

**Summary of Dungeness Crab Dockside Sampling in
Southeast Alaska with an Emphasis on 2001/2002
through 2010/2011 Commercial Fishing Seasons**

by

Gretchen Bishop

May 2013

Alaska Department of Fish and Game

Division of 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)		General		Mathematics, statistics	
centimeter	cm	Alaska Administrative Code	AAC	<i>all standard mathematical signs, symbols and abbreviations</i>	
deciliter	dL	all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.	alternate hypothesis	H_A
gram	g			base of natural logarithm	e
hectare	ha	all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.	catch per unit effort	CPUE
kilogram	kg			coefficient of variation	CV
kilometer	km	at	@	common test statistics	(F, t, χ^2 , etc.)
liter	L	compass directions:		confidence interval	CI
meter	m	east	E	correlation coefficient (multiple)	R
milliliter	mL	north	N	correlation coefficient (simple)	r
millimeter	mm	south	S	covariance	cov
		west	W	degree (angular)	$^\circ$
		copyright	©	degrees of freedom	df
Weights and measures (English)		corporate suffixes:		expected value	E
cubic feet per second	ft ³ /s	Company	Co.	greater than	>
foot	ft	Corporation	Corp.	greater than or equal to	≥
gallon	gal	Incorporated	Inc.	harvest per unit effort	HPUE
inch	in	Limited	Ltd.	less than	<
mile	mi	District of Columbia	D.C.	less than or equal to	≤
nautical mile	nmi	et alii (and others)	et al.	logarithm (natural)	ln
ounce	oz	et cetera (and so forth)	etc.	logarithm (base 10)	log
pound	lb	exempli gratia		logarithm (specify base)	log ₂ , etc.
quart	qt	(for example)	e.g.	minute (angular)	'
yard	yd	Federal Information Code	FIC	not significant	NS
		id est (that is)	i.e.	null hypothesis	H_0
Time and temperature		latitude or longitude	lat. or long.	percent	%
day	d	monetary symbols		probability	P
degrees Celsius	°C	(U.S.)	\$, ¢	probability of a type I error (rejection of the null hypothesis when true)	α
degrees Fahrenheit	°F	months (tables and figures): first three letters	Jan,...,Dec	probability of a type II error (acceptance of the null hypothesis when false)	β
degrees kelvin	K	registered trademark	®	second (angular)	"
hour	h	trademark	™	standard deviation	SD
minute	min	United States (adjective)	U.S.	standard error	SE
second	s	United States of America (noun)	USA	variance	
		U.S.C.	United States Code	population sample	Var var
Physics and chemistry		U.S. state	use two-letter abbreviations (e.g., AK, WA)		
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				

REGIONAL INFORMATION REPORT NO. 1J13-06

**SUMMARY OF DUNGENESS CRAB DOCKSIDE SAMPLING IN
SOUTHEAST ALASKA WITH AN EMPHASIS ON 2001/2002 THROUGH
2010/2011 COMMERCIAL FISHING SEASONS**

By
Gretchen Bishop
Alaska Department of Fish and Game, Division of Commercial Fisheries, Douglas

Alaska Department of Fish and Game
Division of Commercial Fisheries, Publications Section
802 3rd St., Douglas, Alaska, 99824-0020

May 2013

The Regional Information Report Series was established in 1987 and was redefined in 2007 to meet the Division of Commercial Fisheries regional need for publishing and archiving information such as project operational plans, area management plans, budgetary information, staff comments and opinions to Board of Fisheries proposals, interim or preliminary data and grant agency reports, special meeting or minor workshop results and other regional information not generally reported elsewhere. Reports in this series may contain raw data and preliminary results. Reports in this series receive varying degrees of regional, biometric and editorial review; information in this series may be subsequently finalized and published in a different department reporting series or in the formal literature. Please contact the author or the Division of Commercial Fisheries if in doubt of the level of review or preliminary nature of the data reported. Regional Information Reports are available through the Alaska State Library and on the Internet at: <http://www.sf.adfg.ak.us/statewide/divreports/html/intersearch.cfm>.

Gretchen Bishop

*Alaska Department of Fish and Game, Division of Commercial Fisheries,
802 3rd Street, Douglas, AK 99824 USA*

This document should be cited as:

Bishop, G. 2013. Summary of Dungeness Crab Dockside Sampling in Southeast Alaska with an Emphasis on 2001/2002 through 2010/2011 Commercial Fishing Seasons. Alaska Department of Fish and Game, Regional Report Series No. 1J13-06, Douglas, Alaska.

The Alaska Department of Fish and Game (ADF&G) administers all programs and activities free from discrimination based on race, color, national origin, age, sex, religion, marital status, pregnancy, parenthood, or disability. The department administers all programs and activities in compliance with Title VI of the Civil Rights Act of 1964, Section 504 of the Rehabilitation Act of 1973, Title II of the Americans with Disabilities Act (ADA) of 1990, the Age Discrimination Act of 1975, and Title IX of the Education Amendments of 1972.

If you believe you have been discriminated against in any program, activity, or facility please write:

ADF&G ADA Coordinator, P.O. Box 115526, Juneau AK 99811-5526

U.S. Fish and Wildlife Service, 4040 N. Fairfax Drive, Suite 300 Webb, Arlington VA 22203

Office of Equal Opportunity, U.S. Department of the Interior, Washington DC 20240

The department's ADA Coordinator can be reached via phone at the following numbers:

(VOICE) 907-465-6077, (Statewide Telecommunication Device for the Deaf) 1-800-478-3648, (Juneau TDD) 907-465-3646, or (FAX) 907-465-6078

For information on alternative formats and questions on this publication, please contact:

ADF&G, Sport Fish Division, Research and Technical Services, 333 Raspberry Road, Anchorage AK 99518 (907)267-2375.

TABLE OF CONTENTS

	Page
LIST OF TABLES.....	ii
LIST OF FIGURES.....	iii
LIST OF Appendices.....	iv
ABSTRACT.....	1
INTRODUCTION.....	1
METHODS.....	2
Field.....	2
Analysis.....	2
Regression.....	3
ANOVA.....	3
RESULTS.....	3
Harvest and recruit composition.....	3
Shell hardness.....	4
Dockside data.....	4
Fish ticket data.....	5
DISCUSSION.....	5
Harvest and recruit composition.....	5
Shell hardness.....	6
REFERENCES CITED.....	7
APPENDICES.....	46

LIST OF TABLES

Table	Page
1. Fishery area definitions for the commercial Dungeness crab fishery in Southeast Alaska.....	8
2. Sampling goals for the commercial Dungeness crab fishery in Southeast Alaska by fishery area and month.....	9
3. Sampling effort for the commercial Dungeness crab fishery in Southeast Alaska by fishery area and month averaged for 2001/2002 through 2010/2011 fishing seasons.....	9
4. Qualitative descriptions of shell condition categories currently used in dockside sampling of commercial Dungeness crab landings.....	10
5. Recruit class definitions currently in use for Dungeness crab in Southeast Alaska.....	10
6. Southeast Alaska commercial Dungeness crab fishery harvest by fishery area and month averaged for 2001/2002 through 2010/2011 fishing seasons. Month of peak harvest is shaded.....	11
7. Results of regressions of commercial Dungeness crab harvest (lb) vs. fishing season by fishery area for 1975/1976 through 2010/2011 fishing seasons.....	12
8. Results of regressions of commercial Dungeness crab dockside recruit percentage vs. fishing season by fishery area for 1975/1976 through 2010/2011 fishing seasons.....	12

LIST OF FIGURES

Figure	Page
1. Boundaries of commercial Dungeness crab fishery analysis areas established beginning with the 2001/2002 season in Southeast Alaska.....	13
2. Method used to measure Dungeness crab shell hardness with a durometer.....	14
3. Harvest and mean and standard error of the percent of dockside sampled commercial Dungeness crab harvest that is newly recruited for eight fishery areas, 1975/1976 through 2010/2011 fishing seasons.....	15
4. Harvest and the mean and standard error of the percent of dockside sampled commercial Dungeness crab harvest that is newly recruited for seven fishery areas, 1975/1976 through 2010/2011 fishing seasons.....	16
5. Results of one-way ANOVA and of post-hoc Tukey HSD of Dungeness crab shell hardness by shell condition from crabs delivered and purchased during dockside sampling in 2009/2010 and 2010/2011 fishing seasons.....	17
6. Results of 3-way ANOVA and of post-hoc Tukey HSD of effects of fishery area, fishing season, and year on Dungeness crab soft-shell prevalence from dockside sampling of four fishery areas, during summer and fall seasons of 2001/2002 through 2010/2011.....	18
7. West Coast, Prince of Wales Island (District 3) soft shell prevalence by month from dockside sampling of commercially harvested Dungeness crab during summer (June 15–August 15) and fall (October 1–November 30) 2001/2002 through 2010/2011 fishing seasons.....	19
8. Ernest Sound/Clarence Strait (District 7) soft shell prevalence by month from dockside sampling of commercially harvested Dungeness crab, 2001/2002 through 2010/2011 fishing seasons.....	20
9. Duncan Canal (District 6) soft shell prevalence by month from dockside sampling of commercially harvested Dungeness crab during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011.....	21
10. Stikine Flats (District 8) soft shell prevalence by month from dockside sampling of commercially harvested Dungeness crab during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011.....	22
11. Thomas/Farragut Bays (District 10) soft shell prevalence by month from dockside sampling of commercially harvested Dungeness crab, 2001/2002 through 2010/2011 fishing seasons.....	23
12. Port Camden/West Kuiu (Districts 5/9) soft shell prevalence by month from dockside sampling of commercially harvested Dungeness crab during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011.....	24
13. East Admiralty/Mainland Bays, (District 11) soft shell prevalence by month from dockside sampling of commercially harvested Dungeness crab during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011.....	25
14. Peril Strait (District 13) soft shell prevalence by month from dockside sampling of commercially harvested Dungeness crab, 2001/2002 through 2010/2011 fishing seasons.....	26
15. Tenakee Inlet (District 12) soft shell prevalence by month from dockside sampling of commercially harvested Dungeness crab, 2001/2002 through 2010/2011 fishing seasons. Statistical results are included for years with significant one-way ANOVA only.....	27
16. Icy Strait/Glacier Bay (District 14) soft shell prevalence by month from dockside sampling of commercially harvested Dungeness crab, 2001/2002 through 2010/2011 fishing seasons. Statistical results are included for years with significant one-way ANOVA only.....	28
17. Lynn Canal (District 15) soft shell prevalence by month from dockside sampling of commercially harvested Dungeness crab, 2001/2002 through 2010/2011 fishing seasons. Statistical results are included for years with significant one-way ANOVA only.....	29
18. Behm Canal, Portland Canal (District 1) soft shell prevalence by month from dockside sampling of commercially harvested Dungeness crab 2001/2002 through 2010/2011 fishing seasons.....	30
19. East Coast, Prince of Wales (District 2) soft shell prevalence by month from dockside sampling of commercially harvested Dungeness crab during summer (June 15–August 15) and fall (October 1–November 30) 2001/2002 through 2010/2011 fishing seasons.....	31
20. Results of 3-way ANOVA of effects of fishery area, fishing season, and year on Dungeness crab soft shell prevalence from fish tickets for 10 fishery areas, during summer and fall commercial fishing seasons of 2001/2002 through 2010/2011.....	32

21.	West Coast, Prince of Wales Island (District 3) Dungeness crab soft shell prevalence by month from fish tickets during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011.	33
22.	Ernest Sound/Clarence Strait (District 7) Dungeness crab soft shell prevalence by month from fish tickets during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011.	34
23.	Duncan Canal (District 6) Dungeness crab soft shell prevalence by month from fish tickets during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011.	35
24.	Stikine Flats (District 8) Dungeness crab soft shell prevalence by month from fish tickets during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011.	36
25.	Thomas/Farragut Bays (District 10) Dungeness crab soft shell prevalence by month from fish tickets during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011.	37
26.	Port Camden/West Kuiu (Districts 5/9) Dungeness crab soft shell prevalence by month from fish tickets during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011.	38
27.	East Admiralty/Mainland Bays (District 11) Dungeness crab soft shell prevalence by month from fish tickets during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011.	39
28.	Peril Strait (District 13) Dungeness crab soft shell prevalence by month from fish tickets during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011.	40
29.	Tenakee Inlet (District 12) Dungeness crab soft shell prevalence by month from fish tickets during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011.	41
30.	Icy Strait (District 14) Dungeness crab soft shell prevalence by month from fish tickets during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011.	42
31.	Lynn Canal (District 15) Dungeness crab soft shell prevalence by month from fish tickets during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011.	43
32.	Behm Canal, Portland Canal (District 1) Dungeness crab soft shell prevalence by month from fish tickets during fall/winter (October 1–February 28) commercial fishing seasons, 2001/2002 through 2010/2011. This area had a fall/winter season for 2001/2002 through 2008/2009 and a summer/fall season for 2009/2010 and 2010/2011.	44
33.	East Coast, Prince of Wales (District 2) Dungeness crab soft shell prevalence by month from fish tickets during fall/winter (October 1–February 28) commercial fishing seasons, 2001/2002 through 2010/2011. This area had a fall/winter season for 2001/2002 through 2008/2009, a summer/fall season for 2009/2010, and a fall/winter season again in 2010/2011. y.	45

LIST OF APPENDICES

Appendix	Page
A. Summary of commercially harvested Dungeness crab size frequency and shell condition data collected during dockside sampling in Behm Canal, Portland Canal, and East Coast, Prince of Wales, 1975/1976 to present.	47
B. Summary of commercially harvested Dungeness crab size frequency and shell condition data collected during dockside sampling for West Coast, Prince of Wales Island; and Ernest Sound/Clarence Strait, 1975/1976 to present.	48
C. Summary of commercially harvested Dungeness crab size frequency and shell condition data collected during dockside sampling in Stikine Flats, 1975/1976 to present.	49
D. Summary of commercially harvested Dungeness crab size frequency and shell condition data collected during dockside sampling in Thomas/Farragut Bays, 1978/1979 to present.	50

E.	Summary of commercially harvested Dungeness crab size frequency and shell condition data collected during dockside sampling in Duncan Canal, 1976/1977 to present..	51
F.	Summary of commercially harvested Dungeness crab size frequency and shell condition data collected during dockside sampling in Port Camden/West Kuiu, 1975/1976 to present..	52
G.	Summary of commercially harvested Dungeness crab size frequency and shell condition data collected during dockside sampling in East Admiralty/Mainland Bays, 1975/1976 to present.	53
H.	Summary of commercially harvested Dungeness crab size frequency and shell condition data collected during dockside sampling in Peril Strait and Tenakee Inlet, 1975/1976 to present.	54
I.	Summary of commercially harvested Dungeness crab size frequency and shell condition data collected during dockside sampling in Icy Strait/Glacier Bay, Lynn Canal, Outer Coast Baranof/ Chichagof Islands, and Lituya Bay, 1975/1976 to present.	55

ABSTRACT

The Dungeness crab fishery is currently the most valuable commercial invertebrate fishery in Southeast Alaska. During the 2010/2011 season, 3.3 million pounds, with an ex-vessel value of \$5.53 million were harvested. Along the West Coast of North America Dungeness crab management is by sex, size, and season, or 3-S. Because 3-S management does not require annual population estimates, there is no formal stock assessment program. However, crabs are sampled dockside annually at six ports: Haines, Juneau, Sitka, Petersburg, Wrangell, and Ketchikan. The purpose of this report is to summarize dockside sampling data.

Monthly sampling goals were defined beginning with the 2001/2002 season for 16 fishery areas. Carapace width was measured, shell condition determined, and carapace hardness of every fifth crab measured using a durometer. For the first time, Dungeness crabs rejected for purchase by the processor because of soft-shell condition were sampled and measured for shell hardness.

Linear regression was conducted to test the significance of interannual trends in recruit percentage and harvest. One-way ANOVA was conducted to compare shell hardness by shell condition and delivery condition, and between months within fishery areas and years. Three-way ANOVA was conducted to determine the relative effects of fishery area, season, and year on soft-shell prevalence from dockside and fish ticket data. Two-way ANOVA was conducted of the effects of season and year on soft shell prevalence for Behm Canal, which has a fall/winter season.

Both harvest and recruit percentage were cyclic but significantly increasing for 1975/1976 through 2010/2011. Harvest peaked in June for southern areas, but July for northern areas. Soft-shell prevalence was higher in summer than fall, and highest in Duncan Canal, Stikine Flats, and East Admiralty. Within areas, the month of highest soft-shell prevalence varied by area and year but may be later moving north in latitude.

Key words: Dungeness, *Cancer magister*, Management, Life history timing, Soft shell, Sampling, Sea otter, *Enhydra lutris*, Southeast Alaska

INTRODUCTION

The Dungeness crab (*Cancer magister*) fishery is currently the most valuable commercial invertebrate fishery in Southeast Alaska. During the 2010/2011 season, 3.3 million lb, with an ex-vessel value of \$5.53 million were harvested.

Because of its resilient, r-selected life history (Bishop and Stratman 2006; Butler 1961; Hankin et al. 1985; Kondzela 1986; Siddeek et al. 2004), Dungeness crab management along the West Coast of North America is by sex, size, and season (3-S). In Southeast Alaska there is an additional provision to shorten the fishing season if the predicted harvest does not meet one of several thresholds. The base 3-S management consists of male-only harvest, a minimum legal size of 6.5-in (165 mm) carapace width (CW) excluding spines, and three different commercial Dungeness crab fishing seasons depending upon the area. Most of Southeast Alaska has a split summer (June 15 through August 15) and fall (October 1 through November 30) season. For Districts 1, 2 and the portion of Section 13-B not in the Sitka Sound Special Use Area, there is a fall/winter season (October 1 through February 28). However, this was changed by the Alaska Board of Fisheries (BOF) to a summer/fall season beginning in 2009/2010 for Districts 1 and 2, although it was subsequently changed back to a fall/winter season in 2010/2011 for District 2. The portion of Section 13-B that is in the Sitka Sound Special Use area and Whale Passage have a fall season only.

Although 3-S management has sustained the Southeast Alaska Dungeness crab fishery since its inception in the 1930s, allocation issues, sea otter (*Enhydra lutris*) range expansion, the federal closure of waters of Glacier Bay National Park and Preserve to commercial fishing, and the intensity of the modern fishery, are creating management issues (Bishop and Stratman 2006).

Because 3-S management does not require annual population estimates, there is no fishery-independent survey program for the Southeast Alaska Dungeness crab stock. However, dockside sampling is conducted for two purposes: to monitor fishery performance and to facilitate quality control of commercial fish ticket data. The primary fishery performance objective of dockside sampling is to describe spatial and interannual trends in recruit composition of harvest by fishery area. Two additional objectives, to describe seasonal trends in shell hardness, and shell hardness of crabs refused for purchase by processors, have recently been added.

The purpose of this report is to summarize dockside sampling data. We will describe interannual trends in recruit composition by fishery area, shell hardness of crabs refused for purchase by processors, and interannual and seasonal trends in shell hardness by fishery area.

METHODS

FIELD

Commercial Dungeness crab landings were sampled dockside in six ports: Haines, Juneau, Sitka, Petersburg, Wrangell, and Ketchikan. Beginning with the 2001/2002 season 16 fishery areas were defined (Figure 1, Table 1) and monthly sampling goals were established for each area (Figure 1; Table 2). Prior to this time, sampling effort was haphazard and variable (Appendices 1–9). For each sampled landing 50–75 purchased crabs (delivery condition “purchased”) were measured for carapace width, and shell condition was qualitatively assigned (Table 4). Carapace width was measured immediately anterior to the tenth anterolateral spine excluding spines, accurate to the nearest 1 mm. Shell condition was assigned according to a visual assessment of carapace, chela and dactyl wear and the degree of epibiontic fouling (Table 4). Beginning with the 2009/2010 season, carapace hardness was measured using a Pacific Transducer Corp (PTC) crab model (307LCRB) durometer for every fifth crab from landings as time allowed. Three durometer measurements were taken from the ventral shoulder areas in the apices of the bare spots created by abrasion of the chela against the carapace, with at least one measurement from each shoulder (Figure 2). Because the steel ball on the durometer indents the shell, care was taken to make the third measurement in a different spot than the first two. This data was entered into the ADF&G database as project “Commercial Dungeness Crab Trip”.

In addition to individual crab measurements, the total crab weight for the sample was measured and divided by the number of crab in that sample to calculate a mean crab weight for that sample.

For the first time during 2009/2010 and 2010/2011 seasons, 295 Dungeness crabs (3–25 per trip from 18 trips) which had been rejected for purchase by the processor because of soft-shell condition were sampled and measured for shell hardness. This data was entered into the ADF&G database as project “Commercial Dungeness Discard Sample”.

ANALYSIS

Sampled crabs were sorted into recruit classes according to recruit-class definitions based upon size and shell condition (Table 5). The proportion of the “recruit” size class of crab was determined for each trip and the mean and standard error calculated.

Shell hardness was calculated for each crab as the mean of the three durometer readings taken.

The proportion soft-shell crab was calculated for each trip as the number of crabs with shell condition code 1 or 2 divided by the sample size.

The proportion of commercial fish ticket landings, in pounds, that were coded as dead, soft-shell or landed discard was summarized for 2001/2002 through 2010/2011 seasons. This is hereafter referred to as “fish ticket soft-shell prevalence”.

Regression

Linear regression was conducted to determine interannual trends in recruit percentage and harvest by fishery area for 1975/1976 through 2010/2011.

ANOVA

One-way ANOVA was conducted to test effectiveness of shell condition as a predictor of shell hardness, grouping all crabs measured for shell hardness.

One-way ANOVA was conducted to compare shell hardness of crabs rejected by processors with that of those purchased, grouping all crabs measured for shell hardness. Because variances were unequal, a Welch test was used.

Data summarized by trip were used to investigate the effects of year, fishery area and season (summer vs. fall) on soft shell prevalence using three-way ANOVA. In order to obtain a balanced design, only four fishing areas: Duncan Canal, East Admiralty/Mainland Bays, Port Camden, and Stikine Flats for 2001/2002–2008/2009 and 2010/2011 seasons were used.

It was not possible to conduct 3-way ANOVA of the effects of year, fishery area, and season (fall vs. winter) for Behm Canal and Portland Canal, and East Coast, Prince of Wales (East POW) as there was insufficient data for East POW for any season. Thus two-way ANOVA of the effect of season and year on soft shell prevalence was conducted for Behm Canal, Portland Canal only for 2001/2002, 2002/2003, and 2005/2006 seasons.

Dockside data was also used to investigate the effect of month on soft shell prevalence for all fishery areas using one-way ANOVA; when variances were unequal a Welch test was used. However, there was very little data from Behm Canal and Portland Canal, and East POW where there is a fall/winter season, and there were no samples from February.

Fish ticket data were used to investigate the effects of fishery area, season, and year on soft-shell prevalence using 3-way ANOVA for areas with summer/fall and fall/winter seasons. In order to obtain a balanced design, data from only ten fishery areas (Duncan Canal, East Admiralty Island, Ernest Sound, Icy Strait/Glacier Bay, Lynn Canal, Peril Strait, Port Camden, Stikine Flats, Tenakee Inlet, and Thomas/Farragut) was used. For areas with a fall/winter season (Behm Canal, Portland Canal and East POW) not all years' data could be used. The 2001/2002–2004/2005 and 2007/2008 seasons were investigated.

Fish ticket data were also used to investigate the effect of month on soft shell prevalence for all fishery areas using one-way ANOVA; when variances were unequal a Welch test was used. However, there was very limited data for many fishery areas.

RESULTS

HARVEST AND RECRUIT COMPOSITION

On a regional basis, most (76.8%) of the harvest in the Southeast Alaska Dungeness crab fishery occurs during the summer months. Month of peak harvest was June for southern areas: Ernest Sound, Duncan Canal, Stikine Flats, and Thomas Bay but July for northern areas: Port Camden,

East Admiralty Island, Peril Strait, Tenakee Inlet, Icy Strait, and Lynn Canal (Table 6). Harvest exhibited cyclical trends, but increased significantly for most areas from 1974/1975 to 2010/2011 seasons (Table 7; Figures 3 and 4). The exceptions were Icy Strait/Glacier Bay, Lituya, and the Outer Coasts of Baranof and Chichagof Islands (Table 7; Figures 3 and 4) where harvest declined, although the Icy Strait decline was not statistically significant.

The percent of sampled crab that are recruits exhibited a cyclical, but statistically significantly increasing, trend for most areas from 1974/1975 to 2010/2011 seasons (Table 7; Figures 3 and 4). The exceptions were Lituya, Lynn Canal, the Outer Coast of Baranof and Chichagof Islands, and West Prince of Wales Island—areas where there is little, or a short time series of, sampling data. The mean percent recruit for recent seasons (2001/2002 through 2010/2011), ranged from 85.4% in Tenakee to 94.9% for Ernest Sound/Clarence Strait (Appendices 1–9). Cycles in the percent recruit have been dampened considerably in recent seasons.

