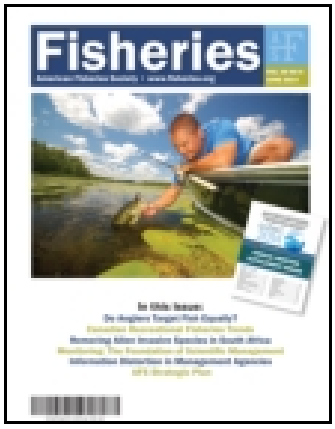

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Information Flow in Fisheries Management: Systemic Distortion within Agency Hierarchies

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INTRODUCTION

The early to mid-1970s provided some of the best Coho Salmon (*Oncorhynchus kisutch*) fishing of the last century in Oregon, in large part a function of productive ocean conditions and a booming hatchery system. However, wild Coho populations exhibited dramatic declines toward the end of the decade and harvest rates subsequently dropped by over 75% (Martin 2009). Even after the Oregon Department of Fish and Wildlife (ODFW) implemented what was deemed at the time to be scientifically defensible harvest reductions, fisheries biologists watched as the number of returning Coho fell into severe decline over the next several years. How could an environmental catastrophe of this magnitude happen under the guardianship of a group of people who cared deeply for the public trust they managed and who were committed to using the best science available to properly manage these fish?

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The history of Oregon Coho provides a case study of management inaction due to barriers in information flow through the hierarchy of a fisheries governance organization. Natural resource agencies are generally complex, multitiered institutions that depend on information flowing vertically through the hierarchy of the organization to make decisions and implement management actions. As information moves between the layers of an organization, there is always opportunity for the message to become distorted by the way in which individuals interpret and communicate information. Making decisions using complete and accurate information becomes more difficult the higher up in the governance system one goes.

"Systemic distortion" of information can be defined as the process of altering information as it is communicated through the layers of a hierarchical system. In general, systemic distortion is a function of organizational pressures (to be right) and people's social tendencies (to be liked). These pressures can cause perceived good news to travel quickly and unverified upward through the hierarchy of an agency, whereas bad news is often late, misinterpreted, and understated; therefore, the people at the top of the organization's hierarchy tend to receive information that is favorably biased. Such favorably biased information supports the status quo within an organization (Bella 1996), reducing the ability of the system to adapt to change. In the worst of cases, outside intervention or system collapse is required for institutional change to occur, clearly to the detriment of fisheries resources and agency reputation. The goal of this article is to create awareness of systemic distortion of information within natural resource organizations and provide tools to counteract this phenomenon in the decision-making process. Distortion of information is well documented in hierarchical systems (Rosen and Tesser 1970; Roberts and O'Reilly 1974; Liberti and Mian 2009) and it is therefore imperative that professionals in our field understand that the effects influence the function, productivity, and sustainability of our fisheries and ecosystems.

Dave Bella, a professor of engineering at Oregon State University, began investigating systemic distortion of information preceding major engineering disasters of the late 20th century. His work focused on the disparity in risk perception between lower and higher levels of decision making in organizations such as the National Aeronautics and Space Administration (NASA). Following the Space Shuttle *Challenger* explosion in 1986, a Presidential Commission Report found that NASA engineers familiar with the mechanics of the rocket identified significant risk in the solid rocket booster feature of the shuttle long before this disaster occurred (Feynman 1986). This information, however, was filtered and diluted, systematically minimizing the perception of risk as it moved up the chain of command (Bella 1987). An independent study estimated that the upper level managers perceived the risk to be about one thousand times less than the risk perceived by on-the-ground, working engineers (Feynman 1986). From our historical viewpoint, the system of reporting within NASA was clearly dysfunctional, with top-level administrators somehow not receiving needed information to make rational decisions. Nonetheless, people within the system at the time perceived their actions to be responsible, reasonable, and justified (Bella 1987); the reason for this stems from how and why information was distorted as it moved from the field personnel to the upper levels of the administration within this highly respected organization.

Good News Tends to Travel Quickly

People generally want to talk about their successes, and a positive attitude is valued in organizations. The majority of people seek the approval of their peers and supervisors. Through both formal and informal communication channels, perceived good news tends to travels quickly and unquestioned up the hierarchy of an agency. Positive reinforcement is often granted to the purveyors of good news, causing information to move through the system ever more quickly, unchecked and increasingly exaggerated. Competition for funding and recognition can cause project forecasting to be overly positive, as the proposals and actions that promise the most economic value to the organization are chosen for implementation (Lovallo and Kahneman 2003).

