Ecological and Economic Effects of Derelict Fishing Gear in the Chesapeake Bay

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Briefing for:
Chesapeake Bay Program Management Board

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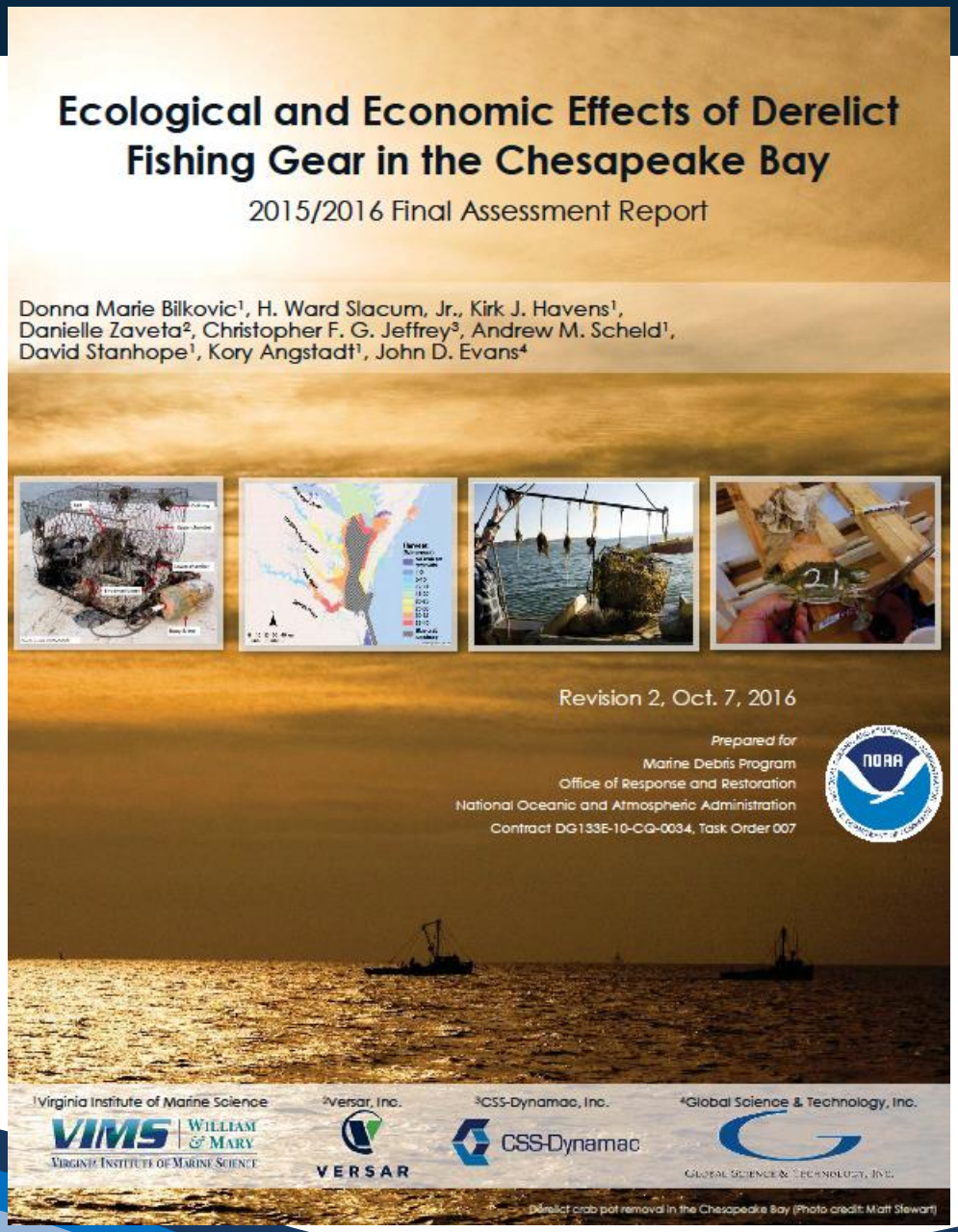
Goal


Ecological and Economic Effects of Derelict Fishing Gear in the Chesapeake Bay
2015/2016 Final Assessment Report
Donna Marie Bilkovic[1], H. Ward Slacum, Jr., Kirk J. Havens[1], Danielle Zaveta[2], Christopher F. G. Jeffrey[3], Andrew M. Scheld[1], David Stanhope[1], Kory Angstadt[1], John D. Evans[4]
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Marine Debris Program
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NOAA
[1]Virginia Institute of Marine Science
VIMS | William & Mary
Virginia Institute of Marine Science
[2]Versar, Inc.
VERSAR
[3]CSS-Dynamac, Inc.
CSS-Dynamac
[4]Global Science & Technology, Inc.
Derelict crab pot removal in the Chesapeake Bay (Photo credit: Matt Stewart)

