Having Our Seafood and Eating It Too

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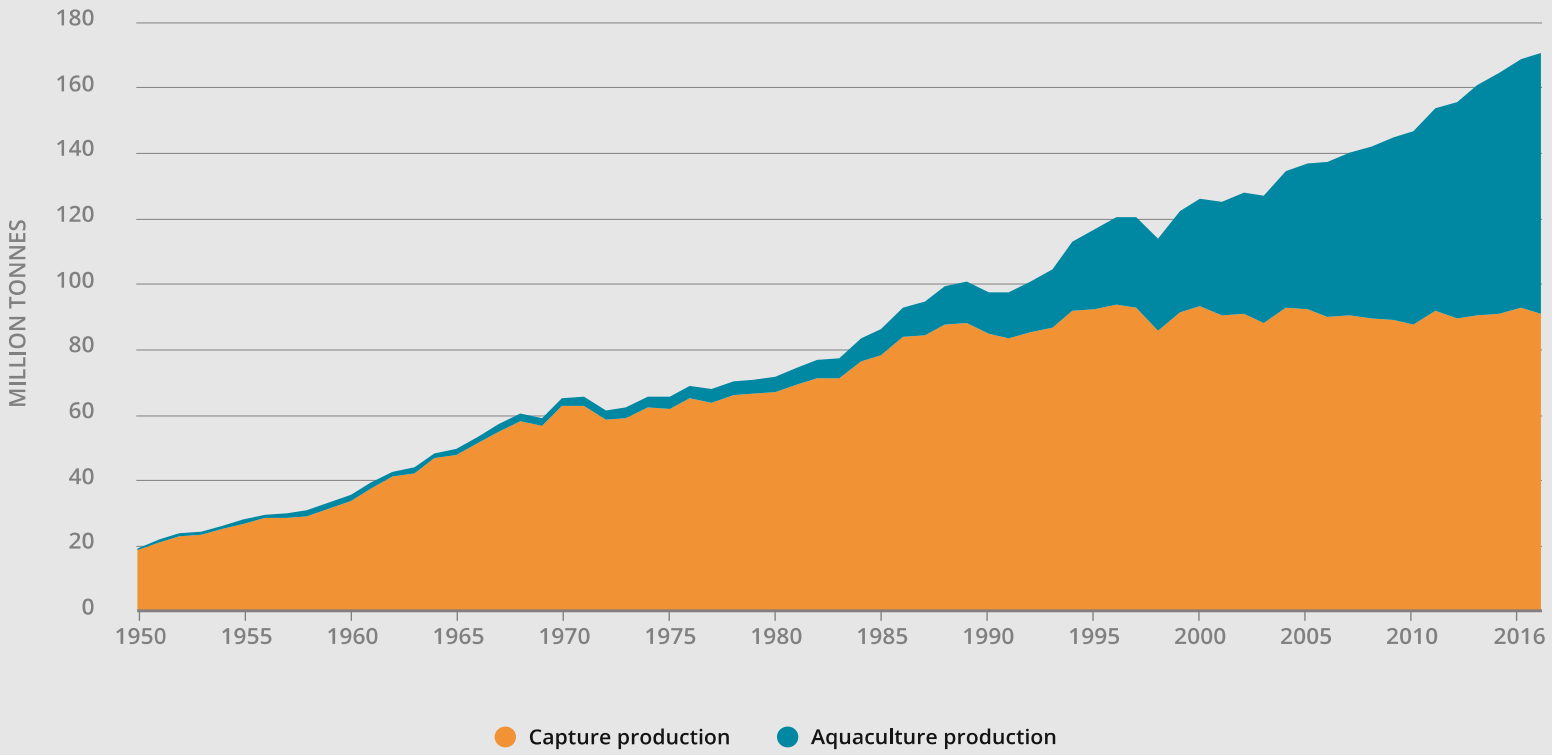
A Growing Demand

- The aquaculture industry improved performance last 20 years
  - Producing more farmed fish per unit of land and water
  - Reducing environmental impacts
  - Largely stopping mangrove conversion
  - Addressing the share of fishmeal and fish oil in aquaculture feeds

- Farming fish now provides about half of the world's seafood and are expanding globally, but……

