

PREVALENCE OF BITTER CRAB SYNDROME AND BACTERIAL INFECTION  
OF TANNER CRAB *Chionoecetes bairdi*  
IN THE KODIAK, CHIGNIK, SOUTH PENINSULA, AND EASTERN ALEUTIAN  
MANAGEMENT AREAS

By

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Regional Informational Report<sup>1</sup> No. 4K92-26

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

July 1992

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#### ACKNOWLEDGEMENTS

We thank the Alaska Department of Fish and Game personnel who worked on the 1990 bottom trawl survey of crabs and groundfish in the Kodiak, Chignik, South Peninsula, and Eastern Aleutian management areas. In particular, Dan Urban for the collection and preparation of crab hemolymph smears, and Gretchen Bishop of the Juneau Fish Pathology Laboratory, FRED Division for assistance in reading the hemolymph smears. Thanks also to Dave Jackson for a critical review of the manuscript and Georgia Putney for help in the preparation of the manuscript.

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## INTRODUCTION

Bitter crab syndrome (BCS) is a fatal dinoflagellate infection known to occur in Alaskan Tanner crabs *Chionoecetes opilio* and *bairdi* (Meyers et al., 1990). The disease was discovered in catches of *C. bairdi* from the northern southeast panhandle of Alaska in 1985, and its occurrence in *C. bairdi* and *C. opilio* from the Bering Sea was reported in 1990 (Meyers et al., 1990). Meyers et al., (1987, 1990) have described the causative agent; a single celled blood parasite belonging to the taxonomic group of dinoflagellate closely resembling *Hematodinium* sp. found in other decapod crustacean hosts. Although the life history is not well known, Meyers et. al, (1987) report that the organism has a life cycle involving three distinct forms; a non-motile vegetative stage which replicates inside the host and develops into one of two types of motile dinospores in a process called sporulation. Early results suggested that the dinospores may be the infectious stage, but more recent studies support the premise that the vegetative stage may be transmitted to new crab hosts during the late spring molting cycle (Meyers et al., 1990). Most infected Tanner crab die before sporulation occurs. Those crab that do survive long enough for sporulation to occur die within two days. Sporulation is believed to occur when seawater temperatures are at their warmest of the year. The progress of the disease may be delayed in colder waters, and some infected crab may survive for more than one season (Meyers et al., 1990).

The disease has been named "Bitter Crab Syndrome" because cooked meat of infected crabs has a bitter aspirin-like aftertaste making it unmarketable. Infected crabs, although unpalatable, are harmless to eat. In 1985 and 1986 commercial fishermen and processors suffered economic losses due to a high prevalence of infected crabs in catches from the southeastern panhandle of Alaska (Meyers et al., 1987).

The Alaska Department of Fish and Game collected hemolymph samples from Tanner crabs taken during the 1990 bottom trawl survey of crab and groundfish in the Kodiak, Chignik, South Peninsula, and Eastern Aleutian Management Districts in order to test for the occurrence of BCS between the extreme locations from which BCS has been reported. The purpose of this report is to present the findings of the laboratory examination of the hemolymph samples and to archive the data.

## METHODS

A total of 423 tows were made during the 1990 bottom trawl survey of crab and groundfish in the Kodiak Island, Chignik, South Peninsula and the Eastern Aleutian Island Management Districts. Areas examined focused on inshore and offshore waters that

historically have produced the majority of the commercial catch around Kodiak Island and along the Alaska Peninsula from Cape Douglas to Morzhovoi Bay and around the Eastern Aleutian Islands of Unimak, Akun, Akutan, Unalaska, and Umnak. Tow locations are illustrated in Appendices A.1 - A.22. From each tow hemolymph samples were taken from up to seven *C. bairdi* Tanner crab. Both male and female, adult and juvenile were sampled (Dead and recently injured crab were discarded from the sample and replaced with healthy crab). Hemolymph samples were collected using a 3cc syringe and 20 gauge needle. The needle was inserted halfway into the arthrodial membrane of one of the coxal joints of a leg, and several drops of hemolymph were withdrawn. Two drops were expressed onto labeled 25mm by 75mm glass slides and a smear was made by drawing a clean slide back and forth across the fluid. Separate syringes, needles and slides were used for each crab. The specimen slides were allowed to air dry and then stained (Diff-Quik stain from Dade Diagnostics Inc., Aquada, Puerto Rico 00602). Finally the specimen slides were allowed to air dry and were placed in slide boxes that prevented contact between adjacent slides. All other measured Tanner crabs in the tow were visually examined for signs of BCS. Infected crabs were recognized by the color of the underside of the crab. Normally the ventral surface of the crab's exoskeleton is slightly translucent with pinkish hues. In infected crabs these translucent areas of the exoskeleton become opaque and ivory in color; the pink hues appear brighter. The normally clear hemolymph of an infected crab becomes milky. In addition to the sample, hemolymph slides were prepared for all individuals suspected of being infected. Crabs suspected of being infected were not returned to the sea but retained and disposed of on land. Specimen slides were sent to the Alaska Department of Fish and Game, FRED Division Juneau Fish Pathology Laboratory for examination. A protocol for the sampling methods used appears in Appendix B.

## RESULTS

A total of 1,708 stained hemolymph slides from sampled *C. bairdi*, Tanner crabs, and 288 hemolymph slides from crabs suspected of being infected with BCS were prepared and examined for the presence of BCS. Stations where the crabs were collected are illustrated in Appendix A. The results from individual tows are presented in Appendix C for the sampled crabs and in Appendix D for the suspect crabs. Hemolymph samples from 1,183 of the sampled crabs and 278 samples from the suspect crabs were readable for BCS. The remaining samples from both crab groups were not readable because the hemolymph smears were too thin, the cells were distorted or the slides had broken during shipment. Observers did very well in identifying infected crabs in the late stages of the disease. BCS was found in 98% (272/278) of the samples examined from suspect crabs. Data on the prevalence of BCS by management district are summarized in Tables 1, 2, 3 and 4.

Table 1. Prevalence of Bitter Crab Syndrome (BCS) found in *C. bairdi* from the Kodiak District.

Section	Dates	BCS Prevalence among Crabs	
		Sampled	Visually Examined
Northeast	6/14-21/90	0/77	0/4298
Eastside	6/22-27/90	0/85	1/4897 (0.02%)
Southeast	6/25-7/5/90	0/85	5/2202 (0.22%)
Southwest	7/1-8/90	15/81 (18.52%)	152/5281 (2.88%)
Westside	8/27-9/16/90	2/141 (1.42%)	18/6362 (0.28%)
N. Mainland	9/12-17/90	0/93	20/5298 (0.38%)
Total		17/562 (3.02%)	196/28,338 (0.69%)

Sampled - Number of crabs positive for BCS / Number of crabs sampled.

Visually Examined - Number of suspect crabs positive for BCS / Number of crabs visually examined for clinical signs of BCS.

Table 2. Prevalence of Bitter Crab Syndrome (BCS) found in *C. bairdi* from the Chignik District.

Section	Dates	BCS Prevalence among Crabs	
		Sampled	Visually Examined
Ivanof Bay	8/20/90	3/18 (16.67%)	3/989 (0.30%)
Mitrofanina Bay	8/21/90	1/22 (4.55%)	13/500 (2.60%)
Chignik Bay	8/22-24/90	0/54	3/3792 (0.08%)
Kujulik Bay	8/25/90	0/18	0/920
Total		4/112 (3.57%)	19/6,201 (0.31%)

Sampled - Number of crabs positive for BCS / Number of crabs sampled.

Visually Examined - Number of suspect crabs positive for BCS / Number of crabs visually examined for clinical signs of BCS.

Table 3. Prevalence of Bitter Crab Syndrome (BCS) found in *C. bairdi* from the South Peninsula District.

Section	Dates	BCS Prevalence among Crabs	
		Sampled	Visually Examined
Morzhovoi Bay	8/2-9/17/90	0/85	0/4081
Sanak Island	8/3/90	0/15	3/331 (0.91%)
Cold Bay/Belkofsk	8/6-8/90	0/76	3/3851 (0.08%)
Pavlof/Volcano B.	8/9-13/90	3/149 (2.01%)	22/4392 (0.50%)
Beaver/Balboa Bay	8/14-18/90	1/38 (2.63%)	10/1375 (0.73%)
West Nagai	8/17-18/90	0/11	5/237 (2.11%)
Stepovak Bay	8/18-19/90	0/22	5/1095 (0.46%)
Total		4/396 (1.01%)	48/15,362 (0.31%)

Table 4. Prevalence of Bitter Crab Syndrome (BCS) found in *C. bairdi* from the Eastern Aleutian District.

Section	Dates	BCS Prevalence among Crabs	
		Sampled	Visually Examined
Akutan Bay	7/21/90	0/22	0/1789
Unalaska/Kalekta	7/21-23/90	0/18	3/1146 (0.26%)
Beaver Inlet	7/23-24/90	0/17	1/1861 (0.05%)
Usof Bay	7/25/90	0/9	0/605
Cape Idak	7/27/90	0/7	0/13
Inanudak Bay	7/28/90	0/3	0/9
Pumicestone Bay	7/29/90	0/6	0/162
Makushin Bay	7/29-30/90	0/31	5/1487 (0.34%)
Akun Bay	8/1/90	0/0	0/3
Total		0/113	9/7,075 (0.13%)

Sampled - Number of crabs positive for BCS / Number of crabs sampled.

Visually Examined - Number of suspect crabs positive for BCS / Number of crabs visually examined for clinical signs of BCS.

BCS was detected in all four of the management districts surveyed; Kodiak, Chignik, South Peninsula, and the Eastern Aleutian. In the Kodiak District, BCS was found to be present in all fishing sections except for the Northeast Section (Table 1, Appendix A.1., A.2., and A.3.). The Southwest Section (Table 1) had the greatest prevalence of BCS in both the sampled crabs (18.52%) and the highest percentage of suspect crabs (2.88%). Among the Southwest locations, BCS was found to be most prevalent in Alitak Bay (tows 140-157, Appendix A.6 and Appendix C) with 22.4% of the sampled crabs infected, and 3.4% of all crabs visually examined were diseased (Appendix D).

BCS was detected in all of the sections of the Chignik District with the exception of Kujulik Bay (Table 2, Appendix A.15.). The highest prevalences among the sampled crabs were found in the Ivanof Bay Section (16.67%) and the Mitrofanina Bay Section (4.55%). The highest prevalence among the visually examined crabs was found in Mitrofanina Bay (2.60%) and in Ivanof Bay (0.30%). BCS was also found in the visually examined crabs from Chignik Bay (Table 2, Appendix A. 13. and A.14.).

BCS was detected in all of the sections of the South Peninsula District with the exception of the Morzhovoi Bay Section (Table 3, Appendix A.8.). The highest prevalence among the sampled crabs was found in Beaver/Balboa Bay Section at 2.63% and in the Pavlov/Volcano Bay Section at 2.01% (Appendix A. 10, 11, 12.). The highest prevalence among the crabs visually examined for the disease was found in the West Nagai Section at 2.11% (Appendix A.12. and Table 3).

In the Eastern Aleutian District, BCS was not detected in any of the sampled crabs but was found among the crabs visually examined for signs of the disease in Makushin Bay, Unalaska/Kalekta and Beaver Inlet (Appendix A.22. and A.19.) at 0.34%, 0.26%, and 0.05%, respectively (Table 4).

A total of 297 crabs were found to have BCS; 25 of the sampled crabs and 272 of suspect crabs. One hundred and fifty-nine (53.5%) were male, 156 were sublegal size and 3 were legal size. One hundred and thirty-eight (46.5%) were female. The shell condition of all 297 of the infected crabs was classified as new, indicating that all of the crabs had molted during the last molting season (generally January through April) and that their shells had hardened.

Many of the slides which could not be read for the presence of BCS could be read for the presence of bacteria. Of the 1,708 hemolymph slides from sampled crabs for the entire study area 1619 could be read for the presence of bacterial rods indicating a bacteremia. 62/1619 (3.83%) were found to be positive the presence of bacterial rods. Of the 1,708 hemolymph slides from sampled crabs for the entire study area 1,183 could be read for both the presence of bacterial rods and the presence of BCS. 11/1,183 (0.93%) were found to be positive for the presence of bacterial rods and

25/1,183 (2.11%) were positive for BCS. 11 of the 1,158 samples (0.95%) negative for BCS were found to be positive for the presence of bacterial rods and none of the 25 samples positive for BCS were also positive the presence of bacterial rods (Table 5 and Appendix C).

The crabs sampled from both the Kodiak and the Eastern Aleutian Management Districts had bacterial infections of 6.47% (53/819) and 5.77% (9/156), respectively (Table 5). No bacterial infections were observed along the entire Gulf of Alaska side of the Alaska Peninsula which includes the Chignik and South Peninsula Management Districts (Table 5) along with the North Mainland Section of the Kodiak Management District (Table 6). In the Kodiak District bacterial infections were found at all sections except the Westside and North Mainland (Table 6). The greatest prevalence was found among crabs from the Southeast and Southwest Sections at 17.2% and 10.7% (Table 6). In the Eastern Aleutian District the Unalaska/Kalekta Section had the greatest prevalence of bacterial infections at 17.1% (Table 7).

Tables 6, 7, and 8 break down the samples from the different districts and sections into three classes: sublegal males, females, and legal males. Prevalence in legal males was highest at 6.9%, followed by sublegal males at 4.2%, and females at 3.0% (Table 8).

Tables 9, 10, and 11 group the samples from the different districts and sections into four classes based on shell condition: soft (recently molted), new (shell hardened after recent molt), old (crab skipped one molt) and very old (crab skipped two or more molts). In the Kodiak Management District, for all sections combined, the prevalence of bacterial infections were found to be similar in each class with the exception of softshell crab, which had 0%. Within the Kodiak Management District, all the infected crabs with old and very old shells came from the Eastside and Southeast Sections. All other infected crabs were new shelled (Table 9). In the Eastern Aleutian Management District all of the infected crabs were new shelled (Table 10).

Due to poor slide smear preparation (436/1708) and handling (89/1708) 32% of the hemolymph smears could not be read for the presence of BCS. This effectively prevented several of the locations from being sampled or reduced the sample size (Appendix C).

## DISCUSSION

Meyers and Bishop (1991b) report that BCS in *C. bairdi* Tanner Crab was found in all four of the Tanner crab management districts surveyed. Visual sorting of subsampled crabs into apparently normal and clinically diseased groups, followed by confirmation of

Table 5. Prevalence of Bitter Crab Syndrome (BCS) and bacterial rods found in *C. bairdi* from the Kodiak, Chignik, South Peninnsula, and East Aleutian Districts.

District	Number of Crabs Sampled	Number of Crabs			
		Readable for BCS and rods (BCS +) (rods +)	Only Readable for BCS (BCS +)	Only Readable for rods (rods +)	Unreadable for BCS and rods
Kodiak	849	562(17)(11)	0(0)	257(42)	30
Chignik	162	112(4)(0)	0(0)	42(0)	8
South Peninsula	531	396(4)(0)	0(0)	94(0)	41
East Aleutian	166	113(0)(0)	0(0)	43(9)	10
Total	1708	1183(25)(11)	0(0)	436(51)	89

Table 6. Prevalence of bacterial infection found in *C. bairdi* from the Kodiak District among sublegal males, females, and legal males.

Section	Total	Sublegal Males	Females	Legal Males
<b>Northeast</b>				
# specimens infected	8	5	3	0
total specimens	147	93	52	2
percent infected	5.4	5.4	5.8	0.0
<b>Eastside</b>				
# specimens infected	7	5	2	0
total specimens	131	95	25	11
percent infected	5.3	5.3	8.0	0.0
<b>Southeast</b>				
# specimens infected	25	13	8	4
total specimens	145	93	32	20
percent infected	17.2	14.0	25.0	20.0
<b>Southwest</b>				
# specimens infected	13	11	2	0
total specimens	122	76	45	1
percent infected	10.7	14.5	4.4	0.0
<b>Westside</b>				
# specimens infected	0	0	0	0
total specimens	147	83	58	6
percent infected	0.0	0.0	0.0	0.0
<b>North Mainland</b>				
# specimens infected	0	0	0	0
total specimens	127	69	53	5
percent infected	0.0	0.0	0.0	0.0
<b>All Sections</b>				
# specimens infected	53	34	15	4
total specimens	819	509	265	45
percent infected	6.5	6.7	5.7	8.9

Table 7. Prevalence of bacterial infection found in *C. bairdi* from the Eastern Aleutian District among sublegal males, females, and legal males.

Section	Total	Sublegal Males	Females	Legal Males
<b>Akutan</b>				
# specimens infected	1	1	0	0
total specimens	25	14	11	0
percent infected	4.0	7.1	0.0	
<b>Unalaska/Kalekta</b>				
# specimens infected	6	4	2	0
total specimens	36	24	12	0
percent infected	16.7	16.7	16.7	
<b>Beaver Inlet</b>				
# specimens infected	1	0	1	0
total specimens	25	15	10	0
percent infected	4.0	0.0	10.0	
<b>Usof Bay</b>				
#specimens infected	1	0	1	0
total specimens	11	6	5	0
percent infected	9.1	0.0	20.0	
<b>Cape Idak</b>				
# specimens infected	0	0	0	0
total specimens	7	3	2	2
percent infected	0.0	0.0	0.0	0.0
<b>Inanudak Bay</b>				
# specimens infected	0	0	0	0
total specimens	5	2	3	0
percent infected	0.0	0.0	0.0	
<b>Pumicestone Bay</b>				
# specimens infected	0	0	0	0
total specimens	10	6	4	0
percent infected	20.0	16.7	25.0	
<b>Makushin Bay</b>				
# specimens infected	0	0	0	0
total specimens	37	23	13	1
percent infected	0.0	0.0	0.0	0.0
<b>All Sections</b>				
# specimens infected	9	5	4	0
total specimens	156	93	60	3
percent infected	5.8	5.4	6.7	0.0

Table 8. Prevalence of bacterial infection found in *C. bairdi* among sublegal males, females, and legal males.

District	Total	Sublegal Males	Females	Legal Males
<b>Kodiak</b>				
# specimens infected	53	34	15	4
total specimens	819	509	265	45
percent infected	6.5	6.7	5.7	8.9
<b>Chignik</b>				
# specimens infected	0	0	0	0
total specimens	154	91	61	2
percent infected	0.0	0.0	0.0	0.0
<b>South Peninsula</b>				
# specimens infected	0	0	0	0
total specimens	490	240	240	8
percent infected	0.0	0.0	0.0	0.0
<b>Eastern Aleutian</b>				
# specimens infected	9	5	4	0
total specimens	156	93	60	3
percent infected	5.8	5.4	6.7	0.0
<b>All Districts</b>				
# specimens infected	62	39	19	4
total specimens	1619	930	626	58
percent infected	3.8	4.2	3.0	6.9

Table 9. Prevalence of bacterial infection found in *C. bairdi* from the Kodiak District among crabs with: soft = 0, new = 1, old = 2 and very old = 3 shells.

