



# Fisheries observers as enforcement assets: 21 Years of lessons from the North Pacific

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## ABSTRACT

Fisheries sustainability through governance is achieved through enforcement of marine resource laws and regulations, and that enforcement depends upon accurate reporting of potential crimes. These potential crimes are reported by fisheries observers in regions where observers have a dual role as scientist and enforcement asset. Trends in reported violations from a large observer program were examined to increase accountability and transparency, identify how compliance has changed over time, and illustrate the complexities that come with the analysis of these data. Large increases in the rate of potential violations reported by observers were due to the passing of new regulations, a delayed response to a major event, or the efforts of few individual change agents. A much smaller proportion of reported violations have resulted in penalties in recent years when compared to a prior study conducted early in the time series. These differences likely reflect the cumulative effect of gradual increases in regulatory burdens put on observers to report relatively minor offenses for which there are inadequate resources to address.

## 1. Introduction

Intensively managed, well-regulated, and well-enforced fisheries carry numerous benefits for fishermen, fish stocks, and fishing communities. Fisheries typified by low incidences of illegal, unregulated, and unreported (IUU) fishing possess stock levels that are above target levels of exploitation or are rebuilding [1–3]. The groundfish fisheries that operate off the coast of Alaska in the North Pacific have enjoyed a reputation as an example of such fisheries [4]. They employ stakeholder input and involvement; near-real-time quota monitoring; extensive use of cooperatives or catch-sharing agreements (termed Limited Access Privilege Programs, or LAPP, [5]) and space, area, and gear-specific closures [6]. The fisheries are supported by a comprehensive fisheries monitoring program that includes at-sea and shore-based observers and video camera systems. Observers in the North Pacific have a mandate to report potential natural resource law violations to the Office of Law Enforcement - Alaska Regional Division (AKD) in addition to their responsibility to collect unbiased scientific data. The dual role of observers presents the paradox of necessarily conflicting mandate: They cannot

effectively be viewed as impartial by fishermen when they also collect information that could result in more law enforcement. This can contribute to observer effects, where the act of monitoring changes the behavior of fishermen and data can become biased and unrepresentative [7,8]. In contrast, fisheries observers cannot collect unbiased data if they are subjected to deliberate interference, harassment, or intimidation.

The analysis of potential violations from fishery monitoring programs are important. Insight into the type, timing, and magnitude of potential violations of fishery regulations can increase the effectiveness of limited enforcement resources. In recognition that behavior modification through fisheries policy is largely accomplished through enforcement, these benefits in turn can increase trust in, and the success of, the entire fisheries management enterprise [9].

The analysis of potential violations reported by observers is in its infancy despite the potential benefits of increased transparency, and accountability, and the evaluation of the effectiveness of observer programs [10]. In this study, the reporting of potential violations with regulations from a large observer program was examined over the course of 21 years. Standardized data reveal trends, resolutions, and

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how changes in fisheries management and regulations have affected the reporting of potential crime by observers. We end by providing ways to improve the efficiency of fishery monitoring and enforcement.

### 1.1. The NPGHOP

This study is from the North Pacific Groundfish and Halibut observer program (NPGHOP). The NPGHOP has utilized observers to monitor the fisheries off the coast of Alaska since the mid-1970s and has employed camera systems for this same purpose since at least 2008 [11]. The program is administered by the Fisheries Monitoring and Analysis (FMA) Division of the Alaska Fisheries Science Center (AFSC; a part of the National Marine Fisheries Service, or NMFS). The NPGHOP divides the fleet into a full coverage portion (where the majority of catch is placed) and a partial coverage portion (where the majority of vessels are placed) on the basis of trips and produces an annual deployment plan for the upcoming year and an annual report for the past year [12]. The NPGHOP is quite large – at last assessment, 423 vessels in the North Pacific were monitored by observers for 35,769 days and an additional 170 vessels were monitored with cameras for 1,442 days for a total monitoring coverage of 43.2 % [13]. There are year-to-year fluctuations in coverage rate in the partial coverage fleet due to changes in fishing effort, funding availability, regulatory requirements, and deployment strategies. A sampling manual and standard operating protocols have been developed for observers and video reviewers respectively to standardize data collections [14].

### 1.2. Training, debriefing and reporting potential violations

Observers must successfully complete a 3-week certification training prior to their first deployment (or if they have not been deployed for 18 months), a 1-day briefing prior to every subsequent cruise (a period of time lasting up to 90 days or a maximum number of vessels determined by NMFS), and 3-day briefing annually. An additional 2-day training may be recommended for some observers who need additional coaching. These training sessions are comprehensive in preparing observers for all aspects of the job, with emphasis on scientific sampling protocols, at-sea safety, and compliance monitoring. AKD provides specific training to observers during their initial 3-week training course on proper compliance monitoring, observer victim crimes, and support services.

The first priority for observers is safety while the second is the monitoring and documentation of compliance infractions [14]. Observers record potential infractions in a logbook and report them to FMA during the debriefing process, which occurs after each cruise. The debriefing process is important to ensure that potential violations are documented clearly and accurately. We emphasize the term *potential violations* because observers are not law enforcement and a determination of whether a violation has occurred does not happen within the realm of fisheries monitoring. If a potential violation or safety issue is identified during debriefing, the observer is directed to write a *statement*. Statements are assigned by the observer to a *statement category* (or *header*). Statements are unique to the observer, the vessel or processing plant on which they were deployed, the statement category, and the target fishery (i.e., the predominant species landed such as Pacific cod - *Gadus macrocephalus*). Statements contain a record of the number of occurrences of the potential violation during a period of time. For example, a single statement for 'Failure to notify' may record a potential violation occurrence for each haul a vessel retrieved without notifying the observer. Once a statement is written, an editing process occurs where an FMA staff member highlights any typos, mistakes, inaccuracies, and/or speculative language and requests that the observer corrects them. Finally, the statement is officially verified by the FMA staff member, signed by the observer, and a hard- and electronic copy is forwarded to either the AKD or the United States Coast Guard (USCG) depending on the statement category.

### 1.3. AKD review

Statements reviewed by the AKD are eventually - usually within a year - assigned a final disposition, or eventual outcome. The statements can be dismissed (AKD determined that a violation did not occur), declined for prosecution (AKD determined that a violation did occur but it could or was mitigated), or be used to open or contribute to an existing "case" for investigation (AKD determined that a pursuable violation did occur). A case may include multiple statements but will have one disposition. In recognition that there are finite law enforcement resources, the AKD has identified the deterrence and detection of observer sexual assault, assault, harassment, observer safety, interference, and significant sample bias violations as their highest priorities for investigation [15].