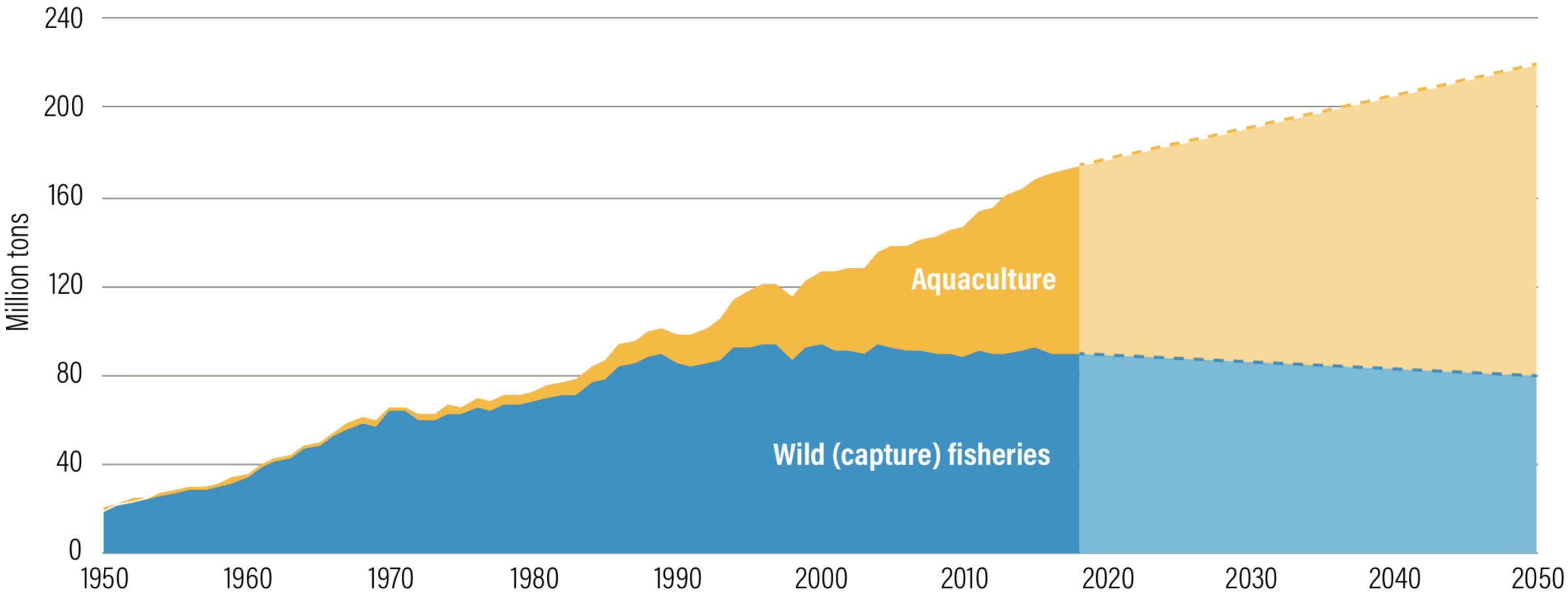
Can supply keep up with demand?

World capture fisheries and aquaculture production



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

How Will We Achieve?



Source: Historical data, 1950–2016: FAO (2017b) and FAO (2018). Projections to 2050: Calculated at WRI; assumes 10 percent reduction in wild fish catch from 2010 levels by 2050, linear growth of aquaculture production of 2 Mt per year between 2010 and 2050.

SYNTHESIS REPORT: Creating a Sustainable Food Future: A Menu of Solutions to Feed Nearly 10 Billion People by 2050

Simple Solutions?

