

## 1. INTRODUCTION

As human communities face increasingly complex and pressing environmental challenges, engaging those communities in resource management decision-making to sustain socio-ecological systems is an imperative. Research and practice have demonstrated the value of stakeholder engagement for improving the social, economic, political, and cultural outcomes of decision-making when stakeholder voices are being heard (Mikalsen and Jentoft 2001, Layzer 2008, Reed 2008, Wendt and Starr 2009, Sayce et al. 2013). Public involvement allows resource managers to explore issues, concerns, and management measures from various viewpoints, and gather a wide range of perspectives and information. In theory (and in many cases, practice), by incorporating a greater quantity and diversity of knowledge and perspectives, managers are driven to more equitable, socially-relevant, and ecologically-sound decisions. This study explores the state of the practice around stakeholder engagement, where practitioners are stumbling, and lessons learned that may be applicable across management contexts.

Employing the key principles of stakeholder engagement, such as using a transparent process that engages stakeholders early and often, has been shown to be valuable in improving process or project outcomes in many contexts (Pomeroy and Douvere 2008, Reed et al. 2009, Gopnik et al. 2012). Effective environmental decision-making thus requires government agencies to transparently and inclusively engage those likely to be affected by decision outcomes. To inform decisions, engagement must continually capture relevant knowledge that reflects the needs of human communities who often have changing values (Reed 2008). Such engagement is required to account for complex human-natural feedbacks, assess resource sustainability, anticipate unintended consequences of decisions, and gain legitimacy to ensure effective governance (Beratan and Karl 2012). Stakeholder engagement, however, is a messy process—it is often characterized by conflict, disagreement, and diverging viewpoints (McCool and Guthrie 2001). This is in part because science alone cannot determine good policy, as many of the environmental and social challenges we face require solutions that balance societal values and norms (Tippett et al. 2007). However, despite the social and ecological benefits, limited practical guidance exists on precisely *how* to implement effective stakeholder engagement within marine resource management. This study investigates what processes are being deployed to improve decision-making for 29 resource managers and distills clear guidelines for practitioners across a variety of natural resource management sectors.

### 1.1 What is stakeholder engagement?

Stakeholders are any group or individual that has a ‘stake’ in a decision-making process because they are somehow affected by or interested in an activity (Reed 2008). Primary categories of stakeholders include (1) those who have an influence on the activity (e.g., other regulators, the press), (2) those who have (or are perceived to have) an impact on the resource (e.g., resource users, communities adjacent to resources), (3) those who have a common interest in the activity (e.g., other indirect beneficiaries of the resource, such as consumers), and (4) the broader public.

A growing body of literature on stakeholder engagement strategies (e.g., Rowe and Frewer 2000, Richards et al. 2004), principles of engagement (e.g., Rowe and Frewer 2000, Udall 2011), and the theoretical underpinnings of engagement (e.g., reviewed in Reed 2008) is emerging from the academic research community. Public agencies that improve public participation processes are demonstrated to be more informed, trusted, and able to incorporate diverse interests, thus improving their decision-making capacity (NRC 2008). One study evaluated 239 case studies of stakeholder participation in environmental decision-making and found that, in most cases, their involvement enhanced the quality of decisions by adding and improving access to information, ideas, and analyses (Beierle 2002). Finally, engagement leads to an increased likelihood that stakeholders will comply with and support management decisions if they have opportunities to inform the process (Hanna et al. 1995).

When implemented poorly, stakeholder engagement can exacerbate contentious resource management issues and degrade public trust in government (Burton et al. 2004). Often an agency's greater interest in, attention to, and funding for stakeholder engagement follows negative backlash from stakeholders when decisions were made without adequate engagement. Since the rise of public participation within natural resource management in the 1990s, engagement failures have led to a "post-participation disillusionment" due to the lack of metrics and evaluation demonstrating positive decision-making outcomes (Rowe and Frewer 2000, Beierle 2002, Reed 2008). In recent decades, research has documented a growing consensus around the value of stakeholder engagement for achieving target management outcomes and the critical need to integrate it across natural resource management sectors (e.g., Beierle 2002, Pomeroy and Douvere 2008, Reed 2008), highlighting its ability to add to the legitimacy and quality of government decisions (Rowe and Frewer 2000, NRC 2008).

Stakeholder engagement is conducted in most public-facing sectors in the United States and internationally under existing mandates (e.g., the Administrative Procedure Act; the National Environmental Policy Act, United Nations Economic Commission for Europe 1998) (Tippett et al. 2007). Resource managers vary significantly in their stakeholder engagement practices based on whether they adhere to the minimum legal requirements of public consultation or go further to engage their constituents. This also depends on the type of management decision being implemented. For example, public participation in federal and state agency rulemaking procedures often consists of both public hearings—open meetings that deliver information and solicit public, oral testimony—and written comment—submitted online or mailed in (e.g., requirements dictated by the federal Administrative Procedure Act (Administrative Procedure Act, 5 U.S.C. §553(b)-(d)). Agencies are also often required to respond to each public comment (e.g., National Environmental Policy Act regulations require that "[a]n agency preparing a final environmental impact statement shall assess and consider comments both individually and collectively, and shall respond . . ." 40 C.F.R. §1503.4). We refer to these approaches as 'traditional' forms of stakeholder engagement. It is widely acknowledged, that the minimum public consultation methods currently required by law are insufficient (Innes and Booher 2004). Under these status quo requirements, stakeholders often do not feel

heard, decisions are poorly informed, and many voices are excluded (Innes and Booher 2004).

Despite the growing body of research on stakeholder engagement, there is still a paucity of research on the experiences, perceptions, and stated needs of practitioners themselves. This study was motivated, in part, by a state agency requesting greater case study evidence of successes and failures in the field.

## **1.2 Challenges in stakeholder engagement**

Engaging the public in resource decision-making is a wicked problem. Wicked problems are extremely difficult challenges to solve and are often characterized by a lack of information, overlapping and difficult-to-map drivers, and conflicting value systems among the actors involved (Rittel and Webber 1973, Buchanan 1992). Stakeholder outreach in resource management is particularly difficult due to a lack of government capacity, the challenge of engaging highly diverse or under-represented populations, a mismatch between the jurisdictional boundaries of governance and the geographic range of the resource, competition for a common pool of resources (e.g., fisheries, air), and the often differing motivations of managers and the public to engage—all challenges relevant, but not unique, to fisheries.

Resource managers and stakeholders often operate from divergent or conflicting socio-cultural contexts (Poncelet 2004, Hicks et al. 2009, Hicks et al. 2013). Managers, for their part, usually require efficient and orderly decision-making characterized by a high degree of certainty and easily implementable actions. On the other hand, it is difficult for many stakeholders to engage in bureaucratic processes structured to restrict their resource use. As fisheries are public, common pool resources, communities have a right to fish that creates a behavioral dilemma—participants do not want their perceived rights to be regulated (Schlager and Ostom 1992). The large geographic range of many fish stocks also make it more difficult to reach fishery stakeholders. One study in the Great Barrier Reef, Australia, found that only 28% of fishermen participated in public consultation programs and those that did were not representative of the broader recreational fishing community in demographics such as age and centrality of fishing to their lifestyle (Sutton 2006). This highlights the need for more inclusive tactics, as losing touch with a silent majority may lead managers to exclude critical stakeholder feedback on management alternatives. Although both managers and fishing communities want simple, efficient processes, these deeply rooted disparities in their motivations can work to impede meaningful communications. These differences are often exacerbated within a governance system that is structured to limit interpersonal interaction and influenced by global economic forces. This represents a classic wicked problem: the drivers are numerous, interrelated, and often uncontrollable, and the actors are not able or motivated to shift the status quo.

