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Governing fisheries for sustainability: how ITQs can contribute to the SDGs

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Introduction

Fisheries face growing challenges in an era of climate uncertainty, overfishing, globalized trade, and rising food demand. Traditional input-based controls (like gear restrictions, area closures or vessel size restrictions) often fail to control the fishing effort thus leading to overfishing (Nilsson et al., 2019). Additionally, input controls almost always lead to excess capitalization in fishing effort (i.e., an oversized fishing fleet), thereby reducing or even eliminating profits in many fisheries (Árnason, 1991; Hannesson, 2015). Because of these problems Individual Transferable Quotas (ITQ) have emerged as an important management tool to govern global fisheries. This management system was first introduced in the Netherlands in the late 1970s. By the early to mid-2000s, ITQs have been implemented in over 20 countries, encompassing more than 250 different species (Chu, 2009). This system transforms incentives. ITQs are market-based fisheries systems that assign secure, tradable fishing rights to harvest a specific quantity of fish, often a fixed percentage of the Total Allowable Catch (TAC). ITQ systems change how fishers utilize the fishing resource by introducing clear, long-term incentives for stewardship. When access rights are secure and transferable, conserving fish stocks is no longer just a regulatory burden. It becomes a profitable strategy. Healthier fish stocks reduce the cost of harvesting and enhance the long-term value of quotas, effectively aligning economic gain with ecological care (Árnason, 2013; Hoshino et al., 2020).

In 2015, the United Nations set out a bold agenda for global development. These were the Sustainable Development Goals (SDGs). These 17 goals cover everything from poverty alleviation to climate action (Pedersen et al., 2023). They are based on the assumption that social, economic, and environmental challenges are connected. It's clear that oceans and the fisheries that depend on them are very important to reaching those goals. In that regard, Goal 14, Life Below Water, is probably the most explicit link. It calls for safeguarding marine ecosystems through actions like rebuilding depleted fish stocks, ending overfishing, and phasing out harmful subsidies. But there are other goals related to fisheries. Goal 2 (Zero Hunger), for instance, highlights the essential role of fish in global nutrition, especially for poorer and coastal populations. Likewise, Goals 8 and 12 focus on decent work, economic growth, and responsible resource use. They are related to how fisheries contribute to livelihoods and long-term sustainability. Then there's climate. Goal 13 is also very important, because fisheries are both affected by and contributors to greenhouse gas emissions. Warming oceans, shifting stocks, and fuel-intensive harvesting methods place the sector in the middle of climate discussions (Singh et al., 2018). Questions of equity also surface quickly. Who owns the rights to fish? Who benefits from the resource? These are not technical details—they're political and moral questions tied to Goal 10 (Reduced

Inequalities) and Goal 1 (No Poverty). So, while fisheries are often discussed in narrow biological or economic terms, their footprint across the SDGs is wide and consequential.

This opinion article examines how ITQ systems relate (both positively and negatively) to the UN SDGs. It shows that ITQs can support SDGs tied to ocean health, economic efficiency, and emissions reduction. At the same time, it highlights the potential adverse effects of ITQ systems on SDGs related to fairness, especially regarding access, inclusion, and the impact on small fishing communities.

Analysis: how ITQs perform across sustainability dimensions

Individual Transferable Quota (ITQ) systems have become a cornerstone of fisheries management in many developed countries. Table 1 summarizes how ITQ systems align with selected SDGs. While ITQs tend to perform well on environmental and economic objectives, their social and equity outcomes are mixed. This uneven pattern reflects the complex trade-offs embedded in quota-based governance.

Empirical evidence from countries like New Zealand, Australia, Iceland, and Denmark suggests that ITQs promote allocative and technical efficiency. The ability to transfer quotas allows less efficient operators to exit the fishery, while more efficient firms buy up their quota and thus consolidate their quota holdings and invest in better planning, harvesting, marketing, and processing strategies (Lock and Leslie, 2007; Grafton and McIlgorm, 2009; Knútsson et al., 2016; Nielsen et al., 2023). These structural adjustments support key goals under SDG 14 (Life Below Water) and SDG 12 (Responsible Consumption and Production) by reducing waste and rationalizing fishing effort.

