Leveraging the power of Big Data at FAO

Applications in Fisheries and Aquaculture

Pierre Maudoux
Consultant
FAO's Fishery Statistics and Information Branch (FIAS)
pierre.maudoux@fao.org

Food and Agriculture Organization of the United Nations

Contents

1. Introduction
   - FAO presentation
   - Statistics at FAO
   - Sustainable development goals (SDGs)
2. Applications of Big Data for Fisheries and Aquaculture at FAO
   - Why Big Data: what do we have to gain?
   - A review of applications
   - Limitations
3. Conclusion

Food and Agriculture Organization of the United Nations

FAO

- **194 Member Countries**, two associate members and one member Organization
- Headquarters in **Rome**, Italy
- Presence in more than **130 countries**

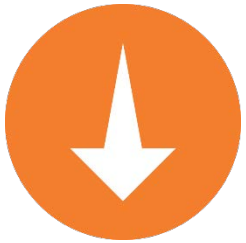
- FAO supports governments and their stakeholders in areas of development, in the design of adequate policies, programmes and legal frameworks to **promote food security and nutrition**

Food and Agriculture Organization of the United Nations

Our priorities

1. Eradicate hunger and malnutrition

2. Make agriculture, forestry and fisheries more productive and sustain-able



3. Reduce rural poverty

4. Enable inclusive and efficient agricultural and food systems

5. Increase the resilience of livelihoods from disasters

Food and Agriculture Organization of the United Nations

Importance of statistics at FAO

Role of FAO:

- Collect, analyze, interpret and disseminate food & agriculture statistics
- Develop and implement methodologies, standards to help generate sound data
- Support for member countries: collection, dissemination, and uptake of data

Reliable, relevant statistics (agriculture, forestry, fishery)

→

Support **decision making**, policies & investment

Better **progress monitoring**

→

Tackle key food and agriculture issues

Food and Agriculture Organization of the United Nations

Big Data in Fisheries and Aquaculture

Advantages – Limitations – Scope – Perspectives

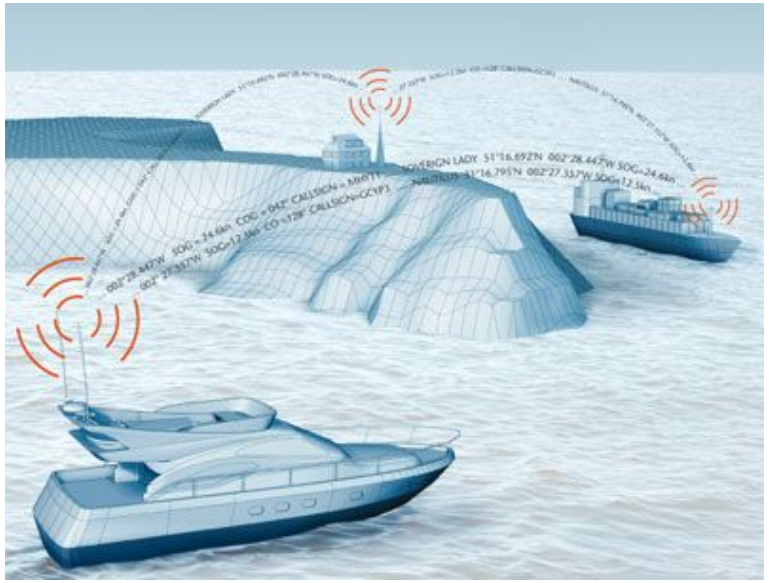
FAO's Fisheries and Aquaculture Statistics

