Shrimp production under the climate change scenarios

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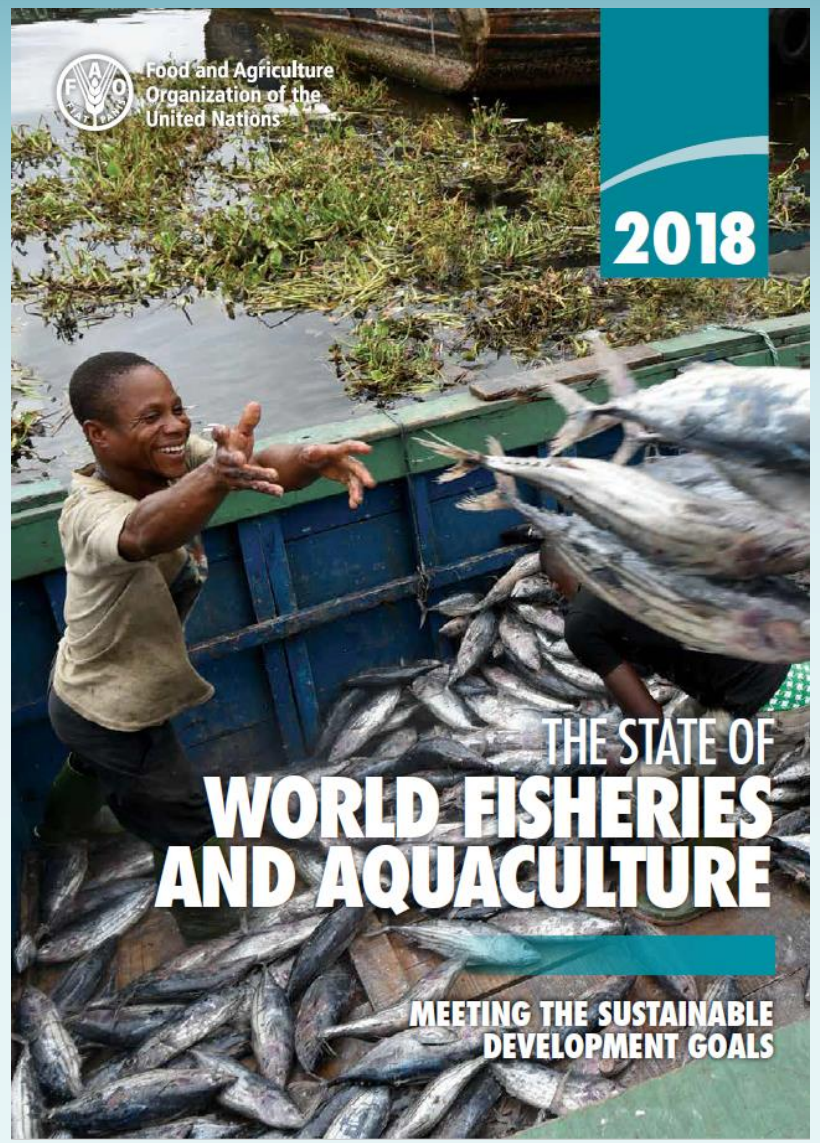
The State of World Fisheries and Aquaculture 2018



Key facts & figures

Global total **capture fishery production** in 2016 was **90.9 million tonnes**.

33.1% of fish stocks are estimated as **overfished** (fished at biologically unsustainable levels).

Global total **aquaculture production** of aquatic animals in 2016 was **80.0 million tonnes**.

Fish consumption has increased from **9 kg** per capita in 1961 to more than **20 kg** per capita today.

Fish trade was valued at **US $143 billion** in 2016.

World fish supply reached a record high of **20.3 kg per capita** in 2016.

Women account for **14%** of all people directly engaged in primary sector of fisheries and aquaculture.

SOFIA 2018 highlights the critical importance of fisheries and aquaculture for the

FOOD, NUTRITION AND EMPLOYMENT

of millions of people, many of whom struggle to maintain reasonable livelihoods.

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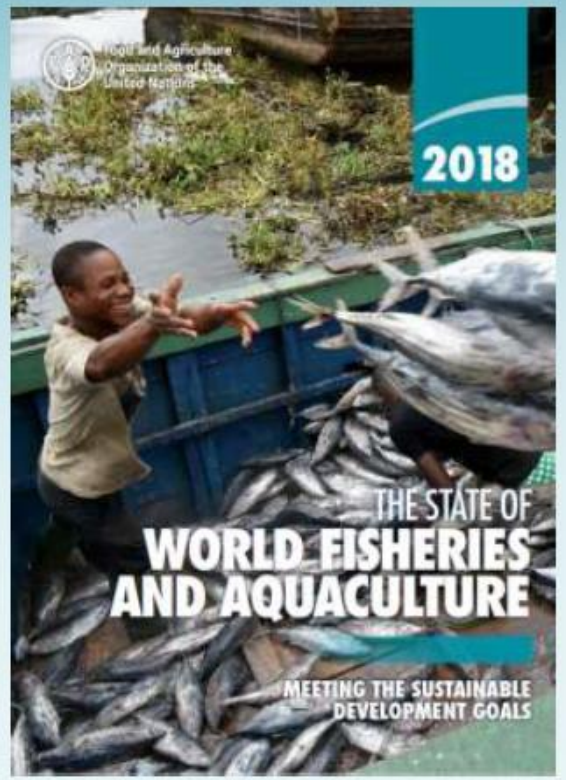
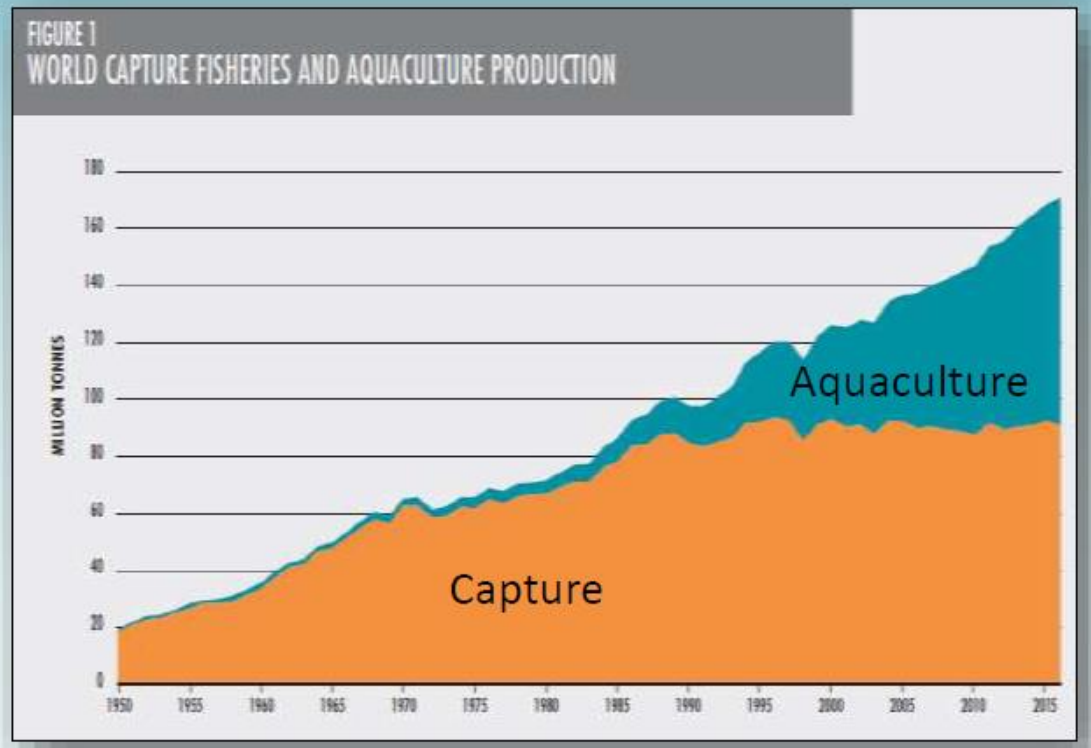
Global Total Fish Production





Note: Excludes aquatic mammals, crocodiles, alligators and caimans, seaweeds and other aquatic plants

- In 2016, reached an all-time high of 171 million tonnes
- 88 % utilized for direct human consumption

Owing to:

- Stable capture fisheries production
- Reduced wastage
- **Growth of Aquaculture**

