

# THE OUTLAW OCEAN REPORT

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## Illegal, Unreported and Unregulated (IUU) Fishing

Stanford Center for Ocean Solutions and the Stanford Law School Law & Policy Lab

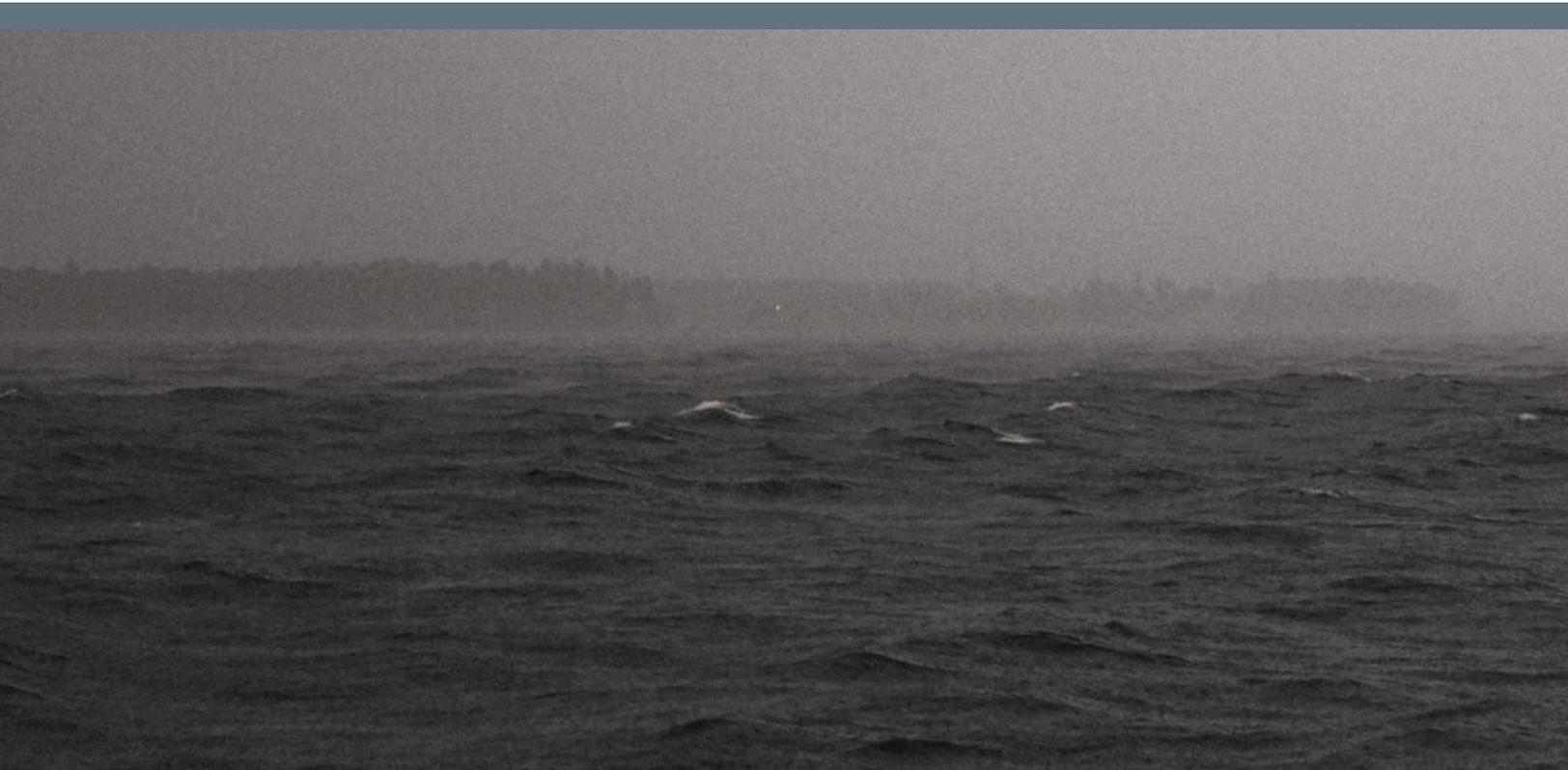


# I. Developing an IUU Risk Assessment Tool: Enabling Seafood Companies to Assess Risk in their Supply Chains

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## Abstract

IUU fishing is a pervasive and persistent problem that is difficult to regulate on a global scale. In the seafood sector, the combination of out-of-sight fishing for highly perishable and wild resources, paper-thin profit margins, and a lack of end-to-end traceability creates conditions where sourcing IUU products occurs regularly, and often with impunity. Seafood supply chains of major public-facing companies are a promising pressure point to target IUU fishing. However, there is currently no simple way to address IUU fishing in the seafood supply chain. The research team partnered with Global Fishing Watch, whose efforts in tracking vessels and identifying likely transshipment behavior allow fine scale investigation into what were previously unidentifiable sources of IUU fishing activity. Over the course of the quarter, the team worked directly with companies to develop the framework for a tool that would illuminate IUU risk and enable them to address IUU fishing within their supply chain. The team identified ten indicators for risk of IUU products through desk research and interviews with key stakeholder and IUU fishing experts. The IUU risk assessment tool will use public and private data to generate risk scores based on how much information companies have about their own supply chains. Areas of high risk flagged by the tool will be accompanied by a Solutions Portfolio. Recognizing that companies have different thresholds of risk aversion and strategies to mitigate it, the tool will offer a suite of practical solutions.



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## A. Introduction

In the seafood industry, a combination of out-of-sight fishing for highly perishable and wild resources, paper-thin profit margins, and a lack of end-to-end traceability creates conditions where illegal, unreported, and unregulated (IUU) fishing occurs regularly, often with impunity. Current structure and accepted practices within the seafood supply chain combine sustainably harvested and IUU products in the marketplace. Seafood supply chains can perpetuate poor fisheries management through lack of transparency and perverse incentives, wherein profits far outweigh fishing and labor compliance in the international fishing market, encouraging unsustainable fishing practices. This report outlines a proposal for a tool to identify IUU risk in a company's supply chain. A tool that illuminates IUU risk and enables companies to address IUU fishing will help companies manage reputational risk, enhance regulatory compliance, and ensure long-term sustainability of an important global food resource.

Although governments and international agreements condemn IUU fishing, global efforts to stop IUU fishing are difficult and slow-moving. Major public-facing companies that buy seafood, such as retailers and processors, are an untapped pressure point to target IUU fishing. But those companies need a simple way to assess IUU fishing in their supply chains. To meet this need, we conducted desk research, stakeholder interviews, and data compilation to develop key indicators that could be used to identify risk of IUU products. Tuna supply chains, for both canned and fresh products, have heavily invested in traceability and transparency efforts. This has generated detailed information on their supply chains that can be used to assess risk of IUU activities. Given that these supply chains have the most data and in order to most extensively reveal the usefulness of our approach, the tool will be initially developed for tuna supply chains.

Our research identified 10 indicators of IUU fishing, which are ordered by how deep companies have gone in their traceability efforts. Risk can broadly be assessed by considering (1) stock assessments and (2) whether fishing was conducted in a generally high-risk area for IUU. On a more specific regional and country level, risk can be assessed by the (3) strength of the regulatory authority and (4) use of ports of convenience. If a buyer can identify the vessel, then a more detailed picture of risk can be provided from (5) complexity of ownership (e.g., use of shell companies or joint ventures to obscure true ownership), (6) use of flags of convenience, and (7) vessel history of illegal activity. For many of these vessels, information from Global Fishing Watch (GFW) and similar partners can help with (8) tracking vessels and (9) characterizing transshipment behavior that could be related to IUU fishing activity. Finally, (10) general transparency in the supply chain is a valuable indicator since risk assessments become less accurate when there is little insight into the supply chain. The proposed IUU risk assessment tool will use a variety of data sources to generate risk scores. After company information is entered through a series of questions, the tool will calculate risk scores for relevant IUU indicators. These scores will spotlight areas of high and low risk within a company's supply chain.

