Enforcement Considerations

For

NOAA Fisheries and North Pacific Fishery Management Council

Developed by NOAA Fisheries Enforcement, U.S. Coast Guard, and State of Alaska

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1.0 INTRODUCTION

Fisheries are in a continual state of change and require Fishery Management Councils, the NMFS Sustainable Fisheries Division, the Protected Resources Division, and the Habitat Conservation Division to respond to these changes through development of and modifications to Fishery Management Plans (FMPs) and their implementing regulations. Involving enforcement personnel in the rulemaking process is essential, but sometimes it is difficult to include enforcement on every conference call and at every meeting. With that in mind, the following law enforcement considerations, which are based on our collective experience, are provided to assist those who are assigned a rulemaking project.

Fisheries managers, enforcement, and resource users share a common interest in maintaining the future of sustainable fisheries with fair and lawful access to our nation's living marine resources. Collaborative and cooperative engagement by all three parties fosters the development of efficient and effective enforcement practices to improve overall enforceability of management measures. NOAA's Office of Law enforcement practices a Compliance Achievement Model with three lines of operations: Education and Outreach, Compliance Assistance, and Enforcement Action.

These law enforcement considerations are intended only as general guidance. Depending on the specific design of any regulatory program, the enforcement tools and strategies used may require a combination of methods. The enforcement considerations contained in this paper in no way limit NOAA Office of Law Enforcement's (OLE) or the U.S. Coast Guard's legal authority or their ability to employ the enforcement techniques, tactics, and procedures they consider most appropriate for accomplishing the goals of a specific regulatory program.

2.0 OVERVIEW – GENERAL ENFORCEMENT OPERATIONS

At sea and dockside enforcement operations are resource intensive. Available enforcement resources are maximized by regulations that can be enforced at more than one point during fishing activity (i.e., not just at the point of landing or when gear is deployed). This is especially critical to successfully preventing the distribution of IUU seafood products and in detecting and preventing seafood fraud throughout the supply chain.

2.1 Dockside enforcement

Regulations that are enforced by offload monitoring require diverse geographic deployment of limited enforcement resources. Even with support from state law enforcement agencies, OLE can only monitor a small fraction of the total fish landings. This resource gap may be mitigated via regulations that require the use of electronic monitoring technologies, such as VMS, electronic logbooks, video monitoring, and pre-landing notifications to remotely monitor vessels and improve directed tasking of available resources.

2.2 At-sea enforcement

OLE relies heavily on the USCG and state Joint Enforcement Agreement (JEA) partners for at-sea patrol, boarding, and inspection efforts. OLE officers work with these partners to provide effective at-sea enforcement of NOAA's regulations, particularly those involving area, gear, and prohibited species restrictions. The Coast Guard is primarily responsible for at-sea enforcement in the EEZ and monitoring of fisheries activities through at-sea patrols, aircraft patrols, fisheries law enforcement boardings, and commercial fishing vessel safety inspection efforts. The Coast Guard works directly with OLE ashore to

effectively target vessels of interest, enforce regulations, and to provide adequate evidence for successful investigations and case evaluations, particularly those involving area, gear, and prohibited species restrictions. OLE and the Coast Guard also use electronic monitoring technologies such as VMS, electronic logbooks and pre-landing notifications to remotely monitor vessels and to improve directed tasking of available resources. Furthermore, OLE and the Coast Guard use air support to cover large areas, photograph and video certain activities, and to direct other law enforcement assets to areas of concern.

3.0 GENERAL PRECEPTS—ENFORCEABILITY:

The following topics offer recommendations for: enhancing enforceability of regulations and FMPs; understanding policy implications for enforcement; and potential statutory and regulatory amendments to address emerging areas such as seafood fraud and traceability.

3.1 Regulations Should Be as Simple and Straightforward as Possible

Simple regulations are easier for Enforcement and the regulated community to understand and enforce/comply with, while the more complicated the rule, the higher likelihood of creating loopholes and legal defenses. Straight-forward requirements that are black and white, without exceptions, make it more difficult for intentional violators and conspirators to evade enforcement, because they are easier to detect and to prove. For example, possession of an undersized halibut on a commercial vessel is clearly a simple prohibition. It is illegal regardless of where taken or how it was harvested or any other variable, condition, or stipulation.

Of course, regulations tend to be complex because the fishing industry itself is highly complex. Regulatory language cannot always be expressed in easy-to-understand language because there is a need for the drafter to account for various qualifications, conditions, and exceptions and the language used must be technical and precise to have legal effect. To the extent practicable, consideration should be given to ensuring consistency of management measures amongst the FMPs and regulatory areas. Consistently defining terms in similar management measures, regulatory areas, and between federal and state waters can reduce complexity.

3.2 Where Feasible, Seek to Reduce the Number of Regulations

Multiple and/or overlapping control measures can frustrate and create ambiguity for resource users as well as enforcement. In addition to being burdensome, an overabundance of regulations may increase the possibility of unintentional errors and omissions, which increase the workload of law enforcement personnel and may subject well-intentioned resource users to enforcement action. To avoid these problems, fishery managers should consider consolidating regulations where possible, removing outdated regulations, and making instructions simpler.

3.3 Clear Record of Council Intent

In order to support enforcement of FMPs after implementation, NOAA's Office of Law Enforcement and General Counsel Enforcement Section benefit from a clear record of the Council's and Agency's intent and rationale. This is especially important for socio-economic regulations intended to level the playing field for participants, but that do not directly impact the resource. Examples are vessel caps, limits on leasing permits, processor shares, and IFQ halibut and sablefish permit holder on board regulations. While prosecutors may be able to prove the elements of these violations, establishing the social and

economic importance of the regulation when explaining the assessed penalty can be challenging when harm to the resource is minimal.

3.4 Accountable and Traceable Seafood Products

Enforcement is strongest when seafood products are accountable and traceable wherever law enforcement personnel encounter them throughout the supply chain. Regulations that require improved documentation and labeling of fish and fish products enable law enforcement to track such products back to the harvester and/or the initial purchaser and to intercept unlawful seafood product at various points between harvest and final sale for consumption. Many of NOAA's existing enforcement authorities are focused on at-sea or dockside enforcement and do not provide the tools needed for addressing trafficking violations.

As the agency responsible for administering the majority of fisheries related statutes, including those implementing international fisheries agreements, NOAA has significant responsibilities related to preventing trafficking in Illegal, Unreported, and Unregulated (IUU) fish and fish product, as well as addressing domestic seafood fraud. The Magnuson Act expressly allows for the boarding, search, and inspection of fishing vessels. Additional authority may be needed for the boarding, search, and inspection of non-fishing vessels and other conveyances that have received and carry seafood product as cargo.

In order for NOAA to effectively address illegal seafood trafficking, traceability, and fraudulently labeled seafood within the United States, additional statutory enforcement authorities would be necessary. IUU compliance measures are designed to protect the resource and ensure a level playing field for resource users and consumers. Therefore, additional compliance measures and authorities should consider the tradeoffs in regards to benefits and cost to industry and consumers. Recommended enforcement provisions include:

1) Inspection authority throughout the supply chain (i.e. the ability to search or inspect any facility or conveyance used or employed in, or which reasonably appears to be used or employed in, the storage, processing, transport, or trade of fish or fish product).
2) Inspection of records related to the trade in fish and fish products throughout the supply chain (i.e. The ability to inspect records pertaining to the storage, processing, transport or trade of fish or fish products).
3) Investigative subpoena authority.
4) Broad prohibition on the possession, sale, purchase, etc. of illegally trafficked fish or fish product or fraudulently labeled seafood (similar to the Lacey Act) throughout the supply chain.

3.5 Electronic Monitoring and Technology

OLE and the Coast Guard already use VMS to monitor fisheries. Other technologies, such as video cameras and flow scales, have shown their worth as well. When developing the regulations that implement the use of new technology, it is important to include enforcement personnel in program development so that issues such as enforcement's capacity to electronically monitor more vessels equipment reliability, performance standards, evidentiary requirements, OLE access and seizure authority, opportunity for tampering, provisions for equipment repair, and enforcement agencies' staffing limitations, can be considered.

VMS is a tool used by law enforcement to focus patrol efforts on high priority areas. VMS does not replace at-sea enforcement by aircraft and vessels, but rather complements these traditional surveillance platforms, thereby increasing the level of monitoring possible. This may, by extension, benefit compliant participants. In addition to providing law enforcement with information regarding vessel position and movements, VMS advanced features can also communicate information about the gear being utilized and the fish species being targeted. Where reasonable, the Council, management, and enforcement should

consider VMS advanced features during fisheries program development and updates. Expanding the use of VMS in monitoring domestic fisheries will help level the playing field for honest participants. It will also increase the effectiveness of law enforcement operations by increasing the efficiency of patrols, vessel boardings, and inspections.

