MONITORING IUU IN INDIA USING SPACE TECHNOLOGY: PROSPECTS AND CHALLENGES

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STRUCTURE

Illegal, Unreported, Unregulated (IUU) Fishing Index - India Score

India's Fishing and IUU Monitoring Control and Surveillance (MCS)

Indian Use of Space Technologies for IUU MCS

- Satellite based Vessel Imaging systems
  - Electro/optical imaging satellites
  - Ocean Colour Monitor (OCM) imaging satellites
  - Synthetic aperture radar imaging satellites (SARsats)
- Satellite based monitoring and tracking data systems
  - Vessel monitoring systems (VMS)
  - Satellite Automatic Identification System (AIS)
  - Long Range Identification and tracking
- Summary

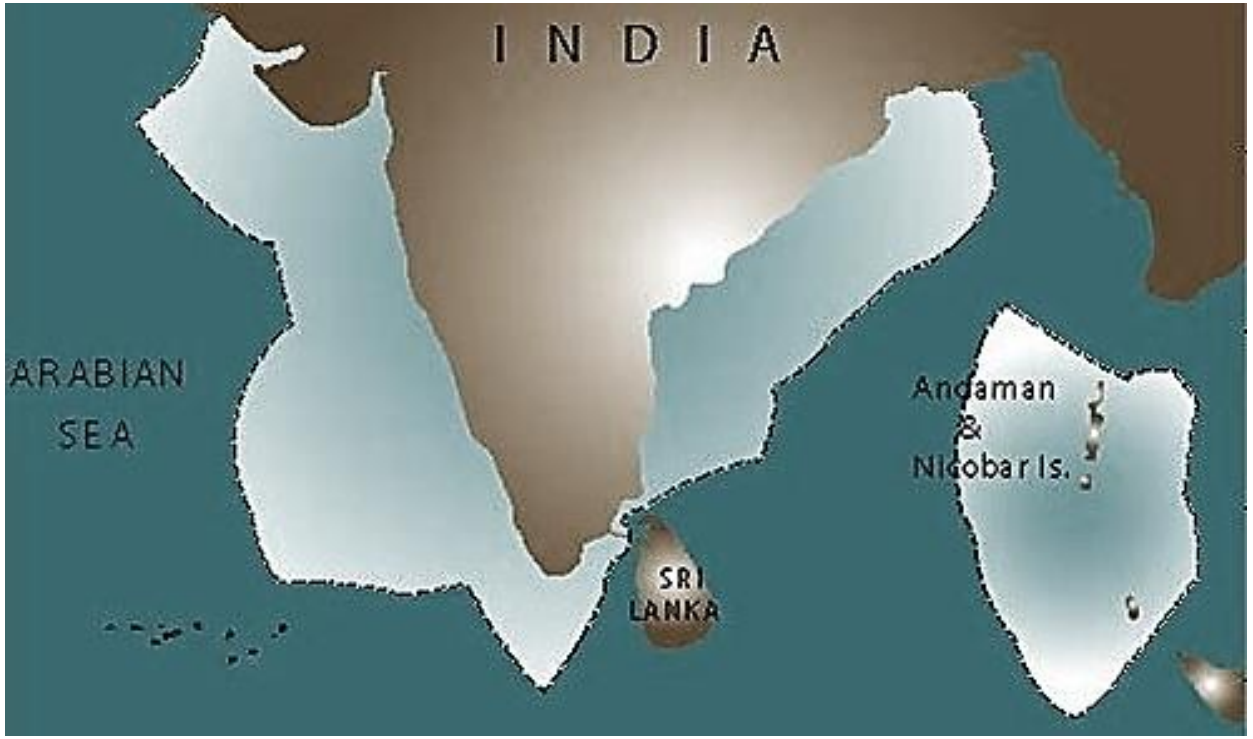
INDIA IUU FISHING INDEX RANKING – 17 OF 152 COUNTRIES

The Indian Exclusive Economic Zone (EEZ) since 1997

Estimated EEZ Area available: 2.02 mn sq km

Coastal population: 560 mn
- Half of 1.3 Bn population on coasts
- 14 mn directly employed in fishing

Annual Fishing Industry Exports: $6.4 bn
- 5.23 % of Agricultural GDP



India has adequate coastal surveillance infrastructure and patrolling capacity

- 5th Largest coast guard fleet in the world
- 60% of Indian Fishermen have Biometric IDs

Monitoring, Control and Surveillance (MCS) Issues

Fractured governance
- Unequal MCS asset distribution between Coast Guard and state Governments agencies

Legal complexities
- Coast Guard Act of 1978 and Maritime Zones of India (Regulation of Fishing foreign Vessels) Act 1981. No management plans to Monitor Indian Vessels or Indian Registered LOPs beyond the EEZ

