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### Title

Community Perception and Recommendations on the Use of Pot Fishing Gear in the Gulf of Alaska Sablefish Fishery

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### Publication Date

2017-04-01

# **Community perception and recommendations on the use of pot fishing gear in the Gulf of Alaska sablefish fishery**

By: Derek Smith

## **Abstract**

Recovering whale stocks coupled with a longer fishing season as a result of the IFQ system have created a whale depredation problem in the Gulf of Alaska sablefish fishery (Schackner et al., 2014). In response, the North Pacific Fishery Management Council has amended the North Pacific Groundfish Fishery Management Plan to allow the use of pot fishing gear in addition to longline gear starting in the 2017 fishing season. Through a series of interviews and surveys with stakeholders of the fishery, this project sought to gauge community reception of the amendment, as well as to identify any unforeseen consequences and recommend potential solutions. A survey of those involved in the community was conducted; 43 written surveys were distributed with a total of 18 responses. Twelve of these responses were longline fishermen, 5 were pot fishermen, and 1 was a longliner. The fishing community was found to be generally supportive of the amendment but recommended some improvements, such as limiting soak time and improving gear location techniques. Recommendations for the fishery include improvement of depredation quantification techniques and increased fisherman involvement in policy decisions.

## **Introduction**

### **The Fishery**

Longline-caught Alaskan sablefish is among the highest valued finfish in the United States, with an ex-vessel price of \$7 per pound in 2015, making an individual fish worth as much as \$153 (O'Connell et al., 2015). Due to its high value, the fishery is fully harvested nearly every year, with 362 vessels having participated in it throughout 2013 and 2014, 117 of which fished exclusively in the Southeast region. A map of the different fishery management areas of the region can be found in Appendix B (North Pacific Fishery Management Council (NPFMC), 2016). The southeast region has a steep, narrow continental shelf. Sablefish are usually found on the upper continental shelf, so a narrow continental shelf creates a small fishing area (Hanselman et al., 2009). A smaller fishing area creates a greater likelihood of having interactions between fishermen (NPFMC, 2016).

The Southeast region tends to have a greater proportion of smaller vessels than other regions (NPFMC, 2016). Most of these smaller vessels' homeports are in Alaska: 95% of vessels less than or equal to 50 feet and 85% of vessels 51-60 feet make their homeport in Alaska, while more than half of vessels over 60 feet have their homeports outside of Alaska (NPFMC, 2016).

As a result, management decisions that put smaller vessels at a disadvantage have the potential to have far-reaching socioeconomic impacts on Alaskan fishing communities. Some safeguards include guaranteeing that 70% of the quota in the Southeast and 42% of the overall quota is allocated to vessels less than 60 feet long and enforcing vessel quota limits. A single vessel cannot fish more than 1% of the overall quota or 1% of the quota in the southeast (NPFMC, 2016).

However, with a fleet of 362 vessels participating in the fishery, these safeguards still allow for enough fleet consolidation to have socioeconomic consequences, primarily through a loss of jobs of both the fishermen and the supporting industries. Depredation and regulations addressing it have the potential to put small vessels at a disadvantage which could cause a loss of jobs and fleet consolidation.

## **History**

Originally, when the United States longline fleet expanded into the fishery in the 1980s, the fishery was managed as a “derby fishery,” with seasons as short as ten days, until 1995 when management implemented an Individual Fishing Quota (IFQ) system. Harvest efficiency was increased by 80% by switching to an IFQ fishery due to reduced crowding of fishing grounds, reduced harvest of immature fish, and less gear conflict (Sigler and Lunsford, 2001). The increased season length, however, had the side effect of increasing exposure to whales and rates of depredation (Schackner et al., 2014, SEASWAP).

A combination of whale stocks recovering following the International Whaling Commission’s whaling moratorium in the 1970s, the passage of the Marine Mammal Protection Act, increased season length, and possible social transmission of depredation behaviors has exacerbated the issue. (Schackner et al., 2014). This social transmission has potentially given rise to novel social behavior within the sperm whale population. The normally solitary males have begun aggregating together in “bachelor schools” around the vessels as a food source, potentially further facilitating social transmission (Schackner et al., 2014). Hill et al. (1999) had accurately predicted that because it is a learned behavior, the problem may grow progressively worse. Both killer and sperm whales engage in the behavior in the Gulf of Alaska, while to the west along the continental shelf, and in the Aleutians and the Bering, sperm whales feed predominantly on squid rather than demersal fishes, and have not shown a tendency to engage in depredation behaviors there (Schackner et al., 2014). Killer whales tend to depredate in the Western region while sperm whales tend to depredate in the Central and Eastern regions. Killer whales can remove up to 30% of overall catch and sometimes 100% of individual sets (Peterson et al., 2014). The effects of sperm whale depredation on individual sets can be less dramatic, but it still can have impacts on the fishery (Hill et al., 2009).

## **Avoidance**

When being followed by a whale, fishermen have few choices; they must either travel to a new area or set additional gear to compensate for lost catch. Peterson et al. (2014) estimated that fishing through killer whale depredation and setting additional gear results in a fuel cost increase of \$433, an 82% increase. Avoiding depredation by fishing in a new area increased costs by \$494 per day, factoring in fuel and crew food. Both strategies cost an additional \$522 per day due to the opportunity costs of time lost (Peterson et al., 2014). While specific values are not available, similar costs are likely imposed on fishermen avoiding depredating sperm whales. Depredation also makes stock assessments more difficult; whales do not always leave evidence of their presence behind, which increases uncertainty when determining the number of fish removed from the population (NPFMC, 2016). For this same reason, determining how often depredation occurs can be difficult. One survey in 2008 reported the presence of sperm whales on 16% of sampling days (Sigler et al., 2008). Hill et al. (2009) recorded depredation occurring on 46.2% of sets. Between 124 and 153 individual sperm whales have been identified as depredators using a new passive acoustic detection technique which may help to quantify future depredation rates (Thode et al., 2015).

A number of different techniques of reducing the effects of depredation have been attempted with varying levels of success. The most effective method to date has simply been to avoid whales, whether by hauling faster, making shorter sets, or leaving the area when whales appear (Tixier et al., 2014). However, these strategies do not always work and are not always economically viable due to the increased fuel and opportunity costs. Acoustic deterrent devices that emit high energy sound waves that repel whales have been attempted, however these have little lasting success due to habituation (Kraus, 1999). These devices require a crane to deploy, preventing small boats from being able to use them, and can be prohibitively expensive. Beads designed to confuse whales due to having the same acoustic return whether or not a fish is present were attempted as well, but were not found to have a statistically significant effect on depredation rates (O’Connell et al., 2015). These beads would increase the cost of each hook, making any lost gear more economically damaging to the fishermen. In the Patagonian toothfish fishery, which experiences

severe depredation as well, sleeves that block access to the fish after they bite the hook were attempted and had a minor effect on reducing depredation, but they also reduced overall catch, negating the benefits of preventing depredation. Even if they were found to be effective, the differences of gear in the Gulf of Alaska, specifically the hooks needing to be closer together and the gear being coiled in tubs, prevent the application of these sleeves (O'Connell et al., 2015). Finally, the most successful method, and the method that the NPFMC decided to pursue, is the use of gear that prevents whales from accessing the catch. The NPFMC passed an amendment to the fishery management plan allowing the use of pot fishing gear in addition to hook-and-line gear starting in the 2017 fishing season (NPFMC, 2016).

