St Matts blue king crab (SMBKC)

2017:

- NMFS trawl and pot survey down
  - Assessment ~45% of average prediction

Gmacs implementation

- New post-doc
- Document script-driven
- Status: mature male biomass ~60% of “Bmsy”

Saint Matthew Island Blue King Crab Stock Assessment 2017

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Executive Summary

1. **Stock**: Blue king crab, *Paralithodes platypus*, Saint Matthew Island (SMBKC), Alaska.
2. **Catches**: Peak historical harvest was 4288 t (9.454 million pounds) in 1983/84[1]. The fishery was

SMBKC: Data extent

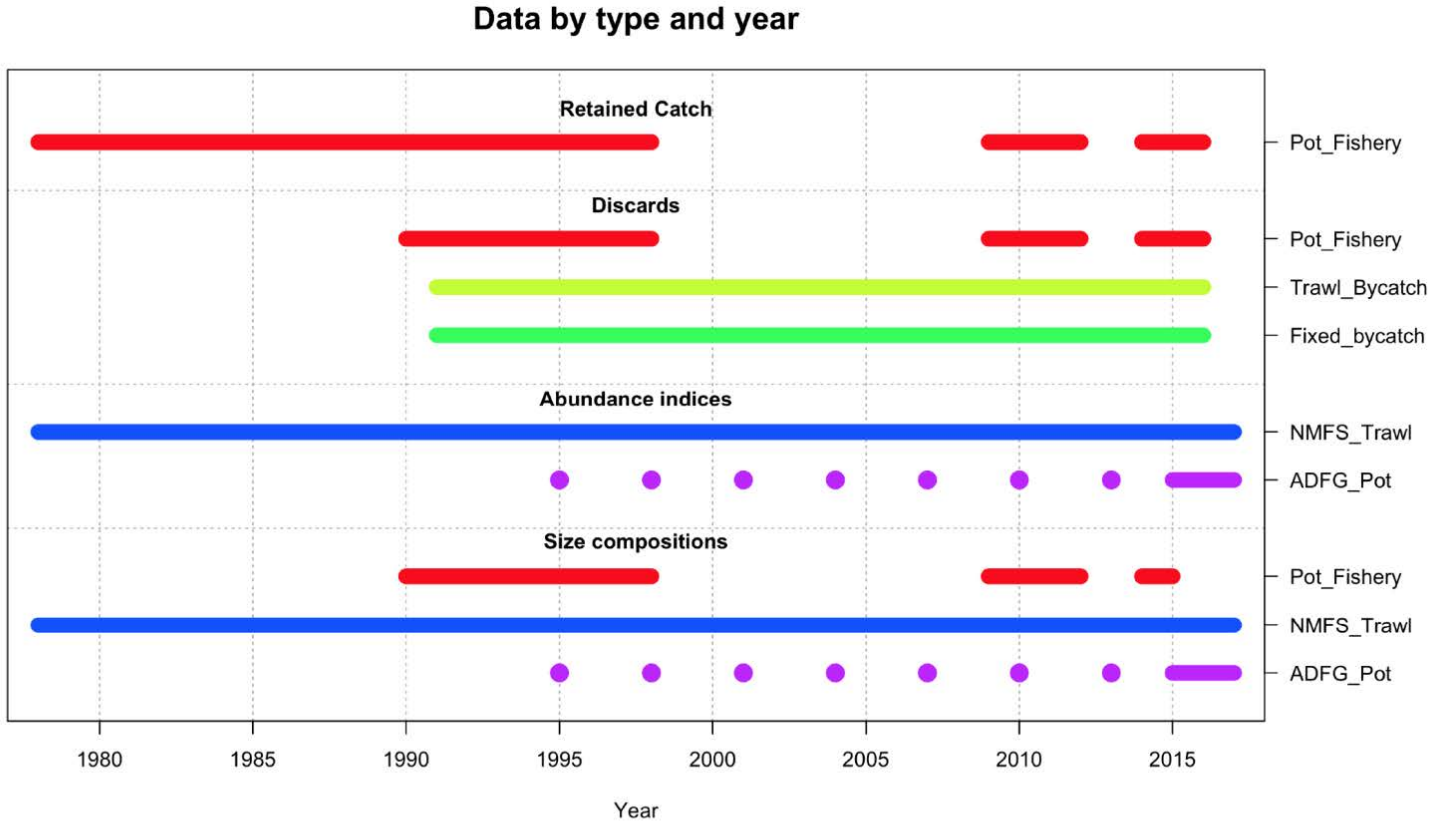
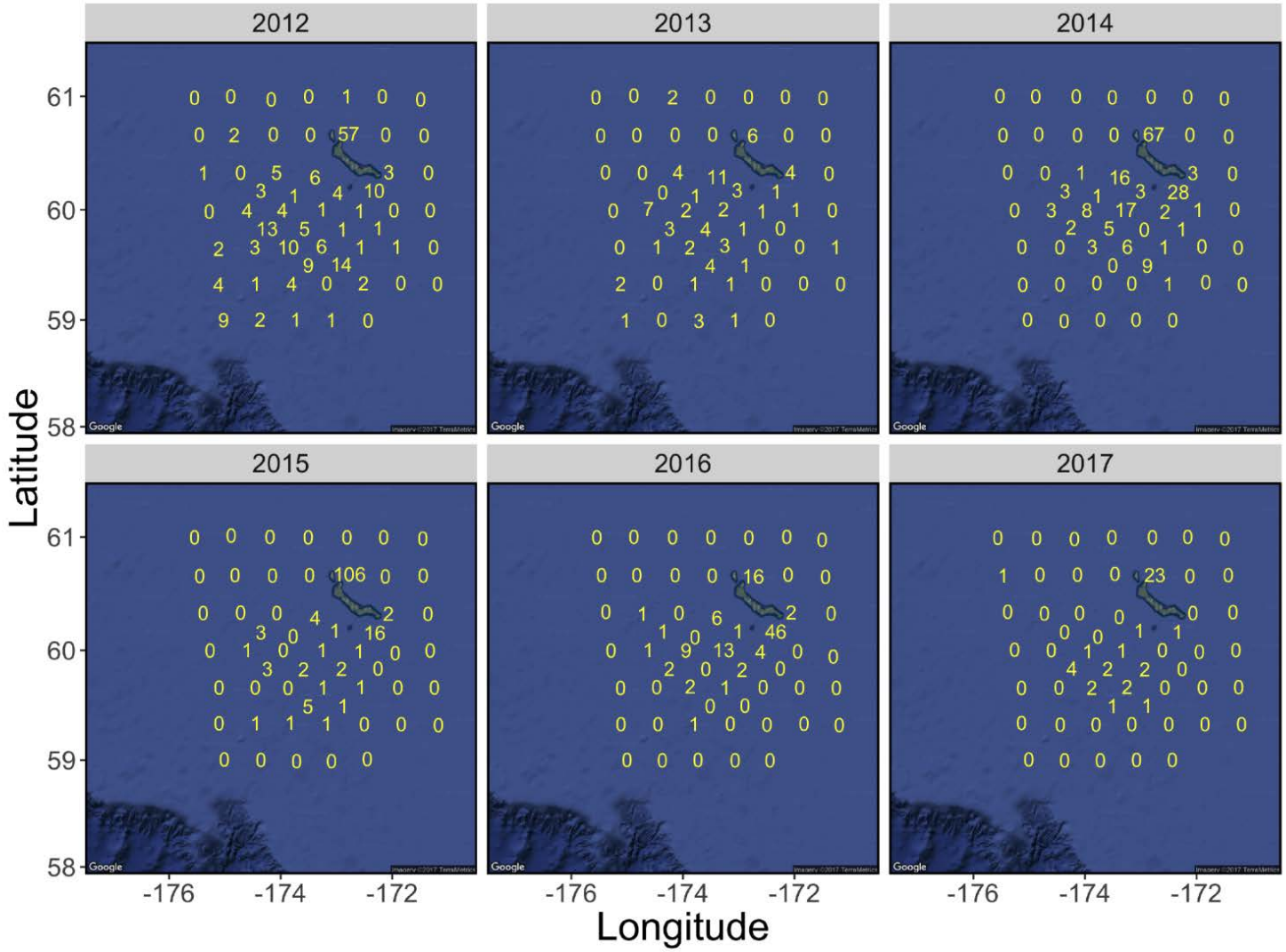