From an economic standpoint, ITQs have demonstrated their effectiveness, with a consistent outcome across all ITQ systems being a reduction in excessive fishing effort (i.e. a smaller fishing fleet). This reduction subsequently increases profits in the industry considerably. Access to secure harvesting rights enables fishers and firms to time landings, enhance quality, and invest in vessels and technology, thus increasing profitability. Studies from Iceland and New Zealand show sustained gains in productivity and earnings following the introduction of ITQs (Yandle and Dewees, 2008; Gunnlaugsson et al., 2018). These results support SDG 8 (Decent Work and Economic Growth) by improving the sector's financial viability and resilience.

However, social and distributional effects remain a persistent concern. A consistent outcome of ITQ implementation is the concentration of quota ownership, often leading to large, vertically integrated companies dominating the industry. In Iceland, the 10 largest firms controlled 58% of quotas in 2013, compared to 24% in 1992 (Gunnlaugsson and Sævaldsson, 2016). In New Zealand, by 2000, the largest 12 companies held 86% of quota compared to 49% in 1986 (Stewart et al., 2006). The universal outcome of ITQ systems is that fishing rights become very expensive. This is evident in Iceland, where in 2019, the total market value of permanent quota shares was estimated at 9.7 billion USD, around 780% of the yearly catch value (Gunnlaugsson and Valtýsson, 2022).

This invariably restricts access for small-scale and new entrants, as they often lack sufficient capital, undermining employment and weakening community cohesion. In Iceland, Canada, and New Zealand, studies report declining fishing opportunities in coastal communities and barriers to intergenerational renewal (Stewart et al., 2006; Nielsen et al., 2018; Gunnlaugsson et al., 2021; Lebedef and Chambers, 2023). These patterns are at odds with SDG 1 (No Poverty) and SDG 10 (Reduced Inequalities), which emphasize inclusive access to resources and the reduction of structural disadvantage.

The social impacts of ITQ systems are not highly variable—they are strikingly similar across countries. In Denmark, the 2007 quota reforms increased profitability and reduced overcapacity, but they also accelerated the decline of small fishing ports and undermined community-based fisheries (Nielsen et al., 2018, 2023). Norway's use of individual vessel quotas produced nearly identical effects: improved efficiency accompanied by regional inequality and barriers for new entrants (Standal and Aarset, 2008; Hannesson, 2013). In Iceland, employment in fishing and fish processing fell by nearly 50% between the mid-1990s and 2008 (Gunnlaugsson and Sævaldsson, 2016). New Zealand followed a similar trajectory: after ITQs were introduced in 1986, more than 3,000 mainly small-scale fishers exited the industry over the late 1980s and 1990s (Stewart et al., 2006). These repeated patterns across different national settings suggest that social exclusion is not an unintended side effect, but an inherent risk of ITQ systems. Addressing these outcomes requires complementary policies that go beyond market efficiency and explicitly protect equity and access.

Beyond ecological and economic dimensions, ITQs also have important implications for climate action. Capture fisheries are estimated to account for roughly 4% of the global food system's greenhouse gas (GHG) emissions and about 0.5% of total anthropogenic CO₂ emissions (Parker et al., 2018). These emissions are primarily driven by fuel consumption, which in turn depends on stock levels, gear type, and fleet structure. Although capture fisheries are relatively low emitters compared to land-based protein sources, their fuel efficiency has declined over time in many regions. ITQ systems offer potential to reduce emissions indirectly by minimizing unnecessary effort and supporting better planning. Nordic studies have shown that fisheries governed by ITQs should have lower emissions per unit of catch compared to those managed under input controls (Waldo et al., 2016). The case of Iceland is especially instructive. A detailed study of the Icelandic ITQ-regulated fleet from 1997 to 2018 found that CO₂ emissions per unit of catch fell by approximately 40% over the period. The ITQ system was fully implemented in Iceland's fisheries in 1990; consequently, this research covers most of the period during which this management system has governed Iceland's fisheries and demonstrates its effects on emissions. The study's findings indicated that the most important drivers of lower emissions in Iceland, were high catch volumes and larger fish stocks. In contrast, fuel prices had a smaller effect, and technological improvements played only a minor role. The study found that stock rebuilding not only increased output and profits but also reduced emissions per unit of output. It concluded as long as the fisheries management system preserves incentives for efficient operations, as the Icelandic ITQ system does, the ITQ system should lead to lower emissions

TABLE 1 Alignment of ITQ systems with selected UN Sustainable Development Goals (SDGs).