We worked with company users in mind to develop a tool with an efficient data-tiering architecture. Outstanding questions include addressing inconsistencies with data source update intervals, finalizing data sources, standardizing risk scoring, and quantifying data reliability. We outline immediate next steps for the development of this framework as a workshop with future tool users. The implementation of this tool carries substantial potential to reduce the risk of

companies selling IUU products, offers a novel platform to holistically assess risk of IUU products entering the supply chain, and provides implementable solutions to mitigate the issue.

## B. Background

The paths that move wild-caught seafood from the ocean to dinner tables worldwide often are cryptic and convoluted. Examination of these paths reveals that overfished stocks, lack of management and enforcement measures, and economic incentives contribute to IUU fishing on a global scale. The industrialization of fishing in the mid-twentieth century made offshore waters increasingly accessible and the associated fish stocks more easily exploitable, resulting in multinational disputes over territorial claims and fishing rights.<sup>1</sup> Marine fish—in particular commercially targeted migratory species—not only cross international boundaries that subject them to exploitation by multiple nations, but also move between sovereign states' exclusive economic zones (EEZs) and the high seas that are beyond national jurisdiction. The management of these fisheries is a logistical challenge, made more difficult by the unreliable enforcement of regulations.

IUU fishing is a global occurrence<sup>2</sup> found in supply chains sourcing from the high seas and state-regulated areas.<sup>3</sup> Overall weak governance contributes to the existence of flags and ports of convenience, transshipment, lack of regulatory authority, and other negative elements of IUU fishing. The poor collective fisheries management can lead to “invisibility” on the high seas.<sup>4</sup> IUU fishing contributes to and hampers the recovery of overexploited marine fish populations, which is estimated to result in global losses of approximately \$US20 billion a year, or one out of every five wild-caught fish.<sup>5, 6</sup> This is not just a conservation concern—organized IUU fishing is typically found alongside other illegal activities (such as human, weapons, and drug trafficking, forced labor, and money laundering) that disproportionately affect losses in revenue and food security in different regions.<sup>7, 8, 9</sup> Additionally, the combination of environmental and socioeconomic factors indicates that the presence of overfishing itself results in a higher likelihood of exploiting cheap or forced labor, because of the need for increased effort to sustain current catch levels.<sup>10</sup>

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- 1 Carmel Finley, “The Industrialization of Commercial Fishing, 1930–2016,” in *Oxford Research Encyclopedia of Environmental Science* (2016).
  - 2 U. Rashid Sumaila, et al., “Winners and Losers in a World where the High Seas Is Closed to Fishing,” *Scientific Reports* 5 (2015): 8481.
  - 3 Southeast Asian Fisheries Development Center, *SEAFDEC Annual Report 2015* (Bangkok, 2016).
  - 4 Anastasia Telesetsky, “Scuttling IUU Fishing and Rewarding Sustainable Fishing: Enhancing the Effectiveness of the Port State Measures Agreement with Trade-Related Measures,” *Seattle University Law Review* 38 (2014): 1237.
  - 5 David J. Agnew, et al., “Estimating the Worldwide Extent of Illegal Fishing,” *PLOS One* 4, no. 2 (2009): e4570.
  - 6 U. R. Sumaila, et al., “Illicit Trade in Marine Fish Catch and Its Effects on Ecosystems and People Worldwide,” *Science Advances* 6, no. 9 (2020): eaaz3801.
  - 7 U. Rashid Sumaila and Mahamudu Bawumia, “Fisheries, Ecosystem Justice and Piracy: A Case Study of Somalia,” *Fisheries Research* 157 (2014): 154–63.
  - 8 *Supra*, note 4.
  - 9 Food and Agriculture Organization of the United Nations, *State of World Fisheries and Aquaculture* (Rome, 2016), accessed November 2, 2020, <http://www.fao.org/fishery/sofia/en>.
  - 10 Elizabeth Selig, personal communication, October 22, 2020.

### Box. 1 Definition of IUU Fishing

IUU fishing encompasses three types of detrimental fishing behavior. The first, illegal fishing, includes fishing behavior violating relevant international, regional, and national laws and regulations.<sup>11,12</sup> The second, unreported fishing, refers to misreporting or failing to report required aspects of fishing activity to national and regional authorities.<sup>13,14</sup> The final practice, unregulated fishing, encompasses fishing in areas or on fish stocks without protections consistent with international law. Additionally, unregulated fishing includes vessels fishing in a manner inconsistent with the relevant regional fisheries management organization’s conservation or management measures, especially if the vessel has no nationality or the nationality of a state that is not a member of the regional fisheries management organization overseeing the area in which the vessel is fishing.<sup>15,16</sup>

## 1. IUU Fishing Indicators

Areas of IUU risk in seafood supply chains have been identified by multiple sources.<sup>17,18,19</sup> From these sources, we compiled a list of ten IUU fishing indicators that could be used in our tool (Table 1). We organized indicators in order of the likelihood that a company has data on the indicator.

We investigated potential data sources that could be used as metrics for each risk indicator. Because risk indicators are multidimensional, there is often more than one metric for a given indicator. For instance, measuring risk at a port entails an international component—if the country has ratified the Port State Measures Agreement (the PSMA); a regional component—the Regional Fisheries Management Organization (RFMO) standing; and a local component—the port risk rating. While proprietary sources need to be investigated further, we were able to find potential public data sources for all the risk indicators, which we provide in a table in Appendix C. This table was further refined to the most relevant sources in the outline of the tool presented under the “User Inputs and Outputs” section.

11 “Understanding Illegal, Unreported, and Unregulated Fishing,” NOAA Fisheries, accessed November 18, 2020, available <https://www.fisheries.noaa.gov/insight/understanding-illegal-unreported-and-unregulated-fishing>.

12 “What Is IUU Fishing,” IUU Watch, accessed November 18, 2020, <http://www.iuuwatch.eu/what-is-iuu-fishing>.

13 *Supra*, note 11.

14 *Supra*, note 12.

15 *Supra*, note 11.

16 *Supra*, note 12.

17 IUU Task Force, *Action Plan for Implementing the Task Force Recommendations (Presidential Task Force on Combating IUU Fishing and Seafood Fraud, 2015)*, accessed November 2, 2016, <https://www.federalregister.gov/documents/2015/10/30/2015-27780/presidential-task-force-on-combating-illegal-unreported-and-unregulated-iuu-fishing-and-seafood>.

18 IUU Fishing Index, *Methodology for IUU Fishing Index (2018)*, accessed October 28, 2020, <http://iuufishingindex.net/methodology.pdf>.

19 C4ADS, *Strings Attached: Exploring the Onshore Networks behind Illegal, Unreported, & Unregulated Fishing (2019)*, accessed November 6, 2020, <https://static1.squarespace.com/static/566ef8b4d8af107232d5358a/t/5d7022301845f300016ee532/1567629912450/Strings+Attached.pdf>.

**Table 1. IUU Fishing Indicators**

Risk Indicator	Definition
Species Risk	The stock status and overall risk of IUU
Fishing in High-Risk Regions	Regions that have IUU offenses or transshipment activity
Regulatory Authority	The power of governance in the region fished
Ports of Convenience	If a port with weaker regulatory oversight was used to land fish
Complexity of Vessel Ownership	The structure of corporate ownership for a vessel, use of shell companies, joint ventures, and use of secrecy jurisdictions that serve as tax havens
Vessel History and Status	If a vessel has an International Maritime Organization (IMO) number, <sup>20</sup> history and current status on IUU lists, International Seafood Sustainability Foundation (ISSF) vessel list standings, changing vessel identifiers
Flags of Convenience	Flag hopping, flying multiple or no flags at all; accountability of flag state
Vessel Track	Vessel behavior, such as disabling automatic identification system (AIS) <sup>21</sup> transmissions (“going dark”)
Transshipment	Meeting with other vessels to transfer catch and supplies
Supply Chain Transparency	Which tier (country, port, vessel, etc.) a seafood product can be traced back to in the supply chain

## 2. Efforts to Monitor and Control IUU Fishing

Identifying and acting upon illegal fishing activity is extremely challenging; however, recent efforts driven by governments, seafood buyers, and conservation groups have resulted in progress made in combating elements of IUU fishing.