Figure 3: Data extent for the SMBKC assessment (with the 2017 Pot survey included).


2012
2013
2014
2015
2016
2017
Latitude
Longitude
61
60
59
58
-176
-174
-172
Google

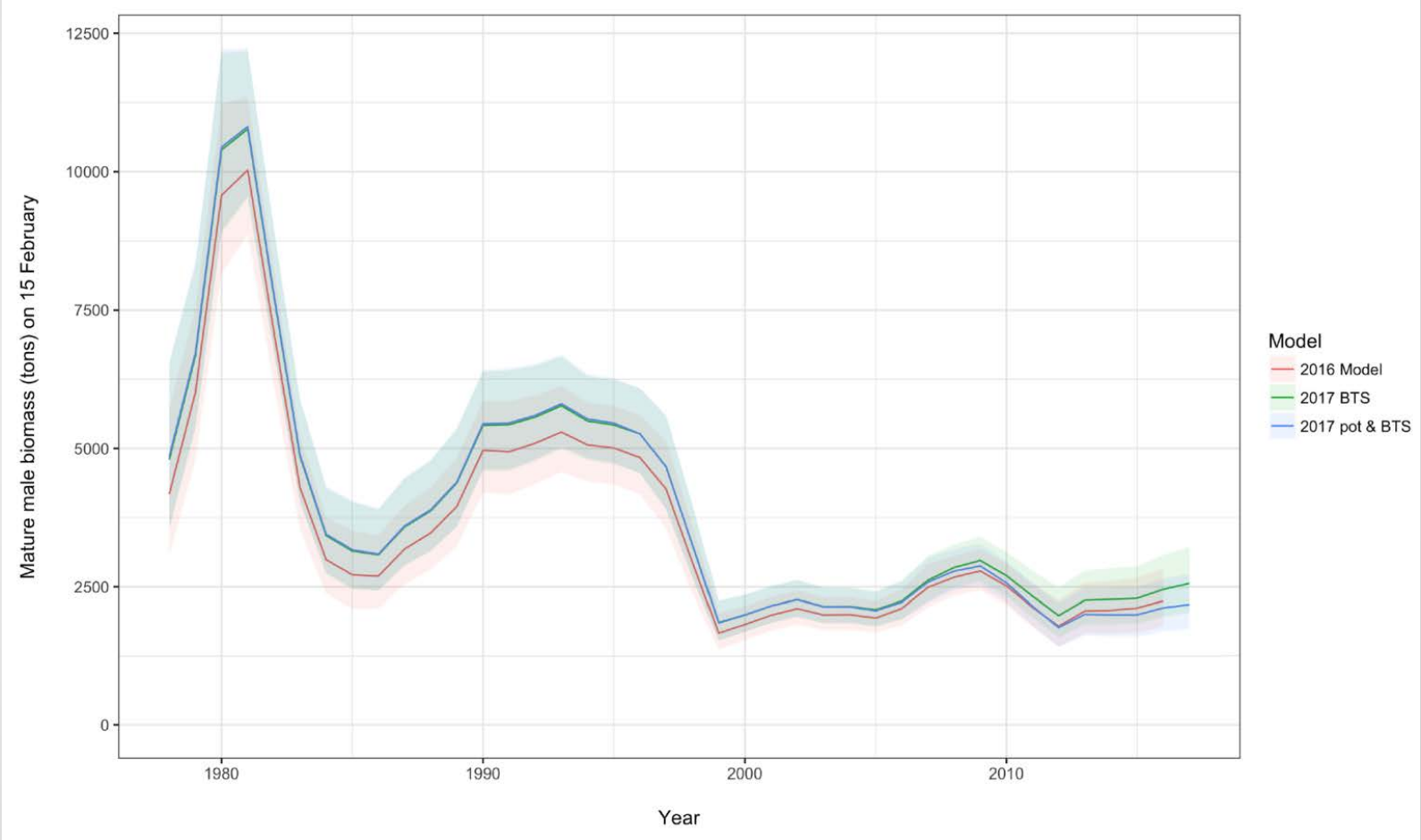
Models

- Sensitivity to new data (based on 2016 config)

1. **2016 Model**: the 2016 recommended model without any new data
2. **BTS**: adds in the 2017 bottom trawl survey (BTS) data
3. **BTS and pot**: as with previous but including the 2017 ADFG pot survey data (Model 16.0 or "reference case")

