

4K 96 - 42

PROJECT OPERATIONAL PLAN FOR THE 1996 NORTON SOUND  
RED KING CRAB TRAWL SURVEY

by

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Regional Information Report<sup>1</sup> No. 4K96-42

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

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ALASKA DEPARTMENT OF FISH AND GAME  
COMMERCIAL FISHERIES MANAGEMENT AND DEVELOPMENT DIVISION

PROJECT OPERATIONAL PLAN

Title: Bering Sea Crab Assessment  
(Norton Sound Red King Crab Trawl Survey)

Yellowbook Project No.: FM-782 (Appendix A)

Project Leader: Donn Tracy PCN: 11-1857  
Biometrician: Ivan Vining PCN: 11-1227

Date Submitted: July 31, 1996

Region: Westward  
Fishery Unit: Bering Sea/Aleutian Islands Crab  
Fishery Management Plan: Fishery Management Plan for the Commercial King and Tanner  
Crab Fisheries in the Bering Sea/Aleutian Islands

File Name: C:\forrest\nortonsd\nspop96.doc

APPROVALS

Level	Signature	Date
Project Leader(s):	_____	_____
Regional Biometrician:	_____	_____
Research Supervisor:	_____	_____
Regional Supervisor:	_____	_____
Headquarters Receipt:	_____	_____
Headquarters Approval:	_____	_____
Further Review:	_____	_____
Approval:	_____	_____

## FOREWORD

The 1996 ADF&G Norton Sound red king crab trawl survey will be the first survey of Norton Sound red king crab stocks since 1991, when the National Marine Fisheries Service conducted its last stock assessment survey of the area. In 1995, ADF&G received funding for the Bering Sea Crab Stock Assessment Initiative (BSCSAI), a program primarily designed to provide population assessment surveys in areas that currently are unsurveyed or to improve the accuracy of existing survey estimates. The 1996 ADF&G stock assessment survey will provide estimates of the Norton Sound red king crab population for use by fishery managers. Additionally, the BSCSAI provides funding for in-season monitoring of the Norton Sound red king crab winter fishery. Fiscal year 1997 ADF&G Bering Sea Test Fishery Project budget appears in Appendix A.

## INTRODUCTION

The regulatory description of the Norton Sound section, located in the Northern district of Area Q, includes all waters east of 168° W longitude, between the latitudes of Cape Romanzof and Cape Prince of Wales (ADF&G 1994). The commercial fishing season for red king crab occurs in two periods: (1) from July 1 through September 3 (summer season); and (2) through the ice only, from November 15 through May 15 (winter season). The commercial fishery began in 1977, however, subsistence use of red king crabs has long been practiced and occurs primarily through the ice during winter (Lean and Brennan 1995).

Summer commercial fishery harvests have averaged less than 0.7 million pounds annually, ranging from a high of about 3 million pounds in 1978 to a low of .07 million pounds in 1992. There was no summer commercial fishery in 1991. The winter commercial fishery is nominal, at an average of 2,582 crabs annually since 1978. The 1978 harvest was the highest at 9,625 crabs, followed by a rapid decline in 1980 and 1981. Modest increases were noted through the 1980s, followed by significant gains in the early 1990s, culminating in a harvest of 7,538 crabs in 1995. Harvests of king crabs in the winter subsistence fishery have been quite substantial, ranging from a high of 12,506 crabs in 1978 to lows of 200 to 400 crabs in the early 1980s. During the 1980s and early 1990s, the harvest ranged from 1,097 crabs in 1993 to a high of 12,152 crabs in 1990. In recent years, the harvest has been about 4,000 crabs. Major factors limiting the winter commercial and subsistence fisheries are poor ice conditions and shifts in the distribution of crabs (Lean and Brennan 1995).

Prior to the advent of the Atomic Energy Commission (AEC) assessment survey of demersal fish and invertebrates of the Chukchi Sea - Norton Sound region in 1959 (Wilimovsky 1966), several investigations provided preliminary information on the distribution and abundance of demersal biota (c.f. Andriyashev 1937 and Ellson et al. 1950). However, the first comprehensive survey of the Norton Sound area was conducted in 1976 to establish a baseline data set for benthic fauna (Wolotira et al. 1977). This study provided critical information on the distribution and abundance of invertebrates, notably absent from the 1959 AEC study. A review of historical Norton Sound investigations is in Wolotira et al. (1977).

Trawl assessment surveys have been conducted in Norton Sound triennially since 1976 by NMFS to provide distribution and abundance of demersal fish and invertebrates. For purposes of this report, red king crab *Paralithodes camtschaticus* stock status and the commercial and subsistence fisheries will be the focus of discussion unless otherwise noted. Results from the six NMFS surveys are summarized in Wolotira et al. (1977), NMFS (1982), Sample and Wolotira (1985), Stevens (1989), Stevens and MacIntosh (1986), and Stevens (1992). The 1991 survey was the last NMFS survey of the Norton Sound area; due to budgetary constraints, NMFS eliminated the Norton Sound area from the 1994 triennial survey.

Pot surveys of the Norton Sound red king crab stock were conducted by ADF&G in 1980, 1981, 1982, and 1985 (Lean and Brennan 1995) and were designed for two primary purposes: (1) to provide annual distribution, abundance and size class profiles during years that NMFS did not

conduct assessment surveys; and (2). to provide preseason information to fishery managers regarding stock size and structure. The 1996 ADF&G trawl assessment survey is the first survey since the 1991 NMFS survey, and is the first ADF&G trawl survey of the area.