SHELL HARDNESS

Dockside data

One-way ANOVA showed a significant effect of shell condition on shell hardness ($F_{(3,4684)}=350.9$, $p<.0001$) and post hoc Tukey HSD tests showed that old-shell (Mean=89.3, SE=0.37) were significantly harder than new-shell (Mean=81.5, SE=0.18) which were harder than light-shell (Mean=54.6, SE=0.97) or soft-shell (Mean=51.0, SE=4.14) crabs; however, hardness of light and soft-shell conditions did not significantly differ (Figure 5).

There was a significant effect of delivery condition ($F_{(1,348.8)}=2038.4$, $p<.0001$) and processor rejected crabs (Mean=52.7, SE=0.60) were softer than purchased product (Mean=81.2, SE=0.18) (Figure 5).

Data summarized by trip were used to investigate the effects of year, fishery area, and season (summer vs. fall) on soft shell prevalence using three-way ANOVA. Because the primary dockside sampling objective is to characterize crab by fishery area and season, not to compare fishery areas, and because of uneven distribution of fishing effort, the design was unbalanced. The unbalanced design meant that only Duncan Canal, East Admiralty/Mainland Bays, Port Camden, and Stikine Flats for 2001/2002–2010/2011, excluding 2009/2010, seasons could be compared. The ANOVA was highly significant ($F_{(71,2232)}=10.7$, $p<.0001$) and fishery area, season, year, fishery area*year, and year*season were all significant effects (Figure 6). Post hoc Tukey HSD tests showed the highest soft shell prevalence in Duncan Canal, or Stikine Flats (which did not differ from East Admiralty Island) in the summer season, and in 2001/2002 or 2008/2009 seasons (Figure 6).

It was not possible to conduct 3-way ANOVA of the effects of year, fishery area, and season (fall vs. winter) for Behm Canal and Portland Canal, and East POW as there was insufficient data for East POW for any season. Thus two-way ANOVA of the effect of season and year on soft shell prevalence was conducted for Behm Canal, Portland Canal only for 2001/2002, 2002/2003, and 2005/2006 seasons. The ANOVA was not significant ($F_{(1,57)}=0.1$, $p=.7684$).

One-way ANOVA showed significant effects of month on soft shell prevalence for only 13 of 130 fishery area/year combinations; there was insufficient data for many fishery area/year combinations (Figures 7–19). Among areas with a summer/fall season, soft shell prevalence was highest in June for 5 (39%), July for 6 (46%), and August for 2 (15%) of the 13 significant ANOVA (Figures 7–19). There was very little data from the two areas (Behm Canal and

Portland Canal, and East POW) with a fall/winter season, and the only two significant regressions showed peak soft shell prevalence respectively in November (Figure 18), and January (Figure 19). There were no samples from February.

Fish ticket data

For areas with a summer/fall season, the 3-way ANOVA of effects of fishery area, season, and year on soft shell prevalence was highly significant ($F_{(199,27360)}=7.0, p<.0001$) and fishery area, season, year, fishery area*year, fishery area*season, and fishery area*year*season were all significant effects (Figure 20). Post hoc Tukey HSD tests showed the highest soft shell prevalence in East Admiralty Island (which did not differ from Tenakee Inlet, or Thomas/Farragut Bays) in the summer season, and in 2009/2010 (which did not differ from 2001/2002, 2003/2004, 2004/2005, 2006/2007, and 2007/2008) seasons (Figure 20). For areas with a fall/winter season three-way ANOVA results were not significant ($F_{(19,543)}=0.8, p=.7049$).

One-way ANOVAs found significant effects of month on soft-shell prevalence for 20 of 130 fishery area/year combinations (Figures 21–33). Among areas with a summer/fall season, soft shell prevalence was highest in June for 8 (33%), July for 5 (21%), and August for 7 (29%) and November for 4 (17%) of the 20 significant ANOVA (Figures 21–33). There were no significant regressions from the two areas (Behm Canal and Portland Canal, and East POW) with a fall/winter season (Figures 32, 33).

DISCUSSION

HARVEST AND RECRUIT COMPOSITION

Fluctuating Dungeness crab harvest levels in Southeast Alaska have both intrinsic and extrinsic causes. For Icy Strait/Glacier Bay, the sharp decline in harvest observed was a result of the closure of Glacier Bay to commercial Dungeness crab harvest beginning with the 1999/2000 season. However, the lack of a decline in recruit percentage for Icy Strait/Glacier Bay, where harvest is declining points to a decline in population size as well; this may be a result of an influx in sea otters to this area. In 2002, an estimated 1,266 sea otters inhabited Glacier Bay (Esslinger and Bodkin 2009). For Lituya Bay, the 1993/1994 season decline in harvest is similar in timing to the Yakutat Dungeness crab fishery decline which we believe to be a result primarily of recruitment failure associated with North Pacific regime-shift (Bishop and Stratman 2006). Given the proximity of these two areas it is likely that similar environmental factors influence Dungeness crab recruitment in both areas. Finally, for Outer Coast Baranof and Chichagof the gradual decline in commercial harvest beginning in the 1990/1991 season was probably associated with the influx of sea otters. In 2003 an estimated 3,104 sea otters occupied the combined area of Glacier Bay, and northern Southeast Alaska, a 2%/yr increase from the 1987 estimate of 2,295, while for southern Southeast Alaska, the otter population size in 2003 was 5,845, a 6.6%/yr increase from 1988 estimate of 2,167 (Esslinger and Bodkin 2009). Sea otters had been virtually extirpated from Southeast Alaska and 403 were reintroduced over a five-year period from 1965–1969 (Burris and McKnight 1973).

Recruit composition of Dungeness crab harvest is a function of both harvest rate and recruitment strength. The fact that cycles in recruit percentage in the commercial harvest have dampened considerably is likely because the current fishery intensity results in very few crabs surviving to become postrecruits, even when recruitment is strong. This is illustrated by the fact that the highest percent recruit in the commercial catch occurs in areas with the most intense fisheries.

Ernest Sound, Stikine Flats, Thomas and Farragut Bays, Duncan Canal, Port Camden, and East Admiralty Island all have commercial harvests with recruit composition in excess of 90% and sustain the largest commercial harvests in the region. This reliance upon annual recruitment makes both the crab stock and the fishery that relies upon it, vulnerable to poor environmental conditions and means that a single year of poor recruitment could propagate through the years as a hole in the year class structure, making the stock more vulnerable to recruitment failure.

SHELL HARDNESS

The timing and magnitude of crab shell hardness is of interest because soft-shelled crabs are not marketable and experience high mortality rates when captured and discarded (Barry 1984; Kruse et al. 1994; Tegelberg 1971; Tegelberg 1972; Tegelberg and Magoon 1971). This means that crabs are wasted when the fishing season overlaps the soft-shell period. Although both dockside and fish ticket data found the highest soft-shell prevalence during the summer for areas with a summer/fall fishing period, peak soft-shell month varied within the summer by fishing area and year. Interestingly, we found that commercial harvest generally peaks earlier in areas where soft-shell crab prevalence peaks earlier. This is likely because fishery removals closely follow the recruitment molt for this intense fishery. Conversely, there are indications of a trend of later peak soft-shell prevalence and peak harvest moving north in latitude within Southeast Alaska, although data are somewhat sparse for northern areas. Commercial fish ticket data indicated occurrence of soft-shell crab in the commercial catch later in the season than dockside sampling data did. However, although soft shell prevalence was similar between June and November far more actual pounds of soft crab were handled in June because most of the harvest occurs during the summer season. The occurrence of November soft-shell highlights the narrow and variable window of opportunity for harvest of hard-shelled crabs in Southeast Alaska.

We show that the extended Dungeness crab season means that dockside sampling for this fishery can be used to gather useful life history information. However, most sampling effort currently occurs during the summer period, when most harvest occurs. Sampling goals could be revised to spread effort more evenly throughout the season to gather additional information on timing of soft shell prevalence.

Duncan Canal fish ticket data exhibited far more consistent trends in soft-shell prevalence than fish ticket data from most other fishing areas. This is likely a result of high fish ticket data integrity in the port of Petersburg (Bishop, pers. comm). A renewed focus of dockside samplers on fish ticket quality control would ensure that pounds of landed soft-shell crabs were accurately recorded on fish tickets.

REFERENCES CITED

- Barry, S. T. 1984. Coastal Dungeness crab project. State of Washington, Department of Fisheries, Project Progress Report No. 1-167-R, Olympia, WA.
- Bishop, G. H., and J. Stratman. 2006. Report to the Alaska Board of Fisheries, 2006 shrimp, Dungeness crab and scallop fisheries of Southeast Alaska. Alaska Department of Fish and Game, Fisheries Management Report No. 06-03, Juneau.
- Burris, O. E., and D. E. McKnight. 1973. Game transplants in Alaska. Alaska Department of Fish and Game, Wildlife Technical Bulletin No. 4, Juneau.
- Butler, T. H. 1961. Growth and age determination of the Pacific Edible Crab, *Cancer magister* Dana. Journal of the Fisheries Research Board of Canada. 18: 873-889.
- Esslinger, G. G., and J. L. Bodkin. 2009. Status and Trends of Sea Otter Populations in Southeast Alaska, 1969-2003. U.S. Department of the Interior; U.S. Geological Survey, Scientific Investigations Report No. 2009-5045, Reston, VA.
- Hankin, D. G., N. Diamond, M. S. Mohr, and J. Ianelli. 1985. Molt increments, annual molting probabilities, fecundity and survival rates of adult female Dungeness crabs in Northern California. pp.189-206, In: B. Melteff, editor. Proceedings of the Symposium on Dungeness Crab Biology and Management. University of Alaska Fairbanks, Alaska Sea Grant College Program, Report No. 85-3,
- Kondzela, C. M. 1986. Survival, feeding, and growth of juvenile Dungeness crabs from Southeastern Alaska at different temperatures. Masters thesis. University of Alaska, Juneau.
- Kruse, G. H., D. Hicks, and M. C. Murphy. 1994. Handling increases mortality of softshell Dungeness crabs returned to the sea. Fishery Research Bulletin. 1(1): 1-9.
- Siddeek, M., B. Sainte-Marie, J. Boutillier, and G. Bishop. 2004. Comparison of reference points estimated using a size-based method for two high-latitude crab species in the United States and Canada. Canadian Journal of Fisheries and Aquatic Sciences. 61: 1404-1430.
- Tegelberg, H. C. 1971. Condition, yield, and handling mortality studies on Dungeness crabs during the 1969 and 1970 seasons. State of Washington, Department of Fisheries, Processed Report No. Olympia, WA.
- Tegelberg, H. C. 1972. Special reports: Condition, yield, and handling mortality studies on Dungeness crabs during the 1969 and 1970 seasons. Pacific Marine Fisheries Commission, 23rd Annual Report No. Olympia, WA.
- Tegelberg, H. C., and D. Magoon. 1971. Handling mortality on soft shell Dungeness crabs. pp.13-14, In: Proceedings of the National Shellfisheries Association. Economy Printing, Volume 61, Easton, MA.

Table 1.–Fishery area definitions for the commercial Dungeness crab fishery in Southeast Alaska.

Fishery area	Statistical areas
West Coast, Prince of Wales Island	103-11, 15, 21, 23, 25, 30, 40, 50, 60, 65, 70, 80, 90, 105-41, 42, 43, 50
West Prince of Wales, outside	104-10, 20, 30, 35, 40, 50
Ernest Sound/ Clarence Strait	106-10, 20, 21, 22, 25, 30, 35, 107-10, 20, 30, 35, 40
Duncan Canal	106-41, 42, 43, 44, 108-30
Stikine Flats	107-45, 108-10, 20, 40, 41, 45, 50, 60, 70, 80
Thomas/Farragut Bays	110-11, 12, 13, 14
Port Camden/West Kuiu	105-10, 20, 31, 32, 109-40, 41, 42, 43, 44, 45, 50, 51, 52, 61, 62, 63
East Admiralty/ Mainland Bays	109-30, 110-15, 16, 17, 21, 22, 23, 24, 31, 32, 33, 34, 111-11, 12, 13, 14, 15, 16, 17, 20, 21, 31, 32, 33, 34, 35, 40, 41, 42, 43, 44, 90
Peril Strait	109-10, 11, 12, 20, 112-11, 18, 19, 21, 22, 67, 71, 72, 73, 80, 90, 113-51, 52, 53, 54, 55, 56, 57, 58, 59, 63, 64, 65
Tenakee Inlet	112-12, 13, 17, 41, 42, 43, 44, 45, 46, 47, 48, 50
Icy Strait/ Glacier Bay	112-14, 16, 61, 63, 65, 113-95, 96, 97, 114-17, 21, 23, 25, 27, 30, 31, 32, 33, 34, 40, 50, 60, 70, 71, 72, 73, 75, 77, 80
Lynn Canal	111-50, 55, 112-15, 115-00, 10, 11, 20, 31, 32, 33, 34, 35
Outer Coast Baranof, Chichagof	113-11, 12, 13, 21, 22, 23, 31, 32, 34, 35, 36, 37, 38, 41, 42, 43, 44, 45, 61, 62, 66, 71, 72, 73, 81, 91, 92, 93, 94, 96
Lituya Bay	116-11, 12, 13, 14
Behm Canal, Portland Canal	101-10, 11, 13, 15, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 40, 41, 42, 43, 44, 45, 46, 47, 48, 51, 53, 55, 60, 71, 73, 75, 77, 80, 85, 90, 95, 102-80
East Coast, Prince of Wales	102-10, 15, 20, 27, 30, 40, 50, 60, 70

Table 2.—Sampling goals for the commercial Dungeness crab fishery in Southeast Alaska by fishery area and month.

Fishery area	Crab/ landing	Landings						Total
		June	July	Aug.	Oct.	Nov.	Dec.	
West Coast, Prince of Wales Island	75	3	6	5	0	0	ND ¹	14
Ernest Sound/Clarence Strait	75	10	5	3	3	0	ND	19
Duncan Canal	50	15	5	3	3	3	ND	24
Stikine Flats	50	11	6	3	3	0	ND	20
Thomas/Farragut Bays	75	4	3	3	3	3	ND	10
Port Camden/West Kuiu	50	4	6	3	3	3	ND	16
East Admiralty /Mainland Bays	50	6	5	3	5	3	ND	20
Peril Strait	50	10	12	4	3	3	ND	32
Tenakee Inlet	75	6	4	4	7	0	ND	21
Icy Strait/Glacier Bay	75	3	6	3	4	3	ND	16
Lynn Canal	75	6	6	3	3	0	ND	16
Behm Canal, Portland Canal	75	ND	ND	ND	7	3	3	10
East Coast, Prince of Wales	75	ND	ND	ND	10	3	0	13
Total		78	64	27	48	13	3	231

¹ No sampling goals area established for months and areas when the season is normally closed. Season timing varies by Fishery area.

Table 3.—Sampling effort for the commercial Dungeness crab fishery in Southeast Alaska by fishery area and month averaged for 2001/2002 through 2010/2011 fishing seasons.

Fishery area	Landings						Total
	June	July	Aug.	Oct.	Nov.	Dec.	
West Coast, Prince of Wales Island	0.2	0.4	0.2	0.1	0.4	ND ¹	1.3
Ernest Sound/Clarence Strait	4.0	1.6	0.6	0.7	0.3	ND	7.2
Duncan Canal	29.2	25.2	8.0	27.4	11.0	ND	100.8
Stikine Flats	26.0	26.2	8.0	13.3	3.6	ND	77.1
Thomas/Farragut Bays	1.8	2.5	1.4	1.9	1.1	ND	8.7
Port Camden/West Kuiu	2.7	8.4	5.5	5.0	4.0	ND	25.6
East Admiralty /Mainland Bays	6.2	13.0	7.6	14.0	9.2	ND	50.0
Peril Strait	3.7	4.8	4.2	2.6	1.8	ND	17.1
Tenakee Inlet	1.6	2.6	1.3	2.1	0.7	ND	8.3
Icy Strait/Glacier Bay	2.3	3.5	2.5	2.4	0.8	ND	11.5
Lynn Canal	2.2	2.4	1.2	1.5	0.7	ND	8.0
Behm Canal, Portland Canal	0.1	0.5	0.2	4.3	4.8	1.7	12.3
East Coast, Prince of Wales	0.2	0.1	0.0	2.7	1.3	0.3	4.9
Total	80.2	91.2	40.7	78.0	39.7	2.0	332.8

¹ No data was collected for areas in months when the season was closed. Season timing varies by Fishery area.

Table 4.—Qualitative descriptions of shell condition categories currently used in dockside sampling of commercial Dungeness crab landings.

Shell condition	Shell condition code	Assumed shell age	Physical description of shell appearance	Range of durometer readings
Soft	1	≤2 wk.	Light color, sharp dactyls, clean carapace, not hard	< 40
Light	2	>2 wk. ≤2 mo.	Light color, sharp dactyls, chelae teeth sharp and fit together, clean carapace, not hard and not full of meat	40–50
New	3	>2 mo. ≤12 mo.	Darker than soft and light but carapace still clean, sharp dactyls and chela teeth match up	50–70
Old	4	>12 mo. ≤24mo.	Scratches on the ventral shell, barnacles may be present on the carapace, dactyls and claws worn down some	70–100
Very old	5	>24 mo.	Heavy ventral scratching with discoloration, heavy encrusting growth, dactyls are rounded and carapace spines are worn down	70–100

Table 5.—Recruit class definitions currently in use for Dungeness crab in Southeast Alaska.

Recruit class	Carapace width	Shell condition code
Prerecruit	≥ 135 mm CW	1, 2, 3, 4 or 5
	< 165 mm CW	
Recruit	≥ 165 mm CW	1, 2, or 3
	< 195 mm CW	
Postrecruit	≥ 165 mm CW	4 or 5
	< 195 mm CW	
	≥ 195 mm CW	1, 2, 3, 4 or 5

Table 6.— Southeast Alaska commercial Dungeness crab fishery harvest by fishery area and month averaged for 2001/2002 through 2010/2011 fishing seasons. Month of peak harvest is shaded.

Fishery area	Harvest (lb)								
	June	July	Aug.	Oct.	Nov.	Dec.	Jan.	Feb.	Total
West Coast, Prince of Wales Island	7,855.8	11,853.0	7,302.8	1,932.0	1,278.4	ND ¹	ND	ND	30,222.0
West Prince of Wales, outside	94.0	142.5	181.2	0.0	0.0	ND	ND	ND	417.7
Ernest Sound/Clarence Strait	144,879.0	76,756.0	16,717.6	16,772.5	13,763.5	ND	ND	ND	268,888.6
Duncan Canal	346,094.0	197,185.9	57,488.7	89,980.3	29,828.0	ND	ND	ND	720,576.9
Stikine Flats	426,682.3	277,195.6	67,891.4	84,192.8	26,619.4	ND	ND	ND	882,581.5
Thomas/Farragut Bays	45,346.9	44,442.3	15,780.8	11,612.4	5,522.9	ND	ND	ND	122,705.3
Port Camden/West Kuiu	204,606.8	254,934.9	113,399.	125,833.	36,481.7	ND	ND	ND	735,255.5
East Admiralty /Mainland Bays	186,589.6	265,500.4	100,039.	205,091.	52,284.7	ND	ND	ND	809,505.5
Peril Strait	50,885.4	95,345.1	40,684.4	23,970.7	17,926.6	ND	ND	ND	228,812.2
Tenakee Inlet	57,790.1	58,321.5	20,578.3	37,914.4	8,467.2	ND	ND	ND	183,071.5
Icy Strait/Glacier Bay	61,716.4	93,345.7	34,949.4	45,124.4	11,839.8	ND	ND	ND	246,975.7
Lynn Canal	56,163.5	59,011.9	20,505.8	45,139.9	14,039.4	ND	ND	ND	194,860.5
Outer Coast Baranof, Chichagof	203.6	99.4	116.3	63.4	398.1	ND	ND	ND	880.8
Behm Canal, Portland Canal	4,138.2	7,887.3	1,283.1	52,078.1	20,320.6	11,424.7	5,843.4	2,980.0	105,955.4
East Coast, Prince of Wales	4,882.4	3,371.0	1,069.0	57,370.2	17,477.9	4,129.4	2,249.9	1,022.6	91,572.4
Total	1,597,928	1,445,393	497,987	797,076	256,248	15,554	8,093	4,003	4,622,282
Percent	34.6	31.3	10.8	17.2	5.5	0.3	0.2	0.1	100.0

¹No harvest occurred for areas in months when the season was closed. Season timing varies by Fishery area.

Table 7.—Results of regressions of commercial Dungeness crab harvest (lb) vs. fishing season by fishery area for 1975/1976 through 2010/2011 fishing seasons.

Fishery area	R ²	DF		F Ratio	Prob > F	Slope
		Model	Error			
West Coast, Prince of Wales Island	0.24	1	33	10.7	0.0025	642.3
Ernest Sound/Clarence Strait	0.33	1	34	16.6	0.0003	6,504.8
Duncan Canal	0.31	1	34	15.2	0.0004	16,435.9
Stikine Flats	0.55	1	34	41.1	<0.0001	25,360.4
Thomas/Farragut Bays	0.33	1	34	16.8	0.0002	3,895.2
Port Camden/West Kuiu	0.39	1	34	22.1	<0.0001	22,177.8
East Admiralty /Mainland Bays	0.63	1	34	57.2	<0.0001	25,486.3
Peril Strait	0.55	1	34	42.2	<0.0001	6,478.7
Tenakee Inlet	0.24	1	34	11.0	0.0022	3,646.2
Icy Strait/Glacier Bay	0.01	1	34	0.3	0.5919	-1,793.1
Lynn Canal	0.61	1	34	53.7	<0.0001	7,094.3
Outer Coast Baranof, Chichagof	0.19	1	34	8.2	0.0710	-747.8
Lituya Bay	0.19	1	34	8.2	0.0071	-7,208.6
Behm Canal, Portland Canal	0.36	1	34	19.1	0.0001	2,652.6
East Coast, Prince of Wales	0.69	1	34	73.8	<0.0001	3,480.5

Table 8.—Results of regressions of commercial Dungeness crab dockside recruit percentage vs. fishing season by fishery area for 1975/1976 through 2010/2011 fishing seasons.

Fishery area	R ²	DF		F Ratio	Prob > F	Slope
		Model	Error			
West Coast, Prince of Wales Island	0.04	1	27	1.1	0.3063	0.7
Ernest Sound/Clarence Strait	0.33	1	111	55.4	<0.0001	1.0
Duncan Canal	0.23	1	1515	463.2	<0.0001	1.1
Stikine Flats	0.20	1	1122	285.5	<0.0001	0.8
Thomas/Farragut Bays	0.12	1	194	26.0	<0.0001	0.6
Port Camden/West Kuiu	0.11	1	578	71.2	<0.0001	0.6
East Admiralty /Mainland Bays	0.12	1	766	107.7	<0.0001	0.6
Peril Strait	0.11	1	217	27.7	<0.0001	0.8
Tenakee Inlet	0.47	1	95	83.0	<0.0001	1.4
Icy Strait/Glacier Bay	0.42	1	139	101.8	<0.0001	1.1
Lynn Canal	0.02	1	99	2.3	0.1325	0.4
Outer Coast Baranof, Chichagof	0.93	1	2	27.4	0.0346	-2.0
Lituya Bay	0.01	1	11	0.1	0.7533	2.0
Behm Canal, Portland Canal	0.14	1	209	34.2	<0.0001	3.4
East Coast, Prince of Wales	0.29	1	68	28.2	<0.0001	3.9

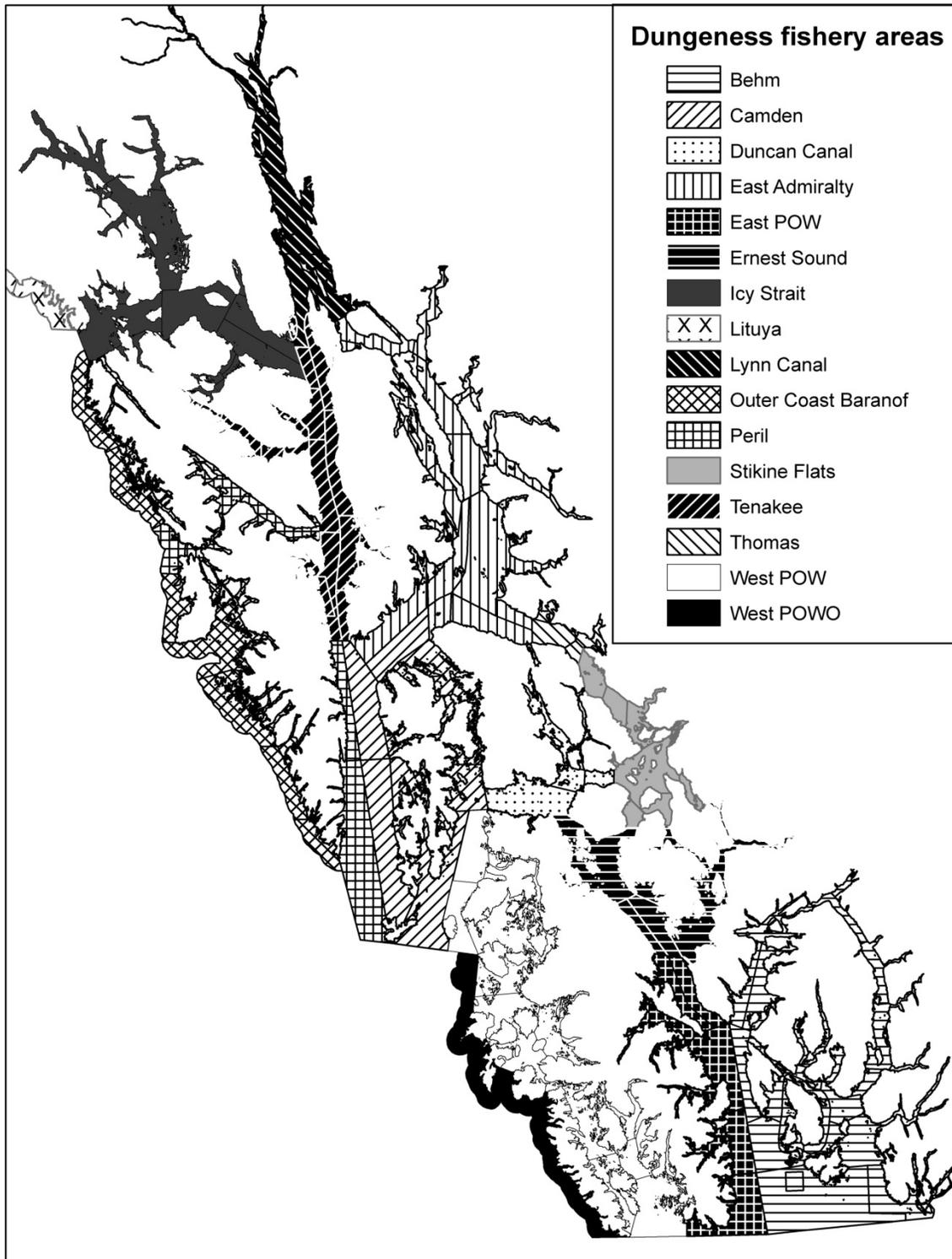


Figure 1.—Boundaries of commercial Dungeness crab fishery analysis areas established beginning with the 2001/2002 season in Southeast Alaska.