Sensitivity to new data

SMBKC crab



Models

- Alternative model sensitivities

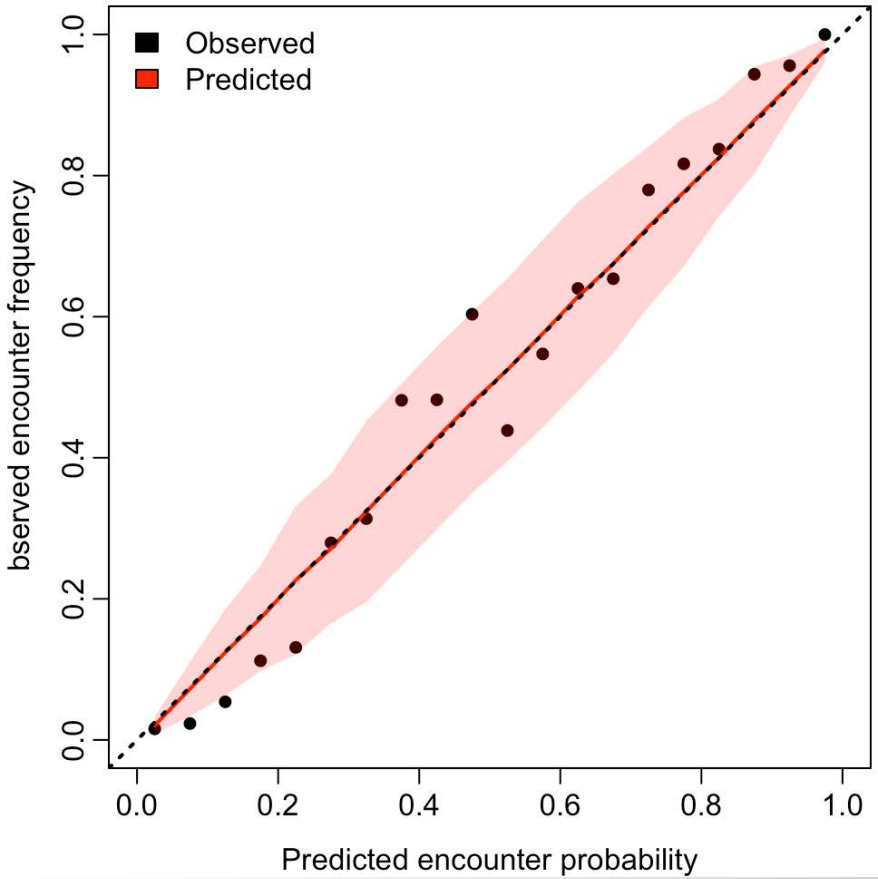
4. **VAST**: applies a geo-spatial delta-GLMM model (Thorson and Barnett 2017) to the BTS data which provides a different BTS index. See appendix B for details and diagnostics. This is a preliminary examination as more work is needed to ensure options for the BTS CPUE data were specified appropriately.

5. **Fit survey**: an exploratory scenario that's the same as the reference model except the NMFS trawl survey is up-weighted by $\lambda^{\text{NMFS}} = 1.5$ and the ADF&G pot survey is up-weighted by $\lambda^{\text{ADFG}} = 2$.

6. **Francis weights**: is similar to the reference model except that it also uses the Francis iterative re-weighting method (Francis 2011), to re-weight the size-composition data relative to the abundance indices. The trawl survey and pot survey weights were unchanged. In this scenario the multinomial distribution was used instead as the theory underpinning the Francis weighting method is based on this distribution.

VAST (appendix C)

Spatio-temporal delta-GLMM



Appendix C. Test of VAST spatio-temporal analysis of SMBKC from NMFS bottom-trawl survey data

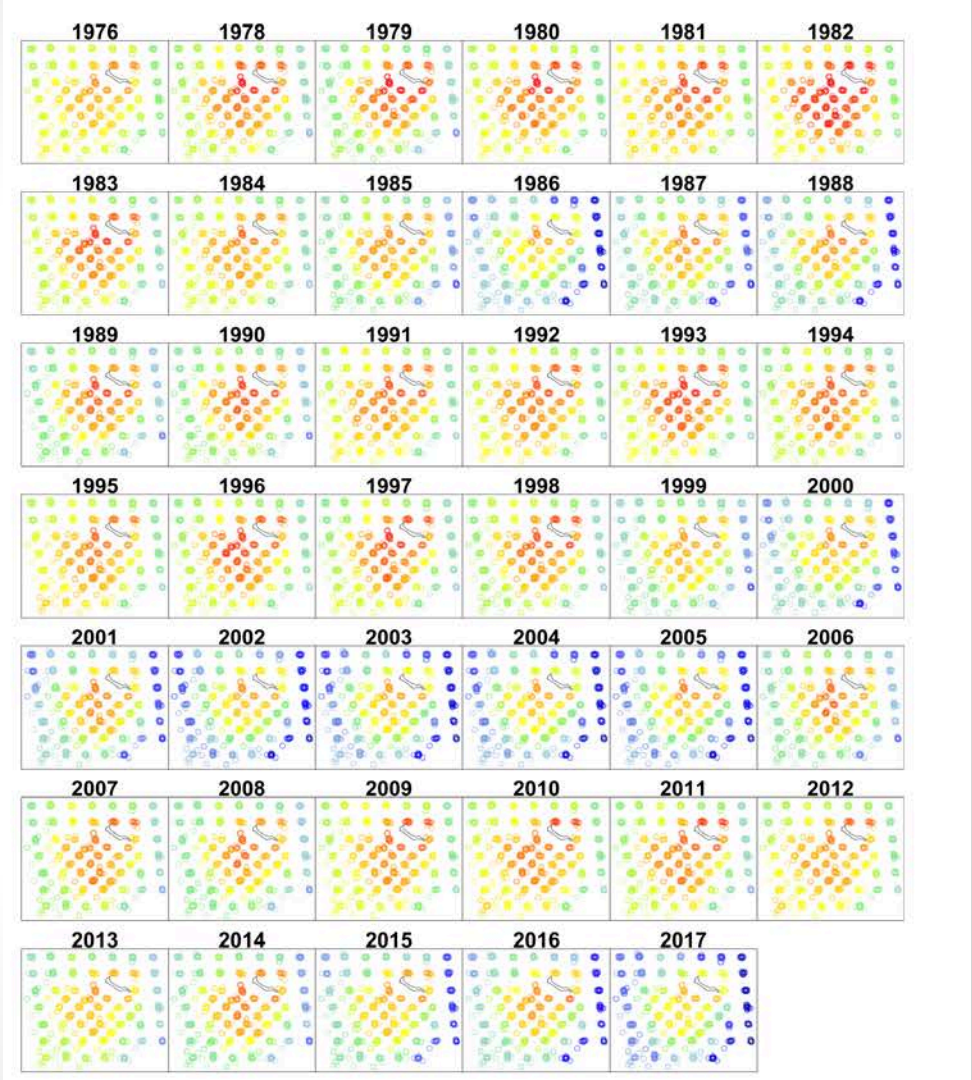
Overview

This is an example application of `VAST` for estimating single-species abundance indices specifically applied to a subset of NMFS/AFSC bottom trawl survey data. Further details can be found at the GitHub repo mainpage, wiki, and glossary. The R help files, e.g., `?Data_Fn` for explanation of data inputs, or `?Param_Fn` for explanation of parameters. VAST has involved many publications for developing individual features (see references section below).

