

**egosphere-2022-393 | Journal relation: OS**  
**Multi-platform study of the extreme bloom of the barrel jellyfish *Rhizostoma pulmo* (Cnidaria: Scyphozoa) in the northernmost gulf of the Mediterranean Sea (Gulf of Trieste) in April 2021**

Dear Editor,

We greatly appreciate the reviewers' comments on our manuscript. We have evaluated all comments very carefully and provide our own point-by-point response (in red) to all points raised. We are confident that the manuscript has been improved and in its current form meets the standards of the journal. Please note that Figure 4 has been added in response to reviewer #1 and you will find the responses to both reviewers embedded.

We hope that the revised manuscript will be accepted for publication in Ocean Science.

Yours sincerely,

Catalina Reyes  
On behalf of all authors.

## **Reviewer #1**

First of all we would like to thank the anonymous review 1 for her/his constructive observations. We have rearranged the manuscript considering the reviewer's comments (in black). Point by point responses to the reviewer's comments and the changes in the manuscript can be found below in red.

The authors describe what was observed in spring 2021 in the Gulf of Trieste using different data sources. In this respect, the paper is rich in information and details.

My main remark is that the authors only took into account the 2021 event although a longer time series of jellyfish observations is available (Fig. 3). The 2021 event appears to be the most remarkable one because of its persistence, but other intense events occurred. For instance, in January 2020 a '3-degree' event took place suddenly after weeks of weak or no jellyfish presence. Was that event connected with the atmospheric forcing in the same way as the 2021 one?

Figure 3 was created to show jellyfish observations made by citizens and reported in avvistAPP, a new app launched in July 2019. We wanted to show that *Rhizostoma* is frequently observed throughout the year in the Gulf of Trieste and that in April 2021 the density of observed jellyfish was often more than 10 jellyfish per m<sup>2</sup>. This figure does not show the number of sightings of *Rhizostoma* and it makes no difference if 1 person reports a density of

Rhizostoma of 2-10 jellyfish (category 2, used as an example) or if 10 people make the same observation: in the figure we only see a line up to level 2. On the other hand, in this figure we can see the frequency of sightings and the average observed density. Rhizostoma were also occasionally reported in 2020, but the highest observed abundances were always lower than those observed in April 2021. We agree with the reviewer that this information was missing, and the situation was probably not presented clearly enough, so we have included this information in the revised version of the manuscript.

We added figure 4 and changed the paragraph starting in line 151 to:

"Citizen science data collected with avvistAPP show that *R. pulmo* was seen in the GOT during the whole period of the time series in Figure 3. The highest abundance (more than 10 ind m<sup>-2</sup>) was recorded in most sightings in April 2021 (Figure 1). High abundances of *R. pulmo* were occasionally reported in 2020, but the highest observed abundances during that year (Figure 4) were always lower than those observed in April 2021 and represented jellyfish aggregations in a limited area, smaller than the large aggregation of *R. pulmo* observed in April 2021.



Figure 4. Picture sent in avvistAPP for the sighting of *Rhizostoma pulmo* (abundance of >10 ind m<sup>-2</sup>) in the GOT, in April 2020."

The analysis of the whole time series of fig. 3 also poses the question if it can be considered homogeneous. As observations are provided by citizens, the number of sightings might be influenced by previous observations: When a remarkable phenomenon is observed once, then many more people are stimulated to pay attention and report their own observation.

Our experience in citizen science tells us that the reviewer's previous statements are only partially true. While it is true that once "a remarkable phenomenon is observed, many more people are stimulated to pay attention to it," it is not so much true that people will report it more. What we observed in the case of the extraordinary bloom of *Rhizostoma* is that people were very interested in what was happening but did not send many reports in avvistAPP because many of them felt that the phenomenon was under everyone's eyes, so it did not need to be reported.

In any case, provided that in the specific event of 2021 things went as described in the paper, can the information be generalised on the basis of observations?