## **Pots**

Fishing with pots eliminates the threat of depredation by enclosing fish within durable pots that whales cannot access. However, the use of pots raises a host of other problems that may or may not be more severe than the problem of depredation itself. Due to deck space issues, stability concerns, and conversion costs (which, according to some fishermen, can be as high as \$400,000) small boat fishermen may be unable to make use of the new gear type (NPFMC, 2017). A large portion of the fishery being unable to use the new gear may be problematic, as a critical mass of fishermen need to adopt the new gear type in order for the use of pots to benefit the fishery as a whole. Thode et al. (2015) showed that whales have associated the cavitation sounds produced by hauling vessels with a free meal. A goal of the use of pots is to remove this association whales have made, which would benefit both the longliners and pot fishermen. However, to attain this benefit, a large enough portion of the fishery would have to switch to pot gear, and vessel limitations may prevent this (NPFMC, 2016).

The heavier pot gear uses thicker lines, which causes longline gear to "lose" any gear conflicts that occur. When both gear types are set in the same area. There is a chance that the gear becomes entangled, if this occurs, the heavier and bulkier pot gear will likely be unaffected, while the longline gear will be lost. This conflict results in the potential for economic losses to those who do not make use of pot gear and facilitating potential fishing grounds pre-emption (NPFMC, 2016). Grounds pre-emption refers to the ability of pot fishermen to lock down certain areas of the fishery merely by setting their gear, because longliners risk losing their gear by setting in the same area as a pot fisherman. The risk of gear conflict is greatest in areas like the Southeast region where the continental shelf is narrower and vessels must fish in closer proximity to each other. Also, the use of pots does not deter whales from depredating on the hook-and-line vessels, so the amount of depredation may not change but may merely get concentrated on the vessels not using pot gear.

There is a possibility that the use of pots would cause more environmental damage than the use of longline gear. In other fisheries, pot gear is a leading cause of whale entanglements usually in the ground or buoy lines (Johnson et al., 2005). However, in the sablefish fishery, both pot and longline gear would only have buoys at the ends of their sets, meaning that both gear types would have equal potential for whale entanglement in buoy lines. If whales become entangled in the groundline, the heavier pot groundline could potentially be more damaging to the whales.

## **The Project**

This project was a proof of concept study to demonstrate the value that can be gained through surveying fishermen on this issue. It has become more and more clear that integrating fishermen's knowledge gained through a lifetime of experience can be beneficial to proper management strategies when used in combination with scientific knowledge (Ames, 2001). Through a series of interviews and surveys I sought to bring this knowledge to light in regards to how the use of pot gear will affect the fishery, anticipate any unforeseen consequences, and provide recommendations on how the amendment could be

improved in anticipation of the 2020 amendment re-evaluation. Fishery management councils do include members of the industry to benefit from this knowledge, this survey seeks to broaden the number of voices involved. Fishermen must fish when the conditions are right to make a living, and due to the conditional nature of their profession, many fishermen may be unable to attend council meetings or submit comments on proposed regulations as they could be at sea. By going directly to the fishermen this survey can get fishermen involved who would otherwise be unable to have their voices heard: a critical aspect of fishery management.

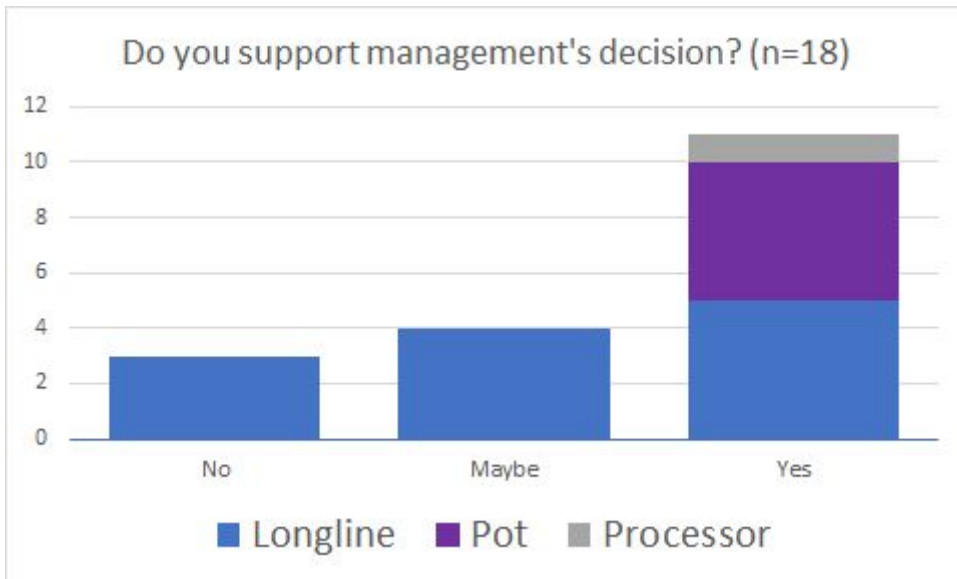
## **Methods**

Data was collected through in-person and phone interviews and by distributing surveys directly to fishermen. See appendix A for a copy of the survey that was distributed. Questions were determined by consulting members of the NPFMC, NOAA fisheries scientists, and an expert in survey design to see what information would be most useful in determining the impact of the policy. The survey was designed to be brief to maximize the chances of a response while still having enough questions to determine the fishermen's perception of the amendment, intended actions in the upcoming season, and demographic questions about the fishermen themselves. Survey participants were asked if they were willing to be interviewed in addition to taking the survey, and if they were comfortable being recorded. Interviews were informal and addressed topics including but not limited to depredation avoidance recommendations, perceived problems with the fishery, view of the future of the fishery, and concerns over gear conflict.

Written surveys were distributed to opportunistically selected participants on the docks of Seward from 04/11/17 to 04/15/17 and Sitka from 04/16-04/19. Fishermen who responded affirmatively when asked if they participated in the Gulf of Alaska sablefish fishery were given a survey. Forty-three surveys were distributed, 18 of which were completed and returned. Twelve of these respondents answered that they would use longline gear in the 2017 season, 5 respondents said that they would use pot gear, and 1 response was from a processing plant manager. 7 interview recordings were obtained, some of which had multiple participants, totalling 15 interviewees.

## **Results and Discussion**

## 1. Do you support management's decision?



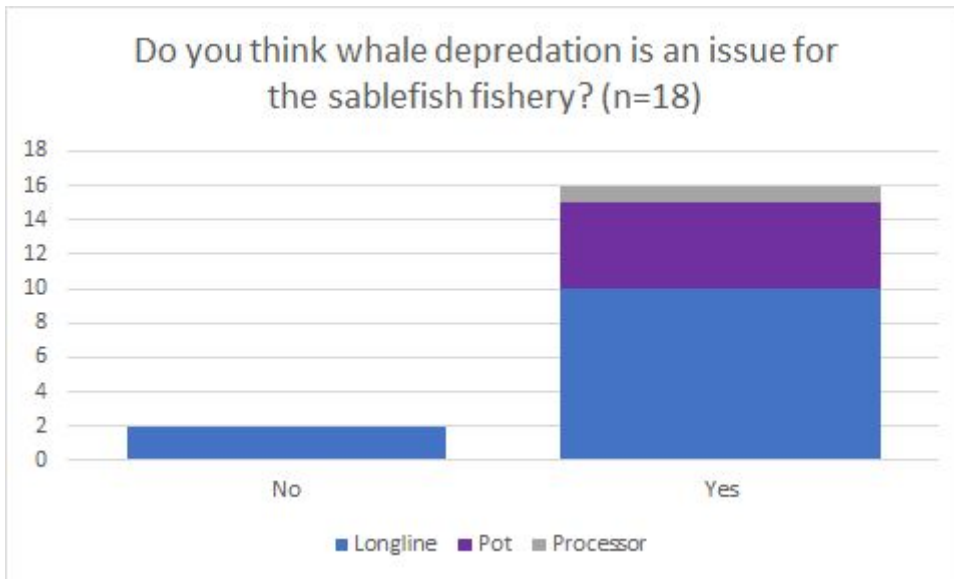
11 out of 18 fishermen surveyed agreed with management's decision to allow the use of pots in the fishery, 5 of these that supported management decisions were longline fishermen and 4 indicated that they intended to use pot gear in the upcoming season. 3 fishermen do not support management's decision and 4 remained neutral, all of which were longliners.