It is also important to recognize that technology imposes additional enforcement staffing and technical needs. For example, tracking down non-compliant vessels, determining the reason for non-compliance, and coming to a solution that recognizes the reality of the fisheries requires personnel hours, timely access to data, and the right technical tools. Additional considerations include chain of custody, environmental factors (e.g. slime on camera lens), technical difficulties, and delay in receiving data/analysis of data. Finally, use of electronic monitoring will increase the length of law enforcement boardings as more time will be needed to review and verify electronic monitoring data (e.g. pulling and viewing video of flow scales while conducting a boarding).

3.6 Observers

Observers provide the foundational data that is used by the Council and multiple divisions of the agency to develop FMPs, manage fisheries, and measure compliance. Observers are not law enforcement personnel, but they do play a significant compliance role by reporting potential violations they witness. Observers can provide evidence for a specific violation and their data, taken in aggregate, can be useful for targeting enforcement activity or proving elements of a violation. Observer inseason data may be used by fishery managers to limit a fishery, cooperative, vessel, or individual. This is especially true for fisheries limited by prohibited species catch.

FMP measures that create dependence on observer data for vessel-level management can contribute to added tensions between onboard observers and vessel operators and managers. As a result, observers may be placed under considerable pressure by vessel crew because of their roles collecting data and reporting violations.

Regulations must consider strong compliance tools that will limit impacts to observer safety, work environments, and work areas. Because of observers' right to a safe and harassment-free work environment, as well as the importance of their data, alleged violations involving observers are given the highest priority by enforcement. This is true for violations directly involving an observer (e.g. assault, harassment and safety violations) and for violations that impact observer samples (e.g. coercion, pre-sorting, or sample biasing).

3.7 Resource Intensive Regulations

Any new plan or regulation should take into consideration enforcement's resources to maximize patrols, conduct compliance data review (e.g. EM, notice of landing, observer, recordkeeping and reporting, registrations) and conduct investigations. Nationally, enforcement is spread thin. Directing effort toward enforcement of new regulations usually means decreasing or, in some cases, ceasing efforts in other areas. Regulations that can be enforced through more than one means, or at more than one point during fishing operations or within the supply chain, allow enforcement some flexibility to use available resources in the most efficient way possible. For example, enforcing halibut and sablefish Individual Fishing Quota (IFQ) regulations is manpower intensive. Inspection authorities throughout the supply chain allow enforcement the ability to detect violations beyond the dock. Use of technologies such as VMS, video monitoring, electronic labeling (traceability), and electronic logbooks can provide enforcement the ability to monitor remotely, thus improving enforcement efficiency.

Fishery regulations that do not allow for a complete accounting of fish from catch to final sale can lead to loopholes that allow illegally-harvested fish to enter the market, either comingled with, or as a substitute for, legal product. For example, fish can appear "legal" merely by doctoring the records, without traceable accountability, or the ability to audit. Accountability and enforceability improve when there are accurate and detailed records to track fish from harvest/offload, through processing/shipping, and to point of final sale.

4.0 MANAGEMENT MEASURES

The following section discusses the advantages and disadvantages of the different types of management measures with regard to enforceability. The goal of this section is to help NMFS understand and identify enforcement concerns regarding various management measures.

4.1 Landing/Size Limits and Maximum Retainable Amounts (MRA)

Goal—Aims to reduce bycatch or secondary target species retention and minimize its mortality by limiting the amount or percentage landed. These regulations can be enforced by a combination of electronic monitoring and reporting technologies and dockside inspections.

Advantages:

- Landing limits help focus fishing efforts in areas that minimize bycatch if there is sufficient penalty associated with excessive bycatch (i.e., the directed fishery will be closed as a result of reaching a bycatch trigger limit).
- MRAs reduce incentives to harvest species that are often higher value than the FMP target species.

Disadvantages:

- Provision can be difficult to enforce at-sea.
- High-grading may be an issue where specific fish species, ancillary products, or fish sizes are of greater value.
- When no enforcement is present to check landings and electronic reports, fishermen may falsify reports or not report landings or bycatch at all.

Recommendations:

- Consider reviewing and removing MRA requirements if not necessary for management.
- Consider simplifying regulations by restricting maximum retainable amounts at delivery and not at-sea.
- At-sea discards and mortality are best determined by observers or appropriate electronic monitoring technologies.
- Regulations should consider industry best practices and other industry recommendations.
- If at-sea enforcement is not desired, consider VMS advanced features (see VMS White Paper that is included in Appendix 1) and electronic reporting and monitoring technologies to facilitate dockside enforcement. Consider requiring segregation of catch at sea where practical (i.e. fixed gear) to facilitate dockside and at-sea enforcement.

4.2 Prohibited Species Catch Retention Prohibition

Goal—Reduce takes of a sensitive or economically valuable species by prohibiting their retention aboard fishing vessels. These prohibitions can be enforced by dockside and at-sea boardings, electronic monitoring and reporting technologies, and through reports routed from the observer program to enforcement.

Advantages:

- Prohibition violations are easier to document and enforce than regulations that allow a limited retainable amount.
- Allows for at-sea enforcement.
- Once fish are landed, detecting a prohibited species retention violation is easy if enforcement is present.

Disadvantages:

- May create an incentive to hide prohibited species from observers and enforcement, or to underreport prohibited species takes or discards, especially if doing so might prevent the deduction of the prohibited species from a quota.
- May create an incentive to enter prohibited species into an illegal market if fish are caught utilizing an illegal gear type or in a prohibited status fisheries.
- In certain scenarios, it may be difficult for fishermen to comply. For example, prohibiting halibut retention by flatfish catcher vessel trawlers may require intensive sorting on small deck areas and in difficult weather.
- Because of heavy reliance on observer data to enforce allocated limits of target and prohibited species catch (PSC), scale tampering and observer interference, coercion, and harassment may result.

Recommendations:

- Integrated electronic reporting, VMS advanced features, and/or electronic monitoring to supplement at-sea enforcement and observer efforts.
- To allow additional utilization of prohibited species, explore the addition of provisions to allow the transfer of law enforcement-seized fish product into regulated donation programs.
- At-sea discards and mortality are best determined by observers or proven electronic monitoring technologies.

4.3 Required Retention

Goal—The retention and reporting of all catch and potential greater utilization of the resource. Full retention is most effectively and efficiently enforced by electronic monitoring/reporting and dockside enforcement.

Advantages:

- Provides managers with an accurate picture of target and bycatch species harvest and allows managers to close the fishery when a limit is landed.
- Can result in simple compliance steps for industry and an accurate monitoring program if

electronic monitoring and reporting are integrated.
- May result in solid evidence for enforcement cases and greater utilization of the resource.

Disadvantages:

- May be costly for industry where retained bycatch displaces valuable target species.
- If not adequately monitored, may result in high grading of catch and failure to report discards.
- Can be resource intensive to enforce depending on how electronic monitoring is configured and the level of data review.

Recommendations:

- Regulations should incorporate industry best practices and consider industry recommendations.
- Consider electronic monitoring and reporting and dockside inspection as the most effective and efficient enforcement tools. At-sea boardings, aerial surveillance, and observer coverage may be effective, but they are resource intensive and may detract from other USCG, observer program and OLE priorities.
- Consider donation programs for landed catch that cannot be sold.

4.4 Closed Areas

Goal—Ensure fishing does not occur in sensitive or protected areas. Closed areas can be enforced by aerial patrols, at-sea boardings, advanced VMS features, electronic monitoring and reporting, and dockside inspection.

Advantages:

- Effective/efficient to monitor with VMS and advanced features. However, even with VMS secondary evidence may be required to document a violation for prosecution.
- Effective/efficient to document presence in the closed area by aircraft overflight and patrol vessel monitoring.

Disadvantages:

- Without VMS, the effectiveness is directly proportional to the costly at-sea surveillance effort.
- Depending on the fishery and gear type, violations can be difficult to document without an at-sea or subsequent dockside boarding.

Recommendations:

- Have more clearly defined areas. Use exact latitude/longitude, straight lines and rectangular shaped areas or center point and radius lines for most effective enforcement. Avoid simply stating distance offshore or using depth contours.
- Having a fewer number of larger closed areas is preferred in most situations. When there are higher numbers of small closed areas, with open areas in between them, a vessel can move quickly to evade detection. If possible, close an area to all activity; limit grand-fathering and other exemptions. Where practical, areas should be closed to all types of fishing as well as transit by fishing vessels.

