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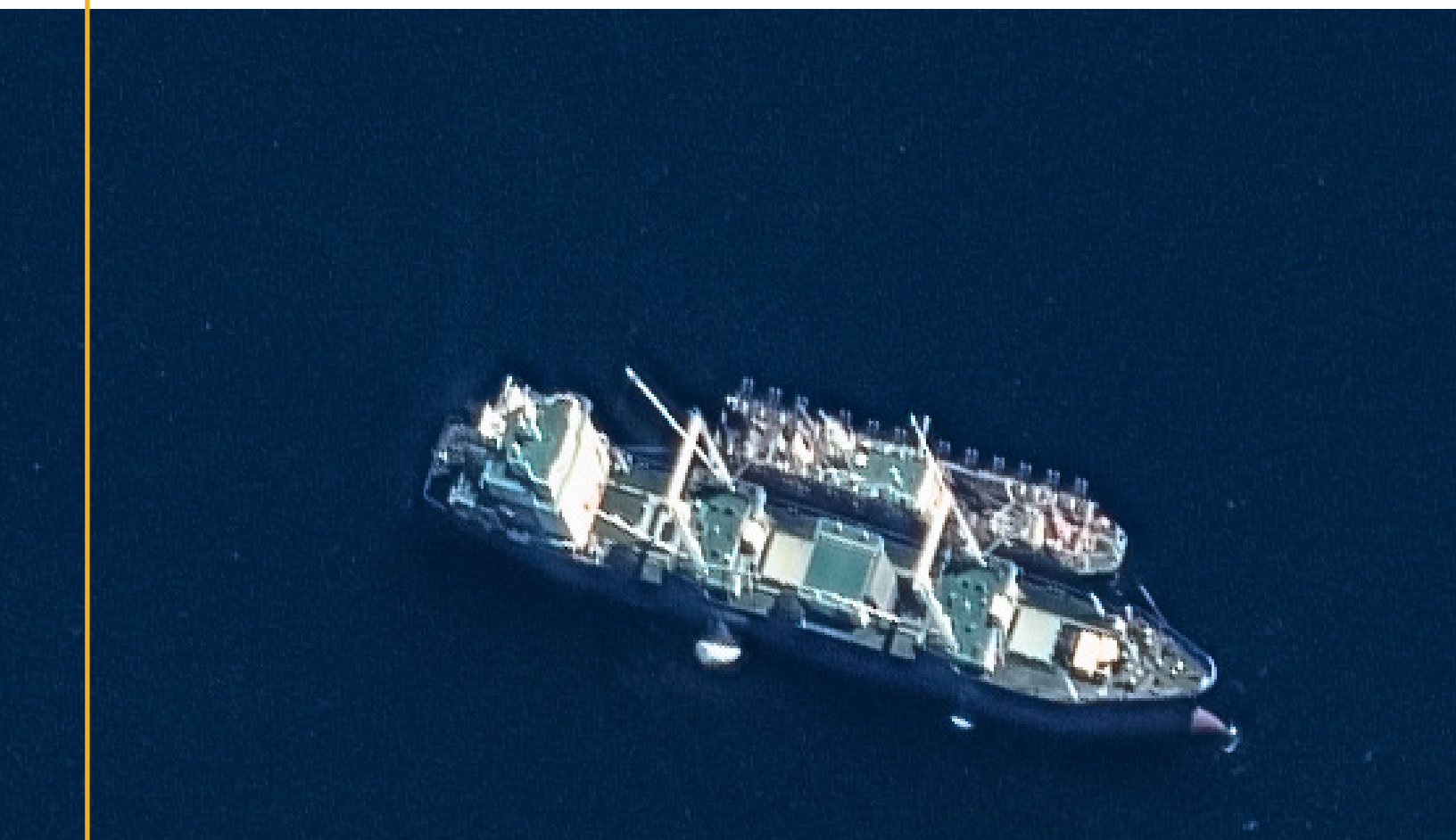
SPOTLIGHT

Disrupting illegal fishing in the Pacific



Gain a geospatial perspective on real-world problems.

See how Maxar satellite imagery and advanced analytics can be applied to solve the world's most complex challenges.

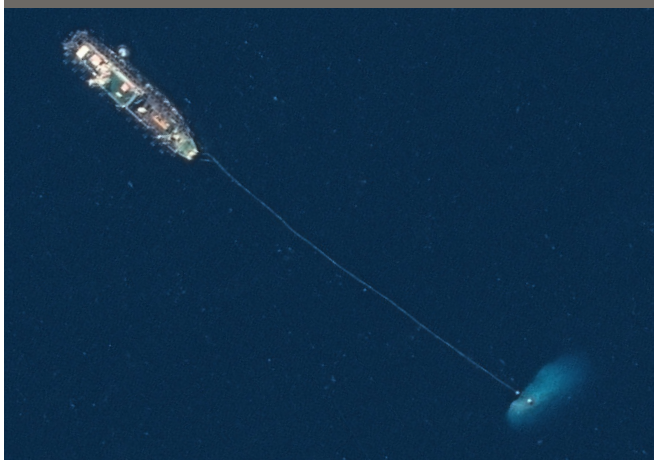
MAXAR

MAXAR TOOLS

Illegal, unreported and unregulated (IUU) fishing is one of the greatest economic, social and environmental threats to the world's oceans, according to the Global Initiative Against Transnational Organized Crime (GI-TOC).[1] Commonly called poaching, IUU fishing costs the global fishing industry tens of billions of dollars each year, according to the U.S. State Department's Office of Marine Conservation[2]—affecting the sustainability of fisheries and the livelihoods of local communities dependent on fishing for both food and income. The Southeast Pacific is among those most affected, with fishing stocks drastically depleted because of increased global consumption, overfishing and IUU profitability, according to the Food and Agriculture Organization of the United Nations (FAO).[3]

This Spotlight highlights the critical need for improved IUU monitoring and enforcement and demonstrates how Maxar's comprehensive analysis and methodology can augment anti-IUU operations. By applying unique geospatial applications and harnessing the power of big data, enforcement agencies and interagency partners can more effectively disrupt and deter IUU fishing operations.