Figure 2.—Method used to measure Dungeness crab shell hardness with a durometer.

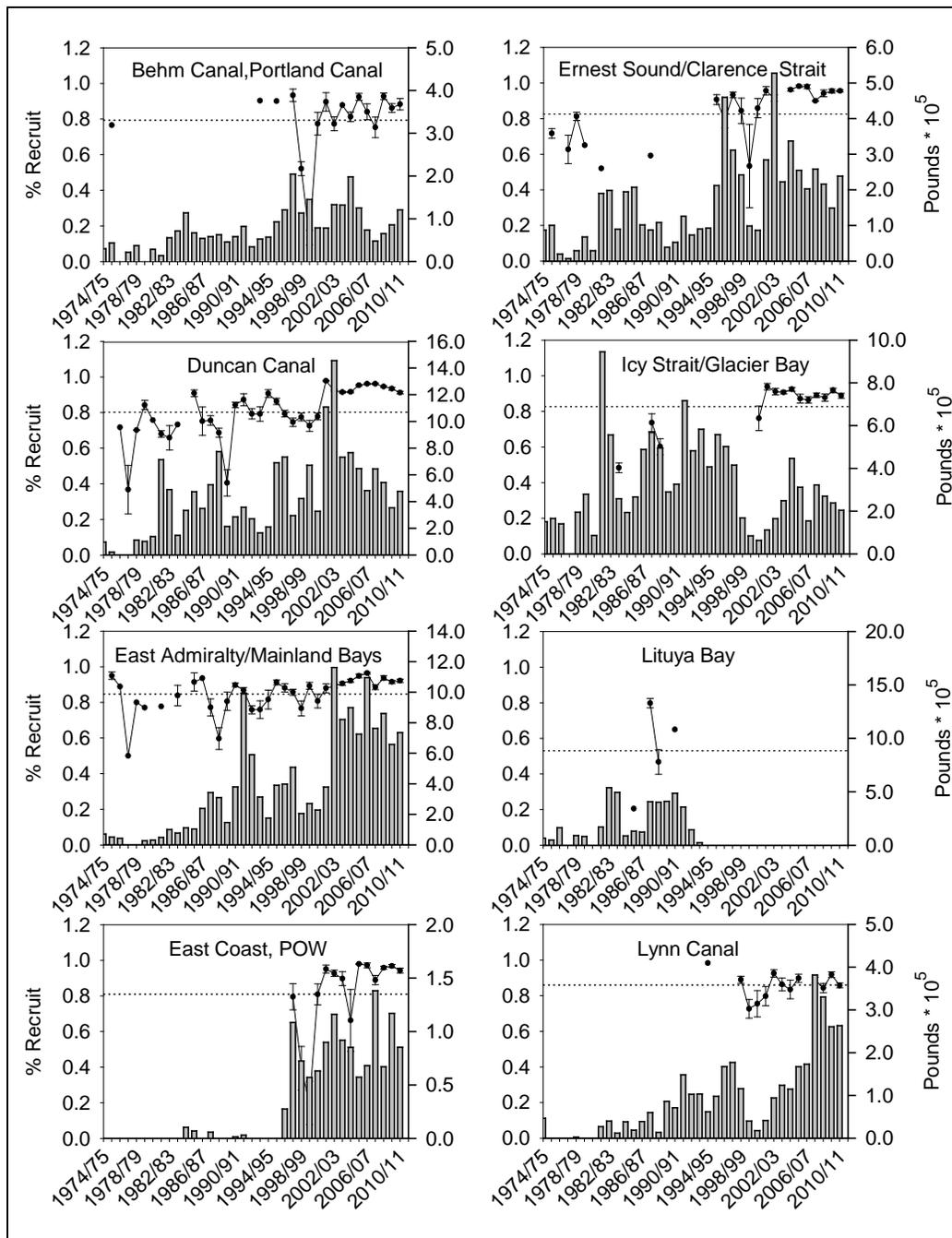


Figure 3.—Harvest and mean and standard error of the percent of dockside sampled commercial Dungeness crab harvest that is newly recruited for eight fishery areas, 1975/1976 through 2010/2011 fishing seasons. The line is percent recruit while the vertical bars represent harvest. Confidential harvest data (where less than 3 vessels made landings) is omitted. Dotted line represents the long-term average percent recruit and its standard error.

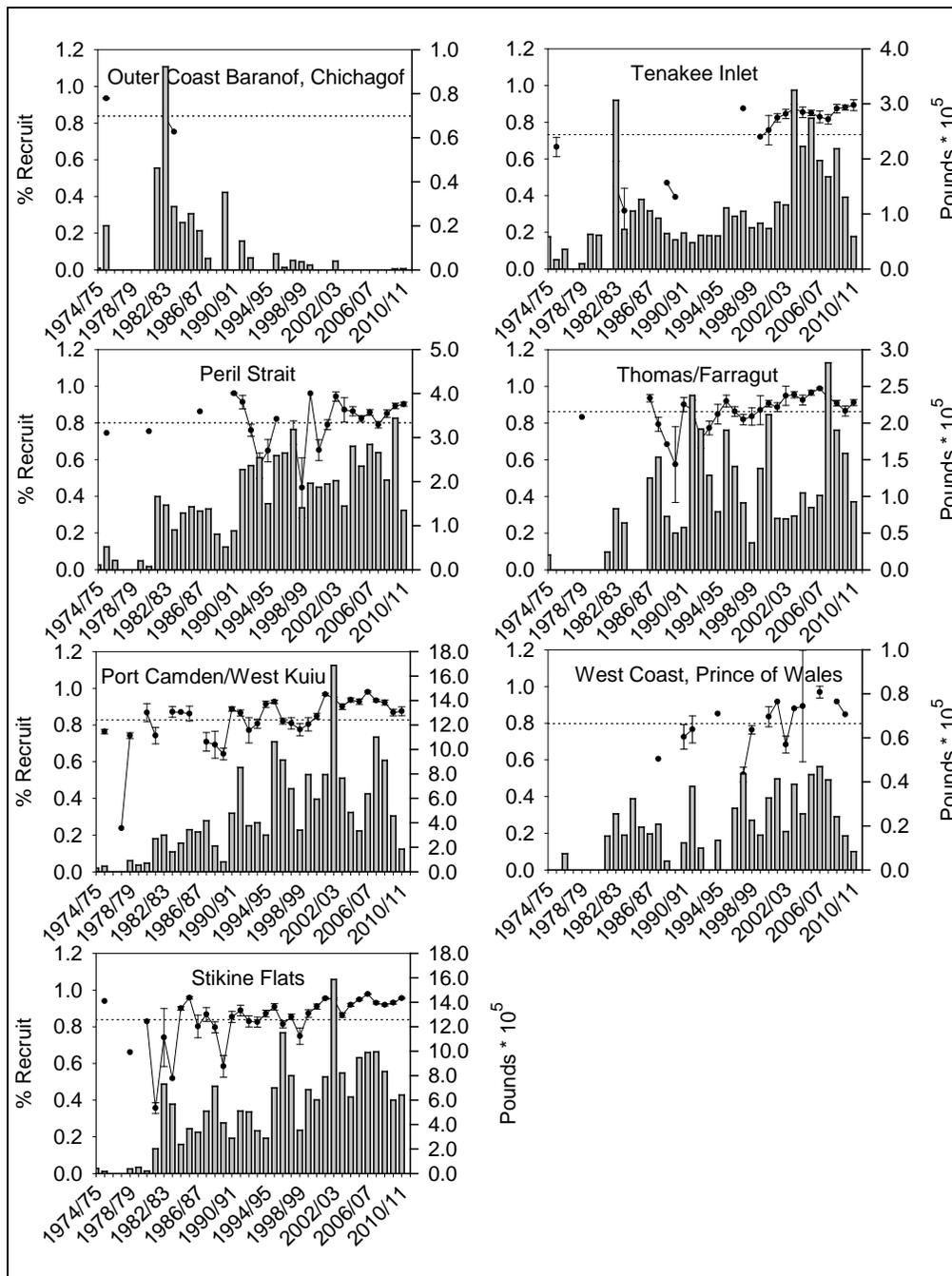


Figure 4.—Harvest and the mean and standard error of the percent of dockside sampled commercial Dungeness crab harvest that is newly recruited for seven fishery areas, 1975/1976 through 2010/2011 fishing seasons. The line is percent recruit while the vertical bars represent harvest. Confidential harvest data (where less than 3 vessels made landings) is omitted. Dotted line represents the long-term average percent recruit and its standard error.

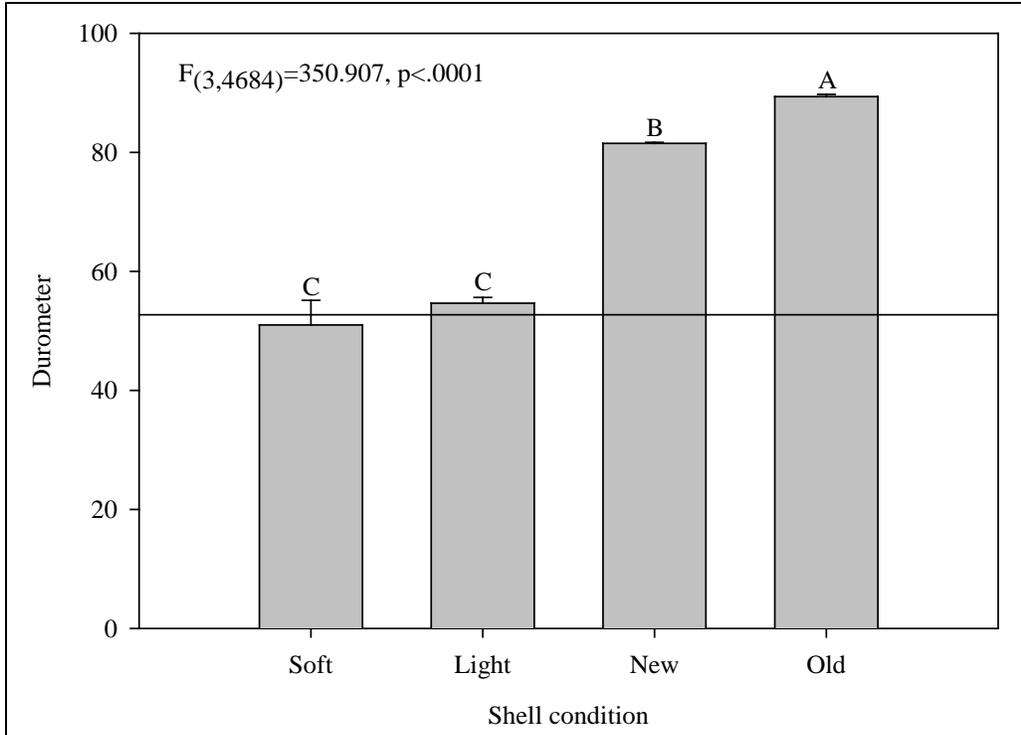


Figure 5.—Results of one-way ANOVA and of post-hoc Tukey HSD of Dungeness crab shell hardness by shell condition from crabs delivered and purchased during dockside sampling in 2009/2010 and 2010/2011 fishing seasons. The reference line at 52.7 is the mean shell hardness of crabs rejected for purchase by the processor.

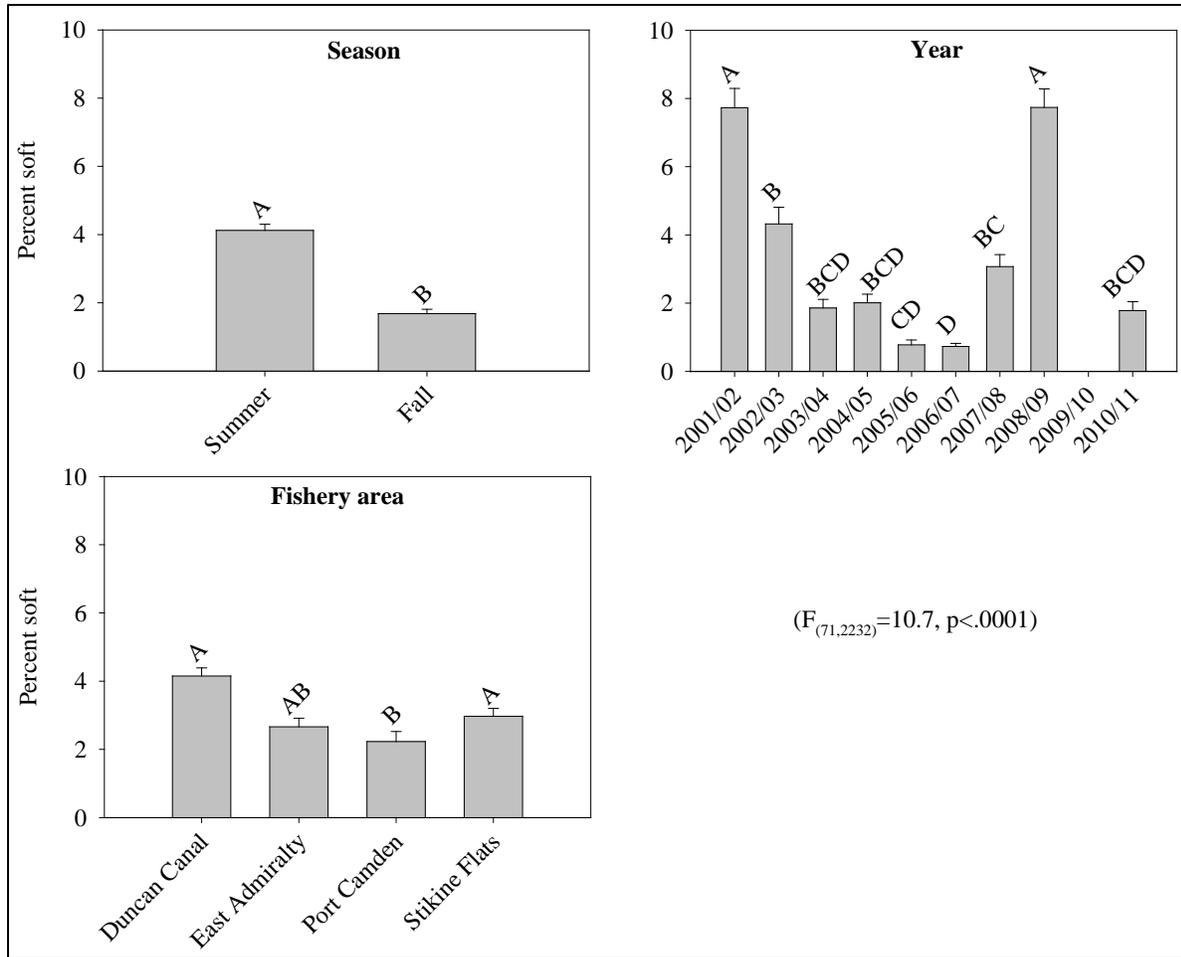


Figure 6.—Results of 3-way ANOVA and of post-hoc Tukey HSD of effects of fishery area, fishing season, and year on Dungeness crab soft-shell prevalence from dockside sampling of four fishery areas, during summer and fall seasons of 2001/2002 through 2010/2011. Not shown are interaction effects, which were significant for fishery area*year ($F_{(24,2232)}=1.7, p=.0152$), and year*season ($F_{(8,2232)}=4.5, p<.0001$).

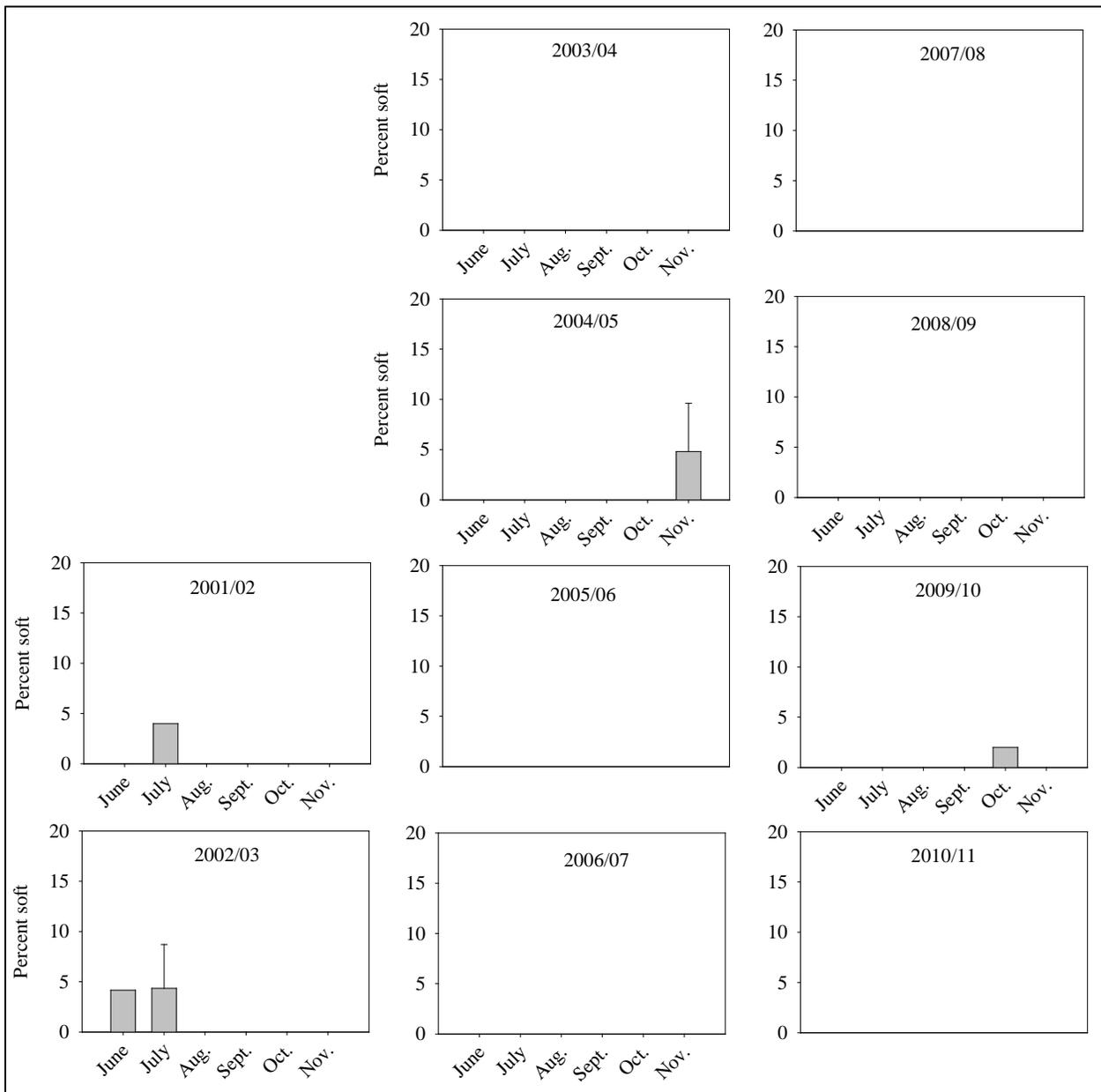


Figure 7.—West Coast, Prince of Wales Island (District 3) soft shell prevalence by month from dockside sampling of commercially harvested Dungeness crab during summer (June 15–August 15) and fall (October 1–November 30) 2001/2002 through 2010/2011 fishing seasons. Statistical results are included for years with significant one-way ANOVA only. There was insufficient sampling effort in missing years.

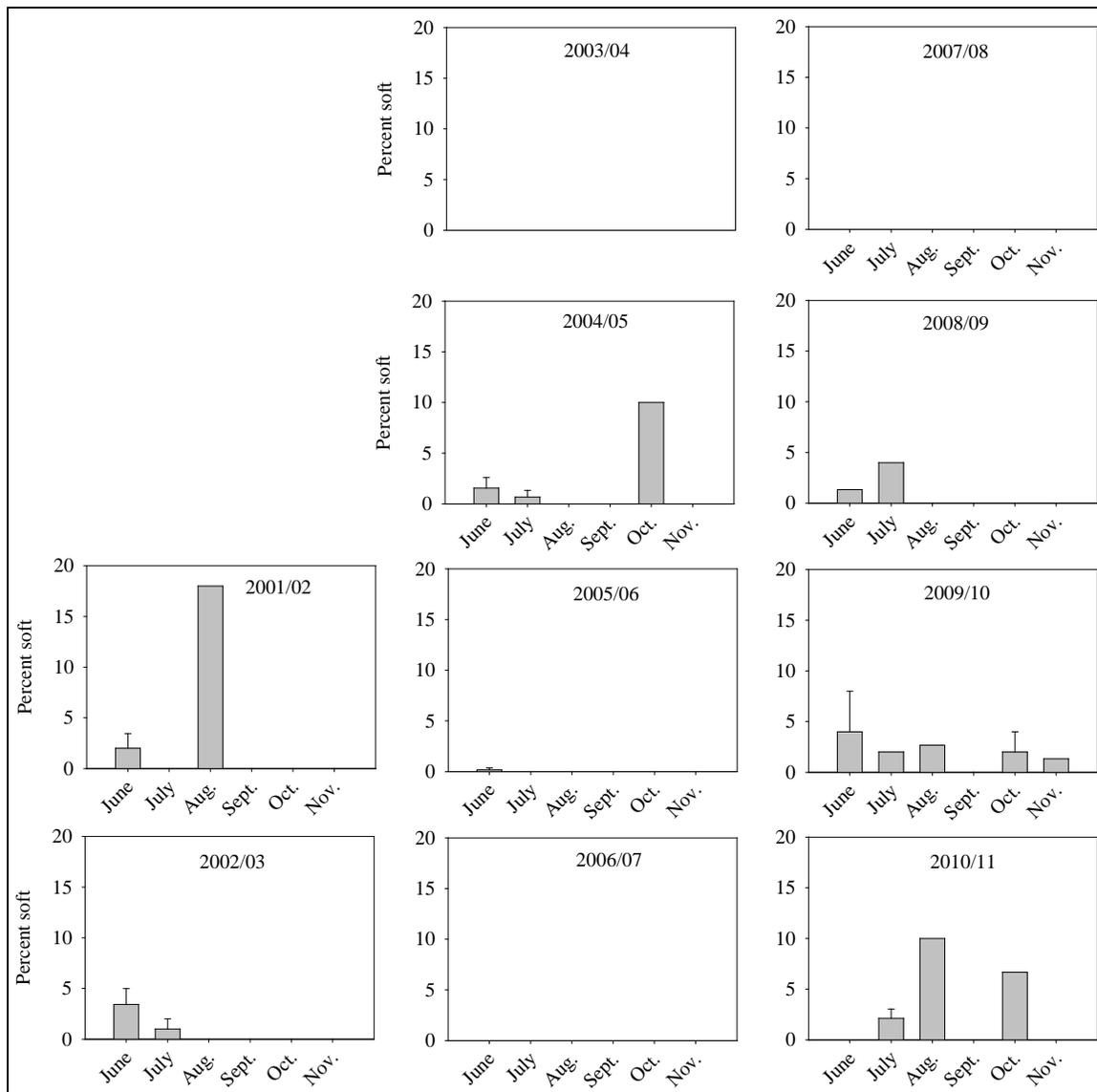


Figure 8.—Ernest Sound/Clarence Strait (District 7) soft shell prevalence by month from dockside sampling of commercially harvested Dungeness crab, 2001/2002 through 2010/2011 fishing seasons. Statistical results are included for years with significant one-way ANOVA only. There was insufficient sampling effort in missing years.

