Revised application for an exempted fishing permit (EFP) to evaluate the effectiveness of a halibut excluder for the GOA trawl cod fishery
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Purpose and Goals of the EFP: The objective of the EFP is to conduct a rigorous field test of a halibut excluder designed to reduce halibut bycatch rates for smaller "inshore" catcher vessels that target Pacific cod in the Gulf of Alaska. The performance goal for this project is to reduce the halibut bycatch rate in terms of kilograms of halibut per metric ton of allocated groundfish by at least 40% over an unmodified net. At the same time, reductions in catch rate for the target species should be minimized (measured in terms of metric tons of cod per hour) compared to an unmodified net. Finally, the test must also evaluate the functionality and handling aspects of the halibut excluder for use on typical Gulf of Alaska trawl vessel which have limited deck space and may have aft net reels only. Considerations for functionality and handling involve evaluating whether the device can be rolled onto the typical vessel's net reel without damage. Other performance variables include resistance to clogging and other maintenance problems. All these performance considerations are critical to the development of an effective halibut excluder which in turn will contribute to the achievement of the total allowable catch of Pacific cod within the halibut PSC cap for the GOA cod fishery.

Justification for the EFP: Mandates to reduce bycatch and bycatch mortality are set out in the Magnuson-Stevens Act. The trawl cod fishery has greatly exceeded its seasonal halibut allowance during the last three September 1 cod fisheries. Additionally, the PSC overage created by the fall inshore cod fishery has had collateral effects on the early closure of the deep water flatfish fishery which was closed prior to the attainment of its halibut bycatch limit to help reduce the overage in the overall halibut PSC cap for the GOA trawl fisheries. The test of a halibut excluder proposed in this application can only be successfully undertaken outside of the regular open access fishery. This is because cod trawlers cannot effectively test the halibut excluder via the regular cod fishery in a manner consistent with the experimental protocol described below. Additionally, *ad hoc* development of bycatch reduction devices typically does not provide scientifically valid performance data and can lead to abandonment of an experimental device before its actual performance has been thoroughly evaluated.

Names of participating vessels, copies of vessel Coast Guard documents, names of vessel masters: This information will be supplied after the review process is completed.

Target and incidental species harvested: The Table 2 from the EFP application materials (included immediately below in this summary) provides total estimated catches for the EFP as well as per vessel estimates of catches. The applicant is requesting that 1,300 MT of groundfish (approximately 950 tons of which is expected to be Pacific cod) and 80 MT of halibut mortality be made available for this EFP test and that these not count against the TACs and trawl halibut prohibited species cap for the Gulf of Alaska. The experimental design section of the description of the EFP research below explains how the requested quantities of groundfish and halibut PSC mortality were derived. As is explained below, actual halibut mortality rate is expected to be lower because the actual mortality rate will likely be lower that the "official" mortality factor for the fishery that was applied for the estimates in the table below. This is because once accounted for by sea samplers aboard each EFP vessel, halibut will be returned to the sea with minimal injury. We expect that the halibut taken for each tow will be returned to the sea within 20 minutes of the time when the boat's cod end is brought on deck. Further, retention of groundfish during the EFP fishing will be conducted manner that complies with the MRA regulations for the regular GAO trawl cod fishery.

Table 2: Estimated groundfish catch and halibut mortality of the halibut excluder EFP

	number of tows	trips	groundfish (MT)	P. cod (MT)	other groundfish (MT)	Halibut catch (MT) assuming 40% excluder effect and excluder used on treatment tows for EFP(50% of tows)	Halibut mortality (MT) assuming "official" mortality rate (61%)
Vessel 1	15	2 or 3	215	156.4	24.5	21.6	13.2
Vessel 2	15	2 or 3	215	156.4	24.5	21.6	13.2
Vessel 3	15	2 or 3	215	156.4	24.5	21.6	13.2
Vessel 4	15	2 or 3	215	156.4	24.5	21.6	13.2
Vessel 5	15	2 or 3	215	156.4	24.5	21.6	13.2
Vessel 6	15	2 or 3	215	156.4	24.5	21.6	13.2
EFP total			1,290.0	938.4	147.2	129.6	79.1

Other requested exemptions from the regular fishery regulations for the EFP: The applicant requests that the six vessels selected for the EFP testing be exempted from their regular (30%) observer coverage requirements. The exempted fishing permit holder will require that each vessel participating in the test will have a “sea sampler” on board the vessel throughout its EFP fishing and that halibut catch is estimated via an on-deck census for each tow during the EFP testing. The at-sea sampling procedures needed for the EFP will focus on accounting for the effects of the excluder on halibut catch rates. This sampling procedure differs from the normal sampling priorities and procedures of at-sea observers techniques used for the regular fishery. Species composition sampling will occur at the processing plant where the at-sea observers will conduct species composition sampling during the offload and prior to the EFP vessels returning to the EFP testing. Sea

samplers hired for this project will be former or current fishery observers who are in good standing with the Observer Program but are not currently working as observers for the regular groundfish fishery.

Disposition of allocated groundfish species caught in the EFP: Participants selected for participation in the experiment can legally retain all groundfish catches in accordance to the MRA standards for GOA Pacific cod fishery that would be applicable to the open access fishery.

Expected impacts on marine mammals and endangered species: None. Fishing will be conducted in accordance with the regulations affecting the areas open to Pacific cod directed fishing for the Gulf of Alaska (when that fishery would normally be open). Further, according to the principles of the current Biological Opinion for the Western population of Steller sea lions, fishing for cod during the time when the EFP test will occur (August) is thought to have lesser effects on sea lion foraging opportunities than during the winter months.

Type and size of vessels and gear: Expected participants are Central Gulf of Alaska shoreside catcher vessels that commonly participate in trawl cod fishery in the GOA. Gear will be normal cod trawls with modifications in the net to exclude halibut (modifications to experimental tows only) and slower towing speeds for vessels fishing with the excluder device.

Approximate time and place for exempted fishing under EFP: The field test portion of the EFP is expected to last approximately 10-14 consecutive days sometime in August 2006. The location for the test will be the common areas of the Central Gulf of Alaska where directed trawling for Pacific cod occurs.

