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Discussions

Interactive comment on "Human-induced influence on eggs and larval fish transport in a subtropical estuary" *by* Maria Helena P. António et al.

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Response to Reviewer

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Dear Reviewer 2,

Thank you for your comments and the opportunity of revising our paper on "Human-induced influence on eggs and larval fish transport in a subtropical estuary" for publication in Biogeosciences. We are also grateful for your insightful observations, com-

ments, and suggestions because they offered and resulted in valuable improvements to our manuscript. Most of the suggestions were incorporated in the manuscript. Also, I have included each numbered comment and concern with their respective responses. We hope this revised version will bring the manuscript to the Biogeosciences standard. We thank you for your valuable contributions.

1. The writing for the introduction and the discussion need improved upon and condensed. The biological component of the fish eggs and larvae representing Micropogonias furnieri is not well supported.

For example, the eggs/yolk sac larvae could be represented in January by several species in this region besides croaker. Along these same lines, croaker eggs and yolk sac larvae are supplied to the estuary for many more days than 5 in January, so why do these five days necessarily relate to croaker for the simulation exercise?

Thanks for your sugestions, we worked on the text to condense and improved the introduction and discussion. Other species are present in January, but we based our modeling on the croaker since it is the most abundant fish egg and larvae during this time in the environment. The reason for the 5 days simulation is given in line 261 of the Methodology section. The simulation time of 5 days considers the growth rate of the croaker larvae and their passive period in the plankton. Additional information on the early life stage of croaker relevant for the simulation time of 5 days are supplied in that paragraph. Five days is also the average time frame for the passage of cold fronts in the region (line 252).

2. I think you could make the fish eggs/yolk sac larvae general, not mapped to any particular species, especially since the particles are entirely passive with no larval movement behaviors. Then the authors could simply write that that the eggs and yolk sac larvae are passively transported by currents and flow fields, that most egg and yolk-sac larval durations are on the order of 1-5 days, and that this time period chosen in January for the simulation experiment could affect transport of a list of particular species,

including M. furnieri, in PLE that are spawned during winter in the coastal waters.

Thank you for your suggestion. We had initially considered to use a generalized species, since there are other planktonic organisms that are subject to the same passive distribution. However, we constrained the transport experiment to include the growth rate and the duration of the planktonic phase of the croaker (as stated above), and we used known spawning time and location for the species. There is quite a diverse duration of the planktonic phase for fish larvae and the time of 5 days of passive transport would not be universal.

3. The writing around the simulation experiments is also very broad and not well supported or defined in relation to this particular study. For example, just mentioning other studies that have evaluated larval transport with coastal restoration is not sufficient. The introductory material could be more focused around the objective of the research to evaluate how the configuration of the jetties affects larval ingress and transport into the estuaries.

Thank you for your suggestion. We taked them into consideration and review the text accordingly.

4. In the Methods section, I suggest removing lines 282-283. Vertical behavior of larval particles and differences in predator fields have been incorporated into particle transport models, so not necessarily a limitation of the model more so than that the authors didn't do it, correct?

Your consideration is correct. Lines 282-223 were removed.

5. The results section is too long in its current form, with too much description of more results than are necessary, and that are readily apparent within the figures. I suggest that the authors use the figures to describe the overall differences or trends (over days) among the treatments. I think that there are too many figures demonstrating the same overall results that: 1) larval transport into and up the estuary is reduced

somewhat by the new jetties configuration compared to the old configuration; 2) larval transport into the PLE is higher under the old jetties configuration than under the new jetties configuration when river discharge is high, with no real difference in transport when river discharge is low; 3) SE and SW winds generally facilitate increased larval transport to the estuaries for both jetty configurations, although not when river flow is high for the new jetty configuration. For example, I don't think it is necessary to walk through the results for each day in Figures 9 and 10. I suggest deleting the first hour panels and then describe the overall results or trends in larval numbers by section over time between the old and new jetties configuration with references to the winds. Thank you for the proposed observations and suggestions. Figures 9 and 10 and the corresponding description of the results were modified and restructured, focusing on the essential aspects and condensing the information in the results section. The first hour panels in figures 9 e 10 was deleted has suggested.

6. I like Figures 3-6 and offer some minor suggestions below. Figure 8 is good to show example trajectories for how flow and old vs. new jetty configuration affects larval transport. Consider removing Figure 7 from the manuscript since Figures 9 and 10 demonstrate the numbers of larvae making it to the six sections in the estuary over days. The panel labels in Figures 3-6, and then especially for Figures 9 and 10 are okay, but make the figures busier than they need to be. I also think that if the results stay focused on the trends over days and differences among treatments, the alphabetic labels will not be necessary. Thank you for the suggestions to improve the visual aspect of our figures. Figure 7 will be removed and we will focus on the trends over days in Figure 9 and 10.

7. Instead, consider adding SW, S, and SE labels with the arrows to the figures and then add "Old Jetties" as top panel label and "New Jetties" as bottom label in Figures 3-6 to more clearly define the treatments in the figure that could also help to describe differences by wind and jetty configuration treatments. Suggest doing the same with Figure 8. Suggest labelling "Old Jetties Configuration" at top of two left panels, "New

Jetties Configuration" at top of two right panels, "High Discharge" at right side for top two panels, and "Low Discharge" at right of bottom two panels.

These suggestions really improved the figures. Thanks!