### Question 1 Discussion

The agreement with management decision, even to fishermen not using pot gear is particularly interesting. The lack of opposition from those who do not intend to use pots is a possible indication of the benefits of fisherman involvement in management decisions. Organizations like ALFA (The Alaska Longline Fishermen's Association) attend meetings and make fishermen's voices heard which gets the community involved with the management process. When a community is involved with the decision making process, and feel that their voices are heard, they are more likely to be in favor of a regulation, even if it does not directly benefit them (Charnley and Engelbert, 2005).

Six fishermen surveyed responded that the regulation would negatively impact them (Question 7), yet the majority still supported the decision and only three were opposed to it, showing that collectively, the fishermen at least understand the rationale behind the decision and do not feel as if management is working against them.

## 2. Do you think whale depredation is an issue for the sablefish fishery?



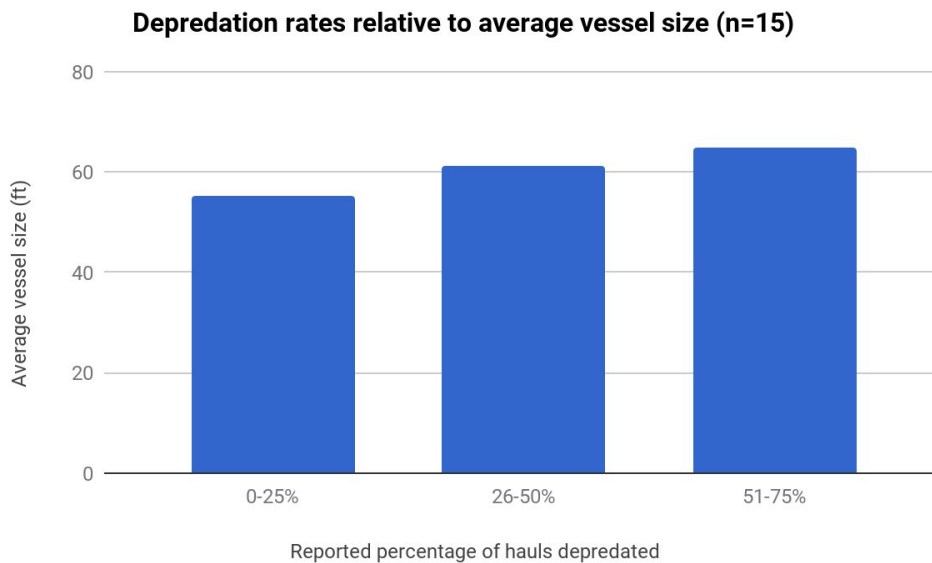
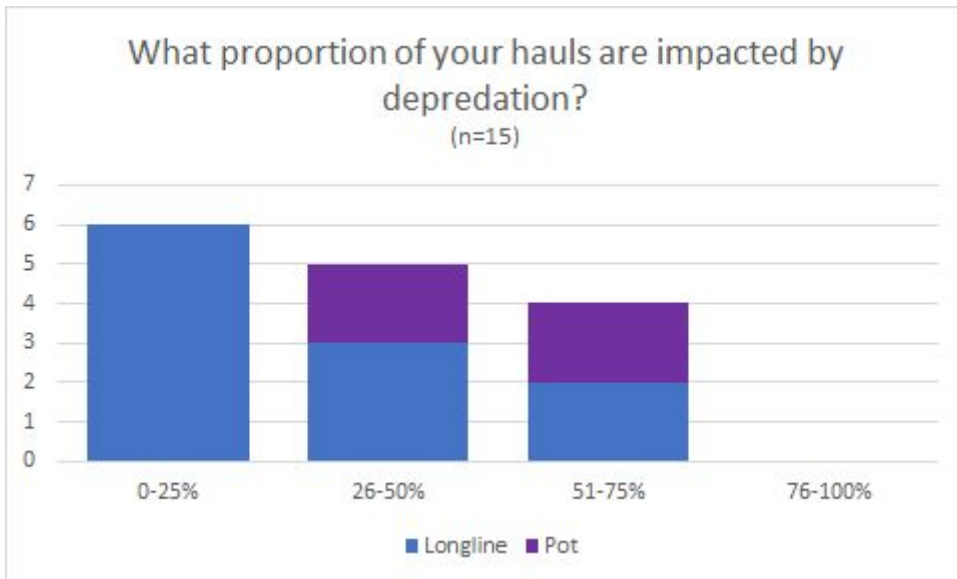
Fifteen fishermen, even those who indicated that they themselves did not experience significant losses to depredation (question 2a) agree that it is a major issue for the fishery. The two responses that indicated that they do not believe that depredation is an issue for the fishery also did not agree with management’s decision to allow the use of pot gear (question 1). As most interviews and surveys were conducted at the beginning of the season most fishermen who responded did not personally experience severe depredation, many of them said that the issue worsens as the season goes on.

### Question 2 Discussion

The majority consider that depredation is an issue. Even those who may not have personally experienced high levels of depredation are affected due to impacts on stock assessment and overall quota. In an attempt to prevent overfishing of sablefish, the NPFMC deducts around 3% of the overall quota each season to account for losses from depredation. Even those fishermen who do not lose catch to the whales directly are indirectly losing catch due to this regulation, causing the depredation to be a universal problem.

The reduction of quota within the fishery is a potentially contentious issue with the introduction of pots. Some pot fishermen have argued that they should not have their quota reduced because, in theory, they are no longer enabling the reduction of stock through depredation. The argument is sound ecologically, but further disadvantages the longliners. Members of ALFA argued that the combined effects of gear conflict, depredation, and quota reduction may make it economically unfeasible to continue longlining causing fishermen to find alternative sources of income, such as leasing their quota to the larger pot fishing vessels. These larger vessels are based out of Seattle where they do most of their vessel maintenance and resupplying. Driving out the smaller fishing vessels, that are based out of towns like Seward and Sitka, therefore would damage the community that they support. However, despite ALFA’s fears there are safety mechanisms in place to prevent this potential collapse: specifically a vessel quota limit that prevents each vessel from fishing more than 1% of the quota in the Southeast, or 1% of the quota in the rest of the regions combined. In addition, a certain share of the quota is reserved for each size class of vessel, preventing large vessels from completely taking over the fishery (NPFMC, 2016).

## 2a. What proportion of your hauls are impacted by depredation?



There was a wide spread of responses for amount of depredation experienced, skewed towards the lower levels. Factoring in vessel size shows a slight positive correlation between vessel size and percent of hauls depredated.

