Updated northern distributional limits of *Acropora* spp. along the Kuroshio Current

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Climate change drives the distributional limits of marine flora and fauna to higher latitudes by increasing average winter seawater temperatures. This phenomenon has been observed in reef-building corals in the Australian region, the Mediterranean Sea, and the Japanese region. In October 2019, two *Acropora* species were observed in Nishiura, along the northwestern coast of the Izu peninsula (~35°0' N) in Shizuoka Prefecture, Japan (Fig. 1). This was the first record for these species around the peninsula. One was a widely-distributed species, *Acropora hyacinthus*, which was previously known from the subtropical Ryukyu Islands (Okinawa Prefecture) to temperate Shikinejima, in the Izu Islands in Shizuoka Prefecture (~24°1' to ~34°2' N; Nakabayashi et al. 2019). This colony may belong to the *A. hyacinthus* lineage HyaD (Suzuki et al. 2016) because all *A. hyacinthus* colonies from the mainland of Japan, examined in Suzuki et al. (2016), belonged to lineage HyaD. The other was a temperate species, *A. japonica*, which has been recorded from subtropical Tanegashima (Kagoshima Prefecture) to temperate Wakayama Prefecture (~30°3' to ~33°2' N; Nomura et al. 2016). The observed colonies were large enough to have distinguishable morphological characteristics. One colony of *A. hyacinthus* was ~17.5 cm and four colonies of *A. japonica* were 23.1–37.1 cm in their longest dimension. While acroporid corals at high-latitude locations grow at 6–10 cm/ year in diameter with tank experiment, keeping the water temperature at 25–26 °C (Hayashi and Iwase 2010), the *A. hyacinthus* colony in Nishiura may grow slower due to lower seawater temperature and may have been recruited more than 3 years ago, and the *A. japonica* colonies probably became established earlier.

These records document the northward progression of distributional ranges for *Acropora* spp. Since populations of *A. hyacinthus* in subtropical and temperate areas along the Kuroshio Current are connected by multi-generation dispersal (Nakabayashi et al. 2019), populations of these *Acropora* spp. in Nishiura probably became established due to poleward larval dispersal. The average winter temperature in Nishiura has been fluctuating around 13–16°C for more than 25 years. However, in the last five years, it has remained above 15°C. Moreover, it was 16.4°C in 2019. These relatively high average winter temperatures around the Izu Peninsula would facilitate survival of recently settled larvae.

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Fig. 1 A and B. *Acropora hyacinthus*, C and D. *Acropora japonica*.

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