Supplemental Material

Table 1. Oyster reef areas for the GIS polygons provided by the US Army Corps of Engineers Norfolk District for the Chesapeake Bay Oyster Population Model (CBOPM). CBOPM reef number refers to the reef identification number used in the model and Field Reef # refers to the reef identification number used by Schulte et al. (2009). Reefs were aggregated in CBOPM due to proximity in relation to the elements in the ADH mesh.

CBOPM Reef #	Field Data Reef #	Total CBOPM (acres)
1	1 - 2	11.714
2	3	4.457
3	4	6.711
4	8	23.681
5	9	23.246
6	10 - 11	40.783
7	12	8.102
8	13	21.764
9*	N/A	13.681
10	16	16.728
	TOTAL	**170.87**

* Very little remains

Table 2. Initial year (Day 80) oyster reef area and oyster reef density by oyster age-cohort. Oyster Density parameters for low relief (LR) and high relief (HR) reefs by age class are based on data from Schulte et al. (2009).

Reef #	Reef Type	Area (m^2)	Oysters/m^2 Density	Spat/Juvenile Density	Sub-adult Density	Adult Density	Adult + Density
1	HR	47,404	2,090	1,253	653	168	16
2	HR	18,038	2,615	1,485	992	116	22
3	LR	27,157	632	346	209	77	0
4	LR	95,834	511	302	164	41	4
5	LR	94,072	488	297	155	34	2
6	LR	165,042	474	277	158	35	4
7	LR	32,786	649	393	189	64	3
8	LR	88,076	491	296	146	44	5
9	LR	55,367	597	344	205	45	3
10	LR	67,697	521	311	156	47	7

Table 3. Initial values for the baseline simulation for oyster reef type (low relief (LR) and high relief (HR) reefs) and oyster reef density (stochastic) by oyster size class. Oyster reef type and reef density parameters for low and high relief reefs by oyster size class are based on data from Schulte et al. (2009).

Reef #	Reef Type	<40 mm Oysters/m^2 Density	40-65 mm Oysters/m^2 Density	66-94 mm Oysters/m^2 Density	95-114 mm Oysters/m^2 Density	115 > mm Oysters/m^2 Density
1	HR	1,248	653	172	10	6
2	HR	1,485	986	121	5	16
3	LR	346	209	77	0	0
4	LR	301	165	41	1	3
5	LR	295	157	34	1	1
6	LR	273	159	37	1	3
7	LR	390	192	64	0	3
8	LR	291	149	45	2	3
9	LR	341	207	46	0	3
10	LR	304	163	47	2	4

Table 4. Initial values for the baseline simulation for oyster reef type (low relief (LR) and high relief (HR) reefs), **and oyster reef biomass (lbs "wet tissue" mass) by oyster size class.** Oyster reef type and reef biomass parameters for low and high relief reefs by oyster size class are based on data from Schulte et al. (2009) using the conversion equations described in section 4.3.3

Reef #	Reef Type	<40 mm Biomass	40-65 mm Biomass	66-94 mm Biomass	95-114 mm Biomass	115 > mm Biomass
1	HR	4,448	15,562	13,101	1,660	2,155
2	HR	2,030	9,181	3,420	394	1,783
3	LR	750	2,826	3,447	0	0
4	LR	2,240	8,083	6,599	359	2,138
5	LR	2,256	7,544	5,228	369	431
6	LR	3,733	13,204	9,757	642	4,130
7	LR	1,068	3,200	3,442	0	793
8	LR	2,271	6,947	6,342	647	1,416
9	LR	1,687	5,950	4,113	0	1,256
10	LR	1,856	5,612	5,320	596	1,833

Calculating Impacts of Environmental Variables on Growth

Oyster energy intake fluctuates based on a negative feedback loop with non-optimal environmental conditions. We represented the effect of environmental conditions on oyster growth as a series of step functions with linear approximations between the steps. Although oysters tolerate salinities between 0 and 42 ppt, growth is maximized at salinities of 14–28 ppt, and slows below 14 ppt and above 28 ppt; slower growth and excessive valve closure occur at salinities below 14 ppt (Shumway, 1996; Volety et al., 2009). Volety et al. (2003) observed high mortality (40% to 75%) of juvenile oysters exposed to <5 ppt and >35 ppt salinities for 2 wk, whereas very little mortality (5%) was seen at salinities of 15–25 ppt (Barnes et al., 2007). Our parameterization of salinity-based growth is listed in Table 5a.

