Oyster Futures

Stakeholder Workgroup

4TH MEETING SUMMARY REPORT

March 24-25, 2017
Horn Point Laboratory, University of Maryland
Cambridge Maryland

Summarized by:

FCRC CONSENSUS CENTER

"Facilitating Consensus Solutions, Supporting Collaborative Action."

THE FLORIDA STATE UNIVERSITY

OysterFutures Stakeholder Workgroup
March 24-25, 2017 Meeting IV Summary Report

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Oyster Futures Workgroup, March 2017

Oyster Futures Workgroup, Facilitators and Research Team, March 2017

OYSTERFUTURES WORKGROUP
MEETING EXECUTIVE SUMMARY
NOVEMBER 5-6, 2016

On behalf of the Oyster Futures Research Team, Elizabeth North and Michael Wilberg welcomed the Members to the fourth meeting of the OysterFutures Workgroup and introduced the facilitation team of Jeff Blair and Bob Jones with the FCRC Consensus Center at Florida State University. Following workgroup member introductions, the facilitator noted the importance going forward of getting as close as possible to full participation in the Workgroup meetings as they develop initial recommendations to the Department of Natural Resources.

The facilitators reviewed the agenda and the Workgroup approved the agenda and the November 2016 Workgroup meeting summary. The facilitator then reviewed the workgroup Goal statement adopted at the organizational meeting in February 2016. This Goal statement calls for a package of Workgroup consensus recommendations informed by modeling collaboratively developed by the Workgroup and the OysterFutures project research team later in 2017. Troy Hartley reviewed with members the Social Science survey study that is being conducted throughout the OysterFutures workgroup process.

Mike Wilberg provided the Workgroup with an overview of the research objectives for the Population Models, OysterFutures Simulation Model, Economics Model, and Water Quality Model. He noted that estimates of abundance, exploitation and mortality rates for each region in the Choptank complex from the Population Models are the starting point for the OysterFutures Simulation Model. These estimates allow the OysterFutures Simulation Model to describe how the population is expected to change over time and to provide the starting levels of abundance at the beginning of the time series. He noted that the Population Models combine data from the fishery, DNR fall survey, and harvest reports to get the best estimates of mortality and abundance. The data included are from 1988-89 to 2014-15 and include harvest estimates; trends in oyster and box density from the MD DNR fall dredge survey; hand tong and power dredge bushels per hour at the beginning and end of the fishing season; numbers stocked; and amount of shell placed (or other materials).

Mike Wilberg reviewed the data on abundance and natural morality from the Populations Models for each of the following 7 regions in the Choptank complex: Broad Creek, Lower Choptank, Middle Choptank, Upper Choptank, Tred Avon River, Little Choptank River and Harris Creek. He noted the OysterFutures Simulation model will be used to project effects of different management options that the Workgroup has identified and said this was a very complex model. The model will reflect and provide monthly estimates for the harvest season from October 1 through March 31.

The Workgroup discussed the following topics on the model: abundance; spat on shells; validating the model; less variability and lower abundance since 2000; areal measurement; mortality in closed areas; habitat loss; enforcement and explaining compliant behavior; oysters per bushel; price per bushel; and nitrogen removal.

The model will apportion the oysters to different regions and habitat types. In terms of reproduction, the model provides estimates on how many eggs an oyster produces each year for one spawning event. The model distributes oysters to bars based on the larval transport model and includes larval and post settlement survival. The model calculates how many oysters can settle in an area based on the quality of habitat. After spat, the model follows oyster growth as they age, and by age 3 most are market size. The model estimates the natural mortality trends based on 2005-2015 data.

The Workgroup discussed the following topics on the model: Habitat loss; Enforcement; Estimating compliant behavior; Number of oysters per bushel; Price per bushel average; and Nitrogen removal.

In the afternoon, Mike Wilberg reviewed the options identified by the Workgroup and provided an initial summary of performance measures and fielded questions. The Workgroup discussed the options and their impacts on: harvest; fishery revenue; cumulative cost of options over 25 years; oyster filtering and ecosystem metrics; nitrogen removal.

On the second day, Mike Wilberg presented the model results for the range of options the Workgroup had identified and refined at its earlier meetings. For each option the Workgroup rated its acceptability and support, discussed concerns, and offered suggestions to the modelers:

ROTATIONAL HARVEST MODELED OPTIONS

1. Two-year rotations in the Lower Choptank, Middle Choptank and Broad Creek. *(92% support)*

Mike Wilberg presented the option and the Workgroup provided comments on their ratings. Concerns raised included: a 2-year rotation may not be enough; no gear type was stipulated in the option; compressed derby effort; rotating the whole area vs. pieces of the area; rotation in areas with low natural spat set; funding to make the rotational system work; no reseeding or restocking assumed.

2. Three-year rotations in the Lower Choptank, Middle Choptank and Broad Creek *(54% support).*

Mike Wilberg presented the option and the Workgroup provided comments on their ratings. Concerns raised included: the option and different gear types; abundance declines; does not account for different participation in the fishery; fishery revenue; economic value of participation in the fishery; prices variation and oyster size; seeding and natural recruitment; survival rates for spat on shells and natural recruitment.

3. Four-year rotations in the Lower Choptank, Middle Choptank and Broad Creek. . *(62% support)*

Mike Wilberg presented the third rotational option and the Workgroup provided comments on their ratings. Concerns raised included: no gear type was stipulated in the option; rotating the whole area vs. pieces of the area; and no reseeding or restocking assumed.

ENFORCEMENT OPTION

1. Full compliance with the current (size limit) regulations. *(79% support)*

Mike Wilberg presented the option and the Workgroup provided comments on their ratings. Concerns raised included: basis for compliance percentages; oyster size and age; disease and immunity; poaching; and illegal harvest in sanctuaries.

USE OF ASSESSMENT OF POPULATION IN MANAGEMENT OPTIONS *(not modeled)*
Mike Wilberg noted this option was not modeled.

LIMITED ENTRY OPTIONS
1) 25% reduction in effort. *(100% support)*
2) 50% reduction in effort. *(86% support)*

Mike Wilberg presented the options modeled. The Workgroup provided comments on their acceptability ratings. Concerns raised included: result is based on current participation; latent licenses and rotation and more oysters; impact on fulltime vs. part time watermen; and accuracy and use of historical landings.

HABITAT MODIFICATION/RESTORATION OPTIONS
1) Add Shell to each bar every 3 years in the Lower Choptank. *(100% support)*
2) Add Shell to each bar every 3 years in the Lower Choptank, Middle Choptank and Broad Creek. *(96% support)*
3) Add Shell to each bar every 3 years in the Lower Choptank, with 3-year rotational harvest in that area. *(93% support)*
4) Make 3d reefs in the current sanctuary region of the Middle Choptank. *(43% support)*

FEE AND TAX OPTIONS
Mike Wilberg noted this option was not modeled at this juncture as it was tough to get at different individual license effects in the model. He suggested holding off on this and returning later to this.

SPATIAL OPTIONS
Mike Wilberg noted this option was addressed and incorporated into other habitat options

REGULATIONS RELATED TO SPECIFIC GEAR OPTIONS
Mike Wilberg noted this option was not modeled.

STOCKING
1) Planting spat on each bar every 3 years in the Lower Choptank. *(93% support)*
2. Planting spat on each bar every 3 years in the Lower Choptank, Middle Choptank, and Broad Creek. *(93% support)*

The Workgroup discussed some combinations that might be considered including: Rotational harvest with shell planting and limited effort; Slot size regulation with rotational harvest; opening areas of the Little Choptank that have not had federal investment.

The facilitator noted that at the end of the November 2016 meeting, the Workgroup members used an acceptability rating for each of the model components to gauge the Workgroup's understanding and support for the work being done on the various the model components. He asked the Workgroup to rate the components based on the review and refinements promised at this meeting and offer any concluding observations or suggestions.

A. Population Model
    1. Reproduction and Larval Transport *(100% support)*
    2. Mortality *(100% support)*
    3. Growth *(100% support)*

B. Habitat Model
    1. Habitat *(100% support)*
    2. Habitat Coding *(100% support)*
C. Fishery/Effort Dynamics *(100% support)*
D. Economics *(79% support)*
E. Ecosystem Services *(100% support)*
    1. Water Quality *(Light Availability, Seston Removal) (100% support)*
    2. Nitrogen Removal *(100% support)*

The Workgroup discussed the meeting scheduled and agreed to proceed with the meetings in May and July to complete the Phase I activities. Elizabeth North reported that the videos of the presentations at the OysterFutures Sea Grant Symposium in October 2016 had not been completed but were still in progress. She also recounted that workgroup members decided at the last meeting to delay discussion of the communications strategy of the results of stakeholder deliberations until there were results.

Workgroup members were asked to comment on the meeting by completing meeting evaluations. The meeting adjourned at 3:45 p.m. on Saturday.