Signature of Applicant:

Detailed explanation of the request for and EFP to develop an effective halibut excluder for GOA trawl catcher vessels targeting cod

Part One: Introduction

Purpose and need for an EFP to test the performance of a halibut excluder device for the Gulf of Alaska cod fishery

For the last two fall (B season) cod fisheries, halibut mortality attributable to the trawl cod fishery in the Gulf of Alaska has greatly exceeded its seasonal allowance. Overages of the fourth-quarter halibut PSC cap (for the GOA shallow water complex) amounted to roughly 550% of the seasonal cap in 2004, and 350% in 2005. The fall cod TACs for the Central and Western Gulf are managed under the same seasonal halibut mortality cap which is the September 1st halibut PSC allowance of 150 metric ton of halibut mortality. Because of the large overages in the halibut cap, the deep complex flatfish fisheries also did not open for the October fishery to prevent exceeding the annual halibut mortality cap for the GOA.

In 2004, the Central Gulf was able attain its cod TAC (actually 20% overage) but clearly would not have been able to do so had the fishery been closed when it had actually attained its seasonal halibut mortality cap. In 2005, fall cod catch fell short of the CGOA B

season cod TAC by approximately 1,700 metric tons (12%) and once again, this relatively large percentage of the TAC that was harvested would not have be possible had the fishery been limited to its seasonal halibut mortality allowance. Approximately 60% and 0% of the B season cod TAC for the Western GOA was taken in 2004 and 2005 respectively. These percentages similarly reflect fishing that was funded by the overage in the seasonal halibut mortality allowance. Table 1 below reports the catch and halibut mortality performance figures for the fall (B Season) trawl cod for the last three years based on data published on the NOAA Alaska Region website.

Table 1: Cod and halibut catch in WGOA and CGOA 2003-2005

Year/Area	fall inshore cod TAC (MT) per area	Cod catch (MT)	Percent taken	GOA-wide halibut mort. cap (MT)*	GOA-wide Halibut mortality (MT)*	Percen t usage
Western Gulf of Alaska						
2003	5,562	3,786	68%	150	n/a	n/a
2004	6,104	3,677	60%	150	n/a	n/a
2005	5,647	1,641	29%	150	n/a	n/a
Central Gulf of Alaska						
2003	8,166	4,482	55%	150	287	191%
2004	8,093	9,761	121%	150	819	546%
2005	9,031	8,008	89%	150	520	347%

Note: The Central and Western Gulf of Alaska trawl cod fisheries are managed under the same halibut PSC cap

While the degree to which the seasonal halibut allowance was exceeded in 2003 was lower, the same basic pattern occurred for fall cod in both the Central and Western Gulf. Approximately 55-70% of the TACs were taken in the two management areas and the seasonal halibut allowance was exceeded by 191%.

According to participants in the trawl cod fishery, the occurrence of overages in the shallow water complex halibut PSC allocation is in part due to the 2001 Steller sea lion protection regulations. Changes in the rules governing the cod fishery in 2001 shifted a larger portion of the trawl cod fishing to later in the year than would otherwise have occurred. Trawlers have testified to the North Pacific Council that halibut bycatch rates for cod fishing were driven up when a larger portion of the fishing was mandated to be later in the year. The reason offered for this was that fishing was shifted outside of the timing of pre-spawning aggregations of cod that peak in the spring. Lower catch per unit of effort is thought to have occurred because cod are less tightly schooled in the fall months. This spawned longer tows and higher halibut bycatch rates as more area is swept with lower CPUE. Another factor that has been identified

by the trawl industry is that moving more cod fishing to the late summer and fall actually places more of the fishery into a time window when there is more spatial overlap with halibut. Halibut are thought to migrate to shallower water in the summer and fall which would suggest greater overlap with Pacific cod.

Previous efforts to date to reduce halibut bycatch in the shoreside trawl fisheries of the Central Gulf of Alaska: For several years, Gulf trawlers have requested that the Council and NMFS consider changing the seasons of trawl cod fishing to closer to the way they were prior to the 2001 sea lion regulation changes. But given the persistence of low population levels for sea lions, it appears that major changes to cod seasons appear unlikely for now. For this reason, in 2004 Central Gulf trawlers initiated development of new approaches to the management of halibut bycatch.

Starting in 2004, Central Gulf trawlers undertook two new initiatives to reduce halibut bycatch and increase utilization of cod and flatfish ABCs. Through some funding made available from the Alaska Fisheries Development Foundation (AFDF), the Alaska Draggers Association contracted for a study of spatially-specific tradeoffs between target and halibut bycatch rates. This study examined the question of whether observer data could be used to identify fishing areas and seasonality of fishing that would be expected to produce positive tradeoffs in target catch rates relative to halibut bycatch rates. The results showed that some fairly strong patterns of positive tradeoffs did exist in observer data from 2000 through 2003. But the lack of an individual quota or cooperative management system makes effective utilization of these opportunities difficult at best. This is because many of the fishing grounds where improved tradeoffs might be found are in fact rather distant from the port of Kodiak, the major Central Gulf of Alaska fishing port. Under a race for fish that exists in the current Olympic fishery, the prevailing incentive is to race to catch fish as fast as possible before the cod TAC or the halibut PSC cap is attained in lieu of spending more time traveling to more distant fishing grounds.

Through continued funding from AFDF in 2005, the Alaska Dragger's Association organized an industry-led halibut bycatch monitoring program modeled after the Sea State program in the Bering Sea. This effort attempted to use industry self-reporting of observer data on a fast turn-around basis to identify halibut bycatch "hotspots". Once identified, peer pressure was mobilized in an effort to get fishermen to move to areas with lower bycatch rates. While some success with data reporting and peer pressure was achieved, the current regulations governing deployment of observers proved to be an impediment to successful cooperative bycatch avoidance. Due to logistical problems with getting observers in Gulf ports and under a system where fishermen are responsible for selecting when to carry observers on their vessels to meet a 30% of the fishing days coverage requirement, there are periods of time when observer coverage levels are high and others where coverage is minimal. For the 2005 initiative, the rather uneven observer coverage over the weeks of the fisheries essentially failed to provide a consistent source of spatial information on halibut bycatch over the course of the fishery. The self reporting did produce more timely catch and bycatch data for in-season managers than would have been available through the normal data reporting system and this allowed fishery participants to alert NMFS of the need to close the fishery earlier than would otherwise have occurred due to the higher than expected halibut bycatch usage.

