frontiers | Frontiers in Marine Science

TYPE General Commentary
PUBLISHED 25 April 2025
DOI 10.3389/fmars.2025.1565843

OPEN ACCESS

EDITED BY
Igal Berenshtein,
University of Haifa, Israel

REVIEWED BY
Brendan J Runde,
The Nature Conservancy, United States

*CORRESPONDENCE
Bryan D. Watts
bdwatt@wm.edu

RECEIVED 23 January 2025
ACCEPTED 07 April 2025
PUBLISHED 25 April 2025

CITATION
Watts BD and Hines C (2025) Response: Commentary: Demographic response of osprey within the lower Chesapeake Bay to fluctuations in menhaden stock.
Front. Mar. Sci. 12:1565843.
doi: 10.3389/fmars.2025.1565843

Response: Commentary: Demographic response of osprey within the lower Chesapeake Bay to fluctuations in menhaden stock

Bryan D. Watts* and Chance Hines

Center for Conservation Biology, William & Mary, Williamsburg, VA, United States

KEYWORDS

osprey, Atlantic menhaden, Chesapeake Bay, reproductive rate, fisheries

A Commentary on

Commentary: Demographic response of osprey within the lower Chesapeake Bay to fluctuations in menhaden stock

By Latour RJ, Gartland J and Ralph GM (2024) *Front. Mar. Sci.* 11:1416687. doi: 10.3389/fmars.2024.1416687

Latour et al. (2024) published a commentary on “Demographic response of osprey within the lower Chesapeake Bay to fluctuations in menhaden stock (Watts et al., 2024).” The paper presents more than four decades of osprey (*Pandion haliaetus*) breeding performance data within a subestuary of the Chesapeake Bay showing trends in breeding success, brood size, reproductive rates, provisioning rates and Atlantic menhaden (*Brevoortia tyrannus*) delivery rates. During the study period the population transitions from a demographic surplus to a demographic deficit. Latour et al. (2024) raise concerns about the statistical methodology used to assess the relationship between reproductive rates and a coast-wide menhaden index and question the use of the index on a local scale. While we agree with some comments concerning methodology, a reanalysis results in no changes to the original findings. We disagree with other comments and collectively they do not alter the conclusions. We address these points below.

One of the central concerns raised by Latour et al. (2024) was the statistical treatment of the relationship between reproductive rates and the menhaden index. The authors suggest that the use of means as measures rather than raw data ignores the inherent error and does not appropriately address uncertainty. The authors also question the use of simple linear regression pointing out violations in the underlying assumptions of normality and suggest that a more appropriate treatment would employ a multiplicative, lognormal error. We agree with these comments and regret that a more complete treatment of this relationship was not presented in the original paper. The authors then take extraordinary measures to extract data from a graph (Figure 4 from Watts et al. 2024), project distributions, develop a new model ($\log(r_y) = \log(\beta_0 + \beta_1 I_x) + \varepsilon_y$) and then run simulations to evaluate the robustness of model results. They conclude that there is a positive relationship between osprey reproduction and the menhaden index but that the β_1 estimate was positioned on the threshold (p = 0.05) of significance. They also conclude that only 41% of the 1,000 simulated data sets were statistically significant casting doubt on the original conclusions.

Neither of the conclusions about the statistical relationship between osprey reproduction and the menhaden index presented in Latour et al. (2024) are accurate. Why the authors spent extraordinary effort to create new datasets for testing is unclear. As indicated in Watts et al. (2024) the dataset was publicly available upon request (now available as a supplement to this paper). Reanalysis of the actual data using the number of young produced at each nest as the response variable within a Poisson regression, as suggested by Latour et al. to handle the multiplicative nature of the data, resulted in a highly significant relationship (Figure 1A). In contrast to the results from the created datasets used by Latour et al., the β_1 estimate from the actual dataset was highly significant ($p = 1.1 \times 10^{-15}$). All of the β_1 estimates from regressions using 1,000 random subsets of the data were significant (Figure 1B) with a mean p-value of 1.25×10^{-15}. In addition, regressions using a two ($p = 2.0 \times 10^{-15}$) and four-year ($p = 1.1 \times 10^{-6}$) lag of the index were both significant. When compared to the regression presented in Watts et al. (2024) the statistical significance of the reanalysis is greater ($p = 1.8 \times 10^{-6}$ vs $p = 1.1 \times 10^{-15}$). The conclusions presented in Watts et al. (2024) remain unchanged.