OYSTERFUTURES
WORKGROUP MEETING VI SUMMARY
MARCH 24-25, 2017

I. OVERVIEW OF THE OYSTERFUTURES CONTEXT

A. WORKGROUP INTRODUCTIONS & SCHEDULE

On behalf of the OysterFutures Research Team, Elizabeth North welcomed the Members to the fourth meeting of the OysterFutures Workgroup and introduced the facilitation team of Jeff Blair and Bob Jones with the FCRC Consensus Center at Florida State University. Following workgroup member introductions *(See Appendix #2 for the Workgroup members list)*, the facilitator noted the importance going forward of getting as close as possible full participation in the Workgroup meetings as they develop initial recommendations to the Department of Natural Resources in 2017.

B. REVIEW OF AGENDA AND WORKGROUP GOAL

The facilitators reviewed the agenda and the Workgroup approved the agenda *(See Appendix #1)* and the November 2016 Workgroup meeting summary. The facilitator then reviewed the workgroup guidelines and goal statement that was adopted at the organizational meeting in February 2016 which calls for a package of Workgroup consensus recommendations informed by modeling collaboratively developed by the Workgroup and the OysterFutures project research team.

C. SOCIAL SCIENCE STUDY SURVEY

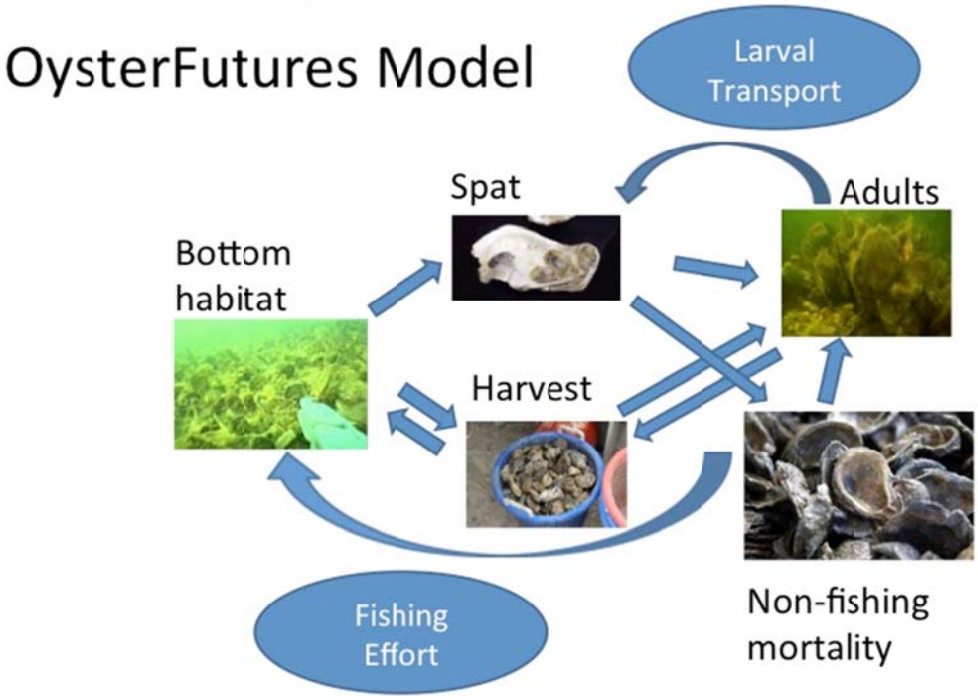
Dr. Troy reviewed with members the Social Science survey study that is being conducted throughout the OysterFutures workgroup process.

II. OVERVIEW OF THE OYSTERFUTURES MODELING

Mike Wilberg provided the Workgroup with an overview of the research objectives for the Population Models, OysterFutures Simulation Model, Economics Model, and Water Quality Model).

He noted that estimates of abundance, exploitation and mortality rates for each region in the Choptank complex from the Population Models are the starting point for the OysterFutures Simulation Model. These estimates allow the OysterFutures Simulation Model to describe how the population is expected to change over time and to provide the starting levels of abundance at the beginning of the time series.

He noted that the Population Models combine data from the fishery, DNR fall survey, and harvest reports to get the best estimates of mortality and abundance. The data included are from 1988-89 to 2014-15 and include harvest estimates (assuming 75% reported); trends in oyster and box density from the MD DNR fall dredge survey; hand tong and power dredge bushels per hour at the beginning and end of the fishing season; numbers stocked; and amount of shell placed (or other materials).



Mike Wilberg reviewed the data on abundance and natural morality from the Populations Models for each of the following 7 regions in the Choptank complex: Broad Creek, Lower Choptank, Middle Choptank, Upper Choptank, Tred Avon River, Little Choptank River and Harris Creek. He noted the OysterFutures Simulation model will be used to project effects of different management options that the Workgroup has identified and suggested this was a very complex model. The model will reflect and provide monthly estimates for the harvest season from October 1 through March 31.

The Workgroup discussed the following topics on the model: abundance; spat on shells; validating the model; less variability and lower abundance since 2000; areal measurement; high mortality in closed areas; habitat loss; enforcement and explaining compliant behavior; oysters per bushel; price per bushel; and nitrogen removal.

Workgroup Questions and Discussion Points

- **Abundance.** How did you calculate relative abundance? A*: Didn't put up the modeling equations. Using the oyster surveys as estimates of relative abundance per area of oyster bottom (square meter). Will change/scale in proportion as oyster abundance changes. The dredge-data needs some sort of correction.*
- **Spat on shells.** County Oyster Committee spat on shell included? *A: Yes, it is in the data. ORP handles everything. County goes through ORP.*
- Any accounting for shelling that might make more habitat available? A*: Yes, in terms of spat sets. Model looks for how many oysters appear in survey.*

- Can you correlate that with good spat sets? *A: That is very difficult to do because the spatial scale of the monitoring does not match shell plantings. Fishery catch per hour is compared to abundance of oysters in harvest category. X amount of harvest will be removed from population each year.*
- **Validating the model.** What data did you use for validation? *A: It is a statistical model with no validation. For model validation we would compare model estimates with independent estimates. Incorporate all available information into the estimates.*
- What about going back the following year and do the same survey? *A: We are somewhat doing that in the model but it is not quite direct validation. We have to predict fishing effort and abundance.*
- Sample 2nd year population to validate the model? Need something there to have confidence in the model's accuracy. *A: Ideally we would be able to do that. Impossible to do predictions. Model not at the bar level but all of creek, etc. The scale isn't right and the data is not complete enough. Less than 50% of the bars are sampled.*
- Perhaps this can be considered as a separate project allowing for the same practices in a more controlled situation to prove the model itself. If we are putting our faith in models, we have to be confident they are accurate. A*: Won't be able to give you certainty in this project. However, this style of model has been used successfully in other fisheries around the world. None have gone through a model validation process because it is too difficult for these kinds of models. Look at the results and test whether they make sense. We will show the data and how the model fits the data. We will show what happened in the past and get your input on how well model captures the trends. Hopefully, this will help develop confidence.*
- **Less variability and lower abundance since 2000.** Before 2000, it looks like there was higher abundance and variability. After 2000 it looks less variable and lower. Why? *A: We will show mortality events in late 90s early 00s. Population was depressed in 00's indicating a longer downward trend.*
- What % of oysters were legally available for harvesting in Broad Creek? *A: Low levels in the early 90s and 00s. up to 40% and relatively high in recent years.*
- Shell added in Broad creek? *A: Yes, but in pretty small amounts related to whole habitat.*
- With no change in shell, why was exploitation high? How to account if there is not additional shell on the bottom. *A: Take fall survey dredge trend- and how harvest affects trend.*
- Everything is status quo with shell but still going up and down? What are the variables? *A: Doesn't expect shell changing as it is hard to estimate. Only estimating one number. The assumption is that habitat not changing year to year.*
- **Areal measurement.** If it is not showing any variation why wouldn't it be going down? A*: This is the most abstract thing that the model estimates and it is not on a volume basis. It is an areal basis of oyster bottom. Areal measurement makes it more stable. Not showing fluctuation is caused by how we model this. Broad Creek is the outlier- it has maintained same conditions over time.*
- How did you do habitat? Square kilometer. If shrink scale still flat. A*: Yes. Start out when sonar map was made. 2011. We know area of habitat. Model estimates the trend away from that. Not accounting for oysters dying and creating new habitat.*
- Show how this might have changed. A*: Describe what happened in past to get numbers for simulation model which will run into the future. Try to get all data in past to get best estimate of what is in the water today. Not using this model to show how shells will improve in the future.*
- In terms of harvesting Broad creek, 40% harvest is contributing 60% to the shell density? *A: That is what is happening biologically, but this model doesn't show that.*
- **High mortality in closed areas.** Why is the mortality high in the closed areas? A*: With survival at 60% it is lower than in other regions. Natural mortality and the Harris creek conundrum. There could be one of three explanations: high natural mortality rate; poaching; and Patent tong is less efficient in areas you don't fish in over time. Fall dredge survey data doesn't show natural mortality. In terms of illegal harvest, the exploitation*

rate is too high and you would expect to see scars on the bottom which are rare. The decrease in patent tong catchability over time may be supported by the Delaware Bay experience (areas fished less made it harder to collect oysters in dredge surveys). (Delaware). Do not think this is natural mortality causing this.

