Revised

Ocean Discharge Criteria Evaluation for General NPDES Permit for Offshore Seafood Processors in Alaska

Permit No. AKG524000

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ACRONYMS

BMP	Best Management Practice
BOD	Biochemical Oxygen Demand
CCE	California Current Large Marine Ecosystem
CFR	Code of Federal Regulations
CPS	Coastal Pelagic Species
CWA	Clean Water Act
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
DPS	Distinct Population Segment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FDA	Food and Drug Administration
fm	fathom
FMP	Fishery Management Plan
FR	Federal Register
FWPCA	Federal Water Pollution Control Act
H&G	Headed and gutted (fish)
HAB	harmful algal bloom
HAPC	Habitat Area of Particular Concern
HMS	Highly Migratory Species
IPHC	International Pacific Halibut Commission
MLLW	Mean Lower Low Water
MMPA	Marine Mammal Protection Act
MSD	Marine Sanitation Device
mt	metric ton (1000 kg)
nm	nautical miles
NMFS	National Marine Fisheries Service
NMS	National Marine Sanctuary
NMSA	National Marine Sanctuaries Act
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Unit
NWR	National Wildlife Refuge
ODCE	Ocean Discharge Criteria Evaluation
PCBs	polycholorobiphenyls
PCS	Permit Compliance System
PFMC	Pacific Fishery Management Council
PSP	Paralytic Shellfish Poisoning
SAFE	Stock Assessment and Fishery Evaluation
TSS	Total Suspended Solids
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
USEPA	United States Environmental Protection Agency
WASP5	Water Quality Analysis Program Version 5.10
ZOD	Zone of Deposition

SECTION 1.0
INTRODUCTION

1.1 PURPOSE OF EVALUATION

The U.S. Environmental Protection Agency (EPA) intends to reissue a National Pollutant Discharge Elimination System (NPDES) General Permit for Offshore Seafood Processors in Alaska, subsequently referred to as "Draft Permit". Section 403(c) of the Clean Water Act (CWA) requires that NPDES permits for such ocean discharges be issued in compliance with EPA's *Ocean Discharge Criteria* (40 CFR 125, Subpart M) for preventing unreasonable degradation of ocean waters. The purpose of this Ocean Discharge Criteria Evaluation (ODCE) is to identify pertinent information and concerns relative to the *Ocean Discharge Criteria* and discharges from vessel-based seafood processing facilities which discharge at least 3.0 nautical miles (nm) seaward of the baseline or, if there is no baseline, the line of ordinary low water along the portion of the coast that is in direct contact with the open sea.

EPA's *Ocean Discharge Criteria* set forth specific provisions for determining whether a discharge would cause unreasonable degradation of the marine environment. If it is determined that unreasonable degradation would occur, the permit will not be issued. "Unreasonable degradation" is defined (40 CFR 125.12[e]) as follows:

1. Significant adverse changes in ecosystem diversity, productivity, and stability of the biological community within the area of discharge and surrounding biological communities
2. Threat to human health through direct exposure to pollutants or through consumption of exposed aquatic organisms
3. Loss of aesthetic, recreational, scientific, or economic values, which are unreasonable in relation to the benefit derived from the discharge

This determination is to be made based on consideration of the following 10 criteria (40 CFR 125.122):

1. The quantities, composition, and potential for bioaccumulation or persistence of the pollutants to be discharged;
2. The potential transport of such pollutants by biological, physical or chemical processes;
3. The composition and vulnerability of the biological communities that may be exposed to such pollutants, including the presence of unique species or communities of species, the presence of species identified as endangered or threatened pursuant to the Endangered Species Act (ESA), or the presence of those species critical to the structure or function of the ecosystem, such as those important for the food chain;
4. The importance of the receiving water area to the surrounding biological community, including the presence of spawning sites, nursery/forage areas, migratory pathways, or areas necessary for other functions or critical stages in the life cycle of an organism;
5. The existence of special aquatic sites including, but not limited to, marine sanctuaries and refuges, parks, national and historic monuments, national seashores, wilderness areas, and coral reefs;
6. The potential impacts on human health through direct and indirect pathways;

7. Existing or potential recreational and commercial fishing, including finfishing and shellfishing;
8. Any applicable requirements of an approved Coastal Zone Management Plan;
9. Such other factors relating to the effects of the discharge as may be appropriate;
10. Marine water quality criteria developed pursuant to CWA Section 304(a)(1).

If the Regional Administrator determines that the discharge will not cause unreasonable degradation to the marine environment, a NPDES permit may be issued. If the Regional Administrator has insufficient information to determine, prior to permit issuance that there will be no unreasonable degradation to the marine environment, an NPDES permit will not be issued unless the Regional Administrator, on the basis of the best available information, determines that all the following are true:

1. Such discharge will not cause irreparable harm to the marine environment during the period in which monitoring will take place, and
2. There are no reasonable alternatives to the onsite disposal of these materials, and,
3. The discharge will be in compliance with certain specified permit conditions (40 CFR 125.123(d)).

1.2 SCOPE OF EVALUATION

Reissuance of the Draft Permit would authorize discharges from facilities engaged in seafood processing within federal waters only. All discharges covered under the Draft Permit would be vessel-based.

This document relies on information provided in the ODCE drafted in 2008 for offshore seafood processors discharging off the coast of Alaska (ADEC, 2008), the existing Alaska NPDES general permit, the NPDES fact sheet for the offshore seafood processors in Alaska, and a literature review. Prior to the reissuance of this Draft Permit EPA issued a general permit, fact sheet, ODCE, and BE for Offshore Seafood Processors Discharging Off the Coasts of Oregon and Washington (WAG520000, EPA, 2016). For more detailed information concerning certain topics, where appropriate, this document refers the reader to some of these publications.

1.2.1 Area of Coverage of the Draft Permit and Applicability of this ODCE

This document evaluates the impacts of waste discharges proposed to be covered under the Draft Permit for vessel-based seafood processing facilities discharging offshore of Alaska pursuant to Section 403(c) of the CWA. The Draft Permit will address discharges from operators of offshore vessels, operating and discharging “seafood processing waste” in federal waters of the United States, greater than 3 nm from the Alaskan MLLW shoreline, engaged in the processing of fresh or frozen seafood products or the processing of mince, surimi, oil, or meal.

1.2.2 Excluded Areas of the Draft Permit

The EPA proposes to exclude the following areas from authorization under the Draft Permit:

1. Within one (1) nautical mile of a State Game Sanctuary, State Game Refuge, State Park, State Marine Park or State Critical Habitat Area.

2. Within one (1) nautical mile of a National Park, Preserve or Monument.

3. Within one (1) nautical mile of a National Wildlife Refuge.

4. Within one (1) nautical mile of a National Wilderness Area.

5. Within three (3) nautical miles of the seaward boundary of a rookery or major haulout area of the Steller sea lion. Rookeries and major haulout areas can be found in 50 CFR § 226.202 and Tables 1 and 2 to Part 226.

6. Waters within one (1) nautical mile of designated critical habitat for the Steller's eider or spectacled eider, including nesting, molting and wintering units. During breeding season (May through August) Steller's and spectacled eider nesting critical habitat units are located on the Yukon-Kuskokwim Delta and North Slope. Molting habitat (July through October) for Steller's eiders includes Izembek Lagoon, Nelson Lagoon and Seal Islands. Molting habitat for spectacled eider includes Ledyard Bay and Norton Sound. Wintering habitat (October through March) for Steller's eider includes Nelson Lagoon, Izembek Lagoon, Cold Bay, Chignik Lagoon and several other locations along the Aleutian Islands. Wintering habitat for spectacled eider is in the Bering Sea between St. Lawrence and St. Matthews Islands.

7. At-risk water resources and waterbodies

   Areas with water depth of less than 60 feet MLLW that have poor flushing, including but not limited to sheltered waterbodies such as bays, harbors, inlets, coves and lagoons and semi-enclosed water basins bordered by sills of less than 60 feet MLLW depth. For the purposes of this section, "poor flushing" means average currents of less than one-third (0.33) of a knot at any point in the receiving water within three hundred (300) feet of the discharging outfall.

1.2.3 Authorized Discharges

The Draft Permit identifies a number of discharges associated with seafood processing facilities. The Draft Permit proposes that the following discharges be authorized:

1. Seafood process wastewater and wastes, including the waste fluids, heads, organs, flesh, fins, bones, skin, chitinous shells, and stickwater produced by the conversion of aquatic animals from a raw form to a marketable form.
2. Wash-down water, including process disinfectants added to wash-down water used to control microbial contamination of seafood processing equipment and containers, and to sanitize seafood processing areas.
3. Sanitary and domestic wastes and gray wastewater associated with the kitchen, shower, sink, and toilet effluents.
4. Other wastewaters generated in the seafood processing operation, including, seafood catch transfer water, live tank water, refrigerated seawater, cooking water, boiler water, gray water, cooling water, refrigeration condensate, freshwater pressure relief water, clean-up water, and scrubber water.

1.2.4 Unauthorized Discharges

1. The Draft Permit does not authorize the discharge of any waste or waste streams, including spills, garbage, equipment, and other unintentional or non-routine discharges of pollutants, that are not part of the normal operation of the facility as disclosed in the NOI to be covered, and specifically authorized by this Permit.

2. The Draft Permit does not authorize the discharge of pollutants from any shore-based facilities, nor the discharge of any pollutants from vessels transporting material for the purposes of dumping materials into ocean waters.

3. The Draft Permit does not authorize any discharges from facilities that (1) have not submitted a Notice of Intent and received written authorization to discharge under this Permit from EPA or (2) have not been notified in writing by EPA that they are covered under this Permit as provided for in the 40 CFR 122.28(b)(2)(vi).

4. The discharge of petroleum (e.g., diesel, kerosene, and gasoline) or hazardous substances into or upon the navigable waters of the U.S., adjoining shorelines, into or upon the waters of the contiguous zone which may affect natural resources belonging to, appertaining to, or under the exclusive management authority of the U.S., is prohibited under 33 U.S.C. § 1321(b)(3).

1.3 OVERVIEW OF REPORT

This ODCE focuses on the sources, fate, and potential effects of seafood processing discharges on various groups of aquatic life. The types and nature of the discharges are detailed in Section 2.0 including anticipated volumes of wastes, proximate chemical composition, and concentrations. The fate, transport, and persistence of the wastes are examined in Section 3.0, which presents numerical analyses including an upper-bound estimate of waste accumulation on the seafloor, an upper-bound estimate of Total Suspended Solids (TSS) concentrations in ocean waters in the vicinity of the discharge, and an estimate of critical TSS concentrations that would reduce the depth of the compensation point for photosynthetic activity by more than 10%. Section 3.0 also includes an analysis of the results from totals metals sampling results between 2010 and 2015.

Before discussing potential biological and ecological effects, an overview of aquatic communities and important species is presented in Section 4.0. Chemicals that are considered bioaccumulative or persistent are not generally used in the process. Potential seafood discharge impacts on marine life are presented in Section 5.0. The potential for the discharges to adversely impact threatened and endangered species as identified under the ESA is discussed in Section 6.0. Particularly important uses and plans for the Draft Permit area, including commercial and recreational harvests, special aquatic sites, and coastal management plans are discussed in Sections 7.0 and 8.0. Section 9.0 discusses compliance of expected seafood discharges with federal water quality criteria. Section 10 summarizes the findings of this report.

SECTION 2.0

COMPOSITION AND QUANTITIES OF MATERIALS DISCHARGED

2.1 HYDROGRAPHY

The Draft Permit applies to facilities operating in federal waters off the coast of Alaska, including discharges within ocean waters, the contiguous zone, and the United States Exclusive Economic Zone (EEZ), in all extending from 3 to 200 nm offshore.

2.1.1 Seasonality and Location of known Seafood Processing Operations

Discharge volumes from individual processing vessels vary significantly. Seafood processing is conducted throughout coastal Alaska from Ketchikan in the south, west through the Aleutian Islands and north to the Chukchi Sea. The quantity and character of the seafood wastes generated vary considerably over the course of a year and among regions reflecting the distribution of exploitable fishing stocks, seasonal variation in their abundance, and the openings and closings of the fishing seasons that are used to manage stocks. The groundfish commercial fishery commences on the first of January and continues throughout the year until the fishery in a particular management region is closed due to catch or bycatch quotas having been reached. Of the groundfish species, Pacific cod and Pollock constitute the largest amount of solid waste discharged under the Draft Permit, with the greatest density in the Bering Sea and Aleutian Islands. Detailed information on general commercial fishing seasons in the BSAI and Gulf of Alaska can be obtained from NOAA[1].

2.1.2 Waste Production

There are two types of offshore processors; catcher-processors and motherships. Catcher-processors are composed of vessels that harvest and process seafood. Motherships do not harvest any seafood, they instead have a number of catcher vessels that harvest and deliver seafood for the mothership to process. Each mothership is typically serviced by three to four catcher vessels.

The location of processing varies continually. Both the catcher-processors and the motherships are in continual motion while processing, with speeds usually ranging from 3 to 18 knots (3.5 to 20.7 mph) at all times. All processing occurs within federal waters.

2.1.3 Example Seafood Processing Techniques

Most offshore seafood processing will result in one or more the following recoverable products:

- H&G blocks (headed and gutted fish with tails removed)
- Fillet blocks
- Minced blocks
- Surimi blocks
- Fishmeal
- Fish oil

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[1] Information Bulletins https://alaskafisheries.noaa.gov/infobulletins/search/
Status of the Fisheries Tables https://alaskafisheries.noaa.gov/status-of-fisheries
Regulations https://alaskafisheries.noaa.gov/fisheries/regs-amds

All offshore processing vessels vary in their production line(s), processing steps, capacity, finished products, etc. The following narrative provides a generalized description of how processing works aboard an offshore processor.

Sea water is used to move fish and waste via flumes to grinders and discharge chutes and secondarily for clean-up and sanitation.

Freshwater is either generated onboard or acquired from a shore-based source. It is then used in the surimi making process, for employee housing and sanitation needs.

The production process begins when fish are hauled on board. The fish are emptied into a holding bin. From the holding bin the fish are transferred onto a sorting belt where the catch is sorted by primary species. All the fish is weighed as it travels along the belt. The prohibited species are sent to the observer, and the rest of the bycatch, that is not processed, is returned to the sea via the discard chute. The remaining catch is sent to the starting point of one of the processing lines.

The fish is then sorted by size for processing on alternative processing lines. Each line consists of a machine that will head, gut, debone and skin the fish. If the desired product is H&G fish only the first two processes are performed. Otherwise the end product is boned and skinned fillets. The belly flap trim is transferred to a mince processing line, if the vessel has that capability onboard. On vessels that have a fishmeal processing line, the head, guts and skin are transferred there for further processing. On vessels where no fishmeal processing line exists, these materials are ground and discharged.

Fillets are transferred by conveyor to the candling table where they are checked for defects and parasites. Those fillets that meet quality standards are packed in a plastic basket, check weighted and transferred into a freezer frame with a box liner. The freezer frame is transferred to the plate freezers and frozen. The frozen blocks are packed in master cartons, strapped and transferred to a storage hold. Those fillets that do not meet quality standards as fillets are transferred either to the mince operation if the quality meets mince standards, to fishmeal if they do not meet mince standards, or are ground and discharged if no further processing is available.

The backbones go to the surimi processing line to extract as much flesh from the bones as possible. This process produces a paste that is extruded into plastic bags and then is frozen in a manner that is similar to the fillets. After the flesh is extracted from the bones, they are transferred to the fishmeal processing line, if available. If the fishmeal line cannot handle all the fish bones due to the volume of the catch, the excess bones are transferred to the discharge sump, ground and discharged.

The only other processing-related waste that is discharged is the wash down water including fish products that end up inadvertently on the vessel floor. This waste is ground and discharged.

Fish processed as H&G recover approximately 50 percent of raw input. Fish processed into fillets have recovery rates ranging from 25 to 50 percent. Surimi production, a minced flesh product, recovers from 7 to 22 percent of the whole fish depending on the primary product of the processing effort. Reported estimates for recovery as fishmeal range from 3 to 7 percent, and a recovery estimate has been reported for fish oil of one percent of raw input.

2.2 QUANTITY OF SEAFOOD WASTE DISCHARGED UNDER THIS PERMIT

The annual waste discharges from the offshore vessels submitting 2014 annual reports ranged from 0 (no discharge) to 87,814,422 pounds. The annual waste discharges from the offshore vessels submitting 2015 annual reports ranged from 0 (no discharge) to 88,188,314 pounds. Of the 91 vessels that reported data in 2015, 11 reported zero discharge. The frequency distribution of vessels in 2014 and 2015 is positively skewed with 60 and 65 percent of the facilities discharging less than 10 million pounds, respectively. The median annual waste discharged from vessels in 2014 and 2015 was 7,119,934 and 6,215,365 pounds, respectively. Total discharge for all offshore vessels reporting in 2015 was 1,123,131,855 pounds. Figures 2-1 and 2-2 present the discharges based on annual reports submitted in 2014 and 2015 from facilities covered under the existing general permit.

Figure 2-1: Range of Annual Waste Discharged in 2014 (millions of pounds)

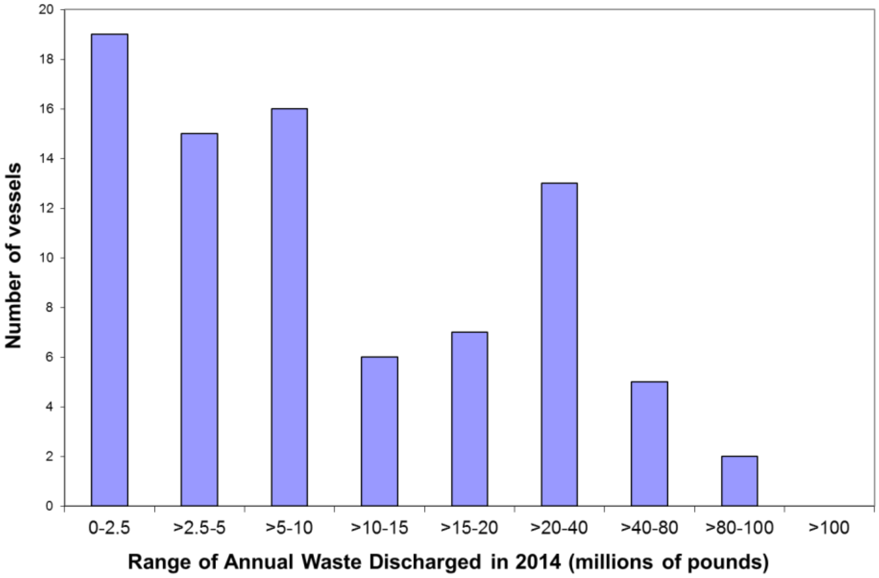
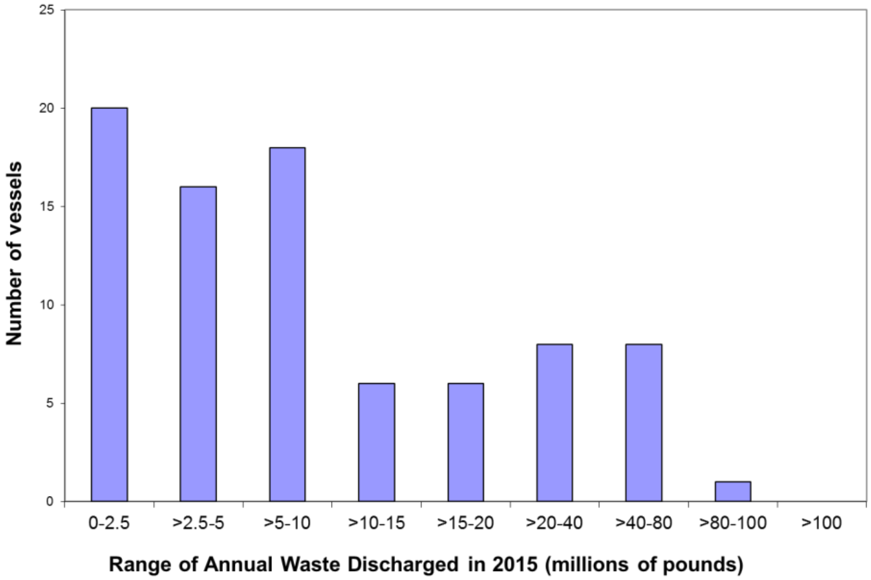


Figure 2-2: Range of Annual Waste Discharged in 2015 (millions of pounds)



2.3 SEAFOOD PROCESSING WASTE CHARACTERISTICS

Discharges from seafood processing facilities may be classified into solid (particulate) and dissolved (soluble) wastes. Two categories of solid waste discharges are generated by seafood processing: ground and unground waste materials. The ground fish waste stream consists of processed raw fish and shellfish include heads, skin, scales, viscera, tail fins, shells discarded during cleaning and butchering operations, damaged fish, and unusable fish. Unground solid waste is comprised of sea debris, prohibited species fish and bycatch species that are neither processed nor retained. Dissolved wastes include solubilized organic matter and nutrients leached from fish tissues after processing. The specific chemical composition of these wastes depends on the amount of protein, fat, bone, chitin, and connective tissue present. The character and quantity of solid and liquid seafood processing wastes is assessed below.

2.3.1 Solid Wastes from Seafood Processing

Seafood waste streams generally consist of the material that cannot be processed by the onboard processing plant and is piped or conveyed to the collecting sumps on the processing deck where it is ground and pumped overboard. It is assumed that the effluent seafood waste has a low impact on the receiving water due to the wide dispersion of waste over a large area and volume of water, as well as the biodegradable nature of the waste.

Additional unground seafood waste includes sea debris and prohibited species fish and by-catch that is neither processed nor retained. All these are discharged directly from the vessel. This category of discharge material represents a small fraction of the solid waste.

The quantity and chemical composition of the solid waste discharged by seafood processing facilities determines the effects that the discharges may have on the aquatic environment. As noted above, seafood processing solid waste consists of both organic and inorganic material including protein, fat (oil and grease), and ash (inorganic component of fish waste). Tables 2-1 and 2.2 present details on the measured contents and theoretical composition of whitefish wastes. Most of the solid fish waste contains at least 75 percent water. The percentages of protein were similar for most types of fish waste sampled (approximately 10-15 percent wet weight). The percentage of fat was generally less than 3 percent, although viscera from pollock had a much higher fat content (40 percent of wet weight). The percentage of ash, which represents the inorganic component of fish waste, was generally less than 5 percent wet weight. The percent of carbon, nitrogen, phosphorus, and sulfur based on wet weights is estimated at 16.7, 2.9, 0.3 and 0.3 percent respectively. Less discrete composition analyses have been performed and reported for whiting (whole fish, fillet, fillet waste) (Nelson et al., 1985). The results of these analyses are consistent with the information presented in Tables 2-1 and 2-2.

Table 2-1: Approximate Composition (Percent) of Whitefish Fillet and Surimi Wastes

Type	Sample	n[1]	Moisture	Protein	Fat	Ash	Source
Pollock	Machine fillet (winter)	4	81.3	11.3	3.0	3.6	Crapo et al., 1988
Pollock	Machine fillet (spawning)	4	82.0	12.5	1.9	3.7	Crapo et al., 1988
Pollock	Hand fillet	n/a	74.8	13.8	8.9	2.7	Babbitt, 1982
Pollock	Heads	n/a	81.1	13.6	1.4	4.9	Babbitt, 1982
Pollock	Viscera	n/a	45.0	8.2	40.1	0.8	Babbitt, 1982

Type	Sample	n[1]	Moisture	Protein	Fat	Ash	Source
Pollock	Frame	n/a	80.4	15.9	0.7	3.3	Babbitt, 1982
Pollock	Skin	n/a	81.8	18.0	0.3	0.9	Babbitt, 1982
Pollock	Bloodwater	3	98.5	0.9	0.2	0.3	Crapo et al., 1988
Surimi	Filet waste	3	81.3	11.3	3.0	3.6	Crapo et al., 1988
Surimi	Bloodwater	3	97.9	1.3	0.4	0.3	Crapo et al., 1988
Surimi	Deboner waste	3	86.1	10.7	0.8	0.7	Crapo et al., 1988
Surimi	Refiner waste	3	86.4	12.1	0.7	0.4	Crapo et al., 1988
Surimi	Rotary screen wastewater	3	98.8	0.8	0.2	0.2	Crapo et al., 1988

[1] n = number of samples analyzed

Table 2-2: Theoretical Composition of Seafood Waste (excerpted from USEPA, 2008)

Constituent	Percent Wet Weight	Approximate[a] Density (g/cm^3)	Percent Dry Weight
Water	75	1.0	-
Protein	7	1.5	60
Fat/Carbohydrates	15	0.9	28
Bone/Chitin	3	3.0	12
Total Estimated Wet Weight Density	-	1.13	-
Carbon	16.7	-	50.0[b]
Nitrogen	2.9[c]	-	8.8[c]
Phosphorus	0.27[c]	-	0.8[c]
Sulfur	0.27[c]	-	0.8[c]

[a] Typical values listed in the Handbook of Chemistry and Physics (Weast, 1982).
[b] Typical dry weight carbon (C) content of organic matter used.
[c] Estimated concentration of nitrogen (N) and phosphorus (P) based on the Redfield ratio of C:N:P (106:16:1) in organic matter (Redfield, 1958; Redfield et al., 1963).
Ratio of sulfur to phosphorus assumed to be 1:1.

2.3.2 Bottom Accumulations of Solid Waste

Accumulations of waste material on the bottom of the receiving water occur when the rates of deposition at a specific location exceed the rates at which material can be assimilated by the community that feeds at that location and/or the rate at which the material is likely to be dispersed by hydrodynamic forces. The likelihood of bottom accumulations due to offshore seafood processing is very low for two reasons:

1. All dischargers are in constant motion. Reported vessel speeds are maintained between 3 and 18 knots (3.3 and 20.7 mph) at all times.
2. Water depth is usually a minimum of 35 fathoms (fm) (210 feet) in reported seafood processing areas. The combination of wind, tide and water depth greatly increases mixing and dispersion of discharges. This minimizes concentrated oxygen consumption, sedimentation of solids, and potential impact on sea life and water quality.

2.3.3 Dissolved Wastes from Seafood Processing

Current effluent data on discharges from offshore seafood processors in the action area are not available. Table 2-3 presents effluent characteristics of dissolved wastes from shore-based groundfish dischargers operating in Alaska in 1992 and 1993. Discharge characteristics in the offshore are expected to be similar to this shore-based data, and the overall characteristics of seafood waste should not vary if ground or unground. Caution should be used when comparing the median and maximum values for each effluent type because the data points, even if equal in number, may be from different facilities or time periods.

Table 2-3: Effluent Data for Alaskan Shore-based Seafood Processors Discharging under Individual Permits in 1992 and 1993[2]

Product[2]		TSS mg/L		Oil & Grease (mg/L)		BOD (mg/L)	
		Monthly Avg.	Daily Max.	Monthly Avg.	Daily Max.	Monthly Avg.	Daily Max.
Bottomfish	Median	105	150	73	91	n/a	n/a
	n	120	124	101	106	n/a	n/a
	Minimum	10	6.0	2.8	4.5	n/a	n/a
	Maximum	4,553	3,324	1,621	1,486	n/a	n/a
Meal	Median	88	142	28	44	80	120
	n	18	18	18	18	15	15
	Minimum	16	24	1.4	1.4	36	36
	Maximum	1,330	1,949	153	284	13,356	39,750
Stickwater	Median	4,900	9,540	2.1	5.6	7,600	7,600
	n	53	53	25	25	47	47
	Minimum	9	23	0.2	0.2	1.5	2
	Maximum	84,000	110,000	91,139	203,800	148,950	432,000
Surimi	Median	1,079	1,366	208	257	2,323	1,845
	n	25	25	25	25	6	6
	Minimum	24	33	8	17	286	286
	Maximum	6,209	7,808	282,400	295,200	7,328	7,750

n/a = not available

[1] Obtained from Discharge Monitoring Reports (DMRs) submitted to EPA's Permit Compliance System (PCS)

[2] Product Classifications are as follows:

Bottomfish = Bottomfish (pollock, cod, sablefish, etc.) sections
Meal = Fishmeal
Stickwater = Stickwater from fish meal operations
Surimi = Surimi production from pollock

In addition to oil and grease, Biochemical Oxygen Demand (BOD), and TSS, other contaminants can be present in effluent from seafood processing facilities. The dissolved wastes may include disinfectants used to maintain sanitary conditions in compliance with requirements for the production of food for human consumption. The following sections provide greater detail on stickwater, surimi wastewater, wash-down water, sanitary wastewater and other wastewaters.

Stickwater

Stickwater is the mixture of water, oil, proteins, fats and ash separated from the press liquor generated during the production of fish meal. After decanting to remove oil, this stream is a dilute solution of insoluble fines, very fine denatured solubles, and water soluble connective tissue. A small amount of fish oil is present as an emulsion with the protein. The impact of this stream is low due to dilute concentration, fine particle size and inability of the oil fraction to coalesce. Note that the effluent data, summarized above in Table 2-3 shows that stickwater has one of the highest median concentrations for TSS and BOD compared to other wastewaters.

Surimi Wastewater

Surimi production is a washed minced fish product. The manufacturing process includes gutting, heading, deboning and filleting followed by mincing and washing. Surimi wastewater is relatively high in TSS and BOD and had the highest median and maximum values for oil and grease compared to other liquid wastes as shown in Table 2-3.

Wash-down Water

Wash-down water is used to remove wastes and maintain sanitary standards during processing operations. In addition to the organic materials, these discharges may include disinfectants that could contain chlorine-, iodine-, or ammonium chloride-based solutions. These wastes are generally low in volume.

Sanitary Wastewater

Sanitary waste is human body waste discharged from toilets and urinals. The pollutants associated with this discharge include TSS, BOD, bacteria, and residual chlorine. All vessels must employ properly functioning Type I or Type II Marine Sanitation Devices (MSDs).

Other Wastewaters

Other wastewaters include other liquid wastes generated during seafood processing operations. These low-volume wastes include catch transfer water, live tank water, refrigerated seawater, cooking water, boiler water, cooling water, refrigerator condensate, pressure relief water, clean-up water and scrubber water. Wastewaters not having contact with seafood are not required to be discharged through the seafood process waste-handling system. These wastes would not be expected to contain concentrations of contaminants that would be detrimental to marine organisms.

2.3.4 Summary

Seafood processing is conducted throughout coastal Alaska from Ketchikan in the south, west through the Aleutian Islands and north to the Chukchi Sea. Processing activities occur year-round with peaks throughout the annual Pollock and Pacific Cod “A” and “B” seasons. Discharge volumes from individual facilities range widely, where the lowest and highest discharge quantities in 2015 were 0 and 88,188,314 pounds.

Seafood processors discharge waste in two forms, solid and dissolved. Solid wastes consist of biological waste materials not used in final products and include fish heads, offal, scales, bones and shells. Dissolved wastes are liquid based and consist of the dissolved and suspended materials that pass through processing operations. The vast majority of the dissolved wastes contain proteins, fats, nutrients, and ash. Small components of the effluent stream, such as wash-down water, may include disinfectants that could be toxic to marine life.

Most wastes discharged from seafood processing facilities are not known to persist in the environment over long periods of time. On a chemical basis, the composition of these organic wastes does not include constituents that would normally be suspected of accumulating or persisting in the environment. Likewise, the dissolved wastes could contribute to localized and short term changes in water chemistry (reduced dissolved oxygen) or reduced light transmission; however, the constituents are unlikely to accumulate or persist in the receiving waters, with vessels in constant motion and high wind and tidal activities.

Criterion #1 of the Ocean Discharge Criteria assesses “the quantities composition, and potential for bioaccumulation or persistence of pollutants in the discharge.” Seafood processing generates a significant volume of wastes, consisting mostly of organic material resulting from butchering and processing operations. The accumulation of toxic contaminants as a result of discharges under the Draft Permit is unlikely.

