Crab Plan Team Report
Jan 14-17, 2020
Kodiak, AK

BSAI Crab Stocks Management Timing

Aleutian Islands golden king crab
Pribilof Islands blue king crab
Pribilof Islands golden king crab *
Western Aleutian Islands(Adak) *
   red king crab

Assessed in
May/June

Now on triennial cycle,
next assessment in 2020

EBS snow crab
Bristol Bay red king crab
EBS Tanner crab
Pribilof Islands red king crab *
St. Matthew blue king crab

Assessed in
September/
October

Now on a biennial cycle,
assessment in 2021

Norton Sound red king crab

Assessed in
January/
February

BSAI Crab Stocks Management

Information available	Tier level	OFL	ABC buffer
Reliable stock-recruitment relationship (S/R)	Tier 1 / Tier 2	Estimated F_{OFL} applied to model biomass	
Life history information Estimates of maturity, recruitment, mortality	Tier 3	F_{OFL} is computed using the sloping control rule	10-20%
Some limited life history information	Tier 4		10-25%
Reliable catch information	Tier 5	OFL = average catch	25-40%

CPT Agenda for January

- Norton Sound RKC - final assessment, OFL and ABC
- AIGKC - model runs for May
- Fishery update
- ESP planning
- St. Matthew Is. BKC rebuilding
- Bering Sea FEP
- Snow crab spatial model
- Economic SAFE
- ADF&G crab observer program
- Research priorities
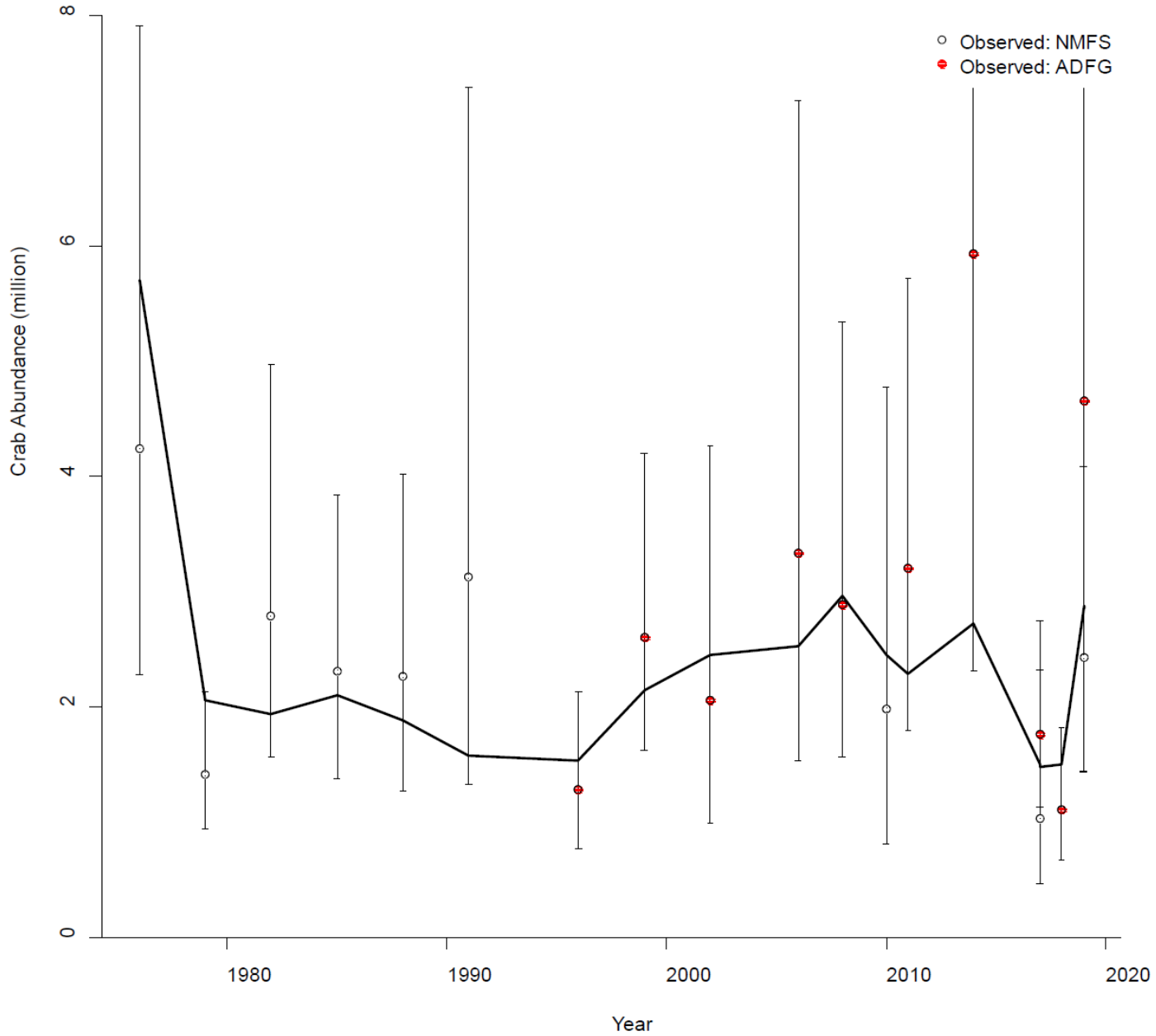- Kodiak crab research overview
- Gmacs workshop

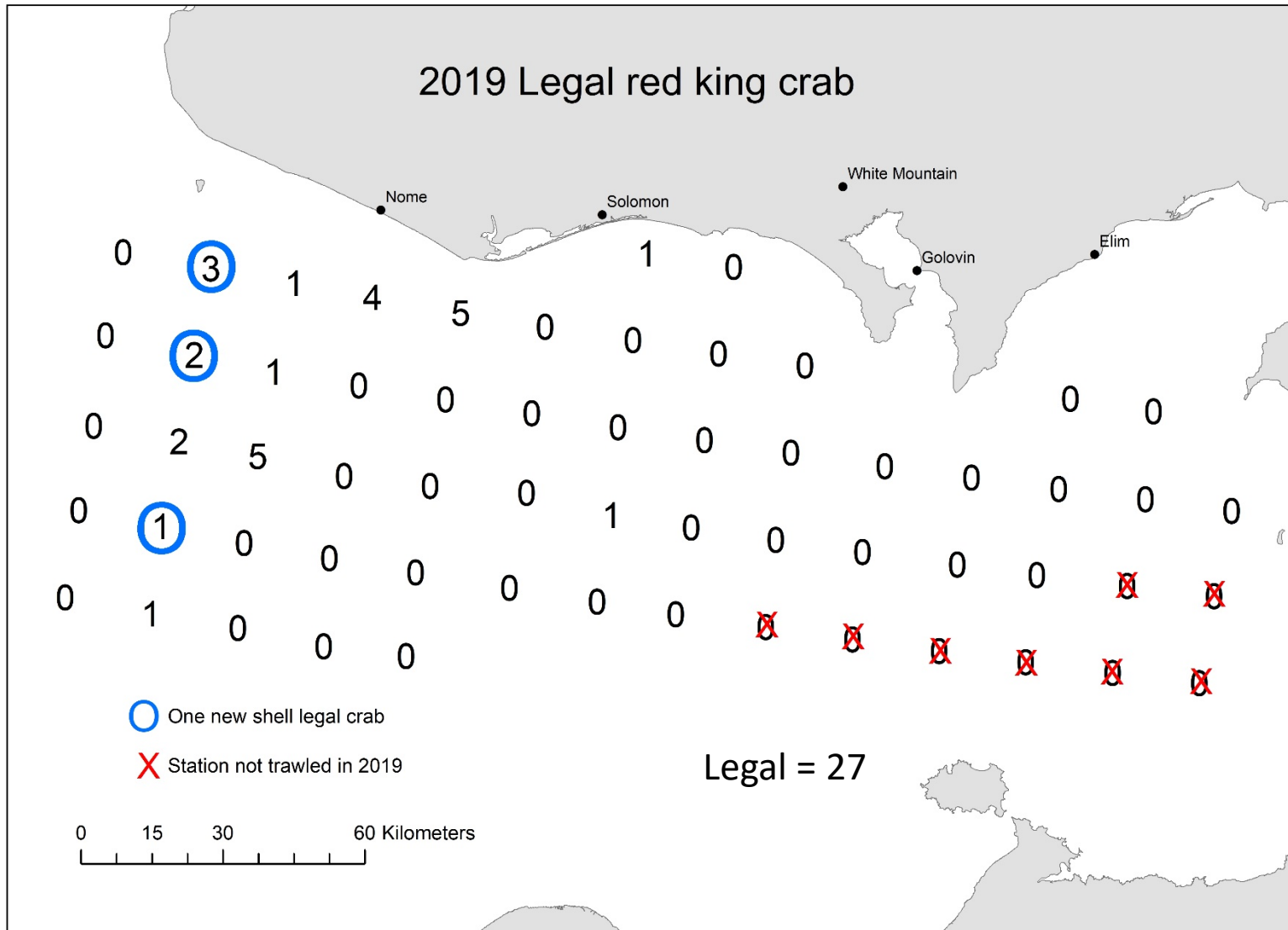# Norton Sound Red King Crab, Final assessment

