



PROCEEDINGS OF THE IMSE 2021 CONFERENCE ON ILLEGAL, UNREGULATED AND UNREPORTED FISHING

8-9 September 2021

The enduring theme of the Indo-Pacific Maritime Security Exchange (IMSE) is *Building Partnerships for Security, Stability and Prosperity*. IMSE's purpose is to provide a forum for senior leaders, subject matter experts, and interested members of the public to engage in dialogue about maritime security in the Indo-Pacific region.

IMSE was founded in 2018 by retired U.S. Navy captains Larry Osborn and Richard Jaeger, both members of Navy League Honolulu Council. They were joined in 2021 by Peter Oleson, a retired senior defense official, in producing IMSE 2021.

Previous editions of IMSE focused on Humanitarian Assistance/Disaster Response (2018) and Collaboration and Capacity Building (2020). As a result of restrictions on large gatherings due to the COVID pandemic, IMSE 2020 had to be cancelled and IMSE 2021 was held as a virtual event.

IMSE 2021 explored **Illegal, Unregulated and Unreported (IUU) fishing** – why it is a big problem in the region and how it might be controlled.

Nearly all of the thirty-six countries that comprise the Indo-Pacific region are maritime nations. The region contains nine of the ten busiest seaports in the world and more than half of global maritime trade transits the region. The national sovereignty and economic well-being of nations in the region are dependent on the maintenance of the rule of law and international norms on the high seas as described in the United Nations Convention on the Law of the Sea (UNCLOS). Today this rule of law is being challenged by expansionist territorial claims in the South China Sea, harassment of foreign vessels in international waters, and illegal, unreported, and unregulated (IUU) fishing.

Countering these threats to maritime security in the region requires the collaborative efforts of like-minded nations in the military, diplomatic, law-enforcement, and commercial arenas.

The conference spanned two days. Day 1 was focused on understanding IUU fishing, what it comprises, its impacts on fisheries and nations, the issues with the rule of law, the challenges of maritime enforcement, and existing political issues. Day 2 explored potential solutions for countering IUU fishing, including remote sensing technologies, the integration and analysis of disparate data, the need for nations to collaborate and share data, and other solutions, such as market-driven measures. Larry Osborn served as the moderator and EMCEE throughout the event.



Day 1 (8 September 2021) – Understanding IUU Fishing

The introductory session asked “What Constitutes IUU Fishing?” There are many aspects to the problem. **Illegal fishing** is that 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. This can involve forgery of records, illegal transshipment of catches, fraud, corruption, false flagging, or other illegalities, such as human slavery involving crews. **Unreported fishing** involves catch that has not been reported, or has been misreported (such as calling Patagonia Toothfish, a protected species, as Tilapia) to the relevant national authority, in contravention of national laws and regulations. **Unregulated fishing** occurs in areas, or for specific fish stocks, where there is no applicable conservation or management measures and where such fishing is conducted in a manner inconsistent with the State responsibilities (i.e., the nation that either provides the flag for a vessel or oversees the ownership of the same) for the conservation of marine resources under international law.

IUU fishing leads to unsustainable harvesting of species, habitat destruction such as occurs when using drag nets, and pollution. It is projected that 16 of the 22 Pacific Island nations will not be able to meet their local food needs given their population growth and continued IUU fishing, especially by in-shore poaching of high value stocks, such as clams, cucumbers, reef fish, and sharks. It is estimated that over 95% of IUU fishing activities in the Pacific Tuna Fleet involve legally licensed boats that operate off-shore beyond the 12 nautical mile national boundary, not by so-called “dark boats” that are unregistered in any country. Mis- or under-reporting of catch, illegal discards, and illegal transshipment of catch are major problems.

Other crimes associated with IUU fishing, include forgery and fraud, corruption, vessel identity and flagging states deception, licensing avoidance and deception, human rights abuses (e.g., forced labor, human trafficking, and child labor), illegal transshipments of catch and fuel, smuggling of drugs and protected species, black marketing and money laundering, and evasion of penalties.

