THE NARRAGANSETT BAY WATERSHED ECONOMY

The ebb and flow of natural capital

Emi Uchida, Professor of Environmental Economics & Associate Director of URI Coastal Institute
University of Rhode Island

The Overarching Project:
Economic Valuation of Ecosystem Services in the Narragansett Bay Watershed

- Conceived by the URI Coastal Institute
- Current Components
  - **The Narragansett Bay Watershed Economy**: **The Ebb and Flow of Natural Capital** by Emi Uchida, Arthur Mead, Azure Giroux, and Sarah Hayden (led by URI Coastal Institute in collaboration with MassAudubon and URI CRC)
  - **Economic History:** *The ebb and flow of the Narragansett Bay Watershed: An economic history* by Maury Klein
  - **Valuation of water quality from land use change**: "Decision support modeling for multi-attribute water quality in the Narragansett Bay watershed" (Stanford University, MassAudubon, URI)
  - **Impact of water quality changes on housing prices** in Narragansett Bay (Liu, Uchida, Opaluch 2018, *Water Resources Research + 41N*)
  - **Nonmarket values of the coast on housing prices** in Narragansett Bay (Hayden and Lang 2018)
  - **Carbon storage and and fish habitat:** Nonmarket values of salt marshes and sea grasses (Mazzocco, Hasan, Uchida, work in progress)

COASTAL INSTITUTE

EPA United States Environmental Protection Agency

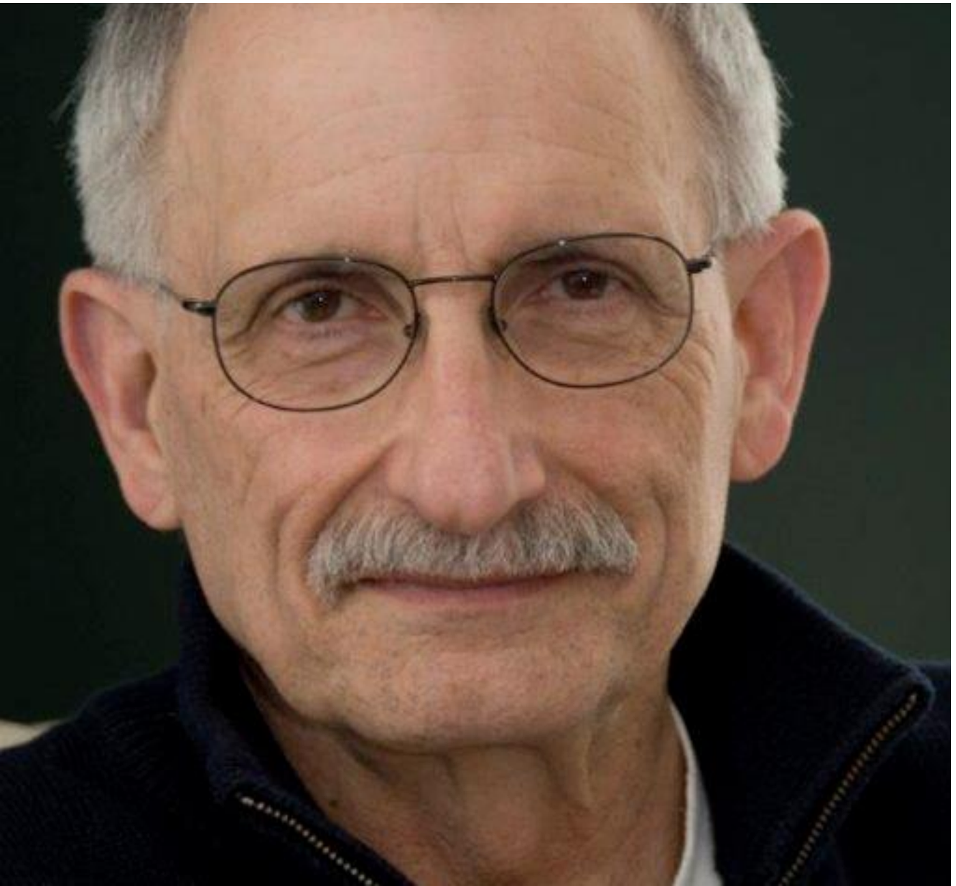
Mass Audubon Shaping the Future of Your Community

natural capital PROJECT

SNEP Southeast New England Program

THE UNIVERSITY OF RHODE ISLAND GRADUATE SCHOOL OF OCEANOGRAPHY

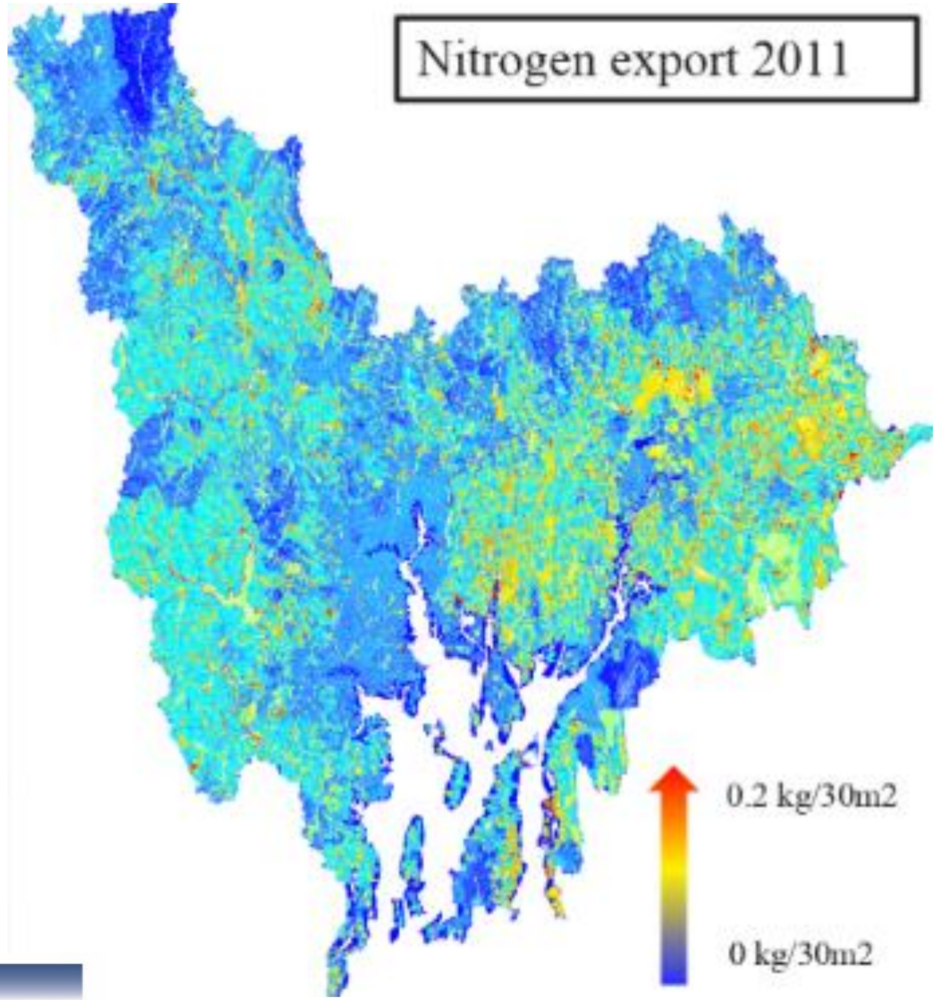
CRC COASTAL RESOURCES CENTER



"THE EBB AND FLOW OF THE NARRAGANSETT BAY WATERSHED: AN ECONOMIC HISTORY"

BY MAURY KLEIN

- The economic history of the bay, its rivers, and the settlements that developed within it over the past three centuries
- Changing roles of the Narragansett Bay Watershed in local economies
  - From the industrial base of the region's economy to new approaches and the revitalization of older sectors such as fishing and tourism
- Describes the damage done to its natural resources over the years and the need to reclaim and restore them



VALUATION OF WATER QUALITY CHANGES FROM LAND USE CHANGE

- DECISION SUPPORT MODELING
- ALTERNATIVE LAND USE CHANGE SCENRIOS
- MODELING OF SEDIMENT/ NUTRIENT TRANSPORTUSING InVEST
- NONMARKET VALUATION USING REGRESSION-BASED BENEFIT TRANSFER
- STAKEHOLDER OUTREACH
- LITERATURE DATABASE & OTHER RESOURCES

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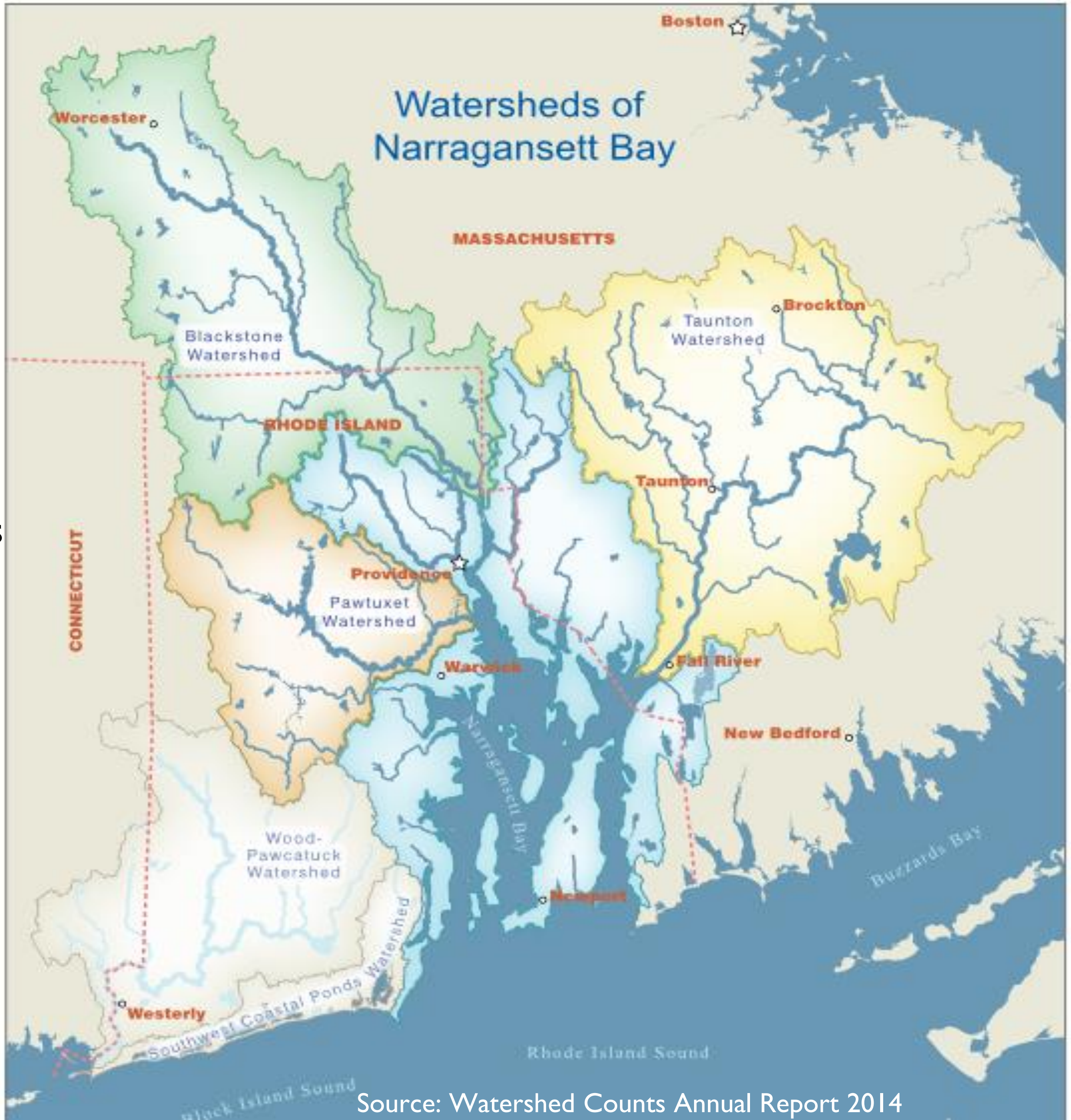
CONTENTS

1700 square miles
420 miles of coastline
105 towns and cities
2 million residents



Source: Watershed Counts Annual Report 2014

WHAT IS THE WATERSHED ?