Population estimates for legal male crabs have fluctuated widely among trawl and pot surveys, from a high of 8.1 million pounds in 1976 to a low of 1.0 million pounds in 1991. Error estimates for legal males have also been fairly high; in the 1985 NMFS trawl survey, the error around the mean was estimated at  $\pm 32\%$  at the 95% C.I. The error around the abundance estimate of the 1985 ADF&G pot survey was slightly higher ( $\pm 36\%$  at the 95% C.I.) (Stevens and MacIntosh 1986). The 1996 ADF&G trawl survey will utilize the same station sampling pattern as established by NMFS. If time permits, stations where large numbers of legal male red king crabs are caught will be sampled again, with the expectation of significantly reducing the error of the resulting abundance estimate. The 1996 survey will be conducted to provide abundance estimates of red king crabs, crab size data and related biological characteristics, and to document benthic species composition in Norton Sound. The 1996 survey will also add to the historical survey record and provide continuity in stock assessment methods.

## OBJECTIVES

Prioritized objectives of the 1996 Norton Sound red king crab trawl survey are listed below.

- I. Survey a portion of Norton Sound for red king crabs and associated marine life for spatial distribution, abundance and population characteristics using a 400 eastern otter trawl. Population estimates of red king crabs will be made from this data using the area-swept technique (Alverson 1969) by ADF&G Alaska-Yukon-Kuskokwim biometricians Jeff Bromaghin, and Lowell Fair.
- II. Maintain continuity of previous trawl survey databases in Norton Sound which were conducted by NMFS 1976 to 1991 by using the same station midpoints, grid pattern, and general sampling procedures.
- III. Lengths, weights, and other biological data will be taken from all of the following commercial or potentially commercial species found in any haul made in Norton Sound; specifically red and blue king crabs, Pacific halibut, and Pacific cod.
- IV. Each tow will be randomly subsampled by filling one to four baskets of the remaining fish, invertebrates, and debris. The contents of the basket(s) will be sorted to the lowest taxon possible, counted and weighed, and will be completed prior to bringing the next haul aboard.
- V. A total of 43 core stations and three lower priority tiers of five stations each (15 stations) for a total of 58 stations will be completed, if a sufficient amount of trawlable weather

during the survey period. If the weather is good, the goal will be to complete an average of six stations per day.

- VI. After all 58 stations in objective V above have been towed, and if there are additional charter days available for biological sampling, then stations will be selected to resurvey based on high catches of red king crabs, by Charlie Lean, Jeff Bromaghin, and Lowell Fair. One to four days of possible resurveying may be available for this purpose if all 58 target stations are towed first and good weather prevails.
- VII. All data will be entered into an electronic database. Data needed for red king crab population estimation by ADF&G AYK biometrical staff (Jeff Bromaghin and Lowell Fair) will be transferred by Kodiak ADF&G staff (Blau, Vining, and Blackburn) no later than December 31, 1996.
- VIII. An ADF&G Regional Information Report on the 1996 Norton Sound trawl survey will be completed by Kodiak ADF&G staff by November 1, 1996

## METHODS

### *Trawl Survey*

#### **Survey Station Locations and Design**

The nonrandom, systematic station location design used by NMFS in their six trawl surveys of Norton Sound (1976 to 1991) was adopted for this survey in an attempt to provide a comparable survey pattern and documentation of marine life for this area. A 10 x 10 nmi grid pattern was established for Norton Sound with each 10 x 10 nmi square identified by a station number. The centers of each survey station have been standardized using latitude and longitude coordinates that denote where each trawl will begin within a station (Figure 1 and Appendix A).

#### **Trawl Gear, Towing Time, Speed and Distance**

A 400 eastern otter trawl, spread by two 1.5 x 2.1 m Astoria "V" doors, will be towed for approximately one half hour at a speed of approximately 2 knots to cover a distance of 1.85 km (1-nmi). This gear will be set and retrieved by a pair of steel cables from hydraulic deck winches. Distance towed will be calculated using the vessel's global position system (GPS) and data recorded by the skipper on the Trawl Survey Haul Record form (Appendix C.1). A computerized temperature probe will be attached to the trawl. A bottom temperature of each haul will be recorded, downloaded to a computer and recorded the Skipper Trawl Record form.

## Survey Coverage Goals

The goal is to trawl the 43 core stations first, followed by the 15 stations in tiers 1,2, and 3 as prioritized fashion, tiers 1-3 (Figure 2). If those goals are accomplished, new stations or previously sampled stations may be trawled.

## Contingency Plans

If six tows per day can be made, then all 58 stations will be completed in 10 days; however if only five stations per day can be towed, it will take almost 12 days to complete all 58 stations. If the ocean conditions prevent the trawl from fishing properly, the vessel will move to calmer waters or day(s) of fishing will be lost, effectively precluding extra stations, resurveying stations, or towing of tier 1-3 stations. High biomasses that slow on-deck sampling may also reduce the number of tows made each day. Additionally, if trawlable areas within a particular station are difficult to locate, or are preempted by commercial king crab pots during the summer red king crab fishery, fewer tows may result.

