

Memorandum

Date: January 10, 2008

To: Corrie Veenstra, USACE

From: Chris Earle

cc: Chris Cziesla

Subject: Response to Services comments on NWP 48 BA for Washington

1 Background

2 Pursuant to the terms of Contract W912DW-05-D-1001, delivery order DT02, Jones & Stokes
3 prepared a “Draft Biological Assessment and Essential Fish Habitat Analysis: Nationwide Permit
4 48 in Washington,” which was delivered to the Portland District, U.S. Army Corps of Engineers
5 for review on September 27, 2007. Following review, the biological assessment (BA) was
6 modified and a second version delivered on October 12, 2007. This version of the BA was
7 subsequently delivered to the National Marine Fisheries Service (NMFS) and U.S. Fish and
8 Wildlife Service (FWS) by USACE. Page numbers cited in the FWS comments below refer to
9 this final draft.

10 The present document, prepared under a modification of the original delivery order (Exercise
11 Optional Letter #01, January 9, 2008), responds to comments on the original BA that were
12 prepared by NMFS and FWS and delivered to USACE on November 21, 2007 (FWS) and
13 December 18, 2007 (NMFS). In addition, a conference call on December 14, 2007 was attended
14 by USACE, NMFS, FWS and Jones & Stokes representatives and served to further inform our
15 understanding of the comment letters.

16 These responses were prepared using references cited by the Services in their comments,
17 references from the peer-reviewed literature as cited below, and verbal or written comments from
18 persons knowledgeable in shellfish aquaculture methods and their effects, also cited below.

1 Response to NMFS Comments

2 General Comments

3 *Comment 1:* We agree with the Corps that there are many uncertainties regarding the effects of
4 aquaculture on protected species, their habitat, and EFH, but we believe that the BA's conclusions
5 can be better supported by examining a larger set of the current literature. We have forwarded to
6 you and the consultants an electronic version of Jeff Fisher's annotated bibliography of the effects
7 of shellfish aquaculture.

8 *Response:* The annotated bibliography was used in preparation of the biological assessment, and
9 relevant citations appear throughout the text.

10 *Comment 2:* The EFH Assessment can also be strengthened by using information provided in
11 Fishery Management Plans (FMPs). Relevant FMPs can be found at the Pacific Fishery
12 Management Council's website (<http://www.pcouncil.org>). Care should be taken to adhere to the
13 definition of an "adverse impact to EFH". An adverse impact to EFH is defined as any impact that
14 reduces the quality and/or quantity of EFH and may include direct, indirect, site-specific, or
15 habitat wide impacts.

16 *Response:* FMPs reviewed during document preparation are cited in Chapter 8 of the BA.
17 Specific comments relevant to that analysis are addressed below.

18 *Comment 3:* We are aware that it is difficult to identify precisely the locations of existing
19 shellfish aquaculture operations in Washington State. However, without accurate descriptions of
20 the action area, our evaluation of the risks posed to listed species, their habitat, and EFH is
21 compromised. We understand that the Corps is working with the consultant to provide more
22 precise and accurate descriptions of the action area, including a clarification of the definition of
23 historic shellfish growing areas.

24 *Response:* As required under NWP 48, all reporting forms received from growers will be
25 provided to NMFS and USFWS for their review. Currently USACE does not plan further
26 analyses of information contained in these reporting forms.

27 *Comment 4:* The analytical framework for assessing the effects of the issuance of NWP 48 is
28 confusing. We look forward to a final version that clarifies that the analysis will compare the
29 magnitude and extent of the effects of shellfish aquaculture prior to issuance of NWP 48, to the
30 effects of shellfish aquaculture expected after the issuance of NWP.

31 *Response:* The final version of the BA has been issued and delivered for your consideration. This
32 memorandum has been prepared to address comments received from the NMFS and the USFWS.
33 Responses presented herein reference sections in the original BA by number and title, as
34 appropriate. The specific issue of effects prior to vs. after issuance of NMP 48 is discussed in BA
35 Section 1.1, Federal Action History, and Section 1.2, Informal Consultation, which states "that

1 shellfish aquaculture, having existed in the action area for a long time prior to the development of
2 NWP 48 and in many cases prior to the Endangered Species Act and Clean Water Act, should be
3 included as part of the environmental baseline. This is consistent with the definition of
4 environmental baseline as including “State, tribal, local, and private actions already affecting the
5 species or that will occur contemporaneously with the consultation in progress” (NMFS and
6 USFWS 1998). However, there is limited understanding of the historical effects of shellfish
7 culture, so the potential effects of culture as regulated under NWP 48 should be interpreted
8 conservatively in the evaluation of how culture activities may affect listed species and their
9 habitat.”

10 Specific Comments

11 *Comment 5:* We look forward to more detail on the description of culture bed preparation
12 activities; and the effect of those activities on critical habitat and EFH. As you know, effects to
13 eelgrass are an important issue. We look forward to a detailed discussion of shellfish culture and
14 eelgrass interaction.

15 *Response:* This comment does not refer to any specific portion of the text. Numerous comments
16 treated below address culture bed preparation and the interaction of shellfish culture and eelgrass.

17 *Comment 6:* ATVs are discussed in the effects analysis section. Please describe their usage in the
18 proposed action, and acknowledge their usage as set forth in the SLOPES consultation. Work
19 conducted on the beach should use pre-existing routes so as to minimize impacts to the intertidal
20 environment.

21 *Response:* ATV's are sometimes used at grower discretion to access shellfish beds or to move
22 equipment on exposed beds. Such vehicles should be operated in accordance with standard
23 measures intended to minimize impacts, such as the provisions of SLOPES 3 (NMFS 2004)
24 which require:

- 25 • Vehicle wash water must be treated before discharge.
- 26 • Vehicles will be stored, fueled, and maintained in a vehicle staging area placed 150 feet
27 or more from any stream, waterbody or wetland.
- 28 • Inspect all vehicles operated within 150 feet of any stream, waterbody or wetland daily
29 for fluid leaks before leaving the vehicle staging area. Repair any leaks detected in the
30 vehicle staging area before the vehicle resumes operation. Document inspections in a
31 record that is available for review on request by Corps or NOAA Fisheries.
- 32 • Vehicles operated within 150 feet of any stream, waterbody or wetland will be inspected
33 daily for fluid leaks before leaving the vehicle staging area.
- 34 • Before operations begin and as often as necessary during operation, all equipment used
35 below ordinary high water will be steam-cleaned.

1 It is not known if all ATV users observe these precautions. We anticipate discussing with NMFS
2 and USFWS the potential adoption of a conservation measure pertaining to ATV use in shellfish
3 aquaculture.

4 *Comment 7:* Please include an analysis of the effects of turbidity from unwashed gravel and sand
5 used for intertidal or subtidal aquaculture to the extent that unwashed product is used.

6 *Response:* Growers report that graveling is only used to provide a benthic substrate that clams can
7 inhabit. Under NWP 48, graveling would only be a covered activity in areas previously graveled.
8 Graveling is only performed in Willapa Bay, where no NMFS-jurisdictional salmonids occur, but
9 bull trout does occur seasonally. Such use is predominantly between April and October.
10 Therefore, the description of graveling is here amended with the provision that it is only a
11 covered activity when performed in Willapa Bay, between November and March. There is still a
12 small possibility that bull trout could be exposed to turbidity associated with gravel placement
13 during that time period. Willapa Bay has very high background turbidity levels due to constant
14 turbation of benthic silts by tidal currents. Turbidity increases associated with graveling have not
15 been reported by growers to cause observable increases in turbidity, but we are not aware of any
16 actual measurements of turbidity changes associated with graveling. Overall, the exposure of bull
17 trout to turbidity effects associated with graveling is thus both insignificant and discountable.

18 *Comment 8:* We look forward to a discussion of the cumulative effects of multiple small impacts,
19 as well as the evidence or lack thereof for long-term effects of shellfish culture on ecosystem
20 services.

21 *Response:* There is essentially no evidence for additive effects of multiple small impacts
22 attributable to shellfish culture. Shellfish culture, specifically oyster culture, has been a well
23 established activity in Willapa Bay since the 1850's, and for nearly as long in Humboldt Bay,
24 California. Both estuaries have remained highly functional throughout that time period. In
25 particular, both have retained exceptional value as rearing habitat for juvenile salmonids, and
26 Willapa remains one of the most productive rearing areas in Washington. Shellfish growers
27 attribute this to their zealous defense of water quality; excellent water quality is an absolute
28 prerequisite for successful shellfish culture. Consideration of the historical record reveals that
29 shellfish culture has had some notable adverse impacts on the Willapa Bay ecosystem, primarily
30 the introduction of the aquatic weed *Spartina* (introduced in the late 19th Century as a packing
31 material for introduced oyster seed) and the replacement of the native *Olympia* oyster with non-
32 native oyster stocks. However, these are not cumulative effects but major discrete events, and
33 mechanisms have been created (discussed in Chapter 2 of the BA) to prevent recurrence of such
34 events.

