Maryland Oyster Stock Assessment Update

June 8, 2020

Marvin Mace III* and Mike Wilberg
University of Maryland Center for Environmental Science
*Currently with Maryland Department of Natural Resources

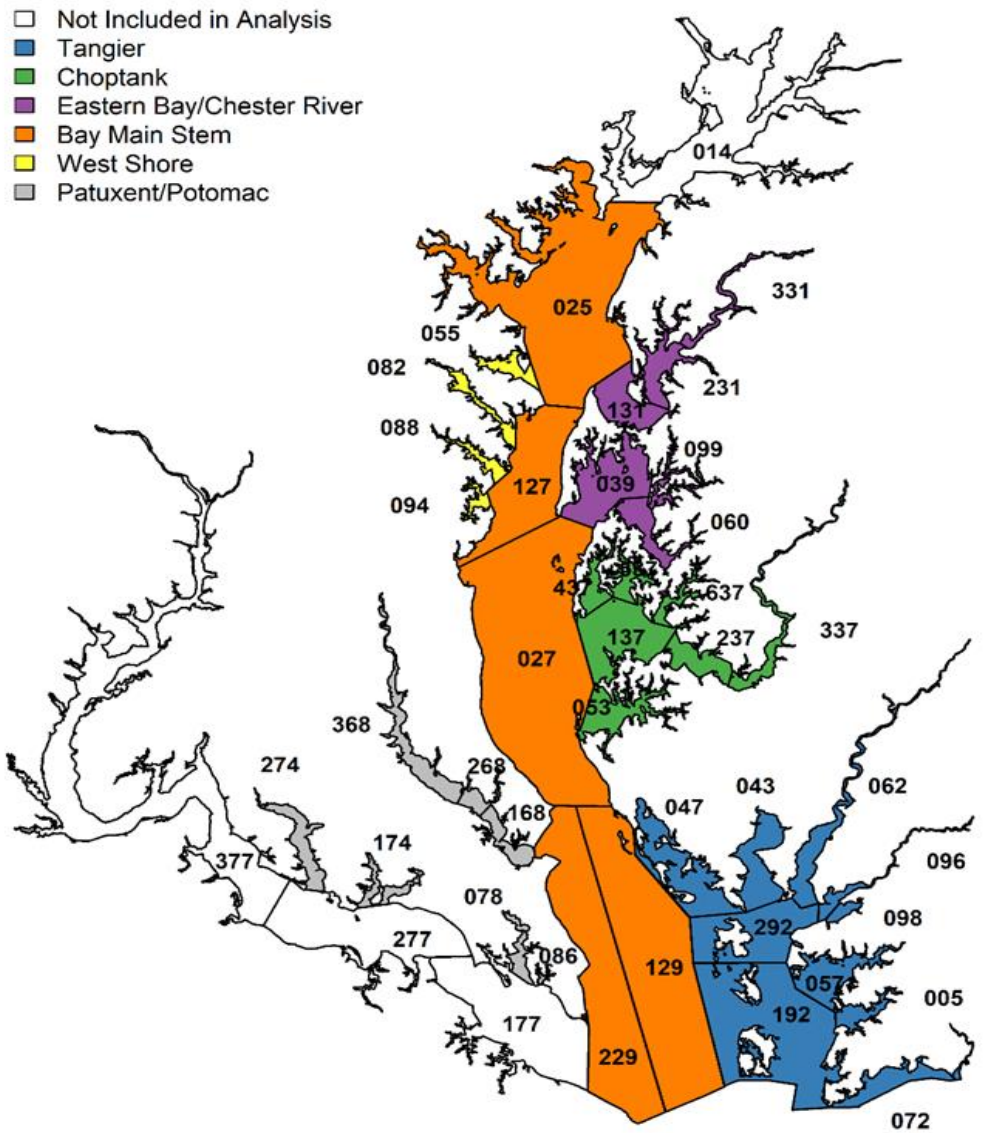
Update Methods

- This is an Update of the 2018 Maryland Oyster Stock assessment
- The same methods as in the 2018 assessment were used
- Updated the stage-structured and reference point models from the 2018 assessment.
- Updated with data from the 2018-2019 and 2019-2020 seasons were included (assessment timeframe is Oct. 1999 through March 2020)

  Updated data included:

  a. Harvest data (Buy ticket data)
  b. Fall Dredge Survey
  c. Seed and Shell data

Harvest reporting “NOAA codes”



Excluded from assessment due to lack of data:
094 (Rhode/West Rivers)
055 (Magothy River)
098 (Monie Bay)

