The Intersection of Climate and Seafood Markets

Supplement to the 2020 Progress Toward Sustainable Seafood – By the Numbers Report

PREPARED BY CEA CONSULTING ON BEHALF OF THE DAVID AND LUCILE PACKARD FOUNDATION

FEBRUARY 2021

CEA Consulting
235 Montgomery Street, Suite 950
San Francisco, CA 94104
ceaconsulting.com

CEA CONSULTING

Table of Contents

Executive Summary

In 2019, the United Nations' Intergovernmental Panel on Climate Change released its *Special Report on the Ocean and Cryosphere in a Changing Climate*, laying bare the sober reality of how a changing climate is compromising the world's ocean. This report, along with subsequent reports by the High Level Panel for a Sustainable Ocean Economy and calls to action from COP25 ("the Blue COP"), placed climate change at the center of the ocean conservation field's strategic deliberations. To date, organizations affiliated with the Conservation Alliance for Seafood Solutions (Conservation Alliance) have had limited discussion as to whether or how the Conservation Alliance's approaches and interventions could or should contribute to climate mitigation or adaptation. In fall 2020, CEA Consulting (CEA) conducted the first landscape review of the climate change and seafood markets nexus. The purpose of this report is to take stock of seafood markets organizations' perspectives, activities, and aspirations with regard to adapting their approaches and strategies in the face of climate change.

This landscape review, which included interviewing and surveying more than 75 percent of Conservation Alliance-affiliated organizations, finds that the global seafood markets community lacks clarity on how it should engage on climate change, although there is substantial interest and an understanding of the urgency. Organizations are not aligned on what effective and strategic engagement on climate change would look like, especially considering the low mitigation potential of seafood markets.[1] It is also not clear how prioritizing climate change might fit into the current theory of change or require shifts in community priorities. Additionally, organizations lack clear guidance and direction on incorporating climate change into existing partnerships and interventions.

In our findings, we highlight the early progress among certifications and ratings standard holders, scientific research institutions, government advocacy organizations, and precompetitive collaborations to incorporate climate change into the strategy of the seafood markets movement. A variety of potential opportunities were raised as ripe for further seafood markets engagement:

- **Engage business partners on relevance of climate change** to their ongoing work by elevating:
    - Impacts to future sourcing and supply chain resiliency
    - Impacts to human rights and well-being commitments
    - Climate change as a complementary reason to engage on illegal, unreported, and unregulated (IUU) fishing and fuel subsidies
- **Incorporate climate science into certifications and ratings standards.**
- **Integrate best practices and lessons learned across the climate fisheries science and seafood markets communities.**
- **Lean on the expertise of existing leaders, such as the Environmental Defense Fund (EDF),** to lead across the Conservation Alliance.

This report is not intended to be a roadmap for how the community should engage with climate change. Rather, it should serve as a resource to inform future discussions about how the seafood markets community can best adapt to and address a changing ocean.

Introduction

In July 2020, CEA produced *Progress Toward Sustainable Seafood – By the Numbers, 6th Edition*, on behalf of the David and Lucile Packard Foundation's (Packard Foundation) Global Seafood Markets Strategy, which tracks the sustainable seafood movement's progress and highlights trends within the sustainable seafood community. The community has improved the sustainability of seafood, yet the effects of climate change threaten to compromise these hard-earned gains. Global fisheries will soon be at a crossroads: we must effectively manage fisheries in the face of climate change or risk undoing what progress has been made to improve the health of fisheries around the world.[2]

Methodology

CEA contacted 44 organizations, 42 of which were affiliated with the Conservation Alliance. In total, 20 organizations were interviewed, and an additional 14 organizations completed Google Form surveys. CEA used a mixed-methods research approach to conduct our research, relying heavily on key informant interviews. Additionally, CEA conducted desktop research to further inform the overall findings at the intersection of climate change and seafood markets.

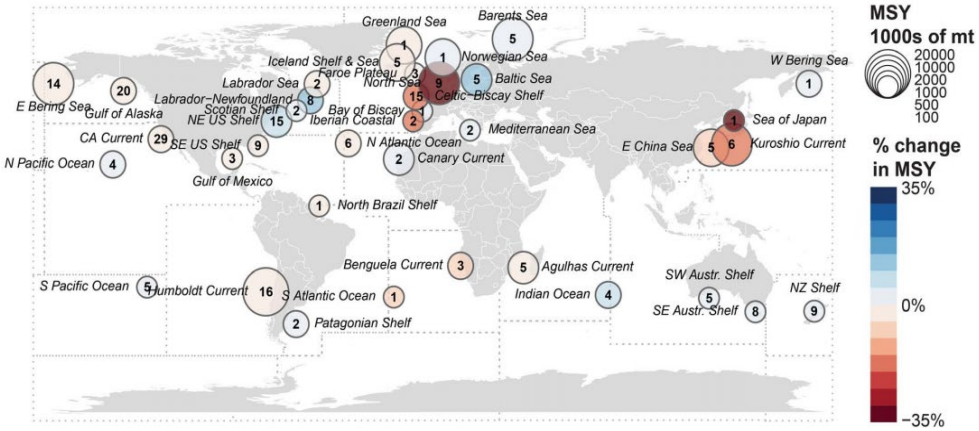
For more information on our methods, please see Appendix A.

