UNITED STATES DEPARTMENT OF COMMERCE
Office of the Under Secretary for
Oceans and Atmosphere
Washington, D.C. 20230

JUN - 9 1997

To All Interested Government Agencies and Public Groups:

Under the National Environmental Policy Act, an environmental review has been performed on the following action.

TITLE: Environmental Assessment of an Experimental Fishing Permit to test the effects of an open-top Trawl Configuration on Species and Size Composition of Catch in Trawls Targeting Yellowfin Sole

LOCATION: Exclusive Economic Zone of the Bering Sea and Aleutian Islands Area off Alaska

SUMMARY: Approval by the National Marine Fisheries Service of an Experimental Fishing Permit proposed by the Groundfish Forum, an industry group representing small and medium size factory trawlers, would test the effects of an experimental trawl configuration on the bycatch of pollock and Pacific cod in the yellowfin sole fishery. To complete the experiment, up to six vessels may harvest 4,700 metric tons of groundfish in July-August 1997. The purpose of the experiment is to provide information to assist in the development of more selective trawl gear for the flatfish fisheries.

RESPONSIBLE OFFICIAL: Steven Pennoyer
Regional Administrator
National Marine Fisheries Service
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The environmental review process led us to conclude that this action will not have a significant impact on the environment. Therefore, an environmental impact statement was not prepared. A copy of the finding of no significant impact, including the environmental assessment, is enclosed for your information. Also, please send one copy of your comments to me in Room 5805, PSP, U.S. Department of Commerce, Washington D.C. 20230.

Sincerely,

Susan Fruchter

Acting NEPA Coordinator

Enclosure

ENVIRONMENTAL ASSESSMENT

FOR

EXPERIMENTAL FISHING PERMIT 97-01

TO TEST THE EFFECTS OF AN OPEN-TOP INTERMEDIATE TRAWL CONFIGURATION ON SPECIES AND SIZE COMPOSITION OF CATCH IN TRAWLS TARGETING YELLOWFIN SOLE

Prepared by

National Marine Fisheries Service
Alaska Regional Office

May 21, 1997

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1.0 INTRODUCTION

The groundfish fisheries in the Exclusive Economic Zone (EEZ) (3 to 200 miles offshore) of the Bering Sea and Aleutian Islands Area (BSAI) are managed under the Fishery Management Plan for the Groundfish Fisheries of the Bering Sea and Aleutian Islands Area (FMP). The FMP was prepared by the North Pacific Fishery Management Council (Council) under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) and become effective in 1982. This Environmental Assessment (EA) addresses an experimental fishing permit (EFP) application by the Groundfish Forum to systematically test the effects of a intermediate trawl escape panel on species and size composition of catch in trawls targeting flatfish.

Under regulations implementing the FMP at 50 CFR 679.6, the Administrator, Alaska Region, NMFS, after consulting with the Council, may authorize for limited experimental purposes, fishing for groundfish in a manner that would otherwise be prohibited. In addition to the Magnuson-Stevens Act, such action is governed by the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), the Marine Mammal Protection Act (MMPA).

NEPA requires a description of the purpose and need for the proposed action as well as a description of alternative actions which may address the problem. This information is included in Section 1 of this document. Section 2 contains information on the biological and environmental impacts of the alternatives as required by NEPA. Impacts on endangered species and marine mammals are also addressed in this section.

1.1 Purpose of and Need for the Action

The need to create innovative methods of reducing catches of pollock and cod in flatfish trawls is great. Pollock discards for the yellowfin sole and rock sole target fisheries combined were estimated to be 54,000 metric tons (mt) in 1994 (NMFS 1995a), and 28,500 mt in 1995 (EA/RIR for IR/IU, July, 1996). Those two fisheries are the major flatfish target fisheries in the Bering Sea. Although Pacific cod discards in the rock sole and yellowfin sole targets combined are lower compared to pollock, they are perhaps more significant relative to the total allowable catch for Pacific cod. Pacific cod discards were approximately 13,450 Mt in 1994 (NMFS 1995a), and 11,500 mt in 1995 (EA/RIR for IR/IU, July, 1996). Head and gut (H&G) vessels probably account for half of the pollock and cod discards in the yellowfin sole fishery and nearly all of the pollock and cod discarded in the rock sole target.

As the EA/RIR for Improved Retention/Improved Utilization (IR/IU) concludes, smaller catcher processor vessels face very large economic impacts from the Council's new retention requirements under IR/IU because prices for head and gut pollock are insufficient to cover production costs on H&G vessels. The industry believes this market situation is unlikely to change in the near future.

A fundamental reason most pollock and cod are discarded on H&G vessels is that frozen product hold capacity is usually limited to 75-200 mt for that portion of the trawl industry. The low price of headed and eviscerated pollock and cod means that if catches of these species cannot be avoided, under the full retention regulations that are to be in effect in 1998, the economic margins necessary for H&G vessels could be destroyed. Margins would be destroyed because as much as 50% of frozen product hold capacity on most H&G vessels could be filled with product that is below the variable cost margin for

these vessels. This means that revenue on a per trip basis could be reduced substantially, while production costs will rise as more vessel time and fuel will be consumed by activities that are not revenue producing (e.g., steaming to port and back to fishing grounds, offloading, etc.).

Virtually all source material developed by the Council and NMFS analysts throughout the development of IR/IU underscores that the Council's intention with IR/IU was to create incentives for avoidance of fish formerly discarded for economic reasons. For the H&G sector, avoidance is critical because making fishmeal out of pollock and cod catches is not a viable option. The combined effect of vessel moratorium and license limitation regulations affecting vessel upgrades, as well as US Coast Guard "processing" regulations, effectively preclude installation of fishmeal plants to reduce unmarketable fish into fishmeal. Even without these regulatory barriers to fishmeal production, space and scale restrictions on H&G vessels make the fishmeal alternative not feasible.

Therefore, the economic survival of most of the head and gut vessels (approximately 25 vessels) critically depends on the fleet's ability to devise ways to avoid catches of pollock and small cod. An area-based approach to avoiding pollock and cod was attempted in the 1994 spring rock sole fishery. This program attempted to identify fishing areas where cod and pollock catches were a large percentage of total catch. Although well-intentioned, this approach proved largely impractical and ineffectual because pollock and cod are ubiquitous in areas where flatfish are fished. Based on its knowledge of the preliminary evidence from NMFS gear research (Rose 1995), Groundfish Forum believes the greatest promise for accomplishing the avoidance objective lies in innovations made to the intermediary portion of the trawl. This net modification is intended to allow pollock and Pacific cod to swim out of the net with little or no impact on the fish, while at the same time conserving flatfish catches.

The ideal net configuration would be one that allows the egress of flatfish that are smaller than market size, as well as all pollock and small-sized cod. This project, however, focuses more narrowly on the exclusion of pollock and cod from the catch, while retaining most of the flatfish catch. Perhaps as experience with innovations to the net intermediary increases, the industry may someday be able to design a flatfish net that approaches the ideal standard.

Despite incentives for developing avoidance modifications (incentives inherent from the knowledge that the Council was likely to create regulations to require retention, as well as the general incentive of not wanting to catch fish that will be discarded), innovation has been stymied by the typical factors that limit pro-active individual actions. First, some companies are scarcely (some not even) covering their operating and fixed costs under the current economic regime. For those companies, experimentation jeopardizes critical fishing time and performance during the regular season. Second, for the more general situation, there is the competitive disadvantage in the short run, whereby, competitors not testing gears that exclude parts of the catch will likely have greater catches of target species, while those companies attempting to experiment may actually reduce catches of marketable fish while methods are being developed and adjusted. Because the total allowable catch and PSC caps for groundfish fisheries are managed under open access (no individual assignments of catch or bycatch), innovation may not be rewarded and, in fact, may be penalized.

Despite economic obstacles to innovation, some companies have attempted to test roundfish exclusion devices on an ad hoc basis, but have encountered problems. Companies have reported experiencing lower catches of target species than firms that were not attempting to innovate. Although modifications and adjustments to the gear design being tested might have eventually corrected this problem, the

competitive aspects of the commons fishery evidently resulted in an untimely termination of ad hoc testing.

In addition, considerably higher vessel incentive program (VIP) rates were reported by industry while experimenting with large mesh net designs. Under the VIP program, prohibited species catch (PSC) per metric ton of total catch is not supposed to exceed a standard rate for the fishery. With large mesh nets or open panel devices that reduce groundfish catches per unit of fishing effort, the rate of prohibited species catch per ton of total groundfish catch reportedly increased even when the actual amount of PSC was similar for tows with alternative net designs. Despite the apparent low probability of prosecution of VIP cases, companies would rather avoid receiving VIP citations. The greater potential for VIP citations from testing alternative trawl designs, thus, served as an additional factor against ad hoc experimentation.

1.2 Alternatives Considered

1.2.1 Alternative 1: No Action

An experimental fishing permit would not be issued. Under this alternative, any experimentation with trawl gear designs would have to occur at times when directed fisheries are open under regulations at 50 CFR 679.

1.2.2 Alternative 2: (Preferred)

Issue the proposed EFP to systematically test the effects of a intermediary trawl escape panel on species and size composition of catch in trawls targeting flatfish.

1.3 Background

1.3.1 Structure of the experiment

The Groundfish Forum, as applicant for an exempted fishing permit, seeks to set up a "request for proposals" (RFP) process whereby companies submit applications to test an open panel placed in the intermediary portion of the trawl that conforms to the general description of the device described by Rose (1995). Under the rules of the experiment the performance of the experimental gear will be tested against a standard control gear. The control gear will be a net configured for yellowfin sole fishing as per current industry practices.

