Learning as a Strategy for Improving Endangered Species Conservation

Tim W. Clark

Justification for the Endangered Species Act of 1973 (ESA) is largely based on recognition that if the biotic enterprise is damaged by the extinction of too many species, the current functioning of ecosystems will be lost or diminished, and the consequences for humans will be unpredictable, but most definitely harmful. It is vital that the ESA policy be refined, administered, and applied well to conserve species and their habitats. Improving the learning capability of professionals and organizations is the strategy most likely to be successful in this regard. This paper examines learning at multiple levels to improve species and ecosystem recovery and conservation.

Learning at Individual and Organizational Levels

Learning is the process of using information to adjust one's responses to the environment, or the process of detecting and correcting "errors," i.e., mismatches between expectations and outcomes (Argyris and Schön 1978). Learning to meet practical conservation goals successfully involves more than refining scientific methods. We must focus on learning capabilities and processes at both individual and societal levels in pragmatic ways. Fundamentally, we must learn how to learn more effectively—an approach that improves performance by explicitly seeking information about our own past performance, the dynamic status of the problems we face, and the contexts of these problems (Clark 1993). This focus on learning brings four targets to attention—individual, professional, organizational, and policy. Learning in any one of these four may affect learning in all the others. An explicit learning strategy requires that inquiry and redirection are common, new ideas welcomed, bridging rewarded, and responsibility for outcomes shared.

There has been considerable experience with endangered species conservation since passage of the ESA, but it is debatable how much of this has been explicitly and systematically converted to organizational or societal learning or how much improvement has actually occurred in species survival (see Yaffee 1982, 1994, Tobin 1990, Kohm 1991, Alvarez 1993). The sad fact is that, as Argyris and Schon (1978:9) noted, "there are too many cases in which organizations know less than their members." Organizational learning capability, in both government, business, and NGOs, has been shown to affect important organizational outcomes and policy implementation (Glynn et al. 1992). In this case, the level of performance in restoring endangered species is largely a function of the ability of organizations to learn from past experience and apply the lessons to new situations.

Learning Theory

Exactly how individuals, professionals, organizations, and policy systems learn is not known. Parson and Clark (1995) provide a good overview, in the context of sustainable development, of numerous theories that explain the phenomenon of individual learning. Some theories focus on people's behavior and what factors (e.g., social, cognitive, symbolic) motivate it. Others emphasize people's rationality, and its "boundedness," as they make decisions, learn, or solve problems. Other theories look at information processing, i.e., the need to filter and structure vast amounts of incoming information. Parson and Clark (1995:436) also summarized the cognitive sciences' definition of learning: "Learning is an experience-driven change in the internal cognitive structures used to represent information. People respond to disparity between their cognitive structures and feedback from their behavior by revising their cognitions." There is also a body of learning theory dealing with the joint development, or "codetermination," of individual thought/learning and social/cultural contexts. Learning by individuals is prerequisite to organizational or policy learning.

For significant improvements to occur in endangered species conservation, organizations must learn. Such a statement seems obvious, but few organizations set explicit learning goals or track their learning performance. No recovery or management plan that I am aware of specifically lists learning as a goal. Leeuw et al. (1994:2) point out that "organizational learning is usually not a deliberate enterprise, but an ad hoc endeavor used for problem solving." In part, the concept of organizational learning is relatively new; many key advances were made beginning in the 1970s building on theories about individual learning (e.g, Argyris and Schön 1978). Recent interest in organizational learning (see Senge 1990) stems from the fact that it has a vast array of practical implications. But despite its potential uses in improving endangered species conservation, these ideas and techniques are little known in species restoration circles.

Organizational learning depends on individual learning, probably in one of two ways. It has been theorized that organizational learning is the sum of its individual members' learning, which is not as simple as it sounds. According to Parson and Clark (1995:439): "What each individual learns may be complexly contingent on the choices and learning of other group members (e.g., in the pursuit of high-level coordinated performance by a group such as a basketball team, a string quartet, or a recovery team). Or the means of individual learning might be through activities that depend on the participation of other group members, such as discourse, imitation, or shared activity." Alternatively, group learning may be analogous to individual learning except that it takes place at a more complex level of

society, i.e., it may be "autonomous, determined by group-level causal processes that correspond to the processes shaping individual learning" (p. 439). Thus, one could speak of organizational perception, memory, or changes in behavior and beliefs.

Etheredge and Short (1983:42), in their study of learning in government agencies, proposed that learning ought to result in "increased intelligence and sophistication of thought and, linked to it, increased effectiveness of behavior." Etheredge (1985:66) drew on three criteria to measure increase in intelligence: "1) growth of 'realism,' recognizing the different elements and processes actually operating in the world; 2) growth of 'intellectual integration' in which these different elements and processes are integrated with one another in thought; 3) growth of reflective **perspective** about the conduct of the first two processes, the conception of the problem, and the results which the decision maker desires to achieve" (emphasis in original).

