

Exxon Valdez Oil Spill
State/Federal Natural Resource Damage Assessment Annual Report

Hydrocarbon Injury Assessment -
Kodiak and Alaska Peninsula Herring

Fish/Shellfish Study Number 12
Annual Report

This annual report has been prepared for peer review as part of the *Exxon Valdez* Oil Spill Trustee Council restoration program for the purpose of assessing project progress. Peer review comments have not been addressed in this annual report.

Kevin Brennan

Alaska Department of Fish and Game
Division of Commercial Fisheries
Mission Road
Kodiak, Alaska 99615

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Study History: This project effort was initiated as part of the State of Alaska and U.S. Government Natural Resource Damage Assessment (NRDA) studies following the *Exxon Valdez* oil spill. Results from this study were planned to be merged with results from NRDA Coastal Habitat Injury Assessment Studies (Coastal Habitat Study #1) and Air and Water Resources Injury Assessment Studies (Air/Water Studies #1-4) to identify potential injury or impact. In addition, results from studies of oil spill damage assessment impacts on herring spawning and recruitment in Prince William Sound (Fish/Shellfish Study #11) were expected to be merged with results from this study to estimate impacts on these stocks. This project was terminated after one year, however, and no further analyses have been completed.

Abstract: Pacific herring spawning aggregations were monitored by aerial surveys during 1989. The estimated spawning biomass in the Kodiak area was approximately 9,550 tons; however, the variability of this estimate is unknown and probably large. The historical record of pre-spawning and spawning aggregations was mapped and the records of herring length at age data from spawning areas from 1981 to 1990 have been summarized.

Key Words: Age, Alaska Peninsula, *Clupea pallasii*, *Exxon Valdez* oil spill, Kodiak Island, Pacific herring, size, spawning stocks.

Project Data: Archival location of data is unknown. All available information is included in this report.

Citation:

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EXECUTIVE SUMMARY

The occurrence and biomass of Pacific herring (*Clupea pallasii*) spawning stocks around Kodiak Island and the Alaska Peninsula in 1989 were documented by aerial surveys. The surveys were less than thorough because they began after spawning had started, and because of hazardous flying conditions and limited availability of charter aircraft.

Biomass estimates used by the Kodiak Area Management staff for setting "Guideline Harvest Levels" are the best estimates of the size of the Kodiak and Alaska Peninsula herring populations. The estimated spawning biomass in 1989 was approximately 9,550 tons. Maps of historical population aggregation areas and spawning areas were compiled to identify areas of potential oil spill impact. No direct herring mortality was observed in 1989, and an influx of juvenile herring (ages 1 and 2) was noted in many bays of the Kodiak area. Comprehensive damage assessment studies of oil impacts on herring fecundity, on egg deposition, and on egg and larvae survival and development were conducted in Prince William Sound, and the results from those studies were planned to be used to extrapolate probable damage on Kodiak/Alaska Peninsula stocks. Historical data on herring length at age, from age-weight-length-sex (AWL) samples taken during herring sac roe fisheries, 1981-1990, are being compiled and analyzed to test for year, area, and possible oil spill effects on herring growth.

INTRODUCTION

This project effort was initiated as part of the State of Alaska and U.S. Government Natural Resource Damage Assessment (NRDA) studies following the *Exxon Valdez* oil spill. Results from this study were planned to be merged with results from NRDA studies to identify potential injury or impact to Pacific herring stocks in the vicinity of Kodiak Island.

OBJECTIVES

No significant departures have been made from the objectives of this study, as outlined in the Detailed Study Plan. They were:

1. Document the occurrence of Pacific herring stocks and spawn in oiled and non-oiled areas of the Kodiak Archipelago and the Alaska Peninsula.
2. Estimate the injury to herring eggs and larvae by directly supplying results from Prince William Sound injury assessment studies.
3. Test the hypothesis that incremental growth by age is independent of oil impacts.
4. Identify potential alternative methods and strategies for restoration of fishery stocks, and/or habitat where injury is identified.

METHODS

With the inception of State/Federal Natural Resource Damage Assessment Plans, an Alaska Department of Fish and Game (ADF&G) fishery biologist was assigned to conduct fixed wing aerial surveys. The survey area comprised all of the Kodiak and Alaska Peninsula Pacific herring management areas (Figure 1). Special emphasis was placed on those locations where herring spawn had been reported or stocks were reaching sexual maturity, as indicated by ADF&G field personnel, commercial fishermen or spotters. Survey data was collected in field "Rite-in-the-Rain" notebooks, or on aerial survey forms. The location, number, relative size (small, medium, large), and an estimate of total biomass observed was noted for all schools of herring and forage fish. Location, duration, and size of spawn were recorded. Similar information was collected by ADF&G herring field crews. Additionally, observations from fishermen, spotters, or oil assessment crews were evaluated and included where possible.

Coastal habitat injury assessment studies (Highsmith, et al. 1993), in conjunction with air/water resources injury assessment studies (Braddock, et al. 1989; Feder 1995; Short and Harris 1996; Short and Rounds 1995), were intended to determine the extent of potential injury, or degree of impact, by habitat type and level of oiling (unoiled, light or moderate/heavily oiled). Impact of oil to all areas was evaluated using the same criteria developed for observational studies in Prince William Sound. Studies in Prince William Sound seek to determine the effect of the oil impacts on adult herring growth and fecundity, egg deposition, and egg and larvae survival and development through field and laboratory studies. Quantifiable damage assessment from the Prince William Sound studies was to be directly applied to the spawning stocks in similarly impacted areas of the Kodiak/Alaska Peninsula area.

The ADF&G has collected age-weight-length (AWL) and sex data from samples of Kodiak/Alaska Peninsula stocks during the sac-roe fishery since 1979 (Appendix A). Between 4,000-9,000 fish were sampled each year. Detailed methodology for collecting AWL samples is described in Appendix B. Length-at-age data are to be summarized, and a "pre-spill database" will be developed as a basis to compare future growth rates.

RESULTS AND DISCUSSION

Fixed wing, aerial survey flights began on May 26, 1989. This was after the start of herring spawning, but it was the earliest that funding would allow. Surveys were continued through July 11, 1989. Flight time was severely limited during that period because of the lack of availability of charter aircraft, which were diverted by the workload imposed by oil spill monitoring and cleanup crews and periods of poor weather. During this period, 16 surveys, with a total of 48.9 hours, were flown. Surveys were limited to the Kodiak Island Archipelago. Additional data were collected by eight ADF&G herring fishery monitoring crews, using inflatable rafts, aluminum skiffs, and a 40' research vessel, and ADF&G and Alaska Department of Environmental Conservation (ADEC) oil spill monitoring crews, using chartered vessels and helicopters.

Notably, no direct mortality of herring was observed by ADF&G or ADEC personnel. In addition, schools of juvenile herring (age 1 and 2) were documented by aerial surveyors and commercial fishermen in many bays of Kodiak Island. The 1989 Kodiak Area spawning biomass index, developed by the Commercial Fisheries Division management staff, was approximately 9,550 tons (Prokopowich 1989). These estimates should be qualified, however, because ADF&G's annual observations represent an unknown and undoubtedly highly variable proportion of the actual biomass. It has been estimated that as little as one quarter to one half of the actual biomass is observed for Kodiak area stocks (L. Malloy, ADF&G, Kodiak, pers. commun.). This is a result of: the relatively low biomass of these stocks; the numerous small schools associated with each stock; the long duration of time over which the entire spawning biomass for each stock disperses its spawning effort; and the relatively small amount of aerial survey effort which can be expended over the spawning period that extends from early April through early August. Results from the 1990 aerial surveys also documented large quantities of "pre-recruit" herring (ages 1, 2 and 3) in many of the bays in the Kodiak area.

Maps have been prepared to show areas where pre-spawning herring have historically aggregated and where herring have consistently spawned, based on data gathered by ADF&G and from observations by commercial fishermen and spotters during the sac roe fisheries of the past ten years (Figures 2-18). These, compared with documentation of observations of oiled beaches in the vicinity of Kodiak Island and the Alaska Peninsula, suggest that there may have been little overlap (ADEC 1990; Endres 1992; Ginalias 1991).

Comprehensive damage assessment studies of oil impacts on herring fecundity, on egg deposition, and on egg and larvae survival and development were scheduled to be conducted in Prince William Sound. Injuries described by results from those studies will be used to extrapolate impacts on Kodiak/Alaska Peninsula stocks. Please refer to the preliminary status report for Fish/Shellfish Study #11 (Brown and Baker 1994), and to the Kodiak/Alaska Peninsula Atlas and Regional Maps of Spring NOAA 1991). This study, however, was terminated before that extrapolation could be made.

Analysis of data on herring length-at-age is continuing. Of the AWL data collected from 1981 through 1989, there are sufficient commercial purse seine samples from 40 management units (36 on Kodiak Island and 4 on Alaska Peninsula) for analysis (Appendix A). The statistical significance of area effects on growth and between-year variability within areas was to be tested, but this project was truncated before that could be accomplished.

During the 1990 commercial herring fishing season, 7,671 herring were collected and sampled from 38 of the 51 statistical areas. AWL data on herring taken during the 1990 season was summarized and available for comparative analysis by October 1990. General linear model extension of analysis of variance models were not used to test for year, area, and oil spill effects on herring growth because there were no observations of direct oiling, and this project was terminated after one year.

CONCLUSIONS

- 1) Records and reports from up to ten years of observations of the distribution of spawning aggregations of Pacific herring in the Kodiak Archipelago and the Alaska Peninsula were recorded on charts. These, compared with a map of oiled and unoiled areas, suggest little overlap.
- 2) The estimated spawning biomass of Pacific herring in the Kodiak area was approximately 9,550 tons.
- 3) No evidence of direct mortality of Pacific herring by oil was observed.
- 4) Because there was no observations of direct mortality of Pacific herring or that spawning aggregations were fouled by the oil, the incremental growth hypothesis was not tested.
- 5) Because there was no observation of direct mortality or injury by the oil to stocks or habitats, no methods or strategies for restoration were investigated.
- 6) This project was terminated after one year and no further analyses have been completed.

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Short, J.W., and P.M. Harris. 1996. Petroleum hydrocarbons in near-surface seawater of Prince William Sound, Alaska, following the *Exxon Valdez* oil spill. I: Chemical sampling and analysis. *Exxon Valdez* Oil Spill State/Federal Natural Resource Damage Assessment Final Report (Air/Water Study Number 3), National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Auke Bay, Alaska.

Short, J.W., and P. Rounds. 1995. Petroleum hydrocarbons in near-surface seawater of Prince William Sound, Alaska, following the *Exxon Valdez* oil spill. II: Analysis of caged mussels. *Exxon Valdez* Oil Spill State/Federal Natural Resource Damage Assessment Final Report (Air/Water Study Number 3, Subtidal Study Number 3A), National Oceanic and Atmospheric Administration. Juneau, Alaska.

FIGURES

Alaska Department of Fish and Game
KODIAK AREA HERRING MANAGEMENT UNITS 1990

This map is intended as a general guide for fishermen, tender operators and other industry personnel. For exact descriptions of the district, section, and subsection boundaries, closed waters, legal gear, etc., please consult the current issue of the Alaska Commercial Herring Fishing Regulations for the Kodiak area (See Chapter 27 - Articles 1,2,3, and 8, and Chapter 30 - Article 1).

- Bays and lagoons closed to commercial fishing, June 12-Oct 31. 
- State water boundaries 
- Food/bait mgt. area boundaries 
- Statistical area boundaries 
- Salmon streams with 500 yard saltwater closures 
- Salmon streams open to the stream terminus 

SAC ROE STATISTICAL AREAS

MAINLAND DISTRICT

- MO10 North Mainland
- MO20 Inner Kukak
- MO30 Outer Kukak
- MO40 Missak
- MO50 Inner Katmai
- MO60 Outer Katmai
- MO70 Alinchak
- MO80 Paule Bay
- MO90 Portage Bay
- MO100 Outer Portage Bay
- MO110 Wide bay
- MO120 Lower Shelikof

UGANEK DISTRICT

- UG10 Kuprenof
- UG20 Viekoda
- UG21 Terror
- UG30 Village Island
- UG31 W. Uganik Pass
- UG32 NE Arm Uganik
- UG33 E. Arm Uganik
- UG34 S. Arm Uganik
- UG40 Offshore Uganik

UYAK DISTRICT

- UY10 Offshore Uyak
- UY20 Harvester Island
- UY30 Inner Uyak
- UY31 Larsen Bay
- UY32 Browns Lagoon
- UY40 Zachar Bay
- UY50 Spiridon Bay

STURGEON/HALIBUT DISTRICT

- SH11 No subsections

ALITAK DISTRICT

- AL10 Outer Alitak
- AL20 Inner Alitak
- AL21 Deadman Bay
- AL30 Sulna/Portage Bay
- AL40 Lower Olga/Moser
- AK50 Upper Olga Bay
- AL60 Gesso/Twoheaded

AFOGNAK DISTRICT

- AO10 Raspberry Straits
- AO20 Malina Bay
- AO31 Paramanof Bay
- AO32 Foul Bay
- AO40 Blue Fox
- AO50 Offshore W. Afognak
- AO60 Shuyak Island
- AO70 Perenosa Bay
- AO71 Delphin Bay
- AG72 Seal Bay
- AG80 Tonki Bay
- AG90 Izhut Bay
- AG91 Kitol Bay
- AG92 MacDonaldis Lagoon
- AG100 Danger Bay
- AG101 Litnik
- AG102 Inshore Marmot

GENERAL DISTRICT

- GO10 Kalugnak
- GO20 W. Sitkalidak Straits
- GO21 Barling
- GO22 E. Sitkalidak Straits
- GO23 Tanginak Anchorage
- GO30 Outer Sitkalidak
- GO40 Outer Kiliuda
- GO41 Inner Kiliuda
- GO42 Shearwater
- GO50 Outer Ugak
- GO51 Inner Ugak
- GO60 Womens Bay
- GO70 Monashka/Hill B.
- GO80 Anton Larsen
- GO81 Sheratin
- GO90 Kiznyak
- GO100 Kalsin Bay
- GO101 Middle Bay
- GO102 Inshore Chiniak
- GO103 Spruce Island
- GO110 Offshore Marmot - Chiniak

- FOOD/BAIT MANAGEMENT AREAS**
- F/B 1 WEST AFOGNAK
 - F/B 2 NORTH AFOGNAK
 - F/B 3 EAST AFOGNAK
 - F/B 4 UGANIK
 - F/B 5 UYAK
 - F/B 6 STURGEON/HALIBUT
 - F/B 7 ALITAK
 - F/B 8 EASTSIDE
 - F/B 9 CHINAK/OUTER MARMOT
 - F/B 10 INNER MARMOT
 - F/B 11 NORTH MAINLAND
 - F/B 12 MID MAINLAND
 - F/B 13 SOUTH MAINLAND

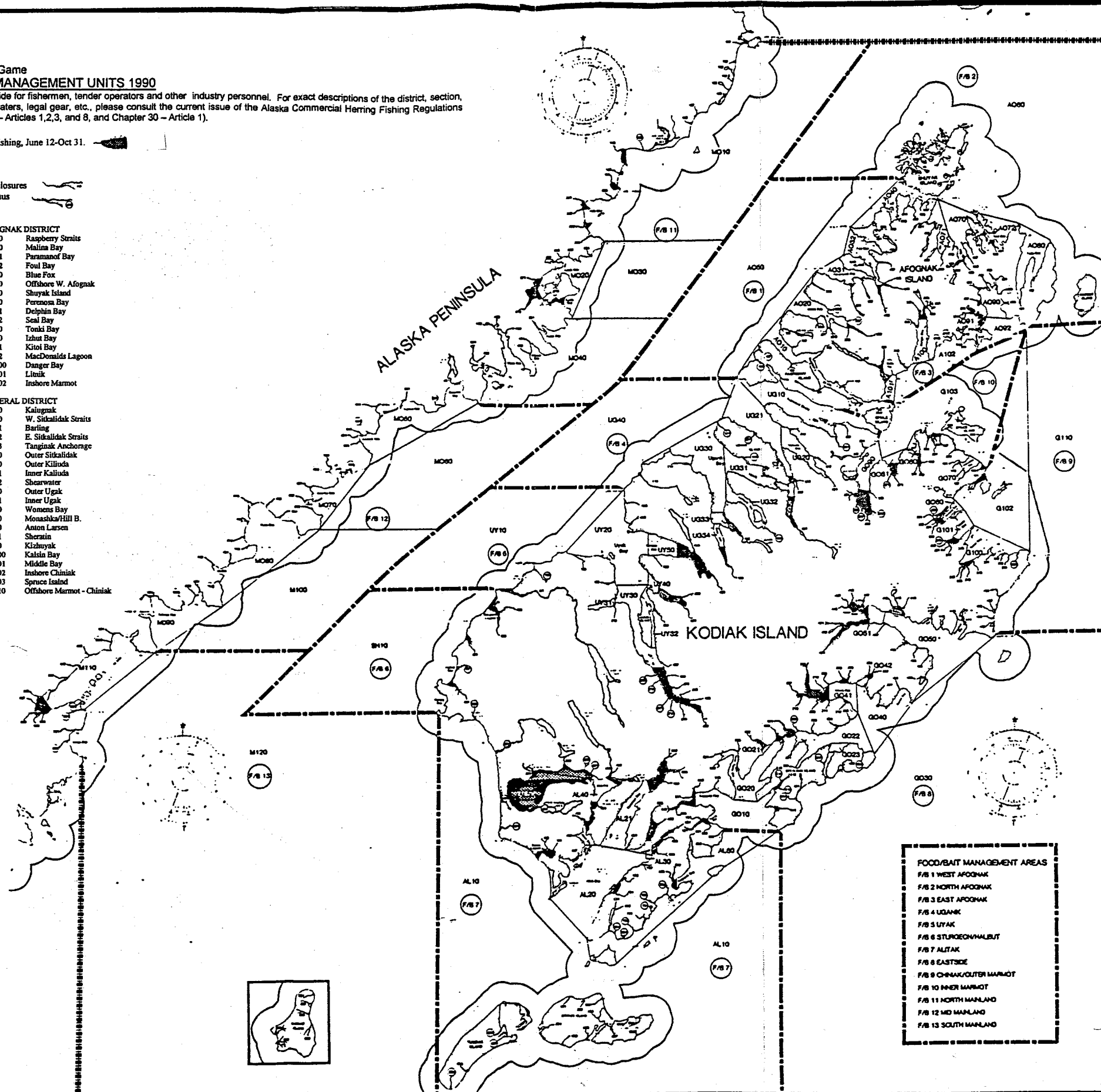


Figure 1. Kodiak Area herring management units, 1990. (From: Prokopowich, D., L. Malloy, K. Brennan, and J. Brodte. 1992. 1990 Kodiak Management Area Annual Herring Management Report, Alaska Department of Fish and Game, Division of Commercial Fisheries. Regional Information Report 4K92-13, Kodiak, Alaska.)