The RFP will set out a general description of the type of trawl design that will be systematically tested against a control trawl gear. The type of gear design that will be tested against the control will be an "open" panel placed in the intermediary or intermediate (both terms are commonly used) portion of the trawl. The panel is effectively open because no net meshes are in the top portion of the net (only the net straps are present in the top panel portion of the net). The device to be tested was first developed by NMFS gear researchers (Rose 1995). The open panel to be tested in this experiment must be at least 16 feet (ft) in length (stretched mesh length) and occupy at least 40 percent of the intermediate portion of the test trawl net (stretched mesh basis).

Placement and shape of the panel will be determined by the company making application to participate in the experiment. Other aspects of the net design for the test gear, as well as the control gear, will have to conform to standards so that the effects of the open panel can be discerned by the experiment. Towing speed, duration of tows, and other aspects of the tows made with experimental and control nets will be restricted for purposes of isolating the effects of the open panel.

Guidelines for applications to participate in the experiment will be provided by Groundfish Forum. Guidelines will include a description of the test and control gear as well as a statement of the rules that must be conformed to for the experiment (described in detail below). This information will be conveyed to potential applicants through a short publication written and distributed by the Groundfish Forum and reviewed by NMFS personnel associated with the experiment.

To ensure compliance with the experimental protocols, data from each days fishing will be sent electronically (fax or email) to NMFS personnel associated with this experiment and Groundfish Forum staff on the fishing grounds and in the Groundfish Forum office in Seattle. Forum staff will review the information and notify the NMFS and the vessel if there are indications that a vessel is not meeting requirements for participation in the experiment. If a vessel continues to violate the experimental protocols, action will be commenced to terminate that vessel's participation in the experiment.

1.3.2 Timing of the Experiment

The proposed timing for the experiment is August 1-14, 1997. During the first two weeks of August, fishing opportunities are typically scarce for participants in the flatfish fisheries because yellowfin sole has typically exhausted its halibut allocation from the May PSC release. Additionally, halibut allocated to the "other flatfish" trawl category has typically been exhausted before the end of July. Starting August 15, the yellowfin sole fishery receives its final halibut release and companies may be unwilling to continue participating in the experiment at that time.

The projected duration of the experimental fishery is based on calculations made of the number of tows of the experimental and control gears needed for reasonable statistical confidence in the results (see Appendix).

1.3.3 Participation

Parties interested in participating in this EFP experiment must make application through an RFP process administered by the Groundfish Forum. The process involves submission of an application which describes the nets the applicant proposes to use and a statement that the applicant agrees to abide by the experimental protocols and other requirements as outlined in the ESP proposal. Trawl catcher processors and catcher vessels will be eligible to apply for participation. However, in addition to the other requirements, participants during the experiment must fish within the definitions set out in the directed fishing standards for the yellowfin sole fishery. Applications for participation will be reviewed by the Selection Committee (described below).

Note: Guidelines for NMFS Exempted Fishing Permits stipulate that the name of companies and their participating vessels be listed in the application. Because this application sets up an RFP process, pre-determining participants in the application is not possible. The design of the experiment calls for, ideally, six vessels to participate in the experiment. That number is believed to be a representative

percentage of the dedicated flatfish fleet (20-25 vessels). In addition, the experiment seeks to conduct the test on several vessels to attempt to learn whether the experimental gear works under a number of fishing vessel characteristics that affect catch composition, such as size of net and towing horsepower. For example, factors determining towing power are likely highly correlated with vessel size.

To further allow inferences about the performance of the test gear on different types of flatfish vessels, the desired number of test vessels (six) may be further divided into two categories: three vessels under 165 feet overall and three greater than that length. The ability to subset the test vessels will depend on the number and variation of vessels for which proposals to participate are made.

1.3.4 Selection Committee

A committee including at least three NMFS employees will be formed to evaluate applications. The Selection Committee will meet in June to evaluate proposals. The merits of a proposal will be based on the proposed set up of the test and control gears, as shown in the diagrams provided by applicants and the rationale provided for the exact location of the open panel within the intermediary portion of the net. Determinations will be based on the Selection Committee's judgment of the proposals as legitimate attempts to eliminate unwanted catches of cod and pollock, while maintaining adequate catches of flatfish. Placement, size, and configuration of the open panel are among the criteria to be evaluated.

The Selection Committee will judge proposals by consensus, without knowledge of the manufacturer of the nets to be used. The Selection Committee will also consider the applicant's record of regulatory compliance and cooperation with past NMFS and industry projects in judging applications. The purpose of including criteria such as regulatory compliance and cooperation with past NMFS and industry projects is to encourage the selection of participants likely to cooperate fully with the experimental protocol and rules of the experiment.

The proposals reviewed by the Selection Committee will be grouped into the two vessel length categories ($\leq$ 165 ft and > 165 ft). If the number of acceptable applications in one or both vessel length categories exceeds three, then the determination of which will be allowed to participate will be decided by random drawing conducted by the Selection Committee.

1.3.5 Description of the RFP process

The Groundfish Forum will be responsible for informing the trawl industry of the goals of the experiment, and the process and guidelines for submitting proposals. Written materials describing the experiment and application process will be available from the Groundfish Forum.

Groundfish Forum will provide a short summary of the general purpose of the experiment. Groundfish Forum will lend to interested potential applicants copies of a video developed by NMFS Alaska Fisheries Science Center, Resource Assessment and Conservation Engineering Division. The video filmed with underwater cameras shows how the open panel performed under NMFS experimental conditions. Also provided will be a short description piece outlining the rules for applying, general type of gear design that the experiment seeks to test, and the conditions that will have to be met by participants. The Groundfish Forum will be responsible for the timely distribution of these materials to the trawl industry.

2.0 NEPA REQUIREMENTS: ENVIRONMENTAL IMPACTS OF THE ALTERNATIVES

An environmental assessment (EA) is required by the National Environmental Policy Act of 1969 (NEPA) to determine whether the action considered will result in significant impact on the human environment. If the action is determined not to be significant based on an analysis of relevant considerations, the EA and resulting finding of no significant impact (FONSI) would be the final environmental documents required by NEPA. An environmental impact statement (EIS) must be prepared for major Federal actions significantly affecting the human environment.

An EA must include a brief discussion of the need for the proposal, the alternatives considered, the environmental impacts of the proposed action and the alternatives, and a list of document preparers. The purpose and alternatives were discussed in Sections 1.1 and 1.2, and the list of preparers is in Section 8. This section contains the discussion of the environmental impacts of the alternatives including impacts on threatened and endangered species and marine mammals.

2.1 Environmental Impacts of the Alternatives

The environmental impacts generally associated with fishery management actions are effects resulting from: (1) harvest of fish stocks that may result in changes in food availability to predators, changes in population structure of target fish stocks, and changes in community structure; (2) changes in the physical and biological structure of the benthic environment as a result of fishing practices (e.g., gear effects and fish processing discards); (3) entanglement/entrapment of non-target organisms in active or inactive fishing gear; and (4) major shifts in the abundance and composition of the marine community as result of disproportionate fishing pressure on a small set of species (also known as "cascading effects" National Research Council 1996).

A summary of the effects of the annual groundfish total allowable catch amounts on the biological environment and associated impacts on marine mammals, seabirds, and other threatened or endangered species are discussed in the final environmental assessment for the annual groundfish total allowable catch specifications (NMFS 1997).

2.1.1 Anticipated Groundfish Mortality

The EFP proposal estimates that 4,500 mt of groundfish are necessary to conduct the full experiment. Table 1 displays the estimated catch composition of 4,500 mt of groundfish taken during an August yellowfin sole target fishery. The catch composition percentages shown in table 1 are estimated by using the groundfish catch composition of the Bering Sea yellowfin sole target fishery during August 1996.

Table 1. Estimated groundfish mortality during the course of the experimental fishing

Species	*Metric Tons*	*Percentage of catch*
Yellowfin sole	2,362.9	52.5
Pollock	1123.0	25.0
Pacific cod	251.0	5.6
Rock sole	250.3	5.6
Other flatfish	180.0	4.0
Flathead sole	164.8	3.7
Other species	110.5	2.5
Arrowtooth flounder	54.6	1.2
Other Rockfish	1.6	0.04
Squid	0.8	0.02
Greenland Turbot	0.5	0.01
Total	**4,500**	**100**

Source: Estimated using NMFS Blend data from August 1996 yellowfin sole target fishery

With the exception of the "other species," arrowtooth flounder and Greenland turbot categories, none of the estimated catches shown in table would be expected to exceed a total allowable catch (TAC) specified for that species. Indeed, the yellowfin sole fishery typically closes far short of the yellowfin sole TAC as a result of prohibited species bycatch. Table 2 displays 1996 TACs and actual landings for the species in question. TACs for the "other species" and arrowtooth flounder categories are set well below acceptable biological catches (ABC). Indeed, the 1996 ABC for arrowtooth flounder is 129,000 mt or nearly 15 times the TAC of 9,000.

The EA prepared for the 1997 groundfish specifications (NMFS 1997) considered the environmental effects of fishing within the specified TAC and ABC levels and concluded that fishing within these levels would not threaten groundfish stocks or species dependent on them. The fishing conducted under the EFP would be outside of the 1997 TACs. However, estimated groundfish removals under the EFP would not exceed the overfishing levels already considered in EA for the 1997 specifications and would therefore not threaten the affected groundfish stocks or species that depend on them.

Table 2. 1996 Bering Sea or Bering Sea and Aleutian Islands Area TACs and estimated catches in metric tons

Species	*estimated catch*	*1996 TAC*	*unharvested TAC*	*% of TAC harvested*
Yellowfin sole	129,574	170,000	40,426	76
Pollock - offshore	708,712	715,487	6,775	99
Pacific cod (trawl)	112,654	130,800	18,146	86
Rock sole	47,152	59,500	12,348	79
Other flatfish	18,583	29,750	11,167	62
Flathead Sole	17,360	25,500	8,140	68
Other species	21,528	20,125	-1,403	107
Arrowtooth flounder	14,667	9,000	-5,667	163
Other Rockfish	171	380	209	45
Squid	1,170	850	-320	138
Greenland turbot	4767	3967	-800	120

Source: NMFS 1996 preliminary catch reports.