Objectives

1) Identify/evaluate factors contributing to distribution and densities of derelict blue crab traps

2) Inventory available data with regard to Obj. 1

3) Identify and fill data gaps – field/lab experiments

4) Develop a spatial model to evaluate Obj. 1 factors

5) Quantify ecological/economic impacts of DFG

6) Develop a DFG framework for use in other fisheries

Objective 4 – spatial model

Geographic Weighted Regression: model structure

Response variable = derelict fishing gear density*

Predictor variables = effort†, depth**, rec boats††, marine traffic***

*MD: systematic, side scan sonar surveys (2007); watermen clean ups (2010, 2012)
VA: fishermen field surveys/removals (2008-2012); tributary-specific surveys (2005-2011, 2015)

†MD: active trap field surveys (2007-2012); DNR reports (1994-2014); expert knowledge (2014-2016)
VA: active trap field survey (2010); VMRC reports (1994-2014)

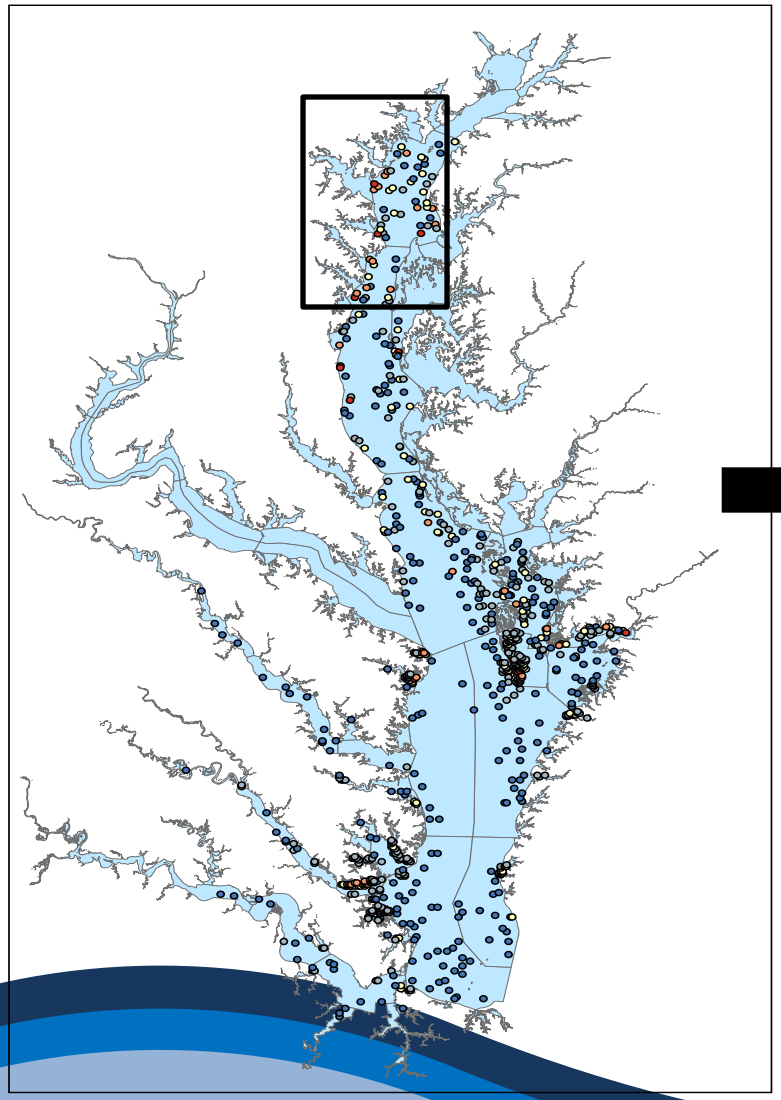
**1995 NOAA Hydrographic Survey data

††MD: fishery independent survey; VA: expert knowledge

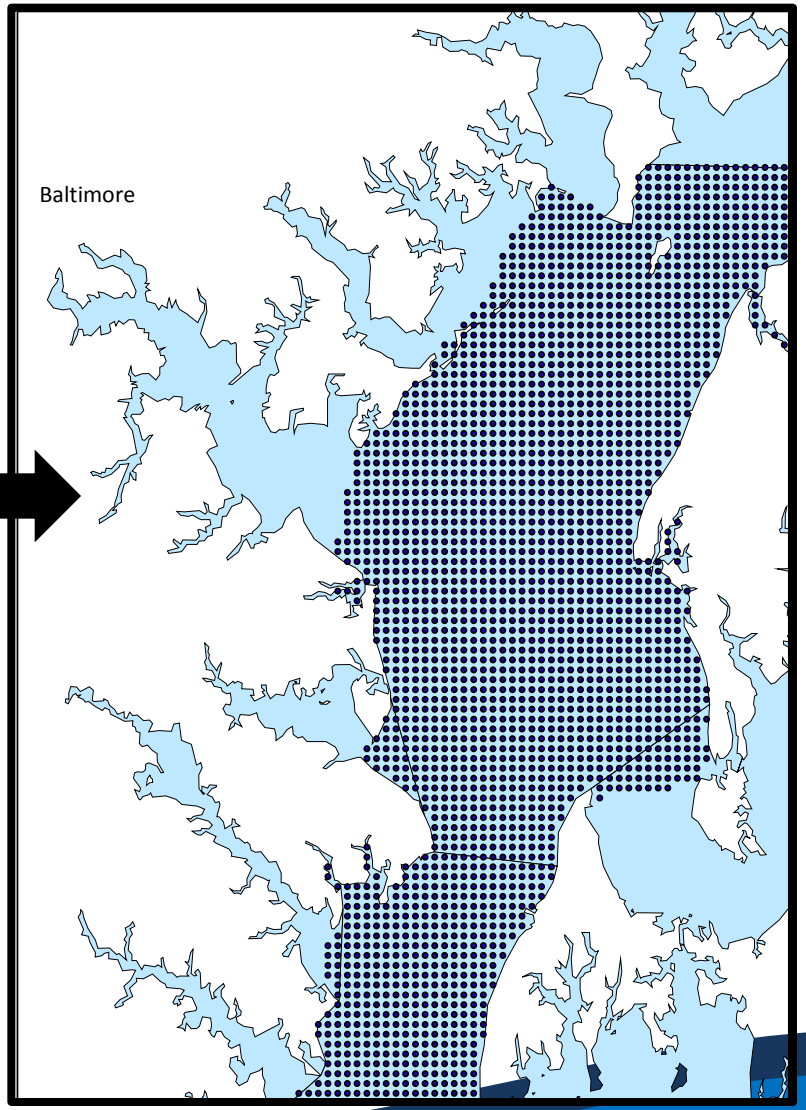
***Marine Cadastre Automatic Identification System (AID) data

