

Interactive comment on “Delineation of marine ecosystem zones in the northern Arabian Sea using an objective method” by Saleem Shalin et al.

Anonymous Referee #1

Received and published: 24 July 2017

Authors have analysed satellite chlorophyll data to delineate ecological zones in the Arabian Sea as done by Longhurst in the global oceans. With the use several other archival data sets and using principal component analysis, they have categorized the Arabian Sea into six zones. Their analysis is interesting but I have a few comments that can improve the manuscript.

Major comments:

1. On what basis, principal component analysis based six ecological zones were divided into two Longhurst provinces? It should be elaborated in the section 4.1.
2. Because of the lack of satellite data during the monsoon seasons, authors have considered only winter data. We know that the Arabian Sea is most productive during summer. Authors should discuss how ignoring monsoon would impact the delineation

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of ecological zones?

3. It appears that only surface chlorophyll values were used. But we know that ocean has a deep chlorophyll maximum (DCM). The justification provided on pages 2-3 (line 34, line 1-2; “the fact that during.content”) is not correct. There are numerous studies showing DCM in the Arabian Sea. Authors have covered almost entire Arabian Sea, and it is not possible to have a weak DCM everywhere. Authors should explain how this analysis would be affected by excluding the most productive parts of the ocean?

4. Provide a climatological data based Chlorophyll image as Fig. 4 (c). It would help to see whether chlorophyll content are drastically different in these six zones (particularly for sentence on Page 10, lines 17-18)

Minor comments:

Title should be revised as “Delineation of marine ecosystem zones in the northern Arabian Sea during winter”

Page 3, lines 9-12 can be deleted as they do not provide any info

Page 4, lines 12-13, same font should be used for variables

Page 4, line 19: (Levitus, 1982) has proposed density criteria to estimate MLD which is used widely (Gardner et al., 1995) and a better criterion than temperature.

Page 5, line 18: I should be in italic, in fact all the variables should be made italic throughout

Page 7, line 4: Oman is an upwelling so how could it be oligotrophic (Wyrтки, 1973)

Page 8, line 2: (Naqvi et al., 2010) have not done sampling off Gujarat and Pakistan

Page 8, line 13: How was coastal Chl a found erroneous?

Page 9, line 2: blows should be replaced by blow

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Page 9, line 17: “These coastal areas.winter.” Reference is needed.

Page 10, line 2: zone 6 is also an upwelling region (Sudheesh et al., 2016)

Page 10, lines 3-4: “Nutrient supply.zones”. Provide reference, perhaps (Singh et al., 2012; Singh and Ramesh, 2011)

Page 10, line 9: parts has should be parts have; and this whole sentence should be revised for grammar

Page 20, lines 5-25: These points should (also) be discussed in the main text (preferably in the discussion).

Page 20, line 13: (Kumar et al., 2017) is another new reference for higher N₂ fixation.

It is not clear what Fig. 8 conveys

Units have periods (.) at most places (e.g., Fig. 5, mg.m⁻³, m.s⁻¹). These periods should be removed throughout the manuscript.

References:

Gardner, W.D., Chung, S.P., Richardson, M.J., Walsh, I.D., 1995. The oceanic mixed-layer pump. *Deep Sea Res. Part II Top. Stud. Oceanogr.* 42, 757–775.

Kumar, P., Singh, A., Ramesh, R., Nallathambi, T., 2017. N₂ Fixation in the Eastern Arabian Sea: Probable Role of Heterotrophic Diazotrophs. *Front. Mar. Sci.* 4, 80.

Levitus, S., 1982. Climatological atlas of the world ocean. NOAA Prof Pap 13, 1–173.

Naqvi, S., Moffett, J.W., Gauns, M., Narvekar, P., Pratihary, A., Naik, H., Shenoy, D., Jayakumar, D., Goepfert, T.J., Patra, P.K., 2010. The Arabian Sea as a high-nutrient, low-chlorophyll region during the late Southwest Monsoon. *Biogeosciences*.

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Singh, A., Ramesh, R., 2011. Contribution of riverine dissolved inorganic nitrogen flux to new production in the coastal northern Indian Ocean: An assessment. *Int. J. Oceanogr.* 2011.

Sudheesh, V., Gupta, G., Sudharma, K., Naik, H., Shenoy, D., Sudhakar, M., Naqvi, S., 2016. Upwelling intensity modulates N₂O concentrations over the western Indian shelf. *J. Geophys. Res. Oceans.*

Wyrski, K., 1973. Physical oceanography of the Indian Ocean, in: *The Biology of the Indian Ocean*. Springer, pp. 18–36.

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