EXHIBIT A
ENVIRONMENTAL ASSESSMENT OF PROPOSED GEODUCK HARVEST
IN MASON COUNTY, PEALE PASSAGE GEODUCK TRACT (#16450)

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 minus 18 foot (corrected to mean lower low water - MLLW) and the minus 70 foot water depth (at any tide height). Harvest is rotated around Puget Sound in five geoduck management regions. The fishery, its management, and its environmental impacts are presented in the Final Supplemental Environmental Impact Statement for the Puget Sound Commercial Geoduck Fishery (WDFW & DNR, May 2001). The proposed harvest in Mason County is described below.

Proposed Harvest Dates: October 1, 2005 to October 1, 2010

Tract name: Peale Passage Tract (tract #16450)

Description (Figure 1):

The Peale Passage tract was re-surveyed for subtidal geoduck clams in the year 2005 by WDFW and DNR. The tract area available to non-Indian harvest is approximately 119 subtidal acres along the southeastern shoreline of Squaxin Island and southwestern shoreline of Hartstene Island, South Puget Sound. The tract is located within the southern portion of Peale Passage and extends northerly, from a line projected southwesterly from Brisco Point on Hartstene Island, about 1150 yards into the passage.

The commercial tract area is deeper than and seaward of the minus 18 foot (MLLW) water depth contour. The commercial tract area is also seaward of a line 200 yards seaward and parallel to the ordinary high tide (OHT) line. The description below is for the Peale Passage tract (Figure 2):

The northern-most point ("control point" #3 in Figure 2) along the west side of the tract is on the 200 yards seaward of the OHT contour line at 47° 10.177' N. latitude, 122° 53.243' W. longitude. From this point the boundary line follows the 200 yards seaward of the OHT contour line southerly to a point at 47° 10.034' N. latitude, 122° 53.332' W. longitude, then projects southeasterly to a point on the –70 ft (MLLW) water depth contour at 47° 9.979' N. latitude, 122° 53.188' W. longitude , then follows the –70 ft (MLLW) water depth contour southeasterly to a point at 47° 9.688' N. latitude, 122° 52.983' W. longitude, then projects northeasterly to a point on the 200 yards seaward of the OHT contour line at 47°

9.744' N. latitude, 122° 52.821' W. longitude, then follows the 200 yards seaward of the OHT contour line northerly to a point at 47° 9.931' N. latitude, 122° 52.738' W. longitude where the 200 yards seaward of the OHT contour line intersects the –18 ft (MLLW) water depth contour, then follows the –18 ft (MLLW) water depth contour northerly to a point at 47° 10.281' N. latitude, 122° 52.628' W. longitude where the –18 ft (MLLW) water depth contour intersects the 200 yards seaward of the OHT contour line, then follows the 200 yards seaward of the OHT contour line northerly to a point at 47° 10.300' N. latitude, 122° 52.637' W. longitude, then projects southwesterly to the point of origin.

For purposes of determining tract area, the minus 70 foot water depth contour corrected to MLLW is used. The maximum allowable fishing depth during harvest is minus 70 feet uncorrected to MLLW (also referred to as gauge depth).

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 bed is primarily determined by the water current velocity. Coarse sediments are generally found in areas of fast currents and finer (muddier) sediments are found 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 currents.

Water currents are weak to moderate in Peale Passage. Currents of up to 0.6 knots occur at maximum flood tide (tidal current tables 2005 National Oceanic and Atmospheric Administration). Current velocities can be moderate to strong in southern portions of the tract near Brisco Point on Hartstene Island and Unsal Point (also known as Tucksel Point) on Squaxin Island. Evidence of this is current-swept substrates, observed near these points of land, consisting of cobble and hardpan.

The Peale Passage tract has variable substrates of mud, sand, sand/mud mixtures, shell fragments (shell hash), gravel, and cobble (Table 1). Mud was present on 25 out of 30 survey transects and was the predominant substrate on 15 of those transects. Sand was present on 17 out of 30 transects and was the predominant substrate on 10 of those transects. Cobble was present on 8 transects in the western and most southern portion of the tract. Shell hash was noted on two transects (#s 7 & 44, locations listed in Table 2 and shown on Figure 3) and gravel was noted on one transect (#44).

Water Quality:

Water quality is good at the Peale Passage commercial geoduck tract. Water mixing at this tract is affected by a convergence of currents from Dana Passage, Peale Passage and Squaxin Passage, which prevents stratification (water layering) and brings deeper nutrient-rich waters to the surface. As a result, the marine waters at the southern portion of Peale Passage are well oxygenated and productive. At a Washington Department of Ecology water quality station (#DNA001) located southeasterly of Brisco Point in Dana Passage (47.1617 degrees N. latitude, 122.8700 degrees W. longitude), the range of dissolved oxygen concentration at the 33-foot water depth is 5.0 to 13.8 mg/liter. Salinities recorded at this water depth are between 26.2 to 32.3 parts per thousand. Water temperatures recorded at this station and these water depths range from 7.2 –15.1° C (44.9-59.3° F).

This geoduck tract status has been reviewed by the Washington Department of Health (DOH) and the tract has been classified as "Approved" for shellfish harvest (Woolrich, 10/8/05).

Biota:

Geoduck:

The Peale Passage tract available for non-Indian harvest is approximately 119 acres and contains an estimated 1,722,000 pounds of geoducks (Table 3). Geoducks at this location are mixed quality, with dark wrinkled epidermis (periostracum, outer surface tissue, outer layer of skin) noted on station #s 5, 16, 26, and 33. Dig station #s 5 and 6 also had geoduck samples with deformed shells, indicating cobble or other hard surfaces adjacent to shell during geoduck growth. The five dig stations within this tract were rated "commercial" (Table 4). Dig station #s 5, 16, and 33 have shell in the substrate noted which can affect ability to dig. The stations with the highest level of dig difficulty (#'s 5, 26, and 33) also had compact mud noted as a factor which inhibited time taken to dig geoducks. The geoduck density is low to moderate, compared to other Puget Sound tracts, averaging 0.10 geoducks/square foot based on the 2005 WDFW tract survey. The average density range from the 2005 survey was 0.000 geoduck/square foot at stations #17 and #24 to 0.385 geoducks/square foot at station #45 (Table 1). The geoducks on the Peale Passage tract are average at 3.26 pounds compared to the Puget Sound average of 2.0 pounds per geoduck clam. The lowest average whole weight was 2.92 pounds per geoduck at dig station 26 and the highest average whole weight was 3.70 pounds per geoduck at dig station #16 (Table 5).

Peale Passage was previously surveyed in 1969 and 1973 by WDFW (18 transects). About 9 of these transects, from the 1969 and 1973 surveys, were located within the

current tract boundary configuration. The tract was resurveyed in 2001 by the Squaxin Tribe (25 transects). The most recent survey in 2005 by WDFW includes only the area (119 acres) available for non-Indian harvest and the biomass estimates in this report are based solely on the 2005 survey.

