ENVIRONMENTAL ASSESSMENT OF PROPOSED GEODUCK HARVEST
ALONG THE SHORELINE OF THE STRAIT OF JUAN DE FUCA
AT THE DUNGENESS WEST GEODUCK TRACT (#00320)

Commercial geoduck harvest is jointly managed by the Washington Departments of Fish and Wildlife (WDFW) and Natural Resources (DNR) and is coordinated with treaty tribes through annual harvest management plans. Harvest is conducted by divers from subtidal beds between the -18 foot and -70 foot water depth contours (corrected to mean lower low water, hereafter MLLW). Harvest is rotated around Puget Sound in seven geoduck management regions. The fishery, its management, and its environmental impacts are presented in the Puget Sound Commercial Geoduck Fishery Management Plan and Final Supplemental Environmental Impact Statement (WDFW & DNR, May 2001). The proposed harvest along the shoreline of the Strait of Juan de Fuca is described below.

Proposed Harvest Years: 2024-2025

Tract name: Dungeness West geoduck tract (#00320)

Description: (Figure 1, Tract Vicinity map)

The Dungeness West geoduck is a subtidal area of approximately 884 acres (Table 1) along the shoreline of the Strait of Juan de Fuca between McDonald Creek and Siebert Creek. The west end of the tract is approximately 1.3 miles easterly of the geographic landmark Green Point, and the tract extends easterly for a total tract length of approximately 1.5 miles. The commercial tract area is deeper than and seaward of the -35 foot (MLLW) water depth contour, due to a very low average density of geoduck resource in shallower water, and also as a management action to provide a sufficient buffer for any potential inshore eelgrass. The tract is bounded by a line projected from a Control Point (CP) on the -35 foot (MLLW) water depth contour in the southeastern corner of the tract at 48°07.748’ N latitude, 123°14.103’ W longitude (CP 1) westerly to a point on the -35 foot (MLLW) water depth contour at 48°07.519’ N latitude, 123°15.688’ W longitude (CP 2); then northerly to a mid-point at 48°07.806’ N latitude, 123°15.666’ W longitude (CP 3); then northwesterly to a point on the -70 foot (MLLW) water depth contour at 48°08.455’ N latitude, 123°16.039’ W longitude (CP 4); then easterly along the -70 foot (MLLW) water depth contour to a point at 48°08.897’ N latitude, 123°14.965’ W longitude (CP 5), then southeasterly to the point of origin (Figure 2, Boundary Control Points map). The western three-control-points side boundary of the Dungeness West tract is a shared boundary line with the eastern boundary of the Siebert Creek tract (#00300). The eastern side boundary of the tract is a shared boundary line with the Kahiyu tract (#00340).

Contour GIS layers were used to generate an estimate of tract area. These contour GIS layers originated from Dale Gombert (WDFW) and were generated from NOAA soundings. Shoreline data was obtained from DNR, digitized at 1:24000 scale in 1999. The -70 ft. (MLLW) water depth contour was used for the deep water boundary, and the shallow water boundary was defined by the -35 ft. (MLLW) water depth contour. The latitude and longitude control point positions were generated using GIS and are reported in decimal minutes, to the closest thousandths of a minute, and are in Datum WGS84. These control point positions will be field verified by DNR to determine consistency with area estimates, landmark alignments, and water depth contours prior to state sanctioned geoduck harvest. Any variance to the stated boundary will be coordinated between WDFW and DNR prior to geoduck harvesting episodes.

Substrate:

Geoducks are found in a wide variety of sediments ranging from soft mud to gravel. The most common sediments where geoducks are harvested are sand with varying amounts of mud and/or gravel. The specific sediment type of a geoduck bed is primarily determined by water current velocity. Coarse sediments are generally found in areas of fast currents and finer (muddier) sediments in areas of weak currents. The major impact of harvest will be the creation of small holes where the geoducks are removed. The holes fill in within a few days to several weeks and have no long-term effects. The substrate holes refill in areas with strong water currents much faster than in areas with weak water currents. Water currents are variable and can be strong in the vicinity of the Dungeness West tract. Currents reach a predicted average daily maximum flood velocity of 2.2 knots and maximum ebb velocity of 3.4 knots at a station (1386) located 5.3 miles east-northeast of the Ediz Hook Light (current chart, Tides and Currents Pro for Windows Version 3.0i, Nobeltec Corporation).

Substrate types that affected digging of geoducks included gravel and shell (Table 2). Gravel, compact substrate, and low abundance were listed as factors that contributed to “difficult” dig conditions on 4 stations (#95, #216, #261, and #282) out of 16 total dig stations. The surface substrates within this tract are highly variable and complex. Sand or mixtures of sand and gravel predominate with other substrate types frequently observed. During the 2011 and 2012 surveys, sand was the dominant component of surface substrates observed on 133 transects (a total of 249 transects were completed on this tract). Sand was present, but was not the dominant substrate type, on an additional 54 transects. Gravel was present on a total of 151 transects, cobble on 65 transects, pea gravel on 57 transects, boulders on 36 transects, shell on 30 transects, shell hash (shells in small pieces) on 23 transects, and mud on 7 transects (Figure 3 - Transect map; Table 3).

Water Quality:

Water quality is good at the Dungeness West geoduck tract. The Washington Department of Health (DOH) has classified the Dungeness West tract as “Approved” for commercial shellfish harvest. However, this tract is subject to frequent closures due to high levels of biotoxins (including paralytic shellfish poison - PSP). DNR will verify the health status of the Dungeness West tract with DOH prior to any state sanctioned commercial geoduck harvest.

At a WA Department of Ecology water quality station at Dungeness Bay Station (DUN001), periodic water quality samples were taken in 2000 (most recent data year available). The following information from this station is for samples taken between water depths of 18 and 70 feet. The mean reported dissolved oxygen concentration is 6.7 milligrams per liter (mg/l) with a range from 4.7 mg/l to 8.7 mg/l. The mean salinity at this station was 31.50 parts per thousand (ppt) with a range from 30.16 ppt to 32.32 ppt. The mean water temperature at this station was 48.4˚ Farenheit (F) with a range from 45.6˚F to 52.3˚F.

Biota:

Geoduck:

The Dungeness West geoduck tract is approximately 884 acres and the pre-fishing biomass estimate was 7,906,780 pounds of geoducks (Table 1). Surveys in 2011 (177 transects) and 2012 (72 transects) were used to calculate this biomass. All geoducks were considered commercial quality at dig stations (Table 2). The current geoduck density on this tract is low, averaging 0.033 geoducks/sq.ft. The density from the 2011 and 2012 LEKT and WDFW pre-fishing surveys ranged from 0.000 (2011 transect #s 21, 48, 202, 241 and 340) to 0.519 geoducks/sq.ft. at transect #52 (Table 3). The geoducks at the Dungeness West tract at 2.20 pounds are near the average weight for Puget Sound (2.1 pounds/geoduck). From dig samples taken in 2012, the lowest average whole weight was 1.3 pounds per geoduck at station #79 and the highest average whole weight was 3.1 pounds per geoduck at station #282 (Table 4). Transect locations (2011 and 2012 survey years), and geoduck siphon “show” factors used to adjust diver observed transect counts, are listed in Table 5. Note that geoduck managers used a standard Strait Region geoduck show factor of 0.51 to correct geoduck counts observed when there was no show plot data available.

The Dungeness West geoduck tract was originally surveyed in 1971 and 1977 by WDFW as portions of the Green Point and Dungeness Spit tracts. A 387 acre portion of the Green Point tract was re-surveyed in 1996 by the PNPTC (130 transects total, 117 transects between -35 ft. and -70 ft. (MLLW). The Green Point tract name was changed to Siebert Creek tract in 1999 at the request of DOH to avoid confusion with Green Point tract in South Puget Sound. An additional 594 acres of Siebert Creek were jointly surveyed by WDFW and PNPTC in 2003 and 2004. The Dungeness West tract is immediately adjacent to and adjoins the Siebert Creek tract. The Dungeness West tract was surveyed by WDFW and the LEKT tribes in 2011 and 2012. The results of the 2011 and 2012 surveys are used in the preparation of this Environmental Assessment report. There have been 5,064,288 pounds of geoducks harvested on this tract since 2012. The remaining geoduck biomass on this tract is about 2,842,492 pounds.

Geoducks are managed for long-term sustainable harvest. No more than 2.7% of the fishable stocks are targeted for harvest (total fishing mortality) each year in each management region throughout Puget Sound. The fishable portion of the total Puget Sound geoduck population includes only geoducks that are found in waters between -18 feet (MLLW) and -70 feet (MLLW). Other geoducks that are not harvestable are found inshore and offshore of the harvest areas. Observations in south Puget Sound show that major geoduck populations continue to depths of 360 feet. Additional geoducks exist in polluted areas and are also unavailable for harvest but continue to spawn and contribute to the total population.

The low rate of harvest is due to geoduck's low rate of natural recruitment. WDFW has studied the regeneration rate of geoducks on certain tracts throughout Puget Sound. The estimated average time to regenerate a tract to its original density, after removal of 65 percent of the geoducks, is 55 years. The recovery time for the Dungeness West tract is unknown. The research to empirically analyze tract recovery rates is continuing.

Fish:

Geoduck beds are generally devoid of rocky outcroppings and other relief features that attract and support certain marine fish, such as rockfish and lingcod. Substrates that tend to support geoducks are relatively flat and composed of soft sediments that provide few attachments for macroalgae. Various species of fish were observed on transects at the Dungeness West tract including sand dabs, sculpins, dogfish sharks, unspecified flatfish, starry flounders, sand lance, Pacific herring, skate, poachers, and greenling (Table 6).

WDFW marine fish managers were asked of their concerns regarding possible impacts of geoduck fishing on groundfish and baitfish. Greg Bargmann of WDFW stated that geoduck fishing would have no long-term detrimental impacts and may have some short term benefits to flatfish populations by increasing the availability of food. Dan Penttila of the WDFW Fish Management Program recommended that eelgrass beds within the harvest tract be preserved for any spawning herring.

No eelgrass survey was performed at this tract. The depth of the nearshore boundary of this geoduck tract is along the -35 foot (MLLW) water depth contour, and eelgrass is not likely to occur at this depth or deeper. The deepest known depth of eelgrass from other eelgrass surveys in the Strait is -30 feet (MLLW) which occurred at two tracts: Jamestown 4 (#00600; surveyed in 1992), and Protection Island (#01000; surveyed in 1999). The nearshore tract boundary along the -35 foot (MLLW) water depth contour should provide a 5-foot vertical water depth buffer to any potential inshore eelgrass beds, which is greater than the required 2 foot vertical buffer adopted by state and tribal managers.

There are no previously documented Pacific herring or sand lance spawning grounds along the shorelines of the Dungeness West tract and in the general area of Green Point (GIS data layers dated November 2005, from Dale Gombert, WDFW). However, Pacific herring were documented during the 2011/2012 geoduck survey and further investigation into spawning habitat may be warranted. Surf smelt spawning has been documented along the Dungeness West tract shoreline (Figure 4). Surf smelt deposit adhesive, semitransparent eggs on beaches that have a specific mixture of coarse sand and pea gravel. Inside Puget Sound, surf smelt spawning is thought to be associated with freshwater seepage, where the water keeps the spawning gravel moist. Eggs are deposited near the water's edge in water a few inches deep, around the time of the high water slack. There is substantial vertical separation between surf smelt spawning (slack high tide) and geoduck harvest activity (-35 ft. to -70 ft., MLLW). Geoduck fishing on Dungeness West tract should have no detrimental impacts on herring, surf smelt, or sand lance spawning.

