



Biology of Norton Sound red king crab: what we know, what we think we know, and what we don't know



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Introduction

Tier 4

- Males only model
- Assumes differential mortality by size- large crab die at a higher rate
- Assumes discard mortality of $M=0.2$
- Molting occurs in September



Abundance

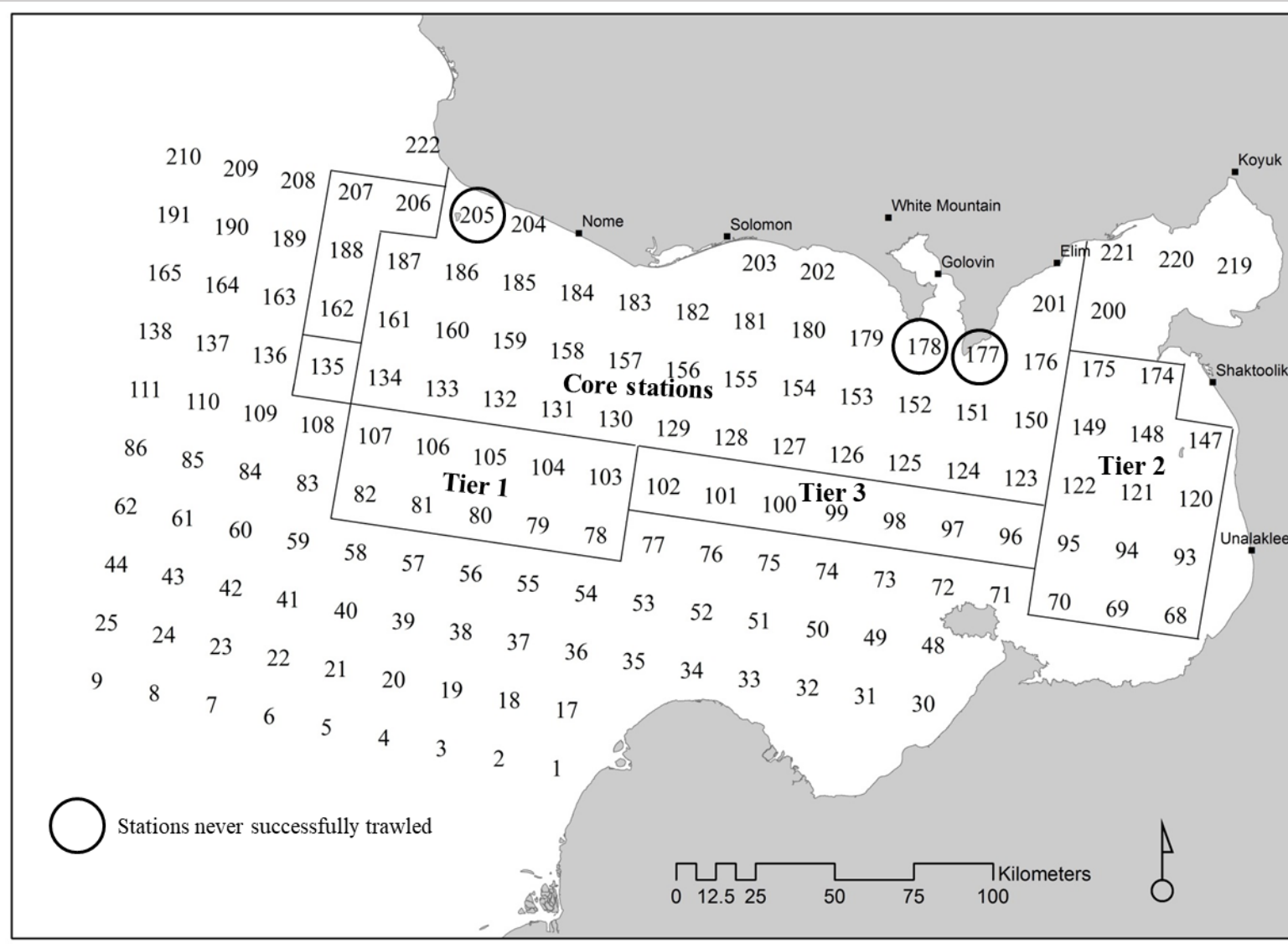
Triennial bottom trawl survey

10 X 10 nmile grid

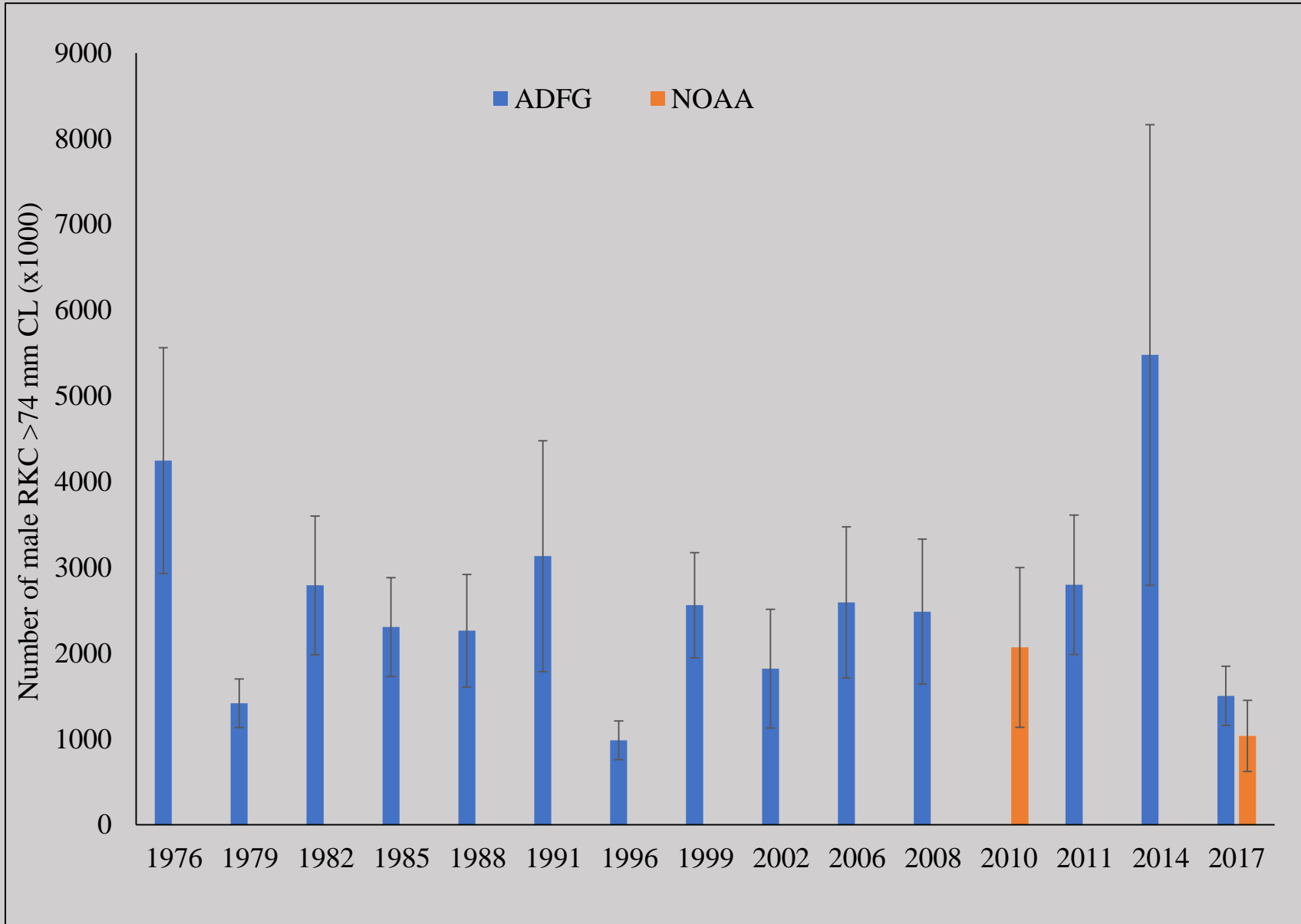
Core and Tier 1 stations became standardized in 1998 (Fair 1998)

Tiers 2 and 3 were reported in 2002 trawl report (Brennan 2002)