Fishers from many nations engage in IUU activities. IUU fishing tends to be a low risk / high value activity. Penalties if and when caught tend to be relatively modest fines.

Speakers included **Ms Gina Fiore**, who is a senior associate of Pew Charitable Trust managing projects on illegal fishing and related crimes, and **Mark Zimring**, who is the director of the large-scale fisheries program of The Nature Conservancy, observed that technical solutions exist for IUU fishing but necessitate political will and technical and financial support to succeed.

The second introductory session examined the status of global fisheries. Speakers included **Mr. Michael Tosatto**, the National Oceanic and Atmospheric Administration



(NOAA) Fisheries Service Pacific Islands Regional Administrator; **Dr. Alex Kahl**, a NOAA international fisheries manager; and **Dr. Tim White**, a senior fisheries scientist at Global Fishing Watch.

Mr. Tosatto briefed that NOAA estimates that worldwide 156 million tons of fish were harvested for human food. An additional 23 million tons were used for non-human uses, such as fish meal and fish oil. Major fishing nations and the approximate percentages of fish each caught are The Peoples' Republic of China (35%), other Asian countries (34%), the Americas (14%), European nations (10%), African nations (7%) and Oceania nations (1%). Almost 60% of fish caught came from the Pacific, and over half of that are of species that are unsustainable at current rates. Of the world's 4.5 million fishing vessels two-thirds are in Asia. One third worldwide are small, many un-motorized boats of local fishermen. Tuna is a major fishing target and mostly come from areas around Indonesia and South Pacific islands.

Across the Pacific are multiple Regional Fisheries Management Organizations (RFMOs). Many nations are members of multiple RFMOs, each of which covers a specific geographical region or are responsible for managing highly migratory fish stocks. RFMOs set the rules and limits for fishers. As Dr. Kahl explained the RFMO system is a complex patchwork with differing and sometimes contradictory regulations.

Dr. White described how Global Fishing Watch tracks fishing activities around the world in near real-time, using multiple sources of information, and identifies fishing trips and vessel's patterns of activity, and gaps in their required broadcasting of Automatic Identification System (AIS) and Vessel Monitoring System (VMS) data.

Major points made by presenters in the morning of Day 1 included:

- IUU fishing has replaced piracy as the leading global maritime security threat;
- 93% of fish stocks are fully exploited, over exploited or significantly depleted;
- IUU fishing costs an estimated US\$23.5 billion annually (according to Pew);
- The Peoples' Republic of China is the worst perpetrator of IUU fishing;
- 3.3 billion people rely upon fish for 20% or more of their animal protein; and
- IUU fishing threatens fishers, associated industries, and takes money out of local economies. Fisheries are the primary source of income for many of the oceanic states in the Pacific.

The next conference session addressed various regional perspectives on IUU fishing.

Dr. Asura Salleh, a Brunei native and special advisor for maritime security at the Yokosuka Council on Asia-Pacific Studies in Japan, presented the results of her recent study of IUU fishing around the multi-nation island of Borneo, which noted a declining



marine habitat. She noted how essential multi-state collaboration and multilateral agreements across RFMOs will be to solve the problems associated with IUU fishing.

Dr. Peter Mous, the director of the sustainable fisheries program at Yayasan Konservasi Alam Nusantara, an affiliate of The Nature Conservancy, in Indonesia estimated that 11 to 28 million tons of fish are lost to IUU fishers globally annually, with an economic value estimated at 10-23 US\$ billion. This is a major problem for countries such as Indonesia which depends on fish for food security and export income. Training of fishers in proper practices and of prosecutors who can address IUU fishing are major recommendations. Mous showed fisher-friendly, form-free, paperless data collection methods now being used to assess stocks.

Mr. Eko Rudianto, the director of marine resources management and surveillance for Indonesia's Ministry of Marine Affairs and Fisheries, explained the challenge Indonesia faces with over 17,000 islands and an Exclusive Economic Zone (EEZ) of 6.4 million kilometers. Since 2015 Indonesia has arrested over 800 IUU fishing vessels, more than half of which were foreign flagged. He noted the importance of improving maritime surveillance (which Indonesia is doing) and law enforcement, the legal policies toward IUU fishing, and bilateral and regional cooperation on information sharing, which, he noted, has not gone well.

