radiant SOLUTIONS

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RADIANTSPOTLIGHT

Illegal Fishing in the Pacific

Radiant Spotlight is Radiant Solutions' new Geospatial Intelligence periodical. It demonstrates how Radiant Solutions addresses diverse global issues through multisource data collection and enrichment, innovative geospatial intelligence tools and techniques, and advanced analytical acumen.

Data + Tools + Expertise

Delivering insight... where and when it matters.

Executive Summary

Illegal, Unreported and Unregulated (IUU) fishing is one of the ocean's great economic, social and environmental threats. It is a worldwide problem that costs the global fishing industry tens of billions of dollars each year. Commonly referred to as 'poaching', IUU fishing negatively affects the sustainability of all fisheries as well as the livelihoods of local communities in developing nations that are dependent on fishing as a source of food and income. The Southeast Pacific is among those most affected, with fishing stocks drastically depleted because of growing consumption and IUU profitability.

This article highlights the critical need for improved IUU monitoring and enforcement. It also demonstrates Radiant Solutions' comprehensive analysis and methodology for augmenting 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.

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 that fishing area or species on the high seas.

Summary of Unique Tools and Applications

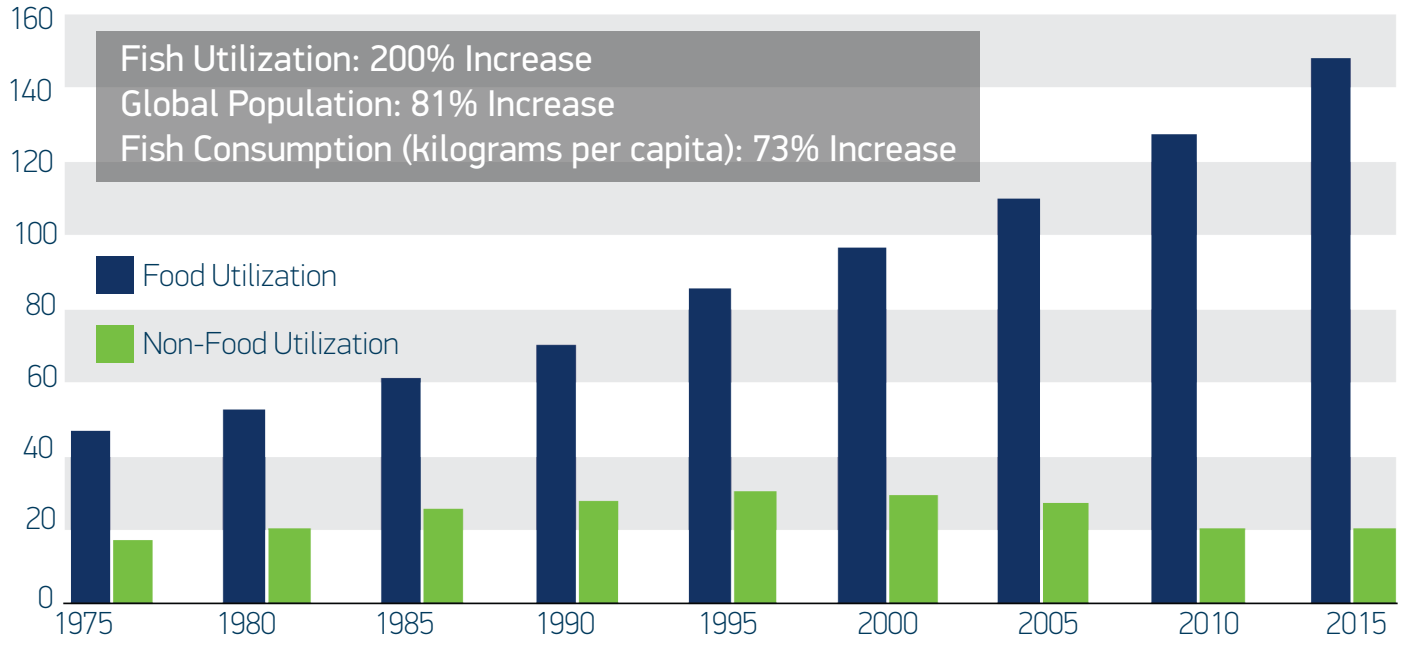
InsightExplorer is Radiant Solutions' new maritime software platform that integrates multiple data layers in order to create actionable intelligence and enable anti-IUU operators. Data layers include Automatic Identification Systems (AIS) vessel movement and tracking, weather information, oceanographic data (i.e. plankton, sea surface temperatures, etc.), high-resolution satellite imagery, synethic aperture radar (SAR), and fish catch information. These data layers deliver a comprehensive intelligence picture for IUU monitoring and enforcement. [Pages 4-6]