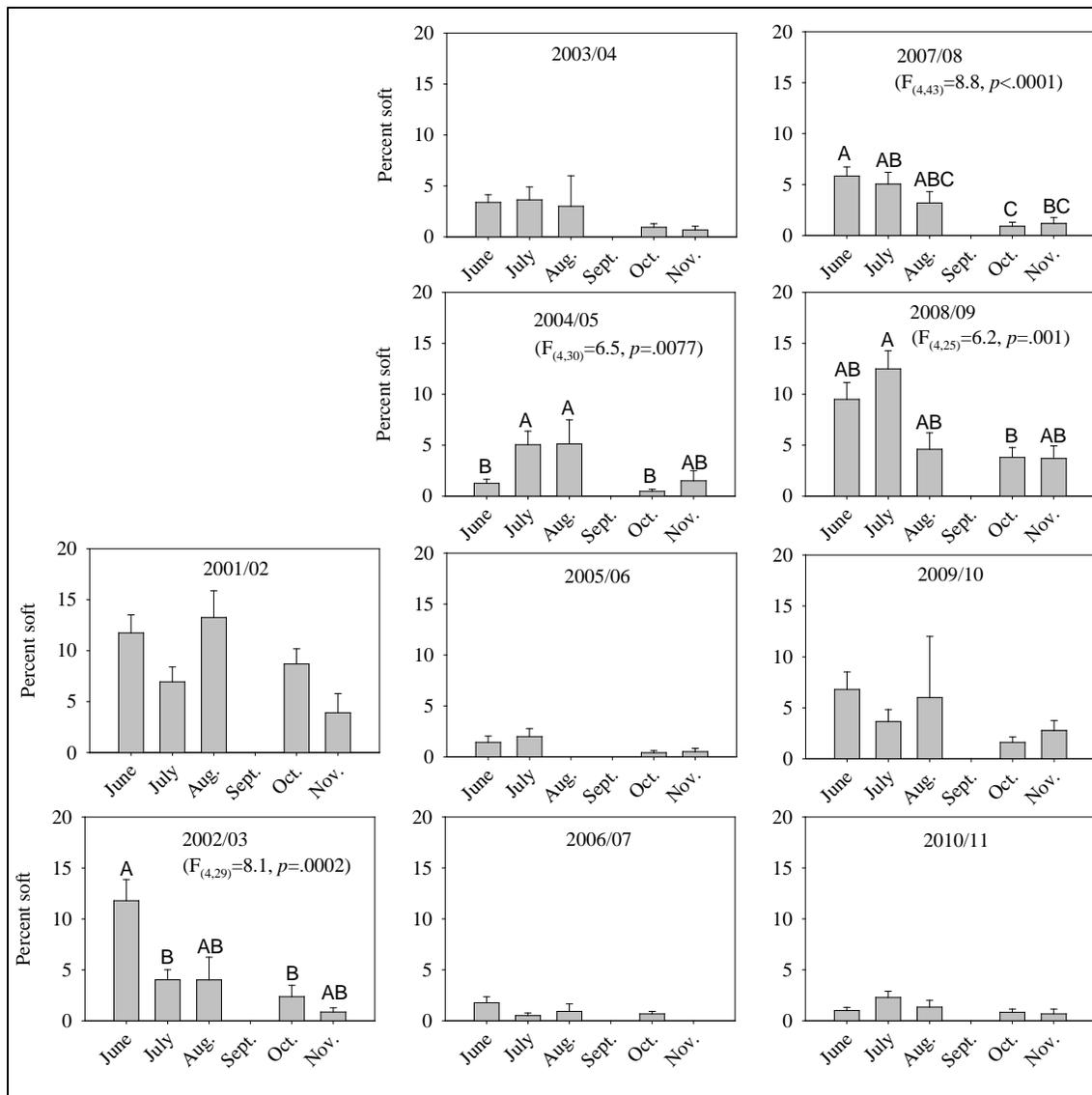


Figure 9.—Duncan Canal (District 6) soft shell prevalence by month from dockside sampling of commercially harvested Dungeness crab during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011. Results of one-way ANOVA and Tukey HSD test are included for years with significant effects only.

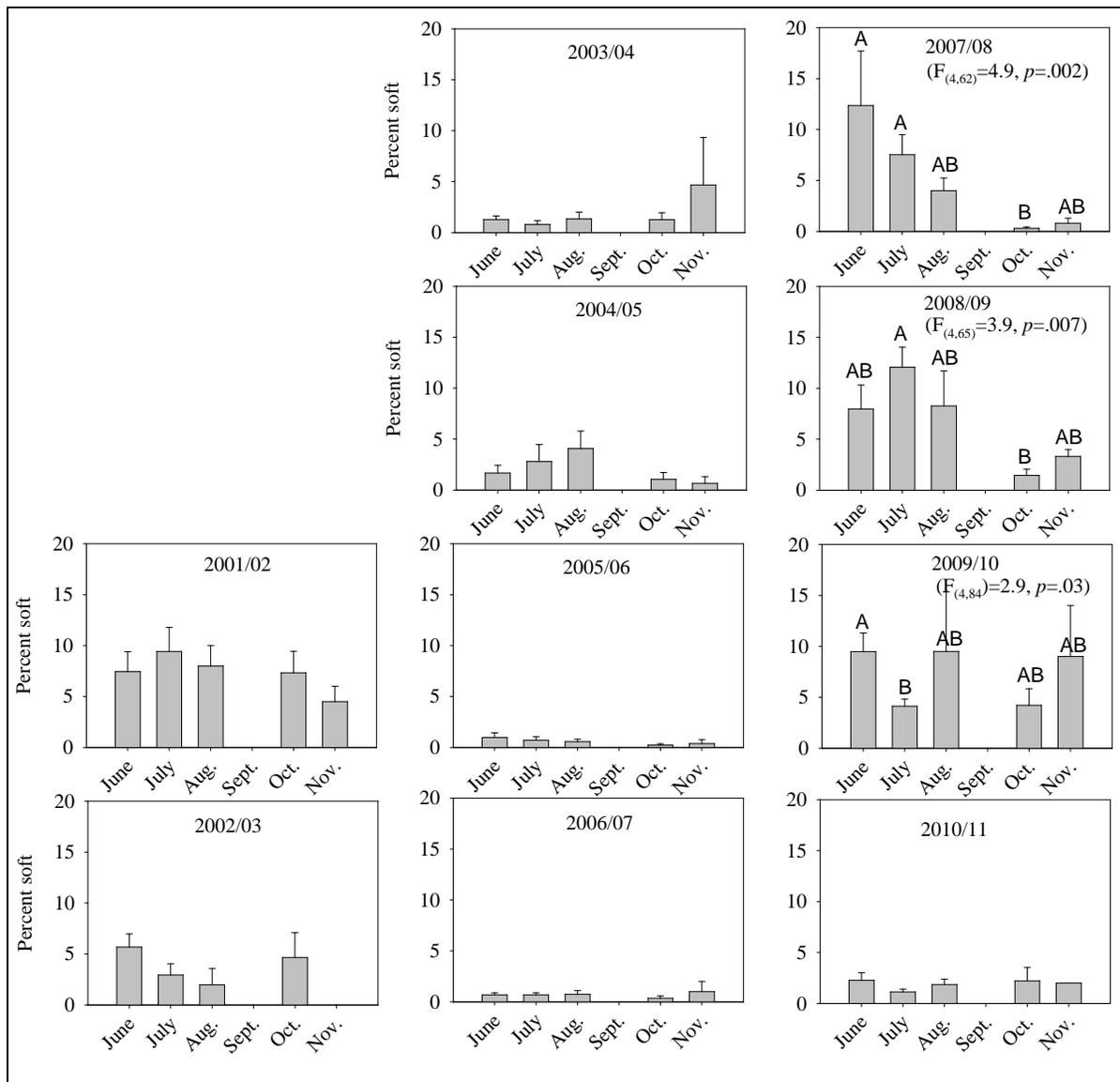


Figure 10.—Stikine Flats (District 8) soft shell prevalence by month from dockside sampling of commercially harvested Dungeness crab during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011. Results of one-way ANOVA and Tukey HSD test are included for years with significant effects only.

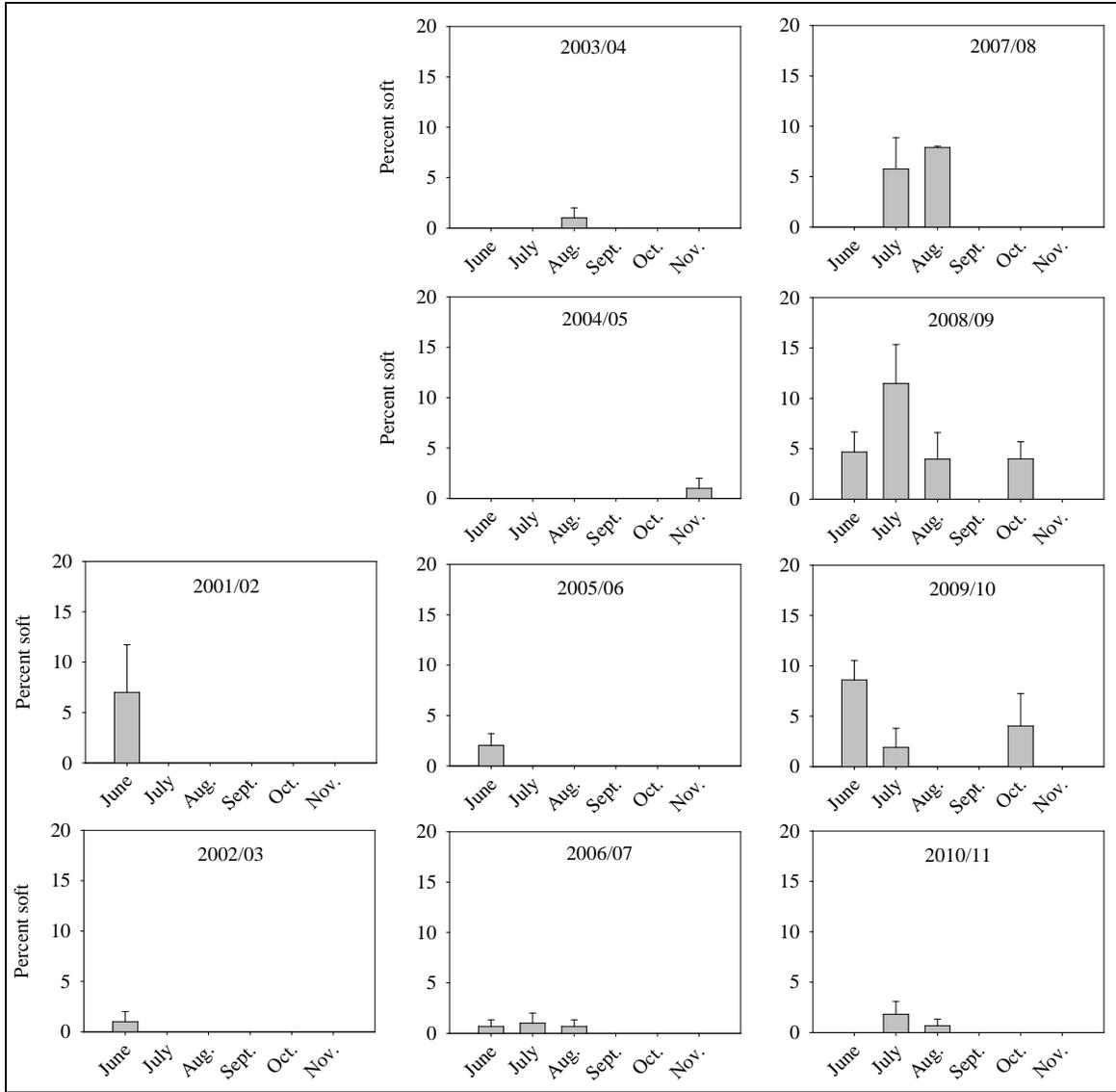


Figure 11.—Thomas/Farragut Bays (District 10) soft shell prevalence by month from dockside sampling of commercially harvested Dungeness crab, 2001/2002 through 2010/2011 fishing seasons. Statistical results are included for years with significant one-way ANOVA only. There was insufficient sampling effort in missing years.

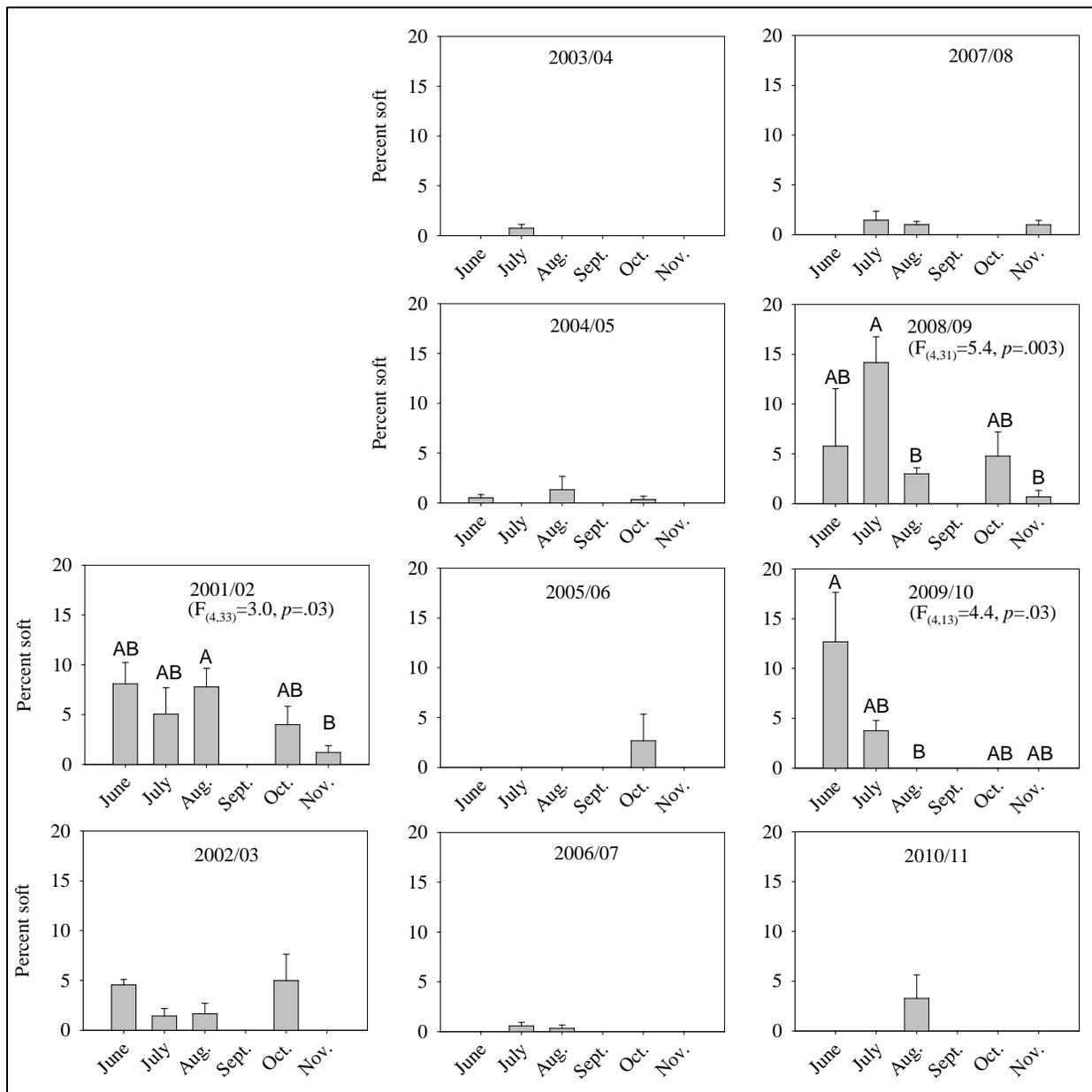


Figure 12.—Port Camden/West Kuiu (Districts 5/9) soft shell prevalence by month from dockside sampling of commercially harvested Dungeness crab during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011. Results of one-way ANOVA and Tukey HSD test are included for years with significant effects only.

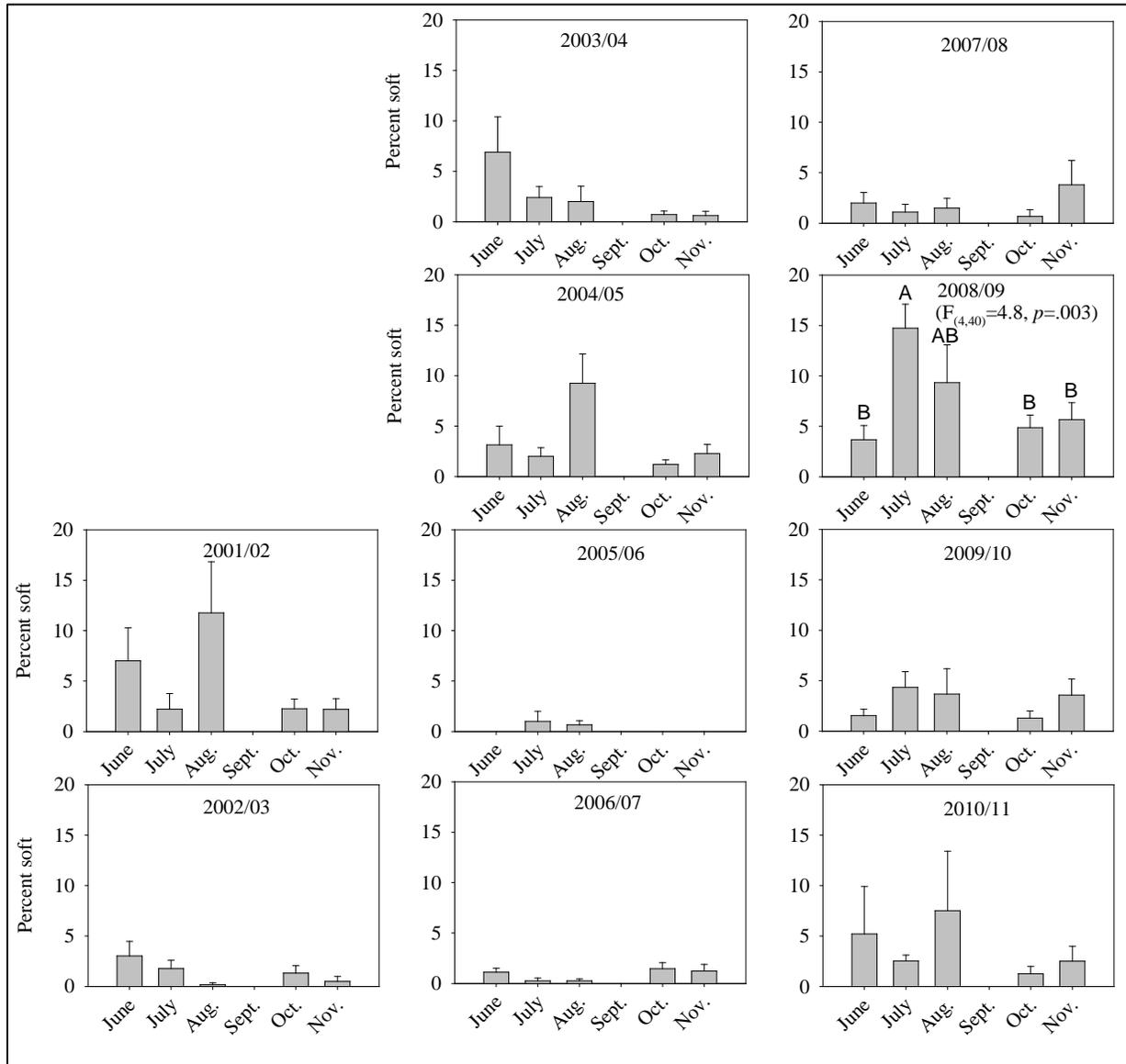


Figure 13.—East Admiralty/Mainland Bays, (District 11) soft shell prevalence by month from dockside sampling of commercially harvested Dungeness crab during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011. Results of one-way ANOVA and Tukey HSD test are included for years with significant effects only.

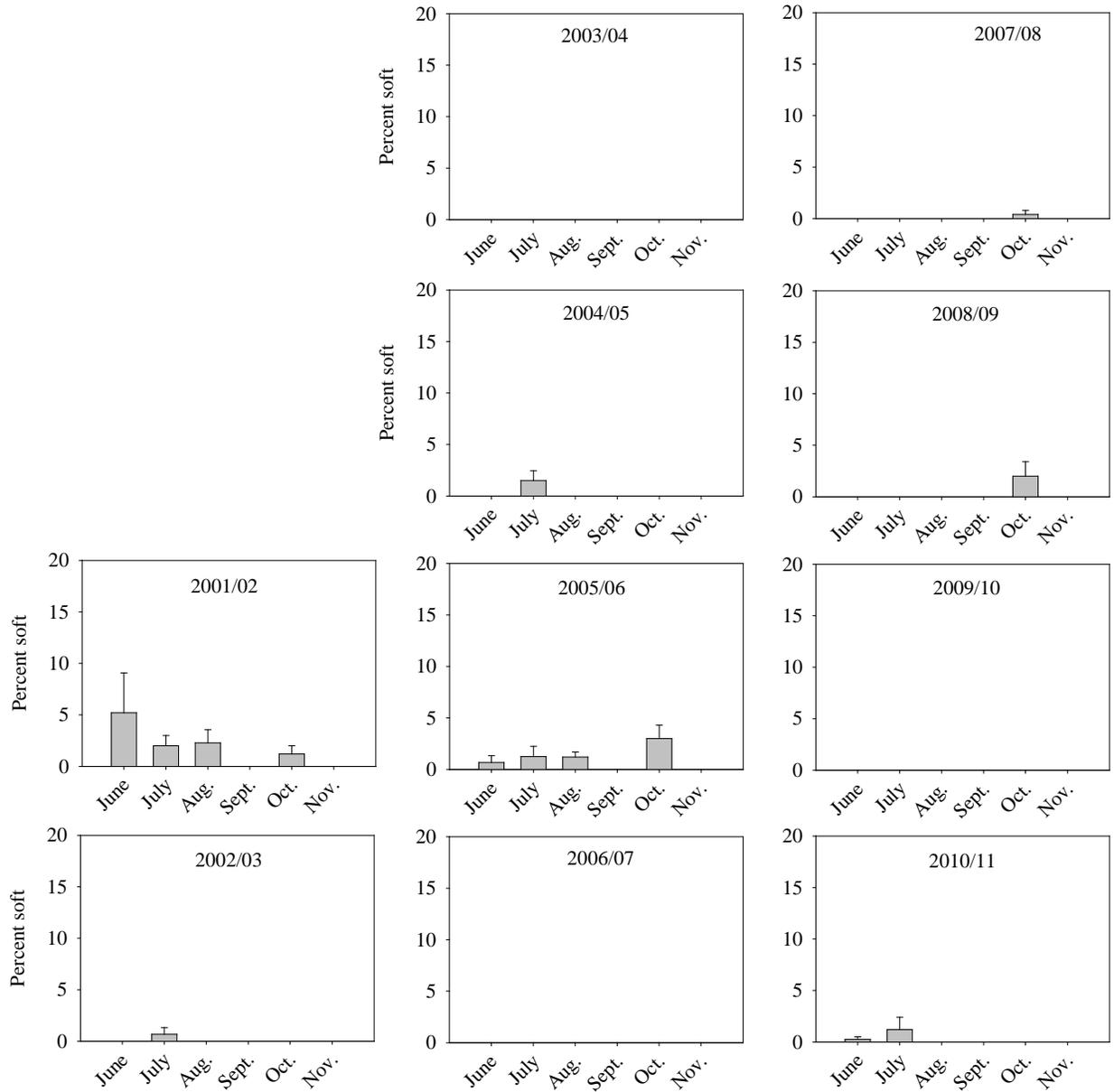


Figure 14.—Peril Strait (District 13) soft shell prevalence by month from dockside sampling of commercially harvested Dungeness crab, 2001/2002 through 2010/2011 fishing seasons. Statistical results are included for years with significant one-way ANOVA only. There was insufficient sampling effort in missing years.