TSS concentration has been shown to negatively affect growth (Davis and Hidu, 1969), however, specific effect values are rare. A concentration of 500 mg/L of sediment led to nearly 20% mortality in eastern oyster larvae after 12 days exposure (Davis and Hidu, 1969) with 50% mortality between 1,000 and 1,500 mg/L and 100% mortality at 3,000 mg/L. One can assume that growth was limited before mortality occurred and that the duration when the effect occurred was not fixed. Larvae reduced growth occurred at 750 mg/L and growth stopped at 2,000 mg/L. Parameters were estimated and derived with the aforementioned information and using data in Kennedy (1991). Our parameterization of TSS-based growth is listed in Table 5b.

Oysters require a water temperature between 19°C to 32°C for eggs/larvae survival (Kennedy 1991). We assumed if temperature was below 5°C or above 32°C then decreased growth would occur (E_{it} * (< 1)). When temperature was between 5°C to 32°C, we assumed that temperature did not influence reproduction (E_{it} * 1). Our parameterization of water temperature-based growth is listed in Table 5c.

Oysters require a minimum of 2.4 ppm of dissolved oxygen for survival (Chesapeake Bay Program, 1989). Oyster larvae cannot survive if they are exposed to dissolved oxygen levels are below 2.5 mg/L for periods of time (11 hrs to 150 hrs) (Widdows et al., 1989; Kennedy, 1991). Since survival is dependent upon size, with larger sizes being less susceptible to low DO, i.e., Widdows et al. (1989), we assumed a similar case for growth. Specifically, we assumed that low DO levels negatively impacted growth (E_{it} * (< 1)) when DO was less than 2.4 mg/L. When DO is equal or above 2.4 mg/L, we assumed that DO did not influence growth (E_{it} * 1). Our parameterization of DO-based growth is listed in Table 5d.

Oyster energy use efficiency is 75% of energy intake (Van der Veer et al., 2006; Bourlès et al., 2009). Energy consumed, fixed and dissipated, for somatic expenditures is assumed to be 57% (the mean of Bourlès et al. (2009) of 40% and Ferreira et al. (2010) of 73%). Energy available for growth after costs is 43%, which is within the range of Dame (1976) at 39-58%. We assumed that energy diverted to the development and accumulation of gametes can be accounted for in part as depressed growth rates as oysters enter successive older age cohorts. The energy dedicated to gamete production is not explicitly parsed out in the energetics submodel, but is captured implicitly following Loosanoff and Nomejko (1949) who reported that the process of development and accumulation of gametes did not interfere with shell growth in terms of length and width. If energy reserves were below the maximum, then the energy gained by the oyster was used to fill the energy reserves. Once oysters had the maximum energy reserves then any remaining energy units were incorporated directly to growth.

Shell length changed as a function energy reserves and age. We calibrated a base shell gain (increase/decrease in shell length) as 0.6667*energy balance. Shell growth was adjusted based on a logistic function developed by Wang et al. (2008), calibrated to data in the Great Wicomico from

Schulte et al. (2009). In general, younger oysters accumulated shell faster than older (Refer to Table 6 for exact values).

Table 5a. The effects of salinity (TDS) on oyster energy assimilation for different ages

TDS Threshold (ppt)	Age (yr)	Duration (days)	Energy Assimilation
TDS < 12	0	< 7	E_{it} * 0.9
TDS < 12	0	≥ 7	E_{it} * 0.8
12 ≤ TDS ≤ 27	0	1	E_{it} * 1
TDS > 27	0	1	E_{it} * 0.5
TDS < 12	> 0	< 7	E_{it} * 0.95
TDS < 12	> 0	≥ 7	E_{it} * 0.9
12 ≤ TDS ≤ 35	> 0	1	E_{it} * 1
TDS > 35	> 0	1	E_{it} * 0.5

Data estimated and derived from Table 1 (Kennedy, 1991)

Table 5b. The effects of total suspended solids (TSS) on oyster energy assimilation for different ages

