COMMENTARY

Strengthening sustainability through data

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There is a well-known folk tale about six blind men who go to see an elephant. Each man touches a different part of the animal, so each believes the elephant to be a different type of creature. Rather than pooling their knowledge to create a complete picture, they argue, and, as John Godfrey Saxe puts it, "Though each was partially in the right. . .all were in the wrong."* This fable is now a cliché because humans so often get embroiled in ideological disputes, arguing not over facts per se, but over interpretations of facts as shaped by their own values, preferences, and prior beliefs. Science is supposed to settle disputes over the elephant, but for complex socioecological systems like fisheries, we are asking the blind men to describe a whole zoo—or perhaps an aquarium—with its human visitors and caretakers as well, a difficult task even for those who are willing to cross ideological or disciplinary divides. Given the diversity and complexity of fisheries systems, carefully prepared, large-scale databases are useful for piecing together a more complete picture of sustainability (1, 2). In PNAS, Asche et al. (3) analyze one of the more comprehensive large-*N* fisheries datasets to date. Their Fisheries Performance Indicators (FPIs) measure social as well as economic and ecological variables, which should help to strengthen the three pillars of sustainability in fisheries governance.

Large datasets that measure a diverse set of attributes are important for several reasons. First, much of the discussion over fisheries governance is shaped by different values regarding outcomes. We see this in the long-standing debates over rights-based management, particularly the use of individual transferable quotas (ITQs) and other mechanisms that establish markets for the right to fish. While some experts embrace the economic benefits of ITQs, others provide critiques of their social costs (4–8). These groups also disagree over the causal relationship between ITQs and biological outcomes, but conflicts over social and economic outcomes stem from disagreements over appropriate goals (industry efficiency vs. social justice). Although Asche et al. (3) do not settle this debate, their inclusion of indicators such as social standing, relative wages, access to education and health care, local ownership, and labor participation, along with more traditional variables such as stock size and profitability, allows researchers and decision makers to better assess the trade-offs associated with different types of management and may also spark new discussions regarding the appropriateness of various governance goals.

Second, for any given outcome, large and diverse datasets can show us why something that works in one context does not necessarily work in another, which is critical to combating the panacea mindset in fisheries governance (9). This has been done for ITQs and other fisheries management practices using small sample sizes (10–12), but there is still much variation that needs to be studied. The FPI dataset measures 68 outcome metrics and 54 input metrics for 121 fisheries from around the world. While outcomes are arranged around the pillars of sustainability, input variables capture important factors such as the location and scale of the fishery, macroeconomic conditions, fleet characteristics, management measures, and scientific uncertainty. Thus, suites of management measures could be compared across different types of contexts to identify the conditions that are necessary and sufficient for attaining the three pillars of sustainability. Such analyses could then be used to create guides to make it easier for decision makers to develop context-specific management measures, rather than relying on one-size-fits-all approaches like panaceas, as described by Young et al. (9).

Asche et al. (3) provide a good starting point for such analyses, but as they note, much work is still needed. The current FPI dataset can be explored in greater detail. For example, this initial analysis of the effects of rights-based management on social outcomes could be extended to differentiate between market-based mechanisms (like ITQs) and community-based mechanisms (like traditional use rights fisheries).

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Author contributions: D.G.W. designed research, performed research, contributed new reagents/analytic tools, analyzed data, and wrote the paper.
The author declares no conflict of interest.

See companion article on page 11221.

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Published online October 19, 2018.

*John Godfrey Saxe (1816–1887), in his poem "The Six Blind Men and the Elephant."