35 There remains the possibility of additive effects of small actions altering habitat in areas subject
36 to other types of shellfish culture, such as clam and mussel culture. Such practices have been
37 performed continuously for a century or more in various waters of eastern North America and
38 northwest Europe that are comparable to the marine environments of western Washington.
39 However, we have not identified any literature addressing the question of cumulative long-term

1 impacts of shellfish culture in these areas.

2 *Comment 9:* Note that EFH identifications are no longer grouped into composites. [8-2, line 331].

3 *Response:* Acknowledged. This information does not alter the conclusions of the EFH analysis.

4 *Comment 10:* Estuaries and seagrass habitats are designated Habitat Areas of Primary Concern
5 (HAPCs) under the Fishery Management Plans. Please include a discussion of the relevance of
6 this designation and the effects of the project on HAPCs.

7 *Response:* Amendment 18/19 of the groundfish FMP (PFMC 2005) identifies Habitat Areas of
8 Particular Concern (HAPC) for the Pacific Coast groundfish fishery. The identified HAPCs in the
9 action area include estuaries, seagrass, and areas of interest. All shellfish culture activities
10 covered by NWP 48 in Washington include the estuary and areas of interest HAPC's (the areas of
11 interest HAPC includes "All waters and sea bottom in state waters shoreward from the three
12 nautical mile boundary of the territorial sea shoreward to MHHW"). The complex relationships
13 between seagrass and shellfish aquaculture, described in the BA, ensure that a substantial fraction
14 of shellfish culture activities covered by NWP 48 include parts of the seagrass HAPC. The
15 effects of the project on estuaries, seagrass and other waters in the action area are described in the
16 BA.

17 *Comment 11:* Table 8-1: Cabezon and English sole are not limited to estuaries in Puget Sound.
18 Starry flounder have been observed in seagrass habitat. Please include a footnote to Table 8-1 that
19 states that species in the table may occur in habitats other than those in which they were observed
20 in the surveys used to prepare the Table.

21 *Response:* Acknowledged. This information does not alter the conclusions of the EFH analysis.

22 **Narrative Comments from December 14, 2007 NMFS Conference Call**

23 *Comment 12:* Do growers use treated wood in rafts? If so, discuss potential effects of leaching.

24 *Response:* Growers are not prohibited from using treated wood in mussel rafts and it is assumed
25 that some growers covered under NWP 48 do construct their rafts using ammoniacal copper
26 zinc arsenate (AZCA) treated wood, which is generally approved and available for marine use in
27 western Washington. Rafts are constructed on land and towed to their moorage, so contamination
28 effects associated with raft construction do not affect surface waters. Wood impregnated with
29 chemicals such as copper, zinc, and arsenic may directly affect salmon that rear or migrate by
30 those structures, or indirectly when the salmon ingest contaminated prey (Poston 2001).
31 However, mussel rafts are cited in waters with continuous and active current flow in order to
32 ensure a steady supply of phytoplankton for the mussels to feed upon. Therefore dilution effects
33 are continuous and no salmonids in the vicinity of the rafts are likely to be exposed to leachate
34 concentrations sufficient to cause measurable physiological effects.

1 *Comment 13:* No need to address Columbia River runs of salmon and steelhead.

2 *Response:* The USACE wishes to withdraw the effect determinations for the Columbia River runs
3 of salmon and steelhead, i.e., the Columbia River chum salmon ESU, the lower Columbia River
4 coho salmon ESU, the lower Columbia River steelhead DPS, the middle Columbia River
5 steelhead DPS, the upper Columbia River steelhead DPS, the Snake River steelhead DPS, the
6 upper Willamette River steelhead DPS, the Snake River sockeye salmon ESU, the lower
7 Columbia River Chinook salmon ESU, the upper Columbia River spring-run Chinook salmon
8 ESU, the upper Willamette River Chinook salmon ESU, the Snake River spring/summer run
9 Chinook salmon ESU, and the Snake River fall-run Chinook salmon ESU.

10 *Comment 14:* Discuss floatation used be growers; should be encapsulated to prevent styrofoam
11 pollution.

12 *Response:* Floatation is made from pressurize plastic floats, reclaimed polyurethane food-grade
13 barrels, or coated or vinyl-wrapped polystyrene foam. Unwrapped polystyrene (Styrofoam[®]) is
14 not used.

15 *Comment 15:* Appropriate to include a conservation measure providing for at least annual cleanup
16 of debris (geoduck tubes, nets, etc.) on grower beaches; relevant to all culture that leaves gear
17 (tubes, nets, longlines, etc.); actions to be only performed on legally accessible properties.

18 *Response:* We have received an e-mail from Wayne Palsson, WDFW research scientist,
19 disclosing unpublished data on aquaculture debris in south Puget Sound. A 2005 bottom trawl
20 survey estimated geoduck culture debris in the south Sound amounting to 61,600 pieces of netting
21 and 21,600 culture tubes (Palsson pers. comm.). We anticipate discussing with NMFS and
22 USFWS the appropriate formulation of a conservation measure intended to address this situation.

23 *Comment 16:* All pump intakes (for geoduck harvest, and for washing down gear or tubs of
24 harvested fish, etc) that use seawater should be screened in accordance with NMFS and WDFW
25 criteria.

26 *Response:* We agree that this is an appropriate precaution and anticipate discussing with NMFS
27 the appropriate formulation of a conservation measure intended to address this situation.

28 *Comment 17:* Make clear that frosting is only performed in previously treated areas.

29 *Response:* This is correct. Frosting is only performed in previously treated areas.

30 *Comment 18:* Shellfish operations using carbaryl are not covered by this consultation and must
31 pursue a separate consultation.

32 *Response:* We anticipate discussing with NMFS and USFWS the appropriate formulation of an
33 analysis of carbaryl use in shellfish aquaculture.

1 *Comment 19:* Include a summary of shellfish culture effects on plankton productivity.

2 *Response:* Shellfish culture effects on plankton productivity are described briefly on page 5-8 of
3 the BA. It is possible to go into considerable detail on this subject. One beneficial effect of
4 shellfish culture appears to be to dampen otherwise extreme natural fluctuations in plankton
5 productivity. Estuaries that have lost a large fraction of their shellfish populations, such as
6 Chesapeake Bay, are vulnerable to short, intense phytoplankton blooms followed by mass
7 mortality of the phytoplankton and the zooplankton that feed upon them. Healthy bivalve
8 populations prevent that outcome by consuming a portion of the phytoplankton and recycling
9 some of the nutrients back into the environment.

10 Shellfish effects on plankton productivity can be measured. In 2003, the Pacific Shellfish Institute
11 completed a comprehensive two-year study to evaluate phytoplankton abundance and seasonal
12 change within and surrounding a mussel raft farm in southern Puget Sound. This farm has 8
13 multiple suspended culture units with a total surface area of one acre and a stocking density at
14 harvest size of 240 tons. While phytoplankton abundance was on average 56.3% lower in the
15 center of the raft units, the feeding effects on phytoplankton were localized and contained in the
16 immediate raft system. Despite reductions in phytoplankton abundance within the mussel unit,
17 phytoplankton concentration and community composition outside the raft system did not differ
18 from reference conditions (PSI, 2003).

19 In a mesocosm study in Rhode Island, Pietros and Rice (2003) specifically investigated the
20 “overgrazing hypothesis” that oyster populations can deplete phytoplankton. They found that
21 “based on rates of ammonia excretion by oysters and observed steady states of ammonia and
22 other forms of inorganic nitrogen in mesocosm tanks, it can be hypothesized that ammonia
23 generated by oysters is taken up by rapidly regenerating phytoplankton in the water column.”
24 They concluded that oysters had no net effect in terms of depleting phytoplankton populations,
25 but that oysters can produce changes in the relative abundance of different phytoplankton species.

26 *Comment 20:* Clarify definitions of growing area per preamble in FR notice that accompanies
27 issuance of NWP 48.

