Marine Eco-Evo-Devo Unit
Professor Vincent Laudet

(From left to right) James Hutasoit, Yuki Irimatsugawa, Danielle Miller, Laurie Mitchell, Saori Miura, Marcela Herrera Sarrias, Manon Mercader, Rio Kashimoto, Prof. Vincent Laudet, Ken Maeda, Marleen Klann, and Ethan Rickards
*Some members are not in the photo.

ABSTRACT

The Marine Eco-Evo-Devo Unit uses coral reef fishes as model systems to study the ecology, evolution and developmental biology of complex traits. Research within the Unit falls within four major research questions: (1) How are hormones controlling and coordinating the environment? (2) How does the completion of metamorphosis impact the quality of the juvenile fish emanating? (3) How are the diverse pigmentation patterns of anemonefish established development and what is their function? (4) How does the symbiotic relationship with different sea anemone hosts affect life history, pigmentation, and metabolism of anemonefish?

The unit is located into two sites: OIST of course in which the majority of unit members are located but also the Yilan Marine Research Station of the Institute of Cellular and Organismic Biology (ICOB) of Academia Sinica in Taiwan in which we benefit from a unique husbandry system and a great Evo/Devo environment. In addition, we have long term established collaboration with the Oceanological Observatory of Banyuls-sur-Mer in France and the Centre for Island Research and Environmental Observatory (CRIOBE) in Moorea, French Polynesia with we organized field trips in remote atoll in the Pacific Ocean.

1. STAFF

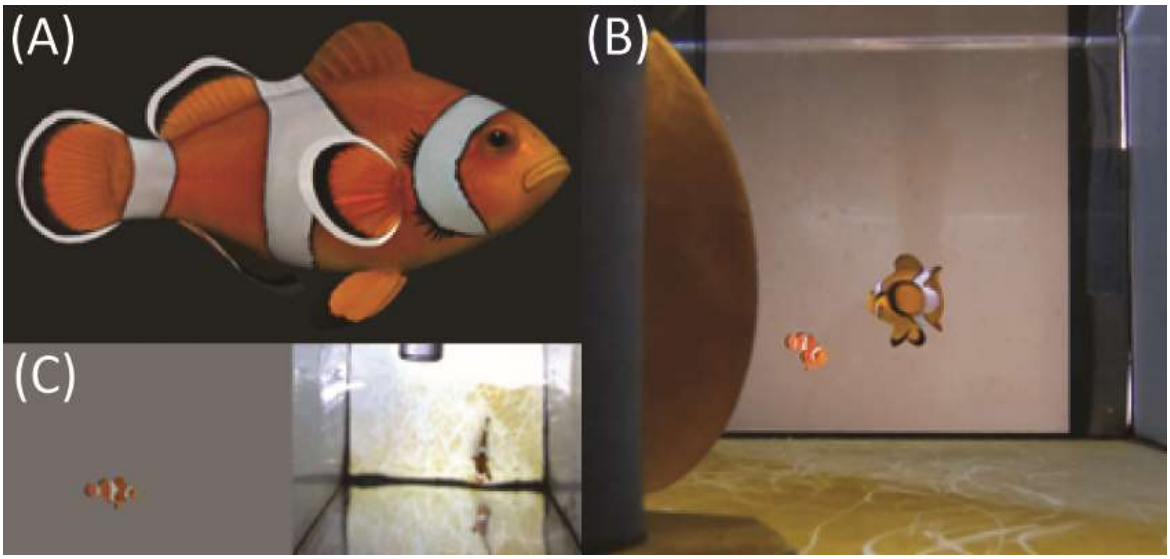
- Dr. Marleen Klann, Staff Scientist
- Dr. Ken Maeda, Staff Scientist
- Dr. Manon Mercader, Postdoctoral Scholar
- Dr. Marcela Herrera Sarrias, Postdoctoral Scholar
- Dr. Saori Miura, Lab Manager
- Dr. Kina Hayashi, Research Fellow
- Dr. Laurie Mitchell, Research Fellow
- Hiroki Takamiyagi, Fieldwork Technician
- Danielle Miller, Husbandry manager
- James Hutasoit, Husbandry Technician
- Emma Gairin, PhD Student
- Jann Zwahlen, PhD Student
- Yuki Tara, PhD Student
- Rio Kashimoto, PhD Student
- Noah Locke, PhD Student
- Ethan Rickards, PhD Student
- Hsiao-Chian Chen, PhD Student (Rotation student)
- Camille Sautereau, Research Fellow (April, 2024-)
- Yuki Irimatsugawa, RUA