### 2.1. IUU Vessel Lists

Given the global scope, the current commonly used method to identify sources of IUU activity is through IUU fishing vessel lists provided by the Regional Fisheries Management Organizations (RFMOs) and curated by Trygg Mat Tracking, which provide updated information on changes to vessel identity, flag state, ownership, and location for all vessels that have been associated with IUU fishing.

<sup>20</sup> International Maritime Organization (IMO) numbers are used as unique identifiers for ships. These numbers are used to prevent maritime fraud.

<sup>21</sup> Automatic Identification Systems (AIS) is a transponder system using both satellite and VHF-radio bands for two-way communication. AIS data aid enforcement of international maritime law by allowing authorities to track and monitor vessel movement.

## 2.2. Global Fishing Watch

The advancement of technology and data accessibility has allowed organizations such as Global Fishing Watch (GFW) to provide innovative solutions for identifying components of IUU fishing. The accessibility of GFW's data allows for increased resolution in tracking suspicious activity of vessels in regions where historically it has been nearly impossible to monitor and enforce regulations. With data from 2012 to present near-real time, GFW uses automatic identification systems (AIS) from more than 70,000 industrial fishing vessels, comprising roughly 50 to 75 percent of all vessels greater than 24 m.<sup>22</sup> This includes the majority of the fishing efforts in the high seas, with a particular focus on the open ocean. GFW's data and algorithms can identify when vessels are fishing in protected areas or in regions where they are not authorized to fish. GFW can also determine when vessels turn off their AIS, when they change their assigned identification number or manipulate their GPS location, and when they are likely transshipping. These continually improving algorithms can estimate vessel size, gear type, and set patterns, even to the point of determining fishing and searching behavior. The applications of these data can extend from identifying illegal fishing activity, to studying fisheries, to evaluating species-specific distribution with overlap of fishing effort.<sup>23</sup>

GFW currently has three ways of identifying fishing vessels: from self-reported AIS devices, from vessel registries, and through inference by algorithms. Their platform has downloadable data on daily fishing effort, complete with gear type and flag state, to 0.01-degree resolution. Identifying incidences of transshipment is not as clear, because vessels can meet at sea for multiple reasons. Before GFW's efforts and their analysis of transshipment,<sup>24</sup> it was nearly impossible to detect when and where vessels might be transshipping. Transshipment activity is often illegal, because it allows the previously invisible transfer of potentially illegitimate catch (and thus mixing with legal catch), as well as instances of smuggling and forced labor abuses that are associated with allowing vessels to remain at sea for an extended period of time. GFW's algorithms identify loitering events and potential transshipments based on vessel behavior.

Specifically intended to combat IUU fishing, Global Fishing Watch data improve insight on illegal behavior to the vessel level and the exact location inferred from satellite data. This insight allows finer-scale localization of illegal activity, allowing for increased, real-time, and high-certainty information on seafood supply chains.

IUU fishing contributes to and hampers the recovery of overexploited marine fish populations, which is estimated to result in global losses of approximately \$US20 billion a year, or one out of every five wild-caught fish.



22 D. A. Kroodsma, N. A. Miller, and A. Roan, *The Global View of Transshipment: Revised Preliminary Findings (Global Fishing Watch and Sky-Truth, July 2017)*, [https://globalfishingwatch.org/wp-content/uploads/GlobalViewOfTransshipment\\_Aug2017.pdf](https://globalfishingwatch.org/wp-content/uploads/GlobalViewOfTransshipment_Aug2017.pdf).

23 Timothy D. White, et al. "Predicted Hotspots of Overlap between Highly Migratory Fishes and Industrial Fishing Fleets in the Northeast Pacific," *Science Advances* 5, no. 3 (2019): eaau3761.

24 *Supra*, note 22.

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### 2.3. The Port State Measures Agreement

The PSMA aims to prevent IUU fishing operations from landing their catch by requiring states to enact strict regulations for vessel entrance to ports.<sup>25</sup> The PSMA entered into force in June 2016; today, there are 72 signatories. As outlined by the agreement, each party is responsible for designating ports permitted for access and for requiring advanced notification and vessel information for any incoming foreign-flagged vessels.

The PSMA operates on the assumption that all catch, whether legitimate or not, must be offloaded at a port where it will subsequently be processed and sold. The PSMA provides that signatories can refuse port access to foreign vessels engaged in IUU fishing and mandates that if such vessels are allowed entry, they must be thoroughly inspected and subjected to any necessary law-enforcement action. This is a cost-effective measure to prevent landing of IUU catch and places responsibility on the port state.

### 2.4. Third-Party Certifications

Third-party certification efforts, such as the Marine Stewardship Council (MSC), provide for independent assessment of sustainability in fisheries based on stock status, management, and environmental impact. Their certification process focuses primarily on environmental sustainability and incorporates efforts to address IUU fishing, as it is a direct threat to overfishing. MSC uses a “chain of custody” standard to track seafood products from a certified fishery to the market, guaranteeing traceability and compliance along the supply chain. Other organizations, such as Fair Trade, certify supply chains based on the social impact of fishing. Presently, only nine seafood supply chains meet the standards for Fair Trade Certification.

### 2.5. Traceability in Seafood Supply Chains

Because complex seafood supply chains allow many opportunities for IUU activity to occur, traceability is the first step many companies take in allowing identification and prevention of IUU fishing. In the past decade, combined efforts from industry trade groups, seafood retailers and suppliers, and nonprofit initiatives have led the charge in implementing traceability initiatives in seafood supply chains.<sup>26</sup> Traceability efforts are often the first step in mitigating IUU risk but are only one part of a comprehensive IUU risk strategy. Traceability efforts stemmed from goals to improve environmental sustainability and are expanding to combat IUU fishing. The Global Dialogue on Seafood Traceability (GDST), launched in 2017, developed global standards for traceability that are endorsed by more than 60 companies and organizations. Initially established by the World Wildlife Fund (WWF) and the Institute of Food Technologists’ Global Food Traceability Centre, the GDST conducted a series of working groups to continually develop relevant solutions related to identifying key data elements, improving data verification and sharing, and forming regulatory alignment among stakeholders.

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25 “Agreement on Port State Measures (PSMA),” Food and Agriculture Organization of the United Nations, <http://www.fao.org/port-state-measures/en>.

26 Sara G. Lewis and Mariah Boyle, “The Expanding Role of Traceability in Seafood: Tools and Key Initiatives,” *Journal of Food Science* 82, no. S1 (2017): A13-A21.

Traceability initiatives are also shifting from voluntary to required actions for some governments, such as regulations mandated by the European Union Catch Documentation Scheme<sup>27</sup> and the United States Seafood Import Monitoring Program.<sup>28</sup>

Other voluntary catch documentation schemes (CDS) are multilateral and created specifically for combating IUU fishing. For example, the International Seafood Sustainability Foundation (ISSF) and its International Seafood Sustainability Association (ISSA) developed the gold standard for verifiable compliance with science-based practices in cooperating tuna supply chains. Participating companies undergo periodic published audits by MRAG, a third party that assesses compliance with conservation measures that apply to all member companies and associated vessels. These efforts result in a tuna supply chain that is widely traceable, allowing for instances of IUU fishing to be identified and pinpointed to a specific stage in the supply chain.

In 2017, 66 companies signed the World Economic Forum's Tuna 2020 Traceability Declaration (TTD), with a goal to end overfishing and IUU fishing in tuna fisheries.<sup>29</sup> As of 2020, there has been substantial progress on meeting traceability commitments, though there is still room for improvement on establishing governmental partnerships and monitoring on the high seas, as compared to on-land regulations and enforcement.<sup>30</sup> Member companies of ISSF contributed most substantially to these efforts as part of the expected traceability conservation measures.