PURSE SEINE FISHING IN THE PACIFIC
JULY 12, 2021 | WORLDVIEW-3



SUMMARY OF UNIQUE TOOLS & APPLICATIONS

InsightExplorer is Maxar's onboard maritime software platform for seafarers that integrates multiple data layers to create actionable intelligence and enable anti-IUU operators at sea. Data layers—powered by **Maxar's Marine Services data collection**—include Automatic Identification System (AIS) vessel movement and tracking, weather observations and forecasts, synthetic aperture radar (SAR), fish catch information and oceanographic analysis including plankton concentration and sea surface temperatures. Fishing recommendations are provided to narrow IUU monitoring areas. These data layers deliver comprehensive intelligence for IUU prediction, monitoring and enforcement.

Crow's Nest Maritime Monitoring and Security (MMS) leverages low-latency alerting via tipping and cueing to collect full-color imagery on vessels of interest in an established area of interest (AOI). Using AIS vessel data, SAR imagery, electro-optical imagery, advanced machine learning and automation, Crow's Nest MMS delivers critical intelligence quickly, saving valuable time and resources. The service provides broad-area surveillance, detection of vessels not transmitting via AIS and the ability to zoom in on vessels of interest for greater understanding of an individual vessel's activity and identity.

[1] Global Initiative Against Transnational Organized Crime. The Illegal, Unreported and Unregulated Fishing Index. January 2019.
[2] U.S. Department of State. Illegal, Unreported, and Unregulated Fishing. ND.
[3] Food and Agriculture Organization of the United Nations. The State of World Fisheries and Aquaculture 2020: Part 1 Overview. 2020.

IMPACT OF GROWING DEMAND AND INDUSTRY PROFITABILITY

The FAO published the State of World Fisheries and Aquaculture 2020 report (hereafter "FAO Report"), which estimates that global fish production reached about 179 million tons in 2018, with marine capture fisheries bringing in 84.4 million tons.[3] According to the FAO Report, the global consumption of fish for food increased by an average annual rate of 3.1% between 1961 and 2017, growing more quickly than the world population, which averaged a 1.6% increase annually.[3]

As demand for fish expands, IUU fishing threatens food security, ocean ecosystems and economic growth around the world, according to the National Oceanic and Atmospheric Administration (NOAA) Fisheries,[4] and undermines port and maritime security, according to the U.S. Department of State.[2] Tens of billions of dollars are lost annually to IUU fishing, says the U.S. State Department,[2] making illegal fishing the sixth most lucrative criminal activity globally, according to Global Financial Integrity, a U.S. think tank focused on illicit financial flows.[5] A 2017 report by Global Financial Integrity estimates the annual revenues of IUU activity could be $15 billion to $36 billion dollars. As fishing activity has increased, global fish stocks have decreased, providing a sobering reminder of the damage caused by overfishing. The FAO Report shows sustainable fish stocks decreased from 90% in 1974 to 65.8% in 2017.[3]

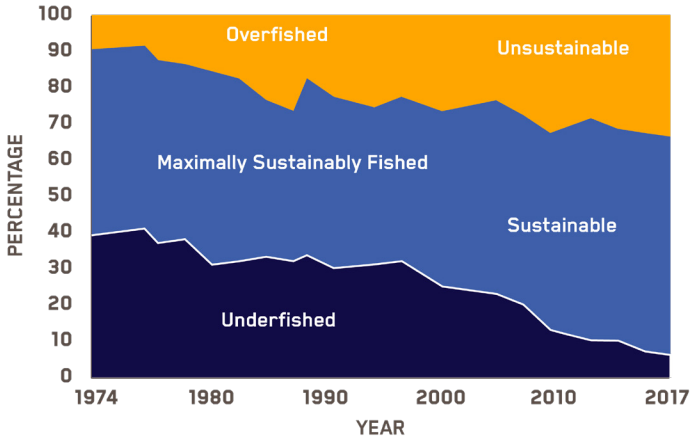
IUU FISHING DEFINED BY NOAA FISHERIES[4]

Illegal fishing: fish taken in violation of regional or international agreements and national laws.

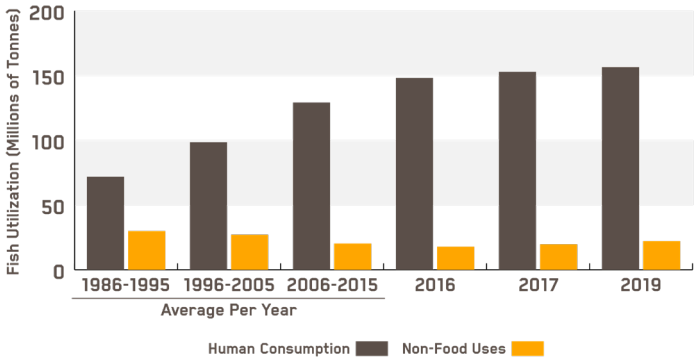
Unreported fishing: fish taken legally but not reported or misreported in national statistics.

