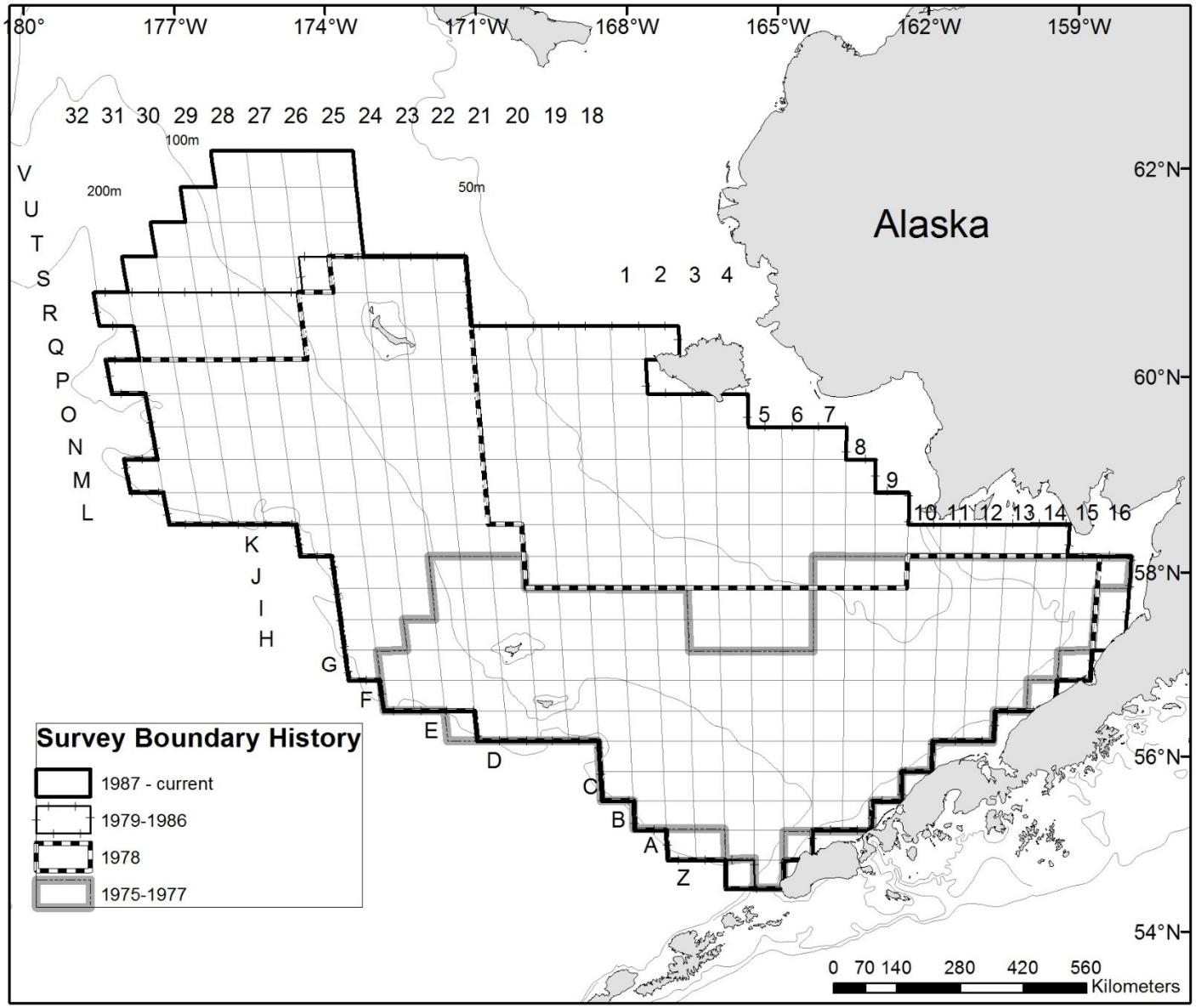
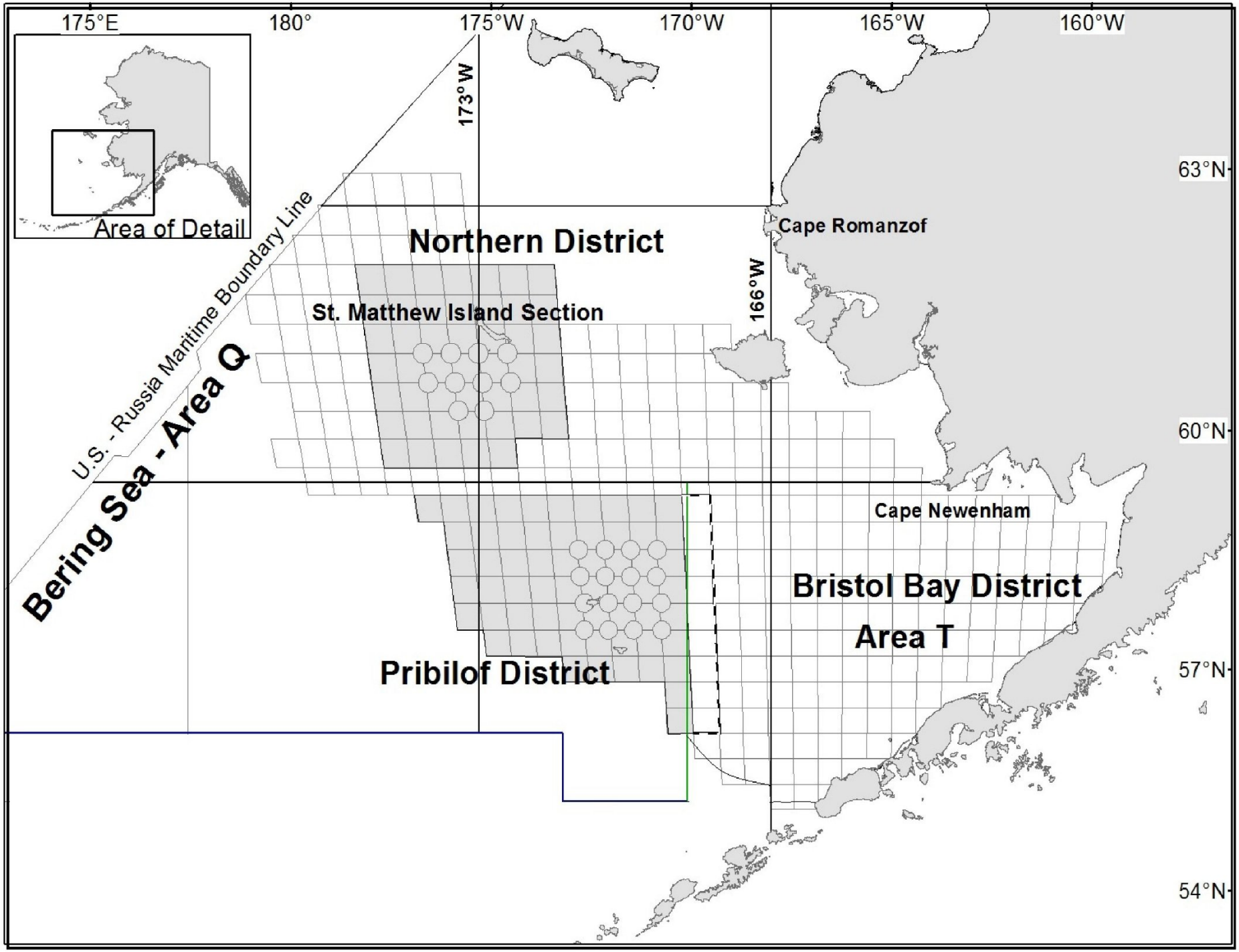
The 2017 Eastern Bering Sea Continental Shelf Bottom Trawl Survey: Results for Commercial Crab Species

NOAA FISHERIES
Alaska Fisheries Science Center-Kodiak Lab

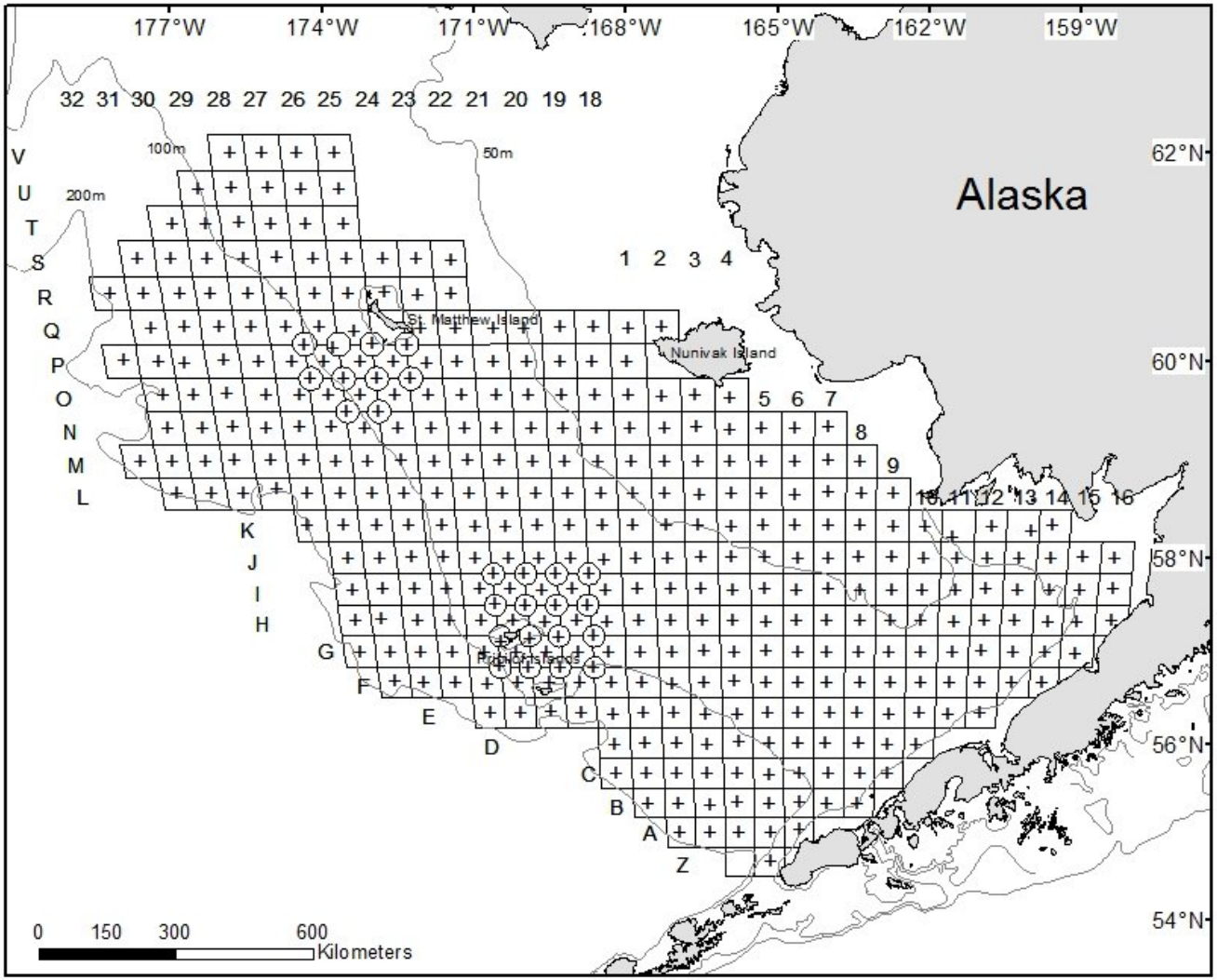
Christie Lang, Jon Richar, Robert Foy,
AFSC SAP and GAP programs

Crab Plan Team
September 2017


180°
177°W
174°W
171°W
168°W
165°W
162°W
159°W
62°N
60°N
58°N
56°N
54°N
Alaska
100m
200m
50m
32 31 30 29 28 27 26 25 24 23 22 21 20 19 18
1 2 3 4
5 6 7
8
9
10 11 12 13 14 15 16
V
U
T
S
R
Q
P
O
N
M
L
K
J
I
H
G
F
E
D
C
B
A
Z
Survey Boundary History
1987 - current
1979-1986
1978
1975-1977
0 70 140 280 420 560
Kilometers


175°E
180°
175°W
170°W
165°W
160°W
173°W
166°W
63°N
60°N
57°N
54°N
Area of Detail
U.S. - Russia Maritime Boundary Line
Bering Sea - Area Q
Northern District
St. Matthew Island Section
Pribilof District
Bristol Bay District
Area T
Cape Romanzof
Cape Newenham

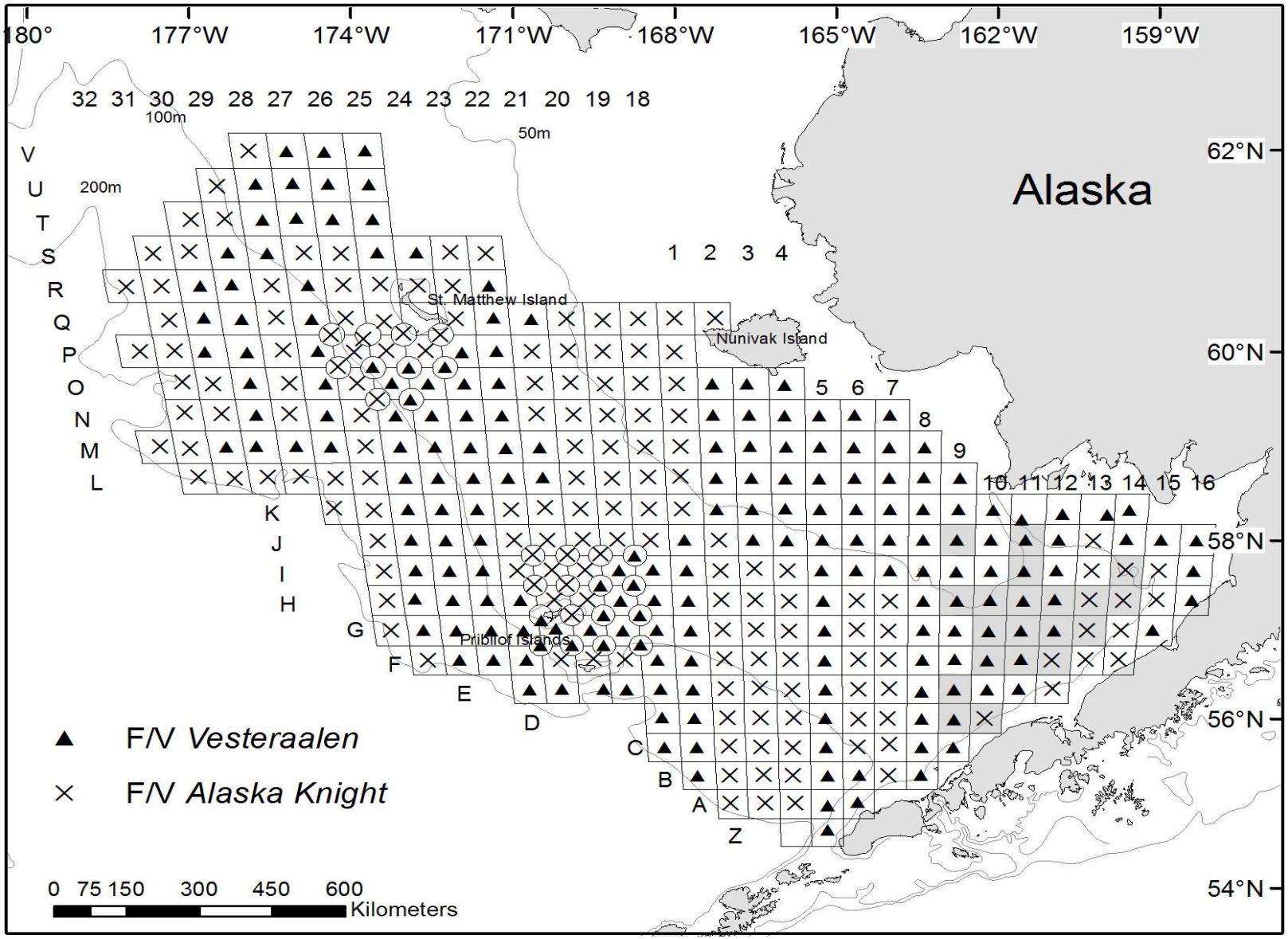
2017 standard Bering Sea survey

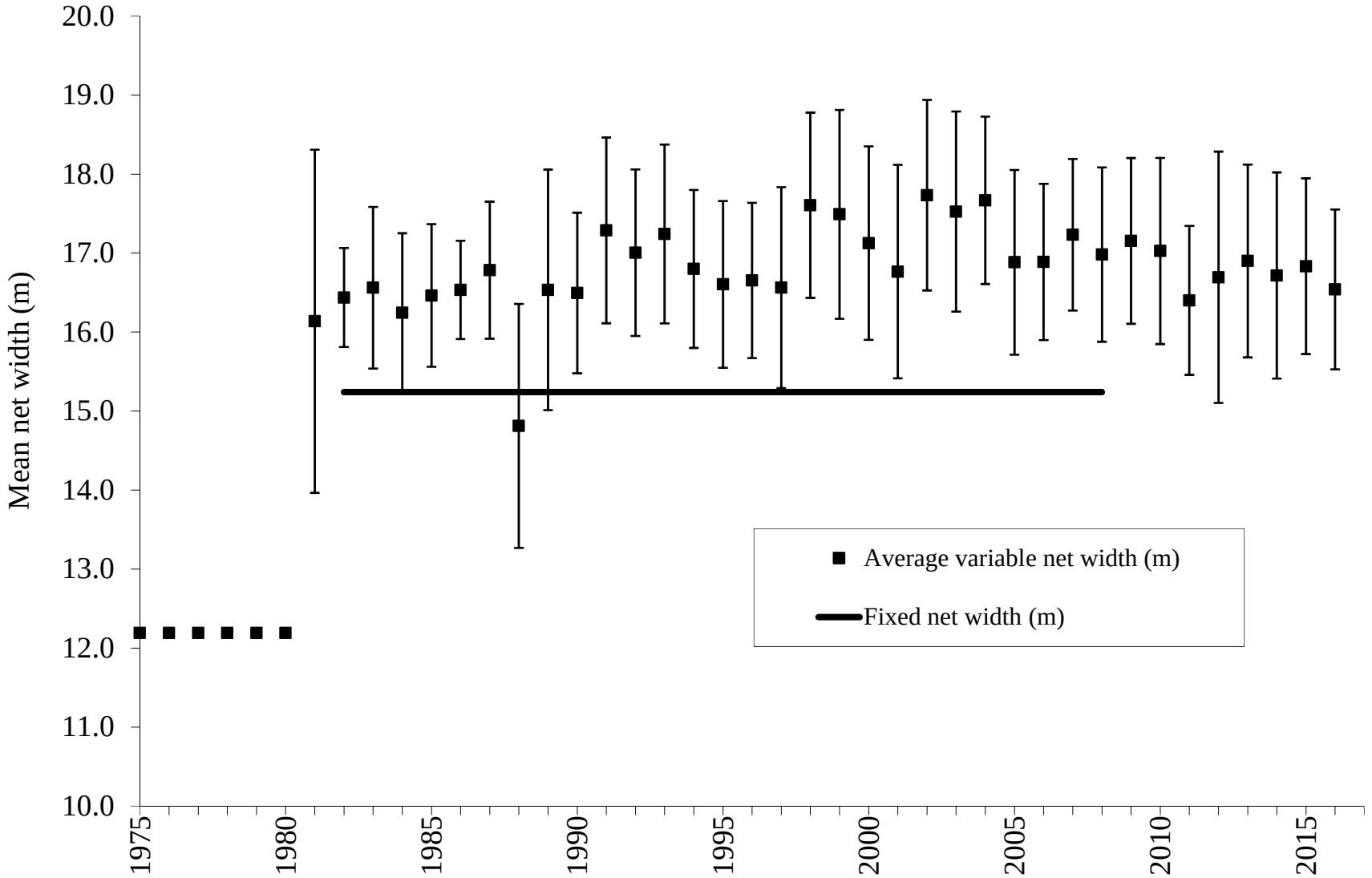


HIGHLIGHTS

- June 4– July 31
- 375 standard stations
- 139,949 nm^2
- 6 special crab projects
- Colder water!
- RESAMPLE 20 stations in Bristol Bay
- Northern Bering Sea

2017 standard Bering Sea survey

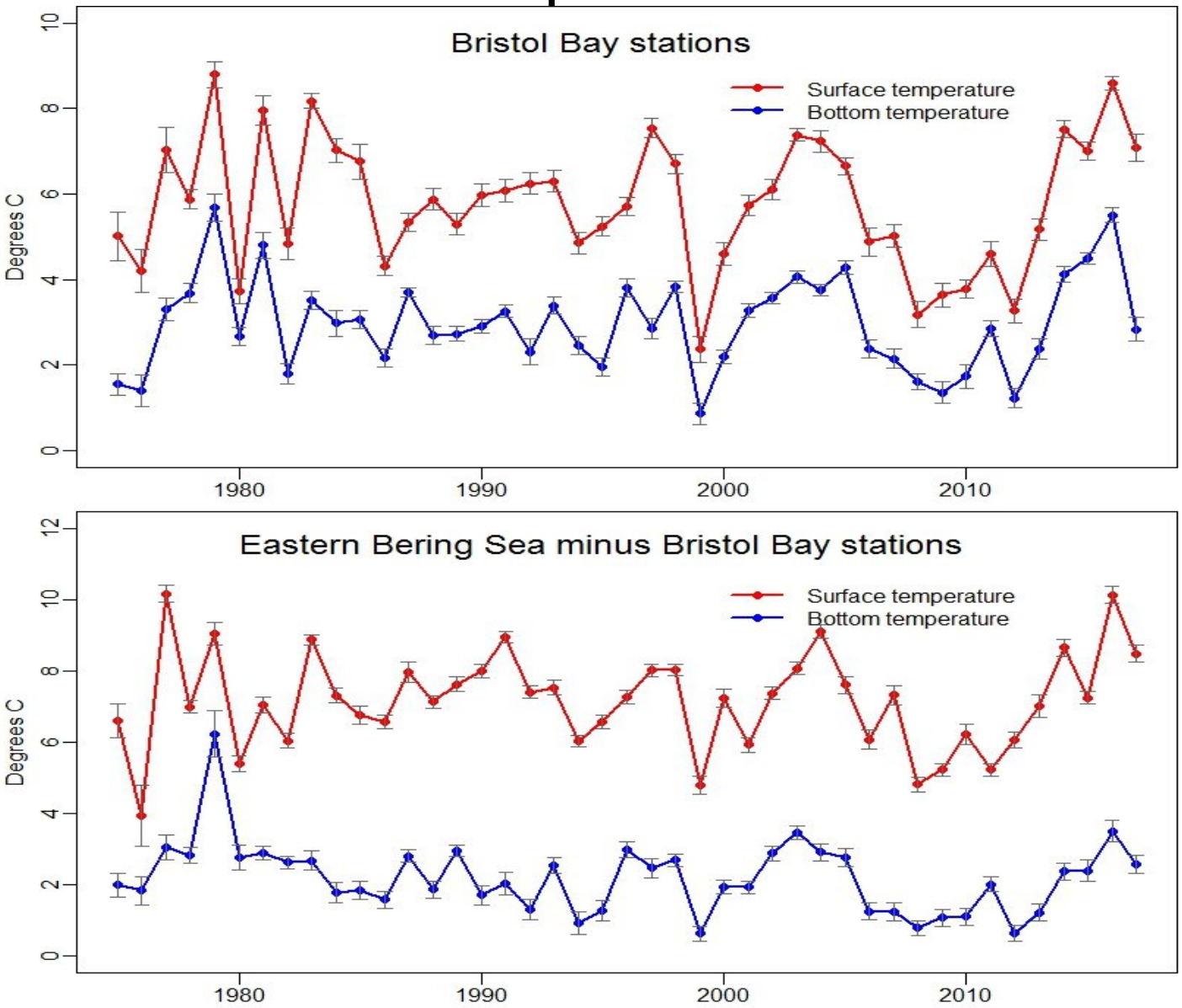


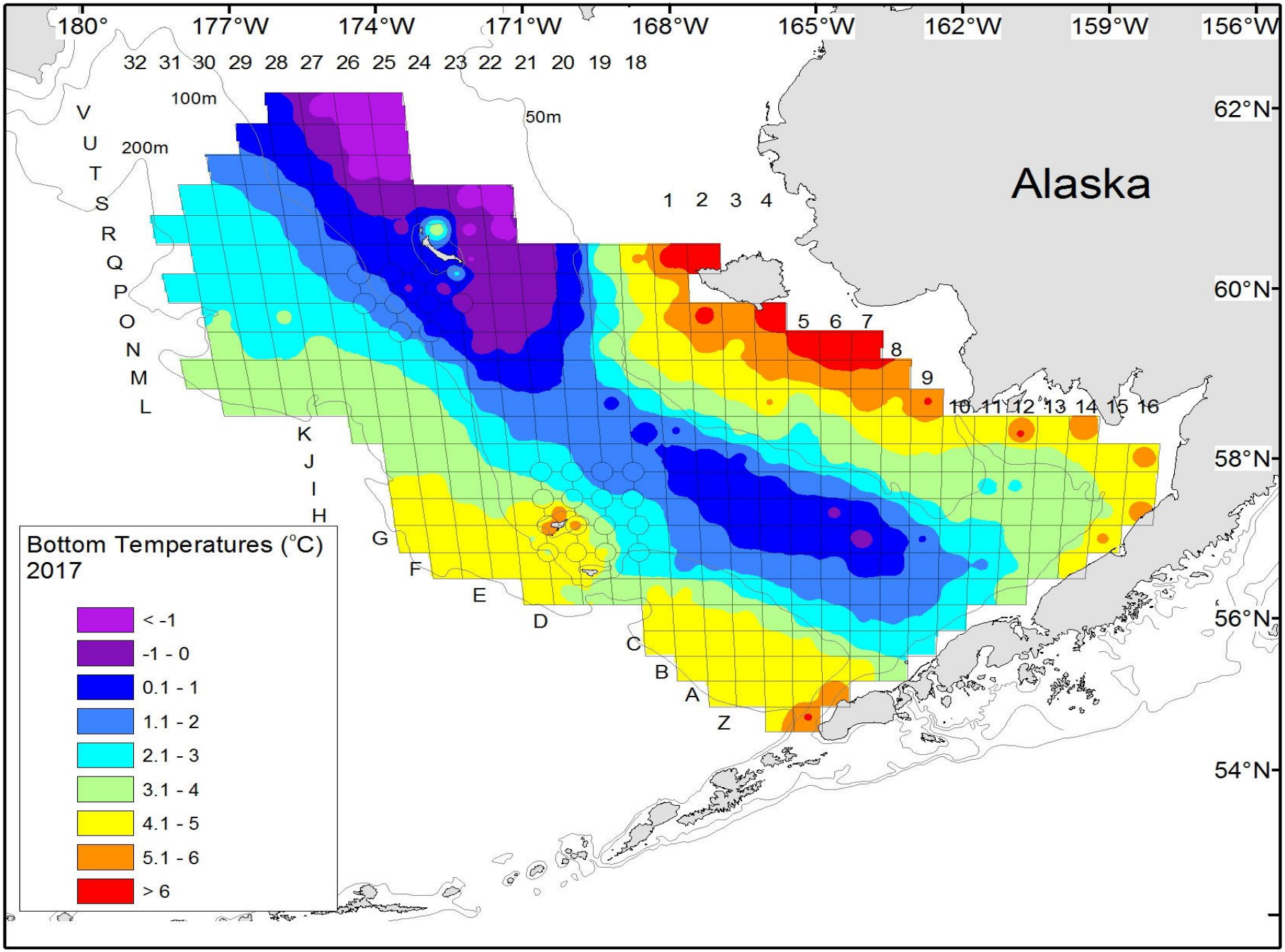

Mean net width (m)
20.0
19.0
18.0
17.0
16.0
15.0
14.0
13.0
12.0
11.0
10.0
1975
1980
1985
1990
1995
2000
2005
2010
2015
Average variable net width (m)
Fixed net width (m)

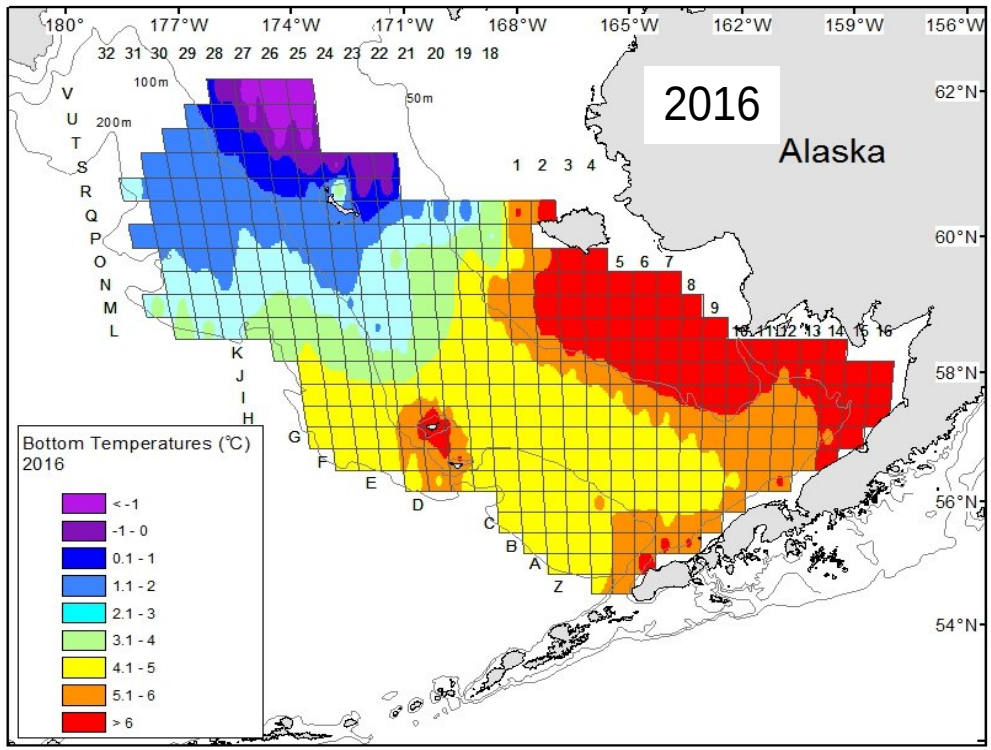
Special projects related to crab species

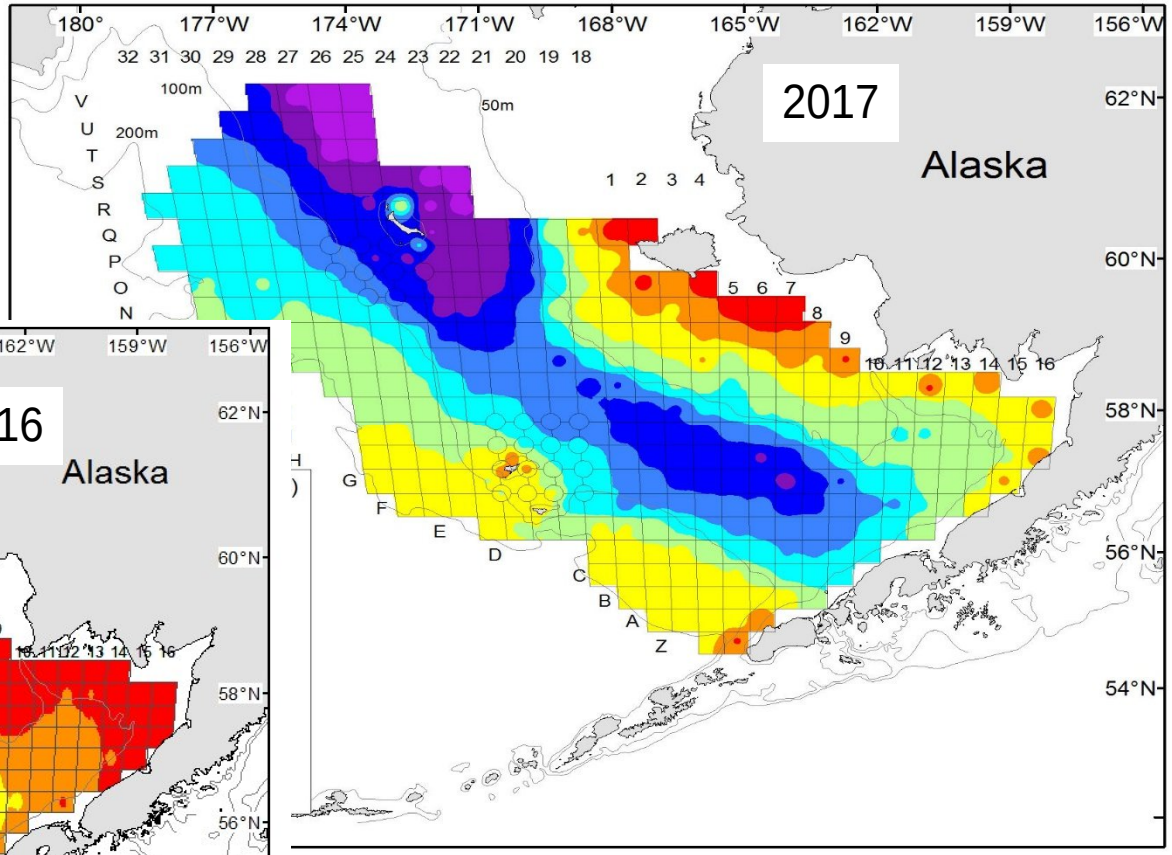
Project title	Principle Investigator	Agency
Bitter crab syndrome	P Jensen	RACE-SAP
Annual vs. biennial snow crab reproductive cycle	J Newby; R Foy	RACE-SAP
Spatial variance in snow crab shell structure	R Foy	RACE-SAP
Snow and Tanner crab growth	Cliff Ryer	RACE-FBE
Tanner crab chela	B. Stockhausen; R. Foy	REFM/RACE
Genetics of mating dynamics in EBS snow crab	Tyler Jackson	ADF&G

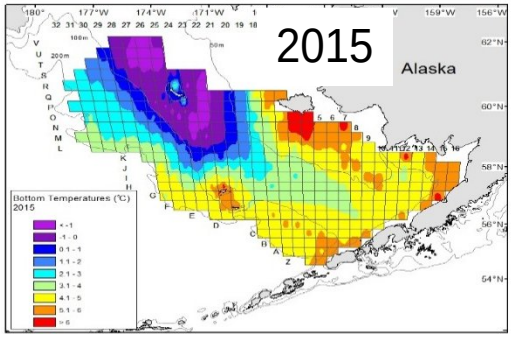
Bristol Bay Surface (red) and Bottom (blue) temperatures

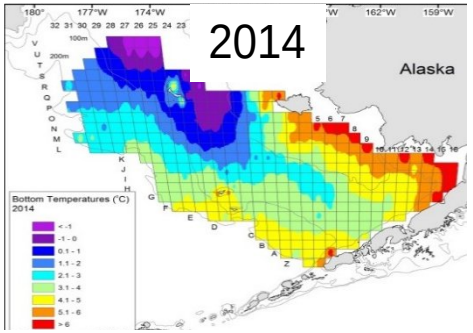


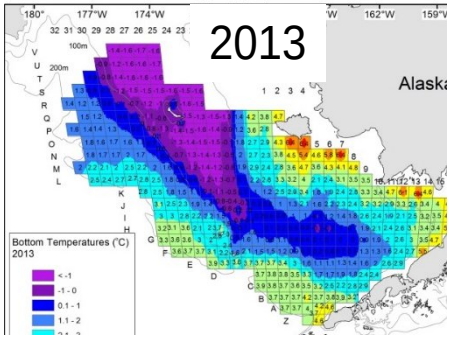

180°
177°W
174°W
171°W
168°W
165°W
162°W
159°W
156°W
62°N
60°N
58°N
56°N
54°N
Alaska
100m
200m
50m
32 31 30 29 28 27 26 25 24 23 22 21 20 19 18
1 2 3 4
5 6 7
8
9
10 11 12 13 14 15 16
V
U
T
S
R
Q
P
O
N
M
L
K
J
I
H
G
F
E
D
C
B
A
Z
Bottom Temperatures (°C)
2017
< -1
-1 - 0
0.1 - 1
1.1 - 2
2.1 - 3
3.1 - 4
4.1 - 5
5.1 - 6
> 6

