Monterey Bay Aquarium Seafood Watch®

Seafood Watch® DRAFT Energy (GHG Emissions) Criteria for Fisheries and Aquaculture

Summary of comments from Public Consultation 1 and Responses

Preamble

Seafood Watch assesses the environmental sustainability of fisheries and aquaculture by compiling relevant science-based information and evaluating that information against our standards (called 'Criteria' elsewhere on this website). We periodically revise our standards to ensure we account for developments in the scientific understanding of the ecological impacts of fisheries and aquaculture operations, as well as in our understanding of what producers and managers can do to mitigate those impacts. Seafood Watch initiated a public comment period from October 27, 2014 to January 16, 2015 and received comments from ENGO's, producers, certification schemes, and other interested stakeholders.

The comments received have been summarized, grouped together by similar themes and are presented in the left hand columns of each table below, with Seafood Watch responses in the right column**.** Seafood Watch has carefully considered all comments received in addition to reviewing many of them with our Technical Advisory Committee and/or Expert Working Group. Below we present our responses to all comments received as part of the official Public Comment Period as per the requirements of the ISEAL Code of Good Practice Standards-Setting Code[1].

Summary of Comments	**Seafood Watch Response**
SFW should communicate that CO_2 emissions from food production are a significant, and thus non-trivial, fraction of anthropogenic CO_2 emissions. Many users of the Seafood Watch may assume that household	We have modified our guiding principle to acknowledge the significance of food

[1] http://www.isealalliance.org/our-work/defining-credibility/codes-of-good-practice/standard-setting-code

Summary of Comments	Seafood Watch Response
transportation and home energy use are the dominant components of their personal GHG emissions and they may assume that emissions from their food consumption are largely insignificant.	production to anthropogenic GHG emissions.
A relative impact factor would provide a highly compelling approach for educating consumers but should be developed with caution. In particular, estimates of land-based protein hinge on assumptions regarding GHG emissions that arise from indirect land-use change. Land-use emissions of various production pathways can change the total life-cycle emissions by a factor of 2 or higher (e.g. Campbell et al., Science, 2009, Campbell and Block, ES&T, 2010). We estimate the ratio of the Global Warming Potential (GWP) of beef to pre-transport wild-caught fish (with a FUI of ~630 L) would be understated by a factor of 2 when land-use emissions are not included (McKuin and Campbell, In Preparation). Similarly, the ratios of the GWP of chicken and aquaculture products to pre-transport wild-caught fish (with a Fuel Use Intensity of ~630 L) would be underestimated by a factor of almost 3 (McKuin and Campbell, In Preparation). Neglecting this potentially large climate effect could bias the comparison between fisheries, aquaculture, and livestock.	We have included a more detailed discussion of what GHG emissions are included in the comparative values for poultry and beef, informed by this comment, and acknowledge that the values we are using (from Nijdam *et al.* 2012) may underestimate emissions associated with poultry and beef production. We are seeking comparative values for poultry and beef that do include soil CO_2 emissions. We are also working on a quantitative measure of uncertainty that can be used in conjunction with the Nijdam *et al*. values.
Aquaculture inputs of feed from land-based sources will depend largely on assumptions regarding CO_2 emissions from land-use change. The CO_2 emissions from land-use are important when considering the impact of aquaculture of products that use land crops for fish feed. Considering aquaculture's fast expanding production with the goal of minimizing environmental impact, important lessons can be learned from the studies of bio-energy crops. The resource use efficiency of bio-energy crops has been studied extensively in recent years (e.g. contributions from our group: Campbell et al., Science, 2009; Mendu et al., PNAS, 2012). Several studies found there is a limited area of land that is available to grow biofuels crops without causing direct or indirect land-use impacts (Campbell et al., ES&T, 2008; Field et al., Trends	We did not summarize this comment, and provide it here in full length b/c of the useful information in contains. In this iteration, we included a broader discussion of the GHG emissions associated with aquaculture feed production. In order to produce as comprehensive an estimation as possible, we now propose using a tiered approach to evaluating the feed contribution to GHG emissions that will allow us to calculate feed related emissions with more accuracy where we can obtain ingredient or formulation specific information. This will allow us to factor