NOAA Fisheries Service announced on April 27, 2010 that it was listing canary and yelloweye rockfish as “threatened” and bocaccio as “endangered” under ESA (federal Endangered Species Act). The listings became effective on July 27, 2010. Historic high levels of fishing and water quality are cited as reasons that these rockfish populations are in peril and have been slow to recover. On January 23, 2017; canary rockfish were delisted based on newly obtained samples and genetic analysis (Federal Register 82 FR 7711). Geoduck fishery managers are tracking this process and will take actions necessary to reduce the risk of “take” of any listed rockfish species that could potentially result from geoduck harvest activity.

Two salmon populations, Puget Sound Chinook salmon and Hood Canal summer run chum salmon, were listed by the National Marine Fisheries Service on March 16, 1999 as threatened species under the federal Endangered Species Act. Critical habitat for summer run chum salmon populations include all marine, estuarine, and river reaches accessible to the listed chum salmon between Dungeness Bay and Hood Canal as well as within Hood Canal. There are presently three Strait of Juan de Fuca streams with summer run chum populations. Salmon Creek and Jimmycomelately Creek are at low return levels, but appear to be stable. The Snow Creek population is at a very low escapement level and appears to be declining. There have been no summer run chum escapements observed in Chimacum Creek since 1984, and the run is believed to be extirpated. The timing for summer run chum spawning is early September to mid-October. Out-migration of juveniles has been observed in Hood Canal during February and March, though may occur as late as mid-April. Siebert Creek drains into the Strait of Juan de Fuca at Green Point. There is no documentation of Hood Canal Summer run chum salmon spawning in

Siebert Creek. Recent recovery and supplementation efforts have reversed the trend of decline in Hood Canal summer run chum salmon stocks. Total escapement for Hood Canal summer run chum salmon has reached historic high levels and risk of extinction has decreased for all stocks (Adicks, K. *et al*., 2007). The Dungeness West geoduck tract is at the edge but is outside of the critical habitat range for Hood Canal summer run chum salmon.

Critical habitats for Puget Sound Chinook salmon include all marine, estuarine and river reaches accessible to listed Chinook salmon in Puget Sound. WDFW recognizes 27 distinct stocks of Chinook salmon; 8 spring-run, 4 summer-run, and 15 summer/fall and fall-run stocks. The existence of an additional five spring-run stocks is in dispute. The majority of Puget Sound Chinook salmon emigrate to the ocean as sub-yearlings. A spring run of Chinook salmon in the Elwha River may be extinct. A summer/fall run of Chinook salmon in the Elwha River is native origin, composite wild and cultured production, and is healthy with a 5-year geometric mean of 1,768. The geographic separation of the Dungeness West geoduck tract and the Elwha River mouth is approximately 14 miles. A fall and a spring run of Chinook salmon in the Dungeness River are both at high risk of extinction. The Dungeness River also has a run of spring/summer-run Chinook salmon that is native stock origin, wild production, and in critical status, with a 5-year geometric mean natural escapement of 105 fish (NMFS, Appendix E, TM-35, Chinook Status Review). The geographic separation of the Dungeness West geoduck tract and the Dungeness River mouth is approximately 11.4 miles.

The geographic separation (horizontal) of this tract from known spawning tributaries and vertical separation of geoduck harvest (deeper and seaward of the -35 ft. MLLW contour) from juvenile salmon rearing areas and migration corridors (upper few meters of the water column) reduces or eliminates potential impacts to salmon populations. Charles Simenstad of the University of Washington School of Fisheries stated that the exclusionary principle of not allowing leasing/harvesting in water shallower than -18 ft. (MLLW) or 2 ft. vertically in elevation from the lower eelgrass margin, and within any regions of documented herring or forage fish spawning, should under most conditions remove the influences of harvest induced sediment plumes from migrating salmon. Geoduck harvest should have no impact on salmon populations.

On May 7, 2007 NOAA Fisheries Service announced listing of Puget Sound steelhead as "threatened" under ESA. This listing includes more than 50 stocks of summer- and winter-run steelhead. Steelhead share many of the same waters as Puget Sound Chinook salmon, which are already protected by ESA, and will benefit from shared conservation strategies. The nearest estuaries, to the Dungeness West tract, that have steelhead runs are the Elwha River and the Dungeness River. The Elwha and Dungeness rivers each support two runs of steelhead (summer and winter). The summer- and winter-runs of steelhead in the Elwha and Dungeness rivers were listed as "depressed" in the 1992 WDFW Salmon and Steelhead Inventory (SaSI) Report and were listed as "unknown" in the 2002 SaSI report. The horizontal separation between these runs and the Dungeness West tract is reviewed in the salmon section above (i.e. 14 miles to the Elwha River mouth and 11.4 miles to the Dungeness River mouth from the Dungeness West tract). Geoduck harvest has not been listed as an activity that affects the health of these steelhead populations. Conditions which have been identified that potentially affect steelhead populations in Olympic Peninsula drainages include land practices that alter estuarine corridors; sediment loading; lack of large woody debris in streams; lack of adequate pool frequency for juvenile rearing; channelizing and bank armoring; loss of riparian vegetation; a significant number of culverts, screens, and dams; reduction of normal stream flow due to irrigation; and poor water quality. WDFW and DNR will continue to monitor recommendations to protect steelhead stocks and will adapt geoduck management to conform with these recommendations as they become available. With information that is known, we conclude that the geoduck management practices in place to protect salmon and forage fish will also serve to protect listed steelhead runs in the vicinity of the Dungeness West tract.

Green sturgeon have undergone ESA review in recent years, due to depressed populations. NOAA Fisheries Service produced an updated status review on February 22, 2005 and reaffirmed that the northern green sturgeon Distinct Population Segment (DPS) warranted listing as a Species of Concern, however proposed that the Southern DPS should be listed as Threatened under the ESA. NMFS published a final rule on April 7, 2006 listing the southern DPS as threatened (71 FR 17757), which took effect June 6, 2006. The green sturgeon critical habitat proposed for designation includes the outer coast of Washington within 110 meters (m) depth (including Willapa Bay and Grays Harbor) to Cape Flattery and the Strait of Juan de Fuca to its United States boundary.

Puget Sound proper has been excluded from this critical habitat designation. The Dungeness West geoduck tract is at the margin of the critical habitat range of green sturgeon therefore geoduck harvest at this location will likely have no known adverse effects on ESA recovery efforts for green sturgeon populations.

Invertebrates:

Many different kinds of invertebrates which are frequently found on geoduck beds were observed on this tract during the 2011 and 2012 surveys (Table 6). The most common and obvious of these include: [1] mollusks (horse clams, truncated mya clam, piddocks, false geoducks, moon snails, moon snail egg collars, nudibranchs, cockles, unspecified hardshell clams, pink scallops, unspecified scallops, gumboot chitons, geoducks, octopus, and squid eggs); [2] echinoderms (California sea cucumbers, white sea cucumbers, unspecified sea cucumbers, sunflower stars, short-spined stars, blood stars, vermillion stars, leather stars, rainbow stars, rose stars, slime stars, sun stars, green sea urchins, and red sea urchins); [3] cnidarians (crimson anemone, plumed anemone, striped anemone, and sea pens); [4] arthropods (Dungeness crabs, red rock crabs, graceful crabs, hermit crabs, sharp-nosed crabs, decorator crabs, ghost shrimps, unspecified shrimps, and giant barnacles); [5] annelids (sabellid tube worms and chaetopterid tube worms); [6] porifera (sponges); [7] tunicates (sea squirts); and [8] bryozoans. Geoduck harvest has not been shown to have long-term adverse effects on these invertebrates. Geoduck harvest can depress some benthic invertebrates, however most of these animals recover within one year.

There is on-going interest from recreational and commercial crab fishers about interactions between geoduck harvest activity and Dungeness crab populations. Dungeness crab were observed on 2 out of 42 transects on the Nisqually tract during the 2015 supplemental survey. Dr. Dave Armstrong at the University of Washington has determined that Dungeness crab utilize Puget Sound bottoms from the +1 foot level out to the -330 foot level. The California Department of Fish and Wildlife suggest that coastal Dungeness crab can be found in waters as deep as 750 feet (https://wildlife.ca.gov/Conservation/Marine/Life-History-Inv-And-Plants). Jensen (2014) and WDFW information (personal comm. WDFW Biologist Don Velasquez, personal comm. 7/23/15) confirm a similar vertical distribution in Puget Sound, though the highest densities are found between the 0 to 360 foot water depth contours.

Dungeness crab were found on this tract in low numbers during the 2011 and 2012 surveys, being observed on 24 of 249 transects (900 sq. ft./transect) or on 9.6% of transects. To determine the potential impacts to Dungeness crab, the percentage of substrate disturbed during fishing was calculated and compared to the entire crab habitat within the tract and shoreward of the tract to the +1 foot level and seaward out to the -360 ft. (MLLW) water depth contour (Figure 5, Potential Dungeness Crab Habitat map). Dr. Dave Armstrong at the University of Washington has determined that Dungeness crab utilize Puget Sound bottoms from the +1 foot level out to the -330 foot level. In the Strait of Juan de Fuca, it is probably not reasonable to calculate the entire crab habitat out to the -330 foot contour, as this would encompass over 10,000 acres. Instead we used area about 1 mile northwesterly of the most northerly extension of the tract to estimate crab habitat (Figure 5). Using this method, the entire crab habitat along this tract is approximately 2,144 acres. There were about 3,583,775 harvestable geoducks on this tract, estimated from the 2011 and 2012 pre-fishing surveys. This estimate includes the adjustment of show factor to 0.51 for survey transect #s 200-219. With a harvest of 65 percent, the total number of geoducks that will be harvested is 2,332,092. Approximately 1.18 square feet of substrate is disturbed for every geoduck harvested, so 2,332,092x 1.18 = 2,751,869 square feet of substrate. This equals about 63.2 acres. This is about 2.9% percent of the total available crab habitat in the vicinity of this tract. Based on the low amount of disturbance, low abundance of Dungeness crab observed, and the lack of effects observed at the Thorndyke Bay study, we conclude that any effects on Dungeness crab will be very minor, if they occur at all.

Aquatic Algae:

Large attached aquatic algae are not generally found in geoduck beds in large quantities. Light restriction often limits algal growth to areas shallower than where most geoduck harvest occurs. Aquatic algae observed during geoduck surveys in 2011-2012 include:

> Unspecified small and large red algae, *Laminaria* spp., diatom layer, Desmarestiales algae, *Gigartina* spp., *Pterygophora californica*, *Ulva* spp. (sea lettuce), *Nereocystis luetkeana* (bull kelp), *Costaria costada*, and crustose coralline algae (Table 7).

John Boettner and Tim Flint, from the WDFW Habitat Division, have stated that if geoduck fishing is restricted to seaward of the eelgrass beds, they have no concerns about the fishing and that the existing conditions in the fishery SEIS are sufficient to protect fish and wildlife habitat and natural resources.

The shallow boundary of geoduck harvest is set at least two vertical feet seaward of the deepest eelgrass to protect all eelgrass from harvest activities. Eelgrass in the general vicinity of this tract has been documented at a maximum depth of -30 ft. (MLLW), east of Dungeness Spit. The shoreward boundary of this tract will be no shallower than the -35 ft. (MLLW) water depth contour, which should provide sufficient buffer for any eelgrass beds in the vicinity of the tract.