IUU FISHING OF TOTAL REPORTED CATCH: **10.9%** IN BAY OF BENGAL AND **2-3%** IN ARABIAN SEA

More than 50% species in the Arabian Sea are at elevated risk of extinction

Sharks, rays, sawfish, hammerheads some of the most threatened fish in the word

Seafloor ecosystem damage: Pink gold rush for prawns by mechanized trawlers

Bycatch use boom: Vulnerable and top of the food chain species particularly affected

Unintended consequences of 2004 Tsunami aid: sudden expansion and modernization of small-scale fisheries

India Sustains one of the last Healthy Tuna Populations in the World!

HILSA COULD BE SOON EXTINCT in the BAY: an estimated 14,000 trawlers hover the migratory path of the fish as it approaches the river to spawn

SPACE TECHNOLOGIES CAN FILL GAPS IN MCS THROUGH SATELLITE IMAGING AND TRACKING OF VESSELS

MCS Challenges

- Vast EEZ
- Unequal MCS asset distribution between states and the Union - Aerial patrolling fragmented
- Industrial vessels do not take on-board observers
- Low prosecution rate due to lack of documented, time stamped proof of IUU fishing
- Low domain awareness: gaps in the availability, reliability, and quality of information on marine assets

Indian Space Research Organisation (ISRO) has developed a mix of imaging and data communication technologies: indigenous and in collaboration with other country space agencies

Satellite based Vessel Imaging systems

- Ocean Colour Monitor (OCM) imaging satellites
- Electro/optical imaging satellites
- Synthetic aperture radar imaging satellites (SARsats)

Satellite based monitoring and tracking data systems

- Vessel monitoring systems (VMS)
- Satellite Automatic Identification System (AIS)
- Long Range Identification and tracking (LRIT)

IRS SATELLITE SYSTEM FOR OCEAN COLOUR MONITORING

24 Indian Remote Sensing (IRS) satellites launched by Indian Space Research Organization (ISRO) since 1988:

- Currently, world's largest operational constellation of 11 IRS for civilian use
- Data available through NRSC Data Centre purchase process and free through Bhuvan Geoportal of ISRO

India provides continuity of Ocean Colour Monitoring (OCM) data to the international ChloroGIN project

- OCEANSAT-1 in 1999: First OCM payload aboard IRS-P4 to assess clorophyll concentrations, algal blooms for ocean modelling, potential fishing zone (PFZ), productivity and harvesting potential
- OCEANSAT-2 in 2009: Second OCM payload
- OCEANSAT-3 to be launched in 2020

OCEANSAT-2 OCM Feb 6, 2017 Irrawaddy River Delta, Bay of Bengal- image credit: ISRO/SAC, Prakash Chauhan

ISRO's ocean color program has evolved into ocean colour-based services: information on the state of the marine ecosystem of Indian EEZ at synoptic scales for policy makers and stake holders including law enforcement agencies

