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The 2005 Eastern Bering Sea Snow Crab *Chionoecetes opilio* Tagging Study

by

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May 2006

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

Symbols and Abbreviations

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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

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ABSTRACT

A tagging project for snow crab *Chionoecetes opilio* was conducted in two distinct areas of the eastern Bering Sea in July and August 2005 aboard the FV *Bella K*. The southern area, comprised of 42 stations northwest of the Pribilof Islands, encompassed the sector between 58°00' - 59°20' N latitude and 170°20' - 173°43' W longitude. The northern area, comprised of 8 stations northwest of St. Matthew Island, encompassed the sector between 60°40' - 61°20' N latitude and 174°49'- 175°41' W longitude. A total of 50 stations and 450 pots were fished, resulting in a total catch of 55,150 male snow crabs. A total of 8,436 large, legal male snow crabs were tagged.

Key words: snow crab, *Chionoecetes opilio*, Bering Sea, tagging, mark-recapture, shell age

INTRODUCTION

The Eastern Bering Sea (EBS) snow crab *Chionoecetes opilio* fishery is managed by the Alaska Department of Fish and Game (ADF&G) with federal oversight under the State/Federal cooperative management regime established by the Fishery Management Plan (FMP) for Bering Sea/Aleutian Islands King and Tanner Crab (NPFMC 1998). The EBS snow crab stock has supported the most valuable crab fishery in the state of Alaska, with annual landings and exvessel values averaging 187-million pounds and $144-million, respectively, over the period 1990-1999 (Bowers et al. 2004). In 1999, that same stock was declared overfished by the National Marine Fisheries Service (NMFS) when estimated mature biomass fell below the minimum stock size threshold (MSST) as defined in the FMP. Following the overfished declaration, annual harvests have been considerably reduced, ranging from 23.9-million pounds to 33.3-million pounds during 2000-2004.

Snow crab distribution in the EBS extends from the shallow waters of the north and northeast to the deeper waters of the middle and outer continental shelves, but is concentrated in the middle continental shelf ("middle shelf"), which is characterized by low circulation and cold bottom water temperatures in the summer (Otto 1998). The fishery occurs in the Bering Sea District of Tanner crab Registration Area J (state regulation 5 AAC 35.505(e)), which includes all the waters of the Bering Sea north of Cape Sarichef at 54º36' N latitude and east of the U.S.-Russia Maritime Boundary Line of 1991. This district is divided into the Eastern and Western Subdistricts at 173º W longitude. The Eastern Subdistrict is further divided at the latitude of Cape Romanzof and 168º W longitude into the Norton Sound Section to the east and the General Section to the south and west (Bowers et al. 2004). Prior to 1986, the fishery was concentrated on the middle continental shelf between the 50 m and 100 m isobaths. Since that time, the fishery has been concentrated in the outer continental shelf ("outer shelf") between the 100 m isobath and the shelf edge (Armstrong et al. 2004).

In an analysis of historic summer survey and winter fishery data through the winter 2002/2003 fishery, Armstrong et al. (2004) noted an apparent spatial mismatch between the distribution of large males ≥ 102 mm carapace width (CW) during summer stock assessment surveys and their distribution in the winter fishery. Data on EBS snow crab distribution collected in the summer during the NMFS annual trawl survey show that the centroids of distribution of large males are always in the middle continental shelf. Conversely, the data collected during the winter fishery clearly show large males are harvested to the south and west of the centroids of the summer distribution and predominantly within the outer edges of the continental shelf. Moreover, within those areas where the fishery is concentrated, the number of large males harvested during the winter fishery was greater than the number estimated to have been present during the trawl survey of the preceding summer. The spatial mismatch between summer distribution of large

males and winter fishery distribution persisted through the 2004 and 2005 fisheries. Those findings suggest the need for investigations on: 1) the existence of a migration, either seasonal or ontogenetic, by large males during the period between the summer survey and winter fishery; 2) the ability of the currently-used area-swept estimation methods applied to the NMFS trawl survey to adequately estimate the abundance of large male snow crabs on the fishing grounds; and 3) the need to control harvest rates spatially to avoid localized overfishing.

The unrealistic estimated local harvest rates of snow crab (e.g., >100% of pre-season abundance estimates; Armstrong et al. 2004) computed from summer survey and winter fishery data could be explained by a combination of crab migration to the fishing grounds and survey selectivity less than the assumed 1.0. Data from the annual NMFS trawl survey strongly suggest an ontogenetic migration by males from the north and northeast to the deeper waters of the outer continental shelf (Armstrong et al. 2004; Otto 1998; Zheng et al. 2001). Although the distribution of fishery effort and catch may not necessarily be coincident with stock distribution, the trend in comparisons between the survey and subsequent fisheries is consistent with the hypothesis that the large males migrate in that direction between summer and winter. If such migrations occur between summer surveys and winter fisheries, localized harvest rates estimated from the summer survey and winter fishery would overestimate the true local harvest rates. Additionally, the survey selectivity for snow crab is assumed to be 1.0 for area-swept estimates of abundance during the summer survey (Rugolo et al. 2003), however survey selectivity for snow crabs has been estimated to be less than 1.0 even for large males (Somerton and Otto 1999; Turnock 2004). Hence, the area-swept estimates may underestimate local abundance, which would result in overestimates of local harvest rates.

The mismatch between summer survey distribution and winter fishery distribution, coupled with a trend towards increased spatial concentration of fishery removals, has raised concerns over the possible effects of the high local harvest rates on the reproductive output of the EBS snow crab stock. The Crab Plan Team (CPT) of the North Pacific Fishery Management Council (NPFMC) noted that, whereas only 26% of the total large males in the EBS were estimated to exist south of 58º30' N latitude during the summer 2003 NMFS trawl survey, 66% of the catch during the fishery of the following winter occurred south of 58º30' N latitude (Draft BSAI King and Tanner Crab Plan Team Minutes, September 20-22, 2004. NPFMC, Anchorage). The CPT also noted that 40% of the catch during the winter 2003/2004 fishery came from a single ADF&G statistical area (735800) of approximately 900 nmi^2. Noting that the disproportionately high harvest from areas south of 58º30' N latitude coincided with incidence of empty clutches and low clutch fullness in that area, the CPT recommended that,

> "…an immediate analysis of the issues surrounding the differential harvest rates be developed to address the conservation issues and to also develop appropriate alternatives to protect the viability and reproductive strength of this stock. The analysis should be directed towards ensuring that the distribution of fishing effort be managed to ensure the equalization of exploitation rates over the range of the exploitable stock."

Tagging studies of EBS snow crab have been suggested as a means to better understand the role of migration by large males in effecting the spatial mismatch between summer survey distribution and winter fishery distribution of large male snow crabs (Armstrong et al. 2004; Turnock 2004). By tagging and releasing large male snow crabs during the summer for their

recovery during the winter fishery, information can be acquired for estimating the probability that large males present in the shallower middle shelf domain during the summer are harvested during the following winter in the deeper outer shelf domain where the fishery is concentrated. Data can also be acquired on the direction and distance between summer release location and winter fishery capture location, which may be a consideration for developing management measures that utilize summer distribution and abundance data for distributing catch and effort during the winter fishery. A tagging study can also provide information useful to developers of stock assessment models for EBS snow crab by providing information on comparability of shell ages (Jadamec et al. 1999) recorded during summer surveys with shell ages recorded during subsequent fisheries, and on the number of fishing seasons that a large male snow crab may live through prior to capture by the fishery.

In response to the needs identified for a tagging study, ADF&G initiated such a study on morphometrically mature male snow crabs ≥ 102 mm CW in the EBS during the summer of 2005. Prioritized objectives for the 2005 Bering Sea snow crab tagging study were as follows:

1. Determine recovery rate as a function of release location during the winter 2005/2006 fishery.
2. Determine recovery rate by statistical area as a function of release location during the winter 2005/2006 fishery and subsequent fisheries.
3. Compare shell age classifications determined during the summer using NMFS shell age classification protocols with shell age classifications determined by fishery observers and ADF&G dockside samplers during the winter 2005/2006 fishery and subsequent fisheries.
4. Estimate the maximum number of fishery seasons that a morphometrically mature male snow crab ≥ 102 mm CW is available to the commercial fishery.

This report documents the tag-release phase of this project and provides information on the capture, tag, and release locations of the targeted morphometrically mature male snow crabs ≥ 102 mm CW. Also included in this report is catch information for snow crabs, Tanner crabs *C. bairdi*, and snow crab x Tanner crab hybrids that were captured but not tagged during the study. This project is coupled with a tag-recovery program during the winter 2005/2006 commercial fishery and subsequent fishery seasons. Tag recoveries from the tag-release phase described in this report will be documented in a companion report.

METHODS

The snow crab tagging study was conducted in the Bering Sea aboard the chartered 39.6 m (130 ft) vessel, FV *Bella K* from 20 July to 16 August 2005. The southern sampling grid encompassed the area between 58º00' - 59º20' N latitude and 170º20' - 173º43' W longitude (Figure 1). The northern sampling grid encompassed the area between 60º40' - 61º20' N latitude and 174º49' - 175º41' W longitude (Figure 1). The charter began and ended in Dutch Harbor with a captain (A. Rogers), engineer (M. Nickerson), and three crewmen. ADF&G staff consisted of K. Gravel (crew leader), R. Alinsunurin, M. Bon and K. Renfro (fishery biologists). The survey itinerary, pot sampling methods and tagging procedures are detailed in Watson et al. (2005).

TERMS

Terms for snow crabs and other commercially-important crab species relative to sex and size groupings used in this report are defined as follows:

Snow Crabs

- Sublegal males: < 79 mm (3.1 in) CW inside lateral spines.
- Small legal males: ≥ 79 mm and < 102 mm (≥ 3.1 in and < 4 in) CW inside lateral spines.
- Large legal males: ≥ 102 mm (4 in) CW inside lateral spines. *This size group of legal males is the tagging target for the survey.*

Note that under state regulation, legal size is 3.1 in (approximately 79 mm) outside lateral spines.

- Immature females: abdominal flap covers only ⅔ of ventral surface (Jadamec et al. 1999).
- Primiparous females: mature, exoskeleton in clean soft, clean hard, or intermediate condition (NMFS shell codes 2 or 3); no mating scars on pereiopods (Sainte-Marie 1993).
- Multiparous females: mature, exoskeleton in intermediate, dirty hard, or dirty soft condition (NMFS shell codes 3, 4 or 5); generally with mating scars on pereiopods.

Tanner Crabs

- Sublegal males: < 140 mm (5.5 in) CW outside lateral spines.
- Legal males: ≥ 140 mm (5.5 in) CW outside lateral spines.
- Females: immature and mature as identified by shape of the abdominal flap (Jadamec et al. 1999).

STUDY DESIGN

All stations were sampled using a string of nine crab pots set 0.125 nmi apart with the fifth pot set directly on the midpoint of the station. The survey crab pots were supplied by the FV *Bella K* and were used in commercial Bering Sea crab fisheries. Each pot measured 7 ft x 7 ft x 34 in, was fitted with 4½ inch stretch mesh on all webbing, and had two opposing tunnel eye entrances each measuring 3 in x 36 in. Each pot was fitted with eight 4-inch escape rings. Each pot was baited with chopped Pacific herring *Clupea pallasi* and Pacific cod *Gadus macrocephalus* as hanging bait with no restriction on the amount used.

Fishing parameters including station, sequential pot number, set and pull date and time, latitude, longitude, and gear performance were recorded for each pot set.

Southern Area

The southern sampling area was based on (1) historic geographic distribution and high densities of large male snow crab catch during the NMFS annual trawl survey, and (2) statistical catch areas with the largest catch per unit effort (CPUE) in recent fisheries. The southern sampling area straddles the 58º30' N latitude line, which is the line that separates the two areas that the NPFMC CPT suggested be considered for separate management. A total of 42 stations were identified in the southern sampling area (Figure 1). Twenty-six of these stations were identified based on regularly trawled stations during the NMFS annual trawl survey in which stations are spaced 20 nmi north-to-south and east-to-west. The other sixteen stations were also based on a 20 nmi X 20 nmi grid but were offset from the regularly surveyed NMFS stations by 10 nmi north-to-south and east-to-west.

