Review of 2024/25 AIGKC TAC

ADF&G presentation to AIGKC industry, 17 June 2024

Join by ZOOM:
https://us02web.zoom.us/j/84844930746?pwd=NxHteo3qZzQL7falGa2v9yy2aAijmT.1

Meeting ID: 848 4493 0746
Passcode: 704559

2024 Stock Assessment model

- 3 model scenarios
  - 2023 assessment model with updated data, truncated crab below model smallest size bin, 2 selectivity periods in pre-rationalized directed fishery

- CPT + SSC: Endorsed scenario 23.1 (truncated small crab)
  - Better fit to total catch size comps
  - 25% buffer on ABC: same as last year, same issues as last year
    - Fishery-dependent data, retrospective patterns in EAG, poor fits to EAG CPUE indices for post-rationalization period

Federal 2024/25 OFL + ABC

ABC= 6.159 mill lb total male catch

- including bycatch mortality of males in all fisheries
- based on a 25% buffer on OFL

OFL = 8.212 mill lb total male catch

Stock estimated at 108% of B_{MSY} in 2023/24
Stock projected to be at 99% of B_{MSY} in 2024/25

Area-specific OFL/ABC

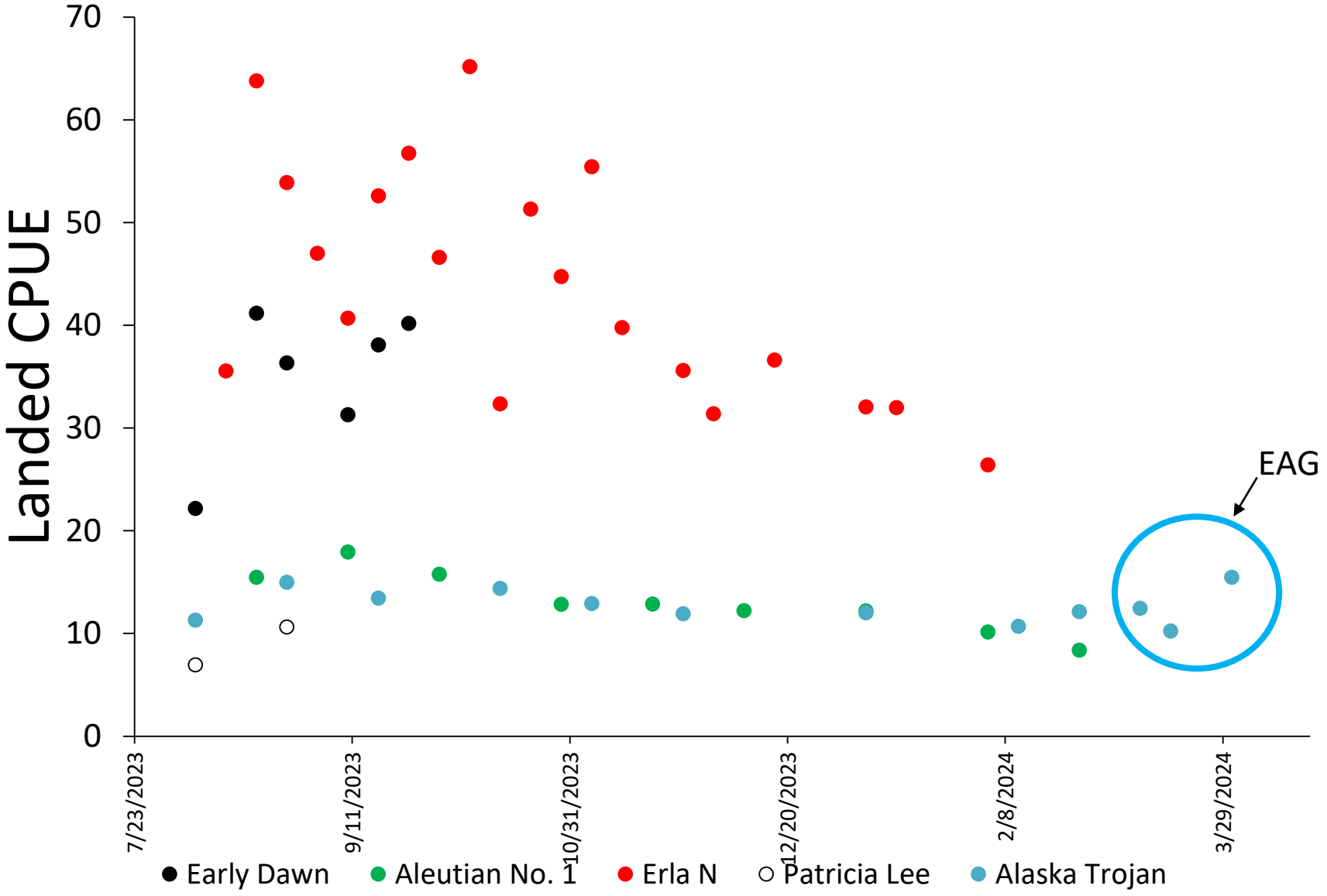
EAG:	OFL: 6.23 mill lb;	ABC: 4.67 mill lb
WAG:	OFL: 1.98 mill lb;	ABC: 1.49 mill lb

Million lb

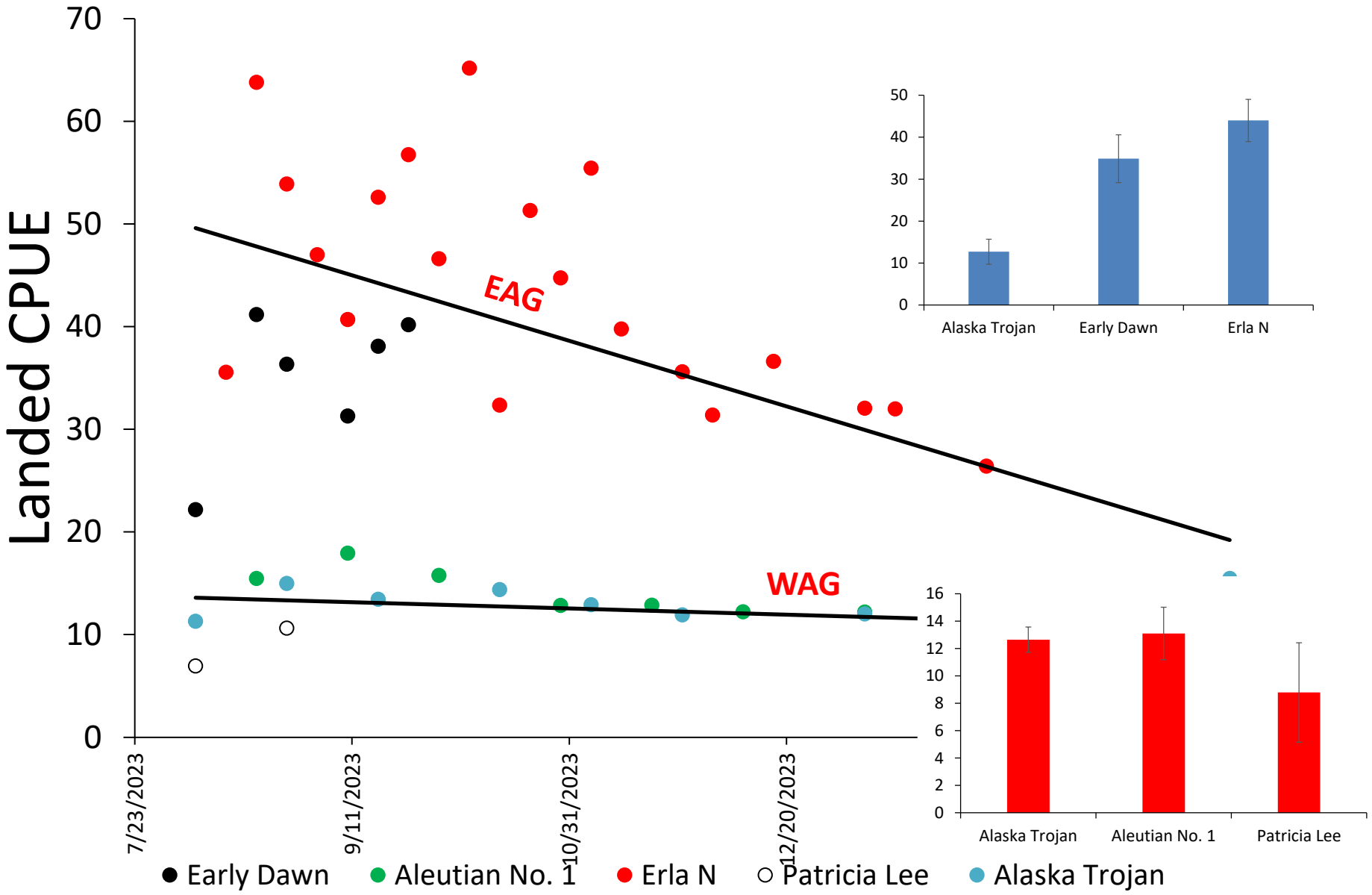
Year	MSST	Biomass (MMB_{mating})	TAC	Retained Catch	Total Catch	OFL	ABC
2020/21	13.285	35.730	6.610	6.614	7.593	10.578	7.934
2021/22	12.917	27.761	5.930	5.950	6.737	10.620	7.434
2022/23	12.857	29.983	5.051	5.223	5.758	8.292	6.219
2023/24	12.725	28.034	5.530	5.684	6.074	9.220	6.916
2024/25		25.107				8.212	6.159