Unregulated fishing: fishing by vessels without nationality or vessels flying the flag of a country not party to the regional fishery management organization governing a specific fishing area or species.

GLOBAL TRENDS IN THE STATE OF THE WORLD'S MARINE FISH STOCKS, 1974-2017



WORLD FISHERIES AND AQUACULTURE PRODUCTION, UTILIZATION AND TRADE



GRAPHS ARE BASED ON DATA FROM FAO, STATE OF WORLD FISHERIES AND AQUACULTURE 2020.[3]

[4] NOAA Fisheries. Understanding Illegal, Unreported, and Unregulated Fishing. ND.
[5] Global Financial Integrity. Transnational Crime. ND.

SIGNIFICANCE OF IUU FISHING IN THE PACIFIC

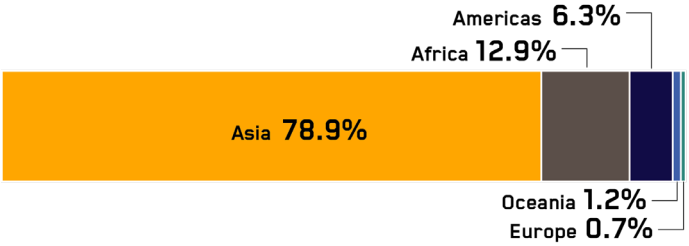
The Southeast Pacific, a region especially dependent on fishing for economic security, has become one of the most unsustainably fished areas in the world, according to the FAO.[3] The FAO Report states approximately 74% of the world's motorized fishing vessels are in Asia, the region that accounts for two-thirds of total global fish consumption.[3] FAO also reports that 79% of global employment in the fishing industry (excluding aquaculture) is in Asia[3]—the fishing industry and the employment it provides are inextricably linked to Pacific states' overall economic health.

These states depend on fishing within their exclusive economic zones (EEZs), areas that stretch 200 nautical miles from the coastline and are protected under the United Nations Convention on the Law of the Sea, per the United Nations.[6] Vessels fishing within EEZs without proper licensing or fishing beyond their quota are engaging in IUU fishing, which greatly affects local fishermen and economies, amounting to resource theft, according to Secure Fisheries.[7] Many such vessels belong to foreign distant-water fishing (DWF) fleets. Overfishing along the borders of EEZs also has a negative impact: depleting stocks of fish in migratory patterns that would otherwise reach sovereign waters, according to Global Fishing Watch.[8]

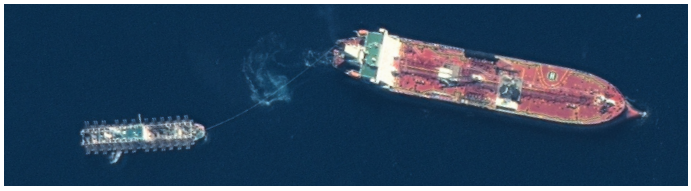
DISTANT-WATER FISHING

Distant-water fishing (DWF) describes state-sanctioned fishing outside a state's own territorial waters. DWF extends the range of action to foreign seas, prompting the establishment of EEZs, reports the International Seafood Sustainability Foundation.[9] Although legal, DWF is criticized for poor monitoring and enforcement, lack of supply chain transparency, and illegal and destructive fishing practices, according to The Roadmap for Improving Seafood Ethics, an organization that aids companies in creating decent work conditions across the seafood supply chain.[10]

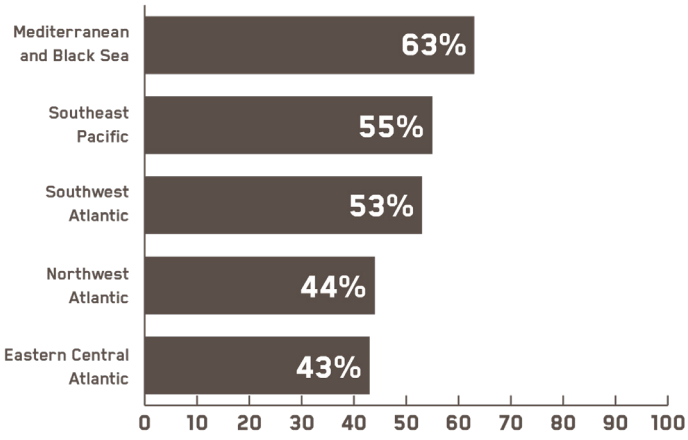
GLOBAL EMPLOYMENT FOR FISHERS AND FISH FARMERS (EXCLUDING AQUACULTURE) IN 2018



FISHING VESSEL REFUELING | PACIFIC OCEAN
JULY 12, 2021 | WORLDVIEW-3



TOP FIVE OCEANS WITH HIGHEST PERCENTAGE OF OVERFISHED STOCK IN 2018



GRAPHS ARE BASED ON DATA FROM FAO, STATE OF WORLD FISHERIES AND AQUACULTURE 2020.[3]

[6] United Nations. United Nations Convention on the Law of the Sea. 1982.
[7] One Earth Future Secure Fisheries. Eight Reasons You Care about IUU Fishing-You Just Don't Know It Yet. June 2018.
[8] Global Fishing Watch. Who Owns the Fish: High Seas and the EEZs. July 2016.
[9] International Seafood Sustainability Foundation. Distant Water Fishing Nations. ND.
[10] The Roadmap for Improving Seafood Ethics (RISE). Distant Water Fishing. ND.

