Osprey Reproduction, Population, Diet and Stressors in the Chesapeake Bay

Barnett A. Rattner, Ph.D. and Daniel D. Day, M.S.
USGS-Eastern Ecological Science Center, Laurel, MD

USGS
science for a changing world

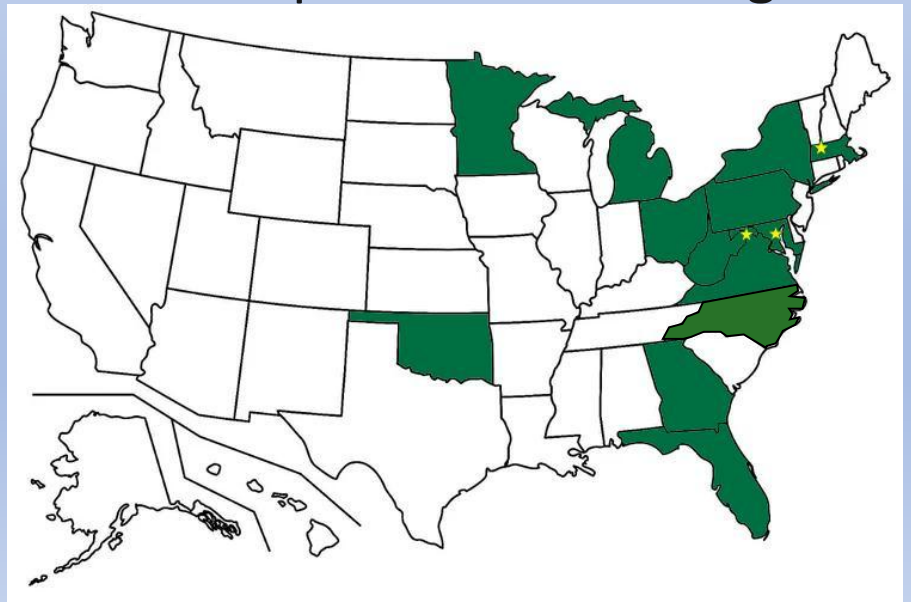
Overview: USGS, Eastern Ecological Science Center

U.S. Geological Survey

- Science arm of the Department of the Interior; non-regulatory
- Reputation for unbiased, scientific excellence

Eastern Ecological Science Center

- Provides world-class science to inform natural resource decision-making
- Three campuses: MD, WV and MA
- Staff located in many states across the U.S. and with scientific capabilities including:
  - Species Population Dynamics & Surveillance
  - Quantitative Methods & Decision Science
  - Animal Health Diagnostics & Surveillance
  - Ecological Patterns & Processes
  - Fish Passage Design & Analysis
  - Remote Sensing & Geospatial Analysis
- Recognized worldwide for migratory bird science
- Collaborative osprey research for >50 years



USGS

Osprey (*Pandion haliaetus*)

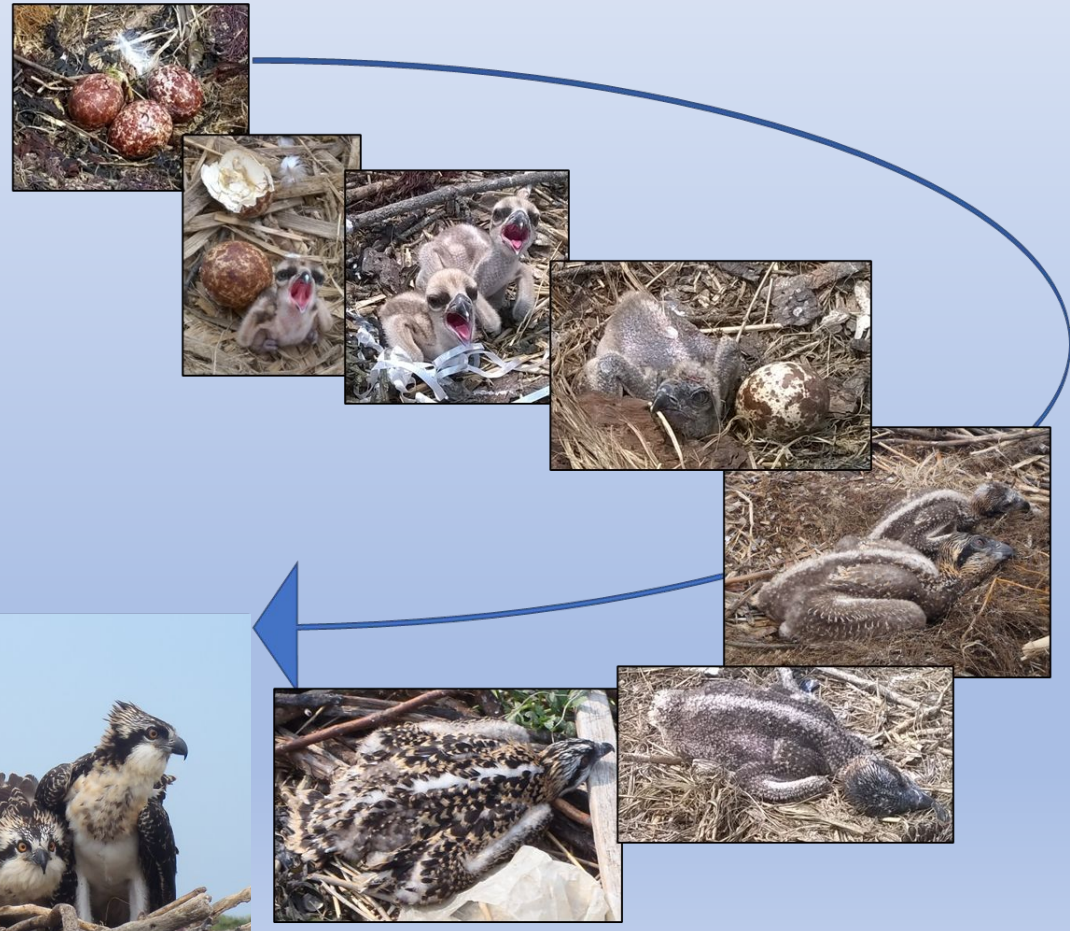
- Day-hunting bird of prey
- Distributed worldwide
- Adults large: 1400-2000 g, wingspan 59-70.8 inches
- Long-lived: generally 8 to 10 years (record 29 years)
- “Fish Hawk”, relies on live fish as food:
  - 99% of diet is fish of 150-300 g, ~6-13 inches
  - plunge dives within a meter of water surface
- Occupies many habitat types near shallow waters
- Northern populations migrate south, return north as waters warm and fish become accessible
- Sexually mature at 3-4 years
- Monogamous, long-term pair bonds