NARRAGANSETT BAY WATERSHED ECONOMY
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WHY STUDY THE ECONOMY OF THE WATERSHED?

- The economy of the watershed provides immense economic benefit through diverse industries
- These industries rely on a healthy watershed ecosystem
- Understanding the watershed’s economy as well as its future threats is critical to informing and improving decision-making policy regarding the management and protection of the watershed’s environment.
- No comprehensive study on NBW’s economy exists
  - Complements NBEP’s current state of the watershed and potential future threats
  - Complements Sproul’s RI economic impact studies (agriculture, maritime trade, commercial fishing, forestry)

OBJECTIVES OF THIS STUDY

- The goal of this report is to synthesize existing data to provide a comprehensive overview of the NBW in one document. This report aims to:
  - **Identify** key industries that contribute to the economy of the watershed and rely on its natural capital.
  - **Quantify** the direct economic impact of these industries by calculating: the number of establishments, size of workforce, and total wages for each sector using data from the Bureau of Labor Statistics, the Bureau of Economic Analysis, and various state-level reports.
  - **Assess** future opportunities and threats for each industry, mainly as they relate to climate change and its impacts.
  - **Provide** a comprehensive overview of the watershed's economy through an overall economic status report, as well as a detailed history of the watershed and information on its geography and demographics.

NARRAGANSETT BAY
WATERSHED ECONOMY
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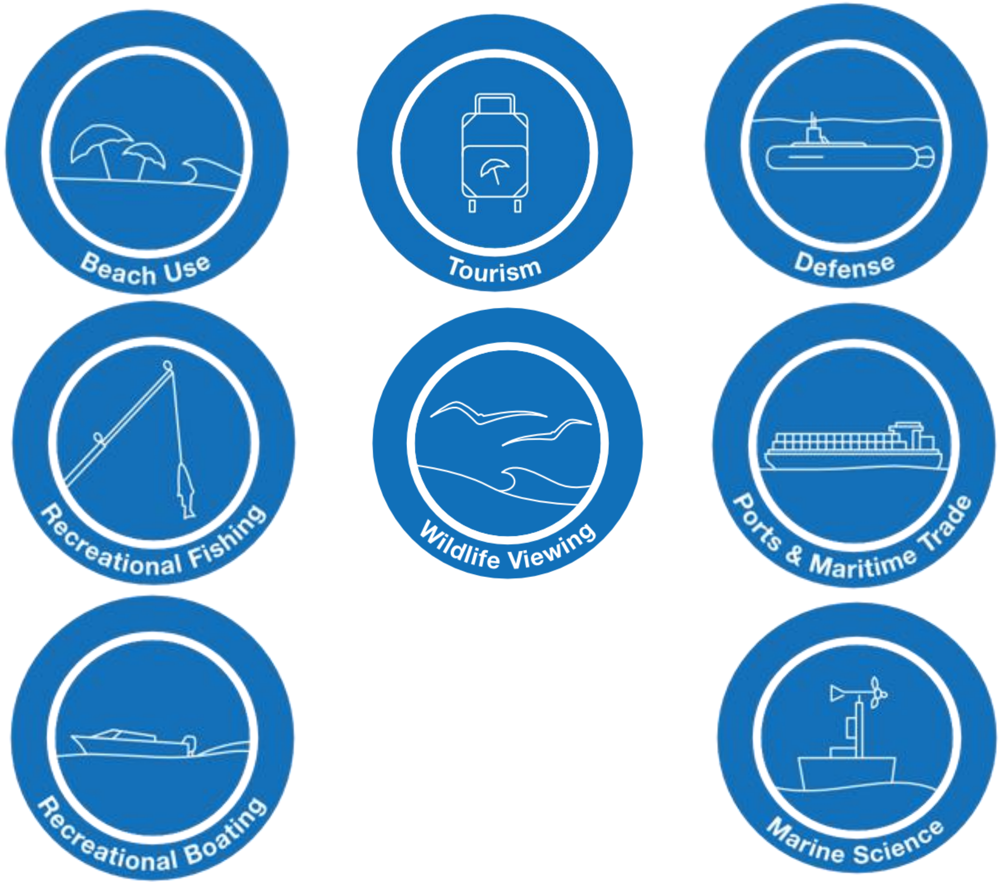
WHAT'S IN THIS REPORT

ECOSYSTEM SERVICES OF THE NARRAGANSETT BAY WATERSHED: 13 NATURAL CAPITAL-BASED SECTORS

USE VALUES

CONSUMPTIVE

NON-CONSUMPTIVE: DIRECT USE



ECOSYSTEM SERVICES OF THE NARRAGANSETT BAY WATERSHED

What’s not covered in this report

- Use values—non-consumptive & indirect use
  - Water quality □ two studies
  - Climate control (carbon storage and sequestration) □ coming soon (salt marshes + sea grass)
  - Habitat support □ coming soon (salt marshes + sea grass)
  - Flood control
  - Coastal erosion prevention
- Non-use values
  - Biodiversity preservation
  - Cultural heritage (arts and culture is included in Tourism)
  - Existence values
  - Bequest values
- Tradeoff analysis

METHODOLOGY

- Compiled data from numerous sources, including BLS, NOEP's Ocean Economy data, NOAA, US EPA, US NFWS, RI economic impacts studies by Dr. Sproul (URI), personal communications with specialists, etc.
- Numbers are scaled when possible to represent only the NBW portion of MA and RI using population or land area
- includes only Rhode Island data for applicable industries (e.g., aquaculture)

[1]USDA, 2014; [2]NMMA, 2013

APPENDIX: TABLES

Land and Population Within Watershed by County

Counties	Area	Population
Bristol, RI	100%	100%
Kent	74%	91%
Newport	82%	93%
Providence	96%	99%
Washington	16%	29%
Bristol, MA	72%	66%
Norfolk	19%	10%
Plymouth	36%	44%
Worcester	20%	42%

Source: NBEP, 2017

METHODOLOGY

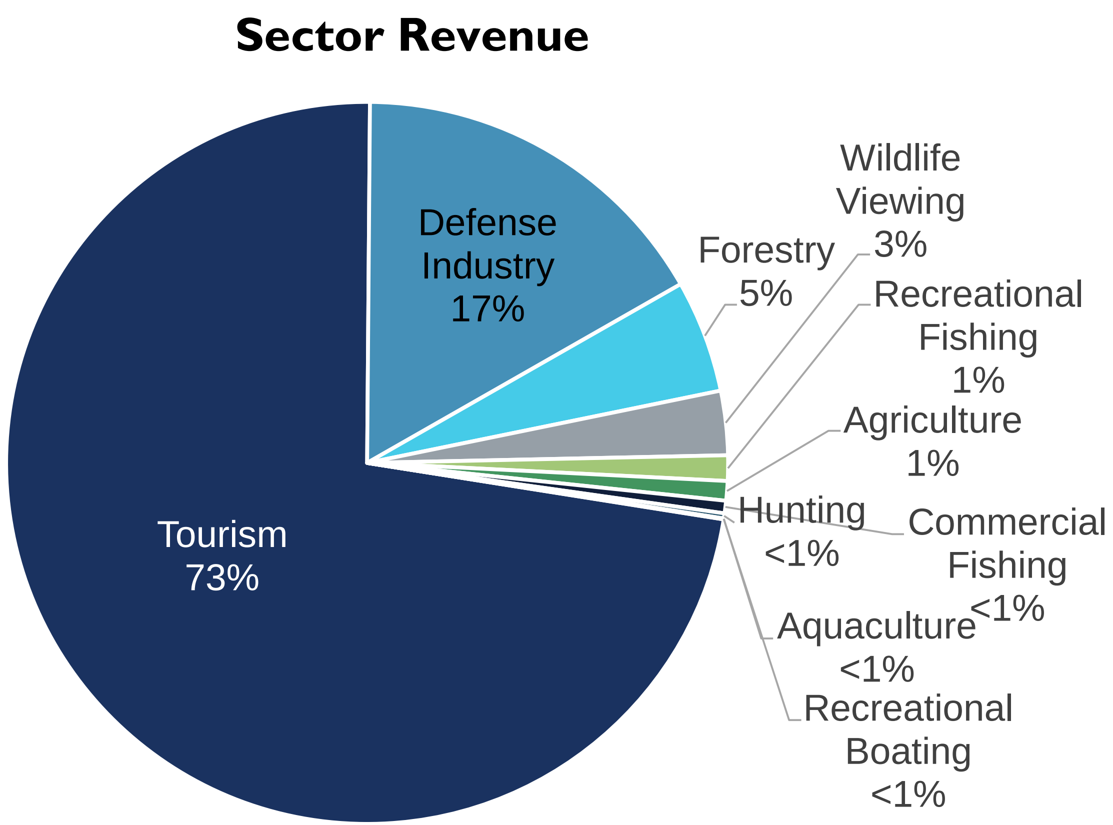
- Data scaling examples:
  - Land area: 717 farms in Bristol, MA, 72% of Bristol's land is in the NBW

    → estimated 513 farms in the NBW portion of Bristol[1]
  - Population: 39,000 registered Boaters in RI, 88.5% RI's population in the NBW

