RESUBMISSION PLAN

\* indicate related topics.

# Editor

# The editors of Global Environmental Change have secured two reviews of your manuscript. The reviewers are critical of the paper in a number of different dimensions and we judge that it does not come up to the standard required for publication in the journal, principally in terms of the rigor and presentation of the arguments. We judge the paper has the potential, with a re-write that takes on board those main criticisms of the two reviewers, to reach the standard of rigor and originality required. We encourage you to undertake such a significant revision that makes the theoretical and empirical contributions of the study much more explicit. We will approach the reviewers again for their further opinion.  In your re-submitted version, please provide an accompanying letter explaining in detail the responses made to each point by the two reviewers. Please also provide a version of your manuscript with tracked changes included and resubmit your revised manuscript by Sep 12, 2020.

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| **Comments** | **Plan to address** | **Who?** |
| principally in terms of the rigor and presentation of the arguments. We judge the paper has the potential, with a re-write that takes on board those main criticisms of the two reviewers, to reach the standard of rigor and originality required. | Clear presentation of arguments | All |
| We encourage you to undertake such a significant revision that makes the theoretical and empirical contributions of the study much more explicit. | Clear presentation and revision of the theoretical and empirical contributions | All |

# Reviewer #1

This paper provides an extremely novel approach for exploring the link between the structure of global seafood trade networks and its relationship to stock status. While ‘macro correlative’ in nature, the findings enrich our understanding of the structure of seafood trade and lays down the challenge of improving seafood sustainability through the governance of international trade relations. I recommend the paper be accepted, subject to some further refinement.  
My call for refinement is essentially a challenge to the authors to (a) sharpen their argumentation around the significance of the findings and (b) consider some potentially confounding factors and alternative explanations of their findings. I have nine related comments.  
1. The paper is dense. While this keeps it short and sharp, it comes at the cost of clarity in some parts.   
The introduction, for instance provides all the necessary information, but the second, third and fourth paragraphs required quite some re-reading (by this reader at least) to be clear on how all the parts come together. Because you want to all readers to be hooked on the paper I suggest breaking down the argument in these paragraphs into more digestible parts. I would suggest adjusting the order of argumentation as follows: global fisheries are under pressure; most attention has gone to the effectiveness of management and not trade; where trade has been addressed it has not been linked to management or stock status; the disconnect between trade structure (speed and scale – which need to be defined clearly up front) and stock status is an important oversight; by understanding the structure of trade networks the effect of trade based approaches to sustainable fisheries can be enhanced (already giving away your main finding of long termism).  
2. I would also encourage you to think of a graphical representation of the link between the speed and scale of trade networks and resource status. Again, this link is not overly intuitive while at the same time being a central contribution of the paper. Having a visual que I feel will held the readers focus their attention – especially given scale and speed have constituent parts that need to be kept clearly in mind when reading the results and discussion.  
3. Continuing on graphical representation – it took me quite some time to interpret the figure, which was only really possible after reading the text. Not an issue as such, but it does mean the figure is not stand alone. In particular, I found it difficult to really see the change from yellow to red in the arrows, the changing intensity of arrows and the direction of the arrows. I unfortunately don’t have an alternative figure in mind, but this one does not really do justice to the trends you want to show for these three species. That means it comes risks coming across as an impressively data rich (and pretty) picture, without really showing what you want it to.  