A view from Taiwan was given by the president of Taiwan's Overseas Fisheries Development Council, **David Chang**. He addressed Taiwan's efforts in combatting IUU fishing, reforming its legal framework, improving monitoring of fishing, and promoting international cooperation. He detailed Taiwan's sequential management of its distant water fleet – fishing permit, VMS tracking, logbook reporting, transshipment management, port inspection, catch certification for market, and export management. He noted that Taiwan's efforts resulted in the lifting of European Union sanctions in 2019.

The final presenter for the session on regional perspectives was **Dr. Tabitha Grace Mallory**, CEO of the China Ocean Institute and professor at the University of Washington. She addressed the People's Republic of China, the world's largest fishing nation, and that it is the #1 IUU fishing nation. Problems include a lack of transparency of its fishing activities, the extensive subsidies provided fishers, and lack of seafood traceability. The PRC's subsidies, the most generous of any nation by far, make otherwise unprofitable fishing profitable. Dr. Mallory noted that in the South China Sea territorial claims are more important than fishing and that for the PRC's distant

water fleet, the world's largest, geopolitical considerations are also important. She also noted that the PRC is the world's largest fish aquaculture producer and a major exporter of processed fish caught by other nations, including the U.S.

The rule of law was the focus of the next session of the conference. **Dr. Camille Goodman**, a lawyer at the Australian National Centre for Ocean Resources and Securi



ty and senior lecturer at the University of Wollongong, addressed the relevance of the 1994 United Nations Convention of the Law of the Sea (UNCLOS) to IUU fishing. While UNCLOS (1982) does not specifically address IUU fishing many of its provisions, which established the legal framework for activities at sea, are relevant. UNCLOS established the concept of EEZs out to 200 NM. Coastal states have the right to consent to and restrict fishers within the EEZ as they do in coastal waters. The flag states have exclusive jurisdiction over vessels flying their flag when on the high seas. Port states can regulate vessels that enter their ports. All UNCLOS signatories have responsibility to ensure their nationals conserve living ocean resources. Dr. Goodman noted the gaps and limitations related to IUU fishing in UNCLOS and the later UN Fish Stocks Agreement of 1995.

A regional perspective on laws related to IUU fishing was given by **Mok Lay Yong**, a Malaysian solicitor to the High Court of Malaysia and consultant to the International Maritime Organization (IMO). She addressed Malaysian laws related to fishing and the challenges faced in enforcing laws, including resource limitations, coordination, data sharing, and unsettled EEZ boundary issues.

With an understanding of the various aspects of IUU fishing, its impact on various countries, and the relevant rule of international and national laws, the conference turned to addressing issues. The first issue session related to the maritime law enforcement challenges faced by nations.

The Pacific Ocean is large, comprising more than 30% of the Earth's surface. Distances are great. **Captain Holly Harrison**, USCG, who recently commanded the USCG Cutter Kimball on a Western Pacific patrol, provided a deck plate perspective on at-sea enforcement operations. She addressed the "tyranny of distance," and the considerations a skipper must assess – ship speed, time, distance, fuel state, weather, remote and limited logistics, and the possibility of help, all related to the need to be self-sufficient. She emphasized the complexity of boarding operations and the importance of intelligence and the value of surveillance assets, such as the ScanEagle remotely piloted aerial vehicle that enables covert surveillance of IUU fishing vessels. She emphasized the key nature of partnerships for language interpreters, fish stock experts, and information sharing.

Mr. Gary Orr then spoke about the issues related to IUU fishing from a South Pacific perspective. He is the director of compliance for the New Zealand Ministry of Primary Industries, which oversees fishing, and serves as the chairman of the International Monitoring Control and Surveillance Network (IMCS). He noted that the issues involved the capacity of nations to enforce their laws, to include adequate resources and relevant regulations; the capabilities needed for enforcement; and the cooperation between nations. Capability needs include training of enforcement officers and having



the necessary basic equipment, including uniforms and communications. Intelligence is critical for managing scarce resources. Cooperation between states ought to include sharing assets, people, and information. He noted that the cross-vesting of powers among states was a positive development.