- Why not do a more scientific survey with diving etc. *A: Some diving studies have been conducted on artificial reefs.*

For each of seven different regions there will be values for: Initial Density; Habitat category; Shell fragment; Shell with mud and sand; All shell; and Shell with some relief- 3D reefs (200 oysters per square meter) The model will apportion the oysters to different regions and habitat types.

In terms of reproduction, the model provides estimates on how many eggs a 6-inch oyster produces each year for one spawning event (~150 million eggs). The model distributes oysters to bars based on the larval transport model and the larval and post settlement survival (0.1%) The model calculates how many oysters can settle in an area based on the quality of habitat. After spat, we follow oyster growth as they age, and by age 3 most are market size. We estimate the natural mortality trends based on 2005-2015 data, which we assume will continue in the future.

Workgroup Questions and Discussion Points

- **Habitat loss.** How quickly are we losing habitat? Tricky issue. For Maryland it is an average 16% per year. For Virginia it averages 35% per year and for New Jersey it average 18% a year.
- **Enforcement.** Are you estimating the poaching? *A: Yes, and including a mechanism for it.*
- Did you try to get data from tickets? *A: No not able to get at that.*
- 30% is high for poaching and is not reasonable to assume 5-10% is probably closer to the mark. *A: 30% not a season long estimate. Start with 5-10% at beginning of the year. The goal is a season long average of 10%*
- Is it the % or the mechanism that is the issue? Trend for higher number of citations for smaller oysters. *A: Reflects a trend in effort and trend in enforcement. (Oct/Nov).*
- Take into consideration the rate of effort-- from lower to higher %-- to see how it affects bottom line across the season. *A: The model calculates # of trips, where they go and the catch.*
- **Estimating compliant behavior.** What about starting with 1% vs. 5%? *A: We start with the average at the beginning of the season and what we expect the average compliant behavior would be. Behavior compliant at beginning of season, drifts as the season goes on.*
- Does it show it is less than compliant? *A; It shows that as harvest gets smaller oysters (2.9 inches) they will be thrown back in the culling process under that behavior.*
- Consider the size distribution of oysters out there. Gives us approximately-
- The supposition is the problem. 30%. *A: The reason we put this together was the observation of compliance at beginning of season, less compliant at end. Estimated 30%- average with 10% noncompliant as end of season.*
- 95% of boats will comply from beginning to the end. 5% will be non-compliant at the end. Closer to end of the season- cut shorter to save "30%" of the oysters. *A: That is analternative way to come up with a reasonable number.*
- **Oysters #s per bushel.** You won't get 500 3 in. oysters in a bushel. More likely 250-300 if you are lucky, and often less. *A: Using an average of 350 per bushel from an old DNR report. We will try to fix it to get something closer to reality.*
- **Price per bushel average.** Consider comparing data for 2015 and 2016 with 2012-14. Trend now is different from the historic market.

- The formula doesn't hold true for today. You have to figure freight prices vs. direct market prices. There is demand in November/December, but January doesn't see a price drop. Demand has slowed down this past year. Currently about $40 a bushel average. Last couple years it was $45-50 average. *A: If this doesn't look like a real pattern, we need to adjust and consider alternative ways to do so. We want to predict what the monthly pattern will be in the future*
- **Nitrogen removal.** Why is this important? *A: potentially as a benefit for oysters in the water to help clean up the Bay.*
- In situ or removal by harvest. Denitrification. *A: Jeff Cornwell's research is the basis for the figures included in the model. Don't have denitrification data by harvest.*

III. MODELING OPTIONS

A. OVERVIEW OF MODELING OPTIONS

In the afternoon, Mike Wilberg reviewed the options identified by the Workgroup, provided an initial performance summary and discussed Workgroup observations and fielded questions.

1. **All Regions- All Hang Tong Option.** What are the water quality parameters? *A: Assumes water quality effects on oysters today is the same for the next 25 years. E.g. no worse dissolved oxygen. We can look at future change in OysterFutures Phase 2.*
    - In terms of natural resistance to disease will you consider a progression going through the year? *A: We are using recent low period for the model. Mortality decreases because developed resistance. Potential natural mortality rate could go lower than included in model. Include a run driving down the mortality a little bit. Limit on understanding- longevity studies in aquarium. Try to do something with that.*
    - Put current date for year zero? *A: Yes, good suggestion.*
2. **Everything's a Sanctuary (moratorium)** *Longer term decrease projected so it is not a silver bullet to bring back oysters. Closer to status quo.*
    - Does any data assume creating viable industry with hatchery input. Create sustainability and investment in processing and create the shell and rebuild habitat. *A: Model assumes increased habitat with spat on shell, but we don't have the mechanism that would allow for investment in processing or increase in aquaculture to supplement wild population and shell creation.*
    - Lack of habitat seems to be stalling the system. Are hatcheries a component? *A: Shell most crucial part of restoration effort.*
3. **Abundance All Regions= 3-year and 4-year rotational harvest.**
    - Are we assuming half of the area closed/open every other year. Half amount of harvest? *A: This will compress the same amount of effort into a smaller area.*
    - Do we assume directly rotational without planting? *A: Yes.*
    - How do these compare to the status quo? *A: 20% higher in beginning and 30% at end compared to status quo.*
    - What would harvest be? *A: will look at other performance metrics.*
    - Areas are low productive areas. When it is rotated as an area it won't produce enough oysters to make it work. Are we over pressuring a certain area? A: VA has a problem. On paper looks good. Drive 3 hours to harvest oysters? VA rotation has created similar problems. Comes out looking nice- but may be creating another problem in terms of cost effectiveness. *A: Increased pressure is included in a response in the model. Other things we can't include in the model such as watermen's on-the-water experience. Consider other options with better, safer, less risk. Changing travel*

distances and profitability. Hard to include in the model. Still an important thing to keep in mind when thinking about policy.

- If we are compressing the effort, what will be the impact? What impacts will be for pounding the place hard. *A: Larval transport is figured in the model – spat settling and accounted for. Crowding of fishermen is a potential issue. Assumptions consistent with recent response to oyster abundance.*
- Does the rotational harvest include Sanctuary areas? *A: No.*
- In the model we are focusing on the Choptank complex for rotational harvest. The Choptank Oyster Advisory Committee is considering recommending bay-wide.
- Create 6 different locations for rotational harvest to avoid derby scramble to those locations. *A: The main purpose today is to give examples of level of detail to include an option in the model. We want the Workgroup members to help draw on maps where those locations might be modeled.*
- Can the model show the difference if we rotated all existing areas open now? *A: The model is not designed to address that well. Trips in each region are not well captured in the simulation.*
- If Harris Creek is out of the picture so should Broad Creek. You can run both with the understanding that there is anxiety of having Broad Creek in the picture. A: *We will need to see how well it is represented on habitat map. May need assistance to show if sonor data didn't show.*

4. **Abundance- Lower Choptank River.**
   - *This option adds an inch deep shell over every square meter in the Lower Choptank River and all areas open to fishing with shell planting on oyster bars.*
   - Why is abundance leveling off over time? *A: There appears to be a balance point in terms of oyster production There is 15% degradation of shell each year built into model.*
5. **Three-year rotation-adding shell in Lower and Middle Choptank & Broad Creek.**
   - *This will cost a lot but triples the oyster abundance. May be able to test a "complete fishery" concept.*
6. **Adding shell in the Lower Choptank with three-year rotation.**
   - *This option improves abundance.*
7. **Compliance option**
   - Is the model sensitive to compliance early and late in season?
8. **Middle Choptank restoration with 2-foot reefs.**
   - *This is an expensive option.*
   - Building 2-foot high reefs will be very expensive. While there is higher abundance at the beginning, there is a decline over time. Won't sustain over time in that region.
   - Not a continuing restoration but a one time one-year effort.
   - Just build them and rely on natural spat sets.
   - Because wouldn't recruit well into the future. Oysters not producing enough shells. No fishing helping the process along. Degrades anyway.
   - We haven't seen this in the Choptank River system for a long time.
   - At the end, this option is double the status quo.
   - Why was the Middle Choptank chosen? *A: If we ran model out, we don't know where or when it would level out.*
9. **Lower Choptank- Spat on shell on 1/3 of Lower Choptank, every 3 years in areas open to harvest with rotation.**
   - *This option provides a boost in production. 50% by year 5 and doubling by year 25. Fishery regulations are the same. Power dredging allowed. Adding spat on shell over larger areas without a harvest rotation.*
10. **Lower Choptank - Spat on Shell on 1/3 of lower Choptank every 3 years.**

- *This option provides a boost in production. 80% by year 5 and 250% by year 25. Status quo regulations in place. Reduced number of trips by 25% vs. original model*
- Abundance increases in year 25 provide more 4 inchers than 3 inchers
- Where are we going to get shell.? Looks like nothing will happen without shell. Should we dig shells in the Bay?
- Year 5- similar to more abundance- adding more shell or more spat on shell makes a difference.

