MEMORANDUM

TO: Council, SSC and AP Members

FROM: Chris Oliver
Executive Director

DATE: March 31, 2005

SUBJECT: Exempted Fishing Permit for testing salmon excluder gear

ESTIMATED TIME
8 HOURS
(all D-1 items)

ACTION REQUIRED

Receive a request for an Exempted Fishing Permit to continue research on salmon excluder devices for the BSAI pollock fishery

BACKGROUND

The Exempted Fishing Permit application for continued research on salmon excluder devices for the BSAI pollock fishery is attached as Item D-1(d)(1). This request builds upon several years of continued testing of salmon excluder devices by the Principal Investigator in the BSAI pollock fishery.

Two tests are proposed in the EFP application. The first experiment evaluates modifications to the excluder in order to potentially improve upon its performance. This experiment will use a recapture net on a catcher vessel to evaluate the performance effects of small adjustments to the excluder. These adjustments include placement of the excluder in the trawl intermediate, alternative tapers in the square-mesh funnel, and different placement locations for the funnel with respect to the escapement portals. This phase of the experiment will be primarily conducted during the B season in 2005 and 2006. However, if Chinook salmon are not available in sufficient amounts in the fall to satisfy the experimental design, there may be some necessity for conducting the remainder of the experiment during the following A seasons.

The second experiment is designed to test the performance of the existing excluder under "real world" conditions. This experiment uses paired tows (with and without the excluder) on an AFA at-sea processor according to an experimental design detailed in the application. In this experiment there is no recapture device attached to the excluder device. In addition to providing data on the relative performance of the excluder under a variety of fishing conditions, this will also provide information on the potential influence (on previous results) of the recapture device. The paired tows experiment would be conducted during the 2005 B season only.

The PIs request relief from the following existing regulations:

1- Request for the ability to conduct EFP testing within the Bering Sea Salmon Savings Areas and Catcher Vessel Operational Area (CVOA) regardless of whether they are closed to pollock fishing (or prohibit the specific vessel type as with the B-Season at-sea processor experiment detailed in the application). For the EFP test conducted on an AFA CP, 2,500 mt of the overall amount of harvest (approximately 8,000 mt) that will take place for this part of the EFP test would occur in the CVOA/ Salmon Savings Areas.

2- Request for exemption from AFA observer requirements for the catcher processor conducting the paired testing experiment. As described in the application, in addition to an EFP project manager, the AFA CP vessel will carry three "sea samplers" (who are NMFS-trained observers not currently engaged in observing) for purposes of catch sampling and data collection. Given that the EFP work requires redirecting the sampling to undertake whole-hauls for salmon and expanded length samples for pollock, the PI has requested a waiver from AFA requirements for observer coverage during the EFP. Species composition sampling and other duties necessary for fully accounting for the catches during the EFP will still be conducted on a haul by haul basis to track the catches against the vessel and its cooperative's AFA allocations (during the portion of the EFP where the selected vessel will utilize its own AFA groundfish).

3- Request for an allocation of 5,000 mt of groundfish catch in the pollock target for September 2005-March 2006 period for the two concurrent experiments (recapture net and paired tows) during the first year of the EFP. For September 2006-March 2007, 2,500 mt is needed for the continuation of the developmental work on the excluder utilizing a recapture device. These allowances would not count against the groundfish TAC.

4- Request for a bycatch allowance request of up to 5,000 chum salmon and 2,000 Chinook salmon (500 Chinook estimated for recapture experiment, 1,500 Chinook estimated for paired tows). These allowances should not count against the salmon bycatch caps.

Item D-1(d)(2) details the requested allowances and exemptions for the 2005-2006 and 2006-2007 seasons. Additional technical information on the statistical methodology and rate calculations employed in the study is provided in Item D-1(d)(3). Item D-1(d)(4) responds to specific methodological questions raised in the recent AFSC review of the EFP application. This document provides additional information regarding the rationale behind the requested groundfish and salmon allocations and expands upon the justification for the requested exemption from specific AFA observer requirements for the catcher processor conducting the paired testing experiment.

Information from these experiments can be used to further develop effective means of salmon bycatch avoidance mechanisms for pollock trawl fisheries in the Bering Sea. In addition to the Bering Sea pollock fishery, the excluder device may also be adaptable to other trawl fisheries where salmon bycatch occurs.

An environmental assessment for the proposed EFP has been prepared and copies will be available at the meeting. The levels of harvest and the manner in which the experimental fishing will be conducted are not expected to have a significant adverse impact on the marine environment.

The Principal Investigator will be available to present additional information and to answer questions.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

Item D-1(d)(1)
April 2005

March 14, 2005

Ms. Stephanie Madsen, Chair
North Pacific Fishery Management Council
605 West 4th Avenue, Suite 306
Anchorage, Alaska 99501

Dear Madam Chair:

We have received an application from Mr. John Gauvin, Principal Investigator, and Mr. John Gruver with the United Catcher Boats Association for an exempted fishing permit (EFP) to continue development of a salmon excluder device for the Bering Sea pollock trawl fishery. The purpose of the project is to improve the performance of the salmon excluder device developed under an EFP in 2004 and 2005, and to validate the performance of this device for pollock trawls. The goal is to develop a device for pollock trawls that reduces salmon bycatch without significantly lowering pollock catch rates. Issuance of EFPs is authorized by the Fishery Management Plan for Groundfish of the Bering Sea and Aleutians Islands Management Area and its implementing regulations at 50 CFR 679.6, Exempted Fisheries. We are providing this application and additional information to the North Pacific Fishery Management Council (Council) as required by 50 CFR 600.745(b)(3)(i).

The EFP would allow for two types of testing of the salmon excluder device in fall 2005, and spring 2006. In the first experiment, a catcher vessel would be used to test minor adjustments to the current excluder device design to improve performance. The second experiment would be conducted using a catcher/processor for the paired-tow experiment to validate the performance of the excluder device. Depending on the results from the work in 2005 and 2006, the EFP may need to be modified to allow for an additional year of testing.

Exemptions from regulations for salmon bycatch limits, observer requirements, salmon savings area closure, the Catcher Vessel Operating Area (CVOA), and total allowable catch amounts (TACs) for groundfish would be necessary to conduct the work. The taking of salmon during the experiment is crucial for determining the effectiveness of the device. Salmon taken during the experiment would not be counted toward the chinook and chum salmon bycatch limits under § 679.21(e)(1)(vii) and (viii). Potentially, the amount of salmon bycatch by the pollock trawl industry during the EFP period could approach or exceed the salmon bycatch limits. The additional salmon taken during the experiment would create an additional burden on the pollock trawl industry and may lead to closures of the salmon savings areas, if the EFP salmon were counted toward the salmon bycatch limits. Approximately 2,500 chum salmon and 1,500 chinook salmon would be required to support the project.

The applicants also have requested an exemption from closures of the Chinook Salmon Savings Area and the Chum Salmon Savings Area (§ 679.21(e)(7)(vii) and (viii)). The experiment must be conducted in areas of salmon concentration to ensure a sufficient sample size. The salmon savings areas are areas of known concentration of salmon and provide an ideal location for conducting the experiment and ensuring that the vessels encounter concentrations of salmon.

Groundfish taken under the EFP would be exempt from the TACs specified in the annual harvest specifications (§ 679.20). A total of 2,500 metric tons (mt) of groundfish (primarily pollock) would be taken during the EFP work and would not be included in the harvest applied against the Bering Sea groundfish TACs, including the pollock TAC of approximately 1.5 million mt. The 2005 Bering Sea pollock acceptable biological catch is 1.960 million mt, well above the combined TAC and the additional harvest anticipated from the project. Because of the nature of groundfish bycatch in the pollock fishery, the harvest of other groundfish species is expected to be very minor.

The experiment using the catcher/processor would require exemption from the CVOA restriction (§ 679.22(a)(5)) because of the location of the Chinook Salmon Savings Area in the CVOA. Catcher/processors are prohibited from operating in the CVOA during the B season. It would be necessary for the catcher/processor to conduct tows in this area to ensure encountering sufficient pollock and salmon.

The EFP would include an exemption from the observer requirements at § 679.50. The applicants would use "sea samplers" who are NMFS-trained observers. They would not be deployed as NMFS observers, however, at the time of the experiment. The "sea samplers" would conduct the data collection and perform other observer duties that would normally be required for vessels directed fishing for pollock.

The activities under the EFP are not expected to have a significant impact on the marine environment, but the potential effects on the marine environment will be further analyzed during review of the application. A draft EA for this EFP will be provided to the Council for consideration.

Under regulations at § 679.6, we have consulted with the Alaska Fisheries Science Center, and have determined that the application contains all the information necessary to judge whether the proposal constitutes a valid fishing experiment appropriate for further consideration. We are initiating consultation with the Council by forwarding the application to you, as required by § 679.6(c)(2).

We understand that you have scheduled Council review of the enclosed application at the Council's April 2005 meeting. Please notify Mr. Gauvin and Mr. Gruver of your receipt of the application and invite the applicants to appear before the Council in April in support of the application, if the applicants desire. We will publish a notice of the application in the Federal Register with a brief description of the proposal. Enclosed is a copy of EFP proposal, as well as the AFSC's approval of the experimental design.

Sincerely,

For James W. Balsiger
Administrator, Alaska Region

Enclosures

UNITED CATCHER BOATS
UCB
Washington · Oregon · California · Alaska

Dr. James Balsiger
Regional Administrator
NMFS- F/AKR
P.O. Box 21668
Juneau, AK 99802

March 8, 2005

RE: EFP application to continue research on salmon excluder devices for the BS/AI pollock fishery

Dear Dr. Balsiger:

We have prepared an application for a new exempted fishing permit (EFP) so we can continue research on a salmon excluder device for pollock trawls. As with our previous work on salmon excluders, this research is being done in collaboration with Dr. Craig Rose. All of the technical aspects covered in our EFP application have been developed under his direction and assistance. It is my understanding that Dr. Stauffer and his staff at the AFSC RACE Division are currently reviewing the experimental design aspects of this EFP application. Once we receive their review comments, we will address their comments/suggestions prior to the April Council meeting so the Council will have the opportunity to review our final EFP application in April. As you may recall from our report during the NPFMC meeting last February, we informed the Council that we are preparing a new EFP application under the assumption that the NMFS/Council approval process can be conducted in time to allow us to start our next stage of EFP field tests in September of 2005.

The proposed new EFP research includes two separate experiments: one on a pollock catcher vessel and another on a pollock catcher processor. For the test conducted on a catcher vessel, we will make small adjustments to our existing salmon excluder design to attempt to improve its performance. This will focus mainly on increasing salmon escapement rates and will continue to utilize a recapture net and the same experimental design and other managerial/ administrative aspects used for our previous EFP. The second experiment will be conducted on an at-sea processor using a paired-tow experimental design (rotating tows with and without the excluder) to validate the performance of our existing excluder on a tow-by-tow basis. This test is designed to approximate as closely as possible a "real world" application of the excluder while still incorporating the necessary scientific controls to allow for a valid assessment of performance.

This EFP application requests exemptions from regulations governing the Bering Sea pollock fishery as well as allowances of groundfish and salmon bycatch that would not count against the TACs or salmon bycatch caps. The need for these exemptions and allowances is fully detailed in our application. Under our expected timeline, the experiment aboard an at-sea processor will be completed during the B season on 2005. The first stage of the experiment to improve the performance of the excluder will take place mainly during the B season of 2005 but may need to

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continue into the winter of 2006 depending on our ability to find adequate testing conditions with both chum and chinook salmon during the B season. Additionally, our EFP application requests continued exemptions to regulations and additional catch allowances to allow for a second phase of design-improvement testing under the same EFP in 2006-2007. Our actual need for this additional year of work will depend on how well our design improvement work goes during the first year. We have incorporated this possibility for an additional year of research to avoid the need to reapply for a new EFP in 2006

This application details the progress to date on our salmon excluder, the purpose and need for a new EFP, as well as a thorough explanation of changes to the experimental design (where needed), including sample size derivations and how the requested groundfish and salmon bycatch allowances relate to the statistical power analysis. This application has omitted detailed descriptions of assignments of responsibilities for the different stages of EFP work, lists of specific elements for RFPs to select a qualified vessel, as well as such items as a description of report preparation responsibilities. While important, these elements are simply referenced from our earlier EFP applications because we are essentially using the same methods as we used for EFP 2003-01.

We believe the EFP application merits approval because it is a crucial step in the development of a better and more effective means of reducing salmon bycatch and because the EFP experimental design has a high probability of determining the actual effectiveness of such a bycatch reduction device. Through this continued work, the pollock industry is expected to gain a great deal of needed information on the performance and design considerations of a salmon excluder device that would be practical for the pollock fishery.

Thanks in advance for considering our application.

Sincerely,

John R. Gauvin
Principal Investigator

John Gruver
Pollock Industry Coordinator

CC: Sue Salveson and Melanie Brown (NMFS AKR); Gary Stauffer (AFSC); Chris Oliver and Stephanie Madsen (NPFMC)

Request for an exempted fishing permit (EFP) to continue research on salmon bycatch reduction devices

Date of Application: March 2005
Name, mailing address, and phone number of applicant:

Principal Investigator:
John R. Gauvin
2104 SW 170th Street
Burien, WA 98166
(206) 660-0359

Pollock Industry Coordinator:
John Gruver
United Catcher Boat Association
4005 20th Avenue West, Suite 116
Seattle, WA 98199

Purpose and Goals of the EFP: The overall purpose of this application for a new EFP is to provide the necessary conditions to make additional progress on the salmon excluder for pollock trawls. Another EFP is needed to allow us to conduct two tests that we feel are the most relevant scientific work at the current stage of development of our salmon excluder. The first experiment will use a recapture net to evaluate the effects of small adjustments to the excluder and its placement in the trawl relative to the escapement portals. These modifications are designed to improve performance. The second experiment is an evaluation of the performance of the existing excluder under as close to a "real world" deployment as is possible. This test will evaluate the difference between pairs of tows (with and without the excluder) according to an experimental design described in detail below.

Justification for the EFP: Mandates to reduce bycatch and bycatch mortality are set out in the Magnuson-Stevens Act. Current tools to avoid salmon bycatch are costly and at times less than effective. Salmon bycatch caps are currently very restrictive and have resulted in closures of the Salmon Savings Areas during the last two pollock B Seasons. These closures have forced pollock vessels to fish outside their traditional B season fishing areas. This has increased fishing costs, reduced fish quality, and contributed to the failure to attain the total allowable catch. Closures of the Salmon Savings Areas can also affect the relative safety of the smaller catcher vessel operations by for requiring them to fish farther from port once the closures have been triggered.

Names of participating vessels, copies of vessel Coast Guard documents, names of vessel masters: The principal investigator will notify the AKR Regional Administrator in writing of the name of the selected vessels including associated document numbers once the RFP process used for EFP vessel selection is completed. The principal investigator will also arrange to notify all relevant enforcement agencies of the vessel documentation and dates and area of operations for the EFP work. This will include ADF&G, NMFS, and the US Coast Guard.

Application Summary: This application requests an exemption from several regulations governing the Bering Sea pollock fishery as well as allocations of groundfish outside of the regular Bering Sea pollock fishery TAC. These are needed to support our continued research on salmon bycatch reduction devices. In light of the current stage of development of the salmon excluder, we feel our continued work should be focused on two specific areas as outlined below. This support document for our application outlines the field experiments we intend to conduct over the two years if granted a permit.

One experiment is devoted to further development of the excluder design via continued EFP field testing with a recapture device. This will be used to evaluate the performance effects of selected small changes in the excluder. Examples of adjustments are different placements of the excluder in the trawl intermediate, alternative tapers in the square-mesh funnel, and different placement locations for the funnel with respect to the escapement portals.

The second experiment is designed to test the current excluder design without the potential influence of a recapture net. Pairs of tows with and without the excluder will be compared via an experimental design described below. This test is designed to evaluate performance over a wide variety of fishing conditions and in a manner as close to a "real world" application as possible. This is needed to "ground truth" performance information we have obtained in previous tests that were made under a fairly narrow set of testing conditions. Additionally, this test will avoid the potential influence of a recapture device and thus should help to help allay concerns expressed by the pollock industry following our presentation of results at Fish Expo last fall. Some *ad hoc* trials of the excluder in the regular pollock fishery suggest that pollock escapement rates may have been underestimated in our previous tests, perhaps due to the weight of pollock in the recapture net reducing the escapement opportunity by pulling the recapture webbing closer to the escapement portals.

Relief from regulations requested in this application for an EFP:
Relief from existing regulations in several forms is necessary to allow us to conduct successful trials under appropriate catch and bycatch conditions. The first exemption we are requesting is the ability to conduct EFP testing inside the Bering Sea Salmon Savings Areas even when the Salmon Savings areas are otherwise closed to pollock fishing or otherwise would not allow the vessel conducting the test to fish in that area (this refers to the second experiment utilizing paired tows during B season 2005 on at-sea processor). For the first test to further improve the excluder design, this exemption is needed throughout our entire testing period. This test will be conducted on a catcher vessel. We need to access the Salmon Savings Areas because our ability to test there increases the potential for testing the excluder under consistent pollock catch and salmon bycatch rates. Consistent pollock and salmon catch rates have been critical to our work to improve excluder design. At times the Salmon Savings Areas have proven to be the only place where such conditions are reliably available.

The performance of the existing excluder without a recapture net will be tested under a variety of fishing conditions via comparisons of paired tows on an AFA at-sea processor.

This will involve alternating between a net with the excluder and one without an excluder and evaluating the catch rate effects over 50 pairs of tows. To include a full range of relevant fishing conditions, we are seeking permission to conduct approximately one-third of the testing inside the Salmon Savings Area and the Catcher Vessel Operations Area (CVOA). This exemption would apply to the 2,500 out of an estimated total of 8,000 MT needed for the 50 pairs that we are requiring be harvested inside the Salmon Savings Areas/CVOA for this part of the EFP work. Catcher processor vessels are by regulation not allowed to fish for pollock inside the CVOA during normal B season operations. Additionally, given that the CVOA overlaps extensively with the Salmon Savings Areas that may be closed to pollock fishing due to salmon bycatch, we are seeking an exemption to Salmon Savings Area restrictions as well. The reasons this exemption is necessary for this part of our EFP testing are explained in our detailed testing plan for this experiment below.

Another exemption needed for our research is to allow the catcher processor conducting the paired testing experiment to carry two EFP "sea samplers" associated with this EFP in lieu of their normal requirements under the American Fisheries Act. This is necessary to allow us to focus catch sampling and data collection on how the excluder affects salmon and pollock catch rates. Additionally, this will allow us to place some of the EFP project management responsibilities with our sea samplers hired for this work. For instance, our samplers will oversee the testing to ensure that rotations between experimental and control nets are carried out correctly and performance data are matched to the net used for each tow.

Our samplers hired for this work will be NMFS-trained observers who are not currently engaged in observing for the NMFS Observer Program. According to our discussions with the NMFS Observer Division, redirection of the duties performed for an EFP by observers working in the regular pollock fishery is not allowed. Because our sampling emphasis for the EFP changes observers' duties, it is our understanding that we are, in effect, unable to use observers who are currently observing for the Observer Program. Thus for our EFP, we are essentially asking that the AFA requirements for observer coverage are suspended during the EFP test and that our sea samplers are substituted in lieu of the normal coverage requirements during the EFP work. Our sea samplers would thus be responsible for performing the official catch monitoring and accounting duties that NMFS observers perform on AFA CPs.

<u>Amounts of groundfish harvest and salmon bycatch allowances requested for the EFP tests over the next two years and projected timing for our EFP testing:</u>

<u>Test to continued development of the excluder:</u> For continued work on the excluder design (the test continuing to utilize a recapture net on a catcher vessel) an allocation of 2,500 mt of groundfish catch in the pollock target is needed for 2005-2006 and again for 2006-2007. A bycatch allowance of up to 2,500 chum salmon and 500 chinook salmon each year is also required. These allowances should not count against the groundfish TAC or salmon bycatch caps.

As in past years, our tests to work on the excluder design will be conducted mainly in the fall (pollock B season). That time of year has provided the most consistently useful testing conditions for our excluder development work with a recapture device. Thus far, we have been able to find locations during B season with adequate abundance of both chum and chinook salmon where pollock fishing was also feasible. So we anticipate that most of the 2,500 mt of pollock in the pollock target year and associated salmon bycatch would likely be taken during the B seasons in 2006 and 2007. There may, however, be a need to carry some of each year's EFP allocation over to the following winter (A season of 2006 and 2007). This is because although chinook have proven to be sufficiently available for testing over the last two years, longer term seasonal patterns have not occurred in this way. So if chinook salmon are not sufficiently available in the fall for us to obtain sufficient data on their response to the new excluder configurations, we would focus our fall testing on chum salmon and return the next winter to address effects on chinook salmon.

While we may be at a stage where a second year of developmental work on the excluder is unnecessary, we are cognizant that our original schedule for excluder development for our previous EFP was probably too optimistic. With this EFP application covering two years of developmental work, we will avoid the necessity for NMFS and the Council to review another EFP application should our research require an additional year of field work.

<u>Paired test of the current excluder on an at-sea processor:</u> For our paired tow test of the existing excluder design on a pollock catcher processor, we are requesting an allowance of 2,500 mt of groundfish in the pollock target that would not count against AFA allocations or the groundfish TAC. This quantity of pollock would be required to be harvested in the Salmon Savings Area (and CVOA). The paired tow test aboard the at-sea processor will also require an allowance of up to 2,500 chum salmon and 500 chinook salmon while the catcher processor conducts the portion of the experiment inside the Salmon Savings Areas/CVOA.

The at-sea processor selected for this test would have to utilize its own AFA pollock allowance for the remainder of the fishing needed to generate 50 pairs of tows with and without the excluder. Based on an average of 80 mt per tow, we estimate that an additional 5,500 mt of the AFA-qualified CP's pollock would be needed to complete the 50 pairs of tows needed for the EFP test.

An additional bycatch allowance of up to 1,000 chinook salmon is required for the portion of the EFP test on a catcher processor conducted <u>outside</u> of the Salmon Savings Areas/CVOA. While harvesting the approximately 5,500 mt of groundfish outside of the Salmon Savings Area and CVOA, we do not want the AFA CP vessel to be under its normal responsibilities and duties to avoid chinook salmon bycatch as stringently as occurs under the AFA salmon bycatch agreements. So in addition to requesting a chinook salmon allowance to cover the extra chinook caught while conducting this portion of the experiment, the catcher processor conducting our test will be exempted from the tiered salmon bycatch avoidance measures that industry enforces. An allowance for chum salmon bycatch for the portion of the test outside the Salmon Savings Areas/CVOA is not needed.

This entire experiment (all EFP testing during the 50 pairs of tows) would be conducted during the 2005 B season. Likewise, the EFP sea sampler coverage for the test would remain in place during the entire time that the at-sea processor is engaged in conducting the test involving the 50 pairs of tows.

These groundfish allocations for all the EFP testing described in this application would be maximum harvest amounts. For the salmon bycatch allowances we would strongly prefer that the number of salmon requested for the EFP work be treated as "target" maximum numbers of salmon needed for the EFP. In the event of unforeseen salmon bycatch conditions, we may need to request additional salmon bycatch allowances and we would request them in consideration of the progress we are making with our EFP tests.

Purpose and need for a new salmon excluder EFP

Background: Since being granted an exempted fishing permit to work on a salmon excluder device in the summer of 2003, we have successfully conducted research to develop a viable salmon bycatch reduction device for the Bering Sea pollock fishery. In addition to the its intended use in the Bering Sea pollock fishery, the device may eventually be adaptable to other trawl fisheries where salmon bycatch occurs such as in the Gulf of Alaska pollock fishery and the West Coast Pacific whiting fishery.

Our work started with little more than a concept for salmon escapement based on observed differences in swimming behavior between pollock and salmon. Drawing on these differences, we changed the water flow in the intermediate via placement of a panel of square mesh in conjunction with oval escape portals cut out of the intermediate. We have since progressed to the point where testing of two different excluder designs has been conducted and both have achieved measurable reduction in salmon bycatch rates with relatively low pollock escapement rates.

Despite the progress achieved under EFP 2003-01, a great deal remains to be done before such a device can achieve the pollock industry's objectives of effectiveness in terms salmon bycatch reduction and overall feasibility. In the interim period, however, the need for an effective salmon excluder appears to have increased because salmon populations that use the Bering Sea are clearly at high abundance levels with little evidence of "relief" in sight. Salmon bycatch caps for chinook and chum salmon have triggered closures of the Bering Sea Salmon Savings Areas during the last two pollock B seasons. These closures have forced pollock vessels to fish outside their traditional B season fishing areas. This has increased fishing costs, reduced fish quality, and contributed to the failure to attain the total allowable catch. Closures of the Salmon Savings Areas can also affect the relative safety of the smaller catcher vessel operations by for requiring them to fish farther from port once the closures have been triggered.

Industry and fish managers are currently exploring alternative measures to control salmon bycatch in the Bering Sea pollock fishery. While in no way a substitute for the changes under consideration to the current salmon bycatch management measures, an effective salmon excluder would provide a much-needed tool to help pollock fishermen control salmon bycatch. Such a tool supplements the effectiveness of any measures to control bycatch by providing fishermen the ability to fish areas where good pollock fishing overlaps with low or moderate salmon abundance. Thus an effective salmon excluder provides a means of controlling bycatch rates without forcing industry to continually incur the costs of moving fishing operations in response to salmon bycatch rates.

Through four different phases of testing under the 2003 EFP (recalling that NMFS amended our EFP to allow us to repeat our experiment in 2004), we have worked in a dedicated collaborative mode with Dr. Rose of the NMFS RACE Division to develop the overall concept of the excluder and its application. While our progress has already exceeded most expectations (considering that our excluder relies solely on behavioral differences between target and bycatch species and utilizes changes in water flow alone), a great deal more work remains before our original objectives for an effective excluder are achieved.

<u>Steps in the evolution of the salmon excluder since 2003:</u> We started in the fall of 2003 with a "tunnel design" excluder employing a "hood" of 4 inch square mesh webbing inserted into the trawl intermediate about three-fourths the distance back from the mouth of the trawl. The tunnel guided water flow (and fish) down as they passed back through the net with the expectation that salmon clearing the back edge of the tunnel excluder would sense the "lee" of slower water above them. This then allowed them to swim up into this area with slower water speed and escape through the four large escapement portals cut out of the intermediate. With this original design, our research concluded that approximately 12% of the Chinook and chum salmon escaped the trawl and that the accompanying pollock loss was roughly 2.5%.

Problems with the recapture device, however, affected our confidence in the data to measure salmon escapement performance of the device. Additionally, through the video observations during the EFP work it became evident that higher rates of escapement might be possible with modifications to the device.

Through a second year of research made possible through NMFS' extension of our EFP, we set out to test a second-generation excluder. To address problems in the 2003 EFP work, our 2004 test employed an improved recapture system. In the 2004 test, we found that the "funnel" design device (in lieu of the original tunnel) improved the chinook escapement rate to approximately 40%. Chum salmon escapement, however, did not improve. Additionally, about the same relatively low loss rate for pollock was achieved. Our confidence in this estimate of salmon escapement was higher with the improved recapture net.

Modifications to the recapture device were particularly successful in addressing concerns with reversed escapes of salmon (salmon returning to the net from the recapture net during haulback) although the effects of the recapture net testing on pollock escapement remain an open question. This is because drag from catches accumulating in a recapture net that is "flown" above the normal trawl via water kites may rapidly overcome the lift from those kites. The resulting reduction in opening of the recapture net may effectively close off the escapement portals.

Additionally, the design of the recapture device incorporated light materials to help reduce drag and reduce visibility to salmon attempting to escape the net. Our ability to measure higher levels of pollock escapement with our recapture net has been hindered by the vulnerability of these materials to damage. For most of the tows where pollock catches in the recapture net appeared to be relatively high before the net is brought aboard, it was impossible to measure exactly how large these pollock escapement rates were. This was due to damage to the recapture net and loss of catch as it was being brought aboard.

<u>Next steps for research on a salmon excluder through a new EFP</u>
For the next phase of our research, we are focusing on two important and somewhat different areas that we believe are complimentary to the overall objective of the salmon excluder project in the long run. These are:

1. Improvements to the existing excluder design
2. Paired testing of existing excluder design without a recapture net to definitively establish its performance.

EFP Test 1: Continuing EFP research to improve the excluder design to attain higher rates of salmon escapement while maintaining relatively low rates of pollock escapement

Part one of our EFP testing will continue to focus on improving the performance of the funnel excluder. This will involve using the same experimental methods we have used for our research thus far. While we have established a general design approach based on behavioral and physical differences between pollock and salmon, a great deal of additional work is needed to optimize the design to make most of these differences. <u>So the next phase of work on improvements involves making relatively small adjustments to the placement of the square mesh funnel in the intermediate</u>.

Key factors to be tested under this part of our experiments are: the diameter of the intermediate relative to diameter of the opening at the aft end of the excluder, as determined by the taper of the excluder. Additionally, we intend to modify the position of the escapement portals in relation to the back edge of the excluder. Our work thus far has demonstrated that escapement rates of salmon are greatly affected by where and how the excluder funnel is installed relative to the escapement portals.

Because we are primarily interested in measuring the effects of these adjustments on salmon escapement, we feel that the current experimental design employing a recapture net is the most practical and efficient (in terms of statistical power) way to continue to improve the excluder design. Thus our analysis of the effects on salmon escapement (by species) would continue to be based on the proportion of salmon recovered in the recapture net as a fraction of the overall number of salmon per haul. For a thorough explanation of the experimental design used for EFP 2003-01, please see our EFP application developed for EFP 2003-01 in 2003. We would utilize an AFA pollock catcher vessel for this developmental work because catcher vessels are clearly the best platform for this type of research that can involve extended delays while repairs to the recapture device are made or when searching for suitable testing conditions in terms of salmon and pollock abundance.

While we recognize there are inherent limitation to the use of a recapture net to measure effects of the excluder on pollock loss rates, particularly when pollock are densely aggregated and catch rates are high, addressing pollock loss rates under high-catch rate conditions has not been the primary focus of our design work to improve salmon escapement performance. Hence we are confident that are continued use of the methods used in EFP 2003-01 is the best possible approach.

For this work, we are requesting an annual allowance of up to 2,500 MT of groundfish in the pollock target fishery for each of the next two years. This is 230 mt more groundfish to be harvested in the pollock target mode than we have used each year for the last two years for EFP 2003-01. The annual salmon bycatch allowances we are requesting for this work are roughly the same upper limit amounts per year for Chinook and chum as were established for EFP 2003-01. With this amount of groundfish and salmon bycatch, we believe we will be able to achieve our target sample sizes (see 2003 EFP application) to estimate the effects of the device on salmon escapement. Additionally, we feel that with this amount of groundfish we will enable us to get a reasonable estimate of pollock escapement, at least to the extent that our previous tests have been able to accomplish this goal.

As with past years, our testing will primarily be conducted during the fall (pollock B season) although as with past EFP work, we may conduct some testing during A season to address specific questions associated with typical A season conditions. During the B season in 2004, we were able to conduct testing during the four trips on a typical Bering Sea pollock catcher vessel. This afforded an adequate opportunity to evaluate the excluder's effects on salmon catch rates during typical pollock B season fishing conditions. The additional 230 mt of groundfish we are requesting for this EFP application (over what was used in our past EFPs) will serve as a buffer in case the EFP groundfish should be not encounter sufficient chinook salmon abundance during our B season testing each year. While testing during B season is the most efficient time for our work in terms of finding suitable salmon bycatch conditions, chinook have not typically been sufficiently available in the fall in years prior to 2003. Another reason for doing a portion of the test in the pollock A season is to evaluate how salmon escapement is affected by relatively high pollock catch rates. Another might be a specific question regarding chinook escapement in low-light conditions typical of winter in the Bering Sea.

Additionally, we continue to need the ability for the catcher vessel engaged for this research to fish within the Salmon Savings Areas for the EFP test, even if they are closed for the fishery. This relief from the regulations has proven critical in the past to the successful testing of the excluder. This is because on several occasions the only location with an adequate mix of pollock and salmon catch rates for our test has been found within the Salmon Savings Areas.

For this continuing design work, we would solicit applications from interested vessel owners through the same RFP process we used in EFP 2003-01. The RFP process and application review process are described in our application for our previous salmon excluder EFP. Our RFP solicitation informs interested applicants of their requirements and responsibilities if selected as the EFP vessel including: requirements for carrying out the experimental protocols, carrying "observers", conducting safety briefings and drills, and addressing any contingencies that may arise. Likewise, vessel applications would be reviewed by a team on knowledgeable scientists from the NMFS RACE Division with experience in setting up NMFS' research charter cruises. Finally, as with previous salmon excluder EFPs, we will prepare draft and final reports to the pollock industry at Fish Expo and the North Pacific Fishery Management Council each year describing our progress on the EFP work.

Test 2: Paired test of existing excluder design to definitively establish its performance

The primary objective of this work is to do a rigorous test of the existing salmon excluder device without the potential effects of a recapture net. Lingering questions regarding the potential influence of the recapture net on salmon and pollock escapement rates merit special consideration because experience with recapture nets have produced similar concerns in other situations and these concerns are impediment to fleet acceptance of the excluder. Additionally, some *ad hoc* trails of the excluder by several pollock fishermen during the regular fishery last year suggest that pollock escapement may be higher than we estimated for that device in previous EFP tests. This issue is clouded, however, by the fact that lacking any concrete experimental design for these trials. Hence, for *ad hoc* trials, one is essentially attempting to evaluate the proverbial "one that got away".

For this reason, a valid test of our current excluder conducted without a recapture net is of large importance at this stage of our project. Lacking a reasonable estimate of variance associated with salmon bycatch in the past, we had initially assumed that variance was too large to allow for a trial based on comparisons of matched pairs of tows (one with and the other without the excluder). However, data from our previous trials have allowed us to evaluate the ambient variability of salmon and pollock catch rates between matched tows and we now believe that such a test is possible. Based on these data, we have designed an experiment without a recapture net that provides sufficient statistical power to have a high probability of determining the excluder's effects on salmon and pollock catch rates.

As we have known from the outset, recapture devices inevitably influence escapement behavior as well as sometimes creating unanticipated problems with measuring performance. For our experiment, the issue of reversed escapes was troublesome but fortunately we were able to detect it through underwater video observation and then finally address it with the one-way "valve" inserted into the recapture net. Beyond that initial issue, however, we cannot measure how much influence the recapture net had on salmon escapement performance. We know that despite our best efforts to fly the recapture net away from the intermediate with water kites, the recapture net probably remained visible to salmon in daylight conditions and this may have discouraged escapement.

A similar confounding issue may have influenced our ability to measure pollock escapement. Although our water kites created sufficient lift to pull the recapture net away from the escapement portals, in cases where pollock escapement was relatively high, this inevitability tended to pull down on the recapture net towards the end of the tow when pollock became tired and began to collect in the cod end of the recapture net. Despite design work to have the weight of the recapture net pull mainly on the body of the intermediate aft of the escapement portals, we cannot dismiss the possibility that pollock escapement we measured were lower than would occur without the recapture net. Finally, for tows when large bursts of pollock escapement occurred in association with the "bulge" issue, we were essentially unable to measure pollock (and salmon) escapement because these large quantities of pollock eventually led to the failure of the recapture net when we attempted to pull it up the vessel's stern ramp.

As an alternative to testing with a recapture device, an experiment based on evaluating the difference in catch of salmon and pollock between pairs of tows with the excluder (treatment) and without (control) is a preferred approach when the excluder device is functioning well enough so that a large number of experimental pairs can be accomplished with a reasonable expectation that the device is sufficient resilient to be functional throughout the test period.