<u>Conducted individual analyses for 36 NOAA Codes organized into 6 Regions</u>

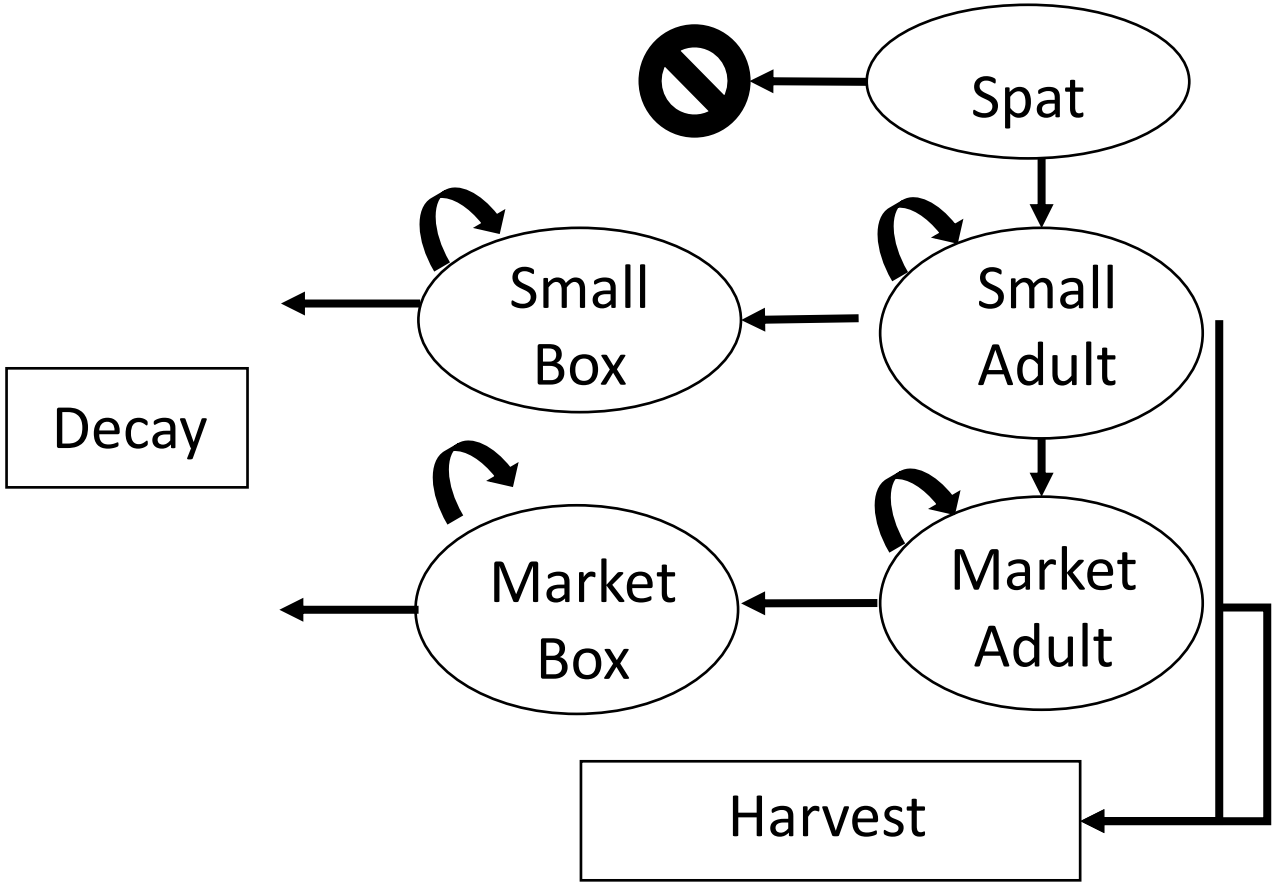
Tangier Sound
Choptank River
Eastern Bay
Bay Mainstem
Patuxent and Potomac
Western Shore

Assessment Model Results

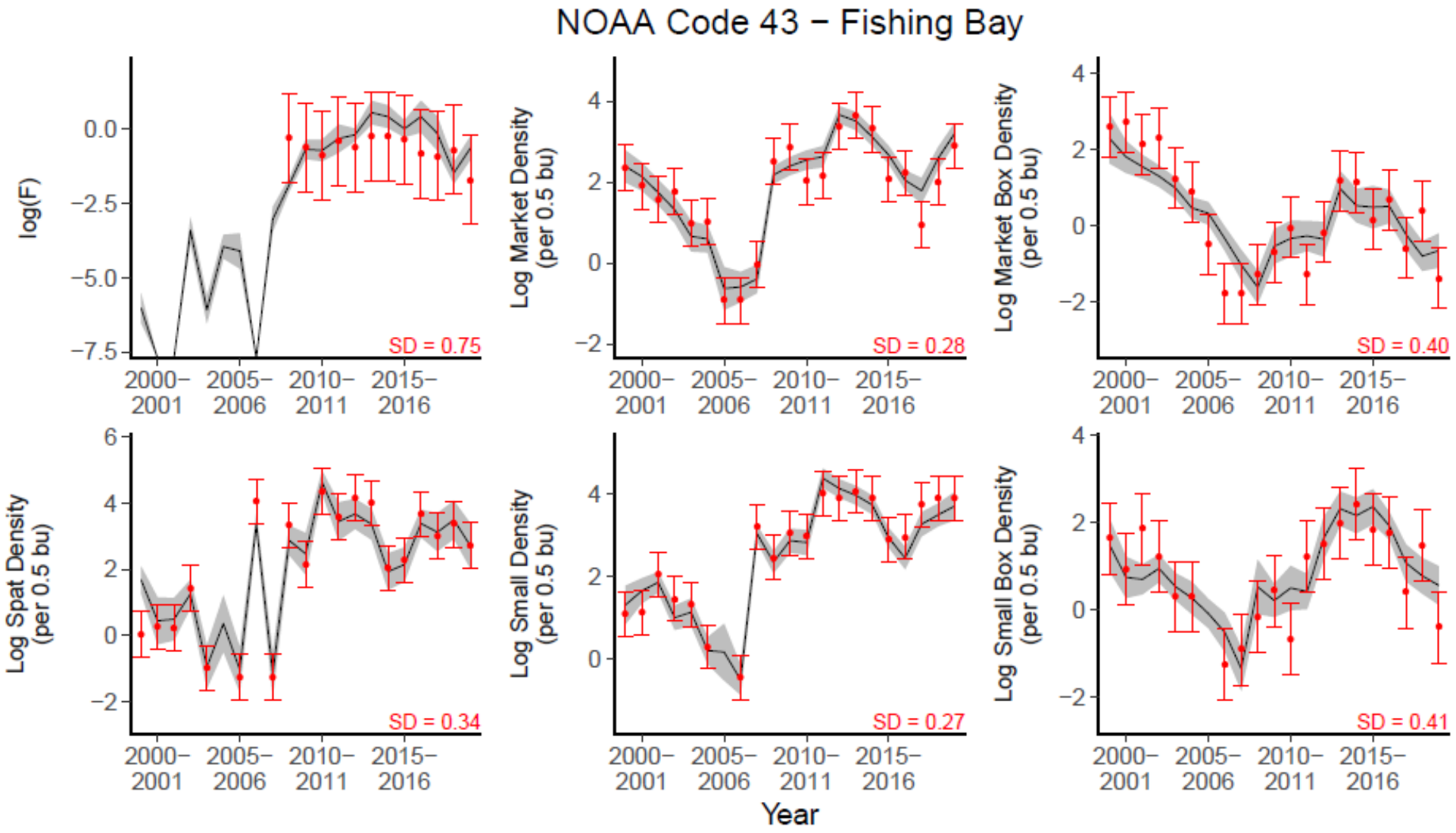
Types of results estimated in model:

