Dear Editor and reviewer,

Thank you for allowing us to submit a revised version of our manuscript entitled: “Marine heatwaves deeply alter marine food web structure and function”. Below, we provided a detailed response regarding the concerns of the reviewers and we listed the improvements made to the manuscript.

These changes will be included in the revised version of the manuscript.

Notably, we follow the guidance from the reviewers to expand the introduction and improve the discussion of our study’s findings.

Sincerely,

Vianney GUIBOURD DE LUZINAIS on behalf of the coauthors,

NB: the text in blue indicates the proposed modifications to the manuscript.

Reviewer 2 :

Comment to the authors:	**Responses to comments**
Summary In this research article, the authors performed global hindcast simulations with the EcoTroph-Dyn numerical model to estimate the distinct impacts of marine heat waves (MHWs) on the trophodynamics of marine ecosystems. They found that MHWs generally lead to a decrease in biomass, with the decrease being stronger and longer lasting for higher trophic levels. They conclude that in the future, ecosystems may not be able to recover between successive MHW events, which may disrupt trends associated with long-term climate change.	
General comments Overall, the manuscript is coherently written and provides novel insights into an important and timely topic. However, the introduction is quite short and should be expanded to provide a better overview and deeper understanding of the topic (see specific comments). Several minor points should also be added or clarified in the Material and Methods, Results, and Discussion sections, which are nevertheless well written and understandable. The conclusions are quite short but precise; however, I think it should at	Dear RC2, thank you for your positive general comment on the manuscript: Through the revised manuscript, grammatical errors will be amended. We agree with your opinion about the introduction, and we will expand some of the sections as proposed. Furthermore, we will clarify the minor points in the Material and Methods, Results, and Discussion sections.

least be specified which repercussions of MHWs were identified in the current study.	
Linguistically, the manuscript contains some minor grammatical, typographical, and formatting issues, especially in the references, that need to be addressed. I have listed the issues I found in "Technical corrections" and also made some suggestions to improve clarity and readability.	Thank you very much for pointing out these issues; we will address them in the revised manuscript.
Specific comments	
Comment1: L. 33-48: A clear, quantitative definition of heatwaves would help this paragraph, especially since you give quantitative changes in heatwave duration, frequency etc.	Thank you for the suggestion. We will specify the definition of MHW as "Over the last century, marine heatwaves (MHWs) - defined as more than 5 days period of anomalously warm sea surface temperatures (SSTs) exceeding a specific threshold, typically determined by natural climatological variations - have increased in frequency, duration, and intensity (Frölicher et al., 2018; Hobday et al., 2016)."
Comment2: L. 49-60: This paragraph should introduce more MHW-related ecosystem modeling studies to put the current study into a broader context. Specifically, it should be made clear to the reader what has been done already and what is new about the current study. I would also recommend to place this paragraph before the last paragraph of the introduction (i.e., between l. 66 and l. 67) to create a nice transition to the description of the current study.	We agree, moving this paragraph before the last paragraph of the introduction is better for transition. We will add more MHW-related ecosystem modelling studies to put the current study into a broader context; we propose from line 54 "Previous studies assessed MHWs impacts through numerical modelling approaches. For example, Cheung et al., (2021) and Cheung & Frölicher, (2020) employed climate-fish-fisheries models to investigate MHW implications for biomass and potential catches of exploited marine species and their implication for fisheries. They found that MHWs may cause biomass decreases and shifts in the biogeography of fish stocks that are faster and bigger in magnitude than the effects of decadal-scale mean changes. They projected a doubling of impact levels by 2050 amongst the most important fisheries species over previous assessments that focus only on long-term climate change. Gomes et al. (2024) use the Ecopath with Ecosim (EwE) modelling approach to assess the ecological impacts of 'the Blob' MHW. They highlighted the alteration of trophic interactions and energy flux following the MHWs which might have profound consequences for the specific ecosystem structure and function. However, there is a gap in applying ecosystem modelling framework to study global impacts of MHWs on ecosystem structure and functions.

