



Project Catch

*A Space-Based Solution for Illegal, Unregulated
& Unreported Fishing*



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Team Project Oceans



International
Intercultural
Interdisciplinary



13 Countries + 5 Continents + 15 Disciplines = 1
Team

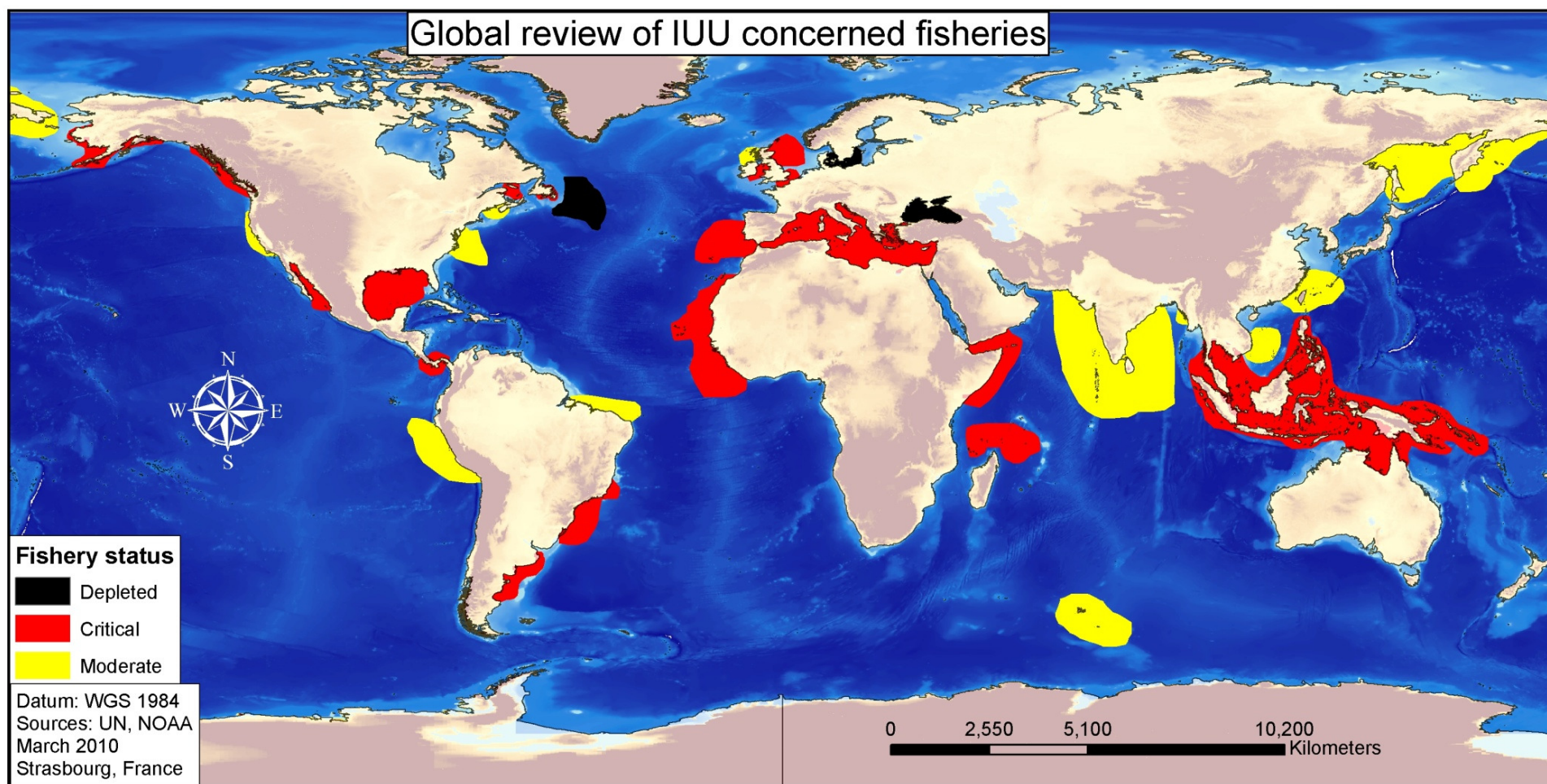
Project Focus: IUU Fishing



What is IUU Fishing?

- ***Illegal:***
 - Fishing in contravention of the laws and regulations (Location, Time, Species, Size, Means)
- ***Unregulated:***
 - Fishing that undermines fishery management efforts
 - Fishing by vessels that are not registered or with forged documents
- ***Unreported:***
 - Misreporting or failing to report catches
 - Discarded species, not included in the official catch

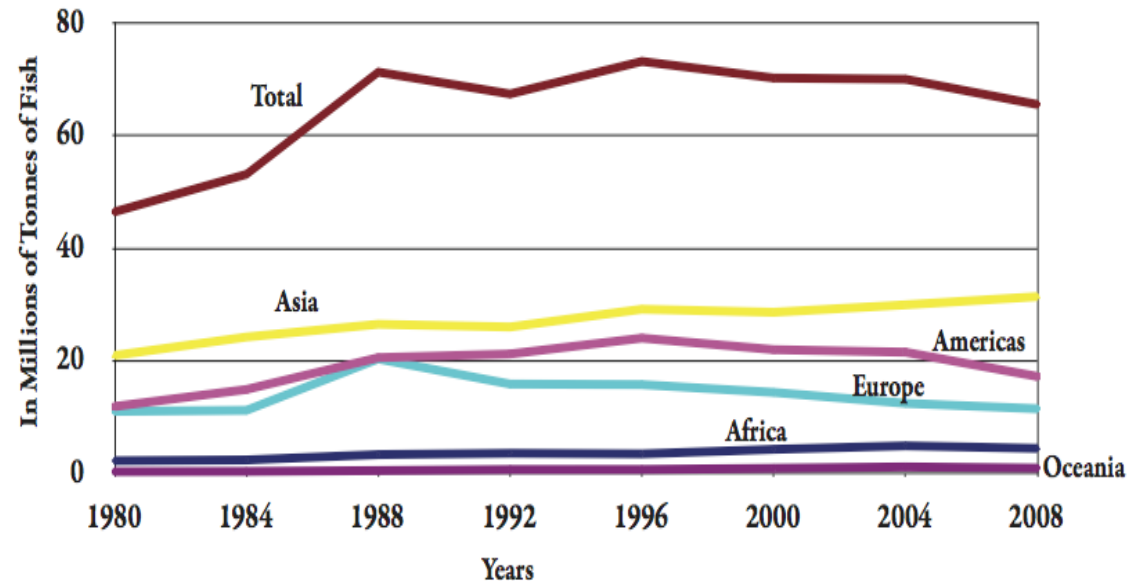
Global Extent of IUU Fishing



Source: TPOceans

Effects of IUU Fishing

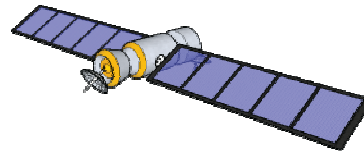
- Loss of fisheries
- Economic losses
- Fragile balance of the ecosystem
- Threat to food security
- Lack of economic sustainability
- Spoil of cultural heritage of human civilizations



Global fish catches. **Source: FAO**

Global IUU estimates: 10-23 Billion USD/year (Agnew, 2009)

Our Vision



Monitor fishing vessels with onboard transmitter

Detect fishing vessels that do not transmit

Identify and Report IUU vessels



Fisheries & Space Technology

IUU

A global problem

Coastal areas as well as remote ocean areas and polar regions

International problem, not limited to one country

Imminent problem

Legal framework is complicated



Space Based Solution

A global solution

Ability to monitor all areas

Space Assets accessible to all

Rapid deployment

Adaptive solution

Mission Statement



“To integrate a global, space-based monitoring system with existing ocean monitoring and detection capabilities in order to combat IUU fishing in a time sensitive manner.”