Marine Mammals:

Several species of marine mammals, including seals, sea lions, and river otters, are observed in the vicinity of this geoduck tract. There have also been sporadic reports of gray whales feeding near this tract (email from John Calambokidis, Cascadia Research, 1/31/07). Killer whales (*Orcinus orca*) may also be observed in the vicinity of this tract. The Southern Resident stock of killer whales resides mainly in the San Juan Islands throughout spring and summer, and incursions south into Puget Sound occur more frequently during winter months (Brent Norberg, NOAA, pers. comm. 5/15/06). The Southern Resident stock of killer whales was listed as "endangered" under the federal Endangered Species Act (ESA) by the National Marine Fisheries Service on November 15, 2005. This is in addition to the designation of this stock in May 2003 as "depleted" under the Marine Mammal Protection Act. More information and a draft conservation plan for this stock can be found at the NOAA website (https://www.fisheries.noaa.gov/action/listing-southern-resident-killer-whale-under-esa). Hand pick shellfish fisheries, like geoduck harvesting, are considered Category III under the Marine Mammal Authorization Program for Commercial Fisheries. This means that there is a "rare or remote" likelihood of marine mammal "take," (Brent Norberg, NOAA, pers. comm. 5/15/06). Precautions should be taken by commercial divers, when marine mammals are in the area, to be aware of marine mammal movements and behavior to eliminate the remote risk of entanglement with the hoses and lines from vessels and divers.

Birds:

A variety of marine birds are common in Puget Sound and the general vicinity of this tract. The most significant of these are rhinoceros auklets, pigeon guillemots, murres, murrelets, grebes, loons, scoters, dabbing ducks, black brant, mergansers, buffleheads, cormorants, gulls, and terns. Blue heron, bald eagles, and osprey are regularly observed. During a survey of the adjacent Siebert Creek tract (from May 24-27, 2004) the most common and obvious birds observed were: gulls, common loon, common murres, grebes, rhinoceros auklets, marbled murrelets, pigeon guillemots, and pelagic cormorants. Birds were usually observed swimming on the surface of the water or flying. Geoduck harvest does not appear to have any significant effect on these birds or their use of the waters where harvest occurs. A study by DNR and the WDFW was conducted at northern Hood Canal to learn the effects of geoduck fishing on bald eagles (Watson *et al*., 1995). A significant conclusion of this study is that geoduck clam harvest in general is unlikely to have any adverse impacts on bald eagle productivity.

A recommended no-activity buffer of 0.25 miles is centered at Green Point (pers. comm. Shelly Ament, WDFW 02/06/2007). A documented bald eagle territory at Green Point contains three known nest trees, two near the shoreline (within 200 feet). Avoiding activity within 0.25 miles from the OHT line at Green Point during nesting season (February 1st through August 15th) will reduce potential impacts to foraging and nesting bald eagles. The nearest distance of the Dungeness West geoduck tract to Green Point is 1.3 miles, therefore geoduck harvest activities inside the tract boundaries should not have a significant impact on eagle productivity.

Other uses:

Adjacent Upland Use:

The upland properties adjacent to the tract are designated as shoreline residential conservancy, shoreline environmental designations.

To minimize possible disturbance to adjacent residents, harvest vessels conducting harvest operations must remain seaward of a line two hundred yards seaward from and parallel to the line of ordinary high tide (OHT) or deeper than -35 ft. (MLLW), whichever is farther seaward. Harvest is allowed only during daylight hours and no harvest is allowed on Saturday, Sunday, or state holidays.

The only visual effect of harvest is the presence of the harvest vessels on the tract. These boats (normally 35-40 feet long) are anchored during harvest and all harvest is conducted out of sight by divers. Noise from boats, compressors and pumps may not exceed 50 dB measured 200 yards from the noise source, which is 5 dBA below the state noise standard.

Fishing:

The waters around this tract have some recreational salmon fishing with season and area restrictions. Sport fishing is open year round for surfperch and some bottomfish in this area. Bottomfish harvest is prohibited in waters deeper than 120 feet. Pacific halibut fishing has specific opening dates, usually in May. Recreational rockfish harvest is closed year-round. The WDFW Sport Fishing Rules pamphlet describes additional seasons, size limits, daily limits, specific closed areas, and additional rules for salmon and other marine fish species. The fishing which does occur should not create any problems for the geoduck harvesting effort in the area.

Geoduck fishing on this tract is managed in coordination with the treaty tribes through annual state/tribal geoduck harvest management plans. The non-Indian geoduck fishery should not be in conflict with any concurrent tribal fisheries.

Navigation:

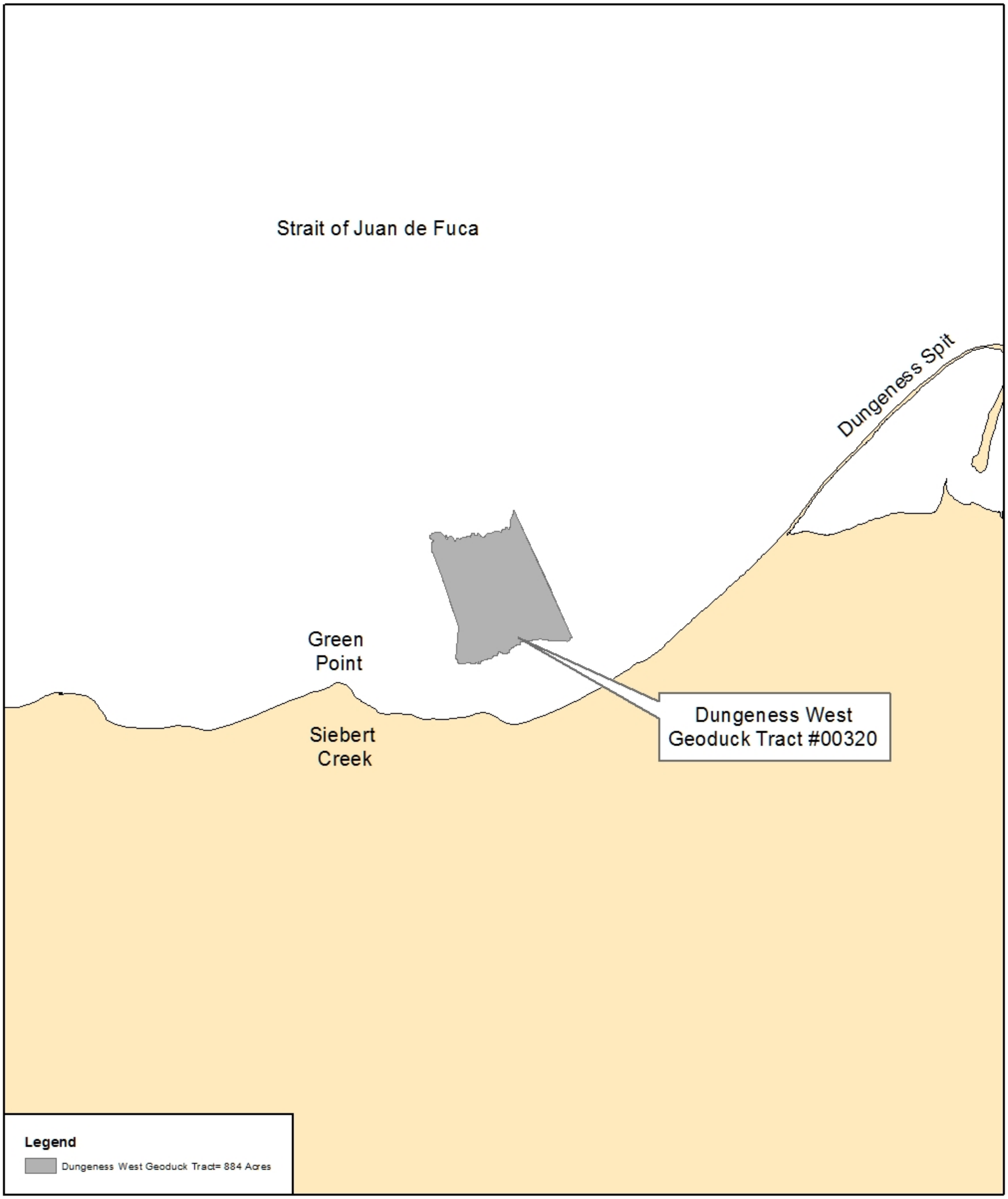
The Dungeness West area is used by recreational and commercial vessels traveling along the Strait of Juan de Fuca. Geoduck harvesting at this site should not result in any significant navigational conflicts. The Washington Department of Natural Resources will notify the local boating community prior to any harvest.

Summary:

The continued geoduck harvest is proposed for one tract along the shoreline of the Strait of Juan de Fuca. The tract was surveyed in 2011 and 2012 by LEKT and WDFW. The current tract biomass estimate of 3,512,201 pounds is based on the most recent surveys and reported harvest. The commercial tract is classified by DOH as “Approved.” The anticipated environmental impacts of this harvest are within the range of conditions discussed in the 2001 Final Supplemental Environmental Impact Statement. To reduce the possible impacts to herring and eelgrass, the harvest will be seaward of the -35 foot (MLLW) water depth contour along the tract. Geoduck harvesting is not expected to impact federally listed salmon, steelhead, green sturgeon, or marine mammals. No significant impacts are expected from this harvest.

File: 240102_Dungeness West_EA_00320.doc

Figure 1. Vicinity Map,
Dungeness West Commercial Geoduck Tract #00320



1:100,000

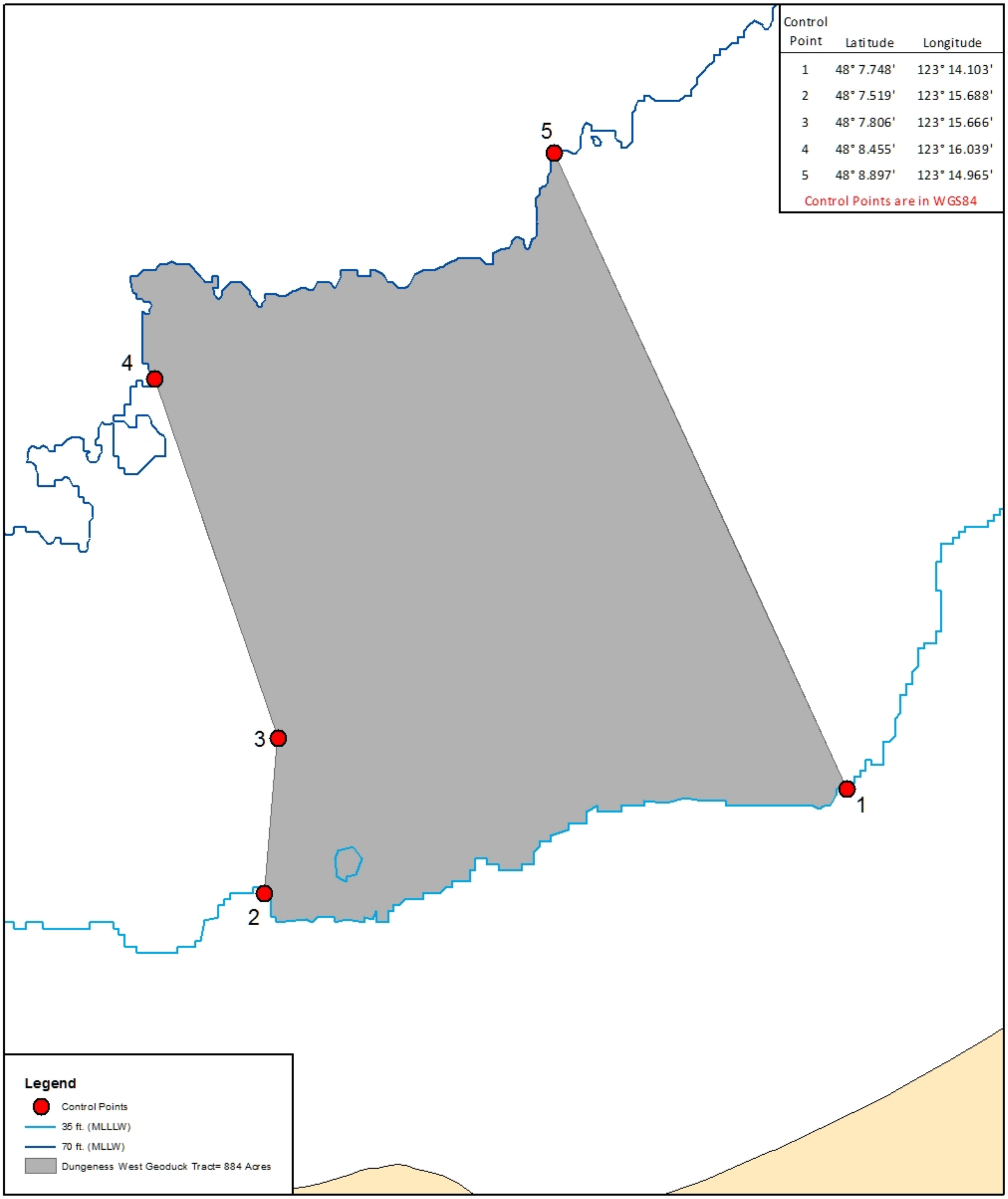
1 inch = 1.58 miles

Data Sources:
Projection for data is GCS_Washington Geographic System 1984, Units: Meters. Coastline layer is from DNR, 1: 24,000 scale, created 09-20-99. Contours are from NOAA soundings.