2024/25 OFL 11% decrease from last year

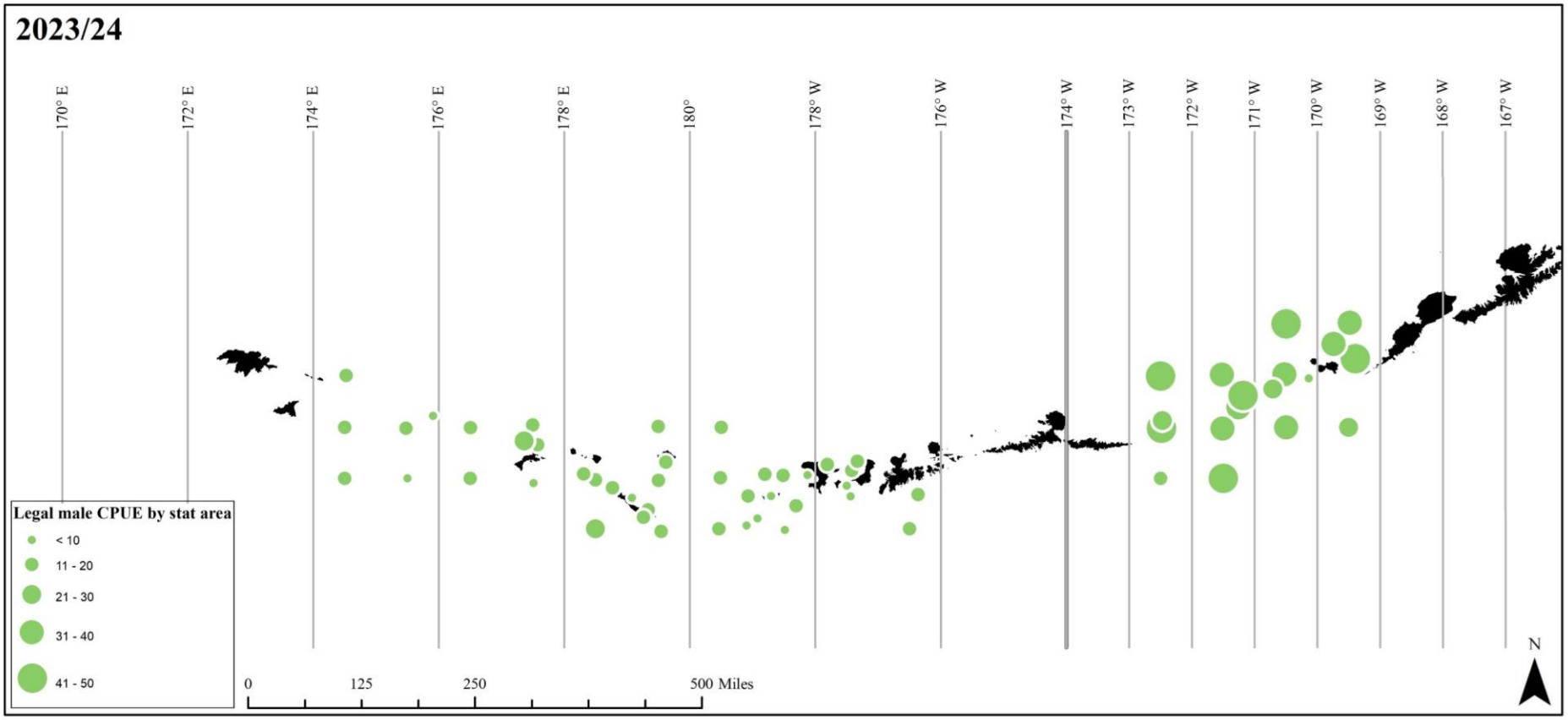
2023/24 Season

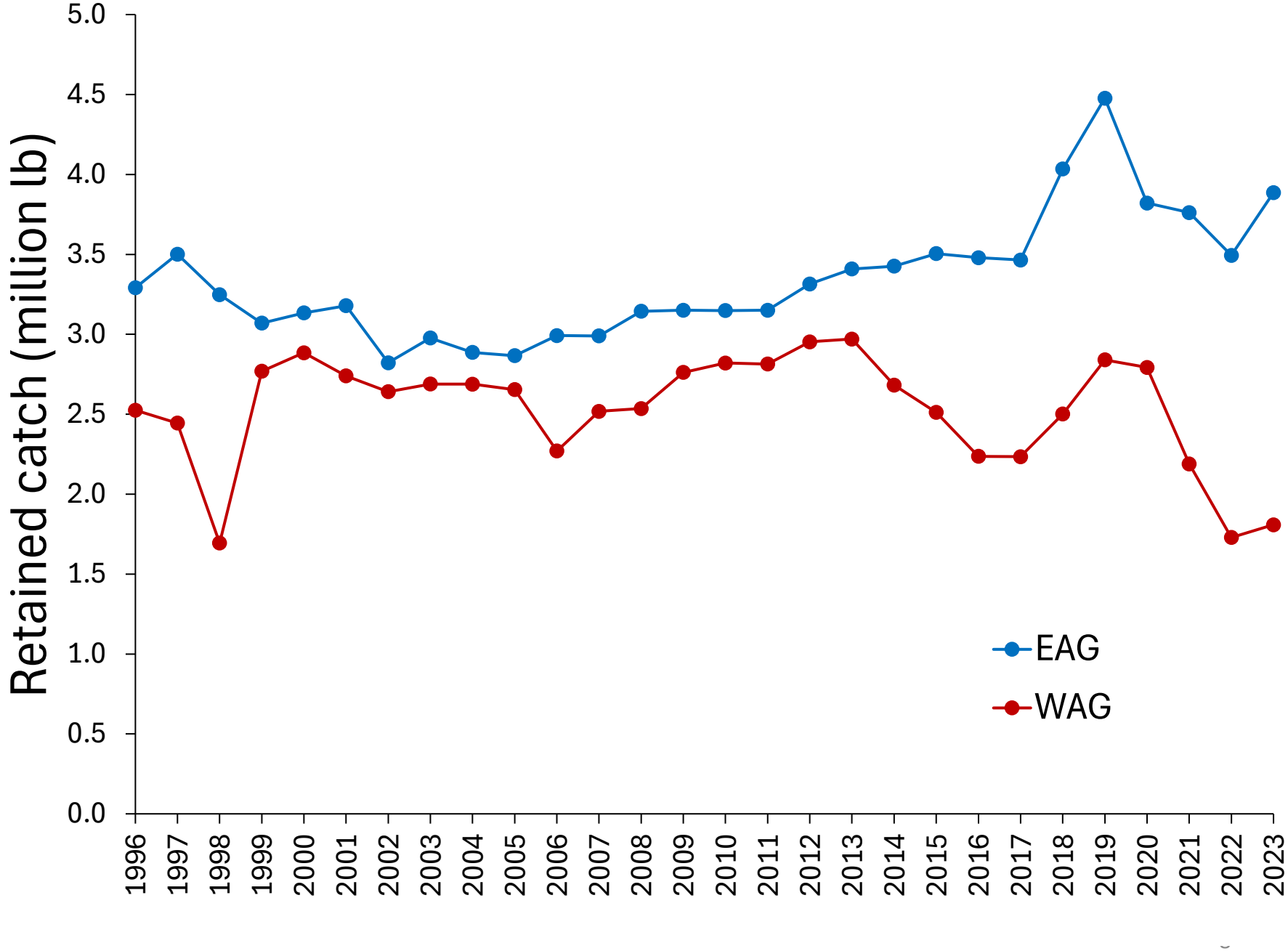


2023/24 Season

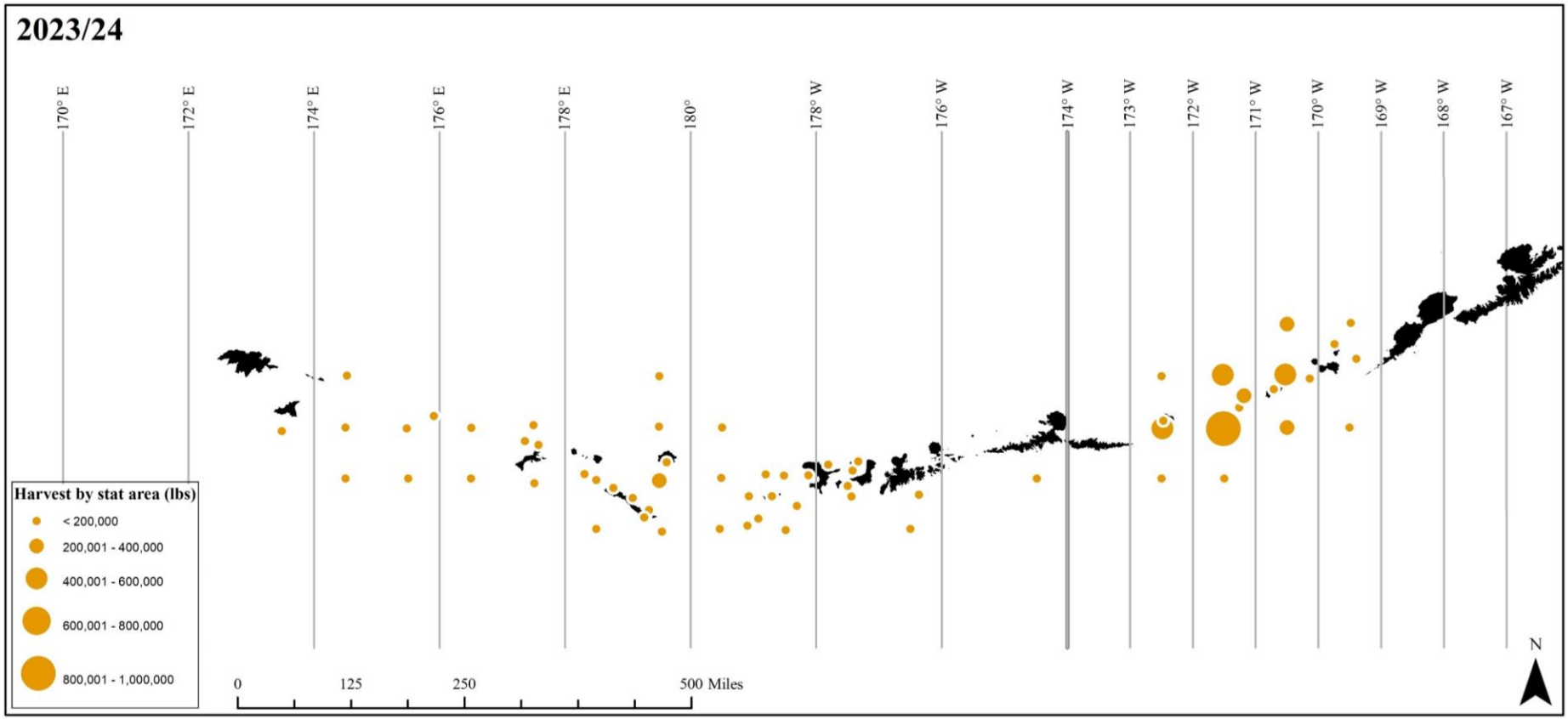


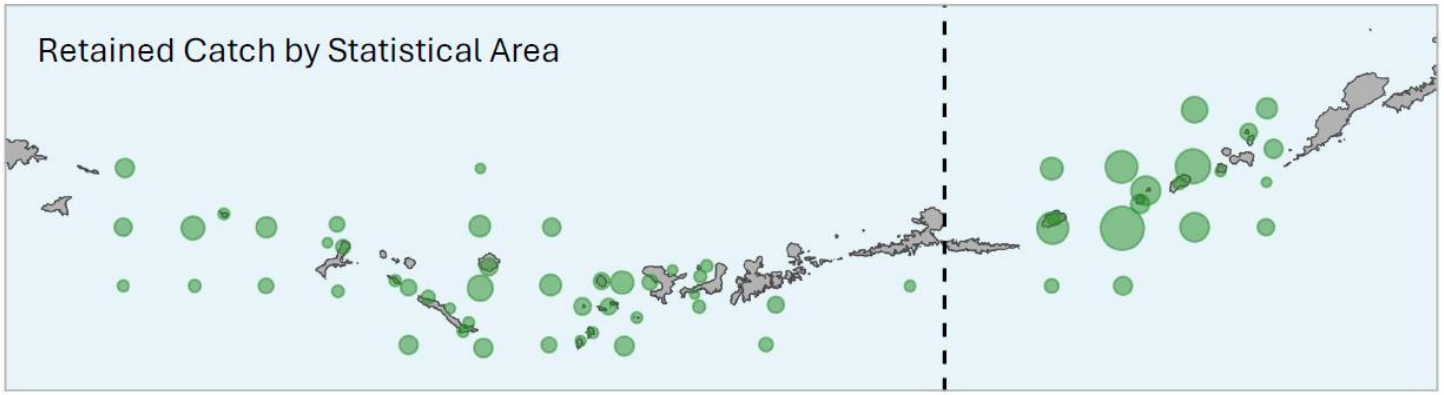
2023/24 Season CPUE

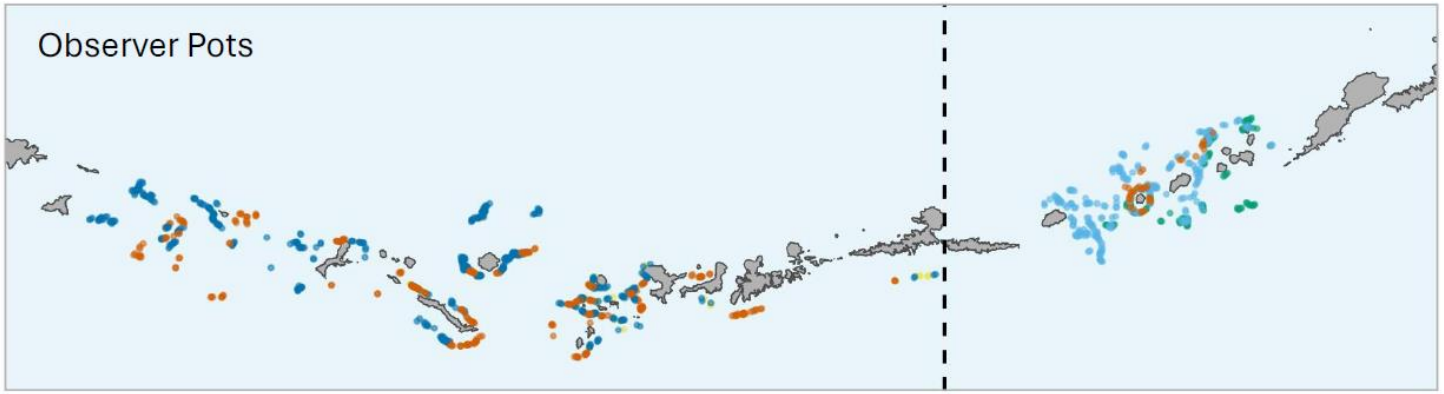



Retained catch (million lb)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
EAG
WAG

2023/24 Season Harvest

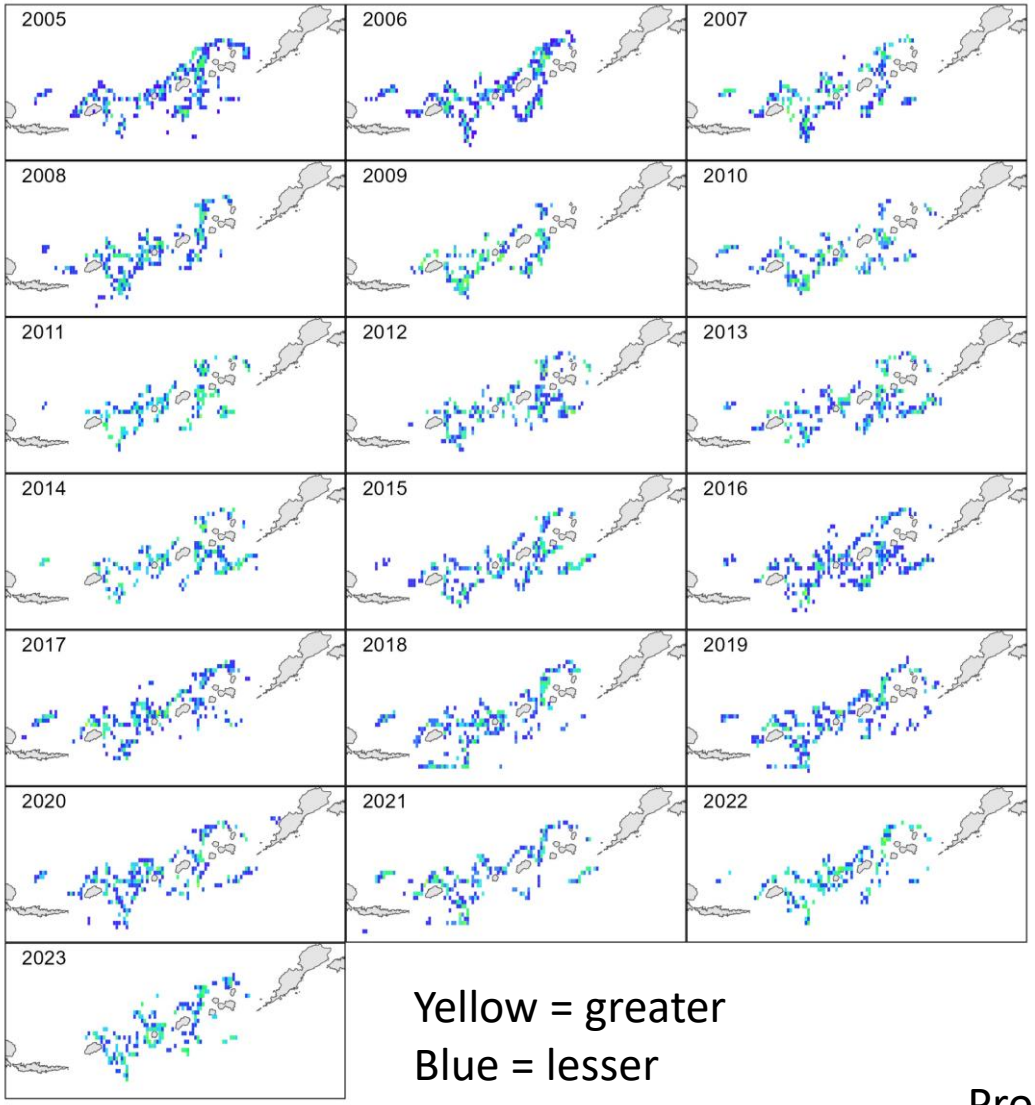






Tyler Jackson presentation to CPT, May 2024

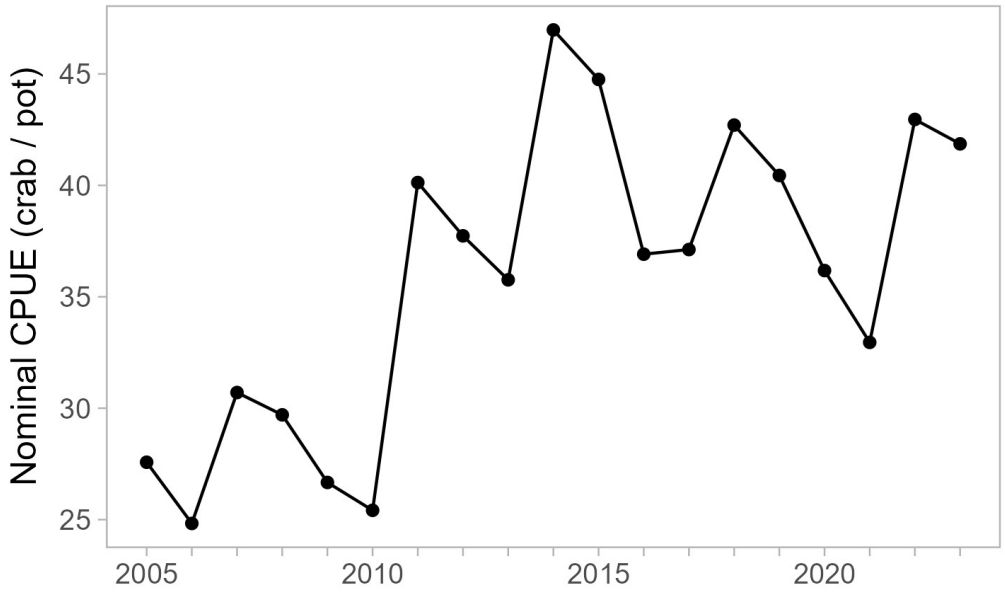
EAG proportion effort by lat/long

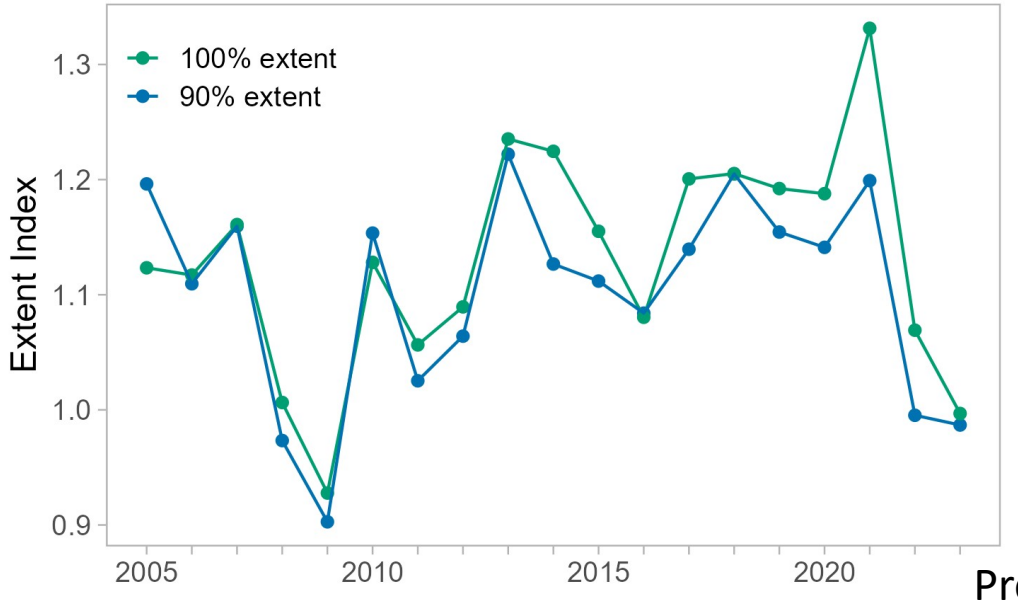


Yellow = greater
Blue = lesser

Produced by Tyler Jackson

EAG



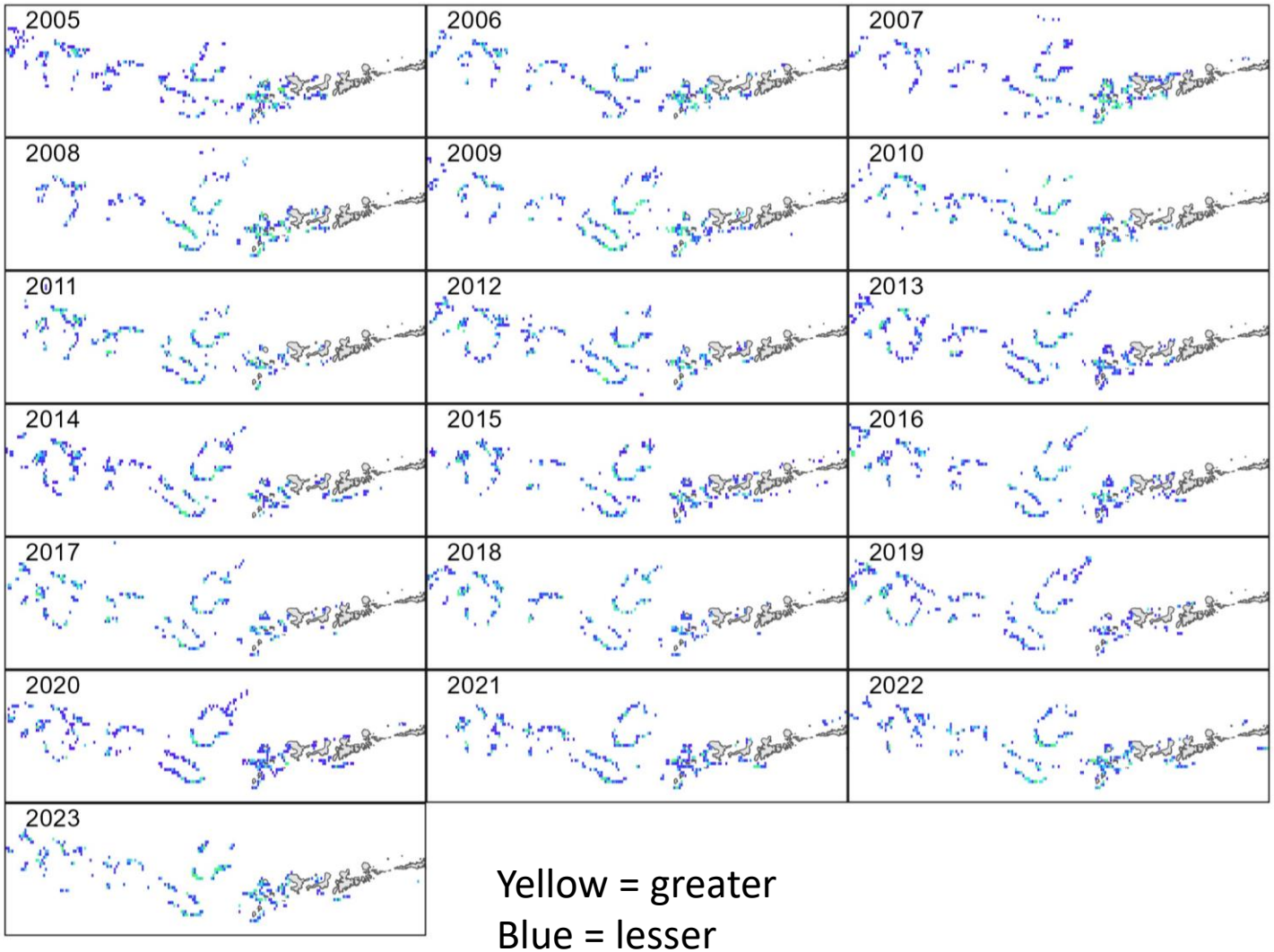


Would like to see strong CPUE with high or increasing extend index

In recent years, high CPUE with low extent implies CPUE improvement not necessarily indicative of population growth