2. COLLABORATIONS

2.1 DEVELOPMENT OF A VIRTUAL SYSTEM TO FOLLOW ANEMONEFISH BEHAVIOR.

- Investigating the function of specific color pattern elements in anemonefish requires lengthy behavioral experiments which rely on having numerous fish to account for non-repeated trials and individual variation *e.g.*, in body size, experience. Moreover, the difficulty of sourcing enough fish is sometimes compounded by the need for rarely traded species and/or costly pedigree strains, such as color pattern mutants. Therefore, it is paramount to develop an alternative testing methodology that minimizes the need for live fish in behavioral studies. To address this technical gap, we are working in collaboration with Dr. Shunichi Kasahara from Sony Computer Science Laboratories, Inc., to apply virtual reality technology in testing the function of anemonefish color patterns. The test setup under development is designed to enable the live camera tracking and analysis of anemonefish behavior in response to a 3D animated anemonefish. This 3D model is displayed on a computer monitor and can be easily modified in its appearance (color pattern and size) and movement. This project will provide a more cost-effective and ethical testing platform for conducting reproducible behavioral experiments.
- Type of Research: Joint Research
- Researchers:
  - Dr. Shunichi Kasahara, OIST Cybernetic humanity Unit

- Noah Locke, OIST Laudet Unit
- Dr. Laurie Mitchell, OIST Laudet Unit

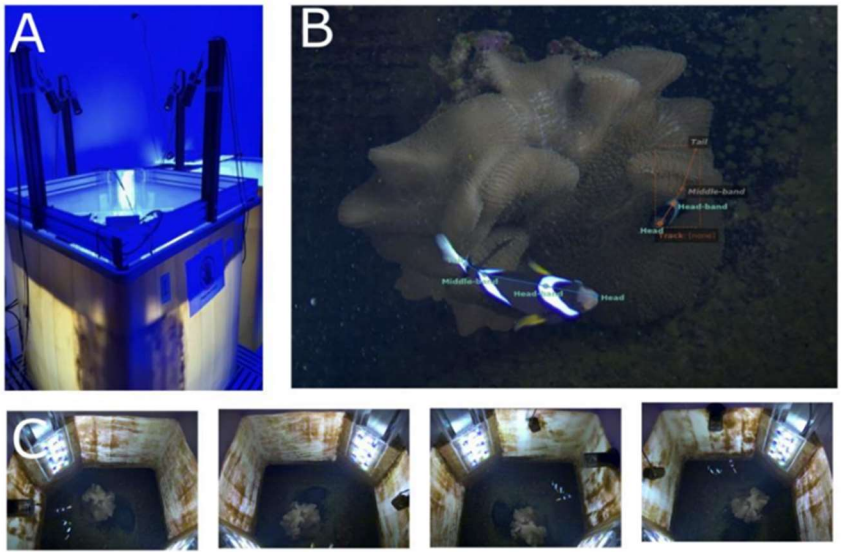


A. ocellaris 3D model with wild type color pattern. B) In-tank view of *A. ocellaris* approaching the 3D model fish. C) Real-time visualization of the 3D model position (left image) and a top-down view of an *A. ocellaris* displaying aggressive behavior towards the 3D model (right image).

2.2. SOCIAL BEHAVIOR AND COEXISTENCE OF ANEMONEFISH.

- Little is known about how anemonefish colonies spend their daily life together. Are tasks distributed among members? How is this communicated or enforced? How do members share their limited space, behave, and communicate as a small society? Anemonefish colonies can be intraspecific but also interspecific, adding a layer of complexity. Do interspecific groups function similarly to intraspecific ones? Field observations can provide valuable insight into the organization and functioning of anemonefish societies. However, quantitative approaches and long-term behavioral tracking are challenging in a 3D marine environment. We used a mesocosm approach in a 1000L tank to track the fish in 3D for extended periods and describe the functioning of intraspecific groups of *Amphiprion clarkii* and *A. sandaracinos* only, and interspecific groups combining both species, which have been observed to cohabit in the wild.
- Our tank contained a single host anemone (*Stichodactyla mertensii*) with four cameras in the upper corners of the tank and we used custom SLEAP and MATLAB algorithms to track specific marker points on the body of the fish. Following a fine-tuning of the tracking pipeline specifically for *A. clarkii* body markers, we have now tracked the movements of a breeding couple over 80 hours and during four spawning events. We defined specific territories within the anemone of the male and female *A. clarkii* and observed a significantly smaller space occupancy of the male *A. clarkii*. We are now working on adapting the pipeline to track *A. sandaracinos*, continuing the analysis of *A. clarkii* videos, and improving tracking metrics.
- Type of Research: Joint Research

- Researchers:
  - Dr. Makoto Hiroi, OIST Reiter Unit
  - Olivier Fernandez, OIST Reiter Unit
  - Sam Reiter, OIST Reiter Unit
  - Manon Mercader, OIST Laudet Unit



Experimental tank with the four cameras on top. B) Tracking algorithm with body marker points for Amphiprion clarkii. C) One example scene viewed from all cameras.