Solutions for Sustainability

- Production System Innovations
- Technology Transfer / Incentivize
- Spatial Planning / Zoning
- Alternative Feed Ingredients

Investment on Innovation

- **Offshore Systems – The Oceans Make up 70% of the Earths surface**
  - **But only 2% of human food energy**
- **Land Based – Recirculating Aquaculture Systems**
  - **Water - reuse and repurpose**
  - **Nutrient - repurpose**
  - **Energy - renewal**
- **Breeding and Genetics**
  - **Species selection / Low trophic**
- **Pathogen Management**
  - **Detection**
  - **Mitigation**

Puregoldfish.com

Off-Shore Innovation:

OCEAN FARM 1

China-Norway:
SALMAR-
R&D prototype

est. 1.5 million
salmon farmed

Key dimensions
Height: 68 m
Diameter: 110 m
Volume: 250,000 m3

Land Based Recirculation Innovation

- Filtration
  - Mechanical, Chemical, Biological (microbial)
- Species
- Renewable energy
- Waste management
  - Biologically active fertilizers
  - Waste treatment (biogas: methane)

Whole Oceans Aquafarm Bucksport ME

Atlantic Salmon, RAS 5,000 mt/yr (10% of US consumption)

JOHN GUTWIN OF PEPPERCHROME

Technological Innovation and Transfer

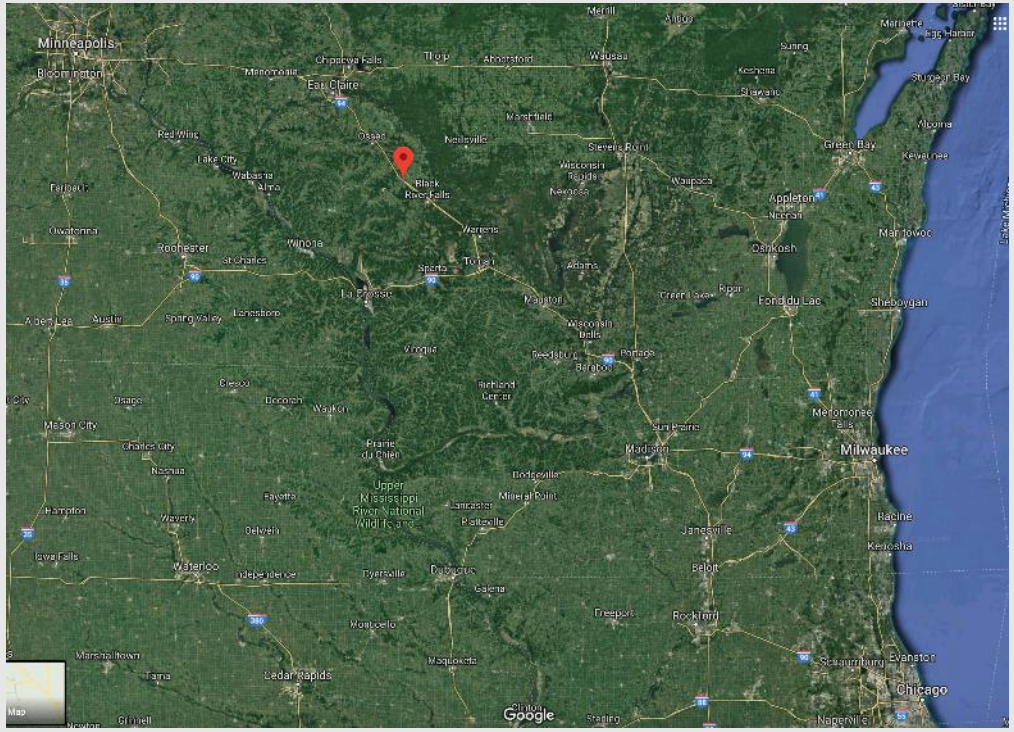
- Science supported improvements:
  - breeding technology
  - disease control
  - feeds and nutrition

Incentivize

- Renewable energy
- Water
- Technology
- Training

Waste/Nutrient Management Solutions

- **Superior Fresh, Hixton WI**



FISH HOUSE

40,000 SQ. FT.
STEEL FISH HOUSE

160,000 LBS.
OF FISH PRODUCTION

99.9%
RECIRCULATION

ZERO
DISCHARGE
OF PRODUCTION WATER

500,000 GALLONS OF WATER

FIRST
ATLANTIC
SALMON
RAS
IN THE U.S.