The entire southern area was sampled between 22 July–10 August, 2005. This same area was sampled by NMFS during the 2005 EBS trawl survey from 1–22 July, 2005. On a per-station

basis, the tagging study sampled certain locations 18 to 34 days after NMFS sampled its stations in the same locations (the average lag time was 25 days).

For reporting purposes, the southern area stations were further subdivided into middle continental shelf and outer continental shelf areas. These two areas were classified based on two factors: 1) the position of the stations east (middle shelf) or west (outer shelf) of the 100-m isobath, and 2) the depth of the stations, i.e., stations at depths < 54 fms (middle shelf) or ≥ 54 fms (outer shelf).

Northern Area

The northern sampling area was based on locations where high abundance estimates for large males have consistently been obtained during the NMFS survey. Eight stations were identified in the northern sampling area (Figure 1). Six of the 8 stations were spaced 20 nmi north-to-south and east-to-west; two of the eight stations were central and spaced 20 nmi apart north-to-south and are offset from the others by 10 nmi north-to-south and east-to-west; all stations were based on regularly trawled NMFS trawl survey stations.

The stations in the northern area were sampled between 11–14 August, 2005 during the tagging study. This same area was sampled by NMFS on 18 July, 2005 during the 2005 EBS trawl survey. On a per-station basis, the tagging study sampled its prescribed stations 24 to 27 days after NMFS sampled its stations in the same locations, with an average lag time of 25 days.

CATCH SAMPLING

Sorting and Recording Pot Catches

The catch of commercially-important crabs in each pot fished at a station was sorted by species, sex, and size or reproductive categories within sexes. During the study the only commercially-important crab species that were caught were snow crab *C. opilio*, Tanner crabs *C. bairdi* and snow crab x Tanner crab hybrids. Male snow crab catch in the first 8 pots at each station was divided into the following size categories and enumerated: 1) sublegals with CW < 79 mm (3.1 in); 2) small legals with CW ≥ 79 mm and < 102 mm (≥ 3.1 in and < 4 in); and 3) large legals with CW ≥ 102 mm (4.0 in). In the last pot at each station, all male snow crabs were sampled for recording of legal status, CW, chela height (CH; Jadamec et al. 1999), and shell age.

All female snow crabs were sampled for recording of CW and maturity status (immature, primiparous or multiparous). Female reproductive condition was characterized for all snow and Tanner crabs, except for those caught at stations 9 and 50. Reproductive condition was characterized by clutch fullness (Orensanz et al. 2003), egg color, egg development, and presence of dead eggs in the clutch.

Tanner crab and snow crab x Tanner crab hybrid catch was sampled for sex, legal status (males only), CW, shell age, and reproductive condition (females only).

Measurements of CW and CH (males only) from snow crabs were recorded to the nearest 0.1 mm. CW measurements were taken across the carapace at the widest part perpendicular to the medial line from the anterior to the posterior of the carapace, with the tips of the calipers reaching inside the lateral spines as shown in Jadamec et al. (1999). CH was measured as in Jadamec et al. (1999) at the greatest height of the right chela, excluding spines, to determine whether the crab is a large-clawed (morphometrically mature) or a small-clawed (morphometrically immature) legal-size male. Determination of small- or large-claw crabs was confirmed using the following separation line: ln (CH) = -2.8628 + 1.2899*ln(CW) in mm,

where a crab is considered morphometrically mature if CH > separation line or morphometrically immature if CH < separation line (by Otto 1998 using updated survey data through 2002; Zheng *personal communication*). Only measurements of CW were taken for Tanner crabs and snow crab x Tanner crab hybrids, which were recorded to the nearest 1 mm. Legal size of snow crab males (≥ 3.1 in CW; ≥ 79 mm CW) was determined by measuring the CW inside the lateral spines. Legal size of Tanner crabs (≥ 5.5 in CW; ≥ 140 mm CW) was determined by measuring the CW outside the lateral spines.

Shell ages of snow crabs, Tanner crabs and snow crab x Tanner crab hybrids were determined using the parameters outlined in Jadamec et al. (1999) for the categories used during the NMFS EBS trawl survey.

Species Composition

Species composition of pot catches was enumerated for each pot at each station for crab species only. Other captured invertebrates and fishes were not sampled.

TAGGING

Only large, legal-size males (CW ≥ 102 mm) were tagged, with the exception of 12 small, legal-size males (CW ≥ 79 mm and < 102 mm) which were inadvertently tagged at stations 37, 39, 44, 49, and 50. All crabs that were tagged during the study were morphometrically mature (large-clawed) according to the CW-CH dividing line from Otto (1998). Each crab was healthy, with no severe new or old injuries, no autotomies, or parasitic infestations. All eligible crabs captured in each pot at each station were tagged with a maximum of approximately 300 tagged crabs per station. Aside from the tagging criteria, there was partial selection for shell age but no selection for size. At stations where the catch of crabs meeting the tagging criteria exceeded 300, crabs were randomly selected with regard to size. New shell males that were too delicate to tag due to their susceptibility to handling-induced injuries as a result of proximity to the spring molt were often encountered. More often than not, we were unable to tag this category of crabs as they bore fresh injuries and autotomies. At the other extreme, very, very old shell crabs were often judged to be in poor condition (i.e., too many injuries or missing limbs, extremely lethargic) and did not meet the criteria for tagging.

Crabs were tagged using fluorescent pink Floy® poly 'spaghetti' tags with fluorescent green tabs. Eligible crabs were tagged by looping the tag between the 2nd and 3rd walking legs (3rd and 4th pereiopods) on the left and right lateral margins. The tag was then tied on the dorsal surface of the carapace with a 'double knot' (as illustrated in Appendix G1 in Watson et al. 2005), and secured with an overhand knot. This method of tagging has been used successfully for a snow crab tagging study undertaken in eastern Canada (B. Sainte-Marie, *personal communication*). This method was chosen because it is non-invasive and does not cause harm or injuries to the crabs, it is highly visible for recovery purposes, and the possibility of crabs losing the tags through a molt are null because the large-clawed crabs that were tagged had terminally molted (Tamone et al. 2005).

OCEAN BOTTOM TEMPERATURES

Ocean bottom temperatures (°C) were obtained across the depth ranges fished within the study area by placing a submersible temperature recorder in the fifth pot at each station. Three Brancker model XR-420 conductivity-temperature-depth recorders (CTDs) and one Brancker model TR-1000 submersible temperature recorder (STR) were deployed during the study.

RESULTS

A total of 450 pots from 50 stations were fished at an average depth of 52 fathoms with an average soak time of 17.5 hours (Appendix A1). The first stations were set July 22 and the last stations were pulled August 14, 2005. Two pots were lost during the study.

SOUTHERN AREA

Snow Crabs

Male snow crabs were captured at all 42 stations (Figure 2; Appendix A1) in the southern area with greater catches on the outer shelf (Table 1). Female snow crabs were captured at 21 of the 42 stations (Figure 3; Appendix A1) with the majority of the catch concentrated on the outer shelf (Table 1).

Tagged Males

A total of 7,833 male snow crabs were tagged and released in the southern area. Twelve small legal males were inadvertently tagged instead of large legal males (Table 2). Shell age was recorded for all but 16 of the tagged crabs. Crabs were tagged and released at all 42 stations with twice as many tagged and released on the outer shelf (5,257) as on the middle shelf (2,576; Table 2). The majority of the tagged crabs were old shell males (68%), followed by new shell (28%), very old shell (4%) and finally very, very old shell (0.03%; Table 3). On the middle shelf, 70% of the crabs tagged were new shell while on the outer shelf 88% were old shell males (Figure 4). Tagged, large legal males ranged in size from 102 mm to 151 mm CW (Figure 5).

Total Catch and Distribution

A total of 16,482 large legal male, 27,186 small legal male, and 2,736 sublegal male snow crabs were caught during the study in the southern area (Table 1). The catch of large legal males was 2.5 times greater on the outer shelf (11,766) than on the middle shelf (4,716); small legal and sublegal male snow crabs were more evenly distributed between the middle and outer shelves (Table 1 and Figure 2). The average CPUE for large legal males in the southern area was 43.7 crabs per pot (average CPUE of 65.4 on the outer shelf and 24.1 on the middle shelf; Table 1). Average CPUE for small legal and sublegal males was 72.5 and 7.3 crabs per pot, respectively (average CPUE on the middle and outer shelves was comparable for small legal and sublegal males; Table 1). Maximum CPUE was 168.4 crabs per pot for large legal males (station 42), 347.1 crabs per pot for small legal males (station 42), and 25.2 crabs per pot for sublegal males (station 9; Appendix A1).

Female snow crabs were much less abundant than males and were caught at 10 of the 22 stations on the middle continental shelf and 10 of the 20 stations on the outer continental shelf, however, the catch was greater on the outer continental shelf (330 crabs) compared to that on the middle shelf (89 crabs; Table 1 and Figure 3). A total of 419 females were caught in the southern area (Table 1); 36 of the females from stations 9 and 50 lack CW measurements or shell age assessments. Of the 383 females for which all data were recorded, the majority were multiparous, and only a few primiparous and immature females were included in the catch. The average CPUE in the southern area was 1.0 crab per pot for multiparous females, 0.02 crabs per pot for primiparous females and 0.1 crabs per pot for immature females (Table 1). Maximum CPUE was 12.9 crabs per pot for multiparous females (station 13), 0.7 crabs per pot for primiparous females (station 9), and 1.0 crabs per pot for immature females (station 16; Appendix A1).

Size Distributions

In the southern area, male crabs caught in the last pot at each station ranged in size from 54 mm to 141 mm CW (Figure 6). Females in the southern area ranged in size from 39 mm to 84 mm CW (Figure 7).

Shell Age and Incidence of Disease

Of the 5,116 males caught and measured in the last pot at each station in the southern area, 54% were old shell, 29% were new shell, 16% were very old shell, and 2% were very, very old shell (Table 4). Six new shell males were assessed with bitter crab syndrome.

Of the 383 females for which we had shell age data in the southern area, 55% were old shell, 35% were very old shell, 6% were very, very old shell, and 4% were new shell (Table 4). No incidence of disease was recorded for this group.

Female Reproductive Condition

Of the 400 mature females caught in the southern area, 301 were ovigerous, 72 were barren, and 27 did not have reproductive condition data recorded. Most of the ovigerous females had clutch fullness scores of ¾ or 100% full (Table 5). The majority of the egg clutches were orange in color (95.7%) and all but 2 clutches, for which no data is available, contained uneyed eggs (Table 5). Dead eggs were apparent in 12% of the clutches.

The 72 barren females caught in the southern area were distributed within 6 different stations (13, 24, 36, 40, 46, and 48). All but one of the stations (48) at which barren females were caught were located on the outer continental shelf; station 48 sat on the middle continental shelf just east of the 100 m isobath (Figure 1). Barren females caught at station 46 constituted 36% of the total barren female catch in the southern area. Also of interest is that 82% of the barren females were caught south of 58°30'N latitude, an area that coincides with recent increased concentrations of fishery removals. Shell age was recorded for all but one barren female. The barren females were comprised of 47 very old shell, 15 very, very old shell, and 9 old shell crab (Table 6).

Tanner Crabs and Hybrids

Tanner crabs and snow crab x Tanner crab hybrids were the only other commercially-important crab species captured in the southern area (Figure 8). A total of 729 Tanner crab males were caught, only 14 of which were of legal size (Table 7). A total of 222 Tanner crab females were caught, 215 of which were mature (Table 7). A total of 15 male snow crab x Tanner crab hybrids were caught, all of which possessed the characteristics to be legally retainable as snow crab under state regulation 5 AAC 35.521 (Table 7). Catch by station is summarized in Appendices B1 and B2.