Abundance:
area swept method



Abundance



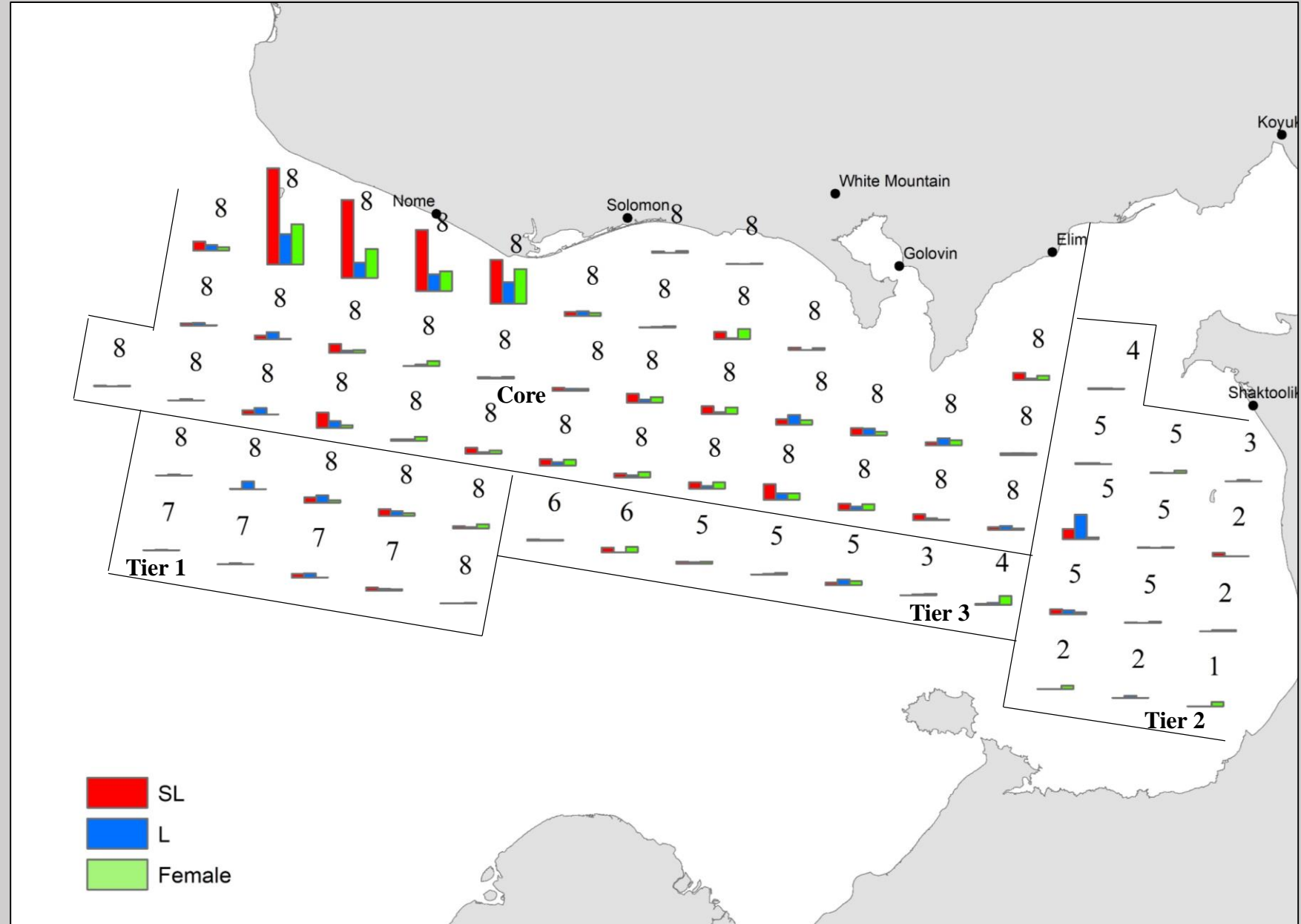
NOAA completed NS
bottom trawl surveys
in 2010 and 2017
(Uses 20 X 20 nmile
grid)

2014- Majority of
crab caught at one
station (186)

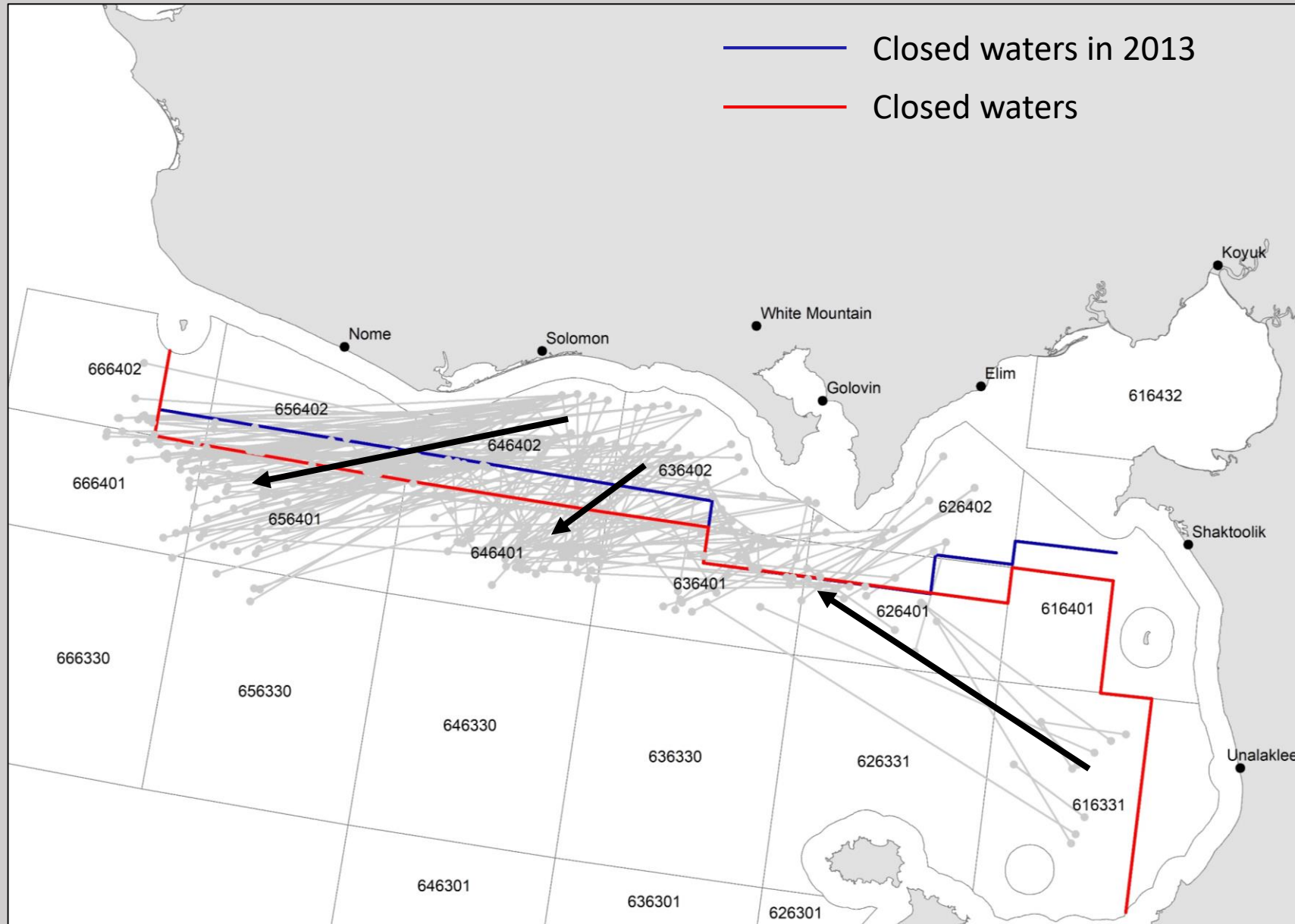
Distribution

Average number of crab captured at each station in trawl surveys from 1996-2017

Stations just south of Nome have highest number of captured crab



Movement



Based on spring tagging –
June, 2012-2015

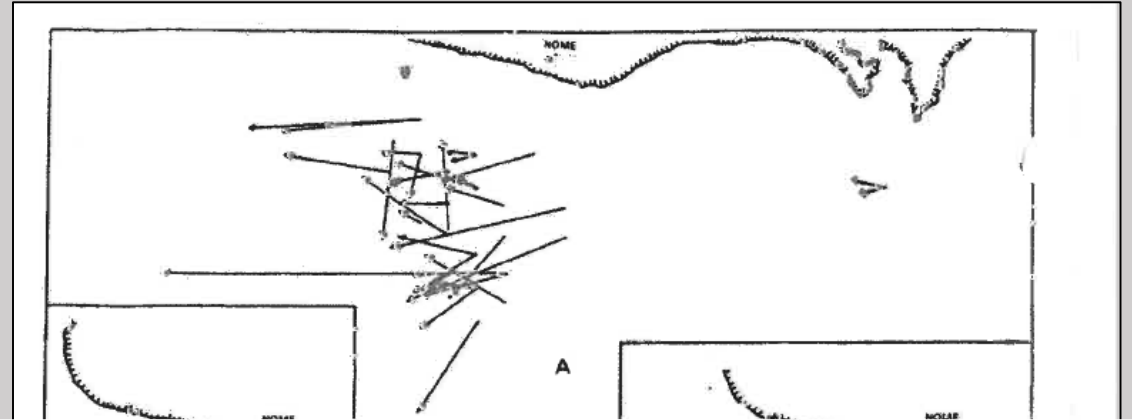
27,721 crab tagged
279 with recovery locations
(2,703 recovered)

- General southwest movement of northern crab
- General northwest movement of southeast crab

Movement

Historical tagging completed by research vessels offshore of Nome (top) or skiff (bottom) and recovered in the commercial fisheries weeks later.