28 *Response:* The referenced FR notice includes the following text (72FR11145):

29 For the purposes of this NWP, an existing operation is one that has been granted a permit,
30 license, or lease from a state or local agency specifically authorizing commercial
31 aquaculture activities and which has undertaken such activities prior to the date of
32 issuance of this NWP. For the purposes of this NWP, the project area is defined as the
33 area of waters of the United States occupied by the existing operation. In most cases, the
34 project area will consist of the area covered by the state or local aquaculture permit,
35 license, or lease. The project area may consist of several sites that are not contiguous. The
36 project area may include areas in which there has been no previous aquaculture activity
37 and/or areas that periodically are allowed to lie fallow as part of normal operations.

38 Relocation of existing operations into portions of the project area not previously used for

1 aquaculture activities may be authorized by this NWP but will require a preconstruction
2 notification. Cultivation in areas that were previously used but allowed to lie fallow does
3 not require a pre-construction notification. Operators should maintain appropriate
4 documentation showing which areas were previously cultivated.

5 The present consultation addresses shellfish culture within project areas defined per 72FR11145,
6 within an action area defined as stated in Section 2.4 of the BA.

7 *Comment 21:* Make it clear that “historic” time included aquaculture.

8 *Response:* All references to “historic” or “historical” conditions in the BA refer to times between
9 the onset of written records and the issuance of NWP 48. In much, but not all of the action area,
10 shellfish aquaculture has occurred through the whole of the historic period. In most areas this
11 only applies to oyster culture; mussel and clam (including geoduck) culture are generally more
12 recent phenomena, and geoduck culture in particular has almost all developed during the 21st
13 Century.

14 *Comment 22:* Corps needs to provide better information about the acreage of the operations being
15 covered under NWP 48.

16 *Response:*

17 Response to FWS Comments

18 General Comments

19 *Comment 23:* 1) We need a description of the scope of the action. Aside from points on a map we
20 have no information was provided on the amount of acres under shellfish cultivation or what
21 percent of Puget Sound (i.e., nearshore habitat) is being farmed. This information is critical to
22 predict the extent of intertidal habitat used by listed fish, migratory birds and other important
23 aquatic resources. This information is available from the state resource agencies and the
24 Washington State Health Department. We also need to know the extent of overlap with forage
25 fish spawning areas and eel grass beds.

26 *Response:* For the spatial scope of the action, see response to Comment 3. The known extent of
27 overlap with forage fish spawning areas and eelgrass beds is as stated within the environmental
28 baseline and effects analysis chapters in the BA.

29 *Comment 24:* 2) It is unclear how a NLAA determination can be made when there is no analysis
30 of the additive effect of how *all* the shellfish farming activities combined affect listed species and
31 their prey. No connection has been made (beneficial or detrimental) between changes in
32 phytoplankton and zooplankton density and ultimately effects to juvenile fish (salmonids, and
33 forage fish). These farmed organisms also compete with native clams and oysters for food. High

1 densities of shellfish in sheltered bays and coves may be removing significant amounts of
2 phytoplankton, reducing this trophic level, very likely to the detriment of zooplankton and higher
3 trophic level species. There is no discussion on the potential effects to forage fish either from a
4 reduction in prey or reduced spawning habitat.

5 *Response:* See the response to comment 19 for discussion of the effects of shellfish culture on
6 plankton productivity. See the response to comment 8 for discussion of the additive effect of all
7 shellfish activities combined. Note also that oyster eggs are used to feed hatchery salmon; about
8 40% of cultured oyster net productivity is thought to go to support spawning, with all of that
9 spawn discharged to estuarine waters. Oyster, manila clam and geoduck culture in western
10 Washington show net productivity of approximately 12,000 (geoduck) to 72,000 (intensive
11 oyster) pounds per acre per year (Davis pers. comm.), so that represents 4,800 to 28,800 pounds
12 per acre per year of spawn released to nearshore waters (note however that approximately 50% of
13 the oyster harvest is represented by triploid oysters, which do not spawn). No water quality
14 impairment has been noted from these spawn releases, and the net supply of food for juvenile
15 salmon, forage fishes and other small marine fauna is evidently substantial. This is probably one
16 reason why Washington's primary shellfish harvest area, Willapa Bay, is also one of its most
17 productive salmon rearing estuaries.

18 *Comment 25:* 3) Too often only one citation is provided which paints a positive picture of the
19 effects of shellfish aquaculture on the environment. We do not deny that there are positive
20 *environmental aspects of this activity on the environment, however, there are negative effects as*
21 *well, and these appear to be glossed over in this analysis. We expect the Corp's information to*
22 *provide an evaluation of the activities under consultation which considers all potential effects.*

23 Under Section 7(a)(2) of the Act "Each Federal agency shall, in consultation with and with the
24 assistance of the Secretary, insure that any action authorized, funded, or carried out by such
25 agency (hereinafter in this *section* referred to as an "agency action") is not likely to jeopardize the
26 continued existence of any endangered species or threatened species or result in the destruction or
27 adverse modification of habitat of such species which is determined by the Secretary, after
28 consultation as appropriate with affected States, to be critical, unless such agency has been
29 granted an exemption for such action by the Committee pursuant to subsection (h) of this section.
30 ***In fulfilling the requirements of this paragraph each agency shall use the best scientific and***
31 ***commercial data available*** [emphasis added]. Jeff Fisher developed a comprehensive
32 compilation of the current literature; we suggest you review this literature.

33 *Response:* The annotated bibliography was used in preparation of the biological assessment, and
34 relevant citations appear throughout the text.

35 *Comment 26:* 4) We still need clarity on what is allowed in the NWP #48 regarding expansion of
36 aquaculture facilities? For example, if a grower owns or leases 50 acres but he/she only has 25
37 acres under cultivation, can he/she expand the operations to the other 25 acres under the NWP
38 #48? In other words does expansion only apply to the acquisition and cultivation on *additional*
39 property not under ownership or lease?

40 *Response:* See the response to Comment 20. In the example you cite, the grower would be

1 eligible to culture “the other 25 acres” under NWP 48, but would require USACE approval of a
2 pre-construction notification in order to do so.

3 *Comment 27:* 5) Are shellfish farmers farming their entire lease/ownership? The baseline
4 condition includes those areas under cultivation. If a grower is only using 50% of his/her
5 ownership that is the baseline condition, then any expansion to the other 50% of the tract should
6 be considered in the effects analysis. Currently, we have no way to determine how many acres are
7 under cultivation relative to the areas that *could be* under cultivation in the future.

8 *Response:* Currently we do not know how much of each farmer’s lease/ownership is under
9 cultivation. There is no provision in NWP 48 for securing information on the acreage
10 leased/owned that is under cultivation, formerly but not currently cultivated, or never previously
11 cultivated, except in cases where growers are required to submit a pre-construction notification.

12 Specific Comments

13 *Comment 28:* 1) Page 2-9, line 1: What is the size range of the mussel rafts?

14 *Response:* Mussel rafts are typically 30 by 34 feet, and a typical mussel farm consists of four to
15 six rafts moored together.

16 *Comment 29:* 2) Page 2-9, line 7: Are fish ever trapped in these nets?

17 *Response:* The nets initially used are discarded from salmon farms and form a box under the raft,
18 in order to prevent predatory fish from consuming the young shellfish. Later, the nets are
19 removed and replaced with a coarser-mesh perimeter net that is open at the bottom; these nets
20 serve to exclude diving ducks. The growers report that no fish or ducks have been found
21 entangled in these nets.

22 *Comment 30:* 3) Page 2-11, line 6: How is the silt manually leveled? What equipment is used?

23 *Response:* The ground is dragged with a steel bar and a square of chain mesh. Some oyster
24 growers simply drag a closed dredge. The equipment is dragged behind a boat, during a falling
25 tide.

26 *Comment 31:* 4) Page 2-14, line 27: Is this crushed shell and gravel spread over eelgrass beds?

27 *Response:* These actions would be performed on a bed recently harvested under NWP 48, and
28 would be performed on a bed previously treated with shell and gravel. This action is intended to
29 facilitate clam culture. Clams can’t be farmed in eelgrass areas; the rhizomes exclude their
30 culture. So, the work would never be done in areas with abundant eelgrass. Also, this work is
31 done in depths above those inhabited by *Zostera marina*. Consequently any eelgrass impacts
32 would only occur to very sparse growth of the invasive seagrass *Zostera japonica*, and even those
33 impacts would rarely occur.

1 *Comment 32:* 5) Page 2-15, line 8: Are these growing areas on the same property or are oysters
2 transported off site? If so, where are they taken? These offsite areas (should they exist) should
3 be included in the action area.

4 *Response:* This BA covers oysters grown in western Washington. Thus the only “off site” areas
5 would be areas out of state. Currently no oysters are taken out of state for fattening and no such
6 activity is proposed. Normally, oysters are only moved within the confines of an existing
7 shellfish farm. They remain not only within the action area, but within the project area.