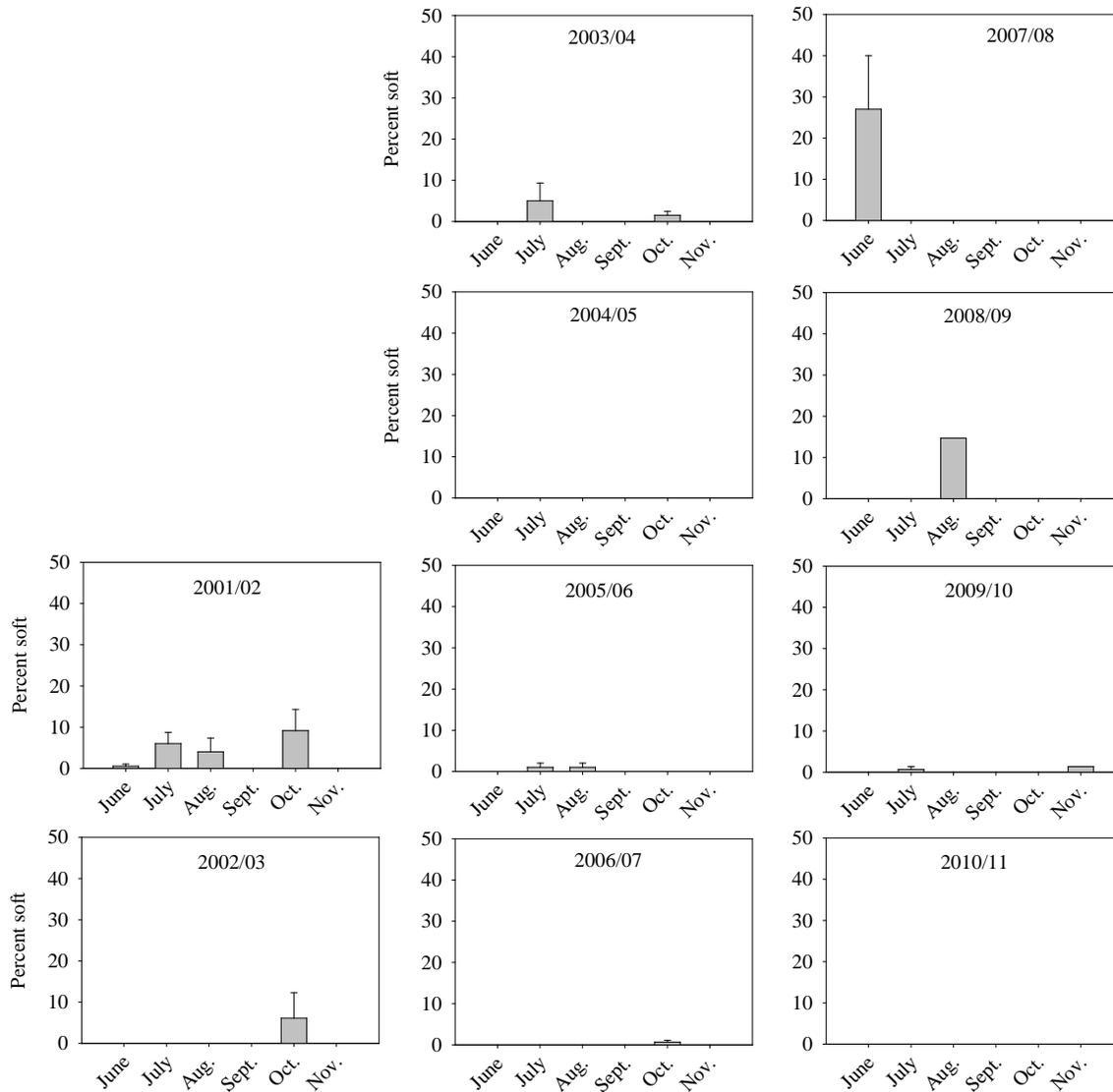


Figure 15.—Tenakee Inlet (District 12) soft shell prevalence by month from dockside sampling of commercially harvested Dungeness crab, 2001/2002 through 2010/2011 fishing seasons. Statistical results are included for years with significant one-way ANOVA only. There was insufficient sampling effort in missing years.

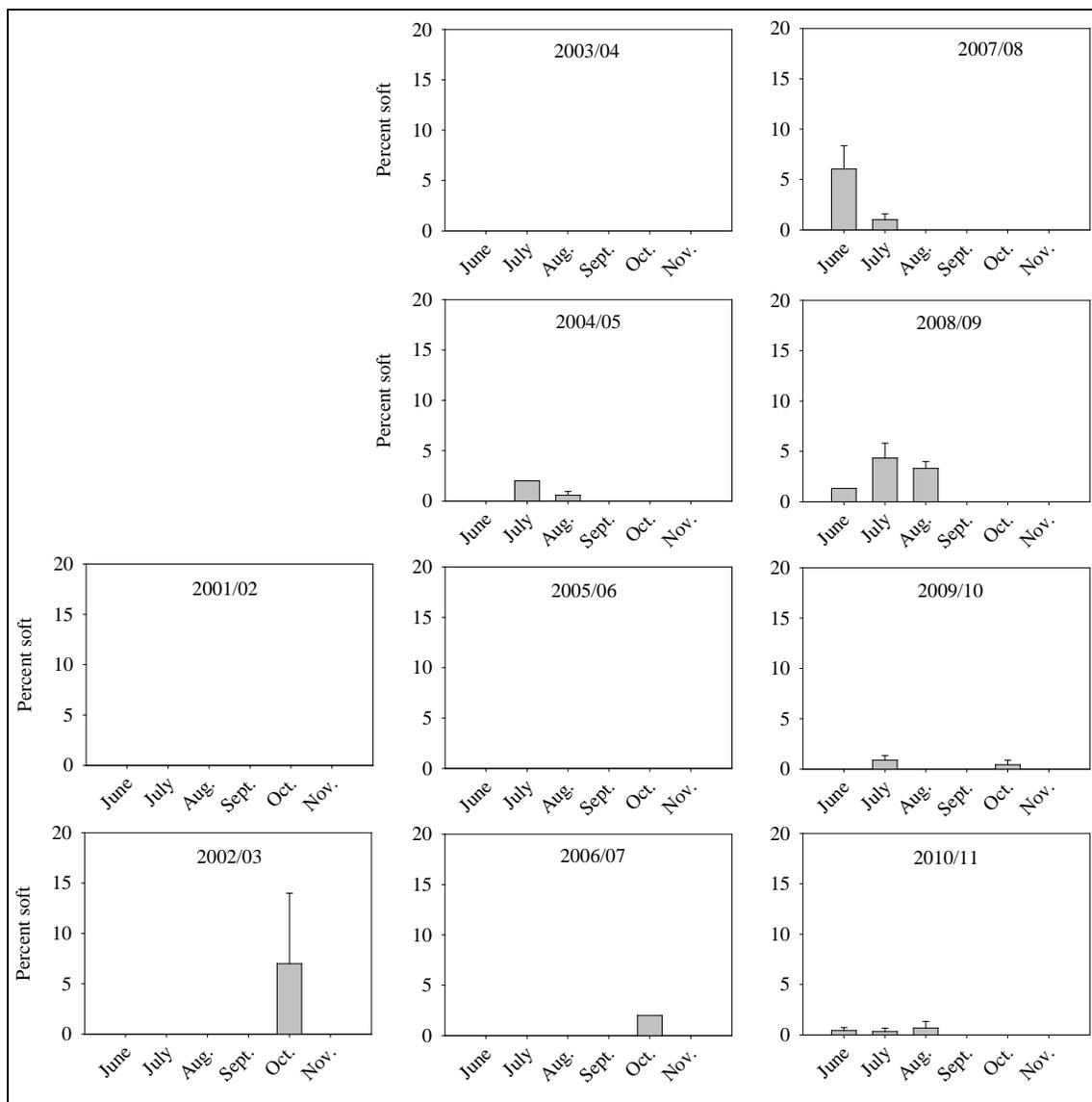


Figure 16.–Icy Strait/Glacier Bay (District 14) soft shell prevalence by month from dockside sampling of commercially harvested Dungeness crab, 2001/2002 through 2010/2011 fishing seasons. Statistical results are included for years with significant one-way ANOVA only. There was insufficient sampling effort in missing years.

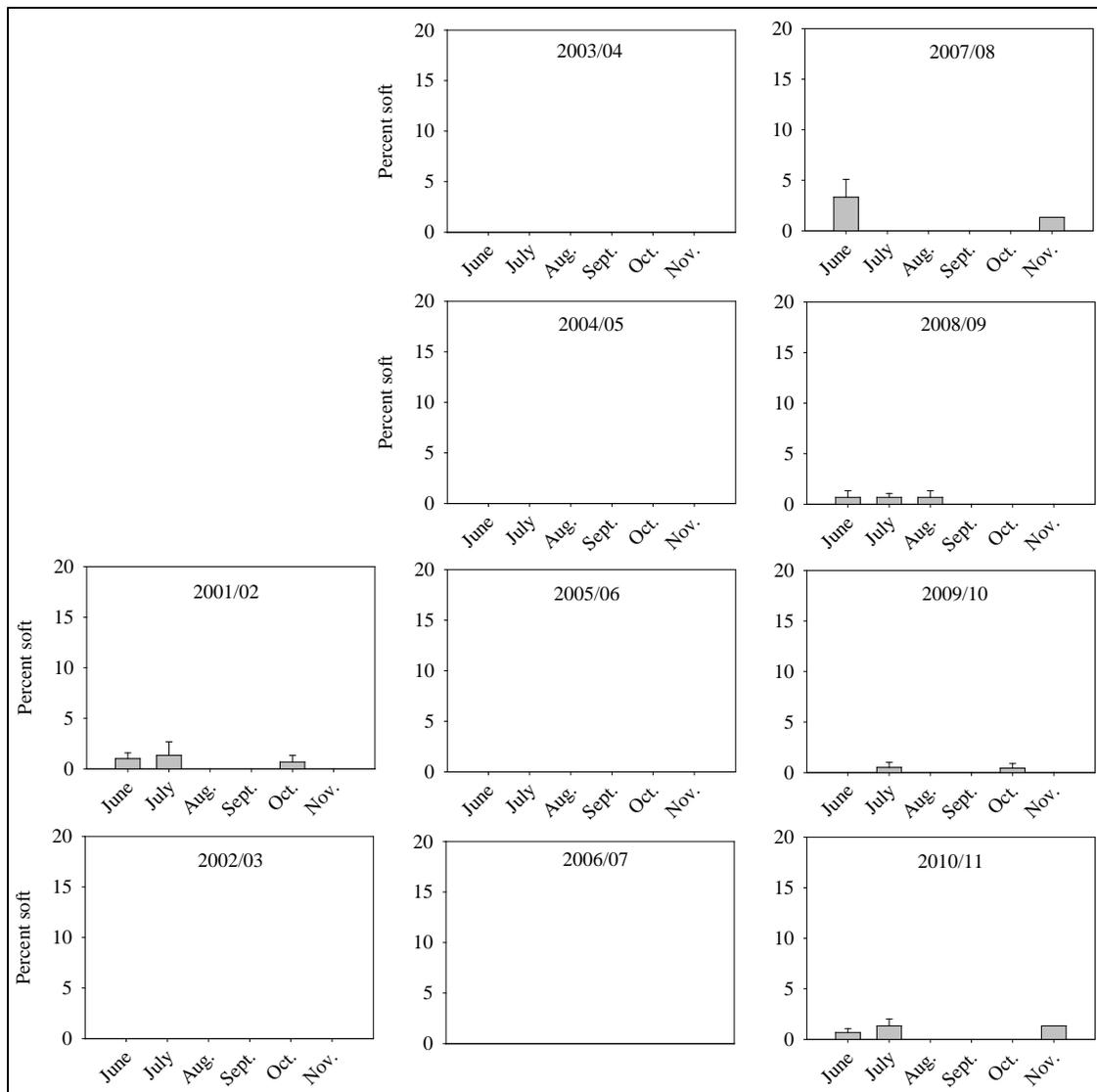


Figure 17.—Lynn Canal (District 15) soft shell prevalence by month from dockside sampling of commercially harvested Dungeness crab, 2001/2002 through 2010/2011 fishing seasons. Statistical results are included for years with significant one-way ANOVA only. There was insufficient sampling effort in missing years.

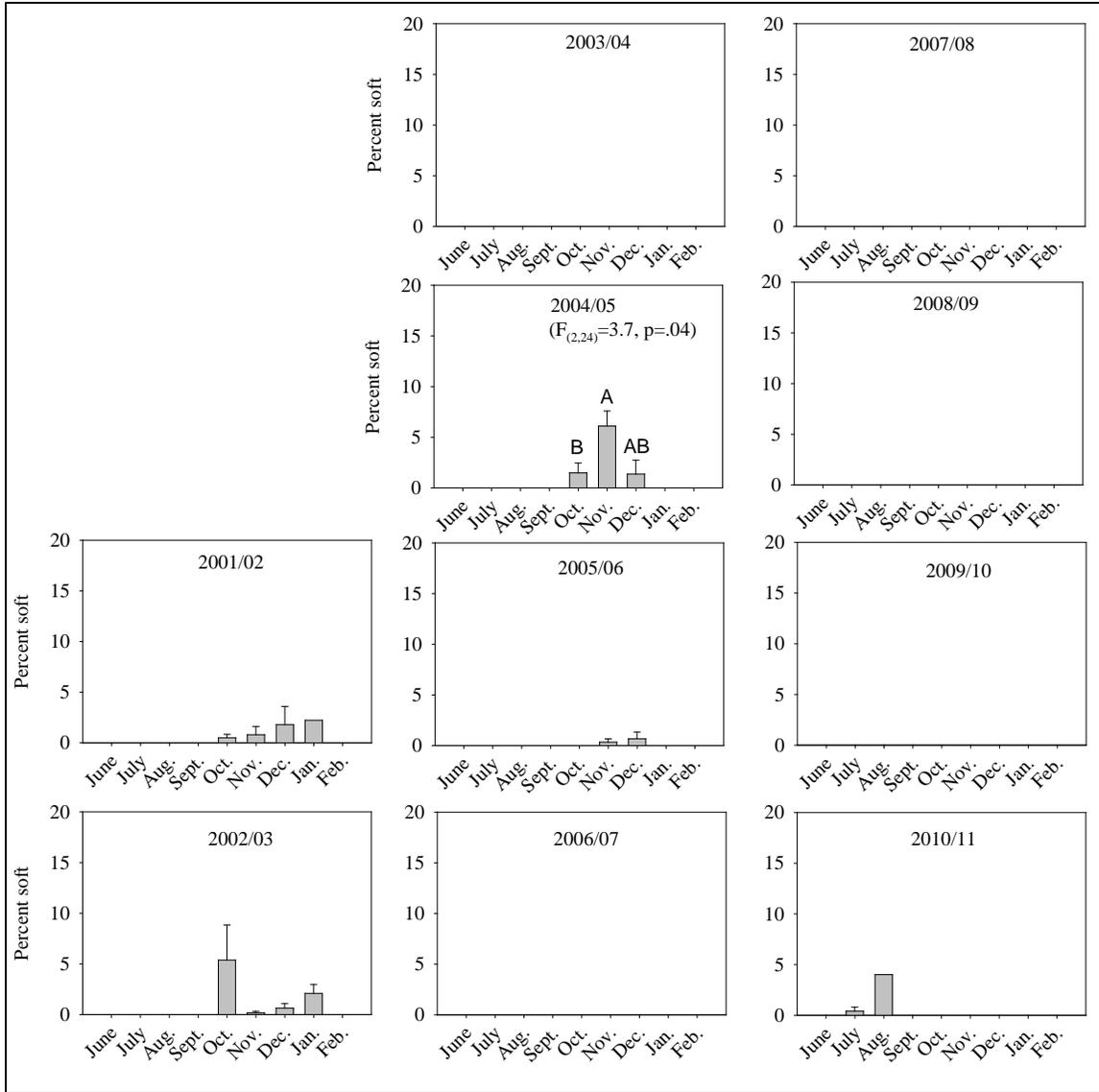


Figure 18.—Behm Canal, Portland Canal (District 1) soft shell prevalence by month from dockside sampling of commercially harvested Dungeness crab 2001/2002 through 2010/2011 fishing seasons. This area had a fall/winter season for 2001/2002 through 2008/2009 and a summer/fall season for 2009/2010 and 2010/2011. Results of one-way ANOVA and Tukey HSD test are included for years with significant effects only. There was no sampling effort in missing years.

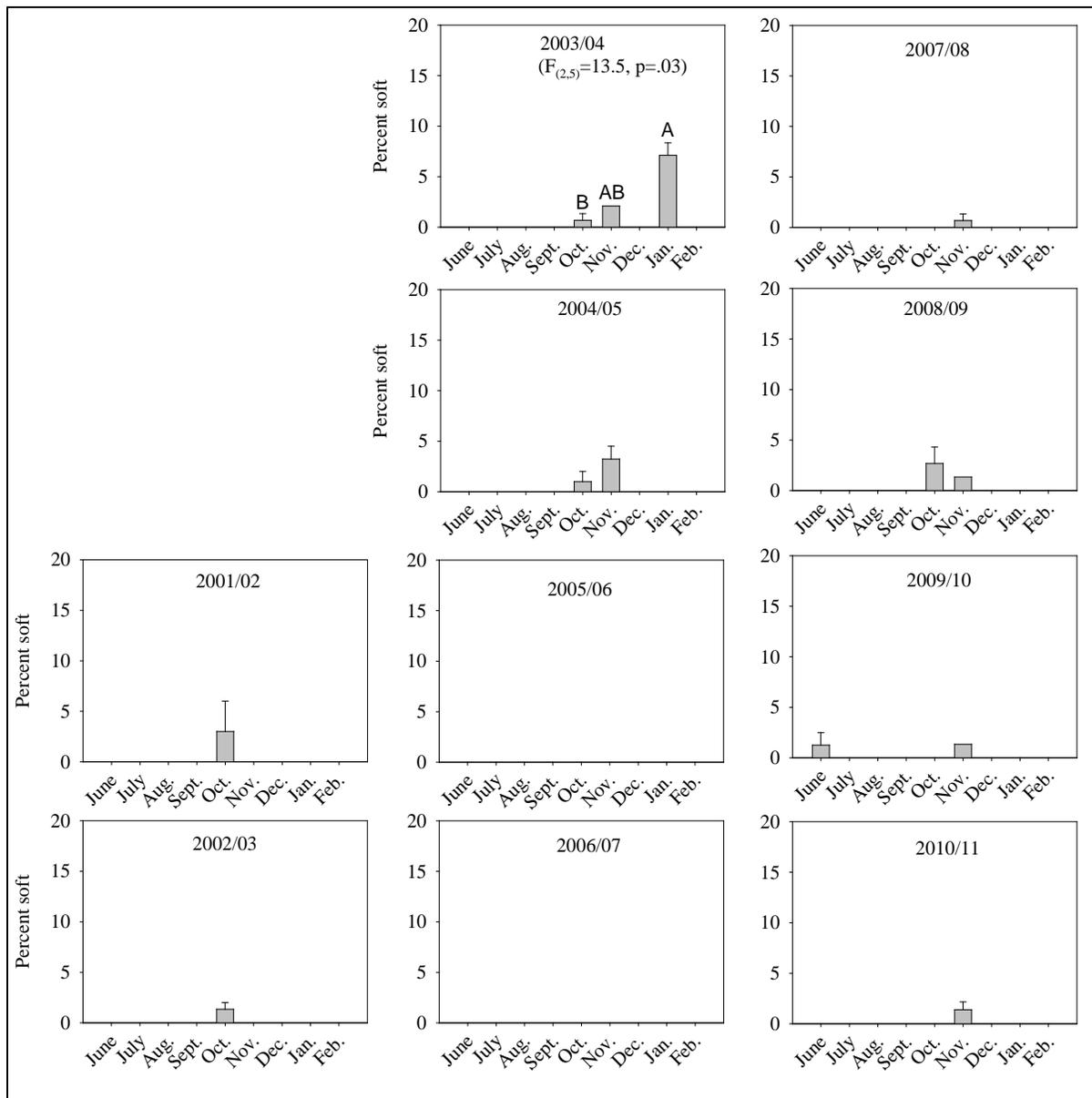


Figure 19.—East Coast, Prince of Wales (District 2) soft shell prevalence by month from dockside sampling of commercially harvested Dungeness crab during summer (June 15–August 15) and fall (October 1–November 30) 2001/2002 through 2010/2011 fishing seasons. This area had a fall/winter season for 2001/2002 through 2008/2009, a summer/fall season for 2009/2010, and a fall/winter season again in 2010/2011. Statistical results are included for years with significant one-way ANOVA only. There was insufficient sampling effort in missing years.

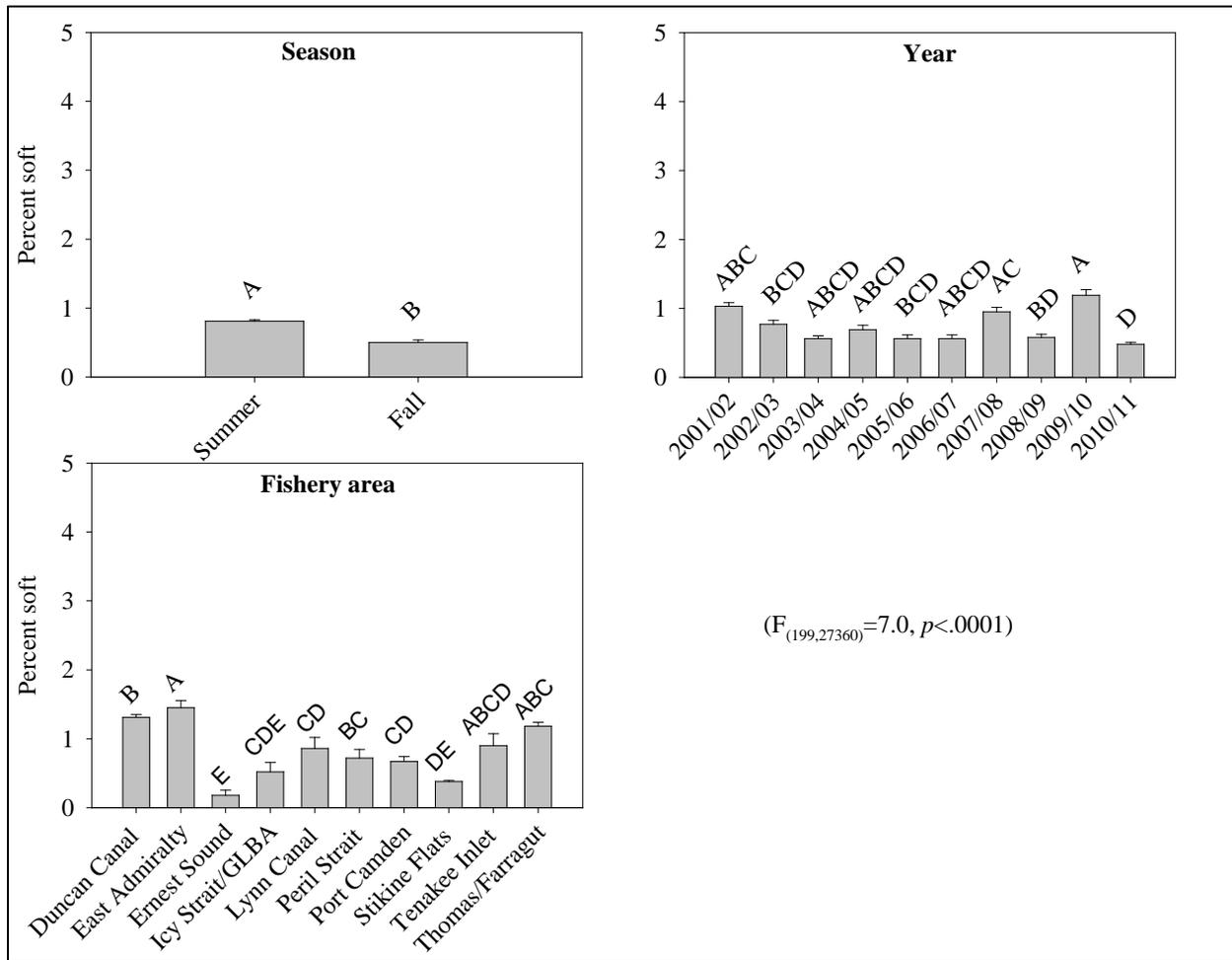


Figure 20.—Results of 3-way ANOVA of effects of fishery area, fishing season, and year on Dungeness crab soft shell prevalence from fish tickets for 10 fishery areas, during summer and fall commercial fishing seasons of 2001/2002 through 2010/2011. Not shown are interaction effects, which were significant for fishery area*year ($F_{(81,27360)}=2.0, p<.0001$), fishery area*season ($F_{(9,27360)}=4.6, p<.0001$), and fishery area*year*season ($F_{(9,27360)}=2.0, p<.0001$). Results of post-hoc Tukey HSD are included.