SECTION 3.0

TRANSPORT, PERSISTENCE, AND FATE OF MATERIALS DISCHARGED

Seafood processing results in the discharge of wastewater consisting of solid and liquid wastes. These wastes consist primarily of dissolved and particulate organic matter and nutrients. Depending on the type and amount of waste discharged, and the physical, biological, and chemical characteristics of the receiving water, wastewater discharges from seafood processors have the potential to impair marine waters. These potential adverse effects on the quality of marine waters include reduction in water column dissolved oxygen due to the decay of particulate and soluble waste organic matter, the release of toxic levels of sulfide and ammonia from decaying waste, nutrient enrichment (eutrophication) and stimulation of phytoplankton growth and alteration of the phytoplankton community, and the accumulation of buoyant waste solids and fish oils on the water surface.

Seafood waste discharges also have the potential to accumulate on the receiving water bottom in the vicinity of the discharge. The accumulation and decay of seafood waste solids can result in the smothering of benthic marine organisms, and the release of carbon dioxide, methane, ammonia, soluble phosphorus, and hydrogen sulfide. The decay of the waste accumulation and the release of microbial decomposition by-products (e.g., sulfide and methane) also exerts a demand on the dissolved oxygen content of the overlying water column and within the sediments. These potential impacts on marine organisms are discussed in detail in Section 5.0.

The following section describes modeling of the transport, fate, and persistence of discharges from seafood processing facilities in the offshore waters of Alaska to evaluate the potential impacts of these discharges.

3.1 CHARACTERISTICS OF DISCHARGES AND RECEIVING WATERS

3.1.1 Characteristics of Discharges

Seafood processing waste from motherships and catcher-processor vessels are discharged by pump, and can, therefore, be characterized in terms of mass and volume.

3.1.1.1 Potential environmental impacts

Seafood processing generates a substantial quantity of waste, primarily organic material from butchering and processing operations. Processing wastewater contains dissolved and particulate organic matter and nutrients that have the potential to negatively impact water quality. Constituents of particular concern include particulate matter, BOD, oil and grease, bacteria, and pH. Solids in the discharges have the potential to accumulate on the seafloor, impacting benthic organisms. Particulate matter also has the potential to impact phytoplankton growth in the water column, by reducing the compensation point for photosynthetic activity. Decay of organic matter reduces dissolved oxygen in the water column, affecting aquatic organisms.

Wash-down water, sanitary wastewater and other wastewaters are also generated and covered under the Draft Permit.

3.1.1.2 Mass estimates

The median annual waste discharged from vessels in 2014 and 2015 was 7,119,934 and 6,215,365 pounds, respectively. Total discharge for all offshore vessels reporting in 2015 was 1,123,131,855 pounds.

3.1.1.3 Volume estimates

The discharge of mass through pumps is associated with a discharge volume. Processors report operating discharges ranging from 1541 – 9400 gpm (350 to 2,135 m^3/hour).

3.1.2 Characteristics of Receiving Waters

The receiving waters for offshore seafood processing discharges are restricted to hydrodynamically energetic waters, located at least three nm offshore of the Alaskan coastline. Several receiving water characteristics were identified that may influence the fate and transport of seafood process discharges. However, as indicated below, the conservative assumptions of the analyses herein did not require their consideration.

- Depth. Results from the analyses in this document are independent of water column depth; the approaches used to estimate bottom accumulation and discharge dilution are simple and conservative and will result in the same estimate regardless of water column depth.
- Temperature. Temperature is not considered in the analyses.
- Stratification. Stratification is not a factor in the analyses.
- Circulation. Circulation is not a factor in the analyses.

3.1.3 Important Processes

Certain key processes were identified beforehand for consideration in this evaluation

- Settling. The gravity-driven deposition of discharged material through the water column to the ocean bottom.
- Dispersion. Spreading of discharged material laterally in the water column induced by hydrodynamic activity.
- Decay/loss. Removal of material from the water column by consumption or transformation.

The analyses performed in this evaluation did not depend on dispersion, uptake or decay (thereby providing very conservative results), while the rate of settling could cause light transmission impacts in the near field.

3.2 NUMERICAL ANALYSIS TO ASSESS POTENTIAL IMPACTS

This section describes the analyses undertaken to assess potential impacts from the discharge of offshore seafood processing wastes on offshore waters. Three analyses were performed:

- An upper-bound estimate of waste accumulation on the seafloor from offshore seafood processing discharges.
- An upper-bound estimate of TSS concentrations in ocean waters in the vicinity of an operating processing vessel. This analysis also estimates the minimum dilution factor for volumetric discharges.
- A summary and analysis of the total metals sampling conducted between 2010 and 2015 and required by the 2009 General Permit.

This analysis was completed for the 2009 General Permit issuance. The EPA is proposing to reissue the permit with a conditional grinding requirement that applies only to discharges of a certain volume if discharge occurs in Steller sea lion critical habitat areas. Additional information regarding this decision is included in the Fact Sheet public noticed with the draft General Permit. The EPA was unable to complete an updated model for this reissuance and anticipates that the porosity and settling rates of unground waste will differ than those used in the analysis below. Nevertheless, since the overall discharge amount is conservative, and the analysis does not factor the fate and transport of the discharge the EPA is leaving the analysis in the ODCE as a potential scenario and reference. There is limited literature regarding the settling behavior of whole vs. unground seafood waste in a marine environment. This permit issuance will be an opportunity to gather information on the settling behavior of waste through daily visual sea surface monitoring.

Descriptions of the analyses, including governing equations, model inputs, and results, are presented below. The analyses were developed to provide extremely conservative estimates of upper bounds on the dependent variables.

3.2.1 Seafloor Waste Accumulation

An upper-bound estimate of waste accumulation on the seafloor was arrived at by distributing the maximum discharged mass as estimated from industry-supplied data over a seafloor area directly below the path of the discharging offshore seafood processor. The analysis assumes that all discharged mass is distributed equally across a rectangular area of water whose width is the beam of the discharging ship and whose length corresponds to the distance traveled by the ship during the period of discharge.

Daily discharge = (daily fish mass processed) * (1 – recovery percentage)
Deposited mass / unit area = (Daily discharge) / (Path area)
Depth of accumulation = (Deposited mass / unit area) / density / (1 – porosity)

The analysis is implemented in a Microsoft Excel worksheet (Figure 3-1)

Figure 3-1: Spreadsheet Presenting Analysis of Seafloor Waste Accumulation

Ship Speed	3	knots	min ship speed
Ship Speed	5,556	m/hr	ship speed (knots) x 1852 (meter/hr)/knot
Ship Beam	15	m	beam or width of smallest ship
Distance Traveled	133,344	m/day	ship speed x 24 hours
Daily Fish Processed	800	mt	max estimate
Daily Fish Processed	800,000	kg	daily fish processed (mt) x 1000 (kg/mt)
Recovery Percentage	26.6	%	lowest reported
Daily Discharge	587,200	kg/day	daily fish processed (kg) x (1- recovery percentage)
Fraction settleable	100	%	complete settling
Density of settleable material	1,130	kg/m^3	published
Porosity of settled material	0.95		max of published range
Mass deposited per unit area	0.29	kg/m^2	daily discharge (kg)/(Distance travelled*ship beam)
Depth of accumulation	0.0052	m	Mass deposit per m^2/(density x (1-porosity))
Depth of accumulation	0.52	cm	Depth in m x 100 cm/m

3.2.1.1 Inputs

The inputs required for the analysis are presented below with an explanations of the values selected:

- **Ship speed** = 3 knots. 3 knots (5556 m/hr) is the lowest speed at which seafood processors in the action area operate; vessels usually travel between 3-18 knots while processing, therefore, this is a **conservative** selection. If the analysis was rerun with a higher speed selected, the path area would increase and result in a lower estimate of depth of accumulation.
- **Ship beam** = 15 m. 15 meters is the beam of the smallest ship described in the narrative description of operations (both catcher-processor vessels and motherships were considered); this is a **conservative** selection in that analysis with a wider beam selected would increase the path area and therefore result in a lower estimate of depth of accumulation.
- **Daily mass of fish processed** = 800 mt. 800 metric tons is the high end of the range of daily processing masses reported by industry representatives; this is a **conservative** selection in that analysis with a lower mass selected would decrease the discharged mass and result in a lower estimate of depth of accumulation. For reference, when calculating the highest average daily discharge (total discharge/days of operation) the maximum value was 478 mt during the 2014 and 2015 seasons.
- **Recovery percentage** = 26.6%. This is the lowest value reported for the percent of mass recovered (mass of product) from processing operations; this is a **conservative** selection in that analysis with a higher recovery percentage selected would decrease the discharged mass and result in a lower estimate of depth of accumulation. Vessels with the highest discharge volumes have the capacity for fish meal and other forms of by-product utilization. Typically, a vessel discharging up to 800 mt per day would achieve by-product recovery rates above 50 percent (section 2.1.3).
- **Fraction settleable** = 100%. The fraction of discharged waste that actually settles to the bottom could range from 0% to 100%, depending on the nature of the solids and on loss rates due to consumption. As it is assumed not all waste will reach the seafloor, the selection of 100% as settleable is a very **conservative** selection, in that analysis using a lower fraction would decrease the deposited mass and result in a lower estimate of depth of accumulation.
- **Density of settleable material** = 1130 kg/m^3. The density of the material is used to translate deposited mass into a volume, and then a depth. This value is taken from Table 2.2 in the Alaska ODCE (ADEC, 2008).
- **Porosity of deposited material** = 0.95. The porosity of the material is used to translate the volume of deposited material into a depth of accumulation. The value of 0.95 is a **conservative** selection for this input, corresponding to a very loose consistency that is unlikely to impede movement of benthic organisms. This porosity value is the upper value in the reported range of 0.8-0.95 for newly deposited muds in coastal environments (Harris, 2003), indicating a very loose consistency.

3.2.1.2 Assumptions

Additional assumptions embedded in the analysis are as follows:

- **Discharge rate.** The discharge rate is assumed to be constant throughout the 24-hour evaluation period.

- **Near-field mixing and dispersion.** Discharges of materials from a moving ship are generally subject to mixing in the wake. Although the literature suggests that the discharge will be distributed across the wake (Loehr et al, 2006), this analysis limits the spread of the material to a narrow area whose width is the ship's beam. This is a **conservative** assumption in that incorporation of any additional near-field dispersion would result in an increase of the depositional area and a lower estimate of depth of accumulation.
- **Hydrodynamically energetic waters.** Settling of material through hydrodynamically energetic waters likely will be accompanied by dispersion processes that would increase the depositional area for the discharged waste. This analysis assumes no dispersion, which is a **conservative** assumption in that any increase in the depositional are would result in a lower estimate of depth of accumulation. Discharge into hydrodynamically active waters would be additionally protective of benthic organisms.
- **Loss from decay, consumption, or transformation.** The discharged ground materials may include components that are either chemically reactive or attractive to marine flora and fauna, leading to their removal from the water column. This analysis assumes no such losses, which is a **conservative** assumption in that any accounting for loss would result in a lower mass deposit and a lower estimate of depth of accumulation.
- **Depth of water column.** Depth is not a parameter for the seafloor accumulation analysis. However, the analysis assumes that operations take place at a sufficient depth that bottom disturbance from ship passage is not an issue.

3.2.1.3 Results

As shown in Figure 3-2, the extremely conservative analysis of discharges from a seafood processing vessel moving at three knots estimates that a maximum of about 294 grams (0.65 pounds) of ground waste will be deposited per square meter of bottom. Assuming a conservatively high porosity value of 0.95, translates to a worst case scenario with an average depth of accumulation of 0.5 cm.

3.2.2 TSS Concentration in Receiving Waters

An upper bound on the concentration of TSS in the receiving waters was estimated using a simple dilution factor calculation. The calculation was developed for the determining dilution of wastewater behind a cruise ship (Loehr et al., 2006):

Dilution factor = 4 * (ship width * ship draft * ship speed) / (volume discharge rate)

Daily TSS discharge = (daily mass fish processed) * (fraction waste)

Daily TSS discharge concentration = (Daily TSS discharge) / (pump speed discharged)

Diluted TSS concentration = (Daily TSS discharge concentration) / (Dilution factor)

This analysis is implemented in a Microsoft Excel spreadsheet (Figure 3-1).

Figure 3-2: Spreadsheet Presenting Analysis of TSS Concentration in Receiving Waters

Input	Max Estimate Value	Min Estimate Value	Unit	Description
Ship Speed	3	3	knots	min ship speed

Ship Speed	5,556	5,556	m/hr	ship speed (knots) x 1852 (meter/hr)/knot
Ship Beam	15	15	m	beam or width of smallest ship
Ship Draft	7.5	7.5	m	draft of smallest ship
Daily Fish Processed	800	800	mt	max estimate
Daily Fish Processed	800,000	800,000	kg	daily fish processed (mt) x 1000 (kg/mt)
Recovery Percentage	26.6	26.6	%	lowest reported
Daily Discharge	587,200	587,200	kg/day	daily fish processed (kg) x (1- recovery percentage)
Discharge Rate	24,467	24,467	kg/hr	daily discharge (kg/day) / 24 (hr/day)
Hourly Volume Discharged	2,135	300	m^3/hr	max and min pump speed reported
TSS Discharge Concentration	11.46	81.56	kg/m^3	daily discharge (kg/hr) / pump speed (m^3/hr)
TSS Discharge Concentration	11,460	81,556	mg/l	discharge concentration (kg/m^3) x 1000mg/l / (kg/m^3)
Dilution Factor	1,171	8,334		4 x (ship width (m) x ship draft (m) x ship speed (m/hr)) / pump seed (m^3/hr)
Diluted TSS Concentration	9.79	9.79	mg/l	daily TSS discharge concentration (mg/l) / dilution factor

3.2.2.1 Inputs

The inputs required for the analysis are presented below with explanations of the values selected:

- **Ship beam** = 15 m. 15 meters is the beam of the smallest ship described in the provided narrative description of operations (both catcher-processor vessels and motherships were considered); this is a **conservative** selection in that analysis with a wider beam selected would increase the displaced volume and therefore result in a lower estimate of TSS concentration.
- **Ship draft** = 7.5 m. 7.5 meters is the draft of the smallest ship described in the narrative description of operations (both catcher-processor vessels and motherships were considered); this is a **conservative** selection in that analysis with a deeper draft selected would increase the displaced volume and therefore result in a lower estimate of TSS concentration
- **Ship speed** = 3 knots (5556 m/hr). 3 knots is the lowest speed operators in the action area travel while processing, as the range is usually 3-18; this is a **conservative** selection in that analysis with a higher speed selected would increase the path area and therefore result in a lower estimate of TSS concentration.

- **Daily mass of fish processed** = 800 mt. 800 metric tons is the high end of the range of reported daily processing; this is a **conservative** selection in that analysis with a lower mass would decrease the discharged mass and result in a lower estimate of TSS concentration.
- **Recovery percentage** = 26.6%. This is the lowest value reported for the percent of mass recovered (mass of product) from processing operations; this is a **conservative** selection in that analysis with a higher recovery percentage selected would decrease the discharged ground waste overall and result in a lower estimate of TSS concentration.
- **Pump speed =** 300, 2135 m^3/h. Figure 3-2 shows the analysis performed at two different assumed rates for pump discharge associated with operations. 2135 m^3/h is the highest possible value ascertainable from provided ship configuration, while 300 m^3/h is the lowest value reported for pumping during operations. Note that there is no difference in receiving water concentration results, though dilution is markedly different. The receiving water concentration remains the same because the total volume of water displaced by the moving ship and therefore available for dilution of the discharged mass is the same under either pumping rate. The calculated dilution factor corresponds to the fraction of the displaced volume that is made up of water pumped from the ship, and so differs for different pumping rates.

3.2.2.2 Assumptions

- **Discharge rate.** The mass and volume discharge rates are assumed to be constant throughout the 24-hour evaluation period.
- **Hydrodynamically energetic waters.** Discharge of material into hydrodynamically energetic waters likely will be accompanied by dispersion processes that would decrease the receiving water concentration. This analysis assumes no dispersion beyond that induced by the motion of the ship through the water, which is a **conservative** assumption, in that any increase in the dispersion would result in a lower estimate of TSS concentration. Discharge into hydrodynamically active waters would be expected to result in further reductions.
- **Loss from decay, consumption, or transformation.** The discharged materials may include components that are either chemically reactive or attractive to marine flora and fauna, leading to their removal from the water column. This analysis assumes no such losses, which is a **conservative** assumption in that any accounting for loss would result in a lower estimate of TSS concentration.

3.2.2.3 Results

As shown in Figure 3-2, the conservative analysis of discharges from a seafood processing vessel moving at three knots estimates a minimum dilution factor of 1,171:1 for waters discharged from the ship when all pumps are operating at maximum capacity; this dilution factor goes up to 8,334:1 at the low end of reported pump operations. These dilutions translate to a worst case scenario maximum incremental increase in TSS concentration of 9.79 mg/L found in mixed water behind the ship, which should be protective of marine water quality.

3.2.2.4 Permit Implementation

In the 2009 General Permit, the EPA applied the ELGs described in 40 CFR Part 408 for "remote" Alaskan locations to the offshore Alaskan seafood processors. This requirement is to “grind solid seafood processing wastes to 0.5 inch or smaller in any dimension prior to discharge.” After a review of the administrative record for the development of the remote Alaska seafood processing ELGs, the EPA has concluded that the half inch size requirement set forth in the ELGs does not apply to offshore seafood processors. As such, there are no applicable ELGs for the offshore seafood processing sector in Alaska.

There remains uncertainty on whether grinding protects water quality and diminishes species interactions in the offshore environment to an extent that justifies the implementation of grinding in this permit. Additionally, the grinding requirement was applied in the 2009 General Permit due to a misinterpretation of the onshore ELGs. Therefore, for this permit cycle, the EPA is proposing to remove the effluent grinding requirement, except in cases when vessels that discharge greater than 10 million pounds per annual report year discharge into Steller sea lion critical habitat areas designated by NMFS in 50 CFR § 226.202 and Tables 1 and 2 to Part 226, and to assess the discharge’s contributions to water quality impairments and any ESA-species interactions through daily visual monitoring. This conditional grinding provision will be included in response to concerns raised by NMFS regarding the potential impacts that removing the grinding provision entirely could have on Steller sea lions in the permit coverage area. NMFS provided the EPA with a list of suggested mitigation measures for vessels exempt from grinding in Steller sea lion critical habitat. The EPA will continue to work with National Marine Fisheries Service and U.S. Fish and Wildlife Service on the issue of species interactions throughout the permit development process. The potential affects to any threatened or endangered species by this permit will also be evaluated in accordance with Section 7 of the Endangered Species Act, discussed in Section X of this Fact Sheet.

3.2.3 Numerical Analysis of Total Metals Monitoring Data

Metals Monitoring Requirement

The 2009 General Permit required each Permittee to conduct, at a minimum, quarterly influent and effluent monitoring for total metals (including arsenic and selenium – both metalloids) for two years. The monitoring requirement was established to evaluate: effluent impacts on the receiving water in contrast to ambient levels, to ensure marine water quality criteria are being met, and/or to determine if additional effluent limitations are required in the future.

The EPA assessed metals monitoring data submitted by vessels between 2010 and 2015. The EPA conducted an analysis of this data to determine whether there is basis for unreasonable degradation of the marine environment (40 CFR 125.122) and continued monitoring. The aquatic life criteria for toxic chemicals is the highest concentration of a pollutant or parameter in water that is not expected to pose a significant risk to the majority of species in a given environment. Table 3-1 lists the EPA's recommended aquatic life criteria for marine waters, published pursuant to Section 304(a) of the Clean Water Act (CWA). The criteria continuous concentration (CCC or chronic) values were used for comparison as they best describe the potential long-term effects from environmental exposure to the pollutants after dilution in the receiving water. The acute value was used for silver in the absence of a chronic criteria.

Table 3-1: 304(a) Marine Criteria for Aquatic Life

Pollutant	304(a) Marine Criteria for Aquatic Life (acute)	304(a) Marine Criteria for Aquatic Life (chronic)
	(µg/L)	
Arsenic	69	**36**
Cadmium	33	**7.9**
Copper	4.8	**3.1**
Lead	210	**8.1**
Mercury	1.8	**0.94**
Nickel	74	**8.2**
Selenium	290	**71**
Silver	**1.9**	—
Zinc	90	**81**

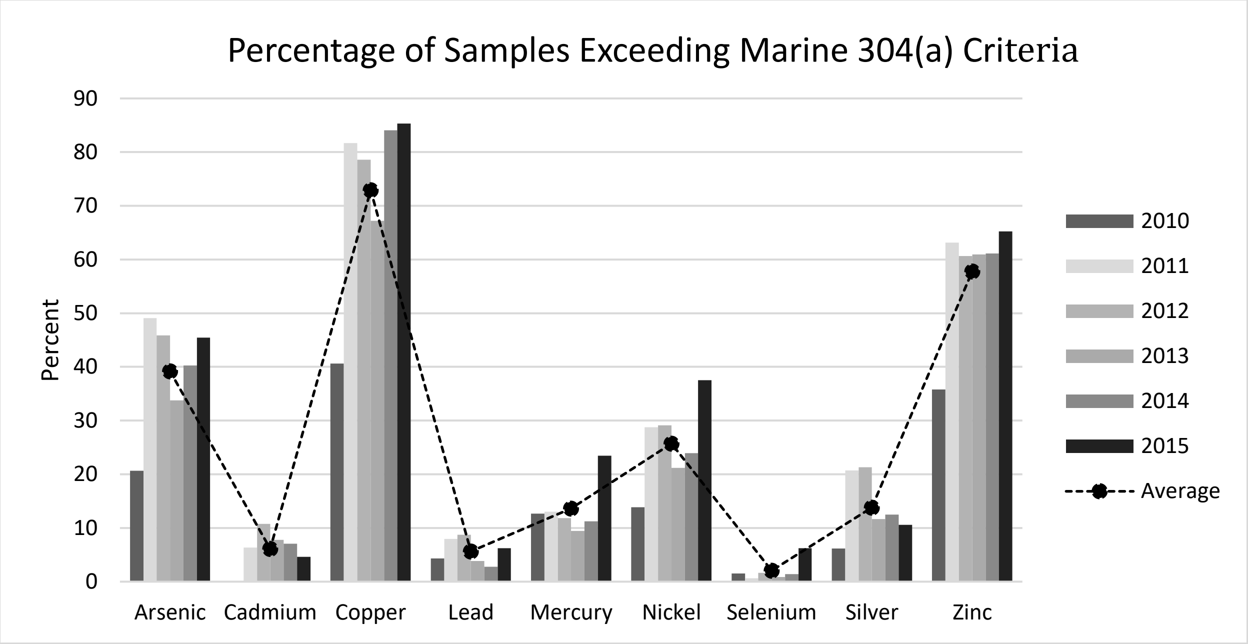
Between 51 and 74 vessels submitted monitoring data each year from 2010 through 2015. A breakdown of the number of vessels and samples evaluated in this report is shown in Table 3-2, below.

Table 3-2: Number of Vessels and Samples Evaluated

Annual Report Year	Number of Vessels Reporting	Number of Effluent Samples Evaluated
2010	51	586
2011	62	1,591
2012	63	1,500
2013	74	2,124
2014	69	641
2015	64	590

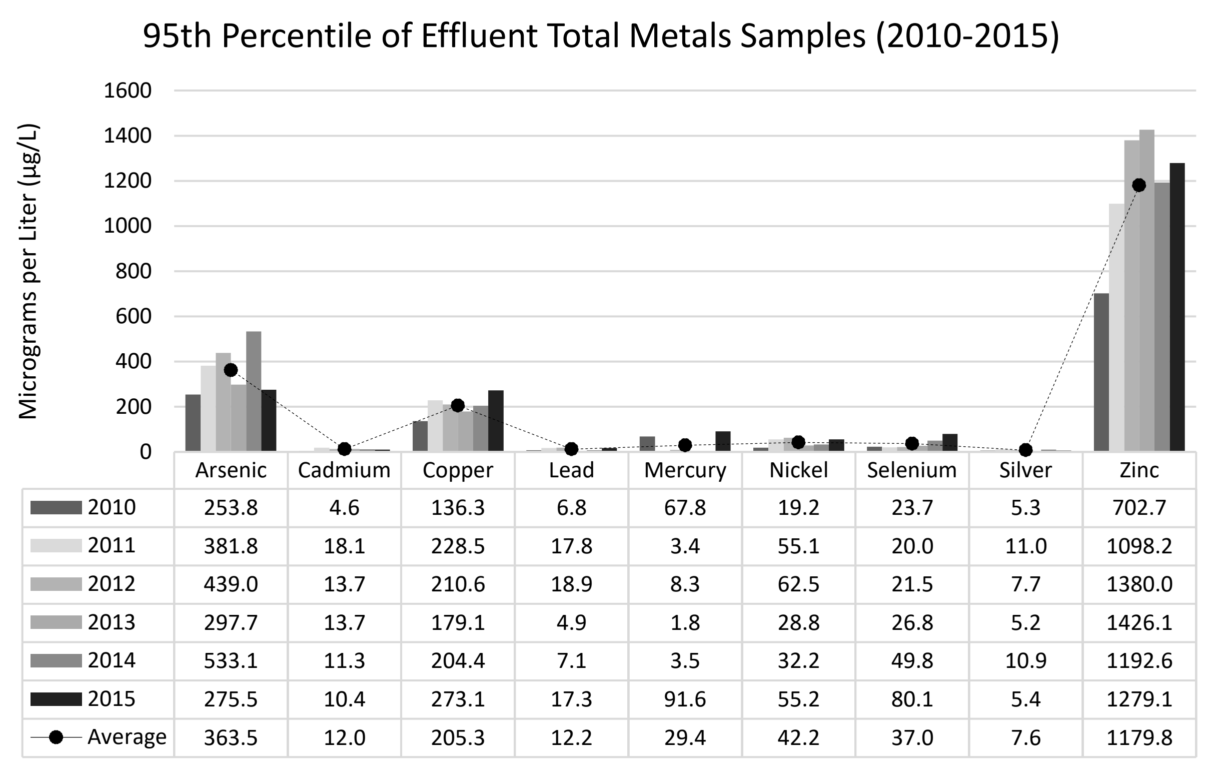
Figure 3-3 compares annual average metals concentrations to the chronic criteria for each pollutant. The monitoring results indicate that total arsenic, copper, and zinc are more likely than the other pollutants to contribute to exceedances of water quality criteria. The EPA compared the reported metals concentrations with the chronic criterion for metals in saltwater (except for silver, where the acute criteria was used in absence of a chronic criterion). On average and over the five-year period, over 72 and 57 percent of the sampled discharges exceeded 304(a) criteria for copper and zinc, respectively. Arsenic had the third highest frequency of exceedance with 39 percent of discharges exceeding marine criteria on average. The remainder of metals were detected in concentrations above marine criteria in less than 26 percent of discharges on average.

Figure 3-3: Percentage of Samples Exceeding 304(a) Criteria



In reference to the guidance provided in the Technical Support Document for Water Quality-based Toxics Control (TSD), EPA calculated the 95th percentile value for all effluent samples reported between 2010 and 2015, shown below in Figure 3-4. In determining reasonable potential, the TSD demonstrates the statistical approach of taking the projected effluent concentration after dilution in the receiving water and then comparing the value to an appropriate water quality criterion. EPA used the 95th percentile of all reported concentrations as a conservative estimate of pollutant concentrations that could be expected in offshore seafood processing effluent.

Figure 3-4: 95th Percentile of Effluent Total Metals Samples (2010-2015)



	Arsenic	Cadmium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Zinc
▬ 2010	253.8	4.6	136.3	6.8	67.8	19.2	23.7	5.3	702.7
▬ 2011	381.8	18.1	228.5	17.8	3.4	55.1	20.0	11.0	1098.2
▬ 2012	439.0	13.7	210.6	18.9	8.3	62.5	21.5	7.7	1380.0
▬ 2013	297.7	13.7	179.1	4.9	1.8	28.8	26.8	5.2	1426.1
▬ 2014	533.1	11.3	204.4	7.1	3.5	32.2	49.8	10.9	1192.6
▬ 2015	275.5	10.4	273.1	17.3	91.6	55.2	80.1	5.4	1279.1
—●— Average	363.5	12.0	205.3	12.2	29.4	42.2	37.0	7.6	1179.8

Table 3-3: Dilution Factors Required to Meet Marine 304(a) Criteria

Parameter	Highest 95th Percentile Value (µg/L)	Marine 304(a) Chronic* Criteria (µg/L)	Dilution Factor Required[1] to Meet 304(a) Criteria	Calculated Dilution Factor for Receiving Water
Arsenic	533.1	36	14.8	1,171
Cadmium	18.1	7.9	2.3	
Copper	273.1	3.1	88.1	
Lead	18.9	8.1	2.3	
Mercury	91.6	0.94	**97.4**	
Nickel	55.2	8.2	6.7	
Selenium	80.1	71	1.1	
Silver	11	1.9*	5.8	
Zinc	1,426.10	81	17.6	

*No chronic criteria available for silver, acute criteria used instead

Bold = Highest calculated dilution factor

[1] Dilution factor required = highest 95th percentile value ÷ marine 304(a) chronic criteria

The pollutant concentrations shown in Figure 3-4 are compared to the amount of dilution available in Table 3-3, above. The second column of Table 3-3 shows the highest 95th percentile value between sampling years 2010 and 2015. These values were divided by the chronic criterion values in column three to calculate the approximate dilution factor that would be required to dilute the effluent concentration in order to meet the water quality criteria. Table 3-3 indicates that a dilution factor of 1,171 was calculated for the receiving water from the discharging vessel. This value is referenced in column five of Table 3-3, adjacent to column four which indicates the minimum dilution factor required for the discharge to fall below the toxic, chronic criteria (97.4). Because the available dilution is greater than 10 times what would be required to dilute the 95th percentile concentration, the toxic effects of the discharge are not expected to cause significant deleterious effects to the marine environment.

EPA used the applicable conditions of 40 CFR 125.122 to evaluate the reasonable potential of metals in the effluent discharged from the permitted vessels to cause unreasonable degradation. This analysis is described in Section 10.0 of this report.

SECTION 4.0

COMPOSITION OF BIOLOGICAL COMMUNITIES

Section 4.0 provides an overview of the biological communities found within the Draft Permit action area. The overview will identify key species that are important from an ecological standpoint, along with interspecies relationships, economic considerations, essential environmental requirements, seasonal distribution and abundance, and prominent areas or habitats.

4.1 Plankton

Planktonic organisms have limited or no ability for self-propulsion and generally are entrained along with water movements; therefore, the distribution, abundance, and seasonal variation of these organisms is strongly influenced by the physical environment. Plankton contain a diverse assemblage of plants (phytoplankton) and animals (zooplankton) that range from a maximum size (equivalent spherical diameter) of a few millimeters to less than 2 microns. These organisms are a vital component of the pelagic plankton community forming the bottom of the food chain for fish, shellfish, birds and some marine mammals within Alaskan coastal waters. Larval stages of many benthic and fish species are temporary members of the zooplankton community during their early developmental stages.

4.1.1 Phytoplankton

The seasonal cycle of phytoplankton productivity and standing stock throughout the area of coverage of the Draft Permit is typical of northern temperate waters. Both phytoplankton productivity and standing stock increase from April to early July with peaks in May and early July, respectively. Diatoms are the most important group of phytoplankton found in high latitude seas and dominate the phytoplankton during spring and summer. Phytoplankton assemblages are dominated by pennate and centric diatoms, with dinoflagellates, microflagellates, and other classes and families of phytoplankton also present. Phytoplankton biomass is controlled by light, nutrients, and the density structure of the water column. A variety of herbivores are dependent upon phytoplankton, including zooplankton, benthic invertebrates, and waterfowl.

