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Overview of Wild Capture Fisheries vs. Aquaculture

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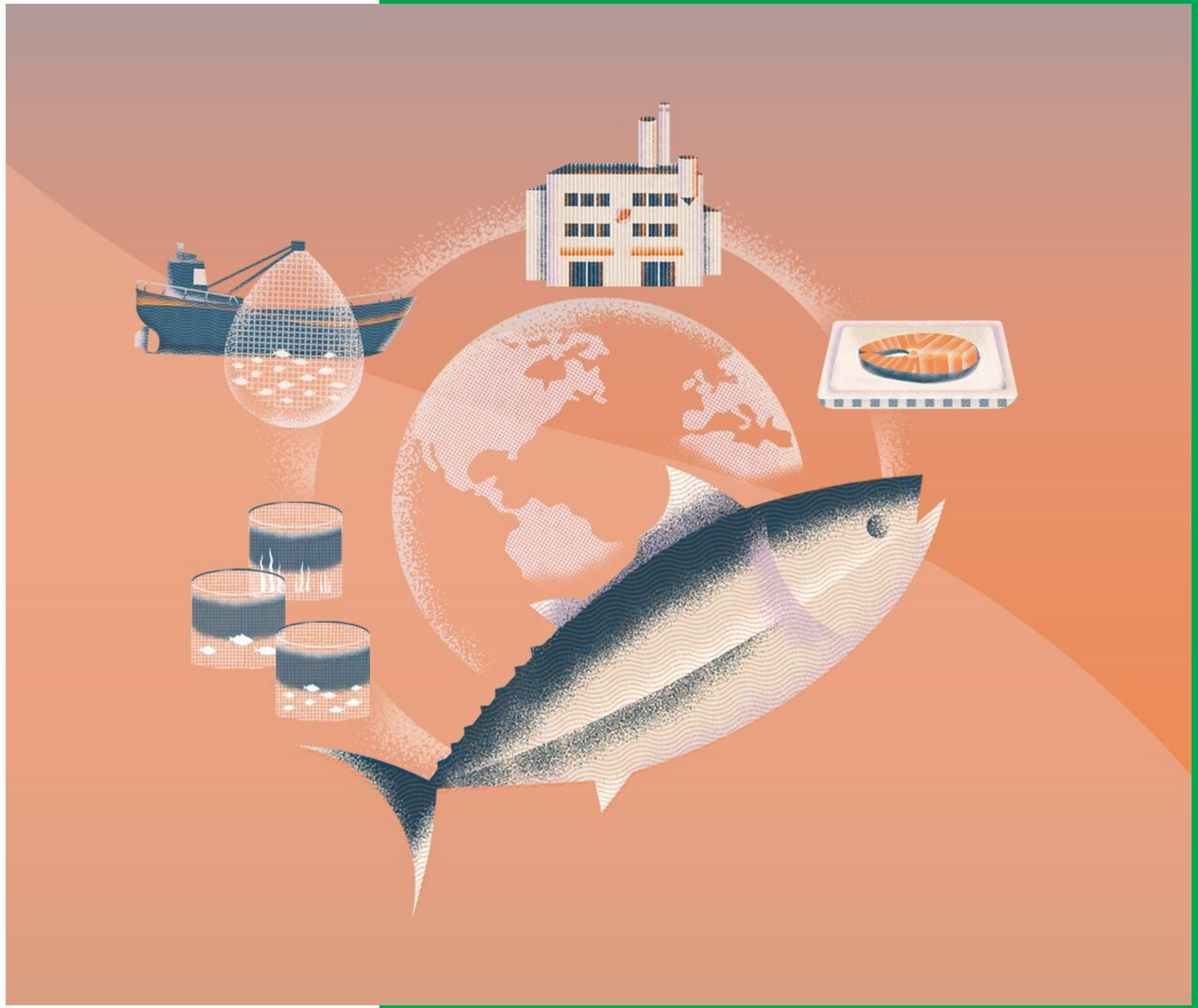
Outline

01 Definitions and Historical Context

02 Economic and Social Dimensions

03 Sustainability Innovations

04 Case Studies



eit.europa.eu

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a. Definition of Wild Capture Fisheries

- The harvesting of free-ranging fish and aquatic organisms (e.g., crustaceans, mollusks) from natural ecosystems such as oceans, rivers, and lakes. It relies on the carrying capacity of the environment and does not involve controlled breeding or feeding [1].
- Often termed "**capture fisheries**," it is the last major food production system based on hunting and gathering, similar to pre-agricultural human practices.

b. Definition of Aquaculture

- The farming of aquatic organisms (fish, shellfish, seaweed) in controlled environments, such as ponds, tanks, or ocean enclosures. This includes practices like selective breeding, feeding, and habitat management [1]..
- Unlike capture fisheries, aquaculture mimics agricultural systems, emphasizing productivity and consistency in output.


fisheries.msc.org


globalseafood.org

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c. The History of Wild-Capture Fisheries

- **Prehistoric Era**: Early humans relied on wild fish as a primary protein source, using rudimentary tools like spears and nets. Coastal and riverine communities developed fishing techniques tailored to local ecosystems.

- **Industrialization** (18th–20th Century): Technological advancements (e.g., steam-powered trawlers, sonar) enabled large-scale exploitation of marine resources. By the 1970s, overfishing became widespread, leading to collapses in iconic fisheries like the Atlantic cod.

- **Modern Challenges**: Today, ~34% of global fish stocks are overexploited, and wild catches have plateaued since the 1990s, unable to meet rising demand [2].

