SITKA BOAT HARBOR HERRING SPAWN DEPOSITION STUDY

1993 SURVEY RESULTS

By

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INTRODUCTION

The Alaska Department of Fish and Game (ADF&G) entered into a cooperative agreement with the U.S. Fish and Wildlife Service (USF&WS), agreement COOP-93-065 number 1448-0007-93-7770, in the spring of 1993 to document the extent of herring spawning activities within the proposed boundaries before and after construction. This report fulfills the State's obligation according to that agreement for fiscal year 1993.

METHODS

Documentation of timing and shoreline lengths of herring spawning activities is conducted with a series of aerial and skiff surveys by Department of Fish and Game employees from the Sitka area office. Maps of daily spawns are included on a master chart and the total miles of beach receiving spawn for the season summed. Underwater surveys using scuba are conducted prior to hatching to document the width of spawn and egg density. The total number of eggs, length of spawn *width of spawn* density of eggs, is divided by an index value of 100,000,000 to produce a spawning biomass estimate in tons. Visual estimates are corrected on an individual diver basis by applying a calibration factor computed from volumetric enumeration of a number of samples each year.

RESULTS AND DISCUSSION

Monitoring of the Sitka area spawning stock started with the aerial survey program on March 19 and continued with flights through April 21, 1993. The first spot spawn occurred at the entrance to Silver Bay on March 24 with major spawning in the boat harbor study area from March 26 to April 3.The last spawn was recorded in the Goddard area on April 20. The entire 1.0 nautical mile of shore within the boat harbor study area received spawn. The total amount of beach receiving spawn in the Sitka area was 55.3 nautical miles.

Based on the amount of spawn observed from the air, five transects were placed systematically, with a random start, within the study area (Figure 1). The spawn deposition surveys were conducted on April 10 and 11 within the study area. Transects outside of the study area were conducted April 11, 12, and 13 located randomly in the area north of Cape Burunof and will act as the control (Figure 2). For the one mile of beach within the study boundaries, an escapement estimate of 1,721 tons was computed using a width of spawn of 267 meters and a density of 313,086 eggs/m^2. The spawn deposition estimate for the control area was 31,076 tons computed using a width of spawn of 91 meters and density of 349,086

eggs/m^2. To account for the spawn south of Cape Burunof an estimate of 2,500 tons was used (Table 2).

Samples of visual estimates were collected from nine sites within Sitka Sound to use in calibrating individual diver estimates. The ratios of laboratory counts compared to visual estimates ranged from .7 to 1.8 for the Sitka samples. The overall calibration data used from these surveys was based on the sum of all samples taken since 1982 and ranged from .85 to 1.11 for individual divers (Table 1).

Individual transect data with number of eggs per quadrant, vegetation type and depth is included in Table 3 for the boat harbor study and Table 4 for the control.

Figure 1.

