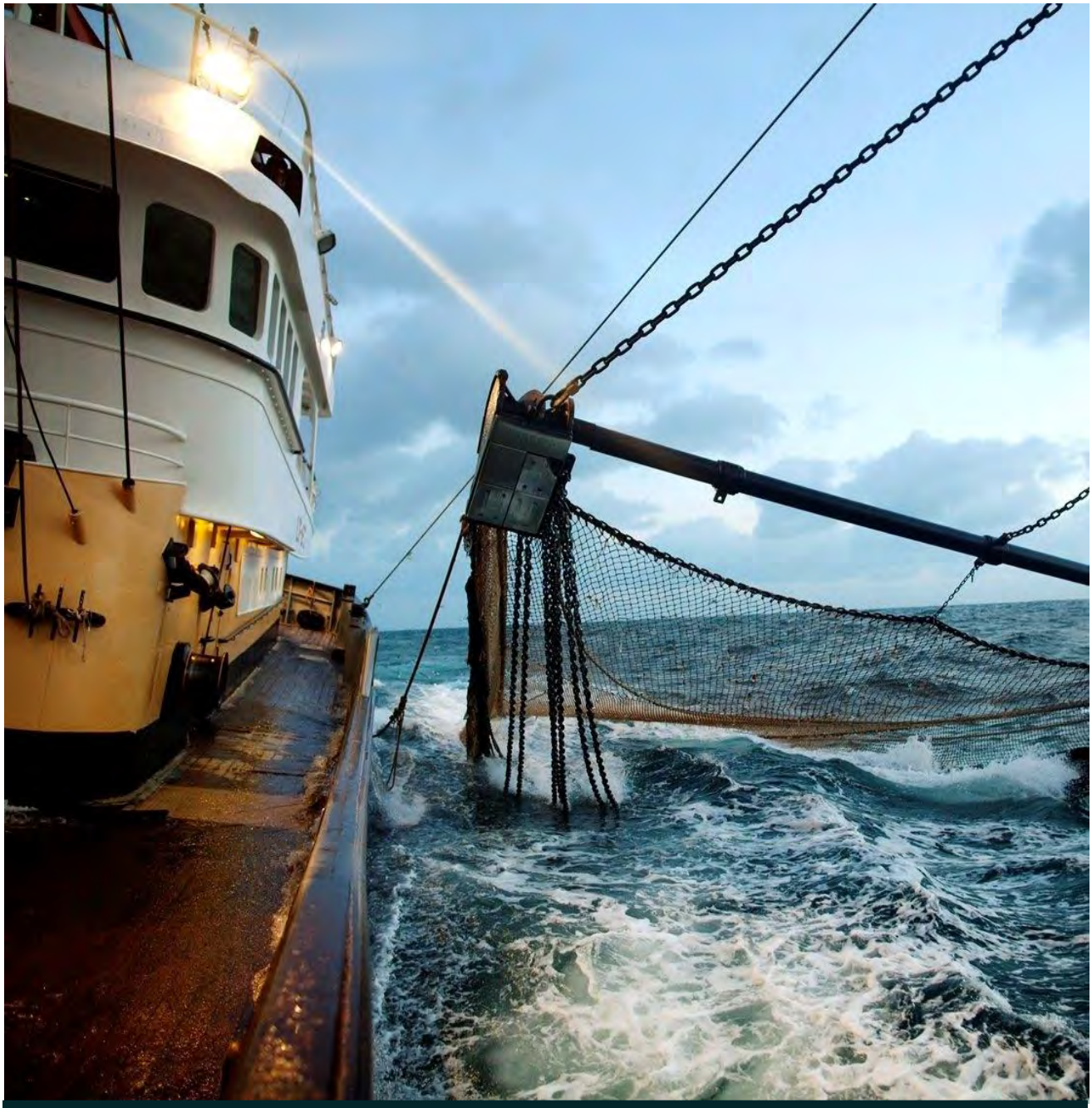

# Illegal, Unreported and Unregulated (IUU) Fishing: A Whitepaper

*Prepared for the Packard Foundation*

May 2015

Bernd Cordes & California Environmental Associates

# OUTLINE

# 1. INTRODUCTION

This whitepaper characterizes the status of IUU fishing, the philanthropic community's current activities to address it, and potential opportunities for the Packard Foundation to engage in initiatives that seek to reduce IUU. The paper was drafted in March and April 2015 by Bernd Cordes and California Environmental Associates, and was compiled through a combination of desk research and a handful of select interviews.[1]

## What is IUU?

Illegal, unregulated and unreported (IUU) fishing refers to fishing activities that do not comply with regional, national, or international fisheries conservation or management measures. To simplify, IUU consists of three distinct but related elements:

- **Illegal** fishing refers to fishing activities that violate national or international laws. In practical terms, illegal fishing can include fishing without a license, under-reporting catches, keeping undersized fish, fishing in closed areas, using prohibited fishing gear types, the illegal transshipment of fish, or other violations of the law.
- **Unregulated** fishing refers to fishing activities in areas where there are no applicable national, regional or international conservation or management measures. Unregulated fishing is not illegal per se and can either occur in an unmanaged fishery within a country's Exclusive Economic Zone (EEZ) or on the high seas, such as fishing by vessels that are un-flagged or flagged to a State not party to international conventions.
- **Unreported** fishing refers to fishing activities that have not been properly reported. Unreported fishing is not necessarily illegal or unregulated, though it can be either. Often unreported fishing is associated with a lack of data collection or weak fisheries management, though the lack of reporting can also conceal illegal activity.

While it is well known that IUU is a major barrier to effective fisheries management, the exact scale of IUU is difficult to quantify. Available evidence suggests that at least 20 percent of wild landings (11-26 million tons of fish) are illegally caught or unreported; representing annual financial losses on the order of $10-24 billion. Developing countries are disproportionately affected by illegal fishing as they often lack the means to safeguard their offshore resources. Unregulated landings are well in excess of these estimates, and are also disproportionately found in the global South.

## Why is addressing IUU important?

There are several reasons why addressing IUU is important. To start, IUU fishing undermines efforts to effectively and sustainably manage fisheries. Undetected fishing leads to poor and ineffective management decisions, and often hinders efforts to protect the most vulnerable and valuable species. In addition to the direct implications for fisheries sustainability, IUU in the marketplace can create unfair competition for legal fishermen, and it has been associated with an array of crimes, including drug smuggling and human trafficking. From a fiscal perspective, IUU is associated with lost government revenue, in that it is not taxable and is often linked to incursions by foreign fleets which circumvent permitting and license fees.