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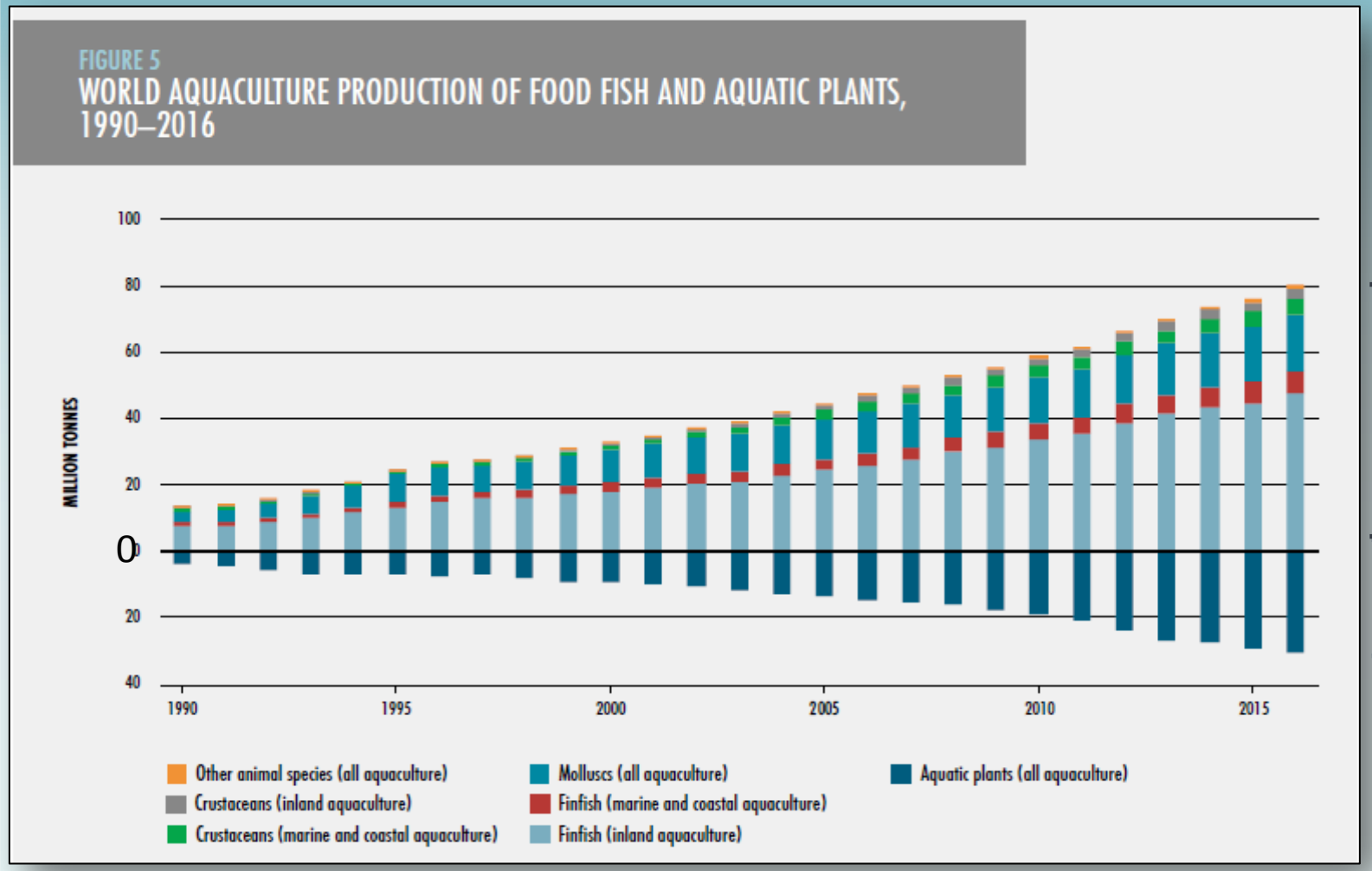
Global Aquaculture Production



In 2016

80 million tonnes of food fish (53% of total food fish)

30 million tonnes of aquatic plants

5.8 percent annual growth rate during 2001-2016

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Aquaculture Growth

- From 2010 to 2016, the aquaculture industry increased its value by USD 100bn, reaching USD 232bn.
- The growth is mainly driven by crustacean and freshwater fish farming in developing economies, particularly in Asia, as well as Atlantic salmon in the West.
- With improved biosecurity, new husbandry technologies, and novel feed ingredients, further growth of USD 100bn can be achieved in less than a decade.

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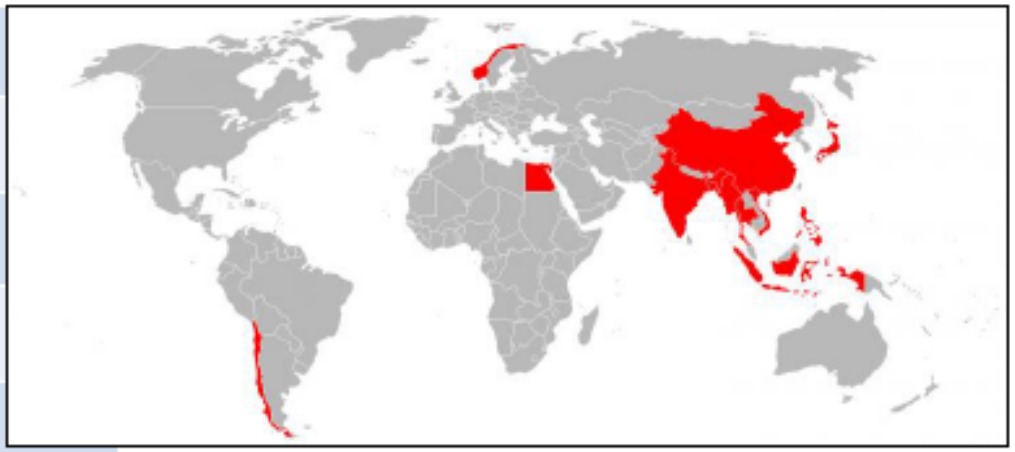
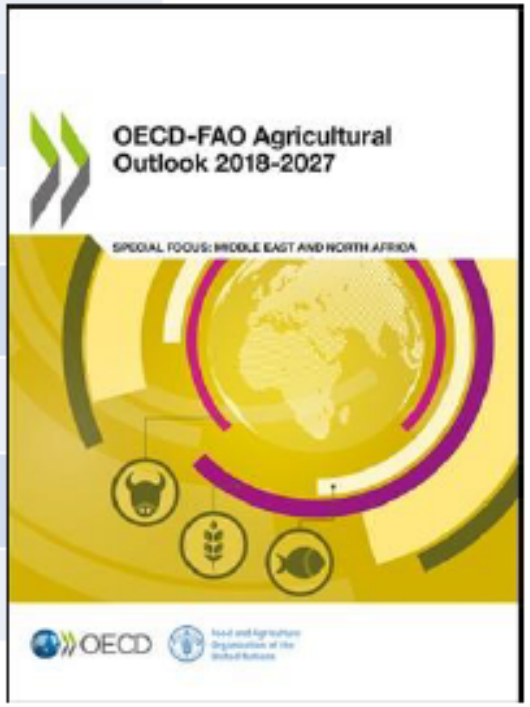
Aquaculture Growth

- From 2010 to 2016, crustaceans enjoyed the highest growth rates in value terms.
- Their production increased by USD 26.5bn – representing 28% of the total aquaculture value growth.
- The production value of shrimp grew by an annual growth rate around 10% – mainly a result of the increasing volume of shrimp production in India, Ecuador, and Vietnam.

Top 12 aquaculture producers

Country	Quantity (million tonnes)	Value (USD)
1. China	49.2 million tonnes	USD 144.7 billion
2. India	5.7 million tonnes	USD 10.6 billion
3. Indonesia	5.0 million tonnes	USD 9 .0 billion
4. Vietnam	3.6 million tonnes	USD 9.3 billion
5. Bangladesh	2.2 million tonnes	USD 5.6 billion
6. Egypt	1.4 million tonnes	USD 1.8 billion
7. Norway	1.3 million tonnes	USD 7.6 billion
8. Chile	1.0 million tonnes	USD 7.9 billion
9. Myanmar	1.0 million tonnes	USD 2.0 billion
10. Thailand	0.96 million tonnes	USD 2.5 billion
11. Philippines	0.8 million tonnes	USD 1.8 billion
12. Japan	0.7 million tonnes	USD 4.0 billion





Chapter 8: Fish and seafood: Project highlights

For production, these include issues related to …**transboundary issues with respect to … diseases and escapes**…

