates on information related to Important Areas may also lead to future updates in the EBSAs.
- Guidance is needed for marine resource managers on how best to use EBSAs in management decisions. For example, it is one 'tool' in a spatial management 'toolbox'. The process of identifying other 'tools' in Canada's Pacific marine waters, such as ecologically significant species (ESSs), should be completed to provide complementary information to spatially-explicit EBSAs. Such guidance should include how to deal with the fuzzy boundaries of the identified EBSAs.
- Recommend that EBSAs in any one ecoregion be re-evaluated approximately every 5 years to update with new information and that a consistent approach be applied to all ecoregions to the extent feasible.
- Specific consideration is needed on nearshore areas (e.g. estuaries, river mouths, fjords, beaches and other shallow subtidal areas) in regards to identifying EBSAs, and these decisions need to be applied in the same way amongst all ecoregions. At present, all estuaries and river mouths supporting anadromous species have been defined as EBSAs,

although they are not mapped due to their small spatial scales. In particular, areas along the west coast of Vancouver Island need to be considered in regards to their potential importance for feeding by grey whales and other migratory species.

- Recognize that EBSA boundaries were defined using a Delphic process and quantitative approaches may improve concordance with the biologically Important Areas. Future EBSA assessments could be improved by refining the definition of physical oceanographic features in a more quantitative and repeatable manner.
- Considering that the EBSA identification process involves identifying physical oceanographic features, geographic bottlenecks and unique areas that overlap with species' Important Areas, future processes identifying EBSAs should conduct a review by the species experts to reach consensus on which species are well-represented by these EBSAs, and which are not.

OTHER CONSIDERATIONS

Next steps

The identification of ecologically and biologically significant areas (EBSAs) in Canadian Pacific waters is an on-going process that needs to be reviewed and reassessed periodically as new information becomes available (a re-assessment interval of 5 years is recommended). Indeed, new information is already available which could be used to update the EBSAs identified in 2006 in the northern shelf region. Such reviews also provide the opportunity to improve upon the limitations of the existing process and to build upon the experience of previous reviews. It is recommended that future exercises to identify EBSAs in Pacific marine waters consider the following:

Species:

- expand the current list of species beyond those of commercial and 'charismatic' interest by using data from surveys which capture non-commercial species and other sources of by-catch information, by working to disaggregate groups of species, and by including other sources of information (e.g. traditional and local knowledge, published literature).

Experts:

- it is expected that the process to identify EBSAs will continue to rely to a large extent on expert opinion. The use of a template to collect common information from these experts is recommended, which will also make it easier to store and retrieve this information later and improve the documentation of how species' Important Areas were defined. The selection of experts who are consulted should be expanded to include those from other jurisdictions who are experts in highly migratory species, and to include traditional and local knowledge. It is recommended, when possible, to consult more than one expert per species group. As well as enriching the data, this will provide some sense of the uncertainty around expert opinion. Stronger reference to the available scientific literature is also recommended, both for use directly and to supplement expert opinion. The identified EBSAs would benefit from a review by these species experts to determine which species are well-represented by the identified EBSAs, and which are not. Options to complement expert opinion include LEK, TEK, published literature, and species distribution modeling.

Nearshore areas:

- nearshore areas have been identified as problematic in the process used here to identify EBSAs, largely because they are numerous, occur at small spatial scales, and existing information is not readily available for analysis. Suggestions for resolving this nearshore problem in an EBSA context include:

  i) defining the nearshore in a manner consistent with other jurisdictions, such as Parks Canada. For instance, Parks Canada distinguishes areas seaward and shoreward of the 'kelp zone'; the latter defined as 'nearshore' and usually interpreted as waters with bottom depths less than 25 m;

  ii) explicitly stating that proposed EBSAs (such as in this report) include only those waters seaward of this kelp zone (i.e. EBSAs apply only to coastal waters with bottom depths greater than 25 m);

  iii) identifying all nearshore waters (such as those defined by criterion (i) above) as EBSAs;

  iv) in addition, recognise as nearshore EBSAs those locations that are 'commonly understood' as being important such as the large reefs in the vicinities of Kyuqout, Checleset Bay, Esperanza, Clayoquot and Barkley Sounds along the west coast of Vancouver Island.

SOURCES OF INFORMATION

This Science Advisory Report is from the February 7-8, 2012 Meeting on Evaluation of Proposed Ecologically and Biologically Significant Areas in Marine Waters of British Columbia. Additional publications from this process will be posted as they become available on the Fisheries and Oceans Canada Science Advisory Schedule at www.dfo-mpo.gc.ca/csas-sccs/index-eng.htm. Information on the EBSA maps and species Important Areas is available at http://www.pac.dfo-mpo.gc.ca/gis-sig/maps-cartes-eng.htm.

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