0 0.5 1 2 3 Miles

Map Date: January 2, 2018
Map Author: O. Working
File: Data\Ocean\Geoduck

Figure 1. Vicinity Map, Dungeness West Commercial Geoduck Tract #00320



Control Point	Latitude	Longitude
1	48° 7.748'	123° 14.103'
2	48° 7.519'	123° 15.688'
3	48° 7.806'	123° 15.666'
4	48° 8.455'	123° 16.039'
5	48° 8.897'	123° 14.965'

Control Points are in WGS84

N W E S

1:20,000

1 inch = 0.32 miles

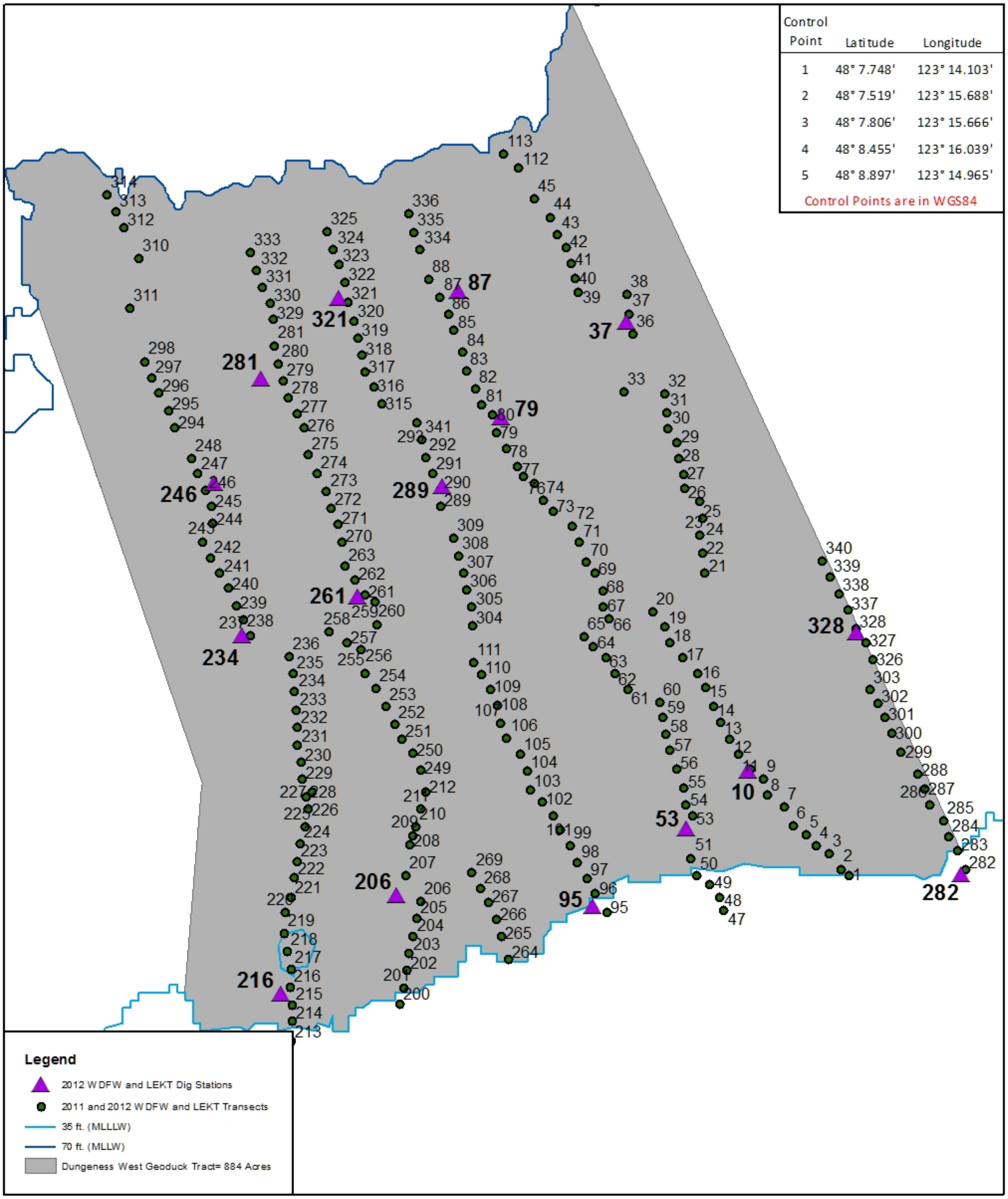
Data Sources:
Projection for data is GCS_Washington Geographic System 1984,
Units: Meters. Coastline layer is from DNR, 1: 24,000 scale, created
09-20-99. Contours are from NOAA soundings.

0 0.1 0.2 0.4 0.6 Miles

Washington Department of FISH and WILDLIFE

Map Date: January 2, 2018
Map Author: O. Working
File: Data\Ocean\Geoduck

Figure 3. Transect and Dig Station Map, Dungeness West Commercial Geoduck Tract #00320



Control Point	Latitude	Longitude
1	48° 7.748'	123° 14.103'
2	48° 7.519'	123° 15.688'
3	48° 7.806'	123° 15.666'
4	48° 8.455'	123° 16.039'
5	48° 8.897'	123° 14.965'

Control Points are in WGS84

N W E S

1:15,000

1 inch = 0.24 miles

Data Sources:
Projection for data is GCS_Washington Geographic System 1984, Units: Meters. Coastline layer is from DNR, 1: 24,000 scale, created 09-20-99. Contours are from NOAA soundings.

0 0.075 0.15 0.3 0.45 Miles

Map Date: January 2, 2018
Map Author: O. Working
File: Data\Ocean\Geoduck

Figure 4. Fish Spawning Areas Near the Dungeness West Commercial Geoduck Tract #00320

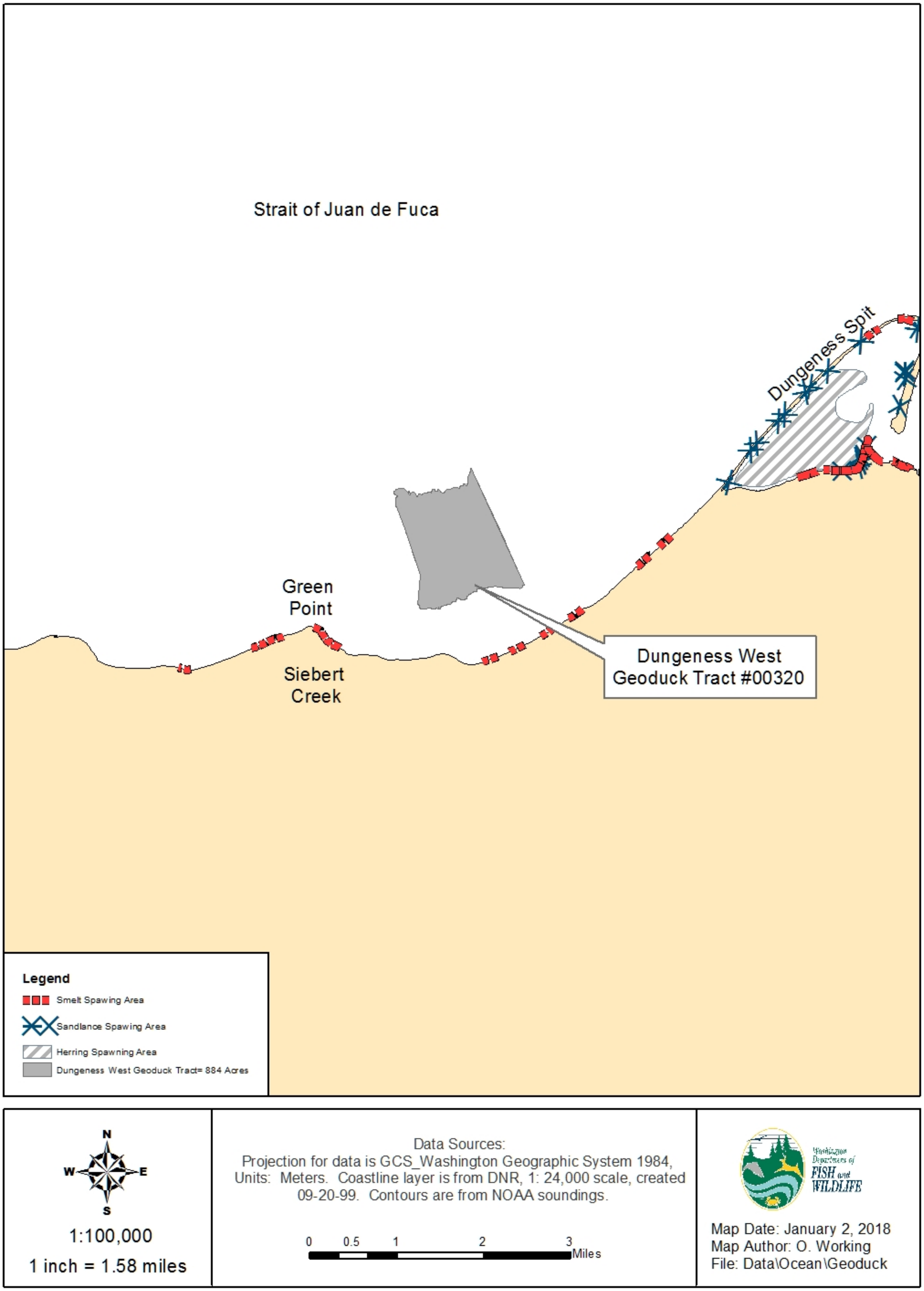
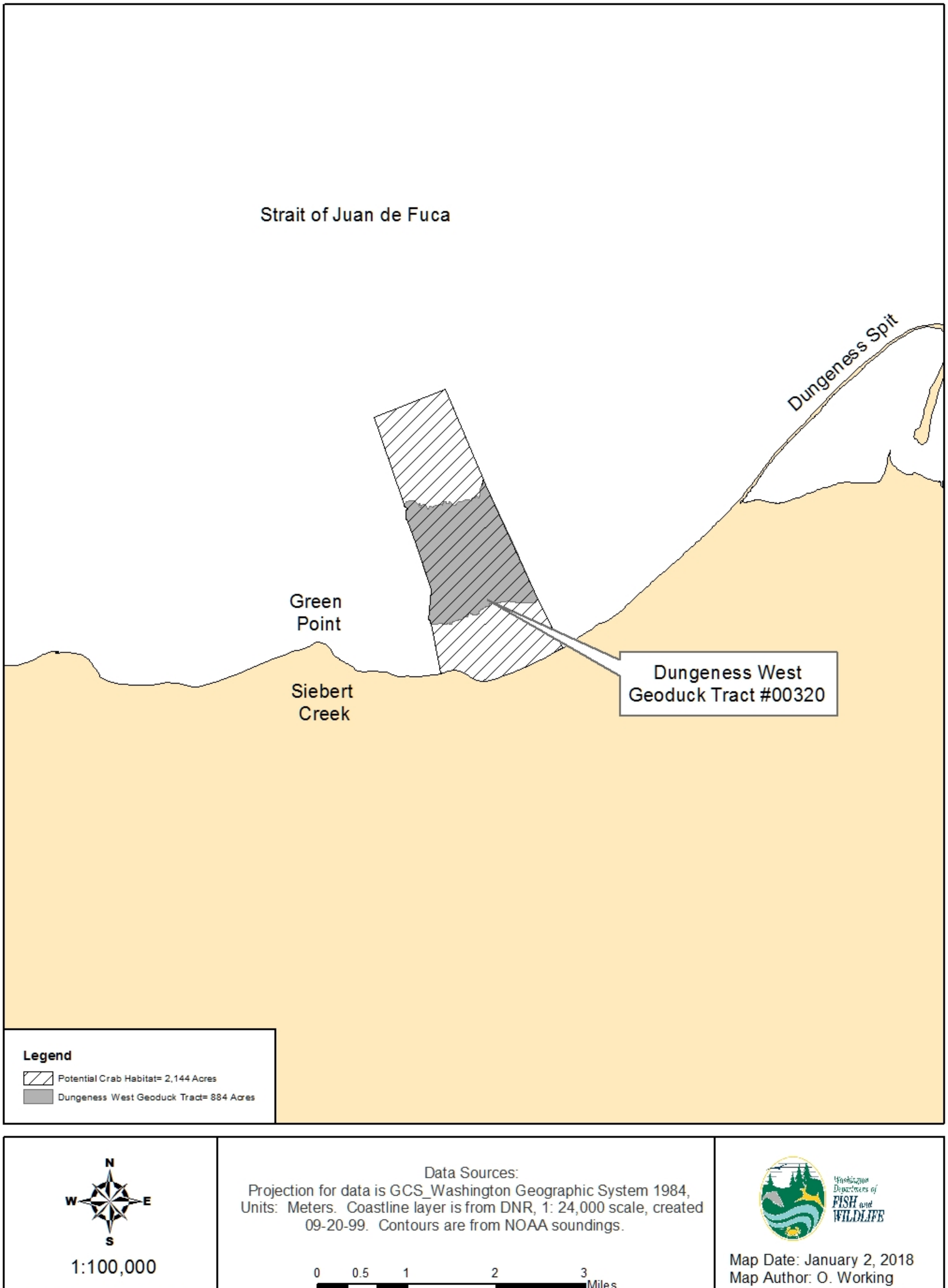


