

**Policy and Practice Report: Overview of  
Marine Environment Issues Potentially Relevant to Fraser Sockeye Salmon  
July 21, 2011**

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## Introduction

1. This Policy and Practice Report (“PPR”) describes the various marine environment-related topics that may be relevant to Fraser River sockeye productivity. The focus is on regulation and management. On July 6-8, 2011, the commission heard testimony from two panels of expert witnesses regarding the marine ecology of Fraser sockeye. This PPR, however, is focused on other topics related to the marine environment, which will be the subject of hearings on August 17-18, 2011.
2. The information in this PPR is derived from documents and information disclosed to the commission or otherwise publicly available.<sup>1</sup> Appendix 1 provides a list of all documents and websites cited in this PPR.
3. The following topics are not addressed by this PPR:
  - a. Aquaculture and disease;
  - b. Habitat enhancement and restoration;
  - c. Contaminants and effluents collected in municipal sewers and treatment systems (“municipal wastewater”);
  - d. Point-source contaminants from pulp mills and mining activities; and
  - e. Predation.
4. Policies, practices and impacts on Fraser sockeye from the aquaculture industry are intended to be the subject of a forthcoming commission PPR and will be covered during the commission’s hearings on that topic. These hearings will also address the topic of disease. An overview of Department of Fisheries and Oceans (“DFO” or the “Department”) policies and programs relating to salmon habitat enhancement and restoration is provided in the PPR for that theme and

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<sup>1</sup> The commission’s Terms of Reference direct the Commissioner to use the automated documents management program specified by the Attorney General of Canada, Ringtail Legal. Many references in this PPR list the unique document identifier attached to a given document by the Ringtail database, such as “CAN001234”. These documents are denoted as “Ringtail Documents”. Note: Where Ringtail Documents are cited to a page number it is the Ringtail page number and not the document page number that is provided.

the related hearings.<sup>2</sup> Policies, practices and impacts on Fraser sockeye from contaminants and effluents collected in municipal wastewater systems or originating from pulp mills and mining are set out in another commission PPR and were covered during the commission's hearings on these topics.<sup>3</sup> Predation issues were the subject of commission hearings and Technical Report.

5. The following commission technical reports relate, at least in part, to Fraser sockeye and effects in the marine environment:
  - a. Technical Report 1: Infectious Diseases and Potential Impacts on Survival of Fraser River Sockeye Salmon;
  - b. Technical Report 1A: Assessment of the potential effects of diseases present in salmonid enhancement facilities on Fraser River sockeye salmon;
  - c. Technical Report 4 (Exhibit 1291): The Decline of Fraser River Sockeye Salmon *Oncorhynchus nerka* (Steller, 1743) in Relation to Marine Ecology;
  - d. Technical Report 5A: Summary of Information for Evaluating Impacts of Salmon Farms on Survival of Fraser River Sockeye Salmon;
  - e. Technical Report 5B: Examination of relationships between salmon aquaculture and sockeye salmon population dynamics;
  - f. Technical Report 5C: Impacts of salmon farms on Fraser River sockeye salmon: results of the Noakes investigation;
  - g. Technical Report 5D: Impacts of salmon farms on Fraser River sockeye salmon: results of the Dill investigation;
  - h. Technical Report 8 (Exhibit 783): Predation on Fraser River Sockeye Salmon and May 4-6, 2011 hearings; and
  - i. Technical Report 12 (Exhibit 735): Sockeye habitat analysis in the Lower Fraser River and Strait of Georgia.<sup>4</sup>
  
6. During the first portion of hearings on the marine environment theme, four expert reports were tendered by Canada:
  - a. Exhibit 1303: Thomson, R.E., Beamish, R.J., Beacham, T.D., Trudel, M., Whitfield, P.H. and Hourston, R.A.S., *Anomalous ocean conditions may*

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<sup>2</sup> Cohen Commission Policy and Practice Report: Overview of Habitat Enhancement and Restoration, April 1, 2011 (Cohen Commission Exhibit PPR11).

<sup>3</sup> Cohen Commission Policy and Practice Report: Municipal Wastewater, Pulp and Paper and Mining Effluents, May 24, 2011 (Cohen Commission Exhibit PPR15).

<sup>4</sup> See also Cohen Commission Exhibits 735-1, 735-2, 735-3, 735A, 735B and 735C.

*explain the recent extreme variability in Fraser River sockeye salmon production, May 2011;*

- b. Exhibit 1305: Preikshot, D.B., Beamish, R.J., Sweeting, R.M., Neville, C.M. and Beacham, T.D., *The residence time of juvenile Fraser River sockeye salmon (Oncorhynchus nerka) in the Strait of Georgia, 2011;*
  - c. Exhibit 1307: Beamish, R.J., Sweeting, R.M., Neville, C.M., Preikshot, D., Lange, K.L. and Beacham, T.D., *A late ocean entry life history type has improved survival for sockeye and chinook salmon in recent years in the Strait of Georgia, 2011;* and
  - d. Exhibit 1309: Beamish, R., Neville, C. and Sweeting, R., *Evidence of a synchronous failure in juvenile Pacific salmon and herring production in the Strait of Georgia in the spring of 2007, 2011.*
7. Finally, there is a commission scientific literature review on salmon farms.<sup>5</sup>

### **Fraser sockeye marine habitat**

8. Many Fraser River sockeye spend more than two years in the marine environment. Marine residence lasts between one and four years, usually two or three years, before they return to their natal river systems to spawn.<sup>6</sup>
9. Below is a brief description of the Fraser sockeye marine environment. For a summary of the scientific literature on the marine portion of the Fraser sockeye life cycle, see the commission's Technical Report 4.<sup>7</sup>

### Nearshore habitat

10. Most young Fraser sockeye are thought to exit their natal river systems in April through May, migrate down to the Fraser estuary and shortly thereafter enter the marine environment of the Strait of Georgia.<sup>8</sup> Juvenile sockeye will spend some

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<sup>5</sup> Cohen Commission, *A scientific literature review to inform the investigation into the potential effects of salmon farms on Fraser River sockeye salmon*, February 2011.

<sup>6</sup> C. Groot & L. Margolis, eds., *Pacific Salmon Life Histories* (Vancouver: University of British Columbia Press, 1991) at 65 [Groot & Margolis 1991].

<sup>7</sup> Cohen Commission Exhibit 1291.

<sup>8</sup> Groot & Margolis 1991 at 65.

time in the estuary undergoing physiological changes in order to adapt to the saltwater environment.<sup>9</sup> Despite the short residence time of most Fraser River sockeye in estuaries, these often very productive environments may be important salmon habitat, for both lake and river-type sockeye.<sup>10</sup> Estuaries are also believed to provide a gradual transition from fresh to salt-water.<sup>11</sup> On their return journey some adult sockeye (stocks in the Late-run timing group) may spend some days at the mouth of the Fraser River transitioning from saltwater to freshwater before migrating upstream.<sup>12</sup>

11. Sockeye spend various amounts of time in the coastal near-shore environment before migrating into offshore habitat and are thought to reach the offshore Gulf of Alaska by fall or early winter.<sup>13</sup> The early marine migration was defined in the late 1970s and early 1980s, while more recent acoustic tagging work has revealed that some sockeye migrate at a rate of about 10-20 kilometres per day.<sup>14</sup> Juvenile sockeye some months in the Strait of Georgia, Johnstone Strait and Queen Charlotte Strait and by the end of June, most Fraser sockeye are thought to have migrated up the coast from the Strait of Georgia through either Johnstone Strait or the Strait of Juan de Fuca and the West Coast of Vancouver Island.<sup>15</sup>
12. Harrison River sockeye appear to have a different life history from many Fraser sockeye, entering the estuary immediately upon hatching.<sup>16</sup> Harrison River sockeye may be resident for longer in the Strait of Georgia than other Fraser stocks and may remain there until the fall before beginning their off-shore

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<sup>9</sup> Cohen Commission Transcripts, October 25, 2010 at p. 13.

<sup>10</sup> Ringtail Documents CAN377177 at 4 and CAN068533 at 3-4; Thomas P. Quinn, *The Behavior and Ecology of Pacific Salmon & Trout* (Vancouver: University of Washington Press, 1995) at 235-236 [Quinn 1995].

<sup>11</sup> Ringtail Document CAN377177 at 4; Quinn 1995, *ibid.* at 237.

<sup>12</sup> Cohen Commission Transcripts, October 25, 2010 at p. 13.

<sup>13</sup> *Ibid.* at p. 35; Groot & Margolis 1991 at 65.

<sup>14</sup> Cohen Commission Transcripts, October 25, 2010 at pp. 33-34; Cohen Commission Exhibit 1291 at 40.

<sup>15</sup> Cohen Commission Transcripts, October 25, 2010 at p. 34; Cohen Commission Exhibit 1291 at 33-36.

<sup>16</sup> Ringtail Document CAN185561 at 16; Cohen Commission Exhibit 1307 at 5; Cohen Commission Transcripts, July 6, 2011 at p. 22.



migration.<sup>17</sup>

### Offshore habitat

13. Sockeye salmon are widely distributed throughout the North Pacific Ocean and adjacent waters, travelling great distances to reach the nutrient-rich waters of Alaska and the Arctic.<sup>18</sup> Their movement in off-shore waters may be affected by physical factors such as season, temperature and salinity and biological factors such as maturity stage, age and size, availability and distribution of food organisms and stock-of origin.<sup>19</sup> While ocean residence is considered an important component of all Pacific salmon life cycles detailed migration and distribution patterns remain poorly understood.<sup>20</sup> However, it is hypothesised that most sockeye smolt migrate northwards along the mainland shoreline, exiting the Strait of Georgia through channels along the island and continuing through Johnstone and Queen Charlotte Straits.<sup>21</sup> The literature suggests that smolts then enter Queen Charlotte Sound south of Haida Gwaii, migrating north and westward in a band along the BC and Alaska coastline, reaching overwintering grounds south of Alaska in late autumn/early December.<sup>22</sup>

### **Legislative framework**

14. The *Constitution Act, 1982*, being Schedule B to the *Canada Act 1982* (U.K.), 1982, c. 11, enumerates powers of the federal and provincial governments. Pursuant to ss. 91 and 92, protecting and conserving Canada's fish and fish habitat is the domain of the federal government insofar as it is a fisheries resource and within the provincial government's domain insofar as it relates to control over natural resources and the management of provincial lands. Local

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<sup>17</sup> Cohen Commission Exhibit 1307 at 8, 13-15; Cohen Commission Transcripts, July 6, 2011 at pp. 91-92.

<sup>18</sup> Ringtail Documents CAN068533 at 4 and CAN377177 at 5; Groot & Margolis 1991 at 71.

<sup>19</sup> *Ibid.*

<sup>20</sup> Cohen Commission Exhibit 1291 at 49.

<sup>21</sup> *Ibid.* at 27.

<sup>22</sup> *Ibid.*

governments have the delegated authority to regulate land use through provincial legislation such as the *Local Government Act*, R.S.B.C. 1996, c. 323, *Community Charter*, S.B.C. 2003, c. 26 and *Vancouver Charter*, R.S.B.C. 1996, c. 55.

15. For a more detailed discussion of the legislative framework governing fisheries, see the commission's PPR, titled, "Legislative Framework Overview".<sup>23</sup>
16. The *Fisheries Act*, R.S.C. 1985, c. F-14, contains two primary provisions for the conservation and protection of fish and fish habitat, within the Part of the *Act* entitled "Fish Habitat Protection and Pollution Prevention": ss. 35 and 36.<sup>24</sup>
17. As described in other commission PPRs,<sup>25</sup> section 36 is the primary pollution prevention provision in the *Fisheries Act*. Sub-section 36(3) prohibits persons, except as authorized by regulation under the *Fisheries Act* or under other federal legislation,<sup>26</sup> from depositing<sup>27</sup> or permitting the deposit of a deleterious substance of any type into water frequented by fish<sup>28</sup> or in any place under any conditions where the deleterious substance may enter any such water.<sup>29</sup> The focus of s. 36 is on preventing harm to fish and fish habitat; it is not necessary to prove that actual harm occurred to fish or fish habitat.<sup>30</sup> An overview of some of the specific regulations for carrying out the purposes and provisions of the

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<sup>23</sup> Cohen Commission Exhibit PPR3.

<sup>24</sup> Sections 34-42.1. "Fish habitat" is defined in sub-section 34(1) as "spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes" (*ibid.*, s. 34(1)).

<sup>25</sup> Cohen Commission Policy and Practice Report: The Department of Fisheries and Oceans' Habitat Management Policies and Practices, March 8, 2011 (Cohen Commission Exhibit PPR8); Cohen Commission Policy and Practice Report: Enforcement of the Habitat Protection and Pollution Prevention Provisions of the *Fisheries Act*, March 7, 2011 (Cohen Commission Exhibit PPR9) and Cohen Commission Exhibit PPR15.

<sup>26</sup> *Fisheries Act*, s.-s. 36(4) and (5).

<sup>27</sup> Sub-section 34(1) defines "deposit" as any discharging, spraying, releasing, spilling, leaking, seeping, pouring, emitting, emptying, throwing, dumping or placing.

<sup>28</sup> "Water frequented by fish" means Canadian fisheries waters (*Fisheries Act*, s. 34(1)).

<sup>29</sup> *Ibid.*, s. 36(3).

<sup>30</sup> See Cohen Commission Exhibit PPR15 at paras. 20-21.

*Fisheries Act*, including with respect to the pollution of waters frequented by fish, is provided in the Cohen Commission Exhibit PPR15.<sup>31</sup>

18. In addition to the *Fisheries Act*, the primary piece of legislation governing oceans management is the federal *Oceans Act*, under which the Minister of Fisheries and Oceans is empowered to lead and facilitate the development and implementation of “a national strategy for the management of estuarine, coastal and marine ecosystems” in Canada’s oceans.<sup>32</sup> The national strategy must be based on three principles mandated by the *Oceans Act*:<sup>33</sup>
  - a. Sustainable development, is, development that meets the needs of the present without compromising the ability of future generations to meet their own needs;
  - b. Integrated management of activities in estuaries, coastal waters and marine waters that form part of Canada or in which Canada has sovereign rights under international law; and
  - c. The precautionary approach, that is, erring on the side of caution.
  
19. Section 32 of the *Oceans Act* directs or empowers the Minister to:
  - a. Develop and implement policies and programs on matters by law assigned to the Minister;
  - b. Coordinate the implementation of policies and programs of the Government with respect to all activities or measures in or affecting coastal waters and marine waters;
  - c. Unilaterally or jointly with another person or body or with another minister, board or agency of the Government of Canada and taking into consideration the views of other ministers, boards and agencies of the Government of Canada, provincial and territorial governments and affected aboriginal organizations, coastal communities and other persons and bodies, including those established under land claims agreements:
    - i. Establish advisory or management bodies and appoint or

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<sup>31</sup> *Ibid.* at paras. 162-171 and 262-268.

<sup>32</sup> *Oceans Act*, s. 29.

<sup>33</sup> *Ibid.*, s. 30.

- designate, as appropriate, members of those bodies;
  - ii. Recognize established advisory or management bodies; and
- d. Establish marine environmental quality guidelines, objectives and criteria respecting estuaries, coastal waters and marine waters.
20. A number of other federal as well as provincial acts also govern various aspects of marine habitat management relevant to Fraser River sockeye. These additional legislative and regulatory instruments are described under each topical section of the PPR, below.

## Contaminants

21. Most contaminants enter the marine habitat of Fraser sockeye as a result of land-based activities, through discharges by industrial and municipal wastewater systems as well as indirect routes such as run-off from land and atmospheric deposition.<sup>34</sup>
22. Policies, practices and impacts on Fraser sockeye from point and non-point source contaminants in freshwater habitat are addressed in the commission's PPRs on effluents and freshwater urbanization and related hearings.<sup>35</sup> Commission Technical Report 2: Effects of Contaminants on Fraser Sockeye Salmon evaluates the potential impacts of contaminants on Fraser sockeye habitat.<sup>36</sup>
23. Contaminants in the marine habitat of Fraser sockeye originate from both natural and anthropogenic point and non-point sources.<sup>37</sup> A "contaminant" is a natural or man-made substance that is present at concentrations above natural background

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<sup>34</sup> Ringtail Document CAN024648 at 9; Federal/Provincial/Territorial Advisory Committee on Canada's National Programme of Action for the Protection of the Marine Environment from Land-based Activities, Environment Canada (June 2000) at 1 [Marine Environment Programme of Action].

<sup>35</sup> See Cohen Commission Policy and Practice Report: Overview of Freshwater Urbanization Impacts and Management, May 11, 2011 (Cohen Commission Exhibit PPR14) and Cohen Commission Exhibit PPR15. See also Cohen Commission Technical Report 2: Effects of contaminants on Fraser River sockeye salmon (Cohen Commission Exhibit 826).

<sup>36</sup> Cohen Commission Exhibit 826 and Cohen Commission Transcripts, May 9-10, 2011.

<sup>37</sup> For more information on both point and non-point source contaminants see Cohen Commission Exhibit 826.

levels, or whose distribution in the environment has been altered by human activities. A “pollutant” refers to a contaminant whose concentration in the environment is high enough to result in deleterious effects. All pollutants are contaminants, but not all contaminants are pollutants.<sup>38</sup> There are two general classes of contaminants, those that are persistent, bioaccumulative and toxic (“PBT”), and those that tend to be water-soluble and less persistent, but still toxic.<sup>39</sup>

24. Once in BC’s coastal waters, depending on their physical properties, contaminants may remain in the water, contaminate and accumulate in sediments and or be taken up by living organisms.<sup>40</sup> PBT contaminants can move up through the marine food chain through the processes of bioaccumulation and biomagnification<sup>41</sup> and can reach relatively high concentrations in some fish species.<sup>42</sup> Salmon have been shown to accumulate persistent contaminants during their open ocean phase and transport them back into coastal areas, spawning streams and lakes.<sup>43</sup>
25. Contaminants may induce a number of effects in salmon.<sup>44</sup> Observed impacts include endocrine disruption, neurotoxicity, olfactory damage, osmoregulation problems, reproductive impairment and loss of immune function.<sup>45</sup> PBT-

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<sup>38</sup> Ringtail Document CAN025074 at 125; Haggerty, D.R., McCorquodale, B., Johannessen, D.I., Levings, C.D. and Ross, P.S. 2003. Marine Environmental Quality in the Central Coast of British Columbia, Canada: A Review of Contaminant Sources, Types and Risks, Can. Tech. Rep. Fish. Aquat. Sci. 2507 at 6 (available online at: <http://www.dfo-mpo.gc.ca/Library/278588.pdf>) [Haggerty *et al.* 2003].

<sup>39</sup> See Cohen Commission Exhibit PPR14 at paras. 111-114; Ringtail Document CAN270107 at 1; Cohen Commission Exhibit 73 at 75.

<sup>40</sup> Haggerty *et al.* 2003 at 4; Ringtail Document CAN025074 at 144.

<sup>41</sup> Ringtail Document CAN025074 at 127-134. For levels of PCBs, PAHs, and mercury in sediments in locations on the BC coast, including on the eastern side of the Strait of Georgia, see *ibid.*, Figure 4 at 143. Several compounds are considered to be toxic under CEPA’s Schedule I List of Toxic Substances. The Schedule I List of Toxic Substances may be viewed at: <http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=ODA2924D-1&wsdoc=4ABEFFC8-5BEC-B57A-F4BF-11069545E434>.

<sup>42</sup> Ringtail Document CAN270107 at 2.

<sup>43</sup> Haggerty *et al.* 2003 at 110; Ringtail Document CAN024922 at 102.

<sup>44</sup> Ringtail Document CAN270107 at 1.

<sup>45</sup> *Ibid.* at 1 and 3. For a brief discussion of reported sub-lethal impacts, see Cohen Commission Exhibit PPR14 at para. 117.

associated toxicity may disrupt physiology or behaviour in fish, consequently reducing their fitness and preventing them from adapting to sub-optimal environmental conditions.<sup>46</sup> Migratory timing and routes may be affected.<sup>47</sup> Exposure to chemicals that disrupt the endocrine system may impair the timing of reproduction.<sup>48</sup>

## Regulation

### *Generally*

26. The federal government has primary responsibility for regulating pollution originating at sea.<sup>49</sup> The provinces are responsible for regulating many aspects of land-based pollution, but the federal government also plays a role in regulating this in the marine environment under the *Fisheries Act* in relation to fish habitat.
27. The *Canadian Environmental Protection Act, 1999*, S.C. 1999, c. 33 (“*CEPA*”) addresses pollution prevention. The Act aims to protect the environment and human health by managing marine pollution, disposal at sea, toxic substances and other sources of pollution. *CEPA* contains provisions regarding international water pollution and the ability of the federal government to take action in instances where a province fails to address a problem. In the case of environmental emergencies, if no other federal or provincial regulations exist, the provisions of *CEPA* govern.<sup>50</sup>
28. Under *CEPA*, after consultation with any other affected minister, the Minister of the Environment has the authority to issue environmental objectives, guidelines and codes of practice to prevent and reduce land-based sources of marine

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<sup>46</sup> Ringtail Documents CAN405817 at 3, CAN270107 at 1 and 2 and CAN025074 at 133.

<sup>47</sup> Ringtail Document CAN405817 at 2.

<sup>48</sup> *Ibid.* at 3.

<sup>49</sup> Ringtail Document CAN198623 at 22.

<sup>50</sup> Water Stewardship: Legislation (Overview for Water), online: BC Ministry of Environment <[http://www.env.gov.bc.ca/wsd/water\\_rights/overview\\_legislation/index.html](http://www.env.gov.bc.ca/wsd/water_rights/overview_legislation/index.html)>.

pollution.<sup>51</sup> The National Programme of Action for the Protection of the Marine Environment from Land-based Activities, a national framework and plan developed by Environment Canada (“EC”), DFO and the provinces and territories, identifies management objectives and priority actions regarding the prevention of land-based marine pollution.<sup>52</sup>

29. The *Canadian Environmental Assessment Act*, S.C. 1992, c. 37 (“CEAA”), sets out responsibilities and procedures for the environmental assessment of proposed projects or prescribed activities involving the federal government in order to avoid significant adverse environmental effects. In addition to proposed projects that trigger CEAA under s. 5, other activities subject to assessment are prescribed by the *Inclusion List Regulations*, SOR/94-637. Part VII (Fisheries) of the regulations requires an environmental assessment of activities requiring authorization under the *Fisheries Act* – i.e. those that destroy fish by means other than fishing, that harmfully alter, disrupt or destroy fish habitat, or that result in the deposit of deleterious substances in water frequented by fish.<sup>53</sup> For further details on how DFO administers CEAA see the commission’s Policy and Practice Report: The Department of Fisheries and Oceans’ Habitat Management Policies and Programs.<sup>54</sup>

### *Pollution from sea*

30. Pollution from marine sources may arise from ship spills, disposal at sea and greywater discharge from boats. For details on impacts and regulation of these sources see sections, “Marine spills”, “Disposal at Sea” and “Greywater”, below.

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<sup>51</sup> CEPA, s. 121.

<sup>52</sup> Environment Canada, A Guide to Understanding the Canadian Environmental Protection Act, 1999 at 18 (available online at: [http://www.ec.gc.ca/lcpe-cepa/E00B5BD8-13BC-4FBF-9B74-1013AD5FFC05/Guide04\\_e.pdf](http://www.ec.gc.ca/lcpe-cepa/E00B5BD8-13BC-4FBF-9B74-1013AD5FFC05/Guide04_e.pdf)).

<sup>53</sup> *Fisheries Act*, ss. 33, 35 and 36.

<sup>54</sup> Cohen Commission Exhibit PPR8.

## *Pollution from land*

31. In Canada, it has been estimated that 80% of marine pollution originates on land.<sup>55</sup> Land-based sources of marine pollution are addressed under *CEPA* through environmental objectives, guidelines and codes of practice that may be issued or released by the Minister of the Environment under Part 7 (Controlling Pollution and Managing Wastes), Division 2 (Protection of the Marine Environment from Land-based Sources of Pollution).<sup>56</sup> An overview of *CEPA* instruments addressing municipal wastewater is provided in Cohen Commission Exhibit PPR15.
32. The term “land-based sources” in *CEPA* (Part 7, Division 2) means, “point and as diffuse sources on land from which substances or energy reach the sea by water, through the air or directly from the coast.”<sup>57</sup> This includes, “any sources under the seabed made accessible from land by tunnel, pipeline or other means.”<sup>58</sup> “Marine pollution” in Part 7 is, “the introduction by humans, directly or indirectly, of substances or energy into the sea that results, or is likely to result, in (a) hazards to human health; (b) harm to living resources or marine ecosystems; (c) damage to amenities; or (d) interference with other legitimate uses of the sea.”<sup>59</sup>
33. The provincial *Environmental Management Act*, S.B.C. 2003, c. 53 (the “*EMA*”), is a key piece of legislation governing environmental protection and management in BC, including effluents introduced to the environment from point sources such as wastewater treatment plants, pulp mills and mines.<sup>60</sup> Under the *EMA*, the primary provision governing the disposal of waste into the environment is s. 6.

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<sup>55</sup> Ringtail Document CAN024922 at 7.

<sup>56</sup> *CEPA*, s. 121(1).

<sup>57</sup> *Ibid.*, s. 120.

<sup>58</sup> *Ibid.*

<sup>59</sup> *Ibid.*

<sup>60</sup> Section 1 of the *EMA* defines “effluent” as “a substance that is introduced into water or onto land and that (a) injures or is capable of injuring the health or safety of a person, (b) injures or is capable of injuring property or any life form, (c) interferes with or is capable of interfering with visibility, (d) interferes with or is capable of interfering with the normal conduct of business, (e) causes or is capable of causing material physical discomfort to a person, or (f) damages or is capable of damaging the environment” (s. 1(1)).



The *EMA's Waste Discharge Regulation*, BC Reg. 320/2004 (“*WDR*”), prescribes the industries, trades, businesses, operations and activities that require some form of authorization before discharging waste into the environment under *EMA's* s.-s. 6(2) and (3). Industries, trades, businesses, operations or activities prescribed in Schedules 1 and 2 of the *WDR* are prohibited from discharging waste into the environment without authorisation.<sup>61</sup> Schedule 1 industries must obtain waste discharge authorizations either through a s. 14 permit, s. 15 approval, order or compliance with another regulation.<sup>62</sup> Schedule 2 industries discharging waste in accordance with a code of practice are exempt from s.-s. 6(2) and (3) and no site-specific permit or authorisation is required.<sup>63</sup> Industries prescribed under Schedule 1 and consequently requiring authorization under the *EMA* include the large oil and natural gas industry, mining, municipal sewage management, plastic manufacturing, metal smelting and processing. Industries, trades, businesses, operations or activities not prescribed in Schedule 1 or 2 of the *WDR* do not require ministerial authorisation to discharge waste into the environment, but they are governed by the general prohibition against causing pollution under s.-s. 6(4) of the *EMA*.

34. Part 7, Division 1 of the *EMA* governs spill prevention, reporting and response.<sup>64</sup> There are also provisions relating to pollution prevention and abatement orders, preventing and abating municipal pollution, environmental protection orders and environmental emergency measures.<sup>65</sup>

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<sup>61</sup> *WDR*, BC Reg. 320/2004.

<sup>62</sup> BC Ministry of Environment, Environmental Protection Division, *Waste Discharge Implementation Guide* at 10 (available online at: [http://www.env.gov.bc.ca/epd/main/pdf/WDR\\_implementation\\_guide.pdf](http://www.env.gov.bc.ca/epd/main/pdf/WDR_implementation_guide.pdf)) [*Waste Discharge Guide*].

<sup>63</sup> *Ibid.* at 4 and 10; *WDR*, s. 4(1).

<sup>64</sup> *EMA*, ss. 79-80.

<sup>65</sup> *Ibid.*, ss. 81-88.

### *Pollution from air*

35. Atmospheric transport is potentially a significant pathway for the deposition of contaminants in BC coastal food webs.<sup>66</sup> Atmospheric deposition of contaminants in the marine environment is mostly from combustion, incineration, industrial and other processes of regional or international origin.<sup>67</sup> For an overview of the long-range transport of pollutants into Fraser sockeye marine habitat as well as Canada's relevant international obligations, see Cohen Commission Exhibit PPR14 at paras. 150-152.