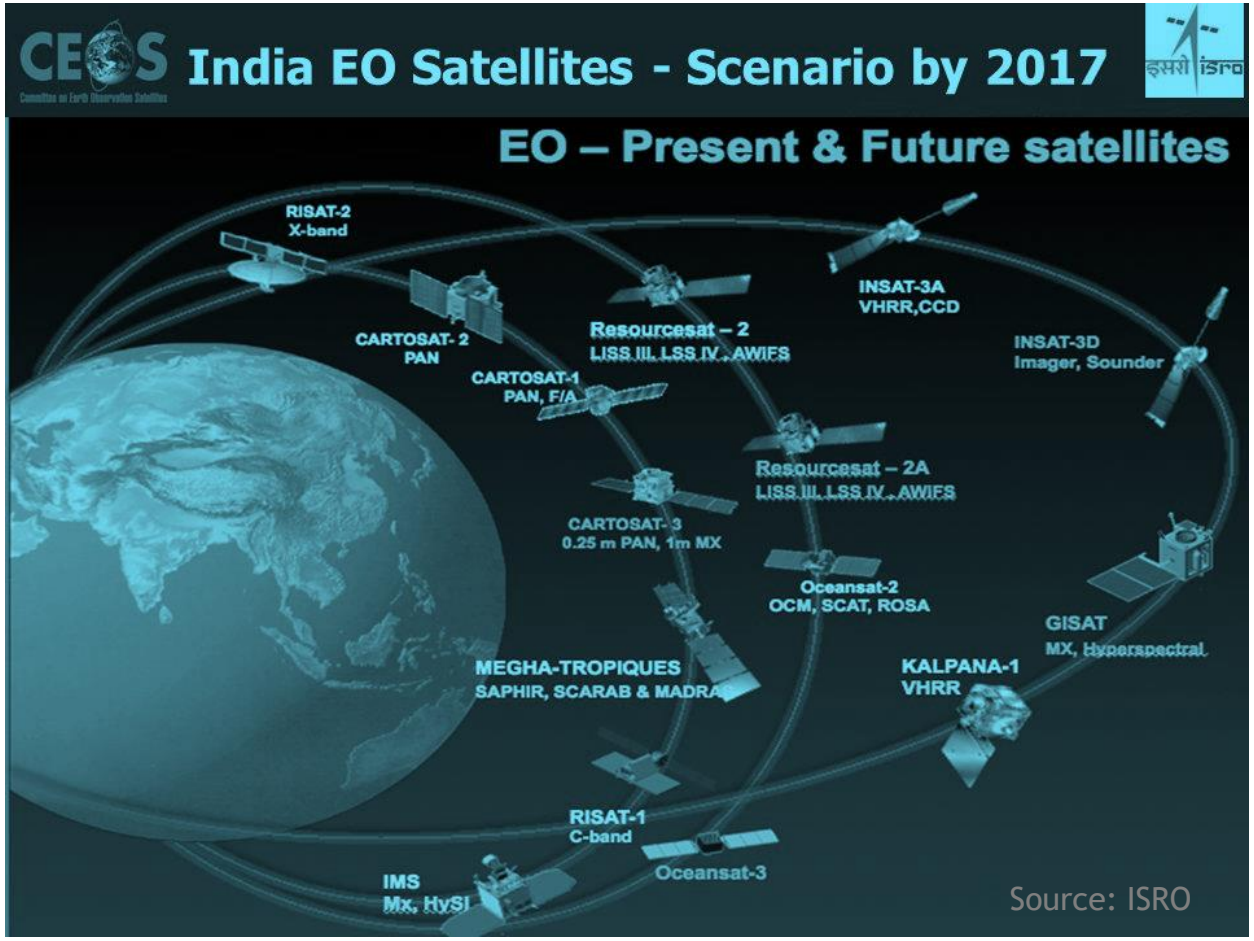
INDIAN REMOTE SENSING OPTICAL IMAGING SATELLITES FOR EARTH OBSERVATION

1980s: India started building and launching several Electro/Optical satellites for long-term spaceborne imaging capability under its **National Natural Resources Management System** program. Examples:

- 2 OCEANSAT – IRSP4 and IRS OS2 in 1980s-90s
- 2 ResourcesSAT satellites (P6 and RS-2) satellites

Optical satellite imaging

- High resolution
- Can detect and also identify vessels
- However, strongly affected by:
  - Darkness
  - Cloud Cover
- Very costly for identifying illegal fishing boats



SATELLITE-BORNE SYNTHETIC APERTURE RADAR (SAR) IMAGING SATELLITES OF INDIA

Globally, current methods for detecting, monitoring and acting on suspicious fishing activity are limited without radar satellite imaging technologies

- Satellite-borne Synthetic Aperture Radar (SAR) or optical sensor units till now were very large and expensive with limited availability. Ver few countries have launched them.

- India launched two SAR Satellites RISAT-1 and RISAT-2. Both are primarily focused on weather surveillance activities; IUU has not been their priority

January 2018

First Finnish commercial satellite ICEYE-X1 with world's first under 100kg SAR sensor payload launched by ISRO's PSLV-C40 rocket from Satish Dhawan Space Center in India

- Enables radar imaging of the Earth through clouds and even in total darkness

https://www.iceye.com/resources/company/history

VMS USING ISRO'S INDIAN REGIONAL NAVIGATION SATELLITE SYSTEM NAVIC

Vessel Monitoring Systems (VMS)

- Global navigation satellite systems and dual-mode communications (Global Position System)
- Use a variety of communication technologies: satellite AIS or Inmarsat, Iridium, Argos, etc.
- Advantages
  - Resource efficient – one law enforcement employee can monitor nearly 500 boats
  - No shore distance limitation
  - Cost effective, especially for monitoring mid-sea trans-shipments

Indian VSM was developed by ISRO's Space application Centre in 2009 for implementing in the EEZ but there was no mandate to use VMS till 2017

Large scale efforts begun by the Government of India to install VMS in all registered vessels (less than 20 m).

Picture source: www.thehindubusinessline.com

India uses its own Indian Regional Navigation Satellite System, a constellation of seven satellites operating under the name NavIC.