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Ecol. Evol. ,2008; Tillman et al., Science, 2006; Fargione et al., Science, 2008). Direct land-use change is the conversion of land, which was not used for crop production before, into land used for a particular crop production. The emissions caused by the conversion process can be directly linked to the crop and thus be allocated to the specific carbon balance of that crop. Whereas indirect land-use change is a market effect that results when crops are increasingly planted on areas already used for agricultural products. This causes a reduction of the area available for food and feed production and therefore leads to a reduction of food and feed supply on the world market. If the demand for food remains on the same level and does not decline, prices for food rise due to the reduced supply. These higher prices create an incentive to convert formerly unused areas for food production since the conversion of these areas becomes profitable at higher prices. Like biofuels, land occupation and land-use change of food crops and livestock have a huge impact on global warming (Schmidinger and Stehfest, Int J Life Cycle Assess, 2011). Until recently, agricultural LCAs have used an attributional approach and neglected the changes in soil organic carbon, and the consequential emissions due to cultivation (Nijdam et al., Food Policy, 2012). For aquaculture feed crops, land occupation affects global warming as it prevents natural vegetation from re-growth and thus from carbon uptake.	in soil CO_2 emissions associated with land use change when the analyst conducting the assessment is able to find this information. Where feed or formulation specific information is not available, we will base the feed GHG estimation on the dominant feed component (aquatic, crop and land-animal), and we will be transparent about what GHG emissions are included and what emissions likely occur but which were are unable to include due to lack of data/information.
In addition to CO_2 emissions, future iterations may consider short-lived climate forcing species. In particular, black carbon emissions may be highly concentrated in this industry due to the large emission factors associated with fishing fleets and the spatial distribution of these emissions. Using a previously reported fishing fleet fuel usage (Tyedmers et al., Ambio, 2005) and a range of global warming potentials and emission factors, we estimate that the climate forcing from black carbon may be up to 70% of the climate forcing from direct CO_2 emissions from fuel combustion on fishing fleets (McKuin	We have now included this information about black carbon in our discussion of GHG (and non-GHG but climate forcing) emissions associated with fisheries production. In future iterations of the fisheries criterion, we hope that data will be available from a wide variety of fisheries so that we can include black carbon emissions in the fisheries GHG intensity calculation.

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and Campbell, In preparation). Neglecting climate effect of black carbon could potentially bias a comparison between fisheries, aquaculture, and land-based protein.	
Future iterations should also incorporate non-energy emissions of N_20 and CH_4 emissions from aquaculture surface water. The importance of N_2O from aquaculture alone was noted in a recent review to be on the order of 5% of total global anthropogenic N_2O emissions (Hu et al., ES&T, 2012). Previous LCAs have already included N_2O emissions from land-based nitrogen fertilizer on aquaculture feed crops (Pelletier and Tyedmers, Journal of Industrial Ecology, 2010). To extend this work, LCAs should incorporate N_2O emissions from aquaculture surface waters that are induced by microbial nitrification and denitrification, which can have comparable climate forcing to the energy emission from pumping and aeration (McKuin et al., California Energy Commission, 2012; McKuin and Campbell, In Preparation).	We have now included this information about non-energy N_20 and CH_4 emissions in our discussion about GHG emissions associated with aquaculture production. Where data is available, and can be obtained by the analyst conducting the assessment, this information will be factored into the report.
Look at the FAO's comments on emissions from marine industry. This is important to include, even if unscored.	We have looked at FAO documents and have referenced the 2014 “The State of World Fisheries and Aquaculture: Opportunities and Challenges” and 2011 ““Energy-smart” Food for People and Climate”.
For the fisheries criterion, perhaps a proxy scale could be created, such as typical distance from shoreline. U.S. companies may report fuel expenses in annual reports or other documents.	At this point, a proxy with such a level of detail would be difficult to achieve, but as we assess of a fishery using this criterion, we will ask the analyst to search for and request fishery specific information on fuel use to compare it against the data in the Fuel Use Intensity database (and add to the database where information is lacking).
It would be helpful to use a greater variety of peer-reviewed sources.	We have included more background information in this draft, hence more references are now cited.