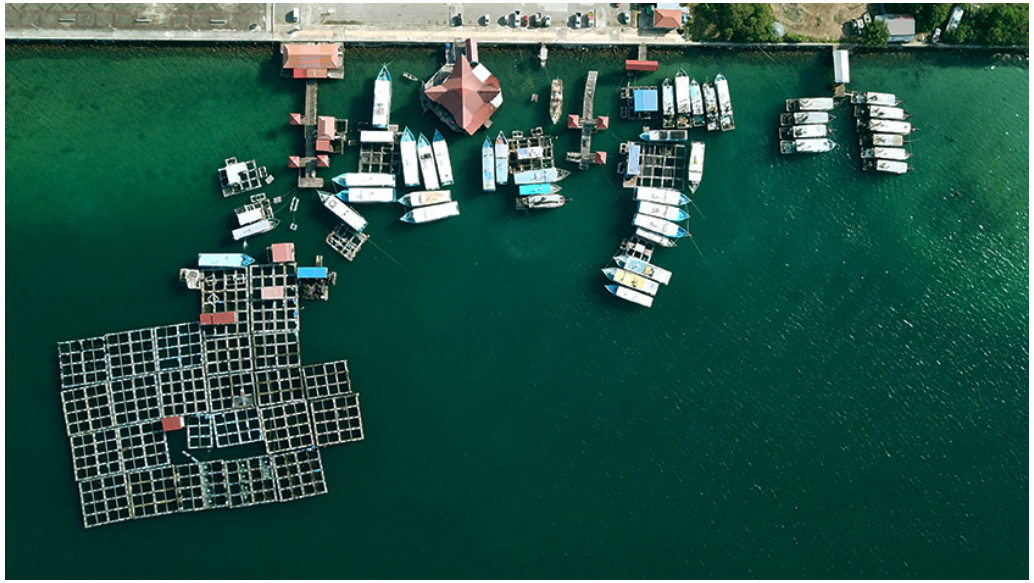
- Fisheries and Aquaculture as important source of food, nutrition, income and livelihoods
  - Marine and inland ecosystems and their resources under growing threat
  - Sustainability only possible with cautious and effective management
  - FAO is the only global source of fisheries and aquaculture statistics
- Our main databases:
  - Global capture and aquaculture production
  - Global trade of fisheries and aquaculture commodities
  - Consumption of Fish and Fishery Products
  - …

Food and Agriculture Organization of the United Nations

Why Big Data in Fisheries and Aquaculture?

- Source of new data
- Alternative source to validate, complement, enhance existing datasets





Food and Agriculture Organization of the United Nations

Application 1 - species distribution

Goal	predicting future distribution of marine species
Data sources	species occurrence data, marine environmental parameters (e.g. depth, temperature, salinity), habitat preferences
Analysis type	ML niche modelling to compute future range under climate change scenarios

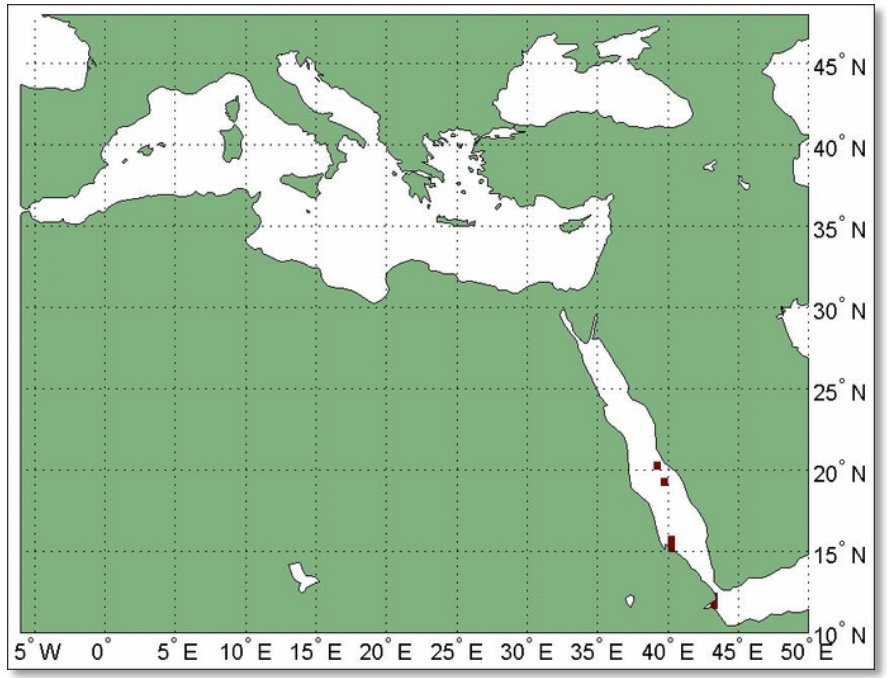
Food and Agriculture Organization of the United Nations