Macroalgae communities (macrophytes) including eelgrass and kelp are distributed throughout coastal areas and serve as an important component of nearshore habitat for a number of species including juveniles of commercially important and forage fish species. Eelgrass (*Zostera marina*) grows in low intertidal and shallow subtidal areas in sand and mud while *Laminaria saccharina* and *L. solidungula*, the primary kelp species, occur in deeper water (to 30 meters) on rocky substrates (Johnson et al. 2003).

4.1.2 Zooplankton

Zooplankton include organisms which are planktonic throughout their entire life (holoplankton) and species that are planktonic only during a portion of their lifecycle (meroplankton). The meroplankton consist mainly of the larval stages of benthic invertebrates, which may outnumber the holoplankton for brief periods in shallow water. More detailed accounts of species found in Shelikof Strait, Cook Inlet, and the southeastern Bering Sea are provided by Seifert and Incze (1991), Damkaer (1977), and Cooney (1987), respectively.

Zooplankton communities are similar in their composition and relative dominance structure in the southeastern Bering Sea, North Pacific, and the northern Gulf of Alaska (Cooney 1978). Copepods are the dominant zooplankton group, both in terms of numbers and biomass (Kendall et al. 1980).

Zooplankton abundance varies seasonally with maximums generally occurring in the summer. Coyle and Pinchuk (2003) found calanoid copepods the most abundant zooplankton over a three-year period in the northern Gulf of Alaska with production peaking at approximately 35 mg C/m^3/day in May of each year. A considerable portion of the seasonal biomass variation that occurs in oceanic regions likely reflects the life histories of three large calanoid copepods: *Neocalanus cristatus*, *Neocalanus plumchrus*, and *Eucalanus bungii.* These copepods migrate vertically in the water column and various developmental stages occur in the upper 500 feet for a minimum of 10 months of the year (Cooney 1987). Smaller copepods, such as *Calanus pacifica* and *Metridia pacficus,* are also abundant at various times of the year. Decapod larvae are present primarily in spring and summer and are more prevalent in bays and nearshore waters (Kendall et al. 1980). Fish eggs and larvae are found throughout the year, although abundance and spatial distribution is highly variable due to seasonal spawning. Euphausiids are most abundant in the summer and display vertical distribution near the surface prior to and during spawning. Seasonal changes in zooplankton distribution are affected by biological factors such as vertical migration and physical factors such as local currents, wind, bathymetry, and fresh water input.

Zooplankton serve as forage for fish (copepod nauplii are critical in the diet of most larval fish), shellfish, marine birds, and mammals. Euphausiids are essential organisms in the diets of yellow Irish lord and yellowfin sole, and mysids are the principal prey of walleye pollock and halibut (SAIC 1979). Copepods and euphausiids are important prey items for blue, bowhead, fin, humpback, minke, northern right, and sei whales.

4.2 Benthic Invertebrates

Benthic organisms are generally sensitive to deposition of solids such as seafood waste, and can be considered indicators of the intensity of pollution. Benthic invertebrates are important as prey for higher trophic levels and are important mediators for nutrient recycling. Several benthic species are harvested commercially: Tanner crab, Dungeness crab, weathervane scallop, and shrimp. Razor clams are harvested from nearshore areas and bays. Benthic species frequently harvested for subsistence purposes include clams (razor, butter, steamer), crabs (Tanner, Dungeness, red king), cockles, and shrimp.

In general, polychaetes, bivalves, and small crustaceans, primarily amphipods, are the most abundant organisms, with polychaetes often constituting the majority of the infauna. Benthic infauna are not uniformly distributed, but many infauna have broadly overlapping ranges. Approximately 165 epifaunal species and 264 infaunal species were collected by Feder (1981) in lower Cook Inlet. Arthropods, mollusks, and echinoderms were the most frequent epifaunal species accounting for 60, 59, and 23 of the total species respectively, as well as dominating the total biomass. Mollusks, arthropods, and echinoderms were the most frequent infaunal species accounting for 128, 54, and 26 of the total species, respectively (Feder 1981).

In southeastern Alaska, polychaetes (*Nephthys cornuta*, *Owenia fusiformis*, *Mesochaetopterus*, and *Euclymene* sp.) and mollusks were found to be dominant taxa in two studies of the region (Meyers 1977; Hughes 1983). Other taxa found in this area included holothuroids, brachiopods, echiuroids, sipunculids, nemerteans, and epibenthic crustaceans. An average of 1,136 individuals/m^2, with an average biomass of 4,092 g/m^2 were documented in this area.

Stoker (1981) studied the benthic communities in the Bering and Chukchi Seas and recognized eight major faunal assemblages. The faunal composition for the Chukchi Sea area was noted as being similar to that found in the eastern Bering Sea. Two major faunal assemblages were identified in the Chukchi Sea that also occurred in the Bering Sea. One group was characterized by the polychaete *Maldae sarsi*, the echinoderm *Ophiura sarsi*, the sipunculid *Golfingia margaritacea*, and the bivalve *Astarte borealis*; the second group was characterized by the bivalves *Macoma calcarea, Nucula tenuis,* and *Yolida hyperborea,* and the amphipod *Pontoporeia femorata.* The Chukchi Sea fauna was dominated by detritus feeders. In examining the species distributions, sediment type was the environmental variable most directly correlated with the observed distributions (Stoker 1981).

Many benthic species are important prey items for higher trophic level consumers such as amphipods, mollusks (particularly *Spisula polynyma* and *Nuculana fossa)*, Tanner crabs, ophiuroids, shrimp, barnacles, and hermit crabs (EPA 1983). As well as being prey for Pacific cod, sculpin, and halibut, the Tanner crab is also a major predator on infaunal and epifaunal benthos. Post-larval red king crabs consume detritus, bryozoans, foraminiferans, copepods, and ostracods, while adults feed on barnacles, mollusks, and hermit crabs. Pandalid shrimp feed primarily on benthic crustaceans, polychaetes, mollusks, diatoms, foraminiferans, and small fish.

4.3 Fish

Fish assemblages are dominated by demersal species, with walleye pollock, Pacific cod, and arrowtooth flounder being the most abundant species in Alaskan waters (NMFS 2005e). Anadromous fish including Chinook, coho, sockeye, chum, and pink salmon are important commercial fish in terms of harvest volume and value. Other fish of commercial value include: yellowfin sole, sablefish, halibut, and herring. Halibut, the five species of salmon, and other anadromous fish such as steelhead trout and Dolly Varden char are popular sport fish. Species important as prey for higher trophic levels include sand lance and capelin, as well as previously mentioned species (U.S.DOI/MMS 1992). Detailed life history information and distribution of the species discussed below can be found in the "*Atlas to the Catalog of Waters Important to Spawning, Rearing, and Migration of Anadromous Fish*" and "*Alaska Habitat Management Guides*" published by the Alaska Department of Fish and Game.

The following discussion is divided into commercially harvested fish, such as Pacific salmon and halibut, and other species that are not commercially harvested. Many of the species, such as sand lance and capelin, which are not commercially harvested are important as prey for higher trophic levels.

4.3.1 Commercially Harvested Fish

Five anadromous species (pink, sockeye, chum, coho, and Chinook salmon), three groundfish species (Pacific cod, sablefish, walleye pollock), and one pelagic species (Pacific herring) constitute the bulk of the fish harvested commercially. A brief description of each of these species is provided below.

Pacific salmon is the major pelagic finfish group of the Alaska region; all five American species occur throughout this region. Only a few occasional salmon are found in the Chukchi Sea. The Bering Sea – Bristol Bay sockeye run is the largest run of this salmon species in the world, although there are more pink salmon in the Alaska region than the other salmon species. Pink salmon are also more widely distributed in the region than other species. All pacific salmon are anadromous, returning to freshwater from the ocean to spawn and then die. The progeny enter the Bering Sea and North Pacific Ocean to mature. Most salmon rear in the North Pacific Ocean while only a few rear in the eastern Bering Sea. Pacific salmon may migrate over long distances during the course of their maturation before returning to their natal spawning areas. Bering Sea salmon migrate from the rivers of southwest Alaska along the coastline and through Unimak and the eastern Aleutian Island passes. Alaska region salmon remain in the ocean for one to three years before returning to spawn. Bering Sea spawning salmon, other than the Bristol Bay and North

Alaska Peninsula runs, migrate in broad bands across the eastern Bering Sea to the major (Yukon and Kuskokwim) and smaller rivers of southwest Alaska.

Pink salmon. Pink salmon spawn annually with substantially larger returns in even-numbered years. Spawning fish migrate to their natal streams in early summer and runs may continue into early August. Fry emerge from the stream gravel in spring and school in estuarine waters for approximately a month before beginning a gradual, irregular movement to the ocean where they usually remain for two years. In late summer and early fall, the large schools move offshore to deeper waters while still remaining relatively close to shore until December when they move further offshore. Copepods, amphipods, tunicates, and euphausiids are the dominate prey of pink salmon.

Sockeye salmon. Sockeye salmon spend two to three years in the ocean before migrating to their natal streams to spawn from early June until late August. Young sockeye remain in coastal waters during their first year of life. Juveniles feed on copepods, fish eggs and larvae, and shrimp larvae. Adult sockeye salmon prey consists of copepods, amphipods, tunicates and euphausiids.

Chum salmon. Chum salmon remain in the ocean for two to four years before migrating to their natal streams. They spawn from late July to late October and are the second most abundant species along the shoreline in lower Cook Inlet from May to September (KPB 1990). The fry spend several months in estuarine waters before beginning their offshore migration in early fall. Juveniles feed on zooplankton (primarily copepods) and aquatic insects while adults feed on zooplankton, small fish, and squid (U.S. DOI/MMS 1984).

Coho salmon. Coho salmon spend one to two years in the ocean before migrating to their natal streams from late July to December. Young coho enter the ocean after one to four winters in freshwater and remain nearshore and near the surface where they feed on small fish and zooplankton crustaceans before moving further offshore (EPA 1983). Adult coho feed on squid, euphausiids, and small fish in the open ocean.

Chinook salmon. Chinook salmon spawn from mid-May to early August. Young Chinook enter the ocean after spending one to two years in freshwater and remain nearshore for a short period before moving further offshore. Juvenile Chinook feed primarily on fish larvae and aquatic insects whereas adults feed on herring. sand lance, squid, and crustaceans.

Pacific cod. Pacific cod is a benthic species that ranges throughout the North Pacific Ocean and eastern Bering Sea. Spawning occurs during winter and the eggs are demersal. Larval cod range from pelagic to benthic waters and they grow rapidly, reaching about 3 feet in length within 2 to 3 years. Adult cod feed on a variety of worms, crabs, mollusks, shrimps, and herring.

Sablefish. The sablefish or black cod is found in large numbers in the Gulf of Alaska. Sablefish occur in deeper waters (1,200-3,000 feet) where they prey on a variety of crustaceans, worms, and small fishes. The species spawns in winter and the eggs are pelagic with the larval stage occurring near the surface. Juveniles are sometimes found in large schools in nearshore waters. Sablefish migrate extensively over long distances, but without apparent timing or routing.

Walleye pollock. Walleye pollock predominates in the groundfish complex of the eastern Bering Sea and largely in the commercial harvest in the Gulf of Alaska. This demersal species is found in large schools. Annual spawning begins in early spring and may continue into early summer. The larvae form dense aggregations that appear to be strongly dependent on ocean dynamics (e.g., the Alaska Coastal Current) for transport (Schumacher and Kendall 1989). Pollock migrate seasonally, moving from deeper waters in the winter to more shallow water in the summer. The fish also undergo diurnal, vertical migrations from deeper to shallow waters in the evenings (U.S. DOI/MMS 1984). Pollock feed on numerous species including mysids, euphausiids, and small fish. In addition to being of great commercial value, pollock serves as food for other marine fishes, birds, and mammals.

Pacific herring. Herring sac-roe is of high commercial value while adult herring are currently used mainly for bait in other fisheries. The Pacific herring populations in Alaska are generally on a downward trend. Bering Sea migrations are along the North Alaska Peninsula and out to the Aleutian Islands, then north toward the Pribilof Islands where herring overwinter in deeper waters. Pacific herring undergo annual spring migrations from pelagic waters to the coastal areas of southwest Alaska, lower Cook Inlet, Prince William Sound, and the islands and coast of southeast Alaska to spawn. The eggs are deposited on kelp, other seaweeds, rock substrate, and detritus in the shallower coastal zone. After spawning and hatching, both adult and larval herring remain in nearshore water until fall when the schools move to deeper and warmer waters to overwinter. Adults and larvae feed primarily on zooplankton (U.S. DOI/MMS 1992). Larvae and juveniles feed and grow in estuaries and embayments, thus making them vulnerable to changes in inshore habitats. Herring are important food fishes for other pelagic fishes, and marine birds and mammals. They are also important target species in the diets of communities participating in subsistence fishing.

4.3.2 Non-Commercially Harvested Species

Pacific sand lance and capelin are important as prey species for higher trophic levels. Dolly Varden char is an important sportfish species recreationally harvested in Cook Inlet. A brief description of each of these species is provided below.

Pacific sand lance. Pacific sand lance are abundant in nearshore areas and bays and generally inhabit water less than 330 feet deep. Sand lance lack a swim bladder and must actively swim, rest on the seafloor, or bury themselves in sand or fine gravel. They may form large pelagic schools during the day and return to the bottom at night. Sand lance spawn during winter in areas of strong currents. The larvae are planktonic and feed on diatoms, copepods, shrimp, and barnacle nauplii (Blackburn 1979). Pacific sand lance are prey items for salmon, Pacific cod, halibut, other demersal fishes, marine birds and mammals.

Capelin. Capelin is a pelagic species that forms large schools near the bottom. The species is distributed throughout the Bering and Chukchi seas and south through the Aleutians. Spawning usually occurs from the end of May to about mid-July. Eggs are deposited on sandy beaches at night or on cloudy days following a high tide and are buried in the sand by wave action. Capelin consume copepods, amphipods, euphausiids, and shrimp and are important prey items for other fishes, marine birds and mammals (EPA 1983).

Dolly Varden char. Dolly Varden char occur throughout Alaska from southeast to the streams and rivers feeding the Beaufort Sea. They spawn mostly in the fall, with eggs incubating over winter. Many anadromous Dolly Varden char are capable of repeated spawning, although they suffer a high postspawning mortality and generally do not spawn in consecutive years.

4.4 Seabirds

Marine birds and waterfowl are significant components of the marine ecosystems in Alaskan waters and with some species being highly vulnerable to human impacts. NMFS (2005e) reports that 38 species of marine birds breed in Alaska in more than 1,600 colonies. Estimates of breeding populations reach 36 million individuals in the eastern Bering Sea and 12 million individuals in the

Gulf of Alaska (NMFS 2005e). Most of the discussions below reflect data that was collected between the 1970s and early 1990 although population updates based on current (2006) information are provided as available.

The short-tailed albatross may occasionally be found within Alaska and is listed as endangered under the ESA. The spectacled eider and Steller's eider are listed as threatened species. These species are discussed in greater detail in Section 6.0.

4.4.1 Important Species and Trophic Relationships

The following discussion addresses marine birds, which spend at least a portion of their lives in the open ocean, shorebirds, and waterfowl. The latter two are not typically found far from land. Discharges from offshore seafood processors would tend to have a greater effect on marine birds preferring open waters while nearshore and onshore discharges would be more likely to affect shorebirds and waterfowl. Accurate estimates of bird populations are difficult to obtain as a result of the large areas involved, migratory and life-history patterns, and funding limitations experienced by the agencies responsible for management. The discussion below is based on data presented in the 1994 ODCE with revisions to population numbers as they have been identified.

4.4.2 Marine Birds

The most prominent and numerous avian group found in the Alaska Region are the pelagic seabirds. This group consists of birds such as shearwater, petrels, murrelets, auklets, and gulls. These seabirds exhibit a wide array of body forms, life history patterns, and strategies for obtaining food, reproducing, and avoiding predation. These birds developed in an environment relatively free from predation but with a less predictable food source. These factors have led to the development of long life spans, late attainment of sexual maturity, and small clutch sizes (U.S. DOI/MMS 1992).

Pelagic distribution of seabirds in the Bering Sea, as elsewhere in Alaskan marine waters, exhibits a patchy pattern of high and low densities (Piatt et al., 1988). Typically, greatest densities (e.g., 100-1,500 birds/mi^2) occur in spring, summer, and fall over the outer continental shelf (OCS) and shelfbreak (330- to 660-foot depth). Densities over the inner shelf, though generally lower, may reach high levels where shearwaters concentrate in huge flocks (tens of thousands to well over a million individuals) (U.S. DOI/MMS 1992). During the winter and early spring, most seabirds are widely dispersed over the southern Bering Sea, Aleutian Islands, and North Pacific Ocean south of the consolidated pack ice. Overwintering seabirds and spring migrants also tend to gather along the ice edge where prey may be concentrated. Bird densities of 1,300 to 2,600/mi^2 commonly occur in the ice front and up to 26,000/mi^2 have been observed (Divoky 1983).

Black-legged kittiwakes are abundant in most Bering Sea colonies, with Alaska populations estimated at 1.3 million individuals (USFWS 2006). Thick billed and common murres often occur together in the Bering Sea and Aleutian Islands with populations of each species in excess of 2.0 million. Annual declines of common murres of approximately 3.6 percent on Saint Paul Island, 9.0 percent on Chisik/Duck Island (Cook Inlet) and 4.5 percent in Bristol Bay have been observed, while populations have been shown to be increasing on Gull Island in Kachemak Bay (USFWS 2006). In addition, fulmars are abundant on the Pribilofs and on St. Matthews Island with Alaskan populations estimated at 1.4 million (USFWS 2006). Red-legged kittiwakes nest on the Pribilofs although declines averaging 2.6 percent per year have been observed on Saint Paul Island (USFWS 2006). Large numbers of auklets inhabit St. Matthews Island, St. Lawrence Island, Little Diomede Island, King Island, and Fairway Rock with a positive population trend observed for crested auklets on Kasatochi Islands in the Aleutians (U.S. DOI/MMS 1992; USFWS 2006). Burrow-nesting species such as storm-petrels and tufted puffins are abundant in the Aleutian

Islands. At least 9 to 10 million nonbreeding shearwaters occupy the Bering Sea and Gulf of Alaska annually in the summer and fall.

Fifteen species of marine birds constitute 90 percent of the total seabird population in the Gulf of Alaska. Six of these species have populations over one million (fork-tailed storm petrel, tufted puffin, Leach's storm petrel, common murre, black-legged kittiwake, and homed puffin) (Baird and Gould 1983). Other common seabirds include shearwaters, fulmars, cormorants, gulls, tern, guillemots, murrelets, and auklets. Many birds such as shearwaters rarely come to land except to breed while others such as arctic tern and mew gulls may breed hundreds of miles inland. Most seabirds return to breeding colonies in April and lay eggs in May, June, and July. While seabirds are rearing young, foraging is limited to nearshore waters. Most seabirds leave their breeding colonies by October.

Seabirds feed primarily on marine invertebrates and fishes, although their diet varies according to body and bill size, age, season, prey size and availability. The major food source during spring and summer months include capelin, sand lance, euphausiids, squid, and pollock. Various benthic invertebrates and demersal fish are the main winter food sources (U.S. DOI/MMS 1984). Studies that have measured the food fed to seabird chicks have indicated that capelin and sand lance comprise 48 to 84 percent of their diets (Baird and Gould 1983). Most foraging of breeding birds occurs within 30 miles of their colony and usually within 3 miles of land.

More than 60 seabird colonies are located in the lower Cook Inlet region and approximately 120 bird colonies have been identified in the Shelikof Strait region (U.S. DOI/MMS 1984). Many seabirds winter in offshore waters while others remain in Alaskan nearshore waters, particularly Kachemak Bay. In Cook Inlet, Shelikof Strait, and the Barren Islands, there are over one million nesting seabirds with the largest aggregation found in the Barren Islands (U.S. DOI/MMS 1984). Afognak Strait and Kodiak Island also provide important winter congregation areas for murres and auklets in particular, as well as other species.

4.4.3 Shorebirds

Shorebird refers to those birds generally restricted to coastline margins (beaches, mudflats, salt marshes, bays, and estuaries). Shorebirds encompass members of the plover, sandpiper, and avocet families. An important characteristic of almost all shorebird species is their migratory behavior, which is strongly developed. The vast majority of shorebirds that occur along the Pacific coast of North America breed in Alaska where important nesting concentrations are found on moist tundra and marshlands of the Arctic north slope and the west coast (e.g., Yukon-Kuskokwim River Delta). From May through September each year, millions of shorebirds may be found in these areas. Species occurring along the shores of the Bering Sea include Pacific golden-plover, bristle-thighed curlew, black turnstone, and western sandpiper. Shorebirds common in the Bering Sea islands and Aleutian Islands include black oystercatcher, dunlin, ruddy turnstone, and rock sandpiper (Alaska Shorebird Working Group 2000).

Limited numbers of mudflats occur within the migratory flyway between the Washington coast and the Alaska Peninsula. Critical habitats for migrating shorebirds include the Copper/Bering River deltas (near Valdez, Alaska), Fox River Flats, Mud Bay, and Kamishak Bay. As noted above, the

Yukon-Kuskokwim River Delta is an important nesting concentration area. A breeding colony of the rare Aleutian terns and more common Arctic terns nest along the mud flats in the Homer area.

4.4.4 Waterfowl

Waterfowl in Alaska include ducks and geese. During the fall migration, the numbers of ducks in saltwater marshes and tideflats increase dramatically as local populations are supplemented by ducks from the north and west. Eighteen species of diving ducks breed in Alaska.

Areas of major importance to waterfowl populations occupying the Bering Sea include the Yukon-Kuskokwim River Delta and lagoons along the north side of the Alaska Peninsula, particularly Izembek and Nelson. The eastern Aleutian Islands area, polynyas near major islands (e.g., St. Lawrence, St. Matthew, and Nunivak), and the ice front also provide important overwintering habitat for some waterfowl species.

Waterfowl breeding on the Yukon-Kuskokwim Delta include tundra swan, white-fronted goose, Taverner's Canada goose, cackling Canada goose, emperor goose, and Pacific black brant, and at least 13 species of ducks and loons. Ten to 50 percent of the population of these species nests in this region. Several of the goose and duck species nest in high densities throughout the coastal Bristol Bay area, on Nunivak Island, and along the north side of the Alaska Peninsula.

Dabbling ducks (mainly American widgeon, mallard, northern pintail, and green-winged teal) comprise approximately 60 percent of the breeding waterfowl in Trading Bay, Redoubt Bay, and the Fox River Flats (KPB 1990). The initial nesting period for dabbling ducks usually begins in mid-April and extends through June. The molt and brood-rearing period occurring from late June to early August is a stressful period and demands considerable energy. Consequently, waterfowl are sensitive and vulnerable during this time. In Cook Inlet, dabbling ducks have two population peaks in the fall. The first is in mid-to-late August and the second is late September to early October. By November, most dabbling ducks have departed for wintering grounds. Dabbling ducks feed primarily on invertebrates and plant matter.

Most diving ducks arrive on their breeding grounds by late May, with the nesting period generally extending through June. Brood rearing and molting occurs throughout July and August. The majority of the diving ducks that breed in Alaska are residents of Alaskan coastal areas in winter. Preferred marine habitats of diving ducks include protected estuaries, and other marine waters within the 60-foot depth contour.

The largest concentrations of geese are found in their preferred habitats; estuaries, lagoons, river deltas, marshes, and tidelands. High concentrations occur on the tidal salt marshes and the extensive mud flats of Cook Inlet during the spring and fall migrations. The only known nesting area of the tule white-fronted goose is on the west shore of Cook Inlet, primarily in Trading and Redoubt Bays. Snow geese congregate on the Kenai flats from mid-April to mid-May to feed and rest en route to their breeding grounds in Siberia. In 1988, 25,000 snow geese were observed using the Kenai flats (KPB 1990). Along the Alaska Peninsula, king and Steller's eiders molt in Nelson Lagoon in August and September with the majority of the females molting in Izembek Lagoon (U.S. DOI/MMS 1992).

Canada geese nest on lakes and ponds, and marshes. Nests are usually initiated in early May, dependent upon weather conditions. Molting flocks typically use large lakes and protected coastal waters away from nesting areas. On coastal marshes and tideflats, geese feed on mollusks, crustaceans, and other invertebrates as well as plants.

Areas of major importance to waterfowl include the Yukon-Kuskokwim Delta, Nunivak Island, bays and inlets along the Alaska Peninsula, Aleutian Islands, Kodiak Island, and the eastern side of the Alaska Peninsula. In the Gulf of Alaska, important areas include the Copper River Delta, Prince William Sound, and several bays in upper and lower Cook Inlet.

4.5 Marine Mammals

Several species of marine mammals occur in Alaskan coastal waters. These species include cetaceans, pinnipeds, and sea otters. All marine mammals are protected under the Marine Mammal Protection Act (MMPA) of 1972. The MMPA also incorporates regulations and restrictions regarding the harvests of marine mammals. Additional protection is provided under the ESA for blue, bowhead, fin, gray, humpback, right, sei, and sperm whales, and the Steller sea lion (northern sea lion). Additional regulations associated with the northern fur seal are provided by a 1957 treaty, the Interim Convention on Conservation of northern fur seals. The endangered or threatened species occurring in Alaskan waters are discussed in Section 6.0.

Marine mammals in the Gulf of Alaska are important constituents of the Alaskan food web, annually consuming 7.55 million metric tons of euphausiids, copepods, fish, cephalopods, and crustaceans (Calkins 1987). The most frequent prey for marine mammals in this region are: copepods, euphausiids, herring, cod, walleye pollock, capelin, salmon, cephalopods, and crustaceans. Fin and sei whales have the highest annual consumption rates followed by the Dall's porpoise and Steller sea lion.

Most of the marine mammals occurring in Alaskan waters can be grouped into two categories: 1) pinnipeds (seals, sea lions, and walrus) that are ice associated during the winter and also reproduce during that time, and 2) whales that use Alaskan waters as summer feeding grounds. The only other marine mammal, the northern sea otter, does not fit with either of these groups.

4.5.1 Pinnipeds

Pinnipeds in Alaskan waters include the northern fur seal, ice seals (spotted, ribbon, bearded, and ringed), harbor seal, and Pacific walrus.

Northern fur seal. The northern fur seal has a range extending from the Bering Sea south to San Diego, California. These seals are migratory and widely dispersed in pelagic waters throughout this range during the non-breeding season (November to May). During the summer breeding season, much of the population is found on the Pribilof Islands. While most fur seals migrate southward from Alaskan waters, a portion of the population, principally young non-breeding males, remain in the Gulf of Alaska year-round. The most recent population estimates for the Eastern Pacific stock of northern fur seals is 709,881. This number has dropped significantly since the late 1950s, resulting in the population being designated as depleted under the MMPA in 1988 (NMFS 2007).

Ice Seals. Four seal species in Alaska (spotted, ringed, bearded, ribbon) are ice-associated for much or all of the year. Their association with nearshore pack ice, offshore pack ice and shorefast ice varies with species and season with the general range of all four species extending from the Beaufort Sea to the southeastern Bering Sea. Spotted and ribbon seals are concentrated in the Bering Sea, while the majority of bearded and ringed seals occupy areas farther north. Population estimates for these seals are generally dated and based on limited surveys; the most current population estimates for ice seals in the Bering-Chukchi-Beaufort area are 225,000 spotted, 95,000 ribbon, 275,000 bearded, and 300,000 ringed (NMFS 2014a and 2016). Winter/spring spotted seal densities are greatest east of the Pribilof Islands, while ribbon seals are most numerous west of the Pribilof and St. Matthew Islands. Ringed seals are abundant in shorefast ice areas of the Chukchi and northern Bering Seas. All four species breed and give birth in the spring and are associated with the ice pack in some way.

Harbor seal. Harbor seals tend to frequent nearshore waters and haul out on offshore rocks, sandbars, and beaches of remote islands. These seals often move considerable distances between various haul out sites, although they tend to have a limited number of preferred sites which they return to repeatedly. The breeding and pupping season occurs from late May through July (KPB 1990). The diet of harbor seals is highly varied with prey primarily consisting of herring, eulachon, walleye pollock, octopus, salmon, shrimp, and flounder.

The harbor seal has an extensive range extending from the Bering Sea southward to Baja California. The Bering Sea and Gulf of Alaska stocks have been in decline since the early 1980s with the status of the southeast stock undetermined. The current population estimate is 180,000 state wide. Although the population has been in decline with no clear reason, none of the stocks has been identified as depleted under the MMPA or considered for listing under the ESA (NMFS 2007).

Pacific walrus. In Alaska, the Pacific walrus ranges from the Beaufort Sea to the southeastern Bering Sea migrating north and south with the seasonal pack ice (U.S. DOI/MMS 1992). During the winter months (January-March), most walruses occur in the drifting pack ice west and southwest of St. Lawrence Island and in the Bristol Bay area. Beginning in April, nearly all the pregnant females and those with young move north with the receding pack ice. By late June, the migrants have passed through the Bering Strait to occupy the area north in the northeastern Bering Sea and western Beaufort Sea. Adult and sub adult males that remain in the Bering Sea in summer most consistently haul out at several sites in the northern Bristol Bay (Walrus Islands State Game Sanctuary) and St. Matthew Island (Alaska Maritime National Wildlife Refuge) areas. Current population estimates are not available and variability in survey methods make previous estimates unreliable (USFWS 2002a). The number of Pacific walruses within an area surveyed in 2006 was estimated at 129,000 with a 95% confidence interval of 55,000 to 507,000 (Speckman et al. 2011).

4.5.2 Cetaceans

Several non-endangered cetaceans occur within Alaskan waters. They include minke, and killer whales, and Dall’s and harbor porpoises.

Dall’s porpoise. The Dall’s porpoise is present year-round throughout the Gulf of Alaska, with the largest numbers occurring over the continental shelf in spring and summer from Kodiak Island east to Icy Strait. Surveys conducted in 1999 and 2000 consistently showed Dall’s porpoise in deeper water than harbor porpoise. Alaska populations were estimated to contain approximately 417,000 individuals based on observations collected in 1993; the estimate was revised downward to an estimated 83,400 based on inflated counts resulting from vessel attraction behavior (NMFS 2007). This species usually travels in groups of 2 to 20 animals, although concentrations of over 1,000 porpoises may occur infrequently. The majority of breeding and calving takes place from June to August. Dall’s porpoises feed on walleye pollock, sablefish, capelin, Pacific herring, sand lance, eulachon, and squid (Crawford 1981).

Harbor porpoise. The harbor porpoise ranges from Point Barrow south to Point Conception, California. In Alaska they occur in coastal waters less than 100 feet deep from the Gulf of Alaska through southeast Alaska, including Glacier Bay, Yakutat Bay, the Copper River Delta and Sitkalidak Strait. Population surveys were conducted in Bristol Bay in summer 1999 resulting in population estimates of over 66,000 individuals; population estimates for other parts of Alaska were not provided (NMFS, 2007). Although they are assumed to be year-round residents where they occur, sightings are much less frequent in fall and winter. They are generally observed in harbors, bays, and river mouths. Breeding occurs from June or July to October with peak calving in May and June (MMS 1984).

Killer whale. Killer whales prefer shallow areas of the continental shelf and are considered surface feeders preying mostly upon large fishes when available and marine mammals. Killer whales form groups called pods with resident and transient pods occurring in Alaskan waters. Transient pods are known to have ranges from the Puget Sound north through Prince William Sound and Kodiak Island while other residents are more localized (e.g. Gulf of Alaska). Killer whales have been observed in the Bering and Beaufort seas. The population estimate for killer whales in Alaskan waters on a permanent or temporary basis is approximately 320 individuals based on surveys conducted between 1994 and 2004 (NMFS 2007).