2.1.2 Anticipated Prohibited Species Catch (PSC) Mortality

Pacific halibut. The EFP proposal estimates a total halibut mortality of 22.5 mt, based on average rate of 5 kg/mt of groundfish consistent with individual performance data from NMFS and Sea State. A high end estimate would be 43 mt, based on an average rate of 10 kg/mt of groundfish.

The 1997 halibut PSC limit for Bering sea trawl fisheries was established in the 1997 specifications at 3,775 mt with 930 mt allocated to the yellowfin sole fishery. The halibut mortality anticipated by the EFP proposal would be managed beyond the specified halibut PSC limits. However, halibut bycatch under the EFP would not pose any measurable additional adverse effects to the halibut resource not already considered in the EA prepared for the 1997 specifications, because these amounts represent a nominal percent of the overall halibut PSC amounts in the Bering Sea.

Tanner crab. The EFP proposal estimates *Chionoecetes bairdi* bycatch (numbers) of 15,750 to 27,750; based on an average of 3.5 to 6 animals per ton of groundfish catch; and estimated *C. opilio* bycatch (numbers) of 104,000 to 140,000; based on an average of 23 to 31 animals per ton of groundfish.

Estimated Tanner crab catches are based on average rates for the yellowfin sole fishery in the first three reporting weeks of August, 1996. The following assumptions were used to develop the estimated groundfish and PSC catches for the experimental fishery: Six participating vessels in the experiment, a total of 300 tows in the experiment (divided evenly among vessels), two vessel

size classes (one using 10 ton codends and one using 20 ton codends), five tows per vessel per day. The assumed average halibut rate of 5 kg/ mt is based on individual vessel rates from NMFS and Sea State.

2.2 Impacts on Endangered, Threatened or Candidate Species

Endangered and threatened species under the ESA that may be present in the GOA and BSAI include:

Endangered

Northern right whale	*Balaena glacialis*
Sei whale	*Balaenoptera borealis*
Blue whale	*Balaenoptera musculus*
Fin whale	*Balaenoptera physalus*
Humpback whale	*Megaptera novaeangliae*
Sperm whale	*Physeter macrocephalus*
Snake River sockeye salmon	*Oncorhynchus nerka*
Short-tailed albatross	*Diomedea albatrus*
Steller sea lion (western population)	*Eumetopias jubatus*

Threatened

Steller sea lion (eastern Population)	*Eumetopias jubatus*
Snake R. spring and summer chinook salmon	*Oncorhynchus tshawytscha*
Snake R. fall chinook salmon	*Oncorhynchus tshawytscha*
Spectacled eider	*Somateria fischeri*

Candidate

Steller's eider	*Polysticta stelleri*

Because the groundfish fisheries of the BSAI are federally authorized activities, any effects of the fisheries on listed species or critical habitat and any takings that may occur are subject to ESA Section 7 consultation. NMFS initiates the consultation and the resulting biological opinions are issued to NMFS. The determination of whether the action "is likely to jeopardize the continued existence of" endangered or threatened species or to result in the destruction or modification of critical habitat is the responsibility of the appropriate agency (NMFS or US Fish and Wildlife Service (FWS)). If the action is determined to result in jeopardy, the opinion includes reasonable and prudent measures that are necessary to alter the action so that jeopardy is avoided. If an incidental take of a listed species is expected to occur under normal promulgation of the action, an incidental take statement is appended to the biological opinion.

In addition to listing species under the ESA, the critical habitat of a species must be 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. The primary benefit of critical habitat designation is that it informs Federal agencies that Steller sea lions are dependent upon these areas for their continued existence, and that consultation with NMFS on any Federal action that may affect these areas is required.

Section 7 consultations have been done for all the above listed species, some individually and some as groups. Below are summaries of the consultations.

Endangered Cetaceans These species of great whales were initially listed in 1969 with the Endangered Species Conservation Act, and maintained in the status of endangered when the Endangered Species Act passed into law in 1973. No critical habitat has been designated for these listed cetaceans.

NMFS concluded a formal Section 7 consultation on the effects of the BSAI and GOA groundfish fisheries on endangered cetaceans within the BSAI and GOA on December 14, 1979, and April 19, 1991, respectively. These opinions concluded that the fisheries are unlikely to jeopardize the continued existence or recovery of endangered whales. Consideration of the bowhead whale as one of the listed species present within the area of the Bering Sea fishery was not recognized in the 1979 opinion, however, its range and status are not known to have changed. No new information exists that would cause NMFS to alter the conclusion of the 1979 or 1991 opinions.

Steller sea lion. On May 5, 1997 NMFS reclassified the U.S. western population of Steller sea lion as endangered and to retain the threatened status for the eastern population (62 FR 24345). Under the final rule, NMFS will manage the Steller sea lion as two distinct population segments under the ESA, classifying the population west of 144 W. longitude (a line near Cape Suckling, Alaska) as endangered and maintaining the threatened listing to the east of this line.

NMFS designated critical habitat (58 FR 45278, August 27, 1993) for the Steller sea lion based on the Recovery Team's determination of habitat sites that are essential to reproduction, rest, refuge, and feeding. Listed critical habitats in Alaska include all rookeries, major haul-outs, and specific aquatic foraging habitats of the BSAI and GOA. The designation does not place any additional restrictions on human activities within designated areas.

NMFS determined that both groundfish fisheries may adversely affect Steller sea lions, and therefore has conducted Section 7 consultation on the overall fisheries, proposed changes in the fisheries, and the annual TAC specification process since the 1990 ESA listing. The most recent biological opinion considered the annual process of proposing TAC specifications (NMFS 1996). NMFS considered whether reinitiation of Section 7 consultation for Steller sea lions as effected by the proposed 1997 TAC specifications was warranted at this time and found that it did not (Memorandum from James Balsiger, January 14, 1997). The reasons include: no significant new information regarding the relationship between the fishery and the Steller sea lion population, no significant alterations in fishing practices either spatially or temporally, no specific management actions which would obviously conflict with ongoing efforts to recover Steller sea lion

populations, and the estimated incidental take of Steller sea lions in groundfish operations during 1996 was less than the MMPA authorized level of 77 animals in the BSAI and GOA.

Pacific Salmon No species of Pacific salmon originating from freshwater habitat in Alaska are listed under the ESA. These listed species originate in freshwater habitat in the headwaters of the Columbia (Snake) River. During ocean migration to the Pacific marine waters a small (undetermined) portion of the stock go into the Gulf of Alaska as far east as the Aleutian Islands. In that habitat they are mixed with hundreds to thousands of other stocks originating from the Columbia River, British Columbia, Alaska, and Asia. The listed fish are not visually distinguishable from the other, unlisted, stocks. Mortal "take" of them in the chinook salmon bycatch portion of the fisheries is assumed based on sketchy abundance, timing, and migration pattern information.

NMFS designated critical habitat (57 FR 57051, December 2, 1992) for the Snake River sockeye, Snake River spring/summer chinook, and Snake River fall chinook salmon, however, it did not include any marine waters, therefore, does not include any of the habitat where the groundfish fisheries are promulgated.

Formal consultation resulting in Biological Opinions and no-jeopardy determinations were completed for listed Pacific salmon in the groundfish fisheries for 1994 and future years (NMFS 1994, 1995b). Conservation measures were recommended to reduce salmon bycatch and improve the level of information about the salmon bycatch. The no jeopardy determination was based on the assumption that if total salmon bycatch is controlled, the impacts to listed salmon are also controlled. The incidental take statement appended to the biological opinion allowed for take of one Snake River fall chinook and zero take of either Snake River spring/summer chinook or Snake River sockeye per year. As explained above, it is not technically possible to know if any have been taken. Compliance with the Biological Opinion is stated in terms of limiting salmon bycatch to under 55,000 and 40,000 for chinook salmon in the BSAI and GOA fisheries, respectively, and 200 and 100 sockeye salmon in the BSAI and GOA fisheries, respectively.

Short-tailed albatross The entire world population in 1995 was estimated as 800 birds; 350 adults breed on two small islands near Japan (H. Hasegawa, per. com.). The population is growing but is still critically endangered because of its small size and restricted breeding range. Past observations indicate that older short-tailed albatrosses are present in Alaska primarily during the summer and fall months along the shelf break from the Alaska Peninsula to the Gulf of Alaska, although 1- and 2-year old juveniles may be present at other times of the year (FWS 1993). Consequently, these albatrosses generally would be exposed to fishery interactions most often during the summer and fall--during the latter part of the second and the whole of the third fishing quarters.

Formal consultation on the effects of the groundfish fisheries on the short-tailed albatross under the jurisdiction of the FWS concluded that BSAI and GOA groundfish fisheries would adversely affect the short-tailed albatross and would result in the incidental take of up to two birds per year, but would not jeopardize the continued existence of that species. Subsequent consultations for changes to the fishery that might affect the short-tailed albatross concluded that no additional adverse impacts beyond those considered in 1989 would occur. A new biological opinion issued

by the FWS on February 12, 1997 concluded that trawl and pot fishing activities in the GOA and BSAI are not likely to adversely affect short-tailed albatross (Letter Rappaport to Pennoyer).

Spectacled Eider These sea ducks feed on benthic mollusks and crustaceans taken in shallow marine waters or on pelagic crustaceans. The marine range for spectacled eider is not known, although Dau and Kistchinski (1977) review evidence that they winter near the pack ice in the northern Bering Sea. Spectacled eider are rarely seen in U.S. waters except in August through September when they molt in northeast Norton Sound and in migration near St. Lawrence Island. The lack of observations in U.S. waters suggests that, if not confined to sea ice polyneas, they likely winter near the Russian coast (FWS 1993). Although the species is noted as occurring in the GOA and BSAI management areas no evidence that they interact with these groundfish fisheries exists.