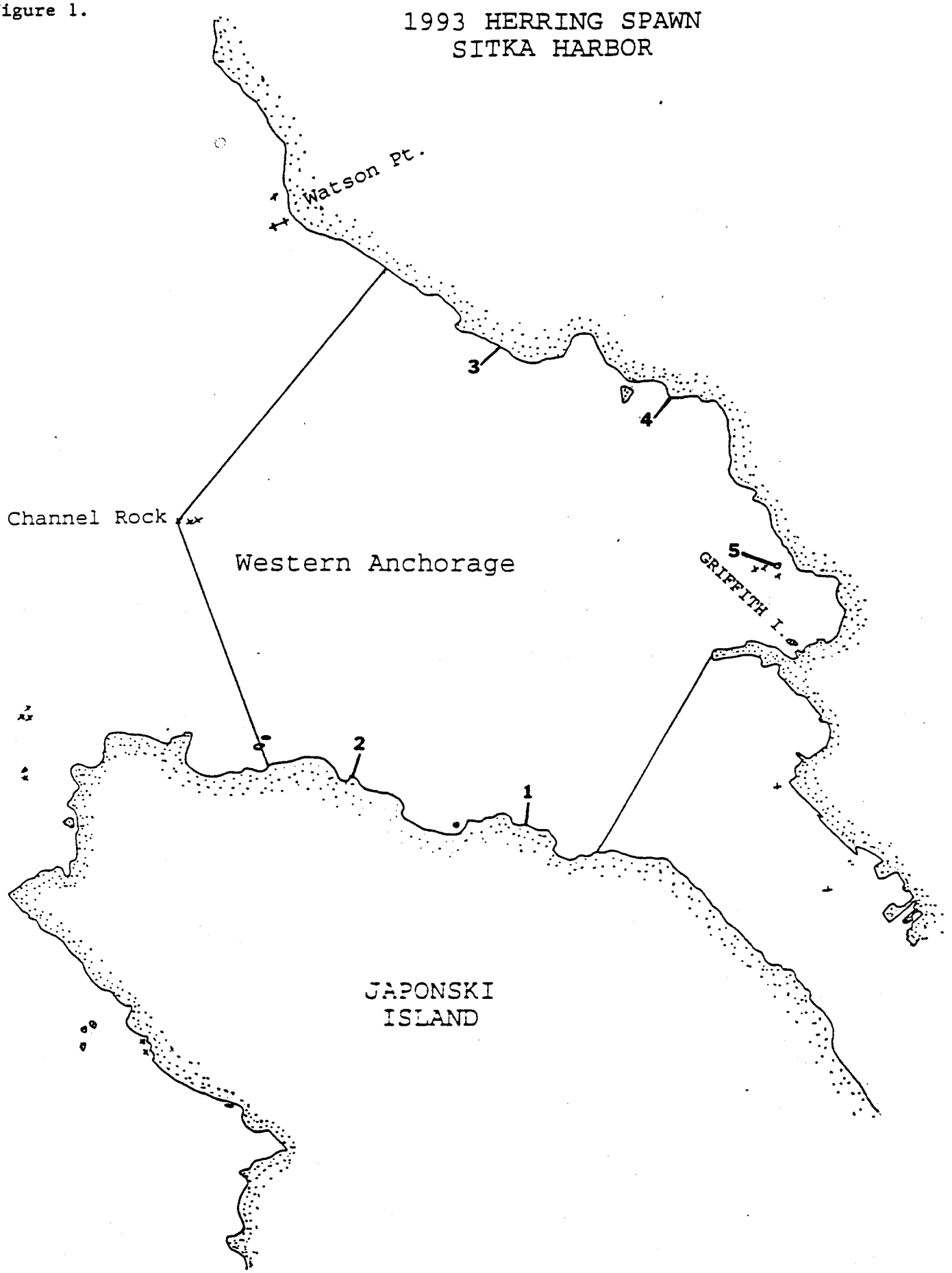
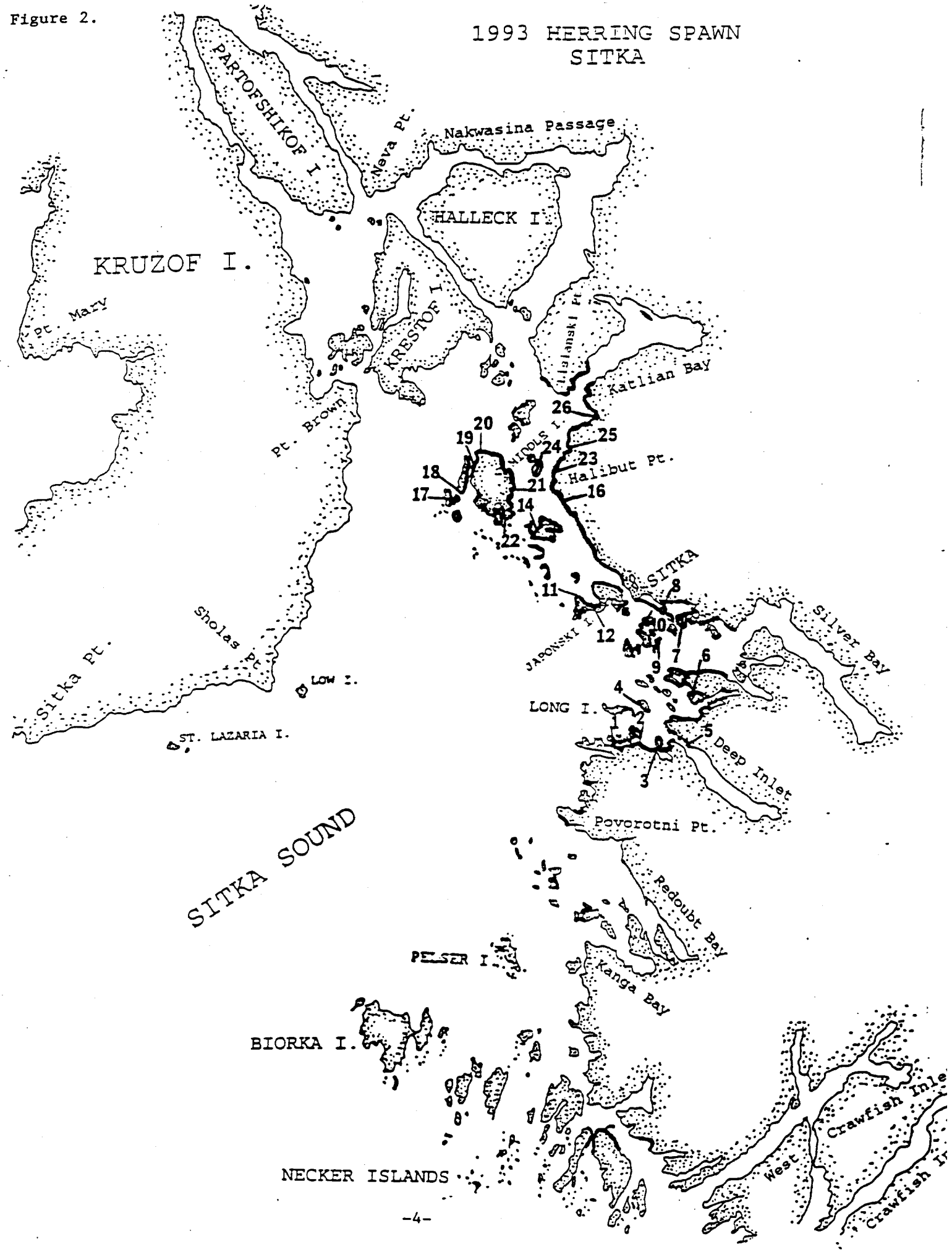

1993 HERRING SPAWN
SITKA HARBOR
Watson Pt.
Channel Rock
Western Anchorage
GRIFFITH I.
JAPONSKI
ISLAND
1
2
3
4
5

Figure 2.