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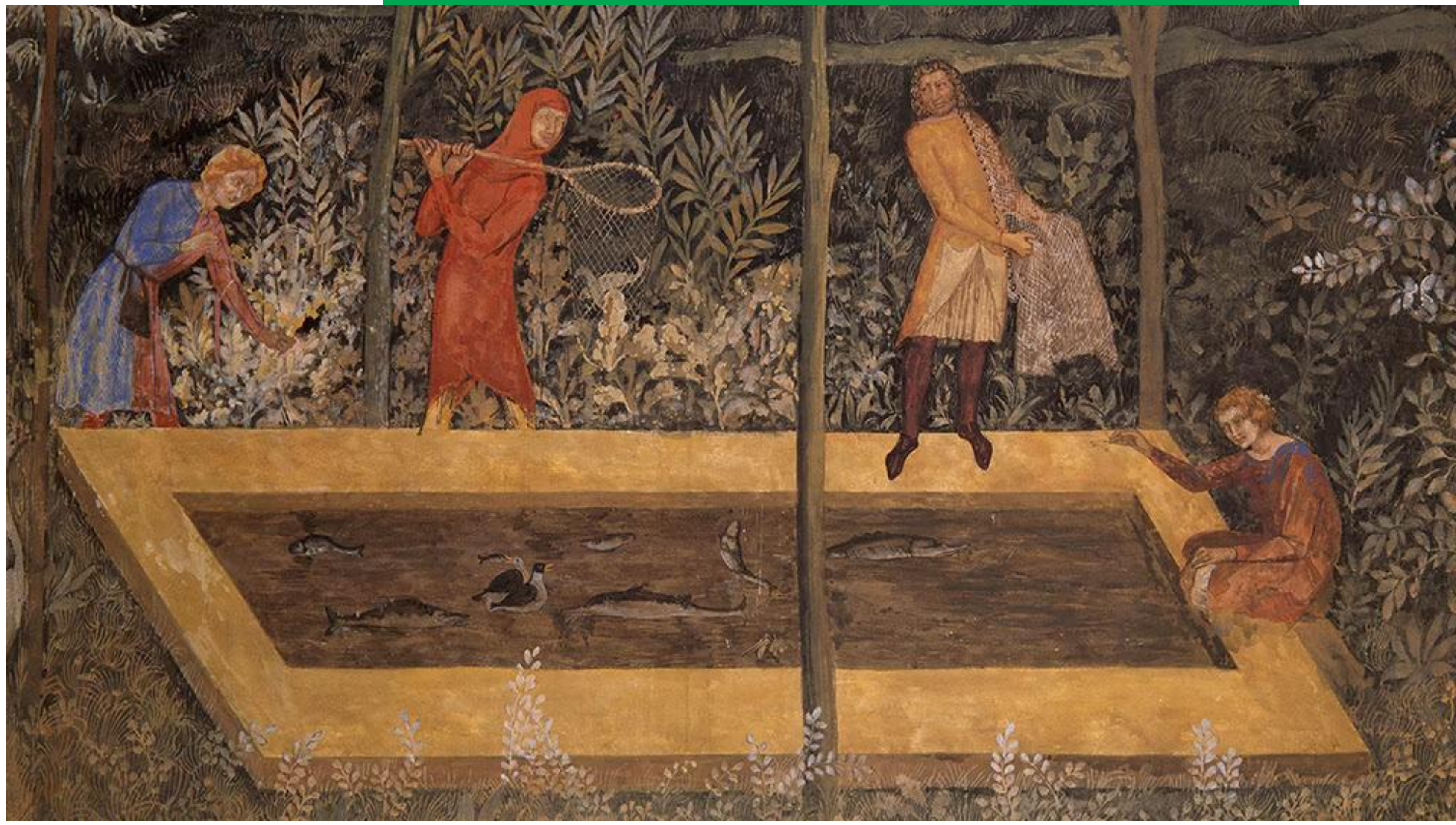
d. The History of Aquaculture

a. **Ancient Origins**:
   - China (1000 BCE): Carp farming in ponds emerged during the Zhou dynasty, with polyculture systems (combining fish, livestock, and crops) developed by the Tang dynasty.
   - Rome (500 BCE): Oyster farms and coastal "vivaria" (fish-holding pools) were established for elite consumption.

b. **Medieval to Renaissance Europe**: Monasteries and aristocrats maintained freshwater ponds for carp, while mussel farming began in the 13th century.

c. **19th–20th Century Innovations**:
   - Artificial breeding techniques for trout and salmon emerged in Europe, driven by industrial pollution and habitat loss.
   - The 1950s saw granulated feed revolutionize fish farming, reducing reliance on agricultural byproducts.
   - Marine aquaculture expanded in the 1970s with floating cages and synthetic materials, though early ventures faced economic challenges.

d. **21st Century Dominance**: Aquaculture surpassed wild fisheries in global seafood production by 2013, now supplying over 50% of human-consumed fish [3].



alimentarium.org

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e. Key Comparison

In the history of Greek antiquity, fishing with a line or harpoon, has developed mainly in the Aegean Sea which bathes all the coasts of the country - lecomptoirgeneral.com

Aspect	Wild Capture Fisheries	Aquaculture
Resource Dependency	Relies on natural ecosystems; limited by overfishing	Requires feed inputs (e.g., fishmeal, soy) and energy
Environmental Impact	Bycatch, habitat destruction, and stock depletion	Mangrove loss (e.g., shrimp farms), antibiotic use
Economic Dynamics	Seasonal yields; volatile prices	Year-round production; higher price stability
Species Diversity	1,680+ marine species harvested globally	Dominated by high-value species (e.g., salmon, shrimp)
Technological Role	Declined due to overexploitation	Rapid innovation (e.g., recirculating systems, IMTA)

