



## Reducing bycatch through a risk pool: A case study of the U.S. West Coast groundfish fishery

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### ABSTRACT

Voluntary collective agreements among fishermen can improve the environmental and economic performance of a fishery, particularly when local leadership, strong incentives, catch accountability, and operational support are in place. Rights-based fisheries, such as Individual Fishing Quota (IFQ) systems, incentivize fishermen to act collectively to reduce fishing impacts, enhance stock health, and improve economic outcomes. However, developing cooperatives requires durable contracts, operational capacity, funding, and the ability to track, monitor, and enforce agreed-upon catches and fishing practices. This project focuses on the U.S. West Coast groundfish trawl IFQ fishery, and how the formation of a voluntary collective agreement, in the form of a bycatch risk pool (California Groundfish Collective), achieved improved fishery performance and other ancillary benefits. Up-front investment in the risk pool by a conservation non-governmental organization (NGO) provided both capacity and quota to cover transaction costs and incentivize transition to a cooperative model that was implemented across 5 ports and more than 48,000 km<sup>2</sup> of fishing grounds off California. The challenges encountered in developing and operating the risk pool offer insights into designing and implementing voluntary collective agreements. By using spatial fishing plans and technology for collecting and sharing catch information, risk pool members reduced bycatch of overfished species relative to the fleet at large. Risk pool members were also able to use their spatial fishing data to inform a seafood sustainability rating and propose areas for Essential Fish Habitat protection, their quota pounds to support collaborative research on overfished species, and their collective membership to advocate for policy.

### 1. Introduction

Fisheries productivity and sustainability is limited worldwide by common pool resource problems such as overfishing, bycatch, and habitat destruction [1,2]. Self-interested individuals without incentives to pursue common good are in a race for fish, often at the cost of fleet profits and resource sustainability [3,4]. Rights-based fishery management systems, such as transferable individual fishing quotas (IFQs), can lead to improved biological and economic productivity of fisheries by aligning incentives of resource users with management and conservation objectives [5–7]. Under rights-based systems, harvest rights or

dedicated access privileges can be allocated in the form of individual and tradable quotas, community or group rights, or exclusive spatial rights. Fishermen, communities, and cooperatives with secure harvest rights have a financial stake in the fishery, and benefit from actions that sustain or enhance the fishery [4,5,8]. Holding secure rights in a fishery provides users with strong incentives to promote sustainability, although rights-based systems alone may be inadequate to solve problems associated with mixed-stock fisheries management, as well as to address operational and management costs and risks that are disproportionate to fishery value [6,9–13].

Voluntary collective agreements have been shown to address

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collective action problems and other challenges across fishery contexts ranging from management limitations to rights-based systems [14–16]. Fishery cooperatives form when a group of fishermen, vessel, or quota share owners agree to share resources, abide by rules, enforcement mechanisms, and collectively manage some aspect of a fishery [16,17]. These types of voluntary agreements can facilitate coordination and change behaviors or practices to improve economic efficiency, enhance enforcement and compliance, and increase local stewardship [6,14,16–18]. Even in the context of rights-based fisheries, there are challenges to establishing strong and durable collective agreements that can achieve fishery sustainability benefits. These challenges include a lack of sufficient incentives; lack of leadership; market instability; lack of capacity and funding to organize, manage, and oversee collective actions; lack of trust or social cohesion; and the presence of outsider actors that threaten benefits [15,19,20].

As an important case study, the U.S. West Coast groundfish trawl IFQ fishery faces a key challenge common to many fisheries: reducing bycatch of overfished species in a mixed-stock fishery. In 2011, the West Coast groundfish trawl fishery transitioned from a limited entry permit program operating with restrictive trip limits to an IFQ management system. The IFQ program allocated quota to individuals based on catch history, and required 100% observer monitoring of fishing activity and offloading to maintain individual accountability for all catch, whether landed or discarded. Importantly, a handful of federally-declared overfished species with low total allowable catch limits constrained the fishery because they were difficult to avoid while fishing for target stocks, and were considered bycatch [11,21,22]. Prior to the transition to the IFQ program, there was less monitoring and there were no penalties for discarding bycatch of overfished species. When the groundfish IFQ program was implemented, very small allocations of overfished species quota presented new financial risks and operational challenges to fishermen. Overfished species catch events were highly variable in timing, location, and magnitude, and could occur even when taking all reasonable avoidance measures. As a result, fishermen could unintentionally exceed their entire individual quota allocation for one or more species during a single ‘disaster’ tow or trip [22,24]. If that happened, the fisherman was required to cover the quota deficit before taking another fishing trip. Finding and obtaining overfished species quota to cover a deficit could be difficult or prohibitively expensive due to the limited amounts of quota and uncertain availability on the quota market.