Evolution of the trawl gear modification idea for reducing halibut bycatch: Throughout these efforts to improve industry management of halibut bycatch in the Central Gulf trawl fisheries since 2004, fishermen have repeatedly observed that trawl gear modification to reduce halibut bycatch in the flatfish and cod fisheries may be the most feasible approach to the objective of increasing yields of target species and avoiding overages in the halibut caps. The prospect for use of these existing devices was generally thought to be low due to the fact that rigid halibut sorting grates cannot easily be rolled onto trawl net reels. This limitation is particularly problematic for catcher vessels with aft net reels, a set up that is common on the shoreside-delivery trawlers in the CGOA. Additionally, physical limitations of deck space on shore-based catcher vessels in the Gulf make rigid halibut excluder generally problematic even on vessels with a forward net reel.

To assist the Central Gulf of Alaska catcher vessel fleet with the development of gear modifications to reduce halibut bycatch in the shallow water flatfish fishery, Dr. Craig Rose of the Alaska Fisheries Science Center at the request of the Alaska Dragger's Association conducted a research charter during the summer of 2005. The goal of this work was to explore potential for a "soft" halibut sorting grid constructed of webbing which could easily roll on net reel and thus be useful to Kodiak trawlers. Unfortunately, the video and catch data from the 2005 research showed only very limited selectively was achieved for the soft excluder device and the potential for clogging and tear-ups in regular commercial scale fishing appeared high. The tendency for large halibut and skates to become entrained on the large-mesh soft sorting panel resulted also in reductions in surface area for sorting and high levels of loss of target species.

As the results of this work were disseminated, however, discussions of the potential for an adaptation of one of Dr. Rose's earlier halibut devices for reducing halibut bycatch began. In a 2000 field test in the Bering Sea, that device was shown to reduce halibut catch rates in the Bering Sea trawl cod fishery by approximately 80% while reducing cod catch rates by only 15%. If that device could be constructed of less rigid plastic materials that allow it to be wound onto the net reel, significant reductions in halibut bycatch rates might be achieved. Less dramatic reductions in halibut bycatch would be expected in the Gulf of Alaska, however, given the larger size of halibut relative to cod compared to the Bering Sea. But even with most of the reduction aimed at halibut in the smaller size range, such savings could be worthwhile. Additionally, fishermen pointed out that other measures such as adjustments in towing speed might be used in combination with the excluder to reduce catches of larger halibut.

An attractive element of the idea is that the cod/halibut excluder device relies on a behavioral escapement response instead of relying on the sorting of all catch as it passes through a grate across the intermediate of the trawl. Thus larger fish such as skates would be far less likely to clog the flow of fish through the net. From this thinking emerged the central idea leading up to the EFP test proposed in this application.

Part Two: Design elements of EFP tests of a halibut excluder for the GOA trawl cod fishery

Objectives for this test of a halibut excluder for the GOA cod fishery

The overall objective of the exempted fishing permit (EFP) requested in this application is to conduct a scientifically valid test of the adapted halibut excluder described below. While valid in terms of scientific methods, the objective is also to conduct testing under conditions closely resembling the actual fishing done on Central Gulf of Alaska trawlers, particularly the fishery as it is expected to be conducted in the future under Gulf rationalization. The method used for determining the effect of the excluder compared to an unmodified net is through paired comparisons of tows conducted simultaneously in the same fishing grounds. Simultaneously conducting experimental and control tows should help to reduce variation in fishing conditions. This is important because conditions affecting halibut bycatch are known to shift in a matter of hours in the Gulf of Alaska

In addition to requesting an allocation of groundfish and halibut PSC that will not be deducted from the Central GOA TAC nor the Gulf-wide halibut PSC cap, the EFP seeks permission to redirect observer sampling duties slightly in order to address the scientific priorities of EFP test. This set of adjustments to fishing and sampling under the EFP will allow participants selected for the test to conduct fishing according to the experimental protocol as well as allowing adequate enumeration of the effects of the device on cod and halibut catch rates. The ability to sell all legally retainable groundfish (as per the regular directed fishing allowances for the GOA cod trawl fishery) will help offset the costs that EFP participants will incur purchasing necessary gear for the test and carrying and assisting with the testing and catch sampling protocol.

Experimental Fishing and Catch Accounting Protocol for the EFP test

Based on the experimental design parameters discussed below, a total of 46 pairs of tows in the cod target are needed to ensure a sufficiently high probability of being able to correctly conclude that the device actually achieves the expected reduction in halibut bycatch rates. After careful consideration, the use of a single vessel to conduct the test was rejected in favor of using six vessels working in three sets of pairs for the following reasons. The foremost reason for selecting six vessels was that cod catch rates and halibut bycatch conditions are known to change rapidly in the Gulf of Alaska. A single GOA catcher vessel does not have the capability to rapidly switch between two different nets (control and experimental) with relative ease. Likewise, removal of the excluder device from the trawl intermediate into which it is sewed for alternating tows is not thought to be practical because the second tow in a pair would likely be started at least three hours after the first tow in the pair was completed. The long delay between tows could greatly increase the variance that would need to be explained in the test. Therefore, while conducting the test with a single vessel might be considered the best way to minimize the “boat effect” on catch rates, the benefit from being able to conduct simultaneous control and treatment tows is thought to be the most critical for the success of the test. Finally, given the relatively large number of pairs of tows needed for the experiment, it is more practical to use three sets of paired vessels so that the testing can occur over a manageable time period.

So the pairing for the EFP will be done as simultaneously paired tows conducted by two vessels forming one of the three pairs for the EFP testing. One vessel in a given pair will make a tow with the excluder and the other will tow without the excluder and cover an adjacent towpath where ambient conditions can be assumed to be as close as possible to the tow with the excluder. Each of the six vessels will make a total for 15 tows during the experiment and approximately half of each participating vessel's tows will be made with the excluder installed in the net. Vessels selected to conduct the test will be typical of the catcher vessels that participate in the Central GOA inshore cod fishery. Companies applying for the EFP field work will propose their vessel for the EFP as well at naming another vessel that they wish to be paired with during the EFP. In the case where a single company owns two vessels that are proposed as a pair for the EFP, one application for both vessels will suffice provided the separate required information for each vessel is provided in the application. Joint applications are also acceptable provided the necessary information is provided for each vessel in the application.

