Dear Philip Munday,
Please find attached our revised version of the manuscript now entitled: “Strong habitat and weak genetic effects shape the lifetime reproductive success in a wild clownfish population”. We have carefully considered your comments and modified the text to clarify the concerns that you raised.

We kept the angle chosen in the last version, which was proposed by Loeske Kruuk, on the evolutionary potential of lifetime reproductive success (LRS) as the individual contribution to self-recruitment. Questioning the global significance of LRS is pertinent because our sampling was restricted to the local population around Kimbe Island. It is important to note that LRS in our study was measured in the exact same way than in other wild population studies estimating its genetic variation. In our study, however, this is not an issue because we clearly address the adaptive potential of the Kimbe Island population and do not speculate about other populations. In fact, we even go further by clearly explaining that this is a measurement of the individual contribution to self-recruitment. We do not see the absence of LRS measurements corresponding to individuals recruiting on other reefs as an issue but as an asset allowing us to assess individual genetic variation in self-recruitment and the local adaptive evolution rate inside the Kimbe Island population.

We read through the manuscript and modified the text in some places to ensure that this is absolutely clear and that no confusion is possible about the scale at which we discuss our results (local and not regional). See for example LL102-107 in the introduction where we define the scale of our evolutionary investigation (local and not regional).

Please find below a point by point response to the comments.

Looking forward to your answer.

Regards,
For the authors, Benoit Pujol

1) You will underestimated LRS because (presumably) most breeders will have a significant component of successful recruitment (reproductive success) beyond the sampled population at Kimbe Island. More importantly, there is also a risk that your estimates of LRS could be biased if some breeders have much higher reproductive success through dispersers compared with self-recruiters.

We now acknowledge more clearly the possibility that breeders have a significant component of reproductive success beyond the sampled population at Kimbe Island (LL379-380). We clarified throughout the manuscript that we estimate and discuss the local component of LRS and that our study is on the local adaptive evolution rate. Successful individuals originating from this population that settled somewhere else are therefore not an issue when measuring the individual contribution to self-recruitment and the local dimension of Kimbe Island adaptive evolution.

Consider a situation where the breeders in poor habitats for self-recruitment at Kimbe Island are also the same breeders that have very high success with recruitment of dispersing juveniles at other reefs. This would bias your estimates of LRS and could inflate your estimate

of the environmental component of variation in LRS at the expense of genetic components of variance in LRS.

This could partly be true if we were concluding to the global/regional significance of the genetic and environmental variation of the local LRS that measured but this is not the case. We only conclude on the ecological and evolutionary significance of our results at the scale of the local population (local adaptive evolution at Kimbe Island). To comment on the scenario that you used as an example: it should ultimately drive the individuals with a good reproductive success outside the Kimbe Island population to be replaced within the Kimbe Island population by individuals having a better reproductive success inside the Kimbe Island population. These genetic variants with a better reproductive success outside Kimbe Island would therefore only remain in other populations where they are fitter and disappear from Kimbe Island. This might have arrived before the population reached evolutionary equilibrium. This is an interesting question that would require a different type of approach. It would be speculative to infer anything about these type of scenario based on our results.

2) It is also possible that the genetic versus environmental components of successful recruitment success are different for the portion of the population that disperse to other locations compared with those that recruit to the natal population. Consider for example if the success of dispersing juveniles has a large additive genetic component. Excluding the 50% of the successful reproduction that disperse could seriously bias the estimation of heritability of LRS. In other words, your estimate of genetic and environmental components of variation in LRS must assume that the same proportions extend to the 50% of the population that is not included in the analysis.

As mentioned above, we agree that the genetic and environmental component of LRS might differ for the portion of the population that disperses to other populations. This is now clearly acknowledged in our revised paper. We also clarified that our paper deals with local adaptive evolution inside the Kimbe Island population, which is not impacted by individuals that are not part of the Kimbe Island population, in particular in terms of self-recruitment.

Based on the responses to reviewer comments, your change from referring to heritability and evolvability of self-recruitment in the original ms to LRS in the revised ms seems to be in response to Loeske Kruuk's 3rd major comment. In that comments she noted that what marine ecologists call self-recruitment would be called local recruitment in other fields. It seems to me that this was just a matter for clarification and I don't think she was necessarily saying you should change the story to argue that you were measuring LRS, even if that is what many of the examples in Table 1 are reporting. An extension of this issue is that many of the examples given in Table 1 probably are indeed able to get a relatively unbiased estimate of LRS because the terrestrial study populations are island bound, and therefore, do not suffer from the inherent problem in marine fish population where there is widespread dispersal beyond the study population and much of the successful recruitment (reproductive success) happens outside the area that can be sampled.

We partly answered to this comment in the first part of our cover letter. One should also note that amongst the 15 case studies on the genetic variation of LRS in wild populations, many were on birds that disperse and that the pedigree of mammal populations in the other studies did not include 100% of the population. It is nearly impossible to get an exhaustive pedigree in the wild (even in terrestrial populations) for various reasons. Conclusions are therefore always based on a sample of the population. In our manuscript, we acknowledge this aspect

by stating clearly that we measured the local component of LRS, which is also the individual contribution to self-recruitment. We also mention that these studies used a similar approach and did not include the measurement of reproductive success gained outside the local population through successful dispersal (LL. 453-455). Although we agree with you that it is an issue for studies considering adaptive evolution at a global scale, it is not a concern in our study because it is on the adaptive rate inside the Kimbe Island population.

I reiterate that I think this is an excellent and important study and I make these comments in the interests of seeing the most robust and convincing ms presented.

Other comments

Line 127. Delete "both"

We have made the requested revision.

Line 154. Delete "the" before "anemone"

We have made the requested revision.

Line 171. Please clarify what you mean by "before settling on an anemone that may or may not be in the population"? I think you mean settling to an anemone, either at their natal location (Kimbe Island) or elsewhere.

We made the clarification. It now reads: "before settling to an anemone, either at their natal location (Kimbe Island) or elsewhere" (L175-176).

Line 199-200. It would be clearer if these two sentences were merged to read "We kept assignments to known parental pairs, but rejected assignments to single adults."
* *

We have made the requested revision.