These two presentations were supplemented by the award-winning 1999 documentary video produced by the **Pacific Islands Forum Fisheries Agency** on the topic of countering destructive activities in the world's largest tuna fishery.

The final session of Day 1 focused political issues and efforts to resolve conflicts in the Pacific region.

David Hogan, who is with the US State Department's Office of Maritime Conservation and an expert on a range of issues related to international conservation and management of living marine resources, discussed how fishing fleets have grown and outstripped the ocean's abilities to replenish stocks and catch competition has increased. This and the migration of fish due to climate change has the potential for conflict between vessels, fleets, and nations. He noted the UN Fish Stocks Agreement and the international agreement to combat IUU fishing, as well as the US's Maritime Security and Fisheries Enforcement (SAFE) Act of 2020 that has the aim of improving coordination among US government agencies. He addressed the UN Port States Agreement intended to bar illegally caught fish from entering the world marketplace, thereby reducing the motivation to pursue IUU fishing.

Australian expert and emeritus professor of politics at the University of New South Wales, **Dr. Carlyle Thayer**, focused on current issues in the South China Sea, where 12% of the world's fish are caught – 70% of which are harvested by China and Vietnam. He also noted that China is the #1 IUU fishing nation whose trawlers are often protected by its maritime militia and coast guard. Vietnam, after receiving a warning from the EU, has formulated a high-level task force to work against its IUU fishing. ASEAN and China have been negotiating for over two decades about a code of conduct for fishing. Finally, a living document has been agreed to, which includes provisions on cooperation and prevention of incidents. But the agreement has holes and issues, such as geographical scope and delimitation of EEZs, need to be resolved.

Lastly, **Mr. Bill Sharp**, who taught Asian politics at Hawaii Pacific University, Chaminda University, and the University of Hawaii at Manoa, spoke of Taiwan's efforts to reform its large distant water fishing fleet. He noted the importance of improving control of its distant water fishing fleets, the second largest in the world, to maintain a positive image internationally. The EU's issuance of a yellow card in 2015 and the US's designation of Taiwan as an IUU fishing nation in 2021 has not helped. Problems that the Taiwan government, which traditionally had a laissez faire approach to controlling fishing, include labor contract violations and failure to pay wages, transshipment of catch



es to avoid inspection, shark finning, and the use of foreign flags for vessels that are Taiwan-owned to evade legal action.

The conference included two keynote address on Day 1 from US Coast Guard leaders. **Admiral Linda Fagan**, the vice commandant, addressed strategic issues related to IUU fishing and its many associated illegalities. She noted the recently published US Coast Guard Strategic Outlook and Implementation Plan regarding IUU fishing. <https://www.uscg.mil/iuufishing/> . The second keynote was from **Rear Admiral Matthew Sibley**, the commander of the USCG 14th District, which encompasses the Pacific Ocean from Hawaii westward. He spoke of the Coast Guard's operations in concert with other Pacific nations in countering IUU fishing and other law enforcement responsibilities.



Day 2 (9 September 2021) – Solutions to IUU Fishing

Finding potential solutions to counter IUU fishing was the focus of the second day of the IMSE conference. It is noted that countering IUU fishing is a classic intelligence problem, involving the collection of data, their integration and analysis, and provision to those who can undertake action.

The initial session was entitled “Shining a Light on a Dark Ocean.” It addressed remote sensing technologies from outer space to underwater. While electro-optical (EO) visible imagery has been readily available from a growing number of sources since LandSat was launched in 1972 by NASA and NOAA and is well understood by most law enforcement and regulatory agencies, the conference focused on newer and emerging remote sensing technologies.