Climate Change Impacts

IMPACTS ON FISHERIES

Climate change is already altering global fisheries' productivity and spatial distribution. Warming waters force fish stocks to shift to cooler waters, and overall productivity is projected to decrease in tropical and temperate regions and increase toward the poles.[3] Changes in ocean temperature during the past 80 years have reduced global fisheries' maximum sustainable yield (MSY):[4] the MSY of 235 global fish and invertebrate populations has decreased by 4.1 percent, with five ecoregions experiencing losses between 15 to 35 percent.[5]

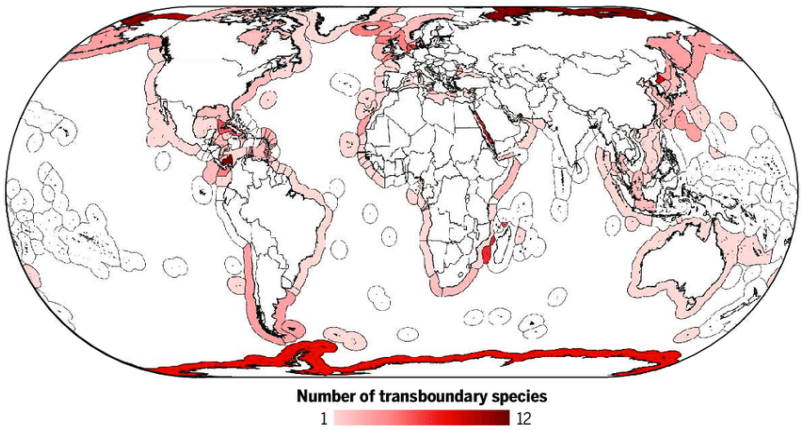
Percent Change in Average Maximum Sustainable Yield[6]



Climate change threatens economically important marine species as they seek new habitat.[7] Further, shifting of stocks to different jurisdictions could lead to international and regional disputes. An estimated 23 to 35 percent of exclusive economic zones will host new stocks by 2100, potentially resulting in significant changes in food security and profits.[8] Cooperation among jurisdictions is necessary for effective management and fair distribution of benefits as stocks shift.

"The threat of overfishing as a result of range shift has a potential to create fish wars between countries and RFMOS (Atlantic mackerel)—we see international disputes and break down in quotas." – Key Informant

Exclusive Economic Zones Projected to Contain New Fishery Stocks by 2100[9]



IMPACTS ON COMMUNITIES

The projected changes in fisheries' productivity and distribution, particularly in tropical regions, pose significant livelihood concerns for coastal communities. Tropical communities dependent on fisheries for food security and employment are highly vulnerable to climate impacts.[10] For example, some African nations are likely to see the value of landed catch drop by about 20 percent within 30 years.[11] Many coastal communities are already facing hardships from extreme weather events, loss of habitat, and ocean pollution.[12] Future changes in fishing stocks will only exacerbate inequitable conditions for communities in countries struggling to adapt to a changing climate.[13] Small island states will be particularly hard hit if their fishing economies cannot adapt.

"Limiting warming to 1.5°C could result in significant gains for countries that are most vulnerable and have the greatest reliance on fish for food security, incomes, and employment." – OurSharedSeas

Among the most vulnerable are Indigenous people and women. Indigenous seafood consumption is 15 times higher per capita than national averages.[14] And women are critical stakeholders in global seafood production, representing about half of the fisheries sector's labor force.[15] In the Pacific, for example, women account for 56 percent of small-scale catches, and changes to fishing access can drastically affect their livelihoods, food security, and local economies.[16] Further, extreme weather will create coastal refugees, often resulting in increased

demand for coastal resources such as fishing access.[17] Conservation Alliance members are already seeing critical impacts on fishers and communities as climate change threatens their source of income and job security.

Global Seafood Markets Community and Climate Change

INTEREST AND URGENCY

The global seafood markets community has expressed interest in incorporating climate science, mitigation, and adaptation into current strategies, approaches, and interventions. Yet the community is uncertain about what guidance and direction it should provide the seafood industry and how to prioritize climate change.

Climate change impacts threaten the sustainable seafood movement's durability as well as the livelihoods of the many people who depend on seafood as a means of survival. There is an urgent need to mitigate climate change as it is causing, or will cause, significant impacts on the wild-capture and farmed seafood landscape. Current and anticipated challenges include ocean acidification, rising ocean temperatures, coral reef bleaching events, and sea-level rise. Current and expected outcomes include shifts in food webs, shifts in fisheries stocks and other marine species, reduction in algae productivity, and coastal flooding. For more information on these expected impacts, please see the *Our Shared Seas' Climate Change Primer*.[18]

BARRIERS TO ENGAGING ON CLIMATE CHANGE

> *"I do not see that there's a huge call to action in the seafood industry [on climate change]." – Key Informant*

Despite the interest and need to engage, many barriers prevent the seafood markets community from substantively engaging on climate change:

- **The climate change challenge is overwhelming in magnitude** and is difficult to strategically address.
- **Climate change action will need to compete for funding, time, and capacity** with other priorities in the movement.
- **The seafood industry's potential for greenhouse gas emissions reductions is relatively small** compared to terrestrial carbon emitters, although some mitigation opportunities do exist. For example, by 2050 the U.S. must reduce emissions by 5,150 Mt CO_2e annually to achieve its contribution to the 2 degree Celsius pathway.[19] All ocean-based measures could jointly contribute 704 Mt CO_2e per year by 2050, which amounts to about 13.7 percent.[20] Of that proportion, only 7.17 Mt CO_2e per year, or 1 percent, could come from seafood and aquaculture production if their efficiency were to improve.[21] Yet the greatest opportunity for emissions reductions in seafood lies in shifting diets. Influencing U.S. consumers to eat more seafood has proved quite difficult, but if successful could result in a total mitigation potential of 10 to 39 Mt CO_2e per year by 2050.[22]

- **Funding for climate change work in seafood markets is limited**, and often excludes climate adaptation funding. Working on climate change in this space would require a deeper understanding of the funding landscape, with an emphasis on partnering with governments and multilaterals, as traditional seafood markets funders are currently not funding this work.
- **Climate mitigation and adaptation work often requires long-term investments** in place-based community engagement, which could challenge the seafood markets movement's focus on change at scale.
- **The climate change burden is disproportionately felt by different stakeholders** and the supply chain, creating differing levels of urgency and concern.

> *"People like to talk about climate change and adaptation, but they don't like to fund it, it is very expensive. Funders are not that interested in funding long-term community engagement." – Key Informant*

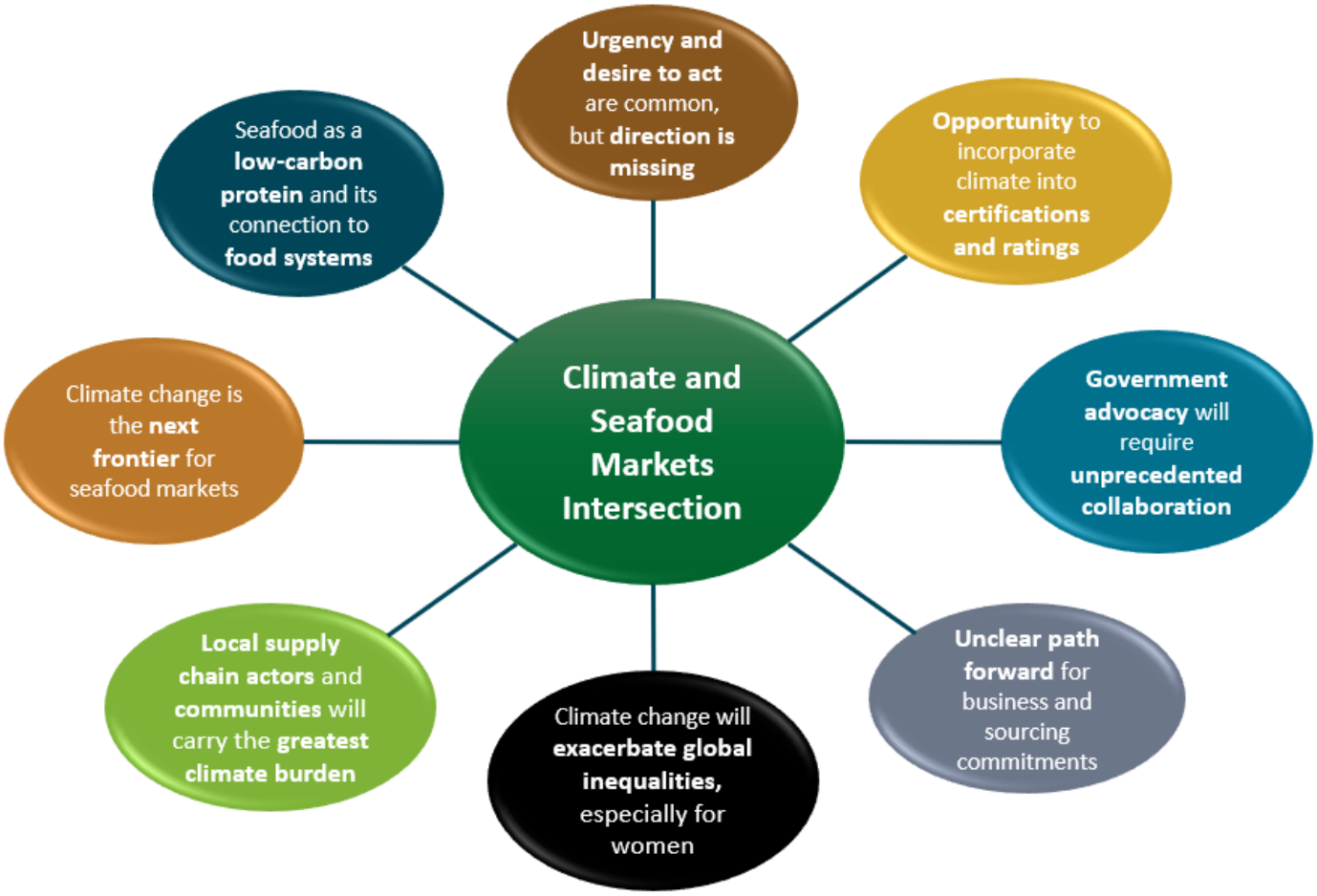
CURRENT PERSPECTIVES ON SEAFOOD MARKETS AND CLIMATE CHANGE

The seafood markets community views climate change as a threat to the progress made toward achieving sustainable and socially responsible seafood. While some key informants shared the desire to tackle climate change as the next frontier for the seafood markets movement, others expressed concern that climate change would draw time, capacity, and funding away from current strategic priorities.

