Economic Impacts of Oyster Reef Restoration

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Introduction

Why are oysters important?

- Keystone species
- Improve water quality
  - Remove nitrogen from water column
  - Filter feeders that remove suspended sediment
  - Support growth of Submerged Aquatic Vegetation
- Habitat to other species
  - Increase biodiversity
  - Provide fish for commercial and recreational fishing

Background

Oyster Decline

http://www.desdemonadespair.net/2015/03/graph-of-day-oyster-harvests-in.html

- ~0.1% of oysters left in the bay

Disease

- "Dermo"- warm-season parasite
- "MSX"- high salinity parasite

Harvesting

- Hand Tonging and Dredging
  - Habitat Loss
  - Decline in commercial harvest

Background

Restoration Site: Choptank River Complex

- Maryland tributaries- Harris creek River, Tred Avon River, and Little Choptank River
- About 564 acres designated for the reef restoration sites
- $47.61 million investment in restoration

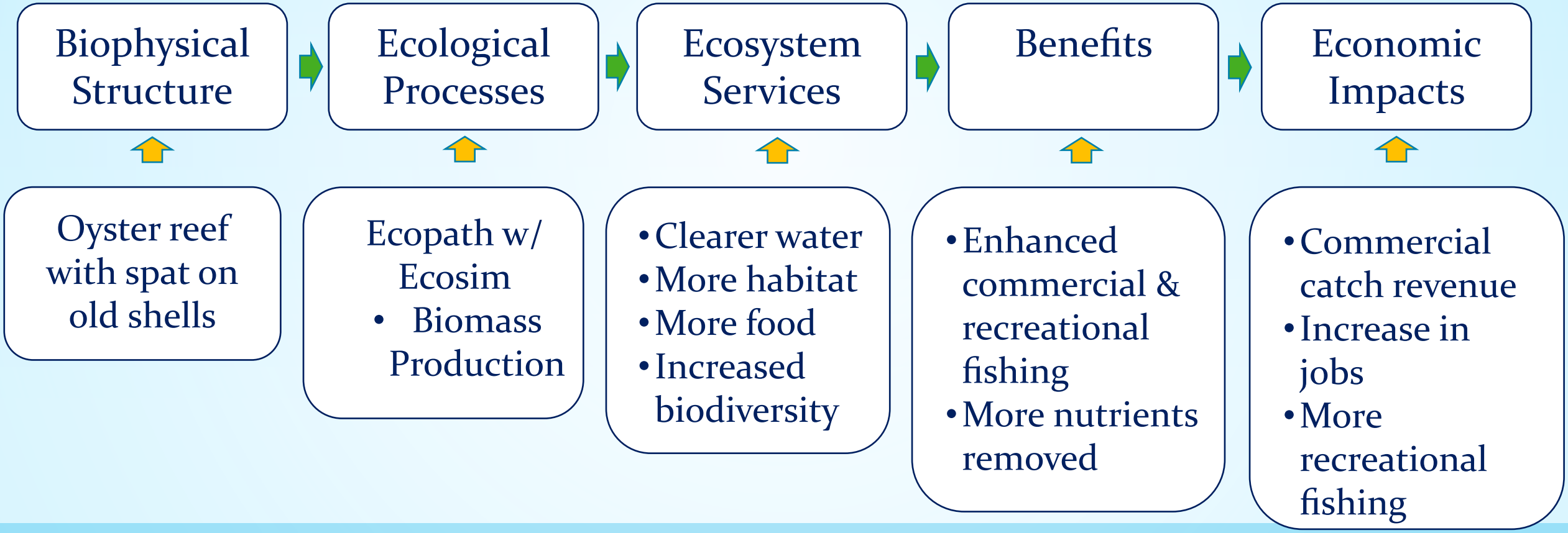
The Project

Project Design

- Creating factsheets for the public that convey the economic impacts of reef restoration.
  - Based on topics: project overview, communities affected and more
  - Goal: To simplify complex data, population measures, and forecasts for the public

The Project

Socio-economic Benefits of restoration



The Project

	Nur	Group Name	Biomass	Total Mortality	Production/ biomass	Consumption/ biomass	Ecotrophic Efficeincy
1							
2	1	**StripedBassJuv**					
3	2	**StripedBass**	ORES data, see spreadsheet "Species_mean_len_by_string_new.xlsx" (0.289 g/m2)	CBFEM 1950 model		CBFEM 1950's model "1950 Mar 08"	
4	3	**Weakfish**	CBFEM 1950's model		CBFEM 1950's model	CBFEM 1950's model	
5			bioparams		bioparams		
6	4	**DivingDucks**	VIMS report (2009) by Paige Ross and Mark Luckenbach		CBFEM 1950 model		
7			Doug Forsell's document "Forsell_F+W_2004.xls"		Anderson 1975		
8			CBFEM 1950's model				
9	5	**CownoseRay**	Link rules of thumb (2010)		EwE 2008 model	EwE 2008 model	
10			EwE 2008 model				
11	6	**Catfish**			Randall and Minns (2000) for channel catfish		
12	7	**ReefFish (incl**	Madeo Model		CBFEM 1950's model	FishBase	
13						CBFEM 1950's	
14	8	**OysterToadfis**	Lisa Kellogg's Final Report (2016)		Madeo model		
			see spreadsheet "Macrofauna Data for Tom -				

Diets | Life History

References

Organized references from the 38 species about life history and diets to be modeled.

The Project

Biophysical Structure → Ecological Processes → Ecosystem Services → Benefits → Economic Impacts

Models Used

Ecopath w/ Ecosim Modeling Software

- Mass-balanced software that examines species interactions, and group functions represented by biomass.
  - Trying to balance enough prey for the predators
  - Shows the harvesting rate in different trophic levels in ecosystem
  - Forecasts the change in fish biomass over time in the reef scenarios

Start | **Basic input**

Define groups... | Edit multi-stanza...