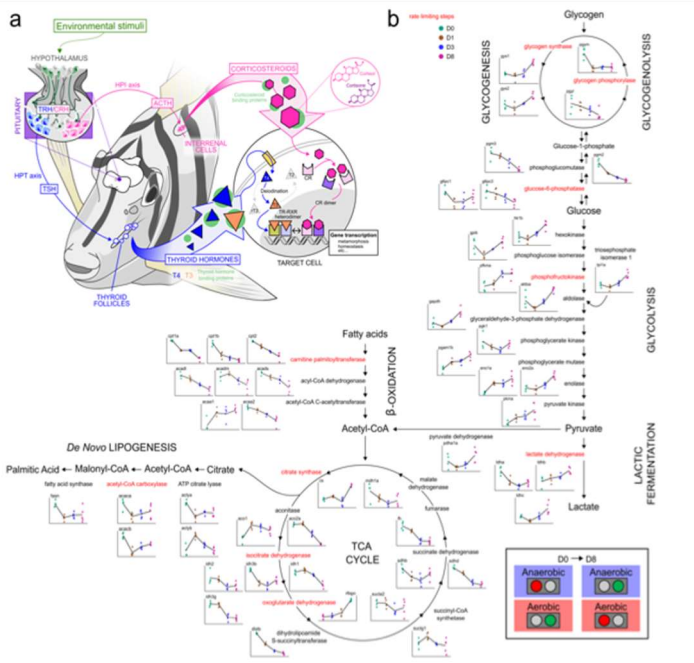
3. ACTIVITIES AND FINDINGS

3.1. METAMORPHOSIS IN THE SURGEONFISH *ACANTHURUS TRIOSTEGUS*

Understanding how thyroid hormones (TH) trigger and coordinate metamorphosis in different species could shed light on the evolution and diversity of the underlying biological mechanisms. The surgeonfish *Acanthurus triostegus* was the first coral reef fish that we investigated as it offers unique advantages as an eco-physiological model. Indeed, surgeonfish can be collected easily at the reef crest during their entry to the reef. This is a stage at which all young fish are synchronized in terms of metamorphosis progress, with TH levels decreasing following a recent climax in the open ocean. We previously used this species to show that reef entry was a TH-controlled metamorphosis (Besson et al., 2020; Holzer et al., 2017).

To gain insights into the molecular pathways involved during their metamorphosis, we produced a chromosome-scale genome of *A. triostegus* using Nanopore and Hi-C sequencing, and then performed a transcriptomic analysis of *A. triostegus* from the reef entry (day 0) until their settlement in nursery habitats (at three steps: day 1, 3, and 8).

The results confirmed that the peak in TH in *A. triostegus* occurs in the open ocean and that, upon entry to the reef, TH signaling declines, with a decrease in the expression levels of related genes. Over the next days, *A. triostegus* larvae must adapt to their new environment. This ecological transition is accompanied by a change in metabolic requirements. Expression profiles revealed a clear overall pattern: fatty acid β-oxidation and TCA cycle genes are highly expressed in crest-captured larvae (at day 0) and their expression decreases at later stages. Inversely, glycolysis-related gene expression increases towards day 8. Thus, while small larvae rely on fatty acids fueling β-oxidation and use the TCA cycle for aerobic energy production, older larvae and juveniles progressively rely on glycolysis and produce energy anaerobically (Fig. 3B). This metabolic transition occurs in parallel with morphological and behavioral changes described for *A. triostegus*. Our results support the notion that TH are instrumental in orchestrating the complex remodeling that occurs during metamorphosis in concert with available environmental resources.



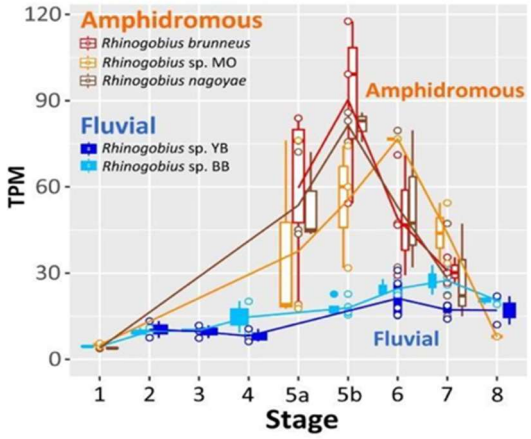
3.2. LIFE HISTORY EVOLUTION AND METAMORPHOSIS: THE CASE OF AMPHIDROMOUS GOBIES

Migration is a common phenomenon among fish and other aquatic organisms. Many types have been described between freshwater and seawater environments. This can allow to decipher factors controlling life history strategies and variations in metamorphosis. What are the physiological mechanisms and adaptive significance of migration patterns?