UN SDG	Goal description	ITQ alignment with UN SDGs	Summary
SDG 1: no poverty	End poverty in all its forms everywhere	No	Quota concentration and high entry barriers reduce access for small-scale and new fishers
SDG 2: zero hunger	End hunger, achieve food security, improve nutrition	Mixed	Increases supply efficiency, but may reduce local employment and food access in coastal areas
SDG 8: decent work and economic growth	Promote sustained, inclusive economic growth and employment	Partly	Supports higher productivity and profitability, but with job losses and consolidation
SDG 10: reduced inequalities	Reduce inequality within and among countries	No	Often leads to wealth concentration and regional disparities
SDG 12: responsible consumption and production	Ensure sustainable consumption and production patterns	Yes (mainly production side)	Encourages efficient resource use, less waste, and better harvest timing. These production-side gains can indirectly support sustainable consumption through better quality, traceability, and availability. However, ITQs do not address consumer-side issues such as certification, species diversity, or food waste
SDG 13: climate action	Take urgent action to combat climate change and its impacts	Yes	Reduces emissions per catch unit, but not by design; climate benefits are incidental
SDG 14: life below water	Conserve and sustainably use oceans, seas, and marine resources	Yes	Aligns harvests with biological targets, incentivizes long-term stewardship

in fisheries (Kristófersson et al., 2021). These findings confirm that well-managed ITQ systems can support SDG 13 alongside economic and ecological goals.

Discussion

The evidence presented here indicates that ITQ systems can make a meaningful contribution to several SDGs, particularly those focused on ecological conservation, economic efficiency, and climate mitigation. ITQs have often played a role in stabilizing fish stocks, reducing fleet overcapacity, and increasing profitability across a range of countries. These outcomes align closely with SDG 14 (Life Below Water), SDG 12 (Responsible Consumption and Production), and SDG 8 (Decent Work and Economic Growth). However, these gains have been accompanied by persistent challenges related to social equity and inclusion—issues at the core of SDG 1 (No Poverty) and SDG 10 (Reduced Inequalities).

The Icelandic case provides a valuable illustration. The substantial decrease in emissions observed in Iceland is notable and primarily attributed to the expansion of fish stocks. This expansion was facilitated by the ITQ system and the environmental stewardship practices implemented by quota holders in Iceland. These findings reinforce the broader conclusion that well-managed ITQ systems can indirectly contribute to SDG 13 (Climate Action) by increasing fuel efficiency and lowering emissions through rationalized effort and healthier fish stocks. Yet, this success has not been without a social cost. The consolidation of quota among a smaller number of operators has reduced access for small-scale fishers and weakened the social fabric of some coastal communities in Iceland. Similar patterns have been observed in Denmark, Sweden, and New Zealand, where ITQ implementation coincided

with a decline in rural employment and the marginalization of less-capitalized actors. These outcomes point to a core tension in ITQ governance: while market mechanisms improve efficiency, they normally fail to safeguard equity without complementary policy instruments.

Importantly, the climate benefits of ITQs, though significant, remain largely incidental. Most ITQ systems were not designed with emission reduction in mind. They happen to reduce fuel use by optimizing fleet structure and scheduling, but climate mitigation is rarely an explicit objective. As international pressure to decarbonize intensifies, this represents a missed opportunity. ITQs could be modified to incorporate carbon pricing, fuel-efficiency standards, or sustainability-linked quota conditions. Such reforms would allow ITQ-based systems to support SDG 13 more directly, without undermining their economic rationale.