District	Total	-----Shell Condition-----			
		0	1	2	3
<b>Northeast</b>					
# specimens infected	8	0	8	0	0
total specimens	147	0	135	6	6
percent infected	5.4		5.9	0.0	0.0
<b>Eastside</b>					
# specimens infected	7	0	2	2	3
total specimens	131	3	75	30	21
percent infected	5.3	0.0	2.6	6.7	14.3
<b>Southeast</b>					
# specimens infected	25	0	19	4	2
total specimens	145	0	104	23	18
percent infected	17.2		18.2	17.4	11.1
<b>Southwest</b>					
# specimens infected	13	0	13	0	0
total specimens	122	1	102	5	14
percent infected	10.7	0.0	12.7	0.0	0.0
<b>Westside</b>					
# specimens infected	0	0	0	0	0
total specimens	147	1	112	17	17
percent infected	0.0	0.0	0.0	0.0	0.0
<b>North Mainland</b>					
# specimens infected	0	0	0	0	0
total specimens	127	4	79	19	25
percent infected	0.0	0.0	0.0	0.0	0.0
<b>All Sections</b>					
# specimens infected	53	0	42	6	5
total specimens	819	9	609	100	101
percent infected	6.5	0.0	6.9	6.0	5.0

Table 10. Prevalence of bacterial infection found in *C. bairdi* from the Eastern Aleutian District among crabs with: soft = 0, new = 1, old = 2 and very old = 3 shells.

District	Total	-----Shell Condition-----			
		0	1	2	3
<b>Akutan</b>					
# specimens infected	1	0	1	0	0
total specimens	25	0	22	2	0
percent infected	4.0		4.5	0.0	
<b>Unalaska/Kalekta</b>					
# specimens infected	6	0	6	0	0
total specimens	36	0	35	1	0
percent infected	16.7		17.1	0.0	
<b>Beaver Inlet</b>					
# specimens infected	1	0	1	0	0
total specimens	25	0	25	0	0
percent infected	4.0		4.0		
<b>Usof Bay</b>					
#specimens infected	1	0	1	0	0
total specimens	11	0	11	0	0
percent infected	9.1		9.1		
<b>Cape Idak</b>					
# specimens infected	0	0	0	0	0
total specimens	7	0	2	5	0
percent infected	0.0		0.0	0.0	
<b>Inanudak Bay</b>					
# specimens infected	0	0	0	0	0
total specimens	5	0	3	2	0
percent infected	0.0		0.0	0.0	
<b>Pumicestone Bay</b>					
# specimens infected	0	0	0	0	0
total specimens	10	0	10	0	0
percent infected	0.0		0.0		
<b>Makushin Bay</b>					
# specimens infected	0	0	0	0	0
total specimens	37	0	24	7	6
percent infected	0.0		0.0	0.0	0.0
<b>All Sections</b>					
# specimens infected	9	0	9	0	0
total specimens	156	0	132	17	7
percent infected	5.8		6.8	0.0	0.0

Table 11. Prevalence of bacterial infection found in *C. bairdi* from the Kodiak, Chignik, South Peninsula and Eastern Aleutian Districts among crabs with: soft = 0, new = 1, old = 2 and very old = 3 shells.

District	Total	-----Shell Condition-----			
		0	1	2	3
<b>Kodiak</b>					
# specimens infected	53	0	42	6	5
total specimens	819	9	609	100	101
percent infected	6.5	0.0	6.9	6.0	5.0
<b>Chignik</b>					
# specimens infected	0	0	0	0	0
total specimens	154	0	126	7	21
percent infected	0.0	0.0	0.0	0.0	0.0
<b>South Peninsula</b>					
# specimens infected	0	0	0	0	0
total specimens	490	0	432	23	35
percent infected	0.0	0.0	0.0	0.0	0.0
<b>Eastern Aleutian</b>					
# specimens infected	9	0	9	0	0
total specimens	156	0	132	17	7
percent infected	5.8	0.0	6.8	0.0	0.0
<b>All Districts</b>					
# specimens infected	62	0	51	6	5
total specimens	1,619	9	1,299	147	164
percent infected	3.8	0.0	3.9	4.1	3.0

positive crabs using hemolymph smears, detected the presence of BCS in a greater number of sections than the hemolymph smears taken from the sampled crabs. This discrepancy was probably due to the greater number of visually examined crabs at each location. Had the sample sizes been equal the hemolymph smears taken from the sampled crabs might have detected the presence of BCS in its subclinical as well as clinical stages. Observers were quite accurate in recognizing diseased crabs; however, in nearly all cases these crabs were in the terminal stages of the disease. Consequently, the detection prevalence is conservative in the sample of visually examined crabs, since less severely infected crabs would appear more normal and could be missed. In all sections where sampled crabs were found to be positive for BCS, infected crabs were also found by visual inspection.

The prevalence of BCS generally decreased from the Kodiak Island area along the Gulf of Alaska side of the South Alaska Peninsula to the Eastern Aleutian Islands. Meyers and Bishop (1991a) reported that other samples collected in the Bering Sea indicate the prevalence of BCS in *C. opilio* generally increased towards the northwest portion of its range in United States' waters.

An additional finding was a substantial number of randomly selected crabs with apparent bacteremias from the Kodiak and the Eastern Aleutian Islands areas. Bacterial rods in the peripheral hemolymph are generally considered to be opportunistic gaining entry into a host debilitated by poor environmental conditions and/or mechanical injury. Such infections generally result in mortality (Meyers et al, 1991b). Dead and recently injured crabs were not included in the sample, and all crabs in the catch (except those suspected of being infected with BCS) were returned to the sea within an hour, thus eliminating sampling technique as a cause of bacterial infection. Crabs having BCS will commonly have a secondary infection, however none of the sampled crabs positive for BCS were also positive for bacterial infection and 0.95% (11 of 1,158) which were negative for BCS were positive for bacterial infection. It has suggested that the bacteremias could have resulted from additional stressful factors such as handling injuries by the commercial crab fishery which return females and sub-legal sized males to the sea after sorting (Meyers et al, 1991b). Other commercial fisheries that handle and return all crabs to the sea include those using pot and bottom trawl gear targeting on groundfish species, such as Pacific cod. Other causes could include abrasion or cumulative damage to older shells allowing the bacteria to gain access.

If the bacteremias were a result of handling during the commercial crab fisheries one would expect a greater prevalence of bacteremia in female and sub-legal size males than in legal size males that are removed by the fishery. The results from the Kodiak District (Table 6) show that in while this was the case in several sections, the overall prevalence of bacterial infections for all sections in the Kodiak District was highest among legal males. In the Eastern Aleutian District the greatest prevalence was among sublegal males

and females (Table 7), however the results are not significant due to the small sample size of legal males. No bacteremias were found in the Chignik and South Peninsula Districts (Table 8). For all districts combined the greatest prevalence of bacterial infections was found among legal males (Table 8). Most of the survey was conducted in Alaska waters closed to the use of bottom trawl gear. However, the use of pot gear targeting on groundfish in the sample areas has greatly increased during the past three years. If natural wear and damage on aging crab shells were a factor a greater prevalence of infections would be expected among crabs which had skipped one (old shell condition) or more molts (very old shell condition) than among recently molted crabs. The results in Tables 9, 10, and 11 do not indicate that bacterial infections are more common among older crab (except in the Eastside Section of the Kodiak Management District), if anything, they appear more common among recently molted crab. This might be explained by mechanical injuries to the cuticle that can occur during molt.

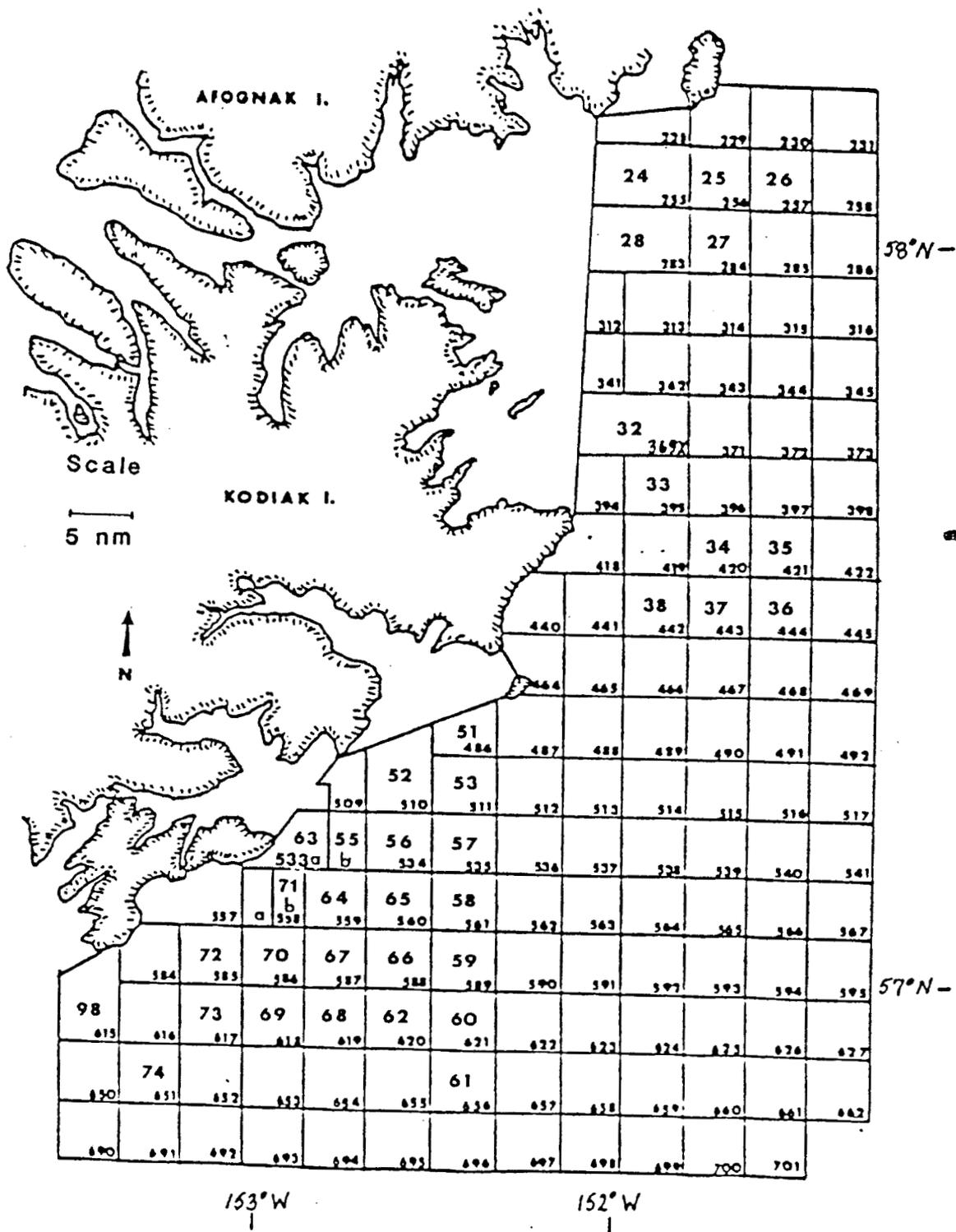
Most of the poor slide smear preparations were made in during the early dates of the survey. With practice the quality of the hemolymph smears greatly improve. In order to increase the number of readable smears we suggest that: 1) personnel should practice making smears first, using the technique described in Appendix B; 2) the smears should be protected from exposure to saltwater, and 3) the slides be carefully padded within the slide boxes to prevent breakage. For the purpose of statistical testing the crabs to be sampled should be selected using a random number table.

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- Meyers, T.R. and four coauthors. 1990. Distribution of bitter crab dinoflagellate syndrome in southeast Alaskan Tanner crabs *Chionoecetes bairdi*. *Diseases of Aquatic Organisms* 9:37-43.
- Meyers, T.R. and Bishop, G. 1991a. Report of Laboratory Examination of Accession No. 91-0542 (unpublished). Alaska Department of Fish and Game, Juneau Fish Pathology Laboratory, FRED Division, Juneau.
- Meyers, T.R. and Bishop, G. 1991b. Report of Laboratory Examination of Accession No. 91-0553 (unpublished). Alaska Department of Fish and Game, Juneau Fish Pathology Laboratory, FRED Division, Juneau.

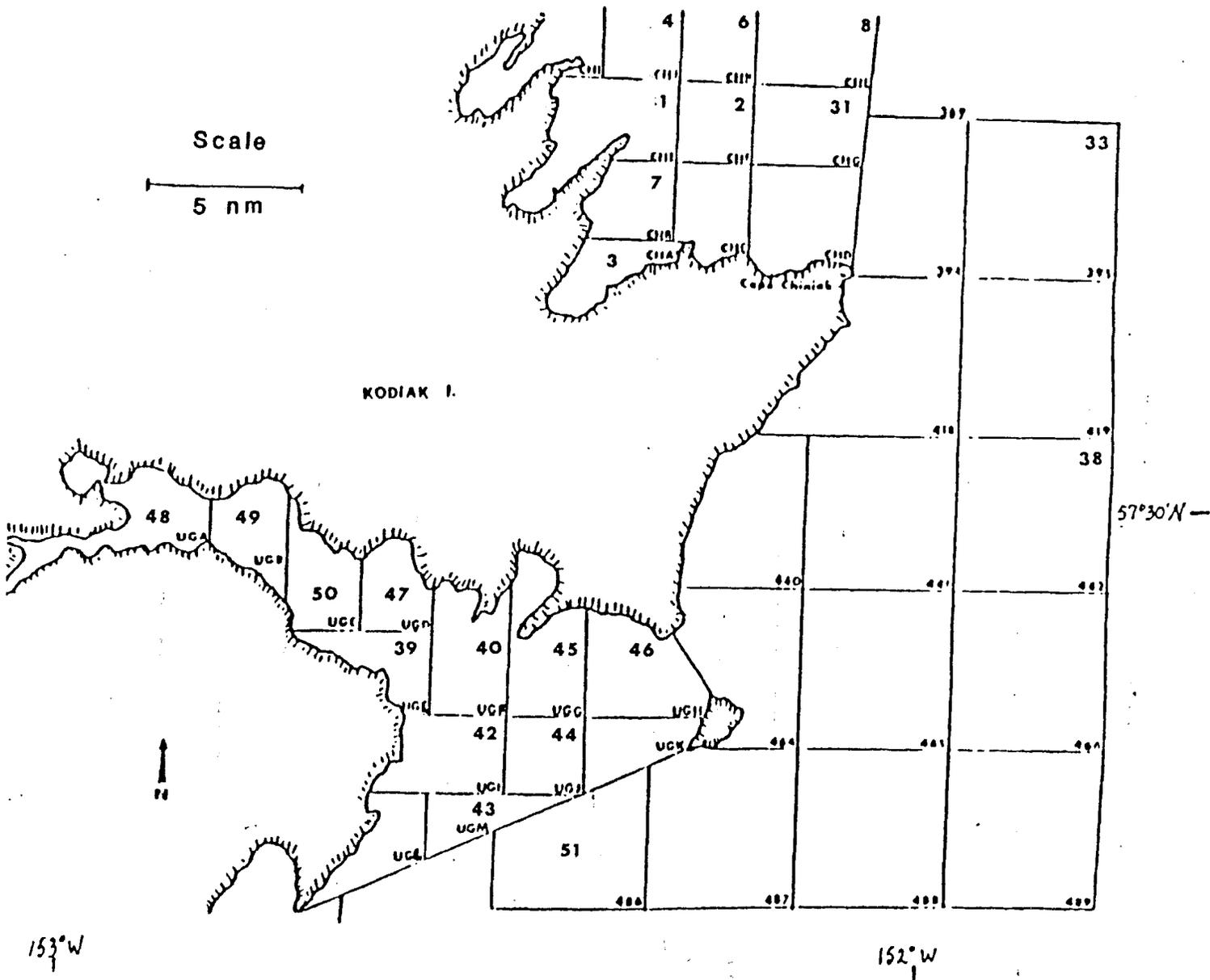
APPENDICES





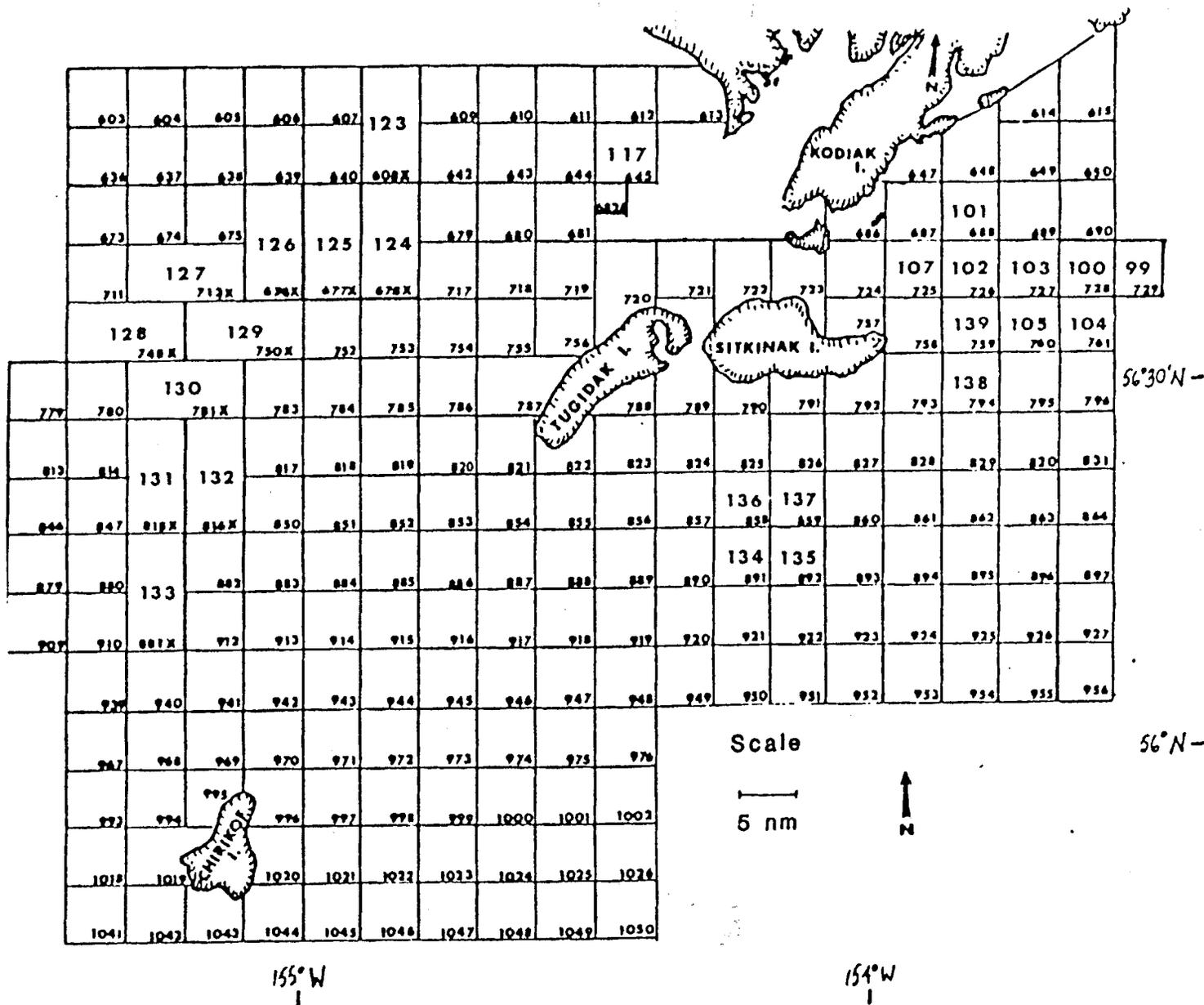
Appendix A. 2. Locations, tow numbers, and station designations (smaller characters) of hauls completed in the Northeast section (tows 24-38), the Eastside section (tows 51-53 and 55-74), and the Southeast section (tow 94) of the Kodiak District.