BlueHawk™ is MDA's maritime surveillance service. It provides an unclassified multi-sensor maritime domain awareness to security organizations worldwide. By fusing space-based radar, AIS vessel tracking and other maritime information, MDA BlueHawk™ monitors vast maritime regions, rapidly detecting potential threats. This article demonstrates how MDA BlueHawk™ can detect potential IUU fishing activity and identify "dark targets", both within controlled fishing areas and on the high seas. "Dark targets" are vessels that turn off their transceiver systems in order to mask their location and/or activity. [Page 7]

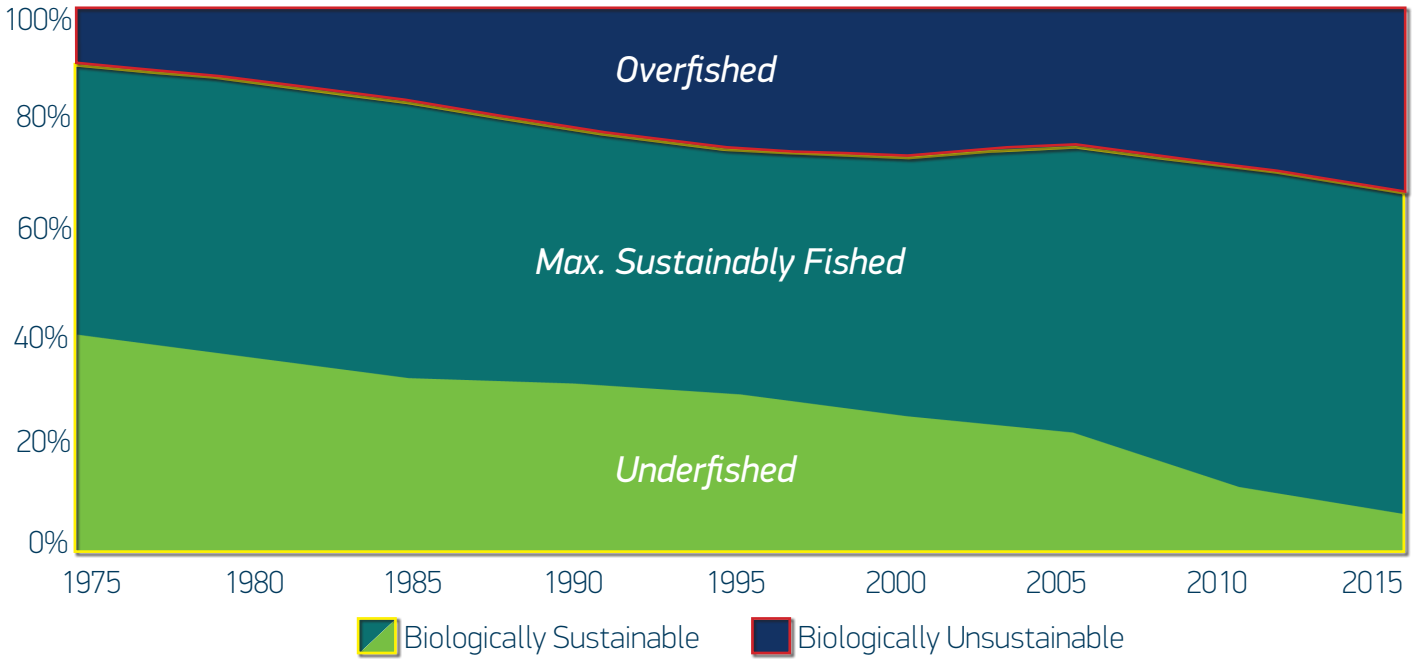
Impact of Growing Demand and Industry Profitability

As world populations continue to soar, the demand for seafood increases, and fisheries' stocks are harvested beyond their ability to sustainably reproduce. Fish have been the largest traded food commodity reaching 171 million tons in 2016. The increased demand for fish has caused the fishing industry to boom. This boom has given way to a highly profitable industry. In 2017, the global fish industry was set to break historic records of over $150 billion. While profits have increased, fishing stocks have decreased. **Operating within international and regional laws for sustainable fishing practices has become expensive as sustainable fishing yields have dwindled, thus incentivizing IUU fishing outside those laws.**

Fish Utilization (Million Tonnes), 1975 to 2015



Global Trends in the State of Marine Fish Stocks, 1975 to 2015



Significance of IUU Fishing in the Pacific

The greatest increase in fish production and consumption has occured in Asia, where almost 85 percent of global fishing vessels are located. Asia accounts for two-thirds of total global consumption. The fishing industry also employs 84 percent of people throughout the region, and as such, it is inextricably linked to their overall livelihood and survival. **The Southeast Pacific, an area especially dependent on fishing as a way of life, has become one of the most unsustainable fisheries across the globe.** These nations heavily depend on fishing within their Exclusive Economic Zones (EEZ)—an area that stretches 200 nautical miles from their coastline that is protected under the United Nations Convention on the Law of the Sea.

