Fishery Data Series No. 05-48

Norton Sound Winter Red King Crab Studies, 2005

by

Joyce Soong

and

Tom Kohler

October 2005

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Measures (fisheries)

fork length	FL
mideye-to-fork	MEF
mideye-to-tail-fork	METF
standard length	SL
total length	TL

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

FISHERY DATA SERIES NO. 05-48

NORTON SOUND WINTER RED KING CRAB STUDIES, 2005

by
Joyce Soong and Tom Kohler
Division of Commercial Fisheries, Nome

Alaska Department of Fish and Game
Division of Sport Fish, Research and Technical Services
333 Raspberry Road, Anchorage, Alaska, 99518-1599

October 2005

The Division of Sport Fish Fishery Data Series was established in 1987 for the publication of technically oriented results for a single project or group of closely related projects. Since 2004, the Division of Commercial Fisheries has also used the Fishery Data Series. Fishery Data Series reports are intended for fishery and other technical professionals. Fishery Data Series reports are available through the Alaska State Library and on the Internet: http://www.sf.adfg.state.ak.us/statewide/divreports/html/intersearch.cfm This publication has undergone editorial and peer review.

Joyce Soong and Tom Kohler
Alaska Department of Fish and Game, Division of Commercial Fisheries,
P.O. Box 1148, Nome, AK 99762, USA

This document should be cited as:
Soong, J., and T. Kohler. 2005. Norton Sound winter red king crab studies, 2005. Alaska Department of Fish and Game, Fishery Data Series No. 05-48, Anchorage.

TABLE OF CONTENTS

Page

LIST OF TABLES

Table **Page**

LIST OF FIGURES

Figure **Page**

ABSTRACT

Biological data were collected for a winter red king crab *Paralithodes camtschaticus* pot survey project, begun in February of 1982 by the Alaska Department of Fish and Game, to monitor the nearshore distribution, abundance, and life history parameters of the red king crab population in the Nome area. Red king crabs were caught with pots, measured, and tagged through established area stations in the sea ice offshore of Nome. Staff also monitored the winter subsistence and commercial fisheries to evaluate crab abundance available to local users. Project data, along with data from various other sources, were incorporated into a length based population model which was developed to predict population estimates for the red king crab biomass in Norton Sound. A total of 406 male and 20 female red king crabs were captured and sampled at 7 survey sites between February 18 and April 21, 2005. A total of 93 pot lifts were made for an overall catch per unit effort (CPUE) of 4.4 male and 0.2 female red king crabs. Carapace length measurements and shell age were recorded from all male king crabs caught. Of the male king crabs, 41.1% were prerecruit, 25.4% were recruit, and 33.5% postrecruit. Analysis of the 2005 winter data indicated recruitment has peaked and is expected to decrease for the next 2 years.

Key words: Norton Sound, red king crab, distribution, abundance, tagging, sea ice, subsistence, crab pots.

INTRODUCTION

Red king crabs, *Paralithodes camtschaticus,* support both commercial and subsistence harvests in the Norton Sound area. For both fisheries, effort is concentrated within 100 miles of Nome. Commercial fisheries occur during the winter and summer months, with most of the catch occurring in the summer. Subsistence fisheries occur primarily in winter months and sporadically in summer months. The king crab population is concentrated near the shore from December through April, during which time shorefast ice allows subsistence fishers easy access. A winter red king crab pot survey project began in February of 1982 and sampling procedures were standardized in 1983. Except in 1988 (poor ice conditions), 1992 and 1994 (lack of funding), the survey has occurred every year up to the present.

The purpose of this study is to collect biological data during the winter months for monitoring the near shore distribution, abundance, and size frequencies of the red king crab population. This collection is done by catching, measuring, and tagging red king crabs through established area stations in the sea ice offshore of Nome. Since shorefast and sea ice conditions around Nome constantly change during the winter months and from year to year, the placement of survey sites has also changed. From 1982 until 1987, survey sites were confined to a single transect of shorefast ice extending 0.5 to 2.0 miles directly offshore from the Nome Post Office (Lean 1987). From 1989 to 1995, in order to reduce lost fishing time due to unstable ice at the original sites, the study area was expanded a few miles to the west of Nome where dredging activity occurred and a few miles east of Nome where little subsistence activity occurred (Brennan and LaFlamme 1995). In 1996, the study site was expanded to the vicinity of Bluff, 50 miles east of Nome, to see if population parameters observed in the Nome area were comparable to other areas of Norton Sound (Rob 1996). The following year the active ice edge was closer to shore, and unstable ice prevented fishing with pots in the vicinity of Bluff. From 1997 to 2004, ice stations located from up to 12 miles west to 10 miles east of Nome were fished (Soong and Kohler 2005).