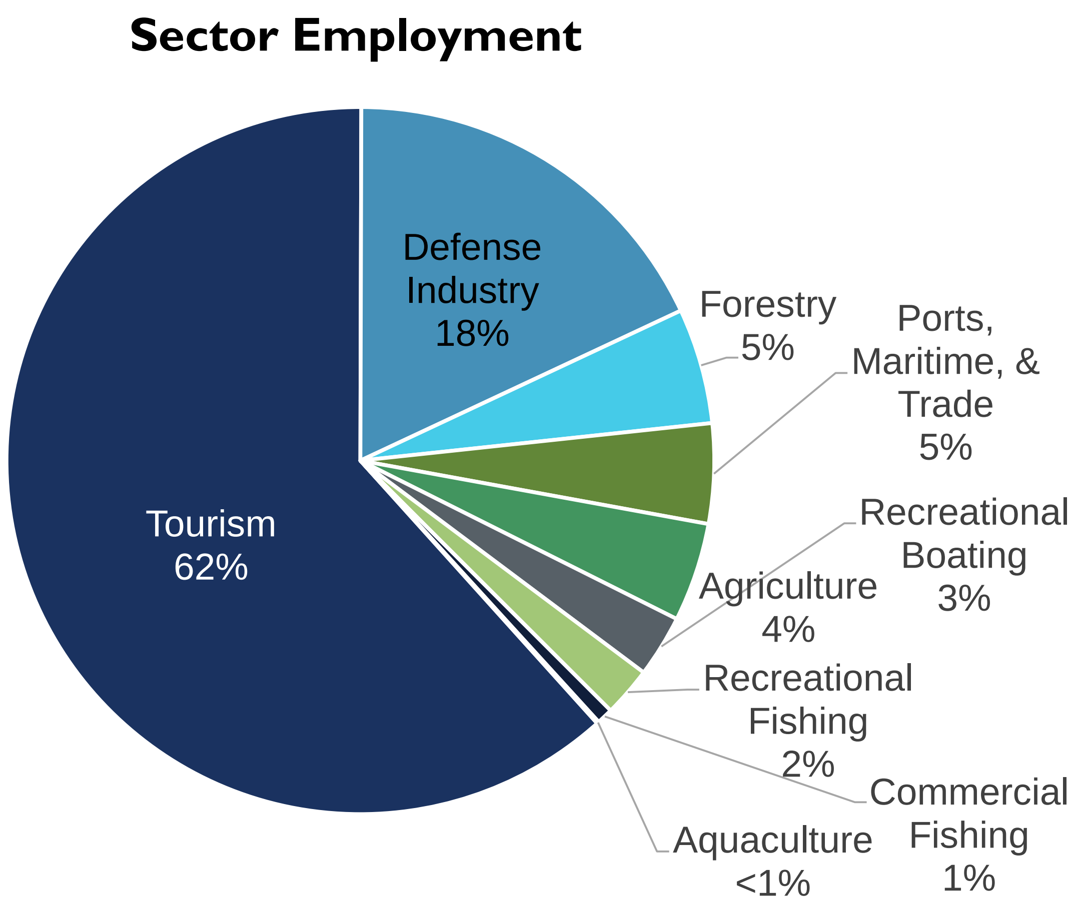
    → estimated 35,000 registered boaters in RI NBW[2]
- Monetary values in 2016 dollars unless otherwise noted

[1]USDA, 2014; [2]NMMA, 2013

OVERVIEW: REVENUE AND EMPLOYMENT



Total annual revenue: $14 billion (2016 US dollars)



Total annual employment: 97,298

TOURISM: AT A GLANCE

- Tourists spent $10+ billion in NBW in 2015
- Generates seasonal tax revenue >$5 million in RI
- 5th highest employment in RI; higher-than-average employment growth RI (3% increase, 2010-15)
- Tourism sector (arts/entertainment/recreation and accommodation/food services):
  - Involved over 5,500 businesses
  - Employed >60,000 people, wages over $1.8 billion
  - Connected to numerous sectors (e.g., beach use, recreational boating and fishing), resulting in large indirect economic impact
  - Arts and culture

[1]Tourism Economics, 2015; [2]BLS n.d.;

SECTOR: TOURISM

- Challenges with data
  - Large scope: Transects multiple areas of the economy: real estate and rental housing, bed and breakfast, retail trade, and restaurant (eating and drinking) industries
  - No one stop shop: Multiple data sources, two states
  - Self employment
- Three approaches
  - "Producer" approach: examines industries most relevant to tourism (employment, wages, GDP)
    - Use National Ocean Economic Program (NOEP) Ocean Economy data for "Tourism and Recreation", scaled for NBW
    - Use Bureau of Labor Statistics for (i) Arts, Entertainment, and Recreation and (ii) Accommodations and Food;
    - Examine seasonality of taxes for (i) and (ii)
  - "Consumer" approach: examines tourism rates and the tourists' levels of expenditure.
    - RI: Tourism Economics (2015)—we use its direct economic impact only
    - MA: Research Department of the U.S. Travel Association (2015)

TOURISM: EXAMPLE OF DATA—PRODUCER APPROACH

Table 2: Arts, Entertainment, & Recreation in RI & Accommodations & Food Services in RI (2016 dollars)

	Establishments	Employment	Wages (in 2016 dollars)
Arts, Entertainment, & Recreation	930	15,003	$436,391,956
Accommodations & Food Services	4,652	76,490	$1,416,163,370
Total	5,582	91,492	$1,852,555,326

Source: BLS

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TOURISM: EXAMPLES OF DATA—CONSUMER APPROACH

Table 6: Traveler Spending in the RI Portion of the Watershed: 2
(2016 dollars)

	Spending (Millions)	Spending Per Resident
Bristol	$75.9	$784
Warwick	$1,024.6	$12,394
Newport	$1,285.4	$16,686
Providence	$1,288.8	$7,251
South County	$466.4	$6,171
Blackstone Valley	$549.6	$2,277
Balance of state	$339.9	$1,852
Watershed	$5,030.8	$4,843

Source: Tourism Economics, 2015

Table 7: Tourism in MA Watershed: (2014)
(in 2016 dollars)

	Bristol	Norfolk	Plymouth	Worcester	Watershed
			Direct Impact		
Expenditures	$307.6	$104.5	$250.5	$352.9	$1,015.5
Employment	1,996.1	978.0	1,662.6	2,304.8	6,941.5
Wages	$60.8	$30.6	$48.0	$66.5	$205.9
			Total Impact		
Employment	3,208.8	1,572.3	2,672.7	3,705.2	11,159.0
Wages	$116.1	$58.4	$91.6	$126.9	$393.0

Source: Research Department of the U.S Travel Association, 2015

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TOURISM: SPENDING BREAKDOWN

- $10 billion breakdown
  - Visitor (>50 miles of RI) spending from the RI portion of the watershed (~$4 billion for all of RI, scaled 89% for watershed portion of state ~ **$3.6 billion**)
  - Traveler (within 50 miles of RI) spending for the RI portion of the watershed (~$6 billion for all of RI, scaled 89% for watershed portion of state ~ **$5.4 billion**)
  - Tourism direct expenditure in MA scaled for the watershed portion of the state **~$1 billion**

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SECTOR: DEFENSE†

- 17,500 employees, 40% in private defense, 60% military defense (2013)[1]
- High paying industry in RI with wages of $1.1 billion[1]
- $2.3 billion (4% to RI's GDP in 2013)[1]
- $736 million in DoD contracts through 4,768 transactions with 200+ firms[2]

The Direct Impact of the Defense Sector

	Employment	Earnings ($1000)	Output ($1000)
Military defense infrastructure	11,106	$680,964	$1,325,864
Private defense industry	6.391	$476,455	$976,288
Total defense sector	17,497	$1,157,419	$2,302,152

[1]Tebaldi, 2014; [2]Personal communication, Tebaldi

SECTOR: PORTS, TRANSPORTATION, MARITIME TRADE†

Port of Davisville, Quonset (1973, public)

- 3000+ acres with air, rail, boat and road access
- 200+ companies, 11,000 employees[1]
- Top 10 auto importer in U.S. (269K automobiles in 2015)[1]

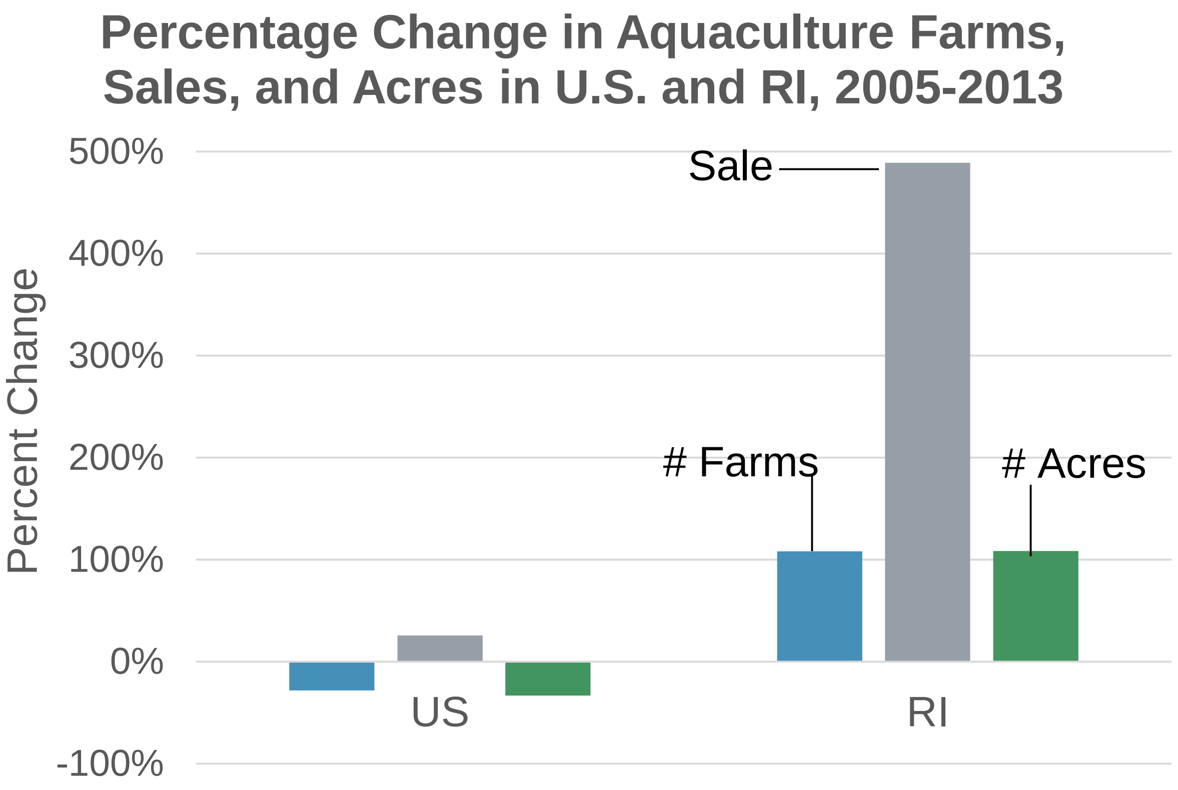
ProvPort, Providence (1004, private)

- Exports used-automobiles, petroleum hub
- 1,700 employees, $122 million in output 1994-2014[2]

- $70 million for modernization/expansion[3]
- RI's Maritime trade: 1712 firms, (4.7% of all firms in RI), $2.65 billion in annual gross sales including indirect economic impact (Sproul and Michaud 2018)

[1]Bramson, 2016;[2]4Ward Planning, 2015; [3]Ballotpedia, n.d.