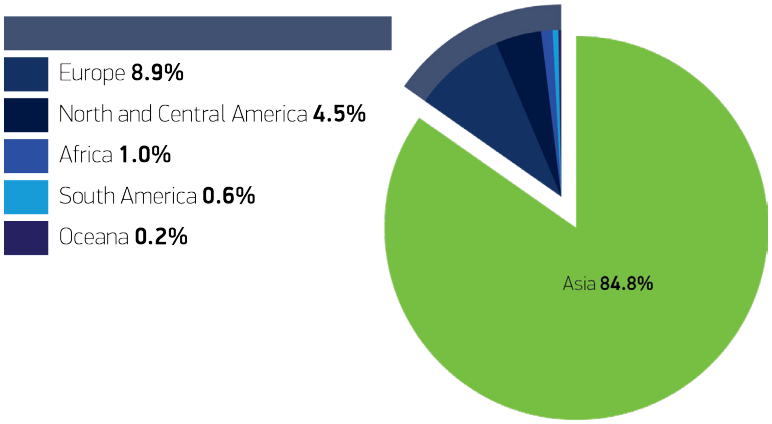
Companies fishing within the EEZs without proper licensing, or those that are registered but fish beyond their quota, are greatly impacting these local economies. Overfishing outside of the EEZs also has a negative impact by depleting stocks of fish in migratory patterns that would otherwise reach the sovereign waters of these Pacifc Island Nations.

Top Unsustainable Fisheries

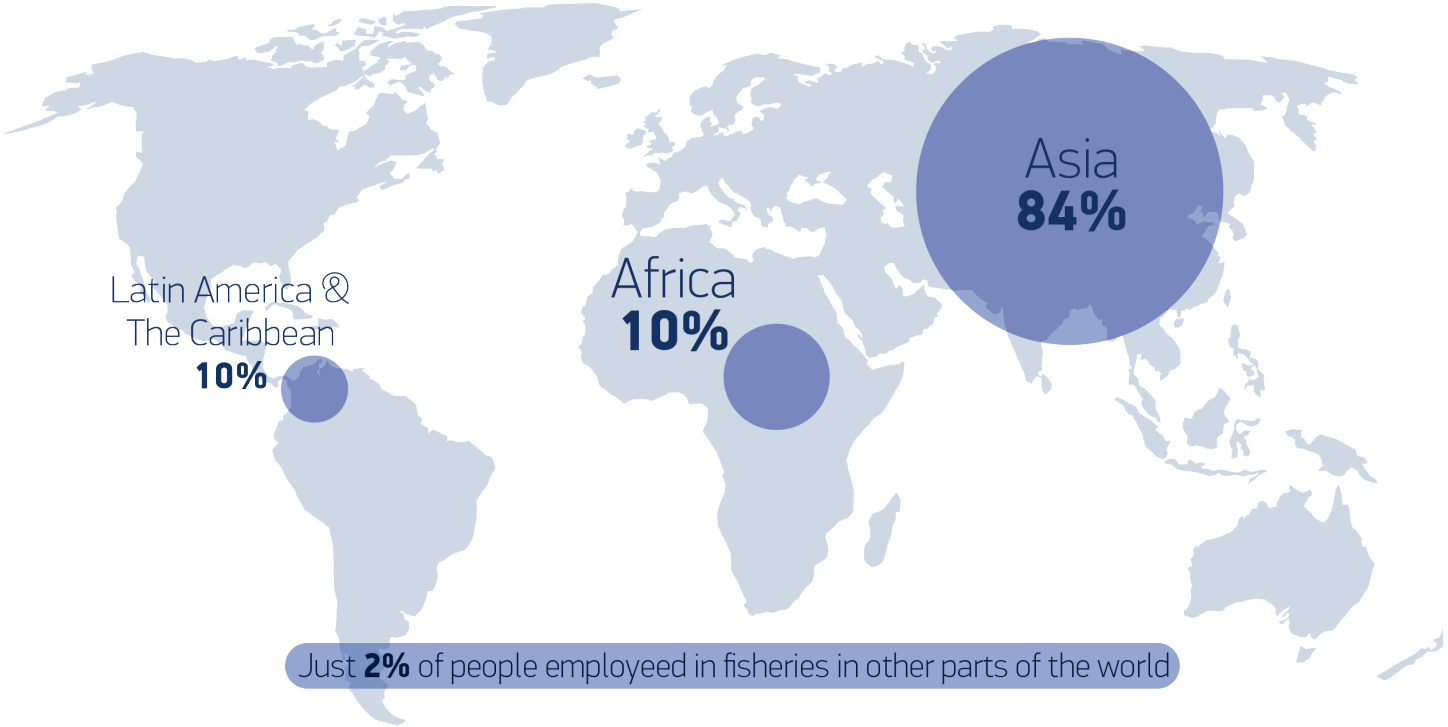
Mediterranean Sea & Black Sea
62.2% Overfished Stocks