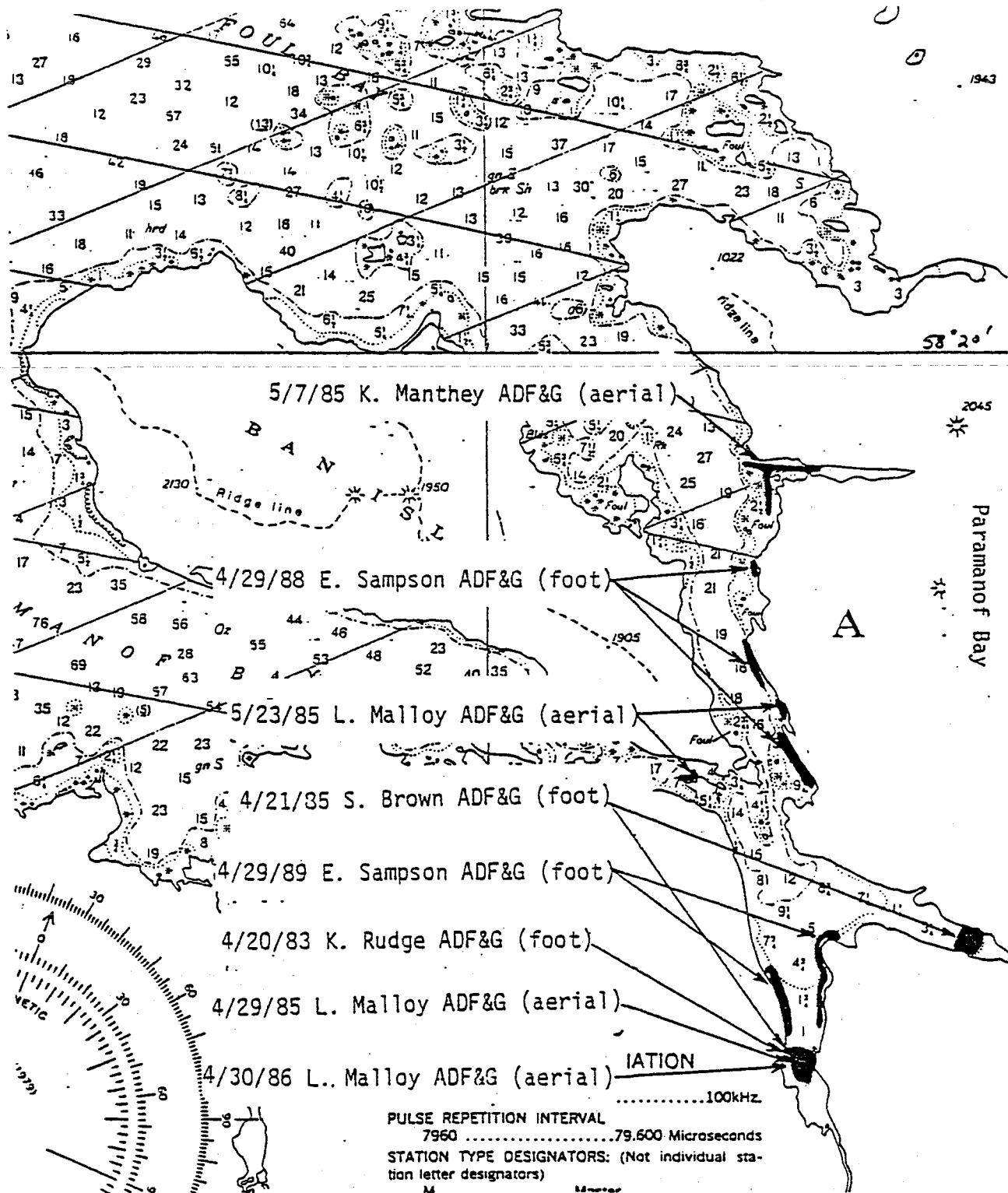
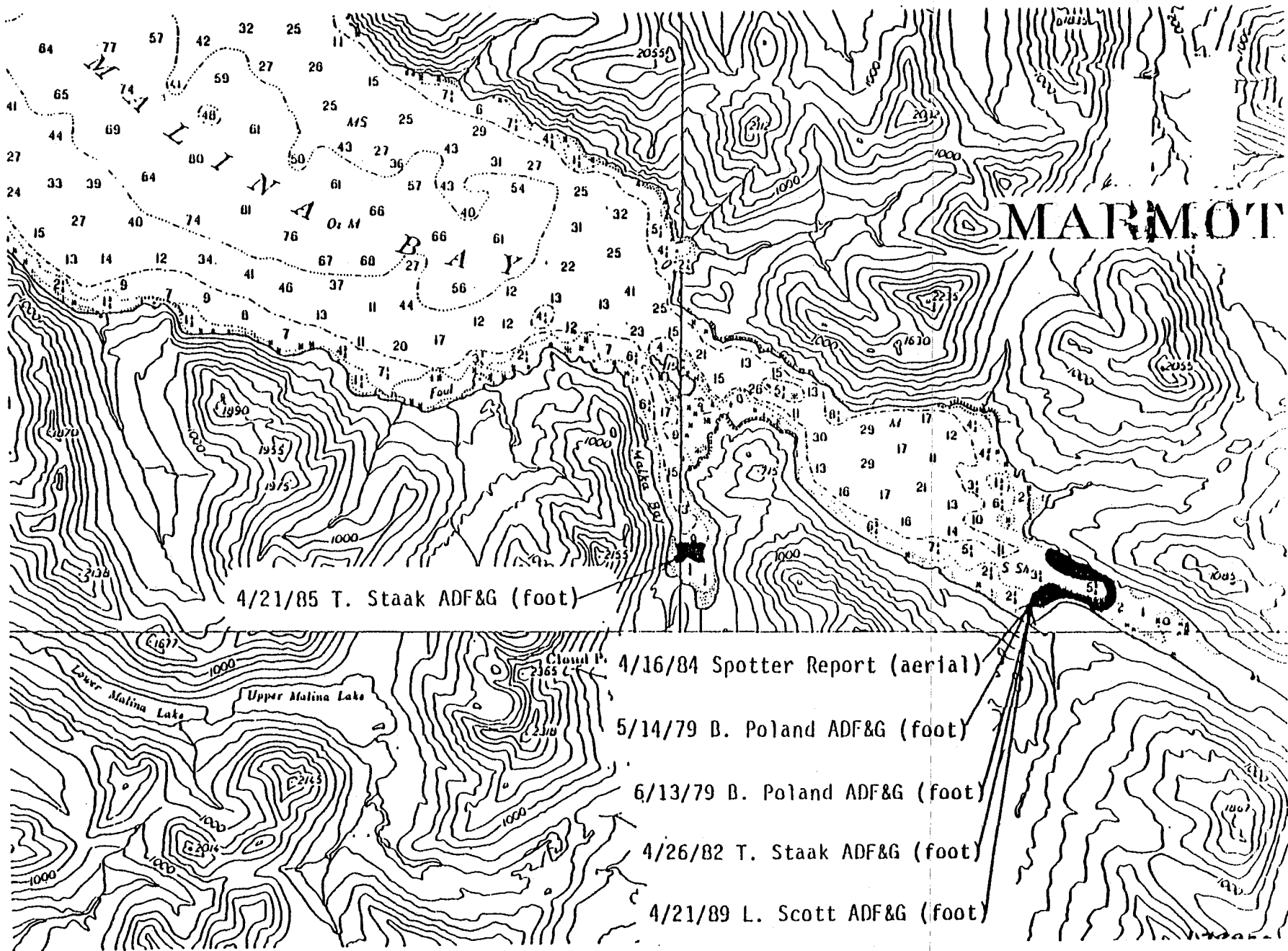


Figure 2: Pacific herring pre-spawning and spawning aggregation sites in the vicinity of Paramonof Bay, Kodiak Island, Alaska

Figure 3: Pacific herring pre-spawning and spawning aggregation sites in the vicinity of Malina Bay, Kodiak Island, Alaska.



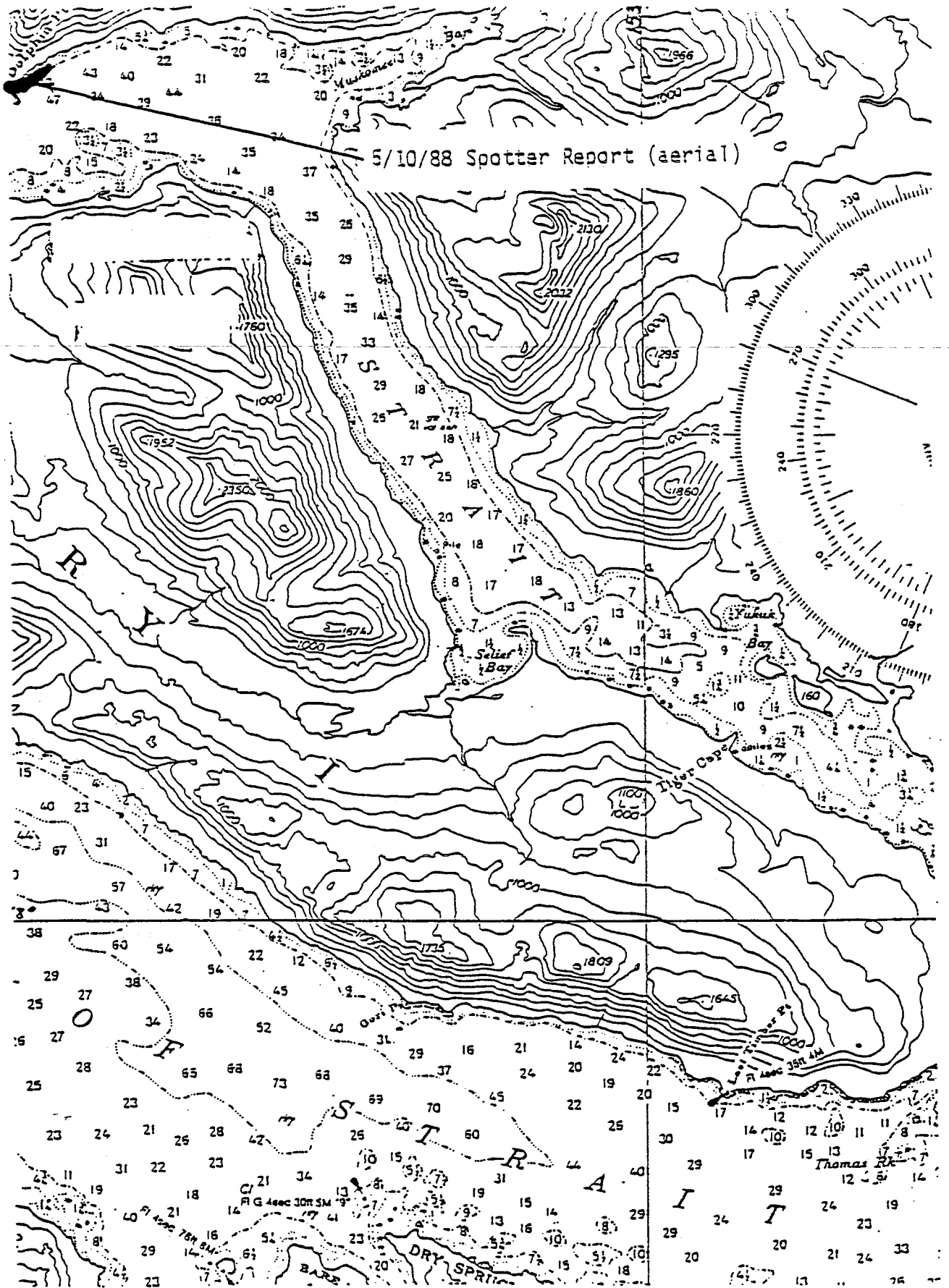
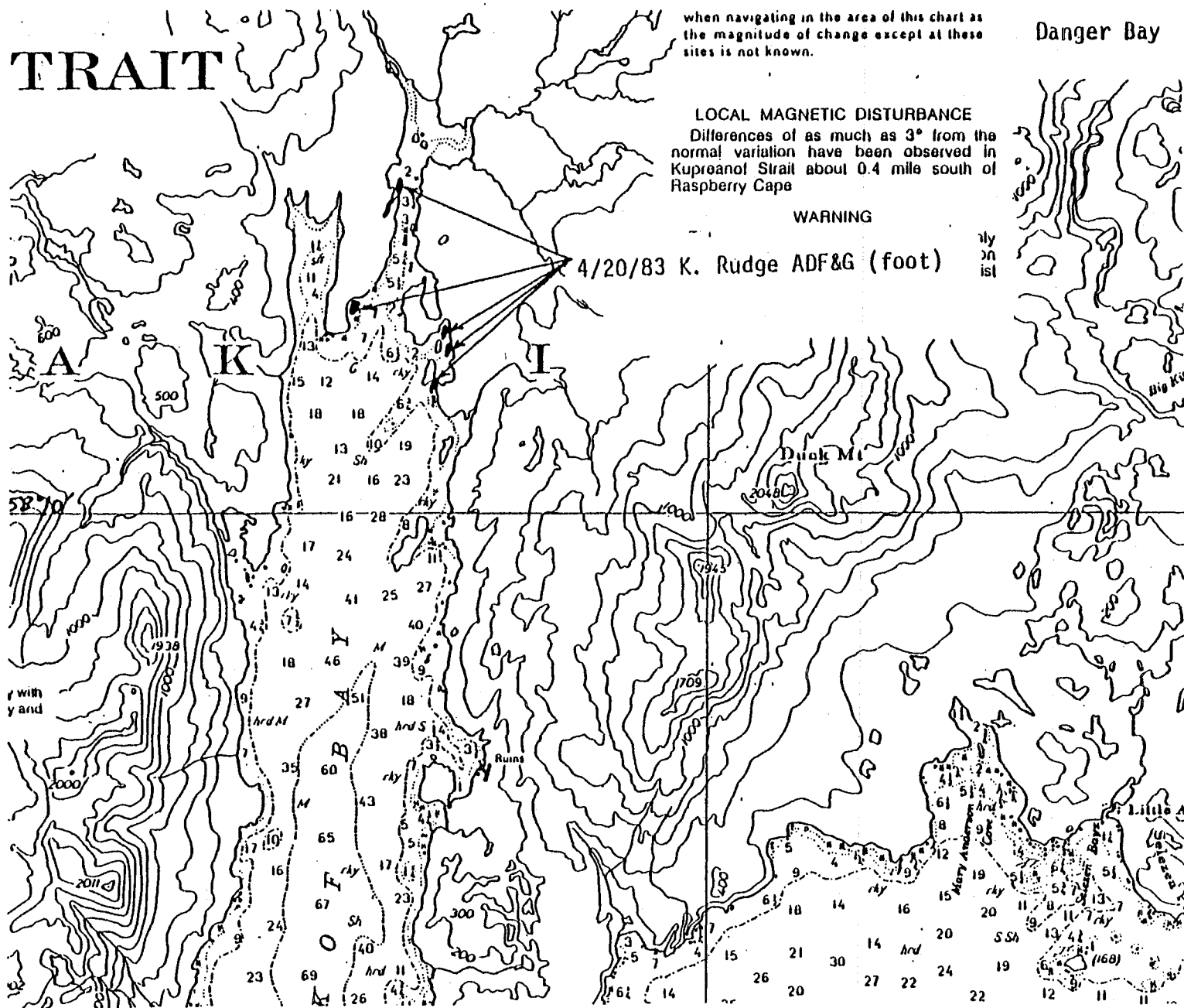


Figure 4: Pacific herring pre-spawning and spawning aggregation sites in the vicinity of Raspberry Strait, Kodiak Island, Alaska.

Figure 5: Pacific herring pre-spawning and spawning aggregation sites in the vicinity of Danger Bay (Kazakof Bay), Kodiak Island, Alaska.



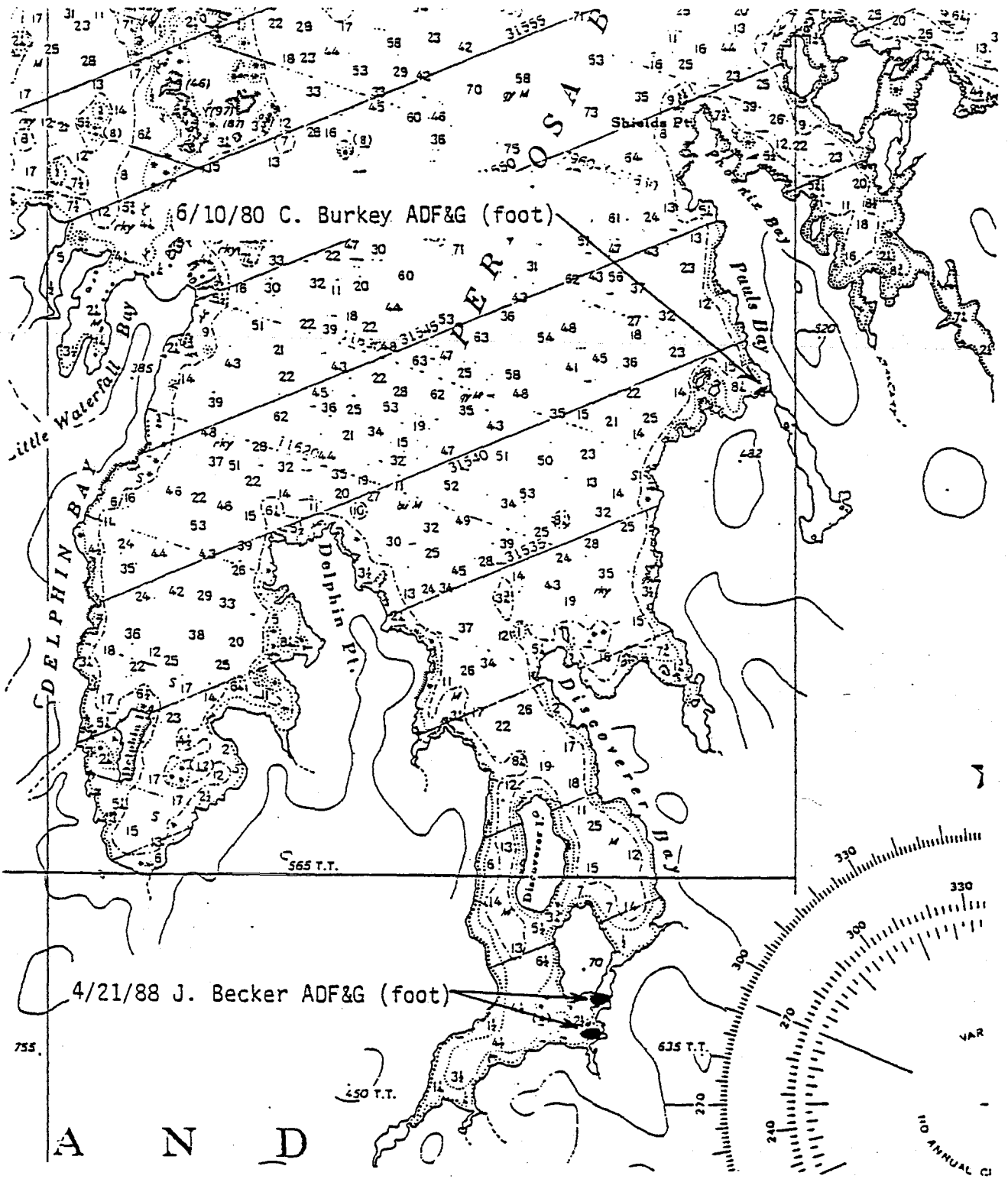


Figure 6: Pacific herring pre-spawning and spawning aggregation sites in the vicinity of Perenosa Bay.