1993 HERRING SPAWN
SITKA
PARTOFSHIKOF I.
Neva Pt.
Nakwasina Passage
HALLECK I.
KRUZOF I.
Pt. Mary
KRESTOF I.
Ilalanski Pt.
Katlian Bay
Pt. Brown
NIDOLS I.
Halibut Pt.
SITKA
Silver Bay
JAPONSKI I.
Sitka Pt.
Sholas Pt.
LOW I.
ST. LAZARIA I.
LONG I.
Deep Inlet
Povorotni Pt.
SITKA SOUND
Redoubt Bay
PELSER I.
Kanga Bay
BIORKA I.
NECKER ISLANDS
West
Crawfish Inlet
Crawfish In
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3
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26

Table 1. Sitka area spawn depositon calibration results, 1993.

SITKA SPAWN DEPOSITION DIVER CALIBRATION ESTIMATES, 1993

Date	Transect #	Observer	Sub-strate	Visual est.	Lab count	lab/ visual
4/13/93	3	RL/BD	lbk	RL=225k	264,478	1.2
				BD=320K		0.8
4/12/93	20	RL/BDJ	hair	RL=250k	449,357	1.8
		TM/BD		BD=320k		1.4
				TM=320k		1.4
				BDJ=360k		1.2
4/12/93	1	RL/BD	lbk	RL=35k	33,930	1.0
				BD=25k		1.4
4/13/93	3	RL/BD	lbk	RL=190k	141,181	0.7
				BD=200k		0.7
4/12/93	4	TM	hair	TM=50k	83,776	1.7
4/13/93	8	TM/BDJ	hair	TM=400k	447,784	1.1
				BDJ=500k		0.9
4/12/93	2	TM	lbk	TM=70k	83,350	1.2
4/13/93	8	TM	hair	TM=35k	29,916	0.9
4/12/93	1	RL/BD	lbk	RL=17k	12,427	0.7
				BD=15k		0.8

TOTAL INDIVIDUAL DIVER CALIBRATIONS 1993 SEASON

Observer	No Estimates	Visual est	Lab count	Lab/Visual
R. Larson	18	1617000	2059827	1.3
T. Minicucci	23	1570000	1816603	1.2
B. Davidson	21	2508000	2796355	1.1
B. DeJong	2	860000	897141	1.0

OVERALL DIVER CALIBRATIONS USING 1982 TO 1993 DATA

Observer	No Estimates	Visual est	Lab count	Lab/Visual
R. Larson	281			1.11
T. Minicucci	166			0.85
B. Davidson	21			1.11
B. DeJong	152			1.03

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Table 2. Sitka area spawn deposition survey results, 1993.

SITKA BOAT HARBOR HERRING SPAWN DEPOSITION PROJECT SURVEY 1993

Number of estimates	267	RL	TM
Unajusted sum of estimates by diver		610	9041
Corrected sum of estimates by diver		677.1	7684.9
Total number of eggs/.1meter quadrant (1,000s)	8,362		
Average length of transects in meters	267	(total samples * 5 meters / total [5] transects)	
Lineal meters of shoreline receiving spawn	1,852	(1.0 nautical miles of shore * 1852 meters / nmile)	
Area of survey in square meters	494,484	(length of shoreline * average width of transects)	
Average density of quadrant samples (1,000s)	31.3	(total eggs[1,000s] / total number of observations)	
Average density of eggs per square meter	313,182	(average .1 meter quadrant sample*1,000 eggs*10 meters)	
Total number of eggs in survey area	154,863,314,000	(total survey area in meters * total eggs per meter)	
Unadjusted escapement estimate in tons	1,549	(total number of eggs / 100,000,000 eggs per ton of spawners)	
Corrected escapement using 10% egg loss	1,721	(adjustment to account for 10% egg loss prior to survey)	
Corrected escapement in pounds	3,441,407	(tons * 2,000)	

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TOTAL SITKA AREA HERRING SPAWN DEPOSITION SURVEY 1993

Number of estimates	435	BDJ	RL	TM
Unajusted sum of estimates by diver		60	8378	6391
Corrected sum of estimates by diver		61.8	9299.6	5432.4
Total number of eggs/.1meter quadrant (1,000s)	14,794			
Average length of transects in meters	91	(total samples * 5 meters/total [24] transects)		
Lineal meters of shoreline receiving spawn	90,748	(49.0 nautical miles of shore * 1852 meters / nmile)		
Area of survey in square meters	8,224,038	(length of shoreline * average width of transects)		
Average density of quadrant samples (1,000s)	34 0	(total eggs[1,000s] / total number of observations)		
Average density of eggs per square meter	340,086	(average .1 meter quadrant sample*1,000 eggs*10 meters)		
Total number of eggs in survey area	2,796,877,937,583	(total survey area in meters * total eggs per meter)		
Unadjusted escapement estimate in tons	27,969	(total number of eggs / 100,000,000 eggs per ton of spawners)		
Corrected escapement using 10% egg loss	31,076	(adjustment to account for 10% egg loss prior to survey)		
Corrected escapement in pounds	62,152,843	(tons * 2,000)		

Note: This spawn estimate is based on the total spawn north of Cape Burunof (50 0 nautical miles) less the spawn occurring inside the proposed boat harbor (1 0 nautical mile)

Biomass estimate south of Cape Burunof= 2,500 tons (average Sitka Sound egg densities * 5.3 nautical miles).