Geoducks are managed for long term sustainable harvest. No more than 2.7% of the commercially fishable stocks are harvested (total fishing mortality) each year, in each harvest management region, throughout Puget Sound. The fishable portion of the total Puget Sound population for non-Indian harvest includes geoducks that are seaward of the 200 yards seaward of the ordinary high tide line (OHT) in water between minus 18 feet (corrected to MLLW) and minus 70 feet (uncorrected to MLLW). Other geoducks, which are not harvestable, are found inshore and offshore of the harvest areas. Observations in South Puget Sound show that 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 primarily to geoduck's low rate of natural recruitment. WDFW has studied the regeneration rate of geoducks on certain tracts scattered throughout Puget Sound. The estimated average time to regenerate a new crop of geoducks after removal of 100 percent of the original geoducks is 39 years. The longest regeneration time is 73 years, and the shortest regeneration time is 11 years. The regeneration research to empirically analyze tract recovery rates is continuing.

Fish:

Geoduck beds are generally devoid of rocky outcroppings and other relief features that attract or support fish. The bottoms are relatively flat and composed of soft, unstable sediments which provide few attachments for macroalgae and few vertical structures which attract fish. As noted in the section of this report describing tract substrate, mud was the predominant substrate present. To a lesser extent sand, and sand/mud mixtures, were observed during the 2005 tract survey (Table 1). The only attached algae observed which may attract marine fish were Laminarian algae, red algae, and bladder kelp. Fish species observed and identified during the 2005 survey were sculpins, tubesnouts, dogfish sharks, and various flatfish including sanddabs and starry flounders.

WDFW marine fish managers were asked of their concerns of any possible impacts on marine fish stocks that geoduck harvest may have. Rock sole (*Lepidopsetta bilineata*) spawning habitat (Figure 4) has been identified along the southern shorelines of Peale Passage, adjacent to the Peale Passage geoduck tract. Rock sole spawning beds are located in the upper and middle beach containing sand and/or gravel mixtures. Greg Bargmann (WDFW Marine Resources, pers. comm. 11/14/05) stated that there are no concerns about impacts to rock sole spawning habitat from geoduck harvest. This is

based on the vertical separation between rock sole spawning habitat (intertidal) and the –18 foot (MLLW) water depth nearshore harvest restriction for geoduck harvest. Marine Fish Managers have previously stated that no problems should occur to other marine fish stocks or fisheries due to geoduck fishing. Geoduck harvest should not affect any recreational or commercial groundfish fisheries in the vicinity of this tract. There has been no concern expressed by WDFW marine fish managers to commercial geoduck harvest, as long as the minimum geoduck harvest depth of -18 ft. (MLLW) is adhered to.

Seven marine fish species were considered for listing under federal Endangered Species Act (ESA). In November 2000, the National Marine Fisheries Service determined that three of the seven species; Pacific cod, Pacific hake and walleye pollock; did not need ESA protection. In April 2001, NMFS announced that the remaining four species under consideration; copper rockfish, quillback rockfish, brown rockfish, and Pacific herring; are also relatively stable or are increasing with existing conservation measures in place. Proposed geoduck harvest at this tract is not in the immediate vicinity of documented herring spawning grounds. There is a herring spawning area identified along the southwestern shoreline of Squaxin Island, just northwesterly of Unsal Point. The Squaxin Passage area is also identified as a herring "holding area." Direct interactions between geoduck harvest and herring spawning habitat is not expected. Surf smelt habitat has been identified along the southern shorelines of Peale Passage (Figure 4). Surf smelt (*Hypomesus pretiosus*) spawning beds are located in the upper beach area containing sand and/or gravel bed materials. Geoduck harvest on the Peale Passage tract should have no detrimental impacts on Pacific herring or surf smelt due to horizontal and vertical separation between harvest activity and spawning habitat.

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 (ESA). 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 and within Hood Canal. 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 out-migration may be as late as mid-April. The Peale Passage tract is outside of the critical habitat range for Hood Canal summer run chum salmon.

Critical habitat for Puget Sound Chinook salmon include all marine, estuarine and river reaches accessible to listed chinook salmon in Puget Sound. WDFW recognizes 108 distinct stocks of Chinook salmon in Washington; 54 considered healthy, 35 considered depressed, 5 considered critical, and 14 have an unknown status. The majority of Puget Sound Chinook salmon emigrate to the ocean as subyearlings.

The stock origin (ancestry) of present day Chinook salmon in South Puget Sound are largely Soos Creek Hatchery (Green River). The independent tributaries in South Puget Sound are not typical Chinook salmon habitat because of the relatively small stream size and low water flows during the late summer/early fall spawning season. Some smaller streams presently support low-escapement populations from current hatchery production or strays from viable South Sound "natural" populations. Most Chinook salmon spawning in South Puget Sound takes place in McAllister Creek, Deschutes River, and Percival Creek. Other independent tributaries that support Chinook spawning in South Puget Sound are Woodland Creek, Mill Creek, Goldborough Creek, Case Inlet streams, Carr Inlet streams, and East Kitsap streams (WDFW Salmonid Stock Inventory, 2002). Streams or tributaries near the Peale Passage geoduck tract are Woodland Creek (approximately 7.2 miles from the tract via marine water route), Deschutes River (approximately 8.6 miles from the tract via marine water route), and Mill Creek (approximately 10.0 miles from the tract via marine water route).

The geographic separation (horizontal) of this tract from known spawning tributaries and vertical separation of geoduck harvest (deeper and seaward of the -18 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 from 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 (within) 200 yards from shore, 2 ft. vertically from elevation of 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 ESA-listed or other salmon populations.

Invertebrates:

Many different kinds of invertebrates, which are frequently found in geoduck beds throughout Puget Sound, were observed on the tract during the 2005 survey. The most common and obvious groups include mollusks, crustaceans, echinoderms, cnidarians, and various species of marine worms (Table 6). 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 populations recover within one year.

WDFW and DNR have studied the effects of geoduck harvest on the population of Dungeness crab at Thorndyke Bay in Hood Canal. The results of this 4.6 year study indicated no adverse effects on crab catch-per-unit-effort due to geoduck fishing.

Dungeness crab were observed on one transect during the survey of the Peale Passage tract. The area in the vicinity of this tract is not considered to be significant Dungeness crab habitat by WDFW crustacean biologists.

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 Carr Inlet in the vicinity of the tract the tract deeper than the +1 foot tide level (Figure 3). 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 minus 330 foot level. The entire crab habitat in the vicinity of this geoduck bed is approximately 425 acres. From the most recent survey in 2005, there is an estimated 528,000 harvestable geoducks on this tract. With a harvest of 85 percent of these geoducks, the total number harvested would be 448,800 geoducks. Approximately 1.18 square feet of substrate is disturbed for every geoduck harvested, so 448,800 x 1.18 = 529,584 square feet of substrate. This equals about 12.2 acres or 2.9 percent of the total available crab habitat in the vicinity of this tract. This represents a low amount of disturbance to the crab habitat in the immediate vicinity of this geoduck tract. Since this tract is outside of the principle range of distribution of Dungeness crab, few Dungeness crab were observed during scuba surveys, 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.