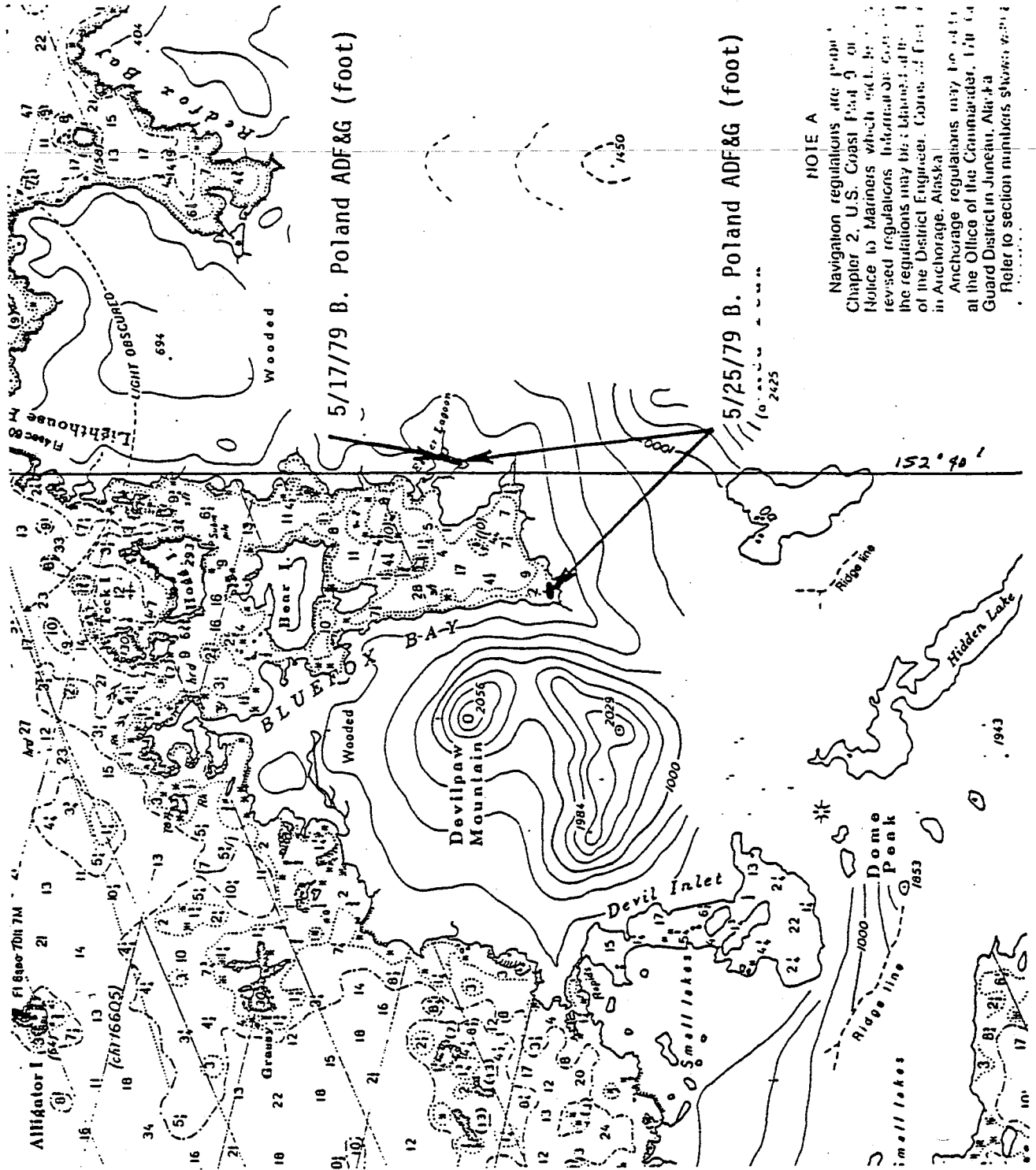


Figure 7: Pacific herring pre-spawning and spawning aggregation sites in the vicinity of Blue Fox Bay (near Shuyak Strait).

Figure 8: Pacific herring pre-spawning and spawning aggregation sites in the vicinity of Viokoda Bay.

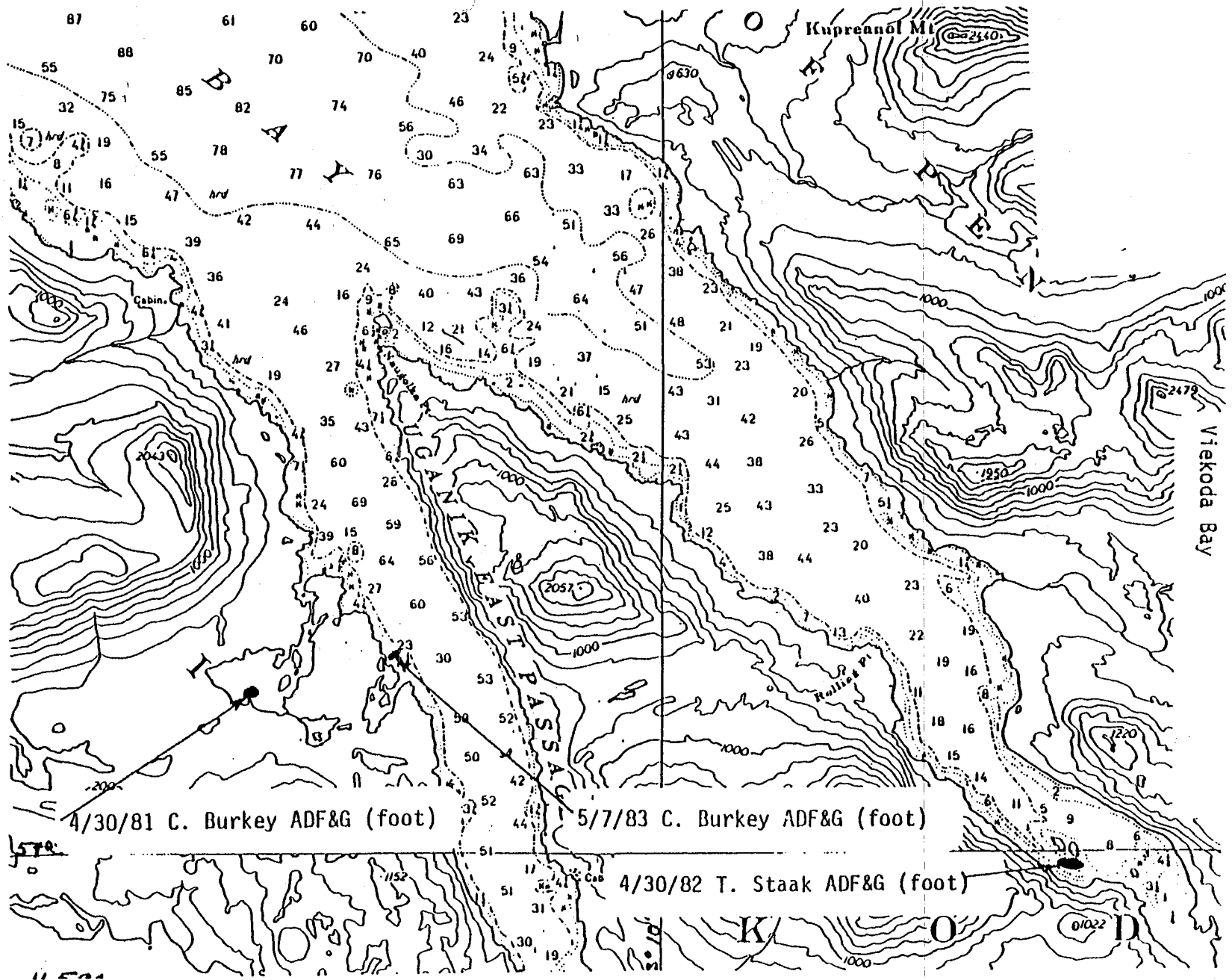
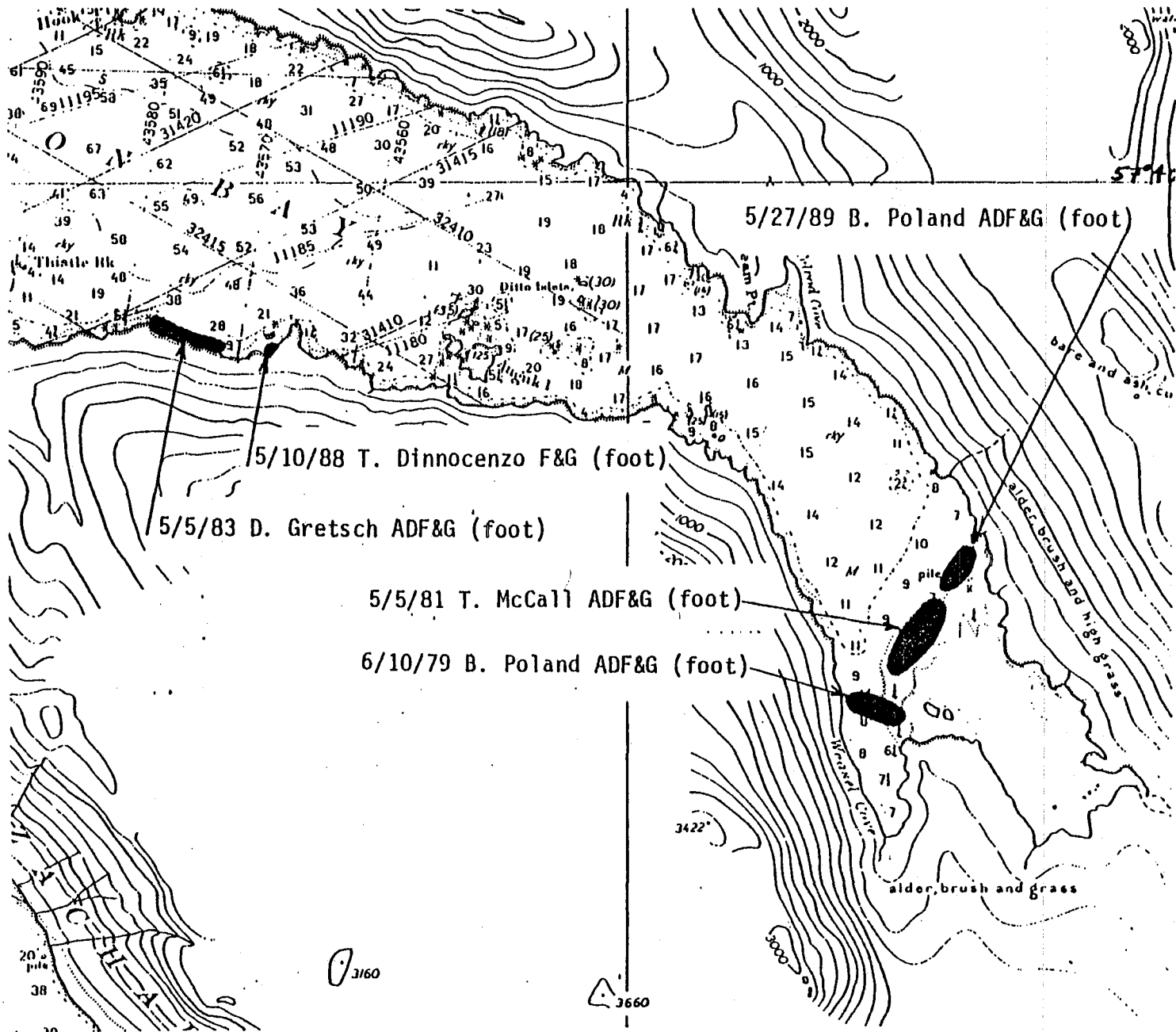


Figure 9: Pacific herring pre-spawning and spawning aggregation sites in the vicinity of Spiridon Bay.



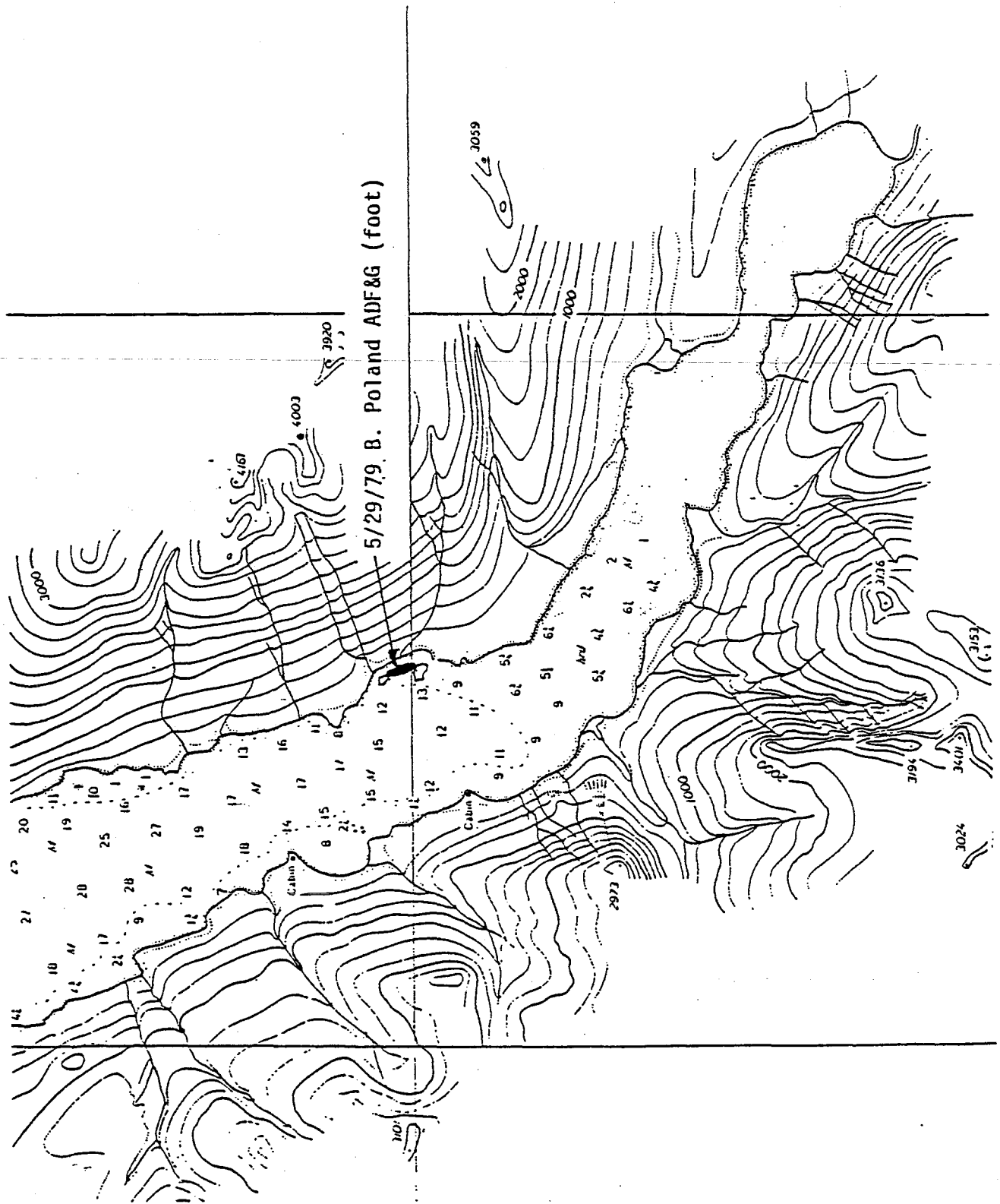


Figure 11: Pacific herring pre-spawning and spawning aggregation sites in the vicinity of Uyak Bay.

Figure 12: Pacific herring pre-spawning and spawning aggregation sites in the vicinity of Olga Bay (West).