4. Another point related to the figure is the apparently striking finding around the geographical scope of trade. Comment is made on this ‘geographic range’ in the paragraph beginning on line 367. Geography is indeed central to the figure, but it is not addressed (unless I am missing something) by clustering or nodes. This is potentially a missed chance to make comment on the degree of and changing structure of ‘globality’ exhibited in the trade of different species. For instance, the example of lobster being mainly traded in North America may mean something very different in terms of trade effects on resource management than for more globally traded and substitutable species like pollock or salmon (I’m assuming).  
5. The discussion is well written if not also very dense. Brevity is nice of course, but I would like to see more thought given to the wider implications, even if in passing, of some of the points raised. One clear theme running through the discussion (and results), for instance, is changing nature of globalization. Long and short termism of trade networks and the apparent trend of increased connectivity (nodes) speak directly to the nature of neo-liberal capitalism. At the same time the apparent trend of declining persistence of established trade relations in favor of new connections.  
There are of course libraries to read on this – some passing recognition and link to these debates would help the authors think through the wider consequences of their findings, and also expand the potential readership of the paper.  
6. Part of the novelty of the paper comes from its additional contribution to the more established economics literature of seafood trade. However, as the authors also note in the discussion, economists have observed some contrasting patterns related, for instance, to the length of connectivity and investment (and realization) of improved stock status. This is addressed in passing in the discussion, but I think could warrant further elaboration – for instance, what is the economic logic tenure and investment behind long termism and how do the results challenge these logics.  
7. Some more reflection on what the paper does not (and is not able to) address would also better position the results. For instance, there is no consideration of the effects of domestic trade, while domestic consumption remains the main destination for fisheries production. Some comment on the importance of these domestic stocks would at least provide some reflection on the limitations of only focusing on export trade.  
In direct contrast, I understand the methodological challenge of excluding tuna from the analysis. But what do you think its addition would add to the overall analysis – given the extent and global structure of its trade.  
8. Another ‘economic’ consideration that could confound the results is the substitutability of fish species in trade. Are there differences, for instance, in the structure of trade networks of species that are easily substituted (e.g. arguably a largely number of white fish species) vs. species that are less easily substituted, either in terms of like-for-like (e.g. rock lobster), or have limited geographical extent (e.g. orange roughy). If a species is highly substitutable then the scope for short termism might be higher for instance. This extends the current observation that focuses on short and long termism in the status of a single stock/species. Perhaps these are questions for further research, but I would still encourage some consideration of such factors in the current paper.  
9. The final paragraph is where the challenge for fisheries management to incorporate trade measures, such as through the WTO. In particular the authors argue, based on their findings that attention by the WTO should focus on fostering long term trade relations. However, I would also be interested to hear whether the authors think there is a role to play for both private and bilateral seafood governance arrangements (e.g. MSC certification, SIMP/EU/private traceability). I would argue that these arrangements are assumed to foster long term trade relations and, as such, improved resource stewardship. Do the authors have something to add here?