Latour et al. (2024) make a series of errant assumptions about the rationale for providing correlation analyses between the various menhaden indices in the methods. The inter-relationships between the various menhaden indices are well known and a full correlation matrix is presented in SEDAR (2022). The authors assume that the rationale for presenting the correlations was explanatory rather than informative. They posit that the presentation is an attempt to justify the use of the coast-wide juvenile index over the others available, that it was an attempt to reconcile the disparity in scale between the index and the osprey study site and that it was an attempt to overcome the age disparity between the index and fish used by osprey. The authors also suggest that the correlation result provided between the Maryland juvenile and coast-wide index was misleading since the Maryland index is included in the coast-wide index and further that the result provided between the coast-wide and mid-Atlantic adult index was either extrapolated beyond the range of the adult index (index was not initiated until 1985) or was dependent on the first two years of the run. None of these assumptions are correct and for the intended use it does not matter that the Maryland index is included in the coast-wide juvenile index. We did not extrapolate the relationship between the juvenile and adult indices beyond the reported range.

The rationale for presenting the correlations within the methods was to inform the reader about the covariance structure within the set of menhaden indices. Within the context of the regression analysis between osprey and menhaden the covariance between indices is such that the use of any of them would produce the same basic result. In fact, regressions between osprey breeding performance and all of the indices including the Maryland juvenile index ($p = 2.7 \times 10^{-13}$), the coast-wide juvenile index ($p = 1.1 \times 10^{-15}$) and the mid-Atlantic adult index ($p = 1.3 \times 10^{-4}$, analyzed using only the last three time periods since the index was only initiated in 1985) are significant. The correlations presented in the methods offer very little explanatory value, could not overcome the various issues raised by the authors and were never intended to do so.

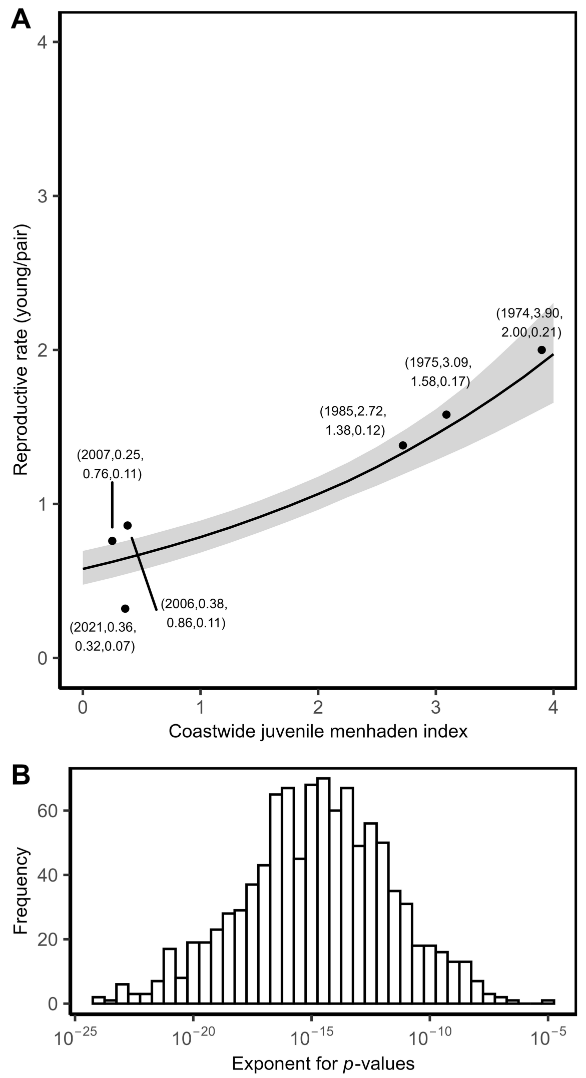

FIGURE 1
(A) Relationship between osprey annual reproductive rates (r_y) and coast-wide juvenile indices (I_y). Point labels are (y, I_y, r_y, SE) and the bias-corrected fitted line with its 95% shaded confidence interval overlaid. **(B)** Histogram of p-values associated with significance tests of β_1 from 1,000 simulated regressions.

