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Salmon Bycatch Management and Monitoring in the Bering Sea Pollock Fisheries

Introduction

The purpose of this discussion paper is to provide information about management and monitoring of salmon bycatch in the American Fisheries Act (AFA) pollock fisheries in the Bering Sea. Information is presented about (1) monitoring requirements currently in effect for these fisheries, (2) methods currently used to estimate salmon bycatch, and (3) management and monitoring issues associated with alternatives that would allocate prohibited species catch limits among the AFA sectors and cooperatives.

NMFS also is developing a more comprehensive analysis about the management, monitoring, and enforcement effects of all of the alternatives the Council is considering to address salmon bycatch. This analysis will build on this discussion paper and will be integrated in to the preliminary draft environmental impact statement (EIS) that the Council will review in April 2008. The management, monitoring, and enforcement analysis of the alternatives will be updated and expanded as necessary throughout the salmon bycatch EIS process.

Current Monitoring Requirements and Salmon Bycatch Estimation Procedures

Catcher/processors and motherships are required to carry two NMFS-certified observers on board. They also must provide a motion compensated flow scale, on which all catch in each haul must be weighed, and an observer sampling station. The observer sampling station is required to include a table, motion compensated platform scale, and other monitoring tools to assist observers in sampling. Each observer covers a 12 hour shift and all hauls are observed unless an observer is incapacitated.

Estimates of the weight of each species in the catch are made through sampling. A sample is a specific portion of the haul that is removed and examined by the observer. Catch in the sample is sorted by species, identified, and weighed by the observer. Species counts also are obtained for non-predominant species. Observer samples are collected using random sampling techniques to the extent operationally possible on commercial fishing vessels. The species weight and numbers found in the sample are assumed to represent the species weight and numbers in the entire haul.

The proportion of each haul that is sampled by an observer on a catcher/processor or mothership in the pollock fisheries is relatively high because catch tends not to be diverse and excellent sampling tools, such as flow scales and observer sample stations, are available. Sampling for salmon is conducted as part of the overall species composition sampling for each haul. The observer collects and records information about the number of salmon in each sample and the total weight of each haul. The total number of salmon in each haul is estimated by NMFS by extrapolating the number of salmon in the species composition samples to the total haul weight. In the rare case that an observer on an AFA catcher/processor or mothership is unable to sample

a haul for species composition, NMFS uses species composition information from other observed hauls.

Unsorted catch is delivered by catcher vessels to the three motherships that participate in the AFA pollock fisheries. These catcher vessels are not required to carry observers because catch is not removed from the codend of the catcher vessels. Observer sampling occurs on the mothership following the same estimation processes and monitoring protocols that are described above for catcher/processors.

While regulations require vessel personal to retain salmon until sampled by an observer, salmon that are retained by catcher/processor and mothership crew outside of the observer's sample are not included in the observer's samples and are not used to estimate the total number of salmon caught. Observers examine these salmon for coded-wire tags and may collect genetic and trophic interaction information from the salmon.

Catcher vessels delivering to shoreside processors or stationary floating processors are required to carry observers based on vessel length.

Catcher vessels 125 feet in length or greater are required to carry an observer during all of their fishing days (100 percent coverage).

Catcher vessels greater than 60 feet in length and up to 125 feet in length are required to carry an observer at least 30 percent of their fishing days in each calendar quarter, and during at least one fishing trip in each target fishery category (30 percent coverage).

Catcher vessels less than 60 feet in length are not required to carry an observer. However, no vessels in this length category participate in the Bering Sea pollock fisheries.

AFA shoreside (inshore) processors are required to provide an observer for each 12 consecutive hour period of each calendar day during which the processor takes delivery of, or processes, groundfish harvested by a vessel directed fishing for pollock in the BSAI. The shoreside processors also are required to have a Catch Monitoring and Control Plan (CMCP) that, among other requirements, identifies the location from which the observer will be able to view all sorting and weighing of fish simultaneously. The CMCP must be approved by NMFS. Observers assigned to the processing plant are responsible for reading the CMCPs and verifying the plant is following the plan laid out in the CMCP.