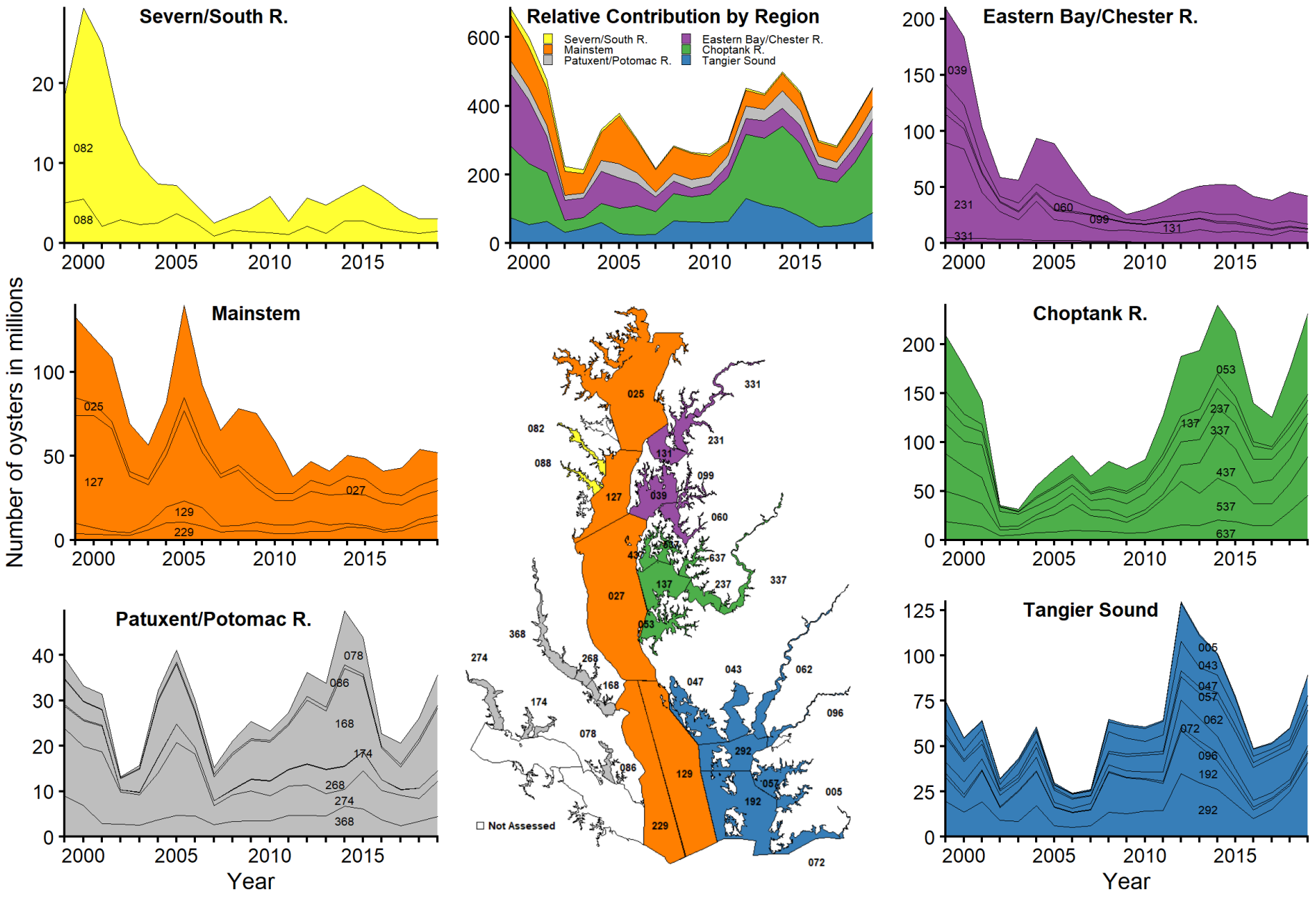
- Number of spat (<1 year old), small (>1 year old, < 3 inches), and market-sized oysters (>3 inches)
- Natural mortality rates (Fraction that die to causes other than harvest)
- Harvest fraction
- Habitat relative to 1980