TSS Threshold (mg/L)	Age (yr)	Duration (days)	Energy Assimilation
TSS < 250	0	1	E_{it} * 1
250 < TSS ≤ 500	0	< 14	E_{it} * 0.9
250 < TSS ≤ 500	0	≥ 14	E_{it} * 0.8
500 < TSS ≤ 2000	0	< 14	E_{it} * 0.5
TSS > 2000	0	< 14	E_{it} * 0.25
TSS > 2000	0	≥ 14	E_{it} * 0.1
TSS < 500	> 0	1	E_{it} * 1
500 < TSS ≤ 1500	> 0	< 14	E_{it} * 0.9
500 < TSS ≤ 1500	> 0	≥ 14	E_{it} * 0.8
1500 < TSS ≤ 3000	> 0	< 14	E_{it} * 0.5
TSS > 3000	> 0	< 14	E_{it} * 0.25

TSS > 3000	> 0	≥ 14	E_{it} * 0.1

Data estimated and derived from Table 1 (Kennedy, 1991)

Table 5c. The effects of H2O temperature (Temp) on oyster energy assimilation for different ages

Temp Threshold (°C)	Age (yr)	Duration (days)	Energy Assimilation
Temp ≤ 5°C	0	< 7	E_{it} * 0.95
Temp ≤ 5°C	0	≥ 7	E_{it} * 0.9
5°C < Temp ≤ 32°C	0	1	E_{it} * 1
Temp > 32°C	0	1	E_{it} * 0.5
Temp ≤ 5°C	> 0	< 7	E_{it} * 0.95
Temp ≤ 5°C	> 0	≥ 7	E_{it} * 0.9
5°C < Temp ≤ 32°C	> 0	1	E_{it} * 1
Temp > 32°C	> 0	1	E_{it} * 0.75

Data estimated and derived from Table 1 (Kennedy, 1991).

Table 5d. The effects of dissolved oxygen (DO) on oyster energy assimilation for different ages

DO Threshold (mg/L)	Age (yr)	Energy Assimilation
DO ≥ 2.4	0	E_{it} * 1
0.5 ≤ DO < 2.4	0	E_{it} * 0.5
DO < 0.5	0	E_{it} * 0
DO ≥ 2.4	> 0	E_{it} * 1
0.5 ≤ DO < 2.4	> 0	E_{it} * 0.75
DO < 0.5	> 0	E_{it} * 0.25

* Daily energy intake (Eit) baseline of 2.8 units.

Table 6. Size dependent oyster shell gain adjustment for decreased age-related growth rates. Developed based on the logistic curve equation in Wang et al. (2008) but calibrated for the Great Wicomico River using field data from Schulte et al. (2009). Sizes are in mm.

Lower Size Limit	Upper Size Limit	Shell gain (growth) adjustment
< 37	N/A	Shell gain * 1.8
≥ 37	≤ 72	Shell gain * 0.7
> 72	≤ 120	Shell gain * 0.46
> 120	≤ 200	Shell gain * 0.20
> 200	≤ 300	Shell gain * 0.06
> 300	N/A	Shell gain * 0.01

Calculating Impacts of Environmental Variables on Reproduction

Salinity is a critical parameter for oyster reproduction. Values that are too high or low can negatively affect reproduction (Shumway, 1996; Volety et al., 2009). Salinity's effect on reproduction was based on Mann and Evans (1998), and was calculated as follows

$$E_S = \frac{(S-8)}{5.5}$$

where E_s is the effect of salinity (S) on overall reproduction, represented as a proportion of offspring that can be produced under a given salinity value. Lower salinities impair gametogenesis at <5 ppt, whereas normal gametogenesis occurred above 7.5 ppt (Loosanoff, 1953a; Loosanoff, 1953b; Barnes et al., 2007).

TSS concentration has been shown to negatively affect reproduction (Kennedy, 1991), however, specific effect values are rare. We represented the effect of TSS (E_{TSS}) on oyster reproduction as a series of step functions with linear approximations between the steps. Step values were derived from Kennedy (1991) (Table 7).

Oysters require a water temperature from 20°C to 24°C for spawning (Chesapeake Bay Program, 1989), and between 19°C to 32°C for eggs/larvae survival (Kennedy, 1991). We assumed if temperature was below 19°C or above 32°C then no reproduction would occur (E_{Temp} = 0). When temperature was between 19°C to 32°C, we assumed that temperature did not influence reproduction (E_{Temp} = 1).

Oyster larvae cannot survive if they are exposed to dissolved oxygen levels are below 2.5 mg/L for periods of time (11 hrs to 150 hrs) (Widdows et al., 1989; Kennedy, 1991). We assumed that low DO levels affected successful reproduction by killing all larva when DO was less than 2.5 mg/L (E_{DO} = 0). When DO is above 2.5mg/L, we assumed that DO did not influence reproduction (E_{DO} = 1).