B. OPTIONS AND IMPACTS

1. **Harvest**
   - *These options have less effect on harvest than abundance. Opening more area would increase harvest a little. In terms of rotational options, the tradeoff is lower harvest. In 25 years, some with shell added to large areas may increase harvest to 1.5 million. Spat on shell options may increase harvest to 1 million bushels a year. Status quo option increases in harvest across all regions.*
   - We are not considering how the option takes pressure off the lower bay. *A: We are only considering the Choptank system and not the rest of the state.*
   - We need to make sure this is noted.
   - Harvest by region by year 25 with shell or spat on shell brings big harvest increases.
2. **Fishery Revenue**
   - *Adding shells/spat on shells predict over $50 million a year increase.*
3. **Cost of options—25-year cumulative**
   - Shell placement in 3 areas- $200 million
   - Restore everything with 3 foot reefs- 1.2 billion
   - Cost for granite similar to shell- similar- $60 million.
   - No maintenance plan for current restoration efforts? *A: Goes out 6 years.*
4. **Filtering- Ecosystem metrics**
   - *Seston deposits are not as responsive as abundance and harvest in year 5. Shell and spat on shell may triple the filtering. This is tied to the size of the oysters and filtration rates.*
5. **Nitrogen Removed**
   - Value of a pound of nitrogen-removed-
   - Estimates from economic modeling considering costs of other methods. $850 a pound.
   - Consider trading nutrient credits for oyster restoration money? Over 5-year period could bring serious $$ in the billions.
   - Remove nitrogen oysters from the system? *Aquaculture BMPs help remove. You have to have lot more oysters to get credit. Builds up over the years.*

IV. WORKGROUP REVIEW AND RATING OF MODELED OPTIONS

Mike Wilberg presented the range of options the Workgroup had identified and refined at its earlier meetings. For each option the Workgroup rated its acceptability and support, discussed concerns and offered suggestions to the modelers.

A. ROTATIONAL HARVEST MODELED OPTIONS

Rotational Harvesting Option: Consider developing a rotational harvesting strategy that features monitoring and builds upon lessons from other fisheries and addressing questions such as:

- Data collection involving watermen and the state to inform management;
- Criteria to ensure a standing stock for when to open or close an area;
- Strategies to avoid concentration of harvest in few areas;
- Significant changes in management approaches;
- Providing local access for rotational harvest;
- Enforcement and compliance strategies; and
- Investments needed to jump start initiatives. *[Average Rating: 3.6]*

Questions regarding modeling results prior to rating

- Fishery revenue on p 31 vs. Abundance p 6- Does this take into account all performance measures?
- Clarify the scenarios regarding status quo? *A: All areas open to fishing on the maps would be put into rotation. All other areas will remain open. Three regions with rotational plans based on maps. All existing sanctuaries remain sanctuaries.*

1) Two-year rotations in the Lower Choptank, Middle Choptank and Broad Creek.

	Support (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
Mar. 17 Rating	**92%**	**1**	**11**	**1**	**0**

Mike Wilberg presented the option and the Workgroup provided comments on their ratings. Concerns raised included: a 2-year rotation may not be enough; no gear type was stipulated in the option; compressed derby effort; rotating the whole area vs. pieces of the area; rotation in areas with low natural spat set; funding to make the rotational system work; no reseeding or restocking assumed.

Workgroup comments following the rating:

- *Major Concerns: 2*-year rotation will not be enough
- *Minor Concern:* that sanctuaries are status quo and not open in the option.
- *Minor Concern:* taken the whole area vs. pieces of the areas to put in rotational harvest.
- *Minor Concern:* No gear type stipulated in this option- concerned with this.
- *Minor Concern:* Concern with depleting the resource because effort compressed in an area in a rotation system.
- *Minor Concern:* This may not work in areas where there is a low natural spat set.
- *Minor Concern:* Where will investment come from to make this rotational system work.
- May look good on paper but not work on the water.
- *Minor Concern:* concerned about anything with a negative trend (but still maybe bit better than status quo into the future.
- *Minor Concern:* hard to give an opinion- assumption that we will replant in a vigorous way? Not sure what we are basing our opinions on.
- *Minor Concern:* clarify the rotation, e.g. open for entire season or limited? E.g. 5-6 weeks, 2-3 days a week?

- Address derby efforts**.** Based on Virginia example, we need to address compressing all effort in a derby.
- Design rotational harvest so there are multiple areas open same days for limited times- minimize.
- Suggest considering alternative type rotations within a season. 3 period rotation.
- Consider alternative years vs. different areas within a season.
- Model currently uses the entire Choptank system. Consider dividing the area into three parts- 1/3 open 6 weeks and the other 2/3rds closed in year one. *A: That would take recoding of the model. Can't do both at the same time.*
- In this option is the public fishery area open every year? *A: Yes*
- Many watermen will go to where the catch is better, some will stay in own areas and catch less.
- Tried some of this in the past e.g. above the bridge. We should be learning from our experience.
- Reseeding and restocking. Go forward and see if we will recommend an aggressive re stocking/reseeding re-shelling? This option is based on no reseeding? *A. Yes.* Might have rated differently knowing that.

2nd Round of Discussions

- Model that opens everything up to see what happens? *A: yes. Sanctuary parts open only to hand tongs. (#2 is open to everyone- hand tongs.)*
- Everything open/everything closed.
- Why not open sanctuaries in the Choptank? *A: Federal funding precludes that.*
- Can you include the creeks in Little Choptank that haven't had federal investment? *A: Caveat is how good the habitat maps are in these areas- e.g. there may not be sonar surveys. Need Workgroup help to draw the habitat.*
- What is the impact of harvesting/cultivating to the bottom? *This model doesn't address that. There may be some new data coming in the future. In the model harvesting doesn't provide any benefit. In the model harvest doesn't negatively impact other than removing live oysters.*
- Does the model account for accretion? *A: Volume of habitat based on live oysters, not directly on the dead oysters.*
- What is impacting habitat besides degradation? *A: Model assumes X amount of shell based on # of live oysters.*

2) Three-year rotations in the Lower Choptank, Middle Choptank and Broad Creek.

	Support (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
Mar. 17 Rating	**54%**	**0**	**7**	**4**	**2**

Mike Wilberg presented the option and the Workgroup provided comments on their ratings. Concerns raised included: the option and different gear types; abundance declines; does not account for different participation in the fishery; oyster size and oyster price; fishery revenue; economic value of participation in the fishery; prices variation and oyster size; seeding and natural recruitment; survival rates for spat on shells and natural recruitment.

Workgroup comments following the rating:

- *Not Acceptable 1*- This option doesn't clarify gear types and does not provide for shelling. Would change these a lot. Not acceptable without knowing that.
- Procedurally- if doesn't get consensus where does it go? *A: It remains and is carried forward in the Workgroup's records. Any Workgroup member can bring back any option.*

- Unclear why abundance declines. Why is this happening? *A: May relate to the open areas (bigger/smaller, better/worse conditions).*
- Clarify why the fishery revenue goes up and down over 25 years.

2nd Round of Discussions

- Clarify whether there will be seeding vs. natural recruitment in the option.
- We should distinguish survival rates between spat on shells and natural recruitment. Important to indicate the differences and expectations. *A: Model does have a difference for spat on shell. Model assumes 20% spat on shell survive from planting to Oct 1. The average is based on OPR monitoring.*
- Are the model rotational harvest options with limited entry at 25% & 50%? *A: Yes.*
- In the model, do rotation areas continue with the same gear type they currently have? *A: Yes. Model says gear type won't change from status quo in any of the simulations except hand tongs in sanctuaries.*
- Clarity on this option can help gain watermen acceptance of rotation strategies
- Does the model maximize the economic value of participation in the fishery related to market demand? This is important in terms of public investments. *A: Tell us what market demand is at particular times of the year. Nothing in model presently.*
- Could this be handled in the economic model? E.g. November-December, February-March. Open areas at that time to maximize value. Spread the season over the 6 months. This should be a major consideration in everything we do here.
- It is important that the model will take into account that oyster price varies by the oyster size.
- When there is an opening, how do you model additional pressure? *A: Model has some built in information (more oysters get more effort). Stronger than that? E.g. Overcrowding of bars. Mortality is in the model- on average- 20-30% mortality each year. Left this random in the model. There isn't evidence that oysters die at a maximum age but oysters grow rapidly in first 3 years. Fishery research struggles with the questions of the optimal age of oyster.*
- What fraction will be 5-6 year olds? *A: The fraction will be relatively small.*
- Look at economic value for a 3, 4 and 5 inch oysters. These will go to different market. Returns on 3 inch will be box/half shell and are more valuable. Pay a difference in size of oyster? Look at this from watermen's perspective first.
- Can we build in a relative price per size?
- Are aquaculture oysters consistently priced throughout season? *A: With year-round markets, the price is pretty stable.*
- What is the difference in price between aquaculture and wild oysters at 2 ½- 4 inches? *A: Wild oysters are priced around $.32-.35 cents while aquaculture oysters are price around $.50-.60 cents.*

3) Four-year rotations in the Lower Choptank, Middle Choptank and Broad Creek.