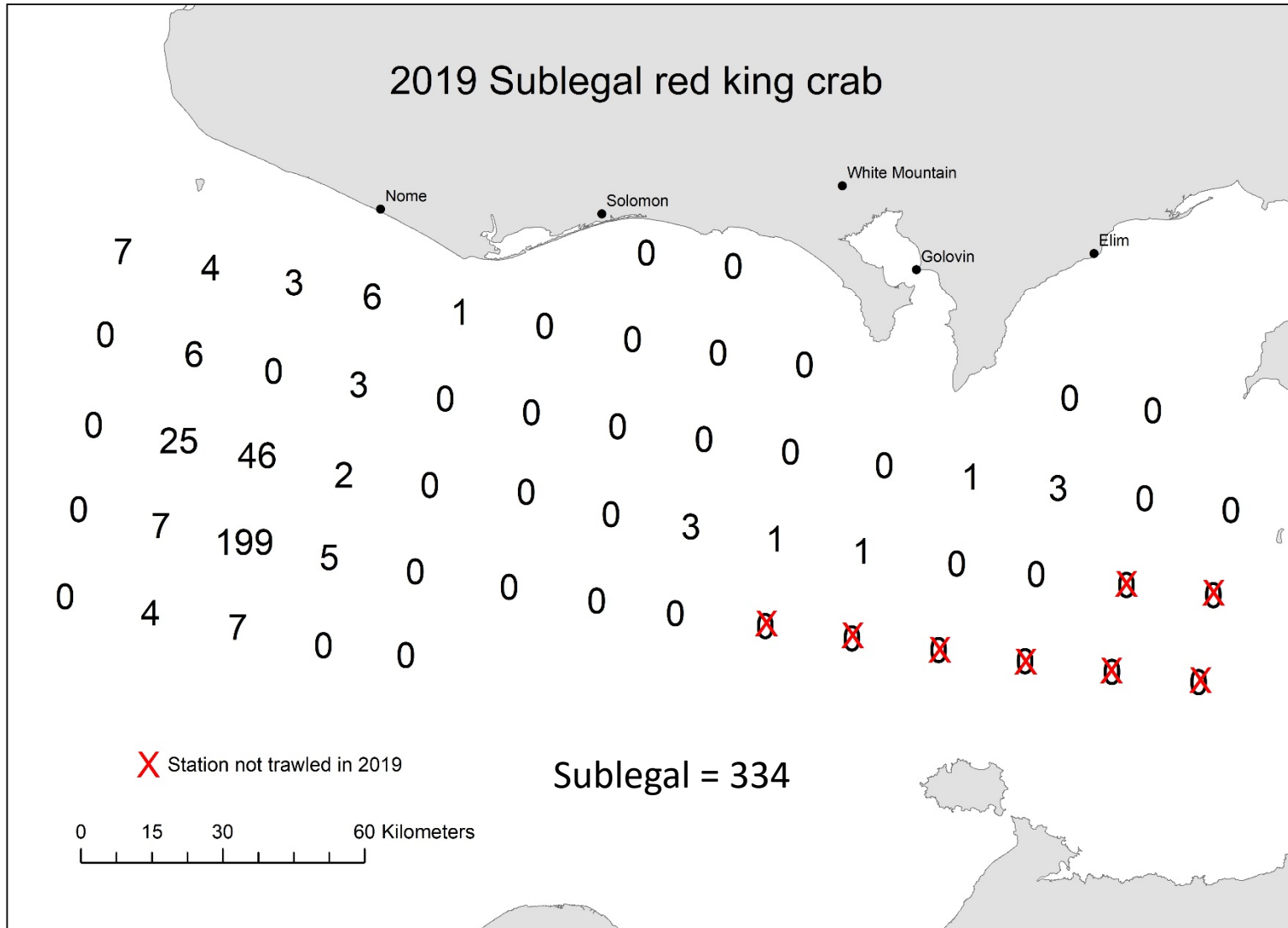# Assessment data time series
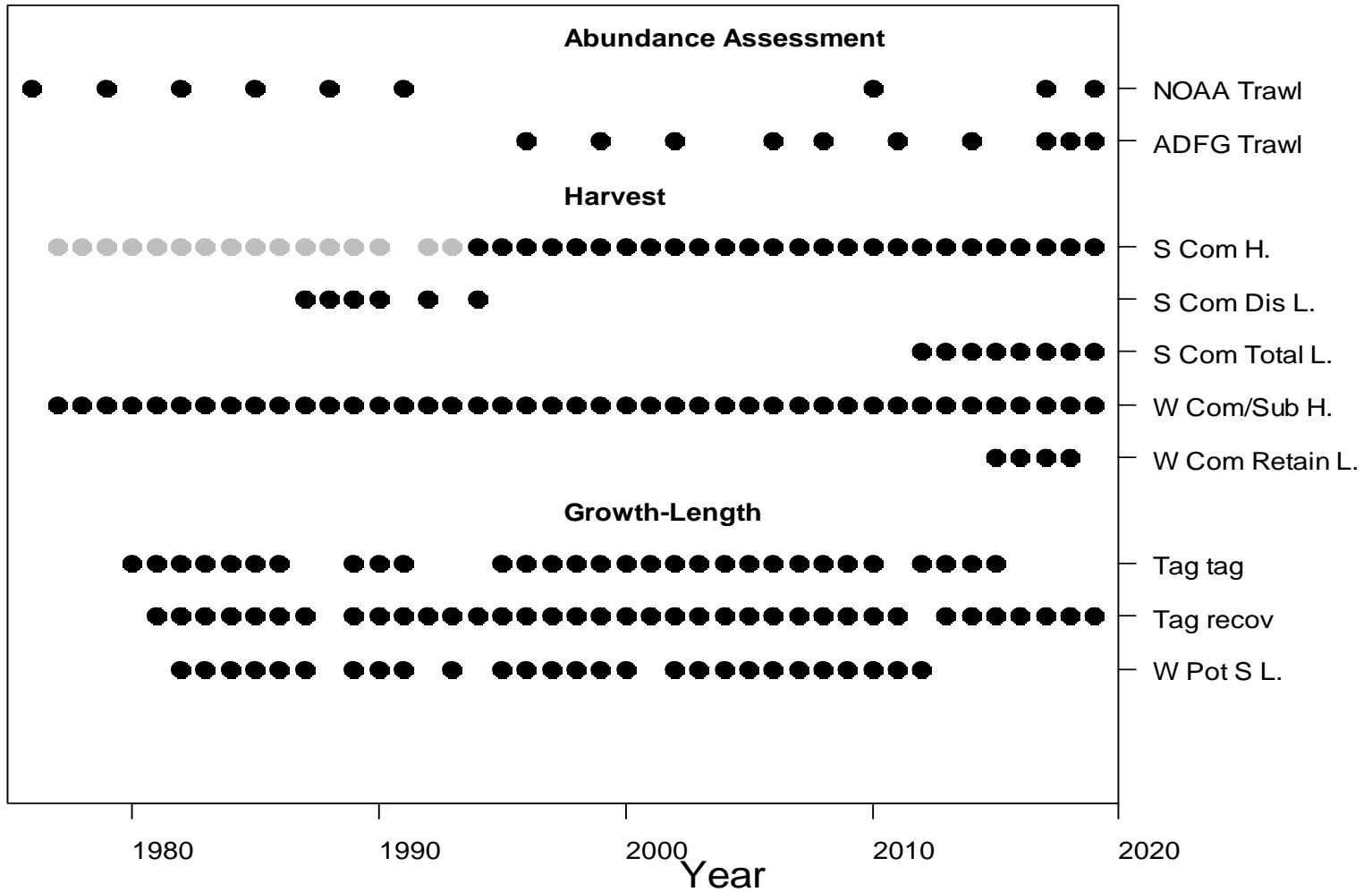