Table 7. The effect of TSS concentration (E_{TSS}) on reproduction. Data are based on Kennedy, 1991.

TSS Threshold (mg/L)	E_{TSS}
< 250	1
$250 \leq TSS \leq 300$	0.73
$300 < TSS \leq 450$	0.5
$450 < TSS < 500$	0.4
$500 \leq TSS \leq 550$	0.31
$550 < TSS < 1000$	0.1
$1000 \leq TSS \leq 1500$	0.03
> 1500	0

Calculating Impacts of Environmental Variables on Mortality

Each life stage of the Eastern oyster is sensitive to changes in salinity, particularly when exposed for long durations. Volety et al. (2003) observed high mortality (40% to 75%) of oysters exposed to <5 ppt or >35 ppt salinities for 14 consecutive days, whereas very little mortality (5%) was seen at salinities of 15-25 ppt (Barnes et al., 2007). Likewise, juvenile oysters have > 95% mortality at salinity of 5 ppt when exposed for seven consecutive days, and that oysters have lowest mortality at salinities between 14-28 ppt. Poor spat production occurs at salinities below 14 ppt (Shumway, 1996; Volety et al., 2009). Adult oysters can tolerate a salinity of 5 ppt for up to 8 weeks, but not below 3 ppt. Our parameterization of daily salinity-based mortality is listed in Table 8a for spat and juveniles and Table 8b for subadults and older.

Total suspended solids (TSS) can have a negative effect on oyster eggs and larvae. (Davis and Hidu, 1969; Kennedy, 1991). Concentrations of 250 mg/L resulted in 27% mortality, with 69% mortality at 500 mg/L, and 97-100% mortality from a concentration greater than 1,000. A concentration of 500 mg/L of sediment led to nearly 20% mortality in Eastern oyster larvae after 12 days of exposure (Davis and Hidu, 1969) with 50% mortality between 1,000 and 1,500 mg/L and 100% mortality at 3,000 mg/L. Larvae reduced growth occurred at 750 mg/L and growth stopped at 2,000 mg/L. Our parameterization of TSS-based mortality for spat/juveniles is listed in Table 8c, and Table 8d for adults.

Oysters can survive a wide range of temperatures, but Kennedy (1991) indicated that optimal survival across all life stages is between 19°C - 32°C. Our parameterization of temperature-based mortality is listed in Table 8e (data and estimates were derived from Kennedy (1991)).

Oysters require a minimum of 2.4 ppm of dissolved oxygen for survival (Chesapeake Bay Program, 1989). Larvae die at 0 mg/L DO, median mortality time in anoxia = 150 hours for 16 mm spat and 11 hours for 82 micrometer larvae (Widdows et al., 1989). Oysters held at anoxia and salinities of 10 ppt lasted 28 days at 10C = 50% mortality, 20 ppt lasted 18-20 days at 20C = 50% mortality, and 30 ppt and 3-8 days at 30C = 50% mortality (Stickle et al., 1989; Kennedy, 1991). Our parameterization of DO-based morality is listed in Table 8f.

Table 8a**.** Salinity-based mortality threshold values for the spat/juvenile age class.

Salinity Threshold (ppt)	**Salinity Duration (days)**	**Probability of Mortality**
5 ≤ Salinity ≤ 10	1	0.005
10 < Salinity ≤ 20	1	0.001
20 < Salinity ≤ 28	1	0.001
> 35	1	0.05
< 5	< 7	0.1
28 < Salinity ≤ 35	< 7	0.01
< 5	≥ 7	0.2
28 < Salinity ≤ 35	≥ 7	0.02

Table 8b**.** Salinity-based mortality threshold values for subadult and older age classes.

Salinity Threshold (ppt)	**Salinity Duration (days)**	**Probability of Mortality**
3 ≤ Salinity ≤ 10	1	0.002
10 < Salinity ≤ 20	1	0.001
20 < Salinity ≤ 28	1	0.001
> 35	1	0.05
< 3	< 7	0.1
28 < Salinity ≤ 35	< 7	0.002
< 3	≥ 7	0.2
28 < Salinity ≤ 35	≥ 7	0.02

Table 8c**.** Total suspended solids (TSS)-based mortality threshold values for the spat/juvenile age class.