Map: Lynx Edicions/BirdLife International

USGS

Life History in Chesapeake's "Osprey Garden"

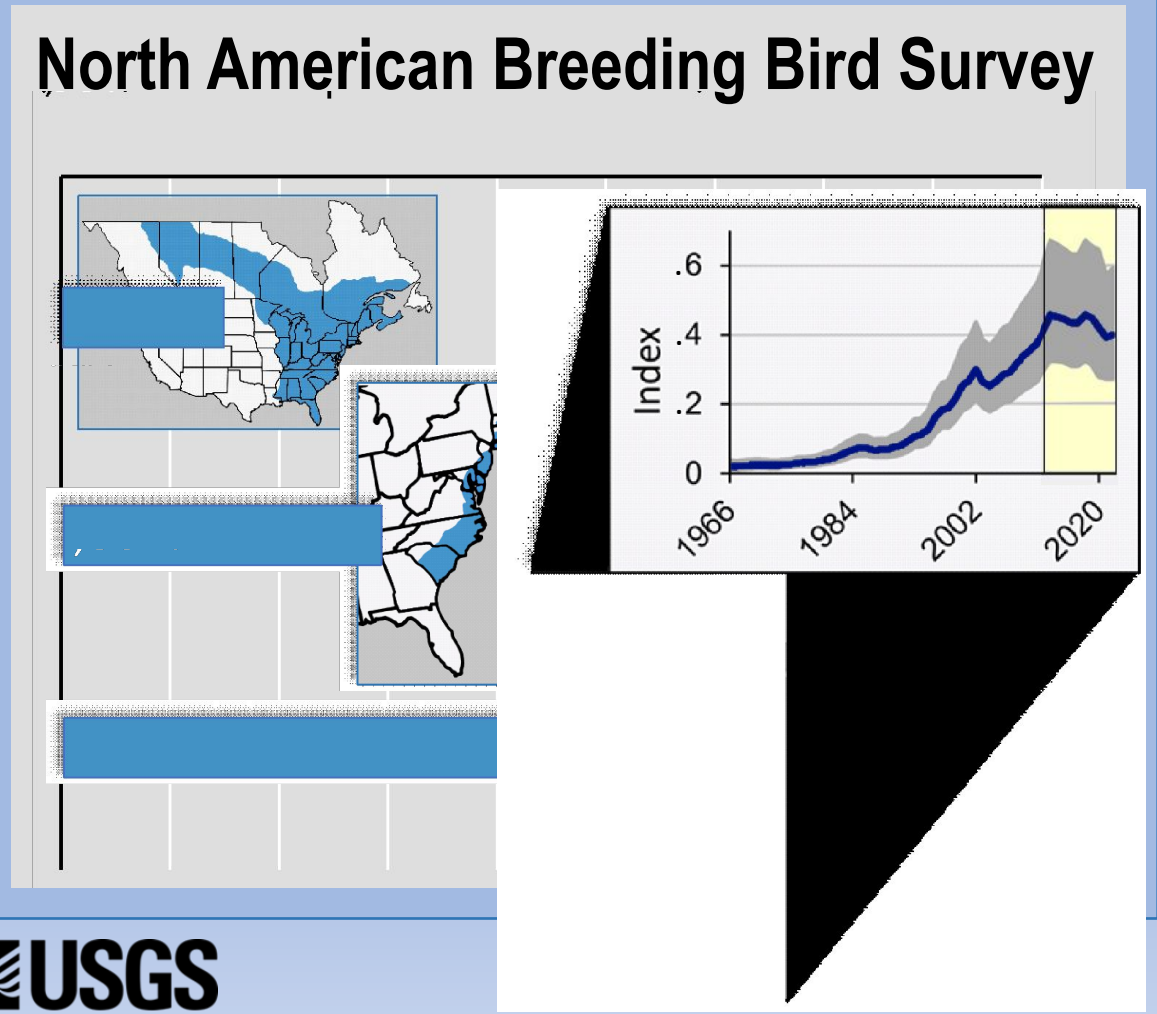
- **Late February to early March**: Migrants arrive
- **mid-March to mid-April**: Courtship and nest building (ATONs, platforms, duck blinds, trees)
- **mid-April to May**: Egg laying (2-4 eggs)
- **day 0-40**: Incubation (38-42 days)
- **day 41-99:** Nestling period (55-60 days)
- **July:** Exercise followed by fledging
- **September:** Migration south