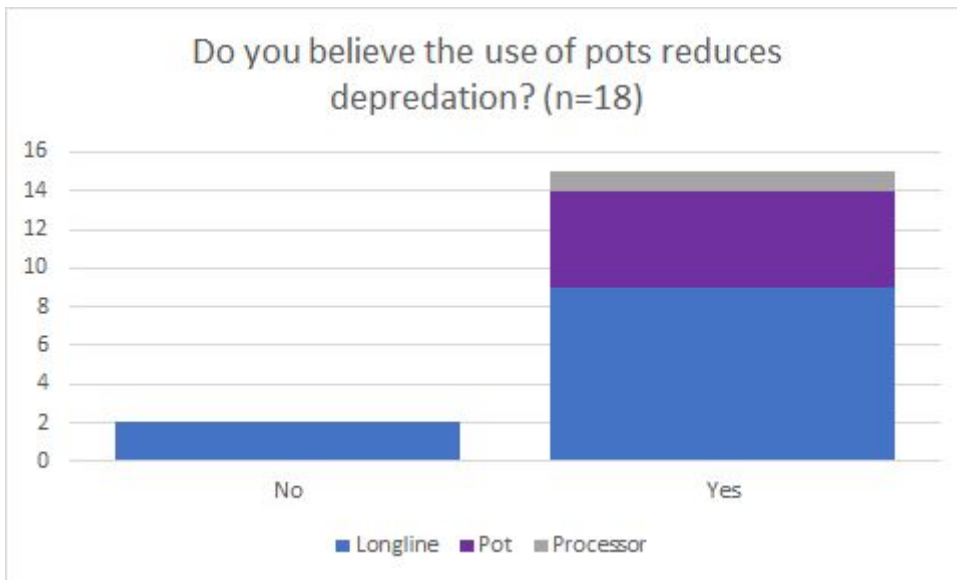
### Question 2a Discussion

The variation in responses to this question is indicative of both how difficult it is to accurately determine whether depredation has occurred, and potentially how differences in fishing techniques can influence amount of depredation that occurs. One of the only methods that has been shown to reduce depredation is to reduce time spent hauling, usually by making shorter sets or hauling more quickly (Tixier, et al, 2014). Smaller vessels tend to have lower quota, thus experience less depredation, this is displayed in the survey results: the average vessel size of those who experienced depredation on 0-25% of their hauls was 55.25ft, while the average vessel size that reported 51-75% depredation was 65ft. While this is a small sample size, this finding warrants



further investigation to confirm if there is a relationship between the size of the vessel and the amount of depredation it experiences. In addition, sperm whales have been shown to track a vessel using sounds the engine makes while hauling gear (Thode et al., 2007), larger vessels may make more noise as well, increasing the likelihood of attracting a whale (Hildebrand, 2009). Given that the larger vessels are the ones capable of transitioning to pot gear, they also stand to benefit the most as they appear to experience depredation to a greater degree. Other differences in levels of depredation could be due to a number of factors including season and fishing area.

3.



Fifteen of those surveyed agreed that the use of pots will reduce depredation for those who are able to use them, though several interviewees voiced concerns that it was only a short term solution.

### Question 3 Discussion

Multiple interviewees have reported stories of killer whales in the Bering Sea breaking into and stealing catch from pots, though records of these incidents have not been published. If killer whales have indeed learned to break into pots then the use of pots may be an ineffective deterrent over time, at least in the western Gulf of Alaska, where killer whale depredation is more prevalent (NPFMC, 2016). Table 14 from NPFMC (2016), shown in appendix C, shows that larger vessels fish more frequently in the western and central Gulf, so these reports of killer whales breaking into pots warrant further investigation as these vessels are more likely to use pots.

Another frequently voiced concern is that the use of pots may indeed reduce depredation for those using pots, but it does not necessarily reduce overall depredation. This would mean that those vessels still longlining would bear the burden of the depredation they were already experiencing in addition to the depredation of the vessels who switched gear. As of now this potential unintended consequence has not been addressed, and more data on changes in depredation rates should be collected prior to the 2020 re-evaluation meeting in order to make properly informed decisions.

### 4. “Can you think of, or are you familiar with effective deterrents to reduce depredation?”

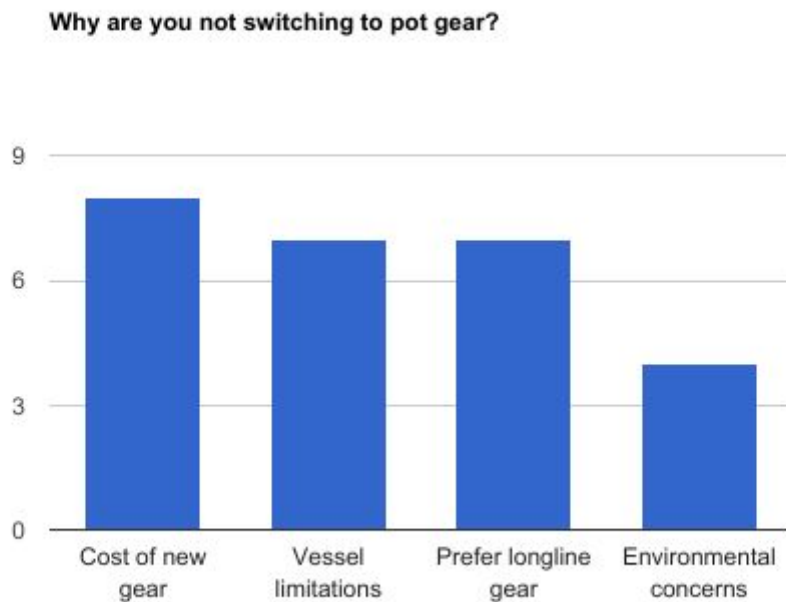
When asked to propose alternative solutions to addressing the “whale problem” fishermen were quick to suggest bringing back the practice of whaling, this answer was written in three times in response to question 4, and was brought up in four of the recorded interviews.

#### **Question 4 Discussion**

History has proven that whaling is an unsustainable practice, and doing so to reduce depredation is akin to burning a house down to eliminate a termite infestation. Whales, particularly apex predators such as sperm and killer whales, have a disproportionate influence on their ecosystem and their presence is usually tied to a more productive environment due to their roles as ecosystem engineers (Estes et al., 2017). They can be considered ecosystem engineers due to their ability to vertically transfer nutrients via surface fecal plumes and diving, as well as providing an entire deep-sea habitat in the form of whale falls. Whales serve as a major source of iron fertilization, a necessary ingredient for primary production which in turn enhances fishery output (Roman et al., 2014). NOAA is unable to provide a confident minimum sperm whale population size, however stocks do appear to be increasing (NPFMC, 2016). Recovering whale stocks coincide with increasing depredation rates, but likely the most significant cause of increasing depredation rates was the transition of the fishery to IFQ management in 1995, which increased the length of the fishing season, resulting in more chances of interaction between whales and fishing vessels (Schackner et al., 2014). The removal of small numbers of whales from the population would not have a significant impact on depredation, and removing a large enough number of whales to reduce the depredation rate would likely have such a negative impact on the productivity of the ecosystem as a whole that a net benefit to the fishermen is unlikely.

Other fishermen proposed solutions that are less environmentally damaging, but tend to be just as ineffective. The next most frequently suggested solution is an acoustic deterrent device. When field tested, these devices have been initially successful but the whales rapidly learn to ignore the deterrent (Thode et al., 2014). Fishermen have also stated that the acoustic equipment necessary is too large to fit on small vessels, the vessels most likely to need a deterrent following the pot gear amendment. A representative of Mustad, a leading fishing supply company has stated that the company is far along in developing a new, more effective acoustic device, however it has yet to be tested and experts interviewed remain skeptical. Another proposed solution are devices attached to longline gear that deploy sleeves over the sablefish after they have been caught, protecting them from depredating whales (Pyper, 2011). However, this gear has not been proven to be effective, and it is expensive. Given that longliners now face a greater risk of losing their gear in the presence of pot gear, due to the aforementioned gear conflicts, it is not feasible for them to invest in this expensive gear that can easily be lost. At the moment, the only reliable methods of reducing depredation consist of using pot gear, avoiding the whales spatially or temporally, or shorter sets (Tixier et al., 2014)

#### **5. Why are you not switching to pot gear?**



When asked why they do not intend to use pot gear most fishermen gave multiple reasons, with the most frequent being the cost associated with converting the vessel into being able to use the new gear. Six out of eight respondents who listed cost of new gear also selected vessel limitations as a reason. Environmental concerns are the least popular reason for continuing the use of longline gear, these concerns may include the potential for whale entanglement, bycatch, or habitat destruction.