Winter project data, along with data from other sources, are incorporated into a length based population model that was developed to predict population estimates for the red king crab biomass in Norton Sound (Zheng et al. 1998). This model improves management of the red king

crab fisheries by providing an annual estimate used to determine the guideline harvest level for the summer commercial red king crab fishery. Before development of the length based model, the triennial Norton Sound king crab trawl survey was the only means of determining the crab biomass.

OBJECTIVES

Objectives for the 2005 winter field season:

1. Measure and record the shell age, size, and number of sublegal and legal male red king crabs caught in order to evaluate recruitment into the legal population before the summer fishery.
2. Tag all male new-shell red king crabs with carapace length (CL) ≤ 100 mm, as part of ongoing studies to estimate growth and movement of tagged crabs recaptured in summer and winter fisheries.
3. Monitor the abundance of red king crab catch accessible to winter subsistence and commercial users in the Nome area.
4. Monitor the intensity and distribution of winter fishing effort in the Nome area.
5. Measure and record the size and number of female red king crabs captured and their egg clutch size.
6. Describe relative distribution of crabs within the winter 2005 study area using catch per unit effort (CPUE; defined as crabs caught per pot) information.
7. Record other biological data such as incidence of disease, parasitism, and other species captured.

METHODS

Historically, survey stations were comprised of paired sites located 7 and 3 miles west of Nome, directly in front of Nome, and 2 and 5 miles east of Nome. Water depth ranged from 30 to 50 feet deep and the sites were located 1 to 2 miles offshore. In 2005, 4 survey stations comprised of 7 sampling sites were established in an area spanning from approximately 7 miles west to 6 miles east of Nome (Figure 1 and Table 1) beginning February 16, 2005. Each sampling site was located in water ranging from 21 to 43 feet deep and from approximately 0.5 mile to 0.75 mile offshore. Travel to and from stations was by snowmachines, with a sled to carry supplies and equipment.

The sampling sites were recorded with a handheld Global Positioning System (GPS) receiver (Garmin GPS 76)[1], and an ice auger was used to drill through the ice to determine its thickness. When ice was found between 1 and 3 feet thick, a square hole about 5 feet long on each side was cut in the ice using a chainsaw. Water depth was checked using a weighted string. Other tools used included ice chisels or "tuks", shovels, and long poles. Conical, 4-foot diameter "Japanese style" king crab pots were baited with 2 one-quart bait containers filled with semi-frozen herring

[1] Product names used in this report are included for scientific completeness, but do not constitute a product endorsement.

chopped into inch-long pieces. Each pot was deployed and attached to a line tethered to a stake at the ice surface. Each hole was covered with styrofoam and plywood to reduce refreezing of the hole and the stake marked per regulation (5AAC 34.925).

Once pots were deployed, each pot was checked and rebaited once or twice per week, depending on weather. When pots were checked, they were brought to the surface and suspended to keep all crabs in the pot immersed in water. Crabs were removed one at a time, determined to be legal (male with a shell width $\geq$ 4.75 inches (121 mm) including spines) or sublegal, and measured biologically, from the posterior margin of the right eye orbit of the carapace to the center of the posterior carapace margin (carapace length). Based on the CL, male crabs were considered to be postrecruit (legal, new-shell crabs > 115 mm and all legal old-shells), recruit (legal, new-shell crabs $\leq$ 115 mm), or prerecruit (sublegal crabs < 115 mm). Prerecruits were further broken down into ones (CL > 89 mm), twos (76 mm $\leq$ CL $\leq$ 89 mm), and threes (CL < 76 mm). Other biological features recorded were shell age (determined as new or old shell by observing features such as scarring on the ventral surface, dullness on the dactyl tips and attached barnacle sizes), sex, and egg development and clutch size of female crabs. All male king crabs $\leq$ 100 mm in CL were tagged with hog rings with spaghetti tags. Any prior injuries on all crabs caught were noted and crabs were released into the same hole in which they were caught.