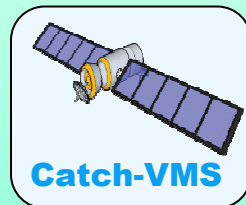
Our Solution

Project Catch

A **space** based solution to **combat IUU fishing**

A Vessel Monitoring System that is:

- A payload on a satellite constellation
- Simple and tamperproof



Catch-VMS

An IUU detection and identification system that:

- Integrates all available data
- Has flexible architecture

Catch-GIS

Catch-GIS

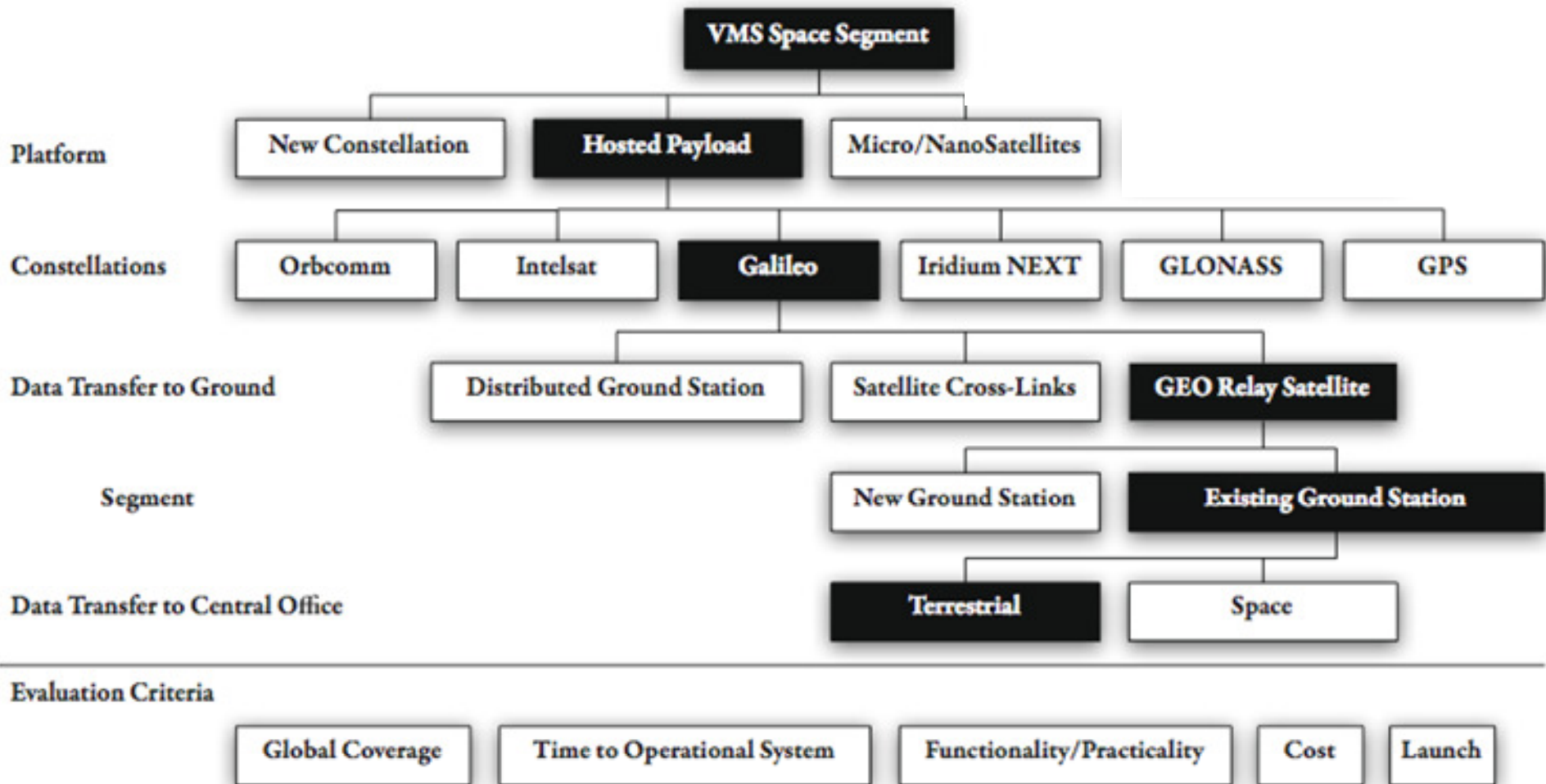
Catch-VMS: Vessel Monitoring

- Vessel Monitoring System (VMS)
- Basic Components:
 - Ship Transmitter
 - Receiving Antenna
- VMS monitors compliant vessels