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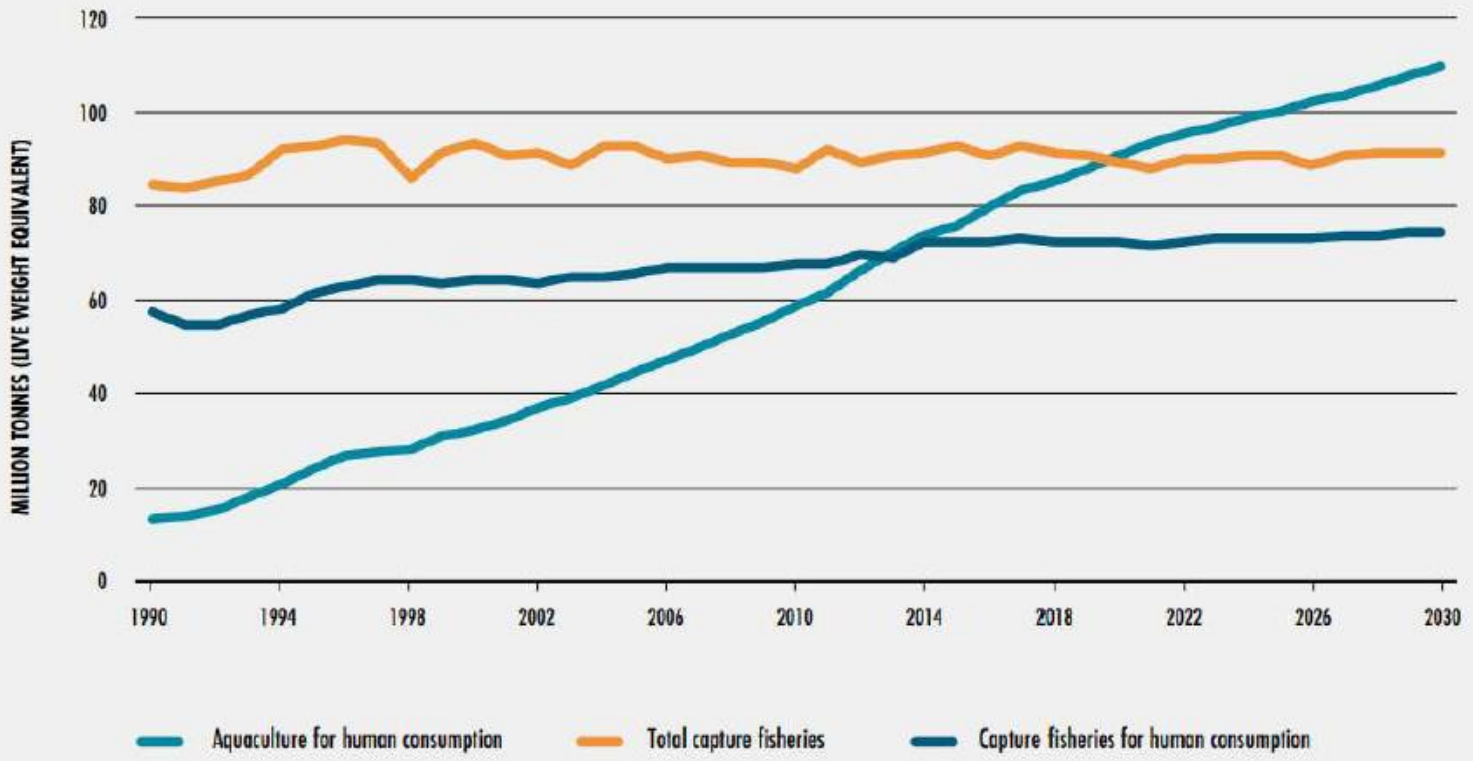
Projected Growth of Aquaculture

FIGURE 50
GLOBAL CAPTURE FISHERIES AND AQUACULTURE PRODUCTION, 1990–2030



- World fish **production, consumption and trade expected to increase**
- Aquaculture expected to **fill the supply–demand gap**
- Most of the production growth for fish will take place in **developing countries** and in particular in **Asia**
- Food fish **supply will increase in all regions**, while per capita fish consumption is expected to **decline in Africa**, which raises **concerns in terms of food security**

Source: FAO SOFIA 2018

Marine fish demand-supply gap in the early 2020s

- Supply: 550,000 t
- Demand: 11.2 mio t
- Demand-supply gap: 10.7 mio t

- Current growth rate: <4 %
- Needed growth rate: >40 %

Source: Figure 31 in FAO Fisheries and Aquaculture Technical Paper 607 – Short-term projection of global fish demand and supply gaps

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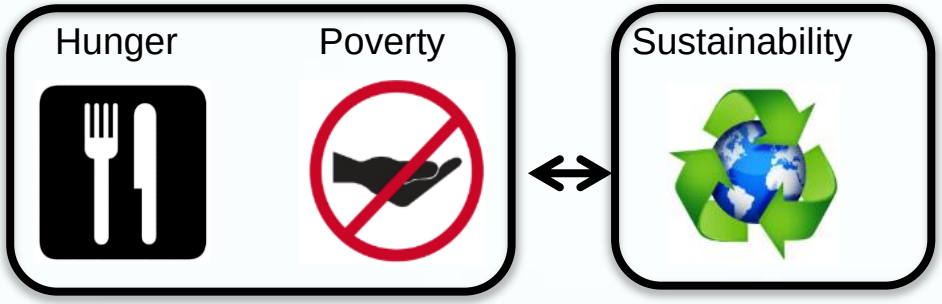
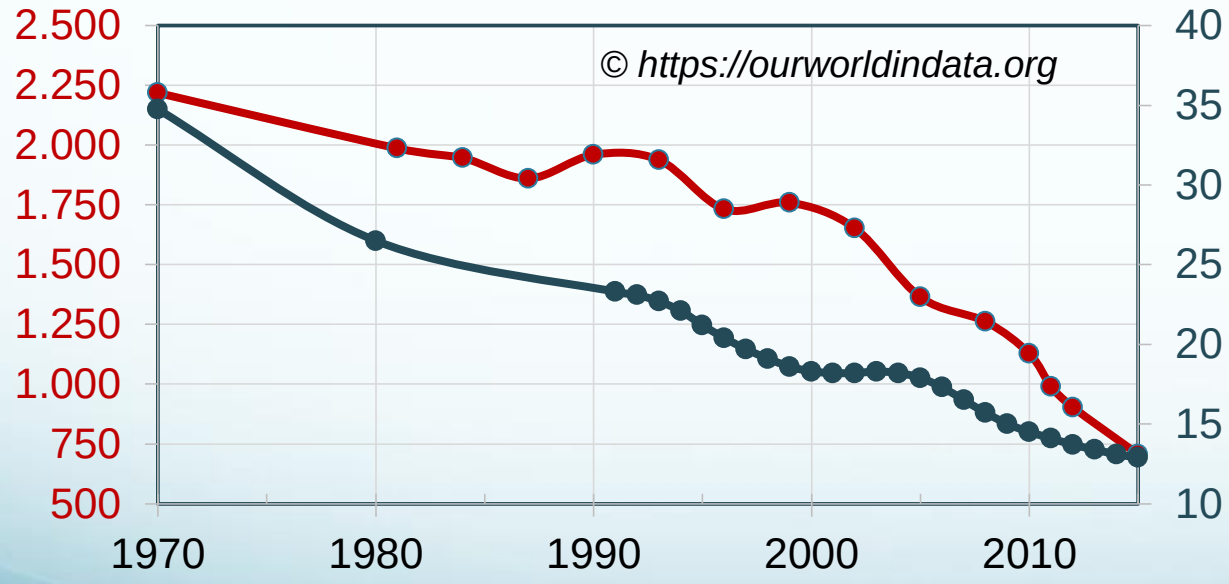
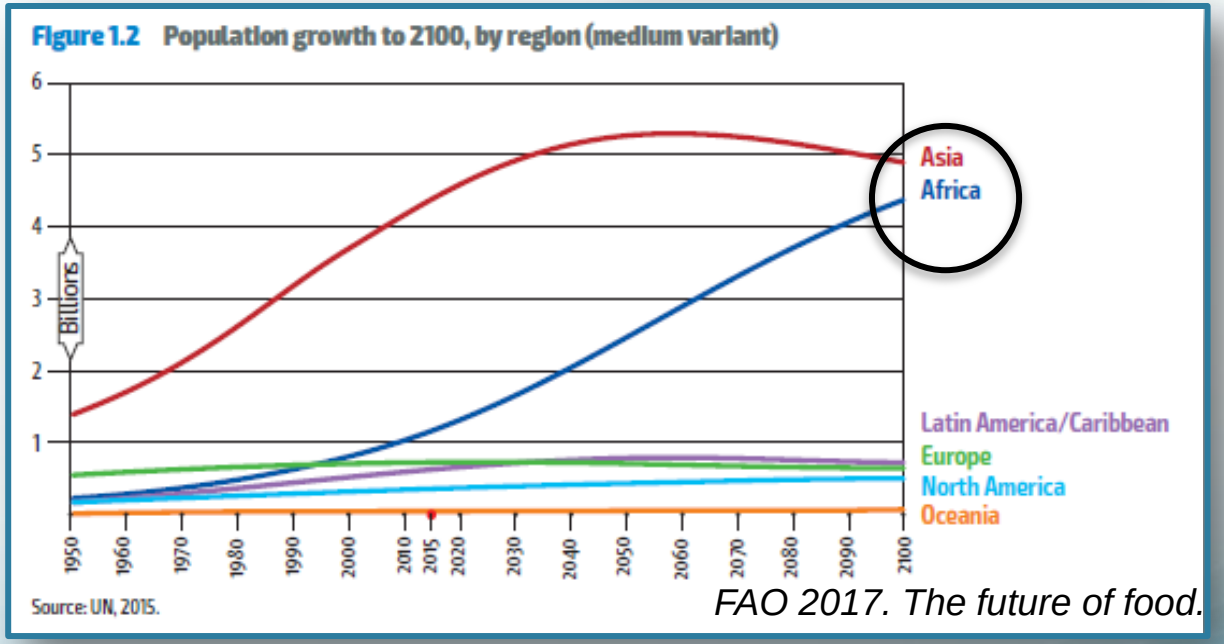






FAO 2017. The future of food.