Appendix A. 3. Locations, tow numbers, and station designations (smaller characters) of hauls completed in the Northeast section (tows 1-4, 6, 8, 31, and 38) and the Eastside section (tows 39-40 and 42-51) of the Kodiak District.

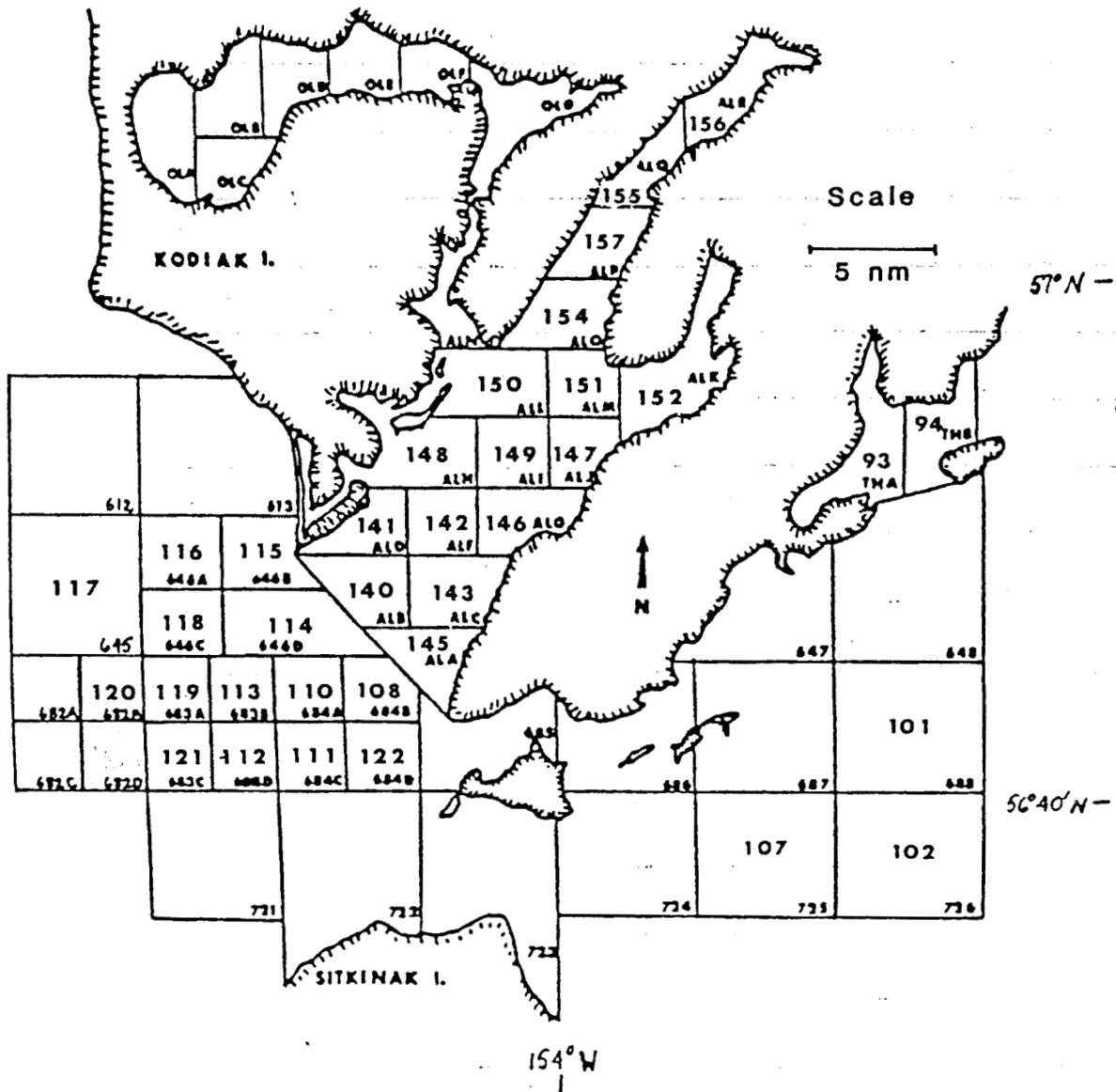




Appendix A. 5. Locations, tow numbers, and station designations (smaller characters) of hauls completed in the Southeast section (tows 99-105 and 134-139) and the southwest section (tows 117 and 123-133) of the Kodiak District.

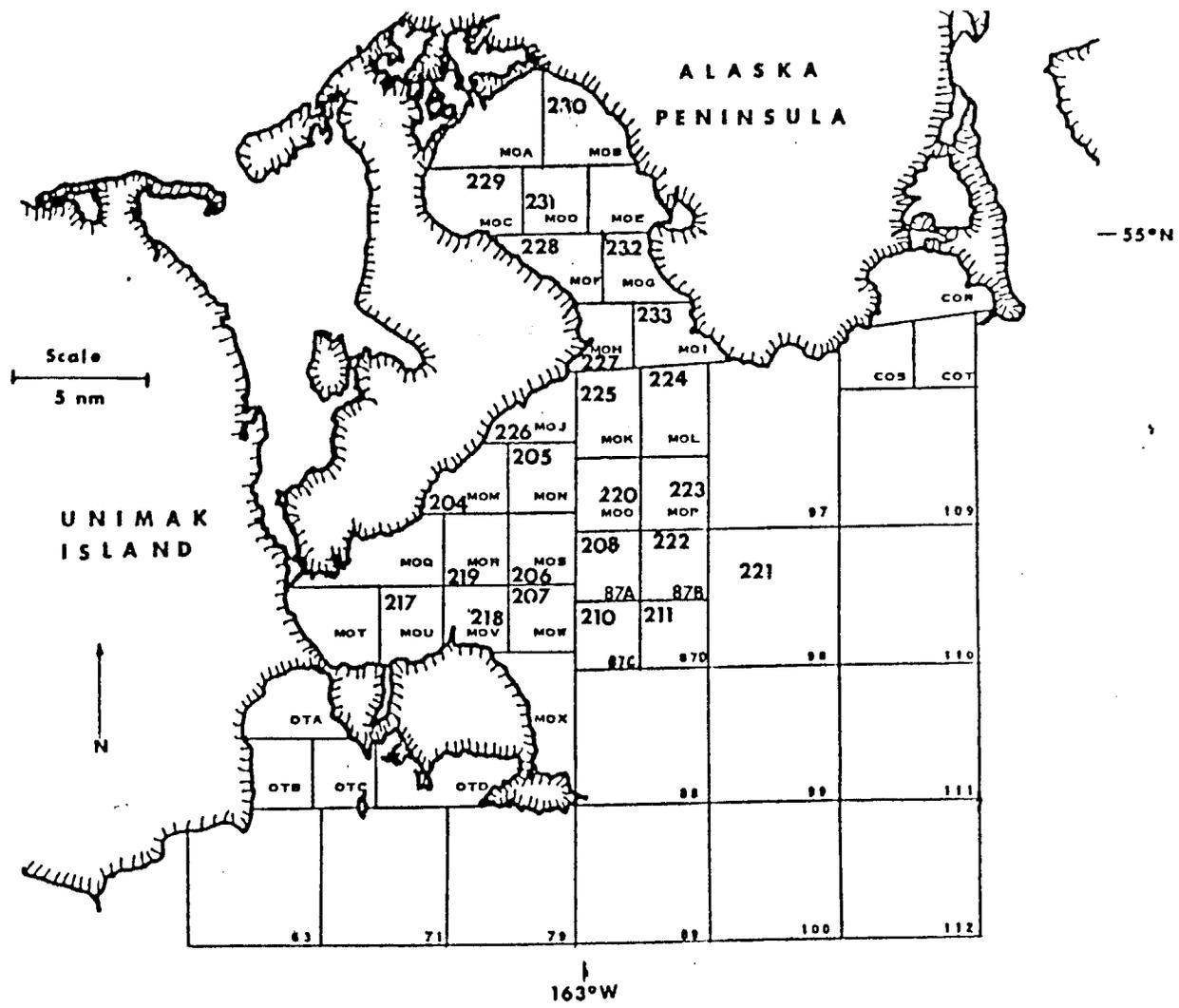


Appendix A. 6. Locations, tow numbers, and station designations (smaller characters) of hauls completed in the Southeast section (tows 93-94, 101-102, and 107) and the Southwest section (tows 108, 110-122, 140-143, 145-152, and 154-157) of the Kodiak District.

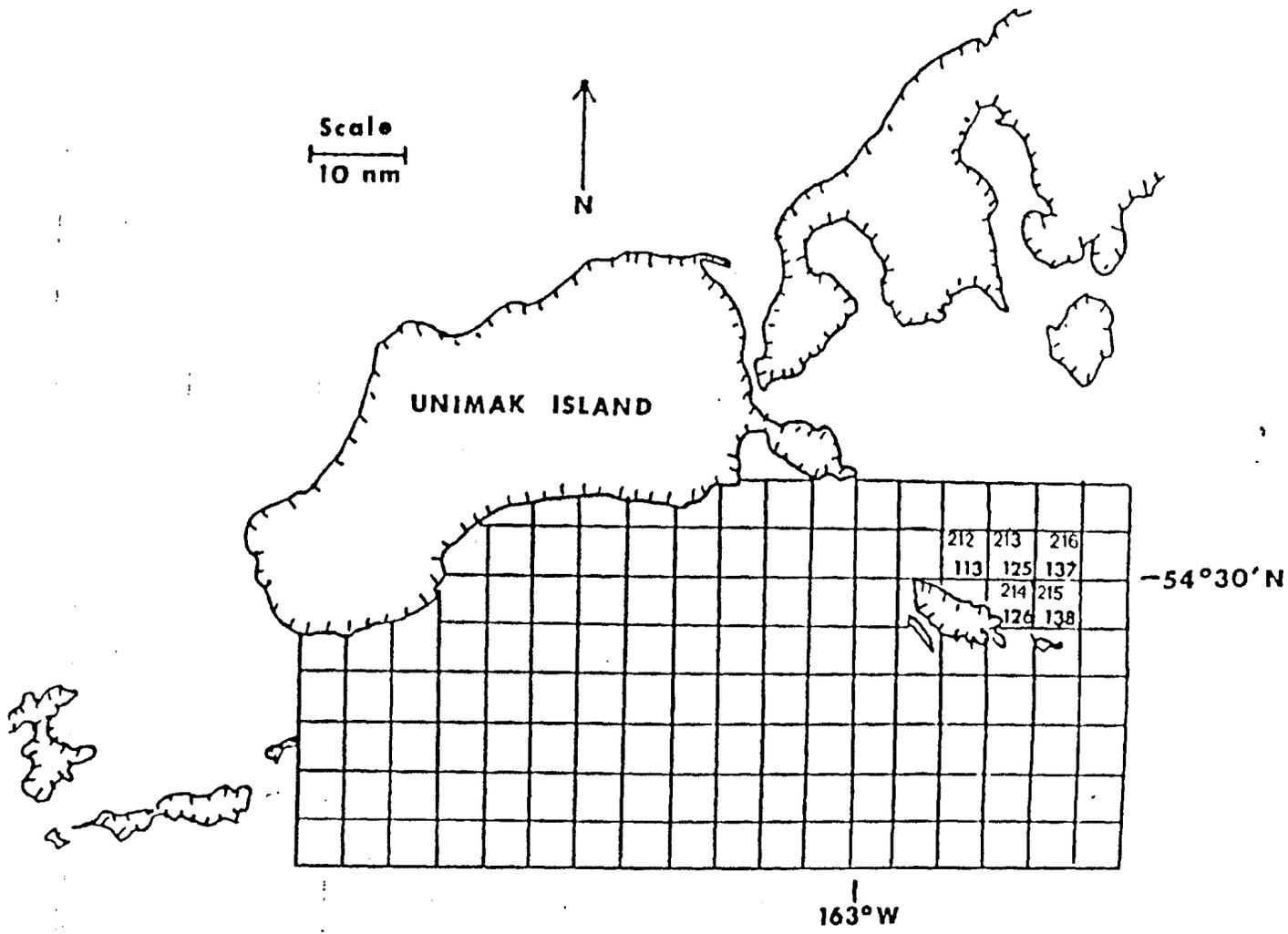




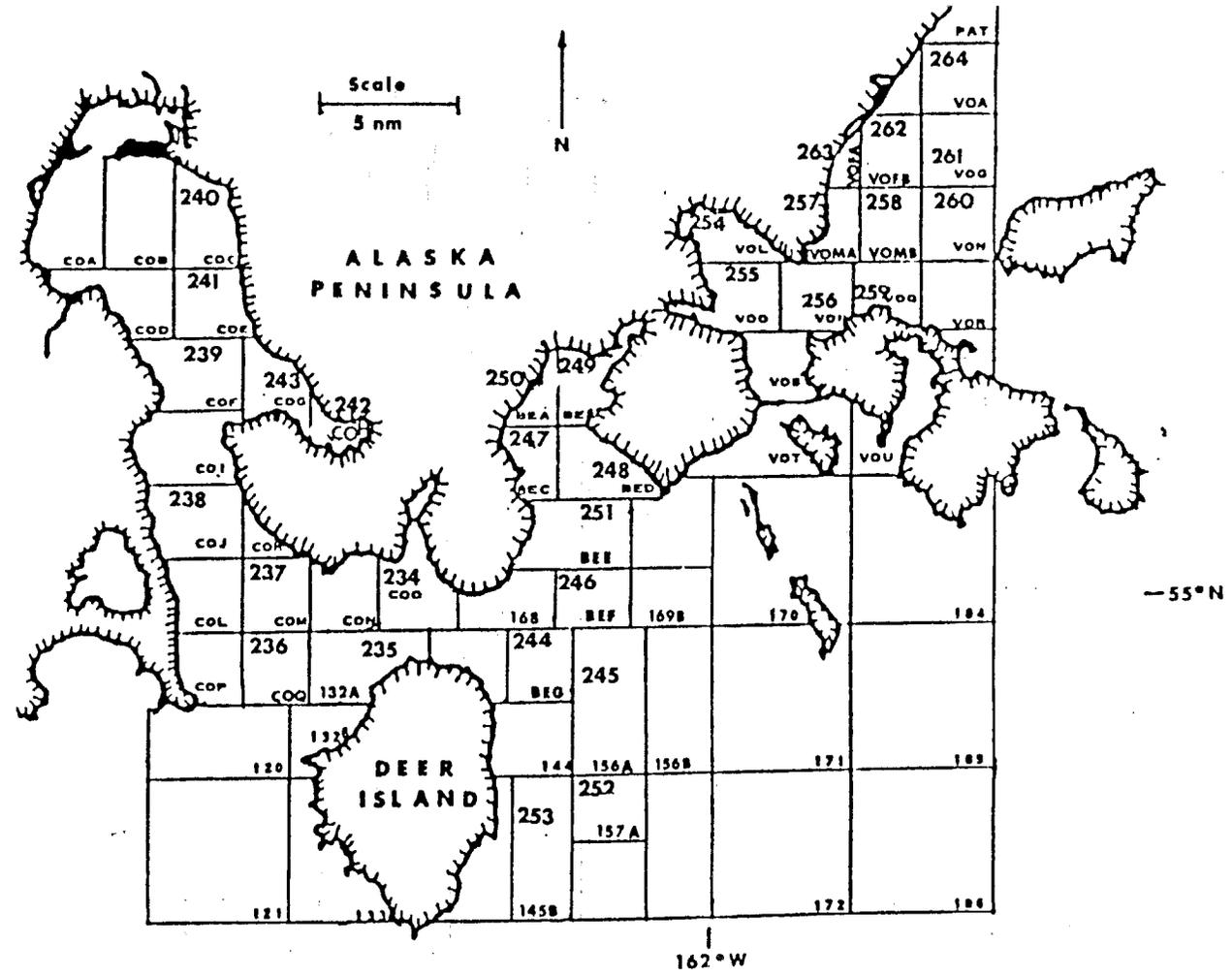
Appendix A. 8. Locations, tow numbers, and station designati (smaller characters) of hauls completed in the Morzhovoi E section (tows 204-208, 210-211, and 217-233) of the Sc Peninsula District.

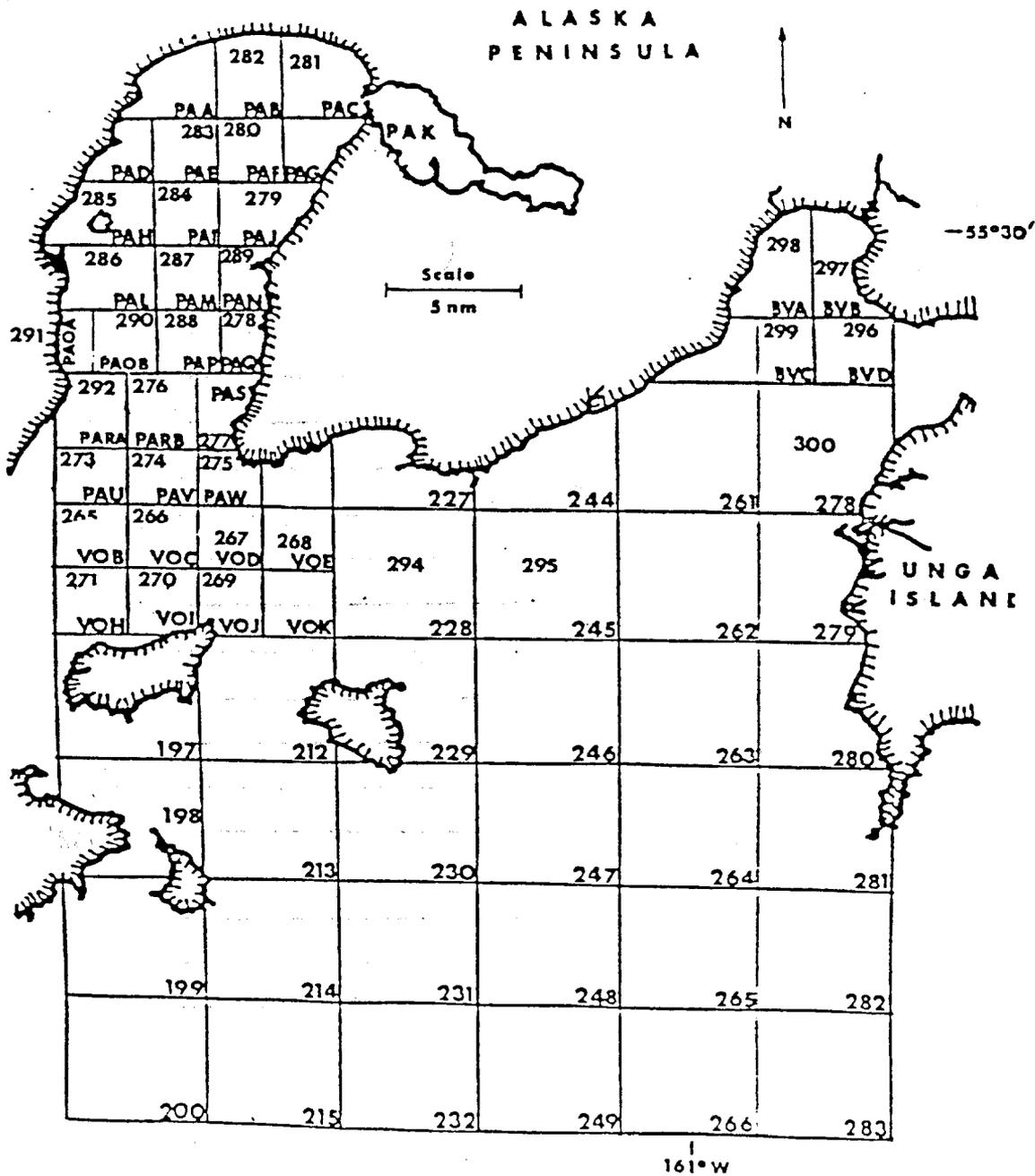


Appendix A. 9. Locations, tow numbers, and station designations (smaller characters) of hauls completed in the Sanak Island section (tows 212-216) of the South Peninsula District.