Catch per unit effort was calculated as the number of crabs caught per pot. Thus, comparison of CPUE between different survey sites gave an indication of relative abundance. CPUE for the entire season was calculated as the total number of crabs caught divided by the total number of pot lifts.

Additionally, conversation with commercial and subsistence fishers was solicited to get their impressions of the season, and how abundant the crab appeared. The winter commercial fishery, which must occur through the ice, runs from November 15 to May 15 and commercial fishers must report and turn in fish tickets to the Nome Alaska Department of Fish and Game (ADF&G) office weekly. Required permits that must be returned were given out to subsistence fishers for recording their catches. Although there is no closed season for subsistence crab fishing, the winter permit is valid only from November 15 to May 15, after which time the fishers must use a summer subsistence crab permit.

RESULTS

All of the stations in 2005 were near historical locations, but due to extremely thick ice, no stations were placed directly in front of Nome. For most of the season, the active ice edge was less than a mile offshore. This combined with a high density of subsistence pots meant that there was only space for one sampling site at some stations, when historically stations have been comprised of paired sites. When space allowed for more than one site at a station, the sites were placed less than 0.5 mile apart. Early in the season, high pressure ridges made travel difficult out on the pack ice, but in March, record snowfalls filled in the ridges and allowed easier access. Trail conditions along the beach line were good all season, but cold temperatures (less than 20° F with wind chill) prevented travel a few times to check the pots.

A total of 406 males (of which 136 were tagged) and 20 female red king crabs were captured and sampled between February 18 and April 21, 2005 (Table 2). The number of pot lifts totaled 93, which made for an overall CPUE of 4.4 male and 0.2 female red king crabs (Tables 1 and 2). The sampling site West 1 (7 miles west of Nome) had the highest CPUE while the sampling site

East 1 (6 miles east of Nome) had the lowest. Male catch rates varied between 0.3 and 11.3 over the season depending on which pots were pulled and how long they soaked (Table 2). Of the 406 male crabs caught, recruit crabs made up 25.4% of the catch, postrecruit crabs comprised 33.5% of the catch, and prerecruits made up the remainder, at 41.1% (Table 3).

The number of male red king crabs caught and the male CPUE were above that of the 2004 study but less than half of the averages from the winter surveys 1983–2004 (Table 4). The number of recruits was two-thirds that of 2004, while postrecruits almost tripled compared to 2004. Of the sublegal catch, prerecruit threes increased slightly compared to 2004, prerecruit twos almost doubled, and prerecruit ones decreased (Table 4). Overall, the prerecruit catch proportion has been decreasing over the last 4 years while correspondingly, the legal crab catch proportion has increased steadily since 2002.

Of the 20 female crabs caught, 2 were juveniles (CL < 72 mm, no eggs) and 18 were adults. The average CL was 67 mm for juveniles, and 76 mm for adult females. Of the adults, 11 had an egg clutch 90–100% full, 1 had an egg clutch 60–89% full, 1 at 30–59% full, and 5 with no egg clutches. All egg clutches were either purple or dark brown. Egg clutches more than 90% full were all eyed, while those less than 90% full were uneyed.

Similar to past studies, other species caught included Arctic Lyre crabs *Hyas coarctatus*, soft crabs *Hapalogaster grebnitzkii*, flatbottom sea stars *Asterias*, sea urchins of the genus *Strongylocentrotus*, shrimp *Pandalus* spp., saffron cod *Eleginus gracilis*, unidentified sculpins and jellyfish. However, in contrast to years prior to 2004, very few sea stars and shrimp were caught, and few sand fleas were observed. No visible signs of disease were detected on the crabs caught in 2005.

Subsistence fishing effort was concentrated between 3 miles east to 4 miles west of Nome. The number of subsistence permits issued, 170, was above the average number of 118 permits issued per year since the 1983/1984 season (Table 5). However, this was the first year that there was a concerted effort by ADF&G staff to issue subsistence permits during visits to outlying villages around Nome. Previously, subsistence crab permits were only issued at the ADF&G office in Nome. Of the 102 fishers who returned their permit by the end of August, 60 actually fished, harvesting 3,973 crabs, or 73% of the average harvest from 1984–2004.