## 2. Methods

We assembled the reported potential violations by fishery observers from the NPGHOP and combined it with the subsequent action by AKD from the start of electronic records (1999) to 2020. We did not include information from video reviewers or cases that were transferred to USCG because they lack the rigor, availability, and disposition information of observer statements that are forwarded to AKD. We standardized the statement categories where appropriate throughout the time series (Table S1). For statements that were missing the number of occurrences, we imputed the mean number of occurrences for the appropriate category from the same year. To account for year-to-year changes in fishing effort and observer coverage rates (monitored sampling units divided by all possible sampling units), we calculated a standardized rate of occurrence (i.e. an occurrence rate) for each statement type and year following previously reported methods [16]. Briefly, the number of occurrences per 1000 observed days is achieved by summing the total occurrences and dividing this value by the total number of observed days for that year and multiplying the result by 1000. The choice of 1000 was made to transform the occurrence rate into whole numbers to ease interpretation of figures.

Prior to this study, Porter [17] reported the resolution of closed enforcement cases that resulted from NPGHOP observer statements during 2001–2006. Due to the non-congruent evolution of electronic databases by the FMA and the AKD, the case dispositions from the time period of the study by Porter [17] were not available to us. To enable comparisons between the present study and that of Porter [17], we characterized the dispositions of observer statements and cases from AKD to match those used in Porter [17] for the most recent period of time of equal duration (2015–2020; Table S2). The disposition of "unknown" posed a problem since statements exist without a case or a dismissed disposition assigned to them. To generate an estimate for the number of cases of unknown dispositions we first calculated the ratio of statements to cases for the period of 2015–2020 for each statement category and then multiplied this ratio by the number of statements with unknown dispositions in each statement category. We mapped the statement category to the case resolution to illustrate whether some statement categories were resolved differently than others.

## 3. Results and discussion

### 3.1. What drives changes in reported statements?

Table 1 summarizes the changes to observer reporting of potential violations with maritime law. The type and frequency of potential violations reported by observers are reported for broad categories in relative terms in Fig. 1 and in absolute terms in Figs. 2 and 3. There were 20,806 statements examined. Annual tallies ranged from 166 in 2001 to 2,203 in 2016 and averaged 945.7 (Fig. 1). We found that the type and frequency of potential violations reported by observers are broadly affected by three factors: new regulatory requirements, a renewed focus

**Table 1**

Timeline of notable events related to the NPGHOP and its impacts on the reports of potential violations reported by observers and video reviewers. Changes to the statements database are entered in Bold.

Year	Trigger Event	Impact to Fisheries Monitoring	Database Changes
1998	Cultural Change - First OLE Liaison Special Agent		
1999	Start of electronic records Renewed Focus - The U.S. Fish and Wildlife Service (USFWS) issues a Biological Opinion on the effects of the Bering Sea and Aleutian Islands Management Area (BSAI) and Gulf of Alaska (GOA) groundfish hook-and-line fisheries on the endangered short-tailed albatross. The opinion effectively establishes a bycatch cap on this species.	Increased vigilance on seabird avoidance methods by vessels, although such gear is not required.	
2002	Renewed Focus - 180 foot FV <i>Galaxy</i> sinks with an observer on board. Three crew members perish.	Renewed focus on observer safety.	<b>Four new safety categories created for observer statements.</b>
2003–2004	New Regulation - Suite of regulations related to the AFA Fleet Cooperatives. 2003: Four amendments are published that incorporate measures that specify - who may fish for BSAI pollock, how cooperatives are formed, harvesting and processing limits, measures that establish catch weighing and monitoring requirements for participating vessels, and extension of an inshore/offshore regime for pollock and Pacific cod in the Gulf of Alaska. 2004: Regulations were re-issued without a sunset date.	This created a suite of new responsibilities for observers not limited to monitoring the accuracy of motion compensated flow scales.	
	New Regulation - 2004: Different forms of seabird deterrence are standardized	While reporting of injured or dead seabirds continued, this new regulation created new	The statement category for potential seabird deterrence violations was

**Table 1 (continued)**

Year	Trigger Event	Impact to Fisheries Monitoring	Database Changes
	depending on vessel type, vessel size, and other factors.	responsibilities for observers.	changed from "Lack of Avoidance" to "Seabird Avoidance Measures" in order to capture violations where the vessel deployed an insufficient amount or type of bird deterrence gear.
2007	Cultural Change - New OLE Observer Special Agent	Emerging concerns over flow scale tampering, intentional sample bias, observer sample stations, and observer assistance motivated stronger resource and training development for observers as well as the development of Limited Access Privilege Program focused statement categories.	
	New Regulation - Amendment 84 to the BSAI Fishery Management Plan (FMP). The goal of Amendment 84 was to create an incentive for vessels to cooperate in order to reduce salmon bycatch.	This category is about operational requirements. Created new pressures on the observer to report related potential violations.	<b>New 'AFA' category created</b> to address catch weighing, catch handling, video monitoring and new observer sampling station requirements for these vessels.
2007–2008	New Regulation - 2007: Central Rockfish <i>Pilot</i> Program established that allows permit harvesters to form voluntary cooperatives and receive an exclusive harvest privilege to groundfish species in the Central Gulf of Alaska begins. The pilot program runs until 2011.	This category is anything specific to reporting requirements, such as not retaining a rockfish species as required, conducting catch monitoring and control plans for processing plants accepting GOA rockfish deliveries.	<b>2008: New 'Rockfish Program' category created.</b>
2008	New Regulation - Amendment 80 BSAI FMP. Allocates several BSAI non-pollock trawl groundfish species among trawl fishery sectors, and facilitated the formation of harvesting cooperatives in the non-American Fisheries Act (non-AFA) trawl catcher/processor sector. In addition,	Created new pressures on the observers since their data is used near real-time to account for bycatch. When bycatch is exceeded, species are placed on discard only status, but do not close the fishery.	<b>New 'A80' category created</b> to address catch weighing, catch handling, video monitoring and observer sampling station requirements of the regulations.