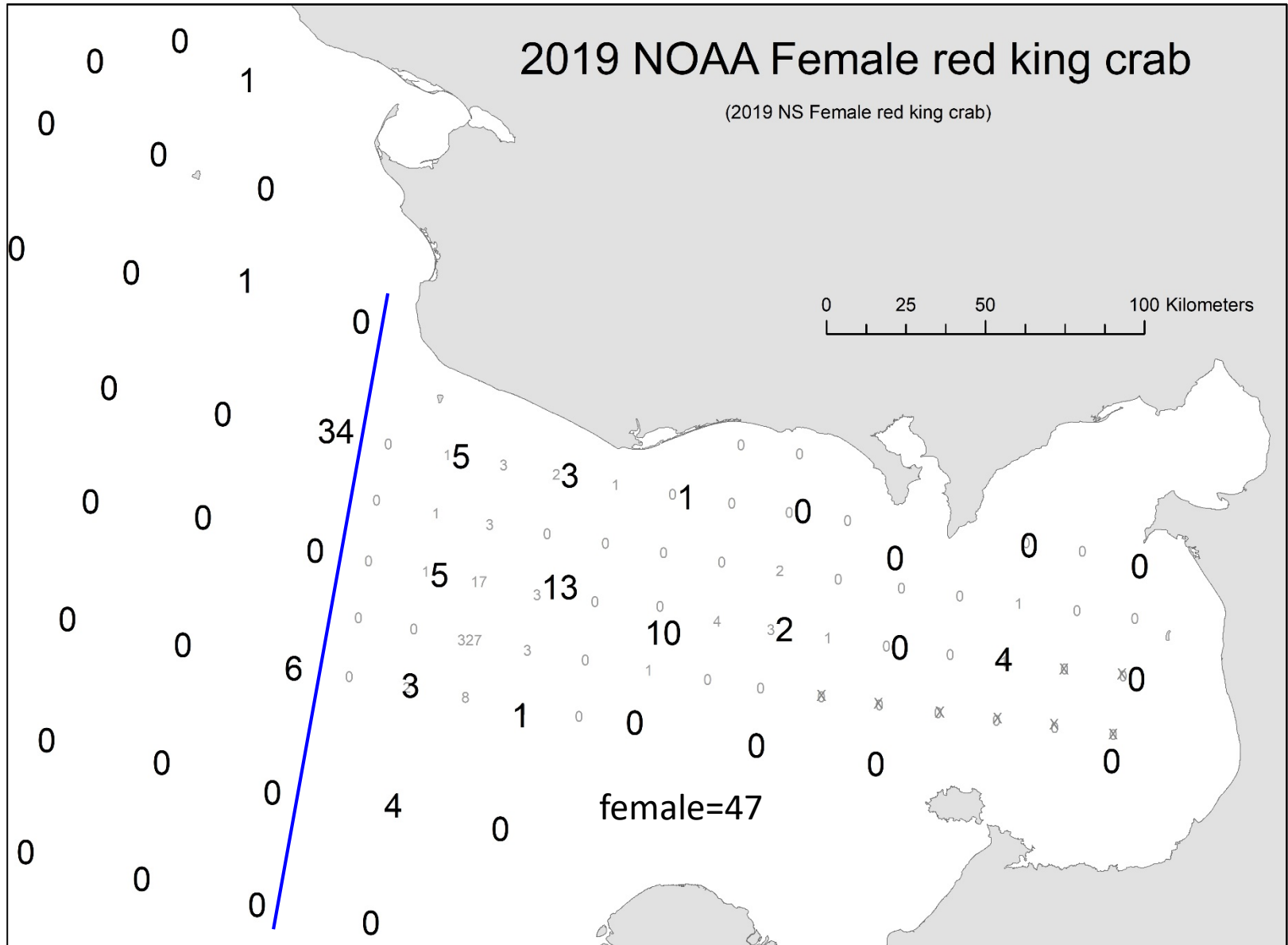
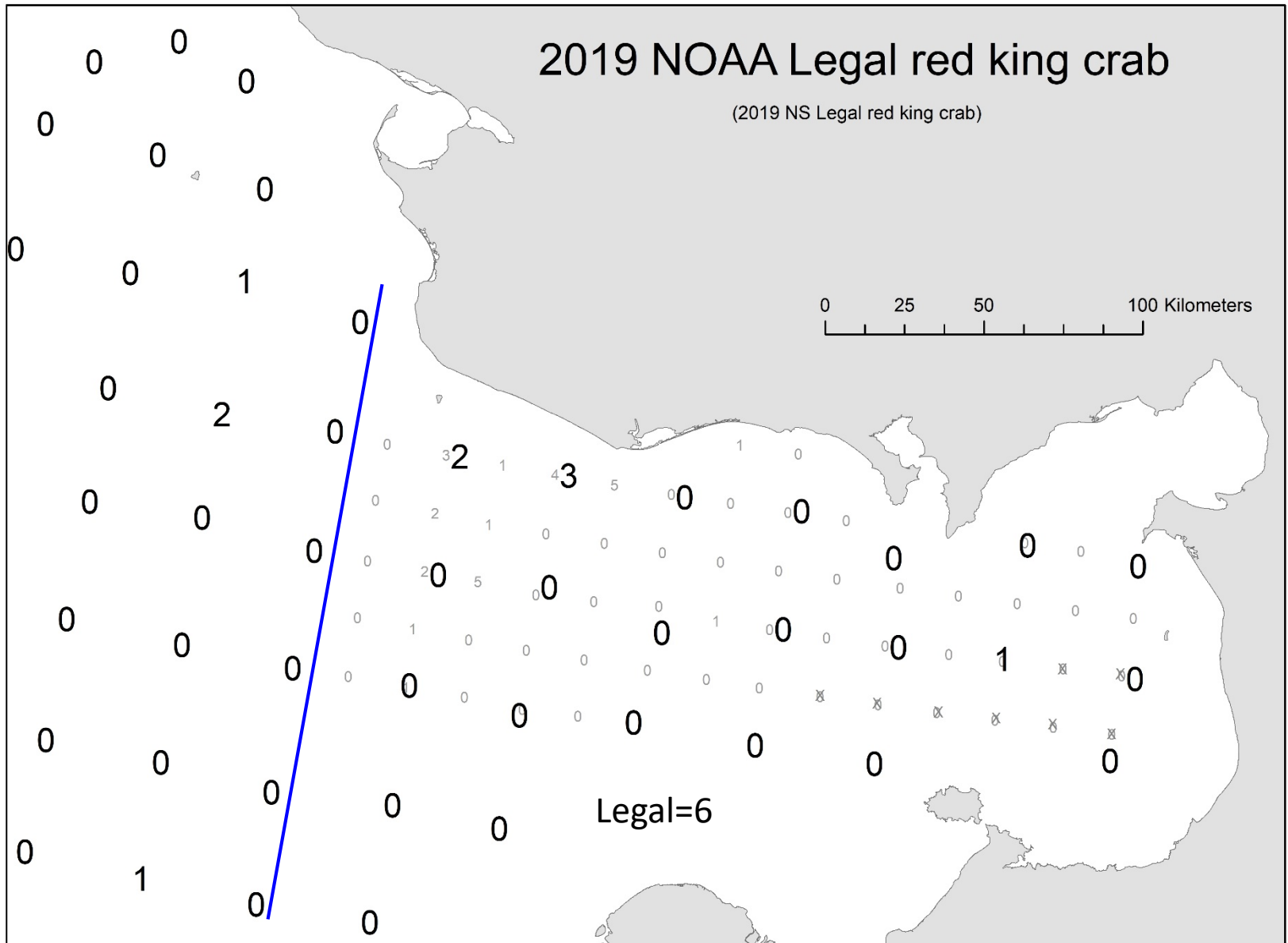**Trawl survey crab abundance**