    - If transit is allowed, fishing gear should be stowed and transit must be continuous (no loitering/stopping). Regulated gear areas are difficult to enforce, because this still requires an enforcement unit to gather evidence that the vessel operator used illegal gear in the closed area.
- Utilize VMS advanced features of geo-fencing and increased automated polling rates to ensure vessels are not fishing in a closed area. The addition of these VMS features would also address some of the challenges of enforcing irregularly shaped areas and extremely small areas. A geo-fence surrounding a small closure coupled with automatically increasing polling rates of a vessel entering the area could assist enforcement to determine if a vessel is displaying fishing behavior.

4.5 Closed Seasons

Goal—Ensure the sustainability of fish stocks by prohibiting fishing during specific times of the year. Closed seasons can be enforced by at-sea boardings, electronic technologies, aerial patrols, and dockside monitoring.

Advantages:

- Fisheries in which a fewer number of large vessels participate are less resource intensive to monitor.
- Pot and longline vessel closed seasons can be enforced by observing port activities (gearing up for a trip) and by the surveillance of fishing gear in the water.

Disadvantages:

- Fisheries in which small vessels participate are more difficult to monitor due to remote port and fishing locations, size on the water, and number of vessels participating.
- Fish products may be illegally sold outside of normal market channels when the season is closed.
- Fisheries with multiple gear types used to harvest the same species are especially difficult to enforce if only one gear type is closed or prohibited during a season.

Recommendations:

- Ensure closures and any stand-down periods are clearly defined and dates/times should be defined to the minute.
- Limit exemptions to the closed season.
- Regulations should fully describe what activity is allowed to occur before, during, and after the closure, e.g. all gear must be hauled in prior to the closure, and gear may not be set prior to the opening.
- Where practical, for short duration fisheries, prohibit all fishing by the participating vessels with any gear type 72 hours before and after the fishery.
- Consider VMS and advanced features to monitor fishing vessels before, during, and after open seasons to greatly aid enforcement.

4.6 Gear Restrictions

Goal—Limits fishing effort by prohibiting specific gear types or gear modifications. Certain gear restrictions may be required to minimize catch of non-target or prohibited fish species or to protect other marine species such as birds or mammals. Examples include pelagic vs non-pelagic trawls, bottom

contact gear, codend mesh size, or seabird avoidance gear. Gear restrictions can be enforced by at-sea boardings, dockside inspections, and observer witness reports. Some restrictions can be enforced by aerial patrols or electronic monitoring technologies.

Advantages:

- Some gear is easy to inspect dockside and readily visible at sea.

Disadvantages:

- Restrictions on gear deployment (i.e., soak time, hook/pot counts, set/trawl depth, bottom v. pelagic) are more difficult to enforce because the gear is invisible to enforcement below the surface of the water.
- Gear may need to be inspected at-sea to ensure it is compliant when deployed in the act of fishing. This becomes resource intensive and intrusive to industry if enforcement needs to conduct multiple checks at sea.

Recommendations:

- Prohibit possession of gear or a quantity of gear on board if it is not allowed for the targeted fishery. This simplifies enforcement because the act of having the gear onboard is a violation.
- Where specific gear must be deployed to exclude catch (i.e. seabird avoidance, codend excluders) consider electronic reporting, sensor, and video monitoring technologies to verify gear deployment.
- Where possible, work with the State to improve consistency with gear restrictions across State and Federal fisheries boundaries.
- Regulations should incorporate industry best practices and consider industry recommendations.

4.7 Catch Shares/Individual Fishing Quotas/Limited Access Programs

Goal—Ensure timely and accurate reporting of catch. This is dependent on quota monitoring, which is best enforced dockside or through fishery data review.

Advantages:

- Industry performs primary management effort while the agency validates and enforces limits.
- Monitoring of fish landings is effective for verifying reporting by vessels.
- Observers record catch data, and quotas can be managed on a daily/vessel basis.

Disadvantages:

- Significant comparative analysis is required to cross-check landings against VMS, observer, and electronic monitoring data.
- Failures of electronic systems (scales or video monitoring systems) require a vessel to cease fishing until repairs can be made.
- Heavy reliance on observer data to enforce allocated limits of target and prohibited species catch (PSC) may result in scale tampering and observer sample bias, interference, coercion, and

harassment.

- Accompanying regulations, such as sideboards and ownership limitations, can be complex and difficult to enforce.
- May spread out fishing effort across time and space. Instead of specific fishing seasons to monitor, a fishery may last nearly year round, over vast areas, and possibly require more enforcement assets for the extended season.
- Accompanying regulations such as ownership limitations are difficult and resource intensive to enforce.
- For some high value species, potential for illegal/unaccounted for landings at remote locations is increased.

Recommendations:

- Consider the addition of dockside monitors with authority to conduct hold checks.
- Clearly identify prohibitions against fishing activity when monitoring measures fail.
- Regulations must be strong to protect observers and observer work environments, sample areas, and data.
- Effectiveness of enforcement depends on observers, technologies deployed, and monitoring of landings.
- Consider electronic monitoring technologies (VMS features, sensor, and video) at sea to detect and deter area fished quota violations. VMS is the established, vetted method for documenting vessel location for enforcement purposes.
- If at-sea quota debiting is desired, the use of certified scales, electronic reporting, observers, and video monitoring are necessary to ensure accuracy.
    - Consider electronic reporting to provide near real time debiting of quota accounts. Timely quota monitoring benefits enforcement, fishermen, and fisheries managers.

4.8 Recordkeeping and Reporting Requirements

Goal—Accurate recording and reporting of fisheries information to facilitate enforcement and fisheries management.

Advantages:

- At-sea boarding can verify the presence and use of logbooks and other records and dockside monitoring of offloads can verify accuracy of landing data.
- Electronic logbooks have been demonstrated to reduce logging errors, especially where GPS and sensor data are integrated.
- Often provides best evidence of a fisheries violation, especially in catch share programs.
- Electronic reporting allows for some monitoring inseason.
- Accurate and applicable electronic logs can provide enforcement near real-time data before or during a boarding. This helps to prioritize effort and creates boarding efficiencies.

Disadvantages:

- Full and accurate accounting of catch at-sea can be difficult for vessel personnel and enforcement boarding parties due to species mixing, limited access to holds, icing, and crew safety concerns.

Recommendations:

- Regulations must identify the timeframes required for completing reports and entering data into logbooks (e.g. per set, daily, end of trip). This allows enforcement to better determine whether to focus effort at-sea or dockside.
- Require the use of gear-specific electronic reports. Where possible, involve industry in development of electronic reports to ensure they are understandable and potentially useful for industry applications.
- Utilize electronic monitoring/reporting technologies to enhance the accurate collection of fishery data and its timely transmission from onboard the vessel to fisheries managers and enforcement.
- Consider existing report formats and integrated reporting where possible. Where industry standard reports are used, consider requiring those rather than duplicative reports (e.g. mate's receipts in lieu of transfer report).

4.9 Permits

Goal—Document allowable gear type(s), fishing area(s), and/or species, which may be retained onboard a vessel or by a specific party. Depending on the nature of the permit, these can be enforced by various methods. Permits are largely used by enforcement to identify allowable fishing activity.

Advantages:

- Easy to track and identify, especially with the use of technology (e.g. online permits, enforcement access to databases).
- Revocation or suspension of permit is an effective penalty provision
- Easy method for enforcement to determine lawful operations.

Disadvantages:

- The process for issuing, amending or re-issuing a permit creates a system where mistakes can be made by industry or agency staff. Fishermen may not be able to wait for errors to be processed before fishing or they may capitalize on such mistakes.

Recommendations:

- Electronic, real-time permit records should be made readily available to industry and enforcement to simplify enforcement verification of permits, eliminate the need for original copies onboard, and improve industry access to permits.
- Permit transfers must follow strict guidelines and should require adequate notification to enforcement agencies.

APPENDIX 1

Report to NPFMC
Potential VMS Expansion for Fleets Required to Carry VMS[1]

Enforcement Committee Working Draft
November 17, 2014

I. North Pacific Fishery Management Council action request

Over a series of three meetings in 2012, the Council reviewed a discussion paper regarding the use and requirements for Vessel Monitoring System (VMS) in the North Pacific fisheries and other regions. When the discussion paper was first tasked to staff in October 2011, the Council noted that, although there is uncertainty regarding whether a major change to (or expansion of) VMS requirements is necessary in the North Pacific, there is interest in reviewing the current state of the North Pacific VMS requirements. At the December 2012 meeting, the Council reviewed an evaluation of how advanced features of VMS are being utilized in the other regions in the U.S. Based on those different usages, the Council recommended that the Enforcement Committee assess the utility of features such as geo-fencing, increased polling rates, and declarations of species, gear, and area for improving enforcement efforts and efficiency for vessels already subject to VMS requirements.

