One-third of the world's assessed fish stocks are overexploited

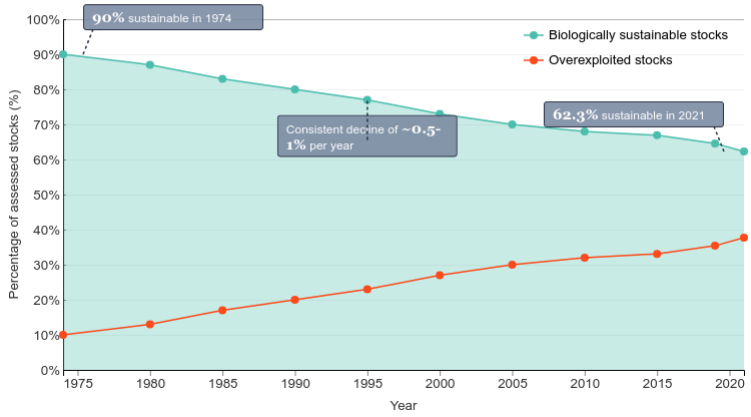
Global fisheries stand at a critical juncture, with 37.7% of the world's assessed fish stocks now fished beyond biologically sustainable levels. This comprehensive analysis examines the trends, challenges, and potential solutions to address this mounting crisis. We track the steady erosion of global fish stock health since the 1970s, analyze regional disparities in management effectiveness, explore key drivers of overexploitation, highlight successful recovery models, and outline governance initiatives designed to rebuild depleted fisheries. By combining rigorous data analysis with case studies of effective interventions, this report offers a nuanced understanding of both the perils and promise in global fisheries management.

Global Trends in Fish Stock Sustainability

The health of the world's marine fisheries has been in steady decline since systematic global monitoring began. According to the UN Food and Agriculture Organization (FAO), the proportion of fish stocks within biologically sustainable levels has fallen dramatically from 90% in 1974 to just 62.3% in 2021. This represents a consistent erosion of approximately 0.5-1% per year over nearly five decades.

Decline in Biologically Sustainable Fish Stocks, 1974-2021

Source: FAO State of World Fisheries and Aquaculture (SOFIA) Reports



This downward trend is particularly concerning given the scale of global wild fish harvest. According to the FAO, wild capture fisheries produced approximately 214 million metric tons in 2020, representing a market value of US $406 billion. Despite this economic significance, the sustainability metrics continue to deteriorate, with the share of stocks fished beyond maximum sustainable yield (MSY) increasing from 10% in 1974 to 37.7% in 2021 (FAO 2024 [1]).

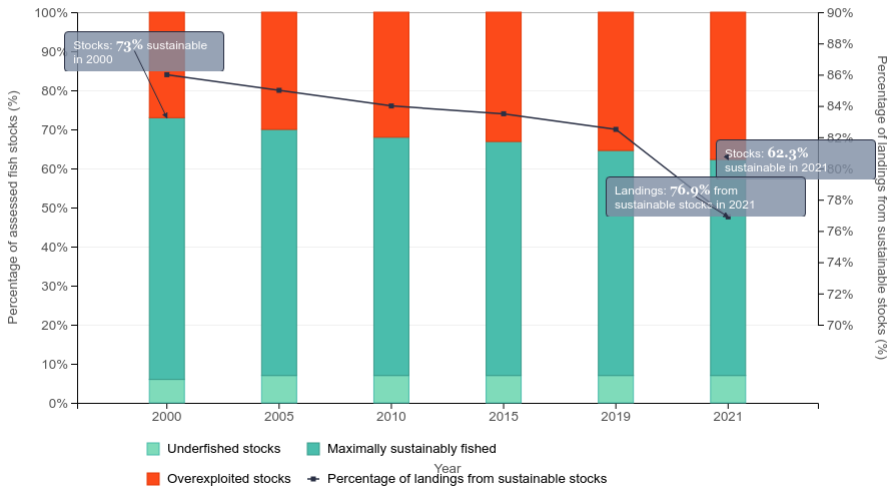
The fine-grained data on global fish stocks reveals three distinct categories of exploitation:

1. **Underfished stocks** (only 7% as of 2022) - These stocks are harvested at levels that allow for potential expansion.
2. **Maximally sustainably fished stocks** (57%) - These are fully exploited but still within biologically sustainable levels.
3. **Overexploited stocks** (37.7%) - These exceed biological reference points and face potential collapse if fishing pressure is not reduced.

An important nuance in this data is the relationship between stock status and catch volume. Despite the concerning trend in stock status, sustainable stocks still account for 76.9% of total landings as of 2021. This suggests that many of the largest commercial fisheries remain under more effective management than smaller stocks, though this advantage has eroded from the 82.5% of sustainable landings recorded in 2019.

Fish Stock Status vs. Landings Sustainability, 2000-2021

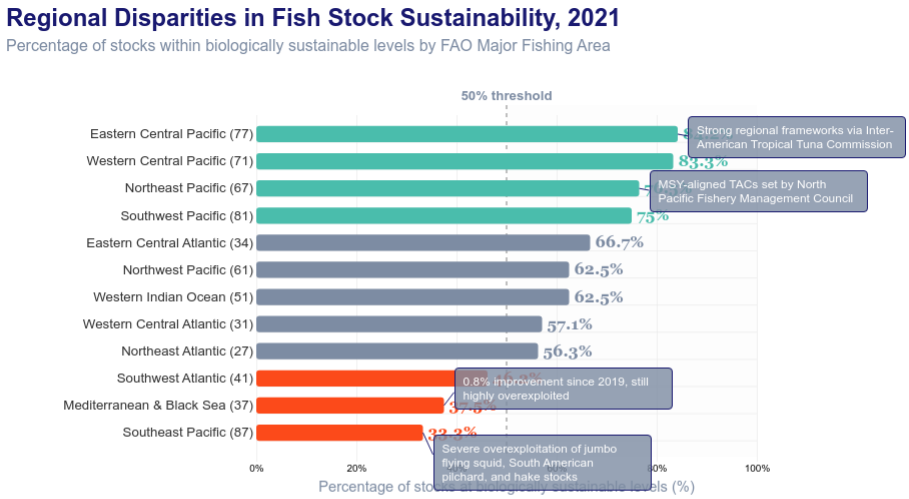
Source: FAO State of World Fisheries and Aquaculture (SOFIA) Reports