In collaboration with Yo Yamasaki and Jun Kitano from the National Institute of Genetics in Japan, we are focusing on *Rhinogobius*, a genus of goby with a variety of migration patterns distributed in eastern and southeastern Asia. In particular, we compared amphidromous (with marine stage) and fluvial (never leaves freshwater) species from Okinawa. Eight developmental stages were described and matched across each species based on similar changes in morphology. To characterize the divergence in development between amphidromous and fluvial species, larvae and juveniles from local streams, estuaries, and the sea, were used for RNA sequencing.

The fluvial species showed similar patterns of gene expression along their development, which were significantly different from amphidromous species. In particular, TH-related genes showed a peak in expression during metamorphosis in amphidromous species, while fluvial species showed a much weaker peak, and at later developmental stages. This indicates that modulations in TH-related gene expression may play a role in the adaptation of fish to a fully fluvial life and

contributed to the evolution of this trait. We will further elucidate the mechanisms at play through direct hormone measurements and hormone treatment experiments.



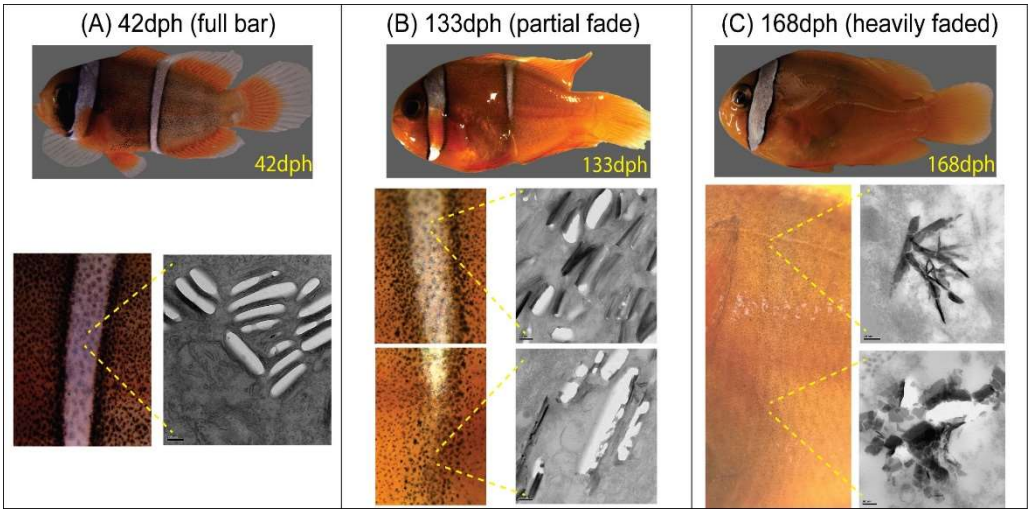
Expression of thyroglobulin (in TPM, transcripts per million) throughout eight developmental stages in amphidromous and fluvial

3.3. SOCIAL FUNCTIONS OF WHITE BARS: AN INTEGRATED ANALYSIS IN *A. FRENATUS*

Most anemonefish have either partially or completely lost the original three white bars. This loss occurred sequentially from the tail to the head*, i.e.,* the inverse of bar formation. Despite the prevalence of bar loss across anemonefishes, our understanding of color pattern formation is limited to the species with three barred adults. Multiple species often still form a full complement of bars (two to three) during larval metamorphosis, but later lose their posterior bar(s) during juvenile development. This ontogenetic change in color pattern provides an opportunity to study the cellular mechanisms and ecological drivers underlying adult coloration in a reef fish.

We are investigating bar loss in the juveniles of *A. frenatus* which have two to three bars as juveniles and retain a single bar as adults. Potential scenarios that might give rise to the bar loss phenotype are: *1*) the masking of iridophores (white structural coloration) by overlying pigmentation (black melanophores and/or orange xanthophores), *2*) the programmed cell death of iridophores, and *3*) the transmutation of iridophores into other chromatophore types.

