

Underwater Bark Debris Survey
Shoal Cove Log Transfer Facility
Revillagigedo Island, Alaska

Submitted to: USDA Forest Service, Region 10
Ketchikan Area, Tongass National Forest
Federal Building, 648 Mission Street
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Introduction:

An underwater survey requested to determine the extent of bark debris accumulation at the Shoal Cove Log Transfer Facility, Revillagigedo Island, Alaska, was performed on September 12, 2000. The purpose of the survey was to satisfy the requirement for a bark monitoring program as specified by the NPDES permit. The protocol for operating a bark monitoring program is given in the new EPA General Permit, which went into effect on March 21, 2000.

Methods:

Once on site, the layout of the facility is evaluated to best adapt the standard survey method to the individual site characteristics. A permanent reference point location is selected, ideally in the center of the log bundle input structure. The reference point is positioned as close as possible to the exact center of the structure (regardless of type: bulkhead with A-frame, drive-down ramp, low-angle slide, etc.) and close to the estimated Mean Low Water (MLLW) depth to facilitate relocation for future surveys. Initially, five transects are established, radiating from the reference point origin at 30-degree intervals. The center transect is located perpendicular to the face of a bulkhead structure, or in line with the centerline of a drive-down ramp/low-angle slide. Additional transects are added if 100 % bark coverage extends more than 15 feet perpendicular to an edge transect. Magnetic compass bearings are selected for the transects by referencing the transects to the center of the log transfer device. The magnetic compass bearing is also the identifying label for that transect.

Each transect is sampled at 15-foot intervals starting from the origin at the permanent reference point. Debris depth measurements are made with a hand-held ruler at the sample point. The measurement is taken by inserting the ruler vertically into the debris until the natural substrate is felt or its location estimated as closely as possible. Periodically, when the confidence level in the measurement decreases due to the substrate type and/or bark amount, the bark depth is confirmed by digging by hand through the bark layer to the natural substrate. Percentage of areal coverage by bark debris is determined by using the ruler, which is randomly dropped at the sample point, as the base of a visually estimated 3-foot square. The proportion of bark cover within that square is then visually estimated.

Sample points are established along a transect until a water depth of 60 feet MLLW is reached or the measured bark debris depth becomes insignificant (usually interpreted to mean that less than one inch of bark depth, less than 10 % cover, and a clear decreasing trend are apparent towards the end of the transect). At each sample location several data points are recorded by the diver: water depth; debris depth; percent coverage of debris; debris composition and character; substrate type; species abundance, condition and diversity; direction and strength of current; visibility; and the presence of any significant operational debris. A qualitative assessment of species abundance is made for the overall survey area.

Photographs are taken of representative sample points along the transects (usually the middle and two side transects) to document substrate, bark debris, algal and animal life, and any other debris/objects that may be of concern. Water depth measurements are taken from a Suunto dive computer with an accuracy of +/- 1%. A Suunto compass attached to a 4-foot measuring ruler is used to navigate the transect compass headings.

The total survey surface area is determined by calculating the total area of triangles formed by adjacent transects, and the total square footage of the debris field area is a summation of all the triangle areas formed by the transects sampled. This figure is converted to acres as required by the guidelines. The calculation method used in this report is outlined in the ADEC publication "**Required Method for Bark Monitoring Surveys under the LTF General Permits**", **June 9, 2000**. The method for calculating continuous and discontinuous areas also follows this prescribed method.

Results:

Reference Point Location: 55°27.372 N, 131°17.398 W DGPS position. The DGPS position was taken from the boat positioned over the underwater reference point, which is in the middle of the bulkhead, on the substrate at its base.

Weather conditions at survey time were overcast skies, with southwesterly winds at fifteen knots; air temperature was near fifty-five degrees. The diving started at 1305, taking place during an ebbing tide cycle. High tide occurred at 1301 with a height of 14.6 feet (corrected to subordinate station # 1435, Nigelius Point, Carroll Inlet, from the Ketchikan reference station) and a tidal range of 12.9 feet. No appreciable current was experienced during the dive survey. Water temperature was measured at 51 degrees. Underwater visibility was estimated to be 30-40 feet at depth. A mixed freshwater layer extended down to a depth of approximately 20 feet.

The LTF has been decommissioned. A total of 76 sample points were taken on the five transects, and all sample points had some bark debris. The total area covered by the dive survey was 0.9 acres. The area with 100 % bark cover was estimated at 0.6 acres. The area of discontinuous bark cover was 0.4 acres.