2019 Trawl Survey ADFG

2019 Trawl Survey ADFG

2019 Sublegal red king crab

X Station not trawled in 2019

Sublegal = 334

2019 Trawl Survey ADFG

2019 Female red king crab

Female= 385

X Station not trawled in 2019

2019 Trawl Survey NMFS

2019 NOAA Female red king crab

(2019 NS Female red king crab)

female=47

2019 Trawl Survey NMFS

2019 NOAA Sublegal red king crab

(2019 NS Sublegal red king crab)

Subegal=70

2019 Trawl Survey NMFS

2019 NOAA Legal red king crab

(2019 NS Legal red king crab)

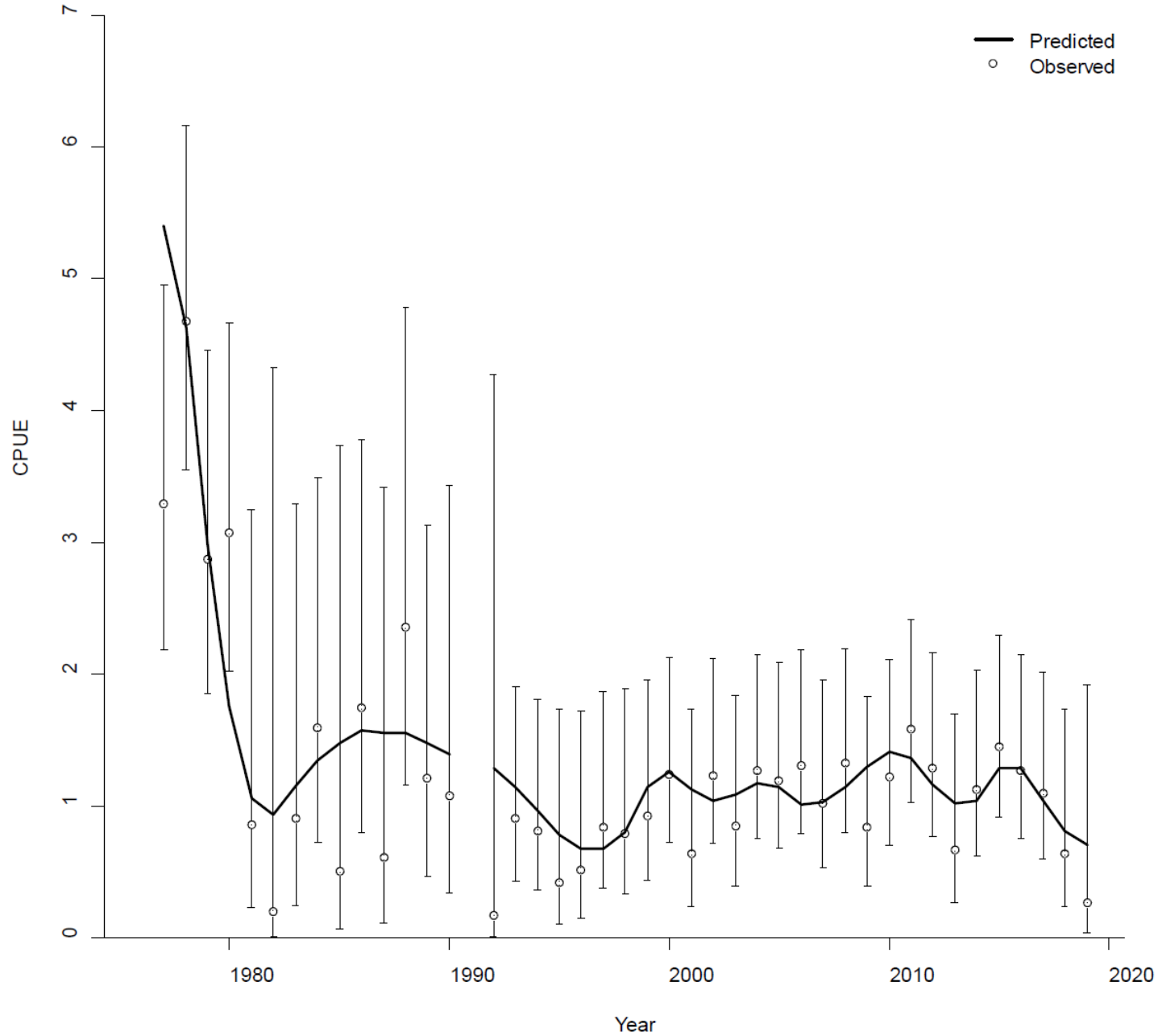Legal=6

Norton Sound Summer Red King Crab Combined Fishery
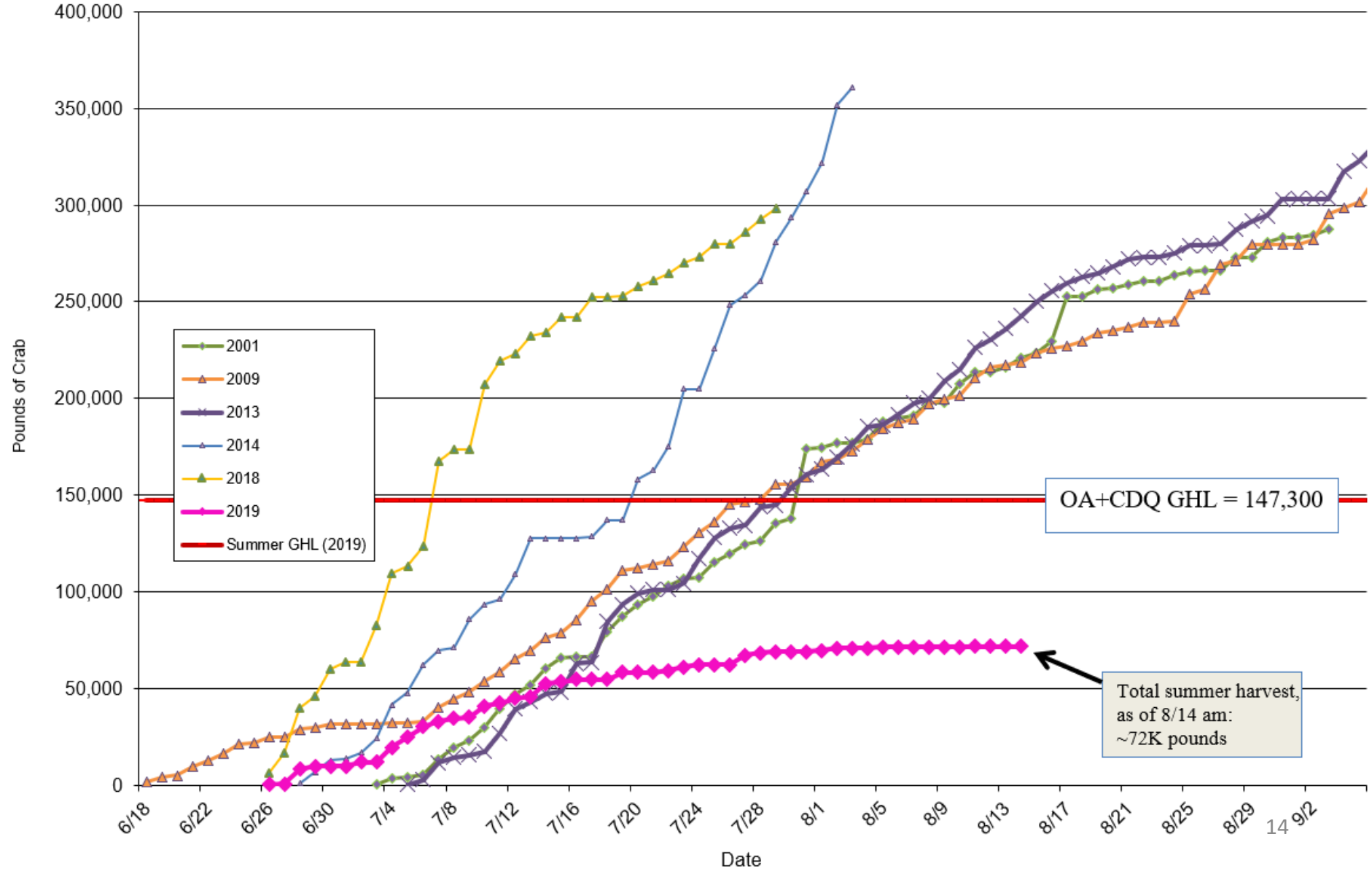
Summer commercial standardized cpue

