Spatio-temporal variability of life history traits and migration trajectories of post-larvae of two species of amphidromous gobies: *Sicyopterus lagocephalus* and *Sicyopterus pugnans* (Teleostei : Gobiidae*)*, during their recruitment in Tahiti

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In the Pacific Ocean, tropical islands are characterised by important meteorological variability, with a hot and wet season from November to April, followed by a cooler and dryer one from May to October. Such a seasonal variability has an impact on the rivers flow, which alternates between periods of flood and drought. An amphidromous life cycle (Fig. 1) reveals to be particularly well adapted to this unstable environment. The two species of goby (Teleostei: gobiidae: Sicydiinae) targeted by our study, ***Sicyopterus lagocephalus*** (Fig. 2B), widely distributed, and ***Sicyopterus pugnans*** (Fig2.A), endemic to French Polynesia and Samoa, show amphidromous life cycle. The larvae grow at sea and are dispersed by oceanic currents, the stochasticity of which should lead to variability in life-history traits: **this is the hypothesis put forward**. This variability will be assessed through the planktonic larval duration (PLD) measured as the age of post-larvae at the time of recruitment

Figure 1: Amphidromous life-cycle of the goby *S. lagocephalus.*

Aim of this study : to compare the variability of the duration of the larval phase and the possible migration trajectories between the 2 goby species.

35 post-larvae of each species (Fig.2) were collected, from fishermen, at the mouth of the selected rivers (Fig.3), in Tahiti island, during the years 2021 and 2022.

Figure 2: Photos of adults
A: Sicyopterus pugnans,
B: Sicyopterus lagocephalus

Figure 3: Location of the sampling areas

global grid with a horizontal resolution of 1/12° ≈ 9 km

Post-larvae were analysed in Paris, otoliths were extracted (Fig.4) and growth increments have been counted (Fig. 5) to assess the pelagic larval duration (PLD).

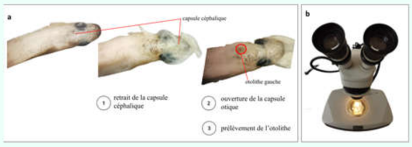

Figure 4: Sagitta extraction from the post-larva head

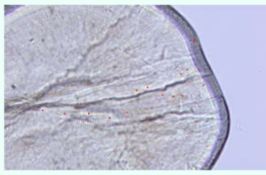

Figure 5: Growth increments counting

The PLD are used as input in the Lagrangian model Parcels, coupled to the global GLORYS reanalysis (Mercator model) simulating the Pacific Ocean currents, to determine the possible larvae migration trajectories.

I- An ANCOVA carried out on the PLD and the standard length (SL) of post-larvae, for both species, shows that there is a significant positive linear relationship between the age of post-larvae (PLD) and their standard length (LS), for both species. This linear relationship has **an identical slope for the 2 species**, but **distinct intercepts**, showing that the *S. pugnans* larvae are younger at a given length than the *S. lagocephalus* larvae, even if their growth are identical (Fig. 6).

II- Temporal variability of the DPL, according to recruitment dates, confirms that *S. pugnans* spend less time at sea than *S. lagocephalus*, even if they return simultaneously to the rivers, where they were sampled at the same time (Fig.7). The average age of *S. pugnans* post-larvae is significantly lower than that of *S. lagocephalus* (Fig.8)

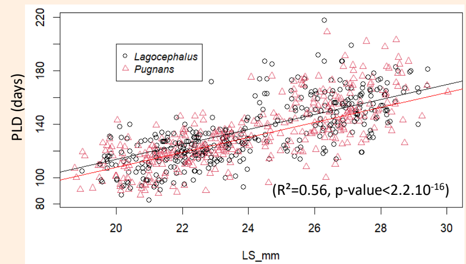

Figure 6: ANCOVA showing the positive and linear relation between the PLD and the SL, for the two species. Equations for the regression are for *S.lagocephalus* : DPL=5.62 * LS + 1.06 + ε ; and for *S. pugnans* : DPL=5.62 * LS + (1.06-5.86) + ε.

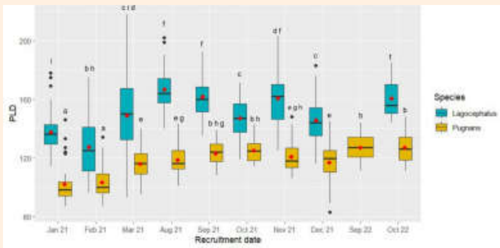

Figure 7: Pelagic Larval Duration (**PLD**) for *Sicyopterus lagocephalus* (blue boxplots) and *Sicyopterus pugnans* (yellow boxplots) depending on the **recruitment date** (Month-Year). The mean DPL of each sample is represented by a red diamond-shaped mark inside the boxplot. Boxplot sharing a same letter show no significant difference between their average DPL.

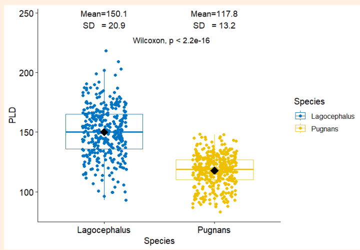

Figure 8: Pelagic Larval Duration (**PLD**) for *Sicyopterus lagocephalus* (blue) and *Sicyopterus pugnans* (yellow). The p-value on the plot results from the **Wilcoxon test** comparing PLDs between *S. lagocephalus* and *S. pugnans.*

III- The particles representing the larvae were emitted from Tahiti and their marine dispersion was simulated for the maximum duration recorded on the otoliths, i.e. 148 days for *S. pugnans* (Fig.9 A) and 218 days for *S. lagocephalus* (Fig.9 B). The results show that *S. pugnans* larvae never reach the Samoa, while *S. lagocephalus* larvae get closer to this island.

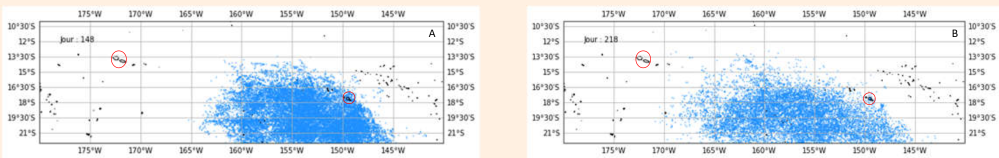

Figure 9: Theoretical location of the particles/larvae after 148 days of dispersion at sea for *S. pugnans* (A) and after 218 days for *S. lagocephalus* (B). Regions circled in red indicate Tahiti and Samoa.

Life-history traits for a given species, are highly variable in particular the age at recruitmen (or PLD). This variability follows the same tendancy for both species, the smallest PLD being recorded for a recruitment in February 2021. The factors influencing this variability, which is also found in other life history traits (LS, weight, condition index), need to be elucidated. The difference in larval phase durations between the 2 species shows that the widely distributed species *S. lagocephalus* is more likely to reach localities distant from Tahiti, such as Samoa, than is the endemic species *S. pugnans*.