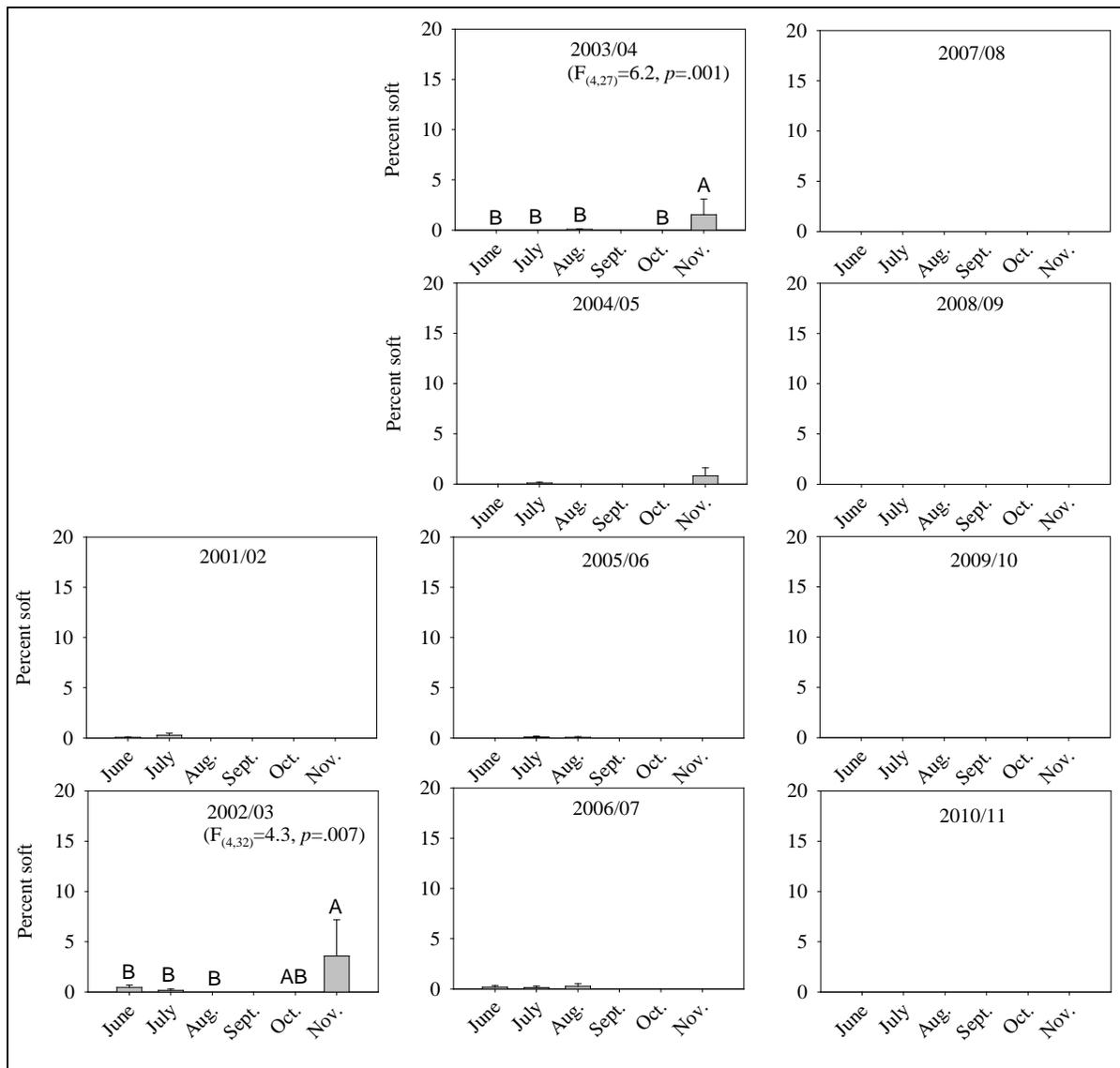


Figure 21.—West Coast, Prince of Wales Island (District 3) Dungeness crab soft shell prevalence by month from fish tickets during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011. Statistical results are included for years with significant one-way ANOVA only.

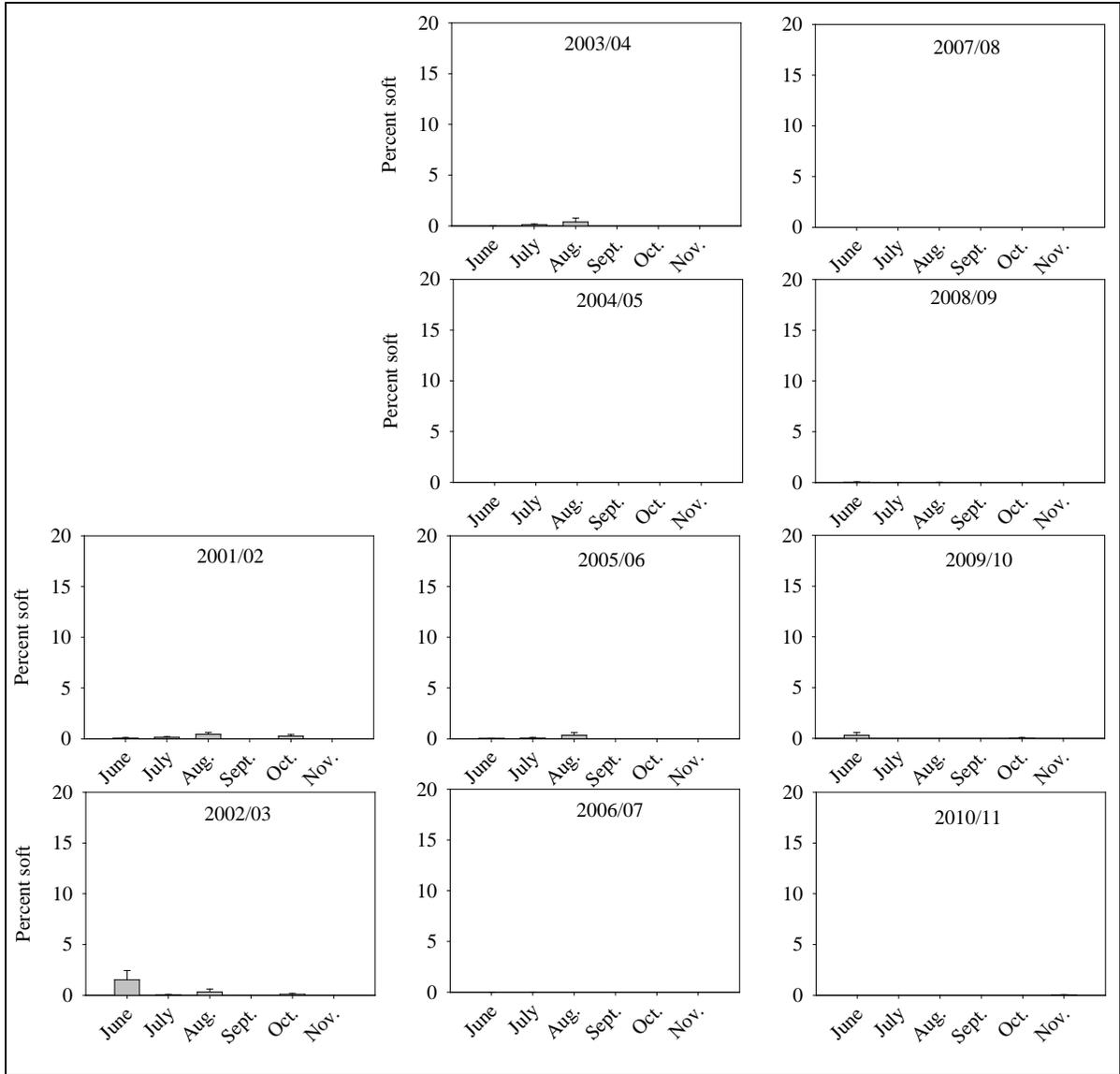


Figure 22.—Ernest Sound/Clarence Strait (District 7) Dungeness crab soft shell prevalence by month from fish tickets during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011. Statistical results are included for years with significant one-way ANOVA only.

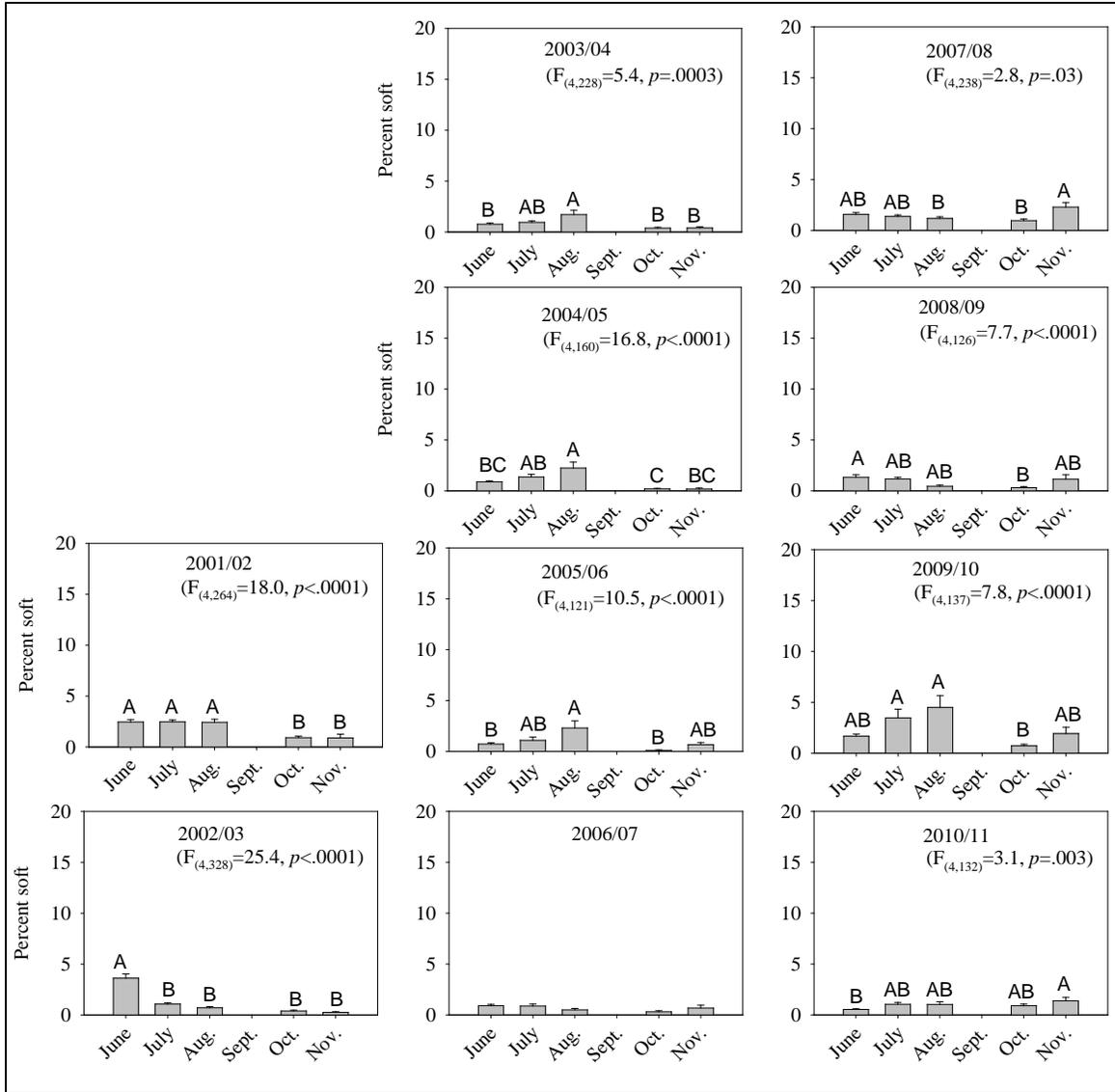


Figure 23.—Duncan Canal (District 6) Dungeness crab soft shell prevalence by month from fish tickets during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011. Statistical results are included for years with significant one-way ANOVA only.

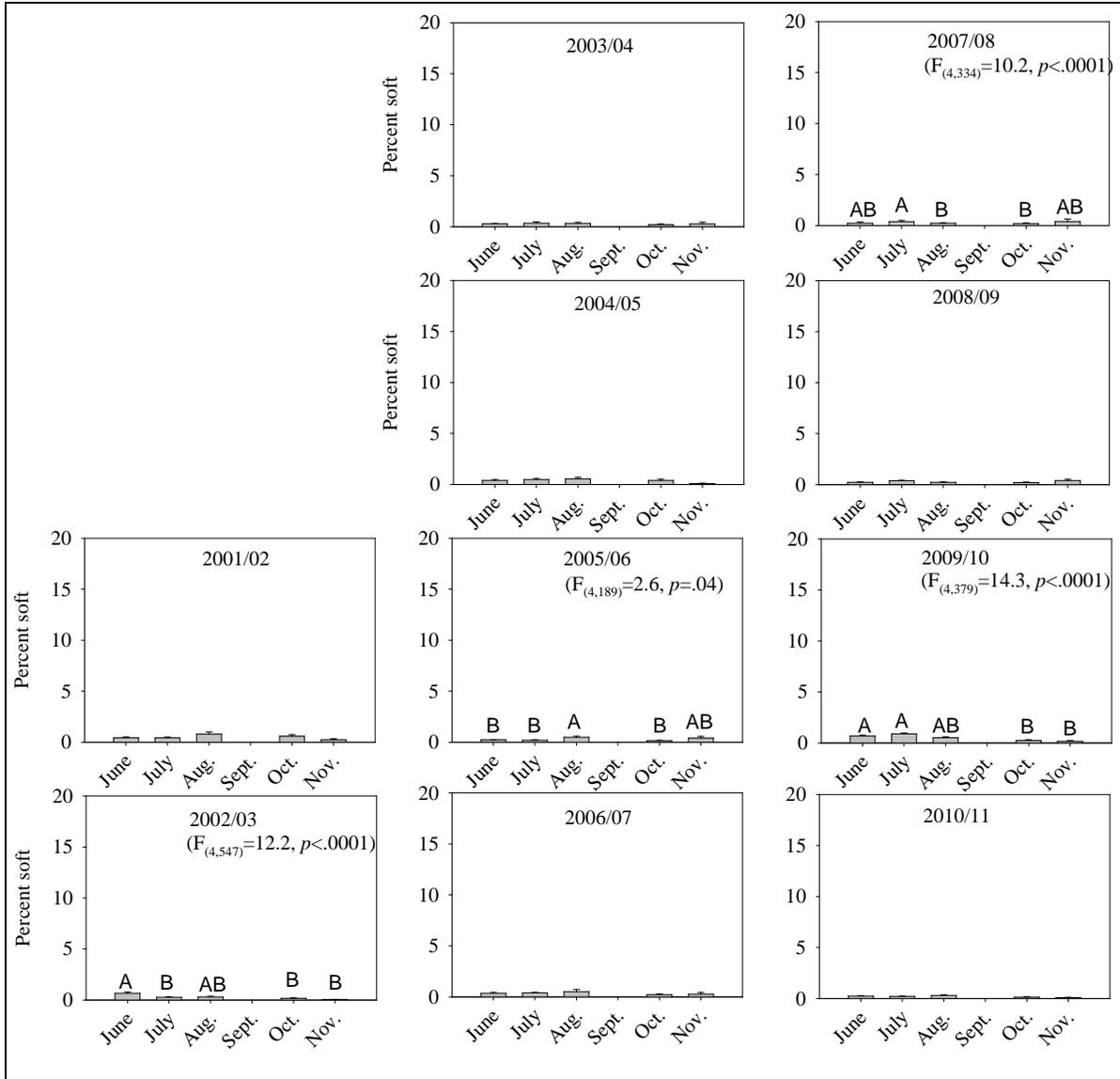


Figure 24.—Stikine Flats (District 8) Dungeness crab soft shell prevalence by month from fish tickets during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011. Statistical results are included for years with significant one-way ANOVA only.

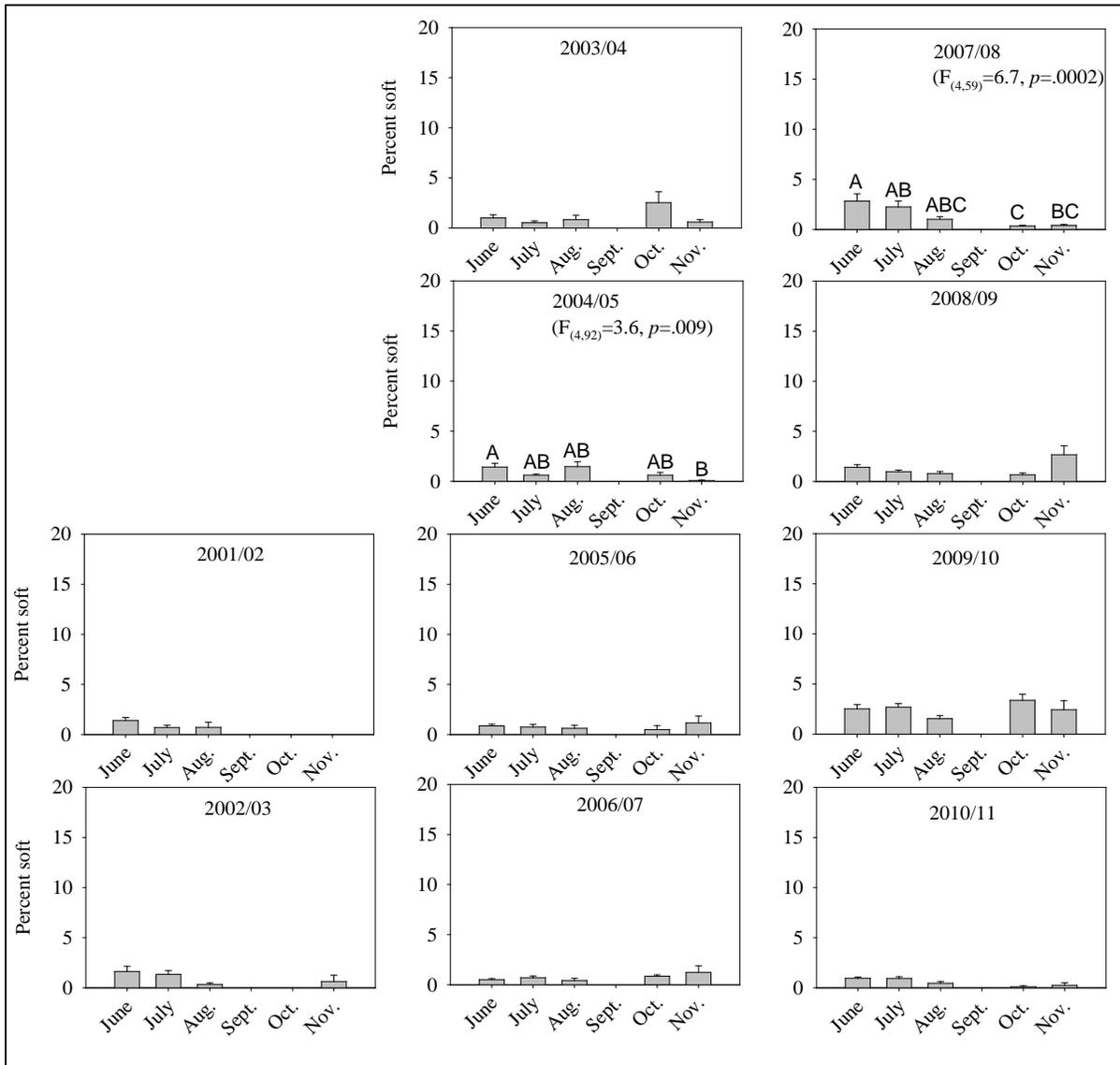


Figure 25.—Thomas/Farragut Bays (District 10) Dungeness crab soft shell prevalence by month from fish tickets during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011. Statistical results are included for years with significant one-way ANOVA only.

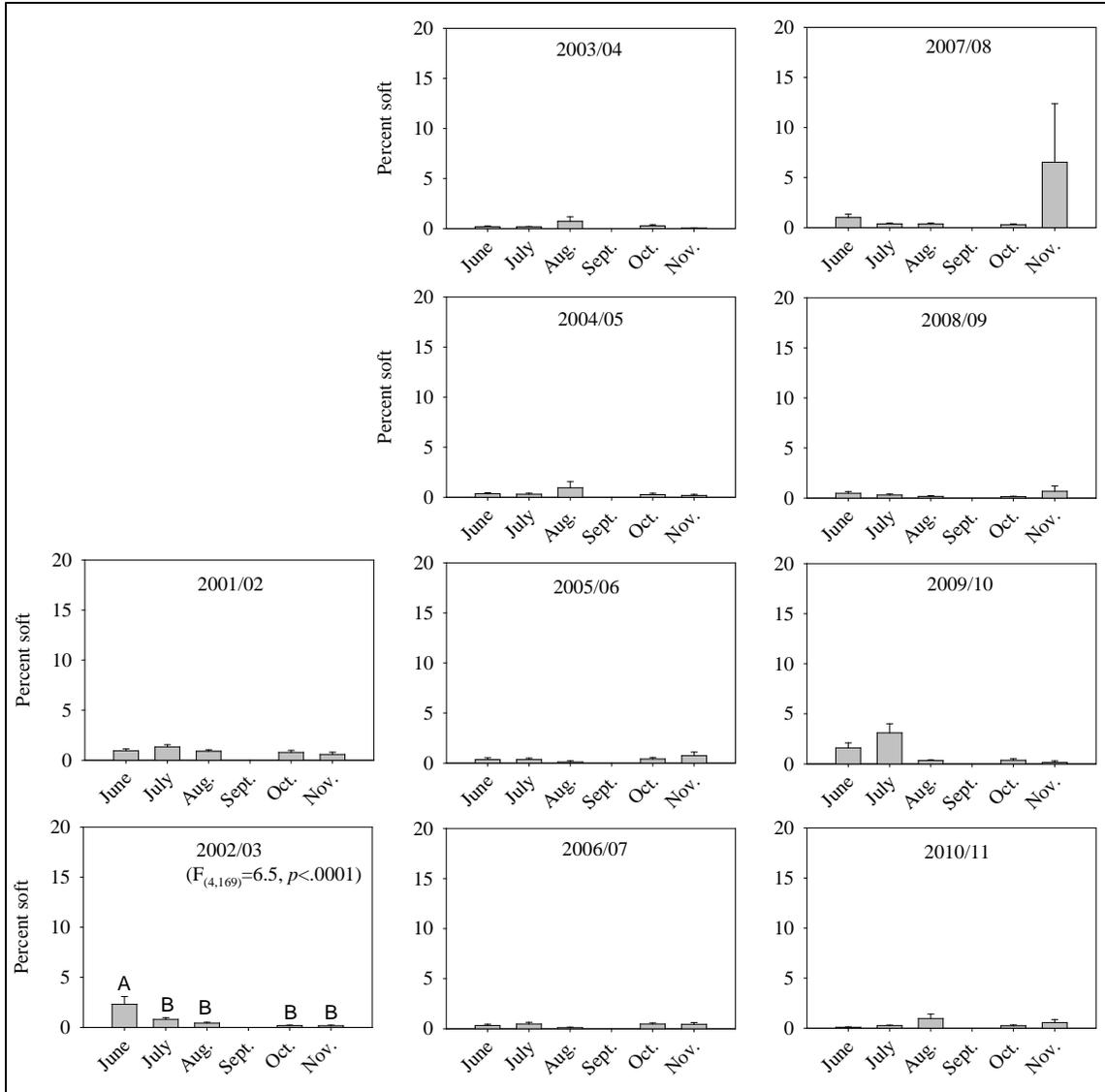


Figure 26.—Port Camden/West Kuiu (Districts 5/9) Dungeness crab soft shell prevalence by month from fish tickets during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011. Statistical results are included for years with significant one-way ANOVA only.