VULNERABLE ISLAND NATIONS AND FOREIGN DWF IMPACT

The People's Republic of China (PRC) and Taiwan together account for 60% of DWF activity globally, reports the Stimson Center, a policy institute that supports international peace and security.[11] GI-TOC found that the PRC ranked as the worst-performing country across multiple indicators related to IUU fishing, with Indonesia, Russia and Cambodia among the 10 worst-performing countries for two out of three indicators.[1]

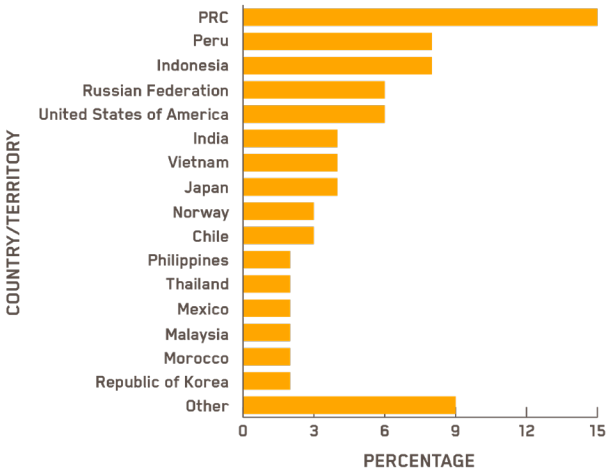
DWF is undertaken in areas of poor governance and low capacity for enforcement, according to the Stimson Center.[11]

In 2019, GI-TOC reported that eight out of the 10 coastal states most vulnerable to IUU fishing have substantial island territory, and six out of 10 coastal states with the weakest response to IUU activity are developing island nations.[1] This indicates island states' deficiency in combatting IUU fishing in and around their territorial waters. Further, island nations with weak anti-IUU enforcement are at risk of pressure from DWF fleets, as seen by PRC fishing fleets intimidating and threatening fishers from neighboring countries, according to the Brookings Institution.[12]

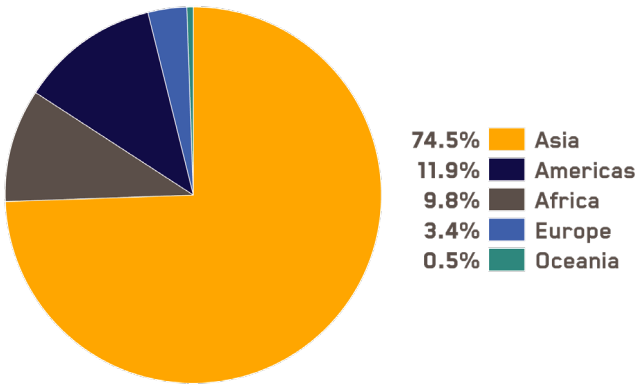
PRC DWF FLEET LARGER THAN PREVIOUSLY KNOWN

The Overseas Development Institute (ODI) conducted research to assess the size of the PRC's DWF fleet in June 2020. The ODI found that the PRC has the largest DWF fleet in the world: With nearly 17,000 DWF vessels, the fleet is five to eight times larger than previous estimates.[13] (The U.S. has fewer than 300 DWF vessels, according to the Yale School of the Environment.[14]) The PRC subsidizes fuel for its DWF fleets around the world, reports China Dialogue Ocean.[15] Trawlers were the most common vessel type observed, and most of the vessels were in the Northwest Pacific, found the ODI.[13]

GLOBAL MARINE CAPTURE PRODUCTION IN 2018



DISTRIBUTION OF MOTORIZED FISHING VESSELS BY REGION 2018



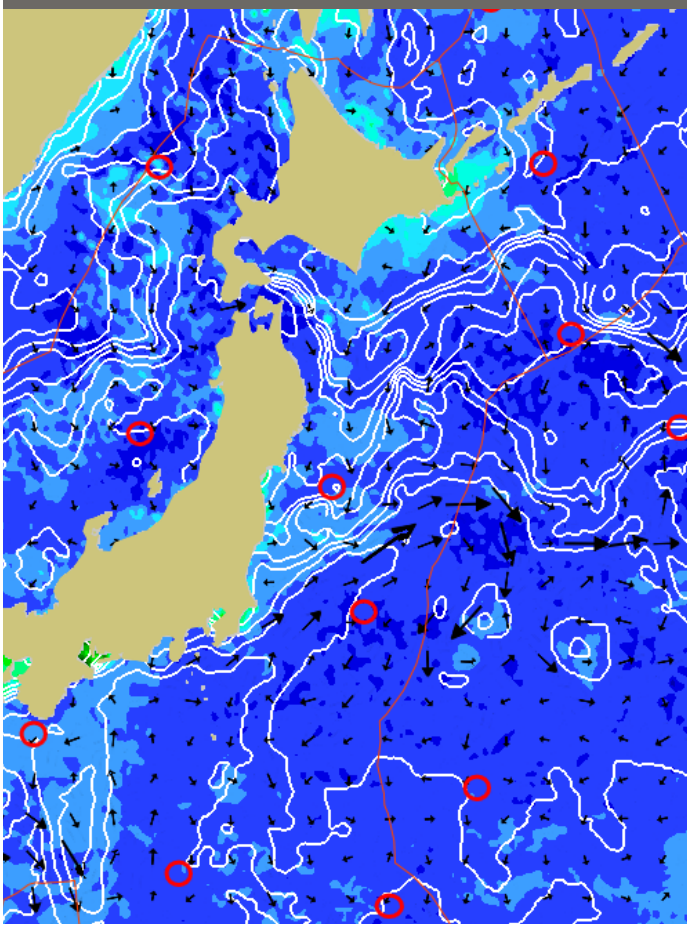
GRAPHS ARE BASED ON DATA FROM FAO, STATE OF WORLD FISHERIES AND AQUACULTURE 2020.[3]