"By 2050 we will need 50% more food than today…"
"50 million new mouths to feed per year"

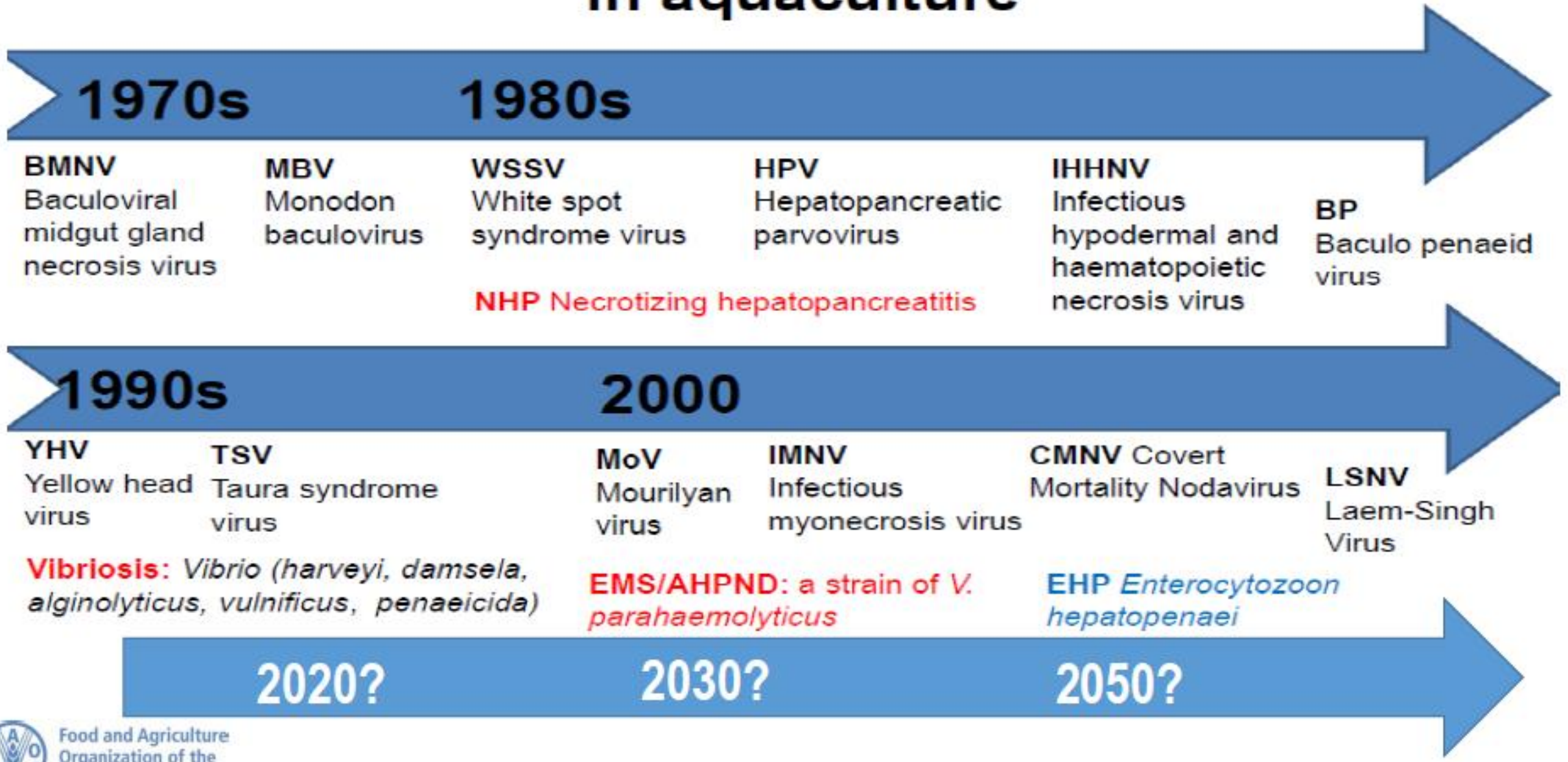
Disease situation in aquaculture

From largest aquaculture-related disease epidemics

White spot syndrome virus (WSSV), Epizootic ulcerative syndrome (EUS)
Infectious salmon anemia virus (ISAV), Koi herpresvirus, Infectious myonecrosis virus,
Acute hepatopancreatic necrosis virus, Tilapia lake virus (TILV), etc

Disease	Diagnostic	Reporting	Vaccination	Control	Disease freedom
The development of an unknown disease in a farm	The development of a diagnostic test	The reporting and communication (national and OIE)	Development of an effective vaccine or other containment measures	Effective diseases control implementations (cost-benefit)	

Chronology of shrimp pathogen emergence in aquaculture



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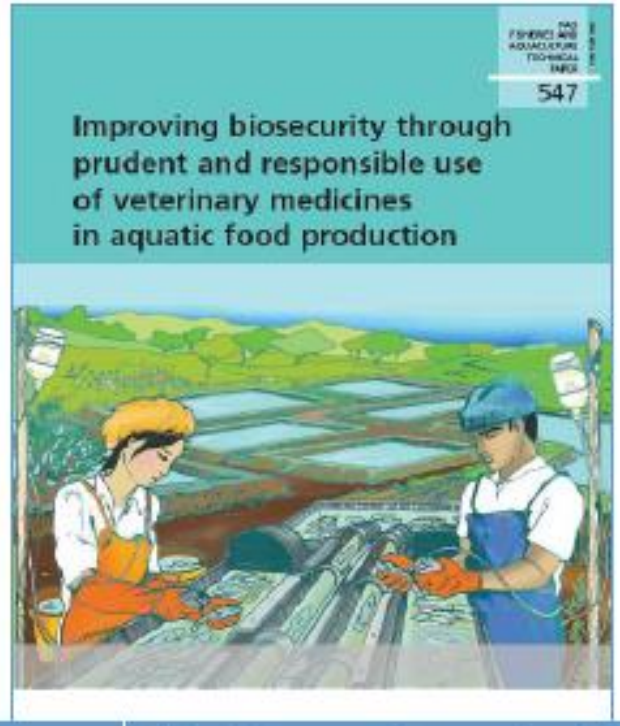
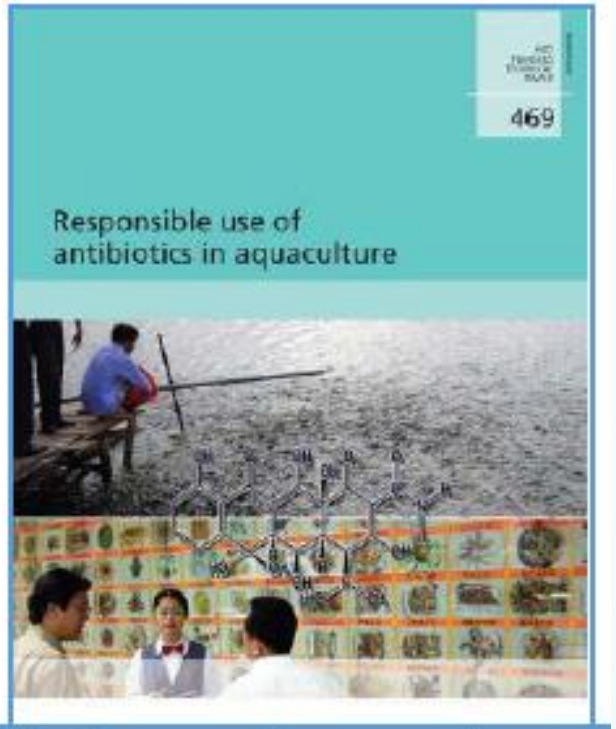
FAO advocacy, tools and future work in promoting prudent and responsible use of veterinary medicines in aquaculture

Aquaculture Biosecurity including AMR is being proposed as an Agenda during the 10th Session of COFI/SCA (August 2019, Norway)

Tools: responsible use guidelines





Issues/Findings
60 different veterinary medicinal ingredients **(26 are antibiotics)** (Rico et al. 2013)
Oxytetracycline (OTC) was the product most reported for treatment of diseases in **all major species**, e.g. shrimp, tilapia, pangasius, marine fish, trout and salmon (FAO, 2012)
Oxytetracycline was also the most-reported antibiotic used for **prevention (prophylactic) and treatment (therapeutic)**
Availability: **91.4%** (n=128) of respondents indicated that **OTC are freely** available and **8.6%** is indicated **OTC based on prescription**
Information on availability of 8 other antibiotics follow the **same trend as for OTC**
Antibiotics are used **through all production stages**
Perceived + impacts::reduced mortality; increased survival, fish/shrimp welfare
Perceived – impacts: build up of clinical resistance in fish/shrimp; residues of food safety concern; toxicity to the environment; build up laboratory bacterial isolates resistance

Type	Most frequently used antibiotics in aquaculture: generic name
Tetracyclines	Oxytetracycline, doxycycline
Quinolones	Oxolinic acid, flumequine, enrofloxacin (and other fluoroquinolone)
Phenicols	Florfenicol, chloramphenicol, thiamphenicol
Anti-folates	Trimethoprim/sulfamethoxazole, trimethoprim, sulfonamides
β-lactams	Amoxicillin
Macrolides	Erythromycin, josamycin, neomycin (for G+ve bacteria)
Nitrofurans	Nitrofurantoin