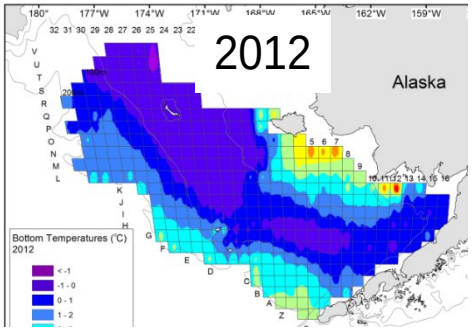

2016
Alaska
Bottom Temperatures (°C)
2016
< -1
-1 - 0
0.1 - 1
1.1 - 2
2.1 - 3
3.1 - 4
4.1 - 5
5.1 - 6
> 6

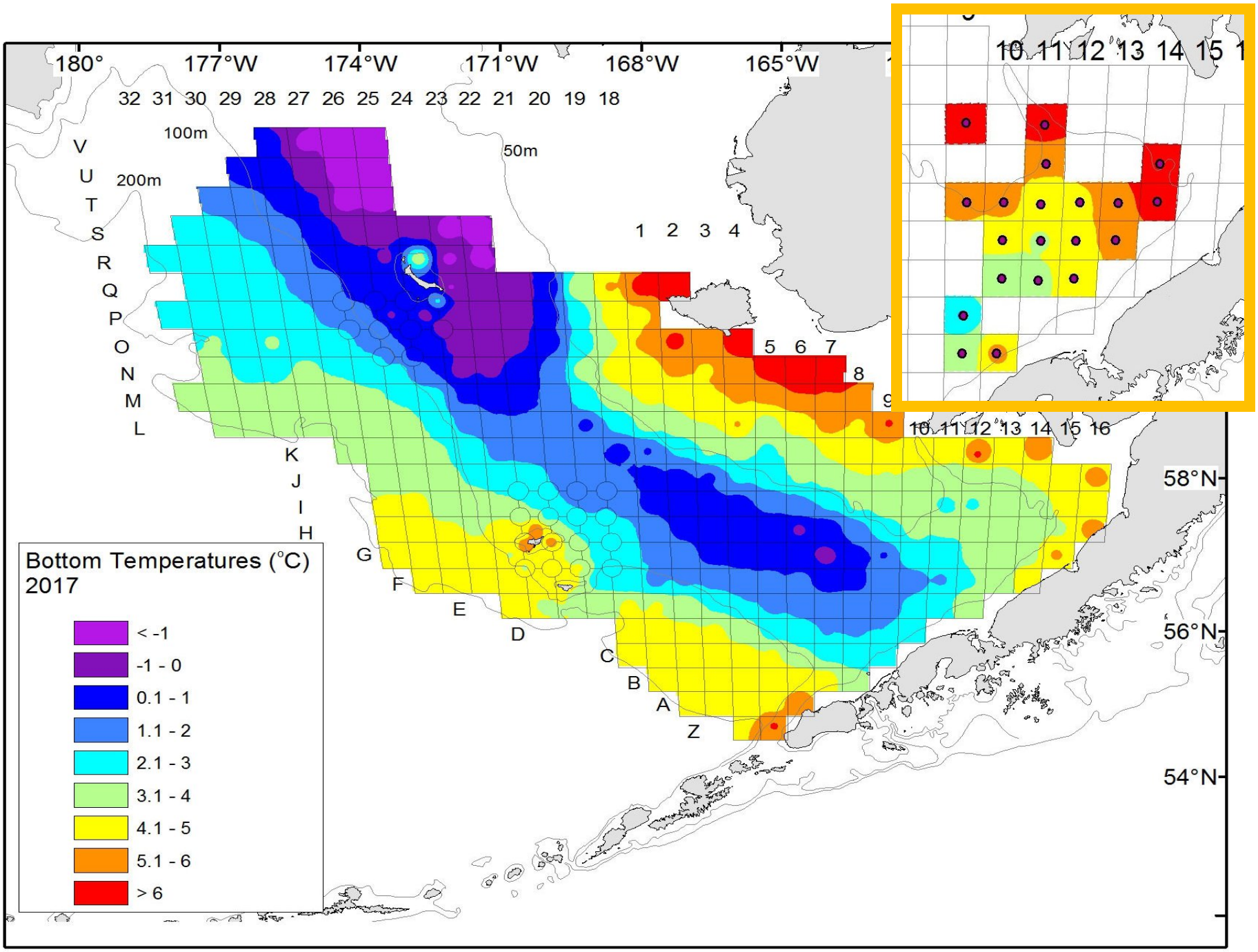

2017
Alaska


2015
Alaska

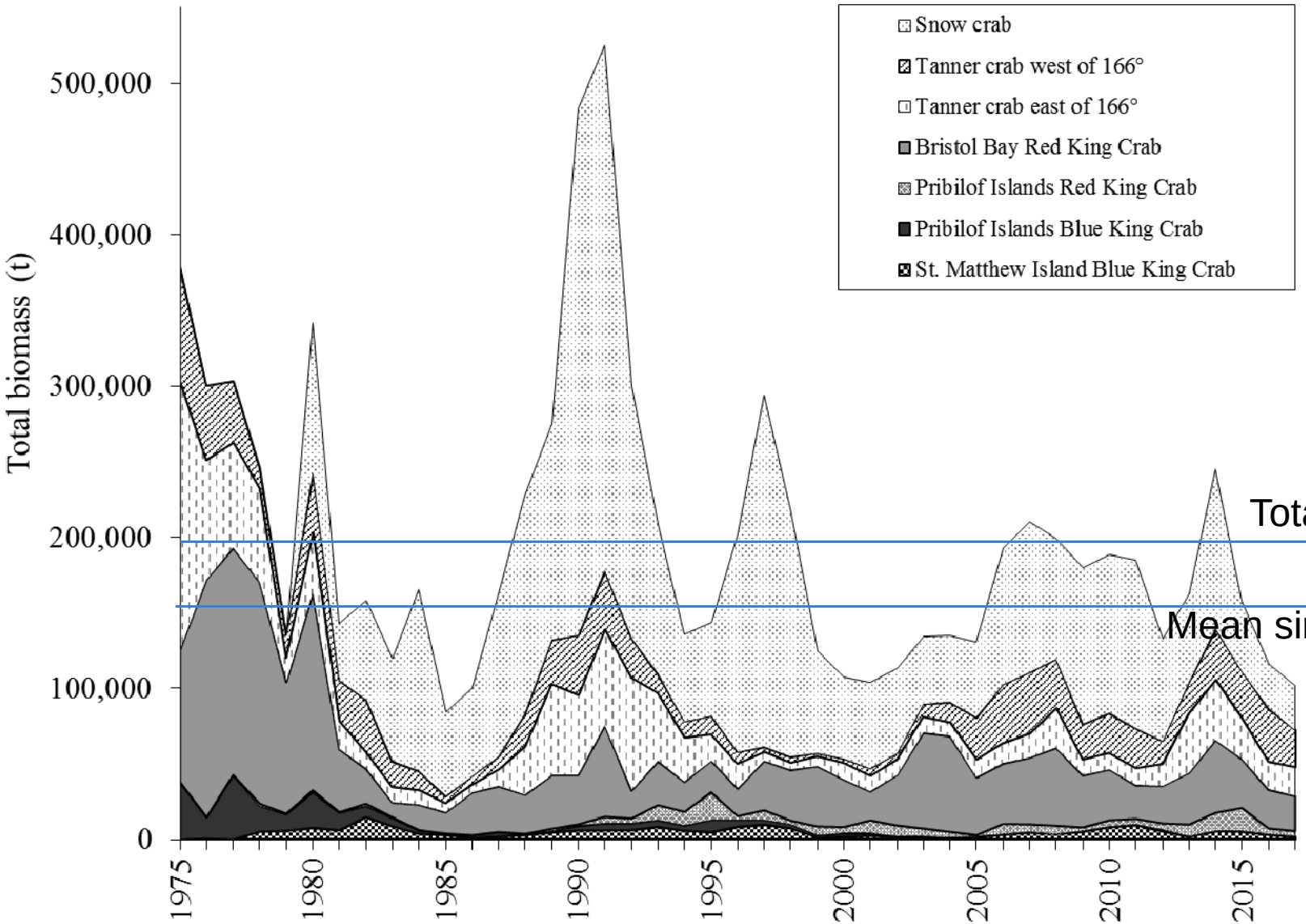

2014
Alaska


2013
Alaska

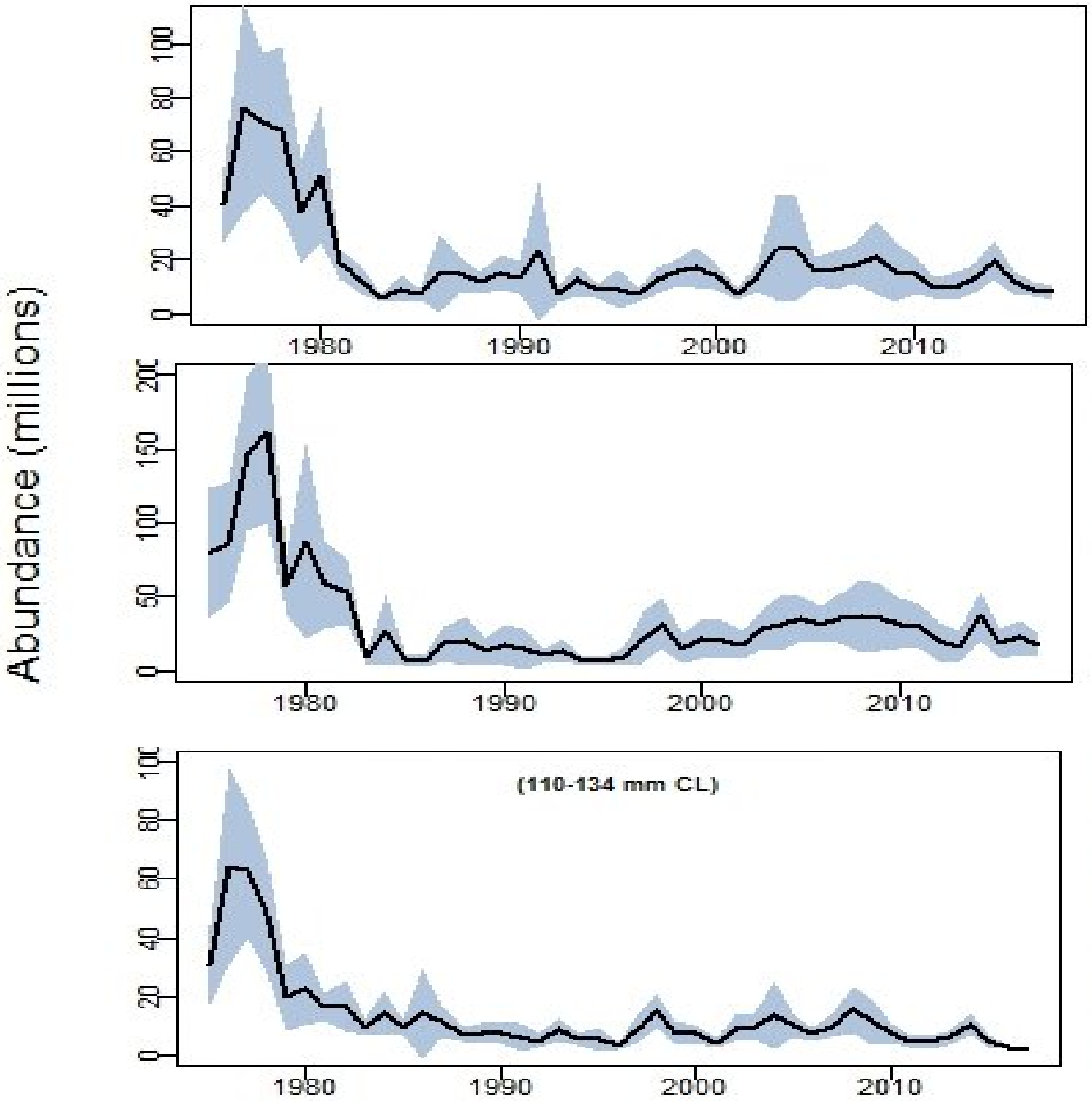

2012
Alaska


180°
177°W
174°W
171°W
168°W
165°W
58°N
56°N
54°N
100m
200m
50m
Bottom Temperatures (°C)
2017
< -1
-1 - 0
0.1 - 1
1.1 - 2
2.1 - 3
3.1 - 4
4.1 - 5
5.1 - 6
> 6

Mature male biomass



Bristol Bay red king crab



Mature male

-9%

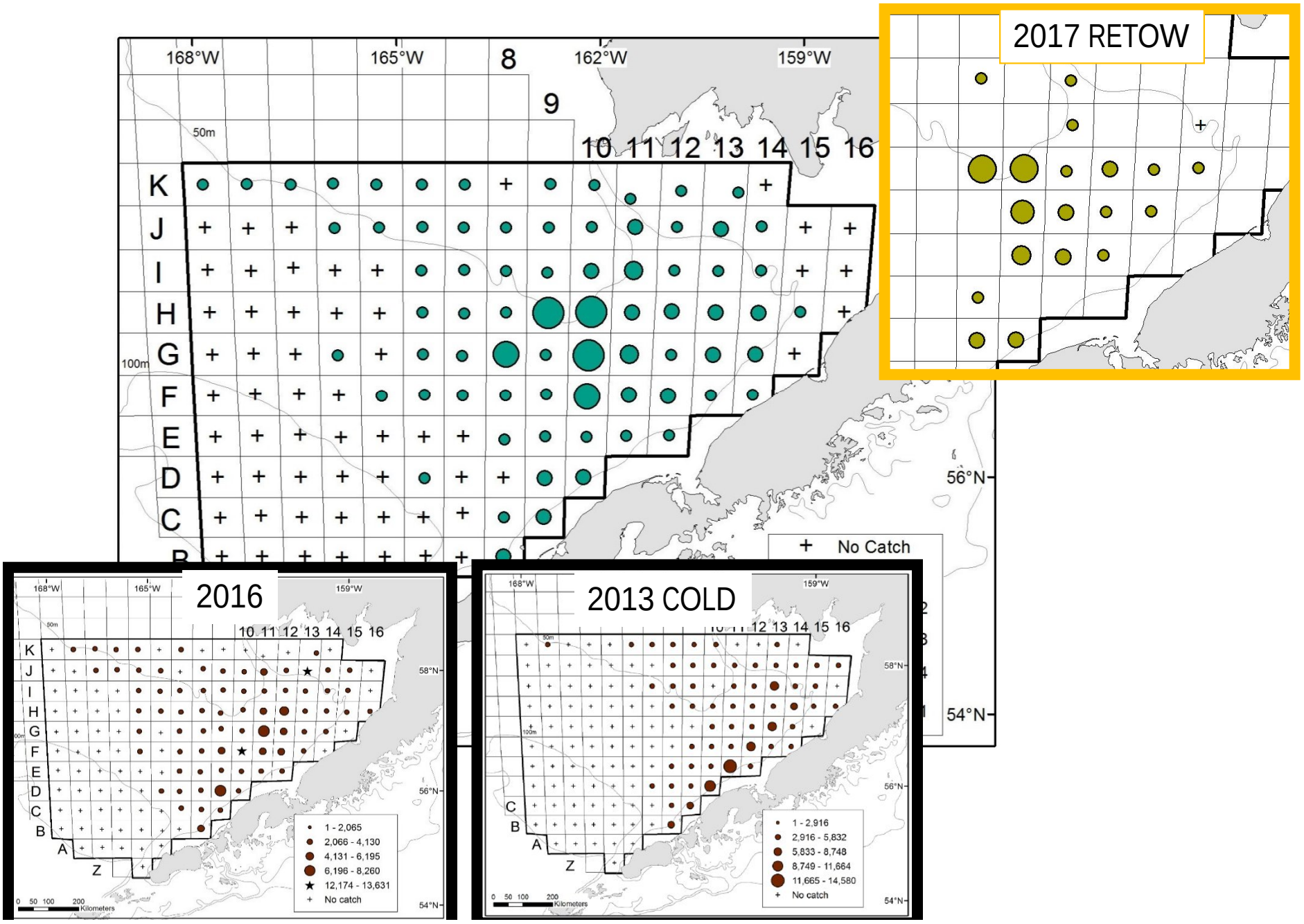
Mature females

-21%

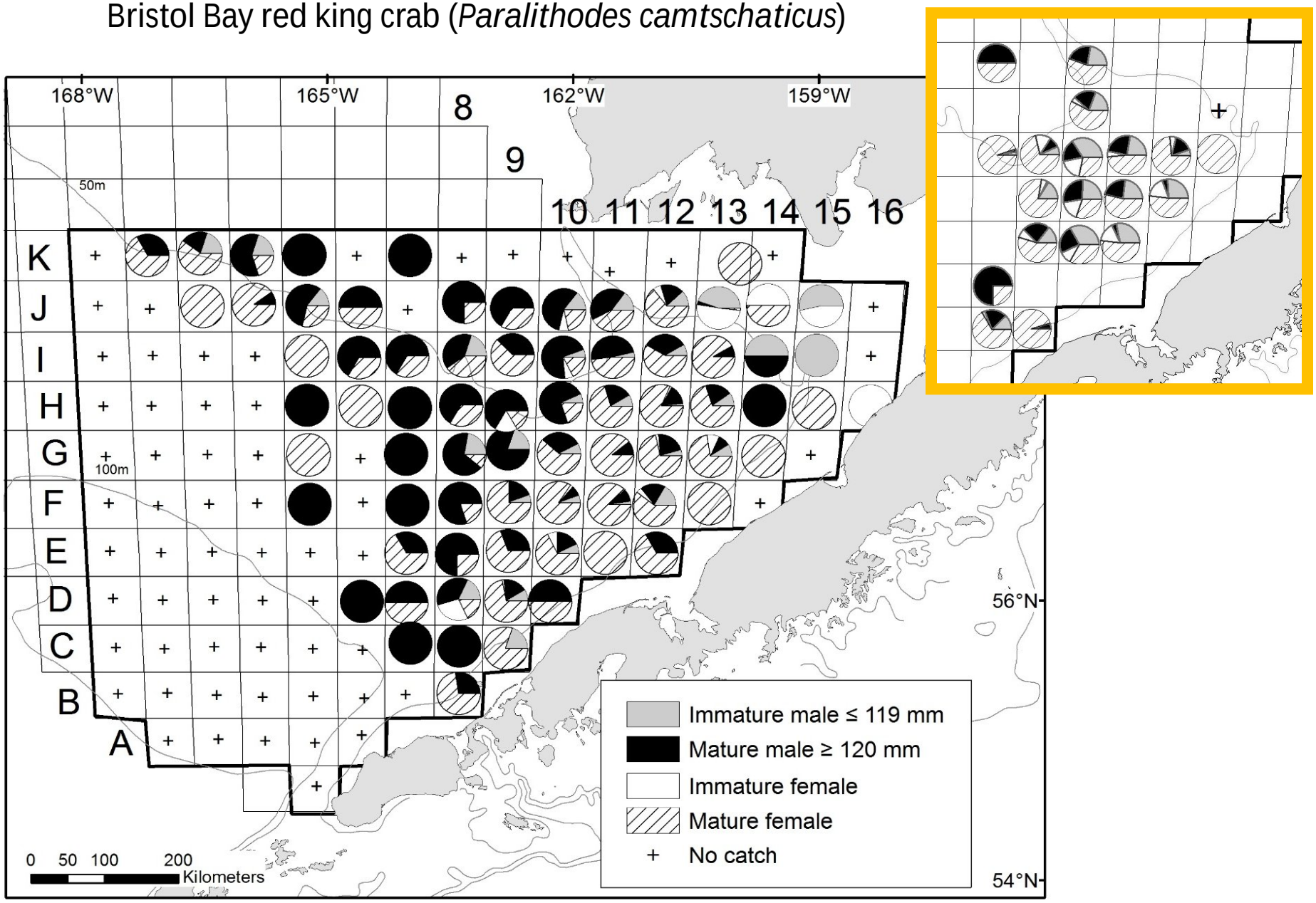
Juveniles

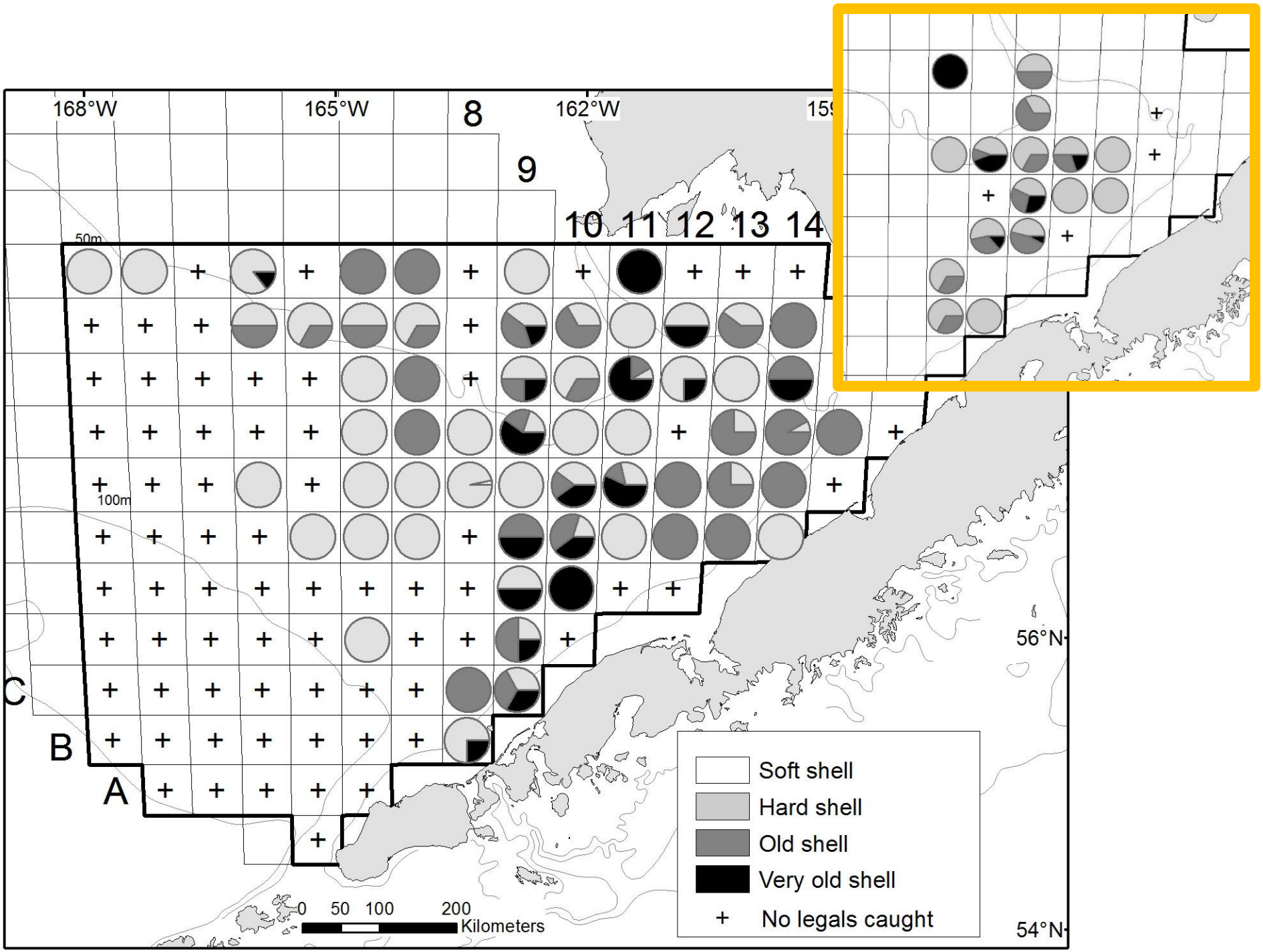
Male +8%
Female +55%

Bristol Bay red king crab total density

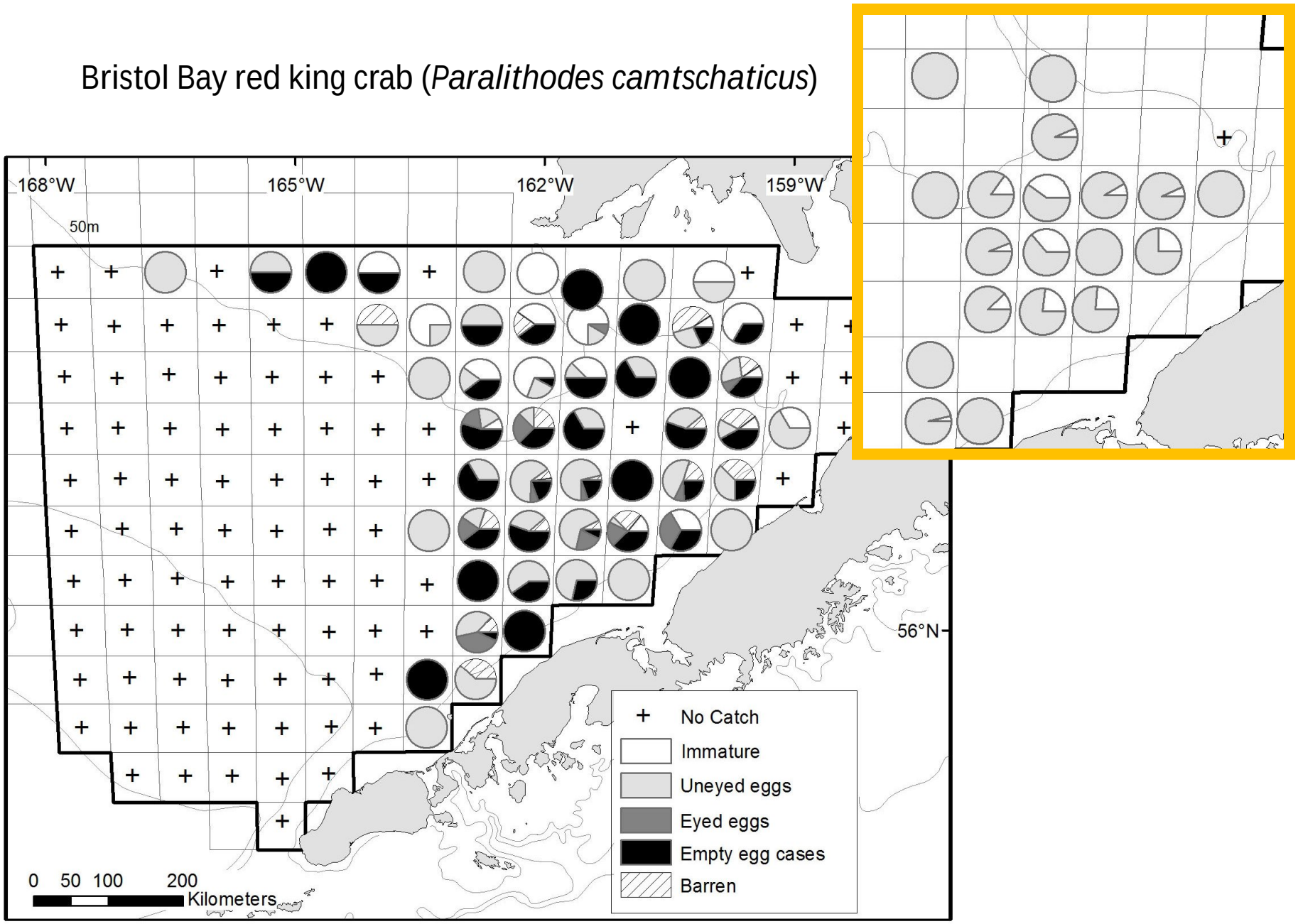


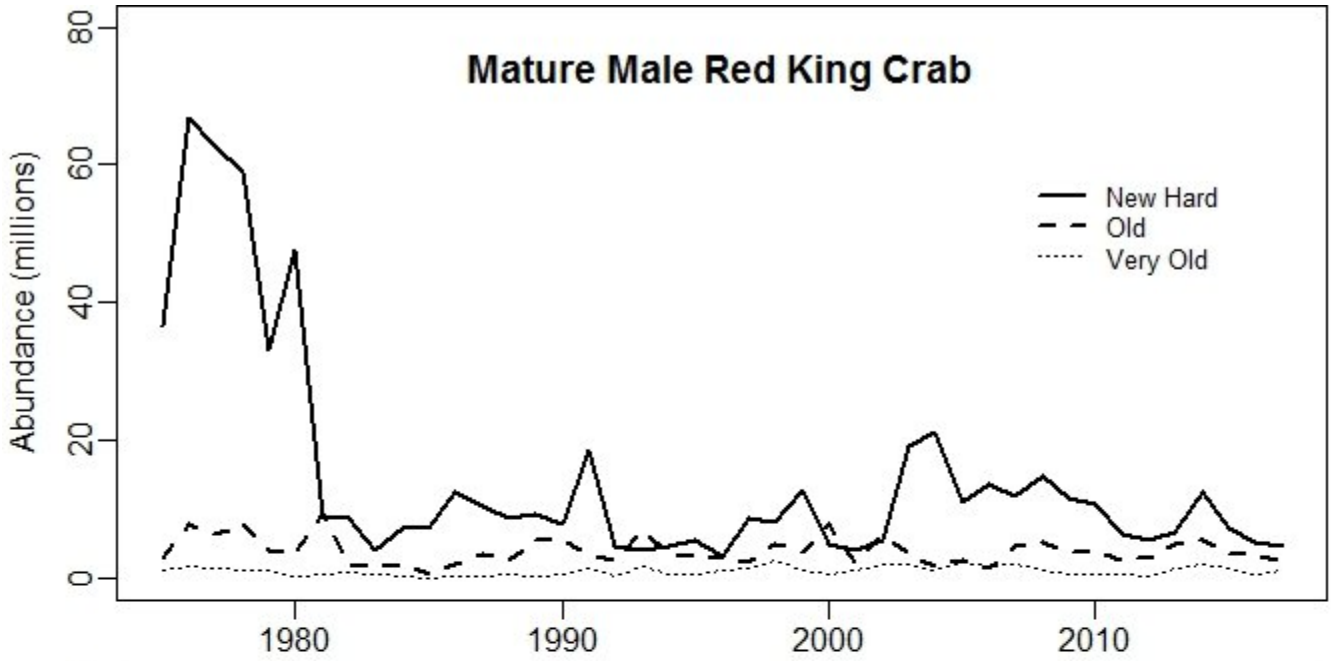
Bristol Bay red king crab (*Paralithodes camtschaticus*)

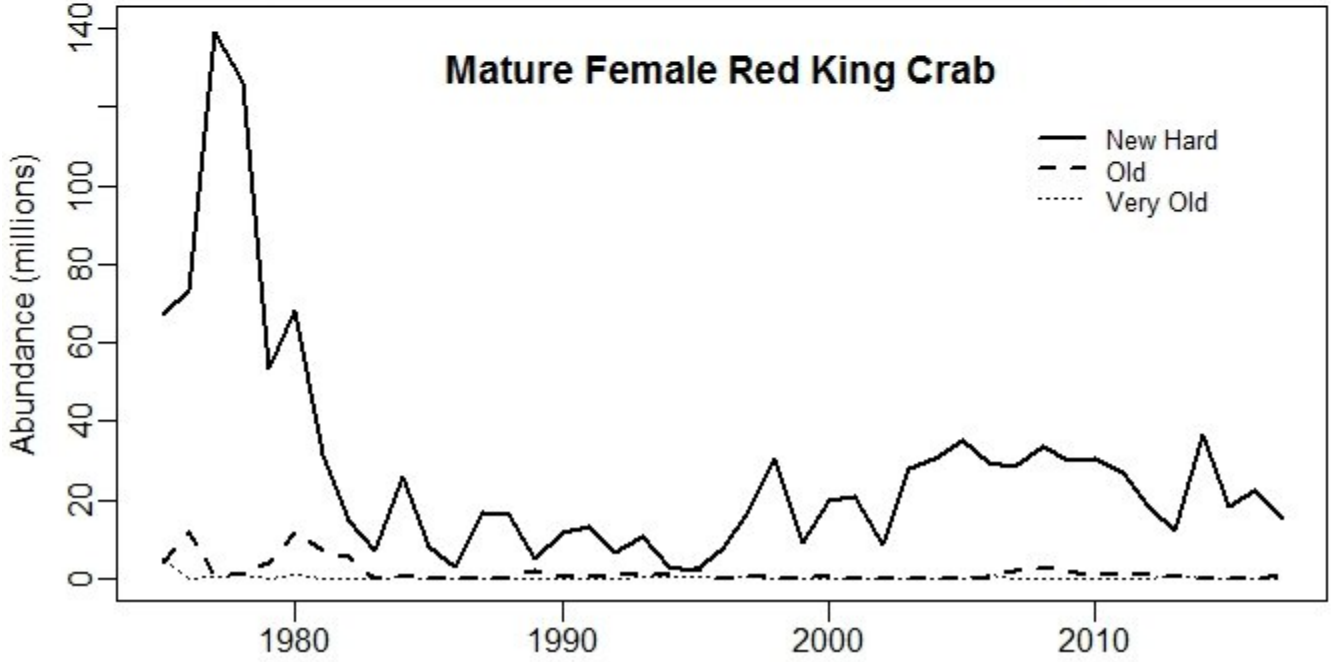


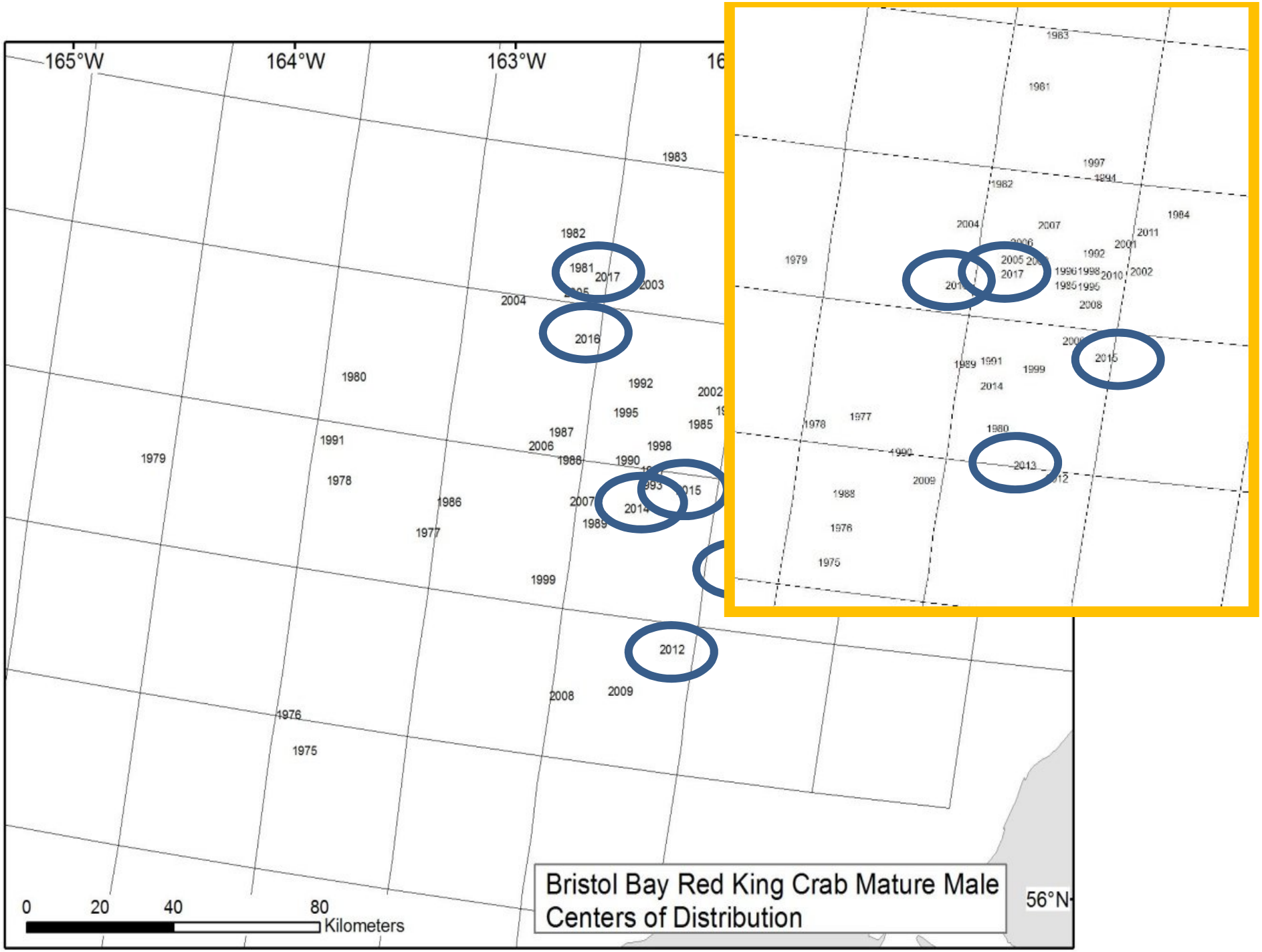

168°W
165°W
162°W
8
9
10
11
12
13
14
50m
100m
A
B
C
56°N
54°N
0 50 100 200
Kilometers
Soft shell
Hard shell
Old shell
Very old shell
+ No legals caught

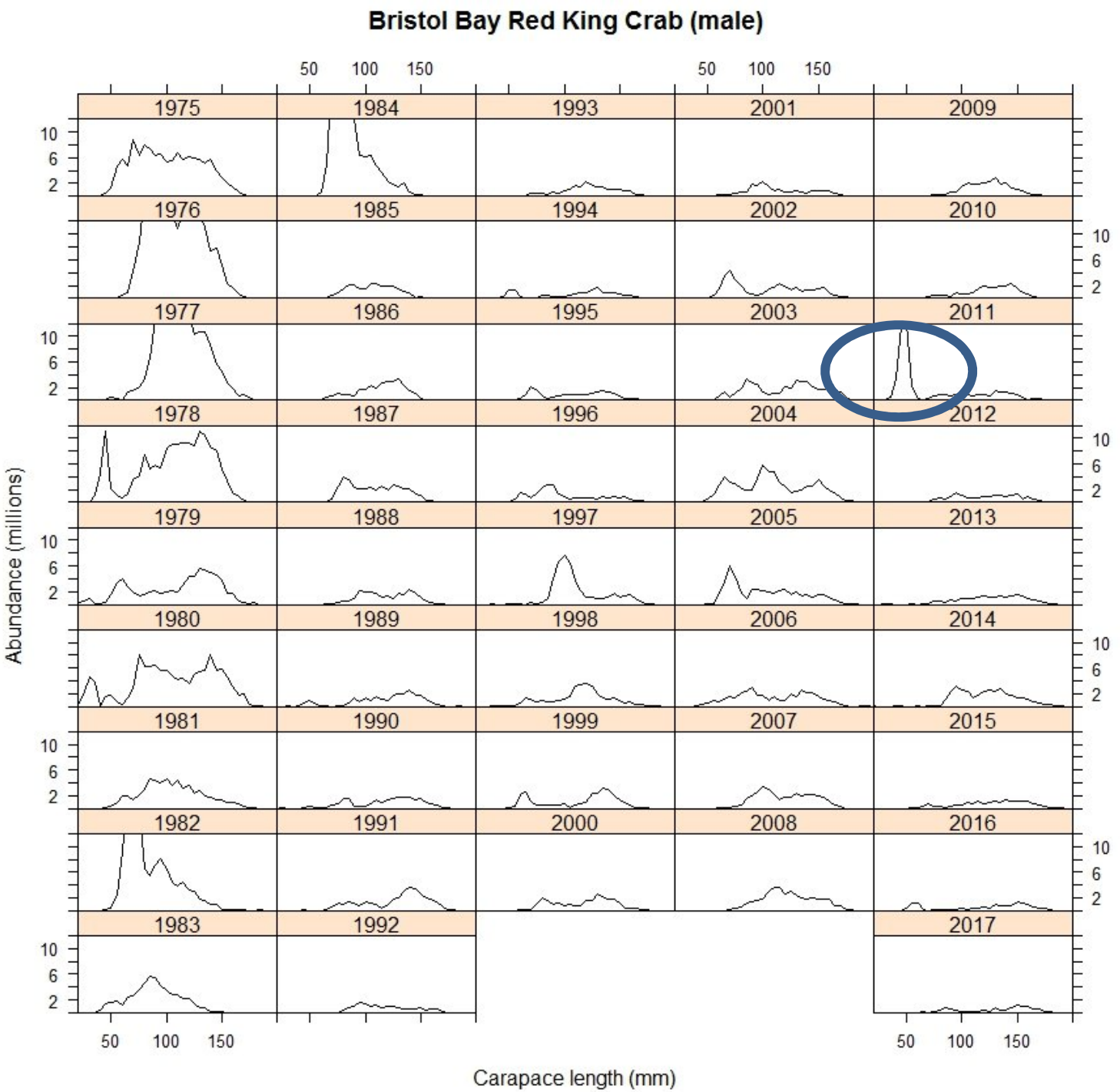
Bristol Bay red king crab (*Paralithodes camtschaticus*)