Sampling on board the catcher vessel: Observers sample hauls on board the catcher vessels to collect species composition and biological information. Observers use a random sampling methodology that requires observers to take multiple equal sized samples from throughout the haul to obtain a total sample size of approximately 300 kilograms. In contrast to catcher/processors and motherships where the entirety of each unsorted haul is available for observer sampling, catch from catcher vessels delivering to shoreside processing plants or floating processors generally is either dumped or mechanically pumped from the codend directly into recirculating seawater (RSW) tanks. Observers attempt to obtain species composition samples by collecting small amounts of catch as it flows from the codend to the RSW tanks.

Because the catch in the pollock fisheries is mostly pollock, species composition sampling generally works well for common species. However, for uncommon species, such as salmon, a larger sample size often is desired and this generally is not physically or logistically possible on the catcher vessels. Therefore, estimates of salmon bycatch are based on a full count or census of the salmon bycatch at the shoreside processing plant or stationary floating processor. Vessel operators are prohibited from discarding salmon at sea until the number of salmon has been determined by an observer, either on the vessel or at the processing plant, and the collection of any scientific data or biological samples from the salmon has been completed. Few salmon are reported discarded at sea by observed catcher vessels. However, any salmon reported as discarded at sea by the observer are added into the observer's count of salmon at the processing plant.

Shoreside Accounting: When a catcher vessel offloads at the dock, prohibited species such as crab, salmon, and halibut are identified and enumerated by the plant observer during the offload. The vessel observer also monitors the offload and, with the assistance of the plant's processing crew, attempts to remove all salmon from the catch. Salmon that are missed during sorting will end up in the processing facility, which requires special treatment by the plant and the observers to ensure they are counted. These "after-scale" salmon (so called because they were initially weighed as pollock), creates tracking difficulties for the plant and the observer.

For each haul brought on board a catcher vessel, NMFS estimates the official total weight of that haul by proportioning the captain's estimated weight ("hail weight") for each haul against the total weight of the delivery reported on the fish ticket. The total count of salmon for the delivery also is distributed among the hauls based on the proportion of groundfish each haul contributed to the total weight of the offload. The official total catch for each haul and the salmon attributed to each haul is then used by the NMFS's Alaska Regional Office (Region) to calculate salmon bycatch rates in a process described in the next section.

Rate calculation and expansion

The observer information, including expanded information, is provided to the Region. The Region estimates salmon bycatch for unobserved catcher vessels using algorithms implemented in the Region's catch accounting system. The haul-specific information is used by the catch accounting system to create salmon bycatch rates that are applied to total groundfish catch in each delivery by an unobserved fishing trip. The rate is calculated using the observed salmon bycatch divided by the groundfish weight, which results in a measure of salmon per metric ton of groundfish caught. Salmon bycatch rates are calculated separately for Chinook salmon and non-Chinook salmon.

The bycatch rates procedure extrapolates information from observed vessels to unobserved vessels by matching the type of information available from observed vessels with that of an unobserved vessel.

Surrogate bycatch rates are applied using the most closely available data from an observed catcher vessel by:

- processing sector (in this case, inshore sector)
- week ending date,
- target species (pollock),
- gear (pelagic trawl), and
- federal reporting area (517, 521, etc).

If no data are available for an observed vessel within the same sector, then rates will be applied based on observer data from all vessels in the target fishery. If observer data is not available from the same week, then a three-week or three-month moving average will be applied. Similarly, if data from the same federal reporting area is not available, then observer data from pollock fishery in the BSAI as a whole will be applied. Table 1 provides more information about the bycatch rate calculation process in the catch accounting system.

Table 1: Description of the type of aggregated information used to calculate a bycatch rate for prohibited species.