Since the 2011 first launch of the Joint Polar-orbiting Satellite System (JPSS) (NASA and NOAA’s Earth Observation Group) the Visible and Infrared Imaging Radiometer Suite (VIIRS) Day Night Band (DNB) provides superior low light imaging than that from the older Defense Meteorological Satellite Program (DMSP). **Dr. Christopher Elvidge**, who is the director of the earth observation group at the Colorado School of Mines, described how VIIRS data can detect the bright nighttime lights used by many purse seiner and ring net fishing boats to attract squid and other species. Widely used, VIIRS is used daily for meteorology (nighttime cloud imaging) and can detect gas flares, platforms, as well as the type of boat associated with specific lights. VIIRS detects smaller boats that are not required to carry either the Automated Identification System (AIS) or Vessel Monitoring System (VMS) and can geolocate them accurately.

The collection of radio frequency (RF) emissions from commercial satellites is a relatively new capability available to counter IUU fishing. **Richard Holmquist** of HawkEye360 explained how the company’s cluster of satellites can pick up navigation radar and radio emissions from 144 MHz to 15 GHz from boats at sea even if the boats turn off their required AIS or VMS broadcasts. It can identify GPS location spoofing. HawkEye 360 has three versions in orbit and expects a constellation of ten by 2023.

Other commercial firms are pursuing the collection of RF signals from space. **Malig Le Nair Doaré** and **Canelle Gaucher** of France’s UnseenLabs provided an overview of its satellite’s RF and signals intelligence capabilities and technical parameters and plans for future launches. It can differentiate individual emitters creating a unique “fingerprint.” With 4 satellites already in orbit, by 2025 UnseenLabs anticipates a constellation of 25 satellites. They noted that 20% of fish are caught illegally worldwide.

A newer form of remote sensing is synthetic aperture radar (SAR). SAR can create two-dimensional images or three-dimensional reconstructions of landscapes or objects on the surface of the Earth. It allows surveillance in all-weather conditions as it pene



trates clouds and at night. Civilian use of SAR satellite data began in 1992 with the European Space Agency's Earth Resources Satellite-1 (ERS-1). Since then many national space agencies have orbited SAR satellites of various capabilities. A recent entry into the commercial SAR satellite business is Iceye, a Finnish company. **Andrew Parlock** spoke of Iceye's capabilities and plans for future satellite launches. It can image in a 100 km by 100 km mode or in a spotlight mode at less than one meter, allowing a detailed image of a vessel and its heading. With four satellites already in orbit Iceye plans to have 22 by the end of 2022.

At a lower altitude, **Ken Perry**, vice president at ThayerMahan, discussed his company's use of underwater acoustic detection and processing to surveil open ocean regions for IUU fishing. The company's relatively inexpensive "Outpost" autonomous unmanned system tows a hydrophone 100 meters or deeper that can detect, classify, and report via satellite vessels by type and activity. The company is developing artificial intelligence (AI) tools to speed its analysis of sonograms.

There are many sources of data for surveilling ocean areas: AIS, VMS, surface and airborne visual reconnaissance, ships' radars, on-board cameras, and observers, as well as satellite remote sensing. These many sources can produce an overwhelming amount of data. And any one data source is rarely sufficient to determine many kinds of IUU fishing. It is the integration of data from disparate sources and the analysis of those data that are critical to counter IUU fishing efforts.

Dr. Chris Wilcox of Australia's national research organization, the Commonwealth Scientific and Industrial Research Organization (CSIRO), examined the CSIRO effort focused on Australia's Great Barrier Reef and how CSIRO is working to develop improved analytical tools for existing monitoring data as well as developing new low-cost methods for surveillance and developing programs to improve analytical skills for fisheries officers.

Windward is a company focused on big data analytics that provides integrated information to maritime interests, to include various fisheries management organizations and businesses for risk management. **Matan Peled**, one of Windward's co-founders, gave an example off of the Galapagos in 2020 of China's distant water fleet that turned off its AIS broadcasts over 36% of the time and engaged in 192 ship-to-ship rendezvous, which is indicative of fisher to reefer transfers. Many of the distant water fleet vessels never enter port. Windward analyzes fishing

patterns and vessel behaviors. Mr. Peled stated that Windward has noticed an evolution in IUU fishing practices in recent years from vessels changing identification to dark activity to identification spoofing, to flag hopping to systemic flag and location (i.e., GPS) manipulation.



