THOMAS MATTHEW GALLIGAN. Using Blubber to Assess Steroid Hormone Homeostasis in Bottlenose Dolphins (Tursiops truncatus) Exposed to Organochlorine Pesticides. (Under the direction of ASHLEY BOGGS and LORI SCHWACKE).

Abstract
The purpose of this dissertation is to examine the impacts of dichlorodiphenyltrichloroethane (DDT) and its metabolites (collectively DDTs or DDx) on steroid hormone homeostasis in the bottlenose dolphin (Tursiops truncatus) using only remotely collected blubber. First, I examined whether blubber is a suitable proxy for blood in the assessment of steroid hormone homeostasis in dolphins. To do so, I developed a liquid chromatography-tandem mass spectrometry (LC-MS/MS) assay for the simultaneous measurement of multi-class steroid hormones in dolphin blood matrices. Then I quantified steroids in matched blood and blubber samples collected from reference populations, and modeled the relationships between the hormones in both matrices. I determined that while blubber hormone measurements are not sufficient to quantitatively predict circulating steroid hormones, blubber is still a useful matrix for endocrine assessment as it reflects physiological state. I examined the impacts of DDx exposure on steroid hormone homeostasis by using a free-ranging population that experiences high DDx exposure. For this population, only remotely collected blubber and skin biopsies are available, thus blubber was used for the measurement of persistent organic pollutants (POPs) and hormones, while skin was used to determine genetic sex. I observed negative correlations between T and several DDTs in male bottlenose dolphins, and negative associations between F and all DDTs in females. Notably though, these hormones are also negatively correlated with other POPs, which are positively correlated with the DDTs. Thus, it is impossible to definitively conclude whether DDTs are impacting steroid hormone homeostasis in this population. Nonetheless, these results indicate that endocrine disruption could be occurring, warranting further investigation. Finally, I examine the ability of blubber microsomes to metabolize F and E. Results suggest that blubber can interconvert F and E. However, these conclusions are limited by low sample size (n = 3). Further experimentation, especially with ex vivo study design, with more samples should be implemented to more conclusively test this hypothesis. This finding could
potentially impact the interpretation of blubber hormones in relation to circulating values. Overall this dissertation advances our understanding of cetacean endocrinology and ecotoxicology.