Managers must balance the attitudes, preferences, and behaviors of stakeholders to increase the compliance and efficiency of their management decisions (Gelcich et al. 2008, Ban et al. 2013) and incorporate the best available science on sustainable resource

use. A lack of information about easy methods for identifying sustainable resource allocations hinders effective and inclusive stakeholder engagement. Conflicting goals and disagreement around how increasing scientific uncertainty should be considered in the context of differing public values demands a more nuanced consideration of how engagement in resource decision-making can and should be tackled (McCool and Guthrie 2001, Beratan and Karl 2012). Further, management processes often do not capture the spectrum or majority opinion on proposed management decisions because managers often only hear, incorporate, or respond to the loudest and closest voices. Thus, even engagement done with the best of intentions can be done poorly and lead to negative outcomes (Mansuri and Rao 2004).

In viewing stakeholder engagement in resource decision-making as a wicked problem, it becomes clear there are no silver bullet solutions. Wicked problems require interventions that consider the system, its complex drivers, and the underlying motivations of those with agency to change the status quo. Thus, a critical leverage point addressing the root causes of disagreement and distrust among key actors is to better align the process of stakeholder engagement with the practice (Reed 2008, Gardner 2009, Udall 2011). For instance, promoting the principles of trust and inclusivity through relationship building in the context of face-to-face engagement strategies.

### 1.3 Connecting the principles of engagement to practice

Our research provides novel insight into how specific strategies are tied to engagement goals and principles in practice, illuminating issues and challenges in fisheries management that are transferable to other resource management contexts. Our approach considers both normative participation—which suggests that stakeholders have a democratic right to participate in decisions affecting public resources—and pragmatic participation—which suggests that participation is useful insofar as it constructively informs decision-making, particularly given practical management constraints (Reed 2008). Although most managers recognize that they should involve those that are directly impacted by their actions, practical barriers and complexities of management make the application of frameworks based on pragmatic participation challenging.

While engagement is highly context dependent, research and investment can shed light on best practices for improving how stakeholders can meaningfully be involved in decision-making. Most studies advise only on outreach *process* (decision support documents exist for specific decision contexts e.g., agencies: Michigan 2009, programs: Nations 2012, UN 2012). However, few studies go beyond this to connect the *principles* (the ‘how’) and metrics that underlie and aid in effective engagement implementation to the *process* of engagement (the ‘what’). This qualitative study builds on the existing scholarship (e.g., Berkes 2010) by illuminating how both traditional and innovative engagement tools are being leveraged by resource agencies across the United States and beyond. Stakeholder engagement in fisheries, as an often geographically diffuse, common pool, and widely depleted resource, offers a ripe case study for how to navigate the complexity of involving resource users in management decision-making (Mikalsen and Jentoft 2001). We hope to provide practitioners with applied theories and practical

strategies from the anecdotal experience of fisheries managers that are transferable across resource management contexts. Using qualitative data from 29 semi-structured interviews we, (1) determine how managers define stakeholder engagement; (2) identify effective stakeholder engagement strategies used in fisheries management; (3) highlight principles and lessons learned from the United States and abroad; and (4) identify metrics, data collection, and capacity building approaches to promote and track effective engagement strategies.

## 2. METHODS

### 2.1 Framework for stakeholder engagement

How managers decide to deploy resources and design strategies for stakeholder engagement depends on the decision-making context (the where and when), the stakeholders (the who), the management goals (the why), and the resources available (the how). The ‘engagement wheel’ in figure 1 illustrates the engagement context for natural resource managers used by this study (adapted from Davidson 1998). The external factors that constrain how stakeholders are engaged include forces such as economic costs, social costs (e.g., trust, agency), law, and time. The outer edge of the wheel—the tire tread that ensures traction on the road of outreach—depicts stakeholders’ various degrees of influence and motivation during the process. Such inhibiting and enabling factors contribute to a stakeholder’s agency to engage, and are necessary for engagement to occur.

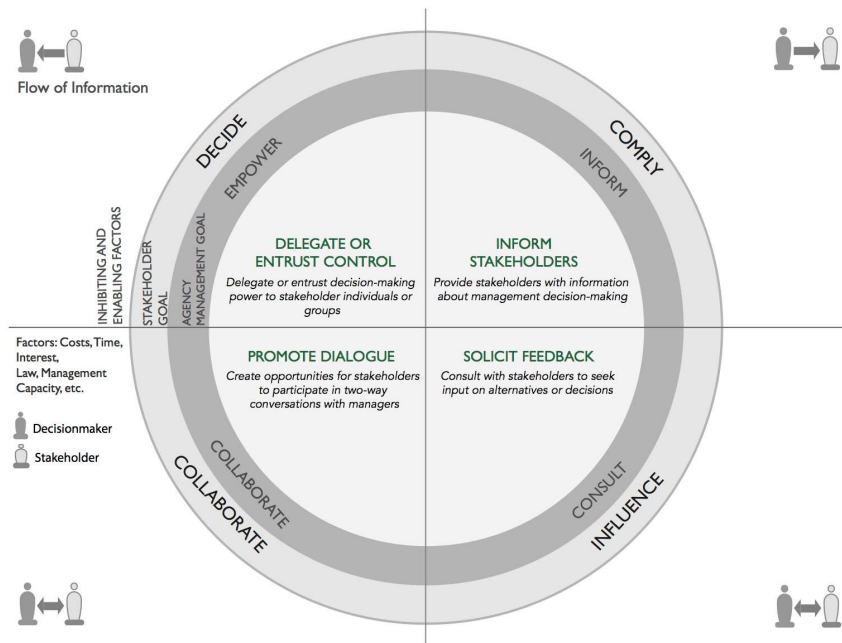


Figure 1: The Engagement Wheel depicts the various constraints and goals that determine a resource manager's ability and options for engaging stakeholders. Moving inward from the outer edge, the wheel shows the additive constraints of the stakeholders' contexts that define what engagement opportunities exist for managers. The inner most circle describes the engagement goals that resource managers may have that can help determine appropriate outreach strategies for their context (adapted from Davidson 1998).