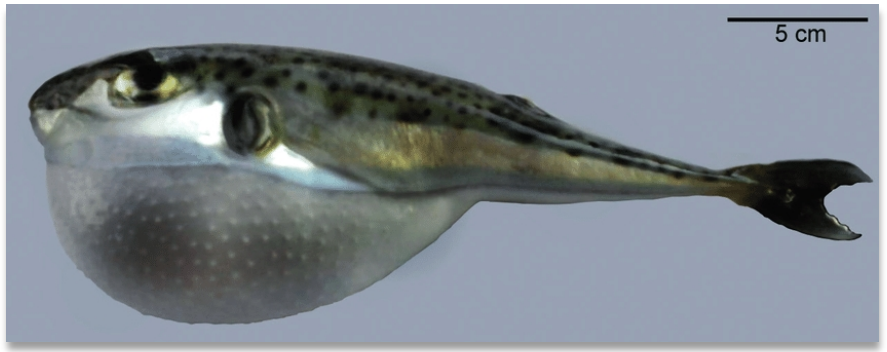
Application 1 - species distribution

Results

- Silver-cheeked toadfish (*Lagocephalus sceleratus*)
- From Red Sea to Mediterranean Sea
- Without intervention, spread will continue and impact on fisheries will worsen

Probability of species occurrence. 1950 -2050





Limitations

- Uncertainty of predictions unclear

Food and Agriculture Organization of the United Nations

Application 2 – AIS for fisheries monitoring

Goal	identify fishing effort location to understand impacts on environment and resources; improve fleet data
Data sources	global **A**utomatic **I**dentification **S**ystem (AIS) data (60k vessels in 2017)
Analysis type	machine learning to identify fishing gear based on movement

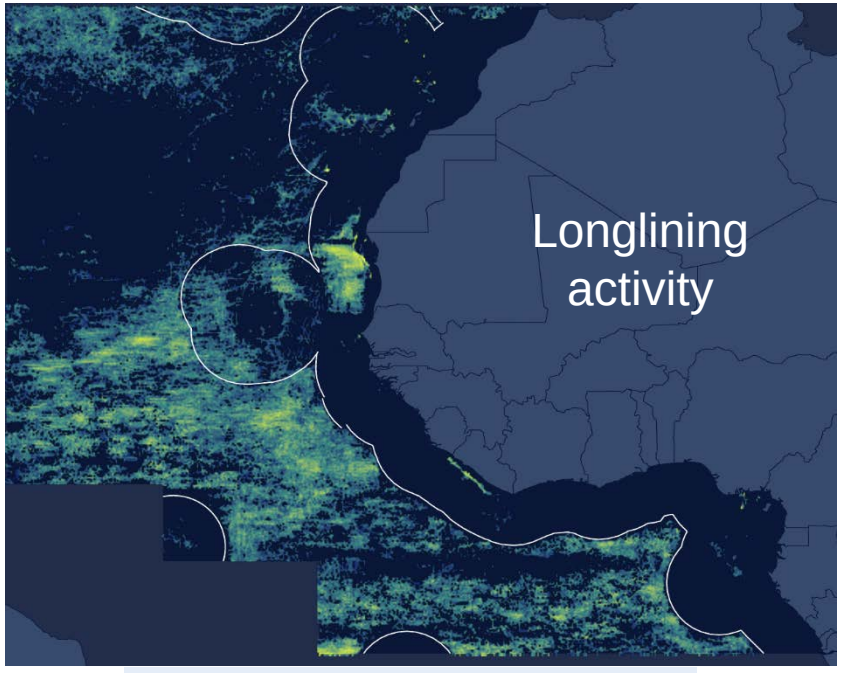
GLOBAL FISHING WATCH

Food and Agriculture Organization of the United Nations

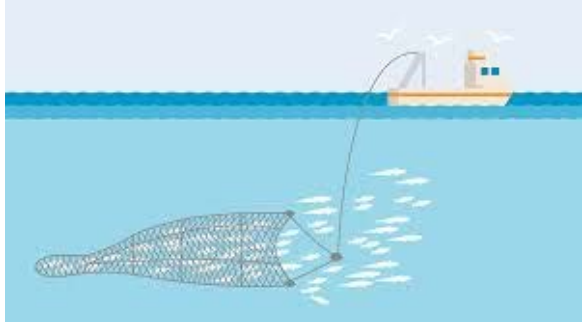
Application 2 – AIS for fisheries monitoring