Southeast Pacific
61.5% Overfished Stocks

Distribution of Fishing Vessels by Continent



Breakdown of Employment in the Fishing Industry



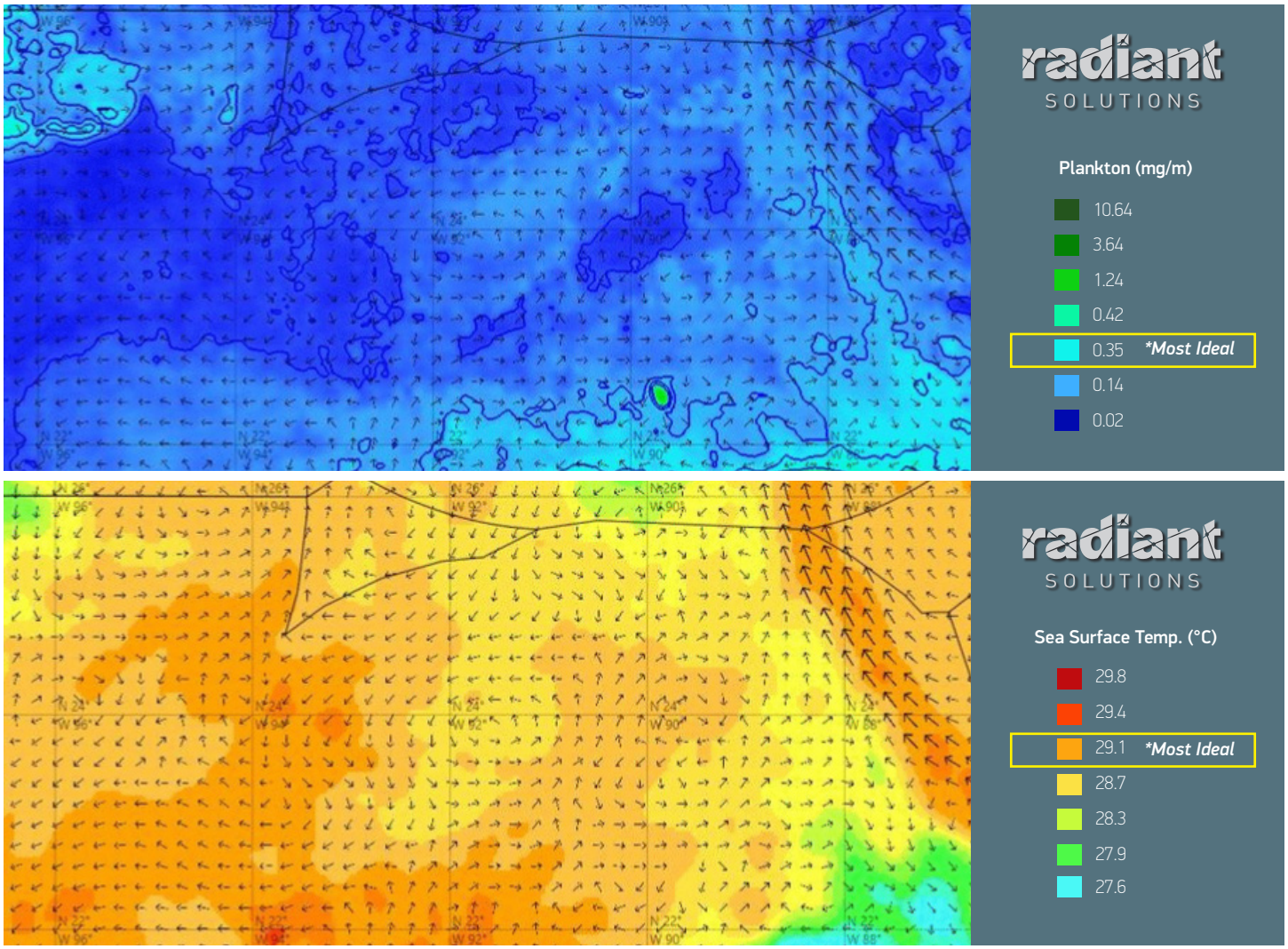
Oceanographic Modeling

Advancements in ocean intelligence and systems integration have enabled a more holistic approach to monitoring and analyzing IUU fishing. Radiant Solutions' Marine Services methodology for countering IUU activity begins with oceanographic modeling in order to illuminate ideal fishing locations.

Many IUU fishers have tools to help identify lucrative fishing zones, particularly for high-demand catches like yellow fin and big eye tuna. In turn, **Radiant Solutions enables anti-IUU operators to stay one step ahead by analyzing weather, migration patterns for individual fish species and oceanographic data (i.e. plankton, sea surface temperatures, etc). Through proprietary programming and predictive modeling, this data can identify current and future fishing hotspots—which is important for search area reduction and resource planning.**

The following graphics showcase some of the oceanographic data that is fully integrated into Radiant Solutions' InsightExplorer software platform, which is a marine mapping program that allows users to display multiple layers of information. In addition to this oceanographic data, InsightExplorer also integrates vessel tracking data, high-resolution satellite imagery and synthetic aperture radar.