Resolution	**Rate Level**	**Type of Rate**	**Type of Information Aggregated**	**Aggregation Level**
High	Precedence 50 Catcher Vessels:	Catcher Vessel Specific	Vessel specific, date trip started, fishing gear, federal reporting area	***Low***
	Precedence 50 Catcher/Processors:	Catcher Processor Specific	Vessel specific, week end date, and if the trip occurred in the GOA or BSAI	
	Precedence 40	Sector specific 3-week moving average	Processing sector (shoreside mothership,) , Target species, week end date, fishing gear, federal reporting area	
	Precedence 30	3- week moving average	Target species, week end date, fishing gear, federal reporting area	
	Precedence 25	3- month moving average	Target species, week end date, fishing gear, and if fishing occurred in the GOA or BSAI	
Low	Precedence 20	FMP area rate	Target species, gear, FMP area	***High***

Monitoring Challenges in Allocating Salmon Bycatch Limits Among AFA Sectors and Cooperatives

One alternative under consideration in the salmon bycatch management EIS is "hard caps", under which directed fishing for pollock would cease if a salmon bycatch cap, or prohibited species catch limit, is reached. The alternative considers managing these hard caps at the fishery level, the sector level, and the inshore cooperative level. Managing caps at the sector level means allocating a portion of the salmon bycatch limit specified for the AFA pollock fisheries as a whole among the three sectors: catcher/processors, motherships, and the inshore sector. Further allocating the inshore sector salmon bycatch limit among the seven inshore cooperatives also is under consideration.

Hard caps for salmon bycatch that could prevent the full harvest of pollock by a sector or cooperative would be an additional potential limitation on the pollock fisheries that does not currently exist. Prior to exemptions issued under the salmon bycatch intercooperative agreements starting in 2006, the salmon bycatch limits currently in regulation closed discrete areas of the Bering Sea when salmon bycatch limits were reached. Vessels directed fishing for pollock were prohibited from fishing in these areas, but could continue to harvest pollock outside of these areas. The current system of triggered closures is different from a system that would prohibit any further directed fishing for pollock once a salmon bycatch limit is reached.

The greater the potential that a salmon bycatch measure could close the pollock fisheries before the pollock allocations are caught, the greater the scrutiny will be on the observers' data and on the catch accounting system. Implementing salmon bycatch hard caps would rely on the NMFS's estimates of salmon bycatch by each sector or cooperative and would require the best possible estimates at the individual vessel level.

Vessel-specific salmon bycatch information currently exists for catcher/processors, motherships, and observed catcher vessels. However, a significant component of the inshore sector are vessels in the 30 percent observer coverage category. When these vessels are not observed, salmon bycatch rates from other observed vessels are used to estimate the salmon bycatch associated with the pollock catch by the unobserved vessels.

Table 2 shows the estimated pollock catch and salmon bycatch in the AFA pollock fisheries in the Bering Sea from 2005 through 2007, by fishery sector and vessel length class. Fifty seven of the 83 vessels participating in the inshore sector in 2007 were in the 30 percent observer coverage category. In 2007, these vessels caught approximately 20 percent of the pollock catch and 27 percent of the Chinook salmon bycatch and 31 percent of the non-Chinook salmon bycatch.

Table 2. Estimated pollock catch and salmon bycatch in the AFA pollock fisheries in the Bering Sea from 2005 through 2007, by fishery sector and vessel length class.

2005

Vessel category	Number of Vessels	Pollock (mt)	% of Pollock Catch	Chinook salmon (#)	% of Chinook salmon	Non-chinook salmon (#)	% of Non-Chinook salmon
C/P	16	517,699	40%	14,271	22%	63,249	9%
Motherships	3	130,669	10%	2,560	4%	15,314	2%
CV 60'-125'	58	271,525	21%	18,566	28%	265,637	38%
CV ≥ 125'	26	376,591	29%	30,517	46%	354,053	51%
Total	103	1,296,484	100%	65,914	100%	698,253	100%

2006

Vessel category	Number of Vessels	Pollock (mt)	% of Pollock Catch	Chinook salmon (#)	% of Chinook Salmon	Non-chinook salmon (#)	% of Non-Chinook salmon
C/P	16	527,134	40%	17,692	22%	18,180	6%
Motherships	3	134,404	10%	5,037	6%	2,013	1%
CV 60'-125'	56	256,923	20%	23,206	29%	135,003	44%
CV ≥ 125'	26	388,684	30%	35,488	44%	154,144	50%
Total	101	1,304,145	100%	81,423	100%	309,340	100%