In turn, managers may have different engagement goals based on the decision context, which is the inner circle of the tire tread. These goals fall across a spectrum of communicating *to*, soliciting feedback *from*, or dialoguing *with* stakeholders. Here, we sort management objectives for stakeholder engagement into four distinct types of goals: inform (provide the public with balanced and objective information), consult (obtain feedback on alternatives and/or decisions), collaborate (partner with public to identify preferred solutions), and empower (enable stakeholders to make decisions) (adapted from IAP2 Spectrum; IAP2 2007). The engagement wheel can help frame the practice of stakeholder engagement (the 'what' of engagement), but the key to successful engagement—and thus its positive outcomes—hinges on effective process (the 'how' of engagement). Goals are context-specific and identified by the resource manager conducting outreach; principles are the best practices that underpin engagement. We analyze which principles tend to coincide with specific engagement goals identified in the engagement wheel. Our findings provide a set of qualitative case studies of management

lessons learned and initial hypotheses for *how* managers may deploy engagement tactics to strategically achieve certain management goals.

2.2 Interviews

We conducted semi-structured interviews (Supplement 1) with 29 stakeholder engagement experts, primarily government staff that lead stakeholder engagement and outreach activities at their state or federal agencies (figure 2). Interviewees were identified by their role as resource managers, primarily focused on marine resources, and often the only people responsible for stakeholder engagement in their respective state agencies; some interviewees were recommended by other study respondents. Two interviewees did not work within fisheries, but rather in ocean management activities more generally.

Deleted: Appendix

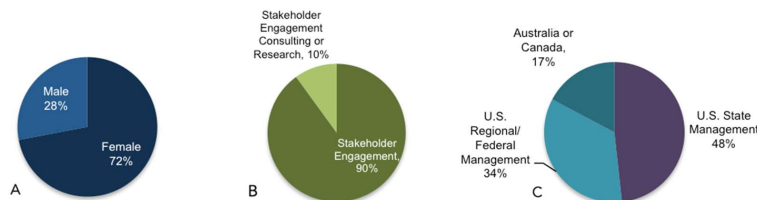


Figure 2: A) Interviewee gender distribution; B) the distribution of the sample that conduct stakeholder engagement as the primary component of their work or conduct research or consult on stakeholder engagement; and C) Canadian, Australian, or United States (state and federal) focus geography.

Stakeholder engagement practitioners have large toolboxes from which they draw an appropriate engagement tool at the right time, for the right audience, and to achieve a particular management goal. These engagement tools and evaluation metrics were identified and defined as interviews were conducted. This categorization of strategies and metrics were then coded retroactively once all the interviews were complete. Key principles of stakeholder engagement, or the *process* principles by which strategies are implemented, were distilled from relevant literature (e.g., Udall 2011, EPA 2013). Initial scoping conversations were conducted before the study began to vet the salience of the stakeholder engagement principles in practice.

We analyzed the interviews using NVivo 10, a qualitative data analysis software. We created a coding scheme for themes of interest (table A2.1), and iteratively modified the scheme to include themes that emerged from the interviews. Coding themes included the definition of stakeholder, types of stakeholder engagement strategy, types of metrics, engagement goals, references to staff capacity, principles of stakeholder engagement, audience, and key lessons and challenges. Additional primary themes helped us identify other relevant findings in the interviews (e.g., how interviewees gathered social data, non-legal stakeholder engagement requirements, etc.). A total of 13 primary themes and 54 sub-themes were identified (Supplement 2). NVivo coding queries were used to

Deleted: Appendix

identify when interviewees co-referenced an engagement strategy with an engagement goal or principle. To ensure coding standardization, content analysis researchers state that 80% agreement across researchers is acceptable while 90% agreement is ideal (Lombard et al. 2002). Two researchers agreed on 99% of their coding when using the coding-comparison query function in NVivo.

### 3. RESULTS

#### 3.1 Defining stakeholder engagement

Interviewees were often all-inclusive when defining stakeholders with whom they strive to engage. One interviewee defined a stakeholder as “anyone that uses our policies and follows our regulations, or anyone who looks to us for information,” which may include fishers, seafood consumers, gear shops, or federal agencies, or the interested public.

#### 3.2 Engagement goals

We identified 10 stakeholder engagement goals from the interviews and from primary literature (figure 3). We also classified when interviewees referenced these goals in relation to particular stakeholder engagement strategies (list of strategies in table 1). The two most oft cited engagement goals referenced by interviewees were building trust between stakeholders and resource managers, and engaging under-represented populations. In particular, females, youth, and racial and ethnic minorities were repeatedly identified as populations underrepresented within the management decision-making process (mentions: n=17), despite their increasing stake in fisheries management, and recreational fishery management in particular.

	Goals	Description	<div> <div># Mentions</div> <div># Interviewees</div> </div>	Quote
ENGAGEMENT GOALS TO SUPPORT DECISION-MAKING	Inform Stakeholders	Inform stakeholders by providing them with information and communicating a message to the greatest number of people or the most impacted populations.	<div> <div>47</div> <div>15</div> </div>	"You can be a surfer, swimmer or diver in terms of information. You can skim, swim deeper, or dive really deep."
	Solicit Feedback	Consult with stakeholders to seek input on alternatives or decisions and integrate the practical and informal knowledge of stakeholders with the scientific knowledge of managers and academic scientists.	<div> <div>52</div> <div>20</div> </div>	"You never know what you are going to hear back that might be better than what we are proposing."
	Promote Dialogue	Create opportunities for stakeholders to participate in two-way conversations with managers to ensure stakeholder interests and concerns are accurately represented in decision-making.	<div> <div>41</div> <div>18</div> </div>	"Management is not just about the best available science, it's also about including people's norms and values"
	Delegate or Entrust Control	Delegate decision-making power to specific stakeholders or groups, while maintaining legal authority (e.g., co-management), or entrust stakeholders with decision-making authority.	<div> <div>1</div> <div>1</div> </div>	"First Nations and the feds share management authority."
CROSS-CUTTING ENGAGEMENT GOALS	Build Trust	Build trust to enhance mutual understanding, increase resiliency after agency missteps, or bolster decision legitimacy. The need for trust-building grows in more complex or high-stakes decision-making processes.	<div> <div>56</div> <div>23</div> </div>	"Trust is hardest to gain and easiest to lose."
	Engage Under-represented Populations	Engage underrepresented populations to ensure equitable decision-making and that policy outcomes are not skewed against their interests.	<div> <div>24</div> <div>16</div> </div>	"Our motivation was to get [the fishing community] involved so they wouldn't be disenfranchised."
	Ensure Compliance	Ensure stakeholder compliance with management decisions by increasing their knowledge of or buy-in to those decisions.	<div> <div>24</div> <div>16</div> </div>	"Public engagement is a necessity and our decisions will be overturned over and over again without it."
	Conduct Research	Where little information on fishery users or the ecological system may be available, collect socio-economic data or conduct collaborative research with stakeholders to understand the socio-ecological context of decision-making.	<div> <div>24</div> <div>16</div> </div>	"Making things explicit through research made it less controversial and a safer environment for participants."
	Engage Efficiently	Engage stakeholders efficiently because resources are limited or the time frame over which the decision-making process must occur is short.	<div> <div>13</div> <div>10</div> </div>	"Find community mediators and work with them. That's how you can make it more efficient."
	Educate Stakeholders	Educate stakeholders about the decision-making process to empower them to involve themselves and peers, and boost their capacity to sustain engagement.	<div> <div>14</div> <div>6</div> </div>	"Our motivation was to get [the fishing community] involved so they wouldn't be disenfranchised."

