

Potential VMS Expansion for Fleets Required to Carry VMS¹ Discussion Paper

**Enforcement Committee Working Draft
November 14, 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.

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

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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 vessels 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. Key punch 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 to 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 vessel's 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-form² 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.

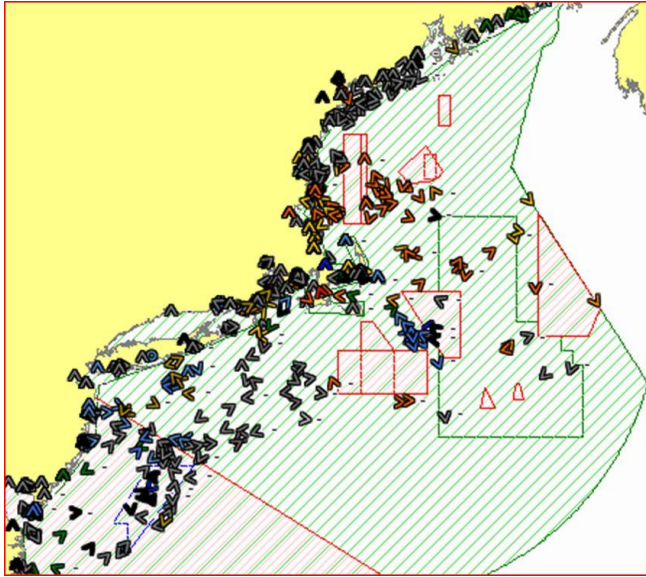


Figure 1 VMS snapshot in the Northeast region

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 collection 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 summarizes 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

Program	Fishery	Monitoring Tools							
		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
	Tig	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 Alka mackerel closure	1	1	1	3
	Area closures - irregular boundaries	Bowers Ridge Habitat	1	1	3	3
Management	Inseason catch limits (catch/PSC)	Closing a specific fishery due to TAC or PSC	3	3	3	3
	Area closures	All area closures	3	1	2	2
Industry	Inseason catch limits (catch/PSC)	Closing a specific fishery due to TAC or PSC	3	2	2	2
	Area closures	All area closures	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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