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a. **Resource Competition**: Aquaculture consumes 70% of global fishmeal/oil, often sourced from wild-caught forage fish like anchovies, creating tension between sectors [4].

b. **Market Shifts**: Farmed fish now dominate premium markets (e.g., fresh salmon), while wild catches are increasingly processed for lower-value products [4].

c. **Sustainability Efforts**:
   - Wild fisheries: Marine protected areas, quota systems (e.g., Magnuson-Stevens Act in the U.S.).
   - Aquaculture: Certifications (e.g., ASC), integrated multi-trophic systems (IMTA) to recycle waste.

Modern Synergies and Conflicts

CONCLUSION

Wild capture fisheries and aquaculture represent two evolutionary stages in humanity's relationship with aquatic resources. While wild fisheries face existential threats from overexploitation, aquaculture has emerged as a critical—though imperfect—solution to global food security. Balancing their ecological and economic roles will require innovations in governance, technology, and consumer awareness to ensure sustainable seafood systems.

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2 a . Economic Dimension

Aspect	Wild Capture Fisheries	Aquaculture
Employment	Employs ~40 million people globally, mostly in small-scale, artisanal roles. Developing nations (e.g., Indonesia, Ghana) rely heavily on coastal livelihoods.	Employs ~20 million people, with growth concentrated in Asia (e.g., China, Vietnam). Jobs range from farm labor to high-tech roles in feed production and genetics.
Market Dynamics	Volatile prices due to seasonal yields, overfishing, and IUU fishing. Wild-caught fish often command premium prices (e.g., bluefin tuna).	Stable, year-round supply. Farmed species (e.g., salmon, shrimp) dominate global trade, with prices influenced by feed costs and disease outbreaks.
Revenue & GDP	Contributes $362 billion annually to global GDP, but overfishing reduces long-term viability. Small-scale fisheries contribute ~50% of catches but receive <1% of subsidies.	Accounts for ~54% of global seafood production (2020). High-value species (e.g., salmon) drive profitability, but dependence on imported feed inflates costs.
Subsidies	Harmful subsidies ($22 billion/year) incentivize overcapacity. Only 10% support sustainability (e.g., stock assessments).	Subsidies often fund infrastructure (e.g., ponds, RAS systems) but rarely address environmental externalities like mangrove loss.
Global Trade	Wild catches are increasingly processed into low-value products (e.g., fishmeal, surimi).	Dominates high-value markets (e.g., fresh salmon, shrimp), with Asia-Pacific supplying 90% of farmed shrimp.

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2 b . Social Dimension

Aspect	Wild Capture Fisheries	Aquaculture
Cultural Significance	Deep ties to Indigenous and coastal communities (e.g., Inuit seal hunting, Lamakera ray hunting).	Less culturally rooted but increasingly vital for rural employment (e.g., Vietnamese shrimp farmers).
Labor Practices	High risk of exploitation: forced labor on distant-water fleets, child labor in small-scale fisheries.	Labor abuses in intensive systems (e.g., Thai shrimp farms). Growing formalization in tech-driven sectors (e.g., Norwegian salmon).
Gender Roles	Women dominate post-harvest roles (processing, marketing) but face wage gaps (e.g., 30% less pay in Ghana).	Women underrepresented in technical roles but key in smallholder aquaculture (e.g., tilapia farming in Bangladesh).
Food Security	Wild fish provide critical protein for 3 billion people. Overfishing threatens local food access (e.g., West Africa).	Farmed fish supply ~50% of global seafood but prioritize export markets, risking domestic food security in producer nations.
Community Displacement	Industrial fleets displace small-scale fishers (e.g., trawlers in Indonesia).	Large-scale shrimp farms destroy mangroves, displacing coastal communities (e.g., Ecuador, Bangladesh, Indonesia).

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2c. Key Challenges & Trade-offs

1. **Resource Competition**:
   - Aquaculture consumes 70% of global fishmeal/oil, sourced from wild-caught forage fish (e.g., anchovies), creating tension between sectors.
   - Wild fisheries face "fishing down the food web," targeting smaller species as larger stocks collapse

2. **Sustainability vs. Profitability** :
   - Wild fisheries: Marine protected areas (MPAs) conserve stocks but reduce short-term catches.
   - Aquaculture: Certifications (e.g., ASC) improve practices but exclude smallholders due to high costs.

3. **Modern Challenges**:
   - Wild fisheries: Slow adoption of monitoring tech (e.g., AIS, eDNA) hampers IUU enforcement.
   - Aquaculture: Automation and RAS systems boost efficiency but require capital inaccessible to small-scale farmers.
4. **Climate Vulnerability**:
   - Wild fisheries: Warming waters shift fish stocks (e.g., mackerel moving northward), sparking geopolitical conflicts.
   - Aquaculture: Rising temperatures increase disease risks (e.g., shrimp farms in Vietnam)

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a. **Wild Fisheries**:
   - Redirect subsidies to support small-scale fishers and co-management (e.g., TURFs in Chile).
   - Strengtraceability to combat IUU fishing and ensure fair wages

b. **Aquaculture**:
   - Promote low-trophic species (e.g., seaweed, mussels) to reduce feed dependency.
   - Invest in community-based aquaculture (e.g., IMTA systems) to balance profit and local needs.

c. **Cross-Sector Synergies**:
   - Use fish waste from processing plants for aquaculture feed, reducing pressure on wild stocks.
   - Align policies with SDGs (e.g., SDG 14) to ensure inclusive, sustainable growth.