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Be clear and transparent as to the system boundaries used to asses average or mean GHG emissions for other protein sources (i.e. will GHG emissions assessments only include feed and farm-level energy use? Or will an assessment GHG emissions from beef production also include methane production from cows?)	We have added clarification text throughout for both the fisheries and aquaculture criterion about what GHG emissions will be considered in our fisheries and aquaculture GHG Intensity calculations and have clarified what GHG emissions are included in the comparative land based protein median GHG Intensity values from Nijdam *et al* 2012.
If SFW is going to create a relative scale of GHG emissions from different protein sources, it might also include soy, a realistic protein alternative for many consumers.	We have chosen poultry as a medium GHG intensity value and beef as a high intensity GHG intensity value for comparative purposes. These values are taken from Nijdam et al 2012, which compiled multiple data points on $kgCO_2$-eq/kg meat from various animal protein production methods in a consistent framework. The two selected land based proteins provide a simple comparative framework to distinguish between low, medium and high emission fisheries and farms.
We agree that the two categories (farm level emissions and feed production) selected for assessment in this criterion are comprehensive enough to result in a meaningful assessment of emissions from aquaculture operations. We would caution, however, suggesting that this is a quantification of "overall emissions from aquaculture operations". There is good evidence in the literature that grow-out infrastructure and smolt production are notable contributors to the overall GHG emissions of aquaculture operations. We do not believe that these two latter categories need to be included in this criterion (as feed and on-farm energy use are certainly dominant emission sources), but simply want to ensure that the messaging here is clear.	Throughout we have clarified what emissions are included in both the fisheries and aquaculture criterion. In addition we added the information you provided on additional energy uses beyond farm level activities (smolt production and grow out infrastructure).

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It seems as though estimating GHG emissions of the feed component based on dominant feed ingredient groups (land, crop, aquatic) is a very cursory approach given the complexity of simply estimating GHG emissions from wild capture fisheries that is proposed in the draft criteria. If assessed as proposed, does it mean that there would be no differentiation for a fish farm sourcing 100% of its fishmeal from by-catch of a regional fishery vs a fish farm sourcing 100% of its fishmeal from an international reduction fishery? In theory, it would seem like the mean GHG emissions for those two scenarios should be different but may not be under the proposed methodology. We understand that it would be near impossible to go into a fully LCA of feeds for each aquaculture operation, but perhaps there should be mean GHG emissions calculated for a series of 'typical' formulations of each feed component.	Seafood Watch recognizes that estimating the GHG emissions associated with feed production is complex. Due to this complexity, we now propose using a tiered approach to evaluating the feed contribution to GHG emissions that will allow us to calculate feed related emissions with more accuracy where we can obtain ingredient or formulation specific information, defaulting to the dominant feed group approach when specific information is lacking.
It is unclear why the FCR is divided by 100 in the "Total feed cumulative GHG emissions" equation.	This was an error, it has been corrected
We would suggest including temperature regulation in the farm-level energy use criterion.	Temperature regulation is now discussed as a contributor to farm level energy use. When carrying out an assessment, SFW will ask the analyst to request data on all farm level energy uses (including temperature regulation) and other sources of GHG emissions from farm level activities. This information, in addition to the data we collected in our literature review, will be used to determine the farm level GHG emission component. Where no data is available that is relevant to the production system under assessment we will default to the pumping and aeration calculation.