TSS Threshold (mg/L)	**TSS Duration (days)**	**Probability of Mortality**
< 250	< 12	0
250 ≤ TSS ≤ 500	< 12	0.001
500 < TSS ≤ 1000	< 12	0.002
1000 < TSS ≤ 1500	< 12	0.01
1500 < TSS ≤ 3000	< 12	0.02
> 3000	< 12	0.15
< 250	≥ 12	0
250 ≤ TSS ≤ 500	≥ 12	0.002
500 < TSS ≤ 1000	≥ 12	0.005
1000 < TSS ≤ 1500	≥ 12	0.015
1500 < TSS ≤ 3000	≥ 12	0.1
> 3000	≥ 12	0.2

Table 8d. Total suspended solids (TSS)-based mortality threshold values for the subadult and older age classes.

TSS Threshold (mg/L)	TSS Duration (days)	Probability of Mortality
< 500	< 12	0
500 ≤ TSS ≤ 1000	< 12	0.0005
1000 < TSS ≤ 2000	< 12	0.0005
2000 < TSS ≤ 3000	< 12	0.0005
3000 < TSS ≤ 3500	< 12	0.001
> 3500	< 12	0.1
< 500	≥ 12	0.001
500 ≤ TSS ≤ 1000	≥ 12	0.001
1000 < TSS ≤ 2000	≥ 12	0.0015
2000 < TSS ≤ 3000	≥ 12	0.002
3000 < TSS ≤ 3500	≥ 12	0.0025
> 3500	≥ 12	0.15

Table 8e. Temperature-based mortality threshold values for all oyster age classes.

Temp. Threshold (°C)	Temp. Duration (days)	Probability of Mortality
4 < Temp. ≤ 8	1	0.0005
8 < Temp. ≤ 10	1	0.0005
10 < Temp. ≤ 20	1	0.00125
> 32	1	0.015
≤ 4	< 7	0.00125
20 < Temp. ≤ 32	< 7	0.0055
≤ 4	≥ 7	0.0025
20 < Temp. ≤ 32	≥ 7	0.01

Table 8f. Dissolved oxygen (DO)-based mortality threshold values for all oyster age classes.

DO Threshold (mg/L)	**DO Duration (days)**	**Probability of Mortality**
2.4 < DO ≤ 4	1	0.0125
≤ 2.4	< 7	0.1
≤ 2.4	≥ 7	0.2

Table 9. Conversions from the number of oysters to bushels for the Great Wicomico River (based on De Broca (1865) and Loosanoff (1947)).

< 40mm	**40 to 65mm**	**66 to 94mm**	**95 to 114mm**	**115>mm**
1,500 / bushel *	690 / bushel *	350 / bushel *	260 / bushel *	180 / bushel *
Year-class 1	**Year-class2**	**Year-class3**	**Year-class4**	**Year-class 5**
44,047 / bushel **	801 / bushel **	383 / bushel **	271 / bushel **	198 / bushel **

Table 10. Descriptive statistics summarizing the sensitivity analysis on the density dependent fecundity parameter. The *SRRH* scenario was simulated. C.I. represents the confidence interval.

				95% CI of Mean	
Treatment	**Reps (N)**	**Mean Market Size Oyster Bushels**	**St. Dev.**	**Lower Bound**	**Upper Bound**
Baseline	25	677,715.88	53,764.31	655,523.06	699,908.7
(-10%)	25	673,456.95	46,792.860	654,141.8	692,772.09
(-20%)	25	676,151.16	47,089.127	656,713.72	695,588.6
(+10%)	25	652,839.95	33,876.355	638,856.48	666,823.42
(+20%)	25	635,253.72	37,325.915	619,846.34	650,661.1

Table 11. Oyster density dependent fecundity parameter sensitivity analysis Bonferroni Post Hoc test results - The *SRRH* scenario was simulated.

Treatment	Baseline	(-10%)	(-20%)	(+10%)	(+20%)
Baseline	N/A	1	1	0.497	0.01
(-10%)	1	N/A	1	1	0.029
(-20%)	1	1	N/A	0.656	0.015
(+10%)	0.497	1	0.656	N/A	1
(+20%)	0.01	0.029	0.015	1	N/A

Table 12. Descriptive statistics summarizing the sensitivity analysis on initial oyster density. The HRS scenario was simulated. C.I. represents the confidence interval.