Experimental Design Considerations for a valid test comparing pairs of tows with and without the excluder

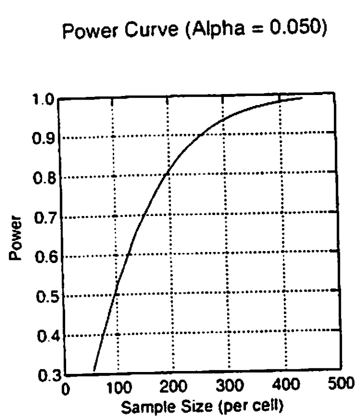
The first consideration for achieving sufficient statistical power is an estimate of the variability associated with the effects we are most interested in measuring. Utilizing data from our EFP tests last fall, we retroactively paired performance data for tows by time and evaluated the standard error of associated logged differences. Variables of interest were between pairs were differences in catch rates per hour of chum, chinook, and pollock. To utilize our EFP data to evaluate "background" variance associated with salmon and pollock catch rates between tows, we aggregated the main net and recapture nets for each tow so that overall salmon and pollock catch per hour would be the metric for comparisons between pairs. This allowed us to generate variability (standard error) for chinook, chum, and pollock catch rates per hour.

For purposes of calculating how many paired trials would be needed to allow us to evaluate the (logged) differences with sufficient statistical power to have a high probability of correctly detecting the effect of the excluder on catch rates, we selected "effect sizes" that for the effects we were trying to measure. These effect sizes were loosely based on our findings thus far in terms of the rates of reduction in chinook, chum, and pollock catch rate differences from our previous experiments with the recapture device. It was necessary, however, in some cases to make adjustments to these expected effect rates. One reason was that when the expected effect we have measured in the past was relatively small, the number of pairs needed to measure it was large (not surprisingly). In these cases, we selected a greater effect size as essentially a "backstop". For instance, our estimate of pollock loss from previous work with the recapture net was between 2-3%. Given the degree of variability in pollock catch rates in our data, detecting such an effect would require an impractical number of pairs. So we selected a larger effect size based on our practical experience regarding the magnitude of an effect (here pollock escapement rate) that would make the excluder impractical for use in the fishery. In this way, the test could at least conclude that the escape rate is less than that threshold effect size.

For the chinook salmon escape rate, to be conservative, we selected 20% as the expected magnitude of the effect that we are trying to measure. While we estimated an effect of over 40% reduction in chinook bycatch for our latest trials, we do not know the actual effects of the excluder (which is what we are trying to ascertain in this performance test). If we assume the same effect as we estimated last fall and the actual effect is smaller, then we risk having insufficient power to detect an actual effect of smaller size then our expected effect. Recognizing that a 20% reduction is probably close to the minimal effect that would make the excluder practical and "worth all the trouble" (cost of building and installing it, consideration of pollock escape rate), we selected a 20% reduction rate as our target effect size.

Statistical power equations utilizing 95% confidence (Alpha=0.05) and statistical power of 80% were generated for the appropriate standard error from our previous data. This power level means that, if the effect actually was the tested size, we would correctly conclude that it was statistically significant in 80 of 100 trials). The number of pairs needed to have this probability of detecting a 20% reduction in chinook catch rate with the excluder is thus roughly 50 pairs (Figure 1).

Figure 1: Sample size needed to detect a 20% decrease in chinook catch using log dif – standard dev. = .24



Alpha = 0.050
Power = 0.800
Model = Paired t-test
Expected Difference = -0.097 =log(0.8)
S.D. of Difference = 0.240
Effect Size = -0.404
Non-centrality parameter= 0.163 * sample
size

SAMPLE SIZE (per cell)	POWER
48	0.783
49	0.792
50	0.800
51	0.808

Total Sample Size = 51 Pairs

We are also interested in the effect of the device on chum salmon bycatch. While chum were also caught on most of the tows in last fall's EFP, there was considerably more variability in the catch rate of chum salmon per hour. Thus to have the same statistical power (as in the above test for chinook salmon) to be able to correctly conclude that the excluder had a 20% reduction in the catch rate of chum salmon, almost 200 pairs of tows would be required (Figure 2).

Figure 2: Sample size needed to detect a 20% decrease in chum catch rate using log dif and standdev = .48

Alpha = 0.050
Power = 0.800
Model = Paired t-test
Expected Difference = -0.097 =log(0.8)
S.D. of Difference = 0.480
Effect Size = -0.202
Noncentrality parameter = 0.041 * sample
size

SAMPLE SIZE (per cell)	POWER

192	0.796
193	0.798
194	0.800
195	0.802

Total Sample Size = 195 Pairs

One could even argue that the magnitude of change we are attempting to measure for chum salmon escapement is high relative to what we have previously detected in our EFP work (9-12%), hence we might even need more pairs than the 195 estimated above. We believe, however, that the data used for sample size estimation may overstate variability vis a vis our ability to conduct testing on effects on chum salmon catch rates. This is because our excluder testing was deliberately attempting to locate areas with sufficient chinook and chum salmon for attaining sample size during last fall's EFP experiment. This was important because our attempts to test the excluder on chinook salmon were thwarted in the winter of 2004 due to an inability to find an area with consistently medium to high chinook bycatch rates. So for our fall 2004 work we intentionally stayed in an area where chinook salmon were present (and some chums were caught) even if this was probably not the ideal place to test the device on chums. Had we had sufficient time and groundfish allocation to target chums, we likely could have worked in an area with less variable chum salmon abundance and if data under those conditions were used for sample size evaluation, a smaller number of pairs would have been required from our power analysis.

The final consideration for sample size is to evaluate the number of pairs of tows needed for measuring the pollock escapement rates with the excluder. Utilizing the same data for calculation of the standard deviation that was used above and the same techniques for the power analysis, we evaluated sample size for detecting a 10% loss in pollock. As can be seen from the power analysis in Figure 3, approximately 37 pairs of tows are needed. We focused on a 10% reduction in pollock catch rate because based on our discussions with members of the pollock industry, any loss rate greater than 10% would make the excluder impractical. This is because the reduction in catch rate would require a considerable amount of additional fishing time to complete trips. Vessels are currently under delivery schedules based on pollock flesh quality requirements. Longer trips would mean either lower quality or coming in with less than complete trips and the latter would decrease profitability costs because fuel for the trip would be the same cost while revenue would be reduced.

Figure 3: Sample size needed to detect a 10% decrease in pollock catch using log dif -standard dev = .22

Alpha = 0.050
Power = 0.800
Model = Paired t-test

Expected Difference = -0.105 (10% pollock loss)

S.D. of Difference = 0.220

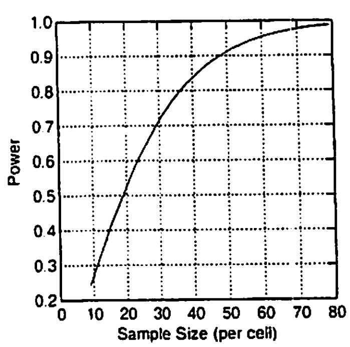
Effect Size = -0.477

Noncentrality parameter = 0.228 * sample size

SAMPLE SIZE (per cell)	POWER
24	0.610
25	0.629
26	0.648
27	0.666
28	0.683
29	0.699
30	0.715
31	0.730
32	0.744
33	0.758
34	0.771
35	0.783
36	0.795
37	0.806

Total Sample Size = 37 Pairs

Power Curve (Alpha = 0.050)



For the sake of evaluation, we also ran a power analysis for a 5% reduction in pollock catch rate. Not surprisingly, the estimated number of pairs needed to measure even a 5% reduction was quite high (148 pairs, power analysis not shown here). As one might expect, the number of pairs needed to measure a relatively small effect increases dramatically. The loss we measured with a recapture device in our different stages of EFP field work thus far have been in the range of 2-3%. Setting up our test to detect this small an effect would be infeasible. The important point here is that designing our test to have more than sufficient power to detect the maximum tolerable reduction rate in pollock catch, we can at least safeguard against failing to detect an effect of that magnitude or greater.

Evaluating the performance of the current excluder via a paired test on an at-sea processor

Applying a statistical power analysis to a multifaceted project such as ours where chinook, chum, and pollock escapement are all of interest is a balancing act. In the end, one must weigh the applicability of the data used to the individual aspects of the problem at hand. Throughout this exercise, on has also to keep in mind what is practical for field work. The practicality is aspect is more than just how much additional groundfish would be required to do the field research. An equally important consideration is that if the number of pairs required for the test is rather large, then the long duration over which that fishing for the experiment would take might involve a higher risk of encountering more variability than the test was designed to control for. For instance, an extended testing period over three months would likely encounter seasonality differences in the abundance of salmon.

At some point, if a large amount of fishing is needed to estimate the effects of the excluder, one might consider redesigning the experiment to use multiple vessels in order to acquire the required number of pairs of tows over a shorter period of time. But the potential for "vessel effect" differences with salmon excluder testing is very large and would thus require addition testing to resolve. This is because for unknown reasons, vessels fishing the same area in the regular fishery using unmodified nets often have radically different salmon bycatch rates. This raises a whole new set of conceptual and practical challenges for EFP work that are beyond our current infrastructural capabilities for an EFP.

For this reason, we settled on a practical approach that we feel generates adequate statistical power while allowing the work to occur in a reasonable timeframe and without necessarily incurring large ambient salmon or pollock abundance changes due to seasonality. Given our multiple testing objectives, we selected a goal of 50 pairs of tows as an amount for fishing for a single vessel that would have a reasonably high possibility of adequately measuring excluder performance for chinook bycatch reduction and pollock escapement.

Because tow by tow measurement of the effects of the excluder is required for our test, we will use pollock catcher-processor for this experiment. This is because a pollock CP is the only vessel where salmon effect can be estimated on a haul by haul basis with whole or partial haul estimations of salmon bycatch. Likewise, the certified flow scales required on pollock catcher processors provide a means of accurately measuring tow by tow groundfish catch rates per hour (and with species composition sampling pollock catch rates per hour). Assuming an average catch rate of 80 mt of groundfish per haul, however, this brings the estimated groundfish catch for this part of the experiment to approximately 8,000 mt (50 pairs = 100 tows times 80 mt per tow).

We are focusing on the pollock B season for this field work because in recent years. that season has produced relatively high bycatch rates for chum and chinook salmon. For the last two years. chum have typically been encountered in September and early October and chinook bycatch rates have also been relatively high starting at the end of September and increasing in October. We estimate that this test will take a pollock catcher-processor approximately one to one and one-half months to complete the required number of pairs of tows. This assumption is based on average catch rates of 300 mt per day and factoring in offloads. travel time to and from the fishing grounds. and some slowdowns due to fishing under the requirement of rotating the experimental and control nets.

To evaluate performance over a variety of typical fishing conditions. our EFP application requests 2,500 mt of groundfish in the pollock target to be used for tows within the Salmon Savings Areas (and CVOA). This would be harvested during the B season of 2005 by the at-sea processor as part of the EFP fishing needed to generate 50 pairs of tows alternating with and without the excluder. While harvesting this 2,500 mt allowance of groundfish, the catcher processor would be required to fish inside the Salmon Savings Areas (and CVOA). The Salmon Savings Areas are of specific interest because a great deal of shoreside pollock effort occurs during B season in the area. Additionally, the relatively high pollock catch rates for B season as well as the relatively shallow fishing depths (hence relatively good ambient light conditions) make it of special interest for this excluder test. For the remaining harvest needed to generate the 50 pairs (approximately 5,500 mt of groundfish), the at-sea processor would utilize its own AFA quota fish and would not be allowed to fish within the Salmon Savings Area (or CVOA).

An allowance of 2,500 chum salmon and 500 chinook salmon is also required for the portion of the test inside the Salmon Savings Areas/CVOA. As is explained above, an allowance of an additional 1,000 chinook is needed for the portion of the test outside the Salmon Savings Areas/CVOA. While the requested groundfish allocations are proposed as hard caps or limits for the experiment, we would prefer that the salmon bycatch amounts be treated as trigger amounts. This means that if catches approach that level, the EFP will need to consult with NMFS in order to evaluate the progress on the EFP relative to the likely salmon bycatch needs to complete the experiment. The salmon bycatch numbers listed above would not be counted against the caps for the Bering Sea Salmon Savings Areas.

Another exemption from existing regulations required for this research is to allow the catcher processor to carry two EFP "sea samplers" associated with this EFP in lieu of their normal observer requirements under the American Fisheries Act. This is necessary to allow us to focus catch sampling and data collection on the effects of the excluder on salmon and pollock catch rates. Additionally, this allows us to entrust some EFP project responsibilities to the sea samplers. For instance, our sea samplers will oversee the testing to ensure that rotations between experimental and control nets are carried out correctly and data collection is matched to the net used for each tow. The sea samplers we will hire for this work will be NMFS-trained observers who are not currently observing for the NMFS Observer Program. Based on a strict interpretation of the regulations governing observer deployments, observers currently observing for the NMFS Observer Program for the regular pollock fishery are not allowed to participate in EFPs because that fishing falls outside of the regular fishery. Even if this condition were relaxed for our EFP, concerns exist for the Observer Division regarding redirection of the sampling duties for observers because EFP requires these duties to be modified for our focus on salmon sampling.

So for our EFP, we are essentially asking that the AFA requirements for observer coverage are suspended during the EFP and that our sea samplers are substituted in lieu of the normal coverage requirements during the EFP work. The EFP sea samplers coverage would take the place of the observer coverage throughout the EFP work on the at-sea processor (during the entire fishing to generate the 50 pairs). During the experiment, our sea samplers would also perform catch monitoring and accounting duties normally performed by NMFS observers on that vessel.

To select a catcher-processor vessel to carry out this paired tow experiment, we would solicit applications from interested vessel owners through a similar RFP process used for our previous EFP work on salmon excluders (see EFP 2003-01). Our RFP solicitation will inform interested applicants of their requirements and responsibilities if selected as the EFP vessel including: requirements for carrying out the experimental protocols, requirements to pay for and carry sea samplers for the entire testing period, as well as things such as conducting safety briefings and drills, and addressing any contingencies that may arise. Likewise, vessel applications would be reviewed by a team on knowledgeable scientists from the NMFS RACE Division with experience in setting up NMFS' research charter cruises. Finally, as with previous salmon excluder EFPs, the principal investigator in conjunction with Dr. Rose of the AFSC RACE Division we will prepare draft and final reports to the pollock industry at Fish Expo and to the North Pacific Fishery Management Council describing the findings of the EFP work.

Sea Samplers hired for this project will be NMFS-trained and certified observers who are not currently performing observer services under the NMFS Observer Program. Project training for sea samplers will be conducted by the principal investigator in conjunction with Dr. Rose of the AFSC's Race Division. The exempted fishing permit holders will keep continuous contact with the sea samplers to ensure that experimental protocols are being followed and to troubleshoot any problems encountered with the field work.

Prior to the paired tow experiment, the principal investigator will conduct an informational briefing with the sea samplers and key vessel personnel to establish an understanding of the project with the vessel crew and facilitate communication and cooperation channels between the crew and the sea samplers. Additionally, the initial installation of the excluder will be evaluated with underwater cameras prior to the start of the paired testing to verify its installation and to familiarize crew members with installation parameters. Qualified personnel from the AFSC RACE Division will provide this assistance prior to the EFP.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

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Seattle, Washington 98115-0070

MAR 1 4 2005

MEMORANDUM FOR: James W. Balsiger
Regional Administrator, Alaska Region

FROM: Douglas P. DeMaster
Science and Research Director, Alaska Region

SUBJECT The Application for an Exempted Fishing Permit to Continue Research on Salmon Bycatch Reduction Devices for the Bering Sea Pollock Trawl Fishery

One member of our staff has reviewed the draft application package from John Gauvin for an Exempted Fishing Permit (EFP) to continue research on salmon (Chinook and chum) bycatch reduction devices. In the first phase of the EFP, they will conduct trials of the current salmon excluder using a recapture net to evaluate the effects of small adjustments to the excluder and the placement of the excluder in the trawl relative to escapement portals. The second phase of the EFP will evaluate the performance of the excluder under actual commercial fishing operations using the optimal adjustment and placement of the excluder following a paired tow design without the recapture net. The first phase will be conducted on pollock catcher vessels that will likely deliver to shore plants while the second phase will likely be conducted from a pollock catcher processor. An EFP is needed for this research to allow quantities of pollock to be caught outside TAC, salmon bycatch to be outside PSC, fishing in the CVOA and Bering Sea Salmon Savings Areas, use of "sea samplers' in place of "observers."

The first phase may require two cruises depending on the outcome of the first trial and the salmon species observed. As we understand the plan, the first cruise will take place in the 2005 fall B season, a second cruise could be necessary again in 2006 B season. If the fall season salmon bycatch is predominately chum, then a portion of a cruise could potentially be conducted in the 2006 or 2007 winter A season to focus on Chinook salmon. The second phase would occur in the 2006 or 2007 fall B season depending the success and timing of the first phase. The P. I. working with Dr. Craig Rose from AFSC conducted a power analysis to determine that 50 paired tows would be needed to detect a 20% reduction in salmon bycatch. Given 50 pairs of tows with the normal cod end catch of 80 tons, they estimated that phase 2 would require 8,000 t of pollock. They propose that they would use 2,500 t of pollock (or about 15-16 pairs) outside of TAC and 5,500 t (or about 34-35 pairs) of AFA allocation from the selected catcher processor.

Given the increasing incidence of salmon in the pollock fishery in recent years, this application addresses finding a gear solution for this very significant problem. Finding such a solution will require research as they are proposing. Again this activity is exactly what EFP process was designed to allow. The quantity of pollock and salmon for phase one has not been justified in this application and should be before the final EFP is issued. The quantity of pollock and salmon requested for phase two is adequately justified. The applicant must also meet with the NMFS observer program leadership to work out an agreement of the sampling/data collection responsibilities of "sea samplers" and "required observers" for the 5,500 t AFA portion of the pollock catch for phase two. We are concerned that the applicant may have underestimated the amount of work to account for salmon bycatch accurately along with the other observer responsibilities. Directing the sampling operations according to the experimental plan and collecting and recording the required data on a 24 hour bases from 80 t cod ends is likely to require more than two people. The application is not specific on whether the P.I., Pollock Industry Coordinator, or the Dr. Craig Rose will participate in any of the at-sea research effort.

The copy of the application that we reviewed has a number of minor errors scattered through out and needs editing. A summary table of the quantity of pollock and salmon by species requested by project phase and fishing season would improve the application.

I have concluded that the proposed research constitutes a valid fishing experiment appropriate for your further consideration and the application sufficiently addresses most of the information requirements for the EFP to proceed with EFP review process. The applicant will need to submit the required identification of the participating vessels to the your office prior to the beginning of any cruises. We would like to review the final application to ensure that quantities of pollock and salmon for phase one have been adequately justified, that the Agency and the applicant have reached an agreement on the use of "sea samplers" to meet the Agency's observer requirements, and that the number of research staff assign to the EFP vessels are sufficient to collect the required data.

cc: Gary Stauffer
Pat Livingston
Bill Karp
Mike Gallagher
Craig Rose

Table 1: Proposed Salmon Excluder EFP Allowances and Exemptions

Part One: Excluder performance research conducted on a catcher vessel	2005-2006	2006 - 2007
requested allowance of groundfish outside of TAC (MT)	2,500	2,500
requested allowance of chum salmon outside of cap (#)	2,500	2,500
requested allowance of chinook salmon outside of cap (#)	500	500
requested exemption to Salmon Savings Areas regulations	yes	yes
Part Two: Excluder "ground truth" experiment on an at-sea processor	**2005**	**N/A**
requested allowance of groundfish outside of TAC (MT)	2,500	
requested allowance of chum salmon outside of cap (#)	2,500	
requested allowance of chinook salmon outside of cap (#)	1,500	
requested exemption to Salmon Savings Area regulations	yes	
requested exemption to Catcher Vessel Operations Area regulations	yes	
requested exemption to AFA observer coverage regulations (substituting sea samplers and focusing sampling on salmon catches)	yes	
Total Groundfish and Salmon Allowances Requested for Salmon Excluder EFP	**2005-2006**	**2006-2007**
requested allowance of groundfish outside of TAC (MT)	5,000	2,500
requested allowance of chum salmon outside of cap (#)	5,000	2,500
requested allowance of chinook salmon outside of cap (#)	2,000	500

Excerpted from Gauvin/Paine 2003 EFP Application (EFP 2003-01) Technical Support Document

Statistical Power To Detect An Effect

A pelagic pollock trawl is equipped with very large meshes (30 meters or greater) in the in the mouth and wings of the net which gradually taper to as little as four inch meshes in the codend. This reduction in mesh size occurs over a distance of approximately 400 meters (stretched mesh basis). Salmon and pollock can escape through the large meshes in mouth and wing sections of a pelagic net, but once they have been successfully herded back into the smaller meshes of the net, there is little chance of escapement from an unmodified trawl due to the relatively small openings.

An important consideration regarding experimental design is that once the pollock and salmon are in the small mesh sections of the trawl intermediate, there are only two possible outcomes for a net rigged with an excluder device. Specifically an individual fish (pollock or salmon) can drop back into the trawl codend or it can "escape" through the excluder, which means in this case it is retained and accounted for in the recapture device used for our experiment.

This "either/or" set of discrete outcomes is suited to statistical treatments that evaluate the probability of detecting the proportion of effect. In this case, the proportion of interest is the percentage of individual salmon escaping (desired effect of the device), thus the proportion of the total number of salmon accounted for in the recapture device relative to total number of salmon caught in the recapture device and trawl codend.

The conventional approach to determination of sample size for proportions is to generate a statistical power relationship (based on the binomial probability distribution) between sample size and statistical power to detect a given effect at a desired statistical confidence level. This relationship is normally depicted as a curve with sample size on the horizontal axis and the power of detecting a difference of a given magnitude.

Of importance is that the magnitude of the effect that is built into this sample size calculation should be designed to be useful to the research question itself. For instance, designing the sample size for the EFP test around the question of whether the excluder has any effect at all on salmon escapement is not really useful to the fishing industry that must later consider the potential tradeoffs associated with using the excluder. Because the pollock industry is faced with the very real possibility of reducing target catch rates in exchange for lowering the bycatch rate of salmon, the sample size for the experiment needs to be designed to allow detection of a performance difference of a fairly small magnitude in terms of reduction of salmon bycatch from the expected level of performance.

Sample Size Calculation

The specific goal that was selected for sample size determination to test escapement of chum salmon from the BRD is based on the number of chum salmon needed to have an

80% chance of detecting an effect that is ten percent different from the underlying or expected effect, at a 95% degree of statistical confidence. The number of salmon needed for the test essentially drives sample size because pollock are obviously far more abundant relative to salmon. Effectively, this means that our confidence that we have correctly detected the effect of the device on pollock retention will occur long before we are confident on the question of how the BRD affects salmon escapement.

Although we have some preliminary information from Dr. Rose's video work suggesting that salmon will egress through an aperture in the top panel of a pollock net, we have no *a priori* or empirical notion of the underlying proportion of salmon that will successfully make use of the excluder developed for the test. Lacking an expectation for this underlying proportion, the risk averse approach to sample size determination (so as to avoid under-sampling) is to assume a proportion of 50%, (probability of 0.50). This, in effect, maximizes sample size for a given set of desired statistical power and desired degree of statistical confidence.

For the chum salmon escapement portion of the experiment, we assumed an underlying proportion of effect (salmon utilizing the escapement device) of 50% (ˆp = 0.5). Our goal is thus to have sufficient statistical power to have an 80% percent probability of detecting a 10% difference in proportion of effect from the underlying proportion of 0.5 with 95% statistical confidence (alpha =0.05). A statistical power curve for those criteria is reproduced in Figure 2 below.

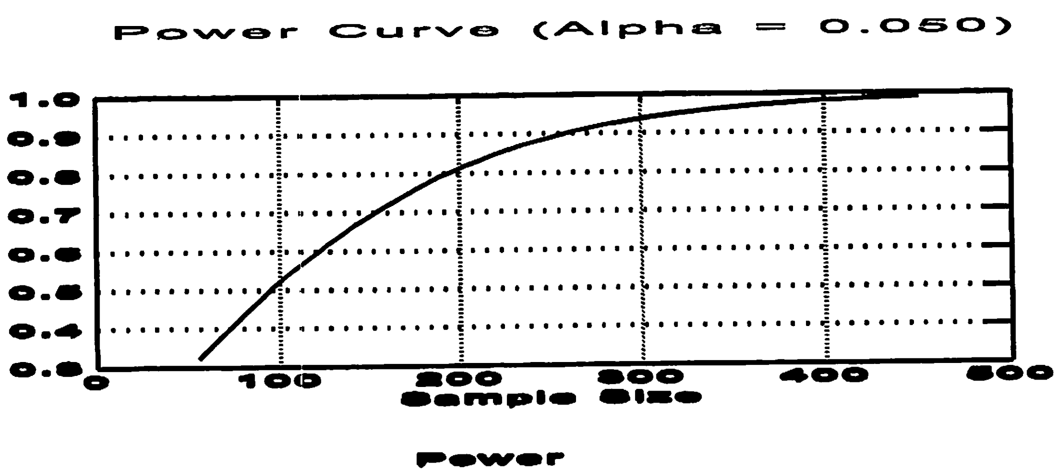


Figure 2: Probability of detecting difference from proportion of 0.6, when the underlying proportion is 0.5

Figure 2 above shows that the desired statistical power for the EFP test requires a sample size of 200 salmon. Recall that the driving factor for sample size is the number of salmon encountering the excluder. This means that for the first part of the EFP work on chum salmon, the goal would be undertake fishing that has an expectation of encountering at least 200 chum salmon.

Calculation of Pollock Catch That Would Be Expected To Generate A Sample Of Approximately 200 Chum Salmon

Because salmon are essentially a byproduct of pollock target fishing, the desired sample size of 200 chum salmon cannot be explicitly and directly generated in an EFP test for the pollock fishery. A practical means of obtaining a sample of 200 chum salmon is to estimate the quantity of pollock fishing that is likely to generate that number of chum salmon. We have done this below based on past conditions associated with chum salmon bycatch in the pollock fishery. We believe that the most reliable representation of what the fishery will encounter when the test is performed next fall is the chum salmon bycatch rates from fall of 2002. This is because strong runs of salmon tend to persist serially based on trends in ocean conditions and year class strength. Thus the most reliable approximation of the availability of chum salmon to the pollock fishery is last fall's bycatch rates. Based on that approach, the target amount of pollock catch that would be likely to achieve a sample of the desired size is derived below.

To evaluate sample size, pollock and salmon catch location-specific data were obtained on a daily basis from Sea State Inc. for the fall pollock fishery in 2002. Daily bycatch rate information on an area-specific basis was used to evaluate variation in daily chum bycatch rates in a specific area identified by Sea State Inc. as a "hotspot" for chum salmon bycatch. This approach was taken because this EFP work will utilize information on chum bycatch rates from the regular pollock fishery to target a specific area with relatively high chum salmon bycatch rates for conducting the experiment. Experience has shown that chum salmon tend to aggregate and that areas of relatively high concentrations can be identified at certain times. While certainly not static and not the only areas where chums are taken as bycatch, these areas are identifiable from the fishery bycatch reporting and management system that is now formalized into the pollock cooperative management system, which industry has agreed to make available to this project.

The goal is to focus the EFP test fishing where salmon are abundant and to plan to do enough fishing so that if bycatch rates are somewhat lower next fall or location of a relative concentration is not as effective as in past years, sufficient fishing will still take place to create a reasonably high probability of obtaining the desired sample size of chum salmon. Assuming that our success at finding an area of relatively high salmon concentration is within the range of what has occurred in the past, this approach in conjunction with somewhat modest expectations of expected bycatch rates will serve to generate the desired sample size.

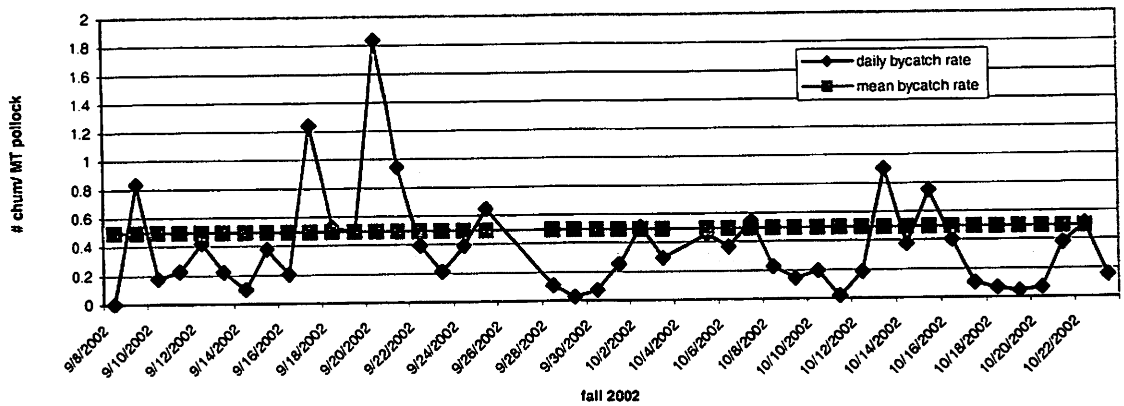
Use Of Fishery Data To Estimate Bycatch Rates For The Chum Salmon EFP Test

In evaluating potential chum salmon bycatch rates, the most useful data for projecting the quantity of pollock catch that would be likely to achieve the target sample size was determined to be data from catcher vessels delivering to motherships during the fall of 2002. This data source was selected for the following reasons. Portions of the Bering Sea shelf area are restricted to catcher vessel operations (Catcher Vessel Operations Area) and this area has consistently experienced relatively high chum salmon bycatch rates (Witherell and Pautzke 1997). For this reason, catcher vessel data was the most applicable for determination of expected chum salmon bycatch rate associated with a concentrated bycatch area.

In addition, for the subset of catcher vessels delivering to motherships, salmon bycatch rate data are available on a haul by haul basis. This allows for assignment of the location and a daily rate of salmon bycatch. Data from catcher vessels delivering to shoreside plants cannot be used consistently to calculate salmon bycatch rates on a haul by haul or daily basis. This is because salmon are not systematically accounted for, in most cases, until observer sampling that occurs at the time of shoreside delivery. For shoreside delivery vessels, quantity of pollock and salmon taken over the course of the fishing trip is the most detailed level of data available. That effectively means bycatch rates for shoreside delivery vessels can only be determined over a three to four day period. During that time, a vessel may fish several different areas, with fish from all areas mixed in the vessel's holding tanks. For this reason, daily chum salmon bycatch rates from catcher vessels delivering to motherships was preferred.

Figure 3 below illustrates daily bycatch rates of chum salmon for an area identified by Sea State to have generally high chum salmon bycatch rates during the fall of 2002. Note that there are several daily periods with relatively high bycatch rates compared to the arithmetic mean rate for the total number of salmon taken by the vessels in the data set divided by the total pollock tons by these vessels. Because the EFP test must be scheduled in advance, and because it is probably unwise to assume that the EFP test will encounter peak bycatch rates, the expectation for daily salmon bycatch rate used for this calculation of pollock tons needed for the experiment was based on only the days with rates that were less than the mean daily rate during the period of data provided by Sea State (9/8/02 – 10/23/02). This removed 11 of the 42 days for which daily rates were available for catcher vessels delivering to motherships in the zone of relatively high bycatch rates from our data set.

Figure 3: Daily Chum Bycatch Rates



The above treatment of the chum salmon bycatch data attempts to balance the ability to target a chum salmon bycatch hotspots with the practical reality that timing for the EFP is not completely flexible and bycatch rates may not be as high as those peak rates encountered in the hotspots within the CVOA last fall. From the above data and the procedure used to remove all the daily rates above the mean bycatch rate, the baseline bycatch rate of 0.23 salmon per ton of pollock was used to calculate the probably amount of pollock needed to generate the desired sample size. Calculation of that expected quantity of pollock was done in the following manner: 200 (number of salmon for desired sample) divided by 0.23, or approximately 870 MT.

Based on the assumptions made above, this should be a sufficient quantity of pollock to derive a sample of 200 chum salmon for the EFP under conditions that occurred in the recent past. Another 100 MT of pollock catch is needed for the chum salmon portion of the EFP work to allow for two pre-test trawl tows with a closed codend and recapture device to ensure that the device is deploying sufficiently on trawl gear of the vessel selected for the EFP work. This brings the overall pollock catch for the chum salmon portion of the EFP to 970 MT.

Establishment Of Limits On The Amount Of Pollock Available For The EFP

The approach to derivation of sample size for the development of the chum salmon excluder portion of the EFP (and later the Chinook EFP work) was based on determination of a sufficient quantity of pollock that was expected to achieve the desired sample size. In reality, given that chum salmon catch rates vary considerably on a tow by tow basis, it is possible that a large fraction of the expected sample size could come from a few hauls during the EFP. This presents a practical consideration for the EFP test. Given that the opportunity to catch pollock outside of the total allowable catch is being used to help fund the EFP research, the EFP work must be structured around a predictable outcome for the vessel owner who is interested in applying to do the EFP work. Specifically, the applicant needs to know how many tons of pollock are available for the EFP work in order to calculate his costs and expected revenues associated with participation in the field work.

This approach of basing the EFP catch limits on the amount of target catch instead of catch of the desired number of salmon for the sampling design was done specifically to make the EFP work feasible for industry applicants. An alternative approach of conducting fishing until the target number of salmon are caught might mean that the EFP test fishing could be accomplished in a few tows or a very large number of tows with a large amount of pollock catch relative to the specified 970 MT of catch for the chum salmon excluder test. We believe the "fish until you obtain the sample" approach is simply not practical for the applicant who, in the end, has to assume the risk of undertaking all the costs of the experimental fishing associated with the EFP. Likewise, fishery managers are not likely to approve an open-ended amount of pollock for this EFP.

Our approach attempts to strike a balance between the goals of the research, the funding model for a portion of the EFP work, fishery management's need for concrete limits for consideration of an EFP application. The actual ability of the EFP to achieve its goals for chum and Chinook salmon sample generation depends heavily on the reliability of the approaches taken to estimate sample size and associated amounts of pollock catch. We have examined other approaches to generating the desired sample size and concluded that the approach described here is reasonable (based on past experiences with EFPs) and preferable given the needs of all parties.

Sample Size For The Chinook Salmon Field Test Portion Of The EFP Work
As is explained above, differences in behavior and depth preference characteristics as well as factors relating to environmental conditions at different times of year (spring versus summer/fall) make a separate test of the salmon excluder necessary if we are to know how the excluder functions for reducing bycatch of Chinook salmon.

Following the first test of the excluder, a process involving input from fishermen will be undertaken to review potential modifications to the device based on how well it performed on chum salmon and what differences would be expected in terms of its expected performance for Chinook salmon. This process may lead to a decision to change the placement or design of the existing excluder device, or it may simply result in a decision to test the device exactly as it was deployed for the chum salmon test. In either case, the question of performance of the device should be treated as a separate question, that of "what proportion of the Chinook salmon does the (modified?) device have the desired effect upon relative to the total number of salmon that encounter the device"?

Sample Size Calculation For The Chinook Excluder Test
Unfortunately, given the relatively low expected bycatch rate for Chinook salmon even under peak bycatch timing and conditions, our ability to build statistical power into this

portion of the EFP test is lower than it was for the chum salmon test. In the test for chum salmon escapement, the experiment is based upon the ability to discern as small as a 10% difference from the underlying proportion (again $\bar{p}$ is set at 0.50). After evaluating expected bycatch rates for Chinook salmon, it was obvious that this degree of statistical power is not practical for the Chinook EFP test. This is because such statistical power would mean that the EFP would have to catch as much as 8,000 MT of pollock to obtain a sample of 200 Chinook salmon.