8. Figures 9 and 10 labelling and as mentioned previously, the panel-by-panel discussion of results is too much. Suggest deleting 1-hour from panels in Figure 9 and 10. I would label top, middle, and bottom panels on right side with SW Wind, S Wind, and SE Wind. The result that passive particle transport and dispersal confirms or looks similar to the salinity transport results is expected, I think. It seems salinity intrusion into the estuary and the 20% reduction in flood and ebb velocities, is already discussed in Antonio et al. (submitted), so emphasis on salinity changes due to the jetties configuration is not needed.

Figures 9 and 10 were modified as suggested. Text was corrected accordingly to take your suggestions into account.

9. I suggest the authors try plotting the larval particles in Figure 4 and 5 with the salinity patterns in Figure 2 and 3. It may be too busy and hard to see the salinity gradients through small black dots, but worth a try to show how the salinity and larval transport map together, and to condense the four figures into two figures.

It would be very nice to present salinity changes in relation to changes in larval distribution. However, the joint plots became too confusing and we opted to maintain the figures separated.

I also suggest removing Section 3.6 and Figures 11-13. Section 3.6 and Figures 11-13 lengthen the paper and add to confusion in describing the results. Although the effects of the new jetties configuration on coastal salinities and flow patterns could be important to larval approach and ingress to the estuary, it seems the larger-scale Figures 2-6, and Figure 8 with larval trajectories, also demonstrate this result to an extent.

Thank you for your suggestion. We do understand, however, that explicity showing the relation between salinity stratification and larvae distribution is an important issue for this paper and is not clearly presented in the previous Figures. Thus, we decided to keep the paper structure.

10. For Figures 9 and 10, please explain the differences in numbers by section over days if the larvae don't die? How can the total numbers go up or down over days?

Thanks for watching. According to our analysis, the larvae are removed from the estuary due to the increased discharge observed on day 2 ($\sim$ 8000 m3s-1), justifying the decrease in the number of larvae in areas A2 and A3 after their entry on day 1. And as they are transported and pass through the northern limit of the estuary, the concentrations are decreasing in the areas within and within the estuary.

11. Are larvae transported back out? For example, how can total numbers be approximately 5,000 between section A2 and A3 in panel I in Figure 9, but total numbers be 6,000 the next day in panel J in A4? Where did 1,000 more particles come from the next day? Thanks for watching. Figure 2 shows that after increasing the discharge on day 2, on day 3 the discharge decreases, allowing larvae to enter the estuary again.

12. The discussion restates the results too much and is also too long. The discussion should discuss what the results might mean regarding ingress and transport of fish to the PLE, how the modeling results might be similar or different to other studies and what other studies have shown that support or are different from this study, also maybe discuss model caveats and assumptions and how the modeling exercise could be expanded or improved upon to further evaluate the effects of the jetties on the PLE system and fish resources.

We agree the discussion needs improvements and the text was corrected accordingly.

13. Another discussion point that is mentioned early in the manuscript and then only briefly mentioned in the conclusions is the limitations of the TELEMEC model. The

authors do not describe what these limitations are, and why they are important to the modeling exercise? Limitations and caveats to the TELEMEC and larval transport modeling should be part of the discussion. For example, some potential limitations or caveats to cover are why only 5-day simulations, did the authors do more simulations for longer periods of time with continued release of larvae first?

TELEMAC's limitations in the hydrodynamic component were not found. The limitations found were in relation to the number of eggs spawned per cubic meter and not being able to attribute biological characteristics to the particles transported.

The use of 5 days of simulations already done answered in question 1 above. And yes it is possible to do simulations with continuous spawning, but this was not the case in the study.

14. Larval fish and eggs are released continuously for much longer time periods than 5 days, why was only passive transport considered?

Only passive transport was considered because this is the period of time when hydrodinamic influences dispersion of planktonic organisms. After 5 days, croaker larvae can settle to the bottom and migrate to the shallow embayments where passive transport is not exclusive.

15. I would think passive particle transport will be somewhat similar to salinity transport, it is the different larval fish behaviors that cause differences in recruitment success and differences from the salinity transport) should be described in the discussion.

This issue was addressed in the discussion.

16. Some other comments :

Table 2 is informative. Perhaps try graphing these results using scatter/line plots to show how the results interact among the treatments? All commas need to be replaced with decimal points such as in Table 2. The suggested way of presenting the results allows analyzes that were not possible in the table format.

17. Be careful of hanging semicolons in citations like after Prumm and Iglesias 2016 in line 658, and in line 663 after Dugan et al. 2011

Thank you. The text was corrected accordingly.

18. For Figure 1: Clarify if panels C and D are scaled to and the insets to the box for A1? Suggest adding lines that point from section A1 to panels C and D if this is the case.

Panels C and D are scaled up to represent changes in configuration of jetties and bathymetry. We did draw lines from A1 to panels C and D to represent this.

19. For Figure 2: What specific conditions were used for the 5-day simulations? I think you could either just show the 5-day conditions or decrease size of Figure 2 and scale up the five days to show them as insets on the figure. Figure 2 legend fix to the "dotted boxes around 1/1.. to 5/1. . ." are the periods of time simulated for the 3 wind events and two discharge periods (but again suggest showing what exact conditions were simulated for the 5 days).

You are correct and we agree that legend for figure 2 is not clear regarding the conditions used for the 5 days simulation. We included this information in the figure 2 legend to make it clear: ' Black dotted rectangles represent the 5 days used in the simulation that have characteristic conditions of periods of constant southern wind, wich the intensity decreased linearly from day 2 to day 5.'

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