For all ESA listed species, consultation must be reinitiated if: the amount or extent of taking specified in the Incidental Take Statement is exceeded, new information reveals effects of the action that may affect listed species in a way not previously considered, the action is subsequently modified in a manner that causes an effect to listed species that was not considered in the biological opinion, or a new species is listed or critical habitat is designated that may be affected by the action.
None of the alternatives are expected to affect endangered, threatened, or candidate species in a manner or to an extent not considered in previous consultations on the groundfish fisheries of the BSAI.

2.3 Impacts on Marine Mammals

Marine mammals not listed under the Endangered Species Act that may be present in the 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*).

NMFS has determined that fishing activities conducted under this EFP would not adversely affect marine mammals.

2.4 Coastal Zone Management Act

Implementation of the preferred 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.

2.5 Conclusions or Finding of No Significant Impact

None of the alternatives are likely to significantly affect the quality of the human environment, and the preparation of an environmental impact statement for the proposed action is not required by Section 102(2)(C) of the National Environmental Policy Act or its implementing regulations.

Assistant Administrator for Fisheries, NOAA

JUN 3 1997
Date

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7.0 AGENCIES AND INDIVIDUALS CONSULTED

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9.0 APPENDIX: EFP Application, Statistical Design and Analysis of the Gear Experiment

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Exempted Fishing Permit Application 3/14/97

Elements of the Groundfish Forum exempted fishing permit proposal
Part One: Introduction and purpose and need for the exempted permit
Part Two: Method and approach for the experiment
Part Three: Experimental design
Part Four: Data collection and processing
Part Five: Administration of the experiment
Part Six: Analysis of results
Part Seven: Dissemination of study results

Part One: Purpose and need for an exempted fishing permit

Objective

The Groundfish Forum seeks to conduct an experiment to systematically test the effects of a radically different trawl net design on species and size composition of catch in trawls targeting flatfish. This experiment is needed to provide the knowledge and experience necessary for participants in flatfish fisheries to develop methods of avoiding unwanted catches of pollock and Pacific cod.

The need to create innovative methods of reducing catches of pollock and cod in flatfish trawls is great. Pollock discards for the yellowfin sole and rocksole target fisheries combined were estimated to be 54,000 MT in 1994 (NOAA Technical Memorandum NMFS-AFSC-58), and 28,500 MT in 1995 (EA/RIR for IR/IU, July, 1996). Those two fisheries are the major flatfish target fisheries in the Bering Sea. Although Pacific cod discards in the rocksole and yellowfin sole targets combined are lower compared to pollock, they are perhaps more significant relative to the total allowable catch for Pacific cod. Pacific cod discards were approximately 13,450 MT in 1994 (NOAA Technical Memorandum NMFS-AFSC-58), and 11,500 MT in 1995 (EA/RIR for IR/IU, July, 1996). Head and gut (H&G) vessels probably account for half of the pollock and cod discards in the yellowfin sole fishery and nearly all of the pollock and cod discarded in the rocksole target.

As the EA/RIR for Improved Retention/Improved Utilization (IR/IU) concludes, smaller catcher processor vessels face very large economic impacts from the North Pacific Council's new retention requirements under IR/IU because prices for head and gut pollock are insufficient to cover production costs on H&G vessels. The industry believes this market situation is unlikely to change in the near future.

A fundamental reason most pollock and cod are discarded on H&G vessels is that frozen product hold capacity is usually limited to 75-200 MT for that portion of the trawl industry. The low price of headed and eviscerated pollock and cod means that if catches of these species cannot be avoided, under the full retention regulations that are supposed to be in effect in 1998, the economic margins necessary for H&G vessels could be destroyed. Margins would be destroyed because as much as 50% of frozen product hold capacity on most H&G vessels could be filled with product that is below the variable cost margin for these vessels. This means that revenue on a per trip basis could be reduced substantially, while production costs will rise as more vessel time and fuel will be consumed by

activities that are not revenue producing (e.g., steaming to port and back to fishing grounds, offloading, etc.).

Virtually all source material developed by the Council and NMFS analysts throughout the development of IR/IU underscores that the Council's intention with IR/IU was to create incentives for avoidance of fish formerly discarded for economic reasons. For the H&G sector, avoidance is critical because making fishmeal out of pollock and cod catches is not a viable option. The combined effect of vessel moratorium and license limitation regulations affecting vessel upgrades, as well as US Coast Guard "processing" regulations, effectively preclude installation of fishmeal plants to reduce unmarketable fish into fishmeal. Even without these regulatory barriers to fishmeal production, space and scale restrictions on H&G vessels make the fishmeal alternative not feasible.

Therefore, the economic survival of most of the head and gut vessels (approximately 25 vessels) critically depends on the fleet's ability to devise ways to avoid catches of pollock and small cod. An area-based approach to avoiding pollock and cod was attempted in the 1994 spring rocksole fishery. This program attempted to identify fishing areas where cod and pollock catches were a large percentage of total catch. Although well-intentioned, this approach proved largely impractical and ineffectual because pollock and cod are ubiquitous in areas where flatfish are fished. Based on its knowledge of the preliminary evidence from NMFS gear research (Rose 1995), Groundfish Forum believes the greatest promise for accomplishing the avoidance objective lies in innovations made to the intermediary portion of the trawl. This net modification is intended to allow pollock and Pacific cod to swim out of the net with little or no impact on the fish, while at the same time conserving flatfish catches.

The ideal net configuration would be one that allows the egress of flatfish that are smaller than market size, as well as all pollock and small-sized cod. This project, however, focuses more narrowly on the exclusion of pollock and cod from the catch, while retaining most of the flatfish catch. Perhaps as experience with innovations to the net intermediary increases, the industry may someday be able to design a flatfish net that approaches the ideal standard.

<u>The failure of *ad hoc* efforts to reduce discards through net modification.</u>
Despite incentives for developing avoidance modifications (incentives inherent from the knowledge that the Council was likely to create regulations to require retention, as well as the general incentive of not wanting to catch fish that will be discarded), innovation has been stymied by the typical factors that limit pro-active individual actions. First, some companies are scarcely (some not even) covering their operating and fixed costs under the current economic regime. For those companies, experimentation jeopardizes critical fishing time and performance during the regular season. Second, for the more general situation, there is the competitive disadvantage in the short run, whereby, competitors <u>not testing</u> gears that exclude parts of the catch will likely have <u>greater catches</u> of target species, while those companies attempting to experiment may actually reduce catches of marketable fish while methods are being developed and adjusted. Because the total allowable catch and PSC caps for groundfish fisheries are managed under open access (no individual assignments of catch or bycatch), innovation may not be rewarded and, in fact, may be penalized.

Despite economic obstacles to innovation, some companies have attempted to test roundfish exclusion devices on an *ad hoc* basis, but have encountered problems. Companies have reported experiencing lower catches of target species than firms that were not attempting to innovate. Although modifications and adjustments to the gear design being tested <u>might</u> have eventually corrected this problem, the competitive aspects of the commons fishery evidently resulted in an untimely termination of *ad hoc*

testing.

In addition, considerably higher vessel incentive program (VIP) rates were reported by industry while experimenting with large mesh net designs. Under the VIP program, prohibited species catch (PSC) per metric ton of total catch is not supposed to exceed a standard rate for the fishery. With large mesh nets or open panel devices that reduce groundfish catches per unit of fishing effort, the rate of prohibited species catch per ton of total groundfish catch reportedly increased even when the actual amount of PSC was similar for tows with alternative net designs. Despite the apparent low probability of prosecution of VIP cases, companies would rather avoid receiving VIP citations. The greater potential for VIP citations from testing alternative trawl designs, thus, served as an additional factor against *ad hoc* experimentation.

Part Two: Structure of the experiment

The Groundfish Forum, as applicant for an exempted fishing permit, seeks to set up a "request for proposals" (RFP) process whereby companies submit applications to test an open panel placed in the intermediary portion of the trawl that conforms to the general description of the device described by Rose (1995). Under the rules of the experiment (described below) the performance of the experimental gear will be tested against a standard control gear. The control gear will be a net configured for yellowfin sole fishing as per current industry practices.

The RFP will set out a general description of the type of trawl design that will be systematically tested against a control trawl gear. The type of gear design that will be tested against the control will be an "open" panel placed in the intermediary or intermediate (both terms are commonly used) portion of the trawl. The panel is effectively open because there are no net meshes on the top portion of the net (only the net straps are present in the top panel portion of the net). The device to be tested was first developed by NMFS gear researchers (Rose 1995). The open panel to be tested in this experiment must be at least 16 ft in length (stretched mesh length) and occupy at least 40% of the intermediate portion of the test trawl net (stretched mesh basis).

Placement and shape of the panel will be determined by the company making application to participate in the experiment. Other aspects of the net design for the test gear, as well as the control gear, will have to conform to standards so that the effects of the open panel can be discerned by the experiment. Towing speed, duration of tows, and other aspects of the tows made with experimental and control nets will be restricted for purposes of isolating the effects of the open panel.

Guidelines for applications to participate in the experiment will be provided by Groundfish Forum. Guidelines will include a description of the test and control gear as well as a statement of the rules that must be conformed to for the experiment (described in detail below). This information will be conveyed to potential applicants through a short publication written and distributed by the Groundfish Forum and reviewed by NMFS personnel associated with the experiment.

To ensure compliance with the experimental protocols, data from each days fishing will be sent electronically (fax or email) to NMFS personnel associated with this experiment and Groundfish Forum staff on the fishing grounds and in the Groundfish Forum office in Seattle. Forum staff will review the information and notify the NMFS and the vessel if there are indications that a vessel is not meeting requirements for participation in the experiment (see item 5, A-I below, Requirements of participants). If a vessel continues to violate the experimental protocols, the

company owning a participating vessel will be notified that its ability to participate under the EFP will be terminated.