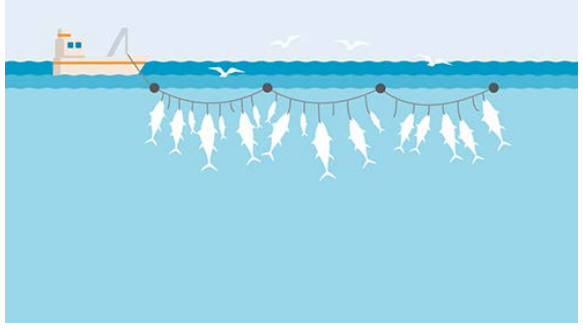
Results

example of output, west Africa (2017)



(Fishing hours/km2)





GLOBAL FISHING WATCH

Food and Agriculture Organization of the United Nations

Application 2 – AIS for fisheries monitoring

Limitations

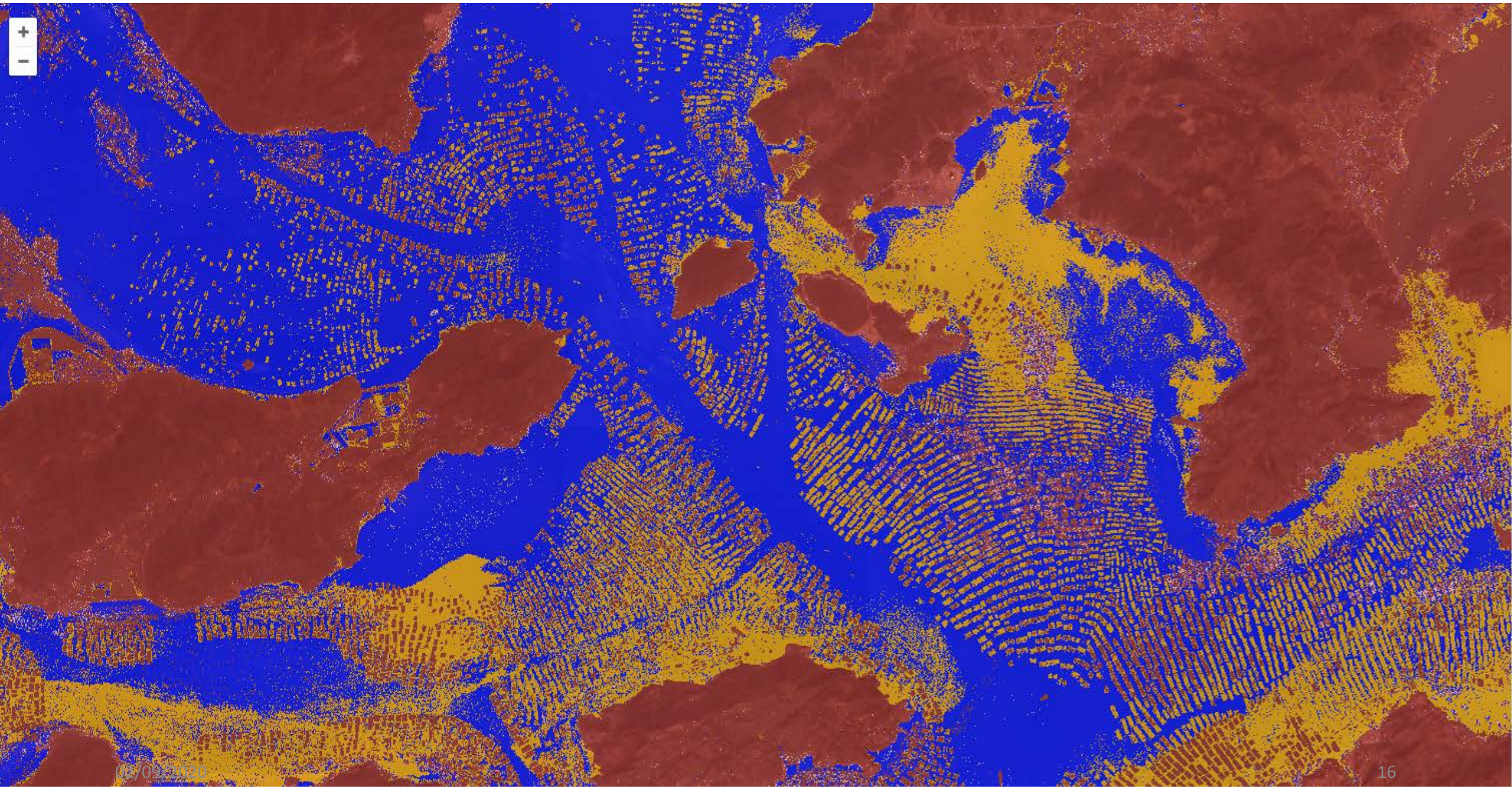
AIS coverage	number of vessels using AIS limited (mostly larger boats, richer countries, distant water fleet)
AIS reception	constrained by presence of satellites/antennae, heavy vessel traffic areas
AIS algorithm	some fishing techniques are less predictable and therefore harder to identify than others (e.g. gillnets, pole and line)