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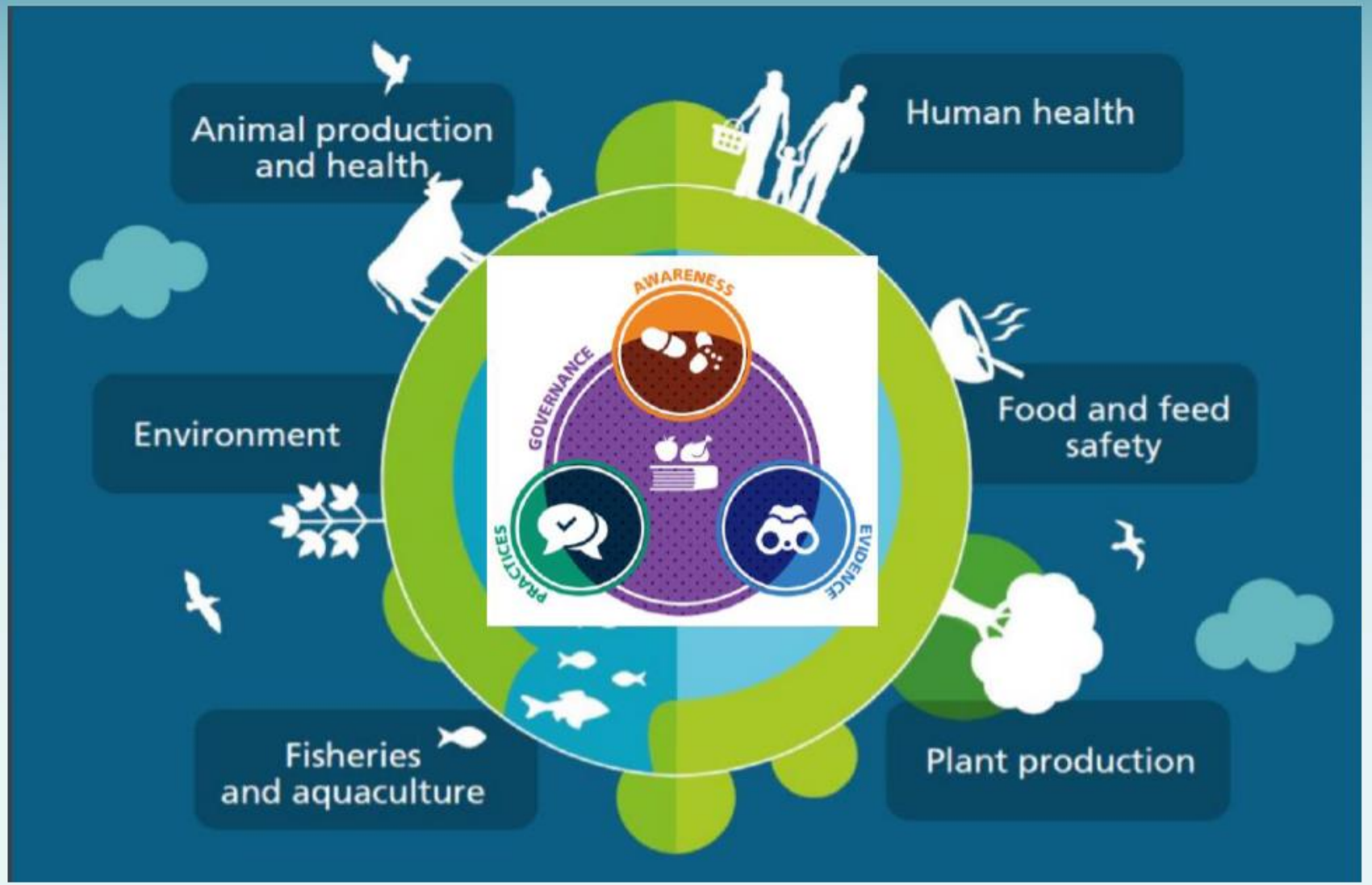
Antimicrobial resistance



FAO's work:

- Awareness
- Evidence
- Practices
- Governance

Tool: Guidance in developing the aquaculture component of the NAP on AMR

- Review and collection of relevant information:
  - most important cultured species based on production
  - most important bacterial diseases affecting the most important cultured species based on agreed criteria; include those not in the FAO list, if any, using criteria review baseline data and diagnostic method used
  - Codex Alimentarius MRLs;
  - actions to deal bacterial diseases (prevention, good aquaculture/biosecurity practices, treatment with antibiotics, alternative treatment)
- Develop guidance in the mechanism for collection of information on antimicrobial usage (AMU)
- Develop guidance in the mechanism for collection of information on AMR surveillance Requirements for AMU and AMR surveillance (personnel, field/lab procedures, skills, facilities, policies/legislation, reporting/record keeping, monitoring, etc.)
- Review member state actions and Tripartite (WHO,OIE, FAO) actions
- Aquaculture component to be integrated in the country NAP on AMR under the One Health framework

Tool: Responsible management of bacterial diseases in aquaculture

Background: Review of important bacterial diseases in aquaculture

- Not much attention to bacterial diseases even though they significantly affect aquaculture production
- Only 2 bacterial pathogens included in the OIE list of aquatic diseases: NHP and AHPND both of shrimp
- An essential first step is to understand what diseases are affecting the sector and how they are being dealt with, e.g. prevention? treatment? management?
- If antibiotics are used - what are these, how are they used? prophylactic or therapeutic? how are they administered? by whom? are they effective or failure?
- If not, what alternatives to antibiotics are being used
- No focus in AMU and AMR in previous books
- Need for information on biosecurity and management of bacterial disease, which could have steps specific to a pathogen
- Need for a book providing guidance on diagnostic methods and antimicrobial susceptibility testing

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A prerequisite to the work on AMR in aquaculture

Responsible Management of Bacterial Diseases in Aquaculture (available by 2019): **will assist in prioritizing bacterial diseases** using the same criteria of: (i) economic importance of affected species; (ii) socio-economic impact; and (iii) zoonotic potential

Chapter 1	**INTRODUCTION**: Background, Objectives and Scope, Importance of Aquaculture, Health of Aquatic Animals, Guide for Users, Reference
Chapter 2	**BACTERIAL DISEASES in AQUACULTURE**: **GENERAL CONSIDERATIONS**: Introduction, Bacterial Classification, Major Bacterial Diseases in Aquaculture, Pathogenesis of Bacterial Infection, Role of Diagnostics, Risk Factors, Reference
Chapter 3	**BACTERIAL DISEASES in AQUACULTURE: PATHOGEN-SPECIFIC CONSIDERATIONS**: Gram-negative bacterial pathogens (n=6); Gram-positive bacterial pathogen (n=4): Each pathogen section contains Background information, causative agent, host, ecological factors, geographical distribution, clinical aspects, diagnostics, transmission, prevention, management (prevention), zoonotic potential, references
Chapter 4	**PREVENTION AND MANAGEMENT**: Prevention (GAP, biosecurity, prebiotic, probiotic, immunostimulants, green water technology, vaccination); Management (treatment, alternatives to antimicrobials), reference
Chapter 5	**PRUDENT USE**: (i) Correct diagnosis, etc.; administration; prophylactic, therapeutic, metaphylactic; medicated feeds (ii) AMU; (iii) AMR, (iv) reference

Tool: Guidance steps on AMU survey and AMR surveillance

1. Understanding and knowledge of AMU/AMR in aquaculture (3 regional workshops)
2. Development of guidance
   - Review of priority diseases in tropical aquaculture (part of aquaculture component of NAP on AMR)
   - Review of important bacterial diseases in aquaculture (part of aquaculture component of NAP on AMR)
   - Prioritise the most important diseases of economically important cultured species (part of aquaculture component of NAP on AMR)
   - AMU/AMR survey guidance: review and assess country level applicability

http://www.fao.org/antimicrobial-resistance/news-and-events/news/news-details/en/c/1029658/

Tool: Guidance document on Performance of antimicrobial susceptibility testing programmes relevant to aquaculture and aquaculture products (available by early 2019):

- **principle;** the absolute need for the use of **internationally agreed standardised test protocols and the adherence to the quality control requirement** of those protocols; & the importance of the use of consensus, internationally harmonised, criteria in the interpretation of the meanings that can be given to *in-vitro* susceptibility data
- **current status of the standard protocols** that can be recommended for use in **bacteria isolated from aquatic animals**; **currently available standardised protocols are adequate** for the determination of the antimicrobial susceptibility of 37 (64%) of 44 species of bacteria representing those most frequently isolated from aquatic animals.
- **design of programmes aimed at monitoring or surveillance of AMR associated with the use of antimicrobial agents in aquaculture**, e.g. investigations of:
  - ***susceptibility of pathogens of aquatic animals.***
  - ***public heath implications of:***
    - ***the presence in aquacultural products of bacteria with reduced susceptibility to antimicrobial agents.***
      - ***antimicrobial agent use in aquaculture mediated through aquacultural products.***
    - ***antimicrobial agent use in aquaculture mediated through the environmental resistome.***

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Paris Climate Agreement

The 2015 Paris Climate Agreement recognizes the need for effective and progressive responses to the urgent threat of climate change, through mitigation and adaptation measures, while taking into account the particular vulnerabilities of food production systems.