Objective 4 – spatial model

Field Data

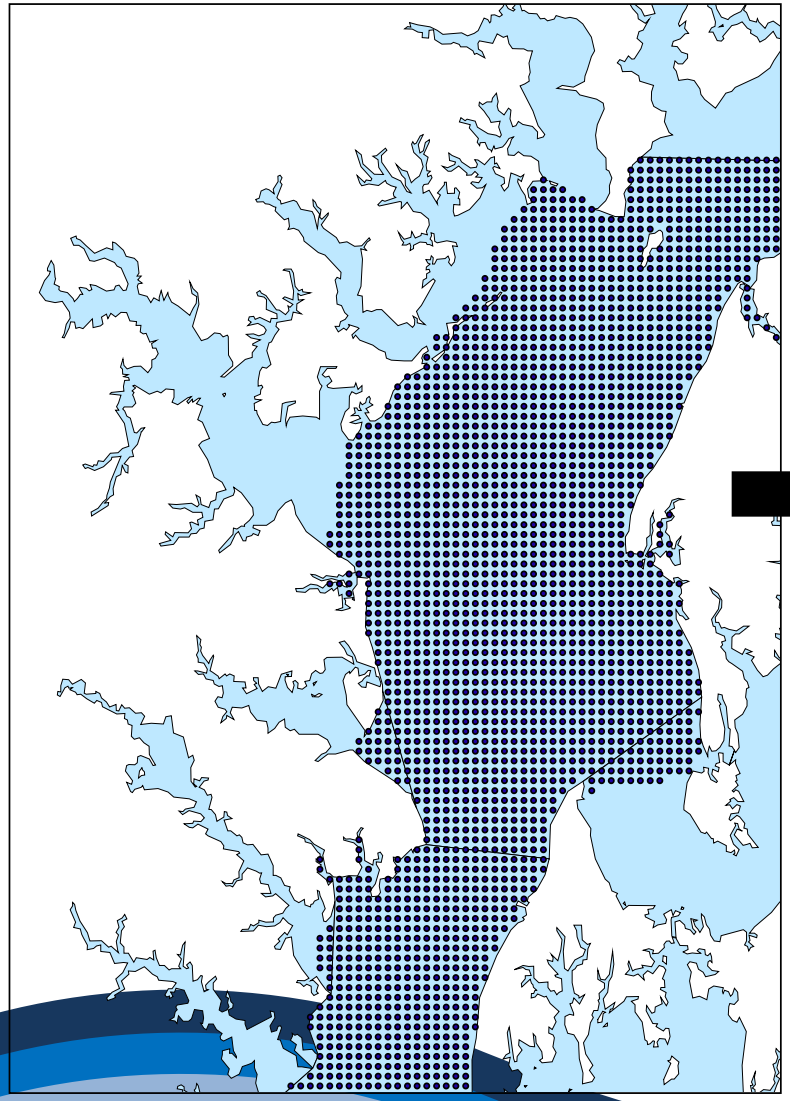


Prediction Grid

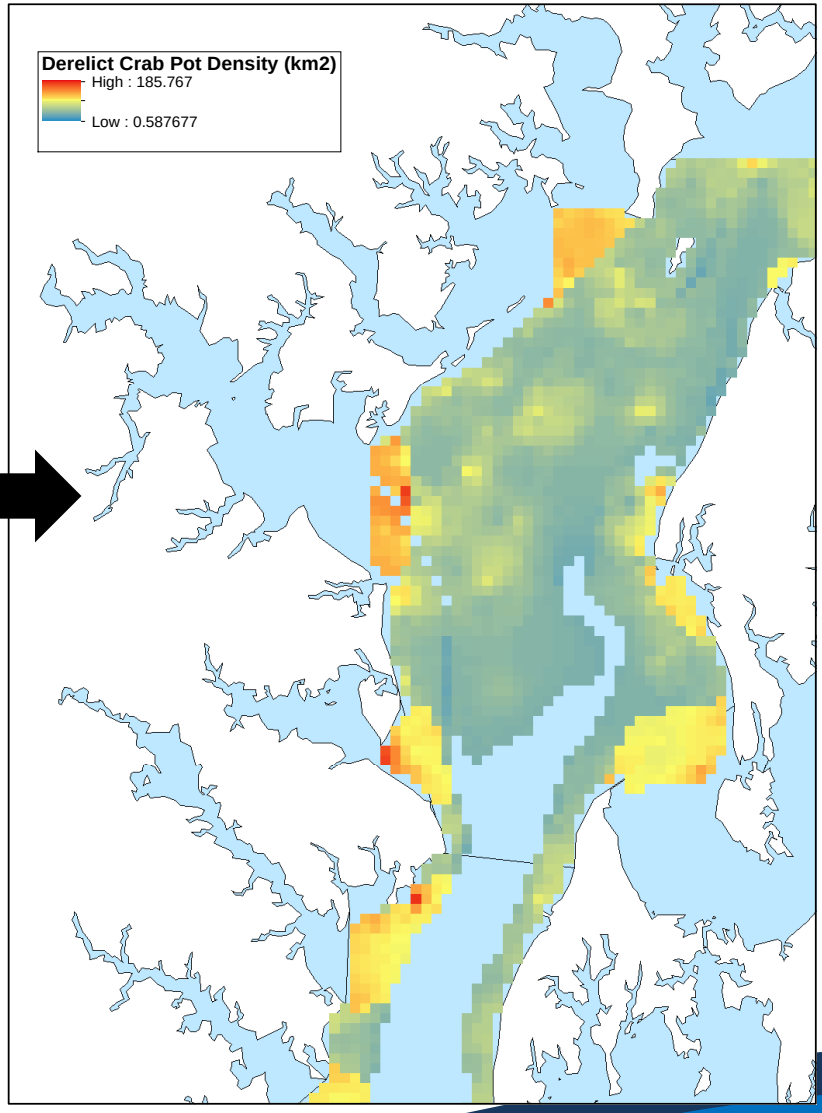


Objective 4 – spatial model

Prediction Grid



Predicted Densities

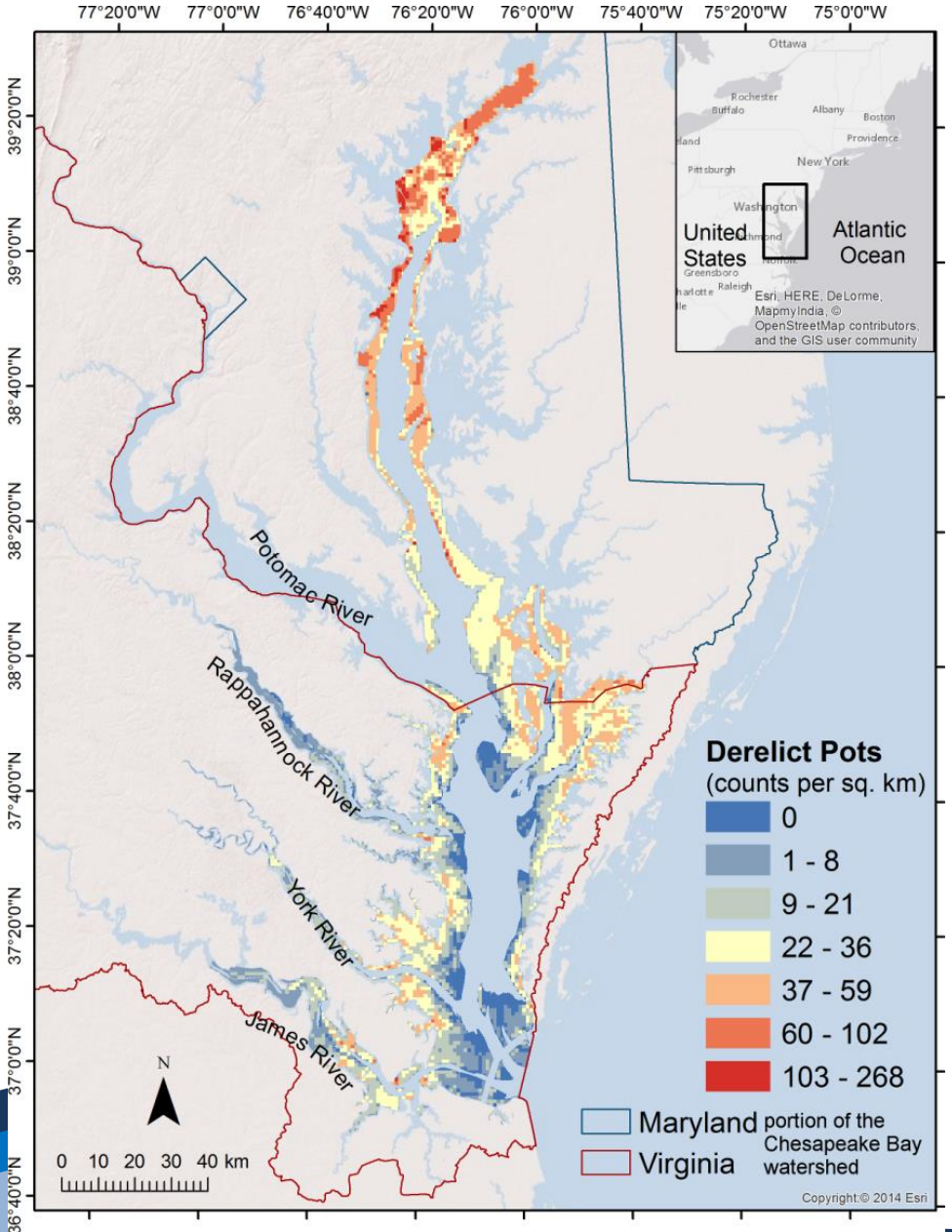


Objective 4 – spatial model

Geographic Weighted Regression: Results

- All predictor variables were significant (effort, vessels, depth)
- Model explained 34% of the variation in the estimates of derelict crab pot density
- Derelict pot density estimates varied considerably across locations, a result of the spatial variability in the predictors
- Generally, high fishing effort + vessel traffic = high derelict pots

Objective 4 – spatial model



Geographic Weighted Regression: Results

Predicted Densities of Derelict Pots

Bay-wide: 145,000+

Maryland: 58,000+

Virginia: 87,000+

Objective 5 – ecological impacts

Blue Crab Bycatch Mortality

	Mean Mortality: crabs/pot/year	# Derelict pots	Mean Mortality: total crabs / year
Maryland	20	58,185	~1.2 million
Virginia	25	87,048	~2.2 million
Bay-wide	23	145,233	~3.3 million