Minke whale. The minke whale is the smallest of the baleen whales. It is a coastal species, usually occurring within the 660-foot depth contour. In spring, most minke whales are located over the continental shelf, especially in shallow nearshore waters. Their highest concentrations in summer are around Kodiak Island, and in the northeast Gulf of Alaska, although they are also common in the Bering and Chukchi seas (NMFS 2007). Most whales are thought to leave the region by October as they are seldom observed in the fall or winter. It is likely that they migrate northward in early spring and southward in the fall. Breeding occurs throughout the year with peaks in January and June. Their prey consists mainly of euphausiids and copepods (MMS 1992).

Northern Sea Otters**.** Three distinct populations have been identified within Alaska. The USFWS issued a final rule listing the southwest Alaska population segment of the northern sea otter as threatened under the ESA on August 9, 2005 (USFWS 2005). The listed population is located between the Aleutian Islands and Cook Inlet, including the Alaska Peninsula and the Kodiak archipelago and is discussed in more detail in the Threatened and Endangered Species section below (Section 6.2.3).

Sea otters (*Enhydra lutris*) occur from northern Japan to southern California. The northern sea otter that occurs in Alaska, *E. lutri kenyoni* is one of three recognized subspecies of *E. lutris*. Their range that extends from the Aleutian Islands in southwestern Alaska to the coast of the state of Washington (USFWS 2005). Once exploited to near extinction, northern sea otters in Alaska have reoccupied most of their known range since coming under protection under the International Fur Seal Treaty in 1911. They are at or near their carrying capacity throughout the Aleutian Islands and east to Prince William Sound. Few sea otters survive in the Pribilof Islands (USFWS 2005). Recent estimates place the Alaskan population between 56,000 and 70,000 individuals. Approximately 6,000 sea otters are located in the Kodiak Island area and an estimated 2,100 are found in the Kenai Peninsula and Cook Inlet area. Otters tend to be non-migratory, moving relatively short distances between breeding and foraging areas. Sea otters are extremely susceptible to marine pollution as their fur must remain clean to maintain its insulative qualities, and they seldom leave the water.

Sea otters generally occur in shallow water areas near the shoreline where they consume large quantities of benthic invertebrates, including sea urchins, mussels, clams, chitons, and crabs. Visual observation of 1,251 dives by sea otters in southeast Alaska indicate that foraging activities typically occur in water depths ranging from 6 to 100 feet, although foraging at depths up to 328 feet was observed (Bodkin et al 2004). In Nanwalek and Port Graham, the sea otter population has expanded to the extent that otters have severely depleted some of the benthic invertebrate resources used by these two subsistence communities (KPB 1990). Sea otter interactions with fisheries are limited to theft of bait from crab pots set in nearshore waters where commercial Tanner crab activities and sea otters overlap. Occasional drownings occur as a result (MMC 1989).

4.6 Important Habitat or Areas

The following discussion identifies key habitats or concentrations for marine mammals. The section is divided into pinnipeds (seals and sea lions), cetaceans (whales), and sea otters.

4.6.1 Pinnipeds

Pinnipeds are found throughout Alaskan waters with the distribution of several species overlapping. Fur seals occur from the Bering Sea to southern California but concentrate in the Pribilof Islands and on Bogoslof Island in the summer (NMFS 2007). Harbor seals usually inhabit marine, estuarine, and freshwater environments from the coast to a few miles offshore. They prefer gently sloping or tidally exposed habitats including reefs, offshore rocks and islets, mud and sand bars, and sand and gravel beaches and are typically found in water depths less than 180 feet (EPA 1984a). Populations of harbor seals occur in the Bering Sea, Gulf of Alaska, and southeast Alaska. Ice seals are concentrated from the Bering Sea north associated with sea and pack ice. These species (bearded, spotted and ring seals) spend most of their time on ice rather than land although concentrations of bearded seals have been observed south of Kivalina (NMFS 2007). Walrus concentrate in Bering and Chukchi seas in continental shelf waters. A group of mostly males also use coastal haulouts in Bristol Bay in the summer (USFWS 2002a).

4.6.2 Cetaceans

Cook Inlet supports killer whales, Dall’s porpoises, and harbor porpoises with beluga whales concentrated in the northern portions of the Inlet for most of the spring and summer. Recent surveys show concentrations of Dall’s porpoises around the shelf break in the central-eastern Bering Sea (NMFS 2007). Minke whales are relatively common in the inshore waters of the Gulf of Alaska and in the Bering Sea, on the north side of the Alaska Peninsula and around the 330 foot (100 meter) contour near the Pribilof Islands (NMFS 2007). Unimak Pass is a known route for gray whales migrating to and from the Bering Sea in spring and fall (ADF&G 1994a). Humpback whales are known to concentrate in certain areas including southeast Alaska, Prince William Sound, Kodiak and the Barren Islands, between Semidi and Shumagin islands, around the eastern Aleutian Islands and in the southern Bering Sea (ADF&G 1994b). This area is also a possible migratory route for fin and humpback whales.

4.6.3 Northern Sea Otters

Sea otters are found in bays, lagoons, and estuaries and most commonly inhabit waters of less than 300 feet deep along the coast. The highest densities are found within the 130-foot isobath where young animals and females with pups forage. When otters haul out, they rest on land and in kelp beds (Calkins and Schneider 1985). Sea otter populations occur in the Barren Islands, northern and southern Kodiak Island, southwestern Kenai Peninsula, Kamishak Bay, along the shoreline of lower Cook Inlet, and the Trinity Islands (MMS 1984).

4.7 Summary

Phytoplankton communities form the basis of the marine food chain and are dominated by diatoms, with dinoflagellates, microflagellates, and other classes and families of phytoplankton also being present. Phytoplankton occurs throughout Alaskan seas particularly the Bering Sea and southern portions of Cook Inlet. Several herbivores, including zooplankton, benthic invertebrates, and waterfowl, are dependent upon phytoplankton.

Zooplankton including copepods, euphausiids and mysids occur throughout marine waters and provide an important part of the food chain. Zooplankton communities are similar in composition and relative dominance structure in the southeastern Bering Sea, North Pacific, and the northern Gulf of Alaska. Zooplankton are prey for fish, shellfish, marine birds and mammals. Copepods are the dominant zooplankton species providing forage to a number of species including the larvae of walleye pollock. Euphausiids are essential prey in the diets of yellowfin sole and minke whales, and mysids are the principal prey of adult walleye pollock and halibut.

Several benthic species are harvested commercially: Tanner crab, Dungeness crab, weathervane scallop, and shrimp. Species frequently harvested for subsistence purposes include clams, crabs, cockles, and shrimp. Kamishak Bay, Kachemak Bay, and areas of Shelikof Strait are important habitats for Tanner, Dungeness, and king crabs. Five species of shrimp are commercially harvested from Kachemak Bay, although populations of shrimp and king crab have been declining in recent years. Amphipods, mollusks, crabs, ophiuroids, shrimp, and other benthic species are important prey items for higher trophic levels as well as mediators for nutrient recycling.

The fish assemblages are dominated by demersal species, with walleye pollock, yellowfin sole, and halibut being the most abundant species. Commercially harvested fish include Chinook salmon, coho salmon, chum salmon, sockeye salmon, pink salmon, walleye pollock, Pacific cod, halibut, and Pacific herring. Salmon, steelhead trout, and Dolly Varden char are important sport fish. Species important as prey for higher trophic levels include sand lance and capelin, as well as previously mentioned species.

Pelagic seabirds are the most prominent and numerous avian group found in the Alaska region. The most abundant species are fork-tailed storm petrel, tufted puffin, Leach’s storm petrel, common murre, blacklegged kittiwake, and horned puffin. Other common seabirds in the eastern Bering Sea and Gulf of Alaska areas include shearwaters, fulmars, cormorants, gulls, tern, guillemots, murrelets, and auklets (NMFS 2005e).

Waterfowl in the area include ducks and geese. Eighteen species of diving ducks breed in Alaska. Many diving ducks overwinter in Kachemak Bay. Other areas of importance to waterfowl include the Yukon-Kuskokwim Delta, Izembek, and Nelson lagoons in the Bering Sea; eastern Aleutian Islands; lower and upper Cook Inlet; Kodiak Island; the eastern side of the Alaska Peninsula; and the Copper River Delta and Prince William Sound in the Gulf of Alaska. Waterfowl feed primarily on crustaceans, mollusks, aquatic insects, and fish.

Several non-listed species of marine mammals occur in Alaskan coastal waters including cetaceans (beluga, minke, killer whales, Dall and harbor porpoises), pinnipeds (northern fur seals, ice seals, harbor seals, walrus), and northern sea otters. Many are found year round in the coastal areas, or use these areas as potential migratory routes. Frequent prey for marine mammals in the Gulf of Alaska include copepods, euphausiids, herring, cod, walleye pollock, capelin, salmon, cephalopods, and crustaceans. Important habitats or areas include the Pribilof Islands for northern fur seals and the Walrus Islands for Pacific walrus.

SECTION 5.0

POTENTIAL IMPACTS OF DISCHARGE ON MARINE ORGANISMS AND HUMAN HEALTH

This section of the ODCE addresses three of the ten criteria listed in Section 1.0 that must be considered in determining whether there is potential for “unreasonable degradation” of the marine environment related to a point-source discharge. As discussed earlier and for the purposes of this section, “unreasonable degradation” is defined as:

1. Significant adverse changes in ecosystem diversity, productivity, and stability of the biological community within the area of discharge and surrounding biological communities;
2. Threat to human health through direct exposure to pollutants or through consumption of exposed aquatic organisms.
3. Loss of aesthetic, recreational, scientific, or economic values, which are unreasonable in relation to the benefit derived from the discharge.

The three criteria to be considered in this section are:

- Criterion # 1: The quantities, composition, and potential for bioaccumulation or persistence of the pollutants to be discharged
- Criterion # 2: The potential transport of such pollutants by biological, physical, or chemical processes
- Criterion # 6: The potential impacts on human health through direct or indirect pathways

The potential adverse effects of seafood processing waste include direct and indirect impacts of the solid and liquid waste discharges to marine organisms. Solid wastes consist of unused portions of the fish that have been processed and may include heads, skin, scales, viscera, and fins discarded during cleaning and butchering. Liquid wastes include soluble organic matter and nutrients leached from fish during processing. The liquid wastes may also include waste from process disinfectants, sanitary wastes, and other wastewaters (i.e., cooling water, boiler water, gray water, freshwater pressure relief water, refrigeration condensate, water used to transfer seafood to the facility, and live tank water). Both solid and liquid waste discharges are proposed by the Draft Permit.

Potential direct impacts of solid waste discharges include waste accumulation on the seafloor. This could alter the benthic community due to burial, the sediment texture, and chemical changes effected within the sediments due to the decay of organic matter accumulations. The decay of accumulations of solid waste may also result in depletion of dissolved oxygen in the overlying water column and releases of potentially toxic decay byproducts like unionized ammonia and undissociated hydrogen sulfide. Nutrients (particularly nitrogen and phosphorus) are also released during the decay of solid waste which may result in eutrophic conditions and subsequent shifts in both phytoplankton community abundance and structure.

The solid waste discharge may also result in water column turbidity which has the potential to decrease photosynthetic production by phytoplankton. Potential direct impacts of liquid wastes include depletion of dissolved oxygen in the water column due to the decay of soluble oxygen demanding substances in the wastewater. Residual concentrations of chlorine disinfectants in the liquid waste stream and additional oxidants produced by the reactions of chlorine with other compounds could potentially impact marine organisms.

Potential indirect impacts of seafood waste discharges involve effects on marine mammals and birds due to their attraction to seafood waste discharges. The attraction of marine mammals to seafood waste discharges may make them easier prey for predators. Birds that are attracted to surface plumes of seafood waste may become oiled due to accumulation of waste fish oils on the water surface. Another potential indirect impact involves the development of dependence on an anthropogenic food supply that may result in concentration and growth of marine mammal and bird populations that could be adversely affected if this food supply was reduced or eliminated. Eutrophication of marine waters may also result in enhancement of phytoplankton species that are toxic to marine organisms and humans. Bacteria associated with the decaying seafood waste may also adversely impact marine mammals and birds.

Although a number of potential impacts to marine organisms are outlined above, no known studies specific to seafood processing waste discharges have been conducted to assess the importance of the direct and indirect impacts in offshore waters. Most studies conducted to date have focused on the direct effects from shore-based seafood processing plants of solid waste accumulations on benthic organisms, the effect of decaying waste on water column dissolved oxygen concentrations, and the potential toxic effect of waste decay byproducts (i.e., unionized ammonia and undissociated hydrogen sulfide) on marine organisms.

The potential direct and indirect impacts of seafood waste discharges are discussed in more detail below. Information specific to seafood processing waste discharges is reviewed and summarized where possible. Literature relevant to potential impacts associated with eutrophication and residual chlorine are from studies conducted on other types of waste discharges (e.g., municipal wastewater facilities), since studies specific to seafood processing wastes are not available. Most of the discussion of the potential indirect impacts of seafood processing discharges relies on personal communications from scientists and regulatory agency personnel familiar with seafood processing in Alaska.

5.1 IMPACTS ASSOCIATED WITH SOLID SEAFOOD PROCESS WASTES

During discharge of seafood processing waste, biological impacts are most likely to occur as a result of the discharge of seafood waste particulates (both direct and indirect effects). The following discussion briefly presents the different potential effects of discharges on biota including burial and habitat modification, the alteration of sediment composition, and the chemistry associated with the decomposition of the waste solids.

5.1.1 Burial and Habitat Modification

Disposal of seafood waste solids will have the greatest impact on less mobile benthic organisms such as polychaetes and bivalves, and on demersal fish eggs that cannot move away from the accumulating waste.

The degradation of this organic material occurs at varying rates according to different characteristics of the discharge area (i.e. biological, physical, and chemical factors). The accumulation of these deposits in areas indicates that the rate of discharge exceeds the assimilation capacity of some water bodies and more specifically, the assimilation capacity of the benthic community and other aquatic life that metabolize this material. The facilities covered by the Draft Permit are constantly moving and discharging in areas with high tidal activity that will ensure dispersion and dilution of the seafood wastes and minimize accumulation of these deposits in one area. If discharge limits are adhered to, the effects on aquatic biota in areas of seafood processing waste discharge should be minimal.

5.1.2 Effects of Deposited Solids

Many benthic invertebrates are relatively sedentary and sensitive to environmental disturbance and pollutants. Short- and long-term effects of seafood waste on benthic invertebrates can include smothering of biota, especially by ground particulates in the area near the discharge. Deposition is likely to reduce and possibly eliminate abundances of infaunal benthos such as polychaetes, mollusks, and crustaceans, and may affect demersal eggs of various benthic species and fish.

Limited information is presently available concerning the direct effects of various deposition depths on benthic communities. Most studies that have investigated deposition impacts on benthos have examined deposition of dredged materials (Hale 1972; Kranz 1974; Mauer et al. 1978; Oliver and Slattery 1973; Saila et al. 1972; Schafer 1972; Wilber 1992). These studies indicate that the response to deposition and survival following such an event is species specific. Of the species examined, burial depths from which organisms were able to migrate to the surface ranged from 0.4 to 12.6 in (1 to 32 cm). If it is assumed that most benthos are not adversely affected by loose deposition of seafood waste less than 0.4 in (1 cm), benthos in the vicinity of the discharge receiving deposition in excess of this amount are likely to be adversely impacted. Seafood solids are highly organic material and the decomposition of this material may lead to other impacts on benthos related to localized depression of dissolved oxygen.

A number of important species release demersal eggs. As with other types of fish eggs, demersal eggs require oxygen for development. Seafood waste discharges resulting in waste excess accumulation are typically anoxic due to decay and decomposition of the waste. Thus, demersal eggs could be smothered if located beneath a discharge. Such smothering of demersal eggs could have a substantial adverse impact on these demersal species and other aquatic organisms that prey upon these fish. Seafood wastes that are discharged during spawning and egg production periods have the most potential to adversely affect these species. Offshore seafood operations are unlikely to adversely impact demersal fish spawning activities because spawning grounds are more commonly found in nearshore waters. A number of studies have been conducted regarding effects of suspended solids on egg mortality, but the effect of waste deposition on egg mortality is not well documented (USEPA 1984b). In particular, it is not known at what depth of deposition egg survival would be impaired. However, it is reasonable to conclude that impairment may occur at fairly shallow waste depths (e.g., 0.4 in) if that depth of waste was sufficient to impair oxygen transfer to the egg or if anoxic conditions were present.

Since facilities discharging under the Draft Permit should not create piles nor mats of organic waste, and any potential accumulation should be less than 0.2in (0.5cm) it is unlikely adverse conditions will be present.

5.1.3 Alteration of Sediment

Alteration of sediment characteristics would be expected to impact the benthic community structure more subtly, but at greater distances from the point of discharge, than smothering. Benthos would be the group of organisms most affected by changes in the sediment, but other organisms may be affected as well; impacts to benthic communities could also conceivably affect epibenthic and pelagic invertebrates, fish, birds, and mammals that rely on benthic invertebrates for food.

The general changes in benthic community structure and function that occur under conditions of increasing organic enrichment of the sediments (such as occurs as a result of stationary seafood waste discharges or municipal sewage effluent discharges) have been well documented (Pearson and Rosenberg 1978 and Germano & Associates 2004). Slight to moderate enrichment results in slight increases in numbers of individuals and biomass of benthic communities, while species composition remains essentially unchanged. As enrichment increases, the overall abundance of benthic organisms increases. However, there is a corresponding decrease in the number of species as the less tolerant species are eliminated. In more extreme cases, only a relatively small number of species adapt to disturbed environments and/or high organic content become very abundant. When the enrichment levels are optimal for those few species, they become extremely abundant, and overwhelmingly dominate the benthic community. Biomass generally decreases as many of these opportunistic species are very small.

These changes in benthic community variables are accompanied by a progressive reduction in the depth of the oxygenated surficial sediment layer, and changes in the predominant trophic groups of benthic organisms. Mixed assemblages, or assemblages dominated by suspension feeders, are first replaced by assemblages dominated by surface deposit feeders, and then replaced by assemblages dominated by subsurface deposit feeders. Under very highly enriched conditions, the sediments become anoxic and macrobenthic organisms may be entirely absent.

It is assumed that a short term, slight to moderate, increase of organic enrichment may be present just after discharge. However, because facilities should not be creating piles or mats of organic wastes, changes in the benthic community is not anticipated.

5.1.4 Decay of Solid Wastes

The decay of organic matter accumulations can effect chemical changes within the sediments and may lead to anoxic conditions within a pile or mat of organic waste. The decay of solid waste accumulations may also result in depletion of dissolved oxygen in the overlying water column and releases of potentially toxic decay byproducts like unionized ammonia and undissociated hydrogen sulfide. Again, benthic communities and demersal eggs would be directly adversely affected by anoxic conditions within the accumulated organic waste. Most infauna would either migrate out of the area or be killed as a result of the lack of oxygen. Anoxic conditions are expected to destroy any demersal eggs that might be present. A few species may be able to survive within the thin upper sediment layer of the waste pile (e.g., *Capirella* spp.).

Since ambient waters containing abundant dissolved oxygen rapidly mix with the affected waters, reductions of dissolved oxygen concentrations throughout the overlaying water column are not expected, nor are significant impacts to mobile marine organisms. Areas of reduced dissolved oxygen, if any, would be expected to be small and would be avoided or quickly passed through by mobile organisms.

5.2 EXPOSURE TO SUSPENDED SOLIDS

Deposition calculations in Section 3.0 indicate that a large discharge event of ground waste will result in less than 0.5 cm of solids on the sea floor (where fate and transport factors such as decay, uptake, and density stratification are not considered). The EPA expects that the discharge of unground waste will also result in minimal impacts due to rapid mixing and the requirement that vessels be moving while discharging. Adverse physical effects to biota from ground seafood discharge should be limited to the nearfield vicinity of the outfall. Since effluent is discharged near the surface, zooplankton may experience local impacts due to turbidity and nutrient loading. Phytoplankton entrained in the discharge plume may have reduced productivity due to decreased light availability. However, such potential impacts may be offset in the farfield by increases in nutrient concentrations. These impacts should result in negligible impacts to populations in the region, as impacts should be restricted to the immediate vicinity of the discharge. Benthic organisms and fish larvae may also be affected in the farfield due to solids deposition which has the potential to alter respiratory or feeding ability due to stress, or clogging of gills and feeding apparatus. Mobile invertebrates, fish, birds, and mammals presumably will avoid the discharge plume if conditions become stressful. However, biota may also be attracted to the discharge plume to feed on the discharged particulates. Secondary impacts associated with attraction are discussed in Section 5.3. Infaunal or sessile organisms near the discharge are not likely to be impacted by the suspended solids.

In addition to potential chemical and physical alterations of the water column and benthos, seafood processing residues can cause some aesthetic and physical effects on the water surface that could impair existing or designated uses. In addition, seafood processing residues can form a surface layer of scum, foam, or fine particles that could present a physical barrier preventing dissolved oxygen re-aeration, block light to the water column, deter avian feeding, and create an aesthetically undesirable condition. Such effects could also attract nuisance species and unwanted predators that would impair beneficial uses. The Draft Permit proposes to prohibit facilities from discharging wastewaters that contain substances that float as debris, scum, oil, or other matter to form nuisances. The Draft Permit also prohibits the discharge of seafood processing wastes that create an attractive nuisance situation whereby fish or wildlife are attracted to waste disposal or storage areas in a manner that creates a threat to fish or wildlife or to human health and safety. If an operator complies with the Draft Permit conditions, these prohibition would limit such concerns under normal operating conditions.

5.3 IMPACTS ASSOCIATED WITH LIQUID SEAFOOD PROCESSING WASTE

Liquid seafood processing discharges include two waste streams, one directly associated with the seafood waste and the other associated with ancillary operations whose wastewaters do not come in contact with seafood waste. The seafood processing discharges contain solid and soluble materials that include soluble oxygen demanding substances (i.e., BOD), nutrients, and oil and grease. These discharges may also contain disinfectants including ammonia and chlorine which may produce direct toxic effects. Liquid discharges that are not directly associated with seafood processing activity and that do not come into direct contact with seafood waste (e.g., bailwater, cooling water, boiler water, etc.) generally do not contain significant amounts of oxygen demanding substances and nutrients however may contain concentrations of total metals that are considered bioaccumulative or persistent. Soluble sanitary wastes are treated prior to discharge. The potential impacts to marine organisms due to the discharge of substances with elevated BOD, nutrients, disinfectants, and total metals are discussed below.

5.3.1 BOD / Dissolved Oxygen

Wastes discharged from seafood processing facilities include relatively high concentrations of BOD. Bacterial oxidation of the soluble organic matter in these wastes results in the consumption of water column dissolved oxygen. Aquatic organisms require adequate dissolved oxygen to survive. The term “dead zone” is often used in reference to the absence of life (other than bacteria) in habitats that are devoid of oxygen. The inability to escape low oxygen areas makes immobile species, such as oysters and mussels, particularly vulnerable to hypoxia. These organisms can become stressed and may die due to hypoxia resulting in significant impacts on marine food webs and the economy. Mobile organisms can flee the affected area when dissolved oxygen becomes too low. Nevertheless, fish kills can result from hypoxia, especially when the concentration of dissolved oxygen drops rapidly (CENR, 2010).

In general, offshore waters are well oxygenated and provide a considerable buffer for the assimilation of soluble organic wastes. In areas of restricted circulation or relatively low ambient dissolved oxygen concentrations resulting from natural processes, the potential for adverse effects on marine organisms from depletion of dissolved oxygen is increased. Nonetheless, seafood waste discharged to well-oxygenated open offshore coastal waters will not likely result in adverse effects from dissolved oxygen depletion.

5.3.2 Nutrients and Dissolved Oxygen

Excessive nutrients can cause a multitude of problems in coastal areas including eutrophication, harmful algal blooms, fish kills, shellfish poisonings, loss of seagrass and kelp beds, coral reef destruction, and reduced DO. As stated above, nitrogen is a common pollutant found in seafood processing waste. Nitrogen is known to be particularly damaging to bays and coastal seas by boosting primary production (the production of algae). With excessive amounts of nitrogen, the growth of algae and denitrifying bacteria increases making the water more turbid. As the algae die and decompose, dissolved oxygen is depleted from the surrounding water if there is insufficient mixing or other re-aeration mechanisms present (Howarth et al., 2000; Novatec, 1994). High levels of living algae can also lead to depletions in oxygen over the nighttime hours due to their oxygen consumption during this time period. Low dissolved oxygen levels can cause direct mortality of organisms, or reduced efficiency of physiological processes (e.g. food processing, growth). These changes in nutrients, light, and oxygen favor some species over others causing shifts in phytoplankton, zooplankton, and benthic communities (Howarth et al. 2000). In particular, animals that rely directly or indirectly on seagrass beds could be affected by algal blooms caused by excessive nutrients.

Unlike solid residues, nutrients are water soluble and can therefore be transported beyond areas of deposition unless assimilated by aquatic life, sorbed to sediments, or released to the atmosphere (denitrification and volatilization of nitrogen). Insufficient dilution or mixing of transported nutrients could conceivably affect other locations.

The discharges proposed by the Draft Permit are from constantly moving vessels in areas of good flushing, reducing the likelihood of accumulating excess amounts of nutrients and adversely effecting water quality.

5.3.3 Enhanced Productivity

Because phytoplankton form the base of the food chain, impacts to the phytoplankton community could have significant effects on the marine ecosystem as a whole (Legendre 1990). Although enhanced phytoplankton growth would not necessarily be an adverse effect since phytoplankton form the base of the marine food chain, a large increase in phytoplankton standing crop or changes in species composition, particularly to toxic species, could have adverse effects on dissolved oxygen concentrations, aesthetic water quality, other marine organisms, and humans.

Several factors control the rate of phytoplankton productivity and the accumulation of algal biomass. These include temperature, light intensity, mixing depth, and the supply of other nutrients such as nitrogen, phosphorus, silica, and a number of other essential elements (e.g., iron, manganese, zinc, copper, and cobalt). Other factors influencing phytoplankton productivity and biomass that are still poorly understood include inhibitory and stimulatory substances such as vitamin B_{12} and chelating agents (Aubert 1990; United Nations 1990). Factors influencing changes in phytoplankton community composition are also poorly understood, but are generally related to adaptations of certain species to specific combinations of the factors identified above. For example, diatoms (a group of marine and freshwater algae) appear to be favored when available nutrient concentrations (especially silica) are high and turbulent water column mixing is adequate to maintain these algae in the upper water column layer where light is available. An additional factor that controls the biomass and species composition of phytoplankton is the grazing activity of zooplankton that may feed selectively on certain species of phytoplankton.

The potential for adverse impacts of nutrient discharges from seafood processing facilities would depend on whether the amount of nitrogen or phosphorus available limit phytoplankton growth in the vicinity of the discharge, or if other influencing factors contained in the waste discharge could significantly influence phytoplankton production. Other relevant factors to consider include water exchange, mixing depth, zooplankton grazing activity, and the depth of light penetration in the water column. These variables make it difficult to predict the potential impact of nutrient rich waste discharges from seafood processors on marine phytoplankton communities. However, impacts would most likely occur in relatively shallow areas of restricted water circulation where nitrogen or phosphorus limitation of phytoplankton growth occurs. Therefore, discharges to the relatively well-flushed offshore coverage area of the Draft Permit have a lower potential to cause enhanced phytoplankton growth and biomass.

The Draft Permit specifies that the discharge flow shall not reduce the depth of the compensation point for photosynthetic activity by more than 10 percent from the seasonally established norm for aquatic life. The requirement ensures minimum impact of nutrient rich wastes on phytoplankton communities.

5.3.4 Alterations in Phytoplankton Species Composition/Toxic Phytoplankton

Alterations in phytoplankton species composition is another potential impact of nutrient rich discharges on marine phytoplankton. Concerns regarding alterations in phytoplankton community composition are related to indirect effects resulting from increasing the populations of phytoplankton species that may produce adverse effects on marine organisms and humans. Effects produced by some phytoplankton species include physical damage to marine organisms (e.g., diatom species of *Chaetoceros* that have caused mortality of penned salmon), toxic effects to marine organisms (e.g., a raphidophyte flagellate species of *Hererosigma*), and toxic effects to humans due to the concentration of algal toxins in marine fish and shellfish [e.g., Paralytic Shellfish Poisoning (PSP), Diarrheic Shellfish Poisoning, Neurotoxic Shellfish Poisoning, Amnesic Shellfish Poisoning, and ciguatera] (Taylor 1990; Haigh and Taylor 1990).

Concerns regarding toxic phytoplankton have been heightened in recent years due to suspicions that the frequency of toxic phytoplankton blooms has increased due to human activities, especially due to agricultural runoff and the discharge of municipal and industrial wastewater to marine coastal areas (Smayda 1990; Smayda and White 1990; United Nations 1990; Anderson 1989).

Several studies in other parts of the US have linked mortalities of relatively large numbers of marine mammals (e.g., O'Shea et al. 1991; Anderson and White 1989; Geraci 1989; Geraci et al. 1989; Gilmartin et al. 1980), fish and shellfish (e.g., Cosper et al. 1990; Smayda and Fofonoff 1989), and aquatic plants (e.g., Cosper et al. 1990) to the occurrence of toxic phytoplankton. PSP is caused by the consumption of shellfish that have concentrated toxins from an algae of the species *Protogonyaulax* (Shimizu 1989); however, direct links between the occurrence of PSP and eutrophication have not been established (Anderson 1989). Therefore, the linkage between PSP and seafood processing discharges, while possible, is tenuous.

Although there is a potential for the discharge of seafood processing waste to cause localized changes in phytoplankton species composition, there are no known studies to indicate that discharges of seafood processing wastes have produced toxic or harmful phytoplankton blooms. The discharges authorized by the Draft Permit are at least 3 nm from shore, with high rapid mixing and high levels of dilution, therefore, impacts nearshore to shellfish would be unlikely. Similarly, while PSP has been documented in Washington and Oregon, there is currently no evidence suggesting a linkage with seafood processing discharges. Additionally, the Draft Permit specifies that the discharge shall not reduce the depth of the compensation point for photosynthetic activity by more than 10 percent from the seasonally established norm for aquatic life. This requirement ensures minimum impact of nutrient rich wastes on phytoplankton communities.

5.3.5 Disinfectants/Residual Chlorine

Soluble wastes from seafood processing discharges may contain residual concentrations of chlorine, iodine, or ammonia based disinfectants. Chlorine based disinfectants are the most commonly used. Residual chlorine and chlorine-produced oxidants have been shown to be toxic to marine organisms at relatively low concentrations (USEPA 2002; Thatcher 1980). Thatcher (1980) conducted 96-hr LC_{50} (lethal concentration for 50% mortality) continuous-flow bioassays on a number of species of fishes and invertebrates typical of the Pacific Northwest and determined that juvenile species of salmon were particularly sensitive. The lowest LC_{50} determined for coho salmon was 32 µg/L.

The Draft Permit does not include a chlorine limit, nor a limit for any other disinfectant, but does require the development of a best management practice (BMP) Plan. The BMP Plan specifically requires that the facility include measures to minimize the use of toxic disinfectants where applicable. Disinfectants should dissipate rapidly and would not be expected to degrade the receiving water quality.

5.3.6 Total Metals

As discussed in Section 3.2.3, soluble wastes from ancillary operations may contain concentrations of total metals which exceed marine 304(a) water quality criteria. Pollutant transfer for total metals can occur through biological, physical, or chemical processes (further discussed in Section 10.2).

Due to the strong dispersion potential of the receiving water, total metals from the effluent are expected to rapidly decrease to concentrations below the safe limits set by marine water quality standards. This action is described by the dilution factor calculated in Section 3.0.

