



## Translating sustainable seafood frameworks to assess the implementation of ecosystem-based fisheries management



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### ABSTRACT

Implementing fisheries management goals that simultaneously consider ecosystem effects of fishing and socioeconomic sustainability is challenging. In recent years, multiple market-based frameworks and guidelines that assess fishery sustainability have been developed, including sustainable seafood recommendation lists and certification schemes. These frameworks use suites of indicators to assess sustainability across fishery types to provide awareness to seafood suppliers, retailers, and consumers. We suggest that these indicators could also be useful to managers to track their own performance. Here we evaluate and compare four of the best-known frameworks available to assess fishery sustainability and consider their potential applicability to fisheries management in California: the Marine Stewardship Council's 2013 certification requirements for fisheries, Friend of the Sea's 2011 certification criteria for wild-caught fisheries, the Seafood Watch program's current criteria for fisheries, and an FAO sustainability checklist combined with the FAO's International Guidelines on Bycatch Management and Reduction of Discards. We assessed the alignment between the indicators used in these frameworks and the goals and requirements of the Marine Life Management Act (MLMA), the primary statute governing fisheries management in California's coastal waters. In general, we found considerable overlap between the biophysical sustainability criteria assessed by these indicators and the requirements of the MLMA, revealing that these indicators align well with practical management needs. While the MLMA is a useful case study, these sustainability indicators could be applied more broadly by other states and federal fisheries managers to concretely evaluate progress towards ecosystem-based management goals. Ultimately, a refined suite of indicators could be operationalized, e.g., via decision trees or questionnaires for fishery managers to assess how well they are meeting ecosystem-based management objectives.

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### 1. Introduction

Managing for fisheries sustainability requires protecting ecosystem structure and function while also considering the current and future needs of people as part of marine ecosystems. Many barriers to sustainable fisheries exist, including data deficiencies, overcapacity, and ecosystem effects of fishing, such as bycatch and habitat destruction, as well as the frequent disconnect between social and ecological goals (Crowder and Murawski, 1998; Pikitch et al., 2004; Beddington et al., 2007; Crowder et al., 2008). Over

the past few decades, federal and state policies have recognized ecosystem-based management (EBM) as a broadly acceptable central strategy for attaining sustainability (Levin et al., 2009; National Ocean Council, 2013). However, statutory and regulatory policies founded in EBM alone are insufficient to achieve this outcome. In reality, fisheries agencies have limited resources to achieve myriad management objectives with which they are tasked, and EBM approaches have proven difficult to implement successfully (Millennium Ecosystem Assessment, 2005; Levin et al., 2009). Lack of funding and capacity to implement even the strongest legal mandates makes it challenging for managers to be transparent in their decision-making and to adequately track their management effectiveness. A key opportunity lies in the delivery of tools that synthesize ecosystem status and trends while simultaneously providing a means for tracking performance in relation to key fishery components, including the target resource, associated species, and

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economic and social dimensions (Garcia, 1997; Garcia and Staples, 2000).

Sustainable fishery frameworks are the leading instruments for quantifying fisheries performance for market-based applications (e.g., seafood certification schemes and recommendation lists). Using a suite of indicators to gauge the sustainability of fishing activities worldwide, sustainable fishery frameworks are influential in driving seafood demand and supply chains, and despite limitations, can contribute to improved stewardship, stock health, and reduced environmental impacts (Table 1) (Jacquet and Pauly, 2007; Froese and Proelss, 2012; Gutiérrez et al., 2012; Martin et al., 2012). Indicators are defined as quantitative measurements that serve as proxies for characterizing natural and socioeconomic systems (Kershner et al., 2011) and can be used to assess ecosystem status, set priorities, and improve communication with stakeholders (Cury and Christensen, 2005). But implementation of appropriate indicators remains elusive for fisheries managers, who need to track how well their practices meet particular fishery management goals and requirements (Caddy, 1996; Garcia and Staples, 2000). Although sustainable fishery frameworks were not designed for tracking management, they offer a potentially useful set of indicators that managers can use to assess adherence to legal mandates. Many of the principles included in market-based frameworks are directly relevant to fisheries management goals, so we argue that a toolbox of specific, context-dependent indicators could be extracted from these frameworks for management purposes. A critical first step is to determine the extent of overlap between existing sustainability indicators and objectives of ecosystem-based fisheries management.