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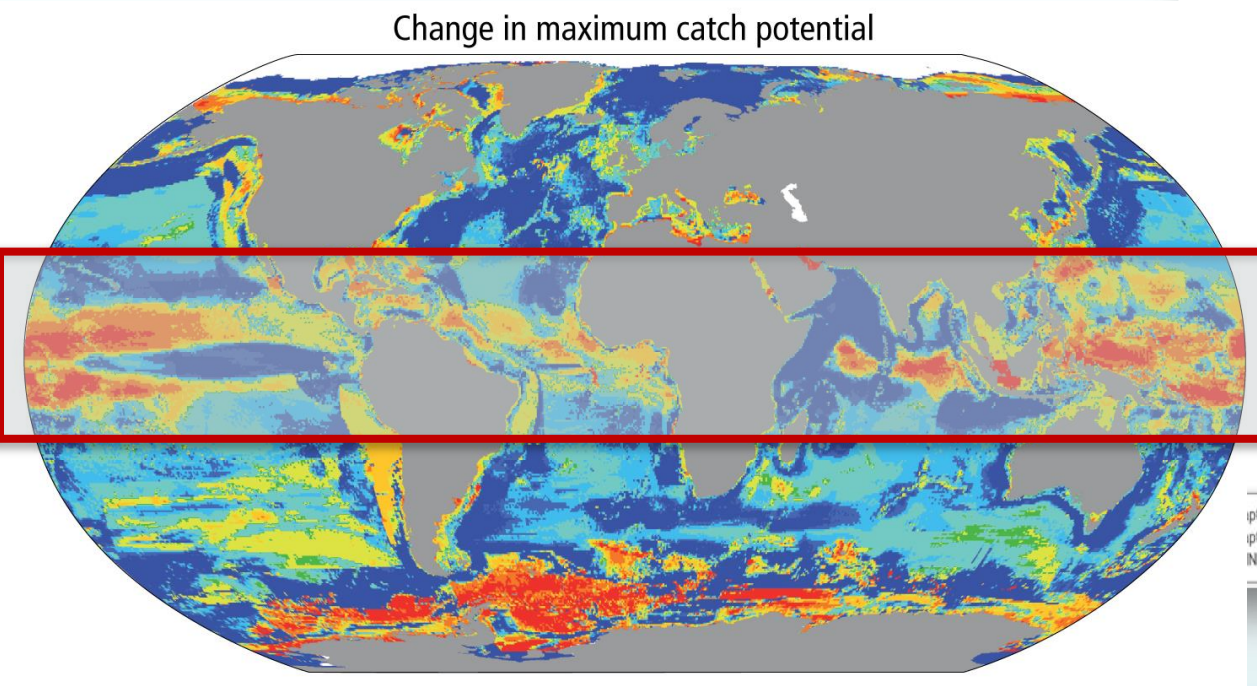
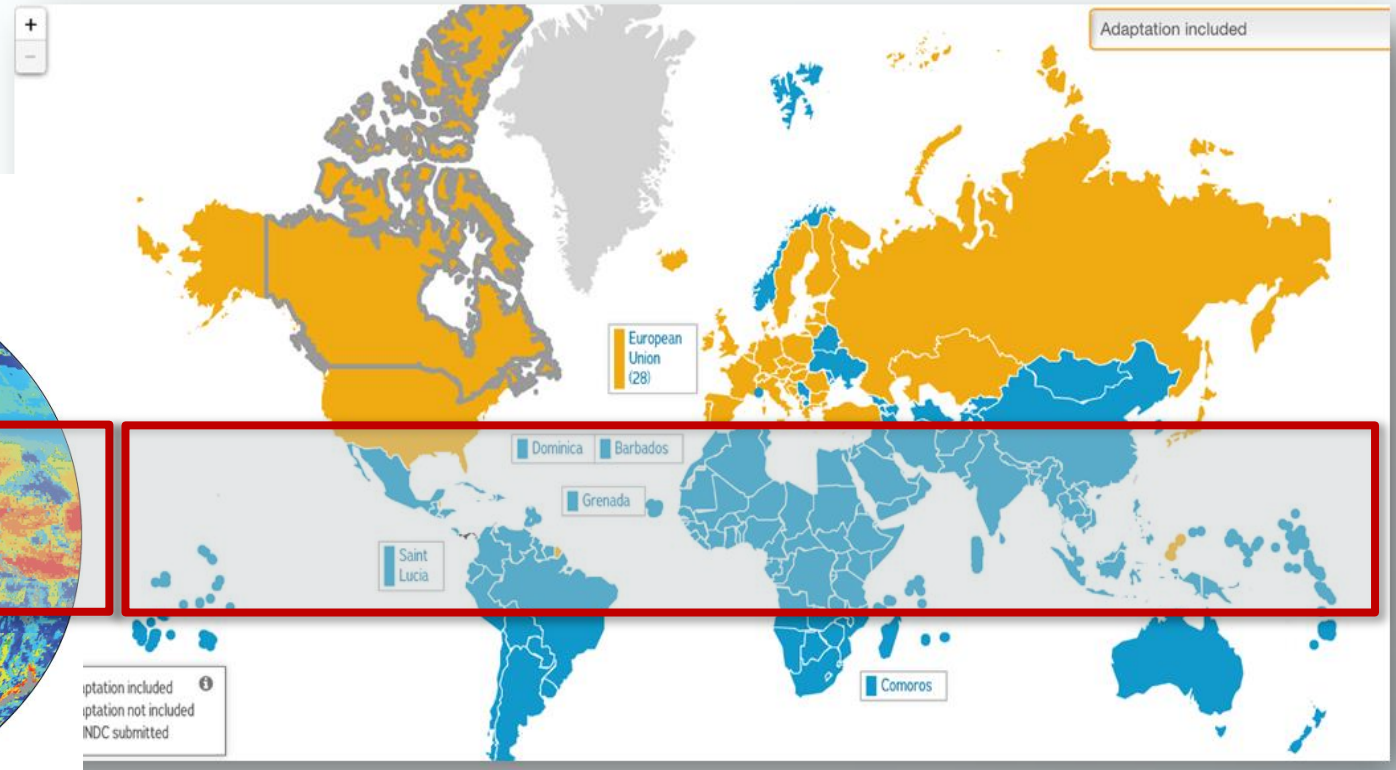
The case for Adaptation

Where is Adaptation needed most?



IPCC AR5 based on Cheung et al. 2010



Is adaptation included in countries NDCs?

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What / When/ How to Adapt

CLIMATE

ECOSYSTEMS

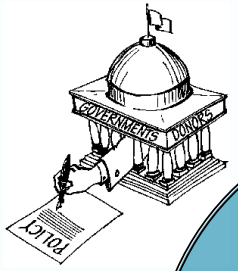
INDIVIDUALS | DISTRIBUTION | HABITAT

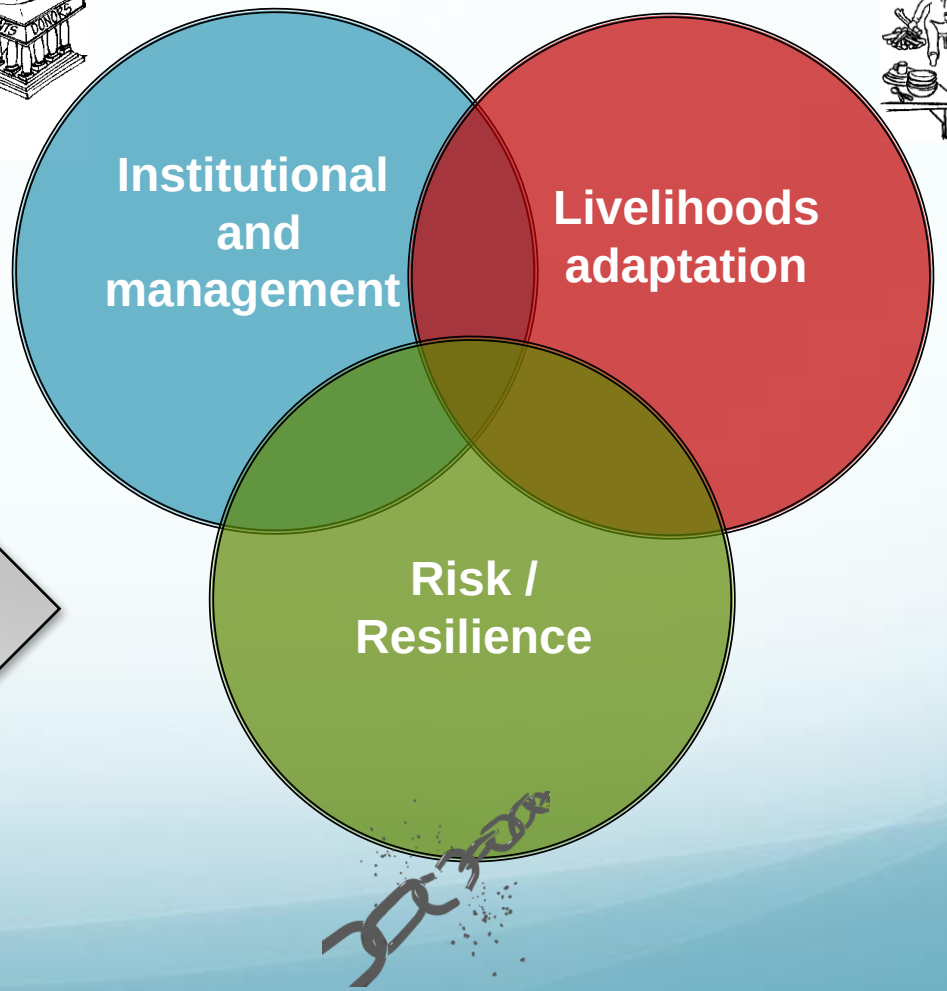
FISHERY (Aquaculture dependence)

SIZE AT FIRST CAPTURE | BIODIVERSITY | REDUCED YIELD, CHANGES IN CATCH

FOOD/ JOBS/ TRADE

Adaptations





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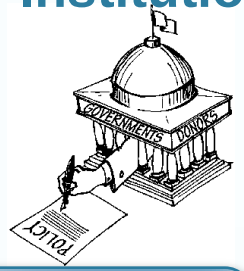
SUSTAINABLE DEVELOPMENT GOALS