SECTOR: AQUACULTURE†



- 36 farms on 140 acres with 90 employees (2016)[1]
- $2.8 million in sales[2]
- Outpacing national trends in farm and value growth[3]

[1]Beutel, 2016; [2]Beutel (unpublished data), 2016; [3]USDA, 2013; Beutel, 2013; Alves, 2005

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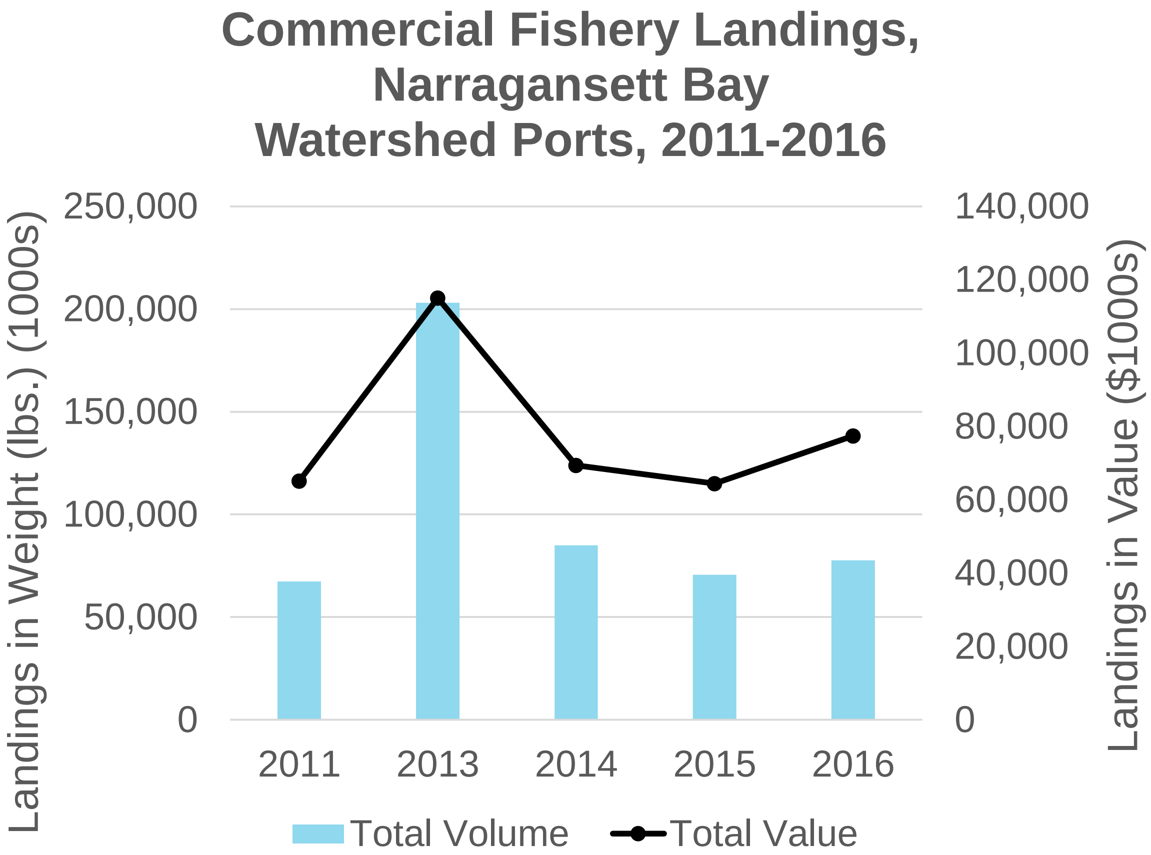
SECTOR: COMMERCIAL FISHING†



- Major ports: Point Judith, North Kingstown, Newport
- Annual landing of 75 million lbs., catch value of $150 million[1]
- 155 establishments, 700 employees, $85 million wages[2]
- Falling short of national trends, lower catch volume and value[3]

[1]NOEP, n.d.; [2]BLS, n.d.; [3]NMFS U.S., n.d.

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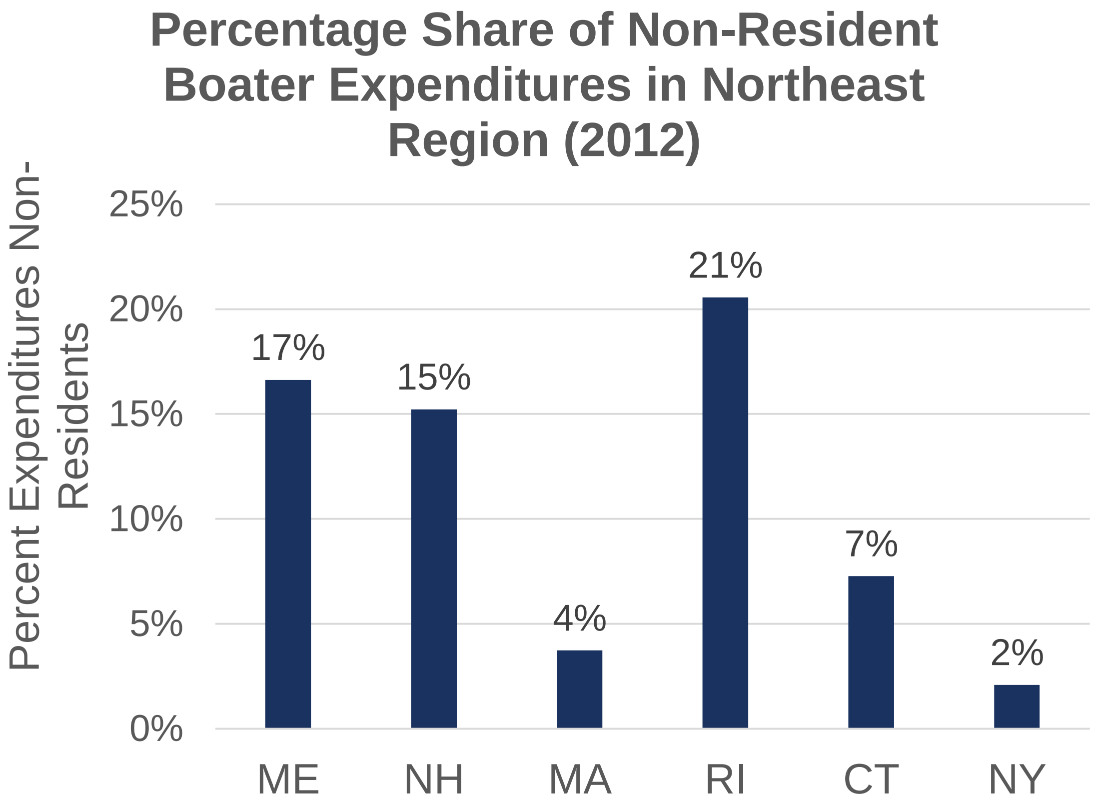
SECTOR: RECREATIONAL FISHING

- 221,600 anglers (2011)[1]
  - 63% fished freshwater
  - 97,000 were out-of-staters
- Fishermen spend millions and support jobs
  - $136 million in related spending[1]
  - Supported 2,200 related jobs
  - Paid $86 million in wages
  - Supports tourism

[1]USFWS (MA), 2013; USFWS (RI), 2013

SECTOR: RECREATIONAL BOATING

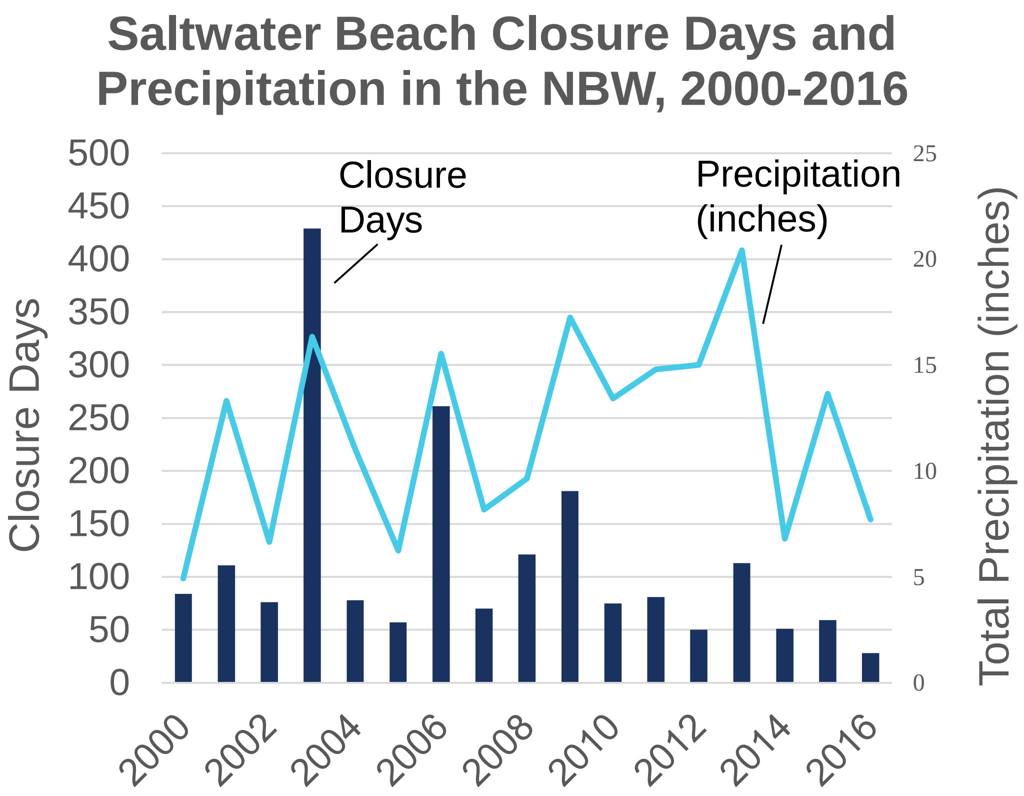
- 56,000 registered boats (2012)[1]
  - 97,000 boating trips
- $201 million in related spending[2]
  - 2,700 jobs, $150 million wages
- Draws in tourists (non-resident boaters)



[1]NMMA, 2014; [2]Starbuck & Lipsky, 2013

SECTOR: BEACH USE

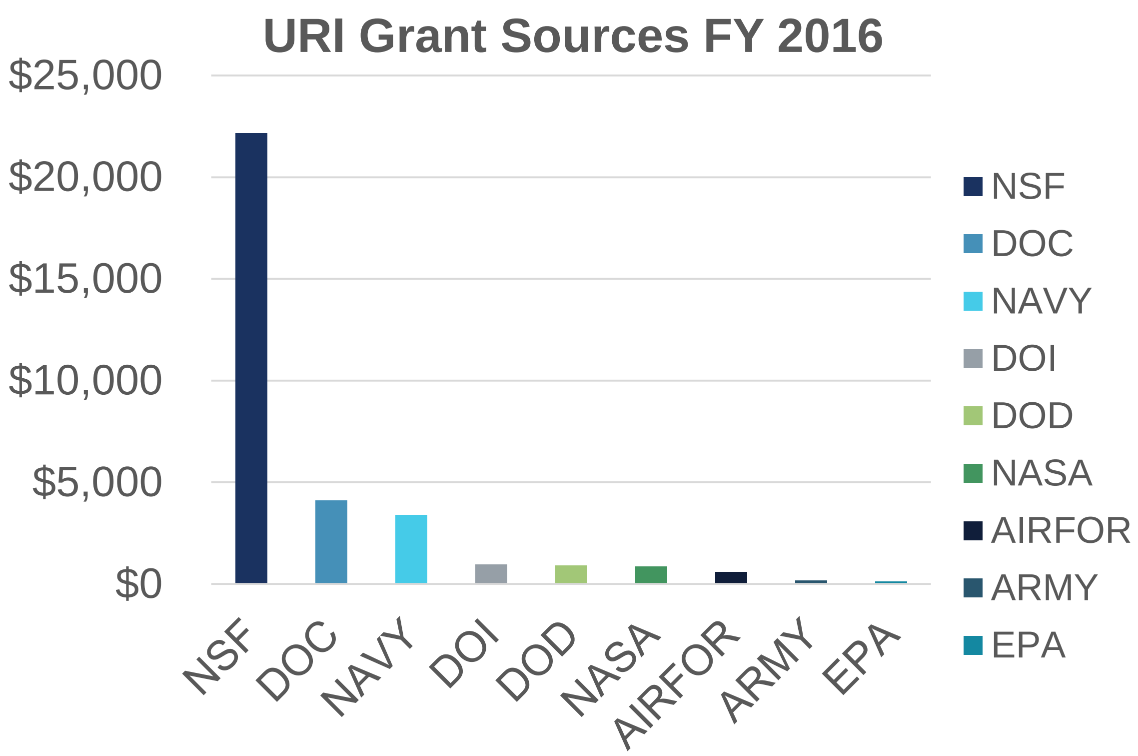
- 560 miles of coastline, 100+ fresh/saltwater beaches[1]
- 20 million annual visitors in RI[2]
- Generate revenue from parking, concessions, and access passes[3]
- Indirect impact from tourism spending
- 28 closure days in 2016[4]