Strategically, addressing IUU can be a natural entry point for philanthropic efforts to promote sustainable seafood and sound fisheries policy. IUU and the risks it poses – and the legal, financial, social, an reputational risks it poses to the common good and private industry alike – can motivate otherwise indifferent actors to care about these issues. And preventing illegal activities is squarely in the stated self-interest of most governments. In the last few years, import controls in Europe aimed at preventing trade in IUU have had substantial ripple effects on fisheries management across the developing world. Similarly, in countries such as Indonesia, fighting illegal fishing (illegal foreign fishing vessels, in

[1] See the Appendix for the interviewee list.

particular) has proven to be a politically powerful effort. From a market perspective, the IUU fish trade can pose significant liabilities for companies in the supply chain. Mitigating that risk is becoming more of a priority, especially in light of recent media investigations linking IUU fishing to human rights and labor abuses, as well as to seafood supply chains and fraudulent labeling. Taking the necessary steps to prevent illegal fish from entering a market in the first place might simply be an easier route than certification or fully vetting the supply chain for sustainability criteria. Recognizing this, early adopters in the seafood business community are starting to implement voluntary measures to improve transparency and to support a handful of global initiatives and policy developments aimed at deterring IUU fishing.

Fishing trawlers transship their catch to a reefer off the cost of Guinea. IUU fishers often prefer to transship their catch at sea rather than in port to avoid being caught by authorities. © Environmental Justice Foundation (EJF)

# 2. ADDRESSING IUU: CURRENT EFFORTS, KEY PLAYERS, CHALLENGES, AND OPPORTUNITIES

Attention to the damage done by IUU fishing has increased in recent years. A wide range of activities focused on addressing unregulated fisheries and weak reporting are currently underway at the individual country level. These efforts are not explicitly addressed in this paper. Instead, we concentrate on three cross-cutting strands of work that appear to have the potential for outsized impact across multiple countries. They are:

(1) The use of new trade policy and import controls in key markets to deter IUU
(2) The development and application of new technologies, particularly remote sensing, to detect and combat illegal fishing where it happens at sea
(3) The establishment and ratification of new policies and practices, such as the Port State Measures Agreement, to address IUU in international waters and in the ports where fishing vessels bring their products

The balance of this white paper focuses in turn on each of these three elements. We characterize the state of current efforts, key actors in the field, challenges to the application of this work, and potential opportunities for the Packard Foundation to become more directly engaged in ending IUU fishing.

## 2.1 TRADE POLICY AND IMPORT CONTROLS

### CURRENT EFFORTS AND KEY PLAYERS

One of the most frequently cited ways to effectively deter illegal fishing is to deny market access for IUU fish. There are two primary ways to do this: (1) Establish and ensure effective implementation of trade-related, anti-IUU regulations in major import markets (e.g., the European Union, United States, and Japan); and/or (2) Help the biggest seafood buyers and retailers in the world institute similar policies in the form of rigorous procurement standards. There is a growing consensus among the conservation community that these trade-related efforts are very important for triggering better fisheries management by exporting countries, but it is less clear and there is less evidence that they can effectively prevent illegal fisheries or fraud. That being said, several countries have undoubtedly already made specific changes to their fishing practices in response to recent EU trade sanctions and the threat that the US will shortly follow suit.

#### EU IUU Regulation

The EU currently has the most aggressive anti-IUU regulation. Entering into force in 2010, the regulation[2] requires that all fisheries products imported into the EU be accompanied by a catch certificate with information about the species, catch location, fishing vessel, date of capture, and any trans-shipments that have taken place. In cases where a product is suspected as IUU, EU Member States can refuse to import the fish.

While the enforcement of these provisions at the point of entry varies considerably, one of the most powerful and high profile elements of the EU regulation is a provision that allows banning of imports or port access from countries

[2] The EU Regulation to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing Council, or Regulation 1005 / 2008

or vessels that don't take clear action to address IUU fishing. Since the inception of the law, the EU has issued yellow cards[3] to several countries and red cards[4] – actual trade sanctions – to countries that are doing nothing to improve fisheries management and prevent IUU. The threat of these trade sanctions has had a powerful effect on exporting countries. For example, in 2013, the EU issued the Republic of Korea a "yellow card" and shortly after, the US placed Korea on a public list of suspected IUU countries. The combined pressure from two large market countries brought about previously unforeseen action by multiple agencies in South Korea, including the Parliament, the Ministry of Foreign Affairs, and the President, to update its distant water fisheries laws.

According to an Environmental Justice Foundation (EJF) report, while the EU's IUU regulation has "the potential to significantly impact the economic and political drivers behind IUU fishing," there are still some weaknesses in terms of implementation. EJF's concerns include a lack of transparency and an electronic data-gathering system, insufficient information sharing, inconsistent implementation amongst EU member states, and a persistent inability to accurately distinguish legal from illegal fish.

EJF's overall recommendations on how to improve implementation of the EU IUU regulation include:

- Increase transparency: Currently, there is no public information available on rejections of IUU shipments by member states. Spain, considered one of the most proactive implementers of the law, has only rejected .04 percent of its imports, a tiny fraction which is, at the same time, said to represent 50 percent of all seafood imports rejected by EU member states.
- Increase consistency: Some member states have not rejected any imports despite importing significant amounts of seafood from outside the EU. A lack of uniformity in applying the regulations could lead to the rerouting of IUU product to less regulated ports or into the EU via containers, which are not considered fishing vessels and are not subject to the same scrutiny.
- Develop a centralized, online data system: The current paper-based catch certificate system is vulnerable to fraud and limits member states' ability to communicate and share data in real-time.
- Improve identification of IUU fish: The EU needs to improve the ability of flag States to accurately validate catch certificates using centralized data and surveillance systems. The EU should also actively support the development and implementation of a Global Record of fishing vessels, as well as the universal and mandated use of IMO numbers as Unique Vessel Identifiers.

The primary non-profit organizations that work on IUU policy in the EU are EJF, Oceana, the Pew Charitable Trusts (Pew), and World Wildlife Fund (WWF).

### US IUU Regulation

In June 2014, the White House established a Presidential Task Force, co-chaired by the departments of State and Commerce, to recommend a comprehensive framework of programs to combat IUU fishing and seafood fraud in the US. With input from several groups, including a WWF-organized Expert Panel, the Task Force released recommendations in December 2014, followed by an action plan in March 2015. The action plan includes measures to expand domestic partnerships to detect IUU fish, strengthen enforcement, and develop a traceability program to track seafood from harvest to entry into the US. The Task Force's action plan also outlines how the US will work internationally to address IUU fishing, including through the Trans-Pacific Partnership (TPP) currently being negotiated with 11 other countries.[5] While the Task Force does not recommend replicating the EU carding system, it agreed to

[3] Yellow carded countries: Belize, Cambodia, Fiji, Guinea, Panama, Sri Lanka, Togo, Vanuatu, and Thailand

[4] Red carded countries: Cambodia, Sri Lanka, Guinea, and Belize

[5] TPP is a free trade agreement currently under negotiation between the U.S., Australia, Brunei, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore and Vietnam.

much of what the Expert Panel recommended, creating what one interviewee called "a breakthrough, threshold moment."

Though a substantial step in the right direction, some are concerned that the Task Force's action plan lacks comprehensiveness, at least initially. The Task Force will ensure that traceability pilots for a handful of high risk products will be implemented, and will then explore the potential to expand the program to include all seafood imports. While the Task Force and other senior US government officials suggest that traceability will eventually be required for all US seafood imports, real political opposition remains. Continued strategic advocacy is needed to ensure this outcome. Those interviewed for this white paper stressed the urgency of acting while there is momentum and before a new Administration takes office.