InsightExplorer Sample Oceanographic Layers: Plankton and Sea Surface Temperature

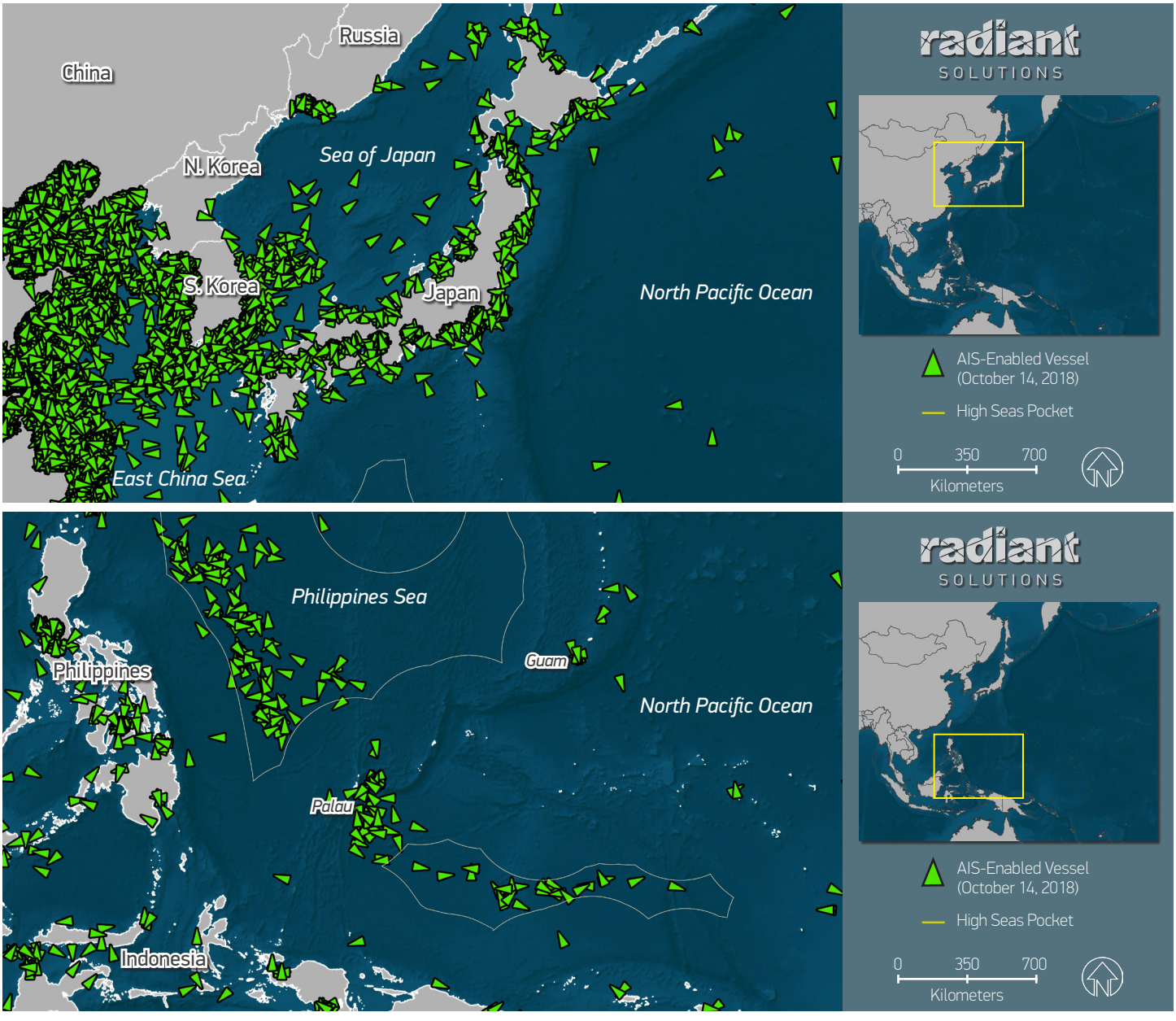


Vessel Tracking

A critical component to monitoring and enforcing IUU fishing is the identification and tracking of potential IUU vessels. Most IUU fishing is dependent upon transshipments—when IUU vessels transfer their illegally caught fish to large refrigerated vessels (or "reefers") outside of territorial waters on the high seas. Transshipment facilitates the laundering of IUU loads with legally caught fish.

