

Interactive comment on “Turbulence and hypoxia contribute to dense zooplankton scattering layers in Patagonian Fjord System” by Iván Pérez-Santos et al.

Anonymous Referee #1

Received and published: 29 November 2017

Summary

Perez-Santos et al. use a dataset comprised of hydroacoustics coupled with hydrographic measurements and zooplankton samplings to examine the effects of physical and chemical properties on zooplankton distributions in a Patagonian Fjord. Interdisciplinary data collected in this study is remarkable, covering biological, physical, and chemical properties. The authors achieved extensive coverage both temporally and spatially by combining moored and ship-based surveys. However, this manuscript lacks clear objectives and significance of the study. As a result, I cannot comment on the significance of the study. The Introduction contains specific information about the

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Patagonian fjords, which are more relevant to the section titled “study area”, without placing the study to the larger context. In addition, the paper does not do an adequate job analyzing the echosounder data. While the paper focuses on the zooplankton distribution, frequency of echosounder chosen (i.e., 38 kHz) is not relevant to examine zooplankton. Although the observations may be of interest, this manuscript is not yet ready for publication.

General comments

Abstract does not contain the objectives of this study, instead heavily focused on the methods. There is fairly detailed description about the study site, which is more appropriate to place in the main text.

Introduction should include the objectives and significance of the study. Currently, there is not enough description on knowledge gap in this field based on previous studies and justification of the study site. Detailed description of the study site is more appropriate to place in the Methods.

I have major concerns on the analysis of echosounder data to extract zooplankton backscatter. In general, zooplankton species found in their net samples (e.g., copepods, euphausiids) cannot be detected at 38 kHz, because they are too small to be significant backscatterers compared to the wavelength of 38 kHz. How did the authors separate zooplankton from fish (Fig. 6)?

When they have two frequencies (following Ballon et al. 2011), Sv data from 120 kHz is useful for up to ~ 200 m depth due to the increase in background noise with range. However, the data analysis was conducted up to ~ 450 m depth (Fig. 7). Only data within the analysis limit should be examined.

There is no discussion on the seasonal change in zooplankton distributions and compositions. Based on their seasonal coverage of the data sets, seasonal component should be considered in addition the difference in study sites.

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The manuscript needs to be carefully reviewed for typos and grammatical errors. Comments from co-authors (lines 710-712) remained in the main text, which need to be removed. Section numbers are not in sequence in the Results, Discussion, and Conclusions.

Technical comments

Description of the data collection is complicated and hard to follow because there are many sensors deployed during different times of the year at different locations. Inclusion of a table summarizing the details (e.g., types of data collected, deployment locations/depth, period of data collection) would increase the readability of the manuscript.

The method lacks detailed description of the echosounders, such as ping rate, calibration information, and preprocessing of the data (e.g., bottom detection, near-field removal, background noise removal).

Use of the word, echosounders, should be consistent throughout the text. The authors use “echo sounders”, “echo-sounders”, and “echosounders”, which need to be fixed.

Sv units, dB re 1 m⁻¹, should be used throughout the text. The authors often use “dB” toward the end of the manuscript and figure legends and captions.

Fig. 1: Color should be consistent between two colorbars. In the manuscript, red is SHALLOWER depth in the overview map, while red is DEEPER depth in zoom-in figure, which are confusing. Some symbols overlap each other, which makes the readers difficult to understand the legends.

Fig. 2: Content of the figures on the top row overlaps with Fig. 3, and the patterns of the Jacaf Channel are very similar to those in the Puyuhuapi Fjord. Also, data points from previous studies are not discussed in the text. Thus, this figure could be removed from the manuscript.

Fig. 3: Define “MSAAW”, “SAAW”, and “ESSW” in the figure caption. No definition of MSAAW and ESSW is stated in the text either. X-axis should be distance from the

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mouth, instead of latitude, because the fjord is positioned diagonally.

Fig. 4: What does “AFIOBIOEX” mean? This term is not introduced in the text, but only appears in the figure captions (Fig. 5 as well). To improve the readability of the manuscript, AFIOBIOEX should be removed from the captions.

Fig. 5: The bars showing the standard deviation are not legible in (c)-(e). There is no x- and y-labels.

Fig. 6: X-axis of (a, c), and (d, f) is not consistent. All figures should be corrected for distance from the same reference point (e.g., distance from the mouth). What do the numbers in (b) and (e) mean? The upper bound of the hypoxia layer needs to be included, because it is not clear where the hypoxic layer is located.

Fig. 7: There is no need to plot the same data at two different frequencies. 38 kHz for fish and 120 kHz for zooplankton are commonly used in bioacoustic field.

Fig. 9: Which frequency is used for Sv values?

Below is some examples of typos: Remove a period from the title.

Line 69: change “has” to “have”.

Line 98: add comma after “advection”.

Line 104: add comma after “CTD profiles”.

Line 128-129: “northern mouth” cannot be identified in Fig. 1, because the subset of the figure blocks the portion of the fjord map.

Lines 143: Be consistent for the use of numbers (e.g., one vs. 1).

Line 205: What does “CITA” mean?

Line 210: Ballon et al. (2011) is not in the References.

Line 210: Unit of NASC is “m² nmi⁻²”. The equation of NASC does not need to be

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presented, because this is a common knowledge.

Lines 240-241: Remove the references, because these are commonly used techniques.

Lines 243-247, 277-279: There is no need to include the study plan that did not happen.

Line 266: What does “ESSW” mean?

Line 274: Change “<” to “>”.

Lines 336-337: There is no time on the x-axis of Fig. 6. Time should be included on the x-axis, so that the readers can follow your interpretation.

Line 371: Change “+” to “and”. “DO” should be defined and used throughout the text, instead of using both DO and dissolved oxygen.

Line 414: “Others” should be “other”.

Lines 425-428: This sentence is contradicting. Did you mean there is twilight vertical migration, or not?

Line 469: Remove “(Fig. 10)”. This is duplication.

Line 480: Cut “in” before “there might be”.

Interactive comment on Ocean Sci. Discuss., <https://doi.org/10.5194/os-2017-89>, 2017.

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