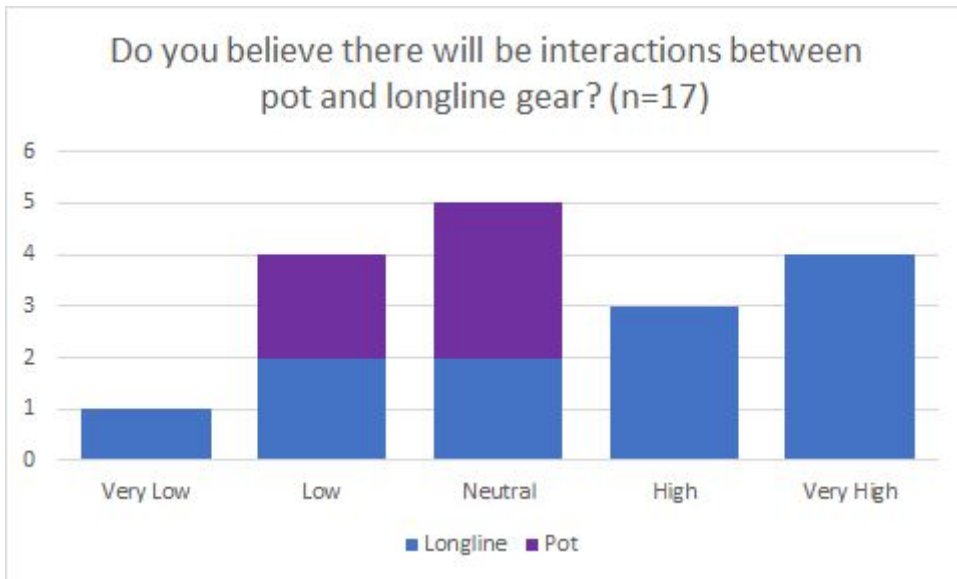
### Question 5 Discussion

Estimates of the cost to switch to pot gear ranged from \$100,000 to \$400,000 depending on the vessel, and with many small boat fishermen not owning a large amount of quota they would likely never get a return on this investment. Most respondents who listed cost of new gear also selected vessel limitations as a reason. This is to be expected as the primary cost of pot gear is not the gear itself, but adapting the vessel to be compatible. In most cases the fishermen said that it would still be unsafe due to lack of deck space and stability issues to use pot gear, even after investing the money to adapt. There are different sized pots available, however interviewees claim that the smaller pots are less efficient and catch smaller, less valuable fish. Interviews with the seafood processing managers revealed that at the moment they do not intend to pay the fishermen different prices depending on the gear, but are monitoring consumer response to determine if it is warranted. Table 27 from NPFMC (2016), shown here in appendix D, shows the difference in price of sablefish caught with each gear type throughout the Gulf of Alaska and the Bering Sea, with longline (referred to as HAL for hook-and-line in the table) the fetching the highest ex-vessel price in every year.

Although it was the least popular reason, environmental concerns may stem from the potential for the much larger pot gear to damage the benthic habitat while hauling, however most fishermen set in soft substrate when targeting sablefish where there is less potential for damage, and research suggests that pot and longline gear do not significantly damage the benthic habitat in Alaska (Heifetz, Stone, and Shotwell, 2009). Longline gear may actually cause greater environmental

damage due to its higher tendency to entangle seabirds, such as the endangered short-tailed albatross (Agnew, Pilling, and Purves, 2001).

### 6. Do you believe there will be interactions between pot and longline gear?

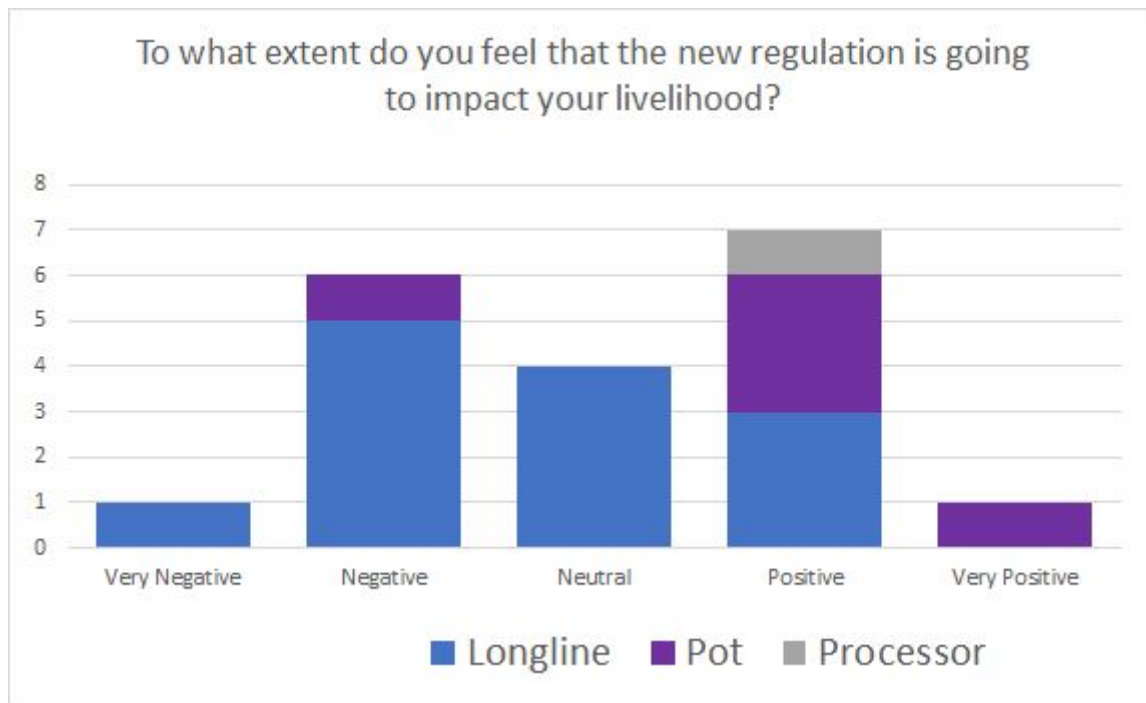


The responses of surveyed fishermen who intend to use pot gear in the near future show that they are not particularly worried about interactions between the two gear types, while those who intend to continue longlining appear to be far more concerned, comprising all of the high and very high responses. Five longline fishermen expressed either indifference or a low to very low concern over the potential to have longline and pot gear conflict.

### Question 6 Discussion

The frequency of longline fishermen who expect low to medium interactions between the two gear types was unexpected, as the potential for gear conflict was frequently mentioned as a primary concern in the interviewing process. This concern led to the NPFMC instituting different regulations for pot soak time in each region. In the Southeast region, where the typical vessel is smaller and where ALFA is active, pot vessels must be in proximity to their gear at all times reducing the chance of accidental entanglement. However in the central Gulf, soak times of up to seven days without a vessel in proximity are allowed. Fishermen rely on the presence of a vessel to determine where is safe to set their gear without risking gear entanglement, if the pot vessel is not present fishermen lack the visual cue to determine where they can set their gear. Buoys used to mark the ends of gear are not a reliable cue as they are not easily seen and currently there are laws against using vessel tracking systems to identify buoy locations, though there is currently an effort underway to allow tracking of buoy location to reduce chance of gear conflict. However, this would still be voluntary and the best way to reduce the likelihood of gear conflict would be to require vessels to remain with their gear at all times in all regions. That being said, allowing more soak time has the benefit of giving smaller fish the opportunity to escape through escape hatches in theory allowing greater size selectivity (NPFMC, 2016). It is also safer for the fishermen themselves because it allows them to take shelter from inclement weather without having to haul their gear first.

7.