Commercial fishing effort occurred primarily in the areas 5 to 8 miles east and 7 to 12 miles west of Nome. Of the 7 fishers registered, 4 made deliveries in the 2005 winter commercial fishery (Table 5). Fish ticket results show commercial fishers harvested 2,091 crabs, almost three-quarters of the average harvest since 1978.

Winter subsistence and commercial crab fishers turned in 3 tags during the 2005 winter season. Two crabs tagged in 2005 were recovered by the study and released with tags intact. One of the tags returned by the fishers was initially deployed during the 2005 project (subsistence crab fishers are not limited by crab size or sex restrictions) and the other 2 were returned without the carapace attached, therefore no growth information was gained from any of the crabs. Generally, more tags are recovered during the summer commercial crab fishery.

DISCUSSION

Red king crab winter pot surveys have been conducted in the Nome area during 20 of the past 23 years since sampling procedures were standardized in 1983. The winter survey has provided opportunities to collect and interpret valuable information on the crab population that is available to residents of Nome during the winter subsistence and commercial fisheries.

Depending on ice conditions and number and placement of subsistence pots, survey sites have been placed at different distances offshore and at different locations along the coast. From 1982 to 1987, survey sites were confined to a single transect of shorefast ice extending 0.5 to 2.0 miles directly offshore from Nome. Starting in 1989, stations made up of paired sampling sites were located directly in front of Nome and within 7 miles east and west of Nome. In years when unstable ice prevented fishing in some of these locations, the survey sites were placed a few miles further east and west. Due to differences in site placements and fishing competition from subsistence and commercial fishers, comparisons of CPUE between seasons may not be an accurate representation of crab abundance over the years. For the same year, CPUE might be a better indication of where the crabs are located. In 2005, from study results and comments from subsistence and commercial fishers, the crabs appeared to be more concentrated in the area 2 to 3 miles east of Nome, and in the area 5 to 7 miles west of Nome.

The composition of the male catch of red king crabs in the 2005 winter survey indicates a higher proportion of legal crab abundance compared to 2004. The high percentage of prerecruit one crabs observed in 2004 molted and became recruit crabs seen in 2005, while the high percentage of recruits molted and became postrecruits. The decrease in the prerecruit portion and increase in the legal portion of the catch over the last 4 years indicate that the crab population has peaked. The low catch proportions of prerecruit threes and twos in 2005 indicate a decline in legal biomass in 2006 and 2007.

During the triennial Norton Sound red king crab trawl survey conducted in 2002, the prerecruit one male abundance estimate was lower than the all-time high observed in 1999, but higher than the 3 prior surveys, while the prerecruit two abundance estimate was the fourth highest since 1976 (Brennan 2003). These high numbers are consistent with the increased recruitment seen in the 2004 and 2005 winter pot studies.

Winter project data are incorporated into a length based population model developed to predict biomass for the red king crab population in Norton Sound. By incorporating data from trawl surveys, winter and summer pot studies, and summer and winter fisheries from 1976 to present, the model improves the trawl estimate because it includes several different sources of data and uses historical abundance trends based on length. Additionally, the model can be used to project estimates in years when there is no trawl survey, allowing abundance based management of the Norton Sound red king crab summer fishery. The length frequency data from the 2005 winter crab project were added into the computer model to predict the Norton Sound summer crab biomass. The expected legal male crab abundance was 6.2 million pounds, with the legal population above 5-inch carapace width (market size) at 4.6 million pounds. Therefore, the 2005 summer commercial crab fishery will be managed for a guideline harvest goal of 370,000 pounds. This goal equates to an 8% exploitation rate in accordance with the harvest strategy set by the Alaska Board of Fisheries.

ACKNOWLEDGEMENTS

Paul Thompson was the project technician and provided invaluable assistance during this study.

REFERENCES CITED

Brennan, E. L. 2003. Analysis of red king crab data from the 2002 ADF&G trawl survey of Norton Sound. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A02-52, Anchorage.