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Table 1 (continued)

Year	Trigger Event	Impact to Fisheries Monitoring	Database Changes
	Amendment 80 modified the management of halibut and crab prohibited species catch (PSC) limits.		
2011	New Regulation - Amendment 91 BSAI FMP. This regulation places caps on the amount of Chinook bycatch that can be caught in cooperatives and establishes incentives for staying below the cap.	Created new pressures on the observer since their data is used near real-time to account for salmon bycatch that can close this fishery.	<b>New 'A91 Salmon' category created.</b>
	New Regulation - NMFS amends existing recordkeeping regulations to make them more clear and consistent.	Recordkeeping and reporting records started to increase in 2010 in anticipation of these regulations.	
2011–2012	Cultural Change - Creation of OLE Observer Liaison Contractor	Interactive scenarios with returning observers, more contact with OP staff, improved statement writing resources, streamlining of information flow.	
2012	New Regulation - Rockfish Program in the GOA FMP regulated.		None – 'Rockfish Program' category retained.
	New Regulation - Amendment 93 to the GOA FMP. Establishes separate bycatch limits in the Central and Western GOA for Chinook salmon.	Created new pressures on the observer since their data is used near real-time to account for salmon bycatch that can close this fishery.	<b>New 'Gulf of Alaska Salmon' category created.</b>
	New Regulation - NOAA Fisheries modified equipment and operational requirements for freezer longliners named on License Limitation Plans (LLPs) endorsed to catch and process Pacific cod at sea with hook-and-line gear in the BSAI.	This created a difficult assignment for observers - they are usually deployed on a vessel with a flow scale by themselves. Created new pressures on the observer since their data is used near real-time to account for bycatch in this fishery.	<b>New 'Catcher Processor Longline' category created.</b>
2013	New Regulation - Amendment 76 GOA FMP/86 BSAI FMP. Observer Program restructured. Fleet divided into a full coverage pool (observers independently obtained by vessels	Observers deployed onto vessels that had not been culturally adjusted to fisheries monitoring. Appears to have driven rate increases in record keeping, safety, and seabird deterrence.	<b>New 'IFQ retention' category created.</b> This category arose because many IFQ vessels were discarding legal sized fish.

Table 1 (continued)

Year	Trigger Event	Impact to Fisheries Monitoring	Database Changes
	through open market) and a fee-based partial coverage pool (observers deployed under a Federally administered contract). IFQ halibut fleet included in monitoring for the first time. Electronic monitoring with camera systems (EM) added as an alternative to observers for longline and pot vessels.		
2014–2016	Total halibut PSC limit reduced for next two years. 15–25 % in the BSAI; 7–15 % in the GOA	Created new pressures on the observer since their data is used near real-time to account for bycatch in this fishery.	
2015 – 2016	Cultural Change - New OLE Observer Special Agent	A new focus on discriminating between types of harassment and non-reporting.	<b>The catch-all categories of 'Harassment – other' and 'Harassment Intimidate / Interfere' are deprecated and replaced with three new categories</b>
2015–2016	Renewed Focus - In May of 2015, all groundfish fisheries for the Non-Rockfish Program catcher vessel sector were closed for the remainder of 2015 because the sector unexpectedly reached its annual Chinook salmon PSC limit for the Western and Central GOA (A93).	2016: A large spike in 'Gulf of Alaska Salmon' statements result from some very active attempts by the fishery to avoid salmon bycatch reporting following the 2015 year. The violations reported under this tend to be along the lines of salmon not being retained, inaccurate salmon numbers, being denied access to salmon, or anything specifically related to the salmon bycatch.	
2016	New Regulation - Reduction in allowable quotas for salmon bycatch in the BSAI by large processors. (A110)	Created new pressures on the observer since their data is used near real-time to account for bycatch in this fishery.	Increase in prohibited species mishandling
	Renewed Focus - The highly unusual loss in a one-year period of two NOAA Fisheries-trained observers (one in a	A national review of Observer Program safety policies and practices was conducted and	

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Table 1 (continued)

Year	Trigger Event	Impact to Fisheries Monitoring	Database Changes
	domestic fishery and one in an international fishery), and a foreign observer on a US-flag fishing vessel in the Western Pacific	published (Heinz et al. 2017).	
2018	New Regulation - Amendment 104 to the GOA FMP and Amendment 114 to the BSAI FMP. EM is regulated for fixed gear. Amendments establish the process and structure for owners and operators of vessels using non-trawl gear in the partial coverage category of the Observer Program to choose to be in the EM selection pool and to use an EM system to monitor catch and bycatch.	Method for reporting violations (focused on sexual assault and sexual harassment) are established as part of the contract issued from NOAA to review video. (2017).	Monitoring system of EM compliance is established.
2019	Cultural Change - New FMA Analyst. Cultural Change - New FMA Director.	Analysis of statements is conducted jointly by FMA and OLE for the first time. New focus is on identifying driving factors and historical trends in data while controlling for observation and fishing effort (Appendix C in 2019 Annual Report).	
2020	New Regulations - From 2012–2019, Experimental Fishing Permits (EFPs) are issued to the trawl catcher processor sector that aim to reduce halibut mortality. From 2016–2019 these allowed the sorting of halibut bycatch on deck in the presence of an observer prior to the catch being transported below deck on a processor. In 2020 this became a regulated practice.	Orcas may feed on halibut discarded from vessels while fishing in waters adjacent to the eastern Bering Sea shelf. Reports of Marine Mammal Feeding increase.	<b>New 'Halibut Deck Sorting' Category created</b> to cover any new operational requirements such as exceeding allowed time to sort catch on deck, processing fish in the factory while the observer is still on deck, etc. Marine Mammal feeding is still reported under a Marine Mammal Feeding category.

on existing regulations, and in response to cultural change.

