MEMORANDUM FOR:	PCOMS Project Files
FROM:	Elizabeth Fetherston-Resch PCOMS Project Manager, SERO
DATE:	May 5, 2021
SUBJECT:	Summary of environmental compliance for biological sample processing in support of PCOMS model development

Summary
The Population Consequences of Multiple Stressors (PCOMS) modeling effort for sperm whales, as a component of the Evaluating the Cumulative Impacts of Multiple Stressors on Cetaceans Monitoring and Adaptive Management Implementation Plan (MAIP), has a number of critical uncertainties that are currently modeled or estimated. NOAA is in possession of biological samples opportunistically collected from two stranded sperm whales, and $8,000 from the PCOMS project is being reprogrammed to process them. The PCOMS project would benefit from this proximate composition analysis and the resulting information would be a major contribution to our regional knowledge and PCOMS model development, and should substantially reduce uncertainty in key PCOMS model parameters.

Background
The goal of the Evaluating the Cumulative Impacts of Multiple Stressors on Cetaceans MAIP is to develop and implement a framework to evaluate the cumulative impacts of multiple anthropogenic stressors and quantify the relative benefit of restoration efforts aimed at reducing those stressors on key stocks of Gulf of Mexico cetaceans. This activity will develop PCoMS models for oceanic marine mammal stocks that were injured during the DWH event, relying on a comprehensive literature search combined with an expert elicitation approach to develop initial parameter estimates (and associated uncertainty) for the impacts of various stressors and the relationships among them. Ranges provided for initial parameter estimates will identify critical knowledge gaps, and preliminary sensitivity runs of PCoMS models will be used to identify parameter uncertainty with the largest impact upon model outcomes.

The PCoMS modeling framework is characterized by a functional relationship between a disturbance, such as anthropogenic noise, and a behavioral response in the target organism. This behavioral response drives an energetic cost such as reduced feeding, which then leads to an individual physiological effect and ultimately may lead to a change in population vital rates and dynamics (Figure 1; King et al. 2015). An example of this type of model has recently been developed for the Northern Gulf of Mexico sperm whale associated with exposure to noise sources from oil and gas exploration (Farmer et al. 2018a). As with many prior studies, the Farmer et al. model found that there was potential for long term negative population-level effects due to increased sound exposure; however, the key uncertainty was the anticipated degree of the behavioral response due to sound exposure. Under the range of behavioral responses tested, the Gulf of Mexico sperm whale was expected to experience a range of effects from no impact to significant reductions in population growth. Identifying key sources of uncertainty and conducting field studies to improve estimation of these parameters is thus a key step in the development and use of models of this type. The PCoMS framework extends the PCoD approach by including multiple stressors (e.g., physical injury, acoustic stressors, pathogens, etc.) that may have

direct physiological effects (e.g., disease processes, decreased body condition) or behavioral effects that indirectly lead to impacts on health.

One source of uncertainty that is important but impossible to study in sperm whales is the relationship between body reserves and resilience to additional stressors. The Farmer et al. (2018) sperm whale bioenergetic model parameterizes terminal starvation as when energy reserves hit zero, but some body tissue is withheld as unavailable energy reserves. "Based on studies of reductions in blubber triacylglycerols (TAGs) in emaciated stranded cetaceans, we modeled between 50 and 67% of TAGs as available in sperm whale blubber, muscle, and viscera (Koopman et al. 2002, Struntz et al. 2004, Dunkin et al. 2005, H. Koopman & W. A. Pabst, UNCW, pers. comm.). Sperm whales (and beaked whales) seem unique amongst odontocetes in that they store the vast majority of their blubber lipids as wax esters (WEs) instead of TAGs (Lockyer 1991, Koopman 2007, Pabst et al. 2016). WEs may have reduced demands on oxygen metabolism relative to TAGs, which may explain their prevalence in deep-diving whales. However, evidence from in vitro and in vivo studies indicates most animals are inefficient at metabolizing. Because substantial uncertainty exists with regards to the amount of WEs available for metabolism during a starvation event, we modeled between 0 and 50% of WE lipids as metabolically available (H. Koopman & W. A. Pabst pers. comm)."