Fisheries Adaptation Toolbox

Institutional



- Planning
  - Mainstreaming EAF
  - Tenure & Access Rights
  - Adaptation plans
  - Vulnerability Assessment
- Management Measures
  - ICZ Management
  - Management Flexibility
  - Incorporate Climate science
- Allocation
  - Seasonal Rights
  - Area Measures
  - Redistributed spp rights

Livelihoods

- Within Sector
  - Market diversification
  - Post-harvest measures
  - Seasonal migration
- Outside Sectors
  - Diversify investments
  - Livelihoods portfolio
  - Cross-sectoral integration

Risk/ Resilience

- Pooling/ Risk sharing
  - Adjust Insurance Markets
  - Private insurance
  - Public insurance
- Early Warning
  - EW systems
  - Anticipatory services to market shocks
- Prevention
  - Safety at sea
  - Infrastructure provision
- Preparedness & Response
  - Post-disaster recovery
  - Rehabilitation
  - Compensation

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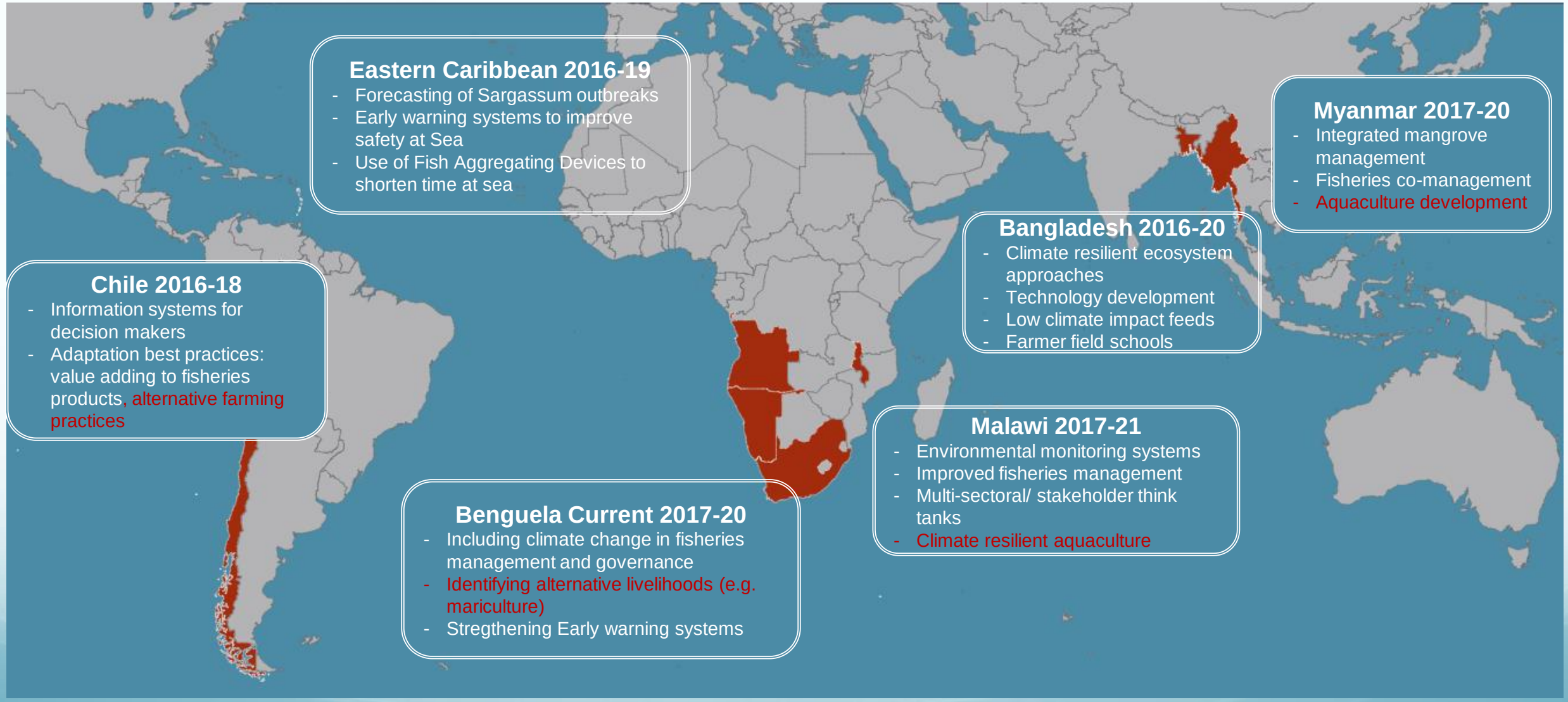
FAO- GEF Adaptation programme



Eastern Caribbean 2016-19
- Forecasting of Sargassum outbreaks
- Early warning systems to improve safety at Sea
- Use of Fish Aggregating Devices to shorten time at sea

Myanmar 2017-20
- Integrated mangrove management
- Fisheries co-management
- Aquaculture development

Bangladesh 2016-20
- Climate resilient ecosystem approaches
- Technology development
- Low climate impact feeds
- Farmer field schools

Chile 2016-18
- Information systems for decision makers
- Adaptation best practices: value adding to fisheries products, alternative farming practices

Malawi 2017-21
- Environmental monitoring systems
- Improved fisheries management
- Multi-sectoral/ stakeholder think tanks
- Climate resilient aquaculture

Benguela Current 2017-20
- Including climate change in fisheries management and governance
- Identifying alternative livelihoods (e.g. mariculture)
- Stregthening Early warning systems

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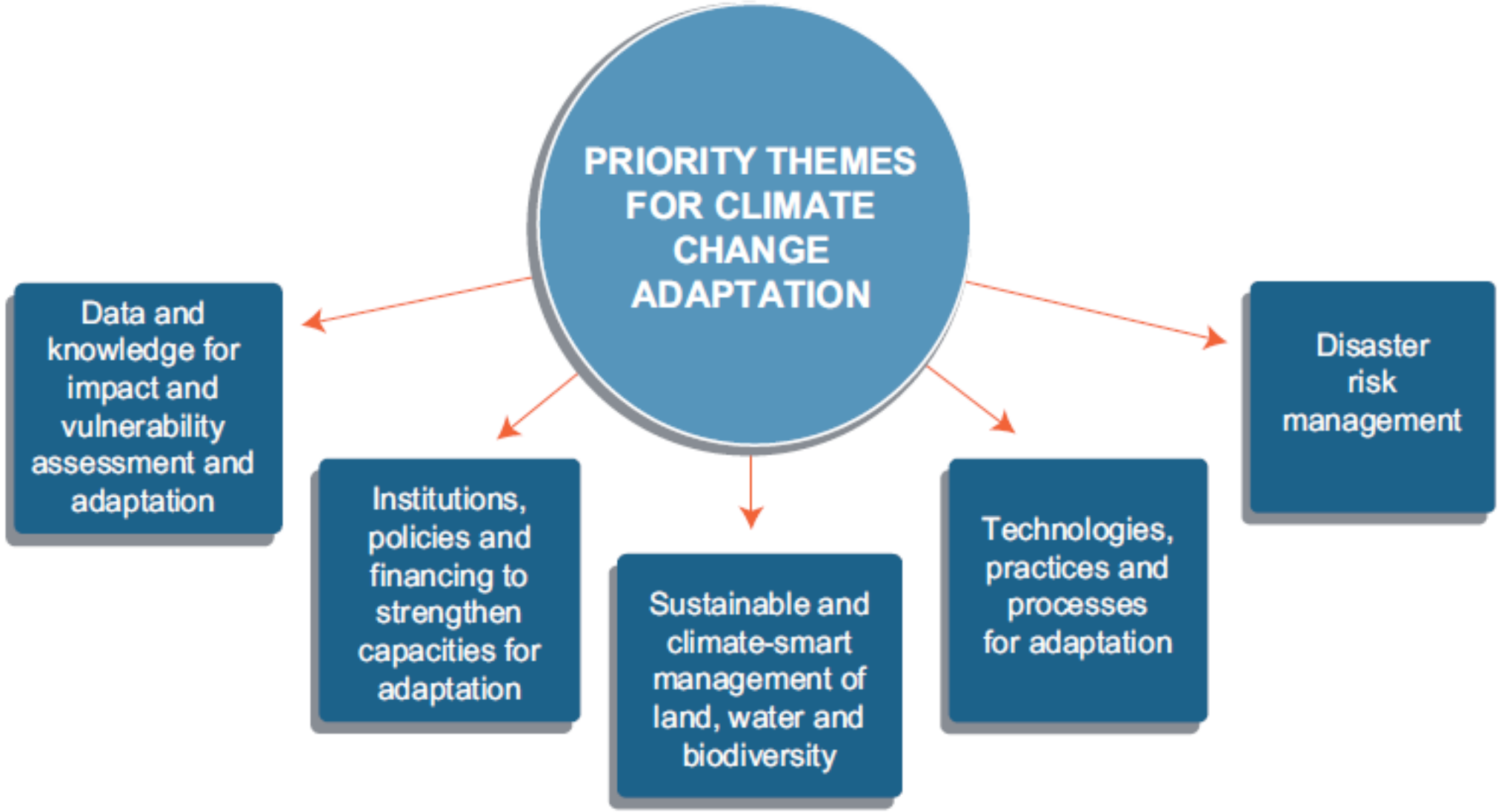
FAO Adapt



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FAO – Fisheries & Aquaculture resources

