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# History of the West Coast groundfish trawl fishery: Tracking socioeconomic characteristics across different management policies in a multispecies fishery

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ABSTRACT

The Pacific groundfish fishery management plan was first approved in 1982, formalizing what would become one of the most economically important fisheries on the West Coast of the U.S. In 2015, the fishery as a whole generated approximately $170 million in income and supported almost 3,000 jobs. Since its inception, the fishery management plan has been amended more than 30 times, transforming a fishery characterized by high discards and overcapacity into one managed under a catch share program that was designed to reduce fishing capacity, help rebuild overfished stocks, and provide for a viable, profitable, and efficient fishery. This paper reviews historical management measures as well as changes in both the fishery resource and the operational characteristics of fishery participants, such as rebuilding stocks, reduced bycatch, seasonality of catch, diversification, and revenues. Observed changes vary across sector and target species, but economic data highlight, among other findings, that consolidation has occurred across shorebased sectors, the seasonality of landings has shifted for whiting sectors, and fleet-wide days at sea have decreased for the non-whiting groundfish fleet. Though these changes cannot be directly attributed to any single management measure, the transition to catch shares coincided with increasing economic benefits to many harvesters and communities in a fishery that was declared an economic disaster less than two decades ago. This review can serve as a resource for managers, stakeholders, and researchers involved in developing, implementing, and analyzing regulations in complex multispecies fisheries.

## 1. Introduction

Designing fisheries management regulations involves choosing between various alternatives in order to meet the diverse goals outlined in a Fishery Management Plan (FMP[1]) while weighing the trade-offs between the potential socioeconomic and biological impacts of each option, and the distribution of those impacts across participants. The implementation of catch share programs is no exception to this, where the consideration of anticipated impacts and the execution of divisive decisions are inevitably complex and controversial. Despite these challenges, rights-based management frameworks such as catch shares have grown in popularity around the world, sparking fervent debate about their efficacy [2,4,6,24,62]. Though several efforts to synthesize outcomes across various metrics for existing catch share programs collectively underscore mixed results [3,5,7,9,11,13,25,38,56,65], one thing is clear: the design of the program and the context in which it is implemented matter. This paper documents how this is true for the West Coast groundfish trawl catch share program ("CS Program") by examining historical management measures alongside socioeconomic and operational changes occurring in the West Coast groundfish fishery ("Fishery") that highlight the complexities and challenges of managing, evaluating, and studying a multispecies catch share fishery.

The CS Program implemented for the limited entry trawl component of the Fishery in 2011 followed nearly three decades of gradual management changes (see Supplemental Information) aimed at reducing overcapacity and building an efficient and profitable fishery. The implementation of the CS Program was anticipated to consolidate the fleet, reduce discarding, help rebuild overfished stocks, and lead to higher revenues for remaining participants ([49], p. xviii). Since 2011, the Fishery has experienced fleet consolidation, reduced bycatch, regional redistribution of fishing effort, increased target species annual catch limits, and gained the flexibility to buy, sell, or lease trawl quota

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[1] Defined as a plan developed by fishery management councils to contain conservation and management measures for fishery resources as required by the Magnuson-Stevens Act.

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[32]. This descriptive history of management changes and related shifts in the biological and socioeconomic landscapes of the Fishery and fishery resource is a useful tool for informing future policy alternatives. This complex and intricately managed CS Program has some of the most comprehensive economic data available for analysis, making this review a significant contribution to the tome of information for fisheries scientists and managers.

### 1.1. Fishery description

The Fishery takes place off the coasts of Washington, Oregon, and California, and includes over 87 species harvested under limited entry, open access, recreational, and tribal components using trawls and fixed gear such as longlines and pots. The CS Program encompasses shorebased buyers and the three limited entry trawl sectors of the Fishery: shorebased catcher vessels, at-sea catcher-processors, and at-sea motherships and associated catcher vessels. Primary target species for shorebased vessels include Pacific whiting and other groundfish such as sablefish, rockfish, Dover sole, petrale sole, and lingcod, all harvested under transferable individual fishing quotas (IFQs) allocated to limited entry permit owners based on catch history. At-sea catcher-processors and motherships operate as cooperatives (co-ops) and target Pacific whiting while participating in the CS Program, but spend the majority of their time operating in the Alaska pollock fishery in the Bering Sea and Aleutian Islands.

Due to the co-occurring nature of species managed under the CS Program, bycatch of overfished and rebuilding stocks has been an ongoing concern and motivation for executing various management measures over time. The impact of management measures varies substantially across participants depending on the size, location, diversity of their operations (ranging from small owner-operated vessels to large multi-entity companies), and how much time they spend participating in the CS Program.