	Support (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
Mar. 17 Rating	**62%**	**0**	**8**	**2**	**3**

Mike Wilberg presented the third rotational option and the Workgroup provided comments on their ratings. Concerns raised included: no gear type was stipulated in the option; rotating the whole area vs. pieces of the area; and no reseeding or restocking assumed.

Workgroup comments following the rating:

- Many of the same concerns as Option 2.
- Why are we rating this option as more acceptable than option 2?

B. ENFORCEMENT OPTION

B. Address and provide funding for enforcement presence on the water (both in increasing numbers and quality through training) to address poaching and support strategies such as focusing on the buyer level. *[Average Rating: 4.0]*

Mike Wilberg presented the option and the Workgroup provided comments on their ratings. Concerns raised included: basis for compliance percentages; oyster size and age; disease and immunity; poaching; and illegal harvest in sanctuaries.

Questions and concerns regarding modeling results

- Compliance option (10th bar on pp 3-6)
- Status quo should be labeled or shown as a flat line.
- Compliance= zero- all compliant with minimum size limit.
- No taking out of sanctuaries- no harvest in there
- Blue line- size of oysters harvested. Compliance run just using the blue line.
- The model assumes that the size limit regulations will not change over 25 years.
- Why the minimum size of 3 inches? *A: Since the 1920's it has been 3 inch which has held stable over time.*
- What % of smaller oysters is estimated in a bushel?
- Show if everyone was in compliance, how does it compare with the status quo.
- What is the status quo in terms of compliance? 30%? *A: Status quo is compliance in first 2 months and less compliant at the end of season. We will review and adjust based on the earlier discussion.*
- Blue line is less than 3 inches? Modeling scenario suggests 5% of catch coming out less than 3 inches. Watermen legally still have to put that back overboard. It is termed "slop allowance".
- Should be half of 5% at around 2%. Watermen are shooting for zero but state provides a buffer zone.
- The Workgroup will rate this again once an adjustment of the compliance % based on the discussion is made.

1) Full compliance with the current (size limit) regulations.

	Support (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
Mar. 17 Rating	**79%**	**0**	**11**	**3**	**0**

Workgroup comments following the rating:

- 2s- Not clear what we are voting on here.

2nd Round of Discussions

- What would be the impact of slot limit would be? In terms of ecosystem services with that in place or without in place. Minimum/maximum size. *A: Need range of sizes- 3-4 ½ inch? Look at seston and denitrification graphs per bio mass basis. Larger oyster contribute more.*
- What about an option that includes harvest in sanctuaries? We know it happens.
- Look at both impact on waterman and ecological services. Protect larger oysters, protect your spat set?
- What about a slot limit? A: May create an enforcement problem. Another thing to be on top of and would make harder on divers and skip jacks who target bigger oysters.

- Is there a disease or immunity issue with larger oysters? *A: The largest oysters don't have more disease than smaller sizes.*
- Need to know how much longer they will live, egg production etc. in order to set the slot based on this. *A: The model is already doing this. Sail dredge and divers are a small fractions of total harvest. Could apply slot limit to different gears.*
- Harvesting in sanctuaries is illegal and hard to quantify. Perhaps using the # of citations over the past 3 years (around 70) for poaching in sanctuaries as a % of number of trips? *A: The modelers have been thinking about this since last meeting in terms of how to quantify and include in the model. Harris Creek has a low level of poaching based on review of sonar detection of scars on the bar. Low level of fishing mortality in those region (e.g. 1% of what it is in legal areas). Works for larger sanctuaries to represent poaching. We could turn that on and off to see the overall effect.*
- Poaching is not as bad now as it was 10 years ago. This decline will continue as you remove this element from the system each year. E.g. 2 boats receiving 5 citations this year. Not sure if we need to put a % on it or not.
- Modelers will ask NOAA to give an estimate of a fraction of area surveyed that has scarring on bottom. Was told previously that this was less than 1% of the area.
- Create low medium and high % of trips based on the NOAA numbers. Sonar bottom maps will be used to quantify level of poaching. Estimates will come from Harris creek and can be applied to all sanctuaries.

C. Use of Assessment of Population in Management Options

- *Not modeled*

D. Limited Entry Options

A) Consider limiting entry to oyster fishery to watermen making the majority of their living from commercial fishing. [Average Rating: 3.9]
B) Create a limited entry oyster fishery. [Average Rating: 3.75]

Mike Wilberg presented the options modeled noting the Abundance time trend was on page 75, and the Status quo on page 62. The Workgroup provided comments on their acceptability ratings. Concerns raised included: result is based on current participation; latent licenses and rotation and more oysters; impact on fulltime vs. part time watermen; and accuracy and use of historical landings.

1) 25% reduction in effort.

	Support (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
Mar. 17 Rating	**100%**	**0**	**14**	**0**	**0**

Workgroup Comments following the Rating:

- *None*

2) 50% reduction in effort.

	Support (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
Mar. 17 Rating	**86%**	**0**	**12**	**1**	**1**

Workgroup comments following the rating:

- Is this based on the level of participation/effort today? Or possible level of effort in the future? *A: # trips based on # of oysters in water. 50% number of trips (effort) relative to the status quo. Fewer licenses=fewer trips. Can't get at it as directly as they would like.*
- More oysters= higher interest in participation and there is currently a reserve of licenses that could get activated. Important that participation today is with mostly watermen, but if more oysters are available, part timers will "flood in"
- "Latent" license-(p 8 A.)
- To achieve 50% reduction, we would need to take out up to 70% of licenses that are not being fully utilized.
- Reduce trips by reducing season, buy backs, dig deeper about how to achieve these two levels and see if there is guidance for modeling.
- Can you use the # of active licenses and work that into the model? *A: try to do better job going forward.*
- Probably about 25% of licenses are held by full time watermen. Cutting down by 70%. If we keep the licenses the same, they will jump in and hurt the fulltime watermen. Limits will get cut, our trips will be cut and they will pay the price. This is a hard issue that impacts full time watermen directly.
- 25-50% reduction of part time watermen. This will be an important consideration if the DNR decides to go into a rotational scheme.
- When you use historical landings as a basis, you have to consider how accurate the reporting history has been. The Blue Crab fishery experience should be looked at in terms of lack of accurate self-reporting. *A: With oysters you have the sell tickets. For the model we are assuming accurate reporting. Looking here for rates of effort in years past.*

2nd Round of Discussions

- Helpful to discuss different ways to achieve the reduction levels.
- Can the model determine different numbers in terms of licenses and their impact? *A: Will try but can't guarantee.*
- Where will the funding come from to address the revenue loss associated with a reduction of licenses?

E. HABITAT MODIFICATION/RESTORATION OPTIONS

A.) Focus on strategies for increasing the funding, use and reclamation of local shells from the Chesapeake Bay and from local watermen to supplement bars and increase the viability of the oyster resource. [Average Rating: 4.0]
B.) Increase productivity of existing bottoms by improving habitat and structure. Increase the potential productivity per acre of existing bottoms by smartly managing them and doing it right. [Average Rating: 3.9]
C.) Develop a strategy that tests the effectiveness of strategically placed 3-dimensional bottoms with artificial reefs and alternative substrates. [Average Rating: 3.9]

Mike Wilberg presented the options modeled and the Workgroup offered initial questions on the results and provided comments on concerns following their acceptability ratings. Concerns raised included: result is based on current participation; latent licenses and rotation and more oysters; impact on fulltime vs. part time watermen; and accuracy and use of historical landings.

Workgroup comments and questions before rating

- Applying about an inch of shell.
- What are the cost estimates for these options? *A: $3.3 million a year. ($82 million over 25 years)*
- Any analysis of payback for the public on investments? *A: Not yet but will.*

1) Add Shell to each bar every 3 years in the Lower Choptank.

	Support (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
Mar. 17 Rating	**100%**	**11**	**3**	**0**	**0**

2) Add Shell to each bar every 3 years in the Lower Choptank, Middle Choptank and Broad Creek.

	Support (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
Mar. 17 Rating	**100%**	**13**	**1**	**0**	**0**

Workgroup comments after the rating :

- What are the costs of this option? *A: $9 million year. $227 million over 25 years.*

3) Add Shell to each bar every 3 years in the Lower Choptank, with 3-year rotational harvest in that area.

	Support (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
Mar. 17 Rating	**93%**	**1**	**12**	**1**	**0**

Workgroup comments after the rating :

- Rotation is the major reservation.