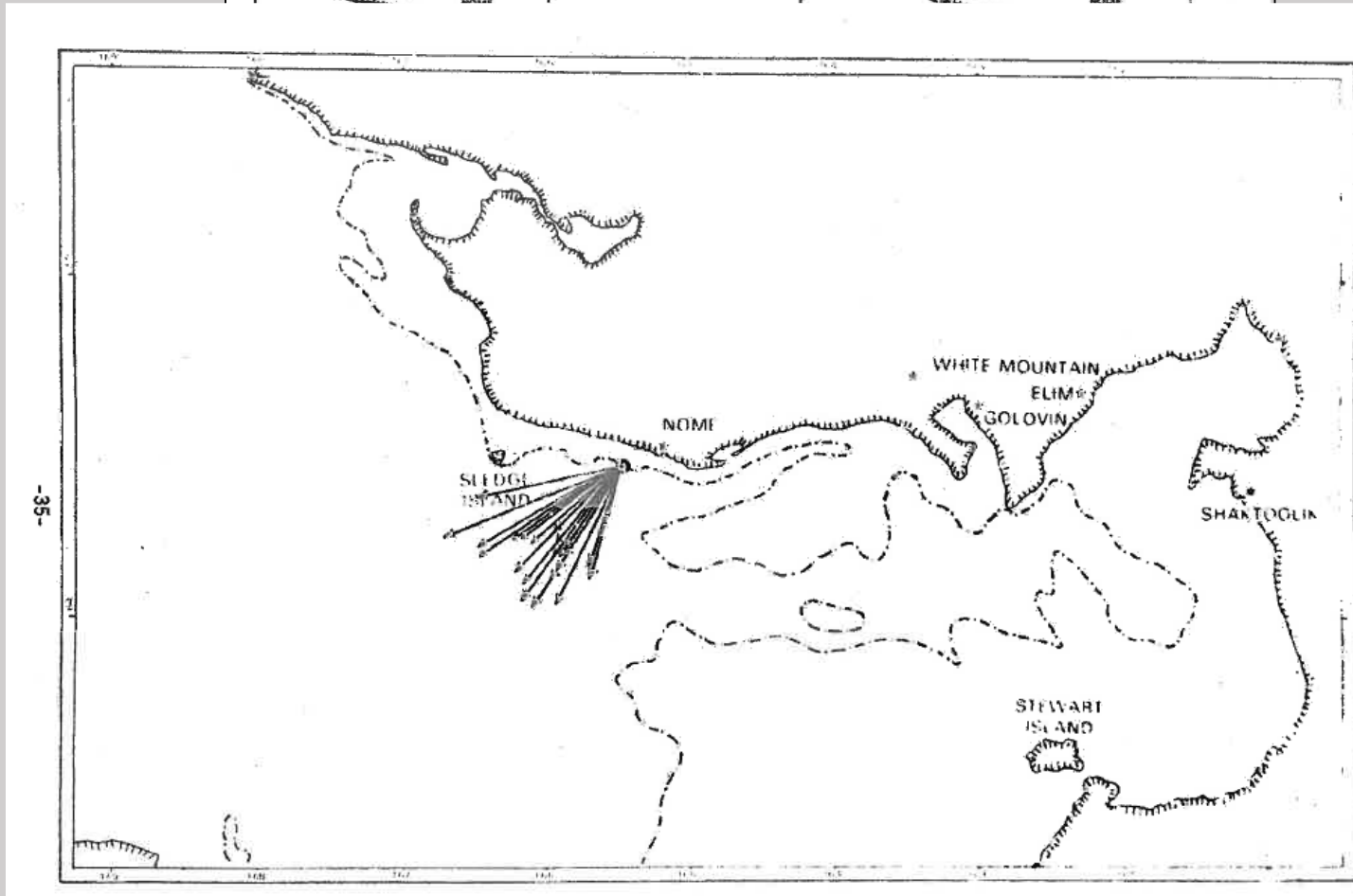
1981 -> 16-39 days free



Movement is generally west/southwest

NS RKC are one population

1981 -> ~30 days free

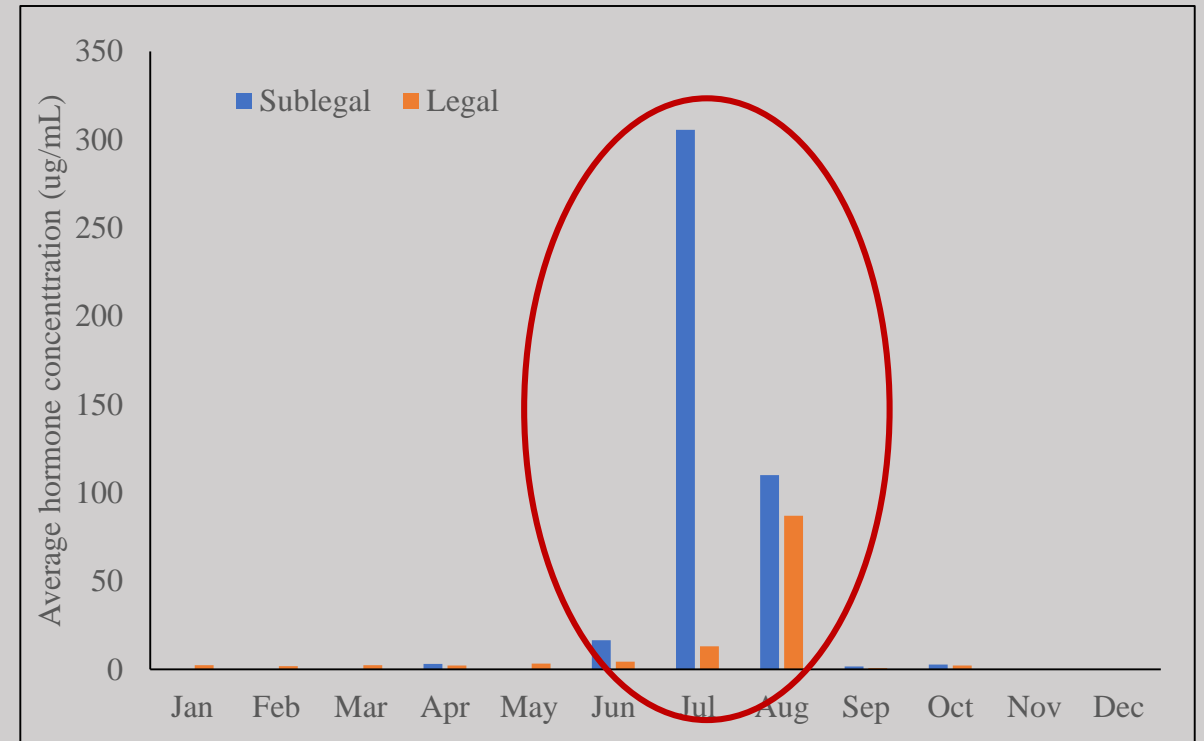
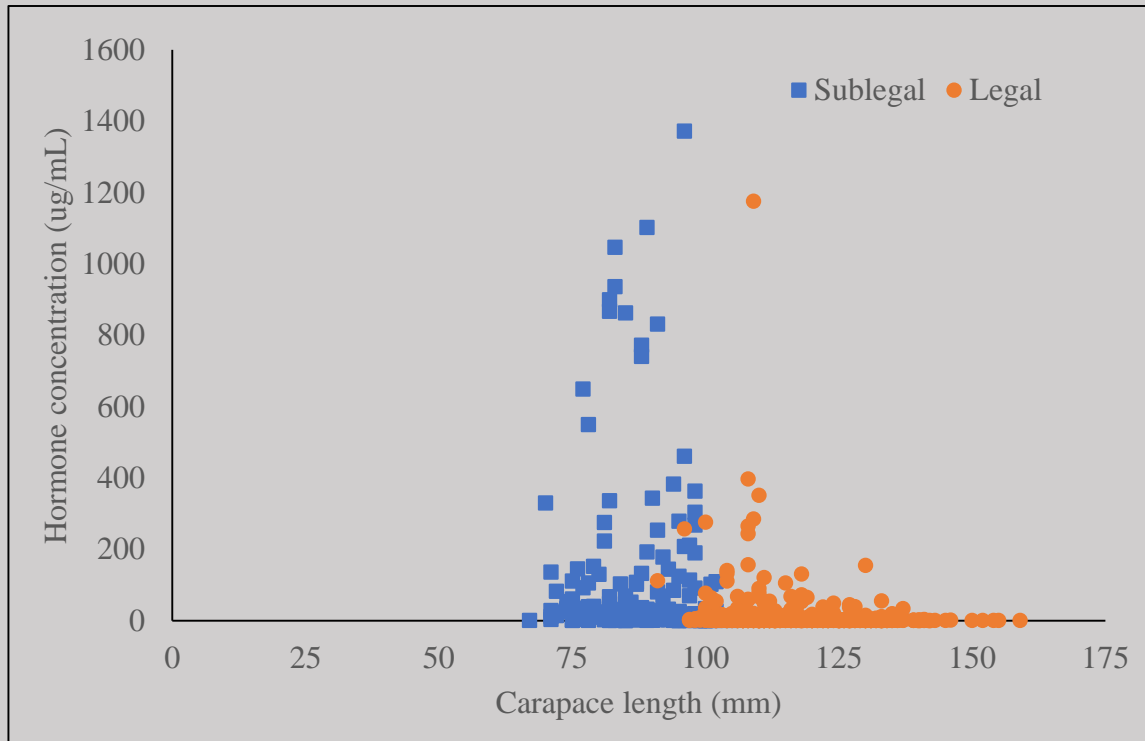


Molt timing

Ecdysteroids- molting hormones can be measured in the blood.
Hormone levels increase 2-4 (?) weeks before molting