Each vessel comprising a pair must be sufficiently well matched in terms of horsepower, fishing characteristics, and nets used for the EFP so as to minimize variation in the catch that is due to factors other than the halibut excluder. This is necessary to minimize the "boat effect" as a source of variation. One vessel in each pair will be randomly selected to have the halibut excluder installed for its first fishing trip and the other vessel will fish without the excluder for its first trip. The excluder will be switched to the other vessel in each pair for the second trip and so forth for a total of 15-16 tows per vessel during the EFP (approximately 2-3 trips overall per vessel based on normal tow size in the regular cod fishery). The vessels working together to form experimental pairs (simultaneous treatment and control tows) must fish in close proximity and in unison so that they essentially cover the same fishing grounds as outlined below.

For each pair of vessels, fishing locations and tow paths will be selected by the vessel that does not have the excluder installed during that trip. The vessel equipped with the excluder will have to simultaneously conduct matching "shadow tows". This means towing immediately adjacent to the towing path of the vessel without the excluder. The vessel towing the net without the excluder will also be responsible for deciding when the nets for the two vessels should be hauled back. Under normal circumstances, the vessel without the excluder will contact the other vessel and announce that it is time for both vessels to haul back. One exception to this rule is when either one of the vessels needs to haul back due to a large quantity of catch for a particular haul. In that event, both vessels will have to haul back at that time. An overall time limit of four hours of towing duration will also be in effect during the EFP.

In reviewing applications for participation in the test, the NMFS review team formed for this purpose will select applicants based on the goal of minimizing "vessel effect" between the pairs of vessels and the nets used by each pair of vessels in order to minimize variation from sources other than the effects of the excluder. Factors such as experience fishing together and information to demonstrate a good working relationship will also be taken into consideration by the NMFS application review team. Information on how vessel owners can apply to participate in this EFP will be made available through a request for proposals (RFP) developed by the

EFP principal investigator (applicant) in consultation with the NMFS application review team. Criteria that will be used to judge applications will be clearly spelled out in the RFP materials.

Once the nets are hauled back for the pair of vessels working together, sea samplers hired for this project will work with the vessel crew to account for the halibut bycatch from each (experimental and control) net in the experimental pair. There will be one sea sampler on each vessel throughout the duration of the EFP trials. The cod end will be emptied into the vessel's holding tank(s) at a sufficiently slow pace to allow crew members working under the direction of the sea sampler to remove all the halibut from the catch. Crew members will be responsible for carrying or sliding the halibut to the area where the sea sampler is stationed so that the sea sampler can "tick off" the length of each halibut on a length grid for later conversion into number and overall weight of halibut per tow. Vessels participating in the EFP must agree in writing to retain all catches except Pacific halibut in order to allow for dockside sampling to accurately estimate species composition (per trip) so that all EFP catches can be accounted for. Sea samplers will do species composition sampling at the processing plant during the vessel offload and the vessel will remain at the processing plant until all fish from a trip are offloaded and species composition sampling by the sea sampler is completed.

Because the catch sampling and accounting needs for this experiment require changes to the normal duties of fishery observers, we are requesting that we be permitted to substitute our sea samplers on each vessel for their normal observer coverage. As described before, we need to place a higher priority on accounting for halibut catch than would otherwise occur in regular NMFS observer coverage. Additionally, we need to have sea samplers on each vessel for the duration of the experiment and we need our sea samplers to account for the halibut catch for each tow.

Within-pair effects of the excluder on halibut catch rates (compared to the unmodified net) will be measured on a kilograms per hour and kilograms per ton of groundfish basis. The latter is clearly more problematic on a tow by tow basis because groundfish weight per haul can only be roughly determined by the volumetric estimate of each codend. Effects on halibut or cod catch rate per ton of groundfish, however, can also be estimated on a trip basis through catch weight by species from the processing plant. To achieve a sufficiently accurate of overall catch on a per trip basis, however, all vessels in the experiment will have to retain all catch except halibut during the EFP testing. Halibut weight per tow will be determined as described above.

Each sea sampler will maintain halibut catch data on a tow by tow basis as well as time and tow number references to ensure that the catch comparisons between experimental and control tows can be compared between the simultaneous sets of pairs achieved for each of the two sets of paired vessels. While the three sets of paired vessels may commence the test at the same time, it is probable that differences in fishing, pace of sampling and catch accounting, and time needed for offloading catch from vessels to shoreside processors will mean that the three pairs of EFP vessels will not work in concert throughout the EFP. This is not detrimental to the

experimental goals although some overlap in fishing areas and timing would be helpful for making subjective evaluations of the potential differences between the two sets of paired vessels participating in the EFP test.

Desirable aspects of a halibut excluder for GOA cod trawls

The following are aspects of an effective excluder device that is practical to the industry.

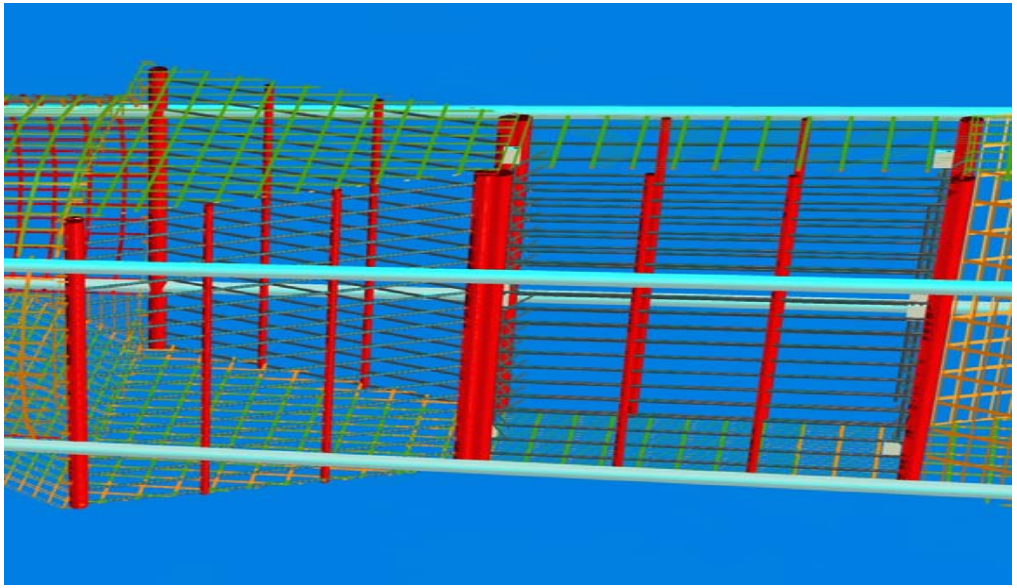
1) Releases a large percentage of the halibut that come into the trawl unharmed
2) Avoids significant reductions in cod
3) Functions with few failures or break downs and be resistant to clogging and debris jams.
4) Rolls easily onto the net reel and is not be damaged by the tension of the reel.
5) Overall durability and ease of function
6) Constructed from affordable materials that are readily available.