1. Timing of the Experiment: The proposed timing for the experiment is August 1-14, 1997. During the first two weeks of August, fishing opportunities are typically scarce for participants in the flatfish fisheries because yellowfin sole has typically exhausted its halibut allocation from the May PSC release. Additionally, halibut allocated to the "other flatfish" trawl category has typically been exhausted before the end of July. Starting August 15th, the yellowfin sole fishery receives its final halibut release and it is anticipated that companies would be unwilling to continue participating in the experiment at that time.

The projected duration of the experimental fishery is based on calculations made of the number of tows of the experimental and control gears needed for reasonable statistical confidence in the results (see Experimental Design below).

2. Participation : Parties interested in participating in this EFP experiment must make application through an RFP process administered by the Groundfish Forum. The process involves submission of an application which describes the nets the applicant proposes to use and a statement that the applicant agrees to abide by the experimental protocols and other requirements as outlined below (see item 5, A-I below, Requirements of participants. Trawl catcher processors and catcher vessels will be eligible to apply for participation. However, in addition to the other requirements, participants during the experiment must fish within the definitions set out in the directed fishing standards for the yellowfin sole fishery. Applications for participation will be reviewed by the Selection Committee (described below).

Note: Guidelines for NMFS Exempted Fishing Permits stipulate that the name of companies and their participating vessels be listed in the application. Because this application sets up an RFP process, it is not possible to pre-determine participants in the application (see Selection Committee below).

The design of the experiment calls for, ideally, six vessels to participate in the experiment. That number is believed to be a representative percentage of the dedicated flatfish fleet (20-25 vessels). In addition, the experiment seeks to conduct the test on several vessels to attempt to learn whether the experimental gear works under a number of fishing vessel characteristics that affect catch composition, such as size of net and towing horsepower. For example, factors determining towing power are likely highly correlated with vessel size.

To further allow inferences about the performance of the test gear on different types of flatfish vessels, the desired number of test vessels (6) may be further divided into two categories: three vessels under 165 feet overall and three greater than that length. The ability to subset the test vessels will depend on the number and variation of vessels for which proposals to participate are made.

3. Selection Committee: A committee will be formed with of a total of three NMFS employees to evaluate applications. The Groundfish Forum suggests as members of the Selection Committee: Russ Nelson and Craig Rose from the Alaska Fisheries Science Center, NMFS, and Andy Smoker of the Alaska Regional Office.

The Selection Committee will meet in June to evaluate proposals. The merits of a proposal will be based on the proposed set up of the test and control gears, as shown in the diagrams provided by applicants and the rationale provided for the exact location of the open panel within the intermediary portion of the net. Determinations will be based on the Selection Committee's judgment of the

proposals as legitimate attempts to eliminate unwanted catches of cod and pollock, while maintaining adequate catches of flatfish. Placement, size, and configuration of the open panel are among the criteria to be evaluated.

The Selection Committee will judge proposals by consensus, without knowledge of the manufacturer of the nets to be used. The Selection Committee will also consider the applicant's record of regulatory compliance and cooperation with past NMFS and industry projects in judging applications. The purpose of including criteria such as regulatory compliance and cooperation with past NMFS and industry projects is to encourage the selection of participants likely to cooperate fully with the experimental protocol and rules of the experiment.

The proposals reviewed by the Selection Committee will be grouped into the two vessel length categories (≤ 165 ft and > 165 ft). If the number of acceptable applications in one or both vessel length categories exceeds three, then the determination of which will be allowed to participate will be decided by random drawing conducted by the Selection Committee.

4. Description of the RFP process. The Groundfish Forum will be responsible for informing the trawl industry of the goals of the experiment, and the process and guidelines for submitting proposals. Written materials describing the experiment and application process will be available from the Groundfish Forum.

Groundfish Forum will provide a short summary of the general purpose of the experiment. Groundfish Forum will lend to interested potential applicants copies of a video developed by NMFS/AFSC/RACE Division. The video filmed with underwater cameras shows how the open panel performed under NMFS experimental conditions. Also provided will be a short description piece outlining the rules for applying, general type of gear design that the experiment seeks to test, and the conditions that will have to be met by participants. The Groundfish Forum will be responsible for the timely distribution of these materials to the trawl industry.

5. Requirements for Participants: In addition to making application and being accepted for participation by the Selection Committee, companies will be required to:

Build or modify existing nets so that the vessel has (1) experimental and (1) control net that meet the requirements of the experiment. Applicants are responsible for all expenses associated with constructing or modifying nets for this experiment.

Take (2) NMFS certified observers during the experimental fishing period so that catch composition and the size distribution of catch with the experimental net and control net can be adequately recorded. Adequate facilities and support infrastructure for observers to conduct expanded species and size composition sampling must be provided by the applicant.

Provide additional manpower to the NMFS certified observers (upon request by the observers) for expanded sampling under the EFP. One or more processors working for the vessel will be made available to assist observers (at the request of the observer). Processors assigned to this role will work as assistants to the observers so that expanded catch composition and size distribution sampling required for this experiment can be carried out (see Part Four: Data collection and processing):

Report groundfish and PSC catch each day to Groundfish Forum and NMFS so that catch can be monitored during the experiment;

Follow the experimental protocols and observer instructions, including:

- prescribed rotation of experimental and control tows
- standardizing towing speed

- standard tow duration (or full codend, whichever occurs first)
- gear setting and towing procedures;

Ensure that catch from separate hauls is not mixed prior to observer sampling;

Agree to abide by any adjustments in the experimental protocol deemed necessary by NMFS personnel associated with the experiment and the Groundfish Forum's contracted statistician responsible for the experimental design (Dr. John Skalski).

A. Allow the catch data from the experiment to be used for analysis of gear effectiveness and the results to be made available to the public (data will be kept anonymous and aggregated such that individual vessel performance will not be discernible);

B. Conduct fishing during the experiment in conformance with the directed fishing standards for the yellowfin sole target fishery, as well as in accordance with any area or zone closures relevant at that point in time to the general fishery for yellowfin sole.

Participants in the study will be allowed to retain for sale all legally retainable groundfish catches resulting from the experimental fishery in accordance with the directed fishing standards and other applicable regulations pertaining to the trawl groundfish fishery.

6. Responsibilities of NMFS: In addition to its review responsibilities, the National Marine Fisheries Service will be asked to serve a number of functions for the experiment and agree to a number of responsibilities for this experiment. These include:

NMFS will make its gear experts and other personnel available to sit on the Selection Committee. One gear expert (Craig Rose) will be asked to assist and help coordinate project administration and provide assistance with camera equipment to monitor the working of the open panel on the fishing grounds during the experiment (see below).

NMFS (after North Pacific Council review) will agree to make a quantity of groundfish and prohibited species catch available for the experiment as outlined below.

Anticipated groundfish and PSC catches are as follows:

Estimated total groundfish catch of approximately 4,500 MT, 70% of which is yellowfin sole.

Estimated total halibut mortality of 22.5 MT, based on average rate of 5 kg/MT of groundfish. A high end estimate would be 43 MT, based on an average rate of 10 kg/MT of groundfish.

A. Estimated bairdi bycatch (numbers) of 15,750 to 27,750; based on an average of 3.5 to 6 animals per ton of groundfish catch.

B. Estimated opilio bycatch (numbers) of 104,000 to 140,000; based on an average of 23 to 31 animals per ton of groundfish.

Estimated PSC catches are based on average rates for the yellowfin sole fishery in the first three reporting weeks of August, 1996. The following assumptions were used to develop the estimated groundfish and PSC catches for the experimental fishery: 6 participating vessels in the experiment, a total of 300 tows in the experiment (divided evenly among vessels), two vessel size classes (one using 10 ton codends and one using 20 ton codends), 5 tows per vessel per day. The assumed average halibut rate of 5 kg/MT appears very reasonable given individual performance data from NMFS and Sea State.

In addition to these anticipated catches during the experiment, one or two pre-test tows per vessel just prior to the experiment are needed. Catches from these pre-test tows are expected add an additional groundfish catch or 90-180 MT, depending whether one or two pre-test tows are needed for

participating vessels. The anticipated additional halibut catch from pre-test tows ranges from 0.45 to 0.90 MT assuming 5 kg per metric ton. Anticipated additional bairdi and opilio catches are approximately 1,575 to 3,150 bairdi (using a rate of 3.5 per MT) and 10,350 to 20,700 opilio (using a rate of 23 per MT).

The purpose of these pre-test tows is to verify the effective deployment of the open panel. Verification will be by special low-light camera attached to the net in close proximity to the open panel. Craig Rose (NMFS/AFSC/RACE) has agreed to provide this service to avoid problems with the functioning of the open panel so that experimental tows are made with the gear working effectively. Pre-test tows are expected to increase the ability of the experiment to ascertain the true effectiveness of the experimental gear.

Part Three: Experimental Design (note: the complete section outlining the details of the experimental design for this EFP application is found in Appendix One)

The experimental design for the gear investigation will consist of a randomized block design with trawls using standard and test gear alternating within the blocks. Consecutive trawls with the two gear types will constitute a test block which will then be replicated over time and across vessels. The principle of blocking helps eliminate variations in catch between areas, days, times of day, and between vessels in order to more readily identify differences between gear types. The randomized block design has been shown to substantially reduce the magnitude of the experimental error and increase the statistical power of a study to detect gear effects over random or haphazard designs (Bergh et al. 1990, Pikitch et al. 1990).

A fishing protocol will be followed that defines operational conditions for the trawls and criteria for what fishing conditions constitute a test block of trials. Within that protocol, the NMFS certified observer will be responsible for one duty, that of informing the skipper (or other vessel personnel responsible for fishing) which net to use for a tow within an experimental block. Observers will also collect auxiliary information on test conditions during the fishing trials that may subsequently be used to refine statistical analyses.