Collected blood in 2014 and 2015

Sublegal crab molt earlier in the year



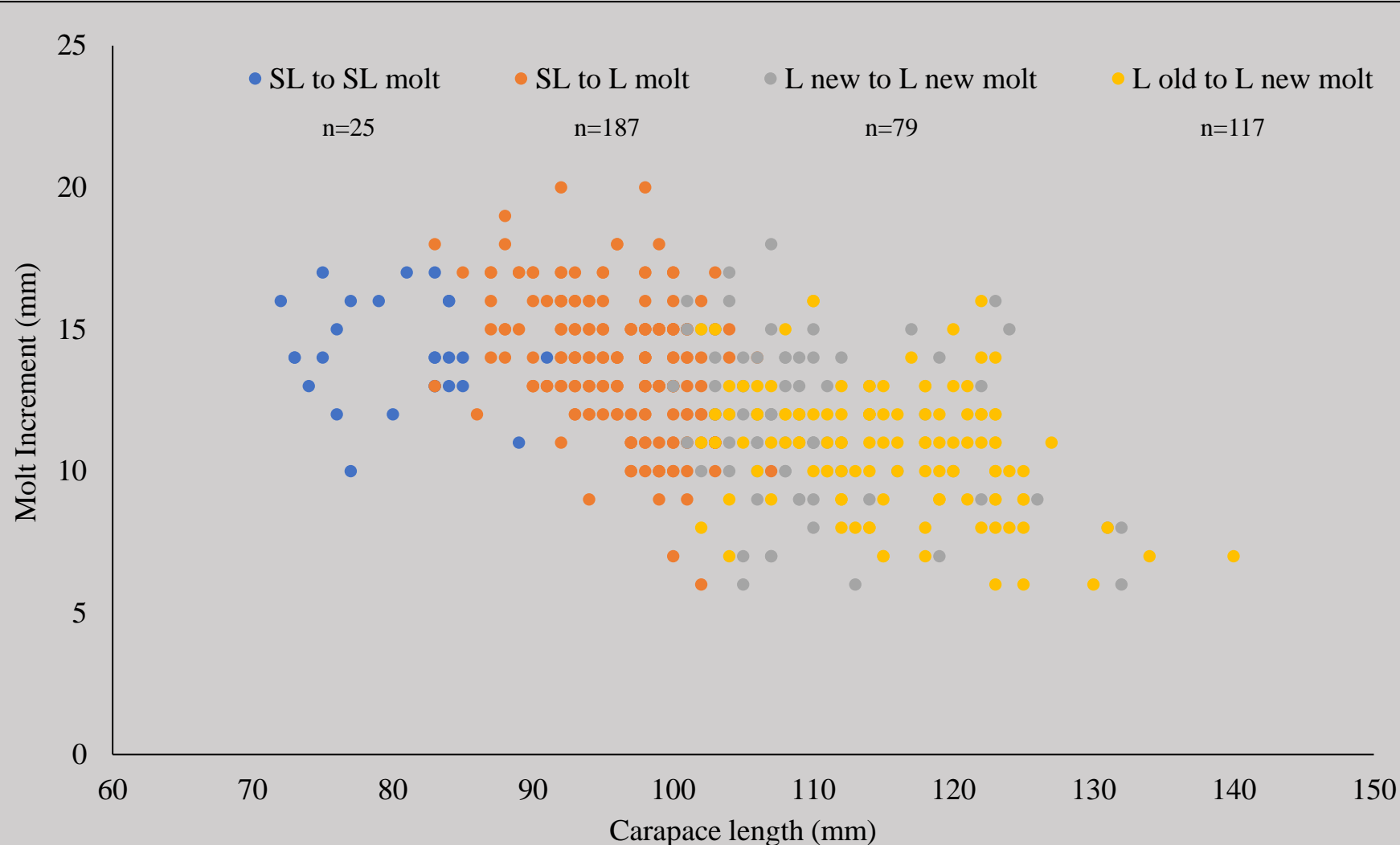
Is hormone concentration a function of sample location?

Offshore sampling

Molt increment

From crab tagged
in spring
nearshore survey
and recovered in
commercial and
spring survey the
next year

Sublegal
RKC grow
faster



Size at maturity

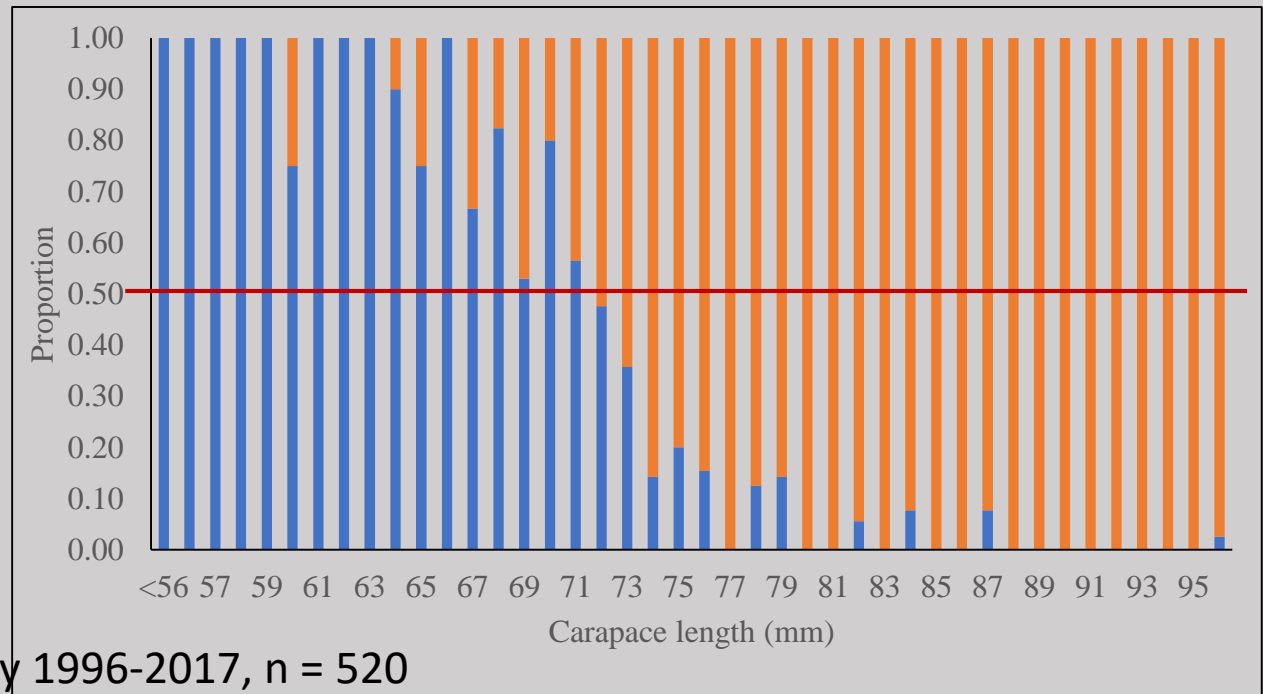
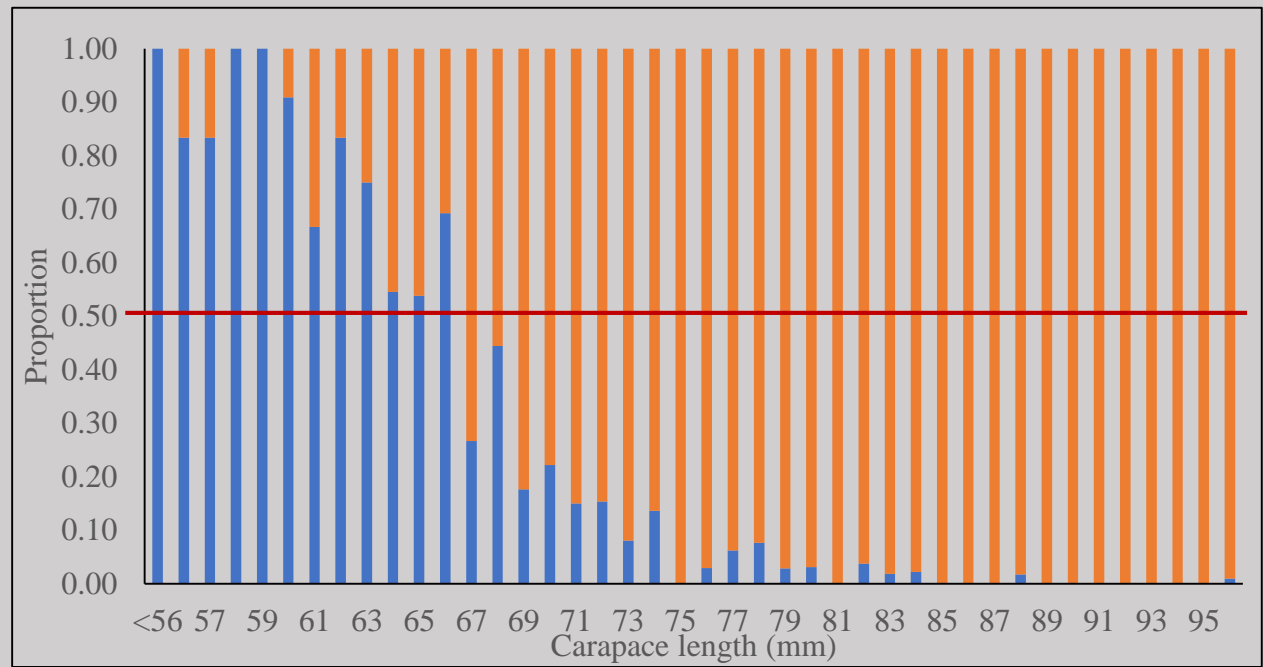
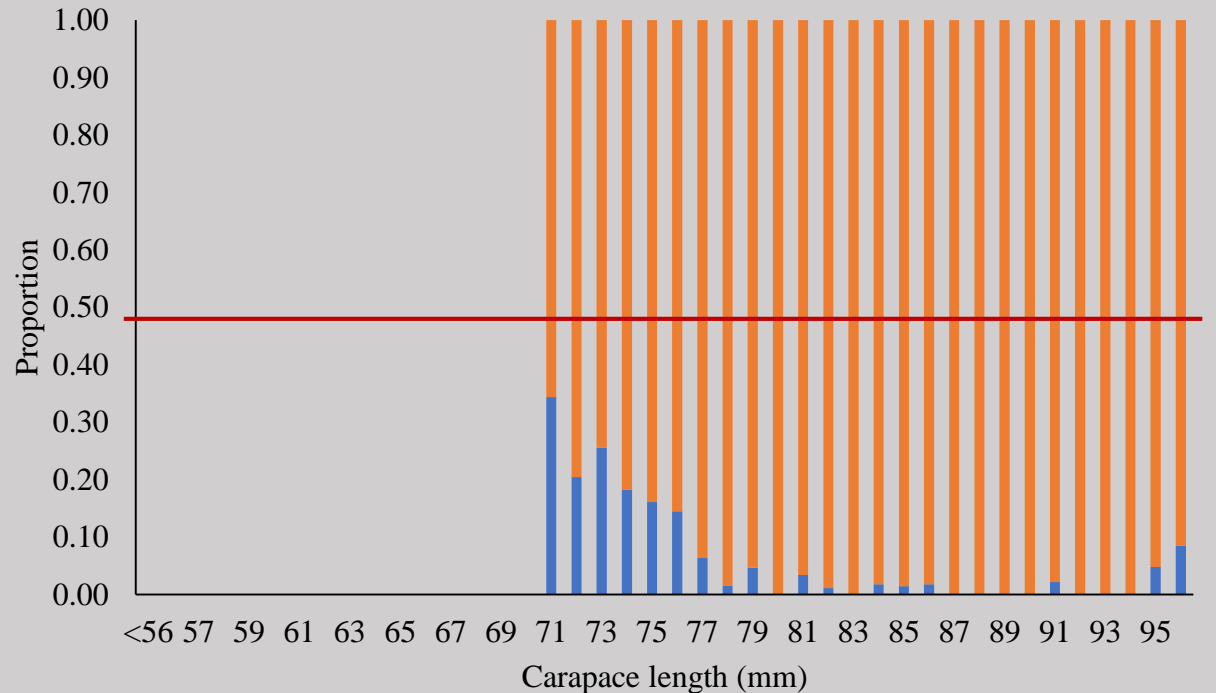
Females