Figure 5. Dungeness Crab Habitat Map, Dungeness West Commercial Geoduck Tract #00320



1:100,000

1 inch = 1.58 miles

Data Sources:
Projection for data is GCS_Washington Geographic System 1984, Units: Meters. Coastline layer is from DNR, 1: 24,000 scale, created 09-20-99. Contours are from NOAA soundings.

Map Date: January 2, 2018
Map Author: O. Working
File: Data\Ocean\Geoduck

EXPLANATION OF SURVEY DATA TABLES

The geoduck survey data for each tract is reported in seven computer-generated tables. These tables contain specific information gathered from transect and dig samples and diver observations. The following is an explanation of the headings and codes used in these tables.

Tract Summary

This table is a general summary of survey information for the geoduck tract including estimates of *Tract Size* in acres, average geoduck *Density* in animals per sq.ft., *Total Tract Biomass* in pounds with statistical confidence, and *Total Number of Geoducks*. Mass estimators are reported in average values for *Whole Weight* and *Siphon Weight* in pounds. Geoduck siphon weights are also reported in *Siphon Weight as a percentage of Whole Weight.* Biomass estimates are adjusted for any harvest that may occur subsequent to the pre-fishing survey.

Digging Difficulty

This table presents a station-by-station evaluation of the factors contributing to the difficulty of digging geoduck samples with a 5/8" inside nozzle diameter water jet. Codes for the overall subjective summary of the digging difficulty are given in the *Difficulty* column. An explanation of the codes for the dig difficulty follows:

Code	Degree of Difficulty	Description
0	Very Easy	Sediment conducive to quick harvest.
1	Easy	Significant barrier in substrate to inhibit digging.
2	Some difficulty	Substrate may be compact or contain gravel, shell or clay; most geoducks still easy to dig.
3	Difficult	Most geoducks were difficult to dig, but most attempts were successful.
4	Very Difficult	It was laborious to dig each geoduck. Unable to dig some geoducks.
5	Impossible	Divers could not remove geoducks from the substrate.

Abundance refers to the relative geoduck abundance; a zero (0) indicates that geoducks were very sparse, a one (1) indicates that they were moderately abundant and a two (2) indicates that they were very abundant. *Depth* refers to the depth that the geoducks were found in the substrate. A zero (0) indicates that they were shallow, a one (1) indicates that they were moderately deep and a two (2) indicates that they were very deep. The columns labeled *Compact*, *Gravel*, *Shell*, *Turbidity* and *Algae* refer to factors that contribute to digging difficulty by interfering with the digging process. A zero (0) in one of these columns indicates that the factor was not a problem, a one (1) indicates that the factor caused moderate difficulty and a two (2) indicates that the factor caused a significant amount of difficulty when digging. *Compact* refers to the compact or sticky nature of a muddy substrate. *Gravel* and *Shell* refer to the difficulty caused by these substrate types. *Turbidity* refers to the turbidity within the water near the dig hole caused by the digging activity. High turbidity makes it difficult to find the geoduck siphon shows. The difficulty of digging associated with turbidity varies with the amount of tidal current present. Therefore, the turbidity rating refers only to the conditions occurring when the sample was collected. *Algae* refers to algal cover, which also makes it difficult for the diver to find geoduck siphon shows. Because algal cover varies seasonally, this value only applies to the conditions when the sample was collected. The *Commercial* column gives a subjective assessment of whether or not it would be feasible to harvest geoducks on a commercial basis at the given station.

Transect Water Depths, Geoduck Densities and Substrate Observations

This table reports findings for each transect. *Start Depth* and *End Depth* (corrected to MLLW) are given for each transect. *Geoduck Density* is reported as the average number of geoducks per square foot for each 900 square foot transect. *Substrate Type* and *Substrate Rating* refer to evaluations of the substrate surface. A two (2) rating indicates that the substrate type is predominant. A one (1) rating indicates the substrate type was present.

Geoduck Weights and Proportion Over 2 Pounds

This table summarizes the size and quality of the geoducks at each of the stations where dig samples were collected. Weight values for any geoduck dig samples that were damaged during sampling to the extent that water loss occurred, are excluded from calculations. The *Number Dug* column lists the number of geoducks collected. The *Avg. Whole Weight (lbs.)* column gives the average sample weight of whole geoduck clams for each dig station. The *Avg. Siphon Weight (lbs.)* column gives the average weight of the siphons of the geoducks for each dig station. The percentage of geoducks greater than two pounds is given in the *% Greater than 2 lbs.* column.

Transect - Corrected Geoduck Count and Position Table

This table reports the diver *Corrected Count*, the geoduck siphon *Show Factor* used to correct the count, and the *Latitude/Longitude* position of the start point of each survey transect. Raw (observed) siphon counts are “corrected” by dividing diver observed counts for each transect with a siphon “show” factor (See WDFW Tech. Report FPT00-01 for explanation of show factor) to estimate the sample population density. Transect positions are reported in degrees and decimal minutes to the thousandth of a minute, datum WGS84.

Most Common and Obvious Animals Observed

This table summarizes the animals, other than geoducks, that were observed during the geoduck survey, and reports the total number of transects on which they were present (*# of Transects Where Observed)*. This is qualitative presence/absence data only, and only animals that can be readily seen by divers at or near the surface of the substrate are noted. The *Group* designation allows for the organization of similar species together in the table. Whenever possible, the scientific name of the animal is listed in *Taxonomer*, and a generally accepted *Common Name* is also listed. Many variables may make it difficult for divers to notice other animals on the tract, including but not limited to poor visibility, diver skill, animals fleeing the divers, animal size, or cryptic appearance or behavior (in crevasses or under rocks).

Most Common and Obvious Algae Observed

This table summarizes marine algae observed during the geoduck survey, and reports the total number of transects on which they were seen (*# of Transects Where Observed)*. This is qualitative presence/absence data only, and only for macro algae, with the exception of diatoms. At high densities diatoms form a "layer" on or above the substrate surface that is readily visible and obvious to divers. Other types of phytoplankton are not sampled and are rarely noted. Whenever possible, the scientific name or a general taxonomic grouping of each plant is listed in *Taxonomer*.

Last Updated: April 14, 2020
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Table 1. GEODUCK TRACT SUMMARY

Dungeness West geoduck tract # 00320.

Tract Name	Dungeness West
Tract Number	00320
Tract Size (acres)[a]	884
Density of geoducks/sq.ft.[b]	0.033
Total Tract Biomass (lbs.)[b]	2,842,492
Total Number of Geoducks on Tract[b]	1,289,828
Confidence Interval (%)	12.7%
Mean Geoduck Whole Weight (lbs.)	2.20
Mean Geoduck Siphon Weight (lbs.)	0.61
Siphon Weight as a % of Whole Weight	28%
Number of Transect Stations	249
Number of Geoducks Weighed	321

[a.] Tract area is between the -35 ft. and -70 ft. (MLLW) water depth contours

[b.] Biomass is based on the 2011 and 2012 WDFW and LEKT pre-fishing geoduck survey biomass of 7,906,780 lbs, minus landings of 5,064,288 pounds through January 2, 2024

Generation Date:	January 2, 2024
Generated By:	O. Working, WDFW
File:	S:\FP\FishMgmt\Geoduck\EAs\2024

Table 2. DIGGING DIFFICULTY TABLE

Dungeness West geoduck tract # 00320, 2011 and 2012 WDFW and LEKT pre-fishing geoduck survey

Dig Station	Difficulty (0-5)	Abundance (0-2)	Depth (0-2)	Compact (0-2)	Gravel (0-2)	Shell (0-2)	Turbidity (0-2)	Algae (0-2)	Commercial (Y/N)
79	1	1	0	0	1	0	1	0	Y
87	1	1	1	0	1	0	1	0	Y
53	1	0	0	0	1	0	0	0	Y
10	1	0	1	0	1	0	0	0	Y
37	2	0	0	0	1	0	0	0	Y
95	3	1	1	0	1	0	0	1	Y
206	2	1	0	0	0	1	1	0	Y
246	0	2	1	0	0	0	0	0	Y
289	1	2	0	0	0	1	0	0	Y
261	3	1	1	1	1	0	0	0	Y
321	0	0	0	0	0	0	0	0	Y
216	3	1	0	1	2	1	0	1	Y
234	0	0	1	0	0	0	0	0	Y
281	0	0	0	0	0	0	0	0	Y
282	3	1	1	0	0	0	0	0	Y
328	1	2	1	0	1	0	0	0	Y