The Presidential Task Force's key next steps are:

- By October 2015, define the information that will be required for seafood products to enter the US, and identify which species this system will first apply to (based on the risk of being illegal).
- By September 2016, finalize rulemaking to collect additional information on species at risk.
- By December 2016, identify the steps needed to expand the program to all seafood entering the US, taking into careful consideration input from relevant stakeholders, as well as the experience from the first year of implementation.
- Throughout the process, determine how information within the traceability system – including species, geographic origin, and means of production – can be shared with consumers.

The primary non-profit organizations that work on IUU policy in the US are Oceana, Pew, and WWF.

### Voluntary Market Import Control and Supply Chain Efforts

In addition to progress being made on US and EU policies, there are also important voluntary market-based actions that fishing companies, processers, major buyers, and others are taking to identify and deny market access to illegal fish. These efforts are important because they promote and facilitate traceability in select markets and build momentum for national level regulations. For example:

- Certification schemes like those administered by the Marine Stewardship Council (MSC) and the Aquaculture Stewardship Council (ASC) now have chain of custody protocols in place to help trace fish back to their source.
- The International Seafood Sustainability Foundation (ISSF) requires its members to source seafood from vessels that have 100% observer coverage, participate in a global vessel monitoring system, and have an IMO number.
- EJF and others have recently exposed clear and widespread human rights abuses in segments of the fishing industry, and have been able to connect those abuses to specific fisheries and supply chains of retailers, thus increasing pressure on corporate actors such as Walmart to take action.
- NGOs have helped the largest North American and European retailers adopt sustainable procurement practices and increase transparency around their sourcing. In addition, the Global Food Traceability Center, a US public-private partnership with sponsors from industry, academia, and the conservation community, has been coordinating efforts to ensure alignment and interoperability of global seafood traceability systems and US regulations.

Funding for these initiatives comes from a number of sources. Oceans 5 has been the primary funder supporting IUU trade measures, with Oak and Moore foundations also making important contributions. This is especially the case with regard to EU-related trade policy and import controls. Oceans 5 provides $1.4 million annually to support EJF, Oceana,

Pew, and WWF for three years (through Summer 2017) for their work focused on the card system and improvements in implementing EU regulations. That Oceans 5 funding will last at least until mid-2017. It is unclear at this point what Oak and Moore foundations will choose to support over the next few years.

Regarding US policy development and implementation, Oceans 5 has also been a leading source of support, providing $1 million annually over the last three years to a coalition including WWF, Oceana, Pew, MFCN, and Greenpeace. As this funding comes to an end this year, Oceans 5 is currently considering whether to renew these grants or not. In addition, the Moore Foundation is currently funding a two-year, $6 million traceability pilot focused on seafood retailers, their supply chains, and progressive industry actors to help them comply with and support US traceability policy efforts. Moore Foundation staff hopes to get board approval for a comprehensive portfolio focused on traceability and IUU in May 2015.

## CHALLENGES

- **Cohesiveness amongst a multitude of players**: Efforts in seafood traceability by governments, companies, and NGOs are varied and often not developed with the coordination needed to effectively stop IUU.
- **Inadequate funding**: Several interviewees cited funding gaps and too few sources of funding as a real constraint. There is, in particular, a significant need for more investment in efforts to ensure robust IUU trade policy in the biggest seafood markets. This will become more of a problem if Oceans 5 opts not to continue funding US IUU policy work.
- **Uncertain political will and effectiveness of IUU trade policies**: It is unclear whether the US IUU regulations are comprehensive enough. It is also unclear whether developing similar legislation in Japan, the world's third largest seafood market, is possible (something Packard Foundation is now exploring). Robust legislation is, of course, important to close legal loopholes allowing illegal vessels to continue their operations, but it must be supported by consistent implementation at sea and in ports.
- **Unequal burden on fishermen**: Traceability and import regulations can have negative, and some believe disproportionate, economic and financial impacts on small-scale fishermen in developing countries, depending on the affordability of traceability systems and the strength of fisheries management in those countries.

## OPPORTUNITIES

- **Improve implementation of the EU's IUU policy:** Help government and non-government partners maintain momentum behind new IUU regulations and avoid backsliding.
- **Help improve policies in countries affected by EU sanctions:** In South Korea, for example invest in initiatives that test the effectiveness of new IUU laws and, at the same time, maintain pressure on the government to enforce those laws. In addition, help local organizations build pressure in other countries, such as Japan and Taiwan, to make similar changes, using Korea as a model.
- **Ensure US regulations are robust have the intended effect:** Ensure that the Presidential Task Force results in binding and enforceable traceability requirements for seafood. Build government, business and public support for strengthened, global transparency requirements.
- **Improve cross-nation coordination of IUU policies:** Ensure that the world's largest seafood markets – the US, the EU, and Japan – fully coordinate their developing efforts to deter IUU fishing.
- **Advocate for other key markets to apply stricter anti-IUU fishing rules** (particularly in Japan and China): The US and EU should work together to encourage other major seafood markets to adopt complementary IUU policies. Targeted campaigns have been important in this regard, by shedding light on illegally caught seafood,

seafood fraud, and human rights abuses in seafood supply chains, and thus opening political windows for anti-IUU policy development and enforcement.

An armed unit of the South Korean Coast Guard arrests Chinese fishermen who have been fishing illegally in South Korean waters. Very few countries can afford effective fisheries surveillance and enforcement. Photo Credit: Dong-A Ilbo/AFP Image Forum/Getty Images

## 2.2 TECHNOLOGY DEVELOPMENT AND APPLICATION

### Current Efforts and Key Players

Technology is a critical component in efforts to reduce IUU and increase transparency. It facilitates the detection and subsequent prosecution of IUU activities. In particular, there has been growing attention paid to the use of remote sensing technology to detect fishing vessels operating in closed waters or otherwise operating illegally. Two primary technologies being used today are Automated Information Systems (AIS) and Vehicle Monitoring Systems (VMS). Both have existed for years, though their use is not universally mandated on fishing vessels by fishing nations and Regional Fisheries Management Organizations (RFMOs). IUU experts generally agree that universal application of AIS and/or VMS on all commercial fishing vessels would be a necessary precondition for accurately tracking fishing effort and reducing IUU fishing. Experts also acknowledge that those technologies are, however, only as good as the political will and the capacity of the people and institutions whose job it is to implement and utilize them.

Most of the technology needed to reduce IUU fishing already exists. However, scalability is limited by several barriers, including cost, a general lack of awareness of the tools and systems that exist, and issues with regard to data sharing and the interoperability of systems. Fortunately, most of the technologies referred to in this section are steadily becoming more affordable while their effectiveness continues to improve. Costs have, by one estimate, already fallen by 40% in Galapagos National Park. A variety of recent technological advances make significant reductions in IUU fishing a possibility in the near term, including (i) the computing power of hand held devices; (ii) the proliferation of very user-friendly GPS applications; (iii) the increased capacity for "big data" storage, sharing, and analysis; (iv) the

variety and improved durability of drones and low maintenance radar stations; (v) the accessibility and accuracy of satellite imagery; (vi) continuous improvements in on board digital cameras and recorders; (vii) expanded use of AIS and VMS; and (viii) advances in DNA testing.