4) Make 3d reefs in the current sanctuary region of the Middle Choptank

	Support (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
Mar. 17 Rating	**43%**	**0**	**6**	**8**	**0**

Workgroup comments after the rating:

- $95 million costs for one year to cover this big area
- Concern that this needs to be tied to investment into commercial fishery. Restoration won't go forward without watermen. It will be hard to continue get these funds without creating jobs at the same time.
- Is this a waste of a commodity? Why not spread it out?
- Concerned about how and where we place the 3-D reefs. We should be allowing commercial sector an opportunity for fishing in that area.
- Would this have to be 2 feet? *(data Allison Colden to Mike Wilberg).*
- Are there estimates of how much spat on shell is reflected in this option? *A: No*
- Should we assume all 3d reefs built with shells? *A: Yes.*

2nd Round of Discussions

- Data on height to see if it can make a difference.
- Consideration of another area more beneficial for restoration efforts (larval and survival). *A: Middle Choptank is good area for larval transport. Work with Stephanie to include other than Harris Creek*

restoration. Fill in the other sanctuaries in Choptank complex. Survey data from Harris Creek in the estimation models. Small bit from little Choptank. None in Tred Avon. Diver surveys and alternate substrates- 2016. Haven't seen data. May be ready soon. Compare what divers vs. patent tong sees but may have limited use.

- Verification and testing of sampling methods should be done.
- Performance measure of a shells ability to catch spat when silted over? *A: included in 15% habitat loss. Haven't provided performance metric on how much lost each year. Will try to build in the performance measure.*
- What about monitoring biases? *Monitoring has built in biases that we should be aware of. ORP monitoring data. Catchability bias with diver data. This is being addressed going forward.*

F. FEE AND TAX OPTIONS

Evaluate and consider changes/increases of oyster fishery related fees and taxes.
[Theme A—Average Rating: 3.9]

Mike Wilberg noted this option was not modeled at this juncture as it was tough to get at different individual license effects in the model. He suggested holding off on this and returning later to this.

G. SPATIAL OPTIONS

A.) Consider modifying regulations so a single bar is not divided between gear types or open and closed. [Average Rating: 3.9]
B.) Modify the shapes of sanctuaries so that whole tributaries are not closed.
[Average Rating: 3.6]
C.) In restoring tributaries provide limited access to the fishery that can allow fishermen the opportunity to work on that river while the restoration plan is developed.
[Average Rating: 3.6]
D.) Continue the Sanctuary program with some modification that may include providing for maintenance including the potential for limited harvest in tributaries and assessing the state of oyster bars within sanctuaries. [Average Rating: 3.4]

Mike Wilberg noted this option was addressed and incorporated into other habitat options

H. REGULATIONS RELATED TO SPECIFIC GEAR OPTIONS

A.) Conduct more and better research to inform regulations and better understand the efficiency of gear types and their impacts on the fishery. [Average Rating: 3.9]

Mike Wilberg noted this option was not modeled.

Workgroup Discussion

- Recommend investing in branches of the Little Choptank designated for hand tong.
- Recommend programs to get Federal seed funding to get those back into production.
- This will help spread out the effort and complement rotational harvest. *A: We can include spat on shells in those areas open to hand tong with three year rotation planting.*

- We have to get to the level of management in some places in the public fishery to bring back hand tonging.
- ACOE can't fund things that can be harvested? NOAA can do some funding. USDA can potentially provide funding.

I. STOCKING

A.) Focus on strategies for increasing the funding for the use of Spat on shells everywhere not just in a few places. [Theme C—Average Rating: 3.9]

Comments and clarifications before rating

- *Planting 1/3 of regions. Harvested 3 years after planted.*
- Just shelling produces more oysters vs. spat on shells? *A: Natural spat set is higher. Model works with competition for space. Difference is there is more shell on the bottom. Natural spat is competing with planted in the model based on habitat volume.*

1. Planting spat on each bar every 3 years in the Lower Choptank

B.	*Support (%)*	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
Mar. 17 Rating	**93%**	**0**	**13**	**1**	**0**

Workgroup comments after the rating:

- It is the rotational component that is a concern.
- How much will each cost? *A: Lower Choptank: $8.3 per year, $207 million over 25 years.*
- Is this taking power out of counties hands? *A: No assumption on who decides in the model. Could be counties deciding to do this or the state deciding. Model doesn't address how that is decided.*
- Major investment for spat on shell needs time to grow and develop. Need to plant and let it develop in rotation. If not, don't recommend it.
- Seed it after harvesting. Close for X years.

2. Planting spat on each bar every 3 years in the Lower Choptank, Middle Choptank, and Broad Creek.

C.	*Support (%)*	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
Mar. 17 Rating	**93%**	**0**	**13**	**1**	**0**

Workgroup comments after the rating:

- $23 million per year $575 million
- Concern about rotational harvest.
- If you work area one year, won't be back for several years since they worked it and won't be large anyway. The issue of closing/opening will bring more people to harvest.

2nd Round of Discussions

- What about alternatives for spat on shells as a way to plant? *A: Would need to get a stocking density and size they would be stocked at. Will have more starting point data in a month- end of April.*

J. DISCUSSION OF COMBINATION OF OPTIONS

The Workgroup discussed some combinations that might be considered including:

- Rotational harvest- with some shell and limiting effort?

- Look at some of these options- rotation of effort (2-3-4) complementing that with some of the shell or seed on shell placement in those areas.
- Slot size regulation impact on rotation? After 4 years there should be more 5 year old oysters. Will that help over the long term with more eggs?
- Throwing back large oysters raises mortality issue. Hand tong does not have as big an impact as do patent tongs and dredging. Incorporate that into the model?
- Catch and releasing oysters multiple times will probably impact on survival rate. The time of year plays a role on that.
- Model slot limits with rotation and without rotation.

V. TESTING SUPPORT FOR MODEL COMPONENTS

The facilitator noted that at the end of the November 2016 meeting, the Workgroup members used an acceptability rating for each of the model components to gauge the Workgroup's understanding and support for the work being done on the various the model components. He asked the Workgroup to rate the components based on the review and refinements promised at this meeting and offer any concluding observations or suggestions.

A. POPULATION MODEL

1. Reproduction and Larval Transport

	Support (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
Nov. 2016 Rating	**92%**	**11**	**0**	**1**	**0**
Mar. 2017 Rating	**100%**	**9**	**2**	**0**	**0**

Workgroup comments following the rating:

- The latest habitat maps were handed out. The modelers are seeking to getting the best available info in the model. Will use color coding.
- Need to map places in the creeks above Harris Creek.

2. Mortality

	Support (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
Nov. 2016 Rating	**100%**	**5**	**3**	**0**	**0**
Mar. 2017 Rating	**100%**	**13**	**0**	**0**	**0**

Workgroup comments following the rating:

3. *The next version will include proposed changes suggested by the Workgroup at this meeting*
4. Do a run of less than 10 years? See what differences between 5 and 10
5. Mortality appears on the rise with a 16% increase since 2011.

3. Growth

	Support (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
Nov. 2016 Rating	**100%**	**3**	**6**	**0**	**0**
Mar. 2017 Rating	**100%**	**12**	**1**	**0**	**0**

Workgroup comments following the rating:

- ORPs- planted, then monitored years after. Start small up to 4 inches average, up to 9 years old.

B. HABITAT MODEL

1. HABITAT

	Support (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
Nov. 2016 Rating	**100%**	**11**	**0**	**0**	**0**
Mar. 2017 Rating	**100%**	**13**	**0**	**0**	**0**

Workgroup comments following the rating:

- 15% decline/reduction in habitat each year? *A: Amount of new growth is based on # of oysters.*

2. Habitat Coding

	Support (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
Nov. 2016 Rating	**100%**	**5**	**7**	**0**	**0**
Mar. 2017 Rating	**100%**	**11**	**2**	**0**	**0**

Workgroup comments following the rating:

- What is the source of the map showing habitat quality different regions and bars? *A: Sonor survey data provided by Jay Lazar NOAA Chesapeake Office.*
- Some bars in Little Choptank and Harris Creek are a major issue.

C. FISHERY/EFFORT DYNAMICS

	Support (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
Nov. 2016 Rating	**100%**	**10**	**1**	**0**	**0**
Mar. 2017 Rating	**100%**	**14**	**0**	**0**	**0**

Workgroup comments following the rating:

- Based on past data, the number of trips is related to the number of harvestable oysters. More oysters, more trips. Trips down to bars based on # oysters on bars
- Are gear types adequately represented? *A: Each gear type that is present in each region is accounted for.*

D. ECONOMICS

	Support (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
Nov. 2016 Rating	**77%**	**3**	**7**	**3**	**0**
Mar. 2017 Rating	**79%**	**7**	**4**	**2**	**0**

Workgroup comments following the rating:

- Plan on building in cost information to get profit out of model not just revenues.
- Includes price per month and price per size? *A: Yes*
- Price is a constant.
- Regional dynamics- may show variability in the model. Improvements will be made? *A: Yes*

- Rate what is currently in the model based on the information and new data that Chris presented and assume a price per month.
- Diesel differences will be included going forward? *A: Yes*

E. ECOSYSTEM SERVICES

1. Water Quality *(Light Availability, Seston Removal)*

	Support (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
Nov. 2016 Rating	**100%**	**13**	**0**	**0**	**0**
Mar. 2017 Rating	**100%**	**14**	**0**	**0**	**0**

Workgroup comments following the rating:

- Modelers are working on light availability data

2. Nitrogen Removal

	Support (%)	*4—Acceptable*	*3—Minor Reservations*	*2—Major Reservations*	*1—Not Acceptable*
Nov. 2016 Rating	**100%**	**12**	**1**	**0**	**0**
Mar. 2017 Rating	**100%**	**14**	**0**	**0**	**0**

Workgroup comments following the rating:

- Incorporating data from Jeff Cornwall's group on denitrification rates.