This divergence between stock status and landing volumes reflects complex dynamics in global fisheries. Many of the most commercially important stocks—such as certain tuna species and Alaska pollock—have more robust management frameworks than smaller, often coastal fisheries. However, the gap between stock status and landing proportions has narrowed significantly in recent years, dropping from a difference of 17.9 percentage points in 2019 to 14.6 percentage points in 2021, suggesting that even well-managed fisheries face increasing pressures.

Regional Disparities and Data Challenges

The global statistics on fisheries sustainability mask significant regional variations. Analysis of FAO's designated Major Fishing Areas reveals dramatic differences in management effectiveness and stock health. The contrast between regions illustrates how governance frameworks, monitoring capabilities, and management approaches profoundly influence outcomes.



Source: FAO State of World Fisheries and Aquaculture (SOFIA) 2024

The regional data reveals stark contrasts. The most sustainably managed regions include the Eastern Central Pacific (84.2% sustainable), Western Central Pacific (83.3%), Northeast Pacific (76.5%), and Southwest Pacific (75.0%). These regions benefit from robust regional fishery management organizations (RFMOs) and science-based policy frameworks.

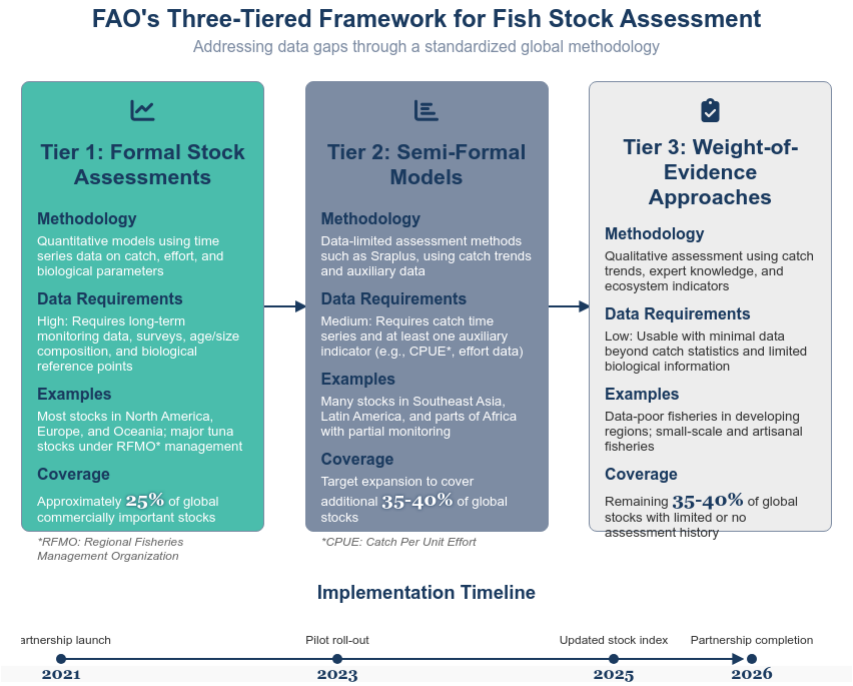
In stark contrast, the worst-performing regions include the Southeast Pacific (just 33.3% of stocks at sustainable levels), the Mediterranean & Black Sea (37.5%), and the Southwest Atlantic (46.2%). These regions suffer from a combination of governance challenges, data limitations, and complex multi-jurisdictional issues.

The Mediterranean & Black Sea (FAO Area 37) illustrates the complex challenges facing many regions. Despite a modest improvement of 0.8% in sustainable stocks since 2019, this region continues to struggle with severely depleted European hake and whiting stocks, alongside overexploited octopus populations. The slight improvement was driven by partial recoveries in deep-water pink shrimp and cuttlefish stocks, but these gains remain fragile and could easily be reversed without continued management improvements.

Similarly, the Southeast Pacific (FAO Area 87) faces severe challenges with only one-third of its stocks at sustainable levels. While the Peruvian anchoveta (with catches around 5.9 million metric tons) remains sustainable, other key commercial species—including jumbo flying squid, South American pilchard, Southern hake, and Patagonian toothfish—are significantly overexploited (FAO 2024 [2]).

Data Quality and Assessment Challenges

A significant challenge in global fisheries management is the uneven quality and availability of stock assessments. Historically, high-quality assessments have been concentrated in developed regions like Europe and North America, while many fisheries in Africa, Asia, and South America lack formal scientific evaluations. This assessment gap has hampered accurate global stock estimates and hindered effective management in many regions.



To address these assessment gaps, FAO has developed a three-tiered approach that accommodates varying levels of data availability across regions:

1. **Tier 1 (Formal Stock Assessments)**: These are quantitative, data-rich models that require extensive monitoring data, surveys, and biological parameters. They cover approximately 25% of globally important commercial stocks, primarily in North America, Europe, and Oceania.
2. **Tier 2 (Semi-Formal Models)**: These employ data-limited assessment methods like Sraplus, which use catch trends alongside auxiliary indicators such as catch per unit effort (CPUE). This tier aims to expand coverage to an additional 35-40% of global stocks, particularly in regions with partial monitoring programs.
3. **Tier 3 (Weight-of-Evidence Approaches)**: These qualitative assessments rely on catch trends, expert knowledge, and ecosystem indicators when minimal data is available. They target the remaining 35-40% of stocks with limited or no assessment history, especially small-scale and artisanal fisheries in developing regions.