NORTHERN AREA

Snow Crabs

Male snow crabs were captured at all 8 stations with the majority concentrated at stations 1, 2, 3 and 5 (Figure 2 and Appendix A2). Female snow crabs were captured at 4 of the 8 stations with the majority of the catch concentrated at station 3 (Figure 3 and Appendix A2).

Tagged Males

A total of 615 large legal male snow crabs were tagged and released in the northern area (Table 2 and Figure 4). Shell age was recorded for all but 1 of the tagged crabs. Crabs were tagged and

released at all 8 stations with a maximum number tagged and released at station 5 (169 crabs; Table 2 and Figure 4). The majority of the tagged crabs were old shell males (62%), followed by new shell (34%), and very old shell (3%) males (Table 3 and Figure 4). Tagged, large legal males ranged in size from 102 mm to 142 mm CW (Figure 5).

Total Catch and Distribution

A total of 878 large legal male, 4,909 small legal male, and 2,959 sublegal male snow crabs were caught during the study in the northern area (Table 1). The average CPUE for large legal males in the northern area was 12.2 crabs per pot, and for small legal and sublegal males the average CPUE was 68.2 and 41.1 crabs per pot, respectively. Maximum CPUE was 24.7 crabs per pot for large legal males (station 5), 169.9 crabs per pot for small legal males (station 3), and 155.8 crabs per pot for sublegal males (station 3; Appendix A2).

Female snow crabs were much less abundant in the northern area than males and were caught at 4 of the 8 stations (Figure 3). A total of 730 females were caught; 6 of which lack shell age assessments (Table 1). The majority of the females were primiparous with a few multiparous and immature females included in the catch (Table 1 and Figure 3). The average CPUE in the northern area was 9.4 crabs per pot for primiparous females, 0.5 crabs per pot for multiparous females and 0.3 crabs per pot for immature females (Table 1). Maximum CPUE was 65.8 crabs per pot for primiparous females (station 3), 3.6 crabs per pot for multiparous females (station 3), and 1.6 crabs per pot for immature females was (station 2; Appendix A2).

Size Distributions

In the northern area, male crabs caught in the last pot at each station ranged in size from 49 mm to 131 mm CW (Figure 6). Females in the northern area ranged in size from 37 mm to 88 mm CW (Figure 7).

Shell Age and Incidence of Disease

Of the 875 males caught and measured in the last pot at each station in the northern area, 67% were new shell, 29% were old shell, 3% were very old shell, and 1% were very, very old shell crabs (Table 4). Eight 8 new shell males were assessed with bitter crab syndrome. All remaining males appeared healthy.

In the northern area 95% of the females were new shell and the remaining 5% were old shell crabs (Table 4). No very old or very, very old shell females were caught. Only 2 new shell females were assessed with bitter crab syndrome. All remaining females appeared healthy.

Female Reproductive Condition

Of the 711 mature females caught in the northern area, 710 were ovigerous and 1 was barren. Most of the ovigerous females had clutch fullness scores of ¾ full (Table 5). All of the egg clutches were orange in color, and with the exception of one female, clutches were uneyed (Table 5). Only 0.5% of the females had egg clutches that contained apparent dead eggs (Table 5). The only barren female was caught at station 1 and was a new shell crab (Table 6).

Tanner Crabs and Hybrids

One sublegal male Tanner crab and 1 male snow crab x Tanner crab hybrid were the only other commercially-important crabs captured in the northern area (Table 7 and Figure 8). The snow crab x Tanner crab hybrid possessed the characteristics to be legally retainable as a snow crab under state regulation 5 AAC 35.521 and was of legal size (Table 7).

OCEAN BOTTOM TEMPERATURES

Ocean bottom temperatures were recorded at every station except for stations 42 and 48 (Table 8). Recordings were taken every 10 minutes while the pots were sitting on the bottom. Lowest temperatures (0.9°C) were recorded in the northern area at stations 2 and 5 at depths of 48 and 51 fathoms, respectively (Table 8 and Figure 9). Highest temperatures (4.2°C) were recorded in the southern area at stations 23 and 34 at depths of 70 and 62 fathoms, respectively (Table 8 and Figure 9). The overall average temperature for the southern area was 3.3°C and 1.5°C for the northern area (Table 8). The overall average temperature for the entire sampling area (southern and northern areas combined) was 3.0°C. Ocean bottom temperatures generally increased with depth within sampling areas (Figure 9).

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TABLES AND FIGURES

Table 1.–Snow crab catch and catch per unit effort (CPUE) by sampling area and sex from the 2005 eastern Bering Sea snow crab tagging study.

			Males						Females					
			Sublegal		Small Legal		Large Legal		Immature		Primiparous		Multiparous	
Area	Stations	Pots	No.	Ave. CPUE	No.	Ave. CPUE	No.	Ave. CPUE	No.	Ave. CPUE	No.	Ave. CPUE	No.	Ave. CPUE
Southern														
Middle Shelf	22	196	1,715	8.7	13,794	70.7	4,716	24.1	18	0.1	8	0.0	63	0.3
Outer Shelf	20	180	1,021	5.7	13,392	74.4	11,766	65.4	1	<0.1	0	0.0	329	1.8
Total	42	376	2,736	7.3	27,186	72.5	16,482	43.7	19	0.1	8	<0.1	392	1.0
Northern	8	72	2,959	41.1	4,909	68.2	878	12.2	19	0.3	676	9.4	35	0.5
All Areas	50	448	5,695	18.5	32,095	71.1	17,360	33.9	38	0.2	684	3.1	427	0.9

Table 2.–Number of male snow crabs tagged per station during the 2005 eastern Bering Sea snow crab tagging study.

Southern Area						Northern Area		
Middle Shelf			Outer Shelf					
Station	Small Legal	Large Legal	Station	Small Legal	Large Legal	Station	Small Legal	Large Legal
9	0	28	12	0	299	1	0	83
10	0	25	13	0	308	2	0	33
11	0	31	14	0	29	3	0	108
15	0	50	18	0	310	4	0	64
16	0	31	19	0	352	5	0	169
17	0	66	23	0	14	6	0	7
20	0	9	24	0	411	7	0	60
21	0	46	25	0	183	8	0	91
22	0	56	29	0	315	-	-	-
26	0	140	30	0	384	-	-	-
27	0	76	31	0	194	-	-	-
28	0	129	34	0	269	-	-	-
32	0	34	35	0	315	-	-	-
33	0	161	36	0	238	-	-	-
37	1	292	40	0	60	-	-	-
38	0	70	41	0	297	-	-	-
39	2	99	42	0	575	-	-	-
43	0	348	45	0	303	-	-	-
44	1	165	46	0	79	-	-	-
48	0	270	47	0	322	-	-	-
49	4	232	-	-	-	-	-	-
50	4	206	-	-	-	-	-	-
Total	12	2,564		0	5,257		0	615

Table 3.–Shell age of large legal male snow crabs tagged and released during the 2005 eastern Bering Sea snow crab tagging study.

Shell Age Category	Southern Area		Northern Area	
	Number	Percent	Number	Percent
New	2,155	27.6	211	34.3
Old	5,335	68.2	382	62.1
Very old	313	4.0	21	3.4
Very, very old	2	<0.1	0	0.0
Not recorded	16	0.2	1	0.2
Total	7,821		615	

Table 4.–Shell age of male snow crabs sampled from the last pot of each station and shell age of female snow crabs sampled from all pots during the 2005 eastern Bering Sea snow crab tagging study.

Shell Age Category	Southern Area		Northern Area	
	Number	Percent	Number	Percent
	Males			
New	1,489	29.1	590	67.4
Old	2,738	53.5	253	28.9
Very old	799	15.6	27	3.1
Very, very old	90	1.8	5	0.6
Total	5,116		875	
	Females			
New	15	3.9	482	94.9
Old	211	55.1	26	5.1
Very old	135	35.2	0	0.0
Very, very old	22	5.7	0	0.0
Total	383		508	

Table 5.–Clutch size and egg characteristics of mature female snow crabs caught during the 2005 eastern Bering Sea snow crab tagging study.

	Southern Area		Northern Area	
Characteristic	Number	Percent	Number	Percent
Clutch Size				
Trace to 1/8 full	12	4.0	0	0.0
1/4 full	28	9.3	3	0.4
1/2 full	39	13.0	34	4.8
3/4 full	118	39.2	492	69.3
100% full	104	34.6	181	25.5
Total	301		710	
Live Egg Color				
Tan	11	3.7	0	0.0
Purple	0	0.0	0	0.0
Brown	0	0.0	0	0.0
Orange	288	95.7	710	100.0
Purple-brown	0	0.0	0	0.0
Pink	0	0.0	0	0.0
Reddish	0	0.0	0	0.0
Other	1	0.3	0	0.0
Not recorded	1	0.3	0	0.0
Total	301		710	
Egg Development				
Uneyed	299	99.3	709	99.9
Eyed	0	0.0	1	0.1
Hatching	0	0.0	0	0.0
Not recorded	2	0.7	0	0.0
Total	301		710	
Dead Eggs				
Not Apparent	264	87.7	706	99.4
Less than 20%	3	1.0	3	0.4
Greater than 20%	34	11.3	1	0.1
Total	301		710	

Table 6.–Shell age of barren snow crab females caught during the 2005 eastern Bering Sea snow crab tagging study, by area and station.

Area and Station	Shell Age				
	New	Old	Very Old	Very, Very Old	Not Recorded
Northern					
1	1	0	0	0	0
Southern					
13	0	4	6	0	0
24	0	0	2	0	0
36	0	3	10	0	0
40	0	0	3	6	1
46	0	1	26	9	0
48	0	1	0	0	0
Total	1	9	47	15	1
Percent	1.4	12.5	65.3	20.8	[a]

[a] Not included in percentage calculation as no shell age was recorded for this crab.

Table 7.–Tanner crab and snow crab x Tanner crab hybrid catch and catch per unit effort (CPUE) by sampling area and sex from the 2005 eastern Bering Sea snow crab tagging study.

Number of Stations	Number of Pots	Tanner Crab								Tanner Hybrid	
		Males				Females					
		Sublegal		Legal		Immature		Mature		Legal Males	
		No.	Ave. CPUE	No.	Ave. CPUE	No.	Ave. CPUE	No.	Ave. CPUE	No.	Ave. CPUE
Southern Area											
42	376	715	1.6	14	<0.1	7	<0.1	215	0.5	15	<0.1
Northern Area											
8	72	1	0.1	0	0.0	0	0.0	0	0.0	1	0.1
All Stations											
50	448	716	1.6	14	<0.1	7	<0.1	215	0.5	16	<0.1

Table 8.–Ocean bottom temperatures at all stations fished during the 2005 eastern Bering Sea snow crab tagging study, excluding stations 42 and 48.

Station	Depth (fm)	Temperature (°C)		
		Average	Minimum	Maximum
Southern Area				
9	43	2.0	2.0	2.1
10	41	1.4	1.3	1.4
11	43	2.1	2.0	2.1
12	64	4.0	3.7	4.0
13	58	3.3	3.3	3.3
14	53	2.7	2.6	2.8
15	47	2.6	2.6	2.7
16	42	2.3	2.2	2.4
17	38	1.9	1.9	2.0
18	63	4.0	3.9	4.0
19	58	3.2	3.2	3.3
20	52	2.9	2.8	2.9
21	47	2.8	2.7	2.8
22	42	2.7	2.5	2.8
23	70	4.1	4.1	4.2
24	61	3.8	3.7	3.9
25	56	3.3	3.2	3.3
26	51	2.9	2.9	2.9
27	45	3.0	3.0	3.1
28	40	2.6	2.4	2.7
29	63	4.0	4.0	4.1
30	58	3.4	3.4	3.4
31	54	3.1	3.1	3.2
32	49	3.2	3.1	3.2
33	42	3.2	3.1	3.3
34	62	4.2	4.1	4.2
35	60	3.8	3.7	3.8
36	56	3.4	3.4	3.4
37	53	3.8	3.7	3.8
38	46	3.6	3.6	3.6
39	40	3.1	3.0	3.1
40	60	4.0	4.0	4.0
41	57	3.5	3.4	3.5
43	50	4.0	4.0	4.0
44	43	3.8	3.7	3.9
45	64	4.1	4.1	4.1
46	60	4.0	4.0	4.1
47	58	3.7	3.6	3.8
49	47	3.8	3.7	3.8
50	40	3.5	3.4	3.5
Area Average		3.3	3.2	3.3

-continued-

Table 8.–Page 2 of 2.