Generation Date: January 2, 2024
Generated By: O. Working, WDFW
File: S:\FP\FishMgmt\Geoduck\EAs\2024

Table 3. TRANSECT WATER DEPTHS, GEODUCK DENSITIES, AND SUBSTRATE OBSERVATIONS

Dungeness West geoduck tract # 00320, 2011 and 2012 WDFW and LEKT pre-fishing geoduck survey

Transect	Start Depth (ft) [a]	End Depth (ft) [a]	Geoduck Density (no. / sq ft) [b]	Substrate [c]							
				boulder	cobble	gravel	mud	peagravel	sand	shell	shellhash
200	35	36	0.033		1	1			2		
201	36	37	0.004	1	1	1			2		
202	37	39	0.000		1	1			2		
203	39	39	0.002		1	1			2		
204	39	41	0.052	1	1	1			2		
205	41	42	0.070		1	1			2		
206	42	42	0.087		1	1			2		
207	44	42	0.041			1			2		
208	42	42	0.070			1			2		
209	42	45	0.072						2	1	
210	45	46	0.044			1			2		
211	47	48	0.028			1			2		
212	48	50	0.020			1			2		
213	38	39	0.048	1	1	1			2		1
214	38	40	0.057	1	1	1			2		1
215	40	40	0.046	1	1	1			2		1
216	40	40	0.068	1	1	1			2		1
217	40	40	0.068		1	1			2		1
218	40	42	0.017	1	2				1		1
219	42	43	0.037	1	1	1			2		1
220	43	43	0.040			1			2		
221	44	44	0.072					1	2		
222	44	44	0.078					1	2		
223	44	45	0.075					1	2		
224	45	47	0.047		1			1	2		

Table 3. Continued

Transect	Start Depth (ft) [a]	End Depth (ft) [a]	Geoduck Density (no. / sq ft) [b]	Substrate [c]							
				boulder	cobble	gravel	mud	peagravel	sand	shell	shellhash
225	47	49	0.028			1		1	2		
226	49	51	0.053			1			2		
227	51	52	0.056					1	2		
228	49	50	0.047	1	1	1			2	1	1
229	50	53	0.103		1	1			2	1	1
230	53	54	0.047		1	1			2	1	1
231	54	55	0.025			1			2	1	1
232	55	55	0.003			1			2	1	1
233	55	55	0.009						2	1	1
234	56	55	0.053			1			2	1	1
235	55	55	0.056			1			2	1	1
236	55	57	0.006			1			2	1	1
237	55	55	0.097						2	1	1
238	55	56	0.097			1			2	1	1
239	56	55	0.126			1			2	1	1
240	55	54	0.042			1			2	1	1
241	54	54	0.000			1			2	1	1
242	54	54	0.017			1			2	1	1
243	54	57	0.004			1			2	1	1
244	55	58	0.008			1			2		
245	58	60	0.034			1			2		
246	60	63	0.177			1		1	2		
247	64	65	0.189			1		1	2		
248	65	66	0.215			1			2		
249	49	51	0.052		1	1			2		
250	51	52	0.108		1	1			2		
251	52	52	0.071		1	1			2		
252	52	52	0.056		1	1			2		

Table 3. Continued

Transect	Start Depth (ft) [a]	End Depth (ft) [a]	Geoduck Density (no. / sq ft) [b]	Substrate [c]							
				boulder	cobble	gravel	mud	peagravel	sand	shell	shellhash
253	53	53	0.014						2		
254	52	53	0.047			1			2		
255	54	54	0.047			1			2		
256	54	54	0.056			1			2		
257	54	54	0.089			1			2		
258	54	54	0.033			1			2		
259	54	54	0.041			1	1		2		
260	54	54	0.060			1	1		2		
261	53	52	0.068			1	1		2		
262	52	54	0.055			1	1		2		
263	54	56	0.030			1	1		2		
264	38	39	0.016			1	1	1	2	1	
265	39	39	0.025	1		1			2	1	
266	39	40	0.128			1			2	1	
267	40	40	0.153		1	1			2	1	
268	40	41	0.158		1	1			2	1	
269	41	42	0.131		1	1			2	1	
270	56	58	0.060					1	2		
271	58	55	0.056					1	2		
272	56	55	0.026	1				1	2		
273	55	55	0.060	1				1	2		
274	55	56	0.089					1	2		
275	56	57	0.035		1			1	2		
276	58	58	0.053		1	1		1	2	1	
277	58	58	0.047		1	1		1	2	1	
278	58	60	0.084		1	1		1	2	1	
279	60	59	0.069		1	1		1	2	1	
280	59	61	0.029		1	1		1	2	1	

Table 3. Continued

Transect	Start Depth (ft) [a]	End Depth (ft) [a]	Geoduck Density (no. / sq ft) [b]	Substrate [c] boulder	cobble	gravel	mud	peagravel	sand	shell	shellhash
281	61	64	0.066		1	1		1	2	1	
282	36	37	0.035	1	1	1		1	1		
283	37	36	0.024	1	1	1		1	1		
284	36	37	0.018		1	1		1	1		
285	37	38	0.005			1		1	2		
286	38	38	0.005	1	1	1		1	1		
287	38	39	0.016	1	1	1		1	2		
288	39	41	0.007		1	1		1	2	1	
289	57	56	0.107			1		1	2		
290	56	56	0.093			1		1	2		
291	56	57	0.126			1		1	2		
292	57	57	0.089		1	1		1	2		
293	57	56	0.033		1			1	2		
294	68	69	0.089			1		1	2		
295	69	70	0.077			1		1	2		
296	70	66	0.097			1			2		
297	66	62	0.075	1	1	1			2		
298	62	62	0.031	1	1	1			2		
299	45	43	0.005		1	1		1	2		
300	43	44	0.018	1	1	1		1	1		
301	44	43	0.002	1	1	1		1	2		
302	43	43	0.029					1	2		
303	43	44	0.031					1	2		
304	48	51	0.038					1	2		
305	51	51	0.020					1	2		
306	51	51	0.009		1			1	2		
307	51	52	0.026			1		1	2		
308	52	55	0.067					1	2		
309	55	54	0.073					1	2		

Table 3. Continued

Transect	Start Depth (ft) [a]	End Depth (ft) [a]	Geoduck Density (no. / sq ft) [b]	Substrate [c]							
				boulder	cobble	gravel	mud	peagravel	sand	shell	shellhash
310	68	68	0.060		1	1			1		
311	68	69	0.031	1	1	1			2		
312	69	70	0.044	1	1	1			1		
313	70	72	0.046			1			1		
314	72	75	0.011	1		1			1		
315	58	58	0.080	1	1	1			2		
316	59	59	0.089	1	1	1			2		
317	59	59	0.080	1	1	1			2		
318	59	60	0.080	1	1	1			2		
319	60	62	0.024	1	1	1			2		
320	62	63	0.073	1	1	1			2		
321	65	68	0.086					1	1		
322	67	67	0.089	1				1	1		
323	67	66	0.058					1	1		
324	66	68	0.098	1				1	1		
325	68	70	0.091					1	1		
326	45	45	0.029						2		
327	45	48	0.064						2		
328	48	50	0.080		1	1			2		
329	66	65	0.056		1	2		1	1		
330	65	68	0.058		1	1		1	1		
331	68	69	0.062			1		1	1		
332	69	68	0.104	1	1	1		2	1		
333	68	70	0.082		1	1		2	1		
334	67	65	0.104		1	1	1		2		
335	65	68	0.067		1	1			2		
336	68	70	0.142		1	1			2		
337	51	52	0.075		1	1			1		
338	52	51	0.042	1	1	1			1		
339	51	49	0.005		1	1			2		

Table 3. Continued

Transect	Start Depth (ft) [a]	End Depth (ft) [a]	Geoduck Density (no. / sq ft) [b]	Substrate [c] boulder	cobble	gravel	mud	peagravel	sand	shell	shellhash
340	49	47	0.000			1			2		
341	57	57	0.082					1	2		
1	35	37	0.103			2			1		
2	37	38	0.017			2			1		
3	38	39	0.026			2			1		
4	39	39	0.094			2			1		
5	39	39	0.146			2			1		
6	39	39	0.120			2			1		
7	39	39	0.043			2			1		
8	39	39	0.197			2			1		
9	39	40	0.215			2			1		
10	40	40	0.257			2			1		
11	39	40	0.094			1			2		
12	40	37	0.378			1			2		
13	43	44	0.480			1			2		
14	44	46	0.232			1			2		
15	46	46	0.034						2		
16	50	47	0.025						2		
17	47	45	0.062						2		
18	45	47	0.049			1			2		
19	47	45	0.019			1			2		
20	45	45	0.086			1			2		
21	49	49	0.000						2		
22	49	51	0.012			1			2		
23	51	51	0.015			1			2		
24	51	51	0.009			1			2		
25	47	48	0.019			2			1		
26	48	48	0.009			2			1		
27	48	49	0.009			2			1		
28	49	50	0.065			2			1		
29	50	51	0.062			2			1		

Table 3. Continued

Transect	Start Depth (ft) [a]	End Depth (ft) [a]	Geoduck Density (no. / sq ft) [b]	Substrate [c] boulder	cobble	gravel	mud	peagravel	sand	shell	shellhash
30	51	51	0.034			1			2		
31	51	53	0.031			1			2		
32	53	54	0.037			1			2		
33	47	50	0.164			2			1		
34	50	54	0.093			2			1		
35	54	56	0.062			2			1		
36	55	55	0.059			2			1		
37	55	56	0.093			2			1		
38	56	58	0.124			2			1		
39	57	59	0.129			2			1		
40	59	61	0.196			2			1		
41	61	63	0.079			2			1		
42	62	63	0.376			2			1		
43	63	65	0.326			2			1		
44	65	66	0.275			2			1		
45	66	65	0.213			2			1		
46	65	65	0.234			2			1		
47	35	36	0.023			2			1		
48	36	37	0.000	1		2			1		
49	37	39	0.019	1		2			1		
50	39	40	0.009	1		2			1		
51	40	43	0.168			1			2		
52	43	45	0.519			1			2		
53	43	46	0.267			1			2		
54	46	46	0.316			1			2		
55	46	47	0.305						2		
56	46	45	0.256						2		
57	45	45	0.331						2		
58	45	45	0.335						2		
59	45	45	0.234						2		
60	45	44	0.026						2		

Table 3. Continued

Transect	Start Depth (ft) [a]	End Depth (ft) [a]	Geoduck Density (no. / sq ft) [b]	Substrate [c]							
				boulder	cobble	gravel	mud	peagravel	sand	shell	shellhash
61	45	44	0.030						2		
62	44	44	0.057						2		
63	44	44	0.026			1			2		
64	44	46	0.015			1			2		
65	46	48	0.026			1			2		
66	46	48	0.019			1			2		
67	48	49	0.015			1			2		
68	49	50	0.057			1			2		
69	51	50	0.090			1			2		
70	50	50	0.177			1			2		
71	50	51	0.060			1			2		
72	52	53	0.113			1			2		
73	53	53	0.128			1			2		
74	53	54	0.158			1			2		
75	54	54	0.180			1			2		
76	54	56	0.192			1			2		
77	56	56	0.223			1			2		
78	56	54	0.174			1			2		
79	54	52	0.220			1			2		
80	52	53	0.114			1			2		
81	53	54	0.057			1			2		
82	54	55	0.134			2			1		
83	55	56	0.097			1			2		
84	58	60	0.189			1			2		
85	60	61	0.169			1			2		
86	61	62	0.172			1			2		
87	63	64	0.323			1			2		
88	64	65	0.272			1			2		
95	35	36	0.014			2			1		
96	36	38	0.142			1			2		
97	38	39	0.185			1			2		