### *Point-source contaminants*

36. Much of the BC coast traditionally has been and remains a resource-based economy.<sup>68</sup> Historically, effluent from pulp and paper mills was a principal source of contaminants in marine waters in Canada.<sup>69</sup> Ten pulp mills are currently operational on the coast and there are numerous log handling and storage tenures.<sup>70</sup> Historical or decommissioned mines also exist in the region, including the Britannia Beach mine in Howe Sound and Island Copper Mine; operating mines include the Quinsam Coal Mine and the Myra Falls Metal Mines at the extreme south of the central coast.<sup>71</sup> Pulp mills and mines discharge effluent into the marine habitat of Fraser sockeye salmon and this effluent may contain contaminants that could affect receiving water quality conditions of Fraser sockeye.<sup>72</sup>

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<sup>66</sup> Ringtail Document CON000107 at 1.

<sup>67</sup> Ringtail Document CAN025074 at 130, 132-133 and 144; Cohen Commission Exhibit 833 at 39.

<sup>68</sup> Haggerty *et al.* 2003 at 33. For the location of key sites for five types of economic activities and tenures affecting the marine environment along the BC coast, such as logging, pulp and paper, finfish aquaculture, and mining, see Ringtail Document CAN025074 at 23, Figure 5.

<sup>69</sup> Ringtail Document CAN024648 at 9.

<sup>70</sup> Cohen Commission Transcripts, June 13, 2011 at p. 67; Haggerty *et al.* 2003 at 33.

<sup>71</sup> Ringtail Documents CAN413774 at 2 and CON000027 at 18; Haggerty *et al.* 2003, *ibid.* at 34.

<sup>72</sup> Cohen Commission Exhibit PPR15 and Cohen Commission Transcripts, June 13, 2011.

37. Future risk of chemical contamination to BC's coast could originate from offshore oil and gas exploration and development, which has been proposed in areas that Fraser River sockeye migrate through on their way to the Gulf of Alaska.<sup>73</sup> In the mid-twentieth century, oil and gas exploration and development below the seabed off the BC coast began and a number of wells were drilled in the seas of the Hecate Strait and Queen Charlotte Sound.<sup>74</sup> In 1972, the federal government imposed a moratorium on crude oil tanker traffic through Dixon Entrance, Hecate Strait and Queen Charlotte Sound, which it extended to include all commercial oil and gas activities.<sup>75</sup> BC delivered a similar prohibition in 1981.<sup>76</sup> However, seabed geological exploration and regional seismic studies by academic and government researchers continued subject to formal permitting.<sup>77</sup> For a more extensive chronology of offshore oil and gas activity in BC, see:
- a. BC Ministry of Energy and Mines, "Offshore Oil & Gas in BC: A Chronology of Activity;"<sup>78</sup> and
  - b. Offshore Hydrocarbon Exploration: Report and Recommendations of the West Coast Offshore Exploration Environmental Assessment Panel, submitted to the Governments of BC and Canada (April 1986), Minister of Supply and Services Canada.<sup>79</sup>
38. Canada and BC have completed scientific reviews and stakeholder consultations on the moratorium on oil and gas activities for offshore BC.<sup>80</sup> In 2003, Canada commenced a scientific review, stakeholder consultations, and a First Nations

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<sup>73</sup> Haggerty *et al.* 2003 at 4.

<sup>74</sup> Ringtail Document CAN024880 at 23.

<sup>75</sup> *Ibid.*; Historical Timeline, online: Energy BC <<http://www.energybc.ca/explore3.html>>; Offshore Oil & Gas in BC: A Chronology of Activity, online: BC Ministry of Energy and Mines <<http://www.empr.gov.bc.ca/OG/offshoreoilandgas/OffshoreOilandGasinBC/Pages/ACHronologyofActivity.aspx>> [Offshore Oil & Gas Chronology].

<sup>76</sup> Ringtail Document CAN024880 at 23.

<sup>77</sup> *Ibid.*

<sup>78</sup> Offshore Oil & Gas Chronology.

<sup>79</sup> Available online at:

<http://www.em.gov.bc.ca/OG/offshoreoilandgas/ReportsPresentationsandEducationalMaterial/Reports/Pages/WCOffshoreExplorationEnviroAssessmentPanel.aspx>.

<sup>80</sup> Ringtail Document CAN024912 at 12-13.

engagement process on whether to lift the moratorium.<sup>81</sup> In a 2004 report, an expert science panel appointed by the Royal Society of Canada identified several science gaps and made several recommendations.<sup>82</sup> In the BC Energy Plan, announced in 2007, the Province expressed its commitment to working to lift the federal moratorium on offshore oil and gas exploration and development and its intention to lift the provincial moratorium at the same time.<sup>83</sup>

39. The impacts of an oil spill or blow-out on aquatic biota may range from subtle sub-lethal effects to large-scale kills, depending on the size and timing of the spill and the nature and biotic populations of the landfall.<sup>84</sup> Acute effects on fish include death or debilitation due to tissue damage, the disruption of the central nervous system, osmoregulatory dysfunction or metabolic dysfunction.<sup>85</sup> According to some DFO scientists, many studies underestimate the harmful impacts of oil by failing to consider the importance of sub-lethal physiological and behavioural effects on organisms.<sup>86</sup> Sub-lethal effects include carcinogenic and cytogenic effects, as well as physiological effects involving reproduction, growth, respiration, excretion, chemoreception, feeding, movement, responses to stimuli and susceptibility to disease.<sup>87</sup>

#### Non-point source contaminants

40. The term “non-point sources” refers to the many and diffuse sources of pollutants that may be discharged directly into water near the shoreline or into rivers flowing into the marine environment.<sup>88</sup> Non-point source contaminants are a source of

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<sup>81</sup> *Ibid.*; Offshore Oil & Gas Chronology.

<sup>82</sup> Ringtail Document CAN024880 at 16-21, 23.

<sup>83</sup> BC Ministry of Energy, Mines and Petroleum Resources, BC Energy Plan (available online at: [http://www.energyplan.gov.bc.ca/PDF/BC\\_Energy\\_Plan.pdf](http://www.energyplan.gov.bc.ca/PDF/BC_Energy_Plan.pdf)); BC Ministry of Energy, Mines and Petroleum Resources, BC Energy Plan: Report on Progress at 2 (available online at: [http://www.energyplan.gov.bc.ca/report/BCEP\\_ReportOnProgress\\_web.pdf](http://www.energyplan.gov.bc.ca/report/BCEP_ReportOnProgress_web.pdf)).

<sup>84</sup> Ringtail Document CAN024880 at 15.

<sup>85</sup> Haggerty *et al.* 2003 at 59.

<sup>86</sup> *Ibid.* at 54.

<sup>87</sup> *Ibid.*

<sup>88</sup> Ringtail Document CAN025074 at 133.

pollution to nearshore habitats in the Pacific Region.<sup>89</sup> In the Strait of Georgia, contaminants include agricultural and urban run-off, wood treatment facilities, ships, spills, local combustion and atmospheric pollution. Rivers flowing into BC coastal waters carry industrial effluents and runoff from agriculture, forestry and urban areas.<sup>90</sup> DFO has acknowledged that non-point source contaminants such as pesticides and other pollutants may potentially impact Fraser salmon.<sup>91</sup>

### *Pesticides*

41. Pesticides refer to agents used to prevent, repel or mitigate pests. They may be grouped according to the type of pest they control, including herbicides, insecticides and fungicides.<sup>92</sup> The broad application of pesticides to crops, lawns and forests results in mostly non-point source pollution in the form of run-off. Pesticides can also get into surface waters from over-spraying, erosion of contaminated soils and from contaminated groundwater.<sup>93</sup> Pesticide exposures are often sub-lethal to wild salmon.<sup>94</sup> For more background on the regulation and possible impacts of pesticides on Fraser sockeye, see Cohen Commission Exhibit PPR14 and Cohen Commission Exhibit 826 (Technical Report 2) and related hearing transcripts.<sup>95</sup>
  
42. Pesticides used in forestry are of concern in the marine environment if they are applied directly or if they are permitted to drift onto the surface of aquatic

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<sup>89</sup> Marine Environment Programme of Action at 32-33.

<sup>90</sup> Ringtail Document CAN025074 at 142-3. For more information on non-point sources of contaminants in the freshwater environment, see Cohen Commission Exhibit PPR14 at paras. 107-110.

<sup>91</sup> Ringtail Document CAN134842 at 2.

<sup>92</sup> Haggerty *et al.* at 89.

<sup>93</sup> Cohen Commission Exhibit 833 at 49.

<sup>94</sup> Baldwin, D.H, Spromberg, J.A., Collier, T.K. and Scholz, N.L. 2009. "A Fish of Many Scales: Extrapolating Sublethal Pesticide Exposures to the Productivity of Wild Salmon Populations", *Ecological Applications*, 19(8): 2004-2015 at 2004 (available online at: [http://www.waterboards.ca.gov/waterrights/water\\_issues/programs/bay\\_delta/deltaflow/docs/exhibits/sfwc/spprt\\_docs/sfwc\\_exh3\\_baldwin.pdf](http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/deltaflow/docs/exhibits/sfwc/spprt_docs/sfwc_exh3_baldwin.pdf)).

<sup>95</sup> See also Schreier, H. Hall, K.J., Brown, S.J., Wernick, B., Berka, C., Belzer, W. and Petit, K. 1998, "Chapter 4.7, Agriculture: An Important Non-Point Source of Pollution" in C. B. J. Gray, Taina Maria Tuominen, Fraser River Action Plan Staff, *Health of the Fraser River Aquatic Ecosystem: A Synthesis of Research Conducted under the Fraser River Action Plan* (DOE FRAP 1998-11) (available online at: [http://research.rem.sfu.ca/frap/S\\_47.pdf](http://research.rem.sfu.ca/frap/S_47.pdf)).

ecosystems, particularly anadromous fish habitats.<sup>96</sup> The regulation of pesticides used for forestry is described in commission PPRs on forestry and freshwater urbanization and was addressed in the commission's hearings on those topics.<sup>97</sup>

43. Agricultural pesticides are a source of persistent organic pollutants in estuaries where upstream use is high.<sup>98</sup> Although agricultural pesticide run-off may be a concern in the Strait of Georgia, this issue may be minor where there is limited agriculture on the coast.<sup>99</sup>

### *Greywater*

44. Greywater from marine vessels may contain wastewater from sinks, showers, kitchen and laundry facilities, cleaners, oil and grease, metals, pesticides, medical waste and other contaminants.<sup>100</sup> The release of greywater from vessels at sea can result in the release of contaminants to marine waters.<sup>101</sup> Concerns are highest in areas such as marinas, small harbours and areas with heavy boating traffic located in shallow, low flush regions. Laws, policies, Best Management Practices and various fact sheets relating to recreational boating in BC have been developed by EC and the BC MOE.<sup>102</sup>
45. Greywater is not considered to be garbage or sewage and the *Canada Shipping Act Regulations for the Prevention of Pollution from Ships and for Dangerous Chemicals*, SOR/2007-86 (the "*Shipping Pollution Regulations*") do not apply as

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<sup>96</sup> Haggerty *et al.* 2003 at 89.

<sup>97</sup> Cohen Commission Policy and Practice Report: Regulation of Forestry Activities Impacting Fraser River Sockeye Habitat, May 20, 2011 (Cohen Commission Exhibit PPR17) at paras. 165-168; Cohen Commission Exhibit PPR14; Cohen Commission Transcripts, June 6-7 and 17, 2011.

<sup>98</sup> Marine Environment Programme of Action at 3.

<sup>99</sup> Haggerty *et al.* 2003 at 4. Agriculture contributes very little to overall land use in BC's central coast; additional agricultural areas are found on Vancouver Island, especially around Campbell River (*ibid.* at 47).

<sup>100</sup> West Coast Environmental Law, Cruise Control: Regulating Cruise Ship Pollution on the Pacific Coast of Canada at 2 (available online at: [http://www.georgiastrait.org/files/share/PDF/CruiseControl\\_WCEL.pdf](http://www.georgiastrait.org/files/share/PDF/CruiseControl_WCEL.pdf)).

<sup>101</sup> Ringtail Document CAN400511 at 101. For an overview of the components of marine vessel greywater, such as conventional contaminants, trace metals, and organic contaminants, see Ringtail Document BCP008260 at 27-36.

<sup>102</sup> Ringtail Document CAN400511 at 101; Best Management Practices for BC, online: Environment Canada <[http://www.pyr.ec.gc.ca/boatyards/BMPsBC\\_e.htm](http://www.pyr.ec.gc.ca/boatyards/BMPsBC_e.htm)>.

long as it does not contain a pollutant prescribed in the *Shipping Pollution Regulations*.<sup>103</sup>

46. The provincial Ministry of the Environment regulates greywater discharges under the authority of the *EMA*. Section 13 prohibits a person from discharging “domestic sewage” or waste from trailers, campers, transportable housing units, boats or house boats onto land or into any reservoir, lake, pond, stream or other natural water body, except in compliance with a permit, approval, order, waste management plan or *EMA* regulation or if disposal facilities are provided. Domestic sewage in the *EMA’s Municipal Sewage Regulation* includes greywater.<sup>104</sup> Discharges from municipal wastewater systems in relation to Fraser sockeye marine habitat were addressed during hearings on municipal wastewater.<sup>105</sup>
47. According to the Province, it is implementing compliance with the *EMA*, s. 13 and its prohibition against greywater discharge from vessels into coastal marine waters in a phased-in approach.<sup>106</sup> The Province stated that it expected full compliance by spring 2010.<sup>107</sup> According to the Province, Transport Canada has advised BC that it is working on a regulatory approach for greywater discharge from small vessels that would be similar to sewage discharge.<sup>108</sup> The Ministry of the Environment is working with Transport Canada to meet the goal of developing a draft greywater discharge regulation by sometime in 2011-2012.<sup>109</sup>

### Monitoring

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<sup>103</sup> *CSA*, ss. 187 and 190(1) and *Shipping Pollution Regulations*, s. 4 and Schedule 1.

<sup>104</sup> *Municipal Sewage Regulation*, BC Reg. 129/99, s. 1.

<sup>105</sup> Cohen Commission Transcripts, June 14-15, 2011.

<sup>106</sup> Letter from Kirsten Heslop, BC MOE Thompson Region, January 7, 2008 at 11 (available online: <http://burrard yachtclub.com/documents/Provincial-Greywater-Feb09.pdf>) [Letter from Kirsten Heslop]; BC MOE, *Greywater Discharges Banned from Vessels in BC’s Inland Waters* (available online at: [http://www.env.gov.bc.ca/bcparks/explore/gen\\_info/greywater\\_fact\\_sheet.pdf](http://www.env.gov.bc.ca/bcparks/explore/gen_info/greywater_fact_sheet.pdf)) at 1 [Greywater Discharges Banned]. See also Ringtail Document CAN085924.

<sup>107</sup> Letter from Kirsten Heslop, *ibid.*; *Greywater Discharges Banned*, *ibid.* at 1.

<sup>108</sup> Shuswap/Mara Lakes Greywater Discharge Q & A (available online at: <http://www.env.gov.bc.ca/wat/wq/shuswap/greywaterqa.pdf>) [Greywater Q&A].

<sup>109</sup> *ibid.* at 1.

48. The *Canadian Environmental Protection Act* directs the Minister of the Environment to establish, operate and maintain a system for monitoring environmental quality.<sup>110</sup> Also, the *Canada Water Act*, R.S.C. 1985, c. C-11, provides for cooperative management of water resources and water quality. Part II of the Act deals with water quality management and allows the Minister to work with the provinces on water quality management.<sup>111</sup>
49. EC does water quality monitoring in BC for freshwater systems under a memorandum of understanding with BC pursuant to the *Canada Water Act*.<sup>112</sup> In the marine environment, there was some water quality monitoring in the Georgia Basin under the Georgia Basin Action Plan, which was funded from 2003-2008, but EC does not currently do any marine water quality monitoring in the Pacific except for work done under the Canadian Shellfish Sanitation Program and the department considers marine quality monitoring to be a DFO responsibility.<sup>113</sup> In any event, EC water quality monitoring is not intended to assess water quality or measure most contaminants of concern for Fraser River sockeye.<sup>114</sup>
50. Section 32 of the *Oceans Act* empowers the Minister of Fisheries and Oceans to establish marine environmental quality guidelines, objectives and criteria respecting estuaries, coastal waters and marine waters. *Canada's Oceans Strategy* is intended to implement the *Oceans Act* and provides for establishment and implementation of a marine environmental quality policy and operational framework.<sup>115</sup>
51. Water quality monitoring does not necessarily mean the monitoring of

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<sup>110</sup> *CEPA*, s. 44.

<sup>111</sup> For further information on the Act, see Cohen Commission Exhibit PPR15.

<sup>112</sup> Cohen Commission Transcripts, June 7, 2011 at p. 5 and Cohen Commission Exhibit 992.

<sup>113</sup> Cohen Commission Transcripts, June 7, 2011 at pp. 4 and 14-15.

<sup>114</sup> Cohen Commission Transcripts, June 6, 2011 at p. 16 and June 7, 2011 at p. 14.

<sup>115</sup> Ringtail Document CAN198623 at 23. For further information on the *Canada's Ocean Strategy* and associated initiatives see section, "Oceans management", below.



contaminants.<sup>116</sup> Contaminant monitoring often involves monitoring specific to assaying the concentration of contaminants in sediments or species of interest. Contaminant monitoring has been identified by DFO as a type of monitoring that would support DFO's healthy and productive aquatic ecosystem strategic outcome and its obligations under the *Fisheries Act*.<sup>117</sup> In 2006, the report of the DFO Science Monitoring Implementation Team on aquatic monitoring in Canada stated that there is considerable confusion with regard to the monitoring of contaminants and whereas EC monitors point sources, in the Pacific, DFO monitors organisms for population health (e.g. killer whales and contaminated fisheries).<sup>118</sup> The report identifies the need to rationalise the work done by DFO, EC, Natural Resources Canada and Health Canada regarding monitoring of contaminants in water, sediment and biota.<sup>119</sup> Regarding monitoring to protect fish habitat specifically, the report states that in general there is very little systematic monitoring of Canada's coastal and littoral zones and that there is a gap in DFO's ability to assess cumulative impacts.<sup>120</sup> With respect to the *Oceans Act*, the 2006 report notes that as of 2006, for the Pacific North Coast large ocean management area (see section, "Oceans management", below) there was no information on the background levels of contaminants such as oil.<sup>121</sup>

## Marine spills

52. Numerous sources introduce oil and its constituents into the marine environment, including chronic oil pollution from mixed sources, as well as episodic spills

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<sup>116</sup> See for example Cohen Commission Exhibits 977 and 993 regarding parameters monitored by EC in the Fraser River and information found at Water Quality Monitoring, online: Environment Canada <<http://www.ec.gc.ca/qualitedeleau-waterquality/Default.asp?lang=En>> and related links.

<sup>117</sup> Ringtail Document CAN210415 at 11-13.

<sup>118</sup> *Ibid.* at 32.

<sup>119</sup> *Ibid.* at 37.

<sup>120</sup> *Ibid.* at 9 and 36.

<sup>121</sup> *Ibid.* at 35.

associated with oil exploration and transport.<sup>122</sup> Some components of oil, particularly polycyclic aromatic hydrocarbons (“PAHs”), have widespread toxic effects, particularly to vulnerable species including seabirds, sea otters and marine larvae.<sup>123</sup> Sensitive marine environments and species could be adversely affected by a catastrophic oil spill, but chronic sources of oil pollution may impact areas such as harbours, marinas, high use areas and shipping routes.<sup>124</sup> Also, pollution forms such black and grey water are associated with all forms of boating as they are with cruise ships.<sup>125</sup> Cumulative impacts from small vessels, such as recreational fishing boats and pleasure craft, may be more difficult to control than pollution from large boats.<sup>126</sup> Of particular concern are persistent chemicals, such as pentachlorophenol, tributyltin and PAHs, which tend to be found in elevated concentrations in harbours.<sup>127</sup>

### Regulation

53. In addition to the general prohibition in s. 36 of the *Fisheries Act*, the *Canada Shipping Act*, S.C. 2001, c. 26 (the “CSA”) is the principal legislation governing the protection of the marine environment from shipping impacts. Under the CSA, responsibilities for dealing with ship-source pollution are shared between the Minister of Transport and the Minister of Fisheries and Oceans. Transport Canada is the lead regulatory agency for all ship-source spills.<sup>128</sup> It also manages the National Aerial Surveillance Program, approves ship source pollution prevention and response plans onboard large commercial vessels, approves oil handling facility response plans, certifies Response Organizations, monitors their activities and exercises, maintains the Pollutants List and is

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<sup>122</sup> Haggerty *et al.* 2003 at 2.

<sup>123</sup> *Ibid.*

<sup>124</sup> *Ibid.*

<sup>125</sup> *Ibid.* at 3.

<sup>126</sup> *Ibid.*

<sup>127</sup> *Ibid.*

<sup>128</sup> Ringtail Document CAN413217 at 18; DFO, *Canadian Coast Guard Environmental Response: Marine Spills Contingency Plan National Chapter* (April 2011) at Annex B [CCG Contingency Plan].

responsible for enforcement and compliance with the CSA.<sup>129</sup> Transport Canada is responsible for administering most regulations under the CSA, including:

- a. *Pollutant Discharge Reporting Regulations*, 1995, SOR/95-351;
- b. *Ballast Water Control and Management Regulations*, SOR/2006-129;
- c. *For the Prevention of Pollution from Ships and for Dangerous Chemicals, Regulations*, SOR/2007-86;
- d. *Environmental Response Arrangements Regulations*, SOR/2008-275; and
- e. *Response Organizations and Oil Handling Facilities Regulations*, SOR/95-405.

54. EC, and in particular its Environmental Emergencies Program, remains the lead agency for land-based spills into the marine environment from federal facilities.<sup>130</sup> For most land-based spills the Province through the Provincial Emergency Program is the lead agency and EC provides environmental advice and support. There is a 1981 agreement between Canada and BC that determines whether EC or BC will be the lead agency for land-based spills.<sup>131</sup>
55. The *Marine Liability Act*, S.C. 2001, c. 6, makes ship owners and ship operators liable in relation to pollution, passengers, cargo and property damage. It sets limits of liability and establishes uniformity by balancing the interests of ship owners and other parties.<sup>132</sup>

#### Marine spill response process

56. Through legislation such as the CSA and the *Oceans Act* and subject to various inter-agency agreements, DFO through the Canadian Coast Guard (“CCG”) is the lead agency responsible for managing responses to ship-source and mystery spills in Canadian waters, spills from oil handling facilities involving a vessel and

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<sup>129</sup> Ringtail Document CAN445493 at 6.

<sup>130</sup> *Ibid.*; Response, online: Environment Canada <<http://www.ec.gc.ca/ee-ue/default.asp?lang=en&n=001CCC7B-1>>.

<sup>131</sup> *Understanding Between Canada and British Columbia Concerning Federal/Provincial Responsibilities in Oil and Hazardous Material Spills*, June 26, 1981.

<sup>132</sup> Civil Liability Insurance for Marine Pollution, online: Transport Canada <<http://www.tc.gc.ca/eng/marinesafety/oep-environment-liability-menu-365.htm>>.

the transfer of oil, spills originating in foreign waters that are in Canadian waters.<sup>133</sup> Whereas Transport Canada is responsible for ensuring that the appropriate resources are in place and for the overall review of national capacity, CCG is responsible for the response and clean-up activities, including maintenance of the Marine Pollution Incident Reporting System (“MPIRS”).<sup>134</sup> MPIRS has a data field for information about impacts on wildlife, but given the nature of the spill response, the information in this field relates to dead or living oiled wildlife and potential longer-term impacts on wildlife, including fish are not caught by this field.<sup>135</sup>

57. The CCG has a *Marine Spills Contingency Plan* with national, regional and area chapters.<sup>136</sup> The *Marine Spills Contingency Plan* establishes CCG policy for monitoring a polluter-led response or for responding to a marine pollution incident where CCG is the lead agency or where it supports another agency leading the response.<sup>137</sup> The *Regional Contingency Chapter* translates policy direction into operational measures appropriate to regional areas.<sup>138</sup>
58. Once CCG assumes management of the response to a pollution incident, CCG’s On-scene Commander initiates a response in one of five categories.<sup>139</sup> CCG Directive D-6010-2001-03 has guidelines on how a spill should be categorised.<sup>140</sup> The level of response is indicative of either the type of incident or the type of response that the incident requires and is not necessarily related to the severity of the incident.<sup>141</sup> If the level of response requires clean-up, the polluter is identified and CCG is satisfied with the polluter’s proposed response plan, then

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<sup>133</sup> CCG Contingency Plan at *i* and 1-4; Ringtail Documents CAN445491, CAN445492, CAN445493 at 6 and CAN445494.

<sup>134</sup> Ringtail Document CAN445493 at 7. For more information on the Marine Pollution Incident Reporting System, see Ringtail Document CAN353802 at 16 (which is the previous version of the CCG Contingency Plan).

<sup>135</sup> Ringtail Document CAN353803.

<sup>136</sup> CCG Contingency Plan.

<sup>137</sup> *Ibid.* at 1-1.

<sup>138</sup> *Ibid.* at 1-6-1-7.

<sup>139</sup> Ringtail Document CAN353803.

<sup>140</sup> *Ibid.* at 11-12.

<sup>141</sup> *Ibid.*

CCG will allow the polluter to handle the clean-up, but will remain on the scene to monitor the clean-up. If a polluter is identified, but is unwilling or unable to respond to the spill, CCG will arrange for the clean-up and invoice the polluter. In the case of mystery spills, CCG makes a claim to the Ship-Source Pollution Fund to cover the costs of the clean-up.

59. CCG does not see the evaluation of habitat impacts as its mandate. Rather, CCG relies on EC and DFO to deal with long-term habitat impacts. The Regional Environmental Emergency Team (“REET”) is the group that develops monitoring plans for habitat issues and conducts long-term monitoring of a particular site.
60. EC is the lead federal authority for environmental advice during a pollution incident, whether land or marine-based. EC normally co-chairs the REET with the Province’s Provincial Emergency Program and the Chairs represent the combined environmental advice of all regulatory and advisory bodies at all levels of government and from industry.<sup>142</sup> However, one DFO scientist has questioned EC’s capacity to provide environmental advice regarding the effects of spills in the marine environment.<sup>143</sup>
61. REET may provide advice to the polluters or to CCG’s On-Scene Commander throughout a spill response.<sup>144</sup> REET is comprised of representatives from EC and DFO as noted above and representatives from other federal departments including Transport Canada, the provincial government, industry or industry cooperatives. It functions in two modes:<sup>145</sup>
  - a. A planning mode that is a form for the exchange of scientific and technical information; and
  - b. A response mode that operates as a flexible and expandable team of experts and agency representatives who provide environmental advice. EC determines which federal departments or agencies need to be brought onto

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<sup>142</sup> Ringtail Document CAN353802 at 7; CCG Contingency Plan at Appendix B.

<sup>143</sup> Ringtail Document CAN136962.

<sup>144</sup> Ringtail Document CAN353802 at 19.

<sup>145</sup> *Ibid.* at C-1.

REET during a spill response and the Provincial Emergency Program does the same with respect to provincial departments/agencies.

Advice provided by REET includes:<sup>146</sup>

- a. Identification of environmental, cultural, social and economic resources at risk and recommendation priorities for clean-up and protection operations in the response plan;
  - b. Pollutant behaviour, fate and effects;
  - c. Use and acceptability of dispersants;
  - d. In-situ burning and other innovative techniques;
  - e. Wildlife protection and rehabilitation strategies; and
  - f. Oily waste storage and disposal.
62. CCG is not a member of REET, but it liaises with it to receive advice on spill response. CCG relies on REET for scientific advice, but seeks to balance a number of considerations in addition to environmental impacts and is not required to accept REET's recommendations.<sup>147</sup> A DFO scientist has raised concerns regarding the fact that CCG does not need to heed REET's recommendations and is ultimately tasked with decision-making regarding science advice and impacts on fish habitat.<sup>148</sup>
63. In addition to the roles and responsibilities of CCG, DFO has other responsibilities during a pollution incident. It is a participant in REET and as such provides scientific and operational advice about the location of critical fisheries resources and their habitat, the timing and location of fishing activities, oceanographic information, support in spill tracking and trajectory modeling, general advice in support of clean-up operations and strategies and priorities for environmental protection related to the fisheries.<sup>149</sup>
64. The Department of National Defence ("DND") is responsible for marine spill response, including clean-up and monitoring, from DND ships and facilities. All

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<sup>146</sup> *Ibid.*

<sup>147</sup> See e.g. Ringtail Document CAN109663.

