Agenda Item F.6.a
Attachment 2
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# **Initial Draft** Whitepaper: Electronic Monitoring and Performance Standards



May 29, 2013

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# 1. INTRODUCTION

In 2011, NMFS implemented a Council developed catch share program for the West Coast limited entry groundfish trawl fishery. The program requires that each vessel acquire quota pounds (QP) to cover its catch (including discards) of nearly all groundfish species.[1] Proper functioning of the program requires some form of at-sea monitoring to ensure that discards are counted. The catch share program specified that this monitoring function be achieved through 100% at-sea observer coverage. The cost of this observer coverage is a burden on industry that is currently being born largely through government subsidies. Those subsidies are phasing out and there are concerns about the impacts that bearing a greater portion of the observer costs will have on industry. Electronic monitoring (EM) is being explored as a potential technically and economically viable substitute for the use of human observers in the function of compliance monitoring for the catch share program. A more complete description of the problem is available in an appendix to the report of the February 2013 Council sponsored workshop on EM (see Council website: http://www.pcouncil.org/wp-content/uploads/D7b_EM_WKSHOP_RPT_APR2013BB.pdf)

During the EM workshop there was a discussion of the potential regulatory requirements for an EM system and the need for regulatory flexibility, both with respect to technologies employed and processes. The needed flexibility would allow private industry to develop efficient and effective monitoring system and to continue to innovate as new technologies become available over time. It was suggested that rather than being prescriptive, regulations should specify performance standards which must be met. This recommendation is in line with Executive Order 12899, which requires that each agency "identify and assess alternative forms of regulation and shall, to the extent feasible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt."

[1] Exceptions were made for some species rarely caught in the trawl groundfish fishery.

In April, 2013, the Council charged Council staff to work with agencies to "develop a whitepaper that would identify monitoring performance standards and other requirements that EM proposals would have to meet." This document provides a preliminary draft of that paper.

The catch share program itself is a performance standard specified within a market-based regulatory framework that includes a monitoring function. The proposal to be developed by the Council would change the means by which that monitoring function is fulfilled from one in which observers ride aboard vessels to one based on EM, in which EM is used to gather data on discard events. Under an EM system, vessels would enter discard data into electronic logbooks and video review would be used to validate the logbook information. However, the purpose of this paper is not to explore the viability of EM but rather to explore the possible use of performance standards rather than prescriptive mandates in the specification of the regulations for the EM function.

Three sections comprise this paper: the first explores different types of regulatory regimes, including regimes based on performance standards; the second begins more specific exploration of EM specifications based on performance standards; and the third provides excerpts from NMFS' recently released policy on EM.



# 2. TYPES OF REGULATORY REGIMES

## 2.1 Overview

Regulations are needed when the actions of individuals do not adequately take into account social concerns (i.e. underproduce social goods or overproduce social bads) (Viscusi, Vernon & Harrington 2000 as cited in Coglianese & Lazer, 2003, p. 3). For Federal fisheries, social outputs of concern include those which diminish achievement of the Magnuson-Stevens Act National Standards,[2] which might be broadly characterized as ultimately relating to biological and human community sustainability (including factors such as overfishing, efficiency, equity, and human safety). Where specific social bads

[2] The MSA National Standards relate to .....

can be traced to individual entities which can then be held accountable for damages, and which have the resources to cover monetary damages, then the court system itself provides adequate means for ensuring social values will be taken into account in private decision process (Hueth and Melkonyan, 2007). Consequently, in such situation there is little need for additional regulation. When regulations are necessary, as is the case in fishery management, "the ultimate goal ...is...to change the production of social outputs" (Coglianese & Lazer, 2003, p. 3).

Different authors use different terminologies and different groupings for classifying types of regulations. Generally, regulations run a range from being prescriptive (specifying the technologies and processes that must be employed) to being performance based (limiting or requiring certain output without regard to the technologies and processes used to achieve that result (Coglianese, et.al, 2003, p. 713). Numerous terms are used to describe variations on these end-points and the hybrids of regulatory systems that array themselves on the gamut between. For example, performance-based systems include a variation with performance incentives: Pigouvian taxes (a tax on negative externalities, e.g. pollution), and other output trading (e.g. emissions trading) (Hueth and Melkonyan, 2007). The catch share program would be considered a performance incentive system which relies on markets.[3] "[M]arket-based regulation still measure firms' performance for the purpose of either assessing taxes or determining if firms possess an adequate number of tradable permits" (Coglianese & Lazer, 2003, p. 2) Coglianese and Lazer identify three stages of production (planning, action, and output) and a regulatory classification system which maps onto these three stages (Table 1).

Table 1. Stages of organization production and types of regulations.

| *Stage of Production* | Planning ➔ | Acting ➔ | Outputs (both good and bad) |
|---|---|---|---|
| *Type of Regulation* | Management Based | Technology Based | Performance Based |

Reproduced from Coglianese & Lazer, 2003, p. 4.

Coglianese and Lazer's technology-based regulations generally encompass those regulations which are described as prescriptive or command-and-control, but also include other terms and sub-categories of regulation, including design standards and action or process regulations. Terminology and groupings used by other authors can be mapped onto the groupings developed by Coglianese and Lazer based on stages of production (Table 2). For the purpose of this paper, the terms *prescriptive* or *technology-based* will be used for the categories of regulation encompassed within Coglianese and Lazer's technology-based regulations.