Model 19.0 MMB trend

BMSY 4.578 mil.lb
MMB 3.728 mil.lb
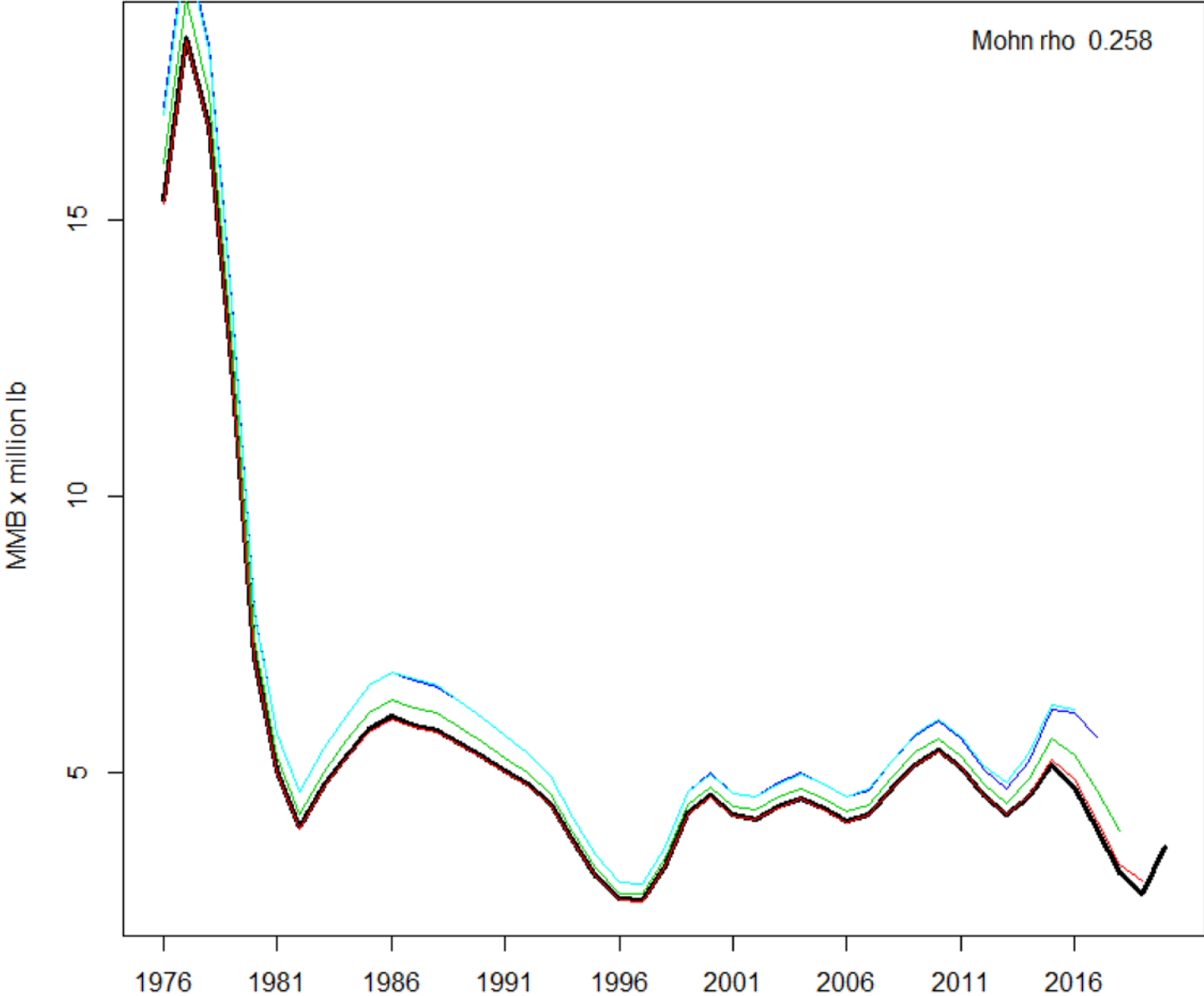Tier 4b
Legal B 2.428 mil.lb
OFL 0.287 mil.lb
ABC 0.229 mil.lb
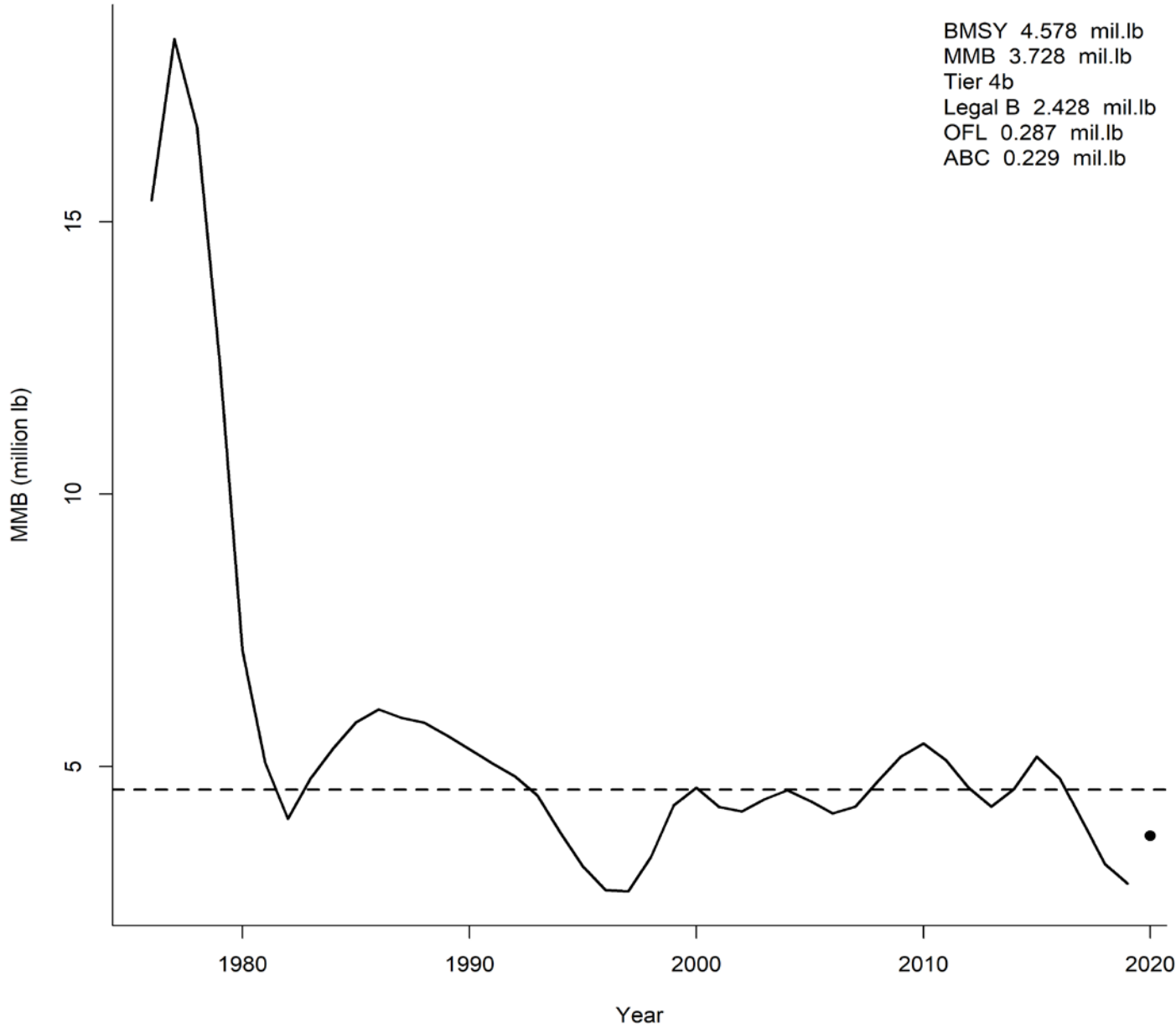
Model 19.0 retrospective analysis

Mohn rho 0.258

CPT recommendations

- The CPT recommends the status quo model 19.0 for calculating the OFL.