Hierarchies tend to inhibit open and honest relationships needed to communicate effectively at work due to an imbalance of power between people within the decision-making chain (Chaleff 2010). Both fear and love of an employer can cause people to distort information. Most people want to be supportive of their leaders and the organizations they represent. What better currency to pay back a good employer than by highlighting the positive results of their decisions? Unfortunately, this blind devotion can encourage employees to seek out information that verifies that their leader's decisions are right and to protect them from complaints or negative feedback. At an extreme, supervisors can build an insular layer around themselves through their hiring and firing practices, surrounding themselves with "yes-men" people who will support their decisions no matter what. This organizational ethos creates a barrier of gatekeepers who filter or minimize any bad news from ever reaching the decision maker and thus puts this person and the organization ultimately in jeopardy due to lack of complete and accurate information on which to base decisions.

Bad News Tends to Arrive Late and Understated

Hierarchical social systems inherently do not support perceived bad news because bad news is viewed as disloyalty and challenges the functioning of the organization (Bella 1987). People who challenge the established protocols within an organization are often ostracized for not being team players, especially if they cut through the chain of command and report above their immediate supervisors. Team projects are often heavily laden with social pressure toward consensus and groupthink (Whyte 1956): not many people want to relay bad news or challenge the decisions of their colleagues because dissent can be taken personally and weaken working relationships. Thus, information that reflects poorly on coworkers or the agency will be diluted and softened as it moves through the layers of an institution. To do otherwise is to risk being tuned out, reorganized, or fired. Multitiered organizations under political or economic pressure tend to revert to a mentality of "keep the system going" (Bella 1997). Every level depends on the others and bad news has the potential to cause chaos throughout the organization, making the entire system impotent.

STEPS TO CORRECT FOR DISTORTION

Systemic distortion cannot be eliminated from hierarchical social systems. Rather, people in an organization must be prepared to recognize and mitigate its effects. Leaders at every level must acknowledge and account for distortion and not punish the people who report bad news or question the status quo. The following are management recommendations that can help agency professionals increase the accuracy and timeliness of information flowing through their organization for the effective management of our fisheries resources.

Be Aware

Distortion of information is endemic to human communication systems. Therefore, the first step in minimizing these forces is for leaders to be aware that the information they receive has already been subject to some level of distortion. Be cautious when receiving only good news and seek out attrition errors—realize that people want to take credit for positive outcomes and attribute negative outcomes to others, especially factors outside the organization (Lovallo and Kahneman 2003). Studies have found that managerial perceptions are often inaccurate (Mezias and Starbuck 2003). Know what bad news looks like and question what the ramifications would be if you are only seeing a piece of the whole problem. Numerous factors affect how information is reported: contextual factors such as the extremity of the news, social factors such as hierarchical power and distance, and individual factors such as personality and past experiences (Lee 1993). Leaders should strive to build relationships within an inclusive communication network so they know what information is likely to be understated and who tends to be overly positive or overly negative. Investigating every piece of information hinders a leader's ability to make timely decisions; therefore, promoting an organizational culture aware of distortion will make day-to-day communication more effective and productive.

Being aware of systemic distortion challenges people to examine their own biases. Past fisheries stock collapses have been linked to the unchallenged acceptance of scientific methods (Finlayson 1994; Lichatowich 1999). In reaction to the Coho Salmon declines in the 1970s, ODFW fisheries researchers implemented the best science available at the time to reestablish harvest quotas. Managers were confident that the new Ricker stock recruitment curves would give them the accurate predictions needed to conserve the fishery. Despite the political unpopularity of the initial decision to reduce harvest limits, managers were confident that the science was sound and credible. For years, the salmon populations continued to decline; this bad news was attributed to ocean conditions or sampling error and sent back for reanalysis before it was ever passed on to the upper levels of the agency's hierarchy. It took the dogged investigation and courageous dissent of a small group of ODFW employees to discover a major error in their methods concerning the spawning index streams used to parameterize the stock recruitment curves. Though believed to be unbiased, these streams were actually nonrandom and not representative