Red rock crab (*Cancer productus*) were observed on 27 of 30 transects (90% of the transects observations on Peale Passage tract had red rock crab listed). The crab catch study at Thorndyke Bay in Hood Canal (Armetta Cain, January 1995) found no significant difference in red rock crab Catch Per Unit Effort (CPUE) on a tract prior to geoduck fishing, during geoduck fishing, and following geoduck fishing. Based on observations of red rock crab within the Peale Passage tract there is a potential for impacts to red rock crab populations in the vicinity of the tract. The impacts will likely not be significant if the findings of the Thorndyke Bay study apply to the Peale Passage tract location. Since the abundance of red rock crab at the Thorndyke Bay study was less (12% of pre-fishing geoduck survey transects had red rock crab observations) it is uncertain that the conclusions will be the same. A post-harvest survey will be conducted on this tract, following geoduck fishing, which should provide better information about relative changes in abundance of red rock crab at this location.

In a note dated October 10, 2005 the WDFW Region 6 Shellfish Manager, Brad Sele, stated that there are no specific shellfish concerns regarding the proposed geoduck harvest in this vicinity.

Aquatic Plants:

Large quantities of attached aquatic plants are not generally found in geoduck beds. Light restriction often limits plant growth to areas shallower than where most geoduck harvest occurs. Aquatic plants observed on the geoduck survey include: Laminarian algae, red algae, bladder kelp, and diatoms (Table 7).

WDFW conducted eelgrass surveys at the Peale Passage tract on August 3, 2005. The conclusion of this work was that no eelgrass was observed deeper than the -16 foot level (corrected to MLLW). Therefore, the shallow boundaries of this tract is set at no shallower than the -18 foot level to conform with state statute (RCW 77.60.070).

Marine Mammals:

There are 26 species of whales observed in Washington, though many are infrequent visitors to South Puget Sound. In 1990 and 1991 gray whales (*Eschrichtius robustus*) were often observed in South Puget Sound (1990 – 174 sightings, 1991 – 158 sightings) and may occasionally be in the vicinity of the Peale Passage N. geoduck tract. Killer whales (*Orcinus orca*), harbor porpoise (*Phocoena phocoena*), and harbor seals (*Phoca vitulina*) are other marine mammals that may be observed on or near geoduck tracts occasionally.

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. 6/25/03). Precautions should be taken by commercial divers, when whales are in the area, to be aware of whale movements and behavior to eliminate the remote risk of entanglement with vessel and hoses and lines. There is no known seal haul-out in the vicinity of this tract and Gray whales are not known to occur predictably in Peale Passage, therefore marine mammal biologists have expressed no concern with geoduck harvest at this location (Brent Norberg, NOAA, 10/11/05). No conflicts have been observed between marine mammals and geoduck harvest activities.

Birds:

A variety of marine birds are observed in South Puget Sound. These include birds such as murres, murrelets, grebes, loons, scoters, dabbling ducks, mergansers, buffleheads, cormorants, and gulls. Blue heron are also common along the shores of this area. 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 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 commercial harvest of geoduck is unlikely to have any adverse impacts on bald eagle productivity.

Other uses:

Adjacent Upland Use:

The upland property at Squaxin Island, along the Peale Passage geoduck tract, is designated "Reservation" and the upland property at Hartstene Island, along the Peale Passage tract, is designated "Rural." Non-Indian geoduck harvest is not allowed shoreward of the 200 yards seaward of the ordinary high tide (OHT) line. Harvest is only allowed during daylight hours, and no harvest is allowed on Saturdays, Sundays, or state holidays.

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

Fishing:

This area has some significant seasonal sportfishing interest, mostly in the vicinity of Brisco Pont, Hartstene Island, using small vessels. The fishing area off Brisco Point has very dynamic water currents, which is not within the geoduck tract area. The WDFW 2005/2006 Sport Fishing Rules pamphlet describes seasons, size limits, daily limits, specific closed areas, and additional rules for salmon and other marine fish species. A few small-scale commercial fisheries may also take place in the area. The fishing which does occur should not create any problems for the geoduck harvesting effort.

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

Navigation:

The Peale Passage geoduck tract is at the southern entrance to Peale Passage. The passage is relatively shallow and narrow, and is therefore not used heavily by vessel traffic. 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, the U.S. Coast Guard for inclusion in the Notice to Mariners, the local Port authority, and the N.W. Vessel Pilots Association prior to geoduck harvests.

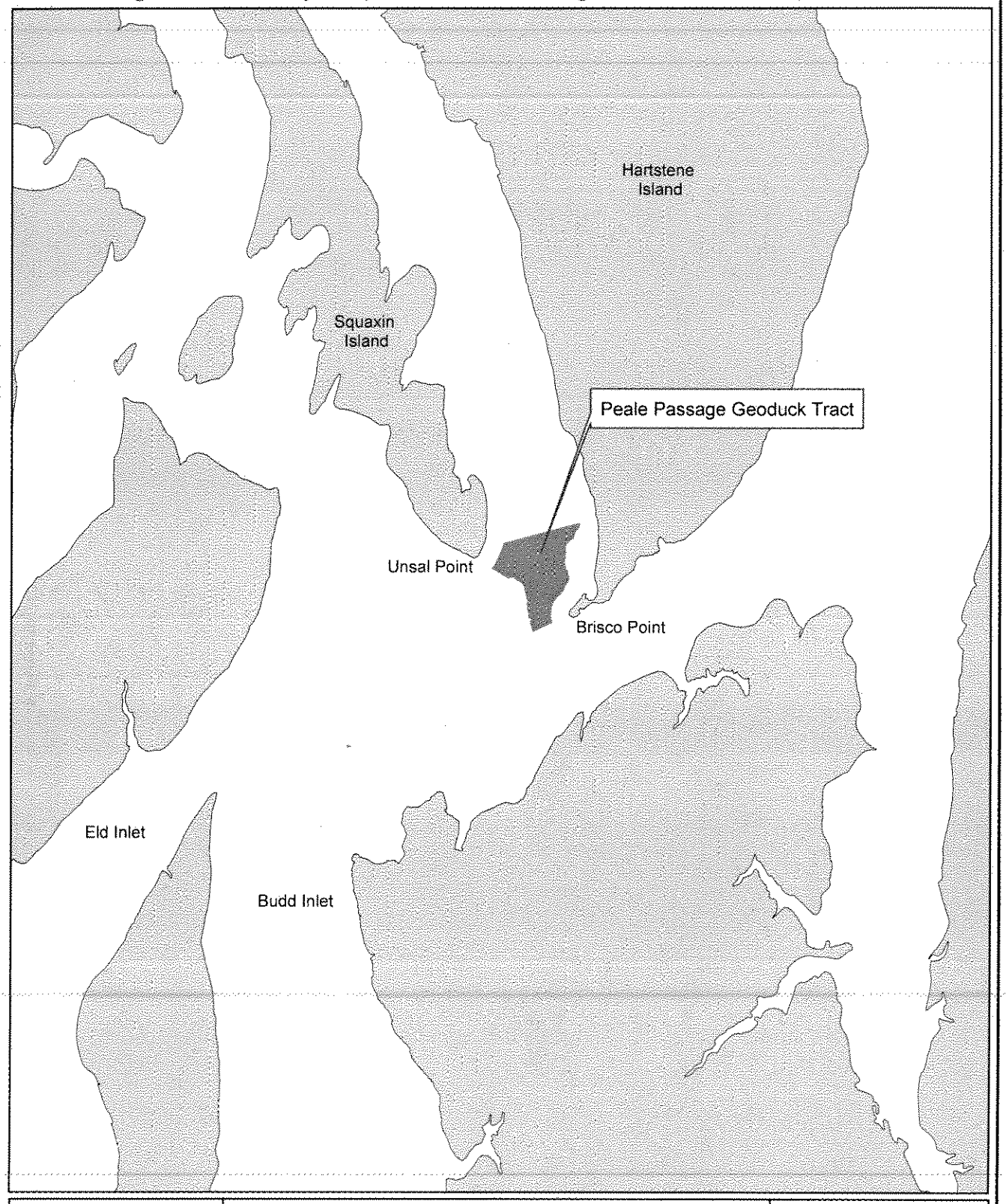
Summary:

Commercial geoduck harvest is proposed for the Peale Passage geoduck tract, located at the entrance of Peale Passage, beginning in 2005. The geoduck population on the tract was most recently surveyed in the year 2005 and the current tract biomass estimate is based on the most recent survey. The anticipated environmental impacts of this harvest are within the range of conditions discussed in the Final Supplemental Environmental Impact Statement (2001) for the commercial geoduck clam fishery. To reduce possible impacts to salmon, baitfish, rock sole, and eelgrass beds, harvest will be deeper and seaward of the -18 foot (MLLW) contour. There are potential impacts to red rock crab populations in the vicinity of this tract due to the high incidence of red rock crab, though studies to date have not confirmed that any significant impacts should be expected. A post-harvest survey of this tract will be done to study potential crab impacts and establish a post-harvest geoduck biomass. No other significant impacts are expected from this harvest.

Date prepared: November 15, 2005
File path - C:\BOB\GEODUCK\EA's\2005\Peale Passage \05Nov9_Peale Passage_#16450_EA.doc

Appendix E

Figure 1. Vicinity Map of Peale Passage Geoduck Tract # 16450



N
W E
S

1:54,000
1 inch equals 4,500 feet

Data Sources:
Projection for data is Stateplane, Washington Zone South, units feet, Datum NAD 27. Coastline layer is from DNR, 1: 24,000 scale, created 09-20-99. Contours are from NOAA soundings.

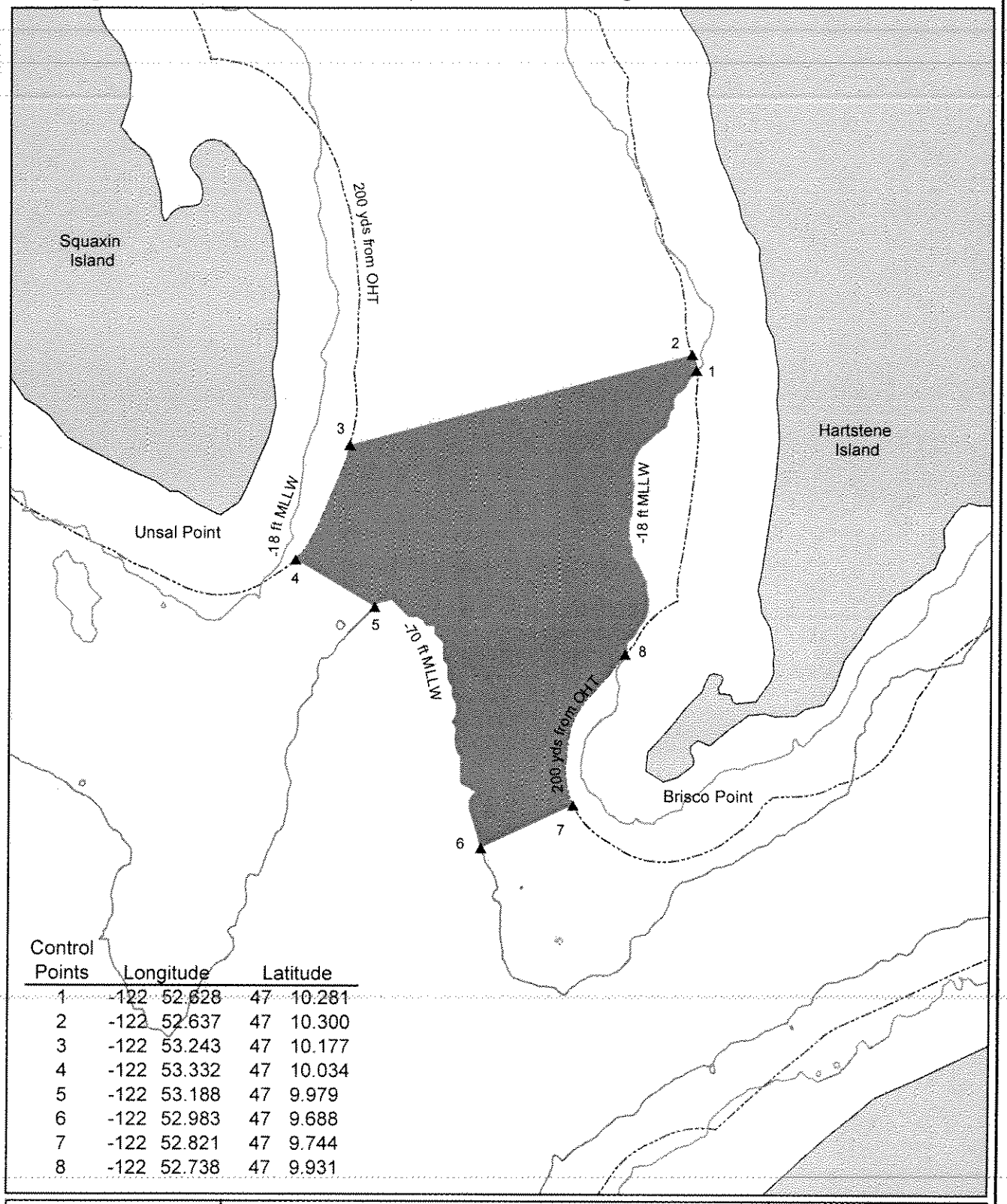
0 0.375 0.75 1.5 2.25 Miles

Washington Department of FISH and WILDLIFE

Map Date: 11-10-05
Map Author: T. Blewett
File: EAmaps_3.mxd

Appendix E

Figure 2. Control Points Map of Peale Passage Geoduck Tract # 16450



Control Points	Longitude	Latitude
1	-122 52.628	47 10.281
2	-122 52.637	47 10.300
3	-122 53.243	47 10.177
4	-122 53.332	47 10.034
5	-122 53.188	47 9.979
6	-122 52.983	47 9.688
7	-122 52.821	47 9.744
8	-122 52.738	47 9.931

N W E S

1:12,000
1 inch equals 1,000 feet

Data Sources:
Projection for data is Stateplane, Washington Zone South, units feet, Datum NAD 27. Coastline layer is from DNR, 1: 24,000 scale, created 09-20-99. Contours are from NOAA soundings.