This framework is being implemented through a partnership running from January 2021 to June 2026 under FAO's Blue Transformation initiative, with pilot roll-outs in Areas 31 (Western Central Atlantic) and 37 (Mediterranean & Black Sea). The initiative aims to deliver an updated "state of stocks index" and a comprehensive global assessment by June 30, 2025 (SDG 14.4.1 [3]).

The progress in improving assessment methodologies is critical for tracking progress toward the Sustainable Development Goal target 14.4.1, which aims to end overfishing and restore fish stocks to sustainable levels. However, even with improved assessment frameworks, fundamental challenges remain in terms of monitoring capacity, enforcement, and addressing the root causes of overexploitation.

Underlying Drivers of Overexploitation

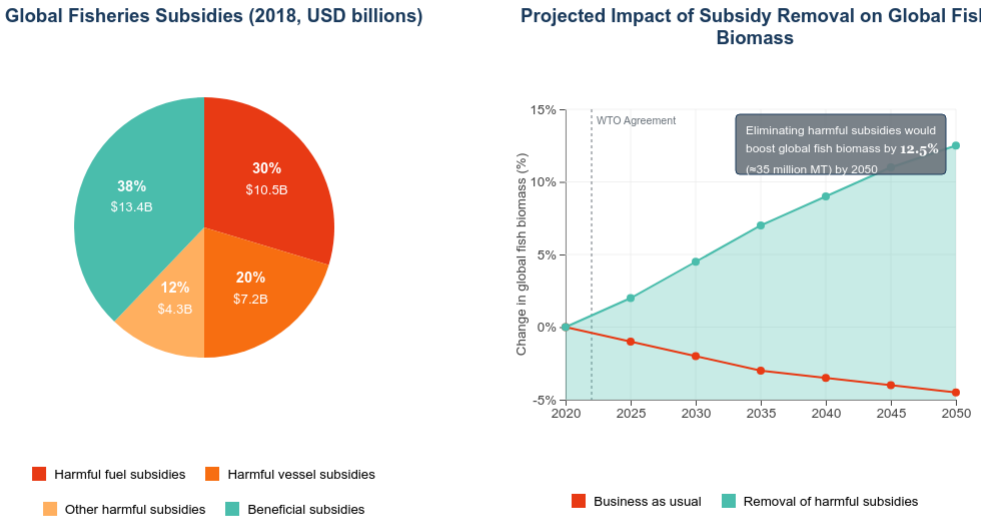
The continued decline in sustainable fish stocks worldwide is driven by several interrelated factors that collectively create powerful economic and operational incentives for overfishing. Understanding these drivers is essential for developing effective interventions.

Harmful Subsidies

Government subsidies to the fishing industry represent one of the most significant drivers of overcapacity and overfishing. In 2018, global governments disbursed approximately USD 35.4 billion in fisheries subsidies, of which USD 22 billion (62%) were classified as "harmful" (ScienceDirect [4]). These harmful subsidies primarily support:

- Fuel subsidies that artificially reduce operating costs
- Vessel construction and modernization programs that increase fleet capacity
- Price supports that mask market signals about diminishing stocks

Impact of Fisheries Subsidies on Global Fish Stocks



Source: Based on Sumaila et al. (2021) and WTO (2022)

The impact of these subsidies is significant. Modeling by Sumaila et al. (2021) demonstrates that eliminating harmful subsidies would boost global fish biomass by 12.5% (approximately 35 million metric tons) by 2050 compared to business-as-usual scenarios. This represents a substantial opportunity for stock recovery that could generate billions in additional sustainable revenue while reducing pressure on depleted populations.

Progress on addressing harmful subsidies has been made through a June 2022 World Trade Organization agreement, which banned three categories of subsidies: (1) those aiding overfished stocks, (2) those facilitating illegal, unreported, and unregulated (IUU) fishing, and (3) those supporting high-seas fishing outside RFMO jurisdiction. However, this agreement will only enter into force once 109 WTO members ratify it, with implementation projected through 2028 (Pew Trusts [5]).

Destructive Fishing Practices

Beyond subsidies, certain fishing methods cause disproportionate damage to marine ecosystems, compromising their long-term productivity and resilience. Bottom trawling is particularly harmful, accounting for approximately 25% of global wild catch while damaging about 5 million km² of seabed annually—equivalent to 13.5% of the continental shelf (Our World in Data [6]).

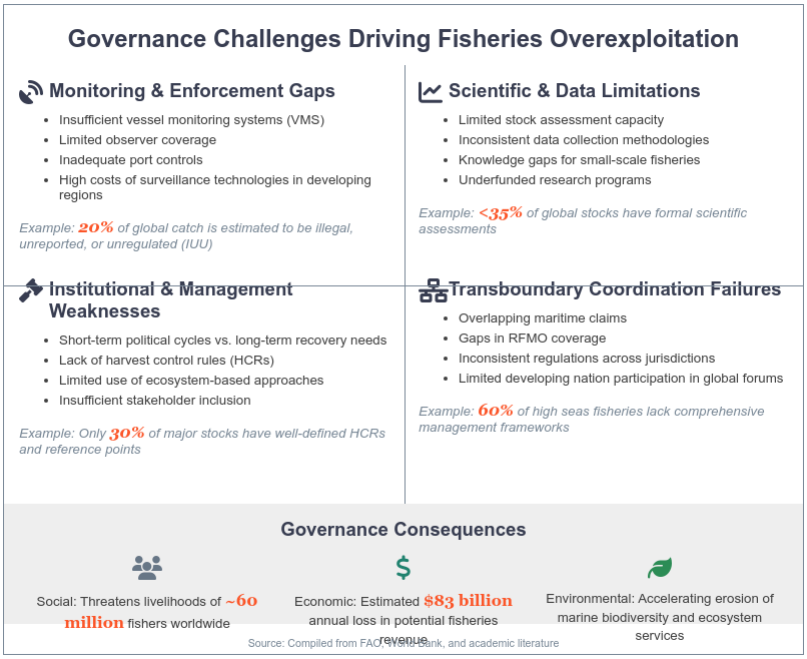
The ecological impact of bottom trawling is severe:

- Killing up to 41% of benthic organisms per trawl pass (with hydraulic dredges causing the highest mortality)
- Disrupting critical nutrient cycles in seabed ecosystems
- Requiring 1.9–6.4 years for benthic communities to recover to 95% of pre-trawl biomass

These impacts extend beyond the targeted fish stocks to affect entire marine food webs. For example, parrotfish depletion allows harmful seaweed blooms that hinder coral reproduction, creating cascading effects throughout reef ecosystems.

Governance Failures

Weak governance frameworks represent the third major driver of overexploitation. This includes inadequate monitoring and enforcement, limited scientific capacity for stock assessment, lack of stakeholder engagement, and insufficient coordination across jurisdictional boundaries.



These governance failures have profound consequences:

- **Social impact**: Overexploitation threatens the livelihoods of approximately 60 million people worldwide who depend on fishing for their income and food security.
- **Economic cost**: The World Bank estimates that improved governance could generate an additional $83 billion annually in global fisheries revenue through recovered stocks.
- **Environmental damage**: Beyond the target species, governance failures accelerate the erosion of marine biodiversity and ecosystem services that support coastal communities.

The interaction between these three drivers—harmful subsidies, destructive practices, and governance failures—creates a feedback loop that accelerates stock depletion. Subsidies enable economically unviable fishing to continue even as stocks decline, destructive practices undermine ecosystem resilience, and governance failures prevent effective intervention. Breaking this cycle requires coordinated action across all three dimensions.

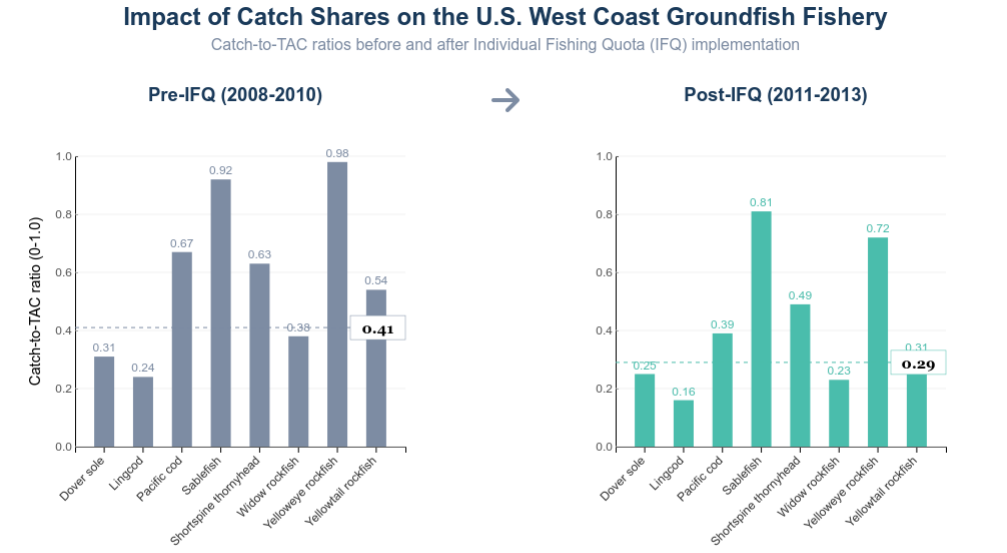
Success Stories in Fisheries Management

Despite the concerning global trends, numerous fisheries have successfully implemented management reforms that reversed overfishing and rebuilt stocks. These success stories provide valuable templates for wider application.

Catch-Share Programs

One of the most effective management approaches has been the implementation of catch-share programs, which allocate secure, exclusive privileges to harvest a specific portion of a fishery's total allowable catch (TAC). According to research by Costello et al. (2008), catch shares implemented across hundreds of global fisheries have demonstrably reduced collapse risk and increased biomass (Costello et al. 2008 [7]).

In the United States alone, 16 federal catch-share programs implemented since 1990 account for over 20% of U.S. landings revenue—approximately $1.1 billion in 2013 (Holland et al. 2017 [8]). These programs have demonstrated several key benefits:



The U.S. West Coast groundfish fishery exemplifies the benefits of catch shares. Following the implementation of Individual Fishing Quotas (IFQs) in 2011, the fishery-wide catch-to-TAC ratio decreased from 0.41 in the pre-IFQ period (2008-2010) to 0.29 in the post-IFQ period (2011-2013), a statistically significant improvement (p = 0.001) (Kuriyama et al. 2016 [9]).

This improvement was particularly notable for constraining species like yelloweye rockfish, which had previously limited the overall fishery due to its extremely low TAC (just 0.6 tons). Under the catch-share system, fishers had stronger incentives to avoid these limiting species, allowing for better overall utilization of the available quota while protecting vulnerable stocks.