<sup>148</sup> Ringtail Document CAN353799.

<sup>149</sup> Ringtail Document CAN353802 at 7; CCG Contingency Plan at Appendix B.

spills are handled under DND Environmental Directive ED 4003-1/2003 (“ED 4003-1”), which is specific to DND’s Maritime Forces Pacific (“MARPAC”), and under local policies and procedures such as the Formation Safety Environment System Manual.<sup>150</sup> MARPAC Formation Safety and Environment office provides environmental oversight for Navy-related contaminated sites and spills in the Pacific Region. If there is a spill, on-scene DND personnel will report it internally as well as to other federal or provincial agencies according to regulatory reporting requirements and ED 4003-1.<sup>151</sup> DND determines whether the spill is a deleterious substance on a site-specific and an incident-specific basis and if so determined, DND reports the spill to the Provincial Emergency Program, which in turn reports spills to EC and DFO.

## **Disposal at sea**

65. In this PPR, the term “disposal at sea” refers to the intentional and regulated disposal of approved material from various structures at sea, such as ships, aircraft, and platforms.<sup>152</sup> The PPR does not address unlawful ocean dumping.

## Regulation

66. Canada is a party to the *Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972* (the “London Convention”) and the related *1996 Protocol to the Convention on the Prevention of Marine Pollution By Dumping of Wastes and Other Matter, 1972*, (the “1996 Protocol”).<sup>153</sup> As such, Canada is obligated to implement a permit system to regulate the disposal of

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<sup>150</sup> Ringtail Document CAN308809.

<sup>151</sup> *Ibid.*

<sup>152</sup> *CEPA*, s. 122(1).

<sup>153</sup> The text of both the London Convention and 1996 Protocol are available on the International Maritime Organization website at:  
<http://www.imo.org/OurWork/Environment/SpecialProgrammesAndInitiatives/Pages/London-Convention-and-Protocol.aspx>.

wastes or other matter at sea.<sup>154</sup> Canada aims to fulfill its international obligations in this regard through Part 7 (Controlling Pollution and Managing Wastes), Division 3 (Disposal at Sea) of the *CEPA*, the purpose of which is to prevent marine pollution, and through EC's Disposal at Sea Program.<sup>155</sup> For further discussion of the London Convention and 1996 Protocol see the commission's PPR on international law and Fraser sockeye.<sup>156</sup>

67. *CEPA* controls the dumping of substances into waters or onto ice from activities taking place at sea by way of a legislated general prohibition. *CEPA* prohibits the disposal at sea of material which may be harmful to human health and the marine environment, such as hazardous wastes.<sup>157</sup> Also, *CEPA* does not permit disposal of a substance from land based sources (pipes), discharges from the normal operations of a vessel (e.g. bilge water, ballast water) or other structure, as well as a few other activities.<sup>158</sup>
68. Disposal of some substances into the ocean from a ship, aircraft, platform or other structure is allowed under *CEPA*, but only if done in accordance with a Disposal at Sea permit issued by EC.<sup>159</sup>
69. Under *CEPA*, allowable "disposal" includes:<sup>160</sup>
  - a. Disposal of a substance at sea from a ship, an aircraft, a platform or another structure;
  - b. Disposal of dredged material into the sea from any source not mentioned in paragraph a;
  - c. Storage on the seabed, in the subsoil of the seabed or on the ice in any area of the sea of a substance that comes from a ship, an aircraft, a platform or

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<sup>154</sup> General Public, online: Environment Canada <<http://www.ec.gc.ca/iem-das/default.asp?lang=En&n=55A643AE-1>> [General Public].

<sup>155</sup> *CEPA*, s. 122.1; Ringtail Documents CAN310081 at 1 and CAN014236 at 22.

<sup>156</sup> Cohen Commission Policy and Practice Report: International Law Relevant to the Conservation and Management of Fraser River Sockeye Salmon (Cohen Commission Exhibit PPR2).

<sup>157</sup> Ringtail Document CAN310081 at 1.

<sup>158</sup> Activities Requiring a Disposal at Sea Permit, online: Environment Canada <<http://www.ec.gc.ca/iem-das/default.asp?lang=En&n=6A58C847-1>> [Activities Requiring a Disposal at Sea Permit].

<sup>159</sup> General Public.

<sup>160</sup> *CEPA*, s. 122(1).



- another structure;
- d. Deposit of a substance on the ice in an area of the sea;
- e. Disposal at sea of a ship or aircraft;
- f. Disposal or abandonment at sea of a platform or another structure; and
- g. Any other act or omission that constitutes a disposal under regulations made under paragraph 135(3)(c).

70. Allowable disposal does not include:<sup>161</sup>

- a. Disposal of a substance that is incidental to or derived from the normal operations of a ship, an aircraft, a platform or another structure or of any equipment on a ship, an aircraft, a platform or another structure, other than the disposal of substances from a ship, an aircraft, a platform or another structure operated for the purpose of disposing of such substances at sea;
- b. Placement of a substance for a purpose other than its mere disposal if the placement is not contrary to the purposes of this Division and the aims of the Convention or the Protocol;
- c. Abandonment of any matter, such as a cable, pipeline or research device, placed on the seabed or in the subsoil of the seabed for a purpose other than its mere disposal; or
- d. A discharge or storage directly arising from, or directly related to, the exploration for, exploitation of and associated off-shore processing of seabed mineral resources.

71. Article 4 of the 1996 Protocol states that Contracting Parties "shall prohibit the dumping of any wastes or other matter with the exception of those listed in Annex 1" to the 1996 Protocol.<sup>162</sup> Some of these materials are captured in Schedule 5 of *CEPA*, including dredged material, fish waste or other material resulting from industrial fish processing operations, vessels and platforms or other man-made structures at sea, inert, inorganic geological material, uncontaminated organic matter of natural origin, bulky items primarily composed of iron, steel, concrete or other similar matter for which the concern is physical impact and limited to those circumstances where such wastes are generated at locations, having no

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<sup>161</sup> *Ibid.*

<sup>162</sup> 1996 Protocol at para. 1.1 of Article 4.

practicable access to disposal options other than dumping.<sup>163</sup> There are some differences between the definition of materials set out in the 1996 Protocol and *CEPA*, however. For example, sewage sludge and carbon dioxide streams from carbon dioxide capture processes for sequestration are listed under the 1996 Protocol but not under Schedule 5 of *CEPA*.<sup>164</sup>

72. According to EC, in BC, material permitted to be disposed at sea is primarily dredged sediment from river or marine sources or excavated native material from the Metro Vancouver area.<sup>165</sup> The majority of the material disposed of at sea by Canada is material dredged to keep shipping channels and harbours clear for navigation and commerce.<sup>166</sup> Approximately 1.6 million cubic meters of material is dredged annually in BC to maintain navigational channels.<sup>167</sup> The annual volume of dredged as well as excavated material from Metro Vancouver cannot be accommodated by existing landfill sites.<sup>168</sup> Consequently, disposal at sea has been the preferred waste management option for these materials.<sup>169</sup>
73. Permit applicants must show that appropriate consideration has been given to other waste management options, such as re-use and off-site recycling, or disposal on land.<sup>170</sup> If there is an appropriate opportunity to use these other methods of disposal, a permit must be refused.<sup>171</sup>

### Permitting process

74. EC regulates disposal at sea by means of a permitting process in accordance

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<sup>163</sup> *CEPA*, Schedule 5; 1996 Protocol at para. 1 of Annex I.

<sup>164</sup> *Ibid.*

<sup>165</sup> Ringtail Document CAN310081 at 1.

<sup>166</sup> Disposal at Sea, online: Environment Canada <<http://www.ec.gc.ca/iem-das/Default.asp?lang=En&n=0047B595-1>>.

<sup>167</sup> Ringtail Document CAN310081 at 2.

<sup>168</sup> *Ibid.*

<sup>169</sup> *Ibid.*

<sup>170</sup> *CEPA*, Schedule 6, para. 5.

<sup>171</sup> *Ibid.*, paras. 6, 14.

with *CEPA*'s requirements and regulations.<sup>172</sup> Only a small list of wastes or other matter can be considered for Disposal at Sea permits:<sup>173</sup>

- a. Dredged material;
- b. Fish waste and other organic matter resulting from industrial fish processing operations;
- c. Ships, aircraft, platforms or other structures;
- d. Inert, inorganic geological matter;
- e. Uncontaminated organic matter of natural origin; and
- f. Bulky substances that are primarily composed of iron, steel, concrete or other similar matter.

In addition to disposal, the loading of waste material onto ships, aircraft, platform or other structure for the purpose of disposal at sea is also regulated by EC under *CEPA*.<sup>174</sup>

75. Approximately 35-40 permits are issued in BC every year. According to EC, permit applications are reviewed and assessed individually to ensure that ocean disposal is the environmentally preferable and practical alternative, that pollution is prevented and that conflicts with other legitimate uses of the sea are avoided.<sup>175</sup> Further, only material that has been rigorously tested and meets the regulations pursuant to s. 135 of *CEPA* and the Disposal at Sea Interim Contaminant Testing Guidelines may be approved for ocean disposal.<sup>176</sup>
76. Disposal at Sea permits are delivered through regional EC offices. EC intends permit review to be a consultative process, between the applicant, EC and other regulators and stakeholders.<sup>177</sup> EC receives advice from the Regional Ocean Disposal Advisory Committee ("RODAC").<sup>178</sup> This is an informal federal inter-

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<sup>172</sup> *Disposal at Sea Regulations*, SOR/2001-275, *Regulations Respecting Applications for Permits for Disposal at Sea*, SOR/2001-276 and *CEPA*, Part 7, Division 3.

<sup>173</sup> *Ibid.*

<sup>174</sup> *CEPA*, s. 124.

<sup>175</sup> General Public.

<sup>176</sup> Ringtail Documents CAN006028 at 39-42, Appendix 5 and CAN310081 at 2.

<sup>177</sup> General Public.

<sup>178</sup> Permits for Dredged Material, online: Environment Canada <<http://www.ec.gc.ca/iem-das/default.asp?lang=En&n=BEFB35FC-1&offset=4&toc=show>>; Ringtail Document CAN310081 at 2. For more

departmental committee that provides advice on as needed, *ad hoc* basis. The EC Regional Director, Environmental Protection Operations, Pacific and Yukon Region, is the decision-maker who issues the permits in BC.

77. All proposed disposal at sea projects are subject to an environmental assessment by EC and permit applications may trigger a *Canadian Environmental Assessment Act* assessment.<sup>179</sup>
78. Before issuing a permit under s. 127(1), the Minister must comply with *CEPA*, Schedule 6 and take into account any factors that he or she considers necessary.<sup>180</sup> Schedule 6 requires the Minister to develop a National Action List to provide a mechanism for screening candidate waste or other matter and its constituents on the basis of their potential effects on human health and the marine environment.<sup>181</sup> In selecting waste substances for consideration in the National Action List, priority shall be given to toxic, persistent and bioaccumulative substances from human sources. The National Action List specifies an upper level of waste or other matter and may also specify a lower level. The upper level is to be set so as to avoid, as much as reasonably possible, acute or chronic effects on human health or on sensitive marine organisms representative of the marine ecosystem.<sup>182</sup>
79. Under *CEPA*, the goal of waste management is to identify and control the sources of contamination.<sup>183</sup> This is intended to be achieved through the implementation of waste prevention strategies and requires collaboration between relevant local and national agencies involved with the control of point

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on applying for a disposal at sea permit, see Applying for a Permit, online: Environment Canada <<http://www.ec.gc.ca/iem-das/default.asp?lang=En&n=11663F70-1>>.

<sup>179</sup> *CEAA*, s. 5(1)(d) and *Law List Regulations*, SOR/94-636; Ringtail Document CAN310081 at 2; General Public. For an overview of the conditions that must apply before an environmental assessment under *CEAA* is required and how they relate to a Disposal at Sea activity, see Disposal at Sea and the *Canadian Environmental Assessment Act*, online: Environment Canada <<http://www.ec.gc.ca/iem-das/default.asp?lang=En&n=03734A73-1>>.

<sup>180</sup> *CEPA*, s. 127(3).

<sup>181</sup> *CEPA*, Schedule 6, para. 9.

<sup>182</sup> *Ibid.*, para. 10.

<sup>183</sup> *Ibid.*, para. 4.

and non-point sources of pollution.<sup>184</sup> Schedule 6 must be applied with a view that acceptance of disposal at sea under certain circumstances does not remove the obligation to make further attempts to reduce the necessity for disposal.<sup>185</sup> The applicant may be required to develop and implement a waste prevention strategy.<sup>186</sup>

### Permit exceptions for safety reasons

80. *CEPA* provides some exceptions to the above permit requirements where:<sup>187</sup>
- a. it is necessary to avert a danger to human life or to a structure at sea in situations caused by stress of weather or in any other case that constitutes a danger to human life or a threat to a structure at sea;
  - b. the disposal appears to be the only way of averting the danger or threat; and
  - c. it is probable that the damage caused by the disposal would be less than would otherwise occur.
81. Disposal in these circumstances must be carried out in a manner that minimises, as far as possible, danger to human life and damage to the marine environment and must be reported without delay.<sup>188</sup>

### Permit conditions

82. Disposal at Sea permits are only valid for one year and include conditions that the Minister of the Environment considers necessary for the protection of marine life, any legitimate uses of the sea or human life, including conditions relating to the following:<sup>189</sup>
- a. the nature and quantity of the substance for loading, disposal;
  - b. the method and frequency of the disposal authorized including, if

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<sup>184</sup> *Ibid.*

<sup>185</sup> *Ibid.*, para. 1.

<sup>186</sup> *Ibid.*, para. 3.

<sup>187</sup> *CEPA*, s. 130(1) (Unless the danger was caused or contributed to by the person's negligent act or omission: *ibid.*, s. 130(3).

<sup>188</sup> *Ibid.*, ss. 130(2) and (4).

<sup>189</sup> *Ibid.*, s. 129(1). For a sample Disposal at Sea permit, see Ringtail Document CAN303177.

- necessary, the date or dates on which disposal is authorized;
- c. the manner of loading and stowing the substance authorized for disposal;
- d. the site at which disposal may take place;
- e. the route to be followed by the ship or aircraft transporting the substance to the disposal site;
- f. any special precautions to be taken respecting the loading, transporting, disposal of the substance; and
- g. monitoring of the disposal and the disposal site to determine the effects of the disposal on the environment and human life.

83. A permit also may include conditions relating to reporting requirements.<sup>190</sup> According to EC, permit conditions are meant to ensure that the quantities, disposal sites and special precautions are considered.<sup>191</sup>

#### Disposal at sea sites in BC

84. There are 14 designated disposal sites in BC (see Figure 1).<sup>192</sup> The disposal site selection criteria under *CEPA* include proximity to fishery resources and habitat, interference with marine use in the area, evaluation of mixing and transport characteristics at the site, feasibility of monitoring the disposal site and First Nations concerns.<sup>193</sup>

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<sup>190</sup> Activities Requiring a Disposal at Sea Permit; see also Schedule 6 of *CEPA*, para. 17.

<sup>191</sup> General Public.

<sup>192</sup> Ringtail Document CAN310081 at 3.

<sup>193</sup> *Ibid.*; *CEPA*, Schedule 6, para. 11.

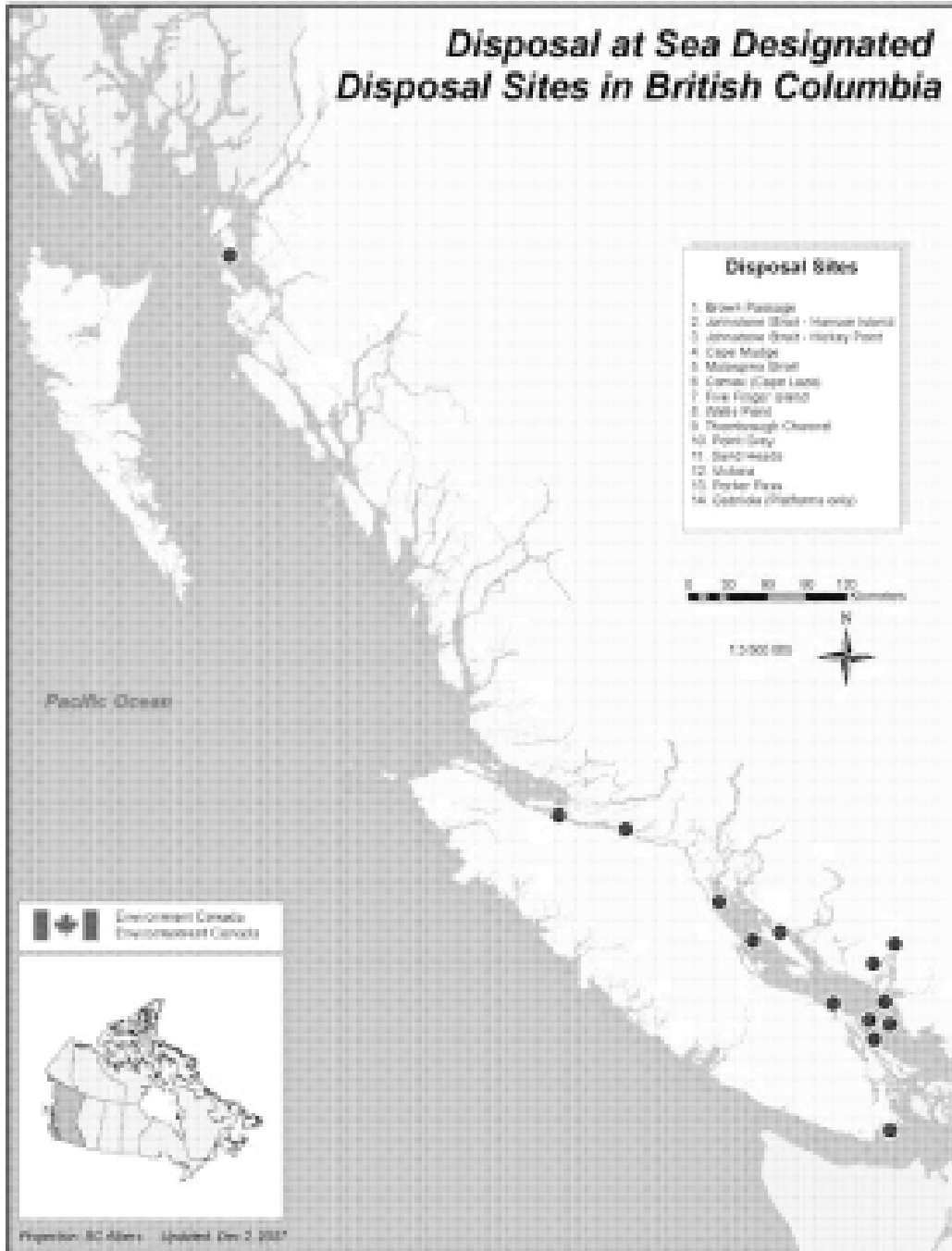


Figure 1: Disposal at Sea Sites in British Columbia<sup>194</sup>

<sup>194</sup> Ringtail Document CAN310081 at 3.

## Monitoring

85. Compliance monitoring by EC verifies that Disposal at Sea permit conditions are met.<sup>195</sup> Field monitoring is intended to verify that the assumptions made during the permit review and site selection process were correct and sufficient to protect human health and the environment.<sup>196</sup> Disposal sites must be reviewed by EC at regular intervals, taking into account the results of monitoring and the objectives of monitoring programs.<sup>197</sup> Monitoring is done according to a national site rotation schedule. Other federal departments, including DFO, provide in-kind support (e.g. ship time, use of equipment).<sup>198</sup> Monitoring involves sediment analysis for chemical, biological and physical parameters.<sup>199</sup> EC states that monitoring results indicate that sediment at BC disposal sites has not been significantly affected by dumping activities.<sup>200</sup>
86. EC enforcement officers may also conduct surveillance monitoring and inspections at both loading and disposal sites to ensure compliance with Disposal at Sea permit conditions.<sup>201</sup>
87. Cost recovery for actions taken to remedy a condition or mitigate damage resulting from an offence regarding ocean disposal, is available from the person or ship that committed the offence.<sup>202</sup>

## Disposal at sea in Species at Risk Act critical habitat

88. Before issuing permits for disposal in an area where DFO has determined that

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<sup>195</sup> CEPA, Schedule 6, para. 16.

<sup>196</sup> *Ibid.*

<sup>197</sup> *Ibid.*, para. 18.

<sup>198</sup> Ringtail Document CAN014236 at 22. A summary of the resources expended by the Disposal at Sea Program, for fiscal year 2001-2002, is presented at 23.

<sup>199</sup> Ringtail Document CAN310081 at 4.

<sup>200</sup> *Ibid.*

<sup>201</sup> *Ibid.* at 2; CEPA, s. 132.

<sup>202</sup> CEPA, s. 136.



there is critical habitat under the *Species at Risk Act*, S.C. 2002, c. 29 (“SARA”), EC consults DFO regarding specific critical habitat requirements to include in the Disposal at Sea permit conditions. Currently, there are only 2 or 3 permits for the disposal site in BC that is currently located in a SARA critical habitat area (Sand Heads, which is located near the Fraser River estuary).

## Land-use

89. Land-use activities can impact the marine environment particularly in coastal areas.<sup>203</sup> The impacts of several types of land-use activities (forestry, development, ports, harbours and fuel depots and agriculture) on the marine environment are described in the sections below.

### Forestry

90. Marine habitat may be affected by timber harvesting, including the construction of roads, through changes in water flow regimes and associated silting and through contaminants from pest and fire control chemicals.<sup>204</sup> Direct information on the impact of forestry operations on marine habitat is scarce.<sup>205</sup> It is assumed that forestry-related impacts on coastal marine ecosystems occur and could impact anadromous fish, including Fraser River sockeye salmon.<sup>206</sup> Information on forestry impacts on sockeye habitat in the freshwater environment can be found in Cohen Commission Exhibit PPR17 and the commission’s hearings transcripts on this topic.<sup>207</sup>
91. The forest industry is regulated by the *Forests and Range Practices Act*, 2004, S.B.C. c. 69 (“FRPA”). The FRPA holds operators accountable for results and

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<sup>203</sup> Ringtail Document CAN024922 at 5, 7.

<sup>204</sup> *Ibid.* at 8.

<sup>205</sup> *Ibid.*; Nelson, K.S., E. Gray and H. Tallis, Research Update: Logging and Marine Coastal Systems (available online at: <http://accessscience.com/popup.aspx?id=YB071520&name=print>) [Nelson].

<sup>206</sup> *Ibid.*

<sup>207</sup> Cohen Commission Transcripts, June 17, 2011.

strategies in their forest stewardship plans, to ensure the conservation of water, fish, biodiversity.<sup>208</sup> Further information on regulation of forestry impacts on sockeye habitat can be found in Cohen Commission Exhibit PPR17 and the commission's hearings transcripts on this topic.<sup>209</sup>

92. Log handling is one forestry activity that has been examined with respect to impacts on marine habitats, although not for Fraser sockeye specifically. Log handling refers to the “[e]stablishment and operation of aquatic and terrestrial areas used for storing and sorting logs’ and includes log sorts at pulp mills and sawmills and underwater log salvage.”<sup>210</sup> Operations include the initial transfer of logs to water, sorting, booming, barging, transport and storage.<sup>211</sup> Because of the terrain, coastline and economic realities of moving wood products in British Columbia, log handling operations are often situated in (or near) marine or freshwater.<sup>212</sup> In fact, most coastal tenures are log handling facilities, however only parts of these sites operate at any one time.<sup>213</sup>
93. According to a collaborative report by DFO, EC, the University of BC and the University of Victoria, log handling sites impact the local environment through “dropping logs into shallow water, scouring benthic habitats, and smothering marine plants and other organisms with woody debris and surface runoff.”<sup>214</sup> Logs are dumped into coastal waters in one of four ways: vertical hoist (including cranes), direct to barge, helicopter dumping and skidways (slides), the last two of which are the most commonly used methods.<sup>215</sup>
94. Log handling practices may result in the creation of debris fields (sunken trees, limbs, bark and bundling debris) in the marine intertidal and sub-tidal

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<sup>208</sup> Ringtail Document CAN025074 at 74.

<sup>209</sup> Cohen Commission Transcripts, June 17, 2011.

<sup>210</sup> Ringtail Document CAN027796 at 22.

<sup>211</sup> Ringtail Document CAN006030 at 9-10.

<sup>212</sup> *Ibid.* at 9.

<sup>213</sup> Ringtail Document CAN025074 at 22.

<sup>214</sup> *Ibid.*

<sup>215</sup> Ringtail Documents CAN027877 at 117 and CAN400541 at 25.

environment.<sup>216</sup> Wood waste material (bark, wood debris, fibres or chips) from sawmills, log storage and sorting facilities dumped in coastal waters and redistributed by currents form debris fields that may bury benthos, alter water quality (e.g. lower dissolved oxygen leading to releases of hydrogen sulphide and toxic leachates) and physically abrade intertidal and shallow sub-tidal habitats<sup>217</sup> and these debris fields may persist for months to decades.<sup>218</sup> Intertidal log storage may compact sediment under grounded logs resulting in reduced pore water space, decreased water circulation and the development of an anoxic layer of sediment.<sup>219</sup> Associated with log handling, barges, log booms and other structures may shade the water column and reduce primary production and growth.<sup>220</sup> In deep, cool water decomposing organic wood material slows and can also cause bacterial matting reducing water quality.<sup>221</sup> Log handling facilities may also alter critical landscape/bottom features through infilling inter- and sub-tidal habitat.<sup>222</sup>

95. In an attempt to minimize environmental impacts, current log handling site selection and operational procedures are regulated by a number of federal and provincial acts.<sup>223</sup> However, as companies move into more remote areas to access timber in the Pacific Region, the number of small log dumps is increasing.<sup>224</sup> Guidelines, developed in 2003 for DFO, direct operations into “steep and deep” areas and away from highly productive inter-tidal and shallow sub-tidal areas.<sup>225</sup> These guidelines aim to assist proponents and regulatory

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<sup>216</sup> Ringtail Documents CAN400543 at 16 and CAN400541 at 25.

<sup>217</sup> *Ibid.*; Ringtail Documents CAN010265 at 49 and CAN162754 at 83.

<sup>218</sup> Ringtail Document CAN400541 at 25.

<sup>219</sup> Ringtail Documents CAN162754 at 83 and CAN010265 at 49.

<sup>220</sup> Ringtail Documents CAN400543 at 16, CAN400541 at 25 and CAN010265 at 49.

<sup>221</sup> *Ibid.*

<sup>222</sup> Ringtail Document CAN010265 at 49.

<sup>223</sup> Ringtail Documents CAN027877 at 118 and CAN006030 at 17-24.

<sup>224</sup> Ringtail Document CAN400541 at 26.

<sup>225</sup> *Ibid.*; Ringtail Document CAN025074 at 22; G3 Consulting Ltd., *Guidebook: Environmentally Sustainable Log Handling Facilities in British Columbia*, April 2003 (available online at: <http://www-heb.pac.dfo-mpo.gc.ca/publications/pdf/274124.pdf>).

agency personnel in meeting relevant log-handling environmental legislation.<sup>226</sup> They describe best management practices for siting and design of log handling facilities and log transfer activities as well as the design, orientation, construction materials and chemical treatments of wharves, docks, piers and floats and the design of dry-land sort facilities.<sup>227</sup>

96. In 2009, DFO collaborated with the BC Coastal Forest Product Association to develop Best Management Practices (“BMPs”) for log-handling activities.<sup>228</sup> These BMPs aim to streamline DFO regulatory reviews of low-risk activities related to log-handling.<sup>229</sup> Relevant BMPs include: Helicopter Log Drop Sites in Marine Waters of British Columbia<sup>230</sup> and Re-activated Log Dumps in Marine Waters of British Columbia.<sup>231</sup> Also available is a land-use operational policy on log-handling produced by the Province.<sup>232</sup>

### Development

97. Activities such as urbanisation and road, port, bridge and marina development can affect fish habitat through physical loss of habitat and the deposition of deleterious substances. Development activities related to urbanisation are described in Cohen Commission Exhibit PPR14 and Technical Report 3: Evaluating the Status of Fraser River Sockeye Salmon and Role of Freshwater Ecology in their Decline.<sup>233</sup>

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<sup>226</sup> Ringtail Document CAN006030 at 9.