Comment3: L. 51-52: It is not clear which method(s) Carneiro et al. used.	We propose the following clarification, "For example, Carneiro et al., (2020) assessed the evolution of physiological and biochemical parameters and survival rates of the clam *Anomalocardia flexuosa* in response to simulated MHWs. Under laboratory conditions, *Anomalocardia flexuosa* was allowed to adapt to a stable control condition before being exposed to simulated conditions of MHWs occurrence lasting up to 21 days by warming the tank water by 3°C above the control temperature."
Comment4: L. 62-63: Could you elaborate on this further and explain the processes behind?	We will elaborate on this part: "Trophic dynamics of marine ecosystems are affected by ocean temperature (Eddy et al., 2021; du Pontavice et al., 2019). In particular, ocean warming is expected to increase the speed of energy transfer through the food web, i.e., flow kinetic (du Pontavice et al., 2020). Faster flow kinetic under ocean warming represents the increasing dominance of short-lived species so that each unit of biomass spends less time at a given TL and, on average, across all TLs, ultimately leading to a decrease in total biomass (Gascuel et al., 2008). Simultaneously, ocean warming is expected to induce a decrease in biomass transfer efficiency, altering both consumer production and biomass due to larger energy losses between each TL (du Pontavice et al., 2019). Therefore, ocean warming alters both the amount and speed of matter and energy transfer within the food web, potentially leading to a decline in consumer biomass through independent and cumulative effects (du Pontavice et al., 2021; Guibourd de Luzinais et al., 2023)."
Comment5: L. 78: I would leave out "proceeding their occurrences", it makes the sentence difficult to understand.	Yes, we agree, we will remove this part of the sentence.
Comment6: L. 89: Is there a specific reason for using TL width = 0.1?	Previous studies applying EcoTroph employed a TL width of 0.1, primarily because of computational efficiency while maintaining a good representation of food web structure and functions. We will mention this in the revised manuscript.
Comment7: L. 92-93: Why is the biomass transfer in lower TLs faster?	It is due to the shorter life expectancy from low TL individuals. We propose this modification: "The time needed for the biomass to flow from one to the next trophic class varies along the food chain, with biomass transfers generally faster in lower TLs (as species generally have short life-expectancy) than in the higher ones.".

Comment8: L. 97: biomass flows between(?) the trophic biomass spectra	No, the correct term is “in” and not “between” as with EcoTroph-Dyn, we analyse biomass flow changes in each trophic biomass spectrum. By "each trophic biomass spectrum," we refer to the trophic biomass spectrum represented in each 1° × 1° longitude-latitude ocean cell.
Comment9: L. 118: I don’t understand what you mean by “the trophic level of each TL classes j.”. Do you mean the trophic level of the j TL class?	Yes, we meant that, we will modify the sentence in the revised manuscript.
Comment10: L. 119-120: Is this assumption based on observations/experiments? Give appropriate references.	We propose the following sentence modification: “MHWs cause marine organism mortality, impacting their life expectancy (Smith et al., 2023). In EcoTroph-Dyn, these changes in life expectancy are reflected in the loss rate within the biomass spectrum, representing the proportion of biomass that neither persists nor progresses through the food web (du Pontavice et al., 2021; Gascuel et al., 2008, Guibourd de Luzinais et al., 2024). Therefore, according to equations used in the steady-state version of EcoTroph, the flow kinetics during MHWs is increased as follows:”
Comment11: L. 125-126: “Biomass spectra in EcoTroph-Dyn are split into trophic classes with variable widths of trophic levels.” – I don’t really understand this sentence. Do you mean: “Biomass spectra in EcoTroph-Dyn are split into trophic classes of variable width.”?	Yes, we meant that. We will modify the sentence in the revised manuscript.
Comment12: L. 164-165: “lasting 15 days of the fortnight” − something must be wrong here.	Sorry it's a misuse of language. We ran the EcoTroph-Dyn model at a half month time step, and the expression seems to be a fortnight? We define a fortnight for our study as 1/24 of a year in line 219. To avoid confusion, we propose to change the term “fortnight” to “15 days” on lines 98, 165, 173, 218, 220, 221, 222, and 237.
Comment13: L. 168: I don’t understand this sentence. Do you mean: “We used an alpha of 0.2 in our simulations.”?	Yes, we meant that, we will modify the sentence in the revised manuscript.
Comment14: Figure 1: How do you derive transfer efficiency, MHW mortality, and flow kinetic from satellite data?	To derive transfer efficiency, MHW mortality, and flow kinetic from satellite data, we use empirical equations where satellite data (SST) intervenes
Comment15: L. 193-194: Why did you use a single threshold and not one for each month, for example? Which impact may the use of only one threshold have on your results?	The objective of the study was to assess the impact of MHWs, to do so we preferably detect the ones where species are undergoing a thermal stress which occurs mostly during summer period.