Objective 5 – ecological impacts

White Perch Bycatch Capture

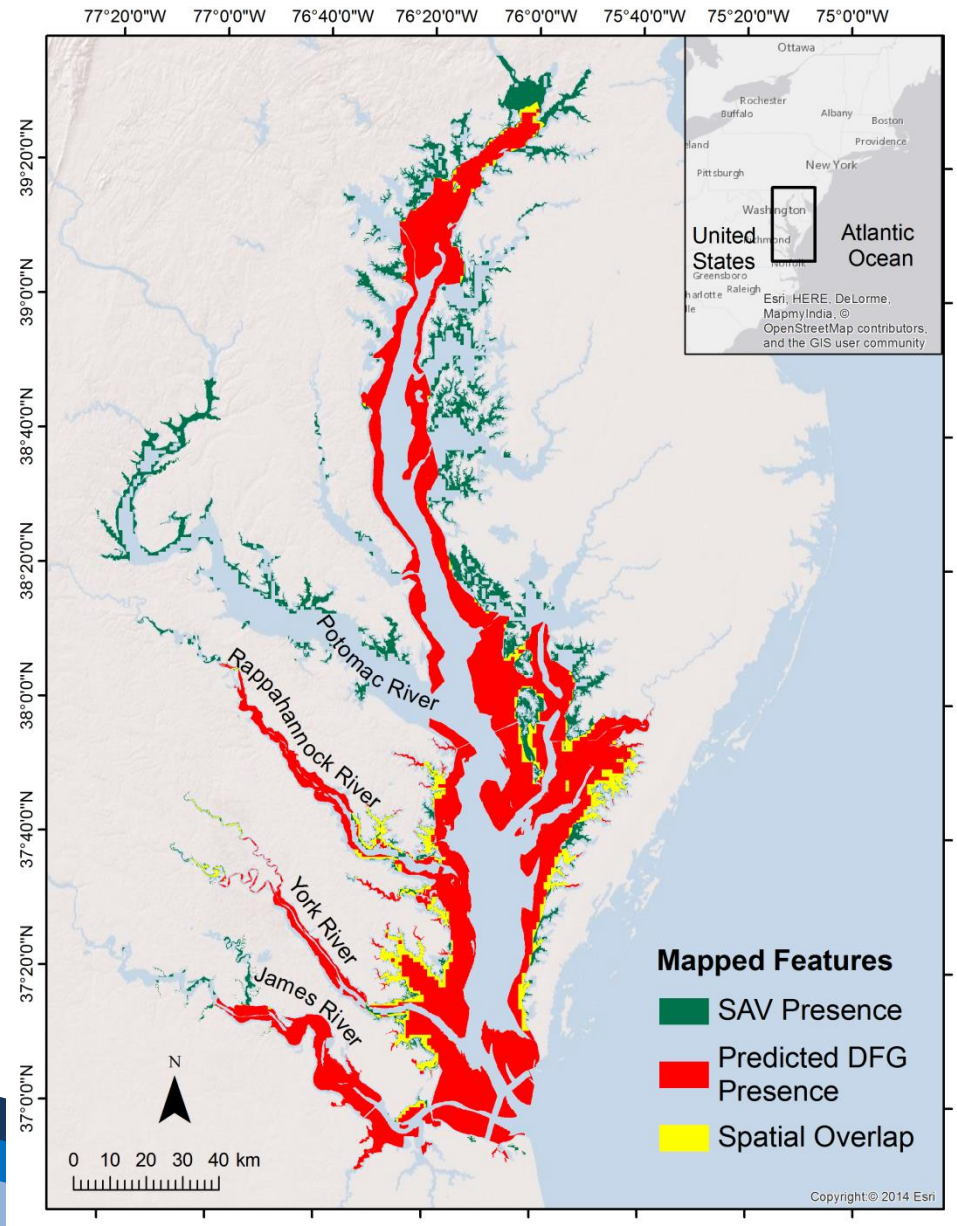
	Capture: Mean fish/pot/year	# Derelict pots	Capture: Mean total fish / year
Maryland	22.4	58,185	~1.3 million
Virginia	25.6	87,048	~2.2 million
Bay-wide	24.3	145,233	~3.5 million

Objective 5 – ecological impacts

Habitat: SAV and oyster

- Pot footprint = 0.36m^2
- 12-20% loss rate
- 350,000 pots deployed in summer
- Potential for 15,000 – 25,000 m^2 impacted seafloor

Objective 5 – ecological impacts



Objective 5 – economic impacts

Spatially-explicit harvest model*

- Estimates annual harvests as a function of effort (number of pots), stock, and derelict gear removals
- Predicts harvests with and without derelict gear removals
- Compares model predictions to evaluate effect of removals on commercial harvests