Similarly, Argyris and Schön (1978) emphasize the change in "reflective perspective" in their distinction between "single-loop learning" and "double-loop learning." In single-loop learning, organizations develop skills to scan their environment, set goals, gather better information, use it in planning, and monitor their own performance in relation to their goals. The entire process is conducted within the context of the organization's central cultural norms and traditions, i.e., its understanding of how to do business and the adequacy and reasonableness of its strategies. Many organizations become good at changing organizational strategies to meet unchanging norms.

But some "errors" are not easily corrected within that framework (Argyris 1992). Sometimes the error or conflict challenges the norms themselves. A program selected to achieve certain goals may be implemented successfully, for instance, yet not be adequate to achieve the goals. It may be that, in the words of Leeuw et al. (1994:9), "evaluations precipitate debate on core organizational issues when they not only ask the question 'how well are we doing,' but also, 'does it make sense to do it, even if it is being done well?'" Organizational learning in these cases requires more than a single feedback loop of changing strategies: it requires a double feedback loop that also reexamines the standards by which the organization operates. The process must start with recognizing the unexpected outcomes, acknowledging that they cannot be "corrected" by doing the same thing better, and developing a new and different perspective on the problem. Double-loop learning must institutionalize systems that "review and challenge basic norms, policies, and operating procedures in relation to changes occurring in the environment" (Morgan 1986:89).

Many of the people and organizations engaged in endangered species conservation could benefit from these concepts and criteria. Appraisal of restoration efforts, for instance, would be improved by a willingness to examine both personal and organizational norms as well as the success of particular programmatic elements. As Senge (1990) suggests, organizational learning depends on developing new values and assumptions, new "action rules," new capacities in both cognition and language, and new practices. Many of the supposedly intractable and recurring problems of recovery programs could be overcome by adopting new approaches to learning. The practical benefits in terms of improving efficiency, developing operational process, and saving species would be enormous.

Barriers to Learning

There are inherent limitations on learning both by individuals and groups. These limitations are at play in endangered species conservation as in many other settings. Michael (1995) notes that three barriers to learning may be largely unconscious at the individual level, but nonetheless real. First, sociocultural constraints against learning are part of every human myth system and its "shared set of tacit assumptions" (p. 469). "Our belief that we are independent agents deters us from recognizing how very much our beliefs and behavior, our ways of evaluating persons and events, are shaped by our myths and our habits" (p. 469). Second, emotional factors also weigh against learning. New ways of understanding the world may create uncertainty, risk, threat, a sense of vulnerability, and anxiety. Third, there are cognitive constraints on how our minds perceive, collect, understand, and analyze information, assess its reliability, and comprehend its massive quantities and complexity. "Learning to perceive and to evaluate the 'facts' differently, including experiencing them from the 'rationality' of other interests, and then learning to act differently with regard to them" (p. 473) may be an overwhelming task.

A number of intrinsic limitations on learning have been recognized within organizations, too, particularly bureaucratic ones. Morgan (1986) cites three such barriers. First, organizations impose fragmented structures of thought on their employees and discourage them from thinking for themselves. Organizationally-set goals, structures, roles, and routines sharply define patterns of attention and responsibility for people within the group. Even successful single-loop learning may inhibit asking deeper questions about the organization's underlying assumptions, norms, and learning capabilities (Argyris 1992). Second is the system of bureaucratic accountability that fosters defensiveness. The organization and its employees may make excuses, deflect responsibility, or obscure issues and problems that might make them look bad. This may be manifest as "cover ups," manipulation of images and impressions, or telling superiors or the public what employees think they want to hear. Third is the difference between what people say and what they actually do. Employees "develop espoused theories that effectively prevent them from understanding and dealing with their problems" (Morgan 1986:90). "Groupthink" pressures may reinforce these tendencies (Janis 1972).

Etheredge (1985) identified several barriers to governmental learning (see also Osborne and Gaebler 1993). First, agencies tend to adopt similar policies and programs across all circumstances. Second, decision processes in agencies tend to be closed, relying primarily on information sources that confirm agency tendencies. Third, government agencies commonly demonstrate errors in judgment and perception: they underappreciate valuable data, dismiss outsiders' suggestions, and base judgments on wishful thinking. Fourth, early appointments of people

(Continued on page 22)

("Learning"continued from p. 6)
to important positions tend to determine later outcomes. Fifth, there is a tendency within bureaucracies for no one to accept complete responsibility. Sixth, policy meetings are usually highly ritualized, which reinforces patterns of collective decision making and bypasses "intellectual integrity" (p. 98). Seventh, group decision processes are generally "designed to affect choices rather than to clarify them" (p. 99). Finally, organizational learning is inhibited when decision makers underuse or penalize information from subordinates.