■ No Clutch

■ Clutch

Observer data 2012-2017; n = 1867

Tagging data 2012-2015; n = 1400



Trawl survey 1996-2017, n = 520

Size at maturity

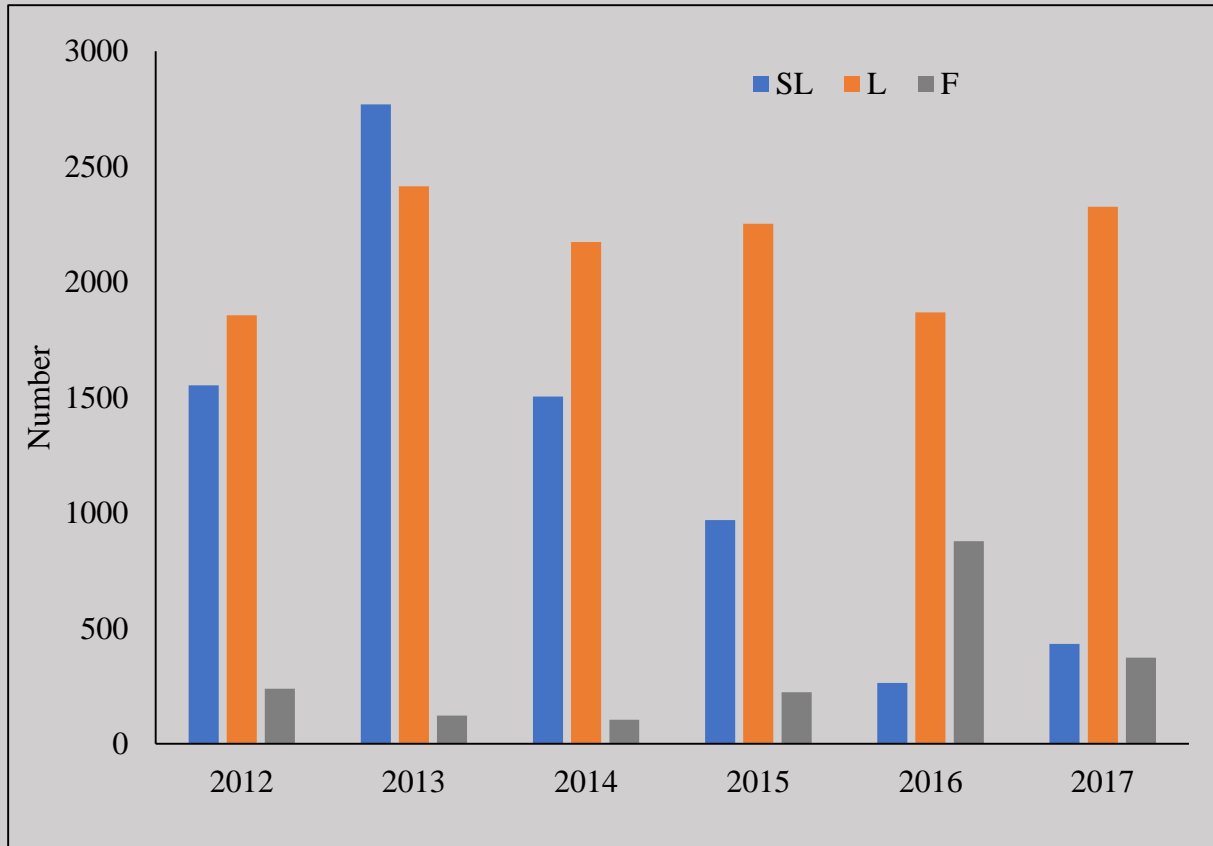
Males



Physiological maturity at 50 mm CL (Paul et al. 1991)

Unknown size of functional maturity but female maturity at 67-75 mm CL suggests males likely are > 70mm to successfully participate in mating

Handling Mortality- Summer Commercial



Handling in summer commercial fishery

Concerns:

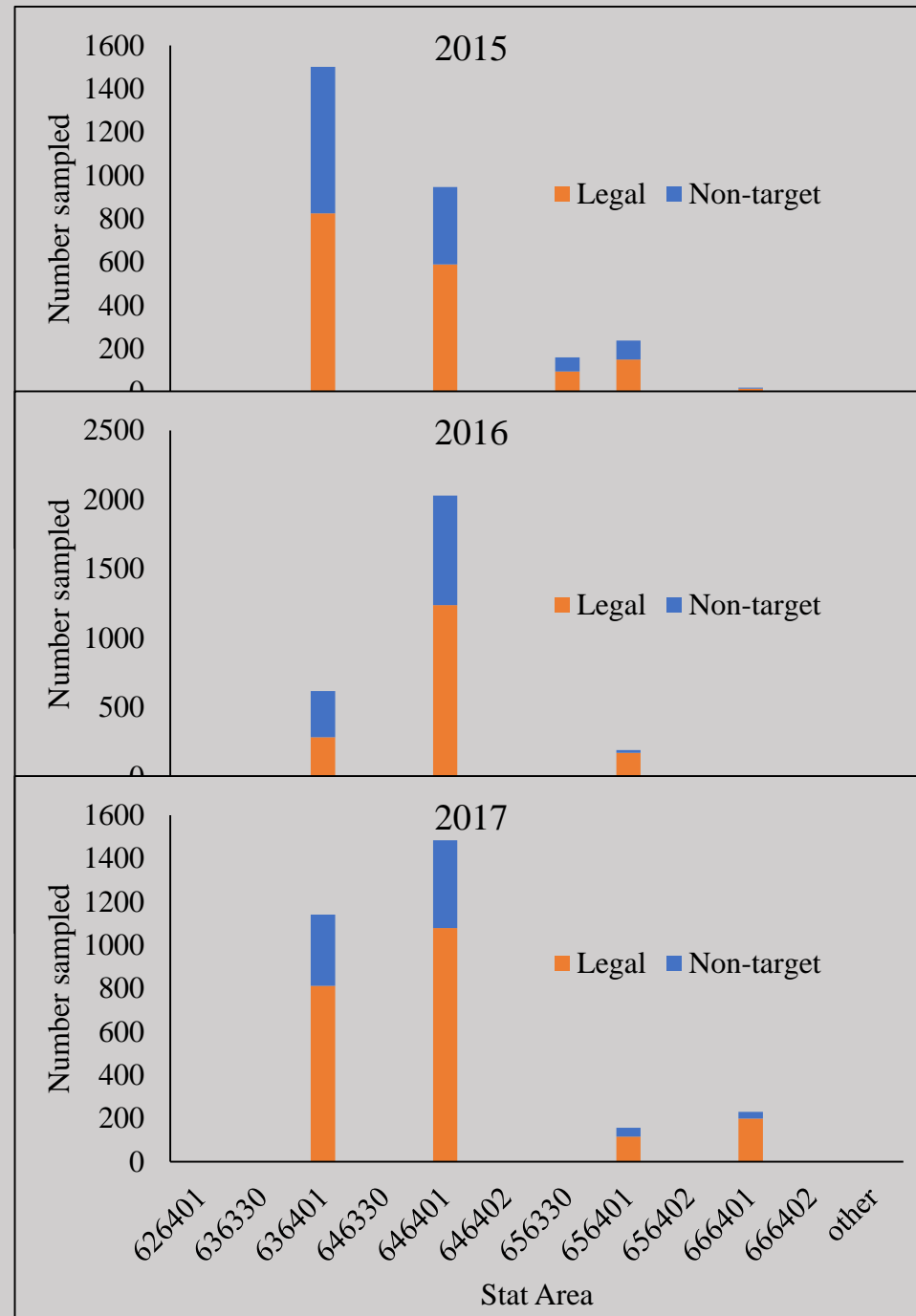
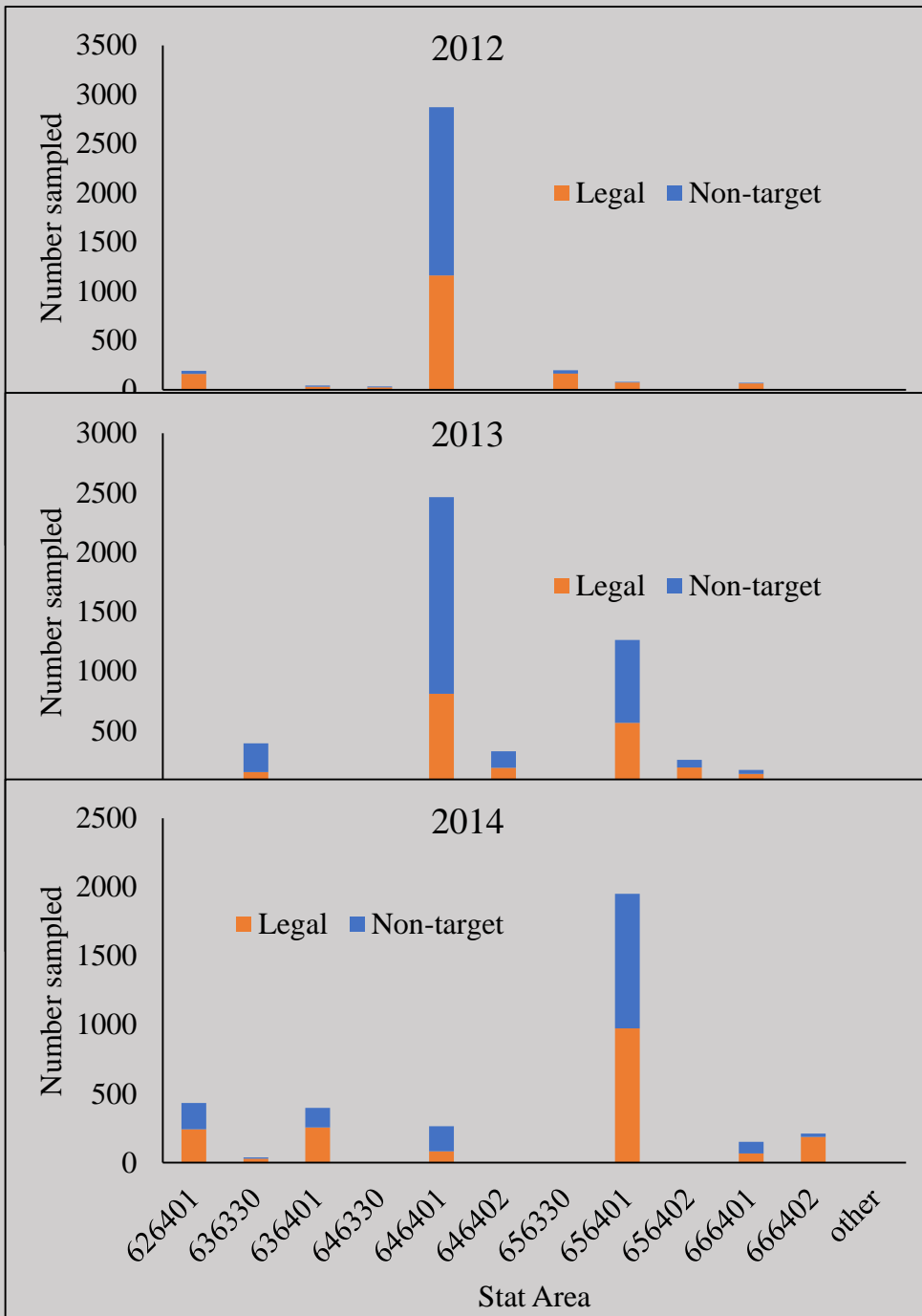
Program participants and use of escape mechanisms

Fishing location and sublegal densities

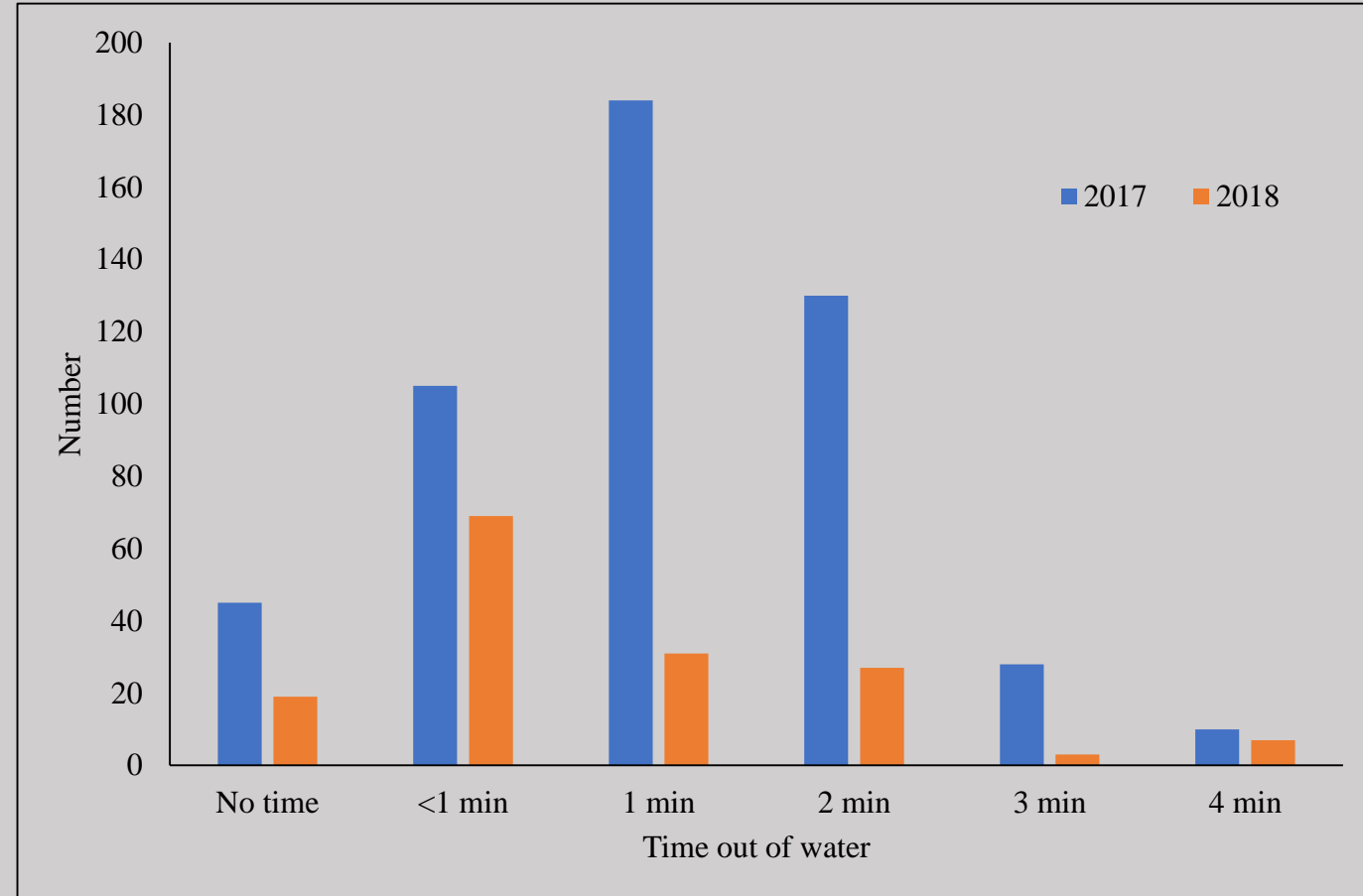
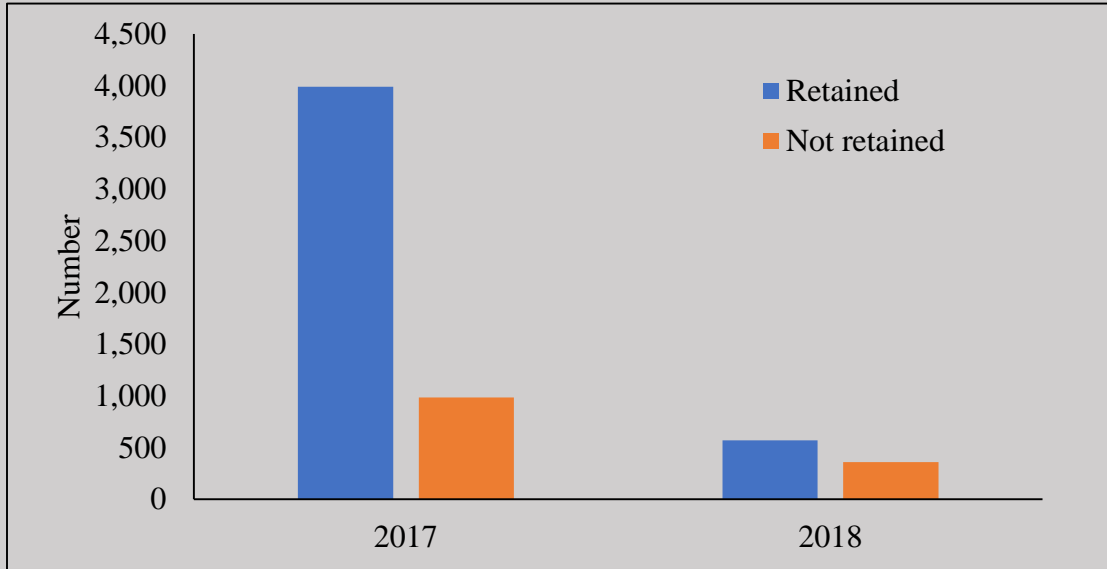
High abundance of sublegal crab in NS (detected by spring surveys) in 2013-2015