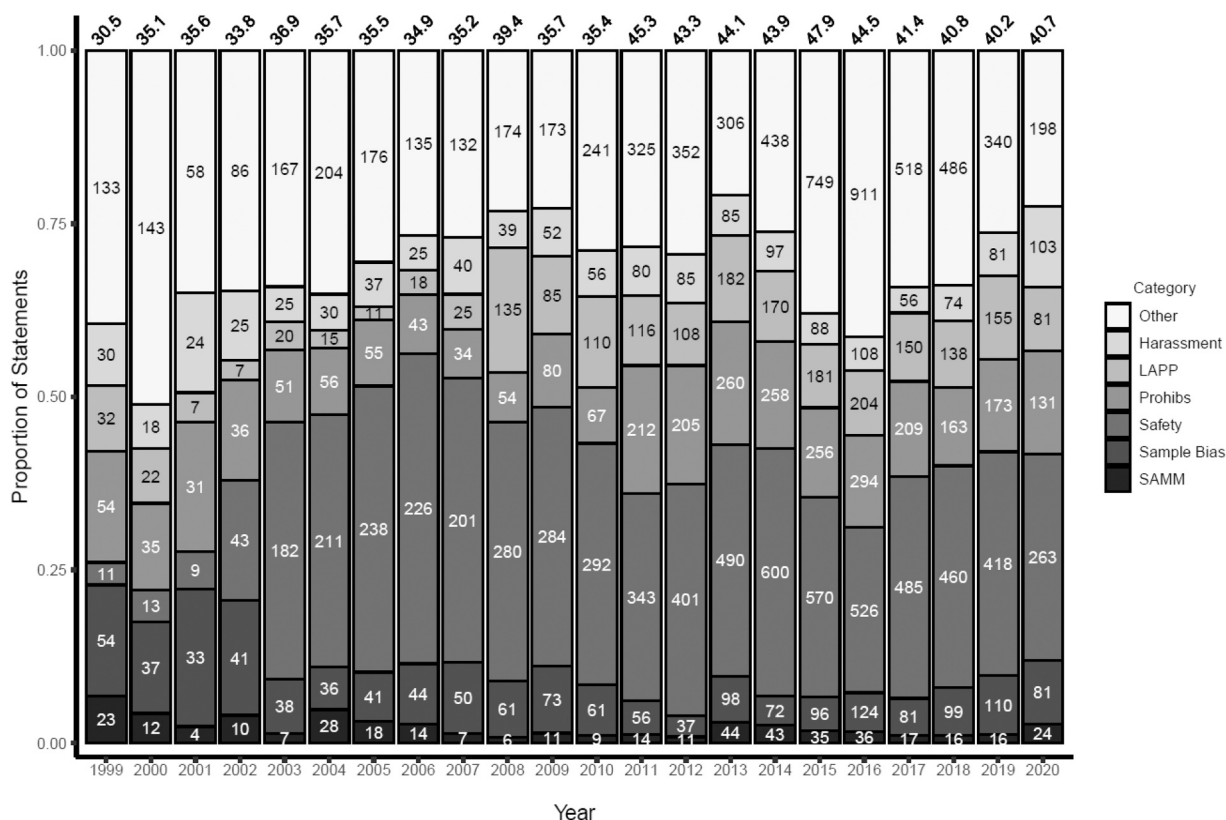
### 3.1.1. New regulations

We found that the largest changes to the reporting of potential violations over time was due to new regulatory requirements - especially those related to the reporting of bycatch species or interactions with

seabirds or marine mammals. We found several examples where a high bycatch event preceded new regulations, and the initiation of those regulations was coincident with an increase in the occurrence rate of potential violations related to bycatch. This timing is important - since observer reports of potential violations are always tied to legal requirements, increases in occurrence rate do not necessarily reflect an increase in violation rates in fisheries. Our first example relates to efforts aimed at reducing seabird interactions with longline gear. In 1997, new regulations established a number of seabird avoidance strategies, but did not establish the use of streamer lines which were eventually found to be the most effective at minimizing seabird-longline gear interactions [18]. The bycatch of all albatross (*Phoebastria* species) in Alaska increased to what would be an all-time high in 1998 before declining between 1999 and 2002 and remaining relatively stable [19]. The bycatch spike of 1998 prompted the writing of an Incidental Take Statement for short-tailed albatross in 1999 that established a bycatch amount for this species that, if exceeded, would prompt action by the United States Fish and Wildlife Service that could detrimentally impact fishing opportunities. It was *this* year (1999) when a large reporting rate of potential violations for seabirds was evident (Fig. 2). Seabird occurrence rates also increased in 2004–2005 (Fig. 2). This increase was due to new requirements established in 2003–2004 that mandated observers record deterrence methods on their data sheets (Table 1) and not increased seabird interactions since bycatch rates were level during this time.

The establishment of new LAPPs also coincided with increased occurrence rates by observers. LAPPs and cooperatives allow for dedicated harvest opportunities for groundfish and bycatch species, and have been heralded as a leading example of successful fisheries management [20–22]. LAPPs and the complete observer coverage they mandate have also been used to defend the quality of fisheries data against detractors (e.g. see Hilborn et al. [23]). However, LAPP establishment has without fail added to the burdens of fisheries observers (Table 1) - a consequence that we are not aware of having been previously reported in the literature. For example, although the occurrence rate related to LAPP increased only slightly in 2008 with the passing of Amendment 80 (A80; Fig. 2) this rate belies the large increase in the actual and relative number of statements associated with LAPP that were generated at this time (actual values increased from 23 to 135 between 2007 and 2008, Fig. 1).

Two other instances of regulations triggering increased reporting were found related to Chinook salmon (*Oncorhynchus tshawytscha*) bycatch. Bycatch of Chinook salmon by trawl vessels in the Bering Sea increased between 2000 and 2007 before dramatically dropping between 2008 and 2010 and remaining relatively low [24]. In 2010, revised quotas were established for this species among trawl catcher processors targeting Walleye pollock (*Gadus chalcogrammus*) in the American Fisheries Act (AFA) cooperative, and in 2011 a new 'Amendment 91 (A91) salmon' type of Prohibited Species statement category was established for observers to match new regulations (Table 1). The A91 regulation greatly increased the relative and absolute number of statements (LAPP statements increased from 67 to 212 between 2010 and 2011, Fig. 1) and effectively doubled the rate of potential violations reported for prohibited species (Fig. 2) - despite bycatch rates being low during this period of time. In the Gulf of Alaska, high years of Chinook salmon by trawl vessels were evident in 1999, 2005, 2007 and 2010 before dropping to half its 2010 peak and remaining steady through 2019 [25]. In response to the peak bycatch in 2010, regulations known as Amendment 93 (A93) revised bycatch salmon quotas for this fleet and established new reporting requirements for observers in 2012 (Table 1). The passing of A93 only slightly increased the reporting rate for prohibited species in absolute or relative terms (Figs. 1 and 2). These examples highlight how increases in the reporting of potential prohibited species violations due to new regulations are delayed from the bycatch event they were created in response to. In the case of Chinook salmon, the increased reporting burden of



**Fig. 1.** Absolute number and relative proportion of each category of potential violations reported by observers. Each year on the horizontal axis is associated with a stacked bar chart with different shadings, each for a different category of potential violation. The numbers in each shading are the number of reports. The italicized number at the top of each stacked bar is the number of observed sea-days / 1000.

observers was enacted after substantial decreases in bycatch had already taken place.

The enactment of new regulations can reveal undesirable practices previously unknown to monitoring and enforcement. For example, in 2013 vessels under 60 feet in length and those fishing in the Individual Fishing Quota (IFQ) Pacific halibut fishery were newly required to carry observers (Table 1). A new statement category of 'IFQ retention' was created in 2013 to record vessels that unlawfully retained or discarded Pacific halibut (*Hippoglossus stenolepis*), sablefish (*Anoplopoma fimbria*), Pacific cod (*Gadus macrocephalus*), and rockfish (family *Scorpaenidae*) when required according to specific area and size retention rules. Coincidentally, a large increase in the occurrence rate of failing to employ 'Seabird avoidance measures' was recorded in 2013 for these previously unobserved vessels (Fig. 2). Over the course of the next five years the occurrence rate of seabird avoidance abated due to the continued vigilance and reporting by observers and enforcement efforts (Fig. 2).

