**ANNEX A: Blue Paper Technical Review Form**

Date:12/08/2019

Title of Blue Paper: Blue Paper 2: The expected impacts of climate change on the ocean economy

Reviewer: 3

**Overarching Questions**

Reviewers are requested to answer the following questions to assess the overall analytical quality of the contributing paper

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| --- |
| 1. Analysis: Are there any concerns, flaws in logic, or gaps in empirical basis, calculations or theoretical reasoning? |
| The main concern is that the paper takes a sectoral approach in analysing past and future trends ina number of sectors. This piece-meal approach makes it difficult for a strong and ambitious vision to emerge for “the whole”. It has become a “sum of parts”, and incidentally these parts are not providing the same level of information and detail. I failed to see what the overall message is (other than that the Ocean economy is important, already adds to much, and will grow).  Also, I fail to see a good “food systems approach” to the discussion of fisheries and aquaculture. It is not just how much we produce, how much we can produce, how much we cannot adapt, etc., but what do these messages mean from a food systems perspective, in a world of 9 billion people? What are the opportunities, the challenges, the trade-offs? |
| 1. Content: Is the paper clearly written, structured, with a logical presentation, and easy to read? |
| Yes, the paper is clearly written and the structure is logical although perhaps too “sequential”. There is no systems analysis that would have helped bridge the different sectors. |
| 1. Content: Does the paper provide a fair and comprehensive treatment of the topic? Are the conclusions justified? Are the recommendations based on the content? |
| These are three difficult and complex questions. I would note that the analysis is largely global – which one would understand and expect. However, most fishers are small scale operators, whose realities, from policy implications to market impacts, differ substantially from the global trends. It is possible this oversight will be criticised by readers for missing the “on the ground” touch.  Linked to this, I found many of the narratives very academic, without much road-testing. For example, (p.9) the implications for adaptation in marine fisheries fail to consider that most fisheries management fails not because we don’t know what has to be done, but because it is very difficult to do it in the socio-economic-political context of many countries. This paper should not overlook this. |
| 1. Eligibility for public distribution: Does the paper require minor/major revisions before it is ready for public distribution? |
| How long is a piece of string? The corrections I suggest are quite straight forward, but I encourage the authors to be more ambitious in their messaging and conclusions. Only when these are right should the paper be released. I will give you a start: Despite covering over 70% of the planet, and despite the fact that land ecosystems are extremely stressed, the ocean economy has not taken off yet (it is only 2.5% of the global GVA). Why is that when it is probably the only region of the planet that has the capacity to multiply the services it provides? What are the compromises we are prepared to take to reach this ambition? What does society expect from Oceans? A place to spend our holidays, a solace to gather emotional tranquillity and relaxation, a source of nature documentaries? Or all this as well as the future of our food, and a central place in our economies? Who owns the Oceans and for what purpose. This is our vision…. |

The issues below are suggestions for the reviewer to consider.

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| **List of issues to be checked** | **Yes/No** | **Comments** |
| Were assumptions clearly identified? | Not all | See below |
| Is the methodology explained in a transparent way? | Mostly yes, but not all | See below |
| Are quantitative and qualitative sources referenced appropriately and thoroughly? | No | See below |
| Does the research effectively address relevant gender aspects? | Certainly not | Fisheries and Aquaculture in particular have a very strong gender component which is not explored |
| Are there significant and relevant issues that are missing from the paper? | An overall vision | See above |
| Are there any faults in empirical basis, calculations or theoretical reasoning? | Only as noted below | See below |
| Is the information contained in the document up-to-date? | Mostly | Be prepared to update refs from IPCC SROCC |
| Does the manuscript present original material and/or an original viewpoint or if it is a synthesis is the methodology comprehensive and appropriate? | There is original material, which I question because it has not been peer-reviews (not enough detail to do so as part of this paper’s review) | Otherwise see above regarding overall vision |
| Was sensitivity analysis performed where applicable? | No |  |
| Are you aware of any reputable evidence that contradicts the arguments presented in the paper and is not mentioned? | No |  |
| Are the conclusions and recommendations supported by the evidence? | Yes |  |