On a finer scale, individual companies have developed their own measures to make their products fully traceable throughout their supply chains. Kwik'pak Fisheries, founded and maintained by native people of the Yupik Nation, runs small and sustainable operations for Yukon Salmon. Not only did they pioneer consumer-facing traceability in their supply chains, but also they were the first seafood company to earn recognition from the Fair Trade Federation for labor and compensation practices. Bumble Bee Seafood is one example of how companies have tackled traceability.<sup>31</sup> A founding member of ISSF, Bumble Bee established traceability opportunities for tuna, salmon, and sardines through their own digitized platform, Trace My Catch. Consumers can scan their can and identify the species composition, fishery location and stock status, fishing method, vessel information, processing center, and cannery.

## 2.6. The Tuna Sector

The tuna sector has extremely high socioeconomic importance and has gained much attention from organizations and conservation groups worldwide. Combined, all tuna and tuna-like species comprise the largest capture fishery globally by volume, estimated to be around 7.9 million metric tons in 2018, with an estimated \$US12.2 billion in landed value.<sup>32</sup> By species, skipjack

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27 G. Hosch and F. Blaha. *Seafood Traceability for Fisheries Compliance: Country-Level Support for Catch Documentation Schemes* (FAO Fisheries and Aquaculture Technical Paper, eng no. 619, 2017).

28 Juan He, "From Country-of-Origin Labelling (COOL) to Seafood Import Monitoring Program (SIMP): How Far Can Seafood Traceability Rules Go?" *Marine Policy* 96 (2018): 163-74.

29 "Tuna 2020 Traceability Declaration," World Economic Forum, Accessed November 1, 2020, <https://oceanconference.un.org/commitments/?id=14427#:~:text=Traceability%20if%20the%20tuna%20is,to%20improve%20supply%20chain%20traceability>.

30 Tom Pickerell, *Tuna 2020 Traceability Declaration Progress Report* (Global Tuna Alliance, March 2020), <https://www.globaltunaalliance.com/wp-content/uploads/2020/03/TTD-Progress-Report-March-2020.pdf>.

31 Fishwise, *Advancing Traceability in the Seafood Industry: Assessing Challenges and Opportunities* (2018), 25.

32 Food and Agriculture Organization of the United Nations, *The State of World Fisheries and Aquaculture 2020: Sustainability in Action* (2020).

tuna (*Katsuwonus pelamis*) ranks third by volume in global fisheries, behind anchoveta (*Engraulis ringens*) and Alaska pollock (*Theragra chalcogramma*). Tuna are top predators with a global distribution, and the industrialization of commercial fisheries, paired with the increased demand for canned and fresh seafood, has allowed for the overexploitation of what historically seemed to be limitless abundance. With more than 70 countries reporting landings, effectively managing these species, whose ranges span multinational jurisdictions, has long been a challenge.

Currently, management is handled through five tuna RFMOs, described in detail below. The species of significant market importance include albacore (*Thunnus alalunga*), Atlantic bluefin (*T. thynnus*), Pacific bluefin (*T. orientalis*), southern bluefin (*T. maccoyii*), bigeye (*T. obesus*), yellowfin (*T. albacares*), and skipjack (*Katsuwonus pelamis*).

**Table 2. Status of Major Tuna Species**

Species	Overfished <sup>33</sup> (Current Stock Biomass)	Overfishing <sup>34</sup> (Fishing Effort)	IUCN Red List Status
Albacore	Not overfished	Within appropriate levels of fishing effort	Near Threatened
Atlantic Bluefin	Overfished	Within appropriate levels of fishing effort	Endangered
Pacific Bluefin	Overfished	Exceeding appropriate levels of fishing effort	Vulnerable
Southern Bluefin	Severely overfished	Within appropriate levels of fishing effort	Critically Endangered
Bigeye	Overfished	Regional variation; exceeding in some regions and within appropriate levels of fishing effort elsewhere	Vulnerable
Yellowfin	Close to fully fished or overfished	Regional variation; overfishing likely in eastern Pacific, Indian, and Atlantic Oceans	Near Threatened
Skipjack	Not overfished	Within appropriate levels of fishing effort	Least Concern

33 Overfished: A stock having a population size that is too low and that jeopardizes the stock's ability to produce its maximum sustainable yield (MSY); MSY: The largest long-term average catch that can be taken from a stock under prevailing environmental and fishery conditions. Fisheries, See NOAA, *Status of Stocks 2019: Annual Report to Congress on the Status of US Fisheries* (2019).

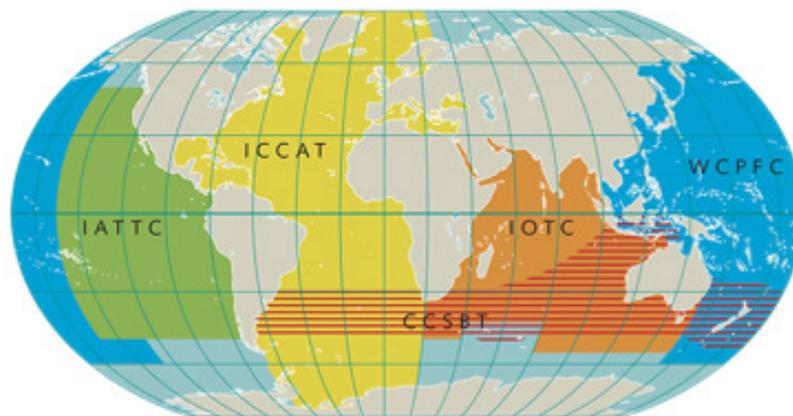
34 Overfishing: A stock having a harvest rate higher than the rate that produces its MSY. Ibid. Note: These are global generalizations and not representative of region-specific status and management.

Table 2 outlines the general stock status and International Union of Conservation of Nature's (IUCN) Red List Status, with the caveat that stock status varies greatly by region, year, and the methods used to conduct the stock assessment. Tuna are typically commercially targeted by purse seining, longlining, drift-netting, hook-and-lining, and trolling. Tuna are also highly susceptible to exploitation because of schooling behavior, attraction to floating objects (such as fish aggregating devices, or FADs), and spawning aggregations that generally occur at the same time and place year after year. As juveniles and adults, their range extends drastically, and tuna conduct large basin-scale migrations that span multiple national jurisdictions and are often a target of offshore and high-seas fisheries, requiring management by many different countries.

## 2.7. Regional Fisheries Management Organizations

Spanning multiple national jurisdictions and the high seas, global tuna fisheries are managed by five separate RFMOs (Figure 1). These organizations establish management quotas and conservation plans for stocks of a particular region. The five tuna RFMOs manage fisheries for tuna and other highly migratory species in more than 90 percent of the world's oceans.

**Figure 1. Major Tuna RFMOs** <sup>35</sup>



The five RFMO regions are Commission for the Conservation of Southern Bluefin Tuna (CCSBT), Inter-American Tropical Tuna Commission (IATTC), International Commission for the Conservation of Atlantic Tunas (ICCAT), Indian Ocean Tuna Commission (IOTC), and Western and Central Pacific Fisheries Commission (WCPFC) (Table 3). RFMOs are generally expected to fund and carry out stock assessments and set the total allowable catch based on the best available science. Each RFMO operates differently, conducting assessments and distributing catch levels in different manners. Thus, RFMOs have varying success in regulating overfishing and IUU fishing, given the uncertainty and variability in stock status, the general difficulties associated with management and catch allocation, as well as the financial and competing interests of their stakeholders.

<sup>35</sup> "RFMOs," IPNLF, <http://ipnlf.org/what-we-do/projects/rfmos>.