**Scheld et al. 2016. The dilemma of derelict gear. Scientific Reports 6:19671*

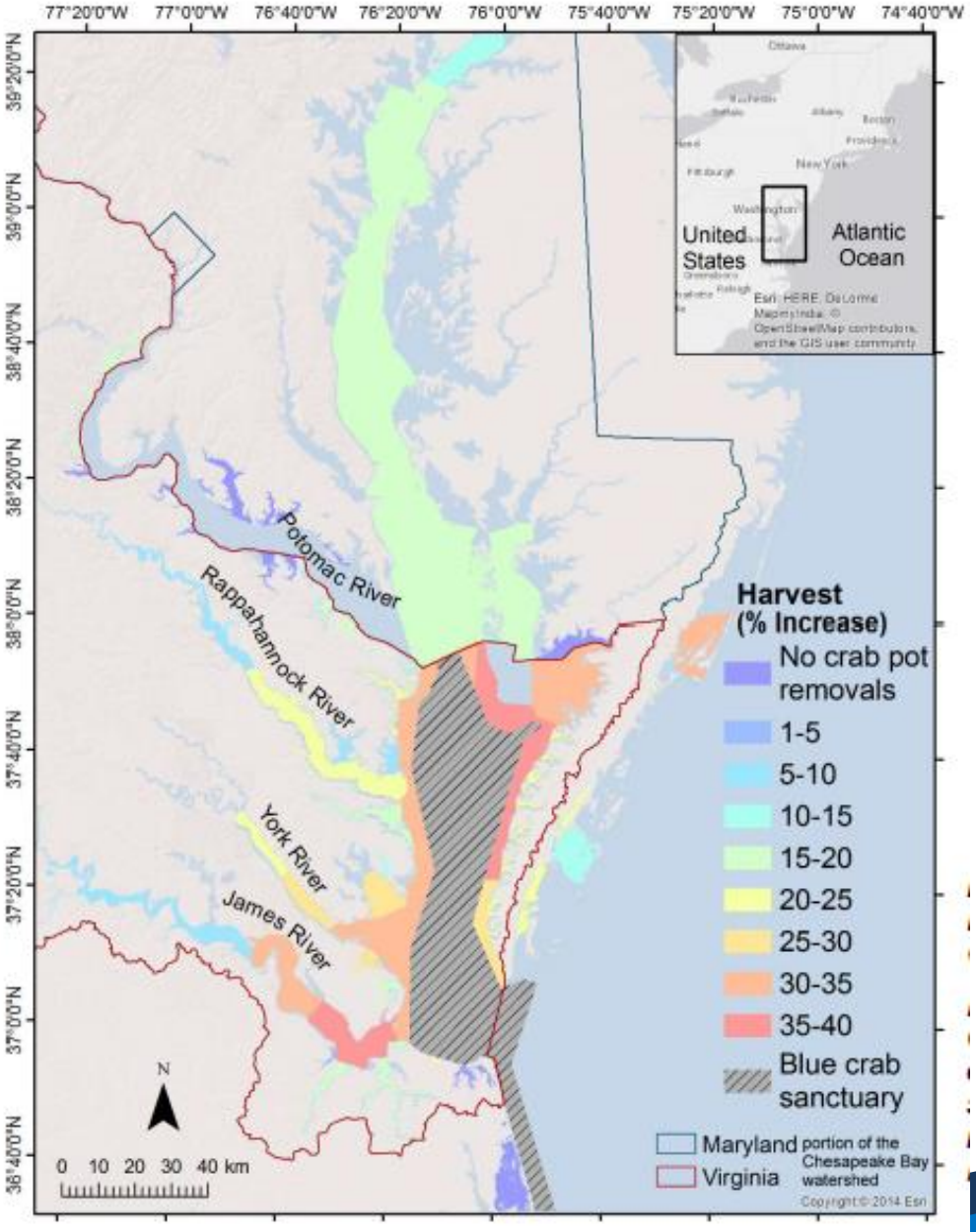
Objective 5 – economic impacts

Spatially-explicit harvest model*

	# Traps Removed	Avg Pounds of Increased Harvest	Avg Increased Revenue
Virginia*	34,408	30 million (27%)	$22.6 million**
Maryland	9,560	8 million (16%)	$10.9 million**
Bay-wide	43,968	38 million (23.8%)	$33.5 million**