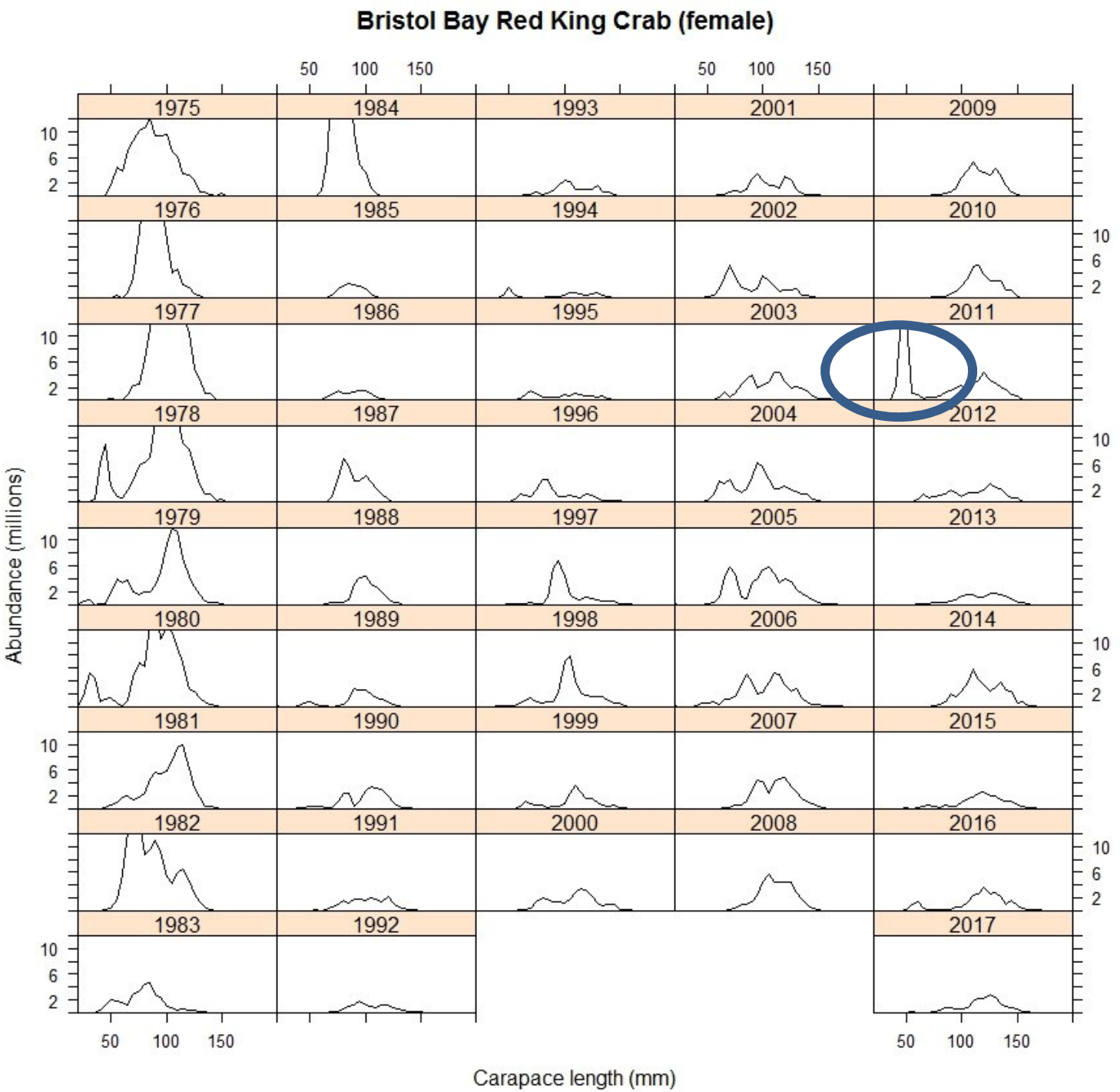


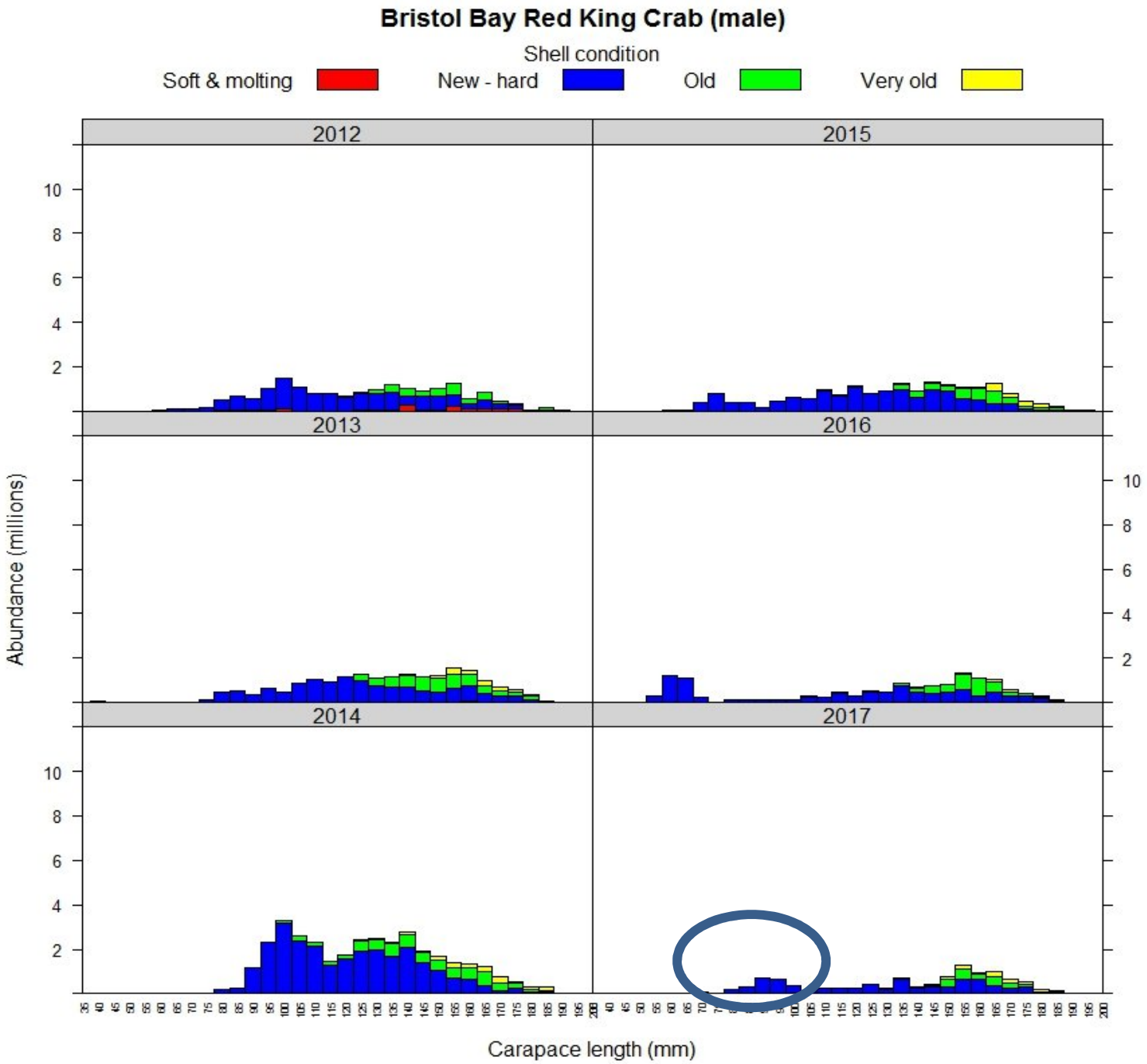

Mature Male Red King Crab
Abundance (millions)
0
20
40
60
80
1980
1990
2000
2010
New Hard
Old
Very Old


Mature Female Red King Crab
Abundance (millions)
0
20
40
60
80
100
140
1980
1990
2000
2010
New Hard
Old
Very Old

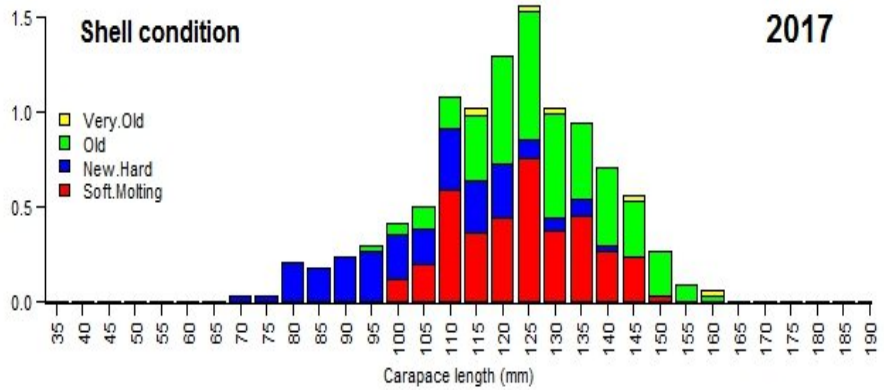

165°W
164°W
163°W
56°N
0
20
40
80
Kilometers
Bristol Bay Red King Crab Mature Male
Centers of Distribution

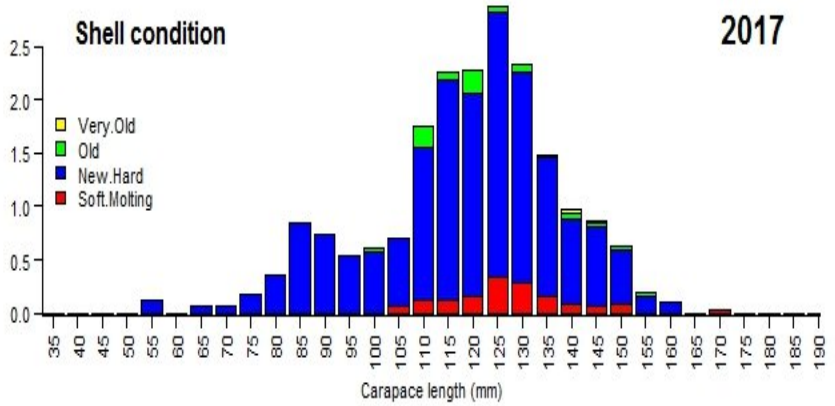

Bristol Bay Red King Crab (male)
1975
1984
1993
2001
2009
1976
1985
1994
2002
2010
1977
1986
1995
2003
2011
1978
1987
1996
2004
2012
1979
1988
1997
2005
2013
1980
1989
1998
2006
2014
1981
1990
1999
2007
2015
1982
1991
2000
2008
2016
1983
1992
2017
50
100
150
10
6
2
Abundance (millions)
Carapace length (mm)

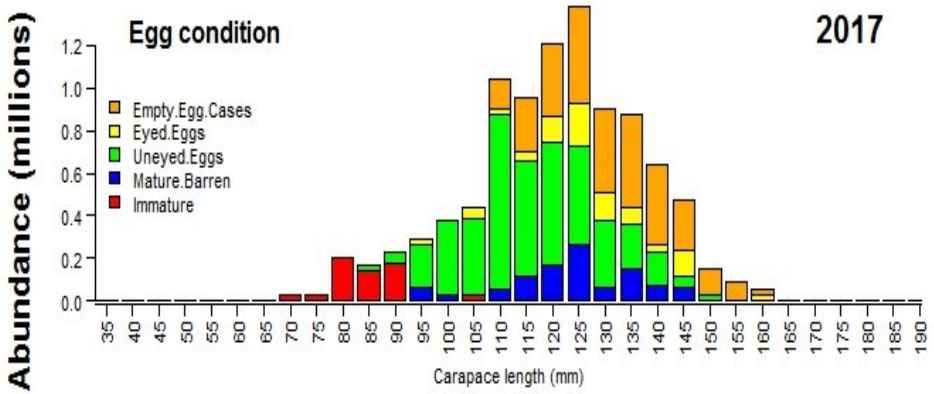

Bristol Bay Red King Crab (female)
1975
1984
1993
2001
2009
1976
1985
1994
2002
2010
1977
1986
1995
2003
2011
1978
1987
1996
2004
2012
1979
1988
1997
2005
2013
1980
1989
1998
2006
2014
1981
1990
1999
2007
2015
1982
1991
2000
2008
2016
1983
1992
2017
50
100
150
10
6
2
Abundance (millions)
Carapace length (mm)

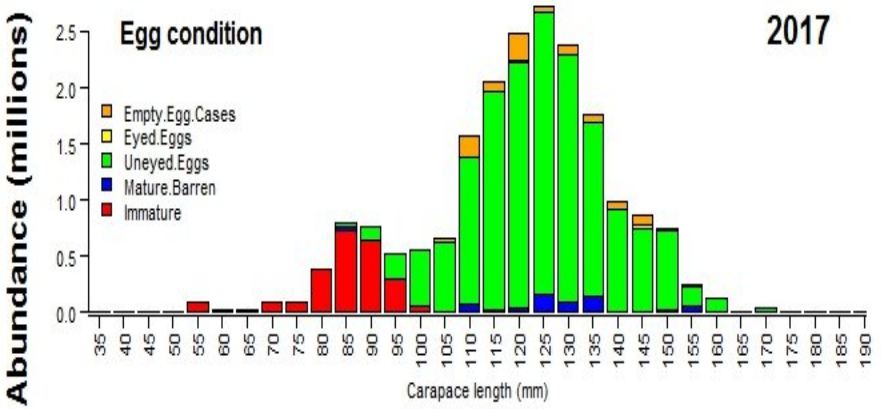

Bristol Bay Red King Crab (male)
Shell condition
Soft & molting
New - hard
Old
Very old
2012
2015
2013
2016
2014
2017
Abundance (millions)
Carapace length (mm)

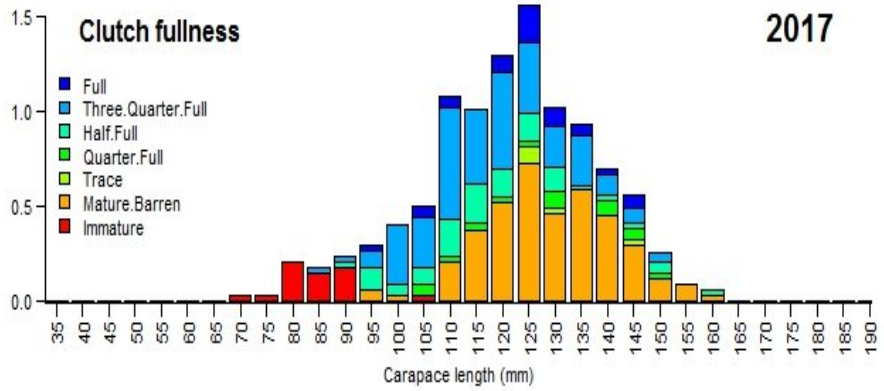
Bristol Bay red king crab

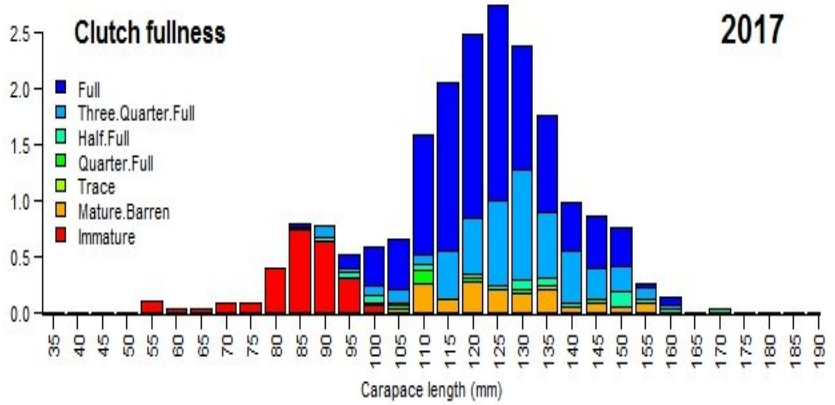




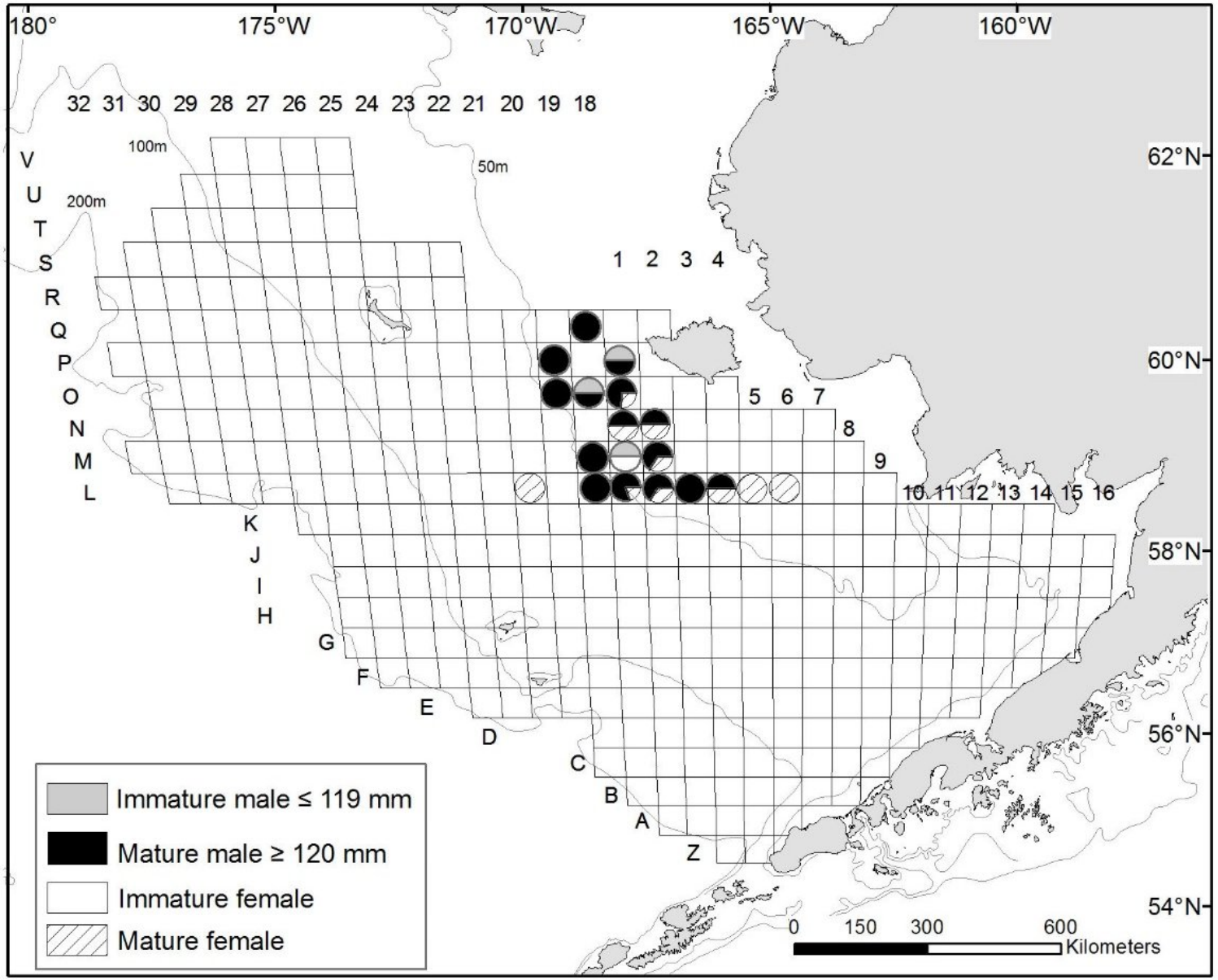


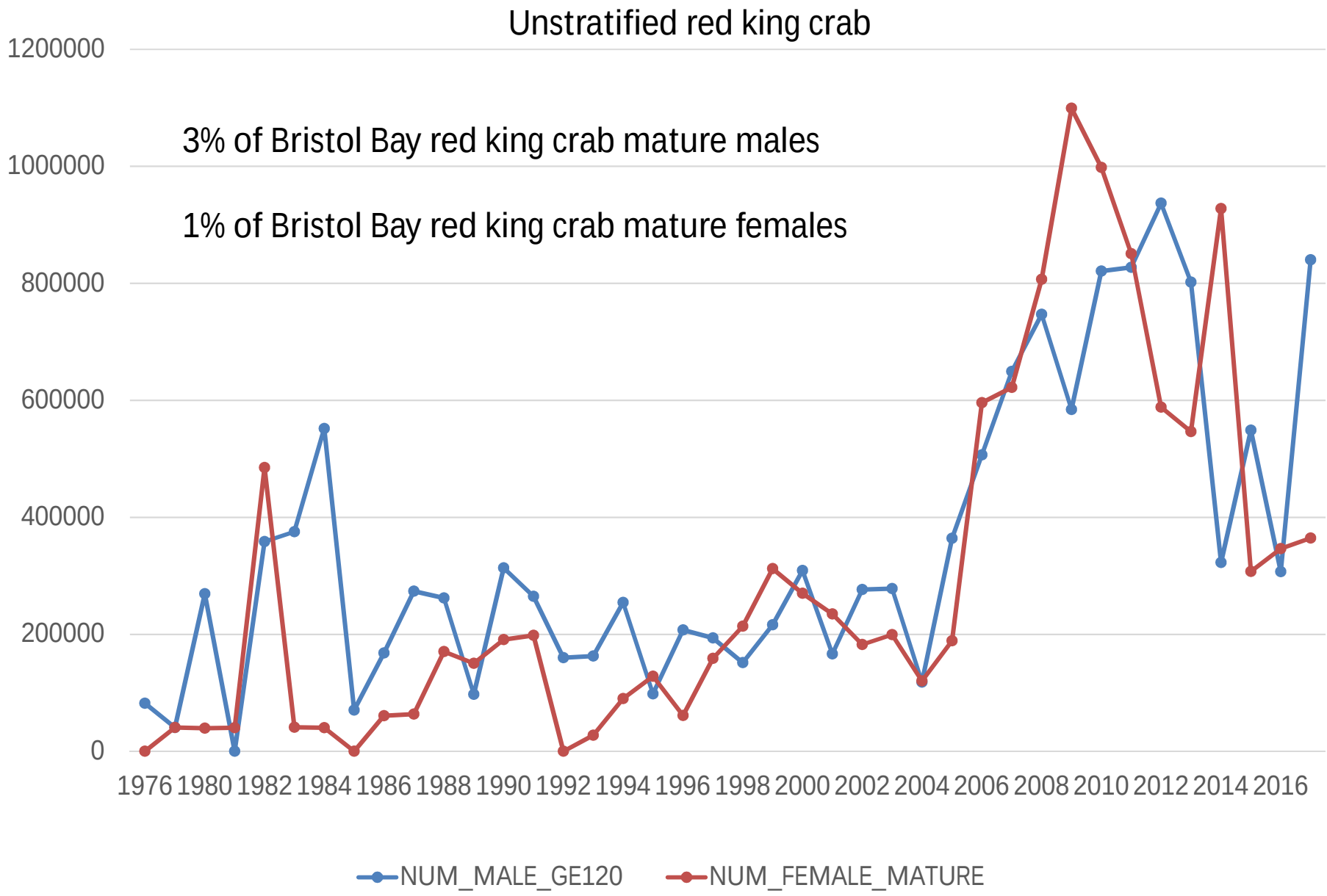


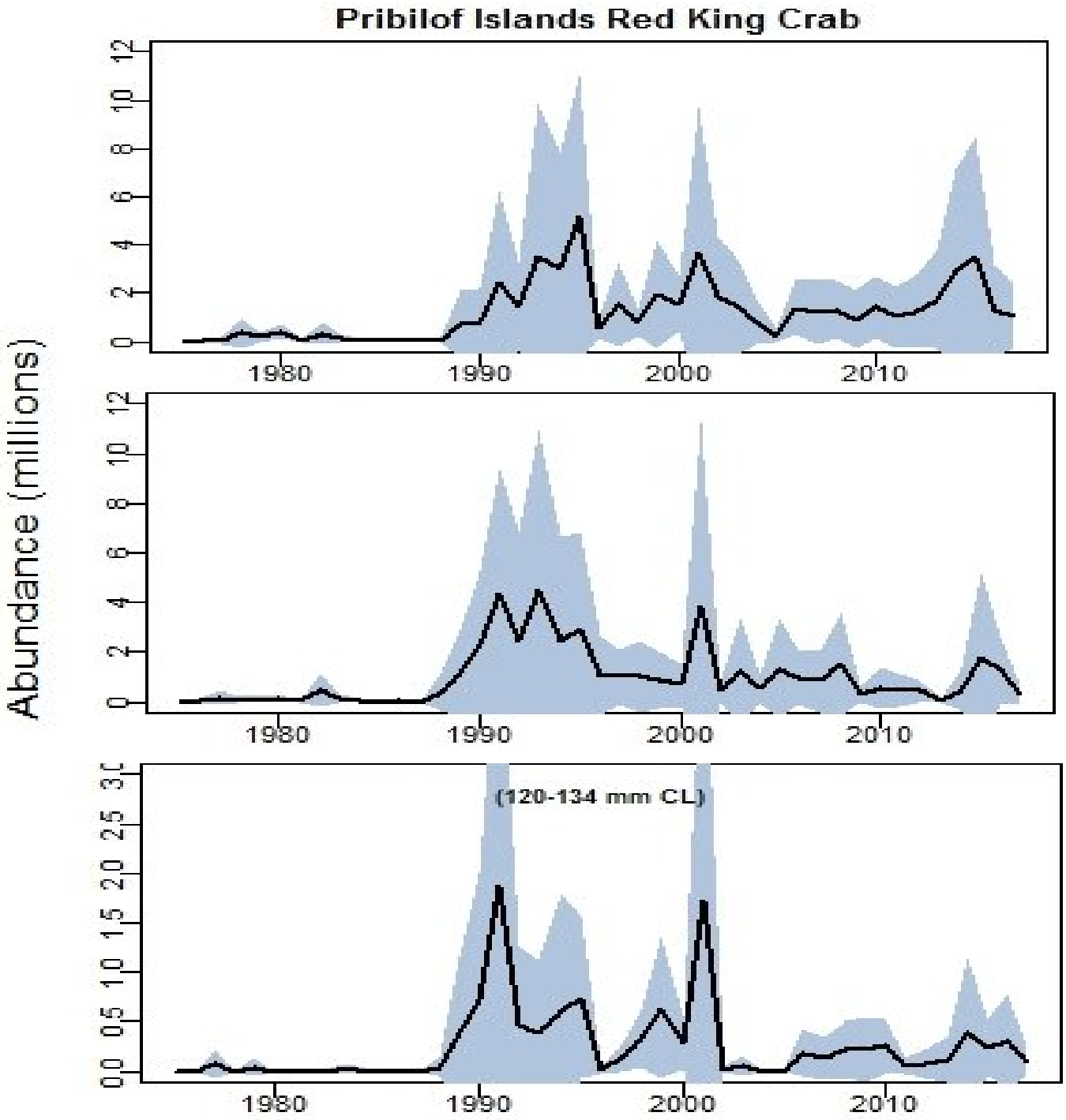




Unstratified red king crab (*Paralithodes camtschaticus*)




Unstratified red king crab
3% of Bristol Bay red king crab mature males
1% of Bristol Bay red king crab mature females
1200000
1000000
800000
600000
400000
200000
0
1976 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016
NUM_MALE_GE120
NUM_FEMALE_MATURE