Design Elements of the halibut excluder for the EFP test:

The device that will be tested during the EFP is designed to meet the performance criteria above in the context of the deck space and net reel configurations and limitations of shoreside delivery trawl vessels that work in the Central Gulf of Alaska cod fishery. The earlier development and field testing of the "slot panel" excluder for the Bering Sea cod fishery resulted in the achievement of a greater halibut reduction than would be expected from its use in the Gulf cod fishery due to the relatively small size of Bering Sea halibut compared to those in the Gulf. Our expectation, however, is for at least a 40% reduction in halibut bycatch in terms of kilograms of halibut per hour or per ton of groundfish.

To maximize the functionality of fishing with the device in the Gulf of Alaska, we have selected a slotted escape panel (Figure 1) for the test in lieu of a rigid or soft (webbing) grate that is rigged to cut across the intermediate of the trawl. The grate across the intermediate design (whether rigid or flexible) has been successful for reducing halibut in the deep water flatfish fishery of the GOA but has not proven to be effective in the shallow water flatfish or the cod target fishery. Grates across the intermediate are designed to sort halibut on the concept that the smaller target will swim through the grate but halibut, which are larger, cannot do so and therefore swim up and out an escapement portal aft of the excluder (see Figure 2 for an example of a rigid sorting grate that is place across the intermediate). But this approach is problematic for the cod and shallow water flatfish targets because the skates tend to become stuck on the grate and cod escapement through the escapement portals can be high. Slotted panels installed on the sides of the intermediate are less likely to plug the intermediate than for rigid or webbing sorting grates that rely on the principal of smaller fish passing through a grate placed across the intermediate.

Figure 1. Slotted escapement panel halibut excluder



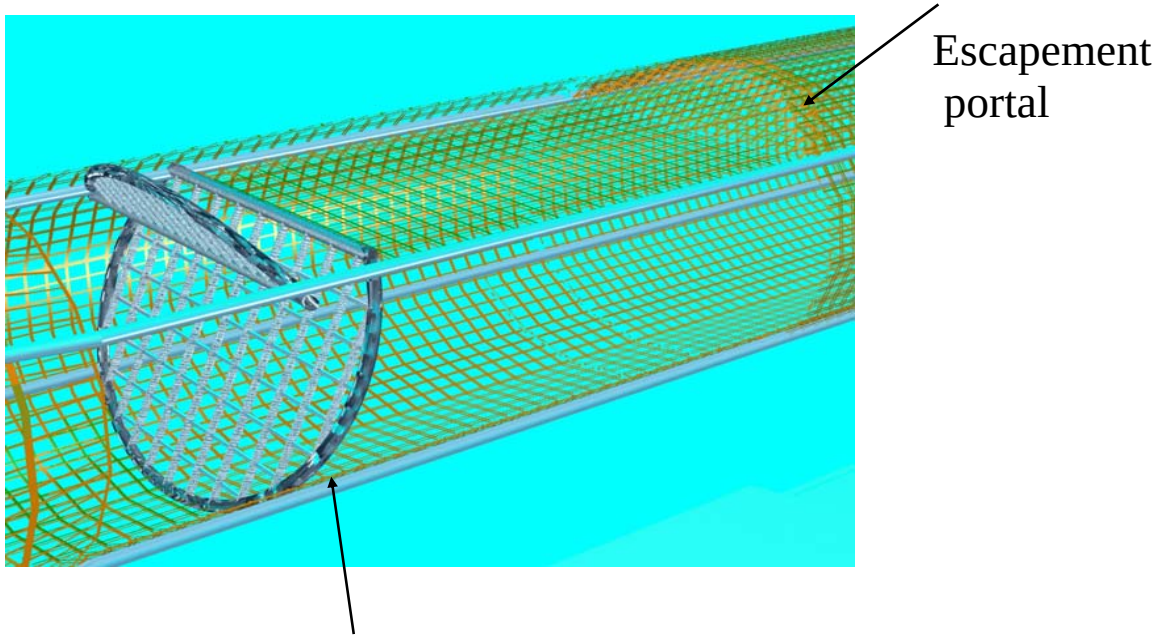
With the slotted escape panels placed on the sides of the intermediate, rods are tied into the intermediate to narrow the passage and slow down the water flow where the escapement slots are located. The sorting principal is that the relatively smaller-headed and flatter halibut will swim to the sides and pass through the slots, thus escaping the net. A smaller proportion of the cod can take advantage of the slots to escape because their relatively larger heads do not allow them to slip through the slots. The cod that can escape are also more likely to be smaller fish that are not the target of the fishery.

An important performance attribute here is that skates and large halibut that fail to respond to the other escapement enticements in the forward part of the net (the slower towing speed and sweep diverters) are likely to pass through the intermediate despite being slowed up where the intermediate is narrowed by the rods. Likewise, larger cod, these larger fish will eventually continue back to the cod end instead of clogging the flow of fish through the trawl.

For rigid or webbing sorting grates rigged to sort across the intermediate, the larger fish do not use the escapement portal are likely to become stuck on the grate. This can cause more fish to fail to pass through the grate as designed and eventually the surface area for escapement can become so reduced that all the fish coming down the trawl end up stuck in the intermediate ahead of the grate. For his

reasons, with fishing conditions like those in the Gulf where large skates are often abundant in cod fishing grounds, sorting grates can be extremely problematic.