<sup>227</sup> *Ibid.* at 37-43.

<sup>228</sup> Ringtail Document CAN401043 at 4.

<sup>229</sup> *Ibid.*

<sup>230</sup> Ringtail Document CAN285240, available online at: [http://www.coastforest.org/media\\_pdf/2008-07-11\\_heli\\_logdrop\\_bmp.pdf](http://www.coastforest.org/media_pdf/2008-07-11_heli_logdrop_bmp.pdf).

<sup>231</sup> Available online at: [http://www.coastforest.org/media\\_pdf/2008-07-11\\_log\\_dump\\_react\\_bmp.pdf](http://www.coastforest.org/media_pdf/2008-07-11_log_dump_react_bmp.pdf).

<sup>232</sup> Ringtail Document BCP001386.

<sup>233</sup> Cohen Commission Exhibits 562 and 562A.

## Regulation

98. Transport Canada is tasked with ensuring a safe, secure, efficient and affordable transportation system.<sup>234</sup> It oversees marine infrastructure for pleasure craft, small vessels and large commercial vessels as well as the transport of dangerous goods by water and the protection of the marine environment. It also ensures that works in navigable waterways are reviewed and regulated according to the *Navigable Waters Protection Act*, R.S.C., 1985, c.N-22 (“*NWPA*”) which is administered by the Navigable Waters Protection Program.<sup>235</sup> The *NWPA* directs that “no work shall be built or placed in, on, over, under, through or across any navigable water without the Minister’s prior approval of the work, its site and the plans for it”<sup>236</sup> and prohibits the throwing or depositing of any material that may interfere with navigation into navigable waters.<sup>237</sup> “Works” include wharfs, docks, piers, dams, booms, bridges, overhead cables and pipelines.<sup>238</sup>
99. DFO has streamlined regulatory reviews of low risk development activities and now manages many of these activities through the use of guidance documents called Operational Statements (“OS”) and BMPs.<sup>239</sup> Land-use and development activities for which OS exist include clear span bridges, bridge maintenance and small moorings.<sup>240</sup> There is also a relevant provincial BMP: *Develop with Care: Environmental Guidelines for Urban and Rural Land Development in British Columbia*.<sup>241</sup> For more information about OS and BMPs, see Cohen

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<sup>234</sup> Ringtail Document CAN025064 at 35.

<sup>235</sup> *NWPA* Regulatory Framework, online: Transport Canada <<http://www.tc.gc.ca/eng/marinesafety/oep-nwpp-framework-250.htm>>.

<sup>236</sup> *NWPA*, s. 5(1).

<sup>237</sup> *Ibid.*, ss. 21-22.

<sup>238</sup> *Ibid.*, s. 2.

<sup>239</sup> Cohen Commission Exhibit PPR8; Ringtail Documents CAN009168 at 49, CAN021555 at 4, CAN393189 at 1 and CAN005941 at 1-2.

<sup>240</sup> Planning Guidance for British Columbia and Yukon, online: Fisheries and Oceans Canada <<http://www.pac.dfo-mpo.gc.ca/habitat/os-eo/index-eng.htm>>.

<sup>241</sup> Guidelines and Best Management Practices, online: Ministry of Environment <<http://www.env.gov.bc.ca/wld/BMP/bmpintro.html>>; Best Management Practices and Guidelines, online:

Commission Exhibits PPR8 and PPR14 and related hearings.<sup>242</sup>

100. The Province has jurisdiction over private and provincial Crown lands and resources.<sup>243</sup> Activities regulated by the Province that may impact marine sockeye habitat include: logging, agriculture and water and land management.
101. An environmental assessment may be required for proposed projects under the *Canadian Environmental Assessment Act*.<sup>244</sup> For more information regarding DFO's role in *CEAA* assessments see Cohen Commission Exhibit PPR8.
102. The *BC Environmental Assessment Act*, S.B.C. 2002, c. 43 ("*BC EAA*"), also provides for environmental review of some projects to ensure that developments are carried out in a social, economical and environmental sustainable manner.<sup>245</sup> When both *CEAA* and *BC EAA* are triggered, cooperation and coordination between federal and provincial agencies are governed by the *Canada-British Columbia Agreement on Environmental Assessment Cooperation (2004)*.<sup>246</sup>

### Oil and gas depots

103. A shipboard oil pollution emergency plan is required of all ships transiting Canadian waters in addition to an arrangement with a certified response organization that can respond to a spill on behalf of the polluter.<sup>247</sup> Oil handling facilities,<sup>248</sup> and anyone else loading or unloading oil or oil products, are required to have an oil pollution emergency plan in addition to on-site response equipment

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Fisheries and Oceans Canada <<http://www.pac.dfo-mpo.gc.ca/habitat/guide-eng.htm#Guides>>; Ringtail Document CAN285243 at 1.

<sup>242</sup> In particular, see Cohen Commission Transcripts, June 8, 2011 at pp. 3-20.

<sup>243</sup> *Constitution Act, 1867* at para. 92-92A.

<sup>244</sup> *CEAA*, ss. 5-10.1.

<sup>245</sup> The Environmental Assessment Process, online: Province of British Columbia <[http://www.eao.gov.bc.ca/ea\\_process.html](http://www.eao.gov.bc.ca/ea_process.html)>. See also Cohen Commission Exhibits PPR8 and PPR14.

<sup>246</sup> Ringtail Document CAN006059.

<sup>247</sup> Response Organizations, online: Transport Canada <<http://www.tc.gc.ca/eng/marinesafety/oep-ers-regime-ros-771.htm>> [Response Organizations].

<sup>248</sup> An oil handling facility is defined in the *Canada Shipping Act, 2001*, as "a facility, including an oil terminal, that is used in the loading or unloading of petroleum in any form, including crude oil, fuel oil, sludge, oil refuse and refined products, to or from vessels."

during the transfer.<sup>249</sup> The Burrard Clean Operations/Western Canada Marine Response Corporation is a Transport Canada certified marine oil spill response agency for all navigable waters of BC.<sup>250</sup>

104. Transport Canada approves oil handling facility response plans and is responsible for administering the *Response Organizations and Oil Handling Facilities Regulations*, SOR/95-405 (“*Oil Handling Facilities Regulation*”) enacted under the *Canada Shipping Act*. The *Oil Handling Facilities Regulation* outlines the procedures, equipment and resources of response organizations and oil handling facilities for use in a potential oil pollution incident.<sup>251</sup> The *Response Organizations Standards (1995)*, TP 12401 E<sup>252</sup> outlines the parameters within which these organizations must respond.<sup>253</sup> These standards include specifications and technical and operational requirements; they are intended to be used in the planning process to prepare for oil spill incident responses.<sup>254</sup>
105. Pollution reports originating from oil handling facilities are compiled by the Marine Communication and Traffic Services (“MCTS”).<sup>255</sup> Pollution from spills at docks may also be observed and reported by Transport Canada aircraft surveillance, floatplane pilots, or individuals on shore.<sup>256</sup> Data on incidents, but not the quantity of oil and other materials spilled, are available through MCTS and the BC Provincial Emergency Program.<sup>257</sup>
106. Canadian Coast Guard is the responsible agency for responding to pollution originating from oil handling facilities.<sup>258</sup> For further information about the effect of

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<sup>249</sup> Response Organizations.

<sup>250</sup> *Ibid.*; About us, online: Burrard Clean Operators/ Western Canada Marine Response Corporation <<http://www.burrardclean.com/about-us>>.

<sup>251</sup> Response Organizations.

<sup>252</sup> Available online at: <http://www.tc.gc.ca/publications/EN/TP12401/PDF/HR/TP12401E.pdf> [Response Organizations Standards].

<sup>253</sup> Response Organizations.

<sup>254</sup> Response Organizations Standards at 3.

<sup>255</sup> Ringtail Document CAN025074 at 44.

<sup>256</sup> *Ibid.*

<sup>257</sup> *Ibid.*

<sup>258</sup> Ringtail Document CAN000379 at 40-41.

potential spills on sockeye habitat see the section, “Marine Spills”, above.

Ports, harbours, docks and buoys

107. The primary stressors on the marine environment associated with ports and marinas have been identified as vessels using these facilities and the physical effects of dredging for navigational purposes, shoreline armouring and floating structures.<sup>259</sup> Dock structures reduce light penetration and floating boats suspend sediment as floats lift sediment as they rise with the tide.<sup>260</sup> In addition, the use of treated wood introduces toxic substances; shoreline protection works change intertidal and nearshore habitat through effects on temperature, circulation, and temperature; the construction of docks and walkways can create acoustic disturbances; uncured concrete can increase water pH; and large scale dredging to maintain harbours<sup>261</sup> can cause sediment plumes.<sup>262</sup> The use of antifoulants can introduce heavy metals and other toxins and zinc anodes can leak. Vessels may release ballast water creating turbidity, spill wood chips, oil and other substances.<sup>263</sup>
108. Canada has created a National Ports System consisting of independently managed self-sufficient Canada Port Authorities.<sup>264</sup> In BC, all former Canada Port Authorities and most Regional/Local Ports have been divested or transferred from Transport Canada to municipal authorities, societies, local interest groups or other federal ministries such as DFO although many remote BC ports remain under Transport Canada control.<sup>265</sup> Ports under Transport Canada are operated

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<sup>259</sup> Ringtail Document CAN024922 at 81.

<sup>260</sup> *Ibid.* at 81-82.

<sup>261</sup> Routine dredging is managed according to a DFO Operational Statement, Ringtail Document CAN330827.

<sup>262</sup> Ringtail Document CAN024922 at 81-82.

<sup>263</sup> *Ibid.*

<sup>264</sup> Ringtail Document CAN027877 at 147.

<sup>265</sup> *Ibid.* For example, the Vancouver Port Authority, North Fraser Port Authority and the Fraser River Port Authority amalgamated into the Vancouver Fraser Port Authority (also called “Port Metro Vancouver”) in 2008 and at this time was established as a non-shareholder, financially self-sufficient corporation under the *Canada Marine Act* (Corporate, online: Port Metro Vancouver <<http://portmetrovancover.com/en/about/corporate.aspx>>).



pursuant to the *Canada Marine Act*, S.C. 1998, c. 10, while DFO's operation of Small Crafts Harbours is guided by the *Fishing and Recreational Harbours Act*, R.S.C. 1985, c. F-24 and the *Federal Real Property and Federal Immovables Act*, S.C. 1991, c. 50.<sup>266</sup> The installation of small moorings, i.e., buoys anchored to the bottom of a water body in open water that are used to secure a boat or to secure navigational aids, is guided by a DFO operational statement.<sup>267</sup>

109. Under the *Canada Marine Act*, the Fraser River Port Authority and North Fraser Port Authority (the "Ports") were required to complete comprehensive Land Use Plans, which they did in 2000, and these enabled the Ports to become managers of the environmental review of projects and physical works occurring on Port lands.<sup>268</sup> The Ports approve some environmental reviews in-house pursuant to delegated authority in the CEEA's *Canadian Port Authority Environmental Assessment Regulations*, SOR/99-318.

### Agriculture

110. In BC, farming may present a threat to marine ecosystems.<sup>269</sup> Land-based activities, such as agriculture, can stress the marine environment through contaminated effluent, sediment and nutrient inputs, wetland destruction, disruption of estuaries, physical changes of the coasts by engineering works and by changing freshwater flows influencing coastal areas.<sup>270</sup> Such stressors may cause eutrophication of coastal waters and hypoxia.<sup>271</sup> Increases in biochemical oxygen demand can cause direct mortalities and or affect biodiversity and productivity and overall marine environmental quality.<sup>272</sup> Key sources of nitrate

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<sup>266</sup> Ringtail Document CAN027877 at 145.

<sup>267</sup> Fisheries and Oceans Canada, *Pacific Region Operational Statement: Small Moorings* at 1 (available online at: [http://www.pac.dfo-mpo.gc.ca/habitat/os-eo/pdfs/moorings\\_e.pdf](http://www.pac.dfo-mpo.gc.ca/habitat/os-eo/pdfs/moorings_e.pdf)) [Small Mooring OS].

<sup>268</sup> Ringtail Document CAN022830 at 73.

<sup>269</sup> Ringtail Document CAN024922 at 9.

<sup>270</sup> Ringtail Document CAN024763 at 94.

<sup>271</sup> *Ibid.*; Ringtail Document CAN024922 at 7.

<sup>272</sup> Ringtail Document CAN024763 at 94.

pollution are agricultural fertilizers, manure storage and spreading operations and fertilizer applied to lawns, golf courses and other recreational facilities.<sup>273</sup>

111. Runoff of silts from tilled land can smother nearshore benthic communities and may contain pesticides that become dispersed in the ocean.<sup>274</sup> DFO reports state that the Strait of Georgia has been affected by coastal urbanization and agriculture – activities that can result in contamination of the ocean by metals, organic pollutants, other chemicals and pathogens.<sup>275</sup> Agriculture and Agri-Food Canada runs two programs to protect water quality from agricultural impacts: *Greencover Canada* and the *National Environmental Farm Planning Initiative*.<sup>276</sup> For more information about contaminants see the “Contaminants” section above, Cohen Commission Exhibit PPR14 and commission Technical Report 2.

## Oceans management

112. As described above, Fraser sockeye migrate through much of BC’s coastal areas (see section “Fraser sockeye marine habitat”, above). Integrated coastal and ocean management (“integrated management” or “coastal zone management”) is a management framework that aims to include activities ranging from area-based planning to coastal and marine habitat and biodiversity protection.<sup>277</sup> Integrated management is provided for in the *Oceans Act*. The Act calls for integrated, ecosystem based management of Canada’s marine regions, grants the government the power to develop integrated management plans (“IMPs”) and designate marine protected areas (“MPAs”), and requires the development of a national strategy.<sup>278</sup> The Act is largely enabling rather than directive. When the Act was passed, DFO reallocated financial resources from its existing budget to establish the Oceans Directorate and to launch MPA and ocean management

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<sup>273</sup> Ringtail Document CAN025063 at 9.

<sup>274</sup> Ringtail Document CAN024922 at 9.

<sup>275</sup> Ringtail Documents CAN385035 at 32 and CAN431049 at 47.

<sup>276</sup> Ringtail Document CAN025063 at 10.

<sup>277</sup> Ringtail Document CAN024763 at 21.

<sup>278</sup> *Oceans Act*, ss. 29-36; Ringtail Document CAN198623 at 23.

pilot projects.<sup>279</sup>

113. With respect to IMPs, two of the objectives of the plan for the priority area on the Pacific North Coast (see section, “Aspects of integrated management potentially relevant to Fraser Sockeye: The Pacific North Coast Integrated Management Area”, below) are to resolve conflicts between different users and reduce ecological risks.<sup>280</sup> Marine protected areas are intended to protect specific features and functions of very specific habitats and thus far have not been established to protect sockeye salmon, or even established in areas that sockeye are known to traverse (see section, “Marine protected areas”, below).

### Canada’s Oceans Strategy

114. According to *Canada’s Oceans Strategy* (the “*Oceans Strategy*”), the *Ocean’s Act* provides a framework for ocean management initiatives and calls for the Minister of Fisheries and Oceans to develop a national ocean management strategy.<sup>281</sup> The “*Oceans Strategy*”, released in 2002, is this strategy. It is the Government of Canada’s policy statement for the management of estuarine coastal and marine ecosystems and it sets out the policy direction for ocean management in Canada.<sup>282</sup>
115. The *Oceans Strategy* has three policy objectives or outcomes, each with several identified activities:<sup>283</sup>
- a. Understanding and protecting the marine environment. Identified activities:
    - i. Improved scientific knowledge base for estuarine, coastal and

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<sup>279</sup> Ringtail Document CAN198623 at 23.

<sup>280</sup> PNCIMA Initiative: What is the purpose of the PNCIMA initiative? (no date), online: PNCIMA <<http://pncima.org/site/what/what-is-the-purpose-.html>>; PNCIMA Planning Office, *PNCIMA Plan: Issues and Outputs and Tasks, Review & Recommendations*, February 14, 2011 at 3 (available online at: <http://pncima.org/media/documents/pncima-publications/issue-outputs-and-tasks-with-review.pdf>) [PNCIMA Issues, Outputs and Tasks].

<sup>281</sup> Cohen Commission Exhibit 263 at 4.

<sup>282</sup> *Ibid.* at 1.

<sup>283</sup> *Ibid.* at 12.

- marine ecosystems;
- ii. Policies and programs aimed at marine pollution prevention; and
- iii. Conservation and protection of the marine environment.

b. Supporting sustainable economic opportunities. Identified activities:

- i. Sectoral measures to improve and support governance and management of marine industries;
- ii. New and emerging opportunities for oceans industries and oceans-related coastal development; and
- iii. Cooperation and coordination to support and promote business development in the oceans sector.

c. International leadership. Identified activities:

- i. Sovereignty and security;
- ii. International oceans governance; and
- iii. Share experience, promote compliance and build capacity, in particular for developing nations.

116. Regarding understanding the marine environment, the *Oceans Strategy* states that the first objective is predicated on solid science and that science support for oceans management is important for delineating ecosystem boundaries, identifying key ecosystem functions and components, developing predictive models and risk assessment techniques, developing ecosystem-based management objectives, developing performance indicators and assessing the state of ecosystem health.<sup>284</sup> With respect to protecting the marine environment, the *Oceans Strategy* states that protection must consider the degradation of the marine environment including, physical alteration and destruction of marine habitat.<sup>285</sup> The first objective is intended to support the creation of a national network of marine protected areas and the establishment of marine environmental quality guidelines.<sup>286</sup>

117. The conservation and sustainable use of fisheries resources and the

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<sup>284</sup> *Ibid.*

<sup>285</sup> *Ibid.* at 13.

<sup>286</sup> *Ibid.* at 14.

development of aquaculture are key goals of the objective of supporting sustainable economic opportunities.<sup>287</sup> The *Oceans Strategy* also mentions offshore energy and mineral resource development, the shipping industry, seabed mapping, marine communications and data management and tourism as activities to be fostered under this objective.<sup>288</sup>

118. The third policy objective, international leadership, is stated to be focused on advancing Canadian and global ocean-related interests “broadly and proactively.” As several federal departments have international activities concerning oceans, the *Oceans Strategy* recognises that no single federal government department has the mandate, capacity or resources to implement all of the international oceans commitments and that as a result a common understanding and consensus on international oceans priorities is necessary among departments.<sup>289</sup>
119. According to the *Oceans Strategy*, the activities associated with each objective were to be implemented over a four-year period from 2002-2006.<sup>290</sup>
120. The *Oceans Strategy* is supposed to advance oceans governance in three specific areas:<sup>291</sup>
  - a. Institutional governance mechanisms to enhance coordinated, collaborative decision-making across the federal government and other levels of government;
  - b. Integrated Management planning program to engage partners in the planning and managing of ocean activities; and
  - c. Promoting stewardship and public awareness.

### Canada’s Oceans Action Plan

121. According to the federal government, the 2005 Oceans Action Plan (the “Action

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<sup>287</sup> *Ibid.*

<sup>288</sup> *Ibid.* at 14-15.

<sup>289</sup> *Ibid.* at 16.

<sup>290</sup> *Ibid.* at 22.

<sup>291</sup> *Ibid.* at 18-20.

Plan”), “serves as the overarching umbrella for coordinating and implementing oceans activities, and as the framework to sustainably develop and manage our oceans.”<sup>292</sup> There are four pillars:<sup>293</sup>

- a. International leadership, sovereignty and security;
- b. Integrated oceans management for sustainable development;
- c. Health of the oceans; and
- d. Ocean science and technology.

Thus, the Action Plan appears to be the instrument through which Canada is attempting to implement the *Oceans Act* and *Oceans Strategy*.

122. The Action Plan states that the most fundamental elements of its plan are the new oceans governance arrangements (i.e. integrated management under the *Oceans Act*) and ecosystem science to improve the management of the marine environment.<sup>294</sup> Phase I of the Action Plan is described as a series of interrelated initiatives that was to be completed within 24 months (i.e. by 2007). These initiatives are related to each of the four pillars.
123. Under the first pillar, initiatives include international oceans management, security and prosperity partnership of North America, cooperative work with the US in the Gulf of Maine, Arctic Marine Strategic Plan, overfishing in the Atlantic and delimiting the outer limits of the continental shelf.<sup>295</sup>
124. The second pillar of integrated oceans management sets out a plan of Integrated Management Planning in five priority areas across the country, one of which is the Pacific North Coast Integrated Management Area (see section, “Integrated management”, below).<sup>296</sup> The Action Plan also sets out “Oceans Management

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<sup>292</sup> Ringtail Document CAN413217 at 5.

<sup>293</sup> *Ibid.*

<sup>294</sup> *Ibid.*

<sup>295</sup> *Ibid.* at 11-12.

<sup>296</sup> *Ibid.* at 13-15.

Tools” to be used in integrated management planning:<sup>297</sup>

- a. Ecosystem overview and assessment reports with basic scientific information to guide user-led oceans planning in each Integrated Management priority area, inform stakeholder consultations and accelerate the production of ecosystem objectives. The reports are also supposed to address the ecosystem components and properties, causality and pressures, land-water interface and water quality.
- b. Identification of ecologically significant areas.
- c. Seabed mapping.
- d. Development of ecosystem objectives to maintain the biodiversity, productivity and physical-chemical properties of marine ecosystems and apply ecosystem-based management approaches in the oceans. Ecosystem objectives are to be adapted to distinct ocean areas called “ecoregions”.<sup>298</sup>

In the Pacific Region, DFO Science appears to have been asked to provide significant science and technical support to the Oceans Division of the former Oceans, Habitat and Enhancement Branch (“OHEB”),<sup>299</sup> to deliver initiatives under the second pillar of the Action Plan.<sup>300</sup>

125. Initiatives to support the third pillar, health of the oceans, include the Marine Protected Areas Strategy (see section, “Marine protected areas”, below), the development of ballast water and marine pollution regulations, pollution prevention surveillance for sea-based sources and amendments to the *Migratory Birds Convention Act, 1994*, S.C. 1994, c. 22 and *CEPA* to try to prevent discharge of oily waste in Canadian waters, in particular such waste that results in birds oiled at sea.<sup>301</sup>
126. The fourth and final pillar, ocean science and technology, has two initiatives: an Oceans Technology Network to link ocean science researchers and technology innovators and the Placentia Bay Technology Demonstration Platform to

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<sup>297</sup> *Ibid.* at 15-16.

<sup>298</sup> Ringtail Document CAN034552 at 8.

<sup>299</sup> OHEB was renamed the “Ecosystems Management Branch” in the spring of 2011.

<sup>300</sup> Ringtail Documents CAN267024, CAN267025, CAN174970 and CAN267355.

<sup>301</sup> Ringtail Document CAN413217 at 17-18.

examine the practicality of technology application to integrated management.<sup>302</sup>

127. Regional Implementation Committees made up of federal, provincial and Aboriginal organisations are intended to implement the Action Plan, with the first focus of implementation being integrated management planning, as noted above.<sup>303</sup> The Pacific Region Committee on Ocean Management (“Pacific RCOM”) is the senior executive forum for the federal and provincial governments that oversees implementation of the Memorandum of Understanding Respecting the Implementation of Canada’s *Oceans Strategy* on the Pacific Coast (the “Oceans Strategy MOU”; see section “Canada-BC agreement on implementation of *Canada’s Oceans Strategy*”, below) and elements of the Action Plan on the Pacific.<sup>304</sup> The roles and responsibilities of Pacific RCOM as well as a list of member federal and provincial government departments, agencies and ministries are set out in Pacific RCOM’s Terms of Reference.<sup>305</sup>
128. The Canada-BC Ocean Coordinating Committee (the “OCC”) was established as a working group under Pacific RCOM to administer delivery of the Oceans Strategy MOU and the Action Plan activities.<sup>306</sup> The OCC is intended, among other things, to provide policy and operational advice and direction to respective agencies, departments and ministries and coordinate multi-jurisdictional aspects and interests.<sup>307</sup> It also is charged with the day-to-day coordination and implementation of federal-provincial agreements, including the Oceans Strategy MOU.<sup>308</sup> Its roles and responsibilities as well as committee structure and membership are provided in the OCC Terms of Reference.
129. The federal government has created similar coordinating bodies within its own ranks. The Pacific Interdepartmental Oceans Committee (“PIOC”) has Regional

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<sup>302</sup> Ringtail Document CAN413217 at 19-20.

<sup>303</sup> Ringtail Document CAN191533.

<sup>304</sup> Ringtail Document CAN285267 at 2.

<sup>305</sup> Ringtail Document CAN285267.

<sup>306</sup> *Ibid.* at 2-3; Ringtail Document CAN285269 at 1.

<sup>307</sup> Ringtail Document CAN285267 at 3.

<sup>308</sup> Ringtail Document CAN285269 at 1



Director General level representatives from federal departments and agencies with oceans-related mandates or interests.<sup>309</sup> PIOC is tasked with ensuring collaboration between federal departments on oceans activities in the Pacific region and developing strategic direction for implementation of the federal oceans agenda on the west coast.<sup>310</sup> The focus of PIOC is on the Action Plan and the implementation of the Oceans Strategy MOU.<sup>311</sup>

130. There is also a coordinating body within the ranks of DFO itself, called the DFO Pacific Region Managers' Oceans Committee.<sup>312</sup> This body seeks to ensure communication among DFO Regional Directors and branch managers concerning Pacific oceans issues, particularly in relation to the discussions of the OCC.<sup>313</sup>
131. Pacific Region's Oceans Division (now part of the Ecosystem Management Branch) has two focuses: integrated oceans management (in particular the Pacific North Coast Integrated Management Area) and marine conservation tools, which include marine protected areas (see section "Marine protected areas", below) and marine parks.
132. In addition to its work supporting integrated management, DFO Science Pacific Region has also provided support to other initiatives and activities under the Action Plan such as marine protected area designation, sensitive fish habitat research, seismic impacts, modelling current patterns, fisheries integration with oceanography, characterisation of primary production patterns by satellite, seabed mapping, the development of aquaculture siting guidelines and science review of potential oil and gas exploration off of the North Coast.<sup>314</sup>
133. Phase I of the Action Plan concluded on March 21, 2007, but funding to support

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<sup>309</sup> Ringtail Document CAN188629 at 2.

<sup>310</sup> *Ibid.* at 1.

<sup>311</sup> *Ibid.* at 2.

<sup>312</sup> Ringtail Document CAN285268 at 1.

<sup>313</sup> *Ibid.*

<sup>314</sup> Ringtail Document CAN267555 at 5-8.

greater water pollution prevention, surveillance and enforcement along Canada's coasts was announced in the spring 2007 federal budget.<sup>315</sup>

Canada-BC agreement on implementation of Canada's Oceans Strategy

134. Canada and BC cooperate in the implementation of the *Oceans Strategy* through the Oceans Task Group of the Canadian Council of Fisheries and Aquaculture Ministers and the Pacific Council of Fisheries and Aquaculture Ministers.<sup>316</sup>
135. In 2004, DFO and BC's Ministry of Agriculture, Food and Fisheries entered into the Oceans Strategy MOU.<sup>317</sup> Annex 1 of the agreement commits various federal and provincial departments, ministries and agencies to implement the MOU.<sup>318</sup> The purpose of the Oceans Strategy MOU is to advance the Pacific Coast implementation of specific activities under two of the objectives in the *Oceans Strategy*: understanding and protecting the marine environment and supporting sustainable economic opportunities.<sup>319</sup> The agreement was still in effect as of June 2010.<sup>320</sup> Six subsidiary memoranda of understanding were also envisioned, but appear never to have been signed.<sup>321</sup> The Oceans Strategy MOU sets out six issues to be covered by these subsidiary agreements:<sup>322</sup>
- a. A marine protected areas framework;
  - b. Coastal planning and integrated oceans management planning;
  - c. An integrated ocean information management system;
  - d. Indicators for oceans management and state of the environment reporting;
  - e. Streamlining and harmonising regulatory decision-making for aquaculture; and
  - f. Sharing of information related to offshore oil and gas resources.