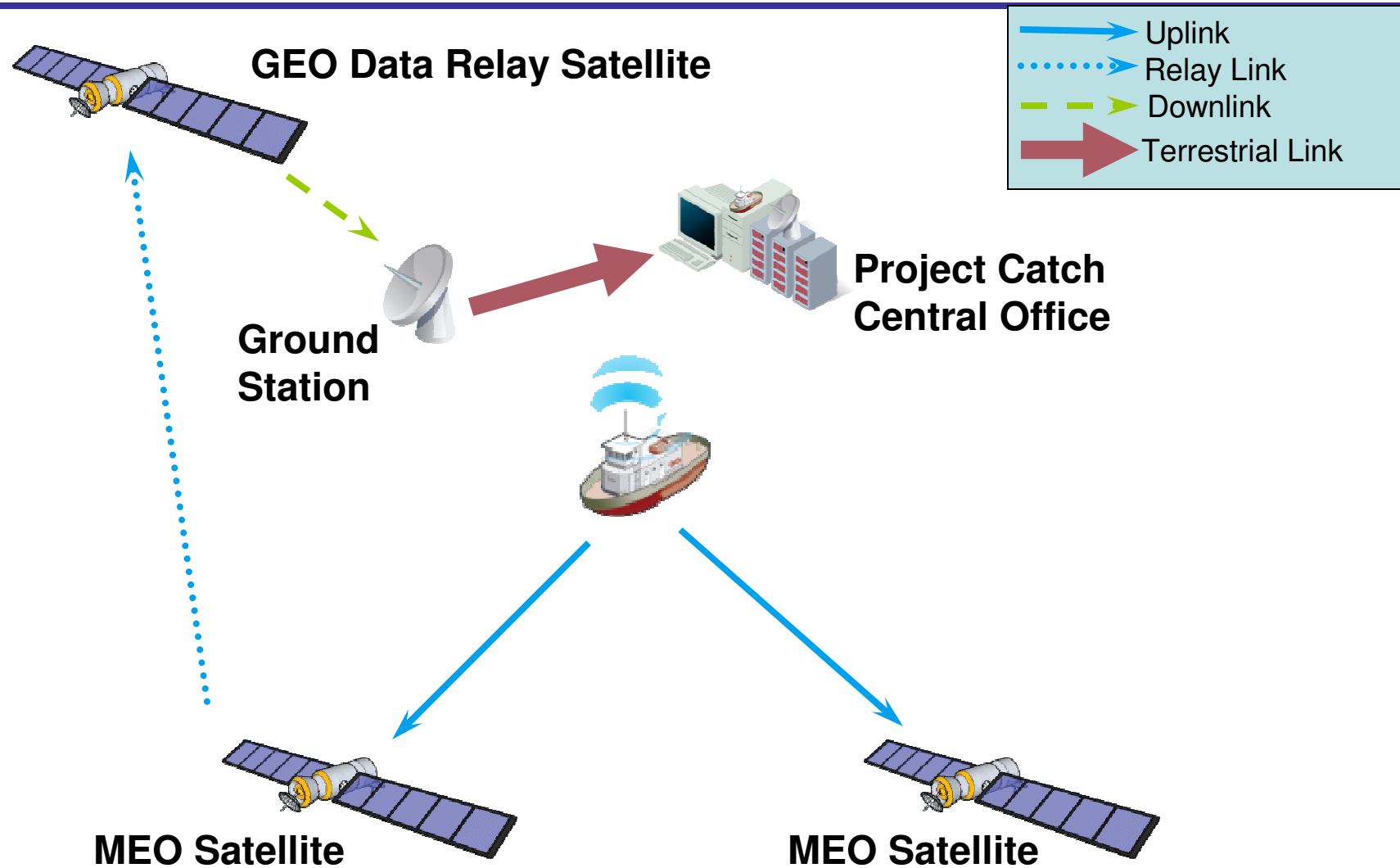


Necessary for efficient fishery management

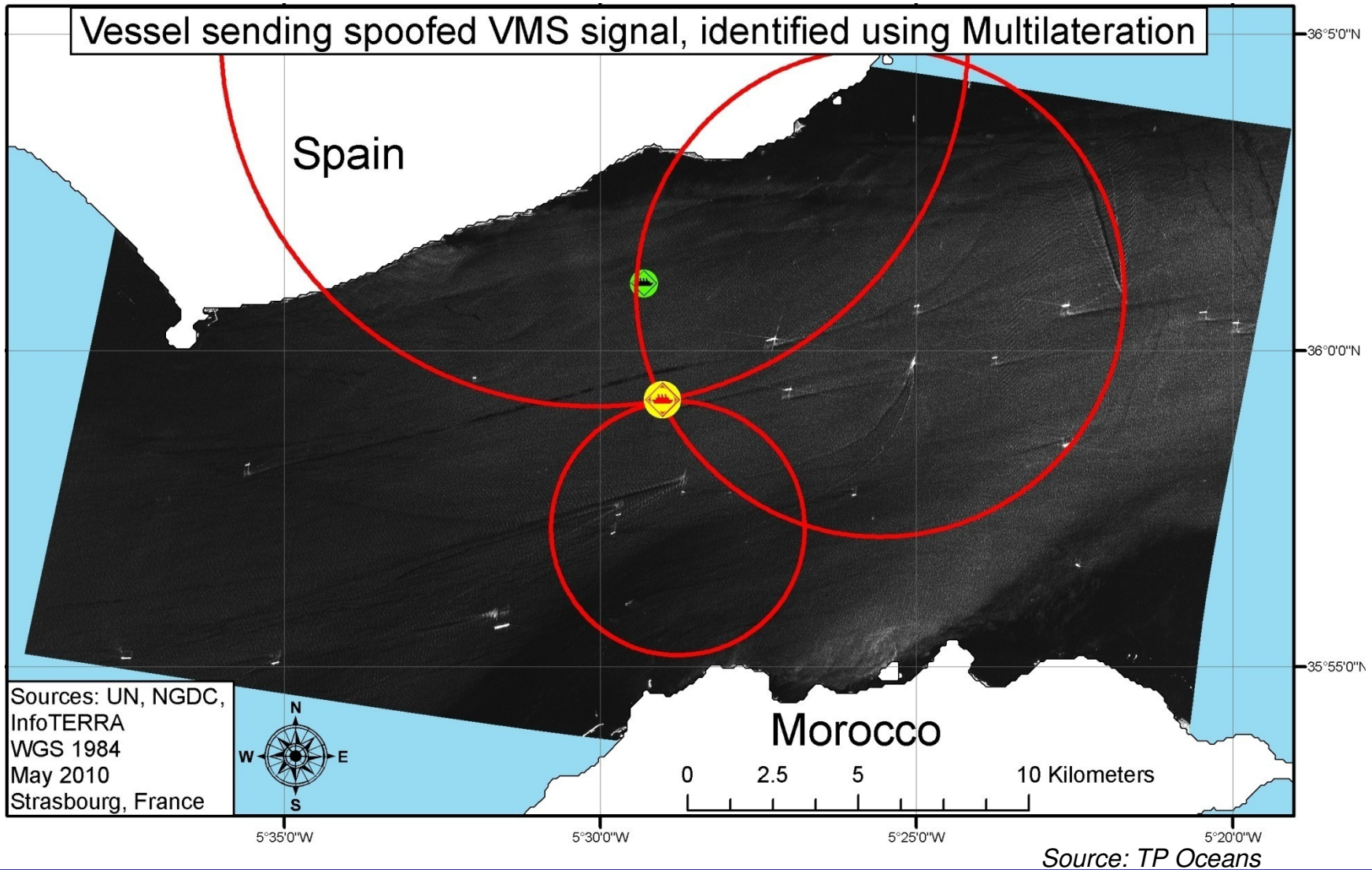
Options for Continuous Global Monitoring