[3] There are also "information-based" systems which require only the divulgence of information (e.g. labeling laws which allow consumer response to encourage firms to better account for the externalities of their production); and risk-based systems, which involve risk assessment modeling to determine compliance and might be considered a type of performance based regulation.

Management-based regulations do not prescribe technologies or behavior (prescriptions), or specific outputs (performance), but "[r]ather... requires firms to engage in their own planning and internal rule making efforts that are supposed to aim toward the achievement of specific public goals" (Bardach & Kagan, 1982 as cited in Coglianese and Lazer, 2003, p. 2). The design of management-based regulations includes determining: the degree of agency involvement in the internal planning process of the regulated entity, whether agency approval of the plan is required, and whether implementation and monitoring of the plan developed by the firm is required. The current trawl catch share program includes what might be considered a management-based component: requirement that first receivers develop a catch monitoring plan and have that plan approved by NMFS (§ 660.140(f)(3)(iii), subpart D).[4] However, for this provision there are very specific performance standards that the plan must meet and through the specificity of these standards an element of prescription enters into the regulation.[5] In general the management-based approach is intended to focus on the internal planning process with an openness to outcomes that provide substantial flexibility for a firm to identify alternative technologies and processes for meeting the social objectives that the agency is pursuing.

Whereas prescriptive regulations largely specify the how by which the problem of meeting a social need is addressed and management-based regulations require a firm to engage in mandated problem solving process to determine the how, performance standards leave the how alone and specify only the output which must be produced. Whether regulations provide prescriptive, management-based, or performance-based standards, a key element of success is monitoring and verification. The Council's current effort is an exploration of whether compliance with catch shares (a performance-based system) can be monitored and verified through a regulatory compliance system which is itself built on performance-based criteria.



[4] 660.140(f)(3)(iii), subpart D (iii) A catch monitoring plan. All IFQ first receivers must prepare and operate under a NMFS-accepted catch monitoring plan for each specific physical location. A proposed catch monitoring plan detailing how the IFQ first receiver will meet each of the performance standards in paragraph (f)(3)(iii)(C) of this section must be included with the application. NMFS will not issue a first receiver site license to a person that does not have a current, NMFS-accepted catch monitoring plan.

[5] A detailed list of performance standards is provided in 660.140 Section (f)(3)(iii)(C) and covers the topics of: (1) catch sorting; (2) monitoring for complete sorting; (3) scales used for weighing IFQ landings; (4) production of printed record; (5) weight monitoring; (6) delivery points; (7) observation area; (8) lockable cabinet; (9) plant liaison; (10) first receiver diagram (showing delivery point(s);the observation area; the lockable cabinet; the location of each scale used to weigh catch; and each location where catch is sorted); and (11) electronic fish ticket submittal.

Table 2. Regulatory terminology and groupings for different authors, organized based on Coglianese and Lazer, 2003.

| Authors | Regulatory Types | | |
|---|---|---|---|
| Coglianese & Lazer, 2003 | Management -based | Technology-based/prescriptive | Performance-based |
| Coglianese, et. al. 2003 | | Prescriptive (of behaviors, technologies, procedures, or processes)<br><br>Design standard<br><br>Technology--based standard[i] | Performance-based (including market-based) |
| Hueth & Melkonyan, 2007 | Management-based[ii] | Command and control<br><br>Design Standards[iii] – technology to use[iv]<br><br>Action Process[v] – steps to follow, implementation[vi] | Performance-based |
| Gunningham, 1999 | Systems-based<br>Process-based | Command and control (also termed "specification" and "prescriptive") | Performance-based |
| May, 2011 | Processes(system-based regulations) | Technology-based regulation<br>Prescriptive regulation | Performance-based |

i Coglianese, et. al. (2003) describe the difference between this category and performance based standards as follows: "In contrast to a design standard or a technology-based standard that specifies exactly how to achieve compliance, a performance standard sets a goal and lets each regulated entity decide how to meet it." (p. 709).

ii Hueth and Melkonyan describe management-based regulation described by Coglianese and Lazer as "conceptually akin to our process standard" (p. 5). However, Coglianese and Lazer emphasize regulations requiring managers to go through an internal planning processes to design systems that meet regulatory objectives. That planning process entails both determining the technologies to be used and processes to be followed during implementation.

iii Imposes a particular mitigation plan choice which then impacts action choice. (Hueth & Melkonyan, 2007, p. 3.)

iv Example: gear regulations.

v "Specifies (and enforces) the efficient action for a given plan" and enforces a particular action, "which in turn affects the firm's ex ante plan choice" (Hueth & Melkonyan, p. 3). "Process (monitoring implementation) standards" (Hueth & Melkonyan, p. 3)

vi Example: declaration requirements, fishing outside of closed areas.