of the spatial heterogeneity of natal Coho streams in Oregon (McGie 1981; Emlen et al. 1990). The index sites that were used in the scientific assessment of Coho stocks were in fact the most productive streams on the Oregon coast, chosen by highly respected agency employees, long retired from the organization. These streams were never intended for evaluating the entire population. Thus, the productivity of the overall Oregon Coho stocks was overestimated year after year before the problem was ever recognized. No one dared to question the way things were done or the integrity of earlier fisheries professionals and, as a result, the scientific examination of the problem was delayed. Intense political and public pressure amplified the internal distortion, as employees defended the decisions of the agency, causing the organization to be even slower to recognize the problem and take the actions necessary to protect all but the most resilient stocks in Oregon.

Cut Through the Layers

In order to evaluate the amount of distortion within a system, it is necessary to tunnel through the multiple layers of a hierarchy. Known as "diagonal communication" (Wilson 1992), leaders are encouraged to seek out problems in their organization from all levels of the hierarchy. Following the chaos of the salmon declines, one of us (Martin) boosted diagonal communication by scheduling one-on-one district tours with each regional fisheries biologist in the state during his time as chief of fisheries for ODFW. The breadth of knowledge he had from the top of the agency met the depth of knowledge from the on-the-ground, field biologists. By cutting through the layers within the organization, Martin felt better prepared to implement the information he was receiving at the local and regional scale while employees had a better understanding of the forces affecting statewide decisions. In a second example, an analysis of the U.S. Fish and Wildlife Service concluded that increasing diagonal communication within the agency's hierarchy would enable employees to more effectively meet agency objectives (Danter et al. 2000). Communication and relationship-building do require a time investment; efficiency must sometimes give way to inclusion and responsiveness in order for institutions to process change (Yaffee 1997).

Celebrate Problem Identification

Systemic distortion is generally not malicious deception, and problems can be ignored or distorted for many reasons. Therefore, employees should not fear reporting bad news nor should they fear that a mistake has been made on their watch. A problem must be identified and characterized before it can be solved. Therefore, rewards are equally due for both problem identification and solution. The goal of this step is to show employees that it is okay to make mistakes as long as the mistakes are found. This step requires humility and accountability across layers in an agency. When people trust that their leaders are concerned with ensuring that they receive the correct information and not the just favorable information, productive problem solving can move forward.

Martin admits that ODFW fisheries biologists, himself included, lacked this humility prior to the collapse of the Coho stocks. "We thought we had complete control over the salmon fishery. With our cutting-edge science and our hatchery capacities, we believed we could adjust the population to whatever level the fishermen wanted. No wonder no one saw the crash coming." This hubris was also observed in a postcollapse analysis of Northern Cod (*Gadus morhua*) management by the Canadian government (Finlayson 1994). In 1977, the Department of Fisheries and Oceans Canada developed a "science-based system of fisheries management" that proceeded to create and defend seriously flawed stock assessments and catch limits, despite concerns from nearshore fishers and academics, until a fishing moratorium was enacted in 1992 (McCay and Finalyson 1995). Agency personnel observed that the Department of Fisheries and Oceans Canada promoted work considered scientifically important while providing little incentive to contribute to organizational function and communication with stakeholders (Finalyson 1994). Even following the collapse, fisheries scientists blamed the cause of Northern Cod declines on ocean conditions, ineffective sampling, and marine mammal predation before questioning the total allowable catch limits generated by their models (McCay and Finalyson 1995). Problem identification inherently questions the status quo; therefore, this step is both radical and critical for an institution to adapt to changing social and biological conditions.