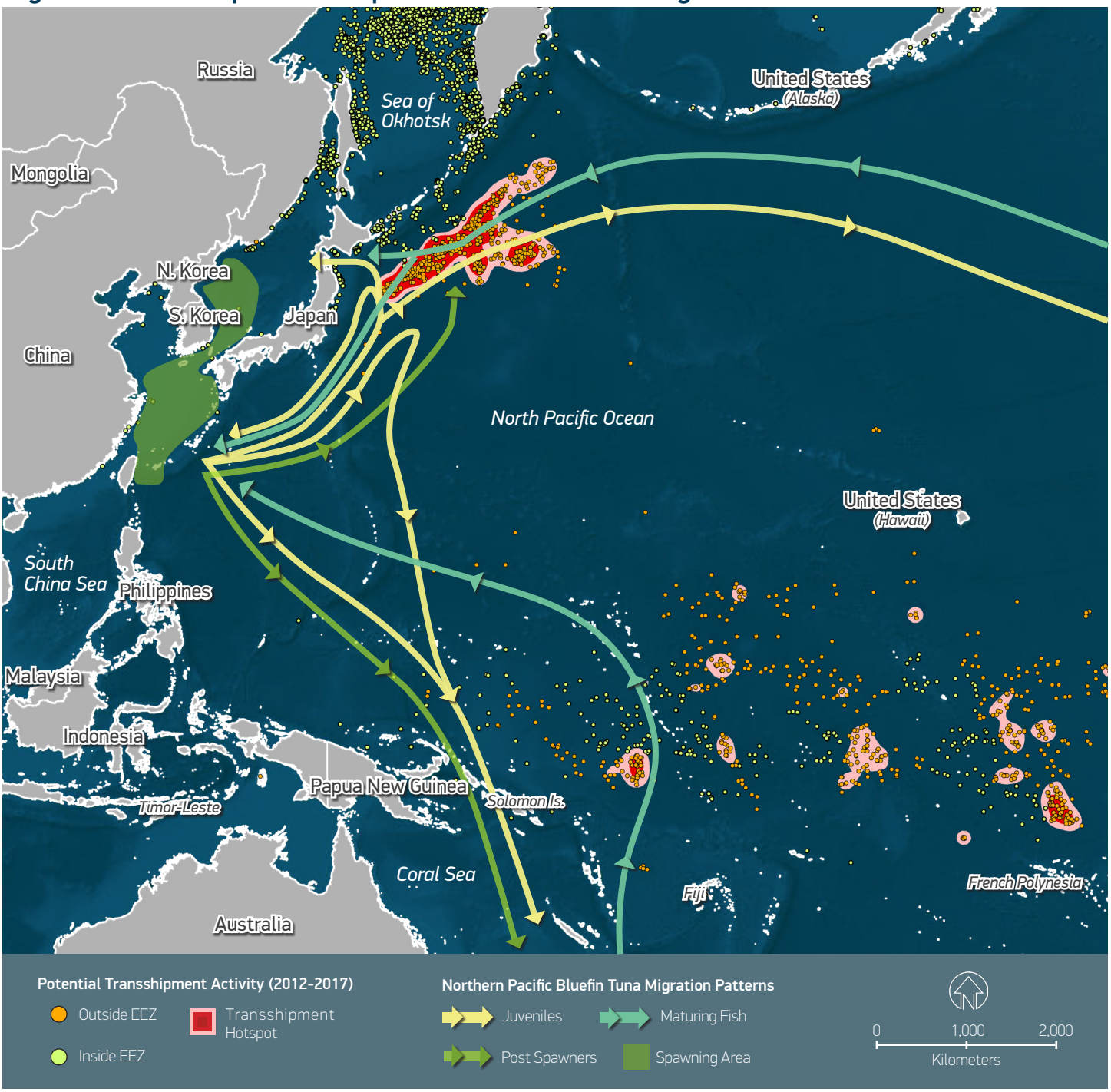
Many fishing vessels, and almost every reefer vessel, possess an Automatic Identification System (AIS) transceiver for navigation purposes. **Each vessel has an AIS signal that provides valuable data on its location and movement. IUU vessels demonstrate unique spatial-temporal signatures that are critical to monitoring real-time activity as well as predicting future events.** As mentioned, AIS data is also fully integrated in Radiant Solutions' InsightExplorer platform. The map below provides a snapshot of AIS data collected on October 7, 2018 and highlights overall vessel activity and density in the Pacific.

Maritime Automatic Identification System (AIS)