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| **Comment** | **Plan to address** | **Who?** |
| 1. The paper is dense. While this keeps it short and sharp, it comes at the cost of clarity in some parts.  The introduction, for instance provides all the necessary information, but the second, third and fourth paragraphs required quite some re-reading (by this reader at least) to be clear on how all the parts come together. Because you want to all readers to be hooked on the paper I suggest breaking down the argument in these paragraphs into more digestible parts. I would suggest adjusting the order of argumentation as follows: global fisheries are under pressure; most attention has gone to the effectiveness of management and not trade; where trade has been addressed it has not been linked to management or stock status; the disconnect between trade structure (speed and scale – which need to be defined clearly up front) and stock status is an important oversight; by understanding the structure of trade networks the effect of trade based approaches to sustainable fisheries can be enhanced (already giving away your main finding of long termism). | Re-write 2,3,4th paragraph using the following order:  I would suggest adjusting the order of argumentation as follows: global fisheries are under pressure; most attention has gone to the effectiveness of management and not trade; where trade has been addressed it has not been linked to management or stock status; the disconnect between trade structure (speed and scale – which need to be defined clearly up front) and stock status is an important oversight; by understanding the structure of trade networks the effect of trade based approaches to sustainable fisheries can be enhanced (already giving away your main finding of long termism) | Andrew |
| 2. I would also encourage you to think of a graphical representation of the link between the speed and scale of trade networks and resource status. Again, this link is not overly intuitive while at the same time being a central contribution of the paper. Having a visual que I feel will held the readers focus their attention – especially given scale and speed have constituent parts that need to be kept clearly in mind when reading the results and discussion. | Graphical representation of the link between the speed and scale of trade networks and resource status | Laura (all) |
| 3. Continuing on graphical representation – it took me quite some time to interpret the figure, which was only really possible after reading the text. Not an issue as such, but it does mean the figure is not stand alone. In particular, I found it difficult to really see the change from yellow to red in the arrows, the changing intensity of arrows and the direction of the arrows. I unfortunately don’t have an alternative figure in mind, but this one does not really do justice to the trends you want to show for these three species. That means it comes risks coming across as an impressively data rich (and pretty) picture, without really showing what you want it to. | Make sure figure caption includes all necessary information included in the text  Clarify what are the key 3 messages to communicate with the figure and adjust figure accordingly | Andrew  Jessica (all) |
| 4. Another point related to the figure is the apparently striking finding around the geographical scope of trade. Comment is made on this ‘geographic range’ in the paragraph beginning on line 367. Geography is indeed central to the figure, but it is not addressed (unless I am missing something) by clustering or nodes. This is potentially a missed chance to make comment on the degree of and changing structure of ‘globality’ exhibited in the trade of different species. For instance, the example of lobster being mainly traded in North America may mean something very different in terms of trade effects on resource management than for more globally traded and substitutable species like pollock or salmon (I’m assuming). | Consider including geography as an indicator or remove text | Maartje (all) |
| 5. The discussion is well written if not also very dense. Brevity is nice of course, but I would like to see more thought given to the wider implications, even if in passing, of some of the points raised. One clear theme running through the discussion (and results), for instance, is changing nature of globalization. Long and short termism of trade networks and the apparent trend of increased connectivity (nodes) speak directly to the nature of neo-liberal capitalism. At the same time the apparent trend of declining persistence of established trade relations in favor of new connections. There are of course libraries to read on this – some passing recognition and link to these debates would help the authors think through the wider consequences of their findings, and also expand the potential readership of the paper. | Identify relevant papers in the economic literature that addresses the ‘changing nature of globalization’ and link to our findings | Laura |
| 6. Part of the novelty of the paper comes from its additional contribution to the more established economics literature of seafood trade. However, as the authors also note in the discussion, economists have observed some contrasting patterns related, for instance, to the length of connectivity and investment (and realization) of improved stock status. This is addressed in passing in the discussion, but I think could warrant further elaboration – for instance, what is the economic logic tenure and investment behind long termism and how do the results challenge these logics. | Add to references on economic arguments for long-termism we have used, explain their mechanisms and contrast our results to those  One explanation could be the overall time span that a fishery has existed. Consider analysis of 1st year of development for SI | Laura (all)  Chris |
| 7. Some more reflection on what the paper does not (and is not able to) address would also better position the results. For instance, there is no consideration of the effects of domestic trade, while domestic consumption remains the main destination for fisheries production. Some comment on the importance of these domestic stocks would at least provide some reflection on the limitations of only focusing on export trade. In direct contrast, I understand the methodological challenge of excluding tuna from the analysis. But what do you think its addition would add to the overall analysis – given the extent and global structure of its trade. | Comment on (1) the importance of domestic stocks and consumption and how they limit our findings, and (2) which patterns we would expect in tuna fisheris given its global extent and network structure | Andrew (all) |
| 8. Another ‘economic’ consideration that could confound the results is the substitutability of fish species in trade. Are there differences, for instance, in the structure of trade networks of species that are easily substituted (e.g. arguably a largely number of white fish species) vs. species that are less easily substituted, either in terms of like-for-like (e.g. rock lobster), or have limited geographical extent (e.g. orange roughy). If a species is highly substitutable then the scope for short termism might be higher for instance. This extends the current observation that focuses on short and long termism in the status of a single stock/species. Perhaps these are questions for further research, but I would still encourage some consideration of such factors in the current paper. | Add next steps should include the substitutability of species and comment on the possible effects of substitutability on our results | Jessica (all) |
| 9. The final paragraph is where the challenge for fisheries management to incorporate trade measures, such as through the WTO. In particular the authors argue, based on their findings that attention by the WTO should focus on fostering long term trade relations. However, I would also be interested to hear whether the authors think there is a role to play for both private and bilateral seafood governance arrangements (e.g. MSC certification, SIMP/EU/private traceability). I would argue that these arrangements are assumed to foster long term trade relations and, as such, improved resource stewardship. Do the authors have something to add here? | Add what the role of private and bilateral seafood governance arrangements could be with regard to managing trade structure and durability | Junfu (all) |