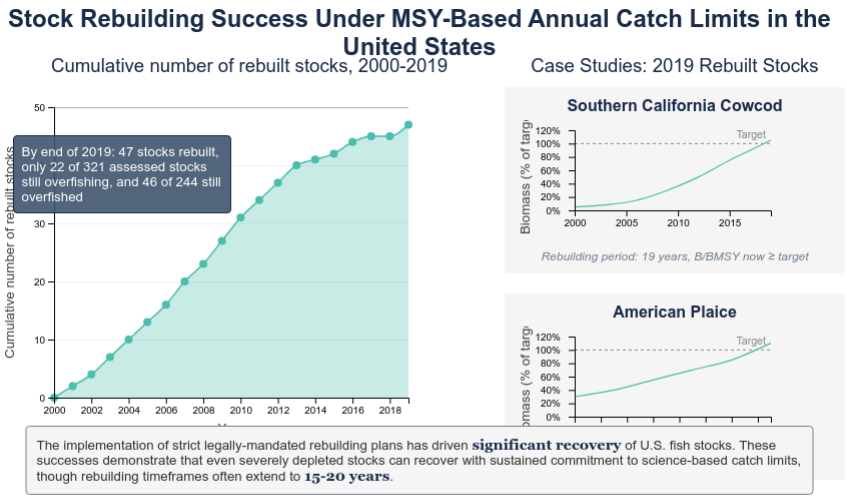
Another example comes from the Bering Sea/Aleutian Islands Crab Rationalization Program, where the implementation of Individual Transferable Quotas (ITQs) led to multiple benefits:

1. A greater than 30% increase in daily "crab-equivalent" contribution margins post-2005
2. Significant fleet consolidation that accounted for approximately 65% of surplus gains
3. More stable crew wages with reduced financial volatility while maintaining a 15-20% premium over alternative regional employment
4. A redistribution of resource rents that brought new capital into the fishery

These outcomes demonstrate how well-designed catch-share programs can simultaneously achieve ecological, economic, and social goals.

MSY-Based Annual Catch Limits

Another successful approach has been the implementation of science-based annual catch limits that aim to keep exploitation at or below the maximum sustainable yield (MSY) level. The United States has been particularly effective in this area, with significant stock rebuilding under the legal mandates of the Magnuson-Stevens Act.



By implementing science-based rebuilding plans with mandatory timelines, the United States has made substantial progress in recovering previously overfished stocks. According to NOAA's Status of Stocks report, 47 stocks were rebuilt between 2000 and 2019. By the end of 2019, only 22 of 321 assessed stocks were still experiencing overfishing, and just 46 of 244 remained in an overfished condition (NOAA Status of Stocks 2019 [10]).

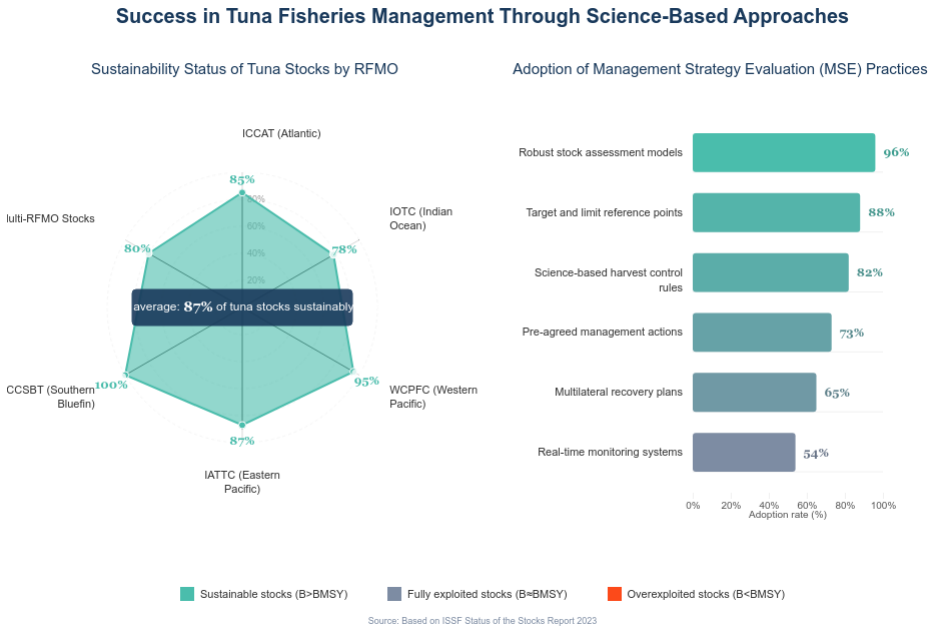
Two stocks rebuilt in 2019 demonstrate the long-term commitment required:

1. **Southern California cowcod** - After 19 years of rebuilding efforts, this stock finally reached its target biomass level. Starting from a severely depleted state at approximately 5% of target biomass, the stock recovered through strict catch limits and area closures.
2. **American plaice** - This stock tripled its biomass over a 15-year rebuilding period, demonstrating that even commercially important flatfish can recover when harvest is appropriately constrained.

These cases highlight that while recovery is possible, rebuilding timeframes often extend to 15-20 years for long-lived species—underscoring the importance of sustained commitment to science-based management.

Regional Fisheries Management Organizations (RFMOs)

For highly migratory and transboundary stocks, effective management requires international cooperation through Regional Fisheries Management Organizations (RFMOs). Tuna RFMOs have been particularly successful in implementing Management Strategy Evaluation (MSE) frameworks that have significantly improved stock status.