8 *Comment 33:* 6) Page 2-15, line 16: How often during the grow-out season is the area harrowed.
9 Is this done where eelgrass is growing?

10 *Response:* Harrowing occurs only in the Willapa and Grays Harbor area, where it is done to keep
11 the oysters on the bed of the bay. Without harrowing, the oysters would sink into the silty bottom
12 due to bioturbation by burrowing shrimp. Thus the frequency of harrowing depends largely on
13 the intensity of bioturbation by shrimp. In the summer, it may have to be done two or three times.
14 The rest of the year, it generally is not necessary. It is conceivable that harrowing could affect a
15 little eelgrass, but generally eelgrass is incapable of occupying areas populated by burrowing
16 shrimp.

17 *Comment 34:* 7) Page 2-17, line 12: How are the stacks de-fouled?

18 *Response:* Defouling is rarely done, and is usually only performed at a harvest. The stacks may
19 be pressure-washed, or changed out and left to dry onshore. The pressure washers use screened
20 intakes (see response to comment 16).

21 *Comment 35:* 8) Page 2-18, line 13: Does other growth include eelgrass?

22 *Response:* See response to comment 31. Clam culture is performed on sites that are too high for
23 *Zostera marina* to grow. *Zostera japonica* is generally controlled as an invasive species.

24 *Comment 36:* 9) Page 2-24: Line 17: If shellfish are taken to other areas for “grow-out” this
25 should be considered interdependent and analyzed in this section.

26 *Response:* See the response to comment 32.

27 *Comment 37:* 10) Page 2-24 line 20: This sentence beginning with “Such facilities...” is unclear.

28 *Response:* Because NWP 48 only covers existing shellfish culture operations, it is not necessary
29 for permittees to secure any other federal authorizations in order to perform work under NWP 48.
30 Thus there are not necessarily any interdependent or interrelated actions linked to NWP 48.
31 However, it is foreseeable that some individual NWP 48 permittees shall perform actions, such as
32 dock repair, that are not covered under NWP 48 and that require additional federal authorizations.

33 *Comment 38:* 11) Page 2-24, line 28: Have you contacted the Washington State Department of
34 Health? Since they have a database with the location and size of the commercial shellfish
35 companies in Washington it would simply require a download of their database into a GIS. I

1 suggest you do this and provide us with the information so that we can determine the scale of the
2 action.

3 *Response:* We have contacted the Washington Department of Health. They state that they are
4 unable to provide GIS data or any other database information. They will only provide
5 unspecified information regarding shellfish permittees.

6 *Comment 39:* 12) Page 2-25, line 16: The double negative makes this sentence very confusing,
7 please clarify.

8 *Response:* There are some areas where shellfish culture is allowed by the Washington Department
9 of Health. These are Area 1. There are some areas where shellfish culture, which could be
10 authorized under NWP 48, currently occurs. These are Area 2. Area 2 is entirely within Area 1,
11 but we don't know exactly where it is. There are also areas where shellfish culture is allowed by
12 the Washington Department of Health, but where it does not occur. These areas would not be
13 covered under NWP 48. This is Area 3. Area 1 equals Area 2 plus Area 3. We do not know of
14 any places that are definitely within Area 3.

15 *Comment 40:* 13) Page 2-25, Line 20: We expect that the area (total acres) where shellfish
16 growing is allowed to be provided in the BA. At this point we have not seen such information.
17 We need to understand the scope of the action (amount of area under cultivation relative to bull
18 trout critical habitat). The other component of the action area that needs to be considered are any
19 and all grow-out areas.

20 *Response:* See the response to comment 3.

21 *Comment 41:* 14) Page 3-2, Table 3-1: Please add the Olympic Peninsula DPS for bull trout as
22 shellfish are grown within this DPS and designated critical habitat.

23 *Response:* We are not aware of the existence of an Olympic Peninsula DPS for bull trout. Please
24 provide a citation for this listing. There is an Olympic Peninsula Management Unit for the
25 Coastal/Puget Sound bull trout DPS. The BA includes the Coastal/Puget Sound bull trout DPS.

26 *Comment 42:* 15) Page 3-37, line 14: Please move the word trout in front of in.

27 *Response:* The sentence should read, "Bull trout in Puget Sound undertake rapid directed
28 migrations that may exceed 250 kilometers, using nearshore marine shorelines as pathways
29 (Goetz et al. 2003)."

30 *Comment 43:* 16) Page 3-37, line 29: Actually, in February 2002 a bull trout was captured by a
31 WDFW technician at river mile 29 in the Willapa River.

32 *Response:* The effects analysis has been re-evaluated in recognition that bull trout may occur in
33 Willapa Bay.

34 *Comment 44:* 17) Page 3-38, line 4: These are not the correct bull trout critical habitat PCEs that
35 apply to marine near-shore waters. They are 1) water temperatures...2) migratory corridor.... 3)
36 abundant food base...and 4) permanent water quality...(see page 56266 of 70 FR 56212)

37 *Response:* The first paragraph on page 3-38 of the BA is here retracted. The proper (marine)

1 PCEs are as follows (70 FR 56266):

2 (i) Water temperatures that support bull trout use. Bull trout have been documented in streams
3 with temperatures from 32 to 72 °F (0 to 22 °C) but are found more frequently in temperatures
4 ranging from 36 to 59 °F (2 to 15 °C). These temperature ranges may vary depending on bull
5 trout life history stage and form, geography, elevation, diurnal and seasonal variation, shade, such
6 as that provided by riparian habitat, and local groundwater influence. Stream reaches with
7 temperatures that preclude bull trout use are specifically excluded from designation;

8 (vi) Migratory corridors with minimal physical, biological, or water quality impediments between
9 spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal
10 barriers induced by high water temperatures or low flows;

11 (vii) An abundant food base including terrestrial organisms of riparian origin, aquatic
12 macroinvertebrates, and forage fish; and

13 (viii) Permanent water of sufficient quantity and quality such that normal reproduction, growth,
14 and survival are not inhibited.

15 *Comment 45:* 18) Page 4-9, line 3: This sentence beginning with “The organic contaminants...” is
16 incomplete.

17 *Response:* The sentence should read, “The organic contaminants polyaromatic hydrocarbons
18 (PAHs), phthalate ester compounds, polychlorinated biphenyls (PCBs), dichloro diphenyl-
19 trichloroethane (DDT) and dibenzofuran were detected in sediments in southern Puget Sound as
20 well.”

21 *Comment 46:* 19) Page 4-11, Line 3: It doesn’t appear that you used WDNRs Shore zone
22 inventory to characterize eel grass. We ask that you use it and create a map with the shellfish
23 farm and an eelgrass layer for the final BA.

24 *Response:* We do not have a shellfish farm layer. Thus data do not exist to precisely overlay each
25 farm project area with an existing eelgrass inventory.

26 *Comment 47:* 20) Page 5-6, line 21: Are forage fish surveys conducted prior to spreading oyster
27 shell?

28 *Response:* No, but shell spreading is not done in areas where surf smelt or sand lance spawn, and
29 activities are deferred if workers observe herring spawn.

30 *Comment 48:* 21) Page 5-7, Line 11: What is the source of the contamination?

31 *Response:* Chlorine is used to clean equipment and is neutralized prior to discharge. Thus the
32 only contaminants expected to occur are chlorine neutralization residues, present at very low
33 concentrations.

1 *Comment 49:* 22) Page 5-8, Lines 14-17: Please provide support (analysis and or citations) for
2 this assertion. How much biomass is consumed by all of the shellfish operations in Washington?
3 What percent relative to the ecosystem productivity is consumed by the shellfish covered under
4 NWP 48? How did you determine that the "...biomass of organisms supported by these
5 operations is too small to represent a measurable fraction of the ecosystem productivity"?

6 *Response:* See response to comment 19 for a general discussion of shellfish culture effects on
7 productivity. However, this comment specifically addresses hatchery and nursery operations. The
8 live biomass in a hatchery or nursery is very small; in a hatchery it is a matter of pounds, and in
9 any event hatcheries grow their own food and so place zero demand upon ecosystem productivity.
10 Nurseries have biomass on the order of tens of pounds, two orders of magnitude less than the live
11 biomass loadings on an acre of oyster farm.

12 *Comment 50:* 23) Page 5-9, line 8: The Simenstad 1999 paper is not in the literature cited section.