Figure 3: The nine management goals for which stakeholder engagement could achieve the target management outcomes, their definitions, the number interviewees that mentioned the goal, the number of times the goal was referenced within interviews, and an illustrative quote.

3.3 Principles of stakeholder engagement

The interviews uncovered 9 principles of stakeholder engagement (figure 4). Each respondent referenced the principles, unprompted, an average of 9 times during the interviews. Relationship-building was the most often cited principle (mentions: n=59) and timeliness was the least (n=7). Interviewees who strive to build trust among constituents also referenced the following principles at the same time: clarity (interviewees: n=6), building relationships (n=21), transparency (n=13), and visibility (n=7).

Principle	# Mentions # Interviewees	Quote
Relationship building can increase trust between managers and fishery stakeholders by putting a human face to management actions, connecting agency staff to communities through key communicators, and increasing empathy and understanding between managers and stakeholders. Relationships build public acceptance and allow managers to recover more quickly after crises, effectively creating social resilience around management decision-making (Sayce et al. 2013).	59 23	"My biggest lesson is to be viewed as a real person who cares about what you are doing and cares about people, and to create relationships."
Transparency of the decision-making process ensures the goals, motivations, and activities of decision-making are communicated publicly and engagement processes are clearly documented. The public should be aware of how they can, and cannot, influence outcomes, and how their perspectives were ultimately considered within decision-making. Transparency around how managers are approaching decision-making processes builds trust and interest in contributing.	49 21	"The more transparency the better."
Engaging stakeholders early and often allows managers to identify the boundaries of social preferences and ensure that management alternatives are in the public interest from the beginning. Retrospective (rather than prospective) input from stakeholders is often inefficient, and can degrade public trust in the management process, which can incite litigation. Early public involvement can reduce delays in the approval process, and the likelihood of issues becoming politicized. Engaging stakeholders early can also nurture trust, expand management options, improve communication, improve process efficiency, enable conflict management, and increase representation (Mikalsen and Jentoft 2001, Layzer 2008, Wendt and Starr 2009, Udall 2011, Sayce et al. 2013).	36 18	"We try to get out in front as much as possible so people aren't surprised—otherwise, we get burned....It's about doing enough, early enough."
Inclusivity of diverse perspectives to enhance knowledge included in decision-making, increase stakeholder buy-in, and ensure under-represented populations have a seat at the table is imperative. Often the people who participate in public consultation, and the opinions and information gathered from them, are not representative of all stakeholders. Including their voices can dramatically improve the equity and efficacy of decisions (Gundry and Heberlein 1984, McComas 2001, Sutton 2006).	37 17	"The Magnuson-Stevens Act always envisioned that all stakeholders would be represented, but this is rarely the case."
Clarity around messaging, expectations, and the decision-making process—as well as tailoring the message and its delivery for the target audience—is critical for any interaction between fishery managers and stakeholders. Often, a lack of clarity was cited as the root cause of public misunderstandings, negative backlash to agency actions, or a decrease in public trust. Clarity is particularly important when communicating the criteria by which decisions are made or sharing scientific data upon which decisions are based.	35 16	"To me, it is most important to send a message as accurate, clear, and un-opinionated as possible."
Visibility of decision makers to stakeholders is a critical first step in incentivizing engagement. Often competing interests limit how agency management may be elevated among stakeholder priorities. Stakeholder engagement tactics that make management actions more visible to constituents are more likely to inform, consult, or involve stakeholders effectively.	24 12	"If they don't see you they won't know you are there."
Managing expectations is important for ensuring both managers and stakeholders understand their role in and access to the management decision-making process. There are outcomes that cannot be guaranteed, or situations where different interpretations or understandings may exist. For example, levels of ownership and control expected under a co-management outcome may differ for different stakeholders. These different understandings and expectations will need to be addressed and negotiated (Evans and Birchenough 2001).	36 12	"People often think they are making decisions in the process. If they don't get to, they get frustrated."
Setting goals is important for ensuring managers and stakeholders alike are working towards a common endpoint. Moreover, clear goals for stakeholder engagement, particularly when established in collaboration with stakeholders, improve clarity around decision-making expectations and opportunities for public participation.	15 9	"I'd recommend setting short, measurable objectives for each year."
Timeliness entails implementing stakeholder engagement strategies at the appropriate time—with sufficient advance notice—for stakeholders to influence the decision-making process and deliver helpful feedback. Timeliness requires upfront understanding of the stakeholder context, and management capacity to meet stakeholders within that context. Timely engagement requires that managers understand what strategies have or have not been successful, and with whom, on a local scale.	7 6	"It makes the most sense to send out a message on all social media hubs at once—messaging might vary, but the topic is consistent."

Figure 4: Stakeholder engagement principles and their definitions, the number of times the principle was referenced within interviews, and an illustrative quote.

3.4 Strategies of stakeholder engagement to meet engagement goals

We identified 22 engagement strategies commonly used by expert interviewees (Supplement 3). Nine out of 13 interviewees who mentioned public hearings indicated that they were ineffective, without being prompted. Advisory groups were the most often cited strategy and were referenced as important for empowering key communicators and helping to build trust, manage expectations, provide space to creatively problem-solve, and engage underrepresented stakeholders (mentions=60). The second most oft cited tool was engagement of key communicators to disseminate information, build trust, and provide critical feedback on management options (interviewees: n=17; mentions: n=35). Interviewees suggest that although relationships between managers, key communicators, and communities take time to foster, it may be a more efficient method overall for reaching target audiences and securing buy-in. When asked what engagement strategies would be on their wish list, interviewees responded with great interest in visual tools (e.g., infographics and YouTube channels) and strategic planning. Eleven interviewees responded with desires for comprehensive strategy development for stakeholder engagement or stakeholder engagement capacity building across agency staff.

3.5 Metrics of stakeholder engagement

Nineteen interviewees indicated they use metrics to assess their stakeholder engagement strategies (Supplement 4). Among those interviewees that explicitly track or implicitly referenced indicators of success, 5 categories of metrics emerged repeatedly. These metrics are also reflected in a 2013 Environmental Protection Agency (EPA) study that used similar variables to determine the efficacy of environmental conflict resolution processes (EPA 2013). Despite the need to understand the social backdrop of the decision-making setting to prescribe an appropriate engagement tool, 63% of the interviewees do not collect social and economic data about their stakeholders.

4. DISCUSSION

As previous literature has illuminated, our study found that managers, primarily operating in the fisheries management context, perceive stakeholder engagement as important from the early stage of deciding which resources (e.g., fish stocks) need to be managed, through the preparation, adoption, implementation, and amendment of those management mechanisms. Engagement expands management options, increases the diversity of ideas, improves communication and process efficiency, and increases representation. The largest number of interviewees mentioned the engagement goal of ‘building trust’ and ‘soliciting feedback’, and the principles of ‘relationship building’ and ‘transparency’. Advisory groups were the most often cited strategy, followed by engaging key communicators. Both of these strategies were co-referenced with building trust and providing substantive feedback on management options. Although these were the most frequently discussed strategies, many interviewees were working to evolve outreach to

Deleted: table 1

Deleted: ¶

Deleted: Strategy

... [1]

Formatted Table

Deleted: table 2

Deleted: Metric

... [2]

use more innovative methods (e.g., online tools, visual tools) to accommodate changing demographics, environmental challenges, and underrepresentation in their management contexts.