> *"I get worried that sustainability takes the back seat to the new kid in the room. A new pitch is exciting. This happened with labor rights. Companies were more concerned with labor rights than sustainability. There's industry fatigue." – Key Informant*

Nonetheless, key informants shared similar thematic perspectives on how climate change is viewed within the seafood markets landscape (see Figure 1). Additionally, many informants spoke about EDF's leadership and its unique role as the community's knowledge and collaboration hub for climate-change-related work.

FIGURE 1: THE INTERSECTION OF CLIMATE CHANGE AND SEAFOOD MARKETS



Findings from Key Informants

This landscape review demonstrated that the intersection between the seafood markets community and climate change is quite complex. Conservation Alliance organizations highlighted both active climate initiatives in the seafood markets space and barriers to incorporating climate science into current community approaches. The following findings can help inform future discussions on how best to engage on climate change as a community.

- **Scientific research and government advocacy**.
- **Certifications, ratings, and improvement projects**.
- **Mitigation challenges, opportunities, and tracking tools.**
- **Buyer commitments.**
- **Precompetitive collaborations.**

1. Scientific Research and Government Advocacy

Scientific research and government advocacy emerged in key informant interviews as actionable ways for the seafood markets community to engage on climate change. This approach could span incorporating climate science into fisheries management plans to supporting government collaboration on updating multinational quota systems. Where it is not possible to proactively engage on climate change through scientific research and government advocacy, many suggested that working to improve data collection, fisheries management, and governance are still appropriate activities, which could lay a foundation for incorporating climate science in the future.

Current scientific research and government advocacy related to climate change are primarily led by the traditional advocacy-oriented organizations (e.g., EDF, Natural Resources Defense Council, The Nature Conservancy) in regions with relatively good governance, and not by the seafood supply chain. A significant portion of this capacity is focused on governmental advocacy in the United States.

> *"To avoid these conflicts and jurisdictional gaps, policymakers should consider requiring comprehensive management coverage for straddling stocks, as well as a framework for cross-regional cooperation and the handing off of authority as stocks shift range across management boundaries."*
> – *NRDC,* On the move: how fisheries policy can address shifting fish stocks*, October 2020.*

While some seafood markets organizations work on climate change and fisheries issues in other program areas within their organizations (e.g., marine reserve initiatives, fisheries conservation work), these efforts do not appear to have fully transferred to climate-change-related initiatives in their seafood markets work. There is an opportunity to integrate knowledge across the fisheries and seafood markets communities and within organizations to create efficiencies, share best practices, and capture lessons learned.

Many initiatives are underway at the intersection of climate change, fisheries, and scientific research and government advocacy that the seafood markets community should be aware of and learn from, including:

- **U.S. aquarium climate advocacy.** The Monterey Bay Aquarium advocates for climate policy at the state and national levels through the Aquarium Conservation Partnership, a collaboration of 22 U.S. aquariums. In 2018, the Aquarium led the development of an ocean-climate agenda for the Global Climate Action Summit in San Francisco.[23]
- **EDF's facilitation of the Sistema de Alerta, Predicción y Observación (SAPO).** EDF is facilitating the creation of the Humboldt Current region's first ecosystem-wide observation, warning, and prediction system for climate change impacts on fisheries. The Humboldt Current is one of the planet's most abundant and productive large marine ecosystems. SAPO lays out a shared vision and plan between Chile's, Peru's, and Ecuador's fisheries science and management agencies to foster adaptive management and provide policy makers with the information they need to confront the challenges of climate change on fisheries, including a comprehensive ocean-observing system.
- **Gulf of Maine Research Institute's (GMRI) Climate Center.** The Climate Center launched in 2019 as a new interdisciplinary climate center focused on identifying climate-change-related solutions to global challenges in the marine and coastal environment, including climate-smart fisheries management, aquaculture business planning, seafood supply chain innovation, and coastal community adaptation. One of the Center's first activities was hosting the Gulf of Maine 2050 conference to bring together environmental, economic, social, and institutional perspectives on climate resilience in the Gulf of Maine.[24]
- **The Nature Conservancy's (TNC) support of the California Dungeness Crab fishery**. The California Dungeness Crab Fishing Gear Working Group is a collective effort of the California Department of Fish and Wildlife, in partnership with California Ocean Protection Council, the National Marine Fisheries Service, and TNC. Established in 2015, the Working Group brings together stakeholders to reduce the risk of whale entanglements in California. A January 2020 article by Santora et al. found that climate change contributed to an unprecedented marine heatwave in the northeast Pacific from 2014 to 2016.[25] These climatic events led to habitat compression, changes in availability of krill and anchovy, and a shoreward distribution shift of foraging whales. As a result, more whales were entangled with California Dungeness crab fishery gear. The Working Group seeks to reduce the risk of entanglements with crab fishing gear and to provide guidance to the crab fishing industry.[26]

2. Certifications, Ratings, and Improvement Projects

Climate change impacts are placing fisheries at risk of losing certification and ratings standings—and are slowing fisheries' general progress toward sustainability. Climate change is a possible cause of lost Marine Stewardship Council (MSC) certifications for multiple fisheries already.[1]

[1] The North Sea cod fishery lost MSC certification because stocks dropped to biologically unsafe levels in 2019 (Seafood Source, September 2019). Pacific cod from the Gulf of Alaska lost MSC certification due to the region's marine heat wave impact on stock levels (Seafood Source, March 2020).