  - The CPT recommends that the SSC increase the buffer to obtain the ABC from 20% to 25% for two reasons:

    - 1) the sharp decline in CPUE and poor fishery performance,

    - 2) the preponderance of large crab in the catch suggesting a lack of recruitment to the fishery.

  - There is an apparent recruitment event but these crab will not recruit to the fishery until 2-3 years.

Status and catch specification table for NSRKC—Crab SAFE introduction

Status and catch specifications (kt). Shaded values are new estimates or projections based on the current assessment. Other table entries are based on historical assessments and are not updated except for total and retained catch.

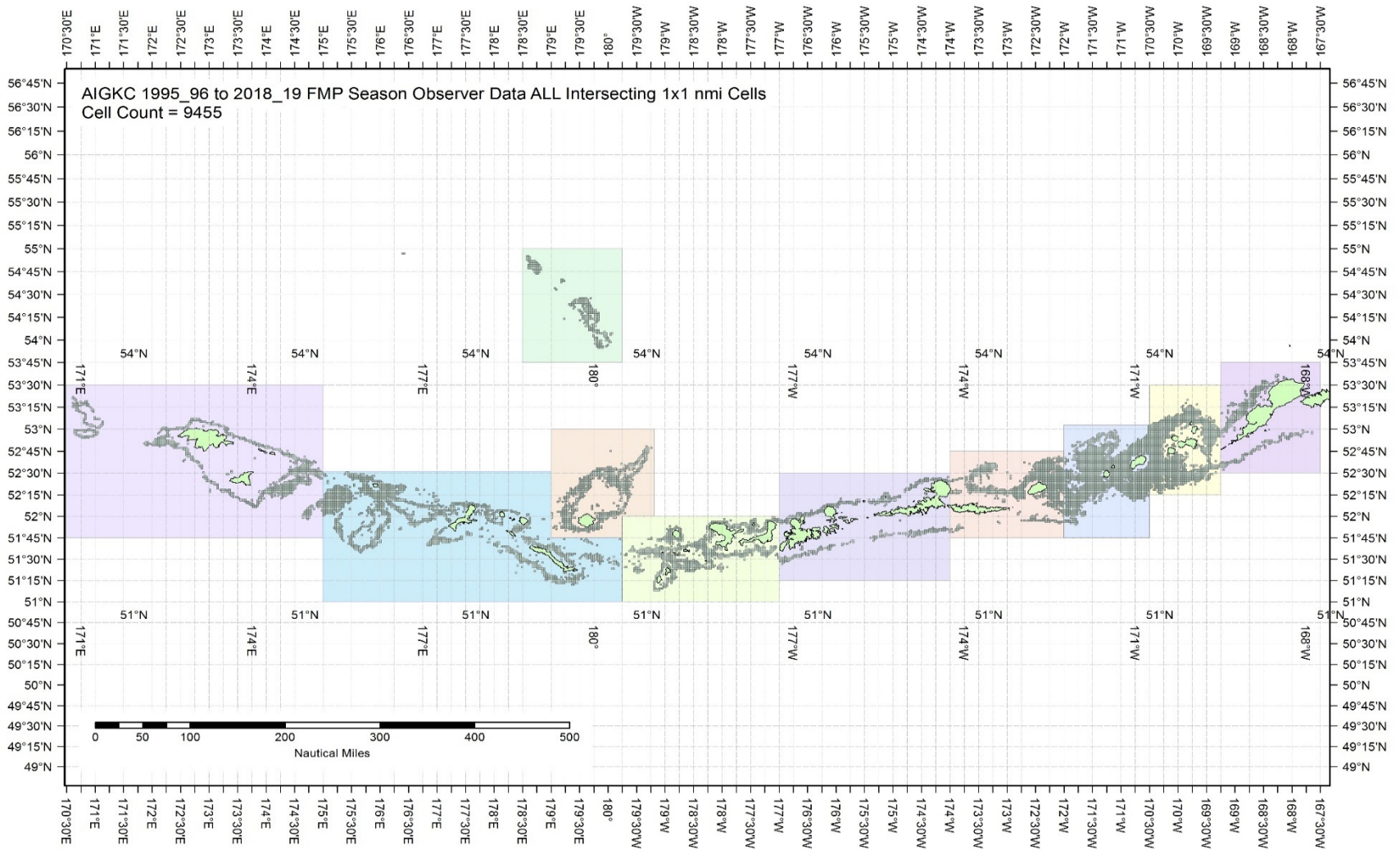| Year	MSST	Biomass (MMB)	GHL	Retained Commercial Catch	Total Retained Catch	Retained OFL	Retained ABC
2016	1.03	2.66	0.24	0.23	0.24	0.32	0.26
2017	1.05	2.33	0.23	0.22	0.24	0.30	0.24
2018	1.09	1.85	0.13	0.14	0.15	0.20	0.16
2019	1.03	1.41	0.07	0.04	0.04	0.11	0.09
2020	1.04	1.66	TBD	TBD	TBD	0.13	0.10

Status and catch specifications (million lb.) Shaded values are new estimates or projections based on the current assessment. Other table entries are based on historical assessments and are not updated except for total and retained catch.

AIGKC - model discussion for May 2020

- Estimating year-area interactions for fishery observer catch-rate data for 1995/96 – 2018/19.

- Analysis of the cooperative survey data.

- Improved maturity ogive.

- Models for June.

Estimation of observer CPUE index by a Year:Area interaction model

AIGKC 1995_96 to 2018_19 FMP Season Observer Data ALL Intersecting 1x1 nmi Cells
Cell Count = 9455

1995/96 – 2018/19 observer pot samples enmeshed in 10 blocks.

CPT recommendations for index standardization

- The CPT supports creating blocks and using this in the standardization, basis for the specific blocks chosen should be more clearly documented.

- Weights should be the total number of 1x1 nmi. cells ever fished in a block.

- Use a linear no-interaction model with a year effect and an area effect to deal with cells with missing data.