A robust toolbox of stakeholder engagement strategies can go a long way towards helping managers design effective outreach. The *process* by which engagement tools are deployed is critical for ensuring the efficacy of those tools, and is closely linked to the mindsets and capacities of resource managers. Defined and structured processes help managers proactively plan, reflectively implement, and retrospectively evaluate their stakeholder engagement decisions. Our study elevates a set of core process principles widely referenced within both academic literature and practitioner guidance, reflecting a strong consensus among those that conduct stakeholder engagement in various management contexts (Gardner 2009, Udall 2011). Our findings also explore the breadth and nuance of specific engagement strategies depending on the management context. Below, we discuss effective strategies highlighted by interviewees and distill guidance on how to apply the 9 principles (figure 4) to the practice of stakeholder engagement.

#### 4.1 Guidance for applying the principles in practice

Of the 8 stakeholder engagement principles referenced by experts throughout the interviews, transparency and relationship-building were the most often cited, and were commonly co-mentioned with the engagement goal of building trust, highlighting the need for communication and interpersonal skills among resource managers (average mentions of principles per interviewee: n=9). Below, we discuss 5 key guidelines that emerged from this study for implementing these principles in the practice of natural resource decision-making. We have vetted and shared these guidelines with California fisheries managers, and they have served as the basis for step-wise manual developed to support stakeholder engagement decision-making.

##### **Start early.**

*“It’s all about being able to do enough early enough.”*

Respondents use more dialogue-based engagement tools in the beginning of the management process to help define the management problem, identify key issues, and encourage stakeholder buy-in. Early engagement is characterized by clear and consistent mechanisms for feedback and enables communication over a time frame during which stakeholders can feasibly influence the management decision (e.g., stakeholders have availability and capacity to engage). Sixty-two percent of interviewees stated that engaging stakeholders early and often is a key lesson they have learned through direct experience “on the job.”

##### **Be inclusive.**

*“You never have all the right people at the table, so you have to create options for getting people’s input in different ways.”*

Ensuring an inclusive process is critical for safeguarding equitable decision-making and incorporating a diversity of stakeholder voices. The marginalization of individuals or groups can lead to the delay or preclusion of management action, and the exclusion of

voices can stunt the information that informs decision-making (Turner and Weninger 2005). Interviewees cited the tendency for dissenting stakeholders to be more vocal and, thus, often more represented in final decision-making. Other studies reinforce this finding—showing that those more actively involved in the consultation process often perceive higher risks, motivating their engagement but potentially biasing the voices at the table (McComas 2001, Sutton 2006). To this end, managers should engage individuals or organizations that match the demographics and relative proportion of those that are affected by management decisions and disseminate information in the languages and communication channels that all possible stakeholders can understand. Finally, interviewees stressed that managers should lead with questions and listen carefully to the interests of marginalized populations who have not traditionally had the power of voice in decision-making.

**Create space for long-term planning and goal setting.**

*“Unless you have a good public engagement plan with strategic goals, it will be hard for you to make change.”*

Setting goals helps clarify stakeholders’ incentives for participation (e.g., stakeholders will be able to contribute to management goal-setting) and the engagement structure (e.g., transparent detail around management process and opportunities for engagement). In planning processes, managers should involve stakeholders in identifying goals both for decision-making and stakeholder engagement. Interviewees consistently advocated for the time and space to set goals and define a vision in support of an agency’s *long-term* engagement strategy.

**Humanize resource managers.**

*“Be honest and have a personality. Be real and they will come.”*

Building relationships between stakeholders and managers is vital for building trust in fishing communities, as well as across other resource management contexts. Even with limited capacity, generating conversation over email after a newsletter has been released can be a simple strategy for humanizing managers. Respondents also referenced multi-day events where managers and stakeholders can develop more intimate relationships as a useful tool for building trust and generating dialogue. When appropriate, managers should use their own names or photos to communicate with stakeholders and solicit feedback from stakeholders on communication platforms that stakeholders already use. Finally, managers should meet or communicate with stakeholders individually and give positive reinforcement to stakeholders for their efforts to engage whenever feasible.

**Be transparent.**

*“People often think they are making the decisions in [a decision-making] process. If they don’t get to, they get frustrated.”*

Transparency is not just about coming out from behind closed doors and making information *available* to the public. It requires that resource managers work to ensure stakeholders acknowledge and understand the management goals, the components of decision-making process, and the details of the resulting outcomes. A number of respondents told stories about decisions that had been made behind closed doors, only to be overturned due to stakeholder discontent with, or mistrust of, the process. The public

will often support decisions against their self-interest if they understand why the solution meets the needs of the majority. Managers should provide mechanisms for stakeholders to easily identify the status of the decision-making process, why any information may be withheld, and how their input will influence decision-making. Managers should also strive to admit and rectify mistakes as soon as they are identified. Finally, managers should clearly define the roles of management, stakeholders, and the general public in the decision-making process.

#### **4.2 Effective stakeholder engagement strategies**

The types and number of stakeholders respondents reported engaging at different points in the management process varies. Thus, it is critical to identify relevant stakeholders early in order to target them appropriately and ensure underrepresented populations (who are often marginalized by the management process) are recognized and included.

Respondents often framed stakeholder engagement strategies in the context of achieving specific management outcomes. For example, advisory groups, leveraging key communicators within fishery communities, and listening sessions were often cited as facilitating feedback from stakeholders, engagement of underrepresented populations, dialogue, and trust-building. Management systems that achieve stakeholder engagement goals (e.g., engage underrepresented stakeholders) can also help achieve broader management goals (e.g., reduce unsustainable fishery harvest). Therefore, managers who are able to identify where specific stakeholder engagement strategies will directly serve management directives or objectives may be able to better execute on both.

Many interviewees recounted how slight adaptations to existing stakeholder engagement strategies worked to dramatically increase their success in engaging constituents. For example, respondents identified social media as one of the first steps they took to increase their outreach ‘footprint.’ However, various social media tools may also be unsuccessful in reaching particular audiences, such as older commercial fishing communities. Overall, effective social media and increased website traffic can have varying degrees of influence, depending on staff capacity to keep information up-to-date and stakeholder demographics. Although some jurisdictions still have commercial fishing groups that check their mailbox, most interviewees who commented on snail-mail indicated it “never gets good results.”

Yet, the strategy most commonly cited as unsuccessful in engaging stakeholders was public hearings. Due to legal requirements, this strategy is often the sole avenue for public input; however, interviewees reported that public hearings can be intimidating, discourage dialogue, and do not provide stakeholders with an opportunity to give substantive feedback on management alternatives. Public hearings are often scheduled at times that may not be convenient for all stakeholders or during the fishing season, require travel, use only one language to communicate, or are designed to control audience involvement (Rowe and Frewer 2000). Staff capacity to attend and lead hearings and the cost of participant attendance were also cited as deterrents for using public hearings to inform or receive feedback on management alternatives.