Bark Deposition Summary		
Total Survey Area	Area with Continuous Bark Cover	Area with Discontinuous Bark Cover
0.9 Acres	0.6 Acres	0.4 Acres

Observations:

The LTF is situated in a shallow bight approximately midway up the eastern shoreline of Carroll Inlet. The bulkhead fill structure protrudes out from the curving shoreline, which is composed mostly of rock down to about 0 feet MLLW. Subtidally, the substrate is composed of varying mixtures of sand, silt, and gravel on the moderate slopes of the

bight. Two narrow, low-profile bedrock reefs projecting roughly perpendicular to shore were encountered along transect 245.

The zone of deposit covers the entire dive survey area. The zone of 100 % coverage by bark encompasses the slopes and bottom of the semi-circular bowl of the bight shape out to the maximum survey depths, except on transect 005 and 245, where the bark debris became discontinuous five sample points before the transect ends. The depth of bark accumulation was decreasing rapidly on the three transects that ended with 100% coverage. In the areas of deepest bark accumulation, the bark layer exhibited a "jiggling" movement when the measuring stick was inserted into the layer. Overall, the size of the bark debris tended to be small, with patches of larger bark chips and chunks on the surface in some areas. Few sunken logs were observed, and they were in various stages of considerable decay.

My impression of the survey area is that the marine life observed appears to be generally healthy and is not being adversely affected by the bark, other than the smothering effect on sessile benthic infauna when bark accumulation reaches a critical depth. The habitat type was typical of that associated with a sand substrate, except on the fill rock structure and the bedrock reefs on transect 245.

Plant abundance and diversity in the area were low. Large-bladed Laminarians were present, but only as scattered plants attached to rocks, shells, or other hard objects. The encrusting red algae *Lithothamnion spp.* was present on some of the rock surfaces, as were small, unidentified red algae plants.

Molluscan abundance and diversity were moderate. Many bivalve siphons were observed, all was identified as *Tresus sp.* Where observable in the lesser bark accumulations, the shell component of the substrate contained shells of *Clinocardium nuttallii*, *Saxidomus gigantea*, and *Protothaca tenerrima*. *Bankia setacea* feces were noted around the larger wood chunks and logs. A small (3/8th inch shell length) unidentified bivalve was observed "hopping" on its muscular foot away from a pursuing *Evasterias troschelii* on the 100% bark debris at sample point 335/2.

Echinoderm abundance and diversity in the area were moderate. The sea star species observed were *Dermasterias imbricata*, *Evasterias troschelii*, *Mediaster aequalis*, and *Pycnopodia helianthoides*. Many individuals of *Parastichopus californicus* were observed on the slopes and the bay bottom, but not in any aggregating pattern.

Crustacean abundance and diversity were moderate. A few *Cancer magister* were observed as individuals scattered over the entire survey area. Another cancer crab, *C. productus*, also was observed. Small crabs of the Majidae family (decorator crabs), commonly observed at LTFs on both the bark and natural substrate, were present in low numbers. Hermit crabs, shrimp, and barnacles were present in the area in low numbers.

Other invertebrates observed during the survey were unidentified sponges; scattered

patches of the tube worm *Spiochaetopterus costarum*; the tunicates *Corella willmeriana*, *Boltenia villosa*, and *Halocynthia aurantia*; thin patches of the bacteria *Beggiatoa sp.*; and unidentified benthic infauna in the sand bottom.

Fish were observed in moderate abundance and diversity in the area. Individuals of *Pholis sp.*, *Lumpenus sagitta*, *Hexagrammos stelleri*, *Ronquilus jordani*, *Sebastes spp.*, *Rhamphocottus richardsoni*, *Anarrhichthys ocellatus*, and unidentified members of the Cottidae family were observed occasionally over the entire survey area. A small number of flatfish were noted actively swimming above the bottom. A small school of *Cymatogaster aggregata* followed me for much of the survey.

No significant man-made debris was observed other than the typical, minor operational debris.

Conclusion:

The 100% bark zone remains under the maximum size limit cited in the general permit. The semi-circular shoreline topography appears to focus most of the debris accumulation in the area directly in front of the bulkhead, and creates a defined area in which the 100% bark cover area will never reach the one-acre limit, at least within the 60 foot MLLW depth limit.

If there are any questions regarding this report, please contact me at 907-826-3481 or by email at craigdiv@aptalaska.net. Thank you for allowing Craig's Dive Center to be of service.