Pathways to Equitable Growth

CONCLUSION

Wild capture fisheries and aquaculture are economically and socially interdependent yet often at odds. While wild fisheries sustain cultural heritage and local food systems, aquaculture offers scalable protein production. Bridging their divides requires policies that prioritize equity (e.g., fair labor practices), innovation (e.g., climate-resilient feeds), and governance (e.g., transboundary stock management). Balancing these dimensions is critical to achieving food security and ecological resilience in a rapidly changing world.

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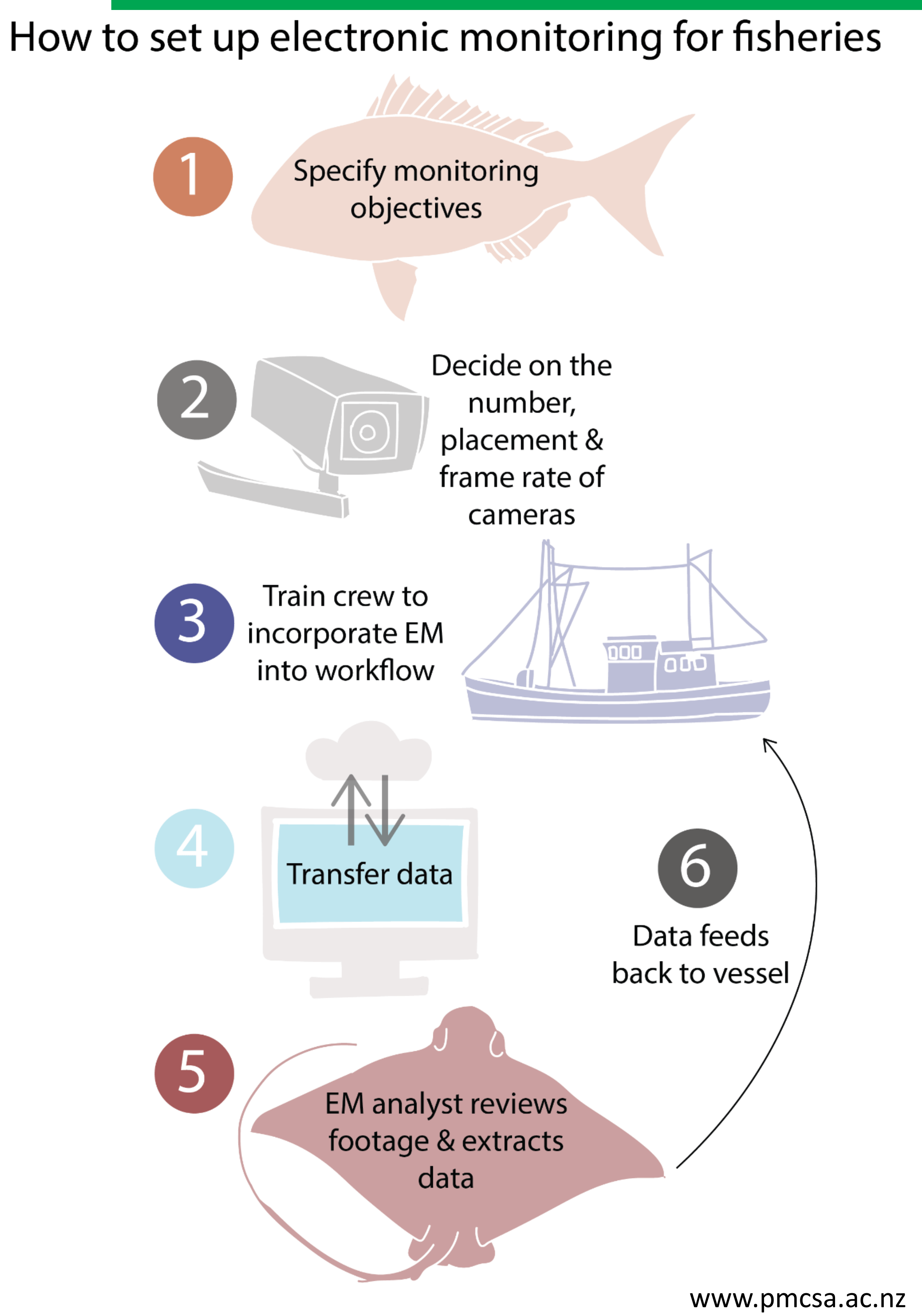
3. Sustainability Innovations

The quest for sustainable seafood production has driven significant innovations in both wild capture fisheries and aquaculture.