Incorporating climate science into certifications and ratings standards can elevate climate action for the sustainable seafood movement. Most standard-holding organizations have expressed interest in integrating climate change indicators or requirements into their standards, and some are already starting to do so. Conversations are also underway between EDF and the Seafood Certification and Ratings Collaboration to discuss the future of climate-resilient fisheries and aquaculture guidance in the Collaboration.

In the improvement project landscape, some aquaculture improvement projects (AIPs) are already including climate change in their workplans, while key informants suggested that fishery improvement project (FIP) implementers are generally not incorporating climate mitigation or adaptation into their FIP workplans. Currently, FisheryProgress does not track climate-related activities as "additional impacts" for FIP implementers to highlight, as is currently done for social impact, traceability, IUU fishing, and supply chain roundtables.

CLIMATE ACTION IN AQUACULTURE CERTIFICATIONS, RATINGS, AND IMPROVEMENT PROJECTS

- **AIP Directory highlights climate change in workplans:** Three out of eight AIPs in the AIP Directory incorporate climate change in their workplans:
    1. Bac Lieu Shrimp AIP, run by Asian Seafood Improvement Collaborative (ASIC) and ICAFIS in Bac Lieu, Vietnam
    2. East Java – PT ATINA Sidoarjo Ecoshrimp AIP, run by PT ATINA and ASIC in East Java, Indonesia
    3. South Sulawesi – ASIC Ecoshrimp AIP, run by ASIC and PT ATINA in South Sulawesi, Indonesia
- **The Aquaculture Stewardship Council (ASC) Feed Standard** requires farms to report their energy consumption to ASC, report their greenhouse gas emissions (GHGe) both publicly and to ASC, and to define and implement an energy efficiency plan, working toward increasing the proportion of energy coming from renewable energy sources. For some species, ASC also specifically requires farms to integrate energy use assessments and GHGe accounting into their policies and procedures. Lastly, ASC's work on social auditing helps to monitor impacts on communities, as well as build social resilience to climate change impacts.
- **Conservation International's (CI) climate-smart aquaculture project** in Indonesia is a collaboration among farmers, supply chain companies, governments, investors, communities, and other stakeholders to couple responsible intensification of shrimp farming with restoration to provide biodiversity and community climate adaptation benefits. For more information, see CI's climate-smart shrimp factsheet.[27]
- **Global Aquaculture Alliance's (GAA) Best Aquaculture Practice (BAP) standards** require data collection about energy use that will allow calculation of efficiency indices such as KWH/kg. Additionally, GAA established the Global Aquaculture Innovation Award to encourage and recognize individuals and companies finding new solutions to key challenges facing aquaculture, including climate change.

- **GlobalG.A.P.'s Integrated Farm Assurance Standard** for aquaculture operations includes climate-change-relevant criteria (e.g., energy use), which may be revised and enhanced in an upcoming version update.
- **Monterey Bay Aquarium Seafood Watch's 2020 revision of its Standards for Aquaculture** incorporates more robust factors related to climate change (e.g., carbon footprint of feed). The feed criterion explicitly utilizes a life cycle assessment database that expresses environmental impact through global warming potential (CO_2 equivalents), and scoring is set up to incentivize the use of feed sources with lower global warming potential.

CLIMATE ACTION IN FISHERIES CERTIFICATIONS, RATINGS, AND IMPROVEMENT PROJECTS

- **Fair Trade's 2020 public consultation process for its Capture Fisheries Standard 2.0.0** took place in fall 2020 and included a question on interest in incorporating a climate change indicator into the standard.
- **Monterey Bay Aquarium Seafood Watch's 2020 revision of its Standards for Fisheries** uses more robust factors related to climate change, as noted above. This new standard looks at management in the context of climate change, which is relevant to all species but critical for species that undergo large shifts in productivity as a function of their life history characteristics. Resilient management in this context includes precautionary, efficient, and responsive policies that address climate change uncertainty through consideration of species' life history characteristics.

3. Mitigation Challenges, Opportunities, and Tracking Tools

MITIGATION LIMITATIONS FOR THE SEAFOOD MARKETS SPACE

The ocean is viewed as a solution in the fight against climate change. In particular, five ocean-based climate change action areas could contribute about 21 percent of the needed annual greenhouse gas emissions reductions the world must achieve by 2050.[28] Improving seafood production and shifting diets from terrestrial to marine protein could contribute about 10 percent of all ocean mitigation opportunity, with shifting diets offering the greatest carbon savings. Key informants detailed opportunities for the seafood markets community to reduce greenhouse gas emissions in current approaches and activities. Yet the seafood markets community does not share a common vision as to whether or how it should promote or prioritize these activities. The climate mitigation opportunities listed below reflect ideas identified in interviews with Conservation Alliance organizations and prior CEA research. Some of these activities, while beneficial for climate mitigation, may be difficult for the seafood markets community to adopt, while others also have environmental and/or human well-being rationales and thus may be more easily adopted.