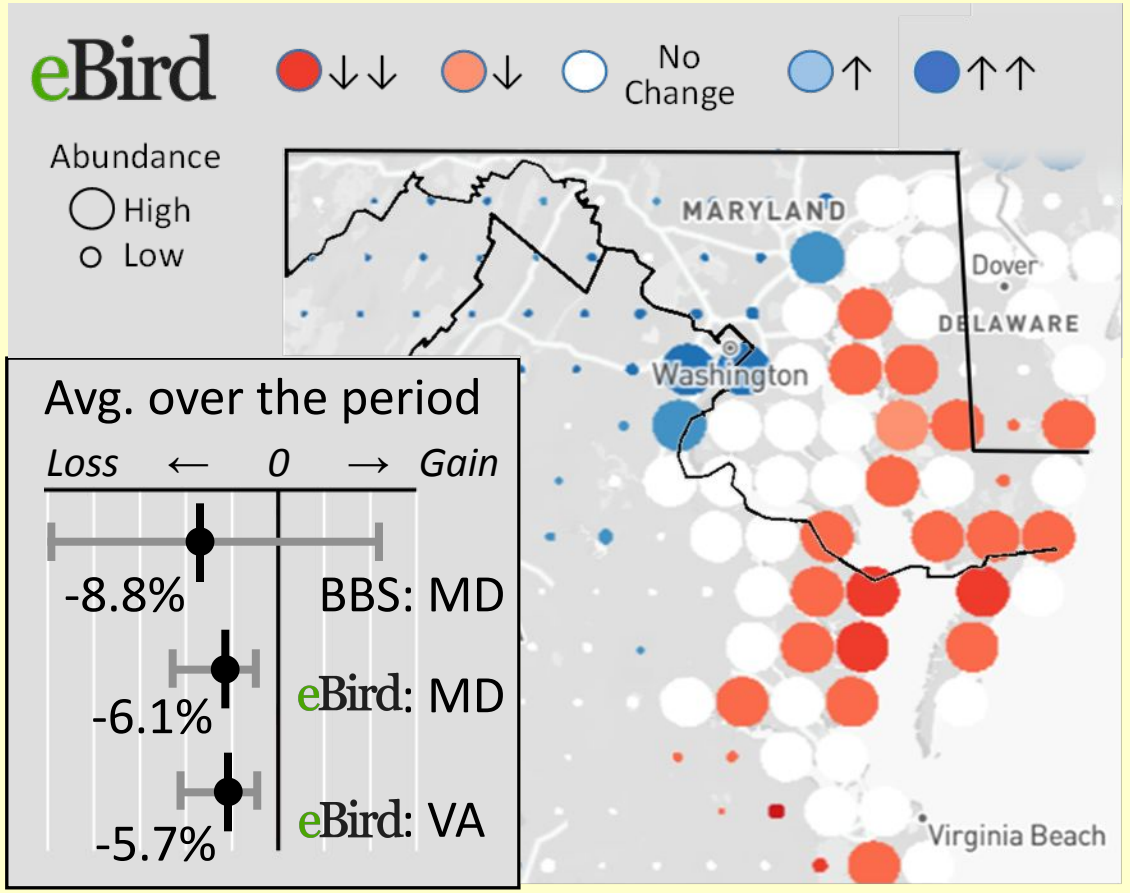
USGS

Continental and Regional Population Trends

Long-term Change
1966 – 2022

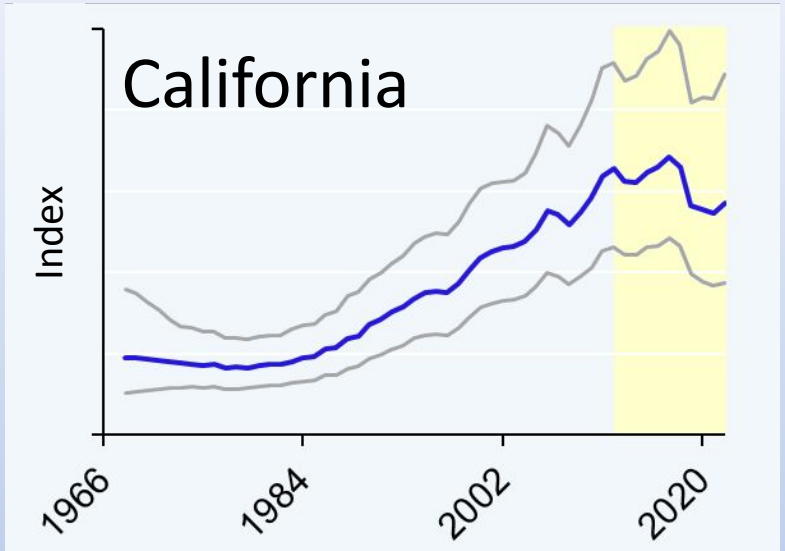


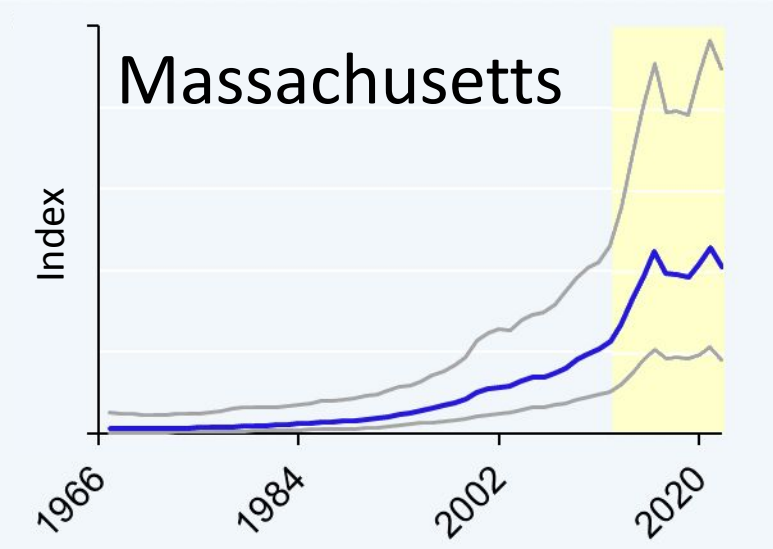
Recent Picture - Chesapeake