## Nonstandard or Untrawlable Stations

An attempt will be made to trawl certain stations that may not be trawlable due to rocky substrates that could damage the trawl gear. These stations include, but are not limited to stations 124, 151, 177, 178, 202, and 205. Additionally, while these stations may be fishable, the trawl may not be set at the center point of the station. The captain will search within the station grid in an attempt to find trawlable bottom, and will have the discretion to decide whether a station is trawlable.

## Additional Stations or Resurveying Stations

Once the target 58 stations are towed, additional survey stations can be fished up to **August 19**, the date the FV *Peggy Jo* will begin her return trip to Kodiak. Any new stations will be selected for trawling by Charlie Lean and or Jeff Bromaghin and Jeff Lowell and will be based on high catches of red king crabs reported during radio schedule with the FV *Peggy Jo*. Selection of stations to be fished will either be: (1) adjacent to the outside borders of the core stations and three tiers of stations (Figure 2); or (2) resurveying of previously sampled stations will be achieved by placing four, 1-nmi tows around the station center point in the four cardinal directions i.e., north, south, east, and west)(Appendix B). Expanded trawl efforts will contribute additional data to refine estimates of variance at locations where high catches of crabs are encountered.

## Survey Itinerary - 1996

July 23	Load <i>Peggy Jo</i> with trawl nets, door, cables and most equipment.
July 24	Assemble trawl cables and hardware on 400 eastern otter trawl.
July 31	Load remaining survey gear, computer and photo gear.
August 1	12:01 am <i>Peggy Jo</i> departs for Nome.

August 4 Blau and Blackburn fly from Kodiak to Nome.  
 August 5 Blau, Blackburn, Brennan, Rob, Lean, Bromaghin meet in Nome ADF&G office to review survey plans and procedures.  
 August 6 ADF&G survey crew boards *Peggy Jo* and begins trawl survey.  
 Aug. 7-14 Complete 43 core stations.  
 Aug. 15-17 Complete tiers 1-3.  
 August 18 Tow six new stations or resurvey around two previously sampled stations.  
 August 19 *Peggy Jo* returns to Kodiak.  
 Aug. 24- 26 *Peggy Jo* returns to Kodiak. Gear is unloaded and charter is over!

### Survey Crews

There will be eight people aboard the FV *Peggy Jo* during the dates that trawling will occur.

#### ADF&G Crew

Forrest Blau - Crew Leader (King Crab Research Biologist), Kodiak  
 Jim Blackburn - Assistant Crew Leader (Fishery Biologist and Database Manager), Kodiak  
 Betsy Brennan - Fishery Biologist, Nome  
 Peter Rob - Fish Culturist, Red King Crab Subsistence Monitor, Nome

#### FV *Peggy Jo* Crew

James Kasner - Captain, Kodiak  
 Scott Weismantel - Engineer, Kodiak  
 Mike Sparks - Deck Boss & Co-cook, Kodiak  
 Don Andrews - Deck Hand & Co-cook, Kodiak

### *Catch Sampling*

#### **Weight of Haul**

While the net is being retrieved, fish and crabs will be shaken from the intermediate portion of the net down to the codend by the vessel crew. Once the codend of the trawl comes aboard a lifting strap will be placed around it to which a crane scale will be attached and the weight taken and recorded on the Station Catch Record form, along with the haul and station number and date (Appendix C.2). The contents of the trawl will then be emptied on deck, the tare weight of the net section originally weighed will be reweighed and recorded on the Station Catch Record form.

### *Whole Haul Sampling*

#### **Red and Blue King Crabs**

All red *Paralithodes camtschaticus* and blue *P. platypus* king crabs will be sampled from each trawl haul. The number and weight of each species will be recorded on the Station Catch Record Form. Each crab will be thoroughly examined and data recorded from each applicable column on the Crab Research Data form (Appendix C.3). Up to five red and/or blue king crabs may be

sampled and dissected for microsporidians (referred to in layman's terms as "cottage cheese disease") if infection is apparent. Tissues of each crab will be saved and sent to Dr. Frank Morado, NMFS shellfish pathologist in Seattle.

### **Pacific Halibut and Pacific Cod**

All Pacific halibut *Hippoglossus stenolepis* and Pacific cod *Gadus macrocephalus* will be picked from each haul prior to subsampling. Halibut lengths will be measured in cms (snout tip to tail) and a total count will be recorded. Basket weights, counts, and fork-lengths of Pacific cod will be also be recorded. Halibut will be handled gently by holding them by the body, not the tail, and released immediately after measurement.

### ***Subsampling the Catch***

One, two or four baskets will be filled with the contents from each tow to serve as a subsample once all king crabs, halibut and Pacific cod are removed from the tow. On the first day of trawling, subsampling may be limited to one basket until species identification and sampling routines are established. Standard sampling effort will be set at two or four baskets to estimate the variance of the catch based on two samples from each haul.

The fish and invertebrates of each basket will be separated to the lowest taxon and from debris (sticks, algae, garbage, tundra). Each taxon will be weighed and counted on the Station Catch Recqrd form and recorded by the assigned NMFS species code. Length frequencies of fish will be taken on an opportunistic basis and recorded on the Fish Length Frequency form (Appendix C.4).