**3. Memo for specific comments**

The following table is intended to facilitate the work of the reviewers, arbiters and authors and we kindly request you to use this format. This provides space for specific comments, suggestions and responses from the author. The memo will be used to inform the sign-off.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Ref. no. | Page/ Para/ Line | Comment | Suggestion | Author Response |
|  | 1/1 | Need to reflect on the fact that a 2.5% GAV is negligible – this is an opportunity |  |  |
|  | 2/1 | I think it would be better to use the E.S. categorization of provisioning, regulating and cultural services, and provide examples as e.g. Otherwise it reads funny (e.g. is swimming a service?; is “enjoying the beach” the best we can do to explain cultural services)? |  |  |
|  | 2/4 | It may be better to separate aquaculture and Fisheries data, if that is possible |  |  |
|  | 2/5 | Costanza et al 2014 is a rather old reference, which was much-criticized at the time. Are there no other sources one can use for E.S. valuation? |  |  |
|  | 3/2 | You need to cite Lotze et al. PNAS 2019 |  |  |
|  | 3, 4, 5, 6 + more | The use of Barange 2018 in this paper is excessive. It is not a prime source of physical, chemical oceanographic patterns and trends, including SLR. More appropriate references are needed. Use it for Fisheries and Aquaculture impacts of CC, not as a source of CC trends. |  |  |
|  | 5/2 | Deoxygenation and OMZs are complex, unresolved issues. The contribution of human activity to current deoxygenation is contested. IPCC SROCC will have language that should be used instead |  |  |
|  | 5/4 | The slowing of the MOC is projected, but stopping? A) I think this is extremely unlikely unless the Earth stops turning and the sun shining. Liu talks of “collapse”, but this does not mean stopping. B) IPCC models all indicate AMOC stability. Liu may be right, but it is not right to place him above the consensus view of IPCC… |  |  |
|  | 6/1 | That EBUS’s “will also likely shift” is unclear and not precise enough. Most EBUSs are linked to coastal geography and bathymetry. The cannot “shift”. They can stop or they can strengthen or weaken. Seasonality of upwelling may shift |  |  |
|  | 7/3 | I am lacking a paragraph that explains that fisheries rely on the natural cycles of life of thousands of naturally occurring species, who over millennia have become very adapted to fluctuations (e.g. Baumgartner 1992 I think it was, iconic sardine and anchovy cycles). We are looking at what CC can do IN THE CONTEXT of very dynamic and adapted systems. |  |  |
|  | 7/3 | I am not convinced – and I don’t think IPCC reports are either (check the language they use in terms of confidence and probability) that CC has resulted in lower growth rates and smaller body sizes…  Also, the discussion on S/R and the role of environmental influences on this relationship is rather naïve. I don’t want to be critical but you can use better and more classical references and more precise language. Britten and Szuwalski are two of hundreds of papers on the topic. The net effect is not so much “under debate” but “impossible to discern as there are many examples of +ves and –ves”. |  |  |
|  | 8/1 | I do not understand the need to bring a 2300 figure which is extremely uncertain and unreliable. The reduction of PP is expected to be about 6% ±3% according to Kwiatkowski et al, for 2100, consistent with IPCC |  |  |
|  | 8/3 | I agree that the global net impacts of CC on fisheries production are modest. But I think you ought to bring this up earlier in the paper, as it is buried in p.8 |  |  |
|  | 8/4 | I suggest you cite Blanchard et al 2012 and maybe Barange et al. 2014 (Nature CC) as also provide similar ranges of net impacts that are worth citing |  |  |
|  | 9/5 | As mentioned earlier, I miss a “down to earth” assessment of academic/ theoretical implications, in the context of a world where ocean matters are not prioritized, where the 1.5 million USD required to manage a stock according to gold standards (NOAA data) are not available for most countries, where poverty and hunger makes it impossible to reduce informal catches, where the international narrative is no longer pro-global, etc. This is what would make the paper novel rather than repeating what some academic papers say! |  |  |