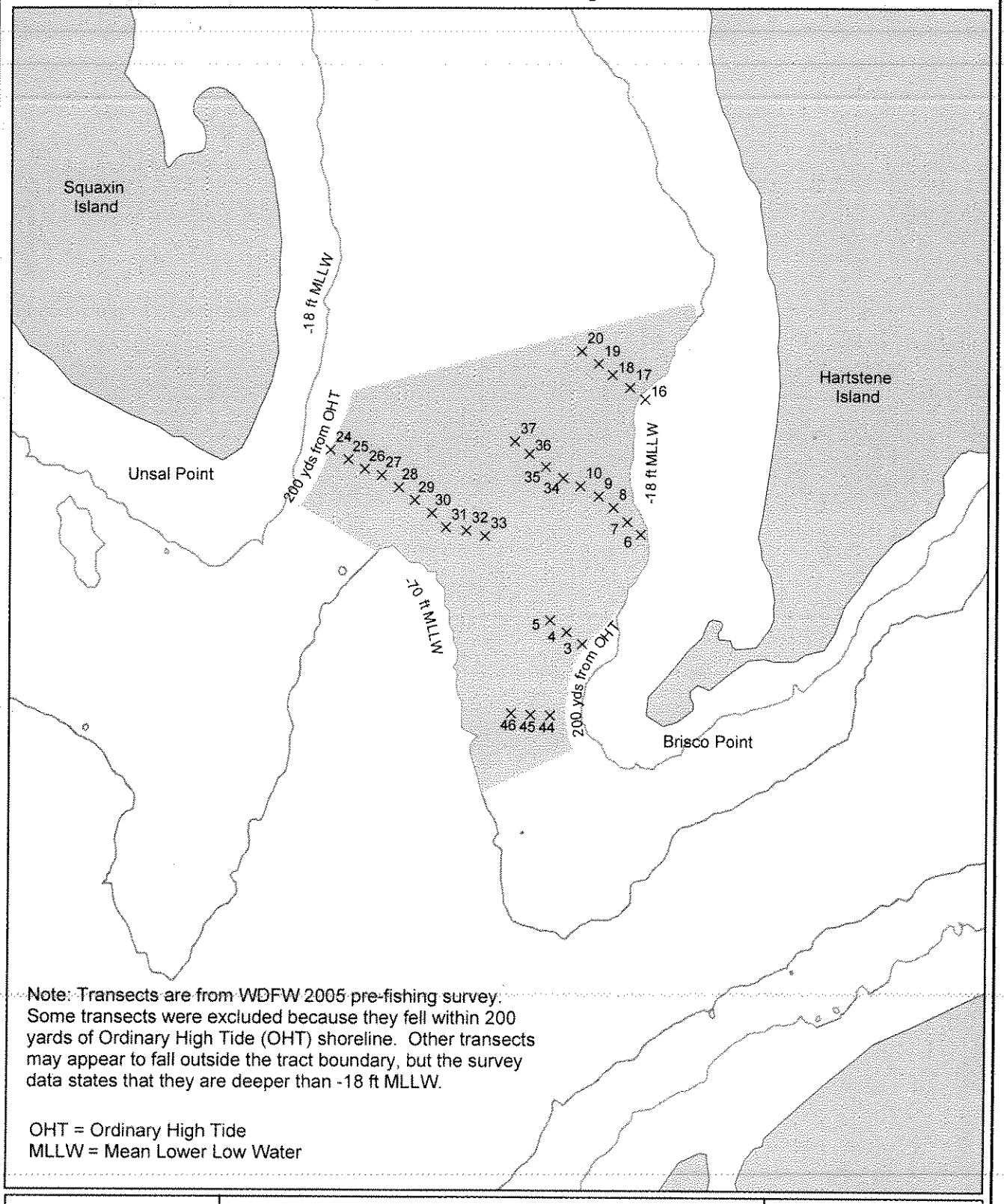
0 0.05 0.1 0.2 0.3 Miles

Washington Department of FISH and WILDLIFE

Map Date: 11-10-05
Map Author: T. Blewett
File: EAmaps_3.mxd

Appendix E

Figure 3. Transect Map of Peale Passage Geoduck Tract # 16450



Note: Transects are from WDFW 2005 pre-fishing survey. Some transects were excluded because they fell within 200 yards of Ordinary High Tide (OHT) shoreline. Other transects may appear to fall outside the tract boundary, but the survey data states that they are deeper than -18 ft MLLW.

OHT = Ordinary High Tide
MLLW = Mean Lower Low Water

N
W E
S

1:12,000
1 inch equals 1,000 feet

Data Sources:
Projection for data is Stateplane, Washington Zone South, units feet, Datum NAD 27. Coastline layer is from DNR, 1: 24,000 scale, created 09-20-99. Contours are from NOAA soundings.