Listening sessions, advisory groups, and open houses were highlighted as popular and complimentary approaches to augment existing public hearings or public comment processes, allowing for increased transparency and quality feedback. Interviewees generally use dialogue-based strategies (e.g., listening sessions) towards the beginning of management decision-making processes and tools for informing stakeholders about final or near final management decisions (e.g., newsletters) towards the end of the process timeline. This finding highlights the importance of planning early which strategies are appropriate as each management context requires different techniques and selecting engagement tools haphazardly can often lead to missing the target (Mansuri and Rao 2004).

#### **4.3 Evaluating stakeholder engagement**

Stakeholder engagement audiences are constantly changing, both in terms of population and culture. Managers, therefore, need to objectively evaluate their current engagement tactics and adapt their engagement to best meet changing needs. Interviewees identified 5 metrics that can be used to discern how stakeholders perceive outreach practices (e.g., surveys to evaluate attitudes), how strategies may achieve various engagement goals (e.g., web analytics to evaluate when stakeholders open newsletters and what stories and information interest them), and public sentiment towards decision-making (e.g., reduced backlash indicating greater trust in management) (table 2). Two of the metrics are used to directly monitor engagement activities (Online Engagement, Attendance/Participation) and 3 are used as proxies for how engagement can achieve various management goals (Stakeholder Feedback, Reduced Backlash, Compliance). However, these metrics can be challenging to implement and standardize, and may have limited utility in evaluating how stakeholders themselves perceive engagement.

More rigorous and easy to track indicators of meaningful engagement are an imperative. Without evaluation, managers will not be able to track and discern whether and how their engagement strategies were effective in meeting their goals. As in many management contexts, tracking metrics for productive stakeholder engagement are in short supply and those that are available (e.g., surveys) can be costly or time intensive.

#### **4.4 Persistent challenges in stakeholder engagement**

Resource managers face a number of tough challenges in engaging stakeholders, particularly when working with diffuse, uninterested, or isolated communities. First, a chronic lack of public agency capacity to conduct outreach and connect with constituents is a consistent challenge across the United States and internationally. Effective stakeholder engagement requires staff capacity building and time-consuming relationship building. However, experts mentioned that researchers and staff biologists are often ill equipped, or sometimes do not wish, to engage with stakeholders. Thus, stakeholder engagement often is or is perceived to be expensive, particularly because the outcomes are difficult to track, impeding managers' ability to assess cost-effectiveness. These barriers impede managers' abilities to design and implement even the most basic outreach

initiatives. Investing in outreach capacity for resource managers can improve an agency's ability to benefit from engagement outcomes (e.g., trust, greater information flow) over the long term.

Second, managers have often viewed the public as incapable of fully grasping the technical information, scientific uncertainty, or relative risk of management decisions. Indeed, perception gaps and entrenched beliefs may limit the public's ability to decipher policy complexities. However, the spectrum of beliefs and motivations to engage is precisely the input that can inform managers about the legitimacy, saliency, and credibility of their actions, and help them shift management priorities to reflect public opinion. Moreover, the public may have information that experts do not otherwise have access to, and may also have higher or lower risk tolerances that should be incorporated into management policies.

Third, to solicit a diversity and depth of perspectives, managers are challenged to identify those most affected by prospective decisions, which may include those that are least likely to be motivated and able to participate in decision-making processes (Sutton 2006, Sayce et al. 2013). For those untrained in outreach, it can be intimidating and uncomfortable to interact with individuals with different perspectives, particularly those with antagonism for the management process. Designing clear messages or connecting with stakeholders in person requires staff to be trained in facilitation and communication skills, as many public-facing managers are agency staff scientists and do not have a background in communications or outreach. Skills most needed, but often lacking across resource management agencies, are an ability to manage group dynamics (e.g., mediating disruptive individuals at public meetings), identify and avoid implicit biases, and re-evaluate entrenched positions (Reed 2008).

Fourth, gathering data about stakeholders to inform how, when, and where they can be engaged is resource intensive and requires specific research expertise. Many interviewees acknowledged the value of social and economic data for creating more realistic and inclusive management objectives and helping to clarify the complex trade-offs among management priorities. The importance of understanding stakeholder demographics—particularly how age, education, gender, and income influence stakeholders' likelihood and ability to engage—highlights the need for socio-economic data to inform appropriate engagement strategies (Ban et al. 2013). The process of gathering socio-economic data can also be beneficial in and of itself, enhancing managers' ability to craft outreach uniquely powerful for a given community's context, as well as nurturing buy-in and visibility through data collection (LeCornu et al. 2014). However, managers have limited guidance on the research methodologies and information most critical for informing engagement, despite calls from both practitioners and academics alike to develop such capacity (Ban et al. 2013, LeCornu et al. 2014). A common response to inquiries about the use of socio-economic data was: "There is a need for it, but that doesn't mean it's happening." Managers need help understanding which data are vital to decision-making, how to collect and use such data, and when and why the data are important. These knowledge gaps are key areas for further inquiry (LeCornu et al. 2014).

Additional challenges facing resource managers include a struggle with the use of “one-size-fits-all” strategies and limited strategic planning around agency engagement goals. Finally, managers consistently face issues with perpetuating existing privileges or group dynamics due to the reliance on traditional engagement approaches (e.g., public hearings), thereby exacerbating the preference of more visible perspectives (e.g., special interests).

#### 4.5 Conclusion

Effective engagement requires that managers shift mindsets and practices to elevate stakeholder perspectives. As depicted in the Engagement Wheel (figure 1), managers must first consider the contextual and personal constraints of stakeholders to engage, in addition to their own goals for outreach. Ultimately, there is no rulebook for effective stakeholder engagement. Rather, managers must be equipped with principles to follow and a toolbox of strategies to enhance existing approaches—a toolbox that will evolve in parallel with the changing populations they seek to engage. Within many of these approaches, experts consistently emphasize a timeless tool: humanizing management, whether through face-to-face engagement or through individual dialogue.

We have conducted a qualitative and informal assessment of various stakeholder engagement strategies deployed in a variety of current fisheries management contexts. We aim to spur continued discussion and provide a starting point for managers to consider future engagement actions, rather than provide a prescription for engagement needs. Managers must tailor their engagement processes to the motivations and behaviors of stakeholders to ensure the durability of their management decisions.

The complexity of considering scientific and conflicting normative perspectives, attempting to meet the needs of diverse and often unknown stakeholders, and uncontrollable global forces make engagement around resource management questions challenging. Yet the experts interviewed in this study represent a new wave for the practice of stakeholder engagement—individuals with the expertise and the motivation to design effective outreach agendas. To support these roles, resource managers need useful and practical metrics for evaluating engagement’s impact on decision-making outcomes; targeted and innovative strategies for engaging specific sectors or populations; information on the socio-economic context of resource users to inform how manager’s tailor outreach; and methods for involving constituents cost-effectively, given agency resource constraints. Finally, resource managers need more guidance on how improved engagement can inform and innovate sustainable natural resource management in order to motivate the prioritization of outreach within agency activities (Reed 2008).