|  | 10-11 | I must admit this section was extremely interesting, but it is appropriate to include in a paper of this calibre, when the analysis has not passed peer-review? I do not think so. This applies to Fig.1 too. Where are the maps from? What does (1B) higher catch and profits mean? Higher from now? If so, in the context of what management? What are the assumptions? |  |  |
|  | 12/3 | I am surprised RFMOs have not been discussed more in this paper, and particularly in these recommendations. They are crucial to CC adaptation and to the ethics of who benefits from the ocean economy (at least as far as fisheries is concerned) |  |  |
|  | 13/1 | Rather than Bostock’s old paper, cite FAO 2018 |  |  |
|  | 13/2 and 14/1+2 | Check conclusions in the Aquaculture chapters of Barange et al. 2018 for consistency |  |  |
|  | 14/3+4 | Careful. Habitat suitability from an ecological perspective (Gentry analysis) is NOT the problem. Access, ownership, permits, etc. ARE more important constraints. |  |  |
|  | 15/5 | This section is not good enough. It is rather academic but misses important elements like: land ownership, technical training, value-chain development, etc. as the MAIN constraints to mariculture |  |  |
|  | 16/1 | This was a good opportunity to change the narratibe on fishmeal: production has halved in the last 20 years, and a growing percentage comes from waste rather than whole fish. Despite this fed-aquaculture as exploded. How come? Because the industry has developed immensely in terms of feed formulations and alternatives. You need to bring this in. |  |  |
|  | 16/2 | VALUE CHAIN, VALUE CHAIN, VALUE CHAIN – it is behind most of the failures of aquaculture industries. You must reflect on this and reflect it on the paper |  |  |
|  | 18/1 | Food systems perspective would be very useful here |  |  |
|  | 20/4 | Tourism is not my area, but a quantitative link between SST or CO2 emissions and coral coverage sounds too forced and simplistic to me |  |  |
|  | 21 | Fig. 3. Is this published? Can you cite? Ditto for the text immediately after the figure. It needs referencing, even though I find these relationships naïve and simplistic, but it is not my field? |  |  |
|  | 23/4 | Controlling nutrient inputs will help reduce the impact of CC to coral reef tourism? Is this not a stretch too far? Sure, clean waters are more attractive and more resilient, so coral reefs are in a better state and visited more, so when CC hits them they are all in better state to cope… But is it defendable as a statement given the many other things that apply? I think Daniel Kahneman refers to this as “the more detail one provides in a prediction the more reliable it sounds, when in fact the opposite is true…” |  |  |
|  | 25 | I am not an expert, but I would clarify and separate “C absorption”, “C fixing” and “C sequestering”, to avoid confusion. Most of the C absorption by oceans is through physical mixing, and only a very small proportion is sequestered (you may want to use Barange et al. 2017 Frontiers in Mar. Sci. 3(290) as a source of references). |  |  |
|  | 25/4 | In % terms, the increase in C sequestration as a result of better fisheries management is, frankly, negligible. |  |  |
|  | 25-28 | It is not my field but I found the renewables, deep sea mining and geoengineering sections rather brief, not very insightful, and disconnected from the rest |  |  |
|  | 31 | I would put Table A2 |  |  |

I must apologise if the above comments are too negative, but I believe that’s what you need rather than pats in the back. As I said at the start the paper is well written, well structured. It is a good summary of many facts and many views. This is all positive. What it lacks is a thorough edit to check the confidence language (e.g. a-la-IPCC), and the difficult bit of deciding what is the message you want to give. At this stage the paper is a sum of parts, not well connected and not necessarily useful for politicians and policy makers looking for advice in the longer term. Give them a vision!