The final presenter for this session was technologist **Ted Schmitt**, director of conservation at the Allen Institute for Artificial Intelligence (AI2), addressed what artificial intelligence can do in countering IUU fishing. The scale of data is a challenge requiring various analytical techniques, including machine learning, computer vision processing, time series analysis, and natural language processing. Mr. Schmitt emphasized that it is critical to ask the most precise question about what an analysis wants to best employ AI. Synthesis across the ecosystem of sources and data types is critical to countering IUU fishing.

IUU fishing knows no national boundaries. It is a global problem. No one nation's management or law enforcement organization is capable of enforcing fishing laws and regulations. The UN Food and Agriculture Agency (FAO) studies the problem and issues analytical reports. Interpol has a unit that focuses on IUU fishing. However, enforcement is largely a localized responsibility. That means that nations and other organizations need to collaborate to be effective. The conference session on Collaboration and Sharing Data included seven speakers.

New Zealander **Gary Orr** provided an overview of the International Maritime Control and Surveillance (IMCS) network, of which he serves as chairman. The IMCS network is voluntary, free, and has 67 member nations globally, plus 2 RFMOs, the Forum Fisheries Agency, European Union, and 8 observer organizations. IMSC serves as a facilitator for sharing information. It also runs biannual training symposia for maritime law enforcement officials.

Greg Poling, the director for the Asia Maritime Transparency Initiative at the Center for Strategic and International Studies (CSIS), noted that we are entering an era of reduced price points for advanced technologies relevant to countering IUU fishing. While satellite electro-optical imagery and AIS have been around for more than a decade, newer technologies, such as SAR and VIIRS, at some point will allow us to monitor any boat anywhere in the world. He demonstrated several of CSIS's efforts to monitor activities in the South China Seas, including the behavior of PRC coast guard vessels and whether their behaviors were escalating or not.

C4ADS is a Washington, D.C.-based firm that specializes in high context analysis and investigative support. **Jessa Dury-Agri** addressed the company's new Triton Project, which seeks to uncover the individuals and organizations behind IUU fishing by examining corporate registries and ties to known IUU fishing or transshipment vessels.

USAID has funded fishery-related programs in Southeast Asia. **John Parks** a maritime scientist with the contractor TetraTech reviewed the recent multi-year Oceans and Fisheries Partnership Project located in Thailand and involving 10 countries. The goal was to involve the private sector in cooperating in countering IUU fishing by developing



inexpensive electronic catch documentation and traceability (eCDT) hardware and software for use on smaller fishing vessels.

Thailand has been a leader in integrating various governmental ministries and agencies into a task force focused on IUU fishing. **Piyachoke Sinanun**, deputy director of operations for the Thai Maritime Enforcement Coordination Center (Thai-MECC), explained how Thailand brought many organizations together to share information and activities to counter IUU fishing. He also explained how Thai-MECC collaborates with other Southeast Asian countries.

The protection of Antarctic fish is covered by international treaty. The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) is the responsible overseer of fishing in the broad Southern Ocean surrounding the Antarctic continent. **Todd DuBois**, who currently serves as the Fisheries Monitoring and Compliance manager in Hobart, Tasmania, spoke of the challenges of remoteness and distances in surveilling its area of responsibility. He also explained how CCAMLR differs from other Regional Fisheries Management Organizations (RFMOs) as it also inspects and certifies the catches of Toothfish (also known as Chilean Sea Bass) and krill by legal fishers in the Southern Ocean.

Concluding this session Global Fishing Watch (GFW) co-founder, **Paul Woods**, provided an overview of that international NGO. He noted the digital revolution for the ocean associated with new sensor systems and analytical tools. GFW seeks to track in near real time fishing around the globe and is working to provide training and support to those who need the relevant data. It seeks to overcome ineffective and inefficient distribution of data, especially nationally-owned VMS data. He spoke of X View 3, the joint competitive experiment involving industry, the Defense Innovation Unit, USCG, and NOAA focused on SAR data, with the expectation that the winning algorithms will be openly available.

