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منظمة
الأغذية والزراعة
للأمم المتحدة

Leveraging the power of Big Data at FAO

Applications in Fisheries and Aquaculture

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- Limitations

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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**





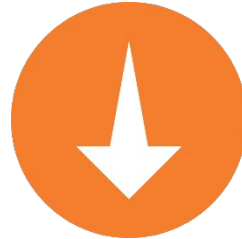
Our priorities



**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**



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





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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
 - ...





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

Application 1 - species distribution



Results

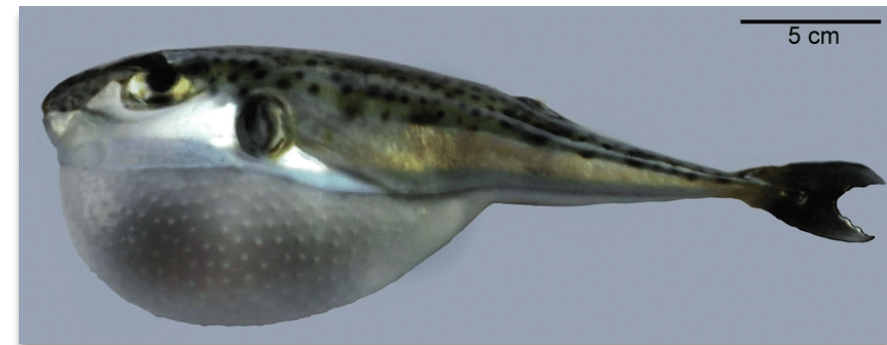
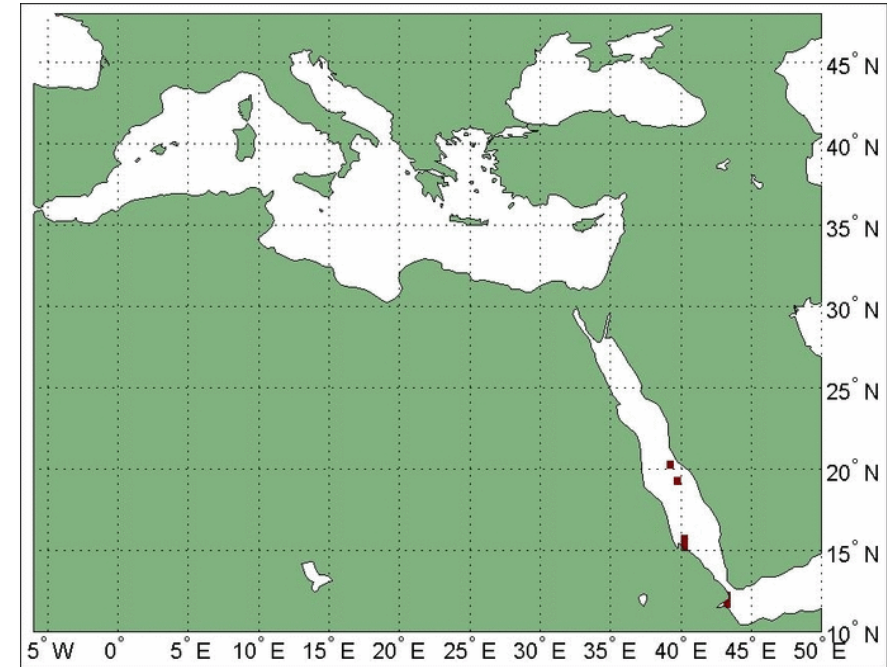
- Silver-cheeked toadfish (*Lagocephalus sceleratus*)
- From Red Sea to Mediterranean Sea
- Without intervention, spread will continue and impact on fisheries will worsen