KEY ADVANCEMENT

1. Wild Capture Fisheries: Innovations for Sustainability
2. Aquaculture: Breakthroughs in Sustainability
3. Emerging Hybrid Models



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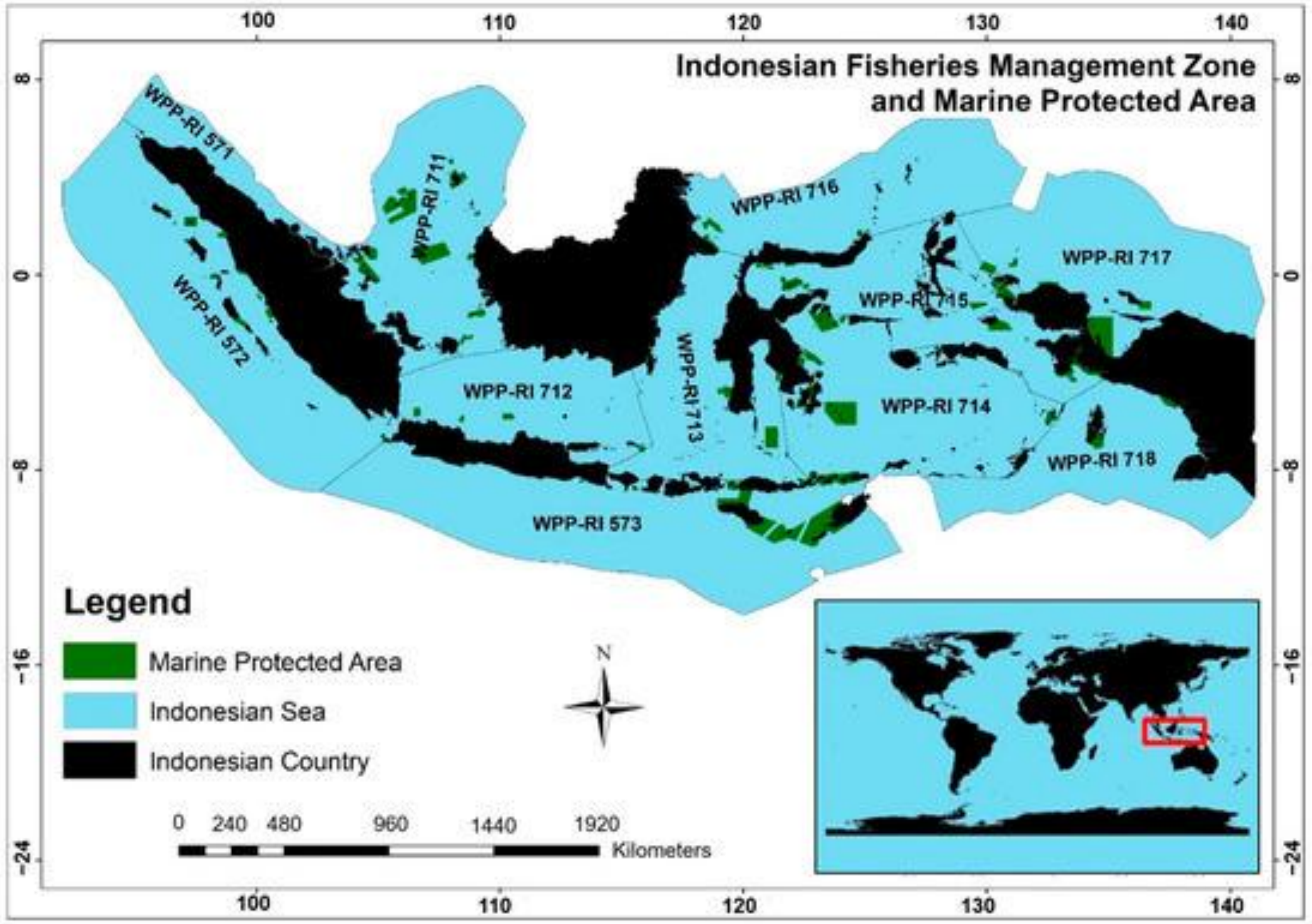
a. Wild Capture Fisheries: Innovations for Sustainability



Map representing The Indonesian Fisheries Management Zone (IFMZ or WPP) and Marine Protected Areas (MPA) – Fauzi et al. (2023)

1. **Science-Based Management Systems**
   - **Adaptive Quotas**: Fisheries in the U.S. are managed under the Magnuson-Stevens Act, which mandates science-based harvest limits to prevent overfishing and rebuild depleted stocks. Over 90% of monitored U.S. fish stocks are no longer subject to overfishing.
   - **Real-Time Monitoring**: Technologies like electronic monitoring (e.g., cameras on vessels) and satellite-based vessel tracking (AIS) combat illegal, unreported, and unregulated (IUU) fishing, improving compliance and data accuracy [5].

2. **Ecosystem-Based Approaches**
   - **Marine Protected Areas** (MPAs): Expanding MPAs helps conserve critical habitats and rebuild biodiversity. For example, Australia’s fisheries reforms reduced production shocks by aligning policies with ecosystem health.
   - **Bycatch Reduction**: Innovations like turtle excluder devices (TEDs) and selective gear minimize unintended catch, protecting endangered species and improving fishery efficiency [5].

3. **Community-Driven Co-Management**
   - **Territorial Use Rights** (TURFs): Programs in Chile and Mexico empower local fishers to manage resources, reducing overexploitation and fostering stewardship [6].