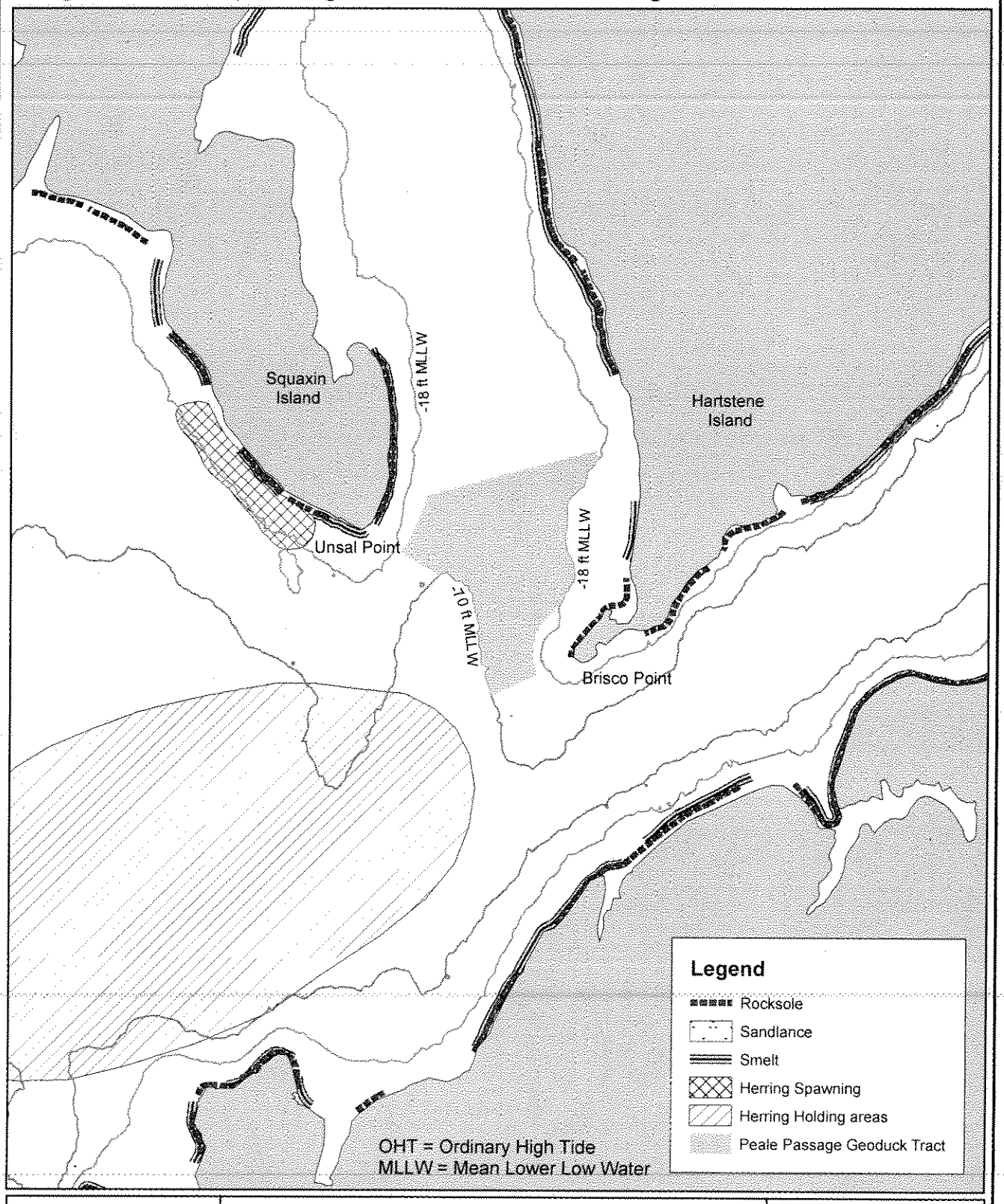
0 0.1 0.2 0.4 0.6 Miles

Washington Department of FISH and WILDLIFE

Map Date: 11-10-05
Map Author: T. Blewett
File: EAmaps_3.mxd

Appendix E

Figure 4. Fish Spawning Areas near Peale Passage Geoduck Tract # 16450



N
W E
S

1:24,000
1 inch equals 2,000 feet

Data Sources:
Projection for data is Stateplane, Washington Zone South, units feet, Datum NAD 27. Coastline layer is from DNR, 1: 24,000 scale, created 09-20-99. Contours are from NOAA soundings.
Beach spawner data from WDFW, the consulting biologist for these coverages is: Dan Penttila, WDFW in La Conner, WA

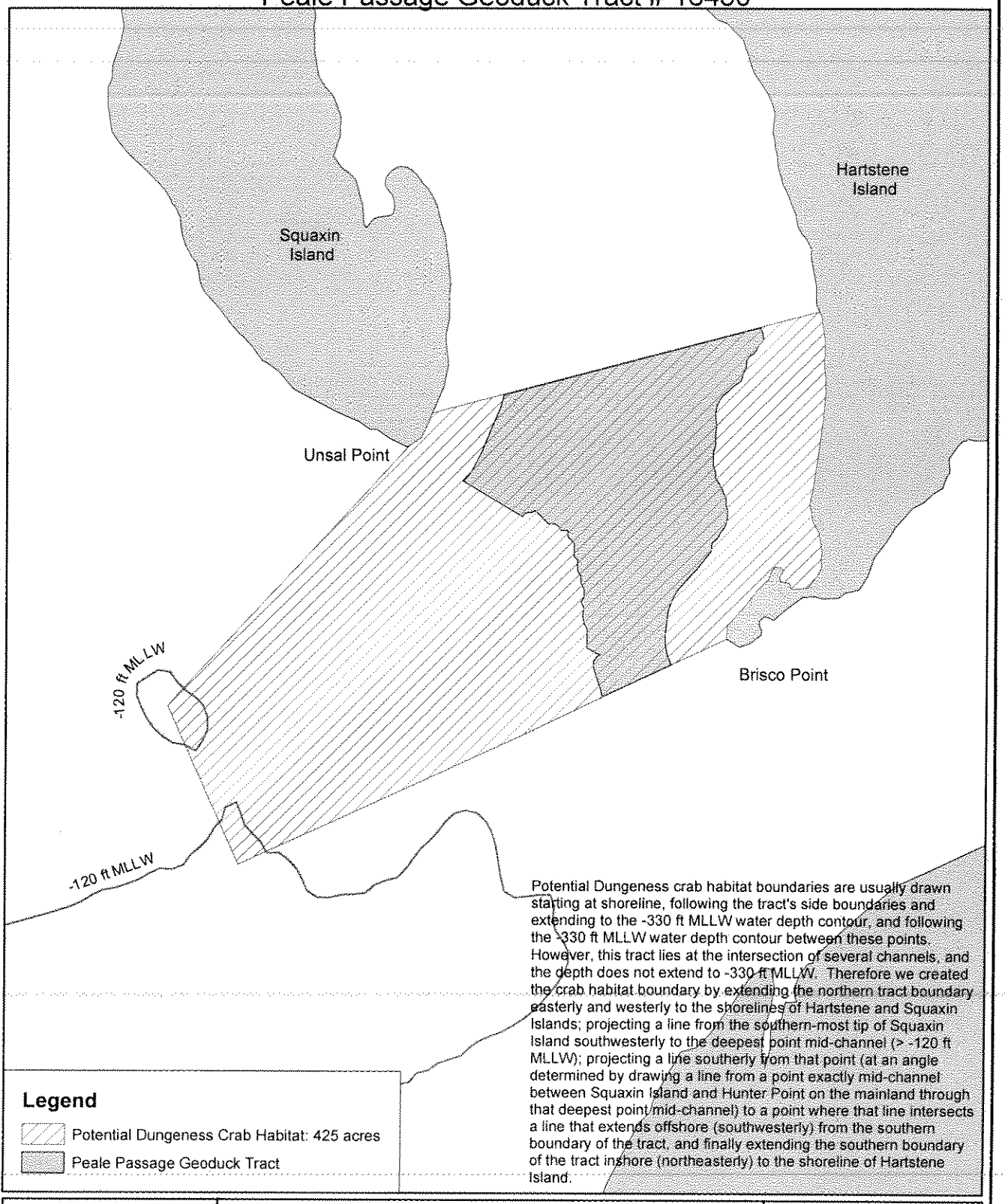
0 0.2 0.4 0.8 1.2 Miles

Washington Department of FISH and WILDLIFE

Map Date: 11-10-05
Map Author: T. Blewett
File: EAmaps_3.mxd

Appendix E

Figure 5. Potential Dungeness Crab Habitat Map
Peale Passage Geoduck Tract # 16450



Potential Dungeness crab habitat boundaries are usually drawn starting at shoreline, following the tract's side boundaries and extending to the -330 ft MLLW water depth contour, and following the -330 ft MLLW water depth contour between these points. However, this tract lies at the intersection of several channels, and the depth does not extend to -330 ft MLLW. Therefore we created the crab habitat boundary by extending the northern tract boundary easterly and westerly to the shorelines of Hartstene and Squaxin Islands; projecting a line from the southern-most tip of Squaxin Island southwesterly to the deepest point mid-channel (> -120 ft MLLW); projecting a line southerly from that point (at an angle determined by drawing a line from a point exactly mid-channel between Squaxin Island and Hunter Point on the mainland through that deepest point mid-channel) to a point where that line intersects a line that extends offshore (southwesterly) from the southern boundary of the tract, and finally extending the southern boundary of the tract inshore (northeasterly) to the shoreline of Hartstene Island.

