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Genetic Connectivity in Scleractinian Corals in the Ryukyu Archipelago, southern Japan

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Hermatypic corals are one of the most important organisms in coral reef ecosystems. Although corals are widely distributed in oceans, they occur mainly in tropical to sub-tropical areas. Japanese seas range from sub-tropical to temperate regions, and southwestern portion includes the Ryukyu Islands (sub-tropical). Species diversity of corals is high even at high latitudes (24-28° N, 123-130° E) because the warm Kuroshio Current runs from the north Philippines to the east coast of mainland Japan. The Ryukyu Islands are divided into three major island groups, the South, Middle, and North Ryukyus. Species richness of corals is highest in the South Ryukyus (approximately 400 species) and decreases gradually to the north.

Coral reefs are faced with both natural and anthropogenic disturbances. The threats to Japanese coral reefs include reclamation of coastal areas, construction of shore protection structures and roads, terrestrial soil outflow, an outbreak of the crown-of-thorns starfish (*Acanthaster planci*), and mass coral bleaching events due to high water temperatures.

The 1998 coral bleaching event was the most extensive and severe recorded to date. Coral bleaching is a global phenomenon that is probably linked to global climate change and increasing ocean temperatures. Mortality rates during 1998 bleaching varied among localities. Coral populations, particularly those of branching species, declined severely in the Okinawa Islands (Middle Ryukyus). In contrast, the Kerama (Middle Ryukyus) and Yaeyama Islands (South Ryukyus), located respectively 30 and 400 km southwest of the Okinawa Islands, maintained healthy coral communities on many reefs. The study of ocean currents supports the hypothesis that the Kerama populations are a source of larvae for the Okinawa populations. To test this hypothesis, we assessed genetic differentiation (F_{ST}) among populations in Yaeyama, Kerama, and Okinawa using allozyme electrophoresis for four species (*Acropora tenuis*, *A. digitifera*, *Goniastrea aspera*, and *Stylophora pistillata*). The F_{ST} values between the Kerama and Okinawa populations were lower than those between the Yaeyama and Okinawa populations. Geographic distance, ocean currents, and the present population genetic analysis largely support the larvae source hypothesis. Based on reproductive modes, relatively high genetic differentiation was found among regions in the brooding coral *Stylophora pistillata* compared to spawning corals. Planula behavior due to reproductive mode may influence genetic differentiation. These results indicate that a longer period is needed for the recovery of brooding species than for spawning species in the Okinawa Islands.