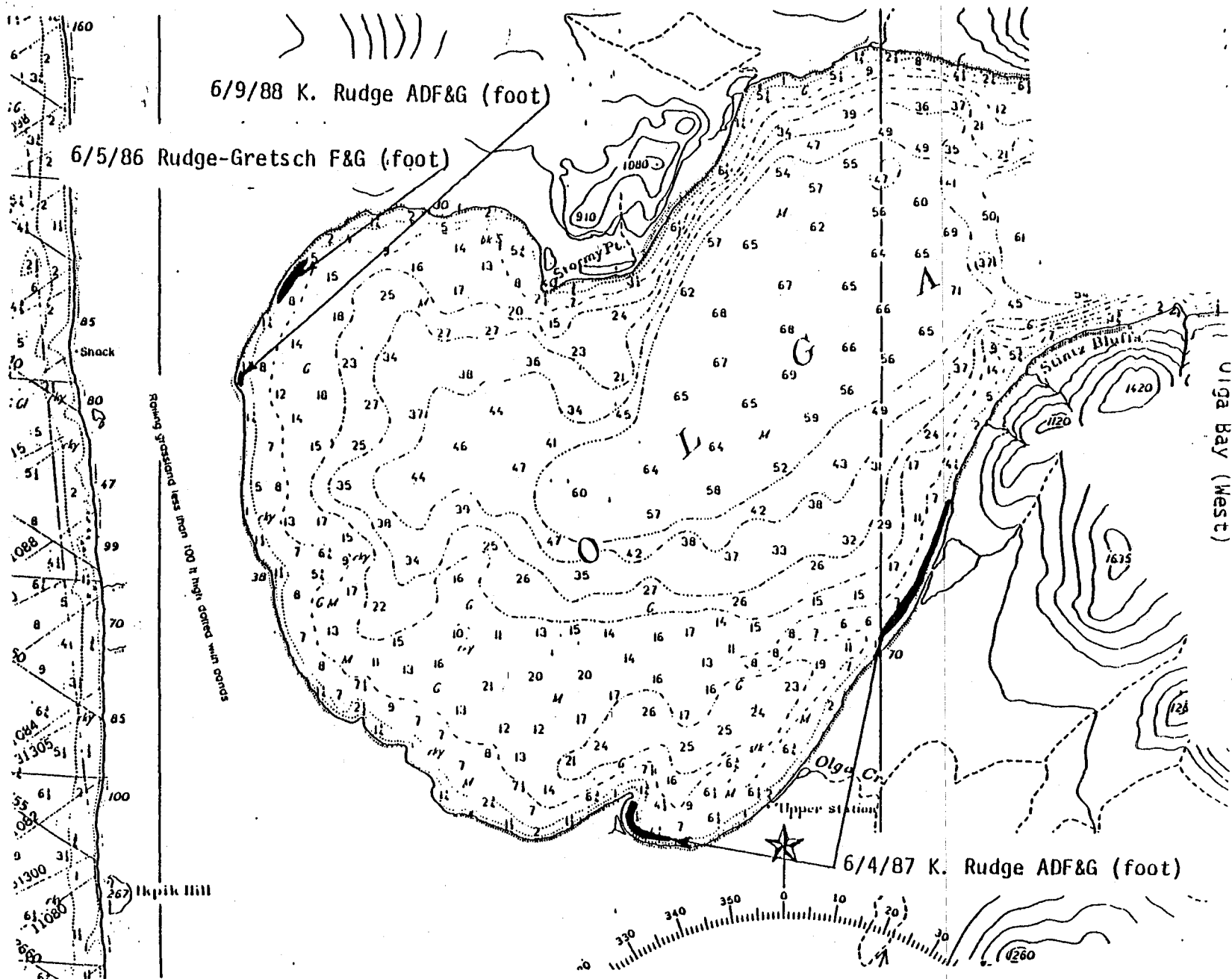
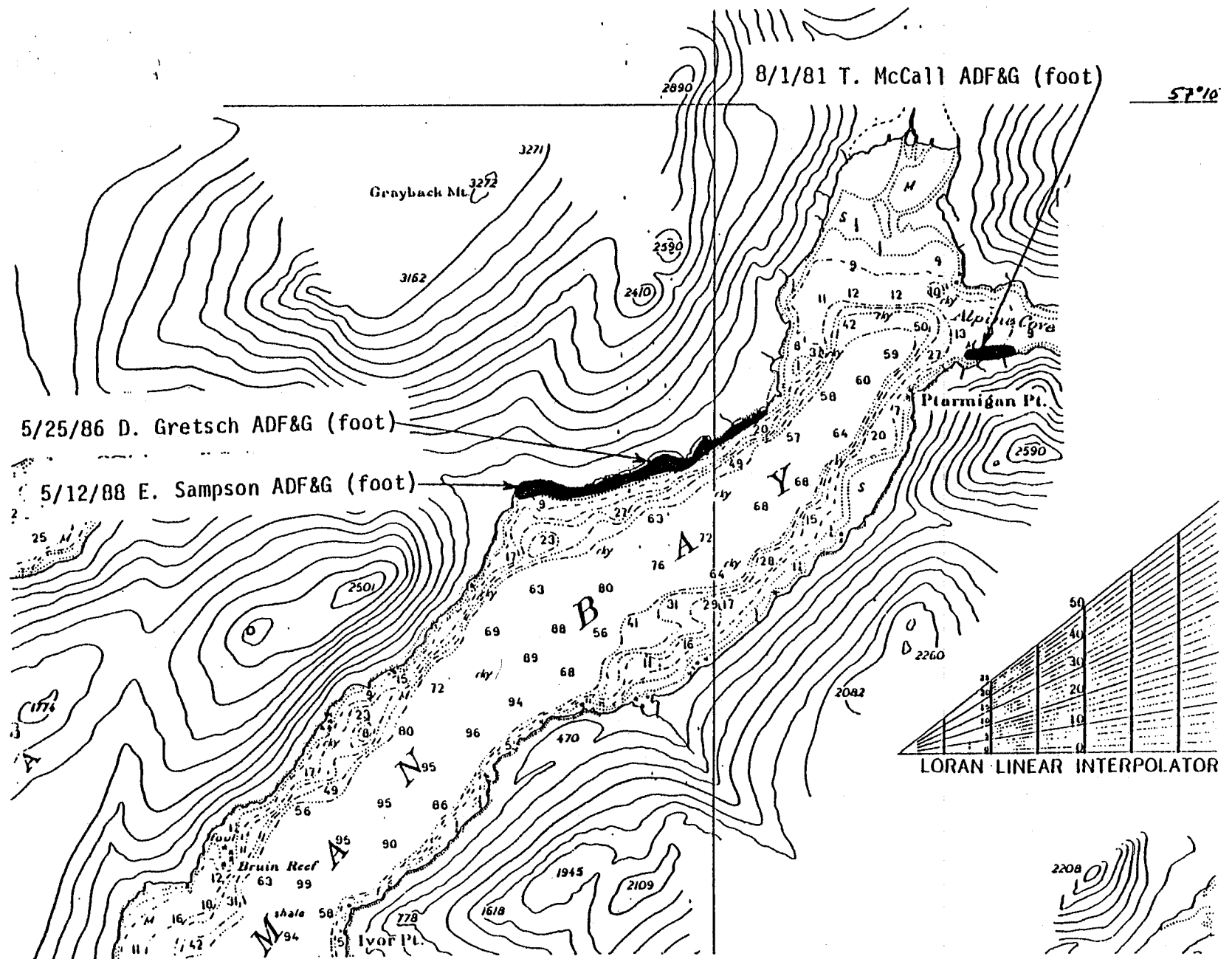


Figure 13: Pacific herring pre-spawning and spawning aggregation sites in the vicinity of Deadman Bay.



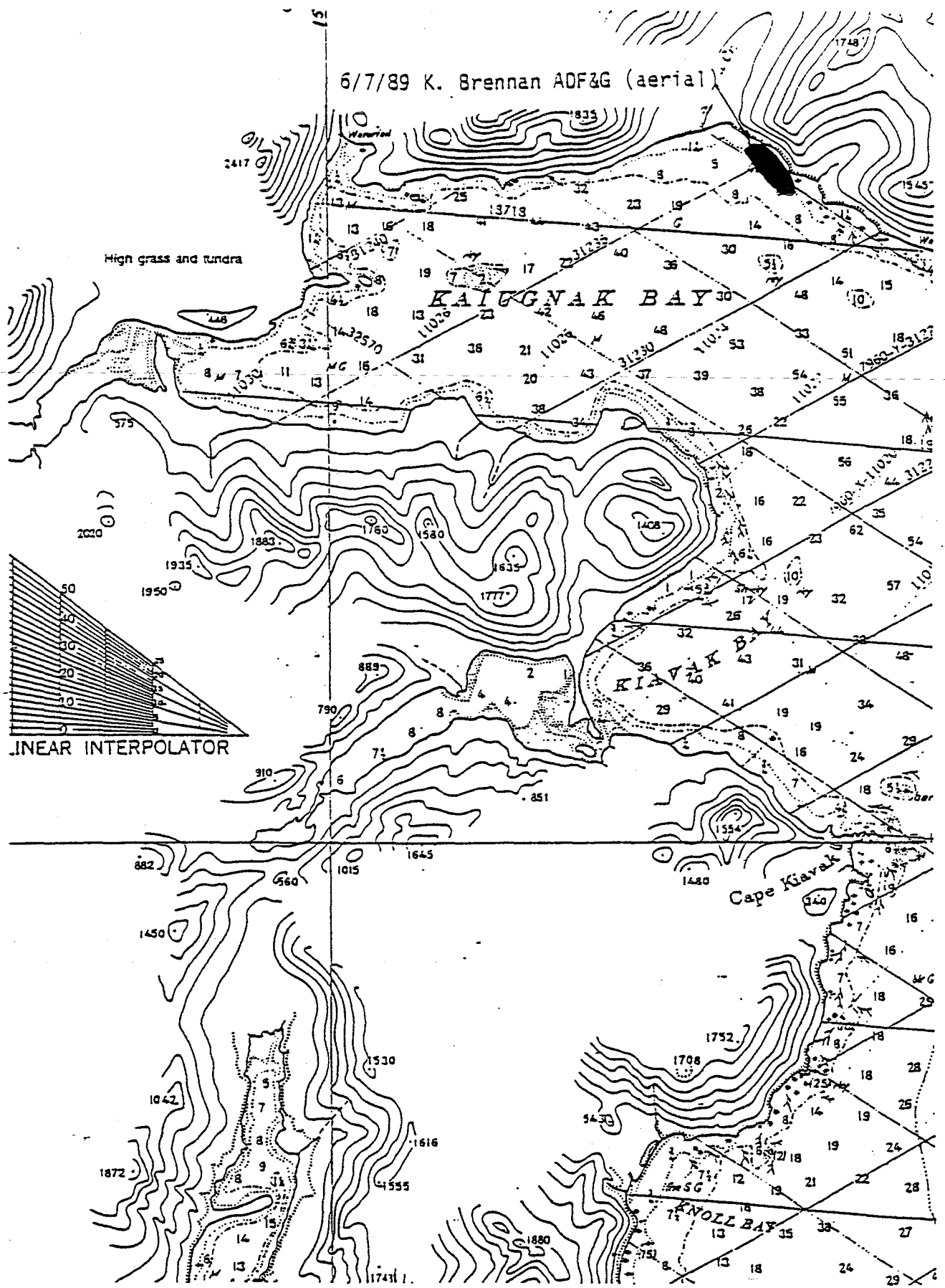


Figure 14: Pacific herring pre-spawning and spawning aggregation sites in the vicinity of Kaiugnak Bay (near Sitkalidak Island).

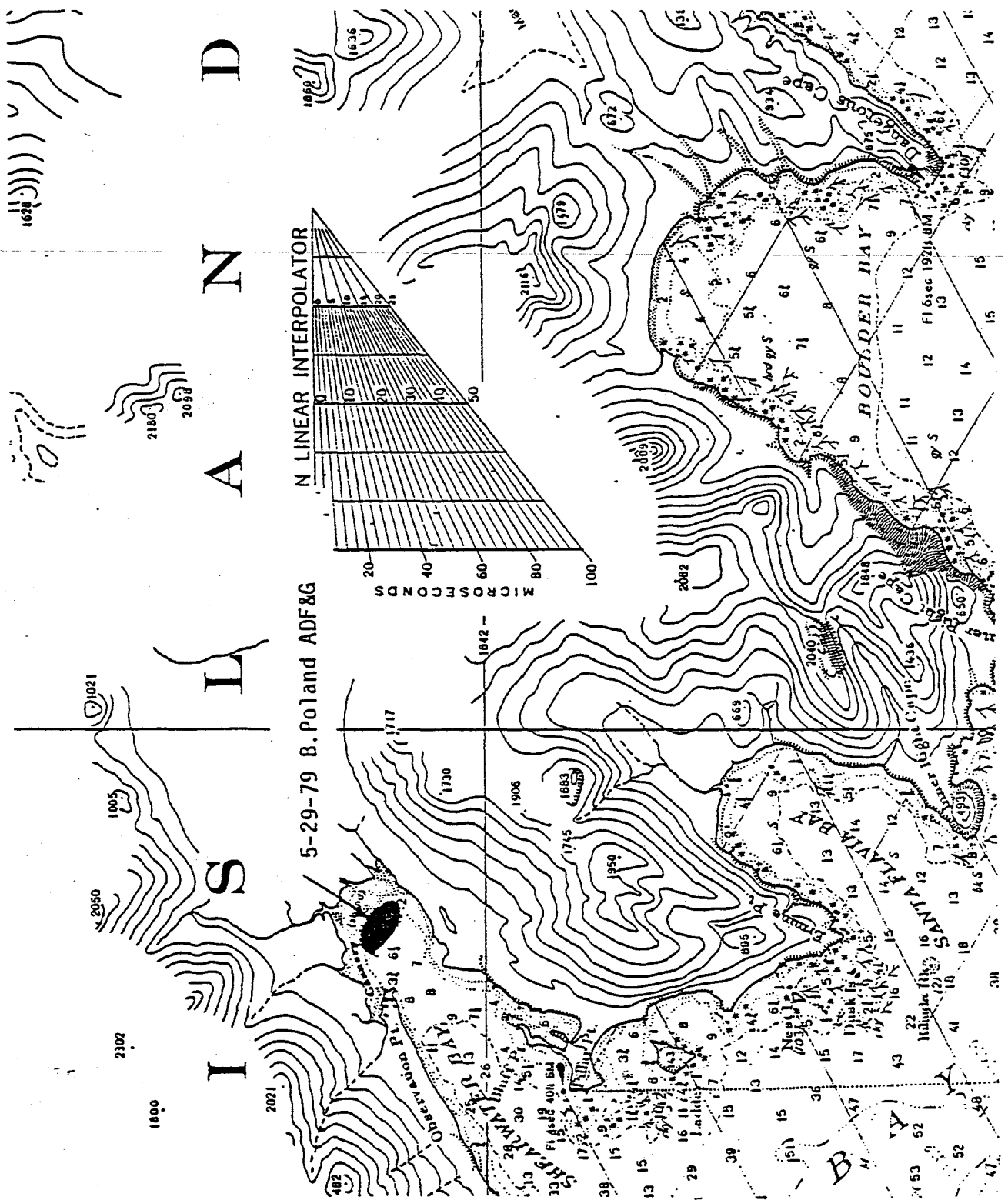


Figure 15: Pacific herring pre-spawning and spawning aggregation sites in the vicinity of Shearwater Bay (near Sitkalidak Island).

Figure 16: Pacific herring pre-spawning and spawning aggregation sites in the vicinity of McDonald Lagoon, Sitkalidak Strait.

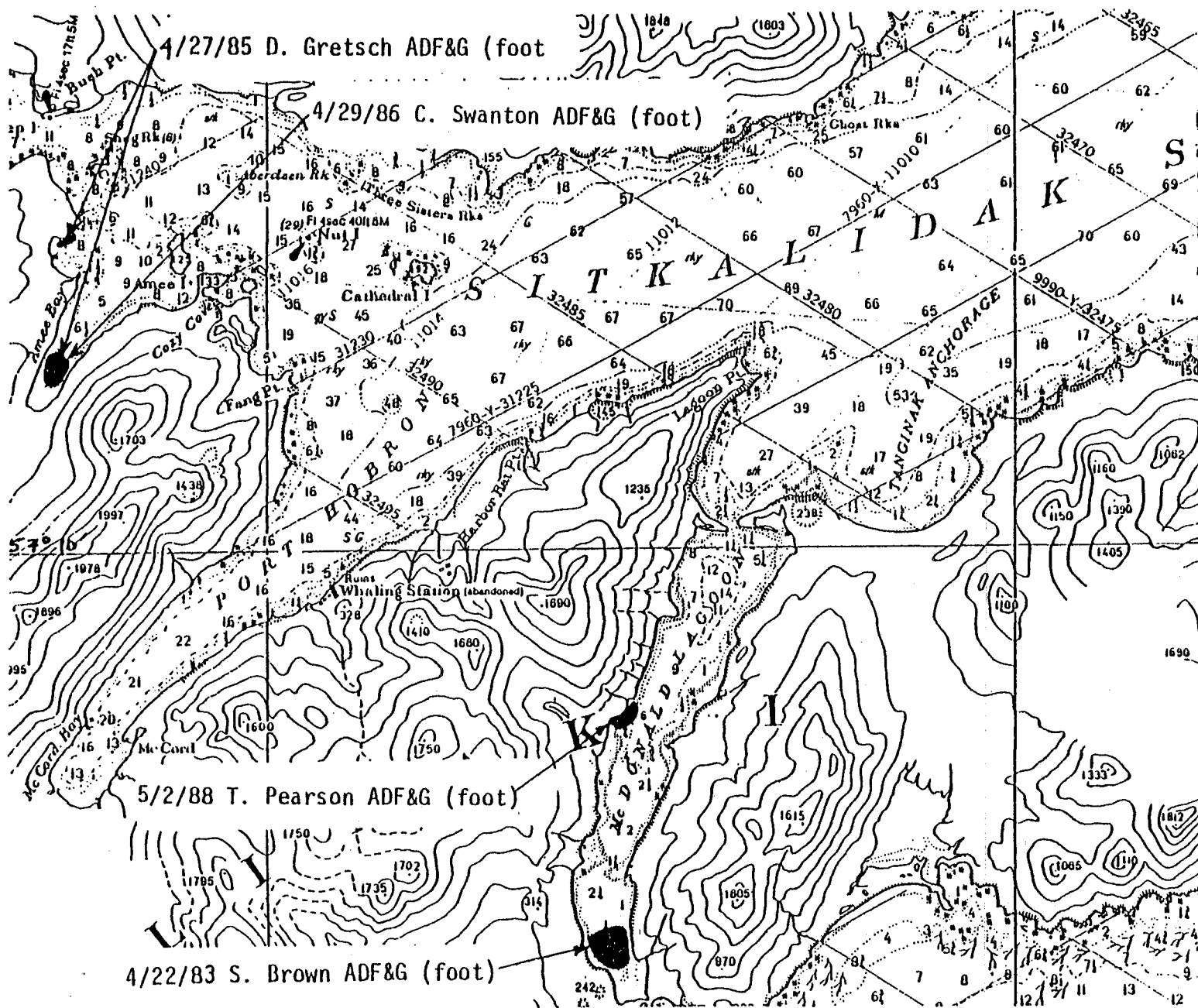
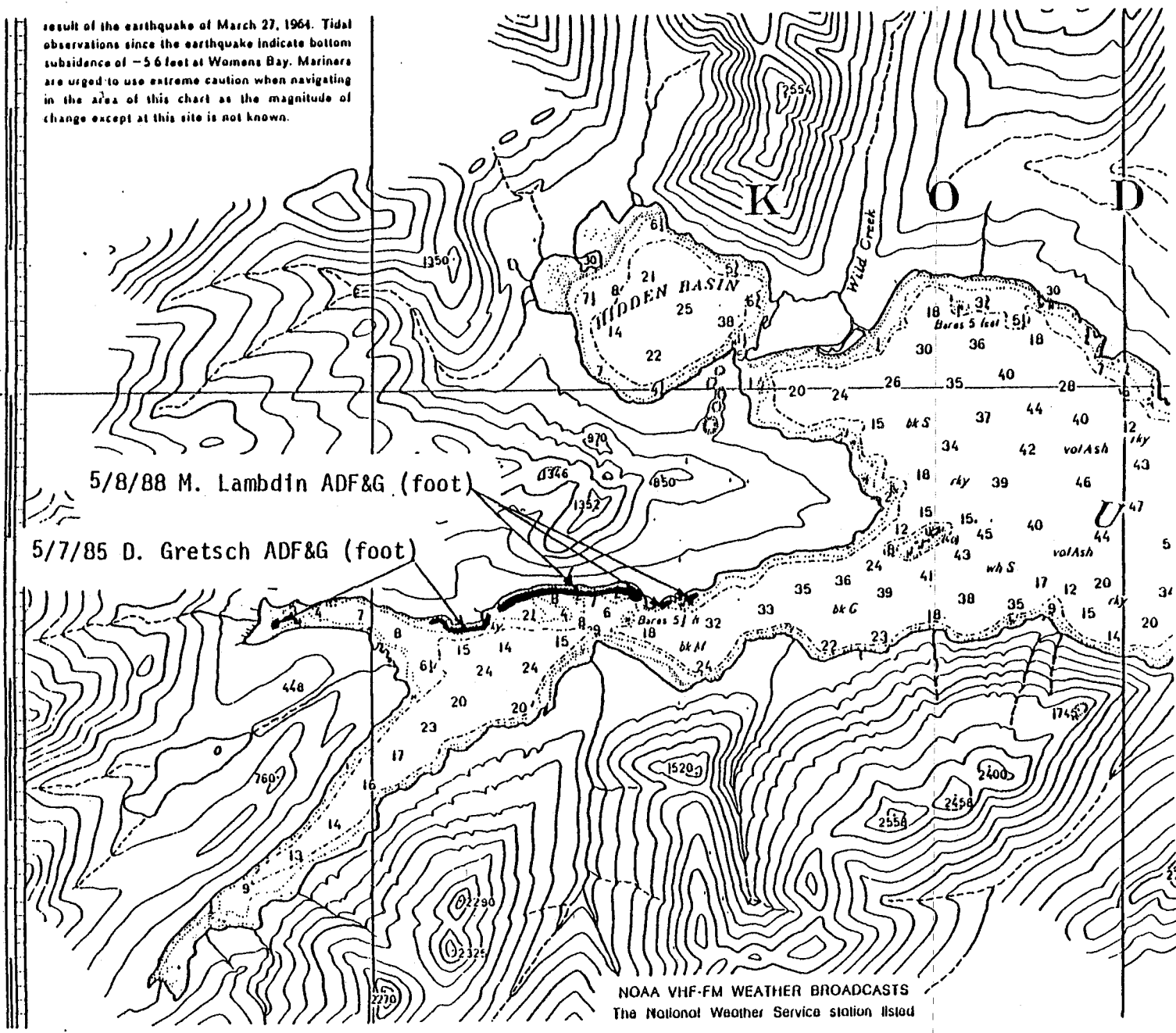


Figure 17: Pacific herring pre-spawning and spawning aggregation sites in the vicinity of Ugak Bay.