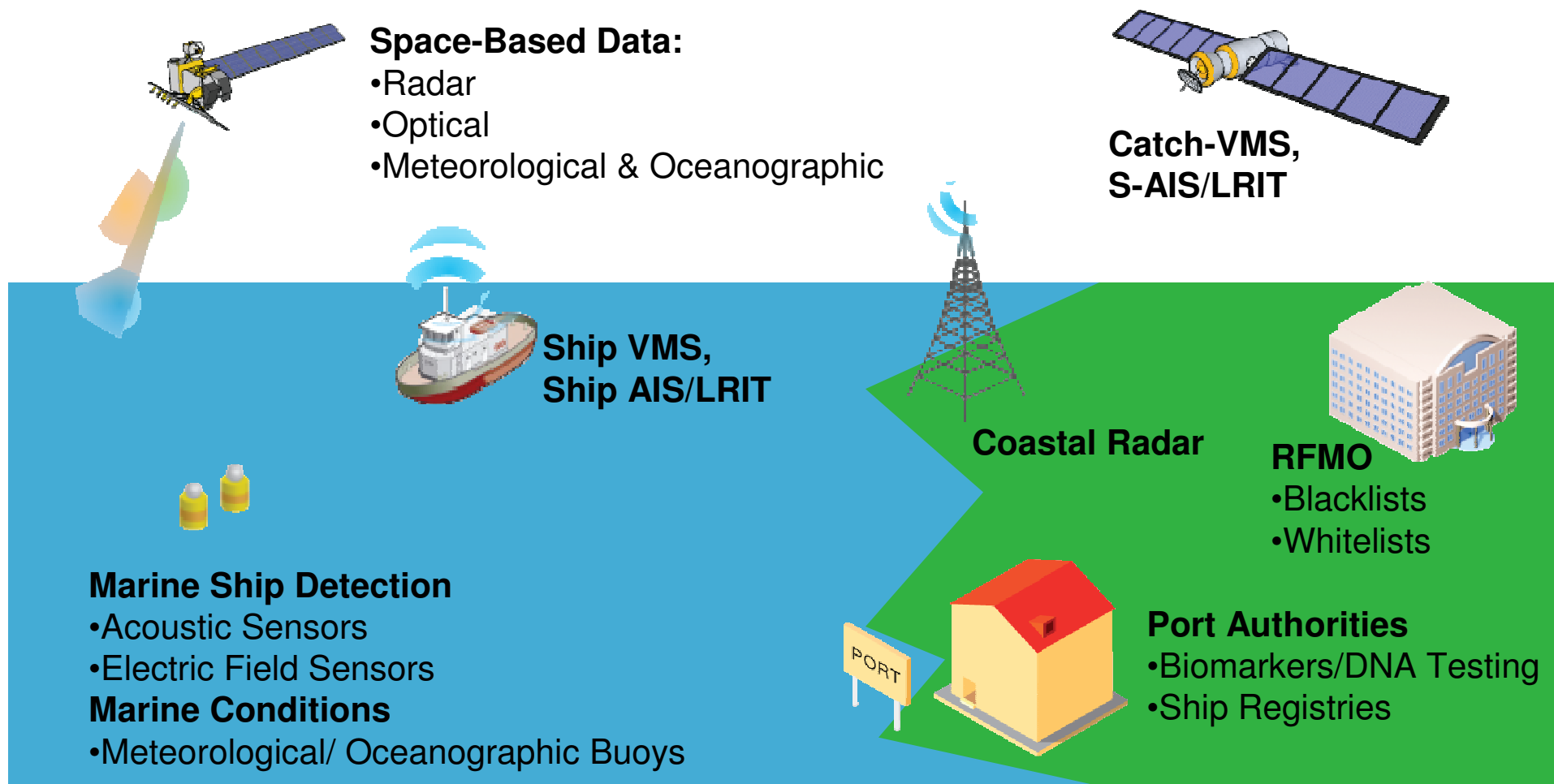
System Architecture



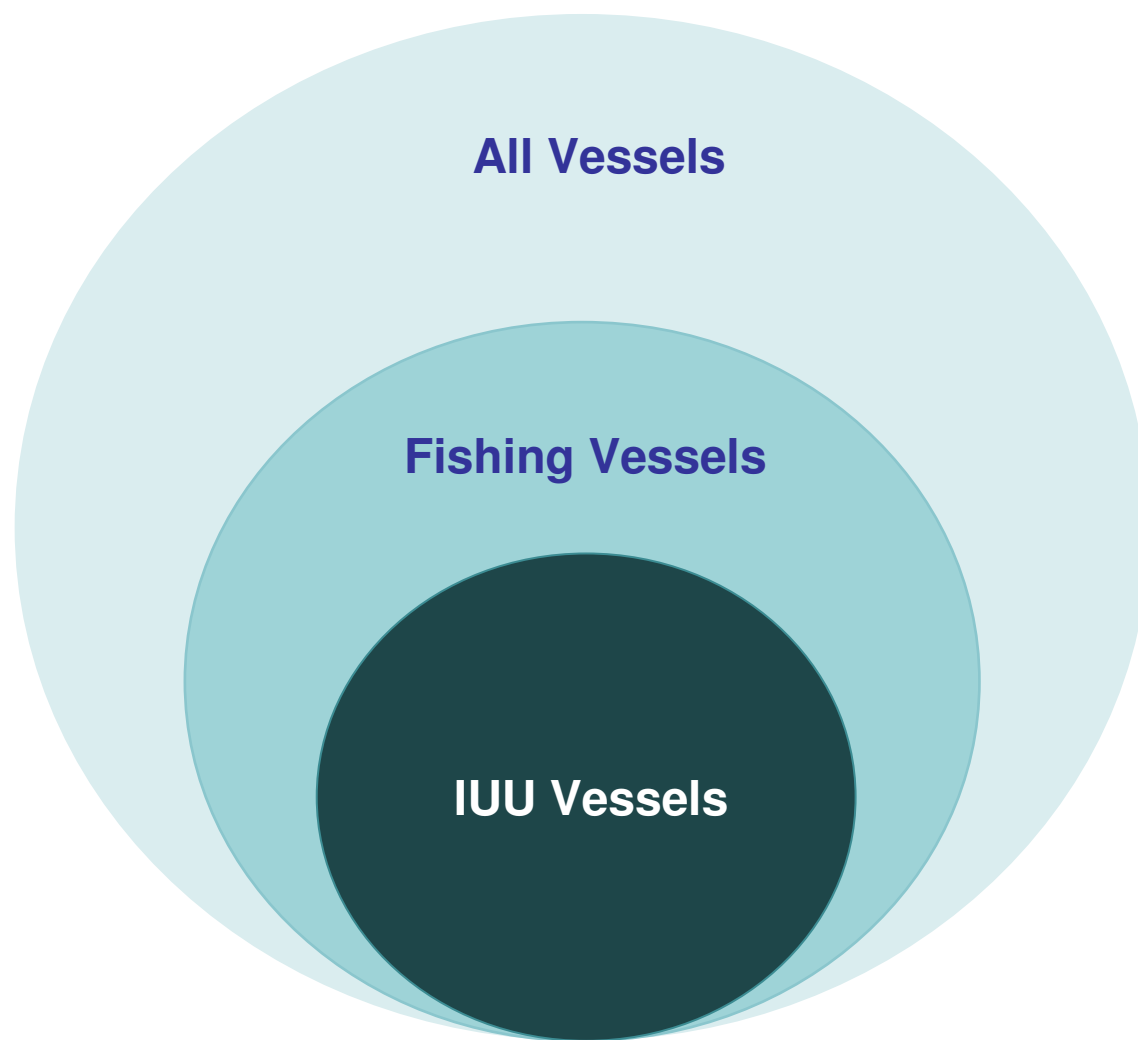
Increased reliability



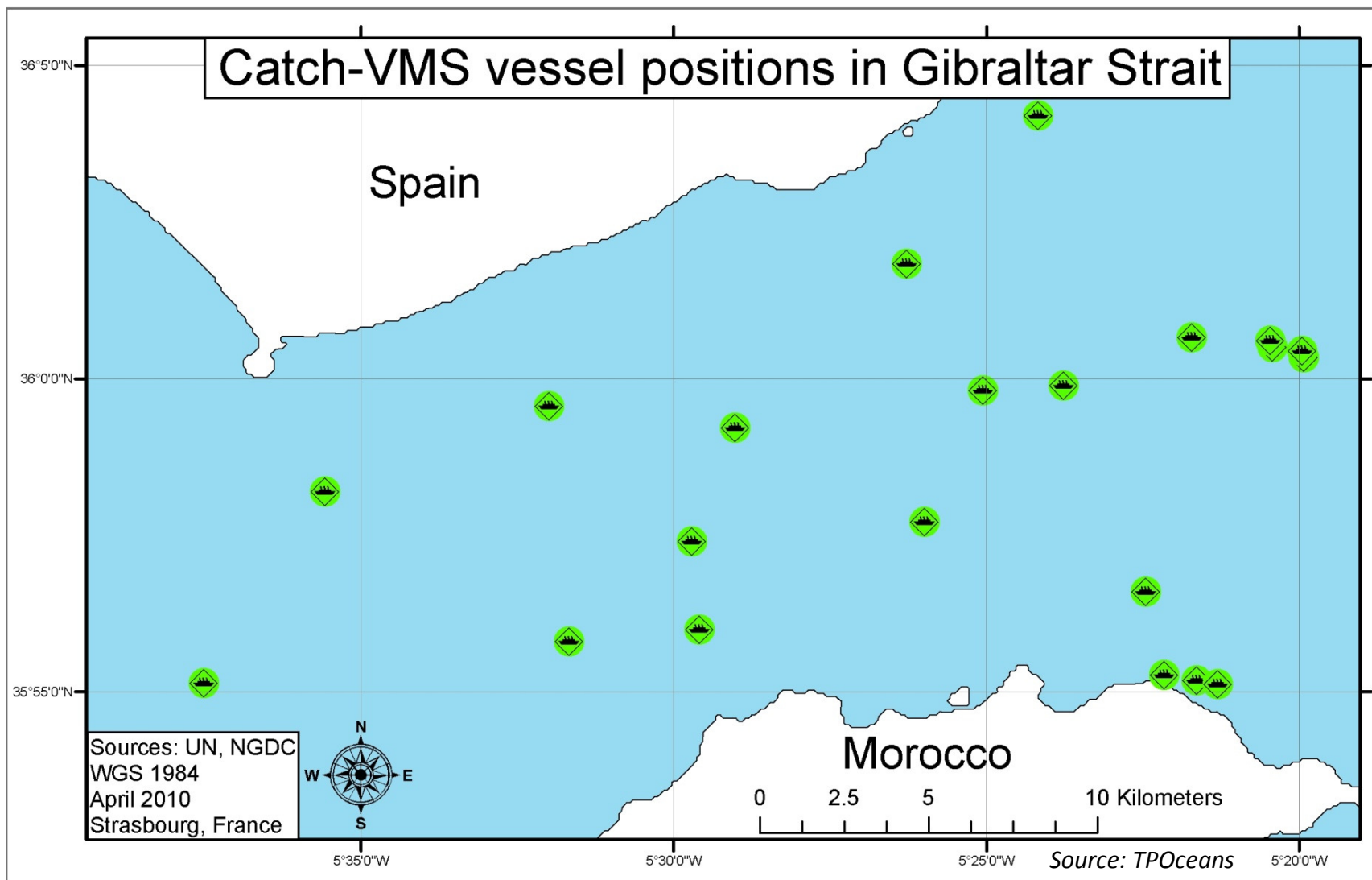
Catch-GIS: Data Acquisition



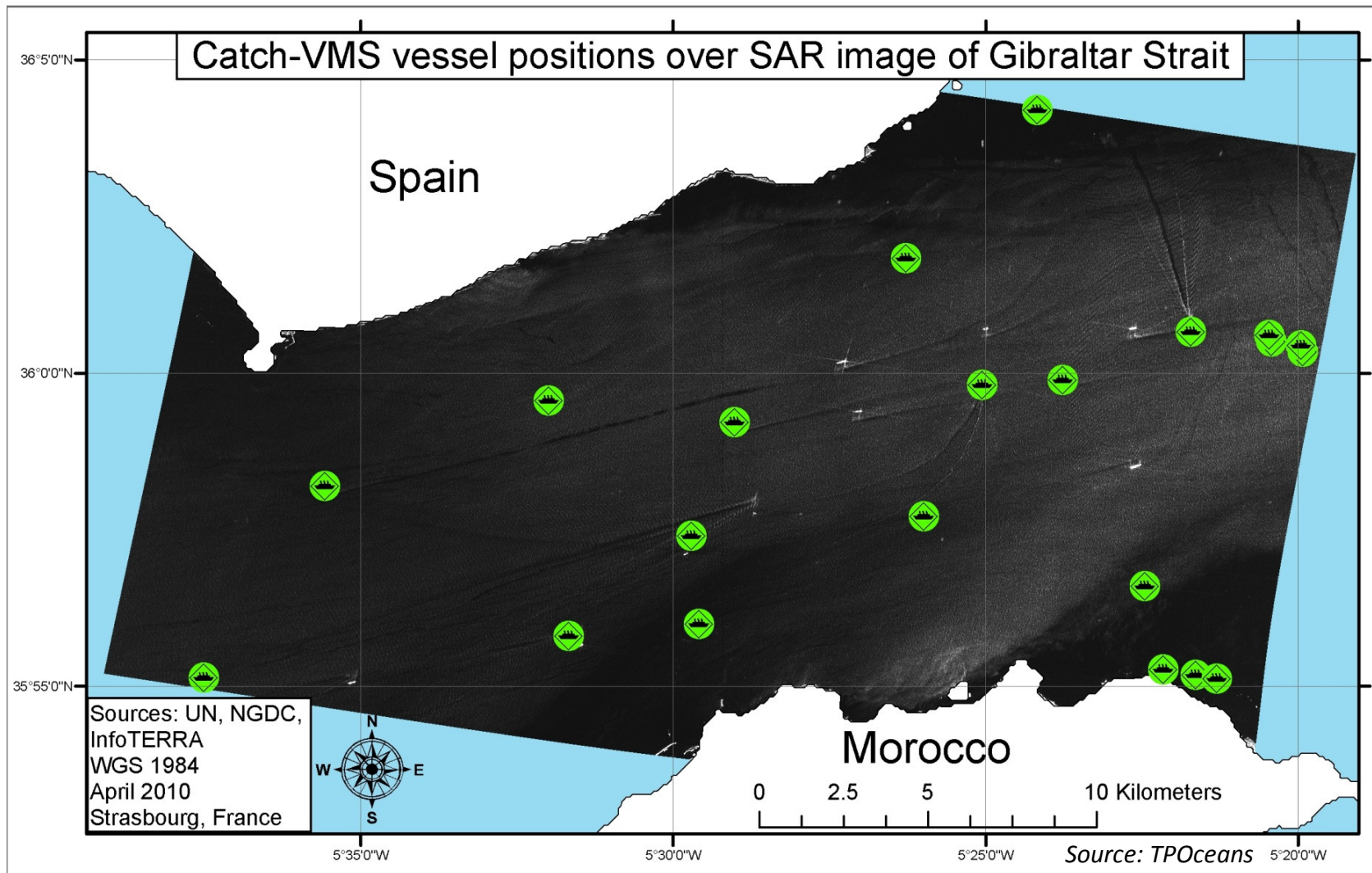
Data Analysis Methods



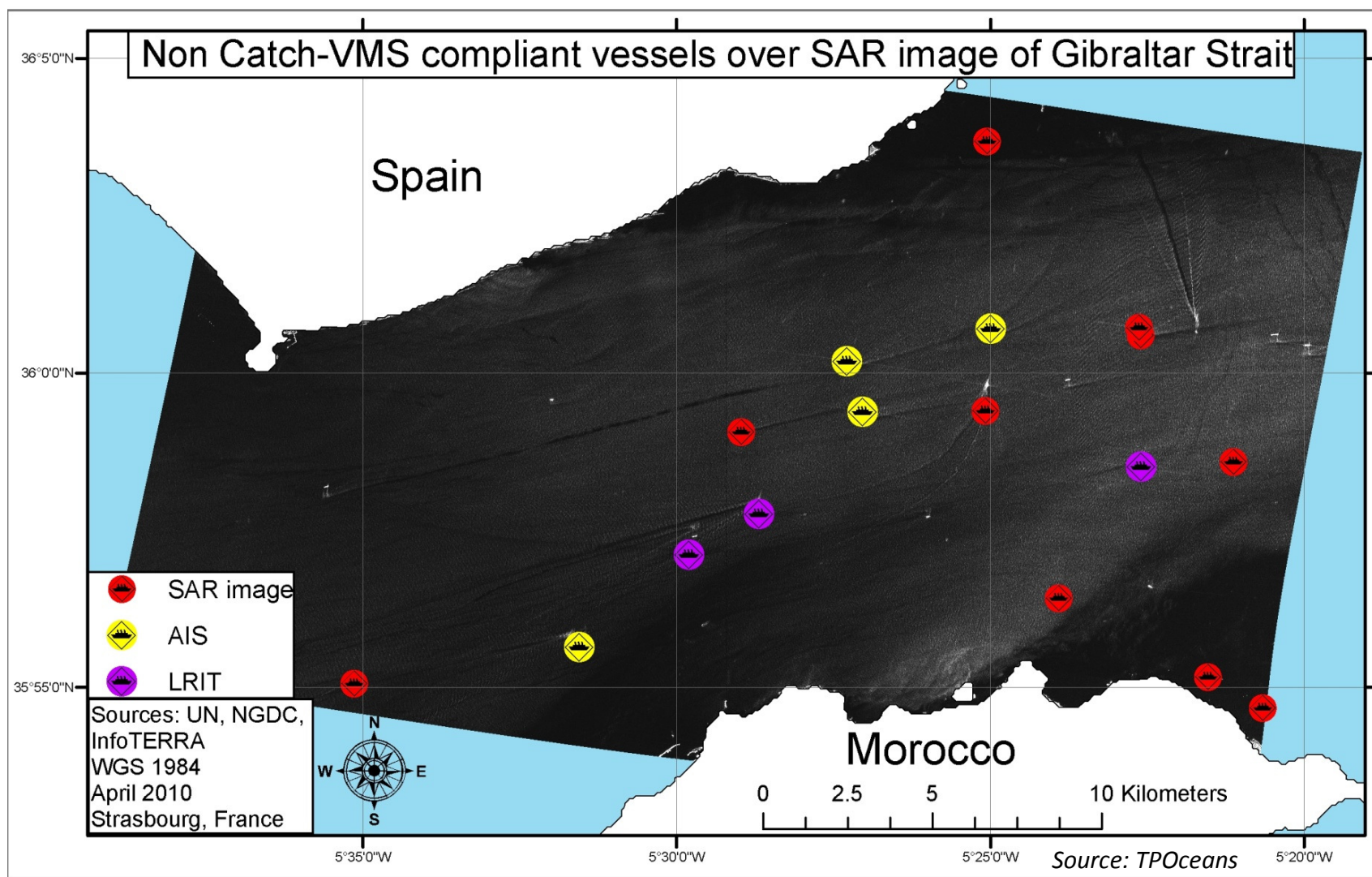
1) Identify All Vessels



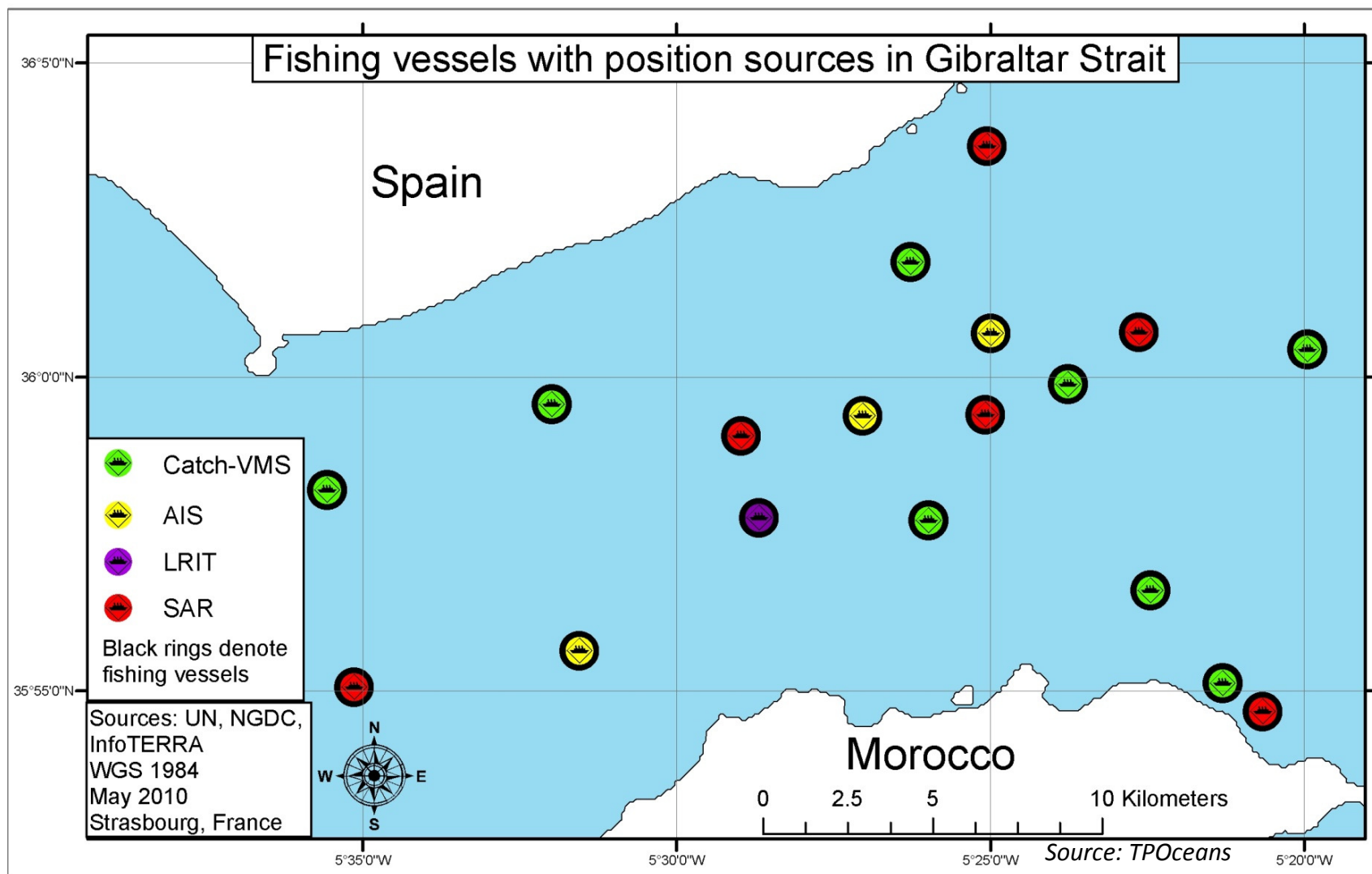
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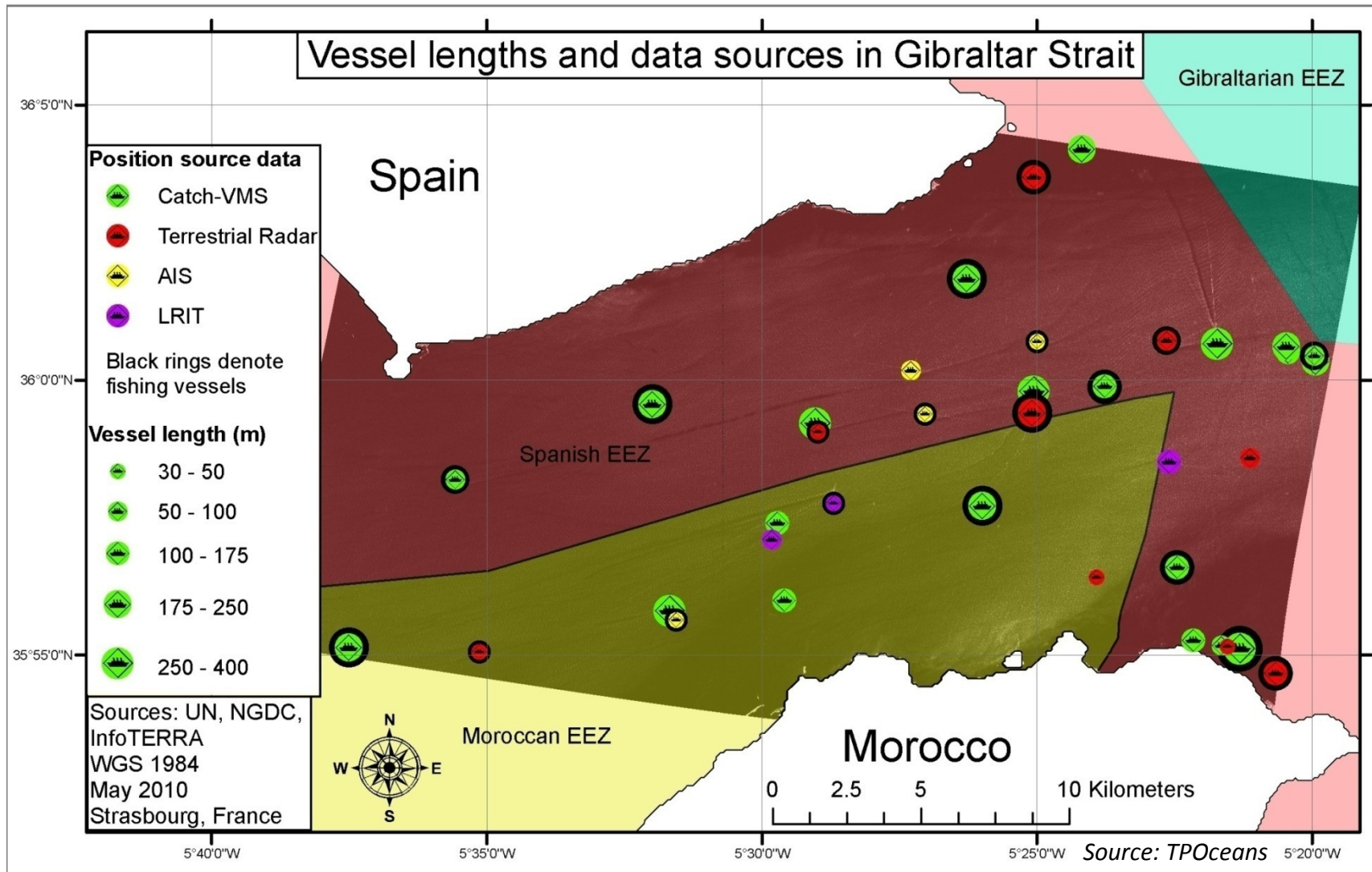