From each fishery trial, observers will collect pertinent catch statistics for subsequent analysis. Basket sampling will be conducted to determine species composition and estimate total catch weight for species in the haul. Additionally, length frequency data will be collected in order to assess how the experimental gear affects not only the quantity of the catch of target and bycatch species, but also the ability of the experimental gear to catch target species of commercial quality (see , Part 4, 1, A-D).

Catch data from the 1996 North Pacific groundfish fleet were analyzed for calculating required sample sizes for the proposed gear experiment. A study with six vessels is likely to accomplish as many as 150 test blocks over the two-week study. With that level of replication, the study should have approximately a 70% chance (i.e., 1 - β= 0.70) of detecting a 10% decline in roundfish catch at a significance level of α = 0.10 (one-tailed). The same effort has approximately a 98% chance of detecting a 20% decline in roundfish catch (α = 0.10). Even more dramatic reductions in pollock and cod catch are anticipated with the test gear. Hence, the proposed test fishery has an excellent chance of successfully identifying gear modifications capable of reducing roundfish catch.

Part Four: Data collection and processing

Due to the unique nature of this experimental fishery, it will be necessary to modify some of the standard NMFS certified observer sampling protocols. These modifications will facilitate the statistical analysis of how effective the experimental gear is at reducing pollock and Pacific cod catches, while preserving adequate amounts of flatfish catch. The principal goal of the re-prioritization of observer duties is for the observer to perform a more comprehensive species composition sample. Modifications in observer sampling are outlined below along with the underlying rationale.

Note: While the observer determines (based on random sampling schedule) which gear is deployed, the skipper/master (or other vessel personnel in charge of fishing operations) maintains authority over where and when to fish. By agreeing to participate in this experiment, fishing companies understand that they must strictly abide by the protocols of the experimental fishery, including following the instructions of the observer as to when to deploy the experimental gear.

To prevent problems caused by the appearance of observers dictating fishing activity, observers will be in contact with Groundfish Forum and/or NMFS personnel who will be on the fishing grounds administering the experiment. Moreover, as stated in Section 2, it is the responsibility of the Groundfish Forum to monitor compliance with the experimental protocols. This will be accomplished by reviewing daily reports from the vessels. Forum staff will review the information and notify a vessel if there is evidence the vessel is not meeting its requirements under the participation agreement (see item 5, A-1 above, Requirements of participants). If a vessel is in not complying with the experimental protocols, Groundfish forum will notify NMFS personnel involved with the experiment and the vessel will be notified that it may no longer participate in the Exempted Fishing Permit.

I. Observer responsibilities

A. Blocks

In order for observers to create the "blocks" of data necessary for statistical analysis, the standard observer program random sampling table will not be used during this experiment. Groundfish Forum will develop and provide a specially designed, random sampling table that observers will use to indicate to the vessel which net (experimental, with open-panel intermediate; or control, with standard intermediate) to deploy.

The goal of blocking the data, as stated in Part Three Experimental Design, is to create a paired set of tows; each pair consisting of one tow with experimental gear and one tow with control gear, that are deployed in a similar manner (spatially and temporally). The two observers assigned to each vessel are required to devise a work schedule that allows for all tows to be sampled, for example 12 hours on and 12 hours off.

Blocking of the data will be accomplished with the above mentioned random sampling schedules which will indicate to the observer which net is scheduled for deployment. This will create a sampling scheme which eliminates bias from the decision of which net to deploy.

B. Species Composition

In terms of biological data, because the experiment is designed to test if the experimental gear is effective in reducing catches of pollock and Pacific cod, sampling for species composition is the highest priority observer duty. The current NMFS protocol for species composition sampling in flatfish fisheries calls for a minimum basket sample of 300 kilograms. In order to strengthen the statistical analysis of how effectively the open-panel gear reduces pollock and Pacific cod catch, the experiment requires that the minimum basket sample be increased to a total of 600 kilograms. To further increase the precision of the observer's estimate of species composition, we would like to stress that samples be taken from throughout a haul.

C. Length Frequency

Length frequency sampling will be of secondary importance to species composition, but remains an important element of this study. In order for open-panel gear to be considered effective, it must reduce pollock and Pacific Cod catches, but must also retain large individuals of the target flatfish species. Length frequency data will be used to measure this variable. The present observer program protocols, 150 fish of a single species per day, will be adequate. In order to determine the effectiveness of the experimental gear, it is critical that length frequency data be linked directly to a specific haul and, therefore, the specific net used for the haul. The experiment requires that the standard length frequency sampling protocol, *"fish to be measured may be collected during or after composition sampling or from an unsampled haul or set"* (Manual for Biologists Aboard Domestic Groundfish Vessels 1996), be modified such that length frequency samples are taken only from sampled hauls. Finally, we would also prefer that length frequency information be collected from all flatfish species targeted by the vessel, rather than the standard protocol of taking length frequency data from a single species for the entire trip. These modifications will provide a better array of information.

D. Observer Logbooks

Because of the unique nature of this experiment it may be necessary that the Groundfish Forum have access to, at least, edited portions of observer logbooks. This potential need for the Groundfish Forum to review logbook entries would be to resolve inconsistencies in the data discovered during data-processing after the experiment is completed.

2. Data entry and quality control procedures

During the experimental fishery, observers will record data on standard NMFS-supplied forms. Additional fields will have been added for observers to record whether the data are from a haul with experimental gear or a haul with control gear. On the form 7US (length frequency data) an additional field will be required that indicates the haul number sampled for length frequency information. Because environmental conditions may be important variables that influence effectiveness of the fishing gear, NOAA weather data for the relevant portion of the Eastern Bering Sea will be incorporated *post facto* into the experimental data-set.

Data necessary to analyze the effectiveness of the experimental gear (forms: 2US, 3US, 7US, and ancillary information) will be housed in a database managed by the Groundfish Forum. Upon return from sea, observers will be debriefed by Groundfish Forum staff, either concurrent with or subsequent to their formal NMFS debriefing. At that time, Groundfish Forum debriefers and the observer will review and visually check the data for errors. After this initial screening, the data will be keyed into the experimental fishery database. Additional quality control measures will be conducted to ensure that the data were keyed correctly and to screen for errors missed during the initial review.

Part Five: Administration of Experiment

To ensure its successful completion, the experiment requires several types of administration.

Groundfish Forum will provide a project supervisor who will work from one or more vessels during the experiment. This person will facilitate communication between participants in the experiment, NMFS certified observers, and NMFS personnel involved in the experiment. The Groundfish Forum supervisor will be responsible for making sure unanticipated occurrences and problems are resolved in a manner that does not jeopardize the conduct or validity of the experiment.

Groundfish Forum's supervisor will also be responsible for contacting NMFS and the Groundfish Forum if there are unanticipated problems requiring adjustments in the conduct of the survey so that Groundfish Forum's contracted statistician can, in consultation with NMFS, suggest adjustments to the experimental design to remedy unforeseen problems, should they occur. The Forum's supervisor will also be responsible for making sure that NMFS personnel who have agreed to provide assistance (such as with underwater camera gear) are able to perform such duties.

Groundfish Forum will also retain the services of Sea State to track groundfish and PSC catch during the experiment to make sure catch levels are within the anticipated bounds. If unanticipated levels of halibut or crab bycatch occur, Groundfish Forum will be responsible for contacting NMFS's personnel involved with the project and taking steps to remedy the situation as advised.

Groundfish Forum, through the interaction of its on site supervisor and office personnel in Seattle, is responsible for making sure vessels in the experiment follow the protocol and other requirements of the experiment. Should it be deemed that a vessel is not abiding by the requirements, the vessel will be notified of this. If this action does not result in the resolution of the problem, Groundfish Forum will notify the vessel and NMFS that the vessel is no longer complying with the EFP so that NMFS can take the appropriate action.

Part Six: Analysis of results

The Groundfish Forum will conduct an analysis of the data from the experiment. This analysis will be conducted in consultation with Groundfish Forum's contracted statistician and NMFS scientists involved in the project. A draft report will be prepared in September/October for review by NMFS personnel connected with the project as well as NMFS project reviewers.

The central question to be answered in the analysis is what is the difference in pollock and cod catches between the experimental and control nets. Other questions include the effects of differences in placement of the open panel, differences in the performance of the panel between vessels or vessel sizes, effects of different light conditions, and the effects of different sea conditions.

There are several secondary questions that can be evaluated based on the experimental data. Groundfish Forum will resolve these questions with NMFS statisticians, gear test personnel, and Groundfish Forum's contracted statistician prior to the beginning of the experiment.

Part Seven: Dissemination of study results

The Groundfish Forum will prepare a succinct report for the trawl industry explaining the results and basic statistical confidence in those results. The purpose of this report is to make interested industry parties aware of the performance of the experimental net so that, in the case that the net proves useful in producing significant decreases in pollock and cod catches, this information can be adapted for use.

This industry report of very limited scope will be prepared in consultation with the Groundfish Forum's contracted statistician. The report will be circulated in draft form to the NMFS personnel connected with the project.

NMFS and other researchers may be interested in performing more rigorous tests of the results of the study. Data will be made available to researchers interested in performing more detailed studies. Vessel identifiers will be removed from individual vessel data prior to public dissemination of the data.

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Appendix:

Statistical Design and Analysis of the Gear Experiment

Study Design

To successfully make statistically defensible inferences to the groundfish fleet, the study design needs to address the competing demands for statistical precision and experimental control versus representative sampling of vessels and crews. The use of a single fishing vessel during the trials would maximize statistical precision and error control, but eliminate the ability to make statistical inferences to the fleet. Alternatively, the use of numerous vessels, each conducting one to few trawls with a variety of gear types, broadens the breadth of the statistical inference, but nearly eliminates the ability to calculate precise estimates of gear effects. The proposed gear trials will balance these competing options by selecting multiple participating vessels within predefined criteria, standardizing fishing trials and performing enough replicate trawls to assure reasonable statistical power. The array of vessels and replicate trawls will permit a useful breadth of inference and statistical performance.