## 2. Management history

### 2.1. Expanding industry capacity and scientific understanding: 1976–1992

Groundfish landings had increased rapidly throughout the 1970s due to growing market demand, improved processing technologies, and policies designed to encourage expansion of domestic fisheries. After the 1976 signing of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act; MSA) that extended the boundaries of national waters, large-scale harvesting and at-sea processing of Pacific whiting became federally managed under a preliminary management plan for foreign trawl vessels operating off the West Coast ([33]; 42 FR 8578). The Pacific Groundfish Fishery Management Plan (FMP) was first approved in 1982 ([34]; 47 FR 43964) in accordance with MSA mandates to promote sustainable fisheries management, formalizing the Fishery and the foundation from which it has continued to evolve over time (see Supplemental Information). By 1989, directed foreign fishing was completely supplanted by joint venture agreements (U.S. harvesters delivering to foreign processing vessels), and then joint venture agreements were further and wholly replaced by domestic operations by 1991.[2] This "Americanization" of the Fishery fostered increased domestic processing capacity, with shorebased whiting processing plants focusing on surimi ramping up in 1992 ([40,41], p. 10). The continued development of shorebased processing operations was reliant on international market demand and the transition away from primarily surimi to a greater diversity of product types, which fueled the construction of additional facilities along the coast.

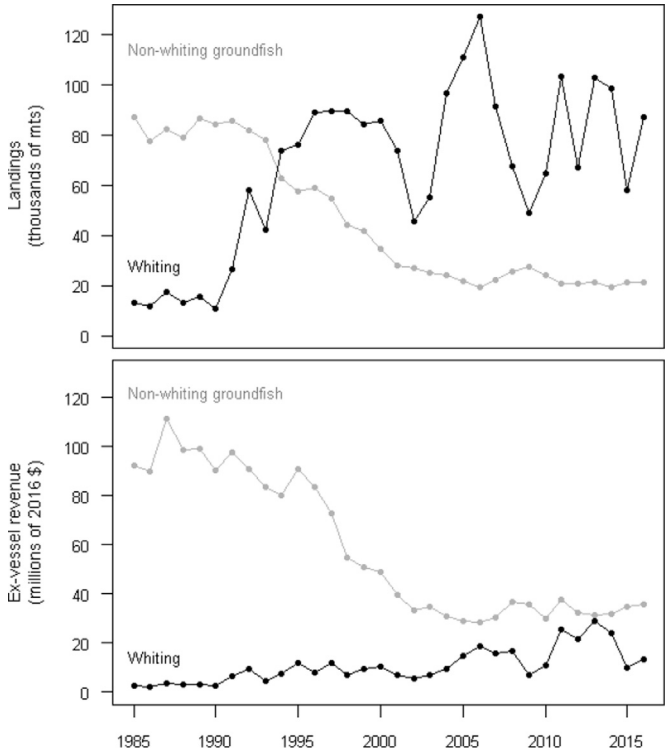


**Fig. 1.** Total fishery-wide landings (top) and ex-vessel revenue (bottom) from shorebased trawl vessels harvesting Pacific whiting (black) and non-whiting groundfish (grey) from 1981 to 2016.

Shortly after the FMP was established in 1982, the Fishery was facing declining biomass and catches of non-whiting stocks as they were being fished down to what were believed to be maximum sustainable yield biomass levels ($B_{msy}$). Total shoreside landings reached a historical high in 1982 at just over 120,000 metric tons (mt) worth $53 million in ex-vessel revenue, the majority of which was non-whiting groundfish due to the relatively lower domestic whiting catches at the time ([49], p. 119) (Fig. 1). The management philosophy of fishing a stock to $B_{msy}$ combined with overestimation of stock productivity led to what are retrospectively recognized as having been unsustainable harvest levels ([45], p. 40). As a result, several groundfish species[3] were declared overfished starting in 1999. By 2000, non-whiting groundfish landings had decreased by two-thirds and revenue had decreased by almost half relative to the peak in 1982 (Fig. 1).

As non-whiting groundfish stocks were showing evidence of decline, landings of Pacific whiting were ramping up, rising from 1,000 metric tons to 85,000 metric tons from 1983 to 2000 ([49], p. 119), facilitated by increasing domestic harvesting and processing capacity. However, these increasing landings were coinciding with declining relative spawning stock biomass (total weight of mature female fish in the stock), which had dropped from 94% to 29% by 2000 due to a combination of low stock recruitment years, ocean conditions, and heavy fishing pressure [64]. Since the mid-2000s, Pacific whiting landings have fluctuated, largely reflecting changes in total allowable catch (TAC), but have remained high relative to non-whiting groundfish (Fig. 1).

During the first decades under the FMP, the predominant concern and focus of most management actions was controlling fishing effort, as the trawl fleet was heavily overcapitalized, with more than 500 vessels in the early 1980s and more than 400 in the early 1990s (Fig. 2). The number of participants was estimated to be 2–3 times the number

[2] Though joint venture operations were no longer occurring, the Council did not officially amend the FMP to exclude them until 2000 when they declared groundfish as being fully utilized by domestic harvesters and processors in FMP Amendment 12 (65 FR 59815; [36]).

[3] Included bocaccio rockfish, canary rockfish, cowcod, darkblotched rockfish, lingcod, Pacific ocean perch, Pacific whiting, widow rockfish, and yelloweye rockfish.