[11] Stimson Center Environmental Security Program. Shining a Light: The Need for Transparency across Distant Water Fishing. November 2019.
[12] The Brookings Institution. The National Security Imperative to Tackle Illegal, Unreported, and Unregulated Fishing. January 2021.
[13] The Overseas Development Institute. China's Distant-Water Fishing Fleet: Scale, Impact and Governance. June 2020.
[14] Yale School of the Environment. How China's Expanding Fishing Fleet is Depleting the World's Oceans. August 2020.
[15] China Dialogue Ocean. China's Deep Sea Fishing Industry Relies on Fuel Subsidies. August 2016.

INSIGHTEXPLORER IDENTIFIES IDEAL FISHING GROUNDS, DELIVERS INFRINGEMENT ALERTS

Maxar enables anti-IUU operators to stay one step ahead of IUU fishers by using real-time data streams to target patrol areas through fish and nautical data and infringement alerts. Proprietary programming and predictive modeling identify current and future fishing hot spots and deliver customized fishing recommendations—key intelligence for search area reduction and prediction of IUU locales. Onboard tools within InsightExplorer include fish catch information, nautical charts, SAR imagery and oceanographic data layers vital for veteran patrollers and those unfamiliar with commercial and illegal fishing operations. Infringement alerts are delivered when vessels cross established boundaries, including EEZs and marine protected areas, rapidly notifying patrol personnel. Taken together, these tools give law enforcement the ability to think like IUU fishers and prevent and interdict IUU activity.

MAXAR'S MARINE SERVICES DATA PREDICTS FISHING HOT SPOTS



CAPTAINS CAN USE THE INSIGHTEXPLORER SOFTWARE, SEEN HERE, FOR VIEWING AND MANIPULATING MAXAR'S MARINE SERVICES MAP DATA TO QUICKLY IDENTIFY AREAS WHERE FISH ARE LIKELY TO CONCENTRATE (RED CIRCLES).

Maxar's InsightExplorer software platform is an onboard marine mapping program that allows users to display multiple layers of information powered by Maxar's robust Marine Services data collection. The system ingests vessel monitoring systems, AIS and oceanographic data, including weather, plankton concentration, sea surface temperatures and currents, and the migration patterns of individual fish species.

Onboard Tools

- Zone infringement alerts, including EEZs and marine protected areas
- Oceanographic and meteorological data
- Accurate and comprehensive vessel movement and tracking
- Aggregation and distribution of catch data
- Real-time asset tracking
- SAR imagery