VI. NEXT STEPS

The Workgroup discussed the meeting scheduled and agreed to proceed with the meetings in May and July to complete the Phase I activities.

Elizabeth North reported that the videos of the presentations at the OysterFutures Sea Grant Symposium in October 2016 had not been completed but were still in progress. She also recounted that workgroup members decided at the last meeting to delay discussion of the communications strategy of the results of stakeholder deliberations until there were results.

Workgroup members were asked to comment on the meeting by completing meeting evaluations *(see Appendix #3)*. The meeting adjourned at 3:45 p.m. on Saturday.

Appendix #1 Workgroup Meeting III Agenda
March 24-25, 2017

WORKGROUP MEETING OBJECTIVES
✓ To Approve Agenda and Meeting III Summary Report
✓ To Receive Update, Discuss and Provide Feedback Regarding Development of the OysterFutures Modeling Tool
✓ To Receive Overview of Preliminary Results of Options Evaluated by OysterFutures Model
✓ To Evaluate the Level of Acceptability of the Results of Options Modeled Relative to Project Goals and Consistency with Performance Measures
✓ To Determine Whether Revisions or Additional Options and/or Performance Measures are Needed
✓ To Identify, Clarify, Discuss and Acceptability Rate Additional Options to be Modeled
✓ To Identify Needed Next Steps, Information Needs, and Agenda Items for Next Meeting

MEETING AGENDA DAY ONE—FRIDAY, MARCH 24, 2017		
All Agenda Times—Including Adjournment—Are Approximate and Subject to Change		
2:00 PM		***LATE LUNCH AND SOCIAL SCIENCE STUDY SURVEY (ON CAMPUS)***
1.)	**2:30 PM**	**WELCOME AND INTRODUCTIONS**
2.)	**2:40 PM**	**AGENDA REVIEW AND APPROVAL**
3.)	**2:45 PM**	**APPROVAL OF FACILITATOR'S SUMMARY REPORT (November 5 – 6, 2016)**
4.)	**2:50 PM**	**UPDATE, DISCUSSION AND FEEDBACK REGARDING THE DEVELOPMENT OF THE OYSTERFUTURES MODELING TOOL (Population and Fishery Dynamics Model, Economics Model, and Water Quality Model)**
~4:30 PM		***BREAK***
5.)	**4:45 PM**	**OVERVIEW AND DISCUSSION OF PRELIMINARY RESULTS OF CONSENSUS OPTIONS MODELED**
6.)	**6:25 PM**	**SUMMARY OF DAY ONE AND REVIEW OF DAY TWO AGENDA**
7.)	***~6:30 PM***	***RECESS AND INFORMAL SOCIAL WITH DINNER (ON CAMPUS)***

MEETING AGENDA DAY TWO—SATURDAY, MARCH 25, 2017		
All Agenda Times—Including Adjournment—Are Approximate and Subject to Change		
8:00 AM		***BREAKFAST (ON CAMPUS)***
8.)	**9:00 AM**	**WELCOME**
9.)	**9:05 AM**	**DISCUSSION, EVALUATION AND ACCEPTABILITY RATING OF MODELED OPTIONS RELATIVE TO PERFORMANCE MEASURES AND PROJECT GOALS**
~10:30 AM		***BREAK***
9.)	**10:45 AM**	**EVALUATION AND ACCEPTABILITY RATING OF MODELED OPTIONS RELATIVE TO PERFORMANCE MEASURES AND PROJECT GOALS—CONTINUED**
~12:00 PM		***LUNCH (ON CAMPUS)***
10.)	**12:30 PM**	**IDENTIFICATION OF AND ACCEPTABILITY RATING OF REVISIONS TO OPTIONS AND PERFORMANCE MEASURES, AS NEEDED**
~2:00 PM		***BREAK***
11.)	**2:15 PM**	**IDENTIFICATION OF AND ACCEPTABILITY RATING OF ADDITIONAL OPTIONS AND PERFORMANCE MEASURES, AS NEEDED**
12.)	**3:00 PM**	**GUIDANCE TO MODELING TEAM REGARDING MODEL DEVELOPMENT, PERFORMANCE MEASURES AND PROJECT GOALS**
13.)	**3:10 PM**	**ACCEPTABILITY RATING OF MODEL COMPONENTS**
~3:25 PM		***SOCIAL SCIENCE STUDY SURVEY***
14.)	**3:40 PM**	**UPDATE ON COMMUNICATION STRATEGY AND ACTIONS FOR THE PROJECT**
15.)	**3:55 PM**	**NEXT STEPS: AGENDA ITEMS AND INFORMATION FOR THE NEXT MEETING** • Review action items and assignments • Identify agenda items and any needed information for next meeting
16.)	***~4:00 PM***	***ADJOURN***

Appendix #2 Workgroup & Research Team Membership and Participation

WORKGROUP MEMBERSHIP	
MEMBER	**AFFILIATION**
WATERMAN	
J.D. Buchanan	Preston, MD, Caroline County, Talbot County Waterman
Robbie Casho	St. Michaels, MD, Dorchester County Waterman
Jeff Harrison	Tilghman, MD, Talbot County, President Talbot Waterman's Associatio
Gregory Kemp	McDaniel, MD, Talbot County, Vice President Talbot Waterman's Asso
Cody Paul	Church Creek, MD, Dorchester County Commercial Oyster Committee
Bobby Whaples	Vienna, MD, Dorchester County Waterman
AQUACULTURE	
Bobby Leonard/ MJ Dubois	Tred Avon Treats, Ruff-N-Ready, LLC.
Johnny Shockley	Hoopers Island Oyster Aquaculture Co.
SEAFOOD BUYERS	
Aubrey Vincent	Lindy's Seafood
ENVIRONMENTAL CITIZEN GROUPS	
Kelly Cox	Phillips Wharf Environmental Center
Allison Colden	Chesapeake Bay Foundation
Joe Fehrer	The Nature Conservancy
RECREATIONAL FISHING GROUP	
David Sikorski	Coastal Conservation Association (CCA)
MARYLAND DEPARTMENT OF NATURAL RESOURCES	
Dave Blazer	Maryland Department of Natural Resources
OYSTER RECOVERY PARTNERSHIP	
Ward Slacum	Oyster Recovery Partnership
FEDERAL AGENCY	
Stephanie Westby	National Oceanic and Atmospheric Administration (NOAA)

PROJECT SCIENTISTS AND FACILITATORS	
NAME	**AFFILIATION**
UNIVERSITY OF MARYLAND CENTER FOR ENVIRONMENTAL SCIENCE	
Elizabeth North	Fisheries Scientist
Jeffery Cornwell	Estuarine Biogeochemist
Raleigh Hood	Biological Oceanographer
Thomas Miller	Fisheries Ecologist
Lisa Wainger	Environmental Economist (Social Scientist)
Michael Wilberg	Fisheries Scientist
VIRGINIA INSTITUTE OF MARINE SCIENCE	
Troy Hartley	Environmental and Natural Resource Policy (Social Scientist)
FCRC CONSENSUS CENTER, FLORIDA STATE UNIVERSITY	
Jeff Blair	Workgroup Facilitator
Robert Jones	Workgroup Facilitator

WORKGROUP MEMBERSHIP PARTICIPATION- FRIDAY

MEMBER (***BOLD*** = *PRESENT*)	AFFILIATION
WATERMAN	
J.D. Buchanan	Preston, MD, Caroline County, Talbot County Waterman
Robbie Casho	St. Michaels, MD, Dorchester County Waterman
Jeff Harrison	Tilghman, MD, Talbot County, President Talbot Waterman's Association
Gregory Kemp	McDaniel, MD, Talbot County, Vice President Talbot Waterman's Associati
Cody Paul	Church Creek, MD, Dorchester County Commercial Oyster Committee Cha
Bobby Whaples	Vienna, MD, Dorchester County Waterman
AQUACULTURE	
Bobby Leonard/ **MJ Dubois**	Tred Avon Treats, Ruff-N-Ready, LLC.
Johnny Shockley	Hoopers Island Oyster Aquaculture Co.
SEAFOOD BUYERS	
Aubrey Vincent	Lindy's Seafood
ENVIRONMENTAL CITIZEN GROUPS	
Kelly Cox	Phillips Wharf Environmental Center
Allison Colden	Chesapeake Bay Foundation
Joe Fehrer	The Nature Conservancy
RECREATIONAL FISHING GROUP	
David Sikorski	Coastal Conservation Association (CCA)
MARYLAND DEPARTMENT OF NATURAL RESOURCES	
Dave Blazer	Maryland Department of Natural Resources
OYSTER RECOVERY PARTNERSHIP	
Ward Slacum	Oyster Recovery Partnership
FEDERAL AGENCY	
Stephanie Westby	National Oceanic and Atmospheric Administration (NOAA)