Stage-structured Assessment Model



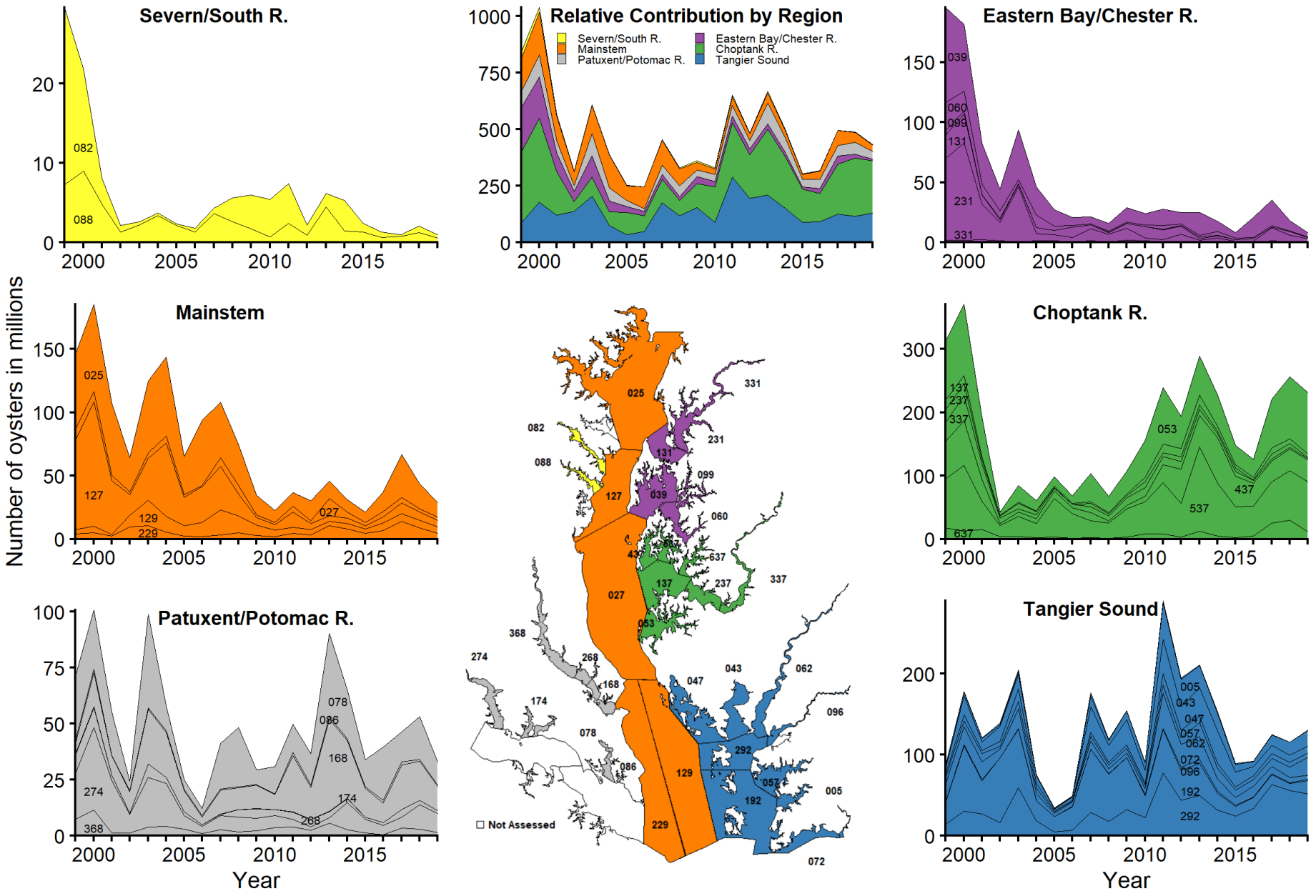
Parameters estimated by fitting the model to data





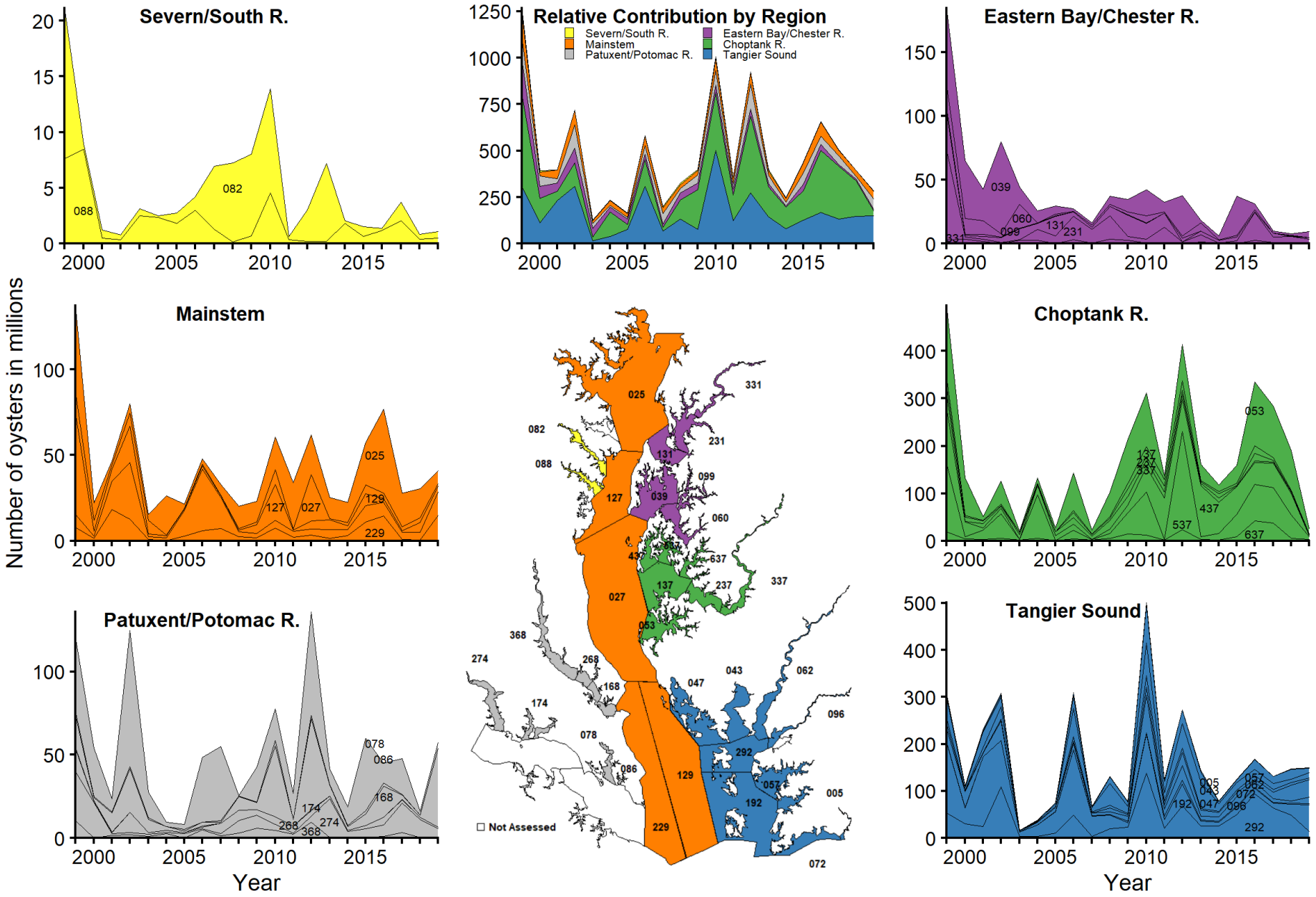
- Current year is 5th highest overall
- Some regions abundance has increased to levels greater than 1999
- Some regions are still much lower than 1999 levels