Station	Depth (fm)	Temperature (°C) Average	Minimum	Maximum
Northern Area				
1	54	1.8	1.7	1.8
2	48	0.9	0.9	1.0
3	52	1.0	1.0	1.1
4	56	2.0	1.9	2.0
5	51	0.9	0.9	0.9
6	55	1.9	1.7	1.9
7	59	2.4	2.2	2.4
8	54	1.5	1.5	1.7
Area Average		1.5	1.5	1.6
Overall Average		3.0	2.9	3.0

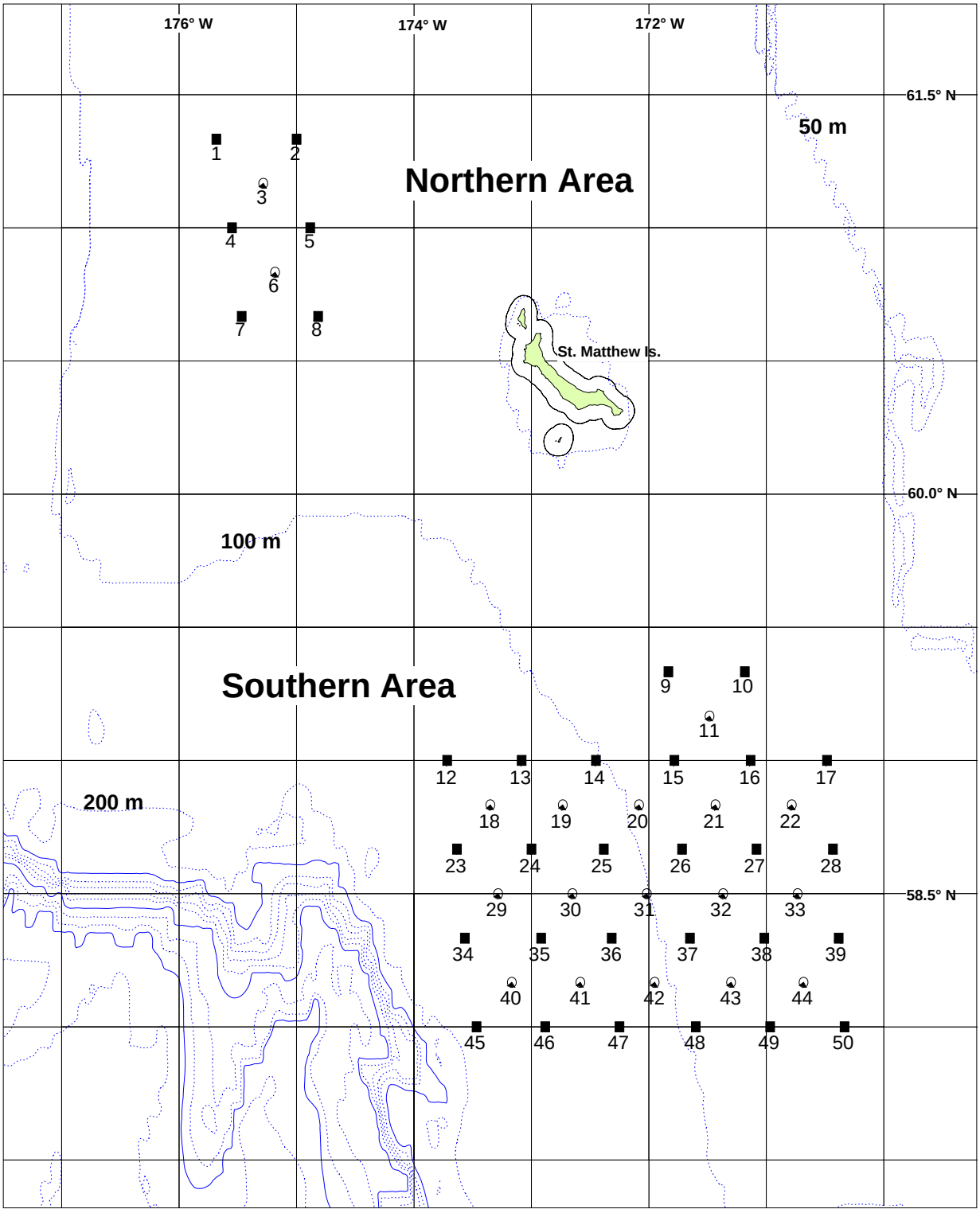

Figure 1.–Layout of the 50 tagging stations to be fished during the 2005 eastern Bering Sea snow crab tagging study. Black squares denote stations based on regularly trawled stations during the NMFS annual trawl survey; open circles denote stations that are offset 10 nmi from regularly trawled stations during the NMFS annual trawl survey.

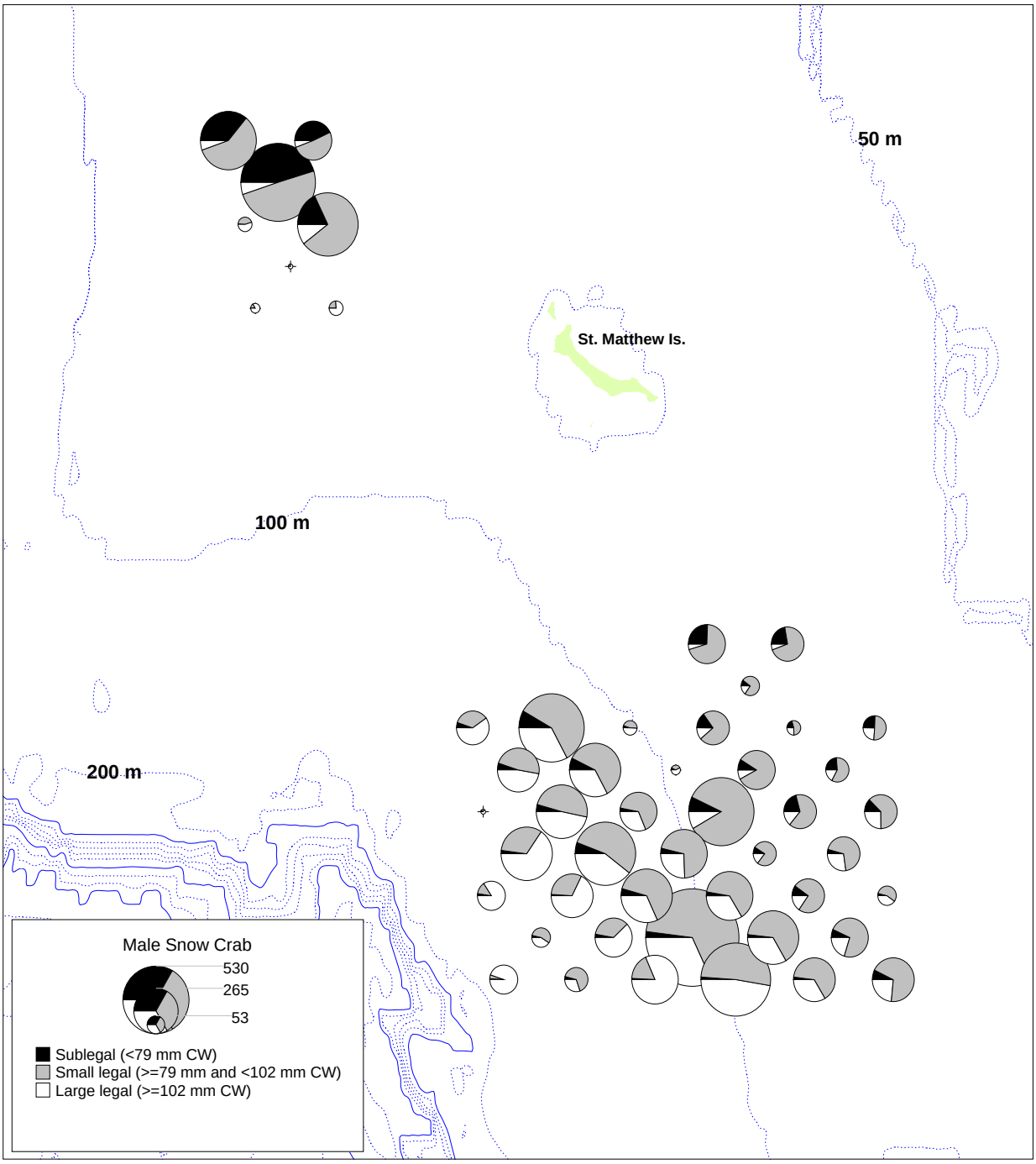

Figure 2.–Male snow crab catch per unit effort (CPUE) by legal status and size category at all stations fished during the 2005 eastern Bering Sea snow crab tagging study.

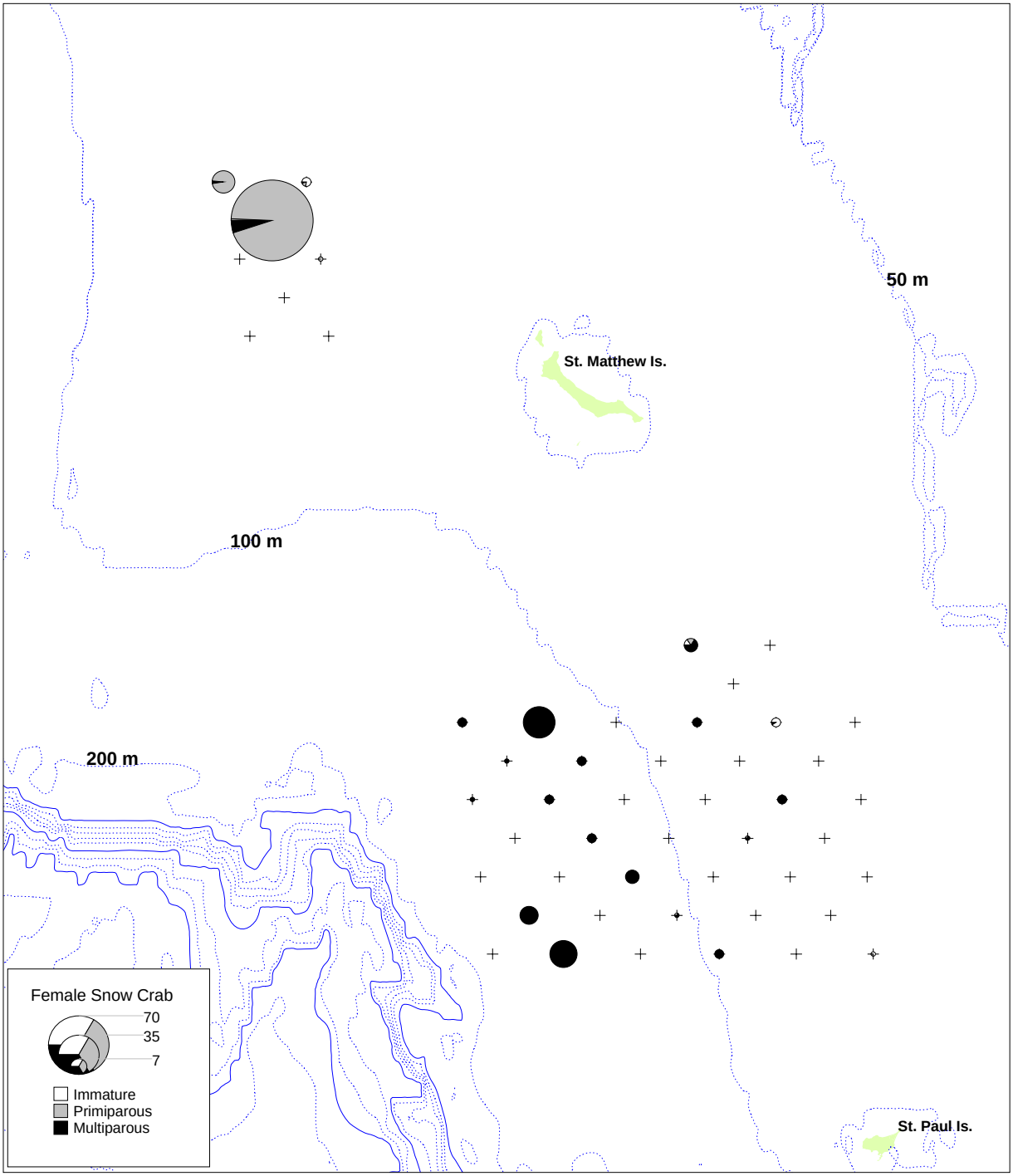

Figure 3.–Female snow crab catch per unit effort (CPUE) by maturity category at all stations fished during the 2005 eastern Bering Sea snow crab tagging study.