For this pragmatic reason, a lower standard of statistical power was adopted for the Chinook salmon BRD test. Our goal for this portion of the test is to have an 80% power to detect a 25% difference from the underlying proportion of 0.50 with 95 % statistical confidence. Sample size under that set of criteria for statistical power is derived below:

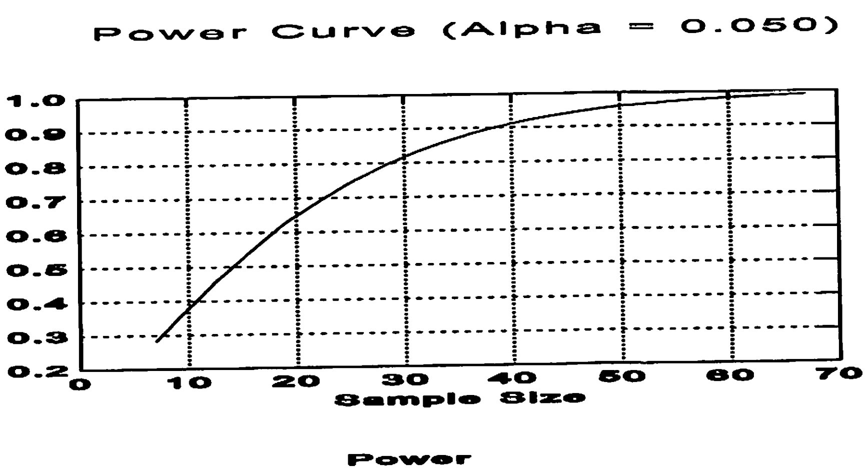


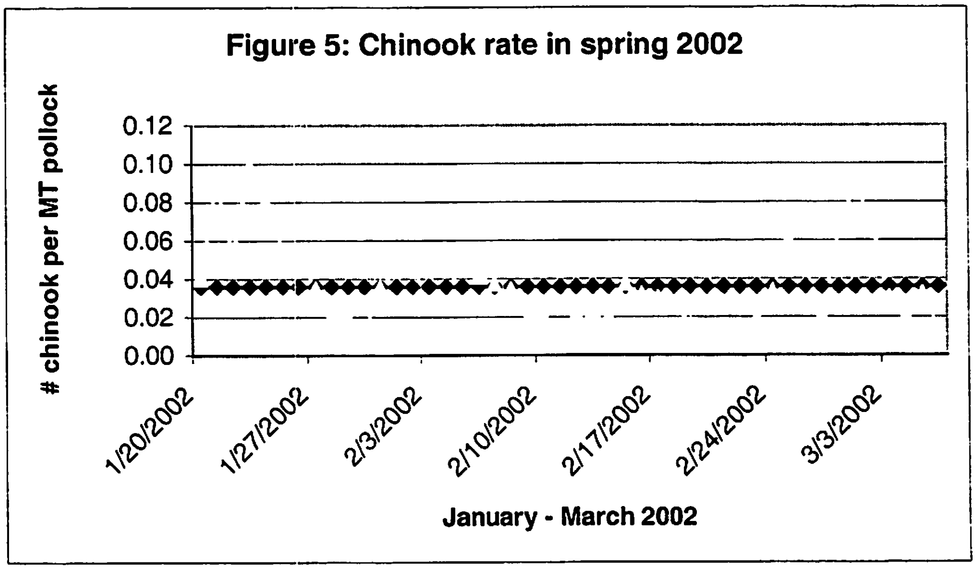
Figure 4: Probability of detecting difference from proportion of 0.75, when the underlying proportion is 0.5

Under this somewhat lower but still meaningful level of resolution to measure the effect of the excluder for releasing Chinook salmon, a sample size of 30 Chinook salmon is expected to provide an 80% probability of detecting a 25% difference from the underlying proportion of 0.50 with alpha set at 0.05 once again (see power curve above). As will be seen below, this sample size is practicable given expected bycatch rates for Chinook salmon. These bycatch rates were once again based on hotspots during the 2002 pollock fishery, this time during the spring pollock fishery.

Use Of Fishery Data To Estimate Bycatch Rates For The EFP Test

Data used to generate an expected rate of salmon bycatch for this portion of the EFP test were once again supplied by Sea State, Inc. This time, however, observed bycatch rates from a Chinook salmon hotspot were from pollock catcher processors during the spring of 2002. In the case of the spring fishery, there are no special regulatory restrictions that affect the areas where catcher processors can fish as was the case for chum salmon bycatch data. The high observer coverage on at-sea vessels fishing in the spring of 2002 makes their data highly suitable for assessing daily bycatch rates.

The same data treatments were performed on this Chinook salmon bycatch rate data as were performed above for the chum salmon data. To remove the effects of the high bycatch rates days from the data, we once again removed all the daily rates above the average (average based on the total number of salmon divided by the total tons of pollock for the period January 20, 2002 through March 6, 2002). That average rate was 0.04 Chinook per MT of pollock. This procedure to drop above-average bycatch rates removed 15 days with relatively high Chinook salmon bycatch rates from the overall number of 45 days in the data set supplied by Sea State (Figure 2 below).



From this procedure, we arrived at a "conservative" daily expected rate of 0.025 Chinook per metric ton of pollock. Once again, the purpose of this manipulation was to develop an expectation of the bycatch rate in an area with a relatively high rate but account for the possibility that the somewhat inflexible timing of the spring 2004 EFP work on Chinook salmon may not allow us to conduct the test during peak periods. If the field work for the test is able to hit a peak period, then sample size will be higher than expected and this will serve to augment the ability of the test to determine the precise effects of the excluder.

Amount Of Pollock Catch That Would Be Expected To Generate The Desired Sample Size of 30 Chinook Salmon For The Chinook Salmon Excluder

Based on the data and data manipulations described above, we calculate that 1,200 MT of pollock needs to be caught to generate a sample of 30 Chinook based on an expected bycatch rate of 0.025 Chinook per ton of pollock (30 Chinook / 0.025 Chinook per MT). Once again, the EFP work will need two pre-test hauls with the cod end and recapture device in place and to make sure the excluder is deploying reasonably for the test work. This brings the overall amount of pollock for this portion of the EFP work to 1,300 MT.

Target and incidental species harvested in the EFP work:

Groundfish: The estimated total harvest of allocated groundfish species including both the chum salmon stage of the EFP work (970 MT of pollock in fall of 2003) and the Chinook salmon stage (1,300 MT in spring of 2004) is 2,270 MT of groundfish. Approximately 98% of which is expected to be pollock and 2% is expected to be other groundfish species such as Pacific cod and flatfish. Retention standards for the EFP work will be the same as those for the directed fishery for pollock.

Pacific salmon: The determination of sample size for each species of salmon for each excluder trial is based on a target amount of pollock catch which, under the assumptions of the EFP work, is expected to have a reasonably high probability of generating the desired sample sizes for the two stages of the EFP. To reduce the risk of "under sampling" if salmon abundance turns out to be lower than it was in the data for the period used to develop sample size calculations, only below average bycatch rates for the period covered by the fishery data used for sample size estimation were used for sample size calculations. This procedure was adopted to increase the probability that the EFP achieves its sampling goals should the EFP fishery work encounter only "below average" salmon abundance conditions in areas where pollock fishing occurs.

An "upper end" estimate for salmon mortality associated with this project is 2,183 chum salmon and 217 Chinook salmon. This estimate was made based an assessment of the highest individual vessel salmon bycatch data used for calculating sample size above. Vessel-specific chum or Chinook salmon bycatch rates (respectively) were evaluated on a weekly average basis to determine what the highest weekly rate for an individual vessel was in our data. These rates (2.25 chum salmon per ton of pollock and 0.17 Chinook per ton of pollock) were then applied to the overall quantity of pollock (including the two test tows) to produce the upper bound estimate of salmon bycatch by species discussed above.

Item D-1(d)(4)
April 2005

Dr. James Balsiger
Regional Administrator
NMFS- F/AKR
P.O. Box 21668
Juneau, AK 99802

Re: Gauvin/Gruver salmon excluder EFP Application (March 05)

Dear Dr. Balsiger:

Thank you for considering our application for a new exempted fishing permit to continue research on salmon excluders. This letter responds to the issues raised in NMFS' March 14th memorandum from Dr. DeMaster to you outlining the Alaska Fisheries Science Center's review of our application. Below we respond to each substantive issues identified in the review.

Thanks in advance for considering this additional information as part of our application. At the request of the reviewers, we have also provided a table outlining the amounts of groundfish (in the pollock target mode) and chum and chinook salmon requested for each part of our EFP research. Included in the table is a list of the specific regulations from which we are requesting an exemption for each part of the EFP work.

We hope this additional information adequately addresses the issues raised in the review. Please contact John Gauvin if you have any questions or require any additional information. Thanks in advance for your consideration of our application.

Sincerely,

John Gauvin

CC: DeMaster, Stauffer, Rose, AFSC; Salveson, Brown, AKR

Issue 1: Sample size calculations for the portion of the EFP devoted to salmon excluder design improvements (providing justification for groundfish and salmon allocations requested)

The portion of our current EFP application that continues developmental work on the excluder will utilize experimental methods that are essentially the same as the one used over the last two years. For this reason, we assumed we could incorporate by reference the experimental methods used for EFP 2003-01. In any case, the methods we have actually used over the last two years have departed slightly from what we set out in our original EFP application so describing these differences is a worthwhile endeavor. To help illustrate the differences from what we originally described in our 2003 EFP application, we have attached as background material the experimental design section for our 2003 salmon excluder EFP application. Additionally we explain below how and why we decided to adjust our methods based on testing conditions encountered in our research.

The reason we departed from the original testing methods set out in our 2003 EFP application was that our field work starting in 2003 encountered much higher than expected abundance of salmon in areas with good pollock fishing. Because sample size for salmon of each species was treated as a function of how much pollock fishing for our experimental design, this meant that we could either exceed our target sample size, conduct less fishing to generate our target sample sizes, or modify our methods to test additional salmon excluder designs and configurations. We opted for the latter approach because clearly at this early stage in the development of a salmon excluder, there is much potential benefit to trying a number of approaches. And based on the success we have had making sequential adjustments to the excluder once we have achieved our target sample sizes and adequately tested a given configuration or design, we have essentially revamped our methods to plan to work in this manner as long as salmon abundance allow us to do so. From this experience, our thinking in terms of how much fish we are requesting for EFP testing has also evolved from one of focusing on sufficient groundfish and salmon to allow for testing of a single excluder configuration to focus on an amount of EFP fishing allowance to provides an adequate opportunity to make progress on the excluder with the goal of substantively improving its performance in the areas described in our EFP application.

The most fundamental aspect of our methods for this part of our EFP work is the use of a recapture device to determine the proportion of salmon or pollock that used the excluder versus the proportion that did not do so. Based on the goal of having adequate statistical power to detect a proportional effect (we originally focused on detection a 50% effect, please see excerpted methods from 2003) our sample size requirements were determined to be 200 chum salmon and 30 chinook salmon. This would adequately assess performance of the excluder for these two species of salmon that are commonly taken as bycatch in the pollock fishery.

With these sample sizes as a goal, we calculated the quantity of groundfish needed to generate these samples from recent (2002) salmon bycatch data from the pollock fishery. The approach was to evaluate how much groundfish catch would be needed to have a reasonably high chance of generating our desired sample sizes. An underlying assumption here was that chum salmon sample size would be generated from B season fishing and chinook salmon could only be found during A season (i.e. that conditions would not allow generation of chum and chinook samples simultaneous).

Fully expecting to follow these methods exactly, we started our field test in the fall of 2003. But conditions encountered differed markedly from our expectations. The relative abundance/availability of salmon to our EFP tests during both A and B season pollock fishing was considerably higher than we had expected. Hence we had overestimated how much pollock fishing it would take to generate our desired sample. This occurred despite our adherence to our original objective of conducting the testing over a range of ambient conditions that commonly occur in the pollock fishery. Specifically, we set out to obtain our sample size over more than just a few test tows to help ensure that we were evaluating the effects of the excluder over varied conditions that are commonly encountered in the fishery. To accomplish this, we required that the vessel selected for the EFP test limit its catch per haul to approximately 60 Mt. This avoided consuming our pollock allocation too rapidly and over too narrow a set of testing conditions. But given the consistently higher than expected abundance of salmon, we were in fact able to attain our desired sample sizes with a portion of the groundfish catch we had expected even with the requirement for smaller than normal catch per tow.

In retrospect, the unexpected ease at which our salmon sample sizes were obtained is not surprising given the large increase in salmon bycatch and bycatch rates in the Bering Sea pollock fishery since 2002. While we could have simply declared our testing completed, we had effectively determined that the first excluder design achieved an escapement rate of approximately 12% with an associated 2-3% loss of pollock. While encouraging, it was certainly possible that this could be improved upon with an alternative excluder design or an adjustment in its placement or configuration. Given that we had already incurred considerable expense to "gear up" for the work at sea, once we had attained our target sample size to measure the effect of the excluder on salmon catch rates we decided to test a different configuration of the excluder. This was done based on information gained from our underwater video, insights gained our experience with the excluder device relative to the proportion of salmon and pollock recovered in the recapture net, and input from the excluder designer (Mr. Gruver), net manufacturers who took part in the field research, and the insights of captain of the test vessel.

In light of what we learned from our experiences testing the salmon excluder over the last two years of testing, we have reconfigured our thinking about how much groundfish and salmon to request in order to have sufficient opportunity to conduct the amount of field design work and testing we feel is productive and feasible on an annual basis. We clearly have been able to stage and make productive use of approximately 4 weeks of testing over the course of two years of work predominantly during the B season but continuing into the A season as conditions require. With the incremental adjustments to the excluder thus far, we have already been able to achieve an escapement rate of greater than 40% for chinook salmon with what we believe is a 2-3 percent pollock loss although there are still lingering questions about pollock escape rates and problems associated with high pollock catch rates.

So the quantities of groundfish and salmon we have requested in our current EFP application are essentially our best estimate of what it will take to allow us to test several adjustments to the current "funnel" salmon excluder device each year to adequately evaluate and hopefully greatly improve its performance. We are seeking performance improvements in both salmon exclusion and avoidance of gear malfunctions associated with the excluder. If salmon bycatch conditions continue as we have experienced over the last two years, then we anticipate being able to test as many as three adjustments aimed at increasing chum and chinook escapement during each year of testing. If salmon bycatch rates return to the more normal levels experienced in 2002 (then year for which data was used to design our original experiment), then we might not be able to test as many adjustments to the excluder design for chum and chinook salmon escapement each year. But based on 2005 conditions in the regular fishery thus far, it appears more likely that we will be able to test at least two adjustments each year.

Another way to consider the requested quantities of groundfish for this portion of the EFP is to view them as what we consider necessary to carry out approximately 4 weeks of field development and excluder testing each year for the next two years. Work to date has generated more potential issues and avenues for improvement than can be exhausted using the single hypothesis per year concept proposed for the first EFP. These include gear design (e.g. funnel tapers, escape portal positions and ways of avoiding entrainment of fish in the excluder) and operational (e.g. slowing and holding during haulback) modifications. While low salmon encounter rates could limit us to a single hypothesis per year, the recapture method has proven efficient enough to evaluate perhaps as many as three per year given better salmon conditions. Given the effort required to launch the field work, it would be wasteful to terminate work after a few days if development could be further advanced by continuing testing on other well-developed concepts. On the other hand, new concepts should not be put into testing without time for data review, consultation, design and preliminary development. Given the resources available to this project, we estimated 4 weeks to be the amount of field testing that we can practically support annually, considering the amount of work it takes to generate that amount of field testing of well-developed concepts. The background work needed to lead up to and support 4 weeks of field development and testing includes reviewing video and sonar footage, holding meetings with fishermen and gear manufacturers to discuss design improvements, flume tank design work to ground truth those suggestions, and finally the gear construction work and preparation for sea trials. Given our current resources from industry sources and those made available from the RACE Division of NMFS, this is a feasible but still ambitious amount of developmental work on the salmon excluder from our experience.

Issue Two: Exemptions from AFA Observer Requirements for the "ground truth" test of the current excluder design on an at-sea processor pollock vessel

The review comments touch on several aspects of sampling, tracking, monitoring, and project management for this part of our EFP application. The project management issue is rather straight forward so we will address that one first. Upon further consideration, we concur that a full-time project manager is needed on board the at-sea processor vessel during the entire period covering the EFP work on the at-sea processor. This project manager will be needed to make sure groundfish catches stay within the allowances of the EFP for the portion of the EFP conducted inside the Salmon Savings Areas/ CVOA. Additionally, the project manager will help make sure the rotations between experimental and control nets are done adequately, that catch is attributed to each net correctly, as well as serving to oversee other aspects of the project including troubleshooting problems as they occur. So we agree to furnish a qualified project manager who will work as the responsible agent for the exempted fishing permit holders throughout the entire EFP "ground truth" test of the current excluder design conducted on an at-sea processor vessel.

Resolving the sampling/ catch accounting matter is more problematic for the "ground truth" experiment. We proposed to use "sea samplers" to conduct the sampling and basic data collection and accounting tasks. The NMFS reviewers request that we resolve the use of our sea samplers with the need for "required observers" for the portion of ground truth experiment where the AFA at-sea processor will be working on its own AFA allocation of groundfish.

The experimental design requires measurement of the salmon and groundfish catches from every tow. Because a few salmon can make a large difference in test results, the salmon measurement needs to be as close to a census as possible. The next priority is to obtain catch composition samples to estimate the proportion of the target pollock in each catch as well as to get more pollock length data than is normally collected during regular observer sampling. Additionally, sampling needs to be consistent throughout the experiment. We believe that making such measurements is a feasible, but full task for two samplers with help from the project manager. The need to focus sampling on EFP objectives was the reason we proposed that catch monitoring be allowed to differ from standard Observer Program procedures and requirements. Our understanding that such departures preclude the use of observers who are currently under contract led us to propose using sea samplers, individuals with observer training that are not currently under contract. This provides the flexibility and focus necessary to achieve the EFP goal of assessing the overall performance of the excluder.

The reviewers have differentiated between the part of this work will occur inside the Salmon Savings Areas (and CVOA) utilizing a groundfish and salmon allowance outside of the normal AFA pollock fishery and TAC/bycatch cap from the rest of the EFP work comprising the "ground truth" experiment overall. We proposed to use our sea samplers for the entire ground truth EFP work whether fishing for the catch outside of the TAC or when the vessel is catching its own AFA allocation. The sea samplers we proposed to use would be NMFS-trained observers who are not currently serving as observers for NMFS and are specifically directed for our EFP to focus sampling on the variables of interest for the EFP. From our understanding of the NMFS review comments, NMFS apparently concurs with our plan to use "sea samplers" for the portion of the "ground truth" experiment where the participating vessel would be catching fish that are not part of its AFA allocation. Our request is essentially to continue to use these same "sea samplers" while the at-sea processor vessel selected for the test conducts the portion of the EFP test utilizing its own AFA allocation of groundfish outside of the Salmon Savings Areas and CVOA. Thus we are in essence requesting that the selected vessel be exempted from its AFA observer requirements under our EFP permit while it conducts the remainder of the EFP test.

To facilitate a clear delineation in terms of participation in the EFP test and in consideration of the monitoring issues raised by the reviewers, we think that it may be worthwhile to require that the selected at-sea processor vessel be required to conduct only EFP fishing once the EFP has commenced and until the test is completed. This would remove the possibility of the vessel conducting non-EFP (non-exempt in terms of observer coverage as we have proposed) AFA fishing with our sea samplers on board in lieu its normal AFA coverage.

An alternative is to "double up" the coverage, having both observers and sea samplers aboard, during the period of time when the AFA vessel is utilizing its own AFA quota during our EFP test. This added cost on the participating vessel as well as the bunk space issues it might trigger might have a negative effect on our ability to find an at-sea processor willing to undertake this EFP work and commit to using approximately 5,500 tons of pollock from its own AFA allocation for roughly two-thirds of the EFP work. For this reason, we would certainly like to avoid this outcome.

We have reviewed the regulations governing EFPs and believe that an exemption to the AFA observer coverage regulations is not specifically problematic in terms of the intent of an "exempted fishing permit" even if the vessel is harvesting its AFA allocation. Additionally, from our understanding of the regulations governing NMFS observers, observers under contract to observe for the NMFS Observer Program can only work for the Program while currently under contract to be deployed as observers for that Program. In the past, we have received advice that this also avoids the potential problems associated with our need to redirect the sampling duties for our experimental purposes.

For this reason, our EFP application and our EFP applications in the recent past have specifically avoided using observers currently working for the Program during our EFPs (at least since we became aware of this regulation). If this is not the case for our current experiment and (most importantly) if we can adequately redirect the sampling duties for purposes of our experiment, then we have no problem utilizing regular observers. We would want to work with Observer contractors to make sure that observers selected for the EFP work were willing to take on the additional challenges of expanded sampling for salmon and pollock effects and paperwork duties associated with tracking catches from experimental and control nets. In any case, we look forward to constructively resolving this matter with NMFS, the Council, and the NMFS Observer Program.

DRAFT ENVIRONMENTAL ASSESSMENT

For Issuing an Exempted Fishing Permit for the Purpose of Testing Salmon Excluder Devices in the Eastern Bering Sea Pollock Fishery

April 2005

Lead Agency: National Marine Fisheries Service
Alaska Regional Office
Juneau, Alaska

Responsible Official: James W. Balsiger
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Alaska Regional Office

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Abstract: This Environmental Assessment (EA) provides an analysis of alternatives to issue an exempted fishing permit (EFP) for the purpose of further development and testing of salmon excluder devices in the pollock trawl fishery of the Bering Sea. The experiment would be conducted in the fall of 2005 and in the spring of 2006 with a possible modification to the permit to allow for an additional year of testing. The EFP would provide exemptions to certain groundfish fisheries regulations to support the activities for necessary to conduct the research. In 2004, the pollock trawl industry exceeded the chinook and non-chinook bycatch limits and the incidental take statement for Endangered Species Act listed chinook salmon in the Bering Sea and may exceed these limits in the future, unless changes in fishing practices are made. Exceeding the salmon bycatch limits in the pollock trawl fishery can affect the locations available to pollock fishing vessels that may result in additional costs to the industry. The successful development of a salmon excluder device for pollock trawl gear may result in reductions of salmon bycatch and potentially reduce costs associated with the harvest of pollock. The proposed action is not expected to have significant impacts on the human environment.

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EXECUTIVE SUMMARY

The purpose of this action is to allow further development and testing of salmon excluder devices in the eastern Bering Sea pollock trawl fishery. Chinook salmon *Oncorhynchus tshawytscha* and non-chinook salmon (primarily chum salmon *O. keta)* are caught incidentally in Alaska groundfish fisheries, primarily in the walleye pollock *Theragra chalcogramma* trawl fishery. Salmon are a prohibited species in the groundfish fisheries (50 CFR 679.21) with annual limits placed on the number of chinook and non-chinook salmon taken in the Bering Sea and Aleutian Islands (BSAI) trawl fisheries. The chinook salmon prohibited species catch (PSC) limit for the BSAI trawl fisheries is 29,000 fish and the non-chinook salmon PSC limit in the Catcher Vessel Operating Area (CVOA) is 42,000 fish between August 15 and October 14. Exceeding these limits triggers the closing of salmon savings areas (50 CFR part 679 Fig. 8 and Fig. 9) for certain time periods to allow for protected areas for the salmon. Pollock also occurs in the salmon savings areas, and closure of these areas may result in added expense to the pollock fishing industry. In 2004, the pollock trawl fishery exceeded the chinook salmon PSC limit and the incidental take statement of 55,000 fish for Endangered Species Act (ESA) listed Chinook salmon in the BSAI. Based on historical bycatch rates, the PSC limit for chinook salmon will likely be exceeded, resulting in the closure of the Chinook Salmon Savings Area. A salmon excluder device would lessen the potential for exceeding the PSC limits and would reduce the potential for constraints being placed on the trawl fisheries due to exceeding salmon PSC limits.

In order to conduct the testing, an exempted fishing permit (EFP) is required. The applicants for the EFP have worked with the Alaska Fisheries Science Center to develop a scientifically sound experiment to test the excluder devices. Exemptions from fishery regulations regarding total allowable catch (TAC) and PSC limits, closures of the salmon savings areas and CVOA, and observer requirements are needed to permit the collection of data required to successfully complete the tests. Based on the need to conduct the work in a scientifically acceptable manner, the alternatives for this proposed action are limited to the status quo (Alternative 1) and issuing the EFP (Alternative 2, preferred alternative).

The analysis of implementing both alternatives determined that there would be no significant impacts on the human environment. The impact of future actions under Alternative 2 could potentially be beneficial economically to those involved in the pollock fishery. However, the amount of future use of the salmon excluder devices cannot be determined, and therefore, the significance of future impacts cannot be determined. Alternative 2 is preferred because it will allow for the testing of the salmon excluder devices in a scientifically acceptable manner, potentially leading to the reduction of salmon bycatch in the pollock trawl fishery.

1.0 PURPOSE AND NEED FOR ACTION

The purpose of this action is to allow the further development and testing of salmon excluder devices in the eastern Bering Sea pollock trawl fishery. Chinook salmon *Oncorhynchus tshawytscha* and non-chinook salmon (primarily chum salmon *O. keta)* are caught incidentally in Alaska groundfish fisheries, primarily in the walleye pollock *Theragra chalcogramma* trawl fishery. Salmon are a prohibited species in the groundfish fisheries (50 CFR 679.21) with annual limits placed on the number of chinook and chum salmon taken in the BSAI trawl fisheries. The chinook salmon prohibited species catch (PSC) limit for the BSAI trawl fisheries is 29,000 fish and the non-chinook salmon PSC limit in the Catcher Vessel Operating Area (CVOA) is 42,000 fish between August 15 and October 14. Exceeding these limits triggers the closing of salmon savings areas (50 CFR part 679 Fig. 8 and Fig. 9) for certain time periods to allow for protected areas for the salmon. Pollock also occurs in the salmon savings areas, and closure of these areas may result in added expense to the pollock fishing industry. Based on historical bycatch rates, the chinook salmon PSC amount will likely be exceeded, resulting in the closure of the Chinook Salmon Savings Area. A salmon excluder device would lessen the potential for exceeding the PSC limits and reduce the potential for constraints being placed on the trawl fisheries due to exceeding salmon PSC limits.

EFPs are an effective way to develop bycatch reduction gear allowing for systematic testing under a rigorous experimental design. In the experience of the fishing industry, informal efforts to test net modifications in an *ad hoc* manner are not efficient because a fisherman working independently typically does not necessarily subject his modification ideas to systematic testing. While fishermen often possess a strong grasp of technical aspects of fishing gear in combination with outstanding ingenuity for adaptation, the coordinated and systematic approach of testing gear modifications through an EFP collaboration of science and industry is a more productive way to develop bycatch reduction devices (BRDs).

EFPs offer advantages given the relatively high cost of research charters on the scale of vessels primarily used in the BSAI pollock fishery. Because harvest limits are typically set below the acceptable biological catch (ABC) limits in the Federal fisheries off Alaska, additional fishing opportunities can be used to help fund research and development costs of conservation engineering without biological effects on stocks. In addition, there are benefits to evaluating gear modifications under the most realistic fishing scale and conditions. Research charters can potentially be a more expensive and less effective way to recreate actual fishing conditions compared to an EFP test. The EFP also allows for the collection of data in context of the experimental design that would not be otherwise allowed under the groundfish regulations. For these reasons, an EFP is considered the best method for developing a salmon excluder device.

The EFP is necessary to allow for the continued development and testing of the salmon excluder device developed under an EFP issued in 2003 and 2004. The goal of using such a device is the reduction of salmon bycatch without significantly lowering pollock catch rates. Further development and testing is not possible without an EFP.

1.1 Project Area

The experiment is limited to the Eastern Bering Sea management area in the portions commonly used by catcher vessels to harvest pollock. Areas where the experiment will be conducted include locations in the CVOA, the Chum Salmon Savings Area (Figure 1.1) and the Chinook Salmon Saving Area. (Figure 1.2). One of the reasons for the need for the EFP for this experiment is to permit the experimental trawling in the salmon savings areas and CVOA, regardless of closure status.

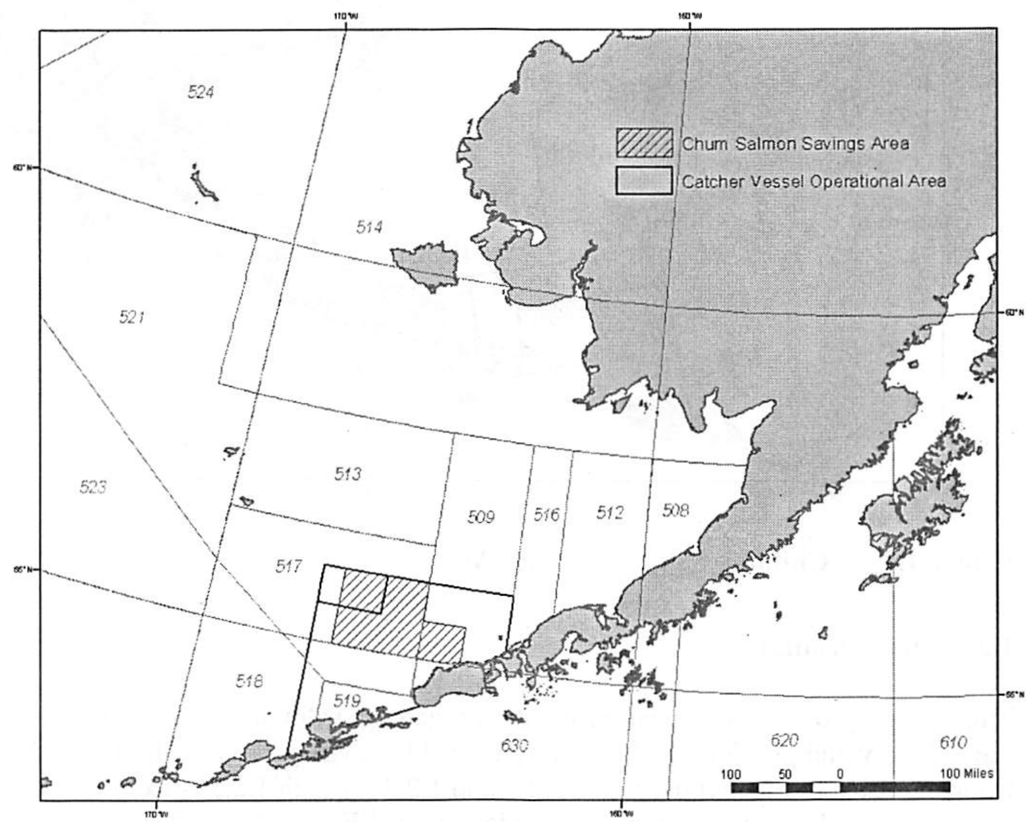

Figure 1.1 Chum Salmon Savings Area

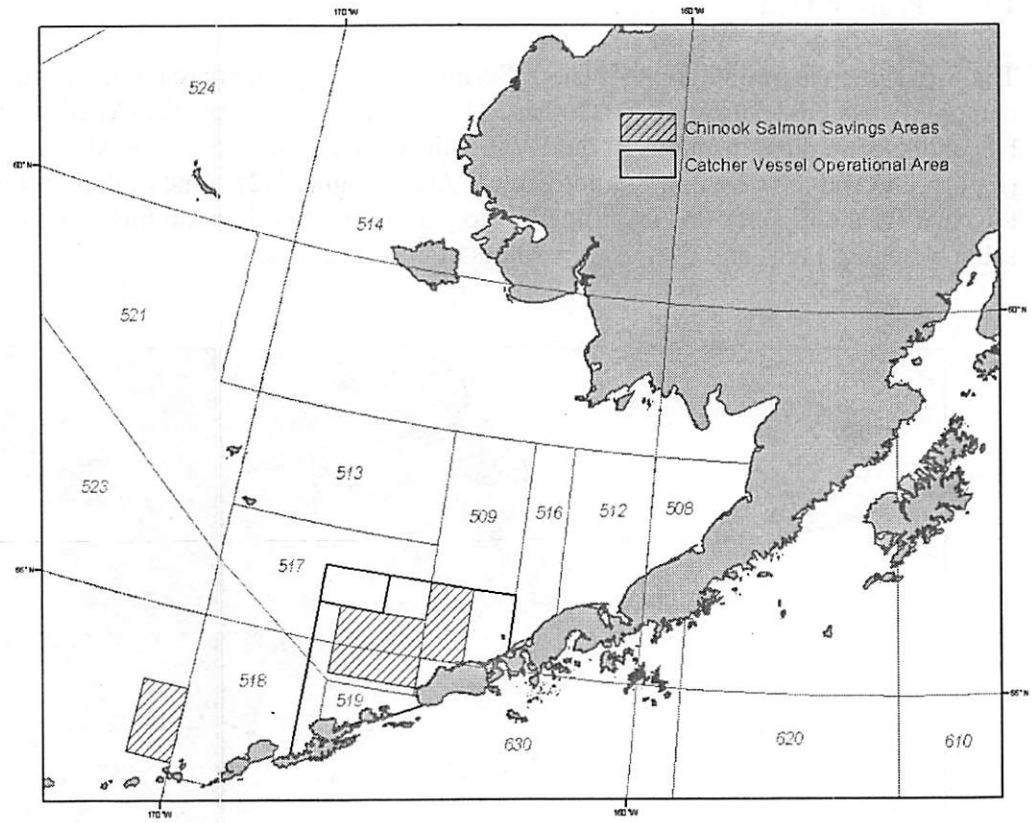

Figure 1.2 Chinook Salmon Savings Area

1.2 Background

This section provides historical information regarding salmon bycatch in the pollock trawl fishery and provides the basis for the need to develop methods for reducing salmon bycatch. Most of the text in section 1.2.1 and 1.2.3 through 1.2.5 is from the EA developed for the previous salmon excluder device EFP (NMFS 2003).

1.2.1 Historical Salmon Bycatch Information

From 1990-2004, a 10 year average of 41,348 chinook salmon and 73,909 other salmon species (> 95% are chum salmon) were incidentally caught annually in BSAI groundfish trawl fisheries (Table 1.1). Bycatch is primarily juvenile salmon that are one or two years away from returning to the river of origin as adults.

Table 1.1 Bycatch of Pacific Salmon in the BSAI Groundfish trawl fisheries

Year	Number of Fish	
	Chinook	Chum
1990	14,085	16,202
1991	48,873	29,706
1992	41,955	40,090
1993	45,964	242,895
1994	44,380	95,978
1995	23,079	20,901
1996	63,205	77,771
1997	50,218	67,349
1998	58,966	69,237
1999	14,586	47,204
2000	8,219	59,306
2001	40,303	60,460
2002	37,507	78,739
2003	54,989	94,479
2004	62,408	163,647
10 year average	41,348	73,909

Source: NMFS Alaska Region website

Pacific salmon support large commercial, recreational, and subsistence fisheries throughout Alaska. In 1999 through 2003, chinook and chum salmon runs in western Alaska were at relatively low levels compared to runs observed over the last 20 years. Although these reduced salmon runs appear to be attributable to changes in ocean conditions (Hare and Francis 1995; Kruse 1998), considerable public concern has been raised as to the effect of low salmon returns on fishery dependent communities in western Alaska. Responding to the crisis in the salmon-industry, the Governor of Alaska declared a state emergency on several occasions from 1999 through 2003. In response to the Governor's concerns, the Council has reviewed the bycatch management measures in place to reduce salmon bycatch to the extent practicable, as required by the Sustainable Fisheries Act of 1996 (NPFMC 1999c), on several occasions.