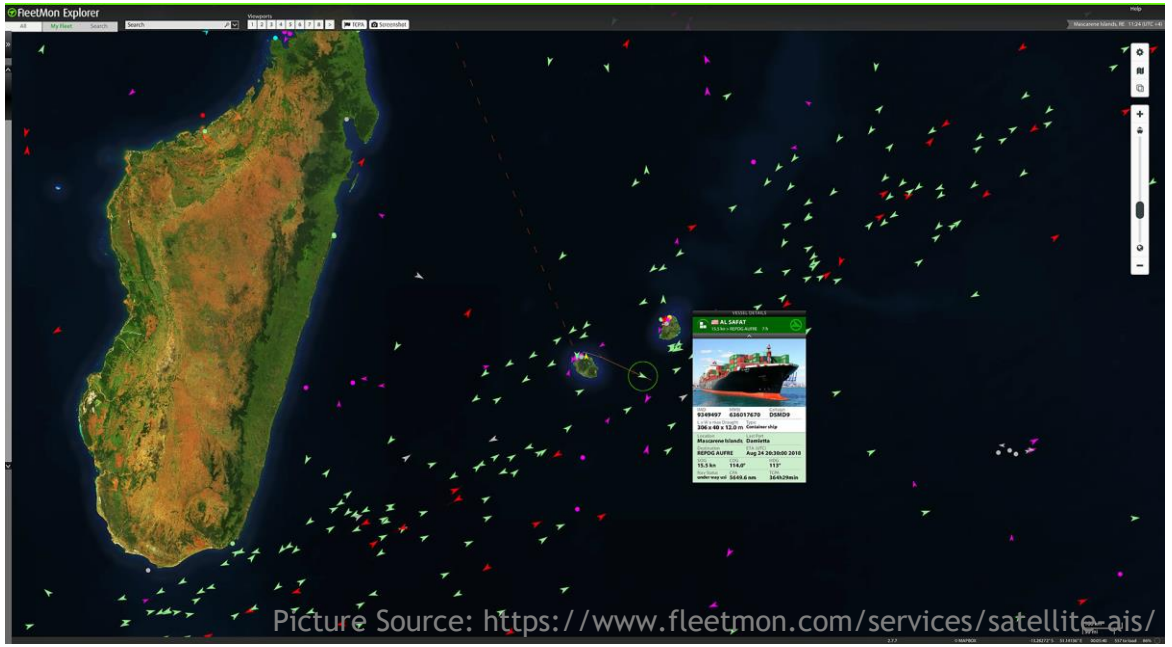
INTERNATIONAL COOPERATION BETWEEN ISRO AND CNES FOR SPACE AUTOMATIC IDENTIFICATION SYSTEM (S-AIS)

VHF and radar based Terrestrial Automatic Identification System (AIS): India set up a National AIS Network on 74 shore stations

Challenge: VHF range limitation of maximum of 25-40 nm from the coast. Currently India has AIS fitted on vessels larger than 20 m

Satellite detection of AIS: Private international companies like 'exactEarth' and 'ORBCOMM' providing commercial service

Current shortcomings in the Satellite AIS technology: ships' position data delayed by ~90 minutes depending upon the number of satellites available for covering a particular area



Picture Source: https://www.fleetmon.com/services/satellite-ais/

August 2019: India' ISRO and France's space agency CNES announced joint development and operations of 10 low-earth orbit satellites for world's first S-AIS series to track merchant ships on a real-time basis

LRIT BASED, REAL-TIME TRACKING AND REPORTING SYSTEM FOR ENHANCED MARITIME DOMAIN AWARENESS

Long-Range Identification and Tracking system (LRIT) - satellite based, real-time tracking and reporting system of ships

- IMO approved system since 2006 for ships of 300 gross tonnage plus
- Consists of Ship Satellite terminal, Inmarsat Satellite Communication, national data centres
- India installed LRIT data centre in 2009; it shares own data with the other Flag States
- Major advantage: very secure access only by authorized governmental agencies

However, in India the system is not being used by the member States regularly for monitoring the illegal fishing because it is costly to obtain positions of ships of another flag. S-AIS is cheaper

DIFFERENCES BETWEEN VMS, AIS AND LRIT SYSTEMS

VMS

Not mandated by IMO

Closed proprietary systems with high barriers to data access

Transmit every 30 min to 2 hr

AIS

Collision avoidance system mandated by the IMO; open and non-proprietary with international standards

Public broadcast system

Transmit continuously

LRIT

Reporting system mandated by the IMO, LRIT Protocol

Transmit every 6 hour, can be set for 15 minutes

Secure data only available to entitled institutions

SUMMARY

Conditions that affect India's space agency's efficacy in responding to maritime threats

- Priortized National Interest in protecting its fish for food security
- A mix of technologies including optical imaging and tracking
- International collaboration
- Domain awareness
- Enforcement

THANK YOU!

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