
Salmon bycatch patterns in the Bering Sea pollock fishery

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Data from the North Pacific Observer Program (Fisheries Monitoring and Assessment) were analyzed for seasonal, temporal, and spatial patterns of bycatch. The bycatch rates within and outside of current salmon savings areas were compared and an index of spatial concentration of salmon was developed. Analyses by fleets were limited by the methods used to assign bycatch levels to areas. Salmon bycatch rates are highly variable. Recent higher bycatch levels are likely due to increased salmon abundance rather than shifting patterns of effort by the pollock fleet.

Salmon abundance and bycatch: a review of salmon distribution and abundance from the Bering-Aleutian Salmon International Survey (BASIS).

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Historic time series of salmon abundance in the Bering Sea and recent patterns of salmon distribution and abundance from the Bering-Aleutian Salmon International Survey (BASIS) are reviewed to provide insight into recent changes in salmon abundance and bycatch potential in the Bering Sea.

Efforts to determine the stock origins of the salmon bycatch in the Bering Sea groundfish fishery

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The salmon bycatch in both the Gulf of Alaska (GOA) and Bering Sea/Aleutian Islands (BSAI) groundfish fisheries has been a major concern of the National Marine Fisheries Service (NMFS) management. The large bycatch of salmon coincided with a period of reduced returns of chum and Chinook salmon to western Alaska Rivers and prompted calls for determining whether or not this large bycatch was contributing to this decline. The Chinook salmon bycatch in the BSAI in 2004 of nearly 63,000 and 75,000 in 2005 exceeded previous highs set in the mid 1990's, substantially exceeded the caps that trigger moving the fleet out of designated Chinook salmon savings areas, and initiated endangered species act (ESA) reviews. The chum salmon bycatch in the BSAI in 2004 of 447,000 fish and over 700,000 in 2005 far exceeded previous catches and likewise triggered moving the fleet out of chum salmon savings areas.

From 1994 to 1996, the Auke Bay Laboratory (ABL) conducted a genetic stock identification study of the BSAI chum salmon bycatch using allozymes. A Pacific Rim chum salmon baseline had been developed over a number of years by cooperation of a number of groups on both sides of the Pacific Rim. Simulations on this baseline showed that eight regions could be identified with a reasonable degree of accuracy: Japan, Russia, Western Alaska summer run, fall Yukon River, Alaska Peninsula/Kodiak/Chignik, Southeast Alaska/Prince William Sound, British Columbia and Washington. Regional estimates of origin averaged over three years showed Asia (41%), Western Alaska (24%), Alaska Peninsula (2%), PWS/SEAK (9%), BC (9%) and Washington (5%). While this effort provided important information about the origins of the chum salmon bycatch, the baseline could not discriminate among stocks from the broad category of western Alaska summer run that includes stocks from Bristol Bay north to Kotzebue and Norton Sound. Chum salmon stocks south of the Kuskokwim River are relatively healthy and are probably not adversely affected by the BSAI chum salmon bycatch. However, stocks from the Kuskokwim north to Kotzebue have experienced serious declines and could possibly be adversely affected by the BSAI chum salmon bycatch. ABL supports efforts by UAF and ADF&G to develop new DNA based markers that hopefully will allow greater discrimination of stocks from the western Alaska group.

In 2005, ABL working in cooperation with the NMFS Observer Program began collecting samples from the Chinook and chum salmon bycatch from the "B" season BSAI groundfish fishery. This effort is ongoing into the 2006 "A" season, and hopefully into the 2006 "B" season.

Development of standardized DNA baselines for high-seas and bycatch applications

Alaska Department of Fish and Game

The Alaska Department of Fish and Game is deeply committed to studies using standardized DNA baselines to identify the composition of mixtures of stocks of salmon such as those found in the BSAI fisheries.

Data from University of Washington studies using scale pattern analyses show that Chinook salmon stocks ranging at least from British Columbia to Russia are present in the bycatch. Data from Auke Bay Laboratory studies using genetics (allozyme markers) show that chum salmon stocks from throughout the species range are present in the bycatch. Both studies found that the Western Alaska stocks dominate.

Accurate stock identification information has been extremely valuable for high-seas, coastal migration, and bycatch studies from throughout the Pacific Rim. This type of information can address concerns of fluctuating and sometimes substantial declined of stocks of western Alaska salmon. Here we review the progress on development of DNA markers for use in bycatch and other high seas applications. DNA techniques provide significant advantages over allozymes, and the State of Alaska has made a commitment to develop and collaborate on comprehensive baselines for chum, sockeye, and Chinook salmon. Of the various DNA markers, single nucleotide polymorphisms (SNPs) assayed through high-throughput technologies are particularly appropriate for bycatch applications where Pacific Rim-wide databases are required. Unlike marker types based on fragment size, SNPs are based on the actual DNA sequence, require no inter-laboratory standardization, are cost-effective, and can be easily automated.