**Table 3. RFMO Jurisdictions**

Tuna RFMO	Species	Region
WCPFC	Pacific Bluefin	Pacific
WCPFC	Yellowfin	Western & Central Pacific
WCPFC	Albacore	North Pacific
WCPFC	Albacore	South Pacific
WCPFC	Bigeye	Western & Central Pacific
WCPFC	Skipjack	Western & Central Pacific
IATTC	Pacific Bluefin, Yellowfin, Bigeye, Skipjack, Mahi	Eastern Pacific
IOTC	Albacore	Indian Ocean
IOTC	Bigeye	Indian Ocean
IOTC	Skipjack	Indian Ocean
IOTC	Yellowfin	Indian Ocean
CCSBT	Southern Bluefin	Southern Hemisphere; 30-50°S
ICCAT	Atlantic Bluefin	Atlantic Ocean
ICCAT	Yellowfin	Atlantic Ocean
ICCAT	Bigeye	Atlantic Ocean
ICCAT	Skipjack	Atlantic Ocean
ICCAT	Albacore	Atlantic Ocean
ICCAT	Small Tuna	Atlantic Ocean

RFMOs are actively involved in reducing IUU fishing. For example, efforts to combat IUU in tuna, such as electronic catch documentation schemes, have reduced IUU fishing in Atlantic bluefin tuna.<sup>36</sup> ISSF works closely with and supports tuna RFMOs, periodically and thoroughly evaluating their efforts for conservation and management.<sup>37</sup>

### 3. Why Tuna

As a result of the work of the Global Tuna Alliance (GTA), ISSF, and individual companies, such as Bumble Bee Seafoods, there is high traceability in the tuna sector.<sup>38,39,40</sup> This level of

36 International Commission for the Conservation of Atlantic Tunas, *Report of the Standing Committee on Research and Statistics (SCRS)* (2019).

37 "Audit Process," International Seafood Sustainability Foundation, accessed October 28, 2020, <https://iss-foundation.org/what-we-do/verification/audit-process>.

38 "Traceability," International Seafood Sustainability Foundation, <https://iss-foundation.org/tag/traceability>.

39 "Dive into the Story of Your Seafood (2016)," Bumble Bee Seafoods, accessed November 2, 2020, <https://www.bumblebee.com/tracemy-catch/>.

40 *Supra*, note 29.

traceability can be fully utilized as part of the development of a risk assessment tool for IUU fishing. Additionally, our research took place in a network of collaboration between GFW, GTA, and ISSF, providing us deep insight into the tuna industry. The combination of resources in seafood traceability and monitoring allows for an unprecedented opportunity to investigate IUU risk and evaluate the feasibility of creating a risk assessment tool. If an IUU risk assessment tool cannot be successfully implemented for tuna, it is unlikely that such an effort can be later expanded to other fisheries.

## 4. The Problem

There is a need to present a synoptic view and enable a seamless integrated use of the many available data sources that address diverse aspects of IUU fishing in seafood supply chains. Many seafood companies claim their dedication to sustainability but lack methods for reducing risk in their supply chain.<sup>41</sup> Combining data sources related to IUU fishing risk into one tool will give seafood companies, especially in the highly traceable tuna sector, a feasible and comprehensive way to understand risks in their supply chains and use this information to make changes to reduce these risks. This report evaluates the potential of an IUU fishing-risk assessment tool for the tuna sector and outlines a prototype. The end goal of this tool is for seafood companies to assess and address risks of IUU fishing in seafood supply chains using public, company-owned, and possibly proprietary data.

## 5. Existing Risk Assessment Tools

Companies vary in their current methods of IUU risk assessment, from manual internal checks to contracting out risk assessments. For example, Kingfisher is a frozen seafood, canned food, and canning company and a member of Maruha Nichiro Group, one of the largest seafood suppliers in the world. Kingfisher's current assessment of IUU risk comes solely from each raw material's Marine Catch Purchasing Document (MCPD), which stipulates that port owners and fish buyers document seafood transactions.<sup>42</sup> Another example is ISSA, which requires companies to meet 27 conservation measures through an annual risk assessment. Among other measures, ISSF requires companies to comply with 100 percent observer coverage, restrict purchases to vessels on the ProActive Vessel Register, and undergo an annual audit contracted by private auditing firm MRAG, which specializes in marine resource management.<sup>43</sup>

We found only one instance of IUU risk assessment guidelines that could holistically address supply chain risk: the Publicly Available Specification (PAS) 1550 created through a partnership between the Environmental Justice Foundation (EJF), Oceana, the Pew Charitable Trusts (Pew), and WWF. PAS 1550 details due diligence information for legally sourcing fish and minimizing IUU risk but asks companies to go deep into the supply chain and address hundreds of guidelines.<sup>44</sup>

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41 "Seafood Stewardship Index," World Benchmarking Alliance, accessed November 2, 2020, <https://www.worldbenchmarkingalliance.org/publication/seafood-stewardship-index>.

42 "Social Value," Maruha Nichiro Corporation, accessed November 14, 2020, <https://www.maruha-nichiro.com/sustainability/social.html>.

43 International Seafood Sustainability Foundation, *Update to ISSF Conservation Measures & Commitments Compliance Report* (Washington, DC, November 2020).

44 British Standards Institution, *PAS 1550: Exercising Due Diligence in Establishing the Legal Origin of Seafood Products and Marine Ingredients – Importing and Processing – Code of Practice* (2017).

Other tools assessing IUU risk in seafood supply chains address risk only on certain levels. The IUU Fishing Index, Minderoo Global Fishing Index, and IUU Risk Intelligence present IUU risk scores on a country level. Trygg Mat Tracking Combined IUU List allows a search for red-flagged vessels. Oversea Ocean Monitor, GFW, Windward, and SkyLight monitor the track of a vessel using satellite data to detect suspicious vessel activity.

## 6. The Value Proposition

Our research and interviews pointed to the value proposition as an important component of this tool. There is already broad recognition of the need to tackle IUU fishing in seafood supply chains.<sup>45</sup> Many companies are committed to addressing this issue internally and externally, through organizations such as ISSF, Seafood Business for Ocean Stewardship (SeaBOS), and GTA. The tool will not only streamline current risk assessments but also bring together diverse IUU fishing data for the first time.

This tool will be valuable to companies because it identifies areas at high risk of IUU fishing and further enables companies to isolate and address issues. Addressing instances of IUU risk decreases a brand's reputational risk and provides the opportunity to highlight the brand's social and environmental responsibility. In improving a company's reputation and competitive advantage, this tool can distinguish a company from others in a positive way and in doing so pressure other companies to follow suit. Additionally, the tool will help to secure the long-term sustainability of fish stocks, especially those with high fisheries pressure. Finally, the tool will assist with both voluntary sustainability commitments and mandatory regulatory compliance.

## C. Methodology

We used interviews and desk research to assess the potential of this tool and lay out a blueprint for the tool. Using snowball sampling, we conducted twelve semistructured interviews with IUU fishing experts and major industry actors (see Appendix B for the full list of interviewees). The goal of the interviews was to understand how stakeholders are already assessing IUU risk, how the tool could be designed to provide valuable information, and what commitments and principles it would help to support. We analyzed and distilled findings from these interviews to guide our approach to the tool's development. After the first few interviews mapping the tool's potential, we narrowed the scope of the tool to the tuna sector. At this point we focused our interviews around identifying the tuna sector's perceived value and needs for the tool.

We started our desk research by pulling together a preliminary list of tools or data sources that can be used to identify risk in a seafood supply chain. Once we determined a comprehensive supply chain risk assessment tool was not yet available, we focused our desk research on outlining a prototype of the tool. We assembled key metrics of IUU fishing mentioned in the literature with the aim of turning this list into a series of IUU fishing indicators. Literature reviewed included policy papers, academic literature, government and nongovernmental (NGO) reports, and supply chain risk and management reports.