5.4 SECONDARY IMPACTS

Potential secondary impacts of seafood waste discharges involve effects on marine mammals, fish, and birds due to their attraction to seafood waste discharges. Bacteria associated with the decaying seafood waste may also adversely impact marine mammals and birds. The potential indirect impacts resulting from eutrophication of marine waters were discussed in Section 5.3.4.

5.4.1 Attraction of Organisms to the Discharge

The attraction of marine mammals to seafood waste discharges may make them easier prey for predators. Loughlin and York (2000) cited that discharges from offshore seafood processing facilities attract both Steller sea lions and killer whales resulting in increased predation above natural levels, although actual increases in mortality has not be accurately quantified.

Seafood waste discharges can increase localized populations of gulls and parasitic birds which may adversely affect the breeding success of some bird species. Similarly, Reed and Flint (2007) cite the correlation of eiders attracted to an area with seafood processing with increased predation by eagles. The Draft Permit prohibits the discharge of seafood processing wastes which create an attractive nuisance situation whereby fish or wildlife are attracted to waste disposal or storage areas in a manner that creates a threat to fish or wildlife or to human health and safety.

Another potential secondary impact involves the development of dependence on an anthropogenic food supply that may result in the concentration and growth of populations of marine mammal and birds that could be adversely affected with a reduction or elimination of this food supply.

Birds that are attracted to surface plumes of seafood waste (especially floating particulates) may potentially become oiled or their feathers fouled if there is an accumulation of waste fish oils on the water surface. Unless the volume of floating oils was significant and the birds were constantly diving through it, it is unlikely that fouling of the feathers would occur. The Draft Permit requires that all receiving waters be free from floating material such as debris, scum, oil or other matter that forms a nuisance on the surface of the water. Assuming plant operators comply with this provision, oils associated with the discharges should not be a significant concern.

5.5 SUMMARY

The potential adverse effects of seafood processing waste include direct and indirect impacts of the solid and liquid waste discharges to marine organisms. Potential direct impacts of solid waste discharges, including burial and habitat modifications, alteration of sediments, and other associated issues with the accumulation of waste on the seafloor are highly unlikely. The Draft Permit requirement that discharges be located in areas of high current activity should minimize the potential accumulation of seafood processing wastes. Discharges of ground seafood waste that comply with Draft Permit limitations are not expected to cause adverse effects on marine organisms nor human health.

Eutrophication of coastal marine waters is not expected to occur in locations where water exchange is adequate to dilute nutrient inputs from seafood processing waste discharges. Residual concentrations of chlorine disinfectants in the liquid waste stream and additional oxidants produced by the reactions of chlorine with other compounds, are expected to be low due to the nature of the treated discharge, amount of dilution, and rapid dispersion.

Eutrophication of marine waters may also indirectly result in enhancement of phytoplankton species that are toxic to marine organisms and humans. Although toxic phytoplankton species occur in marine waters, there is no known evidence to date establishing a link between the occurrence of toxic phytoplankton and offshore seafood processing waste discharges.

The attraction of marine mammals and birds to seafood processing waste discharges has the potential to create indirect impacts. It is anticipated that restrictions and limitations included in the Draft Permit will diminish these types of potential impacts.

SECTION 6.0

THREATENED AND ENDANGERED SPECIES

6.1 INTRODUCTION

The determination of “unreasonable degradation” of the marine environment is to be made based upon consideration of the ten criteria listed in Section 1.0. This section provides information pertinent to consideration of the criterion listed below:

- Criterion #3: “The composition and vulnerability of the biological communities which may be exposed to such pollutants, including the presence of unique species or communities of species, the presence of species identified as endangered or threatened pursuant to the Endangered Species Act, or the presence of those species critical to the structure or function of the ecosystem, such as those important for the food chain”

Section 7(a)(2) of the ESA requires federal agencies, in consultation with the agencies responsible for administering the ESA (the NMFS and the USFWS) to ensure that any action they authorize is not likely to jeopardize the continued existence and recovery of any species listed as threatened or endangered or result in the destruction or adverse modification of critical habitat. The ESA defines an “endangered species” as a species that is in danger of extinction throughout all or a significant portion of its range. A “threatened species” is defined as a species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

The threatened and endangered species list was obtained from the USFWS IPAC website and NOAA and updated January 24, 2018. The list is summarized in the table below and subsequently discussed in detail are included because of their potential presence within portions of the area covered by the Draft Permit. The information on these species is the same as that presented in the Biological Evaluation for this Draft Permit (USEPA, 2018).

Table 6-1: ESA Listed Species Potentially Occurring within the Action Area

SPECIES AND STATUS		RANGE IN ALASKA	CRITICAL HABITAT IN ALASKA
Endangered			
Short-tailed albatross	(*Phoebastria albatrus*)	U.S. Territorial waters, Gulf of Alaska, Aleutian Islands, Bering Sea	No
Western DPS Steller sea lion (west of 144^{o})	(*Eumetopias jubatus*)	Bering Sea, Aleutian Islands, Cook Inlet, Gulf of Alaska, SE Alaska	Yes
Blue whale	(*Balaenoptera musculus*)	Bering Sea, Gulf of Alaska, N. Pacific	No
Bowhead whale	(*Balaena mysticetus*)	Chukchi Sea, Beaufort Sea, Bering Sea	No
Fin whale	(*Balaenoptera physalus*)	Chukchi Sea, Bering Sea, Cook Inlet, Gulf of Alaska,	No

		SE Alaska, Aleutian Islands, N. Pacific	
Western North Pacific DPS Humpback whale	(*Megaptera novaeangliae*)	Beaufort Sea, Chukchi Sea, Cook Inlet, Bering Sea, Gulf of Alaska, Aleutian Islands, N. Pacific	No
North Pacific right whale	(*Eubalaena japonica*)	Bering Sea, Gulf of Alaska, N. Pacific	Yes
Sei whale	(*Balaenoptera borealis*)	Gulf of Alaska, SW Bering Sea, Aleutian Islands, N. Pacific	No
Sperm whale	(*Physeter macrocephalus*)	Bering Sea, Gulf of Alaska, SE Alaska, Aleutian Islands, N. Pacific	No
Cook Inlet beluga whale	(*Delphinapterus leucas*)	Cook Inlet	Yes
Western North Pacific DPS Gray whale	(Eschrichtius robustus)	Beaufort, Chukchi and Bering Sea	No
Leatherback sea turtle	(*Dermochelys coriacea*)	Gulf of Alaska	No
Threatened			
Spectacled eider	(*Somateria fischeri*)	Yukon Delta, Arctic Costal Plain, St. Lawrence Island, Bering Sea, Chukchi Sea, and Beaufort Sea	Yes
Steller's eider	(*Polysticta stelleri*)	Arctic Coastal Plain, Yukon Delta, all coastal waters except southeast Alaska	Yes
Polar bear	(*Ursus maritimus*)	On sea ice and coastlines of Beaufort, Chukchi and Bering Seas	No
Northern sea otter (Southwest Alaska Population)	(*Enhydra lutris kenyoni*)	Aleutian Islands, Alaska Peninsula, Kodiak Island	Yes
Loggerhead sea turtle	(*Caretta caretta*)	Gulf of Alaska	No
Green sea turtle	(*Chelonia mydas* incl. *agassizi*)	Gulf of Alaska	No
Olive Ridley sea turtle	(Lepidochelys olivacea)	Gulf of Alaska	No
Beringia DPS Bearded seal	(Erignathus barbatus nauticus)	Beaufort, Chukchi and Bering Sea	No
Candidate			
None Listed			
FISH			

SPECIES		EVOLUTIONARILY SIGNIFICANT UNIT	STATUS	CRITICAL HABITAT IN ALASKA
Chinook salmon	(*Oncorhynchus tshawytscha*)	Sacramento River Winter-Run	Endangered	No
		Snake River Fall	Threatened	No
		Snake River Spring/Summer	Threatened	No
		Puget Sound	Threatened	No
		Lower Columbia River	Threatened	No
		Upper Willamette River	Threatened	No
		Upper Columbia River Spring	Endangered	No
		Central Valley Spring	Threatened	No
		California coastal	Threatened	No
Chum salmon	(*O. keta*)	Hood Canal Summer-Run	Threatened	No
		Columbia River	Threatened	No
Coho salmon	(*O. kisutch*)	Central California Coast	Endangered	No
		S. Oregon/ N. California Coast	Threatened	No
		Lower Columbia River	Threatened	No
Sockeye salmon	*(O. nerka)*	**Snake River**	Endangered	No
Steelhead	(*O. mykiss*)	Southern California	Endangered	No
		South-Central California	Threatened	No
		Central California Coast	Threatened	No
		Upper Columbia River	Threatened	No
		Snake River Basin	Threatened	No
		Lower Columbia River	Threatened	No
		Central Valley California	Threatened	No
		Upper Willamette River	Threatened	No
		Middle Columbia River	Threatened	No
		Northern California	Threatened	No
		Puget Sound	Proposed Threatened	No

[1] The ESA defines "species" to include any distinct population segment of any species of vertebrate fish or wildlife. For Pacific salmon, NOAA Fisheries considers an Evolutionarily Significant Unit (ESU) a "species" under the ESA. For Pacific steelhead, NOAA Fisheries has delineated Distinct Population Segments (DPSs) for consideration as "species" under the ESA.

In addition to listing species under ESA, the critical habitat of a newly listed species must be designated, concurrent with its listing, to the “maximum extent prudent and determinable” (16 U.S.C. § 1533[b][1][A]). ESA defines critical habitat as those specific areas that are essential to the conservation of a listed species and that may be in need of special consideration. Federal agencies are prohibited from undertaking actions that destroy or adversely modify designated critical habitat. Some species, primarily the cetaceans, which were listed in 1969 under the Endangered Species Conservation Act and carried forward as endangered under ESA, have not received critical habitat designations.

6.1.1 Threatened and Endangered Fish

Snake River Fall Chinook Salmon (Oncorhynchus tshawytscha).
Chinook salmon are anadromous meaning that as adults, they migrate from a marine environment into the fresh water streams and rivers of their birth (anadromous) where they spawn and die. Seasonal runs (i.e., spring, summer, fall, or winter) have been identified on the basis of when adult Chinook salmon enter fresh water to begin their spawning migration (Tetra Tech 2006). Because genetic analyses indicate that fall-run Chinook salmon in the Snake River are a distinct evolutionarily significant unit (ESU) from the spring/summer-run in the Snake River Basin (Waples et al. 1991), Snake River fall-run Chinook salmon are considered separately.

Two distinct races have evolved among Chinook salmon. The stream-type race of Chinook salmon is found most commonly in headwater streams. Steam-type Chinook salmon have a longer fresh water residency, and demonstrate extensive offshore migrations into the North Pacific before returning to their natal streams in the spring or summer months (NMFS 1998; Healy 1991). The ocean-type Chinook, including the Snake River fall-run Chinook salmon ESU are commonly found in coastal streams in North America. Ocean-type Chinook migrate to sea where they tend to spend their ocean life in coastal waters within about 1,000 kilometers (621 miles) from their natal river (NMFS 1998; Healy 1991). Ocean-type Chinook salmon return to their natal streams or rivers in spring, winter, fall, summer, and late-fall runs, but summer and fall runs predominate (Tetra Tech 2006). The difference between these life history types is also physical, with both genetic and morphological foundations (NMFS 1998).

The historical population of Snake River fall-run Chinook salmon is difficult to estimate. Irving and Bjornn (1981) estimated a population of 72,000 for the period of 1938 to 1949 that declined to 29,000 during the 1950s. Numbers declined further following completion of the Hells Canyon Dam complex. The Snake River component of the fall-run Chinook has been increasing during the past few years as a result of hatchery and supplementation efforts in the Snake and Clearwater River Basins.

The critical habitat for the Snake River fall Chinook salmon was listed on December 28, 1993 (NMFS 1993a) and modified on March 9, 1998, (NMFS 1998) to include the Deschutes River in Oregon. The designated critical habitat does not include any waters within the state of Alaska.

Snake River Spring/Summer Chinook Salmon (Oncorhynchus tshawytscha). Recent trends in redd counts in major tributaries of the Snake River indicate that many subpopulations could be at critically low levels. Subpopulations in the Grande Ronde River, Middle Fork Salmon River, and Upper Salmon River Basins are at especially high risk. Both demographic and genetic risks would be of concern for such subpopulations, and in some cases, habitat may be so sparsely populated that adults have difficulty finding mates. NOAA Fisheries estimates that the median population growth rate over a base period from 1980 through 1998 ranges from 0.96 to 0.80, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared with the effectiveness of fish of wild origin (McClure et al. 2000). In 2002, the fish count at Lower Granite Dam was 75,025, more than double the 10-year average. Estimated hatchery Chinook at Lower Granite Dam accounted for a minimum of 69.7 percent of the run (Tetra Tech 2006). The spring Chinook count in the Snake River was at the all-time low of about 1,500 as recently as 1995, but in 2001 and 2002, both hatchery and wild/natural returns to the Snake River increased (FPC 2003).

The critical habitat for the Snake River spring/summer Chinook salmon was listed in 1993 (NMFS 1993a). The designated habitat consists of river reaches of the Columbia, Snake, and Salmon Rivers, and all tributaries of the Snake and Salmon Rivers (except the Clearwater River) presently or historically accessible to Snake River spring/summer Chinook salmon (except reaches above impassable natural falls and Hells Canyon Dam) (Tetra Tech 2006).

Snake River Sockeye Salmon (Onchorhynchus nerka). Snake River sockeye salmon returns to Redfish Lake since at least 1985, when the Idaho Department of Fish and Game began operating a temporary weir below the lake, have been extremely small (1 to 29 adults counted per year). Snake River sockeye salmon have a very limited distribution relative to critical spawning and rearing habitat. Redfish Lake represents one of the five Stanley Basin lakes historically occupied by Snake River sockeye salmon. NMFS proposed an interim recovery level of 2,000 adult Snake River sockeye salmon in Redfish Lake and two other lakes in the Snake River Basin (NMFS 1995). Because only 16 wild and 264 hatchery-produced adult sockeye returned to the Stanley River Basin between 1990 and 2000, NMFS considers the risk of extinction of this ESU to be very high (Tetra Tech 2006). In 2002, 52 adult sockeye were counted at Lower Granite Dam on the Snake River (FPC 2003); 12 sockeye salmon had been counted at Lower Granite Dam through September 2003 (USACE 2003).

The critical habitat for the Snake River sockeye salmon was designated on December 28, 1993 (NMFS 1993a). The designated habitat consists of river reaches of the Columbia, Snake, and Salmon Rivers, Alturas Lake Creek, Valley Creek, and Stanley, Redfish, Yellow Belly, Pettit, and Alturas Lakes (including their inlet and outlet creeks) (Tetra Tech 2006).

6.1.2 Threatened and Endangered Birds

Short-tailed Albatross (Phoebastrai albatross). The short-tailed albatross (Phoebastria albatrus) was originally listed in 1970, under the Endangered Species Conservation Act of 1969, prior to the passage of today’s Endangered Species Act (35 FR 8495). However, as a result of an administrative error (and not from any biological evaluation of status), the species was listed as endangered throughout its range except within the United States (50 CFR 17.11). On July 31, 2000, this error was corrected when the Service published a final rule listing the short-tailed albatross as endangered throughout its range (65 FR 46643).

Species range

The range of the short-tailed albatross includes most of the North Pacific Ocean as shown in Figure 6-1. The species occurs throughout international waters and within the Exclusive Economic Zones (EEZ) of Mexico, the United States, Canada, and other nations in the North Pacific.

As of 2008, 80-85% of the known breeding short-tailed albatross use a single colony, Tsubamezaki, on Torishima Island, an active volcano located off the coast of Japan. The rest breed in the Senkaku Islands in the East China Sea. Both islands are shown in Figure 6-1.

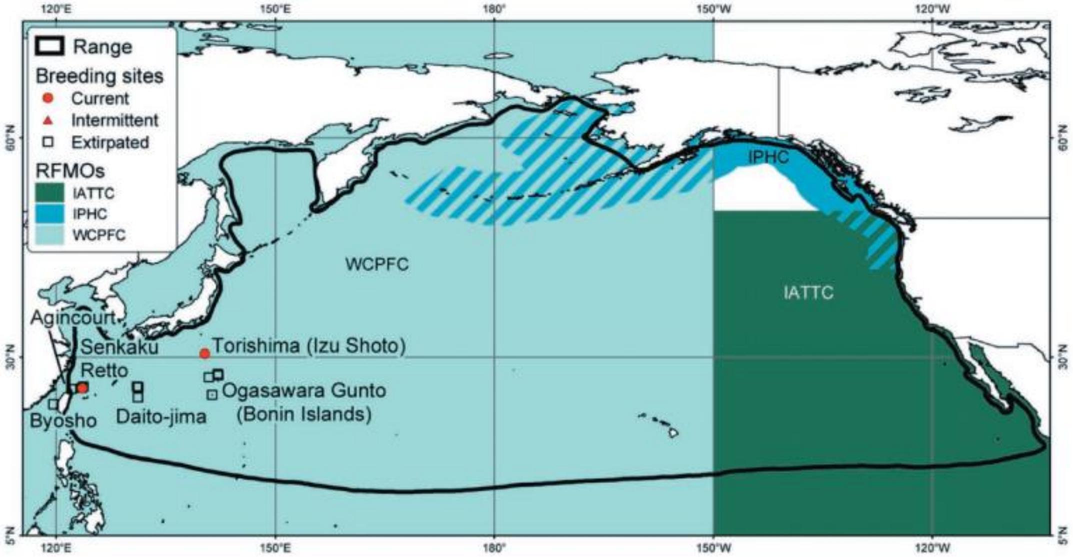


Figure 6-1: Range and Breeding Sites of the Short Tailed Albatross (USFWS, 2008)

Critical habitat

Critical habitat has not been designated for this species. In the 2000 final rule, the Service determined that designation of Critical Habitat was not prudent due to the lack of habitat-related threats to the species, the lack of specific areas in U.S. jurisdiction that could be identified as meeting the definition of Critical Habitat, and the lack of recognition or educational benefits accruing to the American people as a result of such designation (USFWS, 2008).

Life history and ecology

Like many seabirds, short-tailed albatrosses are slow to reproduce and are long-lived, with some known to be over 40 years old. They begin breeding at about 7 or 8 years, and mate for life. Short-tailed albatrosses nest on sloping grassy terraces on two rugged, isolated, windswept islands in Japan. Pairs lay a single egg each year in October or November. Eggs hatch in late December through early January. Chicks remain near the nest for about 5 months, fledging in June. After breeding, short-tailed albatrosses move to feeding areas in the North Pacific. When feeding, albatrosses alight on the ocean surface and seize their prey, including squid, fish, and shrimp (USFWS, 2001).

Population trends and risks

Millions of short-tailed albatross were harvested by feather hunters prior to and following the turn of the 20th century, resulting in the near-extinction of the species by the mid-20th century. In June 2008, about 2400 of these birds were known to exist, with about 450-500 breeding pairs (USFWS, 2008). The major threat of over-exploitation that led to the species' original endangered status no longer occurs. The most notable existing threat to the species' recovery is the possibility of an eruption of Torishima, their main breeding site. Other existing threats include incidental catch in commercial fisheries, ingestion of plastics, contamination by oil and other pollutants, the potential for depredation or habitat degradation by non-native species, and adverse effects related to global climate change (USFWS, 2008).

Steller's Eider (Polysticta stelleri). The Alaska-breeding population of the Steller's eider (*Polysticta stelleri*) was listed as threatened on June 11, 1997, based on the contraction in the species' breeding range in Alaska and the resulting increased vulnerability of the remaining breeding population to extirpation (FR 62 (112): 31748-31757) (USFWS 2002a).

Species range

Three breeding populations of Steller's eiders are recognized - two in Arctic Russia and one in Alaska. The Alaska-breeding population nests primarily on the Arctic Coastal Plain, although a very small subpopulation remains on the Yukon-Kuskokwin Delta (USFWS 2002a) (Figure 6-2). Outside of nesting season Steller's eiders spend their time in shallow, nearshore marine waters. Non-listed Steller's eiders (also P. stelleri) from the Russian breeding population mix with Alaska-breeding eiders during molting and wintering periods. USFWS estimates that less than 1% of Steller's eiders molting and wintering in Alaskan waters are from the listed population (BiOp 2016).

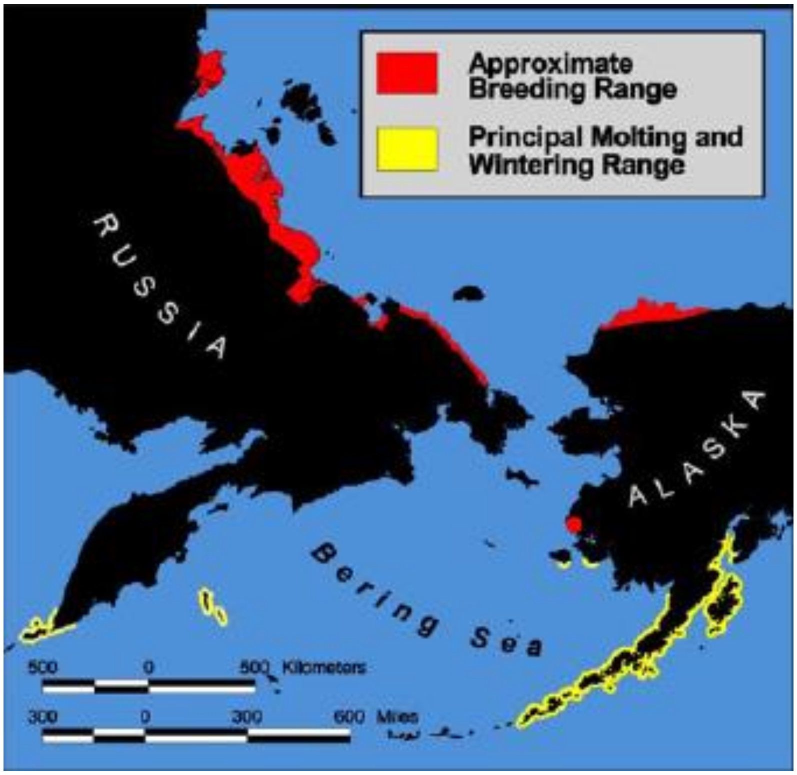


Figure 6-2: Distribution of the Pacific Population of Steller's Eider. Source: USFWS 2002a.

Critical habitat

Critical habitat was designated for the Steller's eider in 2001 (FR 66 (23): 8849-8884), which includes breeding habitat on the Yukon-Kuskokwim Delta, and four units in southwest Alaska marine waters, including the Kuskokwim Shoals in northwest Kuskokwim Bay, Seal Islands, Nelson Lagoon, and Izembek Lagoon on the north side of the Alaska Peninsula.

Life history and ecology

Steller's eiders nest in terrestrial environment but spend majority of the year in shallow, near-shore marine waters. After nesting, Alaska's Steller's eiders migrate south in the fall. These ducks move into the nearshore marine waters of southwest Alaska where they mix with the much more numerous Russian Pacific populations (USFWS 2002a). Adults undergo a flightless molt in autumn. Steller's eiders remain flightless for about three weeks, but the overall period of flight feather molt for the species is from late July to late October (Peterson 1981). Steller's eiders molt in a number of locations in southwest Alaska, but the largest numbers concentrate in four areas along the north side of the Alaska Peninsula - Izembek Lagoon, Nelson Lagoon, Port Heiden, and Seal Islands (Gill et al. 1981, Peterson 1981, Metzner 1993). Molting areas where large numbers concentrate tend to be characterized by extensive shallow areas with eelgrass beds, intertidal sand flats, and mudflats where Steller's eiders forage on marine invertebrates such as mollusks and crustaceans (Metzner 1993).

After molting many Steller's eiders disperse to the Aleutian Islands, the south side of the Alaska Peninsula, Kodiak Island, or as far east as Cook Inlet; however, thousands may remain in the lagoons used for molting unless freezing conditions force them to move to warmer areas (USFWS 2002a). Wintering eiders usually occur in waters less than 10m deep and are usually found within 400m of shore. Prior to spring migration, thousands to tens of thousands of Steller's eiders stage in estuaries along the north side of the Alaska Peninsula, including several areas used during molt and winter. From there, they cross Bristol Bay. It is speculated that majority of the entire Alaska-wintering adult population spends days or weeks feeding and resting in northern Kuskokwim Bay and in smaller bays along its perimeter before continuing northward to nesting areas (USFWS 2002a).

Population trends and risks

The Alaska-breeding populations of Steller's eiders occur in two disjunct regions - western and northern Alaska. The status of the subpopulations occupying these regions is inadequately understood due to lack of precise population size estimates and limited historical information for comparison with current estimates.

Aerial surveys currently provide the only available means of estimating population size and distribution. Population size point estimates, based on annual waterfowl breeding pair surveys from 1989-2000, range from 176-2,543 (Mallek 2002). The observations indicate that Steller's eiders occur over a vast area with a greater density near Barrow, the northernmost point in Alaska, which is thought to be the core of the Steller's eiders breeding distribution (USFWS 2002a).

Spectacled Eider (Somateria fischeri). The spectacled eider (*Somateria fascheri)* was designated as threatened on May 10, 1993 (FR 58 (88): 27474-27480) due to their rapid, continual decline on the Yukon-Kuskokwim Delta breeding grounds. Additionally, there are indications that the population is declining on Alaska's North Slope (USFWS 2012).

Species range

Historically, spectacled eiders nested along much of the coast of Alaska, from Nushagak Peninsula in the southwest, north to Barrow, and east near the Canadian border. Today, spectacled eiders breed in three primary locations - the Yukon-Kuskokwim Delta, the North Slope, and Arctic Russia. Limited nesting may also occur on St. Lawrence Island and the

Seward Peninsula in Alaska (USFWS 2012).

On the Yukon-Kuskokwim Delta, spectacles eiders breed mostly within 15km of the coast from Kigigak Island north to Kokechik Bay, with smaller numbers nesting south of Kigigak Island to Kwigillingok and north of Kokechik Bay to the mouth of Uwik Slough. The coastal fringe of the Yukon-Kuskokwim Delta is the only subarctic breeding habitat where spectacled eiders occur at high density. On Alaska's North Slope, the majority of spectacled eiders breed between Icy Cape and Shaviovik River and generally at low densities (Larned and Balogh 1997). Figure 6-3 provides spectacled eiders breeding distribution.

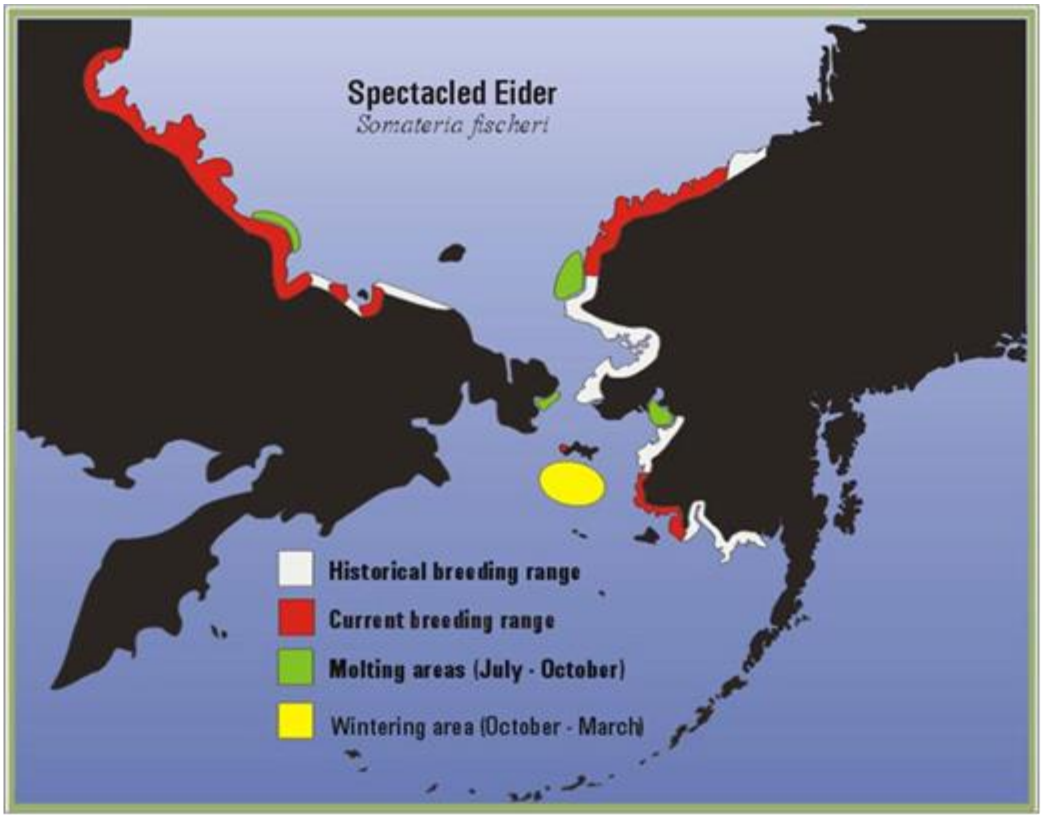


Figure 6-3: Distribution of breeding pairs of spectacled eiders. Current breeding range indicated areas where surveys have confirmed breeding pair occurrence. Low-density breeding may still occur outside these areas.
Source: USFWS 2006b.

Important late summer and fall molting areas have been identified in eastern Norton Sound and Ledyard Bay (USFWS 1996). Wintering flocks of spectacled eiders have been observed in the Bering Sea between St. Lawrence and St. Matthew Islands (USFWS 2012) where they congregate in large and dense flocks in pack ice openings (Larned et al. 1995).

Critical habitat

Critical habitat for the spectacled eider was designated in 2001(FR 66 (25): 9146-9187), and includes areas on the Yukon-Kuskokwim Delta, Norton Sound, Ledyard Bay, and the Bering Sea between St. Lawrence and St. Matthews Islands.

Life history and ecology

Spectacled eiders are diving ducks that spend most of the year in marine waters where they typically feed on bottom-dwelling mollusks and crustaceans. Around spring break-up, breeding pairs move to nesting areas on wet coastal tundra. During this season they feed by diving and dabbling in ponds and wetlands, eating aquatic insects, crustaceans, and vegetation. Shortly after eggs are laid, males leave the nesting grounds for offshore molting areas, usually by the end of June. Females whose nests failed leave the nesting area to molt at sea by mid-August. Breeding females and their young remain on the nesting grounds until early September. Molting flocks gather in relatively shallow coastal water (less than 36m deep). While moving between nesting and molting areas, spectacled eiders travel along the coast up to 50km offshore. From October through March, they move far offshore to waters up to 65m deep where they sometimes gather in dense flocks in openings of nearly continuous sea ice (USFWS 2012).

Population trends and risks

The spectacled eider was listed as threatened primarily because the number of nesting pairs on the Yukon-Kuskokwim Delta had declined from approximately 48,000 pairs in the early 1970s to 1,721 by 1992 (Stehn et al. 1993). Historical data for other nesting areas in scarce; it is estimated that 3000-4000 pairs currently nest on Alaska's North Slope and approximately 40,000 pairs nest in arctic Russia (USFWS 2012). Potential population threats include lead poisoning, predation, overharvest, reduced prey availability, and catastrophic events such as an oil spill or bilge pumping (USFWS 2012).

6.2.3 Threatened and Endangered Marine Mammals

Blue Whale (Baleaptera musculus). The blue whale was listed as endangered under the ESA on June 2, 1970. Blue whales are found in all of the world's oceans from the Arctic to the Antarctic. In the North Pacific, they rarely enter the Bering Sea and are only seldom seen as far north as the Chukchi Sea (ADFG 1994a). In the eastern North Pacific, they winter off southern and Baja California; during the spring and summer, they are found from central California northward through the Gulf of Alaska (Tetra Tech 2006). Historical areas of concentration in Alaska include the eastern Gulf of Alaska and the eastern and far western Aleutians (ADFG 1994a).