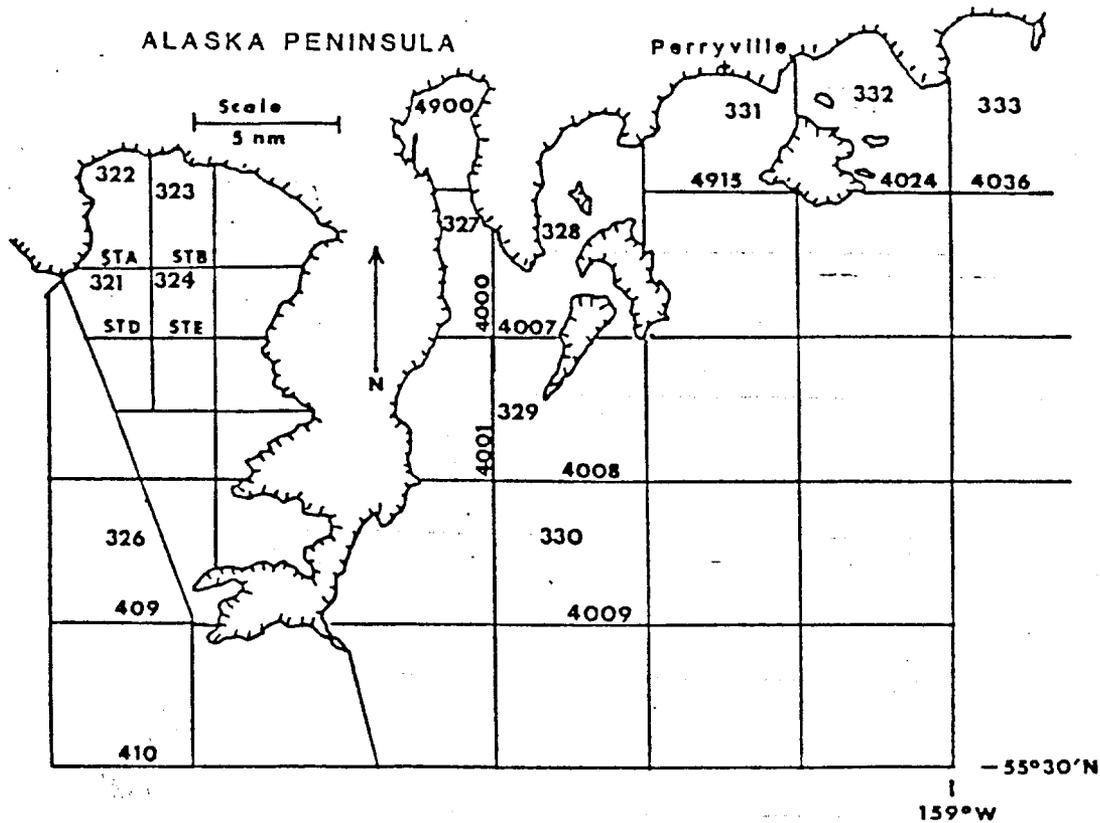
Appendix A. 10. Locations, tow numbers, and station designations (smaller characters) of hauls completed in the Cold Bay/Belkofsk section (tows 234-253) and the Pavlof/Volcano section (tows 254-264 and 272) of the South Peninsula District.





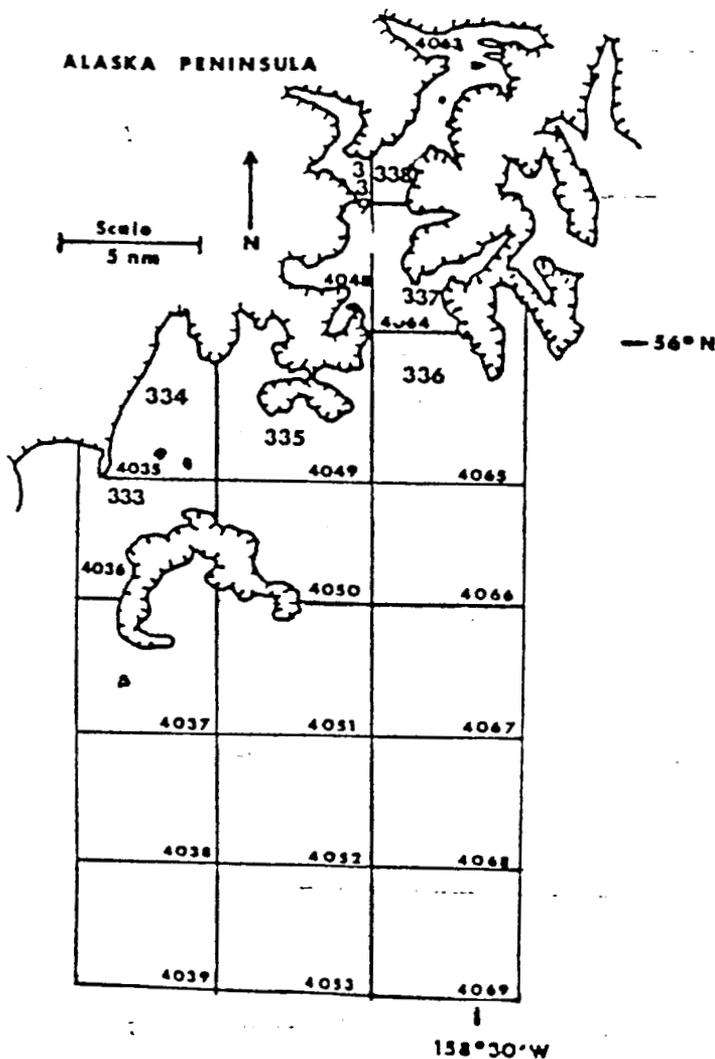
Appendix A. 11. Locations, tow numbers, and station designations (smaller characters) of hauls completed in the Pavlof/Volcano Bay section (tows 265-271 and 273-295) and the Beaver/Balboa Bay section (tows 296-300) of the South Peninsula District.



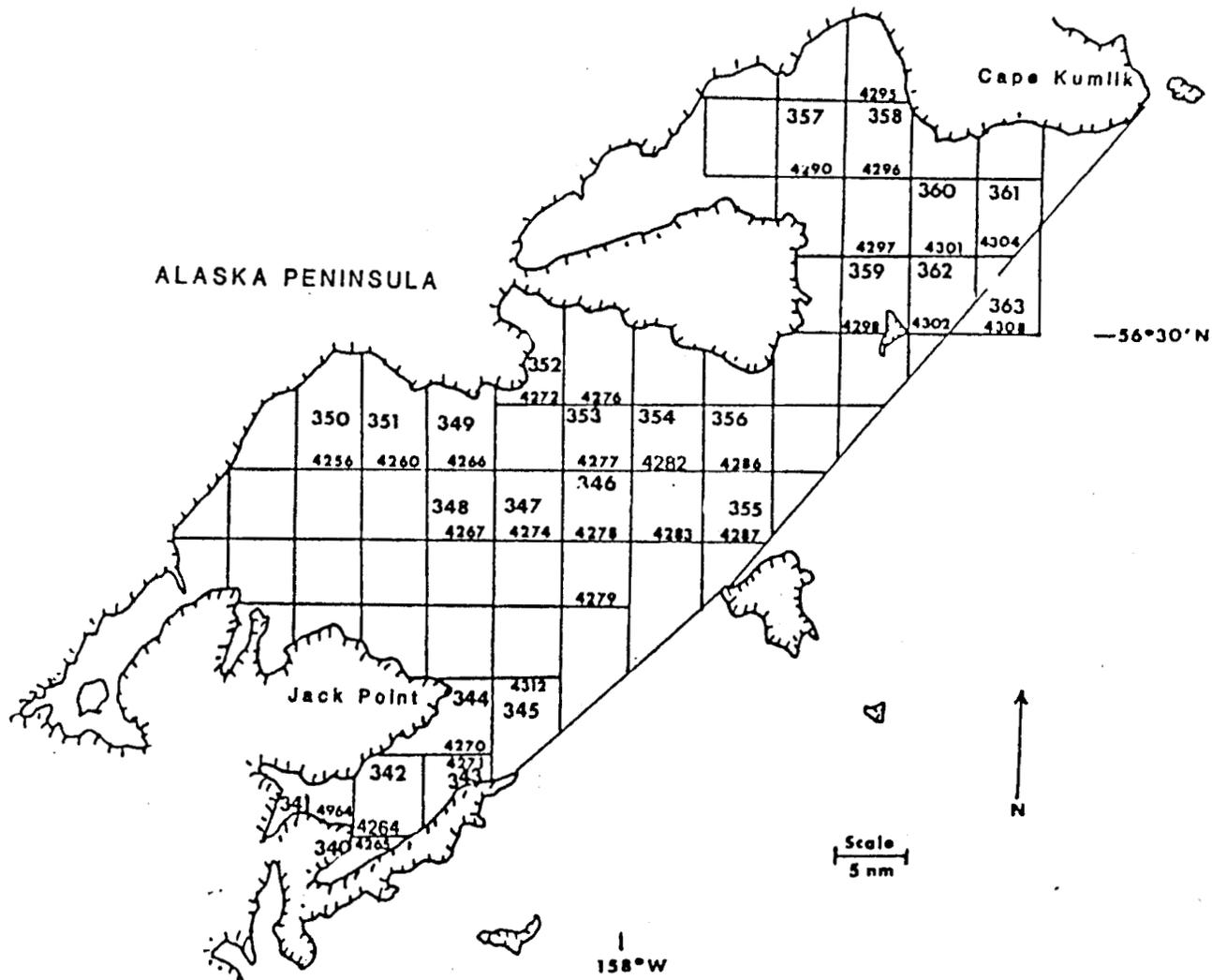


Appendix A. 13. Locations, tow numbers, and station designations (smaller characters) of hauls completed in the Stepovak section (tows 321-324) of the South Peninsula District and the Ivanof section (tows 327-333) of the Chignik District.

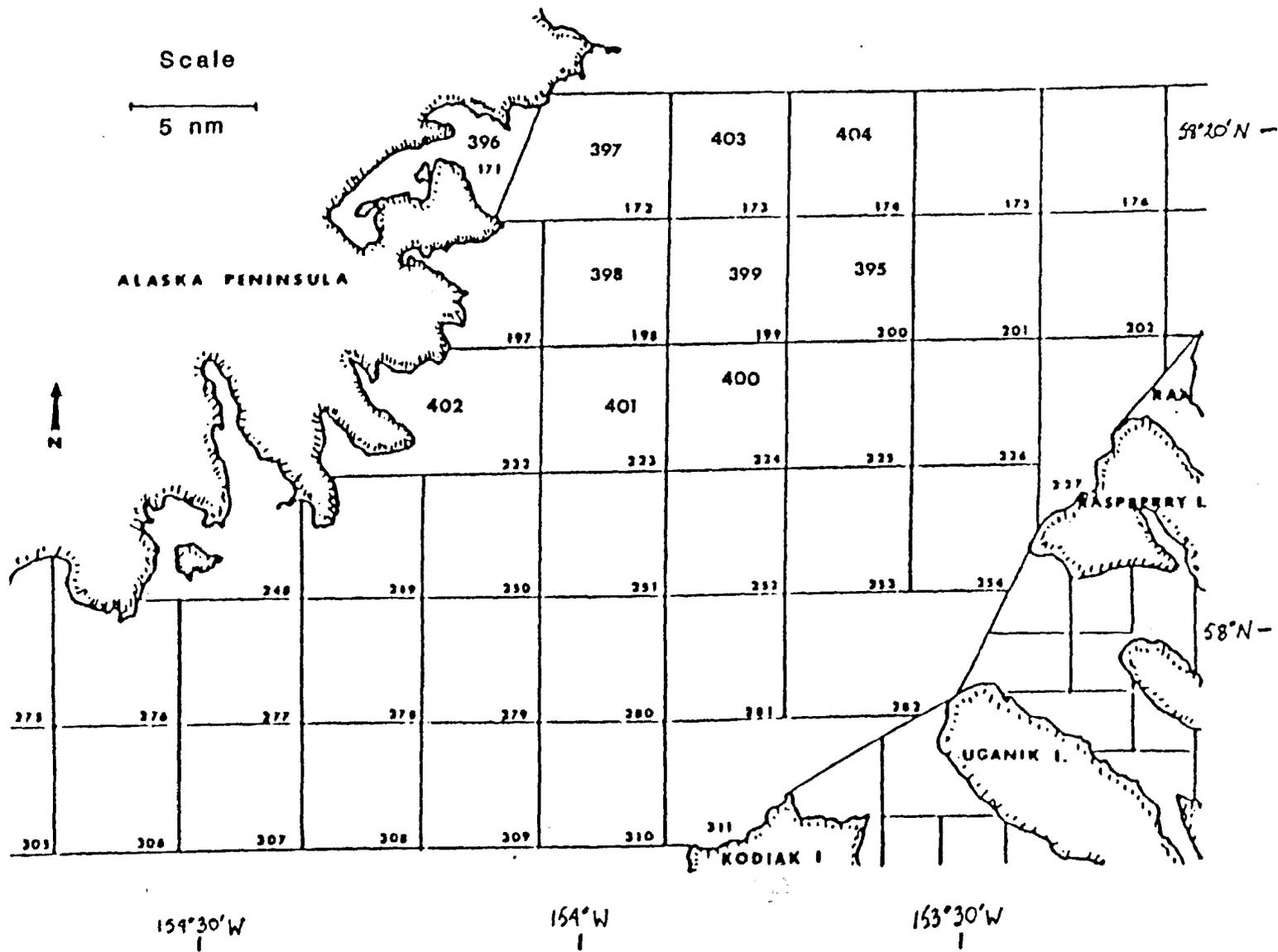
Appendix A. 14. Locations, tow numbers, and station designations (smaller characters) of hauls completed in the Stepovak section (tow 333) of the South Peninsula District and the Mitrofanina section (tows 334-339) of the Chignik District.



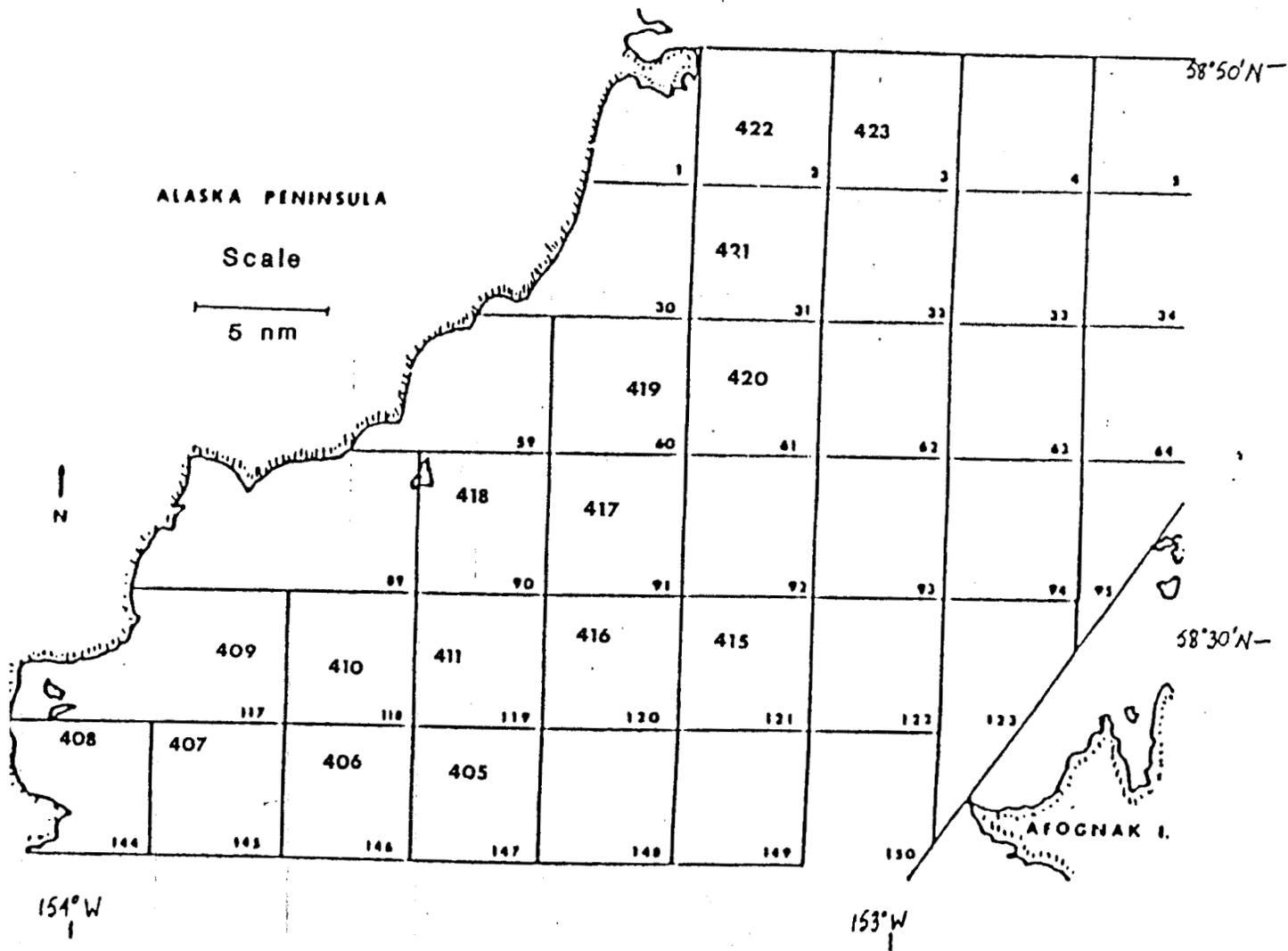
Appendix A. 15. Locations, tow numbers, and station designations (smaller characters) of hauls completed in the Chignik section (tows 340-356) and the Kujulik section (tows 357-363) of the Chignik District.