[1]NBEP, 2017, U.S. EPA, 2010; [2]Mazzotta et al., 2012; [3]Personal Communications with Rosa, T.; Burke, W.; Cronin, W.; Reis, E.; Rooney, M.; and Wright, S.; [4]MADPH, 2001-2106; RIDOH,

SECTOR: RESEARCH & EDUCATION

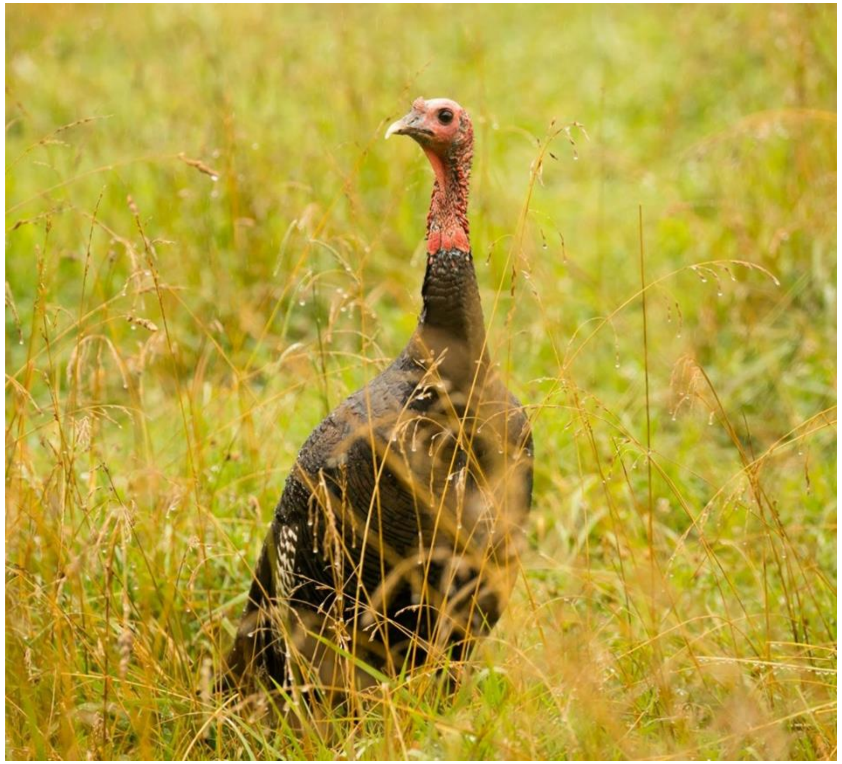
- Academic, non-profit, governmental organizations dedicated to research/outreach
- URI Graduate School of Oceanography receives $25+ million for research projects[1]
- URI and collaborators received 5 NSF grants totaling $57 million[2]
- Non-profit organizations like Watershed Watch, Save The Bay, Clean Water Action complete restoration projects, monitoring, and hands-on education



[1]URI (Marine Science), n.d.; [2]URI Today, 2017; URI, 2010, URI NSF EPSCoR, n.d.; URI Today, 2015;

SECTOR: HUNTING

- 26,000 active hunters, 21% increase from 2001 (2013)[1]
- $32 million in revenue[1]
  - $1,300 per capita spending
- 19% are out-of-staters[1]
- Most hunt on private lands[1]



[1]USFWS (MA) 2013; USFWS (RI), 2013

SECTOR: WILDLIFE VIEWING

- 172,000 wildlife viewers, 2 million viewing days (2011)[1]
- $400 million in expenditure[1]
  - $121 million for food, lodging, transportation
  - $276 million for equipment and related costs
- An average viewer spends $592 annually[1]

[1]USFWS (MA) 2013; USFWS (RI), 2013

FUTURE OUTLOOK

9.8 ft sea-level rise

- Beach use
- Tourism
- Defense
- Ports and maritime
- Research and education

5-10° air temperature rise

- Agriculture
- Forestry
- Hunting
- Wildlife viewing

3.6-5.4° water temperature rise

- Aquaculture
- Beach use
- Commercial fishing
- Recreational fishing
- Recreational boating
- Tourism

1-3 in. increase annual rainfall

- Aquaculture
- Agriculture
- Beach use
- Recreational boating
- Recreational fishing

DISSEMINATION PLAN

Website: http://www.nbweconomy.org/wp/

- The Narragansett Bay Watershed Economy: The Ebb and Flow of Natural Capital
  - Executive Summary + Full Report
- The Ebb and Flow of the Narragansett Bay Watershed: An Economic History
- Valuation studies
  - Valuation of changes in water quality from land use change: Decision support modeling for multi-attribute water quality in the Narragansett Bay watershed
  - Impact of water quality changes on housing prices in Narragansett Bay
  - Nonmarket values of the coast on housing prices in Narrangansett Bay
- Resources

Conferences and meetings with stakeholders

Limited hard copies distributed to decision makers and stakeholders

THANK YOU!

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> **This publication has not been formally reviewed by EPA. The views expressed in this document are solely those of the project. EPA does not endorse any products or commercial services mentioned in this publication*

Lead chapter authors:were Azure Giroux, Sarah Hayden, Arthur Mead and Emi Uchida.

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REFERENCES

4Ward Planning. (2015). The Economic Impact of ProvPort's Terminal Services. Prepared for ProvPort. Retrieved from https://www.provport.com/pdf/ProvPort%20Terminal%20Services%20Economic%20Impact%20Analysis%20FINAL%2012%2015.pdf.

Alves, D. (2005). Aquaculture in Rhode Island: 2005 Annual Status Report. Wakefield, RI: Coastal Resources Management Council (CRMC). Retrieved from http://www.crmc.state.ri.us/aquaculture/aquareport05.pdf.

Ballotpedia. (n.d). Rhode Island Port Infrastrucutre Bonds, Question 5 (2016). Retrieved from https://ballotpedia.org/Rhode_Island_Port_Infrastructure_Bonds,_Question_5_(2016).

Beutel, D. (2013). Aquaculture in Rhode Island: 2013 Annual Status Report. Wakefield, RI: Coastal Resources Management Council (CRMC). Retrieved from http://www.crmc.state.ri.us/aquaculture/aquareport13.pdf.

Beutel, D. (2016). Aquaculture in Rhode Island: 2016 Annual Status Report. Wakefield, RI: Coastal Resources Management Council (CRMC). Retrieved from http://www.crmc.state.ri.us/aquaculture/aquareport16.pdf.

Beutel, D. (2016). Unpublished data for aquaculture farms in Mount Hope Bay, Narragansett Bay, and Sakonnet River.

REFERENCES

Bramson, K. (2016, February 10). Auto Imports to Quonset by Ship Increase for 6th Straight Year. The Providence Journal. Retrieved from http://www.providencejournal.com/news/20160210/auto-imports-to-quonset-by-ship-increase-for-6th-straight-year.

Bramson, K. (2016, February 10). Auto Imports to Quonset by Ship Increase for 6th Straight Year. The Providence Journal. Retrieved from http://www.providencejournal.com/news/20160210/auto-imports-to-quonset-by-ship-increase-for-6th-straight-year.

Bureau of Labor Statistics (BLS). (n.d.). Overview of BLS Statistics by Industry. Retrieved from https://www.bls.gov/bls/industry.htm.

Bureau of Labor Statistics (BLS). (n.d.). Quarterly Census of Employment and Wages. Retrieved from https://www.bls.gov/cew/home.htm.

Burke, W. (2016, 07 July). A. Giroux, Interviewer.

Butler, B. (2016). Forests of Massachusetts, 2015. Resource Update FS-89. Newton Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 4 p. Retrieved from https://www.fs.fed.us/nrs/pubs/ru/ru_fs89.pdf

REFERENCES

Butler, B. (2016). Forests of Rhode Island, 2015. Resource Update FS-90. Newton Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 4 p. Retrieved from https://www.fs.fed.us/nrs/pubs/ru/ru_fs90.pdf

Cronin, W. (2016, 01 July). A Giroux, Interview.

de la Cretaz, A. Fletcher, L., Gregory, P., VanDoren, W., & Barten, P. (2010). An Assessment of the Forest Resources of Massachusetts. Boston: Massachusetts Department of Conservation and Recreation, National Association of State Foresters. Retrieved from http://www.mass.gov/eea/docs/dcr/stewardship/forestry/assessment-of-forest-resources.pdf

Massachusetts Department of Public Health. (2004). Marine and Freshwater Beach Testing in Massachusetts, Annual Report 2003 Season. Retrieved from http://www.mass.gov/eohhs/docs/dph/environmental/exposure/beach-reports/beach-annual-report03.pdf.

Massachusetts Department of Public Health. (2007). Marine and Freshwater Beach Testing in Massachusetts, Annual Report 2006 Season. Retrieved from http://www.mass.gov/eohhs/docs/dph/environmental/exposure/beach-reports/beach-annual-report06.pdf.

REFERENCES

Massachusetts Department of Public Health. (2008). Marine and Freshwater Beach Testing in Massachusetts, Annual Report 2007 Season. Retrieved from http://www.mass.gov/eohhs/docs/dph/environmental/exposure/beach-reports/beach-annual-report07.pdf.

Massachusetts Department of Public Health. (2010). Marine and Freshwater Beach Testing in Massachusetts, Annual Report: 2009 Season. Retrieved from http://www.mass.gov/eohhs/docs/dph/environmental/exposure/beach-reports/beach-annual-report09.pdf.

Massachusetts Department of Public Health. (2011). Marine and Freshwater Beach Testing in Massachusetts, Annual Report: 2010 Season. Retrieved from http://www.mass.gov/eohhs/docs/dph/environmental/exposure/beach-reports/beach-annual-report10.pdf.

Massachusetts Department of Public Health. (2012). Marine and Freshwater Beach Testing in Massachusetts, Annual Report: 2011 Season. Retrieved from http://www.mass.gov/eohhs/docs/dph/environmental/exposure/beach-reports/beach-annual-report11.pdf.

Massachusetts Department of Public Health. (2013). Marine and Freshwater Beach Testing in Massachusetts, Annual Report: 2012 Season. Retrieved from http://www.mass.gov/eohhs/docs/dph/environmental/exposure/beach-reports/beach-annual-report12.pdf.

REFERENCES

Massachusetts Department of Public Health. (2014). Marine and Freshwater Beach Testing in Massachusetts, Annual Report: 2013 Season. Retrieved from http://www.mass.gov/eohhs/docs/dph/environmental/exposure/beach-reports/beach-annual-report13.pdf.