### 3.1.2. Renewed focus on existing regulations

We found two examples where an increase in the occurrence rate was in response to a renewed focus on existing regulations. The first of these was related to safety. Commercial fishing is one of the most dangerous occupations in the United States [26]. On October 20, 2002, the 180-foot factory longline vessel *Galaxy* caught fire and exploded, killing three crew members. The observer aboard the *Galaxy* survived and the NPGHOP changed their approach toward safety training and made improvements on how observers document their vessels' safety practices and any safety incidents that occurred (Table 1). The vague statement category "Safety Issues" was replaced by four new statement categories: USCG regulations - failure to conduct emergency drills, marine casualties, equipment deficiencies, and Safety-NMFS (for remaining safety issues not covered by specific USCG regulations). Increased focus and

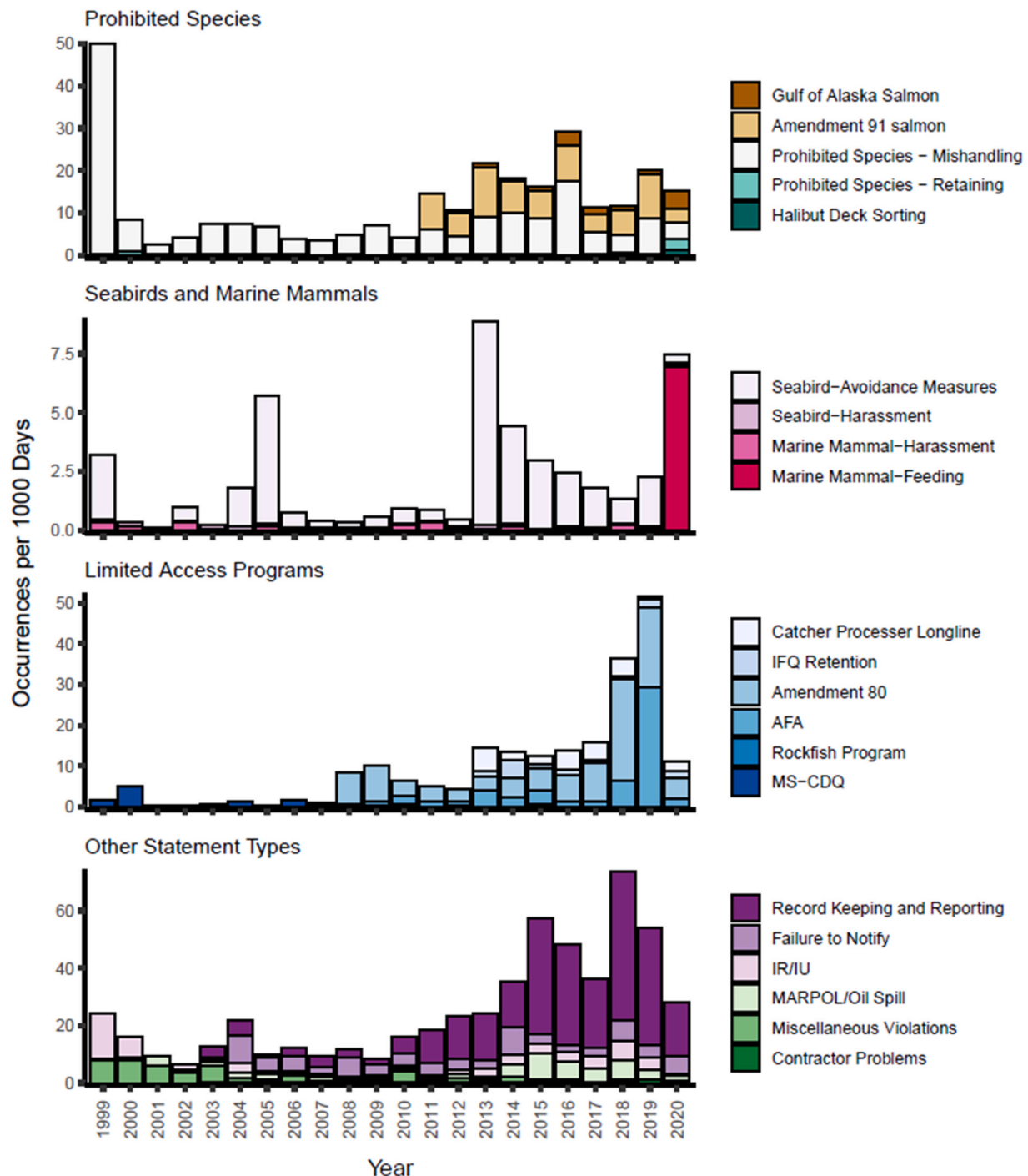
improved reporting of these issues is evidenced by the greatly increased number and relative number of Safety related observer statements beginning in 2003 (Fig. 1). In 2016, there was an unusually high number of marine casualties resulting in the loss of two NOAA Fisheries-trained observers and NOAA initiated a full-scale review of Observer Program safety policies and practices [27]. From this review, the NPGHOP did not need to institute any broad changes to its reporting practices nor did it see a rise in safety issues during or after this time due to the changes put in place in 2003.

Regulations were already in place that governed how much bycatch was allowed in specific fisheries in May of 2015, when all groundfish fisheries for the Non-Rockfish Program catcher vessel sector were closed for the remainder of the year because this cooperative unexpectedly reached its annual Chinook salmon quota limit for the Western and Central Gulf of Alaska (A93). As a result of this high bycatch event, in 2016 we saw a large spike in the occurrence rate of 'Gulf of Alaska Salmon' (Fig. 2). Associated statements documented some very active attempts by fishery participants to avoid salmon bycatch accounting that included: salmon not being retained as required, observers being denied access to salmon bycatch, and interfering in accurate counts of salmon bycatch [28].