Mature male

-12%

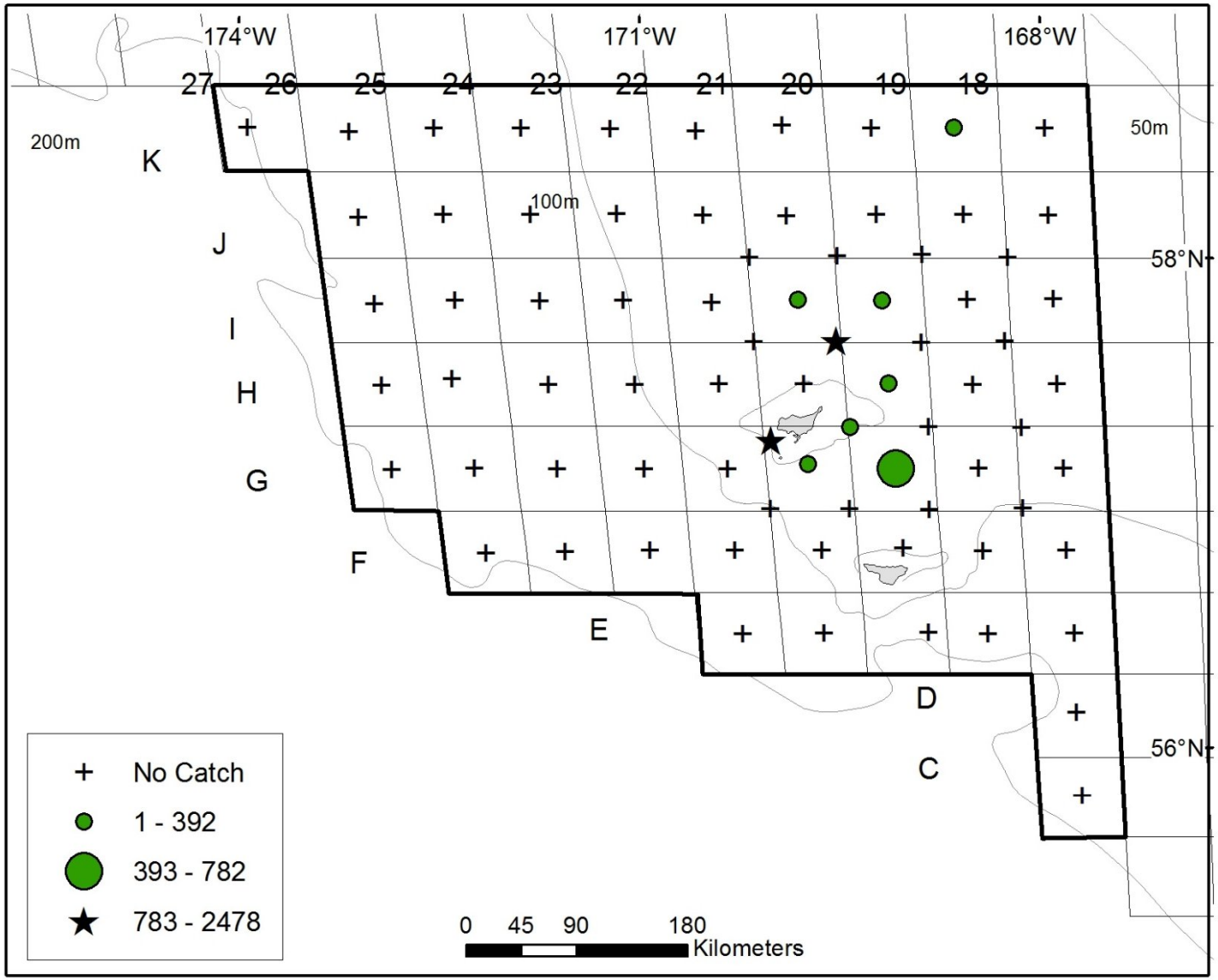
Mature females

-73%

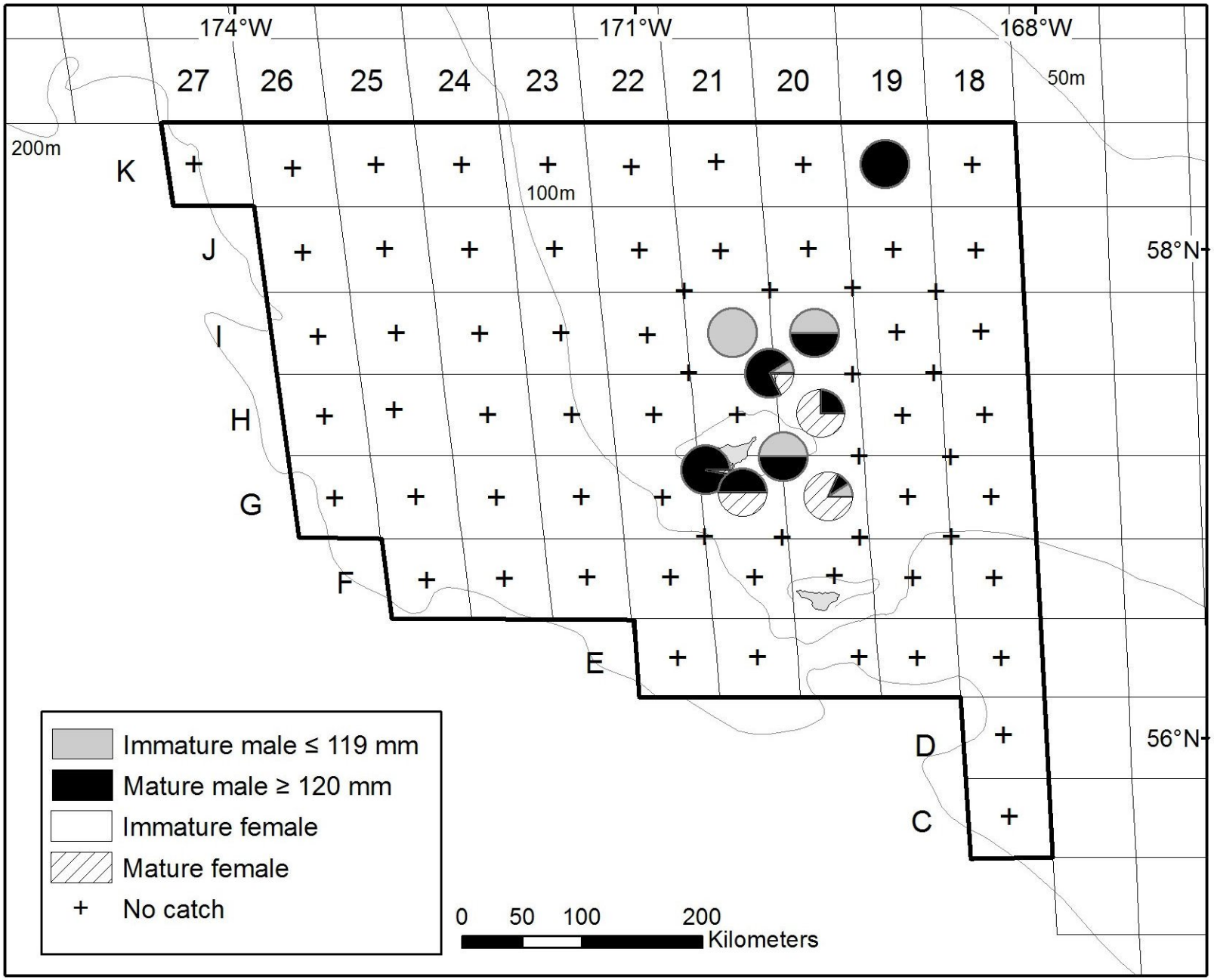
Juvenile

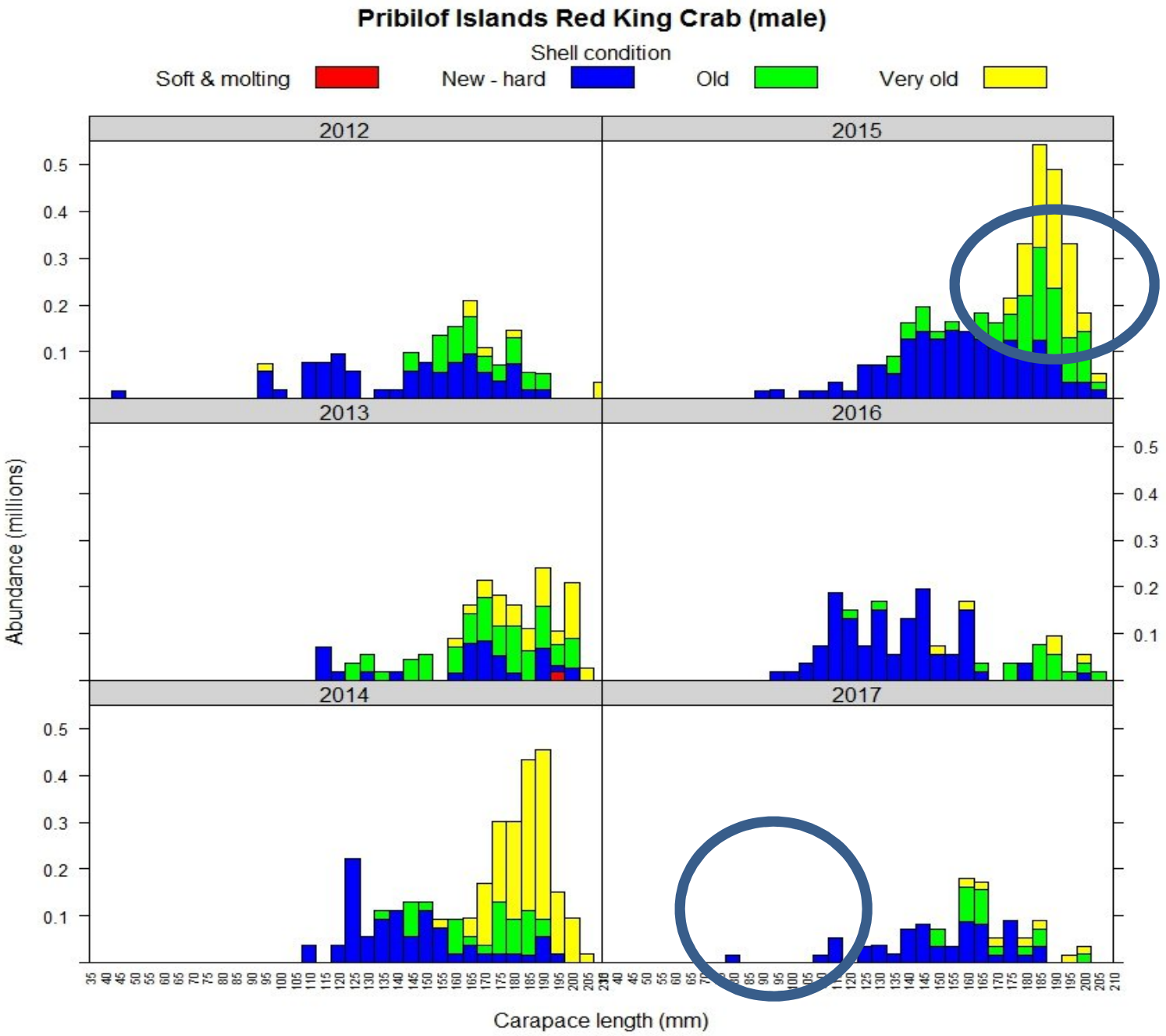
Male -83%

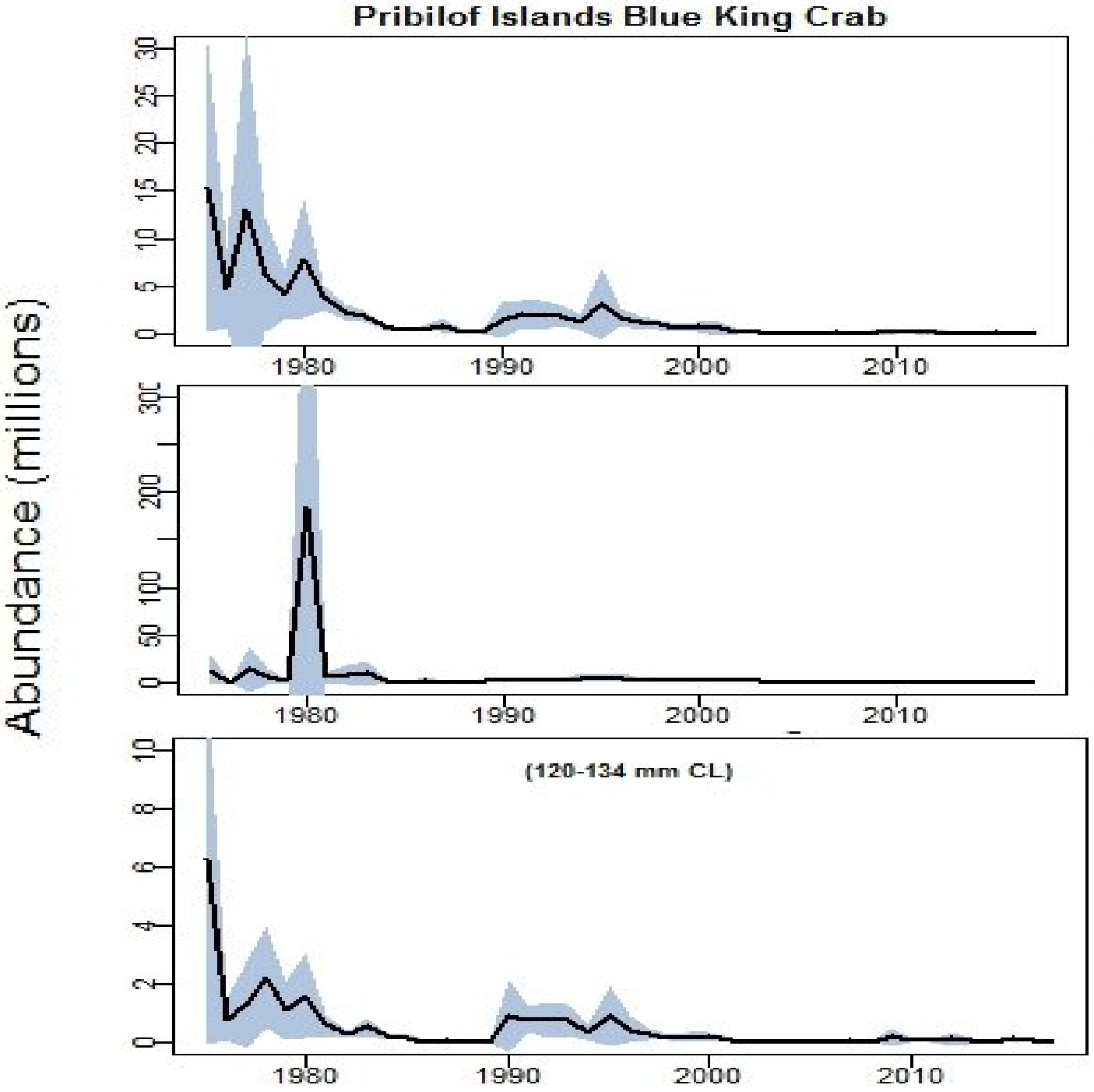
Female zero caught



88% of mature males at stars


174°W
171°W
168°W
27
26
25
24
23
22
21
20
19
18
50m
200m
100m
K
J
I
H
G
F
E
D
C
58°N
56°N
Immature male ≤ 119 mm
Mature male ≥ 120 mm
Immature female
Mature female
No catch
0
50
100
200
Kilometers


Pribilof Islands Red King Crab (male)
Shell condition
Soft & molting
New - hard
Old
Very old
2012
2015
2013
2016
2014
2017
Abundance (millions)
Carapace length (mm)



Mature male

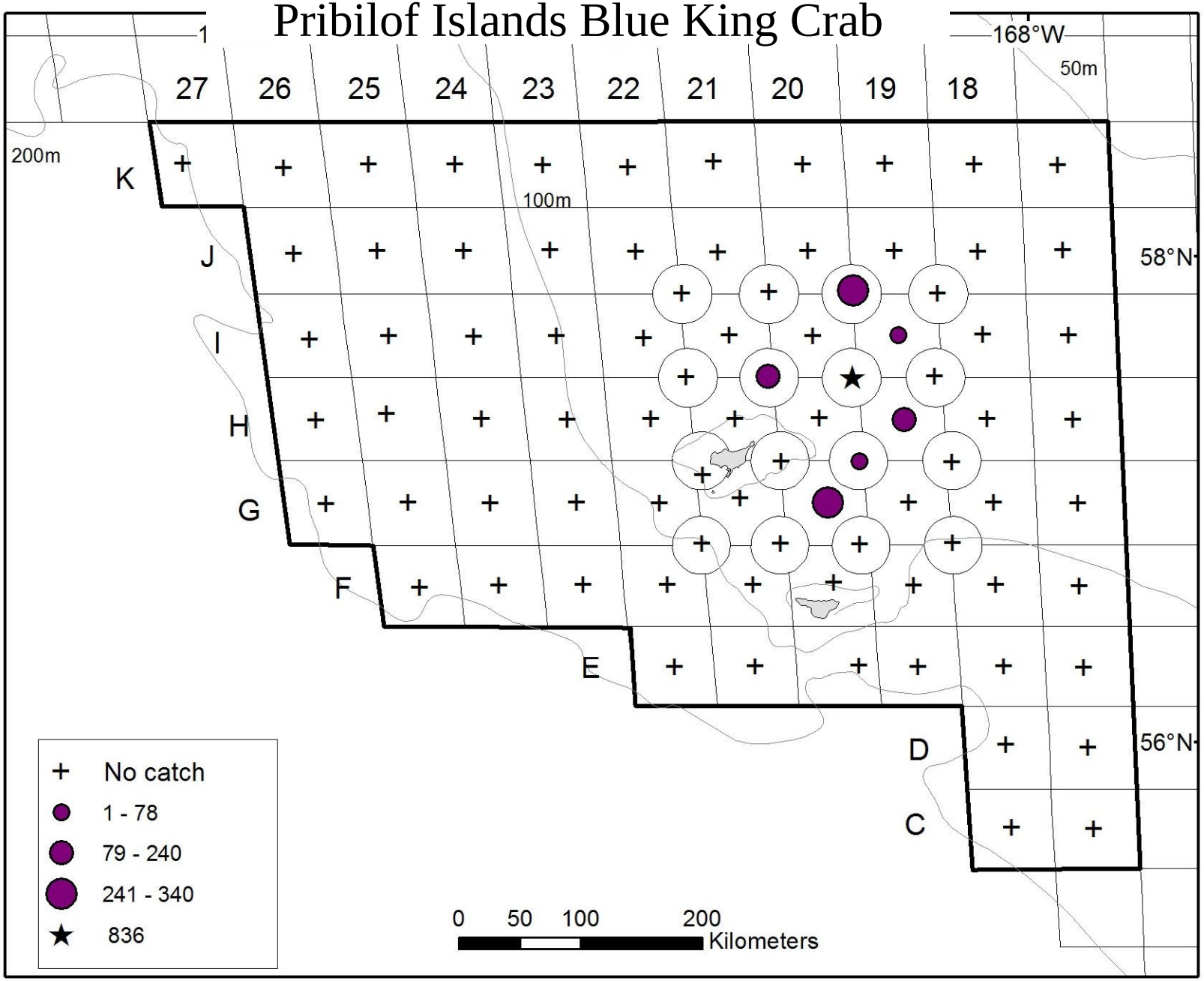
+96%

Mature female

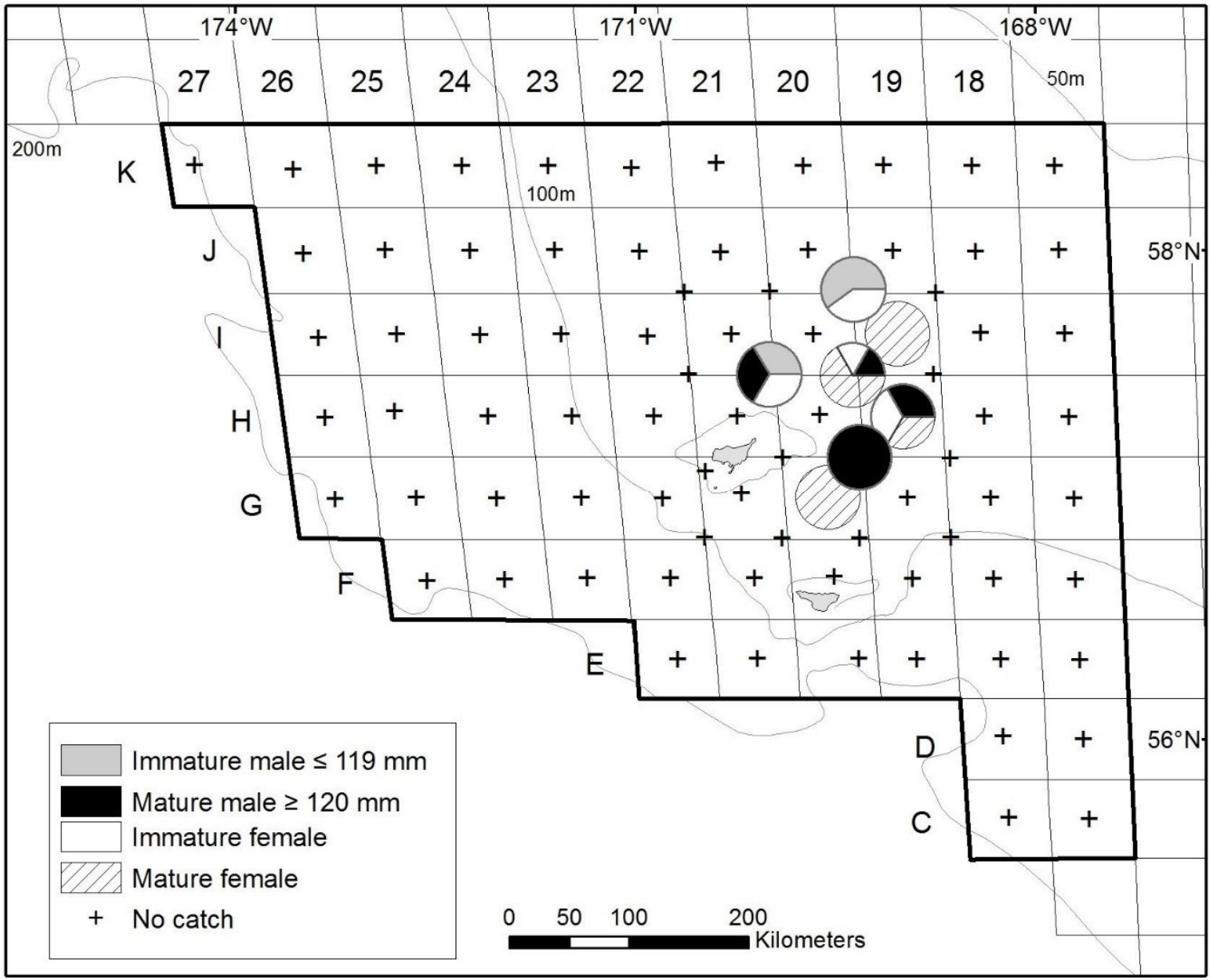
-42%

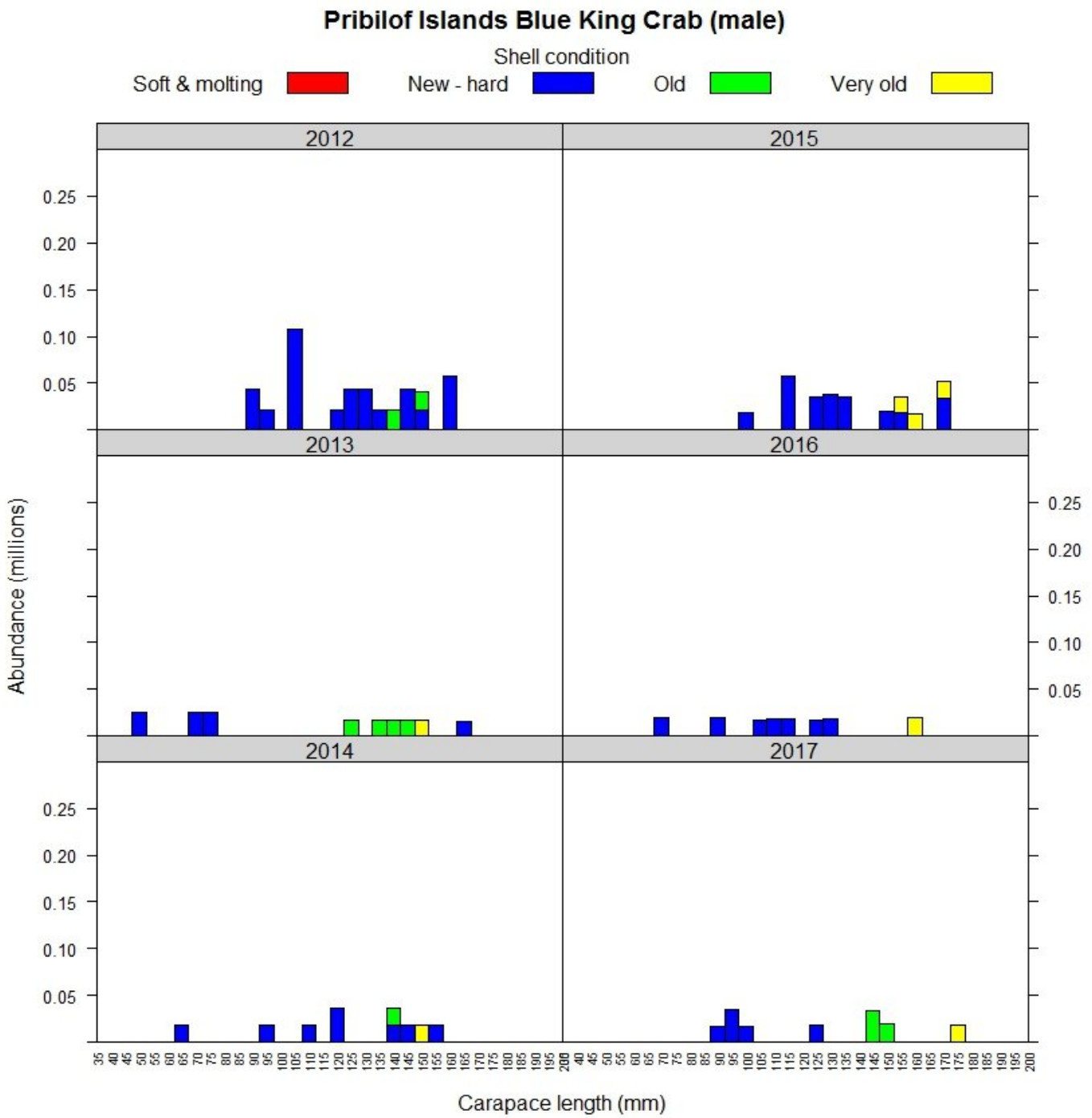
Juvenile

Male -36%
Female +12%


Pribilof Islands Blue King Crab
1
168°W
50m
27
26
25
24
23
22
21
20
19
18
200m
100m
K
J
I
H
G
F
E
D
C
58°N
56°N
No catch
1 - 78
79 - 240
241 - 340
836
0
50
100
200
Kilometers

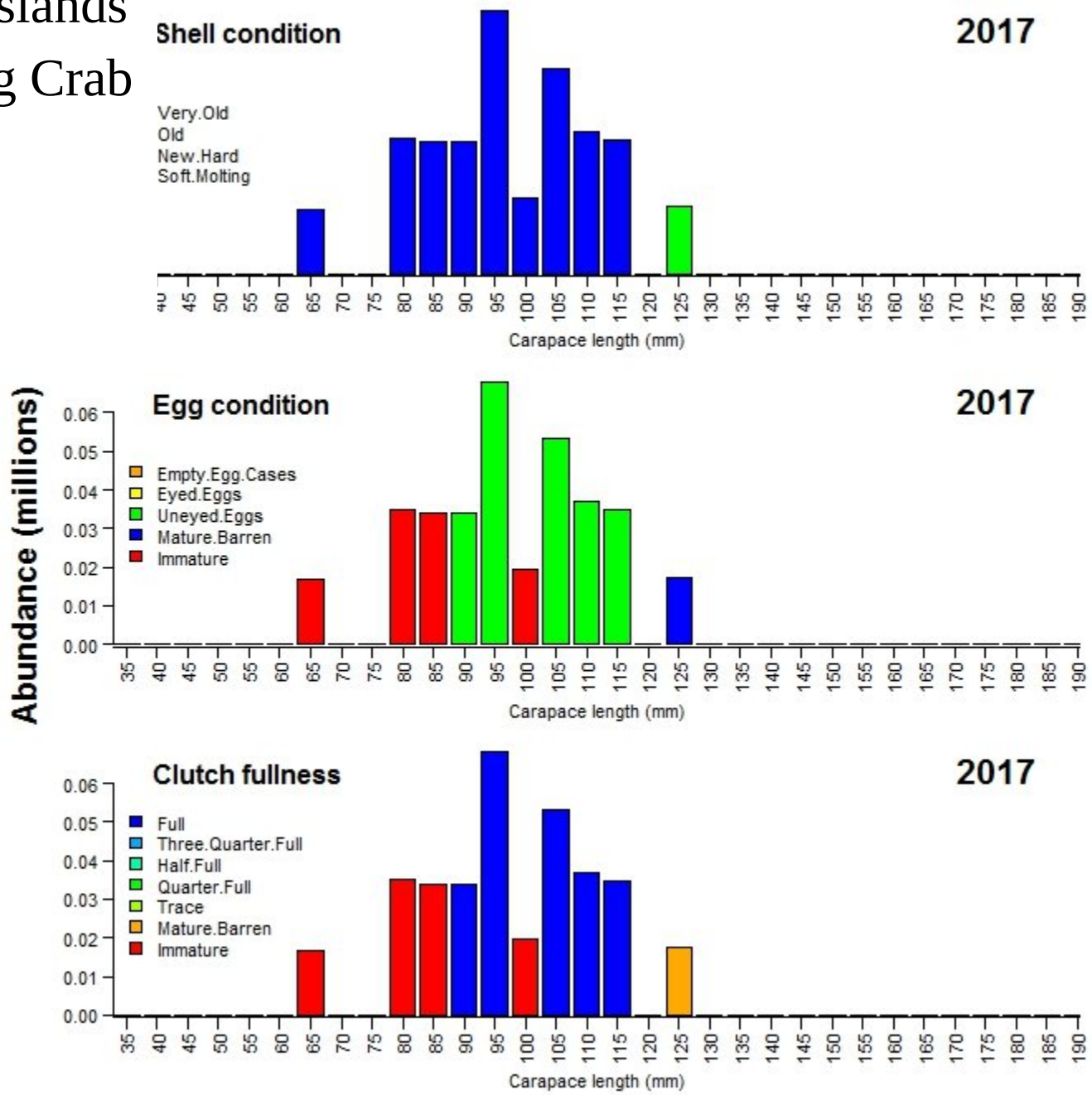
Pribilof Islands Blue King Crab

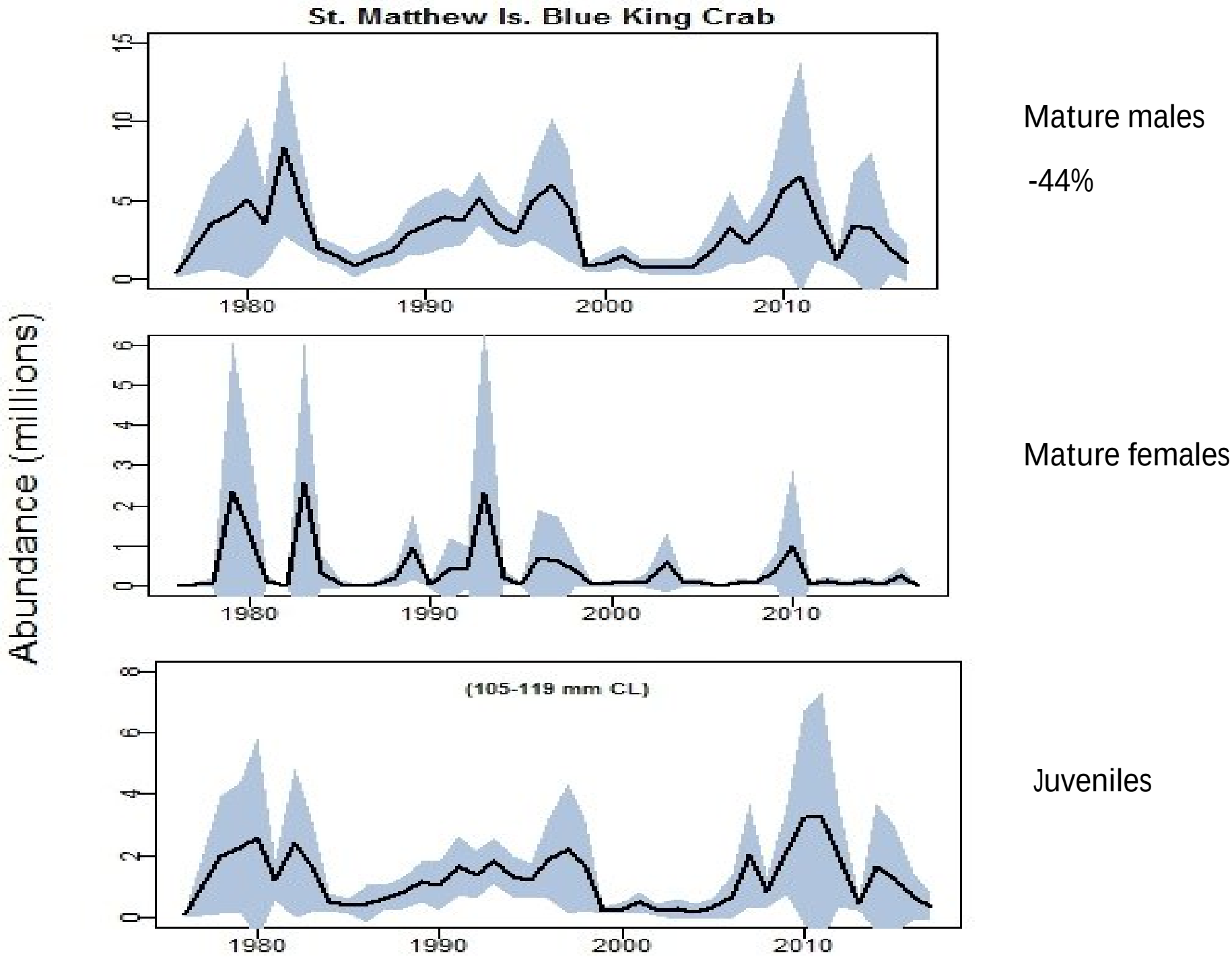



Pribilof Islands Blue King Crab (male)
Shell condition
Soft & molting
New - hard
Old
Very old
2012
2015
2013
2016
2014
2017
Abundance (millions)
0.25
0.20
0.15
0.10
0.05
Carapace length (mm)

Pribilof Islands

Blue King Crab





Mature males

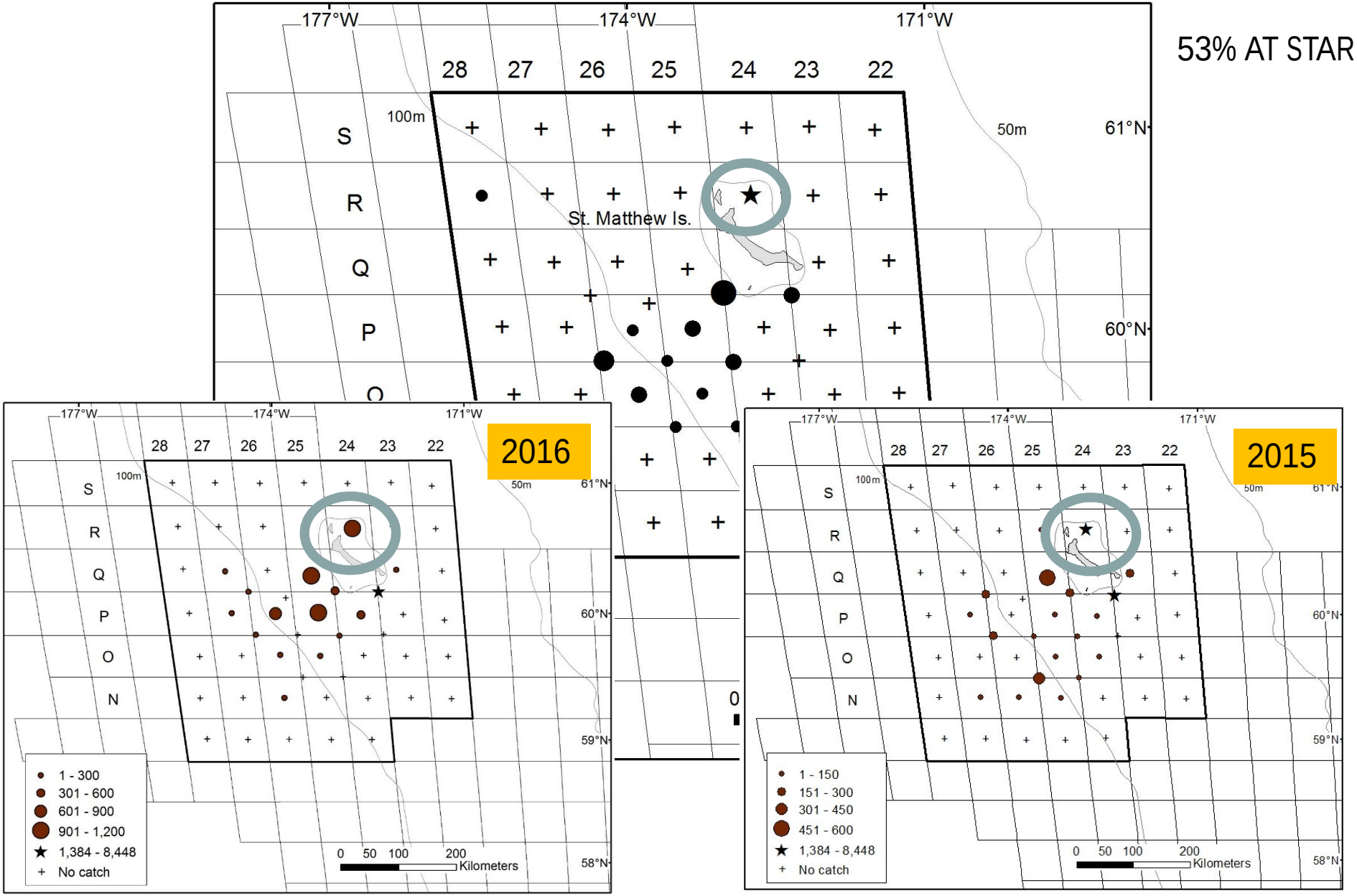
-44%

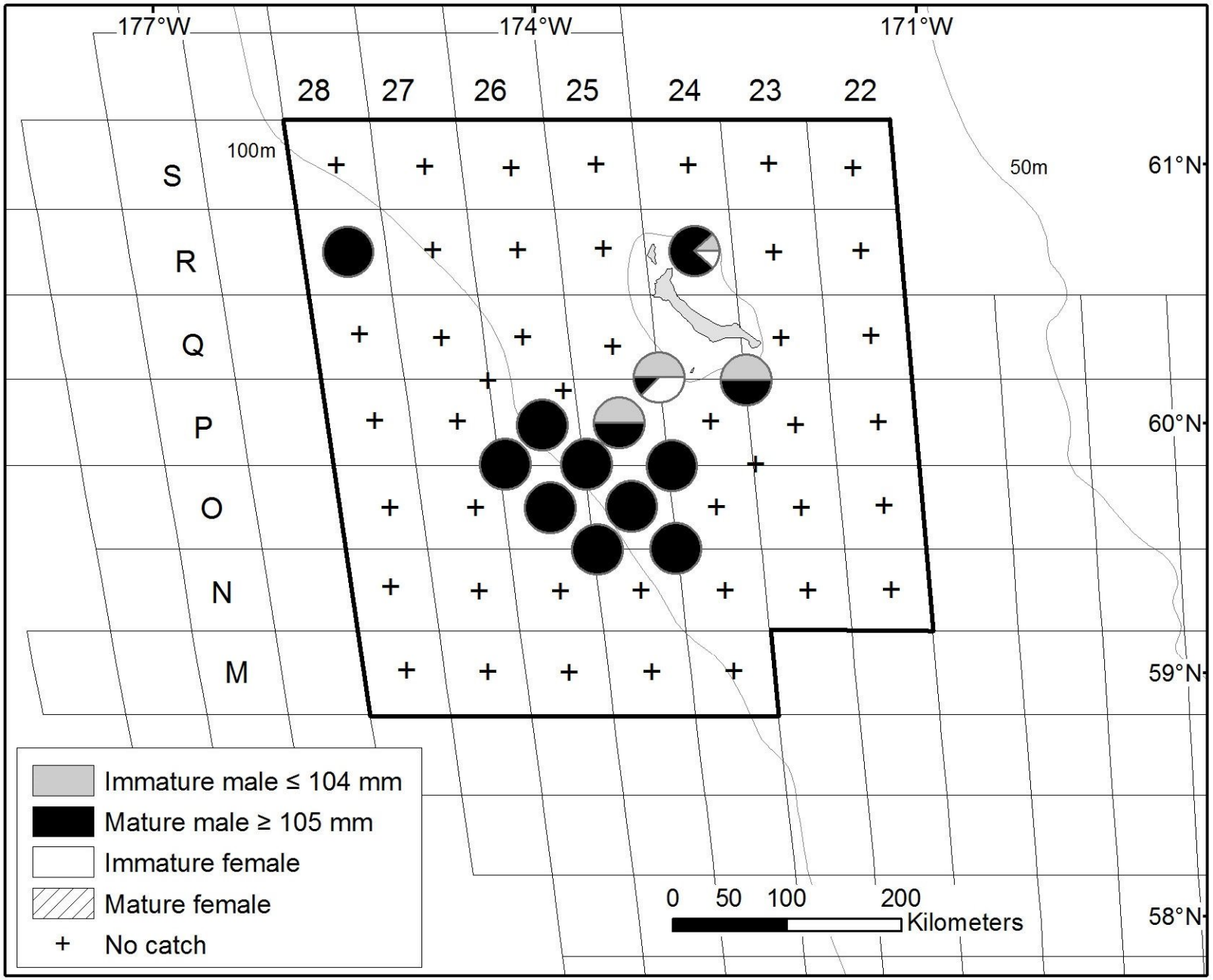
Mature females

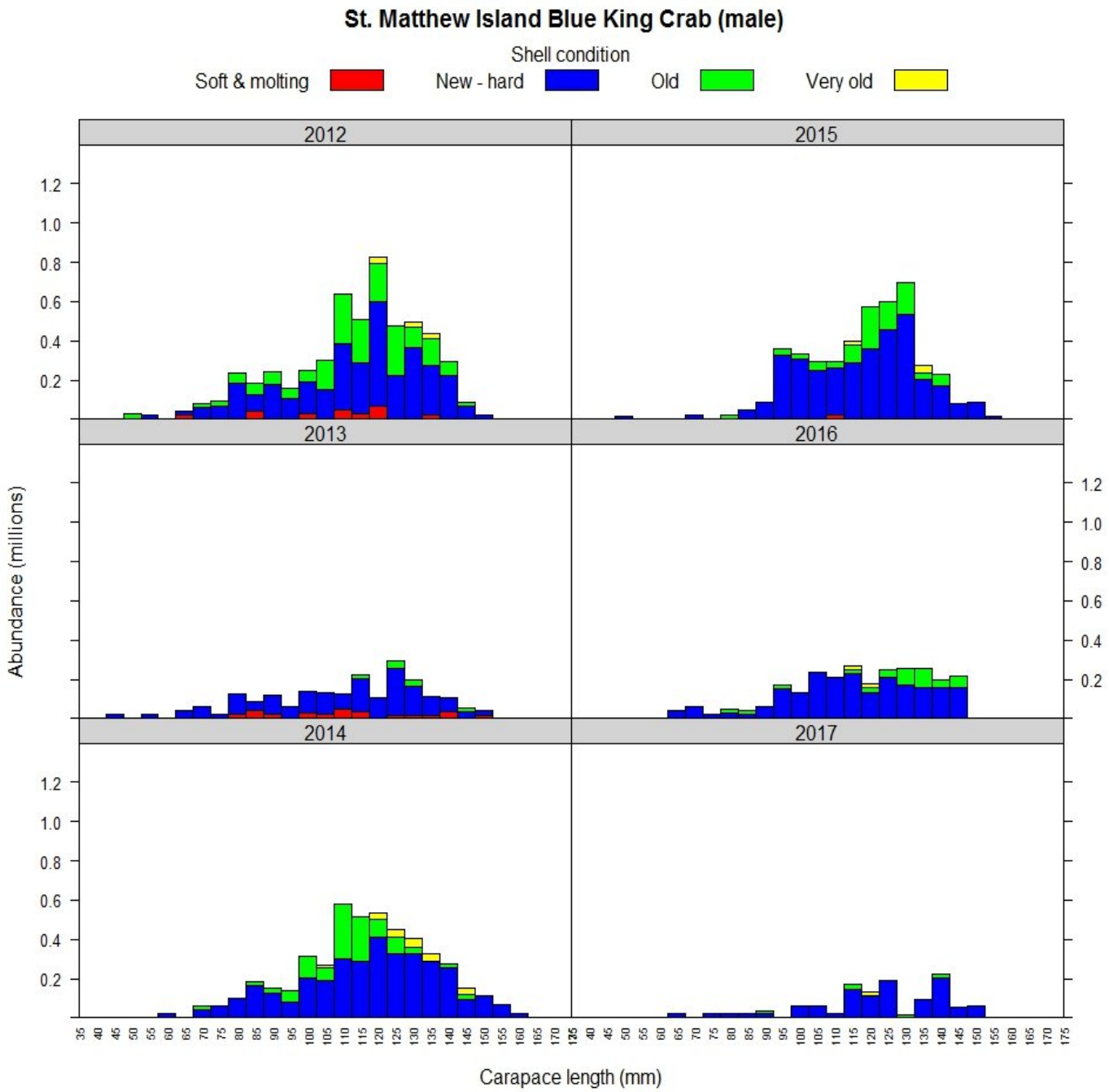
Juveniles

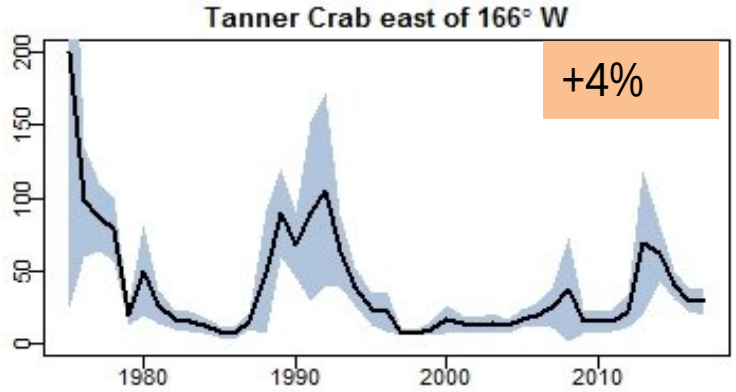
St Matthew Island
blue king crab

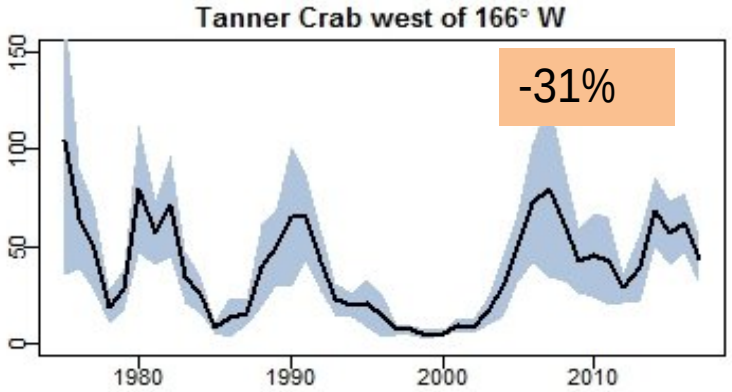
53% AT STAR



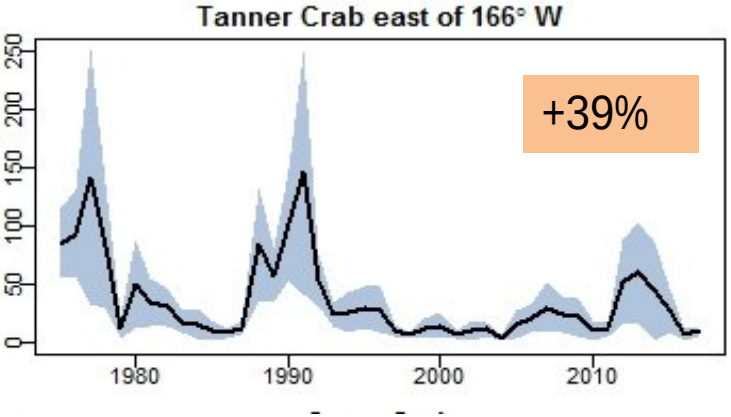

177°W
174°W
171°W
28
27
26
25
24
23
22
S
R
Q
P
O
N
M
100m
50m
61°N
60°N
59°N
58°N
Immature male ≤ 104 mm
Mature male ≥ 105 mm
Immature female
Mature female
+ No catch
0 50 100 200
Kilometers

