Marine-life Data and Analysis Team (MDAT) Cetacean Product Updates
Summary of Changes for v2.0 Update (June 2018)

Overview

Cetacean individual species or species guild models were updated by the Marine Geospatial Ecology Lab at Duke University (MGEL) in fall 2017. These products were reviewed by species experts and are documented in detail in Roberts et al. (2017). These updated products are referred to as the Second Generation Marine Mammal Density results. Development of these models was funded by the U.S. Navy; the Navy refers to them as the "Phase IV models". This document contains a brief summary of the changes to the base-layer models and the MDAT group summary products. Additional details on the base-layer models and summary products can be found in the MDAT Technical Report (Curtice et al., 2018).

Individual species or species guild base-layer updates

1. Additional survey data. An additional 1,591,000 km of aerial and 27,000 km of shipboard survey effort was added, increasing the total effort to 2,435,000 km and 85,000 km, respectively. (Of the additional aerial effort, 1,327,000 km was from the Southeast North Atlantic Right Whale surveys, which only collected sightings of large whales. Therefore, the additional aerial effort that was applicable to other species was 264,000 km.) Reflecting the additional survey data, the new models slightly expand the model study area, adding Long Island Sound and several offshore areas. This update allows for complete seasonal and spatial coverage of the continental shelf (waters from 0 - 200m deep) for most of the study area, and much of the continental slope (waters from 200 - 2000m deep) from Cape Hatteras to Georges Bank.

2. Improved modelling methodology. This update reprocessed the survey data from the North Atlantic Right Whale Sighting Surveys with a methodology that allowed the updated models to incorporate sightings of all species included in multi-species aggregations, rather than just the first species that was sighted, as was done in the first generation models. Detection functions were improved to allow categorical covariates, and many surveys were reprocessed to extract and utilize more covariates in detection functions. The detection hierarchy was updated to reflect the additional surveys. Certain changes to the spatial modeling statistical approached improved model performance.

3. Updated model products were produced for:
    - Fin whale
    - Humpback whale
    - Minke whale

Marine Geospatial Ecology Lab, Duke University, Durham, NC 27708, USA
mgel.env.duke.edu

- North Atlantic right whale
- Sei whale
- Pilot whales (a guild)
- Sperm whale
- Harbor porpoise

In the first generation models, beaked whales were modeled as one guild, owing to the large number of sightings reported as “unidentified beaked whale”. Model collaborators undertook a concerted effort to better identify beaked whales, both in new data and in older surveys for which good photographs existed. These improvements allowed the beaked whales guild to be split into three more taxonomically-precise models:

- Cuvier’s beaked whale
- Mesoplodont beaked whales (a guild)
- Unidentified beaked whales (a guild)

4. Updated environmental predictor data. Some habitat covariates for the spatial models were updated to cover the expanded temporal range, some were replaced by improved covariate products, and two new covariates were added.

Species group summary product updates

1. Treatment of stratified models. Cetacean group richness, diversity, and core area abundance richness summary products now exclude all models which were created as stratified models. Species with too few sightings available to model density from environmental predictors were instead fitted with a so-called stratified density model. Based on scientific literature reviews, some of these models were split into two or more areas, and stratified models were fit to each of those areas, or the species was considered absent from one or more of the areas. Stratified models have uniform density in each individual stratum. Because these species are rarely sighted, their distribution and habitat are less well understood than the cetacean species or species guilds modeled with habitat-based density models. MDAT diversity products are used to show variation across different habitats, and we lack the information to show these species at that level of variation. Sightings data of these rare species do show differences, but we lack enough data to say anything more detailed. This change results in the exclusion of the following species or species guilds from specific group products, including the “all cetaceans” group:

    1. Blue whale: Baleen whales, ESA-listed species, low-frequency sound sensitivity
    2. Bryde’s whale: Baleen whales, low-frequency sound sensitivity
    3. Clymene dolphin: Small delphinoids, mid-frequency sound sensitivity

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4. Dwarf sperm whale (Kogia whales): Sperm and beaked whales, high-frequency sound sensitivity
5. False killer whale: Large delphinoids, mid-frequency sound sensitivity
6. Fraser's dolphin: Small delphinoids, mid-frequency sound sensitivity
7. Killer whale: Mid-frequency sound sensitivity, large delphinoids
8. Melon-headed whale: Large delphinoids, mid-frequency sound sensitivity
9. Northern bottlenose whale: Sperm and beaked whales, mid-frequency sound sensitivity
10. Pantropical spotted dolphin: Small delphinoids, mid-frequency sound sensitivity
11. Pygmy sperm whale (Kogia whales): Sperm and beaked whales, high-frequency sound sensitivity
12. Rough-toothed dolphin: Small delphinoids, mid-frequency sound sensitivity
13. Spinner dolphin: Small delphinoids, mid-frequency sound sensitivity
14. White-beaked dolphin: Medium-frequency sound sensitivity, small delphinoids

2. Cetacean group diversity layers have changed. Previously, there was no filtering on the individual species density layers that went into the diversity algorithm. In v2.0, each individual species layer is pre-filtered to contain only the cells that are included in the area holding 95% of the total predicted abundance for the species. (Note: the same low-density filtering algorithm was implemented for the richness layers in the initial release.)

References

Curtice C., Cleary J., Shumchenia E., Halpin P.N. 2018. Marine-life Data and Analysis Team (MDAT) technical report on the methods and development of marine-life data to support regional ocean planning and management (v2.0). Prepared on behalf of the Marine-life Data and Analysis Team (MDAT). Accessed at: http://seamap.env.duke.edu/models/MDAT/MDAT-Technical-Report.pdf.

Roberts J.J., Mannocci L., Halpin P.N. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab, Durham, NC.