### 3.1.3. Change agents

The importance of motivated individuals - those capable of making changes to how potential crimes at sea are reported - cannot be overlooked for their role in manifesting cultural change. Evidence of the impact of change agents has been also shown in the related fields of law enforcement [29] and health monitoring [30], so it is not surprising to find them in the field of fisheries, although examples are few [31]. We found evidence of impact from these so-called change agents in our analysis (Table 2). In anticipation of maintaining and entering electronic records, the AKD hired the first observer liaison special agent (OA) in



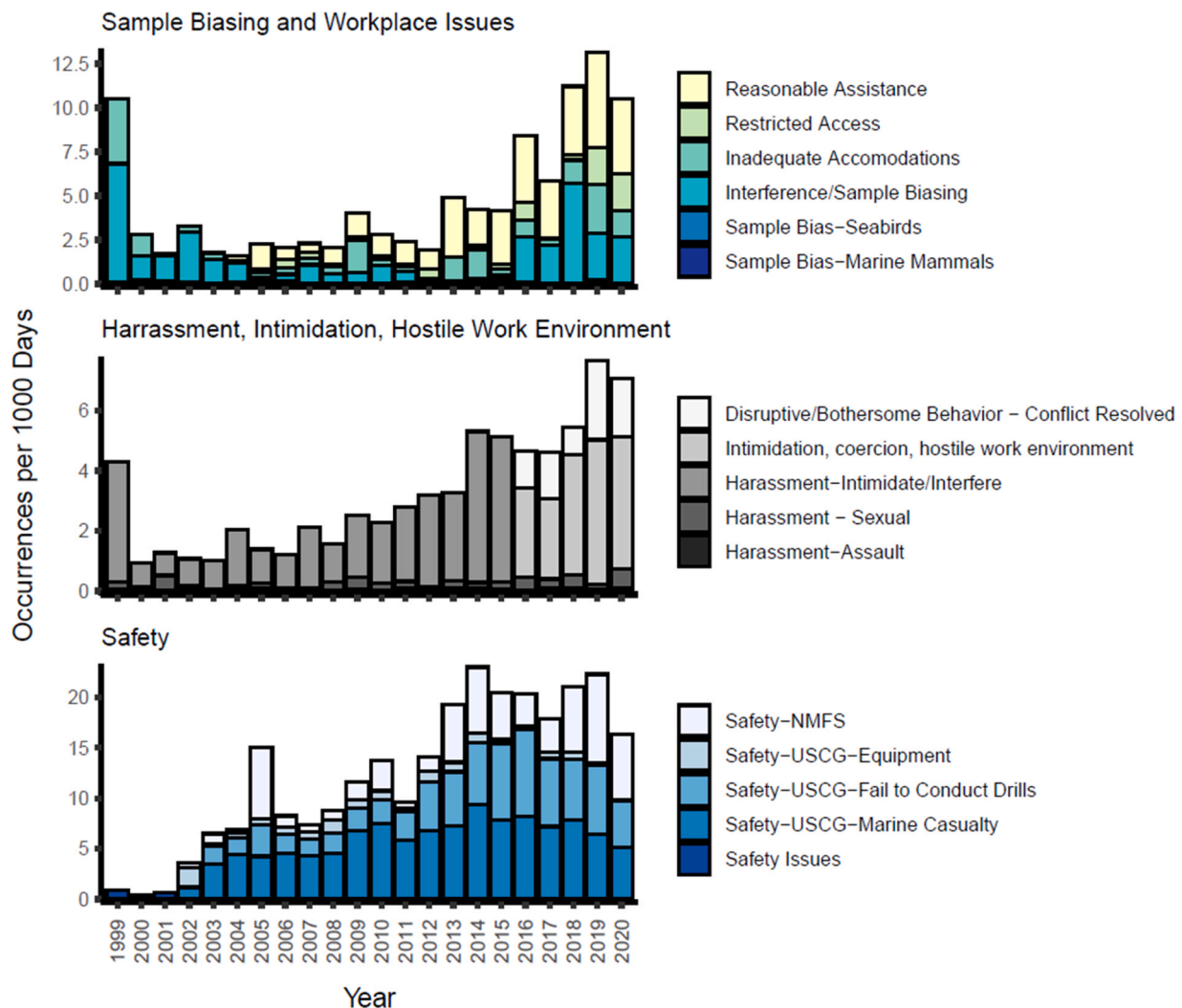


**Fig. 2.** Rate of Occurrences for reports of potential violation types (colors and shading) for each broad category (individual panels) not considered a priority by the Office of Law Enforcement - Alaska Regional Division.

1998 (Table 1). The OA trains observers, meets with industry groups and vessel companies to advise them of regulatory requirements; supports observers who may have been victimized; and investigates high-priority observer-related complaints. The second individual to be the OA started in 2007 and was responsible for addressing observer statements related to a suite of new regulations during the period of 2007–2013 that greatly increased the number of potential violation categories, rules for observers and industry to know and track, and the need for training and coordination among the AKD, FMA, and industry. Concerns over the intentional biasing of observer samples and providing adequate observer assistance motivated stronger training for observers and the

development of LAPP-focused statement categories (Table 2). A new position of OLE Observer Liaison was created in 2011. This individual instituted interactive training scenarios with returning observers, created protocols to increase contact with observer provider companies, improved the resources used to write statements, and streamlined information flow among various agencies.

In 2015 the third individual to be the OA was hired. This individual initiated a new focus on discriminating between types of observer harassment and instituted increased outreach and victim assistance pertaining to sexual assault and sexual harassment (SASH). As the culture of the United States underwent a resurgence of reporting victims of



**Fig. 3.** Rate of Occurrences for reports of potential violation types (colors and shading) for each broad category (individual panels) considered a priority by the Office of Law Enforcement - Alaska Regional Division.

**Table 2**

Summary of case resolutions that were not transferred to another agency from the study of Porter (2010) and this study. The disposition of 'prosecution declined' refers to cases where the Office of Law Enforcement - Alaska Regional Division decided not to pursue enforcement action due to mitigating circumstances. The disposition of 'dismissed' refers to cases where an investigation determined that either no violation occurred, there was not sufficient evidence to support the claim that a violation occurred, or there weren't enough personnel to pursue the investigation.

Source	Porter (2010)		This Study	
Years compared here	2001–2006		2015–2020	
Metric	N	%	N	%
Disposition				
Prosecution Declined	381	42.5	1592	59.4
Resulting in penalty	324	36.1	199	7.4
Dismissed	119	13.3	782	29.2
Unknown / Unclassed	73	8.1	109 *	4.1 *
Total	897	100	2862	100

\*estimated

sexual assault as the result of a boost from the #metoo movement (originated in 2006 by Tarana Burke) in 2017 [32], a decrease in the dismissal of sexual assault has been shown [33]. In our time series, however, a coincident increase in SASH reporting was not evident in our data as might be expected (Fig. 1). We feel this was due to the fact that

increased training and outreach had already occurred. A major benefit of the efforts of this individual was that for the first time enforcement and monitoring had the ability to discriminate between amicably resolved incidents (conflict resolved) and those which required more action (Fig. 3).