Biomass estimate north of Cape Burunof	31,076	tons
Biomass estimate of small boat harbor	1,721	tons
Biomass estimate Crawfish Inlet to Cape Burunof	2,500	tons
Grand Total	35,297	tons

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Table 3. Sitka Boat Harbor spawn deposition transect raw data, 1993.

SITKA BOAT HARBOR HERRING SPAWN SURVEY 1993

DIVERS: Robert Larson (RL), Tim Minnicucci (TM), Bill Hughes (BH), Ed Grossman (EG)

ABVS: Bottom Typ boulder=bld, cobble=cbl, fir=fir, gravel=gvl, mud=mud, mussels-mus, rock= rck, sand=snd, shell or shell hash=shl, woody debris=wdy

Veg. Type: alaria=ala, agarum=agm, coraline algae=cor, eelgrass=elg, filamentous=fil, fucus=fuc, hairkelp=hir, laminaria=lam, large brown kelp=lbk, leafy red=red, loose=los, macrocystis=mac ulva=ulv

DATE	TRAN NO	TIME IN	TIME OUT	TOTAL TIME	MAX DEPTH	DIVER NO.1	DIVER NO.2	INCREMENT (METERS)	DEPTH (FEET)	BOTTOM TYPE	VEG TYPE	RL EYE	TM EYE	COMMENTS
10-Apr-93	1	1753	1817	24	38	RL	BH	5	0	rck	fuc	0		transect starts 15 meters
									7	cbl	red	1		from rock bank
									10	cbl	lbk	1		
									10	gvl	elg	20		target for compass is
									12	gvl	lbk	50		origin of transect #14
									14	gvl	lbk	20		
									17	gvl	lbk	15		
									19	gvl	lbk	40		
									21	gvl	lbk	25		
									23	gvl	lbk	20		
									26	gvl	lbk	65		
									28	gvl	lbk	25		
									32	gvl	lbk	15		
									33	gvl	lbk	10		
									35	snd		0		
									36	snd	red	20		
									37	mud		0		
									38	mud	agm	25		
									38	shl	agm	15		
									38	shl		0		
									38	mud		0		
									38	mud		0		
11-Apr-93	2	1000	1040	40	35	TM	EG	5	-6	rck	fuc		0	from MHHW, compass bearing 350
									-5	rck	fuc		0	mag. (to origin of transect #3)
									-4	rck			0	
									-3	rck	fuc		40	
									-2	rck			30	
									0	rck	fil		80	
									1	rck	fil		30	
									1	rck	lbk		60	
									1	rck	lbk		80	
									1	cbl	lbk		50	
									1	rck	lbk		120	
									1	rck	lbk		100	
									2	cbl	lbk		0	
									2	cbl			0	
									2	rck	cor		1	
									3	rck			1	
									3	rck			30	
									4	rck			0	
									4	cbl	lbk		40	
									4	cbl	lbk		60	
									7	cbl	lbk		40	
									7	cbl	lbk		50	
									8	cbl	lbk		50	
									8	cbl	lbk		90	
									8	cbl	lbk		60	
									9	cbl	lbk		70	
									10	cbl	lbk		40	
									11	cbl	lbk		70	
									11	cbl	lbk		90	
									11	cbl	lbk		100	
									12	cbl	lbk		50	
									12	cbl	lbk		60	
									13	cbl	lbk		4	

									13	cbl	lbk	50	
									14	cbl	lbk	20	
									14	cbl	lbk	10	
									15	snd	lbk	5	
									16	snd	lbk	10	
									16	snd	lbk	30	
									17	snd	lbk	30	
									18	snd	lbk	20	
									18	snd	lbk	5	
									20	snd	lbk	1	
									21	snd	lbk	5	
									22	snd	lbk	5	
									24	snd	lbk	5	
									26	snd	lbk	5	
									29	snd		0	
									31	snd	lbk	3	
									34	snd		0	increased slope of sand and
									35	snd		0	mud, no additional spawn
10-Apr-93	3	1534	161	40	30	TM	EG	5	2	rck		0	from MHHW
									2	rck		2	compass bearing approx. 230
									3	rck	red	40	degrees to Channel Rock
									3	rck		25	
									4	rck	red	50	
									4	rck		20	
									5	rck	red	60	
									5	rck	hir	20	
									7	rck	hir	10	
									7	rck	hir	80	
									7	rck		160	
									8	rck	lbk	160	
									9	rck	lbk	90	
									10	rck		10	
									11	rck	lbk	30	
									13	cbl	lbk	50	
									14	rck	hir	0	
									16	rck	lbk	10	
									16	cbl	lbk	20	
									17	cbl	lbk	5	
									18	cbl	lbk	20	
									18	cbl	lbk	80	
									19	cbl	lbk	200	
									19	cbl	lbk	120	
									19	cbl	lbk	30	
									21	cbl	lbk	5	
									22	cbl	lbk	40	
									22	cbl	lbk	140	
									23	cbl	lbk	70	
									24	cbl	lbk	40	
									24	cbl	lbk	30	
									24	cbl	lbk	70	
									24	cbl	lbk	40	
									24	cbl	lbk	30	
									25	cbl	lbk	30	
									25	cbl		5	loose eggs
									25	cbl		1	loose eggs
									25	cbl		1	loose eggs
									26	snd		0	loose eggs
									26	snd	lbk	2	loose eggs
									26	snd		0	loose eggs
									26	snd	los	1	loose eggs
									26	snd	los	2	loose eggs
									26	snd	los	2	loose eggs
									27	snd	los	1	loose eggs
									28	snd	los	1	loose eggs
									29	snd	los	1	loose eggs
									29	snd	los	1	loose eggs