In 2002, the Council reviewed a retrospective analysis of salmon bycatch trends and estimated effects of Alaska groundfish trawl fisheries on salmon returns in Alaska (Witherell et al 2002). This evaluation of the possible bycatch effects concluded that bycatch in groundfish fisheries reduced western Alaska chinook salmon runs by less than 2.7%. Salmon taken incidentally in these fisheries are known to originate from Alaska and Pacific northwest runs, as well as Asia and Russia. While this is clearly a small percentage effect on fish bound for Alaskan river systems, the effect is nonetheless considered to be slightly greater than the estimated effect of Alaskan groundfish fisheries on other prohibited species in federal fisheries off Alaska, such species as Pacific halibut and several species of king and tanner crabs (Witherell et al. 2002).

In addition, the Council has initiated a review of the current salmon bycatch measures based on information presented at the December 2004 Council meeting that indicated that the closure of the salmon savings areas may have actually resulted in more salmon bycatch than if the areas had been left open. The Council is currently analyzing alternatives to the current salmon bycatch measures.

1.2.2 Existing Fishery Management Bycatch Reduction Measures

Salmon are listed as a prohibited species in the groundfish fishery management plans, meaning that they cannot be retained and sold. Regulations implemented in 1994 prohibited the discard of salmon taken as bycatch in BSAI groundfish trawl fisheries until the number of salmon has been determined by a NMFS certified observer (59 FR 18757, April 20, 1994). Subsequent regulations allowed for voluntary retention and processing of salmon for donation to NMFS qualified distributors of food to underprivileged individuals (50 CFR 679.26).

Bycatch of chinook salmon in Alaska groundfish fisheries is generally higher in the winter and chum salmon bycatch is higher in the summer although this trend is not without exceptions. Based on this seasonal pattern, the Council has adopted extensive seasonal cap and closure measures to control bycatch of salmon in trawl fisheries (Witherell and Pautzke 1997). Regulations establish closures for several areas with historically high bycatch of salmon if the seasonal cap (number) of salmon is taken as bycatch. Beginning in 1994, the Chum Salmon Savings Area (CSSA) (Fig. 1.1) has been closed to all trawling from August 1 through August 31 (50 CFR 679.22(a)(10)). Additionally, the area re-closes after August 31 if a bycatch threshold limit of 42,000 non-chinook salmon is caught incidentally in the CVOA between August 15 to October 14 (50 CFR 679.21(e)(7)(vii)). The CSSA will close immediately if fishermen reach a non-CDQ threshold of 38,850 fish in the CVOA between August 15 and October 14.[1]

From 1996 through 1999, regulations were in place to prohibit trawling in the Chinook Salmon Savings Areas (Fig. 1.2) through April 15, if and when, a bycatch limit of 48,000 chinook salmon was attained in the BSAI trawl fisheries (50 CFR 679.21(e)(7)(viii)). More than 48,000 chinook salmon were taken as bycatch annually from 1996 through 1998, but closures were not triggered because bycatch limits were not exceeded before April 15.

In 2000, new regulations to reduce chinook salmon bycatch in BSAI trawl fisheries were implemented (65 FR 60587, October 12, 2000). The regulations incrementally reduced the bycatch limit for the pollock fishery from 48,000 to 29,000 chinook salmon over a 4-year period and implemented year-round accounting of chinook salmon bycatch in the pollock fishery (50 CFR 679.21(e)(1)(vii)). Additionally, the boundaries of the Chinook Salmon Savings Areas were modified. Under these modifications, in the event the limit is triggered before April 15, the Chinook Salmon Savings Area (CHSSA) closes

[1] The chum PSC cap is 42,000 fish, 7.5% of which is allocated to the CDQ groups, and the remainder of which (38,850 fish) is allocated to the AFA.

immediately. The closure would be removed on April 16, but would be reinitiated September 1 and continue through the end of the year. If the limit were reached after April 15, but before September 1, then the areas would close on September 1. If the limit were reached after September 1, the areas would close immediately through the end of the year (50 CFR 679.21(e)(7)(viii)). The bycatch limit for the BSAI pollock fisheries is 29,000 chinook salmon. The non-CDQ chinook PSC cap is 26,825 chinook starting in 2004.[2]

1.2.3 Costs Associated with Salmon Bycatch

Salmon PSC caps have the potential to impose significant costs on pollock fishermen operating in the BSAI. There are, first of all, the costs imposed by potential closures of the chinook and chum salmon savings areas, described above. Second, there are the costs imposed on the industry as it takes steps to control its salmon PSC. In addition, salmon PSC itself creates costs for inshore fisheries.

Potential closures of chinook and chum savings areas[3]

As noted above, pollock fishermen are subject to separate savings area closures for chinook and chum salmon. The separate closures reflect differences in the PSC patterns for the two species. Chinook PSC tends to be higher in the winter and late fall and lower in the summer. Non-chinook (chum) bycatch tends to be higher in the summer. The chinook cap was 26,825 fish in 2004 was exceeded by over 35,000 fish. The CHSSA was closed, forcing catcher vessels to fish elsewhere. The principal impact of the closure falls on catcher vessels rather than catcher processors, because a large part of the CHSSA lies within the catcher vessel operational area (CVOA) from which catcher processors are already excluded by regulation from June 10 through November 1. (679.22(a)(5) and 679.23(e)(2))[4] The portion of the CHSSA that lies in the Aleutian Islands has not historically been used for pollock fishing and the closure of this area is not likely to have a large impact on the harvest of pollock.

In 2001, the pollock fleet harvested a total of about 30,100 chinook in the BSAI. The fleet exceeded the 26,825 chinook limit during the statistical week ending on October 27. The cap would have stopped fishing in the CHSSA during the following week (ending November 3). However, no catcher vessels reported harvests after the week of October

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[2] The total BSAI chinook cap is 29,000 fish. This is divided between the CDQ fishermen and the AFA fishermen. The CDQ fishermen receive 7.5% of the cap. The discussion in this analysis pertains to the AFA fishermen. Development of a successful excluder device would undoubtedly help CDQ operations deal with their bycatch problems as well.

[3] The following discussion focuses on the years 2001 and 2002. This period differs from earlier periods in the introduction of the American Fisheries Act regulations and the Seller sea lion protection measures. The years 1999 and 2000 are not included because of the unusually small salmon PSC harvests in those years (see Table 1.1).

[4] Part of the chinook savings area lies outside of the CVOA in the Aleutian Islands where pollock fishing was opened in 2004.

27, and catcher processors would not have been affected by the closure of the CHSSA during that season. (NMFS, Alaska Region).

As noted, the pollock fishery also has to operate within a non-chinook (chum) salmon cap of 38,850 fish in the CVOA between August 15 and October 14 (679.21). NMFS in-season managers must make "real time" projections of salmon PSC based on relatively limited information from observers. Not all the vessels in the fleet are observed, so the managers know they have incomplete information. Moreover, in order to avoid exceeding the cap, the managers must project an expected date on which the cap will be taken and close the fishery at that time. This projection is based on apparent PSC rates as the cap is approached, and takes account of the existence of known unobserved harvests.[5] In 2002, from the week ending August 17 to the week ending September 21, the fleet took about 38,000 non-chinook salmon in its pollock operations in the CVOA. On September 19, NMFS in-season managers published a notice closing the CSSA from noon on September 21 until noon on October 14. (NMFS information bulletin at www.fakr.noaa.gov). Catcher vessel pollock harvests in the BS and in the CSSA are shown in Table 1.2.

Table 1.2 2002 AFA catcher vessel harvest

Week ending date	BS catcher vessel harvest	CSSA catcher vessel harvest
Sep 21	34954	7575
Sep 28	19776	58
Oct 5	27646	91
Oct 12	15959	0
Oct 19	12054	3878
Oct 26	7510	3427
Source: NMFS-SF-AKR blend data. Note: CSSA data is based on observer data; this is probably not a complete accounting of harvest from CSSA.		

The Chum Salmon Savings Area falls completely inside the CVOA. Since no catcher-processors are allowed to fish in the CVOA during the B season (June through October) the restriction on savings area fishing would have fallen entirely on the catcher vessel portion of the fleet. In all of 2001, the pollock fleet harvested a total of 27,186 non-chinook salmon, and thus would not have triggered the closure in the savings area.

The conclusions from this analysis: (1) The pollock fleet is operating in ranges where it could, plausibly, reach either the chinook or chum salmon PSC cap in a year and trigger the closure of one or both of the savings areas. (2) Closures are likely to be triggered during the second half of the year. (3) The closures are most likely to affect the catcher

[5] Furuness, Mary. NMFS, 709 W. 9th St., Juneau, AK 99802-1668. NMFS in-season manager. Personal communication, 5-20-03.

vessel component of the pollock fleet, since both savings areas lie predominately in the CVOA, and catcher processor vessels are kept out of this area by regulation during the second half of the year.

By forcing catcher vessels off the grounds they would prefer, PSC closures can reduce revenues or increase costs. Even if catcher vessels can continue to harvest as many pollock as before, they may face increased travel costs if the closure forces them to move to new fishing grounds (which may be further from their delivery ports), they may have to fish for pollock in areas where catch per unit of effort (CPUE) is lower, or they may be forced to fish on pollock stocks of lower quality (maybe on smaller sized fish). CPUE may be particularly affected by closure of the CHSSA since this reaches further south and affects the north side of the productive horseshoe fishing grounds. Pollock quality, and its ex-vessel price, can be reduced if fishermen in catcher vessels are forced by closures to fish further from delivery ports. Increased running time and increased time between harvest and processing can reduce the desirability of pollock. Surimi grades for shoreside processed pollock begin to decline as the time between harvest and delivery increase. Processors producing fillets prefer larger pollock than processors producing surimi. A vessel fishing for a processor with a size preference may be forced off of desirable sized pollock and forced to fish for unsuitably sized pollock by an area closure.[6]

Ongoing PSC control efforts

Reductions in salmon PSC rates during normal fishing activities (prior to closures) may also serve to reduce fishing costs for the industry.

The pollock fleet has developed its own private-sector arrangements to monitor vessel PSC rates and feed the information back to the fishing vessels while they are at sea. In this program, observer data and other reports are transmitted to analysts associated with the private firm, Sea State, Inc. Some of these reports are transmitted from sea in almost real time; some are transmitted at the time catcher vessels make their shoreside deliveries. Sea State processes the data, identifying locations with high salmon PSC rates, and provides the information to the fishing vessels. Vessels are then able to change their trawling operations to avoid areas with high salmon PSC rates. Irrespective of Sea State reports, vessel operators will often conduct "test fishing" on entering new areas. Test fishing involves taking short tows to see if salmon PSC is high. Test fishing adds to the cost of fishing activity. Fishermen vary greatly in the extent to which they participate in voluntary avoidance.[7]

The pollock cooperatives formed under the American Fisheries Act (AFA) have also entered into two formal contractual arrangements to avoid areas of high PSC. One

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[6] Gruver, John. Intercoop Manager, United Catcher Boats. Fisherman's Terminal, 4005 20th Ave. W - Suite 110, Seattle, WA 98199. Personal communication, May 29, 2003.

[7] Haflinger, Karl. Sea State, Inc. Vashon Island, WA. Personal communication, May 21, 2003; Gruver, op. cit.

agreement covers chinook salmon, and the other covers chum salmon. Sea State, in cooperation with the Intercooperative manager of United Catcher Boats, is authorized by the agreement to restrict fishing operations in high PSC areas if salmon PSC exceeds a threshold level (there are limits on the total area that may be restricted in a week). Fishing operations are required, by the terms of their contract in the intercooperative agreement, to limit their fishing activity in an area that is closed. The limitations differ among the cooperatives; cooperatives whose skippers have been fishing with little salmon PSC are limited less than those that have had higher PSC. Cooperatives with high salmon PSC may be prohibited from fishing in the restricted areas for a full week.[8] These agreements are contracts imposing binding obligations on the cooperatives.[9]

Voluntary or contractually obligated changes in fishing patterns will impose costs on pollock fishermen similar to those involved in the closures of chinook and chum salmon savings areas (borne by both catcher processors and catcher vessels). Reductions in salmon PSC rates associated with successful development of the salmon excluder device will reduce the costs of this system and make it more effective. Excluder devices would reduce the PSC harvests associated with initial inadvertent discovery of hot spots. Excluder devices will also slow the rate of PSC harvest in hot spots in the interval between the time the hot spot is identified, and the time the fleet can be notified of its existence and directed away from it or restricted in fishing on it. It may be possible to fish in areas that would otherwise have to be closed if the excluder device lowers salmon PSC rates sufficiently. Finally, some salmon PSC would take place in normal fishing operations outside of hot spots. Successful development of an excluder device would reduce PSC associated with these operations.[10]

Cost of lost salmon to inshore fisheries

Salmon caught by the pollock fleet will not return to their natal waters and will not become available to the fisheries exploiting those waters. Returning salmon are used in subsistence, commercial, and recreational fisheries and for escapement and investment in future stocks. Changes in trawl technology that reduce bycatch rates increase the

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[8] While substantially similar, the 2003 two agreements differ in some respects. The chinook closures kick in after chinook PSC reaches a threshold level, while the chum closures kick in continuously through the fishery. The chinook agreement treats the Bering Sea as a whole and can lead to two weekly closures of 500 to 1,000 square miles. The chum agreement divides the BS in half and can lead to two weekly closures in the same area range in each half. The 2003 chum agreement imposes penalties on coops that violate the fishing restrictions in a closed area. A first offense is penalized 50% of the ex-vessel value of the pollock caught in the restricted area, while a subsequent offense is penalized 100%. Gruver, op. cit.

[9] Haflinger, op. cit.; Gruver, op. cit.

[10] Development of the excluder device is part of a larger pollock industry effort to find ways to reduce salmon PSC. As noted later in this EA, data on fish behavior being collected in connection with the experiment are being analyzed to provide insights into fishing tactics that might reduce salmon PSC. Other techniques, such as modifications of the excluder design (perhaps incorporating strobe lights to prompt salmon to the exits), and experiments with alternative net colors, are under consideration. Successful development of a range of salmon PSC reduction methods might lead, in the long term, justify more fundamental changes in regulatory restrictions than are considered here. One instance might be a relaxation of the automatic August closure of the CSSA. Gruver, op. cit.

possibility that the pollock trawl fleet will not take the full PSC cap, and will increase the numbers of salmon returning to these uses.

Reductions in salmon PSC in the pollock fishery will not translate directly into one-to-one increases in salmon available for U.S. inshore uses for two reasons: (1) the increased return to U.S. fisheries will be less than the reduction in trawl PSC harvest since many of the fish originate in Canada or Asian waters; and (2) because many of the salmon may die from natural causes between the time they escape the trawl and the time they would otherwise have returned to those waters. Chum salmon studies in the 1990s suggested that about 38% to about 50% of the chum salmon taken as bycatch in the Bering Sea may originate in Asia. Data are not complete for chinook salmon, but suggests a much lower percentage originating in Asia (Witherall, et al., pages 59-60). Witherall *et al.* found that chinook salmon were one to two years away from returning to spawn when taken as bycatch; they assumed chinook natural mortality rates of 10% to 20% a year (Witherall, *et al.*, page 61).[11]

1.2.4 Fishing Industry Initiatives To Control And Reduce Salmon Bycatch In Groundfish Fisheries

Over the last ten years, the pollock industry has developed voluntary controls on bycatch of salmon and initiatives to collect and analyze samples for genetic analysis to improve information on country of origin. Efforts have also been undertaken to evaluate temperature and other environmental data collected routinely by industry for information on how these variables are associated with salmon bycatch (Mikol 1997).

Starting in the early 1990s, several programs employing location-specific bycatch avoidance data exchanges between fishermen were implemented by the pollock industry. These programs use fishery observer data on a fast-turn-around basis so fishermen can more effectively avoid bycatch "hotspot" locations. These early efforts were formally adopted into agreements between pollock fishing cooperatives that were established through the AFA. The individual incentives and accountability through internal private contracts within pollock fishing cooperatives established under the AFA have likely increased the effectiveness of industry bycatch management systems. (NMFS 2002) See section 1.2.3 for more information.

Industry efforts to control and reduce salmon bycatch have resulted in tangible improvements in fishery performance. The nature of the bycatch problem with salmon, however, is exceedingly complex and inherently difficult due to the unpredictable nature of salmon locations, population cycles, and movements. From a practical perspective, the pollock industry believes that one of the biggest problems with salmon avoidance is that hotspots are often transitory. By the time such concentrations are identified, a relatively large number of salmon may have already been taken and salmon may have already moved to other locations. Overall, hotspot avoidance and other approaches have provided some success, but these efforts can only achieve success to the degree that

[11] Age specific information was not as good for chum salmon.

salmon movements (and hence bycatch) follow some sort of predictable pattern (UCBA 2003).

The challenges of salmon bycatch avoidance itself, particularly in the context of the restrictive bycatch management measures in place in the BSAI fishery management plan (FMP) create a significant problem for the pollock industry. This situation will undoubtedly be even more acute if salmon populations increase or environmental conditions change in the future to increase the overlap of chinook and chum salmon feeding and migration routes with fishing grounds used for pollock fishing. The potential effects of existing management controls on salmon bycatch can be seen in the fact that the analysis prepared in support of the decision to reduce the chinook bycatch cap determined that had the cap of 36,000 salmon (an amount far in excess of the current cap) been in place during the 1994-1997 period, such a cap would have been triggered three of the four years for which data were available. This would have been expected to reduce the pollock catch in those years by 7-28% (NPFMC 1999c).

One further complication is that salmon avoidance is not the only constraint facing the pollock industry. The decision of where to fish is affected by other constraints. An important constraint on where pollock vessels might fish in order to avoid salmon are regulations governing pollock removals and fishing locations so as to minimize potential competition with Steller sea lions. To avoid harvesting more than the allowable amount of pollock in Steller sea lion protection areas, fishing areas must be selected outside of Steller sea lion protection areas, even when salmon bycatch was relatively low in those areas. In some cases, this tradeoff can mean higher incidental catch rates of salmon.

1.2.5 Evolution Of The Concept Of A Salmon Excluder Device For The Pollock Fishery

Design of bycatch reduction devices (BRDs) necessitates information of fish behavior in response to different stimuli such as the change in water pressure and direction associated with a bycatch reduction device. Development of a salmon BRD for pollock nets would require observation of how salmon behave in a pelagic pollock net relative to pollock, and lacking this, development of concepts for excluders would likely not be productive. Observation of differences in location, swimming ability, or response to stimuli have been critical to the development of effective BRDs (Glass and Wardle 1995).

Given the information obtained from some preliminary video footage of chum salmon behavior in a pelagic pollock trawl, behavioral differences between the target species and salmon may allow for the development of an effective BRD.[12] The first step in the development of prototype salmon BRDs has been to tap into the fishing industry's ideas on how such an excluder might function. A meeting that attempted to accomplish this goal was held by the United Catcher Boat Association (UCBA) in the spring of 2002. The product of the meeting was strong support for development of an excluder device; however, none of the participants had any existing designs for such an excluder.

[12] Dr. Craig Rose, Alaska Fisheries Science Center, personal communication, March 2003.

Following that meeting, Dr. Craig Rose of the Alaska Fisheries Science Center (AFSC) carried out a research charter on a pollock vessel in the summer of 2002 to deploy low light camera equipment and a new technology called "acoustic video" to obtain images of how salmon and pollock behave in the portion of a trawl net called the tapered intermediate. Dr. Rose was also able to perform some basic net modifications (cutting an escapement portal) to get some idea of how salmon react to such an escapement opportunity. This preliminary work suggests that, as would be expected, salmon are strong swimmers compared to pollock. In addition, it appears that salmon may prefer to swim in the upper (furthest from the seafloor) portion of the trawl intermediate.

Dr. Rose's video and digital footage from work in 2003 and 2004 are currently under review by trawl skippers and gear manufacturers. While still preliminary, some concrete ideas for excluder designs have emerged.[13] A depiction of a potential prototype devices is seen in Figure 1.3 of the 2003 salmon excluder device EFP EA (NMFS 2003). The device depicted in the drawing is based upon a funnel of smaller mesh webbing placed within the mid section portion of the trawl. The funnel would attempt to create an eddy in the water flow at the aft section of the device where escapement portals would be used to provide salmon an egress opportunity (See Appendix A).

1.3 Related NEPA Documents

The Affected Environment and Environmental Impacts of the Alternatives sections of this environmental assessment (EA) adopt much of the information in the following environmental analyses.

Final Environmental Impact Statement for American Fisheries Act Amendments 61/61/13/8. February 2002. National Marine Fisheries Service, P.O. Box 21668, Juneau, Alaska 99802.

Steller sea lion protection measures Supplemental Environmental Impact Statement. November 2001. DOC, NOAA National Marine Fisheries Service, P.O. Box 21668, Juneau, Alaska 99802.

Programmatic Supplemental Environmental Impact Statement (PSEIS) For Alaska Groundfish Fisheries June 2004. National Marine Fisheries Service, P.O. Box 21668, Juneau, Alaska 99802 or through the NMFS web site at http://www.fakr.noaa.gov.

Environmental Assessment for the Total Allowable Catch Specifications for the Year 2005 and 2006 Alaska Groundfish Fisheries. January 2005. DOC, NOAA, National Marine Fisheries Service, P.O. Box 21668, Juneau, Alaska 99802.

1.4 Public Participation

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[13] John Gruver, Catcher Vessel Inter-cooperative Manager, personal communication, March 2003, United Catcher Boats Association, 4005 20th Ave. Ste. 116, Fisherman's Terminal, Seattle, WA 98199.

The application for the exempted fisheries permit was noticed in the Federal Register on March 18 2005 (70 FR 13173). Comments regarding the application will be solicited at the Council's April 2005 meeting. The applicant will present the project to the Council at its April 2005 meeting.

2.0 ALTERNATIVES CONSIDERED

The Council on Environmental Quality (CEQ) regulations implementing the National Environmental Policy Act (NEPA) require a range of alternatives to be analyzed for a federal action. The alternatives analyzed may be limited to a range of alternatives that could reasonably achieve the need that the proposed action is intended to address. Section 1.0 of this document described the purpose and need of the proposed action.

The purpose of this action is to allow the testing of salmon excluder devices on pollock trawl gear in the eastern Bering Sea. The applicant has worked closely with the AFSC in the development of the experimental design, and this design has been approved by the AFSC (DeMaster 2005). The experimental design requires the applicant's exemption from several groundfish regulations at 50 CFR part 679 including:

§ 679.7(a)(2): Persons are prohibited from conducting any fishing contrary to notification of inseason actions, closures or adjustments under §§ 679.20, 679.21, 679.22, and 679.25. Groundfish taken under the EFP will not be applied to the total allowable catch (TAC) limit specified in the annual harvest specifications (§ 679.20(a)). The EFP would allow for the harvest of up to 2,500 mt of groundfish. The EFP will allow for the harvest of salmon in the salmon savings areas, even though they may be closed, and the salmon harvested will not count towards that annual PSC limits (see below). As the Council and NMFS have approved for past EFP experiments dedicated to bycatch reduction, groundfish and prohibited species taken during the experiment should not be counted against the annual total allowable catch and prohibited species bycatch caps (65 FR 55223, September 13, 2000).

§679.21(e)(1)(vii) and (viii): Salmon taken during the experiment will not be counted against the bycatch limits established for chinook and non-chinook salmon. The EFP would allow for the take of up to 2,500 non-chinook salmon and 500 chinook salmon, the maximum amount of salmon that may be taken, estimated by the applicants. Taking of the salmon during the experiment is crucial for determining the effectiveness of the device. The potential exists that the amount of pollock trawl salmon bycatch taken by the industry during the EFP period will approach or exceed the salmon bycatch limits. The additional salmon taken during the experiment would create an additional burden on the pollock trawl industry, if the EFP salmon are counted toward the salmon bycatch limits and trigger closure of the salmon savings areas.

§ 679.21(e)(7)(vii) and (e)(7)(viii) and § 679.22(a)(5)(ii) and (a)(10): The applicants have also requested an exemption from closures of the Chinook Salmon Savings Area, the Chum Salmon Savings Area and the Catcher Vessel Operating Area. The experiment must be conducted in areas of salmon concentration to ensure a sufficient sample size.

These areas have high concentrations of salmon and provide an ideal location for conducting the experiment and ensuring the vessel encounters enough salmon to support the experiment.

§ 679.22(a)(7)(vii): The closure of the Steller Sea Lion Conservation Area (SCA) is based on sector specific limits of no more than 28 percent of the annual TAC taken before April 1. This section also requires the closure of the SCA to vessel greater than 99 feet length overall (LOA) to provide for harvesting by vessels in the inshore sector under 99 feet LOA. Large portions of the Chinook Salmon Savings Area and the Chum Salmon Savings Area occur in the SCA. In order to conduct the experiment where salmon are likely to occur, the EFP will include an exemption from closure of the SCA, as long as the total amount of pollock harvest by all sectors remains below the 28 percent annual TAC amount before April 1.

§ 679.50: Vessels harvesting pollock are required to have NMFS certified observers for harvest sampling and monitoring purposes. The EFP would be conducted using "sea samplers" who are NMFS trained observers but who will be performing sampling and monitoring duties for purposes of the EFP. The sea samplers would account for the groundfish and salmon catch to track the catch/processors vessels' harvest of its AFA allocation and to ensure compliance with the amounts of groundfish and PSC specified in the EFP. Whole haul sampling would be used. Because the observer duties under the EFP differ from those duties under Methods are different from sampling requirements under § 679.50, the EFP would include and exemption from observer regulations.

To accomplish the purpose of this proposed action, within the boundaries of the groundfish regulations (50 CFR part 600 and 679) and ensuring the use of the carefully developed experimental design, an exempted fishing permit under 50 CFR 679.6 must be issued. Therefore, the alternatives for this action are limited to:

Alternative 1 No EFP is issued. (Status Quo): The experiment for the salmon excluder devices would not be permitted due to potential violation of regulations, as detailed above.

Alternative 2: An EFP is issued (Preferred Alternative). The testing of the salmon excluder devices would be permitted with exemptions from §§ 679.7(a)(2) (regarding 679.20(a); 679.21(e)(1)(vii) and (viii), and (e)(7)(vii) and (viii); and 679.22(a)(10)); 679.21(e)(1)(vii) and (viii); and (e)(7)(vii) and (viii); and 679.22(a) (5)(ii), (a)(7)(vii) and (a)(10); and 679.50. The EFP would allow the applicant to conduct the experiment as designed in cooperation with the Alaska Fisheries Science Center. Details of the experiment are contained in Appendix A.

The EFP would allow for two types of testing of the salmon excluder device in fall 2005, and spring 2006. In the first experiment, a catcher vessel would be used to test minor adjustments to the current excluder device design to improve performance. The second experiment would be conducted using a catcher/processor for the paired-tow experiment to validate the performance of the excluder device. Depending on the results from the work in 2005 and 2006, the EFP may need to be modified to allow for an additional year of testing.

Analysis will primarily focus on the estimation of the proportions of pollock and salmon excluded from the catch through the device. The experiment is designed to estimate these values for the combination of all tows, representing the value of the device in ordinary fishery conditions. Variability of escape rates between tows will be examined for indications of conditions affecting excluder performance. Combined size composition data will be tested for differences between retained and escaping fish. Groundfish harvested by the charter vessel will be retained for sale to the extent allowed under § 679.20(e) and (f) with pollock designated as the target species. If the salmon is of acceptable quality, it will be donated under the Prohibited Species Donation Program (PSDP) (§ 679.26), otherwise it will be discarded as required by § 679.21(b). Results will be presented by the applicant in preliminary and final reports made available to managers, trawlers, scientist, and the public. Details of the experimental design are in Appendix A to this document.

3.0 AFFECTED ENVIRONMENT

Information provided by the applicant for the EFP indicates that harvesting of target groundfish species and prohibited species (salmon) during the experiment would occur. Potential effects on the environment can occur with the removal of target and prohibited species during groundfish harvesting. Pollock and salmon are also prey species of marine mammals, including Steller sea lions, warranting further analysis of potential effects on marine mammals. Even though this action alone has no impact socioeconomically on the pollock industry, there is the potential that the successful development of a salmon excluder device may affect the efficiency of the pollock fisheries to avoid bycatch and prosecute a fishery with less restrictions. Because of the limited amounts of harvest, manner of testing, and the short duration of the testing, other components of the environment are not likely to be impacted and further analysis is not needed. The impacts will be examined in Section 4.0.

Table 3.1 shows the components of the human environment and whether Alternative 2 may have an impact on the component beyond status quo, or Alternative 1, and require further analysis. Analysis is included for those environmental components on which Alternative 2 may have an impact beyond impacts analyzed for Alternative 1 in previous NEPA analysis (NMFS 2004and 2005a).

Table 3.1 Resources potentially affected by Alternative 2 beyond Status Quo

Potentially Affected Component							
Physical	Benthic Comm.	Groundfish	Marine Mammals	Seabirds	Other Species	Prohibited Species	Socioeco nomic
N	N	Y	Y	Y	N	Y	Y

N = no impact anticipated by the alternative on the component.
Y = an impact is possible if the alternative is implemented.

The PSEIS (NMFS 2004) provides a complete detailed description of the environment that may be affected by groundfish fishing activities in the following sections:
Ecosystem, section 3.10
Physical Oceanography of the Fisheries Management Units section 3.3.
Habitat, section 3.6.
Target Groundfish Species section 3.5,
Marine mammals, section 3.8.
Seabirds, section 3.7
Social and Economic Conditions, section 3.9
Bycatch and Incidental Catch Restrictions, Appendix F, section 5.

This EA adopts the recent, detailed environmental status description in the PSEIS. Additionally, the current, detailed status of each target species category, biomass estimates, and ABC specifications for the BSAI are presented annually both in summary and in detail in the EA/IRFA for the 2005-2006 harvest specifications and the 2005 SAFE Reports (NPFMC 2004, NMFS 2005a). These documents are available through the Council's home page at http://www.fakr.noaa.gov/npfmc.

3.1 Status of Managed Groundfish Species

Designated target groundfish species and species groups in the BSAI are walleye pollock, Pacific cod, yellowfin sole, Greenland turbot, arrowtooth flounder, rock sole, other flatfish, flathead sole, sablefish, Pacific ocean perch, other rockfish, Atka mackerel, squid, and other species. This EA cross-references and summarizes the status of the stock information in the SAFE reports (NPFMC 2005a). For detailed life history, ecology, and fishery management information regarding groundfish stocks in the BSAI, see Physical Oceanography of the Fisheries Management Units (section 3.3) and Target Groundfish Species (section 3.5) in the PSEIS (NMFS 2004a) and the 2005-2006 groundfish fishery EA (NMFS 2005a).

For those stocks where enough information is available, none are considered overfished or approaching an overfished condition. The 2004 BSAI SAFE report shows the Council's ABC and OFL recommendations for 2005-2006 (NPFMC 2004). Table 3.2 below is reproduced from the 2004 SAFE Report to show the 2005-2006 ABC, OFL and TAC amounts recommended for the BSAI groundfish fisheries.

Table 3.2 2005-2006Overfishing Level (OFL), Acceptable Biological Catch (ABC), and Total Allowable Catch (TAC) in the BSAI [Amounts are in mt]

Species	Area	2004				Recommended 2005			Recommended 2006		
		OFL	ABC	TAC	Catch	OFL	ABC	TAC	OFL	ABC	TAC
Pollock	EBS	2,740,000	2,560,000	1,492,000	1,248,817	2,100,000	1,960,000	1,478,500	1,944,000	1,617,000	1,487,756
	Aleutian Islands	52,600	39,400	1,000	1,128	39,100	29,400	19,000	39,100	29,400	19,000
	Bogoslof District	39,600	2,570	50	0	39,600	2,570	10	39,600	2,570	10
Pacific cod	BSAI	350,000	223,000	215,500	166,776	265,000	206,000	206,000	226,000	195,000	195,000
Sablefish	BS	4,020	3,000	2,900	748	2,950	2,440	2,440	2,690	2,310	2,310
	AI	4,620	3,450	3,100	912	3,170	2,620	2,620	2,880	2,480	2,480
Yellowfin sole	BSAI	135,000	114,000	86,075	68,822	148,000	124,000	90,686	133,000	114,000	90,000
Greenland turbot	Total	19,300	4,740	3,500	2,136	19,200	3,930	3,500	11,100	3,600	3,500
	BS	—	3,162	2,700	1,730		2,720	2,700		2,500	2,500*
	AI	—	1,578	800	406		1,210	800		1,100	1,000*
Arrowtooth flounder	BSAI	142,000	115,000	12,000	17,130	132,000	108,000	12,000	103,000	88,400	12,000
Rock sole	BSAI	166,000	139,000	41,000	47,875	157,000	132,000	41,500	145,000	122,000	42,000
Flathead sole	BSAI	75,200	61,900	19,000	16,611	70,200	58,500	19,500	56,100	48,400	20,000
Alaska plaice	BSAI	258,000	203,000	10,000	7,624	237,000	189,000	8,000	115,000	109,000	10,000
Other flatfish	BSAI	18,100	13,500	3,000	4,669	28,500	21,400	3,500	28,500	21,400	3,000
Pacific Ocean perch	BSAI	15,300	13,300	12,580	11,032	17,300	14,600	12,600	17,408	14,600	12,600
	BS	—	2,128	1,408	701		2,920	1,400		2,920	1,400
	AI total	—	11,172	11,172	10,331		11,680	11,200		11,680	11,200
	WAI	—	5,187	5,187	4,998		5,305	5,085		5,305	5,085
	CAI	—	2,926	2,926	2,970		3,165	3,035		3,165	3,035
	EAI	—	3,059	3,059	2,363		3,210	3,080		3,210	3,080
Northern rockfish	BSAI	8,140	6,880	5,000	4,166	9,810	8,260	5,000	9,480	8,040	5,000
Shortraker rockfish	BSAI	701	526	526	207	794	596	596	794	596	596
Rougheye rockfish	BSAI	259	195	195	189	298	223	223	298	223	223
Other rockfish	BSAI					1,870	1,400	1,050	1,870	1,400	1,050
	BS	1,280	960	460	304		810	460		810	460
	AI	846	634	634	309		590	590		590	590
Atka mackerel	Total	78,500	66,700	63,000	54,789	147,000	124,000	63,000	127,000	107,000	63,000
	WAI	—	24,360	20,660	17,341		46,620	20,000		40,230	20,000
	CAI	—	31,100	31,100	27,832		52,830	35,500		45,580	35,500
	EAI/BS	—	11,240	11,240	9,616		24,550	7,500		21,190	7,500
Squid	BSAI	2,620	1,970	1,275	814	2,620	1,970	1,275	2,620	1,970	1,275
Other species	BSAI	81,150	46,810	27,205	21,795	87,920	53,860	29,000	87,920	57,870	29,200
Total	BSAI	4,193,736	3,620,535	2,000,000	1,676,853	3,509,332	3,044,769	2,000,000	3,093,360	2,547,259	2,000,000

*TECHNICAL CORRECTION: The Council recommendation for the Bering Sea Greenland turbot TAC for 2006 was reduced from 2,700 mt to 2,500 mt to comply with the Council's policy to not have TAC exceed ABC; 200 mt was added to the Aleutian Islands TAC so the total Greenland turbot TAC remained the same at 3,500 mt.

3.2 Status of Prohibited Species Stocks

Prohibited species taken incidentally in groundfish fisheries include: Pacific salmon (chinook, coho, sockeye, chum, and pink salmon), steelhead trout, Pacific halibut, Pacific herring, and Alaska king, Tanner, and snow crabs. In order to control bycatch of prohibited species in the BSAI groundfish fisheries, the Council annually specifies halibut and other PSC limits. The status of the prohibited species in the BSAI is detailed in Appendix F, section 5 of the PSEIS entitled: "Bycatch and Incidental Catch Restrictions" (NMFS 2004a) and in the EA/RFA for the 2005-2006 harvest specifications

(NMFS 2005a). During haul sorting, these species or species groups are to be returned to the sea with a minimum of injury except when their retention is required by other applicable law.

