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Response To The Letter To The Editor On Turner (2017)

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COMMENTARY

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Response to the letter to the editor on Turner (2017)

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This commentary responds to Schueller et al. (2018), https://doi.org/10.1002/geo2.48.

The authors of the letter to the editor (LTE; Schueller et al., 2018) raise three objections to the analysis of Turner (2017): (1) using an estimate of MSY (maximum sustainable yield) as a stock management metric; (2) inappropriate analyses; and (3) failure to consider "alternative hypotheses for the putative patterns."

1. They write "neither value described as 'MSY' in Turner (2017) represents an accurate or reliable estimate of MSY for menhaden." The MSY value used is defined by them as a "biological reference point." That is why it was used; it is the maximum equilibrium landing "against which to measure stock or fishery status" and includes a spawner–recruit curve and values for growth, mortality and gear selectivity (Williams & Shertzer, 2015). The MSY usually serves as "a value to be avoided" (Vaughan et al., 2007). The MSY values are indeed, as the LTE author(s) write, "reference points for management." If the LTE authors mean that the estimated MSY in SEDAR (2013) is incorrectly estimated by the NMSF Beaufort Assessment Model (BAM), then that concern should be addressed to the 27 contributors to the BAM development, and to the several reviewers involved in the two lengthy review cycles. The status today is that the MSY used is an authoritative benchmark metric developed using output from the BAM.
2. The analysis of data used in their Table 1 incorrectly attributes similarity to the data used in Turner (2017), which come from table 4 in Vaughan et al. (2010) and are repeated in tables 3.5 and 3.6 of SEDAR (2013). The data are not "mean estimates of size-at-age," as categorised in the LTE, but weighted averages. For example, the table heading for the data includes: "Weighted mean fork length (mm) at age, with weightings based on annual catch in numbers by season and area" and "Weighted mean weight (g) at age, with weightings based on annual catch in numbers by season and area." These data are, therefore, the result of accounting for different numbers of fish taken from different areas and in different months. The LTE authors used the raw data for *all* fish regardless of month, and without discrimination for the number of fish each month, growth between months, or catch area – a crude approach to calculating average size that obviously adds variation to the "average" value for each year; it is not the data set used in Turner (2017) and the comment is, therefore, an inappropriate comparison.
3. The first sentence of the abstract (Turner, 2017) states the hypothesis tested: "to determine if there was evidence of changes consistent with the well documented temperature size rules." The decline in size per degree (slope) is the same when fishing is below the MSY compared with when it is above the MSY (Figure 1), but there is a smaller size with greater fishing intensity for each age group. Support for a temperature effect is, therefore, demonstrated as being consistent with the hypothesis tested and influenced by fishing intensity.

Did the size change with temperature, in general? Yes. Did the analysis show distinction between when fish were over and under a standard metric of fishing intensity? Yes. Perhaps there is another explanation for the trends observed; but the most likely one today is consistent with results from a broad suite of analyses about the effect of warming oceans on organisms

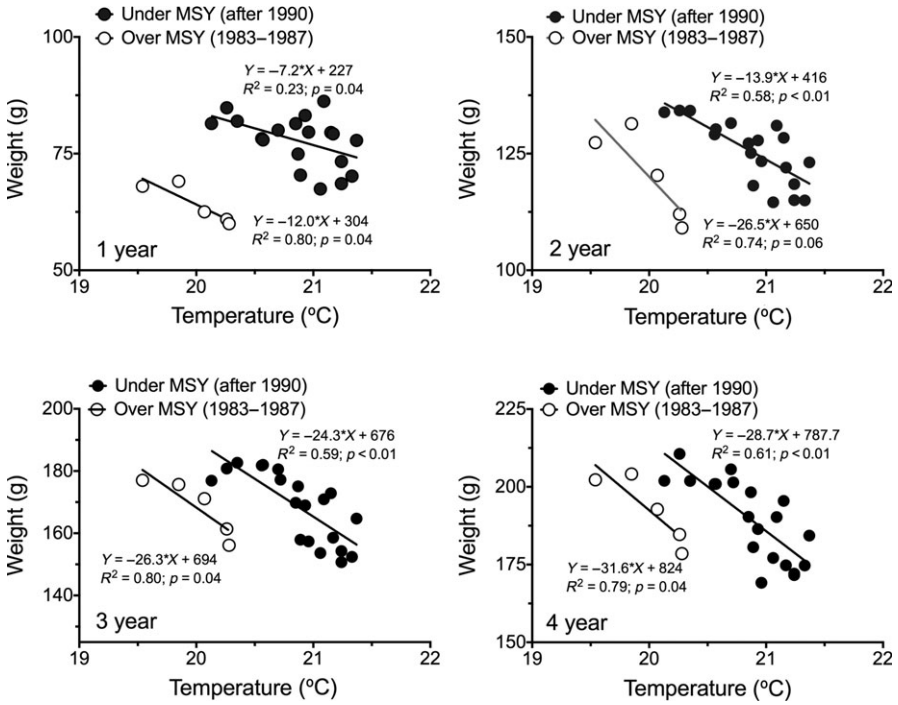

FIGURE 1 Figure 4 in Turner (2017) is sub-divided here into four panels for emphasis. The data are the average weight of fish for each age class of Gulf of Mexico menhaden. The dataset is further divided into years when the total harvest was less than or greater than the modelled maximum sustainable yield (MSY). The slopes were not significant among year classes, whereas the intercept was different.

(Baudron et al., 2014; Daufresne et al., 2009; Ohlberger, 2013; Pauly & Cheung, 2017; Sheridan & Bickford, 2011). It is inconsistent with other hypotheses mentioned in the paper.

The commenters correctly point out that the *Y* axis in Figure 1 (Turner, 2017) should be "thousand mt," not "million mt." I regret the error, and it does not change the results.[1]

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ENDNOTE

[1] This error was corrected online on 11 September 2018.

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