Produced by Tyler Jackson

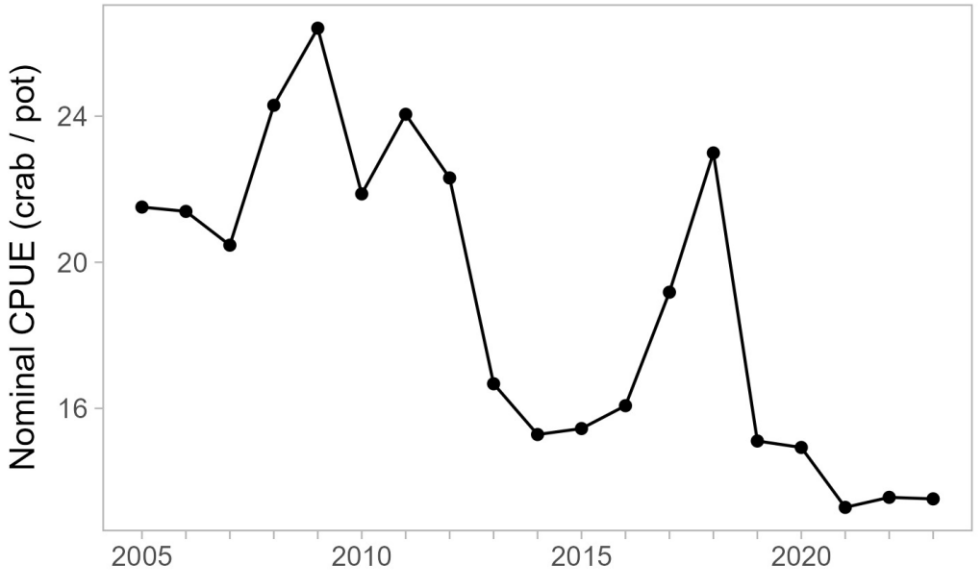
WAG proportion effort by lat/long

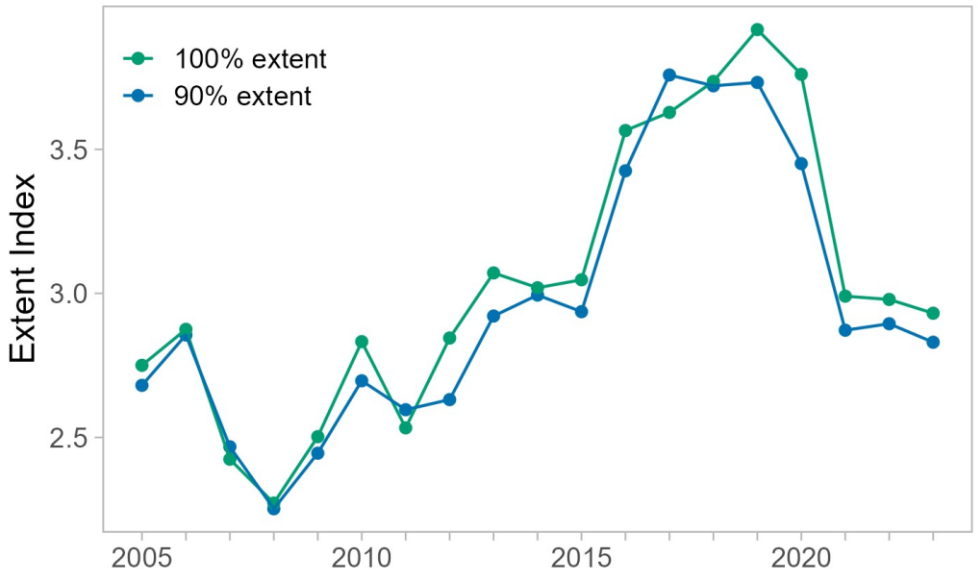


Yellow = greater
Blue = lesser

Produced by Tyler Jackson

WAG





Low CPUE, ~low extent

Potential for improved fishing in non-core areas?

Produced by Tyler Jackson

Harvest Strategy

Stock threshold for opening the fishery

- MMA is ≥25% of $MMA_{AVG1985-2017}$

Exploitation rate on mature-sized (≥116 mm CL) male abundance

- Increases linearly up to 15% (EAG) or 20% (WAG) with increasing MMA up to the 1985-2017 average
- 15% (EAG) or 20% (WAG), when MMA ≥ 1985-2017 average

Harvest capped at 25% of legal male abundance

*Calculate the **number of animals** for harvest:*

EAG

MMA (current year)	TAC computation	25% Legal Cap
$<0.25*MMA_{AVG1985-2017}$	0	0
$\geq 0.25*MMA_{AVG1985-2017}$, but $<MMA_{AVG1985-2017}$	0.15 x $MMA/MMA_{AVE1985-2017}$ x MMA	0.25 x LMA
$\geq MMA_{AVG1985-2017}$	0.15 x MMA	0.25 x LMA

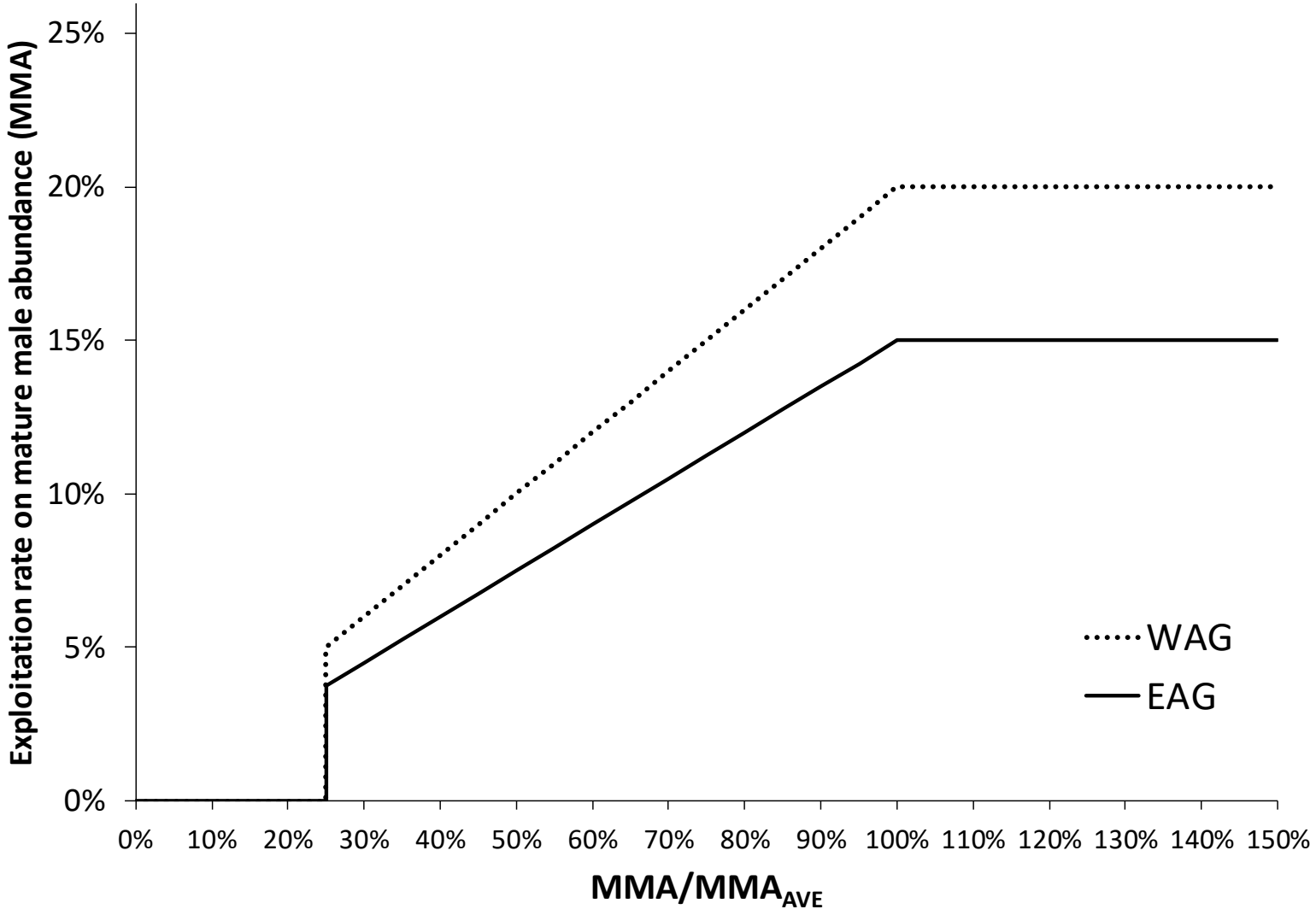
WAG

MMA (current year)	TAC computation	25% Legal Cap
$<0.25*MMA_{AVG1985-2017}$	0	0
$\geq 0.25*MMA_{AVG1985-2017}$, but $<MMA_{AVG1985-2017}$	0.20 x $MMA/MMA_{AVE1985-2017}$ x MMA	0.25 x LMA
$\geq MMA_{AVG1985-2017}$	0.20 x MMA	0.25 x LMA

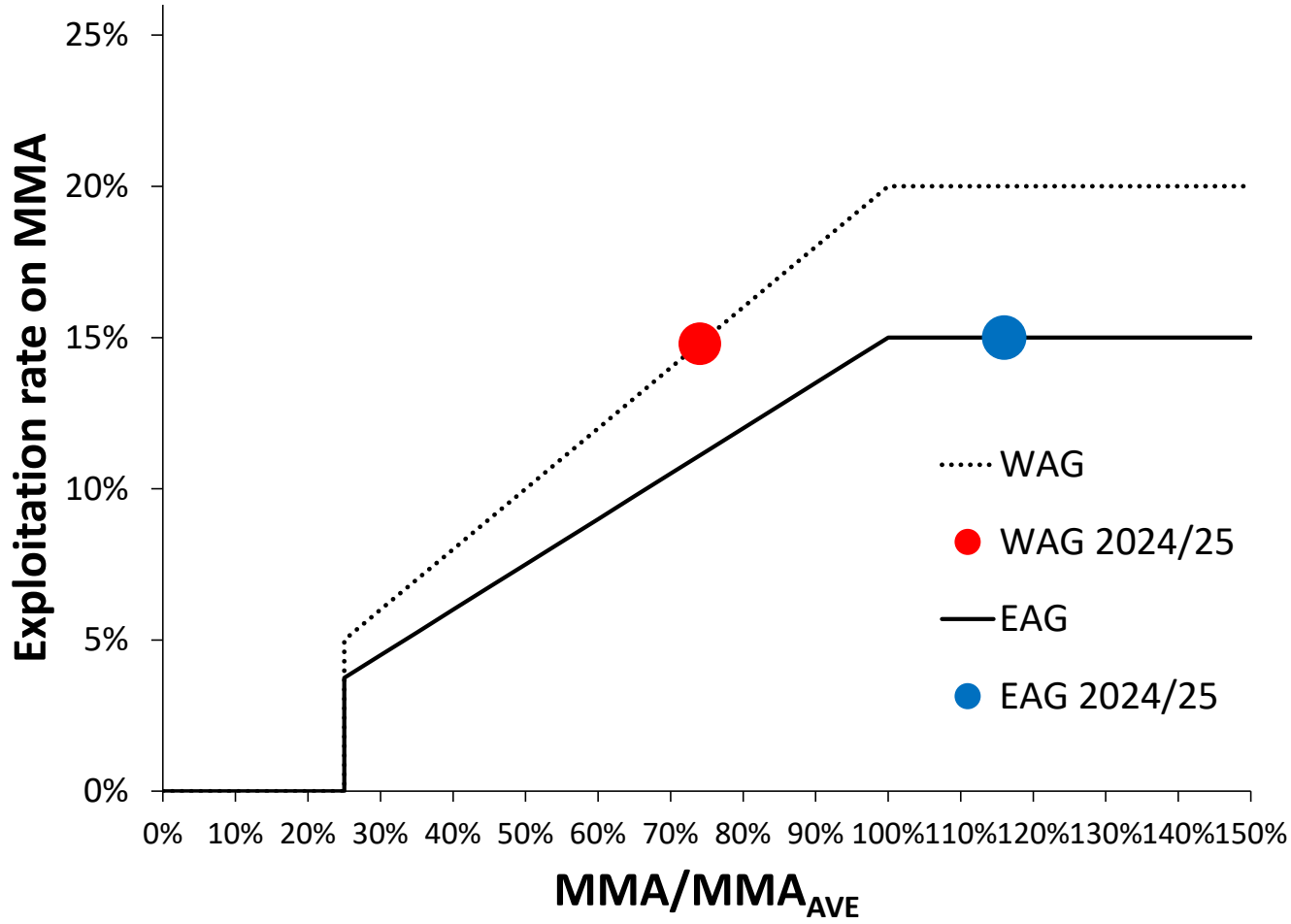
MMA = mature-sized male (≥111 mm CL) abundnace

LMA = legal-size male (≥136 mm CL) abundnace

Sloping control rule



Where are we on the control rule for 2024/25 TAC setting?



Numbers for TAC computations

	EAG	WAG
Current year MMA	5.821	2.596
Average $MMA_{1985\text{-}2017}$	5.019	3.645
MMA/MMA_{AVE}	116%	71%
Expoit. rate on MMA	0.15	0.14
Exp on MMA	0.873	0.370
Current year LMA	4.139	1.645
25% exp on LMA	1.035	0.411
# animals for TAC calc	0.873	0.370
L wt lb (23/24 FT)	4.307	4.022
TAC (million lb): FT ave wt	**3.76**	**1.49**

25% legal cap not limiting TAC in either area

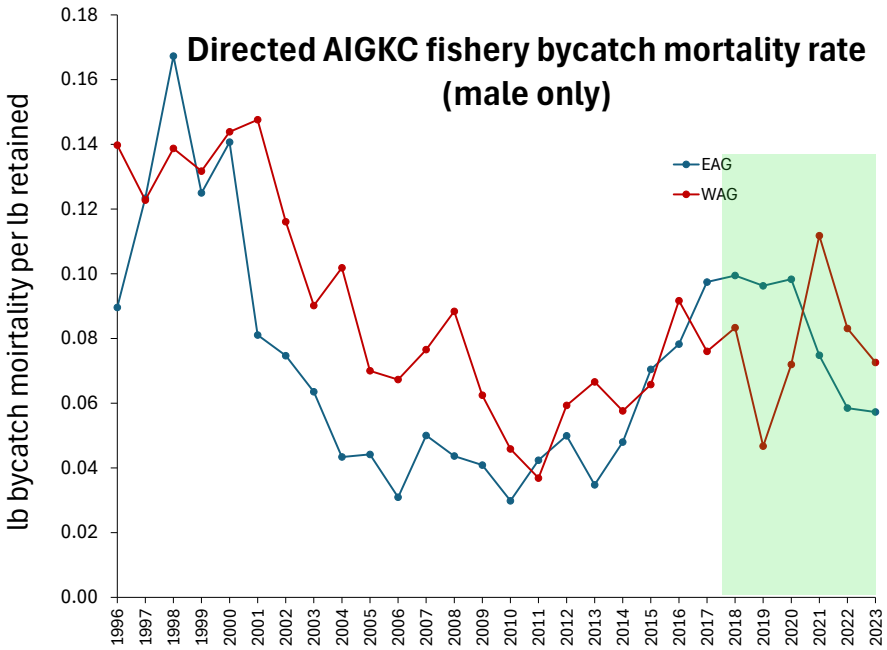
Computed TACs relative to ABC

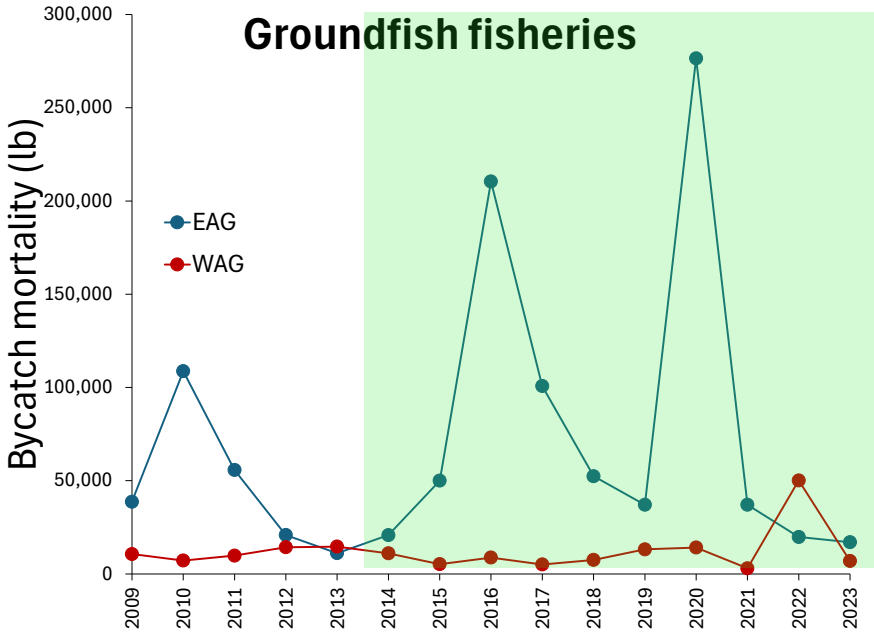
- Combined computed TAC: 5.248 million lb
- Combined ABC: 6.158 million lb

- Computed TACs less than ABC by 0.910 million lb

- Is this enough to account for anticipated bycatch mortality in the directed and groundfish fisheries?
  - What are the estimates of bycatch mortality?