Massachusetts Department of Public Health. (2015). Marine and Freshwater Beach Testing in Massachusetts, Annual Report: 2014 Season. Retrieved from http://www.mass.gov/eohhs/docs/dph/environmental/exposure/beach-reports/beach-annual-report14.pdf.

Massachusetts Department of Public Health (MA DPH). (2016). Marine and Freshwater Beach Testing in Massachusetts, Annual Report: 2015 Season. Retrieved from http://www.mass.gov/eohhs/docs/dph/environmental/exposure/beach-reports/beach-annual-report15.pdf.

Mazzotta, M., Latimer, F., & Zhukavets, M. (2012). A Fact Sheet on the Importance of Rhode Island Beaches. Naragansett: U.S. EPA, Atlantic Ecology Division.

Narragansett Bay Estuary Program. (2017). State of the Bay and its Watershed, Technical Report. Retrieved from http://nbep.org/the-state-of-our-watershed/technicalreport/.

REFERENCES

National Marine Manufacturers Association (NMMA). (2014). 2013 U.S. Recreational Boat Registration Statistics. Retrieved from https://www.nmma.org/statistics/publications/boat-registrations-report.

National Marine Fisheries Service – National Oceanic and Atmospheric Administration (NMFS – NOAA). (n.d.). Annual Landings by Species for Rhode Island. Retrieved from https://www.st.nmfs.noaa.gov/pls/webpls/mf_lndngs_grp.data_in.

National Ocean Economics Program (NOEP). (n.d.) Top Commercial Fishing Ports for All Coastal States in 2016. Retrieved from http://www.oceaneconomics.org/LMR/topPortsResults.asp?selRegions=All&selYears=2016&selOut=display&noepID=unknown.

North East State Foresters Association. (2015). The Economic Importance of Rhode Island's Forest Based Economy 2015. Retrieved from http://www.dem.ri.gov/programs/forestry/documents/econimp15.pdf

Quonset Development Council (QDC). (n.d.). Quonset's Port of Davisville: Infrastructure Rehabilitation/Replacement Program. Retrieved from http://www.quonset.com/_resources/common/userfiles/file/Port_House%20Presentation%20Final%20 4.5.16.pdf.

REFERENCES

Reis, E. (2016, 01 July). A. Giroux, Interviewer.

Rhode Island Department of Health (RI DOH). (n.d.). Beach Monitoring Data. Retrieved from http://www.health.ri.gov/data/beaches/.

Rhode Island Department of Revenue, State of Rhode Island. (2015). Local Revenue Report (Local 1% Hotel Tax Collections and Local 1% Meals & Beverage Tax Collections): FY 2015. Retrieved from http://www.dor.ri.gov/revenue-analysis/2015.php.

Rhode Island Department of Revenue, State of Rhode Island. (2016). Local Revenue Report (Local 1% Hotel Tax Collections and Local 1% Meals & Beverage Tax Collections): FY 2016. Retrieved from http://www.dor.ri.gov/revenue-analysis/2015.php.

Rooney, M. (2016, July 06). A. Giroux, Interviewer.

Rosa, T. (2016, July 01). A. Giroux, Interviewer.

REFERENCES

Starbuck, K & Lipsky, A. (2013). 2012 Northeast Recreational Boater Survey: A Socioeconomic and Spatial Characterization of Recreational Boating in Coastal and Ocean Waters of the Northeast United States. Retrieved from http://www.trpa.org/wp-content/uploads/2012-Seaplan-NE-boater-survey.pdf.

Telbadi, E. (2014). The Economic Impact of the Rhode Island Defense Sector. http://www.rilin.state.ri.us/Reports/2014%20-%20Defense%20Report%20%20-%20Final%20-%2007072014.pdf

Tourism Economics. (2015). The Economic Impact of Tourism in Rhode Island: 2015 Analysis. Prepared for the Blackstone Valley Tourism Council. Retrieved from blackstonevalleytourismcouncil.org/tourism2015.ppt.

United States Department of Agriculture (USDA). 2013. 2013 Census of Aquaculture. Retrieved from https://www.agcensus.usda.gov/Publications/2012/Online_Resources/Aquaculture/.

United States Department of Agriculture, National Agricultural Statistics Service (USDA NASS). (2014). 2012 Census of Agriculture. Retrieved from https://www.nass.usda.gov/Statistics_by_State/Rhode_Island/Publications/2012_Census_Report/index.php.

REFERENCES

United States Department of Agriculture, National Agricultural Statistics Service (USDA NASS). (2017). 2017 State Agriculture Overview: Rhode Island. Census of Agriculture. Retrieved from https://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=RHODE%20ISLAND

United States Department of Agriculture. (1997). 1997 Census of Agriculture. Retrieved from http://agcensus.mannlib.cornell.edu/AgCensus/censusParts.do?year=1997.

United States Department of Agriculture, National Agricultural Statistics Service (USDA NASS). (2014). 2012 Census of Agriculture. Retrieved from https://www.nass.usda.gov/Statistics_by_State/Rhode_Island/Publications/2012_Census_Report/index.php.

University of Rhode Island. (n.d.). Marine Science Research Facility. Retrieved from http://web.uri.edu/marinefacility/.

University of Rhode Island. (2006, April 25). “URI, Brown secure $6.75 million federal grant to stimulate life sciences research in Rhode Island.” URI Today. Retrieved from https://today.uri.edu/news/uri-brown-secure-6-75-million-federal-grant-to-stimulate-life-sciences-research-in-rhode-island/.

REFERENCES

University of Rhode Island (URI), Division of Research and Economic Development. (n.d.). Annual Report FY2016. Retrieved from https://web.uri.edu/researchecondev/annual-report-fy2016/.

University of Rhode Island. (2010, September 7). "National Science Foundation Awards URI $20 Million to Stimulate Marine Life Science Research in Rhode Island." Retrieved from https://web.uri.edu/rinsfepscor/2010/09/07/national-science-foundation-awards-uri-20-million-to-stimulate-marine-life-science-research-in-rhode-island/.

University of Rhode Island. (2015, August 7). $6 Million Federal Grant Addresses Future of Dams in New England. URI Today. Retrieved from https://today.uri.edu/news/6-million-federal-grant-addresses-future-of-dams-in-new-england%E2%80%A8/.

University of Rhode Island. (2017, September 20). "National Science Foundation awards URI $19 million to establish statewide coastal ecology research consortium." URI Today. Retrieved from https://today.uri.edu/news/national-science-foundation-awards-uri-19-million-to-establish-statewide-coastal-ecology-research-consortium/.

University of Rhode Island – Rhode Island NSF EPSCoR. (n.d.). Narragansett Bay Brings Learning to Life. Retrieved from https://web.uri.edu/rinsfepscor/2016/03/15/narragansett-bay-brings-learning-to-life/.

REFERENCES

U.S. Fish and Wildlife Service (USFWS), U.S. Department of the Interior, U.S. Department of Commerce, & U.S. Census Bureau. (2013). 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation - Massachusetts. Retrieved from https://www.census.gov/prod/2013pubs/fhw11-ma.pdf.

U.S. Fish and Wildlife Service (USFWS), U.S. Department of the Interior, U.S. Department of Commerce, & U.S. Census Bureau. (2013). 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation – National Overview. Retrieved from https://www.census.gov/prod/2012pubs/fhw11-nat.pdf.

U.S. Energy Information Administration (EIA). (2017). Rhode Island State Energy Profile. Retrieved from https://www.eia.gov/state/print.php?sid=RI.

United States Environmental Protection Agency (U.S. EPA). (2010). National List of Beaches. Retrieved from https://nepis.epa.gov/Exe/ZyPDF.cgi/P100KMDT.PDF?Dockey=P100KMDT.PDF.

Wright, S. (2016, June 27). A. Giroux, Interviewer.

APPENDIX: TABLES

Land and Population Within Watershed by County

Counties	Area	Population
Bristol, RI	100%	100%
Kent	74%	91%
Newport	82%	93%
Providence	96%	99%
Washington	16%	29%
Bristol, MA	72%	66%
Norfolk	19%	10%
Plymouth	36%	44%
Worcester	20%	42%

Source: NBEP, 2017

APPENDIX: TABLES

Table 2: Estimated Value of Forest-Based Manufacturing and Recreation for Sales and Employment in RI Portion of the NBW, 2013 (in 2016 dollars)

	Sales ($1000s)	Jobs
Forestry & Logging	$1,286	63
Wood Products Manufacturing	$104,168	413
Furniture and Related Product Manufacturing	$131,174	813
Paper Manufacturing	$201,263	750
Wood Energy	$15,433	16
Christmas Trees and Maple Syrup	$3,215	25
Total Forest Products	$456,538	2,080
Forest Recreation Sales	$241,129	938
Total	$697,667	3,018

Source: North East State Foresters Association, 2015

APPENDIX: TABLES

Table 3: Estimated Value of Forest-Based Establishments, Employment, and Wages in MA Portion of the NBW, 2006 (in 2016 dollars)

Licensed Foresters	Licensed Harvesters	Emplo yees	Wages ($1000s)
22	64	2,117	$170,106

Source: de la Cretaz, et al., 2010

Table 4: Expenditures and Impacts of Recreational Boaters in the NBW (2012) (in 2016 dollars)

	Expenditures ($1000s)	Total Impact ($1000s)	Year-Round Jobs Supported	Labor Income Supported ($1000s)
RI	$124,662	$216,793	1,783	$92,131
MA	$76,643	$135,276	975	$58,633
Watershed	$201,305	$352,069	2,758	$150,764

Source: Starbuck & Lipsky, 2013

APPENDIX: TABLES

Table 5: Estimated Recreational Fishing Participation in the NBW (2011)

	Number of Anglers (1000s)	Number of Trips (1000s)	Number of Fishing Days (1000s)	Average Number of Fishing Days
		Freshwater		
RI	37.3	617.2	656.2	18
MA	44.1	559.8	674.9	15
Watershed	81.4	1,177	1,331.1	16.4
		Saltwater		
RI	134.1	986.6	1,269.8	9
MA	6.1	78,185	76.9	13
Watershed	140.2	1,064.8	1,346.8	9.6
		Combined		
Watershed Total	**221.6**	**2,241.7**	**2,677.9**	

Source: 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, 2013

APPENDIX: TABLES

Table 6: Estimated Expenditures of Wildlife Viewers in the NBW (2011) (in 2016 dollars)

	Expenditures ($1000s)	Trip Related Expenses ($1000s)	Equipment/Other Spending ($1000s)	Average per Participant
RI	$191,521	$75,393	$116,128	$440
MA	$206,215	$46,167	$160,048	$733
Watershed	$397,736	$121,560	$276,176	$592

