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Comprehensive incentives for reducing Chinook salmon bycatch in the Bering Sea walleye Pollock fishery: Individual tradable encounter credits

George Sugihara [a,*], Keith R. Criddle [b], Mac McQuown [c], Alfredo Giron-Nava [a], Ethan Deyle [a], Chase James [a], Adrienne Lee [d], Gerald Pao [e], Erik Saberski [a], Hao Ye [a,f],

[a] Scripps Institution of Oceanography, University of California San Diego, 9500 Gilman Dr., La Jolla, CA 92093, USA
[b] School of Fisheries and Ocean Science, University of Alaska Fairbanks, 17101 Pt. Lena Loop Rd., Juneau, AK 99801, USA
[c] Diversified Credit Investments, 201 Spear St. Suite 250, San Francisco, CA 94105, USA
[d] Division of Biological Sciences, University of California San Diego, 9500 Gilman Dr., La Jolla, CA 92093, USA
[e] Salk Institute for Biological Sciences, 10010 North Torrey Pines Rd., La Jolla, CA 92037, USA
[f] Department of Wildlife Ecology and Conservation, University of Florida, 110 Newins-Ziegler Hall, Gainesville, FL 32611, USA

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ABSTRACT

After record salmon bycatch in 2007 by the Eastern Bering Sea and Aleutian Islands fishery for walleye Pollock, the North Pacific Fishery Management Council (NPFMC) concluded that additional management strategies were necessary to further control salmon bycatch. The Preliminary Preferred Alternative (PPA) was selected in April 2009 and implemented in January 2011 as Amendment 91. In this paper, we present the original comprehensive bycatch credits allocation and trading plan as designed by the first author as commissioned by the Alaskan Pollock Fleet for Chinook salmon, the Comprehensive Incentive Plan (CIP). The CIP, which uses individual (vessel-level) tradable encounter credits (ITEC), included incentives that make up the backbone of Amendment 91/PPA. While salmon bycatch has been reduced since the implementation of the PPA, the current amendment does not have individual vessel incentives that vary with the vulnerability of salmon populations. The CIP approach presented here provides robust vessel-level incentives to reduce Chinook salmon bycatch under all levels of salmon abundance, but particularly when salmon populations are at their lowest levels and are most vulnerable. The specific financial incentive structure in the full plan, with trading of by-catch liabilities among vessels, can be applied well in other fisheries where bycatch threatens both sustainability and profitability.

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1. Introduction

1.1. The BSAI walleye Pollock fishery

The Eastern Bering Sea and Aleutian Islands (BSAI) fishery for walleye Pollock (*Theragra chalcogramma*) yields gross ex-vessel revenues in excess of $300 million and is arguably, the premier U.S. fishery. Over time, this fishery has slowly been rationalized, with the last major change occurring in 1998 with the passage of the American Fisheries Act (AFA) (AFA, 1998). This regulation established permanent sector allocations of the total allowable catch (TAC) in addition to placing a moratorium on the entry of new vessels, setting parameters for the formation of cooperatives within sectors and providing funds to buy out nine of the twenty-nine then active catcher-processors. All sectors quickly organized under inter-cooperative agreements – civil contracts – that created sub-sector allocations to each firm. Sub-sector allocations share many of the characteristics of individual fishing quotas (IFQs): they represent an assured opportunity to harvest a known fraction of the TAC and they can be sold or leased within their sector. Since implementation of the inter-cooperative agreements, the catcher boat and catcher processor fleets have consolidated and become more economically efficient, utilization rates (pounds of finished product per pound of fish caught) have increased, production has shifted towards higher-value product forms, and economic returns have increased (Criddle and Macinko, 2000; Anderson, 2002; Felthoven, 2002; NPFMC, 2002; Wilen and Richardson, 2008).

1.2. Chinook salmon bycatch

The walleye Pollock fishery uses mid-water trawls to target schools of fish. This fishery has very low bycatch rates (e.g., 1.1% by weight in 2006 and 1.2% by weight in 2007) and even lower

* Corresponding author.
E-mail address: gsugihara@ucsd.edu (G. Sugihara).

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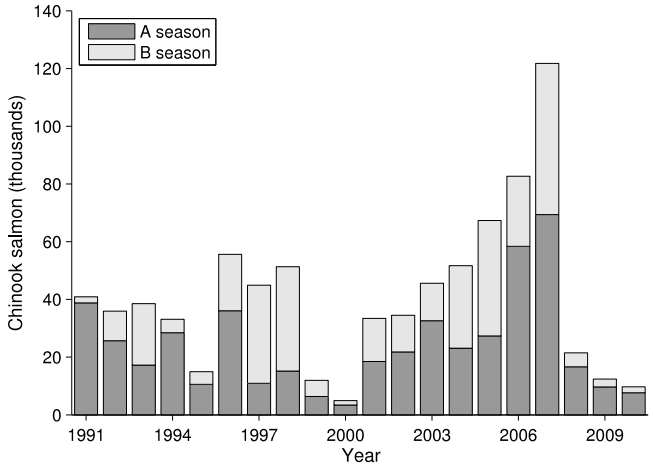

Fig. 1. Chinook salmon bycatch in the BSAI Pollock mid-water trawl fishery, 1991–2010.

discard rates (e.g., 0.28% in 2006 and 0.30% in 2007) (Hiatt et al., 2008). Nevertheless, the magnitude of walleye Pollock catches in the Bering Sea is so large that even small bycatch rates represent substantial levels of bycatch mortality. In 2007, for example, bycatch mortality included 264 mt of Pacific halibut (*Hippoglossus stenolepis*), 338 mt of Pacific herring (*Clupea pallasi*), 3.8 thousand crabs (*Paralithodes sp.*, *Chionoecetes sp.*, and *Lithodes sp.*), 109.1 thousand Chinook salmon (*Oncorhynchus tshawytscha*), and 83.3 thousand other salmon (*O. sp.*) (Hiatt et al., 2008). In particular, Chinook Salmon bycatch is highly variable from year to year and from the A season (January 20–June 10) to the B season (June 10–November 1) (Fig. 1), making necessary a plan to consistently regulate and lower its impact on the population.