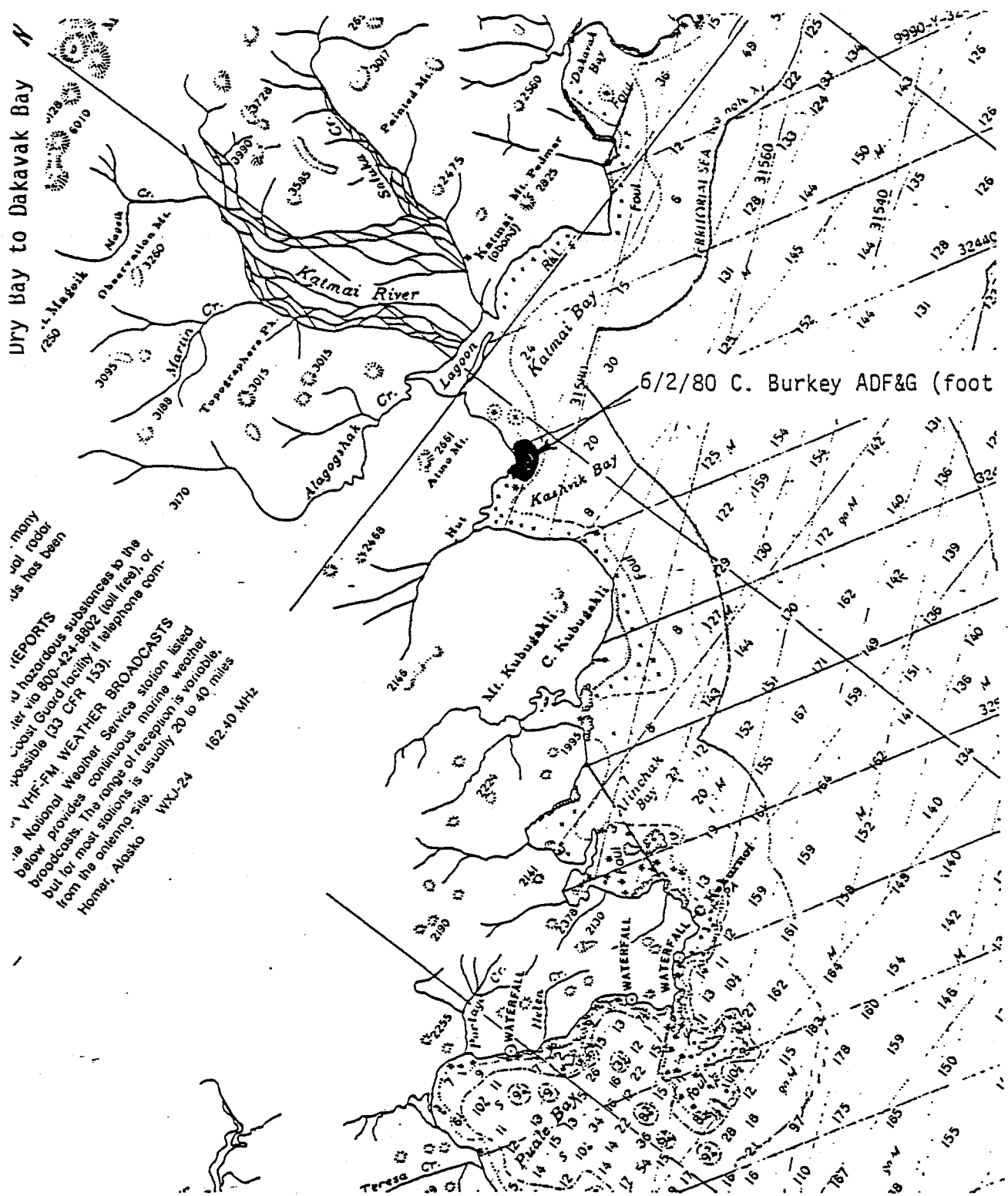


Figure 18: Pacific herring pre-spawning and spawning aggregation sites in the vicinity of Dry Bay to Dakavak Bay (near Katmai), Alaska Peninsula, Alaska.

APPENDICES

APPENDIX A.

Herring Length Summaries, 1981-1990

Table 1. Preliminary length at age data; commercial purse seine herring samples, 1981 - 1990, Raspberry Straits, Kodiak Island.

RASPBERRY STRAIT (A010) MEAN LENGTH 1981 - 1990

AGE	YEAR									
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1										
2					172	162		165		
3				190	186	207	199	184		184
4		207		216	207	217	227	201		199
5		227		230	218	229	254	228		212
6		231		231	230	237				217
7		249			227	246	247	254		224
8		246				249	251	248		248
9		252			240	255		250		
10										
11+						271				

N =	0	74	0	103	91	486	56	457	0	145
										TOTAL # = 1412

Raspberry Strait (A010) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11+
1988										
1987		184								
1986	165		199							
1985		184		212						
1984	162	199	201		217					
1983	172	207	227	228		224				
1982		186	217	254			248			
1981		190	207	229		254				
1980			216	218	237	247	248			
1979				230	230	246	251	250		
1978			207		231	227	249			
1977				227				255		
1976					231			240		
1975						249				271
1974							246			
1973								252		
1972										
1971										

Table 2. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990, Malina Bay, Kodiak Island.

MALINA BAY (A020) MEAN LENGTH 1981 - 1990

AGE	YEAR									
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1										
2				176	165	149	170		157	
3	188	200	188	183	197	167	187	183	183	192
4	208	213	216	199	210		210	203	201	208
5	217	221	222	219	222		230	227	215	220
6	232	226	230	223	235		232	229	224	222
7	233	236	235	229	241		240	240		233
8	225	237	245	220	246		240			244
9	269	241	243	245	259		248	265		
10			242	241	253			245		
11+	264				258					
N =	90	198	192	248	324	129	397	170	268	200
										TOTAL # = 2216

Malina Bay (A020) Length at Age for Brood Years 1970 - 1989

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11
1988										
1987	157	192								
1986		183	208							
1985	170	183	201	220						
1984	149	187	203	215	222					
1983	165	167	210	227	224	233				
1982	176	197		230	229		244			
1981		183	210		232	240				
1980		188	199	222		240				
1979		200	216	219	235		240	265		
1978		188	213	222	223	241		248	245	
1977			208	221	230	229	246			
1976				217	226	235	220	259		
1975					232	236	245	245	253	
1974						233	237	243	241	258
1973							225	241	242	
1972								269		
1971										
1970										264

Table 3. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990. Paramanof Bay, Kodiak Island.

PARAMANOF BAY (A031) MEAN LENGTH 1981 - 1990

AGE	YEAR									
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1									79	
2									137	
3	194	201	189	181		200	186	184	145	185
4	207	213	212	203	205	212	212	202		206
5	225	222	219	220	220	226	233	218		215
6	235	230	228	231	231	237	233	238		219
7	242	238	234	233	239	241	238	247		238
8	243	246	236	237	242	248	257	257		218
9		255	243	239	253	252	245	283		277
10	273	257	254	244	248	259	252	271		
11+	272	250	273	243	250	253	257	255		
N =	255	169	252	265	160	157	191	189	136	196
										TOTAL = 1970

Paramanof Bay (A031) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11
1988										
1987	137	185								
1986		145	206							
1985		184		215						
1984		186	202		219					
1983		200	212	218		238				
1982			212	233	238		218			
1981		181	205	226	233	247		277		
1980		189	203	220	237	238	257			
1979		201	212	220	231	241	257	283		
1978		194	213	219	231	239	248	245	271	
1977			207	222	228	233	242	252	252	255
1976				225	230	234	237	253	259	257
1975					235	238	236	239	248	253
1974						242	246	243	244	250
1973							243	255	254	243
1972									257	273
1971									273	250
1970										272

Table 4. Preliminary length at age data; commercial purse seine herring samples, 1981 - 1990, Foul Bay, Kodiak Island.

FOUL BAY (A032) MEAN LENGTH 1981 - 1990

AGE	YEAR									
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1										
2	172			174					150	
3	195			179		198	190		165	
4	211			202		226	219		162	
5	229			224		228	243			
6	232			217		236	235			
7	239			227		246	246			
8	248					250	262			
9				237		253				
10				240		259	263			
11+						259	262			
N =	122			84		328	117		56	0
									TOTAL # = 707	

Foul Bay (A032) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11
1988										
1987	150									
1986		165								
1985			162							
1984		190								
1983		198	219							
1982	174		226	243						
1981		179		228	235					
1980			202		236	246				
1979	172			224		246	262			
1978		195			217		250			
1977			211			227		253	263	
1976				229					259	262
1975					232			237		259
1974						239			240	
1973							248			
1972										
1971										
1970										

Table 5. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990, Perenos Bay, Kodiak Island.

PERENOSA BAY (A070) MEAN LENGTH 1981 - 1990

AGE	YEAR									
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1										
2	175	179					171			
3	190	202	194	179		196	181	188		
4	212	214	207	205		213	214	204		223
5	212	225	221	222		228	231	224		230
6		235	239	231		235	224	230		239
7	237	240		229		258	237	241		252
8		240	225			242		238		
9		248		260		246				261
10			264			258				261
11+										271
N =	30	152	103	84	0	145	237	136	0	58
										TOTAL # = 945

Perenos Bay (A070) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11
1988										
1987										
1986			223							
1985	171	188		230						
1984		181	204		239					
1983		196	214	224		252				
1982			213	231	230		248			
1981		179		228	224	241		261		
1980	179	194	205		235	237	238		261	
1979	175	202	207	222		258				271
1978		190	214	221	231		242			
1977			212	225	239	229		246		
1976				212	235				258	
1975						240	225	260		
1974						237	240			
1973								248	264	
1972										
1971										
1970										

Table 6. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990, Tonki Bay, Kodiak Island.

TONKI BAY (A080) MEAN LENGTH 1981 - 1990

AGE	YEAR									
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1										
2					167	181				
3				189	211	204		191		190
4				206	214	225		205		223
5				221	229	233		219		225
6				229	239	243		256		236
7					241	248				248
8				221	249	248		244		257
9					251	257				
10				250	256	257				
11+						264				260
N =	0	0	0	61	90	73	0	103	0	90
										TOTAL # = 417

Tonki Bay (A080) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11
1988										
1987		190								
1986			223							
1985		191		226						
1984	181		205		236					
1983	167	204		219		248				
1982		211	225		256		257			
1981		189	214	233						
1980			206	229	243		244			
1979				221	239	248				260
1978					229	241	248			
1977							249	257		
1976							221	251	257	
1975									256	264
1974									250	
1973										
1972										
1971										
1970										

Table 7. Preliminary length at age data; commercial purse seine herring samples, 1981 - 1990, Izhut Bay, Kodiak Island.

IZHUT BAY (A090) MEAN LENGTH 1981 - 1990

AGE	YEAR									
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1										
2				175	166					
3		211		191	205	203	184			193
4		221		200	220	214	216	211	210	222
5		226		224	227	231	230	234	225	229
6		241		204	238	236	237		246	231
7		254			243	243	234	253	258	248
8		255			258	249		253	253	245
9					256		255	269	263	266
10				250	253				265	263
11+							262	264	261	282
N =		75		57	159	88	205	111	134	226
										TOTAL # = 1055

Izhut Bay (A090) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11
1988										
1987		193								
1986			222							
1985			210	229						
1984		184	211	225	231					
1983	166	203	216	234	246	248				
1982	175	205	214	230		258	245			
1981		191	220	231	237	253	253	266		
1980			200	227	236	234	253	263	263	
1979		211		224	238	243		269	265	282
1978			221		204	243	249	255		261
1977				226			258			264
1976					241			256		262
1975						254			253	
1974							255		250	
1973										
1972										
1971										
1970										

Table 8. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990, Kitoi Bay, Kodiak Island.

KITOI BAY (A091) MEAN LENGTH 1981 - 1990

AGE	YEAR									
	*1981	*1982	*1983	1984	1985	1986	1987	1988	1989	1990
1										
2	173	168			167	196				165
3	203	205	203	194	195	212				191
4	219	217	222	211	218	210				222
5	230	233	228	225	226	250				232
6	238	238	240	239	235	257				237
7	235	251	246	244	230					238
8	248	253	245	247	241					
9		231	260							
10		240		248						
11+	265		264		249					
N =	118	202	420	114	74	48	0	0	0	95
										TOTAL # = 1071

Kitoi Bay (A091) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE										
	2	3	4	5	6	7	8	9	10	11	
1988	165										
1987		191									
1986			222								
1985				232							
1984	196				237						
1983	167	212				238					
1982		195	210								
1981		194	218	250							
1980	168	203	211	226	257						
1979	173	205	222	225	235						
1978		203	217	228	239	230					
1977			219	233	240	244	241				
1976				230	238	246	247				
1975					238	251	245				
1974						235	253	260	248	249	
1973							248	231			
1972									240	264	
1971											
1970										265	

Table 9. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990, McDonald's Lagoon, Kodiak Island.

McDONALD'S LAGOON (A092) MEAN LENGTH 1981 - 1990

AGE	YEAR										
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	
1											
2						165					
3	205	208		200	218	201					
4	219	222		215	211	228					
5	225	226		222	227	230					
6	230	235		291	235	238					
7	242	246		241	253	240					
8		247			253	255					
9						257					
10											
11+	279										
N =	47	76	0	71	29	165	0	0	0	0	TOTAL # = 388

McDonald's Lagoon (A092) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11
1988										
1987										
1986										
1985										
1984	165									
1983		201								
1982		218	228							
1981		200	211	230						
1980			215	227	238					
1979		208		222	235	240				
1978		205	222		291	253	255			
1977			219	226		241	253	257		
1976				225	235					
1975					230	246				
1974						242	247			
1973										
1972										
1971										
1970										279

Table 10. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990. Danger Bay, Kodiak Island.

DANGER BAY (A100) MEAN LENGTH 1981 - 1990

AGE	YEAR									
	*1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1									98	
2		198					158		131	136
3	216	205	197	193		204	187	200		
4	222	218	218	209	217	221	224	216		
5	230	228	228	226	224	233	252	242		
6	245	243	236	233	242	239	244			
7	248	245	230	232	249	246	250	262		266
8		246	247		247	271	261	258		
9		248	248		264		263	270		
10				255	255					
11+		263			259	262		251		
N =	40	132	193	124	84	86	313	147	126	147
									TOTAL # = 1392	

Danger Bay (A100) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11
1988	136									
1987	131									
1986										
1985	158	200								
1984		187	216							
1983		204	224	242		266				
1982			221	252						
1981		193	217	233	244	262				
1980	198	197	209	224	239	250	258			
1979		205	218	226	242	246	261	270		
1978		216	218	228	233	249	271	263		
1977			222	228	236	232	247			251
1976				230	243	230		264		
1975					245	245	247	255	255	262
1974						248	246	248	255	259
1973								248		
1972										
1971										263
1970										

Table 11. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990. Litnik, Kodiak Island.

LITNIK (A101) MEAN LENGTH 1981 - 1990

AGE	YEAR										TOTAL # =	
	*1981	1982	1983	1984	1985	1986	1987	1988	1989	1990		
1												
2					177							
3	212			193			191					
4	223			217	224		224	209				
5	237			232	229		237	240				
6	231			245	240		243					
7	251			236	254		247	252				
8	252			247	253			251				
9	272						257					
10							258	262				
11+					257		256	289				
N =	30	0	0	66	67	0	84	48	0	0		
												295

Litnik (A101) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11
1988										
1987										
1986										
1985										
1984		191	209							
1983	177		224	240						
1982				237						
1981		193	224		243	252				
1980			217	229		247	251			
1979				232	240					
1978		212			245	254		257	262	
1977			223			236	253		258	289
1976				237			247			256
1975					231					
1974						251				257
1973							252			
1972								272		
1971										
1970										

Table 12. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990, Inner Alitak Bay, Kodiak Island.

INNER ALITAK BAY (AL20) MEAN LENGTH 1981 -1990

AGE	YEAR									
	*1981	*1982	*1983	*1984	*1985	1986	1987	1988	1989	1990
1	145				115					
2	150		144	144	154					
3	172	196	177	189	153					
4	192	200	193							
5	204	210		208						
6	205	211	212	214						
7	218	224		228						
8		216		229						
9				230						
10				246						
11+	255			250						
N =	179	58	40	50	85	0	0	0	0	0
										TOTAL # = 412

Inner Alitak Bay (AL20) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE										
	2	3	4	5	6	7	8	9	10	11	
1988											
1987											
1986											
1985											
1984											
1983	154										
1982	144	153									
1981	144	189									
1980		177									
1979	150	196	193	208							
1978		172	200		214						
1977			192	210	212	228					
1976				204	211		229				
1975					205	224		246			
1974						218	216		246		
1973										250	
1972											
1971											
1970										255	

Table 13. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990, Deadman Bay, Kodiak Island.

DEADMAN BAY (AL21) MEAN LENGTH 1981 -1990

AGE	YEAR									
	*1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1									89	
2				131	157	153	149		130	
3		191		180	150	198	191	189	194	186
4	196	201		195	216		212	215	214	204
5	212	220		216	222	226	224	227	227	222
6	219	212		224	233	221	223		239	232
7	215	218		230		240	230	254		249
8						246	235		243	246
9				224					252	246
10									251	256
11+							230			234
N =	15	67		305	172	203	553	135	227	440
										TOTAL # = 2117

Deadman Bay (AL21) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11
1988										
1987	130	186								
1986		194	204							
1985	149	189	214	222						
1984	153	191	215	227	232					
1983	157	198	212	227	239	249				
1982	131	150		224			246			
1981		180	216	226	223	254	243	246		
1980			195	222	221	230		252	256	
1979		191		216	233	240	235		251	234
1978			201		224		246			
1977			196	220		230				
1976				212	212					230
1975					219	218		224		
1974						215				
1973										
1972										
1971										
1970										

Table 14. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990, Sulua Bay, Kodiak Island.