To tackle the pressing challenges of environmental management in an increasingly complex and resource-depleted world, we need everyone at the table. Engaging those closest to the problem, and with the most at stake, is an imperative for generating the trust needed to implement solutions. Indeed, it is a messy and imprecise science, yet the thoughtful linkage of stakeholder engagement principles to the practice and evaluation of

outreach strategies is an art worth improving as we strive for better environmental management.

#### ACKNOWLEDGEMENTS

Thank you to Morgan Gopnik, Rebecca Martone, and Elena Finkbeiner for providing valuable feedback on early versions of this manuscript. We are grateful to the Resources Legacy Fund for a grant that funded this research, and the Center for Ocean Solutions for their unwavering support of the project. We also thank the California Department of Fish and Wildlife (DFW) for helping shape, guide, and use this research in their practice. And thank you to all our interviewees for their time, perspectives, and dedicated effort to evolve stakeholder engagement in natural resource management.

#### LITERATURE CITED

- Ban, N. C., M. Mills, J. Tam, C. C. Hicks, S. Klain, N. Stoeckl, M. C. Bottrill, J. Levine, R. L. Pressey, T. Satterfield, and K. M. Chan. 2013. A socio-ecological approach to conservation planning and embedding social considerations. *Frontiers in Ecology and the Environment* **4**:194-202.
- Beierle, T. C. 2002. The quality of stakeholder-based decisions. *Risk Analysis* **22**:739-749.
- Beratan, K. K., and H. A. Karl. 2012. Managing the Science-Policy Interface in a Complex and Contentious World. 183-216.
- Berkes, F. 2010. Devolution of environment and resources governance: trends and future. *Environmental Conservation* **37**:489-500.
- Buchanan, R. 1992. Wicked Problems in Design Thinking. *Design Issues* **8**:5-21.
- Burton, P., R. Goodlad, J. Croft, J. Abbott, A. Hastings, G. Macdonald, and T. Slater. 2004. What Works in Community Involvement in Area-Based Initiatives? A Systematic Review of the Literature. University of Bristol and University of Glasgow, London.
- Davidson. 1998. Wheel of Engagement Community Planning.
- EPA. 2013. Environmental Collaboration and Conflict Resolution Policy Report to OMB-CEQ. Environmental Protection Agency.
- FFMC, G. o. M. 2014. Gulf of Mexico Federal Fishery Management Council Stakeholder Communications Survey Summary Report. Gulf of Mexico Federal Fisheries Management Council.
- Gardner, J., Dowd, A, Mason, C, and Ashworth P. 2009. A framework for stakeholder engagement on climate adaptation. Climate Adaptation National Research.

- Gelcich, S., M. J. Kaiser, J. C. Castilla, and G. Edwards-Jones. 2008. Engagement in co-management of marine benthic resources influences environmental perceptions of artisanal fishers. *Environmental Conservation* **35**:36-45.
- Gopnik, M., C. Fieseler, L. Cantral, K. McClellan, L. Pendleton, and L. Crowder. 2012. Coming to the table: Early stakeholder engagement in marine spatial planning. *Marine Policy* **36**:1139-1149.
- Hanna, S., C. Folke, and K.-G. Maler. 1995. Property Rights and Environmental Resources. S. Hanna and M. Munasinghe (eds.), *Property Rights and the Environment*:15-29.
- Hicks, C. C., N. A. J. Graham, and J. E. Cinner. 2013. Synergies and tradeoffs in how managers, scientists, and fishers value coral reef ecosystem services. *Global Environmental Change-Human and Policy Dimensions* **23**:1444-1453.
- Hicks, C. C., T. R. McClanahan, J. E. Cinner, and J. M. Hills. 2009. Trade-Offs in Values Assigned to Ecological Goods and Services Associated with Different Coral Reef Management Strategies. *Ecology and Society* **14**.
- IAP2. 2007. IAP2 Spectrum. International Association for Public Participation (IAP2).
- Innes, J. E., and D. E. Booher. 2004. Reframing public participation: strategies for the 21st century. *Plann. Theory Prac.* **5**:419-436.
- Layzer, J. 2008. *Natural Experiments: Ecosystem-based Management and the Environment*.
- LeCornu, E., J. Kittinger, Z. Koehn, E. Finkbeiner, and L. Crowder. 2014. Current Practice and Future Prospects for Social Data in Coastal and Ocean Planning. *Conservation Biology* **28**:902-911.
- Lombard, M., J. Snyder-Duch, and C. C. Bracken. 2002. Content analysis in mass communication: Assessment and reporting of intercoder reliability. *Human Communication Research* **28**:587-604.
- Mansuri, G., and V. Rao. 2004. Community-based and -driven development: A critical review. *World Bank Research Observer* **19**:1-39.
- McComas, K. A. 2001. Public meetings about local waste management problems: comparing participants to nonparticipants. *Environ Manage* **27**:135-147.
- McCool, S. F., and K. Guthrie. 2001. Mapping the Dimensions of Successful Public Participation in Messy Natural Resources Management Situations. *Society & Natural Resources* **14**:309-323.
- Michigan. 2009. *Stakeholder Engagement Guidelines*. in M. D. o. Transportation, editor.
- Mikalsen, K., and S. Jentoft. 2001. From user-groups to stakeholders? The public interest in fisheries management. *Marine Policy* **25**:281-292.
- Nations, U. 2012. *Guidelines on Stakeholder Engagement in REDD+ Readiness With a Focus on the Participation of Indigenous Peoples and Other Forest-Dependent Communities*. United Nations' Reducing Emissions from Deforestation and Forest Degradation (REDD+).
- NRC. 2008. *Public Participation in Environmental Assessment and Decision Making*. National Research Council
- Pomeroy, R., and F. Douvère. 2008. The engagement of stakeholders in the marine spatial planning process. *Marine Policy* **32**:816-822.

- Poncelet, E. 2004. Partnering for the environment: multistakeholder collaboration in a changing world. Rowman Littlefield, United States.
- Reed, M. S. 2008. Stakeholder participation for environmental management: A literature review. *Biological Conservation* **141**:2417-2431.
- Reed, M. S., A. Graves, N. Dandy, H. Posthumus, K. Hubacek, J. Morris, C. Prell, C. H. Quinn, and L. C. Stringer. 2009. Who's in and why? A typology of stakeholder analysis methods for natural resource management. *J Environ Manage* **90**:1933-1949.
- Richards, C., K. Blackstock, and C. Carter. 2004. Practical Approaches to Participation. Socio-Economic Research Group (SERG) **1**.
- Rittel, H. W. J., and M. M. Webber. 1973. Dilemmas General Theory of Planning. *Policy Sciences* **4**:155-169.
- Rowe, G., and L. Frewer. 2000. Public Participation Methods: A Framework for Evaluation. *Science, Technology, & Human Values* **25**:3-29.
- Sayce, K., C. Shuman, D. Connor, A. Reisewitz, E. Pope, M. Miller-Henson, E. Poncelet, D. Monié, and B. Owens. 2013. Beyond traditional stakeholder engagement: Public participation roles in California's statewide marine protected area planning process. *Ocean & Coastal Management* **74**:57-66.
- Schlager, E., and E. Ostom. 1992. Property-Rights Regimes and Natural Resources: A Conceptual Analysis. *Land Economics* **68**:249-262.
- Sutton, S. G. 2006. Understanding Recreational Fishers' Participation in Public Consultation Programs. *Human Dimensions of Wildlife* **11**:329-341.
- Tippett, J., J. F. Handley, and J. Ravetz. 2007. Meeting the challenges of sustainable development—A conceptual appraisal of a new methodology for participatory ecological planning. *Progress in Planning* **67**:9-98.
- Turner, M., and Q. Weninger. 2005. Meetings with costly participation: An empirical analysis. *Review of Economic Studies* **72**:247-268.
- Udall. 2011. Principles for stakeholder involvement in coastal and marine spatial planning. Institute for Environmental Conflict Resolution and Udall Foundation.
- UN. 2012. Guidelines on Stakeholder Engagement in REDD+ Readiness With a Focus on the Participation of Indigenous Peoples and Other Forest-Dependent Communities., United Nations' Reducing Emissions from Deforestation and Forest Degradation (REDD+).
- Wendt, D. E., and R. M. Starr. 2009. Collaborative Research: An Effective Way to Collect Data for Stock Assessments and Evaluate Marine Protected Areas in California. *Marine and Coastal Fisheries* **1**:315-324.