Brennan, E. L. and T. R. LaFlamme. 1995. Norton Sound winter red king crab studies, 1995. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report No. 3A95-20, Anchorage.

Lean C. F. 1987. Catch rates, size composition and growth of red king crab taken in Norton Sound near Nome during the winter of 1987. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, AYK Region Shellfish Report #12, Nome.

Rob, P. J. 1996. Norton Sound Winter Red King Crab Studies, 1996. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report No. 3A96-22, Anchorage.

Soong, J., and T. Kohler. 2005. Norton Sound winter red king crab studies, 2004. Alaska Department of Fish and Game, Fishery Data Series No. 05-12, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds05-12.pdf

Zheng, J., G. H. Kruse, and L. Fair. 1998. Using multiple data sets to assess red king crab Paralithodes camtschaticus in Norton Sound, Alaska: A length-based stock synthesis approach. Pages 591-612 in Fishery Stock Assessment Models, edited by F. Funk, T. J. Quinn II, J. Heifetz, J. N. Ianelli, J. E. Powers, J. F. Schweigert, P. J. Sullivan, and C. I. Zhang, Alaska Sea Grant College Program Report No. AK-SG-98-01, University of Alaska Fairbanks.

TABLES AND FIGURES

Table 1.–Location, number of pot lifts, and catch rate per sampling site during the winter red king crab pot survey, Norton Sound, 2005.

Sampling Site	Location (decimal degrees)		Depth (ft)	Distance from Nome	Historical Location	Number of Pot Lifts	Male Red King Crab		Female Red King Crab	
							Number Caught	CPUE[a]	Number Caught	CPUE[a]
East 1	64˚.46431	165˚.21712	21	5 miles E	yes	15	18	1.2	5	0.3
East 2	64˚.46028	165˚.21701	35	5 miles E	yes	12	38	3.2	4	0.3
Roadhouse 1	64˚.47775	165˚.35255	40	2 miles E	no	13	89	6.8	0	0.0
West 1	64˚.51157	165˚.61549	39	7 miles W	yes	13	129	9.2	1	0.1
West 2	64˚.51347	165˚.62988	39	7 miles W	yes	12	50	4.2	4	0.3
West 3	64˚.49469	165˚.47147	36	3 miles W	yes	17	31	1.8	6	0.4
West 7	64˚.51266	165˚.63728	43	7 miles W	yes	11	51	4.6	0	0.0
Total						93	406	4.4	20	0.2

[a] Catch per unit effort, defined as the number of crabs caught per pot lift.

Table 2.–Daily catch of red king crabs for all sampling sites in the winter pot survey, Norton Sound, 2005.

Date Checked	Sampling Sites[a,b] (soak time in days)	Pots Lifted	Males	Females	Male CPUE	Female CPUE
18-Feb	W3(3)	1	1	1	1.0	1.0
22-Feb	E1+W1(6), W3(4)	3	12	1	4.0	0.3
24-Feb	E1+W1+W3(2), W2(1)	4	11	0	2.8	0.0
28-Feb	E1+W3(4)	2	3	1	1.5	0.5
2-Mar	W1+W2+W7(6), W3(2)	4	16	0	4.0	0.0
4-Mar	E1+E2(4), R1(3)	3	13	0	4.3	0.0
7-Mar	W1+W2+W3+W7(5)	4	19	0	4.8	0.0
9-Mar	R1+E1+E2 (5)	3	17	0	5.7	0.0
10-Mar	W1+W2+W3+W7(3)	4	8	1	2.0	0.3
15-Mar	R1(6), W3(5)	2	11	0	5.5	0.0
17-Mar	E1+E2(8), R1+W3(2),W1+W2+W7(7)	7	42	1	6.0	0.1
22-Mar	R1+W3(5)	2	4	1	2.0	0.5
23-Mar	E1+E2+W1+W2+W7(6)	5	31	1	6.4	0.2
25-Mar	R1(3), E1+E2(2)	3	21	1	7.0	0.3
30-Mar	E1+E2(5)	2	5	1	2.5	0.5
1-Apr	R1(7), W3(10)	2	4	1	2.0	0.5
2-Apr	W1+W2+W7(10)	3	34	0	11.3	0.0
5-Apr	E1+E2(6)	2	9	4	4.5	2.0
6-Apr	R1+W3(5)	2	5	0	3.0	0.0
7-Apr	W1+W2+W7(5)	3	21	0	7.0	0.0
8-Apr	E1+E2(3), R1+W3(2)	4	7	0	1.8	0.0
11-Apr	W1+W2+W7(4), W3(3)	4	28	2	7.0	0.5
12-Apr	E1+E2+R1(4)	3	11	1	3.7	0.3
13-Apr	W1+W2+W3+W7(2)	4	2	0	0.5	0.0
15-Apr	E1+E2+R1(3)	3	10	0.0	3.3	0.0
18-Apr	W1+W2+W3+W7(5)	4	38	2.0	9.5	0.5
19-Apr	E1+E2+R1(4)	3	10	0.0	3.3	0.0
20-Apr	E1+E2(1), W3(2)	3	1	0.0	0.3	0.0
21-Apr	R1(2), W1+W2+W7(3)	4	12	1.0	3.0	0.25
	Total / Average	93	406	20	4.4	0.2