Vessel Selection

Vessels participating in the groundfish gear experiment will be selected by a "Selection Committee" comprised of experts from the National Marine Fisheries Service (NMFS) and industry. The committee will select vessels based on proposals submitted by vessel companies responding to a Request for Proposals (RFP).

Criteria for selection of vessels will be established by the Selection Committee *a priori* to help achieve the dual goals of statistical precision and breadth of inference. Among the selection criteria to be used will include the following:

1. Inclusion of participating vessels of both small- and large-size classes (increase breadth of inference).

2. Willingness and ability of vessel and crew to follow experimental protocols and provide accommodations for observers (increase design control and precision).
3. Ability to perform alternative trawls using standard and experimental trawl gear, and with gear changes between trawls.
4. Proposed use of an open top panel placed in a net that has promise of reducing groundfish bycatch.

Materials disseminated by the Groundfish Forum to potential applicants will describe the experimental protocol and study requirements. In addition, the RFP will list the vessel selection criteria that will be refined by the Selection Committee.

Treatment Design

With the purpose of the experiment to compare catch statistics of standard and modified trawl gear, each vessel will be required to use a standard and a modified experimental trawl with an open top panel. The standard gear will be selected to be most representative of the fleet's current equipment used for fishing yellowfin sole. This standard trawl gear will be provided by the company from current inventory on their fishing vessel.

The treatment gear will include an open top panel on the intermediate portion of the trawl to enhance roundfish escapement. The length of the open panel in the trawl intermediate is specified in the EFP application to NMFS. The position of the panel is the responsibility of the participant in the experiment. The treatment trawl gear will be provided by those applying to participate in the EFP.

Other elements of the treatment design include specifications/restrictions on the conduct of the replicate trawls within and across vessels. An experimental protocol will be developed that will include firm guidelines in the deployment of the gear and trawls. Criteria will include duration

of trawl and the time and distance between trawls within experimental blocks. A detailed on-board experimental protocol will be developed, reviewed by the Selection Committee, and provided to each vessel and observer crew. Data forms will record details of the conduct of each trawl (e.g., depths, in and out times, vessel speed, location, sea state, etc.). These conditions related to trawl operations may serve as covariates in subsequent analyses of gear effects.

Measured Response Variables

Several response variables will be measured on each trawl in the investigation of gear effects. The responses will look at the potential changes in the quantity and quality of the roundfish (principally pollock and Pacific cod), and the quantity and quality of the flatfish in the catch. Specific response variables to be measured include:

1. Total catch weight of flatfish by trawl (f),
2. Total catch weight of roundfish by trawl (r),
3. Proportion of catch by weight that are roundfish

$$p = \frac{r}{r+f} .$$

4. Proportion of roundfish by catch that is of commercially acceptable size (C_r),
5. Proportion of flatfish catch that is of commercially acceptable size (C_f),
6. Mean length of flatfish in catch $(\bar{f})$,
7. Mean length of roundfish in catch $(\bar{r})$.
8. Catch rate (R_r) of roundfish (i.e., kgm/hr).
9. Catch rate (R_f) of flatfish (i.e., kgm/hr).

Basket sampling of the catch from each trawl will be used to estimate species composition and size distribution of the fish. For each trawl, approximately 480-600 kgm (12 basket samples) will be taken during processing to estimate species composition (e.g., yellow fin sole). In addition, a minimum of 150 fish per day of the target commercial species will be measured and length and gender recorded. Length data will be used in estimating response variables C_i and $\bar{l}$.

To minimize confounding gear type with fishing effort, tow duration will be standardized. The net will be towed until either the net is full or until a maximum tow duration has been achieved. Catch per unit effort (i.e., catch rate) will then be expressed in terms of kgm/hr. Catch rate (R) will be a more meaningful summary statistic if the majority of tows are fished until the net is full and before a maximum duration has been reached.

Standardized data reporting sheets will be provided by the Groundfish Forum to all observers. In addition, all observer crews will be given training on data recording procedures and representative sampling using basket sampling techniques.

Experimental Design

The experimental design describes the way the standard and treatment trawl gear are deployed in time and space. To minimize experimental error, a randomized block experimental design will be employed. Bergh et al. (1990) found that randomized block designs substantially reduced the experimental error in alternative trawl gear experiments over completely randomized designs. Two consecutive successful trawls will constitute an experimental block. Within a block, the order of standard and treatment trawl gear will be randomized.

The observer on board the fishing vessel will be in charge of designating the sequence for the trawl gears to be tested. The vessel captain (or the employee in charge of fishing operations) will be informed of the sequence after the decision to drop the net has been made. Randomization,

based on random sampling table, will help assure trawl sites are not selected with preconceived notions about gear performance or anticipated catch. The randomization will not completely eliminate the potential for human bias. However, having the vessel captain blind to the trials is impractical. Standardization of trawl duration until the net is full or a maximum time has been attained should also minimize between-trawl variance and fishing bias. Success of the experimental fishery will be measured by the number of successful test blocks conducted and not by the number of trawls. The observers will be trained on the importance of the production of useful test blocks and the criteria for successful production. The observers will be trained in ways to maximize the number of test blocks when unexpected test conditions arise and an adjustment in test sequencing is necessary.

The experimental blocking is important because it helps eliminate vessel-to-vessel differences and some of the differences in catch performance within a vessel over time and locale. Trawls within a block will be restricted to sequential trawls under similar conditions. Restrictions on replicate trawls are to assure similar catch-effort performance among trawls and to reduce the magnitude of the experimental error.

The actual mechanisms associated with escapement of roundfish through the experimental open top panel are unknown. Among the possibilities is the prospect that the roundfish react to visual cues. If true, than the effectiveness of the open panel might be influenced by light conditions and hence, by the depth of the trawls, and more importantly, by day and night time conditions. To assess the influence of light conditions, experimental blocks will be collected under day and nighttime conditions. Statistical analyses will assess both the effects of gear and the influence of lighting on catch performance of the experimental gear. Separate analyses will be performed for day and night trawls to investigate the influence of the open mesh panel on fish catch.

Statistical Analysis

The randomized block design for the fishing experiment can be analyzed as a two-way analysis of variance (ANOVA) or under this simple two-treatment design, as a paired t-test. Analysis of covariance (ANOCOV) may be used if trawl depth, duration, lighting, or other auxiliary variables are found to be related to catch. Variables such as catch weight (f and r will be log-transferred before analysis to stabilize the variance and achieve additivity. Mean lengths ($\bar{f}$ and $\bar{r}$) will likely be analyzed using the untransferred random variables while proportions(p, C_r, and C_f) may be best analyzed using a logistic transformation. Proper data transformations will be based on Box-Cox (Neter et al. 1990: 149-150) analysis and residual plots.

The statistical analysis will test the null hypothesis:

$$H_o: \ \mu_t \geq \mu_c \tag{1}$$

against the alternative one-tailed hypothesis

$$H_a: \ \mu_t < \mu_c$$

that roundfish bycatch is less in the treatment/experimental trawl gear than in the control/standard gear. This set of one-tailed hypotheses will be tested using variables (r, p). For the other response variables (f, C_r, C_f, $\bar{f}$ and $\bar{r}$), the analyses will test the null hypothesis

$$H_o: \ \mu_t \leq \mu_c \tag{2}$$

against the alternative one-tailed hypothesis

$$H_a: \ \mu_t > \mu_c \ .$$

All tests will be performed at a significance level of $\alpha = 0.10$. Separate analyses will be performed

for experimental blocks collected under daylight and nighttime conditions. The experimental design for this test fishery does not permit a direct test of gear-by-nighttime interaction. Possible interactions will be inferred from the results of the separate daytime and nighttime responses. Light conditions may also be used to as a covariate in analyzing the catch data. Light conditions will be measured using portable photometers aboard the fishing vessels and ANOCOV will be performed to test the relationship between gear effects and lighting. The ANOCOV will be evaluated as an alternative to performing separate ANOVAs for daylight and nighttime fishing conditions.

In addition to statistical tests, estimates of the magnitude of the experimental gear effects will be calculated. Relative change (RC) in performance will be estimated by

$$RC = \left(\frac{\hat{\mu}_t}{\hat{\mu}_c} - 1\right) 100\%$$

and associated variance

$$\hat{Var}(\hat{RC}) = (\hat{RC})^2 \left[\frac{\hat{Var}(\hat{\mu}_t)}{\hat{\mu}_t^2} + \frac{\hat{Var}(\hat{\mu}_c)}{\hat{\mu}_c^2} - 2\frac{\hat{Cov}(\hat{\mu}_t, \hat{\mu}_c)}{\hat{\mu}_t \hat{\mu}_c} \right] ,$$

where μ_t is the mean for the treatments trials and μ_c is the mean for the control trials. Separate estimates of RC will be calculated for daylight and nighttime fishing trials. Ninety-percent confidence intervals will be calculated according to the formula

$$\hat{RC} \pm t_{df,0.10} \sqrt{\hat{Var}(\hat{RC})}$$

where t has degrees of freedom (df) equal to the degrees of freedom for the error term in the ANOVA and selected at $\alpha = 0.10$ two-tailed.

Length-frequency distributions will be calculated and displayed for all major species sampled by the observer. Histograms of length-frequency data will be provided. Separate histograms will be provided by species, gear type, and day versus night conditions. Inspection of the graphics may help reveal quantitative changes in fish catch not caught by the ANOVA analysis.