The success in tuna fishery management is particularly notable, with 87% of assessed tuna stocks now fished at sustainable levels[ISSF 2023 [11]]. This achievement is the result of coordinated efforts across several tuna-focused RFMOs, including:

- ICCAT (Atlantic Ocean): 85% of stocks sustainable
- IOTC (Indian Ocean): 78% of stocks sustainable
- WCPFC (Western Pacific): 95% of stocks sustainable
- IATTC (Eastern Pacific): 87% of stocks sustainable
- CCSBT (Southern Bluefin): 100% of stocks sustainable

These RFMOs have implemented a suite of best practices through Management Strategy Evaluation frameworks:

1. **Science-based harvest control rules** (82% adoption rate) - Pre-defined rules that adjust fishing pressure based on stock status indicators
2. **Robust stock assessment models** (96% adoption rate) - Sophisticated modeling approaches that incorporate multiple data sources and uncertainty
3. **Pre-agreed management actions** (73% adoption rate) - Automatic responses to changes in stock status that minimize political delays
4. **Target and limit reference points** (88% adoption rate) - Clear biomass and fishing mortality thresholds that guide management decisions
5. **Multilateral recovery plans** (65% adoption rate) - Coordinated rebuilding strategies for depleted stocks
6. **Real-time monitoring systems** (54% adoption rate) - Technologies such as VMS and electronic reporting that enable adaptive management

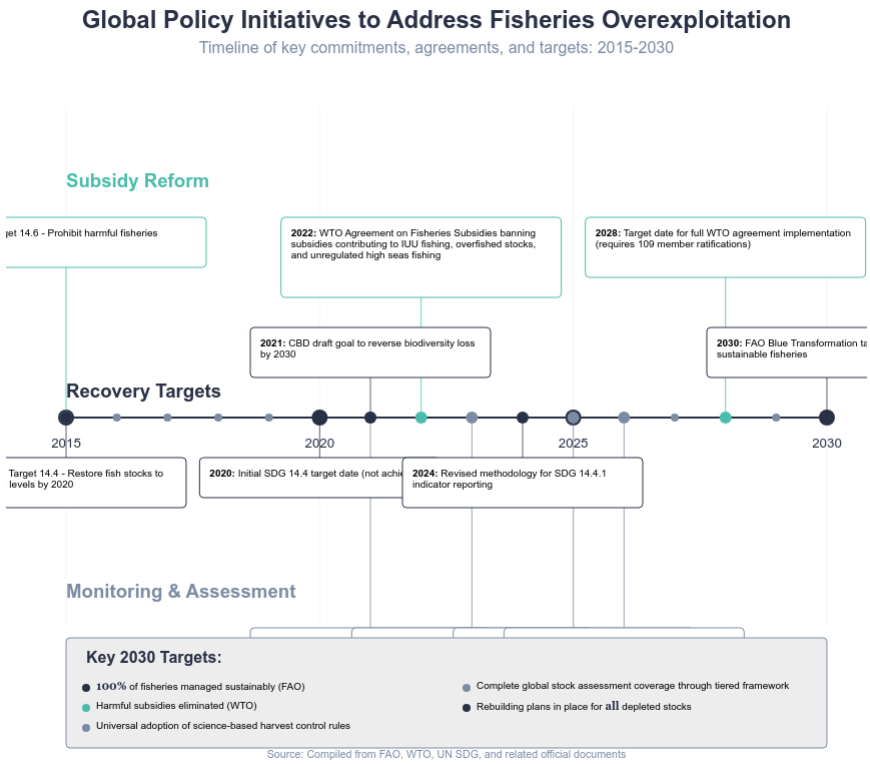
The higher adoption rates of these practices in tuna fisheries compared to many other fisheries help explain their superior performance. The success of these science-based approaches demonstrates that international cooperation can effectively manage even highly migratory stocks when backed by strong scientific foundations and institutional commitments.

Governance Initiatives and Pathways Forward

Building on the demonstrated successes in fishery rebuilding, a variety of governance initiatives are now underway to address the one-third of global stocks that remain overexploited. These efforts span from global policy frameworks to technological innovations in monitoring and enforcement.

Global Policy Frameworks

Several major international initiatives aim to reform fisheries management at the global level:



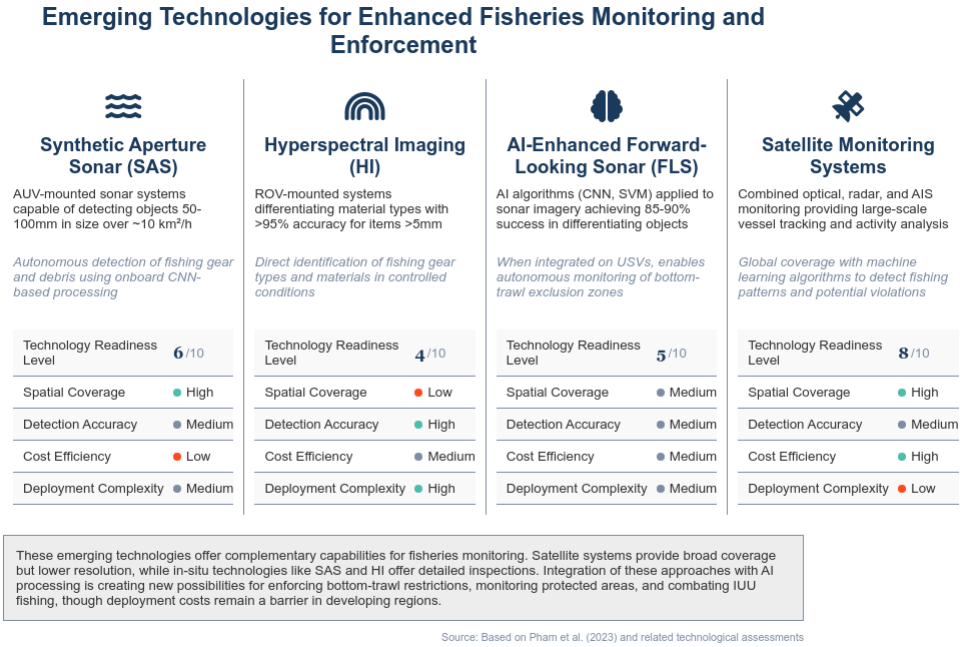
The timeline highlights three major policy domains driving global fisheries reform:

1. **Subsidy Reform**
2. SDG Target 14.6 (established in 2015) sets the goal of prohibiting harmful fisheries subsidies
3. The 2022 WTO Agreement on Fisheries Subsidies banned subsidies that contribute to IUU fishing, overfished stocks, and unregulated high seas fishing
4. Implementation is targeted for 2028, pending ratification by 109 WTO members
5. **Monitoring & Assessment**
6. FAO's Blue Transformation partnership (2021-2026) is overhauling global stock assessment methodologies
7. Pilot implementations of the three-tiered assessment framework began in 2023 in Areas 31 (Western Central Atlantic) and 37 (Mediterranean & Black Sea)
8. A comprehensive updated global assessment is due by June 30, 2025
9. **Recovery Targets**
10. SDG Target 14.4 originally aimed to restore fish stocks to sustainable levels by 2020 (not achieved)
11. Revised methodology for the SDG 14.4.1 indicator was developed in 2024 to improve tracking
12. FAO's Blue Transformation initiative targets 100% sustainable fisheries by 2030

These interlocking policy frameworks create a coordinated approach to addressing overexploitation. The subsidy reforms target the economic drivers of overfishing, the monitoring improvements address data gaps that hinder effective management, and the recovery targets provide benchmarks for measuring progress.

Technological Innovations for Monitoring and Enforcement

Complementing the policy frameworks are emerging technologies that promise to revolutionize fisheries monitoring, control, and surveillance (MCS). These tools could significantly improve compliance with regulations and reduce IUU fishing.



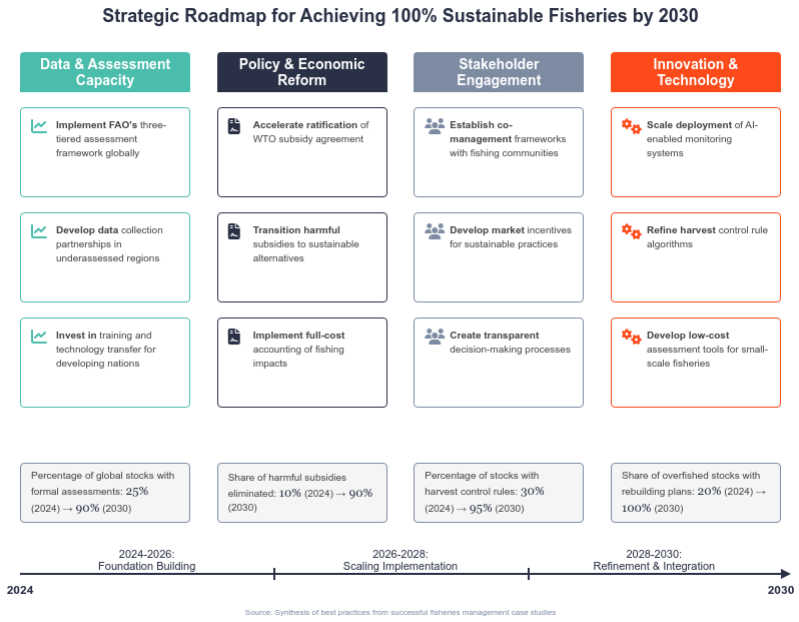
The technological innovations being developed and deployed for fisheries monitoring include:

1. **Synthetic Aperture Sonar (SAS)** - These autonomous underwater vehicle (AUV) systems can detect objects as small as 50-100mm over approximately 10 square kilometers per hour. With onboard CNN-based processing, they can autonomously identify fishing gear and debris. While powerful, their high cost (approximately €450,000 per unit) limits widespread adoption (Pham et al. 2023 [12]).
2. **Hyperspectral Imaging (HI)** - These remotely operated vehicle (ROV) mounted systems can differentiate various types of fishing gear and materials with over 95% accuracy for items larger than 5mm. Despite their precision, their spatial coverage remains low (about 0.1 square kilometers per hour) and deployment complexity is high, making them better suited for detailed inspections rather than broad surveillance (Pham et al. 2023 [13]).
3. **AI-Enhanced Forward-Looking Sonar (FLS)** - AI algorithms applied to sonar imagery achieve 85-90% success in differentiating fishing gear from natural features, with processing times under 2 seconds per frame. When integrated on uncrewed surface vessels (USVs), this approach offers a promising pathway to autonomous enforcement of bottom-trawl exclusion zones.
4. **Satellite Monitoring Systems** - These provide the broadest coverage through a combination of optical, radar, and automatic identification system (AIS) data. Machine learning algorithms can detect fishing patterns and potential violations across large areas. While resolution is lower than in-situ technologies, cost efficiency and deployment simplicity make this approach particularly valuable for developing regions.

These technologies are most effective when deployed in complementary ways. Satellite systems can identify areas of concern for more detailed inspection by in-situ technologies like SAS and HI. Integration of these approaches with AI processing creates new possibilities for enforcing regulations, monitoring protected areas, and combating IUU fishing.

Integrated Roadmap for Stock Recovery

Drawing from both successful case studies and promising initiatives, an integrated roadmap can guide the transition toward 100% sustainable fisheries by 2030.