The following loads in the main libraries.

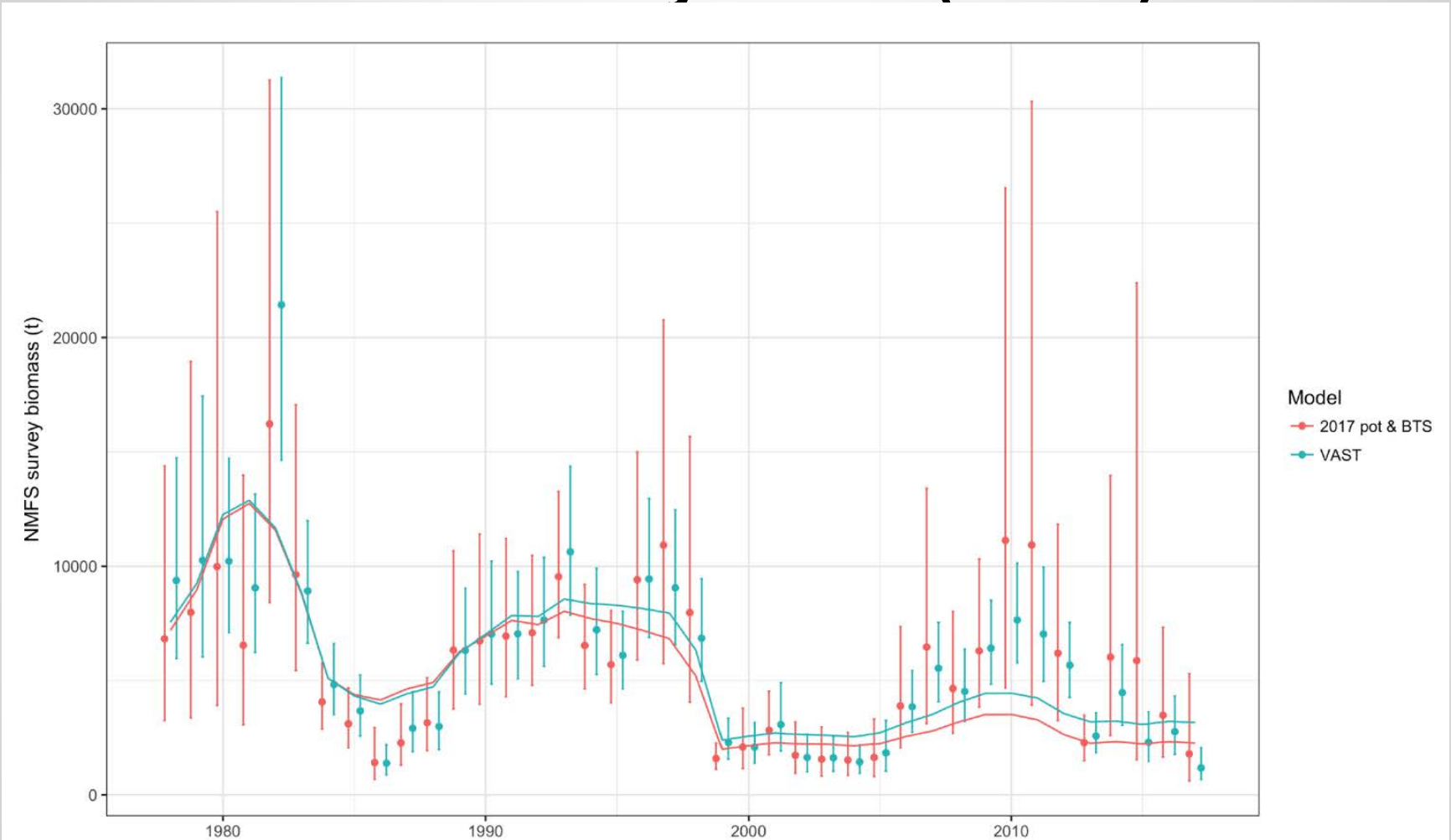
VAST

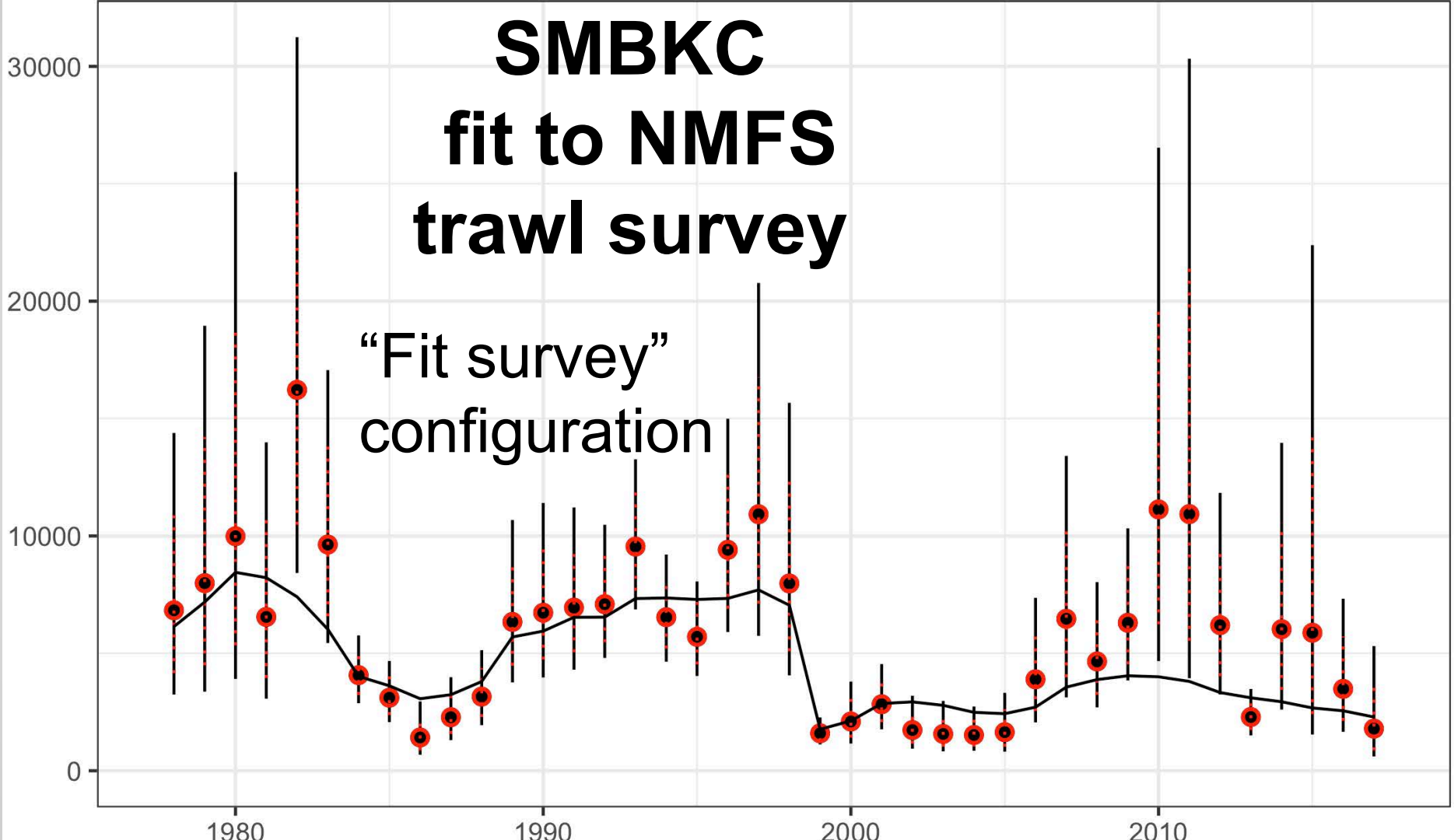
Density map



Alternative trawl survey series (VAST)