## 2.2 Performance-Based Regulations

This section looks more closely at the design considerations and pros and cons of performance-based regulations. There are a number of precautions in the literature indicating that performance-based regulations should be approached with care. Federal regulators participating in a 2002 workshop "noted a general absence of empirical studies evaluating the effectiveness of performance-based standards, let alone systematic work showing when, and how well performance-based standards work in various regulatory settings" (Coglianese, et. al, p. 714).[6] The authors of this document are in the process of

[6] Coglianese et. al. (2003) also "conducted extensive searches in the academic literature, asked colleagues who were not at the conference, and solicited input via a global Internet listserv devoted to regulatory

reviewing the literature to determine whether more recent assessments have remedied this shortage of performancebased regulation evaluations. However, May (2011) found it still relevant to cite Deighton-Smith's (2008) statement: "the lack of critical assessment [of performance-based and process-based regulatory regimes] has lead[sic] to indiscriminate adoptions of these regulatory approaches" (as cited by May, p. 379). There are some notable failures in the use of performance-based regulations (May 2011), so careful attention to their design is warranted. A key area for attention may be accountability (monitoring and verification). While accountability is essential for any regulations, May notes "accountability is the Achilles' heel of performance-based regulation (p. 380).

As discussed above, "[p]erformance-based regulation is predicated on the notions that regulation should focus on achievement of regulatory objectives and leave it to regulated entities to determine how best to achieve them." (May. 2011, p. 373). The reasons for leaving decisions to the regulated entities (i.e. for use of performance standards) are multiple and include:

1. When prescriptive regulations must be very detailed to be effective
    a. they become costly to implement
    b. enforcement becomes arbitrary (may be based on what is most easily or what a particular regulatory enforcer feels is most important).
2. Industry has better information than agencies on the most effective ways to meet social goals.[7]
3. There is substantial heterogeneity across entities or through time, such that determination of a best set of prescriptive regulations for all firms across time is problematic to impossible.

There are a variety of different forms of performance-based regulations and those forms are a function of

1. Regulatory comprehensiveness and associated variation in specificity of regulatory performance, and
2. The blending of performance-based approaches with prescriptive approaches (May, 2011, p. 374)

### 2.2.1 Regulatory Comprehensiveness and Variation in Specificity

May identifies the following as factors which determine regulatory comprehensiveness and degrees of specificity

policy" but "In the end, ... were unable to locate any systematic empirical study evaluating the impact of performance standards relative to other regulatory approaches." (p. 713, fn 21)

[7] "Prendergast (2002) shows that output-based incentives are preferable to input-based incentives when there is uncertainty regarding the appropriate technology for a given task ..." (Prendergast as cited by Hueth and Melkonyan, 2007)

- Desired outcomes that constitute the goals to be achieved
- Desired level of achievement of those goals that constitute acceptable performance
- Assessment of actual performance (May, 2011, p. 274)

Each of these can vary based on level of specificity and quantification.

**Desired Outcomes**

Desired outcomes can be stated with varying degrees of comprehensiveness (May, 2011):

> for the system as a whole or its parts,
>
> *(example: performance standards for the seabird avoidance regulations cover only parts of the system, e.g. "single streamer line must be deployed in such a way that streamers are in the air for a minimum of 40 m aft of the stern and within 2m horizontally of the point where the main groundline enters the water")* (CITE)
>
> over broad or limited spatial areas,
>
> *(example: regulations covering just state waters, state and Federal, or state, Federal and international waters)*
>
> for a broad or narrow target group,
>
> *(example: a groundfish IFQ program just for shoreside trawlers or one that covers the entire commercial groundfish fishery).*

There may be multiple performance goals within a particular system and the performance goals may have differing levels of specificity (May, 2011). In most countries, the basic framework for developing performance related goals is to:

1. State goals or objectives
2. Identify what they mean in terms of functional performance
3. Delineate criteria (performance standards)
4. Specify the methods for verifying compliance (May 2011, p. 376)

In general, identifying the measures of performance and desired levels (standards) is more difficult that stating the performance goal (Gormley, 2000 as cited by May, 2011, p. 374). Included in the consideration of the specified standards are issues of safety margins and potential legal challenges (May, 2011).

**Acceptable Levels of Achievement**

The specificity of standards relates to the problem of identifying the ways in which performance will be measured and the standards that must be achieved against those measures. For example, a performance objective for EM of *monitoring for discards from a vessel* is relatively easy to specify. However, determining how to measure achievement of this objective and the level of achievement a vessel is required to attain (as determined against that measure) is more difficult. Standards can be expressed qualitatively or quantitatively (May, 2011). OFL levels are examples of quantitative performance measures to which fishery managers must regulate. An example of a qualitative standard from building codes is a requirement that certain equipment: "shall be installed so that they will not become a source of ignition" (International Code Council, 2001 as cited by May, 2011).

**Assessment of Performance**

As discussed in the opening paragraph to this section (Section 2.2), accountability is a key element of performance standards. Accountability requires the ability to assess performance. Performance can be assessed through

- direct assessment (observation of outcomes) or
- through prediction (modeling) (May, 2011).

For example, drinking water quality can be assessed through measurement while assessment of nuclear power plant safety generally relies on predictive modeling such as probabilistic risk assessments (May, 2011). Monitoring the catch share fishery is generally done through direct measurement[8] but the primary output for the EM system is what the EM system is supposed to monitor. It may be that assessment of the performance of an EM system developed under performance-based regulations will require some form of a predictive assessment by regulators (a formal or informal qualitative or quantitative model). Uncertainty in assessment enters both with respect to the predictions and the validity of the prediction methods. The complexity of potential interactions in some systems and unanticipated humans response within the systems modeled makes predictive modeling even more challenging (May, 2011).