### ***Data Checking and Entry***

Each day, either between tows, or once all towing has been completed, all data forms will be checked for accuracy and completeness. Following editing, the data may be entered at sea using programs on a 486 notebook PC. All remaining data entry will be performed by an ADF&G administrative clerk in Kodiak.

### ***Radio Schedule and Log***

Each day the ADF&G crew is aboard, a radio schedule will be maintained with the ADF&G Nome office at 1600 hours using 4125 MHz as the initial contact frequency and 3230 MHz as the alternate. Data in eight designated columns will be transmitted for each sampled station using the Station Summary and Radio Log (Appendix D). All radio logs received in Nome will be faxed each day to Jeff Bromaghin or Lowell Fair (267-2442) and Doug Pengilly or Donn Tracy (486-1824). In the event that radio contact between the *Peggy Jo* and Nome cannot be made, or communications between Kodiak and Nome are not possible, Mrs. Peggy Dyson, owner of the *Peggy Jo*, may be able to relay information via her radio at WBH 29 on 4125 MHz in Kodiak.

### ***Photographic Documentation***

To help document the survey (e.g. crew, trawling process and captured marine life) both a video (8mm film) and a 35 mm camera will be used. Copies of the tape(s) and slides will be made available to the ADF&G offices in Nome and Kodiak.

### **SCHEDULES - ADF&G STAFF**

- 7/95-6/96 - Project planning (Tracy, Pengilly).
- 1/96-7/96 - Survey preparations (Blau, Tracy, Lean, Watson, Blackburn).
- 8/1-26/96 - Maximum charter length with the FV *Peggy Jo*.
- 8/6-8/18 - At-Sea trawl survey (Blau, Blackburn, Robb, and Brennan) .
- 9/96-10/96 - Data edit (Blau, Watson) and entry (Blackett).
- 12/96 (or before) - Red king crab data transfer to Bromaghin and Fair; data analysis and writing Regional Information Report on red king crab population estimates from survey findings.

### **REPORTS**

1. The 1996 Norton Sound red king crab trawl survey report, Regional Information Report - Blau (? Blackburn and Watson) due by 12/31/1996.
2. Red king crab population estimates from the 1996 ADF&G Norton Sound trawl survey. Regional Information Report, Bromaghin, Fair and Lean (Feb. 1997?).

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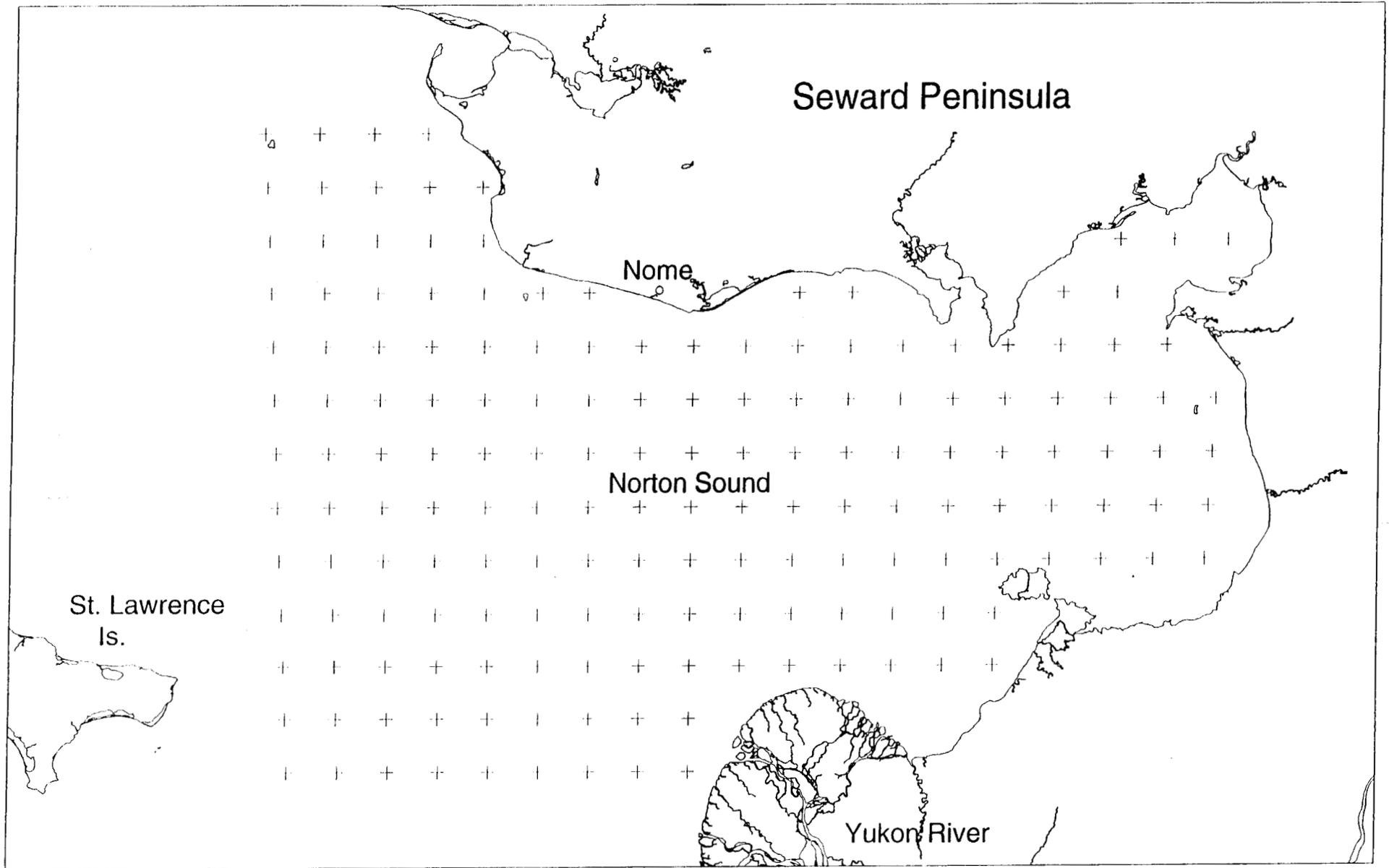