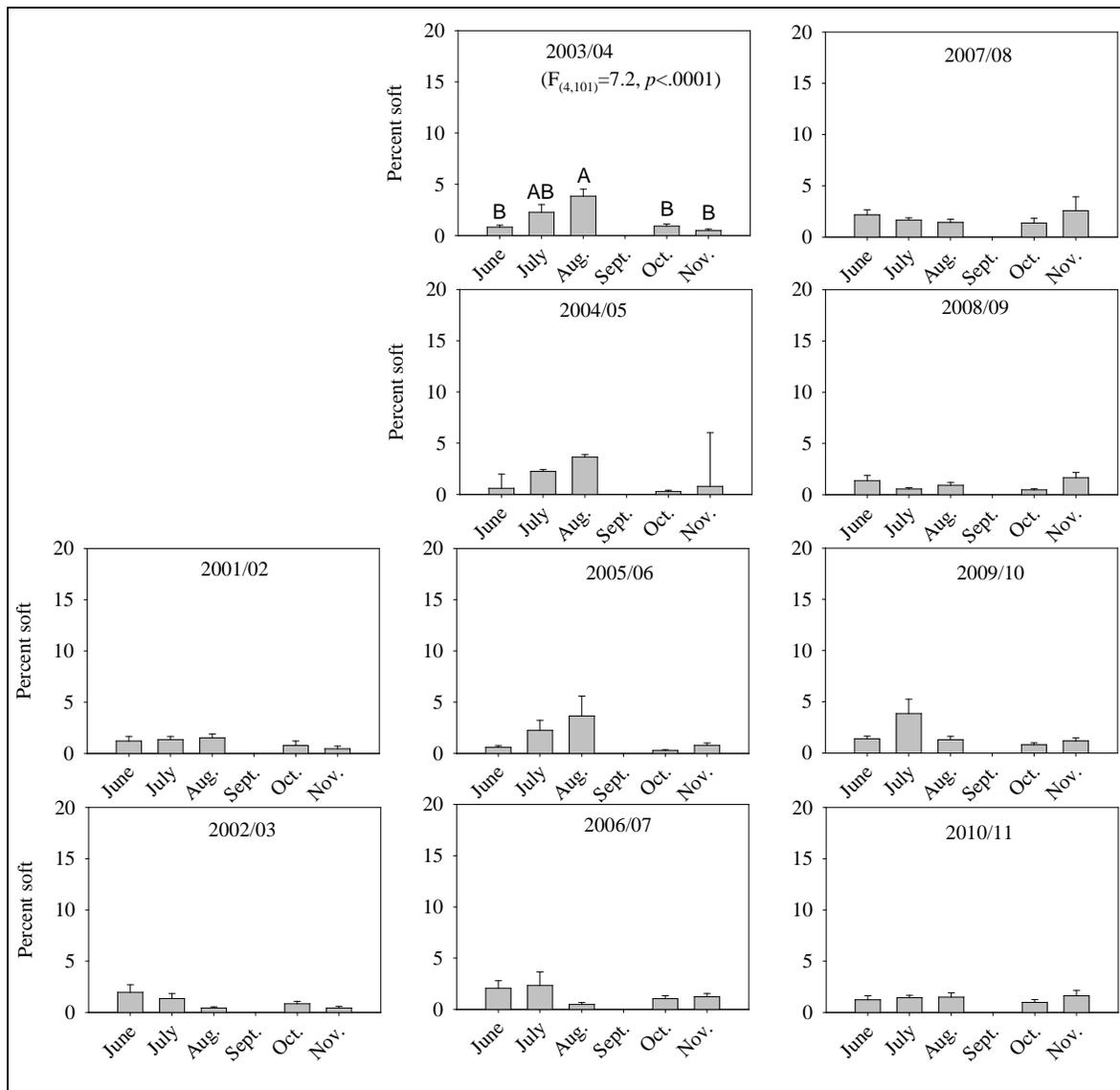


Figure 27.—East Admiralty/Mainland Bays (District 11) Dungeness crab soft shell prevalence by month from fish tickets during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011. Statistical results are included for years with significant one-way ANOVA only.

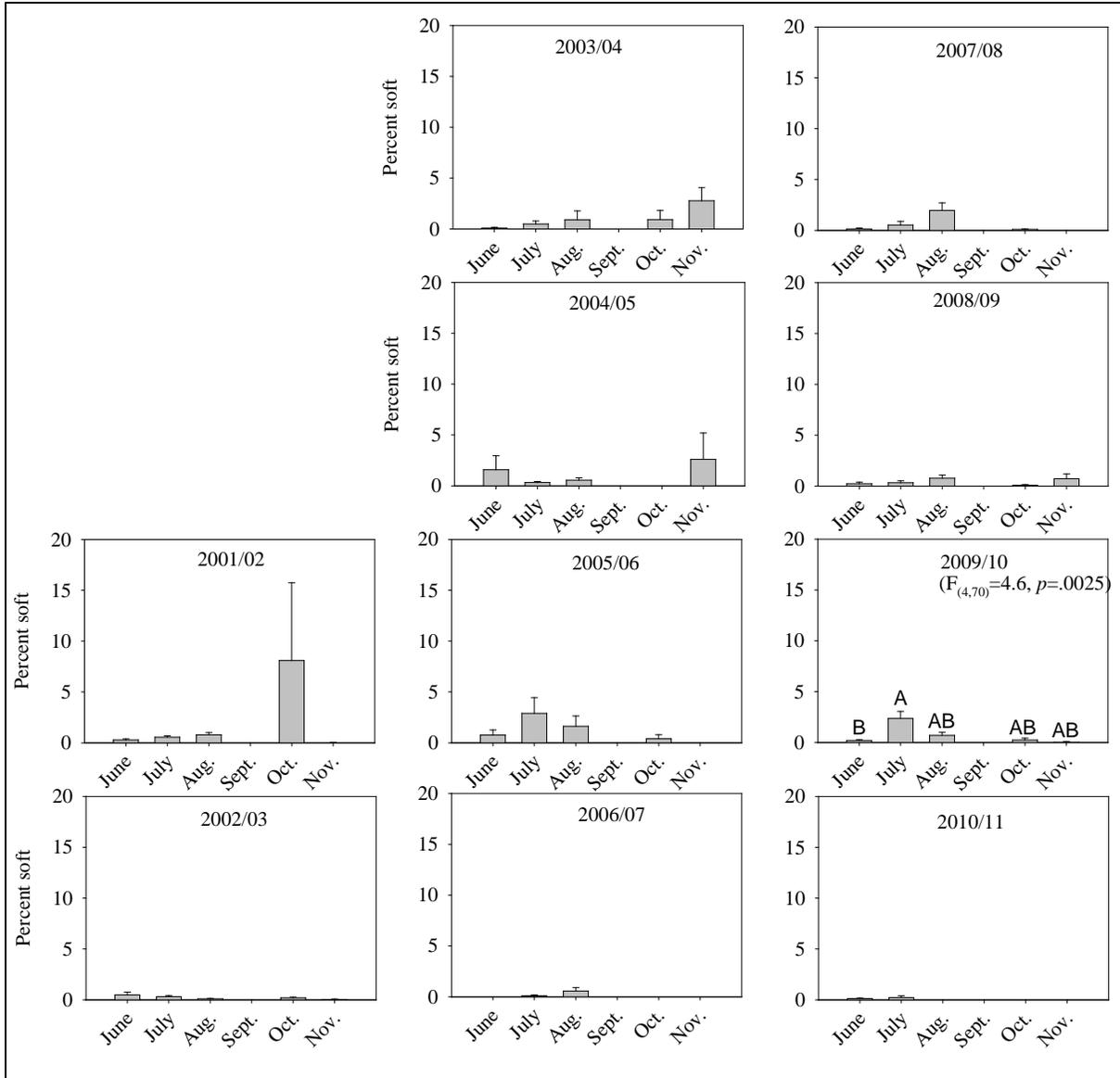


Figure 28.—Peril Strait (District 13) Dungeness crab soft shell prevalence by month from fish tickets during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011. Statistical results are included for years with significant one-way ANOVA only.

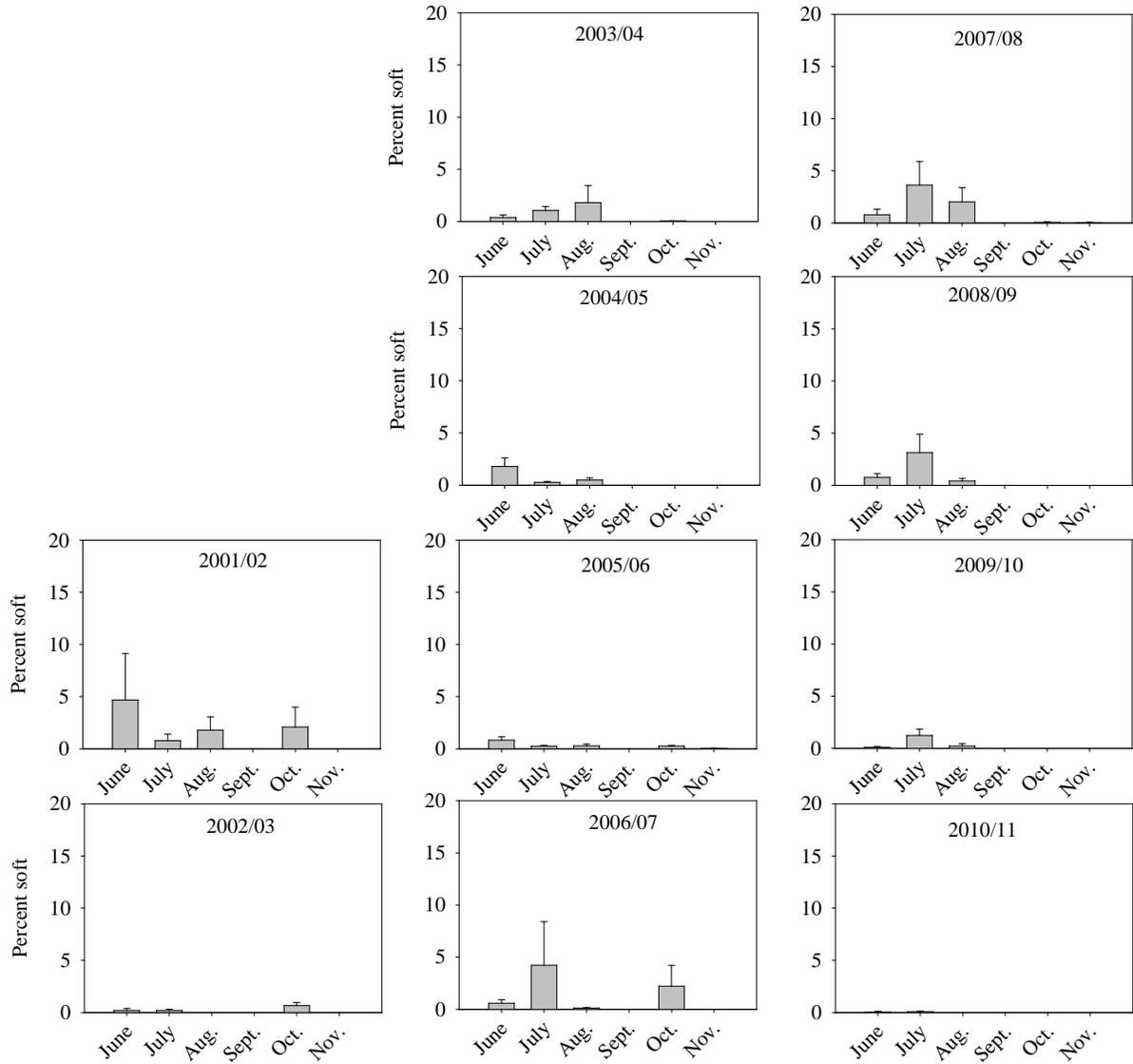


Figure 29.—Tenakee Inlet (District 12) Dungeness crab soft shell prevalence by month from fish tickets during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011. Statistical results are included for years with significant one-way ANOVA only.

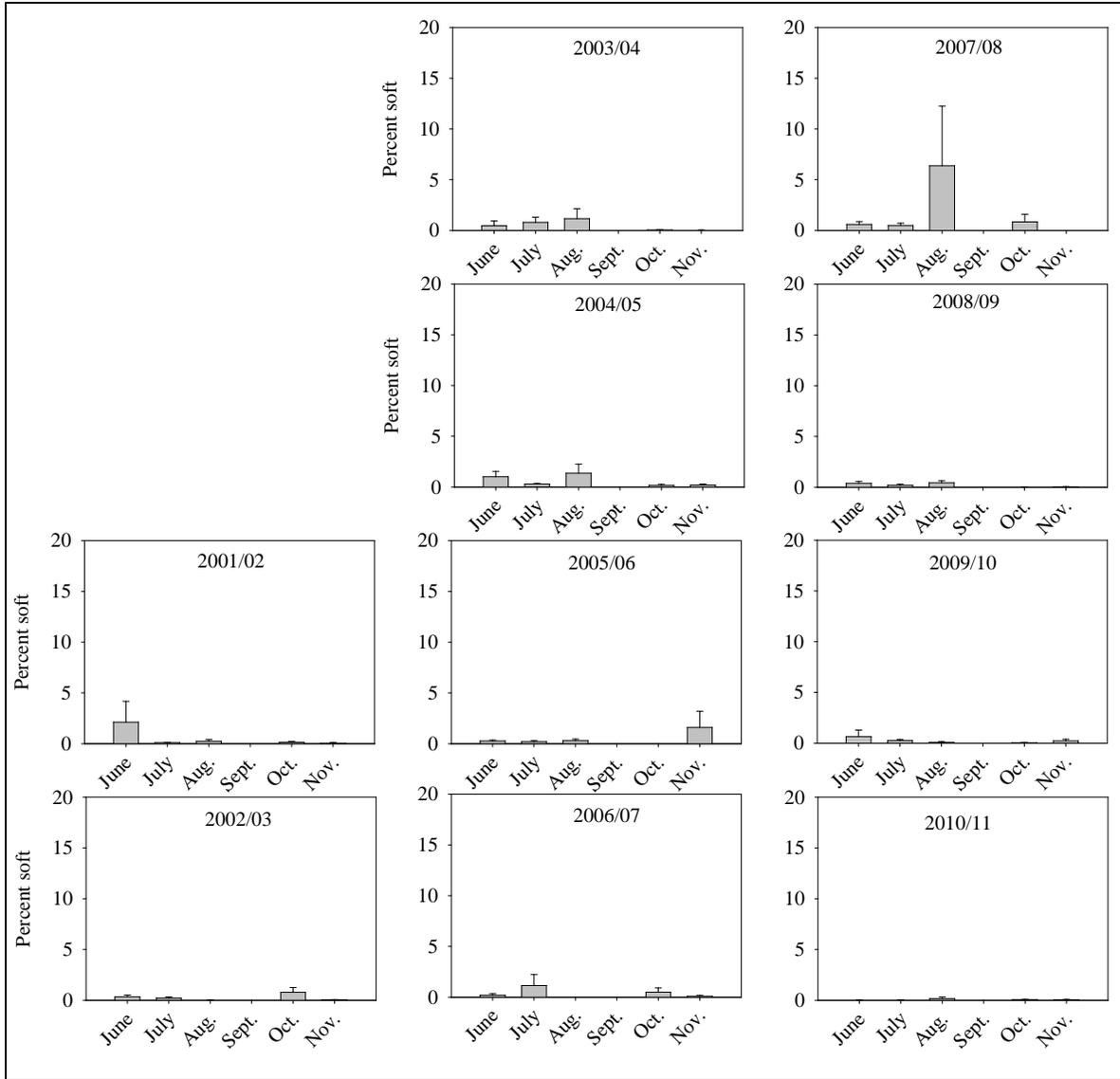


Figure 30.–Icy Strait (District 14) Dungeness crab soft shell prevalence by month from fish tickets during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011. Statistical results are included for years with significant one-way ANOVA only.

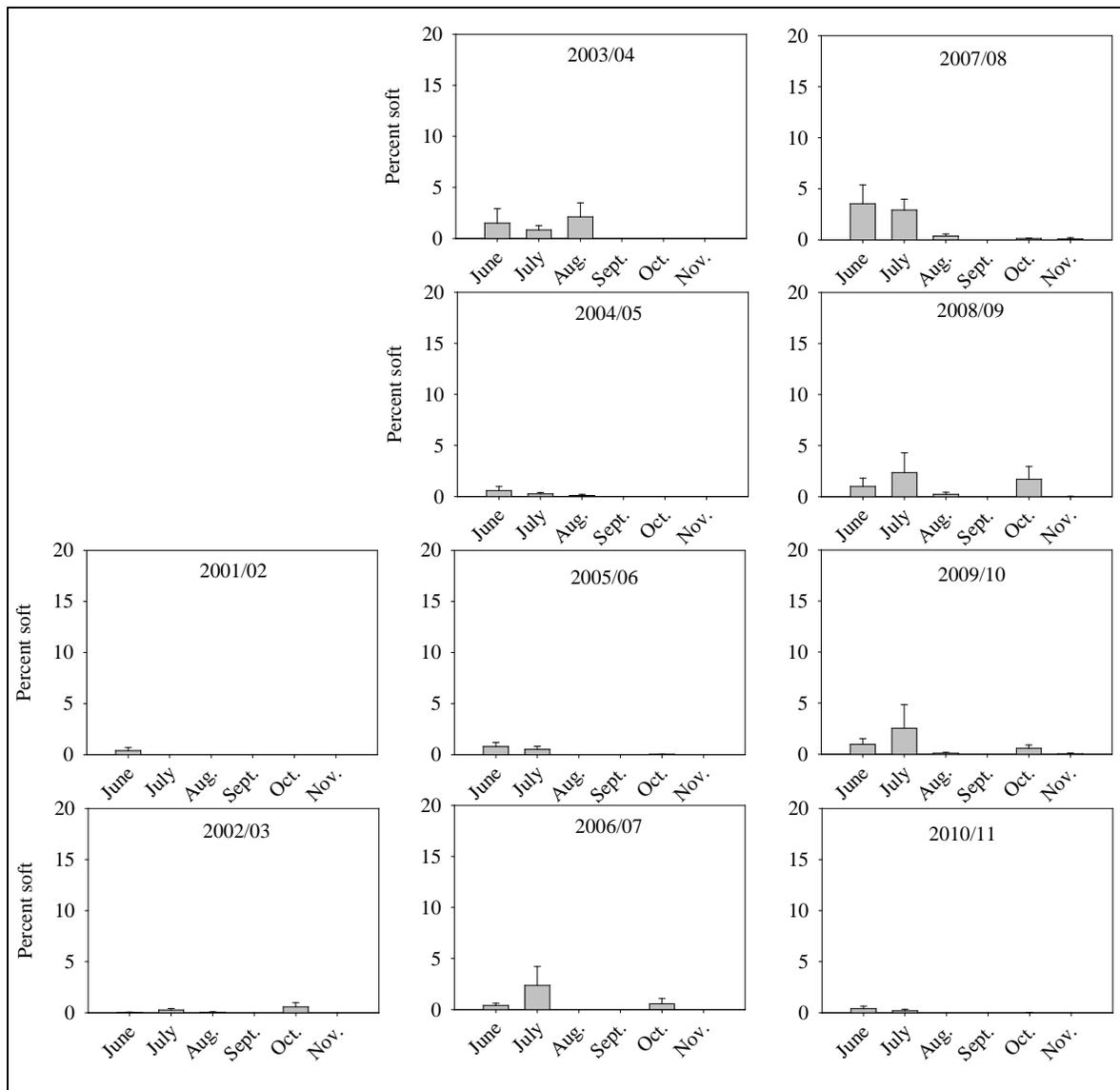


Figure 31.—Lynn Canal (District 15) Dungeness crab soft shell prevalence by month from fish tickets during summer (June 15–August 15) and fall (October 1–November 30) commercial fishing seasons, 2001/2002 through 2010/2011. Statistical results are included for years with significant one-way ANOVA only.

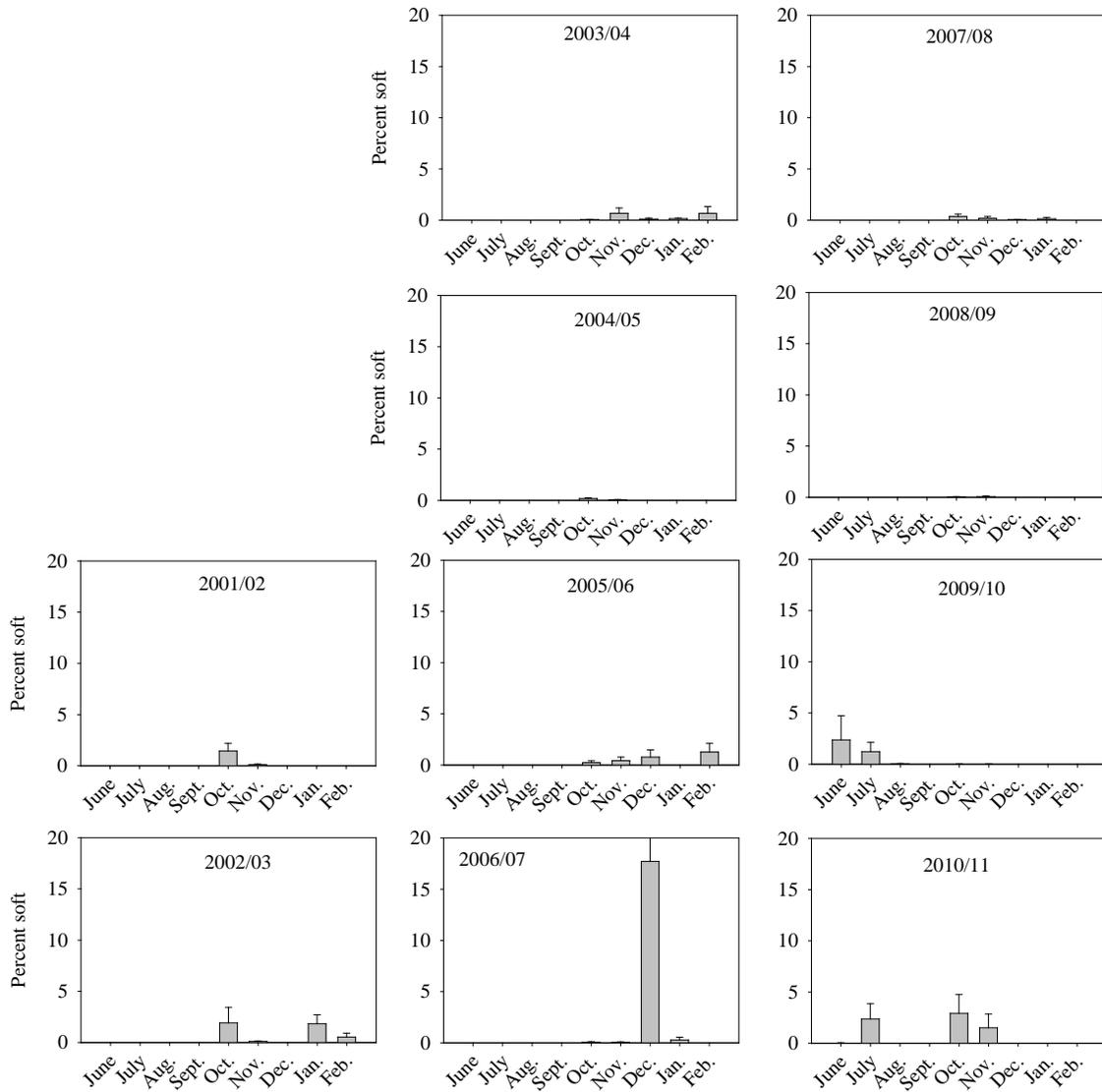


Figure 32.—Behm Canal, Portland Canal (District 1) Dungeness crab soft shell prevalence by month from fish tickets during fall/winter (October 1–February 28) commercial fishing seasons, 2001/2002 through 2010/2011. This area had a fall/winter season for 2001/2002 through 2008/2009 and a summer/fall season for 2009/2010 and 2010/2011. Statistical results are included for years with significant one-way ANOVA only.

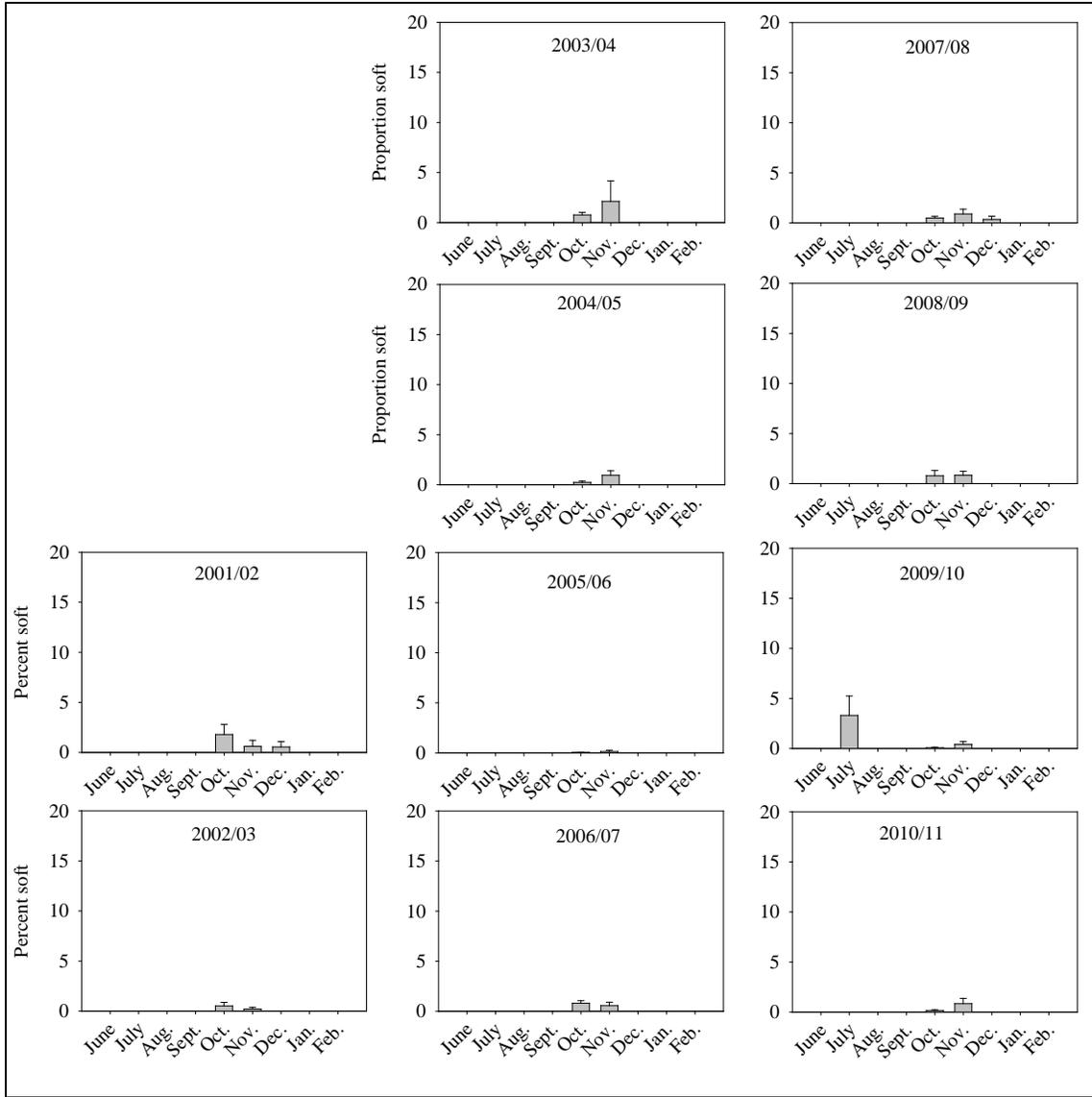


Figure 33.—East Coast, Prince of Wales (District 2) Dungeness crab soft shell prevalence by month from fish tickets during fall/winter (October 1–February 28) commercial fishing seasons, 2001/2002 through 2010/2011. This area had a fall/winter season for 2001/2002 through 2008/2009, a summer/fall season for 2009/2010, and a fall/winter season again in 2010/2011. Statistical results are included for years with significant one-way ANOVA only.