In some regulatory systems third parties are responsible for certifying performance. This approach has been discussed for the electronic monitoring program. May (2011) notes that in such situations, accountability of these third party providers must also be taken into account.

[8] The catch share program is currently monitored based on an implied model which assumes the equivalent of continuous monitoring of discards by the observer (and complete monitoring of landings on shore). In fact, observers are unable to provide continuous and comprehensive monitoring because on both spatial scope (limited viewing field) and temporal scope (needs which prevent the observer from providing 24/7 observation).

### 2.2.2 Blending Of Performance-Based Approaches with Prescriptive Approaches

Regulations not only range between being prescriptive and performance based but can include elements that are more prescriptive and elements, which are more performance based. Additionally, the management-based regulatory approach discussed above is another variation which adds variety to the forms that performance-based regulations may take.

While Coglianese and Lazer (2013) break regulatory scheme types along dividing lines between each of the three phases stages of organization of production (Table 1), the stages themselves are comprised of multiple steps which may provide control points for achieving regulatory objectives. Different types of regulations might be applied to different control points or the same control point. For example, for a particular control point there could be a planning requirement that results in both a prescriptive element and a performance-standard.

Regulatory systems can also be blended by allowing firms with a good compliance record more latitude in how they meet regulatory objectives. The EPA's Project XL (eXcellence in Leadership) provides an example (Wiessner, 2002; Coglianese, et. al., 2003, p. 707; also see, Motor carrier Regulatory Relief and Safety Demonstration Project, 63 Fed. Reg. 37,619 (July 13, 1998)).

### 2.2.3 Advantages of Performance-Based Regulations

**Cost Effectiveness.** Performance-based regulations allow cost-effective innovation. Cost effectiveness refers to the achievement of a given result (standard) at minimum costs (CITE).

**Accounting for Diversity.** Performance standards may work well when regulating a diverse industry. Under such circumstances the prescriptive requirements most appropriate for one firm to achieve a regulatory objective may not be appropriate for another firm. An example is the different compliance challenges that larger and smaller vessels face when it comes to the requirements to carry an observer. A performance standard opens more options for achieving with the regulatory objectives (CITE).

**Accommodating Practices that Change Over Time.** Performance standards may work well when the technologies and processes for achieving a regulatory objective may change rapidly over time, creating opportunities to achieve greater levels of cost effectiveness (CITE).

**Leveling Playing Field Among Providers.** Performance standards level the playing field among the suppliers of equipment and technologies, as compared to a prescriptive approach in which use of the devices or technologies (e.g. software) of a particular manufacturer may be required (May, 2011).

**Highlighting Existing Regulatory Issues.** Even the process of considering performance-based standards can bring to light uncertainties in the specification of existing prescriptive standards. For example, careful consideration of the basis for proposed performance standards may bring to light shortcomings in the basis for existing prescriptive regulations (CITE).

### 2.2.4 Disadvantages of Performance-Based Regulations

**Costs of Searching for Compliance Methods.** Performance-based standards may impose costs on businesses that must do research and design to come up with a system that meets the standards. For some firms, it may be more cost effective, and less risky, to have prescriptive standards which tell them exactly what must be done (Coglianese, et. al., 2003, p. 712). Some of this cost can be reduced through the establishment of nonbinding codes--compliance guidance (Coglianese, et. al., 2003, p. 712).

**Ambiguity.** While providing flexibility, performance-based standards can also generate ambiguity and leave room for uncertainty related to the regulators discretion. Many firms may be anxious to avoid this. (Coglianese, et. al., 2003, 719). This ambiguity would be more likely to occur when non-quantitative performance standards are used and particularly when system modeling is used to evaluate performance. The ambiguity can also increase difficult for enforcement (Coglianese, et. al., 2003, p. 714).

**Uncertainty and Assessments Based on Models.** In some situations models are used to evaluate performance. These models may include both system performance and risk of adverse events (e.g. models for nuclear power plant safety). Limitations of predictive models are often not understood, unrecognized, or ignored. (Coglianese, et. al., 2003, p. 715). Predictive models can lead to "legitimate self-delusion" on the part of regulated entities (Coglianese, et. al., 2003, p. 716).

**Costs of Determining Standards.** For some standards, determination of optimal thresholds can require several levels of modeling and analysis (e.g. relating health to air quality to emission standards). For fish stocks, some of this modeling is already achieved through stock assessments and determination of annual catch limits. The modeling challenge might be greater if an effort were made to develop performance standards for levels of habitat impact.

**Costs of Monitoring Performance.** Regulated outputs must be monitored and assessed. Depending on circumstances it "is often difficult or prohibitively expensive to assess critical outputs" (Ayres & Braithwaite, 1992). The monitoring requirements can also lead back toward significant government intrusion in the day-to-day operations of the firm (Coglianese, et. al., 2003, p. 718). The observer requirement for the trawl catch share program arguably provides an example of this type of a result. However in some cases, the requirements for enforcement of prescriptive and performance-based regulations can be similar in terms of governmental requirements for information.

**Unintended Behaviors**: "Performance-based regulations may engender adverse, unintended behaviors. In other words, the flexibility that performance-based standards provide to firms may be used in ways that cause undesirable side effects, even if the firms still meet the performance goal. Therefore, letting industry choose its own path always presents the possibility of generating new or even larger risks" (Coglianese, et. al., 2003, p. 720).