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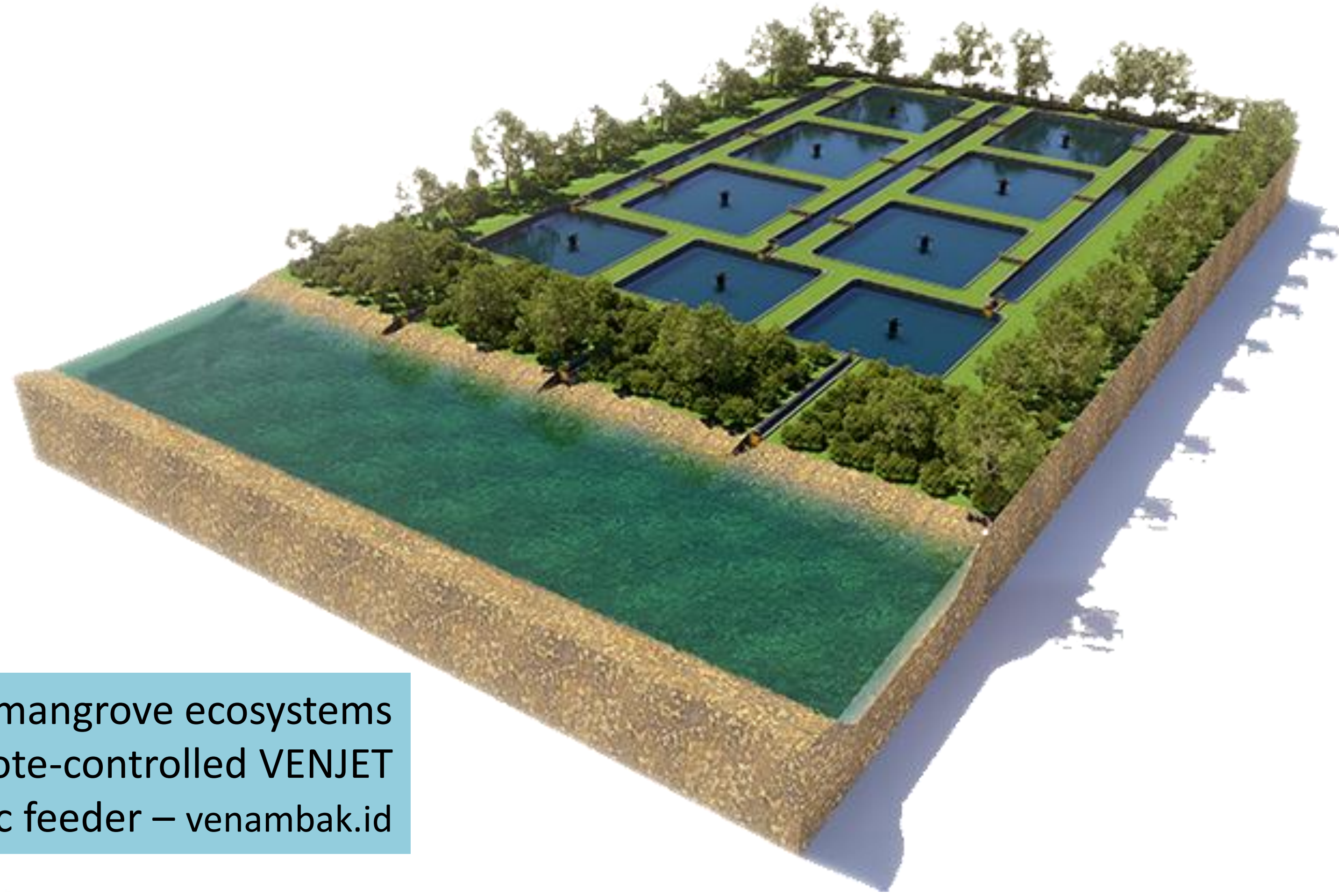
b. Aquaculture: Breakthroughs in Sustainability



Concept of VENAMBAK Silvofishery+: combining mangrove ecosystems with traditional cultivation systems; including remote-controlled VENJET aeration system and automatic feeder – venambak.id

1. **Feed Alternatives and Efficiency**
   - **Insect and Algae-Based Feeds**: Black soldier fly larvae and microalgae reduce reliance on wild-caught fishmeal, addressing the high "fish-in:fish-out" (FI:FO) ratios revealed in recent studies (e.g., 1.78 for carnivorous species).
   - **Circular Systems**: Integrated multi-trophic aquaculture (IMTA) pairs fish with filter feeders (e.g., mussels) and seaweed to recycle waste, lowering nutrient pollution and improving resource efficiency [6].

2. **Technological Advancements**
   - **Recirculating Aquaculture Systems (RAS)**: These closed-loop systems reduce water use by 95% and prevent escapes, mitigating environmental risks. Norway's "traffic light" system regulates salmon farm expansion based on ecosystem capacity [6].
   - **Genetic Improvements**: Selective breeding enhances disease resistance and growth rates in species like shrimp and salmon, reducing antibiotic use and improving yields [6].

3. **Ecosystem Restoration**
   - **Shellfish Reefs**: Oyster and mussel farms restore water quality by filtering pollutants and creating habitats, aligning with UN Sustainable Development Goals (SDGs).
   - **Mangrove-Smart Shrimp Farming**: Practices in Ecuador and Indonesia integrate mangrove conservation with aquaculture, preserving coastal ecosystems while maintaining productivity [6].

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c. Comparative Challenges and Synergies

Aspect	Wild Capture Fisheries	Aquaculture
Resource Dependency	Limited by natural stock recovery rates	Relies on wild fish for feed (e.g., 10–20 kg of feed per 1 kg of tuna)
Climate Resilience	Vulnerable to stock shifts (e.g., mackerel moving poleward)	RAS and IMTA systems buffer against temperature fluctuations
Social Equity	Small-scale fishers often marginalized by industrial fleets	Risks of labor exploitation in low-regulation regions

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d. Emerging Hybrid Models

- **Hatchery-Augmented Fisheries**: Alaska's Pacific salmon stocks are bolstered by hatchery-reared juveniles, blending wild and farmed methods to enhance yields.

- **Bait-Stocked Lobster Traps**: In New England, lobster traps use bait equal to twice the catch volume, blurring lines between wild and farmed production.