SULUA BAY (AL30) MEAN LENGTH 1981 -1990

AGE	YEAR									
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1					105					
2		192			137			165		175
3	193	190	181	191		200	194	187	200	185
4	207	200	206	206	205	218	213	210	210	206
5	218	215	217	221	215	220	211	230	230	219
6	229	222	227	226	225	224	223	243	244	235
7	239	244	227		223	235	232	230	266	243
8					231	230			254	229
9					225	252				261
10						240			259	
11+									260	229

N =	263	186	66	93	177	105	227	167	127	531
										TOTAL # = 1942

Sulua Bay (AL30) Length at Age for Brood Years 1970 - 1989

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11
1988	175									
1987		185								
1986	165	200	206							
1985		187	210	219						
1984		194	210	230	235					
1983	137	200	213	230	244	243				
1982			218	211	243	266	229			
1981		191	205	220	223	230	254	261		
1980	192	181	206	215	224	232				
1979		190	206	221	225	235			259	229
1978		193	200	217	226	223	230			260
1977			207	215	227		231	252		
1976				218	222	227		225	240	
1975					229	244				
1974						239				
1973										
1972										
1971										
1970										

Table 15. Preliminary length at age data; commercial purse seine herring samples, 1981 - 1990. Upper Olga Bay, Kodiak Island.

UPPER OLGA BAY (AL50) MEAN LENGTH 1981 -1990

AGE	YEAR									
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1										
2	141				164			142	167	141
3	184	187	194	185	184	197	198	196	181	177
4	204	186	211	205	204	216	217	219	207	210
5	222	213	214	217	211	220	228	229	217	219
6	225	217	225	222	224	225	231	237	222	228
7	232	228	228	234	237	234	237	238		224
8	252	235	235	258	216	240	249	244	240	230
9		235	243	242	231	235		252	230	
10			251	243	241	241		234	254	
11+					240	251	249	248	240	

N =	214	143	390	229	193	304	396	302	134	100
									TOTAL # = 2405	

Upper Olga Bay (AL50) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE										
	2	3	4	5	6	7	8	9	10	11	
1988	141										
1987	167	177									
1986	142	181	210								
1985		196	207	219							
1984		198	219	217	228						
1983	164	197	217	229	222	224					
1982		184	216	228	237		230				
1981		185	204	220	231	238	240				
1980		194	205	211	225	237	244	230			
1979	141	187	211	217	224	234	249	252	254		
1978		184	186	214	222	237	240		234	240	
1977			204	213	225	234	216	235		248	
1976				222	217	228	258	231	241	249	
1975					225	228	235	242	241	251	
1974						232	235	243	243	240	
1973							252	235	251		
1972											
1971											
1970											

Table 16. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990, Barling Bay, Kodiak Island.

BARLING BAY (G021) MEAN LENGTH 1981 -1990

AGE	YEAR									
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1										
2					186				154	175
3			215				204			202
4			226		224		225	234		217
5			226		234		234	244		
6			240		243		244	225		254
7			247		246		252	260		271
8					252		254	259		
9			261				270	263		274
10										268
11+								265		283
N =	0	0	60	0	97	0	118	130	97	206
										TOTAL # = 708

Barling Bay (G021) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11
1988	175									
1987	154	202								
1986			217							
1985										
1984		204	234		254					
1983	186		225	244		271				
1982				234	225					
1981			224		244	260		274		
1980		215		234		252	259		268	
1979			226		243		254	263		283
1978				226		246		270		
1977					240		252			265
1976						247				
1975										
1974								261		
1973										
1972										
1971										
1970										

Table 17. Preliminary length at age data: commercial purse seine herring samples. 1981 - 1990. Amee Bay, Kodiak Island.

AMEE BAY (G022) MEAN LENGTH 1981 -1990

AGE	YEAR									
	*1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1										
2	171	189			181	182				
3	201	203	206	211		202		223	195	202
4	225	214	225	217	222	246		228	231	215
5	232	230	236	227	229	237		243	241	243
6	250	229		233	238	242		254	251	253
7	255		237	233	245	247		257		262
8	265	244		232	250	255		260	260	254
9					247	253		260	261	265
10						262		266	265	267
11+					261			268	266	272
N =	121	174	55	110	321	254	0	251	134	374
										TOTAL # = 1794

Amee Bay (G022) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11
1988										
1987		202								
1986		195	215							
1985		223	231	243						
1984	182		228	241	253					
1983	181	202		243	251	262				
1982			246		254		254			
1981		211	222	237		257	260	265		
1980	189	206	217	229	242		260	261	267	
1979	171	203	225	227	238	247		260	265	272
1978		201	214	236	233	245	255		266	266
1977			225	230		233	250	253		268
1976				232	229	237	232	247	262	
1975					250					
1974						255	244			261
1973							265			
1972										
1971										
1970										

Table 18. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990, Tanginak Anchorage, Kodiak Island.

TANGINAK (G023) MEAN LENGTH 1981 -1990

AGE	YEAR									
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1										
2										
3			209	192		213	213			202
4			223	215		226	223			208
5			230	227		243	230		246	233
6			237			247	239		257	242
7			240	236		256	251		258	259
8			251	249		257	246		267	270
9			280	249		268			266	265
10			259	252			265		273	268
11+						267			270	266
N =	0	0	125	39	0	66	58	0	112	62
										TOTAL # = 462

Tanginak (G023) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11
1988										
1987		202								
1986			208							
1985				233						
1984		213		246	242					
1983		213	223		257	259				
1982			226	230		258	270			
1981		192		243	239		267	265		
1980		209	215		247	251		266	268	
1979			223	227		256	246		273	266
1978				230			257			270
1977					237	236		268	265	
1976						240	249			
1975								249		267
1974								280	252	
1973									259	
1972										
1971										
1970										

Table 19. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990, Shearwater Bay, Kodiak Island.

SHEARWATER (G042) MEAN LENGTH 1981 -1990

AGE	YEAR									
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1										
2					186					
3							207			200
4					220		220	230	238	224
5					226			242	246	238
6					239		247		258	256
7							248	253	265	258
8					254		256	254	261	264
9								262	268	
10							252		277	
11+									275	
N =	0	0	0	0	110	0	72	88	57	160
										TOTAL # = 487

Shearwater (G042) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11
1988										
1987		200								
1986			224							
1985			238	238						
1984		207	230	246	256					
1983	186		220	242	258	258				
1982						265	264			
1981			220		247	253	261			
1980				226		248	254	268		
1979					239		256	262	277	
1978										275
1977							254		252	
1976										
1975										
1974										
1973										
1972										
1971										
1970										

Table 20. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990, Ugak Bay, Kodiak Island.

UGAK BAY (G050/51) MEAN LENGTH 1981 -1990

AGE	YEAR									
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1									126	
2	165				165				142	
3	195		200	190	180	206	202		202	195
4	211		218	208	215	212	216	229	217	218
5	231		222	221	222	237	239	240	248	236
6				234	241	250	239	249	255	252
7	237		253		236	252	248	253	259	259
8						259	254	249	266	267
9						258		255	272	268
10									273	266
11+									280	273
N =	124	0	160	173	109	100	147	100	293	192
										TOTAL # = 1398

Ugak Bay (G050/51) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE										
	2	3	4	5	6	7	8	9	10	11	
1988											
1987	142	195									
1986		202	218								
1985			217	236							
1984		202	229	248	252						
1983	165	206	216	240	255	259					
1982		180	212	239	249	259	267				
1981		190	215	237	239	253	266	268			
1980		200	208	222	250	248	249	272	266		
1979	165		218	221	241	252	254	255	273	273	
1978		195		222	234	236	259			280	
1977			211					258			
1976				231		253					
1975											
1974						237					
1973											
1972											
1971											
1970											

Table 21. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990, Womens Bay, Kodiak Island.

WOMEN'S BAY (G060) MEAN LENGTH 1981 -1990

AGE	YEAR									
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1	111									
2	163					172			184	
3	203		201	194		211	188		215	
4	224		224	215	221	239	222	220	224	
5	234		229	230	230	236		249	244	
6	237			235	238	240	243	255	253	
7			243	247	252	247	246	259	254	
8			231	232		256	252	256	266	
9						257		269	272	
10						265	251		268	
11+						272	270		271	
N =	279	0	118	114	165	247	116	48	137	0
										TOTAL # = 1224

Women's Bay (G060) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE										
	2	3	4	5	6	7	8	9	10	11	
1988											
1987	184										
1986		215									
1985			224								
1984	172	188	220	244							
1983		211	222	249	253						
1982			239		255	254					
1981		194	221	236	243	259	266				
1980		201	215	230	240	246	256	272			
1979	163		224	230	238	247	252	269	268		
1978		203		229	235	252	256			271	
1977			224			247		257	251		
1976				234		243	232		265	270	
1975					237		231			272	
1974											
1973											
1972											
1971											
1970											

Table 22. Preliminary length at age data; commercial purse seine herring samples, 1981 - 1990, Anton Larson Bay, Kodiak Island.

ANTON LARSON (G080) MEAN LENGTH 1981 -1990

AGE	YEAR									
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1										
2					175	160				
3			197	198		206				
4			223	216	213	220				
5			227	232	223	233				
6			238	243	235	240				
7			242	246	226	245				
8				247	248	248				
9					259	257				
10					248					
11+						252				

N =	0	0	87	83	170	155	0	0	0	0
										TOTAL # = 495

Anton Larson (G080) Length at Age for Brood Years 1970 - 1989

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11
1988										
1987										
1986										
1985										
1984	160									
1983	175	206								
1982			220							
1981		198	213	233						
1980		197	216	223	240					
1979			223	232	235	245				
1978				227	243	226	248			
1977					238	246	248	257		
1976						242	247	259		
1975									248	252
1974										
1973										
1972										
1971										
1970										

Table 23. Preliminary length at age data; commercial purse seine herring samples, 1981 - 1990, Sheratin Bay, Kodiak Island.

SHERATIN (G081) MEAN LENGTH 1981 -1990

AGE	YEAR										
	1981	1982	*1983	1984	1985	1986	1987	1988	1989	1990	
1											
2			159						167		
3			193	192				179	207		
4			219	215				216	215		
5			242	230				243	239		
6				234				245	243		
7								251	254		
8								260			
9								260	259		
10								250	274		
11+									280		
N =	0	0	33	34	0	0	0	66	52	0	
										TOTAL # =	185

Sheratin (G081) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE										
	2	3	4	5	6	7	8	9	10	11	
1988											
1987	167										
1986		207									
1985		179	215								
1984			216	239							
1983				243	243						
1982					245	254					
1981	159	192				251					
1980		193	215				260	259			
1979			219	230				260	274		
1978				242	234				250	280	
1977											
1976											
1975											
1974											
1973											
1972											
1971											
1970											

Table 24. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990, Kizhuyak Bay, Kodiak Island.

KIZHUYAK (G090) MEAN LENGTH 1981 -1990

AGE	YEAR									
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1									87	
2					177	167				153
3		195	199	193	201	204	190	194		188
4		210	220	208	220	217	221	212		221
5		221	231	224	226	233	234	231		220
6		208	237	233	242	239	238	241		231
7			238	243	246	246	244	253		260
8		229	218		244	251	247	252		266
9						253		272		264
10						233		265		263
11+					264	200				266
N =	0	46	107	172	191	437	227	217	60	150
										TOTAL # = 1607

Kizhuyak (G090) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11
1988	153									
1987		188								
1986			221							
1985		194		220						
1984	167	190	212		231					
1983	177	204	221	231		260				
1982		201	217	234	241		266			
1981		193	220	233	238	253		264		
1980		199	208	226	239	244	252		263	
1979		195	220	224	242	246	247	272		266
1978			210	231	233	246	251		265	
1977				221	237	243	244	253		
1976					208	238			233	
1975							218			200
1974							229			264
1973										
1972										
1971										
1970										

Table 25. Preliminary length at age data; commercial purse seine herring samples, 1981 - 1990, Kalsin Bay, Kodiak Island.

KALSIN BAY (G100) MEAN LENGTH 1981 -1990

AGE	YEAR										
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	
1											
2		162									
3		202	194	191			181			197	
4		216	218	207			203			223	
5		231	232	228			224				
6		231	248	236			223			222	
7				246						262	
8		232									
9		271									
10											
11+											
N =	0	184	106	57	0	0	496	0	0	131	TOTAL # = 974

Kalsin Bay (G100) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11
1988										
1987		197								
1986			223							
1985										
1984		181			222					
1983			203			262				
1982				224						
1981		191			223					
1980	162	194	207							
1979		202	218	228						
1978			216	232	236					
1977				231	248	246				
1976					231					
1975										
1974							232			
1973								271		
1972										
1971										
1970										

Table 25. Preliminary length at age data; commercial purse seine herring samples, 1981 - 1990, Middle Bay, Kodiak Island.

MIDDLE BAY (G101) MEAN LENGTH 1981 -1990

AGE	YEAR									
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1										
2										
3					225	210	184			191
4					220	237	224	219		213
5					231	237		240		237
6					238	244	240	250		247
7					243	251	246	250		262
8							248	248		
9					259	255	240			
10										
11+								262		

N =	0	0	0	0	87	76	147	66	0	92
										TOTAL # = 468

Middle Bay (G101) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE										
	2	3	4	5	6	7	8	9	10	11	
1988											
1987		191									
1986			213								
1985				237							
1984		184	219		247						
1983		210	224	240		262					
1982		225	237		250						
1981			220	237	240	250					
1980				231	244	246	248				
1979					238	251	248				
1978						243		240			
1977								255		262	
1976								259			
1975											
1974											
1973											
1972											
1971											
1970											

Table 27. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990, Kukak Bay, Alaska Peninsula

KUKAK BAY (M020) MEAN LENGTH 1981 -1990

AGE	YEAR										
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	
1											
2										131	
3	179		188			194	186			187	
4	201		218		213	212	222			220	
5	209		223		222	220	229			226	
6	235		235		231	230	238			238	
7	225				232	239	244			248	
8	234				242	243	256			258	
9	254		235		231	250	259			259	
10							263			263	
11+										268	
N =	104	0	50	0	81	94	84	0	0	126	
										TOTAL # =	539

Kukak Bay (M020) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11+
1988	131									
1987		187								
1986			220							
1985				226						
1984		186			238					
1983		194	222			248				
1982			212	229			258			
1981			213	220	238			259		
1980		188		222	230	244			263	
1979			218		231	239	256			268
1978		179		223		232	243	259		
1977			201		235		242	250	263	
1976				209				231		
1975					235					
1974						226		235		
1973							234			
1972								254		
1971										
1970										

Table 28. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990, Kashvik Bay, Alaska Peninsula.

KASHVIK BAY (M050) MEAN LENGTH 1981 -1990

AGE	YEAR									
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1										
2	157									
3	187	195	188	185	175	189		186		
4	201	212	213	207	205	215		212		
5	212	225	226	219	219	228		225		
6	212	233	236	228	219	239		231		
7	228	244	242	238	236	244		243		
8	236	248	244	242	247	248		252		
9		258	262	248	240	253		255		
10			258	248	256	255		263		
11+				248	256	253		263		
<hr/>										
N =	165	152	138	152	87	203	0	235	0	0
									TOTAL # = 1132	

Kashvik Bay (M050) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE										
	2	3	4	5	6	7	8	9	10	11	
1988											
1987											
1986											
1985		186									
1984			212								
1983		189		225							
1982		175	215		231						
1981		185	205	228		243					
1980		188	207	219	239		252				
1979	157	195	213	219	219	244		255			
1978		187	212	226	228	236	248		263		
1977			201	225	236	238	247	253		263	
1976				212	233	242	242	240	255		
1975					212	244	244	248	256	253	
1974						228	248	262	248	256	
1973							236	258	258	248	
1972											
1971											
1970											

Table 29. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990, Alinchak Bay, Alaska Peninsula.

ALINCHAK BAY (M070) MEAN LENGTH 1981 -1990

AGE	YEAR										
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	
1											
2											
3	179	210		191				188		185	
4	203	216		209	214			209		213	
5	211	226	221	214	227			224		235	
6	222	236	230	227	235					239	
7	236	248	238	236	244			245		247	
8	220	248	254	242	250			237		262	
9		245		252	255					258	
10			250							260	
11+			254		275			258		275	
<hr/>											
N =	109	100	57	109	71	0	0	83	0	149	TOTAL # = 678

Alinchak Bay (M070) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11+
1988										
1987		185								
1986			213							
1985		188		235						
1984			209		239					
1983				224		247				
1982							262			
1981		191	214			245		258		
1980			209	227			237		260	
1979		210		214	235					275
1978		179	216	221	227	244				
1977			203	226	230	236	250			258
1976				211	236	238	242	255		
1975					222	248	254	252		
1974						236	248			275
1973							220	245	250	
1972										254
1971										
1970										

Table 30. Preliminary length at age data; commercial purse seine herring samples, 1981 - 1990, Wide Bay, Alaska Peninsula.

WIDE BAY (M110) MEAN LENGTH 1981 -1990

AGE	YEAR									
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1										
2					155					
3	191	177	198	193	214	188	192	185		189
4	202	214	206	203	214	211	217	215		217
5	214	222	221	223	231	232	230	229		235
6	224	232	240	234	240	229	242	237		239
7	228	243	243	240	247	245	244			246
8	238	238	253	244	252	253	240	251		256
9	221	249		246	256	246	251			
10			252	249	260	253	259			
11+				243	260	262	268	267		
N =	158	190	66	181	254	89	221	95	0	229
										TOTAL # = 1483

Wide Bay (M110) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11
1988										
1987		189								
1986			217							
1985		185		235						
1984		192	215		239					
1983	155	188	217	229		246				
1982		214	211	230	237		256			
1981		193	214	232	242					
1980		198	203	231	229	244	251			
1979		177	206	223	240	245	240			
1978		191	214	221	234	247	253	251		
1977			202	222	240	240	252	246	259	267
1976				214	232	243	244	256	253	268
1975					224	243	258	246	260	262
1974						228	238		249	260
1973							238	249	252	243
1972								221		
1971										
1970										

Table 31. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990, Kupreanof Straits, Kodiak Island.

KUPREANOF STRAIT (UG10) MEAN LENGTH 1981 - 1990

AGE	YEAR										
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	
1											
2			161								
3			184			201	201	195			
4			217			211	220	214			
5			228			226	229	230			
6			235			234	235	234			
7			226			244	242	242			
8						247	248	244			
9						257	255	253			
10							248				
11+							251				

N =	0	0	113	0	0	82	104	117	0	0	
										TOTAL # =	416

Kupreanof Strait (UG10) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11
1988										
1987										
1986										
1985		195								
1984		201	214							
1983		201	220	230						
1982			211	229	234					
1981	161			226	235	242				
1980		184			234	242	244			
1979			217			244	248	253		
1978				228			247	255		
1977					235			257	248	
1976						226				251
1975										
1974										
1973										
1972										
1971										
1970										

Table 32. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990, Viekoda Bay, Kodiak Island.