Limited enforcement enterprises require efficient, timely, and reliable reports of violations [34]. In 2019 the FMA Division of the AFSC had a new Director and recruited a new analyst who had served as an observer and had extensive database experience. The calculation of occurrence rates was initiated in 2019 and allows for the identification of driving factors and historical trends in data while controlling for observation and fishing effort [16]. This rate calculation was important because prior to this time, summaries of observer statement data had been presented to the public in terms of the total number of statements recorded for the year in each statement category. While this method is informative as a baseline, changes in coverage rates and fishing effort were not accounted for, and this could lead to misinterpretations. For example, an increase in the number of statements recorded for a particular statement category from one year to the next was likely to be interpreted as 'bad' because it is often assumed that the values are comparable. Instead, an increase in the number of statements from one year to the next may have been the result of an increase in fishing effort or observer coverage in a particular fishery, which increased the number of observer deployment days in that fishery.



### 3.2. What are the trends in reported violations?

We found three trends in the reports of potential violations that are related to IUU. The first is an increase in occurrence rates for the LAPPs A80 and AFA, respectively, during 2018–2019. The bulk of these reports of potential violations pertained to regulations that govern how catch is weighed and monitored (50 CFR 679.28) in the Bering Sea. For example, A80 and AFA vessels must test and maintain flow scales that continuously weigh fish as they move through the factory on conveyor belts. Observers recorded high instances of flow scales being ‘overrun’ with catch and run expeditiously. This activity can cause mechanical strain on the instrument leading to weighing errors. In the A80 fleet, observers reported increased concerns about observer working conditions (e.g. missing equipment, high traffic, and cramped conditions), and the illegal practice of mixing the catch among successive hauls which can jeopardize the independence and accuracy of observer samples. Not surprisingly, the categories of interfering and sample bias, Safety-NMFS, Recordkeeping and Reporting (Other Statement Types), and Harassment also show increased occurrence rates during this time (Figs. 2 and 3).

Occurrence rates for Safety previously trended upward but have declined in the most recent years (Fig. 3). Not all safety statements in our time series are related to events where the observers are in immediate physical danger. Many Safety-NMFS statements are related to working conditions on the vessel. Those related to the physical layout of the vessel are difficult to resolve, while those related to crew practices or where equipment is stored are easier to resolve. NMFS encourages observers to discuss with their captains the safest places to work and to avoid working when conditions are unsafe. The apparent rise in safety-related occurrence rate over time in our view is due to the fact that every year the threshold of reporting is lowered to encompass more potential safety threats. Old assumptions about what is safe are constantly being tested by new observers, and the system does not slacken itself into complacency. In support, commercial fishing fatalities in the Alaska region have actually declined 73 % during the period of 1990–2014 [35].

A sustained increase in the occurrence rates for sexual harassment, intimidation, and hostile work environment is evident in our time series. This is concerning because Alaska has the highest rates of sexual violence in the Nation [36]. Workplace bullying and harassment is a significant problem in the maritime industry [37,38] and observers represent a subset of this community. Despite being one of OLEs top stated priorities, harassment of observers remains prevalent in U.S. fisheries [39]. National surveys in the U.S. suggest that half of observers had experienced harassment [40]. We are hopeful that most of this trend in Fig. 3 is due to an increase in reporting. Victim crimes are known to be underreported [41,42] and barriers to reporting victim crimes by observers include gaining a reputation for being an informant, not wanting to worry loved ones, being unsure if they suffered a reportable offense, fear of reprisal, and fear of being blacklisted by the industry and the work for which they enjoy [43]. In December 2015, with the introduction of a new Observer Liaison Special Agent, the Office of Law Enforcement began to change their tactics to reduce risk to observers. Following the Routine Activities Theory of Crime [44], the AKD focused on earning the trust of observers and educating them on a variety of topics during their training. Law enforcement and other authority figures are often considered to be capable guardians, but AKD began to encourage *everyone* to become a capable guardian by being an active bystander, including industry members, observers and staff of other law-enforcement agencies. Annual anonymous surveys have been sent to observers to estimate the ‘dark-figure’ - the extent to which official records of victim crimes are under-reported - and work is underway to calculate reliable estimates of victimization rates from these data [45].

### 3.3. What are the resolutions of observer statements?

So far we have presented and discussed changes in occurrence rates.

Of equal interest is the disposition of associated statements of potential violations. The number of cases in the most recent five-year period was considerably larger than reported by Porter [17] (Table 2). This cannot alone be attributed to the relative size of the observer program - the average sea-days monitored in the prior period (35,397) is 20.3 % smaller than the more recent period (42,599), but the more recent period has almost three times as many cases than the prior period (Table 2). This study had a much greater proportion of cases that had a disposition of ‘declined prosecution’ or ‘dismissed’ and a much lower proportion of cases that resulted in penalty than the cases reported by Porter [17]. At face value, one might assume that law enforcement is failing to hold offenders accountable. However, the sheer volume of regulations is likely a contributing factor. We have documented over 400 regulations resulting from the Marine Mammal Protection Act, the, Magnuson Stevens Act, and United States Code that are applicable to observers in the NPGHOP.<sup>1</sup> Many of these regulations, especially those related to the categories of LAPPs and recordkeeping and reporting (All Other category), have been written since the period examined by Porter [17]. There is undoubtedly confusion with what should be reported among observers and even NMFS staff. This confusion, combined with the fact that observers in this region are trained to ‘report when in doubt’ would result in a high volume of statements that when assigned to cases, would result in dismissal or failure to prosecute because of missing or incomplete information. In support, the propensity to dismiss or fail to prosecute cases appears to be widespread among all categories and is not different for the AKD priority categories of harassment, bias, and safety (Fig. 4). The results of this study are similar to those from Dobson et al. [39] who found that of NOAA Office of General Council enforcement action records for the Nation from 2014 to 2018, only 4 % of citations resulted in fines (compared to 7 % here), 57 % resulted in warnings

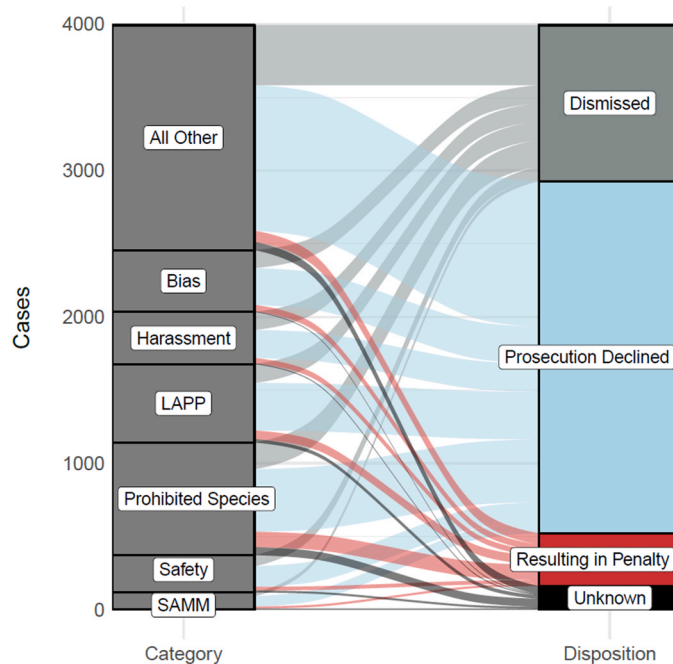


Fig. 4. The disposition of enforcement cases that belong to each broad category. Since cases have more than one category the totals here are larger than those presented in Table 2.