Respectfully submitted,

Craig Sempert
Diver

December 8, 2000

TABLE 1
Transect Data

Transect/Sample Pt.	Depth from MLLW	Debris Depth (in)	Percent Coverage	Substrate Type
Ref. Pt.	5	<1	10	Rk, Gr
035/1	4	3	90	Rk, Gr
035/2	2	<1	25	Rk, Gr
035/3	0	<1	10	Rk, Gr
035/4	1	T	T	Rk, Gr
035/5	0	T	T	Sa, Gr, Rk
035/6	0	<1	10	Sa, Gr
005/1	9	<1	75	Gr, Sa
005/2	12	6	25	Gr, Sa
005/3	16	1	100	Gr, Rk
005/4	19	27	100	Sa, Gr
005/5	23	11	100	Sa, Gr
005/6	27	4	100	Sa, Gr
005/7	29	4	100	Sa, Gr
005/8	33	3	100	Sa, Gr
005/9	39	3	90	Sa
005/10	43	3	90	Si, Sa
005/11	46	<1	75	Si, Sa
005/12	49	<1	25	Si, Sa
005/13	51	<1	25	Si, Sa
335/1	12	4	100	Gr, Sa
335/2	17	30	100	Gr, Sa
335/3	21	24	100	Sa, Gr
335/4	26	11	100	Sa, Gr
335/5	30	6	100	Sa, Gr
335/6	34	4	100	Si, Sa
335/7	39	4	100	Si, Sa
335/8	43	2	100	Si, Sa
335/9	47	2	100	Si, Sa
335/10	52	2	100	Si, Sa
335/11	57	2	100	Si, Sa
305/1	11	4	100	Sa, Rk
305/2	17	12	100	Sa, Gr

305/3	26	21	100	Sa, Gr
305/4	31	12	100	Sa, Gr
305/5	38	8	100	Si, Sa

TABLE 1 – cont.
Transect Data

Transect/Sample Pt.	Depth from MLLW	Debris Depth (in)	Percent Coverage	Substrate Type
305/6	44	7	100	Si, Sa
305/7	51	6	100	Si, Sa
305/8	55	4	100	Si, Sa
305/9	60	4	100	Si, Sa
275/1	8	11	100	Gr, Sa
275/2	13	4	75	Gr, Sa
275/3	20	12	100	Sa
275/4	28	17	100	Sa
275/5	34	16	100	Si, Sa
275/6	40	13	100	Si, Sa
275/7	45	11	100	Si, Sa
275/8	51	8	100	Si, Sa
275/9	54	6	100	Si, Sa
275/10	60	4	100	Si, Sa
245/1	6	6	100	Gr, Sa
245/2	7	3	100	Gr, Sa
245/3	13	1	50	Gr, Rk
245/4	12	1	50	Gr, Rk
245/5	16	14	100	Sa
245/6	21	12	100	Sa
245/7	24	9	100	Sa
245/8	26	5	100	Si, Sa
245/9	28	3	100	Si, Sa
245/10	31	4	100	Si, Sa
245/11	32	4	100	Si, Sa
245/12	33	<1	100	Sa, Gr
245/13	32	<1	90	Sa, Gr
245/14	31	<1	75	Sa, Gr, Rk
245/15	28	<1	75	Sa, Gr, Rk
245/16	25	<1	10	Sa, Gr

215/1	3	3	100	Sa, Rk
215/2	2	1	75	Rk, Sa
215/3	2	<1	50	Rk, Sa
215/4	3	<1	50	Rk, Sa
215/5	4	<1	25	Rk, Sa
215/6	9	1	75	Rk, Sa
215/7	12	3	100	Sa

TABLE 1 – cont.
Transect Data

Transect/Sample Pt.	Depth from MLLW	Debris Depth (in)	Percent Coverage	Substrate Type
215/8	11	1	90	Sa
215/9	13	1	90	Sa
215/10	12	<1	75	Sa