Estimated number of oysters (in millions) by region that are older than one year but below the minimum size limit (3 inches), 1999-2019



- Current year is slightly below long-term average
- Some regions in the north still have decreasing trend since 1999

Estimated number of oysters (in millions) by region that are less than one year old, 1999-2019



- Current year is 6th lowest since 1999
- Highest in 1999 and fluctuates over time with no strong trend. Peaks in 2002, 2006, 2010, 2012, 2016
- Choptank River and Tangier Sound regions generally have highest recruitment

Biological Reference Points

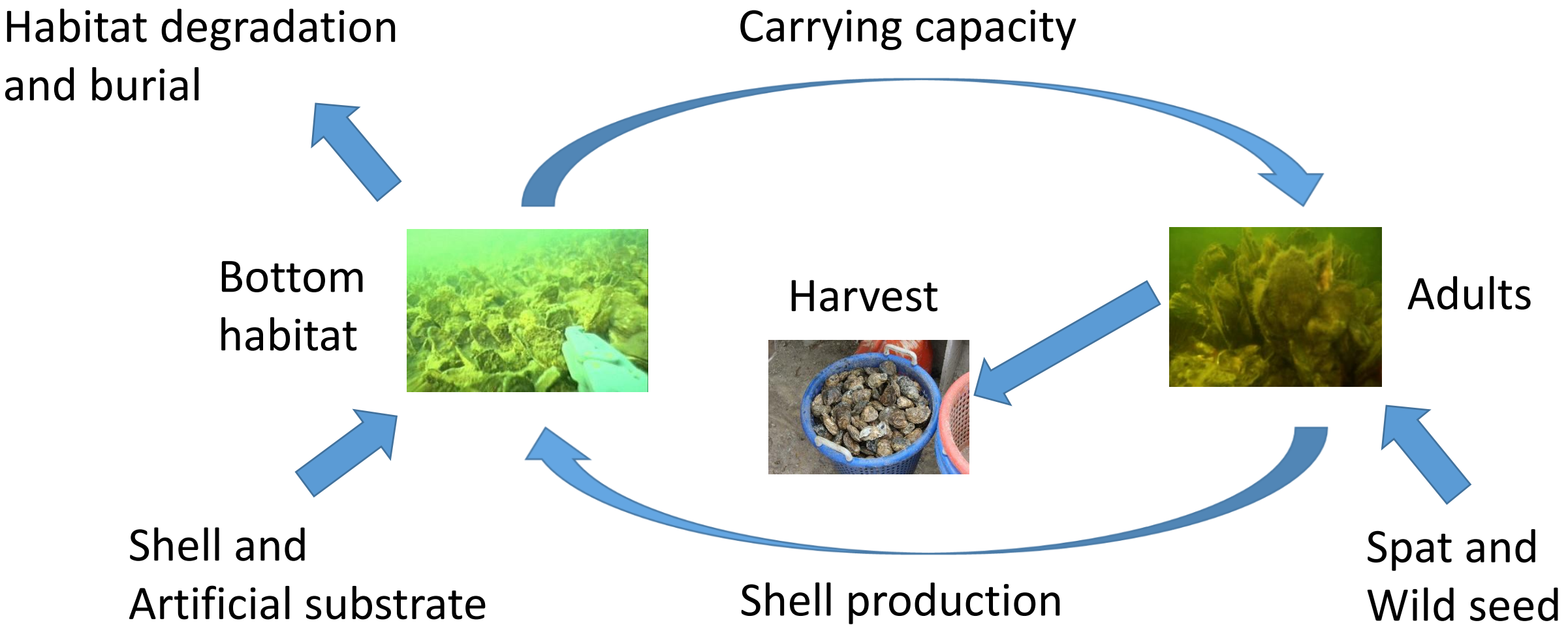
Harvest Rate (target and upper limit)

- Target rate is estimated as the fraction of market-sized oysters that maximizes long-term harvest while resulting in a stable or increasing oyster population
- Upper limit represents the absolute maximum harvest rate that can be sustainable, which will result in eventual disappearance the population if it is regularly exceeded
- Estimated using a model that includes oyster's reliance on shell for habitat and their production of shell
- Goal: Not allow the harvest rate to exceed the upper limit