Bycatch mortality: area specific





Assume average from past 5 years:

- **8% for both areas**

Assume average from past 10 years:

- **82,000 lbs for EAG**
- **12,000 lbs for WAG**

Bycatch mortality: area specific

EAG: 2024/25 maximum total fishery mortality relative to avoiding ABC = 4.673 million lb

Assumptions		Mortality (million lb)
Assume mean mortality in groundfish fisheries, **14/15-23/24 =**		0.08
	Subtotal	0.08
Remaining for directed (incl. bycatch mort), mill lb (ABC-Subtotal) =	4.59	
Assume ave (lb discard mort)/(lb retained) in directed fishery, **19/20-23/24** =	0.077	
Maximum TAC = (remaining for directed)/(1+0.077) =		**4.26**

WAG: 2024/25 maximum total fishery mortality relative to avoiding ABC = 1.485 million lb

Assumptions		Mortality (million lb)
Assume mean mortality in groundfish fisheries, **14/15-23/24 =**		0.01
	Subtotal	0.01
Remaining for directed (incl. bycatch mort), mill lb (ABC-Subtotal) =	1.47	
Assume ave (lb discard mort)/(lb retained) in directed fishery, **19/20-23/24** =	0.077	
Maximum TAC = (remaining for directed)/(1+0.077) =		**1.37**

WAG full computed TAC = 1.49

Thoughts on the WAG

- CPUE past 3 seasons lowest since 2005
- Computed TAC exceeding area-specific ABC

- WAG harvest control rule caps out at 20% (EAG=15%)
  - Historical exploitation estimates in WAG support this
  - Historical exploitation rates likely too high

WAG

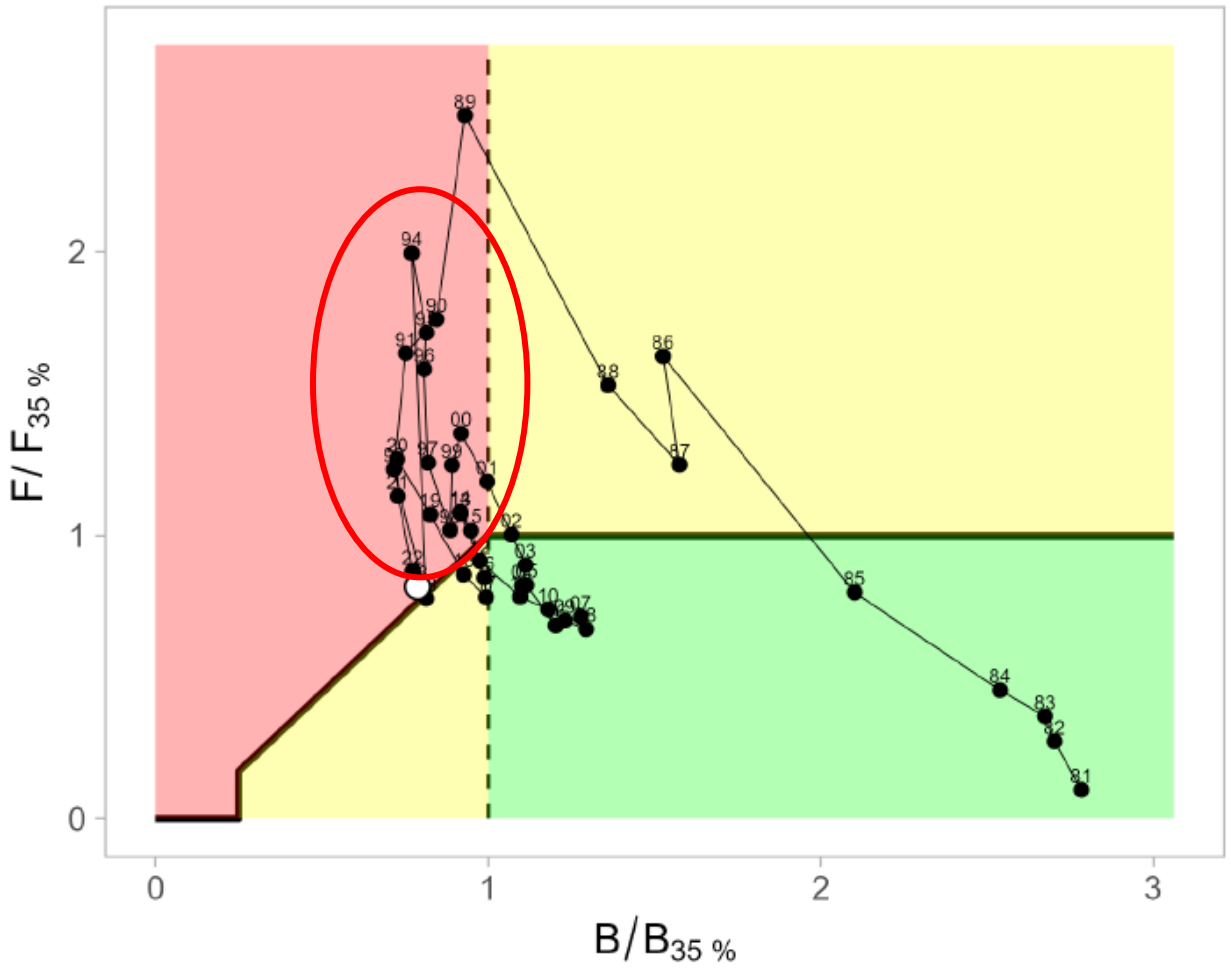


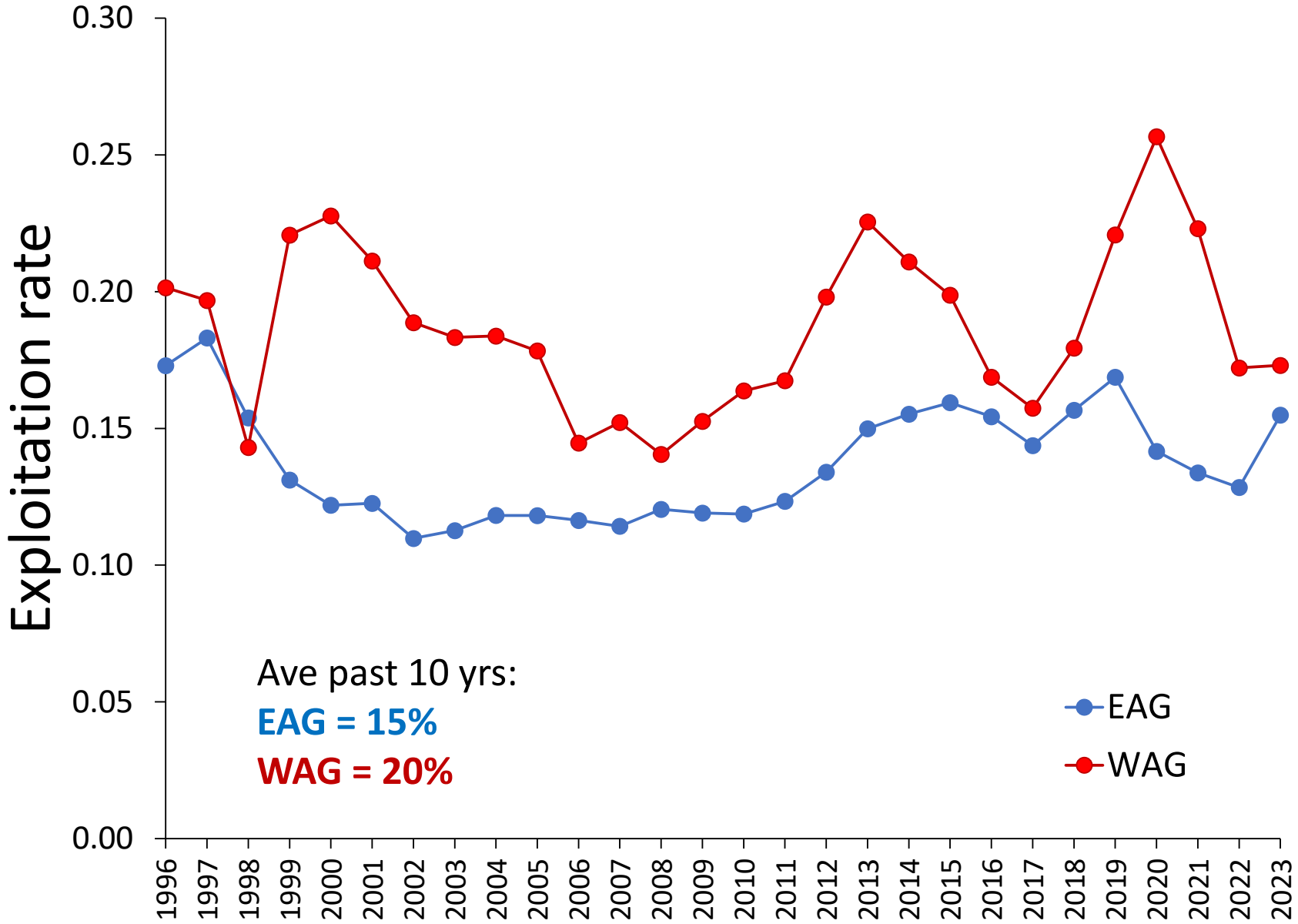
Figure 30: Kobe plot for model WAG 23.1. Bolded line indicates the tier 3 F_{OFL} control rule.

Estimates of recent fishing mortality above that which is advised by F_{OFL} control rule