There is also the question of institutional prerequisites. ITQs are not plug-and-play solutions. They demand a great deal: clear property rights, reliable catch data, strong monitoring and enforcement, and the capacity to adjudicate disputes and prevent abuse. These governance pillars are present, more or less, in OECD countries. But in many developing countries—especially where artisanal fleets dominate, enforcement capacity is thin, and infrastructure is limited. There, ITQs may simply not be feasible to manage fisheries. The governing system presumes a level of administrative control and compliance that cannot be taken for granted, and in such settings, the risk is that poorly implemented ITQs could entrench inequality and fuel informal markets.

The broader lesson is not that ITQs are flawed or foolproof, but that they are powerful tools—ones that require careful design to reach their full potential. When embedded in sound institutions and complemented by inclusive policies, ITQs can advance a wide range of SDGs. They are particularly effective in improving environmental outcomes, enhancing economic

efficiency, and—perhaps most strikingly—reducing emissions through more rationalized, fuel-efficient harvesting. These climate benefits, while often incidental, are real and increasingly relevant in a decarbonizing world.

ITQ systems have shown strong potential to advance several UN SDGs. They support SDG 14 by rebuilding fish stocks, SDG 12 through more efficient and less wasteful production, SDG 8 by improving profitability and resilience, and SDG 13 by indirectly lowering emissions. These outcomes are well-documented in countries like Iceland, New Zealand, and Denmark. Yet the trade-offs are real. Concentration of quota, barriers for small-scale entrants, and regional disparities are not rare exceptions—they are recurring outcomes of most ITQ systems. These effects can be mitigated but not entirely avoided. That reality does not undermine the value of ITQs—it simply underscores the need for complementary policies that address equity, community stability, and long-term access. Rather than discard a proven tool, the task is to refine it. With safeguards to protect inclusion, and design features that reward climate performance and responsible ownership, ITQs can continue to serve as a powerful mechanism for aligning fisheries governance with the broader SDG agenda. Therefore, ITQs can deliver real ecological and economic gains. But to stay legitimate they must be paired with clear social safeguards—quota redistribution, community allocations, and targeted livelihood support—otherwise environmental wins will become social losses.