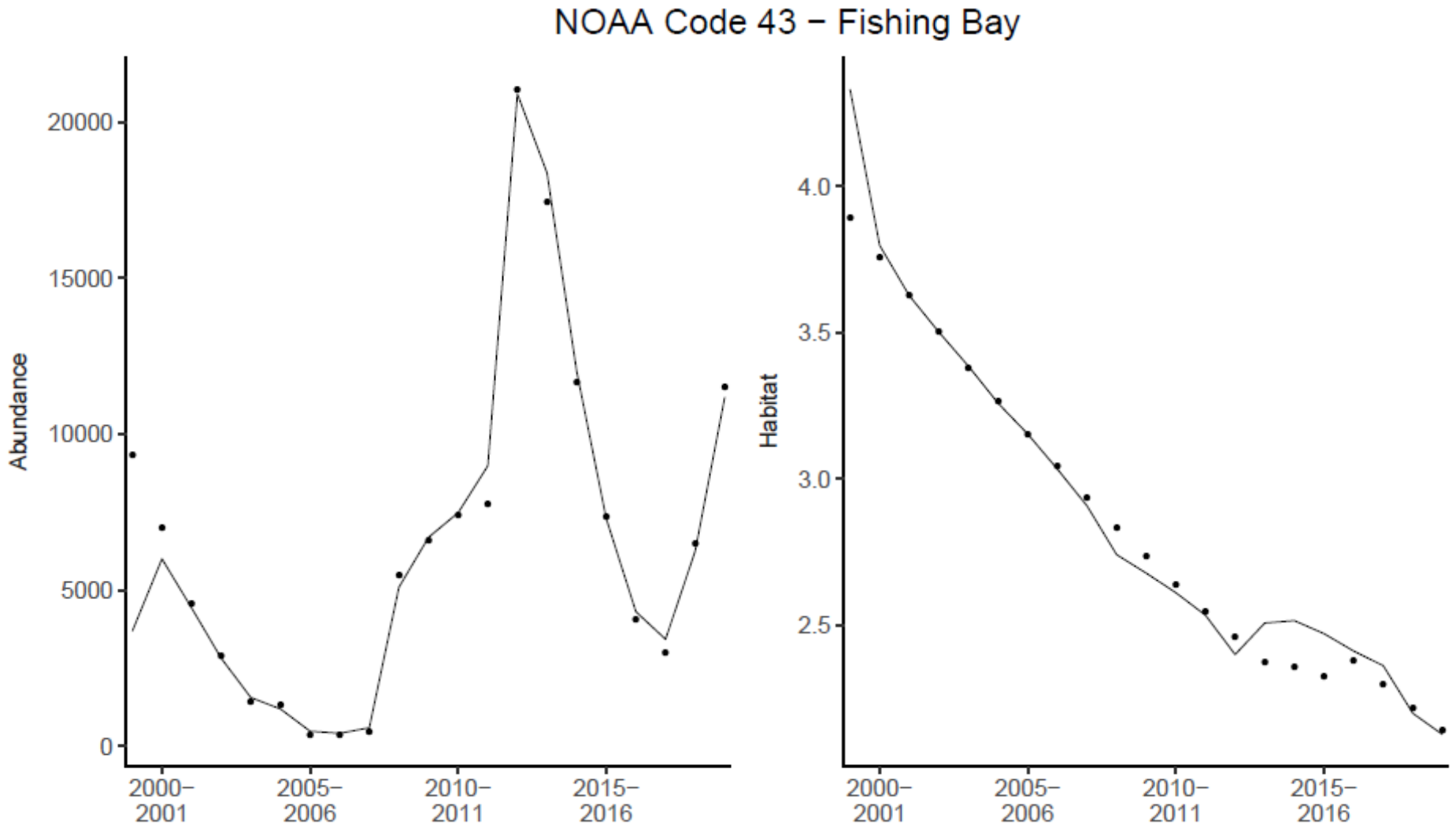
Abundance (lower threshold only)

- Goal – not allow abundance to decrease below the lowest levels observed
- Set to the minimum abundance estimated during 1999-2017

Reference Point Model



Harvest rate reference points estimated by fitting the model to estimates of abundance and habitat



Summary Results of Biological Reference Points – Harvest Rates per Fishing Season

In most recent season:

- 25 NOAA Codes at or below target
- 6 NOAA Codes between target and upper limit
- 5 NOAA Codes above upper limit