To compare the physical state and abundance of chromatophore cells during the bar loss process, we used transmission electron microscopy (TEM) with *A. frenatus* skin. Two fully formed bars were visible at early stages with iridophores as the predominant chromatophore, followed by sparse



melanophores. There were no xanthophores within the white skin until 133dph when the body bar had started to fade in a dorsal-ventral direction. By 168dph, the body bar had completely faded into the surrounding dark orange skin. Bar loss coincided with a major decrease in iridophore cell cover, due to a reduction in both the abundance and size of cells. Furthermore, using cryosectioned skin and a TUNEL assay, we identified, that cell death was intense near the receding edge of the bar. This may be due to an apoptotic process, which we plan to confirm by immunostaining sectioned skin using cleaved/activated caspase 3 antibody (a marker of apoptosis).

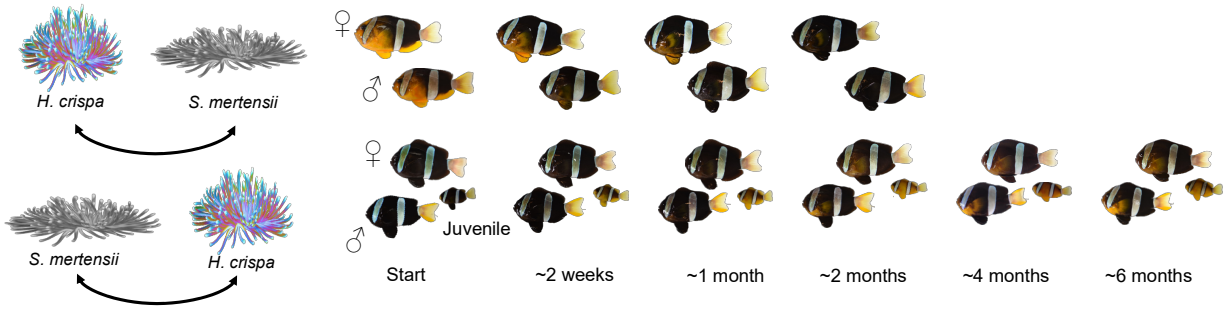
3.4. LOCAL ACCLIMATION TO THE SEA ANEMONE HOST: "*STICHODACTYLA* SYNDROME"

Three broad stages of body bar loss in juvenile *Amphiprion frenatus* with the deteriorating physical state of guanine platelets in iridophores during the bar loss process in *A. frenatus*.

A. clarkii becomes black when hosted in *Stichodactyla* anemones. The species has a wide geographical distribution across Japan, from Ishigaki in the south, near Taiwan, to Shimoda in the north, only 40km from Tokyo. It also colonized remote eastern islands such as Ogasawara where it only has a black morph (Fig.14).

A. clarkii can inhabit ten host anemone species: these are distinct microhabitats to which juveniles must adapt as they settle. To understand phenotypic variations, we compared color morphs from different anemone hosts and locations. We tested the plasticity of the phenotype by moving fish between anemones of different species in the wild as well as in the lab, combined with transcriptomic analysis.

As a detailed example of experiment, to investigate differences in gene expression, we placed six captive-bred *A. clarkii* juveniles without previous anemone contact in *Heteractis crispa* and *S. mertensii* anemones. After three weeks, we performed RNA-seq on the whole fish. Preliminary transcriptome analyses show that host species influences expression of genes involved in melanin-related processes, metabolism, vision, and, interestingly, several genes involved in aging. Jann Zwahlen also exchanged adult breeding pairs from *S. mertensii* (black) to *H. crispa* (orange) (and vice versa) and monitored their color change and hormone levels. The results show that color change does occur and goes faster from orange to black than from black to orange.