									30	snd		0	loose eggs
									30	snd		0	loose eggs
10-Apr-93	4	1228	1310	42	38	TM	EG	5	-6	rck		0	start MHHW south side of
									-3	rck		0	rock, brown house/yellow trim
									-2	mud	elg	0	transect bearing to Coast
									-1	mud	elg	15	Guard main building approx.
									-1	mud	elg	8	210 degrees magnetic
									0	mud	elg	0	
									0	snd	elg	0	
									0	snd	elg	0	
									1	snd	elg	0	
									1	snd	elg	1	
									1	rck		0	
									1	rck	cor	3	
									1	snd	elg	60	
									1	cbl	lbk	70	
									2	cbl	lbk	30	
									2	cbl	lbk	60	
									3	cbl	elg	30	
									3	snd	elg	200	
									4	snd	elg	240	
									4	snd	elg	200	
									4	snd	elg	240	
									4	snd	elg	180	
									5	snd	elg	260	
									5	snd	elg	320	
									5	snd	elg	90	
									5	snd	elg	20	
									6	snd	elg	15	
									6	snd	elg	10	
									7	snd	elg	5	
									7	snd	elg	20	
									7	snd	elg	1	
									7	snd	lbk	40	
									8	snd	lbk	120	
									8	rck	lbk	140	
									8	rck	lbk	70	
									9	rck	cor	240	
									9	rck	lbk	40	
									10	cbl	lbk	30	
									10	cbl	lbk	10	
									11	cbl	lbk	40	
									12	cbl	lbk	120	
									15	cbl	lbk	20	
									13	cbl	lbk	160	
									14	cbl	lbk	60	
									16	cbl	lbk	120	
									16	cbl	lbk	200	
									18	cbl	lbk	100	
									19	cbl	lbk	120	
									20	cbl	lbk		
									22	cbl	lbk	80	
									23	cbl	lbk	10	
									24	snd	los	40	
									25	snd		0	
									27	snd		0	
									29	snd		0	
									30	snd		0	
									32	snd		0	
									33	gvl	lbk	2	
									34	gvl	lbk	10	
									34	gvl	lbk	15	
									35	gvl	lbk	20	
									35	gvl	lbk	60	
									35	gvl	lbk	60	
									35	gvl	lbk	20	

									36	gvl	lbk		40	
									36	gvl	lbk		30	
									37	gvl	lbk		20	
									38	gvl	lbk		15	
10-Apr-93	5	1005	1047	42	35	TM	EG	5	-7	rck	fuc	0		starting point is top of
									-6	rck	fuc	0		rock, north side transect
									-5	cbl		0		bearing to white residence
									-4	cbl		1		building approx. compass
									-4	cbl		0		heading 230 degrees magnetic
									-4	gvl		8		1k loose eggs, cbl with barnacles
									-3	rck		0		butterclams and barnacles
									-3	snd		0		loose eggs
									-2	snd	elg	120		
									-2	snd	elg	7		
									-1	snd	elg	90		
									-1	gvl	fil	1		1k loose eggs on eelgrass
									0	snd	elg	10		
									0	snd	elg	6		
									1	mud			0	
									1	mud	elg		120	
									1	mud	elg		140	
									1	mud	elg		15	
									1	mud	elg		160	
									1	mud	elg		60	
									1	snd	elg		20	
									1	snd			0	
									2	snd			0	
									3	snd			0	
									4	snd	elg		0	
									5	snd	elg		30	
									5	snd	elg		1	
									7	snd	elg		0	
									9	snd			0	
									9	snd			0	
									9	snd			0	
									10	snd			0	
									10	snd			0	
									10	snd			0	
									11	snd			0	
									11	snd			0	
									12	snd			0	
									12	snd			0	
									12	snd			0	
									13	snd			0	
									13	snd			0	
									13	snd			0	
									13	snd			0	
									13	snd			0	
									14	cbl	lbk		40	
									14	cbl	lbk		90	
									14	cbl	lbk		70	
									14	cbl	lbk		90	
									14	cbl	lbk		100	
									14	cbl	lbk		60	
									14	cbl	lbk		20	
									14	cbl	lbk		25	
									15	cbl	lbk		40	
									15	cbl	lbk		15	
									15	cbl	lbk		50	
									16	cbl	lbk		20	
									16	cbl			0	
									16	cbl	lbk		5	
									17	cbl	lbk		80	
									17	cbl	lbk		40	
									17	cbl	lbk		40	
									17	cbl	lbk		15	

18	cbl	lbk	20
18	cbl	lbk	15
21	cbl	lbk	10
21	cbl		0
22	cbl	lbk	10
22	cbl	lbk	5
24	cbl		0
25	cbl		0
26	cbl		0
28	cbl		0
31	snd		0
32	snd		0
33	snd		0
35	snd		0

Table 4. Sitka area spawn deposition study control sites, 1993.