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References

- Árnason, R. (1991). Efficient management of ocean fisheries. *Eur. Econ. Rev.* 35:408. doi: 10.1016/0014-2921(91)90142-6
- Árnason, R. (2013). “Individual transferable quotas in fisheries,” in *Elsevier eBooks*. London: Elsevier BV, 183.
- Chu, C. (2009). Thirty years later: the global growth of ITQs and their influence on stock status in marine fisheries. *Fish Fisheries* 10, 217–230. doi: 10.1111/j.1467-2979.2008.00313.x
- Grafton, R. Q., and McIlgorm, A. (2009). Ex ante evaluation of the costs and benefits of individual transferable quotas: a case-study of seven Australian commonwealth fisheries. *Marine Policy* 33:714. doi: 10.1016/j.marpol.2009.02.001
- Gunnlaugsson, S., and Valtýsson, H. (2022). Sustainability and wealth creation, but no consensus: recent decades in Iceland's ITQ-managed fisheries. *Marine Policy* 135:104836. doi: 10.1016/j.marpol.2021.104836
- Gunnlaugsson, S. B., Kristófersson, D. M., and Agnarsson, S. (2018). Fishing for a fee: Resource rent taxation in Iceland's fisheries. *Ocean Coastal Managem.* 163:141. doi: 10.1016/j.ocecoaman.2018.06.001
- Gunnlaugsson, S. B., and Sævaldsson, H. (2016). The Icelandic fishing industry: its development and financial performance under a uniform individual quota system. *Marine Policy* 71, 73–81. doi: 10.1016/j.marpol.2016.05.018
- Gunnlaugsson, S. B., Sævaldsson, H., Kristófersson, D. M., Agnarsson, S., and Ishimura, G. (2021). Derby versus ITQ: Iceland's coastal fisheries explained and compared to its ITQ-managed fisheries. *Regional Stud. Marine Sci.* 42:101665. doi: 10.1016/j.rsma.2021.101665
- Hannesson, R. (2013). Norway's experience with ITQs. *Marine Policy* 37:264. doi: 10.1016/j.marpol.2012.05.008
- Hannesson, R. (2015). World fisheries in crisis? *Marine Resour. Econ.* 30:251. doi: 10.1086/680443
- Hoshino, E., van Putten, I., Pascoe, S., and Vieira, S. (2020). Individual transferable quotas in achieving multiple objectives of fisheries management. *Marine Policy* 113:103744. doi: 10.1016/j.marpol.2019.103744
- Knútsson, Ö., Kristófersson, D. M., and Gestsson, H. (2016). The effects of fisheries management on the Icelandic demersal fish value chain. *Marine Policy* 63:172. doi: 10.1016/j.marpol.2015.03.015
- Kristófersson, D. M., Gunnlaugsson, S. B., and Valtýsson, H. Þ. (2021). Factors affecting greenhouse gas emissions in fisheries: evidence from Iceland's demersal fisheries. *ICES J. Marine Sci.* 78:2385. doi: 10.1093/icesjms/fsab109
- Lebedef, E. A., and Chambers, C. (2023). Youth and newcomers in Icelandic fisheries: opportunities and obstacles. *Maritime Stud.* 22:3. doi: 10.1007/s40152-023-00326-0
- Lock, K., and Leslie, S. (2007). New Zealand's quota management system: a history of the first 20 years. *SSRN Elect. J.* 83. doi: 10.2139/ssrn.978115
- Nielsen, M., Hoff, A., Nielsen, R., Andersen, P., Waldo, S., Hammarlund, C., et al. (2018). *Structural Adjustment and Regulation of Nordic Fisheries until 2025*. Copenhagen: TemaNord.
- Nielsen, R., Hoff, A., and Andersen, J. L. (2023). Structural and productivity changes from introducing strong user rights in the Danish demersal fisheries. *Marine Policy* 147:105385. doi: 10.1016/j.marpol.2022.105385
- Nilsson, J. A., Fulton, E. A., Johnson, C., and Hawardfs, M. (2019). How to sustain fisheries: expert knowledge from 34 nations. *Water* 11:213. doi: 10.3390/w11020213

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- Parker, R., Blanchard, J. L., Gardner, C., Green, B. S., Hartmann, K., Tyedmers, P. H., et al. (2018). Fuel use and greenhouse gas emissions of world fisheries. *Nature Clim. Change* 8:333. doi: 10.1038/s41558-018-0117-x
- Pedersen, A. B., Hickmann, T., Renn, O., Eckert, N., Jax, K., Lepenies, R., et al. (2023). SDGs at the halfway point: How the 17 global goals address risks and wicked problems. *AMBIO* 52:679. doi: 10.1007/s13280-023-01837-0
- Singh, G. G., Cisneros-Montemayor, A. M., Swartz, W., Cheung, W., Guy, J. A., Kenny, T. A., et al. (2018). A rapid assessment of co-benefits and trade-offs among Sustainable Development Goals. *Marine Policy* 93:223. doi: 10.1016/j.marpol.2017.05.030
- Standal, D., and Aarset, B. (2008). The IVQ regime in Norway: a stable alternative to an ITQ regime? *Marine Policy* 32:663. doi: 10.1016/j.marpol.2007.11.007
- Stewart, J., Walshe, K., and Moodie, B. (2006). The demise of the small fisher? A profile of exiters from the New Zealand fishery. *Marine Policy* 30:328. doi: 10.1016/j.marpol.2005.03.006
- Waldo, S., Jensen, F., Nielsen, M., Ellefsen, H., Hallgrímsson, J., Hammarlund, C., et al. (2016). Regulating multiple externalities: the case of nordic fisheries. *Marine Resour. Econ.* 31:233. doi: 10.1086/685286
- Yandle, T., and Dewees, C. M. (2008). Consolidation in an individual transferable quota regime: lessons from New Zealand, 1986–1999. *Environ. Managem.* 41:915. doi: 10.1007/s00267-008-9081-y