Asymmetrical color change after exchange experiment

4. PUBLICATIONS

4.1 JOURNALS AND BOOKS

- Reynaud M, Gairin E, Lecchini D, Laudet V, Frédérich B. The environment: a vector of phenotypic disparity during the settlement phase of reef fishes. Journal of Experimental Marine Biology and Ecology, 2023, 568, 151937
- Patel AKM, Vilela P, Shaik TB, McEwen A, Hazemann I, Brillet K, Ennifar E, Hamiche A, Markov GV, Laudet V, Moras D, Klaholz BP and Billas IML. Asymmetric dimerization in a transcription factor superfamily is promoted by allosteric interactions with DNA. Nucleic Acid Research, Nucleic Acids Research,2023, 51, 8864–8879.
- Roux N, Miura S, Dussenne M, Tara Y, Lee SH, de Bernard S, Reynaud M, Salis P, Barua A, Boulahtouf A, Balaguer P, Gauthier K, Lecchini D, Gibert Y, Besseau L, Laudet, V. The multi-level regulation of clownfish metamorphosis by thyroid hormones. Cell Reports, 2023 42, 112661.
- Moore B, Herrera M, Gairin E, Li C, Miura S, Jolly J, Mercader M, Izumiyama M, Kawai E, Ravasi T, Laudet V, Ryu, T. The chromosome-scale genome assembly of 1 the yellowtail clownfish *Amphiprion clarkii* provides insights into melanic pigmentation of anemonefish. G3, Genes, Genomes, Genetics, 2023, 13, jkqd002.
- Herrera M, Ravasi T, Laudet V. Anemonefishes: A model system for evolutionary genomics. F1000 Research, 2023, 12, 204
- Kobayashi H, Nishigaki K, Saeki T, Maeda K. First records of *Paloa villadolidi* from Japan with a redescription of *Eleotris macrodon* (Gobiiformes: Butidae). Species Diversity, 2023, 28, 165–175.
- Donaldson J, Maeda K, Iida M, Kobayashi H, Ebner BC, Tran HD. New distributional records of four amphidromous gobies (Gobioidei: Sicydiinae) in continental Vietnam. Cybium, 2023, 47, 467–472.
- Ebner BC, Maeda K, Donaldson JA, Harasti D, Lord C, Haÿ V, Heffernan J, Starrs D, Thuesen P, Beatty S, Boseto D, Copeland LKF, Rashni B, Hevalao RS, Keith P. Pebbled places preferred by people and pipefish in a World Heritage protected area. Cybium, 2023, 47, 401–416.
- Koreeda R, Maeda K, Motomura H. A new subtropical species of goby of the genus *Luciogobius* (Gobiidae) from southwestern Japan. Zootaxa, 2023, 5361, 390–408.
- Gatouillat, H.*, Gairin, E.*, Minier, L., Gourlaouen, A., Carpentier, C., Berthe, C., Teraaitepo, A., Maueau, T., Sturny, V., Bambridge, T., Galzin, R., Lecchini, D. (2023) Study of the coastal reef

fishery pressure in a South Pacific Island (Bora-Bora, French Polynesia). Aquatic Living Resources, 37, 3. doi: 10.1051/alr/2024001

- Minier, L., Bertucci, F., Raick, X., Gairin, E., Bischoff, H., Waqalevu, V., Maueaui, T., Sturny, V., Blin, E., Parmentier, E., Lecchini, D. (2023) Characterization of the different sound sources within the soundscape of coastline reef habitats (Bora-Bora, French Polynesia). Estuarine, Coastal and Shelf Science, 294, 108551. doi: 10.1016/j.ecss.2023.108551
- Vidal, M., Mills, S., Gairin, E., Bertucci, F., Lecchini, D. (2023) Validation of a novel fully immersive Virtual Reality setup with a behavioural study of freely moving fish. Animal Behaviour, 206, 99-123. 10.1016/j.anbehav.2023.09.013
- Reynaud, M., Gairin, E., Lecchini, D., Laudet, V., Frederich, B. (2023) The environment: A vector of phenotypic disparity during the settlement phase of coral reef fishes. Journal of Experimental Marine Biology and Ecology, 568, 151937. doi: 10.1016/j.jembe.2023.151937
- Gautrand, L.*, Gairin, E.*, Sowinski, J., Sowinski, L., Krimou, S., Trotier, M., Minier, L., Chamot, Z., Gourlaouen, A., Waqalevu, V., Rene-Trouillefou, M., Mills, S.C., Bertucci, F., Lecchini, D. (2023) High densities, rapid infestation and high feeding rates of gastropods on corals in Bora-Bora Island, French Polynesia. Regional Studies in Marine Science, 66, 103-125. doi: 10.1016/j.rsma.2023.103125
- Gairin, E., Minier, L., Claverie, T., Dromard, C.R., Maueau, T., Collin, A., Frederich, B., Bertucci, F., Lecchini, D. (2023) Coral reef fish communities of natural habitats and man-made coastal structures in Bora-Bora (French Polynesia). Belgian Journal of Zoology, 153:47-81. doi: 10.26496/bjz.2023.109
- Minier, L., Raick, X., Gairin, E., Maueau, T., Sturny, V., Blin, E., Parmentier, E., Bertucci, F., Lecchini, D. (2023) 'Habitat-associated soundscape' hypothesis tested on several coral reefs within a lagoon (Bora-Bora Island, French Polynesia). Marine Biology, 170:61. doi: 10.1007/s00227-023-04206-3
- Minier, L.*, Fourriere, M.*, Gairin, E.*, Gourlaouen, A.*, Krimou, S., Berthe, C., Maueau, T., Doom, M., Sturny, V., Mills, S.C., Lecchini, D., Bertucci, F. (2023) Roadside sales activities in a South Pacific Island (Bora-Bora) reveal sustainable strategies for local food supply during a pandemic. PLoS ONE, 18(4): e0284276. doi: 10.1371/journal.pone.0284276
- Krimou, S.*, Gairin, E.*, Gautrand, L., Sowinski, J., Trotier, M., Minier, L., Bischoff, H., Sturny, V., Maueau, T., Waqalevu, V., Bulleri, F., Raick, X., Bertucci, F., Lecchini, D. (2023) Herbivory effects of sea urchin species on a coral reef (Bora-Bora, French Polynesia). Journal of Experimental Marine Biology and Ecology, 564:151900. doi: 10.1016/j.jembe.2023.151900