[a] E1 = East 1, E2 = East 2, R1 = Roadhouse 1, W1 = West 1, W2 = West 2, W3 = West 3, W7 = West 7.

[b] Sampling sites grouped by "+" means the pots soaked for the same number of days.

Table 3.–Summary of male red king crab data from the winter pot survey, Norton Sound, 2005.

	Number	Percent	Average CL (mm)
Sublegal Male Crabs			91
New Shell	164	40.4%	
Old Shell	3	0.7%	
Legal Male Crabs			116
New Shell	192	47.3%	
Old Shell	47	11.6%	
Total	406	100.0%	
Prerecruit One Males	6	1.5%	
Prerecruit Twos	64	15.8%	
Prerecruit Threes	97	23.9%	
Total	167	41.1%	
Prerecruit Males	167	41.1%	
Recruit Males	103	25.4%	
Postrecruit Males	136	33.5%	
Total	406	100.0%	

Note: CL = carapace length.

Table 4.–Summary of red king crab data from the winter pot surveys, Norton Sound, 1983–2005.

		Females	Males							
					Prerecruits[a] / Sublegal			Legal		
Year[b,c]	Pot Lifts	# Caught	# Caught	CPUE	Threes[d,e]	Twos[d,f]	Ones[g]	Recruits[h]	Postrecruits[i]	CL (mm)
1983	107	236	2,586	24.2		26.2%	38.0%	26.1%	9.6%	[j]
1984	70	78	1,677	24.0		34.7%	31.0%	18.6%	15.8%	[j]
1985	31	14	760	24.5		24.7%	45.1%	20.4%	9.8%	[j]
1986	31	74	594	19.2		25.7%	35.0%	21.7%	17.7%	[j]
1987	26	6	151	5.8		12.5%	31.3%	10.4%	45.8%	[j]
1989	42	9	548	13.0		26.8%	15.4%	27.3%	30.5%	[j]
1990	99	18	2,076	21.0		15.9%	33.5%	24.7%	26.0%	115
1991	56	8	1,283	22.9	0.2%	4.8%	30.6%	33.5%	30.9%	114
1993	33	1	181	5.5	0.0%	3.3%	8.8%	17.1%	70.7%	118
1995[k]	126	10	776	6.2	2.1%	9.8%	11.4%	32.3%	44.4%	117
1996	159	26	1,582	9.9	9.2%	22.1%	33.1%	10.1%	25.5%	117
1997	140	60	399	2.9	11.0%	32.3%	20.8%	14.3%	21.6%	118
1998	84	38	882	10.9	0.8%	36.6%	44.3%	8.7%	9.5%	113
1999	122	15	1,308	10.7	0.7%	6.5%	42.4%	39.0%	11.3%	110
2000	93	22	575	6.2	3.1%	13.2%	20.3%	38.6%	24.9%	113
2001	14	1	44	3.1	4.5%	18.2%	15.9%	13.6%	47.7%	106
2002	64	46	832	13.0	10.7%	43.1%	25.5%	9.0%	11.8%	117
2003	86	22	826	9.6	4.2%	19.7%	41.6%	20.2%	14.2%	113
2004	77	9	286	3.7	0.0%	9.4%	40.2%	37.1%	13.3%	112
2005	93	20	406	4.4	1.5%	15.8%	23.9%	25.4%	33.5%	116
Avg. 1983-2004	77	36	914	12.4		22.7%	29.7%	22.2%	25.3%	114

[a] Prerecruits are sublegal crabs with CL ≤ 115 mm.