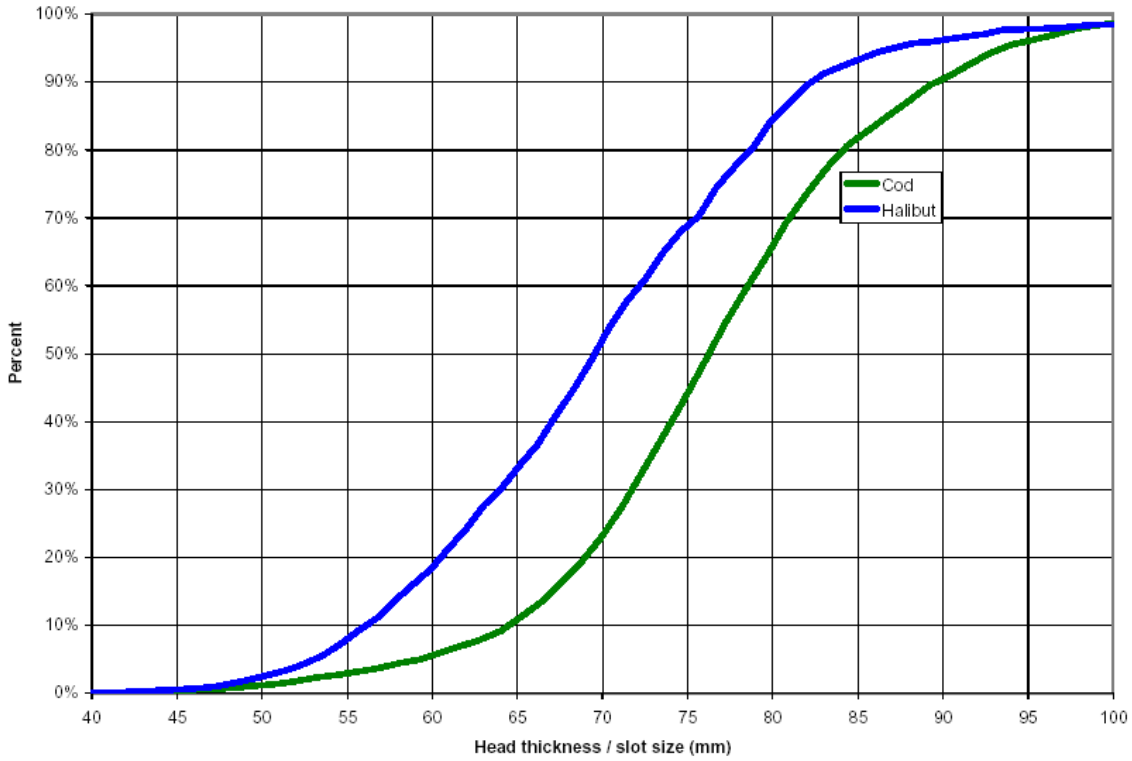
Figure 2: Rigid sorting panel halibut excluder device



To achieve approximately 40% reduction in halibut catch rate, we currently anticipate that the vertical distance between the slots will need to be approximately 66 millimeters. This expectation is based on length composition data from the fall cod fishery over from 2004-2005. Differences in length between halibut and cod from observed hauls are converted into “head size” which is the most important dimension in determining ability to utilize the escapement opportunity between the slots (Figure 3). Even with the expected difference in ability of halibut to swim between the slots compared to cod, we expect that some “tweaks” to the orientation of the slots

to favor the behavioral response of halibut rather than cod will be needed to reduce the escapement of cod. This is because approximately 10% of the cod based on the size would otherwise be able to swim out through the excluder.

Figure 3: Cumulative halibut and cod head thickness expressed in expected



To make the necessary adjustments to the configuration of the excluder prior to the EFP test, Dr. Rose has scheduled some pre-testing in late June or early July of 2006 using video observation capture devices early in the summer of 2006. In this manner, we will have pre-established the configuration that has the best chance of achieving at least 40% halibut escapement and hopefully minimal cod escapement as the gear configuration for the EFP test.

Additionally, we will conduct the EFP test with restrictions on towing speed that are aimed at reducing catch rates for larger halibut. The reduced towing speed will be done only on tows by the vessels that have the halibut excluder installed in their nets. Diverters along the trawl sweeps may also be used in the EFP test to reduce the catch rate of large halibut. The use of diverters will depend on whether work during the pre-test trials suggests potential additional benefit from their incorporation in the test. The combination of these additions to the design of the slotted escapement panels that are principally designed around escapement of small halibut should create a cumulative escapement of at least 40% of the halibut. The length data on halibut catch between the experimental and control tows will help us make some inferences about which of these escapement inducing gear and fishing practices appears to be responsible for the performance results.

Expected benefits from this project:

A detailed report will be provided describing the device, how it was tested, and the degree of halibut and target catch reduction experienced from the test. The report will also hopefully provide some qualitative information that would indicate which factors and design elements were most critical to the effectiveness of the device. For instance, with length composition data on the halibut bycatch for the control and treatment tows, we anticipate being able to have some indicators of the portion of the reduction in the halibut bycatch rate that is likely attributable to the slotted escapement panel device as compared to the part of the reduction that is from the reduction in towing speed. The information from this test should be rather useful to the efforts of GOA catcher vessels to reduce their halibut bycatch rates. The initiative could be in the form of stepped up industry voluntary initiatives for reducing halibut bycatch or even regulations requiring use of the excluder for the GOA cod fishery once its performance is sufficiently demonstrated in the regular fishery. It is also anticipated that once GOA Rationalization is in place, strong incentives for large-scale industry adoption of the halibut excluder device would arise given that fishing cooperatives would likely establish performance guidelines for halibut bycatch reduction or other incentives in terms of the ability to access additional groundfish for fishermen with low halibut bycatch rates.

For the short run, one benefit to the EFP test is that as a condition for being selected for the EFP field testing, all successful applicants will have to agree that if they are selected for the EFP they will commit to using the excluder device in the regular 2006 GOA fall cod fishery starting on September 1, 2006. In making this commitment as part of their applications for the EFP work, a contingency clause would be included such that they would only be committed to using the device in the regular September 1st fall cod fishery opening if the EFP test demonstrated that the reduction in halibut bycatch rates (per hour or per MT of groundfish) was at least 40%

and the loss of cod catch was estimated to be less than 10% by weight. So if the performance of the excluder meets these criteria, then six vessels during the regular fishery can be expected to have lower halibut bycatch rates than the other vessels in the fishery. More importantly, their use of the device in the regular fishery will help demonstrate the feasibility of use of the device to fishermen who are otherwise skeptical about modifying nets to reduce halibut catch rates.

Even if the device is not successful, the experiment has been designed to provide helpful data and information that can be used in the future to reduce halibut bycatch. In addition, the application and experimental process should help foster industry cooperation on the future development of gear modifications to reduce halibut bycatch in the cod and possibly shallow water flatfish fisheries of the Gulf of Alaska.