Legend

- Potential Dungeness Crab Habitat: 425 acres
- Peale Passage Geoduck Tract

N W E S

1:16,000

1 inch equals 1,333.3 feet

Data Sources:
Projection for data is Stateplane, Washington Zone South, units feet, Datum NAD 27. Coastline layer is from DNR, 1: 24,000 scale, created 09-20-99. Contours are from NOAA soundings.

0 0.125 0.25 0.5 0.75 Miles

Washington Department of FISH and WILDLIFE

Map Date: 11-10-05
Map Author: T. Blewett
File: EAmaps_3.mxd

Appendix E

EXPLANATION OF SURVEY DATA TABLES

The geoduck survey data for the Peale Passage tract is reported in seven tables. These tables contain specific information gathered from transect and dig surveys. The following is an explanation of the headings and codes used in these tables.

Water depths, geoduck density 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 predominated. A one (1) rating indicates the substrate type was present.

Transect corrected count and position

This table reports the *Corrected Count*, the *Show Factor* used to correct the count, and the *Latitude/Longitude* position of the start point of survey transect. Counts are "corrected" by dividing diver counts (raw counts) with a siphon show factor (See WDFW Tech. Report FPT00-01 for explanation of show factor). Transect positions are reported in decimal minutes to the thousandth of a minute.

Tract summary

This table is a general summary of survey information for the geoduck tract; *Tract Size* in acres, average geoduck *Density*, *Total Pounds* with statistical confidence, and estimated *Total Number* of geoducks. Size estimators are reported in average values for *Whole Weight* and *Siphon Weight* in pounds. Quality estimators of geoduck samples are reported in *Siphon Weight as a percentage of Whole Weight* and percentage of samples *Over Two Pounds*. Any post-survey harvest information listed is derived from fish receiving tickets and new biomass estimates are survey estimates adjusted for harvest subsequent to the 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. A "checked" check box indicates yes, it would be feasible and a "blank" check box indicates it would not.

Size and quality

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 *Ave. Whole Weight (lbs.)* column gives the average sample weight of whole geoduck clams. The *Ave. Siphon Weight (lbs.)* column gives the average weight of the siphons of the geoducks in the sample. The percentage of geoducks greater than two pounds is given in

the *% Greater than 2 lbs.* column. A "blank cell" in any column indicates that the parameter is not available because the parameter was not measured or the data was not available for that station.

Most common and obvious animals observed

This table summarizes animals observed in association with geoduck transects. This information is presence/absence only. An animal does not have to be within the transect to be noted as "present." *Number of transects where observed* provides a rough relative abundance of animals observed during the survey. For example, piddocks may be observed in association with 2 out of 30 transects completed. *Group* generally classifies the types of animals observed by divers. *Common name* is the local common name in use for a particular species or taxonomic assemblage of morphologically similar species. *Taxonomer* is the current scientific name (genus and species) of an animal or the most specific identification possible from gross morphology observed by divers *in situ*.

Most common and obvious plants observed

This table summarizes plants observed in association with geoduck transects. This information is presence/absence only. A plant does not have to be within the transect to be noted as "present." *Number of transects where observed* provides a rough relative abundance of plants observed during the survey. For example, *Laminaria* sp. may be observed in association with 6 out of 30 transects completed. *Taxonomer* is the current scientific name (genus and species) of a plant or the most specific identification possible from gross morphology observed by divers *in situ*.

Appendix E

Table 1: TRANSECT WATER DEPTHS, GEODUCK DENSITIES, AND SUBSTRATE OBSERVATIONS

Peale Passage, 2005 WDFW Pre-Fishing Survey

Transect [a]	Start depth (ft) [b]	End depth (ft) [b]	Geoduck Density (no. / sq ft) [c]	Substrate [d]				
				mud	sand	gravel	shellhash	cobble
3	34	43	0.366	1	2			
4	43	50	0.271	1	1			
5	50	55	0.288	2	1			
6	18	21	0.114		2			
7	21	26	0.136		2		1	
8	26	38	0.176	1	2			
9	39	43	0.154	2				
10	43	46	0.059	2				
16	18	32	0.137	1	2			
17	32	39	0.000	2				
18	39	38	0.003	2				
19	38	40	0.003	2				
20	40	43	0.023	2				
24	43	54	0.000	1				1
25	54	60	0.007	1				1
26	60	58	0.064	1	1			
27	59	62	0.062	1	2			
28	62	64	0.019		2			1
29	64	63	0.030	1	1			1
30	62	65	0.064	2	1			1
31	65	64	0.070	2	1			1
32	64	65	0.100	2	1			
33	65	62	0.074	2				
34	46	49	0.072	2				
35	49	52	0.035	2				
36	52	54	0.018	2				
37	54	52	0.020	2				
44	43	55	0.018		2	1	1	1
45	55	62	0.385		2			1
46	62	67	0.277	1	2			
		min=	0.0000					
		max=	0.3846					

[a] Transects were excluded if they were within 200 yards of Ordinary High Tide, or if the entire transect line had a count of zero.

[b] All depths are corrected to mean lower low water (MLLW).

[c] Densities were calculated using a daily show factor.

[d] Substrate codes: 1 = present ; 2 = dominant

Generation Date: October 19, 2005

Generated By: T. Blewett, WDFW

File: C:\Data\EA'S\Tables\2005 EA Tables\EATables1-5_PealePassage_101405.xls

Appendix E

Table 2: TRANSECT CORRECTED GEODUCK COUNT AND POSITION TABLE

Peale Passage, 2005 WDFW Pre-Fishing Survey

Transect	Corrected Count	Show Factor [a]	Latitude [b]		Longitude [b]	
3	329	0.787	47	09.875	122	52.813
4	244	0.787	47	09.889	122	52.842
5	259	0.787	47	09.903	122	52.872
6	103	0.787	47	10.012	122	52.715
7	122	0.787	47	10.027	122	52.740
8	159	0.787	47	10.044	122	52.766
9	139	0.787	47	10.057	122	52.793
10	53	0.787	47	10.069	122	52.827
16	123	0.77	47	10.178	122	52.716
17	0	0.77	47	10.192	122	52.744
18	3	0.77	47	10.207	122	52.776
19	3	0.77	47	10.220	122	52.802
20	21	0.77	47	10.235	122	52.833
24	0	0.926	47	10.103	122	53.278
25	6	0.926	47	10.092	122	53.245
26	57	0.923	47	10.081	122	53.215
27	56	0.926	47	10.074	122	53.184
28	17	0.926	47	10.060	122	53.152
29	27	0.926	47	10.045	122	53.123
30	57	0.926	47	10.030	122	53.091
31	63	0.926	47	10.013	122	53.065
32	90	0.926	47	10.010	122	53.028
33	67	0.926	47	10.004	122	53.994
34	65	0.926	47	10.078	122	52.858
35	31	0.926	47	10.091	122	52.890
36	16	0.926	47	10.106	122	52.920
37	18	0.926	47	10.121	122	52.947
44	16	0.91	47	09.786	122	52.866
45	346	0.91	47	09.786	122	52.901
46	249	0.91	47	09.787	122	52.936

[a] Show factor was used to correct combined geoduck counts.