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<sup>315</sup> Ringtail Document CAN285267 at 1.

<sup>316</sup> Ringtail Documents CAN288823 at 2 and CAN287828 at 1. For a list of the First Nations who agreed to this resolution see CAN288738 at 2.

<sup>317</sup> Ringtail Document CAN288823.

<sup>318</sup> *Ibid.* at 6-8.

<sup>319</sup> *Ibid.* at 2; Ringtail Document CAN287825.

<sup>320</sup> Ringtail Documents CAN285267, CAN285269, CAN188629 and CAN285268.

<sup>321</sup> Ringtail Documents CAN288823 at 2-4, CAN287825, CAN287186-CAN287190 and CAN010959 at 1 and 4.

<sup>322</sup> Ringtail Documents CAN288823 at 2-3 and CAN287825.

136. In response to the signing of the Oceans Strategy MOU, on November 4, 2004, a number of Vancouver Island First Nations, including members of the Douglas Treaty Groups passed a resolution signalling their intent to enter into an MOU with Canada and BC that identifies how their Aboriginal and Treaty Rights and Title would be accommodated with the development of marine parks and protected areas within their traditional territories.<sup>323</sup> These First Nations also asked Canada and BC to refrain from implementing the Oceans Strategy MOU until there had been coordinated engagement with Vancouver Island First Nations regarding consultation and accommodation of their Aboriginal and Treaty Rights and Title.<sup>324</sup> As of late March 2005, these First Nations were still seeking a meeting with the Minister and Deputy Minister of DFO to establish a consultative process and accommodation related to the *Oceans Strategy* and to any memoranda of understandings that may later be considered under it.<sup>325</sup>

### Integrated management

#### *Meaning of integrated management*

137. A diverse and sometimes confusing array of labels can be applied to the integrated management concept, including terms such as Ecosystem Management, the Ecosystem Approach, Ecosystem-based Fisheries Management and the Ecosystem Approach to Fisheries, all of which “have a lot in common and relate very closely to the already widely used concept of integrated management.”<sup>326</sup> While these different terms have subtle differences in meaning, which are intended to reflect “the relative importance, explicit or not, given respectively to fisheries objectives and to ecosystem conservation,”<sup>327</sup> they “refer to what appear to be in practice very converging, if not totally similar,

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<sup>323</sup> Ringtail Documents CAN288745 and CAN288746.

<sup>324</sup> Ringtail Document CAN288746 at 2.

<sup>325</sup> Ringtail Document CAN288738.

<sup>326</sup> S.M. Garcia, *The Ecosystem Approach to Fisheries* (2003), online: FAO Fisheries Department <<http://www.fao.org/DOCREP/006/Y4773E/Y4773E00.HTM>> at 7 [FAO Overview].

<sup>327</sup> *Ibid.* at 6.

processes, aiming at largely overlapping sets of objectives.”<sup>328</sup> These objectives are identified by the United Nations’ Food and Agriculture Organization as “the need for sound science, adaptation to changing conditions, partnerships with diverse stakeholders and organizations, and a long-term commitment to the welfare of both ecosystem and human societies.”<sup>329</sup>

138. Those same objectives are reflected in the definition provided on a DFO webpage that divides integrated management into two components:
- a. Ecosystem-based management, which “means considering the environmental impact of an activity on the whole ecosystem, not simply the specific resource targeted. It also means taking into account the cumulative impact of all human activities on the ecosystem within that area. This is different from past management approaches that focused on a single species or single economic activity.”<sup>330</sup>
  - b. Socio-economic considerations, which acknowledge that “[i]nvolvement of stakeholders in the integrated-management process and consideration of social, cultural and economic characteristics and associated objectives are key to the success of integrated management.”<sup>331</sup>
139. Canada’s Oceans Action Plan (2005) provides a definition that appears to synthesise these two components:<sup>332</sup>

Integrated management is a comprehensive way of planning and managing human activities so that they do not conflict with one another and so that all factors are considered for the conservation and sustainable use of marine resources and shared use of oceans spaces. It is an open, collaborative and transparent process that is premised on an ecosystem approach. It involves planning and management of natural systems rather than solely political or administrative arrangements, and is founded on sound science that can provide the basis for the establishment of ecosystem management

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<sup>328</sup> *Ibid.*

<sup>329</sup> *Ibid.*, quoting Kimball, 2001.

<sup>330</sup> DFO, *Integrated Management – Ecosystem Considerations* (last updated July 2010), online: Fisheries and Oceans Canada <<http://www.dfo-mpo.gc.ca/oceans/management-gestion/integratedmanagement-gestionintegree/ecosystemconsiderations-considerationsecosystemiques/index-eng.htm>>.

<sup>331</sup> DFO, *Integrated Management: Socio-Economic Considerations* (last updated July 2010), online: Fisheries and Oceans Canada <<http://www.dfo-mpo.gc.ca/oceans/management-gestion/integratedmanagement-gestionintegree/socioeconomicconsiderations-considerationssocioeconomiques/index-eng.htm>>.

<sup>332</sup> Ringtail Document CAN413217 at 13.

objectives.

140. The term “integrated planning” is sometimes used instead of or alongside integrated management. Unlike integrated management, the term does not benefit from a clear, comprehensive definition in DFO policies or guidelines. According to DFO, integrated management planning must:<sup>333</sup>
- a. Be open to continual improvement and innovation;
  - b. Be science-based;
  - c. Include socioeconomic impact and risk analysis;
  - d. Identify shared accountabilities for compliance, enforcement, auditing and public reporting.

#### *Legislative and regulatory framework*

141. As described briefly above (see section, “Legislative Framework”), the legislative foundation for integrated management in Canada's oceans is the *Oceans Act*. Sections 29-33 of the Act require that the Minister of Fisheries and Oceans develop an oceans management strategy for Canada in which integrated management plays an integral role. These obligations apply only in relation to estuaries and coastal and marine waters, not inland freshwater bodies such as rivers and lakes.
142. Section 29 states that the Minister “shall lead and facilitate the development and implementation of a national strategy for the management of estuarine, coastal and marine ecosystems in waters that form part of Canada or in which Canada has sovereign rights under international law.” Section 30 clarifies that this strategy shall be based upon three principles:
- a. Sustainable development, that is, development that meets the needs of the present without compromising the ability of future generations to meet their own needs;
  - b. Integrated management of activities in estuaries, coastal waters and marine waters that form part of Canada or in which Canada has sovereign rights

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<sup>333</sup> Ringtail Document CAN288904 at 2.

- under international law; and
- c. The precautionary approach, that is, erring on the side of caution.
143. Under s. 31 of the *Oceans Act*, the Minister, in collaboration with the provincial government and other bodies, must “lead and facilitate the development and implementation of plans for the Integrated Management of all activities or measures in or affecting estuaries, coastal waters and marine waters”. Finally, s.33 requires that the Minister cooperate with other federal ministries, provinces, territories, Aboriginal organizations, coastal communities and other relevant parties in performing his or her duties related to the national strategy and integrated management plans. The section also grants discretionary powers to the Minister to enter into agreements related to the national strategy and integrated management plans.
144. *Canada’s Oceans Strategy* is described in detail above (see section, “Canada’s Oceans Strategy”). With respect to integrated management specifically, the *Oceans Strategy* was in part developed to promote the implementation of integrated management plans under the *Oceans Act*, an activity which is described as central to the strategy and the cornerstone of Canada’s oceans governance approach.<sup>334</sup> Integrated management as envisioned by the *Oceans Strategy* establishes advisory bodies that consider both the conservation and protection of ecosystems, while at the same time providing opportunities for creating wealth in oceans-related economies and communities.<sup>335</sup>
145. Integrated management is to be implemented through the Policy and Operational Framework for Integrated Management of Estuarine, Coastal and Marine Environments in Canada (the “Framework”) under the *Oceans Strategy*.<sup>336</sup> The Framework aims to flesh out practical aspects of the *Oceans Strategy* and sets out an integrated management objective:

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<sup>334</sup> Cohen Commission Exhibit 263 at 11 and 19.

<sup>335</sup> *Ibid.* at 19.

<sup>336</sup> Cohen Commission Exhibit 277.

The intent over the long term is to establish a system of Large Ocean Management Areas and smaller Coastal Management Areas. These would cover all marine waters within Canadian jurisdiction. Initial efforts will focus on areas currently under pressure, or soon to come under pressure, from human activities.

146. The Framework sets out six stages for the development of Large Ocean Management Areas (“LOMAs”) and Coastal Management Areas through an integrated management process:<sup>337</sup>
- a. Defining and assessing a management area;
  - b. Engaging affected interests;
  - c. Developing an Integrated Management plan;
  - d. Endorsement of plan by decision-making authorities;
  - e. Implementing the plan; and
  - f. Monitoring and evaluating outcomes.
147. Integrated management plans are to be developed by both governmental and non-governmental representatives with interests in a given ocean space.<sup>338</sup> Participants include representatives from the Province, regional authorities, First Nations, industry and other resource users, non-governmental organisations, community members and organisations, researchers and academics.<sup>339</sup>
148. Canada’s Ocean Action Plan (see section, “Canada’s Ocean Action Plan,” above) states that one of the most fundamental pieces of the plan is integrated management under the *Oceans Act*.<sup>340</sup> Under the second pillar of the Action Plan, dealing with integrated oceans management, there is a plan for integrated management planning in five priority areas across the country, one of which is the Pacific North Coast Integrated Management Area (see below).<sup>341</sup> The Action Plan also sets out “Oceans Management Tools” to be used in integrated management planning, which include ecologically significant area mapping,

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<sup>337</sup> *Ibid.* at 23.

<sup>338</sup> *Ibid.* at iii.

<sup>339</sup> *Ibid.* at 12-13.

<sup>340</sup> Ringtail Document CAN413217 at 5.

<sup>341</sup> *Ibid.* at 13-15.

marine use analysis, ecosystem overview (biophysical), ecological assessment, ecosystems objectives and marine environmental quality.<sup>342</sup>

149. There is no formal program for integrated management of coastal resources at the provincial level.<sup>343</sup> However, some local plans have been initiated.<sup>344</sup>

*Aspects of integrated management potentially relevant to Fraser Sockeye: The Pacific North Coast Integrated Management Area*

150. In 2004, a DFO workshop was held to identify Canadian marine ecoregions to be used as a basis for integrated oceans management.<sup>345</sup> Criteria used were in three categories: geological properties, physical oceanographic properties and biological properties. Seventeen ecoregions were identified, four of which are in the Pacific (Strait of Georgia, Southern Shelf – West Coast of Vancouver Island, Northern Shelf and Offshore).<sup>346</sup> The idea was that ecosystem objectives would be established for each ecoregion and then human activities would be managed in these areas to meet these objectives.<sup>347</sup>

151. Subsequently, Phase 1 of the Action Plan (2005) identified five priority large ocean management areas for development and implementation of integrated management. The Pacific North Coast Integrated Management Area (“PNCIMA”) is the only LOMA on the Pacific.<sup>348</sup> The Action Plan notes that ecological characteristics have been the primary determinant of PNCIMA’s boundaries, which extend from the Alaskan border in the north to Quadra Island, Bute Inlet and Brooks peninsula on Northwest Vancouver Island in the south.<sup>349</sup> The western boundary is set at the foot of the continental shelf and the eastern boundary is the coastline, with a total area of approximately 88,000 square

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<sup>342</sup> *Ibid.* at 15-16; Ringtail Documents CAN174973 at 2-5 and CAN267025.

<sup>343</sup> Ringtail Document CAN024605 at 30.

<sup>344</sup> *Ibid.*

<sup>345</sup> Ringtail Document CAN034552.

<sup>346</sup> *Ibid.*

<sup>347</sup> *Ibid.* at 8.

<sup>348</sup> Ringtail Documents CAN285267 at 1, CAN267355 at 1 and 3 and CAN076994 at 5.

<sup>349</sup> Ringtail Document CAN413217 at 15. See also: PNCIMA Issues, Outputs and Tasks.



kilometres.<sup>350</sup>

152. In 2008, the federal government, the Coastal First Nations and the North Coast Skeena First Nations Stewardship Society signed a *Memorandum of Understanding on Collaborative Governance for PNCIMA* (“PNCIMA MOU”). The Province was initially an observer to the PNCIMA under this agreement, but as of 2010, BC has signed onto the PNCIMA MOU as has the N̄n̄w̄āk̄ōl̄ās Council.<sup>351</sup> Under the PNCIMA MOU, First Nations and federal government staff are to work together in a Bilateral Coordination Steering Committee that provides strategic direction and executive oversight to the PNCIMA initiative.<sup>352</sup> The Pacific Interdepartmental Oceans Committee informs and coordinates federal agencies’ participation on the Bilateral Coordination Steering Committee.<sup>353</sup> First Nations party to the PNCIMA MOU coordinate their participation through a Governance Committee consisting of First Nations leaders from Haida Gwaii, the North Coast and the Central Coast, with support from several organizations, including the Haida Fisheries Program, North Coast Skeena First Nations Stewardship Society and Coastal First Nations – Great Bear Initiative.<sup>354</sup>
153. The general goal of PNCIMA is to “shift toward a broader ecosystem approach to resource management” within the region, which DFO notes is “consistent with the Government of Canada’s overall direction and with Fisheries and Oceans

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<sup>350</sup> Ringtail Document CAN413217 at 15. For a map of this area see PNCIMA Initiative, *Pacific North Coast Management Area: Initiative Overview* (no date), online: PNCIMA <<http://www.pncima.org/site/document-library.html>> at 1 [PNCIMA Initiative Overview].

<sup>351</sup> Ringtail Document CAN076994 at 5; *Memorandum of Understanding on Pacific North Coast Integrated Management Area Collaborative Oceans Governance*, December 11, 2008 (available online at: [http://www.pncima.org/media/documents/pdf/mou\\_-pncima\\_-collaborative\\_-oceans\\_-governance\\_-11dec08.pdf](http://www.pncima.org/media/documents/pdf/mou_-pncima_-collaborative_-oceans_-governance_-11dec08.pdf)); PNCIMA Initiative, *The Province of B.C and the N̄n̄w̄āk̄ōl̄ās Council join PNCIMA Steering Committee* (November 25, 2010), online: PNCIMA <<http://www.pncima.org/site/news/1284765705.html>>. The N̄n̄w̄āk̄ōl̄ās Council is a non-profit society with current membership of the First Nations of Central and North Vancouver Island, including: Kwakiutl, Mamalilikulla-Qwe’Qwa’Sot’Em, ‘Namgis, Tlowitsis, Da'naxda'xw Awaetlala, Gwa'sala-'Nakwaxda'xw, 'Komox and Kwiakah First Nations.

<sup>352</sup> PNCIMA MOU.

<sup>353</sup> PNCIMA Planning Office, *The Context for the PNCIMA Initiative Planning Process – Draft Backgrounder* (March 2010), online: PNCIMA <<http://www.pncima.org/site/document-library.html>> at 8-9 [PNCIMA Planning Process].

<sup>354</sup> *Ibid.*

Canada's new Wild Salmon Policy."<sup>355</sup> DFO describes the PNCIMA initiative as follows:<sup>356</sup>

While not intended to provide a detailed prescription for all measures required to achieve its objectives, PNCIMA will function as an umbrella for various ocean management processes. The aim of the integrated management plan is to augment or enhance existing decision-making processes and link sector planning and management to an overarching set of management objectives and targets. Regulatory authorities will continue to remain responsible and accountable for implementing management policies and measures within their mandates and jurisdictions. Rather than building an entirely separate process, the goal of PNCIMA is to build references and linkages to existing management strategies and actions.

154. There have been efforts to engage stakeholders outside the realm of provincial and First Nations governments; there was an introductory discussion forum in March 2009, followed by other multi-stakeholder meetings.<sup>357</sup> Resulting from these discussions was a PNCIMA Integrated Oceans Advisory Committee ("IOAC") composed of industry (including commercial and recreational fisheries, tourism, the energy sector, transportation and aquaculture), coastal communities, environmental non-governmental organizations and other interested parties.<sup>358</sup> The IOAC advises governments with mandates relevant to the PNCIMA plan on the planning process and the integrated management plan for PNCIMA.<sup>359</sup> *Ex-officio* members from federal and provincial agencies and First Nations can participate in discussions, but are not party to the consensus recommendations of the IOAC.<sup>360</sup>

155. A Marine Technical Advisory Team is being assembled to provide technical and

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<sup>355</sup> DFO, *Pacific North Coast Integrated Management Area: An Ecosystem Approach* (no date), online: Fisheries and Oceans Canada <[www.pac.dfo-mpo.gc.ca/publications/pdfs/pncima-eng.pdf](http://www.pac.dfo-mpo.gc.ca/publications/pdfs/pncima-eng.pdf)> [PNCIMA: An Ecosystem Approach] at 3-4.

<sup>356</sup> *Ibid.* at 6.

<sup>357</sup> PNCIMA Initiative, *PNCIMA Initiative Engagement Strategy* (May 2010), online: PNCIMA <<http://www.pncima.org/site/document-library.html>> at 3-4 [PNCIMA Engagement Strategy].

<sup>358</sup> Draft Terms of Reference for the Integrated Oceans Advisory Committee (February 15, 2011) at 1-2 (available online at: <http://www.pncima.org/media/documents/ioac/ioac-terms-of-reference-june-final.pdf>) [IOAC TOR].

<sup>359</sup> *Ibid.* at 1.

<sup>360</sup> *Ibid.* at 2.

scientific information and advice to the PNCIMA Initiative, to assist in developing an integrated management plan based on the best available scientific and technical information and knowledge.<sup>361</sup>

156. DFO has conducted background research to support development of the PNCIMA integrated management plan, including: an ecosystem overview report,<sup>362</sup> a marine use analysis report,<sup>363</sup> the mapping of ecologically and biologically sensitive areas and a social, economic, and cultural overview and assessment.<sup>364</sup>
157. As of July 2011, the PNCIMA Initiative website states that the planning process is underway, a draft marine plan is scheduled to be produced by June 2012 and a final draft is targeted for December 2012.<sup>365</sup> In February 2011, the PNCIMA Initiative identified key issues, outputs and tasks to be addressed in the final PNCIMA plan.<sup>366</sup> Five topics were recommended for more detailed work in developing the integrated management plan:
- a. Marine ecosystem-based management;
  - b. Integrated economic strategies;
  - c. Marine transportation and vessel safety;
  - d. Fisheries (commercial, recreational and First Nations); and
  - e. Marine protection.
158. According to a 2008 David Suzuki Foundation report, PNCIMA did not get subsequent funding under the Oceans Action Plan after the completion of the ecosystem overview report<sup>367</sup> and attention is shifting instead to the Ecosystem

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<sup>361</sup> Terms of Reference for the Pacific North Coast Integrated Management Area (PNCIMA) Marine Technical Advisory Team (MTAT) (no date) (available online at: <http://www.pncima.org/media/documents/mtat/mtat-tor-final-dec-14-10-clean.pdf>); PNCIMA Initiative, *Marine Technical Advisory Team* (no date), online: PNCIMA <<http://www.pncima.org/site/who/marine-technical-advisory-team.html>>.

<sup>362</sup> Ringtail Document CAN024743.

<sup>363</sup> Ringtail Document CAN027877.

<sup>364</sup> Ringtail Document CAN024604.

<sup>365</sup> PNCIMA Initiative, *When is all of this happening?* (no date), online: PNCIMA: <<http://www.pncima.org/site/when.html>>.

<sup>366</sup> PNCIMA Issues, Outputs and Tasks at 2.

<sup>367</sup> Ringtail Document CAN024743.

Research Initiative in the Georgia Basin.<sup>368</sup> The PNCIMA Initiative website states that it has multi-year funding for the planning stage of the initiative from the Gordon and Betty Moore Foundation and that this funding supplements the financial and human resources contributions from federal, provincial and First Nations Collaborative Governance Parties.<sup>369</sup>

159. In addition to PNCIMA, there are also a number of provincial integrated marine use planning initiatives. See the PNCIMA Initiative website for a listing of, and links to, some of these related initiatives.<sup>370</sup>

*Aspects of integrated management potentially relevant to Fraser Sockeye: FREMP*

160. The Fraser River Estuary Management Program (“FREMP”) was formed in 1985.<sup>371</sup> It coordinates environmental management and decision-making in the Fraser River Estuary and aims to provide for the safeguard of habitat values, yet still permit industry and communities to function around the river.<sup>372</sup> FREMP’s work fits the definition of integrated management set out in the Oceans Action Plan.<sup>373</sup>
161. The commission’s Policy and Practice Report, Overview of Habitat Enhancement and Restoration at 48-50 provides a description of FREMP’s structure, purpose, management plan and programs.<sup>374</sup>

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<sup>368</sup> Ringtail Document CON000034 at 36.

<sup>369</sup> PNCIMA Initiative, *PNCIMA initiative secures multi-year funding*, November 25, 2010, online: PNCIMA <<http://pncima.org/site/news/1284765914.html>>.

<sup>370</sup> PNCIMA Initiative, *Related work* (no date), online: PNCIMA <<http://pncima.org/site/how/related-initiatives.html>>.

<sup>371</sup> Ringtail Document CAN006034.

<sup>372</sup> BIEAP/FREMP Home Page, online: BIEAP/FREMP <<http://www.bieapfrempp.org/>>; Ringtail Document CAN002592 at 83.

<sup>373</sup> Ringtail Document CAN413217 at 13.

<sup>374</sup> Cohen Commission Exhibit PPR11.

## Marine protected areas

162. The *Oceans Act* authorizes the establishment of Marine Protected Areas. Section 35(2) directs the Minister, for the purposes of Integrated Management plans, to “lead and coordinate the development of a national system of marine protected areas on behalf of the Government of Canada”.
163. Under the Act, DFO has the authority to establish MPAs and lead and coordinate implementation of a national system of MPAs.<sup>375</sup> DFO may establish MPAs for a variety of purposes, including the conservation and protection of species at risk and their habitats, fisheries resources and their habitats, unique habitats, marine areas of high biodiversity or high biological productivity and any other marine resource or habitat requiring special protection.<sup>376</sup> MPAs are established following the approach set out in Canada’s Federal Marine Protection Areas Strategy.<sup>377</sup> In BC, there are two MPAs, both of which are off-shore (Endeavour Hydrothermal Vents and Bowie Seamount).<sup>378</sup> DFO Science in the Pacific Region provided science support for the designation of the Endeavour Hydrothermal Vents and the Bowie Seamount MPAs.<sup>379</sup>
164. There are two other related programs that, along with MPAs established under the *Oceans Act*, are part of Canada’s federal marine protected areas network: National Marine Conservation Areas (“NMCAs”) established by Parks Canada pursuant to the *Canada National Marine Conservation Areas Act*, S.C. 2002, c. 18 and Marine Wildlife Areas (“MWAs”) established by EC under the *Canada Wildlife Act*, R.S.C. 1985, c. W-9, to protect and conserve habitat for a variety of

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<sup>375</sup> *Oceans Act*, s. 35; Federal Protected Areas, online: Environment Canada <<http://www.ec.gc.ca/ap-pa/default.asp?lang=En&n=BA28E937-1>>.

<sup>376</sup> *Oceans Act*, s. 35(1).

<sup>377</sup> Marine Protection Areas, online: Fisheries and Oceans Canada <<http://www.dfo-mpo.gc.ca/oceans/marineareas-zonesmarines/mpa-zpm/index-eng.htm>> [MPAs]; Ringtail Document CAN005379.

<sup>378</sup> MPAs.

<sup>379</sup> Ringtail Document CAN267355 at 4-5.

wildlife, including migratory birds and endangered species.<sup>380</sup> All three programs (MPAs, NMCAs and MWAs) are coordinated under Canada's Federal Marine Protection Areas Strategy.<sup>381</sup> There is one NMCA in BC, the Gwaii Haanas National Marine Conservation Area Reserve.<sup>382</sup> There is also currently a feasibility study underway for the proposed Southern Strait of Georgia National Marine Conservation Area Reserve.<sup>383</sup> As of July 2011, there were no national MWAs yet established.<sup>384</sup>

165. There is also provincial legislation under which provincial versions of marine protected areas can be established: *Protected Areas of British Columbia Act*, S.B.C. 2000, c. 17 ("*PABCA*"), *Ecological Reserve Act*, R.S.B.C. 1996, c. 103 ("*ERA*"), *Park Act*, R.S.B.C. 1996, c. 344 and *Environment and Land Use Act*, R.S.B.C. 1996, c. 117 ("*ELUA*"). Under the *PABCA*, the BC Ministry of Environment has the authority to establish ecological reserves, parks and conservancies.<sup>385</sup> Marine ecological reserves also can be established under the *ERA*, which could result in the protection of significant ecosystems that support wildlife habitat, including that of sockeye salmon.<sup>386</sup> A provincial marine protected area is any area of tidal water, together with associated natural and cultural features in the water column within or on top of the seabed, which has

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<sup>380</sup> Ringtail Document CAN025022 at 31; National Marine Conservation Areas of Canada: Canada's National Marine Conservation Areas System Plan, online: Parks Canada <[http://www.pc.gc.ca/progs/amnc-nmca/systemplan/prog\\_E.asp](http://www.pc.gc.ca/progs/amnc-nmca/systemplan/prog_E.asp)>; Marine Protection, online: Fisheries and Oceans Canada <<http://www.dfo-mpo.gc.ca/oceans/management-gestion/marineprotection-protectionmarine/index-eng.htm#network>> [Marine Protection].

<sup>381</sup> Ringtail Document CAN005379.

<sup>382</sup> National Marine Conservation Areas of Canada: National Marine Conservation Area List, online: Parks Canada <[http://www.pc.gc.ca/progs/amnc-nmca/recherche-search\\_e.asp?m=1](http://www.pc.gc.ca/progs/amnc-nmca/recherche-search_e.asp?m=1)>.

<sup>383</sup> Feasibility Study for the Proposed Southern Strait of Georgia National Marine Conservation Area Reserve, online: Parks Canada <[http://www.pc.gc.ca/progs/amnc-nmca/cnamnc-cnmca/dgs-ssg/index\\_e.asp](http://www.pc.gc.ca/progs/amnc-nmca/cnamnc-cnmca/dgs-ssg/index_e.asp)>.

<sup>384</sup> Marine Wildlife Areas, online: Environment Canada <<http://www.ec.gc.ca/ap-pa/default.asp?lang=En&n=738B8BCA-1>>.

<sup>385</sup> *PABCA*, ss. 1-3.

<sup>386</sup> See BC Ministry of Sustainable Resource Management, *Provincial Marine Protected Areas in British Columbia* (2002) (available online at: [ftp://ftp.gis.luco.gov.bc.ca/pub/coastal/rpts/MSRM\\_PMPA.pdf](ftp://ftp.gis.luco.gov.bc.ca/pub/coastal/rpts/MSRM_PMPA.pdf)) [Provincial MPAs in BC].

been designated under the *PABCA*, *ERA*, *Park Act* or *ELUA*.<sup>387</sup>

166. In addition to separate federal and provincial initiatives, a Canada-BC MPA Network Strategy is being developed to further the objectives of the Oceans Strategy MOU (see section “Canada-BC agreement on implementation of *Canada’s Oceans Strategy*”, above).<sup>388</sup> The strategy is currently only in draft form and has not yet incorporated feedback from First Nations, local governments, community, stakeholder or industry perspectives.<sup>389</sup>

#### *Ecosystem Research Initiative for Strait of Georgia*

167. Ecosystem Research Initiatives (“ERI”) are identified by DFO as part of DFO’s Five-Year Research Plan, 2008-2013, which provides strategic direction on how effort and resources will be focused to ensure alignment with federal and DFO priorities while delivering on ecosystem-based management objectives.<sup>390</sup> According to DFO, ERIs are to serve as a pilot for DFO’s ecosystem-based approach by focusing on regional research priorities.<sup>391</sup> The idea is that integrated research on a particular ecosystem with predefined geographical boundaries and the knowledge gained from large-scale ecosystem studies will allow the development and testing of tools required to manage human activities within aquatic ecosystems.<sup>392</sup> The general themes for ERIs include: 1) understanding ecosystem processes; 2) understanding the impacts of climate variability; and 3) developing tools for ecosystem-based management.<sup>393</sup>
168. The Strait of Georgia ERI has three principal goals:<sup>394</sup>

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<sup>387</sup> *Ibid.* at 4.