Blue whales are believed to migrate away from coastlines and feed preferentially in deeper offshore waters (Gregr and Trites 2001; Mizroch et al. 1984). They are seldom seen in nearshore Alaska waters (ADFG 1994a). No critical habitat has been designated for the blue whale (Tetra Tech 2006).

Blue whales are estimated to reach sexual maturity between 5 and 10 years of age, and may live as long as 70 to 80 years (Environment Canada 2004b). Upon reaching sexual maturity, females bear a single calf every 2 to 3 years (ADFG 1994a). Like many other species of baleen whales, blue whales migrate from low-latitude wintering areas to high-latitude summer feeding grounds (Tetra Tech 2006).

Blue whales appear to practice more selective behavior in feeding than other rorquals (those baleen whales that possess external throat grooves during gulp-feeding) and specialize in plankton feeding, particularly swarming euphausids (krill) in the Antarctic (Tetra Tech 2006). In the North Pacific, the species Euphausia pacifica and Thysanoessa spinifera are the main foods of blue whales (ADFG 1994a).

The pre-whaling abundance of blue whales in the North Pacific has been estimated at 4,900 to 6,000 animals and is now 1,200 to 1,700 animals (ADFG 1994a). There have been very few sighting of blue whales in Alaskan waters (Tetra Tech 2006). The first confirmed blue whale sighting in 30 years was observed by NOAA scientists on July 15, 2004, 100 nautical miles southeast of Prince William Sound (Joling 2004).

Bowhead whale (Balaena mysteicetus). The majority of these whales inhabit areas around Alaska as part of the Western Arctic stock. Five populations existed historically. Today, one population might be extinct, and three others exist in low numbers. Bowhead whales live only in Arctic or subarctic waters and have adapted to living along the pack ice and do not travel to temperate waters to calve (Sheldon and Rugh 1995).

The western Arctic or Bering Sea stock, which is the only stock found in United States waters, follows a 3,600 mile (5800km) migration route. They winter in the Bering Sea in polynyas (areas of consistently open water within pack ice) and at the edge of the pack ice. From late March through April, bowheads move north through the Bering Strait as the pack ice retreats. Most bowheads follow leads or cracks in the ice through the Chukchi Sea along the Alaska coast to Point Barrow. They travel offshore across the Beaufort Sea and arrive in Canadian waters from mid-May through June. The bowhead whale spends the summer in the Canadian Beaufort Sea, then migrate west along the continental shelf of the Beaufort Sea to Point Barrow from August through October. Next, the whales cross the Chukchi Sea and travel south along the Russian coast passing through the Bering Strait by November (Carroll 1994). Studies of stable isotope ratios in bowhead baleen suggest that the Bering and Chukchi Seas are the preferred feeding habitats rather than Beaufort Sea (Lee and Schell 1999).

Before commercial whaling, there were over 50,000 bowhead whales worldwide. Between the 1600s and 1800s, the eastern arctic stocks of bowheads were reduced from over 50,000 animals to less than 1,000. The Bering Sea stock originally numbered about 18,000 whales and was reduced significantly in the 1800s and early 1900s. They remain severely depleted. However, the population had increased from 6,400 to 9,200 in 1992(Carroll 1994).

Beluga whale. In Alaska, Beluga whales are divided into five stocks: Cook Inlet, Bristol Bay, eastern Bearing Sea, eastern Chukchi Sea, and Beaufort Sea (NMFS 2017c). The Cook Inlet population is numerically the smallest of these, and is the only one of the five Alaskan stocks occurring south of the Alaska Peninsula in waters of the Gulf of Alaska. The Cook Inlet Beluga (CIB) whale stock was listed under the ESA as endangered in 2008 (73 FR 62919). The stock was also determined to be depleted under the Marine Mammal Protection Act. On April 11,2011, NMFS published the final rule designating the two areas (minus and exclusion zone) of Cook Inlet as critical habitat for the Cook Inlet beluga whales (76 FR 20180; 50 CFR part 226.220). On May 15th, 2015, NMFS published a draft recovery plan for the CIB whales under the ESA (NMFS 2017c).

Belugas are social and are frequently observed in groups ranging in size from two to five to pods of more than 100 individuals. They are known to vocalize using grunts, clicks, chirps, and whistles to navigate, find prey and communicate. During summer months, they are often found in shallow waters and feed on schooling and anadromous fish including herring, capelin, eulachon, salmon and sculpins (NMFS 2017c). They are also known to eat octopus, squid, crabs, shrimp clams, mussels and sandworms (NMFS 2017c).

The Cook Inlet stock has been severely reduced in numbers over the last several decades. We estimate this population numbered as many as 1,300 in the late 1970s. The 2014 estimate is about 340 beluga whales in the Cook Inlet (NMFS 2016e).

Fin Whale (Balaenoptera physalus). The fin whale was listed as endangered under the ESA on June 2, 1970. In the North Pacific, fin whales can be found from above the Arctic Circle to lower latitudes of approximately 20ºN (Leatherwood et al. 1982). Fin whales along the Pacific coast of North America have been reported during the summer months from the Bering Sea to as far south as central Baja California (Tetra Tech 2006); three stocks are recognized: Alaska (Northeast Pacific), California/Washington/Oregon, and Hawaii (NMFS 2007).

Fin whales are believed to feed preferentially mainly in offshore waters, with preferred habitat encompassing a large area that includes the continental shelf break and offshore waters (Gregr and Trites 2001). They are seldom seen in inshore coastal waters. Fin whales regularly inhabit areas included within the NPDES general permit coverage including the Gulf of Alaska. No critical habitat has been designated for the fin whale (Tetra Tech 2006).

Fin whales tend to be more social than other rorquals, gathering in pods of 2-7 whales or more. Sexual maturity occurs at ages of 6 to10 years in males and 7 to 10 years in females and both sexes may live as long as 90 years (OBIS 2005). Reproductive activity occurs in winter, when whales have migrated to warmer waters. Females can mate every 2 to 3 years (Tetra Tech 2006). Fin whales eat a variety of fish and zooplankton species including capelin, sand lance, herring, and euphausids (krill) (OBIS 2005).

The pre-whaling abundance of fin whales in the North Pacific has been estimated at 42,000 to 45,000 animals while early 1970s population estimates ranged from 14,620 to 18,630 whales (Ohsumi and Wada 1974). Very few sightings of fin whales have occurred in Alaska waters (Tetra Tech 2006). A survey conducted in August 1994 covering 2,050 nautical miles of track line south of the Aleutian Islands encountered only 4 fin whale groups (NMFS 2003b).

Humpback Whale (Megaptera novaengliae). The humpback whale was listed as endangered under the ESA on June 2, 1970. The humpback whale is distributed worldwide in all ocean basins, although it is less common in Arctic waters. Currently there are four recognized stocks of humpback whales in U.S. waters based on geographically distinct winter ranges (NMFS 2007): Gulf of Maine stock, eastern North Pacific stock, central North Pacific stock, and the western North Pacific stock. The central North Pacific stock includes animals found in Alaskan waters. In Alaskan waters, most humpbacks tend to concentrate in southeast waters, Prince William Sound, the area near Kodiak and Barren Islands, the area between the Semidi and Shumagin Islands, eastern Aleutian Islands, and the southern Bering Sea (ADFG 1994b). In Southeast Alaska (i.e., Glacier Bay and Frederick Sound) photo identification studies summarized by Perry et al. (1999) appear to show that humpback whales use discrete, geographically isolated feeding areas that individual whales return to year after year. These studies find little documented exchange in individual animals between Prince William Sound areas and the Kodiak Island area, and between the Kodiak Island area and Southeast Alaska feeding areas, suggesting that while movement among these areas may occur, it is reasonably uncommon (Tetra Tech 2006). Although humpback whales can be observed year-round in

Alaska, most animals are thought to migrate to winter in waters near Hawaii (ADFG 1994b; Perry et al. 1999). No critical habitat has been designated for the humpback whale anywhere throughout its range (Tetra Tech 2006).

Humpback whales feed preferentially over continental shelf waters (Gregr and Trites 2001) and are often observed relatively close to shore, including major coastal embayments and channels (NMFS 2005b). Sexual maturity occurs at age 4–6 years, with mature females giving birth every 2–3 years (ADFG 1994b).

Humpback whales use a variety of feeding behaviors to catch food including underwater exhalation of columns of bubbles that concentrate prey, feeding in formation, herding of prey, and lunge feeding (ADFG 1994b). On the basis of their diet, humpbacks have been classified as generalists (Perry et al. 1999). They have been known to prey upon euphausids (krill), copepods, juvenile salmonids, Arctic cod, capelin, Pacific herring, sand lance, walleye pollock, pteropods; and some cephalopods (Tetra Tech 2006). On Alaska feeding grounds, humpback whales feed primarily on capelin, juvenile walleye pollock, sand lance, Pacific herring, and krill (NMFS 2003c; Perry et al. 1999).

The pre-whaling abundance of humpback whales in the North Pacific has been estimated to be approximately 15,000 animals (ADFG 1994b). The current total estimated abundance of the Central North Pacific stock of humpback whales is 4,005 individuals (NMFS 2005b). NMFS (2005b) reports abundance within known feeding areas in Alaska as southeast Alaska (961 whales), Kodiak Island area (651 whales), and Prince William Sound (149 whales). At least some portions of this stock have increased in abundance between the early 1800s and 2000 (Tetra Tech 2006). The rate of population increase in southeast Alaska may have recently declined, which may indicate the stock is approaching its carrying capacity (NMFS 2005b).

North Pacific Right Whale (Eubalaena japonica). The northern right whale was listed as endangered under the ESA on June 2, 1970. On April 10, 2003, NMFS published a final rule (NMFS 2003a) that split the endangered northern right whale into two endangered species: North Atlantic right whale (Eubalaena glacialis) and North Pacific right whale (Eubalaena japonica) (Tetra Tech 2006). This section discusses the North Pacific right whale.

The North Pacific stock of northern right whale has historically occurred across the North Pacific, north of 35ºN latitude, with concentrations of whales occurring in the Gulf of Alaska, eastern Aleutian Islands, south-central Bering Sea, Sea of Okhotsk, and the Sea of Japan (NMFS 2001).

Two populations of North Pacific right whale are thought to exist, one in the western North Pacific off Russia and the other in the eastern North Pacific off Alaska (MMC 2002). The distribution and status of neither population is well understood. The eastern population is more severely depleted than the western population, with the population thought to number in the tens of individuals versus hundreds for the western population (MMC 2002; NMFS 2007). Between 1900 and 1994, there have been only 29 reliable sightings of right whales in the eastern North Pacific (Tetra Tech 2006). Since that time, between 4 and 13 individuals have been sighted each year; all these sightings have occurred in a 60 by 100 nautical mile area about 200 nautical miles north of Unimak Pass in the southeastern Bering Sea (CBD 2000; MMC 2002; NMFS 2002a).

Because the North Pacific eastern population is so small and infrequently sighted, little is known about their range and movements (Tetra Tech 2006). The whales are thought to move northward to high latitudes in the spring, summer in the Bering Sea and Gulf of Alaska, and move southward in the fall and winter possibly as far south as Baja, California (CBD 2000; NMFS 2002a).

Historically, right whales often were observed in coastal waters where their slow speed and tendency to float after death resulted in their near-decimation by whalers in the 1800s. Recent whale sightings have all occurred within the shallower waters of the continental shelf (CBD 2000). The feeding preferences of North Pacific right whales have not been determined; however, NMFS has noted that these whales probably feed almost exclusively on calanoid copepods, a component of zooplankton (NMFS 2002b).

The pre-exploitation size of the population of North Pacific right whales has been estimated as likely exceeding 10,000 animals (67 FR 7660, February 20. 2002) to 19,000 animals (CBD 2000). The current population is thought to be very small, perhaps in the tens of animals and no sightings of a cow with a calf have been confirmed since 1900 (NMFS 2002b).

On June 3, 1994, NMFS designated critical habitat for the species of northern right whale (NMFS 1994a), which as of April 10, 2003, became referred to as the North Atlantic right whale (NMFS 2003a). The three areas designated as critical habitat are in the North Atlantic Ocean off the eastern United States. NMFS determined at the time that insufficient information was available to consider critical habitat designation for other stocks of northern right whale, including whales residing in the North Pacific (Tetra Tech 2006).

On October 4, 2000, the Center for Biological Diversity petitioned the NMFS to designate a portion of the southeastern Bering Sea as critical habitat for the North Pacific right whale on the basis of annual sightings of whales in the area that suggest the area is a summer feeding ground for this severely depleted population (CBD 2000). On July 11, 2001, the Marine Mammal Commission responded to this request by recommending that NMFS proceed with designating the area as critical habitat and modify the boundaries as future data about future population distribution becomes available (MMC 2002). However, on February 20, 2002, NMFS published notice that it had determined that the petitioned action to designate critical habitat was not warranted (NMFS 2002b). NMFS noted that because the essential biological requirements of the population in the North Pacific Ocean are not sufficiently understood, the extent of critical habitat cannot be determined. No critical habitat has been designated for the Northern Pacific right whale (Tetra Tech 2006).

Sei Whale (Balaenoptera borealis). The sei whale was listed as endangered under the ESA on June 2, 1970. Sei whales have historically occurred in all oceans of the world, migrating from low-latitude wintering areas to high-latitude summer feeding grounds (Fisheries and Oceans Canada 2005). In the eastern North Pacific, sei whales are common in the southwest Bering Sea to the Gulf of Alaska (Tetra Tech 2006), and offshore in a broad arc between 40ºN and 55ºN (Environment Canada 2004a).

The sei whale prefers deeper offshore waters, with preferred habitat tending to occur in offshore areas that encompass the continental shelf break (Gregr and Trites 2001). Commercial whaling catch records off British Columbia indicate that less than 0.5 percent of sei whales were caught in waters over the continental shelf (Environment Canada 2004a). No critical habitat has been designated for the sei whale (Tetra Tech 2006).

Sei whales reach sexual maturity between 5 and 15 years of age and may live as long as 60 years. Sei whales feed primarily on copepods, followed by squid, euphasids, and small pelagic fish (Trites and Heise 2005).

The pre-whaling abundance of sei whales in the North Pacific has been estimated to range from 42,000-62,000 animals (Ohsumi and Wada 1974). There are no current data on trends in sei whale abundance in the eastern North Pacific waters. A fact sheet prepared by NMFS (2000b) on the eastern North Pacific stock of sei whale suggests that the population is expected to have grown since being given protected status under the Marine Mammal Protection Act in 1976; however, continued unauthorized take, incidental ship strikes, and fill net mortality makes this uncertain (Tetra Tech 2006).

Sperm Whale (Physeter macrocephalus). The sperm whale was listed as endangered under the ESA on June 2, 1970. Sperm whales inhabit all ocean basins, from equatorial to polar waters. Their distribution generally varies by gender and the age composition of groups, and is influenced by prey availability and oceanic conditions (Perry et al. 1999). In the North Pacific, sperm whales are distributed widely, with the northernmost boundary extending from Cape Navarin (62ºN) to the Pribilof Islands (NMFS 2007). Mature females, calves and immature whales of both sexes in the North Pacific are found in social groups, and remain in tropical and temperate waters year round from the equator to approximately 45ºN latitude (NMFS 2007; Perry et al 1999). Males lead a mostly solitary life after reaching sexual maturity between 9 and 20 years of age, and are thought to move north in the summer to feed in the Gulf of Alaska, Bering Sea, and waters around the Aleutian Islands (Tetra Tech 2006). Research has revealed considerable east-west movement between Alaska and the western North Pacific (Japan and Bonin Islands), with little evidence of north-south movement in the eastern Pacific (NMFS 2007; Perry et al 1999).

The habitat preferred by sperm whales differs among the sexes and age composition of individual whales (Tetra Tech 2006). The social groups composed of females, calves, and immature whales have a broader habitat distribution than males; they are generally restricted to waters with surface temperatures greater than 15ºC and are rarely found in areas with water depths less than 650 to 3,300 feet (Gregr and Trites 2001; Reeves and Whitehead 1997). Males exhibit a tighter distribution over deeper waters along the continental shelf break, and are often found near steep drop-offs or other oceanographic features (e.g., offshore banks, submarine trenches and canyons, continental shelf edge), presumably because these areas have higher foraging potential (AKNHP 2005; Gregr and Trites 2001).

The distribution of sperm whales indicates that male sperm whales are the only sex that frequent Alaskan waters. Available evidence indicates that males are present offshore in the Gulf of Alaska during the summer (Tetra Tech 2006). No critical habitat has been designated for the sperm whale.

Sperm whales feed primarily on medium-sized deep water squid, with the remaining portion of their diet composed of octopus, demersal and mesopelagic sharks, skates, and fish; feeding occurs all year-round, usually at depths below 400 feet (AKNHP 2005; NMFS 2005c).

Pre-whaling abundance estimates of sperm whale in the North Pacific are considered unreliable and range from 472,000 to 1,260,000 animals (NMFS 2007; Perry et al 1999; NMFS 2005c).

The abundance of whales in the North Pacific in the 1970s was estimated to be 930,000 animals (Rice 1989). The current abundance of the North Pacific stock (Alaska) of sperm whale is unknown (NMFS 2005c).

Steller Sea Lion (Eumetopias jubatus). The Steller sea lion (Eastern and Western Stocks) was listed as a threatened species on April 5, 1990 (FR 55 (227): 49294-49332) due to substantial declines in the western portion of the range. In contrast, the eastern portion of the range (southeastern Alaska and Canada) was increasing at 3% annually prior to 1990. In 1997, the Steller sea lion population was split into a western distinct population segment (DPS) and an eastern DPS based on demographic and genetic dissimilarities (FR 62 (86): 24345-24356). Due to the persistent decline, the western DPS was reclassified as endangered, while the increasing eastern DPS remained classified as threatened. Finally, the eastern distinct population segment of Steller sea lions was delisted under the ESA on November 4, 2013 (78 FR 66140).

The WDPS of Steller sea lion inhabits an area of Alaska from Prince William Sound (144° W) west through the Aleutian Islands and in Russia on the Kamchatka peninsula, Kuril Islands and the Sea of Okhotsk. In the U.S., the WDPS ranges from 144° W longitude west through 172° E longitude. Steller sea lions use 38 rookeries and hundreds of haulouts within the range of the WDPS in Alaska (NMFS 2014).

The Western DPS includes Steller sea lions that reside in the central and western Gulf of Alaska, Aleutian Islands, as well as those that inhabit the coastal waters and breed in Asia (e.g., Japan and Russia). The Eastern DPS includes sea lions living in southeast Alaska, British Columbia, California, and Oregon (NMFS 2016a)The breeding season for the Steller sea lion is from May to July, where the animals congregate at rookeries, the males defend territories, mating occurs, and the pups are born (Tetra Tech 2006). Non-reproductive animals congregate to rest at more than 200 haulout sites where little or no breeding occurs. Sea lions continue to gather at both rookeries and haulout sites throughout the year, outside of the breeding season (NMML 2004b). Habitat types that typically serve as rookeries or haulouts include rock shelves, ledges, and slopes and boulder, cobble, gravel, and sand beaches. Seasonal movements occur generally from exposed areas in summer to protected areas in winter (ADFG 1994c).

It is estimated that there were over 300,000 Steller sea lions in the world in the late 1970s. Since then, the Alaskan sea lion population has declined. The western population declined approximately 70% between the late 1970s and 1990. They reached a peak of approximately 15% per year decline during 1985-1989. NMFS uses six sub-regions within the WDPS in Alaska for trend and status monitoring, three (eastern, central and western) within both the Aleutian Islands and Gulf of Alaska. An estimate of the abundance of the entire (U.S. and Russia) WDPS of Steller sea lions (pups and nonpups) in 2012 was estimated to be 79,300 sea lions (NMFS 2014).

In the consultation process for this Draft Permit, NMFS raised concerns about the potential impacts that discharges of whole (unground) seafood waste could have on Steller sea lion foraging behavior in the permit coverage area. In response, the EPA included a conditional grinding provision that would require permittees that discharge greater than ten million pounds per reporting year to grind seafood waste if discharge occurs in Steller sea lion critical habitat areas. The EPA will also be taking comments on NMFS' suggested mitigation measures for vessels exempted from grinding in Steller sea lion critical habitat to help quantify and reduce the effects of the action.

Northern Sea Otter (Enhydra lutris kenyoni). The northern sea otter (Southwest Alaska population) was designated threatened on September 8, 2005 (FR 70 (152): 46365-46386). This designation was due to a 55-67% decline in this population segment since the mid-1980s.

Sea otters generally occur in shallow water areas near the shoreline where they forage in shallow water (Tetra Tech 2006). Visual observation of 1,251 dives by sea otters in Southeast Alaska, indicates that foraging activities typically occur in water depths ranging from 6 to 100 feet), although foraging at depths over 300 feet was observed (Bodkin et al 2004).

Sea otter movements are influenced by local climatic conditions such as storm events, prevailing winds, and in some areas, tidal conditions (Tetra Tech 2006). They tend to move to protected or sheltered waters during storm events or high winds (USFWS 2005). The home ranges of sea otters in established populations are relatively small and animals usually do not migrate or travel unless an area has become overpopulated or food is scarce (ADFG 1994d). Sexually mature females have home ranges of 5 to10 miles. Breeding males remain for all or part of the year within the bounds of their territory which ranges from 300 feet to 0.6 mile. Male sea otters that do not hold territories may move greater distances between resting and foraging areas than territorial males (USFWS 2005). No critical habitat has been designated for the northern sea otter.

Sea otters mate at all times of the year, and young may be born in any season; however, in Alaska, most pups are born in late spring (ADFG 1994d). Females typically give birth in the water, although they have been observed giving birth on shore (USFWS 2005). Male sea otters appear to reach sexual maturity at 5 to 6 years of age and have a lifespan of about 10 to 15 years (Tetra Tech 2006). Female sea otters reach sexual maturity at 3 to 4 years of age and have a lifespan of about 15 to 20 years (USFWS 2005). Sea otters are gregarious and may become concentrated in an area, sometimes resting in pods of fewer than 10 to more than 1,000 animals (ADFG 1994d).

The search for food is one of the most important daily activities of sea otters, as large amounts are required to sustain the animal in healthy condition. Sea urchins, crabs, clams, mussels, octopus, other marine invertebrates, and fishes make up the normal diet of sea otters (ADFG 1994d).

Commercial harvest drastically reduced historical populations to a few hundred animals at the beginning of the 20th century. Population regrowth began following legal protection and sea otters have since recolonized much of their historic range in Alaska (USFWS 2014). By the 1980s, sea otters were present in all the island groups of the Aleutians (Estes 1990). The most recent abundance estimates for survey areas within the Southwest Alaska stock along the shorelines of the Aleutian Islands in April 2000 resulted in a count of 2,442 sea otters in the nearshore waters (Doroff et al. 2003). Although current numbers are well below historical levels, the overall population trend for the Southwest Alaska stock is believed to have stabilized. Comparison of aerial and skiff survey counts at six islands in 2000 was used to calculate an adjusted population estimate of 8,742 sea otters (USFWS 2014).

By the 1980s, sea otters in Southwest Alaska increased in abundance and recolonized much of their former range. The population in Southwest Alaska is currently estimated at 41,865 animals (USFWS 2005).

Beluga Whale – Cook Inlet Distinct Population Unit (Delphinapterus leucas). Beluga whales are one of the two members of the family Monodontidae and are divided into five stocks on the basis of mitochondrial DNA analyses: Cook Inlet, Bristol Bay, eastern Bearing Sea, eastern Chukchi Sea, and Beaufort Sea (NMFS 2007). Beluga whales are circumpolar in distribution, inhabiting subarctic and Arctic waters. In Alaska, their range extends from Yakutat to the Alaska-Canada Border in the Beaufort Sea. Some of the northern populations undertake seasonal migrations spending winters in the Bering Sea and following the receding sea ice to the Beaufort Sea in summer (NMFS 2007). Beluga whales tend to spend winters in offshore areas associated with pack ice or open leads and polynyas in ice-covered areas; in spring they move shoreward to estuaries, bays, and rivers.

NMFS stock assessment reports estimate the combined population of the five beluga whale stocks in U.S. waters at nearly 60,000 individuals (NMFS 2007). NMFS reports that the population trends for the Beaufort Sea and Eastern Bering Sea stocks are unknown; these two stocks account for over 90 percent of the estimated population of beluga whales in U.S. waters. The population of the Eastern Chukchi stock, consisting of 3,710 individuals, shows no evidence of decline, and NMFS considers the population of the Bristol Bay stock (1,619) to be stable to increasing (NMFS 2007).

Population trend analyses conducted on the Cook Inlet stock between June 1994 and June 1998 were constrained by the limited data available but showed a high probability that a 40 percent decline in the population had occurred during the time period (NMFS 2000a; NMFS 2005d). The Cook Inlet stock of beluga whales was placed on the ESA candidate list in 1991 (NMFS 1991). The stock was more recently determined to be depleted under the Marine Mammal Protection Act (NMFS 2000a).

Little information is available on the winter distribution of the Cook Inlet stock although some tracking data places individuals in the southern portions of the inlet in winter months. In summer, beluga whales concentrate near the mouths of the sediment-laden rivers in the northern portion of the Cook Inlet.

NMFS investigated the potential sources of the decline of the Cook Inlet stock, identifying natural and human-induced sources of potential impacts that included:

- Habitat capacity and environmental change
- Strandings events
- Predation
- Subsistence harvest
- Commercial fishing
- Oil and gas development

Despite the imposition of mandatory and voluntary restrictions on subsistence harvests beginning in 1999, there has been no clear trend or indication that the population is increasing (NMFS 2005d). As a result, NMFS developed the Draft Conservation Plan for the Cook Inlet Beluga Whale (Delphinapterus leucas) in 2005 to establish goals and objectives that can be achieved cooperatively to promote the recovery of the Cook Inlet beluga whale population. The goals and objectives apply to a range of potential sources of impacts including those identified above as well as shoreline development, vessel traffic, and noise (Tetra Tech 2006). Since the species has not received a designation under the ESA, critical habitat is not applicable.

Gray whale

The Gray whale (Eschrichtius robustus) was listed as endangered throughout its range on June 2, 1970 under the Endangered Species Conservation Act of 1969 (35 FR 31094). Gray whales are also protected under the Marine Mammal Protection Act of 1972.

Gray whales are frequently observed traveling alone or in small, unstable groups, although large aggregations may be seen on feeding and breeding grounds. Gray whales are bottom feeders and known to filter food through baleen plates while rolling on their sides and swimming (NMFS 2013b). Gray whales become sexually mature between 6-12 years, at an average of 8 years old. After 12-13 months of gestation, females give birth to a single calf (NMFS 2013b).

The Western North Pacific population remains highly depleted and its continued survival is questionable (NMFS 2013b). According to the 2014 stock assessment (NMFS 2015a), the population is estimated to include approximately 100 individuals. Given that some WNP gray whales occur in U.S. waters, there is some probability of WNP gray whales

being killed or injured by ship strikes or entangled in fishing gear within U.S. waters. Additional concerns include shipping vessel congestion in migratory corridors, oil and gas projects, and ocean acidification (NMFS 2015).

6.2 EFFECTS OF PERMITTED DISCHARGES ON THREATENED AND ENDANGERED SPECIES

This section summarizes potential effects on threatened and endangered species of discharges by offshore seafood processors covered under the Draft Permit. There have been limited studies directed at evaluating these impacts; however, it is possible to make inferences based on species life history as described above and the information in Section 5.

The primary concern of the proposed seafood processing waste is a short term chemical and physical change in the water column. This potential change decreases over time and with distance from the outfall. Some of the dissolved constituents of the discharge, such as disinfectants, could be toxic to marine organisms, but should be in low levels and dissipate quickly. Chemical reactions, including reductions in dissolved oxygen, could result from constituents in the discharge as well as byproducts formed during the decomposition of seafood wastes. The potential effects of discharges, therefore, could occur as direct or indirect impacts, including exposure to decreased water quality, alterations in abundance and composition of food source communities, habitat degradation, and increased predation.

6.2.1 Fish

Assuming that that Snake River fall-run Chinook salmon, Snake River spring/summer run Chinook salmon, and Snake River sockeye salmon were to swim within the vicinity of a seafood processing waste discharge covered by the general permit, the potential for impacts is low. The fish are mobile and can transit out of the location of seafood processor waste discharge.

Because these fish do not lay eggs in ocean and areas of discharge, there is no danger of burial or suffocation of demersal eggs under waste piles. Salmonids and sturgeon remain in fresh water and estuaries for a few months to a few years, depending on the species, before migrating to the open ocean. Due to their small size and reliance on currents for transport, these are the most susceptible to water quality effects of offshore seafood processing discharge such as hypoxia, turbidity, and presence of disinfectants. Juvenile and adult fish are mobile and thus able to avoid discharge plumes as necessary.

Some fish species might be attracted to seafood processing discharge as a food source, with several potentially harmful results. First, it would put them at increased risk of toxic effects due to reduced water quality in the vicinity of the waste. Second, it could put them at increased risk of predation. Third, it could create dependence on an anthropogenic food supply which might run out. Finally, proximity to fishing vessels could increase the risk to these species of being caught as bycatch.

The primary threats to recovery of threatened and endangered anadromous fish are generally considered to be disruptions in spawning paths and degradation or loss of spawning grounds, often associated with water storage, conveyance, and withdrawal projects. Another threat to both anadromous and marine fish is overharvest, both directly and as bycatch. Nonetheless, reduction in water quality and prey abundance due to offshore discharge could potentially cause negative impacts on these species, particularly in earlier life stages.

Seafood processing waste is discharged in high tidal activity areas which allow for adequate dispersion and dilution, therefore, effects on habitat and prey of these fish species should be minimal.

6.2.2 Birds

The Steller’s and spectacled eiders and short-tailed albatross have designated critical habitat likely to be found within the Draft Permit action area.

The short-tailed albatross is a pelagic seabird, although it has been observed within three miles of shore. Since they typically do not make use of nearshore habitats, these birds would be more likely to be exposed to discharges from offshore facilities than those nearshore operations. Short-tailed albatross are surface feeders and the primary concern would be related to solid waste discharges and floating wastes, including offal as a food source.

Steller’s and spectacled eiders are more likely to be present along the shorelines where they would be exposed to the discharges from nearshore facilities rather than the floating, offshore dischargers. Sea birds may be attracted to discharge plumes as a food source and, therefore, be at increased risk of toxic effects of the discharge. Sea birds could also be indirectly affected by seafood processing waste if abundance of fish and other prey is disrupted due to eutrophication and related effects. Reed and Flint (2007) describe studies conducted in Dutch Harbor on the movement and foraging of Steller’s eiders (and harlequin ducks). They found that eiders are attracted to an area around a seafood processing discharge and municipal wastewater discharge likely due to eutrophication and associated enrichment of prey species. As a result of this attraction, the eiders may be at greater risk of impacts due to increased predation by bald eagles and other avian species (Reed and Flint, 2007). Other effects of waste discharges on eiders have not been documented to date. The Alaska Sealife Center, however, is currently completing research on the eider health, including the occurrence of diseases. Such diseases could be caused by consumption of commingled sanitary waste and possibly the seafood processing wastes. The results of the study, which should be available later in 2008, will likely provide additional data on whether seafood processing discharges are impacting eiders.

The permit lists protected areas excluded from coverage by the permit within 1 nautical mile of critical habitat for Steller’s or spectacled eiders from May 1 through September 30, and within 1 nautical mile of a state game sanctuary, refuge, critical habitat area, national park, preserve, or wildlife refuge. These exclusions to areas that are areas in which Steller’s and spectacled eiders spend the majority of their time should minimize potential effects to these species.

Seafood processing waste discharges are localized and limited to well-mixed waters in order to allow for dispersion and dilution of pollutants, therefore, potential impacts to threatened and endangered sea birds are likely to be minimal.