	We will clarify the framework of defining MHWs in this study in the introduction: line 67 "This study aimed to disentangle the additional or synergistic consequences of MHWs occurring during the year's warmest month, when species are undergoing a thermal stress, with the effects of the slow-onset climate changes in marine ecosystems." Furthermore, we will incorporate the following paragraph after line 655 in the discussion. "Here, we focused solely on the direct impacts of MHWs occurring during the year's warmest month via thermal stress, resulting in species mortality (Oliver et al., 2021; Smith et al., 2023). However, MHWs in other seasons can also have consequences on populations by affecting a specific stage of the life cycle of certain species (Crickenberger & Wethey, 2018; Oliver et al., 2021; Smith & Thatje, 2013). For example, MHWs that stress adult breeders can lead to a decrease in reproductive investment and, consequently, fewer, smaller, and lower quality gametes (e.g., Shanks et al., 2020), resulting in a loss of abundance and biomass of some species (Johansen et al., 2021). While taking seasonality into account will increase the number of detected extreme events, some may not have ecological consequences (Oliver et al., 2021; Smith et al., 2023). Thus, our approach can be seen as conservative and may underestimate the impact of MHWs. Nevertheless, we detected MHWs with potentially significant ecological impacts. Studying MHWs occurring in seasons other than summer would involve considering the phenological effects of MHWs. However, since the EcoTroph-Dyn model does not directly represent this phenological aspect of marine organisms, future studies can apply other approaches that explicitly represent seasonal processes such as spawning and migration to elucidate the effects of phenology"
Comment16: L.215: How can a day with Yt < Tt + St be an MHW day? Can you explain this in more detail?	In our study, we can have a MHW day with Yt < Tt + St. This comes from the use of an annual threshold value to detect MHW events (see appendix figure S5 just before April month). We propose to add line 216: "In our study, we can have a MHW day declared even though Yt<Tt + St. This specific situation is rare (less than 0.5% of time series) and occurs because of the use of an annual threshold value to detect MHW events that mainly occurred during the year's warmest months. (See appendix figure S5 just before April