Measures to manage Chinook salmon bycatch date back to the early 1980s when an overall cap of 55,250 Chinook salmon was set for foreign and joint-venture trawl fisheries (NPFMC, 1982, 1983, 1984). Fixed portions of the overall cap were allocated to each nation licensed to operate in the fishery. Any nation that exceeded its annual cap was prohibited from fishing in large parts of the Bering Sea for the remainder of that year. Rather than extend the fixed cap to the domestic fisheries that subsequently displaced the joint-venture fisheries, the North Pacific Fishery Management Council (NPFMC) explored a variety of fixed and triggered spatial closures (NMFS, 1995, 1999; NPFMC, 1995, 1998, 2005). Failure of these measures to avert the large bycatches observed in 2005, 2006, and 2007 provided the impetus for re-adoption of an annual hard cap on Chinook salmon bycatch mortality in this fishery (NPFMC, 2008).

1.3. Amendment 91—The preliminary preferred alternative

After record salmon bycatch in 2007, the NPFMC concluded that additional management strategies were necessary to further control salmon bycatch. The Preliminary Preferred Alternative (PPA) was selected in April 2009 and implemented in January 2011 as Amendment 91. It specified a framework under which one of two binding caps would apply, how those caps would be apportioned among the sectors, and conditions under which they could be apportioned within sectors (NPFMC, 2009).

The PPA apportions 70% of the bycatch cap to the A season and 30% to the B season. All unused A season bycatch allowances can rollover into the B season cap. These bycatch caps are broken down further into four sectors: catcher processors, mothership, shore-based catcher boats and Community Development Quota (CDQ) entities (Ginter, 1995; NRC, 1999). Although these sector allocations are primarily based on sector bycatch history (2002–2006), they also reflect Pollock allocations under the AFA. In effect, sectors with "dirty" fishing history received a somewhat smaller bycatch allocation than their proportionate share of historical bycatch. The Incentive Plan Agreement (IPA), a private contractual arrangement, provides individual incentives for sectors at all bycatch encounter levels to keep bycatch below 60,000 Chinook salmon per year. To ensure bycatch savings, the NPFMC established a sector level performance standard in which each sector's bycatch is evaluated against that sector's hard cap of 47,591 Chinook salmon. For sectors to continue to receive bycatch allocations based on an IPA's 60,000 salmon cap, sectors must not exceed its performance standard in any 3 of 7 consecutive years. If a sector fails the performance standard, it will no longer be allowed to participate in an IPA and will permanently be allocated a percentage allocation of the original 47,591 Chinook salmon hard cap. Vessels that opt out of the ICA face an open access bycatch pool equivalent to their share of an overall hard cap of 28,496 Chinook salmon.

Since the implementation of Amendment 91, Chinook salmon bycatch has declined by 59% compared to bycatch rates from 1991–2010 and in-river Chinook returns have improved in 2015–2016; however, long-term salmon management is still a major concern.

1.4. ICA requirements

To operate under the Inter-Cooperative Agreement (ICA) fisheries hard cap level, sectors or groups of vessels within a sector must prepare a National Oceanographic and Atmospheric Agency (NOAA) fisheries plan that demonstrates the following attributes: (1) it rewards individual vessels that successfully avoid Chinook salmon or penalizes individual vessels that fail to avoid Chinook salmon; (2) it creates incentives to avoid Chinook salmon bycatch at all levels of abundance[1] in all years; and, (3) it creates incentives that will influence fishing decisions even when bycatch is at levels below the hard cap. These requirements were established to address the negative outcomes that can occur when restrictive hard caps alone are used for managing fishery bycatch (Boyce, 1996; Abbott and Wilen, 2009). For example, fleet-wide hard caps with no individual vessel incentives to avoid bycatch can induce a careless race to fish until the bycatch hard cap is hit, thereby jeopardizing the profitability of the fleet (Boyce, 1996; Abbott and Wilen, 2009).

1.5. A comprehensive incentive plan for bycatch avoidance

In this paper, we present the original comprehensive bycatch credits allocation and trading plan, the Comprehensive Incentive Plan (CIP). The CIP, which uses Individual (vessel-level) Tradable Encounter Credits (ITEC) (Sugihara, 2007), also includes incentives that make up the backbone of Amendment 91/PPA. This approach provides robust vessel-level incentives to reduce Chinook salmon bycatch under all levels of Pollock biomass and at any rate[2] of Chinook salmon bycatch. Additionally, the incentives could act cumulatively through time to continually reduce overall Chinook salmon bycatch. The plan is flexible and could be tuned to meet predetermined performance standards through experimental implementation and monitoring. It rewards vessels with consistently low bycatch rates and penalizes those with chronic high bycatch rates (Boyce, 1996). The plan is structured so that the avoidance incentive is greatest during low encounter periods of Chinook

[1] At present, there are no estimates of Chinook salmon abundance in federal waters off Alaska.

[2] The bycatch rate is the number of Chinook salmon caught per metric ton of walleye Pollock.

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