

Underwater Bark Debris Survey
Margaret Bay Log Transfer Facility
Revillagigedo Island, Alaska

Submitted to: USDA Forest Service, Region 10
Ketchikan Area, Tongass National Forest
Federal Building, 648 Mission Street
Ketchikan, AK 99901

Prepared by: Craig's Dive Center
P.O. Box 796
107 Main Street
Craig, AK 99921

September 7, 2000

Introduction:

An underwater survey requested to determine the extent of bark debris accumulation at the Margaret Bay Log Transfer Facility, Revillagigedo Island, Alaska, was performed on September 7, 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°42.084 N, 131°38.154 W DGPS position. The DGPS position was taken from the boat positioned over the underwater reference point, after lining the boat up with the onshore stakes that marked the position of the former input point.

Weather conditions at survey time were overcast skies, with rainshowers and southeasterly winds at twenty knots; air temperature was near fifty degrees. The diving started at 1031, taking place during an ebbing tide cycle. High tide occurred at 0936 with a height of 10.9 feet (corrected to subordinate station # 146, Traitors Cove [lower section], from the Ketchikan reference station) and a tidal range of 5.0 feet. Only a light surface current was experienced in the 2- to 3-foot freshwater surface layer. Water temperature was measured at 55 degrees. Underwater visibility was estimated to be a dark 25 feet, with a tannin-laden freshwater surface layer absorbing much of the morning light.

The LTF has been decommissioned. A total of 60 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 0.8 acres. The area covered by 100 % bark cover was estimated at 0.1 acres. The area of discontinuous bark cover was 0.7 acres.

Bark Deposition Summary		
Total Survey Area	Area with Continuous Bark Cover	Area with Discontinuous Bark Cover
0.8 Acres	0.1 Acres	0.7 Acres

Observations:

The LTF is situated in a large, shallow bay near the outlet of a large stream. The alluvial plain created by the stream dominates the underwater topography at the site. The shallow alluvial plain, composed of varying mixtures of sand and gravel, is nearly flat up to where it breaks sharply to a steep drop down to the nearly flat, silty bay bottom. The drop-off edge of the alluvial plain curves through the survey area to where it ends just west of the LTF fill rock. Transect 150 remains entirely on top of the alluvial plain, whereas transect 180 runs along the steep sand slope at the edge of the alluvial shelf.

The zone of deposit covers the entire dive survey area. The zone of 100 % coverage by bark is now only on the lower portions of the steep slope and the first one or two sample points of the bay bottom, where the debris has sloughed down and not been buried by either sand from the shelf edge or silt deposition on the bay flats. Much of the 100% zone of deposit is now being mixed or covered by the substrate in that particular area. For example, along transect 270, none of the sample points were estimated to have 100% bark cover, yet upon digging into the substrate a bark/ sand mixture was found to extend to a considerable depth. Another issue peculiar to this site is the considerable amount of woody detritus washed down from the stream. The character of much of this stream debris is obviously different and distinctive, allowing differentiation from LTF bark debris at some sample points, but at other sample points it was not possible to distinguish a difference. 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 bay bottom, which was predominantly silt. On the steeper slopes descending from the alluvial shelf, the sand substrate appeared to be unstable.

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. A low-density *Zostera marina* bed was observed on transect 150, on top of the shallow alluvial shelf, as were small, unidentified red algae plants.

Molluscan abundance and diversity appeared to be low. Few bivalve siphons were observed, but the shell component of the substrate, especially piled on the lower portions of the steep slope, contained shells of *Tresus sp.*, *Clinocardium nuttallii*, *Saxidomus gigantea*, and *Protothaca tenerrima*. *Bankia setacea* feces were noted around the larger wood chunks and logs.

Echinoderm abundance and diversity in the area were low. The only sea star species observed were *Evasterias troschelii* and *Pycnopodia helianthoides*. A few individuals of *Parastichopus californicus* were observed on the slopes of the drop-off and the bay bottom.

Crustacean abundance and diversity were moderate. Juvenile and adult *Cancer magister*

were observed, as individuals scattered over the entire survey area and buried in the unstable sand on the drop-off slope. 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 and barnacles were present in the area.