Figure 1. 1996 Alaska Department of Fish and Game Norton Sound trawl survey station centers, based on the 10 X 10 nmi grid pattern used by National Marine Fisheries Service on trawl surveys in Norton Sound, from 1976 to 1991.

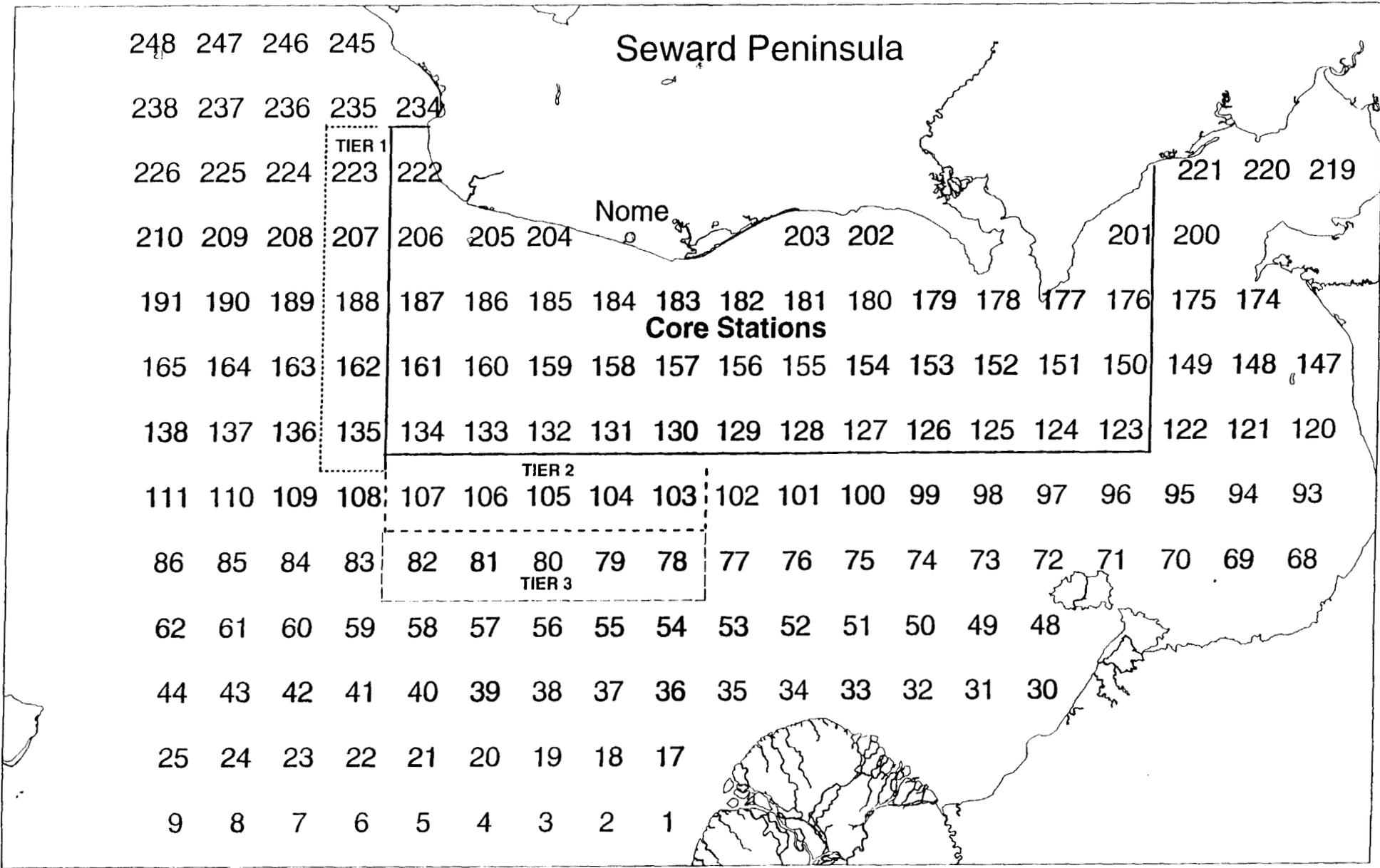


Figure 2. Layout of core stations and tier stations 1, 2, and 3 for the 1996 Alaska Department of Fish and Game Norton Sound red king crab trawl survey.

## **APPENDIX**

APPENDIX A. Fiscal Year 1997 ADF&G Yellowbook for the Bering Sea Crab Test Fishery Project.