2012 – 2022

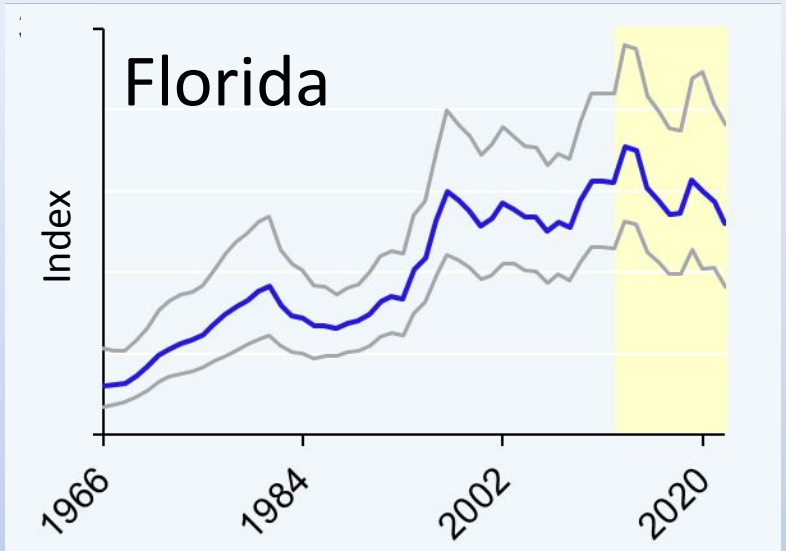


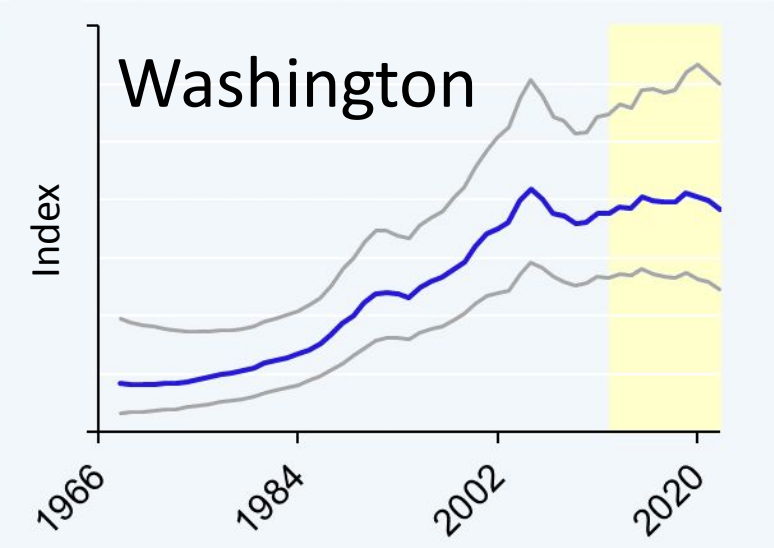
USGS

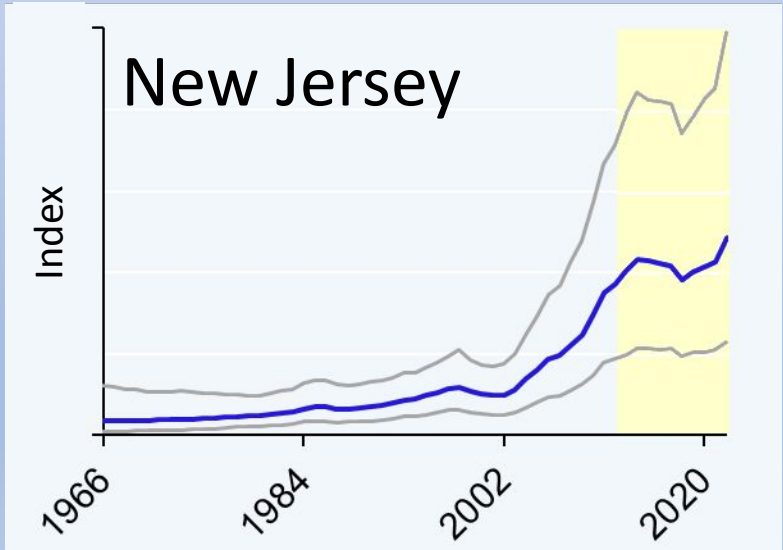
Continental Perspective

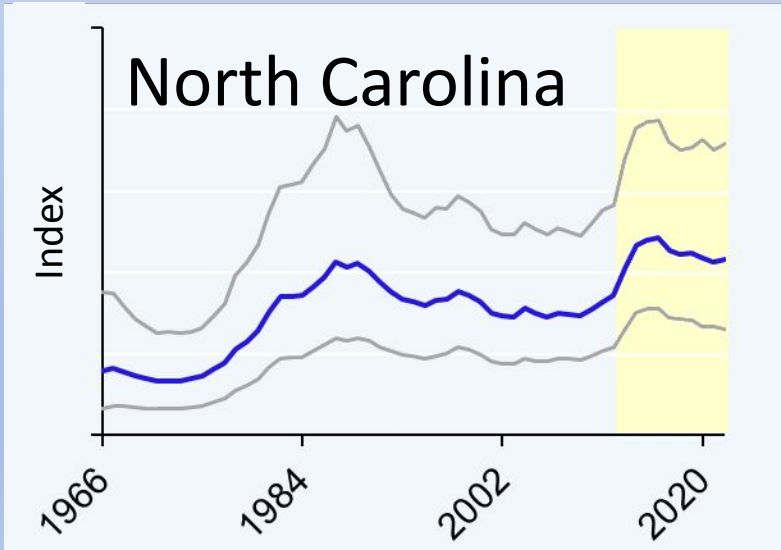












USGS