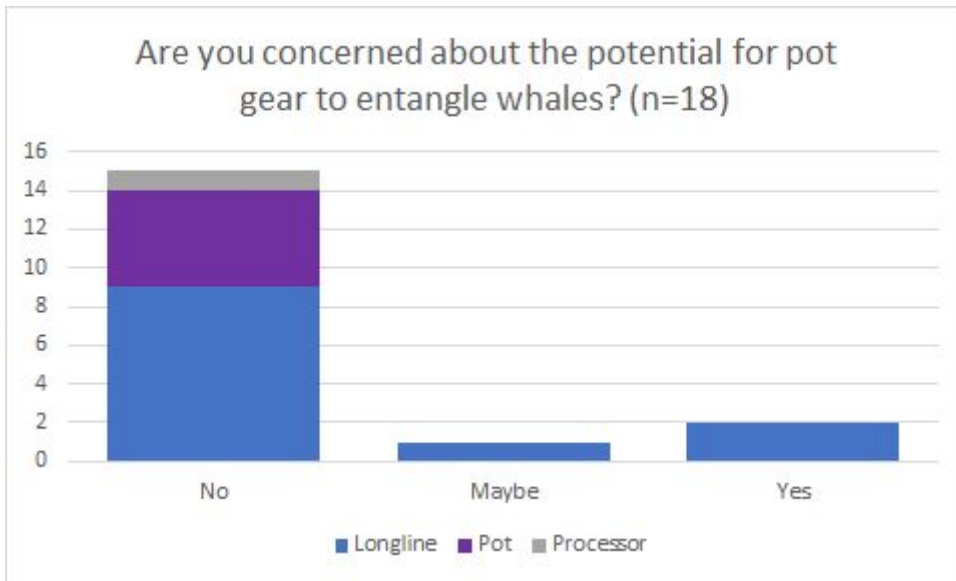


4 out of 5 of the pot fishermen feel that this amendment will positively affect their livelihood, with 6 out of 7 selecting this option. The remaining one pot fisherman indicated a negative impact. Longliners had a wide spread of responses, with two longliners feeling that the new gear type would have a net positive impact on their livelihood, four were neutral, four expecting a negative outcome, and one expecting a very negative outcome.

### Question 7 Discussion

It is unlikely that fishermen would adopt the new gear type if it did not benefit them in some way so the positivity of the pot fishermen is unsurprising. On the other hand, the amount of longline fishermen who felt that this amendment will either have a neutral effect or be beneficial in some way is surprising. A possible explanation is that the rise of pot gear will potentially remove the whale's association of hauling sounds with a free meal. If enough vessels use gear that the whales cannot access they may no longer be willing to expend the effort of following a vessel if they are not guaranteed easy access to a food source. Another explanation of the positive impacts is that the use of pot gear may reduce unnecessary fish loss from depredation, in turn increasing sablefish stock and quota for the fishermen, benefiting both the pot and longline fishermen. Those that believe they will be negatively affected are likely concerned about the potential for gear conflict and increased depredation rates.

### 8. Are you concerned about the potential for pot gear to entangle whales?

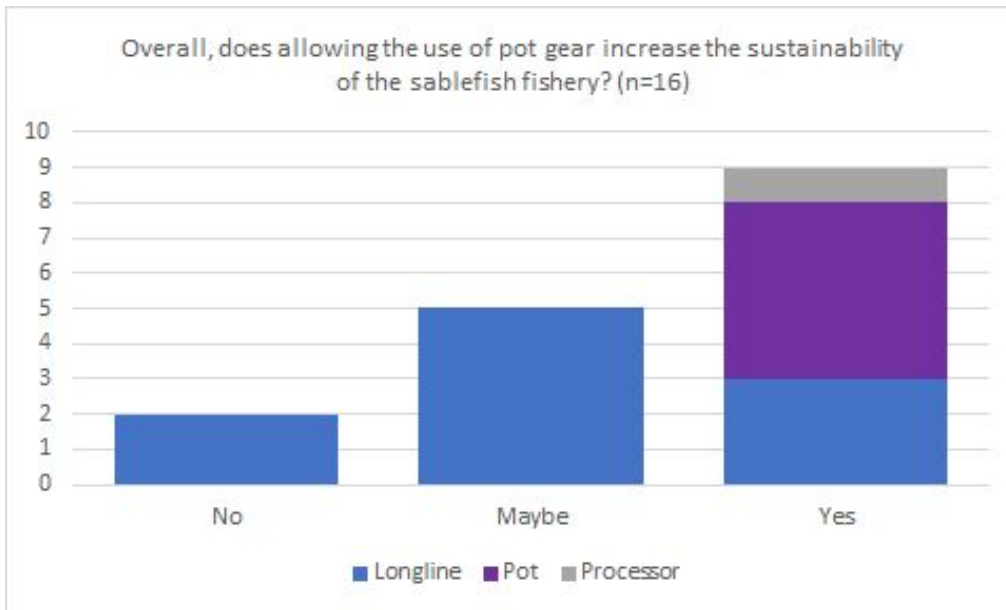


The majority of respondents indicated, n=15, no concern for the potential of pot gear to entangle whales: two longliners indicated concern, one was neutral, and the other fourteen respondents, both longliners and pot fishers, did not express any concern. Of the 15 people who were recorded, none feared potential entanglement either.

### Question 8 Discussion

The respondents are not concerned about the potential for whales to be entangled in pot gear, despite pot gear being one of the most prevalent causes of whale entanglements, especially humpbacks (Johnson et al., 2005). This response is not surprising considering the fishermen's desire to bring back the practice of whaling, in fact several fishermen expressed desire for the whales to be entangled (in other people's gear). The species of whale entangled did not seem to be a concern either, despite humpback whales not being a depredation threat; the fishermen were concerned about humpback whales consuming the planktonic juvenile sablefish, thus reducing eventual stock. The potential for humpback entanglement in pots was also not addressed in the amendment proposal, possibly because when feeding in the Gulf of Alaska, humpbacks prefer to stay in shallow waters (NMFS, 2017) where fishermen do not set for sablefish, causing a minimal potential for entanglement.

### 9. Overall, does allowing the use of pot gear increase the sustainability of the sablefish fishery?



The majority of both longline and pot fishermen believe that at the very least the amendment will not have an overall negative effect on the fishery's sustainability: all five pot fishermen, and three of the longliners believe it will increase the sustainability of the fishery. Five longliners remained neutral and two believe that it will reduce the sustainability of the fishery. The two longliners who gave a negative response also disagreed with management's decision, feel that depredation is not an issue for the fishery, are very highly concerned about gear conflict, and are concerned about pots entangling whales.

### Question 9 Discussion

Those who indicated that the amendment would increase sustainability most likely said so for the same reasons previously mentioned. The use of pots may reduce the overall depredation rate, which would improve the sustainability of the fishery preventing the excessive removal of stock. The most common response for longliners was maybe, most likely indicating that they believe the positive and negative effects will balance each-other out.

While it may indeed have a neutral or positive effect on the ecological sustainability, whether it is socio-economically sustainable has yet to be seen. The small boat longline fishermen provide community stability by purchasing services and supplies locally, rather than in Seattle like the larger boats. If longlining loses its viability the community could easily lose the structure these local vessels provide, possibly causing socio-economic consequences throughout the Gulf.

### Recommendations

The amendment included a provision requiring the council to evaluate the efficacy of the new regulations after a three year period, this section summarizes recommendations that would benefit the council's review process.

#### 1. Change AIS regulations

The greatest concern that longline fishermen have in regards to this regulation, as shown by the responses to question six and due to it being listed as a concern in every interview with a longliner, is the potential for gear conflict between the gear types. In the short term, the best way to address

the issue is to allow the use of AIS tracking on pot buoys. It is currently illegal to mark buoy locations using AIS, a regulation initially put in place to prevent excess “noise” when using the software. According to my interviews, the technology is now advanced enough that this would not be an issue, thereby allowing longline fishermen to avoid pot fishing gear and allowing the pot fishermen to retrieve their gear more easily. Legalizing the use of AIS transponders on fishing gear is not within the management council’s jurisdiction, so reaching out to the Coast Guard, who enforces this law, would be beneficial for the fishery. Using this tracking software on the fishing gear also allows easier enforcement of soak limits as well, an issue frequently discussed among the longliners.