<sup>388</sup> Ringtail Document CAN407806 at 6.

<sup>389</sup> *Ibid.* at 5.

<sup>390</sup> Cohen Commission Exhibit 48 at 3 and 21.

<sup>391</sup> *Ibid.* at 5.

<sup>392</sup> *Ibid.*

<sup>393</sup> *Ibid.*

<sup>394</sup> *Ibid.* at 9.

- a. Understanding how this ecosystem works;
- b. Identifying drivers of change most likely to determine future conditions; and
- c. Analyzing future responses of the system under these influences.

There are three major research priorities: 1) controls on productivity in the Strait of Georgia; 2) the importance of mismatches in the timing of physical and biological processes within the Strait of Georgia to ecosystem functioning; and 3) determining what properties of the ecosystem provide resilience against major disruptions and collapses of the system.<sup>395</sup>

169. The commission's Technical Report 8 and related hearings on the topic of predation and Fraser sockeye contain evidence regarding the Strait of Georgia ERI.<sup>396</sup>

### **Harmful algal blooms**

170. The term "harmful algae" includes any phytoplankton species<sup>397</sup> that is harmful to marine organisms, humans, other animals or the environment.<sup>398</sup> This includes what are known as "toxic phytoplankton", which produce "phycotoxins" that have observable toxic effects as well as non-toxic species that can detrimentally affect other organisms by physical or chemical means.<sup>399</sup> According to DFO, there are at least 36 phytoplankton species that can be toxic or pose other hazards, including Paralytic Shellfish Poisoning, Amnesic Shellfish Poisoning and Diarrhetic Shellfish Poisoning.<sup>400</sup> Occurrences in the marine environment of toxic and or harmful phytoplankton are called "harmful algal blooms."<sup>401</sup>

171. Harmful algae do not necessarily cause harm, however, if their concentrations

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<sup>395</sup> *Ibid.*

<sup>396</sup> Cohen Commission Technical Report 8: Predation of Fraser River Sockeye Salmon (Cohen Commission Exhibit 783) and Cohen Commission Transcripts, May 4-6, 2011.

<sup>397</sup> Phytoplankton are microscopic, single-celled organisms that are photosynthetic and supply virtually all of the energy for creatures of the ocean (Cohen Commission Transcripts, July 8, 2011 at pp. 79-80).

<sup>398</sup> Ringtail Document CAN010345 at 35.

<sup>399</sup> *Ibid.*

<sup>400</sup> *Ibid.* For a listing of major toxic and harmful species in Canadian waters see Table 2 at 39.

<sup>401</sup> Ringtail Document CAN010345 at 35.



are sufficiently low relative to other phytoplankton species and a species may be toxic under some conditions and non-toxic under other conditions.<sup>402</sup> Moreover, harmful algae are sometimes important components of the marine food web and thus merely the presence of these species is not necessarily a cause for concern.<sup>403</sup> The development of a harmful algal bloom is dependent on the environmental conditions under which the bloom grows. Various levels of nutrient concentrations and flux, light and water column stability (which are influenced by heat and fresh water input) will favour the growth of a particular species.<sup>404</sup> In addition to the natural variability of conditions, anthropogenic effects such as eutrophication, altered hydrological regimes resulting from changing land-use patterns, dredging and climate change can affect oceanographic variables (e.g. freshwater inputs or temperature changes) that may influence whether a bloom will occur.<sup>405</sup>

### Harmful algal blooms in BC

172. Blooms of species of the toxic alga *Heterosigma* occur on an annual basis in BC waters, particularly within Georgia Strait and Barkley Sound and have been identified as a cause of net-pen salmon losses in BC<sup>406</sup> although mortalities of sockeye salmon have not been directly attributed to this alga.<sup>407</sup> *Heterosigma* blooms have been shown to be seeded from shallow areas in the vicinity of the Fraser River plume (e.g. English Bay) with the spread of the bloom influenced by Fraser River currents in the Strait of Georgia.<sup>408</sup> The appearance and development of *Heterosigma* blooms in Georgia Strait may coincide with a rise in

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<sup>402</sup> *Ibid.* at 36.

<sup>403</sup> *Ibid.*

<sup>404</sup> *Ibid.* at 38.

<sup>405</sup> *Ibid.*

<sup>406</sup> Ringtail Document PSC007525 at 171, citing Taylor, F.J.R. and Haigh, R. 1993. "The ecology of fish-killing blooms of the chloromonad flagellate *Heterosigma* in the Strait of Georgia and adjacent waters" in T.J. Smayda and Y. Shimizu (eds.), *Toxic Phytoplankton Blooms in the Sea* (Amsterdam: Elsevier), pp. 705-710 [Taylor and Haigh (1993)].

<sup>407</sup> Cohen Commission Exhibit 73 at 72; Cohen Commission Exhibit 1359.

<sup>408</sup> Ringtail Document PSC007525 at 171, citing Taylor and Haigh (1993).

temperature above 15<sup>0</sup>C and a decline in surface salinity to less than 15 ppt.<sup>409</sup> Run-off from the Fraser may contribute to the proliferation of the bloom by stratifying the water (which increases the surface residence time for algae) and by contributing nutrients.<sup>410</sup> Earlier and larger spring and early summer flows have been linked to major blooms of *Heterosigma*.<sup>411</sup>

173. *Heterosigma* blooms are reported to develop in May or early June near the mouth of the Fraser River in the vicinity of English Bay and last as long as four months; the duration of blooms each season is likely dependent on the persistence of stratification in Strait of Georgia.<sup>412</sup> They are thought to be confined to the surface waters, with a maximum depth of 5-10 metres.<sup>413</sup>
174. Despite being associated with farmed fish kills in BC and wild and farmed fish kills in Puget Sound, the physiological cause of fish mortality from *Heterosigma* remains unknown, although it has been suggested that death is the result of severe gill epithelium damage resulting from contact with the phytoplankton or an unknown fish toxin within the algae.<sup>414</sup> The lethal cell concentration for fish is also unknown.

#### Management of harmful algal blooms

175. A December 2009 briefing note to the Minister of Fisheries and Oceans from Claire Dansereau, Assistant Deputy Minister DFO,<sup>415</sup> states that toxic algal blooms in the Strait of Georgia were one of three possible factors that may have lead to the poor 2009 returns of Fraser River sockeye.<sup>416</sup> However, there appears to be no DFO monitoring or research on harmful algal blooms (“HABs”)

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<sup>409</sup> *Ibid.*

<sup>410</sup> *Ibid.* at 171-172, citing Taylor and Haigh (1993); Cohen Commission Exhibit 1359.

<sup>411</sup> Cohen Commission Exhibit 1359.

<sup>412</sup> Ringtail Document PSC007525 at 172, citing Taylor and Haigh (1993).

<sup>413</sup> Ringtail Document PSC007525 at 172.

<sup>414</sup> *Ibid.* at 171; Ringtail Document CAN087862 at 1; Rensel *et al.* 2010.

<sup>415</sup> At July 2011.

<sup>416</sup> Cohen Commission Exhibit 616A.

in BC coastal waters.

### *Monitoring*

176. In 1995, at a Pacific Salmon Commission workshop on the Late-run early entry problem, it was noted that the lack of consistent and annual monitoring of bloom development across all sockeye migration and holding areas and time periods in Georgia and Johnstone Straits would likely contribute to an inability to detect significant Late-run sockeye mortalities due to harmful *Heterosigma* blooms.<sup>417</sup>
177. DFO Science in the Pacific Region had a Harmful Algae Monitoring Program (“HAMP”) from 1999-2004 under the direction of a DFO scientist whereby water sampling was done weekly.<sup>418</sup> This program was run out of DFO’s Pacific Biological Station in Nanaimo and was a collaborative effort between DFO and BC salmon aquaculture companies.<sup>419</sup> Funding was provided by the aquaculture industry and DFO Science provided in-kind funding through expertise and lab and office space. There were 18 monitoring sites in 1999, which increased to 28 in 2000 and then decreased to 27 in 2001, to 13 in 2002 and finally to 11 in 2003. Published data reports exist for 1999-2003 only.<sup>420</sup> Most of the monitoring sites are either at or near fish farms.
178. Since 2004, HAMP has been fully supported by the aquaculture industry and is now housed at Vancouver Island University. The focus continues to be fish farm-related harmful algae monitoring, management and mitigation, although some samples are taken in Departure Bay and also opportunistically in other locations. Overall, the monitoring program continues to be limited in spatial coverage and only considers surface waters.<sup>421</sup> HAMP’s data is considered proprietary by the aquaculture industry and by HAMP as this industry now provides all funding for

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<sup>417</sup> Ringtail Document PSC007525 at 175.

<sup>418</sup> Ringtail Document CAN316356 at 1.

<sup>419</sup> *Ibid.* at 1-2.

<sup>420</sup> Ringtail Document CAN007440 at 477.

<sup>421</sup> Cohen Commission Exhibit 73 at 72.

the program.<sup>422</sup>

179. In 2006, members of DFO Science's Phycotoxins Working Group noted that reliable, long-term monitoring data for harmful algal species were incomplete or absent in many DFO regions and that this situation could hamper decision-making regarding these blooms.<sup>423</sup>
180. In December 2009, Dr. Jack Rensel, an expert in harmful algae, noted that the available data in BC was not sufficient to conclusively judge whether HABs were the primary cause or even a major contributing factor if the Fraser sockeye recruitment failure in 2009, although Dr. Rensel has suggested that this is likely a causal factor (see section, "Harmful algal blooms and Fraser sockeye 2009 returns", below).<sup>424</sup>
181. In a presentation to DFO Science staff in May 2010 regarding the Fraser sockeye recruitment failure of 2009, Dr. Jim Irvine of DFO discussed developing a monitoring program for HABs.<sup>425</sup> Nicky Haigh, Program Manager and Senior Phytoplankton Analyst of HAMP, has suggested that to effectively assess the extent of the HAB problem in BC and the potential effects on wild salmon, several actions are needed:<sup>426</sup>
  - a. Monitor areas away from salmon aquaculture operations, where there is little or no HAB data, including the Strait of Georgia;
  - b. Monitor areas known to be important to juvenile and returning salmon stocks; and
  - c. Isolate and culture harmful algae species from known fish-killing blooms in BC in order to identify harmful algal species, assess harmful levels and develop non-microscopic methods of HAB detection.

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<sup>422</sup> Ringtail Document CAN320630 at 1.

<sup>423</sup> Ringtail Document CAN010345 at 38.

<sup>424</sup> Ringtail Document CAN124838 at 1.

<sup>425</sup> Ringtail Document CAN446828 at 12.

<sup>426</sup> Haigh, N. 2010. Assessing the Impact of Harmful Algal Blooms on Wild Salmon Populations in BC: Planning for a HAB Monitoring Program at 2.

## *DFO Science*

182. In her testimony before the Cohen commission, Regional Director of Science, Dr. Laura Richards, stated that toxic algae was not an area where DFO has expertise.<sup>427</sup> An internal DFO e-mail explains that the lack of work in this subject area is a DFO Science management decision and not the fault or shortfall of subject matter experts.<sup>428</sup> Other DFO e-mails note that toxic algae is not a priority topic for DFO and that there is hardly any harmful algal bloom research in BC at present.<sup>429</sup>

## *Harmful algal blooms and Fraser sockeye 2009 returns*

183. The Pacific Salmon Commission's June 2010 Workshop ("PSC Workshop") considered the hypothesis that harmful algal blooms in the Strait of Georgia and or northern Puget Sound and Strait of Juan de Fuca contributed to the 2009 returns as well as to the long-term decline in Fraser sockeye productivity.<sup>430</sup> The PSC Workshop concluded that, based on the evidence presented at the workshop, HABs were a possible contributing factor to the poor 2009 returns, but an unlikely contributor to the longer-term decline in Fraser sockeye productivity.<sup>431</sup> One reason for the former conclusion was that despite a large *Heterosigma* bloom in the Strait of Georgia in 2008 during the Fraser sockeye out-migration period in the spring, there was a record return of a number of Fraser sockeye in 2010. The primary reasons given for the latter conclusion were the lack of consistency of the declining trend in productivity compared to the uncertainty in spatial and temporal variability in intensity of *Heterosigma* blooms and the variation between years through the 1990s.<sup>432</sup>

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<sup>427</sup> Dr. Laura Richards, Cohen Commission Transcripts, March 17, 2011 at p. 21, l. 38-p. 22, l. 2.

<sup>428</sup> Ringtail Document CAN134836 at 1.

<sup>429</sup> Ringtail Documents CAN354074 at 1; CAN096611 at 1; and CAN134822 at 1;

<sup>430</sup> Cohen Commission Exhibit 73 at 9, 14, 22, 24 and 72-75.

<sup>431</sup> *Ibid.* at 9 and 74.

<sup>432</sup> *Ibid.* at 74.

184. Subsequent to the PSC Workshop, a paper was published by Dr. Jack Rensel and others regarding the possibility that Fraser River sockeye marine survival declines are linked with blooms of *Heterosigma akashiwo* in the Strait of Georgia.<sup>433</sup> The paper found that the Strait of Georgia had the most intense and prolonged *Heterosigma* blooms of all BC regions analysed and that between 1989-2007, marine survival of Chilko sockeye averaged 2.7% in years when juvenile sockeye migration through the Strait of Georgia coincided with major blooms versus 10.9% marine survival in years with no or minor blooms. Moreover, a correlation was found between the marine survival rates of Chilko sockeye and young-of-the-year herring in the Strait of Georgia; these two species can co-occur in the Strait for several weeks from mid-May through June. The authors speculate that *Heterosigma* blooms in the Strait of Georgia may affect sockeye salmon through acute and chronic toxicity or food web impoverishment.
185. Based on their findings, the authors conclude that there is an immediate need to expand regular sampling of phytoplankton species composition in Georgia Strait at least during juvenile and adult sockeye salmon migration periods. They also suggest that, in the longer-term, automated and remote sampling technologies could be used to provide estimates of *Heterosigma* depth and distribution at specific locations linked to known oceanographic variables. In addition to potentially informing factors that may affect Fraser sockeye marine survival, the paper states that if blooms originate from cysts in shallow inlets and bays, then there may be ways to remove or mitigate blooms before they spread into the main Strait of Georgia.

### **Marine climate change**

186. Specific factors that regulate Pacific salmon abundance, including those that may be responsible for the decline in Fraser River sockeye productivity are not well understood, which makes it difficult to predict the impacts of climate altered

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<sup>433</sup> Cohen Commission Exhibit 1359.

ecosystems.<sup>434</sup> However, a number of studies have concluded that climate-related changes that could occur in the ocean will have a major impact on the population ecology of Pacific salmon.<sup>435</sup> For example, for Fraser sockeye, a decrease in size at maturity has been shown to coincide with an increase in sea surface temperature in the ocean<sup>436</sup> and thermal boundaries that limit the distribution of sockeye in the Pacific have been proposed.<sup>437</sup> Also, changes in the El Niño Southern Oscillation variations have been correlated to marine survival of BC sockeye, including the Chilko stock.<sup>438</sup>

187. Decadal-scale regime shifts in the North Pacific Ocean cause climate and oceanic changes that can reorganise ecosystems over large regions. Climate and ocean conditions changed in 1925, 1947, 1977, 1989 and 1998/99 and shifts in 1947, 1977, 1989 and 1999 have been associated with changes in Pacific salmon abundance, although not necessarily Fraser sockeye specifically.<sup>439</sup> Some scientists suggest that not all species of salmon and not all regions of the Pacific will be equally affected by regime shifts and in fact, regimes may force opposite effects on the same salmon species in different sub-regions or opposite

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<sup>434</sup> Beamish, R.J., Riddell, B.E., Lange, K.L., Farley Jr., E., Kang, S., Nagasawa, T., Radchenko, V., Temnykh, O. and Urawa, S. 2009. The effects of climate change on Pacific salmon – A Summary of published literature (available online at: [www.npafc.org/new/publications/Special%20Publications/LRMP\\_Synthesis.pdf](http://www.npafc.org/new/publications/Special%20Publications/LRMP_Synthesis.pdf)) [Beamish *et al.* 2009] at 1.

<sup>435</sup> Beamish *et al.* 2009 at 1; Beamish, R.J., Lange, K.L., Riddell, B.E. and Urawa, S. (eds.), 2010. *Climate Impacts on Pacific Salmon: Bibliography*, North Pacific Anadromous Fish Commission, Special Publication No. 2 (available online at: [http://www.npafc.org/new/publications/Special%20Publications/NPAFC\\_Sp\\_Pub\\_2.pdf](http://www.npafc.org/new/publications/Special%20Publications/NPAFC_Sp_Pub_2.pdf)); Aydin, K.Y., McFarlane, G.A., King, J.R., Megrey, B.A., 2003. PICES-GLOBEC International Program on Climate Change and Carrying Capacity, PICES Scientific Report No. 25 (available online at: [www.pices.int/publications/scientific\\_reports/Report25/default.aspx](http://www.pices.int/publications/scientific_reports/Report25/default.aspx)); Ringtail Documents CAN030147, CAN070367, CAN002606 and references therein, CAN030146, CAN007496 and CAN201229; Cohen Commission Exhibit 1320.

<sup>436</sup> Beamish *et al.* 2009 at 2.

<sup>437</sup> Cohen Commission Exhibit 1291 at 43-50 and references therein.

<sup>438</sup> Ringtail Document CAN185979.

<sup>439</sup> Irvine, J.R. and Fukuwaka, M. 2011. Pacific salmon abundance trends and climate change, *ICES Journal of Marine Science*, 68(6): 1122-1130 (available online at: <http://icesjms.oxfordjournals.org/content/early/2011/03/02/icesjms.fsq199.abstract>); Ringtail Documents CAN070367, CAN030147, CAN030146 and CAN007496; Cohen Commission Exhibit 1291 at 81 and references therein.

effects on different species in the same region.<sup>440</sup> With climate change, major sources of early marine mortality in the ocean may become more variable and more extreme and it is not known how temperature boundaries of salmon distribution may change and affect stock distribution.<sup>441</sup>

188. For a review of potential climate change effects on survival of Fraser sockeye in the freshwater environment, see commission Technical Report 9: A Review of Potential Climate Change Effects on Survival of Fraser River Sockeye Salmon and an Analysis of Interannual Trends in En Route Loss and Pre-Spawn Mortality and related hearings.<sup>442</sup>

### Management and science

189. Canada has identified its ability to adjust management policies and practices in an appropriate and timely manner to deal with shifts in fish species distribution and relative abundance in response to climate change as a major challenge for regulators.<sup>443</sup> It has also asserted that climate change can be incorporated into fisheries risk management.<sup>444</sup>
190. However, in a recent article, Hastings and Wysham suggest that leading indicators of regime shifts are limited and that there is likely to be a class of natural systems for which there will be no forewarning of a regime change.<sup>445</sup> Moreover, Beamish *et al.* 2009 suggest that adjusting management at a stock level to adapt to climate-related changes in the ocean would range between challenging and impossible.<sup>446</sup> Similarly, a recent paper on cumulative impacts

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<sup>440</sup> Beamish *et al.* 2009 at 2.

<sup>441</sup> *Ibid.* at 3.

<sup>442</sup> Cohen Commission Exhibit 553 and Cohen Commission Transcripts, March 8-9, 2011.

<sup>443</sup> Ringtail Document at CAN024586 at 104.

<sup>444</sup> *Ibid.* at 107.

<sup>445</sup> Hastings, A. and Wysham, D.B. 2010. Regime shifts in ecological systems can occur with no warning. *Ecology Letters*, 13: 464-472.

<sup>446</sup> Beamish *et al.* 2009 at 3.



of climate change on Fraser sockeye states that it is unlikely that any mitigation will sustain salmon populations in the long run as global warming continues.<sup>447</sup>

191. But, the latter paper nevertheless states that policy and management changes can help mitigate the impacts of climate change if the focus of these efforts is put on maximising salmon resilience, a concept that the author states is contained in the *Wild Salmon Policy* (although the focus of the author's comments here appears to be the freshwater environment).<sup>448</sup> Moreover, Beamish *et al.* state that if climate impacts could be identified, then it may be possible to convince Canadians and others that reductions in greenhouse gases are essential for the protection of salmon in their southern range.<sup>449</sup>
192. In 2000, DFO Science produced a report on DFO climate variability and change impacts and adaptations research for Canada's marine and freshwater fisheries.<sup>450</sup> The report states that DFO, "clearly has the leadership role and responsibility for impacts and adaptations research in the fisheries sector, although collaboration with federal and provincial agencies, industry, universities, and other user groups will be essential."<sup>451</sup> A number of recommendations were generated:<sup>452</sup>
- a. That DFO develop a national program to address climate variability and change ("CVC") impacts and adaptation for Canada's marine and freshwater fisheries with four goals:
    - i. To identify regional, ecosystem, and fishery sensitivities and vulnerabilities induced by CVC;
    - ii. To develop "plausible futures" for Canada's aquatic resources by region, ecosystem, and fishery;
    - iii. To reinforce movement towards ecosystem management by incorporating incremental improvements in the understanding of

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<sup>447</sup> Cohen Commission Exhibit 1320 at 730.

<sup>448</sup> *Ibid.*

<sup>449</sup> Beamish *et al.* 2009 at 3.

<sup>450</sup> Ringtail Document CAN453180.

<sup>451</sup> *Ibid.* at 6.

<sup>452</sup> *Ibid.* at 6-7.

- climate variability and change effects into day-to-day management advice;
    - iv. To help and enable the industry to adapt successfully to climate change by reducing negative impacts and taking advantage of new opportunities;
  - b. That DFO implement and lead such a program by:
    - i. Summarising what DFO can say today about the impacts of CVC on fisheries and aquaculture resources, and ensuring that this information is distributed to clients;
    - ii. Producing plausible regional and national impacts futures for all fishery resources;
    - iii. Assessing the adaptive capacity and options of fishery users;
    - iv. Increasing understanding of the spatial distribution of fish resources and changes in distribution (first priority), species productivity and composition, and genetic diversity;
    - v. Employing an integrated mixture of retrospective data-mining, simulation modelling, field and laboratory studies, and ecosystem monitoring;
    - vi. Collaborating regionally and nationally with clients, other agencies, user groups, and universities;
  - c. That DFO implement the impact and adaptation research program as an integrated mission-oriented, non-competitive task, driven by an evolving framework of directed resource-management questions, and ensuring that all components are adequately addressed;
  - d. That DFO appoint a full-time national coordinator in Ottawa, to:
    - i. knowledgeably cover ocean climate and fisheries impacts and adaptations research relative to all aspects of the climate change issue;
    - ii. provide the linkage and coordination among regional activities and a liaison with other agencies involved in this program, especially with the Department of Energy-Natural Resources Canada lead via the Canada Climate Change Action Fund;
  - e. That DFO establish an Ocean Climate and Fisheries Impacts and Adaptations Science Committee (with the national coordinator as secretariat):
    - i. As an inter-regional research committee coordinating all aspects of the climate change research program for marine and freshwater resources, covering aquatic climate, fisheries impacts, and adaptation;
    - ii. reporting directly to the National Science Directors Committee; and
  - f. That DFO seek incremental resources of approximately \$8M per year for a period of 5 to 10 years, including provision for an infusion of new scientists necessary to implement this impacts and adaptations research program.

193. As it was recognised that the recommendations would take time to implement and would need to be phased in, the report went on to recommend some immediate steps:<sup>453</sup>

a. DFO should establish an Ocean Climate Science and Fisheries Impacts and Adaptations Committee, reporting to the National Science Directors Committee, to:

- i. Summarise what DFO-Science can say now about the impacts of CVC on fisheries and aquaculture;
- ii. Assess what additional knowledge is needed to fulfill DFO's mandate, beginning with the information in this workshop report;
- iii. Identify a few specific priorities, national or regional, for CVC research in DFO, building on this workshop report, the synthesis recommended above, and the work presently underway in Canada and internationally;
- iv. Establish how current resources and programs can be used to meet those research priorities;
- v. Determine how the new resources allocated to DFO for the “Ecosystem” and “Precautionary” approaches can assist, complement, or support DFO’s CVC research on these priorities;
- vi. Identify which priorities could be considered for funding under the current High Priority Fund or others such as the Climate Fund, and under what guiding principles;
- vii. Establish a national strategy to obtain funding from non-DFO sources such as the CCAF and CMOS;
- viii. Ensure adequate linkages with national and international initiatives; and
- ix. Ensure adequate linkages with DFO’s ocean modelling program.

194. In 2004, the government of Canada published a report called, *Climate Change Impacts and Adaptation: A Canadian Perspective*, which was intended to provide an overview of research in Canada in the field of climate change impacts and adaptation from 1999-2004. Despite this stated intention, the document does not provide details on DFO climate change research on fisheries, although the report does set out predicted impacts on fish and fisheries in the Pacific region.<sup>454</sup> Under the “Adaptation” piece of the report, Canada states that the adaptive capacity of the Canadian fisheries sector with respect to climate change

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<sup>453</sup> *Ibid.* at 7.

<sup>454</sup> Ringtail Document at CAN024586 at 97-98.

is poorly understood, but that there is growing recognition of the need to anticipate and prepare for potential changes.<sup>455</sup> The 2004 report goes on to identify 10 knowledge gaps and or research needs with respect to climate change and Canadian fisheries:<sup>456</sup>

- a. Improved monitoring and prediction of the impacts of climate change on species and ecosystems;
- b. Research on the impacts of rapid climate change and extreme events on the fisheries sector;
- c. Improved incorporation of local knowledge into impact assessments;
- d. Research focusing on impacts of changes in ocean conditions, such as ocean circulation and sea ice, on fish;
- e. Studies that address the socio-economic consequences of climate change for marine and freshwater fisheries;
- f. Methodologies for improving communication and collaboration between scientists, policymakers and stakeholders;
- g. Investigations into the best methods to increase the resilience of fishery systems and improve their ability to respond to change;
- h. Studies on the role of aquaculture in adapting to climate change;
- i. Development of adaptation models that incorporate the knowledge of scientists, fishery managers and fishers; and
- j. Research targeted to assist the development of policies and programs that will help coastal communities deal with potential fish expansions and contractions.

195. In an internal DFO document that appears to be from 2006, a list of DFO climate change initiatives is provided. Included are the following:<sup>457</sup>

- a. DFO Climate Change Working Group to coordinate activities, exchange information and develop a DFO agenda to meet mitigation, adaptation and science targets to address climate change issues;
- b. DFO Climate Change Strategy;
- c. DFO Climate Change Risk Assessment;
- d. DFO Climate Change Risk Management Plan; and
- e. DFO Sustainable Development Strategy 2007-2009.

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<sup>455</sup> *Ibid.* at 103.

<sup>456</sup> *Ibid.* at 106-107.

<sup>457</sup> Ringtail Document CAN009467 at 1.

A DFO Climate Change Working Group appears to have been in existence in at least in 2005-2006.<sup>458</sup> The DFO Climate Change Risk Assessment and DFO Sustainable Development Strategy have been produced,<sup>459</sup> but a search of the Ringtail Database and the internet was unable to find an official Climate Change Strategy or Climate Change Risk Management Plan. There is, however, a draft DFO Climate Change Strategy attached to a June 22, 2006 e-mail in Ringtail.<sup>460</sup> The draft Climate Change Strategy states that it was developed to address the risks to DFO's business resulting from climate change.<sup>461</sup> It commits DFO to the, "transformative, long-term change required to deal with climate change while at the same time ensuring sustainable development of Canada's aquatic resources."<sup>462</sup>

196. The DFO Climate Change Risk Assessment Report (2005) states that there are three fisheries management-related risks of climate change. These are jeopardising DFO's ability to: 1) Meet its strategic policy objectives related to oceans management, and the sustainable development and integrated management of resources in Canada's aquatic environment; 2) Manage and protect the abundance, distribution and quality of harvested fisheries and aquaculture stocks; and 3) Protect species diversity and species at risk.<sup>463</sup> The second risk was ranked first among all risks identified by the report.<sup>464</sup> The following specific response options were identified:<sup>465</sup>
- a. Ensure that the Science Program has the direction, capacity, and tools to support a better understanding of the potential impacts of climate change on ecosystems and fisheries:
    - i. Plan science activities systematically to address issues incrementally;

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<sup>458</sup> See e.g. Ringtail Documents CAN191526 and CAN194802.