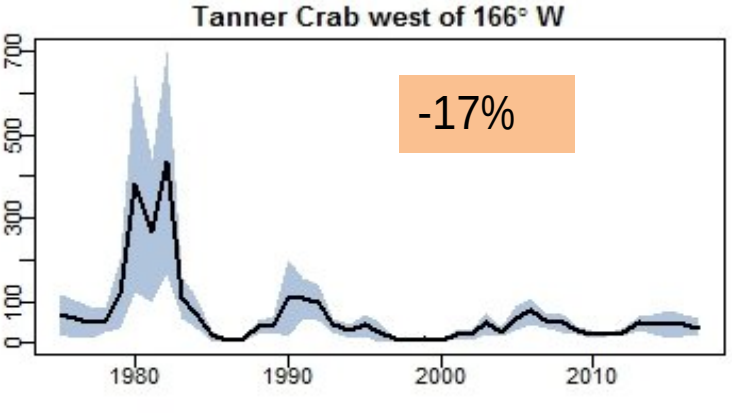

St. Matthew Island Blue King Crab (male)
Shell condition
Soft & molting
New - hard
Old
Very old
2012
2015
2013
2016
2014
2017
Abundance (millions)
Carapace length (mm)



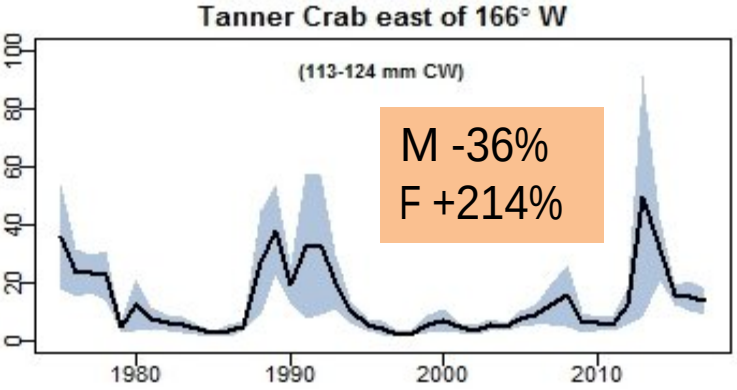


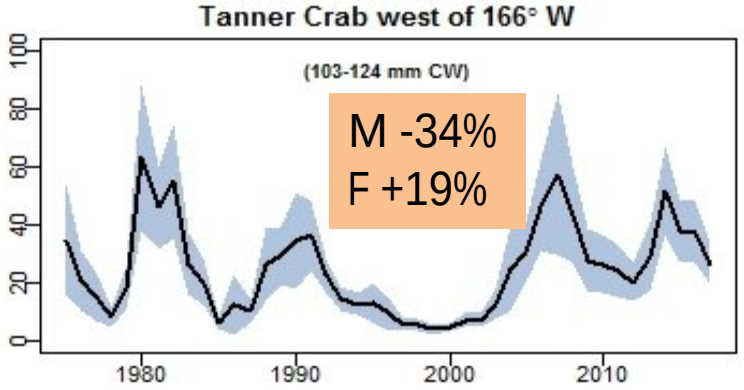
Mature male





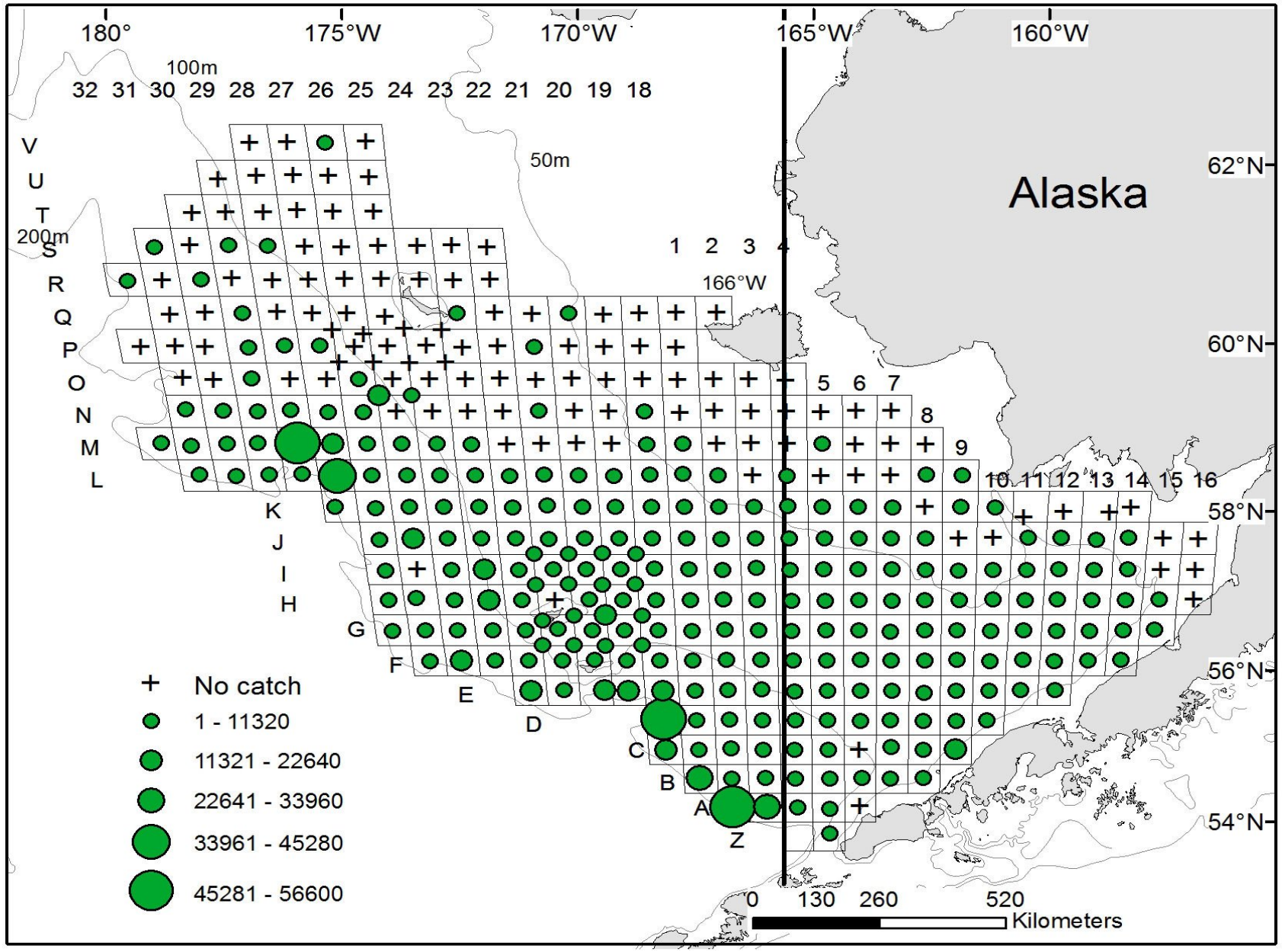
Mature females



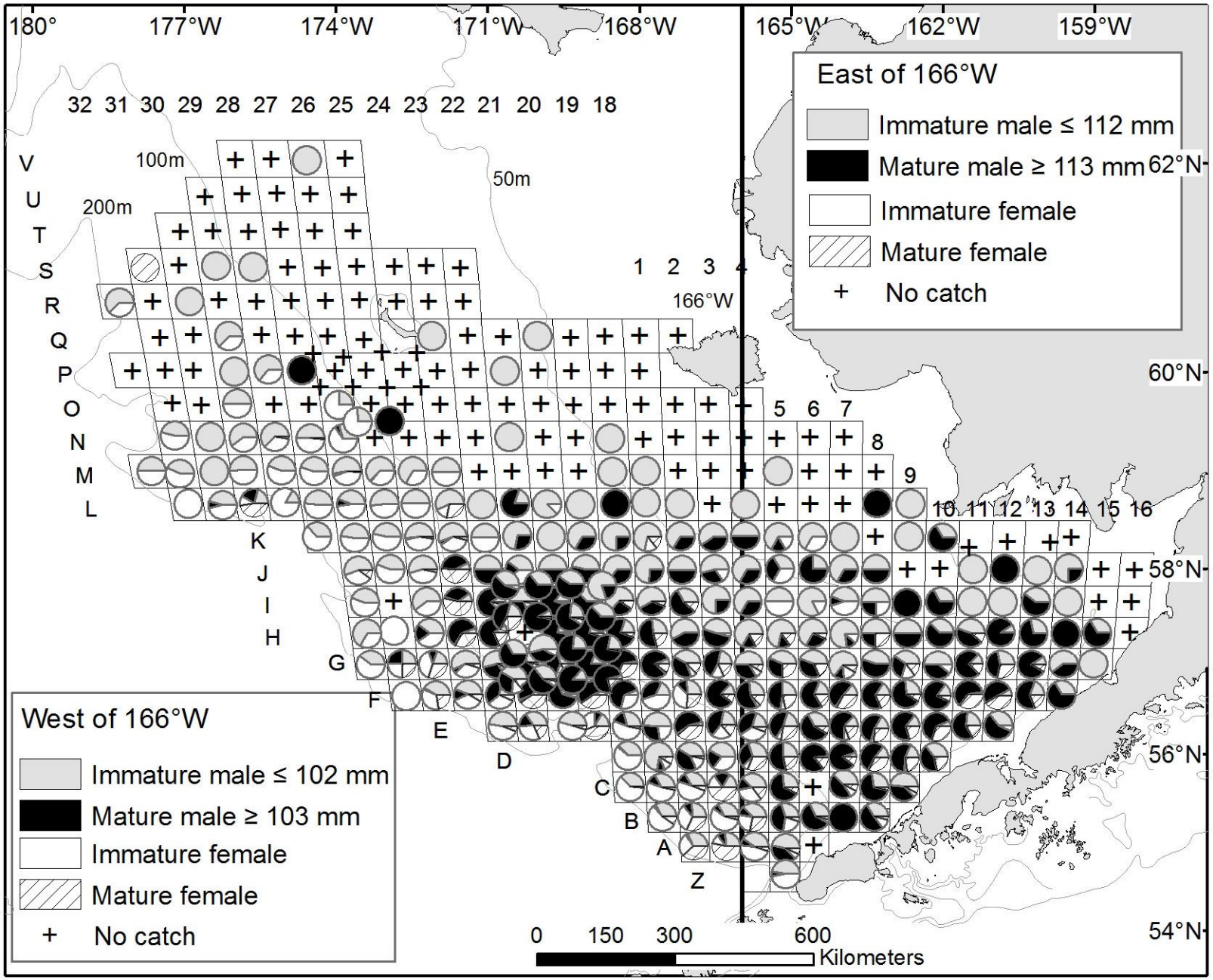


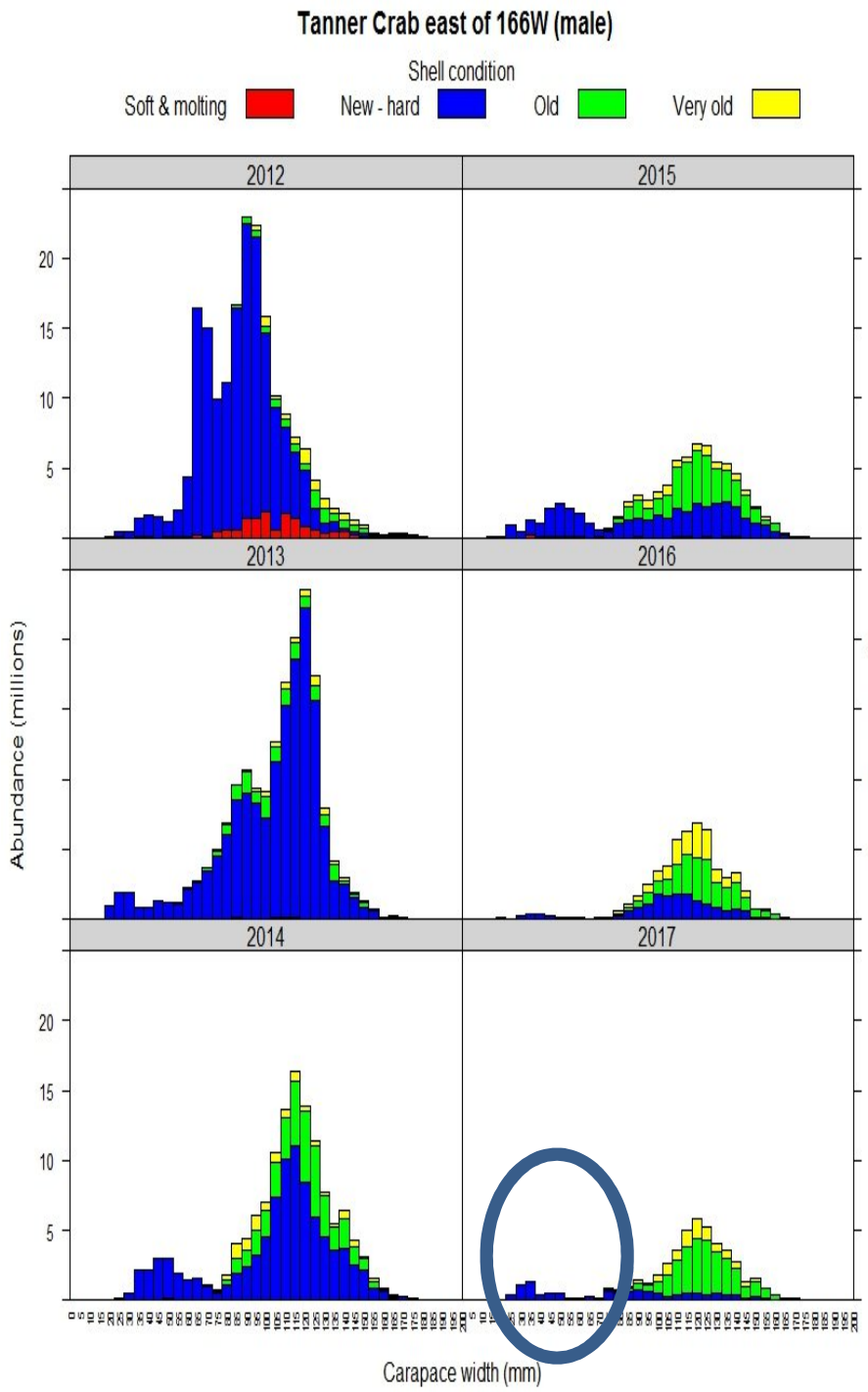
Juvenile

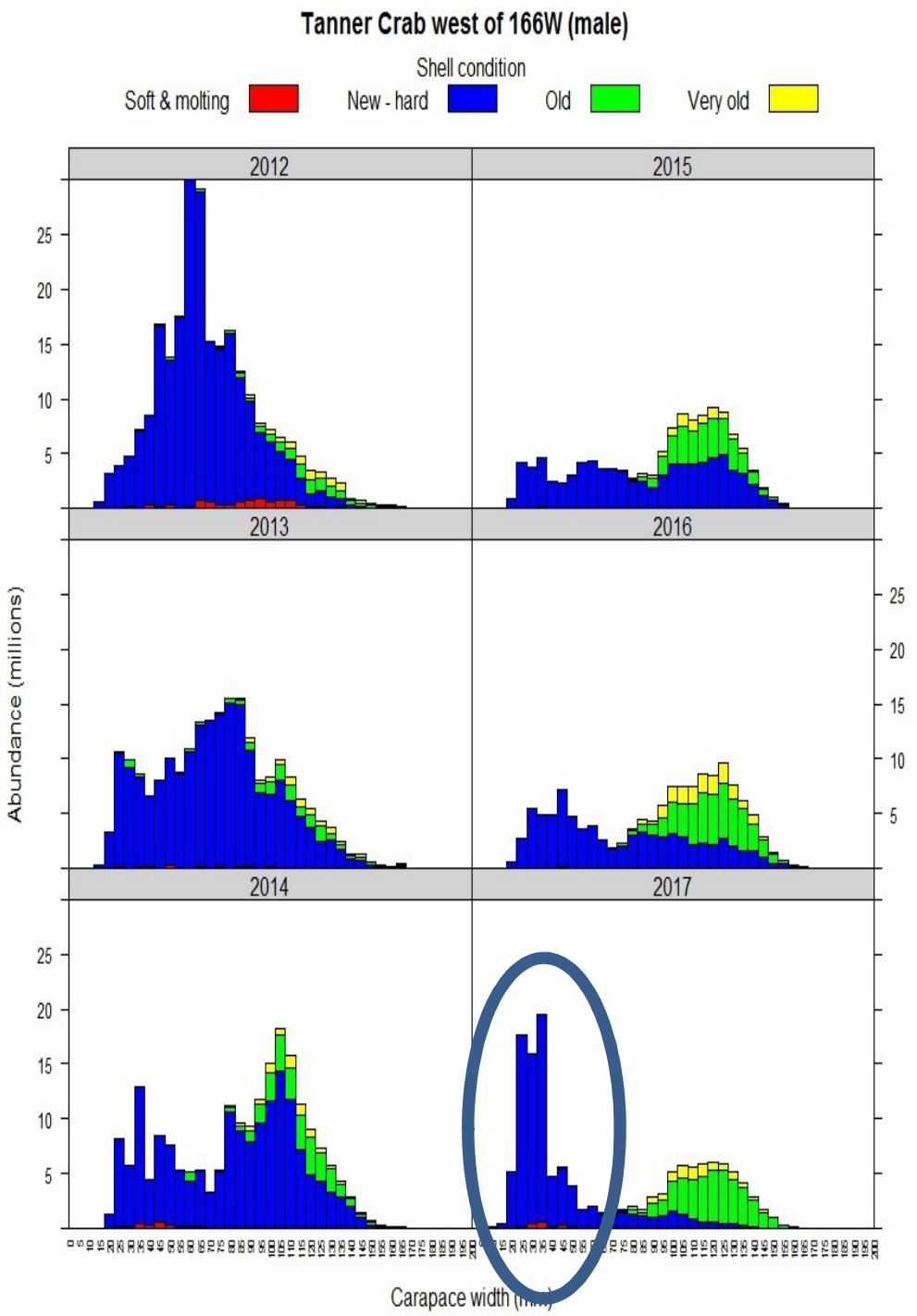
Tanner crab (*Chionoecetes bairdi*) total density

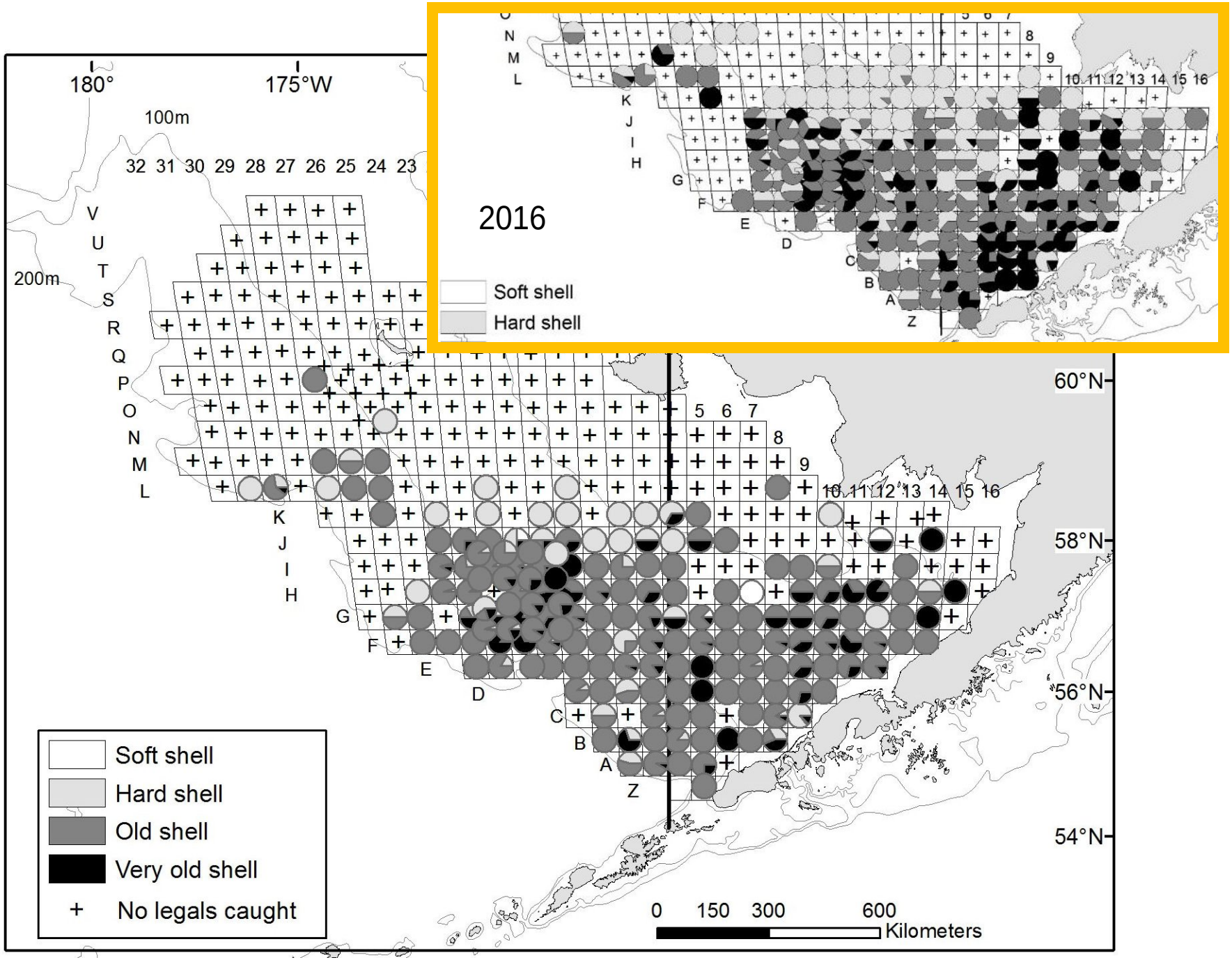


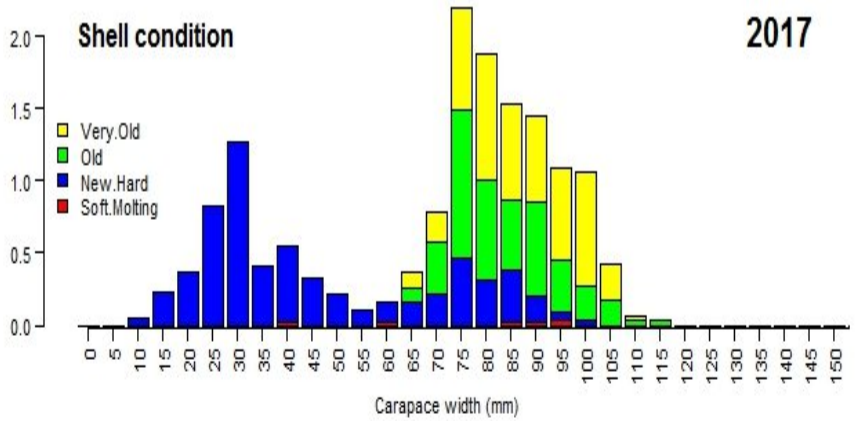
Tanner crab

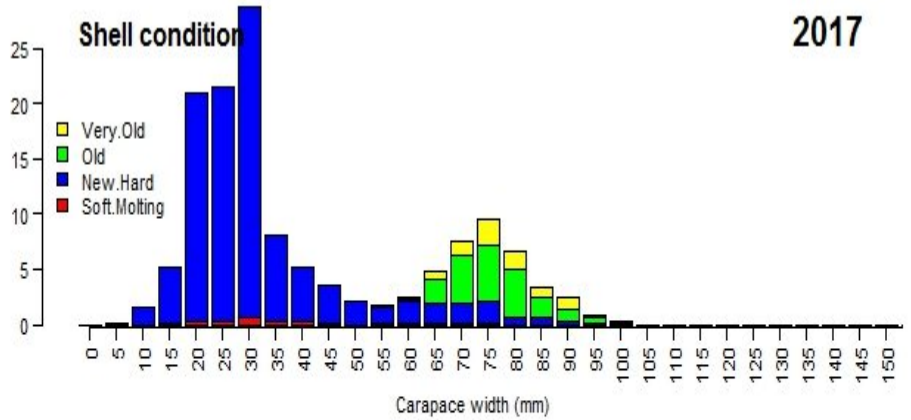

180°
177°W
174°W
171°W
168°W
165°W
162°W
159°W
32 31 30 29 28 27 26 25 24 23 22 21 20 19 18
1 2 3 4
5 6 7 8 9 10 11 12 13 14 15 16
V U T S R Q P O N M L
K J I H G F E D C B A Z
100m
200m
50m
166°W
62°N
60°N
58°N
56°N
54°N
East of 166°W
Immature male ≤ 112 mm
Mature male ≥ 113 mm
Immature female
Mature female
+ No catch
West of 166°W
Immature male ≤ 102 mm
Mature male ≥ 103 mm
Immature female
Mature female
+ No catch
0 150 300 600
Kilometers

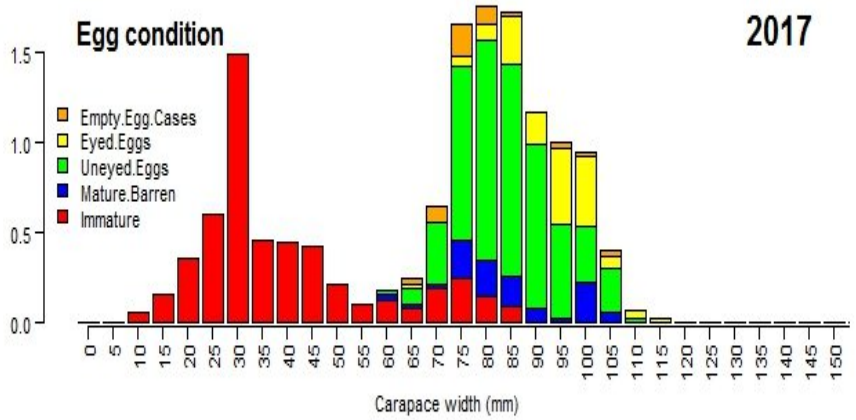

Tanner Crab east of 166W (male)
Shell condition
Soft & molting
New - hard
Old
Very old
2012
2015
2013
2016
2014
2017
Abundance (millions)
Carapace width (mm)

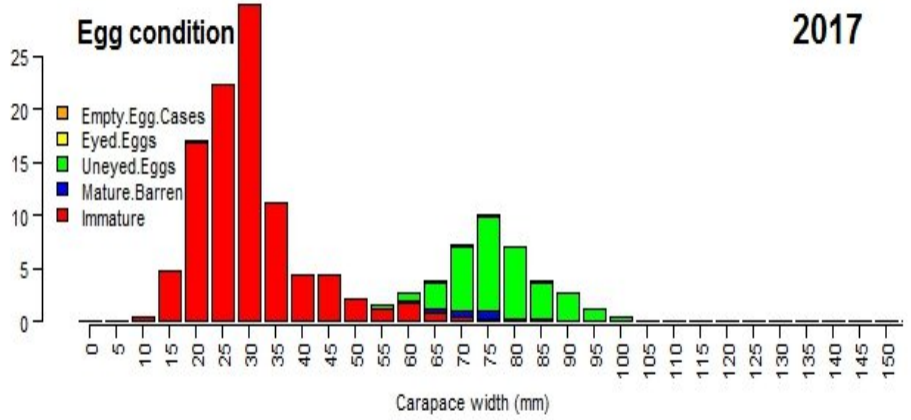

Tanner Crab west of 166W (male)
Shell condition
Soft & molting
New - hard
Old
Very old
2012
2015
2013
2016
2014
2017
Abundance (millions)
Carapace width (mm)

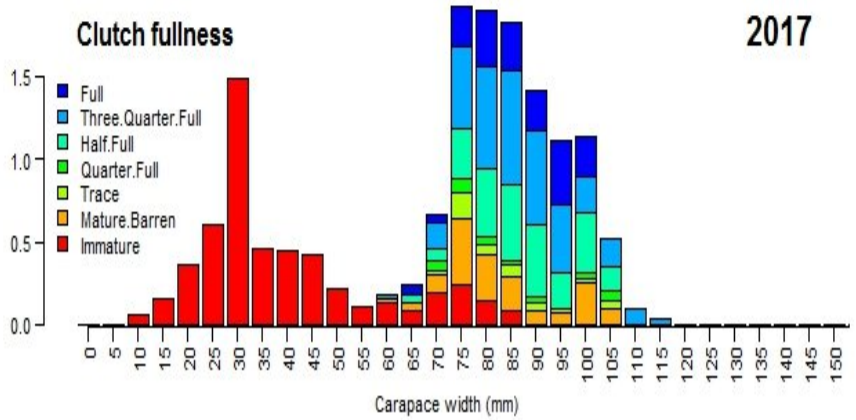

2016
Soft shell
Hard shell
180°
175°W
100m
200m
60°N
58°N
56°N
54°N
Soft shell
Hard shell
Old shell
Very old shell
+ No legals caught
0 150 300 600
Kilometers

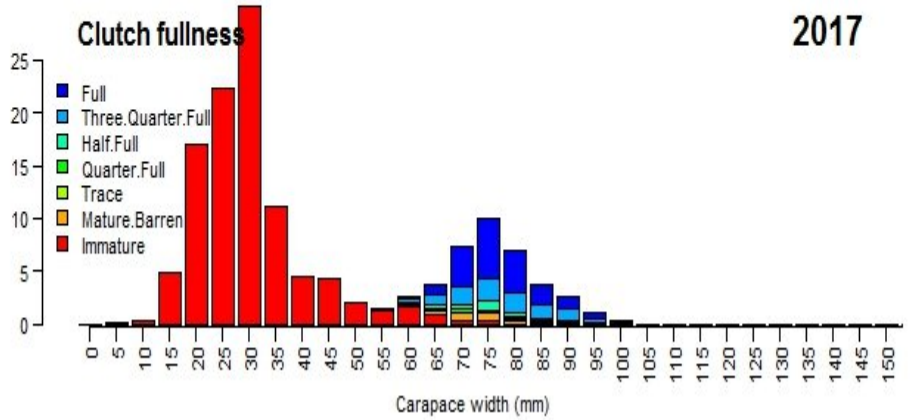

Shell condition
2017
Very.Old
Old
New.Hard
Soft.Molting
Carapace width (mm)

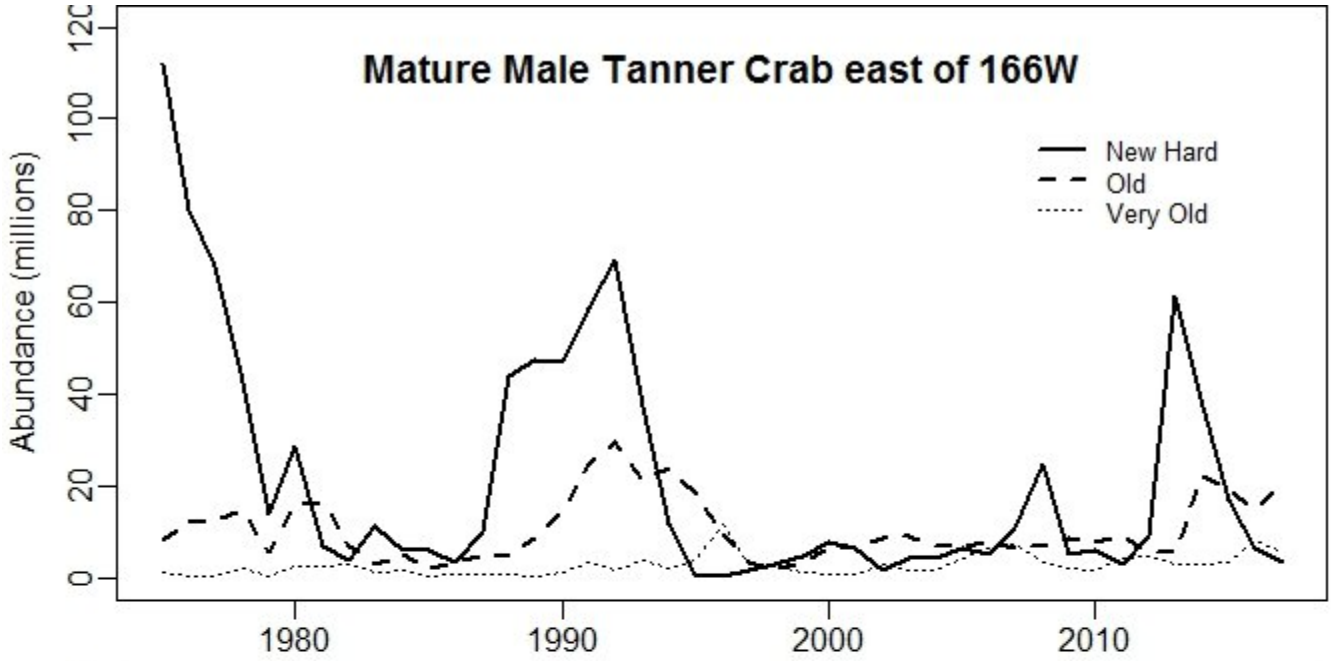

Shell condition
2017
Very.Old
Old
New.Hard
Soft.Molting
Carapace width (mm)

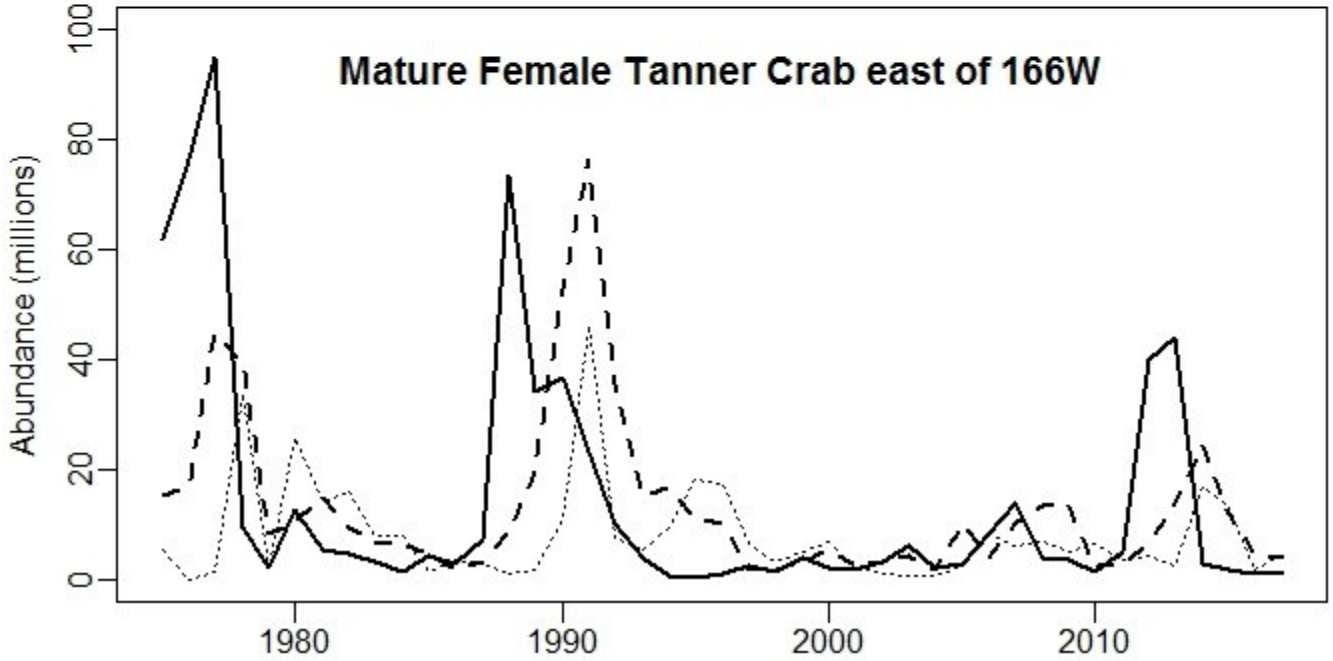

Egg condition
2017
Empty.Egg.Cases
Eyed.Eggs
Uneyed.Eggs
Mature.Barren
Immature
Abundance (millions)
Carapace width (mm)