4.2 BOOKS AND OTHER ONE-TIME PUBLICATIONS

- Maeda K (2023) "Mystery of red gobies (Chapter 5)". In: Shimano S & Waki T (eds) New species stories, pp. 95–114. Iwanami Shoten, Tokyo.
- Zwahlen J (2024) "Finding Nemo(’s gender): Sex change and gender roles in anemonefishes". In: Balakrishan C & Wasowski M (eds) How to win friends and influence fungi. Collected quirks of science, tech, engineering and math from Nerd Nite. St. Martin's press, New York.
- Sautereau C, Gairin E, Besson M, Laudet V, Lecchini D, Besseau L. Coral reef fish larvae as model systems to understand marine fish larval recruitment. In "Marine Larvae: Developments and Applications" edited by Se-Kwon Kim, CRC Press, in press.

4.3 ORAL AND POSTER PRESENTATIONS

1. Laudet V « Coral reef fish, hormones and metamorphosis: a tale of adaptation». Indo-Pacific Fish Conference, Auckland, New Zealand, 20-24 November 2023 (invited by Jennifer Donaldson).
2. Klann M. « Color patterning in anemonefishes». Indo-Pacific Fish Conference, Auckland, New Zealand, 20-24 November 2023.
3. Herrera M « A Transcriptome Insight During Larval Settlement of a Coral Reef Fish». Indo-Pacific Fish Conference, Auckland, New Zealand, 20-24 November 2023.
4. Mitchell, L. J. « Ecological drivers and pigmentation changes underlying adult colour pattern formation in the anemonefish, Amphiprion frenatus». Indo-Pacific Fish Conference, Auckland, New Zealand, 20-24 November 2023.
5. Zwahlen, J. « Phenotypic plasticity in Clark's Anemonefish Amphiprion clarkii pigmentation in response to host anemones». Indo-Pacific Fish Conference, Auckland, New Zealand, 20-24 November 2023.
6. Maeda K « Migration and distribution patterns of freshwater gobies of the genus Rhinogobius in continental rivers and tropical island's streams». Indo-Pacific Fish Conference, Auckland, New Zealand, 20-24 November 2023.
7. Locke, N. « The role of colour patterns in anemonefish species recognition». Indo-Pacific Fish Conference, Auckland, New Zealand, 20-24 November 2023.
8. Kobayashi H, Maeda K, Sato M, Tan HH, Shirai K, Iida M, Yamahira K « Cavefishes across the ocean: evidence for amphidromy in a cavernicolous goby on tropical islands. »The 11th Indo-Pacific Fish Conference, New Zealand, 20–24 November 2023.
9. Motomura H, Koreeda R, Maeda K « Preliminary review of the interstitial gobiid genus Luciogobius Gill, 1859 in the Ryukyu Archipelago, Japan. » The 11th Indo-Pacific Fish Conference, New Zealand, 20–24 November 2023.
10. Maeda K, Iida M, Kobayashi H, Shirai K, Palla HP, Tran HD « Migration and distribution patterns of freshwater gobies of the genus Rhinogobius in continental rivers and tropical island's streams. » The 11th Indo-Pacific Fish Conference, New Zealand, 20–24 November 2023.
11. Ziadi-Künzli F, Maeda K, Puchenkov P, Venkadesan M, Bandi M « Anatomy of adaptation: exploring the internal structure of locomotor fins in the terrestrial mudskipper, Periophthalmus argentilineatus, using contrast enhanced micro-CT. » The 11th Indo-Pacific Fish Conference, New Zealand, 20–24 November 2023.
12. Koreeda R, Motomura H, Maeda K « Taxonomic review of a subterranean goby group "Luciogobius pallidus" in the Ryukyu Islands. »The 57th Annual Meeting of the Ichthyological Society of Japan, Nagasaki, Japan, 1–4 September 2023.
13. Maeda K « "Access and Benefit-Sharing" procedures for fish research in Palawan, Philippines. Symposium of the Ichthyological Society of Japan "Basic concept and recent trends of the Nagoya Protocol on Access and Benefit-Sharing (ABS) from the perspective of ichthyological research" », Nagasaki, Japan, 4 September 2023 (invited by the committee).
14. Laudet V «進化/生態/発生のモデル生物クマノミ類の色素パターンに関する研究». The 94th Annual Meeting of the Zoological Society of Japan, Yamagata, Japan, 7-9 September 2023.
15. Laudet V«Clownfish and giant sea anemones: Molecular dissection of a symbiosis», The 29th East Asia Joint Symposium (EAJS), Chungcheongnam-do, Korea, 24-27 October 2023.