Other invertebrates observed during the survey were *Metridium sp.* anemones; thin patches of the bacteria *Beggiatoa sp.*, mostly on the deeper debris accumulation at the base of the steep slope; and unidentified benthic infauna on top of the alluvial shelf and the bay bottom.

Fish were observed in moderate abundance and diversity in the area. Individuals of *Pholis sp.*, *Lumpenus sagitta*, *Hexagrammos stelleri*, *Coryphopterus nicholsi*, 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 well under the maximum size limit, and is now confined to a band along the bottom portion of the drop-off slope. Two major factors affect the bark deposit at this site, both resulting from the close proximity of the large stream. First, the sand and gravel substrate of the alluvial shelf appears to be continually sloughing down from the abrupt edge from the shallow, flat top to the steep slope down to the bay bottom. This sloughing sand is mixing with, and also covering, the bark debris deposited by the LTF operation. The second major factor is the continual introduction of woody debris over the survey area, which does not originate from the LTF operation, but is discharged by the stream system. For example, the bark debris on top of the shallow alluvial shelf has been mostly removed by tidal currents and wave action, yet there are patches of woody debris that are clearly of stream origin and being deposited post-LTF operation (see photos 27 & 28). The Dungeness crab population has noticeably increased since the 1998 dive survey, with a higher proportion of adult crabs.

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 2, 2000

TABLE 1
Transect Data

Transect/Sample Pt.	Depth from MLLW	Debris Depth (in)	Percent Coverage	Substrate Type
Ref. Pt.	4	T	T	Rk, Gr
150/1	6	<1	25	Gr, Sa
150/2	5	<1	10	Gr, Sa
150/3	5	1	75	Sa, Gr
150/4	4	3	100	Sa, Gr
150/5	5	1	75	Sa, Gr
150/6	4	1	50	Sa, Gr
150/7	4	<1	10	Sa, Gr
150/8	3	<1	75	Sa, Gr
180/1	6	<1	25	Gr, Sa
180/2	6	<1	25	Gr, Sa
180/3	5	3	90	Sa, Gr
180/4	6	<1	90	Sa, Gr
180/5	5	<1	10	Sa, Gr
180/6	10	<1	25	Si, Sa, Gr
180/7	14	<1	25	Si, Sa, Gr
180/8	19	10	100	Si, Sa, Gr
180/9	25	10	100	Si, Sa, Gr
180/10	29	10	100	Si, Sa, Gr
180/11	33	11	100	Si, Sa
180/12	36	14	100	Si, Sa
180/13	39	17	100	Si, Sa
180/14	41	8	90	Si, Sa
180/15	42	6	75	Si, Sa
180/16	42	4	50	Si, Sa
180/17	42	2	25	Si, Sa
210/1	7	<1	10	Gr, Sa
210/2	6	3	100	Gr, Sa
210/3	6	<1	10	Sa, Gr
210/4	12	<1	10	Sa, Gr
210/5	24	<1	25	Sa, Gr
210/6	33	6	100	Si, Sa
210/7	39	17	100	Si, Sa
210/8	42	12	100	Si, Sa

210/9	46	4	90	Si, Sa
210/10	49	3	90	Si, Sa
210/11	50	3	75	Si, Sa

TABLE 1 – cont.
Transect Data

Transect/Sample Pt.	Depth from MLLW	Debris Depth (in)	Percent Coverage	Substrate Type
210/12	52	3	50	Si, Sa
210/13	52	3	50	Si, Sa
240/1	7	<1	10	Gr, Sa
240/2	7	<1	10	Gr, Sa
240/3	14	<1	10	Gr, Sa
240/4	23	3	75	Gr, Sa
240/5	33	15	100	Si, Sa
240/6	39	10	100	Si, Sa
240/7	45	4	100	Si, Sa
240/8	48	4	100	Si, Sa
240/9	50	3	50	Si, Sa
240/10	51	2	25	Si, Sa
240/11	52	2	25	Si, Sa
270/1	8	<1	10	Gr, Sa
270/2	8	<1	25	Gr, Sa
270/3	16	<1	25	Gr, Sa
270/4	23	3	50	Sa
270/5	30	6	50	Si, Sa
270/6	36	10	75	Si, Sa
270/7	42	18	90	Si, Sa
270/8	47	9	75	Si, Sa
270/9	50	3	50	Si, Sa
270/10	52	3	10	Si, Sa