Suggests that we may have been harvesting too aggressively

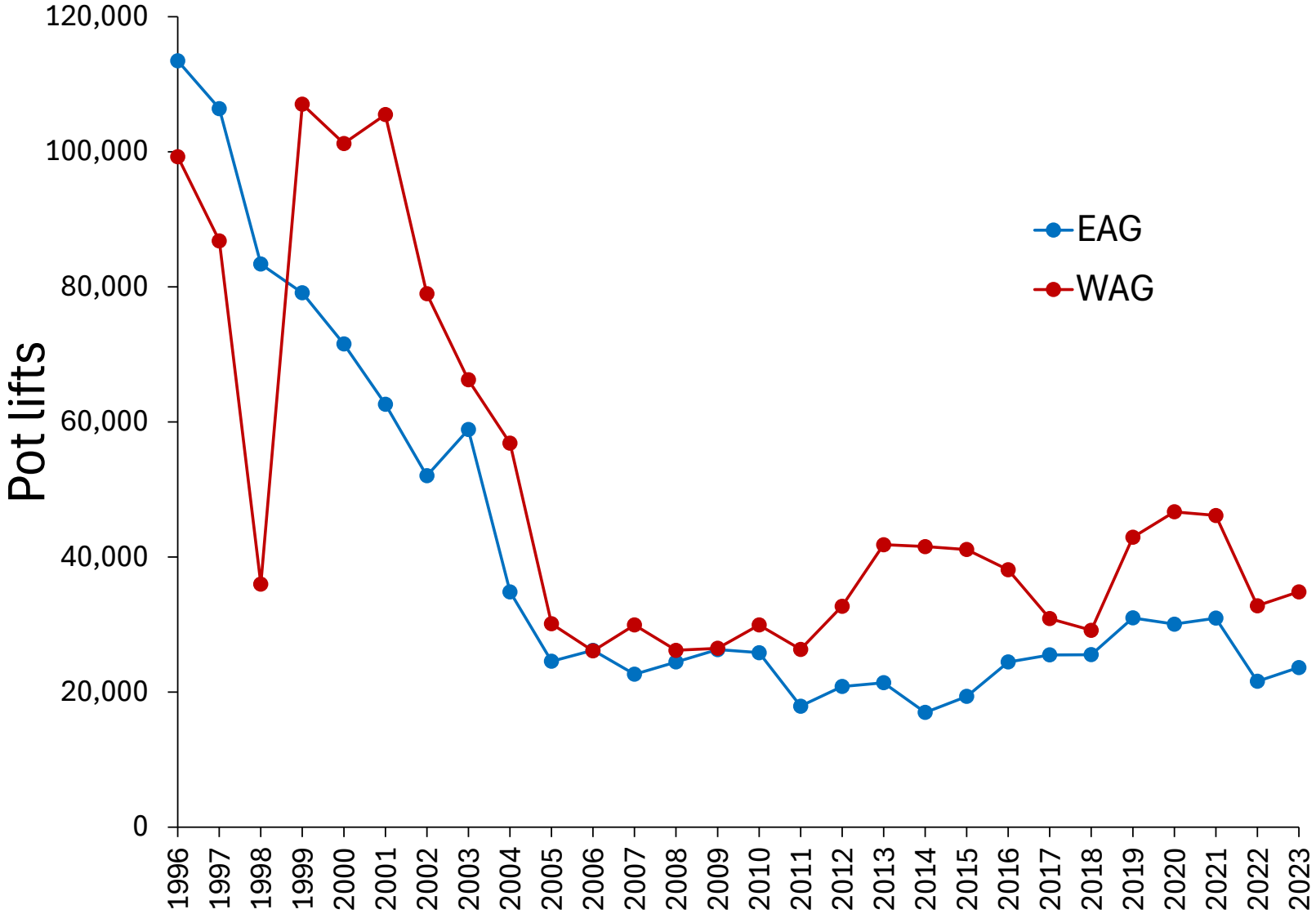
2024 AIGKC SAFE; Jackson 2024

Realized exploitation rate on MMA*

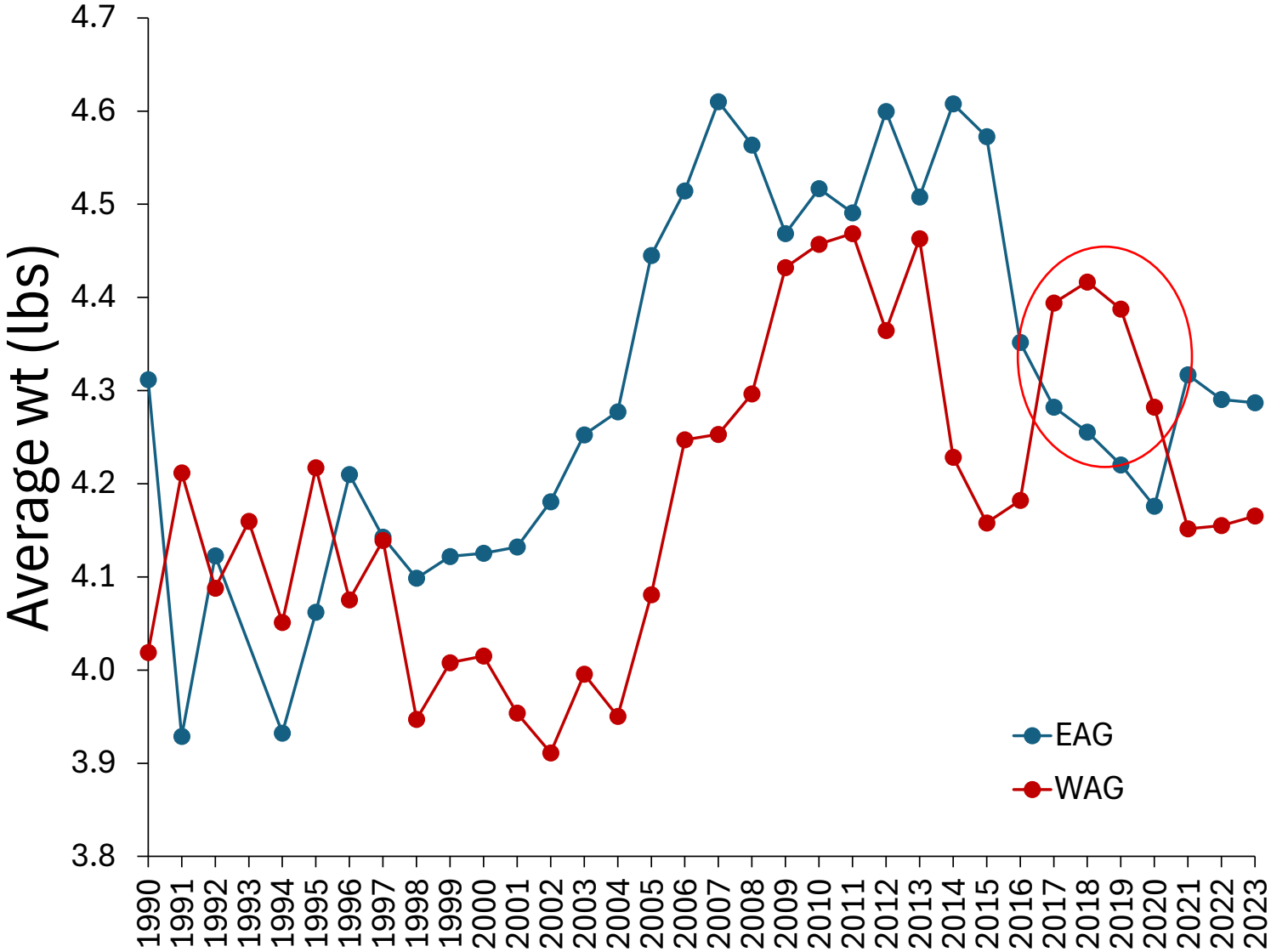


** Calculated from retained catch data and model 23.1 model estimates*

Historical Pot Lifts

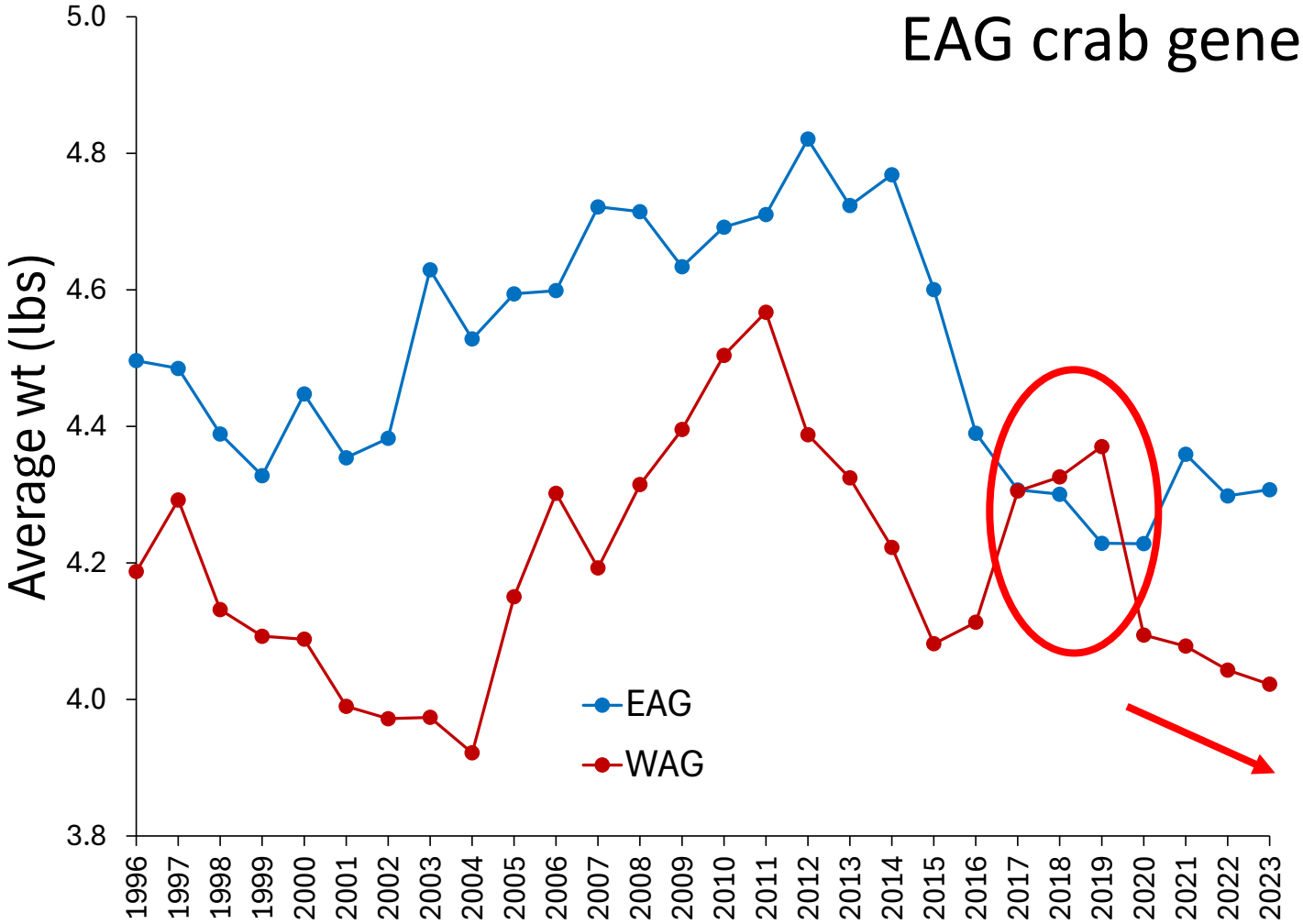


At-sea observer legal crab

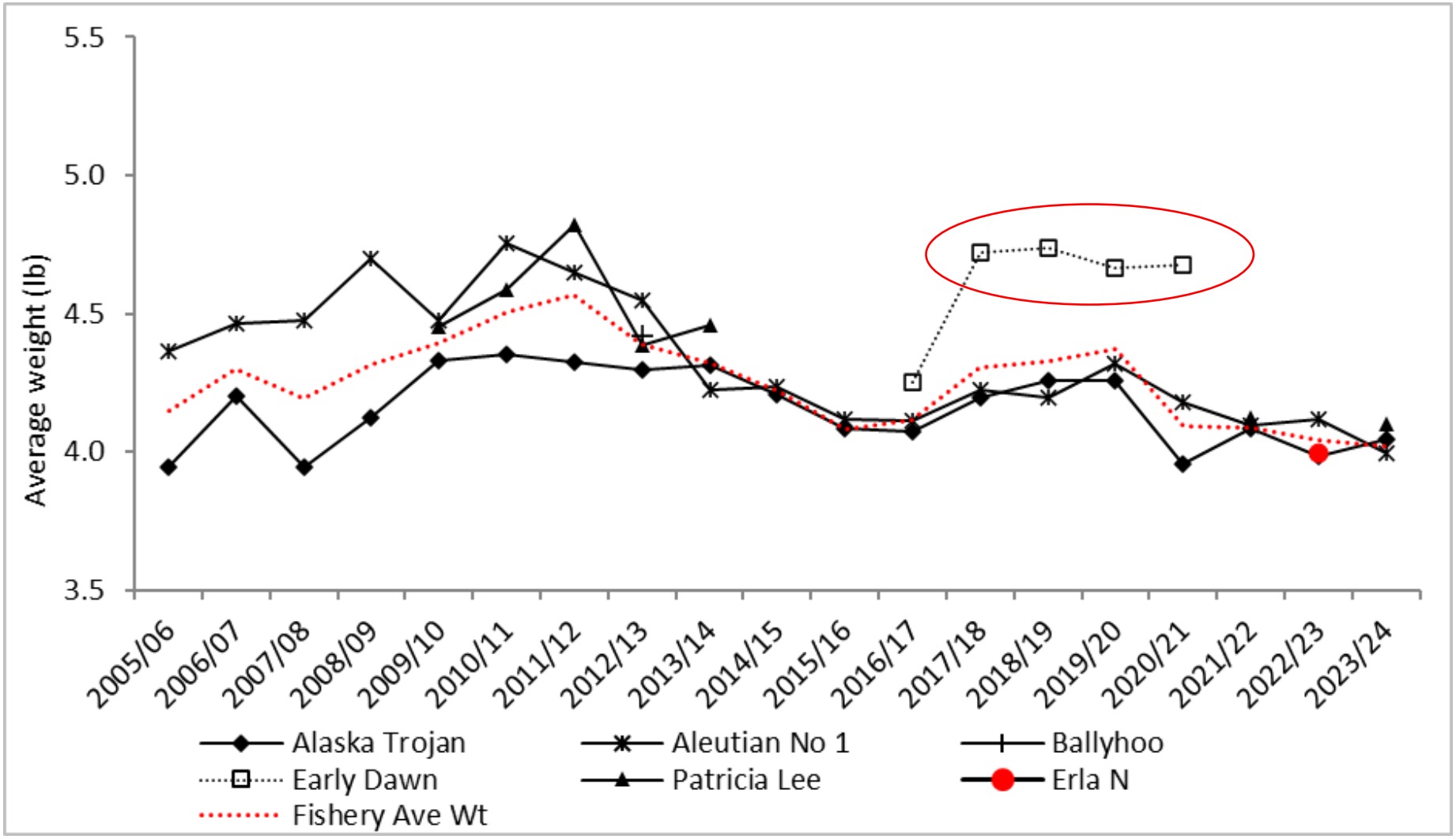


Landed crab ave wt

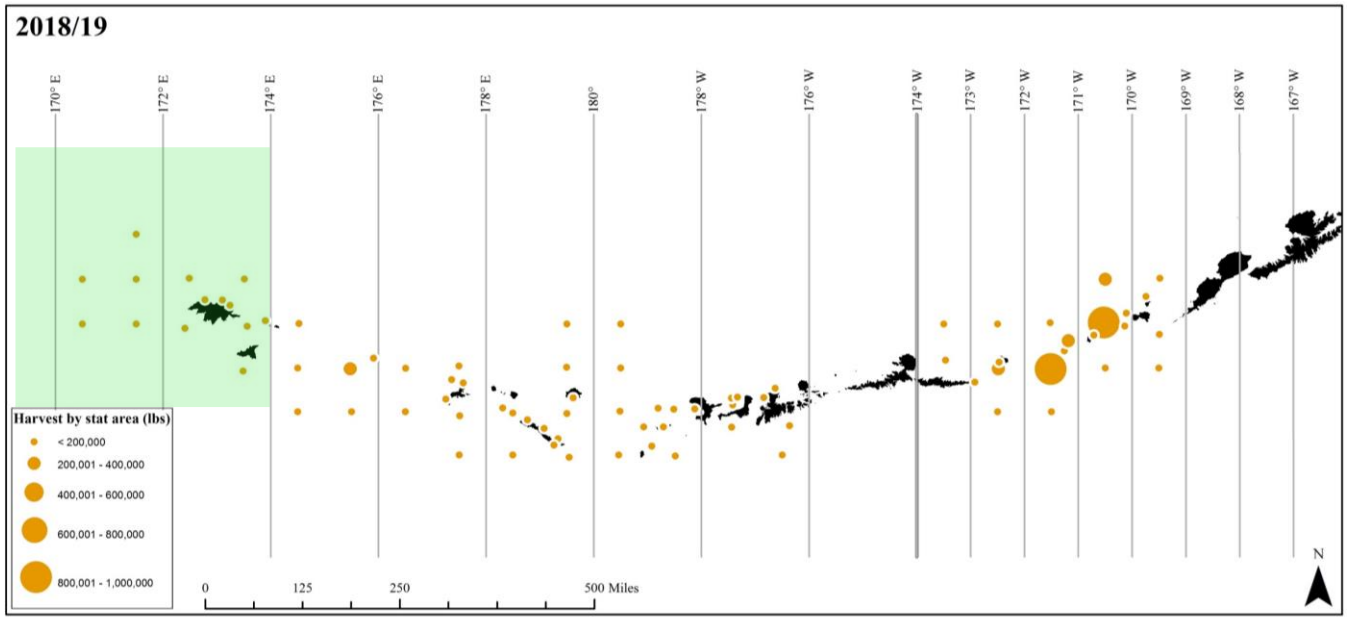
EAG crab generally larger

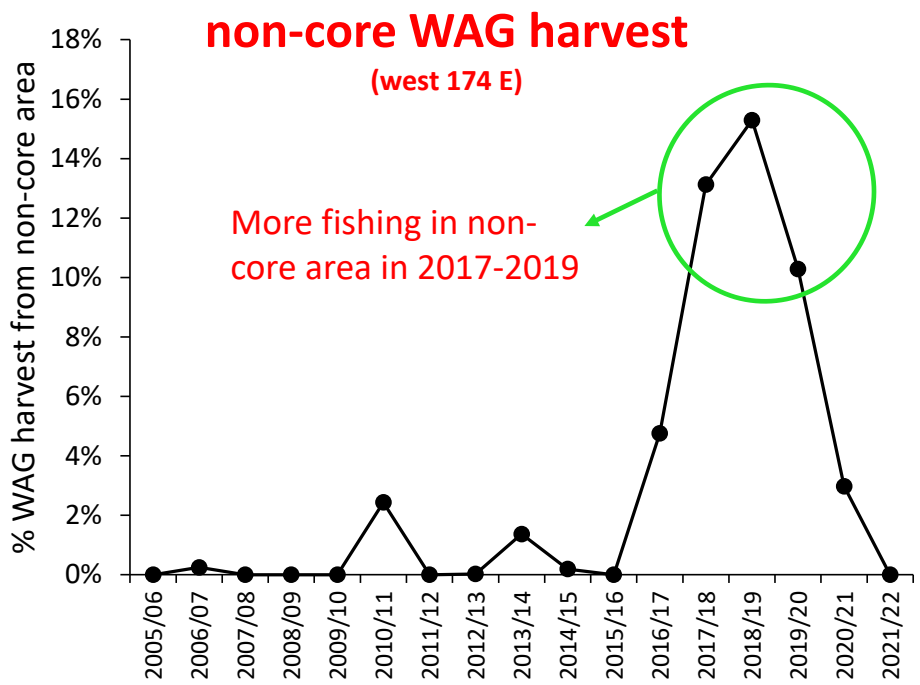


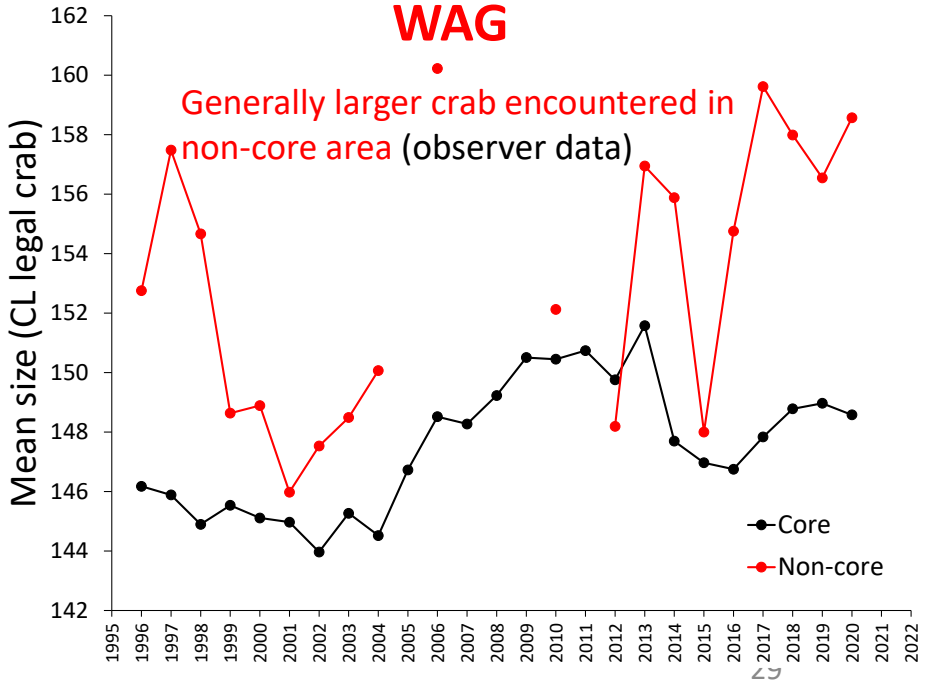
Landed crab ave wt



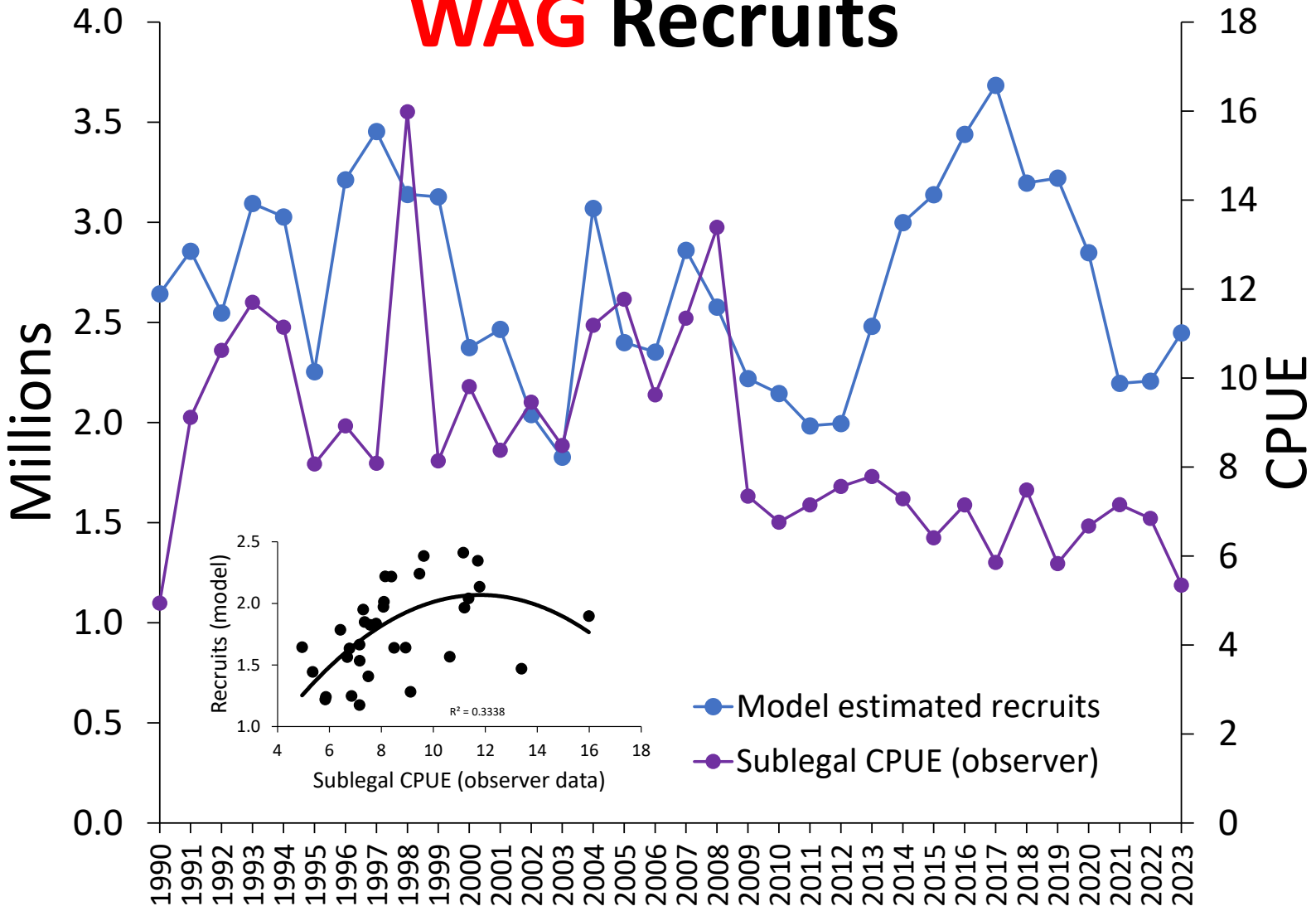
WAG core vs non-core





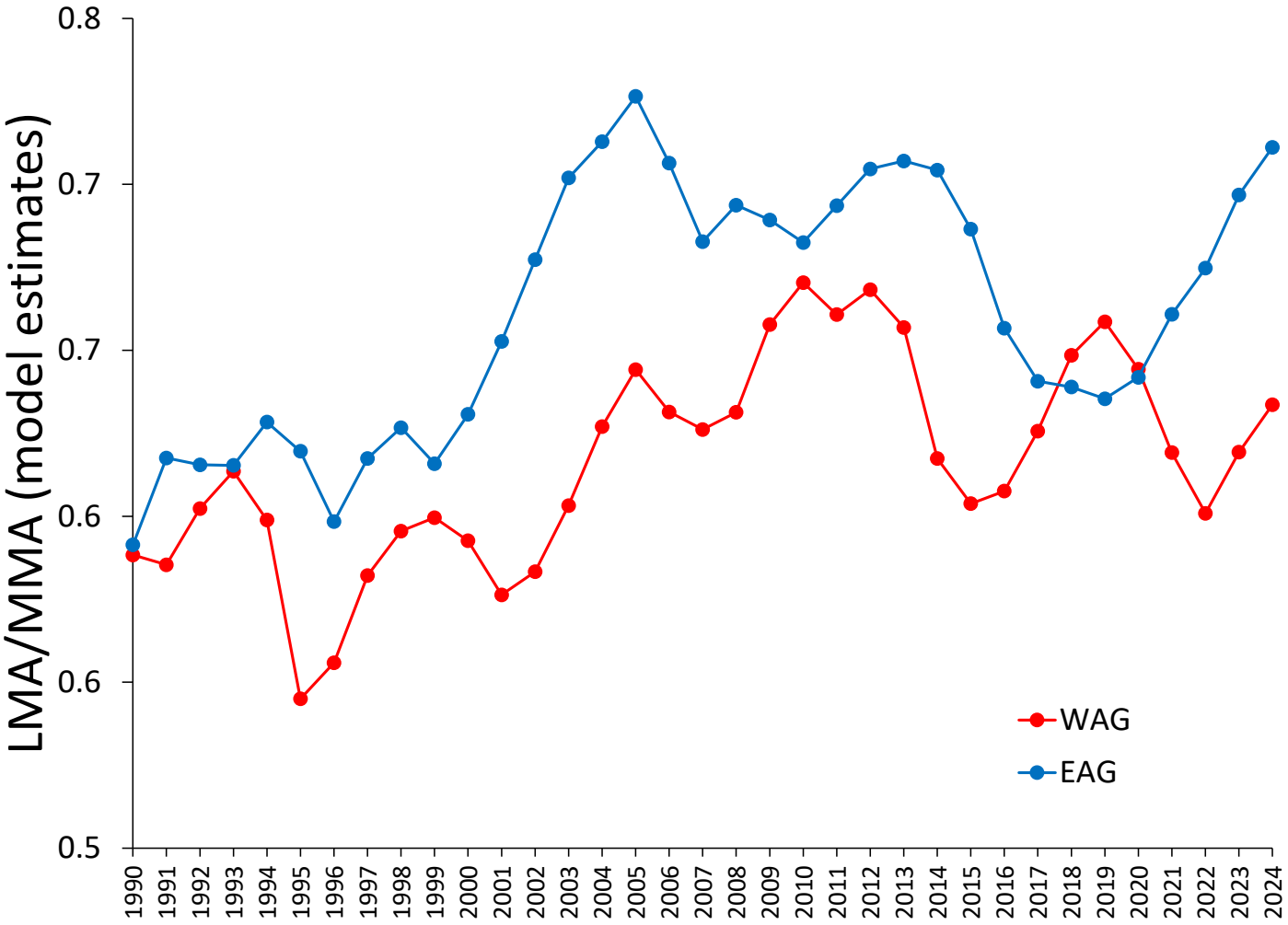


WAG Recruits



- Low estimated recruits in past 3 years
- Decreasing trend in sublegal crab in fishery

Proportion legal males



Fewer legal males relative to mature males in WAG

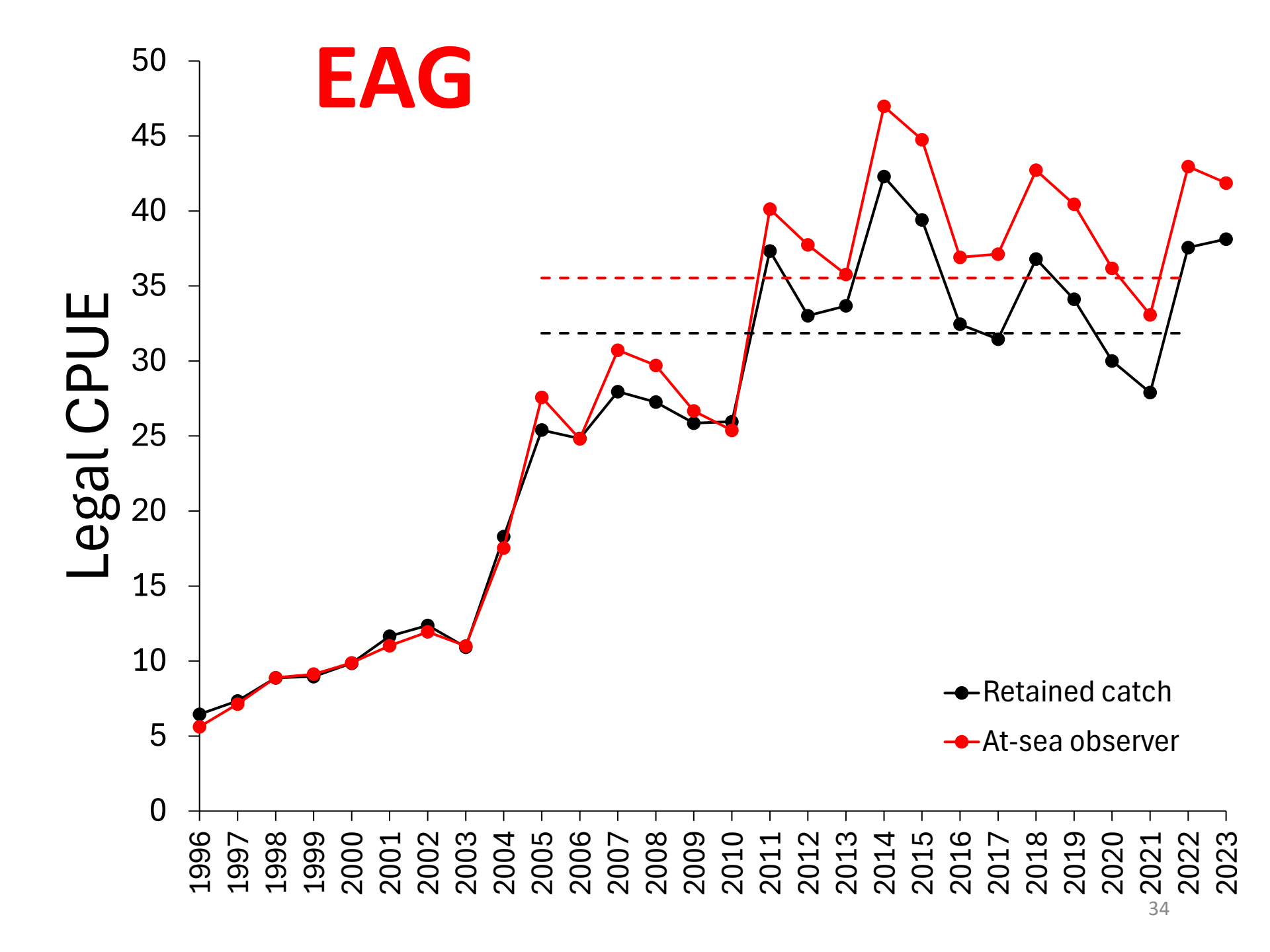