GLOBAL FISHING WATCH

Food and Agriculture Organization of the United Nations

Application 3 – detection of aquaculture sites

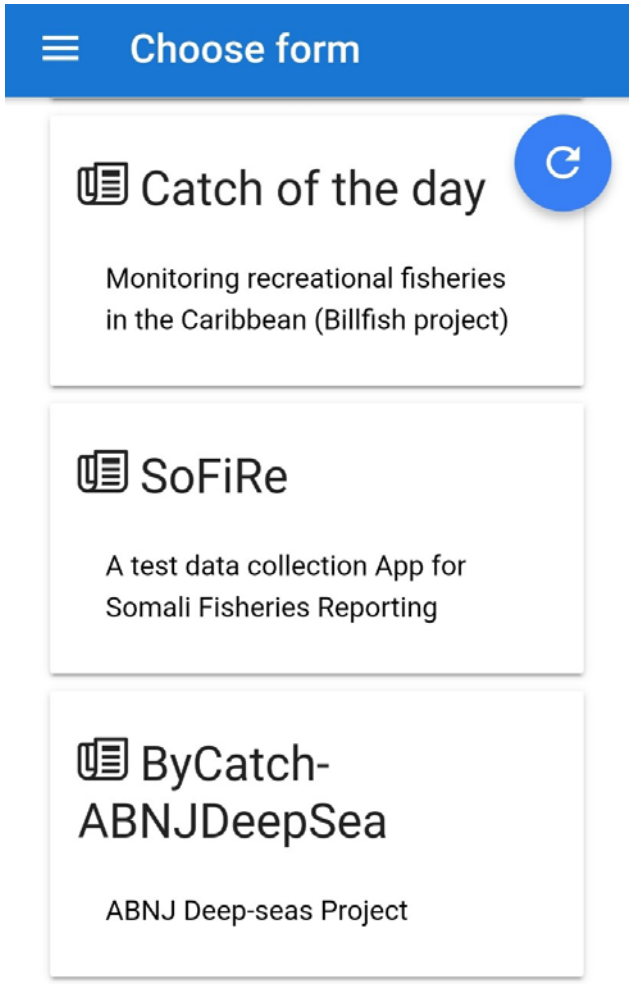
Goal	detection and mapping of aquaculture sites for improved information insights and production capacity analysis, spatial planning and potential disaster assessments
Data sources	satellite imagery (Sentinel II)
Analysis type	image classification algorithms
Limitations	imagery resolution (the better the more expensive), type of aquaculture, complex production calculation
Result	example in South-East China