**Capturing the Spirit**. "Even assuming that all the affected parties understand and agree with the spirit of a given regulation, it is often difficult to find the exact words to capture that spirit without leaving room for interpretation or manipulation, and thereby creating uncertainty" (Coglianese, et. al., 2003, p. 717).

### 2.2.5 Shortcomings of Performance-Based Regulations

These considerations are separated from the "disadvantages" category because they are factors that are not necessarily overcome by alternative regulatory approaches. They are, however, considerations that may affect the design of performance-based regulations, particularly with respect to advantages of including a market component to performance-based regulation (in situations where such inclusion is possible).

**No Incentive to Excel.** Performance-based measures do not provide incentive to find ways to exceed the requirements of the performance standards (Gunningham, 1999, p. 196-197). For example, a manufacturing plant that meets air quality standards may not have incentives to reduce emissions further, unless performance standards are coupled with a market trading program of some sort. The trawl IFQ program provides for trading. The opportunity to trade increases vessels' incentive to avoid some high demand limiting species (e.g. yelloweye), not only so that they can catch more target species but also to provide themselves with the opportunity to increase profits by selling quota they do not need.

**Limited Scope of Incentive for Innovation.** While performance-based regulations stimulate cost savings innovations for the equipment and processes industry uses to meet the performance standards, these innovations do not take government costs into account. For example, in an electronic monitoring program in which the government bears the cost of reviewing video there would not necessarily be an incentive for industry to develop and adopt technologies that reduce the costs of video review.

**Inappropriate Uniformity of Standards.** Performance-based standards require firms with very different cost structures to achieve similar levels of compliance (Coglianese & Lazer, 2003, p. 9). This problem can be addressed by combining performance standards with market-based approaches. For example, by allowing firms to trade pollution credits, firms that can reduce emissions cheaply can sell their credits to firms for which it would be much more expensive to control emissions, reducing the overall cost of achieving a given level of aggregate reduction in pollution (Coglianese & Lazer, 2003, p. 9-10).

# 3. A TWO TIER IMPLEMENTATION AND PERFORMANCE STANDARD APPROACH

Societal shifts in acceptance of technology have occurred in recent years, and numerous applications improving the functionality of technology in our daily lives have changed the way humans interact with each other and their environments. Fisheries management has been slower to adopt these evolutions in technology than other commercial sectors commonplace in today's emerging global economy. Currently, EM technology tested in West Coast groundfish fisheries that are immediately available for implementation may not take full advantage of these societal shifts, which include cloud-based computing and recent improvements in integrated hardware solutions, or fully consider the ways in which social media and web-based applications may be able to improve fisheries accountability and management in the future. However, EM solutions are needed now, while more research occurs on other technologies. At the same time, private research and development efforts are not likely to move forward to develop and implement technologies that primarily benefit the public good (e.g. increase the certainty with which unreported or misreported discards are detected) unless there is also substantial private benefit. Once a set of regulatory requirements is developed (whether prescriptive or based on performance standards) the private incentive of which we can be certain is to research and develop more cost effective ways to meet the requirements of those regulations. There is an incentive to achieve even higher levels of data collection and validation only to the degree that the private needs for such data overlap with the public/social/collective need. Even where an overlap exists, there may be an under-investment in research and development because private parties will not account for the full measure of that potential social benefit. On this basis, it may be appropriate to consider development of an EM policy in two tiers:

- Tier 1 policies would address EM technology tested and immediately available for implementation, and
- Tier 2 policies would address creating incentives and flexibility to develop and test technologies that further both the private and collective need.

The term *collective need* is used here to encompass both the public and the fishermen's collective need for a resource that is managed well and with low administrative costs.[9] Performance-based standards may be of value in policy for both of these tiers.

Allowing EM technologies and monitoring strategies into the fishery to help supplement the 100 percent monitoring coverage on a shorter time frame (<5 years) should also help to increase industry and management driven collaboration and innovation. By allowing for a manner in which currently proven Tier 1 solutions can be integrated into the fishery,

[9] Individual fishermen incentives do not match fishermen's collective needs, as indicated by the arguments of Harden's "Tragedy of the Commons" (1968).

market-based incentives and improved accountability will likely benefit the effort to improve ecosystem information acquisition and monitoring strategies in the future (>5 years) as cooperative tier 2 R&D pilot projects have had a fair chance to evolve *with* the fishery and new technologies develop. [10]

### 3.1 EM Tier 1:

**Currently Tested EM Equipment/Strategies and Operational Requirements (30,000' level)**

The goal of Tier 1 would be to keep it simple and immediate. Change what needs to be changed based on what's been proven thus far. Currently available technology and the regulatory/management strategies that depend upon these technologies have already been well tested and proven in a variety of global fisheries, although few have been implemented via regulation in US fisheries. Although new technologies may allow for greater capabilities in the near future, there may be benefits to embarking on a strategy using existing proven strategies in the short term, such as to provide some relief to the fishery.[11]

This paper assumes that currently available and tested hardware technologies are adequate, and explores whether regulations that would allow those technologies to be used for catch monitoring can be specified as performance standards. Specification as performance standards would allow industry to develop more cost effective equipment and processes without requiring revisions to the regulations to allow the use of that equipment and those processes. Additionally, if regulations for all fisheries utilizing EM as a monitoring strategy are drafted as performance standards, the regulatory flexibility may benefit the efficiency of the Council and regulatory process by reducing the need for regulatory changes.