[b] Unstable ice conditions in 1988 and 2001.

[c] The project was not funded in 1992 and 1994.

[d] Prior to 1991, carapace lengths (CL) were consolidated in pairs so that prerecruit threes and twos cannot be accurately separated.

[e] Prerecruit three crabs have CL < 76mm.

[f] Prerecruit two crabs have 76 ≤ CL ≤ 89mm.

[g] Prerecruit ones are sublegal crabs with CL > 89mm.

[h] Recruits are new-shell, legal crabs with CL ≤ 115 mm.

[i] Postrecruits are new-shell, legal crabs with CL > 115 mm and all old-shell legal crabs.

[j] Prior to 1990, CL averages were not calculated.

[k] Includes catch from 12 sampling sites and from one commercial fisher's catch on April 5.

Table 5.–Winter commercial and subsistence red king crab harvests, Norton Sound, 1978–2005.

	Commercial		Subsistence						
				Permits			Total Crabs		Average/
Year[a]	# Fishers	# Crabs Harvested	Winter[b]	Issued	Returned	Fished	Caught[c]	Harvested[d]	Permit Fished
1978	37	9,625	1977-1978	290	206	149	[e]	12,506	84
1979	[f]	[f]	1978-1979	48	43	38	[e]	224	6
1980	[f]	[f]	1979-1980	22	14	9	[e]	213	24
1981	0	0	1980-1981	51	39	23	[e]	360	16
1982	[f]	[f]	1981-1982	101	76	54	[e]	1,288	24
1983	5	549	1982-1983	172	106	85	[e]	10,432	123
1984	8	856	1983-1984	222	183	143	15,923	11,220	78
1985	9	1,168	1984-1985	203	166	132	10,757	8,377	63
1985-86	5	2,168	1985-1986	136	133	107	10,751	7,052	66
1986-87	7	1,040	1986-1987	138	134	98	7,406	5,772	59
1987-88	10	425	1987-1988	71	58	40	3,573	2,724	68
1988-89	5	403	1988-1989	139	115	94	7,945	6,126	65
1989-90	13	3,626	1989-1990	136	118	107	16,635	12,152	114
1990-91	11	3,800	1990-1991	119	104	79	9,295	7,366	93
1991-92	13	7,478	1991-1992	158	105	105	15,051	11,736	112
1992-93	8	1,788	1992-1993	88	79	37	1,193	1,097	30
1993-94	25	5,753	1993-1994	118	95	71	4,894	4,113	58
1994-95	42	7,538	1994-1995	167	71	57	5,918	4,059	71
1995-96	9	1,778	1995-1996	84	44	35	2,936	1,679	48
1996-97	[f]	[f]	1996-1997	38	22	13	1,617	745	57
1997-98	5	984	1997-1998	94	73	64	20,327	8,622	135
1998-99	5	2,714	1998-1999	95	80	71	10,651	7,533	106
1999-2000	10	3,045	1999-2000	98	64	52	9,816	5,723	107
2000-01	3	1,098	2000-2001	50	27	12	366	256	21
2001-02	11	2,591	2001-2002	114	61	45	5,119	2,177	48
2002-03	13	6,853	2002-2003	107	70	61	9,052	4,140	68
2003-04[g]	2	522	2003-2004	96	77	41	1,775	1,181	29
2004-05	4	2,091	2004-2005[h]	170	102	60	6,496	3,973	108
Avg 1978-2003/04	11	2,861	Avg 1983/84-2003/04	118	89	70	8,143	5,421	71

[a] Prior to 1985 the winter commercial fishery occurred from January 1–April 30. As of March 1985, fishing may occur from November 15–May 15.

[b] The winter subsistence fishery can occur as early as December and continues through May.

[c] The number of crabs actually caught; some may have been released.

[d] The number of crabs harvested is the number of crabs caught and kept.

[e] Information not available.

[f] Data confidential under Alaska Statute 16.05.815.