Anticipated Statistical Power and Sample Size

The study is anticipated to include six participating vessels that are likely to generate over 300 trawls during the approximate two-week study. These 300 trawls represent as many as 150 test blocks of fishing trials. Furthermore, these blocks may be subdivided into daylight and nighttime conditions. Approximately, two-thirds of the blocks will be collected during daylight hours (e.g., 100) and another one-third during nighttime conditions (e.g., 50). Based on these anticipated sample sizes, the anticipated statistical performance of the experiment can be evaluated.

The noncentrality parameter for the F-test of hypothesis (1) or (2) can be written

$$\phi_{1,n-1} = \frac{1}{\sqrt{2}} \frac{\sqrt{n}\,|\ln(1+RC)|}{\sqrt{2CV^2(1-\rho)}} \qquad (3)$$

where

CV = coefficient of variation (i.e., s/μ) among replicate trawls,

ρ = correlation between catches of the standard and experimental gears,

n = number of two-trawl blocks performed.

Power to reject the null hypothesis of equal catch under standard and experimental trawl gear conditions can be calculated from Equation (3) using preliminary values of CV and ρ.

Using observer data from the North Pacific groundfish industry for 1996, catch data were analyzed to provide preliminary survey data to perform sample size calculations. The fraction of roundfish in the catch (p) was estimated to have a value of 0.186 with a CV of 76.03% and a correlation between replicate trawls of $\rho = 0.378$. Figure 1 plots the power to reject the null hypothesis (1) at a significance level of $\alpha = 0.10$ as a function of the number of replicate trawl/treatment and anticipated relative change. With a total of 150 test blocks, the study has approximately a 60% chance of detecting a 10% decline in the fraction of catch that is roundfish. For example, a relative change of -10% corresponds to the fraction of roundfish decreasing from 0.186 to 0.167. This same effort has approximately a 98% chance of detecting a 20% decline in the fraction of the catch that are roundfish. Other levels of anticipated performance can be read directly from Figure 1. One-hundred daylight test blocks would have a power of 90% to detect a 20% decline in the percent of roundfish catch. As few as 50 nighttime blocks would have a power of 90% to detect a 30% decline in percent of roundfish catch at $\alpha = 0.10$ one-tailed. There is also certainty of detecting the 70% to 80% decline in roundfish catch if the reduction of roundfish is as great as anticipated from preliminary trials of the open panel intermediate (Rose, 1995).

Figure 2 presents sample size curves for detecting relative decreases in the mean weight of roundfish/trawl. Preliminary survey data provided values of $\bar{x} = 60.5$ kgm, $CV = 65.9\%$, and $\rho = 0.468$. Inspection of Figure 2 suggests about an 70% chance of detecting a 10% decline in roundfish catch and almost certainly ($1 - \beta = 0.98$) of detecting a 20% decline in catch with 150 test blocks.

In summary, the power calculations suggest almost certainty ($1 - \beta > 0.98$) of detecting a 20% shift in response variables at $\alpha = 0.10$ with the 150 test blocks. As few as 50 nighttime blocks have better than a 90% chance of detecting declines in bycatch of 30% or more at $\alpha = 0.10$ one-tailed. *Post hoc* power calculations will be performed after the test fishery to evaluate those variables not found to be statistically significant. Such power calculations will be used to help interpret the nonrejection of the null hypotheses.

Figure 1. Power to detect a decrease in roundfish catch as a function of the number of replicate (n) control and treatment trawls, and relative change (RC) at α = 0.10 one-tailed.

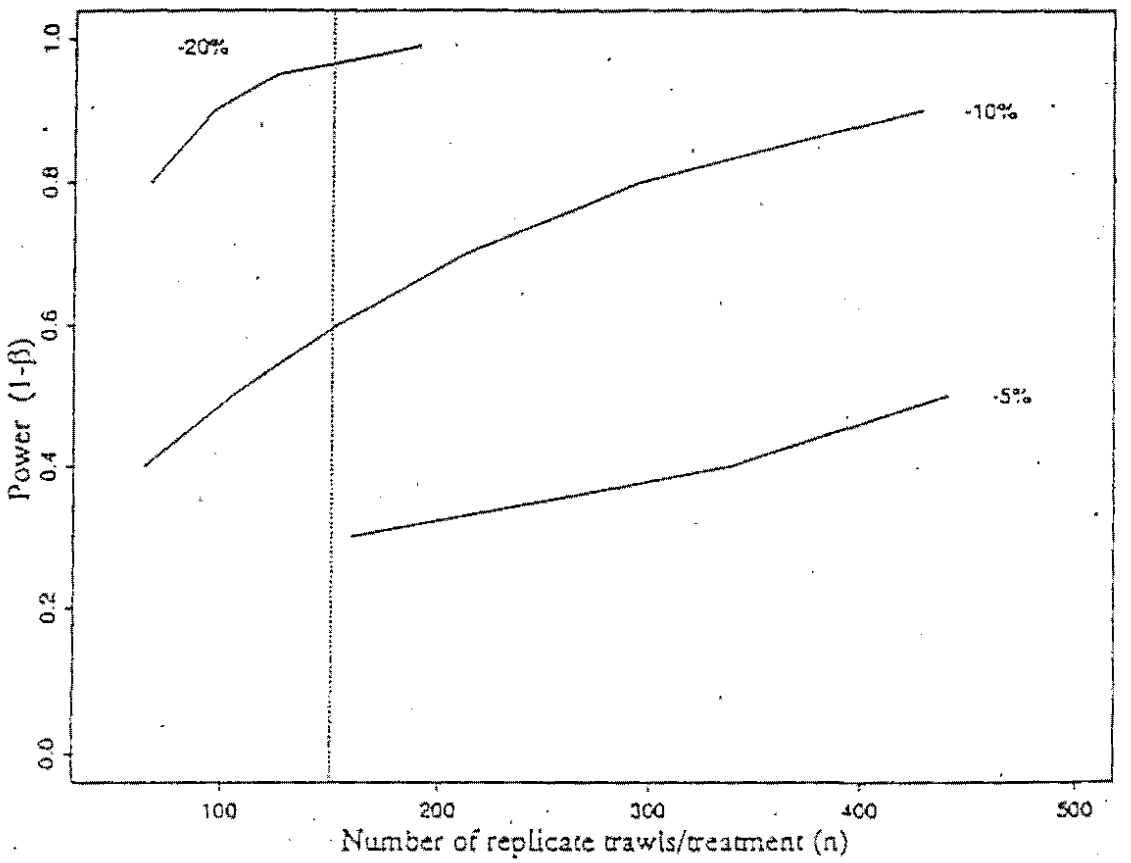
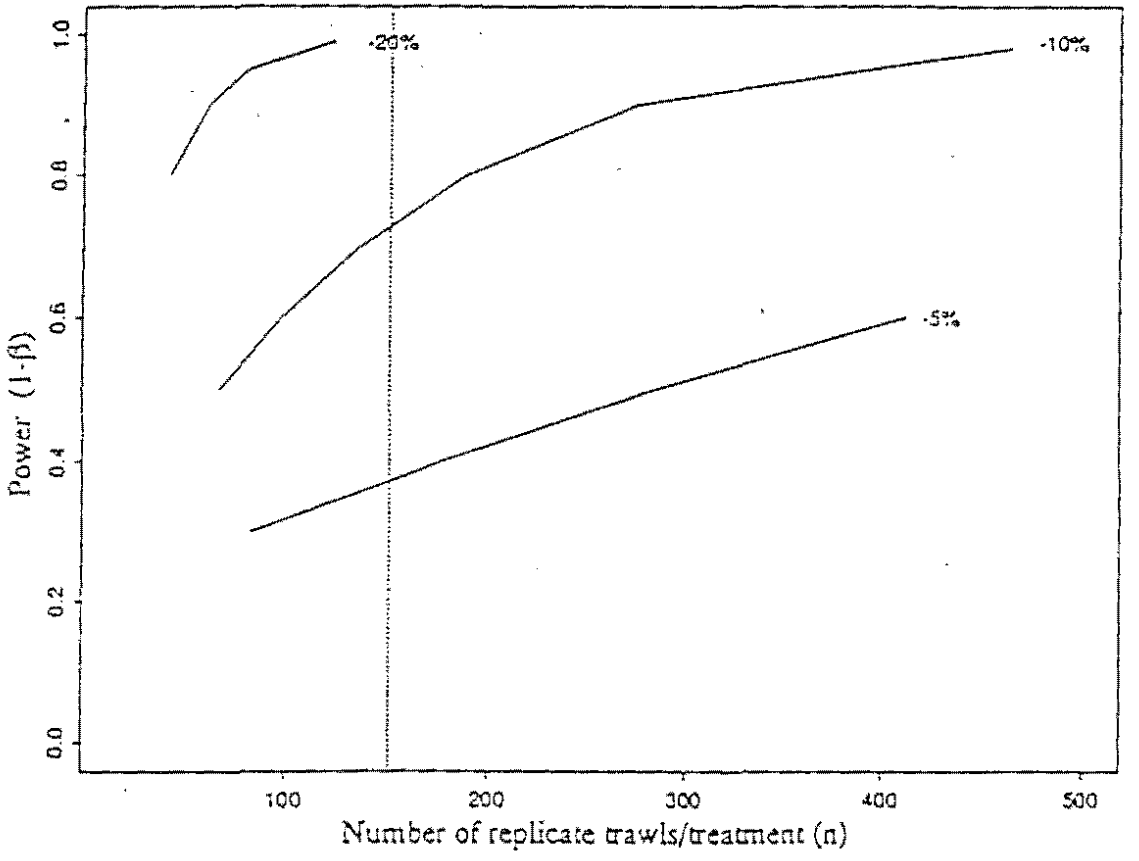


Figure 2. Power to detect a decrease in the mean weight of roundfish per trawl as a function of the number of replicate (n) control and treatment trawls, and relative change (RC) at $\alpha = 0.10$ one-tailed.



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Document Print Summary

Description: Appendix to Groundfish Forum

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Total	14
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Document Revision	1.032
Total Words in Document Body	2538