	month for schematic visualisation. The time series created using this algorithm is referred here as 'without MHW'."
Comment17: L. 224-229: Could you further explain the EPPLEY-VGM method? Not all readers may be familiar with this method nor the VGM method, so I think especially basic information would be helpful. For example, what is the general concept of these methods and what is Pb_opt?	Yes, we will add these details. We propose to develop the idea as "The EPPLEY-VGPM method is a hybrid model that employs the basic model structure and parameterisation of the standard VGPM (Vertically Generalized Production Model) computation. This model estimates net primary production (NPP) based on chlorophyll concentration, incorporating the vertical distribution of primary production. The specificity of the EPPLEY-VGPM method is that the polynomial description of the maximum daily net primary production found within a given water column (Pb_opt, expressed in units of mg carbon fixed per mg chlorophyll per hour) is replaced by the exponential relationship described by Morel (1991), based on the curvature of the temperature-dependent growth function described by Eppley (1972)."
Comment18: L. 230-235: This should at least be mentioned in the Discussion (somewhere in the paragraph l. 656-675).	We propose to add this sentence in line 673: "Secondly, in this study, in order to propose a suitable representation of the world ocean, we use an interpolation method to reconstruct an incomplete NPP time series. The interpolation was constrained by the minimum and maximum satellite data values of the NPP observed over their respective time series to ensure reliable interpolation and reduce potential bias."
Comment19: L. 236-237: Which biases may be introduced by this duplication? This should also be included into Sect. 5.3.	We propose to add this sentence after preview comment modification: "Thirdly and lastly, in this study, we duplicated NPP monthly value to able the EcoTroph-Dyn to run at a 15 days basis. This duplication may have smoothed marine ecosystem response to the historical changes in marine environment; However, it has not changed trends and conclusions of our results."
Comment20: L. 285-287: "Furthermore, more days with MHWs with lower intensity were identified for low latitude regions (23°N - 6°S) (Figure 3c) compared to MHWs identified in higher latitude regions (> 23°N and 25°S)." This sentence is not really clear. Do you mean that the intensity of MHWs was generally lower in high latitude regions?	Yes, see response to comment4 of reviewer RC1.
Comment21: Figure 3: The figure caption seems to be mixed up. The description for c) seems to match panel d), while the description for d) does	Please, see response to comment4 of reviewer RC1.

not match any panel. Thus, panel c) has no fitting description.	
Comment22: L. 304: "effects of the short-term impacts of MHWs on the long-term changes" This part seems a bit confusing and contradictory, I would leave out the "short-term impacts".	Yes, we agree, we will remove this part of the sentence.
Comment23: L. 320: Even if explained in the caption of Fig. 4, I would also define the three biomes in the text since the figure may be placed somewhere else in the typeset paper.	Ok, we will add the biomes definition in the main text, we propose to modify the text line 320 as "While total consumer biomass was projected to decrease slightly across the three biomes (temperate, tropical, and upwelling biomes represented in Figures 4b, c, and d, respectively)".
Comment24: L. 337: Using numbers for biomass increase for both scenarios would make it easier to compare the results, i.e., "a biomass ~~decrease~~increase was projected to occur in ~~76%~~24% of the global ocean"	We agree, we will modify the sentence in the revised manuscript.
Comment25: L. 358: Maybe it would be useful to give the number for global biomass loss without MHWs again for direct comparison.	We agree, we will add the percentage in the revised manuscript "Under the 'with MHWs' scenario, this proportion decreased and a biomass decrease was projected to occur in 76% of the global ocean, with a projected global biomass decrease of 4.8% by 2015-2021 relative to 1998-2009 compared to an only 2.4% biomass loss under 'without MHW' scenario."
Comment26: L. 365: What do you mean with "expected"? You already analyzed the differential impact of MHWs on trophic levels in Sect. 4.2.2, didn't you?	Yes, we propose to change the wording "were expected" by "are projected".
Comment27: L. 377: Can you explain what an ANOVA is?	Sure, we proposed to add an explanation in the Material & Methods section line 173: "We performed a three-way ANOVA, that is a statistical test we used to analyse the effects of trophic levels, biomes, and α value on biomass change."
Comment28: L. 383: greatest instead of greater?	No, the correct word is greater.
Comment29: L. 403: Why do you use different reference periods to define temperature anomalies? In this way, the anomalies are not consistent. I would suggest to choose one of both periods. Did you use the same reference periods to calculate the temperature anomalies shown in Fig. 8? If yes, these should be corrected as well.	We always used the reference period 1982-2011 to define temperature anomalies. We propose to rephrase the sentence 403 as "Temperature anomalies were on average >=4 °C (between 2013 to 2016) and up to 8 °C in 2015 relative to 1982-2011."
Comment30: L. 430-431: This part is difficult to understand. Do you mean: "Considering the influence of MHWs from 2013 to 2016 using the	We agree, we will modify the sentence in the revised manuscript.