[g] Confidentiality was waived by the fishers.

[h] Prior to 2005, permits were only issued at the Nome ADF&G office. Starting with the 2004–2005 season, permits were issued in Elim, Golovin, Shaktoolik, and White Mountain.

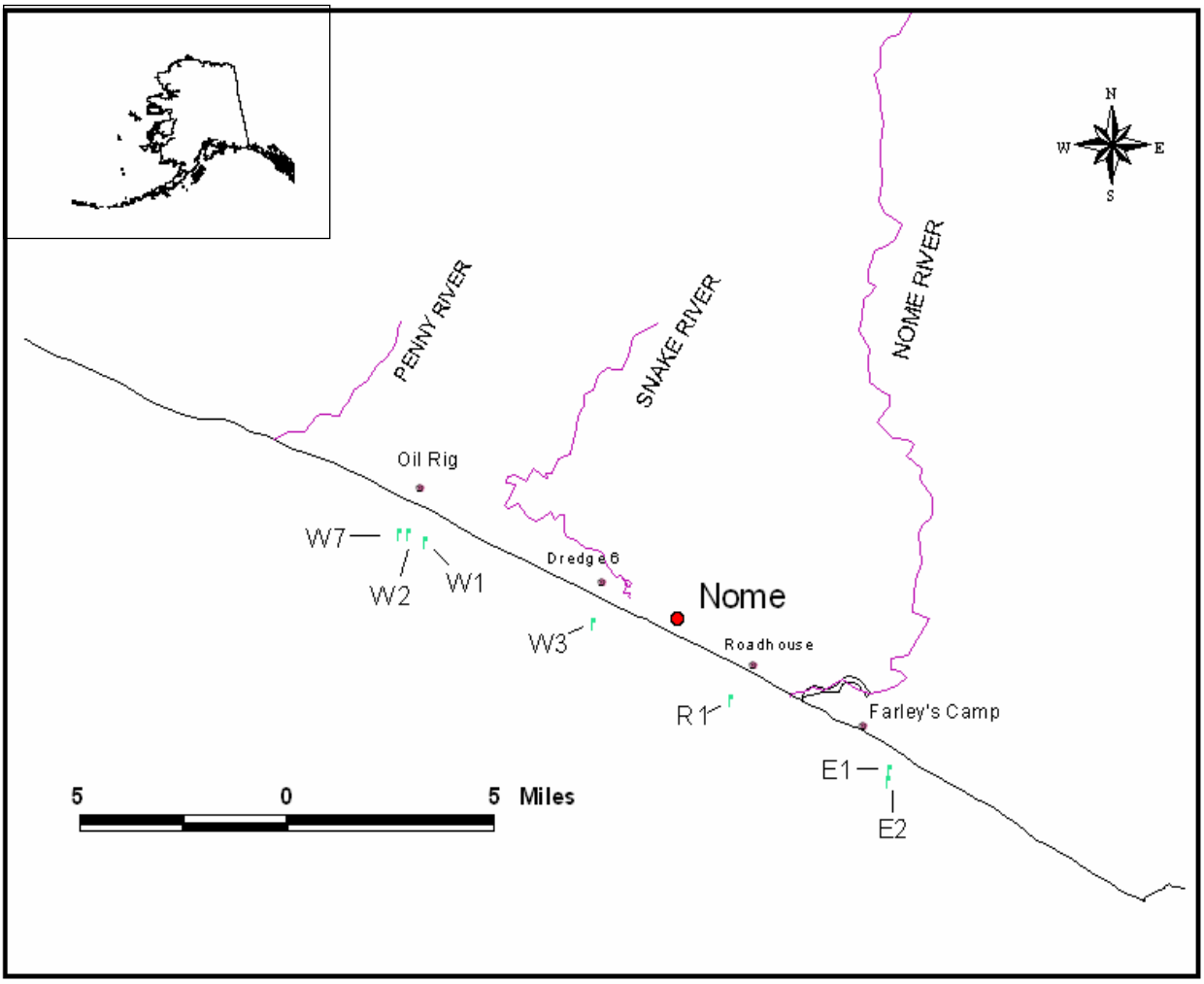

Figure 1.–Location of sampling sites for the winter red king crab pot survey, Norton Sound, 2005.