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Master Thesis Defense

Entitled

POPULATION STRUCTURE AND GENETIC DIVERSITY OF THE SOCOTRA CORMORANT (PHALACROCORAX NIGROGULARIS)

by

Noura Mabkhout Almansoori

Faculty Advisor

Dr. Oliver Manlik, Department of Biology

College of Science

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Abstract

The Socotra cormorants (Phalacrocorax nigrogularis) are regional endemic seabirds restricted to the Arabian Gulf, Gulf of Oman, and the Arabian Sea. This species is classified as vulnerable by the IUCN Red List. However, no population genetic study has been conducted on P. nigrogularis in their range, and population structure, gene flow and connectivity between colonies is unknown. Likewise, genetic diversity of this species has not yet been characterized. Thus, the aim of this thesis was to fill these gaps by inferring population structure, assessing gene flow and genetic diversity of Socotra cormorant colonies in their known distribution range. For this purpose, I sequenced over 200 individuals, sampled from 4 colonies in the Arabian Gulf and 1 colony in the Arabian Sea (Hasikiya) for two genetic loci, the nuclear β-fibrinogen intron 7 (FIB7), and the mitochondrial gene, cytochrome oxidase subunit 1 (COI). I used various bioinformatic tools to infer population structure, and gene flow among the colonies, based on these two loci. I also assessed and compared genetic diversity between colonies and populations inside and outside the Arabian Gulf. Finally, I employed neutrality tests to detect possible signals of selection. Overall, the results suggest very low genetic diversity for the two loci in all colonies. The results based on COI indicate that there was extensive gene flow within the Arabian Gulf, suggesting that the 4 colonies inside the Gulf form one large panmictic population. In contrast, based on COI, I detected little gene flow between those colonies inside the Gulf and the Hasikiya colony in the Arabian Sea. This strong differentiation between the colonies inside the Gulf and the colony in Arabian Sea suggests that they represent two separate populations. However, I could not detect any differentiation between any of the colonies, based on the nuclear, FIB-7 locus. Overall, the Hasikiya colony in the Arabian Sea harbors substantially greater mtDNA COI diversity than any of the colonies inside the Arabian Gulf. In contrast to the Arabian Gulf cormorants, the Arabian Sea colony also showed potential signs of purifying selection, based on mtDNA COI. The high connectivity between colonies inside the Arabian Gulf, may be interpreted as a positive sign for the conservation of this endemic seabird. On the other hand, the relatively low genetic diversity may present a challenge for the Socotra cormorant population in the Gulf to adapt to a changing environment. In conclusion, my thesis presents the first characterization of population structure and genetic diversity of the Socotra cormorant, and I hope that the insight from this will guide the conservation of these seabirds.

Keywords: Population structure, Socotra Cormorants, Arabian Gulf, Gene flow, mitochondrial DNA, Arabian Sea. Genetic diversity, mitochondrial DNA, seabirds.