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PROJECT TITLE: Bering Sea Crab Assess. Survey  
 PROJECT NUMBER: FM-782  
 FISHERY UNIT: Bering Sea/Aleutians Crab  
 LEDGER: 1140782  
 COMPONENT: 400110100 - Fisheries Mgt.  
 LOCATION: Kodiak  
 PROG.ELEMENT: Crab Assessment Survey  
 LEGISLATIVE DISTRICT: 26 27  
 FISHERIES AFFECTED: Bering Sea/Aleutian Islands Crab  
 SPECIES AFFECTED: King Crab

PROJECT DESCRIPTION:

This project provides funding for personnel, and vessel charters to assess the population size of important Bering Sea Crab Stocks.

PROJECT OBJECTIVES:

To obtain accurate stock assessments on mature crab stocks in the Bering Sea and Aleutian Islands. Current surveys (NMFS) do not cover the area and lack of focus due to their groundfish priority. Only through such survey data can the health of the stocks be assessed.

BUDGET MANAGER: 11-1202 Douglas Pengilly

TITLE: Fishery Biologist IV

PRIOR YEAR ALLOCATIONS

Budget Detail	FY96	FY97
100 Personal Services	34.00	262.89
200 Travel	0.00	0.00
300 Contractual	169.50	1.69
400 Commodities	5.00	0.00
500 Equipment	0.00	0.00
Project Totals	208.5	264.58

Funding sources	FY96	FY97
Federal Receipts	0.00	0.00
General Fund	208.50	264.58
Interagency Receipts	0.00	0.00
Program Receipts	0.00	0.00
General Fund Match	0.00	0.00
Fish and Game Fund	0.00	0.00
CIP Funds	0.00	0.00
 Staff months	 4.00	 56.00

**PROJECT NUMBER:** FM-782

**PROJECT TITLE:** Bering Sea  
Crab Assess.

**COMPONENT:** 400110100 Fisheries Mgmt.

**UNIT:** Bering Sea Aleutians Crab

**REGION:** 4

**LEDGER CODE:** 11140782

PCN	TITLE	NAME	RS	S	LOC	PM	SWD	RDO	OT	HAZ	GY	SW	SB	TOTAL
11-1409	Fish Bio I	Moore, Holly	14 A	FS	BKB	6.0	0	0	0	0	0	0	0	\$29,833.40
11-7092	Fish Bio II	Boyle, Larry	16 J	FR	BKB	12.0	0	0	0	0	0	0	0	\$76,242.71
11-1637	Admin Clerk II	Chisum, Tammy	8B	FS	BKB	11.0	0	0	0	0	0	0	0	\$40,095.61
11-1755	Admin Clerk II	Budka, Grace	8 A	FS	AWA	6.0	0	0	0	0	0	0	0	\$15,800.47
11-1905	F&W Tech. III	Thompson, Paul	11 A	FS	CAA	6.0	0	0	20	0	0	0	0	\$22,670.97
11- 1919	Fish. Bio. I	Brennan, Betsy	14 B	FS	CAA	3.0	0	0	15	0	0	0	0	\$11,335.86
11-1857	Fish Bio III	Tracy, Donn	18 A	FR	CAA	12.0	0	0	0	0	0	0	0	\$66,710.16
TOTALS						56.0	0	0	35	0	0	0	0	\$262,899.18

Line	Description	Amount	Comments
72240	Field travel	0.0	Travel
72500	Per Diem/Other costs	0.0	Per diem Expenses
73000	Other	1,690.0	pot storage DH
	services/charges		
74480	Household/Institutional	0.0	
74520	Scientific supply	0.0	
74600	Other operation	0.0	
	supplies		
75690	Mach/Equip summary	0.0	
TOTALS		1,690.0	

Grand Total

\$264,589.18

Appendix B. 1996 Norton Sound red king crab trawl survey station locations<sup>a,b,c</sup>.

NMFS GRID	STATION	NORTH	LATITUDE	WEST	LONGITUDE	AREA
ID	NO	DEGREES	MINUTES	DEGREES	MINUTES	(nmi <sup>2</sup> )
A11	1	63	0.00	164	58.20	100
A12	2	63	0.00	165	20.13	100
A13	3	63	0.00	165	42.06	100
A14	4	63	0.00	166	3.99	100
A15	5	63	0.00	166	25.92	100
A16	6	63	0.00	166	47.84	100
A17	7	63	0.00	167	9.77	100
A18	8	63	0.00	167	31.70	100
A19	9	63	0.00	167	53.63	100
B11	17	63	10.00	164	58.20	100
B12	18	63	10.00	165	20.25	100
B13	19	63	10.00	165	42.31	100
B14	20	63	10.00	166	4.36	100
B15	21	63	10.00	166	26.42	100
B16	22	63	10.00	166	48.47	100
B17	23	63	10.00	167	10.53	100
B18	24	63	10.00	167	32.58	100
B19	25	63	10.00	167	54.64	100
C05	30	63	20.00	162	45.11	
C06	31	63	20.00	163	7.29	100
C07	32	63	20.00	163	29.47	100
C08	33	63	20.00	163	51.65	100
C09	34	63	20.00	164	13.84	100
C10	35	63	20.00	164	36.02	100
C11	36	63	20.00	164	58.20	100
C12	37	63	20.00	165	20.38	100
C13	38	63	20.00	165	42.56	100
C14	39	63	20.00	166	4.75	100
C15	40	63	20.00	166	26.93	100
C16	41	63	20.00	166	49.11	100
C17	42	63	20.00	167	11.29	100
C18	43	63	20.00	167	33.48	100
C19	44	63	20.00	167	55.66	100
D05	48	63	30.00	162	44.33	