Dozens of initiatives are underway right now using these technologies to combat IUU at different spatial scales and levels of intensity around the world, from the Atlantic coast of the United States to the Pacific coast of Nicaragua, and on to the southeast coast of Kenya and Tanzania. The two most prominent, international NGO-led initiatives with a heavy technology component profiled here are the Pew Charitable Trust's Ending Illegal Fishing Campaign and Oceana's Global Fishing Watch.

### Pew's Ending Illegal Fishing Campaign

Pew's Ending Illegal Fishing Campaign is probably the most comprehensive NGO effort currently being undertaken. Pew and its partners are (a) identifying useful, existing technologies and actively applying them to improve surveillance and data gathering; (b) identifying gaps in existing hardware and software, and developing new databases and data-sharing software to fill those gaps; and (c) negotiating with companies and governments to drive down the cost of technological fixes and, in particular, the costs of satellite imagery and data collection/sharing.

At the center of Pew's work is a partnership with the Satellite Applications Catapult (SAC), a British private innovation and technology company. Pew and SAC work directly with self-selected governments that are interested in reducing IUU fishing in their waters. They combine satellite monitoring and imagery data with fishing vessel databases—that rely on Unique Vehicle Identification numbers (UVIs)[6] as well as AIS and VMS—to detect illegal fishing off the coasts of, for example, southeast Africa, Chile and, most recently, Palau.[7] The cost of implementing the program in a given country varies a great deal and depends on a range of local conditions, but it seems to hover around $500,000 per year, at least during the startup phase.

This Pew-led initiative has more financial resources than most. It was initiated with a $15 million pledge from a Pew board member, and has since raised several million dollars more from multiple sources, including, for example, $2 million from the MacArthur Foundation. According to Pew staff, however, the Campaign, which they hope to run for a 10-year period, is not yet fully funded, so Pew is actively seeking more investment from multiple private foundations.

### Global Fishing Watch

Oceana, for its part, is partnering with Google and SkyTruth to implement Global Fishing Watch, a "technology platform that uses satellite data [which is reliant upon AIS] to inform the public about overfishing." Google contributes its cloud computing, software programming, and data management expertise; SkyTruth makes the hardware and skills available to access reliable satellite imagery and other data; and Oceana contributes ocean science, campaign skills, and the work needed to make the databases publicly available.

Global Fishing Watch is, essentially, a campaign based upon state of the art technology that aims to give hard, actionable data to specific constituencies that have the ability to change fishing rules and behavior. An online prototype for Global Fishing Watch has been developed and tested using fishing vessel data from 2012 and 2013, but the tool (which aims to provide fishing vessel data for free to any audience) has not yet gone live and, therefore, has not yet been directly linked to action at sea or in fishing ports. When it does go live, Oceana, SkyTruth and Google believe it will help convince governments to expand the mandatory use of AIS, improve traceability of fish from sea to consumer,

[6] The International Maritime Organization keeps a global registry of UVI numbers for commercial boats, including fishing vessels. The UVI number assigned by the IMO stays with the vessel during its entire life, regardless of name, flag and ownership changes.

[7] Palau's government is considering a recent $30 million offer of assistance—along with two patrol boats—from the Japanese government to help pay for monitoring and surveillance if, indeed, the Palau government enacts a law that would place 80% of its EEZ under no-take status.

and be used as a credible source of verifying a vessel's catch data for constituents like the MSC.

At the time of this writing, Global Fishing Watch has not secured future funding. Oceana believes it will need to raise $1-3 million per year for the next three years to create wide scale impact (note: Google's philanthropic arm is not funding the initiative to avoid the appearance of a conflict of interest with the contribution made by the for-profit side of the company). Oceana is also seeking funding for a separate but related initiative focused on traceability and seafood fraud—an initiative it is coordinating with WWF, and for which it believes it needs $800,000 over the next two years. Two of the initiative's key components are direct policy work to promote AIS requirements on fishing vessels, and verification of catch documentation.

As mentioned, the Ending Illegal Fishing Campaign and Global Fish Watch are just two of the more prominent, NGO-led initiatives currently underway to reduce IUU fishing. Other NGOs working on this issue include:

- Environmental Justice Foundation
- Pacific Islands Fisheries Forum Agency
- WildAid
- Wildlife Conservation Society
- World Wildlife Fund
- TRACE Wildlife Forensics Network

In addition, there are several companies developing technologies that are or could be applied to reduce IUU fishing, including:

- Aero Environment
- Archipelago Marine Research
- DigitalGlobe
- Liquid Robotics
- Shellcatch/Pelagic Data
- FishpopTrace
- Eurofins

Appendix 3 includes a brief description of the above-mentioned NGOs, companies, and activities they're working on.

To date, technology-related funding from private donors for all of these NGO-led initiatives is, given the size of the problem, probably insufficient. Total funding is probably on the order of $5-7 million per year. No private foundation has a funding program whose primary aim is ending IUU fishing (apart from Pew), much less developing or applying IUU-related technologies. That being said, Oceans 5, Kingfisher, MacArthur, Moore, and Walton foundations have all already invested in or are considering future investments in IUU monitoring and surveillance, all of which will almost certainly include some technological component.

### Challenges

- **Insufficient political will:** IUU experts all seem to agree that until the use of UVIs, AIS and/or VMS systems are required on all commercial fishing vessels, illegal and unreported fishing will continue, and regulating fish catch will remain very difficult. And until AIS and/or VMS use is made mandatory, most of the other technologies that can help end IUU fishing (satellite imagery and locational data, land- and water-based radar, vessel databases that can be shared digitally and wirelessly, etc.) will be of limited utility. Political will is needed not only to put these technologies in place, but also, at the "back end" of the process, to establish the legal/prosecutorial procedures

and penalties to make full use of the evidence fisheries agents and dockside customs officers collect with the technology they have.

- **Prohibitively high costs for some technologies:** As of today, the price tag for using some technologies remains prohibitively high for many governments or NGOs, particularly for prolonged periods of time. This is one reason why monitoring and surveillance is often neglected, even for high profile MPA designations. This is true for satellite imagery, as well as for software development and data mining for data sharing. For satellite imagery, in particular, to become a consistently and broadly useful tool for surveillance and enforcement, the current cost and process of acquiring it needs to be re-negotiated. It is worth noting, however, that the cost of installing and using AIS and/or VMS systems on a boat is generally not prohibitively high; that is, cost is usually less of an impediment than a fishing vessel not wanting to reveal to its competitors where it is catching fish, or reveal to enforcement agencies where it might be fishing without permits.
- **Significant levels of consistency and coordination are needed:** A significant reduction in IUU fishing requires accurate data collection, sharing, and analysis. The pieces of software and hardware exist to gather the data, but three things need to happen to make that data more useful: (1) AIS and/or VMS systems need to be mandated to cover much more of the global fish catch than is currently covered; (2) agreement is needed on the precise types of data to be gathered and stored in a universally useful database (customs officers and fisheries agents need the fisheries equivalent of a universal financial audit format), and (3) agreement is needed on the software platforms that can get, in a cost effective and consistent way, surveillance imagery and locational data, boat numbers, catch histories, and trip logs into the hands of enforcement officials who can then use it, for example, to identify high risk vessels, prioritize dockside vessel inspections, or deny port access when illegal fishing is suspected. IUU experts are in general agreement that the best way to catalyze such coordination is for more governments to truly commit to and ratify the Port State Measures Agreement (see next section).