SITKA HERRING CONTROL SITE SPAWN DEPOSITION SURVEY, 1993

DIVERS: Robert Larson (RL), Tim Minnicucci (TM), Bill Hughes (BH), Ed Grossman (EG)

ABVS: Bottom Type: boulder=bld, cobble=cbl, fir=fir, gravel=gvl, mud=mud, mussels-mus, rock= rck, sand=snd, shell or shell hash=shl, woody debris=wdy

Veg. Type: alaria=ala, agarum=agm, coraline algae=cor, eelgrass=elg, fillamentous=fil, fucus=fuc, hairkelp=hir, laminaria=lam, large brown kelp=lbk, leafy red=red, loose=los, macrocystis=mac ulva=ulv

DATE	TRAN NO	TIME IN	TIME OUT	TOTAL TIME	MAX DEPTH	DIVER NO.1	DIVER NO.2	INCREMENT (METERS)	DEPTH (FEET)	BOTTOM TYPE	VEG TYP	BDJ EYE	RL EYE	TM EYE	COMMENTS
13-Apr-93	1	1035	111	36	20	RL	BD	5	0	cbl	fuc		1		
									4	cbl	fil		2		
									7	gvl	lbk		35		bag #5 RL 35/ BD 25
									8	gvl	lbk		5		
									11	shl	hir		1		
									14	mud	lbk		3		
									15	mud	lbk		17		bag #18 RL 17/ BD 15
									10	mud	lbk		10		
									18	mud			5		
									20	mud			0		
									20	mud			0		
									20	mud			0		
									20	mud	lbk		20		
									20	mud	lbk		30		
									20	mud	lbk		20		
									19	mud	lbk		20		
									18	mud	lbk		15		
									18	mud	lbk		2		
									17	mud	lbk		25		
									17	mud	lbk		4		
									16	mud	lbk		3		
13-Apr-93	2	1040	1105	25	27	TM	BDJ	5	0	rck	fuc			15	eggs mostly dead to 20'
									-5	rck	fuc			80	
									-7	rck				0	
									4	cbl	fuc			35	
									5	cbl	elg			90	
									6	cbl	elg			45	
									9	mud	elg			20	
									9	mud	elg			15	
									10	mud				0	
									11	mud	lbk			3	
									13	mud				0	
									16	mud	lbk			70	
									17	mud	lbk			1	
									19	mud				0	
									20	mud				0	
									23	mud				0	
									24	mud	lbk			70	bag #A1 TM 70
									25	mud	lbk			140	
									25	mud	lbk			110	
									27	mud	lbk			90	
13-Apr-93	3	1141	1155	14	37	RL	BD	5	-6	cbl	fuc		12		
									-3	cbl	fuc		20		
									0	cbl	fuc		10		
									2	snd	fir		10		
									4	snd	elg		75		
									6	snd	lbk		35		
									7	snd	lbk		10		
									8	snd	lbk		65		
									9	gvl	lbk		180		
									11	rck	agm		35		bag #22 RL 225/ BD 320
									15	rck	agm		20		LBK, sample only
									18	rck	agm		40		

									22	rck	agm		80		bag #C RL 190/ BD 200
									26	rck	agm		30		LBK, sample only
									27	gvl	agm		10		
									32	rck			0		
									37	gvl			0		
13-Apr-93	4	1115	1135	20	38	TM	BDJ	5	0	rck	fuc			130	
									-7	rck	fuc			0	
									-9	rck				0	
									4	rck	rck			120	
									6	rck	lbk			20	
									7	rck	lbk			100	
									12	rck	lbk			35	
									16	rck				1	
									22	cbl	hir			50	bag #3 TM 50
									29	cbl				1	steep slope end
									38	cbl				0	of spawn
13-Apr-93	5	1244	1251	7	31	BD	RL	5	-1	rck	fuc		150		
									11	rck	lbk		50		
									21	rck	lbk		40		
									31	rck			0		
13-Apr-93	6	1200	1215	15	20	TM	RL	5	-6	rck	fuc	40			
									-2	rck	fuc	20			
									0	rck	fuc			0	
									3	rck	lbk			120	
									8	rck	lbk			90	
									13	cbl	lbk			20	
									17	cbl	lbk			8	
									19	snd	lbk			10	
									20	snd	lbk			20	
									20	mud				0	
									19	mud	lbk			3	
									16	snd	lbk			15	
13-Apr-93	7	1325			4	BD	RL	5	-4	rck	fuc		4		
									-2	cbl	fuc		3		
									2	mud	mud		0		
									3	mud	fuc		45		
									4	mud	elg		0		
									3	mud			0		
									3	mud			0		
									3	snd			0		
									3	snd	los		1		
									3	snd			0		
									3	snd			0		
									2	snd			0		
13-Apr-93	8	1315	1345	30	30	TM	BDJ	5	-6	rck	hir			200	
									-4	rck	fuc			100	
									-3	rck				0	
									0	rck				0	
									2	rck	hir			400	bag #5T TM 400+150 lost
									3	rck	hir			140	BDJ 500+200 lost
									4	snd	lbk			120	
									6	snd	hir			35	bag #31 TM 35
									7	snd	lbk			20	
									8	snd	hir			3	
									8	snd	lbk			100	
									12	snd	los			15	
									16	rck	lbk			80	
									20	mud				0	
									25	mud				0	
									30	mud				0	drops off fast
13-Apr-93	9	1405			34	RL	BD	5	0	gvl	fuc		0		
									1	gvl			0		
									3	gvl			0		
									4	cbl	lbk		20		
									6	cbl	lbk		160		
									7	gvl	lbk		300		