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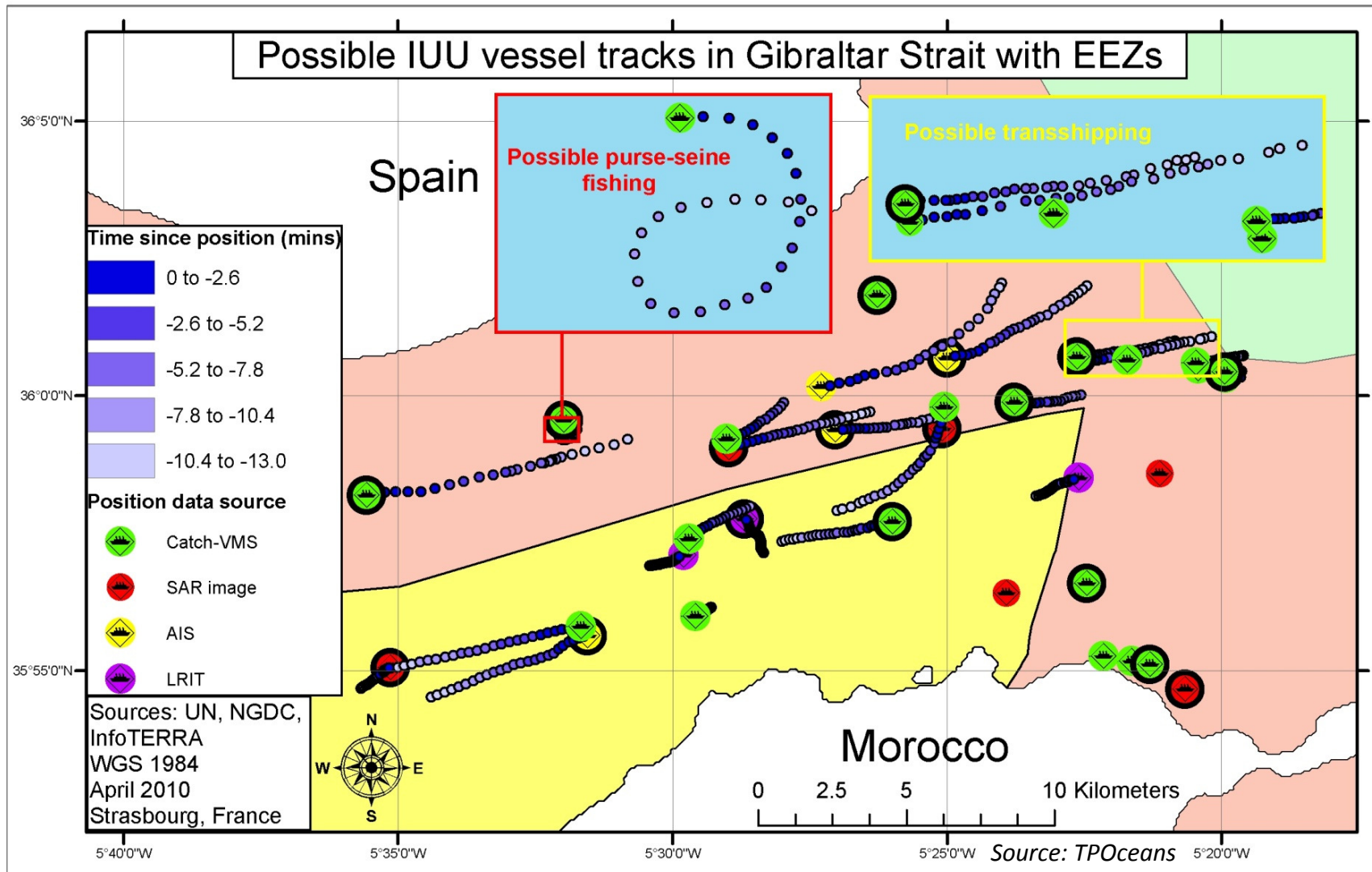
2) Identify Fishing Vessels



3) Identify IUU Fishing Activity



3) Identify IUU Fishing Activity



Sample IUU Alert

IUU ALERT - ID #372

VESSEL

IMO Number: IMO 5555555

Company Name: Fishing, Ltd.

Address:

4-123 rue des Poissons

Marseille

France

13067

Registration Country: France

OFFENCE

Summary: Entry into restricted area.

Date: 09 April 2010

Time: 18:32

Latitude: 39° 05' 52" N

Longitude: 05° 24' 33" E

Activity Summary: Vessel entered protected marine area MPA1847 during prohibited times. Track analysis indicates purse-seine fishing.

Vessel Description: Could not find match in vessel registries. Wake analysis indicates 30 metre length, 7 metre beam, two-propellers.

If you want to undertake hot pursuit of this vessel and require vessel position updates, please contact Project Catch at 0800-555555 with the alert id (#372).