VIEKODA BAY (UG20) MEAN LENGTH 1981 - 1990

AGE	YEAR									
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1										
2	161			179						162
3	183	199		185		199	187	185		184
4	194	209		204	208	213	217	202		206
5	209	221		217	223	227	223	207		237
6	210	230		231	228	232	236			242
7	224	238		233	244	241	243			250
8		244		236	242	260	250			253
9							250			259
10						268	247			257
11+					254	271				264

N =	83	94	0	185	71	189	113	100	0	234
										TOTAL # = 1069

Viekoda Bay (UG20) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11
1988	162									
1987		184								
1986			206							
1985		185		237						
1984		187	202		242					
1983		199	217	207		250				
1982	179		213	223			253			
1981		185	208	227	236			259		
1980			204	223	232	243			257	
1979	161	199		217	228	241	250			264
1978		183	209		231	244	260	250		
1977			194	221		233	242		247	
1976				209	230		236		268	
1975					210	238				271
1974						224	244			254
1973										
1972										
1971										
1970										

Table 33. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990. Terror Bay, Kodiak Island.

TERROR BAY (UG21) MEAN LENGTH 1981 - 1990

AGE	YEAR									
	*1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1									72	
2				172		144			139	120
3	196			187	193	196	180	187	194	184
4	212			204	209	216	199	203	208	212
5	232			219	218	217		219	217	219
6				223	227	229	212	240	236	220
7	230			238	236	236			258	226
8				233	240				254	
9					241					257
10					250				275	263
11+					250					248
N =	16			167	145	190	572	178	328	131
									TOTAL =	1596

Terror Bay (UG21) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE										
	2	3	4	5	6	7	8	9	10	11	
1988	120										
1987	139	184									
1986		194	212								
1985		187	208	219							
1984	144	180	203	217	220						
1983		196	199	219	236	226					
1982	172	193	216		240	258					
1981		187	209	217	212		254	257			
1980			204	218	229				263		
1979				219	227	236			275	248	
1978		196			223	236					
1977			212			238	240				
1976				232			233	241			
1975									250		
1974						230				250	
1973											
1972											
1971											
1970											

Table 34. Preliminary length at age data; commercial purse seine herring samples, 1981 - 1990, Village Islands, Kodiak Island.

VILLAGE ISLANDS (UG30) MEAN LENGTH 1981 - 1990

AGE	YEAR										
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	
1											
2											
3		199	186	181			198	195		188	
4		208	208	201	227		227	214	209	211	
5		217	219	215	235		234	238	217	225	
6		228	218	225	240		244	246	239	222	
7				226	234		249	236		244	
8				230			254	248	260		
9								259	251	241	
10							239		244	258	
11+										251	
<hr/>											
N =	0	40	64	184	30	0	210	150	337	285	
											TOTAL # = 1300

Village Islands (UG30) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11
1988										
1987		188								
1986			211							
1985		195	209	225						
1984		198	214	217	222					
1983			227	238	239	244				
1982				234	246					
1981		181	227		244	236	260	241		
1980		186	201	235		249	248	251	258	
1979		199	208	215	240		254	259	244	261
1978			208	219	225	234				
1977				217	218	226			239	
1976					228		230			
1975										
1974										
1973										
1972										
1971										
1970										

Table 35. Preliminary length at age data; commercial purse seine herring samples, 1981 - 1990, West Uganik Passage, Kodiak Island.

W. UGANIK PASS. (UG31) MEAN LENGTH 1981 - 1990

AGE	YEAR									
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1										
2						164				
3		196		182	215	197			189	186
4		208		201	214	221			206	215
5		220		218	224	224			221	215
6		228		216	233	233			240	225
7		247		236		241				248
8		235			255	247			243	
9		236				238			259	
10									256	255
11+										258
N =	0	51	0	87	61	167	0	0	63	62
										TOTAL # = 491

W. Uganik Pass (UG31) Length at Age for Brood Years 1970-1990

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11
1988										
1987		186								
1986		189	215							
1985			206	215						
1984	164			221	225					
1983		197			240	248				
1982		215	221							
1981		182	214	224			243			
1980			201	224	233			259	255	
1979		196		218	233	241			256	258
1978			208		216		247			
1977				220		236	255	238		
1976					228					
1975						247				
1974							235			
1973								236		
1972										
1971										
1970										

Table 36. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990.
East Arm Uganik, Kodiak Island.

EAST ARM UGANIK (UG33) MEAN LENGTH 1981 - 1990

AGE	YEAR										TOTAL # =	
	*1981	1982	1983	1984	1985	1986	1987	1988	1989	1990		
1												
2		154		189	159							
3	202	195		188	202		185	192				
4	204	209		206	211		211	208				
5	215	217		217	225		183	227				
6	235	238		224	232		229	226			238	
7	241			227	237		242	242			248	
8					236							
9				218	236						259	
10											255	
11+											261	
<hr/>												
N =	30	97	0	103	134	0	98	197	0	39		
												698

East Arm Uganik (UG33) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE										
	2	3	4	5	6	7	8	9	10	11	
1988											
1987											
1986											
1985		192									
1984		185	208		238						
1983	159		211	227		248					
1982	189	202		183	226						
1981		188	211		229	242		259			
1980	154		206	225		242			255		
1979		195		217	232						261
1978		202	209		224	237					
1977			204	217		227	236				
1976				215	238			236			
1975					235						
1974						241					
1973											
1972											
1971											
1970											

Table 37. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990, South Arm Uganik, Kodiak Island.

SOUTH ARM UGANIK (UG34) MEAN LENGTH 1981 - 1990

AGE	YEAR									
	*1981	1982	*1983	1984	1985	1986	1987	1988	1989	1990
1										
2	154		154			159				149
3	185	196	189	188		199	192	188	196	188
4	199	208	205	201			213	202	209	205
5	213	218	223	218		225	250	220	218	229
6	226	227	233	224		235	228		233	236
7	223	232	233	230		235	243		255	241
8		241		241		232	248	246		220
9		234					250		259	252
10						263	264		254	253
11+	255	252					275		218	257
N =	49	238	49	260	0	79	158	376	260	427
										TOTAL # = 1896

South Arm Uganik (UG34) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11
1988	149									
1987		188								
1986		196	205							
1985		188	209	229						
1984	159	192	202	218	236					
1983		199	213	220	233	241				
1982				250		255	220			
1981	154	188		225	228			252		
1980		189	201		235	243	246	259	253	
1979	154	196	205	218		235	248		264	257
1978		185	208	223	224		232	250		218
1977			199	218	233	230			264	
1976				213	227	233	241		263	275
1975					226	232				
1974						223	241			
1973								234		
1972										
1971										252
1970										255

Table 38. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990, Inner Uyak Bay, Kodiak Island.

INNER UYAK (UY30) MEAN LENGTH 1981 -1990

AGE	YEAR										
	1981	1982	*1983	1984	1985	1986	1987	1988	1989	1990	
1											
2	142	154				151		140	137		
3	184	181	177	184	196	191	188	190	204	186	
4	201	207	206	203	211	178	212	215	213	215	
5	219	216	207	215	217	218	221	232	222	228	
6	220	218	227	214	227	228	232	223	238	233	
7	222	231	231	226	235	232	234	248	233	240	
8		234		234	231	240	240	250	243	230	
9		240	247			240	234	253	249	239	
10			231				235	256	251	251	
11+					248	228	231	242	262	255	
<hr/>											
N =	265	215	133	171	151	214	758	223	354	354	TOTAL # = 2838

Inner Uyak (UY30) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11+
1988										
1987	137	186								
1986	140	204	215							
1985		190	213	228						
1984	151	188	215	222	233					
1983		191	212	232	238	240				
1982		196	178	221	223	233	230			
1981		184	211	218	232	248	243	239		
1980	154	177	203	217	228	234	250	249	251	
1979	142	181	206	215	227	232	240	253	251	255
1978		184	207	207	214	235	240	234	256	262
1977			201	216	227	226	231	240	235	242
1976				219	218	231	234			231
1975					220	231				228
1974						222	234	247		248
1973								240	231	
1972										
1971										
1970										

Table 39. Preliminary length at age data: commercial purse seine herring samples, 1981 - 1990, Zacher Bay, Kodiak Island.

ZACHER BAY (UY40) MEAN LENGTH 1981 -1990

AGE	YEAR									
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1									87	
2	160	147			175				131	131
3	187	189	185	200	186		191	187	192	184
4	201	204	214	202	199		219	203	208	
5	207	213	217	220	217		236	217	219	235
6	233	233	222	224	227		253		238	226
7	223		233	231			251	243		241
8	237	228			234		248	244	241	
9	242								252	248
10									252	253
11+								257		252
N =	166	357	235	206	88		222	203	236	150
										TOTAL # = 1863

Zacher Bay (UY40) Length at Age for Brood Years 1970 - 1990

BROOD YR	AGE										
	2	3	4	5	6	7	8	9	10	11	
1988	131										
1987	131	184									
1986		192									
1985		187	208	235							
1984		191	203	219	226						
1983	175		219	217	238	241					
1982		186		236							
1981		200	199		253	243	241	248			
1980	147	185	202	217		251	244	252	253		
1979	160	189	214	220	227		248		252	252	
1978		187	204	217	224						
1977			201	213	222	231	234			257	
1976				207	233	233					
1975					233						
1974						223	228				
1973							237				
1972								242			
1971											
1970											

Table 40. Preliminary length at age data; commercial purse seine herring samples, 1981 - 1990, Spiridon Bay, Kodiak Island.

SPIRIDON BAY (UY50) MEAN LENGTH 1981 -1990

AGE	YEAR									
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1										
2	166	164	150							
3	191	191	184	176		192	187	194		185
4	208	192	211	209		208	214	210		216
5	217	206	217	219		224	230	235		224
6	228		221	241		231	233			236
7	236		237	224		238	242	243		243
8	236			242		240	245	254		242
9	257					239	255	257		256
10	256						257	267		256
11+						264				258
N =	176	76	408	245	0	211	362	144	0	274
										TOTAL # = 1896

Spiridon Bay (UY50) Length at Age for Brood Years 1970-1990

BROOD YR	AGE									
	2	3	4	5	6	7	8	9	10	11+
1988										
1987		185								
1986			216							
1985		194		224						
1984		187	210		236					
1983		192	214	235		243				
1982			208	230			242			
1981	150	176		224	233	243		256		
1980	164	184	209		231	242	254		256	
1979	166	191	211	219		238	245	257		258
1978		191	192	217	241		240	255	267	
1977			208	206	221	224		239	257	
1976				217		237	242			
1975					228					264
1974						236				
1973							236			
1972								257		
1971									256	
1970										

APPENDIX B

**Westward Region Procedures for Collecting Data from
Test and Commercial Fishing Catches**

INTRODUCTION

Herring from the commercial catch and test fishing are sampled for sex, size and age annually by field crews in coastal waters of the state from Ketchikan to Kotzebue to form a data base essential to the management of the state's herring resources. This information is drawn upon by management and research biologists for monitoring and regulating harvest levels, determining run timing, entry patterns and distribution of herring arriving on the spawning grounds, monitoring sexual maturity and age composition of herring spawning populations, developing methods to forecast herring abundance and determine optimum spawning goals, and to gain a better understanding of the biology of each stock. The usefulness of this AWL data depends on the manner and accuracy in which the samples were taken.

This manual was prepared as a guide for collecting information on age, sex, maturity, length, weight and fecundity of herring and recording the appropriate data on A-W-L mark-sense forms. Also included are methods used for collecting similar information for capelin and other fishes encountered during herring sampling. The sampling and recording procedures are listed in a logical order of activity and should be followed in sequence to develop accurate sampling techniques.

Responsibility for accuracy lies first with the primary data collector(s). Above all, KEEP THE MARK-SENSE FORMS FLAT, DRY AND CLEAN. Fish gurry and water curling will cause data to be incorrectly read. Project supervisors will return sloppy or incomplete data to individual collectors. Each form shall be marked with the data recorder's and interpreter's initials.

When using the reverse side of the mark-sense form to record data, the sheet code must be transferred on to the extreme left hand column of the back page. To transfer the code, fold the form over (without creasing) so that both code columns are visible and mark the corresponding number blocks onto the back grid.

Please read all the instructions carefully so that information is collected and recorded accurately and properly. Process all fishes within 48 hours of capture. Use a number 1 (or 2) lead pencil to record data and write labels. Please print legibly.

If you have comments or suggestions for improving sampling methods or this manual, please contact Larry Malloy or Len Schwarz.

EQUIPMENT LIST

1. Plain glass microscope slides (25 x 75 x 1mm)
2. Forceps
3. Scissors
4. Scalpel
5. Lead pencils (number 1 or 2)
6. Small beakers (at least two)

7. Wide mouth sample jars containing Gilsons Fluid (fecundity samples)
8. Ziplock plastic bags
9. Measuring board (calibrated in mm)
10. Dial-a-Gram or Lume-O-Gram scale
11. Small vials with caps (otolith sampling)
12. Labels
13. Paper towels
14. Mucilage glue
15. Water
16. Ethanol or glycerol (otolith sampling)
17. A-W-L MarkSense data forms
18. Formalin
19. Eyedropper (otolith sampling)
20. Stick-on white labels 5/8 inches by 7/8 inches.

METHODS

Herring

I. AWL Labeling

- A. Before any fish are handled, label the waterproof A-W-L mark-sense form(s) with a soft No. 1 or (2) pencil referring to (Figures 1a, 1b, and 1c).
 1. Leave the mark sense spaces blank if you are uncertain of a factor i.e. district number. These will be filled in in town.
 2. Enter the following information in the blank space between the LOCATION heading the and WEIGHT and AGE heading.
 - a. Sampler's name
 - b. Sample number: each sample should start with the crew leader's initials and then be numbered sequentially by sample.
 - c. Location: the exact location where the sample was CAUGHT is very important. Note the distance from the nearest headland (i.e. 2 miles N.E. Rocky Point). In the Port Moller and Canoe Bay fisheries refer to chart provided (Figure 2 and 2A) and record the nearest headland and subsection number.
 - d. Date: record the date the fish were CAUGHT on
 - e. Source: record how the fish were taken. i.e. commercial seine sample, variable mesh gillnet, seine test set, etc.
 - f. Vessel: record the name of the vessel the sample was taken from.
 - g. Collector: record the name of the person who collected the sample from the vessel or cannery.

3. Additional information should be entered on the back of the AWL form under comments. Such comments could include estimated size of the delivery, roe percentage, or other background information. If a sample contains more than 30 fish, it will require more than one AWL form. In the top right hand corner, write in which page of the sample it is (i.e. page 1 of 3; in other words this is the first page of a sample that contains 3 pages).

II. Filling out AWL Forms

- A. When entering data, blacken the entire block for its full length and width (■). Be sure to mark all the way from the top to the bottom.
 1. A single light pencil mark in the block is not acceptable (—)
 2. If a mistake is made, erase the mistake as completely as possible without rubbing away the paper and be sure to thoroughly blacken the correct mark to prevent a data entry error when the forms are machine processed.
- B. Refer to the area code for a listing of designated A-W-L mark-sense codes (Figures 1b and 1c).

III. Labeling slides

- A. Determine the number of microscope slides needed for mounting herring scales.
 1. Scales will be mounted on plain slides with labels on one end.
 2. Each slide will contain a maximum of 10 scales. One scale from each of 10 herring.
- B. Label each slide with 5 lines of information (Figure 1a).
 1. General Area: Write in either North or South Peninsula, Kodiak, Chignik, etc.
 2. Catch location. Enter the exact location the fish were taken in. Do not record where the tender is but where the fish were harvested.
 3. Catch date. Enter the date that the fish were harvested on.
 4. Sample number. Enter the sample number. This should correspond with the sample number of the AWL form you are using.
 5. Scale number. Scale numbers should start with 1 and continue in multiples of 10. (i.e. 1-10, 11-20, 21-30, 31-40, 41-50, 51-60). If a sample contains 90 samples there will be 3 AWL forms labeled page 1 of

3, page 2 of 3, and page 3 of 3. Page 1 will have length and weight data corresponding to scales 1-30, Page 2 31-60, and Page 3 61-90.

C. Each sample and day should begin with a new AWL form.

IV. Measurements and Observations

A. IMPORTANT: After each herring is measured, weighed, sexed, etc., it should be placed aside in the same order it was sampled so that the scale taken will correspond to the correct herring specimen number (Figure 1a).

B. Standard length must be measured for every herring sampled unless the specimen has been too badly mangled (Figure 3).

1. Place each herring on the measuring board so that its anterior extremity is against the stop at the 0 mm line of the ruler (make sure the herring's mouth is closed).
2. Locate the area where the audal (tail) fin rays meet the hypural plate by sharply bending the tail and noting the location of the crease.
3. Record the measurement (to the nearest mm) from the anterior most extremity of the herring (the tip of the lower jaw) to the middle of the crease formed when the tail is bent.
4. Length is recorded on the A-W-L form by marking the appropriate column blocks.

C. Sex must be determined for every herring sampled, and appropriate column 1-4 marked under the SEX heading.

1. If herring are not ripe and running eggs or milt, they must be dissected to visually inspect the gonads.
2. If herring are immature (virgin), it is not possible to determine the sex without use of a microscope. Simply record these specimens as juveniles on the A-W-L coded as 3.
3. If specimens cannot be sexed for some other reason (i.e. specimen badly mutilated, etc.) record as unknown on the A-W-L form coded as 4.

D. Sexual maturity index must be determined for every specimen whenever possible. Use the guide (Figure 1c) to identify the appropriate Gonrad Maturity number and mark the corresponding GONAD INDEX column block.

V. Scale Sampling

- A. Only one readable scale will be taken from each herring with a maximum of 10 scales placed on each slide (Figure 1a).
- B. Remove each scale from one of the preferred body areas (Figure 3) on the left side of the fish (right side used as alternate site if necessary) using forceps. Body area locations are numbered in order of preference (location 1 is most preferred; location 3 is least preferred). If stock separation is intended find a scale from the blackened area only (Figure 3) and mark P in the margin next to that fish. You will be instructed if this is necessary.
- C. Dip each scale in clean water, rub between thumb and forefinger to remove dirt and slime, examine (hold up to a light) for regeneration (regenerated scales appear blurred in the center), DISCARD IF REGENERATED REPEATING PROCEDURE UNTIL A SUITABLE SCALE IS LOCATED.
- D. To mount a scale on the glass slide, dip the scale into the mucilage glue solution, (1 part mucilage glue: 10 parts water), shake off excess solution, and place the scale onto the slide making sure the unsculptured (concave) side of the scale is facing down and the anterior margin (portion embedded in the integument of the fish) is facing towards the bottom of the slide. The ridges on the sculptured side of the scale can be felt with a fingernail or forceps. Make certain that scales are placed on the slides in the positions corresponding to the correct specimen number on the A-W-L form (Figure 1a).
- E. Press each scale firmly against the slide with a paper towel after mounting to remove excess glue from underneath the scale. Press firmly and blot excess glue with the towel. (Too much pressure, however, can break your slide.)
- F. Store completed scale mounts in slide boxes to avoid loss or breakage.
- G. Mark the age of each specimen in the appropriate blocks on the A-W-L forms after the scales have been aged. A regenerated scale is marked as 18, illegible as 19 and missing as 20 in the age column.
- H. Completed A-W-L mark-sense forms should be stored in an appropriate notebook, file, etc.