									6	rck	lbk	10		
									9	gvl	lbk	70		
									11	rck	lbk	80		
									14	shl	lbk	2		
									15	gvl	lbk	1		
									17	gvl		0		
									17	gvl	lbk	3		
									18	gvl	lbk	30		
									18	gvl	lbk	25		
									19	gvl	lbk	40		
									20	gvl	lbk	70		
									21	gvl	lbk	120		
									21	snd	lbk	80		
									21	snd	lbk	80		
									21	snd	lbk	35		
									22	snd	lbk	30		
									22	snd	lbk	60		
									22	mud		60		
									22	mud		0		
									22	mud		0		
									23	mud		6		
									23		lbk	4		
									23		lbk	10		
									21	rck		35		
									21	rck		15		
									21	rck		15		
									27	rck		10		
									30	rck		0		
									34	shl		0		
13-Apr-93	10	1400	1410	10	40	TM	BDJ	5	-8	rck	fuc		130	
									-6	rck	fuc		10	
									-1	rck	fuc		0	
									0	rck	fuc		0	
									3	rck			60	
									16	rck			50	
									23	snd	los		2	
									31	snd			0	
									40	snd			0	see to 60' steep
12-Apr-93	11				32	TM	BDJ	5	-8	rck			0	
									-5	rck			0	
									12	rck	lbk		0	
									26	rck	lbk		0	heavy surge
									29	rck			0	
									32	rck			0	
									32	rck			0	
12-Apr-93	12					TM	BD	5	0	rck	fuc		0	
									-7	rck	fuc		0	
									12	cbl	los		2	
									12	cbl	los		2	
									13	cbl	lbk		5	
									15	cbl	los		2	
									15	cbl	los		5	
									15	cbl	lbk		20	loose
									16	cbl	lbk		10	loose
									17	cbl	lbk		25	loose
									18	cbl	lbk		30	loose
									18	cbl	lbk		5	loose
									20	cbl	lbk		20	loose
									21	cbl	lbk		35	loose
									21	cbl	lbk		15	loose
									21	cbl	los		3	
									22	cbl	los		4	
									23	cbl	lbk		7	
									24	cbl	los		1	
									25	cbl	los		1	
									26	cbl	los		1	

									27	cbl	los		1	
									27	cbl			0	
									28	cbl			0	
									28	cbl			0	
									30	cbl			0	
									30	cbl			0	
12-Apr-93	14	1315	1655	40	32	RL	BDJ	5	5	rck	fil	0		
									15	rck		40		
									15	shl	lbk	10		
									18	shl	lbk	60		
									21	shl	lbk	25		
									23	shl	lbk	7		
									27	shl	lbk	8		
									29	snd		0		
									32	snd		0		
11-Apr-93	16	NA	NA	NA	38	RL	BH	5	3	cbl		0		from 0'
									5	bld		0		
									7	cbl	los	1		
									8	cbl	fil	40		
									8	cbl	fir	55		
									8	snd	elg	360		
									10	snd	elg	380		
									11	snd	elg	120		
									12	snd	elg	5		
									13	gvl	lbk	3		
									13	cbl	lbk	10		
									13	cbl		8		
									15	gvl	elg	90		
									15	gvl	hir	100		
									10	snd		0		
									17	snd	los	1		
									17	snd		0		
									18	snd		0		
									18	snd		0		
									19	snd	los	2		
									20	snd		0		
									20	snd		0		
									20	rck		0		
									17	rck	lbk	2		
									26	rck	agm	60		
									28	snd	lbk	2		
									29	snd		0		
									31	snd		0		
									33	snd		0		
									36	snd	lbk	1		
									38	snd		0		
12-Apr-93	17	1035	1105	30	25	RL	BDJ	5	-3	rck	fuc	30		
									0	rck	fuc	80		
									3	rck	lbk	40		
									4	rck	lbk	25		
									6	gvl	lbk	10		
									7	gvl	lbk	5		
									10	gvl	los	2		
									12	gvl	los	3		
									14	gvl	los	2		
									15	gvl	los	3		
									17	gvl	los	2		
									19	gvl	los	1		
									22	gvl	los	2		
									23	gvl	los	1		
									24	gvl		0		
									25	gvl		0		
									25	snd		0		truncated softshell
									25	snd		0		clams
12-Apr-93	18			6	39	TM	BD	5	0	rck	fuc		100	
									3	rck	los		0	