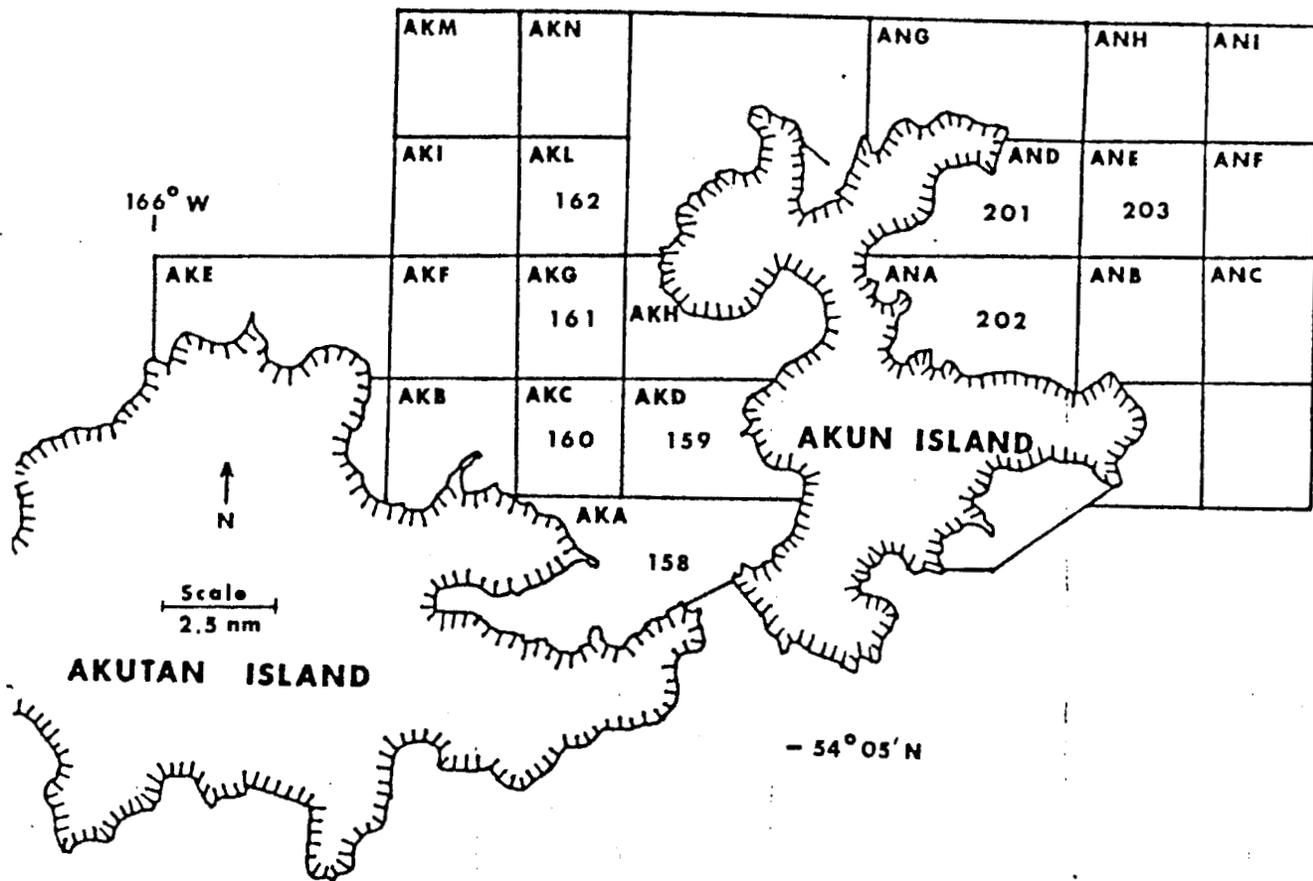
Appendix A. 16. Locations, tow numbers, and station designations (smaller characters) of hauls completed in the North Mainland section (tows 395-404) of the Kodiak District.



Appendix A. 17. Locations, tow numbers, and station designations (smaller characters) of hauls completed in the North Mainland section (tows 405-411 and 515-423) of the Kodiak District.

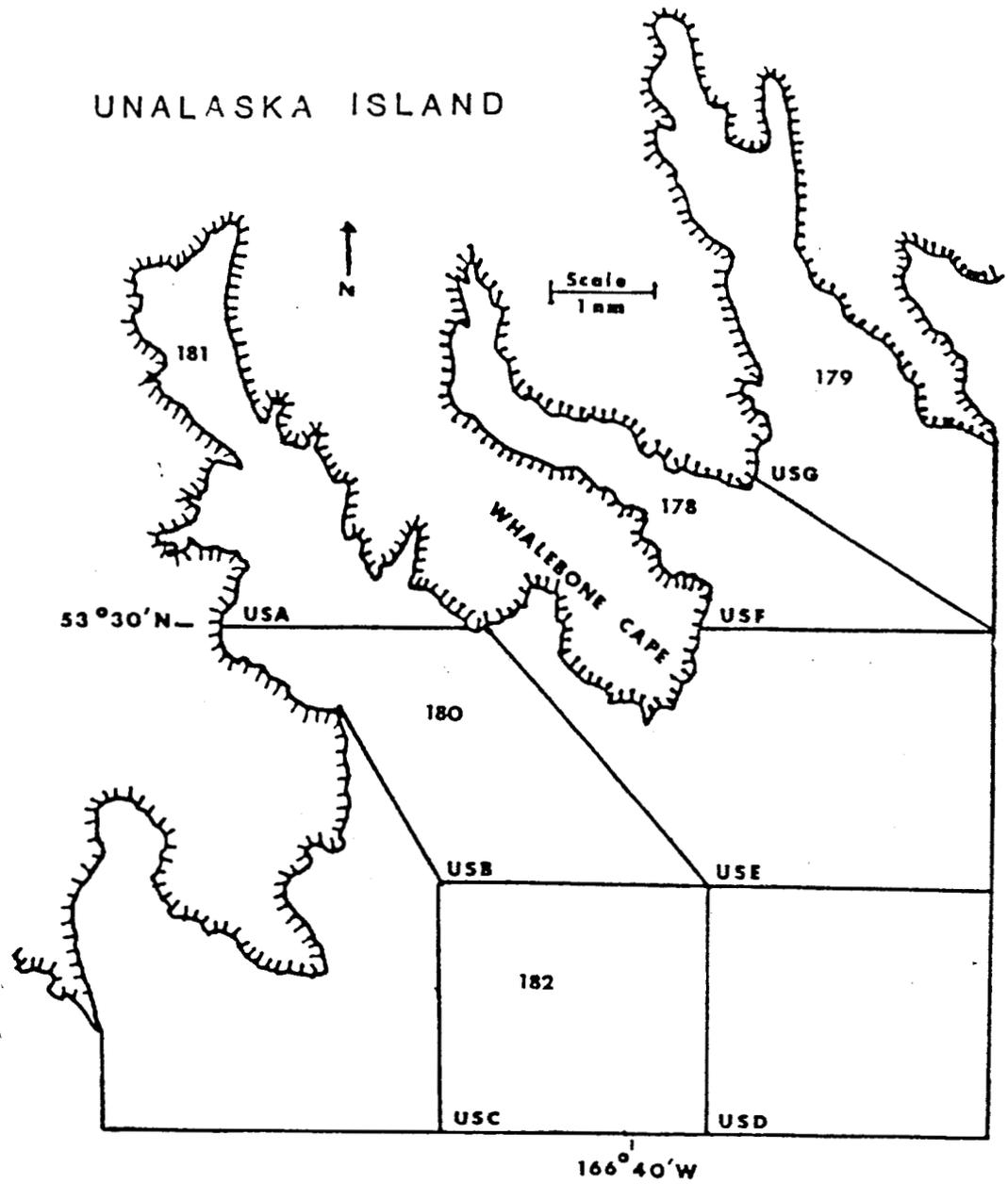


Appendix A. 18. Locations, tow numbers, and station designations (smaller characters) of hauls completed in the Akutan Island section (tows 158-162) and the Akun Bay section (tows 201-203) of the Eastern Aleutian District.



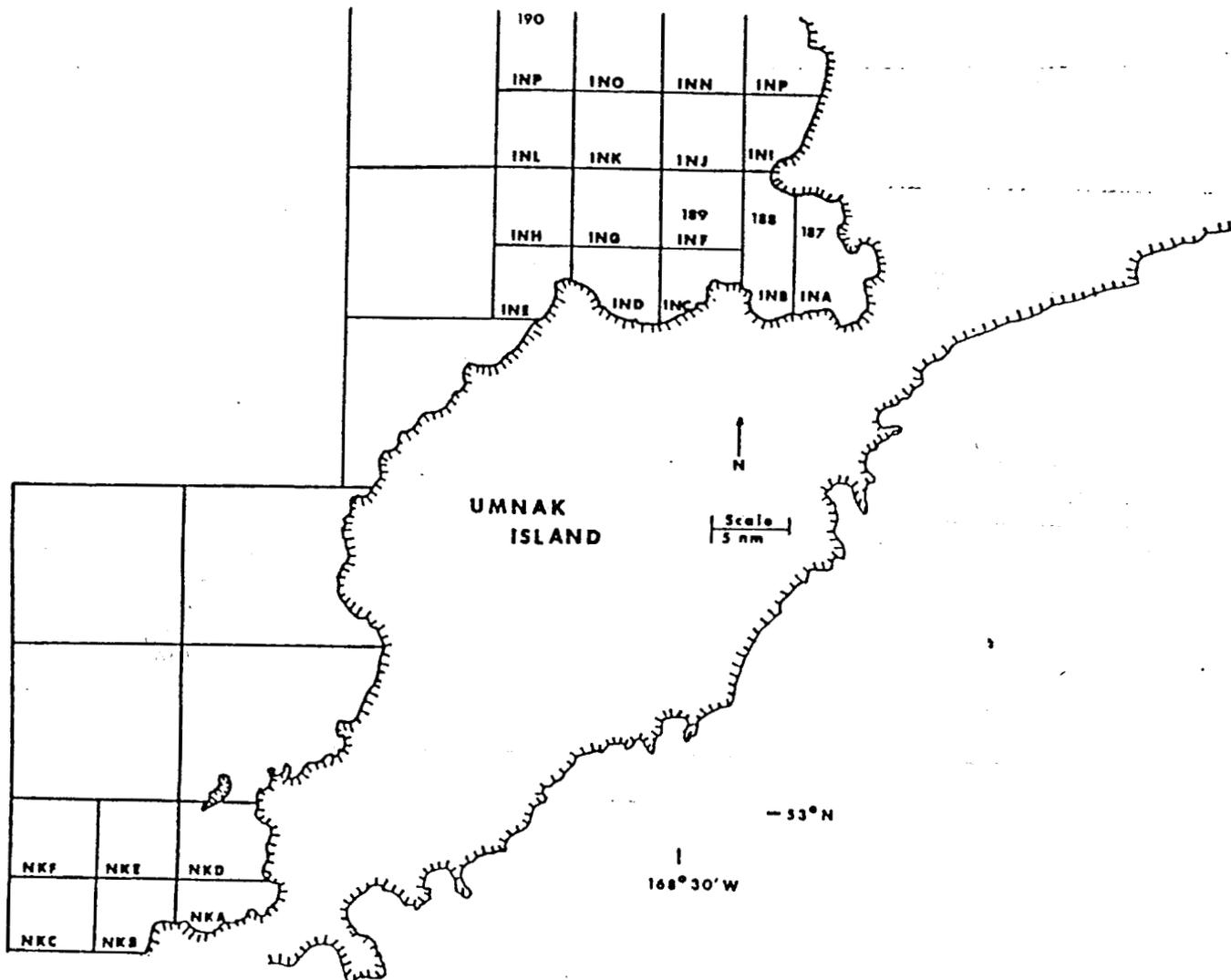


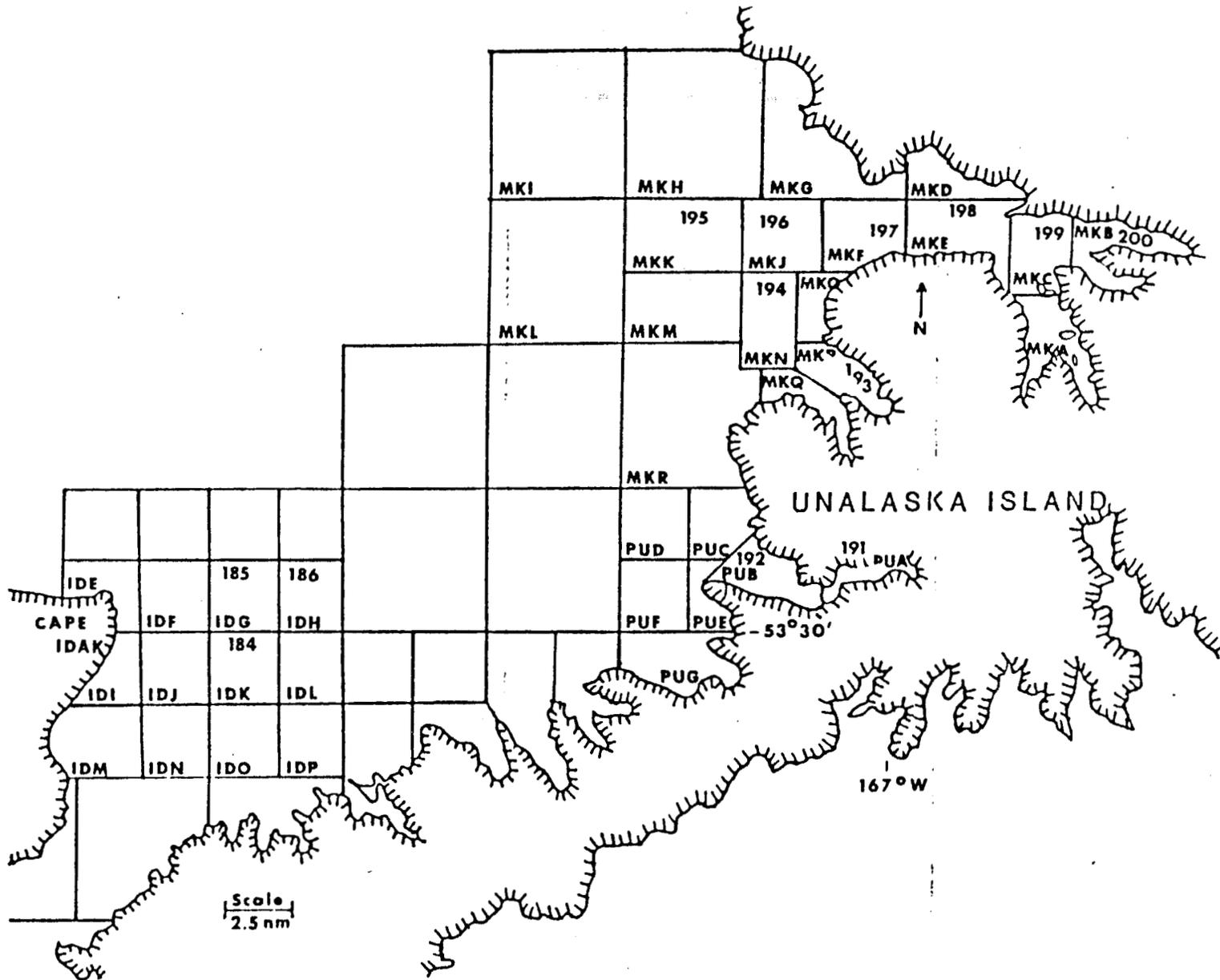




Appendix A. 20. Locations, tow numbers, and station designations (smaller characters) of hauls completed in the Usof Bay section (tows 178-182) of the Eastern Aleutian District.

Appendix A. 21. Locations, tow numbers, and station designations (smaller characters) of hauls completed in the Inanudak Bay section (tows 187-190) of the Eastern Aleutian District.





Appendix A. 22. Locations, tow numbers, and station designations (smaller characters) of hauls completed in the Cape Idak sections (tows 184-186) and the Makushin Bay section (tows 193-200) of the Eastern Aleutian District.

APPENDIX B: Protocol for procedures to be used for the preparation of blood smears of blood smears for bitter crab disease examination.

Required Sampling Equipment:

1. 200 25mm X 75mm frosted slides per area sampled.
2. 100 lcc syringes with 20 gauge needles per area sampled.
3. Hematology slide staining set (this consists of three polypropylene containers in a metal rack and a slide holder for 25 slides used for staining and fixing slides).
4. Diff-Quik stain set (three solutions per set, a fixative solution and two stains).
5. Distilled water.
6. Slide box(es) to hold 100 slides.
7. Marking pen or wax pencil to number slides.
8. Specimen/length frequency data forms reproduced on Rite-in-the-Rain paper.

All the above items can be ordered from either VWR Scientific or American Scientific Products.

It is suggested that the slides be numbered and dated and the location noted on the frosted edge of the glass during a quiet moment before sampling commences. This will limit the amount of information that must be transcribed during sampling such as sex, size and shell condition of the individual crab being sampled. It also expedites sampling and minimizes confusion in the often hectic sampling process. The data on the slides is also written on Rite-in-the-Rain specimen/length frequency forms as each sample is taken.

It is essential that slides used in making smear preparations be unscratched, non-corroded and meticulously clean, free from grease, dust acid, or alkali and that the slides be handled by their edges.

From each location, randomly select 100 *Chionoecetes bairdi* crabs for examination. Each crab should be given a unique number. On a data form write the crab number (e.g., 1, 2, ... 99, 100), location (latitude and longitude), sex (male or female), shell condition (soft, new, old and very old) and carapace width.

I. Method 1

- a. This is a non-destructive procedure for sampling hemolymph using a 1cc Tuberculin syringe and a 22 gauge needle requiring a separate needle and syringe per crab specimen. Two drops (one drop may not be enough from the needle bore) of hemolymph are expressed from the syringe onto a glass slide previously labeled with appropriate data; crab #, sex, date, location, etc.

To collect hemolymph, the needle should be inserted into the arthrodistal membrane of the coxal joint of any leg. Also the "elbow" joint of the right or left cheliped is very good for obtaining hemolymph since these joints are usually presented in a bent position while the crab is in a defensive posture. The needle needs to be plunged about halfway to obtain the flow of blood.

Each collector needs to experiment to get the hang of it first. Whichever leg is used should be consistent.

## II. Method 2

- a. In the absence of needles and syringes, blood may be collected by pulling a rear walking leg and allowing 1 to 2 drops of hemolymph onto a glass slide. Care needs to be taken in that these drops will be very large to excessive.
- b. This is a less desirable technique since crabs may die later from the handling and are less valuable as a product due to missing legs.