### Opportunities

- **Mandate vessel monitoring and a Global Vessel Record:** Convince governments and RFMOs to mandate the use of two known technologies, namely AIS/VMS instruments on boats, as well as a common format database with fishing vessel data that is publicly accessible and easily shared. In doing so, it might be possible to establish a system whereby, in the next decade, an enforcement officer will be given a vessel's unique identification number and, with a few clicks, gain access to accurate information about that vessel's true identity, whether it has been involved in illegal fishing, whether to permit or deny it port entry, or whether to begin gathering evidence and preparing legal proceedings against the boat and its owners.
- **Develop proof points in a handful of fisheries:** Few examples exist outside of the US and Europe where comprehensive monitoring, traceability, surveillance, and enforcement have been proven effective either for a large MPA/Reserve (like the Pacific Monuments), for a particular fishery, or for a full supply chain from source to plate (like Chilean sea bass). More of these examples are needed to prove it can be done in a way that is credible, cost effective and of clear social, economic and environmental value to relevant stakeholders. Enforcement in the Galapagos National Park comes close. Pew's Ending Illegal Fishing Campaign and WWF's traceability work are designed to result in a handful of these examples. And Oceana's Global Fishing Watch campaign could essentially shame bad government and industry actors into better performance and behavior by increasing transparency across the board. But careful selection of 5-7 fisheries, supply chains and/or MPAs, and then thoughtful design of a monitoring, surveillance and enforcement protocol for the whole portfolio, could go a long way to prove the concept, to test the technologies that are most cost effective under different conditions, to train people in the use of new technologies, and to get the cost of technology use down. With a critical mass of successes, the momentum to stop IUU fishing will accelerate.


Unique and permanent vessel identification numbers can help cut down IUU. Photo credit: Wikimedia Commons

## 2.3 Fisheries governance and the Port State Measures Agreement

### Current Efforts and Key Players

In addition to import controls and the application of technology to fight IUU, there is a well-established effort to increase the governance of fisheries on the high seas, which have historically fallen in a legal gray area. As background, the high seas, or international waters, are the open waters of an ocean or a sea beyond the limits of territorial jurisdiction of a country, falling outside the boundaries of any country's Exclusive Economic Zone. The Convention on the High Seas was one of four international treaties created at the United Nations Conference on the Law of the Sea (UNCLOS) in 1958[8] It has been revised many times since 1958, but its fundamental intent is to establish international norms and laws governing the high seas, where no single country's laws otherwise take clear precedence. As of 2013, 63 states had ratified the Convention.

UNCLOS asserts that ships sailing the high seas are generally under the jurisdiction of the flag of the state they fly under. An abiding challenge in encouraging stronger management on the high seas is that thousands of vessels are now registered under "flags of convenience" from countries with weak oversight, such as Panama and Liberia. However, UNCLOS also states that, "when a ship is involved in a *criminal act*, such as piracy, any nation can exercise jurisdiction under the doctrine of universal jurisdiction." Universal jurisdiction allows states to claim criminal jurisdiction over an accused vessel regardless of where the alleged crime was committed, and regardless of the accused's nationality.

This reality is important in that, as of today and despite its name, IUU fishing is not considered an international crime in the way that international drug trafficking is. This makes monitoring, surveillance, interdiction and, especially, prosecution of IUU fishing on the high seas more difficult, despite the well-established and widespread use (though not universal use) of assigned UVI numbers for industrial fishing vessels for easier identification, as well as the use of voluntary electronic on-board tracking systems for vessel safety (AIS and VMS). It also makes enforcement difficult for illegal fishing within EEZ boundaries because it represents an exploitable loophole ("Those fish? We caught them on the high seas…").

[8] The US finally signed the oft-revised UNCLOS Agreement in 1994, and generally treats it as a legitimate arbiter of rules on the high seas though it has never ratified the treaty.

### Port States Measures Agreement (PSMA)

One important attempt to remedy the legal ambiguities at sea is the UN's 2009 Agreement on Port States Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (PSMA). Where UNCLOS is about the actions of boats offshore and beyond easy surveillance, the PSMA covers what happens when those vessels land their catch. Critically, the PSMA's provisions apply to all boats and fish that come into port, regardless of whether they have been fishing in the high seas or an EEZ. The Treaty "requires parties to exert greater port controls on foreign-flagged vessels" thereby closing loopholes and eliminating some incentives for illegal and unreported fishing. The PSMA's premise is straightforward: If ports where fish are landed are the choke points for the fishing industry, then make it much more difficult to find a port-side buyer for illegally caught product.

Countries that agree to implement the PSMA are obligated to:

1. Designate which ports foreign-flagged vessels may seek to enter.
2. Restrict port entry and access to port services (including for the landing, transshipment, processing and packaging of fish) by vessels that have been engaged in IUU fishing, particularly those on the IUU vessel list of a regional fishery management organization (RFMO).
3. Conduct dockside vessel inspections in designated ports and meet minimum standards for inspections, inspection reports and inspector training.
4. Share information, including inspection results, when evidence of IUU fishing is found.

There is general agreement amongst those trying to reduce IUU fishing that ratification and implementation of the PSMA, in combination with better surveillance technology and mandating the use of AIS and VMS, is a prerequisite for putting an end to business as usual on the high seas. The PSMA will come into force when 25 countries ratify it. Thus far, only eleven have: Chile, the European Union, Gabon, Mozambique, Myanmar, New Zealand, Norway, Oman, Seychelles, Sri Lanka, and Uruguay. The US has not yet ratified the Agreement.

The PSMA has a lot of moving parts. It attempts to bring together disparate rules and norms on offshore fishing, some new and some old, under one consistent framework. While momentum behind the PSMA may be building (e.g., seven of the eleven PSMA ratifications occurred since mid-2012), few groups are directly involved in promoting the PSMA. Those that are include:

- **FAO**, which is the international body responsible for the PSMA standards-setting, ratification and application. FAO also manages the Global Record of Fishing Vessels, an international database of industrial fishing vessels that contains the UVI of all known industrial fishing boats as well as information on their ownership, flag state, history, and fishing authorizations.
- **Pew**, whose Ending Illegal Fishing campaign includes a strong push to increase the number of countries ratifying the PSMA and, just as importantly, is implementing training programs for port officials and others whose job it is to enforce the laws and provisions established by the PSMA. Pew also commissioned an important 2011 gap analysis comparing the port state measures RFMOs have established, and the provisions set forth in the FAO's PSMA. Pew's analysis describes very specifically how the protocols of 10 RFMOs fall well short of the standards established by the PSMA.
- **Greenpeace**, which maintains an IUU blacklist database compiled from publicly available official registries of IUU vessels and companies. Greenpeace also published last year a report on the extent of IUU fishing by South Korea's distant water fishing fleets, and is one of the few NGOs closely tracking both legal and illegal fishing in Melanesia (i.e., Papua New Guinea, Solomon Islands, etc.), where IUU is a particular problem.
- **Oceana**, which is actively fundraising to start a campaign—as part of its Global Fishing Watch program—promoting PSMA ratification and PSMA protocol training for government officials.

