IAGC Zooplankton Paper Talking Points

IAGC Position Statement

IAGC: Plankton Study Speculative and Needs Better Data

"While we found the study interesting, we are also troubled by the small sample sizes, the large day-to-day variability in both the baseline and experimental data, and the large number of speculative conclusions that appear inconsistent with the data collected over a two-day period. Both statistically and methodologically, this project falls short of what would be needed to provide a convincing case for adverse effects from geophysical survey operations.

"Although the initial report is peer-reviewed, it has not been widely accepted by the expert scientific community. We look forward to discussing this topic further with the authors and other experts in this field to determine the best path forward toward more scientifically solid and consistent results that can be replicated and verified by other independent researchers, in the best traditions of science.

"While we remain open to all emerging new scientific information, after more than 50 years of continuous seismic surveying around the world, including extensive operations in the Gulf of Mexico, and over a decade of intense scrutiny by hundreds of scientists, there is still no scientific evidence that sound from seismic operations has negative population impacts on marine life."

Background

The researchers are:
Robert D. McCauley, Ryan D. Day, Kerrie M. Swadling, Quinn P. Fitzgibbon, Reg A. Watson and Jayson M. Semmens

Title of the article:
Widely used marine seismic survey air gun operations negatively impact zooplankton

Journal that published the paper:
Nature Ecology & Evolution, 22 June 2017; Volume 1; Article Number: 0195

Talking Points

Flaws in the Research and Conclusion

- The "evidence" presented by the researchers consists of only two samples on two consecutive days, carried out in about 1.5 hours.
- The research finding may suggest but does not prove the conclusion that seismic survey air sources negatively impact zooplankton. The small sample size, inconsistency in the data and questionable "pruning" of the raw data undermine confidence in the reported values for degree of impact.
- The stark difference in plankton abundance reported between the two days clearly shows to any expert plankton ecologist that the data set should have been increased at least ten-fold to produce statistically meaningful data.
- The authors claim in their abstract that all juvenile krill ("nauplii") were killed, but their own data in Table 3 of the Supplementary Information indicates only fractional mortality, which overlapped with the mortality seen in the control samples (control samples also contained a larger fraction of dead krill).
    - Numerical comparisons are difficult because the counts were not controlled for observer bias (blind controls), and individual samples were pooled and presented without measures of variance within the pooled samples. The fact that the reviewers of the paper did not catch this egregious error casts a pall of uncertainty about the quality of the review conducted by the journal.
- All of the "pseudo-quantitative" results, for example the claim of a 64 percent decrease in abundance following sound exposure, are statistically questionable and were further biased by selective "weeding" of the data to produce the desired answer. (See Table 1 of the Supplemental Materials for this publication to appreciate the disparity between the actual raw data and the arbitrarily selection analyses reported in the body of the paper.)
    - The value of 64 percent was obtained by selectively eliminating more than half of the data, and giving inappropriate weighting to data on the second day, when the small sample sizes created anomalously large ratios of control to exposure.
    - The plankton data was derived using sound coming from sonar on a ship or towed by a ship, which measured the amount of sound reflected to the sonar receiver but can be skewed if the plankton turn from facing horizontally in the water to all looking up or down vertically. The reflected sound increasing or decreasing is interpreted by the sonars display as more or fewer plankton, but in fact what has changed is the way the plankton are oriented, like turning a mirror toward or away from a light source. Those data derived from acoustic backscatter such as the purported 'hole' may have been due to plankton not moving out of the area but only changing their orientation relative to the sonar, as the authors themselves noted.
    - In the body of the paper, the authors admit that changes in sonar signal of this magnitude can be produced by movement or changed orientation of the plankton and not mortality.

    - Also on the second day almost all values at 80 meters range presented greater plankton abundance from exposed samples and lower abundance of control samples, indicative of a flaw in the sampling scheme and analysis protocol.
- The results are not consistent with other research, which would lead us to expect higher mortality in close proximity (10 meters or so), decreasing with range. This is yet another indicator that the complex schema to attempt to track a moving body of water carrying the plankton likely did not actually capture data at the true exposure distances.
- The researchers' conclusion that there is a significant and unacknowledged *potential* for negative impact to ocean ecosystem function and productivity is pure speculation beyond the data and unsupported by the data.
    - *Potential* is the key word here, and scientifically speaking there is equal if not greater *potential* that there will be no impact; that is the null hypothesis that must be disproven by data beyond what is presented here.
- *Independent consultation with several internationally renowned experts in this type of work elicited comments consistent with the above points: the sample size was inadequate with sample variability that could not support the statistical treatments used by the authors, the work should not have been published, and the conclusions were not supported by the data. More than one reviewer noted that the authors of this paper are not trained plankton ecologists and questioned their qualifications as an underlying factor in the problematic aspects of how the data were collected and analyzed.*