With the proposed action, salmon and herring are the only PSC species expected to be taken in any appreciable amounts, so additional status information regarding salmon and herring is provided in this section. Salmon and herring are the most common PSC species taken in the midwater trawl pollock fishery (NMFS 2002).

3.2.1 Salmon

See section 3.7 of this document for a description of the status of ESA listed salmon. Table 3.3 shows the bycatch of salmon in the BSAI trawl fisheries in 2004.

Table 3.3 Incidental Take of Salmon in BSAI Pelagic Trawl (Pollock) and Non-pelagic Trawl Fisheries (non-pelagic trawls mostly targeting flatfish and cod) (values are in numbers of fish), Year 2004 data are from January 20, 2004 through December 31, 2004.

BSAI Trawl Fishery Group	Year 2004		
	Chinook	Other Salmon	Total
Midwater Pollock	51,131	436,543	487,674
Non-pelagic Trawl	8,301	9,505	17,806
Total Trawl	59,432	446,048	505,480

Chinook salmon incidental catch (excluding CDQ) through December 31, 2004, in the BSAI was 59,432 fish, of which 51,131 were taken in the pollock trawl fishery (86%). Incidental catch of chinook salmon in the BSAI (non-CDQ) was well above its annual limit of 26,825 for 2004 for the pollock trawl fishery (191%). Additionally, the Chum Salmon Savings Area was closed again in 2004 due to attainment of its seasonal bycatch limit. This occurred from September 14 through October 14, 2004. NMFS' prohibited species reports indicate that 163,674 non-chinook salmon were taken in the CVOA in 2004 (421% of the 38,850 cap for the CVOA). Because the bycatch limit for chinook salmon that triggers closure of the Chinook Salmon Savings Area was also attained in 2004 (non-CDQ catch of 51,134 of the 26,825 cap for non-CDQ fishing), the Chinook Salmon Savings Area was closed to the pollock fishery on September 5th, 2004.

Evidence suggests that these chinook salmon are derived from stocks from many areas. For example, Myers, *et al.* found, on the basis of scale analysis of BSAI observer samples, "stock composition estimates for the five brood-year strata (1991-1995) averaged 56% Western Alaska, 31% Cook Inlet, 8% Southeast Alaska-British Columbia, and 5% Kamchatka chinook salmon." Pacific Northwest chinook salmon would have been included in the Southeast Alaska-British Columbia grouping.[14]

Through March 19th, 2005, the bycatch of chinook salmon in the AFA pollock fishery is 24,774 fish. This is 92% of the annual limit of 26,825 chinook salmon. Hence, the AFA pollock fishery is approaching its 2005 chinook salmon PSC limit, and it appears likely that the Chinook Salmon Savings Area will need to be closed for a portion of 2005. (NMFS inseason data at http://www.fakr.noaa.gov)

3.2.2 Pacific Herring

Pacific herring bycatch rates in the midwater pollock trawl fishery have decreased somewhat since the early 1990's although incidental catches of herring taken in the pollock fishery have occasionally approached the PSC limit for that species. The Pacific herring PSC limit in 2004 was 1, 456 mt and a total of 965 mt of Pacific herring was taken in the BSAI trawl fisheries last year (66%). In 2003, herring bycatch in the BSAI pollock fishery was approximately 87% of its annual limit for that fishery (1,028 mt out of a limit of 1,184). The Herring Savings Areas are shown figure 4 to 50 CFR part 679. Only the Summer savings areas 1 and 2 are located in the area where the EFP activities would be conducted. Closures of these areas are specified in 50 CFR 679.21(e)(7)(vi).

3.3 Forage Species and Nonspecified Species

Forage fish species are abundant fishes that are preyed upon by marine mammals, seabirds and other commercially important groundfish species. The following forage species are included in the forage fish category established in 1998: Osmeridae (which includes capelin and eulachon), Myctophidae (lanternfishes), Bathylagidae (deep sea smelts), Ammodytidae (sand lances), Trichodontidae (sandfishes), Pholididae (gunnels), Stichaeidae (pricklebacks), Gonostomatidae (bristlemouths), and the Order Euphausiacea (krill). For further detailed discussion of forage fish species, see section 3.10 of the PSEIS (NMFS 2004) or section 4.4 of the EA/IRFA for the 2005-2006 harvest specifications (NMFS 2005a). Nonspecified species are fish and invertebrate species that are not managed under the FMPs, such as jellyfish and sea stars. Detailed information on nonspecified species may be found in section 3.10 of the PSEIS (NMFS 2004a) and section 4.4 of the 2005-2006 harvest specification EA/RFA (NMFS 2005a)

3.4 Status of Marine Habitat

The adjacent marine waters outside the exclusive economic zone, adjacent State of Alaska waters, shoreline, freshwater inflows, and atmosphere above the waters, constitutes habitat for prey species, other life stages, and species that move in and out of, or interact with, the target species in the management areas (NMFS 2001a). Distinctive aspects of the habitat include water depth, substrate composition, substrate infauna, light

[14] Meyers, Katherine W. School of Aquatic and Fisheries Science, University of Washington. Personal communication, 11-16-04.

penetration, water chemistry (salinity, temperature, nutrients, sediment load, color, etc.), currents, tidal action, phytoplankton and zooplankton production, associated species, natural disturbance regimes, and the seasonal variability of each aspect. Substrate types include bedrock, cobbles, sand, shale, mud, silt, and various combinations of organic material and invertebrates that may be termed biogenic or "living" substrate. Biogenic substrates present in these management areas include corals, tunicates, mussel beds, tube worms. These substrates have the aspect of ecological state (from pioneer to climax) in addition to the organic and inorganic components. Ecological state is heavily dependant on natural and anthropogenic disturbance regimes.

The recently completed EIS for the Identification and Conservation of Essential Fish Habitat (NMFS 2005b) as well as the FMPs (NPFMC 1999a, 1999b) contain descriptions of habitat requirements and life histories of the managed species. All the marine waters and benthic substrates in the management areas comprise the habitat of the target species. Much remains to be learned about habitat requirements for most of the target species. A detailed discussion of habitat and potential effects of fishing on habitat can be found in Appendix B of the recent EFH EIS (NMFS 2005b).

3.5 Status of Marine Mammal Populations

Marine mammals not listed under the Endangered Species Act (ESA) that may be present in the Gulf of Alaska (GOA) and BSAI include cetaceans, [minke whale (*Balaenoptera acutorostrata*), killer whale (*Orcinus orca*), Dall's porpoise (*Phocoenoides dalli*), harbor porpoise (*Phocoena phocoena*), Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), and the beaked whales (e.g., *Berardius bairdii* and *Mesoplodon spp.*)] as well as pinnipeds [northern fur seals (*Callorhinus ursinus*), and Pacific harbor seals (*Phoca vitulina*)] and the sea otter (*Enhydra lutris*). The sea otter has been identified as a candidate for listing under the ESA, and the US Fish and Wildlife Service (USFWS) is conducting a formal review. For further information on marine mammal population status, see Section 3.8 of the PSEIS (NMFS 2004a) as well as section 4.6 of the EA/IRFA for the 2005-2006 annual groundfish harvest specifications (NMFS 2005a).

3.6 Seabird Species Population Status and Raptor Interactions with Groundfish Fisheries

Seabirds by definition spend the majority of their life at sea rather than on land. Alaska's extensive estuaries and offshore waters provide breeding, feeding, and migrating habitat for approximately 100 million seabirds. Thirty-four species breed in the BSAI and GOA regions numbering 36 million and 12 million individuals in each respective area. Another 6 species breed at other locations in Alaska. In addition, up to 50 million shearwaters and 3 albatross species feed in Alaskan waters during the summer months but breed farther south. The current world population of short-tailed albatross is approximately 1200 individuals. Detailed seabird information on species population status, life history, ecology, and bycatch is contained in section 3.7 of the PSEIS (NMFS 2004a) and section 3.7 of the Steller sea lion SEIS (NMFS 2001b).

The Bald Eagle Protection Act (16 U.S.C. 668(a)) and the Migratory Bird Treaty Act (16 U. S. C. 703-712) prohibit the taking of bald eagles. Taking includes causing the injury or death of an eagle. In February 2001, the USFWS surveyed the pollock shoreside fish processing facilities in Unalaska regarding interactions with Bald Eagles.[18] Anecdotal information indicated that eagles were attracted to the pollock vessels delivering shoreside, with birds entering the ship holds, and becoming caught in the hoppers as fish is being delivered. It was determined that the covering of fish totes on deck, cleaning the decks of fish parts and dragging the trawl nets through the water to remove fish parts were key to reducing the food source attraction for the eagles. It is not known what percentage of the fishing industry uses these practices. Occasionally an injured bird would be sent to the Bird Treatment and Learning Center (BTLC) in Anchorage, Alaska for rehabilitation. The BTLC maintains a database recording information about the nature and cause of each birds injury, but many birds received from Unalaska are not accompanied by information on the cause of the injury. The current database contains no birds reported as injured by groundfish fishing activities.[19] The BTLC staff also reported that they received an owl that had head injuries from flying into lights on a fishing vessel and have had an eagle injured by being stuck in a crab pot. It is believed that the incident of raptor injury or death from interactions with the groundfish fisheries is rare, (one or two per year).

NMFS, the United States Department of Interior/ Fish and Wildlife, and an AFA pollock fishing cooperative called the Pollock Conservation Cooperative (PCC) are jointly working to better understand and reduce seabird interactions with trawl vessels. For trawl gear, interaction centers on potential strikes with the vessel's "third wire" (net sounder) cable and perhaps the trawl cables (warps) themselves. A recent study underway is evaluating this interaction and developing potential mitigation measures for trawl vessels and particularly for catcher processors that release offal as part of processing operations (Melvin, et al. 2004). These measures remain under study and have not been considered for regulation at this time. Additionally, the current detailed status of information on environmental effects of harvest specifications on ESA listed seabirds can be found in the Biological Opinion on the effects of the TAC-setting process for the Gulf of Alaska and Bering Sea/Aleutian Islands groundfish fisheries to Short-tailed albatross and Steller's Eider (United States Fish and Wildlife Service 2003).

3.7 Status of Endangered or Threatened Species

The Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq*; ESA), provides for the conservation of endangered and threatened species of fish, wildlife, and plants. The program is administered jointly by the NMFS for most marine mammal

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[18]Michael Jacobson, Wildlife Biologist, Personal Communication, April 22, 2003, USFWS 3000 Vintage Blvd. Ste. 201, Juneau, AK 99801.

[19]Ferg Fergeson, Volunteer, Personal Communication, April 22, 2003, The Bird Treatment and Learning Center, 6132 Nielson Way, Anchorage, AK.

species, marine and anadromous fish species, and marine plants species, and by the USFWS for bird species, and terrestrial and freshwater wildlife and plant species.

The designation of an ESA listed species is based on the biological health of that species. The status determination is either threatened or endangered. Threatened species are those likely to become endangered in the foreseeable future [16 U.S.C. § 1532(20)]. Endangered species are those in danger of becoming extinct throughout all or a significant portion of their range [16 U.S.C. § 1532(20)]. Species can be listed as endangered without first being listed as threatened. The Secretary of Commerce, acting through NMFS, is authorized to list marine fish, plants, and mammals (except for walrus and sea otter) and anadromous fish species. The Secretary of the Interior, acting through the USFWS, is authorized to list walrus and sea otter, seabirds, terrestrial plants and wildlife, and freshwater fish and plant species..

In addition to listing species under the ESA, the critical habitat of a newly listed species is designated concurrent with its listing to the "maximum extent prudent and determinable" [16 U.S.C. § 1533(b)(1)(A)]. The ESA defines critical habitat as those specific areas that are essential to the conservation of a listed species and that may be in need of special consideration. Federal agencies are prohibited from undertaking actions that destroy or adversely modify designated critical habitat. Some species, primarily the cetaceans, which were listed in 1969 under the Endangered Species Conservation Act and carried forward as endangered under the ESA, have not received critical habitat designations.

Federal agencies have an affirmative mandate to conserve listed species. One assurance of this is Federal actions, activities or authorizations (hereafter referred to as Federal action) must be in compliance with the provisions of the ESA. Section 7 of the ESA provides a mechanism for consultation by the Federal action agency with the appropriate expert agency (NMFS or USFWS). Informal consultations, resulting in letters of concurrence, are conducted for Federal actions that may affect, but are not expected to adversely affect, listed species or critical habitat. Formal consultations, resulting in biological opinions, are conducted for Federal actions that may have an adverse affect on the listed species. Through the biological opinion, a determination is made as to whether the proposed action is likely to jeopardize the continued existence of a listed species (jeopardy) or destroy or adversely modify critical habitat (adverse modification). If the determination is that the action proposed (or ongoing) will cause jeopardy, reasonable and prudent alternatives may be suggested which, if implemented, would modify the action to avoid the likelihood of jeopardy to the species or destruction or adverse modification of designated critical habitat. A biological opinion with the conclusion of no jeopardy may contain conservation recommendations intended to further reduce the negative impacts to the listed species. These conservation recommendations are advisory to the action agency [50 CFR. 402.25(j)]. If a likelihood exists of any taking[20] occurring

[20] The term "take" under the ESA means "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct" [16 U.S.C. § 1538(a)(1)(B)].

during promulgation of the action, an incidental take statement may be appended to a biological opinion to provide for the amount of take that is expected to occur from normal promulgation of the action.

Twenty-three species occurring in the GOA and/or BSAI groundfish management areas are currently listed as endangered or threatened under the ESA (Table 3.4). The group includes great whales, pinnipeds, Pacific salmon and steelhead, and seabirds.

Table 3.4 ESA listed and candidate species that range into the BSAI or GOA groundfish management areas and whether Reinitiation of Section 7 Consultation is occurring

Common Name	Scientific Name	ESA Status	Whether Reinitiation of ESA Consultation is occurring
Blue Whale	*Balaenoptera musculus*	Endangered	No
Bowhead Whale	*Balaena mysticetus*	Endangered	No
Fin Whale	*Balaenoptera physalus*	Endangered	No
Humpback Whale	*Megaptera novaeangliae*	Endangered	No
Right Whale	*Balaena glacialis*	Endangered	No
Sei Whale	*Balaenoptera borealis*	Endangered	No
Sperm Whale	*Physeter macrocephalus*	Endangered	No
Steller Sea Lion (Western population)	*Eumetopias jubatus*	Endangered	No
Steller Sea Lion (Eastern Population)	*Eumetopias jubatus*	Threatened	No
Chinook Salmon (Puget Sound)	*Oncorhynchus tshawytscha*	Threatened	Yes
Chinook Salmon (Lower Columbia R.)	*Oncorhynchus tshawytscha*	Threatened	Yes
Chinook Salmon (Upper Columbia R. Spring)	*Oncorhynchus tshawytscha*	Endangered	Yes
Chinook Salmon (Upper Willamette .)	*Oncorhynchus tshawytscha*	Threatened	Yes
Chinook Salmon (Snake River Spring/Summer)	*Oncorhynchus tshawytscha*	Threatened	Yes
Chinook Salmon (Snake River Fall)	*Oncorhynchus tshawytscha*	Threatened	Yes
Sockeye Salmon (Snake River)	*Oncorhynchus nerka*	Endangered	No
Steelhead (Upper Columbia River)	*Onchorynchus mykiss*	Endangered	No
Steelhead (Middle Columbia River)	*Onchorynchus mykiss*	Threatened	No
Steelhead (Lower Columbia River)	*Onchorynchus mykiss*	Threatened	No
Steelhead (Upper Willamette River)	*Onchorynchus mykiss*	Threatened	No
Steelhead (Snake River Basin)	*Onchorynchus mykiss*	Threatened	No
Kittlitz Murrelet[1]	*Brachyramphus brevirostris*	Candidate	No
Steller's Eider [1]	*Polysticta stelleri*	Threatened	No
Short-tailed Albatross [1]	*Phoebaotria albatrus*	Endangered	No
Spectacled Eider[1]	*Somateria fishcheri*	Threatened	No

Common Name	Scientific Name	ESA Status	Whether Reinitiation of ESA Consultation is occurring
Northern Sea Otter[1]	*Enhydra lutris*	Candidate	No

[1]The Kittlitz murrelet, Steller's eider, short-tailed albatross, spectacled eider, and Northern sea otter are species under the jurisdiction of the U.S. Fish and Wildlife Service. Critical habitat has been established for the Steller's eider (66 FR 8850, February 2, 2001) and for the spectacled eider (66 FR 9146, February 6, 2001). The northern sea otter has been proposed by USFWS as a candidate species (November 9, 2000; 65 FR 67343). The Kittlitz murrelet has been proposed as a candidate species by USFWS (69 FR May 4, 2004).

Section 7 consultations with respect to actions of the federal groundfish fisheries have been done for all the species listed in Table 3.1, either individually or in groups. An FMP level biological opinion was prepared pursuant to Section 7 of the ESA on all NMFS listed species present in the fishery management areas for the entire groundfish fisheries program. This comprehensive biological opinion (FMP BiOp) was issued November 30, 2000 (NMFS 2000). The Steller sea lion was the only species to be determined to be in jeopardy or risk of adverse modification of its habitat based upon the FMPs. NMFS has implemented protection measures for the groundfish fisheries that avoid the likelihood of posing jeopardy or adverse modification of critical habitat for the western distinct population segment of Steller sea lions (NMFS 2001b, appendix A and 68 FR 204, January 2, 2003). Consultations prepared subsequent to 1998 are summarized below.

Steller sea lions and other ESA listed marine mammals.

In compliance with the ESA, NMFS developed a reasonable and prudent alternative (RPA) for the BSAI and GOA groundfish fisheries to avoid jeopardy to endangered Steller sea lions and adverse modification of their critical habitat. The RPA is based on the following three main principles: (1) temporal dispersion of fishing effort, (2) spatial dispersion of fishing effort, and (3) sufficient protection from fisheries competition for prey in waters adjacent to rookeries and important haulouts. The RPA focused on three fisheries that posed the most concern for competition with Steller sea lions for prey; the BSAI and GOA pollock and Pacific cod fisheries, and the BSAI Atka mackerel fishery. Neither the conclusions of the FMP BiOp (NMFS 2000) nor the RPA was adopted by the Council at its December 2000 meeting for numerous reasons, including lack of confidence in the scientific premises supporting the biological opinion, lack of public and Council input during its development, and general disagreement about the efficacy of the RPA measures. Subsequently, the Alaska congressional delegation sponsored a rider to the 2001 appropriations bill (Section 209 of Pub. L. 106-554) that provided direction for a one-year phase-in of the RPA and opportunity for the Council to assess and potentially modify the RPA prior to full implementation in 2002 based on independent scientific reviews or other new information.
The protection measures in the emergency rule (66 FR 7276, January 22, 2001) reflect the first year implementation phase of the RPA. In January 2001, the Council established an RPA Committee to make recommendations on Steller sea lion protection measures for the second half of 2001 and to develop Steller sea lion protection measures for 2002 and beyond. The RPA Committee was composed of 21 members from the fishing community, the environmental community, NMFS, the Council's Science and Statistical

Committee, the Council's Advisory Panel, and ADF&G. In April 2001, the RPA Committee presented its recommendations to the Council for fishery management measures for the second half of 2001. These recommendations were then forwarded by the Council to NMFS and were implemented by amendment to an emergency interim rule (66 FR 37167, July 17, 2001). In June 2001, the RPA Committee recommended Steller sea lion protection measures for 2002 and beyond, and the Council modified and forwarded these recommendations to NMFS in October 2001. ESA consultation was requested on these protection measures and a biological opinion (2001 BiOp) was prepared by the Protected Resources Division (NMFS 2001b, Appendix A). The final 2001 BiOp concluded that the proposed Steller sea lion protection measures were not likely to jeopardize the continued existence of either the eastern or western distinct population segment of Steller sea lions or adversely modify their critical habitat. These protection measures were implemented by final rule in 2003 (68 FR 204, January 2, 2003). Detailed analysis of the Steller sea lion protection measures is contained in the SEIS for Steller sea lion protection measures (NMFS 2001b).

On December 18, 2002, the United States District Court for the Western District of Washington remanded to NMFS the 2001 BiOp for the groundfish fisheries managed pursuant to the Steller sea lion protection measures published on January 2, 2003 (68 FR 204). Greenpeace, et al. v. National Marine Fisheries Service, No.C98–492Z (W.D. Wash.). The Court held that the biological opinion's findings of no jeopardy to the continued existence of endangered Steller sea lions and no adverse modification of their critical habitat were arbitrary and capricious. On December 30, 2002, the Court issued an Order declaring that the 2001 BiOp "shall remain effective until June 30, 2003," while NMFS completes the response to the remand. NMFS' response therefore evaluated the effects of fishing activities authorized pursuant to the Steller sea lion protection measures final rule on listed species and critical habitat.

ESA Listed Pacific Salmon and Steelhead

Using the year 2000 proposed TAC specifications, NMFS reinitiated consultations for ESA listed Pacific salmon for twelve ESUs of Pacific salmon and steelhead that are thought to range into Alaskan waters. The consultation for the Pacific salmon and steelhead species was issued December 22, 1999, and contained a determination of not likely to jeopardize their continued existence. No critical habitat has been designated for these species within the action area, therefore, none will be affected by the groundfish fisheries. The biological opinion reviewed the status of Snake river fall chinook, Snake River spring/summer chinook, Puget Sound chinook, Upper Columbia river spring chinook, Upper Willamette River chinook, Lower Columbia river chinook, Upper Columbia river steelhead, Upper Willamette River steelhead, Middle Columbia river steelhead, Lower Columbia river steelhead, and Snake river Basin steelhead, the environmental baseline for the action area, the effects of the proposed fishery and the cumulative effects. The opinion was accompanied by an Incidental Take Statement (ITS) that states the catch of listed fish will be limited specifically by the measures proposed to limit the total bycatch of chinook salmon. Bycatch should be minimized to the extent possible and in any case should not exceed 55,000 chinook per year in the BSAI fisheries or 40,000 chinook salmon per year in the GOA fisheries. The FMP BiOp (NMFS 2000) stated that ESA listed Pacific salmon and steeelhead are not in jeopardy or risk of adverse modification of their habitat by the groundfish fisheries in the BSAI or GOA, and reaffirmed the ITS in the previous opinion.

NMFS has conducted a code wire tag study on surrogate stocks of ESA listed salmon for the Upper Willamette and Lower Columbia rivers nearly annually since 1984. For all the years data have been collected, no more than 3 tagged fish in a year was estimated taken in the BSAI groundfish fisheries[21].

Chinook salmon incidental catch in the BSAI in 2004 was 59,432 fish in the BSAI groundfish fisheries. Incidental catch in the BSAI area is above the amount stated in the incidental take statement. Approximately 86 percent of the2004 incidental catch of chinook salmon was taken in the pelagic trawl fisheries targeting pollock in the BSAI. Additionally, in 2004 in the BSAI 456,857 "other" salmon (mostly chum) were incidentally taken, 98 percent in the pelagic trawl fisheries targeting pollock.

Regulations at 50 CFR part 679 authorize the incidental catch of no more than 29,000 chinook salmon, annually, in the Chinook Salmon Savings Area of the BSAI by trawl vessels targeting pollock for 2004, and future years. The incidental catch of chinook salmon in the BSAI pollock trawl fishery exceeded the 29,000 fish limit and as a result the Chinook Salmon Savings Areas were closed to pollock trawling September 5, 2004. On September 14, 2004, the Chum Salmon Savings Area was also closed, due to the trawl fishery reaching the 42,000 non-chinook salmon PSC limit in the Catcher Vessel Operating Area (CVOA).

According to the EA/RFA for 2005-2006 harvest specifications, the high incidental catch of salmon in the BSAI in 2004 may well have been exacerbated by the closure of the salmon savings areas (NMFS 2005a). Following these closures, the pollock fleet apparently moved into areas where they experienced higher incidental catch rates of salmon. It is not known if 2004 was an anomalously high year for the incidental catch of salmon in the BSAI or if similar rates of incidental take of salmon during the 2005 and 2006 groundfish fisheries can be expected.

The ESA incidental take statement for listed salmon is 55,000 chinook salmon in the BSAI and 40,000 chinook salmon in the GOA (NMFS, 1999). On December 1, 2004, NMFS requested reinitiation of formal Section 7 consultation of the ESA listed chinook salmon incidental takes in the BSAI groundfish fishery because the groundfish fisheries exceeded the amount stated in the incidental take statement in 2004. The Council is in the process of considering changes to the measures in place to reduce salmon bycatch in the BS/AI pollock fishery. One measure under consideration is modeled after the salmon bycatch management contracts implemented by the AFA pollock cooperatives. Another is the bycatch hot spot avoidance program used by the pollock cooperatives in

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[21] Adrian Celewycz, NMFS, Auke Bay Lab, Personal Communication regarding CWT database, November 14, 2002.

conjunction with a third-party data collection and analysis contractor called Sea State. Additionally, further research to develop an effective salmon bycatch reduction device is cited as a potentially important area of focus for improving salmon bycatch control measures (NMFS, 2005a).

ESA Listed Seabirds

The only new information on seabirds since 1998 concerns the taking of short-tailed albatross and subsequent Section 7 consultations on listed seabird species. It is summarized below:

On 22 October 1998, NMFS reported the incidental take of 2 endangered short-tailed albatrosses in the hook-and-line groundfish fishery of the BSAI. The first bird was taken on 21 September 1998, at 57 30' N, 173 57' W. The bird had identifying leg bands from its natal breeding colony in Japan. It was 8 years old. In a separate incident, one short-tailed albatross was observed taken on September 28, 1998, at 58 27'N, 175 16'W. A second albatross was also taken on 28 September 1998, but the species could not be confirmed (3 species of albatross occur in the North Pacific). Both vessels were using seabird avoidance measures when the birds were hooked.

The USFWS listed the short-tailed albatross as an endangered species under the ESA throughout its United States range (65 FR 46644, July 31, 2000). Under terms of the 1999 biological opinion ITS, a take of up to 4 birds is allowed during the 2-year period of 1999 and 2000 for the BSAI and GOA hook-and-line groundfish fisheries (USFWS 1999). NMFS Regional Office, NMFS Groundfish Observer Program, and the USFWS Offices of Ecological Services and Migratory Bird Management are actively coordinating efforts and communicating with each other in response to the 1998 take incidents and are complying to the fullest extent with ESA requirements to protect this species. Regulations at 50 CFR § § 679.24(e) and 679.42(b)(2) contain specifics regarding seabird avoidance measures. In February 1999, NMFS presented an analysis on seabird mitigation measures to the Council that investigated possible revisions to the currently required seabird avoidance methods that could be employed by the long-line fleet to further reduce the take of seabirds.

The Council took final action at its April 1999 meeting to revise the existing requirements for seabird avoidance measures. The Council's preferred alternative would: 1) explicitly specify that weights must be added to the groundline; 2) the offal discharge regulation would require that prior to any offal discharge, embedded hooks must be removed; 3) streamer lines, towed buoy bags and float devices could both qualify as bird scaring lines; 4) towed boards and sticks would no longer qualify as seabird avoidance measures; 5) the use of bird scaring lines would be required in conjunction to using a lining tube; and 6) night-setting would continue to be an option and would not require the concurrent use of a bird scaring line. These revised seabird avoidance measures were implemented in 2004 (69 FR 1930, January 13, 2004). The avoidance measures affect the method of harvest in the hook-and-line fisheries, but are not intended to affect the amount of harvest.

A biological opinion on the BSAI hook-and-line groundfish fishery and the BSAI trawl groundfish fishery for the ESA listed short-tailed albatross was issued March 19, 1999, by the USFWS for the years 1999 through 2000 (USFWS 1999). The conclusion continued a no jeopardy determination and the ITS expressing the requirement to immediately reinitiate consultations if incidental takes exceed four short-tailed albatross over two years time. In September 2000, NMFS requested re-initiation of consultation for all listed species under the jurisdiction of the USFWS, including the short-tailed albatross, spectacled eider, and Steller's eider for the BSAI and GOA FMPs and 2001-2004 TAC specifications. Based on NMFS' review of the fishery action and the consultation material provided to USFWS, NMFS concluded that the BSAI and GOA groundfish fisheries are not likely to adversely affect either the spectacled eider or the Steller's eider or destroy or adversely modify the critical habitat that has been proposed for each of these species. Critical habitat has now been established for both the Steller's eider and the spectacled eider (66 FR 8850, February 2, 2001 and 66 FR 9146, February 6, 2001, respectively).

The USFWS new biological opinion on the effects of the groundfish fisheries on listed seabirds was issued in 2003. The USFWS's Biological Opinion details the status of information on environmental effects of harvest specifications on sea birds in Alaska. (United States Fish and Wildlife Service 2003). Additionally, the Pollock Conservation Cooperative, NMFS and United States Department of Interior/ Fish and Wildlife are jointly working to better understand and reduce seabird interactions with trawl vessels. For trawl gear, interaction centers on potential strikes with the vessel's "third wire" (net sounder) cable or the trawl cables (warps) themselves. A field project study started in 2003 is evaluating this interaction developing potential mitigation measures for trawl vessels and particularly for catcher processors which may release offal as part of processing operations (Melvin, et al. 2004). These measures remain under study and have not been considered for regulation at this time.

3.8 Ecosystem Considerations

Ecosystem considerations for the BSAI and GOA groundfish fisheries are detailed in the Ecosystem section (section 3.10) of the PSEIS (NMFS 2004a). That document provides updated information on biodiversity, essential fish habitats, consumptive and non-consumptive sustainable yields, and human considerations. This information is intended to be incorporated into ecosystem-based management decisions such as establishing ABC and TAC levels.

3.9 The Human Environment

The operation of the groundfish fishery in the BSAI and the GOA is described by gear type in the PSEIS (NMFS 2004a). General background on the fisheries with regard to each species is given in the BSAI and GOA groundfish FMPs (NPFMC 1999a and 1999b). The pollock trawl and State salmon fishery sectors are the only sectors that may be affected by this proposed action.

3.9.1 Fishery Participants

For detailed information on the fishery participants including vessels and processors in the pollock fishery see sections 3.3 of the Final Environmental Impact Statement for the American Fisheries Act Amendments 61/61/13/8 (NMFS 2002). Additional information regarding fishery participants can be found in the 2004 annual SAFE report (NPFMC, 2004).

3.9.2 Economic Aspects of the Fishery

The most recent description of the economic aspects of the groundfish fishery is contained in the 2003 Economic SAFE report (Hiatt, Felthoven, and Terry, 2004). This report, incorporated herein by reference, presents the economic status of groundfish fisheries off Alaska in terms of economic activity and outputs using estimates of catch, bycatch, ex-vessel prices and value, the size and level of activity of the groundfish fleet, the weight and value of processed products, wholesale prices, exports, and cold storage holdings. The catch, fleet size, and activity data are for the fishing industry activities that are reflected in Weekly Production Reports, Observer Reports, fish tickets from processors who file Weekly Production Reports, and the annual survey of groundfish processors. External factors that, in part, determine the economic status of the fisheries are foreign exchange rates, the prices and price indices of products that compete with products from these fisheries, and fishery imports.

4.0 ENVIRONMENTAL IMPACTS OF THE ALTERNATIVES

The environmental impacts generally associated with fishery management actions are effects resulting from (1) harvest of fish stocks which may result in changes in food availability to predators and scavengers, changes in the population structure of target fish stocks, and changes in the marine ecosystem community structure; (2) changes in the physical and biological structure of the marine environment as a result of fishing practices, e.g., effects of gear use and fish processing discards; and (3) entanglement/entrapment of non-target organisms in active or inactive fishing gear. A recent summary of the effects associated with groundfish harvest on the biological environment is discussed in the 2003 groundfish fishery EA (NMFS 2003). The PSEIS (NMFS 2004a) analyzes the impacts of fishing over a range of TAC specifications.

As described in Section 3, Table 3.1, the proposed action may impact only certain components of the environment: groundfish target species, prohibited species, marine mammals, seabirds, and socioeconomic components. This section will focus on only these components of the environment.

The criteria used to evaluate the significance of impacts on each component of the environment are adopted by reference from the 2005 and 2006 Harvest specifications EA/IRFA (NMFS 2005a).

4.1 Groundfish Target Species

The potential direct and indirect effects of the groundfish fisheries on target species are detailed in section 3.5 of the PSEIS (NMFS 2004a). Direct effects include fishing mortality for each target species and spatial and temporal concentration of catch. Indirect effects include the changes in prey composition and changes in habitat suitability. Indirect effects are not likely to occur with either alternative because the proposed action does not change overall fishing practices that indirectly affect prey composition and habitat suitability.

Alternative 1. Status Quo

All direct, indirect and cumulative effects under this alternative would be insignificant for the same reasons as explained in sections 4.2 and 5.0 of the 2005 and 2006 Harvest Specifications EA/IRFA (NMFS 2005a).

Because the amount of pollock and other groundfish harvested under the proposed experiment (5,000 mt in 2005-2006 and 2,500 mt in 2006-2007) and in the directed pollock fishery (TAC 1,478,500 mt for 2005 and 1,487,756 in 2006) is well below the pollock ABC for 2005 and 2006 (1.9 million mt for 2005 and 1.6 million mt for 2006), it is unlikely that not harvesting groundfish under the status quo compared to Alternative 2 would have any beneficial effect for the groundfish stocks.

Alternative 2. Issue the EFP

Temporal and spatial concentration of harvest is not likely to occur under Alternative 2. Temporal concentration of harvest is not likely because the experiments will occur during two seasons and over the time period of approximately 30-40 days for one vessel and 15 days with the other vessel. Spatial concentration also is not likely because the harvest during the experiment occurs in various locations that are known for high chum and chinook salmon bycatch rates but are also common pollock trawling areas. These potential areas cover many square miles, (Fig. 1.1 and 1.2) and harvest will be done by two vessels. By comparison, the overall number of active trawl vessels targeting pollock in the Bering Sea is approximately 120 vessels.

The only potential direct effect on target species is groundfish fishing mortality during the testing of the salmon excluder devices. The applicants for the EFP have requested a total of 5,000 mt of allocated groundfish in 2005-2006 (September 2005 through March 2006) and 2,500 mt of groundfish during 2006-2007 September 2006 through March 2007. This overall quantity of groundfish will be used in the following manner. The requested groundfish allocation for the first year of research will be used to conduct two separate experiments. The first experiment will be conducted in fall 2005 only and will utilize 2,500 mt of groundfish in addition to approximately 5,500 mt of the EFP applicant's own AFA groundfish. This test will evaluate the performance of the current excluder design on an at-sea processor. A "ground truth" experiment is necessary to evaluate the potential influence on escapement that occured from the use of a recapture net in previous experiments. The EFP groundfish allocation of 2,500 for this experiment is needed for the portion of the EFP test conducted inside the Salmon Savings Areas and Catcher Vessel Operations Area. The second experiment during the first year will utilize 2,500 mt of groundfish starting in the fall of 2005 and possibly continuing into the winter of 2006 (September 2005 through March 2006). The objective of this test is to continue design and development work to improve the performance of the salmon excluder. This latter study will be conducted on an AFA-qualified catcher vessel.

Additionally, the applicant has requested permission for EFP testing during a second year (September 2006 through March 2007). The requested allocation of 2,500 mt of groundfish for the second year would be used to continue development work on the salmon excluder aboard an AFA catcher vessel should such additional design improvement work be necessary.