123,000 SQ. FT.
GLASS GREENHOUSE

1,100+
LED GROW LIGHTS

GREENHOUSE

LARGEST
AQUAPONICS FACILITY
IN THE WORLD

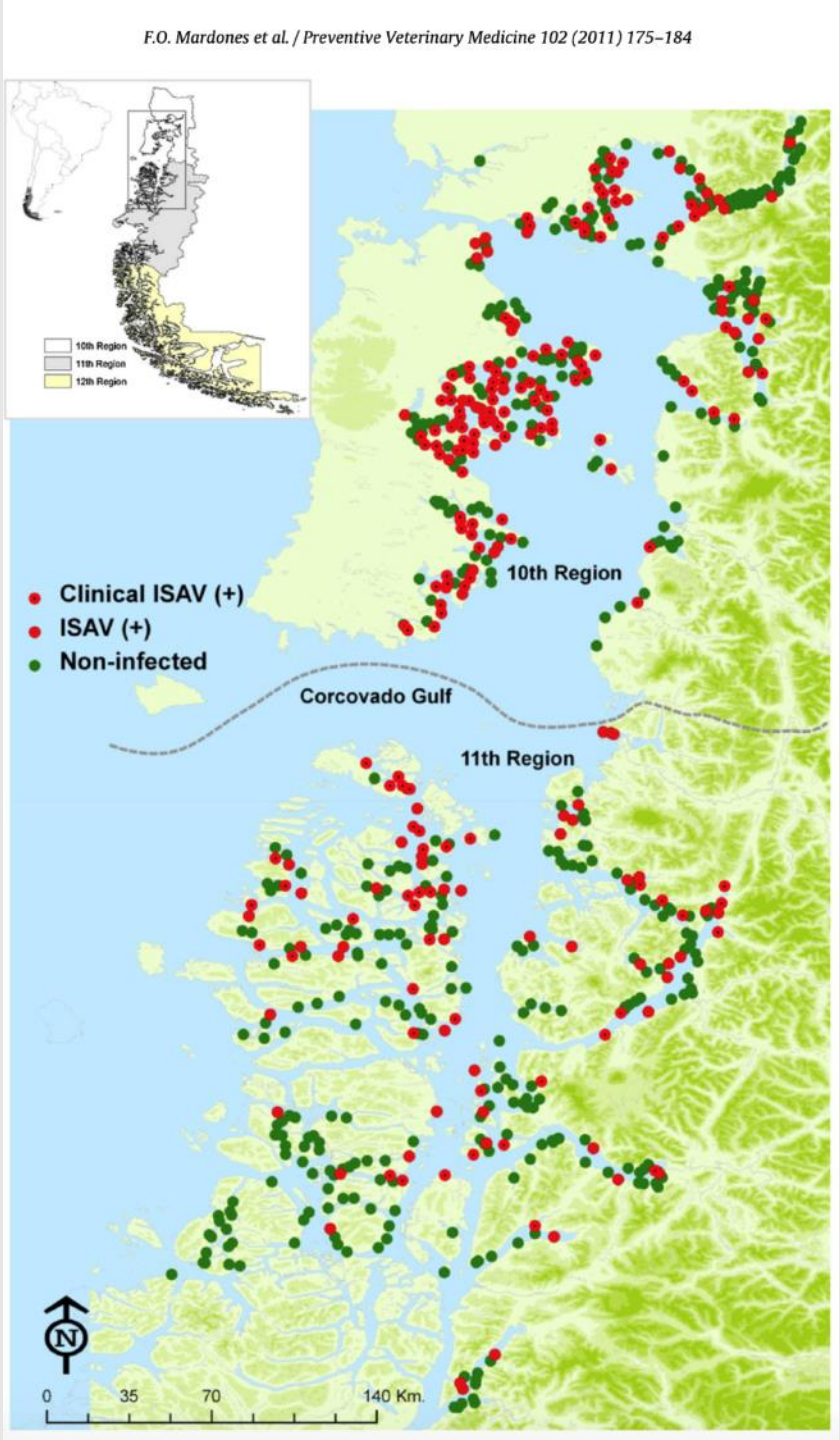
850,000
GALLONS OF WATER

1.8 MILLION LBS.
OF LEAFY GREANS ANNUALLY

Tsar Nicoulai Caviar, Wilton CA

Spatial Planning

- Farm level regulations and certification necessary to reduce cumulative environmental impacts
  - water pollution
  - fish diseases
- Spatial planning and zoning
  - Aquaculture exist within the surrounding ecosystem's carrying capacity and conditions.
  - This ensures that producers are more diffusive which reduces disease risk and environmental impacts.