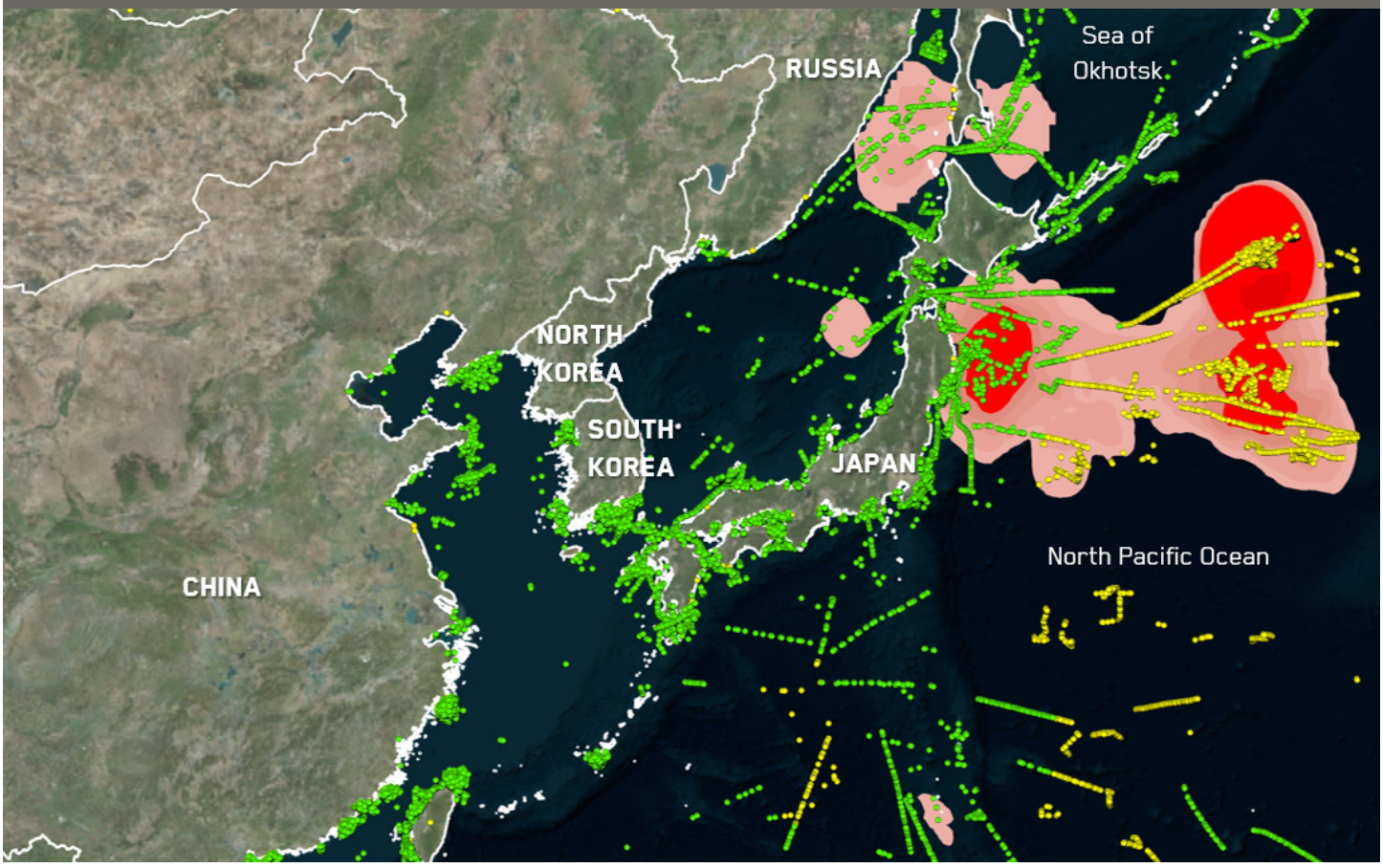
Accessibility

- Software downloaded onto computer for use on land or at sea
- Minimal system requirements
- Technical training and support available
- No internet required to use at sea after download

CROW'S NEST MMS ENABLES IDENTIFICATION OF POTENTIAL TRANSSHIPMENT HOT SPOTS

Identifying and tracking vessels is critical to monitor the extent of IUU fishing and enforce EEZ boundaries. Many fishing vessels and reefers—large refrigerated cargo vessels—possess AIS transceivers for navigation and safety purposes. Each AIS signal provides valuable data on the vessel's location and movement. Most IUU fishing relies on transshipments, the practice of combining IUU loads with legally caught fish by transferring the illegal catch to reefers outside of territorial waters, according to FAO.[16] Vessels known to engage in IUU fishing demonstrate unique spatiotemporal signatures, including speed, that are key to monitor activity and predict locations of future events. Crow's Nest MMS enables comprehensive analytic capabilities for extraction of the most valuable intelligence available from real-time and historical AIS data. The platform allows analysts to track vessel movement across EEZs and calculate ship density, which can lead to uncovering potential transshipment hot spots. Hot spots are areas around EEZ borders where clusters of ships cross or congregate, signifying potential IUU activity.

MAXAR ANALYSIS REVEALS TRANSSHIPMENT HOT SPOTS IN NORTH PACIFIC OCEAN | AUGUST 1-7, 2021



DATA COLLECTED AUGUST 1-7, 2021, SHOWS VESSELS TRANSMITTING AIS SIGNALS. THOSE WITHIN ESTABLISHED EEZS ARE REPRESENTED IN GREEN, WHILE THOSE OUTSIDE EEZS ARE YELLOW. RED INDICATES A HIGH CONCENTRATION OF VESSELS BELIEVED TO BE POTENTIAL TRANSSHIPMENT HOT SPOTS.

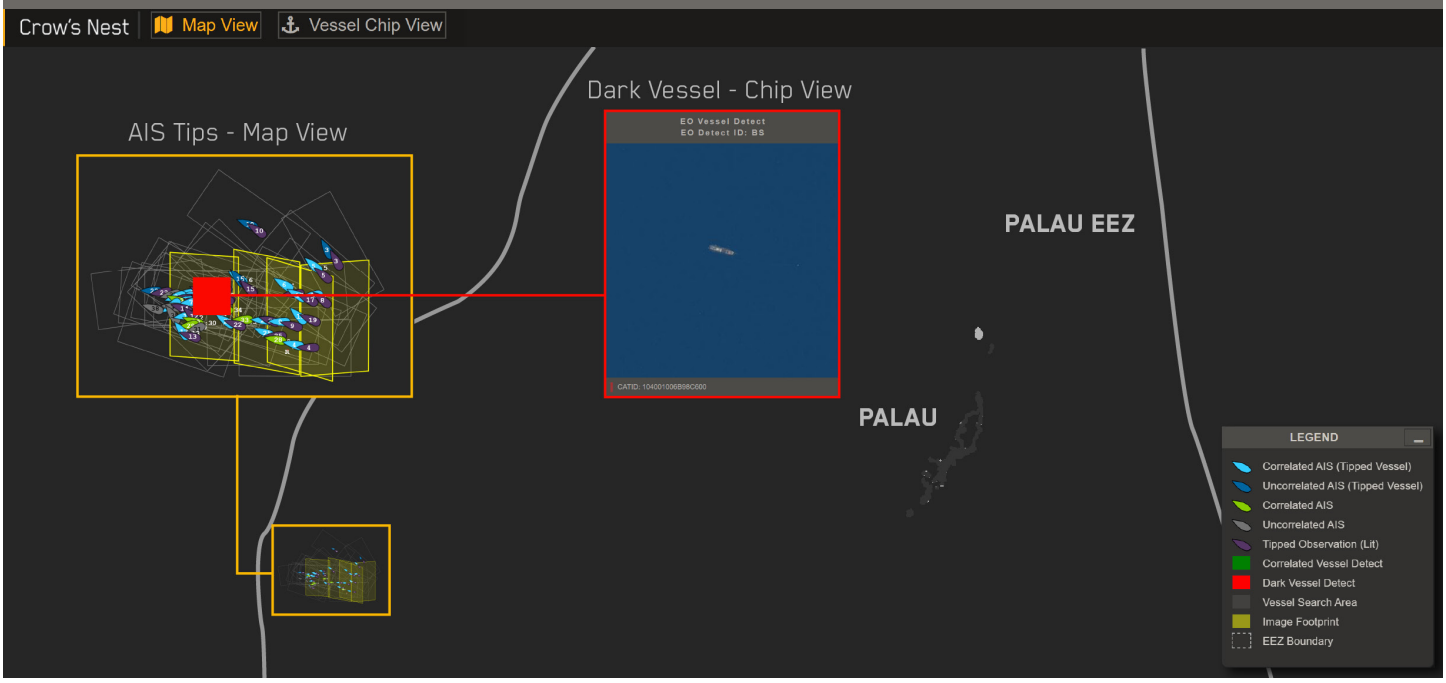
[16] Food and Agriculture Organization of the United Nations. Transshipment: A Closer Look. 2020.