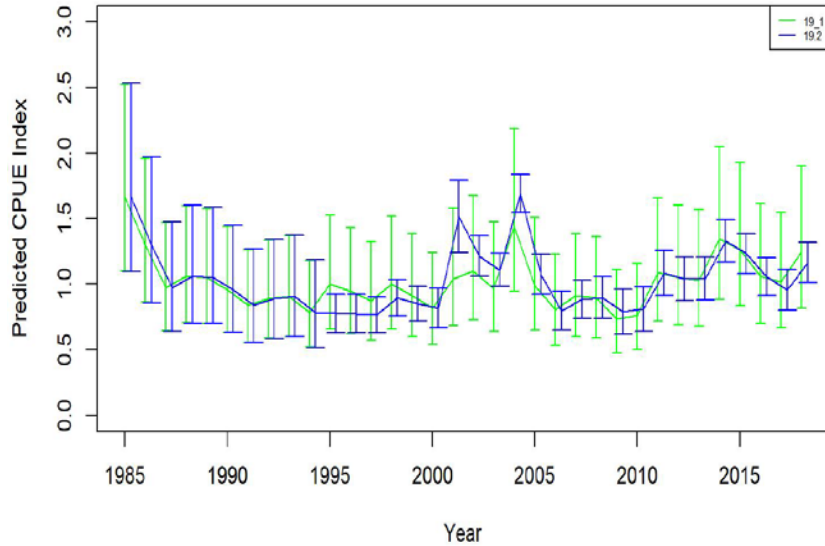# Initial results with a year-area interaction look reasonable

Figure A.10. Comparison of standardized (negative binomial GLM) CPUE indices with +/- 2 SE between no interaction (green line, 19.1) and Year:Area interaction (blue line, 19.2) models for EAG.
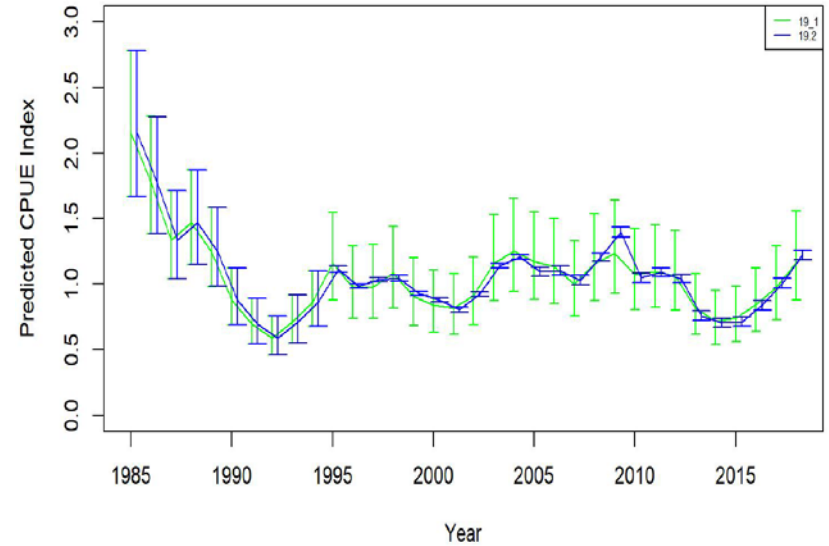
Figure A.11. Comparison of standardized (negative binomial GLM) CPUE indices with +/- 2 SE between no interaction (green line, 19.1) and Year:Area interaction (blue line, 19.2) models for WAG.

Analysis of the cooperative survey data

- The use of a mixed-effects model is appropriate.

- In general, the model for the analysis of the survey data should be more closely aligned with the design of the survey.

- A hierarchical structure for strings * block should be considered, such as string random within block, which is itself random.
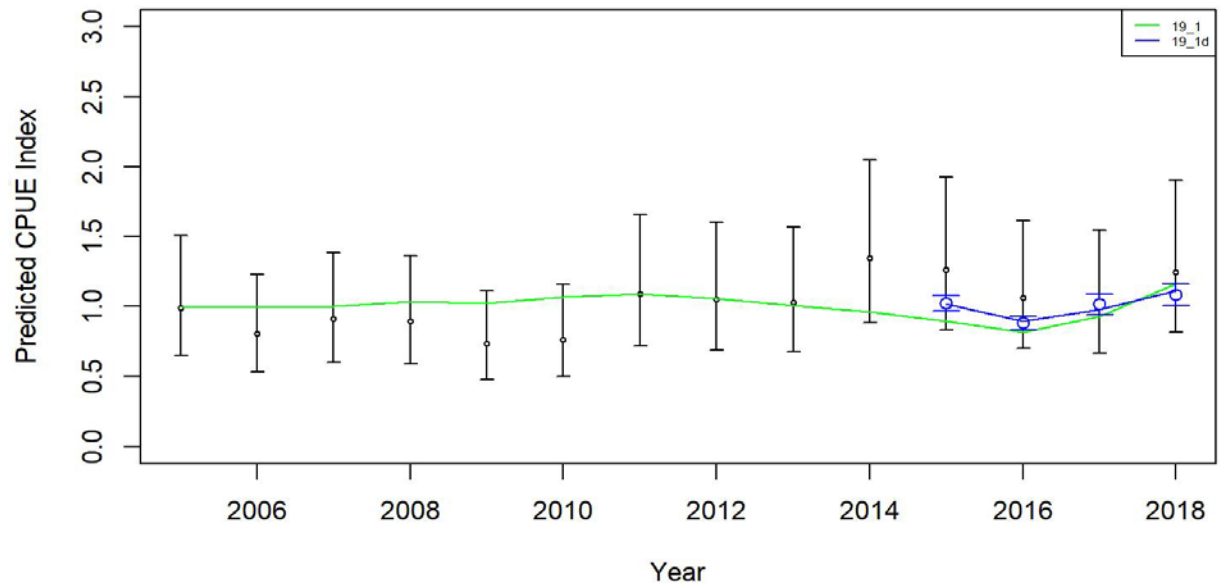
Improved maturity ogive (break-point method, 1991 ADF&G data)
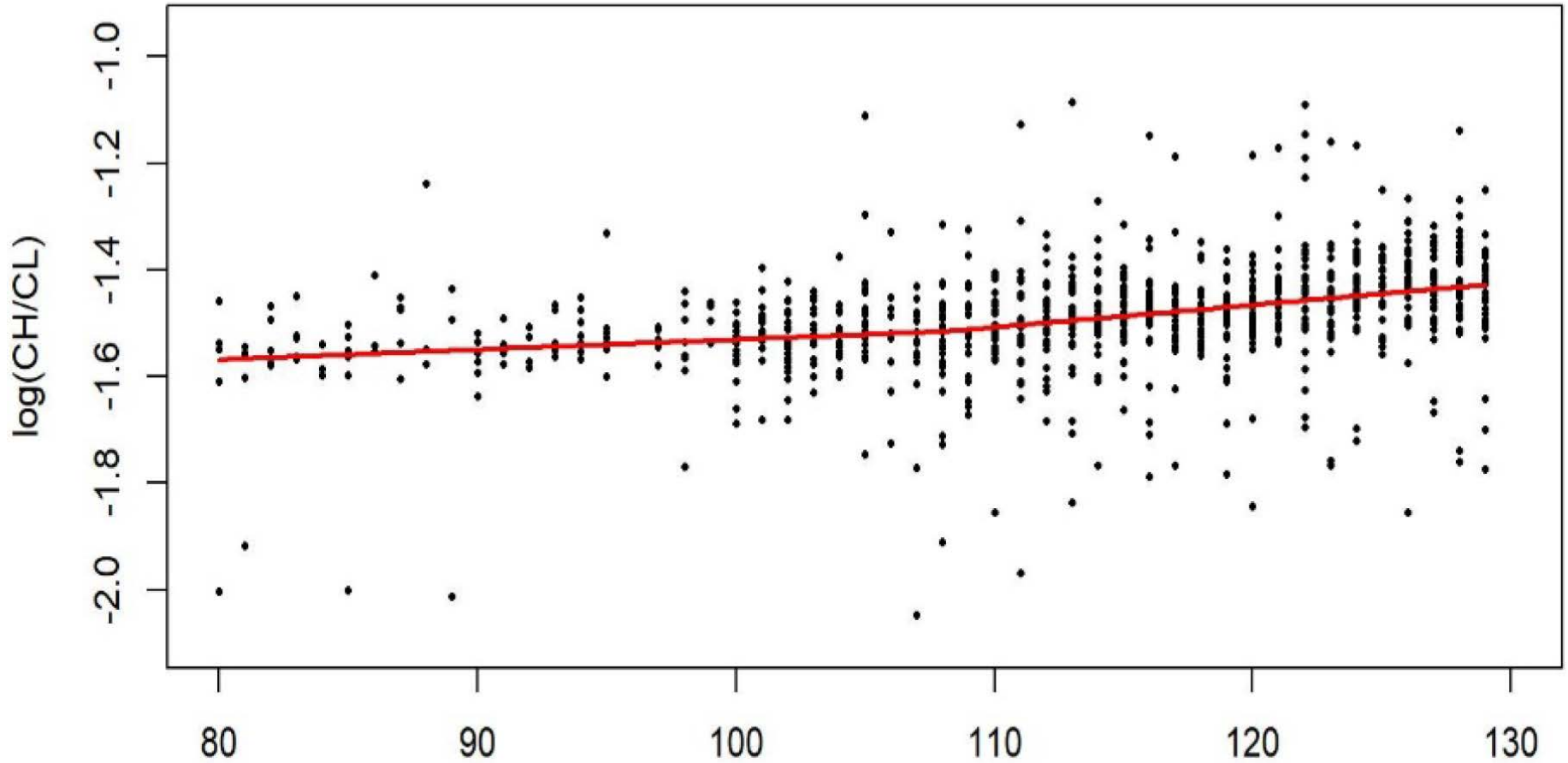
Improved maturity ogive (cut line method, 1991 ADF&G data)