The conference's final session focused on solutions to the IUU fishing problem other than law enforcement.

Former New Zealand ambassador to the UN in Geneva and who now leads the global futures laboratory at Arizona State University, **Amanda Ellis** focused on the role of subsidies that support IUU fishing. Despite unmet global goals of ending IUU fishing and subsidies by 2020, she identified the nations that have the largest subsidies – China (\$5.9B), Japan (2.1 B), the EU (2.0 B), Korea, Russia, the US (\$1.1 B), Thailand, Taiwan, Spain, Indonesia, and Norway. Ambassador Ellis also addressed the destructive nature of bottom trawling and the collateral damage to



corals and sea grasses. The losses of sea grasses are important regarding CO2 and climate change. She estimated the loss of grasses had greater effect than the emissions from Germany or the international aviation industry.

Mr. Huw Thomas, who founded 3 Pillars Seafood, a British NGO, titled his address “A Seafood Buyer’s Approach to IUU Fishing: a View from the Market.” He described the complex process that fish pass through from boat to port to primary purchaser to processor (if canned) to wholesaler or exporter to market. Certifying the legitimacy of fish catch the lack of certification can alert buyers to possible illegal origins. Mr. Thomas described the birth of sustainable seafood coalitions in the UK in 2012 and their growth elsewhere subsequently. He emphasized the importance of collaborative efforts and noted that many buyers are increasingly on-board to counter IUU fishing.

Dr. Liz Selig of Stanford’s Center for Ocean Solution described the Seafood Business for Ocean Stewardship (SeaBOS) program that conducts international scientific assessments of aquatic resources. SeaBOS involves ten of the largest seafood companies. Stanford’s analysis identifies areas and port of high risk for IUU fishing, plus information on vessels associated with IUU fishing and their fishing methods. This helps reduce the risk to companies of acquiring IUU fish.

The conference concluded with a presentation by **Dr. Cheng Sheng Lee** of the University of Hawaii at Manoa. Dr. Lee addressed the history of aquaculture, its contributions to food stocks, and the technologies involved. He envisioned a future of “farming” the oceans rather than “hunting,” which he equated today’s practices to, in order to sustain fish stocks needed for future food security for growing populations.

The keynote address on Day 2 was by **Rear Admiral Blake Converse, USN**, deputy commander of the U.S. Navy Pacific Fleet. He spoke of the role of the Navy in helping to enforce maritime rules and where IUU fishing intersects with other security interests, such as freedom of navigation and human rights.

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The conference included several videos. Some were provided by the participating companies to supplement their presentations. *The Outlaw Ocean*, by **Ian Urbina** and **Fabio Nascimento** shown on Day 2, documented the activities of more than 700 of the People’s Republic of China’s IUU fishing fleet in the Yellow Sea within North Korea’s EEZ and the devastating impact it has had on small-scale North Korean fishers.

On the IMSE website is an extensive library of written and video materials related to IUU fishing. This on-line library is open to anyone at <https://www.imsehawaii.org/#> . Click on the tab labeled 2021 Library. This includes the 2015-16 *New York Times* series on “The Outlaw Ocean” by **Ian Urbina** and reports from the UN FAO and various non-governmental organizations (NGOs).



The IMSE 2021 conference was held virtually due to the continuing Covid-19 pandemic. A total of 209 attendees registered for the conference from 38 countries. The conference had 43 speakers representing more than a dozen nations (Australia, Brunei, Finland, France, Indonesia, Malaysia, New Zealand, Taiwan, Thailand, the UK, the US, and the Pacific Islands Forum, which comprises 24-member nations throughout the Pacific region).

The conference proceedings were recorded in full. Conference registrants can access the password-protected video at <https://imsehawaii.org> using the username and password provided when they registered for the conference.

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