<sup>1</sup> For example of these see: <https://www.fisheries.noaa.gov/alaska/rules-and-regulations/regulations-acts-treaties-and-agreements-federal-fisheries-alaska>.

(compared to 59 % here) and 38 % were closed without enforcement action (compared to 29 % here).

### 3.4. What can be done to improve the transparency, accountability, and efficiency of fisheries monitoring and enforcement?

Multiple studies have called for increased transparency and summaries of violations reported by observers [10,46]. In this section, we provide some possible explanations from our experience for why more fisheries monitoring and enforcement enterprises are not performing these activities. First, estimating crime rates is difficult. Occurrence rates in this region were not calculated until a dedicated analyst was assigned to these data 20 years after the establishment of electronic records! Second, occurrence rates over time do not solely reflect changes in compliance by fishermen. We found several instances where new regulations, renewed attention to existing regulations, and staff changes have resulted in increased reporting of potential violations. Third, the data can be messy. Our data needed to be relabeled for consistency over time and single reports with many occurrences can skew rates for rarely reported categories. For example in 2005 the rate of occurrences was high for 'Safety NMFS' because of a hose that had been continuously tripping an observer each time they went to sample (Fig. 3). Data can also be misreported. This seems reasonable given the sheer volume of regulations that pertain to potential violations an observer is expected to remember.

The establishment of new fishery regulations likely exacerbates all of the aforementioned barriers to transparency. While Alaska fisheries have earned a reputation as well managed, this reputation has come at an invisible cost to fisheries monitors and enforcement. In the North Pacific, numerous regulations have been passed that increase the burdens and scrutiny of observers to perform their duties. Each new regulation increases the number of potential violations for observers to report and for AKD to review. Although mandatory observer reporting in this region has been heralded as a positive to the fisheries enforcement enterprise [17], a tipping point may have been reached. Given limited resources and the high volume of reports it is not surprising that so few cases get prosecuted. This phenomenon is especially problematic since the motivation to participate in IUU fishing increases as restrictions on legal fishing become greater [47]. Altogether, high levels of regulation and restrictions, small-boat fleets with many participants, and low observer coverage rates results in a very low detectability of crime. In these situations, the penalties assigned to prosecuted crimes become extremely important [48], but these are often many times lower than would be needed to actually deter crime [47].

The solution to these problems is achieving a compliant fishing culture. Achieving a compliant fishing culture has the combined benefits of reducing the risks of sustainability and enabling a gain in efficiency of fisheries monitoring and enforcement through a reduction in effort [49,50]. Ideally, compliance is obtained voluntarily, first through cooperative outreach and educational efforts that target a wider audience with the goal of providing general education, then through compliance assistance that targets those who have already violated a regulation to remind them of the requirements. Results from this study related to seabird avoidance strategies starting in 2013 point out that such efforts need to be sustained - short-term educational interventions do not change attitudes or behavior [38]. Rather, it is the continued pursuit of improvements and the willingness to change that results in cultural shifts.

Increased compliance can be achieved through trust in governance [49,51]. Although the U.S. fleet in the North Pacific has had fishery observers since 1990, many participants in the Pacific halibut fishery were relatively new to monitoring starting in 2013 [11]. Many of these new participants reside in southeast Alaska, where no fisheries monitoring is preferred over the use of logbooks, which is preferred over EM, which is preferred over observers [52]. In recognition of the impact that governance has on the well-being of fishers of the region [53], improved

acceptance of fisheries monitoring has been pursued through the replacement of observers with Electronic Monitoring (camera systems). However, in at least one study those responsible for monitoring and enforcement had a dim view of the technology for control, monitoring and surveillance compared to human observers [54].

Building a culture of compliance may require a focus on individuals. Individual trust in government, job satisfaction and beliefs will be drivers of behavior [55]. Robertson and Wilcox [50] showed that individual vessels are an important factor to bycatch, and suggested that management frameworks that account for individual performance could be more effective at reducing overall bycatch levels. To reduce the footprint of monitoring and enforcement assets, it may be necessary to identify potential bad actors and monitor these individuals at different rates (see [56] for one way to accomplish this).

There are multiple benefits to the role of observers as enforcement assets. If the challenges of regulatory interpretation and observer safety can be overcome, the data provided by observers on potential violations are a means for using enforcement resources efficiently and effectively since they point to where the potential problems are. Each potential violation of a rule reported by observers is an example of IUU fishing, and reducing all types and sizes of this fishing bears merit [49]. Observers can bear witness to events that are not visible to cameras or otherwise quantified in databases. At recent assessment approximately 19 % of incidents created by the AKD were sourced solely from observers [57]. Observers are in a position to witness potential violations first-hand, in real-time and represent a source of timely information to law enforcement. Observers also act as a visible presence during fishing activities, and this presence acts to deter active crime [55]. Observers are also in an ideal position to build rapport with the fishers they work with and inform them of possible violations so the issues are resolved before they escalate to severe violations that negatively impact the fishery resources.

The long history of fishery policy and management actions and their impact on fisheries observers in the North Pacific suggest that increased efficiency in fisheries monitoring and enforcement in this region will likely not come from further regulation, but from a serious look at the efficacy of the existing regulatory framework as previously suggested [38,51]. The drivers of observer reports of potential violations are diverse and require the support of electronic databases, the interpretation of regulations, staff, and observers themselves. Improving the accountability, transparency, and efficiency of the fisheries monitoring and enforcement enterprise through the analysis of potential violations by observers is difficult but achievable. It is hoped that this work inspires other regions to strengthen their programs and relationships with industry.

### CRedit authorship contribution statement

**Craig H. Faunce:** Conceptualization, Methodology, Software, Formal Analysis, Resources, Writing – Original Draft, Visualization, Project administration. **Jaclyn Smith:** Conceptualization, Validation, Investigation, Data Curation, Writing – Review & Editing. **Andy Kingham:** Methodology, Software, Formal analysis, Investigation, Visualization, Writing – Review & Editing. **Dennis Jaszka:** Validation, Investigation, Data Curation, Writing – Review & Editing.

### Data Availability

The data that has been used is confidential.

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## Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.marpol.2023.105868](https://doi.org/10.1016/j.marpol.2023.105868).

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