Call for applications for a PhD in Marine Science

1 PhD bursary overview

- **Thesis title:** Marine connectivity in a network of marine protected areas (MPAs) as a key factor for assuring climate change resilience in the marine ecosystems of East Africa
- **Thesis subjects of research:** Larval dispersal modeling; Global change; Conservation biology; Genetic diversity; Fish physiology

- **Thesis directors:** David M. Kaplan (IRD, MARBEC, France), Christophe Lett (IRD, MARBEC, France), Gladys Okemwa (KMFRI, Kenya)
- **Additional advisers:** Bernardino Malawene (InOM, Mozambique; NMU, South Africa), Thomas Lamy (IRD, MARBEC, France), James Mwaluma (KMFRI, Kenya), Barnabas Tarimo (UDSM, Tanzania), MESCAL project team
- **Hosting institutions:** The student will be based 50% of the time at the Kenya Marine and Fisheries Research Institute (KMFRI) in Mombasa, Kenya and 50% of the time at the Marine Biodiversity exploitation and conservation (MARBEC) mixed research unit in Sète, France, with regular research and fieldword trips to other MESCAL project partners in South Africa, Mozambique and Tanzania

- **Expected PhD start date:** September 1, 2026
- **Duration:** 3 years (2026-2028)
- **Funding:** IRD ARTS bursary includes stipend, insurance and one round-trip airline ticket per year from France to Kenya. Additional research costs will be covered by the MESCAL project.

- **Application deadline:** March 10, 2026

2 Project description

2.1 Scientific context

Climate change threatens the long-term sustainability of marine ecosystems (Hoegh-Guldberg et al. 2017). Although Marine protected areas (MPAs) are recognized as an effective tool to protect harvested species and biodiversity, they were generally not explicitly designed to increase the resilience of marine ecosystems to climate change (Bates et al. 2019). In this context, a major issue that remains to be explored is whether and by what mechanisms current and future MPAs can simultaneously buffer intraspecific (genotypes and phenotypes) diversity and community diversity against climate change, thereby enhancing sustainability of marine ecosystems. Marine connectivity via larval dispersal plays a pivotal role by potentially ensuring that individuals from climate or fishing refugia can repopulate impacted areas (Balbar & Metaxas 2019). These questions are particularly important in the Western Indian Ocean (WIO), given that warming and fishing exploitation in this region are increasing at an alarming rate (Roxy et al. 2016). In the WIO, fish support key ecological functions and are the primary source of protein and income for coastal communities (Obura et al. 2017), and the creation or expansion of MPAs is a promising mitigation measure for the negative impacts of climate change on fish stocks. Importantly, it has recently been shown that fish in MPAs tend to exhibit higher aerobic scope than those in fished areas, suggesting that reserve individuals may be more tolerant of extreme temperature events caused by climate change and, therefore, more likely to survive and adapt to future environmental conditions (Duncan et al. 2019).

2.2 Project objectives and expected methodology

The main objective of this PhD project is to assess the value of marine protected areas (MPAs) along the coast of East Africa for assuring the resilience of coastal marine fish populations to climate change via the export of more genetically, and therefore more physiologically, diverse individuals from MPAs via larval dispersal. This work will assess the value of existing MPAs as a buffer against the significant changes in oceanic conditions predicted for the region over the next 80 years, as well as identify additional spatial zones that may merit protection in the future to stabilize marine communities and assure food production and livelihoods in the region.

To address these issues, this thesis project will use **larval dispersal models** to examine how exchange of larval fish from protected to exploited areas can increase overall climate change resilience of exploited marine fishes along the East African coast via exchange of traits associated with climate change resilience that are more prevalent within MPAs. The PhD will be carried out within the wider MESCAL project, an international project with an ~1 million € budget. MESCAL will focus on two commercially important and heavily exploited East African fish species (*Diplodus capensis*, blacktail, a warm-temperate species found in South Africa & Mozambique; and *Lutjanus fulviflamma*, dory snapper, found primarily from Kenya

to Mozambique) and includes collaborators from Kenya, Tanzania, Mozambique and South Africa, in addition to France. One of the major objectives of MESCAL is to collect data on fish physiological traits linked to climate change resilience, along with genetic information for fish populations inside and outside MPAs in East Africa. This will help assess the value of protection and identify specific genes associated with climate change resilience. The proposed thesis project will have the key role of understanding how dispersal can transfer highly resilient individuals from MPAs to surrounding areas (Brochier et al. 2009, Andrello et al. 2013, Muller et al. 2023), thereby maintaining climate change resilience among fished populations. This information will contribute to assessments of the robustness of regional MPAs networks to climate change (see, e.g., Kaplan et al. 2009) in collaboration with local and regional stakeholders (e.g., WRTI in Kenya).

3 Context of the thesis project

3.1 Thesis supervision

The student will be directed by the three project directors who have extensive experience in the study area and subject matter: David M. Kaplan, Christophe Lett and Gladys Okemwa. In addition the student will interact closely with other members of the MESCAL project, including, but not limited to, Bernardino Malawene, Mike Roberts, Thomas Lamy, James Mwaluma, Barnabas Tarimo and Mohammed Omar. Supervising will include regular meetings with the thesis directors, as well as participation in larger MESCAL project meetings and status updates.