To our knowledge, no private foundations have invested substantial funds in promoting the PSMA ratification or PSMA-related training for fisheries agents and customs officials. This is, in part, because the type of government-to-government collaboration it requires is usually considered more appropriate for bi-lateral and multi-lateral donors (e.g., the European Fisheries Fund can be used to implement activities that improve traceability).

### Challenges

- **High cost and complexity of campaigns around ratifying the PSMA**: For the PSMA to take effect, 14 more countries need to ratify it. While adherence to the PSMA's provisions is critical to fighting IUU on the high seas, successful campaigns to encourage countries to ratify the PSMA will require a well-crafted strategy and a lot of persistence. Encouraging ratification will also require careful adherence to lobbying rules in target countries. Whether or not to focus limited resources on the wider adoption of an international treaty or on practical, day-to-day management is a difficult calculation.
- **Limited capacity to implement the PSMA:** Even if the PSMA secures 25 ratifications, implementation will require significant financial resources and collaboration between governments, the industry, and NGOs. Each jurisdiction will need to train enough people in ports to effectively and consistently administer the provisions and obligations attached to the PSMA; without wide adoption, IUU vessels will sail to "friendly" ports where enforcement is lax.

### Opportunities

- **Develop an IUU list:** Develop a coordinated and widely distributed list of suspected illegal fishing vessels on a common database platform for easy sharing.
- **Work with the Indonesian government and NGO community:** Indonesia presents an apparent window of opportunity to build on the momentum created behind recent efforts to crack down on illegal foreign fishing. NGOs could, for example, promote Indonesia's ratification of the PSMA. Alternatively, even if Indonesia doesn't ratify the PSMA, there may be value in working with the government to set up a training program for fisheries officials using the protocols found within the PSMA. Pew is conducting something similar in southeast Africa. There is hope that Indonesian leadership in the Western Pacific could induce others to follow suit.
- **Have IUU declared an international crime:** Promote efforts at Interpol and other international bodies to have IUU fishing declared an international crime in the same way, for example, wildlife trafficking is.

# 3. CONCLUSION

Overall, there is a great deal of enthusiasm and recent momentum around efforts to address IUU. This funding space is not well covered, and a handful of NGO actors (EJF, Oceana, Pew) are repeatedly playing the main leadership roles. It will take an interconnected and well-coordinated set of efforts to effectively deter illegal fishing globally – this is by no measure an easy problem to solve. However, efforts to specifically address illegal fishing (whether through import controls, the PSMA, or technology) appears to be a promising approach because it inevitably leads national governments to also put to the test ways of reducing Unregulated and Underreported fishing. Ultimately, reducing IUU fishing complements both in-country fisheries reform and the promotion of sustainable seafood.

To summarize, the main opportunities identified during our research and interviews include:

### Trade Policy and Import Controls

- **Improve implementation of the EU's IUU policy:** Help government and non-government partners maintain momentum behind new IUU regulations and avoid backsliding.
- **Help improve policies in countries affected by EU sanctions:** In South Korea, for example invest in initiatives that test the effectiveness of new IUU laws and, at the same time, maintain pressure on the government to enforce those laws. In addition, help local organizations build pressure in other countries, such as Japan and Taiwan, to make similar changes, using Korea as a model.
- **Ensure US regulations are robust have the intended effect:** Ensure that the Presidential Task Force results in binding and enforceable traceability requirements for seafood. Build government, business and public support for strengthened, global transparency requirements.
- **Improve cross-nation coordination of IUU policies:** Ensure that the world's largest seafood markets – the US, the EU, and Japan – fully coordinate their developing efforts to deter IUU fishing.
- **Advocate for other key markets to apply stricter anti-IUU fishing rules** (particularly in Japan and China): The US and EU should work together to encourage other major seafood markets to adopt complementary IUU policies. Targeted campaigns have been important in this regard, by shedding light on illegally caught seafood, seafood fraud, and human rights abuses in seafood supply chains, and thus opening political windows for anti-IUU policy development and enforcement.

### Technology Development and Application

- **Mandate vessel monitoring and a Global Vessel Record:** Convince governments and RFMOs to mandate the use of two known technologies, namely AIS/VMS instruments on boats, as well as a common format database with fishing vessel data that is publicly accessible and easily shared. In doing so, it might be possible to establish a system whereby, in the next decade, an enforcement officer will be given a vessel's unique identification number and, with a few clicks, gain access to accurate information about that vessel's true identity, whether it has been involved in illegal fishing, whether to permit or deny it port entry, or whether to begin gathering evidence and preparing legal proceedings against the boat and its owners.
- **Develop proof points in a handful of fisheries:** Few examples exist outside of the US and Europe where comprehensive monitoring, traceability, surveillance, and enforcement have been proven effective either for a large MPA/Reserve (like the Pacific Monuments), for a particular fishery, or for a full supply chain from source to plate (like Chilean sea bass). More of these examples are needed to prove it can be done in a way that is credible, cost effective and of clear social, economic and environmental value to relevant stakeholders. Enforcement in the Galapagos National Park comes close. Pew's Ending Illegal Fishing Campaign and WWF's traceability work are

designed to result in a handful of these examples. And Oceana's Global Fishing Watch campaign could essentially shame bad government and industry actors into better performance and behavior by increasing transparency across the board. But careful selection of 5-7 fisheries, supply chains and/or MPAs, and then thoughtful design of a monitoring, surveillance and enforcement protocol for the whole portfolio, could go a long way to prove the concept, to test the technologies that are most cost effective under different conditions, to train people in the use of new technologies, and to get the cost of technology use down. With a critical mass of successes, the momentum to stop IUU fishing will accelerate.

### Fisheries Governance and the PSMA

- **Develop an IUU list:** Develop a coordinated and widely distributed list of suspected illegal fishing vessels on a common database platform for easy sharing.
- **Work with the Indonesian government and NGO community:** Indonesia presents an apparent window of opportunity to build on the momentum created behind recent efforts to crack down on illegal foreign fishing. NGOs could, for example, promote Indonesia's ratification of the PSMA. Alternatively, even if Indonesia doesn't ratify the PSMA, there may be value in working with the government to set up a training program for fisheries officials using the protocols found within the PSMA. Pew is conducting something similar in southeast Africa. There is hope that Indonesian leadership in the Western Pacific could induce others to follow suit.
- **Have IUU declared an international crime:** Promote efforts at Interpol and other international bodies to have IUU fishing declared an international crime in the same way, for example, wildlife trafficking is.