	Group name	Habitat area (fraction)	Biomass in habitat area (t/k	Total mortality (year)	Production / biomass	Consumption / biomass	Ecotrophic Efficienc	Other mortality	Production / consum
	StripedBass								
1	StripedBass	1.000	2.135	2.300		12.29			
2	StripedBass	1.000	0.450	0.900		4.000			
3	Weakfish	1.000	0.500		2.500	8.500			
4	DivingDucks	1.000	0.0433		0.511	120.0			
5	CownoseRay	1.000	0.200		0.160	10.000			
6	Catfish	1.000			0.280	2.500	0.800		
7	ReefFish	1.000			0.510	4.050	0.900		
8	OysterToadfish	1.000	6.800		2.400	5.000			
9	AmericanEel	1.000	2.550		0.250				0.100
1	Panfish	1.000	1.800		1.800	6.500			
1	WhitePerch	1.000	4.531		0.989	3.800			
1	AtlanticCroaker	1.000	1.650		0.916	5.400			
1	GizzardShad	1.000			0.530	5.000	0.750		
1	Peprilus spp.	1.000			2.000	7.300	0.750		
1	Menhaden	1.000			2.000	15.00	0.900		
1	ForageReefFis	1.000	35.00		3.245	9.000			
	BlueCrab								
1	BlueCrabJu	1.000	2.500	3.000		12.00			
1	BlueCrab	1.000	11.98	2.000		4.237			
1	MudCrabs	1.000	100.00		5.000	13.00			
2	Isopods,Amphi	1.000	39.00		10.000	50.00			
2	Mysids	1.000	25.00		12.00				0.300
2	Ctenophores	1.000	3.400		8.800				0.250
2	SeaNettles	1.000	2.500		8.500				0.450
2	SeaAnemone	1.000			2.200	5.000	0.990		
2	HookedMussel	1.000	157.0		2.230				0.200
2	LgClam	1.000	38.00		3.000	8.000			
2	SmBivalves	1.000	35.00		4.500	14.50			
2	Barnacles	1.000	25.00		4.700				0.200
	Oyster								
2	OysterJuv	1.000	95.00	3.200		10.27			

EwE

Model tracks each species biomass per area, mortality, consumption/biomass and how these change.

The Project

Biophysical Structure → Ecological Processes → Ecosystem Services → Benefits → Economic Impacts

Models Used

IMPLAN

IMPLAN

- Input-output model that links the change in landings values to economic outcomes.
  - Multiplier-rate of economic change in: outcome, income, employment, and revenue.
  - Shows the dollar flow in the fishing industry and the local economy.
  - Shows the positive or negative impact on the state economy.

Healthy Oysters, Healthy Economy

Reef Restoration creates more jobs & income for the Choptank River

Facts & background

50 Gallons of water that a healthy oyster can filter in 1 day.

<1 Percent of the historic oyster population remains in Chesapeake Bay.

564 Acres will be restored in the Choptank River Watershed.

100 Percent successful to date reef restorations. 10 Tributaries are planned to be restored by 2025.

Why is it important?

Oysters keep the water clean which makes a healthier environment.

Decrease in oyster population because of disease & harvest means less fish and less jobs.

Reefs attract fish and crabs that people catch. More fish also means more tourism.

The reefs slow down the waves to protect coastal properties.

NOAA PEARL NFWF

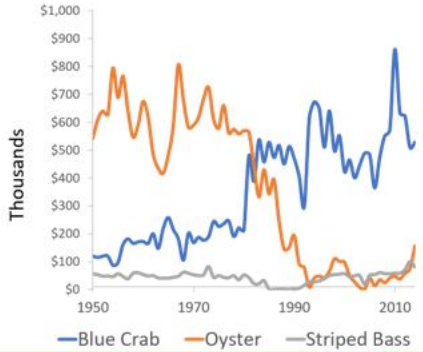
Factsheet Design 1

Importance of Harvested Fish in Choptank River

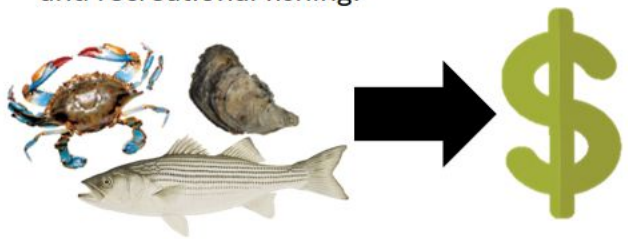


607+ Watermen in the Choptank Watershed in 2015

Maryland Dockside Value of Blue Crabs, Oysters, & Striped Bass



Oyster catches decreased, while blue crab catches increased. Oysters, Blue Crabs, and Striped Bass are popular for both commercial and recreational fishing.



Choptank River Facts

Economic Output

- Blue crab catch makes up 20% of the Chesapeake Bay's Blue Crab catch
- $807,000 value of Finfish caught
- $8.7 million value of Blue Crab caught

Commercial Fishing

- 2,322 Finfish trips
- 21,517 Blue Crab fishing trips

Factsheet Design 2

Acknowledgements

Funders

Data contributions

Literature

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- http://www.chesapeakebay.net/discover/bayecosystem/dissolvedoxygen
- http://www.habitat.noaa.gov/pdf/value_of_oysters.pdf
- http://www.vims.edu/_docs/oysters/oyster-diseases-CB.pdf
- http://www.ct.gov/doag/lib/doag/aquaculture/dermo.pdf

Questions