

Larval dispersal networks between coral reefs in the Nansei Islands, Japan



Naoki Saito (n.saito@aist.go.jp)^{1*}, Hiroki Kise¹, Yuichi Nakajima², Akira Iguchi¹

(¹ National Institute of Advanced Industrial Science and Technology (AIST), Japan; ² Japan Fisheries Research and Education Agency, Japan)

Key Points

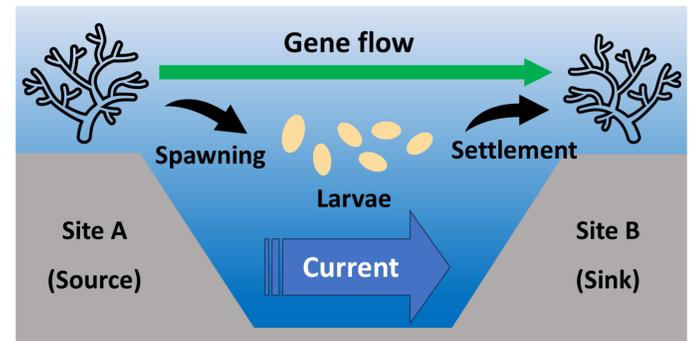
- We conducted larval dispersal simulations and population genetic analyses on corals in the Nansei Islands, Japan.
- Strong connectivity was observed along the Kuroshio Current, from the southernmost to the northernmost islands.
- Our findings provide fundamental insights into connectivity along the Kuroshio Current and its implications for conservation.

Introduction

- To conserve corals, it is important to maintain genetic connectivity between populations through larval dispersal.
- However, for the highly biodiverse coral reefs of the Nansei Islands, combined insights into larval dispersal and genetic connectivity remain limited.

Purpose To understand connectivity of corals in the Nansei Islands

Content Larval dispersal simulations and population genetic analyses between coral populations



Larval dispersal carried by ocean currents results in genetic connectivity.

Methods

- **Target species** | *Acropora digitifera*, the major reef-building coral in the region.

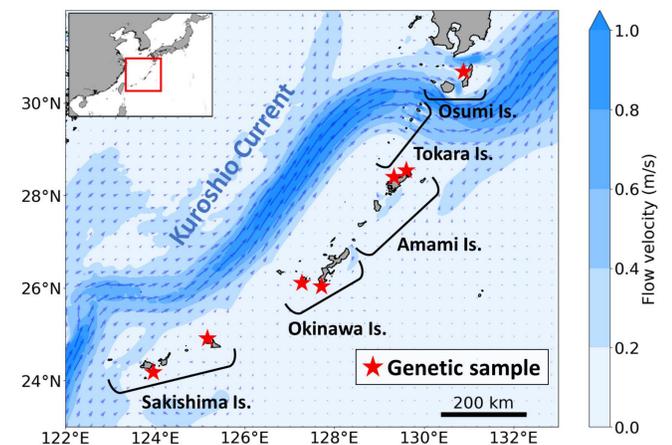
Larval dispersal simulation

- Virtual larvae were released at 0 m depth from 68 sites covering the entire region.

Current velocity data	Ocean model JCOPE-T (resolution 1/36°)
Calculation period	5 years (2018–2022)
Pelagic larval duration (PLD)	10–130 days (Graham et al. 2008 <i>Coral Reefs</i>)

Population genetic analysis

- Samples collected from seven sites (Nakajima et al. 2010 *PLoS One*) were used.
- The genetic differentiation index (F_{st}) was analysed using SNP markers.