'with MHWs' scenario and alpha=0.2 resistance capacity"?	
Comment31: L. 456-459: This sentence is difficult to understand. Maybe replace with something like: "In this study, we accounted for MHWs in the last four decades using hindcast simulations and showed the potential of synergic impacts of MHWs (pulses) and long-term climate change (presses) on bio-mass and trophodynamics of ecosystems.".	We agree, we will modify the sentence in the revised manuscript.
Comment32: l. 494-495: This explanation of TE would be helpful in the methods section.	We agree, and will move it to the method section.
Comment33: L. 521: metabolic efficiency or transfer efficiency? Shouldn't the ratio between ingested and stored energy be high, i.e., only a small part of the ingested energy is stored and the rest is lost?	Thank you for pointing out this mistake, we propose to modify the sentence as "Tropical ecosystems are composed of species with low transfer efficiency (TE) (low ratio between stored energy and ingested energy), with significant energy losses that increase with temperature (Brown et al., 2004; du Pontavice et al., 2020; Schramski et al., 2015).
Comment34: L.529-530: Why is the mortality higher in low TLs?	We propose to add "as low TLs tend to have lower thermal limit than high TLs" to enhance clarity.
Comment35: L. 534: If the increase is 1% I wouldn't use the word "sharp".	We agree and will remove the word sharp in the revised manuscript.
Comment36: L. 561-562: I don't understand part (ii), could you explain this further?	We propose this modification: "(ii) the specific functioning of these ecosystems with cool water rising from depth to the surface, tends to reduce the number of MHW days compared to their adjacent open ocean (Varela et al., 2021). More generally, it has been highlighted that ocean warming does not affect coastal regions with upwelling in the same way as the open ocean (Varela et al., 2021)."
Comment37: L. 585-587: The structure of this sentence seems odd and makes it difficult to understand. Please check and revise.	Thank you, we propose the following correction: "In contrast, in the California Current biogeochemical region, the MHW was associated with a substantial increase in the abundance of pyrosomes which implied a limitation of energy flow moving toward higher trophic levels has been observed (Gomes et al., 2024)"
Comment38: L. 599-600: What defines the models in this family? What do they have in common?	We propose to rephrase the sentence to enhance clarity as "Despite its apparent simplicity and the reduced number of parameters, EcoTroph-Dyn is part of the family of "complete ecosystem models and dynamic system models" (Plagányi, 2007) as it represents all trophic levels, from primary producers to top predators."

Comment39: L. 607-608: What are biomass density values?	Mistake in the wording, it is simply biomass: we will delete density.
Comment40: L. 615: The word "projection" usually refers to simulations/estimates for the future. Since you performed hindcast simulations, I would use a different word here to avoid confusion. Please also check the rest of the manuscript.	We will change this to "historical simulation".
Comment41: L. 629-632: Can you quantitatively compare your results to those of Arimitsu et al. (2021)?	We can only compare qualitatively our results with those of Arimitsu et al., 2021, as in their study they work at the species level and did not account for species of the entire food-web/model, while in our study we use a trophic level-based approach.
Comment42: L. 640: The reference Cheung et al. (2020) does not exist in your reference list. Do you mean Cheung & Frölicher (2020)?	Yes, thank you for pointing out this mistake.
Comment43: L. 647-448: This part is difficult to understand. Maybe replace with "It would therefore have been valuable to test EcoTroph-Dyn against other MHWs in the world ocean".	Yes, your proposition is simpler, we will change it.
Comment44: L. 681: What do you mean by "dismiss any possibility"?	The sentence should be rewritten as "To be cautious, we considered various loss rate scenarios to obtain a complete range of responses from marine ecosystems."
Comment45: L. 684-688: This sentence is quite complex and difficult to understand. Maybe replace with something like: "Even though the global impact of MHWs is negative, species-explicit modelling could improve our understanding of how various impacts of climate change and species-level responses will affect trophodynamics and ecosystem structure and function.".	We agree and will make changes to the revised version of the manuscript.
Comment46: Sect. 5.4: You could highlight here how future work can build on your study in particular. For example, what analyses should your model be used for in the future? Should your model be modified/extended, and if so, how?	Yes EcoTroph-Dyn model can be used to project the impacts of hypothetical future MHWs at global and local scales. See response to reviewer RC1 comment5.
Technical corrections	
Throughout the manuscript, there are some issues with reference formatting (i.e., the use of parentheses, commas, and semicolons). I have already included a few examples below. • L. 11: are becoming have become • L. 20: (NPP) data	Thank you for pointing out these technical corrections line by line. We will address them through the revised version of the manuscript and make a full check of the manuscript for others.