								5	rck	los		1		
								18	rck			1		
								32	rck			0		
								39	rck			0		
12-Apr-93	19			7	38	TM	BD	5	0	rck	fuc	40		
									6	rck		0		
									13	rck		50		
									19	rck	lbk	40		
									28	rck	lbk	20		
									38	cbl		0	steep drop see to 45+	
12-Apr-93	20	1207	1225	18	34	RL	BDJ	5	-5	rck	fuc	40		
									-1	rck	fil	280		
									1	rck	fir	100		
									3	gvl	los	20		
									4	gvl	los	25		
									6	gvl	lbk	25		
									8	gvl	lbk	210		
									10	gvl	lbk	150		
									12	gvl	lbk	160		
									12	gvl	lbk	50		
									15	gvl	lbk	100		
									19	gvl	lbk	120		
									22	shl	los	100		
									26	rck	lbk	10		
									30	shl	los	2	cucs start	
									31	snd		0		
									34	rck		0		
12-Apr-93	21	1300	1320	20	34	RL	BDJ	5	0	rck	fir	70		
									3	rck	lbk	160		
									5	cbl	lbk	110		
									5	cbl	los	50		
									5	cbl	hir	1100		
									5	cbl	lbk	90		
									10	cbl	lbk	210		
									10	cbl	lbk	110		
									10	cbl	lbk	85		
									10	cbl	lbk	25		
									19	snd	lbk	0		
									21	snd	lbk	0		
									25	shl		0		
									27	snd	lbk	3	first cuc	
									31	snd	lbk	0		
									34	snd		0		
12-Apr-93	22				36	TM	BD	5	0	rck		0		
									8	rck	fuc	0		
									10	rck	lbk	0		
									13	rck	lbk	5		
									18	rck		50		
									20	snd	los	1		
									24	rck	lbk	25		
									26	cbl	lbk	2		
									28	cbl		1		
									30	cbl		1		
									33	cbl		0	see to 40'	
									36	cbl		0	end of spawn	
11-Apr-93	23	1640	1651	11	40	RL	BH	5	3	rck	fuc	65	from 0'	
									6	rck	fir	40		
									13	rck	ulv	0		
									17	cbl		0		
									17	rck	lbk	0		
									17	rck	lbk	0		
									17	rck		0		
									19	rck		0	red urchin	
									23	rck		20		
									31	rck	lbk	50		
									35	rck		0		

									40	cbl		0		
12-Apr-93	24	1559	1615	16	33	RL	BH	5	2	cbl	los	1		from 0'
									4	cbl	los	7		
									6	cbl	fir	130		
									7	snd	elg	240		
									9	rck	lbk	35		
									11	snd	elg	60		
									13	snd	elg	100		
									15	snd	elg	50		
									17	gvl	lbk	30		
									20	snd	lbk	10		
									22	snd	lbk	25		
									26	snd		0		no vegetation
									29	mud		0		
									33	mud		0		
11-Apr-93	25	1340	1420	40	35	TM	EG	5	-7	rck	fuc		10	
									-5	rck			20	
									-4	rck			10	
									-3	rck	fuc		30	
									-2	rck			0	
									-1	rck			0	
									0	rck			0	
									2	cbl	hir		180	
									2	cbl	fuc		120	
									4	rck	fuc		90	
									5	cbl			10	
									5	cbl	lbk		60	
									5	cbl	lbk		240	
									5	cbl	lbk		280	
									5	cbl	lbk		160	
									8	cbl	lbk		140	
									9	cbl	lbk		200	
									9	cbl	lbk		160	
									9	cbl	lbk		160	
									9	rck			10	
									9	cbl	lbk		120	
									7	rck	lbk		40	
									6	rck			40	
									6	rck			20	
									7	rck	lbk		90	
									9	rck			120	
									10	rck	lbk		70	
									12	rck	lbk		30	
									13	cbl	lbk		30	
									15	cbl	lbk		5	
									17	cbl	lbk		90	
									17	rck			80	
									20	rck			40	
									25	cbl			0	
									28	cbl			0	
									30	cbl			0	
									35	cbl			0	
11-Apr-93	26	1255	1310	15	38	TM	EG	5	-8	cbl	fuc		1	50 meters to tree line
									-8	cbl	fuc		1	
									-8	cbl	fuc		5	
									-8	cbl	fuc		10	
									-8	cbl	fuc		3	
									-8	cbl	fuc		3	
									-8	cbl	fuc		10	
									-8	cbl	fuc		2	
									-8	cbl	fuc		5	
									-8	cbl	fuc		10	
									-8	cbl	fuc		1	
									-8	cbl	fuc		10	
									-8	cbl	fuc		5	
									-8	cbl	fuc		20	

-7	cbl	fuc	10
-6	cbl	fuc	0
-5	cbl	fuc	1
-4	cbl	fuc	1
-4	cbl	fuc	30
-3	cbl	fuc	60
-2	cbl	fuc	5
-2	cbl	fuc	0
-2	cbl	fuc	20
-2	cbl	fuc	0
-2	cbl	fuc	0
-2	cbl	fuc	0
-2	cbl	fuc	0
-2	cbl	fuc	0
-2	cbl	fuc	0
-2	cbl	fuc	0
-2	cbl	fuc	0
-2	cbl	fuc	0
-2	cbl	fuc	0
-2	cbl	fuc	0
-2	cbl	fuc	0
-2	cbl	fuc	0
-2	cbl	fuc	0
-2	cbl	fuc	0
-2	cbl	fuc	0
-2	cbl	fuc	0
-2	cbl	fuc	0
-2	cbl	fuc	0
2	snd	fuc	0
2	snd	fuc	0
2	snd	fuc	0
2	snd	fuc	0
2	snd	fuc	0
2	snd	fuc	0
2	cbl	fil	0
2	cbl	fil	0
2	cbl	fil	0
2	cbl	fil	0
2	cbl	fil	0
2	cbl	fil	0
4	cbl	fil	0
4	cbl	fil	0
4	cbl	fil	0
4	cbl	fil	0
4	cbl	fil	0
9	mud		0
14	mud		0
19	mud		0
24	mud		0
29	mud		0
38	mud		0

Note: Transect #15 Data sheet lost.
Note: No Transect #13 due to darkness

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