Source: 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, 2013

APPENDIX: FIGURES

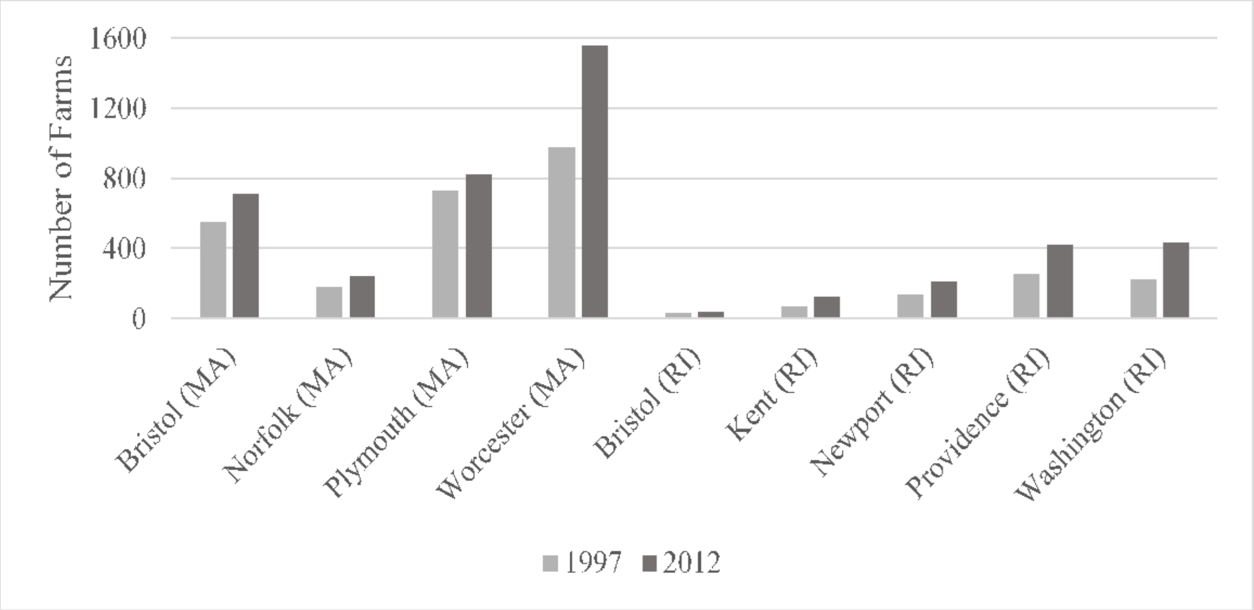


Figure 1: Growth in Number of NBW Farms by County, 1997-2012
Source: USDA, 1997 & 2012 Census of Agriculture

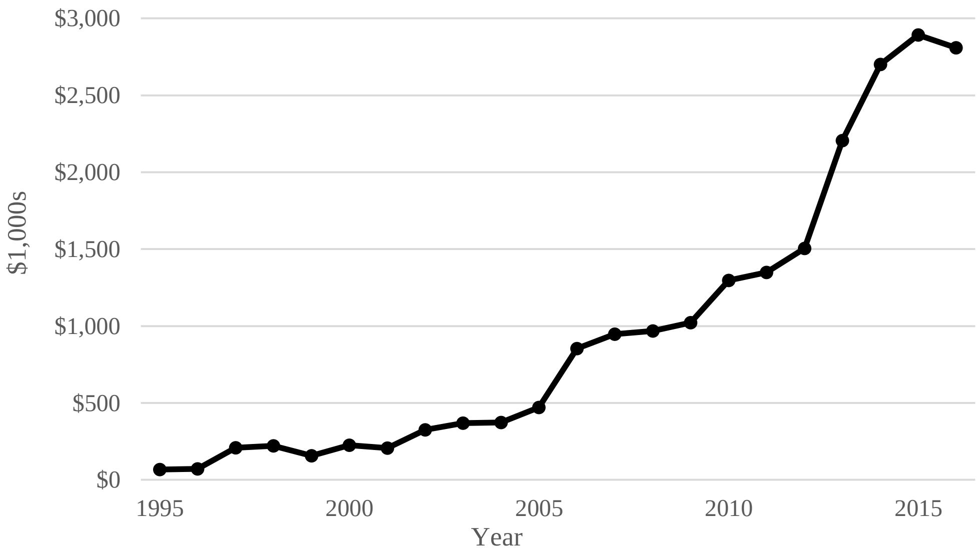
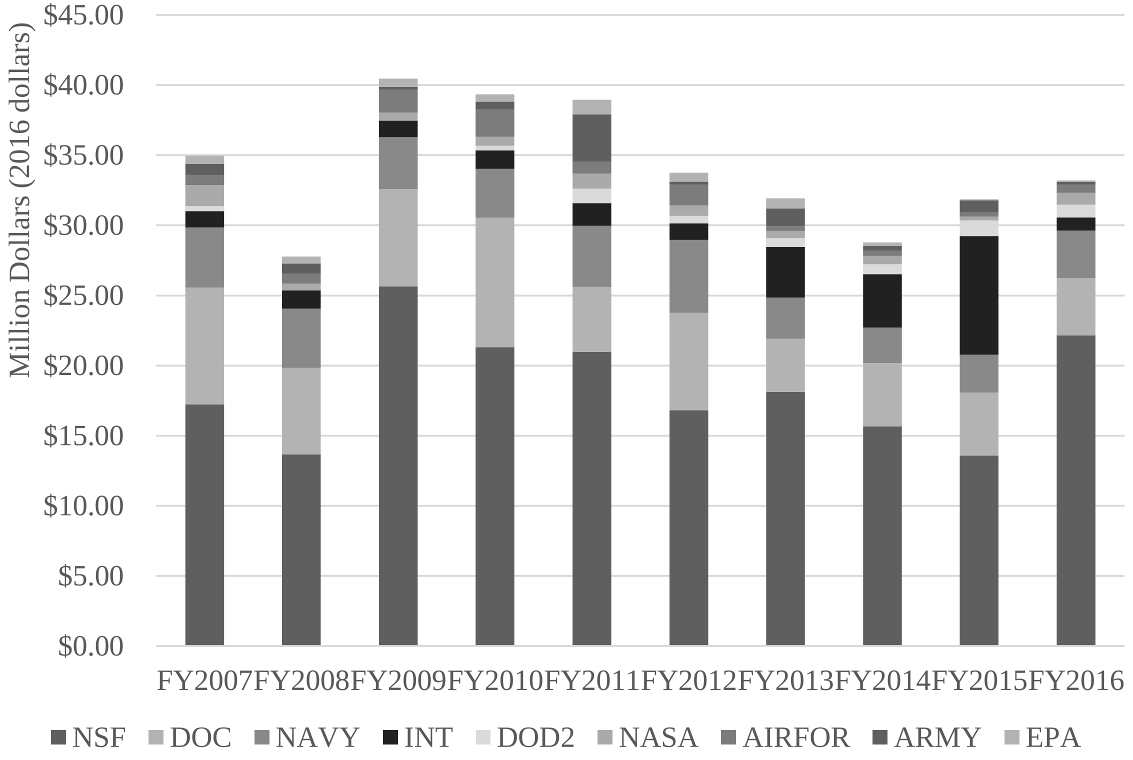


Figure 2: Inflation-Adjusted Market Value of Aquaculture Sales in the NBW, 1995-2016 (in 2016 dollars)
Source: CRMC Annual Reports, 1995-2016

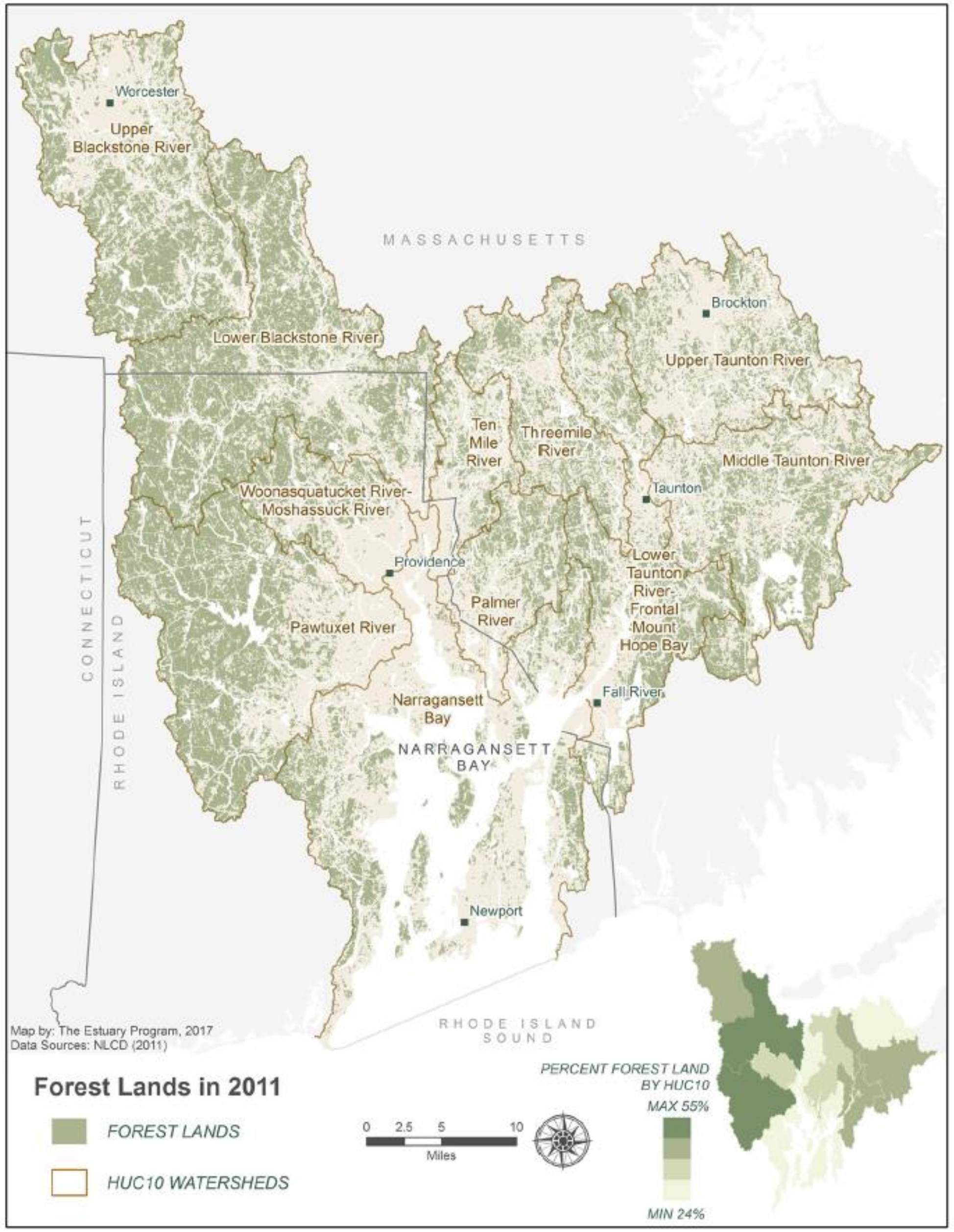
APPENDIX: FIGURES

Figure 3: Grants awarded to URI through Division of Research and Economic Development, by agency, 2007 to 2016 (2016 million dollars)