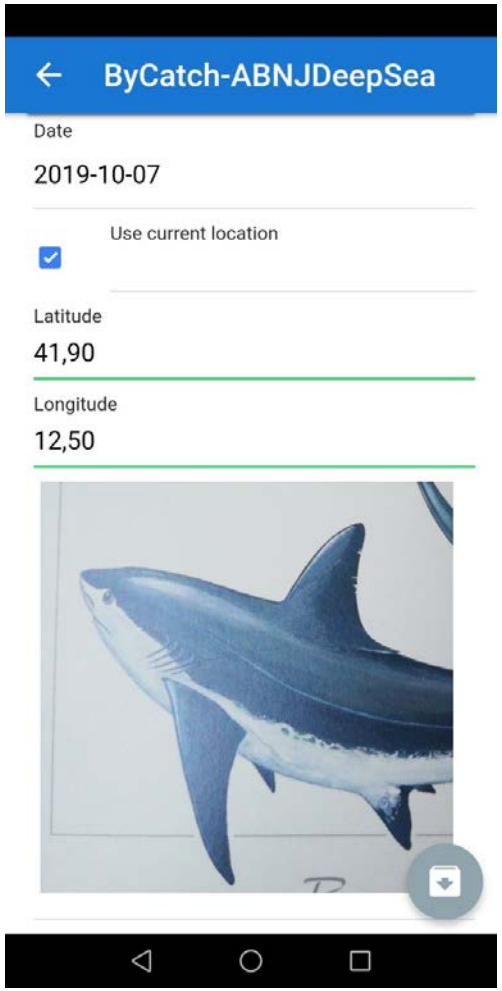


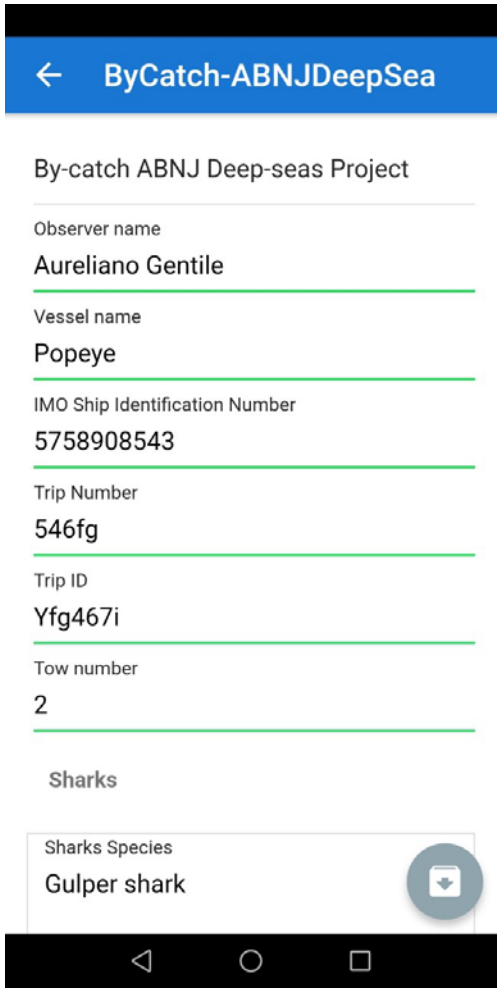
Application 4 – SmartForms mobile app

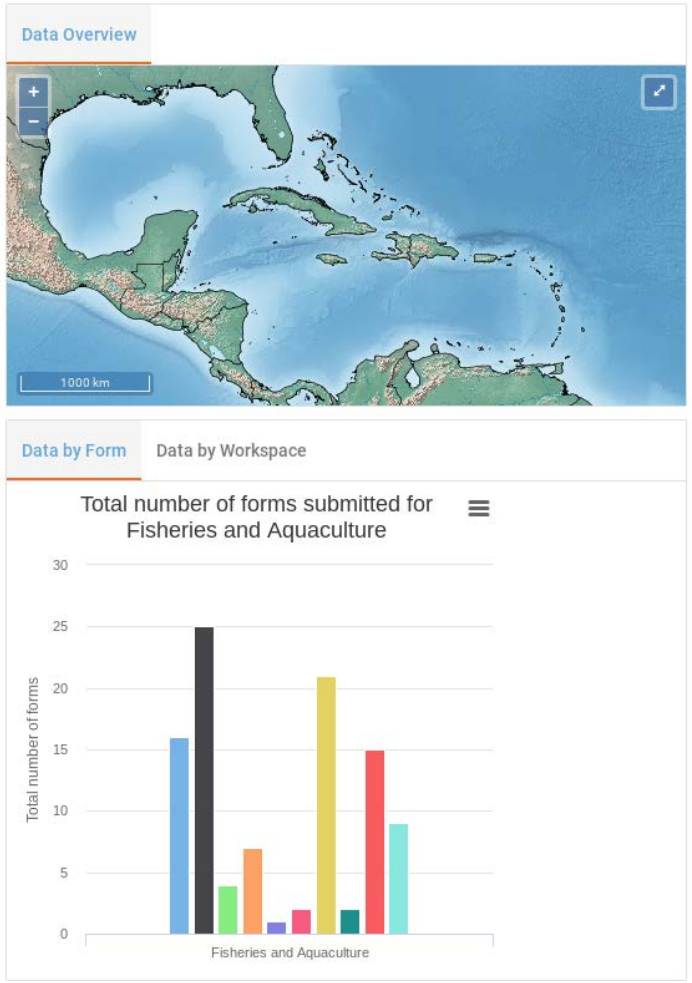
Goal	decentralized collection of important but sparse data (e.g. bycatch, recreational catch, marine litter)
Data sources	customizable forms designed to collect standardized data
Analysis type	visualization of key data collection statistics
Limitations	control over accuracy of data collection
Result	currently in beta version, release within months