# APPENDIX 1: FAO DEFINITION OF IUU

**Illegal** fishing refers to fishing activities:

- conducted by national or foreign vessels in waters under the jurisdiction of a State, without the permission of that State, or in contravention of its laws and regulations;
- conducted by vessels flying the flag of States that are parties to a relevant regional fisheries management organization but operate in contravention of the conservation and management measures adopted by that organization and by which the States are bound, or relevant provisions of the applicable international law; or
- in violation of national laws or international obligations, including those undertaken by cooperating States to a relevant regional fisheries management organization.

**Unreported** fishing refers to fishing activities:

- which have not been reported, or have been misreported, to the relevant national authority, in contravention of national laws and regulations; or
- undertaken in the area of competence of a relevant regional fisheries management organization which have not been reported or have been misreported, in contravention of the reporting procedures of that organization.

**Unregulated** fishing refers to fishing activities:

- in the area of application of a relevant regional fisheries management organization that are conducted by vessels without nationality, or by those flying the flag of a State not party to that organization, or by a fishing entity, in a manner that is not consistent with or contravenes the conservation and management measures of that organization; or
- in areas or for fish stocks in relation to which there are no applicable conservation or management measures and where such fishing activities are conducted in a manner inconsistent with State responsibilities for the conservation of living marine resources under international law.

# APPENDIX 2: INTERVIEWEES

- Chuck Fox, Oceans 5
- Bob Gillett, Gillett, Preston and Associates
- Tony Long, The Pew Charitable Trusts
- Michael Kellerman, The Pew Charitable Trusts
- Marcel Bigue, WildAid
- Steve Trent, Environmental Justice Foundation
- David Schorr, WWF
- Andy Sharpless, Jim Simon, and Jackie Savitz, Oceana
- Dave Balton, US Department of State

# APPENDIX 3: KEY PLAYERS

## FOUNDATIONS

### Moore Foundation

Moore is currently implementing a two year, $3 million/year traceability pilot with hopes of getting board approval in May 2015 for a comprehensive portfolio focused on traceability and IUU. Pilot grants include:

- FishWise (2014) — $634,520 — To support efforts to create traceability principles at an international and national level create tools for companies with the willingness to improve and ensure coordination amongst stakeholders to expedite progress and reduce redundancy.
- Institute of Food Technologists (2014) — $677,000 — to develop a tool to conduct cost/ benefit analysis of establishing various levels of traceability in seafood supply chains and the return on investment of traceability to individual companies.
- WWF (2014) — $1,552,753 — to develop a strategy and vision for a Global Dialogue on Seafood Traceability with a reputable organization that significantly advances concrete industry and government commitments.

### Oceans 5 Alliance

Oceans 5 seeks to strengthen the traceability requirements in dominant import markets, including the US and EU. Grantees include: Oceana, WWF, MFCN, and Greenpeace. Sample grants include:

- EU policy advocacy: EJF, Oceana, Pew, and WWF (2014-2016) – $1.4 million/year – to combat illegal fishing, improve transparency, and improve implementation of the EU IUU Regulation by the European Commission and EU Member States.
- US policy advocacy: Oceana, World Wildlife Fund, MFCN, and Greenpeace (2012-2014, considering a renewal now) – $1 million/year – to combat illegal fishing and improve accountability for fisheries conservation. The project seeks enforceable new rules in the United States to ensure that all seafood is legally sourced and fully traceable "from bait to plate." By closing one of the world's biggest seafood markets to imports of illegal fish, the project aims to drive global standards for seafood traceability and well-monitored fishing.

### Oak Foundation

- Oceana (2013-2016) — $8,600,000 — to provide core support to Oceana. Some of this funding is dedicated to IUU campaigns in the EU.
- Pew Charitable Trusts (2014) — $300,000 — to support Trygg Mat Tracking Foundation's initiative to build a global database of fishing vessels. The database will allow enforcement agencies and other stakeholders to access the identity and history of a fishing vessel, regardless of changes in name, ownership or flag registry. This will enhance the effectiveness and accuracy of the analysis and investigation of illegal fishing operations.
- Pig Shed Trust (2014) — $3,700,000 — to fund projects that support the implementation of the 2014 Common Fisheries Policy (CFP) reform (and inform the 2022 CFP reform) in order to achieve improved marine ecosystem health and fish stocks in Europe. Pig Shed Trust will establish a trusted platform for collaborative philanthropic investment in European fisheries. The platform will fund projects across Europe that ensure the new elements of the reformed CFP are tried and tested
- Oceans 5 Alliance (2014-2016) — $3,000,000 — To support the Oceans Five Alliance, a global funder's collaborative that focuses on expanding marine protected areas and constraining overfishing.

## NGOs

### Environmental Justice Foundation (EJF)

EJF seeks to expose pirate fishing globally. It implements, for example, a community surveillance project in West Africa to monitor and report pirate fishing by industrial vessels in inshore areas, and is increasingly using satellite technology to identify illegal fishing further offshore as well as illegal trans-shipments of fish at sea. EJF is also quite focused on potentially criminal labor conditions and human trafficking related to IUU fishing. In 2013, EJF-generated data was used to build the case for "yellow carding" the South Korean and Ghanaian fishing industries by the EU Commission, and EJF is currently gathering data on abuses in the Thai fishing industry. EJF is based in London and provides film and advocacy training to individuals and grassroots organizations in the global south, enabling them to document and expose environmental abuses. The organization's Global Fisheries Transparency Project calls for the urgent development of a Global Record of fisheries vessels and an end to the exploitation of Flags of Convenience.

### FishWise

FishWise has been a leader in seafood traceability research and has specifically worked to highlight links between IUU and social issues and labor abuses. FishWise also plays an important role coordinating IUU fishing and traceability efforts in North America. FishWise is currently partnered with retailers, including Safeway, Target, and Hy-Vee, and works to establish sustainable procurement practices and increase the transparency around their sourcing.

### The Global Food Traceability Center

The Global Food Traceability Center, a US public-private partnership with sponsors from industry, academia, and NGOs, has been coordinating efforts to ensure alignment and interoperability of global seafood traceability systems and US regulations.

### Greenpeace

Greenpeace maintains an unofficial blacklist on their website to help combat IUU fishing and advocates for seafood traceability in their tuna and retailer campaigns.

### International Seafood Sustainability Foundation (ISSF)

ISSF is a coalition of companies and NGOs aimed at conserving tuna stocks. ISSF requires member companies only buy fully traceable tuna from purse seine vessels that have IMO numbers, have not transshipped at-sea, and have onboard observer coverage. ISSF members are to withdraw product from the marketplace if it is found to be from a vessel on an RFMO's IUU list. ISSF also manages the pro-vessel registry (PVR), a third-party-audited database of vessels that have adopted best-in-class practices including 100% observer coverage, participation in a global vessel monitoring system, obtaining an IMO number, etc.

### MSC

The MSC has established a chain of custody certification capable of ensuring traceability back to the source fishery. The Aquaculture Stewardship Council (ASC) and other farmed certification schemes have similarly demonstrated the viability of boat-to-plate traceability. Companies that use the MSC eco-label must obtain independent chain of custody verification that the product originated from a certified fishery, which must be demonstrated by a certificate held at each link in the chain.