13 *Response:* The citation is: Simenstad, C.A., B.J. Nightingale, R.M. Thom and D.K. Schreffler.
14 1999. Impacts Of Ferry Terminals On Juvenile Salmon Migrating Along Puget Sound Shorlines
15 [sic] Phase I: Synthesis Of State Of Knowledge. Seattle, Washington: Washington State
16 Transportation Center (TRAC). 199pp.

17 *Comment 51:* 24) Page 5-9, Line 13: What is your conclusion? Are piscivorous birds going to
18 perch on such structures while foraging for juvenile salmonids or forage fish since "in theory" it
19 could happen?

20 *Response:* FLUPSYs are located in water that is too deep for heron foraging, so the principal
21 piscivorous birds in the vicinity of these structures are divers such as diving ducks, alcids and
22 grebes. These predators do not forage from perches, but by actively swimming beneath the water
23 surface. Thus the perching opportunity provided by a FLUPSY is not likely to be utilized by
24 piscivorous birds, and will neither aid nor hinder the foraging behavior of such birds.

25 *Comment 52:* 25) Page 5-12, Lines 12-17: There are significant bacteria growing under the
26 mussel rafts cited by APHETI 2006. I assume that mussel rafts are placed in quiescent waters.
27 Correct? Are mussel rafts located in bull trout critical habitat, if so how many? We need to know
28 the amount of nearshore taken up by mussel rafts.

29 *Response:* Mussel rafts are not placed in quiescent waters. A steady but slow current is preferable
30 to ensure a steady supply of phytoplankton for the mussels. Mussel rafts in western Washington
31 are sited in waters from 15 feet to 60 feet deep. Bull trout critical habitat includes nearshore
32 waters up to -33 feet MLLW depth (70 FR 56266). The growers estimate that a quarter to a third
33 of western Washington mussel rafts are sited in waters less than 33 feet deep, representing a total
34 of less than 10 rafts covering a total acreage of less than 0.25 acre.

35 *Comment 53:* 26) Page 5-12, Line 29 – 30: What is your conclusion?

36 *Response:* See response to comment 52.

37 *Comment 54:* 27) Page 5-13, Line 2: So your best professional judgment is?

1 *Response:* See response to Comment 51 (FWS number 24).

2 *Comment 55:* 28) Page 5-15, Line 23: There is no mention of the use of carbaryl to eradicate
3 ghost shrimp from oyster beds. This is an interrelated action which must be evaluated for its
4 direct and indirect effects on listed species.

5 *Response:* We anticipate discussing with NMFS and USFWS the appropriate formulation of an
6 analysis of carbaryl use in shellfish aquaculture.

7 *Comment 56:* 29) Page 5-16, Line 25: How much is most? Please provide a citation for this
8 phenomenon in Puget Sound. Newell 2005 is cited often yet it isn't in the literature cited section.

9 *Response:* The phenomenon has not been studied in Puget Sound. However, one of the BA
10 authors had an opportunity to meet Roger Newell at the shellfish conference and discussed this
11 phenomenon with him. He provided a copy of Newell et al. (2005):

12 Newell, R.I.E., T.R. Fisher, R.R. Holyoke and J.C. Cornwall. 2005. Influence Of Eastern Oysters
13 On Nitrogen And Phosphorus Regeneration In Chesapeake Bay, USA. Pages 93 - 120. in: The
14 Comparative Roles of Suspension Feeders in Ecosystems. R. Dame and S.Olenin, eds. Vol. 47,
15 NATO Science Series: IV - Earth and Environmental Sciences. Springer, Netherlands.

16 As for "how much is most," Newell et al. (2005) explain that:

17 "N and P burial and sediment denitrification ... remove N and P from the water column, thereby
18 reducing phytoplankton biomass and primary production. In situations where bivalves are either
19 at very high population densities or living in locations with low water circulation, biodeposition
20 can stimulate microbial metabolism sufficiently to cause the sediments to become anaerobic
21 (Tenore et al. 1982). In such situations, nutrients are regenerated primarily as NH₄⁺ and PO₄³⁻,
22 with little or no loss due to burial and denitrification."

23 In the interview described above, when asked how common this situation is, Dr. Newell replied
24 that it has often been seen in experimental situations where the experimental chambers do not
25 contain populations of denitrifying bacteria, and that the situation might be encountered in natural
26 settings with extremely high shellfish biomass loadings.

27 The shellfish biomass loadings encountered in western Washington are of the same order as the
28 loading created by natural oyster reefs observed in early historical time, so the phenomenon
29 would not be expected in western Washington waters.

30 *Comment 57:* 30) Page 5-16, Lines 34 -39: This is perhaps true for the regions where the
31 Olympia oyster was found. However, oyster culture occurs all over the Puget Sound region and
32 so aerobic/anaerobic sediment stratification is likely occurring on a much greater scale. This is
33 one reason why it is critical that we know the scale of the action under consultation.

34 *Response:* See response to comment 3 in regard to the spatial scale of the analysis. Nonetheless,
35 the great majority of oyster production in Washington waters is from Willapa Bay, Grays Harbor
36 and south Puget Sound, areas where the Olympia oyster was formerly very abundant.

1 *Comment 58:* 31) Page 5-17, line 24: Please see the Puget Sound Nearshore Partnership report on
2 Kelp and Eelgrass in Puget Sound page 3 at the following link:
3 http://pugetsoundnearshore.org/technical_reports.htm

4 It is highly unlikely that oyster bottom culture provides more species abundance, biomass and
5 diversity than an eelgrass meadow or the same functions.

6 *Response:* References supporting the statement are presented in the text, page 5-17. Copies are
7 available upon request. In this connection, a significant new publication has appeared. Wisehart
8 et al. (2007) explore the relationship between shellfish aquaculture and *Zostera marina* seedling
9 establishment. They find high rates of seed production and seedling establishment in dredged
10 oyster beds, with much lower rates for these variables in longline beds. They proposed that
11 eelgrass recovery from oyster harvest disturbance is substantially more rapid in dredged than in
12 longline beds.

13 *Comment 59:* 32) Page 5-29, Line 1: Are the growers required to prepare a spill plan? When a
14 spill occurs it must be reported to DOE. Have any spills been reported to DOE; this information
15 will give an indication of the frequency of this event.

16 *Response:* The growers are not required to prepare a spill plan. We queried the Southwest Region
17 DOE for spill reports for calendar year 2007. They returned approximately 450 reports, none of
18 which were identified as connected with shellfish. We examined the details in 16 reports for
19 potentially shellfish-related incidents reported in Pacific and Grays Harbor counties, which
20 together produce the majority of Washington's shellfish harvest. One report proved to be
21 shellfish related. It concerned a crane that had fallen off a dock at Nahcotta, Willapa Bay. The
22 incident was immediately reported by Coast Seafoods, who also immediately deployed absorbent
23 booms. The incident is DOE number 530386. The spill included potentially 15-20 gallons of
24 diesel and 20-25 gallons of hydraulic fluid, most of which was successfully pumped off with loss
25 of an estimated 2 gallons. The next day a crane was brought in and the fallen crane recovered.

26 *Comment 60:* 33) Page 5-29, Line 12: The growers in Willapa used crushed rock rather than
27 gravel. Is this same substrate that Thom et al., (1994) used in his experiment? Does crushed rock
28 compact differently than gravel forming a relatively impermeable surface?

29 *Response:* Thom et al. (1994) performed their study in Puget Sound and did not use the same
30 gravel/rock source. Crushed rock as used at Willapa does not compact; it is used for clam culture
31 and must remain loose so that clams can easily move within it.

32 *Comment 61:* 34) Page 5-35, Line 1 on: Is there any grey literature or non-peer reviewed studies
33 available? Since it is plausible that geoducks will compete for prey resources (particularly in
34 sheltered bay and coves and when they are planted in high densities) and dominate as a consumer
35 of the local food web, and then you must assume that juvenile salmonids and forage fish will have
36 less to eat which will lower their growth and survival. This translates into a reduction in prey for
37 bull trout and marbled murrelets and may constitute an adverse effect. I think it would be prudent
38 to alleviate this uncertainty (Line 6) *prior* to the Corp allowing more widespread geoduck culture
39 given the tenuous condition of salmonid and bull trout populations in Puget Sound. It is difficult
40 to see how given the substantial uncertainty how issuance of the NWP#48 would result in

1 minimal individual adverse environmental effects either separately or cumulatively on the aquatic
2 environment.

3 *Response:* The Corps is not proposing to allow more widespread geoduck culture. The proposed
4 action, issuance of NWP 48 , covers only existing aquaculture operations. This action does not
5 entail any increase in geoduck farming beyond the minor changes that may result on a year-to-
6 year basis as areas within an existing lease are cultured or allowed to remain fallow.