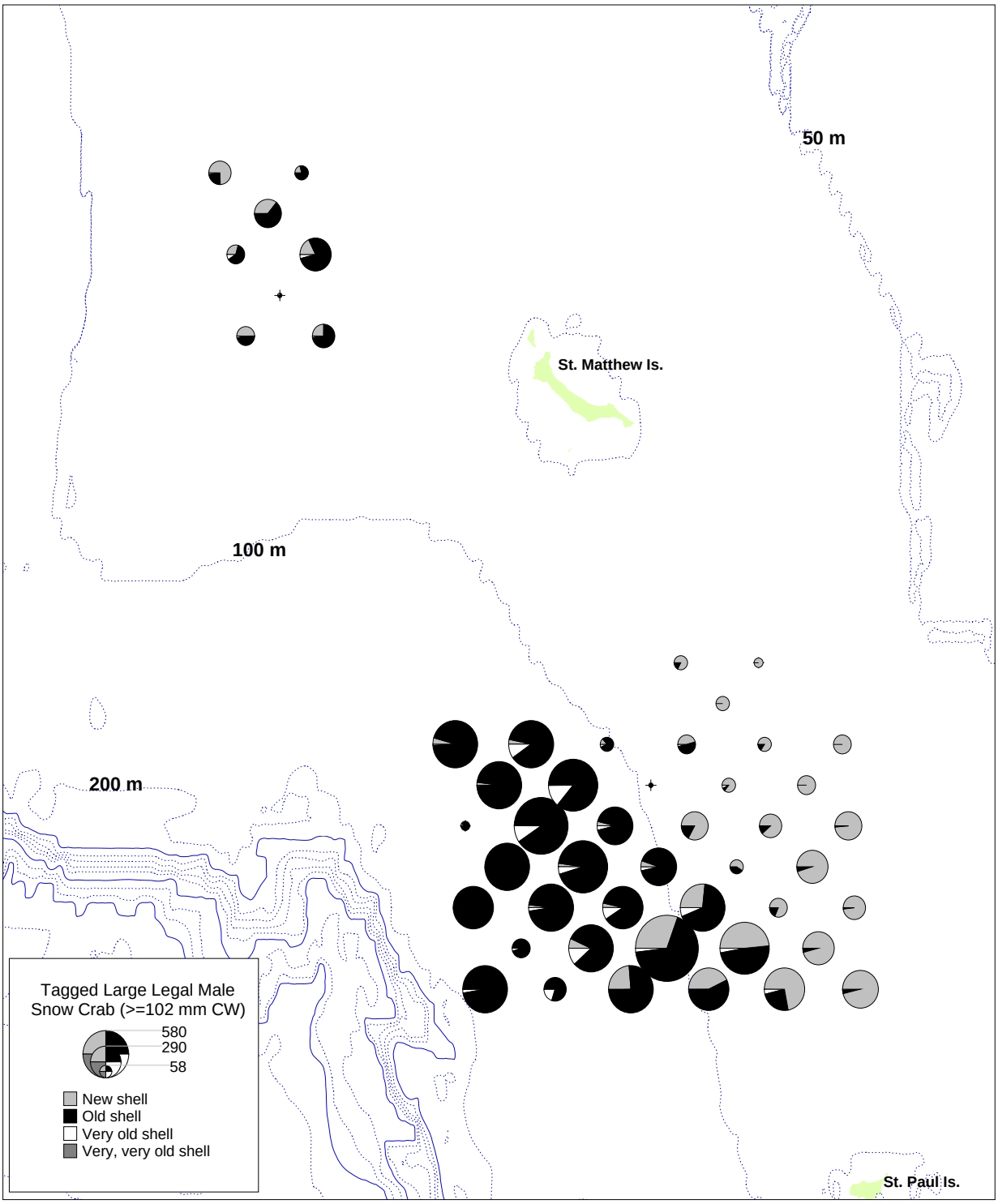

Figure 4.–Tagged, large, legal (CW ≥ 102 mm) male snow crab catch per station by shell age during the 2005 eastern Bering Sea snow crab tagging study.

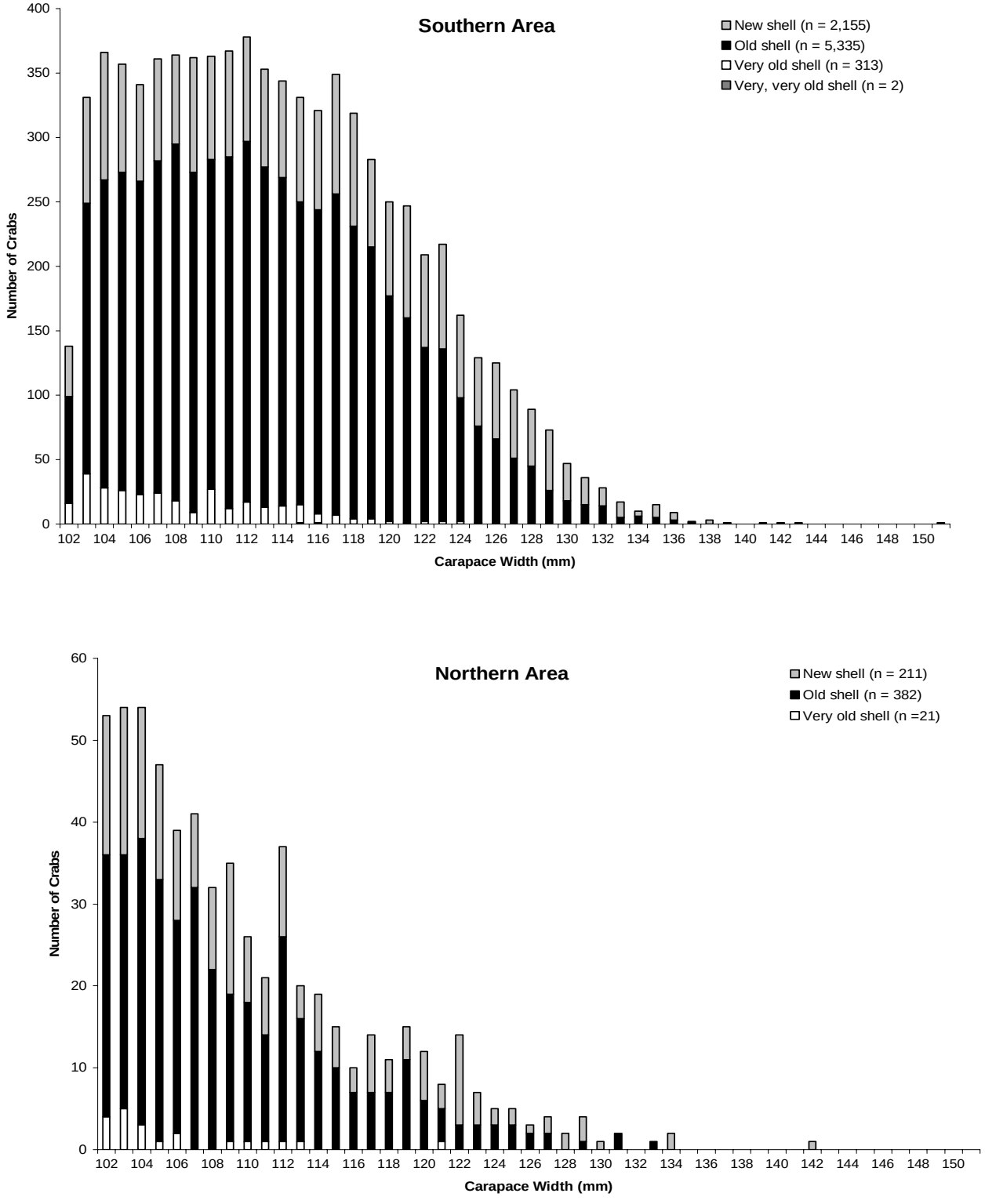

Figure 5.–Size frequency histograms by shell age of tagged, large, legal (CW ≥ 102 mm) male snow crabs in the southern (top panel) and northern (bottom panel) sampling areas.

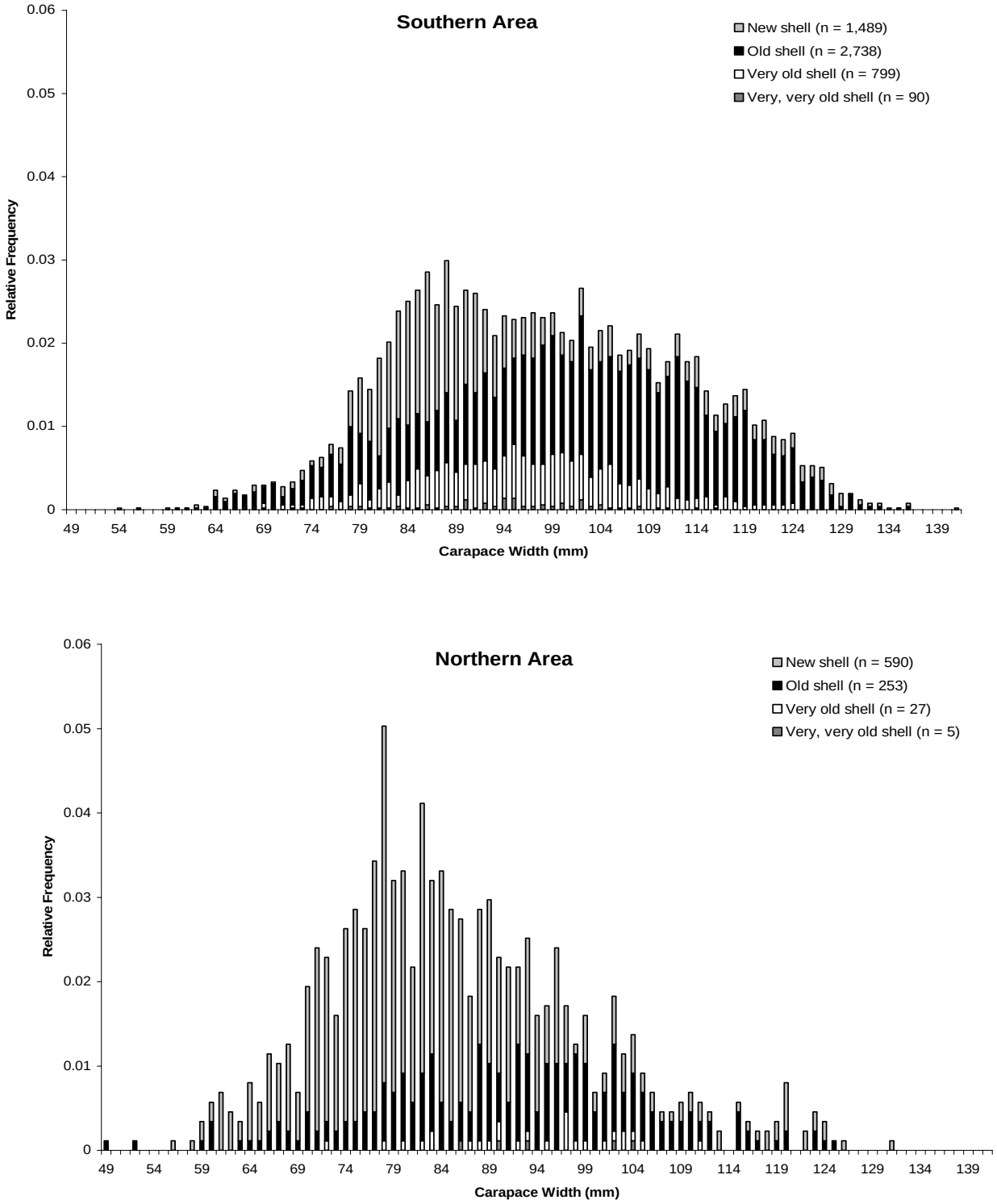

Figure 6.–Relative size frequency histograms by shell age for all male snow crabs caught in the last pot at each station in the southern (top panel) and northern (bottom panel) sampling areas during the 2005 eastern Bering Sea snow crab tagging study.

