Population structure of *Sepioteuthis lessoniana* in the northwestern Pacific: inference by genetic structure, life-history traits and statolith morphology

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Sepioteuthis lessoniana is widely distributed in coastal waters in the Indo-Pacific region and is an important fisheries resource along its distributional ranges. At least three taxa of the squid have been identified in the northwestern Pacific region; namely *Sepioteuthis* sp. 1, sp. 2, and sp. 3. However, geographic distribution and basic biological information of these taxa is limited. In this study, taxa composition of *Sepioteuthis* spp. in the waters off southwestern Japan and off northern Taiwan was examined using molecular evidences, and the life-history traits and statolith morphology of taxa were analyzed to illustrate potential population structure of the species. The objectives of this study are, (1) taxa composition of *Sepioteuthis* spp. in the waters off southwestern Japan and off northern Taiwan; (2) life-history traits for the taxa in the two areas; (3) statolith morphology for the taxa in the two areas. The results may provide better understandings for the population structure of the squid in the northwestern Pacific region.

In the first part of this study, *Sepioteuthis* spp. off southwestern Japan were examined. A total of 142 squid samples were collected from six sites in the waters off southwestern Japan. Three taxa (*Sepioteuthis* sp. 1, sp. 2 and sp. 2A) were identified based on the mitochondrial cytochrome oxidase c subunit I (COI) gene, among which *Sepioteuthis* sp. 2A was defined for the first time. *Sepioteuthis* sp. 2 was predominant in the region (average occurrence rate 84%), whereas *Sepioteuhtis* sp. 1 was rare, with only two individuals found near Goto Islands. The mantle length (ML) composition, ML-body weight (BW) relationship, age structure, and average growth rates were similar for *Sepioteuthis* sp. 2 and sp. 2A. However, *Sepioteuthis* sp. 2 mainly hatched during summer (June to July), whereas *Sepioteuhtis* sp. 2A hatched during winter (December to February). The statolith shapes of the squids were similar for both taxa, although slight differences were noted in the wing regions. The three taxa largely overlapped in a principal component analysis bi-plot based on variations extracted from five life-history traits.

In the second part of the study, the squid samples off southwestern Japan and off northern Taiwan were analyzed. A total of 189 squid samples were collected from 2 sites in the waters off northern Taiwan. Three taxa (*Sepioteuthis* sp. 1, sp. 2 and sp. 2A) were identified off northern Taiwan.

Sepioteuthis sp. 1 was predominant in Taiwan (average occurrence rate 70%), while *Sepioteuthis* sp. 2 was predominant in Japan (81%). For the same taxa, the ML composition, ML-BW relationship, age structure, and average growth rates were different between Japan and Taiwan. *Sepioteuthis* sp. 2 in Japan mainly hatched in summer (June to July), whereas that Taiwan hatched in early season (April to July). The statolith shapes of the squids for the same taxa were different between Japan and Taiwan, particularly in lateral dome and rostrum. Results of a principal component analysis and cluster analysis varied in life-history traits between two geographic locations (Japan and Taiwan) and in statolith morphology between three taxa. These results suggested that life-history traits of squid were mainly influenced by the experienced environments, while the statolith morphology were influenced by synergistic effects of genetic and environmental factors. The results of this study could provide better understanding in population structure and connectivity of *Sepioteuthis* spp. in the northwestern Pacific region, which is crucial information for future conservation and management measures in this region.

Keywords: *Sepioteuthis lessoniana*, population structure, genetic structure, life-history traits, statolith morphology, northwestern Pacific