The expected total harvest of allocated groundfish species for the two experiments during the first year (fall 2005 to winter 2006) is 5,000 mt. Should the second year of design improvement work be necessary, a maximum of 2,500 mt of allocated groundfish species starting in the fall of 2006 and possibly continuing through the winter of 2007 would be harvested. Groundfish catches during all phases of the proposed research are expected to be approximately 98% pollock, and 2% is expected to be other groundfish species such as Pacific cod and flatfish. The pollock TAC for the Eastern Bering Sea is 1,478,500 mt for 2005 and 1,487,756 mt for 2006 (assuming 2006 TAC remains as currently specified). The acceptable biological catch is 1,960,000 in 2005 and 1,617,000 in 2006. The potential harvest of pollock under this proposed action is less than one-third of one percent of the TAC for the first year and one-sixth of one percent the following year. The combined harvest of the TAC and the groundfish that would be allowed under the EFP is well below the ABC in each year. The harvest of other groundfish (Pacific cod and other flatfish) under the proposed action is also far less than one percent of the TACs for the other groundfish species.

Issuing the EFP will allow for the additional removal of approximately 5,000 mt of groundfish (primarily pollock) from the BSAI in 2005 and 2,500 mt in 2006 above the TAC for the Eastern Bering Sea. As described above, this amount of harvest is far less than one percent of the pollock TAC and ABC. Additionally, the expected additional catch of Pacific cod and flatfish if the EFP is approved is a relatively small fraction of the TACs and ABCs in the Bering Sea/ Aleutian Islands for those species. Because the amount of groundfish anticipated to be harvested during the experiment is very small and well below the ABCs, it is not likely that harvesting groundfish under Alternative 2 will have any effect on groundfish stocks and is therefore insignificant.

4.2 Effects on Prohibited Species in Groundfish Fisheries Harvest

Catches of Pacific halibut, crabs, salmon, and herring are controlled by PSC limits for the BSAI that are established in regulations as part of the annual specification process. Appendix F, section 5 of the PSEIS (NMFS 2004a) analyzes the impacts of fishing over a range of TAC specifications and compares them to impacts of status quo fishing on prohibited species. Potential direct and indirect effects include: the impact of incidental catch of prohibited species in the groundfish fisheries on stocks of prohibited species, the impact of incidental catch of prohibited species in the groundfish fisheries on the harvest levels of those species in their respective directed fisheries, and the effect on levels of incidental catch of prohibited species in the groundfish fisheries. An indirect effect of the groundfish fisheries is a potential change to the prey composition for PSC species. This action is not likely to affect PSC prey because any changes to the habitat or prey composition during the experiment is not expected.

Alternative 1: Status Quo

All direct, indirect, and cumulative effects under this alternative would be insignificant or unknown for the same reasons as explained in sections 4.5 and 5.0 of the 2005 and 2006 Harvest Specifications EA/IRFA (NMFS 2005a).

If the EFP is not issued, an effective salmon excluder device is less likely to be developed, and the pollock fisheries may continue to experience rates of salmon bycatch that could potentially result in the restriction of pollock fishing. Less pollock may be taken under this alternative when the Chum and/or Chinook Salmon Savings Areas and the CVOA are closed. For instance, the PSC limits for the Chinook and Chum Salmon Savings Areas were reached in 2004 and negative effects on the Bering Sea pollock fishery were experienced (NMFS 2005a). These impacts included higher operating costs for shoreside delivery vessels fishing outside the Salmon Savings Areas and a failure to reach the 2004 pollock TAC (NMFS 2005a). Of additional concern here is that there is some evidence that salmon bycatch rates were actually higher for the fishing that occurred outside the Salmon Savings Areas once the savings areas closed, therefore possibly increasing salmon bycatch in the pollock fishery over what might have otherwise occurred. This suggests that Alternative One, even if it does reduce pollock and salmon catches by small amounts relative to the TAC and overall salmon bycatch caps (by the amount of groundfish and salmon bycatch proposed for the research) is inferior to Alternative 2 because with Alternative 1 there is a lower chance that an effective salmon excluder device will be developed.

Alternative 2: Issue the EFP

Salmon and herring are the primary PSC species of concern in the BSAI directed pollock fishery (NMFS 2002), and are potentially impacted by the proposed action. In order to have sufficient sample sizes to support the statistical analysis, the experimental design calls for salmon bycatch limits for the EFP experiments (combined) in 2005-2006 of 2,000 chinook salmon and 5,000 chum salmon that would not count towards the respective bycatch caps. For 2006-2007, the applicant has requested an allowance of 2,500 chum salmon and 500 chinook salmon that would not count against the bycatch limits that trigger closures of the respective Salmon Savings Areas. The applicant has also requested exemption from salmon bycatch management regulations establishing fishing area closures for the groundfish fisheries. The taking of salmon during the experiment is crucial for determination of the effectiveness of the excluder device. The success of the EFP work depends on the ability to conduct the experiment in areas where reasonable pollock abundance overlaps with average to high salmon bycatch rates for the EFP experiments. Based on the applicants' previous research experiments leading up to the current stage of development of the salmon excluder, such conditions are only feasibly obtained when access to the Salmon Savings Areas is allowed.

Because the harvest of salmon during the experiment will not be counted towards the salmon PSC limits for the groundfish fisheries, no effect on the level of incidental catch of salmon in the groundfish fisheries is expected. The amount of salmon taken during the proposed experiments also is not expected to have an impact on the State commercial salmon fishery. For instance, the expected harvest for the 2003 commercial fishery in the Central and Westward Regions of Alaska was 171,000 chinook salmon and 48,530,000 chum salmon (Eggers 2003). The expected maximum harvest of salmon during the proposed experiment is less than 1 percent of the number typically harvested in Alaska commercial salmon harvest. Therefore, Alternative 2 will likely have no impact on the harvest of salmon in the State commercial salmon fishery.

The experiment is not directly focused on changes in salmon mortality in pollock trawl interactions. The focus of the experiment is on the relative proportions of salmon and of other groundfish that escape via the excluder device. The experimental presumption is that any salmon that escape through the excluder are alive and the researchers will continue to use underwater video cameras to evaluate any effects of the excluder on expected survival of escaping salmon. Mortality in salmon-trawl interactions is likely to occur primarily through contact with the trawl, and video evidence produced in earlier experimental work on the salmon excluder suggests that escaping salmon do not contact the any part of the trawl intermediate.

Although the estimated environmental effect of salmon bycatch on salmon runs in Alaska are thought to be minimal, the reduction in these effects would create some expected benefits for commercial and recreational fishermen, Alaskan natives and tribal values associated with salmon, and salmon management and conservation goals. In years where salmon returns are relatively low, the reduction in bycatch effects on salmon runs, however minimal those effects might be, would be avoided to the timely benefit of those runs. Therefore, the successful development of an effective salmon bycatch reduction device for the Bering Sea pollock fishery (and any other pollock or whiting fishery) where the device may prove effective could produce long term net economic and social benefits in terms of lower salmon bycatch in trawl fisheries where salmon bycatch is prevalent.

Pacific herring are managed by the State of Alaska on a sustained yield principal. Pacific herring are surveyed each year and the Guideline Harvest Levels (GHLs) are based on an exploitation rate of 20% of the projected spawning biomass. These GHLs may be adjusted inseason based on additional survey information to insure long term sustainable yields. The ADF&G have established minimum spawning biomass thresholds for herring stocks that must be met before a commercial fishery may occur. As was described above, the amount of herring harvested overall in the pollock fishery is well below the 1 percent of biomass limit. Any potential additional harvest of herring under the proposed action is likely to be well below the one percent biomass limit for herring because of the small amount of herring that is normally taken in the pollock fishery. The EFP has no exemptions from the herring PSC limit or the Herring Savings Area closures (§ 679.21(e)(7)(vi)). No impact on herring resources is expected beyond those already analyzed (NMFS 2005a).

The proposed action will remove salmon from the environment. As stated above, the amount of removal is very small compared to the commercial fishery which is based on conservation of the biomass of the stocks. Base on this it is unlikely that there will be any impact on the salmon stocks.

The benchmark used to determine the significance of effects on salmon stocks was whether or not salmon minimum escapement needs would be reasonably expected to be met. If the action was reasonably not expected to jeopardize the capacity of the salmon stocks to produce long term sustainable yields it was deemed insignificant. Because the expected harvest of salmon under Alternative 2 is less than one percent of the projected harvests for the Central and Westward State commercial fisheries, the proposed action is not expected to jeopardize the capacity of the salmon stocks to produce sustainable yield either in the short or long term, and is therefore, not significant.

The benchmark used to determine the significance of effects under each alternative on herring stocks was whether minimum spawning biomass threshold levels would reasonably be expected to be met (NMFS 2005a). Much less than 1 percent of the herring biomass is expected to be harvested, and therefore, the impact is not significant.

The cumulative effects of the groundfish fisheries for PSC species are described in section 5.0 of the 2005 and 2006 Harvest Specifications EA/IFRA (NMFS 2005a). The EA/IRFA determined that the cumulative effects on salmon PSC were unknown based on the high level of bycatch in past actions combined with the future bycatch controls. For purposes of this analysis, the comparative amounts of salmon bycatch between years does not necessarily indicate the potential impact on the salmon stock from bycatch in the groundfish fisheries. It is possible that the salmon biomass in years of high salmon bycatch was also high so that higher level of removals may not necessarily lead to increased impact on the salmon population. Because the relationship of high bycatch to stock abundance is not known, it is possible that increased bycatch between years would not affect the salmon stock capacity to produce long term sustainable yield. Large increases in chinook salmon catch were seen in the years between 2001 and 2004 in the State salmon fisheries which may indicate that chinook salmon abundance was also elevated (Alaska Department of Fish and Game Commercial Fisheries Division data at http://www.cf.adfg.state.ak.us/geninfo/finfish/salmon/catchval/history/chin1878.php).

Because past increases in salmon bycatch may reflect increases in abundance and future bycatch controls may reduce salmon bycatch, it is likely that the taking of salmon under this EFP in combination with past and future effects on salmon will not prevent the salmon stock capacity to provide long term sustainable yield. The cumulative effect of this action on PSC is therefore insignificant.

4.3 Effects on Endangered Species

Alternative 1 (Status Quo)

All direct, indirect, and cumulative effects under this alternative would be insignificant for the same reasons as explained in sections 4.6 and 5.0 of the 2005 and 2006 Harvest Specifications EA/IRFA (NMFS 2005a).

Alternative 2

The Steller sea lion is the only ESA listed species under NMFS jurisdiction that has been identified as adversely affected by the groundfish fisheries (NMFS 2001b). In order to avoid jeopardy of extinction or adverse modification or destruction of critical habitat, the Council recommended and NMFS has implemented the Steller sea lion protection measures (68 FR 204, January 2, 2003, corrected (68 FR 24615, May 8, 2003)). This proposed action would be conducted in compliance with the Steller sea lion protection measures, except for the sector specific limits in the SCA (see section 2.0). Salmon and pollock have been identified as a prey species of Steller sea lions (NMFS 2001b). This proposed action will be conducted in a manner that will not likely affect prey availability for Steller sea lions. Testing will be conducted outside of protection areas (except the SCA), and the amount of groundfish and salmon harvested is expected to be very small, taken by two vessels in 2005-2006 and a single vessel in 2006-2007 over a large area, and dispersed over two seasons in the case of the EFP research on a catcher vessel.

The exemption from the sector closures of the SCA is not expected to have an impact on Steller sea lions. In 2003, almost 80,000 mt of sector combined pollock quota was left unharvested in the SCA before April 1. The amount of groundfish expected to be taken in the spring test is approximately 1,300 mt. The goal of the Steller sea lion protection measures for harvest in the SCA is to prevent the temporal concentration of harvest before April 1. This is accomplished by limiting harvest to 28% of the annual TAC. The SCA has not been closed since 1999 since the AFA allowed for the establishment of pollock cooperatives that monitor their own fishing, generally leaving the SCA before quotas are exceeded. During 2003, the catcher vessels over 99 feet LOA harvested 101 percent of their sector's quota for the SCA. Because this sector is likely to take all of their quota and could potentially be restricted from fishing in the SCA, an exemption from the sector specific quota (the research vessel may be a greater than 99 ft LOA catcher vessel) is necessary to ensure sufficient amounts of salmon can be encountered during the experiment. (Large portions of the salmon savings areas overlap with the SCA.) This exemption will only apply as long as the combined amount of pollock taken from the SCA does not exceed the 28 percent annual TAC before April 1, as specified in the Steller sea lion protection measures (§ 679.20(a)(5)(i)(B)). Because this exemption ensures that the temporal harvest of pollock remains dispersed as specified in the Steller sea lion protection measures, this exemption is not expected to have any adverse impacts.

The 2005-2006 groundfish fisheries EA established that actions within the spatial and temporal concentrations established by the Steller sea lion protection measures were not significant for ESA listed species (NMFS 2005a). Because this proposed action will be implemented within compliance with the Steller sea lion protection measures, the potential impacts of this action are considered insignificant.

4.4 Seabirds

Direct and indirect impacts on seabirds from groundfish fishing activities may include incidental take by gear and vessel strikes, affects on prey availability and fishery wastes, and effects on benthic habitat. This proposed action is unlikely to have any affects on benthic habitat because of the use of pelagic trawl gear. Prey availability is also unlikely to be affected because of the species targeted and the relatively small amount of harvest in comparison to the groundfish fisheries as a whole. The most likely potential for impacts is incidental take from vessel strikes and third wire strikes.

Alternative 1 (Status Quo)

All direct, indirect, and cumulative effects under this alternative would be insignificant for the same reasons as explained in sections 4.6 and 5.0 of the 2005 and 2006 Harvest Specifications EA/IRFA (NMFS 2005a).

Alternative 2 Issue the EFP

The additional groundfish harvest that would be permitted under the EFP would result in additional time for the interaction between seabirds and the vessel beyond the amount of interaction analyzed in the 2005 and 2006 harvest specifications EA/IFRA (NMFS 2005a). Because the amount of harvest under the EFP is a small fraction of the overall harvest of the groundfish fisheries TACs, it is likely that the additional interaction overall with seabirds would be minimal. A minimal addition of interaction is not likely to increase incidental take of seabirds to the point of having population level effects or adversely impact ESA listed seabird species. Therefore, the effects of this action on seabirds are insignificant.

4.5 Socioeconomic Effects

The potential socioeconomic effects of this proposed action primarily are future benefits that may result from the use of a salmon excluder device in the pollock trawl fisheries. Pollock taken during the testing will be sold to help offset the costs to the vessel operations during the experimental work. Salmon harvested during the testing will be donated for distribution under the PSDP (§ 679.26) or disposed of in accordance with § 679.21(b).

Alternative 1 Status Quo

If the EFP is not issued, the development of an effective salmon excluder device may be more difficult, if not impossible. The pollock fishery is experiencing salmon bycatch rates that have exceeded and are likely to continue to exceed salmon bycatch limits for chum and chinook salmon as occurred in 2004. The economic impact to the pollock fishery is the potential closure of salmon savings areas, limiting the fishing area choices for pollock harvest. Limited fishing grounds can result in additional expenses associated with finding other areas with sufficient catch rates and quality of fish. Alternative 1 would not facilitate the development of a salmon excluder device, eliminating the potential for future socioeconomic benefits identified under Alternative 2.

Alternative 2 Issue the EFP

The knowledge gained from this experiment may make it possible to reduce the costs of salmon bycatch in the pollock trawl fisheries. However, there are several caveats. The experiment may not be successful; the excluder may fail to increase salmon escapement over the levels achieved in EFP development and testing to date (43% for chinook and 9-13% for chums). Additionally, the ground truth experiment conducted on a catcher processor may be successful but this may indicate that the escapement rates detected through the previous EFP work with recapture devices may overstate salmon escapement (a highly unlikely outcome) or underestimate pollock loss (now thought to be 2-3% from previous EFP tests). One byproduct of the experiment may be particularly valuable. The video technologies used in the experiment are expected to produce a lot of information about the behavior of salmon in trawls. This information is likely to lead to new insights into fishing strategies that may reduce salmon PSC at low operational cost. Preliminary work with the video in preparation for the experiment has already generated considerable information. For example, there is evidence that the trawls are capturing much of the salmon in the upper mid-water parts of the water column. Persons involved with the experiment have already been able to advise skippers on fishing tactics that may reduce salmon bycatch, for example, by launching their nets in ways that minimize the time they spend in the water column. Other insights are expected.[23]

Under Alternative 2, the proposed action may allow for the development of an effective salmon excluder device for trawl gear. If such a device were available, trawl vessels

[23]Gruver, op. cit.

could use this device to lower the bycatch of salmon, resulting in less potential for exceeding the PSC limits. By not exceeding the PSC limits, pollock and other trawl fisheries would have more locations available for selecting fishing grounds, potentially leading to less harvesting expense and higher quality product. Benefits to consumers and the country overall from the pollock fishery could also increase under the expectation that the benefits of efficiency gains and increased product quality would accrue to consumers and the nation.

These environmental benefits are based on the assumption of minimal injury to salmon utilizing the escapement device. Any evaluation of the performance of salmon bycatch reduction device and its costs and benefits would clearly need to explicitly evaluate the question of long term survival in order to assess actual benefit/cost tradeoffs. The expectation of benefits from a BRD also assumes that changes in fishing behavior as a result of widespread use of the device would not increase some other potential environmental costs associated with the fishery. It is also not possible to predict the level of acceptance of using such a device in the pollock trawl fishery.

4.6 Coastal Zone Management Act

Implementation of either alternative would be conducted in a manner consistent, to the maximum extent practicable, with the Alaska Coastal Management Program within the meaning of Section 30(c)(1) of the Coastal Zone Management Act of 1972 and its implementing regulations.

5.0 SUMMARY AND CONCLUSIONS

Context: The action is to issue an EFP to allow for additional testing of salmon excluder devices for pollock trawl gear in the Bering Sea. Any effects of the action are limited to areas commonly used by the pollock trawl fishery. The effects on society within these areas are on individuals directly and indirectly participating in the pollock fisheries, those participating in the experiment, and those who may receive the small amount of salmon through the Prohibited Species Donation Program (PSDP). Because this action may affect the efficiency of pollock fishing and the bycatch of salmon in the future, this action may have impacts on society as a whole or regionally.

Intensity: Listings of considerations to determine intensity of the impacts are in 40 CFR § 1508.27 (b) and in the NOAA Administrative Order 216-6, Section 6. Each consideration is addressed below in order as it appears in the regulations.

> **Adverse or beneficial impact determinations for marine resources, including sustainability of target and nontarget species, damage to ocean or coastal habitat or essential fish habitat, effects on biodiversity and ecosystems, and marine mammals**: The components of the environment that were identified to possibly be affected by the action were groundfish target species, prohibited species, marine mammals, seabirds, and socioeconomic components. The analysis in section 4.0 determined that none of these components were likely to be

significantly impacted by the action. Future actions that may result from the successful development of a salmon excluder device may affect the socioeconomic component, but enough information to determine the significance of such future actions is not available at this time.

Public health and safety would not be affected in any way by the action which is limited to the use of a pollock catcher vessel and catcher/processor to test a bycatch reduction device.

Cultural resources and ecologically critical areas: This action will take place in the geographic area of the Bering Sea in locations commonly used by pollock catcher vessels. The land adjacent to these areas contain cultural resources and ecologically critical areas. The marine waters where the fisheries occur contain ecologically critical area. Effects on the unique characteristics of these areas are not anticipated to occur with this action because fishing practices are not affected and mitigation measures such as a bottom trawling ban in the Bering Sea are part of fisheries management measures.

Controversiality: This action is initiated by industry in cooperation with NMFS, and would reduce the potential for salmon bycatch. Because it could potentially further the goals to reduce bycatch in the groundfish fisheries and does not affect current fishery regulations, it is not considered controversial.

Risks to the human environment, including social and economic effects are not expected with this action. The experiment is limited in scope and does not change current fishing practices. Harvest taken by the vessel would be sold to offset the cost of the experiment. When possible, salmon taken will be provided to the PSDP to feed underprivileged individuals. The amount of harvests of pollock and salmon is very small in relation to annual harvests and is not likely to have an impact socially or economically.

Future actions related to this action may result in beneficial economic impacts. See section 4.7. If the testing of the salmon excluder device allowed by this action is successful, the use of such a device by pollock trawl vessels could result in economic advantages for the pollock industry. Fewer restrictions on pollock fishing may occur if the amount of salmon bycatch is kept under the prohibited species catch limits. Economic benefits will depend on the effectiveness of the device and participation by trawl vessel owners. Therefore, determining the significance of any future beneficial economic effect is not possible.

In 2004, the Council initiated a process to consider modifications to salmon bycatch control measures in the Bering Sea. Salmon bycatch reduction measures are also currently under consideration for GOA groundfish trawl fisheries in conjunction with GOA rationalization. These measures may include bycatch limits that when attained, would trigger closures in areas with the historically highest bycatch rates. Use of an effective salmon excluder device developed for the BSAI fishery may allow Bering Sea pollock fishermen to more feasibly adapt to the new bycatch measures for the Bering Sea (when effective). Additionally, the salmon excluder may lessen the impact of or even remove the need for future salmon bycatch reduction measures in the GOA.

Cumulatively significant impacts, including those on target and nontarget species, are not expected with this action. No significant impacts on the components of the environment were identified, and no past, present, or reasonably foreseeable future actions are known to combine with this action to cause a significant impact on the environment. The significance of the future action identified above regarding the use of a salmon excluder device cannot be determined because of the uncertainty of the extent of use of such a device in the pollock fishery and its effectiveness.

Districts, sites, highways, structures, or objects listed or eligible for listing in the National Register of Historic Places: This action will have no effect on districts, sites, highways, structures, or objects listed or eligible for listing in the National Register of Historic Places, nor cause loss or destruction of significant scientific, cultural, or historical resources. This consideration is not applicable to this action.

Impact on Endangered Species Act (ESA) listed species and designated critical habitat: ESA listed species that range into the fishery management areas are listed in Table 3.4 of this EA. The status of Section 7 consultations is summarized in section 3.7. Based on the coded wire tag surrogate study, very few ESA listed salmon have been taken in the BSAI fishery. Because of the small amount of groundfish and salmon harvest, this action is not likely to take ESA listed salmon.

This action will not likely have an effect on Steller sea lions due to the very low amount of harvest of prey species by two vessels, short duration of the action, and location of harvest outside of most Steller sea lion protection areas and maintenance of the temporal dispersion of harvest. Consultations for ESA listed marine mammals or Pacific salmon are not being reinitiated for this action because changes in fishing activities would not occur that would result in effects sufficient to trigger reinitiation. Those triggers include: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the biological opinion; and (4) a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the amount or extent of incidental take is exceeded, the action agency must immediately reinitiate formal consultation. No adverse impacts on ESA listed species or on critical habitat are likely for this action.

There is no known violation of Federal, state, or local law for environmental protection with the implementation of this action.

No introduction or spread of non-indigenous species is expected with this action because the experiment is limited to a single pollock vessel in areas normally used by pollock trawl vessels.

Comparison of Alternatives and Selection of a Preferred Alternative

Alternative 1 does not meet the need or the purpose of this action, to allow for implementing the experiment for salmon excluder devices on trawl gear to reduce the amount of salmon bycatch in the pollock trawl fishery. Alternative 2 would provide an EFP that permits the testing of such a device in a scientifically valid manner and within groundfish regulations (50 CFR 679 and 600), meeting the need and purpose of this action. Without the EFP, the testing would not be conducted following the carefully conceived experimental design, potentially resulting in no development of the bycatch reduction device. Therefore, Alternative 2 is the preferred alternative.

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8.0 LITERATURE CITED

DeMaster, D. 2003. Memorandum to James W. Balsiger regarding review of Exempted Fishing Permit to Test Salmon Excluder, March 14, 2003. Alaska Fisheries Science Center, 7600 Sand Point Way N. E., Seattle, WA 98115-0070.

Egger, D. M. ed. 2003. Run Forecast and Harvest Projections for 2003 Alaska Salmon Fisheries and Review of the 2002 Season. Regional Information Report No. 5J03-01. Alaska Department of Fish and Game, Division of Commercial Fisheries, P. O. Box 25526, Juneau, AK 99802-5526.

Glass, C. and C. Wardle. 1995. A review of fish behavior in relation to species separation and bycatch reduction. Pages 243-250 in: Solving Bycatch: Considerations for Today and Tomorrow. Alaska Sea Grant College Program Report No. 96-03, University of Alaska Fairbanks.

Haflinger, K. 2004. Presentation to the North Pacific Fishery Management Council regarding Chum and Chinook Salmon in the Pollock Trawl Fishery. October 2004.

Hare, S.R., and R. C. Francis. 1995. Climate change and salmon production in the Northeast Pacific Ocean. Pages 357-372 in R. J. Beamish, editor. Climate change and northern fish populations. Canadian Special Publication of Fisheries and Aquatic Sciences 121.

Healy, M.C. 1991. "The life history of Chinook salmon." In *Pacific Salmon Life Histories*. C. Groot and L. Margolis (eds). U.B.C. Press. Pages 311-393.

Hiatt, T. , R. Felthoven, and J. Terry. 2004. Stock Assessment and Fishery Evaluation Report for the Groundfish Fisheries of the Gulf of Alaska and Bering Sea/Aleutian Island Area: Economic Status of the Groundfish Fisheries Off Alaska, 2003. November 2004. National Marine Fisheries Service, P.O. Box 21668, Juneau, Alaska 99802.

Kruse, G. H. 1998. Salmon run failures in 1997-1998: A link to anomalous ocean conditions? Alaska Fishery Research Bulletin: 5(1):55-63.

Melvin, Edward F., Kimberly S. Dietrich and Tim Thomas. 2004. Pilot Tests of Techniques to Mitigate Seabird Interactions with Catcher Processor Vessels in the Bering Sea Pollock Trawl Fishery: Final Report. November 19, 2004. Washington Sea Grant Program University of Washington 3716 Brooklyn Ave NE Seattle, WA 98103.

Meyers, Katherine W., Robert V. Walker, Janet L. Armstrong, and Nancy D. Davis. 2004. "Estimates of the Bycatch of Yukon River Chinook Salmon in the U.S. Groundfish Fisheries in the Eastern Bering Sea, 1997-1999." Final Report to the

Yukon River Drainage Fisheries Association. School of Aquatic and Fishery Sciences, University of Washington. Seattle; March, 2004.

Mikol, R. A. 1997. Temperature Directed Fishing: How to Reduce Bycatch and Increase Productivity. Alaska Sea Grant Marine Advisory Bulletin. MAB-48, University of Alaska Fairbanks.

National Marine Fisheries Service (NMFS). 2005a. Environmental Assessment/Final Regulatory Flexibility Analysis for the Harvest Specifications for the Years 2005-2006 Alaska Groundfish Fisheries Implemented Under the Authority of the BSAI and GOA Groundfish Fishery Management Plans. February 2005. DOC, NOAA, National Marine Fisheries Service, P.O. Box 21668, Juneau, Alaska 99802.

NMFS. 2005b. Preliminary Final Environmental Impact Statement for Essential Fish Habitat Identification and Conservation in Alaska. January 2005. National Marine Fisheries Service, P.O. Box 21668, Juneau, Alaska 99802.

NMFS, Protected Resources Division, Pacific Northwest Region 1999. "Endangered Species Act – Reinitiated Section 7 Consultation. BIOLOGICAL OPINION. Take of Listed Salmon in Groundfish Fisheries Conducted under the Bering Sea and Aleutian Islands and Gulf of Alaska Fishery Management Plans."

NMFS, Protected Resources Division, Pacific Northwest Region. 1994. "Endangered Species Act – Section 7 Reinitiation of Consulation. BIOLOGICAL OPINION. Groundfish Fisheries Conducted under the Bering Sea and Aleutian Islands and Gulf of Alaska Fishery Mangement Plans of the North Pacific Fishery Management Council."

NMFS. 2004a. Programmatic Supplemental Environmental Impact Statement For Alaska Groundfish Fisheries Implemented Under the Authority of The Fishery Management Plans for the Groundfish Fishery of the Gulf of Alaska and the Groundfish of the Bering Sea and Aleutian Islands Area. June 2004. National Marine Fisheries Service, P.O. Box 21668, Juneau, Alaska 99802.

NMFS. 2003. Environmental Assessment for Issuing an Exempted Fishing Permit for the Purpose of Testing Salmon Excluder Devices in the Eastern Bering Sea Pollock Fishery. May 2003. National Marine Fisheries Service, P.O. Box 21668, Juneau, Alaska 99802.

NMFS. 2002. Final Environmental Impact Statement for American Fisheries Act Amendments 61/61/13/8. February 2002. National Marine Fisheries Service, P.O. Box 21668, Juneau, Alaska 99802.

NMFS. 2001. Steller sea lion protection measures supplemental environmental impact statement. November 2001. DOC, NOAA National Marine Fisheries Service, P.O. Box 21668, Juneau, Alaska 99802.

NMFS 2000. ESA Section 7 Consultation Biological Opinion and Incidental Take Statement. Activities Considered: Authorization of Bering Sea/Aleutian Islands groundfish fisheries based on the Fishery Management Plan for the Bering Sea/Aleutian Islands Groundfish and Authorization of the Gulf of Alaska groundfish fisheries based on the Fishery Management Plan for Groundfish of the Gulf of Alaska. November 30, 2000. NMFS Alaska Region, P. O. Box 21668, Juneau, Alaska 99802. Also available at http://www.nmfs.noaa.gov/steller/fmp_sec07-NOV30_2000_FINAL.pdf.

North Pacific Fishery Management Council NPFMC. 2004. Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Bering Sea/Aleutian Islands Regions. November 2004. NPFMC, 605 W. 4th St., Suite 406, Anchorage, AK 99501. 1093 pp. and appendices.

NPFMC. 1999a. Fishery Management Plan for the Bering Sea/Aleutian Islands Groundfish (updated). June 1999. NPFMC, 605 W. 4th St., Suite 406, Anchorage, AK 99501, 410 pp.

NPFMC. 1999b. Fishery Management Plan for the Gulf of Alaska Groundfish (updated). July 1999. NPFMC, 605 W. 4th St., Suite 406, Anchorage, AK 99501, 325 pp.

NPFMC. 1999c. Environmental Assessment / Regulatory Impact Review for Amendment 58: An amendment to further reduce chinook salmon bycatch in groundfish trawl fisheries of the Bering Sea and Aleutian Islands. NPFMC, 605 W. 4th St., Suite 406, Anchorage, AK 99501.

Rose, C. 2001. Development and testing of halibut excluders for Alaska cod trawling. Available from http://www.iphc.washington.edu/halcom/research/bycatch/halexcl.pdf. Alaska Fisheries Science Center, NMFS, 7600 Sand Point Way NE, Seattle, WA 98115.

United Catcher Boats Association (UCBA). 2003. An Exempted Fishing Permit Application to Test A Salmon Excluder Device for Pollock Trawls, March 2003. United Catcher Boats, 4005 20th Ave. W. Ste. 116, Fisherman's Terminal, Seattle, WA 98199.

University of Washington Sea Grant 2004. Pilot Tests of Techniques to Mitigate Seabird Interactions with Catcher Processor Vessels in the Bering Sea Pollock Trawl Fishery. Issued November 2004. Available from: Washington Sea Grant Program, University of Washington 3716 Brooklyn Ave NE Seattle, WA

United States Fish and Wildlife Service (USFWS). 2003. Biological Opinion on the Effects of the Total Allowable Catch (TAC)-Setting Process for the Gulf of Alaska (GOA) and Bering Sea/Aleutian Islands (BSAI) Groundfish Fisheries to the Endangered Short-tailed Albatross (*Phoebastria albatrus*) and Threatened

Steller's Eider (*Polysticta stelleri*). Issued May, 2003. U.S. Department of the Interior, Fish and Wildlife Service, 1011 E. Tudor Road, Anchorage, Alaska 99503-6199.

USFWS. 1999. Endangered Species Act Formal Section 7 Consultation for 1999-2000 Hook-and-Line Groundfish Fisheries of the Gulf of Alaska and Bering Sea and Aleutian Islands Area (Short-tailed Albatross.) Issued March 19, 1999. U.S. Department of the Interior, Fish and Wildlife Service, 1011 E. Tudor Road, Anchorage, Alaska 99503-6199. 36pp + Tables and Figures.

Witherell, D. and C. Pautzke. 1997. A brief history of bycatch management measures for the Eastern Bering Sea groundfish fisheries. Marine Fisheries Review 59 (4): 15-22.

Witherell, D., D. Ackley, and C. Coon. 2002. An overview of salmon bycatch in Alaska groundfish fisheries. Alaska Fishery Research Bulletin. Vol. 9, No. 1, Summer 2002.

Appendix: EFP Application

Request for an exempted fishing permit (EFP) to continue research on salmon bycatch reduction devices

Date of Application: March 2005
Name, mailing address, and phone number of applicant:

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Purpose and Goals of the EFP: The overall purpose of this application for a new EFP is to provide the necessary conditions to make additional progress on the salmon excluder for pollock trawls. Another EFP is needed to allow us to conduct two tests that we feel are the most relevant scientific work at the current stage of development of our salmon excluder. The first experiment will use a recapture net to evaluate the effects of small adjustments to the excluder and its placement in the trawl relative to the escapement portals. These modifications are designed to improve performance. The second experiment is an evaluation of the performance of the existing excluder under as close to a "real world" deployment as is possible. This test will evaluate the difference between pairs of tows (with and without the excluder) according to an experimental design described in detail below.

Justification for the EFP: Mandates to reduce bycatch and bycatch mortality are set out in the Magnuson-Stevens Act. Current tools to avoid salmon bycatch are costly and at times less than effective. Salmon bycatch caps are currently very restrictive and have resulted in closures of the Salmon Savings Areas during the last two pollock B Seasons. These closures have forced pollock vessels to fish outside their traditional B season fishing areas. This has increased fishing costs, reduced fish quality, and contributed to the failure to attain the total allowable catch. Closures of the Salmon Savings Areas can also affect the relative safety of the smaller catcher vessel operations by for requiring them to fish farther from port once the closures have been triggered.

Names of participating vessels, copies of vessel Coast Guard documents, names of vessel masters: The principal investigator will notify the AKR Regional Administrator in writing of the name of the selected vessels including associated document numbers once the RFP process used for EFP vessel selection is completed. The principal investigator will also arrange to notify all relevant enforcement agencies of the vessel documentation and dates and area of operations for the EFP work. This will include ADF&G, NMFS, and the US Coast Guard.

Application Summary: This application requests an exemption from several regulations governing the Bering Sea pollock fishery as well as allocations of groundfish outside of the regular Bering Sea pollock fishery TAC. These are needed to support our continued research on salmon bycatch reduction devices. In light of the current stage of development of the salmon excluder, we feel our continued work should be focused on two specific areas as outlined below. This support document for our application outlines the field experiments we intend to conduct over the two years if granted a permit.

One experiment is devoted to further development of the excluder design via continued EFP field testing with a recapture device. This will be used to evaluate the performance effects of selected small changes in the excluder. Examples of adjustments are different placements of the excluder in the trawl intermediate, alternative tapers in the square-mesh funnel, and different placement locations for the funnel with respect to the escapement portals.

The second experiment is designed to test the current excluder design without the potential influence of a recapture net. Pairs of tows with and without the excluder will be compared via an experimental design described below. This test is designed to evaluate performance over a wide variety of fishing conditions and in a manner as close to a "real world" application as possible. This is needed to "ground truth" performance information we have obtained in previous tests that were made under a fairly narrow set of testing conditions. Additionally, this test will avoid the potential influence of a recapture device and thus should help to help allay concerns expressed by the pollock industry following our presentation of results at Fish Expo last fall. Some *ad hoc* trials of the excluder in the regular pollock fishery suggest that pollock escapement rates may have been underestimated in our previous tests, perhaps due to the weight of pollock in the recapture net reducing the escapement opportunity by pulling the recapture webbing closer to the escapement portals.