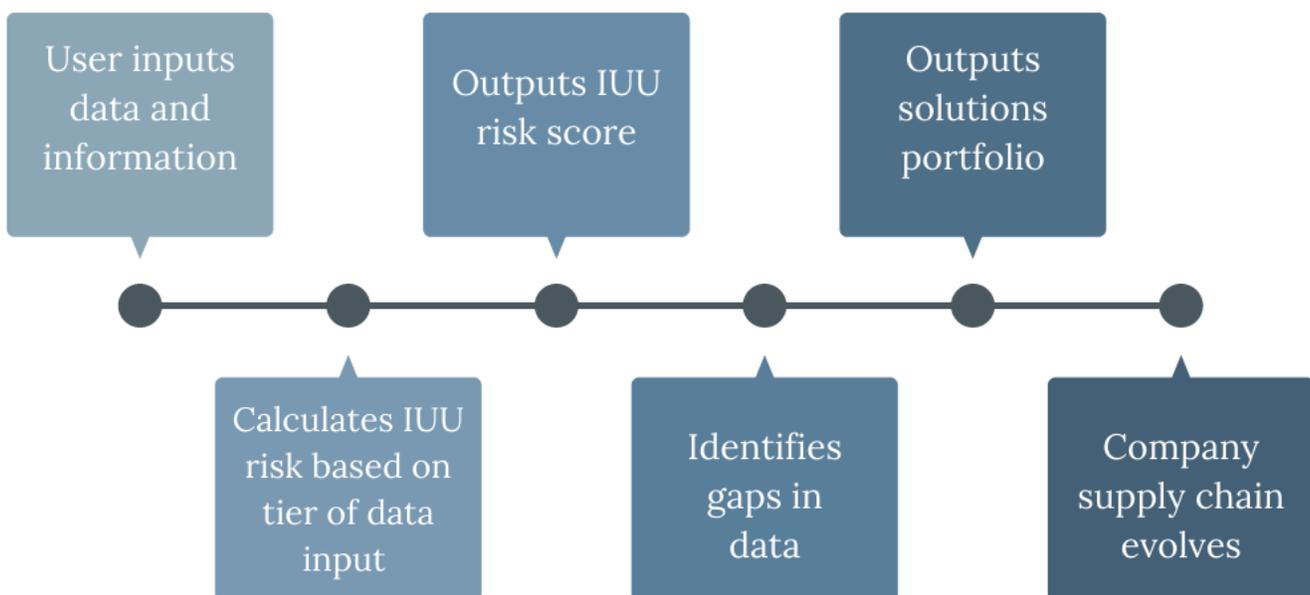
Having identified the unique aspects of our tool in the IUU fishing risk assessment space and ten IUU risk indicators, our research team conducted a data survey, examining fifty-eight potential sources of information to incorporate into the risk assessment tool. Data sources reviewed came from government and nongovernmental organizations in addition to the private sector. To determine the feasibility of integrating a source into the tool, we assessed data sources for their relevance to IUU, data format, reliability, update intervals, and ease of use. Through this evaluation, we also determined areas of weakness in quantifying IUU risk, and how additional information beyond tuna could be incorporated in the future. We note that our data sources are not fully representative of all information available—particularly in that we only searched for and assessed work in English.

This methodology of integrating and analyzing information from interviews and desk research is similar, albeit scaled down, to the approach of Pramod et al.<sup>46</sup> To estimate illegal and unreported fish imports to the US, Pramod et al. consulted more than 180 sources and conducted 41 interviews to supplement or fill in missing information for fisheries data. Our methodology has obvious shortcomings compared to this example due to the short timeline (ten weeks); we reviewed fewer data sources, conducted fewer interviews, and had a less-structured methodology. However, we used similar methodology to existing literature for this project and introduced as much structure as possible to ensure the validity of our preliminary work.

#### D. The Intervention: Key Elements of Tool Design

Here we outline the framework of the tool and the order of operations from the user’s perspective. The application brings together IUU data and research to create a richer picture of risks and help find solutions. The tool initially will be developed as exclusively company oriented and not public facing. A public version that protects company privacy and provides a high-resolution overview may be developed in future iterations.

**Figure 2. Outlining the User Experience**



46 Ganapathiraju Pramod, et al., “Estimates of Illegal and Unreported Fish in Seafood Imports to the USA,” *Marine Policy* 48 (2014): 102-13.

## 1. User Inputs and Outputs

First, the user will input information by answering a series of ten simple questions that define their level of knowledge about their company supply chain. Questions are found below in Table 4. The ten questions are ordered into tiers of how deep companies have gone in their traceability efforts; if the supply chain has traceability to the tier of information (species, region, country, port, fleet, vessel, tracking data, fishing gear, certifications), the company will be able to answer the question.

For each tier, the tool has one to five relevant risk metrics, which operationalize the different risk indicators at the relevant data tiers. The data for each metric is used to internally calculate the score. (See Table 4 for risk metrics and related data sources.) After a user answers questions that detail their knowledge of the supply chain, the tool will score each IUU risk metric within that supply chain, discussed in more depth in the following section.

**Table 4. Data Tiering Structure (cont. on next page)**

Tier	Question	Answer	Risk Metric	Data Source	Data Availability	Data Updates	Data Reliability
Species	What species do you target?	Species name	Species IUU index	Sea Around Us	Public	Annual	Medium
Region	What region/RFMO does it come from?	Region/RFMO name	RFMO ability/success to enforce regulations	Experts	Private	None	Medium-high
			Fisheries Improvement	FIP	Public	Annual	Medium
Country	In what country was it landed?	Country name	Country IUU risk index	IUU Fishing Index	Public	None	Medium
			The PSMA ratification	The PSMA	Public	None	High
			EU carding status	EU	Public	As Needed	High
			World Governance Indicator	Minderoo Global Fishing Index	Public	Annual	Medium
			Corruption Index	Transparency International	Public	Annual	Medium
Port	At what port was it landed?	Port name and location	RFMO compliance	ISSF	Public	Annual	High
			The PSMA standing	The PSMA	Public	Annual	High
			Port risk index	Selig & Pew port risk tools	Public	None	High

Tier	Question	Answer	Risk Metric	Data Source	Data Availability	Data Updates	Data Reliability
Fleet	What fleet captured it?	Fleet and nationality	Flags of Convenience	ITF	Public	None	Medium-high
			Average IUU fleet risk	GFW and Trygg Mat Tracking	Public	Daily	High
			Ownership complexity	Triton (C4ADS platform)	Public	Annually	High
Vessel	What vessel caught it?	Vessel name/IMO /PVR number	Flags of Convenience	ITF	Public	None	Medium-high
			Participation in PVR Program	ISSF	Public	As needed	High
			History of IUU records and most recent status	ISSF (VOSI, PVR); Trygg Mat Tracking	Public	As needed	High
			History of national violations	ISSF (VOSI, PVR)	Public	As needed	High
			Ownership complexity	Triton (C4ADS platform)	Semipublic	Annually	High
Tracking data	Is AIS/VMS data available?	Yes/no	Continuous track (e.g., no obscure zones)	GFW	Public	Daily	High
			Fishing in high-risk areas	COS risk assessment	Public	None	High
			Fishing inside MPAs	GFW	Public	Daily	High
			Transshipment record and IUU potential	GFW	Public	Daily	High
Fishing gear	What fishing gear was used?	Fishing gear name	Bycatch risk	ISSF PVR (shark and turtles best practices)	Public	As Needed	High
			IUU gear risk index	ISSF PVR (LS drift net); Sea Around Us	Public	As Needed	High
Certifications	Is it a certified fishery?	Certification name and status	Certification score				
	Does the certification include an IUU component?	Yes/no	IUU certification score	Certification	Public	None	High

\*For specifics on how the risk indicators and risk metrics are connected, see Appendix C.

**Figure 3. Example Risk Assessment for Bumble Bee Tuna**

### Prototyping the IUU Supply Chain Risk Tool

Using data from Bumble Bee's Trace My Catch platform, we present an example of how this tool might work with publicly available data.



#### Step 1: The User Inputs

The designated corporate social responsibility or human resources representative from Bumble Bee enters company data in response to the ten questions for all information they have available.

#### Step 2: Calculating Risk Metrics

Using inputted answers, the tool accesses relevant data. For Example, using the vessel name, the tool reviews IUU blacklists, identifies vessel-tracking data through GFW, detects suspicious behavior, and check the gear type deployed.