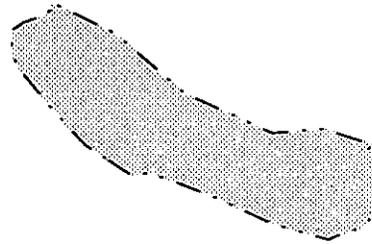
Key to Substrate Type	
Brk	Bedrock
Gr	Gravel
Rk	Rock
Sa	Sand
Sh	Shell
Si	Silt

Table 2

<u>Species Abundance</u>		
L = Low C = Common A = Abundant		
Scientific Name	Common Name	Abundance
<u>Plants</u>		
<i>Rhodophyta sp.</i>	Red algae	L
<i>Laminaria saccharina</i>	Sugar kelp	L
<i>Zostera marina</i>	Eel grass	L
<u>Invertebrates</u>		
<i>Beggiatoa sp.</i>	Bacteria	L
Benthic infauna	Unidentified benthic infauna	C
<i>Metridium spp.</i>	Anemone	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 sp.</i>	Horse neck clam	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>Balanus spp.</i>	Barnacle	L
<i>Pagurus spp.</i>	Hermit crab	L
<i>Hyas lyratus</i>	Lyre crab	L
<i>Oregonia gracilis</i>	Graceful decorator crab	L
<u>Vertebrates</u>		
Cottidae spp.	Sculpins	L
Pleuronectidae spp.	Righteye flounders	L
<i>Pholis spp.</i>	Gunnel	L
<i>Cymatogaster aggregata</i>	Shiner perch	L
<i>Hexagrammos stelleri</i>	Whitespotted greenling	L
<i>Lumpenus sagitta</i>	Pacific snake prickleback	L
<i>Coryphopterus nicholsi</i>	Blackeye goby	L
Agonidae sp.	Poacher	L

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Margaret Bay LTF Dive Survey



