USE OF THREE-DIMENSIONALCONSTRUCTION TECHNIQUE IN PHOTO-IDENTIFICATION OF THE MEDITERRANEAN MONK SEAL (*MONACHUS MONACHUS*) IN THE NORTHEASTERN MEDITERRANEAN

Meltem Ok * and Ali Cemal Gucu

Middle East Technical University, Institute of Marine Sciences (METU-IMS), P.O. Box 28, 33731 Erdemli, Mersin, Turkey - meltemok@ims.metu.edu.tr

Abstract

In order to photo-identify the critically endangered Mediterranean monk seal (*Monachus monachus*) inhabiting the northeastern Mediterranean, the monk seal photographs were processed using three-dimensional construction technique. This results show that in order to reach an accuracy level sufficient to identify a monk seal, which has a specific body shape, at least 4 phonographs taken simultaneously from 4 opposing angles are needed. On each these photos, at least 100 matching reference points are needed to be determined.

Keywords : Conservation, Eastern Mediterranean, Sampling Methods.

The Mediterranean monk seal (*Monachus monachus*, Hermann 1779) has been listed as one of the most endangered mammals [1]. Amongst the Mediterranean coastal areas, the northeastern Turkish coast provide one of the last refuge areas where the monk seal still exists and can successfully reproduce. Status of the monk seal colony in the area has been monitored since 1994 by METU, Institute of Marine Sciences. In general, various direct and indirect methods are used to observe and monitor the monk seal populations. The standard sampling methods that are commonly applied to other animals are not practical for the Mediterranean monk seals due to its critical status. One of the most effective methods for identification, cataloging and monitoring individuals without creating any disturbance in their habitat is to use camera traps to obtain high resolution photographs [2]. This technique was effectively used on monk seals by Scoullos et al. [2] Hiby and Jeffery [3], and Gucu et al. [4]. In this study, 3D model construction from photographs was tested as an alternative photo-identification method for monk seals. This technique is based on matching the points on a set of photographs of the same object taken from different angles.

The photogrammetry software Photomodeler Ver.3.1a was used for 3D model construction of monk seals from photographs. In order to obtain appropriate photographs for the software, some of the caves that are suitable for seal use were equipped with Vigil P-Box infrared monitors that may detect a seal up to 18 meter distance with a passive infrared motion detector and sense heat-in-motion with its conical beam. This system was deployed in the caves from January 2004 to December 2005. Besides, to choose sufficient and appropriate reference points that precisely describe the shape of the monk seal, the object having true proportions of a monk seal was used to estimate the minimum number of reference points. For this estimation, after the 3D model construction, real volume of the object was calculated and compared to those estimated by the model. Total number of reference points used in the estimation was plotted against the error term (the error term: the real volume / the estimated volume by the model.The software has several steps including setting the approximate project size and data unit, defining the parameters of the camera used, importing the photographs, marking and referencing points on each photograph and finally processing the project. In the first trial, the best scenes in a video footage of a seal displaying all aspects of the body were captured in still images. These images were transferred to computer and processed following the steps mentioned above. In the next step, still photographs of a seal taken at the same time from varying angles were required due to the limitation emerged in the use of photo captures from a video footage. Therefore, four digital cameras automatically triggered by infrared sensors were installed to the corners of a hauling platform in 2 different caves in order to capture four main aspect of a seal.

The 90 % accuracy was obtained above 100 reference points to construct 3D model of the monk seal including 25 reference points in the head, 66 reference points in the abdomen and 9 reference points in the tail and the maximum accuracy was reached at 150 reference points (Fig.1). The seal modeling trials using the photographs captured from video footage did not reach the necessary levels to give accurate results because of the plasticity of the body of the seal while swimming or crawling on the land. Increasing the number of the reference points, even higher than 150 did not improve the accuracy. After that, 4 seals were photographed from different direction at their haul out platforms in the resting caves. A total of 98 pictures were taken. The ceiling of one the cave was too low to mount the cameras in the proper position. Therefore, none of the photographs were good enough to display entire body of the seal. In the other cave, the photographs were able to frame the whole body of the seal. Due to dimmed light in the cave, only 25 reference points could be choosen on the photographs which was not enough for 3D model construction.

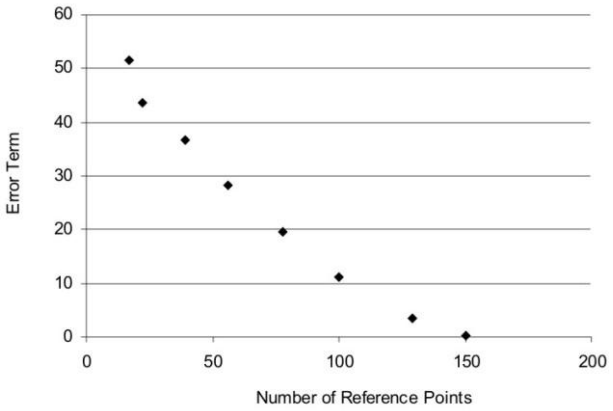

Fig. 1. Different 3D monk seal model volume results with different number of reference points. The error term: the real volume/ the estimated volume by the model.

In this study, as an alternative photo-identification method for monk seals, 3D construction from photographs by using the Photomodeler Version 3.1a were not yielded successful, however it was proven that the technique is able to provide valuable data on seals without giving any disturbance to the animals. At least 4 cameras should be placed horizontally in a way to capture lateral, anterior and posterior aspects of the animal and at least 100 reference points should be defined. Moreover, wider angle lens may be preferred, source of the light may be improved and infrared film may be used to improve the method.

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