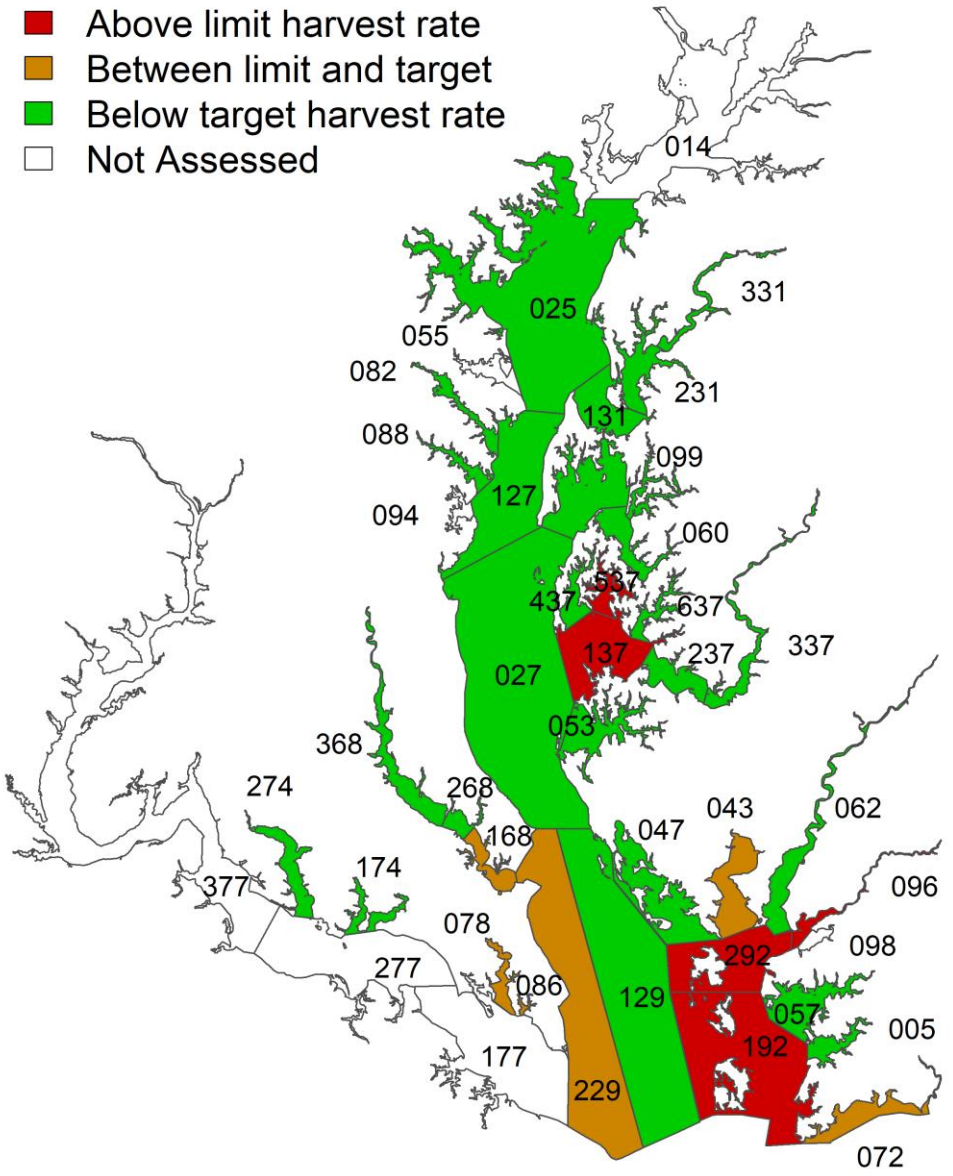
NOAA Code	Upper Limit	Target	2017-2018	2018-2019	2019-2020
5	0.12	0.06	0.05	0.04	0.02
25	0.00	0.00	-0.92	-0.74	-0.75
27	0.14	0.07	0.03	-0.13	-0.04
39	0.04	0.02	0.10	-0.25	-0.27
43	0.55	0.28	0.57	0.20	0.44
47	0.32	0.16	0.20	0.08	0.13
53	0.06	0.03	-0.12	-0.58	-0.69
57	0.18	0.09	0.17	0.09	0.03
60	0.00	0.00	0.03	-0.05	-0.07
62	0.00	0.00	0.05	-0.07	-0.13
72	0.23	0.12	0.44	0.26	0.16
78	0.38	0.19	0.87	0.55	0.34
82	0.00	0.00	-4.98	-3.80	-1.55
86	0.23	0.11	0.52	0.36	0.21
88	0.00	0.00	-3.16	-2.73	-3.11
96	0.04	0.02	0.25	-0.16	0.07
99	0.00	0.00	0.01	0.00	0.00
127	0.00	0.00	-0.47	-0.85	-1.19
129	0.28	0.14	0.42	0.22	0.11
131	0.00	0.00	-1.24	-1.04	-1.71
137	0.26	0.13	0.50	0.51	0.52
168	0.16	0.08	0.19	-0.12	0.10
174	0.00	0.00	0.09	0.00	0.00
192	0.31	0.15	0.28	0.18	0.32
229	0.10	0.05	0.04	0.02	0.09
231	0.00	0.00	-0.29	-0.34	-0.63
237	0.00	0.00	-0.38	-0.19	-0.28
268	0.10	0.05	0.16	-0.12	-0.06
274	0.00	0.00	-0.20	-0.34	-0.44
292	0.41	0.21	0.49	0.20	0.47
331	0.00	0.00	0.00	0.00	0.00
337	0.00	0.00	-1.59	-1.34	-1.17
368	0.00	0.00	0.15	-0.62	-0.59
437	0.02	0.01	-5.23	-1.81	-2.36
537	0.22	0.11	0.33	0.26	0.22
637	0.02	0.01	-3.16	-2.73	-3.11

Red shaded boxes indicate fishing over the upper limit.

Orange shaded boxes indicate fishing over the target rate and under the upper limit.

Green shaded boxes indicate fishing at or below the target rate.

Harvest rate (corrected for spat plantings) in the 2019-2020 season relative to target and upper limit harvest rates