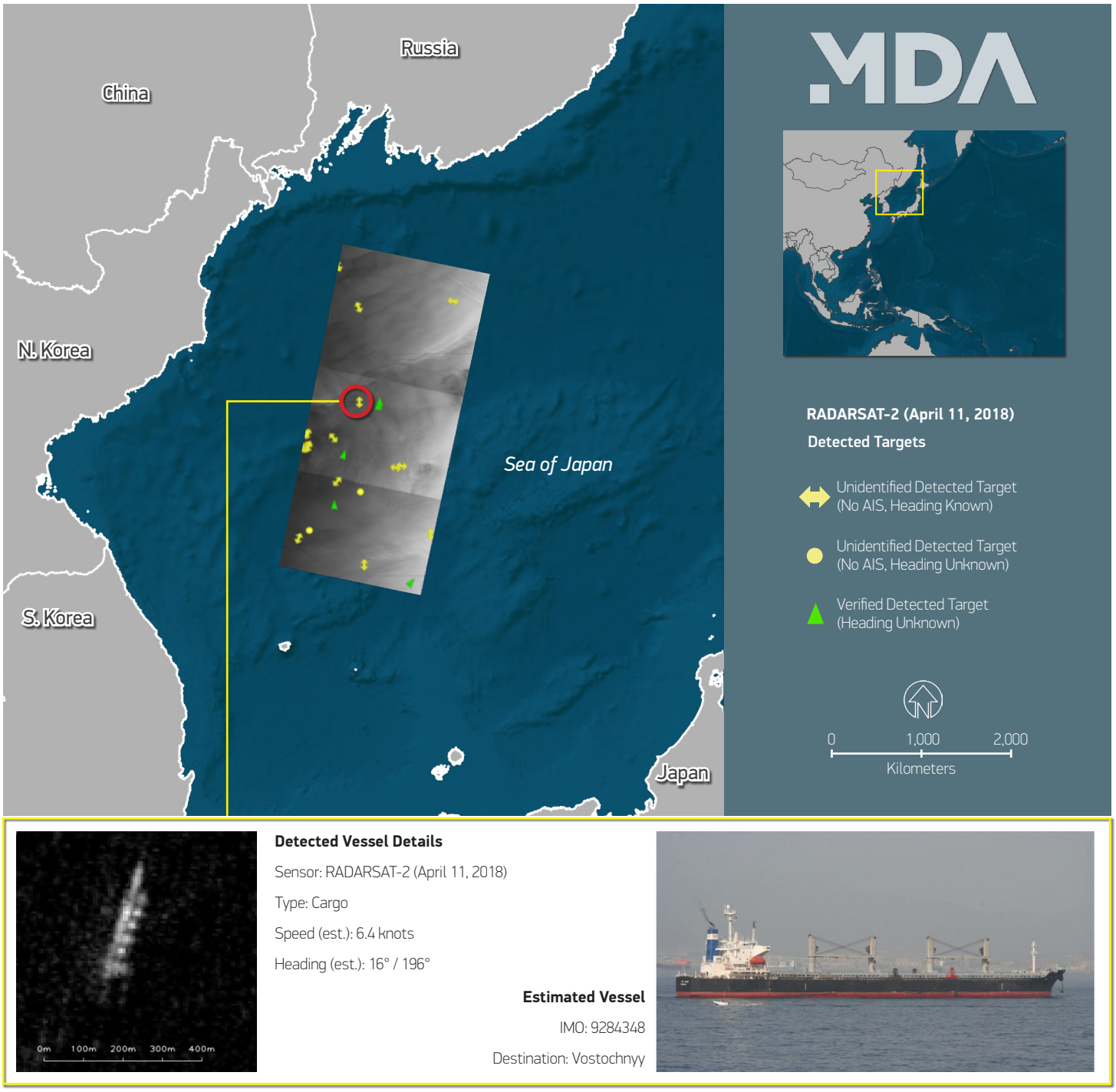
Radiant Solutions also uses AIS data to identify transshipment hotspots through geospatial and statistical analysis. The following map displays potential transshipment points from 2012 to 2017. It is layered with hotspot mapping and fish migration patterns for Bluefin Tuna, which demonstrates the comprehensive analytic capability offered by Radiant Solutions' Marine Services and the InsightExplorer platform. (Of note, the potential transshipment point data was obtained from Global Fishing Watch, an independent, international non-profit organization.)

High Seas Transshipment Hotspots with Bluefin Tuna Migration Patterns



Historically, the enforcement of transshipment activity has been impended by vessels that turn off their AIS transceivers to mask their location and signature. However, improvements in ship detection and surveillance are greatly enabling anti-IUU operators. By leveraging satellite imagery as well as machine learning (vessel behavior algorithms and automated object detection), Radiant Solutions and its partners can spot when vessels exhibit transshipment behavior or when suspect vessels go "dark" or "radio silent." In particular, **MDA's BlueHawk Maritime Surveillance service uses AIS data and near real-time synthetic aperture radar (SAR) to identify and track "dark targets."**