Treatment	Reps (N)	Mean Market Size Oyster Bushels	St. Dev.	95% CI for Mean Lower Bound	95% CI for Mean Upper Bound
Baseline	25	677,715.88	53,764.312	655,523.06	699,908.7
-25%	25	520,835.56	40,511.035	504,113.43	537,557.69
-50%	25	345,988.68	32,893.872	332,410.76	359,566.6
+25%	25	795,722.56	55,829.737	772,677.18	818,767.94
+50%	25	954,108.20	67,249.566	926,348.94	981,867.46

Table 13. High-relief oyster reef multiplier parameter sensitivity analysis Bonferroni Post Hoc test results - Sanctuary Reserves Rotational Harvest (SRRH) scenario, treatment 3 (50% of all age classes not harvested).

Treatment	Baseline	-25%	-50%	+25%	+50%
Baseline	N/A	< 0.001	< 0.001	< 0.001	< 0.001
-25%	< 0.001	N/A	< 0.001	< 0.001	< 0.001
-50%	< 0.001	< 0.001	N/A	< 0.001	< 0.001
+25%	< 0.001	< 0.001	< 0.001	N/A	< 0.001
+50%	< 0.001	< 0.001	< 0.001	< 0.001	N/A

Table 14. Descriptive statistics results for model scenarios under treatment 1 (harvest of reefs with 10% spat/juvenile oysters remaining after harvest)

Scenario	Reps (N)	Mean	St. Dev.	95% CI for Mean Lower Bound	95% CI for Mean Upper Bound
LRAH	25	0	0	0	0
HRS	25	2,509,760.40	108,368.498	2,465,028.08	2,554,492.72
SRRH	25	324,503.28	23,258.074	314,902.82	334,103.74
SURH	25	143,908.88	14,405.323	137,962.65	149,855.11
LRS	25	281,600.20	53,786.740	259,398.13	303,802.27
LRRH	25	4,754.92	1,295.868	4,220.01	5,289.83

Mean refers to the mean number of bushels of market-sized oysters remaining at the end of the set of simulations

LRAH = All low-relief harvested annually
HRS = All reefs high-relief sanctuaries
SRRH = Mixture of Low relief/Sanctuaries reefs (sanctuaries were reefs 3, 4, 8, & 10; other reefs were harvested 3 year rotations)
SURH = Mixture of Low relief/Sanctuaries reefs (sanctuaries were reefs 1, 2, 3, & 4; other reefs were harvested on 3 year rotations)
LRS = All reefs low-relief sanctuaries
LRRH = Low-relief rotational harvest (each reef was harvested once every 3 years)

Table 15. Bonferroni Post Hoc test results for model scenarios under treatment 1 (harvest of reefs with 10% spat/juvenile oysters remaining after harvest)

Scenario	*LRAH*	*HRS*	*SRRH*	*SURH*	*LRS*	*LRRH*
LRAH	N/A	< 0.001	< 0.001	< 0.001	< 0.001	1.000
HRS	< 0.001	N/A	< 0.001	< 0.001	< 0.001	< 0.001
SRRH	< 0.001	< 0.001	N/A	< 0.001	0.048	< 0.001
SURH	< 0.001	< 0.001	< 0.001	N/A	< 0.001	< 0.001
LRS	< 0.001	< 0.001	0.048	< 0.001	N/A	< 0.001
LRRH	1.000	< 0.001	< 0.001	< 0.001	< 0.001	N/A

LRAH = All low-relief harvested annually
HRS = All reefs high-relief sanctuaries
SRRH = Mixture of Low relief/Sanctuaries reefs (sanctuaries were reefs 3, 4, 8, & 10; other reefs were harvested 3 year rotations)
SURH = Mixture of Low relief/Sanctuaries reefs (sanctuaries were reefs 1, 2, 3, & 4; other reefs were harvested on 3 year rotations)
LRS = All reefs low-relief sanctuaries
LRRH = Low-relief rotational harvest (each reef was harvested once every 3 years)

Table 16. Descriptive statistics results for model scenarios under treatment 2 (harvest of reefs with 50% spat/juvenile oysters remaining after harvest). Mean refers to the mean number of bushels of market-sized oysters remaining at the end of the simulation.