<sup>459</sup> See Ringtail Documents CAN011837 and CAN015848, respectively.

<sup>460</sup> Ringtail Documents CAN194801 and CAN194802.

<sup>461</sup> Ringtail Document CAN194802 at 3.

<sup>462</sup> *Ibid.*

<sup>463</sup> Ringtail Document CAN011837 at 3-4.

<sup>464</sup> *Ibid.* at 32.

<sup>465</sup> *Ibid.* at 34-36.

- ii. Identify and model appropriate climate change indicators and predictors that distinguish between climate change and climate variability, ensuring that the focus is on the cumulative effects of the direct and indirect risk factors;
  - iii. Enhance the monitoring program in the Arctic to leverage the fact that climate change impacts are likely to be the most dramatic and rapid in the Arctic;
  - iv. Enhance the capacity of the science, oceanography, and fisheries programs to support an ecosystem approach; and
  - v. Strengthen the rigor of stock assessments by incorporating environmental and climate change considerations on a regular basis.
- b. Position the Department to more effectively engage its key external stakeholders:
  - i. The Department must better collaborate with and engage Transport Canada, EC and Natural Resources Canada on issues for which it has the lead or can contribute, and develop more effective mechanisms for addressing risks for which control lies outside of DFO;
  - ii. Extend and enhance funding for the GCIARN Fisheries Node, to build scientific knowledge related to the impacts of climate change on fisheries;
  - iii. The Northern Strategy (interdepartmental ADM committees) could be leveraged for climate change purposes and cross-related to interdepartmental science planning activities;
  - iv. Leverage the Federal Council (in Maritimes) to engage stakeholders on climate change issues; and
  - v. Leverage existing processes and the outreach elements of the Oceans Action Plan to more effectively communicate and address climate issues with key stakeholders, such as harvesters, and First Nations, folding integrated management into coastal, fisheries and habitat management. Stakeholders should be actively engaged to contribute information and be a part of any adaptive approaches.
- c. Enhance the Department's ability to manage the horizontality of climate change across the Oceans Sector, Science Sector, and Fisheries and Aquaculture Management. Develop and institutionalize management structures to facilitate an integrated approach to identifying and priorities, addressing issues, and communicating information:
  - i. DFO must move in real ways towards developing support mechanisms and applying integrated management. Entities such as the Science Policy Forum, can help to bridge the integration and communication gap; and
  - ii. Establish an active national network of cross-sectoral working groups with linkages to the Departmental Management Committee ("DMC") to coordinate and communicate monitoring results, and

identify priorities for impact assessment research. Regular reporting to DMC would be an important element of the working group mandates.

- d. Incorporate climate change planning into the Departmental business planning cycle. Specific suggestions include:
  - i. Building on the national working group concept, charge experts groups to develop, in consultation with managers, strategic proposals for targeted areas of research for submission into the business planning and priority setting process;
  - ii. Consider integrating strategic environmental assessments into the Departmental planning and policy development exercise. A strategic environmental assessment, a charter under the Canadian Environmental Assessment Act, involves reviewing policy, plan and program proposals to incorporate environmental considerations into the development of public policies;
  - iii. Incorporate the latest climate change information, including changes in the oceans or aquatic environment into the formal Departmental resource allocation processes, perhaps holding a resource allocation workshop focused on climate change; and
  - iv. Incorporate into the SARA evaluation an assessment of the likelihood that an intervention will be successful, considering the impact of climate change risk to the species.

197. DFO's, *A New Ecosystem Science Framework in Support of Integrated Management* was released in 2007.<sup>466</sup> Key components forming the basis of this framework and reflecting the highest priority management and policy challenges of DFO and the Government of Canada are set out in the document.<sup>467</sup> Number four on the list is the need to "[o]perationalise the concept of ecological regime shifts to deal with large-scale shifts, such as climate change."<sup>468</sup> DFO has not yet operationalised regime shifts.<sup>469</sup>

198. *A Five-Year Research Agenda (2007-2012)* for DFO sets out 10 research priority areas for the Department.<sup>470</sup> Specific priority research under climate change/variability priority are:<sup>471</sup>

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<sup>466</sup> Cohen Commission Exhibit 47.

<sup>467</sup> *Ibid.* at 8-10.

<sup>468</sup> *Ibid.* at 9.

<sup>469</sup> Cohen Commission Transcripts, July 7, 2011 at pp. 23-24.

<sup>470</sup> Cohen Commission Exhibit 40.

- a. Analysing climate change projections from the Canadian Centre for Climate Modelling and Analysis (“CCCMA”) coupled carbon-climate model and other international models and developing the next generation models at CCCMA;
  - b. Downscaling global climate model projections and interpreting their impact on Canadian waters, including freshwater systems;
  - c. Assessing flood risks and develop possible mitigation strategies;
  - d. Analysing climate change impacts on contaminant pathways;
  - e. Assessing the resilience of aquatic populations, from algae to marine mammals, in part through the inclusion of impacts of climate change on populations in fishing plans.
199. The *Five-Year Research Agenda (2007-2012)* provided the basis for the detailed *Five-Year Research Plan (2008-2013)*.<sup>472</sup> The plan provides a rationale for what research is conducted in support of priority areas and how this research will be delivered from 2008 to 2013.<sup>473</sup> Twenty key Science initiatives are listed. Relevant to Fraser sockeye and climate changes effects are the following two:
- a. The Strait of Georgia Ecosystem Research Initiative that has three major themes:<sup>474</sup>
    - i. Understanding how the ecosystem works;
    - ii. Identifying drivers of change most likely to determine future conditions; and
    - iii. Analysing future responses of the system under these influences;
  - b. Climate Change Science Initiative with research focused on:<sup>475</sup>
    - i. Understanding the role of oceans in regional climate;
    - ii. Assessing impacts of climate change on ecosystem composition, structure and function; and
    - iii. Investigating emerging issues that could impact ecosystem health.
200. In its 2008 Corporate Risk Profile (finalised in April 2009), DFO states that there is a risk that sufficient and appropriate information will not be available on a timely basis to support decision-making, including information with respect to climate change impacts on fish stocks.<sup>476</sup> Furthermore, under risks to

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<sup>471</sup> *Ibid.* at 9.

<sup>472</sup> *Ibid.* at 14 and Cohen Commission Exhibit 48 at 3.

<sup>473</sup> Cohen Commission Exhibit 48 at 3.

<sup>474</sup> *Ibid.* at 9.

<sup>475</sup> *Ibid.*

<sup>476</sup> Ringtail Document CAN033577 at 34.



organizational adaptability, the risk that DFO will be unable to effectively adapt to emerging environmental conditions, including the impacts of climate change is acknowledged.<sup>477</sup> DFO's *2011 Corporate Risk Profile*, approved by the DMC, September 22, 2010, updates the 2009 version (in turn stated to be a reaffirmation of the 2008 version).<sup>478</sup> Under the external category of key corporate risks, the risk that DFO will be unable to adapt quickly to the effects of climate change is described.<sup>479</sup> The first key sub-risks or elements of the climate change risk are exactly the same as the risks identified in 2005 in the DFO Climate Change Risk Assessment Report.<sup>480</sup> The policy response approved by the DMC states that DFO is developing a Policy Framework on Climate Change.

201. The DMC identified climate change adaptation as a DFO priority at the extended DMC meeting on September 29-30, 2010. Specifically, "[u]ndertake science to respond to gaps in understanding with respect to climate change in the marine environment, and impacts on DFO/CCG policies, programs, operations and infrastructure".<sup>481</sup>

### Recommendations

202. The *2010 Fall Report of the Commissioner of the Environment and Sustainable Development to the House of Commons* examined five federal departments including DFO to see whether the departments were identifying and assessing the risk posed by climate change.<sup>482</sup> The Commissioner found that overall, the departments had not taken concrete actions to adapt to the impacts of a changing climate although DFO had taken the first steps of risk management by completing assessments of the risks to its mandate from climate change and that

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<sup>477</sup> *Ibid.* at 39.

<sup>478</sup> Ringtail Document CAN410703 at 15.

<sup>479</sup> *Ibid.* at 3, 16, 27 (Table 2) and 50 (Annex E).

<sup>480</sup> Compare Ringtail Documents CAN011837 at 3-4 and CAN410703 at 27.

<sup>481</sup> Ringtail Document CAN474001 at 4.

<sup>482</sup> Office of the Auditor General of Canada, *2010 Fall Report of the Commissioner of the Environment and Sustainable Development to the House of Commons*, "Chapter 3: Adapting to Climate Impacts" (available online at: [http://www.oag-bvg.gc.ca/internet/docs/parl\\_cesd\\_201012\\_03\\_e.pdf](http://www.oag-bvg.gc.ca/internet/docs/parl_cesd_201012_03_e.pdf)) [CESD 2010 Report].

it had prioritised the risks.<sup>483</sup> It did this by completing the 2005 Climate Change Risk Assessment Report.<sup>484</sup> With respect to whether DFO had adjusted existing policies and plans or created new ones for adapting or responding to the risks associated with climate change, the report notes that there were limited examples of this, but the consideration of climate change in the development of the *Wild Salmon Policy* and the *Ecosystem Science Framework* and the prioritisation of science to support adaptation in the *Five-Year Research Agenda (2007-2012)* were such instances.<sup>485</sup> The Commissioner recommended that DFO identify the adaptation measures necessary to respond to the risk that climate change presents for DFO.<sup>486</sup> DFO agreed with this recommendation and stated that it had prioritised improving understanding oceanic and aquatic elements of the climate system through research and monitoring and was actively pursuing avenues to fill knowledge gaps with regard to the ocean aspects of climate change.<sup>487</sup> The Department also noted that it was at a disadvantage in identifying the adaptation measures needed to respond to the risks of climate change because it had not received incremental climate adaptation funding, but that it had reallocated funds to begin this work and was attempting to secure a resource base to move the program forward.<sup>488</sup> Finally, DFO stated that significant action to identify adaptation measures would be required.<sup>489</sup>

## Marine ecology

203. Relevant aspects of marine ecology regarding possible causes for the poor return of Fraser sockeye in 2009 and the longer-term decline, as well as

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<sup>483</sup> *Ibid.* at 2 and 9.

<sup>484</sup> *Ibid.* at 10.

<sup>485</sup> *Ibid.* at 12.

<sup>486</sup> *Ibid.* at 13.

<sup>487</sup> *Ibid.* at 15.

<sup>488</sup> *Ibid.*

<sup>489</sup> *Ibid.*

recommendations for long-term sustainability of Fraser sockeye are contained in the following commission technical reports and associated hearings:

- a. Technical Report 4 and July 6-8, 2011 hearings;
- b. Technical Report 8 and May 4-6, 2011 hearings; and
- c. Technical Report 10 (Exhibit 748; 748-1; 748-2; 748-3; 748-4; and 748-5): Fraser River Sockeye Production Dynamics and April 20-21, 2011 hearings.

204. In addition on May 2 and 4, the commission held hearings on Fraser sockeye and habitat enhancement and restoration. There was evidence from these hearings about potential inter- and intra-specific interactions affecting Fraser sockeye during their oceanic life stages.<sup>490</sup>

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<sup>490</sup> Cohen Commission Transcripts, May 1 and 2, 2011 and Cohen Commission Exhibits 759, 765, 773 and PPR11.

## Appendix 1: List of documents and websites cited by this Policy and Practice Report

### Ringtail documents

Count	Doc ID	Main Date	Title
1	BCP001386	29-Oct-2005	Land Use Operational Policy, Log Handling
2	BCP008260	28-Jul-2010	Review of Greywater Management Strategies to Improve Public Health and Water Quality in Shuswap Lake
3	CON000027	8-Jan-1999	A New Direction - Habitat Conservation and Stewardship Forum
4	CON000034	10-Mar-2008	Returning salmon: integrated planning and the wild salmon policy in B.C.
5	CON000107	1-Jan-2007	Atmospheric Transport of Persistent Organic Pollutants (POPs) in Southern British Columbia: Implications for Coastal Food Webs
6	EV.CAN.0001.000000.CAN000379	1-Sep-1999	Guiding Principles & Operational Policies
7	EV.CAN.0001.002000.CAN002592	30-Jun-1999	Freshwater Habitat
8	EV.CAN.0001.002000.CAN002606	30-Apr-2008	Climate Effects on Pacific Salmon in the Ocean - Creating a Canadian Focus
9	EV.CAN.0005.000000.CAN005379	1-Jan-2005	Canada's Federal Marine Protected Areas Strategy
10	EV.CAN.0005.000000.CAN005941	20-May-2005	Subject: Roll-out of BCI Area Operating Principles for Habitat
11	EV.CAN.0005.000000.CAN006028	1-Jan-2005	Fraser River Estuary Management Program (FREMP) - Dredge Management Guidelines
12	EV.CAN.0005.000000.CAN006030	1-Apr-2003	Guidebook - Environmentally Sustainable Log Handling Facilities in British Columbia
13	EV.CAN.0005.000000.CAN006034	1-Jan-2003	A Living Working River - The Estuary Management Plan for the Fraser River
14	EV.CAN.0005.000000.CAN006059	1-Jan-2004	Canada-British Columbia Agreement on Environmental Assessment Cooperation (2004)
15	EV.CAN.0005.002000.CAN007440	1-Feb-2008	Broughton Archipelago: A State of Knowledge
16	EV.CAN.0005.002000.CAN007496	16-Sep-2002	Recent Returns of Pink Salmon to the Fraser River Indicate the Importance of Relating Stock to Recruitment on a Regime Scale
17	EV.CAN.0006.001000.CAN009168	31-Mar-2007	Fisheries and Oceans Canada - Departmental Performance Report - For the Period Ending March 31 2007
18	EV.CAN.0006.001000		Department of Fisheries and Oceans Climate Change

	.CAN009467		Projects/Activities
19	EV.CAN.0007.000000 .CAN010265	1-Sep-2005	Canadian Science Advisory Secretariat - Proceedings Series 2004/025 - Proceedings of the Central Coast Marine Environmental Quality Indicators Workshop - March 10-12 2004
20	EV.CAN.0007.000000 .CAN010345	1-Jan-2006	Canadian Science Advisory Secretariat - Research Document 2006/089 - Background Scientific Information for Candidate Criteria for Considering Species and Community Properties to be Ecologically Significant
21	EV.CAN.0007.001000 .CAN010959	10-Oct-2007	Meeting with Barry Penner British Columbia Minister of Environment
22	EV.CAN.0008.000000 .CAN011837		Fisheries and Oceans Canada - Climate Change Risk Assessment Report
23	EV.CAN.0008.002000 .CAN014236	1-Feb-2005	Department of Fisheries and Oceans - Monitoring Activities in Support of Fish Habitat Management Program - Report on Survey Completed January 2005
24	EV.CAN.0009.001000 .CAN015848	1-Jan-2006	Our Waters Our Future - Sustainable Development Strategy - Fisheries and Oceans Canada - 2007-2009
25	EV.CAN.0010.000000 .CAN021555	1-Jan-2007	Mid Year Review - Status of 2007-2010 Plans
26	EV.CAN.0010.001000 .CAN022830	1-Jan-2003	A Living Working River
27	EV.CAN.0010.003000 .CAN024586	1-Jan-2004	Climate Change Impacts and Adaptation: A Canadian Perspective
28	EV.CAN.0010.003000 .CAN024604		The Pacific North Coast Integrated Management Area (PNCIMA) Scoping Paper
29	EV.CAN.0010.003000 .CAN024605	29-May-2008	CZC 2008 and CCC 2008 - Managing Our Oceans and Coasts for a Sustainable and Prosperous Future - Abstracts and Papers
30	EV.CAN.0010.003000 .CAN024648	1-Jan-1998	State of the Environment Reporting - Tracking Marine Ecosystem Health in Canada: A Possibility in the Next Century?
31	EV.CAN.0010.003000 .CAN024743	1-Jan-2007	Ecosystem Overview: Pacific North Coast Integrated Management Area (PNCIMA)
32	EV.CAN.0010.003000 .CAN024763	6-May-2005	A Handbook for Measuring the Progress and Outcomes of Integrated Coastal and Oceans Management - Preliminary Versions
33	EV.CAN.0010.003000 .CAN024880	1-Feb-2004	Report of the Expert Panel on Science Issues Related to Oil and Gas Activities - Offshore British Columbia
34	EV.CAN.0010.003000 .CAN024912	23-Jul-2008	Pacific Region Briefing Package
35	EV.CAN.0010.003000 .CAN024922		Chapter 13: Impacting Activities and Stressors
36	EV.CAN.0010.003000 .CAN025022	1-Jan-2008	A Policy and Planning Framework for Marine Protected Area Networks in Canada's Oceans
37	EV.CAN.0010.003000		Contaminants and Nutrients in the Coastal Zone:

	.CAN025063		Impact on Water Quality
38	EV.CAN.0010.003000 .CAN025064	30-Mar-2008	Federal Roles Document - Draft Version
39	EV.CAN.0010.003000 .CAN025074	1-Jan-2006	Alive and Inseparable - British Columbia's Coastal Environment: 2006
40	EV.CAN.0010.006000 .CAN027796	31-Mar-2008	Annual Report - April 1 2007 to March 31 2008 - Annual Report to Parliament on the Administration and Enforcement of the Fish Habitat Protection and Pollution Prevention Provisions of the Fisheries Act
41	EV.CAN.0010.006000 .CAN027877	1-Jan-2007	Canadian Technical Report of Fisheries and Aquatics Sciences 2677 - Marine Use Analysis of the Pacific North Coast Integrated Management Area
42	EV.CAN.0010.008000 .CAN030146	1-Jan-1999	National Research Council Canada - Reprinted from Canadian Journal of Fisheries and Aquatic Sciences - The Regime Concept and Natural Trends in the Production of Pacific Salmon
43	EV.CAN.0010.008000 .CAN030147		Fisheries Climatology: Understanding the Interannual and Decadal Scale Processes that Regulate British Columbia Fish Populations Naturally
44	EV.CAN.0010.012000 .CAN033577	22-Apr-2009	Fisheries and Oceans Canada - 2008 Corporate Risk Profile - Final Version
45	EV.CAN.0010.013000 .CAN034552	1-Aug-2004	Canadian Science Advisory Secretariat - Proceedings Series 2004/016 - Proceedings of the Canadian Marine Ecoregions Workshop - March 23-25 2004
46	EV.CAN.0014.005000 .CAN068533		Habitat Requirements for Stream / Estuary Rearing Sockeye Salmon Populations
47	EV.CAN.0014.007000 .CAN070367	1-Jan-1998	The Regime Concept and Recent Changes in Pacific Salmon Abundance
48	EV.CAN.0016.000000 .CAN076994	6-Jul-2009	Meeting with Barry Penner British Columbia Minister of Environment - July 6 2009
49	EV.CAN.0017.008000 .CAN085924	16-Apr-2009	SLIPP Education, Compliance and Enforcement meeting
50	EV.CAN.0017.010000 .CAN087862	14-Aug-2009	RE: Fraser River sockeye mortality, alternative contributing factors?
51	EV.CAN.0017.019000 .CAN096611	15-Dec-2009	FW: Sockeye salmon - Heterosigma manuscript
52	EV.CAN.0019.001000 .CAN109663	24-Oct-2007	FW: 2007 10 03 Robson Bight CCG response
53	EV.CAN.0020.007000 .CAN124838	22-Dec-2009	FW: Factors Implicated in Poor Canadian Sockeye Salmon Returns
54	EV.CAN.0021.003000 .CAN134822	22-Mar-2010	FW: Strait of Georgia phytoplankton survey
55	EV.CAN.0021.003000 .CAN134836	9-Jun-2010	RE: Strait of Georgia phytoplankton survey
56	EV.CAN.0021.003000 .CAN134842	4-May-2010	RE: Messages for Canadian Press - urgent approval required
57	EV.CAN.0021.005000 .CAN136962	8-Jul-2007	RE: Robertson II
58	EV.CAN.0022.024000	1-Feb-	Broughton Archipelago: A State of Knowledge

	.CAN162754	2008	
59	EV.CAN.0023.011000 .CAN174970	1-Apr-2005	Draft - Science / OHEB Support Meeting - Meeting Minutes
60	EV.CAN.0023.011000 .CAN174973	2-May-2005	Science Roadmap in Support of: Ocean Action Plan
61	EV.CAN.0023.022000 .CAN185561		Habitat Issues Affecting Fraser River Sockeye Salmon
62	EV.CAN.0024.000000 .CAN185979	27-Jul-2010	ENSO induced harmonic oscillations of marine survival (HOMS) in southern British Columbia sockeye salmon populations: Adult sockeye returns in HOMS way!
63	EV.CAN.0025.002000 .CAN188629		Draft Terms of Reference - Pacific Interdepartmental Oceans Committee
64	EV.CAN.0025.005000 .CAN191526	31-Oct-2005	RE: DFO Climate Change Working Group Meeting / R+ -union du groupe de travail du MPO sur le changement climatique
65	EV.CAN.0025.005000 .CAN191533	20-Apr-2006	Canada's Ocean Action Plan - Governance Progress Report April 20-21 2006
66	EV.CAN.0025.008000 .CAN194801	22-Jun-2006	FW: DFO's Climate Change Strategy - Strat+ -gie sur le changement climatique du MPO
67	EV.CAN.0025.008000 .CAN194802		DFO Climate Change Strategy
68	EV.CAN.0026.002000 .CAN198623	1-Jun-2005	An Assessment of Fisheries and Oceans Canada Pacific Region's Effectiveness in Meeting its Conservation Mandate
69	EV.CAN.0026.005000 .CAN201229	4-Apr-2002	Opposite Effects of Ocean Temperature on Survival Rates of 120 Stocks of Pacific Salmon (Oncorhynchus Spp.) in Northern and Southern Areas
70	EV.CAN.0027.004000 .CAN210415	1-May-2006	Aquatic Monitoring in Canada A Report from the DFO Science Monitoring Implementation Team - Proceedings Series: 2006/003
71	EV.CAN.0033.003000 .CAN267024	30-Mar-2005	Science/OHEB Support Meeting Fri Apr 01 10_15am
72	EV.CAN.0033.003000 .CAN267025		Ocean Action Plan Deliverables: Status and Inputs Required from Science Directorate
73	EV.CAN.0033.003000 .CAN267355	1-Mar-2005	Oceans-Science Meeting in Quebec City - March 2005 - What is Science Contributing to the Oceans Action/Oceans Agenda?
74	EV.CAN.0033.003000 .CAN267555	26-Aug-2009	Subject: Conservation of Fraser River Sockeye
75	EV.CAN.0033.006000 .CAN270107	10-Jun-2010	Salmon and Contaminants
76	EV.CAN.0034.011000 .CAN285240	5-Mar-2008	Best Management Practices (BMPs) for Helicopter Log Drop Sites in Marine Waters of British Columbia
77	EV.CAN.0034.011000 .CAN285243	3-Jun-2009	Habitat Resources BMP's
78	EV.CAN.0034.011000 .CAN285267	7-Jun-2010	Pacific Region Committee on Ocean Management (Pacific RCOM)) Terms of Reference

79	EV.CAN.0034.011000 .CAN285268	16-Jun-2010	DFO Pacific Region Managers' Oceans Committee Terms of Reference
80	EV.CAN.0034.011000 .CAN285269	20-Oct-2010	Canada-BC Ocean Coordinating Committee Terms of Reference/Roles of Responsibilities
81	EV.CAN.0036.001000 .CAN287186	20-Feb-2007	Respecting Collaborative Coastal Planning and Integrated Oceans Management for the Pacific Coast of Canada Between Her Majesty the Queen in Right of Canada as Represented by the Minister of Fisheries and Oceans the Minister Responsible for Parks Canada ~
82	EV.CAN.0036.001000 .CAN287187	20-Feb-2007	Respecting the Cooperative Development of an Integrated Ocean Information Management System for the Pacific Coast of Canada Between Her Majesty the Queen in Right of Canada as Represented by the Minister of Fisheries and Oceans the Minister of Environme~
83	EV.CAN.0036.001000 .CAN287188	20-Feb-2007	Subsidiary Memorandum to the Canada-British Columbia Memorandum of Understanding Respecting the Implementation of Canada's Ocean Strategy on the Pacific Coast of Canada - Respecting a Marine Protection Areas System for the Pacific Coast of Canada
84	EV.CAN.0036.001000 .CAN287189	20-Feb-2007	Respecting a Process to Facilitate Gathering and Sharing of Information Related to Offshore Oil and Gas Resources Between Her Majesty the Queen in Right of Canada as Represented by the Minister of Natural Resources the Minister of Fisheries and Oceans t~
85	EV.CAN.0036.001000 .CAN287190	20-Feb-2007	Respecting the Cooperative Development of Indicators for Oceans Management for the Pacific Coast of Canada Between Her Majesty the Queen in Right of Canada as Represented by the Minister of Fisheries and Oceans the Minister Responsible for Parks Canada ~
86	EV.CAN.0036.002000 .CAN287825	19-May-2004	Canada-British Columbia MOU on Implementation of Canada's Oceans Strategy
87	EV.CAN.0036.002000 .CAN287828		Memorandum of Understanding for the Implementation of Canada's Oceans Strategy in British Columbia
88	EV.CAN.0036.003000 .CAN288738	24-Mar-2005	Re: Request for Meeting over Memorandum of Understanding for the Implementation of the Canada's Ocean Strategy
89	EV.CAN.0036.003000 .CAN288745	2-Dec-2004	Re: First Nations of Vancouver Island Response to the Canada/British Columbia MOU on Canada's Ocean Strategy
90	EV.CAN.0036.003000 .CAN288746	4-Nov-2004	Vancouver Island First Nations Resolution - Responding to the Signing of the Canada/British Columbia MOU on the Implementation of Canada's Ocean Strategy on the Pacific Coast of Canada of September 2004



91	EV.CAN.0036.003000 .CAN288823	2-Mar-2004	Memorandum of understanding respecting the implementation of Canada's Oceans strategy on the pacific Coast of Canada
92	EV.CAN.0036.003000 .CAN288904	28-May-2004	Memorandum of Understanding Respecting the Implementation of Canada's Oceans Strategy on the Pacific Coast of Canada - Statement of Principles
93	EV.CAN.0038.007000 .CAN303177	9-Jan-2006	Department of Environment - Disposal at Sea Permit 4543-2-03374 - Canadian Environmental Protection Act
94	EV.CAN.0039.004000 .CAN308809	1-Jan-2003	Environmental Directive ED 4003 - 1/2003: Spill Reporting
95	EV.CAN.0039.006000 .CAN310081	1-Feb-2008	Fact Sheet - Disposal at Sea in British Columbia
96	EV.CAN.0040.002000 .CAN316356	27-Sep-2006	RE: HAB Tables
97	EV.CAN.0040.006000 .CAN320630	28-May-2010	RE: Phytoplankton in Strait of Georgia
98	EV.CAN.0040.016000 .CAN330827		Routine Maintenance Dredging for Navigation - Pacific Region Operational Statement
99	EV.CAN.0042.001000 .CAN353799	24-Oct-2007	RE: 2007 10 03 Robson Bight CCG Response
100	EV.CAN.0042.001000 .CAN353802		Canadian Coast Guard National Contingency Chapter
101	EV.CAN.0042.001000 .CAN353803	1-May-2005	Canadian Coast Guard Environmental Response Directive#: D-6010-2001-03: The Reporting of Marine Pollution Incidents
102	EV.CAN.0042.001000 .CAN354074	8-Aug-2006	RE: West coast blooms
103	EV.CAN.0044.005000 .CAN377177		Habitat Requirements for Lake Rearing Sockeye Salmon Populations
104	EV.CAN.0045.002000 .CAN385035	1-Jan-2010	Ecosystem Status and Trends Report for the Strait of Georgia Ecozone - Canadian Science Advisory Secretariat Research Document 2010/010
105	EV.CAN.0046.000000 .CAN393189	18-Jan-2006	Regional Management Committee Information Paper - Title: Environmental Process Modernization Plan and ERC Reductions
106	EV.CAN.0046.008000 .CAN400511	1-Mar-2009	Recommendations for Actions to Address Priority Issues Relating to Toxic Substances in the Georgia Basin
107	EV.CAN.0046.008000 .CAN400541	15-Mar-2010	Pacific Region Cold-Water Coral and Sponge Conservation Strategy
108	EV.CAN.0046.008000 .CAN400543	1-Jan-2010	A Review of the Biological Characteristics and Ecological Functions Served by Corals Sponges and Hydrothermal Vents in the Context of Applying an Ecosystem Approach to Fisheries
109	EV.CAN.0046.008000 .CAN401043	1-Jan-2010	2004-10 CESD Chapter 5 - Fisheries and Oceans Canada - Salmon stocks Habitat and Aquaculture
110	EV.CAN.0047.003000 .CAN405817	29-May-2006	Interactions Between Toxic Chemicals and Other Environmental Factors - A Key Issue for an Effective