## III. Making a blood smear - (Attachment 1)

Two important points to remember:

- a. Do not make the smears too thick, but not too thin either.
- b. Do not let any saltwater drip onto the slide as it causes artifacts in stain and cellular detail.
- c. A drop or two of hemolymph is expressed onto a glass slide just below the frosted end (C) and a clean slide (B) is brought to the drop(s) until contacted and then moved to the end of the slide (A). Capillarity between the clean slide and the sample slide will spread the smear evenly along the length of the sample slide. Experimenting with the size of the drop of hemolymph and the acute angle of the clean slide will produce different smear thicknesses. It is suggested you discard the clean slide, however, it may be re-used as long as its used edge is thoroughly wiped clean of the previous sample.

Place the slide with the hemolymph smear in the slide holder used for staining. When you run out of space in the slide holder, slides should be fixed and stained.

Fill each polypropylene container with one of the solutions. Each of the bottles is labeled with the contents. The slides are dipped first in the fixative five times. Second, the slides are dipped five times in solution 2. Each dip should be followed by a short draining period such that the repeated dipping in the fixative and solutions takes about a minute. Following the final dip in solution 2, rinse the tray and slides with distilled water until the rinse water runs clear.

Remove the slides from the tray and lay them out to dry, stained side up, in a horizontal position on paper towels away from flies, dust and salt spray. Slides should be stored in a slide box that prevents adjacent slides from contacting each other. Be sure and keep the slides dry to prevent contamination by mold.

Used needles and slides should be collected and disposed of in an acceptable manner. Some hospitals will incinerate the materials. A commercial landfill may require a special fee for disposal of laboratory products.

Appendix C: Prevalence of Bitter Crab Syndrome (BCS) found among the *C. bairdi* Tanner Crab sampled during the Alaska Department of Fish and Game 1990 Bottom Trawl Survey of Crab and Groundfish in the Kodiak, Chignik, South Peninsula and Eastern Aleutian Management Districts.

C.1 - Prevalence of Bitter Crab Syndrome (BCS) and bacterial rods found in *C. bairdi* Tanner crab during the 1990 bottom trawl survey of crab and groundfish in the Kodiak District, Northeast.

Location and Tow #	Number of Crabs Sampled	Number of Crabs			
		Readable for BCS + (BCS +)	Only Readable for BCS + (BCS +)	Only Readable for rods (rods +)	Unreadable for BCS and rods
Kodiak District					
Northeast					
1	2	0(0)(0)	0(0)	2(0)	0
2	5	3(0)(0)	0(0)	2(0)	0
3	5	2(0)(0)	0(0)	3(0)	0
4	5	0(0)(0)	0(0)	5(0)	0
5	0	0(0)(0)	0(0)	0(0)	0
6	3	3(0)(0)	0(0)	0(0)	0
7	7	0(0)(0)	0(0)	7(0)	0
8	5	0(0)(0)	0(0)	5(0)	0
9	4	1(0)(0)	0(0)	3(0)	0
10	5	4(0)(0)	0(0)	1(0)	0
11	5	3(0)(0)	0(0)	2(1)	0
12	5	4(0)(0)	0(0)	1(0)	0
13	5	4(0)(0)	0(0)	1(0)	0
14	5	4(0)(0)	0(0)	1(0)	0
15	5	3(0)(0)	0(0)	1(0)	1
16	5	5(0)(0)	0(0)	0(0)	0
17	5	1(0)(0)	0(0)	1(0)	3
18	5	3(0)(0)	0(0)	0(0)	2
19	5	5(0)(0)	0(0)	0(0)	0
20	5	2(0)(0)	0(0)	1(0)	2
21	4	3(0)(0)	0(0)	1(0)	0
22	5	5(0)(0)	0(0)	0(0)	0
23	5	1(0)(0)	0(0)	4(0)	0
24	5	2(0)(0)	0(0)	3(0)	0
25	2	0(0)(0)	0(0)	2(0)	0
26	1	1(0)(0)	0(0)	0(0)	0
27	4	4(0)(0)	0(0)	0(0)	0
28	0	0(0)(0)	0(0)	0(0)	0
29	5	3(0)(0)	0(0)	2(1)	0
30	5	3(0)(0)	0(0)	2(0)	0
31	5	1(0)(0)	0(0)	4(2)	0
32	5	0(0)(0)	0(0)	5(3)	0
33	0	0(0)(0)	0(0)	0(0)	0
34	0	0(0)(0)	0(0)	0(0)	0
35	5	3(0)(0)	0(0)	2(0)	0
36	5	1(0)(0)	0(0)	4(1)	0
37	3	1(0)(0)	0(0)	2(0)	0
38	5	2(0)(0)	0(0)	3(0)	0
-----					
Northeast Total	155	77(0)(0)	0(0)	70(7)	8

C.2 - Prevalence of Bitter Crab Syndrome (BCS) and bacterial rods found in *C. bairdi* Tanner crab during the 1990 bottom trawl survey of crab and groundfish in the Kodiak District, Eastside.

Location and Tow #	Number of Crabs Sampled	Number of Crabs			
		Readable for BCS and rods (BCS +)	Only Readable for BCS (BCS +)	Only Readable for rods (rods +)	Unreadable for BCS and rods
Kodiak District					
Eastside					
39	5	4(0)(0)	0(0)	1(0)	0
40	0	0(0)(0)	0(0)	0(0)	0
41	0	0(0)(0)	0(0)	0(0)	0
42	0	0(0)(0)	0(0)	0(0)	0
43	5	2(0)(0)	0(0)	1(0)	2
44	2	0(0)(0)	0(0)	1(0)	1
45	0	0(0)(0)	0(0)	0(0)	0
46	0	0(0)(0)	0(0)	0(0)	0
47	5	0(0)(0)	0(0)	3(0)	2
48	5	3(0)(0)	0(0)	1(0)	1
49	4	2(0)(0)	0(0)	0(0)	2
50	5	3(0)(0)	0(0)	0(0)	2
51	5	1(0)(0)	0(0)	2(1)	2
52	5	5(0)(0)	0(0)	0(0)	0
53	1	1(0)(0)	0(0)	0(0)	0
54	5	5(0)(0)	0(0)	0(0)	0
55	5	4(0)(0)	0(0)	1(0)	0
56	3	2(0)(0)	0(0)	1(0)	0
57	5	2(0)(0)	0(0)	3(0)	0
58	5	4(0)(0)	0(0)	1(0)	0
59	5	2(0)(1)	0(0)	3(2)	0
60	5	3(0)(0)	0(0)	2(0)	0
61	5	4(0)(0)	0(0)	1(0)	0
62	5	2(0)(0)	0(0)	3(0)	0
63	5	4(0)(1)	0(0)	1(0)	0
64	5	4(0)(0)	0(0)	0(0)	1
65	5	3(0)(0)	0(0)	2(0)	0
66	5	5(0)(0)	0(0)	0(0)	0
67	5	3(0)(0)	0(0)	2(0)	0
68	5	4(0)(0)	0(0)	1(0)	0
71	0	0(0)(0)	0(0)	0(0)	0
75	0	0(0)(0)	0(0)	0(0)	0
76	5	2(0)(0)	0(0)	3(0)	0
77	5	4(0)(0)	0(0)	1(0)	0
78	5	2(0)(0)	0(0)	3(0)	0
79	0	0(0)(0)	0(0)	0(0)	0
80	5	1(0)(0)	0(0)	4(2)	0
81	5	2(0)(0)	0(0)	2(0)	1
82	0	0(0)(0)	0(0)	0(0)	0
83	5	2(0)(0)	0(0)	3(0)	0
-----					
Eastside Total	145	85(0)(2)	0(0)	46(5)	14

C.3 - Prevalence of Bitter Crab Syndrome (BCS) and bacterial rods found in *C. bairdi* Tanner crab during the 1990 bottom trawl survey of crab and groundfish in the Kodiak District, Southeast.

Location and Tow #	Number of Crabs Sampled	Number of Crabs			
		Readable for BCS and rods (BCS +)	Only Readable for BCS (BCS +)	Only Readable for rods (rods +)	Unreadable for BCS and rods
Kodiak District					
Southeast					
69	5	3(0)(0)	0(0)	2(1)	0
70	5	5(0)(0)	0(0)	0(0)	0
72	5	3(0)(0)	0(0)	2(0)	0
73	5	5(0)(0)	0(0)	0(0)	0
74	5	4(0)(2)	0(0)	1(1)	0
84	5	1(0)(0)	0(0)	4(2)	0
85	5	2(0)(0)	0(0)	3(1)	0
86	5	3(0)(1)	0(0)	2(1)	0
87	5	3(0)(0)	0(0)	2(0)	0
88	5	5(0)(0)	0(0)	0(0)	0
89	5	5(0)(0)	0(0)	0(0)	0
90	5	4(0)(0)	0(0)	1(0)	0
91	5	2(0)(0)	0(0)	3(1)	0
92	0	0(0)(0)	0(0)	0(0)	0
93	5	3(0)(0)	0(0)	2(0)	0
94	5	0(0)(0)	0(0)	5(4)	0
95	5	5(0)(2)	0(0)	0(0)	0
96	5	5(0)(1)	0(0)	0(0)	0
97	5	5(0)(1)	0(0)	0(0)	0
98	5	3(0)(0)	0(0)	2(1)	0
99	0	0(0)(0)	0(0)	0(0)	0
100	5	2(0)(0)	0(0)	3(0)	0
101	5	0(0)(0)	0(0)	5(1)	0
102	5	0(0)(0)	0(0)	5(1)	0
103	5	1(0)(0)	0(0)	4(0)	0
104	5	2(0)(0)	0(0)	3(1)	0
105	5	2(0)(1)	0(0)	3(2)	0
106	0	0(0)(0)	0(0)	0(0)	0
107	0	0(0)(0)	0(0)	0(0)	0
134	5	4(0)(0)	0(0)	1(0)	0
135	0	0(0)(0)	0(0)	0(0)	0
136	0	0(0)(0)	0(0)	0(0)	0
137	5	2(0)(0)	0(0)	3(0)	0
138	5	3(0)(0)	0(0)	2(0)	0
139	5	3(0)(0)	0(0)	2(0)	0
=====					
Southeast Total	145	85(0)(8)	0(0)	60(17)	0

C.4 - Prevalence of Bitter Crab Syndrome (BCS) and bacterial rods found in *C. bairdi* Tanner crab during the 1990 bottom trawl survey of crab and groundfish in the Kodiak District, Southwest.

Location and Tow #	Number of Crabs Sampled	Number of Crabs			
		Readable for BCS and rods (BCS +)	Only Readable for BCS (BCS +)	Only Readable for rods (rods +)	Unreadable for BCS and rods
Kodiak District					
Southwest					
108	5	2(0)(0)	0(0)	3(3)	0
109	0	0(0)(0)	0(0)	0(0)	0
110	0	0(0)(0)	0(0)	0(0)	0
111	0	0(0)(0)	0(0)	0(0)	0
112	0	0(0)(0)	0(0)	0(0)	0
113	0	0(0)(0)	0(0)	0(0)	0
114	0	0(0)(0)	0(0)	0(0)	0
115	0	0(0)(0)	0(0)	0(0)	0
116	5	0(0)(0)	0(0)	5(3)	0
117	5	5(0)(1)	0(0)	0(0)	0
118	5	0(0)(0)	0(0)	5(1)	0
119	5	0(0)(0)	0(0)	5(1)	0
120	5	4(0)(0)	0(0)	1(0)	0
121	0	0(0)(0)	0(0)	0(0)	0
122	0	0(0)(0)	0(0)	0(0)	0
123	3	1(0)(0)	0(0)	2(0)	0
124	0	0(0)(0)	0(0)	0(0)	0
125	0	0(0)(0)	0(0)	0(0)	0
126	5	1(0)(0)	0(0)	4(0)	0
127	5	0(0)(0)	0(0)	5(2)	0
128	5	1(0)(0)	0(0)	4(2)	0
129	0	0(0)(0)	0(0)	0(0)	0
130	0	0(0)(0)	0(0)	0(0)	0
131	0	0(0)(0)	0(0)	0(0)	0
132	0	0(0)(0)	0(0)	0(0)	0
133	0	0(0)(0)	0(0)	0(0)	0
140	5	3(1)(0)	0(0)	2(0)	0
141	5	5(0)(0)	0(0)	0(0)	0
142	5	3(1)(0)	0(0)	1(1)	1
143	5	4(0)(0)	0(0)	0(0)	1
144	0	0(0)(0)	0(0)	0(0)	0
145	5	5(0)(0)	0(0)	0(0)	0
146	5	3(1)(0)	0(0)	1(0)	1
147	4	4(0)(0)	0(0)	0(0)	0
148	5	4(0)(0)	0(0)	1(0)	0
149	5	4(0)(0)	0(0)	1(0)	0
150	5	4(0)(0)	0(0)	1(0)	0
151	5	5(3)(0)	0(0)	0(0)	0
152	5	5(4)(0)	0(0)	0(0)	0
153	0	0(0)(0)	0(0)	0(0)	0
154	5	4(0)(0)	0(0)	0(0)	1
155	5	4(1)(0)	0(0)	0(0)	1
156	5	5(2)(0)	0(0)	0(0)	0
157	5	5(2)(0)	0(0)	0(0)	0
Southwest					
Total	127	81(15)(1)	0(0)	41(13)	5

C.5 - Prevalence of Bitter Crab Syndrome (BCS) and bacterial rods found in *C. bairdi* Tanner crab during the 1990 bottom trawl survey of crab and groundfish in the Kodiak District, Westside.

Location and Tow #	Number of Crabs Sampled	Number of Crabs			
		Readable for BCS and rods (BCS +)	Only Readable for BCS (BCS +)	Only Readable for rods (rods +)	Unreadable for BCS and rods
Kodiak District					
Westside					
364	5	1(0)(0)	0(0)	4(0)	0
365	0	0(0)(0)	0(0)	0(0)	0
366	5	5(0)(0)	0(0)	0(0)	0
367	5	5(0)(0)	0(0)	0(0)	0
368	5	0(0)(0)	0(0)	0(0)	0
369	5	0(0)(0)	0(0)	0(0)	0
370	5	5(0)(0)	0(0)	0(0)	0
371	5	5(0)(0)	0(0)	0(0)	0
372	0	0(0)(0)	0(0)	0(0)	0
373	5	5(0)(0)	0(0)	0(0)	0
374	5	5(0)(0)	0(0)	0(0)	0
375	5	5(0)(0)	0(0)	0(0)	0
376	5	5(0)(0)	0(0)	0(0)	0
377	5	5(0)(0)	0(0)	0(0)	0
378	5	5(0)(0)	0(0)	0(0)	0
379	5	5(0)(0)	0(0)	0(0)	0
380	5	5(0)(0)	0(0)	0(0)	0
381	5	5(0)(0)	0(0)	0(0)	0
382	5	4(1)(0)	0(0)	1(0)	0
383	0	0(0)(0)	0(0)	0(0)	0
384	5	4(0)(0)	0(0)	0(0)	1
385	5	4(0)(0)	0(0)	0(0)	1
386	5	5(0)(0)	0(0)	0(0)	0
387	5	5(0)(0)	0(0)	0(0)	0
388	5	5(0)(0)	0(0)	0(0)	0
389	5	5(0)(0)	0(0)	0(0)	0
390	5	5(1)(0)	0(0)	0(0)	0
391	5	5(0)(0)	0(0)	0(0)	0
392	5	5(0)(0)	0(0)	0(0)	0
393	5	4(0)(0)	0(0)	0(0)	1
394	5	5(0)(0)	0(0)	0(0)	0
412	0	0(0)(0)	0(0)	0(0)	0
413	5	5(0)(0)	0(0)	0(0)	0
414	5	4(0)(0)	0(0)	1(0)	0
Westside					
Total	150	141(2)(0)	0(0)	6(0)	3

C.6 - Prevalence of Bitter Crab Syndrome (BCS) and bacterial rods found in *C. bairdi* Tanner crab during the 1990 bottom trawl survey of crab and groundfish in the Kodiak District, North Mainland.

Location and Tow #	Number of Crabs Sampled	Number of Crabs			
		Readable for BCS and rods (BCS +)	Only Readable for BCS (BCS +)	Only Readable for rods (rods +)	Unreadable for BCS and rods
Kodiak District					
North Mainland					
395	5	2(0)(0)	0(0)	3(0)	0
396	5	4(0)(0)	0(0)	1(0)	0
397	5	4(0)(0)	0(0)	1(0)	0
398	5	5(0)(0)	0(0)	0(0)	0
399	5	2(0)(0)	0(0)	3(0)	0
400	5	2(0)(0)	0(0)	3(0)	0
401	5	5(0)(0)	0(0)	0(0)	0
402	2	1(0)(0)	0(0)	1(0)	0
403	5	4(0)(0)	0(0)	1(0)	0
404	5	5(0)(0)	0(0)	0(0)	0
405	5	3(0)(0)	0(0)	2(0)	0
406	5	3(0)(0)	0(0)	2(0)	0
407	5	4(0)(0)	0(0)	1(0)	0
408	5	1(0)(0)	0(0)	4(0)	0
409	5	1(0)(0)	0(0)	4(0)	0
410	5	5(0)(0)	0(0)	0(0)	0
411	5	3(0)(0)	0(0)	2(0)	0
415	5	4(0)(0)	0(0)	1(0)	0
416	5	5(0)(0)	0(0)	0(0)	0
417	5	5(0)(0)	0(0)	0(0)	0
418	5	5(0)(0)	0(0)	0(0)	0
419	5	4(0)(0)	0(0)	1(0)	0
420	5	4(0)(0)	0(0)	1(0)	0
421	5	5(0)(0)	0(0)	0(0)	0
422	5	5(0)(0)	0(0)	0(0)	0
423	5	2(0)(0)	0(0)	3(0)	0
North Mainland					
Total	127	93(0)(0)	0(0)	34(0)	0

C.7 - Prevalence of Bitter Crab Syndrome (BCS) and bacterial rods found in *C. bairdi* Tanner crab during the 1990 bottom trawl survey of crab and groundfish in the Kodiak District.

Section	Number of Crabs Sampled	Number of Crabs			
		Readable for BCS and rods (BCS +) (rods +)	Only Readable for BCS (BCS +)	Only Readable for rods (rods +)	Unreadable for BCS and rods
Northeast	155	77(0)(0)	0(0)	70(7)	8
Eastside	145	85(0)(2)	0(0)	46(5)	14
Southeast	145	85(0)(8)	0(0)	60(17)	0
Southwest	127	81(15)(1)	0(0)	41(13)	5
Westside	150	141(2)(0)	0(0)	6(0)	3
North Mainland	127	93(0)(0)	0(0)	34(0)	0
<b>Total</b>	<b>849</b>	<b>562(17)(11)</b>	<b>0(0)</b>	<b>257(42)</b>	<b>30</b>

C.8 - Prevalence of Bitter Crab Syndrome (BCS) found in *C. bairdi* Tanner crab during the 1990 bottom trawl survey of crab and groundfish in the Chignik District; Ivanof, Mitrofanina and Chignik Bays.