7 Some grey literature does exist, however, addressing the relative differences in carrying capacity
8 likely to exist between different types of aquaculture. All of the following data were provided by
9 Joth Davis (pers. comm.):

10 Geoducks at harvest represent a biomass loading of 35,000 clams per acre, or 60,000 pounds per
11 acre of living biomass. It takes an average of 5 years for the clams to attain harvest size, so net
12 primary productivity is $60,000/5 = 12,000$ pounds per acre per year. In contrast, longline oysters
13 have a net primary productivity of 72,000 pounds per acre per year (six times as much as
14 geoducks), bottom cultured oysters have a net primary productivity of 36,000 pounds per acre per
15 year (three times as much as geoducks), and manila clams have a net primary productivity of
16 50,000 pounds per acre per year (four times as much as geoducks). With regard to feeding
17 behavior, geoducks filter about 1 million gallons per acre per day, bottom culture oysters filter
18 about 5.3 million gallons per acre per day, and longline oysters filter about 26 million gallons per
19 acre per day. With regard to production of feces and pseudofeces, geoducks produce about 39
20 pounds per acre per day, bottom culture oysters produce about 95 pounds per acre per day, and
21 longline oysters produce about 473 pounds per acre per day. According to all of these metrics,
22 oyster culture interacts with the surrounding biological environment at a rate at least several times
23 higher than geoducks; yet, as described in previous comment responses, oysters have not been
24 shown to measurably deplete phytoplankton and thus to not impair marine food webs. Therefore
25 it is not plausible that geoducks have these effects, either.

26 *Comment 62:* 35) Page 5-36, Line 19: According to the Conservation measure on page 6-1
27 “Activities in spawning area (e.g., for age fish spawning areas) during spawning seasons must be
28 avoided to the maximum extent possible”. So how is it that eggs of herring, sand lance and surf
29 smelt will be trampled during geoduck harvest if this conservation measure is being enforced?

30 *Response:* USACE policy directs that conservation measure enforcement is the responsibility of
31 the Services. We look forward to further discussion of this matter with NMFS and USFWS.

32 *Comment 63:* 36) Page 5-36, Line 30: Many of the photographs I’ve seen show lots of activity
33 along the beach therefore these eggs could be trampled as well.

34 *Response:* The growers have stated that they do not conduct activities at the elevations used by
35 surf smelt and sand lance for spawning. We have not located any review of this issue in the
36 literature, however.

37 *Comment 64:* 37) Page 5-36, Line 26: According to the WDFW Website:
38 <http://wdfw.wa.gov/fish/forage/smelt.htm#sbiology>

1 “Spawning occurs in the summer months on beaches along Washington's coast and the Strait of
2 Juan de Fuca. Many additional suspected spawning areas and possible extensions of the
3 documented spawning seasons await investigation, and previously unreported areas continue to
4 found”. Thus, surf smelt spawning could occur when tube placement, seeding and net installation
5 are being done (Line 38) if geoducks are grown in these areas.

6 *Response:* See response to comment 63.

7 *Comment 65:* 38) Page 5-37, Line 12: Therefore, predator exclusion netting is a potential hazard
8 to marbled murrelets as well as bald eagles.

9 *Response:* It would be exceedingly unusual behavior for a marbled murrelet to be walking
10 through a geoduck farm. No episodes of injury to marbled murrelets have been reported in
11 association with use of shellfish predator netting. Mortality by this mechanism would appear to
12 be discountable.

13 *Comment 66:* 39) Page 5-38, Line 15: The harvest of geoducks does not invasively disturb
14 sediments?

15 *Response:* Page 5.38, line 15, is part of Section 5.1.6, Support Activities. The effects of geoduck
16 harvest are discussed in Section 5.1.5, Geoduck Culture.

17 *Comment 67:* 40) Page 6-1, Line 8: There is no discussion herein regarding the overlap between
18 forage fish spawning areas and shellfish aquaculture. Where does this overlap exist? At a
19 minimum you should overlay the approved and conditional shellfish growing areas (available
20 from the DOH website) with the location of spawning and holding areas for all forage fish
21 species, this includes eelgrass beds. We expect an analysis of the indirect effects to the prey base
22 of forage fish (epibenthic invertebrates and zooplankton) and bull trout forage fish and juvenile
23 salmonids. If conservation measure number 2 (spawning areas) is to be enforced there should be
24 no shellfish aquaculture allowed in forage fish spawning areas. According to Pentilla (2007)
25 “Standard aquaculture practices may have profound effects of the benthic ecology of Washington
26 State’s tidelands and the conservation of forage fish spawning areas, especially for herring. In
27 many areas, herring spawning grounds are coincident with shellfish culture areas, particularly on
28 tideflats occupied by beds of the native eelgrass”. I suggest you review Pentilla (2007) and
29 conduct an analysis on the effects of shellfish aquaculture on forage fish. Please see the Puget
30 Sound Nearshore Partnership report on Marine Forage Fishes on Puget Sound. Kelp and Eelgrass
31 in Puget Sound at the following link: http://pugetsoundnearshore.org/technical_reports.htm

32 *Response:* Forage fish spawning and shellfish aquaculture are discussed in the BA, pages 2-23,
33 page 5-36, and page 7-13, in addition to the conservation measure proposed on page 6-1, and are
34 also discussed in the responses to comments 47 and 63. Pentilla’s (2007) review does not
35 contribute any substantive information on the effects of shellfish culture on forage fishes.

36 *Comment 68:* 41) We are not just concerned about herring but also sand lance and surf smelt
37 who’s spawning areas and prey species composition may be affected through modification of the
38 beach substrate for clam and oyster bottom culture; we expect to see an analysis of these effects
39 as well.

40 *Response:* See the BA, especially pages 5-36 and 7-13, as well as the responses to comments 47

1 and 63.

2 *Comment:* 42) Page 6-1, Line 15: There is no analysis of the overlap between bull trout critical
3 habitat and shellfish aquaculture activities please include this in the BA. How is the reporting of
4 listed species and critical habitat a conservation measure? What is done with this information
5 and how is implemented to benefit or promote the recovery of listed species?

6 *Response:* For the analysis of the overlap between bull trout critical habitat and shellfish
7 aquaculture activities see the BA, page 7-14. The requirement that a pre-construction notification
8 include identification of endangered species and critical habitat ensures that the USACE can
9 determine if a given shellfish operation can be covered under NWP 48, or if a biological
10 assessment is required to evaluate the proposed action's effects on listed species and/or critical
11 habitat.

12 *Comment 69:* 43) Section 7.2.1: Are brown pelicans and snowy plovers feeding in areas where
13 carbaryl is used to eradicate ghost shrimp? If not, please demonstrate this with literature citations
14 and if so, then please include an analysis of the effects of this insecticide of birds through the
15 ingestion pathway.

16 *Response:* We anticipate discussing with NMFS and USFWS the appropriate formulation of an
17 analysis of carbaryl use in shellfish aquaculture.

18 *Comment 70:* 44) Page 7-3 Line 29: Please provide an overlay with the Western Snowy plover,
19 brown pelican and marbled murrelet occurrence data.

20 *Response:* See the response to comment 3. The requested information is not currently available at
21 the spatial scale of this analysis.

22 *Comment 71:* 45) Page 7-4, Line 13: Do aquaculture activities occur where snowy plovers will
23 be feeding at low tide in the inter-tidal areas?

24 *Response:* As stated in the BA, page 7-4, line 18, the culture beds are located at elevations low
25 enough that they are rarely if ever used by snowy plover.

26 *Comment 72:* 46) Page 7-4, Line 17: Does clam culture occur in snowy plover critical habitat?

27 *Response:* As stated in the BA, page 7-4, line 17, no.

28 *Comment 73:* 47) Page 7-4, line 24: Marbled murrelets generally forage in shallow waters within
29 1.25 miles of shore (Strachan et al. 1995). Traditional feeding areas (nurseries) are used
30 consistently on a daily and yearly basis (Carter and Sealy 1990). Foraging locations include
31 physical processes that concentrate prey. In general, small schooling fish and large pelagic
32 crustaceans are the main prey items thus they tend to forage in eel grass beds. Since eelgrass and
33 oyster culture co-occur it is likely that feeding birds may be disturbed by aquaculture activities
34 and reduction in eelgrass would lead to a reduction in forage fish.

35 Carter, H.R., and S.G. Sealy. 1990. Daily foraging behavior of marbled murrelets. *Studies in*
36 *Avian Biology* 14:93-102.