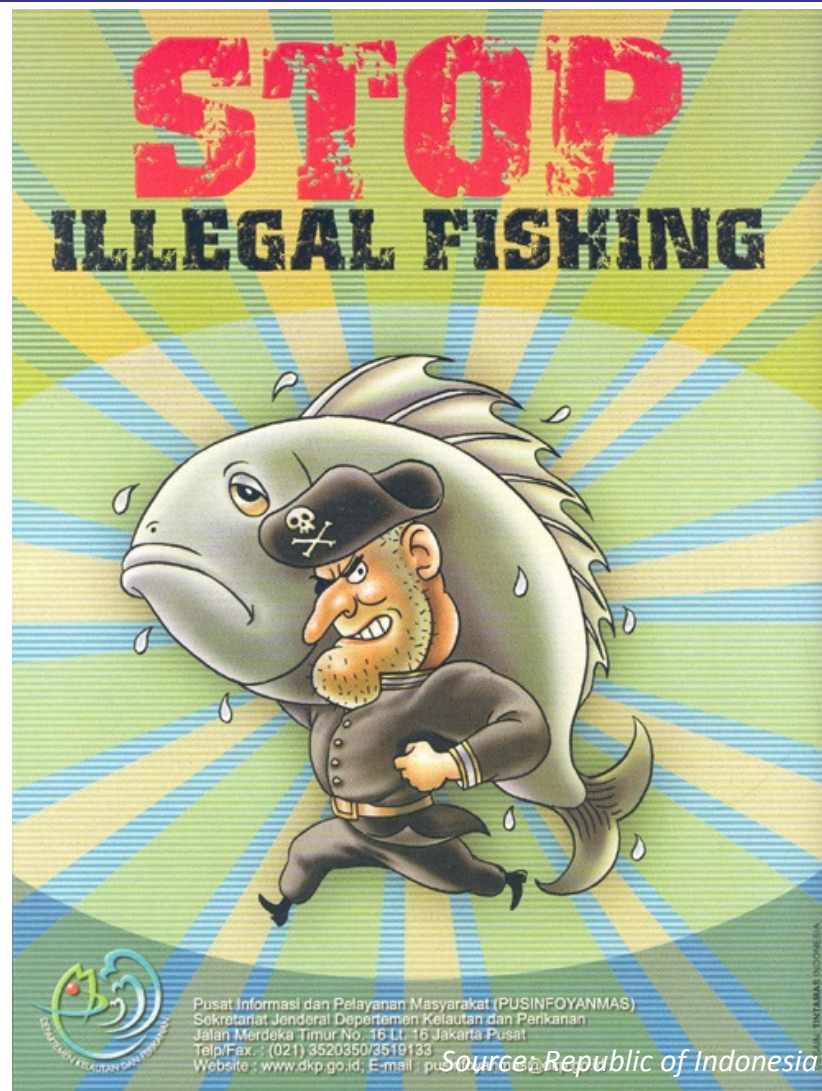
Case Study: Blue Fin Tuna in Europe

Component	USD (thousands)	Assumptions
Transmitters	560	560 ships
Transmitters: Installation	80	
Payload	50,000	to 30 satellites
Ground Station:		
Development	15	use existing
Ground Station:		
Maintenance	1,500	per year
Ground Station: Labor	1,500	
Imagery	500	Varies greatly
Social Costs	170,000	fleet retirement/subsidies
Total	~250,000	

Additional Benefits: Efficiency of marine patrols, Increase number of fines, Other uses (security, logistics, search and rescue)

Conclusions

- IUU Fishing:
 - A serious global threat
- Project Catch:
 - Turnkey, global solution
 - Interoperable components
 - Flexible data integration
 - Financially viable
- Additional applications:
 - Piracy
 - Trafficking
 - Environmental response
 - Search and Rescue

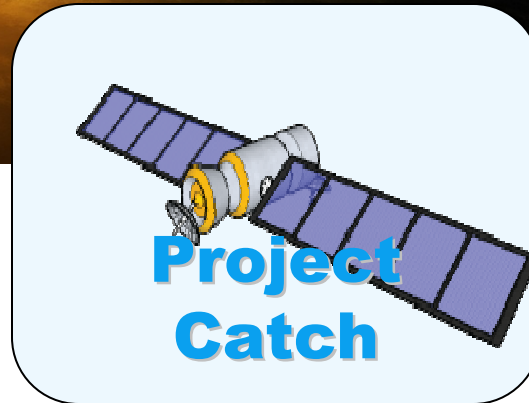


Acknowledgements






- Dr. Scott Madry, University of North Carolina, USA
- Dr. Susan Lieberman, The Pew Environment Group, USA
- Mr. Alex Soucek, ESA, Austria

- ISU Resident Faculty & Staff
- Dr. Marlene Alvarez, JRC, EU
- Barrister Shu'aib Al-Hayatt Balance, Federal Inland Water Ways, Nigeria
- Dr. Milan Cermack, ISU, Switzerland
- Mr. Stephen Clandillon, Sertit, France
- Mr. Antonio Cuba, Alpha Corredores de Seguros, Peru
- Dr. Adriana Fabra, The Pew Environment Group, Spain
- Mr. Marcel Kroese, Monitoring, Control, Surveillance Network, USA
- Dr. Rebecca Lent, NOAA, USA
- Mr. Renzo Martini, Melecnet, Peru
- Mr. Cesar Santisteban, Geomap, Peru
- Dr. Greg Slater, McMaster University, Canada

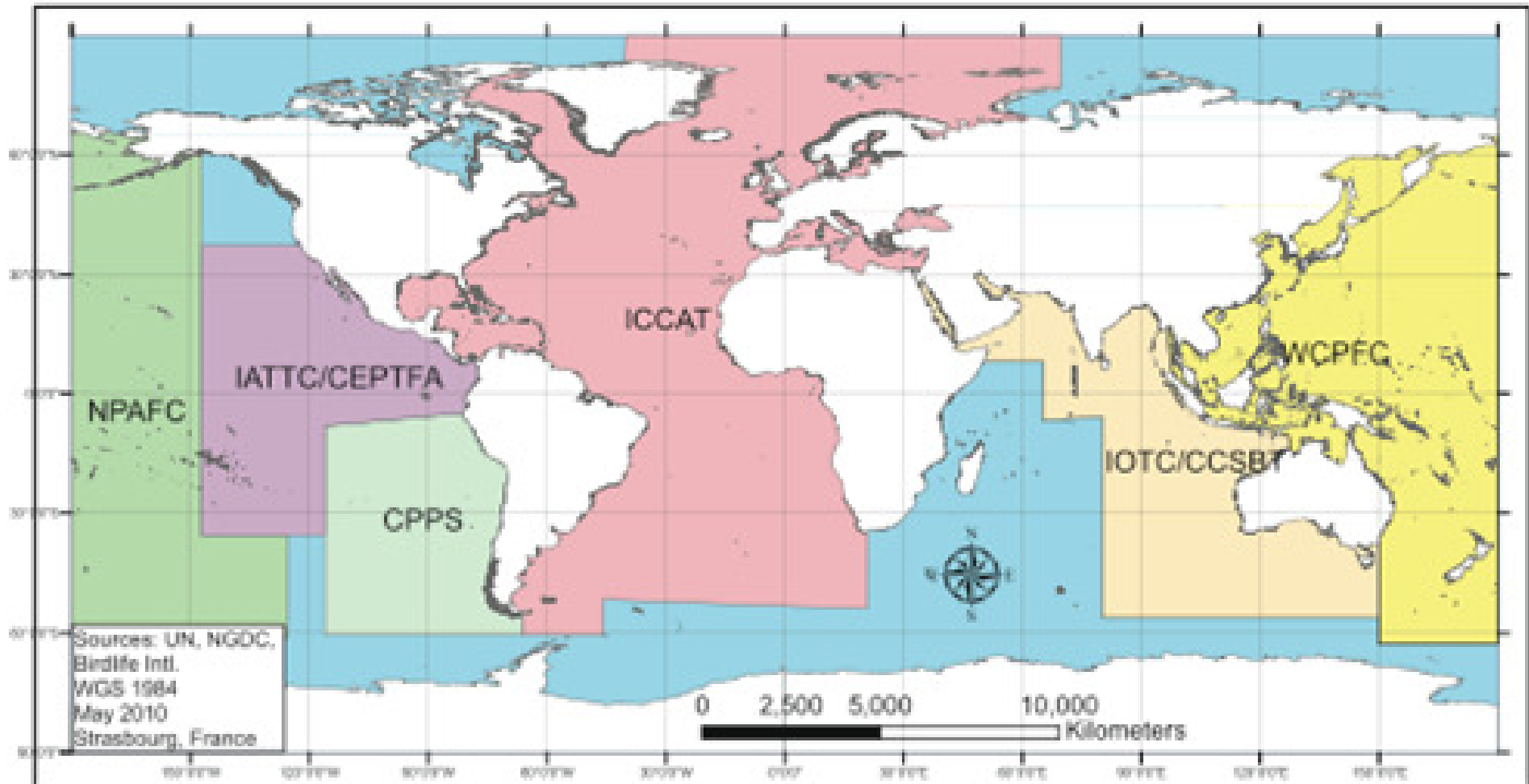
Questions?