To predict large *R. pulmo* bloom is very difficult but we believe that the mechanism we described will take place again if the conditions, both biological (high number of jellyfish) and

meteo-ocnographic (strong Bora wind and consequent counter current), will be comparable and occurring in concomitance.

I recommend a major revision.

Minor points:

Line 59: Scirocco blows from SE (ESE-SSE), SSW is approximately Libeccio (SW); I suggest 'warmer southerly wind blowing from SE to SSW directions'.

Amended: line 59 has been changed as suggested in the revised manuscript.

Lines 77-78: '... 2020). When the water column is stratified, the surface layer ...'.

Amended: lines 77-78 have been modified as suggested in the revised manuscript.

Lines 112, 126, 127: What is 'pi:'?

Pi stands for "product identifier". Line 113 and 114 in the revised manuscript clarifies this better.

Lines 113-119: Are the CTD and hydrometer data publicly available?

No, the data is not publicly available. "Upon request" has been added to lines 116 and 120 in the revised manuscript

Line 123: I suggest to replace the '=' character with 'corresponds to', otherwise it is misleading. Please define 'ind' (individuals?). According to the definition, 1 ind m<sup>-2</sup> is both included in case 1 and case 2. The same occurs in fig. 3 (page 8). Please solve the ambiguity.

= has been changed for "corresponds to" in the text. The second group interval "2" has been changed to 2-10 ind m<sup>-2</sup> in line 125 and in figure 3 in the revised manuscript.

Line 131: Please define 'L1' (layer 1?).

Layer 1 has been defined in line 132 in the revised manuscript.

Lines 132-134: 'Model and reanalysis data were used ...'. How big were the gaps in the observations?

This paragraph describes only the model data used. See line 134, "data" was changed for "Model data" in the revised manuscript.

In table 1 we aimed to describe the multiplatform dataset giving the spatial and temporal resolution for the considered period of each dataset. Data were not always continuous, as an example CTD was bimonthly and during the analyzed period (21 March to 21 April) we had just 2 CTD casts available, so it was necessary to use the model data to assess the water column structure. The same criteria was applied for the current data: the surface currents were provided by the HF radar while bottom currents were obtained from the model output.

Line 164: Please describe how the RMSE is normalised.

Amended: See lines 169-170 in the revised manuscript

Table 2 (page 9): Please outline the meaning of 'corr-u', 'corr-v' and 'corr-sp' in the caption.

Amended

Lines 176-177: Please note that the variables used for the statistics have a non-normal distribution. The authors should explain how correlation was computed and how significant the results are. 'Fairly good' does not mean much.

Pearson correlation was used to calculate the correlation between the variables. Even though the variables have a non-normal distribution, Pearson correlation does not require normality and is a consistent estimator under relatively general conditions. "Pearson" has been added in Line 170 and upper and lower limits with 95% confidence level were also added to table 2.

Line 179: Here there is '0.5540' but in Table 2 it is '0.4633'. Please check.

The values in line 179 (submitted manuscript) corresponded to the correlations between the components of the mean hfr currents and vada wind observations, which were calculated but not shown in table 2. We thank the reviewer for pointing out this issue and we acknowledge that there was a confusion during the transcription and revision processes. An outlier was removed from the radar time series and the correlations were recalculated to double check. We added upper and lower bounds at 95% confidence level and Line 179 has been modified. See lines 183 to 188 in the revised manuscript:

"Finally, a pronounced influence of the wind on the circulation of the GOT was supported by the significant correlation between SSC and wind, mainly along the u-component, as expected. The correlation for the u-component attains the value of 0.5656 (lower limit= 0.5142, upper limit= 0.6131 at 95% confidence level) for the entire period, which greatly increases to 0.7384 (lower limit= 0.6320, upper limit= 0.8174 at 95% confidence level) during the strong Bora wind event (3-6 April, shaded area in figure 5). The correlation for the v-component is very small (0.1802) and not significant."