VI. Otolith Sampling (see following Capelin sections I and III).

- A. Do Not Collect otoliths unless directed to in the project operational plan.

CAPELIN

- I. Preparations Prior to Data Collection (Do Not Collect otoliths unless directed to in your project operational plan).
 - A. Mix a solution of 1 part water to 1 part ethonol or use 100% glycerol.
 - B. Determine the number of vials needed for collecting otoliths.
 1. Each vial will hold one pair of otoliths.
 2. Thirty vials are required for every complete A-W-L form.
 - C. Place a label in each vial with the following information.
 1. Sample number. This should correspond with the sample number on the AWL form being used.
 2. Otolith Number. This should correspond with the A-W-L number which contains the appropriate length and sex for that otolith (i.e. 1-30 on the first page of the sample, 31-60 on the second page of the sample, etc.)
 3. Species. Either capelin or herring.
 4. Date. Put the date the fish were captured on.
 5. Location. Put the area of capture.
 6. Sampler's name.
 - D. Make certain that capelin samples from test fishing catches have been correctly subsampled and contain equal numbers of males and females (see Test Fishing-Variable Mesh Gillnets, Operational Plan).
- II. Measurements and Observations
 - A. IMPORTANT: After each capelin is measured, weighed, sexed, etc. it should be placed side in the same order it was sampled so that the otoliths taken will correspond to the correct capelin specimen number (Figure 4). All capelin data will be recorded on A-W-L mark-sense forms similar to herring data.
 - B. Fork length must be measured for every capelin in a sample, unless the specimen has been too badly mangled (Figure 5).
 1. Place each capelin on the measuring board so that its anterior extremity is against the stop at the 0 mm line of the ruler (make sure the capelin's mouth is closed).
 - C. Weight to the nearest g must be taken for every capelin in the sample, unless a portion of the body is missing.

- D. Sex must be determined from every capelin in the sample, whenever possible.
1. Sexually mature males can be distinguished by the prominent raised "hairy" bands of scales along their sides (above the lateral line).
 2. If capelin are not ripe and running eggs and sperm (and if males cannot be sexed externally), they must be dissected so that gonads can be visually inspected.
 3. If specimens cannot be sexed, indicate this on the A-W-L form. Do not record these specimens as juveniles unless you have good reason to believe they are immature.
- E. Sexual maturity index must be determined for every specimen whenever possible. use the appropriate code (Figure 1C). Although the code guide was developed specifically for herring, it is general enough to use for most fishes, if specific gonad measurements are ignored.

III. Otolith Sampling

- A. One pair of otoliths will be taken from each capelin and placed in an individual vial.
- B. To find the otoliths make a shallow, horizontal cut beginning just behind the head and extending to the snout. This will expose the brain cavity (Figure 4).
- C. The otoliths will be found on either side of the skull behind the eyes. (There are three pairs of otoliths located within the chambers of the inner ears. The largest pair, sagitta, are the easiest to find and remove.)
- D. Remove the otoliths with forceps and clean each specimen between your fingers.
- E. Place the pair in an appropriately labeled vial, fill with the ethanol solution or glycerol and cap tightly.
- F. If an otolith breaks during the extraction process, place all pieces in the vial.

Other Fishes

Other fishes, such as yellowfin sole, may also need to be sampled in some areas. Process these specimens using the methods outlined for capelin (see above). However, use fork length on species with forked tails and total length on species that do not have forked tails. Indicate on A-W-L form under "remarks" when total length is used.

Figure 1A.

Don't forget this → P 1 of 1

ADE A G HERRING AGE-WEIGHT LENGTH FORM
VERSION 20

Dessery Date: 1986 N Peninsula Sac Roe Herring

TYPE OF LENGTH MEASUREMENT: FISHRY GEAR

AGE MEASUREMENT: FISHRY GEAR

NET LENGTH: _____

SEX/SAMPLE: _____

TIME FISHED: _____

HOUS: _____

SEX: _____

GONAD INDEX: _____

LENGTH: _____

IN THIS SPACE WRITE IN:
CREW LEADER'S NAME
SAMPLE NUMBER

YEAR: _____

PAGE: _____

DISTRICT: _____

SECTION/SUBDISTRICT: _____

LOCATION: _____

John Doe
Meterege, Co., La.
JDOO1

5-30-86

W/ Recruit
M/V Protegna

AGE: _____

WEIGHT: _____

LOCATION OF CATCH: _____

DATE OF CATCH: _____

SOURCE (GEND): _____

VESSEL: _____

COLLECTOR OF SAMPLE: _____

GOOD SCALE

REGENERATED SCALE

DO NOT WRITE IN THIS MARGIN

1 2 3 4 5 6 7 8 9 10 11 12

N Pen. Meteregeen Bluff Pt. 5-30-86 JDOO1

13 14 15 16 17 18 19 20 21 22 23

N Pen. Meteregeen Bluff Pt. 5-30-86 JDOO1

24 25 26 27 28 29 30 31 32 33 34

N Pen. Meteregeen Bluff Pt. 5-30-86 JDOO1

HERRING 1 2 3 4

" " " "

" " " "

HERRING SHOULD BE POSITIONED IN ROWS SO AS TO MATCH ENTRIES ON AML FORMS

LEAVE A SPACE ON THE SLIDE FOR HERRING YOU CAN'T GET A SCALE FROM

Figure 1B.

Description:

ADF & G HERRING AGE-WEIGHT-LENGTH FORM
VERSION 2.0

<input type="checkbox"/> TYPE OF <input type="checkbox"/> LENGTH MEASUREMENT <input type="checkbox"/> AGE MEASUREMENT <input type="checkbox"/> FISHERY <input type="checkbox"/> GEAR <input type="checkbox"/> SET/SAMPLE <input type="checkbox"/> TIME SET <input type="checkbox"/> HOURS FISHED	MESH SIZE Inches Eighths	NET LENGTH Feet Tenths	YEAR MONTH/DAY PAGE DISTRICT SECTION/SUBDISTRICT LOCATION
	Hours Minutes Hours Tenths		

DESCRIPTION - Accurately state where sample was taken.

YEAR-MONTH-DAY - Date on which samples were collected. Remember - only one date per NWL.

LENGTH MEASUREMENT - SL = standard; FL = fork.

AGE MEASUREMENT - SC = scale; OT = otolith.

FISHERY - BC = bait catch; TI = trawl incidental; TE = test; CO = commercial; SU = subsistence.

GEAR - Type of gear used to collect samples. Obtain from the code guide (Figure 2A-B).

MESH SIZE - If gill net used to collect samples indicate actual mesh size in inches.
00 = dropout (fish sampled from unknown mesh size).

NET LENGTH - Record length of net in fathoms.

SET/SAMPLE # - Number assigned test fish sets only. Number sequentially starting with 1.
Use a separate numbering sequence for each district and section.

TIME SET - Actual time test net set. Use 24 hour (military) time format. For test fishing only.

HOURS FISHED - Total hours (in tenths) test net fished.

PAGE - Number sequentially starting with 1. Use a separate numbering sequence for each district, section and gear type. Be sure this number corresponds to the correct scale slide number.

LENGTH - Record all lengths in millimeters.

WEIGHT - Record all weights in grams.

OBTAIN THE FOLLOWING INFORMATION FROM THE CODE GUIDE (Figure 2A-B).

DISTRICT

SEX

SECTION

GONAD

LOCATION

AGE

Figure 1C.

AWL CODES

Gear
1 = Variable mesh gillnet - floating
2 = Variable mesh gillnet - sinking
3 = Set gillnet
4 = Drift gillnet
5 = Purse seine
6 = Beach Seine
7 = Otter trawl
8 = Hand picked
9 = Dip net

Sex
1 = Male
2 = Female
3 = Juvenile
4 = Unknown

Speciman Age
1-17 = actual fish age in years
18 = regenerated
19 = illegible
20 = missing

Mesh Size
1-4 7/8 = inches
00 = dropout

Maturity	GONADS (Relative Maturity) Key Characteristics
1	Virgin herring. Gonads very small, threadlike, 2-3 mm broad. Ovaries wine red. Testes whitish or grey brown.
2	Virgin herring with small sexual organs. The height of ovaries and testes about 3-8 mm. Eggs not visible to naked eye but can be seen with magnifying glass. Ovaries a bright red color; testes a reddish grey color.
3	Gonads occupying about half of the ventral cavity. Breadth of sexual organs between 1 and 2 cm. Eggs small but can be distinguished with the naked eye. Ovaries orange; testes reddish grey or greyish.
4	Gonads almost as long as body cavity. Eggs larger varying in size, opaque. Ovaries orange or pale yellow; testes whitish.
5	Gonads fill body cavity. Eggs, large round; some transparent. Ovaries yellowish, testes milkywhite. Eggs and sperm do not flow, but sperm can be extruded by pressure.
6	Ripe gonads; eggs transparent; testes white; eggs and sperm flow freely.
7	Spent herring. Gonads baggy and bloodshot. Ovaries empty or containing only a few residual eggs. Testes may contain remains of sperm.
8	Recovering spents. Ovaries and testes firm and larger than virgin herring in Stage II. Eggs not visible to naked eye. Walls of gonads striated; blood vessels prominent. Gonads wine red color; (this stage passes into Stage III).

Figure 2 A.

1st Ed., Feb. 1926 C 1943-604

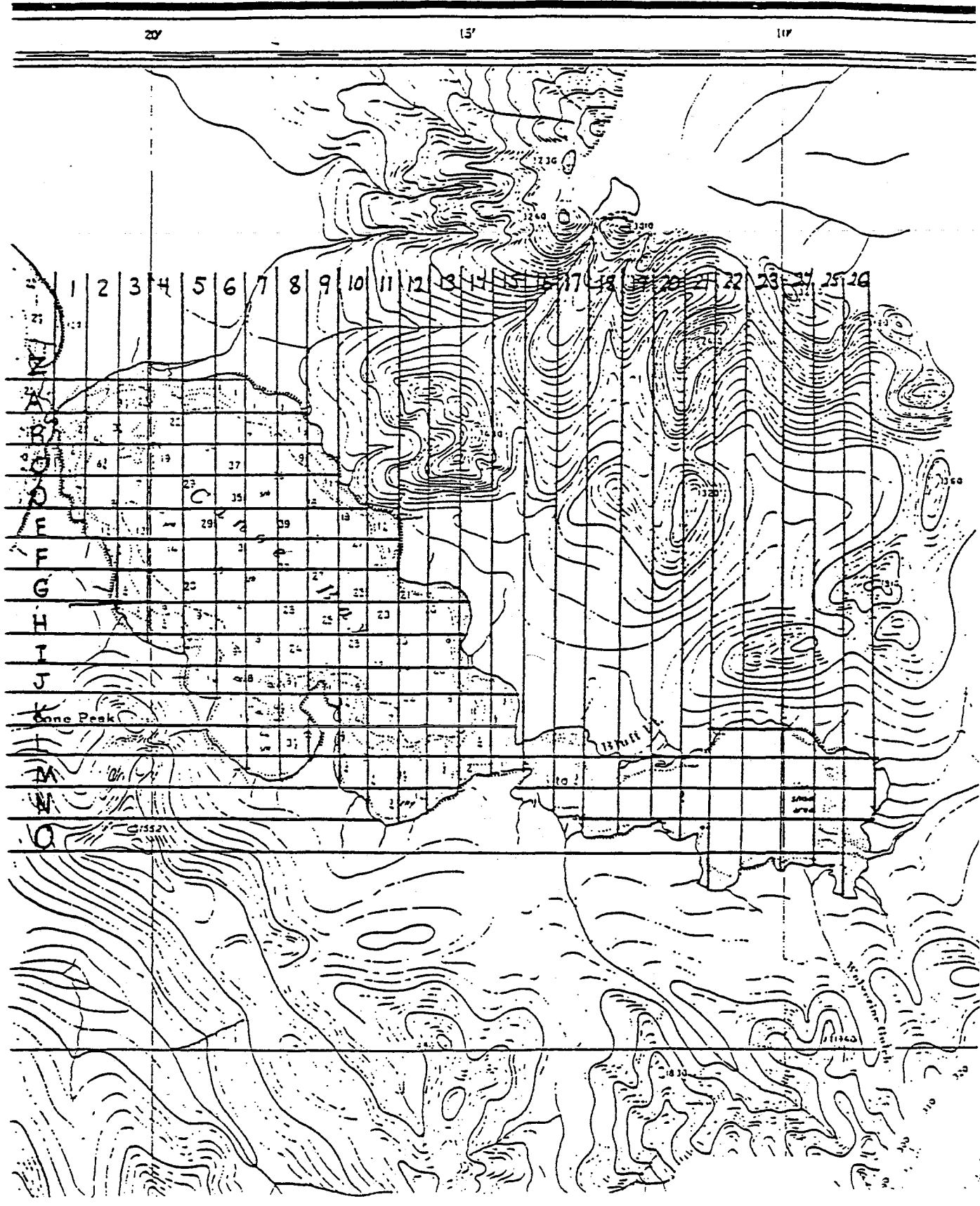
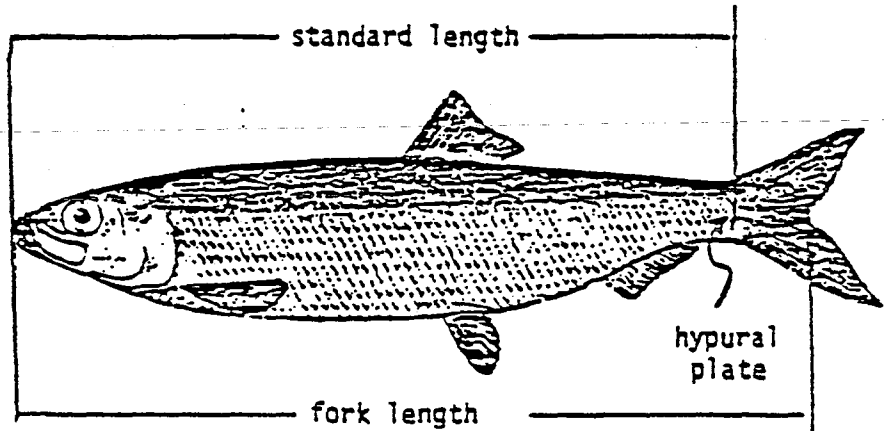
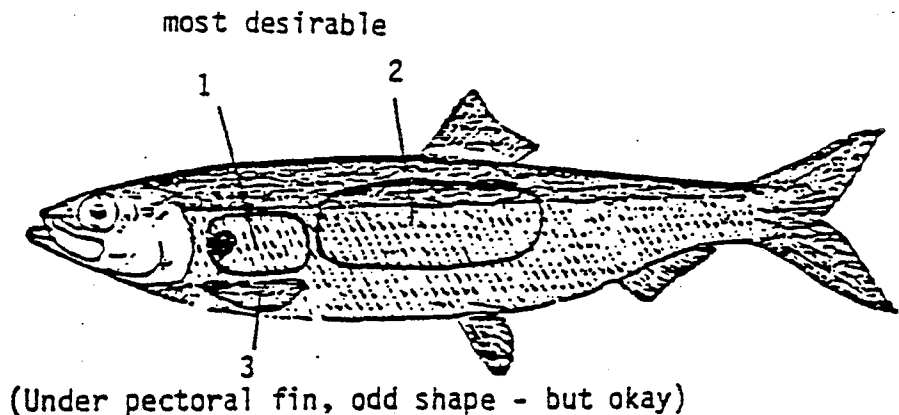


Figure 3.

Standard Length: the straight line distance from the anterior most part of the fish, including the lower jaw with the mouth closed, to the end of the vertebra (hypural plate). The vertebra end is recognized by the folding of the skin on an unskinned fish when the tail is sharply bent.
(Use)



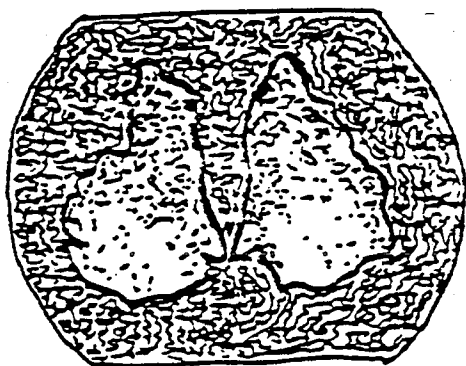
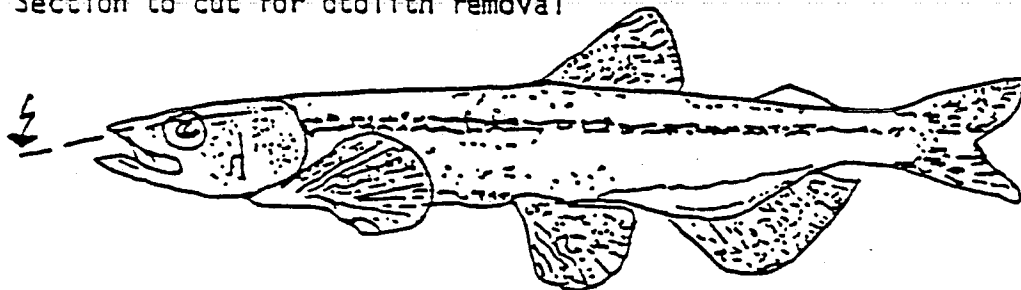
Fork Length: the straight line distance from the anterior most portion of the snout or upper jaw to the extreme end of the center of the caudal fin. It does not include a projection lower jaw.
(Don't Use)



Preferred body areas from which to collect scales for aging are shown above. Scales should be collected from the left side of the herring if possible. If no scales are present in any of the above areas on the left side, check the right side (using the same preference sequence). If scales are really scarce, take any good one you can find that is not regenerated.

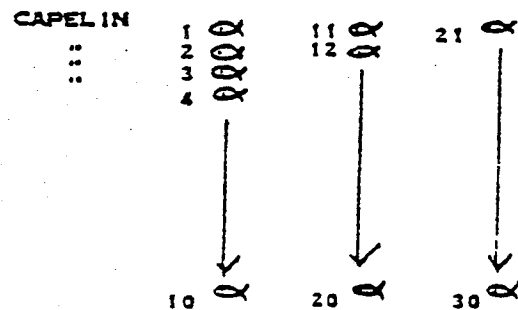
Figure 4.

Section to cut for otolith removal



Capelin Otoliths

(Actual size)



CAPELIN SHOULD BE POSITIONED SO AS TO MATCH ENTRIES ON AXL FORMS. THIS IS IMPORTANT FOR LATER SCALE SAMPLING.