www.pnas.org/cgi/doi/10.1073/pnas.1816077115

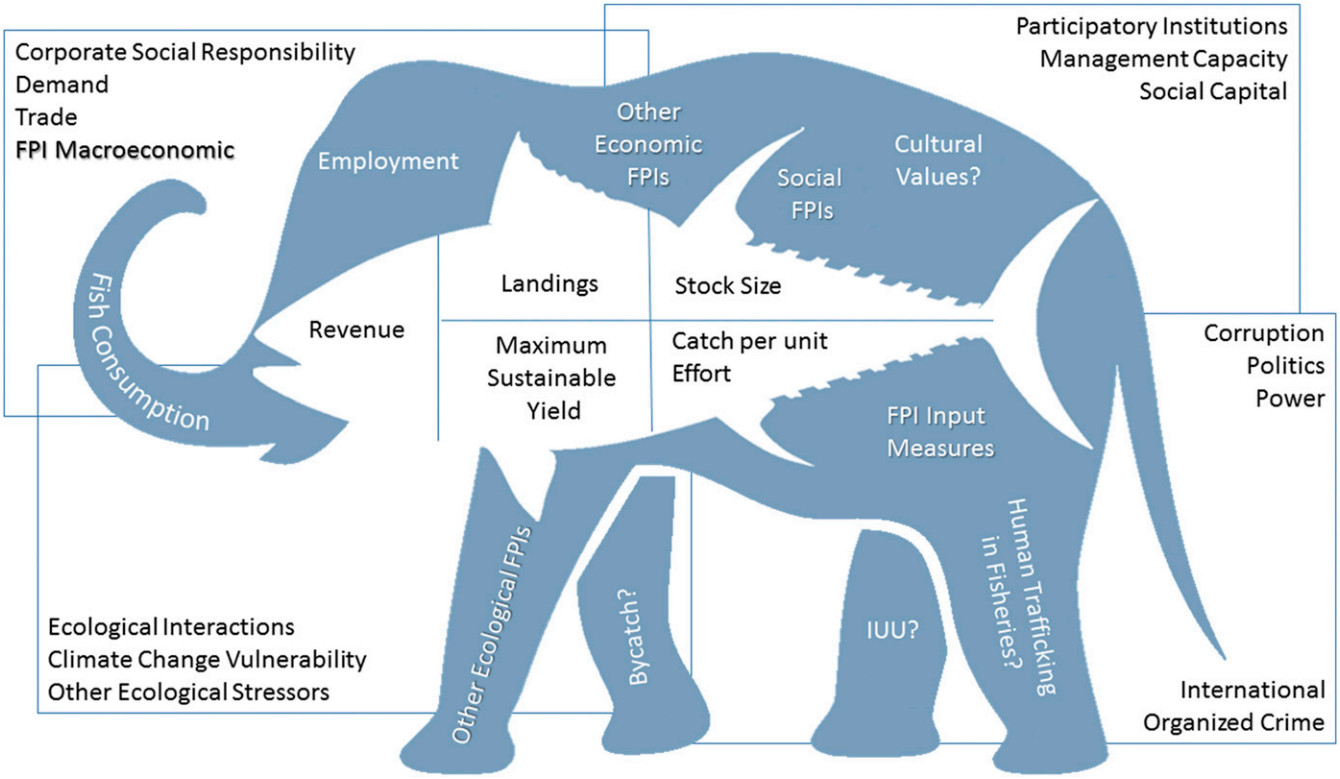

Fig. 1. Important factors in fisheries sustainability. Elephant image modified with permission from Pixabay/InspiredImages. Tuna image modified with permission from Pixabay/kreatikar. IUU, illegal, unreported, and unregulated.

They could also compare across scales and control for other factors such as management history and even the potential circularity between healthy social systems and good governance. Of course, the more they parse the dataset, the lower the degrees of freedom, so expanding the number of cases coded would be useful as well. Because the social data were collected on the ground using stakeholder surveys, expanding the number of cases would be an expensive process but could be made easier by sharing data protocols and crowd-sourcing the expansion. The current dataset is built on a convenience sample, with some attention to coverage based on scale, geographic location, and management type, but other considerations should also guide additional sampling, as explained below.

To fully describe the complexities of fisheries governance, additional data are needed. Determining the complete array of necessary variables is beyond the scope of this analysis, but Fig. 1 sums up some important additions from the literature. The most commonly available fisheries indicators, such as landings and stock status, are found in the central tuna image. Less widely collected indicators—like consumption, employment, and other FPI metrics—are shown in the proverbial elephant, along with key fishery-specific measures that are missing from the FPIs. For instance, Asche et al. (3) do not assess cultural losses to coastal communities and so cannot address one of the most common critiques of ITQs (13, 14). In fact, their social data come from people who remain in the industry, which suggests that social costs will necessarily be underestimated for any type of management measure that excludes some groups of fishers over others. Other fisheries-specific variables that could be useful would be measures of bycatch and both illegal, unreported, and unregulated fishing and forced labor in fisheries (15–18). Although largely ignored in the management literature, human trafficking is increasing in the fisheries sector, with some degree of forced labor reported in fisheries in over 51 countries in 2016 (19, 20).

The boxes surrounding the elephant in Fig. 1 represent cross-scale interactions in economic, social, political, and ecological spheres. Politics, power relationships, corruption, and international organized crime are grouped together because they all undermine good governance and link fisheries to wider illegal activities (21–23). In contrast, factors like participatory institutions, management capacity, and social capital can strengthen governance across the different types of measures recorded in the FPIs (24–26). In addition to the macroeconomic variables included in the FPIs, demand, trade, and various forms of corporate social responsibility (e.g., sustainability labeling programs) are important determinants of fishing effort and (un)willingness to comply with rules or regulations (21, 27). Environmentally, ecological interactions, climate vulnerability, and other stressors can amplify the effects of overfishing or counteract good fisheries governance and, therefore, may be important to understanding sustainability (28, 29). Again, this list is not comprehensive, but it provides examples of the types of cross-scale variables that are needed.

Unfortunately, most of the additional variables described above are difficult or even risky to measure, and more knowledge is no guarantee of better governance. Nevertheless, we will not be able to attain sustainability in global fisheries without a better understanding of these factors. No fishery is independent of outside influences, so sustainability cannot be achieved by looking at fisheries in isolation. The FPIs should be combined with existing national-level datasets on the factors shown in Fig. 1 and with metaanalyses of the wealth of information found in detailed

case studies, government reports, and related sources (e.g., refs. 30 and 31). Presented via an innovative interface, like the Gapminder.com data visualization tool, the resulting hybrid dataset could provide important insights into fisheries sustainability while also initiating new interest in the issue (32). Furthermore, creation of this hybrid dataset could foster communication among different groups of experts, advancing our collective understanding of the complex nature of sustainability in global fisheries.

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