Alternative feed ingredients needed for supply chain bottleneck for production and growth

Problem

- Fishmeal (protein) and fish oil supplies fluctuate
- Supply limited by forage fish harvest
- Increasing costs

- New and reliable ingredients are needed.
- Alternative protein exist without impact on fish growth and health.
- **No** substitute for fish oil that is cost-effective and available at scale.

F3

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F3 Fish-Free Feed Challenge

Energy, Environment & Resources

To encourage innovation of alternative ingredients for aquafeeds, improve the industry's sustainability, and reduce pressure on fisheries.
Read Overview...

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$145,050

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***UPDATE*:**

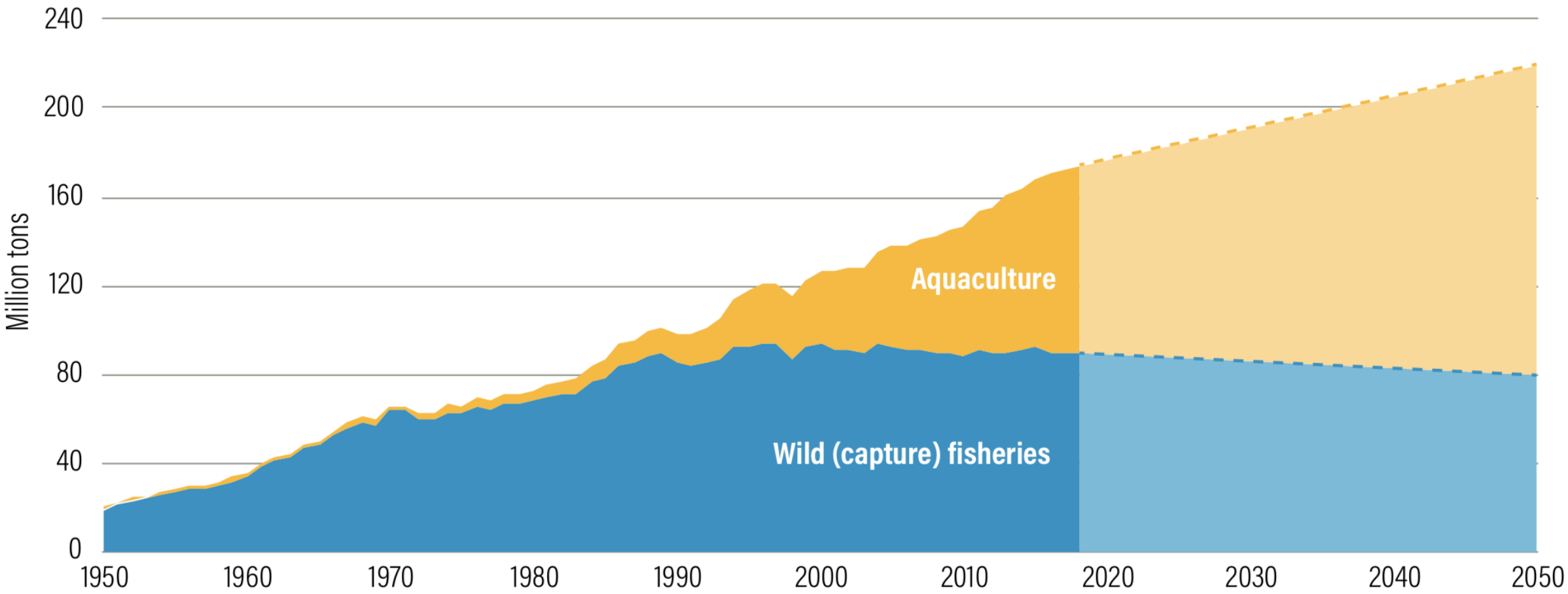
Congratulations to Guangdong Evergreen Feed Industry Co. for Winning the F3 Fish-Free Feed Challenge! Read more here.

Also, make sure to check out our new **F3 Fish Oil Challenge**, which launched September 2017!

Feed Innovation Network

A collaborative network to replace wild-caught fish in aquaculture feeds globally.

How Will We Achieve?



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Thank you for
your time.