Abstract of Doctoral Dissertation

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The Application of Discriminant Function Analysis to Atlas and Axis Vertebrae of Toothed Whales: Aiding Species Identification of Zooarchaeological Remains
（ハクジラ類第一・第二頸椎への判別分析の適用：遺跡出土試料の種同定に向けて）

Toothed whale remains are common finds from archeological sites across Japan from the Jomon to the Ainu Culture Period, suggesting a key marine resource of subsistence in this region. However, the actual state of whale exploitation at each archeological site remains unclear. The reason is that most assemblages consist of primarily postcranial bones that are similar in morphology and are difficult to identify. To date, zooarchaeological toothed whale bones have been identified by differences in morphological traits based on a small number of specimens. In this study, I attempted to establish taxonomic identification criteria for atlas and axis vertebrae of modern toothed whales using discriminant function analysis (DFA) and applied the criteria to atlas and axis vertebrae from Japanese archeological sites.

Canonical discriminant function analysis was effective at classifying the atlas and axis vertebrae of 18 modern toothed whale species in a hierarchical classification system, with a high successful classification rate at the superfamily (97.1%), family (89.6%), and subfamily (78.9%) levels. At the species level, six received the highest score (100.0%) for correct identification rate for each species, while four other species had sufficiently high correct identification rates (above 80.0%). The established canonical discriminant functions were applied to 44 zooarchaeological atlas and axis vertebrae from three archeological sites in Japan ranging from the early Jomon to the Okhotsk Culture periods. Twenty-six of the zooarchaeological specimens (59.1%) were identified in a hierarchical taxonomic classification scheme without contradiction and six species (Pacific white-sided dolphin (N=11), Striped dolphin (N=5), Risso's dolphin (N=5), short-beaked common dolphin (N=2), common bottlenose dolphin (N=2), and northern right whale dolphin (N=1)) including four species not found in the previous morphological analysis and three not distributed around the sites, were found.

Based on these results, DFA-based classification was suggested to be useful for taxonomic identification at the family level and higher, and thus, effective in improving the identification quality of zooarchaeological specimens. Adding more modern reference specimens in the dataset may further improve the certainty and accuracy of identification for future work. Furthermore, the presence of other species as unexpectedly revealed by DFA-based classification offers not only insight into the taxonomic diversity of species exploited by the early Jomon and Okhotsk people but also questions about the acquisition routes from archeological perspectives and temporal distribution changes of the species from zoogeographical perspectives.