MITIGATION OPPORTUNITIES

Opportunities for the seafood markets landscape could include:

- Eliminate fuel subsidies
- Increase the energy-efficiency standards of fishing vessels
- Improve the energy efficiency of refrigerants on vessels
- Improve the energy efficiency of supply chain operations
- Incentivize less carbon-intensive transportation
- Reduce food waste in seafood supply chains by improving on-vessel handling practices (e.g., ice) and improving the cold chain (e.g., nitrogen packing, freezing equipment)
- Reduce harvesting of the most carbon-intensive species
- Reduce the most carbon-intensive forms of fishing
- Support high seas closed areas

TRACKING TOOLS

The following carbon emissions tracking tools are specifically designed for the seafood markets community:

- **Monterey Bay Aquarium Seafood Carbon Emissions Tool.** This tool provides a platform for business partners, nongovernmental organizations, and scientific advisors to explore opportunities to communicate greenhouse gas emissions associated with products from fisheries and aquaculture. The tool allows users to
    - Explore the relative carbon footprints of wild and farmed seafood,
    - Calculate the emissions associated with transporting seafood, and
    - Compare carbon footprints of seafood with those of terrestrial protein options.

- **Blueyou's Carbon Footprint Project.** This two-year project consists of analyzing 35 seafood origins across aquaculture and fisheries. The primary goal is to publish the assessed seafood's carbon footprints by mid-2021 and have seafood products labeled with their carbon footprint to increase consumer awareness of climate-change-smart options. The project also aims to explore integration of energy efficiency as an additional parameter for future sustainability assessments of aquaculture and fishery operations.

4. Buyer Commitments

Seafood markets organizations that hold major buyer partnerships are generally not engaged in dialogue with these partners on climate mitigation and adaptation opportunities, and seafood sourcing commitments have not incorporated climate change concerns. While there are clearly competing priorities for refreshing and expanding commitments (e.g., social, traceability), feedback was inconsistent about whether major buyers are facing commitment fatigue, and whether introducing climate change as a component of future commitment refreshes

> *"When we start interacting with major seafood companies, the picture is less clear here. We don't want [a buyer] to just say they will buy the fish from a different country after it migrates. It will require a longer dialogue." – Key Informant*

would be feasible and productive. Some NGO buyer partners are concerned that introducing the risk of climate change with a corporate partner, without knowing specific impacts or having recommendations on specific solutions, would be unproductive and not worthwhile.

While key informants encouraged future conversations between NGO partners and buyer partners, many suggested that incorporating climate science into certifications and ratings programs, as discussed above, would be a more realistic path for engaging the seafood buyer community on climate change.

The World Benchmarking Alliance's Seafood Stewardship Index (SSI) is another platform that tracks businesses engagement on climate change in the seafood markets space. SSI benchmarks the 30 most influential companies in the seafood industry. SSI's methodology currently includes a greenhouse gas emissions indicator that measures whether a company has demonstrated that it is reducing its greenhouse gas emissions, through managing its energy consumption and improving its energy efficiency.

5. Precompetitive Collaborations

Understanding how precompetitive collaborations engage on climate change was not a significant focus for this research effort, with only three interviews conducted. The effects of climate change are felt differently across the seafood supply chain, with the mid-supply chain and local producers more acutely impacted. This may lead to varying climate change engagement by precompetitive collaborations in the seafood markets space.

> *"We look at risks to supply, and climate is one of them. Climate will be destabilizing to the vendor and buyer relationships. Farther down the supply chain, their operations are one and the same with the resource." – Key Informant*

At least two precompetitive collaborations have started to incorporate climate change into their approaches and priorities. As the climate challenge is elevated across industry, precompetitive collaborations can serve to educate and promote climate-change-friendly approaches for the seafood sector.

- **SeaBOS's Climate Resilience Task Force.** The task force was influenced by survey responses from SeaBOS members on climate change awareness and current strategies. It will focus on global solutions to the impacts of climate change on sustainable seafood production, as well as the role of seafood production and a healthy ocean in climate mitigation and adaptation. Companies have committed to setting science-based targets for their emissions reductions by October 2021, which will be part of their combined mitigation and adaptation strategy.
- **ClientEarth's Sustainable Seafood Coalition (SSC).** In 2019, SSC members expressed interest in acting on climate change but did not feel equipped to take collective action. ClientEarth intends to assess members' priority concerns and recommend future commitments across key issue areas that may include climate change. ClientEarth will survey SSC members to understand the impacts of climate change on the businesses,

planned and existing mitigation and risk reduction strategies, and reporting requirements for governments or investors.