This discussion paper provides an overview of VMS program, advance features of the VMS not currently utilized in the North Pacific, uses of VMS by the different user groups, where VMS fits into the Strategic Plan for Electronic Monitoring/Electronic Reporting (EM/ER) in the North Pacific, and the Enforcement Committee's implementation recommendations to the Council.

II. Description of VMS and current status of fleets requiring coverage

VMS units integrate global positioning system (GPS) and communication electronics in a single, tamper-resistant package to automatically determine the vessel's position several times per hour. VMS is composed of: (1) On-board transceiver units that transmit positions and may send and receive other data and messages; (2) satellite communications networks that transmit information to and from the vessel and monitoring center(s); (3) surveillance software and its associated systems/processes that interface with the communications providers; (4) monitoring center(s) and staff; and (5) government IT services and systems that parse and store the data (NOAA 2013).

The VMS unit is passive and automatic, requiring no reporting effort by the vessel operator. The transceiver units send position reports that include vessel identification, time, date, and location, and are mapped and displayed on the end user's computer screen. The units can be set to transmit a vessel's location periodically and automatically to an overhead satellite in real time. In most cases, the vessel owner is unaware of exactly when the unit is transmitting and is unable to alter the signal or the time of transmission. A communications service provider receives the transmission and relays it to NOAA Fisheries Office of Law Enforcement (OLE) and U.S. Coast Guard. Enforcement of measures, such as critical habitat no-fishing and directed fishing closures, is reliant on use of VMS.

[1] This report was prepared by Jon McCracken (NPFMC), Guy Holt (NMFS Alaska Region), Josh Keaton (NMFS Alaska Region), and Anthony Kenne (U.S. Coast Guard)

Currently, the type-approval specifications (requirements) for VMS units are published in Federal Register (73 FR 5813). These specifications provide the requirements related to: technical requirements of the VMS unit, satellite communications for the VMS unit, and data security, delivery, and latency of the VMS unit. The specifications also address roles and responsibilities for the type-approval process, change control, customer service, billing, and litigation support. On September 9, 2014, a proposed rule was published in the Federal Register that will codify the type-approval specifications, revise latency standards, and establish initial type-approval renewal, revocation, and appeals processes for industry and constituents.

Access to VMS data is gained through a secure, web-based system and is viewable on a color chart on a computer monitor. NOAA OLE can monitor real time vessel activity from their computers. In Alaska, there are two Enforcement Technicians who are tasked with monitoring vessel activity using VMS. In-season managers in the NMFS Alaska Region Sustainable Fisheries Division, U.S. Coast Guard, Alaska Department of Fish and Game, and Alaska State Troopers also have access to the VMS data.

Uses of VMS data as include:

- Tracking, monitoring, and predicting fishing effort, activity, and location;
- Evidence in legal and administrative proceedings;
- Monitoring for illegal, unreported, and unregulated (IUU) operations;
- Monitoring activity and arrivals in port to allocate sampling;
- Supporting catch share and annual catch limits (ACL) programs;
- Monitoring and enforcing compliance with regulatory requirements and sensitive area restrictions;
- Managing observer programs (safety, deployment and coverage, enforcement);
- Verifying/validating data from other sources;
- GIS mapping;
- Supporting Homeland and National Security initiatives.

Since 2000, the Secretary of Commerce has introduced VMS requirements and options in connection with several management actions in the Alaska Region. The first VMS requirements for the North Pacific Region were implemented in order to meet three principles to attempt to avoid the likelihood of jeopardizing the continued existence of the western population of Steller sea lions or adversely modifying critical habitat. These three principles are as follows:

- Temporal dispersion of fishing effort
- Spatial dispersion of fishing effort
- Protection from fisheries competitions for Steller sea lion prey in waters adjacent to rookeries and important haulouts.

As noted in the final rule (October 17, 2000) implementing VMS, when critical habitat areas are closed, continued Atka mackerel fishing takes place very close or adjacent to the closed critical habitat areas. The boundaries of these areas are complex, the areas are remote, and the weather is frequently poor. Ensuring that no fishing is taking place inside critical habitat using traditional methods of enforcement, such as aerial surveillance, is difficult and costly. Effective enforcement of these closures would be enhanced if vessels participating in the fishery use a VMS transmitter that automatically and frequently transmits vessel position to NMFS so that vessels fishing near critical habitat can be monitored closely.

In June 2005, the Council discussed the VMS issue, in connection with essential fish habitat/habitat areas of particular concern (EFH/HAPC) related proposals to implement VMS for the GOA. During that

discussion, the Council recommended that NMFS develop an analysis and alternatives to address the issue of a broader VMS application in the GOA and BSAI in a manner that would address enforcement, monitoring, and safety concerns. At the February 2007 meeting, the Council received a preliminary initial review draft. At that meeting, the Council decided to postpone indefinitely any further work on a comprehensive VMS program. The Council noted that other tools may be available to address specific problems or enforcement needs for different circumstances, and a comprehensive solution may not be optimal.

Since 2000, the Secretary of Commerce has introduced VMS requirements or options in connection with several management actions as noted in Table 1. Together, these numerous regulations have created VMS requirements for the groundfish and crab fleets.

Table 1 Description of VMS requirements

Source of VMS requirement	Description of VMS requirement	Regulations
Steller Sea Lion Measures	Vessels in any Federal reporting area that participate in the Atka mackerel, Pacific cod, or pollock directed fisheries must have an operating VMS unit onboard vessel	679.7(a)(18)
Steller Sea Lion Measures (2015)	Vessels in the AI subarea using trawl gear to directed fish for groundfish, VMS units must be transmitting vessel location at least 10 times per hour.	Scheduled to implemented Jan 1, 2015
EFH/HAPC	All vessels named on an FFP or FCVP when operating in the Aleutian Islands subarea or in adjacent State waters must have an operating VMS unit onboard vessel.	679.28(f)(6)(ii), 679.7(a)(21)
EFH/HAPC	All vessels named on an FFP or FCVP when operating in the GOA or adjacent State waters with nonpelagic trawl or dredge gear must have an operating VMS unit onboard vessel.	679.28(f)(6)(iii), 679.7(a)(22)
Rockfish Program	Vessels that are assigned to a rockfish cooperative when operating in a reporting area off Alaska from May 1 until November 15, or until the cooperative has submitted a termination of fishing declaration must have an operating VMS unit onboard vessel.	679.28(f)(6)(iv), 679.7(n)(3)(i)
Rockfish Program	Vessels that are subject to a sideboard limit when operating in a reporting area off Alaska from July 1 until July 31 must have an operating VMS unit onboard vessel.	679.7(n)(3)(ii)
GOA Pacific cod sector splits	A vessel in Federal reporting areas 610, 620, or 630, that receives and processes groundfish from other vessels must have an operating VMS unit onboard vessel.	679.28(f)(6)(v)
Sablefish vessel clearance requirement	Any vessel who fishes for sablefish in the BSAI must have an operating VMS unit onboard vessel.	679.42(l)(1)
Crab Rationalization Program	Any vessel harvesting Crab Rationalization crab must have an operating VMS unit onboard vessel.	680.7(c)(2), 680.23(a)(1), and 680.23(b)(1)

Table 2 shows the number of groundfish, crab, and halibut vessels that as of 2010 have a VMS unit and the number of vessels without a VMS unit. Of the total 1,656 groundfish, crab, and halibut vessels, 546 have a VMS unit, while 1,110 do not have a VMS unit. Of those 1,110 vessels that are not equipped with a VMS unit, 346 vessels are less than 30’ LOA and 731 vessels range in length from 30’ to 59’. The remaining 23 vessels without a VMS unit are between 60’ – 120’.

Table 2 Vessel count of all North Pacific groundfish, halibut, and crab vessels with and without VMS units in 2010

Vessel length	No VMS	VMS	Total
<30	346	0	346
30-59	731	247	978
60-89	21	96	117
90-124	1	137	139
125-200	0	55	55
200+	0	21	21
Total	1,110	556	1,656

Source: AKFIN Vessel Table and Patty Britza of Sustainable Fisheries

III. Current uses of VMS

State Fisheries Management

The State of Alaska is delegated management authority for several fisheries managed under Federal Fishery Management Plans (FMP). Thus, ADFG managers access current VMS data for multiple fisheries jointly coordinated and managed with National Marine Fisheries Service through FMPs (specifically crab, scallop, and Pacific cod fisheries). Crucial in the management of these fisheries resources is access to the best available data on a timely basis, which includes current VMS data. Some of the most important uses of real-time VMS data by the State are as follows:

- To access fishery effort inseason and to anticipate fishery closures to meet, but not exceed, catch limits (how many and which vessels are actively participating in the fishery)
- To collect biological samples (tracking tenders or fishing vessels for delivery locations and estimated time of arrival in order to have port samplers or observers available in the correct location)
- To access fleet distribution/harvest areas – the State is authorized to close areas if there are concerns about localized depletion
- To verify vessels are staying out of closed waters, most notably for Steller sea lion and habitat protection measures enacted by NMFS
- To verify actual fishing locations to amend fish tickets if the fish ticket notes an erroneous statistical area
- To notify Alaska Enforcement staff if an enforcement issue is identified

In summary, the management process responsible for the stewardship of the North Pacific fishery resource has necessitated a collaborative approach with the State of Alaska. Together, the Council and the State of Alaska have managed these important fishery resources. Crucial in the management of these fisheries resources is access to the best available data on a timely basis, which includes current VMS data.