5. INTELLECTUAL PROPERTY RIGHTS AND OTHER SPECIFIC ACHIEVEMENTS

Nothing to report

6. MEETINGS AND EVENTS (YUKI WILL EDIT)

6.1 SEMINAR TITLE IN FULL

OIST-CNRS Joint Symposium on West Pacific Marine Biology
Date: Tuesday, April 23, 2024 (All day) to Friday, April 26, 2024 (All day)
Location: OIST Conference Center (Auditorium + Meeting Rooms)
Speakers:

- Yutaka Satou, Department of Zoology, Graduate School of Science, Kyoto University,
- Mikiko Tanaka,Tokyo Institute of technology
- Kate Quigley, The University of Western Australia
- Andrew Chin, James Cook University
- Hugues Roest Crollius, Ecole Normale Supérieure, Paris
- Stéphanie Bertrand, Observatoire Océanologique de Banyuls-sur-Mer
- David Lecchini, CRIOBE, French Polynesia
- Fanny Houlbreque, IRD New Caledonia
- Neo Mei Lin.National University Singapore (zoom)
- Rebecca Case, Nanyang Technological University, Singapore
- Sung-Jin Hwang, Department of Life Science, Woosuk University
- Yong-Jin Won, Division of EcoScience, Ewha Womans University
- Sen-Lin Tang,Biodiversity Research Center, Academia Sinica,
- Shinya Shikina,Institute of Marine Environment and Ecology, National Taiwan Ocean University,
- James Reimer.University of the Ryukyus
- Sumio Udagawa, Ochanomizu University
- Takumi T Shito, Keio University
- Alexia Dubuc, James Cook University
- Adam Downie, University of Queensland
- Eric Koch, Observatoire Océanologique de Banyuls-sur-mer
- Yuuki SHIKAYA, Institute de la Mer de Villefranche
- Lana Minier, CRIOBE french Polynesia
- Lucie Cartairade, MAREPOLIS
- Nicholas Yap, National University of Singapore
- Sirius Ng, National University of Singapore
- Boongho Cho, Inha University
- Jae Gon Park, Korea Institute of Ocean Science & Technology
- Stefano Vianello, Institute of Cellular and Organismic Biology, Academia Sinica
- Arnaud Guerbet, National Taiwan University, Taiwan

7. OTHER

7.1 OIST PRESS RELEASES FOR UNIT RESEARCH

- Can noisy and polluted coastlines harm baby fish? OIST researchers aim to find out (2023/4/13)
https://www.oist.jp/news-center/news/2023/4/13/can-noisy-and-polluted-coastlines-harm-baby-fish-oist-researchers-aim-find-out
- OIST research paper on sea anemones receives 2023 Zoological Science Award (2023/7/7)
https://www.oist.jp/news-center/news/2023/6/29/oist-research-paper-sea-anemones-receives-2023-zoological-science-award
- The incredible journey of clownfish larvae: Mini athletes, maximum performance (2023/7/10)
https://www.oist.jp/news-center/news/2023/7/6/incredible-journey-clownfish-larvae-mini-athletes-maximum-performance
- Clown anemonefish seem to be counting bars and laying down the law (2024/2/2)
https://www.oist.jp/news-center/news/2024/2/2/clown-anemonefish-seem-be-counting-bars-and-laying-down-law
- Anemonefish are better taxonomists than humans (2024/3/12)
https://www.oist.jp/news-center/news/2024/3/12/anemonefish-are-better-taxonomists-humans

7.2 TV PROGRAMS

- Nippon TV “Waratte Koraete!” (Jann Zwahlen), 2023/5/31
- NHK “Mogure! Sakana-kun – Okinawa Special” (Ken Maeda), 2023/7/17