Relief from regulations requested in this application for an EFP:
Relief from existing regulations in several forms is necessary to allow us to conduct successful trials under appropriate catch and bycatch conditions. The first exemption we are requesting is the ability to conduct EFP testing inside the Bering Sea Salmon Savings Areas even when the Salmon Savings areas are otherwise closed to pollock fishing or otherwise would not allow the vessel conducting the test to fish in that area (this refers to the second experiment utilizing paired tows during B season 2005 on at-sea processor). For the first test to further improve the excluder design, this exemption is needed throughout our entire testing period. This test will be conducted on a catcher vessel. We need to access the Salmon Savings Areas because our ability to test there increases the potential for testing the excluder under consistent pollock catch and salmon bycatch rates. Consistent pollock and salmon catch rates have been critical to our work to improve excluder design. At times the Salmon Savings Areas have proven to be the only place where such conditions are reliably available.

The performance of the existing excluder without a recapture net will be tested under a variety of fishing conditions via comparisons of paired tows on an AFA at-sea processor.

This will involve alternating between a net with the excluder and one without an excluder and evaluating the catch rate effects over 50 pairs of tows. To include a full range of relevant fishing conditions, we are seeking permission to conduct approximately one-third of the testing inside the Salmon Savings Area and the Catcher Vessel Operations Area (CVOA). This exemption would apply to the 2,500 out of an estimated total of 8,000 MT needed for the 50 pairs that we are requiring be harvested inside the Salmon Savings Areas/CVOA for this part of the EFP work. Catcher processor vessels are by regulation not allowed to fish for pollock inside the CVOA during normal B season operations. Additionally, given that the CVOA overlaps extensively with the Salmon Savings Areas that may be closed to pollock fishing due to salmon bycatch, we are seeking an exemption to Salmon Savings Area restrictions as well. The reasons this exemption is necessary for this part of our EFP testing are explained in our detailed testing plan for this experiment below.

Another exemption needed for our research is to allow the catcher processor conducting the paired testing experiment to carry two EFP "sea samplers" associated with this EFP in lieu of their normal requirements under the American Fisheries Act. This is necessary to allow us to focus catch sampling and data collection on how the excluder affects salmon and pollock catch rates. Additionally, this will allow us to place some of the EFP project management responsibilities with our sea samplers hired for this work. For instance, our samplers will oversee the testing to ensure that rotations between experimental and control nets are carried out correctly and performance data are matched to the net used for each tow.
Our samplers hired for this work will be NMFS-trained observers who are not currently engaged in observing for the NMFS Observer Program. According to our discussions with the NMFS Observer Division, redirection of the duties performed for an EFP by observers working in the regular pollock fishery is not allowed. Because our sampling emphasis for the EFP changes observers' duties, it is our understanding that we are, in effect, unable to use observers who are currently observing for the Observer Program. Thus for our EFP, we are essentially asking that the AFA requirements for observer coverage are suspended during the EFP test and that our sea samplers are substituted in lieu of the normal coverage requirements during the EFP work. Our sea samplers would thus be responsible for performing the official catch monitoring and accounting duties that NMFS observers perform on AFA CPs.

<u>Amounts of groundfish harvest and salmon bycatch allowances requested for the EFP tests over the next two years and projected timing for our EFP testing:</u>

<u>Test to continued development of the excluder:</u> For continued work on the excluder design (the test continuing to utilize a recapture net on a catcher vessel) an allocation of 2,500 mt of groundfish catch in the pollock target is needed for 2005-2006 and again for 2006-2007. A bycatch allowance of up to 2,500 chum salmon and 500 chinook salmon each year is also required. These allowances should not count against the groundfish TAC or salmon bycatch caps.

As in past years, our tests to work on the excluder design will be conducted mainly in the fall (pollock B season). That time of year has provided the most consistently useful testing conditions for our excluder development work with a recapture device. Thus far, we have been able to find locations during B season with adequate abundance of both chum and chinook salmon where pollock fishing was also feasible. So we anticipate that most of the 2,500 mt of pollock in the pollock target year and associated salmon bycatch would likely be taken during the B seasons in 2006 and 2007. There may, however, be a need to carry some of each year's EFP allocation over to the following winter (A season of 2006 and 2007). This is because although chinook have proven to be sufficiently available for testing over the last two years, longer term seasonal patterns have not occurred in this way. So if chinook salmon are not sufficiently available in the fall for us to obtain sufficient data on their response to the new excluder configurations, we would focus our fall testing on chum salmon and return the next winter to address effects on chinook salmon.

While we may be at a stage where a second year of developmental work on the excluder is unnecessary, we are cognizant that our original schedule for excluder development for our previous EFP was probably too optimistic. With this EFP application covering two years of developmental work, we will avoid the necessity for NMFS and the Council to review another EFP application should our research require an additional year of field work.

<u>Paired test of the current excluder on an at-sea processor:</u> For our paired tow test of the existing excluder design on a pollock catcher processor, we are requesting an allowance of 2,500 mt of groundfish in the pollock target that would not count against AFA allocations or the groundfish TAC. This quantity of pollock would be required to be harvested in the Salmon Savings Area (and CVOA). The paired tow test aboard the at-sea processor will also require an allowance of up to 2,500 chum salmon and 500 chinook salmon while the catcher processor conducts the portion of the experiment inside the Salmon Savings Areas/CVOA.

The at-sea processor selected for this test would have to utilize its own AFA pollock allowance for the remainder of the fishing needed to generate 50 pairs of tows with and without the excluder. Based on an average of 80 mt per tow, we estimate that an additional 5,500 mt of the AFA-qualified CP's pollock would be needed to complete the 50 pairs of tows needed for the EFP test.

An additional bycatch allowance of up to 1,000 chinook salmon is required for the portion of the EFP test on a catcher processor conducted <u>outside</u> of the Salmon Savings Areas/CVOA. While harvesting the approximately 5,500 mt of groundfish outside of the Salmon Savings Area and CVOA, we do not want the AFA CP vessel to be under its normal responsibilities and duties to avoid chinook salmon bycatch as stringently as occurs under the AFA salmon bycatch agreements. So in addition to requesting a chinook salmon allowance to cover the extra chinook caught while conducting this portion of the experiment, the catcher processor conducting our test will be exempted from the tiered salmon bycatch avoidance measures that industry enforces. An allowance for chum salmon bycatch for the portion of the test outside the Salmon Savings Areas/CVOA is not needed.

This entire experiment (all EFP testing during the 50 pairs of tows) would be conducted during the 2005 B season. Likewise, the EFP sea sampler coverage for the test would remain in place during the entire time that the at-sea processor is engaged in conducting the test involving the 50 pairs of tows.

These groundfish allocations for all the EFP testing described in this application would be maximum harvest amounts. For the salmon bycatch allowances we would strongly prefer that the number of salmon requested for the EFP work be treated as "target" maximum numbers of salmon needed for the EFP. In the event of unforeseen salmon bycatch conditions, we may need to request additional salmon bycatch allowances and we would request them in consideration of the progress we are making with our EFP tests.

Purpose and need for a new salmon excluder EFP

Background: Since being granted an exempted fishing permit to work on a salmon excluder device in the summer of 2003, we have successfully conducted research to develop a viable salmon bycatch reduction device for the Bering Sea pollock fishery. In addition to the its intended use in the Bering Sea pollock fishery, the device may eventually be adaptable to other trawl fisheries where salmon bycatch occurs such as in the Gulf of Alaska pollock fishery and the West Coast Pacific whiting fishery.

Our work started with little more than a concept for salmon escapement based on observed differences in swimming behavior between pollock and salmon. Drawing on these differences, we changed the water flow in the intermediate via placement of a panel of square mesh in conjunction with oval escape portals cut out of the intermediate. We have since progressed to the point where testing of two different excluder designs has been conducted and both have achieved measurable reduction in salmon bycatch rates with relatively low pollock escapement rates.

Despite the progress achieved under EFP 2003-01, a great deal remains to be done before such a device can achieve the pollock industry's objectives of effectiveness in terms salmon bycatch reduction and overall feasibility. In the interim period, however, the need for an effective salmon excluder appears to have increased because salmon populations that use the Bering Sea are clearly at high abundance levels with little evidence of "relief" in sight. Salmon bycatch caps for chinook and chum salmon have triggered closures of the Bering Sea Salmon Savings Areas during the last two pollock B seasons. These closures have forced pollock vessels to fish outside their traditional B season fishing areas. This has increased fishing costs, reduced fish quality, and contributed to the failure to attain the total allowable catch. Closures of the Salmon Savings Areas can also affect the relative safety of the smaller catcher vessel operations by for requiring them to fish farther from port once the closures have been triggered.

Industry and fish managers are currently exploring alternative measures to control salmon bycatch in the Bering Sea pollock fishery. While in no way a substitute for the changes under consideration to the current salmon bycatch management measures, an effective salmon excluder would provide a much-needed tool to help pollock fishermen control salmon bycatch. Such a tool supplements the effectiveness of any measures to control bycatch by providing fishermen the ability to fish areas where good pollock fishing overlaps with low or moderate salmon abundance. Thus an effective salmon excluder provides a means of controlling bycatch rates without forcing industry to continually incur the costs of moving fishing operations in response to salmon bycatch rates.

Through four different phases of testing under the 2003 EFP (recalling that NMFS amended our EFP to allow us to repeat our experiment in 2004), we have worked in a dedicated collaborative mode with Dr. Rose of the NMFS RACE Division to develop the overall concept of the excluder and its application. While our progress has already exceeded most expectations (considering that our excluder relies solely on behavioral differences between target and bycatch species and utilizes changes in water flow alone), a great deal more work remains before our original objectives for an effective excluder are achieved.

Steps in the evolution of the salmon excluder since 2003: We started in the fall of 2003 with a "tunnel design" excluder employing a "hood" of 4 inch square mesh webbing inserted into the trawl intermediate about three-fourths the distance back from the mouth of the trawl. The tunnel guided water flow (and fish) down as they passed back through the net with the expectation that salmon clearing the back edge of the tunnel excluder would sense the "lee" of slower water above them. This then allowed them to swim up into this area with slower water speed and escape through the four large escapement portals cut out of the intermediate. With this original design, our research concluded that approximately 12% of the Chinook and chum salmon escaped the trawl and that the accompanying pollock loss was roughly 2.5%.

Problems with the recapture device, however, affected our confidence in the data to measure salmon escapement performance of the device. Additionally, through the video observations during the EFP work it became evident that higher rates of escapement might be possible with modifications to the device.

Through a second year of research made possible through NMFS' extension of our EFP, we set out to test a second-generation excluder. To address problems in the 2003 EFP work, our 2004 test employed an improved recapture system. In the 2004 test, we found that the "funnel" design device (in lieu of the original tunnel) improved the chinook escapement rate to approximately 40%. Chum salmon escapement, however, did not improve. Additionally, about the same relatively low loss rate for pollock was achieved. Our confidence in this estimate of salmon escapement was higher with the improved recapture net.

Modifications to the recapture device were particularly successful in addressing concerns with reversed escapes of salmon (salmon returning to the net from the recapture net during haulback) although the effects of the recapture net testing on pollock escapement remain an open question. This is because drag from catches accumulating in a recapture net that is "flown" above the normal trawl via water kites may rapidly overcome the lift from those kites. The resulting reduction in opening of the recapture net may effectively close off the escapement portals.

Additionally, the design of the recapture device incorporated light materials to help reduce drag and reduce visibility to salmon attempting to escape the net. Our ability to measure higher levels of pollock escapement with our recapture net has been hindered by the vulnerability of these materials to damage. For most of the tows where pollock catches in the recapture net appeared to be relatively high before the net is brought aboard, it was impossible to measure exactly how large these pollock escapement rates were. This was due to damage to the recapture net and loss of catch as it was being brought aboard.

Next steps for research on a salmon excluder through a new EFP

For the next phase of our research, we are focusing on two important and somewhat different areas that we believe are complimentary to the overall objective of the salmon excluder project in the long run. These are:

1. Improvements to the existing excluder design
2. Paired testing of existing excluder design without a recapture net to definitively establish its performance.

EFP Test 1: Continuing EFP research to improve the excluder design to attain higher rates of salmon escapement while maintaining relatively low rates of pollock escapement

Part one of our EFP testing will continue to focus on improving the performance of the funnel excluder. This will involve using the same experimental methods we have used for our research thus far. While we have established a general design approach based on behavioral and physical differences between pollock and salmon, a great deal of additional work is needed to optimize the design to make most of these differences. So the next phase of work on improvements involves making relatively small adjustments to the placement of the square mesh funnel in the intermediate.

Key factors to be tested under this part of our experiments are: the diameter of the intermediate relative to diameter of the opening at the aft end of the excluder, as determined by the taper of the excluder. Additionally, we intend to modify the position of the escapement portals in relation to the back edge of the excluder. Our work thus far has demonstrated that escapement rates of salmon are greatly affected by where and how the excluder funnel is installed relative to the escapement portals.

Because we are primarily interested in measuring the effects of these adjustments on salmon escapement, we feel that the current experimental design employing a recapture net is the most practical and efficient (in terms of statistical power) way to continue to improve the excluder design. Thus our analysis of the effects on salmon escapement (by species) would continue to be based on the proportion of salmon recovered in the recapture net as a fraction of the overall number of salmon per haul. For a thorough explanation of the experimental design used for EFP 2003-01, please see our EFP application developed for EFP 2003-01 in 2003. We would utilize an AFA pollock catcher vessel for this developmental work because catcher vessels are clearly the best platform for this type of research that can involve extended delays while repairs to the recapture device are made or when searching for suitable testing conditions in terms of salmon and pollock abundance.

While we recognize there are inherent limitation to the use of a recapture net to measure effects of the excluder on pollock loss rates, particularly when pollock are densely aggregated and catch rates are high, addressing pollock loss rates under high-catch rate conditions has not been the primary focus of our design work to improve salmon escapement performance. Hence we are confident that are continued use of the methods used in EFP 2003-01 is the best possible approach.

For this work, we are requesting an annual allowance of up to 2,500 MT of groundfish in the pollock target fishery for each of the next two years. This is 230 mt more groundfish to be harvested in the pollock target mode than we have used each year for the last two years for EFP 2003-01. The annual salmon bycatch allowances we are requesting for this work are roughly the same upper limit amounts per year for Chinook and chum as were established for EFP 2003-01. With this amount of groundfish and salmon bycatch, we believe we will be able to achieve our target sample sizes (see 2003 EFP application) to estimate the effects of the device on salmon escapement. Additionally, we feel that with this amount of groundfish we will enable us to get a reasonable estimate of pollock escapement, at least to the extent that our previous tests have been able to accomplish this goal.

As with past years, our testing will primarily be conducted during the fall (pollock B season) although as with past EFP work, we may conduct some testing during A season to address specific questions associated with typical A season conditions. During the B season in 2004, we were able to conduct testing during the four trips on a typical Bering Sea pollock catcher vessel. This afforded an adequate opportunity to evaluate the excluder's effects on salmon catch rates during typical pollock B season fishing conditions. The additional 230 mt of groundfish we are requesting for this EFP application (over what was used in our past EFPs) will serve as a buffer in case the EFP groundfish should be not encounter sufficient chinook salmon abundance during our B season testing each year. While testing during B season is the most efficient time for our work in terms of finding suitable salmon bycatch conditions, chinook have not typically been sufficiently available in the fall in years prior to 2003. Another reason for doing a portion of the test in the pollock A season is to evaluate how salmon escapement is affected by relatively high pollock catch rates. Another might be a specific question regarding chinook escapement in low-light conditions typical of winter in the Bering Sea.

Additionally, we continue to need the ability for the catcher vessel engaged for this research to fish within the Salmon Savings Areas for the EFP test, even if they are closed for the fishery. This relief from the regulations has proven critical in the past to the successful testing of the excluder. This is because on several occasions the only location with an adequate mix of pollock and salmon catch rates for our test has been found within the Salmon Savings Areas.

For this continuing design work, we would solicit applications from interested vessel owners through the same RFP process we used in EFP 2003-01. The RFP process and application review process are described in our application for our previous salmon excluder EFP. Our RFP solicitation informs interested applicants of their requirements and responsibilities if selected as the EFP vessel including: requirements for carrying out the experimental protocols, carrying "observers", conducting safety briefings and drills, and addressing any contingencies that may arise. Likewise, vessel applications would be reviewed by a team on knowledgeable scientists from the NMFS RACE Division with experience in setting up NMFS' research charter cruises. Finally, as with previous salmon excluder EFPs, we will prepare draft and final reports to the pollock industry at Fish Expo and the North Pacific Fishery Management Council each year describing our progress on the EFP work.

Test 2: Paired test of existing excluder design to definitively establish its performance
The primary objective of this work is to do a rigorous test of the existing salmon excluder device without the potential effects of a recapture net. Lingering questions regarding the potential influence of the recapture net on salmon and pollock escapement rates merit special consideration because experience with recapture nets have produced similar concerns in other situations and these concerns are impediment to fleet acceptance of the excluder. Additionally, some *ad hoc* trails of the excluder by several pollock fishermen during the regular fishery last year suggest that pollock escapement may be higher than we estimated for that device in previous EFP tests. This issue is clouded, however, by the fact that lacking any concrete experimental design for these trials. Hence, for *ad hoc* trials, one is essentially attempting to evaluate the proverbial "one that got away".

For this reason, a valid test of our current excluder conducted without a recapture net is of large importance at this stage of our project. Lacking a reasonable estimate of variance associated with salmon bycatch in the past, we had initially assumed that variance was too large to allow for a trial based on comparisons of matched pairs of tows (one with and the other without the excluder). However, data from our previous trials have allowed us to evaluate the ambient variability of salmon and pollock catch rates between matched tows and we now believe that such a test is possible. Based on these data, we have designed an experiment without a recapture net that provides sufficient statistical power to have a high probability of determining the excluder's effects on salmon and pollock catch rates.

As we have known from the outset, recapture devices inevitably influence escapement behavior as well as sometimes creating unanticipated problems with measuring performance. For our experiment, the issue of reversed escapes was troublesome but fortunately we were able to detect it through underwater video observation and then finally address it with the one-way "valve" inserted into the recapture net. Beyond that initial issue, however, we cannot measure how much influence the recapture net had on salmon escapement performance. We know that despite our best efforts to fly the recapture net away from the intermediate with water kites, the recapture net probably remained visible to salmon in daylight conditions and this may have discouraged escapement.

A similar confounding issue may have influenced our ability to measure pollock escapement. Although our water kites created sufficient lift to pull the recapture net away from the escapement portals, in cases where pollock escapement was relatively high, this inevitability tended to pull down on the recapture net towards the end of the tow when pollock became tired and began to collect in the cod end of the recapture net. Despite design work to have the weight of the recapture net pull mainly on the body of the intermediate aft of the escapement portals, we cannot dismiss the possibility that pollock escapement we measured were lower than would occur without the recapture net. Finally, for tows when large bursts of pollock escapement occurred in association with the "bulge" issue, we were essentially unable to measure pollock (and salmon) escapement because these large quantities of pollock eventually led to the failure of the recapture net when we attempted to pull it up the vessel's stern ramp.

As an alternative to testing with a recapture device, an experiment based on evaluating the difference in catch of salmon and pollock between pairs of tows with the excluder (treatment) and without (control) is a preferred approach when the excluder device is functioning well enough so that a large number of experimental pairs can be accomplished with a reasonable expectation that the device is sufficient resilient to be functional throughout the test period.

Experimental Design Considerations for a valid test comparing pairs of tows with and without the excluder

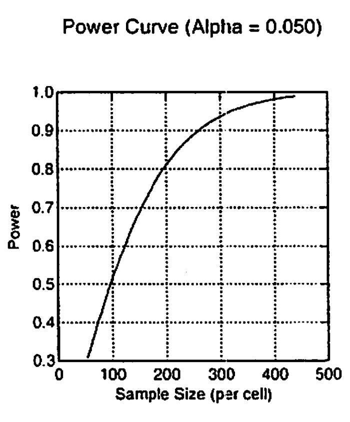
The first consideration for achieving sufficient statistical power is an estimate of the variability associated with the effects we are most interested in measuring. Utilizing data from our EFP tests last fall, we retroactively paired performance data for tows by time and evaluated the standard error of associated logged differences. Variables of interest were between pairs were differences in catch rates per hour of chum, chinook, and pollock. To utilize our EFP data to evaluate "background" variance associated with salmon and pollock catch rates between tows, we aggregated the main net and recapture nets for each tow so that overall salmon and pollock catch per hour would be the metric for comparisons between pairs. This allowed us to generate variability (standard error) for chinook, chum, and pollock catch rates per hour.

For purposes of calculating how many paired trials would be needed to allow us to evaluate the (logged) differences with sufficient statistical power to have a high probability of correctly detecting the effect of the excluder on catch rates, we selected "effect sizes" that for the effects we were trying to measure. These effect sizes were loosely based on our findings thus far in terms of the rates of reduction in chinook, chum, and pollock catch rate differences from our previous experiments with the recapture device. It was necessary, however, in some cases to make adjustments to these expected effect rates. One reason was that when the expected effect we have measured in the past was relatively small, the number of pairs needed to measure it was large (not surprisingly). In these cases, we selected a greater effect size as essentially a "backstop". For instance, our estimate of pollock loss from previous work with the recapture net was between 2-3%. Given the degree of variability in pollock catch rates in our data, detecting such an effect would require an impractical number of pairs. So we selected a larger effect size based on our practical experience regarding the magnitude of an effect (here pollock escapement rate) that would make the excluder impractical for use in the fishery. In this way, the test could at least conclude that the escape rate is less than that threshold effect size.

For the chinook salmon escape rate, to be conservative, we selected 20% as the expected magnitude of the effect that we are trying to measure. While we estimated an effect of over 40% reduction in chinook bycatch for our latest trials, we do not know the actual effects of the excluder (which is what we are trying to ascertain in this performance test). If we assume the same effect as we estimated last fall and the actual effect is smaller, then we risk having insufficient power to detect an actual effect of smaller size then our expected effect. Recognizing that a 20% reduction is probably close to the minimal effect that would make the excluder practical and "worth all the trouble" (cost of building and installing it, consideration of pollock escape rate), we selected a 20% reduction rate as our target effect size.

Statistical power equations utilizing 95% confidence (Alpha=0.05) and statistical power of 80% were generated for the appropriate standard error from our previous data. This power level means that, if the effect actually was the tested size, we would correctly conclude that it was statistically significant in 80 of 100 trials). The number of pairs needed to have this probability of detecting a 20% reduction in chinook catch rate with the excluder is thus roughly 50 pairs (Figure 1).

Figure 1: Sample size needed to detect a 20% decrease in chinook catch using log dif – standard dev. = .24



Alpha = 0.050
Power = 0.800
Model = Paired t-test
Expected Difference = -0.097 =log(0.8)
S.D. of Difference = 0.240
Effect Size = -0.404
Non-centrality parameter= 0.163 * sample size

SAMPLE SIZE (per cell)	POWER
48	0.783
49	0.792
50	0.800
51	0.808

Total Sample Size = 51 Pairs

We are also interested in the effect of the device on chum salmon bycatch. While chum were also caught on most of the tows in last fall's EFP, there was considerably more variability in the catch rate of chum salmon per hour. Thus to have the same statistical power (as in the above test for chinook salmon) to be able to correctly conclude that the excluder had a 20% reduction in the catch rate of chum salmon, almost 200 pairs of tows would be required (Figure 2).

Figure 2: Sample size needed to detect a 20% decrease in chum catch rate using log dif and standdev = .48

Alpha = 0.050
Power = 0.800
Model = Paired t-test
Expected Difference = -0.097 =log(0.8)
S.D. of Difference = 0.480
Effect Size = -0.202
Noncentrality parameter = 0.041 * sample size

SAMPLE SIZE (per cell) POWER

192	0.796
193	0.798
194	0.800
195	0.802

Total Sample Size = 195 Pairs

One could even argue that the magnitude of change we are attempting to measure for chum salmon escapement is high relative to what we have previously detected in our EFP work (9-12%), hence we might even need more pairs than the 195 estimated above. We believe, however, that the data used for sample size estimation may overstate variability vis a vis our ability to conduct testing on effects on chum salmon catch rates. This is because our excluder testing was deliberately attempting to locate areas with sufficient chinook and chum salmon for attaining sample size during last fall's EFP experiment. This was important because our attempts to test the excluder on chinook salmon were thwarted in the winter of 2004 due to an inability to find an area with consistently medium to high chinook bycatch rates. So for our fall 2004 work we intentionally stayed in an area where chinook salmon were present (and some chums were caught) even if this was probably not the ideal place to test the device on chums. Had we had sufficient time and groundfish allocation to target chums, we likely could have worked in an area with less variable chum salmon abundance and if data under those conditions were used for sample size evaluation, a smaller number of pairs would have been required from our power analysis.

The final consideration for sample size is to evaluate the number of pairs of tows needed for measuring the pollock escapement rates with the excluder. Utilizing the same data for calculation of the standard deviation that was used above and the same techniques for the power analysis, we evaluated sample size for detecting a 10% loss in pollock. As can be seen from the power analysis in Figure 3, approximately 37 pairs of tows are needed. We focused on a 10% reduction in pollock catch rate because based on our discussions with members of the pollock industry, any loss rate greater than 10% would make the excluder impractical. This is because the reduction in catch rate would require a considerable amount of additional fishing time to complete trips. Vessels are currently under delivery schedules based on pollock flesh quality requirements. Longer trips would mean either lower quality or coming in with less than complete trips and the latter would decrease profitability costs because fuel for the trip would be the same cost while revenue would be reduced.

Figure 3: Sample size needed to detect a 10% decrease in pollock catch using log dif -standard dev = .22

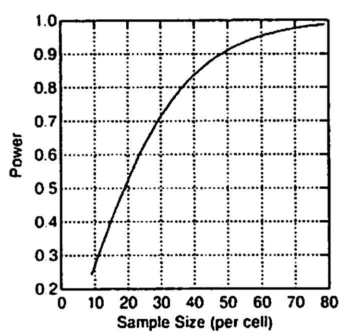
Alpha = 0.050
Power = 0.800
Model = Paired t-test

Expected Difference = -0.105 (10% pollock loss)
S.D. of Difference = 0.220
Effect Size = -0.477
Noncentrality parameter = 0.228 * sample size

SAMPLE SIZE (per cell)	POWER
24	0.610
25	0.629
26	0.648
27	0.666
28	0.683
29	0.699
30	0.715
31	0.730
32	0.744
33	0.758
34	0.771
35	0.783
36	0.795
37	0.806

Total Sample Size = 37 Pairs

Power Curve (Alpha = 0.050)



For the sake of evaluation, we also ran a power analysis for a 5% reduction in pollock catch rate. Not surprisingly, the estimated number of pairs needed to measure even a 5% reduction was quite high (148 pairs, power analysis not shown here). As one might expect, the number of pairs needed to measure a relatively small effect increases dramatically. The loss we measured with a recapture device in our different stages of EFP field work thus far have been in the range of 2-3%. Setting up our test to detect this small an effect would be infeasible. The important point here is that designing our test to have more than sufficient power to detect the maximum tolerable reduction rate in pollock catch, we can at least safeguard against failing to detect an effect of that magnitude or greater.

Evaluating the performance of the current excluder via a paired test on an at-sea processor

Applying a statistical power analysis to a multifaceted project such as ours where chinook, chum, and pollock escapement are all of interest is a balancing act. In the end, one must weigh the applicability of the data used to the individual aspects of the problem at hand. Throughout this exercise, on has also to keep in mind what is practical for field work. The practicality is aspect is more than just how much additional groundfish would be required to do the field research. An equally important consideration is that if the number of pairs required for the test is rather large, then the long duration over which that fishing for the experiment would take might involve a higher risk of encountering more variability than the test was designed to control for. For instance, an extended testing period over three months would likely encounter seasonality differences in the abundance of salmon.

At some point, if a large amount of fishing is needed to estimate the effects of the excluder, one might consider redesigning the experiment to use multiple vessels in order to acquire the required number of pairs of tows over a shorter period of time. But the potential for "vessel effect" differences with salmon excluder testing is very large and would thus require addition testing to resolve. This is because for unknown reasons, vessels fishing the same area in the regular fishery using unmodified nets often have radically different salmon bycatch rates. This raises a whole new set of conceptual and practical challenges for EFP work that are beyond our current infrastructural capabilities for an EFP.

For this reason, we settled on a practical approach that we feel generates adequate statistical power while allowing the work to occur in a reasonable timeframe and without necessarily incurring large ambient salmon or pollock abundance changes due to seasonality. Given our multiple testing objectives, we selected a goal of 50 pairs of tows as an amount for fishing for a single vessel that would have a reasonably high possibility of adequately measuring excluder performance for chinook bycatch reduction and pollock escapement.

Because tow by tow measurement of the effects of the excluder is required for our test, we will use pollock catcher-processor for this experiment. This is because a pollock CP is the only vessel where salmon effect can be estimated on a haul by haul basis with whole or partial haul estimations of salmon bycatch. Likewise, the certified flow scales required on pollock catcher processors provide a means of accurately measuring tow by tow groundfish catch rates per hour (and with species composition sampling pollock catch rates per hour). Assuming an average catch rate of 80 mt of groundfish per haul, however, this brings the estimated groundfish catch for this part of the experiment to approximately 8,000 mt (50 pairs = 100 tows times 80 mt per tow).

We are focusing on the pollock B season for this field work because in recent years, that season has produced relatively high bycatch rates for chum and chinook salmon. For the last two years, chum have typically been encountered in September and early October and chinook bycatch rates have also been relatively high starting at the end of September and increasing in October. We estimate that this test will take a pollock catcher-processor approximately one to one and one-half months to complete the required number of pairs of tows. This assumption is based on average catch rates of 300 mt per day and factoring in offloads, travel time to and from the fishing grounds, and some slowdowns due to fishing under the requirement of rotating the experimental and control nets.

To evaluate performance over a variety of typical fishing conditions, our EFP application requests 2,500 mt of groundfish in the pollock target to be used for tows within the Salmon Savings Areas (and CVOA). This would be harvested during the B season of 2005 by the at-sea processor as part of the EFP fishing needed to generate 50 pairs of tows alternating with and without the excluder. While harvesting this 2,500 mt allowance of groundfish, the catcher processor would be required to fish inside the Salmon Savings Areas (and CVOA). The Salmon Savings Areas are of specific interest because a great deal of shoreside pollock effort occurs during B season in the area. Additionally, the relatively high pollock catch rates for B season as well as the relatively shallow fishing depths (hence relatively good ambient light conditions) make it of special interest for this excluder test. For the remaining harvest needed to generate the 50 pairs (approximately 5,500 mt of groundfish), the at-sea processor would utilize its own AFA quota fish and would not be allowed to fish within the Salmon Savings Area (or CVOA).

An allowance of 2,500 chum salmon and 500 chinook salmon is also required for the portion of the test inside the Salmon Savings Areas/CVOA. As is explained above, an allowance of an additional 1,000 chinook is needed for the portion of the test outside the Salmon Savings Areas/CVOA. While the requested groundfish allocations are proposed as hard caps or limits for the experiment, we would prefer that the salmon bycatch amounts be treated as trigger amounts. This means that if catches approach that level, the EFP will need to consult with NMFS in order to evaluate the progress on the EFP relative to the likely salmon bycatch needs to complete the experiment. The salmon bycatch numbers listed above would not be counted against the caps for the Bering Sea Salmon Savings Areas.

Another exemption from existing regulations required for this research is to allow the catcher processor to carry two EFP "sea samplers" associated with this EFP in lieu of their normal observer requirements under the American Fisheries Act. This is necessary to allow us to focus catch sampling and data collection on the effects of the excluder on salmon and pollock catch rates. Additionally, this allows us to entrust some EFP project responsibilities to the sea samplers. For instance, our sea samplers will oversee the testing to ensure that rotations between experimental and control nets are carried out correctly and data collection is matched to the net used for each tow. The sea samplers we will hire for this work will be NMFS-trained observers who are not currently observing for the NMFS Observer Program. Based on a strict interpretation of the regulations governing observer deployments, observers currently observing for the NMFS Observer Program for the regular pollock fishery are not allowed to participate in EFPs because that fishing falls outside of the regular fishery. Even if this condition were relaxed for our EFP, concerns exist for the Observer Division regarding redirection of the sampling duties for observers because EFP requires these duties to be modified for our focus on salmon sampling.

So for our EFP, we are essentially asking that the AFA requirements for observer coverage are suspended during the EFP and that our sea samplers are substituted in lieu of the normal coverage requirements during the EFP work. The EFP sea samplers coverage would take the place of the observer coverage throughout the EFP work on the at-sea processor (during the entire fishing to generate the 50 pairs). During the experiment, our sea samplers would also perform catch monitoring and accounting duties normally performed by NMFS observers on that vessel.

To select a catcher-processor vessel to carry out this paired tow experiment, we would solicit applications from interested vessel owners through a similar RFP process used for our previous EFP work on salmon excluders (see EFP 2003-01). Our RFP solicitation will inform interested applicants of their requirements and responsibilities if selected as the EFP vessel including: requirements for carrying out the experimental protocols, requirements to pay for and carry sea samplers for the entire testing period, as well as things such as conducting safety briefings and drills, and addressing any contingencies that may arise. Likewise, vessel applications would be reviewed by a team on knowledgeable scientists from the NMFS RACE Division with experience in setting up NMFS' research charter cruises. Finally, as with previous salmon excluder EFPs, the principal investigator in conjunction with Dr. Rose of the AFSC RACE Division we will prepare draft and final reports to the pollock industry at Fish Expo and to the North Pacific Fishery Management Council describing the findings of the EFP work.

Sea Samplers hired for this project will be NMFS-trained and certified observers who are not currently performing observer services under the NMFS Observer Program. Project training for sea samplers will be conducted by the principal investigator in conjunction with Dr. Rose of the AFSC's Race Division. The exempted fishing permit holders will keep continuous contact with the sea samplers to ensure that experimental protocols are being followed and to troubleshoot any problems encountered with the field work.

Prior to the paired tow experiment, the principal investigator will conduct an informational briefing with the sea samplers and key vessel personnel to establish an understanding of the project with the vessel crew and facilitate communication and cooperation channels between the crew and the sea samplers. Additionally, the initial installation of the excluder will be evaluated with underwater cameras prior to the start of the paired testing to verify its installation and to familiarize crew members with installation parameters. Qualified personnel from the AFSC RACE Division will provide this assistance prior to the EFP.

Dr. James Balsiger
Regional Administrator
NMFS- F/AKR
P.O. Box 21668
Juneau, AK 99802

Re: Gauvin/Gruver salmon excluder EFP Application (March 05)

Dear Dr. Balsiger:

Thank you for considering our application for a new exempted fishing permit to continue research on salmon excluders. This letter responds to the issues raised in NMFS' March 14th memorandum from Dr. DeMaster to you outlining the Alaska Fisheries Science Center's review of our application. Below we respond to each substantive issues identified in the review.

Thanks in advance for considering this additional information as part of our application. At the request of the reviewers, we have also provided a table outlining the amounts of groundfish (in the pollock target mode) and chum and chinook salmon requested for each part of our EFP research. Included in the table is a list of the specific regulations from which we are requesting an exemption for each part of the EFP work.

We hope this additional information adequately addresses the issues raised in the review. Please contact John Gauvin if you have any questions or require any additional information. Thanks in advance for your consideration of our application.