Strategy	Description	# Mentions
<b>Advisory Groups</b>	Stakeholder advisory groups are multi-interest bodies of appointed stakeholders convened for a pre-determined period of time to provide advice to a decision-making body. Stakeholder advisory groups can serve to identify key issues, generate management alternatives, or liaise between managers and advisory group constituencies.	60
<b>Blogs</b>	Blogs are an internet-based method for writing informally about management status and processes. Managers use blogs to share information and ideas.	3
<b>Collaborative Research</b>	Managers, researchers, and resource users co-design and co-conduct research to assess a resource or test a management option.	16
<b>Education Programs</b>	Education programs train stakeholders to build their understanding of the management process and capacity to engage in scoping or revising management rules.	12
<b>Gear Shops</b>	Gear shops (e.g., tackle shops) are private businesses that may be frequented by both recreational and commercial resource users. Management information in the form of flyers or brochures can be placed at the check-out counter or storefront of tackle shops to disseminate details to stakeholders that are not electronically connected.	3
<b>Industry Associations</b>	Managers attend association meetings convened by industry associations or recreational fishers to make announcements and meet stakeholders.	10
<b>Key Communicators</b>	Managers can use key members (usually leaders) of a community and other stakeholder groups as nodes for building trust, communicating with other stakeholders about management processes, and providing critical feedback on management options.	35
<b>List Serves</b>	Emails to a large group of people that include relatively brief messages used to inform or share information with intended recipients.	21
<b>Listening Sessions</b>	Listening sessions are in-person meetings between managers and stakeholders focused on providing a venue for stakeholders to voice their interests and concerns. Managers are present primarily in a listening (rather than information presentation) capacity.	22
<b>Newsletters</b>	Electronic newsletters can be used to disseminate information to a large number of stakeholders in a formal and consistent manner.	24
<b>Online Forums / Message Boards</b>	Proactive participation on informal message boards and forums allows staff to virtually meet stakeholders on frequently visited websites to exchange ideas and information.	5
<b>Open House</b>	Open houses are often structured in an open-floor format with different 'stations' placed around a large room. Stakeholders may engage in dialogue with content experts and provide comment as desired.	5
<b>Phone Apps</b>	Phone applications provide cell phone users with a method to input information about a resource, report use of a resource, or to quickly and efficiently receive information.	4
<b>Phone Calls</b>	Phone calls are an opportunity for managers to communicate	11

	orally with individual stakeholders via telephone.	
<b>Press Release</b>	Written or recorded communication directed at members of the news media to announce something newsworthy (often a major project milestone or regulatory decision).	7
<b>Public Hearings</b>	Public hearings are opportunities for members of the public to provide oral testimony at formal public meetings or as part of a regulatory process.	28
<b>Social Media</b>	Facebook, Twitter, Instagram, Flickr, and YouTube are online social media tools to inform a large number of people (beyond those on existing list serves) of key messages and increase the visibility of managers among specific stakeholder groups.	16
<b>Town Halls</b>	Different from listening sessions, town halls are open, public meetings often structured around a brief presentation on a specific topic followed by time for questions.	5
<b>Trade Shows</b>	Trade shows are periodic events (typically annual) that bring together gear suppliers and resource users (commercial and recreational). Agency staff can host a booth at trade shows to disseminate general information about and increase visibility of agency structure, process, and activities.	5
<b>Webinars</b>	Webinars are virtual meetings with auditory and visual components that allow participants to share information and dialogue across distances.	10
<b>Websites</b>	Websites are internet sites where organizations can share structured and searchable information.	29
<b>Written Comment</b>	Written public comment is an opportunity for members of the public to provide input (e.g., via email, letter, or website) on draft policy and regulatory documents.	18

Table 1: A list of the stakeholder engagement strategies identified in expert interviews and their definitions.

Metric	Definition	Interviewees
Online Stakeholder Engagement	Web analytics are used with social media platforms, webpages, and list serves to assess where stakeholders are directing their attention on an agency website, the demographics of social media followers, and which links stakeholders are pursuing within electronic newsletters (e.g., Google, Facebook, Tweetreach). The information can be used for adapting online tools and understanding online audiences. Respondents broadly acknowledged that analytics alone cannot measure participation, as they do not capture the degree of stakeholder engagement.	13
Reduced Negative Backlash	Reduced burden on resource managers from decreased negative backlash was the most referenced metric (mentions: n=29). Interviewees noted less demand for agency responses when there were "fewer angry phone calls" or no stakeholder litigation around management decision-making on account of	13

	insufficient engagement. Evaluation was primarily of perceived reduced backlash, thus quantitative metrics need to be developed to track substantive change.	
Attendance and Participation	Individual attendance and participation in comment periods and in-person meetings can serve as a proxy for the number of people exposed to a management message or participating in feedback processes. The substantive quality of commentary and dialogue, particularly when informing management alternatives, was cited as more important than the number of people who submit comments.	10
Stakeholder Feedback	Surveys can evaluate the degree to which audiences use and understand agency messaging. For example, the Gulf of Mexico Federal Fishery Management Council conducted a survey of stakeholders which found that respondents relied on Council press releases, NOAA fishery bulletins, Council website, and friends for fishery related information. The survey also found that stakeholders believed they could be better engaged if the Council contacted permit holders with direct mail, involved recreational fishing clubs, scheduled meetings after 6pm, refrained from scheduling meetings during fishing seasons, provided better access to landings data, and ran meeting notices in local newspapers (FFMC 2014).	6
Increased Compliance	Greater compliance with management regulations indicates agencies are communicating rules effectively and securing sufficient buy-in. Identifying those who are chronically under-compliant can help managers detect populations underrepresented in agency outreach strategies. For example, one interviewee uses documented license suspensions to understand which stakeholders she has been failing to reach in the management process.	6

Table 2: The 5 metrics for evaluating the efficacy of stakeholder engagement and the number of interviewees who reported using them.