One of the most progressive examples of ecosystem-based fisheries management law is California's Marine Life Management Act (MLMA) (Ruckelshaus et al., 2008). Enacted in 1999, the MLMA is groundbreaking in that it represents an early statutory reflection of EBM principles to "ensure the conservation, sustainable use, and, where feasible, restoration of California's marine living resources for the benefit of all the citizens of the state," and emphasizes a number of overarching principles for sustainability, including ecological, social, economic, and governance considerations (MLMA, 1998; Ruckelshaus et al., 2008) (Appendix A). The authors of the original bill based it upon the larger national debate around ending overfishing, protecting habitat, reducing bycatch, employing ecosystem principles in fishery management, and sustaining important natural resources, all of which are reflected in the MLMA's goals and requirements (Box 1). While the MLMA and its associated regulations identify specific goals and requirements, like many resource management laws no guidance or process exists for how to systematically track its implementation.

Here we examine four prominent sustainable fishery frameworks to assess their potential to track the performance of fishery management strategies with respect to the MLMA. The frameworks we reviewed include: the Marine Stewardship Council's fisheries certification requirements, a well-known eco-label and certification program; the Monterey Bay Aquarium Seafood Watch Program criteria for fisheries, a key market-based approach to promote fisheries sustainability; Friend of the Sea's certification criteria checklist for wild-capture fisheries, another eco-labeling certification program; and, the FAO "Caddy checklist" and complementary International Guidelines on Bycatch Management and Reduction of Discards, which both offer distinct guidance for evaluating responsible fisheries management. Our comparative analysis is an essential first step in developing new management tools and provides a foundation for state fisheries managers to quantitatively and objectively assess the progress and performance of their decisions under the MLMA. Such tools could streamline assessment of future management efforts, with the added value of improving transparency and efficiency. In addition, similar goals and chal-

lenges are widely relevant to fisheries management in states and nations throughout the world, making this case study easily transferable and of broad interest.

## 2. Methods

We selected four of the best-known sustainable seafood frameworks based on the available literature (Micheli et al., 2014), which allowed us to narrow our analysis to the most visible, transparent, and widely applied standards for wild-caught fisheries. The frameworks we selected also provide a diversity of program types: two certification programs, a recommendation list, and a set of management guidelines. We selected sustainable seafood standards with transparent assessment processes and recommendations that are available to the public. We examined performance indicators and methodologies for the following four frameworks: the MSC's *Fisheries Certification Requirements* v.1.3 (Marine Stewardship Council, "Certification Requirements," 2013), Friend of the Sea's *Certification Criteria Checklist for Wild-Catch Fisheries* (Friend of the Sea, 2010), the Monterey Bay Seafood Watch Program *Criteria for Fisheries* (Seafood Watch, 2014), and the FAO "Caddy checklist" (as adapted for local use) (Caddy, 2007) with FAO's *International Guidelines on Bycatch Management and Reduction of Discards* (Food and Agriculture Organization, 2011). These four frameworks differ in purpose, rigidity, and scoring systems. Seafood Watch uses a three-tiered categorization, while MSC and Friend of the Sea grant certification only when a scoring threshold is surpassed. In contrast, the FAO Caddy checklist is not scored and instead is intended to encourage responsible fisheries management.

The Marine Stewardship Council (MSC) is perhaps the best-known eco-label and certification program globally. The MSC certifies fisheries as sustainable only if they score highly on each of the following three principles: (1) the fishery does not result in overfishing or depleted populations, or, if depleted, recovery must be taking place; (2) the structure, productivity, function, and diversity of the ecosystem (including habitat and associated dependent and ecologically related species) are maintained; and (3) the current management system effectively respects local, national, and international laws and standards, and incorporates frameworks that require responsible and sustainable use (Marine Stewardship Council, 2013).

The Monterey Bay Aquarium's Seafood Watch program is another key market-based approach to promote fisheries sustainability, which generates ranked recommendations for consumers and retailers. The Seafood Watch assessment process considers sustainability to be a "journey" rather than an end point, and thus scores fisheries along a more nuanced gradient of green (best choice), yellow (good alternative), and red (avoid) (Monterey Bay Aquarium Seafood Watch 1999–2015). Seafood Watch is regularly revised to include the most current scientific understanding. Quickly broadening its coverage, its methodology and criteria have also been adopted or have been recommended by other marine conservation organizations (e.g., FishWise, Safina Center, Environmental Defense Fund, Audubon).

Friend of the Sea, the third framework we assessed, is another eco-labeling certification program. The Friend of the Sea eco-label originated from the Earth Island Institute's work on dolphin-safe fisheries. Friend of the Sea now certifies both wild fisheries and aquaculture, although only its criteria for wild fisheries are considered here (Friend of the Sea, 2014). Like MSC and Seafood Watch, the program assesses fisheries on primarily ecological criteria.

The fourth and final framework we examined is the FAO "Caddy checklist" and complementary International Guidelines on Bycatch Management and Reduction of Discards. We considered both as a single framework in order to consider the full suite of FAO indi-

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