3.2 Hosting laboratories

The student will spend ~6 months of each year of the thesis in France and in Kenya. While in France, the student will be based in the UMR MARBEC at the campus in Sète, France. While in Kenya, the student will be based at the KMFRI laboratory in Mombasa, Kenya. In addition, the student will travel regularly to the other countries involved in the MESCAL project (Tanzania, Mozambique and South Africa) for project meetings, to contribute to project fieldwork and/or to collaborate with project members.

3.3 Research activities

In addition to developing larval dispersal models and assessments of MPA networks, the student will be expected to contribute to project fieldwork to collect physiological and genetic data that will form the basis of the modeling work, as well as participate in MESCAL project meetings and publication and diffusion of results.

3.4 Funding

This bursary is funded by the IRD ARTS program (the bursary is already funded by the ARTS program, no separate application process for the program is necessary). The bursary covers the student stipend, health insurance and the costs of one round-trip travel per year between the two host countries (France and Kenya). Student stipend amount is adjusted based on the living costs of the country where the student is based at a given moment.

Additional research and travel costs of the thesis will be covered by the MESCAL project.

3.5 Expected start date and duration

Ideally, the thesis will begin September 1, 2026 for a duration of 3 years.

4 How to apply

4.1 Conditions of eligibility

Candidates must originate from one of the partner nations of the IRD and they must possess a Masters in marine science, ecology, bioinformatics, oceanography or other related fields.

4.2 Desired qualifications

The ideal candidate will have a Masters degree with course work in or exposure to marine population dynamics, ecological modeling, statistics and population genetics. Previous use of R, Python or Matlab is highly desirable. In addition, as the project will involve collaboration with a number of international partners in a large project, the student must possess strong teamwork skills, including a positive attitude, professional demeanor and good communication skills. A strong desire to live and work in France, Kenya and other MESCAL partner countries is central to successful completion of the thesis. Proficiency in scientific communication and writing in English will be essential to project success and diffusion of thesis results.

Candidates from Kenya, Tanzania, Mozambique and South Africa are highly encouraged.

4.3 Application deadline

March 10, 2026

4.4 Application materials

Interested applicants should send an email on or before **March 10, 2026** with subject "MESCAL ARTS connectivity PhD application" to david.kaplan@ird.fr containing the following materials:

- A letter of motivation, including discussions of the applicant's interest in this particular project and aspects of the applicant's background that make him or her particularly appropriate for the project
- A detailed CV
- Names and contact information for 2-4 professional references
- Most recent course grades and class rankings

5 Cited literature

Andrello M, Mouillot D, Beuvier J, Albouy C, Thuiller W, Manel S (2013) Low Connectivity between Mediterranean Marine Protected Areas: A Biophysical Modeling Approach for the Dusky Grouper Epinephelus marginatus. *PLoS ONE* **8**:e68564. doi:10.1371/journal.pone.0068564

Balbar AC, Metaxas A (2019) The current application of ecological connectivity in the design of marine protected areas. *Global Ecology and Conservation* **17**:e00569. doi:10.1016/j.gecco.2019.e00569

Bates AE, Cooke RSC, Duncan MI, Edgar GJ, Bruno JF, Benedetti-Cecchi L, Côté IM, Lefcheck JS, Costello MJ, Barrett N, Bird TJ, Fenberg PB, Stuart-Smith RD (2019) Climate resilience in marine protected areas and the "Protection Paradox." *Biological Conservation* **236**:305–314. doi:10.1016/j.biocon.2019.05.005

Brochier T, Colas F, Lett C, Echevin V, Cubillos LA, Tam J, Chlaida M, Mullon C, Fréon P (2009) Small pelagic fish reproductive strategies in upwelling systems: A natal homing evolutionary model to study environmental constraints. *Progress in Oceanography* **83**:261–269. doi:10.1016/j.pocean.2009.07.044

Duncan MI, Bates AE, James NC, Potts WM (2019) Exploitation may influence the climate resilience of fish populations through removing high performance metabolic phenotypes. *Scientific Reports* **9**:1–10. doi:10.1038/s41598-019-47395-y

Hoegh-Guldberg O, Poloczanska ES, Skirving W, Dove S (2017) Coral Reef Ecosystems under Climate Change and Ocean Acidification. *Frontiers in Marine Science* **4**:158

Kaplan DM, Botsford LW, O'Farrell MR, Gaines SD, Jorgensen S (2009) Model-based assessment of persistence in proposed marine protected area designs. *Ecological Applications* **19**:433–448

Muller C, Lett C, Porri F, Pattrick P, Bailey D, Denis H, Barrier N, Potts W, Kaplan D (2023) Coastal connectivity of an abundant inshore fish species: Model-data comparison along the southern coast of South Africa. *Marine Ecology Progress Series* **MFC**. doi:10.3354/meps14272

Obura D, Smits M, Chaudhry T, McPhillips J, Beal D, Astier C (2017) Reviving the Western Indian Ocean economy: Actions for a sustainable future.

Roxy MK, Modi A, Murtugudde R, Valsala V, Panickal S, Prasanna Kumar S, Ravichandran M, Vichi M, Lévy M (2016) A reduction in marine primary productivity driven by rapid warming over the tropical Indian Ocean. *Geophysical Research Letters* **43**:826–833. doi:10.1002/2015GL066979