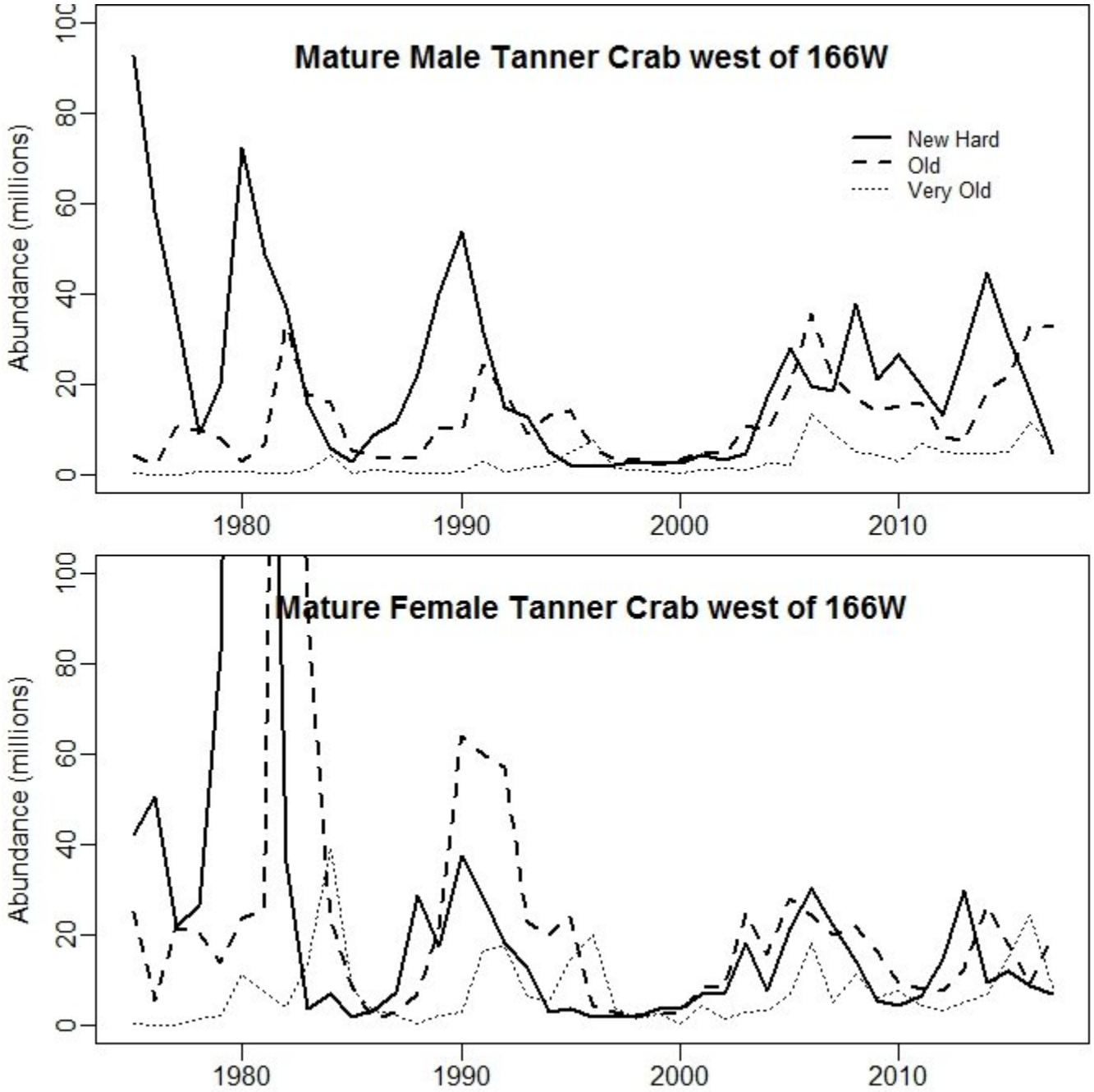

Egg condition
2017
Empty.Egg.Cases
Eyed.Eggs
Uneyed.Eggs
Mature.Barren
Immature
Abundance (millions)
Carapace width (mm)

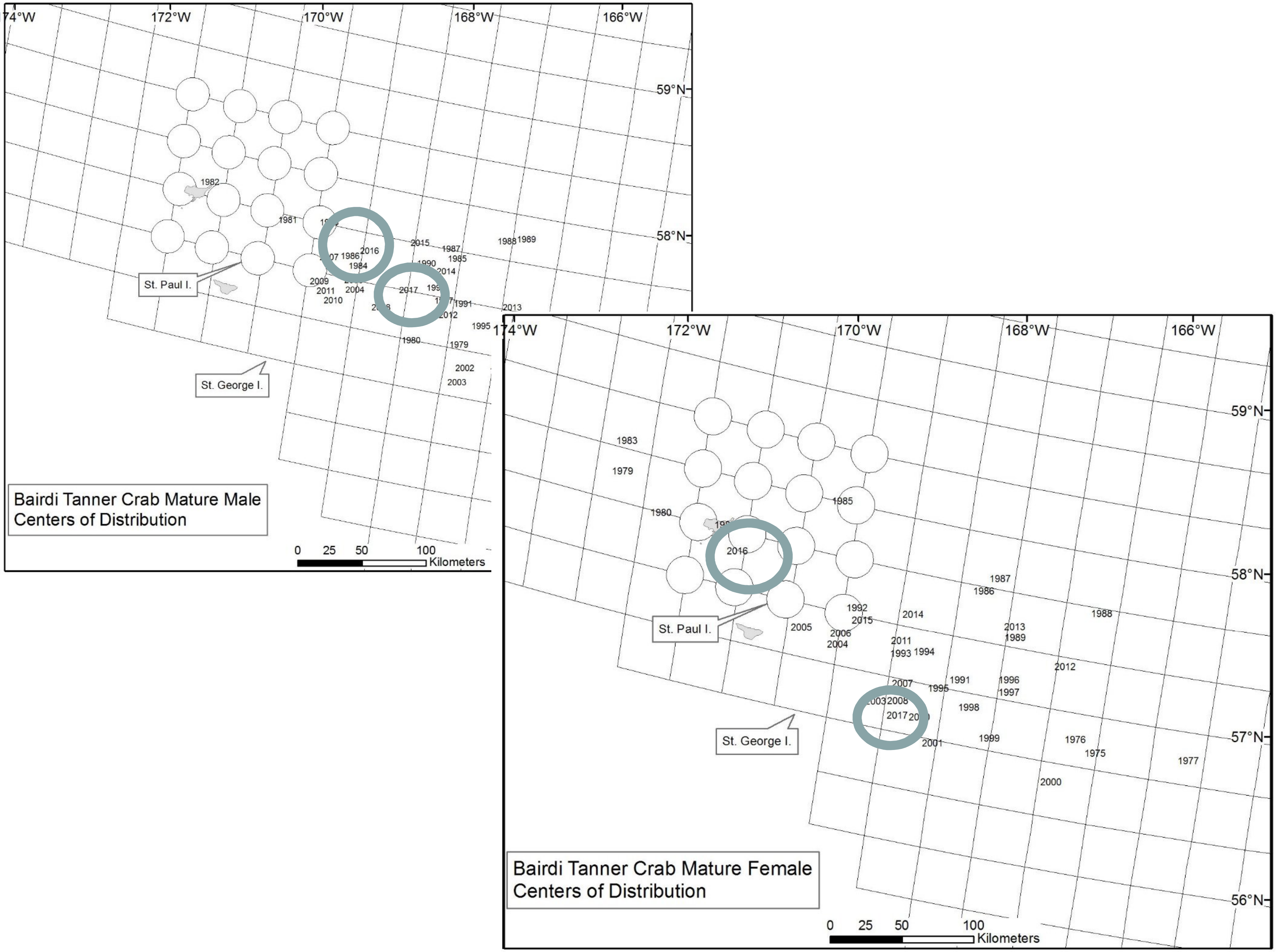

Clutch fullness
2017
Full
Three.Quarter.Full
Half.Full
Quarter.Full
Trace
Mature.Barren
Immature
Carapace width (mm)

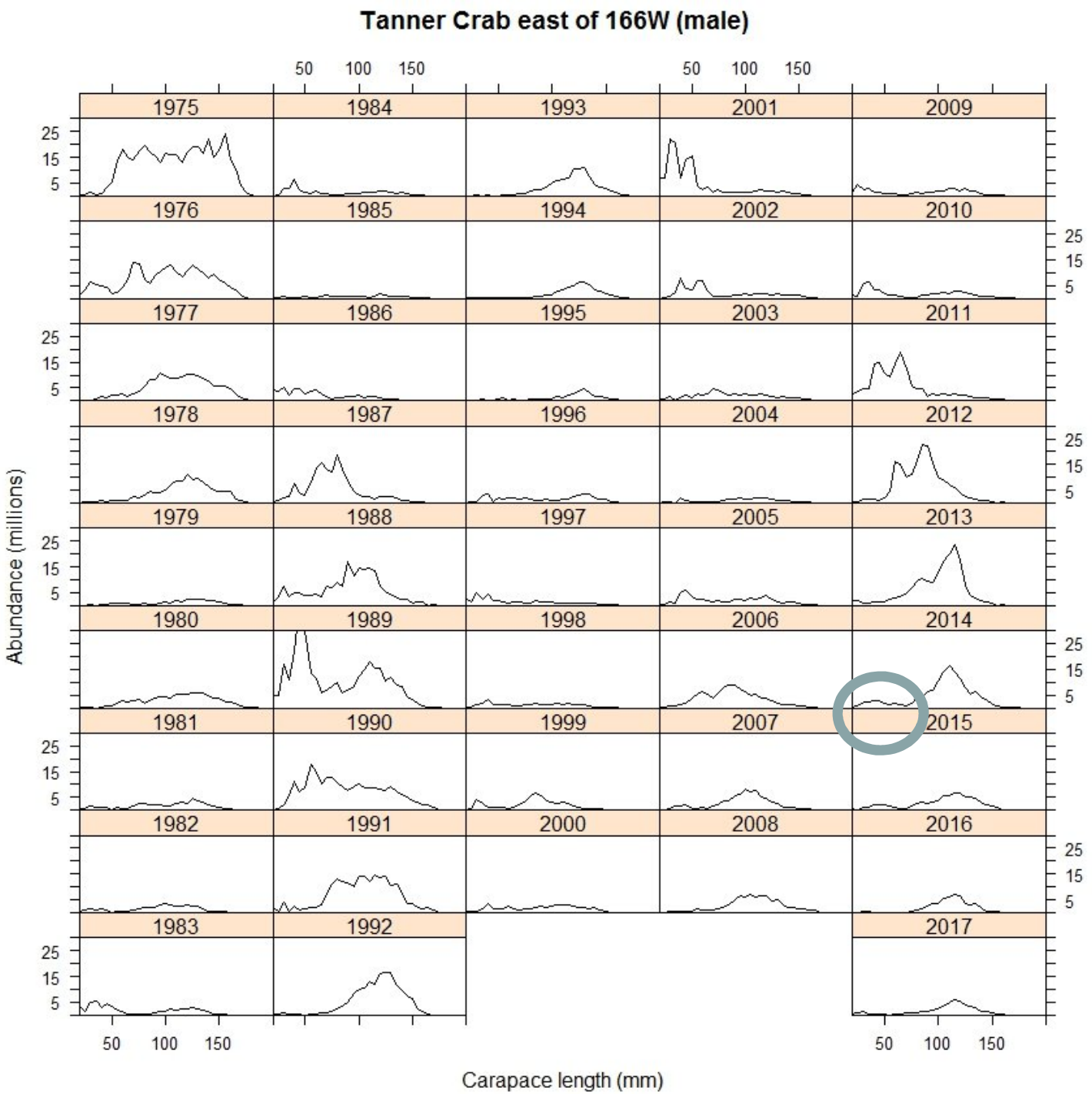

Clutch fullness
2017
Full
Three.Quarter.Full
Half.Full
Quarter.Full
Trace
Mature.Barren
Immature
Carapace width (mm)

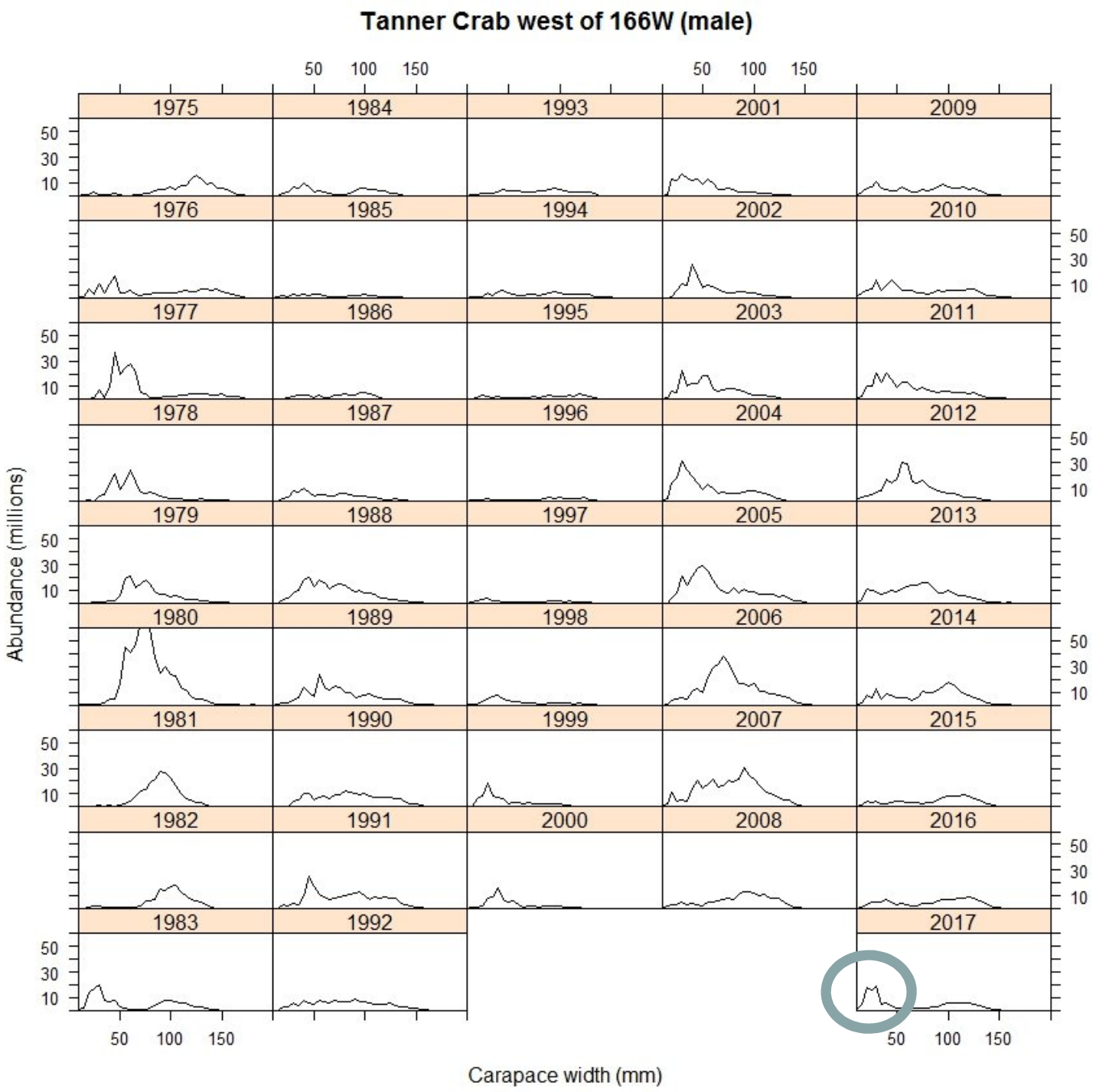

Mature Male Tanner Crab east of 166W
Abundance (millions)
0
20
40
60
80
100
120
1980
1990
2000
2010
New Hard
Old
Very Old

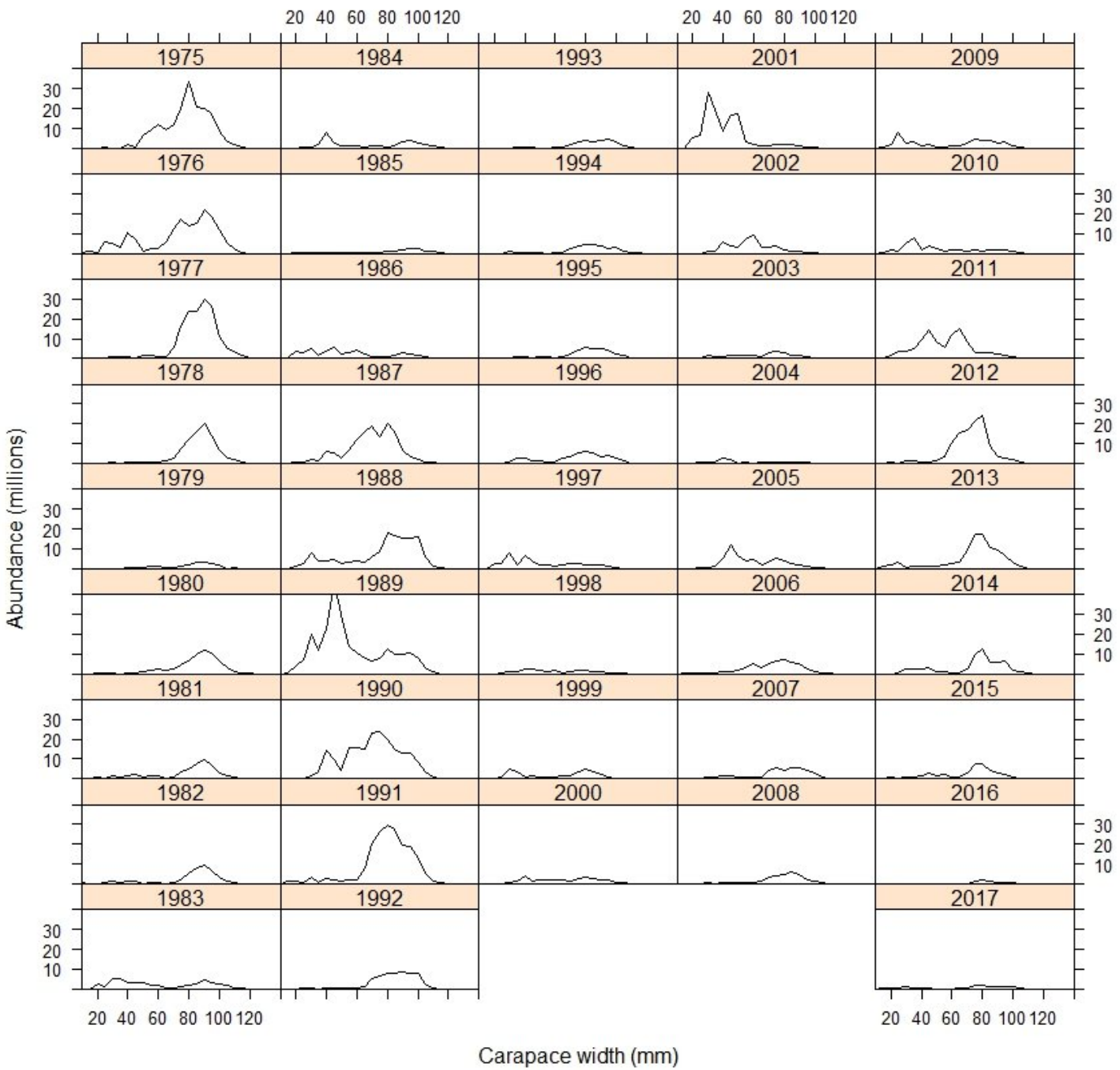

Mature Female Tanner Crab east of 166W
Abundance (millions)
0
20
40
60
80
100
1980
1990
2000
2010

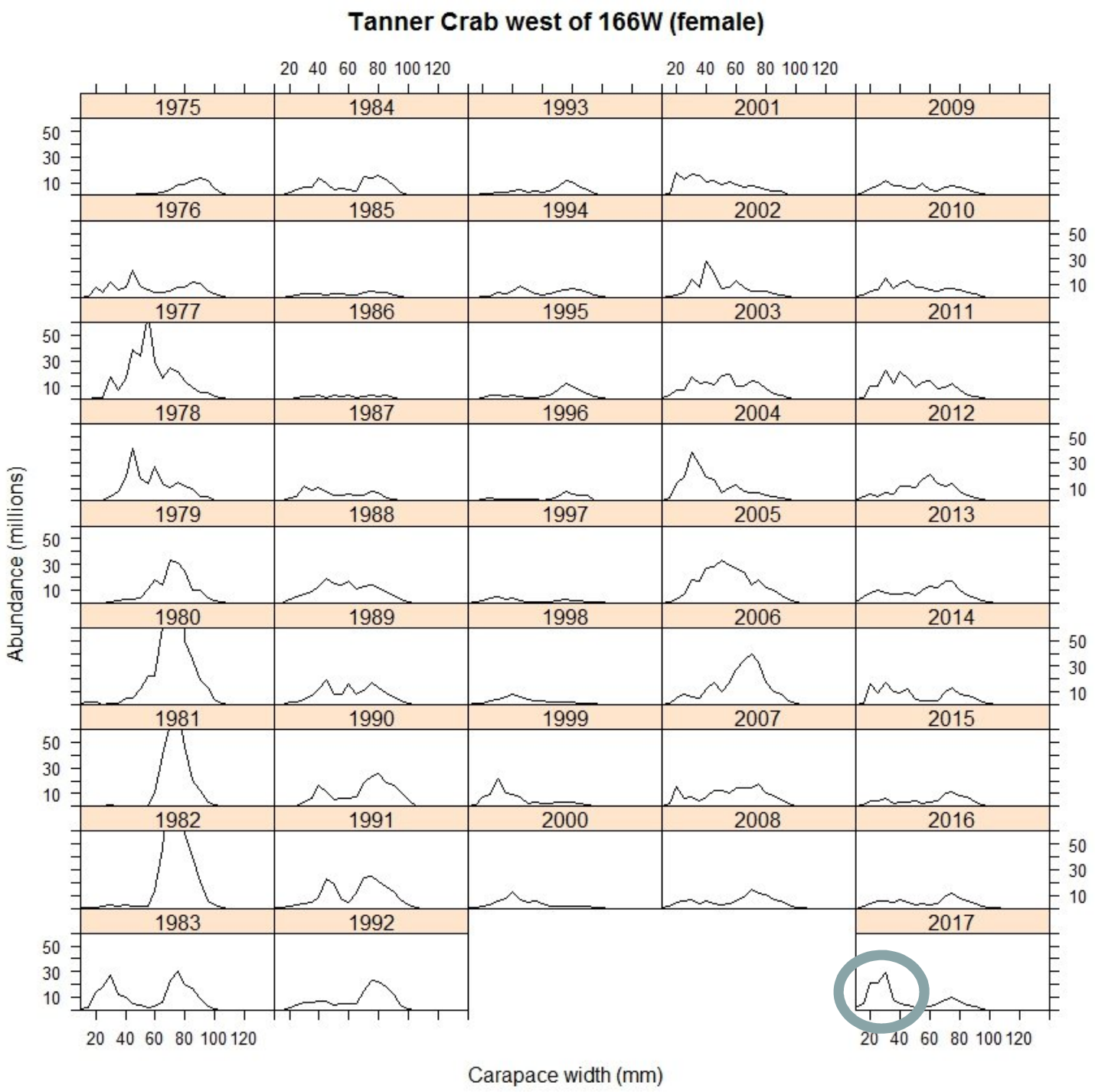

Mature Male Tanner Crab west of 166W
New Hard
Old
Very Old
Abundance (millions)
0
20
40
60
80
100
1980
1990
2000
2010
Mature Female Tanner Crab west of 166W
Abundance (millions)
0
20
40
60
80
100
1980
1990
2000
2010

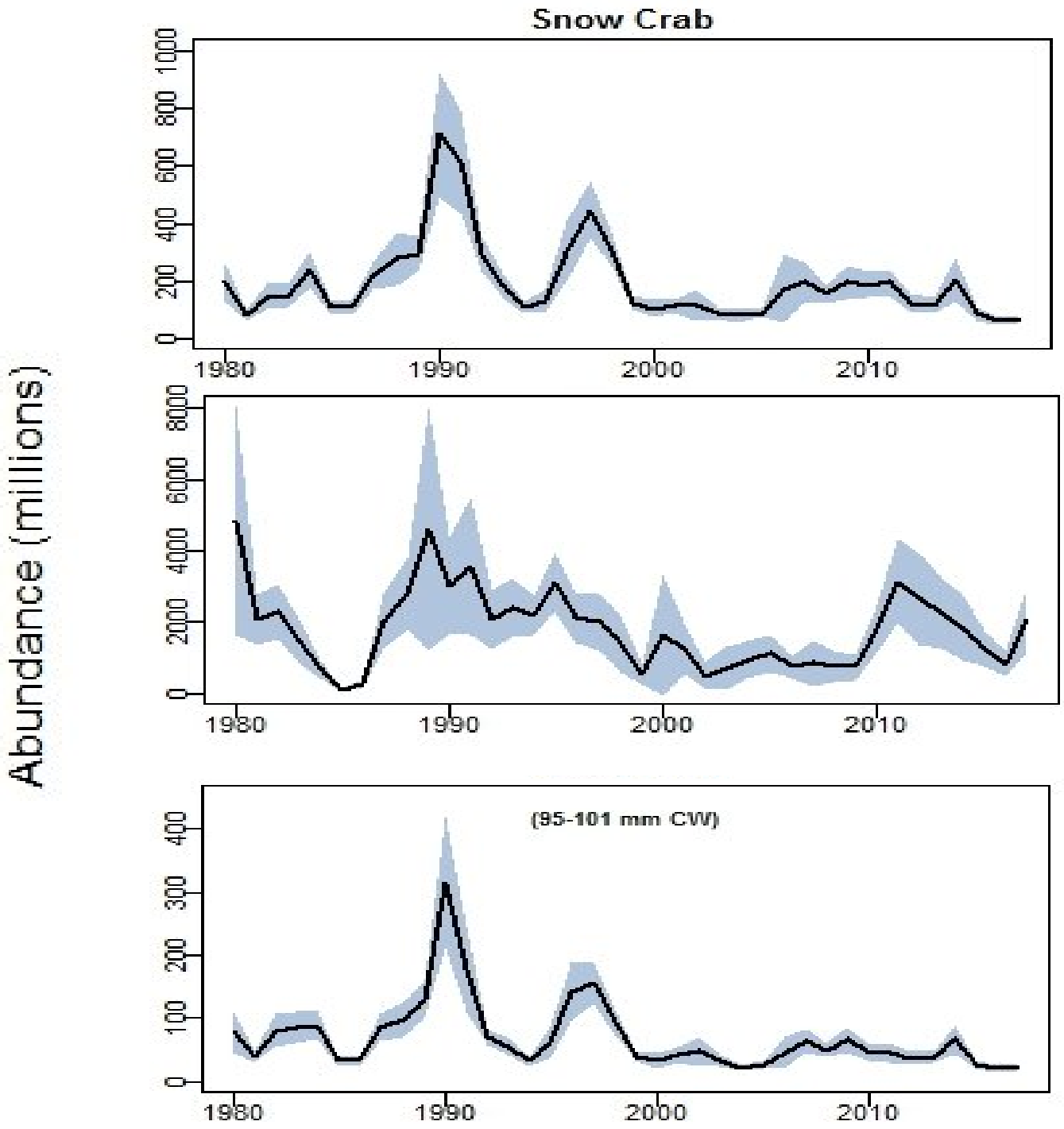

174°W
172°W
170°W
168°W
166°W
59°N
58°N
St. Paul I.
St. George I.
Bairdi Tanner Crab Mature Male Centers of Distribution
0 25 50 100 Kilometers
174°W
172°W
170°W
168°W
166°W
59°N
58°N
57°N
56°N
St. Paul I.
St. George I.
Bairdi Tanner Crab Mature Female Centers of Distribution
0 25 50 100 Kilometers


Tanner Crab east of 166W (male)
1975
1984
1993
2001
2009
1976
1985
1994
2002
2010
1977
1986
1995
2003
2011
1978
1987
1996
2004
2012
1979
1988
1997
2005
2013
1980
1989
1998
2006
2014
1981
1990
1999
2007
2015
1982
1991
2000
2008
2016
1983
1992
2017
25
15
5
50
100
150
Abundance (millions)
Carapace length (mm)


Tanner Crab west of 166W (male)
1975
1984
1993
2001
2009
1976
1985
1994
2002
2010
1977
1986
1995
2003
2011
1978
1987
1996
2004
2012
1979
1988
1997
2005
2013
1980
1989
1998
2006
2014
1981
1990
1999
2007
2015
1982
1991
2000
2008
2016
1983
1992
2017
50
100
150
10
30
Abundance (millions)
Carapace width (mm)


Tanner Crab east of 166W (female)
1975
1984
1993
2001
2009
1976
1985
1994
2002
2010
1977
1986
1995
2003
2011
1978
1987
1996
2004
2012
1979
1988
1997
2005
2013
1980
1989
1998
2006
2014
1981
1990
1999
2007
2015
1982
1991
2000
2008
2016
1983
1992
2017
20 40 60 80 100 120
10 20 30
Abundance (millions)
Carapace width (mm)


Tanner Crab west of 166W (female)
1975
1984
1993
2001
2009
1976
1985
1994
2002
2010
1977
1986
1995
2003
2011
1978
1987
1996
2004
2012
1979
1988
1997
2005
2013
1980
1989
1998
2006
2014
1981
1990
1999
2007
2015
1982
1991
2000
2008
2016
1983
1992
2017
20 40 60 80 100 120
50
30
10
Abundance (millions)
Carapace width (mm)