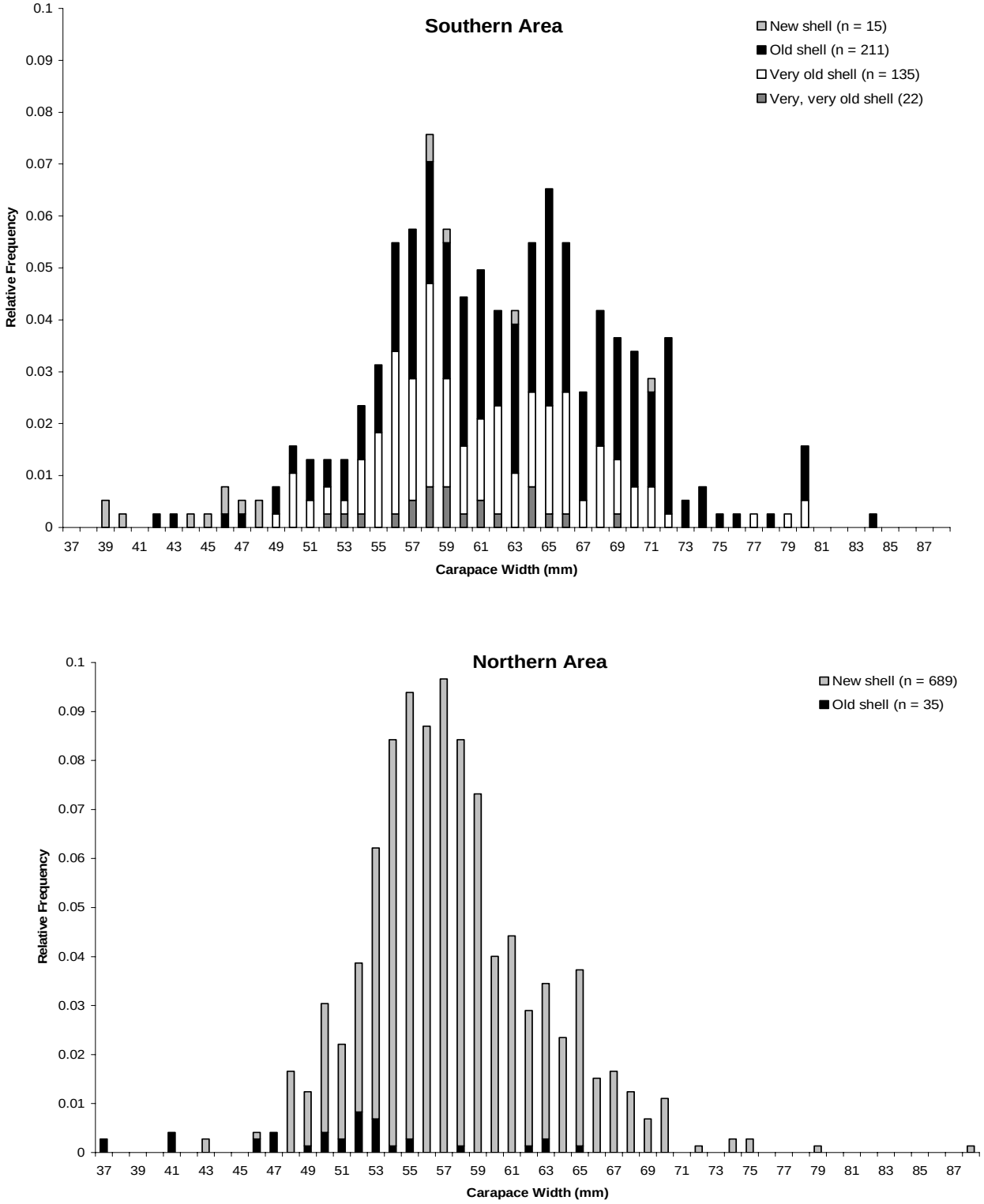

Figure 7.–Relative size frequency histograms by shell age for female snow crabs caught in the southern (top panel) and northern (bottom panel) sampling areas during the 2005 eastern Bering Sea snow crab tagging study.

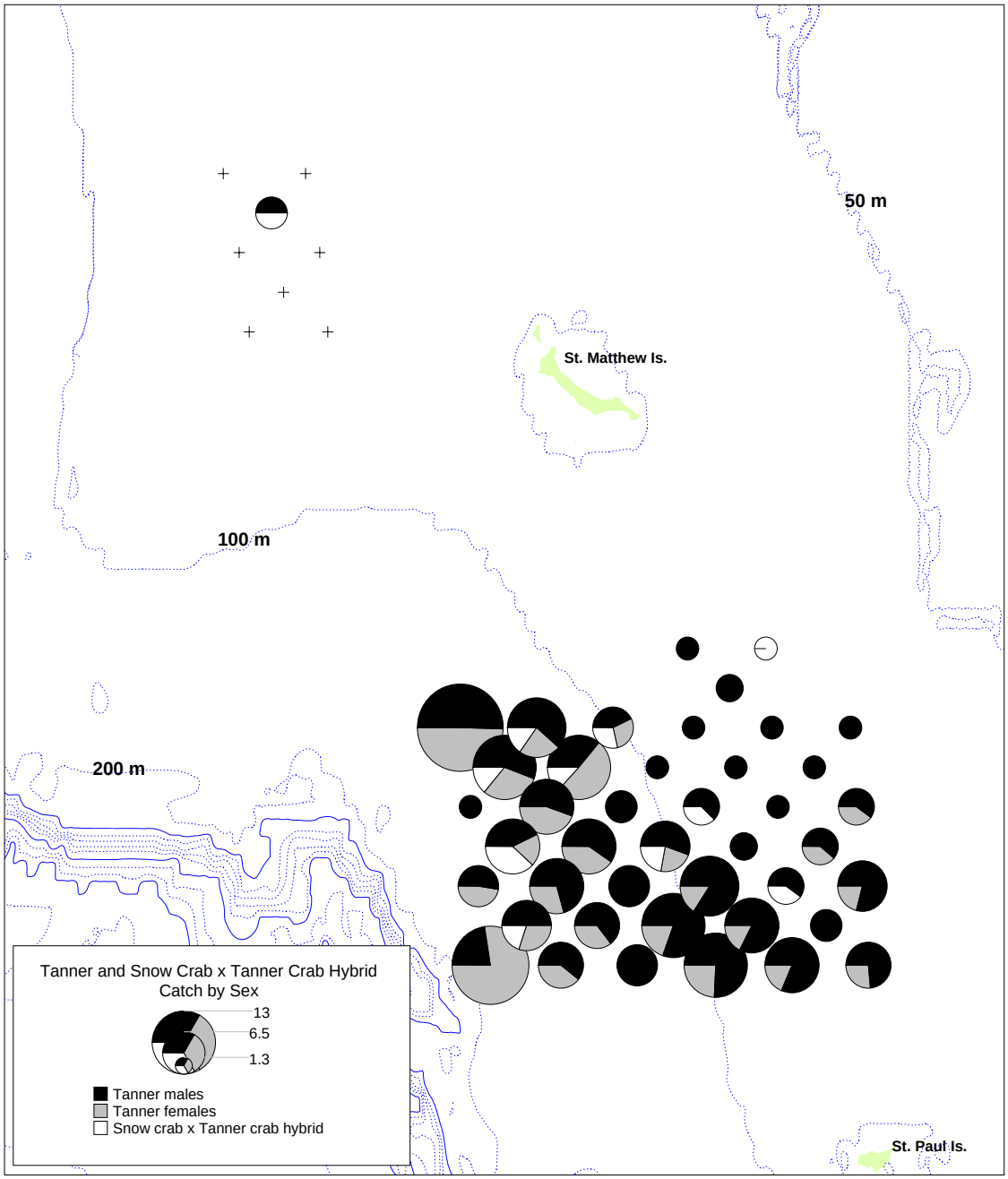

Figure 8.–Tanner male and female and snow crab x Tanner crab hybrid male crab catch per unit effort (CPUE) during the 2005 eastern Bering Sea snow crab tagging study.

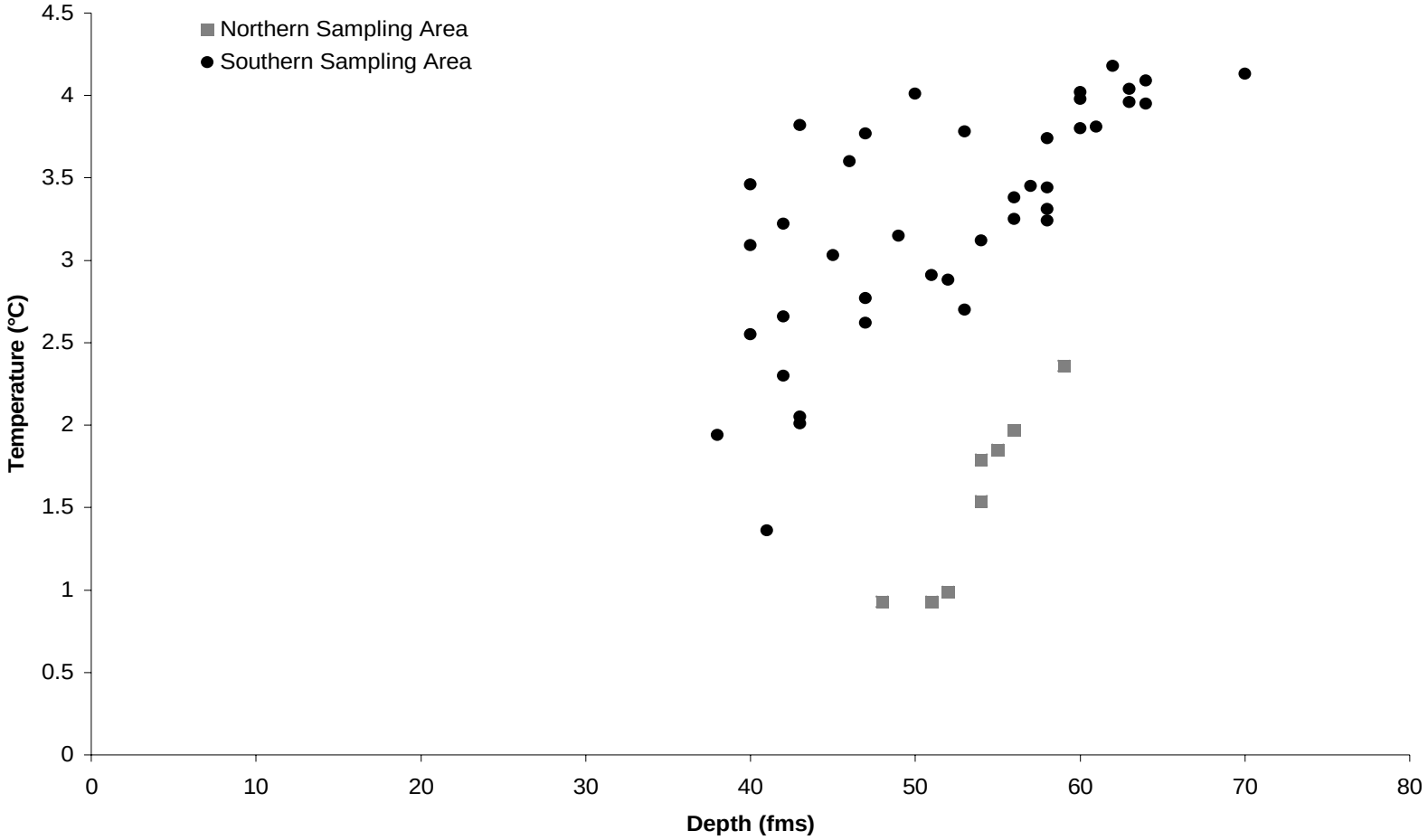

Figure 9.–Ocean bottom temperatures in the southern and northern sampling areas during the 2005 eastern Bering Sea snow crab tagging study.