2007

Vessel category	Number of Vessels	Pollock (mt)	% of Pollock Catch	Chinook salmon (#)	% of Chinook Salmon	Non-chinook salmon (#)	% of Non-Chinook Salmon
C/P	16	488,528	41%	32,212	28%	27,241	31%
Motherships	3	121,514	10%	6,663	6%	5,427	6%
CV 60'-125'	57	240,546	20%	31,381	27%	27,207	31%
CV ≥ 125'	26	332,081	28%	45,937	40%	27,715	32%
Total	102	1,182,669	100%	116,193	100%	87,590	100%

NMFS recommends the following management and monitoring elements for salmon bycatch limits:

- ***Data collected at-sea by NMFS-certified observers are the best source of information to estimate salmon bycatch by catcher/processors and catcher vessels delivering to motherships.***

The objective of the observer requirements is to have information about catch collected by a trained, independent third party who does not face economic consequences associated with the catch data. NMFS considers catch composition data collected by an observer on board a vessel as the best source of information for prohibited species catch accounting for catcher/processors and motherships. Salmon bycatch is discarded at sea from processor vessels, unless it is retained for donation through the prohibited species donation program. The nature of the processing operations on these vessels requires that catch composition data must be collected on board the vessel before discard or processing occurs.

In general, all catch by pollock AFA catcher/processors and catcher vessels delivered to motherships is conveyed past an observer before catch sorting occurs. The observer has the opportunity to monitor the flow of fish and to include salmon bycatch from the catch in the species composition sample. In addition, through regulations implemented under the AFA, the observer coverage levels and equipment and sampling stations are available on board these vessels to collect species composition samples and the total weight of the catch necessary to estimate salmon bycatch. Therefore, NMFS proposes that the observer, equipment, and procedural requirements currently in effect are adequate to continue to be used to collect information necessary to estimate salmon bycatch of catcher/processors and catcher vessels delivering to motherships.

- ***If no salmon are discarded at sea, data collected by observers at the processing plant are the best source of information to estimate salmon bycatch by catcher vessels delivering to shoreside processors and stationary floating processors.***

For the operational reasons described earlier, at-sea sampling by an observer to estimate salmon bycatch by catcher vessels is logistically difficult. Due to cost, space, and operational constraints, it is unlikely that additional equipment or operational requirements could be implemented that would remove the logistical barriers to sampling at-sea for rarely occurring species such as salmon. Therefore, NMFS recommends that the current process through which vessel and plant observers collaborate to count any salmon discarded at sea and to monitor the entire offload of each observed pollock vessel should provide the basis for salmon bycatch accounting under any alternative considered in the salmon bycatch EIS.

Plant monitoring currently is regulated through a permitting process. Each plant that receives AFA pollock is required to develop and operate under a NMFS-approved catch monitoring and control plan. Each plant's catch monitoring and control plan details monitoring standards described in regulation at 50 CFR 679.28(g). These monitoring standards detail the flow of fish from the vessel to the plant ensuring all groundfish delivered are sorted and weighed by species. CMCPs include descriptions and diagram of the flow of catch from the vessel to the plant, scales

for weighing catch, and accommodations for observations. Depending on the plant, observers will physically remove all salmon from the flow of fish before the scale as it is conveyed into the plant, or supervise the removal of salmon by plant personnel. While the CMCPs require plants to remove all salmon from the catch prior to passing over the scale and define the number of personnel and flow rate of fish needed for appropriate sorting, plant operators are able to manipulate the volume of fish, and salmon do pass by the observer or plant sorting personnel when the fish are flowing fast, deep, or in larger quantities than anticipated. While "after scale" salmon are required to be given to an observer, there is no direct observation of salmon once they are moved past the observer and into the plant. Although observers currently record after scale salmon as if they were collected independently, they can better be thought of as plant reported information. Further complications in plant based salmon accounting occur when multiple vessels are delivering sequentially, making it difficult or impossible to determine which vessel's trip these salmon should be assigned to. Currently, plant personnel are very cooperative with saving after scale salmon for observers at this stage of sampling and after scale salmon numbers are relatively low. However, if management measures create incentives for not reporting salmon, this cooperation could be reduced.