Application 4 – SmartForms mobile app





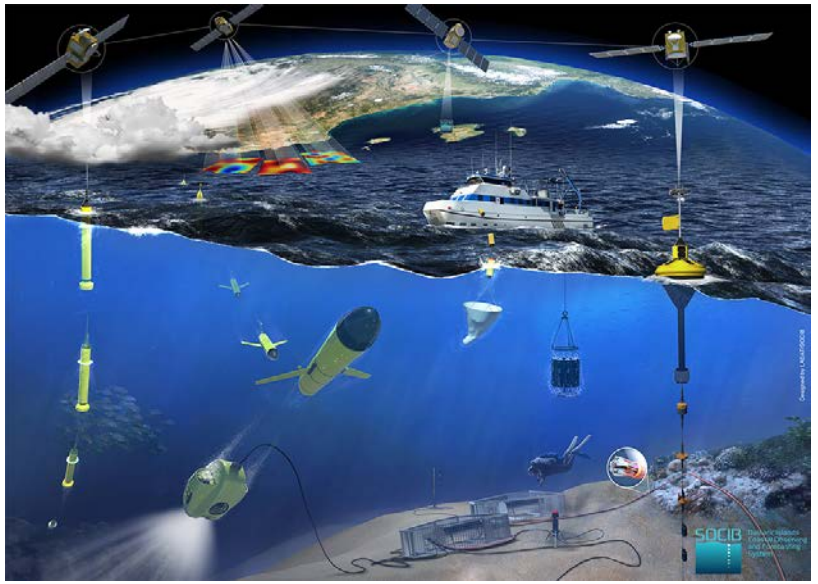




Food and Agriculture Organization of the United Nations

Implementation in FAO Fisheries and Aquaculture

- Strategy on the use of Big Data under development
- Range of experimental projects
- Promising applications but no routine use of Big Data yet



Food and Agriculture Organization of the United Nations

Conclusion

- Very promising technology, but limitations exist
- Does not replace data collection by national statistical offices, but can be a very good complement
- Technology constantly improves, creating more and more opportunities (e.g. AIS use, satellite imagery resolution, machine learning algorithms)
- The future of fisheries and aquaculture will include these technologies and FAO is getting prepared to leverage them fully

Food and Agriculture Organization
of the United Nations

}f3#

謝謝

Merci

Thank You

Благодарю

¡Muchas Gracias!

Questions and inquiries:

pierre.maudoux@fao.org

fish-statistics-inquiries@fao.org

Contributed to the contents of this presentation:

Marc Taconet, Stefania Vannuccini, Kiran Viparti,

Jennifer Gee, Aureliano Gentile, Anton Ellenbroek

Food and Agriculture Organization of the United Nations

Annex – List of relevant publications and websites

- *Advances in geographic information systems and remote sensing for fisheries and aquaculture*
  - http://www.fao.org/3/i3254e/i3254e.pdf
- *E-agriculture in Action: Big Data for Agriculture*
  - http://www.fao.org/e-agriculture/news/fao-itu-e-agriculture-action-big-data-agriculture
- *Forecasting the ongoing invasion of Lagocephalus sceleratus in the Mediterranean Sea*
  - https://www.sciencedirect.com/science/article/pii/S0304380018300164
- Upcoming: *Atlas of Fishing Activity using AIS data*

Food and Agriculture Organization of the United Nations

Annex – List of relevant publications and websites

- FAO's Fisheries and Aquaculture statistics website: http://www.fao.org/fishery/statistics/en
- Global Fishing Watch website: https://globalfishingwatch.org/
- *SmartForms: A mobile App platform to collect and review fishery and observer data*: http://www.fao.org/fi/static-media/MeetingDocuments/cwp/ReferenceHarmonization/2018/S3_3.pdf