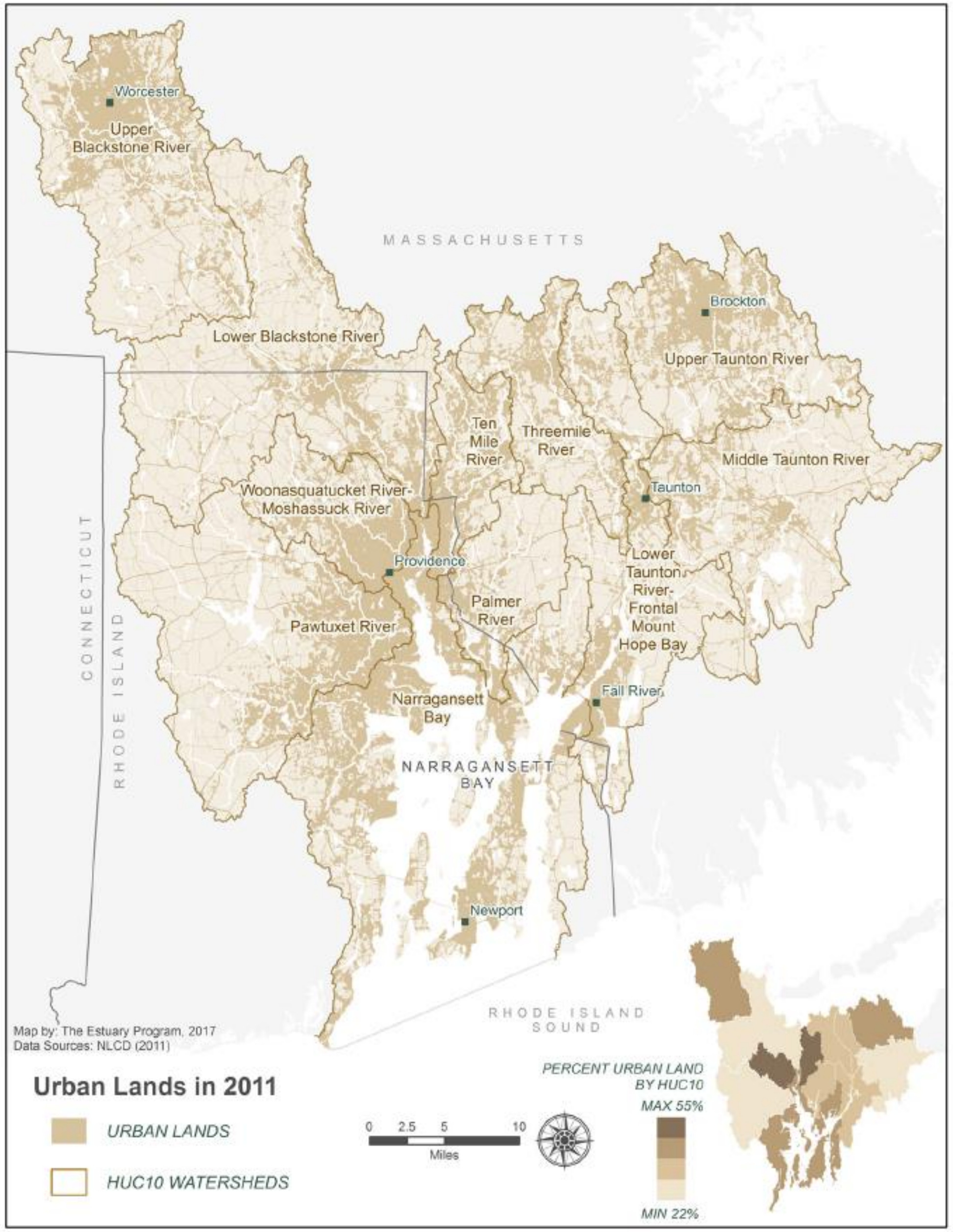


Source: URI, Division of Research and Economic Development Annual Report FY2016.

Note: The acronyms stand for the following agencies: **NSF**: National Science Foundation, **DOC**: U.S. Department of Commerce, **NAVY**: U.S. Navy, **INT**: U.S. Department of the Interior, **DOD2**: U.S. Department of Defense (Excludes Army, Navy, & Air Force), **NASA**: National Aeronautic & Space Administration, **AIRFOR**: U.S. Air Force, **ARMY**: U.S. Army, **EPA**: Environmental Protection Agency



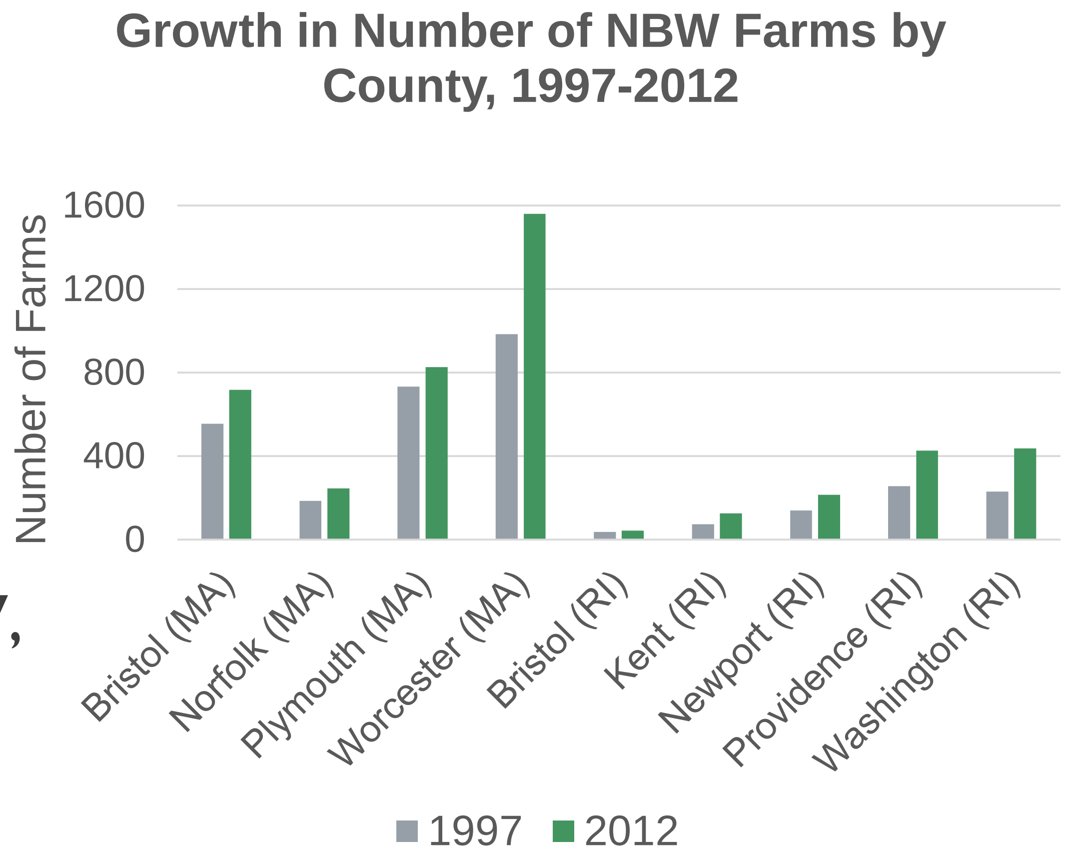
Source: NBEP, 2018



Source: NBEP, 2018

SECTOR: AGRICULTURE

- 4,600 farms, ½ sell agricultural products[1]
  - Top crops: sod, nursery products, tobacco, fruit/berries/tree nuts[2]
- Annual value $121 million crops and livestock[1]
- 2,675 employees[1]
- Industry growth: 44% more farms since 1997, constant acreage[3]

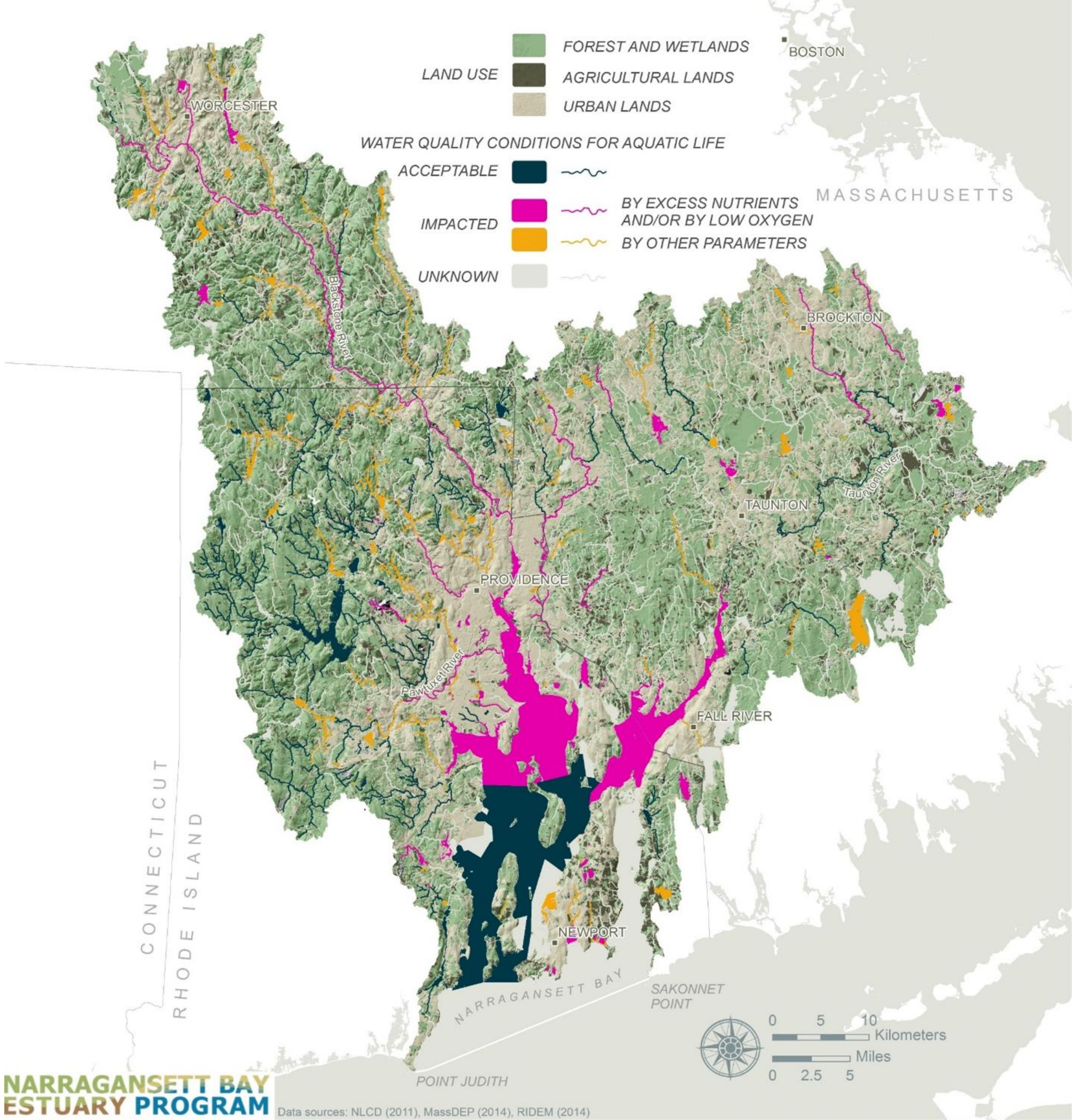


[1]USDA Census, 2014; [2]USDA NASS RI 2017; USDA NASS MA; [3]USDA Census, 1997

SECTOR: FORESTRY

- RI – $55 million in wages, 3,000 employees (2013)[1]
- MA - $170 million wages, 2,000 jobs (2006)[2]
- Most forests privately owned – RI (74%), MA (65%)[3]
- Increasing fragmentation

[1]NESFA, 2015l; [2]de la Cretaz, et al., 2010; [3]Butler (MA), 2016; Butler (RI), 2016



WHAT IS THE WATERSHED?

Source: NBEP 2018