- Assessing climate change vulnerability in fisheries and aquaculture
- Available methodologies and their relevance for the sector
- Climate change adaptation in fisheries and aquaculture
- Compilation of initial examples from around the world
- Priority adaptations to climate change for Pacific fisheries and aquaculture
- Reducing risks and capitalizing on opportunities

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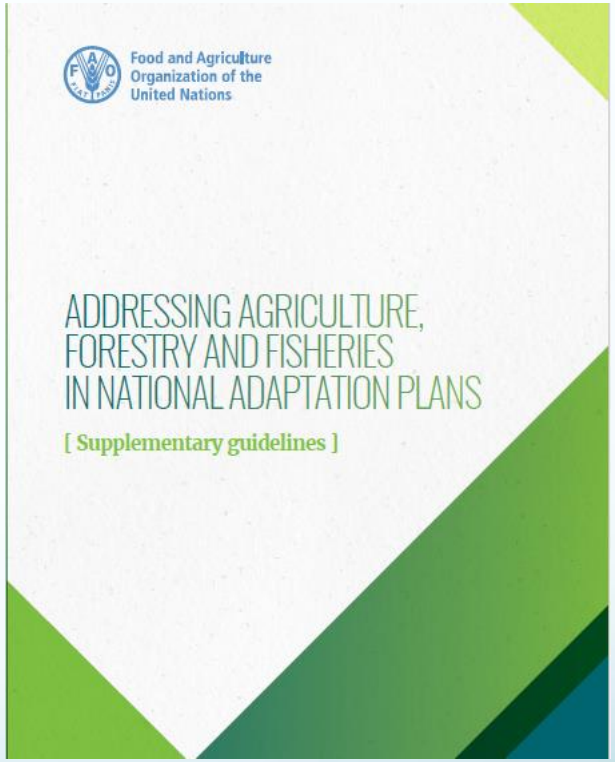
FAO NAP Guidelines for Fisheries & Aquaculture

- Addressing agriculture, forestry and fisheries
- Draft guidelines for fisheries and aquaculture

  Objectives:
  - Assist fisheries and aquaculture institutions to map their knowledge into the climate change world and language and articulate their needs;
  - Ensure that the visibility and specificities of fisheries and aquaculture are captured in the process to formulate and implement NAP;
  - Support the mainstreaming of fisheries and aquaculture in the NAP implementation; and
  - More broadly, support adaptation planning within fisheries and aquaculture.



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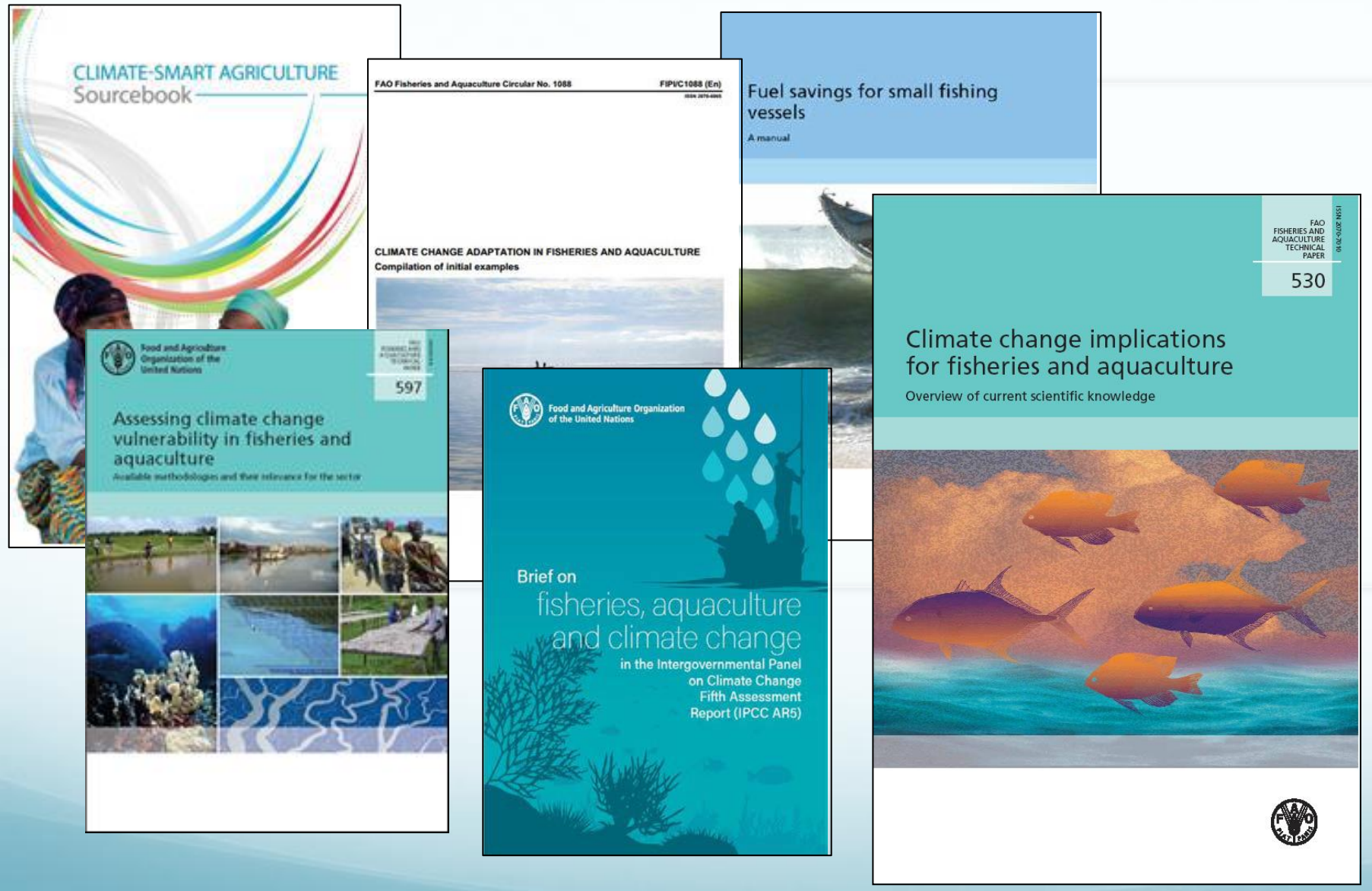
FAO Fisheries Normative work



- 2009 edition in revision
- Over 40 authors
- Includes National, regional, Global outlooks for marine fisheries, inland fisheries and aquaculture
- Adaptation and Mitigation toolboxes

- Released in July 2018 @ COFI

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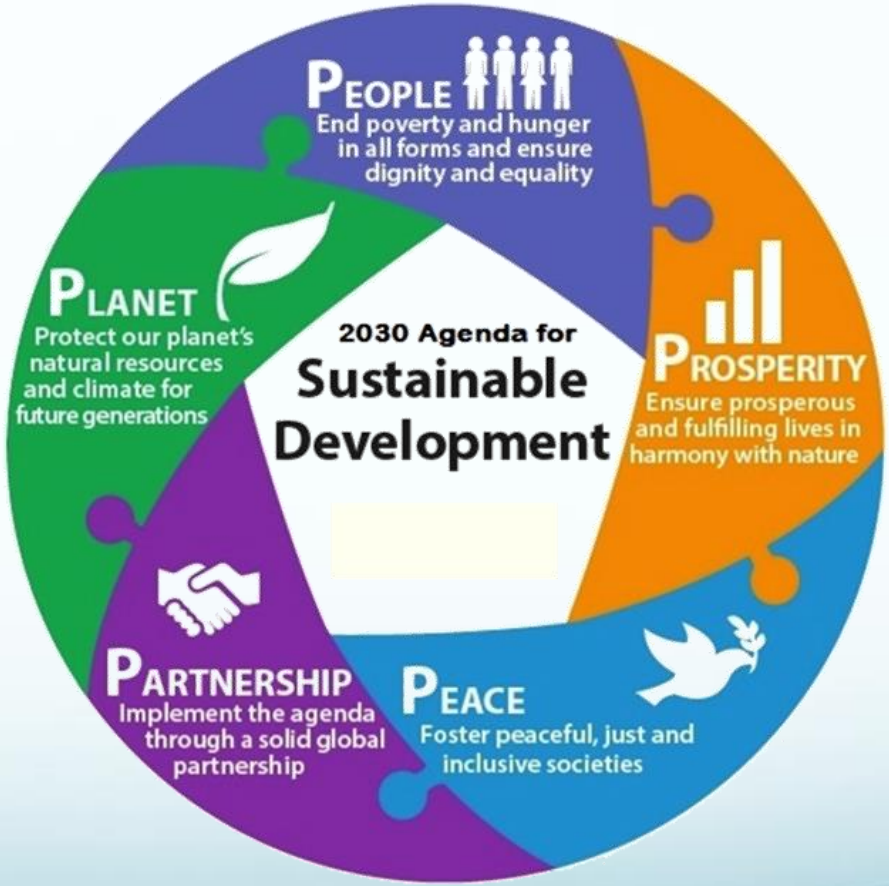
- 17 SDGs and 169 targets integrated and indivisible
- Equality & non-discrimination at the heart of sustainable development
- **Leaving no one behind**
- Ambitious – 2030 horizon
- Country-driven
- Paris Agreement on Climate Change
- Addis Ababa Action Agenda on Financing for Development



Leaving no one behind

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SUSTAINABLE DEVELOPMENT GOALS

Thank you for your time and attention.

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