Osprey Nesting Population in Chesapeake Bay

- Aerial and ground survey (1973, DDT era)

  1,450 pairs (Henny et al. 1973)

- Aerial, boat and ground survey (1995/96)

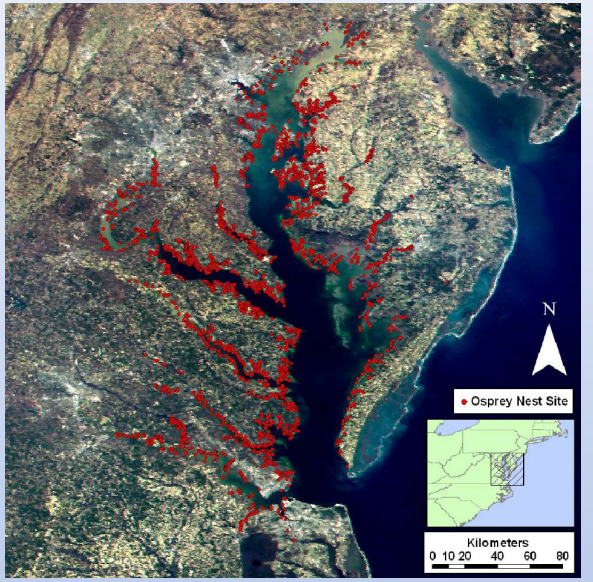
  3,473 pairs (Watts et al. 2004)