#### Step 3: Output

The tool uses information to determine an output for each risk metric. Included in the assessment are the confidence intervals and data sources that inform the result.



Tier	Question	Answer
<b>Species</b>	What species do you target?	Albacore tuna
<b>Region</b>	What region/RFMO does it come from?	WCPFC
<b>Country</b>	In what country was it landed?	Fiji
<b>Port</b>	At what port was it landed?	Levuka (Ovalu, Fiji)
<b>Fleet</b>	What fleet captured it?	Fiji or China
<b>Vessel</b>	What vessel caught it?	Zhong Shui 709
<b>Tracking data</b>	Is there AIS/VMS data available?	Yes
<b>Fishing gear</b>	What fishing gear was used?	Longline
<b>Certifications</b>	Is it a certified fishery?	ISSF Member (Founder)
	Does the certification include an IUU component?	Yes

Risk Indicator	Output
Species IUU index	Yellow
RFMO IUU Risk index	Green
RFMO ability/success to enforce regulations	Green
Country IUU risk index	Green
PSMA ratification	Green
EU carding status	Green
World Governance Indicator	Green
Corruption Index	Green
RFMO compliance	Green
PSMA standing	Green
Port Risk index	Green
Flags of convenience	Green
Average IUU fleet risk	Green
Ownership complexity	Green
Flags of convenience	Green
Participation in PVR program	Green
History of IUU records and most recent status	Green
History of national violations	Red
Ownership complexity	Green
Continuous track (e.g. no obscure zones)	Green
Fishing in high risk areas	Green
Fishing inside MPAs	Green
Transshipment record and IUU potential	Green
Bycatch risk	Yellow
IUU gear risk index	Green
Certification score	Green
IUU certification score	Green

#### Example Responses to Questions in Step 1

- The species was albacore tuna, harvested within the Western and Central Pacific Fisheries Commission (WCPFC) territory and managed by the WCPFC.
- The fish were caught within Fiji's EEZ and landed at a port in Fiji.
- The fleet was comprised of vessels from Fiji and China; the company has data on the exact vessel that caught the fish, and we are able to associate it with its IMO number.
- The fish are MSC and Fair Trade certified; in this case Bumble Bee is a member (and founder) of ISSF and is responsible for their standards, which include an IUU component in their auditing measures.

\*This is an example risk assessment and has no reflection on Bumble Bee Tuna.

## Box 2. Key Principles of Design

Key design elements of the tool are that it will be easy to use, adaptable, transparent, and enabling. Ease of use will be assured by continuous codesign of the tool with company users. Adaptability addresses the range of different users and the varying levels of information users input into the tool. For all users, the tool will provide informative insight into their supply chain. Transparency refers to the observability of the data used to determine risk and where in the supply chain that risk can be addressed. The tool will illuminate a company's risk of IUU products entering their supply chain, enabling the risk(s) to be addressed by the company.

### *User Friendly*

This tool will be user friendly, meaning that it will be easy for company users to use. The tool aims for an easily operated interface and succinct, intelligible outputs that do not add more work to the tool users are already using. Ease of use will be ensured by continuous codesign of the tool with company users.

### *Adaptable*

This tool will be highly adaptable, meaning that it can operate regardless of how much information is known about a specific supply chain. The tool will be originally developed with data from the tuna sector and expanded to other species as the approach is refined and depending on data availability.

### *Transparent*

This tool will be transparent, meaning that we will clearly document and share how each score is calculated, the confidence in that score, and where the inputted data sources or evidence come from.

### *Enabling*

This tool is enabling, meaning that it will not only give risk scores but also pinpoint and state directly where IUU risk is high in the supply chain, enabling companies to address specific risks.

## 2. Solutions Portfolio

The solutions portfolio will have two components: increased traceability and IUU risk mitigation strategies. By offering a suite of practical solutions, the solutions portfolio enables a company to modify its supply chain and mitigate the risks of IUU fishing.

The first component of the portfolio will offer solutions to increase traceability in the supply chain. Increasing traceability will improve the depth of knowledge of the supply chain and improve the ability for the tool to assess risk of IUU products. We envision this aspect of the portfolio to include links to services, white papers, and consultancy firms that can help a company increase transparency and traceability.

The second component will enable companies to initiate change by suggesting a spectrum of solutions, including options to further investigate chains that have a high risk of IUU fishing

involvement. In most cases, the response to high risk of IUU fishing will be to work within the supply chain to address the risk. Factors such as cost, feasibility, degree of disruption, company values, and commitments to existing partners influence what measures a company would decide to take.

A company may decide between investing in building the capacity of existing suppliers and shifting to a new supplier. The company would be able to explore options to improve legal sourcing. It could also explore the option to source fish from an entirely new location; the tool will provide a map to show “green” regions (basins, ports, vessels, etc.) where the likelihood of IUU fishing is low. In addition to providing solutions within a company’s supply chain to eliminate IUU fish, this feature can be used for companies looking to expand their supply chains sustainably. By using an interactive heat map graphic, companies can explore the value of these recommended future supply chain options.

## E. Considerations for the Development of the IUU Supply Chain Risk Tool

This report seeks to outline a framework for an IUU risk assessment tool to be used by companies. The following section elaborates on key questions and concerns to be addressed within the tool. Primary areas for future development include refining the output of the tool as detailed above, working out the business side of the tool, and prototyping with companies.

### 1. Considerations to Address through Further Research

#### 1.1. Data Reliability

Data reliability is a crucial aspect in the legitimacy and helpfulness of the tool. Thorough and professional review of the data sources should be conducted to determine the best sources to include as inputs to the tool. Confidence ranges for data sources should be established and can help determine tradeoffs between less in-depth quantitative sources that are more accessible and translatable to risk scores versus more substantial qualitative information.

#### 1.2. Data Maintenance

Integrating diverse data with different periodicity is a challenge. Because the tool takes in multiple sources and these data sources update at irregular intervals at various times during the year, the tool would need continuous updating and maintenance to ensure it uses the most up-to-date information. Care should be taken around assessing and phasing out data that are no longer relevant. The tool should also be flexible to allow easy incorporation as new data, legislation, and partners become available. Anticipating that the host platform will need to invest in tool upkeep, a regular update interval should be set. The importance of up-to-date information differs across tiers and indicators because the period of time of a source’s relevance varies based on the timescale of change for a particular indicator. For example, RFMO IUU blacklists are updated frequently. For reports or indices, it is typical to get an annual update or one every few years, such as the Minderoo Global Fishing Index (GFI). C4ADS plans to update Triton, a database to help clarify vessel ownership, about once a year because of the large amount of labor involved.

### 1.3. Calculating Scores for Risk Metrics

To calculate risk scores for a user-friendly interface, we must characterize risk from quantitative and qualitative data. Interviewees emphasized the importance of a tool that is straightforward and easy to use, so further development must ensure that all risk metrics, inputted data sources, update intervals, and accuracy of the data will be clearly defined.

There are a number of options for how the tool could score risk. For each tier, there will be one to five relevant risk metrics. Standardized and transparent procedures will be developed to transform data into scores for each metric. One option for risk scoring would be to assign scores as low, medium, or high for each risk metric, with clear definitions and differentiations as deemed appropriate for the data type and source. This is exemplified in the Bumble Bee assessment in Figure 3.

A final question is how to score scarce or missing data in an indicator area. In developing a scoring system, it is important to account for the nuance of every missing piece of data. In some cases, missing data represents increased risk, while in others it may just be irrelevant.

### 1.4. Public/Private Data Access

There are multiple data sources available for assessing the risk metrics. Public data are openly and freely available, data from commercial providers are available for a fee, and proprietary data are available as a company enters information while using the tool. For backend data (for our risk metrics), the tool would initially use only public data sources, with the possibility of incorporating proprietary data in the future. If the tool pays for access to private backend data, there are additional baseline costs and complications surrounding data sharing and transparency (e.g., legal constraints concerning usage—right to use is not the right to erode an owner's proprietary asset).