**Performance-Based Regulation**

Performance standards can be stated in a number of ways including by specifying particular outcome or output (including a measurement standard) or by specifying particular equipment or processes and appending the phrase "or better." Electronic monitoring is itself a technology to be employed to verify accurate measurement of a vessel output (catch) in a performance-based program (the catch share program). Consequently, catch data cannot be used to verify the performance of EM, unless there is another source for that data (such as through observers, as is occurring in current field

[10] Additionally, Cooperative Research grant opportunities should enable fishermen to retain Tier 2 R&D equipment as forms of financial compensation for participation in the cooperative research, as the outcomes of such research could have significant long-term financial benefits to industry participants, as long as the equipment will still satisfies Tier 1 EM obligations.

[11] Beginning a Tier 1 EM strategy will be particularly beneficial in rural communities, where the ability to take advantage of shortened weather windows in between storms in winter months could provide much needed economic opportunities. Additionally, with quota share trading under the TRAT program allowed in January 2014, more cost effective monitoring means may help to conserve the integrity of small fishing businesses.

tests). Therefore, performance standards for electronic monitoring must be specified in the form of intermediate outputs (visual images with adequate spatial scope, continuity, quality, and context data—such as time, date, location and vessel identification—etc.) and processes (both fish and technology handling processes on the vessel as well as review processes). And, there must be an evaluation or model of some kind (qualitative conceptual, risk model, etc.) by which managers determine that a system that meets these standards for individual components is likely to ensure adequate catch monitoring.

It is highly likely that performance-based regulations for EM will include prescriptive elements and may also include management-based elements. Prescriptive regulations or performance standards might be developed for individual pieces of equipment and particular processes but what may be most important is how all the pieces work together in a system that is able to adequately detect discard events and determine whether such events have been properly recorded in logbooks. Because of the uniqueness of circumstances for each vessel, it is likely that a monitoring plan will be required for each vessel (as is currently done for first receivers in the catch share program and was proposed in the strawmen proposals endorsed at the February EM workshop).

**Management-Based Regulations**

Development of a monitoring plan for agency approval might be considered more of a management-based regulatory approach. As discussed in the first section of this paper, a management-based approach emphasizes individual firms making plans for how to meet public/agency objectives, in this case discard monitoring. The management-based approach used here would likely require approval of the individual vessel's plans and some form of verification of its implementation. Under a management-based approach, the vessel might be afforded considerable latitude. For example, assume that with current technologies it is determined that review of 20% of the video is necessary to reasonably ensure compliance with requirements to record all discards in a logbook.

Under a management-based approach with prescriptive elements, if a vessel were able to develop equipment and processes that provide a substantially higher degree of certitude of compliance with the logbook requirements, or technologies that allowed a video review to substantially narrow the amount of video that that needs to be reviewed for possible unrecorded discards, then lower sampling rates of video review might be possible. For example, work is ongoing now to develop computer detection of any deck activity that might possibly involve a discard. If such a technology is developed, but a 20% minimum sampling rate is required in regulation, then regulatory changes would be required to take full advantage of the innovation. However, if the sampling rate is specified as a modifiable default that may be altered in an approved individual vessel monitoring plan, then the regulatory barrier to innovation is reduced.

**Specific Elements for Specification**

**Vessel Monitoring Plan:** The current strawmen alternatives call for individual vessel monitoring plans. Assuming that such plans would be an element of EM, two of the first things to decide may be

- the degree to which design latitude might be provided through a vessel monitoring plan and
- the criteria by which the adequacy of such a plan will be judged.

Depending on the degree of flexibility allowed in equipment and processes specified in the vessel monitoring plans, the process for approval can require considerable agency resources and judgment calls on the part of individuals responsible for administrating the program. Careful specification of the approval process and criteria and full documentation of the decisional basis can control the amount of resources consumed and reduce the chances of arbitrary decisions. Conversely, very specific criteria may be difficult to develop without the criteria becoming arbitrary. A multi-agency/division approval panel might be considered a possibility for reducing potential biases and increase the likelihood of consistent determinations. The approval processes might even include a requirement for an agency personnel ride-along on the vessel to confirm effectiveness of a plan. As new technologies are developed and plans approved or disapproved, careful documentation over time may allow the identification and development of specific decision rules and criteria. Vessel monitoring plans may be approved on a contingent or temporary basis until enough experience is developed to allow the Council and agency to codify more specific criteria.

**Discards (Full/Maximum Retention):** Based on current technologies it appears that

- For trawl vessels, discards will need to be minimized (term to be defined) and adequate deck and water lighting provided during all fish handling activities.
- For longline vessels, discards will need to pass down a mechanism on which there is adequate lighting and camera coverage.
- For fishpot vessels, discards will need to pass down a mechanism on which there is adequate lighting and camera coverage.