NOAA Fisheries Management

VMS is integral to the efficient management of quotas. One of the primary uses of VMS data is the determination of fishing effort. Prior to the use of VMS, managers relied solely on catch report information that were only available after fishing had taken place. Without any additional information, effort was assumed to be those vessels that had fished prior. This method could not predict when new vessels joined the fishery or if vessel s left the fishery. Management precision was lacking and fisheries would be closed prematurely or TACs were exceeded with greater frequency.

Combining VMS data with Catch accounting system (CAS) information can provide managers with data that identifies if a vessel is actively fishing and what the target fishery may be. These data can also be

used to determine how good fishing is based on trip length and identify any new effort joining the fishery. VMS is also used to confirm information that managers gather while managing a fishery. For example if a fisherman states that weather is too bad for fishing and most of the fleet is in town, Inseason management used VMS to confirm the location and activity of the fleet. The use of VMS data has resulted in greater precision in management of TACs.

Because vessel travel rates can be determined from VMS, managers can determine where fishing is occurring. Speeds greater than .3 knots and less than 4.3 knots are assumed to be indicative of fishing behavior. When there are incidental catch concerns, these data are used to identify where "hotspots" (areas with higher incidental catch) are. This provides managers with the data needed to use pinpoint spatial management methods to reduce incidental catch and minimize impacts on the fleet. While these fine scale spatial management methods in a regulatory sense can only be implemented when there is an over fishing concern, these tools are used frequently in daily communications with the industry. After reporting where hotspots are to the industry, industry generally tries to avoid those areas identified. Using VMS we can identify if the fleet moved and adjust management accordingly.

VMS is also used in correctly assigning catch to area. Spatial management in the North Pacific has become more complex. TACs are subdivided into smaller spatial units and limits on how much catch can be harvested in fine spatial scale area cannot be managed without tools to help identify where that catch occurred. NMFS has linked VMS data with Catch accounting and observer data to correctly identify what harvest should be deducted from a limit.

VMS can be used to identify errors. A lot of the catch information used for management relies on industry reported spatial location information. Keypunch errors or actual misreporting can result in catch being incorrectly assigned to a limit. When potential errors are identified, VMS data can verify the reported data or identify what the correct area should be. Using that information we can get these errors fixed. Without VMS data we would have no ability to fix these potential errors.

VMS is also required for analysis of future regulations when a spatial component is included. CAS data is consolidated at a large spatial scale, the federal reporting area. Proposed management measures in some actions require data at a different scale. To accomplish this VMS data has been linked with other data sources (CAS, Observer data, fish tickets, etc.). A new analytical database was created called the Catch-in-Areas (CIA) dataset. The CIA partitions CAS data into 7 kilometer (km) blocks. These data can then be used to determine how much catch has historically occurred in the action area. CIA data is now used in almost all analyses done in Sustainable Fisheries, Alaska Region. Without VMS we would be unable to do analysis at the spatial scales that are needed.

NOAA Observer Program

The observer program has been using VMS data for a number of years to perform necessary quality control on observer recorded data. A key piece of information that observers are required to record is the latitude and longitude of when gear goes in the water and when gear comes out of the water. These positions are an important piece to fisheries management as they identify the specific area where the fish were caught. This information is initially supplied to the observer via the vessel logbook. Logbook data is typically recorded by an onboard GPS unit then written in the vessel logbook. Due to transcription errors in the logbook, data does not always get recorded correctly. When the positions arrive in the observer data they are verified through a number of spatial database error checks. When potential position errors are identified in observer data, VMS is a primary source of correcting the errors. Overall VMS data has become a valuable tool that is used daily by observer program staff to help correct potential errors in vessel positions.

The VMS data may also provide a data source that can be helpful in evaluating observer coverage in the

future. Conceptually, the observed fishing positions could be plotted against the unobserved fleet track lines to evaluate if there is a mismatch in the relative observer coverage by area. This information could be used to identify potential bias in the data set. However, a limitation for VMS for this type of analysis is that VMS does not specifically identify the fishing positions at present due to the low polling rate. Thus, VMS track-lines would need to be interpreted to attempt to distinguish fishing locations from transiting. This type of analysis would be better informed through logbook information or VMS if the specific fishing location could be incorporated into the VMS data stream.

NOAA OLE

The enforcement of fishery regulations in the North Pacific continually proves to be difficult and challenging, due in part to the large area that must be covered, the remoteness of much of the region, extreme weather conditions, limited enforcement infrastructure, large fleets, and the complexity of the regulations. VMS is not affected by these spatial logistics, and provides a level of real-time knowledge of fishing vessel location that cannot be attained by traditional means.

The frequency and severity of fishing violations is affected by the resources used for traditional enforcement measures. Traditional enforcement measures include recordkeeping and reporting requirements, review and validation of these records and reports, at-sea monitoring and surveillance using patrol aircraft and vessels, dockside inspections, investigative work by NOAA OLE agents, and prosecutions by NOAA's Office of General Council and the U.S. Department of Justice. VMS provides alternative data and surveillance to enhance and support these traditional methods.

USCG Enforcement

The USCG uses VMS data for fisheries enforcement activities. USCG reviews VMS data on a daily basis to assist in targeting limited at-sea law enforcement assets to the most critical locations. Review of VMS data gives the USCG a broad overview of vessel activity throughout Alaska, and allows us to conduct analysis given knowledge of the fisheries, vessels, and locations to determine the most appropriate location for enforcement assets. Daily VMS data also assists the Boarding Teams in identification of vessels that are sighted by the cutter, and who by virtue of their permits should be showing on VMS but whose positional data is not currently entering or being displayed in the NOAA system.

USCG Search & Rescue

Though not a primary rescue alert device, VMS provides significant advantage for SAR operations because of the real-time reporting of positional data. Other monitoring technologies are limited because they lack this real-time capability. For example, the Council and NMFS have been developing an electronic video monitoring program as a component of the restructured observer program, to be implemented in 2013. While this technology would include vessel position data via an onboard GPS, the information is merely stored for later review. Additionally, for 2013, the program is strictly voluntary, and will only be deployed on a small number of vessels (likely less than 60). VMS is currently deployed on 556 vessels.

The addition of a VMS unit, combined with EPIRB, may provide a relatively accurate measure of the area within which survivors may be found. In many situations, this may help reduce the time it takes SAR personnel to find and rescue survivors. In those cases where an EPIRB distress signal does not provide coordinates, the use of VMS to identify the last known position will provide precise location information for the drifting survivors and debris in USCG SAR simulation programs. Reducing the amount of time between receipt of a distress signal and the location of survivors can play an important

role in reducing fatalities during an emergency. The Coast Guard could save search time by beginning a search in the general vicinity of the last known position from VMS before the accurate position from the EPIRB is transmitted. A comprehensive VMS program also provides the Coast Guard with a picture of all fishing vessels near a vessel in distress. The Coast Guard can determine the location of nearby fishing vessels and whether they can respond to a vessel in distress. Good Samaritans provide an invaluable resource to get help to those in distress when they may be hours away from Coast Guard resources.

Industry

The pollock fishery and the whiting fishery off the coast of Washington and Oregon uses satellite-communication-based tracking systems to help identify bycatch hotspots and direct the fleet away from areas of high bycatch. Some of this redirection is quite formal, with actions prescribed by cooperative contracts that indicate areas that must close when bycatch rates reach a certain level (the pollock fishery), and sometimes they are less prescribed, as in the hake fishery.

In the case of the hake fishery, the cooperative monitors shoreside landings and offshore observer reports. Whenever a report with a bycatch rate in excess of preset levels for a given species appears in the system, a time frame involved in the event (start/end time for a single tow, leave port/arrive port time for a shoreside trip), is determined, and relevant position reports are extracted and assembled into a track line. The track lines are put into a high-tracks table in the cooperative web site database with a link to a google-maps based section of that site. This link is sent to the vessels in the participating fleet so that they can see where the bycatch event occurred. Note that those receiving the link must also have a user id/password to access the high bycatch tracks maps. They can also then look through all the high-VMS tracks for current and past seasons to see if there are trends that may be useful in avoiding bycatch.