• L. 21: observations • L. 22: by trophic levels • L. 25: specific MHW-induced decline in biomass of 8.7% ± 1.0 (standard error) in the region from 2013 to 2016. • L. 27: than in lower • L. 36: resulting in more than a doubling of the number of MHWs days • L. 37: a space is missing before the reference • L. 43: have caused a decrease • L. 50: simulationnumerical modelling • L. 51: Don't use a comma for in-text citations: Carneiro et al., (2020) • L. 66: function globally have not yet been clearly understood on a global scale • L. 68: climate changes • L. 69 and l. 70: Since this is an article with multiple authors, I would use "we" consistently. • L. 70: MHWs (see (Guibourd de Luzinais et al., 2024) • L. 77: occurred in on the • L. 79: Material and methods • L. 83: from by primary producers • L. 85: food webs • L. 87: TLs, i.e.,	

• L. 88: trophic spectra spectrum • L. 90: the whole consumers biomass • L. 92: generally being faster • L. 94-95: the references should be put into parentheses • L. 96: ecosystems biomass • L. 102: MHWs occurrence. EcoTroph-Dyn's algorithms' details • L 112: TL. year-1 • L. 114: trophic level, using • L. 131: within the TL class [τ,τ+Δτ[. It], is expressed as • L. 144: depenant dependent • L. 147: flow kinetic (K)) and where • L. 149: 3.2 MHW loss rate algorithm computation • L. 152: loss rate algorithm computation • L. 153: into EcoTroph-Dyn • L. 154: period (period 1982-2011) • L. 156: Matching historical MHWs' historical distributions and characteristics with species distribution • L. 158: Estimation bBased on this percentage estimation of an additional loss rate • L. 159-160: Finally, through loss rate (ηi) mathematical expression, we assumed in	

the mathe-matical expression of loss rate ηi that species arewere continuously challenged by MHW in-creased MHW intensity, which is expressed as: • L. 164-165: with β rangesranging from β=0; (no MHW), to β=1; (MHW lasting 15 days of the fortnight) • L. 165: MHWcat,i corresponds to an MHW intensity index • L. 169: to community resistance capacity to MHW by testing • L. 184: without MHWs • L. 189: every MHWs day • L. 207: seasonal component (St), is then • L. 208: estimation of (St) on the trend-adjusted series • L. 212-213: without MHWs • L. 215: component, i.e., • L. 215: For MHW days with Yt below ($Tt + St$) or not an MHW daynon-MHW-days, we keep • L. 217: referred to here as • L. 218: match adapt • L. 222: when an MHW lasts for an entire fortnight. • L. 225: is a hybrid model • L. 239-240: under for the scenarios	

• L. 246: of simulating 12 years • L. 254: past MHWs events • L. 267: by in the period 2015-2021 • L. 268: NPP changes were was observed • L. 268: Notably In particular • L. 270, 272: in the period 2015-2021 • L. 273: warmed up warming by 1°C during over • L. 277: relative to the average between and the average of • L. 292: Evolution of the spatial extent • L. 292-293: Evolution of MHWs averaged duration categorised by their intensity • L. 299: on average, by 0.07 ± 0.02% • L. 317: S2 for biomes spatial definition • L. 321: with MHWs', the declines • L. 332, L. 339, L. 358, L. 375: by in the period 2015-2021 • L. 335 and Fig. 5 caption: For the trophic level classes, the second opening parenthesis needs to be a losing parenthesis • L. 336-337: notably with the tropical and upwelling biomes being notably more impacted.	