Scenario	Reps (N)	Mean	St. Dev.	95% CI for Mean Lower Bound	95% CI for Mean Upper Bound
LRAH	25	0	0	0	0
HRS	25	2,509,760.40	108,368.498	2,465,028.08	2,554,492.72
SRRH	25	441,783.84	32,064.377	428,548.32	455,019.36
SURH	25	123,096.28	24,162.060	113,122.67	133,069.89
LRS	25	281,600.20	53,786.740	259,398.13	303,802.27
LRRH	25	14,121.80	2,459.876	13,106.41	15,137.19

LRAH = All low-relief harvested annually
HRS = All reefs high-relief sanctuaries
SRRH = Mixture of Low relief/Sanctuaries reefs (sanctuaries were reefs 3, 4, 8, & 10; other reefs were harvested 3 year rotations)
SURH = Mixture of Low relief/Sanctuaries reefs (sanctuaries were reefs 1, 2, 3, & 4; other reefs were harvested on 3 year rotations)
LRS = All reefs low-relief sanctuaries
LRRH = Low-relief rotational harvest (each reef was harvested once every 3 years)

Table 17. Bonferroni Post Hoc test results for model scenarios under treatment 2 (harvest of reefs with 50% spat/juvenile oysters remaining after harvest)

Scenario	*LRAH*	*HRS*	*SRRH*	*SURH*	*LRS*	*LRRH*
LRAH	N/A	< 0.001	< 0.001	< 0.001	< 0.001	1.000
HRS	< 0.001	N/A	< 0.001	< 0.001	< 0.001	< 0.001
SRRH	< 0.001	< 0.001	N/A	< 0.001	< 0.001	< 0.001
SURH	< 0.001	< 0.001	< 0.001	N/A	< 0.001	< 0.001
LRS	< 0.001	< 0.001	< 0.001	< 0.001	N/A	< 0.001
LRRH	1.000	< 0.001	< 0.001	< 0.001	< 0.001	N/A

LRAH = All low-relief harvested annually
HRS = All reefs high-relief sanctuaries
SRRH = Mixture of Low relief/Sanctuaries reefs (sanctuaries were reefs 3, 4, 8, & 10; other reefs were harvested 3 year rotations)
SURH = Mixture of Low relief/Sanctuaries reefs (sanctuaries were reefs 1, 2, 3, & 4; other reefs were harvested on 3 year rotations)
LRS = All reefs low-relief sanctuaries
LRRH = Low-relief rotational harvest (each reef was harvested once every 3 years)

Table 18. Descriptive statistics results for model scenarios under treatment 3 (harvest of reefs with 50% of all oysters remaining after harvest).

Scenario	Reps (N)	Mean	St. Dev.	95% CI for Mean Lower Bound	95% CI for Mean Upper Bound
LRAH	25	1,108.88	680.398	828.03	1,389.73
HRS	25	2,509,760.40	108,368.498	2,465,028.08	2,554,492.72
SRRH	25	677,715.88	53,764.312	655,523.06	699,908.7
SURH	25	225,795.36	32,927.338	212,203.62	239,387.1
LRS	25	281,600.20	53,786.740	259,398.13	303,802.27
LRRH	25	47,434.04	5,591.118	45,126.14	49,741.94

LRAH = All low-relief harvested annually
HRS = All reefs high-relief sanctuaries
SRRH = Mixture of Low relief/Sanctuaries reefs (sanctuaries were reefs 3, 4, 8, & 10; other reefs were harvested 3 year rotations)
SURH = Mixture of Low relief/Sanctuaries reefs (sanctuaries were reefs 1, 2, 3, & 4; other reefs were harvested on 3 year rotations)
LRS = All reefs low-relief sanctuaries
LRRH = Low-relief rotational harvest (each reef was harvested once every 3 years)

Table 19. Bonferroni Post Hoc test results for model scenarios under treatment 3 (harvest of reefs with 50% of all oysters remaining after harvest).