The emerging lobster industry in Lombok, Indonesia, is supported by ongoing studies with juvenile sand lobsters housed in replicated cage or tank systems - globalseafood.org

norwegianseafoodcouncil.com

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a. **Policy Harmonization**:
   - trengthen international agreements (e.g., WTO subsidy reforms) to curb overfishing and promote transparent aquaculture feed reporting.

b. **Consumer-Driven Demand**:
   - Ecolabels (e.g., ASC, MSC) and blockchain traceability can incentivize sustainable practices in both sectors.

c. **Climate Adaptation**:
   - Invest in predictive models for stock shifts and heat-resistant aquaculture species.

Future Pathway

CONCLUSION

Wild capture fisheries and aquaculture each offer unique sustainability innovations, from tech-driven monitoring in fisheries to closed-loop systems in aquaculture. However, challenges like feed dependency and equity gaps persist. Hybrid models and international cooperation, as advocated by the UN's SDGs, provide a roadmap for integrating the strengths of both sectors. By prioritizing science, equity, and ecosystem health, the global seafood industry can achieve a balance between productivity and planetary stewardship.

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4a. Case Studies: Aquaculture

01 Integrated Multi-Trophic Aquaculture (IMTA) in Canada

02 Mangrove-Shrimp Silvofisheries in Indonesia

03 Land-Based Salmon Farming (RAS) in Denmark

04 Bivalve Aquaculture in the U.S. (Puget Sound)

05 Barramundi Farming in Vietnam

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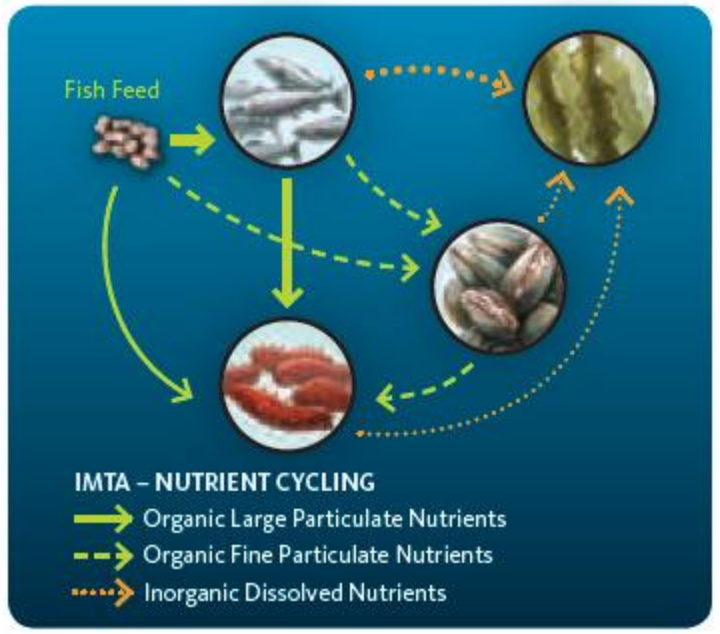
a. Integrated Multi-Trophic Aquaculture (IMTA) in Canada

- **Location**: Bay of Fundy, New Brunswick.
- **Practices**: Co-cultivates Atlantic salmon, blue mussels, and sugar kelp. Salmon waste provides nutrients for filter-feeding mussels and kelp, which absorb excess nitrogen and CO_2
- **Outcomes**:
  - Reduces nutrient pollution by 50% compared to monoculture.
  - Kelp biomass sequesters ~20 tons of CO_2 per hectare annually.
  - Certified by the Aquaculture Stewardship Council (ASC).
- **Key Lessons**: Mimicking natural ecosystems minimizes waste and diversifies revenue streams.



dfo-mpo.gc.ca

b. Land-Based Salmon Farming (RAS) in Denmark

- **Location**: Danish Salmon A/S.
- **Practices**: Uses Recirculating Aquaculture Systems (RAS) to farm salmon in closed, land-based facilities. Water is filtered and reused, eliminating sea lice and escapes.
- **Outcomes**:
  - Reduces water use by 99% compared to open-net pens.
  - Achieved a 1.1:1 feed conversion ratio (FCR) with plant-based feeds.
  - Supplies carbon-neutral salmon to EU markets.
- **Key Lessons**: Technology decouples aquaculture from coastal ecosystems, reducing environmental risks.
- **Visit**: https://www.youtube.com/watch?v=J1iPH73YsF4

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c. Bivalve Aquaculture in the U.S. (Puget Sound)

- **Project**: Taylor Shellfish Farms.
- **Practices**: Farms oysters, clams, and mussels using suspended longlines and beach seeding.
- **Outcomes**:
  - Filters 50 million liters of water daily, reducing algal blooms.
  - Restores native Olympia oyster populations.
  - Certified by Best Aquaculture Practices (BAP).
- **Key Lessons**: Filter-feeding species improve water quality while requiring no feed inputs.

d. Barramundi Farming in Vietnam

- **Company**: Australis Aquaculture.
- **Practices**: Farms barramundi in offshore pens using plant-based feeds (soy and algae).
- **Outcomes**:
  - Achieves a 1.5:1 FCR, outperforming salmon (1.2:1) and shrimp (1.8:1).
  - Supplies 10% of the U.S. barramundi market.
  - Partners with WWF to reduce bycatch in feed sourcing.
- **Key Lessons**: Choosing low-trophic, omnivorous species reduces dependency on wild fish for feed.