log(Carapace Length)
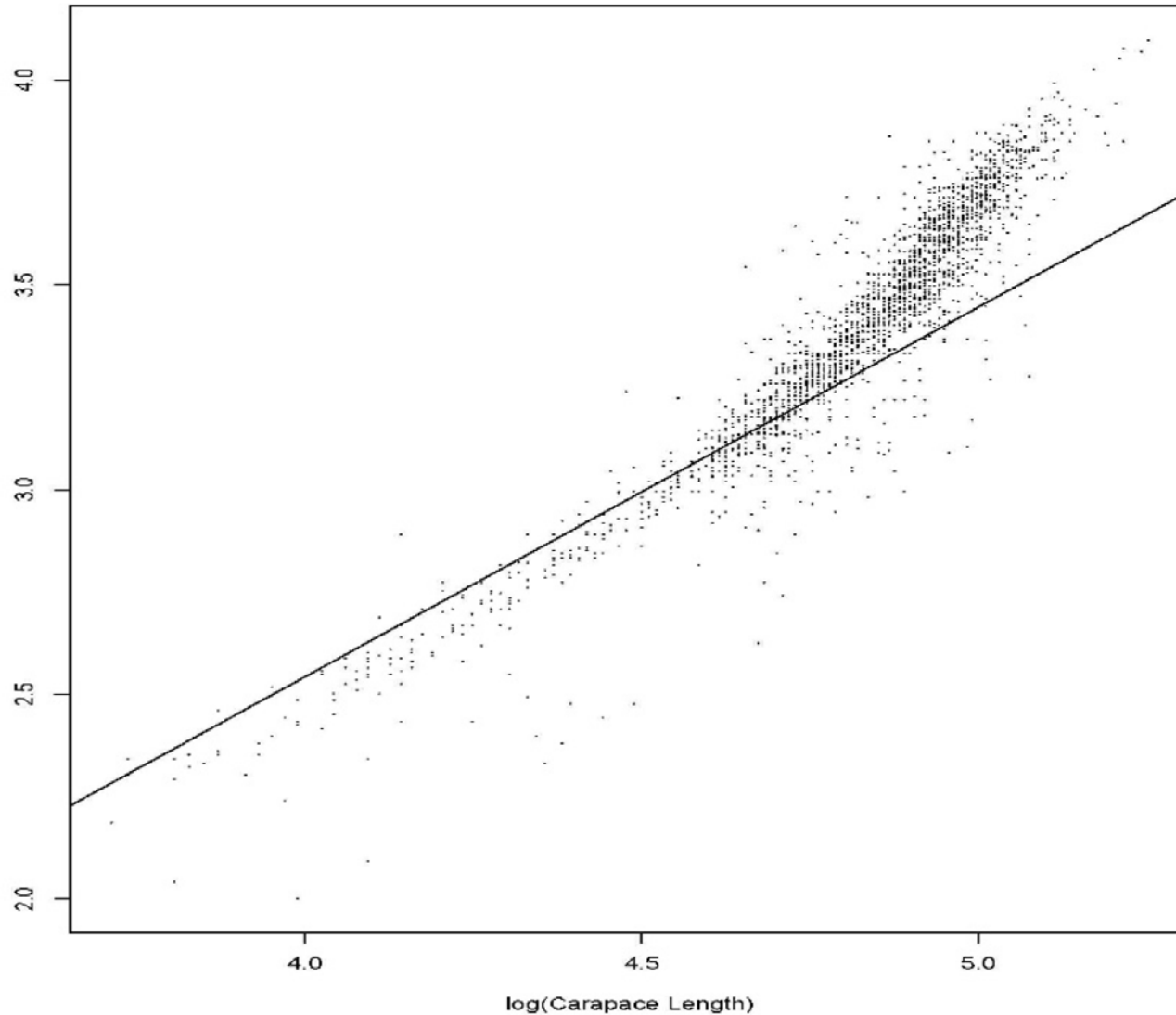
CPT model recommendations for June

- The results of the cut-line and bend point approaches are not convincing. No changes in maturity curve recommended.

- Base model will include a new set of years for BMSY estimation and a revised early standardized CPUE.

- Add cooperative survey CPUE index.

- Add later CPUE standardized using a year*area interaction.

- Add both.

Fishery Update

- Ben Daly from ADF&G gave an update on crab observer data, catch data estimation, and future assessment needs.

- Length-weight regressions NMFS EBS trawl survey are used in fishery catch estimation. CPT recommends that LW data be collected during the fishery to evaluate this practice.

- ADF&G is currently working to re-calculate the time series of total catch using standardized methods for May. The CPT recommended that the base model from last year be used to evaluate the new estimates prior to further model runs.

- Ben proposed starting the time series for observer data in 1995 to avoid some of the errors and lack of documentation that are found further back in time. The CPT agreed with the 1995 start date.

ESP planning

- Erin Fedewa presented on BSAI crab Ecosystem and Socio-economic Profiles (ESPs).

- An ESP was done last year for St. Matts. BKC. Crab-specific report cards for snow crab, Tanner crab, BBRKC were also completed.

- CPT recommends that the report cards be maintained and updated, and included in the SAFE stock assessments.

- Draft report cards should be presented and reviewed by the CPT in May to inform the assessment for the fall SAFE.

- The CPT did not see a need for a separate ecosystem status report for crab (but give thought to making the EBS ecosystem status report more relevant for crab stocks

- The CPT recommends that Bristol Bay RKC be the next crab stock for developing an ESP, due to concerns about its continued decline.

- The CPT recommends that an ESP "team" be formed to develop the ESP.

Economic SAFE

- Update on SAFE through calendar year 2018
- Future priorities:
  - Report card type metrics
  - ESP integration
  - Price forecasts & current year estimates
  - Demographics
  - Processing sector income analysis

ADF&G observer program overview (Bo Whiteside)

- Review of observer program and data collection

- Noted difficulties in collecting crab data – especially with a large proportion of new observers each year

- Discussion on trade-offs between count and measure pots.
    - CPT recommends that variance estimates for total catch be calculated so trade-offs can be evaluated.

- CPT requests a future presentation on the spatial coverage of observer sampling

Research Priorities

- Reviewed top 5 priorities from May 2018

- Discussed other high priority topics
  - Estimation of discard mortality
  - Management strategy evaluations
  - Growth estimation
  - Radiometric aging for natural mortality estimation
  - Impacts of trawling on benthic habitat

Revisit top 5 priorities:

1. 148--Spatial distribution and movement of crabs relative to life history events and fishing.

2. 225--Develop projection models to evaluate management strategies under varying climate, ecological, and economic conditions and evaluate impacts to managed resources and coastal communities.

3. 592--Maturity estimates for Bering Sea and Aleutian Island crab stocks.

4. 147/171--Acquire basic life history information (e.g., natural mortality through radiometric aging or other methods, growth, size at maturity) needed to inform the crab assessment models.

5. New research priority called "Studies on physiological responses to climate stressors". Description: "Investigate how observed environmental changes (temperature, OA, etc.) affect physiological condition & survival of multiple life stages and reproductive output. Consider interactions among multiple stressors."