BlueHawk Maritime Surveillance

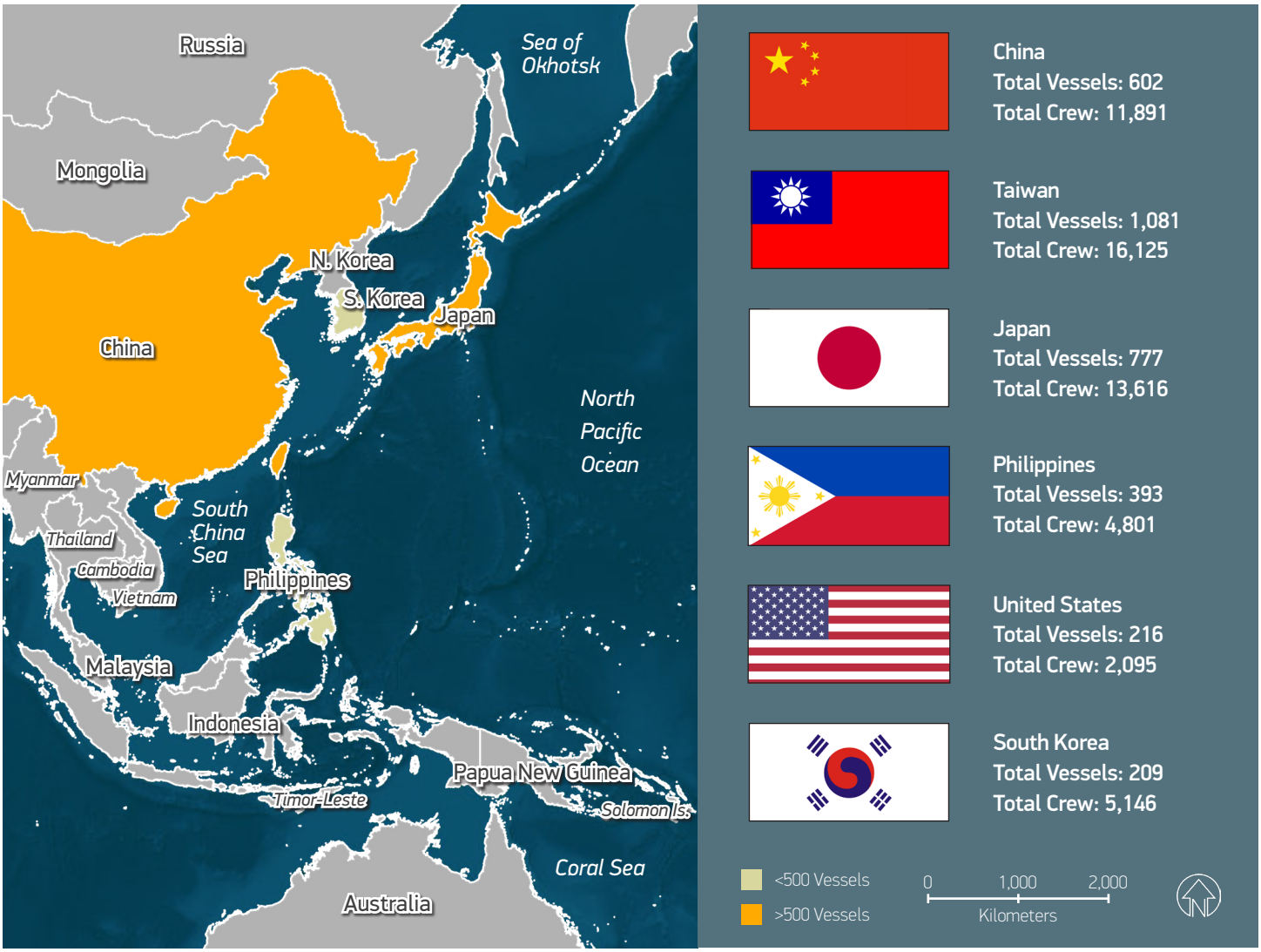


IUU Network Analysis and Interagency Coordination

In addition to offering services that improve the surveillance and interdiction of IUU fishing, Radiant Solutions maintains a team of analysts that are highly experienced in network analysis. This begins with tracking and analyzing the industrial fishing efforts for countries in the region through information obtained by the Western and Central Pacific Fisheries Commission (WCPFC), the Forum Fisheries Administration (FFA), the United Nations Food and Agriculture Organization (FAO), AIS vessel data and other sources.

However, in addition to tracking and targeting individual vessels, **Radiant Solutions specializes in analyzing the affiliated nodes within the network (i.e. companies, key stakeholders, suppliers, customers, ports) as well as their relationships and transactions. This network analysis involves exploiting all the components of the IUU value chain in order to deter, disrupt, or eliminate the entire illicit network.**

Major Industrial Fishing Countries (Pacifc Ocean)



IUU fishing is considered a transnational organized crime. These crimes can be enforced with sanctions and demarches through national and international authorities. The effects include shutting down the violating company, all of its vessels, and any one who chooses to conduct business with the sanctioned company. This is a powerful enforcement tool, but it must be done while working with policy makers to broaden the spectrum of IUU charges, to include categorization under transnational criminal organizations (TCO). **Categorizing IUU fishers as TCOs would allow national and international agencies greater tools to enforce IUU fishers, similar to those used against international drug traffickers and cartels.**

Anti-IUU Options

IUU Fishing Vessel	IUU Fishing Company/Company Owners
	
• Monitor/predict IUU fishing incidents • Capture satellite imagery (visual evidence)	• Sanctions • Fines • Arrests

Conclusion

The promotion, regulation and monitoring of responsible fishing practices, through robust fisheries management and governance frameworks, are essential for the sustainability of fisheries resources in both coastal areas and high seas. By harnessing the collective power of oceanographic data, vessel tracking technologies, advanced analytics, satellite imagery and holistic network analysis, enforcement agencies and interagency partners can more effectively disrupt and deter IUU fishing operations. Concurrently, changing perspectives and policies to view IUU fishers as transnational criminal organizations will increase the options for a more coordinated interagency and international response that increases the cost to IUU fishing violators.

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