Former Input Point

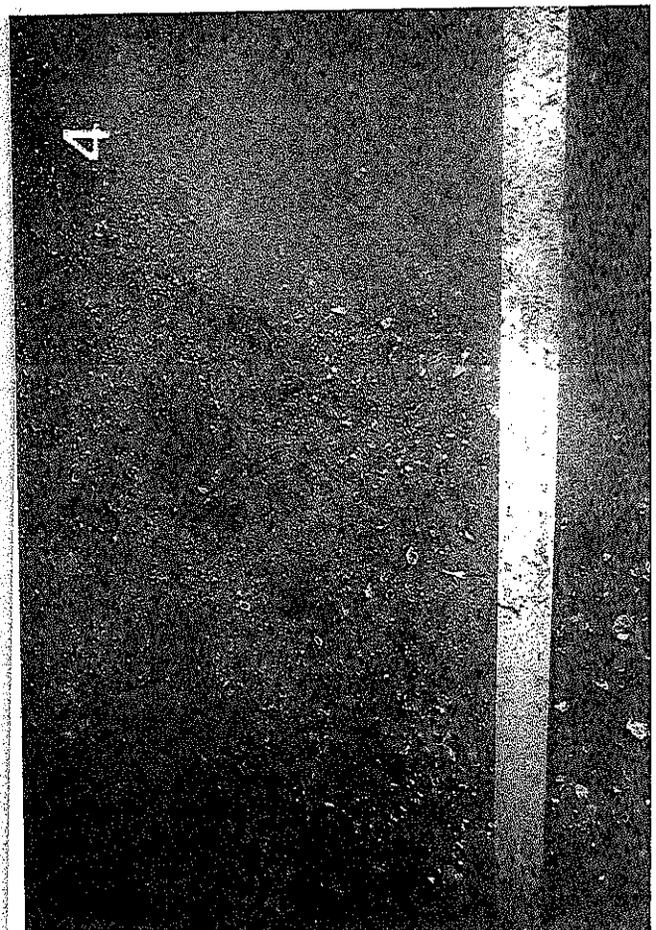
Ramp

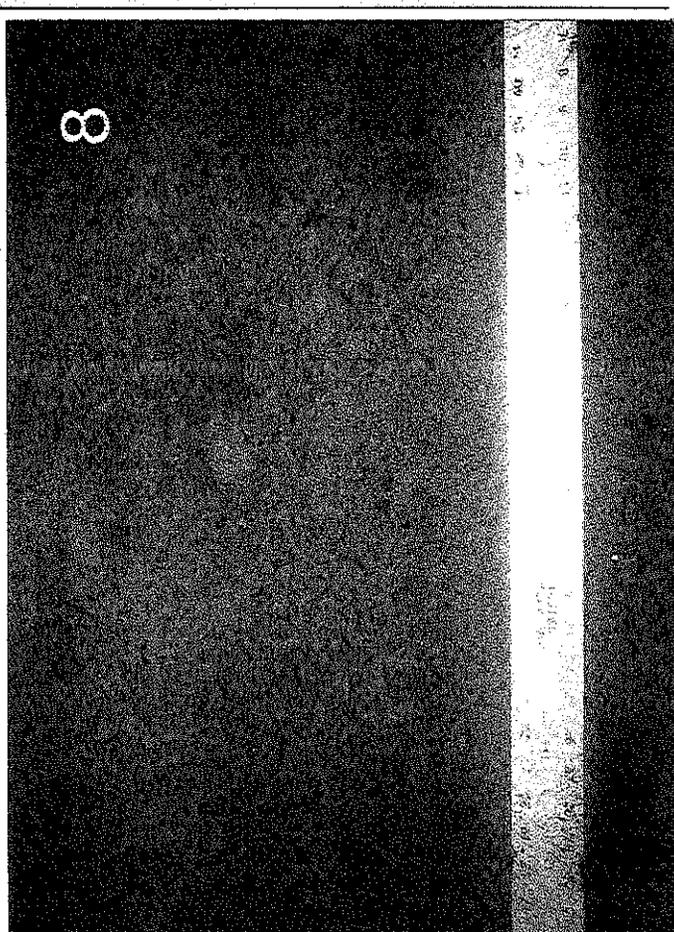
Photograph Key		
Photo Number	Transect/ Sample Pt.	Description
1	Reference Point	Base of fill rock, start of shallow shelf
2	250/1	Little bark and some stream debris
3	250/2	Little bark on gravel, sand, and shell

