

## Comment on Health of Common Bottlenose Dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana, Following the *Deepwater Horizon* Oil Spill

In their article, Schwacke et al.<sup>1</sup> inferred that the health of dolphins in Barataria Bay (BB) was impacted by the *Deepwater Horizon* accident and oil spill. In reading the paper, I identified several issues and uncertainties that I would like to bring to your attention. By way of background, I have a Ph.D. in chemical oceanography and 25 years of experience in natural resource damage assessment, including work for the Trustees of Prince Williams Sound where I led efforts to assess lingering oil and resource conditions 15 years after the *Exxon Valdez* oil spill.

First and foremost, Schwacke et al.<sup>1</sup> did not establish a cause–effect relationship between oil from the *Deepwater Horizon* incident and the health of dolphins in BB. The authors did not present any information related to dose and exposure to support a dose–response relationship and establish causation. Additional issues and uncertainties that should be considered when interpreting these data include the following:

- The absence of baseline data showing the preaccident health or condition of dolphins in BB.
- Systematic evaluation of other stressors in BB and the Gulf of Mexico in general, including persistent organic pollutants, disease, toxic algae, anomalous temperature fluctuations and freshwater incursions, prey health and availability, industrialization, commercial and recreational fishing activities, and habitat and water quality concerns.
- Differences in conditions in the two bays at the time of sampling, including temperatures, as unusually high or low temperatures can be stressors.
- Differences in the two bays in general (e.g., flushing characteristics, trophic status, long-term water quality trends and effectiveness of ongoing prevention/remediation efforts, and population densities and industrial activities in adjacent watersheds).
- The 5-day oil release associated with an abandoned wellhead break in BB in July 2010 due to a tugboat collision unrelated to the *Deepwater Horizon* accident.
- The influence of the unusual mortality event (UME), which preceded the *Deepwater Horizon* accident and affected large portions of the Texas and Louisiana coastline but not most of Florida or Sarasota Bay (SB).
- Small sample sizes and the resulting sex and age class distributions obtained for dolphins sampled in the two bays, which can limit the authors' ability to detect, quantitatively characterize, and draw conclusions regarding significant differences between BB and SB populations.
- Transport and fate processes acting on the *Deepwater Horizon* oil release between the wellhead and dolphin home range.
- Morphological, genetic, and behavioral differences in the dolphin subpopulations in BB and SB.

For example, mass/length relationships were used to define reference ranges and assess body condition. However, the dolphins used to develop these relationships included individuals only from SB,<sup>2</sup> and the authors did not discuss any of the uncertainties that need to be considered when extrapolating population-specific reference intervals to other populations or sampling years. Using reference ranges developed for SB dolphins, the authors identified five “significantly underweight” dolphins from BB that were determined to be in poor body condition. In several cases, these findings were inconsistent with observations made at the time of capture; observers identified only two underweight individuals and the remaining three were characterized as having ideal body condition. Hart et al.<sup>2</sup> alluded to some degree of “size similarit[y]” between SB dolphins and populations inhabiting the western North Atlantic, but did not provide detail to facilitate a quantitative comparison of reference ranges between these populations.

Overall, Schwacke et al.<sup>1</sup> acknowledged a number of issues and uncertainties, and used language like “consistent with” and “potential connections among the observed conditions...,” recognizing the limitations in the data and analyses. However, those caveats are lost when this work is communicated to the popular press, at least in part due to the less measured way in which the authors have communicated the results of this study directly to the press and public.

For example, with the exception of alveolar-interstitial syndrome (AIS), pulmonary abnormalities were not statistically different between BB and SB populations. Despite this observation, the authors concluded that “BB dolphins were 5.0 times more likely to have moderate-severe lung scores as compared to SB dolphins,” suggesting that the prevalence and severity of AIS played a significant role in determining overall pulmonary health. The authors provided no cautionary language alerting the reader to the limited diagnostic value of AIS as they have done in other peer-reviewed literature. In particular, Smith et al.<sup>3</sup> concluded that “AIS was generally non-specific as it represented several possible disease states, ranging from mild to severe, acute to chronic, and active to inactive conditions” and that “[t]he diagnosis of pleural effusion, pulmonary masses, and pulmonary consolidation was more straightforward to assess clinical significance.” As noted above, the prevalence of each of these more specific pulmonary abnormalities was evaluated in both BB and SB dolphins and no statistical differences were observed.

The conceptual model developed by Schwacke et al.<sup>1</sup> is limited in that it addresses only exposure to oil—a more complete conceptual model would have included other stressors and their relationship to the health measures evaluated by the authors. The authors acknowledged in their discussion

that a number of other stressors (e.g., persistent organic pollutants, infections) may be responsible for some of these same disease conditions. Clearly, consideration of other stressors is needed.

To better interpret the significance of these findings, it would be helpful for NOAA to share with the larger scientific community the necropsy data for the hundreds of dolphins that died during the Gulf of Mexico UME that began in February 2010. That information is clearly relevant to the conditions in the Gulf, and should be made available to other scientists so we can, collectively, better understand the health of dolphins in the Gulf of Mexico, the various stressors that may be adversely affecting their health, and the potential causes of dolphin mortality in this region. Ongoing studies of dolphin prey in the Gulf of Mexico will further advance our understanding of dose and exposure. Similarly, ongoing population studies of dolphins in the Gulf of Mexico will further advance our understanding of the cumulative impact of all stressors that might adversely affect long-term dolphin health in this region.

**Lucinda A. Jacobs\***

Integral Consulting Inc., 411 First Avenue S, Suite 550,  
Seattle, Washington 98104, United States

#### ■ AUTHOR INFORMATION

##### Corresponding Author

\*Phone: (206) 957-0328; fax: (206) 230-9601; e-mail: ljacobs@integral-corp.com.

##### Notes

The authors declare the following competing financial interest(s): I am a consultant to BP. These comments are my own.

#### ■ ABBREVIATIONS

AIS     aveolar-interstitial syndrome  
BB     Barataria Bay  
NOAA   National Oceanic and Atmospheric Administration  
SB     Sarasota Bay  
UME    unusual mortality event

#### ■ REFERENCES

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