THE USE OF COMPUTER-ASSISTED MATCHING SOFTWARE IN THE RE-EVALUATION OF AN ESTABLISHED BOTTLENOSE DOLPHIN PHOTO-ARCHIVE

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Introduction

Whether conducting behavioural research or establishing population parameters, photo-identification is generally regarded as the most effective, non-invasive method available to researchers for gathering information about cetacean societies in the wild. Nevertheless, misidentification of individuals during the photo matching process can be hard to avoid, and can subsequently result in the accumulation of false positive / negative errors over time, leading to erroneous estimations of population size (Stevick et al., 2001). Whilst application of a strict grading system for photograph quality allows corrections to be made to minimise this bias (Culloch, 2004), advances in computer-assisted matching programmes provide a welcomed development in addressing this intractable problem.

Methods

In the present study, the extraction programmes FinEx and FinMatch™ v.1.1.0 (developed for Europhukes by CWI, Amsterdam) were applied to an existing archive of bottlenose dolphin (Tursiops truncatus) images (from 1997 to 2004 inclusive) to isolate errors that may have resulted from previously undetected misidentifications. This analysis was carried-out prior to the calculation of population estimations for T. truncatus in the outer southern Moray Firth, NE Scotland. Accordingly, only “marked” animals –individuals with dorsal edge nicks or tears – were used in this evaluation. The major steps of the extraction and matching process are described in detail in the handbook accompanying this software. However, a brief summarisation of the stages involved is illustrated in figure 1 a-c, below left.

Results

- From a total of 96 “marked” bottlenoses, 2 false positive errors (where two images of 2 different individuals were recorded as 1 individual) and 22 false negative errors (where two images of 1 individual were recorded as 2 separate individuals) were found from 578 sightings in the present study. This resulted in a revised total of 82 marked individuals in the bottlenose archive.
- When extracting dorsal fins displaying multiple serrations (Fig. 2), subsequent matches were found to have a higher match probability if the point of fine extraction was taken from the uppermost point of the top nick to the lower most point of the bottom nick (depicted by arrows in fig). Where nicks were well-spaced along the dorsal edge (as seen in Fig. 1b), however, the match probability was greater if each nick was extracted independently.
- Conversely, in practice, the matching programme FinMatch™ was not very effective in finding matches for animals with shallow dorsal nicks that had acquired one or more “new” nicks – particularly where the new nick was found to be larger than the existing nick(s). In this case, a positive match was still very much dependent upon the familiarity and knowledge of an experienced observer; although once found, the software could be used to confirm the match by extracting and comparing individual nick positions, thereby giving greater confidence in the decision making process.
- The accuracy of positive matches was found to be further dependent upon the visibility of the dorsal base, i.e. the full baseline of the dorsal should ideally be selected by the user during extraction (as indicated by points A & B in Fig. 1a) for best results.
- Finally, after the removal of false positive/negative errors from the database, all but the best and/or most recent right or left dorsal image for each marked animal were deselected from the project panel window in FinEx. Subsequently, even inexperienced personnel could use the FinMatch software to effectively identify new recaptures.

Discussion & Recommendations

The Europhukes software proved particularly useful in the present study for the detection of integral errors within the established archive, and its application is likely to be equally valuable to any new study for the eradication of comparable errors in the first place. Although a laborious task for archives containing in excess of 150 marked individuals, once extractions have been made, the software serves as a useful tool for photo-ID studies in addition to existing methods of organisation, ranking and retrieval. That saying, user discretion and experience of the study animals remain of utmost importance in the identification process, especially where animals acquire new nicks between encounters. Furthermore, since not all recognisable dolphins in a population bear distinguishing dorsal edge marks, procedures for the retrieval of individuals displaying other features, such as unusual fin shapes, or unique pigmentation patterns, would be a useful addition to this existing software.

References