Table 3. Continued

Transect	Start Depth (ft) [a]	End Depth (ft) [a]	Geoduck Density (no. / sq ft) [b]	Substrate [c]							
				boulder	cobble	gravel	mud	peagravel	sand	shell	shellhash
98	39	41	0.242						2		
99	41	43	0.161						2		
100	43	45	0.194						2		
101	45	47	0.303			1			2		
102	47	46	0.117			1			2		
103	46	46	0.062			1			2		
104	46	44	0.049			1			2		
105	46	45	0.062			1			2		
106	45	46	0.272			1			2		
107	46	45	0.173			1			2		
108	45	46	0.161			1			2		
109	47	48	0.241			2			1		
110	48	48	0.266			1			2		
111	48	48	0.105			1			2		
112	66	69	0.327			2			1		
113	69	73	0.284			2			1		

a. All depths are corrected to mean lower low water (MLLW)

b. Densities were calculated using a daily siphon show factor when possible. Otherwise, the default Strait of Juan de Fuca show factor of 0.51 was used.

c. Substrate codes: 1 = present ; 2 = dominant

Generation Date: January 2, 2024
Generated By: O. Working, WDFW
File: S:\FP\FishMgmt\Geoduck\EAs\2024

Table 4. GEODUCK SIZE AND QUALITY

Dungeness West geoduck tract # 00320, 2011 and 2012 WDFW and LEKT pre-fishing geoduck survey

Dig Station	Number Dug	Avg. Whole Weight (lbs.)	Avg. Siphon Weight (lbs.)	% of geoducks on station greater than 2 lbs.
79	20	1.3	0.4	5%
87	29	1.6	0.6	28%
53	25	2.6	None Recorded	80%
10	27	2.4	0.8	59%
37	21	2.1	0.7	48%
95	21	2.6	0.8	86%
206	22	2.6	0.7	86%
246	20	1.9	0.6	45%
261	17	2.1	0.7	53%
216	22	2.8	0.9	86%
234	24	2.0	0.7	46%
289	22	2.2	0.6	64%
321	20	1.6	0.5	20%
281	22	1.8	0.5	36%
282	21	3.1	1.0	86%
328	23	2.2	0.7	61%

Generation Date: January 2, 2024
Generated By: O. Working, WDFW
File: S:\FP\FishMgmt\Geoduck\EAs\2024

Table 5. TRANSECT CORRECTED GEODUCK COUNT AND POSITION TABLE

Dungeness West geoduck tract # 00320, 2011 and 2012 WDFW and LEKT pre-fishing geoduck survey

Transect	Corrected Geoduck Count per 900 sq. ft. Transect	Geoduck Siphon Show Factor [a]	Latitude [b]	Longitude [b]
200	29	0.51	48° 07.513	123° 15.246
201	4	0.51	48° 07.534	123° 15.239
202	0	0.51	48° 07.559	123° 15.233
203	2	0.51	48° 07.583	123° 15.230
204	47	0.51	48° 07.606	123° 15.223
205	63	0.51	48° 07.631	123° 15.218
206	78	0.51	48° 07.654	123° 15.211
207	37	0.51	48° 07.689	123° 15.243
208	63	0.51	48° 07.732	123° 15.237
209	65	0.51	48° 07.745	123° 15.231
210	39	0.51	48° 07.757	123° 15.226
211	25	0.51	48° 07.782	123° 15.217
212	18	0.51	48° 07.805	123° 15.207
213	43	0.51	48° 07.457	123° 15.467
214	51	0.51	48° 07.484	123° 15.466
215	41	0.51	48° 07.506	123° 15.466
216	61	0.51	48° 07.530	123° 15.472
217	61	0.51	48° 07.555	123° 15.472
218	16	0.51	48° 07.580	123° 15.480
219	33	0.51	48° 07.604	123° 15.489
220	36	0.357	48° 07.633	123° 15.487
221	64	0.357	48° 07.654	123° 15.476
222	70	0.357	48° 07.681	123° 15.472
223	67	0.357	48° 07.704	123° 15.466
224	42	0.357	48° 07.728	123° 15.461
225	25	0.357	48° 07.752	123° 15.453
226	48	0.357	48° 07.776	123° 15.448
227	50	0.357	48° 07.800	123° 15.441
228	42	0.357	48° 07.793	123° 15.453
229	92	0.357	48° 07.817	123° 15.462
230	42	0.357	48° 07.841	123° 15.465
231	22	0.357	48° 07.864	123° 15.474
232	3	0.357	48° 07.888	123° 15.477
233	8	0.357	48° 07.912	123° 15.479
234	48	0.357	48° 07.937	123° 15.484
235	50	0.357	48° 07.962	123° 15.489
236	6	0.357	48° 07.985	123° 15.497
237	87	0.264	48° 08.012	123° 15.580
238	87	0.264	48° 08.033	123° 15.594
239	114	0.264	48° 08.053	123° 15.609
240	38	0.264	48° 08.076	123° 15.628

Table 5. Continued

Transect	Corrected Geoduck Count per 900 sq. ft. Transect	Geoduck Siphon Show Factor [a]	Latitude [b]	Longitude [b]
241	0	0.264	48° 08.097	123° 15.646
242	15	0.264	48° 08.117	123° 15.667
243	4	0.264	48° 08.139	123° 15.683
244	8	0.264	48° 08.165	123° 15.665
245	30	0.264	48° 08.188	123° 15.669
246	159	0.264	48° 08.209	123° 15.682
247	170	0.264	48° 08.232	123° 15.700
248	193	0.264	48° 08.253	123° 15.713
249	47	0.236	48° 07.835	123° 15.219
250	97	0.236	48° 07.858	123° 15.238
251	64	0.236	48° 07.877	123° 15.260
252	51	0.236	48° 07.897	123° 15.277
253	13	0.236	48° 07.921	123° 15.296
254	42	0.236	48° 07.945	123° 15.317
255	42	0.236	48° 07.966	123° 15.341
256	51	0.236	48° 07.998	123° 15.350
257	81	0.236	48° 08.007	123° 15.380
258	30	0.236	48° 08.021	123° 15.418
259	37	0.407	48° 08.033	123° 15.320
260	54	0.407	48° 08.065	123° 15.325
261	61	0.407	48° 08.074	123° 15.346
262	49	0.407	48° 08.093	123° 15.369
263	27	0.407	48° 08.112	123° 15.389
264	15	0.407	48° 07.580	123° 15.026
265	22	0.407	48° 07.611	123° 15.042
266	115	0.407	48° 07.634	123° 15.054
267	138	0.407	48° 07.656	123° 15.071
268	143	0.407	48° 07.675	123° 15.088
269	118	0.407	48° 07.697	123° 15.107
270	54	0.61	48° 08.145	123° 15.398
271	51	0.61	48° 08.169	123° 15.407
272	23	0.61	48° 08.191	123° 15.423
273	54	0.61	48° 08.214	123° 15.433
274	80	0.61	48° 08.239	123° 15.453
275	31	0.61	48° 08.264	123° 15.474
276	48	0.61	48° 08.301	123° 15.484
277	43	0.61	48° 08.320	123° 15.499
278	75	0.61	48° 08.341	123° 15.518
279	62	0.61	48° 08.364	123° 15.530
280	26	0.61	48° 08.387	123° 15.542
281	59	0.61	48° 08.412	123° 15.551
282	31	0.61	48° 07.724	123° 14.094
283	21	0.61	48° 07.750	123° 14.112

Table 5. Continued

Transect	Corrected Geoduck Count per 900 sq. ft. Transect	Geoduck Siphon Show Factor [a]	Latitude [b]	Longitude [b]
284	16	0.61	48° 07.769	123° 14.130
285	5	0.61	48° 07.791	123° 14.142
286	5	0.61	48° 07.812	123° 14.171
287	15	0.61	48° 07.834	123° 14.183
288	7	0.61	48° 07.854	123° 14.198
289	97	0.61	48° 08.199	123° 15.197
290	84	0.61	48° 08.222	123° 15.199
291	113	0.61	48° 08.244	123° 15.217
292	80	0.61	48° 08.266	123° 15.231
293	30	0.61	48° 08.313	123° 15.252
294	80	0.61	48° 08.295	123° 15.750
295	69	0.61	48° 08.317	123° 15.763
296	87	0.61	48° 08.341	123° 15.784
297	67	0.61	48° 08.362	123° 15.800
298	28	0.61	48° 08.384	123° 15.816
299	5	0.61	48° 07.883	123° 14.234
300	16	0.61	48° 07.908	123° 14.255
301	2	0.61	48° 07.930	123° 14.270
302	26	0.61	48° 07.949	123° 14.285
303	28	0.61	48° 07.968	123° 14.302
304	34	0.61	48° 08.036	123° 15.123
305	18	0.61	48° 08.062	123° 15.126
306	8	0.61	48° 08.086	123° 15.138
307	23	0.61	48° 08.109	123° 15.146
308	61	0.61	48° 08.132	123° 15.158
309	66	0.61	48° 08.156	123° 15.168
310	54	0.61	48° 08.525	123° 15.836
311	28	0.61	48° 08.456	123° 15.850
312	39	0.61	48° 08.567	123° 15.868
313	41	0.61	48° 08.589	123° 15.886
314	10	0.61	48° 08.611	123° 15.905
315	72	0.61	48° 08.337	123° 15.326
316	80	0.61	48° 08.360	123° 15.344
317	72	0.61	48° 08.380	123° 15.362
318	72	0.61	48° 08.404	123° 15.370
319	21	0.61	48° 08.427	123° 15.380
320	66	0.61	48° 08.449	123° 15.389
321	77	0.61	48° 08.476	123° 15.402
322	80	0.61	48° 08.503	123° 15.410
323	52	0.61	48° 08.527	123° 15.424
324	89	0.61	48° 08.547	123° 15.436
325	82	0.61	48° 08.571	123° 15.450
326	26	0.61	48° 08.009	123° 14.299

Table 5. Continued

Transect	Corrected Geoduck Count per 900 sq. ft. Transect	Geoduck Siphon Show Factor [a]	Latitude [b]	Longitude [b]
327	57	0.61	48° 08.032	123° 14.314
328	72	0.61	48° 08.050	123° 14.336
329	51	0.61	48° 08.449	123° 15.554
330	52	0.61	48° 08.470	123° 15.562
331	56	0.61	48° 08.492	123° 15.579
332	93	0.61	48° 08.515	123° 15.592
333	74	0.61	48° 08.539	123° 15.606
334	93	0.61	48° 08.552	123° 15.258
335	61	0.61	48° 08.575	123° 15.273
336	128	0.61	48° 08.600	123° 15.284
337	67	0.61	48° 08.076	123° 14.353
338	38	0.61	48° 08.098	123° 14.373
339	5	0.61	48° 08.120	123° 14.392
340	0	0.61	48° 08.142	123° 14.410
341	74	0.61	48° 08.290	123° 15.241
1	93	0.129	48° 7.711	123° 14.332
2	15	0.129	48° 7.719	123° 14.350
3	23	0.129	48° 7.740	123° 14.374
4	85	0.129	48° 7.750	123° 14.402
5	131	0.129	48° 7.765	123° 14.424
6	108	0.129	48° 7.776	123° 14.450
7	39	0.129	48° 7.802	123° 14.470
8	178	0.129	48° 7.817	123° 14.505
9	193	0.129	48° 7.839	123° 14.515
10	232	0.129	48° 7.853	123° 14.542
11	85	0.129	48° 7.873	123° 14.568
12	340	0.129	48° 7.893	123° 14.587
13	432	0.129	48° 7.916	123° 14.608
14	209	0.129	48° 7.937	123° 14.623
15	31	0.129	48° 7.962	123° 14.641
16	22	0.180	48° 7.982	123° 14.657
17	56	0.180	48° 8.003	123° 14.690
18	44	0.180	48° 8.023	123° 14.718
19	17	0.180	48° 8.044	123° 14.729
20	78	0.180	48° 8.064	123° 14.755
21	0	0.360	48° 8.120	123° 14.650
22	11	0.360	48° 8.147	123° 14.657
23	14	0.360	48° 8.172	123° 14.664
24	8	0.360	48° 8.195	123° 14.659
25	17	0.360	48° 8.218	123° 14.666
26	8	0.360	48° 8.235	123° 14.698
27	8	0.360	48° 8.255	123° 14.701
28	58	0.360	48° 8.276	123° 14.712