Limitations

- Uncertainty of predictions unclear

Probability of species occurrence. 1950 -2050





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



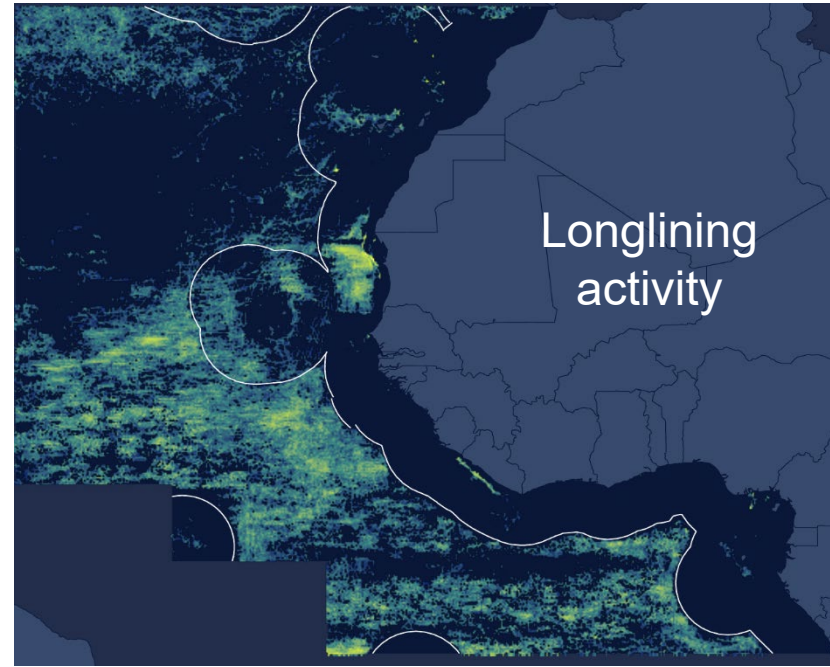


Application 2 – AIS for fisheries monitoring

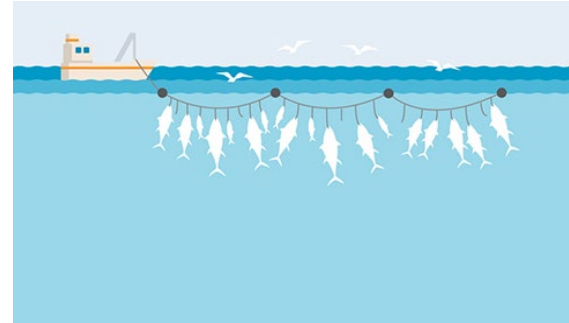
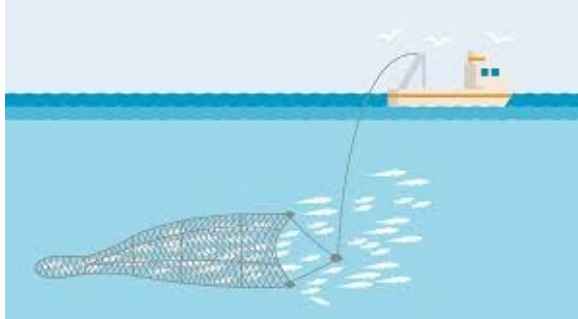


Results

example of output, west Africa (2017)



(Fishing hours/km²)





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)





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

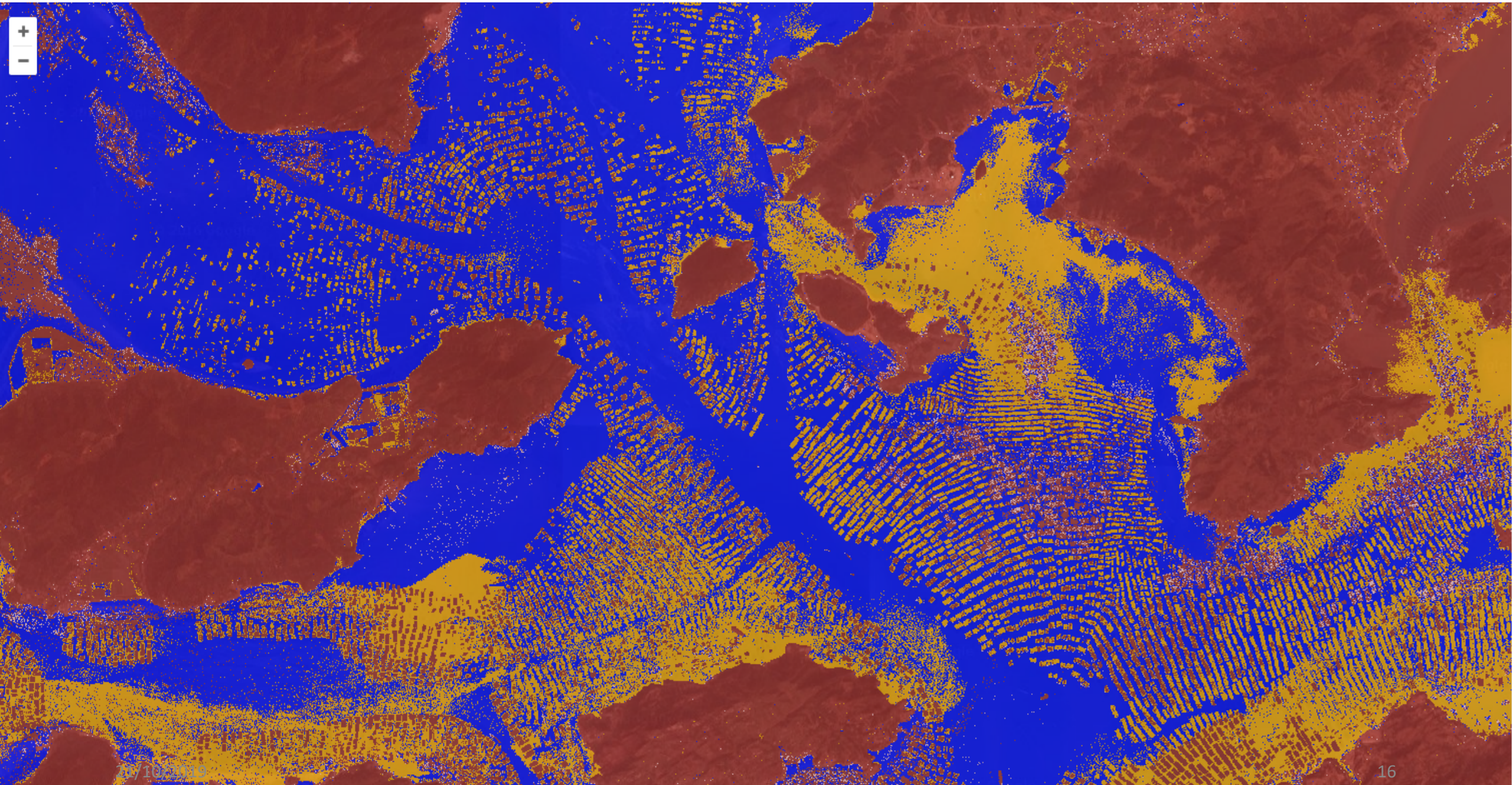
imagery resolution (the better the more expensive), type of aquaculture, complex production calculation