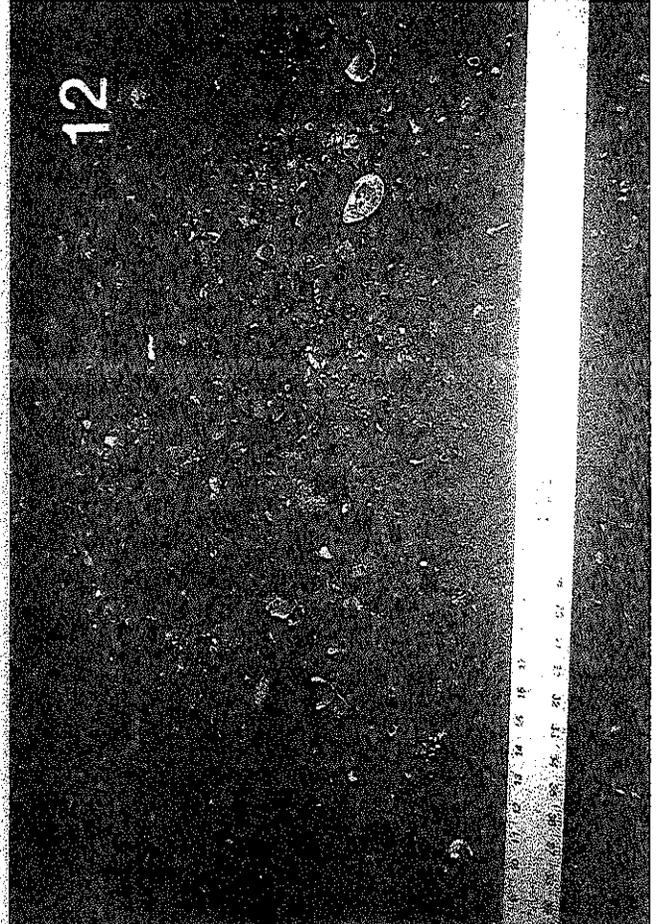
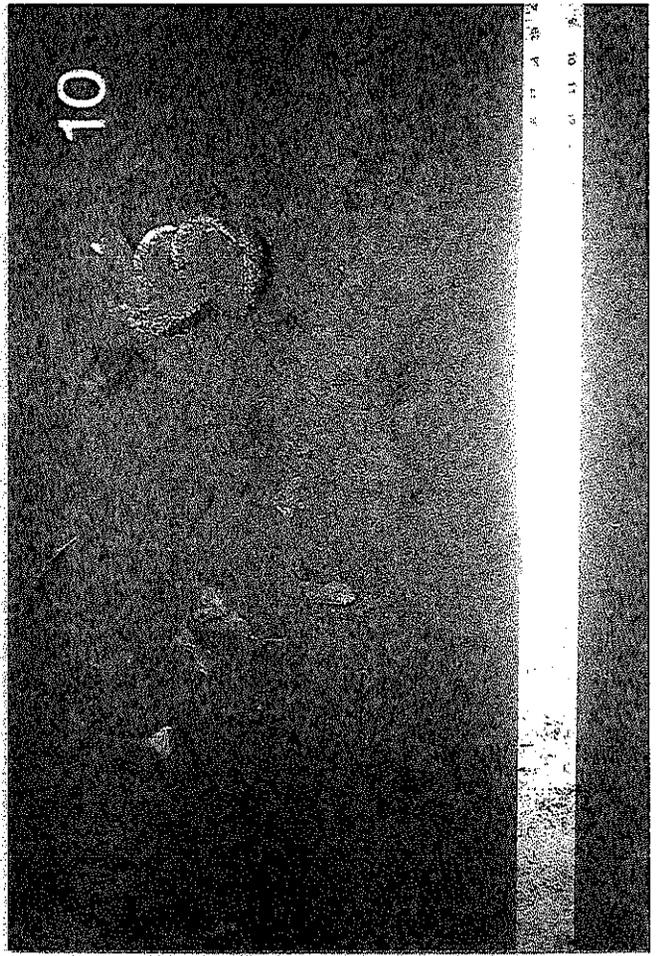
4	250/3	Little bark on gravel, sand, and shell
5	250/4	Patch of fine bark debris
6	250/5	Patches of surface debris on descending slope
7	250/6	Some surface debris, sand over debris layer
8	250/7	Now on bay bottom, mixed bark and substrate
9	310/1	Sea star, kelp on mixed bark and substrate
10	310/2	Flagging and shell on surface
11	310/3	Pipe on surface of substrate
12	310/4	Little bark on gravel, sand, and shell
13	310/5	Mixture of bark and stream debris
14	310/6	Little bark on gravel, sand, and shell
15	310/7	Little bark on gravel, sand, and shell
16	220/1	Patchy debris at start of slope
17	220/2	100% debris on slope
18	220/3	Thin bacteria on 100% bark
19	220/4	Thin bacteria on 100% bark
20	220/5	Mixture of bark stream debris and silt on bay bottom
21	220/6	Mixture of bark stream debris and silt on bay bottom
22	220/7	Mixture next to small, eroded log
23	010/1	Less bark in substrate
24	010/2	Infauna den in silt and bark mix
25	010/3	Little bark on gravel, sand, and shell
26	010/4	Little bark on gravel, sand, and shell
27	010/5	Stream debris on gravel, sand
28	010/6	Nearly complete cover by stream debris
29	010/7	Dungeness crabs on fish parts, stream debris
30	010/9	Dungeness crabs on fish parts, stream debris

Photograph Key – cont.