Sincerely,

John Gauvin

CC: DeMaster, Stauffer, Rose, AFSC; Salveson, Brown, AKR

Table 1: Proposed Salmon Excluder EFP Allowances and Exemptions

Part One: Excluder performance research conducted on a catcher vessel	2005-2006	2006 - 2007
requested allowance of groundfish outside of TAC (MT)	2,500	2,500
requested allowance of chum salmon outside of cap (#)	2,500	2,500
requested allowance of chinook salmon outside of cap (#)	500	500
requested exemption to Salmon Savings Areas regulations	yes	yes
Part Two: Excluder "ground truth" experiment on an at-sea processor	**2005**	**N/A**
requested allowance of groundfish outside of TAC (MT)	2,500	
requested allowance of chum salmon outside of cap (#)	2,500	
requested allowance of chinook salmon outside of cap (#)	1,500	
requested exemption to Salmon Savings Area regulations	yes	
requested exemption to Catcher Vessel Operations Area regulations	yes	
requested exemption to AFA observer coverage regulations (substituting sea samplers and focusing sampling on salmon catches)	yes	
Total Groundfish and Salmon Allowances Requested for Salmon Excluder EFP	**2005-2006**	**2006-2007**
requested allowance of groundfish outside of TAC (MT)	5,000	2,500
requested allowance of chum salmon outside of cap (#)	5,000	2,500
requested allowance of chinook salmon outside of cap (#)	2,000	500

Issue 1: Sample size calculations for the portion of the EFP devoted to salmon excluder design improvements (providing justification for groundfish and salmon allocations requested)

The portion of our current EFP application that continues developmental work on the excluder will utilize experimental methods that are essentially the same as the one used over the last two years. For this reason, we assumed we could incorporate by reference the experimental methods used for EFP 2003-01. In any case, the methods we have actually used over the last two years have departed slightly from what we set out in our original EFP application so describing these differences is a worthwhile endeavor. To help illustrate the differences from what we originally described in our 2003 EFP application, we have attached as background material the experimental design section for our 2003 salmon excluder EFP application. Additionally we explain below how and why we decided to adjust our methods based on testing conditions encountered in our research.

The reason we departed from the original testing methods set out in our 2003 EFP application was that our field work starting in 2003 encountered much higher than expected abundance of salmon in areas with good pollock fishing. Because sample size for salmon of each species was treated as a function of how much pollock fishing for our experimental design, this meant that we could either exceed our target sample size, conduct less fishing to generate our target sample sizes, or modify our methods to test additional salmon excluder designs and configurations. We opted for the latter approach because clearly at this early stage in the development of a salmon excluder, there is much potential benefit to trying a number of approaches. And based on the success we have had making sequential adjustments to the excluder once we have achieved our target sample sizes and adequately tested a given configuration or design, we have essentially revamped our methods to plan to work in this manner as long as salmon abundance allow us to do so. From this experience, our thinking in terms of how much fish we are requesting for EFP testing has also evolved from one of focusing on sufficient groundfish and salmon to allow for testing of a single excluder configuration to focus on an amount of EFP fishing allowance to provides an adequate opportunity to make progress on the excluder with the goal of substantively improving its performance in the areas described in our EFP application.

The most fundamental aspect of our methods for this part of our EFP work is the use of a recapture device to determine the proportion of salmon or pollock that used the excluder versus the proportion that did not do so. Based on the goal of having adequate statistical power to detect a proportional effect (we originally focused on detection a 50% effect, please see excerpted methods from 2003) our sample size requirements were determined to be 200 chum salmon and 30 chinook salmon. This would adequately assess performance of the excluder for these two species of salmon that are commonly taken as bycatch in the pollock fishery.

With these sample sizes as a goal, we calculated the quantity of groundfish needed to generate these samples from recent (2002) salmon bycatch data from the pollock fishery. The approach was to evaluate how much groundfish catch would be needed to have a reasonably high chance of generating our desired sample sizes. An underlying assumption here was that chum salmon sample size would be generated from B season fishing and chinook salmon could only be found during A season (i.e. that conditions would not allow generation of chum and chinook samples simultaneous).

Fully expecting to follow these methods exactly, we started our field test in the fall of 2003. But conditions encountered differed markedly from our expectations. The relative abundance/availability of salmon to our EFP tests during both A and B season pollock fishing was considerably higher than we had expected. Hence we had overestimated how much pollock fishing it would take to generate our desired sample. This occurred despite our adherence to our original objective of conducting the testing over a range of ambient conditions that commonly occur in the pollock fishery. Specifically, we set out to obtain our sample size over more than just a few test tows to help ensure that we were evaluating the effects of the excluder over varied conditions that are commonly encountered in the fishery. To accomplish this, we required that the vessel selected for the EFP test limit its catch per haul to approximately 60 Mt. This avoided consuming our pollock allocation too rapidly and over too narrow a set of testing conditions. But given the consistently higher than expected abundance of salmon, we were in fact able to attain our desired sample sizes with a portion of the groundfish catch we had expected even with the requirement for smaller than normal catch per tow.

In retrospect, the unexpected ease at which our salmon sample sizes were obtained is not surprising given the large increase in salmon bycatch and bycatch rates in the Bering Sea pollock fishery since 2002. While we could have simply declared our testing completed, we had effectively determined that the first excluder design achieved an escapement rate of approximately 12% with an associated 2-3% loss of pollock. While encouraging, it was certainly possible that this could be improved upon with an alternative excluder design or an adjustment in its placement or configuration. Given that we had already incurred considerable expense to "gear up" for the work at sea, once we had attained our target sample size to measure the effect of the excluder on salmon catch rates we decided to test a different configuration of the excluder. This was done based on information gained from our underwater video, insights gained our experience with the excluder device relative to the proportion of salmon and pollock recovered in the recapture net, and input from the excluder designer (Mr. Gruver), net manufacturers who took part in the field research, and the insights of captain of the test vessel.

In light of what we learned from our experiences testing the salmon excluder over the last two years of testing, we have reconfigured our thinking about how much groundfish and salmon to request in order to have sufficient opportunity to conduct the amount of field design work and testing we feel is productive and feasible on an annual basis. We clearly have been able to stage and make productive use of approximately 4 weeks of testing over the course of two years of work predominantly during the B season but continuing into the A season as conditions require. With the incremental adjustments to the excluder thus far, we have already been able to achieve an escapement rate of greater than 40% for chinook salmon with what we believe is a 2-3 percent pollock loss although there are still lingering questions about pollock escape rates and problems associated with high pollock catch rates.

So the quantities of groundfish and salmon we have requested in our current EFP application are essentially our best estimate of what it will take to allow us to test several adjustments to the current "funnel" salmon excluder device each year to adequately evaluate and hopefully greatly improve its performance. We are seeking performance improvements in both salmon exclusion and avoidance of gear malfunctions associated with the excluder. If salmon bycatch conditions continue as we have experienced over the last two years, then we anticipate being able to test as many as three adjustments aimed at increasing chum and chinook escapement during each year of testing. If salmon bycatch rates return to the more normal levels experienced in 2002 (then year for which data was used to design our original experiment), then we might not be able to test as many adjustments to the excluder design for chum and chinook salmon escapement each year. But based on 2005 conditions in the regular fishery thus far, it appears more likely that we will be able to test at least two adjustments each year.

Another way to consider the requested quantities of groundfish for this portion of the EFP is to view them as what we consider necessary to carry out approximately 4 weeks of field development and excluder testing each year for the next two years. Work to date has generated more potential issues and avenues for improvement than can be exhausted using the single hypothesis per year concept proposed for the first EFP. These include gear design (e.g. funnel tapers, escape portal positions and ways of avoiding entrainment of fish in the excluder) and operational (e.g. slowing and holding during haulback) modifications. While low salmon encounter rates could limit us to a single hypothesis per year, the recapture method has proven efficient enough to evaluate perhaps as many as three per year given better salmon conditions. Given the effort required to launch the field work, it would be wasteful to terminate work after a few days if development could be further advanced by continuing testing on other well-developed concepts. On the other hand, new concepts should not be put into testing without time for data review, consultation, design and preliminary development. Given the resources available to this project, we estimated 4 weeks to be the amount of field testing that we can practically support annually, considering the amount of work it takes to generate that amount of field testing of well-developed concepts. The background work needed to lead up to and support 4 weeks of field development and testing includes reviewing video and sonar footage, holding meetings with fishermen and gear manufacturers to discuss design improvements, flume tank design work to ground truth those suggestions, and finally the gear construction work and preparation for sea trials. Given our current resources from industry sources and those made available from the RACE Division of NMFS, this is a feasible but still ambitious amount of developmental work on the salmon excluder from our experience.

Issue Two: Exemptions from AFA Observer Requirements for the "ground truth" test of the current excluder design on an at-sea processor pollock vessel

The review comments touch on several aspects of sampling, tracking, monitoring, and project management for this part of our EFP application. The project management issue is rather straight forward so we will address that one first. Upon further consideration, we concur that a full-time project manager is needed on board the at-sea processor vessel during the entire period covering the EFP work on the at-sea processor. This project manager will be needed to make sure groundfish catches stay within the allowances of the EFP for the portion of the EFP conducted inside the Salmon Savings Areas/ CVOA. Additionally, the project manager will help make sure the rotations between experimental and control nets are done adequately, that catch is attributed to each net correctly, as well as serving to oversee other aspects of the project including troubleshooting problems as they occur. So we agree to furnish a qualified project manager who will work as the responsible agent for the exempted fishing permit holders throughout the entire EFP "ground truth" test of the current excluder design conducted on an at-sea processor vessel.

Resolving the sampling/ catch accounting matter is more problematic for the "ground truth" experiment. We proposed to use "sea samplers" to conduct the sampling and basic data collection and accounting tasks. The NMFS reviewers request that we resolve the use of our sea samplers with the need for "required observers" for the portion of ground truth experiment where the AFA at-sea processor will be working on its own AFA allocation of groundfish.

The experimental design requires measurement of the salmon and groundfish catches from every tow. Because a few salmon can make a large difference in test results, the salmon measurement needs to be as close to a census as possible. The next priority is to obtain catch composition samples to estimate the proportion of the target pollock in each catch as well as to get more pollock length data than is normally collected during regular observer sampling. Additionally, sampling needs to be consistent throughout the experiment. We believe that making such measurements is a feasible, but full task for two samplers with help from the project manager. The need to focus sampling on EFP objectives was the reason we proposed that catch monitoring be allowed to differ from standard Observer Program procedures and requirements. Our understanding that such departures preclude the use of observers who are currently under contract led us to propose using sea samplers, individuals with observer training that are not currently under contract. This provides the flexibility and focus necessary to achieve the EFP goal of assessing the overall performance of the excluder.

The reviewers have differentiated between the part of this work will occur inside the Salmon Savings Areas (and CVOA) utilizing a groundfish and salmon allowance outside of the normal AFA pollock fishery and TAC/bycatch cap from the rest of the EFP work comprising the "ground truth" experiment overall. We proposed to use our sea samplers for the entire ground truth EFP work whether fishing for the catch outside of the TAC or when the vessel is catching its own AFA allocation. The sea samplers we proposed to use would be NMFS-trained observers who are not currently serving as observers for NMFS and are specifically directed for our EFP to focus sampling on the variables of interest for the EFP. From our understanding of the NMFS review comments, NMFS apparently concurs with our plan to use "sea samplers" for the portion of the "ground truth" experiment where the participating vessel would be catching fish that are not part of its AFA allocation. Our request is essentially to continue to use these same "sea samplers" while the at-sea processor vessel selected for the test conducts the portion of the EFP test utilizing its own AFA allocation of groundfish outside of the Salmon Savings Areas and CVOA. Thus we are in essence requesting that the selected vessel be exempted from its AFA observer requirements under our EFP permit while it conducts the remainder of the EFP test.

To facilitate a clear delineation in terms of participation in the EFP test and in consideration of the monitoring issues raised by the reviewers, we think that it may be worthwhile to require that the selected at-sea processor vessel be required to conduct only EFP fishing once the EFP has commenced and until the test is completed. This would remove the possibility of the vessel conducting non-EFP (non-exempt in terms of observer coverage as we have proposed) AFA fishing with our sea samplers on board in lieu its normal AFA coverage.

An alternative is to "double up" the coverage, having both observers and sea samplers aboard, during the period of time when the AFA vessel is utilizing its own AFA quota during our EFP test. This added cost on the participating vessel as well as the bunk space issues it might trigger might have a negative effect on our ability to find an at-sea processor willing to undertake this EFP work and commit to using approximately 5,500 tons of pollock from its own AFA allocation for roughly two-thirds of the EFP work. For this reason, we would certainly like to avoid this outcome.

We have reviewed the regulations governing EFPs and believe that an exemption to the AFA observer coverage regulations is not specifically problematic in terms of the intent of an "exempted fishing permit" even if the vessel is harvesting its AFA allocation. Additionally, from our understanding of the regulations governing NMFS observers, observers under contract to observe for the NMFS Observer Program can only work for the Program while currently under contract to be deployed as observers for that Program. In the past, we have received advice that this also avoids the potential problems associated with our need to redirect the sampling duties for our experimental purposes.

For this reason, our EFP application and our EFP applications in the recent past have specifically avoided using observers currently working for the Program during our EFPs (at least since we became aware of this regulation). If this is not the case for our current experiment and (most importantly) if we can adequately redirect the sampling duties for purposes of our experiment, then we have no problem utilizing regular observers. We would want to work with Observer contractors to make sure that observers selected for the EFP work were willing to take on the additional challenges of expanded sampling for salmon and pollock effects and paperwork duties associated with tracking catches from experimental and control nets. In any case, we look forward to constructively resolving this matter with NMFS, the Council, and the NMFS Observer Program.

Excerpted from Gauvin/Paine 2003 EFP Application (EFP 2003-01) Technical Support Document

Statistical Power To Detect An Effect

A pelagic pollock trawl is equipped with very large meshes (30 meters or greater) in the in the mouth and wings of the net which gradually taper to as little as four inch meshes in the codend. This reduction in mesh size occurs over a distance of approximately 400 meters (stretched mesh basis). Salmon and pollock can escape through the large meshes in mouth and wing sections of a pelagic net, but once they have been successfully herded back into the smaller meshes of the net, there is little chance of escapement from an unmodified trawl due to the relatively small openings.

An important consideration regarding experimental design is that once the pollock and salmon are in the small mesh sections of the trawl intermediate, there are only two possible outcomes for a net rigged with an excluder device. Specifically an individual fish (pollock or salmon) can drop back into the trawl codend or it can "escape" through the excluder, which means in this case it is retained and accounted for in the recapture device used for our experiment.

This "either/or" set of discrete outcomes is suited to statistical treatments that evaluate the probability of detecting the proportion of effect. In this case, the proportion of interest is the percentage of individual salmon escaping (desired effect of the device), thus the proportion of the total number of salmon accounted for in the recapture device relative to total number of salmon caught in the recapture device and trawl codend.

The conventional approach to determination of sample size for proportions is to generate a statistical power relationship (based on the binomial probability distribution) between sample size and statistical power to detect a given effect at a desired statistical confidence level. This relationship is normally depicted as a curve with sample size on the horizontal axis and the power of detecting a difference of a given magnitude.

Of importance is that the magnitude of the effect that is built into this sample size calculation should be designed to be useful to the research question itself. For instance, designing the sample size for the EFP test around the question of whether the excluder has any effect at all on salmon escapement is not really useful to the fishing industry that must later consider the potential tradeoffs associated with using the excluder. Because the pollock industry is faced with the very real possibility of reducing target catch rates in exchange for lowering the bycatch rate of salmon, the sample size for the experiment needs to be designed to allow detection of a performance difference of a fairly small magnitude in terms of reduction of salmon bycatch from the expected level of performance.

Sample Size Calculation

The specific goal that was selected for sample size determination to test escapement of chum salmon from the BRD is based on the number of chum salmon needed to have an

80% chance of detecting an effect that is ten percent different from the underlying or expected effect, at a 95% degree of statistical confidence. The number of salmon needed for the test essentially drives sample size because pollock are obviously far more abundant relative to salmon. Effectively, this means that our confidence that we have correctly detected the effect of the device on pollock retention will occur long before we are confident on the question of how the BRD affects salmon escapement.

Although we have some preliminary information from Dr. Rose's video work suggesting that salmon will egress through an aperture in the top panel of a pollock net, we have no *a priori* or empirical notion of the underlying proportion of salmon that will successfully make use of the excluder developed for the test. Lacking an expectation for this underlying proportion, the risk averse approach to sample size determination (so as to avoid under-sampling) is to assume a proportion of 50%, (probability of 0.50). This, in effect, maximizes sample size for a given set of desired statistical power and desired degree of statistical confidence.

For the chum salmon escapement portion of the experiment, we assumed an underlying proportion of effect (salmon utilizing the escapement device) of 50% ('p = 0.5). Our goal is thus to have sufficient statistical power to have an 80% percent probability of detecting a 10% difference in proportion of effect from the underlying proportion of 0.5 with 95% statistical confidence (alpha =0.05). A statistical power curve for those criteria is reproduced in Figure 2 below.

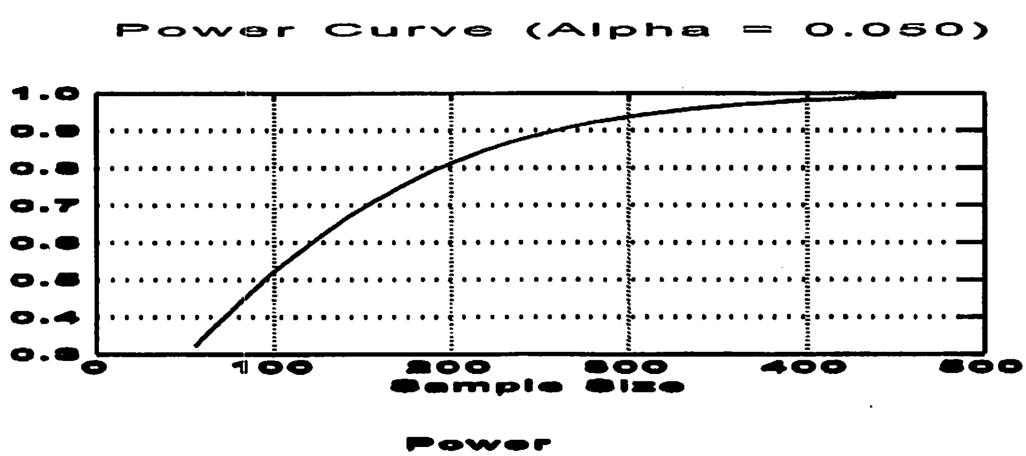


Figure 2: Probability of detecting difference from proportion of 0.6, when the underlying proportion is 0.5

Figure 2 above shows that the desired statistical power for the EFP test requires a sample size of 200 salmon. Recall that the driving factor for sample size is the number of salmon encountering the excluder. This means that for the first part of the EFP work on chum salmon, the goal would be undertake fishing that has an expectation of encountering at least 200 chum salmon.

Calculation of Pollock Catch That Would Be Expected To Generate A Sample Of Approximately 200 Chum Salmon

Because salmon are essentially a byproduct of pollock target fishing, the desired sample size of 200 chum salmon cannot be explicitly and directly generated in an EFP test for the pollock fishery. A practical means of obtaining a sample of 200 chum salmon is to estimate the quantity of pollock fishing that is likely to generate that number of chum salmon. We have done this below based on past conditions associated with chum salmon bycatch in the pollock fishery. We believe that the most reliable representation of what the fishery will encounter when the test is performed next fall is the chum salmon bycatch rates from fall of 2002. This is because strong runs of salmon tend to persist serially based on trends in ocean conditions and year class strength. Thus the most reliable approximation of the availability of chum salmon to the pollock fishery is last fall's bycatch rates. Based on that approach, the target amount of pollock catch that would be likely to achieve a sample of the desired size is derived below.

To evaluate sample size, pollock and salmon catch location-specific data were obtained on a daily basis from Sea State Inc. for the fall pollock fishery in 2002. Daily bycatch rate information on an area-specific basis was used to evaluate variation in daily chum bycatch rates in a specific area identified by Sea State Inc. as a "hotspot" for chum salmon bycatch. This approach was taken because this EFP work will utilize information on chum bycatch rates from the regular pollock fishery to target a specific area with relatively high chum salmon bycatch rates for conducting the experiment. Experience has shown that chum salmon tend to aggregate and that areas of relatively high concentrations can be identified at certain times. While certainly not static and not the only areas where chums are taken as bycatch, these areas are identifiable from the fishery bycatch reporting and management system that is now formalized into the pollock cooperative management system, which industry has agreed to make available to this project.

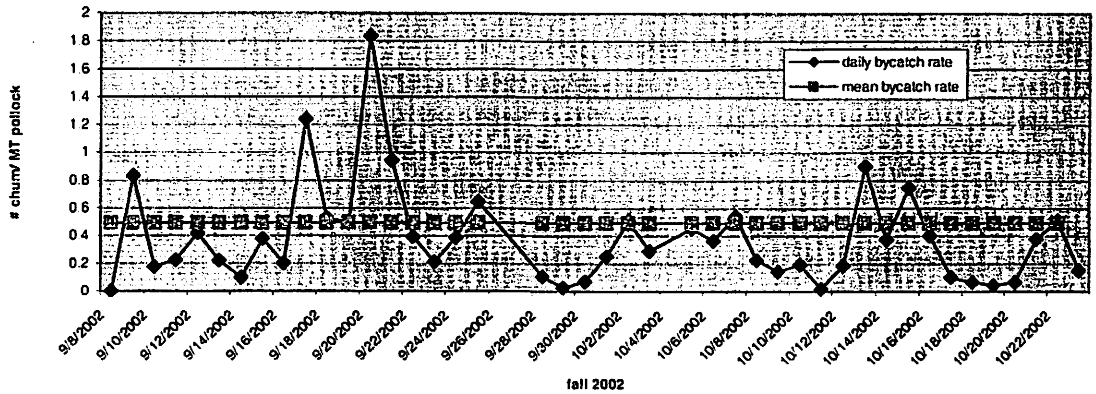
The goal is to focus the EFP test fishing where salmon are abundant and to plan to do enough fishing so that if bycatch rates are somewhat lower next fall or location of a relative concentration is not as effective as in past years, sufficient fishing will still take place to create a reasonably high probability of obtaining the desired sample size of chum salmon. Assuming that our success at finding an area of relatively high salmon concentration is within the range of what has occurred in the past, this approach in conjunction with somewhat modest expectations of expected bycatch rates will serve to generate the desired sample size.

Use Of Fishery Data To Estimate Bycatch Rates For The Chum Salmon EFP Test
In evaluating potential chum salmon bycatch rates, the most useful data for projecting the quantity of pollock catch that would be likely to achieve the target sample size was determined to be data from catcher vessels delivering to motherships during the fall of 2002. This data source was selected for the following reasons. Portions of the Bering Sea shelf area are restricted to catcher vessel operations (Catcher Vessel Operations Area) and this area has consistently experienced relatively high chum salmon bycatch rates (Witherell and Pautzke 1997). For this reason, catcher vessel data was the most applicable for determination of expected chum salmon bycatch rate associated with a concentrated bycatch area.

In addition, for the subset of catcher vessels delivering to motherships, salmon bycatch rate data are available on a haul by haul basis. This allows for assignment of the location and a daily rate of salmon bycatch. Data from catcher vessels delivering to shoreside plants cannot be used consistently to calculate salmon bycatch rates on a haul by haul or daily basis. This is because salmon are not systematically accounted for, in most cases, until observer sampling that occurs at the time of shoreside delivery. For shoreside delivery vessels, quantity of pollock and salmon taken over the course of the fishing trip is the most detailed level of data available. That effectively means bycatch rates for shoreside delivery vessels can only be determined over a three to four day period. During that time, a vessel may fish several different areas, with fish from all areas mixed in the vessel's holding tanks. For this reason, daily chum salmon bycatch rates from catcher vessels delivering to motherships was preferred.

Figure 3 below illustrates daily bycatch rates of chum salmon for an area identified by Sea State to have generally high chum salmon bycatch rates during the fall of 2002. Note that there are several daily periods with relatively high bycatch rates compared to the arithmetic mean rate for the total number of salmon taken by the vessels in the data set divided by the total pollock tons by these vessels. Because the EFP test must be scheduled in advance, and because it is probably unwise to assume that the EFP test will encounter peak bycatch rates, the expectation for daily salmon bycatch rate used for this calculation of pollock tons needed for the experiment was based on only the days with rates that were less than the mean daily rate during the period of data provided by Sea State (9/8/02 – 10/23/02). This removed 11 of the 42 days for which daily rates were available for catcher vessels delivering to motherships in the zone of relatively high bycatch rates from our data set.

Figure 3: Daily Chum Bycatch Rates



The above treatment of the chum salmon bycatch data attempts to balance the ability to target a chum salmon bycatch hotspots with the practical reality that timing for the EFP is not completely flexible and bycatch rates may not be as high as those peak rates encountered in the hotspots within the CVOA last fall. From the above data and the procedure used to remove all the daily rates above the mean bycatch rate, the baseline bycatch rate of 0.23 salmon per ton of pollock was used to calculate the probably amount of pollock needed to generate the desired sample size. Calculation of that expected quantity of pollock was done in the following manner: 200 (number of salmon for desired sample) divided by 0.23, or approximately 870 MT.

Based on the assumptions made above, this should be a sufficient quantity of pollock to derive a sample of 200 chum salmon for the EFP under conditions that occurred in the recent past. Another 100 MT of pollock catch is needed for the chum salmon portion of the EFP work to allow for two pre-test trawl tows with a closed codend and recapture device to ensure that the device is deploying sufficiently on trawl gear of the vessel selected for the EFP work. This brings the overall pollock catch for the chum salmon portion of the EFP to 970 MT.

Establishment Of Limits On The Amount Of Pollock Available For The EFP

The approach to derivation of sample size for the development of the chum salmon excluder portion of the EFP (and later the Chinook EFP work) was based on determination of a sufficient quantity of pollock that was expected to achieve the desired sample size. In reality, given that chum salmon catch rates vary considerably on a tow by tow basis, it is possible that a large fraction of the expected sample size could come from a few hauls during the EFP. This presents a practical consideration for the EFP test. Given that the opportunity to catch pollock outside of the total allowable catch is being used to help fund the EFP research, the EFP work must be structured around a predictable outcome for the vessel owner who is interested in applying to do the EFP work. Specifically, the applicant needs to know how many tons of pollock are available for the EFP work in order to calculate his costs and expected revenues associated with participation in the field work.

This approach of basing the EFP catch limits on the amount of target catch instead of catch of the desired number of salmon for the sampling design was done specifically to make the EFP work feasible for industry applicants. An alternative approach of conducting fishing until the target number of salmon are caught might mean that the EFP test fishing could be accomplished in a few tows or a very large number of tows with a large amount of pollock catch relative to the specified 970 MT of catch for the chum salmon excluder test. We believe the "fish until you obtain the sample" approach is simply not practical for the applicant who, in the end, has to assume the risk of undertaking all the costs of the experimental fishing associated with the EFP. Likewise, fishery managers are not likely to approve an open-ended amount of pollock for this EFP.

Our approach attempts to strike a balance between the goals of the research, the funding model for a portion of the EFP work, fishery management's need for concrete limits for consideration of an EFP application. The actual ability of the EFP to achieve its goals for chum and Chinook salmon sample generation depends heavily on the reliability of the approaches taken to estimate sample size and associated amounts of pollock catch. We have examined other approaches to generating the desired sample size and concluded that the approach described here is reasonable (based on past experiences with EFPs) and preferable given the needs of all parties.

Sample Size For The Chinook Salmon Field Test Portion Of The EFP Work
As is explained above, differences in behavior and depth preference characteristics as well as factors relating to environmental conditions at different times of year (spring versus summer/fall) make a separate test of the salmon excluder necessary if we are to know how the excluder functions for reducing bycatch of Chinook salmon.

Following the first test of the excluder, a process involving input from fishermen will be undertaken to review potential modifications to the device based on how well it performed on chum salmon and what differences would be expected in terms of its expected performance for Chinook salmon. This process may lead to a decision to change the placement or design of the existing excluder device, or it may simply result in a decision to test the device exactly as it was deployed for the chum salmon test. In either case, the question of performance of the device should be treated as a separate question, that of "what proportion of the Chinook salmon does the (modified?) device have the desired effect upon relative to the total number of salmon that encounter the device"?

Sample Size Calculation For The Chinook Excluder Test
Unfortunately, given the relatively low expected bycatch rate for Chinook salmon even under peak bycatch timing and conditions, our ability to build statistical power into this

portion of the EFP test is lower than it was for the chum salmon test. In the test for chum salmon escapement, the experiment is based upon the ability to discern as small as a 10% difference from the underlying proportion (again ¯p is set at 0.50). After evaluating expected bycatch rates for Chinook salmon, it was obvious that this degree of statistical power is not practical for the Chinook EFP test. This is because such statistical power would mean that the EFP would have to catch as much as 8,000 MT of pollock to obtain a sample of 200 Chinook salmon.

For this pragmatic reason, a lower standard of statistical power was adopted for the Chinook salmon BRD test. Our goal for this portion of the test is to have an 80% power to detect a 25% difference from the underlying proportion of 0.50 with 95 % statistical confidence. Sample size under that set of criteria for statistical power is derived below:

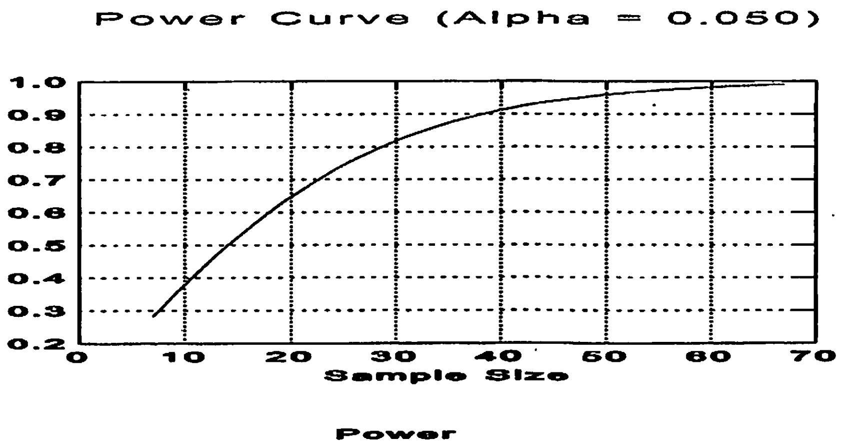


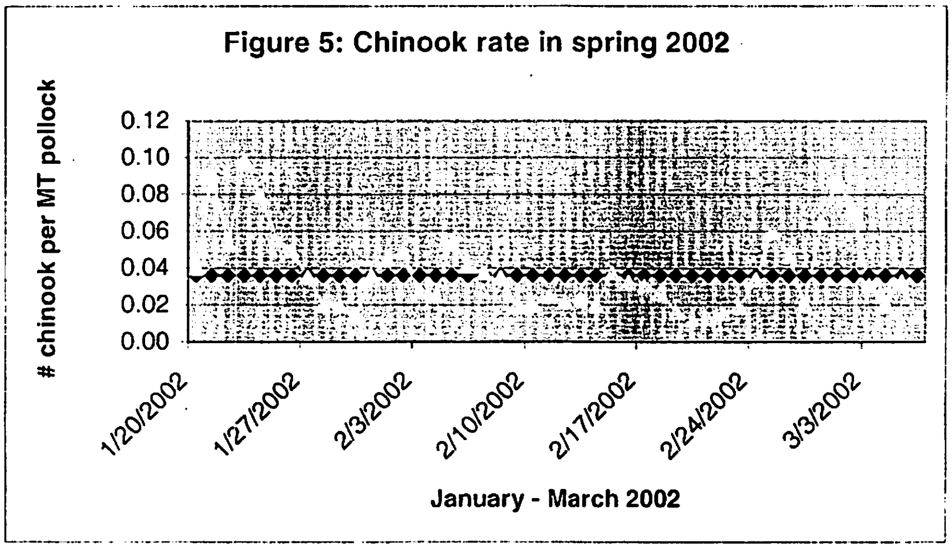
Figure 4: Probability of detecting difference from proportion of 0.75, when the underlying proportion is 0.5

Under this somewhat lower but still meaningful level of resolution to measure the effect of the excluder for releasing Chinook salmon, a sample size of 30 Chinook salmon is expected to provide an 80% probability of detecting a 25% difference from the underlying proportion of 0.50 with alpha set at 0.05 once again (see power curve above). As will be seen below, this sample size is practicable given expected bycatch rates for Chinook salmon. These bycatch rates were once again based on hotspots during the 2002 pollock fishery, this time during the spring pollock fishery.

Use Of Fishery Data To Estimate Bycatch Rates For The EFP Test

Data used to generate an expected rate of salmon bycatch for this portion of the EFP test were once again supplied by Sea State, Inc. This time, however, observed bycatch rates from a Chinook salmon hotspot were from pollock catcher processors during the spring of 2002. In the case of the spring fishery, there are no special regulatory restrictions that affect the areas where catcher processors can fish as was the case for chum salmon bycatch data. The high observer coverage on at-sea vessels fishing in the spring of 2002 makes their data highly suitable for assessing daily bycatch rates.

The same data treatments were performed on this Chinook salmon bycatch rate data as were performed above for the chum salmon data. To remove the effects of the high bycatch rates days from the data, we once again removed all the daily rates above the average (average based on the total number of salmon divided by the total tons of pollock for the period January 20, 2002 through March 6, 2002). That average rate was 0.04 Chinook per MT of pollock. This procedure to drop above-average bycatch rates removed 15 days with relatively high Chinook salmon bycatch rates from the overall number of 45 days in the data set supplied by Sea State (Figure 2 below).



From this procedure, we arrived at a "conservative" daily expected rate of 0.025 Chinook per metric ton of pollock. Once again, the purpose of this manipulation was to develop an expectation of the bycatch rate in an area with a relatively high rate but account for the possibility that the somewhat inflexible timing of the spring 2004 EFP work on Chinook salmon may not allow us to conduct the test during peak periods. If the field work for the test is able to hit a peak period, then sample size will be higher than expected and this will serve to augment the ability of the test to determine the precise effects of the excluder.

Amount Of Pollock Catch That Would Be Expected To Generate The Desired Sample Size of 30 Chinook Salmon For The Chinook Salmon Excluder

Based on the data and data manipulations described above, we calculate that 1,200 MT of pollock needs to be caught to generate a sample of 30 Chinook based on an expected bycatch rate of 0.025 Chinook per ton of pollock (30 Chinook / 0.025 Chinook per MT). Once again, the EFP work will need two pre-test hauls with the cod end and recapture device in place and to make sure the excluder is deploying reasonably for the test work. This brings the overall amount of pollock for this portion of the EFP work to 1,300 MT.

Target and incidental species harvested in the EFP work:

Groundfish: The estimated total harvest of allocated groundfish species including both the chum salmon stage of the EFP work (970 MT of pollock in fall of 2003) and the Chinook salmon stage (1,300 MT in spring of 2004) is 2,270 MT of groundfish. Approximately 98% of which is expected to be pollock and 2% is expected to be other groundfish species such as Pacific cod and flatfish. Retention standards for the EFP work will be the same as those for the directed fishery for pollock.

Pacific salmon: The determination of sample size for each species of salmon for each excluder trial is based on a target amount of pollock catch which, under the assumptions of the EFP work, is expected to have a reasonably high probability of generating the desired sample sizes for the two stages of the EFP. To reduce the risk of "under sampling" if salmon abundance turns out to be lower than it was in the data for the period used to develop sample size calculations, only below average bycatch rates for the period covered by the fishery data used for sample size estimation were used for sample size calculations. This procedure was adopted to increase the probability that the EFP achieves its sampling goals should the EFP fishery work encounter only "below average" salmon abundance conditions in areas where pollock fishing occurs.

An "upper end" estimate for salmon mortality associated with this project is 2,183 chum salmon and 217 Chinook salmon. This estimate was made based an assessment of the highest individual vessel salmon bycatch data used for calculating sample size above. Vessel-specific chum or Chinook salmon bycatch rates (respectively) were evaluated on a weekly average basis to determine what the highest weekly rate for an individual vessel was in our data. These rates (2.25 chum salmon per ton of pollock and 0.17 Chinook per ton of pollock) were then applied to the overall quantity of pollock (including the two test tows) to produce the upper bound estimate of salmon bycatch by species discussed above.