In the case of the salmon closures in the pollock fishery, Sea State uses the position reports to determine if vessels have violated the salmon agreement and fished inside the closures.

Freezer Longline Coalition (FLC) members use the VMS software to monitor their vessels from land, typically from their office. In general, members described VMS as an inexpensive way to track their boat(s) and get current coordinates. A number of FLC members utilize VMS to track where their boats are located and what they are doing. The technology provides our members a way to check for fishing hot spots on a given day and functions as a safety tool. For some, VMS is also a tool to help determine if one of the boats is in (or near) a closure area so corrective measures may be taken as needed. In addition to tracking the current status of their vessels, some members utilize VMS to look at the history of where their boats have been on a trip. Many members cited the benefit of VMS to services such as Sea State, which is increasingly utilizing the technology to monitor catch data vs. catch area. Members rely on Sea State to provide accurate, regularly updated catch data.

IV. Advanced VMS options and the current use of VMS?

In the North Pacific, VMS is a relatively simple system that sends vessel identification and location at fixed 30-minute intervals. However, VMS units are capable of much more. A VMS unit may incorporate targeted species, gear, and area declarations, variable poll rates, geo-fencing, and transfer of data such as electronic log books. The following sections provide a detailed description of these advance features of the VMS units.

Geo-fencing

Geo-fencing is the process of setting a virtual perimeter for a geographic area. Geo-fencing allows Enforcement to create an area which, when entered by a vessel equipped with VMS, can trigger an

automatic increase in the polling rate, and can also trigger an email alert. When the vessel exits the area, the polling rate can be reduced to the normal rate. Geo-fencing allows for alerts (general email or text message) to be sent to the agency or VMS user if deemed necessary. Increased polling as well as email alerts would result in higher VMS costs that may need be borne by industry using these areas.
Geo-fencing is a spatial management application not currently utilized in Alaska, though its application has potential, for example, in conjunction with EFH and HAPC conservation areas. Currently, VMS in Alaska is used to monitor fishing activities within EFH and HAPC conservation areas. A geo-fence would be triggered when the electronic transmitter crosses the fence or boundary line. More than one parameter can be linked to an individual vessel, including position, vessel characteristics, type, and speed. Not all vessel behaviors will warrant a closer look when operating within an area. A closer look could be initiated when a vessel enters a geo-fenced area and exhibits certain behavior, such as reduced speeds for fishing. In this instance, the vessel's speed would be at slower than normal transit speed. Vessel type and behavior could also alert OLE VMS technicians that further investigate a vessels activity if warranted. Lastly, the geo-fence could be activated when a vessel carrying VMS first crosses the boundary line and then at specific intervals, depending on the size of the area and the required confidence needed to adequately monitor vessel activities in each area. The geo-fencing feature would also enable a virtual perimeter to be set at a specified distance from an area so that when a vessel passes that perimeter, an alert is sent to OLE AKD advising them that a vessel has entered the geo-fenced area.

Declarations

A declaration system could require a vessel operator to declare on their VMS unit a variety of codes, such as which species is being targeted, the gear being used to target that species, and the area the vessel will be targeting these species. Creating a fishery declaration system could facilitate enforcement and compliance monitoring, as well as enhance the management of those fisheries. Vessels could be permitted to participate in multiple fisheries that authorize numerous fishing gears. A VMS-based declaration system could provide advance notice of the target fishery and the intended gear to be used. These declarations provide Enforcement with critical information concerning which regulations apply to that particular vessel during that trip. A declaration system is not currently utilized in the Alaska region. The Northeast Region currently uses such a system. Vessels in that region must declare target species, gear, and area to be fished and are not permitted to change this declaration while outside a VMS demarcation line.

Polling Rate

The rate at which VMS units send signals can be remotely modified. Currently, units in the Alaska region are programmed to report every 30 minutes but can be reprogrammed in response to pre-defined criteria. For example, a vessel can be monitored more frequently if deemed necessary. More frequent reports result in more data and therefore a more accurate picture of the vessel's activity, but also increased data management costs. NOAA OLE may sometimes program a VMS unit to report a vessel's position more frequently, for example, if it appears to be operating near a no-transit or no-fishing zone. In another example, an increased polling rate may be needed when vessels are operating in medium or small no fishing zones. The required one poll every 30 minutes may not be sufficient enough to know if a vessel is transiting through a no fishing zone or if the vessel is fishing. In general, the average additional cost to the VMS user for each incremental additional poll, repeated over the entire month, is $25.88.

Recognizing the benefits of increased polling rates, the proposed regulations for Steller sea lion protection measures will require operators of federally permitted vessels in the AI subarea using trawl gear to directed fish for groundfish, must ensure their VMS unit is transmitting the vessel location at least 10 times per hour and that NMFS is receiving the transmission starting January 1, 2015.

Two-way communication

VMS units can also be used to communicate through electronic messages with shore-based fishery personnel, which could allow fishery participants to communicate directly with NOAA OLE if necessary; download updated software without removal of the device; communicate with manufacturers to remedy malfunctions; receive required software upgrades with little interference; communicate with vessel owners and processors; and send distress calls to monitoring companies in the event of an emergency. One example of the communication features of VMS is the transmitting of electronic logbooks. Currently, electronic logbooks are sent daily via email for those fleets required to transmit their electronic logbooks. However, electronic logbooks could be sent via the VMS units. Although not necessarily useful for fleets that currently have satellite communication capabilities, transmitting electronic logbooks via VMS for smaller vessels that don't have satellite communication capabilities could be significant.

V. VMS Uses in Other Regions

Northeast Region

The Northeast region encompasses all EEZ waters from Maine south to North Carolina, and includes the boundaries of both the New England Fishery Management Council and the Mid-Atlantic Fishery Management Council. VMS coverage in this region is the most comprehensive of any NOAA region. There are approximately 1,080 registered VMS vessels in the Northeast region that generate 40,000 "trips" annually and 17,000 VMS e-form[2] reports annually and 10,000 possible VMS activity declarations. Fishing vessels are required to carry an operational VMS if they are operating in the following fisheries: scallop, monkfish, mackerel, surf clam, ocean quahog, and herring. With the exception of the scallop fishery, vessels in these fisheries must transmit a VMS signal once an hour. Vessels in the scallop fishery must transmit at least twice per hour. Prior to crossing the VMS demarcation line, generally defined as the state water boundary, vessels must declare via their VMS units the target species, gear, and area to be fished. Vessels are not permitted to change this declaration while outside the VMS demarcation line. For fisheries that do not require VMS, vessels already carrying VMS must continue to broadcast position information while participating in these other fisheries, but are not required to declare their target species, gear, or fishing area. Figure 1 shows an example of a VMS snapshot in the Northeast region. The figure shows one position per vessel, color-coded to the vessel's activity. Each color represents a different fishery. The benefit of the color codes is that enforcement personnel can get a quick view of where the various fleets are located in relationship to the areas where fishing is permitted and the authorized gear. Other uses of VMS in the Northeast region include daily e-forms and trip-level reporting, fleet-wide messaging, and third-party reporting to NMFS (hails and electronic vessel trip reports (eVTRs)) and others through "open" ports.

[2] E-form is a computer version of paper forms that eliminate the cost of printing storing, copying, and distributing forms.

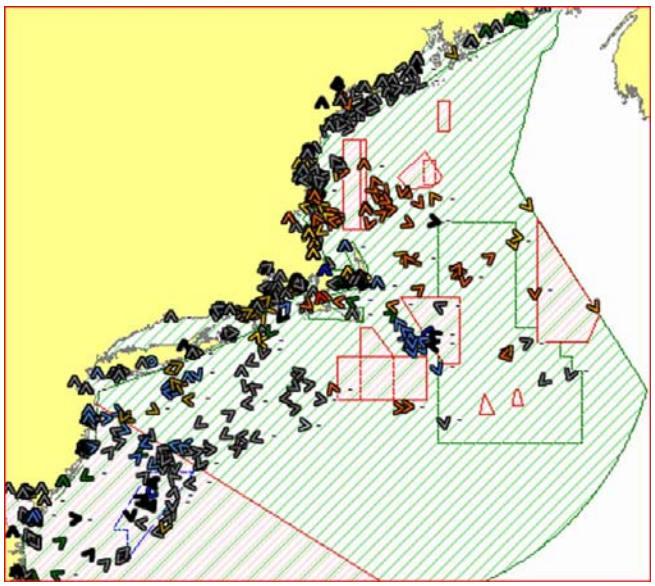


Figure 1 VMS snapshot in the Northeast region

Southeast Region

The Southeast region extends from the North Carolina through the Gulf of Mexico to the Southern border of Texas. The region also includes U.S. territories of Puerto Rico and the U.S. Virgin Islands. The purpose of VMS in this region is to monitor compliance with area-specific regulations and track and prosecute violations for these restricted or prohibited areas. One example is the reef fishery. There are 1,113 registered VMS vessels in this region that support 9 joint enforcement agreements (JEA) with partner states for managing Gulf of Mexico rock shrimp and 19 partner states that manage fisheries of highly migratory species (HMS). The region includes a number of area-specific regulations where reef fishing is restricted or prohibited in order to protect habitat or spawning aggregations of fish. Vessels required to carry VMS in this region include those that range in length from 12' to 145' LOA that participate in the following fisheries:

- Gulf of Mexico commercial reef fish fishery
- Pelagic longline fishery for highly migratory species
- Shark fishery using gillnet and nonpelagic longline gear
- South Atlantic rock shrimp trawl
- A sample of vessels (about 550 of 1600) in the off-shore Gulf of Mexico shrimp fishery have VMS devices used to estimate effort
- Penalty fishery – vessels required to use VMS because they have violated fishery regulations

Program uses of VMS in the Southeast region include declarations, pre-landing notices, E-forms data processed into individual fishing quota (IFQ) system, and interactive voice response (IVR) call0in system integrated into VMS.