APPENDIX A. SNOW CRAB CATCH

Appendix A1.–Snow crab catch and catch per unit effort (CPUE) in the southern sampling area from the 2005 eastern Bering Sea snow crab tagging study.

							Males						Females					
	Date	No.	Soak	Location		Depth	Sublegal		Small Legal		Large Legal		Immature		Primiparous		Multiparous	
Station	Set	Pots	Hrs.	N. lat.	W. long.	(fms)	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE
9	25-Jul	9	17.9	59.33	171.83	43	227	25.2	614	68.2	41	4.6	5	0.6	6	0.7	21	2.3
10	25-Jul	9	16.8	59.33	171.18	41	150	16.7	485	53.9	38	4.2	0	0.0	0	0.0	0	0.0
11	26-Jul	9	17.9	59.17	171.48	43	34	3.8	253	28.1	53	5.9	0	0.0	0	0.0	1	0.1
12	9-Aug	9	22.0	59.00	173.72	65	38	4.2	268	29.8	450	50.0	0	0.0	0	0.0	15	1.7
13	9-Aug	9	19.5	59.00	173.08	59	207	23.0	1486	165.1	829	92.1	0	0.0	0	0.0	116	12.9
14	6-Aug	9	17.9	59.00	172.45	54	7	0.8	66	7.3	70	7.8	0	0.0	0	0.0	0	0.0
15	26-Jul	9	18.8	59.00	171.78	47	114	12.7	552	61.3	86	9.6	0	0.0	0	0.0	9	1.0
16	27-Jul	9	19.3	59.00	171.13	42	43	4.8	112	12.4	53	5.9	9	1.0	0	0.0	1	0.1
17	24-Jul	8	18.2	59.00	170.48	38	101	12.6	199	24.9	95	11.9	0	0.0	0	0.0	0	0.0
18	9-Aug	9	16.8	58.83	173.35	64	62	6.9	580	64.4	575	63.9	0	0.0	0	0.0	8	0.9
19	6-Aug	9	18.5	58.83	172.73	58	130	14.4	1062	118.0	586	65.1	0	0.0	0	0.0	16	1.8
20	5-Aug	9	19.3	58.83	172.09	52	6	0.7	35	3.9	54	6.0	0	0.0	0	0.0	0	0.0
21	27-Jul	9	18.4	58.83	171.43	47	89	9.9	842	93.6	79	8.8	0	0.0	0	0.0	0	0.0
22	24-Jul	9	16.7	58.83	170.78	42	92	10.2	228	25.3	68	7.6	0	0.0	0	0.0	1	0.1
23	8-Aug	9	15.4	58.67	173.63	70	3	0.3	7	0.8	18	2.0	0	0.0	0	0.0	2	0.2
24	7-Aug	9	19.0	58.67	173.00	61	72	8.0	843	93.7	803	89.2	0	0.0	0	0.0	10	1.1
25	3-Aug	9	19.6	58.67	172.38	56	31	3.4	682	75.8	328	36.4	0	0.0	0	0.0	0	0.0
26	5-Aug	9	18.2	58.67	171.72	50	187	20.8	2262	251.3	223	24.8	0	0.0	0	0.0	0	0.0
27	28-Jul	9	18.1	58.67	171.08	45	168	18.7	620	68.9	113	12.6	0	0.0	0	0.0	15	1.7
28	23-Jul	9	18.8	58.67	170.43	40	84	9.3	425	47.2	172	19.1	0	0.0	0	0.0	0	0.0
29	7-Aug	9	21.9	58.50	173.28	64	34	3.8	557	61.9	1112	123.6	0	0.0	0	0.0	0	0.0
30	3-Aug	9	16.3	58.50	172.65	58	130	14.4	1243	138.1	902	100.2	0	0.0	0	0.0	10	1.1
31	4-Aug	9	16.8	58.50	172.02	54	54	6.0	1034	114.9	372	41.3	0	0.0	0	0.0	0	0.0
32	28-Jul	9	19.1	58.50	171.36	49	40	4.4	352	39.1	69	7.7	1	0.1	0	0.0	3	0.3
33	23-Jul	9	17.4	58.50	170.73	42	33	3.7	551	61.2	219	24.3	0	0.0	0	0.0	0	0.0
34	8-Aug	9	13.7	58.33	173.57	63	12	1.3	71	7.9	459	51.0	0	0.0	0	0.0	0	0.0
35	2-Aug	9	14.7	58.33	172.92	60	11	1.2	344	38.2	739	82.1	0	0.0	0	0.0	0	0.0
36	4-Aug	9	14.7	58.33	172.32	56	69	7.7	1027	114.1	514	57.1	0	0.0	0	0.0	21	2.3
37	29-Jul	9	23.1	58.33	171.65	52	37	4.1	903	111.4	480	53.3	0	0.0	0	0.0	0	0.0
38	29-Jul	9	18.7	58.33	171.02	46	70	7.8	538	59.8	112	12.4	0	0.0	1	0.1	0	0.0
39	22-Jul	9	17.7	58.33	170.39	40	11	1.2	179	19.9	127	14.1	0	0.0	0	0.0	0	0.0

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							Males						Females					
	Date	No.	Soak	Location		Depth	Sublegal		Small Legal		Large Legal		Immature		Primiparous		Multiparous	
Station	Set	Pots	Hrs.	N. lat.	W. long.	(fms)	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE
40	2-Aug	9	13.2	58.17	173.22	60	8	0.9	131	14.6	96	10.7	0	0.0	0	0.0	36	4.0
41	1-Aug	9	15.1	58.17	172.58	57	26	2.9	336	37.3	588	65.3	0	0.0	0	0.0	1	0.1
42	30-Jul	9	25.7	58.17	171.95	55	94	10.4	3124	347.1	1516	168.4	1	0.1	0	0.0	2	0.2
43	29-Jul	9	20.4	58.17	171.30	50	27	3.0	1037	115.2	534	59.3	0	0.0	0	0.0	0	0.0
44	22-Jul	9	19.2	58.17	170.68	43	71	7.9	768	85.3	214	23.8	0	0.0	0	0.0	0	0.0
45	2-Aug	9	14.8	58.00	173.47	64	6	0.7	25	2.8	580	64.4	0	0.0	0	0.0	0	0.0
46	2-Aug	9	13.3	58.00	172.88	60	16	1.8	268	29.8	123	13.7	0	0.0	0	0.0	92	10.2
47	1-Aug	9	12.5	58.00	172.25	58	11	1.2	238	26.4	1106	122.9	0	0.0	0	0.0	0	0.0
48	30-Jul	9	29.1	58.00	171.60	54	29	3.2	1404	156.0	1285	142.8	0	0.0	0	0.0	12	1.3
49	22-Jul	8	17.9	58.00	170.97	48	18	2.3	624	78.0	326	40.8	0	0.0	0	0.0	0	0.0
50	22-Jul	9	15.7	58.00	170.34	40	84	9.3	811	90.1	275	30.6	3	0.3	1	0.1	0	0.0
		376[a]	18.0[b]			52[b]	2,736[a]	7.3[b]	27,186[a]	72.5[b]	16,482[a]	43.7[b]	19[a]	0.1[b]	8[a]	0.02[b]	392[a]	1.0[b]

[a] Column total

[b] Column average

Appendix A2.–Snow crab catch and catch per unit effort (CPUE) in the northern sampling area during the 2005 eastern Bering Sea snow crab tagging study.

							Males						Females					
	Date	No.	Soak	Location		Depth	Sublegal		Small Legal		Large Legal		Immature		Primiparous		Multiparous	
Station	Set	Pots	Hrs.	N. lat.	W. long.	(fms)	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE
1	13-Aug	9	16.4	61.33	175.68	54	754	83.8	1221	135.7	113	12.6	1	0.1	73	8.1	2	0.2
2	13-Aug	9	15.4	61.33	175.00	48	419	46.6	495	55.0	56	6.2	14	1.6	3	0.3	1	0.1
3	12-Aug	9	16.0	61.17	175.28	52	1402	155.8	1529	169.9	158	17.6	4	0.4	592	65.8	32	3.6
4	12-Aug	9	14.2	61.00	175.55	56	2	0.2	83	9.2	102	11.3	0	0.0	0	0.0	0	0.0
5	12-Aug	9	14.9	61.00	174.88	51	380	42.2	1519	168.8	222	24.7	0	0.0	8	0.9	0	0.0
6	12-Aug	9	13.9	60.83	175.18	55	0	0.0	5	0.6	16	1.8	0	0.0	0	0.0	0	0.0
7	11-Aug	9	14.4	60.67	175.47	59	1	0.1	16	1.8	82	9.1	0	0.0	0	0.0	0	0.0
8	11-Aug	9	13.5	60.67	174.82	54	1	0.1	41	4.6	129	14.3	0	0.0	0	0.0	0	0.0
		72[a]	14.8[b]			54[b]	2,959[a]	41.1[b]	4,909[a]	68.2[b]	878[a]	12.2[b]	19[a]	0.3[b]	676[a]	9.4[b]	35[a]	0.5[b]

[a]Column total

[b]Column average

APPENDIX B. TANNER CRAB AND HYBRID CATCH

Appendix B1.–Tanner crab catch and catch per unit effort (CPUE) by station during the 2005 eastern Bering Sea snow crab tagging study.