6.2.3 Marine Mammals

Of the thirteen threatened and endangered marine mammals likely to be found within the Draft Permit action area, four have had critical habitat designated. In the proposed seafood general permit, excluded areas for discharges are located out to 3 nm from a Steller sea lion rookery or major haul-out. The Northern Sea Otter critical habitat only extends to approximately 100 meters offshore, which is well inside the 3 nm boundary for federal waters. The Cook Inlet Beluga Whale critical habitat is within the Cook Inlet and while extends up to 3 nm offshore it is unlikely to overlap with vessel activities. The North Pacific right whale critical habitat includes a large area of the Bering Sea and is likely to overlap with the Draft Permit action area.

The threatened and endangered marine mammals are relatively large in size, which would lessen the direct impact of localized seafood processing discharge plumes on individual animals. These mammals are highly mobile and therefore able to avoid discharge areas. However, fish-eating species might be attracted to discharge as a food source. This would put them at increased risk of vessel strike or predation. This attraction could also create dependence on an anthropogenic food supply which might run out, and could habituate the animals to humans, potentially increasing danger to them if they are perceived as a nuisance.

Only the Right whale relies on phytoplankton as a food source. The Right whale forages in large areas is able to travel long distances for food sources. Therefore, the effects of seafood processing waste discharge on phytoplankton community abundance and structure, as described in Section 5, would only have minimal impacts on the Right whale and indirect impacts on the others mentioned above. If zooplankton abundance is affected indirectly by changes in the phytoplankton community or directly by the discharge itself, mammals such as the baleen whale species (right, sei, blue, fin, and humpback whales) that feed on zooplankton could be indirectly affected. Species such as killer whales and sperm whales that feed at a higher trophic level are less likely to be impacted.

Habitat degradation, depletion of prey, and aquatic pollution are considered to be threats to all threatened and endangered marine mammals. Impacts due to seafood processing waste are limited to the immediate vicinity of the discharge, and the receiving waters are sufficiently oxygenated and well-mixed to allow for dispersion and dilution of pollutants, therefore, effects on these species are likely to be minor. The potential exists for indirect effects as a result of a decrease of prey abundance if the discharges have the potential to affect prey species (e.g., benthic organisms or demersal fish species). Because of the localized areas of effects, however, the effects due to loss of prey are likely to be limited. Indirect effects further include the sea lions attraction to seafood processing waste discharges as well as to piles (to prey on the species foraging on the piles). In offshore locations, killer whales are also attracted to the discharges and pose a threat of predation to the sea lions (Loughlin and York, 2000). For offshore facilities, the attraction to seafood processing discharges places them at increased risk of human contact. The habituation to humans can be a danger to the animals if they become a nuisance and humans take action against them. Most of the offshore seafood discharges will occur in high tidal areas which allow for dispersion and dilution of the seafood wastes which should minimize the potential for sea lions or killer whales to be attracted to the discharge therefore minimizing predation from killer whales and contact with humans.

The potential also exists for sea otters and Steller sea lions to experience indirect effects that include a reduction in food sources in the form of burial of food or changes to the benthic community. Most of the offshore seafood processors will be in areas of high tidal activity allowing for dispersion of the wastes and less potential for waste piles to occur resulting in burial of prey resources. Because of the localized areas of effects and dispersion of wastes, the effects due to loss of prey are likely to be limited.

While the Cook Inlet stock of beluga whales feed within shallow waters on prey species that include benthic organisms the general location of their feeding activity in northern Cook Inlet would generally preclude them from direct interactions with fish processing vessels.

Habitat degradation, depletion of prey, and aquatic pollution are considered to be threats to all threatened and endangered marine mammals. Impacts due to seafood processing waste are limited to the immediate vicinity of the discharge, and the receiving waters are sufficiently oxygenated and well-mixed to allow for dispersion and dilution of pollutants, therefore, effects on these species are likely to be minor.

6.2.4 Reptiles

Of the four marine turtle species discussed, only two (leatherback and loggerhead) are likely to be found within the Draft Permit action area. Green sea turtles and olive ridleys prefer subtropical and tropical waters over the colder waters found in the EEZ off of Alaska. Loggerheads have been reported as far north as Alaska and as far south as Chile in the eastern Pacific. In the U.S., occasional sightings are reported from the coasts of Washington and Oregon, but most records are of juveniles off the coast of California. Leatherbacks have a global range; they are primarily pelagic but also forage in coastal waters, and follow their prey to temperate waters in the summer. Therefore, it is highly likely that leatherbacks will be found in the Draft Permit action area, and moderately likely that loggerheads will be found there. No known sea turtle nesting sites are located in the Draft Permit action area.

The primary constituent element essential for conservation of leatherback turtles is the sufficient availability of prey species, primarily scyphomedusae (jellyfish). Jellyfish are not expected to be directly affected by seafood processing discharge, although the lower trophic species on which they feed, such as plankton and small crustaceans, could be affected, resulting in indirect impacts to jellyfish and thus to leatherbacks.

If turtles are attracted to discharge plumes as a food source, this would increase risk of incidental capture and vessel strikes. Indirect effects to prey species of sea turtles due to eutrophication are possible. Environmental contamination is considered a minor threat to the recovery of all four ESA listed turtles.

Since the Draft Permit only allows seafood processing waste discharge to high tidal activity areas, and the receiving waters are sufficiently oxygenated and well-mixed to allow for dispersion and dilution of pollutants, effects on prey and habitat of these sea turtles are likely to be minimal.

6.3 SUMMARY

Species listed under the ESA that are likely to occur in waters that are included in the general permit include fish, marine birds, and marine mammals. Limited research on the impacts of seafood processing waste discharges on these species means the impacts are generally unknown. However, it is possible to make inferences based on species life history and information on the potential impacts to marine organisms.

Discharges could have direct or indirect impacts including exposure to decreased water quality, alterations in abundance, and composition of food source communities, habitat degradation, and increased predation. Most marine mammals, fish, and birds are highly mobile and therefore able to swim out of possible harm’s way. Also, seafood processing discharges can present a food source or can change the dynamic of the presence of other species foraging on the waste that may influence the endangered or threatened species.

The Draft Permit prohibits the occurrence of substances that float as debris, scum, oil, or other matter to form nuisances on the sea surface and thereby eliminate potential impact of oil on species foraging on the waste. Since, seafood processing wastes are discharged in high tidal activity areas which allows for adequate dispersion and dilution, and impacts to receiving waters are localized, effects on habitat and prey are likely to be minor.

SECTION 7.0

COMMERCIAL AND RECREATIONAL FISHING

The determination of “unreasonable degradation” of the marine environment is to be made based upon consideration of the ten criteria listed in Section 1.0. This section provides information pertinent to consideration of the ocean discharge criteria shown below:

Criterion #7: “Existing or potential recreational and commercial fishing, including finfishing and shellfishing”

This section will assist in evaluating criterion #7 by briefly describing the commercial and recreational fisheries in the Draft Permit action area, and discussing the potential impacts that seafood processing waste discharges may have on these activities.

7.1 COMMERCIAL HARVESTS

Alaskan waters sustain several commercially important fisheries. Major fisheries exist for salmon, groundfish, crab, herring, and shrimp. Other minor fisheries include invertebrates, such as scallops, clams, sea cucumbers, and abalone.

Activities covered under the existing general permit result directly from commercial harvest of seafood from Alaskan waters. Section 2.1 discusses the location of commercial fisheries along with the characterization of the fish processing industry. Information on commercial harvests is presented briefly below. The management of marine resources in the Draft Permit action area is vested in the North Pacific Fishery Management Council (NPFMC or Council), one of eight regional councils established by the Fishery Conservation and Management Act of 1976. It is a stakeholder body that formally advises the National Marine Fisheries Service (NMFS) on management of fisheries in federal waters off of the coast of Alaska. The Council has primary responsibility for groundfish management in the Gulf of Alaska, Bering Sea and Aleutian Islands, including cod, pollock, flatfish, mackerel, sablefish, and rockfish species. Other large Alaska fisheries such as salmon, crab and herring are managed primarily by the State of Alaska.

7.1.1 Groundfish

The commercial groundfish fishery is the largest fishery in terms of pounds landed and value. The fishery consists chiefly of walleye pollock, Pacific cod, Pacific halibut, rockfish, flounder, and sablefish with walleye pollock and Pacific cod being the primary target species. The majority of groundfish harvested in Alaskan waters are taken in the Gulf of Alaska, Bering Sea, and offshore waters of the Aleutian Islands.

Walleye pollock comprise the largest proportion of the catch for the Gulf of Alaska and Bering Sea fisheries. In these two areas, commercial fishing is concentrated along the outer continental shelf and upper slope.

The groundfish fishery is managed by imposing catch limits on target and bycatch species for specific management regions and by restricting fishing activities from specified areas (which may include important spawning and marine mammal habitats). The groundfish commercial fishery commences on the first of January and continues throughout the year until the fishery in a particular management region is closed due to catch or bycatch quotas having been reached.

A regulatory closure of the Bering Sea fishery for the protection of marine mammals from April through September results in a fishery that is concentrated in the first and last three months of the year in the Bering Sea.

Walleye pollock is the most abundant groundfish species in the Bering Sea and Aleutian Islands and constitutes the majority of the total groundfish harvested. The 2017 Bering Sea pollock total allowable catch was 2,965,217,426 pounds (NMFS, 2017a). Over 3 billion pounds are harvested annually from the Bering Sea and Aleutian Islands.

Pacific cod are harvested by foreign and domestic fisheries in the Bering Sea. The 2017 Bering Sea Pacific cod total allowable catch was 493,182,899 pounds (NMFS, 2017a). In general, total allowable catch numbers have increased in the past decades also seasonal apportionments to prevent adverse modification of critical habitat for Steller sea lions have been in effect in recent years.

The Pacific halibut fishery in the Gulf of Alaska has been an important fishery since the 1910s and the Bering Sea halibut fishery began in 1928. Halibut were traditionally harvested by Canadian and U.S. fishermen and Japanese and Soviet fishermen were allowed to fish in the Bering Sea from 1962 to 1976. In 1981, however, the fishery was restricted to domestic vessels only, although significant quantities continue to be taken by foreign fisheries as bycatch (Aleutians East CRSA 1984).

7.1.2 Salmon

The State of Alaska manages the salmon fishery which includes five harvested species: pink (Oncorhynchus gorbuscha), sockeye (O. nerka), Chinook (O. tshawytscha), coho (O. kisutch), and chum (O. keta). This fishery is separated into four management regions: Southeastern, Central, Arctic-Yukon-Kuskokwim, and the Westward Management Region.

The most abundant salmon species harvested in Alaskan waters is the pink salmon. In 2005, the highest volume of salmon harvested was in Prince William Sound at 208 million pounds with Southeast Alaska next at 124 million pounds. Sixty-two million pounds were harvested in Bristol Bay and the Naknek River. Other areas received lower harvest amounts.

The Bering Sea-Bristol Bay sockeye run is the largest run of this species in the world. Major salmon runs for this area occur in the Togiak, Nushagak, Kvichak, Egegik, Ugashik, Meshik, And Chignik river drainages (Bristol Bay Coastal Resource Service Area 1992).

The five salmon species are located in several different habitats in any given location. Cook Inlet may be used as an example of salmon habitat utilization. Adult salmon are present in nearshore and estuarine waters adjacent to the Kenai Peninsula from late April to early November and begin migration to freshwater from May to November. Juvenile salmon emerge from bottom substrates in freshwater from April to June. Pink and chum salmon move immediately downstream to estuarine areas while Chinook, coho, and sockeye remain in freshwater for one to four years before moving to marine waters. Chum salmon remain within 30 miles of the shore during July through September and young Chinook remain in nearshore waters during their first year at sea.

7.1.3 Herring

The Pacific herring fishery is managed by the Alaska Department of Fish & Game. Pacific herring stocks occur from southeast Alaska to Norton Sound. The majority of the commercial harvest occurs in the form of sac roe with significantly smaller production for food and bait. The sac roe fishery occurs during the spawning season (from late March in southeast to July in the north) while the food and bait fishery occurs in the winter (southeast) and summer (Dutch

Harbor). Fisheries are monitored and closed as necessary to maintain sustainable population numbers. The fishery in Prince William Sound, for example, has been closed since 1998 and fisheries in Cook Inlet have been limited to certain areas. Herring spawning grounds are located in the intertidal and shallow subtidal waters where they typically spawn on eelgrass, kelp, rockweed, and other marine vegetation (Pelican Coastal Management Program 1994).

7.1.4 Shellfish

Shellfish fisheries are composed chiefly of crab (Tanner, Dungeness, and king), shrimp, scallops, clams, sea cucumbers, and abalone. These fisheries are managed by the Alaska Department of Fish & Game in state waters and the North Pacific Fisheries Management Council in the Fisheries Conservation Zone. The crab fishery is the largest shellfish fishery and the fishing season varies with location, species harvested, and allowable catch. Large crab fisheries are located in the Bering Sea and Bristol Bay. Since the early 1980s, harvests of king and Tanner crab have been in decline (ADF&G 2005). Many of the king, Dungeness, Tanner, hair, and snow crab fisheries have been closed intermittently (and in some cases for multiple years) in different locations since 1998. Potential reasons for the depressed numbers include overharvest, decline in recruitment due to adverse climatic conditions, and unintentional bycatch of broodstock (ADF&G 2005).

Shrimp populations crashed in the western and central portions of the Gulf of Alaska in the late 1970s through the early 1980s. The crash coincided with a warming of the waters in these areas and increases in the populations of pollock, Pacific cod, and flatfish. As a result of the crash, fisheries in these portions of the Gulf of Alaska have been closed to trawling, Cook Inlet is closed to all shrimp harvests, and Prince William Sound is closed to commercial shrimp pot fishing. Shrimp production therefore is currently concentrated in Southeast Alaska where production levels have dropped since the mid-1990s although the fisheries are considered stable (ADF&G 2005).

Fisheries for scallops, clams, sea cucumbers, and abalone are generally on a much smaller scale than for other harvested invertebrates. Fisheries occur throughout most of the year in various locations, depending upon species harvested, and are generally concentrated near coastal areas.

7.2 RECREATIONAL HARVESTS

Alaskan residents and non-residents participate in Alaskan recreational fisheries in all areas of Alaska. Since the early 1990s, a shift has occurred in the percentage of resident to non-resident participants in recreational fishing with continued increases in the number of non-residents purchasing sport fishing licenses. In 2003, over 477,000 non-residents purchased fishing licenses along with 188,000 residents (ADF&G 2006). While residents accounted for only 40 percent of the fishing licenses sold, they accounted for 60 percent of the days fished in 2003 (ADF&G 2006). The majority of the fishing effort has consistently occurred in the southcentral region (including Cook Inlet, Kenai Peninsula, Prince William Sound, and Kodiak), followed by the southeast region (the area from Ketchikan to Yakutat), and to a much lesser extent, the Arctic-Yukon-Kuskokwim region. Since 1993, the Kenai Peninsula has annually received the greatest number of angler-days fished (30 to 35 percent of the state total) with the Upper Copper/Upper Susitna Drainages and North Gulf Coast/Prince William Sound receiving the second-most number of angler-days (ADF&G 2006). The predominant species harvested are salmon, trout, Dolly Varden char, and Pacific halibut. Other species commonly harvested include herring, cod, clams (razor and steamer), crab, and shrimp. The 2003 marine fish harvested in all areas of Alaska included 177,102 Chinook salmon, 783,328 coho salmon, 447,492 sockeye salmon, 136,495 pink salmon, 34,110 chum salmon, 67,330 Dolly Varden char, 402,232 halibut, and 590,018 razor clams (ADF&G 2006).

7.3 SUBSISTENCE HARVESTS

Subsistence, as defined by state and federal law, is the customary and traditional non-commercial use of wild resources for a variety of purposes such as food, clothing, fuel, arts, crafts, sharing, and customary trade. Under State law, rural residents qualified for subsistence between 1978 and 1989; court rulings resulted in changes to qualifications for subsistence in 1990 where all Alaska residents may qualify as subsistence users (ADF&G 2000). Subsistence resources are important to the economy and culture of many Alaskan communities, especially for the residents of rural areas with limited road access. Subsistence harvests in many of these communities constitute a major proportion of the daily diets for these residents. Over 123,000 people in about 270 communities lived in rural areas in 1999 with 51 percent being Alaska Natives. Statewide, 95 percent of households in rural areas used fish gathered as part of subsistence activities and 86 percent used game (ADF&G 2000). Subsistence harvesting occurs in all regions of the state with the largest annual harvest occurring in the western and Arctic regions of the state, from the tip of southern Norton Sound to Kuskokwim Bay and from southern Norton Sound to the North Slope, respectively (Wolfe and Bosworth 1990).

Subsistence harvesting generally occurs in rivers and nearshore waters on a year round basis for shellfish and other marine invertebrates, and seasonally for salmon and halibut. Species harvested include salmon, halibut, herring, whitefish (pollock), various shellfish and other invertebrates, marine mammals, and terrestrial mammals. Fish constitute the majority of the subsistence harvest, accounting for approximately 60 percent by weight of the total harvest (ADF&G 2000). The proportion of each species harvested varies among households and between communities. Marine mammals are allowed to be used as a subsistence resource by regulation and the numbers taken vary substantially among communities.

Waterfowl, particularly year round residents such as white-winged scoters, mallards, and goldeneyes, are harvested in winter months in coastal areas. Other ducks and geese are taken in the spring and fall when they are in coastal areas, rivers, and lakes.

7.4 EFFECTS OF SEAFOOD WASTE DISCHARGES ON HARVEST QUANTITY

Commercial, recreational, and subsistence fisheries have the potential to be adversely impacted by seafood waste discharges either directly by the discharged processing wastes or indirectly through effects such as alteration of habitat and increased predation. Potential direct and indirect effects to these fisheries are discussed below.

7.4.1 Commercial Fisheries

Seafood waste discharges may adversely impact commercial groundfish fisheries in areas proximal to the discharges by decreasing fish stocks of walleye pollock and Pacific cod.

For example, walleye pollock form dense aggregations, particularly on the Alaska Peninsula side of Shelikof Strait and in the western Gulf of Alaska, during a spawning period from mid-March to early-May (Picquelle and Megrey 1993). Spawning produces a large concentration of eggs (ranging from 3,004 to 23,171/m2) that generally remain below 492 feet for two weeks until hatching. Once hatched, the larvae tend to concentrate in the upper 164 feet and drift southwestward (Incze et al. 1989). Eggs have the potential to be smothered by the deposition of solids and larvae may be affected by increased predation from the attraction of fish and waterfowl to the discharges. The extent to which impacts could occur is dependent upon the type of wastes, the amount of wastes generated, and the location of the discharge.

The proposed NPDES general permit retains the prohibition of discharges within 1 nautical mile of designated critical habitat, protecting species and special resource areas.

Pacific cod produce large concentrations of demersal eggs which hatch after a 10 to 20 day incubation period. They are believed to spawn during the winter mainly in coastal areas with rocky bottoms. Although it is not likely, discharges during this time could adversely affect both egg and larvae survival if smothered. These effects are discussed further in Section 5.0.

7.4.2 Recreational and Subsistence Fisheries

The presence of nearshore and shore-based seafood processing plants, tenders, fishing vessels, and all the associated activities can impact recreational activities of anyone wishing to use that shoreline or waters near and around the seafood plant/vessel for other purposes.

In some small rural, Alaskan communities, the locals are willing to accept the presence of a seafood processing plant for the economic gains of having a place to sell and process their fish. Seafood discharges in one Alaskan community attracts hundreds of seagulls and the town resonates with the sound of these birds most of the summer in addition to their presence on buildings, docks and in the harbor. In some areas, the smells from the seafood discharges at low tide can be quite strong but most of the locals accept this in order that they or others may benefit from having fish processors in town. Other people in the community often do not wish to complain for fear of becoming unpopular in a small town or village (ADEC 2007 pers. comm). Since discharges covered by the proposed permit are at least 0.5 NM from shore, these issues should not arise, if the limitations and monitoring in the proposed permit are adhered to.

In other instances, the presence of seafood waste discharges increases the presence of species that are then harvested readily by recreational and subsistence fishers. For example, halibut fishing can improve in areas where at-sea discharges occur on a regular basis. (ADEC,per.com., 2007).

7.5 SUMMARY

Alaskan waters sustain several commercially important fisheries. Major fisheries exist for salmon, groundfish, herring, and crab. Other minor fisheries include invertebrates, such as shrimp, clams, and scallops.

The groundfish fishery is the largest fishery in Alaska in terms of pounds harvested and employment. The commercial groundfish fishery consists chiefly of walleye pollock, Pacific cod, Pacific halibut, rockfish, flounder, and sablefish with walleye pollock and Pacific cod being the primary target species. The majority of groundfish harvested in Alaskan waters are taken in the Gulf of Alaska. Bering Sea, and offshore waters off the Aleutian Islands. Five species of salmon are commercially harvested in Alaskan waters: pink, sockeye, Chinook, coho, and chum, with pink salmon being the most frequently harvested species. The Bering Sea Bristol Bay sockeye salmon run is the largest run of this species in the world.

Alaskan residents as well as non-residents participate in Alaskan recreational fisheries in all areas of Alaska. The majority of the fishing effort occurs in the southcentral region (includes Cook Inlet, Kenai Peninsula, Prince William Sound, and Kodiak), followed by the southeast region (includes area from Ketchikan to Yakutat), and to a much lesser extent, the Arctic-Yukon-Kuskokwim region. The primary species harvested are salmon, trout, Dolly Varden char, and Pacific halibut. Other species commonly harvested include herring, cod, clams (razor and steamer), crab, and shrimp.

Subsistence, as defined by state and federal law, is the customary and traditional non-commercial use of wild resources for a variety of purposes such as food, clothing, fuel, arts, crafts, sharing, and customary trade. Subsistence resources are important to the economy and culture of many Alaskan communities especially for the residents of rural areas with limited road access. Subsistence harvests in many of these communities constitute a major proportion of the daily diets for these residents. Subsistence statistics released by ADF&G indicate that approximately 123,000 people living in 270 communities qualified for subsistence within Alaska. Specific production figures are not available; however, 83 percent of households reported harvesting fish and 95 percent reported using fish within the context of subsistence. (ADF&G 2000).

Seafood waste discharges may potentially adversely impact commercial groundfish fisheries in areas proximal to the discharges by decreasing fish stocks of walleye pollock and Pacific cod. Walleye pollock and Pacific cod eggs have the potential to be smothered by the deposition of solids and larvae may be affected by increased predation from the attraction of fish and waterfowl to the discharges. The extent of potential impacts is dependent upon the type of wastes, the amount of waste generated, and the location of the discharge.

Localized areas of increased turbidity, increased particle suspension, seafood waste accumulation, and lower dissolved oxygen content could occur within the action area and could negatively affect all of the fisheries. In addition to potential direct impacts caused by poor water quality, the fisheries could be indirectly affected if the abundance and health of their prey is affected by seafood processing waste discharges. It is anticipated that restrictions included in the Draft Permit will diminish these types of potential impacts. Impacts due to seafood processing waste are limited to the immediate vicinity of the discharge, and the receiving waters are sufficiently oxygenated and well-mixed to allow for dispersion and dilution of pollutants.

SECTION 8.0

COASTAL ZONE MANAGEMENT AND SPECIAL AQUATIC SITES

The determination of “unreasonable degradation” of the marine environment is to be made based upon consideration of the ten criteria listed in Section 1.0. The following section provides information pertinent to consideration of the two criteria shown below:

Criterion #8: “Any applicable requirements of an approved Coastal Zone Management plan”

Criterion #5: “The existence of special aquatic sites including, but not limited to marine sanctuaries and refuges, parks, national and historic monuments, national seashores, wilderness areas, and coral reefs”

8.1 COASTAL ZONE MANAGEMENT

The Coastal Zone Management Act requires that states issue consistency determinations for any federally licensed or permitted activity affecting the coastal zone of a state with an approved Coastal Zone Management Program (CZMP) [16 USC Sec. 1456 (c). Under the Coastal Zone Management Act, applicants for federal licenses and permits must submit a certification to the Department of Natural Resources, Office of Project Management and Permitting (OPMP) that the proposed activity complies with the approved Alaska Coastal Zone Management Program (ACMP). The state then has the responsibility to either concur with or object to the consistency determination. For general NPDES permits, the USEPA is the applicant and must submit, for consistency review the general permit and a consistency determination that says the proposed activity complies with and will be conducted in a manner consistent with the coastal management program.

Alaska withdrew from the voluntary National Coastal Zone Management Program on July 1, 2011. The CZMA Federal consistency provision, section 307, no longer applies in Alaska. The Alaska Coastal Management Program (ACMP) expired by operation of Alaska Statutes 44.66.020 and 44.66.030 on June 30, 2011. As of July 1, 2011, there is no longer a CZMA program in Alaska. Because a federally approved coastal management program must be administered by a state agency, no other entity may develop or implement a federally approved coastal management program for the state.

Because the CZMA Federal consistency provisions no longer apply in Alaska, consistency determinations from Federal agencies and consistency certifications from applicants for Federal authorizations or funding that are currently pending ACMP response are no longer required to receive a response from the ACMP and may proceed in accordance with other applicable law and procedures.

8.2 SPECIAL AQUATIC SITES

All facilities covered under the proposed NPDES general permit are prohibited from discharging within 1 nautical mile of a State Game Sanctuary, State Game Refuge, State Critical Habitat Area, National Park, Preserve, or Monument, National Wildlife Refuge or National Wilderness Area. A list of excluded areas can be found in Appendix A of the proposed permit. The proposed permit authorizes mixing zones to a 100 foot radius and site specific ZODs can be authorized after a public comment period. While water quality criteria do not have to be achieved within these areas, it is assumed that their small size and relative distance from any sensitive habitats make impacts to special aquatic sites unlikely.

SECTION 9.0

MARINE WATER QUALITY

The determination of “unreasonable degradation” of the marine environment is to be based on consideration of the ten criteria listed in Section 1.0. The following section provides information pertinent for the consideration of the ocean discharge criterion listed below:

Criterion #10: “Marine water quality criteria developed pursuant to Section 304(a)(I).”

9.1 INTRODUCTION

The state of Alaska’s marine water quality standards at Alaska Administrative Code (AAC) 18 Chapter 70 are established for the protection of the designated beneficial uses of the receiving water. These uses include 1) water supply for aquaculture, seafood processing, and industrial uses, 2) water recreation including primary or contact recreation (e.g., swimming) and secondary recreation (e.g., boating), 3) growth and propagation of fish, shellfish, and other aquatic life, and 4) harvesting for consumption of raw mollusks or other raw aquatic life.”.

The primary pollutants of concern for water quality impacts from offshore seafood facilities result from the discharge of soluble and suspended solid wastes. Both soluble and suspended solid wastes include organic matter and nutrients with the potential to reduce light penetration, reduce dissolved oxygen levels of the receiving water, enhance the growth of algae and phytoplankton, and alter phytoplankton species composition. Chlorine and other disinfectant wastes are an additional concern when these products are used to sanitize seafood processing work areas and are then discharged without treatment to the receiving water.

In this section the potential pollutant discharges resulting from seafood processing operations are discussed in terms of its compliance with federal marine water quality criteria. The marine water quality criteria that are relevant to the evaluation of potential adverse impacts of seafood processing waste include:

- Settleable and Suspended Solids
- Oil and grease
- Aesthetics
- Color
- Dissolved Oxygen
- Toxic substances including residual chlorine, unionized ammonia, and undissociated hydrogen sulfide
- pH

The application of these criteria is described below.

9.1.2 Settleable and suspended solids

For the aquatic life, the criterion for settleable and suspended solids is as follows:

“Settleable and suspended solids should not reduce the depth of the compensation point for photosynthetic activity by more than 10 percent.”

As demonstrated in Section 3.0, solids concentration in the receiving water should be less than 9.79 mg/l. Violations of the settleable and suspended solids criteria for the compensation point for photosynthetic activity will depend on the ambient conditions at each discharge location, but will be unlikely. As such, the water quality criterion for settleable and suspended solids currently is incorporated as an adherence in the Draft Permit under effluent limitations and requirements.

9.1.3 Oil and Grease

Oil and grease is regulated by a narrative criteria depending on the designated use of the water. The criteria that applies to the action area include:

- Levels of oils or petrochemicals in the sediment which cause deleterious effects to the biota shall be prevented.
- Surface waters shall be virtually free from floating nonpetroleum oils of vegetable or animal origin, as well as petroleum-derived oils.

The Draft Permit also includes the following prohibition:

The discharge of petroleum (e.g., diesel, kerosene, and gasoline) or hazardous substances into or upon the navigable waters of the U.S., adjoining shorelines, into or upon the waters of the contiguous zone which may affect natural resources belonging to, appertaining to, or under the exclusive management authority of the U.S., is prohibited under 33 U.S.C. 1321(b)(3)

The primary water quality concern from seafood processing waste is floating oils derived from fish fats and discharged as waste. These discharges are also covered under the aesthetics criteria below. Many vessels recover the oil from the fish they process either to use as a sellable product or to use onboard, as a fuel source. Violations of the oil and grease criteria are unlikely. The water quality criterion for oil and grease is currently incorporated as an adherence under effluent limitations and requirements.

9.1.4 Aesthetics

Aesthetics are regulated by the following narrative criteria:
All receiving waters shall be free from substances attributable to wastewater or other discharges that:

- settle to form objectionable deposits;
- float as debris, scum, oil, or other matter to form nuisances;
- produce objectionable color, odor, taste, or turbidity;
- injure or are toxic or produce adverse physiological responses in humans, animals or plants; and,
- produce undesirable or nuisance aquatic life.

The water quality concern is the creation of floating oil sheens derived from fish and shellfish fats and oils that are discharged as wastes. As with foam and floating material, the presence of floating oil sheen will depend on the physical and chemical characteristics of the discharged wastewater and the receiving water. Another water quality concern is the accumulation of waste on the seafloor or creation of waste piles. As demonstrated in section 3.0, there should not be a large accumulation of seafood processing waste on the seafloor. The very conservative, worst case scenario predicted an average solids deposit of 0.5 cm. It is believed that very little if any waste will reach or be accumulated on the seafloor.

The water quality criterion for aesthetics is incorporated in the Draft Permit under effluent limitations and requirements.

9.1.5 Color

Color is regulated by the following numeric and narrative criteria:

Waters shall be virtually free from substances producing objectionable color for aesthetic purposes and increased color (in combination with turbidity) should not reduce the depth of the compensation point for photosynthetic activity by more than 10 percent from the seasonally established norm for aquatic life.

Color from seafood processing waste is mainly associated with the blood of the fish. With the high dilutions discussed in section 3.0, it is anticipated that the criterion for color will not be violated. The water quality criterion for color is incorporated in the Draft Permit under effluent limitations and requirements.

9.1.6 Dissolved Oxygen

Hypoxia, a low concentration of dissolved oxygen, is increasing in coastal waters worldwide. In general, the Alaskan continental shelf is hydrodynamically energetic and well flushed with less concern for hypoxia when compared to the Washington and Oregon coastlines. Although coastal hypoxia can be caused by natural processes, a dramatic increase in the number of U.S. waters exhibiting hypoxia is linked to eutrophication due to nutrient (nitrogen and phosphorus) and organic matter enrichment resulting from human activities (CENR, 2010).

Dissolved oxygen concentrations at the surface of cold marine waters in Alaska are typically greater than 7.0-8.0 mg/L. As a result, it is expected that dissolved oxygen levels near the surface at the edge of seafood processing plumes should be greater than 6.0 mg/L. The permit does not require any dissolved oxygen monitoring to verify compliance with the standards.

9.1.7 Toxics and Other Deleterious Organic and Inorganic Substances

The toxic pollutants of concern for seafood processing waste include residual chlorine, unionized ammonia, undissociated hydrogen sulfide, and metals.