Northwest Region

The Northwest region covers the states of Washington, Oregon, and California. The purpose of VMS in this region is to monitor compliance with groundfish conservation areas, trawl and non-trawl gear prohibition for the rockfish conservation area, and prohibition of trawl and bottom contact gear for essential fish habitat areas. VMS is required on any fishing vessel in federal waters that takes, retains, or transports groundfish. This requirement applies to any size vessel ranging in length from 17.5' to 308'

LOA, which includes skiffs that carry small waterproof boxes to house the VMS unit. There are more than 900 registered vessels with VMS in this region. Program uses include required VMS declarations of gear types used and areas to be fished that has generated over 28,270 gear type declarations since inception, and an interactive voice response call in system that is integrated into the VMS units that has generated over 24,600 calls since 2005.

Pacific Islands

The Pacific Islands region covers the waters around the Hawaiian Islands, and the Western and Central Pacific. The EEZs in this region is very large and are often non-contiguous. The size of the EEZs creates problems for fisheries surveillance and enforcement, due to the distances involved and the scarcity of suitable logistic support throughout the region. Resources to conduct surveillance and enforcement are constrained by limited budgets and other information for fisheries management is generally insufficient and/or unreliable. The Western Pacific Fishery Management Council has developed the following policy concerning VMS:

- Where appropriate and desired, implement satellite-based fishing vessel monitoring system to assist fishery management programs in the region.
- Develop specific technical and operational guidelines for VMS programs under the authority of each FMP, as appropriate and in consultation with the domestic and foreign fishing industry and relevant government agencies.
- Concentrate VMS programs on the enforcement of area and seasonal closures (i.e., automated, real-time reporting of vessel identification and location) until such time when the Council, NMFS, and state/territorial agencies decide that real-time reporting of fisheries and research data is desirable and feasible.
- When developing VMS programs, consider efficiency and cost-effectiveness for the fishing industry and management agencies.

The Western Pacific was the first region to require VMS, dating back to the mid-1980s. VMS units are on vessels ranging in length from 41’ to 260’ LOA in the U.S. fisheries of the Western and Central Pacific, which are mostly longline vessels with a few bottom fishing vessels operating in the Commonwealth of the Northern Mariana Islands. Additionally, vessels permitted to operate in the Northwest Hawaiian Islands Monument are required to have an operational VMS unit. Information gathered from the VMS units in this region are the most basic, providing vessel name, position, date, and time that tracked 1,580 vessels of which 230 are domestic vessels and 1,350 are foreign vessels.

In a recent review of the Western Pacific VMS program in 2010, the program appeared to be meeting the basic needs of the region’s conservation and management measures. However, there were a number of issues raised concerning contracted service provider difficulties, the high operating costs of the VMS program, and data sharing arrangements which limit the VMS manager’s ability to manage and use the system as well as member countries ability to conduct marine stewardship activities in their EEZ. To address these issues, a number of recommendations were included in the review. Some of these recommendations are noted below:

- Develop a central data base system to store all original VMS data received with a goal of eliminating redundant, separate satellite transmissions to multiple entities
- Move more ongoing/routine responsibilities for VMS management from the commercially-contracted service providers to trained Western and Central Pacific Fisheries Commission staff

- Update data sharing rules to allow the VMS managers, VMS operators, and technicians amongst the key players in the Western Pacific area to have full access to all the data under very strict confidentiality guidelines, and
- Reduce VMS costs by 1) reducing the amount of information transmitted, 2) ensuring correct polling rates across all vessels, 3) reduce polling rates when appropriate, and 4) reduce duplication of data transmission.

VI. Strategic Plan for Electronic Monitoring/Electronic Reporting

NMFS has a long history of collaboration with the Council to define processes and strategies to integrate new technologies into fisheries operating in the North Pacific. The restructure of the observer program in 2013 addressed many of the long-standing issues of bias in the observer deployment. This necessitated deploying observers across more fisheries and onto smaller vessels (<60' LOA) not previously observed where it can be logistically difficult to place an observer. Additional data collections approaches are being sought that have the potential to supplement fisheries dependent information by means of electronic monitoring (EM) and electronic reporting (ER).

Developing and implementing technology requires careful thought given that technologies and automated image processing techniques are rapidly evolving. Decisions about where and what to invest in represent strategic choices; wrong choices can be costly. To guide integration of EM and ER into North Pacific fisheries a strategic plan was presented to the Council in June 2013, and the Council adopted the plan as a guidance document for incorporating EM/ER into the Observer Program. The Council recommended use of a catch estimation approach to develop EM tools for the halibut and sablefish fisheries and initiated development of an EM Workgroup. The following is the vision statement from the EM Strategic Plan:

> *A future where electronic monitoring and reporting technologies are integrated into NMFS North Pacific fisheries dependent data collection program where applicable to ensure that scientists, managers, policy makers, and industry are informed with fishery dependent information that is relevant to policy priorities, of high quality, available when needed, and obtained in a cost effective manner.*

The EM Strategic Plan has identified four main goals, and numerous objectives, strategies and actions to implement electronic monitoring tools into the North Pacific fisheries-dependent data collection program. In aggregate, the strategies and actions are designed to meet a specific objective and the cumulative achievement of objectives is intended to achieve an overall goal.

Implementation of the strategic plan and completion of the action items it defines requires sufficient staff and budget resources to complete the tasks. Monies have been acquired through NMFS and its partners including NPRB and PSMFC to advance on a number of action items. NMFS is seeking additional funding to complete all the goals defined in strategic plan and several avenues for future funding are being investigated. The Strategic plan provides an outline of our current work describing the process and study design to meet the objectives and goals described in the document, and the Council's objective of applying EM in a catch estimation capacity.

Although the Strategic Plan focuses heavily on developing a video based electronic monitoring system to supplement the observer program, numerous other EM tools, including VMS, were noted in the plan. Appendix A of the strategic plan includes a table (provided below as Table 3) that summarizes the existing monitoring tools currently implemented in the North Pacific fisheries. Note that the catch share programs require a more intensive suite of tools for management. In addition, Appendix B summaries the

compliance monitoring and electronic reporting options to fisheries management and/or supplement observer data collection. One such compliance monitoring objective is area closures. EM in the form of VMS has been used for many years as a tool for monitoring time and area closures. Appendix B of the EM Strategic Plan notes that the internal infrastructure to support VMS is in place and functioning. Finally, Appendix F assesses the range of monitoring tools and their applicability to fisheries data needs. Based on the information in the Appendix F, VMS is applicable for 1) spatial information for trips and fishing events in single and multiple management areas; 2) data to assess compliance with specific regulations; 3) and time sensitivity.