Mature male

-2%

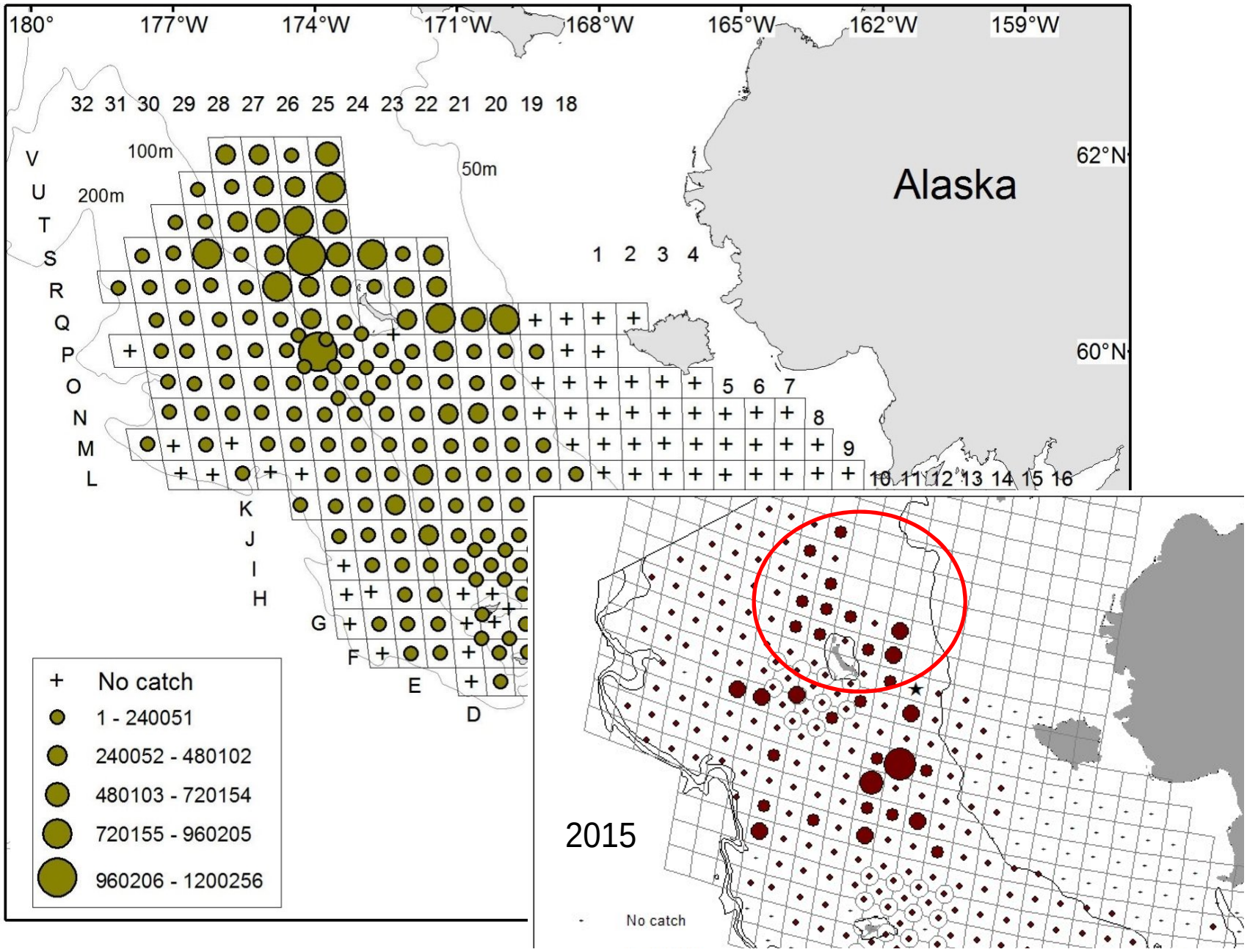
Mature female

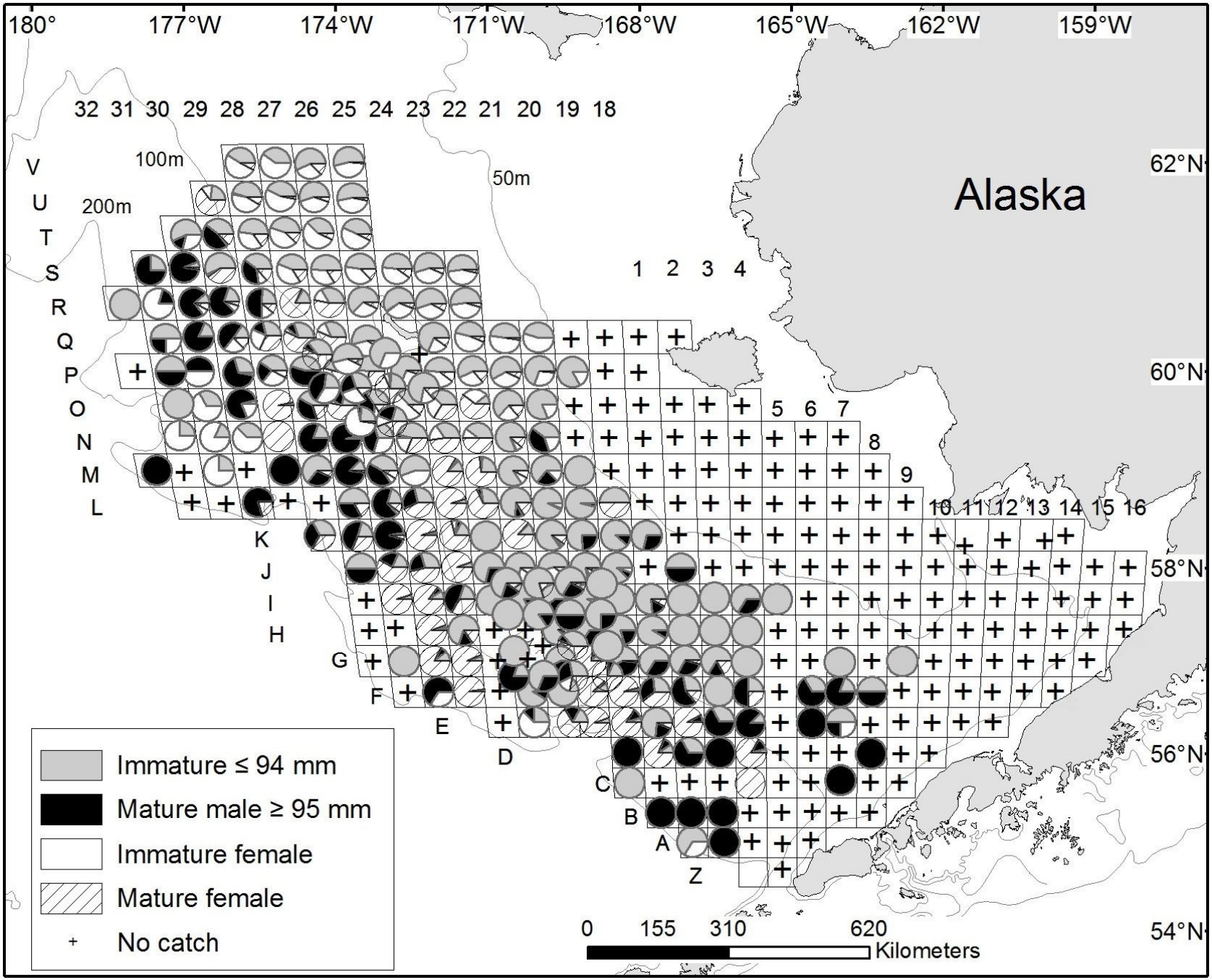
+99%

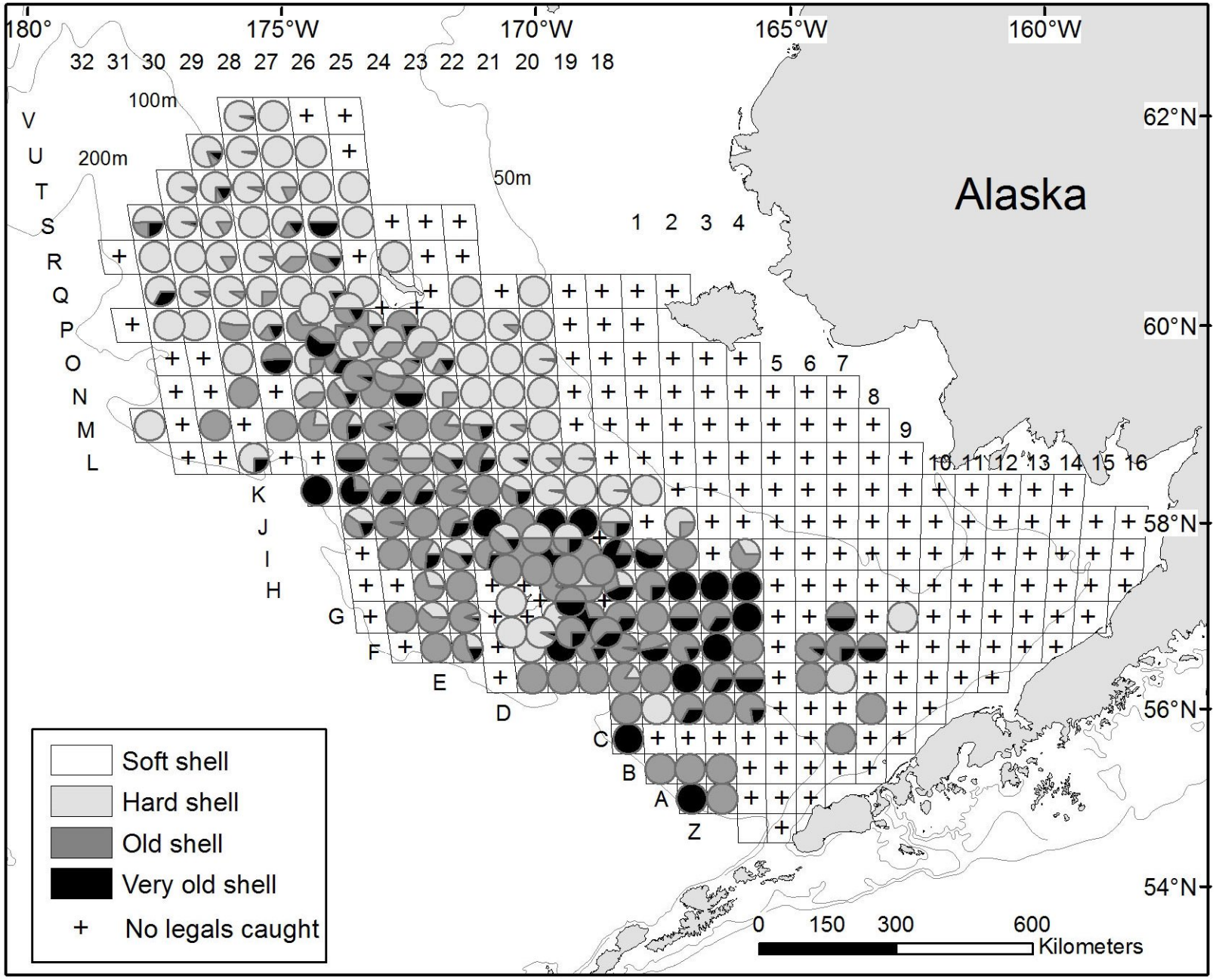
Juvenile

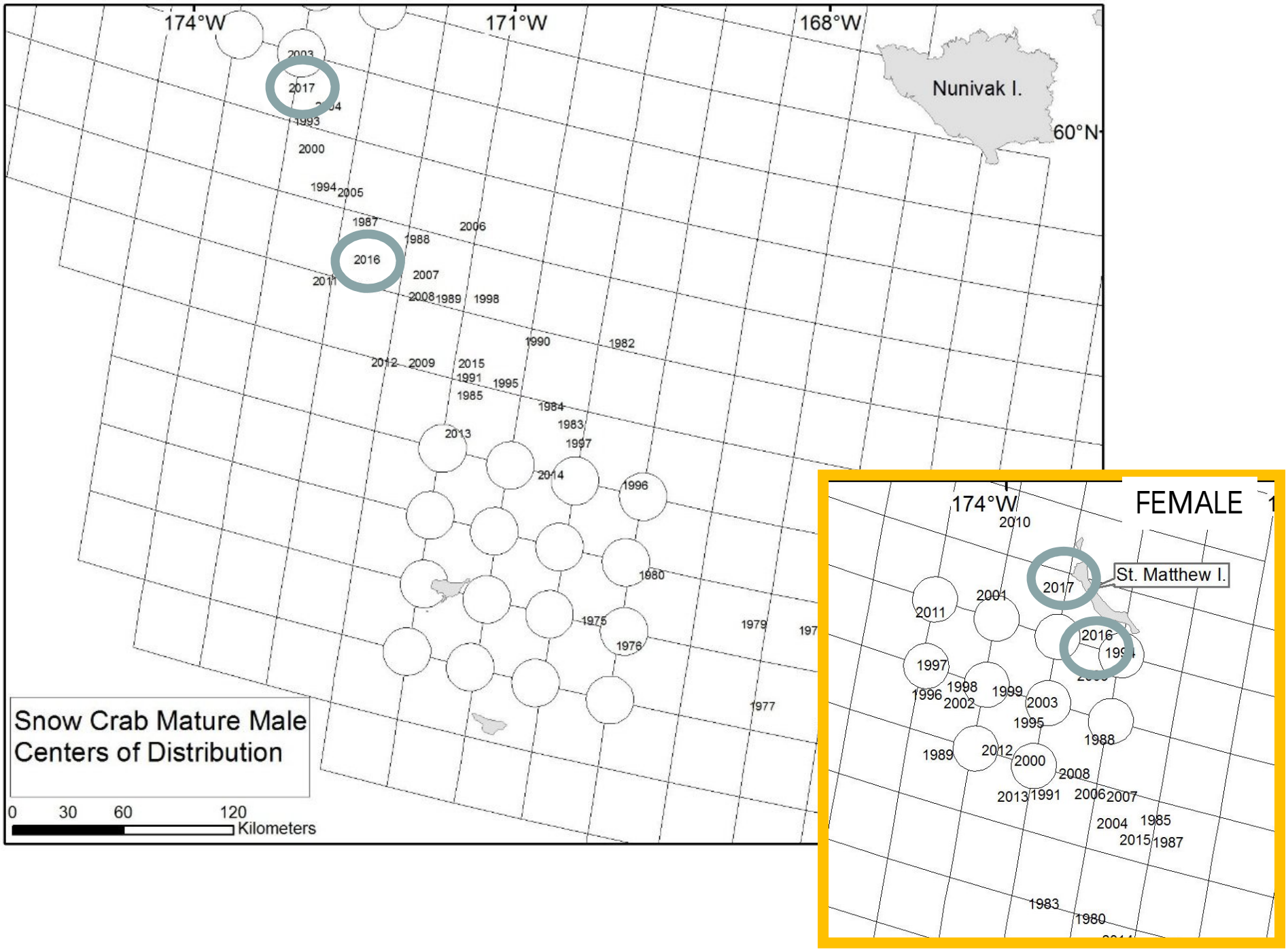
Male +82%
Female +99%

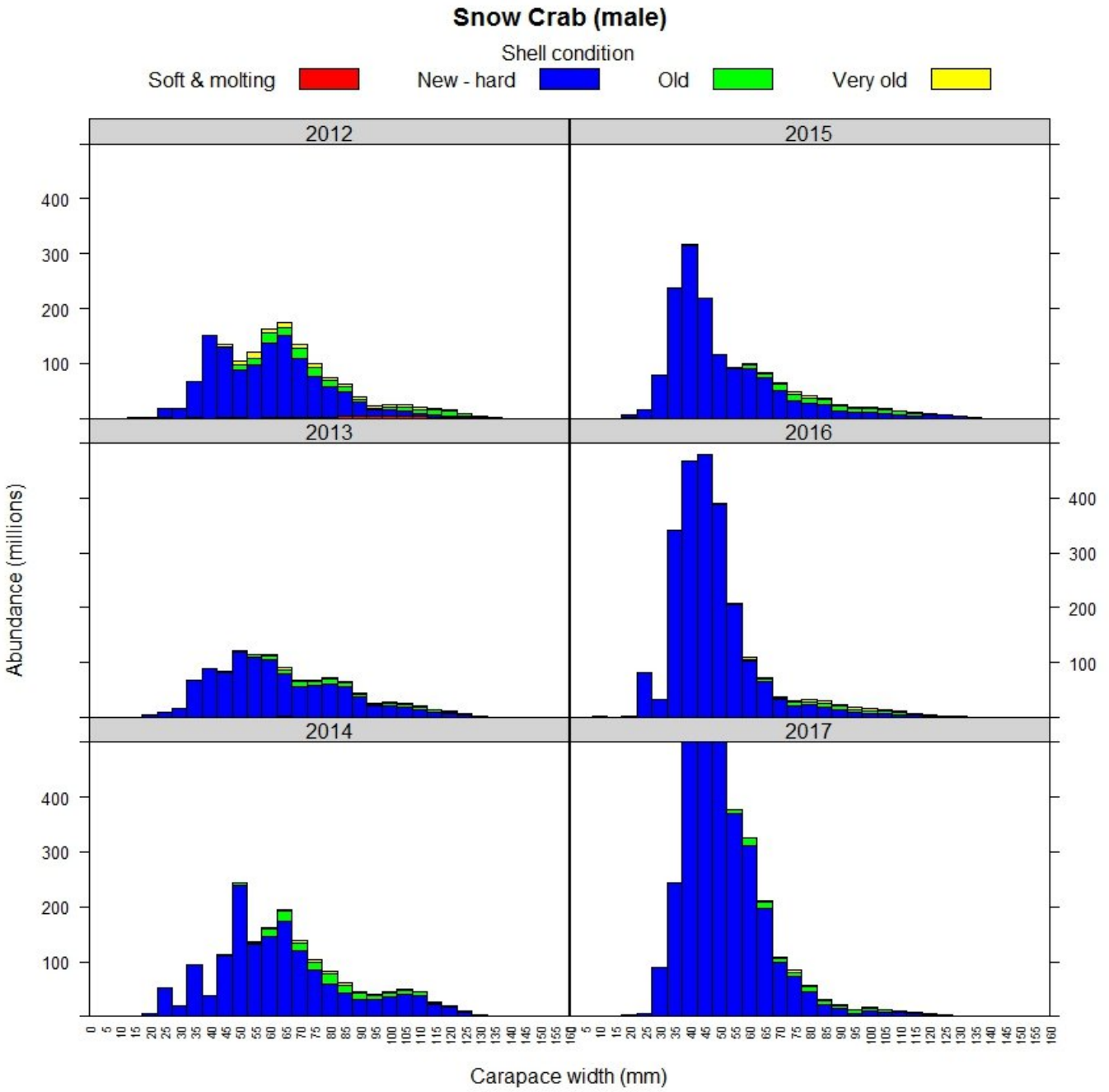
snow crab total density

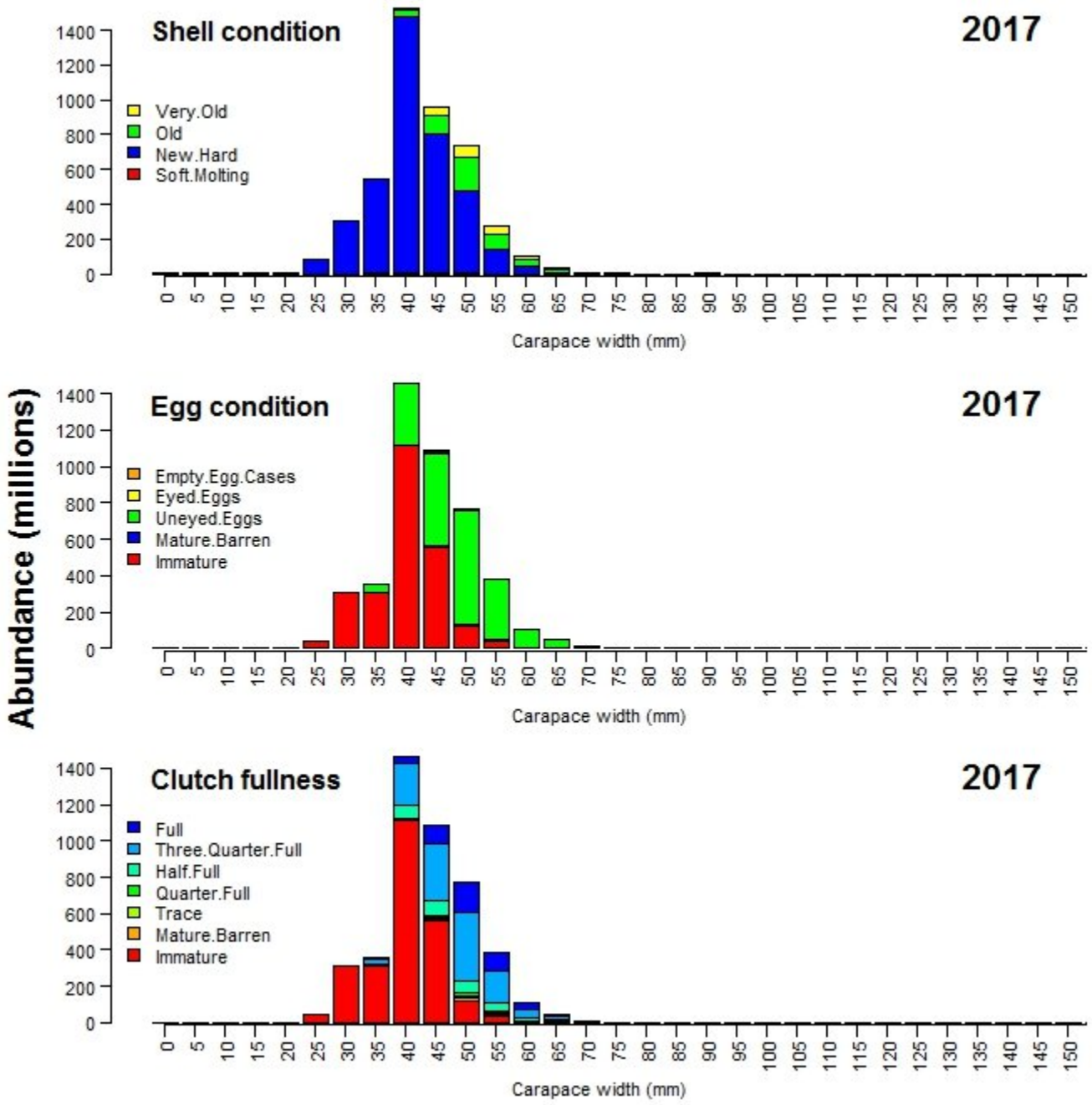


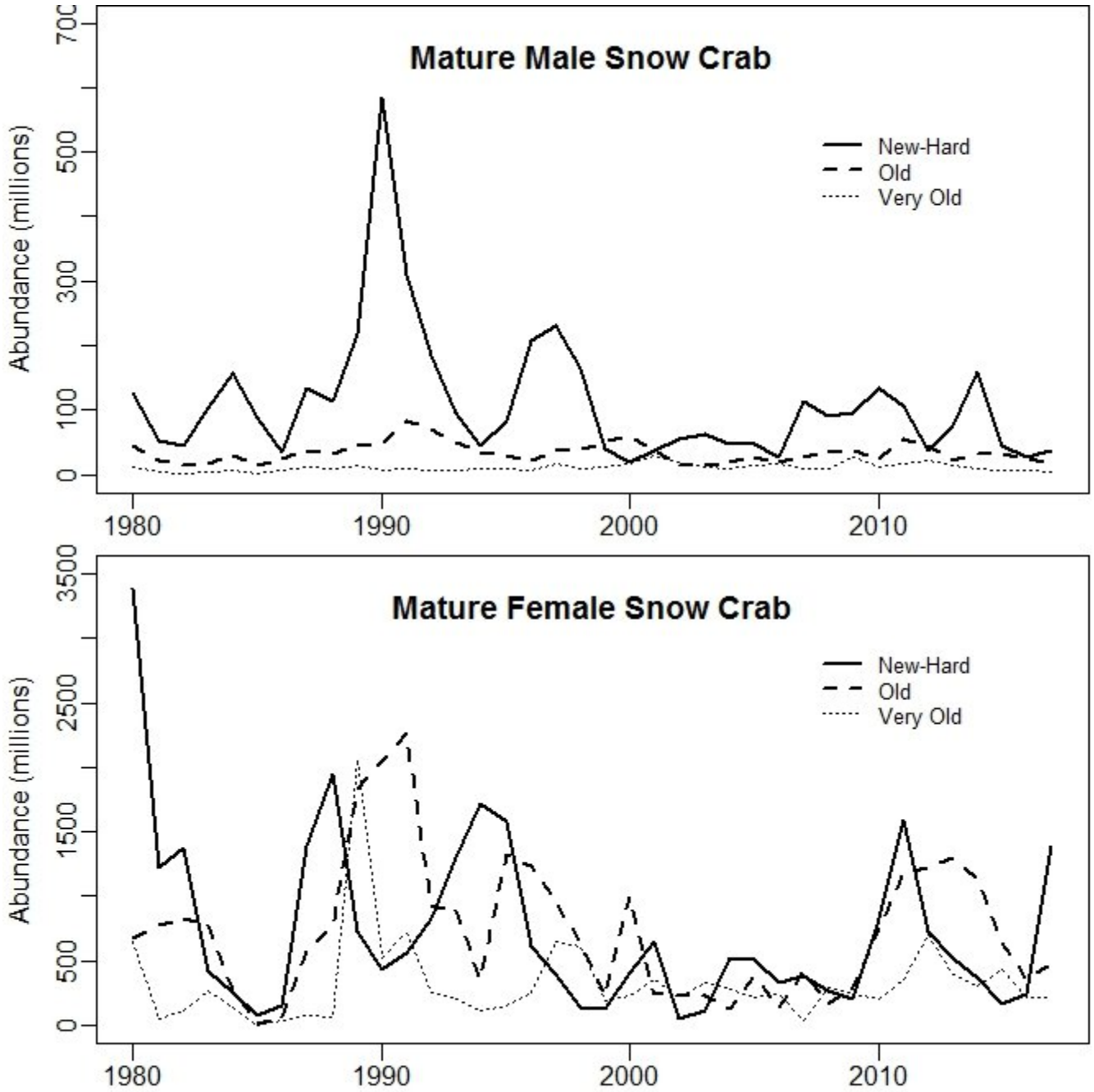

180°
177°W
174°W
171°W
168°W
165°W
162°W
159°W
62°N
60°N
58°N
56°N
54°N
Alaska
100m
200m
50m
Immature ≤ 94 mm
Mature male ≥ 95 mm
Immature female
Mature female
No catch
0 155 310 620
Kilometers

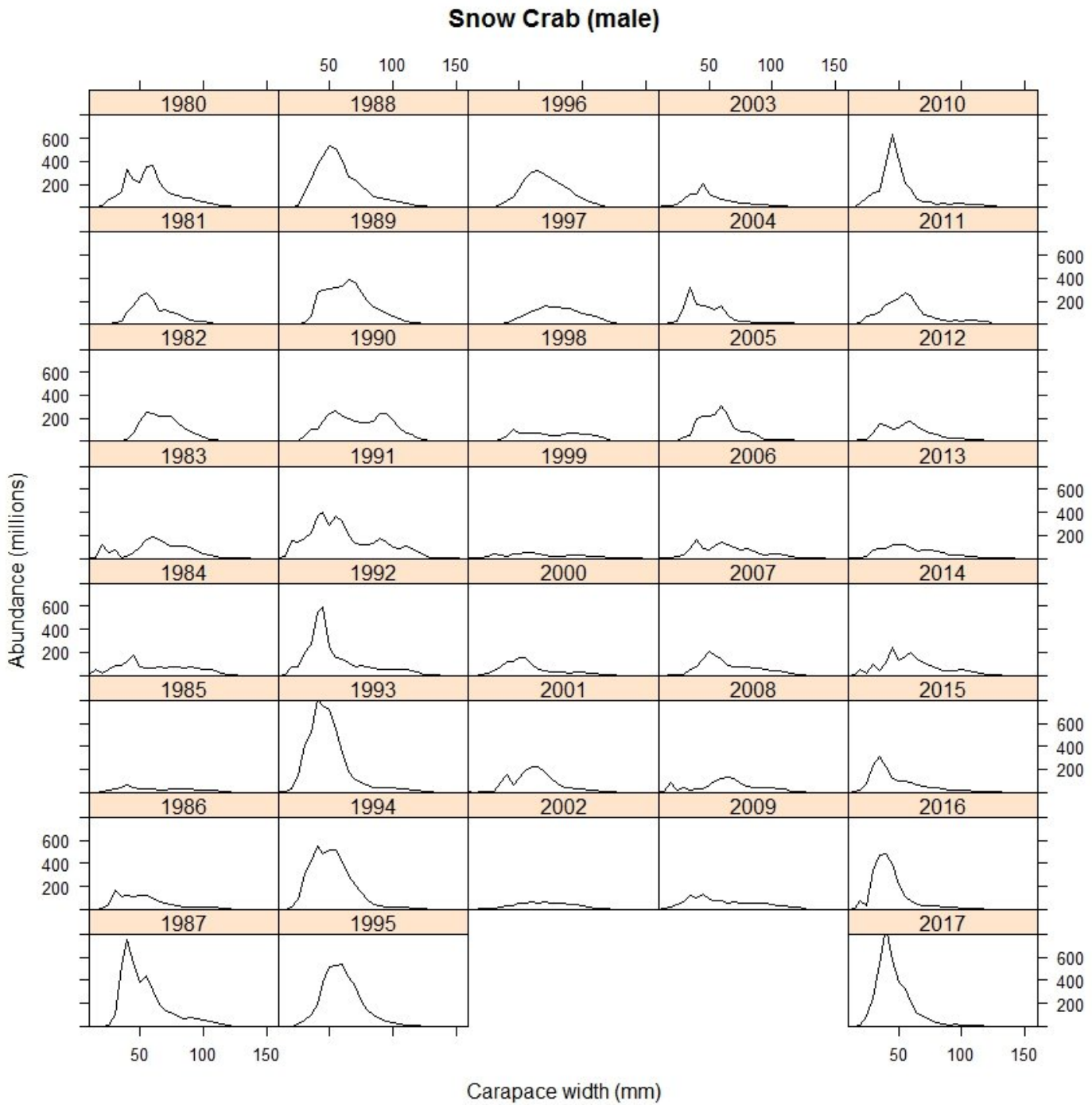

180°
175°W
170°W
165°W
160°W
62°N
60°N
58°N
56°N
54°N
Alaska
100m
200m
50m
Soft shell
Hard shell
Old shell
Very old shell
+ No legals caught
0 150 300 600
Kilometers

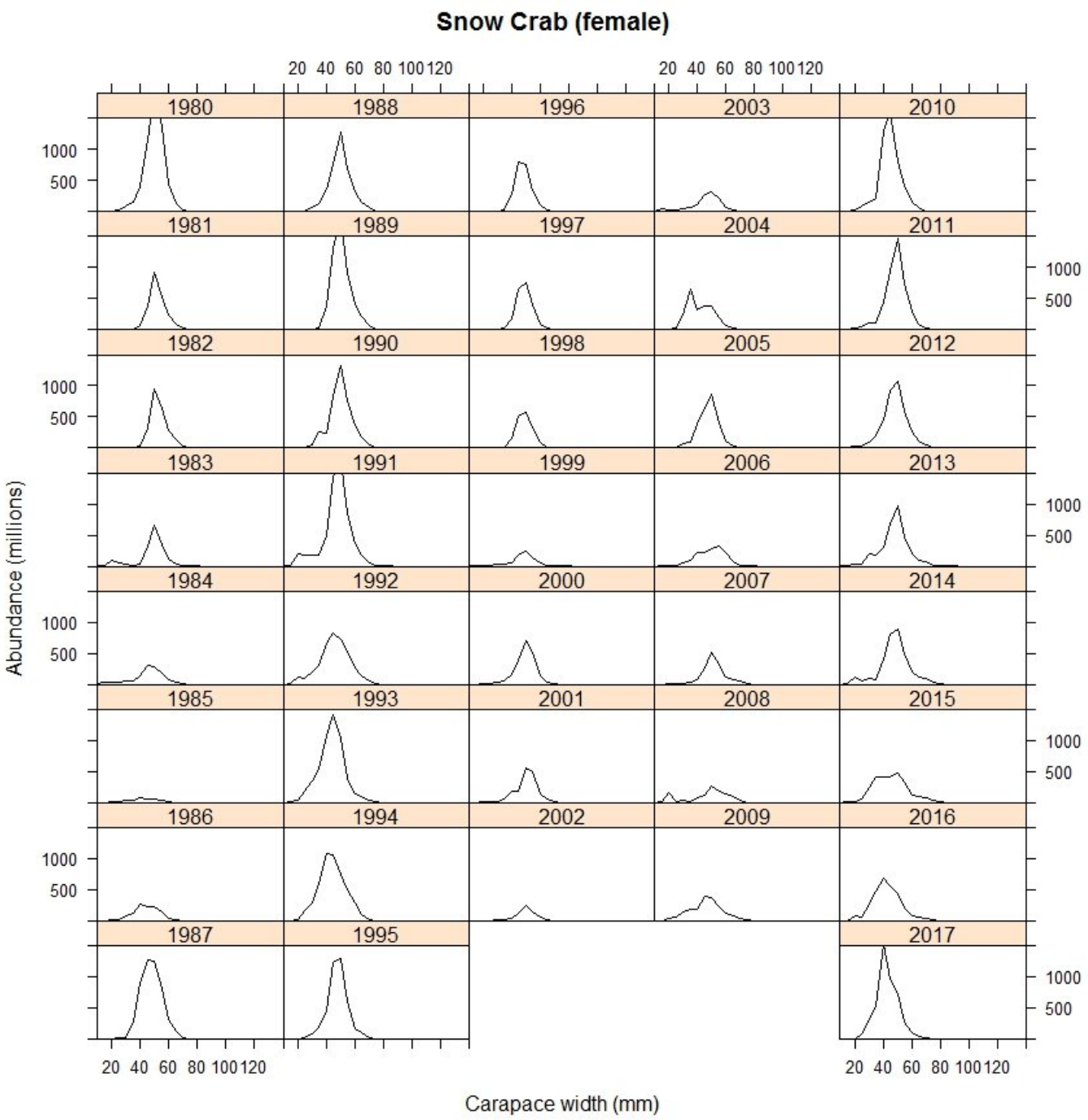

174°W
171°W
168°W
Nunivak I.
60°N
2017
1993
2000
1994
2005
1987
2006
1988
2016
2007
2011
2008
1989
1998
1990
1982
2012
2009
2015
1991
1995
1985
1984
1983
2013
1997
2014
1996
1980
1975
1979
1976
1977
Snow Crab Mature Male
Centers of Distribution
0 30 60 120
Kilometers
FEMALE
174°W
2010
St. Matthew I.
2017
2001
2011
2016
1997
1996
1998
1999
2002
2003
1995
1988
1989
2012
2000
2008
2013
1991
2006
2007
2004
1985
2015
1987
1983
1980


Snow Crab (male)
Shell condition
Soft & molting
New - hard
Old
Very old
2012
2015
2013
2016
2014
2017
Abundance (millions)
Carapace width (mm)


Shell condition
2017
Very.Old
Old
New.Hard
Soft.Molting
Egg condition
2017
Empty.Egg.Cases
Eyed.Eggs
Uneyed.Eggs
Mature.Barren
Immature
Clutch fullness
2017
Full
Three.Quarter.Full
Half.Full
Quarter.Full
Trace
Mature.Barren
Immature
Abundance (millions)
0
200
400
600
800
1000
1200
1400
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 145 150
Carapace width (mm)


Mature Male Snow Crab
Abundance (millions)
0
100
300
500
700
1980
1990
2000
2010
New-Hard
Old
Very Old
Mature Female Snow Crab
Abundance (millions)
0
500
1500
2500
3500
1980
1990
2000
2010
New-Hard
Old
Very Old

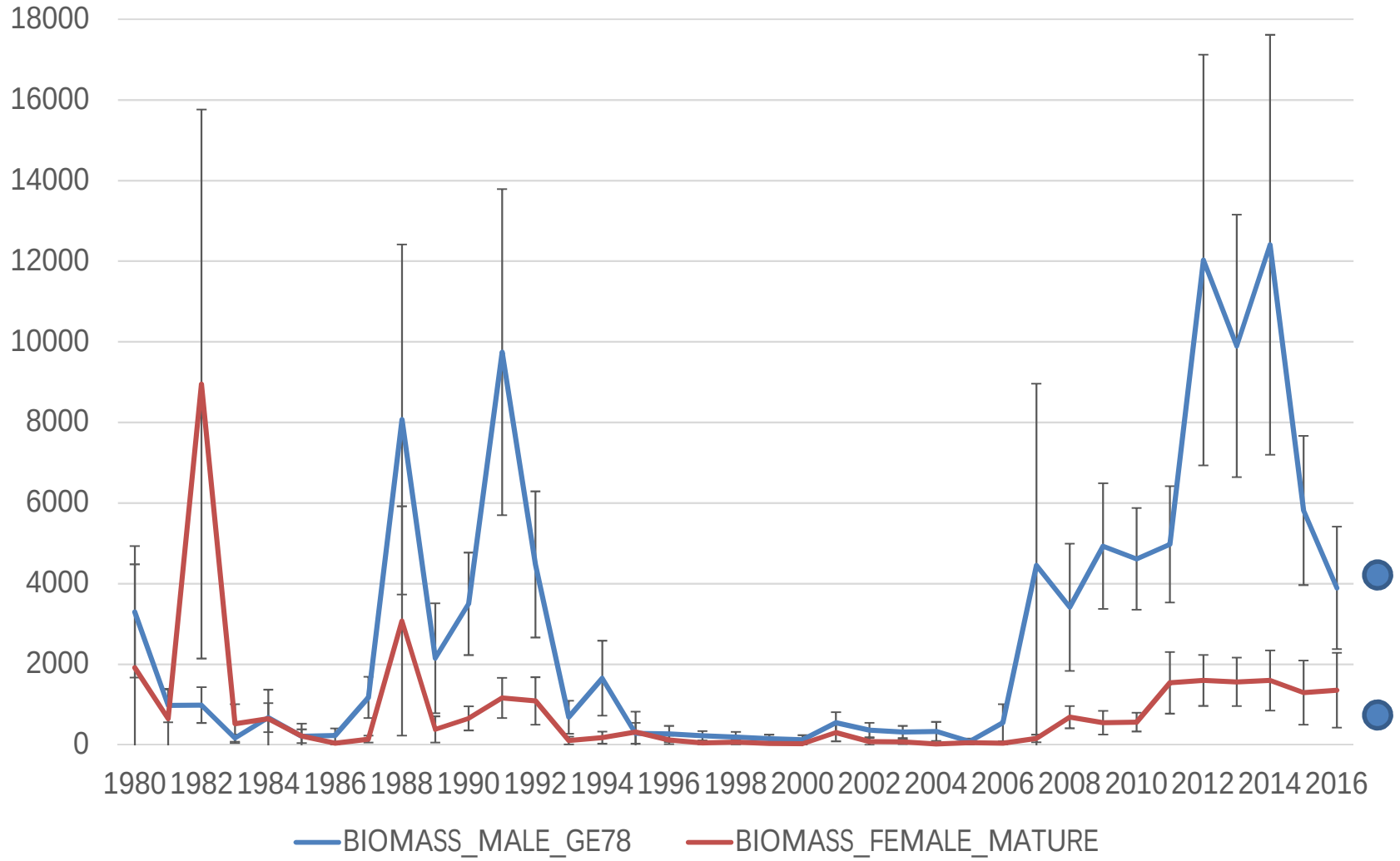

Snow Crab (male)
1980
1988
1996
2003
2010
1981
1989
1997
2004
2011
1982
1990
1998
2005
2012
1983
1991
1999
2006
2013
1984
1992
2000
2007
2014
1985
1993
2001
2008
2015
1986
1994
2002
2009
2016
1987
1995
2017
50
100
150
200
400
600
Abundance (millions)
Carapace width (mm)


Snow Crab (female)
1980
1988
1996
2003
2010
1981
1989
1997
2004
2011
1982
1990
1998
2005
2012
1983
1991
1999
2006
2013
1984
1992
2000
2007
2014
1985
1993
2001
2008
2015
1986
1994
2002
2009
2016
1987
1995
2017
20 40 60 80 100 120
1000
500
Abundance (millions)
Carapace width (mm)

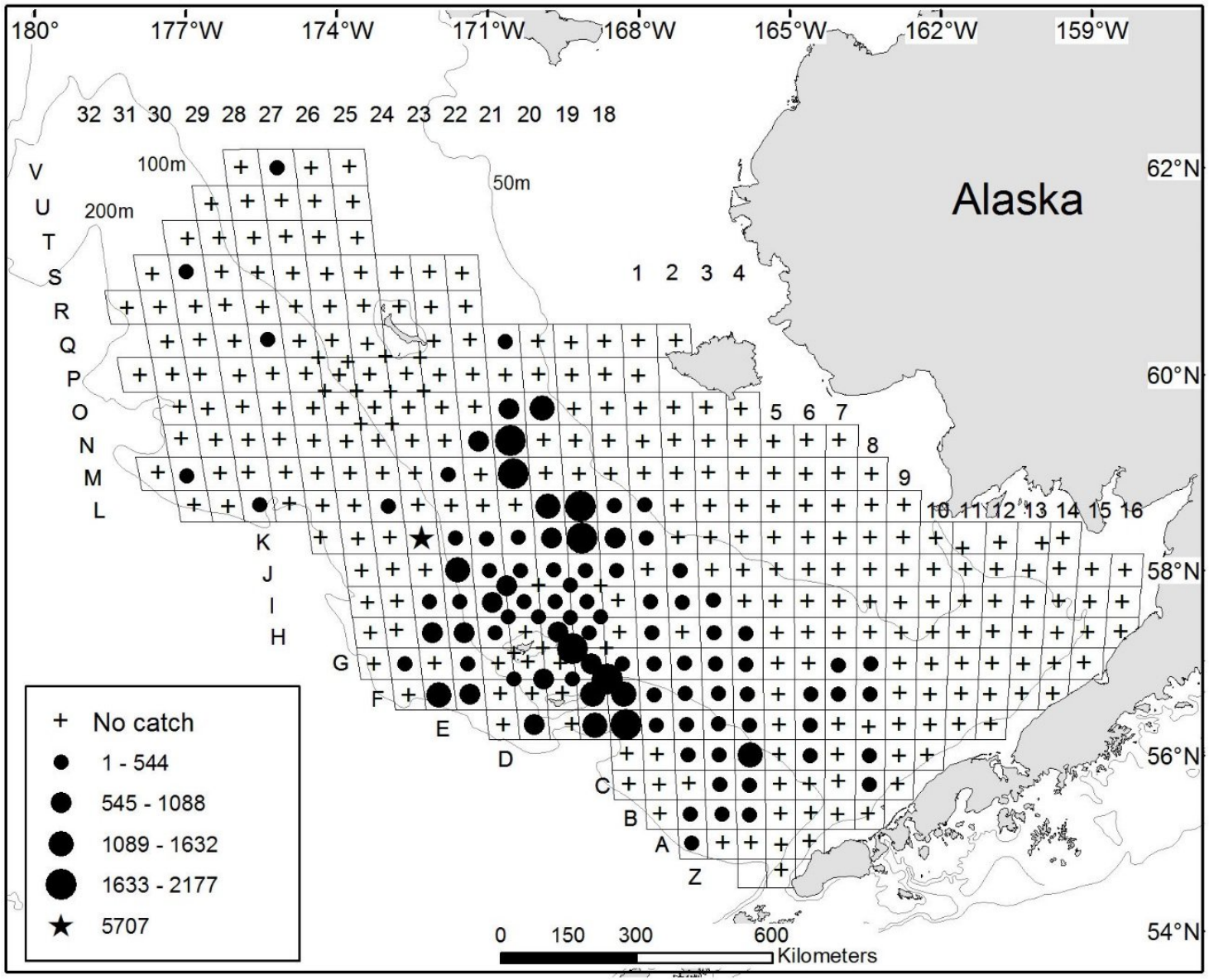
Chionoecetes bairdi/opilio hybrid crab biomass (t)