Identify Reverse Distortion Personalities

Within natural resource agencies, leaders should seek to build a culture of problem finders as well as problem solvers. Too often, the problem solvers are touted as the most essential components of an institution. In truth, the people who identify problems are equally vital to an agency. In any team environment, supervisors benefit from identifying what we call "reverse distortion personalities." These are people who are not interested in distorting information for the better and will even go as far as to amplify bad news. Reverse distortion personalities have a psychology built around the identification of problems. Unfortunately, these people are often negatively labeled as organizational malcontents, cynics, or simply not team players. Like a splinter in the human body, the organization will often attempt to isolate and get rid of the irritant, usually by reorganizing these personalities to positions where they can be, at best, tolerated or ignored. However, a good leader will recognize that reverse distortion personalities are key components to a healthy system—they are not splinters to be removed. Because they are not concerned about going against the groupthink current, reverse distortion personalities serve as an internal warning system that information might be getting distorted on the way to the top. These individuals beg that the problem be addressed and there is generally value in this consideration. Minority input and respectful disagreement are important pieces of a healthy decision-making process (Whyte 1956). As such, in any team environment, leaders should reinforce that "between the extreme of rote compliance and counterproductive undermining of leadership, there is an important place for thoughtful, divergent views" (Chaleff 2010, p. 15).

Be Prepared to Act

Once a problem is identified, the system must be flexible enough to react to the information before negative impacts become irreversible. Too often, it takes sociopolitical or ecological catastrophes, such as the crash of Northern Cod or Oregon Coho stocks, for organizations to change their behavior (White 2001). Fisheries managers rely on empirical evidence to defend decisions, yet lack of resources for monitoring is considered a major barrier to successful adaptive management in fisheries (Walters 2007). Recognizing problems before a catastrophe requires constant vigilance and evaluation, which includes creating measureable objectives directly linked to desired impacts of management decisions (Riley et al. 2002). These objectives are red flags in the monitoring program, and when these flags go up, the agency must be prepared to take action rather than delay intervention due to incomplete, inconclusive, or distorted information.

Institutional flexibility is a critical component in the framework of adaptive management (Gunderson et al. 1995) that monitors the impacts of fisheries management intervention in order to learn and change with the addition of new information (Walters 1986). Risk management strategies, such as decision support tools, provide professionals with the means to make decisions that account for the complex uncertainty of fishery systems (Hillborn 1987). These strategies foster management plans prepared to deal with economic and biological surprises (Sethi 2010).

CONCLUSION: DISTORTION AND ACCOUNTABILITY

In Oregon, systemic distortion of information enabled aggressive harvest rates to remain unchallenged as wild Coho stocks became severely depleted. It took complete closure of the fishery, coupled with 15 years of concentrated research efforts (e.g., Emlen et al. 1990), to begin to reverse the effects of management decisions based on distorted information. In the end, the ODFW managed to avoid complete loss of the Oregon stocks. From our perspective, this chapter of Oregon Coho history is not a result of scientific failure but rather a failure to question the veracity of scientific information flowing into the management process. The changes in management practices that were necessary to protect the fishery were fueled by courageous individuals who held themselves and the organization accountable for ensuring that information flowing to top agency decision makers was accurate and timely.

The steps we have outlined here are meant to facilitate critical thinking and trust within fisheries management agencies. Studies in organizational behavior have found that trust in the supervisor facilitates a more productive work environment (Roberts and O'Reilly 1974; Scott 1980). However, the responsibility of correcting for distortion falls on all individuals in an organization. Silver and Geller (1978) asserted that "an organization obscures an individual's relationship to an end state, thus permitting the individual to feel uninvolved and devoid of responsibility" (p. 127). Effective leadership demands both individual and organizational accountability. Because ethical considerations are inherent to almost all management decisions in natural resources (Decker et al. 1991), such decision making requires a leader to see beyond his or her organizational role to the role of responsible citizen. Professional societies can support such courageous leadership by exposing distortions and biases of organizations (Bella 1992): The American Fisheries Society's *Standards of Professional Conduct* speaks to member's responsibility to aquatic resources and the public and furthermore establishes a process for situations when a member finds employment obligations incongruent with ethical standards (American Fisheries Society 1997). Paradigm shifts in fisheries toward adaptive management require an organizational culture that is prepared to embrace constantly changing, nonlinear processes that are outside the experience of many agency personnel (Danter et al. 2000).

As stewards of the public trust, we are fighting huge battles against pollution, habitat loss, invasive species, climate change, and competing stakeholder interests for fisheries resources. This is precisely why leaders should strive to minimize the internal distortive forces that counteract an organization's best intentions to protect aquatic resources. Recognizing and correcting for systemic distortion keeps information flowing accurately through an organization, reducing bias in management decisions and promoting more effective and sustainable conservation of our fisheries and their ecosystems.

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