This strategic roadmap integrates four complementary pillars of action:

1. **Data & Assessment Capacity**
2. Implementing FAO's three-tiered assessment framework globally to address data gaps
3. Developing data collection partnerships in underassessed regions, particularly in Africa and Asia
4. Investing in training and technology transfer to build local capacity for scientific assessment
5. **Policy & Economic Reform**
6. Accelerating ratification of the WTO subsidy agreement to eliminate harmful financial incentives
7. Transitioning subsidies toward sustainable alternatives such as gear modernization for selectivity
8. Implementing full-cost accounting of fishing impacts to internalize ecological costs
9. **Stakeholder Engagement**
10. Establishing co-management frameworks with fishing communities to improve compliance
11. Developing market incentives for sustainable practices, including certification programs
12. Creating transparent decision-making processes that incorporate diverse stakeholder input
13. **Innovation & Technology**
14. Scaling deployment of AI-enabled monitoring systems to reduce IUU fishing
15. Refining harvest control rule algorithms to respond more effectively to changing conditions
16. Developing low-cost assessment tools appropriate for small-scale fisheries

Implementation is envisioned in three phases:

- **2024-2026: Foundation Building** - Establishing key frameworks and piloting approaches
- **2026-2028: Scaling Implementation** - Expanding successful models to more fisheries and regions
- **2028-2030: Refinement & Integration** - Fine-tuning approaches and ensuring coordination across pillars

Progress will be tracked through key performance indicators that provide quantifiable targets for 2030: - Increase in stocks with formal assessments from 25% to 90% - Elimination of harmful subsidies from 10% to 90% - Expansion of harvest control rules from 30% to 95% of stocks - Implementation of rebuilding plans for all overfished stocks (from 20% to 100%)

This integrated approach builds on the documented success stories in fisheries management while addressing the systemic drivers of overexploitation. By combining scientific, economic, social, and technological dimensions, it offers a comprehensive pathway toward the goal of 100% sustainable fisheries by 2030.

Conclusion

The challenge of fisheries overexploitation is significant, with one-third of the world's assessed stocks currently fished beyond biologically sustainable levels. This represents a decline from 90% sustainable stocks in 1974 to just 62.3% in 2021. Regional disparities are stark, with some areas like the Southeast Pacific and Mediterranean having less than 40% of stocks at sustainable levels.

Despite these concerning trends, there are clear pathways forward. Success stories from fisheries that have implemented catch-share programs, science-based annual catch limits, and robust international frameworks demonstrate that recovery is possible. The rebuilding of 47 U.S. stocks over two decades and the achievement of 87% sustainable tuna stocks globally provide powerful examples of what can be accomplished with sustained commitment.

Emerging technologies, policy reforms, and assessment frameworks create new opportunities for addressing the drivers of overexploitation. By eliminating harmful subsidies, improving monitoring capabilities, strengthening governance, and engaging stakeholders, the global community has the tools to reverse the decline in fisheries health.

The roadmap toward 100% sustainable fisheries by 2030 is ambitious but achievable. It requires coordinated action across multiple dimensions—scientific, economic, social, and technological—and sustained commitment from governments, industry, communities, and other stakeholders. The stakes are high, as fisheries not only provide critical food security and livelihoods for millions but also maintain the health of marine ecosystems on which we all depend.

References

[1] https://ourworldindata.org/data-insights/one-third-of-the-worlds-assessed-fish-stocks-are-overexploited
[2] https://www.fao.org/3/cc0461en/online/sofia/2022/status-of-fishery-resources.html
[3] https://www.fao.org/3/cd0683en/online/sofia/2024/status-of-fishery-resources.html
[4] https://www.fao.org/publications/home/fao-flagship-publications/the-state-of-world-fisheries-and-aquaculture/
[5] https://sdgs.un.org/partnerships/improving-assessment-marine-fishery-stocks-ensuring-data-accuracy-and-enhancing
[6] https://www.seafoodwatch.org/seafood-basics/sustainable-solutions/avoid-overfishing
[7] https://earth.org/solutions-to-overfishing/
[8] https://www.worldwildlife.org/threats/overfishing
[9] https://www.pnas.org/doi/10.1073/pnas.1702382114
[10] https://www.sciencedirect.com/science/article/abs/pii/S0308597X16302925
[11] https://www.fisheries.noaa.gov/national/sustainable-fisheries/status-stocks-2019
[12] https://www.pewtrusts.org/en/trust/archive/winter-2023/a-global-deal-to-end-harmful-fisheries-subsidies
[13] https://www.sciencedirect.com/science/article/pii/S0308597X23001884
[14] https://www.iisd.org/articles/policy-analysis/wto-fisheries-subsidies-negotiations
[15] https://caplinnews.fiu.edu/the-impact-of-overfishing-on-the-economy-ecosystem-and-social-life/
[16] https://ourworldindata.org/fish-and-overfishing
[17] https://www.fao.org/4/i0318e/i0318e02.pdf
[18] https://repository.library.noaa.gov/view/noaa/22014/noaa_22014_DS1.pdf
[19] https://www.pnas.org/doi/10.1073/pnas.2109154119
[20] https://www.researchgate.net/publication/333134999_Fishery_Socioeconomic_Outcomes_Tool_A_rapid_assessment_tool_for_evaluating_socioeconomic_performance_of_fisheries_managem
[21] https://www.sciencedirect.com/science/article/pii/S2468013323000372
[22] https://www.oceancare.org/wp-content/uploads/2024/10/TrawlSupremacy_Report_OceanCare_2024.pdf
[23] https://www.europarl.europa.eu/RegData/etudes/STUD/2024/762843/EPRS_STU(2024)762843_EN.pdf
[24] https://openknowledge.fao.org/server/api/core/bitstreams/66538eba-9c85-4504-8438-c1cf0a0a3903/content/sofia/2024/status-of-fishery-resources.html#fig18

[25] https://openknowledge.fao.org/server/api/core/bitstreams/66538eba-9c85-4504-8438-c1cf0a0a3903/content/sofia/2024/status-of-fishery-resources.html#fig19
[26] https://www.pewtrusts.org/en/research-and-analysis/articles/2022/09/20/global-deal-will-help-reduce-overfishing-and-improve-ocean-health
[27] https://ourworldindata.org/fish-and-overfishing#methods-of-fishing
[28] https://doi.org/10.1016/j.marpol.2016.05.010
[29] https://iss-foundation.org/
[30] https://doi.org/10.1016/j.joes.2023.07.004