Part Three: Responsibilities of EFP applicant, NMFS, and applicants for the EFP field testing

EFP Applicant

The EFP applicant and principal investigator, John Gauvin, will administer all aspects of the EFP including development of materials for the request for proposals, project management for the field testing during the EFP, analysis of EFP data, preparation of draft and final EFP reports describing testing methods and findings, as well as other coordination duties necessary to the successful completion of the EFP work. The EFP applicant will supply up to two project field managers throughout the field work to oversee the EFP. The managers will rotate between vessels on different trips and will be available to troubleshoot problems throughout the testing. The EFP applicant will also be responsible for finding qualified sea samplers for the EFP field work as well as scheduling arrangements for ensuring that sea samplers are available for the EFP test. All technical aspects of this work will be undertaken in close coordination and with oversight from Dr. Craig Rose, Alaska Fisheries Science Center, RACE Division.

NMFS Alaska Fisheries Science Center

Dr. Craig Rose has agreed to provide the technical assistance described above in pre-testing the halibut excluder prior to the EFP test so that the EFP can test a device that through video evaluation at least, appears to create useful selectivity. Dr. Rose has also agreed to provide other assistance with technical and analytical aspects of the EFP testing, data analysis, and report preparation. The NMFS AFSC Race Division is also requested to serve as reviewer for EFP vessel applications for the field work. NMFS is asked to provide three NMFS scientists with experience in review of vessel charter applications to rank the applications bases on criteria established in the RFP that will be developed by the EFP applicant. The EFP applicant (permit holder) will first conduct an initial “pre-review” of applications to determine if they are complete. As time allows, applicants for the EFP field work will be informed by the EFP holder of any obvious deficiencies and items missing from their applications so that these can be remedied prior to the final due date for EFP field work vessel applications.

Vessel Owner Applicants for EFP: In addition to the preparation of applications to participate in the EFP field work, all applicants must agree in writing that, if selected for the EFP test, they will agree to follow the experimental fishing protocol as described in the RFP for participation in the field test. Successful applicants will be responsible for paying for the costs of sea sampler coverage throughout the EFP field testing. Additionally, successful applicants will pay all of their vessel costs during the field work and will be responsible for purchasing the excluder materials and all installation costs. Vessel owners selected for the EFP field work must agree to make the data from the EFP work available to the experimental fishing permit holder for purposes of the analysis and generation of draft and final reports of results. EFP applicants (and/or the processors who receive fish from the EFP work) may be requested to make a donation to a "not for profit" foundation based on a per pound assessment for the landed amount of cod during the EFP. Any donations received from this EFP would be used to defray the costs of the EFP field testing and any remainder will be earmarked for use in future projects to reduce bycatch in GOA fisheries.

Timing for tasks associated with the experiment

The month of August of 2006 is the target time for conducting the EFP test. Figure 4 below outlines the anticipated timing for each EFP task leading up to August of 2006. Given that final approval of the EFP application may not be possible before July, some important steps in preparation for the EFP, such as the circulation of the RFP to select vessels for the EFP test and the selection of vessels for the EFP will likely need to be undertaken prior to final approval. In that case, all RFP materials and decisions by the NMFS vessel selection panel will be noticed and treated as "preliminary" and "subject to final NMFS approval of the EFP application".

Figure 4: Anticipated timeline and milestones for the GOA halibut excluder for cod fishery EFP

Task	Feb-06	Mar-06	Apr-06	May-06	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06	Dec-06
draft EFP to AFSC	x										
AFSC internal review	x	X									
NMFS AK Region review											
NPFMC review			x								
circulation of draft RFP			x	x							
NMFS pre-test charter					X	x					
EFP permit received						x					
vessel selection panel						x					
EFP field work							X				
data analysis								x			
draft report of findings								x	x		
SSC review									x	x	
report to NPFMC											x
final report of findings											x

Part Four: Experimental Design

The principal variables of interest for this experiment are the catch rates (kg/hr) of Pacific cod and halibut from tows with and without the experimental device. Auxiliary environmental data, including depth, temperature, light level, speed, and time of day will be collected and analyzed for any important factors which may be associated with the selectivity of the device under the fishing protocol for the test. The sample unit for all variables will be the trawl tow.

All tows will be conducted in pairs (statistical blocks), consisting of simultaneous sets of pairs of tows with and without the device conducted by three pairs of vessels. For purposes of practicality, the switching of the excluder and reduction of the towing speed to reduce halibut bycatch will be done on a trip by trip basis. Each vessel serving as the control for that trip will select the fishing area for each tow during that trip. The experimental vessel for each pair will make a simultaneous "shadow" tow adjacent to its control vessel for each tow during that trip. Thus paired tows will be conducted simultaneously in as close together as practical in space and

time, using “identical” nets within the pairs of vessels and the same fishing procedures except for the addition or removal of the device and the lower towing speed for the vessel serving as treatment for that set of pairs.

The experiment will be conducted on six vessels, dividing the number of pairs needed for the experiment needed to achieve the target level of statistical power (46 pairs or 92 tows total as explained below) equally between the six vessels. This is needed to gauge the effects of vessel-specific variation on the performance of the device selected for the test and to complete the experiment in a reasonable amount of time (a long time duration could mean the experiment is conducted under conditions of varying groundfish and halibut abundance, which could affect results). The experiment is expected to take 10-12 days of fishing. This is based on an average of 6 tows per trip and 2-3 trips per vessel to complete the EFP work. Based on our previous experience with GOA catcher vessels, we believe that this anticipated testing schedule will allow for sufficient time for the additional time needed for conducting a census of the halibut catch on each vessel tow under the supervision of the sea sampler.

Towing will occur in the normal fishing areas available to the regular commercial cod trawl fishery in the Central Gulf of Alaska. A small number of test tows of short duration (20-30 minutes) may be carried out to determine if the species mix is suitable before commencing experimental tows at a new site. Because accounting for the groundfish catches (catch other than halibut) during the experiment may have to be done on a trip total basis, catch from any of these brief test tows will be returned to the sea from the deck. Results of these tows will not be used in the analysis. Tows will also not be used for the data analysis if the trawl suffers such significant damage that it is considered unlikely to have fished in an otherwise normal manner. If this occurs on one of the tows comprising a pair, the pair will need to be removed fro the data set and another pair will be started. Catch from these tows will however count towards the groundfish and halibut catch limits for the EFP.