Line 181 and 187: 'wind speed' (m s<sup>-1</sup>) not 'wind intensity'.

Done, intensity was changed to wind speed. See lines 190 and 196 in the revised manuscript.

Line 212: There are different responses of the sea to wind forcing. For instance, surface cooling near the eastern coast in case of Bora requires just a few hours. Please clarify.

The response of the water column to the wind depends on the intensity of the wind and its duration, the stratification of the water column and the corresponding heat loss. It can vary from hours to several days. Gacic et al.,2002 have shown that the recovery of the water column after a cold air outbreak and violent episodes of vertical mixing leading to a strong heat loss can be visible after a few days of calm weather with several intermittent phytoplankton blooms. Consequently, this response of the water column influences the sea surface temperature.

Line 213: 'occupied' instead of 'filled'.

Amended. See line 222 in the revised manuscript.

Figure 6 (page 12): The moving-average curve within the data gap has no meaning; please delete it.

The moving average has been deleted. See figure 7 in the revised manuscript.

Fig. 7 (page 13): 'left black dashed line' and 'right black dashed line'.

Done, see caption in figure 8 in the revised manuscript.

Line 239: 'north Adriatic Sea'.

Amended, see line 248 of the in the revised manuscript.

Lines 243-244: Also  $-200$  is  $<50$ . Do the authors mean 'from  $-200$  to approximately  $+50$   $W\ m^{-2}$ '? Please rephrase. Also, 50% of what?

Line 243-244 (submitted manuscript) has been changed to: "from  $-200$  to approximately  $+50$ " and "It can be seen  $Q_{NET}$  decreasing to less than  $50\ W\ m^{-2}$  as the Bora strikes the GOT..." as suggested. See lines 253 and 254 in the revised manuscript.

See also previous comment.

"North" has been changed to "north". See line 258 in the revised manuscript.

## Reviewer #2

In general, the scientific significance of the paper submitted by Reyes-Suárez et al. to EGUSPHERE is excellent (1). The manuscript represents a substantial contribution to scientific progress within the scope of Ocean Science regarding the population dynamics of the jellyfish *Rhizostoma pulmo* in the Gulf of Trieste, linking the biology of this organism with different oceanographic and meteorologic features that characterize the area.

Moreover, the scientific quality is also of the same level that the scientific significance (1), due to the fact that the scientific approach and applied methods are valid. The results are discussed in an appropriate and balanced way, taking into account the consideration of related work and including appropriate references.

In general, again, few times a first version of a manuscript has such a high presentation quality (1). The scientific results and conclusions are presented in a clear, concise, and well-structured way, being the number and quality of figures/tables good. The appropriate use of English language I will not give a score as it is not my mother language.

First, we would like to thank anonymous reviewer 2 for her/his useful and constructive remarks and kind comments on our manuscript. All requested revisions were incorporated into the revised version of the manuscript. Responses to the reviewer's comments and changes in the manuscript are reproduced below in red font.

Detail comments:

Line 109: a space is need after "al."

The sentence has been rearranged. Please see lines 110 in the revised version of the manuscript.

Line 132: a space is need before "Data"

The space has been added. Please see line 134 in the revised version of the manuscript.

Table 2: In the legend or in the head table itself should be detailed that "sp" corresponds to "speed"

The legend in Table 2 has been modified and abbreviations have been added.

Line 255: a space is need before "The"

Amended

Line 263: spaces are need after "C" of the mentioned temperatures

Done

Figure 10d: the rest of the plots in this figure, the "y axis" are well representing the range, but in the case of the Autumn, my opinion is that the authors could short the range. I understand that in the other 3 plots always a range of 10 degrees are used.

We understand the reviewer's point, but to facilitate comparison between the seasons (Figure 11 a, b, and c in the revised manuscript), we would prefer to leave this figure as it is.