Appendix: Vessel Monitoring Systems

	<i>Main Use</i>	<i>Space</i>	<i>Global</i>	<i>Secure</i>	<i>Issues</i>
VMS	Fisheries Management				Tamper-proof, Cost, Poles
AIS	Maritime Traffic				Security, High Seas, Poles
S-AIS	Maritime Traffic				Security, High Seas, Poles
LRIT	Maritime Security				Report Rate, Poles

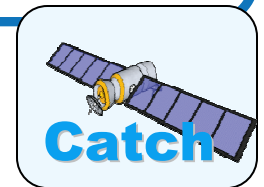
Appendix: Regional Fisheries



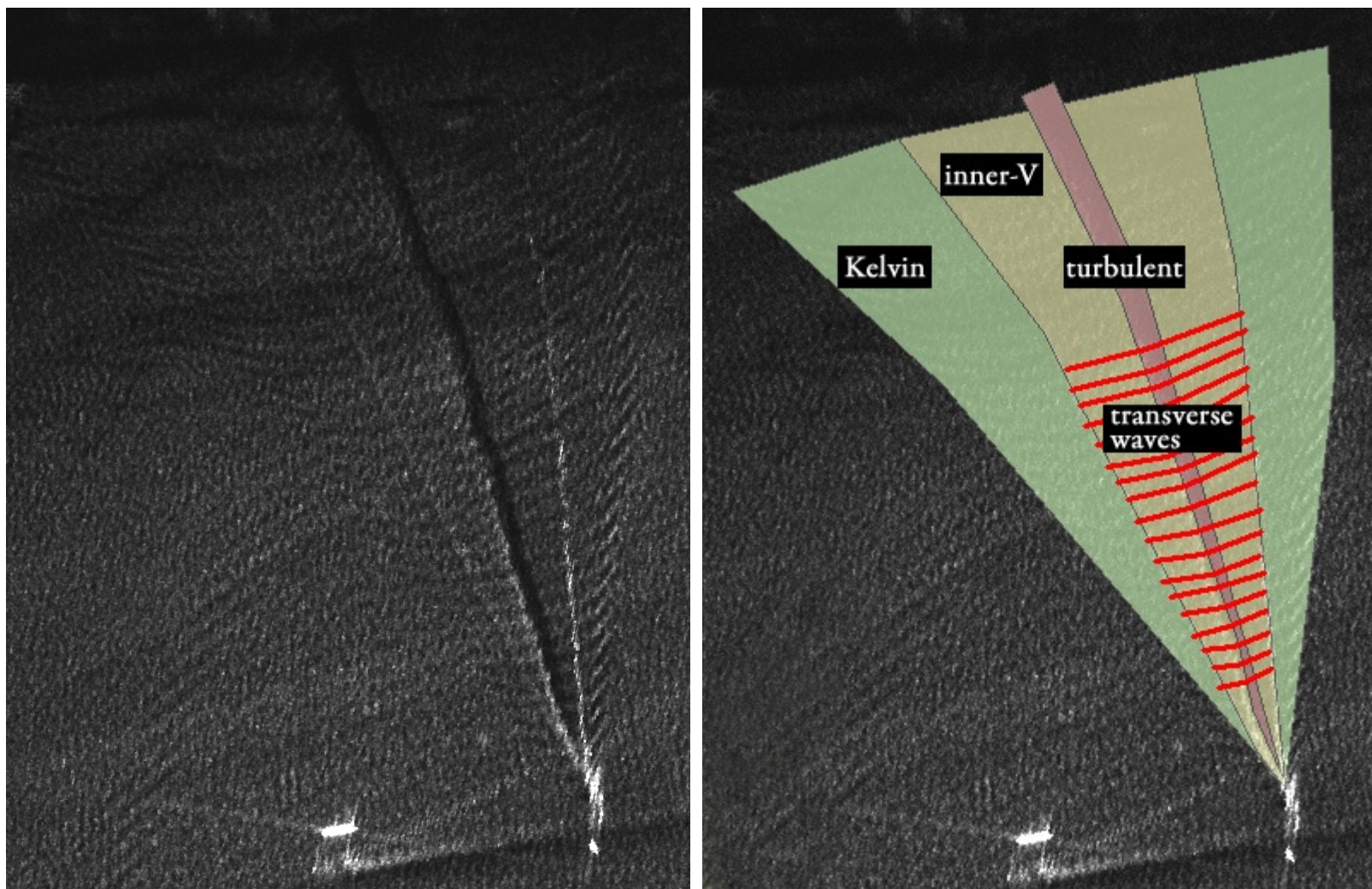
Source: TPOceans

Existing Monitoring Systems

	<u>Goal</u>	<u>Input Data</u>	<u>Delivery Time</u> [min]	<u>Shortcomings</u>
VDS/ IMPAST	Vessel Detection	Radar+VMS	30-60	False Alarm Rate, Detection Probability, Reliability, Identification Capability
DECLIMS	Benchmark Existing AutoDetect Software	Radar+VMS	N/A	False Alarm Rate, Detection Probability, Reliability, Identification Capability
MARISS	Vessel Detection and Tracking Assessment of Satellite Capability	Radar+VMS +AIS	30-60	Spatial Coverage, Response Time



Appendix: Analysis Example



Source: TPOceans

Appendix: Link Architecture

Input Parameters	UPLINK	INTER-SATELLITE LINK
	(Ship to Galileo)	(Galileo to EGNOS)
Band	L-Band	L-Band
Frequency	1575 MHz	1640 MHz
Modulation	BPSK	BPSK
BER	1.00 ⁴	1.00 ⁴
Data Rate	64 Kbps	64 Kbps
Link Margin	5.69	0.24
EIRP	10.09 dB	23.41 dB
G/T	4.81 dB	11.5 dB
Orbit	MEO	MEO/GEO
Propagation Path	23222 Km	47000 Km
Angle of Elevation	Omnidirectional	N/A
Transmitter Power	5 W	30 W
Antenna Diameter	0.2 m	0.3 m
Peak Antenna Gain	6.10 dB	11.64 dB
Polarization	LHCP	LHCP

Appendix: EU Common Fishery Policy, 2009



Article 9: Vessel Monitoring System (VMS)	Member States shall operate a satellite-based VMS for effective the monitoring vessels flying their flag.
Article 10: Automatic Identification System (AIS)	Vessels exceeding 15 metres' length overall shall be fitted with and maintain in operation AIS which meets the IMO standards.
Article 11: Vessel Detection System (VDA)	Member states shall use a vessel detection system matched by remotely sensed images or other equivalent systems with the data received by VMS or AIS.
Article 12: Data Transmission	Data collected in the framework of this Regulation may be transmitted to competent authorities engaged in surveillance operations of the marine environment and general law enforcement

Appendix: Link Budget

Data	Bit Size
Msg Type	6
Repeat Indicator	2
Source sequence count	14
Vessel ID (IMO number)	30
Navigation Status	4
Position Accuracy	1
Longitude	28
Latitude	27
Time Stamp (UTC)	6
Spares	6
SOTDMA Sync State	3
SOTDMA Slot Timeout	3
SOTDMA Slot Offset	14
Receiver Autonomous Integrity Monitoring	1
Total Bits per Message	145

Appendix: Catch-GIS Analysis Algorithms

Table 4-2. Summary of the operations of the Catch-GIS analysis algorithms.

Analysis Technique	Description
Retrospective identification of IUU fishing activities	Compare the claimed catch area against the region indicated by DNA, isotope and other molecular signatures measured from catch sample
Fishing hotspot prediction maps	Use nutrient concentrations, water column temperatures, weather and sea-state forecasts to determine regions of heightened future fishing activity
Identification of fishing vessels	Use vessel positions (e.g. from AIS, VMS, SAR imagery) and vessel identification (e.g. from vessel registries) to separate fishing vessels from all vessels
Vessel activity identification	Detect features in vessel track history that correspond to various fishing activities
Identification of non-compliant vessels	Use vessel positions and VMS to identify vessels that appear to be non-compliant with or have tampered with VMS
Illegal fishing zone identification	Use fishing vessel positions, boundaries of illegal fishing zones and regulated fishing seasons to detect illegal fishing
IUU vessel identification and classification	Assign a rank to any vessel that has been identified as engaging in IUU by Catch-GIS to indicate the severity of the offence
Obtaining IUU fishing vessel information	Create a report of an IUU fishing event for a vessel by querying all vessel identification sources and summarizing the analysis that led to the infringement detection
Validation and dissemination of alerts	Manually validate IUU alerts and automatically refine alert ranking based on validation
Updating master Catch-GIS database	Store alerts and all supporting information in database
Vessel wake detection and identification	Detect and analyze vessel wakes in SAR imagery to detect vessels and determine identifying features

Source: TP Oceans