We assume handling mortality is low in summer commercial because of **warm** temps, **small** pots, short drop to water (<6ft)

Handling Mortality- Summer Commercial



Handling Mortality- Winter Commercial



- High-grading in 2018
- Assume initial mortality is low- live tanks
- Long-term effects unknown (Carls and O'Clair 1990, Shirley 1998)

Carls, M.G. and C.E. O'Clair. 1990. Influence of cold air exposures on oviferous red king crabs (*Paralithodes camtschatica*) and Tanner crabs (*Chionoecetes Bairdi*) and their offspring. Pages 329-343 in: Proceedings of the International Symposium on king and Tanner crabs. Alaska Sea Grant College Program Report 90-04, Fairbanks.

Shirley, T.C. 1998. Effects of wind chill on red king crabs. Appendix B in: Kruse, G.H. 1999. King and Tanner crab research in Alaska: Annual Report for July 1, 1998 through June 30, 1999. Alaska Department of Fish and Game, Commercial Fisheries Division, Regional Information Report 5J99-10, Juneau.

Summary

What we know:

- NSRKC is one population
- Male –legal and sublegal, and Female abundance estimate every 3 years
- Crab hotspots- not evenly distributed throughout NS
- Well-documented offshore movement in spring
- Molting earlier in SL crab, molting is offshore
- Growth is greater in SL crab
- Females >68 mm CL are reproductively viable



Summary

What we think we know:

Method of stratification
to calculate abundance

Not all crab move offshore;
Crabs stay inshore and don't
molt: skip molt crab

Discard mortality may be low in the summer commercial fishery



Summary

What we don't know:

- Yearly male abundance estimate
- Timing of inshore movement
- Functional maturity of males
- Long-term effects of cold exposure
- Natural mortality-differential mortality by size?
- Location of large males



Moving to Tier 3

We have spent 8 years adding to the existing understanding of NS RKC biology

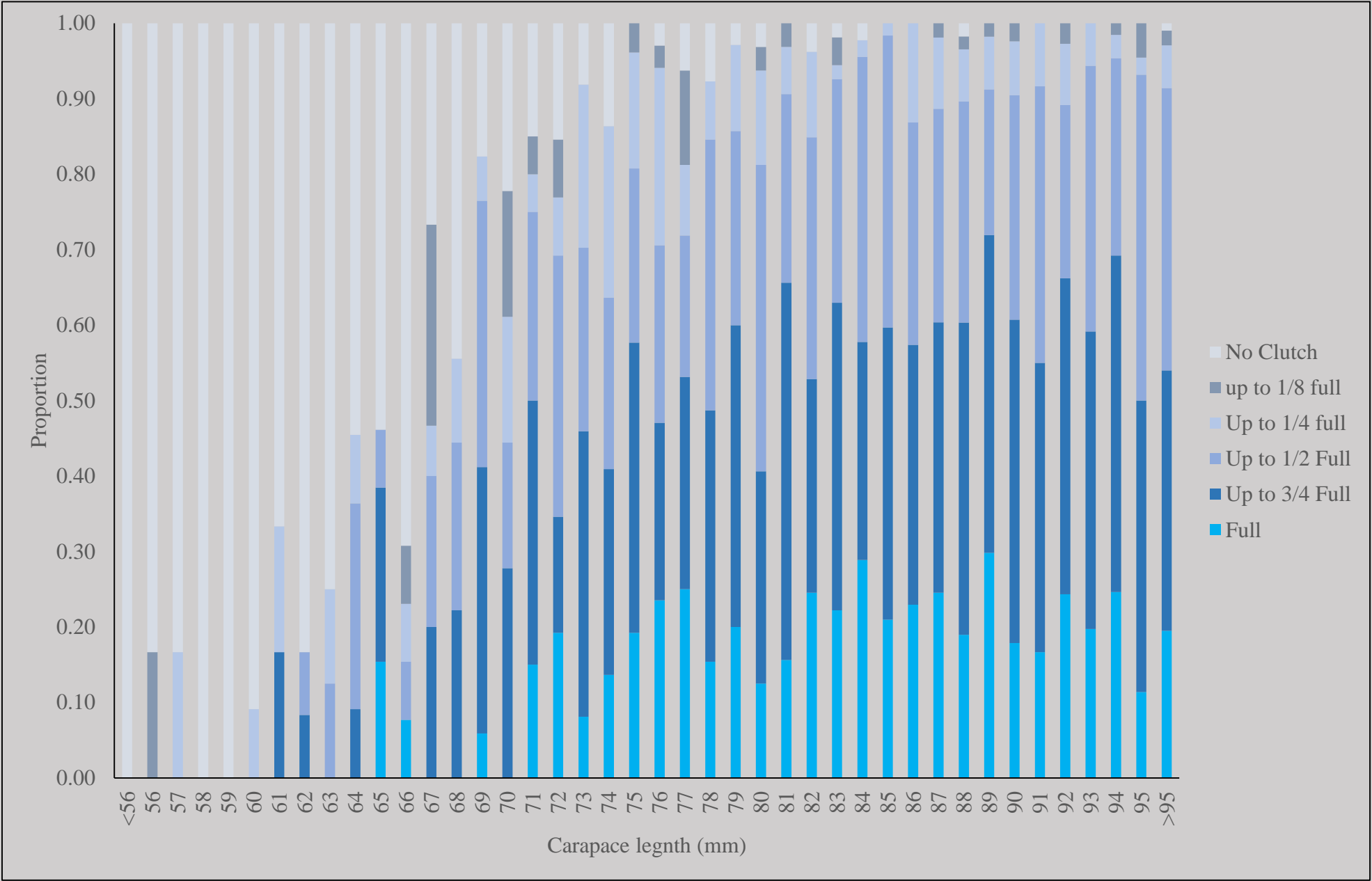


What does the CPT recommend to move to Tier 3?

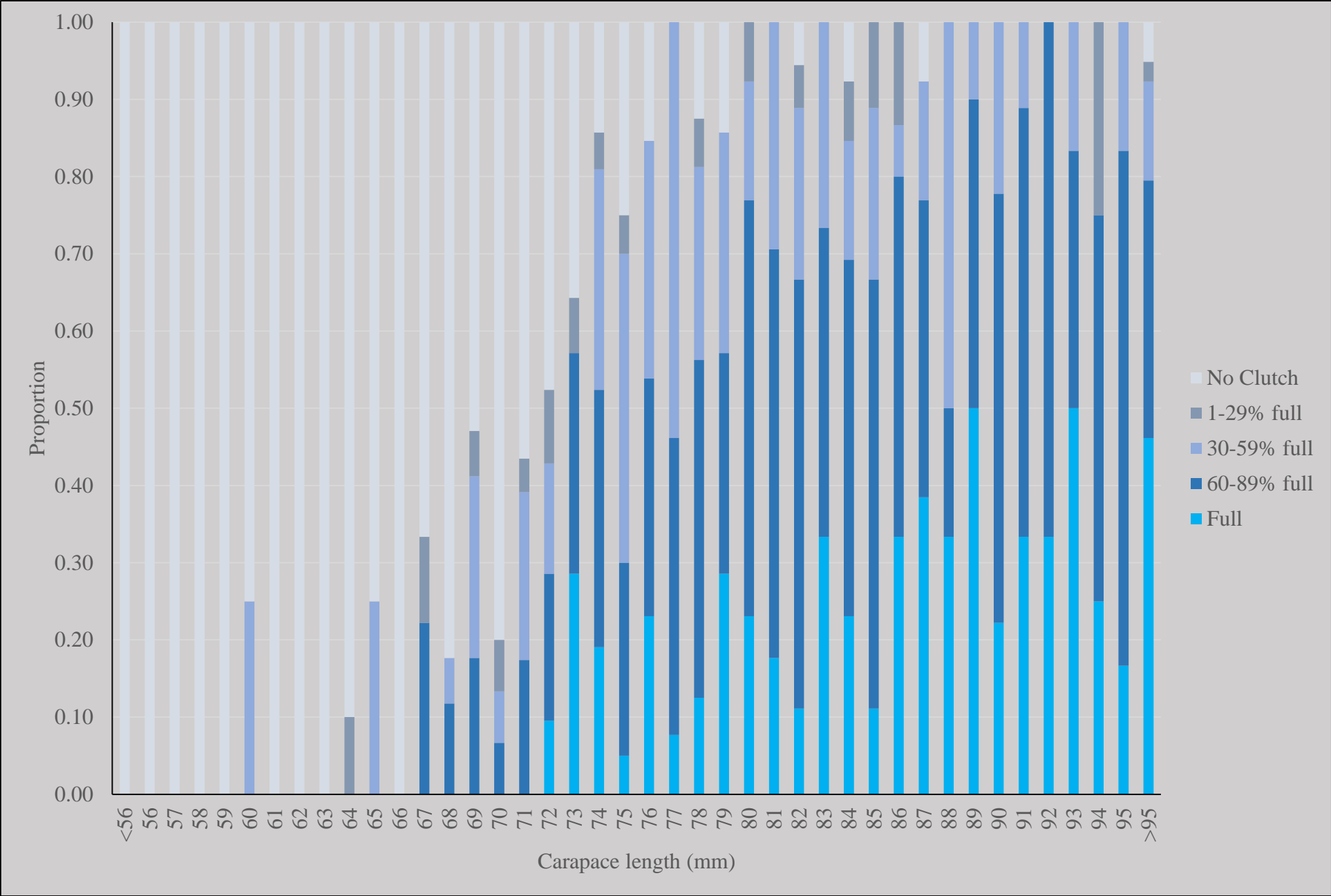
- Research ideas?
- Data mining?