Economic theory and empirical studies have shown quota markets can fail in efficiently allocating quota or can exhibit high price variability when bycatch occurrences are rare, uncertain, and highly variable, as was the case in the West Coast groundfish fishery [23,24]. The variability and uncertainty of bycatch of overfished species creates financial risk in addition to other common risks that fishermen face [25,26], and reduces the management efficiencies of the IFQ system. Pre-emptive risk management through formation of cooperative “risk pools” that transfer financial risk away from individuals and redistribute costs of unexpected financial losses associated with quota can address uncertainty and variability in bycatch occurrence [23,26,27]. Risk pools, a form of risk management used widely in the insurance industry, are voluntary collective agreements that can be applied in quota-based fisheries to establish a common fund of quota that participants can draw from during the fishing season, on the condition that they comply with the risk pool rules [28]. Rules may stipulate fishing strategies and information sharing to reduce collective bycatch risk. Risk pools are intended to reduce individual incentives to ‘hoard’ overfished species quota and bycatch information, reduce transaction costs associated with obtaining quota, and reduce the risk that an overfished species catch event could exceed the quota available to cover it [24].

In this study, commercial fishermen worked in collaboration with The Nature Conservancy, (TNC) a conservation NGO, to demonstrate how to transition from an individual harvesting model to a voluntary

cooperative risk pool. Prior to the implementation of the IFQ program, TNC conducted a buyout of six vessels and 13 limited entry permits [34]. After the IFQ program was established, TNC owned approximately 7% of the total quota share for the West Coast fishery, which included overfished species quota. The Nature Conservancy collaborated with fishermen to develop and implement a risk pool, now known as the “California Groundfish Collective,” aimed at reducing bycatch of overfished species and financial risks to fishermen. This risk pool has been referred to in numerous publications [e.g., [17,22,23,24,28]], but to date there has not been an analysis of how it was operationalized nor how successful it has been at meeting intended goals. This study documents how challenges to forming the California Groundfish Collective were overcome, how its fishing plans and information-sharing aimed to reduce bycatch and transaction costs, and how it produced unanticipated benefits for its members.

## 2. U.S. West Coast groundfish fishery background

The U.S. West Coast groundfish fishery is a dynamic, multi-species fishery with complex management and distinct challenges. The fishery extends along the continental shelf and slope of California, Oregon, and Washington, and comprises over 90 species of flatfish, scorpaenids (i.e. rockfishes), roundfish and others [29–31]. While some commercial vessels in the groundfish fishery use ‘fixed’ gear in the form of baited hook and line or pots and traps, most of the harvest by volume is caught by vessels using trawl gear, which is not highly selective [32]. Most of the fishing effort is directed at a few high-value target species that are relatively abundant, fast growing, and short-lived, but less productive and longer-lived stocks co-occur and are typically caught with target species [21,22,31].

Under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the Pacific Fishery Management Council (PFMC) is tasked with developing regional groundfish management measures that are implemented by the National Marine Fisheries Service (NMFS), which is a division of the U.S. Department of Commerce. The groundfish fishery experienced considerable growth between the mid-1970s and early 1980s, with landings peaking in 1981 and 1982. Fishery landings declined through the 1990s, and the PFMC responded with a suite of effort controls aimed at reversing the trend. These controls included gear restrictions, trip limits, shortened fishing seasons, bycatch limits, and implementation of a trawl limited entry. Despite these changes, groundfish stocks, landings, and fishing revenue continued to decline, and in 2000, the federal government declared the fishery an economic disaster [32].

Between 1999 and 2009, federal fisheries managers declared nine species of groundfish as overfished, and implemented rebuilding plans and management measures intended to minimize their take and rebuild their populations over decadal timelines [30]. Gear restrictions and spatial management measures moved trawl effort from rocky habitat and depth contours where overfished species are primarily found [33]. Spatial management measures included depth-based and gear-based fishery closure areas called ‘Rockfish Conservation Areas’ (RCAs) established in 2002, and restrictions on trawling in ‘Essential Fish Habitat’ (EFH) areas established in 2006 [31,33,34]. In addition to these spatial restrictions, the PFMC implemented increased constraints on catch, adjusting the quota for target species found in the same habitats as overfished species and imposing an aggregate cap on overfished species catch [31]. While some of the overfished species have been recently declared rebuilt (e.g. widow rockfish, canary rockfish), other species (e.g. yelloweye rockfish) are slower-growing and may take many years to recover [35].

In 2010, the PFMC approved Amendment 20 to the West Coast Groundfish Fishery Management Plan, which established the trawl IFQ program. That program created “quota shares” (QS) for 29 species and species complexes, which would be allocated to limited entry trawl permit holders and regulated harvester cooperatives. Quota share

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