### Oceana

Oceana is an active policy advocate in the EU and the US on IUU legislation, campaigning for more transparency and accountability in the seafood supply chain. Oceana is also a leader in exposing seafood fraud which has generated widespread media coverage and supported their policy efforts. Oceana's 2013 US seafood fraud report tested 1,200 samples from 674 retail outlets in 21 states and found one-third mislabeled according to FDA guidelines. More recent efforts include an exposé on US shrimp (in which Oceana found 30 percent mislabeled), and on local, iconic species such as Chesapeake blue crab (38 percent is mislabeled).

### The Pew Charitable Trusts

Pew's Global Campaign to End Illegal Fishing is working to set up a global fisheries enforcement system to combat IUU fishing. Pew is working to build the international capacity for generating critical analysis and intelligence on IUU fishing, developing ways for nations to share information about IUU fishing, and putting critical information and tools in the hands of enforcement authorities worldwide. PEG will continue to assist in efforts by national and

international bodies, including Regional Fisheries Management Organizations, to implement the Port State Measures Agreement, create a global record of fishing vessels, and create minimum standards for flag state responsibility.

### The Pacific Islands Fisheries Forum Agency (FFA)

FFA is an international, membership organization representing 17 Pacific Island nations. Its mandate is to help member states improve the management of and maximize benefits from their tuna fisheries. FFA has fairly generous funding from the European Union and Australia to implement a program anchored by on-board observer programs (people and cameras) and VMS-based monitoring and surveillance (especially of purse seiners). FFA's program is complemented by Australian and French air force flyovers that patrol the waters of French Polynesia and Australia's Melanesian neighbors.

### SkyTruth

SkyTruth's in-house satellite image technology has been applied by Pew to, as just one example, help monitor illegal fishing off Easter Island, and by Oceana to develop its Global Fishing Watch online prototype by providing locational data on thousands of fishing vessels from 2012-2013. [skytruth.org]

### TRACE Wildlife Forensics Network

TRACE Wildlife Forensics Network (a Marine Stewardship Council partner), Applied Food Technologies, the US Food and Drug Administration, the EU's FishpopTrace, Eurofins, Agilent Technologies and many other companies and government agencies conduct DNA analyses themselves or sell mobile kits that enable DNA testing of fish. DNA testing represents another important data point in the process of tracing what fish are caught and from where they are sourced. The price of kits is going down (usually in the hundreds of dollars) while their mobility, ease of use, and accuracy is going up.

### WildAid

WildAid has been utilizing various surveillance technologies in different combinations and different locations for the last decade. WildAid works with local government and NGO partners on MPA and shark monitoring, and on surveillance and interdiction in, for example, the Galapagos National Park and Raja Ampat, Indonesia (where they partner with the Misool Resort to monitor and enforce fishing in a Conservation Concession negotiated between the Resort and the local community). WildAid is also building programs in the Ecuador, in the Revillagigedo Islands, Mexico, and in northern Palau. In Galapagos National Park, WildAid and its partners gather data by way of land radar stations, GPS, AIS, and VMS systems, then feed the information to boat patrol teams and the Navy for enforcement. WildAid and its partners in the Galapagos rely heavily on VMS for large offshore fishing vessels, and on radar and high-powered land-based cameras for nearshore artisanal fisheries, cameras that cost about $15,000-$20,000 each and that can "see" 10 nm out from shore.

### Wildlife Conservation Society

Wildlife Conservation Society is implementing an increasingly successful multi-regional campaign against illegal shark and ray fishing (with particular recent success in Indonesia), as well as developing new, locally appropriate tools for improving surveillance of and reporting on near shore and small scale IUU fishing.

### WWF

WWF's Transparent Seas program works to increase transparency and ensure that seafood is fully traceable to legal sources. The Project was launched in 2012 as part of WWF's Smart Fishing Initiative and has staff based in Washington, Brussels, Maputo and Hamburg. TSP works in both "market" and "producer" countries with its main activities currently focused in the US, EU and Africa. TSP is funded through WWF's Smart Fishing Initiative core budget, Oceans 5, the Moore Foundation, and the Norwegian Agency for Development Cooperation (for activities focused on Coastal East Africa).

WWF's SmartFish program has multiple dimensions, but at its heart is a desire to curtail IUU fishing and promote full supply chain traceability by improving catch documentation and the use of satellite data. WWF's emphasis on AIS, satellite imagery, catch documentation, etc. is in many respects quite similar to that of Oceana and Pew, and it is even working with a company called navama to create a new vessel tracking tool and data sharing platform that is similar to Oceana's. On the other hand, WWF's emphasis is distinct in that it is more narrowly applied to a handful of carefully selected and important commercial species and specific early adopters in the fishing industry. WWF has, for example, started a 5-year partnership with the Global Environment Facility and the Food and

Agriculture Organization to make it mandatory that all tuna purse seine vessels have and use AIS and other electronic monitoring systems (including, for example, cameras) to improve the accuracy of tuna catch data. WWF is also working with a fishing company in Fiji, Seaquest, to experiment with AIS transmitters and full tracking transparency in a local long-line tuna fishery using satellite technology.

## FOR-PROFIT COMPANIES

### Aero Environment

Aero Environment is one of several companies that builds unmanned aircrafts/drones. They are usually utilized in support of military operations, but can also be used for ocean surveillance. Each aircraft costs about $100,000. While drones are a relatively new technology, at least in their applications for IUU fishing, they are often used to replace or, more often, complement aerial surveillance conducted by government air forces. WildAid has been in contact with Aero Environment about possible collaboration.

### Archipelago Marine Research

Archipelago Marine Research works with government agencies and the fishing industry to monitor fishing effort in western Canada. In addition to at-sea observer services, Archipelago provides the technology needed to improve dockside monitoring to verify catch, as well as electronic monitoring at sea, using gear sensors, cameras, data collection software, etc.

### DigitalGlobe

DigitalGlobe's Sea Star team provides data and imagery to, among many others, the US Coast Guard on all areas in the Pacific that are within US Exclusive Economic Zones. DigitalGlobe typically concentrates on the edges of EEZs, where illegal fishing is most likely to occur. The USCG uses DigitalGlobe's data to plan both air and naval surveillance to intercept violators (see www.geoeye.com). DigitalGlobe currently works with both WildAid and Pew, both of whom sometimes buy their satellite images. Satellite images cost about $1,500 each, and DigitalGlobe's program with the USCG costs about $120k each year.

### Liquid Robotics

Liquid Robotics builds Wave Gliders—water borne drones that have the capacity to assist with a range of needs, from "Maritime Domain Awareness" to fish stock assessments.

### Shellcatch

Shellcatch is a for-profit company working directly with fishermen to install the hardware boats need to collect data and verify what fish are caught where, using which methods. Shellcatch's verification system is based on the use of photos, video and telecommunication tools on boats, docks and processing plants. "Location data, images, weight information, and radio frequency codes along the supply chain enable Shellcatch's verification of seafood products."