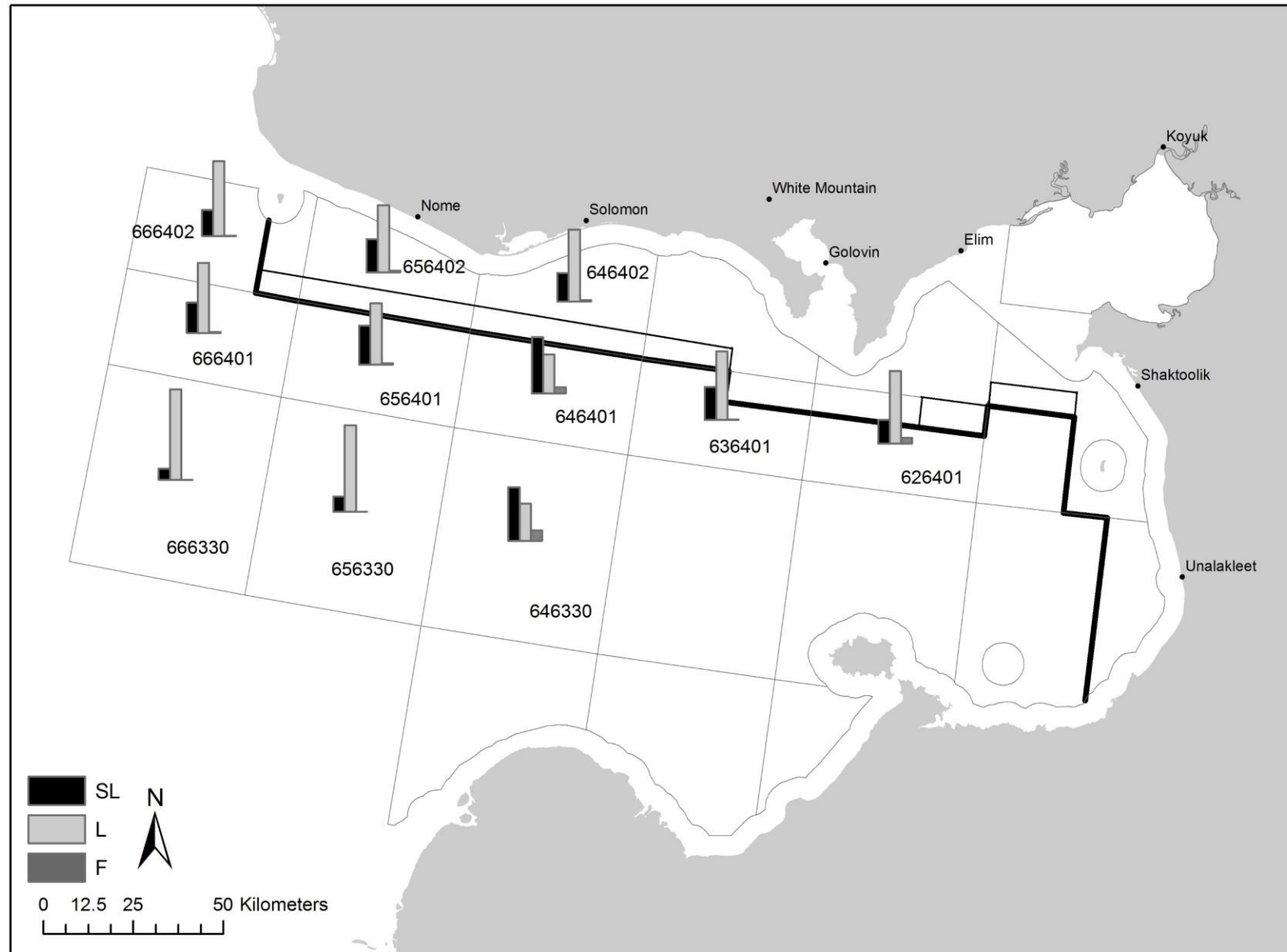
Additional slides...

Female clutch fullness by CL, observer data 2012-2017



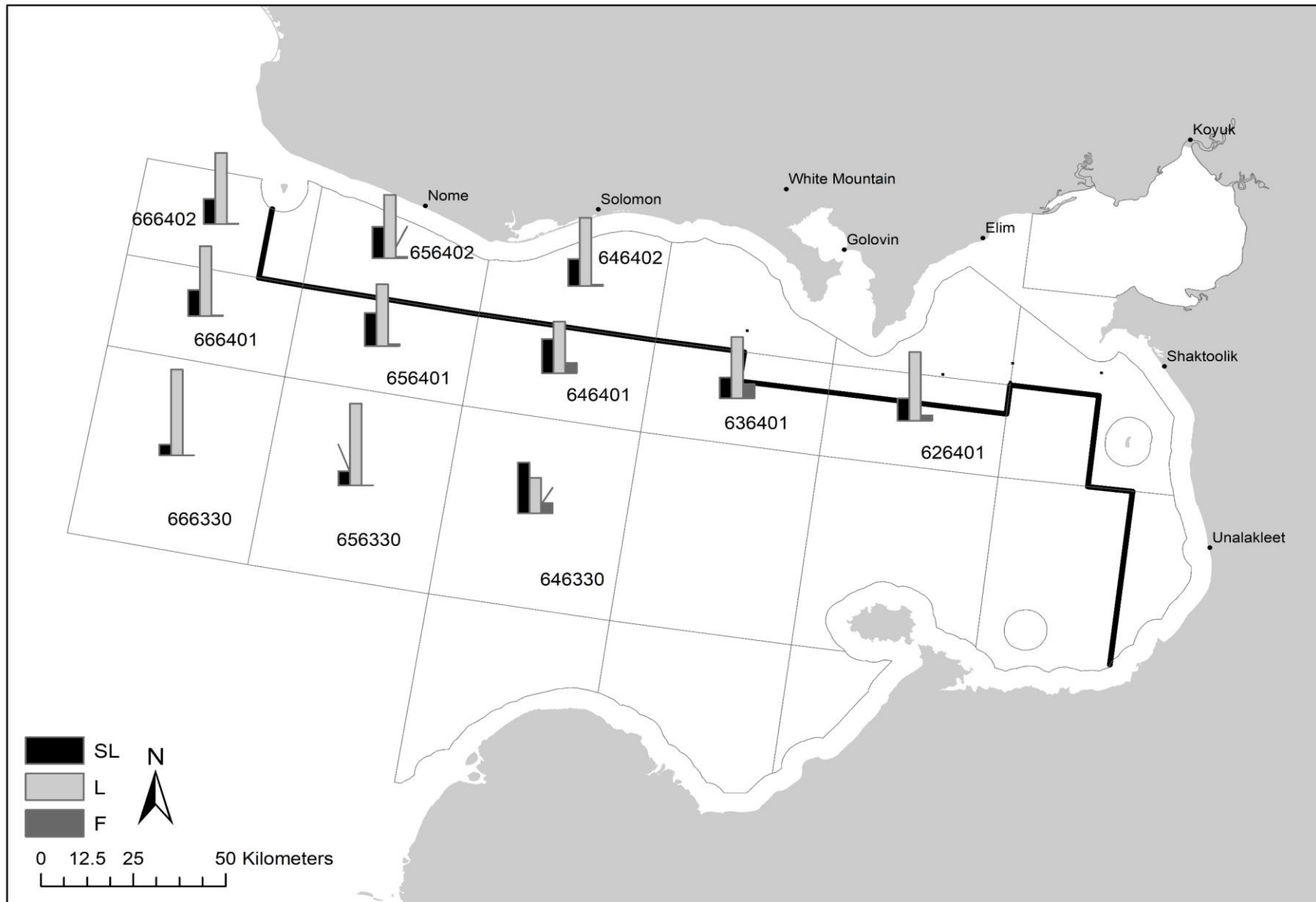
Female clutch fullness by CL, trawl data 1996-2017





Pot composition from
observer data,
2012-2014

Pot composition from
observer data,
2012-2017



Length distribution of spring
tagged crab 2012-2014