We are currently conducting various projects to develop Pacific Rim-wide databases in cooperation with NPAFC laboratories (Japan, Russia, and Korea) and ten laboratories funded by the Pacific Salmon Commission. Projects funded by the North Pacific Board, USFWS Office of Subsistence Management, Pacific Salmon Commission, and State of Alaska general funds have started to track the migration and distribution of stocks of sockeye, chum, and Chinook salmon. In addition, common concerns voiced by ten stakeholders produced an umbrella plan for the Western Alaska Salmon Stock Identification Program (WASSIP) to seek federal funds to track the interceptions of sockeye and chum salmon in interception fisheries in the NW Gulf of Alaska and Bering Sea. Finally, a three-year project just approved by the AYK SSI funds the analysis of Chinook salmon bycatch in an attempt to develop a forecast model for AYK stocks.

Genetic methods for determining origins of salmon in trawl bycatches

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Chum salmon (*Oncorhynchus keta*) bycatch in the Gulf of Alaska and Bering Sea continues to create problems for the groundfish fisheries, particularly the Bering Sea trawl fisheries. Chum salmon are critical to the livelihood and culture of rural Alaskans and the focus of a number of other issues including allocation among Alaskan users and between the U.S. and Canada. Between 1997 and 2002 unexpected and dramatic declines in returns to watersheds of western Alaskan salmon runs prompted 15 disaster declarations by the Governor of Alaska and federal agencies (AYK Scientific Technical committee 2005). Although those runs appear to be rebounding, incidental catches in the pelagic trawl fisheries have been increasing dramatically.

Central to bycatch questions is the origin/destination of intercepted fish. Use of natural genetic markers is the best method for stock identification of wild fish in the marine environment; and substantial effort has been (and continues to be) devoted to genetic studies of North Pacific salmon stocks. An extensive allozyme baseline was developed in the last two decades to address those questions, but the logistics of sampling and increasing costs of storing and processing the samples have obviated their use. Most labs have terminated allozyme operations. Moreover, allozymes do not appear to provide the fine-scale resolution needed to address some important questions involving origins of western Alaskan chum salmon stocks.

Two promising approaches include analysis of microsatellite variation and the recent development of tools to resolve single nucleotide polymorphisms (SNPs) from both nuclear and mitochondrial DNA. Both approaches have challenges and all genetic methods require that substantial baseline data, which includes most of the geographic range of a species, have been assembled before these tools can be confidently applied.

Our University of Alaska Fairbanks genetics laboratory has been examining both the microsatellite and SNP approaches, by using a common set of DNA samples from populations that represent most of the geographic range of chum salmon. We are surveying microsatellite variation and using loci that are being applied by other labs acquiring microsatellite data from Alaskan chum salmon. Preliminary comparisons for data from samples analyzed by two labs indicate that the data are highly concordant. We are developing SNP markers. One of our goals in developing and evaluating SNPs markers is to find or create inexpensive methods to resolve SNP variation and to be able to resolve multiple variants that occur in a short region of DNA. The advantage of the SNP markers is that by their nature, the data should be concordant from lab to lab. We are still in the process of developing and evaluating these microsatellite and SNP tools.

Chinook and Chum Salmon Stock Status in the AYK Region

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A short description of subsistence and commercial fisheries in the AYK Region is provided. Present harvest and escapement trends of Chinook and chum salmon in AYK Region focusing on 1980 to present in the Kotzebue Sound, Norton Sound, Yukon River, Kuskokwim River Areas are covered. The overall trend in abundance for the region since 1980 will be summarized and the status of stocks of concern under the Alaska Board of Fisheries Sustainable Salmon Fisheries Policy will be presented.

Incentives for bycatch avoidance: hotspot closures and individual bycatch quotas

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Using data from the North Pacific Observer Program and SeaState, hotspot closures for 2006 are examined to assess how pollock vessels are responding to closures. Different methods of evaluating the success of hotspot closures in the future are discussed. The vessel incentives in the current inter-cooperative agreement are reviewed and compared to individual bycatch quotas or incentives. Two types of potential tradable quotas are addressed: quota tradable within the pollock fishery and quota that could potentially be sold by commercial salmon fisheries to the commercial pollock fishery.