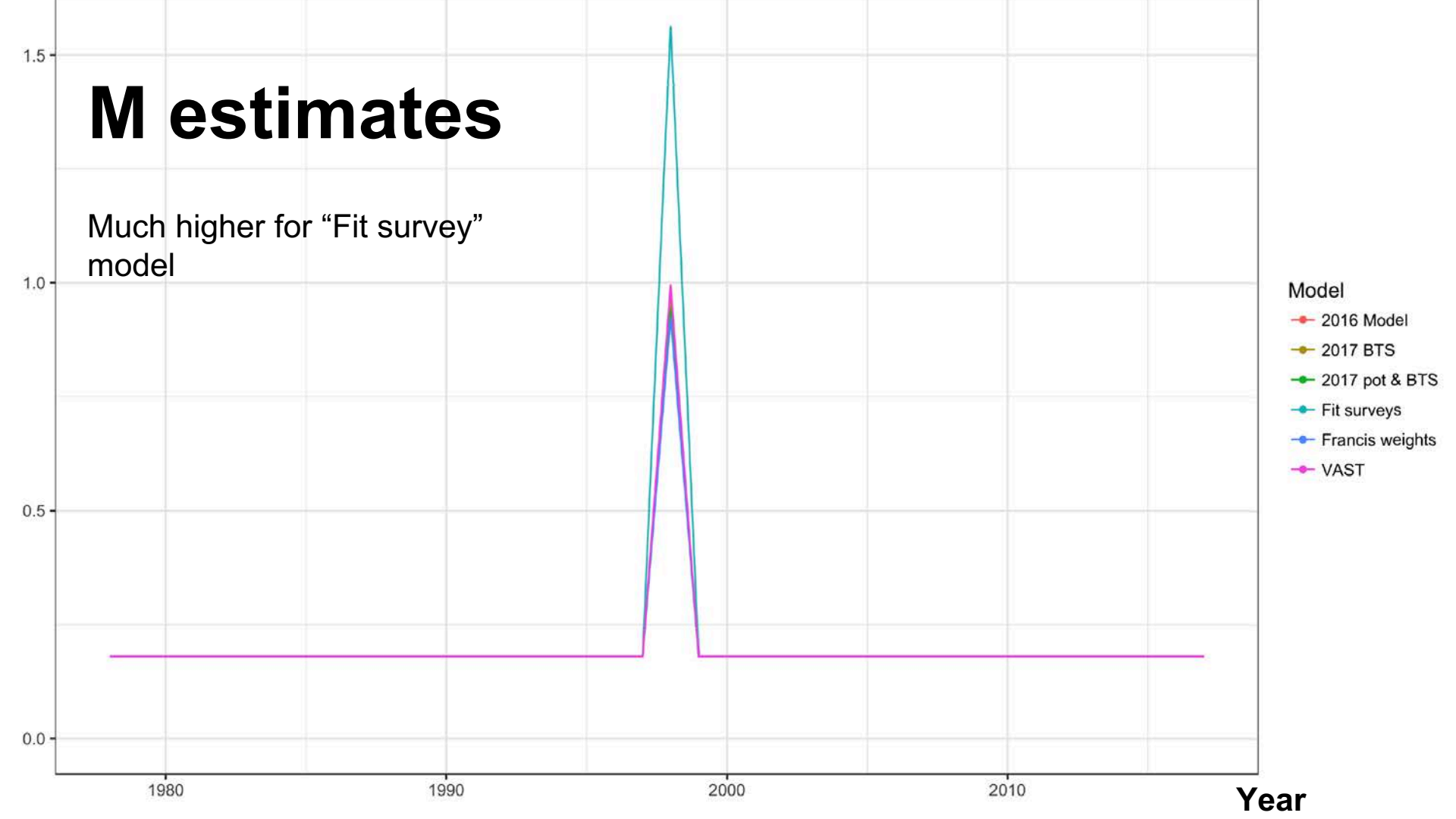
SMBKC crab



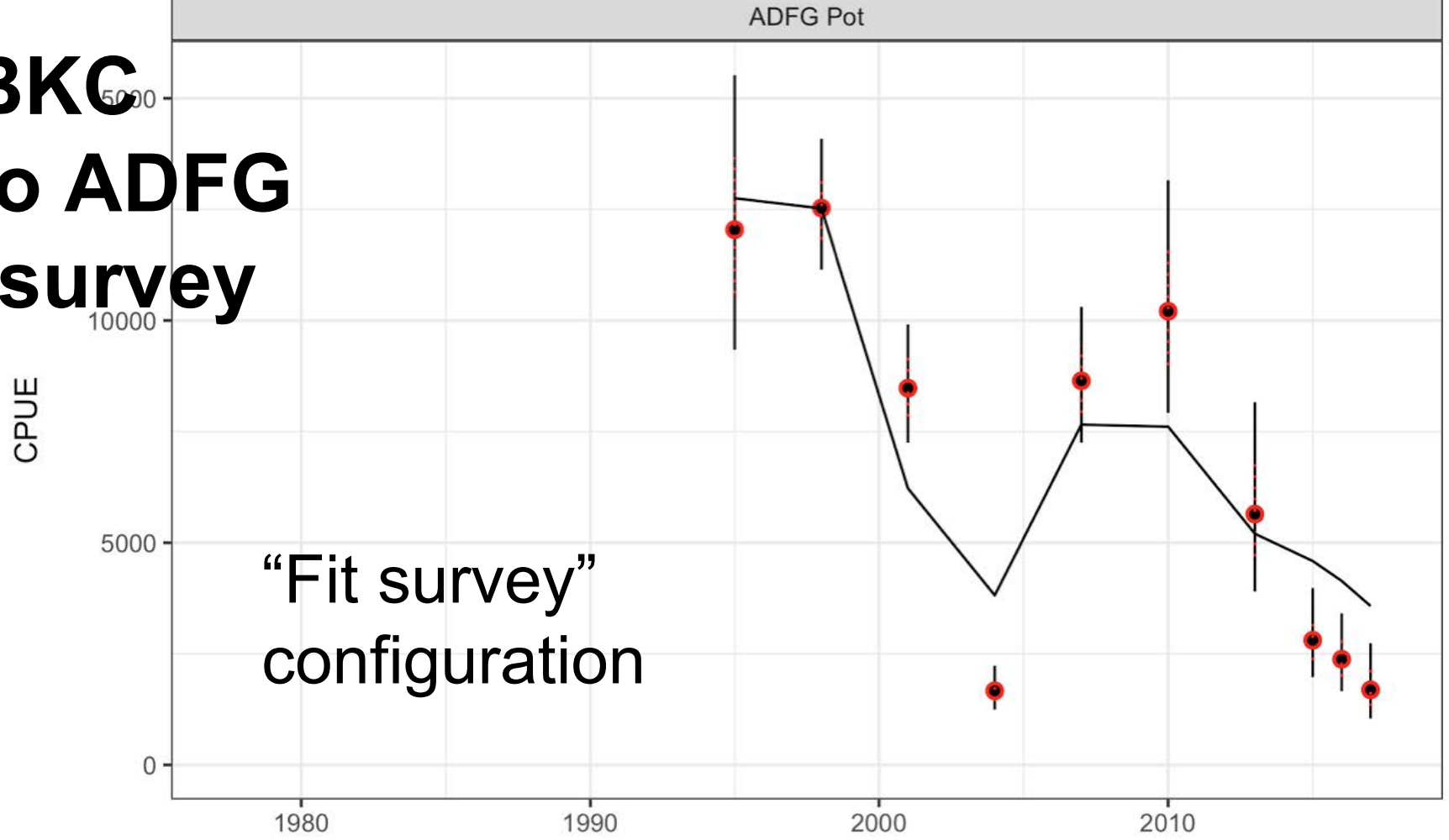

SMBKC
fit to NMFS
trawl survey
"Fit survey"
configuration
30000
20000
10000
0
1980
1990
2000
2010