## **2. Reduction of soak time**

The regulation currently states that pot fishermen are allowed to leave their pots unattended for up to three days in the Central Gulf (NPFMC, 2016) allowing potential grounds pre-emption and gear entanglement. Increasing observer coverage during that time could provide more valuable data for this assessment, particularly in terms of gear conflict. If observer data reveals a large difference in rates of gear conflict between the Central Gulf and the Southeast, where vessels must tend their gear at all times, a reduction in soak time to one or two days may be warranted. Hanselmann et al. (2009), shown in appendix E, shows that two days was the most common soak time in the Bering Sea, with almost half of all pots falling within that category. Most fishermen do not want to soak for much longer than that, due to sand fleas attacking the fish and concerns over the freshness of the fish. If gear conflict becomes too prevalent, limiting soak time to two days would be reasonable. Longer soak times could be allowed in extreme weather events to minimize the safety risks associated with shorter soak times.

## **3. Depredation quantification improvement**

Another important consideration for the council to review at the three year mark is whether the regulation actually reduced overall depredation, instead of shifting the burden. Sigler et al. (2008) estimates depredation levels to be at less than 2%, which is not a statistically significant amount, however even that low of a rate could represent the entire profit margin for many fishermen. Also, the tendency for sperm whales to not leave evidence behind may result in underestimating rates of depredation.

A recent study has proposed a new method of identifying depredation events using passive acoustic data: sperm whales make a distinct noise known as a “creak-pause” event when engaging in depredating behavior that varies from natural foraging sounds (Thode et al., 2015). This method will be useful for measuring rates in the future, however as it is a new technique that requires the use of specialized equipment it can not be applied to the data retroactively and may not be available for a large number of vessels to use. A solution to this issue would be to combine this technique with an alternate quantification technique. Researchers involved in the Patagonian toothfish fishery have proposed a method that capitalizes on depredating whales’ prey selectivity. Sperm whales in the Southeast region tend to avoid consuming rockfish and grenadiers caught as bycatch, so with a relatively constant bycatch rate, depredation can be estimated based on the ratio of grenadier and rockfish bycatch to sablefish (Gasco et al., 2015). A future study would simultaneously use both techniques to compare against each-other, then, if both give similar results, the bycatch assessment technique could be applied retroactively to previous years using observer data. This would allow a direct comparison of past depredation rates to rates following the adoption of pot gear. If the rate is found to be unaffected, a re-evaluation of the amendment would be necessary.



## **Fishermen Involvement**

When it comes to fishing resources, fishermen have the most incentive for conservation due to their livelihood depending on the health and persistence of the stock. In this particular case, the fishermen's majority opinion that allowing the use of pots is a good idea shows the mindset: it does not benefit them in the short term, but overall likely increases the sustainability of the resource that they depend on, so they support it. This response also indicates the benefits that can be gained by further involving fishermen in management decisions. Currently, they are encouraged to participate in public council meetings and to comment on regulations, however the nature of the profession can prevent involvement in key management decisions. The majority of fishery participants are involved in other fisheries during the offseason (NPFMC, 2016) and as such may be unable to travel to attend management meetings, preventing their voices from being heard. These voices have been shown to often provide information that is valuable to management (Ames, 2001). It is also possible that fishermen may simply be unaware of the extent that they can be involved. Annual surveys and key interviews similar to this one may help to better inform management decisions with the knowledge that fishermen possess.

## **Caveats**

### **1. Question Structure**

Before conducting future surveys, it is important to understand and remedy the problems that arose during this particular study. After reviewing some responses it became apparent that the structure of the questions confused some respondents. Specifically, some yes or no questions were formatted as follows:

- a. Yes/No

Respondents were asked to circle either yes or no but would circle both or just the letter "a" indicating the question. A solution would be to separate the yes and no options into separate lines, for example:

- a. Yes
- b. No

In most cases where this occurred the written comments section clarified the respondent's intended answer, and additional information was used to correct their answers.

### **2. Reluctance to fill out survey**

Most fishermen were eager to voice their opinions on the matter, though they were less willing to sit down and fill out the survey: getting consistent responses would often require persistence.

### **3. Sample size**

As previously mentioned, this was done at the beginning of the season, when many larger vessels had not yet arrived, future studies would ideally have more respondents who work on the large vessels more suitable for using pot gear. Most fishermen in Seward tend to fish in the Central region and have larger vessels, while those in Sitka fish in the Southeast region and tend to have smaller vessels. Being able to survey fishermen in the Western region, such as in Kodiak and Homer, would have been ideal and are locations to include in future surveys. Similarly, distributing interviews and surveys at multiple times throughout the season would have been preferable, many fishermen only fish at certain times during the season and may feel differently about depredation or the use of pots, especially as whale depredation rates change throughout the course of a season.

Incorporating an online survey could help reach larger numbers of people. Similarly, a more general survey should seek to get responses from all involved in the fishery, including management, more processors, and scientists. These changes would address the relative lack of data presented as well.

#### **4. Standardized oral interview questions**

Finally, a more structured interview design that can be more easily organized and quantified would strengthen the conclusions derived from the interview process. Having the same predetermined questions in every interview would help control the experiment, and to quantify the results. This would also assist in identifying recurring themes and keywords brought up by the participants. Having some of the conversations' audio recorded was helpful, but a greater effort should be made in the future to record all interviews, as well as including demographic information within the recording for identification and data purposes. This could

#### **Summary**

To summarize: fisherman responses confirm that allowing the use of pot gear to address the depredation problem is overall a positive step in improving the sustainability of the Gulf of Alaska sablefish fishery, however it leaves room for improvement. Fishermen and the council could work with the Coast Guard to allow the tagging of buoys with AIS transponders to limit the potential for gear entanglement. Surveys, such as this, given annually could be conducted to monitor changes in the fishery and to be more able to address any unforeseen and unintended consequences that may have arisen. They could also serve as a means to engage fishermen in the management process. A combination of passive acoustic monitoring and bycatch analysis should be established to closely monitor depredation rates of the past and present to quantify any changes in depredation behavior over the next several years. Over the next three years in which the amendment will be under review observer coverage should be increased for more accurate catch data and gear conflict rates. If these gear conflict rates cause substantial losses to the longline fishermen, particularly if there is a significant difference between the Southeast and the rest of the Gulf the allowed soak time should be reduced to two days.

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## **Appendix A: The survey**

### Survey Questions

1. The North Pacific Fisheries Management Council has recently authorized the use of pot gear in the Gulf of Alaska sablefish fishery. Do you support this decision?
  - a. Yes/No
  - b. Why or why not?





8. Are you concerned about the potential for pot gear to entangle whales?
  - a. Yes/No
  - b. Why or why not?

9. Overall, does allowing the use of pot gear increase the sustainability of the sablefish fishery?
  - a. Yes/No
  - b. Why or why not?

10. Any additional comments about the depredation problem, gear switching, or The North Pacific Fishery Management Council's decision?