Table 5. Continued

Transect	Corrected Geoduck Count per 900 sq. ft. Transect	Geoduck Siphon Show Factor [a]	Latitude [b]	Longitude [b]
29	56	0.360	48° 8.298	123° 14.717
30	31	0.360	48° 8.317	123° 14.736
31	28	0.360	48° 8.339	123° 14.740
32	33	0.360	48° 8.364	123° 14.746
33	147	0.360	48° 8.365	123° 14.830
34	83	0.360	Position not recorded	
35	56	0.360	Position not recorded	
36	53	0.360	48° 8.445	123° 14.816
37	83	0.360	48° 8.473	123° 14.825
38	111	0.360	48° 8.499	123° 14.831
39	116	0.266	48° 8.500	123° 14.930
40	177	0.266	48° 8.519	123° 14.938
41	71	0.266	48° 8.539	123° 14.947
42	338	0.266	48° 8.561	123° 14.959
43	293	0.266	48° 8.578	123° 14.977
44	248	0.266	48° 8.602	123° 14.994
45	192	0.266	48° 8.627	123° 15.028
46	210	0.266	Position not recorded	
47	21	0.237	48° 7.657	123° 14.587
48	0	0.237	48° 7.674	123° 14.596
49	17	0.237	48° 7.692	123° 14.618
50	8	0.237	48° 7.703	123° 14.646
51	152	0.237	48° 7.727	123° 14.658
52	468	0.237	Position not recorded	
53	241	0.295	48° 7.786	123° 14.658
54	285	0.295	48° 7.800	123° 14.672
55	275	0.295	48° 7.823	123° 14.678
56	231	0.295	48° 7.849	123° 14.694
57	298	0.295	48° 7.874	123° 14.709
58	302	0.295	48° 7.896	123° 14.718
59	210	0.295	48° 7.919	123° 14.726
60	24	0.295	48° 7.940	123° 14.734
61	27	0.295	48° 7.956	123° 14.800
62	51	0.295	48° 7.977	123° 14.828
63	24	0.295	48° 7.999	123° 14.848
64	14	0.295	48° 8.014	123° 14.874
65	24	0.295	48° 8.027	123° 14.894
66	17	0.295	48° 8.052	123° 14.843
67	14	0.295	48° 8.069	123° 14.856
68	51	0.295	48° 8.091	123° 14.859
69	81	0.295	48° 8.115	123° 14.876
70	159	0.295	48° 8.129	123° 14.894
71	54	0.295	48° 8.156	123° 14.910

Table 5. Continued

Transect	Corrected Geoduck Count per 900 sq. ft. Transect	Geoduck Siphon Show Factor [a]	Latitude [b]	Longitude [b]
72	102	0.295	48° 8.178	123° 14.926
73	115	0.295	48° 8.198	123° 14.966
74	142	0.295	48° 8.212	123° 14.988
75	162	0.388	48° 8.235	123° 15.007
76	172	0.388	48° 8.244	123° 15.029
77	201	0.388	48° 8.258	123° 15.042
78	157	0.388	48° 8.282	123° 15.067
79	198	0.388	48° 8.303	123° 15.089
80	103	0.388	48° 8.327	123° 15.097
81	51	0.388	48° 8.341	123° 15.120
82	121	0.388	48° 8.363	123° 15.135
83	88	0.388	48° 8.386	123° 15.154
84	170	0.388	48° 8.413	123° 15.163
85	152	0.388	48° 8.442	123° 15.183
86	154	0.388	48° 8.464	123° 15.196
87	291	0.388	48° 8.486	123° 15.214
88	245	0.388	48° 8.511	123° 15.239
95	13	0.388	48° 7.649	123° 14.827
96	128	0.367	48° 7.674	123° 14.852
97	166	0.367	48° 7.694	123° 14.871
98	218	0.367	48° 7.716	123° 14.891
99	144	0.367	48° 7.738	123° 14.908
100	174	0.367	48° 7.760	123° 14.928
101	272	0.180	48° 7.779	123° 14.944
102	106	0.180	48° 7.797	123° 14.967
103	56	0.180	48° 7.813	123° 14.993
104	44	0.180	48° 7.839	123° 15.001
105	56	0.180	48° 7.862	123° 15.017
106	245	0.180	48° 7.883	123° 15.045
107	156	0.180	48° 7.903	123° 15.059
108	145	0.180	48° 7.928	123° 15.066
109	217	0.180	48° 7.949	123° 15.082
110	239	0.180	48° 7.969	123° 15.102
111	95	0.180	48° 7.986	123° 15.119
112	295	0.180	48° 8.668	123° 15.062
113	256	0.180	48° 8.687	123° 15.095

[a.] A daily siphon show factor was used to correct combined geoduck counts when possible. Otherwise, the default Strait of Juan de Fuca show factor of 0.51 was used.
[b.] Latitude and longitude are in WGS84 datum, degrees and decimal minutes

Generation Date: January 2, 2024
Generated By: O. Working, WDFW
File: S:\FP\FishMgmt\Geoduck\EAs\2024

Table 6. MOST COMMON AND OBVIOUS ANIMALS OBSERVED

Dungeness West geoduck tract # 00320, 2012 WDFW pre-fishing geoduck survey

# of Transects where Observed	Group	Common Name	Taxonomer
4	ANEMONE	CRIMSON ANEMONE	*Cribrinopsis fernaldi*
11	ANEMONE	PLUMED ANEMONE	*Metridium* spp.
93	ANEMONE	STRIPED ANEMONE	*Urticina* spp.
3	ASCIDIAN	SESSILE TUNICATE	Unspecified Tunicate
11	BIVALVE	FALSE GEODUCK	*Panomya* spp.
21	BIVALVE	HARDSHELL CLAMS	*Veneridae* spp.
11	BIVALVE	HEART COCKLE	*Clinocardium nuttalli*
34	BIVALVE	HORSE CLAM	*Tresus* spp.
8	BIVALVE	PIDDOCK	Unspecified Pholadidae
1	BIVALVE	PINK SCALLOP	*Chlamys rubida*
2	BIVALVE	SWIMMING SCALLOPS	*Chlamys* spp.
51	BIVALVE	TRUNCATED MYA	*Mya truncata*
1	CEPHALOPOD	OCTOPUS	Octopus or *Enteroctopus* spp.
1	CEPHALOPOD	SQUID EGGS	*Loligo opalescens*
1	CNIDARIA	SEA PEN	*Ptilosarcus gurneyi*
63	CRAB	DECORATOR CRAB	*Oregonia gracilis*
24	CRAB	DUNGENESS CRAB	*Cancer magister*
22	CRAB	GRACEFUL CRAB	*Cancer gracilis*
97	CRAB	HERMIT CRAB	Unspecified hermit crab
104	CRAB	RED ROCK CRAB	*Cancer productus*
39	CRAB	SHARP-NOSED CRAB	*Scyra acutifrons*
3	CUCUMBER	BLACK CUCUMBER	Unspecified Holothurian
20	CUCUMBER	SEA CUCUMBER	*Parastichopus californicus*
13	CUCUMBER	WHITE CUCUMBER	*Eupentacta quinquesemita*
1	FISH	BROWN ROCKFISH	*Sebastes auriculatus*
33	FISH	DOGFISH SHARK	*Squalus acanthias*
2	FISH	FISH	Unspecified Fish
13	FISH	FLATFISH	Unspecified flatfish
2	FISH	GREENLING	Unspecified *Hexagrammos* spp.
1	FISH	LINGCOD	*Ophiodon elongatus*
3	FISH	PACIFIC HERRING	*Clupea harengus pallasi*
2	FISH	POACHER	Unspecified Agonidae
4	FISH	SAND LANCE	*Ammodytes hexapterus*
68	FISH	SANDDAB	*Citharichthys* spp.
54	FISH	SCULPIN	Unspecified Cottidae
2	FISH	SKATE	Unspecified *Raja* spp.
13	FISH	STARRY FLOUNDER	*Platichthys stellatus*
22	GASTROPOD	MOON SNAIL	*Polinices lewisii*
56	GASTROPOD	MOON SNAIL EGGS	*Polinices lewisii* egg case
17	GASTROPOD	NUDIBRANCH	Unspecified nudibranch
44	MISC	BRYOZOAN COLONY	Unspecified Bryozoan
2	MISC	GIANT BARNACLE	*Balanus nubilis*
7	MISC	GUMBOOT CHITON	*Cryptochiton stelleri*
68	MISC	SPONGE	Unspecified Porifera

Table 6. Continued

# of Transects where Observed	Group	Common Name	Taxonomer
1	NUDIBRANCH	DENDRONOTUS	*Dendronotus* spp.
6	NUDIBRANCH	DIRONA	*Dirona albolineata*
4	NUDIBRANCH	HERMISSENDA	*Hermissenda crassicornis*
40	SEA STAR	BLOOD STAR	*Henricia leviuscula*
2	SEA STAR	LEATHER STAR	*Dermasterias imbricata*
17	SEA STAR	RAINBOW STAR	*Orthasterias koehleri*
1	SEA STAR	ROSE STAR	*Crossaster papposus*
13	SEA STAR	SHORT-SPINED STAR	*Pisaster brevispinus*
10	SEA STAR	SLIME STAR	*Pteraster tesselatus*
10	SEA STAR	SUN STAR	*Solaster* spp.
106	SEA STAR	SUNFLOWER STAR	*Pycnopodia helianthoides*
1	SEA STAR	VERMILLION STAR	*Mediaster aequalis*
2	SHRIMP	GHOST SHRIMP	Unspecified ghost shrimp
28	SHRIMP	SHRIMP	Unspecified shrimp
1	URCHIN	GREEN URCHIN	*Strongylocentrotus droebachiensis*
2	URCHIN	RED URCHIN	*Strongylocentrotus franciscanus*
74	WORM	ROOTS	Chaetopterid polychaete tubes
101	WORM	SABELLID TUBE WORM	*Sabellid* spp.
22	WORM	TEREBELLID TUBE WORM	*Terebellid* spp.

Generation Date: January 2, 2024
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Table 7. MOST COMMON AND OBVIOUS ALGAE OBSERVED

Dungeness West geoduck tract # 00320, 2012 WDFW pre-fishing geoduck survey

# of Transects Where Observed	Taxonomer
1	*Costaria costada*
65	*Desmarestia* spp.
2	*Nereocystis luetkeana*
94	Diatoms
1	Crustose coralline algae
3	*Pterygophora californica*
106	*Laminaria* spp.
64	Unspecified large red algae
2	*Ulva* spp.
142	Unspecified small red algae
3	*Gigartina* spp.

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