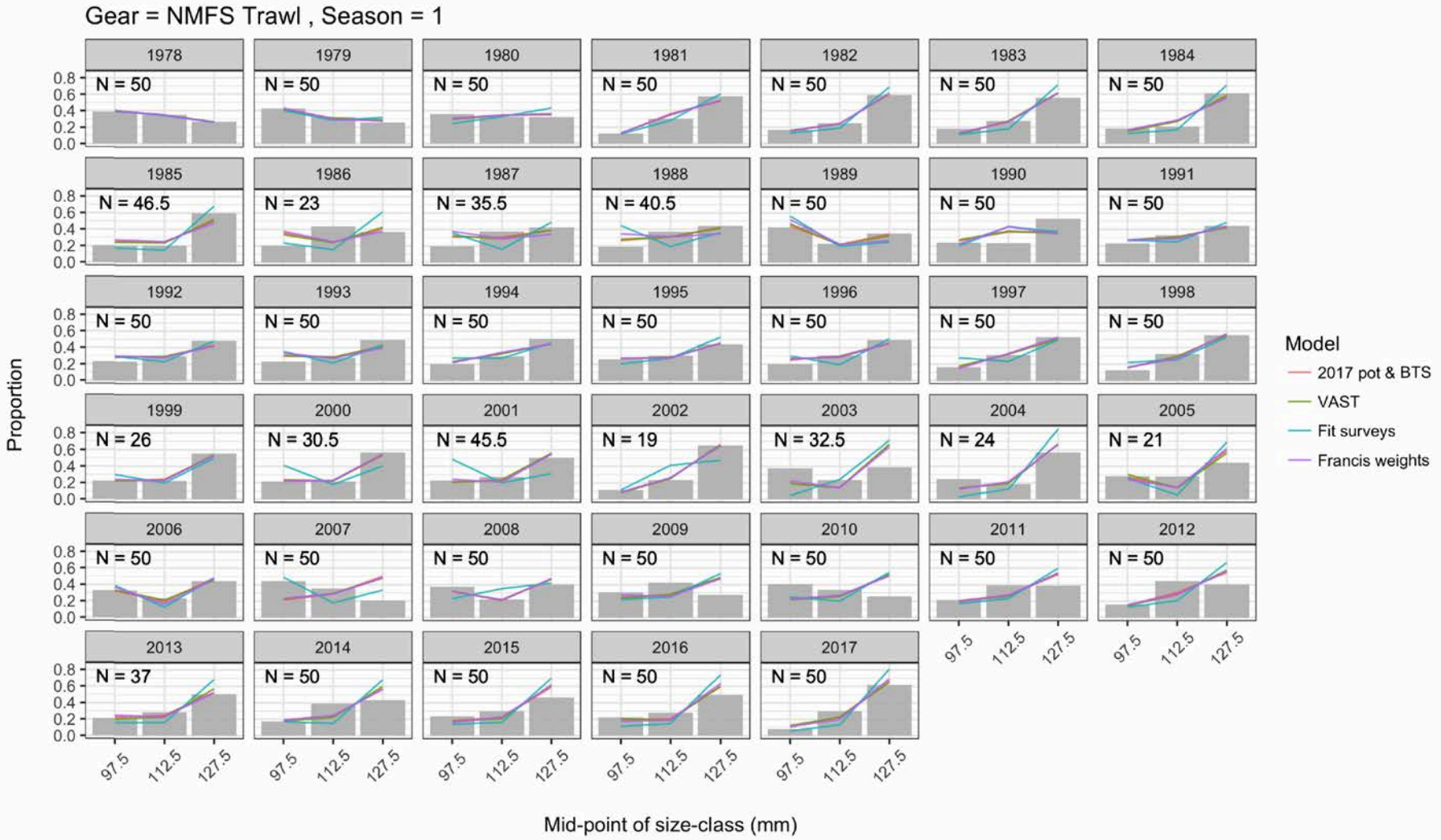
M estimates

Much higher for “Fit survey” model



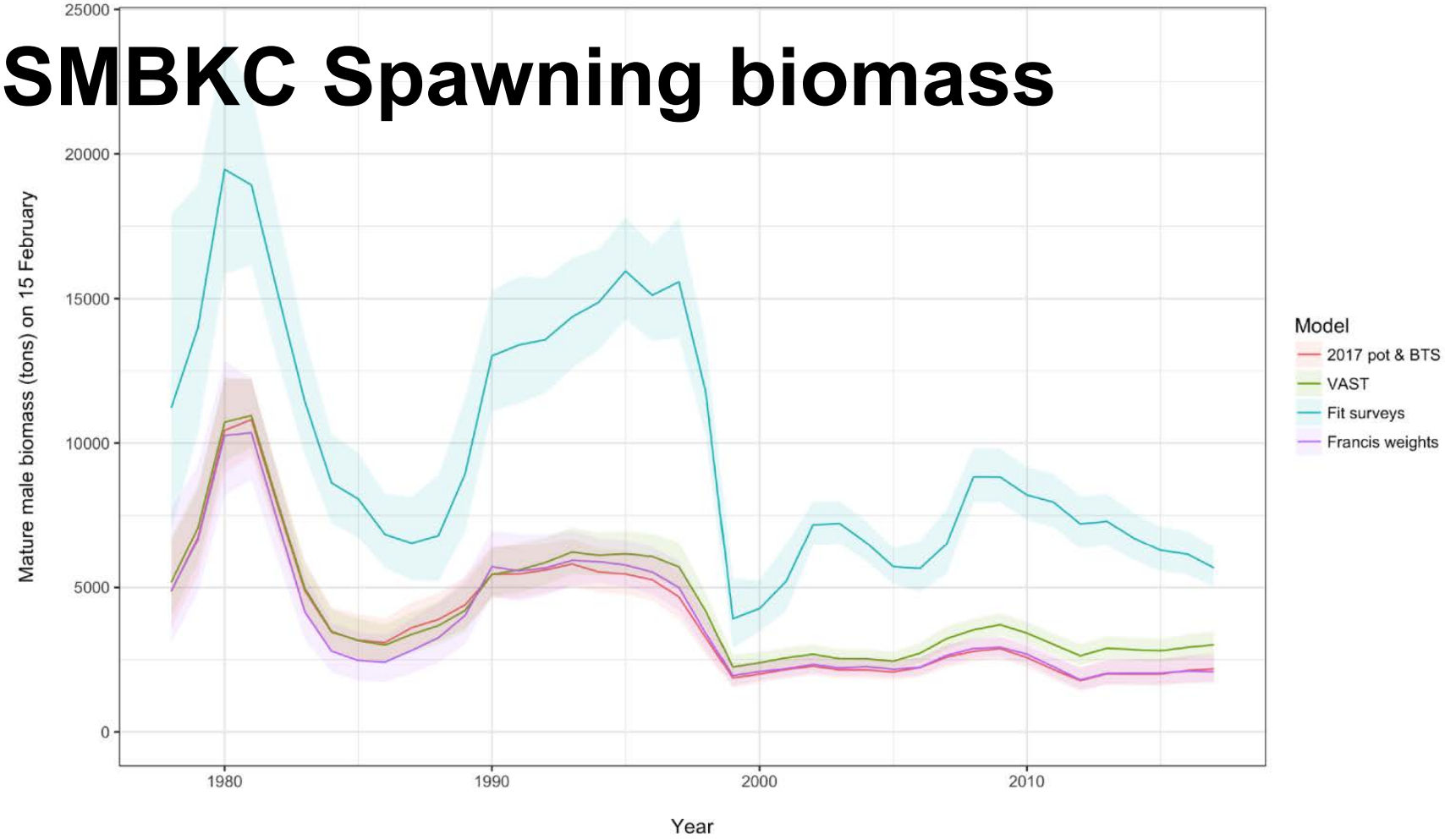
SMBKC fit to ADFG Pot survey



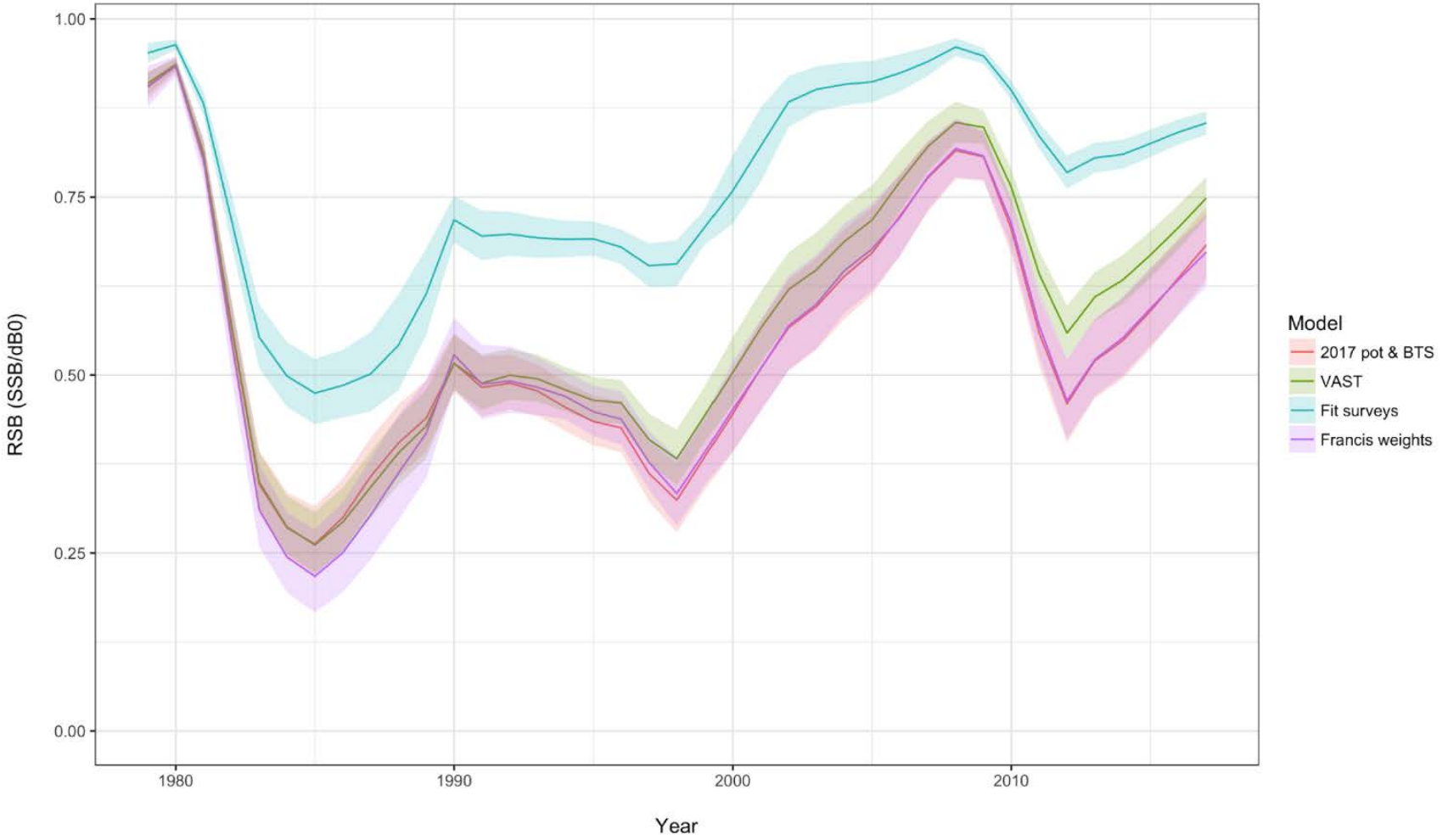

Gear = NMFS Trawl , Season = 1
1978 N = 50
1979 N = 50
1980 N = 50
1981 N = 50
1982 N = 50
1983 N = 50
1984 N = 50
1985 N = 46.5
1986 N = 23
1987 N = 35.5
1988 N = 40.5
1989 N = 50
1990 N = 50
1991 N = 50
1992 N = 50
1993 N = 50
1994 N = 50
1995 N = 50
1996 N = 50
1997 N = 50
1998 N = 50
1999 N = 26
2000 N = 30.5
2001 N = 45.5
2002 N = 19
2003 N = 32.5
2004 N = 24
2005 N = 21
2006 N = 50
2007 N = 50
2008 N = 50
2009 N = 50
2010 N = 50
2011 N = 50
2012 N = 50
2013 N = 37
2014 N = 50
2015 N = 50
2016 N = 50
2017 N = 50
Proportion
0.0
0.2
0.4
0.6
0.8
97.5
112.5
127.5
Mid-point of size-class (mm)
Model
2017 pot & BTS
VAST
Fit surveys
Francis weights

Component	Reference	VAST	Fit survey	Francis