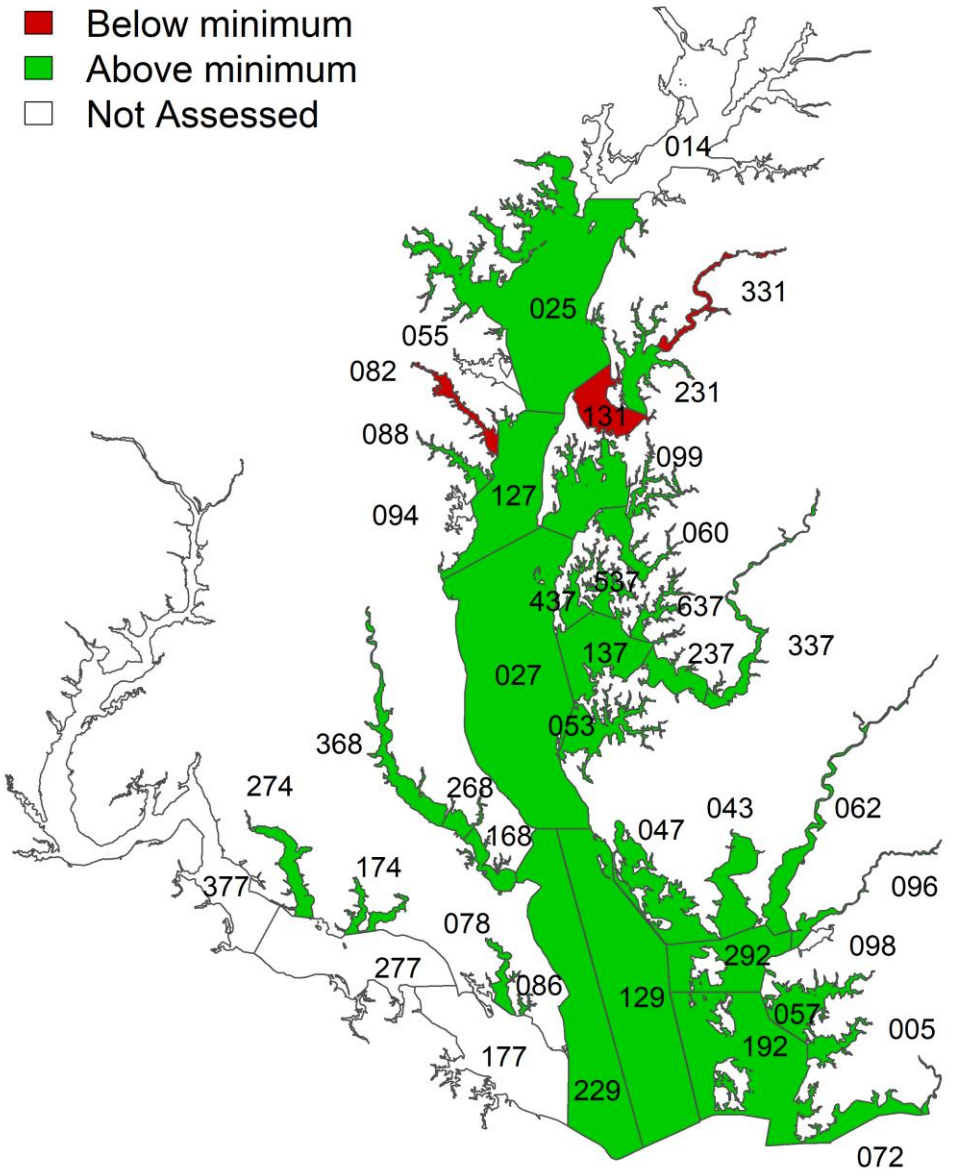


Red shading indicates fishing over the upper limit.

Orange shading indicates fishing over the target rate and under the limit rate.

Green shading indicates fishing at or below the target rate.

Market abundance in 2019 relative to the lower threshold



Red shading indicates abundance below the lower threshold.

Green shading indicates abundance above the lower threshold.

Recent changes in harvest rate and market abundance

- 75% of NOAA Codes had a decrease in harvest rate
- 72% of NOAA Codes had an increase in market abundance

	Harvest Fraction				Market Abundance		
NOAA Code	2017	2019	Change		2017	2019	Change
5	0.05	0.02	↓		0.44	0.32	↓
25	-0.92	-0.75	↑		16.43	15.61	↓
27	0.03	-0.04	↓		5.41	6.99	↑
39	0.10	-0.27	↓		20.67	24.86	↑
43	0.57	0.44	↓		2.95	11.06	↑
47	0.20	0.13	↓		2.47	4.92	↑
53	-0.12	-0.69	↓		29.83	82.09	↑
57	0.17	0.03	↓		2.66	3.22	↑
60	0.03	-0.07	↓		4.88	3.94	↓
62	0.05	-0.13	↓		19.13	19.41	↑
72	0.44	0.16	↓		2.79	2.90	↑
78	0.87	0.34	↓		4.72	6.69	↑
82	-4.98	-1.55	↑		2.57	1.56	↓
86	0.52	0.21	↓		0.52	0.60	↑
88	-3.16	-3.11	↑		1.53	1.53	↑
96	0.25	0.07	↓		0.99	1.32	↑
99	0.01	0.00	↓		0.92	0.60	↓
127	-0.47	-1.19	↓		13.69	14.85	↑
129	0.42	0.11	↓		2.00	3.50	↑
131	-1.24	-1.71	↓		4.91	2.96	↓
137	0.50	0.52	↑		2.92	5.92	↑
168	0.19	0.10	↓		4.98	13.75	↑
174	0.09	0.00	↓		0.06	0.04	↓
192	0.28	0.32	↑		5.40	5.14	↓
229	0.04	0.09	↑		5.35	11.20	↑
231	-0.29	-0.63	↓		6.24	9.33	↑
237	-0.38	-0.28	↑		10.19	13.89	↑
268	0.16	-0.06	↓		1.29	2.31	↑
274	-0.20	-0.44	↓		6.66	7.69	↑
292	0.49	0.47	↓		15.10	40.89	↑
331	0.00	0.00	↓		0.70	0.53	↓
337	-1.59	-1.17	↑		21.07	9.49	↓
368	0.15	-0.59	↓		2.43	4.51	↑
437	-5.23	-2.36	↑		24.10	34.51	↑
537	0.33	0.22	↓		22.49	39.75	↑
637	-0.04	-2.31	↓		14.91	45.30	↑

Blue shading indicates an increase in harvest rate or a decrease in abundance

Yellow shading indicates a decrease in harvest rate or an increase in abundance

Summary Findings from Update Model Assessment Results and Biological Reference Points

- 31/36 NOAA Codes are estimated to be below the upper limit fishing rate in the most recent year.
- 33/36 NOAA Codes were above the minimum abundance threshold in the most recent year.
- Most NOAA Codes had a decrease in harvest rate and an increase in market abundance since the 2018 assessment.
- Generally, the status of oysters in Maryland has improved in recent years.
- Detailed written report will be available by July 1, 2020