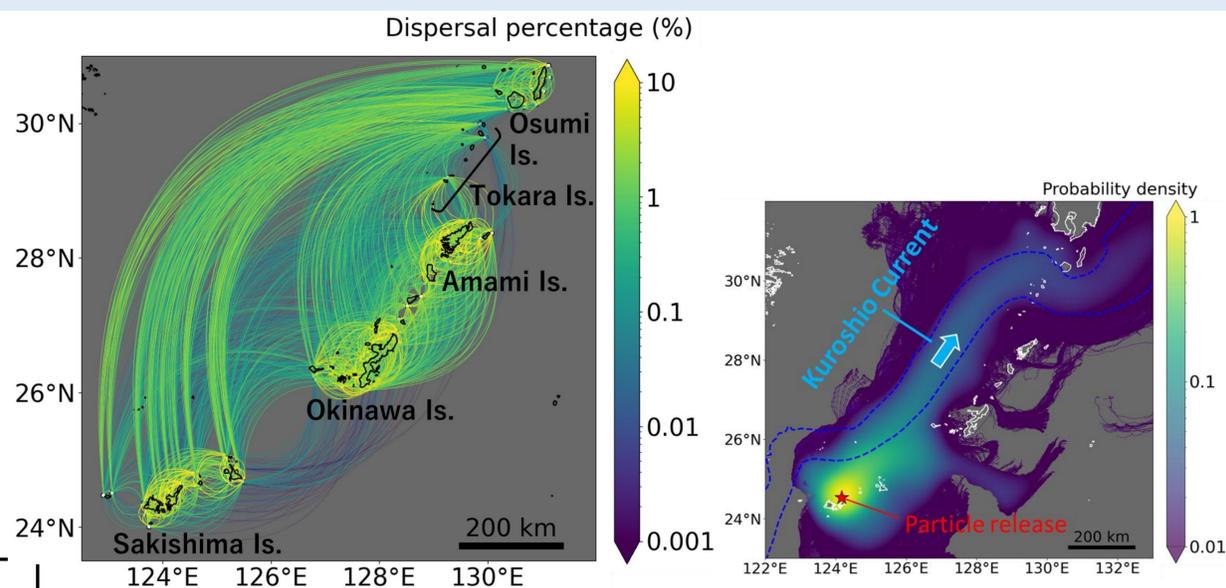


Map of the Nansei Islands.

Results

Larval dispersal

- Strong connectivity was observed along the Kuroshio Current, linking the southernmost and northernmost islands while bypassing intermediate islands.
- This trend is consistent with the genetic connectivity observed in previous studies (e.g. Nakajima et al. 2010 *PLoS One*; Tsuchiya et al. 2022 *Mol Ecol*).

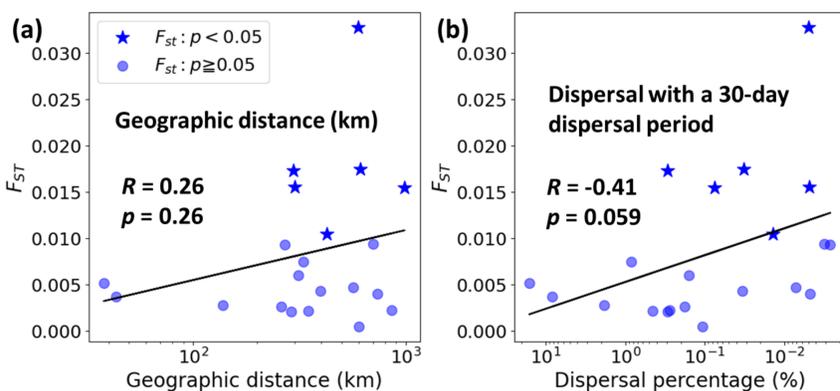


Larval dispersal network with a 30-day dispersal period.

Example of dispersal trajectories from the southernmost islands.

Correlation between dispersal and genetic connectivity

- The genetic differentiation index (F_{st}) between sites showed a relatively high correlation with modelled dispersal (Panel b) rather than with geographic distance (Panel a).



Discussion

This study quantified larval dispersal between coral habitats in the Nansei Islands and yielded the following findings:

- 1) A significant dispersal pathway exists via the Kuroshio Current, enabling larvae to reach the northernmost from the southernmost part of the Nansei Islands.
- 2) Genetic connectivity between sites may depend more on dispersal than on geographic distance.
- 3) Our findings can offer fundamental insights into the understanding and conservation of coral connectivity in this region.

Acknowledgment: This work was supported by JSPS KAKENHI Grant Number 24K08961.