							Males				Females			
	Date	No.	Soak	Location		Depth	Sublegal		Legal		Immature		Mature	
Station	Set	Pots	Hrs.	N. lat.	W. long.	(fms)	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE
1	13-Aug	9	16.4	61.33	175.68	54	0	0.0	0	0.0	0	0.0	0	0.0
2	13-Aug	9	15.4	61.33	175.00	48	0	0.0	0	0.0	0	0.0	0	0.0
3	12-Aug	9	16.0	61.17	175.28	52	1	0.1	0	0.0	0	0.0	0	0.0
4	12-Aug	9	14.2	61.00	175.55	56	0	0.0	0	0.0	0	0.0	0	0.0
5	12-Aug	9	14.9	61.00	174.88	51	0	0.0	0	0.0	0	0.0	0	0.0
6	12-Aug	9	13.9	60.83	175.18	55	0	0.0	0	0.0	0	0.0	0	0.0
7	11-Aug	9	14.4	60.67	175.47	59	0	0.0	0	0.0	0	0.0	0	0.0
8	11-Aug	9	13.5	60.67	174.82	54	0	0.0	0	0.0	0	0.0	0	0.0
9	25-Jul	9	17.9	59.33	171.83	43	4	0.4	0	0.0	0	0.0	0	0.0
10	25-Jul	9	16.8	59.33	171.18	41	0	0.0	0	0.0	0	0.0	0	0.0
11	26-Jul	9	17.9	59.17	171.48	43	3	0.3	0	0.0	0	0.0	0	0.0
12	9-Aug	9	22.0	59.00	173.72	65	49	5.4	0	0.0	0	0.0	36	4.0
13	9-Aug	9	19.5	59.00	173.08	59	32	3.6	0	0.0	0	0.0	9	1.0
14	6-Aug	9	17.9	59.00	172.45	54	6	0.7	0	0.0	1	0.1	0	0.0
15	26-Jul	9	18.8	59.00	171.78	47	5	0.6	0	0.0	0	0.0	0	0.0
16	27-Jul	9	19.3	59.00	171.13	42	2	0.2	0	0.0	0	0.0	0	0.0
17	24-Jul	8	18.2	59.00	170.48	38	2	0.3	0	0.0	0	0.0	0	0.0
18	9-Aug	9	16.8	58.83	173.35	64	32	3.6	0	0.0	0	0.0	13	1.4
19	6-Aug	9	18.5	58.83	172.73	58	11	1.2	0	0.0	0	0.0	31	3.4
20	5-Aug	9	19.3	58.83	172.09	52	7	0.8	0	0.0	0	0.0	0	0.0
21	27-Jul	9	18.4	58.83	171.43	47	3	0.3	1	0.1	0	0.0	0	0.0
22	24-Jul	9	16.7	58.83	170.78	42	4	0.4	0	0.0	0	0.0	0	0.0
23	8-Aug	9	15.4	58.67	173.63	70	1	0.1	0	0.0	0	0.0	0	0.0
24	7-Aug	9	19.0	58.67	173.00	61	25	2.8	0	0.0	0	0.0	15	1.7
25	3-Aug	9	19.6	58.67	172.38	56	12	1.3	1	0.1	0	0.0	0	0.0
26	5-Aug	9	18.2	58.67	171.72	50	10	1.1	0	0.0	0	0.0	0	0.0
27	28-Jul	9	18.1	58.67	171.08	45	7	0.8	0	0.0	0	0.0	0	0.0
28	23-Jul	9	18.8	58.67	170.43	40	9	1.0	0	0.0	1	0.1	0	0.0

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							Males				Females			
	Date	No.	Soak	Location		Depth	Sublegal		Legal		Immature		Mature	
Station	Set	Pots	Hrs.	N. lat.	W. long.	(fms)	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE
29	7-Aug	9	21.9	58.50	173.28	64	18	2.0	0	0.0	0	0.0	1	0.1
30	3-Aug	9	16.3	58.50	172.65	58	31	3.4	0	0.0	0	0.0	14	1.6
31	4-Aug	9	16.8	58.50	172.02	54	15	1.7	0	0.0	0	0.0	1	0.1
32	28-Jul	9	19.1	58.50	171.36	49	6	0.7	0	0.0	0	0.0	0	0.0
33	23-Jul	9	17.4	58.50	170.73	42	11	1.2	0	0.0	0	0.0	1	0.1
34	8-Aug	9	13.7	58.33	173.57	63	10	1.1	0	0.0	0	0.0	6	0.7
35	2-Aug	9	14.7	58.33	172.92	60	30	3.3	0	0.0	0	0.0	14	1.6
36	4-Aug	9	14.7	58.33	172.32	56	23	2.6	0	0.0	0	0.0	0	0.0
37	29-Jul	9	23.1	58.33	171.65	52	42	4.7	0	0.0	0	0.0	1	0.1
38	29-Jul	9	18.7	58.33	171.02	46	4	0.4	2	0.2	0	0.0	0	0.0
39	22-Jul	9	17.7	58.33	170.39	40	27	3.0	3	0.3	2	0.2	0	0.0
40	2-Aug	9	13.2	58.17	173.22	60	5	0.6	0	0.0	0	0.0	3	0.3
41	1-Aug	9	15.1	58.17	172.58	57	17	1.9	0	0.0	0	0.0	4	0.4
42	30-Jul	9	25.7	58.17	171.95	55	42	4.7	2	0.2	0	0.0	4	0.4
43	29-Jul	9	20.4	58.17	171.30	50	26	2.9	2	0.2	1	0.1	2	0.2
44	22-Jul	9	19.2	58.17	170.68	43	21	2.3	0	0.0	0	0.0	0	0.0
45	2-Aug	9	14.8	58.00	173.47	64	12	1.3	0	0.0	0	0.0	41	4.6
46	2-Aug	9	13.3	58.00	172.88	60	18	2.0	0	0.0	0	0.0	5	0.6
47	1-Aug	9	12.5	58.00	172.25	58	32	3.6	1	0.1	0	0.0	0	0.0
48	30-Jul	9	29.1	58.00	171.60	54	52	5.8	0	0.0	0	0.0	13	1.4
49	22-Jul	8	17.9	58.00	170.97	48	26	3.3	0	0.0	1	0.1	0	0.0
50	22-Jul	9	15.7	58.00	170.34	40	23	2.6	2	0.2	1	0.1	1	0.1
		448[a]	17.5[b]			52[b]	716[a]	1.6[b]	14[a]	0.03[b]	7[a]	0.02[b]	215[a]	0.5[b]

[a] Column total

[b] Column average

Appendix B2.–Snow crab x Tanner crab hybrid catch and catch per unit effort (CPUE) by station during the 2005 eastern Bering Sea snow crab tagging study.

							Males				Females			
	Date	No.	Soak	Location		Depth	Sublegal		Legal		Immature		Mature	
Station	Set	Pots	Hrs.	N. lat.	W. long.	(fms)	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE
1	13-Aug	9	16.4	61.33	175.68	54	0	0.0	0	0.0	0	0.0	0	0.0
2	13-Aug	9	15.4	61.33	175.00	48	0	0.0	0	0.0	0	0.0	0	0.0
3	12-Aug	9	16.0	61.17	175.28	52	0	0.0	1	0.1	0	0.0	0	0.0
4	12-Aug	9	14.2	61.00	175.55	56	0	0.0	0	0.0	0	0.0	0	0.0
5	12-Aug	9	14.9	61.00	174.88	51	0	0.0	0	0.0	0	0.0	0	0.0
6	12-Aug	9	13.9	60.83	175.18	55	0	0.0	0	0.0	0	0.0	0	0.0
7	11-Aug	9	14.4	60.67	175.47	59	0	0.0	0	0.0	0	0.0	0	0.0
8	11-Aug	9	13.5	60.67	174.82	54	0	0.0	0	0.0	0	0.0	0	0.0
9	25-Jul	9	17.9	59.33	171.83	43	0	0.0	0	0.0	0	0.0	0	0.0
10	25-Jul	9	16.8	59.33	171.18	41	0	0.0	2	0.2	0	0.0	0	0.0
11	26-Jul	9	17.9	59.17	171.48	43	0	0.0	0	0.0	0	0.0	0	0.0
12	9-Aug	9	22.0	59.00	173.72	65	0	0.0	0	0.0	0	0.0	0	0.0
13	9-Aug	9	19.5	59.00	173.08	59	0	0.0	1	0.1	0	0.0	0	0.0
14	6-Aug	9	17.9	59.00	172.45	54	0	0.0	1	0.1	0	0.0	0	0.0
15	26-Jul	9	18.8	59.00	171.78	47	0	0.0	0	0.0	0	0.0	0	0.0
16	27-Jul	9	19.3	59.00	171.13	42	0	0.0	0	0.0	0	0.0	0	0.0
17	24-Jul	8	18.2	59.00	170.48	38	0	0.0	0	0.0	0	0.0	0	0.0
18	9-Aug	9	16.8	58.83	173.35	64	0	0.0	1	0.1	0	0.0	0	0.0
19	6-Aug	9	18.5	58.83	172.73	58	0	0.0	1	0.1	0	0.0	0	0.0
20	5-Aug	9	19.3	58.83	172.09	52	0	0.0	0	0.0	0	0.0	0	0.0
21	27-Jul	9	18.4	58.83	171.43	47	0	0.0	0	0.0	0	0.0	0	0.0
22	24-Jul	9	16.7	58.83	170.78	42	0	0.0	0	0.0	0	0.0	0	0.0
23	8-Aug	9	15.4	58.67	173.63	70	0	0.0	0	0.0	0	0.0	0	0.0
24	7-Aug	9	19.0	58.67	173.00	61	0	0.0	0	0.0	0	0.0	0	0.0
25	3-Aug	9	19.6	58.67	172.38	56	0	0.0	0	0.0	0	0.0	0	0.0
26	5-Aug	9	18.2	58.67	171.72	50	0	0.0	1	0.1	0	0.0	0	0.0
27	28-Jul	9	18.1	58.67	171.08	45	0	0.0	0	0.0	0	0.0	0	0.0
28	23-Jul	9	18.8	58.67	170.43	40	0	0.0	0	0.0	0	0.0	0	0.0
29	7-Aug	9	21.9	58.50	173.28	64	0	0.0	4	0.4	0	0.0	0	0.0
30	3-Aug	9	16.3	58.50	172.65	58	0	0.0	0	0.0	0	0.0	0	0.0
31	4-Aug	9	16.8	58.50	172.02	54	0	0.0	1	0.1	0	0.0	0	0.0
32	28-Jul	9	19.1	58.50	171.36	49	0	0.0	0	0.0	0	0.0	0	0.0

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Appendix B2.–Page 2 of 2.

Station	Date Set	No. Pots	Soak Hrs.	Location		Depth (fms)	Males				Females			
							Sublegal		Legal		Immature		Mature	
				N. lat.	W. long.		No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE
33	23-Jul	9	17.4	58.50	170.73	42	0	0.0	0	0.0	0	0.0	0	0.0
34	8-Aug	9	13.7	58.33	173.57	63	0	0.0	0	0.0	0	0.0	0	0.0
35	2-Aug	9	14.7	58.33	172.92	60	0	0.0	0	0.0	0	0.0	0	0.0
36	4-Aug	9	14.7	58.33	172.32	56	0	0.0	0	0.0	0	0.0	0	0.0
37	29-Jul	9	23.1	58.33	171.65	52	0	0.0	0	0.0	0	0.0	0	0.0
38	29-Jul	9	18.7	58.33	171.02	46	0	0.0	1	0.1	0	0.0	0	0.0
39	22-Jul	9	17.7	58.33	170.39	40	0	0.0	0	0.0	0	0.0	0	0.0
40	2-Aug	9	13.2	58.17	173.22	60	0	0.0	2	0.2	0	0.0	0	0.0
41	1-Aug	9	15.1	58.17	172.58	57	0	0.0	0	0.0	0	0.0	0	0.0
42	30-Jul	9	25.7	58.17	171.95	55	0	0.0	0	0.0	0	0.0	0	0.0
43	29-Jul	9	20.4	58.17	171.30	50	0	0.0	0	0.0	0	0.0	0	0.0
44	22-Jul	9	19.2	58.17	170.68	43	0	0.0	0	0.0	0	0.0	0	0.0
45	2-Aug	9	14.8	58.00	173.47	64	0	0.0	0	0.0	0	0.0	0	0.0
46	2-Aug	9	13.3	58.00	172.88	60	0	0.0	0	0.0	0	0.0	0	0.0
47	1-Aug	9	12.5	58.00	172.25	58	0	0.0	0	0.0	0	0.0	0	0.0
48	30-Jul	9	29.1	58.00	171.60	54	0	0.0	0	0.0	0	0.0	0	0.0
49	22-Jul	8	17.9	58.00	170.97	48	0	0.0	0	0.0	0	0.0	0	0.0
50	22-Jul	9	15.7	58.00	170.34	40	0	0.0	0	0.0	0	0.0	0	0.0

[a] Column total

[b] Column average