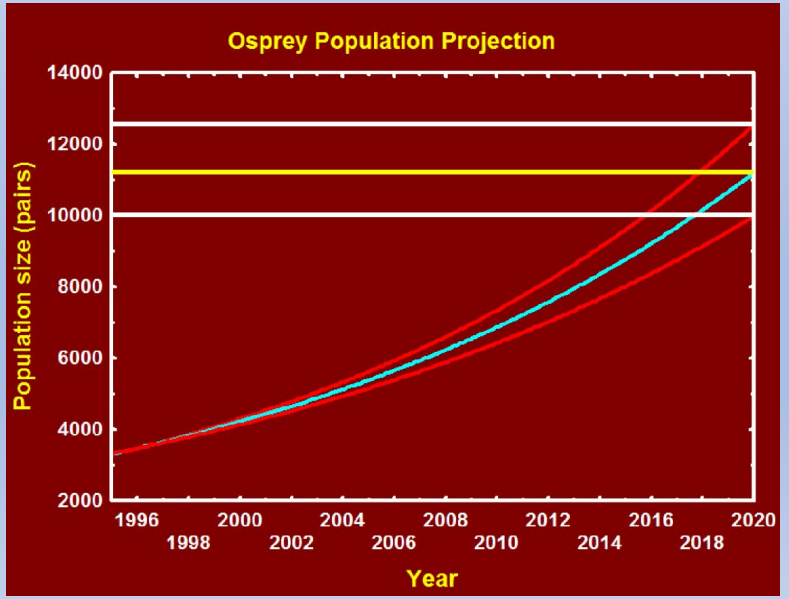
  Rapid growth in tidal fresh/brackish waters

  Slowest recovery Eastern Shore

- Chesapeake osprey population project (2020)

  11,000 pairs (Watts and coworkers)





USGS

Food Requirements

- Opportunistic feeders (if abundant, right size and accessible, it is eaten)
- Energy intake per day (Poole 1989, 2019)

	Breeding	Wintering
Number of fish	6-8	1-3
Daily catch (grams)	1250	300-350
Male's share (grams)	400	300-350
Male's (kilocalories)	360	200-250
Time (minutes/day)	195	30

- During nesting, male provides fish to mate and young (but not always)
- Provisioning rate depends on number of nestlings
- Male foraging distance from nest: 5-10 miles (rarely 15-20 miles)

USGS

Fish Species Consumed by Ospreys in Chesapeake Depends where Feeding/Nesting

(Glass and Watts 2009; Lazarus et al. 2016)

Susquehanna: salinity <0.5 ppt

- Catfish (77%)
- Gizzard shad (20%)

Upper Bay Estuarine Areas: salinity 0.5-5 ppt

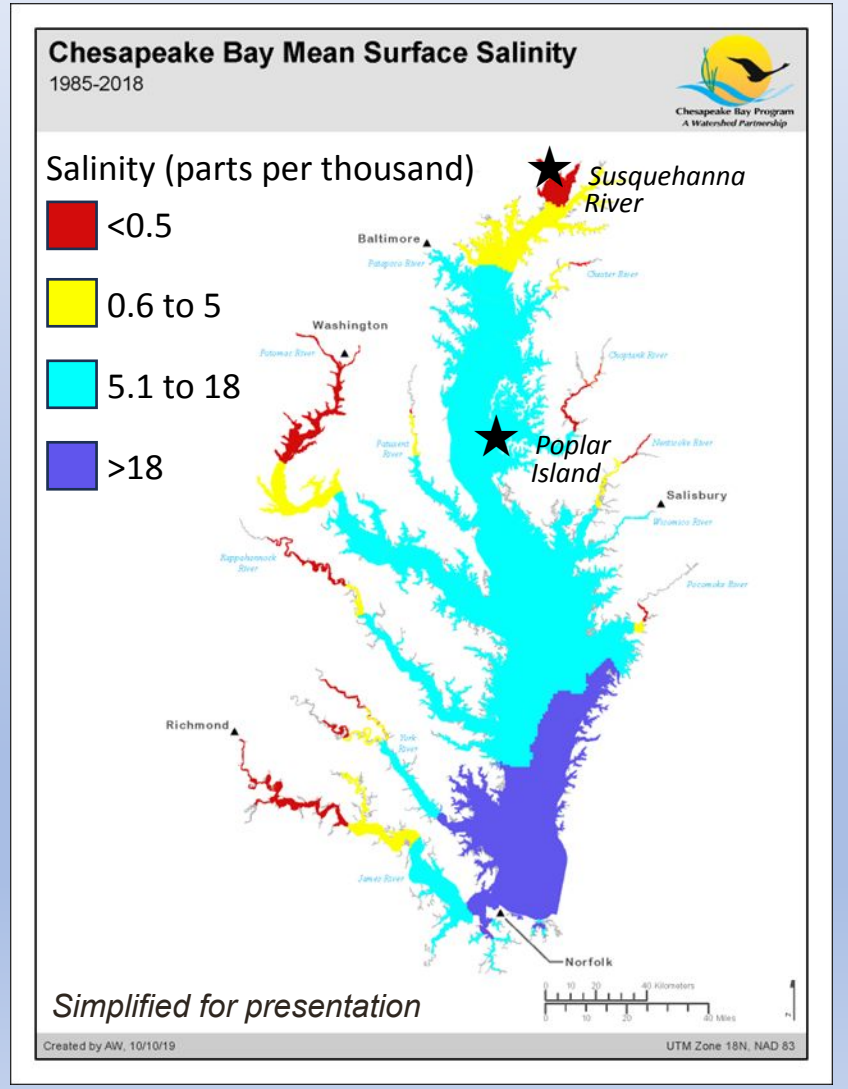
- Catfish (52%)
- Gizzard shad (28%)
- Atlantic croaker (7%)