1 Strachan, G., M. McAllister, and C.J. Ralph. 1995. Marbled Murrelet Food Habits and Prey
2 Ecology. *In*: C.J. Ralph, G.L. Hunt, M.G. Raphael, and J. F. Piatt (tech. eds.). Ecology
3 and conservation of the marbled murrelet. General Technical Report PSW-GTR-152.
4 Pacific Southwest Experiment Station, U.S. Forest Service, Albany, California. U.S. Dept.
5 of Agriculture. 420 pp.

6 *Response*: The BA details at length the interaction between shellfish culture and eelgrass, and the
7 interaction between shellfish culture and fish communities. Since these interactions have not
8 been shown to have a net harmful effect on either eelgrass or fish communities, there is no
9 apparent support for the assertion that adverse impacts occur to forage fish or, by extension, to
10 their predators.

11 *Comment 74*: 48) Page 7-5 Line 14: Please evaluate the transport of carbaryl to snowy plover
12 habitat as the insecticide will deplete prey resource should concentrations be elevated. Please
13 provide data for the Washington State Department of Ecology and citations for your conclusions.

14 *Response*: We anticipate discussing with NMFS and USFWS the appropriate formulation of an
15 analysis of carbaryl use in shellfish aquaculture.

16 *Comment 75*: 49) Page 7-13, Line 19: Rather than referring us to the effects section for salmon
17 and steelhead please prepare a separated effects section for bull trout. Additionally, the effects
18 documents in this section address specific action in isolation. This analysis needs to consider the
19 entire action of permitting all shellfish aquaculture throughout the Puget Sound and the additive
20 effects of all activities on the species. Additionally, “take” under the Act occurs on the individual
21 level.

22 *Response*: See the response to comment 8 for discussion of additive effects. The following text
23 replaces Section 7.6.1 in the BA:

24 *Effects on the Species*

25 Bull trout have not been recorded in the action area south of Grays Harbor, including Willapa
26 Bay and the Columbia River estuary (WDFW 2004d). Thus the Columbia River bull trout DPS is
27 not known to occur in the action area and the proposed action will have *no effect* on Columbia
28 River bull trout.

29 Bull trout have been recorded in all parts of the action area from Grays Harbor north, through the
30 Strait of Juan de Fuca, in Hood Canal, and in much of Puget Sound. These fish are all presumed
31 to represent the Puget Sound/Coastal DPS of bull trout. The proposed action *may affect, but is*
32 *not likely to adversely affect* Puget Sound/Coastal bull trout.

33 Bull trout in the action area are adults or subadults. They use the action area in migration, an
34 activity which primarily occurs along the marine nearshore, and for foraging, which primarily
35 addresses prey that includes small fishes such as forage fish and juvenile salmon.

36 The environmental effects of shellfish culture activities are detailed in Chapter 5 and are
37 summarized in Table 5-1, and below.

1 Habitat-Forming Processes

2 All shellfish culture activities have some potential to affect habitat-forming processes, which
3 include sediment distribution and currents. However, none of the culture activities were found to
4 have a demonstrable adverse effect on these processes. Although measurable changes in the
5 baseline indicators may occur, those changes are in no case shown to have a measurably
6 beneficial or a measurably adverse effect on habitat suitability for use by bull trout.

7 Water Quality

8 Nearly all shellfish culture activities have some potential to affect water quality. The principal
9 effects are as follows:

10 Changes in turbidity. These include one beneficial chronic effect and several temporary adverse
11 effects. The beneficial chronic effect is removal of phytoplankton from the water column,
12 which improves water clarity and supports growth of eelgrass. Temporary adverse effects
13 occur in response to bed preparation activities sometimes performed for clam and oyster
14 culture, and during oyster, clam, and geoduck harvest. Most of the adverse effects occur in
15 the course of activity performed during low tide, which minimizes delivery of turbidity to
16 surface waters. Effects from spraying bed material (gravel or crushed shell) occur at high
17 tide, and are minimized by only using washed material. In view of the infrequent and
18 temporary nature of these turbidity-causing activities, and the relatively small zone around
19 the activity in which turbidity is actually observable, it is unlikely that the activities are
20 resulting in harm to any fish that may be in the area.

21 Changes in nutrient status and dissolved oxygen availability. All shellfish have a dynamic
22 relationship with the water column whereby they consume phytoplankton and excrete
23 nitrogenous wastes, some of which is suspended or dissolved in the water column, where it
24 provides a nutrient source that is rapidly converted into phytoplankton biomass, which is
25 again consumed by the shellfish, completing the cycle. The effect is measurable but does not
26 constitute an adverse effect. Besides this, certain activities (harrowing and harvest of bottom
27 culture oysters, oyster bed leveling, and geoduck harvest) have the potential to re-suspend
28 nitrogenous wastes in the water column, causing a short-term increase in water nutrient
29 concentrations and biochemical oxygen demand (BOD). The BOD increase could
30 theoretically support increased algal or bacterial growth that could cause a reduction in
31 dissolved oxygen, but this effect has not been observed. Thus shellfish culture does not have
32 an adverse effect on water quality variables related to nutrient availability, and does not have
33 the potential to adversely affect bull trout via this pathway.

34 Contamination from human sources. This could occur if a chemical (the only common ones are
35 gasoline and engine oil) were spilled from equipment used on the shellfish beds, or while in
36 transit to the beds, or at the shoreline support facilities (docks, hatcheries, processing
37 facilities). Shellfish growers strive to avoid any form of water quality impairment due to
38 contaminants, which have an immediate and severe adverse impact on the shellfish crop.

1 Such events are very rare and, when they occur, are immediately addressed using the best
2 available technologies. Thus the effects of such contamination on bull trout are discountable.

3 **Sediment Quality**

4 Nearly all shellfish culture activities have some potential to affect sediment quality. The most
5 common effects are those on sediment nutrient status. Shellfish excrete feces and pseudofeces,
6 either directly to the sediment (in the case of bottom grown oysters or infaunal clams) or to the
7 water column, where they settle to the sediment (in the case of raft, suspended, bagged, racked, or
8 longline culture). Because this process reflects a net transfer of nutrients from the water column
9 to the sediment, it generally represents a beneficial effect that results in measurably improved
10 water quality. In some settings with extremely high shellfish culture densities, the biodeposition
11 of nutrients has been rapid enough to curtail aerobic decay of the biodeposits within the upper
12 sediment stratum, thereby terminating the denitrification process that represents the primary
13 pathway by which shellfish remove nutrients from the estuary. However, this adverse effect has
14 only been observed in warm water shellfish culture in areas having much higher densities of
15 shellfish than are cultured anywhere in the action area. Therefore the risk of impaired sediment
16 denitrification is minimal in the action area, and this does not represent a plausible pathway of
17 effect on bull trout.

18 Shellfish growers strive to avoid any form of sediment quality impairment due to contaminants,
19 which have an immediate and severe adverse impact on the shellfish crop. Such events are very
20 rare and, when they occur, are immediately addressed using the best available technologies. Thus
21 the effects of such contamination on bull trout are discountable.

22 **Biological Condition**

23 Most effects of shellfish culture are associated with modification of biological condition.
24 Shellfish are environmental engineers that are capable of modifying almost every aspect of their
25 ecosystem. Those modifications are often beneficial, but some adverse effects may occur during
26 certain culture activities.

27 Hatchery and nursery operations, and mussel raft culture, have not been found to affect the prey
28 base for juvenile salmonids and forage fishes, which are bull trout prey species. These activities
29 primarily alter phytoplankton availability in the water column over subtidal areas, with effects
30 only observable very close to the actual culture facility. However, all types of intertidal culture
31 do alter the prey base, primarily by altering the benthic environment. The benthic environment in
32 most of the action area consists of an open sandy to muddy bottom, and/or a bottom with sparse
33 to dense eelgrass and macroalgae cover. Shellfish culture creates a variety of new substrates.
34 These include shelly bottoms, oyster-covered bottoms, bottoms covered with anti-predator netting
35 that is colonized by macroalgae, and bottoms covered by geoduck tubes, oyster stakes, or oyster
36 racks that provide a hard substrate where previously there was none. Additionally, oyster culture
37 is often associated with new growth of eelgrass, which seems to occur in response to enrichment
38 of benthic nutrients and/or reduction in currents and erosion on the bottom. The new benthic
39 environments are accompanied by a more diverse benthic microfaunal community, which is

1 actively exploited as a prey resource for juvenile salmon and forage fish. By increasing the
2 complexity and diversity of benthic habitats, shellfish culture has a beneficial effect on prey
3 resources for juvenile salmon and forage fish. However, certain culture activities have a
4 temporary adverse effect on prey resources. Removal of antipredator netting, harvest of clams,
5 and harrowing and harvest of oyster bottom culture all result in a temporary reduction in the
6 biomass and diversity of benthic infauna and epifauna, as well as temporary loss or reduction in
7 submerged vegetation (macroalgae and eelgrass) and temporary loss of the physical structure
8 represented by oysters on the bottom. All of these impacted resources recover within a period of
9 a few weeks to a few months, so that use of a site for shellfish aquaculture represents an
10 enhancement of habitat structure and diversity for most (75 percent to 95 percent) of a culture
11 cycle, alternating with a reduction of habitat structure and diversity for the remainder of the
12 culture cycle. The net effect, however, is beneficial, tending to maintain bull trout prey resources.