# Reviewer #2

This paper aims to assess "whether the speed and scale of the global seafood trade network is indicative of fishery status". The authors set up the paper as though they are going to investigate the causal link between the network development and stock status. Yet, they provide no theoretically (or otherwise) grounded hypothesis about the causal connections for why this would be the case. The choice of network metrics seems to me odd and not well justified. For instance scale is not well defined, and is captured by two proxies; degree of clustering and degree of individual nodes (the latter which is not even a whole network metric). The authors do not provide an explanation for why scale would be relevant in the first place (it is never really defined), and I fail to see how either of these two metrics even capture scale.  
It is perhaps slightly more intuitive to understand why the second variable, speed, would matter for stock status. But unfortunately the authors loose me in their explanation of the technicalities of these proxies.   
  
The introduction is not very well written and leaves me with a lot of questions. Statements are made that are not well explain or supported - and again, the logic of the argument is missing. This, and the choice of network metrics (and lack of theoretical grounding of these) is my main concern, and based on this I cannot recommend this for publication in GEC.  
I think the paper needs a lot of work, and would urge the authors to go back and think critically about what their data can actually show, and then work to develop a theoretical justification for their design.   
My detailed comments are provided in the attached pdf  
    

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| **Part of text** | **Text** | **Comment** | **Plan to address** | **Who?** |
| Abstract |  | I find the abstract a bit technical and hard to understand | Remove technical language and clearly argue for the relevance of speed and scale \* | Andrew |
| Introduction |  | The introduction is not very well written and leaves me with a lot of questions. Statements are made that are not well explain or supported - and again, the logic of the argument is missing. | Explain and support the causal link between network development and stock status | Laura (all) |
|  | The authors set up the paper as though they are going to investigate the causal link between the network development and stock status. Yet, they provide no theoretically (or otherwise) grounded hypothesis about the causal connections for why this would be the case. The choice of network metrics seems to me odd and not well justified. For instance scale is not well defined, and is captured by two proxies; degree of clustering and degree of individual nodes (the latter which is not even a whole network metric). The authors do not provide an explanation for why scale would be relevant in the first place (it is never really defined), and I fail to see how either of these two metrics even capture scale. | Improve the choice (and argumentation) for the network metrics used. Consider a compound index and removing the language of speed and scale \* | Maartje & Elaine (all) |
| However, present-time marine resource use patterns are more complex. For  48  example, new patterns of marine resource use have emerged in recent years such as that of  49  sequential exploitation in which one fish stock is substituted for another, facilitated by a trade  50  network in which the number and speed of new trade connections forming is increasing (Anderson  51  et al., 2011a; Berkes et al., 2006; Eriksson et al., 2015) | not so recent any more | Rephrase | Andrew |
| This phenomenon is mirrored globally by  52  the rapid increase in speed and scale of the global trade network (Bellmann et al., 2016; Gephart  53  and Pace, 2015) | how is sequential exploitation mirrored? you mean it is caused by it? | Clarify | Laura |
| This increase is illustrated by changes in the continuity, number and grouping  54  of connections in the global trade network. It is now more interconnected than ever before, | so increase in speed and connectivity is illustrate by continuity and grouping of connections?  I don't understand what this means. | Clarify what the individual network metrics mean for trade and stock status \* | Ed (all) |
| In this new reality, (i) the  58  formation of new trade connections may outpace that of regulatory action in fisheries (Berkes et  59  al., 2006; Eriksson et al., 2015) and (ii) the state of one fishery stock may depend on its trade-  60  related connectivity to other stocks (Eisenbarth, 2017; Gephart et al., 2016). | meaning what? dependent in what way? | Expand on the interdependence between stocks through trade \* | Andrew |