Demographic Questions:

1. What is your profession? \_\_\_\_\_
2. What fishery management area do you work in? (circle all that apply)
  - a. Western Regulatory Area
  - b. Central Regulatory Area

c. Eastern Regulatory Area

**Figure 3-1 Regulatory Areas of the Gulf of Alaska**



Put the citation for the map here:

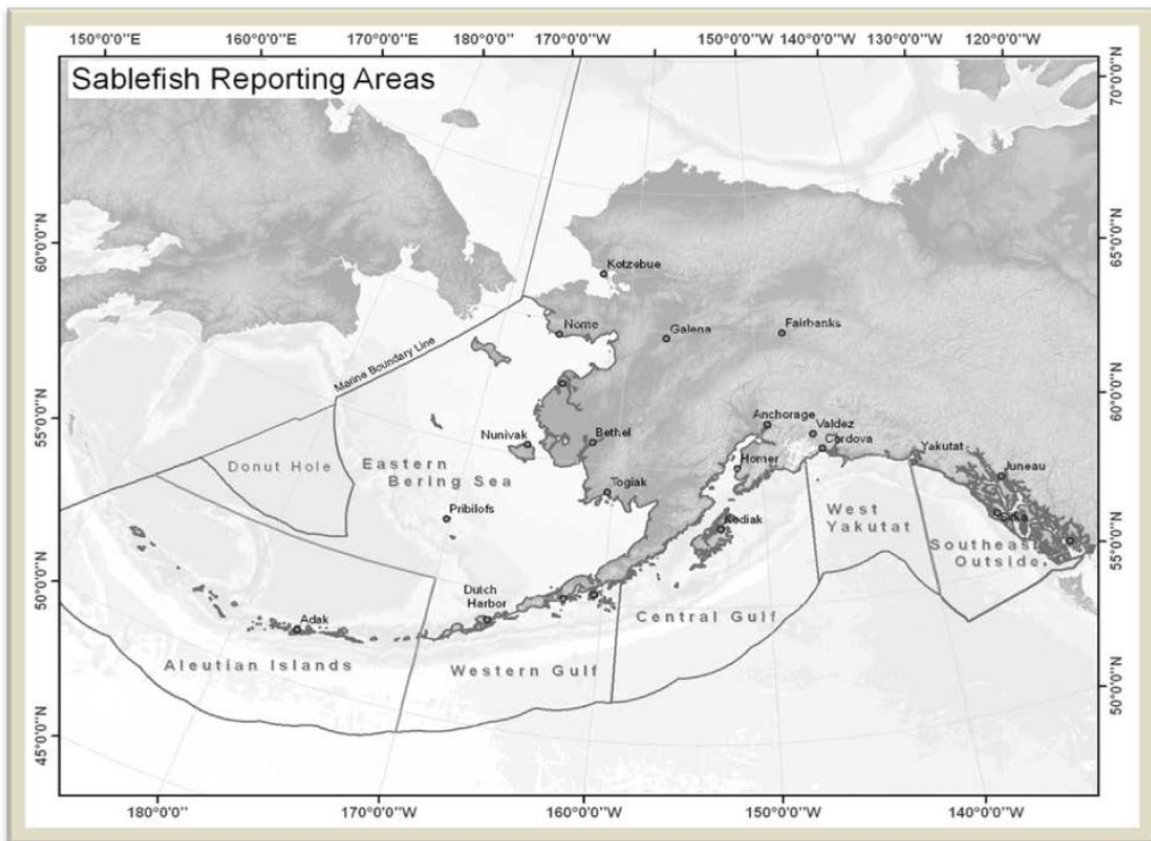
(from the NPFMC Fishery Management Plan)

3. If you are a fisherman what type of gear will you use in the upcoming season?
  - a. Longline
  - b. Pot
4. How many years have you been involved in the fishing industry? \_\_\_\_\_
5. How large (in feet) is the boat that you work on?

**Appendix B**



Figure 1 Sablefish Management Areas and Districts in the GOA



Source: (NPFMC, 2016)

### Appendix C

Table 14 Number of vessels by size category catching sablefish IFQ in each GOA management area, 2009 through 2013

LENGTH	AREA	YEAR	Vessel Count	LENGTH	AREA	YEAR	Vessel Count
≤ 40	WG	2009	2	51 - 60	WG	2009	30
		2010	2			2010	30
		2011	1			2011	30
		2012	2			2012	26
		2013	3			2013	25
	CG	2009	7		CG	2009	84
		2010	7			2010	86
		2011	8			2011	81
		2012	6			2012	87
		2013	10			2013	81
	WY	2009	-		WY	2009	70
		2010	-			2010	71
		2011	-			2011	69
		2012	-			2012	70
		2013	-			2013	69
SE	2009	11	SE	2009	104		
	2010	11		2010	109		
	2011	10		2011	108		
	2012	12		2012	112		
	2013	9		2013	104		
41 - 50	WG	2009	4	> 60	WG	2009	25
		2010	5			2010	28
		2011	7			2011	26
		2012	10			2012	24
		2013	6			2013	21
	CG	2009	29		CG	2009	56
		2010	27			2010	52
		2011	33			2011	49
		2012	36			2012	49
		2013	35			2013	44
	WY	2009	6		WY	2009	39
		2010	8			2010	37
		2011	6			2011	37
		2012	8			2012	35
		2013	6			2013	34
SE	2009	61	SE	2009	32		
	2010	64		2010	29		
	2011	59		2011	26		
	2012	52		2012	25		
	2013	48		2013	22		

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive\_FT

Source: NPFMC, 2016

## Appendix D

Table 27 Average ex-vessel value per pound of sablefish delivered (\$), by gear type from 2009 through 2013 (includes GOA and BSAI management areas for HAL and trawl)

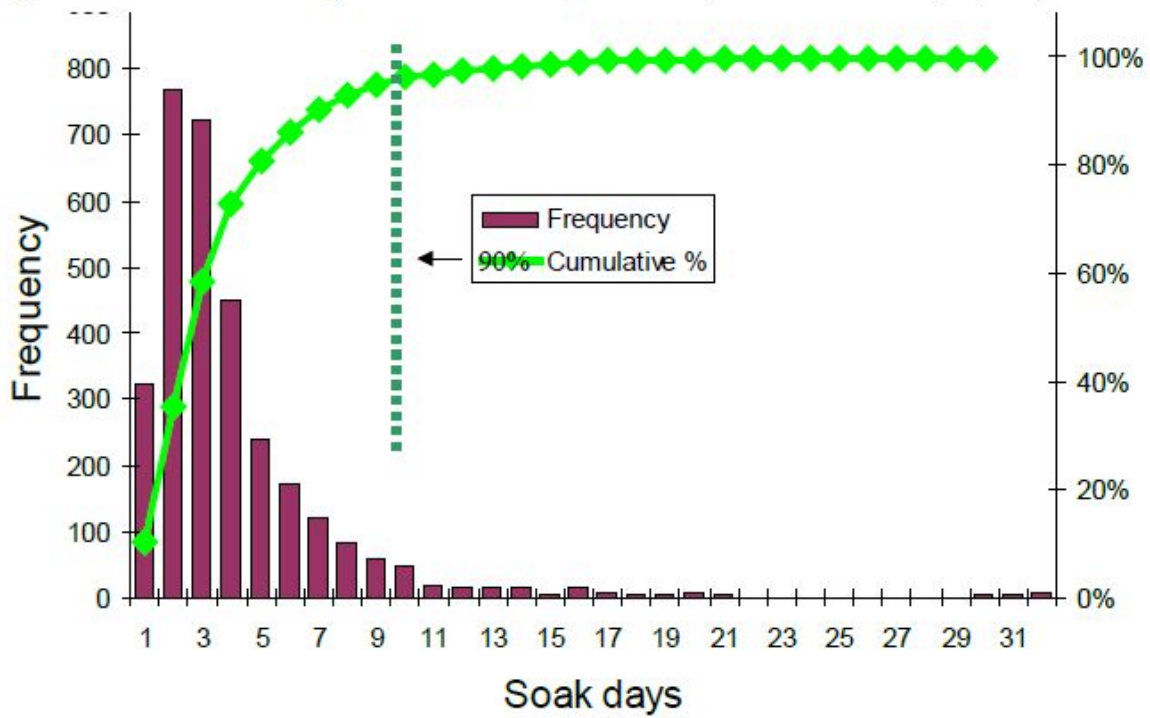
Year	HAL	Pot	Trawl
2009	3.11	2.84	2.05
2010	3.69	3.30	2.81
2011	4.94	4.56	4.03
2012	3.96	2.62	3.26
2013	2.79	2.47	2.34

ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive\_FT

Source: NPFMC, 2016

### Appendix E

Figure 8 Number of soak days for 1999-2005 BSAI pot fisheries. (Source: GOA Safe Report, 2008)<sup>8</sup>



Source: Hanselmann et al., 2009)