MSM4PCoD

Proposed work post-scoping workshop

*Task 2: Select suitable metrics for monitoring populations of deep diving odontocetes*

*and large baleen whales using PCoD models that already exist or are currently in development.*

* Develop existing bioenergetics models for beaked whales and pilot whales to identify metrics to be used in Task 3 and develop suitable disturbance scenarios, taking account of uncertainty associated with the parameters and structure (e.g. allowing for variation in length at age as a consequence of energy intake) of the models.
* Explore possibility of adapting the bioenergetics model that has been developed for sperm whales (Farmer et al 2018) and the model that is being developed for humpback whales by UC Santa Cruz for the same purpose.
* Explore use of data from CEEs to improve modelling of feeding rates before, during and after exposure to sonar, as in Wisniewska et al. 2018, Goldbogen et al 2019, Pirotta et al in prep.

*Task 3: Conduct power analyses to assess the power of these metrics to inform PCoD*

*analyses when collected within existing MSM projects, and determine the effort required to*

*increase this power.*

* **Scenario development**Goal: Develop realistic scenarios of effect size, precision/variability and effort/sample size (using current and realistic future single-modality data collection methods) for two populations of interest. These scenarios will form the basis of the power calculations.

Scenarios: Long-term declines in abundance and associated changes in demographic parameters; sudden declines (relevant to early warning detection); scenarios from Task 2.

* **Power calculations**

Goal: Calculate power for given scenarios using density, demographic parameters and metrics suggested by Task 2

Methods: Monte Carlo simulations using generalised population models for two populations of interest.

* **Methods for improving precision of effect estimates**

Goal: Investigate methods for improving precision of parameter estimates (and hence power to detect declines) without greatly increasing spending (i.e., more “bang for the buck”) by combining multiple data sources (e.g. passive acoustic monitoring, telemetry, photo-ID, photogrammetry) for a single case study population (e.g., Cuvier’s beaked whale at SOCAL).

Potential avenues: Combining data sources (e.g., telemetry + photo-ID) to better estimate parameters. integrated population modelling (fitting population dynamics models with multiple data sources) for Cuvier’s beaked whale at SOCAL