Table 3 Existing monitoring tools currently implemented in the North Pacific fisheries

		Monitoring Tools							
Program	Fishery	Paper logbook [1]	E-logbook	Flow Scale	VMS	Video	100% observer coverage	2nd observer	ATLAS
Catch Share	AFA CPs/motherships	N	Y	Y	Y	Y	Y	Y	Y
	BSAI Trawl CPs in H&G	Y	Y - voluntary	Y	Y	Y	Y	Y	Y
	CGOA Rockfish CP	N	Y	Y	Y	Y	Y	Y	Y
	BSAI P.cod Freezer Longliner	N	Y	Y	Y	Y	Y	Y	Y
	CR Crab CP	Y	N	Y	Y	N	Y- not NMFS	N	N
	AFA CVs	Y	few- voluntary	NA	Y	N	Y	N	Y[3]
	CGOA Rockfish CV	Y	N	NA	Y	N	Y	N	Y
	IFQ CP Sablefish	Y	N	N	Y -AI only	N	Y	N	N
	IFQ CP Halibut	Y	N	N	Y -AI only	N	Y	N	N
	IFQ CV Sablefish	Y	N	NA	Y -AI only	N	N	N	N
	IFQ CV Halibut [2]	Y [2]	N	NA	Y -AI only	N	N	N	N
Non-Catch Share	BSAI CP Longline Turbot	Y	N	N	Y	N	Y	N	Y
	GOA CP Trawl	Y	Y- voluntary	N	Y	N	Y	N	Y
	GOA CP Longline	Y	Y voluntary	N	Y	N	Y	N	Y
	BSAI CV Trawl P.cod	Y	N	NA	Y	N	Y-voluntary	N	N
	GOA CV Trawl	Y	N	NA	Y	N	N	N	N
	GOA CV Longline	Y	N	NA	Y	N	N	N	N
	CP Pot	Y	N	N	Y	N	Y	N	Y
	CV Pot	Y	N	NA	Y	N	N	N	N
	Jig	Y	N	NA	Y-AI only	N	N	N	N

1-Paper logbooks are required by NMFS for vessels >60ft

2-Paper logbooks are required by IPHC for vessels >26ft fishing for halibut; vessels >60ft are also required to submit paper logbooks by NMFS and there is a shared IPHC-NMFS paper logbook.

3-Atlas is required for vessels over 125 LOV, but many vessels voluntarily use ATLAS

VII. Enforcement Committee's Implementation Recommendations

Table 4 rates the utility of advanced features of VMS from the perspective of the different user groups. Depending on the user group, the utility of the advanced features are either extremely useful, useful, or less useful.

From the perspective of the different enforcement user groups, geo-fencing, increased polling rates and declarations would likely be extremely useful. The ability to establish a virtual perimeter around a geographic area that results in an alert to NOAA OLE or USCG Enforcement and automatically triggers increased polling rate results in better resolution of a vessel's track that could assist enforcement personnel in determining the vessel's behavior. A vessel that has declared its gear and target in a geo-fenced area with an automatic increased poll rate that is authorized for mid-water gear only provides valuable information on the vessel's intent. A vessel exhibiting unusual behavior outside the vessel's stated intent could warrant further investigation by enforcement personnel using more traditional enforcement resources. Advance VMS features also provide an incentive for participants to follow the rules, which would likely reduce the number of enforcement actions. Knowing that enforcement personnel have better resolution of a vessel's track through increased polling rate, warnings of vessel activity in an area closure, or a declaration of a vessel's gear and target could make participants more reluctant to fish illegally.

Table 4 VMS utility to different user groups

Purpose of VMS usage	Specific user group	**Geofencing** (virtual fence around area closures)	**Polling rate increase** (better track resolution in closure areas)	**Declarations** (identifying gear, target, and commencing and ending fishing)	**Two-way communications** (between VMS unit and shore-based personnel)
Enforcement	NOAA OLE	1	1	1	3
	USCG Enforcement	1	1	1	3
	ADF&G	1	1	1	3
Management	NOAA Fisheries Management	3	1	1	2
	NPFMC (data to understand proposed conservation actions)	2	2	2	3
	ADF&G	2	2	2	3
	Industry	3	2	3	2
Search & Rescue	USCG Search & Resuce	2	1	2	1

1 = extremely useful
2 = useful
3 = less useful

From the perspective of management, the advanced features of VMS vary depending on the different users and the advance features. For NOAA Fisheries Management and ADG&G, increased polling rates and declarations would likely be extremely useful. Increased polling rates and declarations would provide useful management information like the regional fishing effort, the number active vessels targeting a specific species, and the gear used in the target fishery. This type of information could assist in determining the level of catch and forecasting fishery closures in different areas. From the Council's perspective, the information provided from these advanced VMS features could be a tool used in proposed conservation actions. Declarations combined with geo-fencing and increased polling rates could provide historical effort, catch, PSC, and fishing tracks, all potential elements for the Council in making conservation management decisions. Finally, the utility of the advanced features would likely be useful for some industry users. For example, cooperatives often coordinate their fishing effort so as not exceed their quota or PSC. Increased poll rates provide better vessel track resolution for cooperative managers, so when combined with other vessel tracks in an area and the associated PSC data, salmon hot spots could be better identified.

From the search and rescue perspective, all of the advanced VMS features are extremely useful. Increased polling provides better resolution of the vessel track, which could be used to provide more accurate last know position of a vessel in distress. The VMS unit could also be a means of communication between a vessel in distress and search and rescue forces. Other VMS features, although useful for search and rescue since they provide additional information about a vessel in distress, they are not as crucial.

Table 5 looks at area and inseason management approaches and rates the utility of VMS advance features from the perspective of enforcement, management, and industry. Looking first at enforcement of the area closure, the usefulness of the VMS advanced features vary depending on the type of area closure that is utilized. Under the most restrictive closure which is no fishing, geo-fencing and increased polling rates would likely be extremely useful tools for ensuring that vessels are not fishing in a closed area. The same is likely true for area closures during a specific season. In cases where a specific gear or target fishery is restricted, geo-fencing and increased polling rates would likely also be extremely useful, but the addition of declarations would likely add additional clarity for enforcement. Irregular shaped area closures are often difficult to enforce since it is less clear cut that a vessel is west/east, north/south of an indicated line, and therefore, in or outside a closed area. However, the addition of the geo-fencing and increased polling rates assist greatly in clarifying if a vessel is in or outside a closed area. The addition of these advanced features also addresses the limitations of enforcing small closure areas. A geo-fence surrounding an extremely small closure area could be designed to automatically increase polling rates of a vessel entering the area, which could assist enforcement to determine if a vessel is showing fishing behavior.

From the perspective of management, increase polling rates would likely be the most useful of the advance VMS features for managing area closures. Declarations and two-way communication would be useful VMS advance features for both managing area and inseason catch limits. From the perspective of industry, the increased polling rates and two-way communications would likely be useful. The increased polling rates provide a more complete vessel track history for both individual vessels and cooperative managers, while two-way communications would allow smaller vessels, that do not have an internet connect while at-sea, to receive notifications of season openers and closures from in-season management. Geo-fencing and declarations would likely be less useful for the industry.

Table 5 VMS utility based on purpose of VMS usage and management approach utilized

Purpose of VMS usage	Management approaches	Example	**Geofencing** (virtual fence around area closures)	**Polling rate increase** (better track resolution in closure areas)	**Declarations** (identifying gear, target, and commencing and ending fishing)	**Two-way communications** (between VMS unit and shore-based personnel)
Enforcement	Area closures - no fishing all gears	Sitka Pinnacle Marine Reserve	1	1	3	3
	Area closures - specific season	Kodiak Island king crab closure Type I and Type II	1	1	3	3
	Area closures - specific gear type	Kodiak Island King crab closure Type I - no bottom trawling	1	1	1	3
	Area closures - specific target fishery	Steller sea lion Atka mackerel closure	1	1	1	3
	Area closures - irregular boundaries	Bowers Ridge Habitat	1	1	3	3
	Inseason catch limits (catch/PSC)	Closing a specific fishery due to TAC or PSC	3	3	3	3
Management	Area closures	All area closures	3	1	2	2
	Inseason catch limits (catch/PSC)	Closing a specific fishery due to TAC or PSC	3	2	2	2
Industry	Area closures	All area closures	3	2	3	2
	Inseason catch limits (catch/PSC)	Closing a specific fishery due to TAC or PSC	3	2	3	2

1 = extremely useful
2 = useful
3 = less useful

In summary, the Enforcement Committee believes that VMS is and will likely continue to be a very useful EM tool for management, policy makers, enforcement, and the industry in the North Pacific for the foreseeable future. VMS, with its well-established technology, is a valuable tool in the Strategic Plan for the EM/ER in the North Pacific. VMS has been in place and functioning for over a decade in a cost effective manner. VMS provides in-season managers specific effort information in real-time that leads to improved fishery closure precision. VMS is also crucial for enforcement and compliance. VMS has the ability to provide positional information in real-time that helps deter or identify attempts to bypass systems to monitor landings.

Recognizing the usefulness of VMS advance features for management, enforcement, policy makers, and the industry, the Enforcement Committee recommends the Council utilize these VMS advanced features where appropriate while preparing Fishery Management Plan amendments and regulatory actions. Geo-fencing, declarations, variable polling rates, and two-way communications would increase the usefulness of the VMS unit immensely for all user groups. These VMS advanced features have been very effective in other regions and would likely provide significant benefit for management, policy makers, enforcement, and the industry in the North Pacific.

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