• Fig. 5: Change in trophic groups biomass (y-axis) • L. 345-346: Projected changes in consumer biomass by trophic levels and biomes under the 'without MHW' and 'with MHWs' scenarios relative to the 1998-2009 average between 1998-2009. • L. 362: off the coast of Papua New Guinea Coast • L. 389: by trophic levels • L. 392: 75th quantiles • L. 395: the response of low TLs response • L. 402: in the biomass spectrum • L. 403: relative to the 2016 average • L. 416: exhibited a significant total consumer biomass decrease • L. 417: the scenarios with and without MHWs • L. 420: the most • L. 420-421: However, uUnder • L. 425: provinces were the most affected by the MHW • L. 426: biomass decreases of 5% and 3.8% 'with MHWs' relative to the 'without MHW' scenario • L. 429: lower TLs • L. 433: as of by 2021	

• L. 443: change in the 'without MHW' and 'with MHWs' scenarios • L. 444: indicates the duration of 'the Blob' duration. • L. 451: 0.2, while • L. 452: by in the period 2013-2016 • L. 457-458: longterm long-term • L. 466, 468: Be careful with the use of past tense. The suggestions of your study have not expired, so use "suggest" instead of "suggested" in L. 466. Similar cases appear throughout the manuscript • L. 470: ecosystems, which is congruent with studies by Arimitsu et al., (2021);, Gomes et al., (2024);, and Smith et al., (2023) studies. • L. 373: ecosystems perturbations • L. 475: of the perturbation in ecosystem functioning perturbation • L. 476-477: intensity and duration of MHWs characteristics have continuously increased • L. 478: hindcast period hindcast • L. 482: recover to pre-perturbed • L. 484: upwelling biomes, where the hindcast biomass of high TLs consistently	

• L. 488: may, therefore, be • L. 490: continuing continued • L. 514: , which is used • L. 551: These MHWs • L. 564: through our modelling approach in our simulations • L. 566: in the California Ocean • L. 568: with anthe increase • L. 570: differently differentially • L. 575: Differences in exposure to the intensity • L. 577: subjected • L. 592-595: For example, communities in the Gulf of Alaskan Gulf are more efficient than those in the Californian Current (du Pontavice et al., 2020), and the energy entering the food web was less disrupted than in the Californian Current, which may explain the greater impact of the MHW on the Californian Current. • L. 598: MHWs hindcast • L. 602: by their trophic levels • L. 632-634: It is worth noting that projections obtained fromusing a smaller (larger) α led to an underestimation (overestimation) of biomass losses and changes in biomass flow parame-ters	

relative to the estimates of Cheung & Frölicher, (2020) and Gomes et al., (2024) esti-mates. • L. 640-641: Grey violin plots correspond to results from Cheung et al., (2020), while the red ones corresponds to our hindcasted EcoTroph-Dyn simulation with α=0.2 scenario. • L. 656: Furthermore, uncertainties aboutin our results arise from EcoTroph-Dyn the environmental drivers of EcoTroph-Dyn. • L. 657: EcoTroph-Dyn has been was driven • L. 660: In this study, we did not consider the 'with' and 'without' MHWs scenarios for NPP. • L. 663: couldmay have overestimated MHWs impacts • L. 666: Why do you capitalize marine ecosystem models? • L. 681-682: Running the aforementionedthese five MHW-induced loss rate-induced scenarios • L. 683-684: with a worsening an increasing biomass loss over marine ecosystems with de-creasing resistance	

capacities decreasing (increasing α increasing). • L. 690: From In our study • L. 693: anomalously low wind, an anomalously weak Ekman transports • L. 694: north, and, coupled with anomalously low air-sea heat exchanges • L. 696: have already contributed • L. 700: better understand better	