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

Choose form

Catch of the day

Monitoring recreational fisheries in the Caribbean (Billfish project)

SoFiRe

A test data collection App for Somali Fisheries Reporting

ByCatch-ABNJDeepSea

ABNJ Deep-seas Project


ByCatch-ABNJDeepSea

Date
2019-10-07

Use current location

Latitude
41,90

Longitude
12,50



Sharks

Sharks Species
Gulper shark

ByCatch-ABNJDeepSea

By-catch ABNJ Deep-seas Project

Observer name
Aureliano Gentile

Vessel name
Popeye

IMO Ship Identification Number
5758908543

Trip Number
546fg


Trip ID
Yfg467i

Tow number
2

Sharks

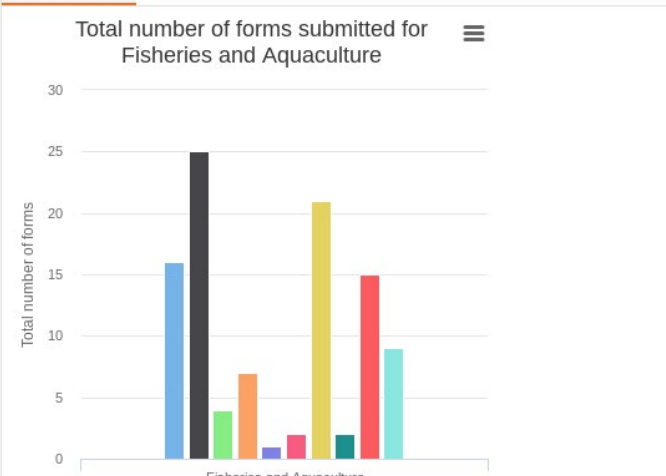
Sharks Species
Gulper shark

Data Overview



Data by Form Data by Workspace

Total number of forms submitted for Fisheries and Aquaculture

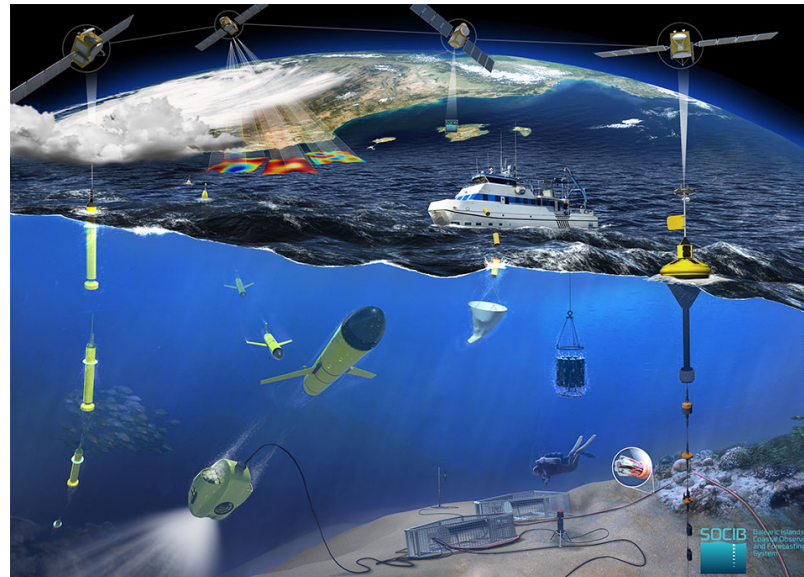


Category	Total number of forms
Category 1	16
Category 2	25
Category 3	4
Category 4	7
Category 5	1
Category 6	2
Category 7	21
Category 8	2
Category 9	15
Category 10	9



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





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



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شكرا

謝謝

Merci

Thank You

Благодарю

¡Muchas Gracias!

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Contributed to the contents of this presentation:

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Jennifer Gee, Aureliano Gentile, Anton Ellenbroek



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*



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