- Harvest strategy: we hit “MAX TAC” in WAG more often

Thoughts on WAG fishery.....

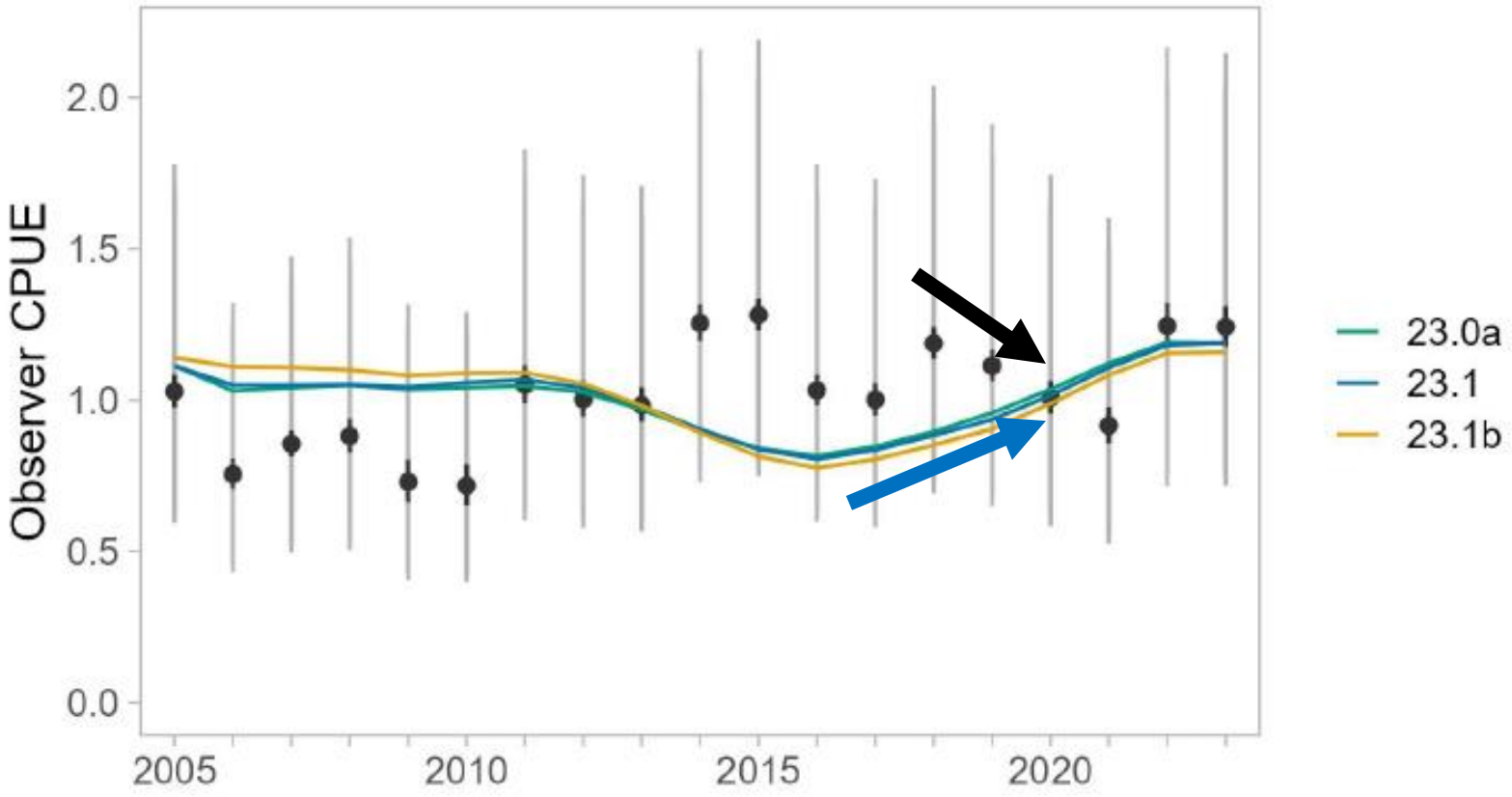
- Both areas generally harvested at maximum exploitation rates allowed by harvest strategy
  - Given 2024 model estimates of MMA, WAG harvested above 20% in some years
- WAG: more gear, larger area, lower catch rates (CPUE ~half), higher exploitation rate, proportionately fewer legal males

- We've been hitting the WAG hard
  - Past 3 seasons have the lowest CPUE since rationalization
  - Decreasing ave wts + low recruitment (model estimates) + low sublegal crab (fishery CPUE)
  - Consider reduced exploitation rate.... EAG ramp?

Model performance


EAG
Legal CPUE
50
45
40
35
30
25
20
15
10
5
0
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
Retained catch
At-sea observer

EAG CPUE



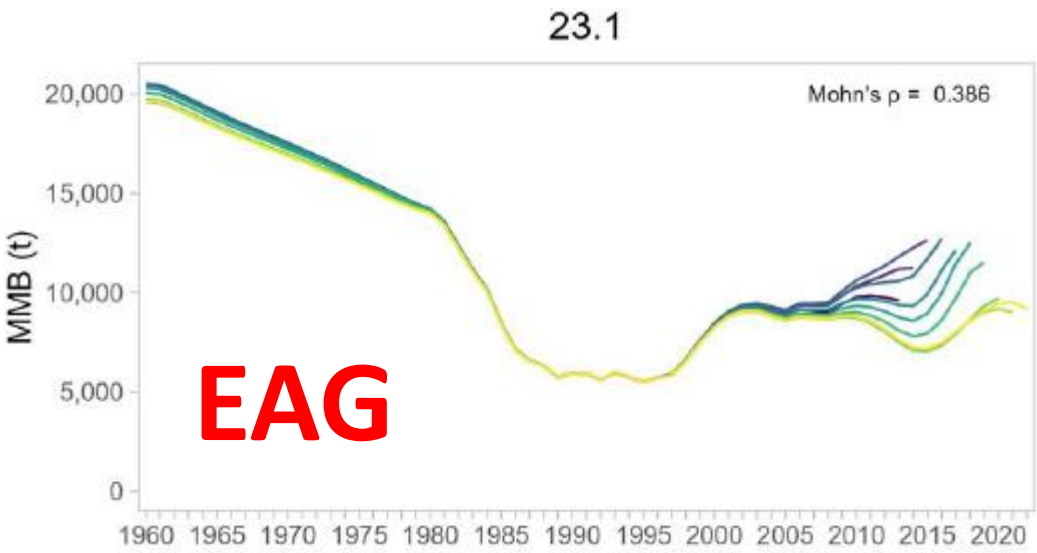
- Conflicting trends 2017-2021
- 2022-2023: model estimate ~flat
- Fit is not great