8% of legal male snow crab
3% of mature female snow crab

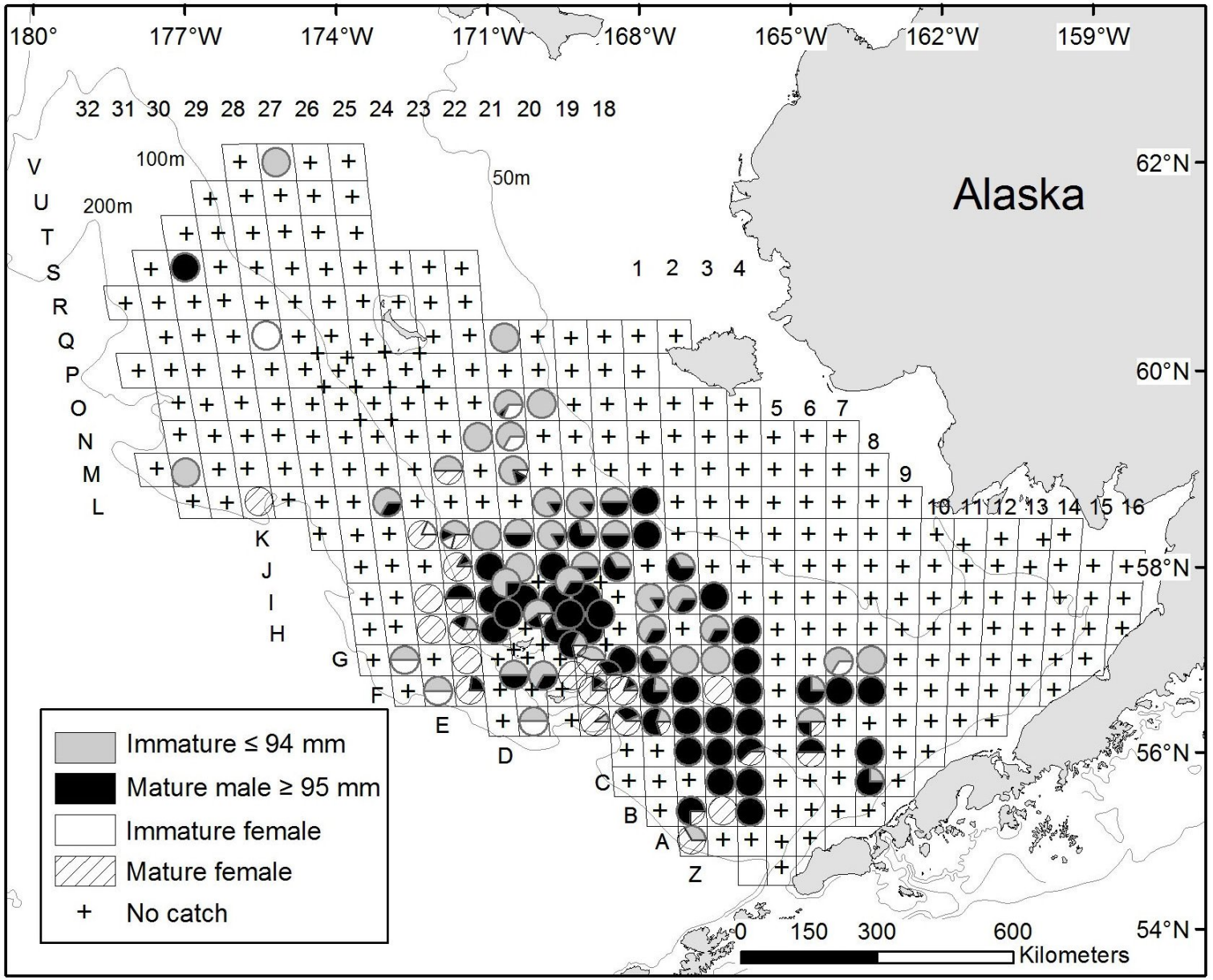
10% of legal male Tanner crab (west)
22% of mature female Tanner crab (west)



Chionoecetes bairdi/opilio hybrid crab



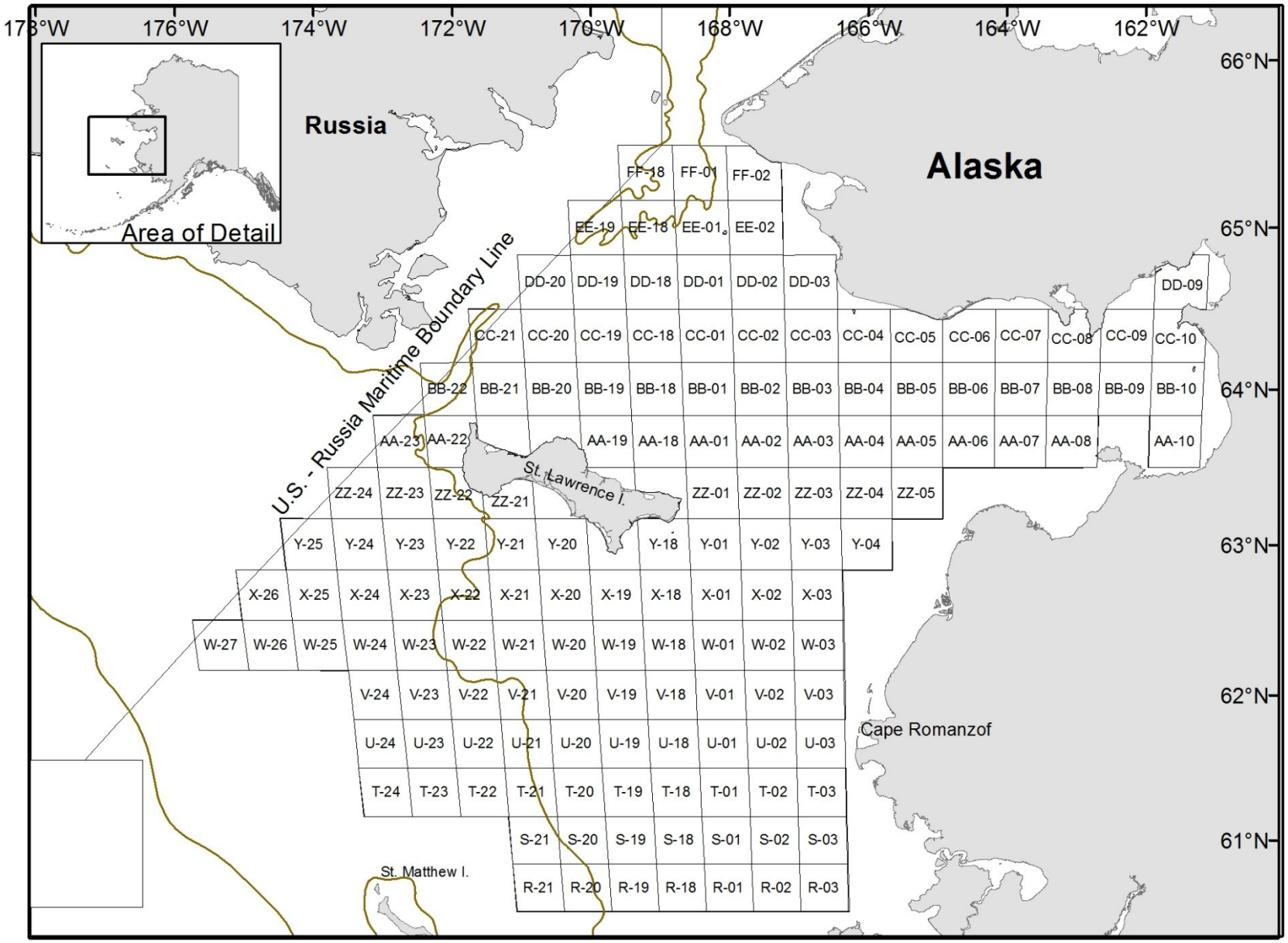
Chionoecetes bairdi/opilio hybrid crab



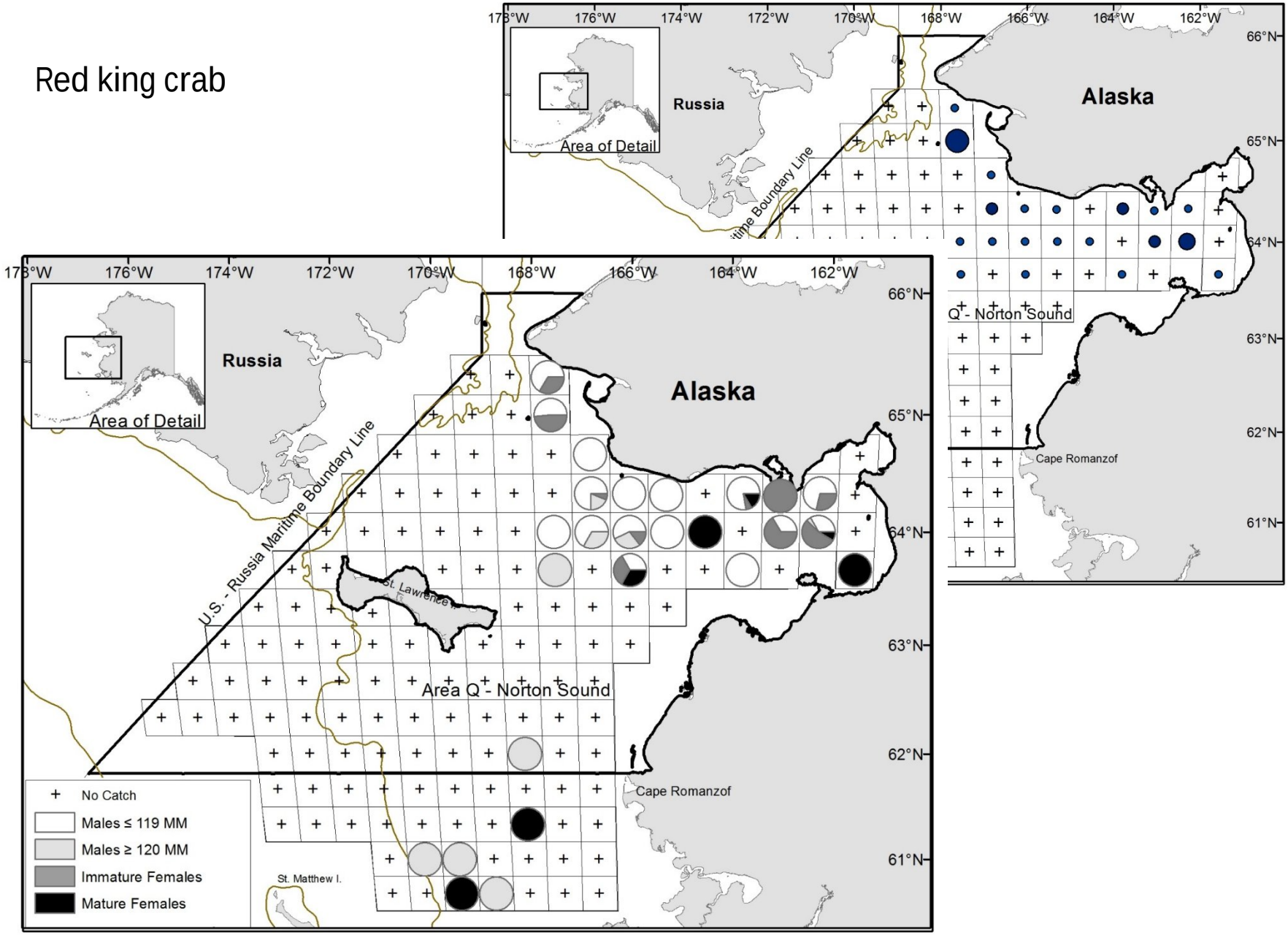
2017 Mature Males (2016 value in parentheses)

	# tows	#tows with crab	# caught	% measured	Biomass (t)
BB RKC	136	64 (59)	266 (302)	100%	23,102 (25,481)
PI RKC	77	8 (5)	57 (69)	100%	3,658 (4,150)
PI BKC	86	4 (3)	4 (3)	100%	253 (129)
SM BKC	56	13 (16)	39 (83)	100%	1,721 (3,072)
TC east	120	80 (99)	1,053 (1,011)	100%	19,313 (18,523)
TC west	255	107 (112)	1,955 (2,797)	99%	24,268 (35,119)
SC	375	167 (190)	2,198 (2,191)	96% (86%)	29,240 (29,961)

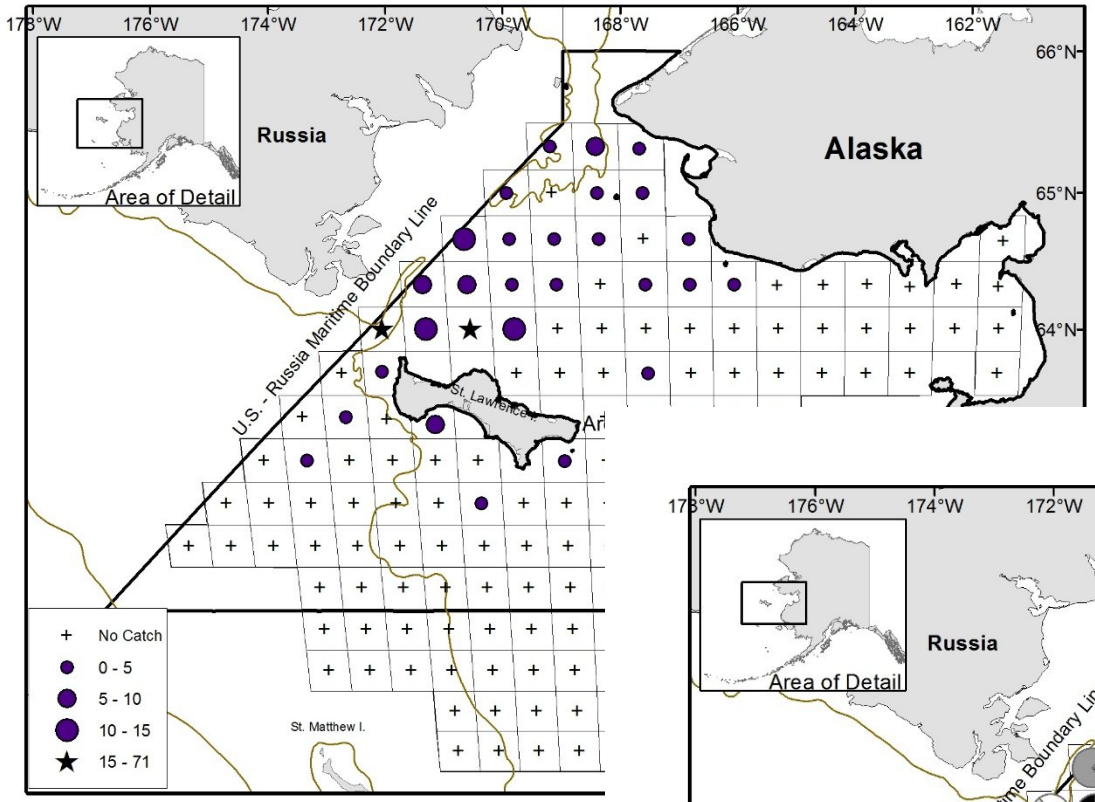
2017 Northern Bering Sea Survey

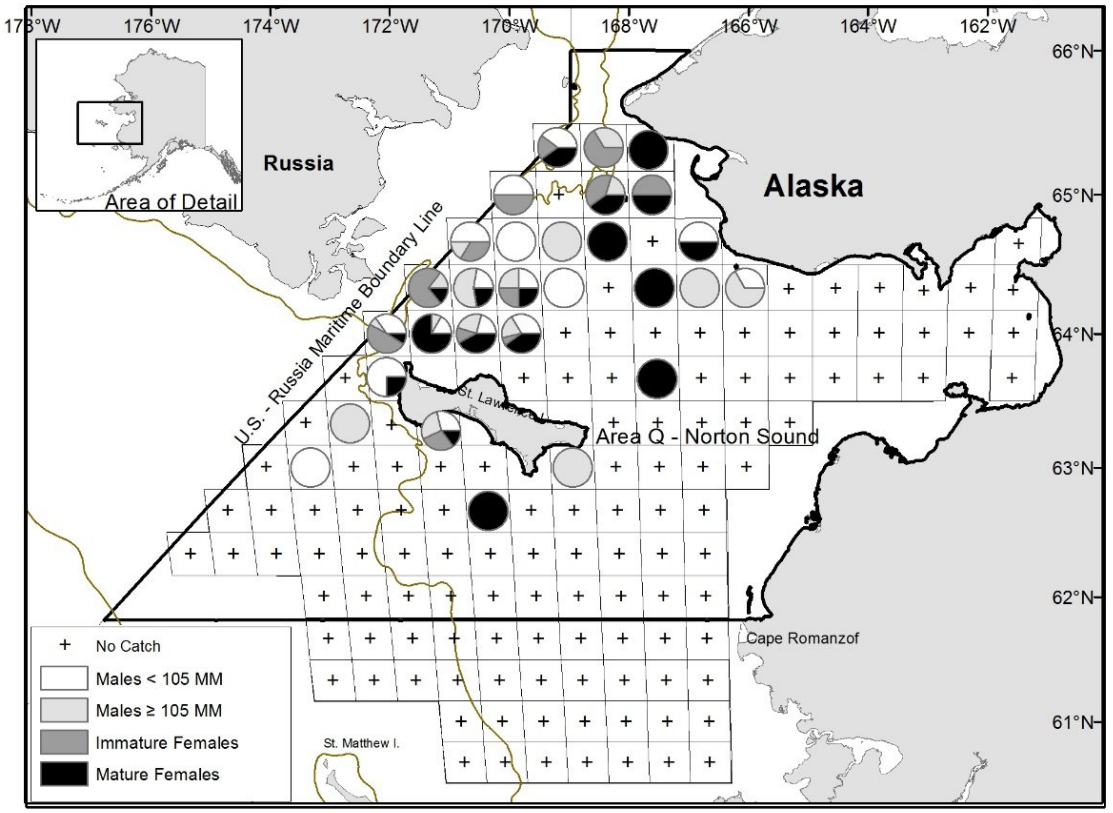


Red king crab

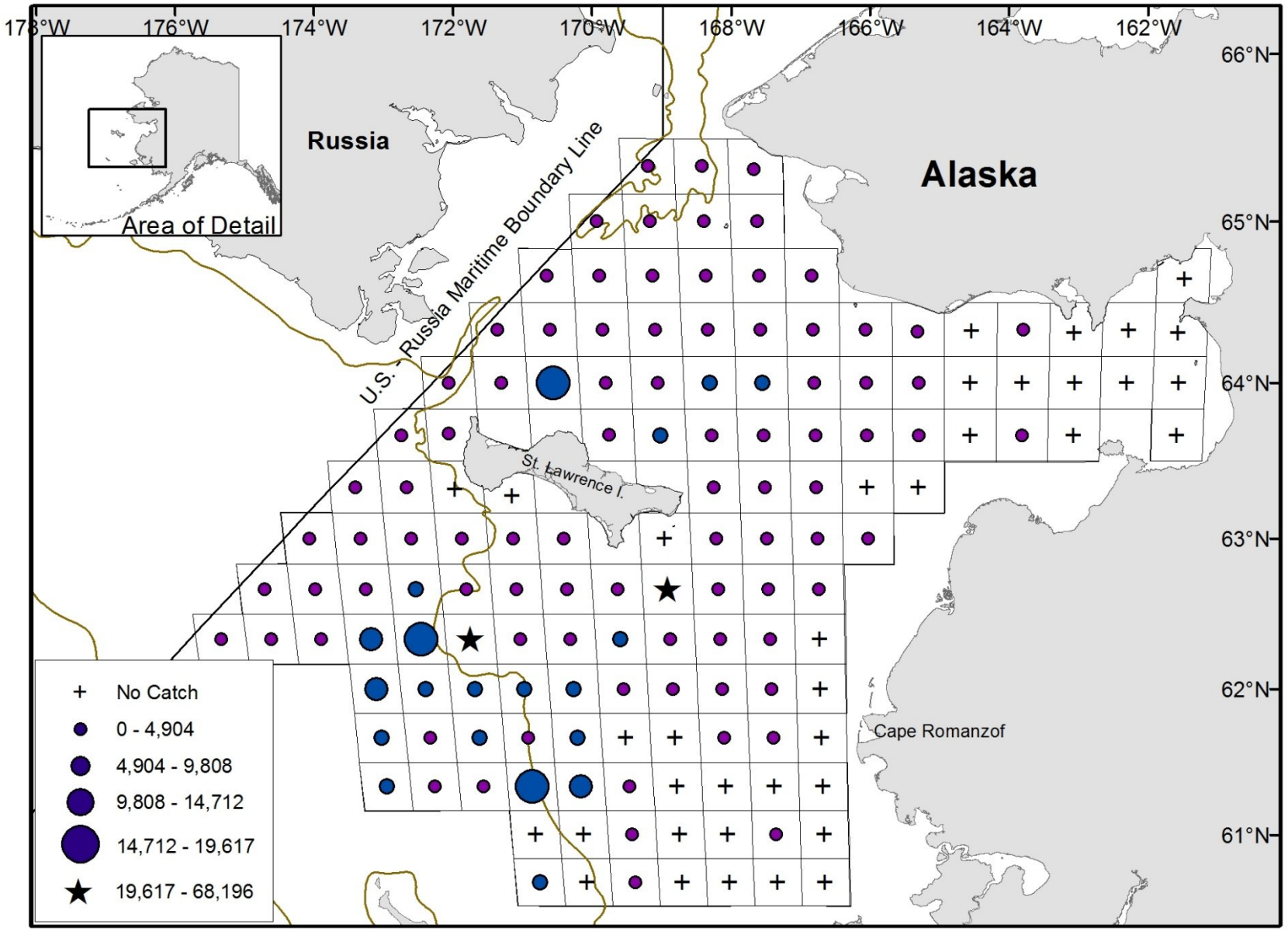


Blue king crab

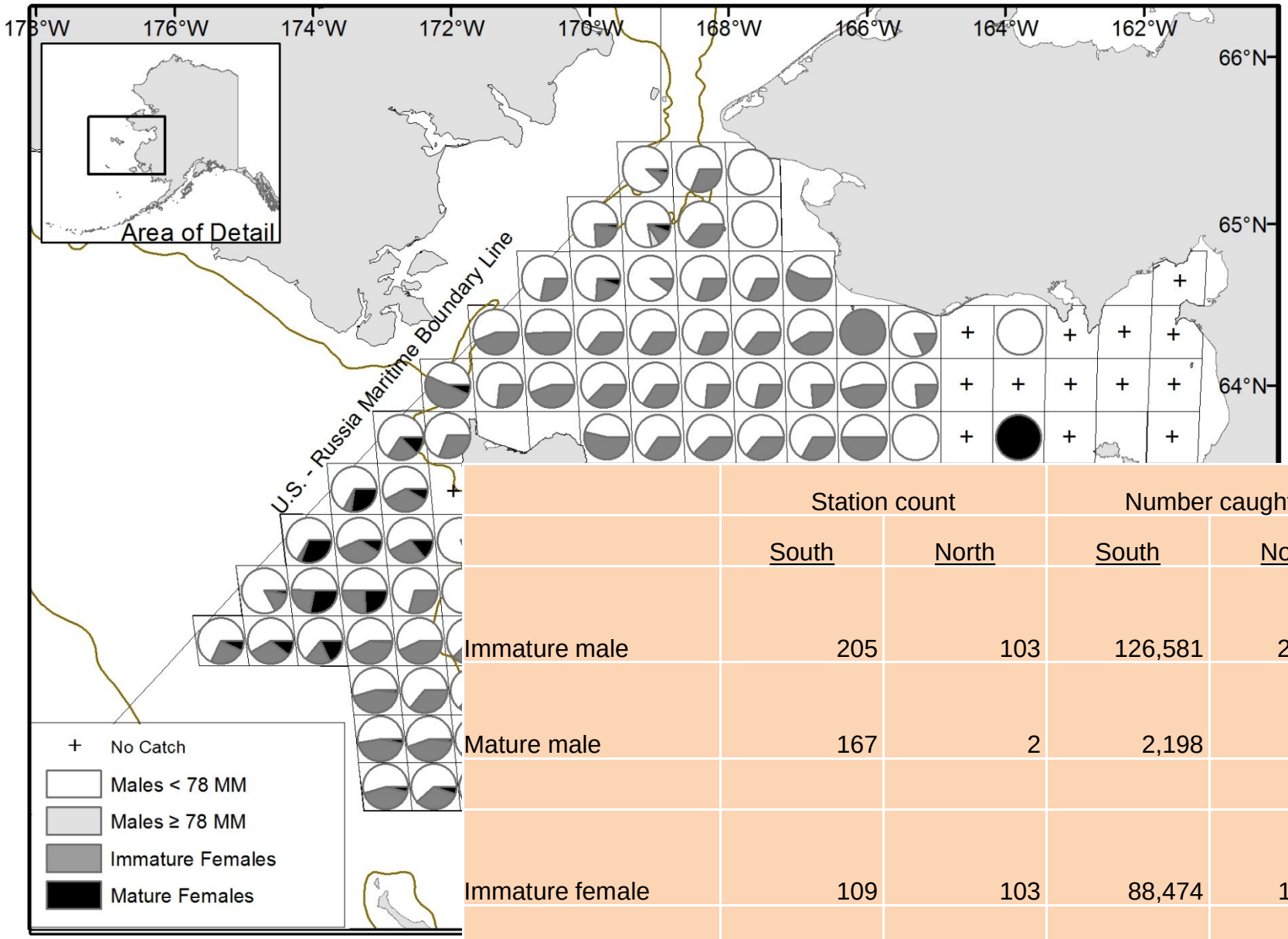




Snow crab

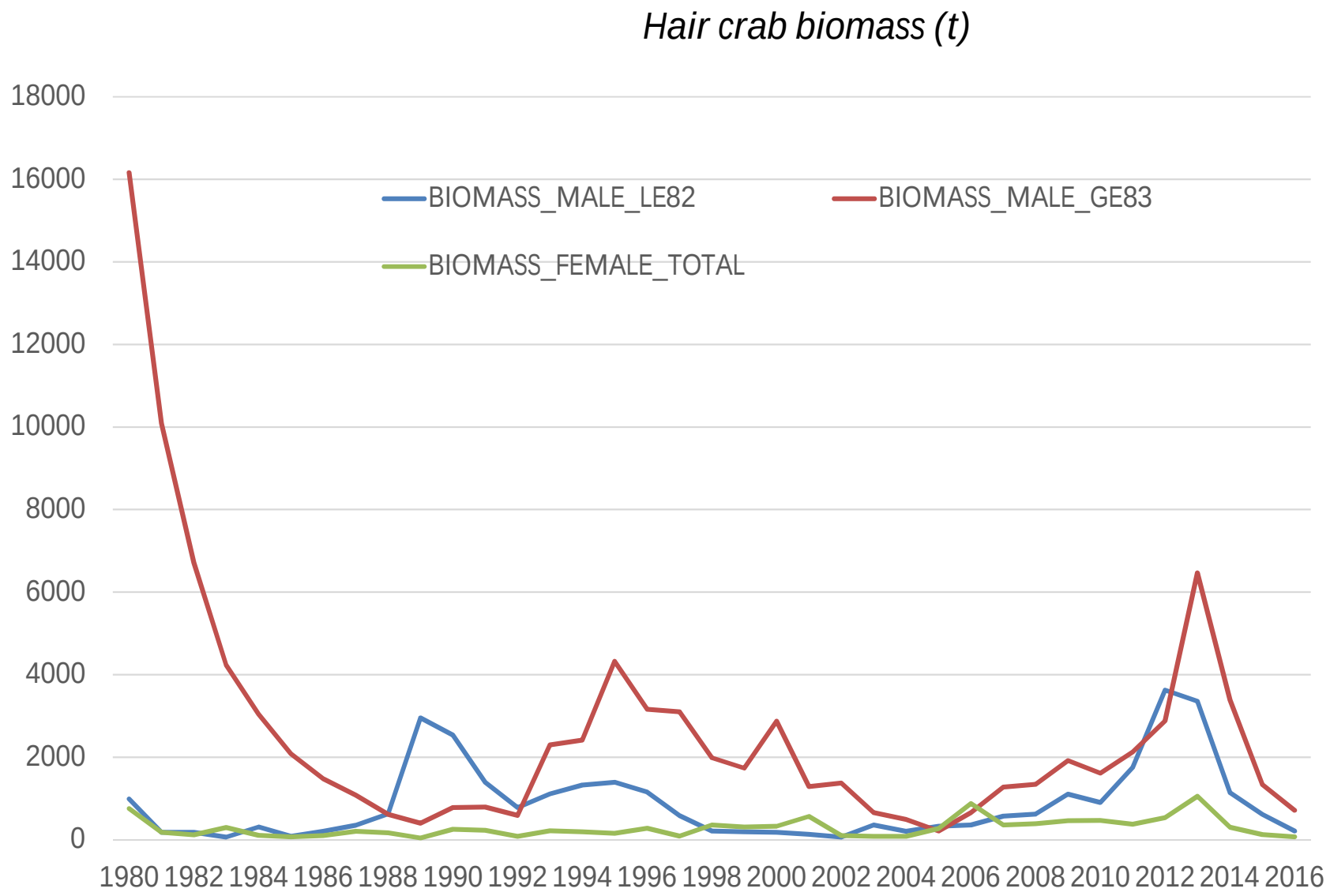

178°W
176°W
174°W
172°W
170°W
168°W
166°W
164°W
162°W
66°N
65°N
64°N
63°N
62°N
61°N
Area of Detail
Russia
Alaska
U.S. - Russia Maritime Boundary Line
St. Lawrence I.
Cape Romanzof
No Catch
0 - 4,904
4,904 - 9,808
9,808 - 14,712
14,712 - 19,617
19,617 - 68,196

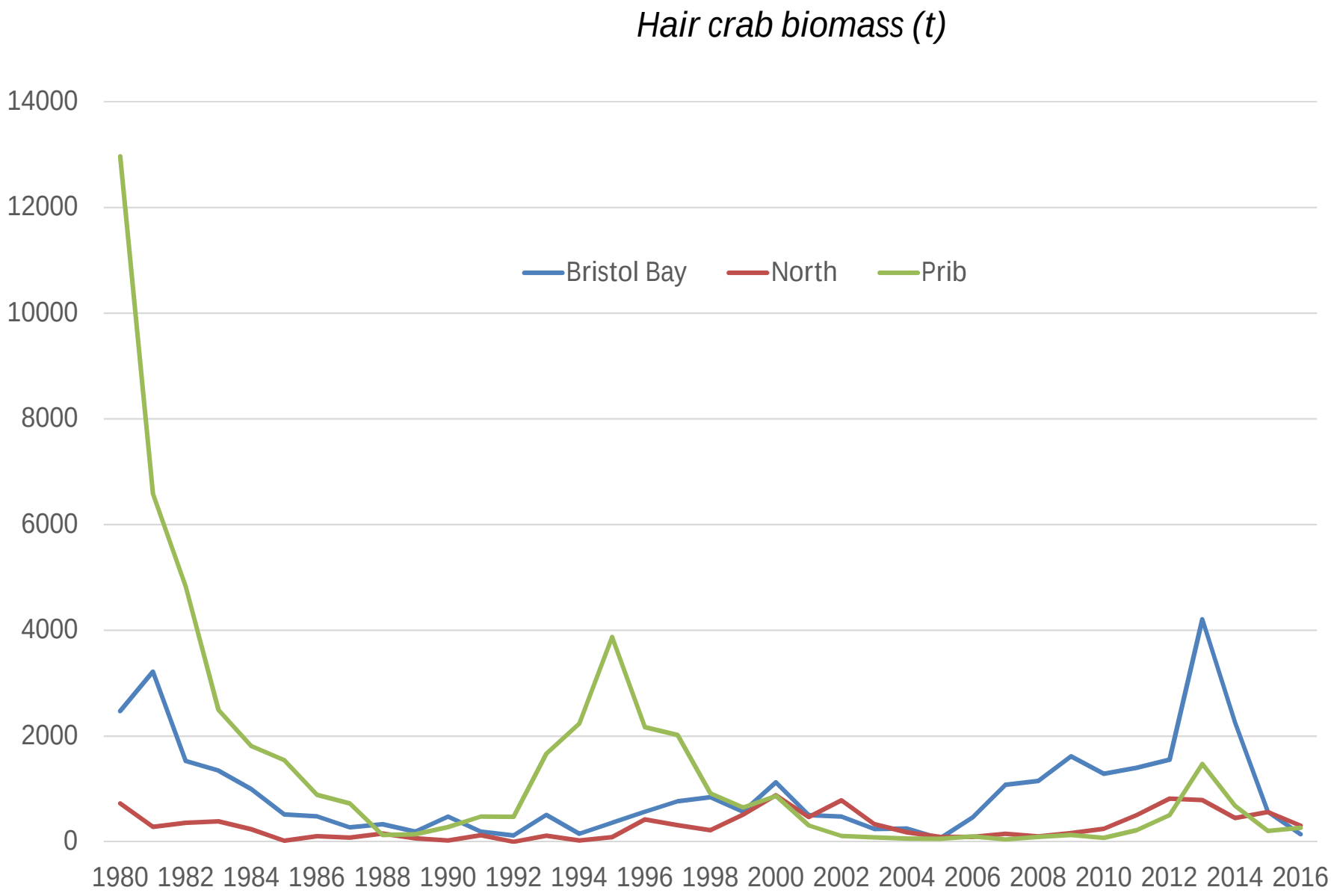
Snow crab

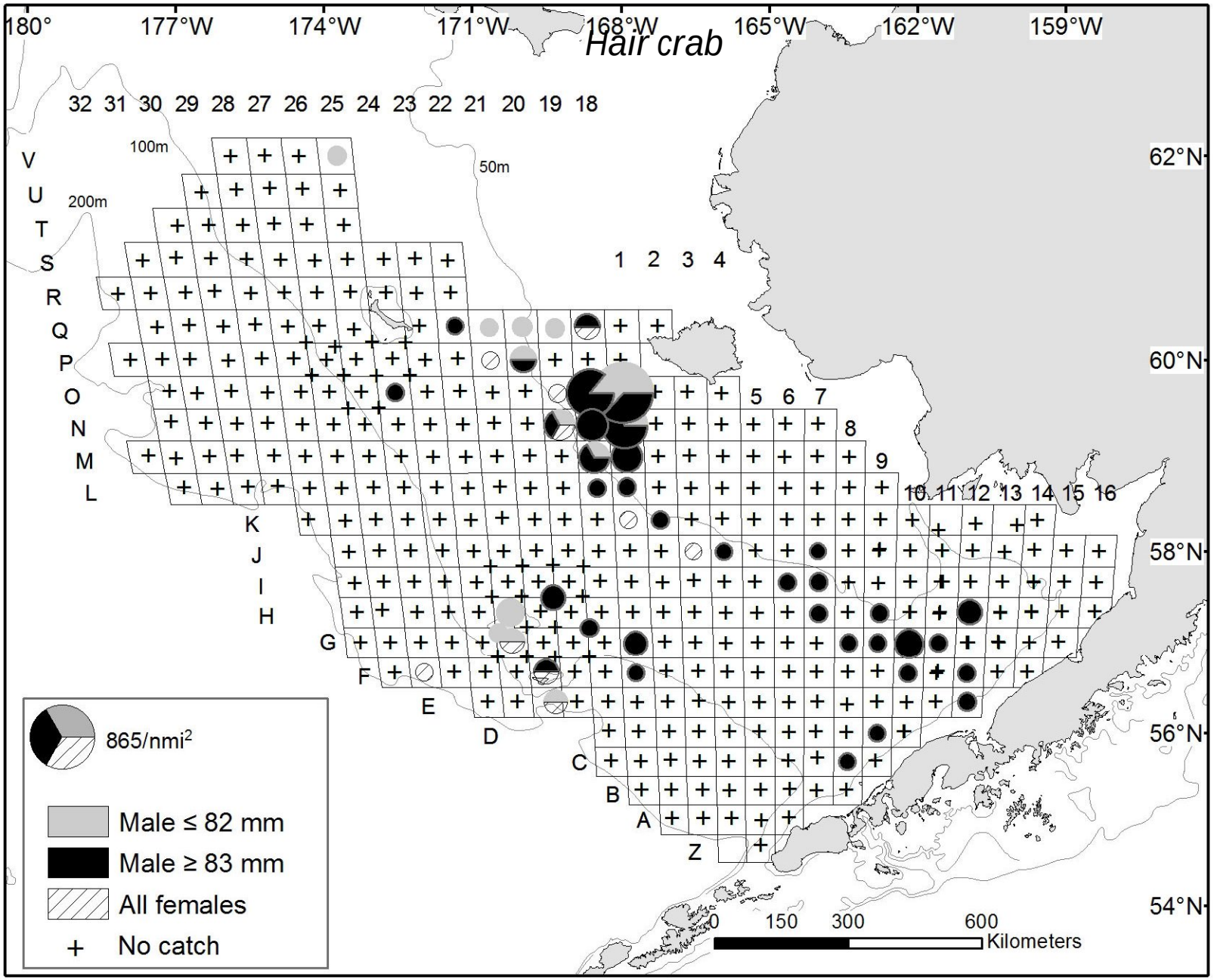


	Station count		Number caught	
	South	North	South	North
Immature male	205	103	126,581	221,893
Mature male	167	2	2,198	2
Immature female	109	103	88,474	143,311
Mature female	135	53	74,073	4,651

https://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM_2017_DRAFT_091517.pdf


Hair crab biomass (t)
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
BIOMASS_MALE_LE82
BIOMASS_MALE_GE83
BIOMASS_FEMALE_TOTAL
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016


Hair crab biomass (t)
14000
12000
10000
8000
6000
4000
2000
0
Bristol Bay
North
Prib
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016


Hair crab
180°
177°W
174°W
171°W
168°W
165°W
162°W
159°W
62°N
60°N
58°N
56°N
54°N
100m
200m
50m
865/nmi²
Male ≤ 82 mm
Male ≥ 83 mm
All females
No catch
0 150 300 600
Kilometers

2017 EBS Crab Survey Results (1000 metric tons)

Stock	2016 survey MMB	2017 survey MMB	2016 to 2017 % change	2016-17 B_{MSY}	2016/17 MODEL MMB	Last Year $\%B_{MSY}$	2016/17 OFL	2016/17 ABC	Overfishing?	Overfished ?	ADFG TAC
EBS snow crab	30.0	29.2	-2% (-35%)	151.6	96.1	63%	23.7	21.3	No	No	**Likely OPEN** **Mature females up 53%**
BB red king crab	25.5	23.1	-9% (-21%)	25.8	24.0	93%	6.6	6.0	No	No	OPEN (OFL may constrain TAC) **Mature females down 21%**
EBS Tanner crab	53.6	43.6	-19% (-8%)	25.7	45.3	177%	25.6	20.5	No	No	**??????** **Mature females up in east and down in west** **Mature males up 4% in east and down 31% in west**
Pribilof Islands red king crab	4.2	3.7	-12% (-73%)	5.5	7.0	125%	1.5	1.1	No	Not likely	CLOSED
Pribilof Islands blue king crab	0.1	0.3	+97% (-57%)	4.1	0.2	6%	0.00116	0.00087	No **(last year it was)**	Yes	CLOSED
St. Matthew Island blue king crab	3.1	1.7	-44% (-40%)	3.7	2.2	61%	0.14	0.11	No	??	**CLOSED**