| The scale of trade networks has been associated with unsustainable resource use in a number  66  of environments including fisheries (Anderson et al., 2011; Berkes et al., 2006; Eriksson et al.,  67  2015), | what is meant by scale? number of links? geographic scale?  I am confused as to how this is argued to have been associated with unsustainability | Clarify using literature examples and our metrics \*  Clarify causal link between scale and exploitation of stocks \* | Maartje (all) |
| For example, national seafood supplies of exporters with many import connections may  69  be particularly vulnerable to external shocks due to trade exposure from a higher number of  70  partners (Gephart et al. 2016). | I am not sure what Gephart exactly says, but diversity of trade relations can actually create resilience for individual importers/exporters, as over-reliance on singular trading partners can leave actors too dependent and vulnerable to shocks - see for e.g.  Stoll, J. S., Crona, B. I., Fabinyi, M., & Farr, E. R. (2018). Seafood trade routes for lobster obscure teleconnected vulnerabilities. Frontiers in Marine Science, 5, 239.  So I am not sure this argument really holds - it is more complex than saying lots of trade connections leaves one more exposed | Clarify the mechanism between high connectivity and shocks | Jessica (all) |
| Also, the position of a country in the trade network is a good  71  predictor of environmental pollution (Burns et al., 2015; Prell, 2016; Prell et al., 2015) | meaning what? more centrality = more pollution? or what?  and if environmental pollution is driving tarde network configuration - there seems to be som sort of circularity going on here...  It is unclear to me how this fits with the rest | Clarify connection to this study or remove | Ed |
| Collectively, this research suggests that  74  changes in the speed and scale of trade networks impacts the sustainable use of natural  75  environments. | but you just said env pollution affects network formation...? | Clarify circularity in argument | Andrew |
| High-  81  speed trade networks that exhibit high turnover with many, short-lived trade partnerships could  82  be incongruous with the pace and time frames over which fisheries assessments and  83  management occur. For exa | I am not convinced - you're saying that a trade relation lasting only one o a few years would deplete a whole stock? this could be for highly sessil animals like sea cucumber and maybe slow growing deep sea species, but seems unlikely for many other.  In fact - I am not convinced that highly temporal bilateral trade links are the main problem - rather the persistence of a continuous market for a particular commodity | Pick up the argument of ‘rather the persistence of a continuous market for a particular commodity’ in the introduction \* | Laura |
| Annual turnovers in  88  trade connections may therefore drive unsustainable fishing practices as markets mediate  89  demand and the subsequent exploitation of stocks at rates quicker than fisheries regulation can  90  scrutinize and act (Berkes et al., 2006). | The causal mechanisms behind thsi statement need to be much more clearly articulated  Currently, it seems the authors are setting up a bit of a straw man | Clarify causal mechanisms how the speed of trade incentives different exploitation rates due to a lack of regulation \* | Andrew |
| Collectively, the literature suggests that the speed and scale of trade can affect mechanisms and  93  incentives for sustainable use of fisheries. | what mechanism?  you haven't explain how this speedy trade would affect incentives | See above \* | Andrew |
| To this end, we assembled an extensive global dataset of stock status estimates  97  of 1,740 fisheries, linked it to the status to 401,027 bilateral trade flows over a period of 20 years  98  and analyzed it using both static and dynamic panel analysis methods | this is interesting - but the link is one of association - not causality - and since the causal argument remains clouded to this point I am not sure | Clarify causal mechanisms between scale and stocks \*  Explain how our methods do (not) address causal links | Maartje  Junfu (all) |
| Methods | Although the Comtrade data provides information on the amount and  147  value of seafood product trades between nations, it does not necessarily represent the  148  geographical origin of the fish products being traded | but since you then have to lump all fisheries from the same country - how do you deal with the fact that individual fisheries from the same country could have varying stock status? | Discuss limitation of varying stock status within countries | Chris |