13 Other Effects

14 Certain aspects of shellfish culture have the potential to cause a direct adverse effect on bull trout:

15 Rafts, FLUPSYs, and docks (located at support facilities) constitute overwater structures that may
16 have a suite of impacts on fish such as shading benthic habitat, reducing benthic productivity,
17 interrupting longshore migration movements, and providing a perch for avian predators.

18 Rafts and FLUPSYs are not likely to have a substantial adverse effect via these pathways
19 because they are typically sited away from the shore in relatively deep water (at least 20 feet
20 deep, often over 33 feet deep) that receives little use by bull trout. Docks are more likely to
21 result in these impacts, but NWP 48 does not authorize the construction or maintenance of
22 such docks. Construction or maintenance of docks does require a Department of the Army
23 permit and a separate ESA section 7 consultation. Assuming that such a consultation would
24 require various measures intended to minimize the adverse effects of dock construction, and
25 in view of the typically small size of docks used to support shellfish aquaculture activities as
26 well as the small number of such docks within the action area, the interdependent effects
27 attributable to such docks are unlikely to represent a substantial adverse effect on bull trout.

28 Harvest and harrowing of bottom cultured oysters entails dragging an apparatus across the bed
29 while it is under water. Additionally, accessing the beds entails operation of motor boats in
30 shallow waters near and over the beds. These activities have the potential to disturb bull trout
31 in the vicinity. No instances of injury or mortality of bull trout have been observed in
32 connection with these activities, but it is reasonable to expect that some fish have had to
33 actively avoid such activities, or have altered their behavior in response to the stimuli
34 provided by these activities. Due to the low intensity of the effect, though, it does not amount
35 to an adverse effect.

36 It is theoretically possible that shellfish culture could introduce new species that could adversely
37 affect the habitat for bull trout. Although some such pests have been introduced in the past
38 (for instance, the introduction of *Spartina* as a packing material for eastern oysters), the
39 shellfish industry has responded by vigorously regulating all such potential introductions,

1 using precautions summarized in Chapter 5. In view of these precautions, the risk of future
2 introductions of this kind appears discountable. It is also possible that shellfish culture could
3 provide a suitable habitat for organisms not introduced by the shellfish growers, for instance,
4 organisms introduced in ballast water from ocean-going vessels. However, the potential
5 effects of such introductions cannot be anticipated.

6 *Comment 76:* 50) Page 7-13, Line 20: See comment Page 3-37, line 29.

7 *Response:* See response to comment 43.

8 *Comment 77:* 51) Page 7-13, Line 29 on: This section is poorly written and difficult to
9 understand please re-write it. Also, please refer to all of the general comments.

10 *Response:* Please refer to all of the general comment responses.

11 *Comment 78:* 52) Page 7-14, Line 22: These are not the marine PCEs for bull trout. See CFR 70
12 part 17 56266 and prepare an analysis of these PCEs. Please prepare a thorough analysis
13 documented with citations as to why or why not a PCE is adversely affected.

14 *Response:*

15 PCE (i), Water temperature. There are no data documenting alteration of water temperature as a
16 result of shellfish culture. Shellfish culture does sometimes create shade, as when mussel rafts
17 are cited or longlines are placed on an oyster bed, but these structures would tend to reduce solar
18 heating of affected waters, which would not constitute an adverse effect on bull trout PCE (i).

19 PCE (vi) Migratory corridors with minimal physical, biological, or water quality impediments.
20 There are no data asserting that shellfish culture creates a physical impediment to fish movement.
21 Fish have not been observed trapped by shellfish gear. Shellfish culture also does not create an
22 intermittent barrier because it does not alter flow or water temperature, or place structures that
23 impede fish movement.

24 PCE (vii) An abundant food base. The potential effects of shellfish culture on food base for bull
25 trout primarily include potential effects on juvenile salmonids and forage fish, as well as effects
26 on food and habitat for those organisms. These effects are detailed at length in Chapter 5 of the
27 BA and in the responses to comments presented above. Those analyses establish that there is no
28 evidence that shellfish culture leads to a reduction in these prey resources, and there is some
29 evidence that the net effect of shellfish culture on marine system productivity is a beneficial one,
30 contributing to increased phytoplankton and resulting enhancement of marine food webs.

31 PCE (viii) Permanent water of sufficient quantity and quality such that normal reproduction,
32 growth, and survival are not inhibited. Shellfish culture has no effect whatsoever on water
33 quantity. Shellfish culture contributes to high water quality both directly, by transporting
34 nitrogen wastes from the water column into the substrate, and indirectly, in that shellfish farmers
35 require the highest water quality and are active in protecting the health of the waters that they use.
36 In areas such as Willapa Bay and Grays Harbor this has produced a record of consistently high

1 water quality reaching back for over 100 years.

2 *Comment 79: Comments under other Statutes:* Page 2-18, line 20: Do ducks get caught in these
3 nets? How else are predators “controlled”?

4 *Response:* USACE is addressing the effects of NWP 48 implementation as it pertains to
5 interagency consultation responsibilities identified in Section 7 of the ESA. We anticipate
6 discussing with NMFS and USFWS the appropriate mechanism for addressing compliance with
7 other federal statutes.

8 *Comment 80:* 2) Page 5-27, Line 7: Please see the report: Washington State Exotics Expedition
9 2000: A rapid survey of Exotic Species in the Shallow Waters of Elliott Bay, Totten and Eld
10 Inlets and Willapa Bay Link : <http://faculty.washington.edu/cemills/WSX2000.pdf>

11 This report highlights the introduction of exotic species associated with ballast water and
12 aquaculture. You will note that a greater number of exotic species have been introduced in
13 shellfish growing areas than Elliott Bay (location of the Port of Seattle). This will likely continue
14 to occur in the future therefore, please provide an evaluation of the effects from introduction of
15 invasive species.

16 *Response:* Cohen et al. (2001) accurately state that “aquaculture activities have **historically** been
17 efficient vectors for moving pests and parasites of shellfish. The shipment and planting of oysters
18 for commercial aquaculture is considered to be a possible mechanism responsible for introducing
19 onto the Pacific Coast 35 of the 40 exotic species collected by the Expedition” (emphasis added).
20 However aquaculture as **currently** practiced in Washington does not entail the introduction of
21 any shellfish stocks from other areas. Such introduction can be performed, subject to receipt of a
22 permit from the Washington Department of Fish and Wildlife, which contains numerous
23 provisions intended to prevent any further exotic species introductions. NWP 48 authorizes
24 shellfish culture as currently practiced, thus the risk of exotic species introduction is small,
25 although not negligible. The effects of introduction of an unknown organism cannot be predicted.

26 *Comment:* 3) Page 5-31, Line 1: This there any predator control of non-listed species (e.g.,
27 migratory birds)? What interactions are you referring to in Line 11?

28 *Response:* See response to Comment 79.

29 *Comment:* 4) Page 5-39, Line 24: As mentioned previously the use of carbaryl is an interrelated
30 activity with direct and indirect effects to aquatic organisms and birds and will need to be
31 analyzed in the BA.

32 *Response:* We anticipate discussing with NMFS and USFWS the appropriate formulation of an
33 analysis of carbaryl use in shellfish aquaculture.

34 *Comment:* 5) Page 7-4, Line 31: According to the information presented in the slideshow (see
35 link: http://www.protectourshoreline.org/slideshow/POS_ShellfishAquacultureConcerns.pdf)
36 There have been 3 documented occurrences of bald eagles trapped in predator exclusion netting.
37 Although bald eagles have been de-listed, they are still protected under the Bald and Golden
38 Eagle protection Act. It is very likely that other birds get caught in anti-predator netting even

1 though it is not reported (I wouldn't expect these incidents to be reported often). Therefore, anti-
2 predator netting is a hazard for avian species and should be considered such in the effects
3 analysis.

4 *Response:* See response to Comment 79.

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