			Management of the Risk Related to Toxic Chemicals in Fish - A White Paper on Research Needs in the DFO's Toxic Chemicals Program
111	EV.CAN.0047.005000 .CAN407806	31-May-2010	Canada-British Columbia Marine Protected Area Network Strategy - Draft Submission to Regional Committee on Oceans Management
112	EV.CAN.0047.008000 .CAN410703	22-Sep-2010	Integrated Risk Management - Fisheries and Oceans Canada 2011 Corporate Risk Profile as Approved by the Departmental Management Committee
113	EV.CAN.0048.000000 .CAN413217	1-Jan-2005	Canada's Oceans Action Plan - For Present and Future Generations
114	EV.CAN.0048.001000 .CAN413774	25-Aug-2008	Responses to Subtidal Benthos of the Strait of Georgia British Columbia Canada to Ambient Sediment Conditions and Natural Anthropogenic Depositions
115	EV.CAN.0049.008000 .CAN431049	14-Mar-2008	Change in the Strait of Georgia
116	EV.CAN.0051.001000 .CAN445491		Letter of Understanding
117	EV.CAN.0051.001000 .CAN445492	19-Jun-1996	Letter of Agreement Respecting Transfer of Responsibility for Mystery Spills from Environment Canada to the Canadian Coast Guard/Fisheries and Oceans Canada
118	EV.CAN.0051.001000 .CAN445493		Memorandum of Understanding between the Department of Fisheries and Oceans (DFO) and Transport Canada (TC) Respecting Transfer of Marine Safety Policy Responsibilities
119	EV.CAN.0051.001000 .CAN445494	1-Apr-1996	Memorandum of Understanding
120	EV.CAN.0051.002000 .CAN446828		What specific research needs to be done to change the degree of belief in the hypothesis that you have been asked to address? Specifically, what type of practical and feasible research is needed to reduce critical uncertainties affecting scientific advice
121	EV.CAN.0051.008000 .CAN453180	1-Mar-2005	Canadian Technical Report of Fisheries and Aquatic Sciences 2575 - DFO Climate Variability and Change Impacts and Adaptations Research for Canada's Marine and Freshwater Fisheries: Proceedings of a Workshop Held in Halifax April 30 - May 2 2000 and the~
122	EV.CAN.0054.004000 .CAN474001	30-Sep-2010	Departmental Priorities - Extended DMC - September 29-30 2010
123	PSC007525	1-May-1995	Pacific Salmon Commission - Run-size Estimation Procedures: An Analysis of the 1994 Shortfall in Escapement of Late-run Fraser River Sockeye Salmon - Pacific Salmon Commission - Technical Report No. 6

Cohen Commission Exhibits

- 124. Cohen Commission Exhibit 40;
- 125. Cohen Commission Exhibit 47;
- 126. Cohen Commission Exhibit 48;
- 127. Cohen Commission Exhibit 73;
- 128. Cohen Commission Exhibit 263;
- 129. Cohen Commission Exhibit 277;
- 130. Cohen Commission Exhibit 553;
- 131. Cohen Commission Exhibit 562;
- 132. Cohen Commission Exhibit 562A;
- 133. Cohen Commission Exhibit 616A;
- 134. Cohen Commission Exhibit 735;
- 135. Cohen Commission Exhibit 735-1;
- 136. Cohen Commission Exhibit 735-2;
- 137. Cohen Commission Exhibit 735-3;
- 138. Cohen Commission Exhibit 735A;
- 139. Cohen Commission Exhibit 735B;
- 140. Cohen Commission Exhibit 735C;
- 141. Cohen Commission Exhibit 759;
- 142. Cohen Commission Exhibit 765;
- 143. Cohen Commission Exhibit 773;

144. Cohen Commission Exhibit 783;
145. Cohen Commission Exhibit 826;
146. Cohen Commission Exhibit 833;
147. Cohen Commission Exhibit 977;
148. Cohen Commission Exhibit 992;
149. Cohen Commission Exhibit 993;
150. Cohen Commission Exhibit 1291;
151. Cohen Commission Exhibit 1307;
152. Cohen Commission Exhibit 1309;
153. Cohen Commission Exhibit 1320;
154. Cohen Commission Exhibit 1359;
155. Cohen Commission Exhibit PPR2;
156. Cohen Commission Exhibit PPR3;
157. Cohen Commission Exhibit PPR8;
158. Cohen Commission Exhibit PPR9;
159. Cohen Commission Exhibit PPR11;
160. Cohen Commission Exhibit PPR14;
161. Cohen Commission Exhibit PPR15; and
162. Cohen Commission Exhibit PPR17.

Cohen Commission Transcripts

163. Cohen Commission Transcripts, October 25, 2010;
164. Cohen Commission Transcripts, March 8, 2011;
165. Cohen Commission Transcripts, March 9, 2011;
166. Cohen Commission Transcripts, March 17, 2011;
167. Cohen Commission Transcripts, May 1, 2011;
168. Cohen Commission Transcripts, May 2, 2011;
169. Cohen Commission Transcripts, May 4, 2011;
170. Cohen Commission Transcripts, May 5, 2011;
171. Cohen Commission Transcripts, May 6, 2011;
172. Cohen Commission Transcripts, May 9, 2011;
173. Cohen Commission Transcripts, May 10, 2011;
174. Cohen Commission Transcripts, June 6, 2011;
175. Cohen Commission Transcripts, June 7, 2011;
176. Cohen Commission Transcripts, June 8, 2011;
177. Cohen Commission Transcripts, June 13, 2011;
178. Cohen Commission Transcripts, June 14, 2011;
179. Cohen Commission Transcripts, June 15, 2011;
180. Cohen Commission Transcripts, June 17, 2011;
181. Cohen Commission Transcripts, July 6, 2011;
182. Cohen Commission Transcripts, July 7, 2011; and

183. Cohen Commission Transcripts, July 8, 2011.

Non-Ringtail documents (not available online)

184. C. Groot & L. Margolis, eds., *Pacific Salmon Life Histories* (Vancouver: University of British Columbia Press, 1991) (not provided);

185. Cohen Commission, *A scientific literature review to inform the investigation into the potential effects of salmon farms on Fraser River sockeye salmon*, February 2011 (previously provided);

186. DFO, *Canadian Coast Guard Environmental Response: Marine Spills Contingency Plan National Chapter* (April 2011) (this document will become available through Ringtail, but is not yet available at the publication date of this PPR);

187. Federal/Provincial/Territorial Advisory Committee on Canada's National Programme of Action for the Protection of the Marine Environment from Land-based Activities, Environment Canada (June 2000) (this document will become available through Ringtail, but is not yet available at the publication date of this PPR);

188. Haigh, N. 2010. Assessing the Impact of Harmful Algal Blooms on Wild Salmon Populations in BC: Planning for a HAB Monitoring Program (this document will become available through Ringtail, but is not yet available at the publication date of this PPR);

189. Hastings, A. and Wysham, D.B. 2010. Regime Shifts in Ecological Systems can occur with no Warning. *Ecology Letters*, 13: 464-472 (this document will become available through Ringtail, but is not yet available at the publication date of this PPR);

190. Thomas P. Quinn, *The Behavior and Ecology of Pacific Salmon & Trout* (Vancouver: University of Washington Press, 1995) (not provided); and

191. *Understanding Between Canada and British Columbia Concerning Federal/Provincial Responsibilities in Oil and Hazardous Material Spills*, June 26, 1981.

Non-Ringtail documents (available online)

192. Baldwin, D.H, Spromberg, J.A., Collier, T.K. and Scholz, N.L. 2009. A Fish of Many Scales: Extrapolating Sublethal Pesticide Exposures to the Productivity of Wild Salmon Populations, *Ecological Applications*, 19(8): 2004-2015 (available online at:  
[http://www.waterboards.ca.gov/waterrights/water\\_issues/programs/bay\\_delta/delta\\_flow/docs/exhibits/sfwc/spprt\\_docs/sfwc\\_exh3\\_baldwin.pdf](http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/delta_flow/docs/exhibits/sfwc/spprt_docs/sfwc_exh3_baldwin.pdf));
193. Beamish *et al.* 2009 at 1; NPAFC 2010 bibliography on climate change and Pacific salmon; Aydin, K.Y., McFarlane, G.A., King, J.R., Megrey, B.A., 2003. PICES-GLOBEC International Program on Climate Change and Carrying Capacity, PICES Scientific Report No. 25 (available online at:  
[http://www.npafc.org/new/publications/Special%20Publications/NPAFC\\_Sp\\_Pub\\_2.pdf](http://www.npafc.org/new/publications/Special%20Publications/NPAFC_Sp_Pub_2.pdf));
194. Beamish, R.J., Riddell, B.E., Lange, K.L., Farley Jr., E., Kang, S., Nagasawa, T., Radchenko, V., Temnykh, O. and Urawa, S. 2009. The effects of climate change on Pacific salmon – A Summary of published literature (available online at:  
[www.npafc.org/new/publications/Special%20Publications/LRMP\\_Synthesis.pdf](http://www.npafc.org/new/publications/Special%20Publications/LRMP_Synthesis.pdf));
195. BC Ministry of Environment, Environmental Protection Division, Waste Discharge Implementation Guide (available online at:  
[http://www.env.gov.bc.ca/epd/main/pdf/WDR\\_implement\\_guide.pdf](http://www.env.gov.bc.ca/epd/main/pdf/WDR_implement_guide.pdf));
196. BC, Ministry of Sustainable Resource Management, Provincial Marine Protected Areas in British Columbia (2002) (available online at:  
[ftp://ftp.gis.luco.gov.bc.ca/pub/coastal/rpts/MSRM\\_PMPA.pdf](ftp://ftp.gis.luco.gov.bc.ca/pub/coastal/rpts/MSRM_PMPA.pdf));

197. BC, Ministry of Environment, Greywater Discharges Banned from Vessels in BC's Inland Waters (available online at: [http://www.env.gov.bc.ca/bcparks/explore/gen\\_info/greywater\\_fact\\_sheet.pdf](http://www.env.gov.bc.ca/bcparks/explore/gen_info/greywater_fact_sheet.pdf));
198. BC Ministry of Energy, Mines and Petroleum Resources, BC Energy Plan (available online: [http://www.energyplan.gov.bc.ca/PDF/BC\\_Energy\\_Plan.pdf](http://www.energyplan.gov.bc.ca/PDF/BC_Energy_Plan.pdf));
199. BC Ministry of Energy, Mines and Petroleum Resources, BC Energy Plan: Report on Progress (available online: [http://www.energyplan.gov.bc.ca/report/BCEP\\_ReportOnProgress\\_web.pdf](http://www.energyplan.gov.bc.ca/report/BCEP_ReportOnProgress_web.pdf));
200. Draft Terms of Reference for the Integrated Oceans Advisory Committee (February 15, 2011) at 1-2 (available online at: <http://www.pncima.org/media/documents/ioac/ioac-terms-of-reference-june-final.pdf>);
201. Environment Canada, A Guide to Understanding the Canadian Environmental Protection Act, 1999 (available online at: [http://www.ec.gc.ca/lcpe-cepa/E00B5BD8-13BC-4FBF-9B74-1013AD5FFC05/Guide04\\_e.pdf](http://www.ec.gc.ca/lcpe-cepa/E00B5BD8-13BC-4FBF-9B74-1013AD5FFC05/Guide04_e.pdf)) ;
202. Haggerty, D.R., McCorquodale, B., Johannessen, D.I., Levings, C.D. and Ross, P.S. 2003. Marine Environmental Quality in the Central Coast of British Columbia, Canada: A Review of Contaminant Sources, Types and Risks, Can. Tech. Rep. Fish. Aquat. Sci. 2507 (available online at: <http://www.dfo-mpo.gc.ca/Library/278588.pdf>) ;
203. Fisheries and Oceans Canada, Helicopter Log Drop Sites in Marine Waters of British Columbia (available online at: [http://www.coastforest.org/media\\_pdf/2008-07-11\\_heli\\_logdrop\\_bmp.pdf](http://www.coastforest.org/media_pdf/2008-07-11_heli_logdrop_bmp.pdf));
204. Fisheries and Oceans Canada, Pacific Region Operational Statement: Small Moorings (available online at: [http://www.pac.dfo-mpo.gc.ca/habitat/os-eo/pdfs/moorings\\_e.pdf](http://www.pac.dfo-mpo.gc.ca/habitat/os-eo/pdfs/moorings_e.pdf));



205. Fisheries and Oceans Canada, Re-activated Log Dumps in Marine Waters of British Columbia (available online at: [http://www.coastforest.org/media\\_pdf/2008-07-11\\_log\\_dump\\_react\\_bmp.pdf](http://www.coastforest.org/media_pdf/2008-07-11_log_dump_react_bmp.pdf));
206. G3 Consulting Ltd., Guidebook: Environmentally Sustainable Log Handling Facilities in British Columbia, April 2003 (available online at: <http://www-heb.pac.dfo-mpo.gc.ca/publications/pdf/274124.pdf>);
207. Irvine, J.R. and Fukuwaka, M. 2011. Pacific salmon abundance trends and climate change, ICES Journal of Marine Science, 68(6): 1122-1130 (available online at: <http://icesjms.oxfordjournals.org/content/68/6/1122.full.pdf+html>);
208. Letter from Kirsten Heslop, BC MOE Thompson Region dated January 7, 2008 (available online: <http://burrard yachtclub.com/documents/Provincial-Greywater-Feb09.pdf> at 11);
209. Memorandum of Understanding on Pacific North Coast Integrated Management Area Collaborative Oceans Governance, December 11, 2008 (available online at: [http://www.pncima.org/media/documents/pdf/mou\\_-pncima\\_-collaborative\\_-oceans\\_-governance\\_-11dec08.pdf](http://www.pncima.org/media/documents/pdf/mou_-pncima_-collaborative_-oceans_-governance_-11dec08.pdf));
210. Nelson, K.S., E. Gray and H. Tallis, Research Update: Logging and Marine Coastal Systems (available online at: <http://accessscience.com/popup.aspx?id=YB071520&name=print>);
211. Office of the Auditor General of Canada, 2010 Fall Report of the Commissioner of the Environment and Sustainable Development to the House of Commons, "Chapter 3: Adapting to Climate Impacts" (available online at: [http://www.oag-bvg.gc.ca/internet/docs/parl\\_cesd\\_201012\\_03\\_e.pdf](http://www.oag-bvg.gc.ca/internet/docs/parl_cesd_201012_03_e.pdf));
212. Offshore Hydrocarbon Exploration: Report and Recommendations of the West Coast Offshore Exploration Environmental Assessment Panel, submitted to the Governments of BC and Canada (April 1986), Minister of Supply and Services Canada (available online at:

- <http://www.em.gov.bc.ca/OG/offshoreoilandgas/ReportsPresentationsandEducationalMaterial/Reports/Pages/WCOffshoreExplorationEnviroAssessmentPanel.aspx>);
213. PICES-GLOBEC International Program on Climate Change and Carrying Capacity, PICES Scientific Report No. 25 (available online at: [www.pices.int/publications/scientific\\_reports/Report25/default.aspx](http://www.pices.int/publications/scientific_reports/Report25/default.aspx));
  214. PNCIMA Planning Office, PNCIMA Plan: Issues and Outputs and Tasks, Review & Recommendations, February 14, 2011 (available online at: <http://pncima.org/media/documents/pncima-publications/issue-outputs-and-tasks-with-review.pdf>);
  215. Schreier, H. Hall, K.J., Brown, S.J., Wernick, B., Berka, C., Belzer, W. and Petit, K. 1998, "Chapter 4.7, Agriculture: An Important Non-Point Source of Pollution" in C. B. J. Gray, Taina Maria Tuominen, Fraser River Action Plan Staff, *Health of the Fraser River Aquatic Ecosystem: A Synthesis of Research Conducted under the Fraser River Action Plan* (DOE FRAP 1998-11) (available online at: [http://research.rem.sfu.ca/frap/S\\_47.pdf](http://research.rem.sfu.ca/frap/S_47.pdf));
  216. Shuswap/Mara Lakes Greywater Discharge Q & A (available online at: <http://www.env.gov.bc.ca/wat/wq/shuswap/greywaterqa.pdf>);
  217. Terms of Reference for the Pacific North Coast Integrated Management Area (PNCIMA) Marine Technical Advisory Team (MTAT) (no date) (available online at: <http://www.pncima.org/media/documents/mtat/mtat-tor-final-dec-14-10-clean.pdf>);
  218. Transport Canada, Response Organizations Standards (1995), TP 12401 E (available online at: <http://www.tc.gc.ca/publications/EN/TP12401/PDF/HR/TP12401E.pdf>); and
  219. West Coast Environmental Law, Cruise Control: Regulating Cruise Ship Pollution on the Pacific Coast of Canada (available online at: [http://www.georgiastrait.org/files/share/PDF/CruiseControl\\_WCEL.pdf](http://www.georgiastrait.org/files/share/PDF/CruiseControl_WCEL.pdf)).

## Websites

220. About us, online: Burrard Clean Operators/ Western Canada Marine Response Corporation <<http://www.burrardclean.com/about-us>>;
221. Activities Requiring a Disposal at Sea Permit, online: Environment Canada <<http://www.ec.gc.ca/iem-das/default.asp?lang=En&n=6A58C847-1>>;
222. Applying for a Permit, online: Environment Canada <<http://www.ec.gc.ca/iem-das/default.asp?lang=En&n=11663F70-1>>;
223. Best Management Practices and Guidelines, online: Fisheries and Oceans Canada <<http://www.pac.dfo-mpo.gc.ca/habitat/guide-eng.htm#Guides>>;
224. Best Management Practices for BC, online: Environment Canada <[http://www.pyr.ec.gc.ca/boatyards/BMPsBC\\_e.htm](http://www.pyr.ec.gc.ca/boatyards/BMPsBC_e.htm)>;
225. BIEAP/FREMP Home Page, online: BIEAP/FREMP <<http://www.bieapfrempp.org/>>;
226. Civil Liability Insurance for Marine Pollution, online: Transport Canada <<http://www.tc.gc.ca/eng/marinesafety/oep-environment-liability-menu-365.htm>>;
227. Corporate, online: Port Metro Vancouver <<http://portmetrovancover.com/en/about/corporate.aspx>>;
228. DFO, Integrated Management – Ecosystem Considerations (last updated July 2010), online: Fisheries and Oceans Canada <<http://www.dfo-mpo.gc.ca/oceans/management-gestion/integratedmanagement-gestionintegree/ecosystemconsiderations-considerationsecosystemiques/index-eng.htm>>;
229. DFO, Integrated Management: Socio-Economic Considerations (last updated July 2010), online: Fisheries and Oceans Canada <<http://www.dfo-mpo.gc.ca/oceans/management-gestion/integratedmanagement-gestionintegree/socioeconomicconsiderations-considerationssocioeconomiques/index-eng.htm>>;

230. DFO, Pacific North Coast Integrated Management Area: An Ecosystem Approach (no date), online: Fisheries and Oceans Canada <[www.pac.dfo-mpo.gc.ca/publications/pdfs/pncima-eng.pdf](http://www.pac.dfo-mpo.gc.ca/publications/pdfs/pncima-eng.pdf)>;
231. Disposal at Sea, online: Environment Canada <<http://www.ec.gc.ca/iem-das/Default.asp?lang=En&n=0047B595-1>>;
232. Disposal at Sea and the Canadian Environmental Assessment Act, online: Environment Canada <<http://www.ec.gc.ca/iem-das/default.asp?lang=En&n=03734A73-1>>;
233. Feasibility Study for the Proposed Southern Strait of Georgia National Marine Conservation Area Reserve, online: Parks Canada <[http://www.pc.gc.ca/progs/amnc-nmca/cnamnc-cnmca/dgs-ssg/index\\_e.asp](http://www.pc.gc.ca/progs/amnc-nmca/cnamnc-cnmca/dgs-ssg/index_e.asp)>;
234. Federal Protected Areas, online: Environment Canada <<http://www.ec.gc.ca/ap-pa/default.asp?lang=En&n=BA28E937-1>>;
235. General Public, online: Environment Canada <<http://www.ec.gc.ca/iem-das/default.asp?lang=En&n=55A643AE-1>>;
236. Guidelines and Best Management Practices, online: Ministry of Environment <<http://www.env.gov.bc.ca/wld/BMP/bmpintro.html>>;
237. Historical Timeline, online: Energy BC <<http://www.energybc.ca/explore3.html>>;
238. London Convention and Protocol, online: International Maritime Organization <<http://www.imo.org/OurWork/Environment/SpecialProgrammesAndInitiatives/Pages/London-Convention-and-Protocol.aspx>>;
239. Marine Protection, online: Fisheries and Oceans Canada <<http://www.dfo-mpo.gc.ca/oceans/management-gestion/marineprotection-protectionmarine/index-eng.htm#network>>;
240. Marine Protection Areas, online: Fisheries and Oceans Canada <<http://www.dfo-mpo.gc.ca/oceans/marineareas-zonesmarines/mpa-zpm/index-eng.htm>>;

241. Marine Wildlife Areas, online: Environment Canada <<http://www.ec.gc.ca/ap-pa/default.asp?lang=En&n=738B8BCA-1>>;
242. National Marine Conservation Areas of Canada: Canada's National Marine Conservation Areas System Plan, online: Parks Canada <[http://www.pc.gc.ca/progs/amnc-nmca/systemplan/prog\\_E.asp](http://www.pc.gc.ca/progs/amnc-nmca/systemplan/prog_E.asp)>;
243. National Marine Conservation Areas of Canada: National Marine Conservation Area List, online: Parks Canada <[http://www.pc.gc.ca/progs/amnc-nmca/recherche-search\\_e.asp?m=1](http://www.pc.gc.ca/progs/amnc-nmca/recherche-search_e.asp?m=1)>;
244. NWPA Regulatory Framework, online: Transport Canada <<http://www.tc.gc.ca/eng/marinesafety/oep-nwpp-framework-250.htm>>;
245. Offshore Oil & Gas in BC: A Chronology of Activity, online: BC Ministry of Energy and Mines <<http://www.empr.gov.bc.ca/OG/offshoreoilandgas/OffshoreOilandGasinBC/Pages/ACronologyofActivity.aspx>>;
246. Pacific North Coast Management Area: Initiative Overview (no date), online: PNCIMA <<http://www.pncima.org/site/document-library.html>>;
247. Permits for Dredged Material, online: Environment Canada <<http://www.ec.gc.ca/iem-das/default.asp?lang=En&n=BEFB35FC-1&offset=4&toc=show>>;
248. Planning Guidance for British Columbia and Yukon, online: Fisheries and Oceans Canada <<http://www.pac.dfo-mpo.gc.ca/habitat/os-eo/index-eng.htm>>;
249. PNCIMA Initiative, Marine Technical Advisory Team (no date), online: PNCIMA <<http://www.pncima.org/site/who/marine-technical-advisory-team.html>>;
250. PNCIMA Initiative, PNCIMA Initiative Engagement Strategy (May 2010), online: PNCIMA <<http://www.pncima.org/site/document-library.html>>;

251. PNCIMA Initiative, PNCIMA Initiative Secures Multi-Year Funding, November 25, 2010, online: PNCIMA < <http://pncima.org/site/news/1284765914.html>>;
252. PNCIMA Initiative, Related work (no date), online: PNCIMA <<http://pncima.org/site/how/related-initiatives.html>>;
253. PNCIMA Initiative, The Province of B.C and the Nanwakolas Council join PNCIMA Steering Committee (November 25, 2010), online: PNCIMA <<http://www.pncima.org/site/news/1284765705.html>>;
254. PNCIMA Initiative: What is the purpose of the PNCIMA initiative? (no date), online: PNCIMA <<http://pncima.org/site/what/what-is-the-purpose-.html>>;
255. PNCIMA Initiative: When is all of this happening? (no date), online: PNCIMA: <<http://www.pncima.org/site/when.html>>;
256. PNCIMA Planning Office, The Context for the PNCIMA Initiative Planning Process – Draft Backgrounder (March 2010), online: PNCIMA <<http://www.pncima.org/site/document-library.html>>;
257. Response, online: Environment Canada < <http://www.ec.gc.ca/ee-ue/default.asp?lang=en&n=001CCC7B-1>>;
258. Response Organizations, online: Transport Canada <<http://www.tc.gc.ca/eng/marinesafety/oep-ers-regime-ros-771.htm>>;
259. S.M. Garcia, The Ecosystem Approach to Fisheries (2003), online: FAO Fisheries Department <<http://www.fao.org/DOCREP/006/Y4773E/Y4773E00.HTM>>;
260. Schedule I List of Toxic Substances, online: Environment Canada <<http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=0DA2924D-1&wsdoc=4ABEFFC8-5BEC-B57A-F4BF-11069545E434>>;
261. The Environmental Assessment Process, online: Province of British Columbia <[http://www.eao.gov.bc.ca/ea\\_process.html](http://www.eao.gov.bc.ca/ea_process.html)>;

262. Water Stewardship: Legislation (Overview for Water), online: BC MOE  
<[http://www.env.gov.bc.ca/wsd/water\\_rights/overview\\_legislation/index.html](http://www.env.gov.bc.ca/wsd/water_rights/overview_legislation/index.html)>; and
263. Water Quality Monitoring, online: Environment Canada  
<<http://www.ec.gc.ca/qualitedeleau-waterquality/Default.asp?lang=En>>.

## **Appendix 2: List of abbreviations**

*BC EAA – BC Environmental Assessment Act*

BC MOE – BC Ministry of Environment

BMPs – Best Management Practices

CCCMA – Canadian Centre for Climate Modelling and Analysis

CCG – Canadian Coast Guard (DFO)

*CEAA – Canadian Environmental Assessment Act*

*CEPA – Canadian Environmental Protection Act*

*CSA – Canada Shipping Act*

CVC – climate variability and change

DFO – Fisheries and Oceans Canada

DMC – Departmental Management Committee (DFO)

DND – Department of National Defence

EC – Environment Canada

*ELUA – BC Environment and Land Use Act*

*EMA – BC Environmental Management Act*

*ERA – BC Ecological Reserve Act*

ERI – Ecosystem Research Initiative

FREMP – Fraser River Estuary Management Program

*FRPA – BC Forests and Range Practices Act*

HABs – Harmful algal blooms



HAMP – Harmful Algae Monitoring Program

ICS – US Incident Command System

IMPs – Integrated Management Plans

IOAC – Integrated Oceans Advisory Committee

*LGA – BC Local Government Act*

LOMAs – Large Ocean Management Areas

MARPAC – Maritime Forces Pacific (DND)

MCTS – Marine Communication and Traffic Services

MOU – Memorandum of Understanding

MPAs – Marine Protected Areas

MPIRS – Marine Pollution Incident Reporting System

MWAs – Marine Wildlife Areas

NMCAs – National Marine Conservation Areas

*NWPA – Navigable Waters Protection Act*

OCC – Canada-BC Ocean Coordinating Committee

OHEB – Oceans, Habitat and Enhancement Branch

OS – Operational Statements

*PABCA – Protected Areas of British Columbia Act*

Pacific RCOM – Pacific Region Committee on Ocean Management

PAHs – polycyclic aromatic hydrocarbons

PBT – persistent, bioaccumulative and toxic

PCBs – polychlorinated biphenyls

PIOC – Pacific Interdepartmental Oceans Committee

PNCIMA – Pacific North Coast Integrated Management Area

PNCIMA MOU – *Memorandum of Understanding on Collaborative Governance for PNCIMA*

PPR – Policy and Practice Report

PSC – Pacific Salmon Commission

REET – Regional Environmental Emergency Team

RODAC – Regional Ocean Disposal Advisory Committee

*SARA – Species at Risk Act*

*WDR – Waste Discharge Regulation*