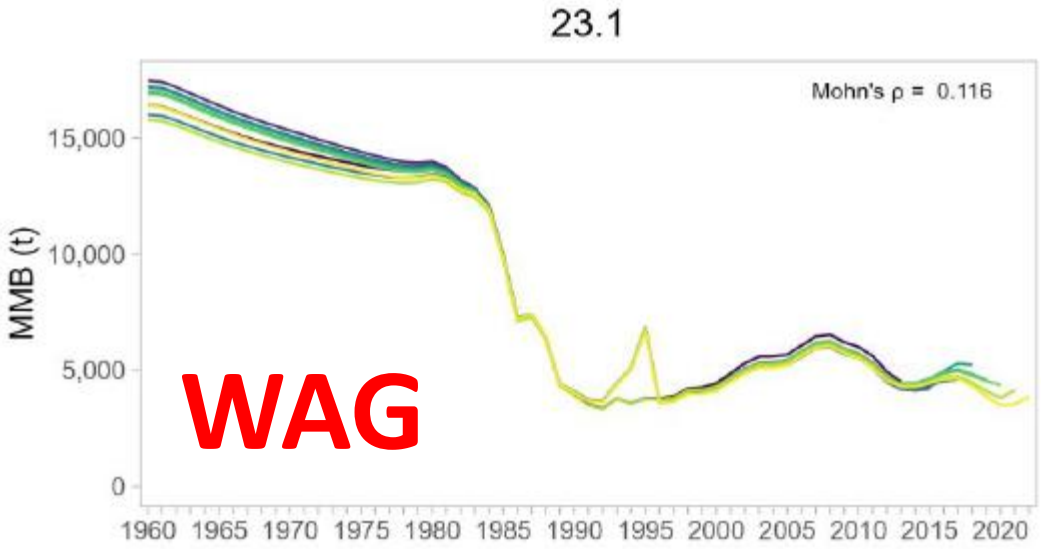
2024 AIGKC SAFE; Jackson 2024

Model performance

Retrospective patterns persist in **EAG**

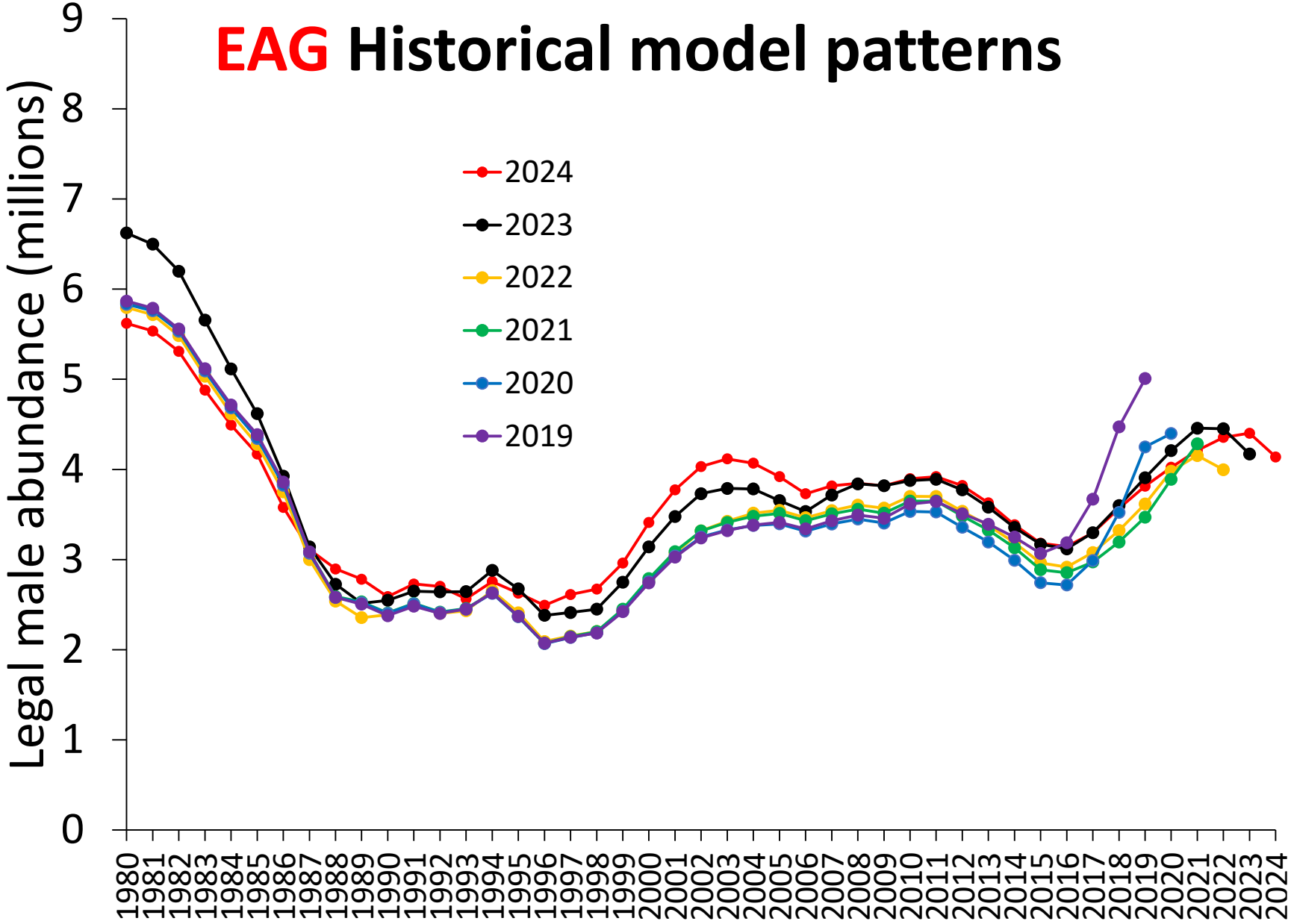
- Generally, more uncertainty in EAG terminal year estimates
- Conflicting signals between CPUE and size comp data
- Same model scenario, peeling back terminal year data and rerunning model, and repeat



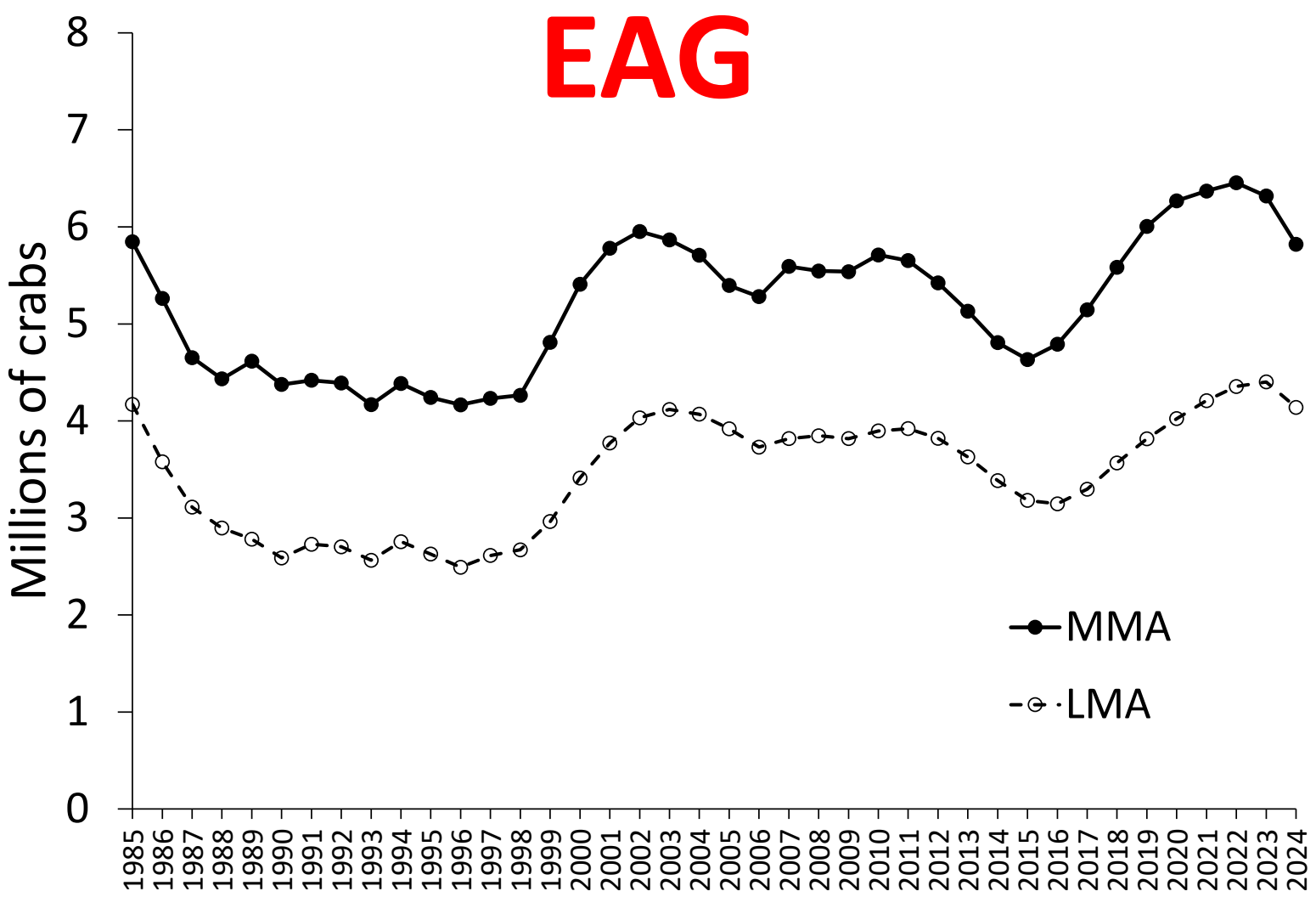


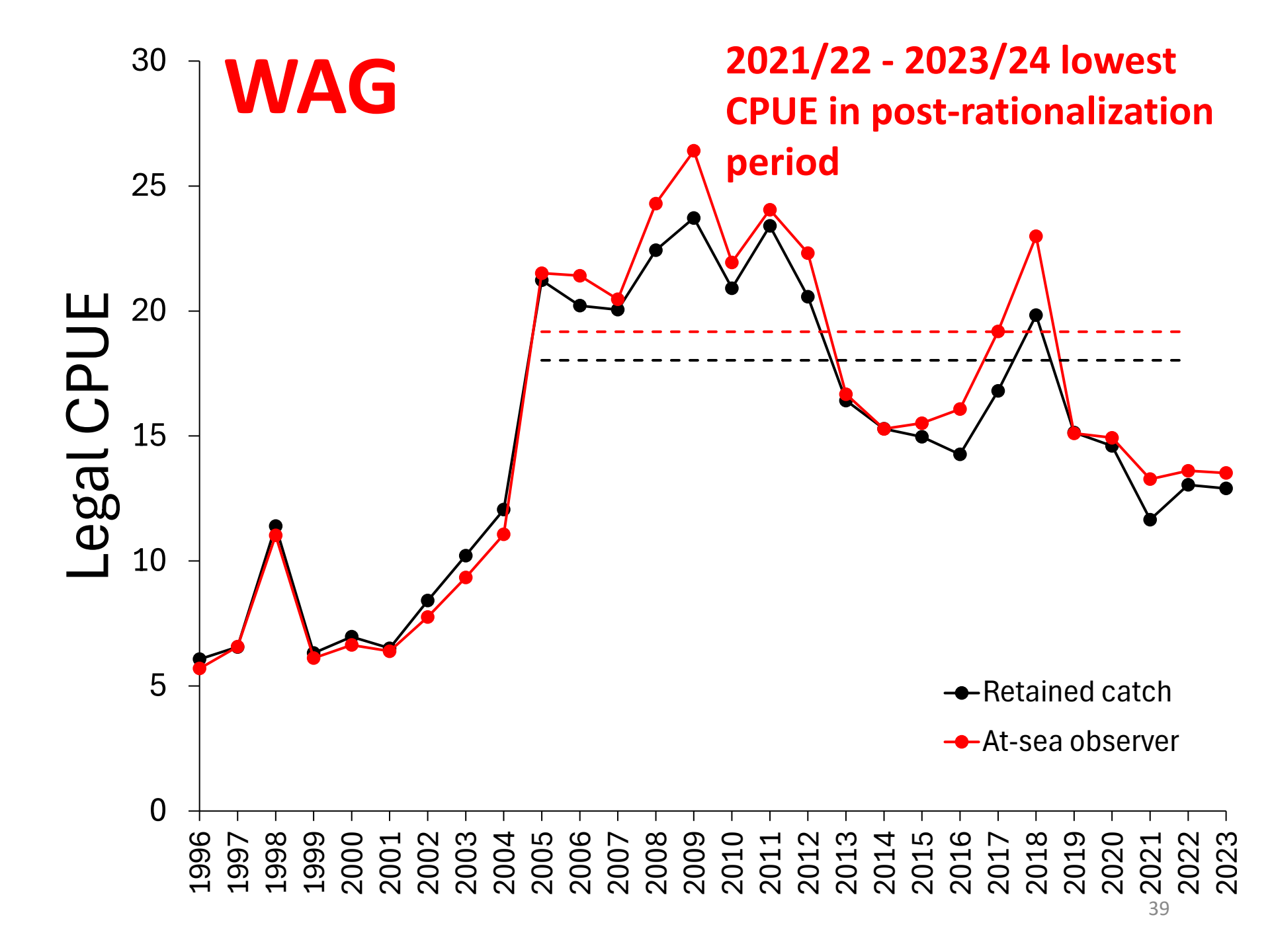
2024 AIGKC SAFE; Jackson 2024

EAG Historical model patterns

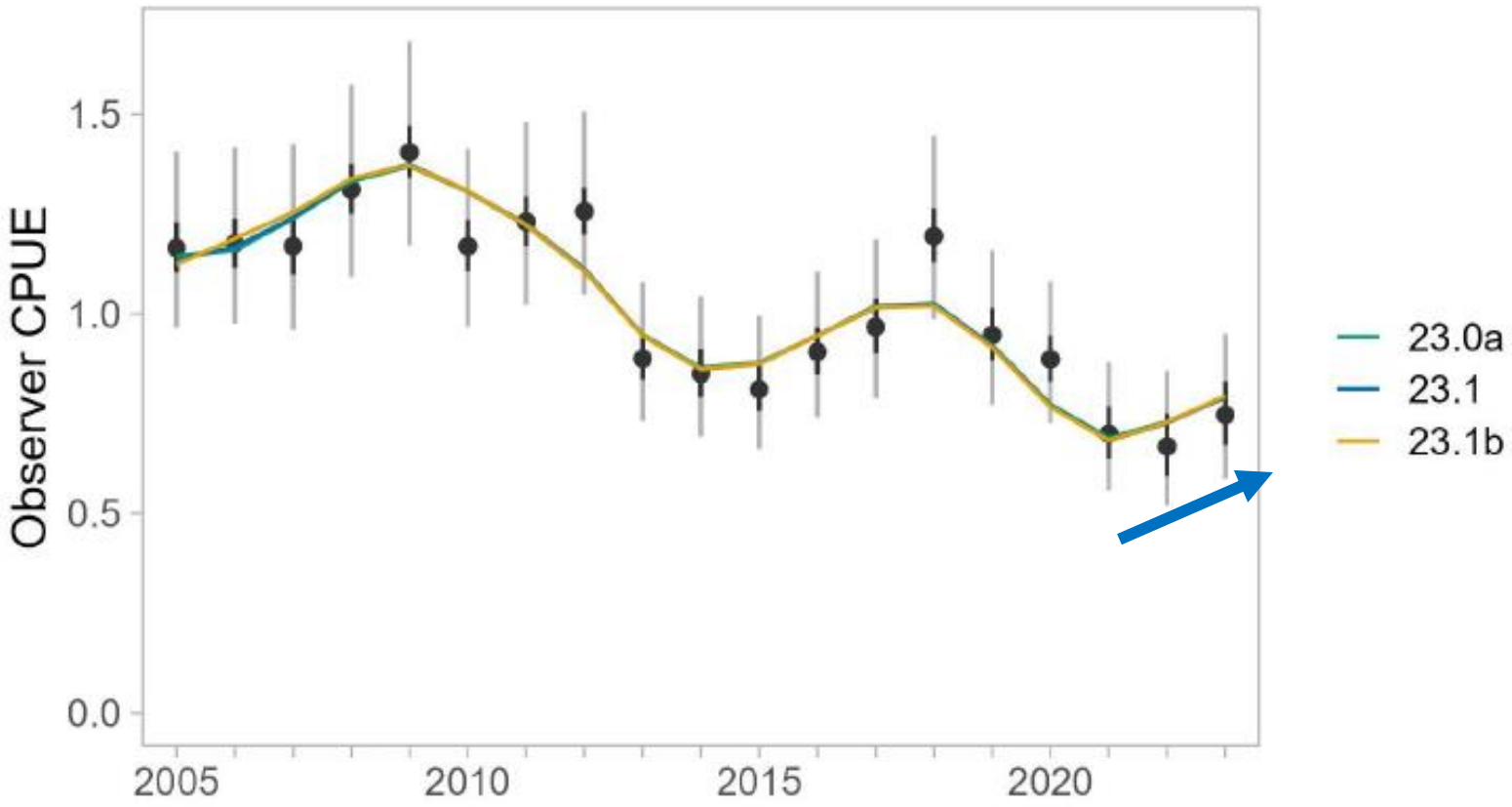


Model estimates: scenario 23.1




WAG
2021/22 - 2023/24 lowest CPUE in post-rationalization period
Legal CPUE
30
25
20
15
10
5
0
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
Retained catch
At-sea observer