9.1.8 Total Residual Chlorine

Disinfectants, including chlorine-based products, are used in the seafood processing industry to destroy potential disease-causing microorganisms that could contaminate finished seafood products destined for human consumption. The Food and Drug Administration (FDA) regulations mandate frequent cleaning (through the use of alkaline detergents) and disinfection (through the use of hypochlorites, iodophors, and quaternary ammonium compounds) of seafood processing utensils, equipment, and processing areas to minimize microbiological contamination of seafood products (21 CFR 123). Associated with the benefits of disinfection, however, are potential adverse effects associated with the reaction of chlorine and chlorine compounds with organic matter and ammonia in the wastewater. Disinfectant reaction byproducts include potentially carcinogenic chlorinated organic compounds and toxic forms of chlorinated ammonia and chloroamines. In freshwater, chlorine reacts with water to form hypchlorous acid, hypochlorite ion, and other reactive forms that include mono- and dichloroamines. These reactive forms are termed “residual chlorine”. In seawater, chlorine also reacts with bromide to form hypobromous acid, hypobromite ion, and bromamines. Therefore, the term “chlorine-produced oxidants” is used to refer to the residual chlorine forms measured in seawater.

Marine water quality criteria for total residual chlorine have been established by the State of Alaska. The chronic marine water quality criterion of 7.5 µg/L for total residual chlorine is most restrictive numeric criteria.

Because of the complexity of chlorine reactions in marine waters (Johnson 1980), it is difficult to assess the potential adverse effects of the intermittent application of disinfectants to seafood processing areas. No data are available on the typical amounts and rates of application of active disinfectant ingredients in a typical seafood processing facility. However, it is assumed that residual chlorine concentrations in the effluent discharged to the receiving water is low considering the following:

- The equipment to be disinfected is first washed to remove much of the visible organic residue and contamination to minimize the quantity of disinfectant required. The disinfectants are applied in diluted form only to the areas to be disinfected.
- The process wastewater effectively dilutes residual disinfectant concentrations.
- The residual chlorine compounds remaining after equipment disinfection are reduced when they contact the high concentration of readily oxidized organic waste matter in the wastestream.

The Draft Permit requires permittees to evaluate potential pollutants based on the hazards they present to human health and the environment. This includes minimizing toxic disinfection use where applicable, as disinfectants are known to be toxic to marine organisms at relatively low concentrations.

9.1.9 Unionized Ammonia

Unionized ammonia can be toxic to marine organisms. The concentration of unionized ammonia depends on the total ammonia concentration and the salinity, temperature, and pH of the water. A relatively conservative estimate of the chronic criterion for total ammonia for the action are, based on a salinity of 30 parts per thousand (ppt), pH of 8.2, and water temperature of 15°C, is 1.0 mg N/L.

Sources of ammonia attributable to seafood processing discharges include ammonia dissolved in the seafood processing wastewater, ammonia used in refrigerants, and ammonia released from the decaying waste organic matter in the water column or from seafood waste that has accumulated on the bottom.

Review of historical water quality studies conducted in confined bays in the vicinity of active Alaskan seafood processing discharges (Tetra Tech 1986) indicates that maximum water column total ammonia concentrations did not exceed 0.75 mg/L. Other data are not available. The historical data, however, remain valid because ammonia use has not changed in the industry over the past 20 years.

9.1.10 Undissociated Hydrogen Sulfide

The saltwater chronic criterion for undissociated hydrogen sulfide is 2.0 µg/L. Hydrogen sulfide (H_2S) is produced by the anaerobic decay of organic matter by bacteria that use sulfate as an electron acceptor. In studies conducted in Alaskan marine waters, most of the hydrogen sulfide (approximately 97.5 percent) dissociates to HS^- and H^+ (Tetra Tech 1987; Goldhaber and Kaplan 1975). The remaining undissociated sulfide (approximately 2.5 percent) can be toxic to marine organisms.

Because hydrogen sulfide in marine water occurs primarily in the dissociated form, and because hydrogen sulfide is also rapidly oxidized to sulfate in sea water (Almgren and Hagstrom 1974), undissociated hydrogen sulfide concentrations above seafood waste piles are expected to be below water quality criteria, except possibly just above the waste pile (Tetra Tech 1987). As demonstrated in section 3.0, large amounts of waste accumulation on the seafloor is unlikely, therefore, violations of the water quality criteria are not anticipated.

9.1.11 pH

The current national saltwater pH range recommended for the protection of aquatic life is 6.5-8.5 standard units. Some of the wastewater associated with seafood processing wastes can be slightly alkaline or acidic but is generally within the range of the water quality criteria. This is evidenced by monitoring data from individual permits between 2002 and 2005, which show most values within the 6.5-8.5 range.

Over the past few years there has been a growing awareness of ocean acidification, which is the decrease in ocean pH caused by the increased uptake of carbon dioxide (CO_2) from the atmosphere. Since the beginning of the industrial era in the 1800s, the pH of open-ocean surface waters has decreased by about 0.1 pH units from 8.2 to 8.1, which represents an overall increase of about 30% in the hydrogen ion concentration, and it is projected to decline by another 0.3–0.4 pH units by the end of this century (Feely et al., 2012).

At this time there have been no changes made to state or federal laws to address this water quality issue, so this document can only base its assessment on current regulations. Given the general pH range of seafood processing waste as well as the relatively small volume of waste generated with respect to the volume of the receiving waters, the discharge is not expected to have a significant impact on the pH of the ocean offshore of Alaska.

9.2 SUMMARY

If operators comply with the limitations and requirements of the Draft Permit, exceedances of water quality criteria should be prevented.

SECTION 10.0

DETERMINATION OF UNREASONABLE DEGRADATION

Section 1.0 of this ODCE provides the regulatory definition of unreasonable degradation of the marine environment (40 CFR 125.121[e]) and indicates the ten criteria which are to be considered when making this determination (40 CFR 125.122). The actual determination of whether the discharge will cause unreasonable degradation is made by the USEPA Regional Administrator. Section 10.1 briefly summarizes information pertinent to the determination of unreasonable degradation with respect to the ten criteria. Section 10.2 provides recommendations to avoid unreasonable degradation of the marine environment.

10.1 DETERMINATION CRITERIA

10.1.2 Criterion 1

The quantities, composition, and potential for bioaccumulation or persistence of the pollutants to be discharged.

Section 3.0 of this report describes effluent characteristics and presents numerical analyses for pollutants in the discharge. The analysis in Section 3.2 uses conservative estimates for conditions and inputs (e.g., daily waste discharge) to demonstrate that the accumulation of waste on the seafloor is highly unlikely. Section 3.2.3 discusses the results of total metals sampling, where some bioaccumulative metals were measured at levels exceeding 304(a) marine criteria. While the calculated 95th percentile metals concentrations exceeded water quality standards by up to 97 times the chronic 304(a) limitations, the immediate dilution of the ocean is conservatively estimated to be 1,171:1. After dilution with the receiving waters, seafood processing effluent is not expected to contain pollutants in concentrations that would bioaccumulate in aquatic organisms or humans with deleterious effects, and therefore are not expected to pose a long-term threat to the health of aquatic organisms or humans.

10.1.3 Criterion 2

The potential transport of such pollutants by biological, physical, or chemical processes.

Mobile offshore seafood processors are located in areas of high tidal activity which allows for dispersion and dilution of organic wastes and minimizes the potential for accumulation of settleable solids. The fact that processor vessels are in constant motion while processing further enhances the potential for dilution. Soluble waste authorized under the Draft Permit are expected to be rapidly diluted or degraded by biological, physical, and chemical processes.

Biological transport processes:

Biological transport processes of total metals may include bioaccumulation in soft or hard tissues, biomagnification, ingestion and excretion in fecal pellets, and physical reworking to mix solids into the sediment (bioturbation). Biological transport processes occur when an organism performs an activity with one or more of the following results:

- An element or compound is removed from the water column;
- A soluble element or compound is relocated within the water column;
- An insoluble form of an element or compound is made available to the water column; or
- An insoluble or particulate form of an element or compound is relocated.

Two major pathways or uptake vectors are available for metal incorporation in aquatic species: The ingestion of metal-enriched sediment and suspended particles during feeding (by benthic or plant uptake and then along the food chain), and direct uptake from the mixed effluent and receiving water (USGS, 1995).

Chemical transport processes:

Chemical transport of metals within the effluent from seafood processing is highly dependent upon water chemistry, especially pH which may change the speciation or increase the metal solubility and bioavailability (Salmon et al., 2014). Chemical transport will most likely occur through oxidative and reductive reactions in sediments.

Physical transport processes:

Physical transport processes include currents, mixing and diffusion in the water column, particle flocculation, and discharged material settling to the seafloor. Vessels discharging under the Draft Permit should not create piles nor mats of organic waste, and any potential accumulation should be less than 0.2 in (0.5 cm), according to the numerical analysis calculated in Section 3-2. Discharges covered under the Draft Permit are for offshore vessels that are constantly moving and discharging in depths usually greater than 210 ft. In addition, permittees will be required to be underway while discharging, unless doing so will compromise vessel safety.

The ocean waters of the Bering Sea and Gulf of Alaska provide for highly turbulent and rapid mixing of the effluent. The discharge from the vessels will be diluted and mixed thereby minimizing uptake and exposure in marine organisms. The dispersion of seafood effluent should mitigate the attraction for marine mammals thus minimizing bioaccumulation effects.

10.1.4 Criterion 3

The composition and vulnerability of the biological communities which may be exposed to such pollutants, including the presence of unique species or communities of species, the presence of species identified as endangered or threatened pursuant to the ESA, or the presence of those species critical to the structure or function of the ecosystem, such as those important for the food chain.

Benthic and pelagic biological communities:

Small pelagic organisms which drift in ocean currents, such as fish larvae, fish eggs, and plankton, could be directly impacted by components present in seafood processing waste discharges. Disinfectants in the waste stream could be toxic to them. Suspended particles could stress feeding and respiratory processes. Excess nutrients and changes in water column light penetration could lead to shifts in relative abundance and ecosystem structure. Potential indirect impacts include a reduction in dissolved oxygen content and/or the release of potentially toxic decay byproducts. Any of these changes could lead to direct mortality as well as reduced efficiency of physiological processes such as food processing and growth. As these organisms form the base of the marine food chain, negative impacts on their health and abundance would likely adversely affect the animals which rely on them as food. The numerical analysis in Section 3.0 indicates that compensation depth is unlikely to be significantly impacted by suspended solids from seafood processing waste; therefore, photosynthetic activity by phytoplankton is not expected to be affected.

Benthic communities in the area of seafood waste discharges could be smothered due to burial by waste piles or by anoxic conditions or changes in sediment chemistry due to decay of the accumulated wastes. The numerical analysis in Section 3 suggests that waste piles are unlikely to accumulate, so physical smothering is not anticipated. Discharges of seafood processing waste to oxygenated well-flushed waters consistent with Draft Permit limitations are not expected to cause reduction of dissolved oxygen sufficient to have an adverse effect on marine organisms.

Section 4.0 describes the essential functions of planktonic and benthic organisms in the biological communities in marine waters off of Alaska. Phytoplankton are considered the primary producers in an aquatic ecosystem and essential for the health of marine oceans and surrounding organisms. Toxicity thresholds for species of phytoplankton are well studied and widely vary between species and toxic effects (EPA, 1980). Metals absorbed by planktonic organisms would transfer to higher tropic levels via consumption by primary consumers such as zooplankters, mollusks, fish, and mammals. As previously mentioned, the discharge from the vessels will be highly diluted and mixed due to highly energetic receiving waters. The adsorption processes of metals and phytoplankton have been described in two steps: rapid physical adsorption first, and then slow chemical adsorption (Jin-fen et. al., 2000 and Simeonova et al., 2007). Significant factors of metals biosorption by planktonic species include adsorption contact time, the concentration of biomass, water chemistry, and metals speciation (Kapkov et. al, 2011 and EPA 1980). The extent to which rapid physical adsorption would occur to essential planktonic organisms from the discharge should be minimized by dilution. Additionally, vessels are required to move while processing to shorten the duration of activities at any one location.

<u>Threatened and endangered species:</u>

Twenty threatened and endangered species occur within the area of coverage: three avian species (short-tailed albatross, spectacled eider, and Steller's eider), eight cetacean species (blue, bowhead, fin, gray, humpback, Sei, sperm, right and Cook Inlet beluga whales), two pinnipeds (Steller sea lion and bearded seal), four reptiles (leatherback, loggerhead, green sea, Olive Ridley turtles), and the northern sea otter. These species live or spend a portion of their lives in the area of coverage. The potential effects on those species include the direct exposure to contaminants in the discharge and from secondary exposure through consumption of biota that have metals accumulation. Most marine mammals, fish, and turtles are highly mobile and, therefore, able to swim out of harm's way. The exception to this is rockfish and eulachon larvae. Of these species, the Stellar sea lion, short-tailed albatross, and Steller's eider are mostly likely to come into direct contact with the effluent discharge. Species that are attracted to waste as a food source may be at increased risk of harm from predation or ship strikes. To mitigate this, vessels are required to be moving while processing in order to shorten the duration of activities at any one location and conduct visual sea surface monitoring for water quality issues or ESA-listed species interactions.

Bioaccumulation is an existing concern for the Stellar sea lion. A study conducted in 2008 investigated the metals loading in juvenile Stellar sea lions and pups off the shores of the Western Aleutian Island in Alaska (Rhea et. al., 2013). Total mercury was analyzed in 162 liver samples, where 159 of the samples detected concentrations from 0.17 to 9.38 ug/g wet weight (the current action level for mercury is 1 ppm or 1 ug/g in fish for human consumption). The General Permit does not authorize the discharge of seafood processing by-product within 3 nm of Stellar sea lion rookeries and haul-outs. This provision is in place to mitigate incidental take of Stellar sea lions and should hinder direct contact with the discharge.

EPA has completed a Biological Evaluation (BE) on the effects of authorized discharges on endangered, threatened, proposed and candidate species. The General Permit contains area restrictions to prevent impacts to critical marine habitat and biological communities. The BE concluded that the discharges “are not likely to adversely affect” ESA listed, candidate, and proposed species, or their designated critical habitat areas.

Assuming seafood processing waste is discharged in compliance with Draft Permit limitations and requirements, then impacts to receiving waters should be localized; therefore, effects on overall marine habitat and biological communities are likely to be minor.

10.1.5 Criterion 4

The importance of the receiving water area to the surrounding biological community, including the presence of spawning sites, nursery/forage areas, migratory pathways, or areas necessary for other functions or critical stages in the life cycle of an organism.

The area of coverage for this draft General Permit includes essential fish habitat (EFH) throughout the Bering Sea and Aleutian Islands (BSAI) and Gulf of Alaska (GOA). The EFH areas include the pelagic, epipelagic, and meso-pelagic waters, as well as on-bottom and near-bottom habitats of the BSAI and GOA. EFH distributions for individual species in the area of coverage are detailed in the Fisheries Management Plan (FMP)-managed species in Alaska (from Appendix D, Section D-3, Final Environmental Impact Statement for Essential Fish Habitat Identification and Conservation in Alaska, NOAA, 2005).

There are numerous areas in the Alaskan coastal waters that are important areas for a variety of species, ranging from phytoplankton to marine mammals. Additional details describing some of these areas are listed below;

- Areas in the Chukchi Sea include most coastal waters. These areas are used by a variety of marine mammals for migration and feeding. The Bering Sea is also an important area for many species including crab species, many commercial fish species, and many marine birds and mammals. Bristol Bay and the Yukon-Kuskokwim Delta are important areas for sockeye salmon, seabirds and waterfowl.

- The Aleutian Islands and the Pribilof Islands, in particular, are very important areas for marine mammals and seabirds. Discharges from facilities operating in the Pribilof Islands are excluded from coverage under the proposed general permit and are covered in a separate permit. Exclusions for a number of important ecological areas in the Aleutians prohibit discharges in these areas.

- St. George Island supports possibly the largest thick-billed murre colony in the world and is also the primary nesting area for most of the world’s population of red-legged kittiwakes. Discharges from facilities operating on St. George Island are excluded from coverage under the proposed general permit and are covered in a separate permit.

- Shelikof Strait/Cook Inlet is a known migratory route for gray whales and a possible migratory route for fin and humpback whales. This area is also a major spawning area for walleye pollock. Cook Inlet and Kachemak Bay are important areas for killer whales, beluga whales, Dall’s porpoises, and harbor porpoises. Sea otters utilize the Kenai Peninsula, Kodiak Island, and Cook Inlet areas. Steller sea lions use the entire coastal area, with Shelikof Strait being a particularly critical habitat resource area.

- Areas of major significance to waterfowl include lower and upper Cook Inlet, Kodiak Island, and the eastern side of the Alaska Peninsula. Kachemak Bay, Shelikof Strait, and the Barren Islands are important resource areas for many seabirds. In the Gulf of Alaska, important areas include the Copper River Delta, Prince William Sound and several bays in Cook Inlet. The largest concentration of waterfowl during spring and fall are found in the Kenai Lowlands, Trading Bay, Redoubt Bay, and Fox River Flats.

- Karnishak Bay, Kachemak Bay, and pan of Shelikof Strait are nurseries for Tanner crab as well as important habitats for King and Dungeness crabs.

Vessels discharging under the Draft Permit should not create piles nor mats of organic waste, and any potential accumulation should be less than 0.2 in (0.5 cm), according to the numerical analysis calculated in Section 3.2. Discharges covered under the Draft Permit are for offshore vessels that are constantly moving and discharging in depths usually greater than 210 ft. In addition, permittees will be required to be underway while discharging, unless doing so will compromise vessel safety. Flushing in the action area is high, which will disperse seafood processing wastes. The conservative analysis of discharges from a seafood processing vessel moving at three knots estimates that a maximum of about 294 grams (0.65 pounds) of ground waste could be deposited per square meter of bottom, translating to a worst case scenario with an average depth of accumulation of 0.5 cm (Section 3.2.1.1). Due to the short duration of discharge in a single location, the expected areas of deposition and thickness, and the distances between independent vessels, benthic habitat effects are expected to be minimized and occur in limited areas.

The draft General Permit contains area restrictions to prevent impacts to critical marine habitat and biological communities. Other marine mammals and avian wildlife utilize the area of coverage for feeding, spawning, and migration. The Draft Permit also requires sea surface monitoring to ensure protection of the receiving water environment and regional biological communities. This monitoring is required to record interactions with certain ESA species and should observe behavioral effects and species interactions with the discharge. The Draft Permit prohibits the occurrence of substances that float as debris, scum, oil, or other matter to form nuisances on the sea surface and thereby eliminate potential impact of oil on species foraging on the waste. Since, seafood processing wastes are discharged in high tidal activity areas which allows for adequate dispersion and dilution, and impacts to receiving waters are localized, effects on habitat and the receiving water are likely to be minor.

10.1.6 Criterion 5

The existence of special aquatic sites including, but not limited to, marine sanctuaries and refuges, parks, national and historic monuments, national seashores, wilderness areas, and coral reefs.

The following areas are excluded from authorization for effluent discharges under the draft General Permit:

1. Within one (1) nautical mile of a State Game Sanctuary, State Game Refuge, State Park, State Marine Park or State Critical Habitat Area.
2. Within one (1) nautical mile of a National Park, Preserve or Monument.
3. Within one (1) nautical mile of a National Wildlife Refuge.
4. Within one (1) nautical mile of a National Wilderness Area.
5. Within three (3) nautical miles of the seaward boundary of a rookery or major haulout area of the Steller sea lion.
6. Waters within one (1) nautical mile of designated critical habitat for the Steller’s eider or spectacled eider, including nesting, molting and wintering units.

7. At-risk water resources and waterbodies.
8. Areas with water depth of less than 60 feet MLLW that have poor flushing, including but not limited to sheltered waterbodies such as bays, harbors, inlets, coves and lagoons and semi-enclosed water basins bordered by sills of less than 60 feet MLLW depth.

Due to the relative distance from any sensitive habitats and the rapid dilution provided by the receiving water, the special aquatic sites listed above would not be affected by authorized discharges.

10.1.7 Criterion 6

The potential impacts on human health through direct and indirect pathways.

Direct human exposure to seafood processing effluent is very unlikely as the discharge occurs at least three nautical miles from shore and receives rapid dilution from deep ocean waters. There is potential for indirect exposure to heavy metals due to bioaccumulation through the food web, where humans are the top trophic consumer.

With respect to human health effect impacts, four metals are of primary concern: arsenic (a metalloid), cadmium, lead, and mercury (U.S. Congress, 1987). Of these four metals, cadmium and mercury tend to bioaccumulate in marine organisms, while neither arsenic nor lead have been shown to bioaccumulate significantly in seafood (U.S. Congress 1987, ADEC). Heavy metals concentrations in Alaskan fish and shellfish are closely monitored for human consumption advisories. The levels of mercury in Alaska-caught fish, as reported by the Alaska Department of Environmental Conservation (ADEC) Fish Monitoring Program up until 2013, are well described and interpreted (ADEC, 2017). Mercury is the contaminant that drives risk interpretation of fish consumption in Alaska.

Subsistence fishing, defined as, “noncommercial, long-term, customary and traditional use necessary to maintain the life of the taker or those who depend upon the taker to provide them with such subsistence,” is not affected by the FMP (50 CFR 216). Because of the danger associated with transiting the distances between shore and the location of the discharges, subsistence fishing is not expected to be directly affected by the discharges.

Fish collected for tissue monitoring were collected all around BSAI. ADEC study establishes a baseline for metals concentrations in Alaskan fish. Current Alaska advisory for fish consumption recommends unrestricted consumption of Pacific cod, walleye pollock, black and dusty rockfish, and Alaskan salmon based on mercury (ADEC, 2103 and www.epi.hss.state.ak.us/).

Seafood processing waste discharges are not expected to result in impacts to human health. These discharges are not expected to discharge pollutants at levels that would significantly contribute to elevated levels of toxic or carcinogenic pollutants in marine organisms consumed by humans.

10.1.8 Criterion 7

Existing or potential recreational and commercial fishing, including finfishing and shellfishing.

The areas of discharge covered under this General Permit are extensively used for commercial, recreational, and subsistence fishing. In 2015, the annual commercial landings for Alaska totaled over 1.7 billion dollars for all species. At-sea processors off the coasts of Alaska, Washington, Oregon, and Hawaii reported over 14.5 million dollars in commercial landings for 2015 (NMFS, 2017). Commercial fisheries in Alaska include: salmon, groundfish (chiefly walleye pollock, Pacific cod, and Pacific halibut), herring, tanner, dungeness, and king crabs, clams, shrimp, scallops, and abalone. Seafood waste discharges may potentially adversely impact stocks of walleye pollock and Pacific cod. The likelihood of impacts to these species is strongly dependent on the timing, composition, quantity, and location of discharges, although the overall impact is assumed to be minimal. Other species commercially harvested are also assumed to not be impacted.

Discharges may cause direct harm by habitat alteration throughout the water column. On the seafloor, accumulated waste that restricts oxygen, could bury and smother demersal eggs of squid and several groundfish species. This decomposing waste could also alter parts of the benthic habitat in which many groundfish live. Larvae, juveniles, and adults are mobile, so they may be able to avoid these areas. Many groundfish could also be indirectly affected by the loss of benthic food sources due to waste piles. However, the analysis reported in Section 3.0 demonstrates that accumulation of waste piles is not likely to occur in the Draft Permit action area.

In the pelagic zone, localized areas of short-term increased turbidity, increased particle suspension, and lower dissolved oxygen content could occur. In addition to potential direct impacts caused by short-term effects on water quality, fish could be indirectly affected if the abundance and health of plankton and other food sources are affected. However, the analysis in Section 3.0 demonstrates that TSS in the water column will be minimal which should ensure dissolved oxygen levels are not depleted, reducing potential adverse effects on the growth of plankton and food sources.

Increased predation may occur, particularly of larvae and juveniles, due to the attraction of fish and waterfowl to the discharges. However, the Draft Permit contains the narrative standard that, the discharge of seafood processing wastes must not create an attractive nuisance situation whereby fish or wildlife are attracted to waste disposal or storage areas in a manner that creates a threat to fish or wildlife or to human health and safety.

The North Pacific Fishery Management Council (NPFMC) develops fisheries management plans (FMPs) for fish resources off the coast of Alaska. The FMP governs all commercial fishing including finfish, shellfish, and other marine resources with the exception of Pacific salmon and Pacific halibut (NPMFC, 2017). The NPFMC is one of eight regional councils established by the Magnuson-Stevens Fishery Conservation and Management Act in 1976. The policy prohibits commercial fishing in the area until sufficient information is available to enable a sustainable commercial fishery to proceed (74 FR 56734).

- The Magnuson-Stevens Fishery Conservation and Management Act (January 21, 1999) requires EPA to consult with the NMFS when a proposed discharge has the potential to adversely affect (reduce quality or quantity or both of) EFH. Due to the possibility that adverse effects on EFH may arise from offshore seafood processors, and because the provisions in the regulation do not ensure that adverse effects to EFH will be avoided, EPA has determined that EPA’s proposed approval of the General NPDES permit for offshore seafood processors in Alaska may adversely affect essential fish habitat. EPA issued the permit in 2009 after completing a consultation and receiving concurrence from NMFS.

The emergence of unregulated, or inadequately regulated, commercial fisheries in the Arctic EEZ off Alaska could have adverse effects on the sensitive ecosystem and marine resources of this area, including fish, fish habitat, and non-fish species that inhabit or depend on marine resources of the U.S. Arctic EEZ, and the subsistence way of life of residents of Arctic communities (NMFS 2017a).

Discharges in compliance with the Draft Permit should have minimal effects on aquatic biota and benthic communities. Since the offshore seafood processors covered under this permit will be 3 nm from shore, the seafood processing discharge would be in areas with strong currents and high tidal ranges and would dissipate rapidly preventing accumulation of the seafood discharge in waste piles. Therefore, it is expected that deposition of seafood deposits on the seafloor should result in minimal effects to the aquatic biota.

10.1.9 Criterion 8

Any applicable requirements of an approved Coastal Zone Management Plan

Because the CZMA Federal consistency provisions no longer apply in Alaska, consistency determinations from Federal agencies and consistency certifications from applicants for Federal authorizations or funding that are currently pending ACMP response are no longer required to receive a response from the ACMP and may proceed in accordance with other applicable law and procedures.

10.1.10 Criterion 9

Such other factors relating to the effects of the discharge as may be appropriate.

Concerns have been raised about potential indirect effects of the discharge of seafood processing waste on marine organisms. These indirect effects include the following:

- Nutrient enrichment of marine waters may result in enhanced biomass of phytoplankton and/or alteration of plankton species composition. Toxic phytoplankton species may occur more frequently and at higher levels under these conditions resulting in adverse effects to aquatic organisms, and potentially to human health.
- The attraction of certain species to waste discharges which makes them easier prey for predators.
- The attraction of seabirds to waste discharges which may result in a number of adverse effects that range from oiling, and enhancement of the numbers of gulls that may disturb threatened or endangered species.

These concerns should be minimal due to the fact that mobile offshore seafood processors will be located in areas of high tidal activity allowing for dilution and dispersion of seafood waste discharges. Permitted discharges of seafood waste to oxygenated well-flushed areas consistent with Draft Permit limitations and requirements are not expected to cause reduction of dissolved oxygen sufficient to have an adverse effect on marine organisms. The Draft Permit prohibits discharges that float as debris, scum, oil, or other matter to form nuisances and thereby eliminate potential impact of oil on birds foraging on the waste.

These discharges are subject to the ‘best practicable control technology’ (BPT) and the best available technology (BAT) limitations of the CWA. Prior to the issuance of this General Permit, EPA must determine that the discharges will not unreasonably degrade the marine environment in compliance with 40 CFR 125, M). For this permit, EPA considered technology-based and water quality-based requirements under the CWA, including the CWA’s Ocean Discharge Criteria. In addition, EPA considered any requirements that might arise out of any applicable statutes in addition to the CWA. EPA has not promulgated technology-based effluent limit guidelines for pollutant discharges from offshore seafood processing vessels. In addition, EPA has not promulgated any new source performance standards for offshore seafood processing vessels. For the 2019 permit reissuance the EPA has chosen to discontinue the grinding requirement, except in cases where vessels that discharge greater than 10 million pounds per annual report year discharge into Steller sea lion critical habitat areas designated by NMFS in 50 CFR § 226.202. Permittees will conduct visual sea surface monitoring on a daily basis to determine whether the discharge of unground seafood waste is causing deleterious effects to the sea surface or promoting interactions between ESA-species and the discharge.

Similar conclusions have been met by the EPA in studies related to the 2013 Vessel General Permit. The EPA's 2010 "Study of Discharges Incidental to the Normal Operation of Commercial Fishing Vessels and Other Non-Recreational Vessels Less Than 79 feet" concluded that impacts from pollutant discharges from small commercial fishing vessels are likely to have a minimal environmental impact. However, it concluded that "the impacts are potentially significant where there are high vessel concentrations, low circulation in waters, additional environmental stressors, or pollutant loadings from other sources" (US EPA, 2010a). The combined effects of the rapid dilution of the effluent in the receiving water and the short duration of activities at any one location should be sufficient to prevent deleterious effects from the seafood processing effluent.

<u>Reasonable Alternatives:</u>

40 CFR 125.121(d) defines "no reasonable alternatives" as:

(1) No land-based disposal sites, discharge point(s) within internal waters, or approved ocean dumping sites within a reasonable distance of the site of the proposed discharge the use of which would not cause unwarranted economic impacts on the discharger, or, notwithstanding the availability of such sites,

(2) On-site disposal is environmentally preferable to other alternative means of disposal after consideration of:

    (i) The relative environmental harm of disposal on-site, in disposal sites located on land, from discharge point(s) within internal waters, or in approved ocean dumping sites, and

    (ii) The risk to the environment and human safety posed by the transportation of the pollutants.

At the time of this General Permit reissuance, there are no feasible treatment alternatives to the discharge of the pollutants at sea. Treatments systems for seafood processing discharge typically consist of equalization tanks, screening, coagulation, flocculation, and hybrid dissolved air centrifugal flotation (dissolved air flotation) (Colic et al., 2007) Treatment solutions for metals may include adsorbent media, ion-exchange, and polymeric coagulants and flocculants (USEPA and Clu-in.org, 2017). Where full-scale treatment train technologies are infeasible, screening is a feasible technology that is currently implemented in remote areas with seafood processing. This technology is appropriate for the onshore seafood processing environment, where treatment and storage space is available prior to the transport of retained solids to ocean dumping locations, landfill, and by-product recovery facilities. The number of times that a commercial fishing vessel departs from port ranges from 3 to 6 times per month or more. This is based on an average length of fishing trips of 5 to 8 days and is consistent with data from Northeast fisheries that show average trip durations of 7.9 days for groundfish trips and 4.7 days for non-groundfish trips (NOAA, 2011). The logistical challenges of retaining screened solids for extended time periods has not been adequately studied, however equipment maintenance and the volumes of solids are known challenges. The capacity for treatment will greatly depend on a vessel's construction date, size, and class, all of which vary under this Permit. EPA is of the opinion that treatment and screening are currently infeasible for vessels covered under this General Permit.

10.1.11 Criterion 10

Marine water quality developed pursuant to Section 304(a) of the CWA.

With consideration to the dilution provided by Alaskan offshore waters, the regulated discharge of seafood processing waste is expected to comply with relevant marine water quality criteria for available and relevant criteria for pH, color, temperature, oil and grease, and total metals. Section 3.2 provides specific details regarding dilution factors and projected compliance with marine 304(a) criteria for aquatic life.

10.2 CONCLUSIONS

The EPA has evaluated the discharges authorized under the Draft Permit against the ocean discharge criteria at 40 CFR 125.122. Based on this evaluation, EPA concludes that the discharges will not cause unreasonable degradation of the marine environment under the conditions, limitations and requirements established by the Draft Permit.

SECTION 11.0

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