[b] Latitude and Longitude are in Degrees and Decimal Minutes (NAD 27).

Generation Date: October 19, 2005

Generated By: T. Blewett, WDFW

File: C:\Data\EA'S\Tables\2005 EA Tables\EATables1-5_PealePassage_101405.xls

Appendix E

Table 3 - TRACT SUMMARY

Tract Name	Peale Passage
Tract Number	16450
Tract Size (acres) [a]	119
Density of geoducks/sq.ft [b]	0.10
Total Tract Biomass (lbs.) [b]	1,722,189
Total Number of Geoducks on Tract [b]	527,762
Confidence Interval (%)	39.8%
Mean Geoduck Whole Weight (lbs.)	3.26
Mean Geoduck Siphon Weight (lbs.)	0.65
Siphon Weight as a % of Whole Weight	20%
Number of 900 sq.ft. Transect Stations	30
Number of Geoducks Weighed	47

[a] Tract area is based on GIS using the -18 ft MLLW water depth contour or 200 yds seaward from Ordinary High Tide, whichever is farther, and the -70 ft MLLW water depth contour, and 2005 WDFW geoduck transect data.

[b] Biomass is based on the 2005 WDFW geoduck survey.

Generation Date: October 19, 2005

Generated By: T. Blewett, WDFW

File: C:\Data\EA'S\Tables\2005 EA Tables\EATables1-5_PealePassage_101405.xls

Appendix E

Table 4: DIGGING DIFFICULTY TABLE

Peale Passage, 2005 WDFW Pre-Fishing 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)
5	2	0	2	1	0	1	0	0	Yes
16	0	0	1	0	0	1	0	0	Yes
26	2	1	1	1	0	0	2	0	Yes
33	2	0	0	1	0	1	1	0	Yes
45	0	2	0	0	0	0	0	0	Yes

Generation Date: October 19, 2005

Generated By: T. Blewett, WDFW

File: C:\Data\EA'S\Tables\2005 EA Tables\EATables1-5_PealePassage_101405.xls

Appendix E

Table 5: GEODUCK SIZE AND QUALITY

Peale Passage, 2005 WDFW Pre-Fishing Survey

Dig Station	Number Dug	Avg. Whole Weight (lbs)	Avg. Siphon Weight (lbs)	% Greater than 2 lbs
5	8	3.14	0.59	100%
16	11	3.70	0.70	91%
26	10	2.92	0.60	80%
33	10	3.37	0.71	100%
45	8	3.09	0.60	88%

Generation Date: October 19, 2005

Generated By: T. Blewett, WDFW

File: C:\Data\EA'S\Tables\2005 EA Tables\EATables1-5_PealePassage_101405.xls

Appendix E

Table 6: MOST COMMON AND OBVIOUS ANIMALS OBSERVED

Peale Passage Geoduck Tract # 16450, 2005 WDFW Pre-Fishing Survey

Number of Transects where observed	Group	Common Name	Taxonomer
8	ANEMONE	BURROWING ANEMONE	Pachycerianthus fimbriatus
1	ANEMONE	PLUMED ANEMONE	Metridium senile
13	ANEMONE	STRIPED ANEMONE	Urticina sp.
12	BIVALVE	HARDSHELL CLAMS	Veneridae sp.
19	BIVALVE	HORSE CLAM	Tresus spp.
2	BIVALVE	PIDDOCK	Unspecified Pholadid
2	BIVALVE	TRUNCATED MYA	Mya truncata
2	CRAB	DECORATOR CRAB	Oregonia gracilis
1	CRAB	DUNGENESS CRAB	Cancer magister
26	CRAB	GRACEFUL CRAB	Cancer gracilis
28	CRAB	HERMIT CRAB	Unspecified hermit crab
27	CRAB	RED ROCK CRAB	Cancer productus
1	FISH	DOGFISH SHARK	Squalus acanthias
4	FISH	FISH	Unspecified Fish
10	FISH	FLATFISH	Unspecified flatfish
14	FISH	SANDDAB	Citharichthys sp.
13	FISH	SCULPIN	Unspecified cottid
4	FISH	STARRY FLOUNDER	Platichthys stellatus
2	FISH	TUBESNOUT	Aulorhynchus flavidus
1	GASTROPOD	MOON SNAIL EGGS	Polinices lewisii egg case
16	MISC	SEA PEN	Ptilosarcus gurneyi
25	MISC	SEA WHIP	Stylatula elongata
4	MISC	SPONGE	Unspecified Porifera
5	NUDIBRANCH	ARMINA	Armina californica
1	NUDIBRANCH	DENDRONOTUS	Dendronotus sp.
1	NUDIBRANCH	HERMISSENDA	Hermissenda crassicornis
2	SEA STAR	LEATHER STAR	Dermasterias imbricata
22	SEA STAR	SHORT-SPINED STAR	Pisaster brevispinus
1	SEA STAR	SUN STAR	Solaster sp.
21	SEA STAR	SUNFLOWER STAR	Pycnopodia helianthoides
4	SEA STAR	VERMILLION STAR	Mediaster aequalis
8	SHRIMP	GHOST SHRIMP	Unspecified ghost shrimp
7	WORM	SABELLID TUBE WORM	Sabellid sp.
13	WORM	TEREBELLID TUBE WORM	Terebellid sp.

Generation Date: November 15, 2005

Generated By: T. Blewett, WDFW

File: C:\Data\EA'S\Tables\2005 EA Tables\EATables1-5_PealePassage_101405.xls

Appendix E

Table 7: MOST COMMON AND OBVIOUS PLANTS OBSERVED

Peale Passage Geoduck Tract # 16450, 2005 WDFW Pre-Fishing Survey

Number of Transects where observed	Taxonomer
15	No Plants
6	Laminaria
2	Nereocystis luetkeana
11	Unspecified small red algae
3	Unspecified large red algae
4	Diatoms

Generation Date: November 15, 2005

Generated By: T. Blewett, WDFW

File: C:\Data\EA'S\Tables\2005 EA Tables\EATables1-5_PealePassage_101405.xls