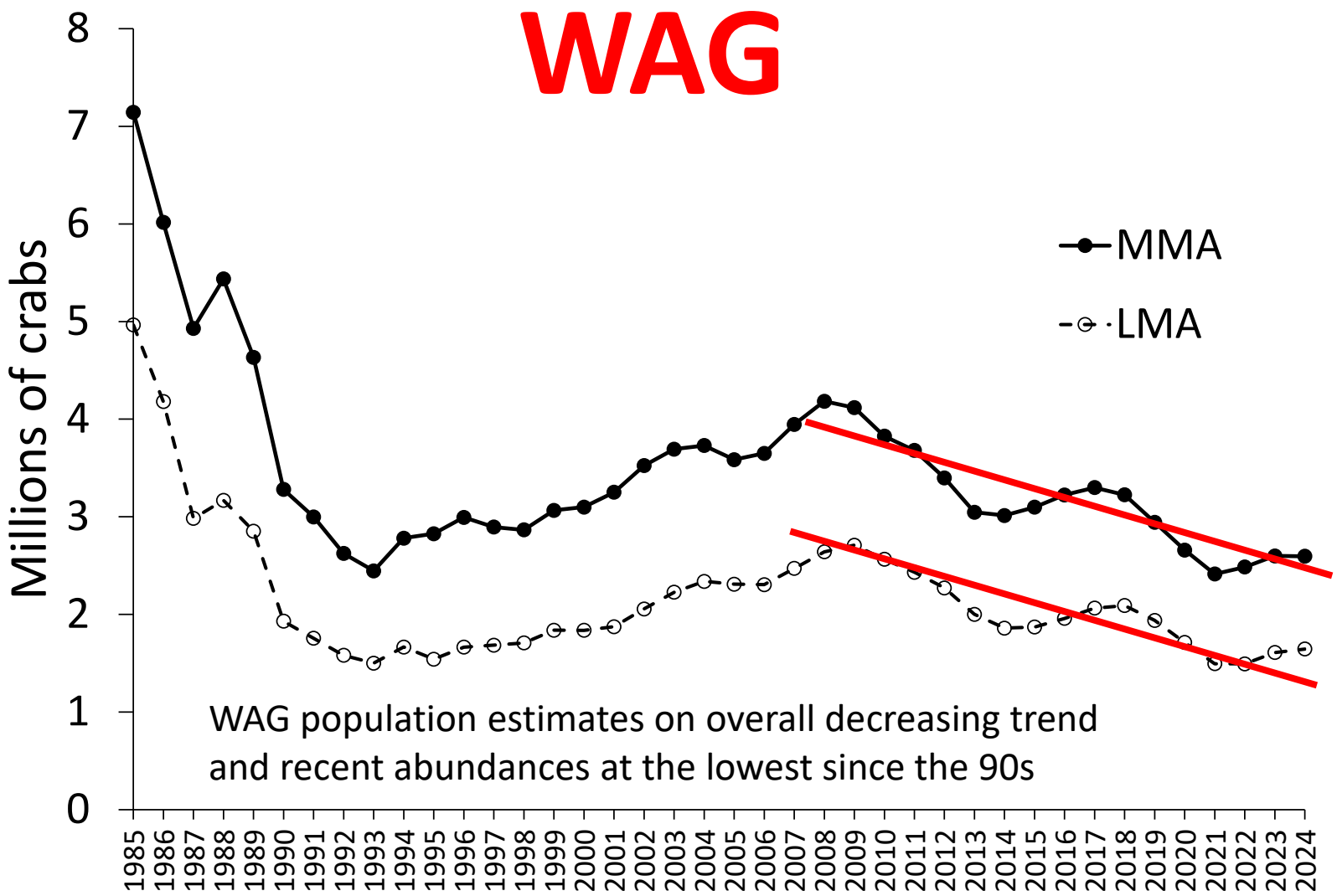
WAG CPUE



Model estimates capturing CPUE trend in recent years well

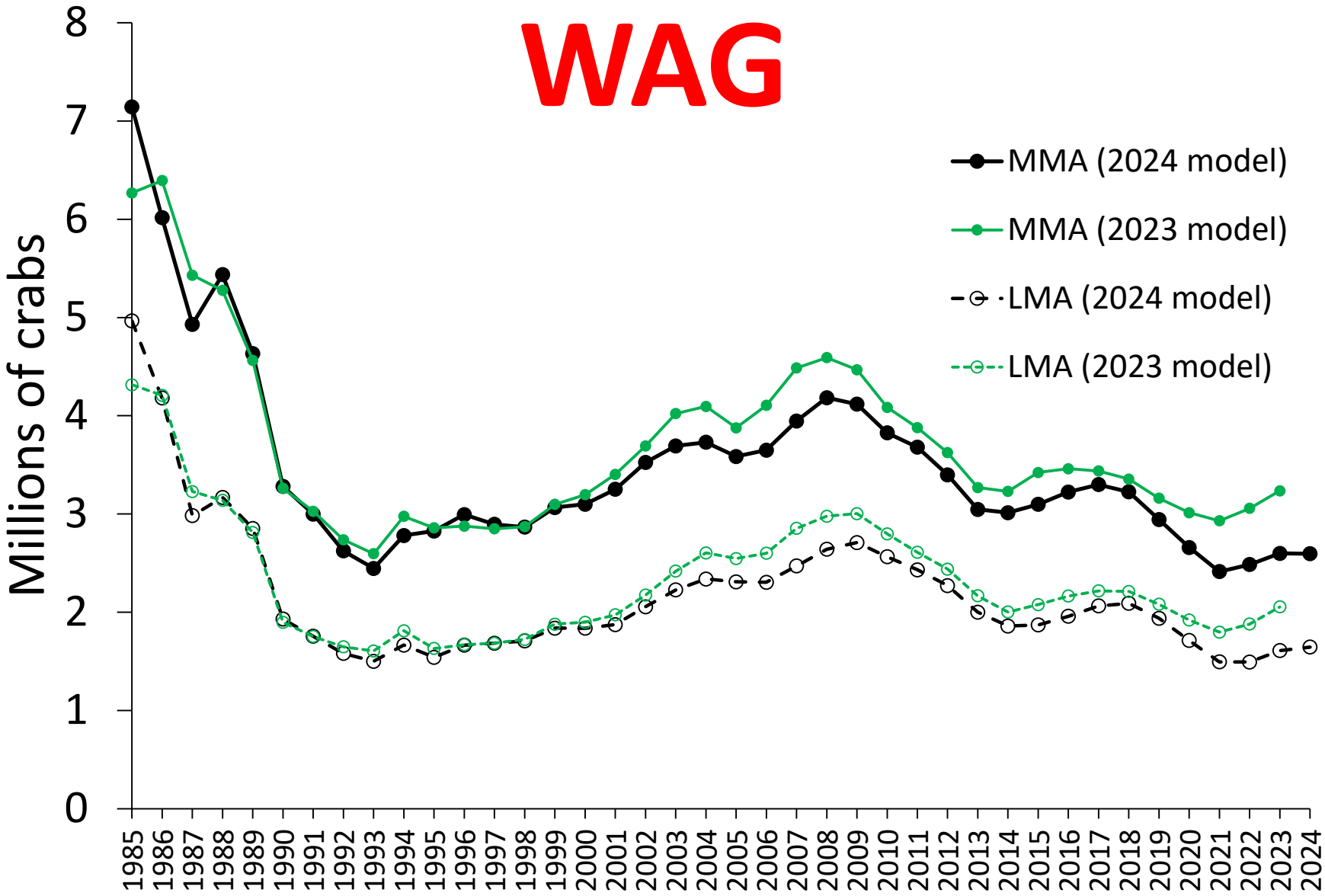
2024 AIGKC SAFE; Jackson 2024

Model estimates: scenario 23.1



	EAG	WAG	Notes/Concerns
Reference points			
2024/25 ABC	**4.67**	**1.49**	
ABC reduced for bycatch	**4.26**	**1.37**	ABC minus bycatch in directed + GF. Was used in WAG in 2022 + 2023
2023/24 TAC	**3.72**	**1.81**	EAG: full computed WAG: ABC minus bycatch
2024/25 TAC Options			
Full computed	**3.76**	**1.49**	Will exceed WAG area-specific ABC with bycatch.
Full computed 15% ramp BOTH areas	**3.76**	**1.12**	11% exploit. rate in WAG

* Green circles indicate recommended TACs


WAG
Millions of crabs
0
1
2
3
4
5
6
7
8
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
MMA (2024 model)
MMA (2023 model)
LMA (2024 model)
LMA (2023 model)

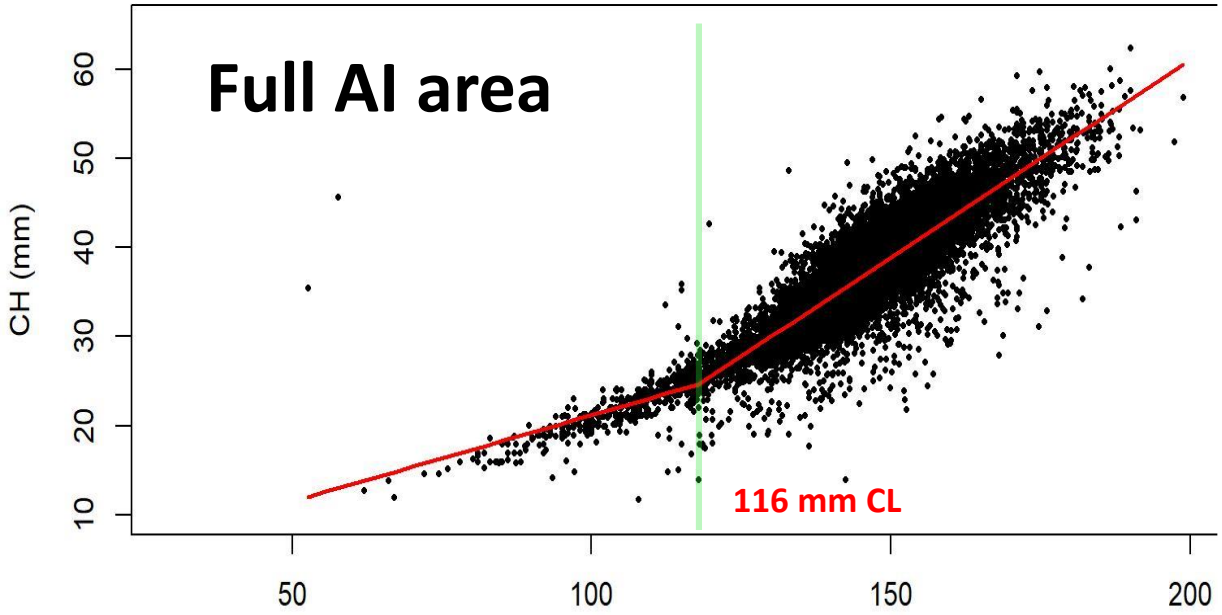
Historical EAG TAC buffering

- Implemented a **20% buffer** on EAG computed TACs to reflect model uncertainty (2018-2021)
  - Retrospective bias (Mohns Rho values)
  - Historical model bias: 20% approximated mean overestimation of terminal year
  - Poor CPUE fits
- Decreased to **10% buffer** in 2022 to reflect uncertainty in change in estimated size-at-maturity used in assessment
  - Increase in size-at-maturity means fewer animals in population are “mature” thereby reducing absolute population abundance used to calculate TAC (i.e. lower TAC)
  - Disconnect between what is used in assessment (full-area 116 mm) vs area-specific (EAG: 108 mm)
    - Likely/possible that assessment underestimates number of mature animals in EAG..... thus the reduction in buffer
    - We gave the fleet the benefit of the doubt
      - 2023 implement full computed TAC in EAG

Change in estimated size-at-maturity

Change to larger estimated **size-at-maturity** (116 mm vs 111 mm CL) in 2022 (and later) assessments*

- Predicts fewer animals in population are mature



Area-specific:
EAG 108 mm CL
WAG 120 mm CL

Stock-wide usage of 116 mm CL size-at-maturity may:

- *Underestimate* EAG MMA
- *Overestimate* WAG MMA

** This analysis is being revisited with the existing data.*

Final TAC recommendations

EAG 3.76: full computed (1% increase from last year)

- Equates to 15% exploitation on MMA
- Have used 20% and 10% buffers in past due to high model retrospective pattern + poor model fit to CPUE data
  - Some stability in recent retrospective peels
- Status quo TAC seems reasonable given last year fishery performance

WAG 1.12: full computed (38% decrease from last year)

- EAG 15% ramping control rule
- Conservation concern: continued low CPUE, high exploitation, low recruitment, possible overestimate of MMA
- Equates to 11% exploitation on MMA (last year was 14%)

Total fishery mortality

- EAG 3.76 and WAG 1.12 = **4.88 mill lb**
- Combined ABC: 6.158 million lb
- 4.88 safely accounts for bycatch
  - Allows room for TF: 170,000 lbs
- TAC = 79% of ABC (80% last year)
- Total fishery mortality = 90% of ABC
  - 5.52 mill lb
    - TAC: 4.88 mill lb
    - Bycatch: 0.38 mill lb directed + 0.09 mill lb groundfish
    - Test fishery: 0.18 mill lb (0.17 ret + 0.01 bycatch)

Summary

2023/24 CPUE

- EAG: flat from prior season, near timeseries high, causes for large increase unclear
- WAG: flat from prior season, past 3 seasons lowest in rationalized timeseries

Assessment model estimates

- EAG has higher uncertainty
  - Conflicting signals between CPUE and size comps
  - Large retrospective pattern
- WAG has less uncertainty but greater conservation concern
  - Low CPUE, high exploitation, low recruitment, decreasing ave wts

TACs relative to last year

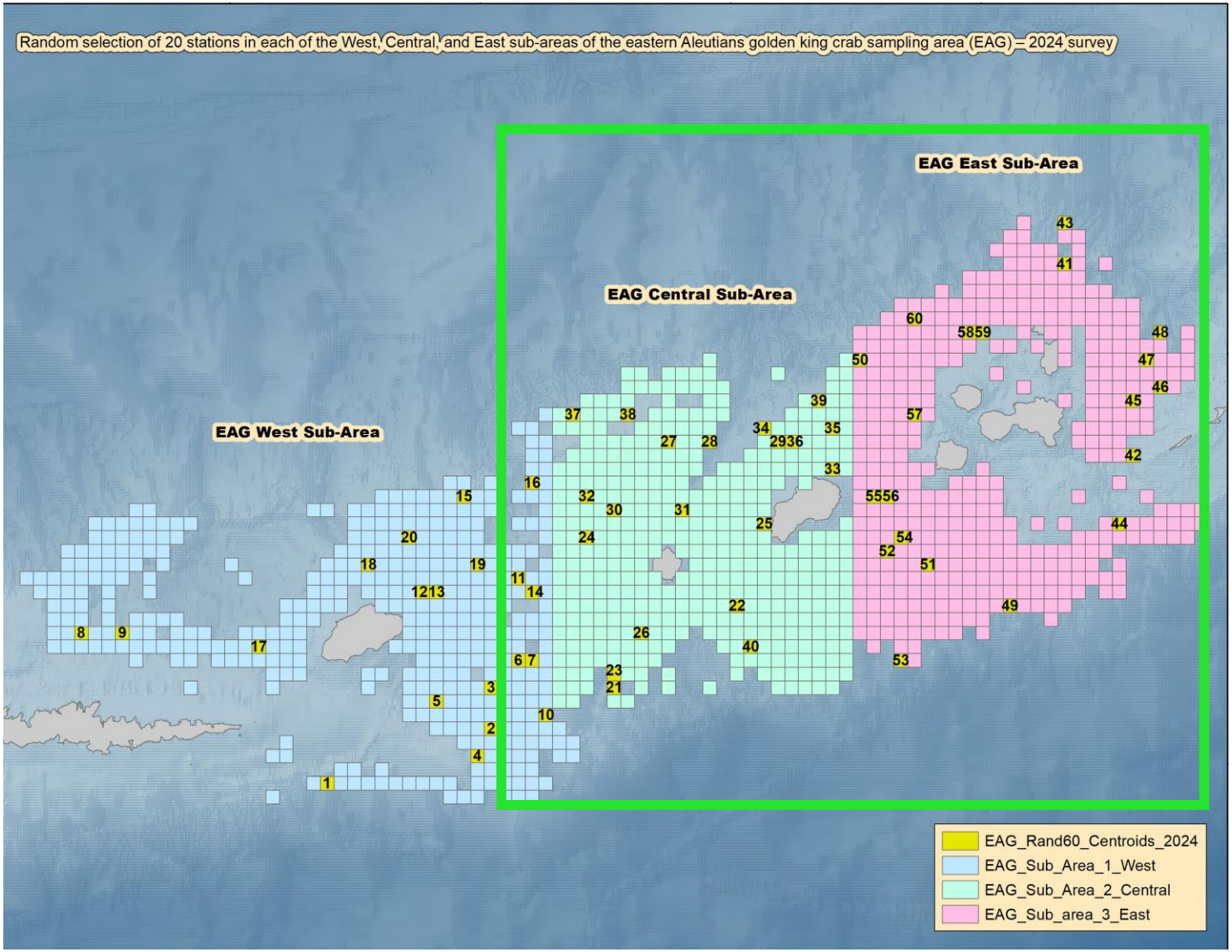
- EAG: up 1% (full computed)
- WAG: down 38% (full computed at 15% ramp)

Industry Cooperative Survey

Future of survey

- Important to keep the survey going...
- Will eventually be incorporated in the assessment model with continued refinements
- Likely yields more accurate depiction of population trends
  - *Trends* in CPUE (avoids hyperstability)
  - Size composition information

2024 EAG survey stations



Research Priorities (not ranked)

- WAG survey
- Movement via tagging studies
  - E.g., Core vs non-core movement in WAG
- Growth + molt probabilities via tagging studies
- Handling mortality rate: is assumed 20% reasonable?
- More weight measurements in WAG for L-W regression
- Size-at-maturity estimation in space/time
  - More chela measurements on small crab
  - Better understand size at “functional maturity”
- Environmental monitoring (temperature measurements)
- Small mesh pots (recruitment)
- Larval drift (population connectivity, stock structure)