**Scheld et al. 2016. The dilemma of derelict gear. Scientific Reports 6:19671*
***2014 dollars*

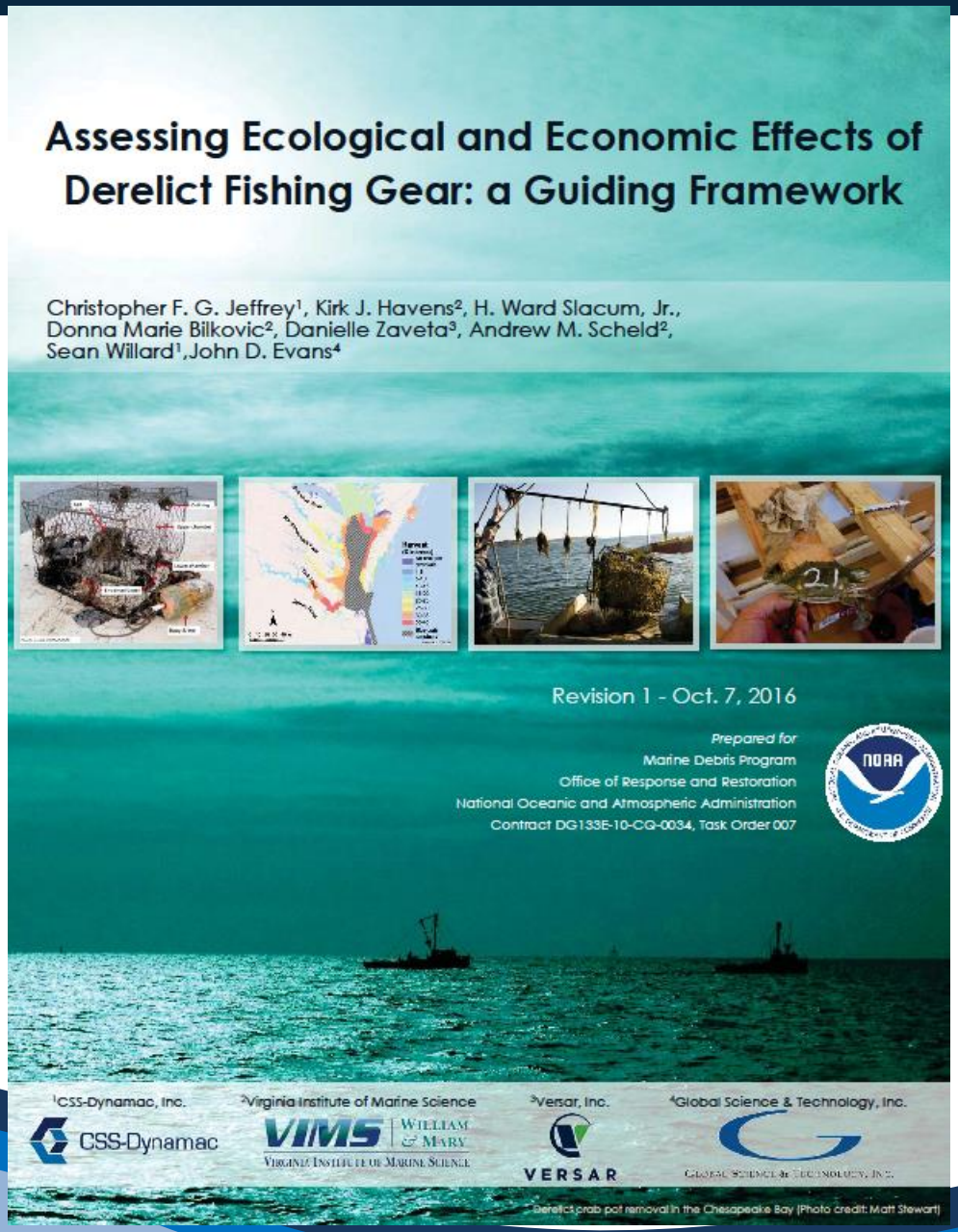
Objective 5 – economic impacts



Management Strategies

- Removals more effective if hotspots targeted
- Biodegradable escape panels
- Reduce overlap b/w boating and fishing activities
  - Boater education

Objective 6 – guiding framework



Objective 6 – guiding framework

Recommends best practices for 5 key elements:

- Characterization of abundance & distribution of DFG and fishery effort
- Analyses to quantify economic impacts on target & bycatch species
- Analyses to determine impacts to living resources
- Evaluation of management implications
- Recommendations for appropriate management actions to mitigate impacts from DFG