Additional specificity might be added to this list. While criteria like these might be applied in the practice of approving a vessel monitoring plan, the regulations might incorporate a performance standard alternative. For example:

> Discards by trawl vessels will be either be minimized (maximum retention) or the vessel must have an approved vessel monitoring plan which specifies the means by which the species and weight will be adequately determined for any above minimum level discards. The function of such a system must be verified by agency personnel in the field and a vessel monitoring plan may be revoked if

during data review processes it is determined that either species or weight of discards cannot be adequately determined.

**General Camera Coverage:** Based on current technologies it appears that for all vessels, cameras will need to be placed such that any discard event will be recorded on camera and sufficient context data (time, location, etc.) captured to determine whether or not an event was recorded in the vessel logbook. Camera performance standards might specify

Image resolution and quality
Video frame rate (frames per second, FPS)
Scope of camera coverage
Continuity of video record
Tamper evident/proof equipment.

**Control Point Camera Coverage:** A variation on general camera coverage to be developed.

**Video Review:** As conceived in the strawman alternatives forwarded from the February EM workshop, vessels would be required to enter discard information in a vessel logbook, which would serve as the primary data source for information on discarded catch. Video would be reviewed to verify whether or not data has been entered accurately. Substantial exploration of video review requirements will need to occur during the Council policy development process. The differences between, for example, a10% audit review standard and a 100% computer/human review census approach will have a substantial bearing on program costs. However, as indicated in the example provided in the above section on management-based regulation, it might be feasible to specify a regulation with a default review level modifiable based on the vessel monitoring plan.

Video review requirements will have a strong effect on EM program costs. , Many existing EM cost estimates assume a 10% audit review strategy (which may, or may not best represent the intent of the TRAT program). Short-term EM cost savings as compared with observer cost data may not be realized if 100% human review is maintained. Maintaining 100% human EM review will mean that existing EM cost comparisons will have to be revisited. However, it is also important to note that increases in flexibility of operating without waiting for an observer provides financial benefit to fishermen, especially in rough weather conditions, and for small rural fishing businesses.

**Other Provisions to be Developed:** The development of EM prescriptive and performance standards will require continued discussion, covering issues such as the need to establish appropriate Tier 1 standards for the establishment of: (1) a regulatory process for approval of EM Individualized Vessel Monitoring Plans; (2) well defined standards for how and when an EM system or strategy may allow for discarding through well defined “control points,” and; (3) Well established “Crew Handling Protocols (including observers)” using currently tested technology strategies.

Additionally, regulatory specifications of the Individual Vessel Monitoring Plans need to be further developed:

- to ensure that all selective discarding must pass through "Control Points" which ensure that the weight and species of all discards is accounted for**;**

- to ensure that the system collects sufficient EM data from an entire trip;

- to specify accepted data transmission and data archival strategies;

- to ensure that effort, and catch events are captured in a manner that is sufficient for effective accountability monitoring;

- to define what level of lighting during daytime and approved nighttime fishing activities is considered accountable;

- to define logbook requirements, including differentiation between paper and E-Logbook requirements with any EM strategy;

- to clearly define *all* quantifiable forms of reviewable discard for review purposes, including "bleeding" events; and

- To specify what constitutes adequate EM "tamper-evident" hardware.

**Other Issues to Consider in Developing an EM Proposal**

- Determine appropriate funding streams.

- Establish the roles that EM Cooperatives may play in ensuring compliance by providing disincentives and consequences for violations, or when a vessel needs to cease fishing operations.

- Consider a process by which vessel owners have continuous access to any EM data generated, by NMFS-approved system components and configuration.

- Consider additional regulatory requirements between gear types approved for use with EM.

- Consider required levels of human observing that shall still be required for each fishery or gear-type under consideration (i.e., Bottom trawl, Whiting midwater trawl, Non-whiting rockfish-directed midwater trawl, longline, pot, vertical longline, etc.).

- Investigate opportunities for improved coordination between NWFSC, industry, and management (including international bodies such as IPHC).

### 3.2 EM Tier 2:

**Initiate a three-Year Review during Tier 1 implementation in order to implement Tier 2 in Five Years.**

As discussed above, the purpose of EM Tier 2 is to consider whether policy can be developed that would encourage improvements in the quality or scope of data captured or efficiencies in the data review system, beyond that for which the industry has private incentive. To some degree the scope of the services and equipment paid for by industry will determine the scope of the incentive to seek efficiencies. For example, if the industry is not paying for video review,[12] then there would not necessarily be a significant incentive for the private sector to focus on innovations to improve the efficiency and accuracy of that video review.

The Council might set a policy to revisit EM regulations within three years of Tier 1 implementation. At that time, the Council could review newly available technologies and strategic opportunities for improvement in:

- Scientific data acquisition.
- Integration of VMS/ EM technologies into one overarching strategy.
- Increased accountability of rare events detection.
- More cost-effective automated data transmission and review strategies.
- Ways to reduce costs for management and industry, while also increasing compliance accountability.

***Private Incentives***

After implementation of Tier 1, research and development would be expected to continue as a result of private incentives for cost minimization. Further alignment between industry and the public is likely to occur in a manner that allows for future Council consideration of improved management strategies defined by Tier 2 performance standards. As investments in technology become an increasing beneficial catalyst and component of enabling fisheries management to improve automated real-time (and near real time, NRT) information streams, this will allow inclusion of these models in the EM program to be considered.