The captain or other wheelhouse crew will record the start and end times of each tow as well as the average speed, depth, captain’s estimate of catch weight and whether the device was installed. A self-contained data-logger will be attached to the trawl net during every tow to measure the depth, temperature, and light level during fishing.

As described above, a procedure will be used under the supervision of the sea samplers on the vessels participating in the test to work on deck to remove all the halibut from each tow, and then measure and return them to the sea as soon as proper accounting has occurred. These procedures will be done under the direct supervision of the sea sampler and EFP fishing will not occur if sea conditions or other factors do not allow full halibut accounting for the effects of the excluder on halibut catch rates. Crew members will be instructed as part of the EFP fishing protocol on the proper methods to sort and handle halibut from the catch and move them to the area on deck where the sea sampler is stationed. The sea sampler will check off the lengths of each halibut so that weight equivalents can be used to generate an estimate of weight of halibut per tow. If numbers of halibut are extremely high on some tows, sea samplers may have to resort to counting the number of halibut and collecting a sub-sample of lengths of the halibut in that tow.

Based on past experience with deck sorting halibut on catcher processors and catcher vessels, all the halibut from a given tow can normally be returned to the sea with minimal injury under these controlled conditions in less than 20 minutes from the time the net is brought on deck. This obviously requires the assistance of crew members in the handling and conveyance of halibut to the sea sampler, as described above.

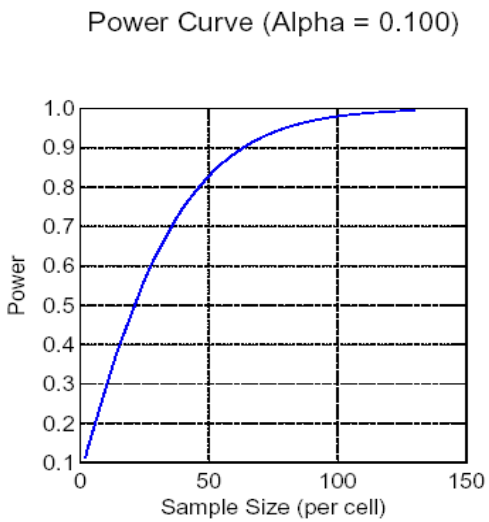
The EFP applicant will supply up to two additional project field managers throughout the field work to oversee the EFP. The managers will rotate between vessels on different trips and will be available to troubleshoot problems throughout the testing. In addition, Dr. Rose or one of his employees will be invited to help with gear issues or other technical aspects of the work including underwater camera work to help understand the working of the excluder if feasible.

Statistical power for the EFP test

The target number of pairs of tows for the EFP was arrived at from the following considerations. The minimal expected effect of the excluder on halibut catch rates compared to an unmodified net fished at the regular towing speed for the cod fishery is a 40% reduction. This was derived from the differential in head size from halibut that were measured by observers during the fall cod fishery from 2004-2005. The Power analysis below is based on differences between log transformed catches of halibut between the pairs of tows and an expected standard deviation within pairs of 1.37. This standard deviation was calculated from observed tows in the last two regular fall cod fisheries (2004 and 2005) which were paired in a *post hoc* using a pairing routine to select pairs based on minimization of location differences of the haulback positions as well as minimization of the time difference of recorded net retrieval time. A 40% reduction in halibut catch corresponds to an effect of $\ln(.6) = 0.51$. The desired power for of the test is 0.80 (or 80% which is standard for most power analyses) and the Alpha for our test was selected to be 0.10. While the standard Alpha of 0.05 would have been preferable, the larger number of pairs needed to meet this higher standard (60 pairs) was deemed to be infeasible. Based on these parameters selected for the power analysis, 46 pairs are needed (Figure 5 below).

Figure 5: Power analysis for and EFP to test a halibut excluder for the GOA fall cod fishery

```
                    Alpha =        0.100
                    Power =        0.800
                Model = One Sample t-test with alternative 'not equal'
Mean under the Alternative =        0.510
       Mean under the Null =        0.000
        Standard Deviation =        1.370
       Expected Difference =        0.510
                Effect Size =        0.372
   Noncentrality parameter =        0.372 * sqrt(sample size)
                     SAMPLE
                      SIZE          POWER
                   (per cell)
                        42          0.767
                        43          0.775
                        44          0.784
                        45          0.792
                        46          0.800
```



Expected groundfish and halibut catch for the EFP:
To evaluate the amount of groundfish catch of different species that would be expected from 92 tows (46 pairs) that are typical of the catch in the fall Central Gulf cod fishery, observer data from the last two fall cod fisheries were examined. For 190 observed tows in sub-areas 620 and 630 occurring between Sept 1 - 5 2004 and 2005, the tows made by catcher boats that had more that 500 kg of cod had the following characteristics:

Average total tons 14.0 mt
Average Cod catch 10.2 mt
Average Halibut catch 2.2 mt
Average tow duration 135 minutes

These averages were used in Table 2 below to evaluate the groundfish, Pacific cod, and halibut catches of each of the six vessels participating in the EFP. For the estimated halibut mortality, the following assumptions were made. First it was assumed that each vessel would be using the halibut excluder during half of its EFP tows and that the halibut catch rates for the excluder would be 40% lower than the average halibut catch rate for observed tows from the 2004-2005 cod fisheries. Lastly, the mortality rate used for the regular cod fishery (61%) was used as an upper bound of the halibut mortality for the EFP. In reality, we expect that the methods for measurement and quick return to the sea used during the EFP will have lower expected mortality than occurs in the regular fishery.

Table 2: Estimated groundfish catch and halibut mortality of the halibut excluder EFP

	number of tows	trips	groundfish (MT)	P. cod (MT)	other groundfish (MT)	Halibut catch (MT) assuming 40% excluder effect and excluder used on treatment tows for EFP(50% of tows)	Halibut mortality (MT) assuming "official" mortality rate (61%)
Vessel 1	15	2 or 3	215	156.4	24.5	21.6	13.2
Vessel 2	15	2 or 3	215	156.4	24.5	21.6	13.2
Vessel 3	15	2 or 3	215	156.4	24.5	21.6	13.2
Vessel 4	15	2 or 3	215	156.4	24.5	21.6	13.2
Vessel 5	15	2 or 3	215	156.4	24.5	21.6	13.2
Vessel 6	15	2 or 3	215	156.4	24.5	21.6	13.2
EFP total			1,290.0	938.4	147.2	129.6	79.1