Poplar Island: salinity 8-13 ppt

- Striped bass (48%)
- Atlantic menhaden (44%)

Lower Bay Estuarine Areas: salinity > 18 ppt

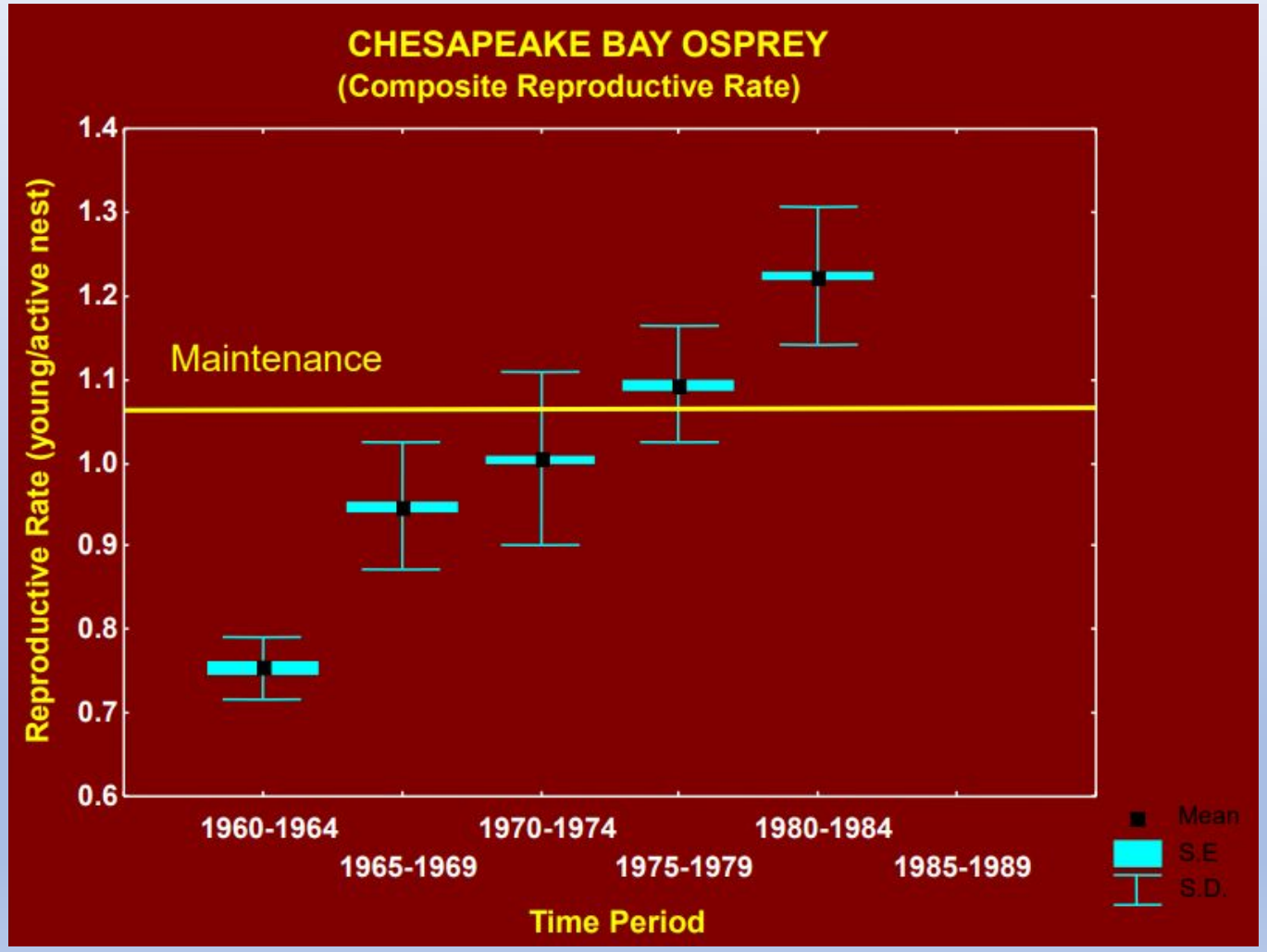
- Spotted seatrout (29%)
- Atlantic menhaden (24%)
- Atlantic croaker (12%)



USGS

Reproductive Rates for Population Stability

(Watts and Paxton 2007)



USGS

Prey Abundance Drives Reproductive Rate

Symmetrical Brood vs. Asymmetrical Brood (food stress)

- Establishment of dominance, sibling aggression, brood reduction

USGS

Reproductive Rates in Lower Chesapeake Demographic Sink

(Watts et al. 2024)

Reproductive rate and Brood provisioning

Parameter	1974-75	1985	2006-07	2021	F-statistic	p value
Nests (N)	75	68	132	68		
Clutch size	2.7 ± 0.08	3.0 ± 0.09	3.0 ± 0.27	2.7 ± 0.09	2.2	0.084
Reproductive Rate	1.7 ± 0.10	1.4 ± 0.11	0.8 ± 0.08	0.3 ± 0.11	34.9	<0.001
Brood Size	2.0 ± 0.10	1.8 ± 0.10	1.5 ± 0.09	1.2 ± 0.17	10.0	<0.001

Estimated reproductive rate required for a stable population within the Chesapeake Bay is 1.15.