APPENDICES

Appendix A.–Summary of commercially harvested Dungeness crab size frequency and shell condition data collected during dockside sampling in Behm Canal, Portland Canal, and East Coast, Prince of Wales, 1975/1976 to present. Means are of 2001/2002 through 2010/2011 seasons only.

Fishery area	Season	Harvest (lb)	Number of sampled		Carapace width (mm)		% Recruits
			Trips	Crab	Average	Range	
Behm Canal/Portland Canal	1975/76	43,446	1	100	180.6	161-206	76.5
	1995/96	92,721	1	98	173.2	163-198	90.0
	1996/97	120,723	0	0	ND	ND	ND
	1997/98	204,383	5	255	178.2	164-204	93.3
	1998/99	113,338	10	511	177.6	164-208	52.1
	1999/00	145,093	41	2,068	174.5	160-212	13.4
	2000/01	78,743	30	1,511	175.0	161-204	77.4
	2001/02	78,280	17	921	172.0	154-198	89.6
	2002/03	132,851	26	1,568	174.2	154-203	77.3
	2003/04	132,229	27	1,650	173.3	93-200	87.8
	2004/05	197,842	25	1,504	175.7	158-206	81.2
	2005/06	125,348	15	750	174.9	164-197	92.4
	2006/07	73,614	11	550	175.5	158-199	84.0
	2007/08	47,781	8	404	174.4	162-203	75.3
	2008/09	65,274	6	375	174.8	164-200	92.8
2009/10	85,509	6	426	177.2	164-202	86.2	
2010/11	120,826	8	550	177.7	164-207	88.3	
Mean		105,955					85.5
East Coast, Prince of Wales	1997/98	108,547	4	251	183.2	164-204	79.5
	1998/99	72,483	4	222	178.4	164-206	39.4
	1999/00	57,108	8	405	179.7	162-207	19.9
	2000/01	63,157	5	251	176.7	161-205	80.9
	2001/02	89,828	5	250	174.4	163-205	95.0
	2002/03	116,051	3	151	179.9	165-198	92.7
	2003/04	91,807	11	713	175.6	158-206	89.7
	2004/05	85,253	4	262	174.0	160-197	66.3
	2005/06	57,216	2	100	175.3	163-203	97.9
	2006/07	68,114	5	253	176.4	163-211	97.2
	2007/08	138,147	8	550	178.7	157-209	88.9
	2008/09	67,006	5	325	173.7	162-215	95.8
	2009/10	116,964	5	450	177.1	163-204	96.8
2010/11	85,338	6	518	177.5	163-202	94.2	
Mean		91,572					91.4

Appendix B.—Summary of commercially harvested Dungeness crab size frequency and shell condition data collected during dockside sampling for West Coast, Prince of Wales Island; and Ernest Sound/Clarence Strait, 1975/1976 to present. Means are of 2001/2002 through 2010/2011 seasons only.

Fishery area	Season	Harvest (lb)	Number of sampled		Carapace width (mm)		% Recruits
			Trips	Crab	Average	Range	
West Coast, Prince of Wales Island	1987/88	20,778	1	76	182.1	165-205	60.5
	1990/91	12,325	3	297	176.5	162-201	72.5
	1991/92	37,969	2	190	183.5	164-208	76.6
	1994/95	13,500	1	80	173.4	163-192	85.1
	1997/98	43,597	3	151	180.3	164-207	52.0
	1998/99	22,551	2	98	178.3	161-198	76.3
	2000/01	32,633	4	202	176.6	164-202	83.5
	2001/02	41,382	1	50	180.2	162-201	91.7
	2002/03	17,429	5	201	181.1	163-208	68.3
	2003/04	38,890	1	50	182.5	165-207	88.0
	2004/05	25,472	3	154	177.0	163-197	89.3
	2006/07	46,888	2	100	178.9	163-197	
	2008/09	24,147	1	75	178.2	164-208	96.9
	2009/10	15,489	1	50	179.0	163-204	
Mean		30,222					87.3
Ernest Sound/Clarence Strait	1975/76	*	4	412	183.3	160-217	71.7
	1977/78	*	2	218	176.4	159-203	62.7
	1978/79	*	2	209	178.3	164-207	81.3
	1979/80	67,733	1	104	179.0	160-207	65.1
	1981/82	189,945	1	100	185.0	165-210	52.0
	1987/88	87,277	1	95	175.9	163-199	59.1
	1995/96	212,104	4	398	172.6	164-200	90.7
	1996/97	459,440	14	697	175.2	160-203	79.1
	1997/98	311,561	2	100	173.3	161-199	93.3
	1998/99	242,200	3	153	178.2	162-197	84.4
	1999/00	98,374	3	152	174.9	165-198	53.3
	2000/01	85,955	4	202	177.1	164-198	85.9
	2001/02	283,877	9	450	173.6	162-204	95.6
	2002/03	527,535	10	501	179.5	156-205	91.5
	2003/04	222,094	12	601	175.6	164-204	
	2004/05	336,875	14	701	178.0	140-200	96.2
	2005/06	254,601	15	750	176.4	159-205	98.1
2006/07	202,650	4	200	177.1	160-205	97.9	
2007/08	258,243	2	100	178.9	164-203	89.9	
2008/09	215,914	5	325	175.9	163-198	94.2	
2009/10	148,638	7	400	176.0	163-214	95.5	
2010/11	238,459	7	425	175.5	161-201	95.5	
Mean		268,889					94.9

* Confidential data where less than 3 permit holders fished is omitted

Appendix C.–Summary of commercially harvested Dungeness crab size frequency and shell condition data collected during dockside sampling in Stikine Flats, 1975/1976 to present. Means are of 2001/2002 through 2010/2011 seasons only.

Fishery area	Season	Harvest (lb)	Number of sampled		Carapace width (mm)		% Recruits ^a
			Trips	Crab	Average	Range	
Stikine	1975/76	17,096	1	100	177.2	164-198	93.9
Flats	1978/79	37,233	1	113	179.6	161-200	66.1
	1980/81	19,809	1	105	180.9	167-207	82.9
	1981/82	201,651	2	202	183.2	165-205	35.6
	1982/83	730,425	2	202	182.3	164-215	74.1
	1983/84	567,426	1	81	193.8	172-219	51.9
	1984/85	237,138	2	202	176.2	164-205	90.0
	1985/86	366,412	7	745	174.9	157-228	95.8
	1986/87	337,814	6	536	173.9	156-210	80.2
	1987/88	509,004	2	128	175.9	165-192	86.7
	1988/89	712,499	12	965	177.9	160-206	79.7
	1989/90	414,216	23	2,149	182.0	161-218	58.4
	1990/91	288,434	15	1,475	174.2	156-223	85.4
	1991/92	509,784	18	1,734	175.2	158-207	88.9
	1992/93	502,734	18	1,780	177.0	160-208	82.9
	1993/94	347,955	12	948	179.9	163-212	82.6
	1994/95	287,948	19	1,942	175.7	161-212	87.2
	1995/96	700,392	16	1,609	173.8	161-208	90.8
	1996/97	1,150,997	48	2,418	177.5	162-210	81.4
	1997/98	800,241	43	2,153	178.6	161-216	85.3
	1998/99	353,591	28	1,439	176.6	161-212	74.9
	1999/00	685,141	38	1,938	175.0	113-210	87.2
	2000/01	601,339	39	1,960	176.3	160-204	91.0
	2001/02	789,025	70	3,499	173.6	160-207	95.5
	2002/03	1,585,536	58	2,843	178.1	161-210	95.1
	2003/04	820,510	81	4,034	180.7	160-218	86.3
	2004/05	624,835	54	2,700	176.4	155-212	91.9
2005/06	946,833	102	5,122	177.6	90-212	94.8	
2006/07	989,010	152	7,590	175.7	157-207	97.8	
2007/08	995,358	63	3,145	178.1	123-208	93.0	
2008/09	833,938	66	3,305	176.5	161-217	91.9	
2009/10	600,472	85	4,235	175.0	161-211	93.1	
2010/11	640,945	68	3,398	177.3	159-207	95.5	
Mean		882,646					93.5

Appendix D.–Summary of commercially harvested Dungeness crab size frequency and shell condition data collected during dockside sampling in Thomas/Farragut Bays, 1978/1979 to present. Means are of 2001/2002 through 2010/2011 seasons only.

Fishery area	Season	Harvest (lb)	Number of sampled		Carapace width (mm)		% Recruits
			Trips	Crab	Average	Range	
Thomas/ Farragut Bays	1978/79	*	*				83.2
	1986/87	125,137	4	405	175.9	161-204	93.6
	1987/88	153,597	4	326	176.2	162-201	79.3
	1988/89	72,605	*				68.4
	1989/90	50,115	*				57.4
	1990/91	57,596	7	683	175.1	161-217	90.1
	1991/92	237,579	7	661	178.0	161-205	87.3
	1992/93	191,812	8	745	183.2	163-211	70.9
	1993/94	128,758	7	688	181.4	163-210	77.3
	1994/95	79,136	3	301	176.8	163-211	84.8
	1995/96	190,107	3	300	175.8	164-201	91.9
	1996/97	140,798	14	710	177.7	163-204	86.3
	1997/98	91,193	11	552	180.8	164-207	81.9
	1998/99	36,804	4	212	176.2	162-208	83.6
	1999/00	138,075	12	611	173.0	162-200	87.0
	2000/01	211,462	21	1,051	177.1	163-209	90.6
	2001/02	70,091	5	248	180.7	164-212	88.7
	2002/03	69,381	*				94.9
	2003/04	73,211	4	201	180.2	163-206	95.5
	2004/05	104,662	6	278	177.3	162-207	92.6
2005/06	84,892	3	149	176.6	162-201	96.5	
2006/07	101,340	9	453	172.7	163-197	98.9	
2007/08	282,036	26	1,781	177.1	162-206	93.8	
2008/09	190,047	16	1,115	178.9	161-207	90.8	
2009/10	158,681	8	554	175.5	162-203	86.6	
2010/11	92,712	8	501	179.8	163-209	91.2	
	Mean	122,705					92.9

* Confidential data where less than 3 permit holders fished is omitted

Appendix E.—Summary of commercially harvested Dungeness crab size frequency and shell condition data collected during dockside sampling in Duncan Canal, 1976/1977 to present. Means are of 2001/2002 through 2010/2011 seasons only.

Fishery area	Season	Harvest (lb)	Number of sampled		Carapace width (mm)		% Recruits
			Trips	Crab	Average	Range	
Duncan	1976/77	*	*				71.7
Canal	1977/78	*	*				36.8
	1978/79	110,907	*				70.1
	1979/80	101,731	*				84.2
	1980/81	137,242	*				75.7
	1981/82	712,893	5	525	182.1	164-211	67.9
	1982/83	489,188	*				65.8
	1983/84	147,499	*				73.2
	1985/86	473,335	10	963	178.3	162-210	90.8
	1986/87	348,713	7	683	178.3	160-214	75.1
	1987/88	526,318	21	2,075	176.3	160-205	75.5
	1988/89	773,471	31	2,869	182.2	157-225	68.7
	1989/90	213,487	16	1,463	183.7	158-220	40.5
	1990/91	285,419	44	4,232	174.7	158-219	84.3
	1991/92	357,385	10	941	177.4	162-204	87.2
	1992/93	270,874	24	2,417	179.7	157-211	79.3
	1993/94	165,476	19	1,775	179.6	162-210	79.2
	1994/95	209,959	19	1,800	173.6	162-209	90.7
	1995/96	690,673	30	3,015	175.6	161-208	86.3
	1996/97	733,372	42	2,153	180.6	156-211	79.3
	1997/98	294,979	38	1,970	178.8	156-208	74.5
	1998/99	422,868	52	2,632	175.7	161-206	77.5
	1999/00	671,544	65	3,277	178.3	112-210	72.6
	2000/01	327,768	67	3,330	177.8	156-205	77.8
	2001/02	1,108,555	142	7,075	173.5	153-204	97.7
	2002/03	1,454,364	106	5,280	180.1	160-225	92.4
	2003/04	731,933	116	5,781	178.1	158-224	91.5
	2004/05	765,533	110	5,463	178.5	158-215	91.6
	2005/06	646,426	88	4,399	177.2	159-209	95.3
	2006/07	481,678	92	4,583	177.4	162-210	96.1
	2007/08	644,628	114	5,697	174.7	158-204	96.1
	2008/09	541,846	84	4,205	177.6	160-208	94.6
	2009/10	354,015	79	3,944	176.1	161-207	93.4
	2010/11	476,907	83	4,111	178.3	160-212	91.2
	Mean	720,589					94.0

* Confidential data where less than 3 permit holders fished is omitted

Appendix F.—Summary of commercially harvested Dungeness crab size frequency and shell condition data collected during dockside sampling in Port Camden/West Kuiu, 1975/1976 to present. Means are of 2001/2002 through 2010/2011 seasons only.

Fishery area	Season	Harvest (lb)	Number of sampled		Carapace width (mm)		% Recruits ^a
			Trips	Crab	Average	Range	
Port Camden/ West Kuiu	1975/76	45,498	4	403	180.7	165-206	76.4
	1977/78	*	1	101	180.5	167-200	23.8
	1978/79	90,488	3	301	180.3	163-213	74.3
	1980/81	70,114	2	206	177.6	161-204	86.8
	1981/82	269,333	2	218	180.3	160-202	74.2
	1983/84	162,126	2	203	178.0	163-207	87.1
	1984/85	233,918	1	101	175.2	164-194	87.0
	1985/86	343,702	5	511	178.5	163-203	86.2
	1987/88	416,851	5	520	181.5	164-213	70.8
	1988/89	210,834	3	242	183.9	164-212	69.2
	1989/90	80,505	4	372	178.0	162-205	64.2
	1990/91	478,670	36	3,597	175.3	158-209	88.7
	1991/92	851,442	37	3,625	180.7	163-209	86.6
	1992/93	375,580	11	1,101	178.7	162-212	77.1
	1993/94	400,147	12	1,204	181.4	160-214	80.7
	1994/95	299,371	10	1,066	176.0	160-208	91.3
	1995/96	1,063,310	37	3,720	176.9	162-210	92.6
	1996/97	912,085	55	2,758	179.8	154-215	82.1
	1997/98	677,984	23	1,196	180.1	158-218	80.9
	1998/99	340,006	35	1,822	177.5	111-207	77.5
	1999/00	794,429	44	2,248	176.4	110-210	80.4
	2000/01	592,524	68	3,406	177.9	87-207	84.7
	2001/02	794,132	66	3,296	173.8	158-207	96.7
	2002/03	1,686,939	85	4,246	179.2	160-209	94.5
	2003/04	764,372	32	1,552	181.1	162-222	90.0
	2004/05	483,952	40	2,011	178.0	162-213	93.6
	2005/06	334,139	22	1,111	178.3	162-208	92.7
	2006/07	636,905	44	2,199	174.9	160-203	98.0
	2007/08	1,101,417	64	3,213	178.0	162-207	93.3
	2008/09	909,728	49	2,482	177.9	161-212	92.2
	2009/10	456,150	38	1,905	180.2	162-215	86.8
	2010/11	184,821	28	1,403	179.7	161-210	87.5
	Mean	735,256					92.5

* Confidential data where less than 3 permit holders fished is omitted

Appendix G.—Summary of commercially harvested Dungeness crab size frequency and shell condition data collected during dockside sampling in East Admiralty/Mainland Bays, 1975/1976 to present. Means are of 2001/2002 through 2010/2011 seasons only.

Fishery area	Season	Harvest (lb)	Number of sampled		Carapace width (mm)		% Recruits
			Trips	Crab	Average	Range	
East	1975/76	51,815	2	203	175.9	163-199	95.0
Admiralty/ Mainland Bays	1976/77	42,562	1	101	172.9	164-190	88.9
	1977/78	*	1	101	177.0	164-205	50.0
	1978/79	*	1	100	180.2	167-198	80.0
	1979/80	27,081	1	109	183.9	165-207	77.1
	1981/82	48,044	1	103	183.7	166-201	77.7
	1983/84	77,502	2	194	181.4	163-217	83.9
	1985/86	103,670	2	224	177.3	164-202	91.4
	1986/87	238,441	1	108	176.8	165-210	93.5
	1987/88	342,220	5	569	179.8	165-210	77.2
	1988/89	309,301	10	996	185.2	162-214	59.7
	1989/90	146,624	10	929	177.7	160-215	80.6
	1990/91	379,351	33	3,305	175.6	158-216	89.8
	1991/92	989,084	57	5,651	178.1	153-213	86.8
	1992/93	591,006	41	3,955	181.0	161-215	75.8
	1993/94	313,071	11	1,081	183.5	160-226	76.0
	1994/95	174,679	9	888	177.6	163-222	81.6
	1995/96	390,274	24	2,323	175.6	161-211	91.2
	1996/97	397,574	21	1,057	176.9	161-201	88.2
	1997/98	508,386	27	1,417	178.8	161-210	85.7
	1998/99	205,063	21	1,110	177.5	142-211	76.6
	1999/00	269,686	24	1,219	175.1	117-211	89.3
	2000/01	228,135	25	1,248	177.3	161-208	80.8
	2001/02	378,169	51	2,540	175.4	161-212	87.9
	2002/03	1,161,905	63	3,159	180.4	140-214	89.2
	2003/04	820,439	74	3,684	178.9	162-220	90.6
	2004/05	898,367	73	3,610	178.7	160-210	92.1
	2005/06	725,311	40	2,024	176.2	161-211	94.9
	2006/07	1,095,199	73	3,685	177.6	160-212	96.4
	2007/08	762,085	47	2,453	177.3	161-209	88.5
	2008/09	860,013	53	2,791	177.5	160-210	93.7
	2009/10	657,651	72	3,778	177.2	157-213	91.5
	2010/11	735,916	70	3,533	179.6	161-213	92.1
	Mean	809,506					91.7

* Confidential data where less than 3 permit holders fished is omitted

Appendix H.—Summary of commercially harvested Dungeness crab size frequency and shell condition data collected during dockside sampling in Peril Strait and Tenakee Inlet, 1975/1976 to present. Means are of 2001/2002 through 2010/2011 seasons only.

Fishery area	Season	Harvest (lb)	Number of sampled		Carapace width (mm)		% Recruits
			Trips	Crab	Average	Range	
Peril Strait	1975/76	52,032	1	97	183.8	159-208	74.4
	1980/81	6,959	1	66	187.3	164-206	75.4
	1986/87	133,263	1	102	176.4	164-207	86.1
	1990/91	88,313	2	194	173.4	161-200	96.1
	1991/92	227,316	3	312	175.4	164-211	91.3
	1992/93	236,274	7	707	183.3	165-212	76.0
	1993/94	253,990	5	490	192.4	170-217	56.7
	1994/95	149,950	4	405	187.2	164-219	64.9
	1995/96	258,880	1	98	178.1	158-212	82.1
	1997/98	264,737	6	300	184.1	163-216	74.7
	1998/99	318,293	4	213	179.5	159-212	44.7
	1999/00	140,433	1	51	177.5	165-204	96.0
	2000/01	196,223	13	641	178.8	11-213	65.2
	2001/02	187,391	29	1,449	179.5	161-219	79.0
	2002/03	194,398	7	351	176.1	163-203	94.4
	2003/04	201,863	2	104	177.3	164-201	87.1
	2004/05	144,344	13	644	182.4	160-214	86.3
	2005/06	280,321	29	1,452	182.8	160-225	82.4
	2006/07	235,050	22	1,106	181.5	164-214	85.7
	2007/08	284,391	27	1,355	183.4	162-229	79.0
2008/09	265,760	21	1,050	180.2	160-225	85.0	
2009/10	203,411	24	1,200	180.3	163-213	89.3	
2010/11	343,788	25	1,250	181.6	163-215	90.2	
	Mean	228,812					85.8
Tenakee Inlet	1975/76	16,852	2	200	186.1	163-215	66.5
	1982/83	306,304	2	178	194.3	165-218	44.9
	1983/84	72,052	2	269	194.7	159-225	31.7
	1988/89	64,338	1	102	187.3	161-215	46.9
	1989/90	52,937	1	97	191.9	165-218	39.2
	1997/98	104,902	1	48	182.8	165-203	87.5
	1999/00	82,847	1	51	183.0	167-200	72.0
	2000/01	73,557	4	200	177.6	162-212	75.7
	2001/02	121,433	16	799	181.6	162-212	82.4
	2002/03	116,258	7	348	180.8	164-206	84.5
	2003/04	324,613	13	650	179.2	161-212	87.5
	2004/05	222,470	6	301	183.5	161-209	85.4
	2005/06	273,909	14	700	181.0	162-214	85.0
	2006/07	196,945	10	500	181.4	162-230	82.9
	2007/08	167,495	5	250	179.8	162-215	81.6
	2008/09	218,371	3	175	180.5	164-208	87.4
2009/10	130,358	4	250	182.7	164-200	88.0	
2010/11	58,863	5	295	179.2	162-206	89.3	
	Mean	183,072					85.4

Appendix I.—Summary of commercially harvested Dungeness crab size frequency and shell condition data collected during dockside sampling in Icy Strait/Glacier Bay, Lynn Canal, Outer Coast Baranof/Chichagof Islands, and Lituya Bay, 1975/1976 to present. Means are of 2001/2002 through 2010/11 seasons only.

Fishery area	Season	Harvest (lb)	Number of sampled		Carapace width (mm)		% Recruits
			Trips	Crab	Average	Range	
Icy Strait/Glacier Bay	1983/84	258,377	2	245	184.4	163-215	48.3
	1987/88	567,967	11	1,082	178.4	163-206	73.7
	1988/89	495,508	10	1,016	180.2	162-210	60.2
	1995/96	557,677	1	142	178.4	165-209	
	2000/01	62,388	4	201	171.7	163-196	76.1
	2001/02	111,927	13	648	175.4	162-211	93.9
	2002/03	164,526	18	900	177.6	162-215	91.1
	2003/04	248,304	21	1,005	179.2	162-212	90.7
	2004/05	446,251	14	698	177.8	161-208	92.4
	2005/06	311,266	16	811	179.8	161-210	87.2
	2006/07	153,606	8	400	178.3	163-211	86.4
	2007/08	322,348	9	474	179.7	163-213	89.0
	2008/09	269,510	12	826	178.4	162-206	87.7
	2009/10	238,145	10	700	177.0	162-223	91.8
2010/11	203,874	13	925	179.5	162-210	88.8	
	Mean	246,976					89.9
Lynn Canal	1994/95	61,458	1	62	177.9	164-196	98.4
	1998/99	115,709	9	505	180.6	161-214	89.0
	1999/00	39,808	5	217	180.8	158-209	72.6
	2000/01	17,552	6	302	178.0	157-207	75.4
	2001/02	41,265	10	486	176.8	157-207	79.7
	2002/03	94,108	9	435	178.1	163-200	92.5
	2003/04	123,409	7	360	180.4	158-205	86.4
	2004/05	114,700	4	225	181.3	164-211	83.5
	2005/06	167,215	2	92	180.0	162-203	89.8
	2006/07	172,749	1	50	178.8	166-195	
	2007/08	381,652	10	550	180.5	162-205	88.8
	2008/09	330,064	10	725	181.5	163-212	84.3
	2009/10	260,538	14	1,000	178.0	162-215	91.8
2010/11	262,905	15	1,051	178.6	162-215	85.8	
	Mean	194,861					87.0
Outer Coast Baranof/Chichagof	1975/76	20,055	2	214	172.5	154-198	93.5
	1982/83	92,285	1	100	184.0	164-208	82.8
	1983/84	28,785	1	101	180.6	165-225	75.3
	Mean	881					
Lituya Bay	1985/86	131,027	1	107	190.0	165-217	20.6
	1987/88	406,744	4	518	180.7	162-209	79.7
	1988/89	401,920	7	708	184.4	165-213	46.8
	1990/91	485,848	1	117	189.2	165-212	65.0