CROW'S NEST MMS TIPPING LEADS TO HIGH-RESOLUTION IMAGERY OF DARK VESSELS

Crow's Nest MMS enables IUU monitors to drastically reduce the search area for prevention and interdiction by delivering automated low-latency and high-resolution electro-optical imagery of suspected IUU vessels. Activity revealed by AIS analysis can be fed into a tipping and cueing ruleset within Crow's Nest MMS, which triggers the capture of high-resolution imagery over the targeted AOI for rapid results, delivered as quickly as 30 minutes from collection. Imagery is available on the Crow's Nest MMS platform for analysis, including convenient Vessel Chip Views of all known and dark vessels.

The Pacific island nation of Palau, with a population of about 20,000, has experienced the fallout from overfishing and changing ocean conditions in and around its sovereign waters, according to NASA.[17] The result has been reduced consumption of local fish species in residents' diets, which poses a challenge because Palauans consume more wild fish per capita than nearly any country, NASA reports.[17] Further, Palau is facing pressure from PRC IUU fishing vessels: In December 2020, a PRC fishing vessel was detained by Palauan authorities for illegally fishing in Palau's territorial waters, reports The Guardian.[18] IUU pressure on the small island nation may be related to Palau's close ties to Taiwan, according to Indo-Pacific Defense Forum magazine.[19] Palau is one of Taiwan's few remaining allies, and The Guardian reports the PRC expressed displeasure over this alliance by unofficially boycotting tourism to the nation in 2018.[18]

PALAU EEZ INFRINGEMENT | CROW'S NEST MMS PLATFORM | HYPOTHETICAL MAP VIEW



THIS CROW'S NEST MMS PLATFORM VIEW SHOWS AN EXAMPLE OF THE MAP VIEW OF THE USER INTERFACE IF TIPPING WERE TASKED NEAR PALAU'S EEZ AND DARK VESSELS WERE IDENTIFIED. THE DATA IN THIS IMAGE IS HYPOTHETICAL ONLY, TO ILLUSTRATE USE PERTINENT TO THE INFORMATION ABOVE.

[17] NASA. NASA Satellites Help Plan Future for Palau Fish Stocks. August 2021.
[18] The Guardian. Tiny Pacific Nation of Palau Detains 'Illegal' Chinese Fishing Vessel. December 2020.
[19] Indo-Pacific Defense Forum. Chinese Fishing Fleet Poses Threat to Pacific Island Economies. June 2021.

DETECT AND VERIFY MARITIME ACTIVITY AND DARK VESSELS ANYWHERE IN THE WORLD WITH CROW'S NEST MMS

The detection of transshipment activity is often thwarted by vessels that go "dark" by switching off their AIS transceivers to obscure their locations. Recent advancements in ship detection and surveillance technologies, such as Maxar's Crow's Nest MMS, are greatly enabling counter-IUU operations. By leveraging Maxar satellite imagery and machine learning (specifically, vessel behavior algorithms and automated object detection), Crow's Nest MMS can spot when vessels exhibit transshipment behavior or when suspect vessels go dark. Using AIS data, near real-time SAR and electro-optical tipping and cueing, Crow's Nest MMS can identify and track dark targets.

SUSPECTED TRANSSHIPMENT PACIFIC OCEAN
AUGUST 20, 2021 | WORLDVIEW-2

Benefits

- Imagery delivered as quickly as 30 minutes from the time of collection
- Imagery provides the ability to positively ID dark targets
- Determine vessel class, activity and individual vessel identity
- Detect vessels reporting—and not reporting—via AIS
- Multisatellite approach allows for more frequent revisit and coverage
- Easy integration into existing workflows

Tipping Rulesets

- International vessel watch lists: tipped when known vessels confirmed or suspected of IUU activity enter the AOI
- Vessel speed: tipped when any vessel travels at 0.5-2 knots, the speed of transshipment activity
- SAR dark vessel to electro-optical collect: tipped by high-confidence SAR imagery of vessels not transmitting AIS