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e. Mangrove-Shrimp Silvofisheries in Indonesia

- **Location**: East Java and Sumatra [7][8].
- **Practices**: Shrimp ponds are integrated with mangrove forests, where trees filter water, prevent erosion, and provide habitat for juvenile fish.
- **Outcomes**:
    - Mangrove cover increased by 30% in participating regions.
    - Shrimp yields rose 15–20% due to improved water quality.
    - Supports 10,000+ smallholder farmers through the Sustainable Shrimp Partnership.
- **Key Lessons**: Combining aquaculture with habitat restoration enhances resilience and livelihoods.

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The effectiveness of silvofishery system in water treatment in intensive whiteleg shrimp (*Litopenaeus vannamei*) ponds, Probolinggo District, East Java, Indonesia

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Mangrove species diversity and carbon stock in silvofishery ponds in Deli Serdang District, North Sumatra, Indonesia

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Research article

Innovative silvofishery model in restored mangrove forests: A 10-year assessment

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4b. Case Studies: Wild-Capture

01 Alaskan Salmon Fisheries (USA)

02 Icelandic Cod Fisheries (Iceland)

03 Chilean TURFs (Chile)

04 Madagascar Octopus Fishery (Madagascar)

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a. Alaskan Salmon Fisheries (USA)

- **Location**: Alaska, USA.
- **Practices**:
  - Science-based quotas informed by annual stock assessments.
  - Habitat protection (e.g., safeguarding spawning grounds).
  - Seasonal closures during spawning periods.
- **Outcomes**:
  - Sustained salmon populations for over 70 years.
  - MSC certification since 2000, ensuring market access.
  - Contributes $1.5 billion annually to Alaska’s economy.
- **Key Lessons**: Science-driven management and stakeholder collaboration (fishers, scientists, policymakers) ensure ecological and economic resilience.

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b. Icelandic Cod Fisheries (Iceland)

- **Location**: Iceland.
- **Practices**:
  - Individual Transferable Quotas (ITQs) since 1984, capping total catches.
  - Seasonal closures and gear restrictions to protect juveniles.
- **Outcomes**:
  - Cod stocks recovered from collapse in the 1990s to sustainable levels by 2013.
  - xports generate $2 billion yearly, supporting 10% of Iceland’s workforce.
- **Key Lessons**: Quota systems align economic incentives with conservation, preventing overexploitation.

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b. Madagascar Octopus Fishery (Madagascar)

- **Location**: Southwest Madagascar.
- **Practices**:
  - Temporary closures (2–3 months) led by coastal communities.
  - Minimum size limits to protect juveniles.
- **Outcomes**:
  - Octopus catches doubled post-closure, with larger individuals.
  - Income for 10,000+ fishers rose by 30%.
- **Key Lessons**: Community-led temporal closures balance ecological and social needs.
- Visit: https://www.youtube.com/watch?v=tYtez9pVcpw

c. Chilean TURFs

- **Location**: Coastal of Chile.
- **Practices**:
  - Territorial Use Rights for Fisheries (TURFs): Communities manage defined coastal zones.
  - Harvest limits and no-take zones enforced locally.
- **Outcomes**:
  - Fish biomass increased by 150% in managed areas.
  - 30,000+ fishers earn stable incomes through co-management.
- **Key Lessons**: Secure access rights and local stewardship enhance sustainability and equity.

smea.uw.edu

wwf.mg

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SUSTAINABLE WILD-CATCH FISHERIES

a. **Science-Based Management:** Data-driven quotas and monitoring.
b. **Stakeholder Collaboration**: Fishers, governments, and NGOs working together.
c. **Market Incentives**: Certifications (MSC) and premium pricing for sustainability.
d. **Policy Innovation**: Quotas, spatial closures, and co-management models.

SUSTAINABLE AQUACULTURE

a. **Technology**: RAS, AI monitoring, and biofloc systems reduce environmental footprints.
b. **Certification**: ASC, BAP, and Fair Trade labels ensure accountability.
c. **Community Engagement**: Co-management models prioritize local needs.
d. **Circularity**: Waste is repurposed (e.g., seaweed for biofuels, fish waste for fertilizer).

COMMON SUCCESS FACTORS

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Further Reading

01 FAO.2011. *FAO Technical Guidelines for Responsible Fisheries 5: Aquaculture Development*. FAO of The UN, Rome.

02 Jiang S. 2010. Aquaculture, capture fisheries, and wild fish stocks. *Resource and Energy Economics* 31(1): 65-77.

03 Alimentarium. The history of aquaculture. Available online at https://www.alimentarium.org/en/fact-sheet/history-aquaculture

04 Villasante S, Rodríguez-González D, Antelo M, Rivero-Rodríguez S, Lebrancón-Nieto J. 2013. Why are prices in wild catch and aquaculture industries so different? *Ambio* 42(8): 937-950.

05 Doubleday ZA, Willoughby J, Martino JC, Cottrell RS, Gephart JA. 2024. Improved fisheries management and aquaculture growth align with fewer shocks to Australian seafood production. *Cell Reports Sustainability* 1(7): 100131.

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Further Reading

06 Garlock TM, et al. 2024. Environmental, economic, and social sustainability in aquaculture: the aquaculture performance indicators. *Nature Communications* 15:5274.

07 Harefa MS, Nasution Z, Mulya MB, Maksum A. 2022. Mangrove species diversity and carbon stock in silvofishery ponds in Deli Serdang District, North Sumatra, Indonesia. *Biodiversitas* 22(2): 655-662.

08 Suyono, Fithor A. 2025. Innovative silvofishery model in restored mangrove forest: A 10-year assessment. *Heliyon* 11: e42043.

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