Assessing Tagging and Chemical Marking as Monitoring Tools for the Marbled Octopus (*Amphioctopus aegina* Gray, 1849)

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Abstract

Tagging and marking are widely used techniques for tracking individual cephalopods in natural environments, enabling investigations of growth, survival, and individual trajectories in wild populations. However, the effectiveness of these approaches varies considerably among species due to their soft–bodied morphology and complex behavioral responses to external manipulation. This study evaluated and practical application the suitability of external physical tagging and chemical marking techniques for monitoring the Marbled octopus (*Amphioctopus aegina* Gray, 1849). A total of 28 individuals were used, comprising 21 octopuses subjected to external tagging using medical–grade PE silk and 7 octopuses treated with chemical marking using Alizarin Red S administered via enriched prey. The chemical marking was administered in three pulses at 7–day intervals. Tag retention, survival, and behavioral responses were monitored throughout the experimental period. Subsequently, beak structures were examined under fluorescence microscopy to detect distinct fluorescent bands produced by each marking pulse. These bands served as permanent internal reference marks, allowing retrospective identification of marked individuals and reconstruction of growth chronology over time. Results showed that all tagged individuals removed the external tags within 36–48 hours, and tag rejection was consistently associated with tissue damage and subsequent mortality during the observation period. Therefore, the high rate of tag rejection rendered physical tagging ineffective for long–term tracking. In contrast, the chemical marking group resulted in high survival and produced clearly distinguishable fluorescent bands in the beaks, confirming successful incorporation of the marker and enabling reliable long–term individual identification and growth tracking. These findings demonstrate that external physical tagging is unsuitable for *A. aegina* due to high tag rejection and associated injury, whereas chemical marking using Alizarin Red S provides an effective, minimally invasive, and biologically stable alternative for long–term monitoring and individual–based studies in this species.

Keywords

Marbled Octopus, *Amphioctopus aegina*, Chemical Marking, Alizarin Red S, Physical Tagging