The references on available TAGs are from stranded harbor porpoise and bottlenose dolphin, with independent expert elicitation from Koopman and Pabst used to fill gaps for TAGs and derive a range for WE. This is a major point of uncertainty in available body reserves with direct impacts on resilience to starvation. Getting the percent composition of the various body tissues (%TAG/WE/protein/ carbohydrate in blubber, muscle, and viscera) from emaciated sperm whales from the region would be a significant advancement for model parameterization and should substantially reduce uncertainty.

In November of 2020, an emaciated sperm whale stranded in Alabama and the Alabama Marine Mammal Stranding Network was able to collect blubber, tissue, and other samples operating under the MMHSRP permit #18786-04. Another sperm whale stranded in Jensen Beach, Florida and Harbor Branch Oceanographic Institute at Florida Atlantic University (HBOI) was able to collect samples under MMHSRP permit #18786-04. The samples are currently held at the Dauphin Island Sea Lab in Alabama and HBOI, and upon approval, multiple blubber samples would be transferred to the Alaska Fisheries Science Center Laboratory in Juneau, Alaska for processing under the authority granted by 50 CFR 216.37. Processing these samples would cost approximately $8,000 and the resulting information should substantially reduce uncertainty in key PCOMS model parameters. PCOMS would benefit from this proximate composition analysis, as it will directly inform the lower end of body composition for terminal starvation. This information would be a major contribution to our regional knowledge and PCOMS model development.

Compliance Determinations

NEPA

The prior NEPA analysis in the 2019 MAIP, incorporated here by reference, addressed certain field activities, including tissue sampling, that would require permitting and authorization under the Endangered Species Act (ESA) and Marine Mammal Protection Act (MMPA). The analysis anticipated that these activities would fall within the range of activities permitted and authorized under existing ESA Section 10(a)(1)(A) scientific research permits and MMPA take authorizations, thus would require no additional NEPA evaluation. The tissue samples herein considered were collected under permit #18786-04, held by Teri Rowles of the National Marine Fisheries Service (NMFS) Marine Mammal Health and

Stranding Response Program (MMHSRP) and Co-Investigator Blair Mase-Guthrie, NOAA's Southeast Region Marine Mammal Stranding Network Coordinator. This action involves only processing of the biological samples previously collected and the associated data processing. As such none of the activities involve field-based efforts and will not result in impacts to the environment. Based on review of the proposed activities against those actions previously evaluated in the PDARP/PEIS and actions authorized under ESA and MMPA permits, no additional NEPA evaluation is necessary at this time.

Other Compliance

Due to the nature and location of the proposed work – processing biological samples in a lab from previously collected samples, there are no effects to species or habitats protected under ESA, designated EFH, or cultural or historic resources protected under NHPA. Additionally there will be no ground disturbance or on the ground work, thus no Rivers and Harbors Act/Clean Water Act permits or reviews under the Coastal Zone Management Act are required.

For the Marine Mammal Protection Act (MMPA) permits are required to collect and process tissue samples. The tissue samples were collected under MMPA permit #18786-04, held by Teri Rowles of the NMFS MMHSRP and Co-Investigator Blair Mase-Guthrie and will be transferred to the NMFS Alaska Fisheries Science Center. Teri Rowles, the permit holder making the transfer, will receive no remuneration of any kind for the tissue samples. The samples are being transferred for scientific research, and will be uniquely numbered, with the number affixed to each tissue sample or container. The AK Fisheries Science Center has agreed that any further transfer of these tissue samples will conform to the requirements of 50 CFR 216.37(a) and required notifications will be made at the time of the parts transfer.

Federal environmental compliance responsibilities and procedures follow the Trustee Council Standard Operating Procedures (SOP), which are laid out in Section 9.4.6 of that document. Following this SOP, the Implementing Trustees for each activity will ensure that the status of environmental compliance (e.g., completed vs. in progress) is tracked through the Restoration Portal. The Implementing Trustees will keep a record of compliance documents (e.g., ESA biological opinions, USACE permits) and ensure that they are submitted for inclusion in the Administrative Record