Scenario	*LRAH*	*HRS*	*SRRH*	*SURH*	*LRS*	*LRRH*
LRAH	N/A	< 0.001	< 0.001	< 0.001	< 0.001	0.058
HRS	< 0.001	N/A	< 0.001	< 0.001	< 0.001	< 0.001
SRRH	< 0.001	< 0.001	N/A	< 0.001	< 0.001	< 0.001
SURH	< 0.001	< 0.001	< 0.001	N/A	0.008	< 0.001
LRS	< 0.001	< 0.001	< 0.001	0.008	N/A	< 0.001
LRRH	0.058	< 0.001	< 0.001	< 0.001	< 0.001	N/A

LRAH = All low-relief harvested annually
HRS = All reefs high-relief sanctuaries
SRRH = Mixture of Low relief/Sanctuaries reefs (sanctuaries were reefs 3, 4, 8, & 10; other reefs were harvested 3 year rotations)
SURH = Mixture of Low relief/Sanctuaries reefs (sanctuaries were reefs 1, 2, 3, & 4; other reefs were harvested on 3 year rotations)
LRS = All reefs low-relief sanctuaries
LRRH = Low-relief rotational harvest (each reef was harvested once every 3 years)

Table 20. Descriptive statistics results - comparison of Treatments 1-3 for oyster reef harvest scenarios. Mean refers to the mean number of bushels of market-sized oysters remaining at the end of the simulation.

					95% CI for Mean	
LRAH	**Treatment**	**Reps (N)**	**Mean**	**St. Dev.**	**Lower Bound**	**Upper Bound**
	1	25	0.00	0	0	0
	2	25	0.00	0.000	0	0
	3	25	1,108.88	680.398	828.03	1,389.73
SRRH					**95% CI for Mean**	
	Treatment	**Reps (N)**	**Mean**	**St. Dev.**	**Lower Bound**	**Upper Bound**
	1	25	324,503.28	23,258.07	314,902.82	334,103.74
	2	25	441,783.84	32,064.377	428,548.32	455,019.36
	3	25	677,715.88	53,764.312	655,523.06	699,908.7
SURH					**95% CI for Mean**	
	Treatment	**Reps (N)**	**Mean**	**St. Dev.**	**Lower Bound**	**Upper Bound**
	1	25	143,908.88	14,405.32	137,962.65	149,855.11
	2	25	123,096.28	24,162.060	113,122.67	133,069.89
	3	25	225,795.36	32,927.338	212,203.62	239,387.1
LRRH					**95% CI for Mean**	
	Treatment	**Reps (N)**	**Mean**	**St. Dev.**	**Lower Bound**	**Upper Bound**
	1	25	4,754.92	1,295.868	4,220.01	5,289.83
	2	25	14,121.80	2,459.876	13,106.41	15,137.19
	3	25	47,434.04	5,591.118	45,126.14	49,741.94

CI= Confidence Interval
LRAH = All low-relief harvested annually
HRS = All reefs high-relief sanctuaries
SRRH = Mixture of Low relief/Sanctuaries reefs (sanctuaries were reefs 3, 4, 8, & 10; other reefs were harvested 3 year rotations)
SURH = Mixture of Low relief/Sanctuaries reefs (sanctuaries were reefs 1, 2, 3, & 4; other reefs were harvested on 3 year rotations)
LRS = All reefs low-relief sanctuaries
LRRH = Low-relief rotational harvest (each reef was harvested once every 3 years)

Table 21. Bonferroni Post Hoc test results - comparison of Treatments 1-3 for oyster reef harvest scenarios

	Treatment	**1**	**2**	**3**
LRAH				
	1	N/A	1	< 0.001
	2	1	N/A	< 0.001
	3	< 0.001	< 0.001	N/A
SRRH	**Treatment**	**1**	**2**	**3**
	1	N/A	< 0.001	< 0.001
	2	< 0.001	N/A	< 0.001
	3	< 0.001	< 0.001	N/A
SURH	**Treatment**	**1**	**2**	**3**
	1	N/A	0.013	< 0.001
	2	0.013	N/A	< 0.001
	3	< 0.001	< 0.001	N/A
LRRH	**Treatment**	**1**	**2**	**3**
	1	N/A	< 0.001	< 0.001
	2	< 0.001	N/A	< 0.001
	3	< 0.001	< 0.001	N/A

LRAH = All low-relief harvested annually
HRS = All reefs high-relief sanctuaries
SRRH = Mixture of Low relief/Sanctuaries reefs (sanctuaries were reefs 3, 4, 8, & 10; other reefs were harvested 3 year rotations)
SURH = Mixture of Low relief/Sanctuaries reefs (sanctuaries were reefs 1, 2, 3, & 4; other reefs were harvested on 3 year rotations)
LRS = All reefs low-relief sanctuaries
LRRH = Low-relief rotational harvest (each reef was harvested once every 3 years)

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