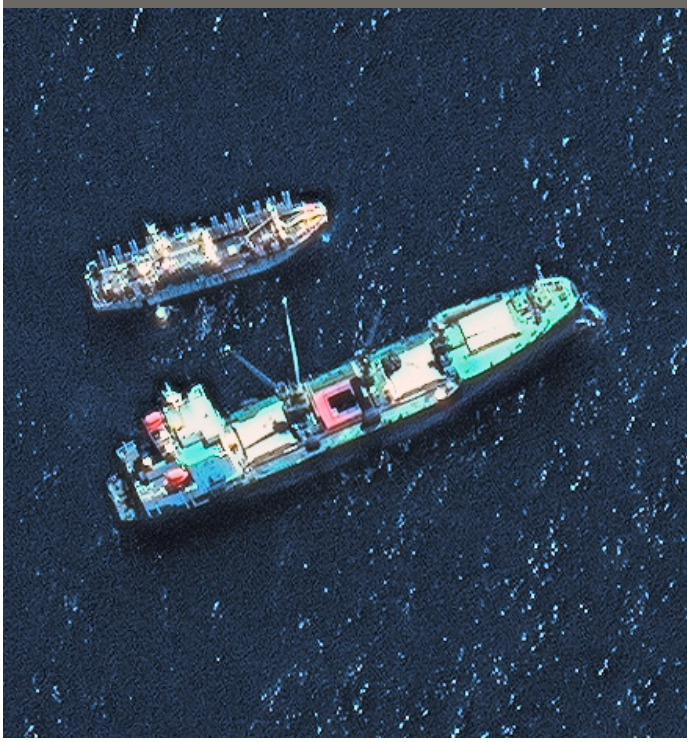
FISHING VESSELS IN THE PACIFIC | CROW'S NEST MMS PLATFORM | VESSEL CHIP VIEW

THIS CROW'S NEST MMS PLATFORM VIEW SHOWS AN EXAMPLE OF THE VESSEL CHIP VIEW OF THE USER INTERFACE WITH DATA FROM JULY 2021.

MAXAR TOOLS COMBINE FOR UNMATCHED IUU VISIBILITY

Maxar products and services are applicable throughout the IUU monitoring life cycle and can be selected based on customer requirements. When these resources are applied individually or together, anti-IUU operators gain critical insights into IUU vessel signatures, enabling prevention and interdiction of trespassing vessels. Anti-IUU operators begin with InsightExplorer, gaining key intelligence for predicting likely IUU hot spots. AIS and SAR data narrow the search area, saving time and resources. Crow's Nest MMS is introduced to request imagery over the narrowed AOI, and dark vessels are revealed with high-resolution electro-optical imagery delivered directly to the customer.

MAXAR IMAGERY FROM CROW'S NEST MMS ENABLES VISUAL IDENTIFICATION



CRISP, CLEAR ELECTRO-OPTICAL IMAGERY REVEALS TOP-DECK INFRASTRUCTURE, VESSEL LENGTH AND SHARP COLOR FOR HIGHEST LIKELIHOOD OF IDENTIFICATION.

MAXAR TOOLS WORK TOGETHER TO PREDICT, ASSESS AND DETECT IUU FISHING

Maxar's Marine Services

Robust, global big data layers are powered by Maxar's Marine Services

InsightExplorer

Access Marine Services data on patrol with InsightExplorer software

Crow's Nest MMS

Narrow AOI with InsightExplorer → Introduce Crow's Nest MMS ruleset over targeted AOI

SAR

Detect transmitting and dark vessels entering AOI with SAR

Dark Vessel Activity

Identify vessels, track suspicious activity and capture ship-to-ship transfers

Maxar Constellation

Satellites collect near real-time imagery

IUU NETWORK ANALYSIS AND INTERAGENCY COORDINATION

Maxar maintains a team of analysts who specialize in analyzing the holistic fishing network, including companies, key stakeholders, suppliers, customers and ports, as well as relationships and transactions. This team's work begins with tracking and analyzing the industrial fishing efforts of countries in a region through information obtained by the Western and Central Pacific Fisheries Commission, the Forum Fisheries Agency, the United Nations FAO, AIS vessel data and other sources. By exploiting all components of the IUU value chain, our analysts help maritime authorities deter, disrupt or eliminate an entire illicit network.

PROSECUTING IUU FISHING

Intelligence from Maxar provides concrete and tangible evidence of IUU fishing offenses. Although the United Nations Convention on the Law of the Sea prohibits criminal prosecution of IUU offenses where there is no established agreement between two states, evidence of extreme IUU activity may amount to "grave breaches" as outlined in the Geneva Conventions, according to the Brookings Institution.[12] Proof of IUU offenses can help analysts quantify economic loss, determine breaches of territorial sovereignty, and prevent, interdict and ultimately prosecute IUU fishers.

CONCLUSION

Illegal, unreported and unregulated fishing threatens the sustainability of global fish resources. By harnessing the collective power of oceanographic data, vessel-tracking technologies, advanced analytics, SAR, satellite imagery tipping and cueing and holistic network analysis, enforcement agencies and interagency partners can more effectively disrupt and deter IUU fishing operations. Crow's Nest MMS and the InsightExplorer platform provide unmatched maritime intelligence for government or commercial applications. Used together, Maxar's robust maritime monitoring platforms provide anti-IUU operators the most comprehensive intelligence to prevent, interdict and prosecute law-breaking vessels.

Prevent

Interdict

Prosecute

FOR A BETTER WORLD

Maxar is a trusted partner and innovator in Earth Intelligence and Space Infrastructure. We deliver disruptive value to government and commercial customers to help them monitor, understand and navigate our changing planet; deliver global broadband communications; and explore and advance the use of space.

Our unique approach combines decades of deep mission understanding and a proven foundation of commercial technology to deliver solutions with unrivaled speed, scale and cost-effectiveness.

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