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D06	49	63	30.00	163	6.64	100
D07	50	63	30.00	163	28.95	100
D08	51	63	30.00	163	51.27	100
D09	52	63	30.00	164	13.58	100
D10	53	63	30.00	164	35.89	100
D11	54	63	30.00	164	58.20	100
D12	55	63	30.00	165	20.51	100
D13	56	63	30.00	165	42.82	100
D14	57	63	30.00	166	5.13	100
D15	58	63	30.00	166	27.45	100
D16	59	63	30.00	166	49.76	100
D17	60	63	30.00	167	12.07	100
D18	61	63	30.00	167	34.38	100
D19	62	63	30.00	167	56.69	100
E01	68	63	40.00	161	13.78	100
E02	69	63	40.00	161	36.22	100
E03	70	63	40.00	161	58.66	
E04	71	63	40.00	162	21.10	
E05	72	63	40.00	162	43.55	100
E06	73	63	40.00	163	5.99	100
E07	74	63	40.00	163	28.43	100
E08	75	63	40.00	163	50.87	100
E09	76	63	40.00	164	13.32	100
E10	77	63	40.00	164	35.76	100
E11	78	63	40.00	164	58.20	100
E12	79	63	40.00	165	20.64	100
E13	80	63	40.00	165	43.08	100
E14	81	63	40.00	166	5.53	100
E15	82	63	40.00	166	27.97	100
E16	83	63	40.00	166	50.41	100
E17	84	63	40.00	167	12.85	100
E18	85	63	40.00	167	35.30	100
E19	86	63	40.00	167	57.74	100
F01	93	63	50.00	161	12.45	100
F02	94	63	50.00	161	35.03	100
F03	95	63	50.00	161	57.60	100
F04	96	63	50.00	162	20.18	100
F05	97	63	50.00	162	42.75	100
F06	98	63	50.00	163	5.33	100
F07	99	63	50.00	163	27.90	100
F08	100	63	50.00	163	50.48	100

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F09	101	63	50.00	164	13.05	100
F10	102	63	50.00	164	35.63	100
F11	103	63	50.00	164	58.20	100
F12	104	63	50.00	165	20.77	100
F13	105	63	50.00	165	43.35	100
F14	106	63	50.00	166	5.92	100
F15	107	63	50.00	166	28.50	100
F16	108	63	50.00	166	51.07	100
F17	109	63	50.00	167	13.65	100
F18	110	63	50.00	167	36.22	100
F19	111	63	50.00	167	58.80	100
G01	120	64	0.00	161	11.11	
G02	121	64	0.00	161	33.82	100
G03	122	64	0.00	161	56.53	100
G04	123	64	0.00	162	19.24	100
G05	124	64	0.00	162	41.94	100
G06	125	64	0.00	163	4.65	100
G07	126	64	0.00	163	27.36	100
G08	127	64	0.00	163	50.07	100
G09	128	64	0.00	164	12.78	100
G10	129	64	0.00	164	35.49	100
*G11	130	64	0.00	164	58.20	100
G12	131	64	0.00	165	20.91	100
G13	132	64	0.00	165	43.62	100
G14	133	64	0.00	166	6.33	100
G15	134	64	0.00	166	29.04	100
G16	135	64	0.00	166	51.75	100
G17	136	64	0.00	167	14.46	100
G18	137	64	0.00	167	37.16	100
G19	138	64	0.00	167	59.87	100
H01	147	64	10.00	161	9.75	
H02	148	64	10.00	161	32.59	
H03	149	64	10.00	161	55.44	100
H04	150	64	10.00	162	18.28	100
H05	151	64	10.00	162	41.13	100
H06	152	64	10.00	163	3.97	100
H07	153	64	10.00	163	26.82	100
H08	154	64	10.00	163	49.66	100
H09	155	64	10.00	164	12.51	100
H10	156	64	10.00	164	35.35	100
H11	157	64	10.00	164	58.20	100