| Therefore we excluded all species groups that accounted for more than 5% of global aquaculture production (FAO, 2019). | why 5% cut-off? seems low  this seems like another major issue with this dataset | Test a 10% cut off and report in SI | Junfu & Laura (all) |
| First, we used FishStat to generate a combined dataset of FAO trade data and the UN  158  Comtrade data (FAO, 2020). | can you explain what the difference between comtrade and fishstat data is - which dataset contains what variables of interest | Explain which variables were of interest from which dataset | Laura |
| For example, stock status estimates for  165  European plaice (Pleuronectes platessa) were matched to the commodity group category  166  ‘European plaice (Pleuronectes platessa), fresh or chilled’. | so this suggests you used only commodity categories fresh or chilled - what about processed?  were they not included? if so, why not?  does this not affect results? | Clarify | Andrew |
| There was no suitable commodity group for 337  173  species with stock status estimates including roach (Rutilus rutilus), garfish (Belone belone), and  174  surmullet (Mullus surmulettus). | so does this mean that the toel number of fisheries included in analysis is 1740 - 337? | Correct \* | Laura |
| 1995. We associated HS 1992 commodity groups with 24 species groups  178  (i.e. HS 1992 ‘Plaice (Pleuronectes platessa), frozen’ with species group ‘plaice’), being an  179  aggregate of market substitutable species | I don't follow this step | Clarify | Laura & Andrew |
| a total of 746 stocks. | so isn't this the number you should be highlighting in the intro - not 1740 | Correct \* | Laura |
| We characterized network scale as the clustering coefficient and degree of the network and  184  network speed as the average duration and turnover rate of trade connections in the ne | I fail to understand how degree of clustering would be a good proxy for scale?  how do you even define scale?  and what is meant by degree of the network? degree is (as far as I understand) a measure applied at the level of network nodes - it is not a whole network measure  what's the difference between these two?  so are you assessing this at the network level or individual nodes? Confusing | Definition of speed and scale (introduction) \*  Motivate node level metric \*  Clarify definitions according to such as ‘the difference between these two’ | Laura & Maartje  Andrew |
| The clustering coefficient, hereafter called clustering, is an indicator of network scale indicating  192  the level of grouping in the network. It is a measure of the ratio of adjacent triangular relationships  193  in a network i.e., the degree to which nodes in a network tend to cluster together (Table S6).  194  Adjacent triangular relationships form, for example, if country X has seafood trade connections  195  with country Y and country Z while country Y also trades with country Z. In a network with many | again - why? and scale not defined | Definition of scale (introduction) \* | Laura & Maartje |
| adjacent triangular relationships, the clustering coefficient is high. Adjacent triangular  197  relationships are accounted for independent of the directionality of a link, i.e., whether the link is  198  an export or import link. We calculated the clustering coefficient at network level using the igraph  199  R package (Csárdi and Tamás, 2020). | how are you suggesting that clustering degree explains unsustainability? (as you allude to in the intro)  What is the causal link? | Clarify causal mechanisms with regard to clustering coefficient and stock status \* | Jessica |
| As a second indicator of the speed of trade, we calculated the turnover of trade connections.  224  Turnover measures the continuity of trade connections through the sum of unique trade  225  connections subtracting overlapping unique trade connections in a network between two years  226  (Table S6). | I don't follow | Clarify how we calculated turnover | Chris |
| Discussion | 388  Our findings highlight the importance of speed and scale of seafood trade networks on the status  389  of fisheries traded internationally. Here | I am not sure how they do.  The choice of network characteristics are poorly justified, and it is unclear how they can convincingly be linked to a hypothesis of how trade networks affects the sustainability of stocks | Discuss the hypothesized mechanisms between the metrics we are using and stock status \* | Laura (all) |