Location and Tow #	Number of Crabs Sampled	Number of Crabs			
		Readable for BCS and rods (BCS +)	Only Readable for BCS (BCS +)	Only Readable for rods (rods +)	Unreadable for BCS and rods
<b>Chignik District</b>					
<b>Ivanof Bay</b>					
327	5	5(0)(0)	0(0)	0(0)	0
328	5	3(1)(0)	0(0)	2(0)	0
329	5	3(1)(0)	0(0)	2(0)	0
330	5	3(1)(0)	0(0)	2(0)	0
331	5	1(0)(0)	0(0)	4(0)	0
332	1	0(0)(0)	0(0)	1(0)	0
333	5	3(0)(0)	0(0)	2(0)	0
<b>Ivanof Bay Total</b>	<b>31</b>	<b>18(3)(0)</b>	<b>0(0)</b>	<b>13(0)</b>	<b>0</b>
<b>Mitrofanina Bay</b>					
334	5	3(0)(0)	0(0)	2(0)	0
335	5	2(0)(0)	0(0)	3(0)	0
336	2	2(0)(0)	0(0)	0(0)	0
337	5	5(0)(0)	0(0)	0(0)	0
338	5	5(1)(0)	0(0)	0(0)	0
339	5	5(0)(0)	0(0)	0(0)	0
<b>Mitrofanina Bay Total</b>	<b>27</b>	<b>22(1)(0)</b>	<b>0(0)</b>	<b>5(0)</b>	<b>0</b>
<b>Chignik Bay</b>					
340	0	0(0)(0)	0(0)	0(0)	0
341	0	0(0)(0)	0(0)	0(0)	0
342	5	4(0)(0)	0(0)	1(0)	0
343	5	4(0)(0)	0(0)	0(0)	1
344	5	5(0)(0)	0(0)	0(0)	0
345	5	5(0)(0)	0(0)	0(0)	0
346	5	4(0)(0)	0(0)	1(0)	0
347	5	5(0)(0)	0(0)	0(0)	0
348	5	4(0)(0)	0(0)	1(0)	0
349	5	4(0)(0)	0(0)	1(0)	0
350	0	0(0)(0)	0(0)	0(0)	0
351	5	2(0)(0)	0(0)	2(0)	1
352	5	5(0)(0)	0(0)	0(0)	0
353	5	5(0)(0)	0(0)	0(0)	0
354	5	4(0)(0)	0(0)	0(0)	1
355	5	2(0)(0)	0(0)	0(0)	3
356	5	1(0)(0)	0(0)	2(0)	2
<b>Chignik Bay Total</b>	<b>70</b>	<b>54(0)(0)</b>	<b>0(0)</b>	<b>8(0)</b>	<b>8</b>

C.9 - Prevalence of Bitter Crab Syndrome (BCS) found in *C. bairdi* Tanner crab during the 1990 bottom trawl survey of crab and groundfish in the Chignik District, Kujulik.

Location and Tow #	Number of Crabs Sampled	Number of Crabs			
		Readable for BCS and rods (BCS +)	Only Readable for BCS (BCS +)	Only Readable for rods (rods +)	Unreadable for BCS and rods
Chignik District					
Kujulik Bay					
357	5	3(0)(0)	0(0)	2(0)	0
358	5	1(0)(0)	0(0)	4(0)	0
359	5	3(0)(0)	0(0)	2(0)	0
360	4	2(0)(0)	0(0)	2(0)	0
361	5	2(0)(0)	0(0)	3(0)	0
362	5	4(0)(0)	0(0)	1(0)	0
363	5	3(0)(0)	0(0)	2(0)	0
Kujulik Bay					
Total	34	18(0)(0)	0(0)	16(0)	0

C.10 - Prevalence of Bitter Crab Syndrome (BCS) and bacterial rods found in *C. bairdi* Tanner crab during the 1990 bottom trawl survey of crab and groundfish in the Chignik District.

Section	Number of Crabs Sampled	Number of Crabs			
		Readable for BCS and rods (BCS +)	Only Readable for BCS (BCS +)	Only Readable for rods (rods +)	Unreadable for BCS and rods
Ivanof Bay	31	18(3)(0)	0(0)	13(0)	0
Mitrofanía Bay	27	22(1)(0)	0(0)	5(0)	0
Chignik Bay	70	54(0)(0)	0(0)	8(0)	8
Kujulik Bay	34	18(0)(0)	0(0)	16(0)	0
Total	162	112(4)(0)	0(0)	42(0)	8

C.11 - Prevalence of Bitter Crab Syndrome (BCS) and bacterial rods found in *C. bairdi* Tanner crab during the 1990 bottom trawl survey of crab and groundfish in the South Peninsula District, Morzhovoi Bay and Sanak Island.

Location and Tow #	Number of Crabs Sampled	Number of Crabs			
		Readable for BCS + (BCS +)	Only Readable for BCS + (rods +)	Only Readable for rods (rods +)	Unreadable for BCS and rods
=====					
South Alaska Peninsula District					
Morzhovoi Bay					
204	0	0(0)(0)	0(0)	0(0)	0
205	5	5(0)(0)	0(0)	0(0)	0
206	5	5(0)(0)	0(0)	0(0)	0
207	1	1(0)(0)	0(0)	0(0)	0
208	5	4(0)(0)	0(0)	1(0)	0
209	0	0(0)(0)	0(0)	0(0)	0
210	0	0(0)(0)	0(0)	0(0)	0
211	5	5(0)(0)	0(0)	0(0)	0
217	5	1(0)(0)	0(0)	1(0)	3
218	5	3(0)(0)	0(0)	1(0)	1
219	5	4(0)(0)	0(0)	0(0)	1
220	5	5(0)(0)	0(0)	0(0)	0
221	2	1(0)(0)	0(0)	1(0)	0
222	5	5(0)(0)	0(0)	0(0)	0
223	5	5(0)(0)	0(0)	0(0)	0
224	5	5(0)(0)	0(0)	0(0)	0
225	5	5(0)(0)	0(0)	0(0)	0
226	5	3(0)(0)	0(0)	2(0)	0
227	5	3(0)(0)	0(0)	0(0)	2
228	5	4(0)(0)	0(0)	0(0)	1
229	5	3(0)(0)	0(0)	2(0)	0
230	5	4(0)(0)	0(0)	1(0)	0
231	5	4(0)(0)	0(0)	1(0)	0
232	5	5(0)(0)	0(0)	0(0)	0
233	5	5(0)(0)	0(0)	0(0)	0
=====					
Morzhovoi Bay Total	103	85(0)(0)	0(0)	10(0)	8
Sanak Island					
212	5	2(0)(0)	0(0)	3(0)	0
213	5	3(0)(0)	0(0)	2(0)	0
214	5	4(0)(0)	0(0)	1(0)	0
215	5	4(0)(0)	0(0)	0(0)	1
216	5	2(0)(0)	0(0)	0(0)	3
=====					
Sanak Island Total	25	15(0)(0)	0(0)	6(0)	4

C.12 - Prevalence of Bitter Crab Syndrome (BCS) and bacterial rods found in *C. bairdi* Tanner crab during the 1990 bottom trawl survey of crab and groundfish in the South Peninsula District, Cold Bay/Belkofsky and Stepovak.

Location and Tow #	Number of Crabs Sampled	Number of Crabs			
		Readable for BCS and rods (BCS +)	Only Readable for BCS (BCS +)	Only Readable for rods (rods +)	Unreadable for BCS and rods
South Alaska Peninsula District					
Cold Bay/Belkofsk					
234	5	5(0)(0)	0(0)	0(0)	0
235	5	3(0)(0)	0(0)	2(0)	0
236	5	4(0)(0)	0(0)	1(0)	0
237	5	4(0)(0)	0(0)	1(0)	0
238	5	4(0)(0)	0(0)	0(0)	1
239	5	5(0)(0)	0(0)	0(0)	0
240	5	3(0)(0)	0(0)	2(0)	0
241	5	5(0)(0)	0(0)	0(0)	0
242	5	4(0)(0)	0(0)	1(0)	0
243	5	5(0)(0)	0(0)	0(0)	0
244	5	3(0)(0)	0(0)	1(0)	1
245	5	5(0)(0)	0(0)	0(0)	0
246	5	2(0)(0)	0(0)	2(0)	1
247	5	1(0)(0)	0(0)	3(0)	1
248	5	4(0)(0)	0(0)	0(0)	1
249	5	4(0)(0)	0(0)	0(0)	1
250	0	0(0)(0)	0(0)	0(0)	0
251	5	5(0)(0)	0(0)	0(0)	0
252	5	5(0)(0)	0(0)	0(0)	0
253	5	5(0)(0)	0(0)	0(0)	0
Cold Bay/Belkofsk					
Total	95	76(0)(0)	0(0)	13(0)	6
Stepovak Bay					
318	5	3(0)(0)	0(0)	2(0)	0
319	5	2(0)(0)	0(0)	3(0)	0
320	5	3(0)(0)	0(0)	2(0)	0
321	5	2(0)(0)	0(0)	3(0)	0
322	5	2(0)(0)	0(0)	3(0)	0
323	5	1(0)(0)	0(0)	4(0)	0
324	5	1(0)(0)	0(0)	4(0)	0
325	5	4(0)(0)	0(0)	1(0)	0
326	5	4(0)(0)	0(0)	0(0)	1
Stepovak Bay					
Total	45	22(0)(0)	0(0)	22(0)	1

C.13 - Prevalence of Bitter Crab Syndrome (BCS) found in *C. bairdi* Tanner crab during the 1990 bottom trawl survey of crab and groundfish in the South Peninsula District, Pavlof/Volcano Bays.

Location and Tow #	Number of Crabs Sampled	Number of Crabs			
		Readable for BCS and rods (BCS +)	Only Readable for BCS (BCS +)	Only Readable for rods (rods +)	Unreadable for BCS and rods
=====					
South Alaska Peninsula District					
Pavlof/Volcano Bay					
254	5	5(0)(0)	0(0)	0(0)	0
255	5	3(0)(0)	0(0)	2(0)	0
256	5	5(0)(0)	0(0)	0(0)	0
257	5	5(0)(0)	0(0)	0(0)	0
258	5	4(1)(0)	0(0)	0(0)	1
259	5	2(0)(0)	0(0)	1(0)	2
260	5	3(0)(0)	0(0)	0(0)	2
261	5	5(0)(0)	0(0)	0(0)	0
262	5	4(0)(0)	0(0)	1(0)	0
263	5	4(1)(0)	0(0)	1(0)	0
264	5	5(1)(0)	0(0)	0(0)	0
265	5	5(0)(0)	0(0)	0(0)	0
266	5	4(0)(0)	0(0)	0(0)	1
267	5	5(0)(0)	0(0)	0(0)	0
268	5	3(0)(0)	0(0)	2(0)	0
269	5	1(0)(0)	0(0)	0(0)	4
270	5	4(0)(0)	0(0)	0(0)	1
271	5	5(0)(0)	0(0)	0(0)	0
272	5	5(0)(0)	0(0)	0(0)	0
273	5	5(0)(0)	0(0)	0(0)	0
274	5	5(0)(0)	0(0)	0(0)	0
275	5	4(0)(0)	0(0)	1(0)	0
276	5	5(0)(0)	0(0)	0(0)	0
277	5	5(0)(0)	0(0)	0(0)	0
278	5	3(0)(0)	0(0)	2(0)	0
279	2	2(0)(0)	0(0)	0(0)	0
280	5	3(0)(0)	0(0)	1(0)	1
281	5	0(0)(0)	0(0)	5(0)	0
282	0	0(0)(0)	0(0)	0(0)	0
283	0	0(0)(0)	0(0)	0(0)	0
284	0	0(0)(0)	0(0)	0(0)	0
285	2	0(0)(0)	0(0)	1(0)	1
286	5	5(0)(0)	0(0)	0(0)	0
287	5	5(0)(0)	0(0)	0(0)	0
288	5	5(0)(0)	0(0)	0(0)	0
289	2	2(0)(0)	0(0)	0(0)	0
290	5	5(0)(0)	0(0)	0(0)	0
291	5	5(0)(0)	0(0)	0(0)	0
292	5	5(0)(0)	0(0)	0(0)	0
293	0	0(0)(0)	0(0)	0(0)	0
294	5	5(0)(0)	0(0)	0(0)	0
295	5	3(0)(0)	0(0)	0(0)	2
=====					
Pavlof/Volcano Bay					
Total	181	149(3)(0)	0(0)	17(0)	15

C.14 - Prevalence of Bitter Crab Syndrome (BCS) found in *C. bairdi* Tanner crab during the 1990 bottom trawl survey of crab and groundfish in the South Peninsula District, Beaver/Balboa Bays and West Nagai.

Location and Tow #	Number of Crabs Sampled	Number of Crabs			
		Readable for BCS and rods (BCS +)	Only Readable for BCS (BCS +)	Only Readable for rods (rods +)	Unreadable for BCS and rods
South Alaska Peninsula District					
Beaver/Balboa Bay					
296	2	2(0)(0)	0(0)	0(0)	0
297	0	0(0)(0)	0(0)	0(0)	0
298	0	0(0)(0)	0(0)	0(0)	0
299	5	1(0)(0)	0(0)	4(0)	0
300	5	5(0)(0)	0(0)	0(0)	0
301	5	5(0)(0)	0(0)	0(0)	0
302	5	5(0)(0)	0(0)	0(0)	0
303	5	0(0)(0)	0(0)	5(0)	0
304	5	0(0)(0)	0(0)	2(0)	3
305	0	0(0)(0)	0(0)	0(0)	0
306	5	2(0)(0)	0(0)	3(0)	0
307	5	4(0)(0)	0(0)	1(0)	0
308	0	0(0)(0)	0(0)	0(0)	0
309	5	4(1)(0)	0(0)	1(0)	0
310	4	2(0)(0)	0(0)	2(0)	0
316	5	4(0)(0)	0(0)	1(0)	0
317	5	4(0)(0)	0(0)	0(0)	1
Beaver/Balboa Bay Total					
	61	38(1)(0)	0(0)	19(0)	4
West Nagai					
311	5	3(0)(0)	0(0)	2(0)	0
312	5	2(0)(0)	0(0)	2(0)	1
313	5	4(0)(0)	0(0)	0(0)	1
314	5	2(0)(0)	0(0)	2(0)	1
315	1	0(0)(0)	0(0)	1(0)	0
West Nagai Total					
	21	11(0)(0)	0(0)	7(0)	3

C.15 - Prevalence of Bitter Crab Syndrome (BCS) and bacterial rods found in *C. bairdi* Tanner crab during the 1990 bottom trawl survey of crab and groundfish in the South Peninsula District.

Section	Number of Crabs Sampled	Number of Crabs			
		Readable for BCS and rods (BCS +) (rods +)	Only Readable for BCS (BCS +)	Only Readable for rods (rods +)	Unreadable for BCS and rods
Morzhovoi Bay	103	85(0)(0)	0(0)	10(0)	8
Sanak Island	25	15(0)(0)	0(0)	6(0)	4
Cold Bay/Belkofsk	95	76(0)(0)	0(0)	13(0)	6
Stepovak Bay	45	22(0)(0)	0(0)	22(0)	1
Pavlof/Volcano B.	181	149(3)(0)	0(0)	17(0)	15
Beaver/Balboa B.	61	38(1)(0)	0(0)	19(0)	4
West Nagai	21	11(0)(0)	0(0)	7(0)	3
<b>Total</b>	<b>531</b>	<b>396(4)(0)</b>	<b>0(0)</b>	<b>94(0)</b>	<b>41</b>

C.16 - Prevalence of Bitter Crab Syndrome (BCS) found in *C. bairdi* Tanner crab during the 1990 bottom trawl survey of crab and groundfish in the Eastern Aleutian District; Akutan, Unalaska/Kalekta, Beaver Inlet and Usof Bay.

Location and Tow #	Number of Crabs Sampled	Number of Crabs			
		Readable for BCS (+)	Only Readable for BCS (+)	Only Readable for rods (+)	Unreadable for BCS and rods
===== East Aleutian District					
Akutan Bay					
158	5	4(0)(0)	0(0)	1(0)	0
159	5	5(0)(0)	0(0)	0(0)	0
160	5	5(0)(0)	0(0)	0(0)	0
161	5	3(0)(0)	0(0)	2(1)	0
162	5	5(0)(0)	0(0)	0(0)	0
===== Akutan Bay					
Total	25	22(0)(0)	0(0)	3(1)	0
===== Unalaska/Kalekta					
163	5	5(0)(0)	0(0)	0(0)	0
164	5	4(0)(0)	0(0)	1(0)	0
165	5	4(0)(0)	0(0)	1(0)	0
166	5	1(0)(0)	0(0)	4(1)	0
167	5	2(0)(0)	0(0)	3(2)	0
168	5	1(0)(0)	0(0)	4(2)	0
169	5	0(0)(0)	0(0)	5(1)	0
170	1	1(0)(0)	0(0)	0(0)	0
===== Unalaska/Kalekta					
Total	36	18(0)(0)	0(0)	18(6)	0
===== Beaver Inlet					
171	5	3(0)(0)	0(0)	2(1)	0
172	5	5(0)(0)	0(0)	0(0)	0
173	1	0(0)(0)	0(0)	1(0)	0
174	0	0(0)(0)	0(0)	0(0)	0
175	5	3(0)(0)	0(0)	2(0)	0
176	5	2(0)(0)	0(0)	3(0)	0
177	5	4(0)(0)	0(0)	0(0)	1
===== Beaver Inlet					
Total	26	17(0)(0)	0(0)	8(1)	1
===== Usof Bay					
178	2	1(0)(0)	0(0)	1(1)	0
179	0	0(0)(0)	0(0)	0(0)	0
180	5	3(0)(0)	0(0)	0(0)	2
181	5	1(0)(0)	0(0)	0(0)	4
182	5	4(0)(0)	0(0)	1(0)	0
===== Usof Bay					
Total	17	9(0)(0)	0(0)	2(1)	6

C.17 - Prevalence of Bitter Crab Syndrome (BCS) found in *C. bairdi* Tanner crab during the 1990 bottom trawl survey of crab and groundfish in the Eastern Aleutian District, Cape Idak, Inanudak Bay, Pumicestone Bay, Makushin Bay and Akun Bay.