NMFS trawl survey weight	1.00	1.00	1.50	1.00
ADF&G pot survey weight	1.00	1.00	2.00	1.00
Directed pot LF weight	1.00	1.00	1.95	1.61
NMFS trawl survey LF weight	1.00	1.00	0.22	0.50
ADF&G pot survey LF weight	1.00	1.00	0.10	3.72
Francis weight for directed pot LF	1.69	1.57	1.96	1.55
Francis weight for NMFS trawl survey LF	0.57	0.53	0.22	0.50
Francis weight for ADF&G pot survey LF	2.08	1.20	0.10	4.13
SDNR NMFS trawl survey	1.45	1.85	1.83	1.36
SDNR ADF&G pot survey	3.78	3.88	5.45	3.72
SDNR directed pot LF	0.71	0.78	1.39	0.91
SDNR NMFS trawl survey LF	1.23	1.28	1.06	0.94
SDNR ADF&G pot survey LF	0.80	0.92	0.96	1.01
MAR NMFS trawl survey	1.18	1.13	1.52	1.12
MAR ADF&G pot survey	2.96	2.63	4.57	2.97
MAR directed pot LF	0.59	0.66	0.66	0.76
MAR NMFS trawl survey LF	0.52	0.62	0.69	0.53
MAR ADF&G pot survey LF	0.49	0.78	0.55	0.59

SMBKC Spawning biomass



Dynamic B-zero...alternative to evaluate fishing effects



Bottom line

Table 1: Status and catch specifications (1000 t) for the reference model. Notes: A - calculated from the assessment reviewed by the Crab Plan Team in September 2013, B - calculated from the assessment reviewed by the Crab Plan Team in September 2014, C - calculated from the assessment reviewed by the Crab Plan Team in September 2015, D - calculated from the assessment reviewed by the Crab Plan Team in September 2016 E - calculated from the assessment reviewed by the Crab Plan Team in September 2017.

Year	MSST	Biomass (MMB_{mating})	TAC	Retained catch	Total male catch	OFL	ABC
2012/13	1.80^{A}	2.85^{A}	0.74	0.73	0.82	1.02	0.92
2013/14	1.50^{B}	3.01^{B}	0.00	0.00	0.00	0.56	0.45
2014/15	1.86^{C}	2.48^{C}	0.30	0.14	0.15	0.43	0.34
2015/16	1.84^{D}	2.11^{D}	0.19	0.05	0.05	0.28	0.22
2016/17	1.97^{E}	2.12^{E}	0.00	0.00	0.05	0.28	0.22
2017/18		2.18^{E}				0.12	0.1