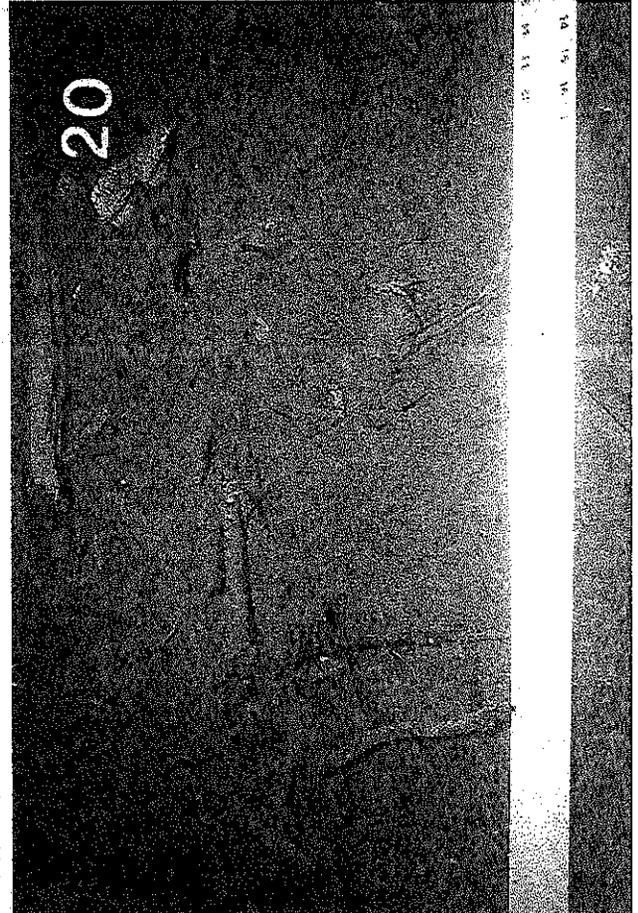
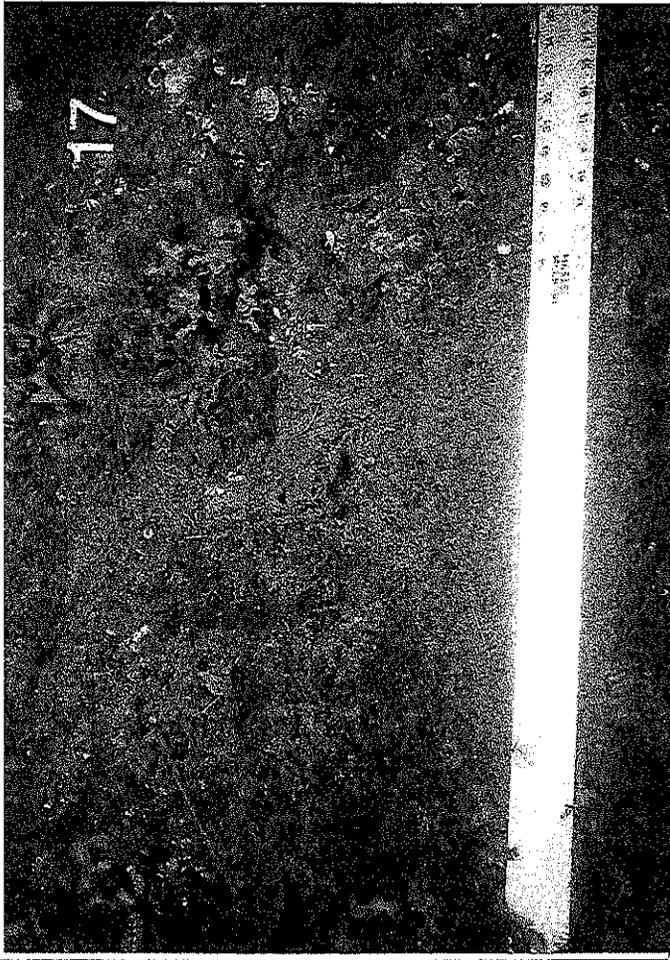
Photo Number	Transect/ Sample Pt.	Description
31	150/7	Pocket of small, mostly stream debris
32	150/8	Pocket of small, mostly stream debris in eel grass











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