Given the various data sources and the transparency of the tool, conflicts arise over how public the results should be. We will start with a more confidential version for companies, in which companies will create accounts to store their information and access private data. A future public version could either include only public data sources or incorporate proprietary (risk metric) information in risk calculations but obscure the underlying data.

### 1.5. Building Out the Solutions Portfolio

Building out a portfolio of recommended solutions is another key step. This involves identifying evidence-based interventions in the supply chains and ranking these options according to their difficulty of implementation. Our interviewees recommended marrying the level of risk with what the supply chain can handle as far as cost and logistics. Feasible and practical solutions will need to be discussed with companies before this part of the tool is built.

## 2. Considerations to Address through the Co-Design Process

### 2.1. Hosting a Workshop

Obtaining additional input from companies into the design of the tool is necessary for refining both the tool's interface and the data visualization component. Opportunities such as hosting a workshop session through the GTA or SeaBOS to pilot and receive feedback on the tool will ensure that our tool's outputs are useful for companies.

### 2.2. Refining the Indicators

We identified ten indicators to measure IUU fishing risk, which were operationalized in 27 risk metrics. These indicators and metrics should be reviewed and refined. Given its modular design through the tiering system, this tool has the potential to include risk scores for other environmental, social, and governance initiatives, such as forced labor risk or carbon footprints estimated throughout the supply chain.

### 2.3. Defining the User and Use

Further work is needed to identify companies that are most likely to be first adopters, who the users within those companies are likely to be, and how they might use the tool.

Companies in the tuna sector that are already interested in IUU fishing risk in their supply chains, such as ISSA companies, are expected to be first adopters of this tool. A consideration for choosing first-adopter companies to approach may be the most effective entry point in the supply chain to use this tool. In each country, one needs to examine which actors can have the most influence. There are markets in which retailers have strong leverage over suppliers, such as in Europe, and others where fishing companies would be better equipped to do so. For example, in the United Kingdom the focus should be on retailers such as Tesco, given the strong leverage they hold in relationships with their suppliers. However, the US has both influential retailers and big tuna companies; companies such as Bumble Bee are less controlled by buyers, though retailers such as Walmart, Costco, and Kroger exert considerable influence on their suppliers.

Interviewees identified future users of this tool as corporate social responsibility (CSR) teams in the short term and procurement officers in the long term, with potential use also by human resources (HR) departments, quality control, and recruitment. Within companies, these potential users can utilize the tool to support regulatory compliance and sustainability commitments. Interviewees suggested that specific instances in which companies might use the tool include completing annual checks, reviewing a potential new supplier or after significant changes in a supplier's operations, or checking on a suspicious vessel.

## 2.4. Improving the Value Proposition

With further stakeholder involvement, we aim to further develop the value proposition for this tool—how it can best fit the needs of specific seafood supply chains, offering low cost and time investment and high value derived from tool use. The workshop should be used to clarify how different stakeholders will value and use the tool. In particular, it will be important to hear from companies about which existing processes or sustainability commitments the tool will help address. The tool should also be tailored to facilitate regulatory compliance.

## 2.5. Visualizing Risk

We hope to gather recommendations from the key stakeholders and seafood companies on how best to visualize risk. Once it has been decided how to score risk, it is still crucial that these scores be translated into succinct and easily grasped visuals. Interviewees emphasized an easy-to-use interface, with a tiered approach allowing the user to see at what level (species, port, vessel, etc.) the IUU fishing risk is located and what component caused the risk to be high. A tool that is intuitive to use and produces clear outputs is necessary to ensure widespread adoption.

A challenge is how the tool will prioritize metrics and enable the user to understand competing scores. The output of the risk assessment should rearrange metrics so that those to be prioritized are visually clear. Along with visually presenting the prioritization, guidelines could equip companies with how to interpret the results and assess the full picture. To illustrate this challenge, we provide the following example: Perhaps a country-level assessment indicates high risk by the IUU Fishing Index, and the port landing also indicated high risk, but the vessel has no transshipments, passes every metric on the ProActive Vessel Register (PVR) list, and has observers that report no IUU fishing. In this case, by looking at more detailed data on a particular boat, there is strong evidence that the vessel is not engaging in IUU fishing. A standardized process will be developed to determine how risk at different levels and across indicators interacts. The outputs and tool interface should be iteratively piloted.

## F. Implications

The following section elaborates on how to maintain the tool and solidify its use as a long-term aid in eliminating IUU.

### 1. Determining the Host

A long-term host and revenue model needs to be identified to keep the tool useful and available for future years of IUU fishing supply-chain risk assessment. A workshop should prompt discussion surrounding the designation of a host institution that can develop the interface for this tool and a suitable business model to fit with the institution. The ultimate host of this tool currently remains undecided. One possibility is to host the tool through an NGO. Suggestions include GFW, FishWise, WWF, Environmental Defense Fund (EDF), and the World Economic Forum (WEF). Advantages of these institutions are established reputation and industry penetration, long-term platform security, and financial stability. The tool could also be hosted by a private firm using a

subscription model (e.g., consultancies). Finally, hosting the tool with precompetitive business coalitions like GTA and ISSA might facilitate tool adoption by companies.

## 2. Financial Model

Once the host is established, a long-term model to finance tool updates and keep the tool available can be developed. A possible option for our proposed IUU risk tool is to charge a fee for use. C4ADS will release Triton in December 2020 and is considering a subscription model to fund updates once grant money runs out. It is also possible that financial support could be provided by a partnership with a trade organization or industry leader, such as SeaBOS, ISSF, or Walmart.

## 3. Opportunities for Expansion

The tool will work most effectively with supply chains that are highly traceable; therefore, we started with tuna. Future iterations and development of this tool will need to expand to fisheries with less transparent supply chains. With the expansion to other fisheries, it will be important to establish strong relationships with leaders in the area. This will enable widespread adoption to new fisheries.

A final opportunity for expansion is incorporating additional data sources. We investigated publicly available data sources. While we identified some possible proprietary sources, we could not fully explore the potential of the private sector. The data currently are heavily skewed for English-speaking countries. However, we see this as an opportunity in the future to expand the range and scope of data sources.

## 4. Continued Stakeholder Engagement

There are opportunities to forge partnerships with trade organizations and major retailers to foster collective buy-in. We recommend building out a working group with SeaBOS, ISSF, and GTA to address the key questions from our work thus far and to formulate the next steps and extension opportunities for developing the IUU risk tool. Additionally, more stakeholders, such as insurance companies, industry representatives of trade organizations, and HR, CSR, and procurement officers, should be interviewed and incorporated into the design process.

## G. Conclusion

We present an IUU risk assessment tool that is the first to holistically present a suite of scores and solutions for seafood companies to easily assess and isolate supply-chain risk. This framework focuses on the tuna sector with the hope that the tool can later be expanded to other sectors. Through interviews and desk research, we have outlined risk indicators for IUU fishing and determined that the further development of this IUU risk-scoring tool is both possible with publicly available data and useful for buyer and producer companies, trade organizations, and other stakeholders. The novelty and distinct strength of this work is that we collaborate directly with companies in developing the tool. This open communication and iterative refinement ensure

the tool meets stakeholder needs and helps accomplish their goals to identify and address IUU risk within their supply chains.

As there are many data-specific aspects of the tool that need to be thoroughly researched, the immediate next step of design development is to conduct a targeted workshop with potential users to further distill the value proposition, determine a host, and structure a revenue model. User input to prototype data and risk score visualizations is also imperative at this stage. Although there are many steps before the risk assessment platform is ready to be standardized and serve as a resource for the industry, our work has generated high levels of interest, forecasting a promising outlook for this tool and its usage.

There are opportunities to forge partnerships with trade organizations and major retailers to foster collective buy-in.



We recommend building out a working group with SeaBOS, ISSF, and GTA to address the key questions from our work thus far, and to formulate the next steps and extension opportunities for developing the IUU risk tool.

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