While not a precompetitive collaboration, the Global Seafood Assurances' Sustainable Oceans Leadership Institute (SOLI) seeks to engage and educate industry leaders on various issues, including climate. SOLI launched in 2019 in partnership with Diversified Communications and the Global Aquaculture Alliance and is supported by the Packard Foundation. SOLI will bring together a network of industry leaders to address oceans issues through education and collaboration, with climate change as the priority topic. The platform will officially begin in 2021.[29]

Recommendations from Key Informants

The threat of climate change to the sustainable seafood movement is unquestionable, including the impact of climate change on people who rely on fisheries and aquaculture for survival. Yet it is uncertain what role the seafood markets movement can play in climate mitigation and adaptation from both strategic and impact perspectives. The limited mitigation potential for the seafood industry makes adaptation approaches more promising, which would likely require changes in strategic prioritization, tradeoffs and capacity shifts across the Conservation Alliance, inclusion of new thought partners with expertise on equitable market approaches, and engagement with new funding partners.

> *"If sustainability for fisheries doesn't include climate in a central way, you're missing the boat. It's like the policies that didn't incorporate social responsibility or traceability, it's the next frontier and even more critical. The good news is, if we get it right now, we won't have to spend a decade trying to re-align everything like has happened with certifications and ratings." – Key Informant*

Despite barriers to strategic engagement on climate change, interviews suggest that the seafood markets community is interested in collaborating, initiating climate-change-related conversations across the Conservation Alliance, and ensuring that their interventions proactively address the impacts of a changing climate on the seafood industry and those who depend on it.

Key informants suggest opportunities for collective action and engagement on climate change by using the expertise that already exists within the Conservation Alliance community. While some of these opportunities remain aspirational, others are already underway, and many are supported through collaborations (informal or formal) with EDF.

The following list of opportunities represents the community's current sense of direction for working at the intersection of climate change as a seafood markets movement.

Actor	Near-term (6-12 months)	Medium-term (1-3 years)	Long-term (3+ years)
NGOs	• Engage in adaptation work in fishing communities to build resilience to climate change shocks and stresses	• Create a Conservation Alliance subgroup to develop climate change recommendations for the community • Incorporate climate science into Certification and Ratings Collaboration standards • Integrate knowledge on best practices and lessons learned across ocean and fisheries climate	• Engage in broader discussions with food-system stakeholders about the climate change benefits and mitigation opportunity of shifting diets to include more wild-capture and farmed seafood

	science communities and the seafood markets community • Continue to engage on eliminating fuel subsidies in the context of climate mitigation, in addition to addressing IUU fishing and human rights abuses • Leverage knowledge from fishers about changes on the water by increasing cross-regional collaboration to inform climate science and adaptation strategies	
Funders	• Support EDF to aggregate climate science, develop recommendations, and partner on implementation with seafood markets organizations	• Engage in broader discussions with food-system stakeholders about the climate change benefits of wild-capture and farmed seafood
Seafood Industry	• Discuss climate change with seafood supply chain/business stakeholders as an extension of the supply chain resiliency discussions currently underway due to COVID-19 • Discuss climate change with seafood supply chain/business stakeholders in the context of human rights and well-being as a potential business rationale	• Engage in broader discussions with food-system stakeholders about the climate change benefits of wild-capture and farmed seafood

Appendices

Appendix A: Methods

In the course of the investigation, CEA asked the following questions to key informants and survey respondents:[30]

- What are the general perspectives on how individual organizations and the broader seafood markets community are thinking about climate change?
- What risk does climate change pose to individual organizations' strategy and to the broader seafood markets community?
- How does climate change compare to other priorities in the seafood markets space? What is its impact on current and future work?
- What mitigation or adaptation efforts are individual organizations pursuing, either directly or indirectly? Can specific examples of activities be provided?
- Which organizations are partnering with one another to address climate change?
- What opportunities exist at the intersection of climate change and fisheries for individual organizations and the seafood markets community more broadly?
- What are the funding opportunities for climate-change-related activities in this space?
- Corporate partnerships: For organizations that have industry partners, are conversations and/or activities with these partners underway to incorporate climate change? What have these conversations looked like?
- Certification organizations: How is climate change being incorporated into certifications and ratings?
- FIP implementers: How do FIP implementers see climate change impacting progress, and what are the opportunities to adapt fisheries management plans?

Appendix B: List of Participating Organizations

CEA interviewed representatives of the following organizations:

- Blueyou
- Canadian Parks and Wilderness Society British Columbia Chapter
- Comunidad y Biodiversidad
- Conservation International
- Environmental Defense Fund
- Environmental Justice Foundation
- Fair Trade USA
- FishChoice
- FishWise
- Future of Fish
- Gulf of Maine Research Institute
- Marine Stewardship Council
- Natural Resources Defense Council
- Ocean Nexus
- Sea Pact
- SeaBOS
- Sustainable Oceans Leadership Institute
- Sustainable Fisheries Partnership
- The Nature Conservancy
- World Wildlife Fund - US

CEA received Google Form survey responses from the following organizations:

- Aquaculture Stewardship Council
- ClientEarth
- David Suzuki Foundation
- Ecology Action Centre
- Global Aquaculture Alliance
- GlobalG.A.P.
- Living Oceans Society
- Monterey Bay Aquarium Seafood Watch
- New England Aquarium
- Seafood Legacy
- Shedd Aquarium
- SmartFish AC
- Virginia Aquarium & Marine Science Center
- World Benchmarking Alliance

[1] Michelin et al., "Opportunities for Ocean-Climate Action in the United States," CEA Consulting, www.oursharedseas.com/oceanclimateaction.