Location and Tow #	Number of Crabs Sampled	Number of Crabs			
		Readable for BCS and rods (BCS +)	Only Readable for BCS (BCS +)	Only Readable for rods (rods +)	Unreadable for BCS and rods
<b>East Aleutian District</b>					
<b>Cape Idak</b>					
183	0	0(0)(0)	0(0)	0(0)	0
184	5	5(0)(0)	0(0)	0(0)	0
185	2	2(0)(0)	0(0)	0(0)	0
186	0	0(0)(0)	0(0)	0(0)	0
<b>Cape Idak Total</b>	<b>7</b>	<b>7(0)(0)</b>	<b>0(0)</b>	<b>0(0)</b>	<b>0</b>
<b>Inanudak Bay</b>					
187	0	0(0)(0)	0(0)	0(0)	0
188	0	0(0)(0)	0(0)	0(0)	0
189	5	3(0)(0)	0(0)	2(0)	0
190	0	0(0)(0)	0(0)	0(0)	0
<b>Inanudak Bay Total</b>	<b>5</b>	<b>3(0)(0)</b>	<b>0(0)</b>	<b>2(0)</b>	<b>0</b>
<b>Pumicestone Bay</b>					
191	5	1(0)(0)	0(0)	4(0)	0
192	5	5(0)(0)	0(0)	0(0)	0
<b>Pumicestone Bay Total</b>	<b>10</b>	<b>6(0)(0)</b>	<b>0(0)</b>	<b>4(0)</b>	<b>0</b>
<b>Makushin Bay</b>					
193	5	5(0)(0)	0(0)	0(0)	0
194	5	5(0)(0)	0(0)	0(0)	0
195	5	5(0)(0)	0(0)	0(0)	0
196	5	3(0)(0)	0(0)	2(0)	0
197	5	4(0)(0)	0(0)	1(0)	0
198	5	5(0)(0)	0(0)	0(0)	0
199	5	2(0)(0)	0(0)	1(0)	2
200	5	2(0)(0)	0(0)	2(0)	1
<b>Makushin Bay Total</b>	<b>40</b>	<b>31(0)(0)</b>	<b>0(0)</b>	<b>6(0)</b>	<b>3</b>
<b>Akun Bay</b>					
201	0	0(0)(0)	0(0)	0(0)	0
202	0	0(0)(0)	0(0)	0(0)	0
203	0	0(0)(0)	0(0)	0(0)	0
<b>Akun Bay Total</b>	<b>0</b>	<b>0(0)(0)</b>	<b>0(0)</b>	<b>0(0)</b>	<b>0</b>

C.18 - Prevalence of Bitter Crab Syndrome (BCS) and bacterial rods found in *C. bairdi* Tanner crab during the 1990 bottom trawl survey of crab and groundfish in the East Aleutian District.

Section	Number of Crabs Sampled	Number of Crabs			
		Readable for BCS and rods (BCS +) (rods +)	Only Readable for BCS (BCS +)	Only Readable for rods (rods +)	Unreadable for BCS and rods
Akutan Bay	25	22(0)(0)	0(0)	3(1)	0
Unalaska/Kalekta	36	18(0)(0)	0(0)	18(6)	0
Beaver Inlet	26	17(0)(0)	0(0)	8(1)	1
Usof Bay	17	9(0)(0)	0(0)	2(1)	6
Cape Idak	7	7(0)(0)	0(0)	0(0)	0
Inanudak Bay	5	3(0)(0)	0(0)	2(0)	0
Pumicestone Bay	10	6(0)(0)	0(0)	4(0)	0
Makushin Bay	40	31(0)(0)	0(0)	6(0)	3
Akun Bay	0	0(0)(0)	0(0)	0(0)	0
<b>Total</b>	<b>166</b>	<b>113(0)(0)</b>	<b>0(0)</b>	<b>43(9)</b>	<b>10</b>

APPENDIX D: Prevalence of Bitter Crab Syndrome (BCS) found among the *C. bairdi* Tanner Crab visually examined during the Alaska Department of Fish and Game 1990 Bottom Trawl Survey of Crab and Groundfish in the Kodiak ,Chignik, South Peninsula and Eastern Aleutian Management Districts.

Location	Tow #	# Crabs Visually Examined	# Crabs Suspect & Tested for BCS	# Readable Hemolymph Slides	# Crabs Positive for BCS
=====					
Kodiak District					
Northeast	1	2	0	0	0
	2	544	0	0	0
	3	333	0	0	0
	4	19	0	0	0
	5	0	0	0	0
	6	619	0	0	0
	7	33	0	0	0
	8	49	0	0	0
	9	127	0	0	0
	10	70	0	0	0
	11	10	0	0	0
	12	436	0	0	0
	13	327	0	0	0
	14	17	0	0	0
	15	9	0	0	0
	16	120	0	0	0
	17	191	0	0	0
	18	405	0	0	0
	19	189	0	0	0
	20	168	0	0	0
	21	179	0	0	0
	22	57	0	0	0
	23	44	0	0	0
	24	131	0	0	0
	25	3	0	0	0
	26	1	0	0	0
	27	6	0	0	0
	28	7	0	0	0
	29	22	0	0	0
	30	28	0	0	0
	31	33	0	0	0
	32	6	0	0	0
	33	3	0	0	0
	34	4	0	0	0
	35	48	0	0	0
	36	17	0	0	0
	37	3	0	0	0
	38	8	0	0	0
-----					
Northeast Total		4,298	0	0	0

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Location	Tow #	# Crabs Visually Examined	# Crabs Suspect & Tested for BCS	# Readable Hemolymph Slides	# Crabs Positive for BCS
=====					
Kodiak District					
Eastside	39	57	0	0	0
	40	9	0	0	0
	41		Bad Tow - Net Torn		
	42	9	0	0	0
	43	379	0	0	0
	44	4	0	0	0
	45	0	0	0	0
	46	0	0	0	0
	47	299	0	0	0
	48	619	0	0	0
	49	10	0	0	0
	50	12	0	0	0
	51	179	0	0	0
	52	343	0	0	0
	53	5	0	0	0
	54	51	0	0	0
	55	16	0	0	0
	56	4	0	0	0
	57	235	0	0	0
	58	160	0	0	0
	59	230	0	0	0
	60	34	0	0	0
	61	25	0	0	0
	62	158	0	0	0
	63	180	0	0	0
	64	159	0	0	0
	65	163	0	0	0
	66	113	1	1	1
	67	169	0	0	0
	68	194	0	0	0
	71	0	0	0	0
	75	6	0	0	0
	76	17	0	0	0
	77	235	0	0	0
	78	206	0	0	0
	79	2	0	0	0
	80	241	0	0	0
	81	314	0	0	0
	82	43	0	0	0
	83	17	0	0	0
-----					
Eastside Total		4,897	1	1	1

Appendix D: (page 3 of 13)

Location	Tow #	# Crabs Visually Examined	# Crabs Suspect & Tested for BCS	# Readable Hemolymph Slides	# Crabs Positive for BCS
=====					
Kodiak District					
Southeast	69	68	0	0	0
	70	82	0	0	0
	72	13	0	0	0
	73	58	0	0	0
	74	33	0	0	0
	84	171	1	1	0
	85	145	0	0	0
	86	148	0	0	0
	87	27	0	0	0
	88	25	0	0	0
	89	320	0	0	0
	90	104	0	0	0
	91	114	1	1	1
	92	4	0	0	0
	93	16	0	0	0
	94	24	0	0	0
	95	136	0	0	0
	96	135	0	0	0
	97	81	0	0	0
	98	49	0	0	0
	99	48	0	0	0
	100	64	1	1	1
	101	10	0	0	0
	102	11	0	0	0
	103	97	4	3	3
	104	83	1	0	0
	105	43	0	0	0
	106		Bad Tow - Torn Net		
	107	3	0	0	0
	134	9	0	0	0
	135	3	0	0	0
	136	1	0	0	0
	137	6	0	0	0
	138	11	0	0	0
	139	59	0	0	0
<hr/>					
Southeast Total		2,202	8	6	5

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Location	Tow #	# Crabs Visually Examined	# Crabs Suspect & Tested for BCS	# Readable Hemolymph Slides	# Crabs Positive for BCS
=====					
Kodiak District					
Southwest	108	352	0	0	0
	109		Bad Tow - Torn Net		
	110	3	0	0	0
	111	1	0	0	0
	112	6	0	0	0
	113	4	0	0	0
	114	5	0	0	0
	115	3	0	0	0
	116	9	0	0	0
	117	97	0	0	0
	118	55	0	0	0
	119	21	0	0	0
	120	125	0	0	0
	121	0	0	0	0
	122	0	0	0	0
	123	5	0	0	0
	124	0	0	0	0
	125	0	0	0	0
	126	15	0	0	0
	127	21	0	0	0
	128	46	0	0	0
	129	0	0	0	0
	130	5	0	0	0
	131	0	0	0	0
	132	0	0	0	0
	133	0	0	0	0
	140	14	0	0	0
	141	110	5	5	5
	142	157	9	9	9
	143	255	16	15	15
	144		Bad Tow - Torn Net		
	145	638	5	4	3
	146	112	14	13	13
	147	520	11	10	10
	148	223	15	15	15
	149	462	1	1	1
	150	490	6	5	4
	151	102	37	36	36
	152	40	17	16	16
	153		Bad Tow - Torn Net		
	154	339	11	10	10
	155	460	6	6	6
	156	227	6	6	5
	157	389	4	4	4
-----					
Southwest Total		5,281	163	155	152

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Location	Tow #	# Crabs Visually Examined	# Crabs Suspect & Tested for BCS	# Readable Hemolymph Slides	# Crabs Positive for BCS
=====					
Kodiak District					
Westside	364	51	0	0	0
	365		Bad Tow - Net Malfunction		
	366	189	0	0	0
	367	191	0	0	0
	368	50	0	0	0
	369	205	0	0	0
	370	190	0	0	0
	371	14	0	0	0
	372	0	0	0	0
	373	512	0	0	0
	374	378	1	1	1
	375	33	1	1	1
	376	480	2	2	2
	377	147	1	1	1
	378	214	2	2	2
	379	399	0	0	0
	380	375	7	7	7
	381	386	3	3	3
	382	253	0	0	0
	383	1	0	0	0
	384	236	0	0	0
	385	386	0	0	0
	386	15	0	0	0
	387	374	1	1	1
	388	6	0	0	0
	389	6	0	0	0
	390	312	0	0	0
	391	7	0	0	0
	392	319	0	0	0
	393	11	0	0	0
	394	96	0	0	0
	412		Bad Tow - Crab Pot in Net		
	413	430	0	0	0
	414	173	0	0	0
-----					
Westside Total		3,362	18	18	18

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Location	Tow #	# Crabs Visually Examined	# Crabs Suspect & Tested for BCS	# Readable Hemolymph Slides	# Crabs Positive for BCS
Kodiak District					
North Mainland	395	338	0	0	0
	396	353	2	2	2
	397	588	0	0	0
	398	243	0	0	0
	399	365	2	2	2
	400	468	1	1	1
	401	169	0	0	0
	402	5	0	0	0
	403	425	2	2	2
	404	154	2	2	2
	405	279	4	4	3
	406	199	0	0	0
	407	141	1	1	1
	408	118	0	0	0
	409	100	0	0	0
	410	148	0	0	0
	411	234	1	1	1
	415	170	4	4	4
	416	182	1	1	1
	417	69	0	0	0
	418	93	0	0	0
	419	52	0	0	0
	420	27	0	0	0
	421	181	1	1	1
	422	112	0	0	0
	423	85	0	0	0
North Mainland Total		5,298	21	21	20

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Location	Tow #	# Crabs Visually Examined	# Crabs Suspect & Tested for BCS	# Readable Hemolymph Slides	# Crabs Positive for BCS
=====					
South Peninsula District					
Morzhovoi Bay					
	204	0	0	0	0
	205	105	0	0	0
	206	461	0	0	0
	207	2	0	0	0
	208	84	0	0	0
	209		Bad Tow - Net Malfunction		
	210	1	0	0	0
	211	109	0	0	0
	217	12	0	0	0
	218	132	0	0	0
	219	254	0	0	0
	220	297	0	0	0
	221	9	0	0	0
	222	44	0	0	0
	223	67	0	0	0
	224	337	0	0	0
	225	308	0	0	0
	226	122	0	0	0
	227	381	0	0	0
	228	281	0	0	0
	229	75	0	0	0
	230	34	0	0	0
	231	224	0	0	0
	232	331	0	0	0
	233	411	0	0	0
<hr/>					
Morzhovoi Bay Total		4,081	0	0	0
Sanak Island	212	44	0	0	0
	213	52	1	1	1
	214	110	0	0	0
	215	50	1	1	1
	216	75	1	1	1
<hr/>					
Sanak Island Total		331	3	3	3

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Location	Tow #	# Crabs Visually Examined	# Crabs Suspect & Tested for BCS	# Readable Hemolymph Slides	# Crabs Positive for BCS
South Peninsula District					
Cold Bay/Belkofsky					
	234	218	0	0	0
	235	20	0	0	0
	236	25	0	0	0
	237	374	0	0	0
	238	99	0	0	0
	239	165	0	0	0
	240	293	0	0	0
	241	252	0	0	0
	242	161	1	1	1
	243	358	0	0	0
	244	147	0	0	0
	245	224	1	1	1
	246	323	0	0	0
	247	17	0	0	0
	248	350	0	0	0
	249	84	0	0	0
	250	4	0	0	0
	251	278	0	0	0
	252	366	1	1	1
	253	93	0	0	0
Cold Bay/Belkofsky Total		3,851	3	3	3
Stepovak					
	318	38	0	0	0
	319	42	0	0	0
	320	88	1	1	1
	321	94	0	0	0
	322	294	1	1	1
	323	219	2	2	2
	324	106	0	0	0
	325	129	1	1	1
	326	85	0	0	0
Stepovak Total		1,095	5	5	5

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Location	Tow #	# Crabs Visually Examined	# Crabs Suspect & Tested for BCS	# Readable Hemolymph Slides	# Crabs Positive for BCS
=====					
South Peninsula District					
Pavlof/Volcano Bays					
	254	104	2	2	2
	255	96	4	4	4
	256	282	1	1	1
	257	35	2	2	2
	258	419	3	3	3
	259	47	0	0	0
	260	178	0	0	0
	261	174	0	0	0
	262	407	6	6	6
	263	55	2	2	2
	264	74	1	1	1
	265	172	0	0	0
	266	247	0	0	0
	267	147	0	0	0
	268	20	0	0	0
	269	118	0	0	0
	270	213	0	0	0
	271	283	1	1	1
	272	12	0	0	0
	273	279	0	0	0
	274	154	0	0	0
	275	10	0	0	0
	276	238	0	0	0
	277	5	0	0	0
	278	15	0	0	0
	279	2	0	0	0
	280	61	0	0	0
	281	12	0	0	0
	282	0	0	0	0
	283	0	0	0	0
	284	3	0	0	0
	285	8	0	0	0
	286	49	0	0	0
	287	18	0	0	0
	288	11	0	0	0
	289	2	0	0	0
	290	49	0	0	0
	291	51	0	0	0
	292	146	0	0	0
	293		Bad Tow - Net Malfunction		
	294	34	0	0	0
	295	162	0	0	0
<hr/>					
Pavlof/Volcano Bays Total		4,392	22	22	22

Appendix D: (page 10 of 13)

Location	Tow #	# Crabs Visually Examined	# Crabs Suspect & Tested for BCS	# Readable Hemolymph Slides	# Crabs Positive for BCS
=====					
South Peninsula District					
Beaver/Balboa Bays					
	296	2	0	0	0
	297	1	0	0	0
	298	1	0	0	0
	299	6	0	0	0
	300	39	0	0	0
	301	253	0	0	0
	302	215	2	2	2
	303	159	0	0	0
	304	159	0	0	0
	305	4	0	0	0
	306	99	1	1	1
	307	144	3	3	3
	308		Bad Tow - Net Malfunction		
	309	95	3	3	3
	310	5	0	0	0
	316	98	1	1	1
	317	95	0	0	0
-----					
Beaver/Balboa Bays Total		1,375	10	10	10
West Nagai	311	17	0	0	0
	312	84	1	1	1
	313	119	3	3	3
	314	10	1	1	1
	315	7	0	0	0
-----					
West Nagai Total		237	5	5	5
Location	Tow #	# Crabs Visually Examined	# Crabs Suspect & Tested for BCS	# Readable Hemolymph Slides	# Crabs Positive for BCS
=====					
Chignik District					
Ivanof	327	351	2	2	2
	328	202	0	0	0
	329	185	1	1	1
	330	139	0	0	0
	331	69	0	0	0
	332	14	0	0	0
	333	29	0	0	0
-----					
Ivanof Total		989	3	3	3
Mitrofanina	334	23	0	0	0
	335	75	0	0	0
	336	8	0	0	0
	337	86	0	0	0
	338	242	13	13	12
	339	66	2	1	1
-----					
Mitrofanina Total		500	15	14	13

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Location	Tow #	# Crabs Visually Examined	# Crabs Suspect & Tested for BCS	# Readable Hemolymph Slides	# Crabs Positive for BCS
<b>Chignik District</b>					
Chignik	340	9	0	0	0
	341	8	0	0	0
	342	241	0	0	0
	343	377	0	0	0
	344	213	0	0	0
	345	239	0	0	0
	346	197	0	0	0
	347	583	0	0	0
	348	291	1	1	1
	349	400	1	1	1
	350	46	0	0	0
	351	211	1	1	1
	352	13	0	0	0
	353	324	0	0	0
	354	231	0	0	0
	355	191	0	0	0
	356	218	0	0	0
<b>Chignik Total</b>		<b>3,792</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>Kujulik</b>					
	357	14	0	0	0
	358	29	0	0	0
	359	239	0	0	0
	360	39	0	0	0
	361	59	0	0	0
	362	231	0	0	0
	363	309	0	0	0
<b>Kujulik Total</b>		<b>920</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Eastern Aleutian District</b>					
Akutan	158	265	0	0	0
	159	375	0	0	0
	160	368	0	0	0
	161	264	0	0	0
	162	517	0	0	0
<b>Akutan Total</b>		<b>1,789</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Unalaska/Kalekta</b>					
	163	317	0	0	0
	164	26	0	0	0
	165	76	0	0	0
	166	278	2	2	2
	167	57	0	0	0
	168	362	1	1	1
	169	26	0	0	0
	170	4	0	1	0
<b>Unalaska/Kalekta Total</b>		<b>1,146</b>	<b>3</b>	<b>3</b>	<b>3</b>

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Location	Tow #	# Crabs Visually Examined	# Crabs Suspect & Tested for BCS	# Readable Hemolymph Slides	# Crabs Positive for BCS
=====					
Eastern Aleutian District					
Beaver Inlet	171	255	0	0	0
	172	402	0	0	0
	173	3	0	0	0
	174	1	0	0	0
	175	569	1	1	1
	176	461	0	0	0
	177	170	0	0	0
<hr/>					
Beaver Inlet Total		1,861	1	1	1
<hr/>					
Usof Bay	178	2	0	0	0
	179	1	0	0	0
	180	49	0	0	0
	181	547	0	0	0
	182	6	0	0	0
<hr/>					
Usof Bay Total		605	0	0	0
<hr/>					
Cape Idak					
	183		Bad Tow - Net Malfunction		
	184	8	0	0	0
	185	4	0	0	0
	186	1	0	0	0
<hr/>					
Cape Idak Total		13	0	0	0
<hr/>					
Inanudak Bay	187	1	0	0	0
	188	1	0	0	0
	189	7	0	0	0
	190	0	0	0	0
<hr/>					
Inanudak Bay Total		9	0	0	0
<hr/>					
Pumicestone Bay	191	24	0	0	0
	192	138	0	0	0
<hr/>					
Pumicestone Bay Total		162	0	0	0
<hr/>					
Makushin Bay	193	170	0	0	0
	194	125	0	0	0
	195	25	0	0	0
	196	27	0	0	0
	197	534	3	3	3
	198	306	2	2	2
	199	97	0	0	0
	200	203	0	0	0
<hr/>					
Makushin Bay Total		1,487	5	5	5

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Location	Tow #	# Crabs Visually Examined	# Crabs Suspect & Tested for BCS	# Readable Hemolymph Slides	# Crabs Positive for BCS
=====					
Eastern Aleutian District					
Akun Bay	201	1	0	0	0
	202	2	0	0	0
	203	0	0	0	0
-----					
Akun Bay Total		3	0	0	0

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