Data information providers have valuable long-term understandings of the fisheries they purvey, and the Council may benefit from creating a development environment that seeks to provide transition opportunities to private data information provider interests through defining Tier 2 performance standards in advance. By providing incentive to form partnerships with software start-ups and surveillance and computer hardware manufacturers, private interests will likely realize Tier 2 Council-guided public

[12] And, assuming program costs are well above the 3% of exvessel value maximum that can be charged to industry.

incentives, because they are able to plan for them. Alternately, Council defined incentives may create new opportunities for recruiting new information providers (hardware and software) with no fisheries experience (although with potentially higher information gathering skill sets) from other disciplines (data-mining, health care, military, surveillance, etc.) into the fisheries data acquisition business. Additionally partnerships with Non-Governmental Organizations and industry may increase in such a climate in meeting Council-guided public/private incentives in a shorter amount of time as that preferred by the Council. Vessels that comply with Tier 2 performance standards sooner than five years may find it possible to realize increased economic benefits and improved sustainability of their fisheries of interest.

***Provide Improved Public & Private Incentive Integration***

A few key starting concepts for 5-year Tier 2 public incentives, enabled by innovations in improved technologies and improved strategies through current EM implementation, could consist of the following Tier 2 standards:

1. Reduce EM monitoring costs to industry and management, including all back-end expenses.

2. Outline opportunities for improved integration of EM and VMS units for collection and archiving of EM data. Include data from fisher logs, observer and electronic logs and unloading slips.

3. Improve timeliness and validation of IFQ credit/deductions.

4. Improvements allowing at-sea accountability of discards, to reduce groundfish mortalities where feasible; in a manner that preserves full catch accountability.

5. Improve tamper-proofing.

6. Improve NRT & real-time automated species, length, and weight capabilities for shoreside First Receiver landings and at-sea vessel “control points.”

7. Inclusion of underwater net sensory technologies.

8. Improved First Receiver EM/computational vision-based monitoring systems to insure full-circle fishery accountability and data poor market category complex sub-speciation.

9. Improved ocean biodiversity Informatics data acquisition compatibility.

10. Improvements in sensory resolution (including video).

11. Provide increased vessel safety.

# 4. NMFS POLICY ON ELECTRONIC TECHNOLOGIES AND FISHERY-DEPENDENT DATA COLLECTION

On May 3, 2013, NMFS released its Policy on Electronic Technologies and Fishery Dependent Data Collection to " adoption of electronic technology solutions in fishery-dependent data collection programs" (NMFS, 2013). A complete copy of this policy has been posted on the EM page of the Council web site (http://www.pcouncil.org/groundfish/trawl-catch-share-program-em/). The objective for this policy is stated as follows:

> It is the policy of the National Oceanic & Atmospheric Administration's (NOAA's) National Marine Fisheries Service (NOAA Fisheries) to encourage the consideration of electronic technologies to complement and/or improve existing fishery-dependent data collection programs to achieve the most cost-effective and sustainable approach that ensures alignment of management goals, data needs, funding sources and regulations.

There are eight statements related to achievement of the objective (bolding added):

> 1. NOAA Fisheries **encourages the consideration** of all electronic technology options to meet science, management, and compliance data needs.
>
> 2. Fishery-dependent **data collection programs will be designed and periodically reviewed** by NOAA Fisheries regions to ensure effective, efficient monitoring programs that meet industry and government needs, increase coordination between regions, and promote sharing of research, development and operational outcomes.
>
> 3. Fishery-dependent data collection **programs may be comprised of a combination of methods and techniques** including self-reporting, on-board observers, and dockside monitoring, as well as the use of electronic technologies including electronic reporting and video monitoring.
>
> 4. **Where full retention regulations and associated dockside catch accounting measures are in place,** NOAA Fisheries supports and **encourages the evaluation/adoption of video cameras** to meet monitoring and compliance needs in federally managed fisheries.
>
> 5. NOAA Fisheries encourages the use of electronic technologies that **utilize open source code or standards** that facilitate data integration and offer long-term cost savings rather than becoming dependent on proprietary software.
>
> 6. NOAA Fisheries, in consultation with the Councils and subject matter experts, will **assemble guidance and best** practices for use by Regional Offices, Councils and

stakeholders when they consider electronic technology options. Implementation of electronic technologies in a fishery-dependent data collection program is subject to the Magnuson-Stevens Act and Council regulatory process, other relevant state and federal regulations, and the availability of funds.

7. No electronic technology-based fishery-dependent data collection program will be approved by NOAA if its provisions create an **unfunded or unsustainable cost of implementation or operation contrary to applicable law or regulation**. Funding of fishery-dependent data collection programs is expected to consider the entire range of funding authorities available under federal law, including those that allow collection of funds from industry.

8. Where **cost-sharing** of monitoring costs between the agency and industry is deemed appropriate and approved under applicable law and regulation, NOAA Fisheries will work with Councils and stakeholders to develop transition plans from present to future funding arrangements.

Authorities and responsibilities within NMFS are assigned, including responsibilities assigned to regional offices for "initiating consultations in FY 2013 with their respective Science Centers, Councils, States, Commissions, industry, and other stakeholders on the consideration and design, as appropriate, of fishery-dependent data collection programs that utilize electronic technologies for each Federal fishery."

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