USGS

Stressors Affecting Osprey Reproduction

- Limited food availability/quality
- Depredation
- Intraspecific competition for nest sites, prey, etc.
- Interspecific competition (e.g., bald eagle) for nest sites, prey, etc.
- Disease, HABs and other stressors
- Inexperienced breeders
- Weather events
- Environmental contaminants
- Water depth and clarity

USGS

Information Needs and Data Gaps

- Relationship between trends in osprey abundance with:
  - prey species trends
  - fish community composition shifts
  - population trend of other high trophic level feeders (e.g., other piscivorous birds, striped bass, bluefish)
- Better information about relation among salinity, osprey diet, brood provisioning & demography
- More fishery independent data of prey fish abundance and age/size class

USGS

Ongoing Research

- Osprey population and the availability of menhaden and other prey as their food source in Chesapeake Bay: historical and present-day comparison

  Study area: Lower Bay, Patuxent River, Poplar Island, Choptank River

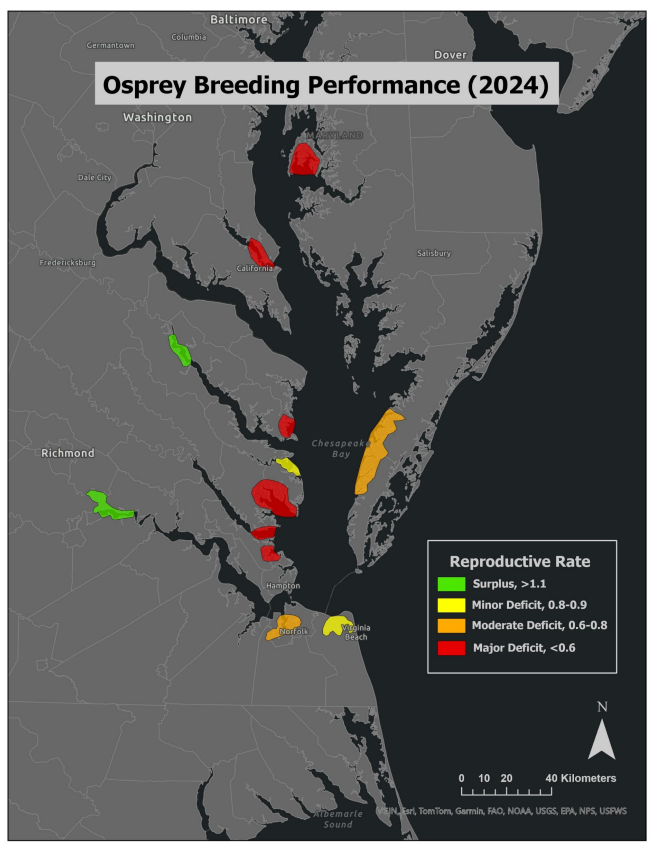
  April 2024-December 2025

  Multiple collaborators: USGS, USFWS, William & Mary, and others

USGS

Poor Reproduction of Ospreys in Some Parts of Chesapeake in 2024

- Success below threshold for population maintenance in mainstem of Bay
- Poor reproductive performance not limited to lower Chesapeake
- Largest contributing factor seemingly loss of young due to starvation



Site	Pairs	Reproductive Rate young/pr (SE)	Successful Pairs (%)
Main Stem (>10 ppt)			
Choptank River	60	0.23 (0.07)	18.3
Patuxent River	49	0.51 (0.11)	34.7
Fleets Bay	38	0.08 (0.05)	7.9
Eastern Shore	57	0.75 (0.13)	40.4
Piankatank River	37	0.89 (0.16)	54.1
Mobjack Bay	75	0.40 (0.08)	29.3
York River	58	0.52 (0.12)	31
Poquoson River	47	0.43 (0.10)	31.9
Elizabeth River	36	0.69 (0.14)	47.2
Lynnhaven River	30	0.90 (0.19)	50
MAIN STEM TOTAL	**487**	**0.51 (0.04)**	**33.1**
Reference (<1 ppt)			
Rappahannock River	33	1.31 (0.19)	63.6
James River	51	1.39 (0.33)	66.7
REFERENCE TOTAL	**84**	**1.36 (0.12)**	**65.5**

Bryan Watts, Center for Conservation Biology, College of William and Mary

Barnett Rattner and Dan Day, USGS Eastern Ecological Science Center

USGS

The CENTER for CONSERVATION BIOLOGY

Acknowledgements and Questions

- Bryan Watts Center for Conservation Biology, William & Mary
- Marie Pitts Center for Conservation Biology, William & Mary

- David Ziolkowski Jr. USGS-EESC at the Patuxent Research Refuge
- Jeffrey Hostetler USGS-EESC at the Patuxent Research Refuge
- Francine Rattner USGS-EESC at the Patuxent Research Refuge

USGS