Key to Substrate Type	
Brk	Bedrock
Gr	Gravel
Rk	Rock
Sa	Sand
Sh	Shell
Si	Silt

Table 2

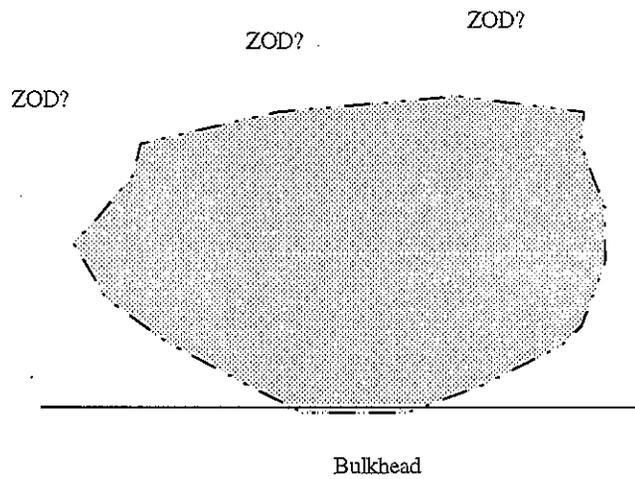
<u>Species Abundance</u>		
L = Low C = Common A = Abundant		
Scientific Name	Common Name	Abundance
Plants		
<i>Rhodophyta</i> sp.	Red algae	L
<i>Lithothamnion</i> spp.	Crustose red algae	L
<i>Laminaria saccharina</i>	Sugar kelp	L
<i>Agarum clathratum</i>	Sieve kelp	L
Invertebrates		
<i>Beggiatoa</i> sp.	Bacteria	L
Porifera spp.	Unidentified sponge	L
Benthic infauna	Unidentified benthic infauna	C
<i>Spiochaetopterus costarum</i>	Tube worm	L
<i>Bankia setacea</i>	Ship worm	L
<i>Clinocardium nuttallii</i>	Cockle	L
<i>Saxidomus gigantea</i>	Butter clam	L
<i>Protothaca tenerrima</i>	Littleneck clam	L
<i>Tresus</i> sp.	Horse neck clam	C
<i>Dermasterias imbricata</i>	Leather star	L
<i>Evasterias troschelii</i>	False ochre star	L
<i>Mediaster aequalis</i>	Red star	L
<i>Parastichopus californicus</i>	Sea cucumber	L
<i>Pycnopodia helianthoides</i>	Sunflower star	L
<i>Evasterias troschelii</i>	False ochre star	L
<i>Cancer magister</i>	Dungeness crab	L
<i>Cancer productus</i>	Red rock crab	L
<i>Pandalus</i> sp.	Shrimp	L
<i>Balanus</i> spp.	Barnacle	L
<i>Pagurus</i> spp.	Hermit crab	L
<i>Hyas lyratus</i>	Lyre crab	L
<i>Oregonia gracilis</i>	Graceful decorator crab	L
<i>Corella willmeriana</i>	Solitary tunicate	L
<i>Halocynthia aurantia</i>	Sea peach	L
<i>Boltenia villosa</i>	Spiny-headed tunicate	L

Table 2 (cont.)

<u>Species Abundance</u>		
L = Low C = Common A = Abundant		
Scientific Name	Common Name	Abundance
Vertebrates		
Cottidae spp.	Sculpin	L
Pleuronectidae spp.	Righteye flounders	L

<i>Bothidae</i> spp.	Lefteye flounders	L
<i>Platichthys stellatus</i>	Starry flounder	L
<i>Hexagrammos decagrammus</i>	Kelp greenling	L
<i>Sebastes</i> spp.	Rockfish	L
<i>Pholis</i> spp.	Gunnel	L
<i>Cymatogaster aggregata</i>	Shiner perch	L
<i>Coryphopterus nicholsi</i>	Blackeye goby	L
<i>Rhamphocottus richardsoni</i>	Grunt sculpin	L
<i>Anarrhichthys ocellatus</i>	Wolf eel	L
<i>Lumpenus sagitta</i>	Pacific snake prickleback	L
<i>Ronquilus jordani</i>	Northern ronquil	L

60 feet MLLW



Photograph Key		
Photo Number	Transect/ Sample Pt.	Description
1	Reference Point	Little bark at base of pilings
2	005/1	Bark mixed with silt, sand, and gravel
3	005/2	Some bark in rock crevices
4	005/3	Sea star on surface of 100% bark layer
5	005/4	100% bark layer

6	005/5	Shell, tube worms in 100% bark layer
7	005/6	Sea cucumber, more shell in 100% bark layer
8	005/7	Anchor creating a reef for a variety of life
9	005/9	Now into discontinuous bark cover
10	005/11	Now into discontinuous bark cover
11	305/1	Kelp on rock surrounded by bark
12	305/2	Old eroded log, wire in 100% bark layer
13	305/3	Kelp attached to rock, bacteria on 100% bark layer
14	305/4	Sea cucumber on 100% bark layer
15	305/5	Some silt on 100% bark layer
16	305/7	More silt on 100% bark layer