- **Current methods of applying salmon bycatch rates from observed vessels to catch by unobserved vessels probably will not be adequate to manage salmon bycatch caps allocated among the inshore cooperatives.**

The current system of applying information collected from observed vessels to unobserved vessels uses the best information available under the current observer coverage levels. However, this system does not provide direct information about salmon bycatch or at sea-discards of any species at the individual vessel level. Hard caps for salmon bycatch, particularly if those hard caps are allocated to the inshore cooperative level, will require a better system of estimating salmon bycatch for each vessel subject to the caps and resulting pollock fishery limits. Salmon bycatch information available from observed vessels may not be representative of the salmon bycatch by unobserved vessels. This uncertainty will make it difficult for NMFS to enforce very constraining fishery closures or penalties that rely on applying catch data from an observed vessel to an unobserved vessel. Therefore, NMFS proposes that the current system of applying bycatch rates to unobserved vessels will not support the alternative to allocate salmon bycatch hard caps among inshore cooperatives with unobserved catcher vessels.

Recommendations for Improving Salmon Bycatch Estimates for Unobserved Catcher Vessels

In the salmon bycatch EIS, NMFS will examine options that might be necessary to support the monitoring requirements of salmon bycatch hard caps. For the inshore sector, these options include:

- *All catcher vessels would be required to deliver all salmon to a shoreside processor or staionary floating processor for accounting,*

- *Managers of shoreside processors and stationary floating processors would be required to ensure all salmon are counted by an observer.*

- *Observers could be required on all catcher vessels to provide the necessary monitoring to ensure that no salmon are discarded at sea,*

- *Electronic monitoring could be an alternative to increased observer coverage to verify compliance with salmon retention requirements,*

Because of the difficulties of at-sea sampling for salmon on catcher vessels, NMFS recommends continuing to account for salmon at shoreside AFA processors. The challenge then becomes how to ensure that all salmon are delivered to the processing plany by every catcher vessel.

To date, NMFS has considered two options to ensure all salmon are delivered:

1. all vessels could be required to carry an observer at all times. Under this scenario, each catcher vessel observer would conduct species composition sampling at sea for all species, observe that all salmon are retained for delivery, and work with plant observers to account for all salmon at the plant.

2. any unobserved catcher vessels could be allowed the option of providing an electronic monitoring (EM) system that would likely include a series of cameras digitally recording differing views of all locations sorting or discarding could occur. Several demonstration projects in Canada and in the hake fishery off Oregon and Washington have shown that video monitoring has potential for compliance monitoring of a full retention requirement.

Because individual hauls are not kept separate on catcher vessels, some level of observer coverage would be necessary to gather haul-level biological information to support agency processes such as stock assessment work. Additionally, several Bering Sea pollock catcher vessels currently sort catch at sea, and an acceptable monitoring approach would need to be implemented on these vessels, or this practice would need to be prohibited.

In addition to the technical aspects of video monitoring for this application, several other issues related to EM must be resolved. These include the availability of resources required to review and catalog video footage, the ability to protect against tampering with the systems and the reliability of EM systems in the harsh climates over long periods of time. Until these issues are

satisfactorily resolved, NMFS would recommend established monitoring and catch estimation protocols that include observer coverage, retention requirements, and shoreside accounting of salmon.

NMFS has several concerns associated with accounting for all salmon from each delivery, and the current shoreside processor monitoring protocols would likely be inadequate to manage salmon bycatch under hard caps. Changes to plant-specific monitoring protocols would be dealt with through changes to CMCPs, and would be largely focused on changes to plant operations to ensure an observer can remove all salmon from each delivery, or supervise salmon removals.

Depending on the how catcher vessels are monitored, additional plant observers could be needed. For example, if catcher vessels are required to carry EM, supplemented by a minimum observer coverage level for purposes of collecting biological information, a single plant observer would not be capable of monitoring all offloads by unobserved vessels.