2 Gaines et al., "Improved fisheries management could offset many negative effects of climate change," Science Advances vol. 4 no. 8, August 2018, DOI: 10.1126/sciadv.aao1378. CEA personal conversations with Conservation Alliance members, September 2020.

3 Free et al., "Realistic fisheries management reforms could mitigate the impacts of climate change in most countries," PLOS One, March 2020, https://doi.org/10.1371/journal.pone.0224347.

4 Free et al., "Impacts of historical warming on marine fisheries production," Science 363, no. 6430 (March 1, 2019): 979-983. DOI: 10.1126/science.aau1758.

5 Ibid.

6 Ibid.

7 Gaines et al., "The Expected Impacts of Climate Change on the Ocean Economy," World Resources Institute, 2019, https://www.oceanpanel.org/sites/default/files/2019-12/expected-impacts-climate-change-on-the-ocean-economy.pdf.

8 Pinsky et al., "Preparing Ocean Governance for Species on the Move." Science 360, no. 6394 (June 15, 2018): 1189–91. https://doi.org/10.1126/science.aat2360.

9 Ibid.

10 Science Daily, "Impact of climate change on tropical fisheries would create ripples across the world," University of British Columbia, August 6, 2020, https://www.sciencedaily.com/releases/2020/08/200806101751.htm.

11 Ibid.

12 Nazrul Islam and John Winkel, "Climate Change and Social Inequality," United Nations Department of Economic and Social Affairs, (October 17, 2017) DESA Working Paper No. 152.

13 Taylor et al., "Measurement and implications of marine food security in the Western Indian Ocean: an impending crisis?" Food Sec. 11, 1395–1415 (2019), https://doi.org/10.1007/s12571-019-00971-6.

14 Cisneros-Montemayor et al., "A Global Estimate of Seafood Consumption by Coastal Indigenous Peoples. PLOS ONE 11(12): e0166681, 2016, https://doi.org/10.1371/journal.pone.0166681. https://theconversation.com/for-indigenous-communities-fish-mean-much-more-than-food-70129.

15 FAO, "The Global Contribution of Capture Fisheries," May 2012, http://documents1.worldbank.org/curated/en/515701468152718292/pdf/664690ESW0P1210120HiddenHarvest0web.pdf.

16 Harper et al., "Women and fisheries: Contribution to food security and local economies," Marine Policy vol. 39, May 2013 p.56-63, https://doi.org/10.1016/j.marpol.2012.10.018.

17 Garcia, Serge M., and Andrew A. Rosenberg, "Food security and marine capture fisheries: characteristics, trends, drivers and future perspectives," Philosophical transactions of the Royal Society of London, Series B, Biological sciences vol. 365,1554 (2010): 2869-80. doi:10.1098/rstb.2010.0171.
18 OurSharedSeas, "Threats: Climate Change," accessed December 2020, https://oursharedseas.com/threats/threats-climate-change/.
19 Michelin et al., "Opportunities for Ocean-Climate Action in the United States," CEA Consulting, www.oursharedseas.com/oceanclimateaction.
20 Ibid.
21 Ibid.
22 Ibid.
23 Ocean Climate Action, "Why the Ocean Is Important in Climate Action," accessed December 2020, https://www.oceanclimateaction.org/.
24 Gulf of Maine Research Institute, "Strategic Initiatives Action Area: Climate Center," accessed December 2020, https://www.gmri.org/commitments/strategic-initiatives/climate-center/.
25 Santora et al., "Habitat compression and ecosystem shifts as potential links between marine heatwave and record whale entanglements," Nature Communications, 2020; 11 (1) doi: 10.1038/s41467-019-14215-w.
26 Xia, Rosanna, "What's tangling up the humpback whales? A food chain snarled by climate change," Los Angeles Times, 2020. Paige Berube, West Coast Entanglement Science Workshop, Ocean Protection Council, 2020. Berube, Paige. California Dungeness Crab Fishing Gear Working Group. Ocean Protection Council, 2020.
27 Conservation International, "Climate Smart Shrimp," accessed December 2020, https://www.conservation.org/docs/default-source/publication-pdfs/climatesmartshrimp_fact_sheet_200309.pdf?sfvrsn=30cea3b4_2.
28 Hoegh-Guldberg et al., "The Ocean as a Solution for Climate Change: Five Opportunities for Action," World Resources Institute, www.oceanpanel.org/climate.
29 Cliff White, "Global Seafood Assurances Launching the Sustainable Oceans Leadership Institute," SeafoodSource, 2019.
30 Of the 44 organizations contacted, 42 were affiliated with the Conservation Alliance. The two organizations outside the Conservation Alliance, Oceans Nexus and SeaBOS, were interviewed because of their unique role within the seafood markets space and connection to the Conservation Alliance. The perspectives included in this supplement are quite representative of the Conservation Alliance. However, only a couple of organizations spoke about human well-being implications, presenting an opportunity for future research at the intersection of human well-being, climate, and fisheries.