PROJECT SCIENTISTS AND FACILITATORS	
NAME	AFFILIATION
UNIVERSITY OF MARYLAND CENTER FOR ENVIRONMENTAL SCIENCE	
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Raleigh Hood	Biological Oceanographer
Thomas Miller	Fisheries Ecologist
Lisa Wainger	Environmental Economist (Social Scientist)
Michael Wilberg	Fisheries Scientist
VIRGINIA INSTITUTE OF MARINE SCIENCE	
Troy Hartley	Environmental and Natural Resource Policy (Social Scientist)
FCRC CONSENSUS CENTER, FLORIDA STATE UNIVERSITY	
Jeff Blair	Workgroup Facilitator
Robert Jones	Workgroup Facilitator

WORKGROUP MEMBERSHIP PARTICIPATION- SATURDAY

MEMBER (***BOLD*** = *PRESENT*)	AFFILIATION
WATERMAN	
J.D. Buchanan	Preston, MD, Caroline County, Talbot County Waterman
Robbie Casho	St. Michaels, MD, Dorchester County Waterman
Jeff Harrison	Tilghman, MD, Talbot County, President Talbot Waterman's Association
Gregory Kemp	McDaniel, MD, Talbot County, Vice President Talbot Waterman's Associatio
Cody Paul	Church Creek, MD, Dorchester County Commercial Oyster Committee Chai
Bobby Whaples	Vienna, MD, Dorchester County Waterman
AQUACULTURE	
Bobby Leonard/**MJ Dubois**	Tred Avon Treats, Ruff-N-Ready, LLC.
Johnny Shockley	Hoopers Island Oyster Aquaculture Co.
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Kelly Cox	Phillips Wharf Environmental Center
Allison Colden	Chesapeake Bay Foundation
Joe Fehrer	The Nature Conservancy
RECREATIONAL FISHING GROUP	
David Sikorski	Coastal Conservation Association (CCA)
MARYLAND DEPARTMENT OF NATURAL RESOURCES	
Dave Blazer/Chris Judy	Maryland Department of Natural Resources
OYSTER RECOVERY PARTNERSHIP	
Ward Slacum	Oyster Recovery Partnership
FEDERAL AGENCY	
Stephanie Westby	National Oceanic and Atmospheric Administration (NOAA)

PROJECT SCIENTISTS AND FACILITATORS	
NAME	AFFILIATION
UNIVERSITY OF MARYLAND CENTER FOR ENVIRONMENTAL SCIENCE	
Elizabeth North	Fisheries Scientist
Jeffery Cornwell	Estuarine Biogeochemist
Raleigh Hood	Biological Oceanographer
Thomas Miller	Fisheries Ecologist
Lisa Wainger	Environmental Economist (Social Scientist)
Michael Wilberg	Fisheries Scientist
VIRGINIA INSTITUTE OF MARINE SCIENCE	
Troy Hartley	Environmental and Natural Resource Policy (Social Scientist)
FCRC CONSENSUS CENTER, FLORIDA STATE UNIVERSITY	
Jeff Blair	Workgroup Facilitator
Robert Jones	Workgroup Facilitator

Appendix #3 Workgroup Meeting Evaluation Summary

OYSTERFUTURES WORKGROUP
MARCH 24-25, 2017—CAMBRIDGE, MARYLAND
MEETING EVALUATION SUMMARY

Members used a 0 to 10 rating scale where a 0 meant Totally Disagree and a 10 meant Totally Agree. The average ratings and comments from 13 evaluation forms that were received are reflected below:

1. Please assess the overall meeting.

8.0 The background information was very useful.
8.7 The agenda packet was very useful.
8.7 The objectives for the meeting were stated at the outset.
8.8 Overall, the objectives of the meeting were fully achieved.

2. Do you agree that each of the following meeting objectives was achieved?

8.3 Update and feedback regarding development of the OysterFutures modeling tool.
8.4 OysterFutures model demonstration and example results of simulated options
8.4 Review and discussion of current options and performance measures
8.0 Discussion and identification of any additional options and/or performance measures
8.7 Review of Next Steps and Agenda Items for Next Meeting.

3. Please tell us how well the Facilitator helped the participants engage in the meeting.

8.8 The members followed the direction of the Facilitator.
9.3 The Facilitator made sure the concerns of all members were heard.
9.5 The Facilitator helped us arrange our time well.
8.9 Participant input was documented accurately in the April Facilitator's Summary.

4. Please tell us your level of satisfaction with the meeting?

9.0 Overall, I am very satisfied with the meeting.
9.0 I was very satisfied with the services provided by the Facilitator.
8.4 I am satisfied with the outcome of the meeting.

5. Please tell us how well the next steps were communicated?

8.1 I know what the next steps following this meeting will be.
8.0 I know who is responsible for the next steps.

6. What did you like best about the meeting?

- Excellent discussions- very open and thoughtful and constructive. Good Presentations and explanation of the models.
- The continued dialogue
- Information presented and the conversation
- Open discussion
- Conversation
- The civil back and forth between different stakeholders

- Best discussion was during the identification of options and performance measures.
- Well arranged, we were able to cover a lot.
- The level of effort to make sure everyone's opinion is heard and respected.
- Great discussions, I can see consensus building and relationships growing.

7. How could the meeting have been improved?

- Making sure we get full workgroup attendance.
- In the beginning of the meeting it would be helpful to clarify what the panel should expect as next steps. I think it was unclear how decisions and ideas during the workgroup discussions would be incorporated into the next steps.
- Find more/continued watermen involvement. How?
- Full attendance
- Everyone shows up.
- Having the material earlier to review
- Faster

8. Do you have any other comments?

- Thank you for inviting me to participate in this project.

Appendix #4 OysterFutures Workgroup Purpose and Project Summary

STATEMENT OF PURPOSE. The goal of OysterFutures is to develop recommendations for oyster policies and management that meet the needs of industry, citizen, and government stakeholders in the Choptank and Little Choptank Rivers.

With funding from the National Science Foundation, we will hold a series of workgroup meetings with a representative group of stakeholders. Through these meetings, the stakeholders will produce a collective vision for the future of oysters in this region and build consensus on policy and regulatory options which will be informed by stakeholder and scientific knowledge and by the joint development and use of a modeling tool. The Maryland Department of Natural Resources has agreed to evaluate the consensus recommendations that result.

The stakeholders participating on the workgroup will be representatives from the key interest groups that affect and are affected by the oyster fishery. Researchers from the University of Maryland Center for Environmental Science and the Virginia Institute of Marine Science will serve as consultants to the stakeholders. Professional independent facilitators with experience in fisheries issues will convene the stakeholder meetings. The facilitators will ensure that a consensus-based approach which includes the input of diverse stakeholders is used to develop the collective vision and recommended actions for a sustainable and profitable future for the oyster industry in the Choptank and Little Choptank Rivers.

PROJECT SUMMARY. Achieving effective natural resource management is challenging because of the multiple and often competing objectives of different stakeholder groups, a limited set of policy options, and uncertainty in the performance of those options. Yet, managers need policies that allow continued use of natural resources while ensuring access for future generations and maintenance of ecosystem services. Formal approaches are needed that will assist managers and stakeholders in choosing policy options that have a high likelihood of achieving social, ecological, and economic goals. The goal of this project, OysterFutures, is to address this need by improving the use of predictive models to support sustainable natural resource policy and management. A stakeholder-centered process will be used to build an integrated model that combines estuarine physics, oyster life history, and the ecosystem services that oysters provide (e.g., harvest, water quality) to forecast outcomes under alternative management strategies. Through a series of facilitated meetings, stakeholders will participate in a science-based collaborative process which will allow them to project how well policies are expected to meet their objectives using the integrated model. This iterative process will ensure that the model will incorporate the complex human uses of the ecosystem as well as focus on the outcomes most important to the stakeholders. In addition, a study of the socioeconomic drivers of stakeholder involvement, information flow, use and influence, and policy formation will be undertaken to improve the process, enhance implementation success of recommended policies, and provide new ideas for integrating natural and social sciences, and scientists, in sustainable resource management. In this presentation, the strategy for integrating natural system models, stakeholder views, and sociological studies as well as methods for selecting stakeholders and facilitating stakeholder meetings will be described and discussed.