

# Genetic Differences in Spatially and Temporally Isolated Populations: Winter and Spring Populations of Pelagic Mollusk *Clione* (Gymnosomata), Southern Okhotsk Sea, Japan

<sup>1</sup>Tomoyasu Yamazaki, <sup>2</sup>Takashi Kuwahara and <sup>3,4</sup>Kunio T. Takahashi

<sup>1</sup>Shellfish Museum of Rankoshi

<sup>2</sup>Okhotsk Sea Ice Museum of Hokkaido

<sup>3</sup>National Institute of Polar Research, Research Organization of Information and Systems

<sup>4</sup>Department of Polar Science, School of Multidisciplinary Sciences, The Graduate University for Advanced Studies (SOKENDAI)

The pelagic mollusk *Clione* is a naked pteropod with a sympatric two-species distribution in the southern Okhotsk Sea, Japan, consisting of the morphologically and genetically distinct *C. elegantissima* and *C. okhotensis*. *Clione elegantissima* appears in both winter and spring, and body length differs between the winter coastal population (WCP, January to March, 10–20 mm) and the spring offshore population (SOP, April to July; up to 30 mm). This body size difference and temporal-spatial separation of the populations suggests that the SOP is either a cryptic species or *C. limacina* drifted from the Subarctic Atlantic Ocean or an interspecies of *C. elegantissima* resulting from reproductive isolation. We investigated the taxonomic positions of both populations using morphological and genetic analyses and identified both as *C. elegantissima* with very high genetic similarity. We explain the occurrence of spatio-temporal isolated populations using the water mass dynamics in the Okhotsk Sea. Warm water entering the southern Okhotsk Sea around Japan through the Soya Straits is divided into the Soya Warm Water (SWW: June to November) and the Forerunner of the SWW (FSWW: March to May); cold water entering the Okhotsk Sea around Japan, east of Sakhalin Island, is divided into the East Sakhalin Current Water (ESCW: November to April). The Cold Water Belt (CWB) is frequently formed off the SWW during summer and autumn and comprises upwelling cold water originating from either subsurface water of the Japan Sea off Sakhalin or Okhotsk Sea bottom water. We present the temporal-spatial isolation mechanism of WCP and SOP per the SWW, FSWW, ESCW and CWB dynamics.

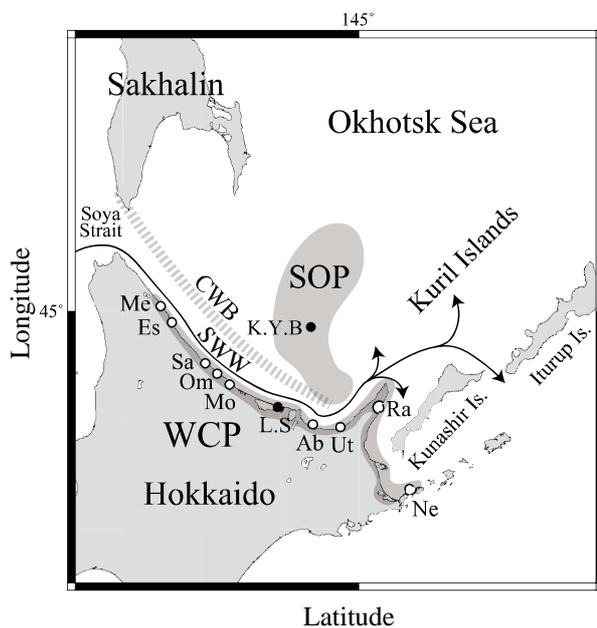


Figure 1. Distribution of the winter coastal population (WCP) and spring offshore population (SOP) and sampling location. L.S. (N44°13, E143°97) and K.Y.B. (N44°46, E144° 23) points indicated with ● are sampling locations. Abbreviation: SWW, Soya Warm Water; ESCW, East Sakhalin Current Water; CWB, Cold Water Belt; O.M, Oarai Marina; Me, Menashidomari; Es, Esashi; Sa, Sawaki; Om, Omusaro; Mo, Monbetsu; L.S, Lake Saroma; Ab, Abashiri; Ut, Utoro; Ra, Rausu; Ne, Nemuro; K.Y.B, Kitami-Yamato Bank

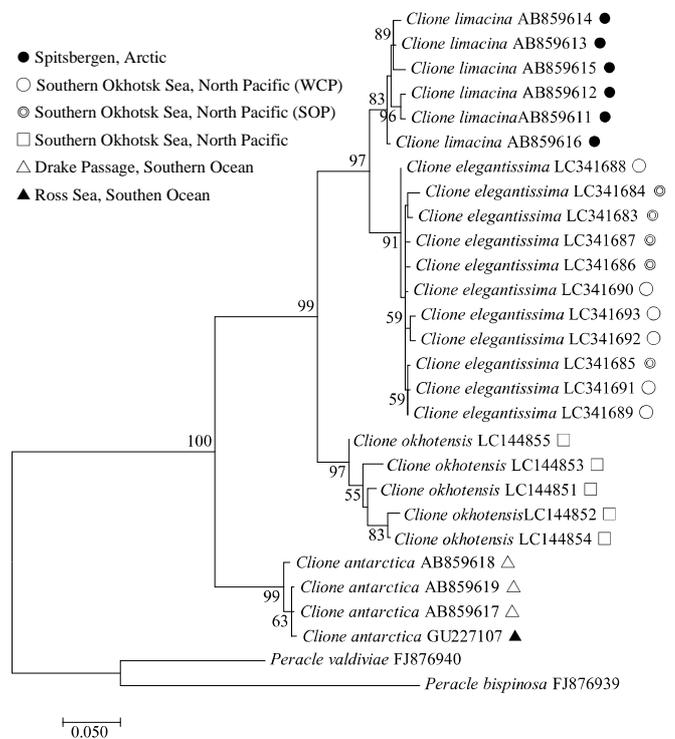


Figure 2. Maximum likelihood (ML) phylogenetic tree of *Clione* species based on mtDNA individual *Clione elegantissima* (COI) sequences. Numbers at nodes represent bootstrap support