The link between osprey breeding performance and menhaden within Mobjack Bay is established within the osprey field data. The significant decline in breeding performance coincided with an increase in brood reduction caused by food stress, a significant reduction in provisioning rate and a shift in diet composition. The rate of menhaden delivery to nests declined by more than 80% over the study period while the delivery rate of other major fish species in the diet increased (McLean and Byrd, 1991; Glass and Watts, 2009; Academia, 2022). Because the energy density for menhaden is among the highest within the diet, the shift in diet composition away from menhaden resulted in a 50% decline in the overall energy content of the diet. The singular decline of menhaden in the diet reduced energetic provisioning below a threshold for demographic stability. Experimental supplementation of nests with menhaden demonstrated this relationship by increasing reproductive output above maintenance for treatment nests while control nests remained below maintenance (Academia and Watts, 2023). While we agree that contemporaneous menhaden abundance data collected on the local level would advance our understanding of this relationship, we do not agree with the suggestion by Latour et al. (2024) that a functional link cannot be established in the absence of such data.

The use of the coast-wide menhaden index was an attempt to couch the osprey pattern in the currency used by the fisheries community. The regulatory community has held for decades that Atlantic menhaden represents a single stock and should be managed as such (SEDAR, 2022). A great deal of investment has been made to develop a coast-wide index and management policy is set based largely on the behavior of this index. When questions arise about local abundance or the health of menhaden within portions of the geographic range, fisheries scientists, managers and the commercial fishing industry deflect to the coast-wide index. Latour et al. (2024) argue that the coast-wide index may not reflect the abundance of menhaden in Mobjack Bay. We agree that the sole reliance on coast-wide data masks local dynamics. Future monitoring efforts should begin to investigate trends in menhaden abundance that are on a spatial scale that is relevant to local consumers. Such efforts would allow for the evaluation of correspondence between local and coast-wide patterns.

Author contributions

BW: Conceptualization, Formal Analysis, Writing – original draft, Writing – review & editing. CH: Formal Analysis, Writing – review & editing.

Funding

The authors declare that no financial support was received for the research, authorship, and/or publication of this article.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declare that no Generative AI was used in the creation of this manuscript.

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fmars.2025.1565843/full#supplementary-material

References

Academia, M. H. (2022). *Food supplementation increases performance of ospreys in the lower Chesapeake Bay* (Williamsburg, Virginia, USA: M.A. Thesis. College of William and Mary).

Academia, M. H., and Watts, B. D. (2023). Food supplementation increases reproductive performance of ospreys in the lower Chesapeake Bay. *Front. Mar. Sci.* 10. doi: 10.3389/fmars.2023.1172787

Glass, K. A., and Watts, B. D. (2009). Osprey diet composition and quality in high and low salinity areas of lower Chesapeake Bay. *J. Raptor Res.* 43, 27–36. doi: 10.3356/JRR-08-22.1

Latour, R. J., Gartland, J., and Ralph, G. M. (2024). Commentary: Demographic response of osprey within the lower Chesapeake Bay to fluctuations in menhaden stock. *Front. Mar. Sci.* 11. doi: 10.3389/fmars.2024.1416687

McLean, P. K., and Byrd, M. A. (1991). The diet of Chesapeake Bay ospreys and their impact on the local fishery. *J. Raptor Res.* 25, 109–112.

Southeast Data Assessment and Review [SEDAR] (2022). *Atlantic States Marine Fisheries Commission – Atlantic Menhaden Stock Assessment Update* (North Charleston, SC: National Oceanic and Atmospheric Administration).

Watts, B. D., Stinson, C. H., McLean, P. K., Glass, K. A., Academia, M. H., and Byrd, M. A. (2024). Demographic response of osprey within the lower Chesapeake Bay to fluctuations in menhaden stock. *Front. Mar. Sci* 10. doi: 10.3389/fmars.2023.1284462