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H12	158	64	10.00	165	21.05	100
H13	159	64	10.00	165	43.89	100
H14	160	64	10.00	166	6.74	100
H15	161	64	10.00	166	29.58	100
H16	162	64	10.00	166	52.43	100
H17	163	64	10.00	167	15.27	100
H18	164	64	10.00	167	38.12	100
H19	165	64	10.00	168	0.96	100
I02	174	64	20.00	161	31.35	
I03	175	64	20.00	161	54.33	100
I04	176	64	20.00	162	17.32	100
I05	177	64	20.00	162	40.30	<b>78.1</b>
I06	178	64	20.00	163	3.28	<b>89.8</b>
I07	179	64	20.00	163	26.27	
I08	180	64	20.00	163	49.25	100
I09	181	64	20.00	164	12.23	100
I10	182	64	20.00	164	35.22	100
I11	183	64	20.00	164	58.20	100
I12	184	64	20.00	165	21.18	100
I13	185	64	20.00	165	44.17	100
I14	186	64	20.00	166	7.15	100
I15	187	64	20.00	166	30.13	100
I16	188	64	20.00	166	53.12	100
I17	189	64	20.00	167	16.10	100
I18	190	64	20.00	167	39.08	100
I19	191	64	20.00	168	2.07	100
J03	200	64	30.00	161	53.21	100
J04	201	64	30.00	162	16.34	<b>91.2</b>
J08	202	64	30.00	163	48.83	<b>85.6</b>
J09	203	64	30.00	164	11.95	<b>82.8</b>
J13	204	64	30.00	165	44.45	<b>61.4</b>
J14	205	64	30.00	166	5.00	<b>78.1</b>
J15	206	64	30.00	166	30.69	100
J16	207	64	30.00	166	53.82	100
J17	208	64	30.00	167	16.94	100
J18	209	64	30.00	167	40.06	100
J19	210	64	30.00	168	3.19	100
K01	219	64	40.00	161	5.55	
K02	220	64	40.00	161	28.81	
K03	221	64	40.00	161	52.08	
K15	222	64	40.00	166	31.26	<b>67.4</b>

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K16	223	64	40.00	166	54.53	100
K17	224	64	40.00	167	17.79	100
K18	225	64	40.00	167	41.06	100
K19	226	64	40.00	168	4.32	100
L15	234	64	50.00	166	31.84	
L16	235	64	50.00	166	55.24	100
L17	236	64	50.00	167	18.65	100
L18	237	64	50.00	167	42.06	100
L19	238	64	50.00	168	5.47	100
M16	245	65	0.00	166	55.97	
M17	246	65	0.00	167	19.53	100
M18	247	65	0.00	167	43.08	100
M19	248	65	0.00	168	6.64	

- <sup>a</sup> Norton Sound standard station location positions taken from National Marine Fisheries Service, 1991. (Data source: 1991 North Shelf - Norton Sound survey, Kodiak laboratory crab and other invertebrate sampling. NMFS, Alaska Fisheries Science Center, Kodiak).
- <sup>b</sup> Square nautical miles in bold were calculated for those stations using a planimeter by ADF&G on NOAA chart 1620: Norton Sound to Bering Sea, 7/82 ed. Area calculated includes all ocean surface area greater than five fathoms in depth.
- <sup>c</sup> Stations less than 100 nmi<sup>2</sup> due to adjacent islands or mainland Alaska within their grid area are denoted by blanks in the area column. No data was available from National Marine Fisheries Service to refine or define the shore ward depth boundary used to calculate these grid areas.

Appendix C.1. ADF&G trawl survey haul record - Norton Sound trawl survey form.

ADF&G TRAWL SURVEY HAUL RECORD - NORTON SOUND TRAWL SURVEY

PG \_\_\_\_ OF \_\_\_\_

CAPTAIN: James Kasner

VESSEL: PEGGY JO

SEQUENTIAL HAUL NUMBER	STATION NUMBER	VESSEL CODE	DATE			STARTING POSITION				COMPASS HEADING
						N. LATITUDE		W. LONGITUDE		
			MO.	DAY	YEAR	DEG.	MINUTES	DEGREE	MINUTES	

TRAWL TIME			DIST. TOWED (NMI)	DEPTH (FM)			WEATHER (SEE CODES BELOW)			SCOPE (FM)	GEAR PERF.	BOTTOM TEMP. (C)
START	END	TOTAL (MIN)		MIN.	AVE.	MAX.	CLOUD	SEA	SWELL			
:	:											

COMMENTS:

SEQUENTIAL HAUL NUMBER	STATION NUMBER	VESSEL CODE	DATE			STARTING POSITION				COMPASS HEADING
						N. LATITUDE		W. LONGITUDE		
			MO.	DAY	YEAR	DEG.	MINUTES	DEGREE	MINUTES	

TRAWL TIME			DIST. TOWED (NMI)	DEPTH (FM)			WEATHER (SEE CODES BELOW)			SCOPE (FM)	GEAR PERF.	BOTTC TEMP.
START	END	TOTAL (MIN)		MIN.	AVE.	MAX.	CLOUD	SEA	SWELL			
:	:											

COMMENTS:

WEATHER CODES						GEAR PERFORMANCE CODES		
CLOUD COVER		SEA STATE (FEET)		SWELL (FEET)				
Clear	1	0 to 2	1	0 to 2	1	Performance Unsatisfactory		
1/8 obscured	2	2 to 4	2	2 to 4	2	Performance Satisfactory		
1/4 obscured	3	4 to 6	3	4 to 6	3	Doors non-functional (collapsed, crossed)		
3/8 obscured	4	6 to 8	4	6 to 8	4	Net non-functional (collapsed, torn, twisted, etc.)		
1/2 obscured	5	8 to 10	5	8 to 10	5	Gear hung up on bottom		
5/8 obscured	6	10 to 12	6	10 to 12	6	Trawl flipped or upside down		
3/4 obscured	7	12 to 14	7	12 to 14	7	Mudded down		
7/8 obscured	8	14 to 16	8	14 to 16	8	Telemetry malfunction (GPS, fathometer, etc.)		
Completely overcast	9	Over 16	9	Over 16	9			









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