Many of these "self-blocked learning" patterns appear over and over again within organizations, and the same strategies for organized behavior are repeated—despite continuing incongruities between people's expectations of how their actions and decisions will affect matters and the actual outcomes and effects.

Improving Conservation by Improving Learning

The constraints on achieving a more learning-based approach to endangered species conservation are fundamental cultural, biological, and organizational factors. Yet, the necessity of change is widely recognized. To put it simply, we need to learn how to learn explicitly and systematically at all levels—individual, professional, organizational, and policy. A number of suggestions have been put forward to implement and facilitate improved learning and reorientation of our approach to conservation.

Michael (1995:475-484) offers nine recommendations for improving learning in the context of the renewal of ecosystems: (1) "Use the metaphoric power of language." Michael points out that war (and its derivative sports) is a pervasive metaphor used to describe many of our society's activities: "These metaphors tacitly emphasize we/they, before/after, winner/loser, beginning/ending, fixed boundaries in time and space, and relationships that map poorly onto the amorphous information world . . . and onto the fluid ecological environment. . . . [And] it is usually by these metaphors (data never stand alone) that activists and policy makers present their proposals" (p. 476). He suggests building an alternative vocabulary of metaphors that more accurately reflect the realities of "an amorphous, problematic, information-rich world of multiple myths described by such words as reciprocal, resilient, circular, emergent, development, ebb and flow, cultivate, seed, harvest, potential, fittingness, both/and" (p. 477). Such metaphors might come from the fields of biology, ecology, music, storytelling, and learning itself. (2) "Use myth reinforcement to encourage learning." Traditions that esteem learning have long existed within Western culture —science, exploration, art, athletics, "American ingenuity"—and these should be highlighted and strengthened. (3) "Acknowledge uncertainty and embrace errors." Learning requires recognition of many future uncertainties: "When uncertainties in the outcomes of proposed policy and action are acknowledged, perceived risks and vulnerabilities increase. However, options and the opportunities for resilience also increase" (p. 479). (4) "Minimize the learner's sense of vulnerability." Michael notes that learning groups are more successful when they acknowledge that there are other significant issues besides "the facts," including individual fears and "protecting organizational turf or political expediency." (5) "Use facilitators rather than chairpersons." Training in the skills of group facilitation can be extremely beneficial to a group's learning. (6) "Introduce training of group process skills." Special training can also help group members overcome predispositions toward poor listening, interrupting, "withdrawal from active participation, resistance to every suggestion, longwindedness, putting down other participants, and scapegoating" (p. 481). (7) "Provide short-term reinforcements/rewards." To help counteract the inherently long time frames of environmental management, Michael calls for the invention of rituals that regularly recognize and reward learning and acknowledge the many risks taken. (8) "Reinforce the learning mode by becoming educators." Educators at all levels can practice modeling this new kind of learning, including using more appropriate metaphors and thus changing the social context. (9) "Use disasters and crises as learning occasions." Sudden, even violent, disruptions in the world provide a potent and unique opportunity for learning that could be anticipated and capitalized through scenario construction or gaming simulation. These nine can be applied to endangered species recovery, as can the following suggestions.

Other authors have offered useful suggestions for upgrading the learning performance of organizations, although they have not specifically addressed the conservation arena. Morgan (1986:91-95) summarized four general principles: (1) "Encourage and value an openness and reflectivity that accepts error and uncertainty as an inevitable feature of life in complex and changing environments." (2) "Encourage an approach to the analysis and solution of complex problems that recognizes the importance of exploring different viewpoints. . . . This is best facilitated by managerial philosophies that recognize the importance of probing the various dimensions of a situation, and allow constructive conflict and debate between advocates of competing perspectives. In this way issues can be fully explored, and perhaps redefined so that they can be approached and resolved in new ways. The kind of inquiry helps an organization absorb and deal with the uncertainty of its environment rather than trying to avoid or eliminate it." (3) "Avoid imposing structures of action upon organized settings. . . . When goals and objectives have a predetermined character they tend to provide a framework for single-loop learning but discourage double-loop learning. . . . More double-loop learning can be generated by encouraging a 'bottom-up' or participative approach to the planning process." And finally, (4) "Make interventions and create organizational structures and processes that help implement the above principles."

Westrum (1986) provided seven principles for developing "generative" rationality within organizations, i.e., a strategy of creative problem solving: (1) "Encourage system-wide awareness for all members of the system. No one can be expected to help solve the system's problems if they do not understand what those problems are. An empowered periphery must be one aware of overall goals and approaches." (2) "Encourage creative and critical thought for all organization

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members. Although some members of the organization will contribute disproportionately, it is vital to realize that some important ideas may come from unlikely sources." (3) "Link the parts of the system whose work is interdependent. The members of a task system must understand each other's work if they are to co-operate in solving the system's problem—not just their own. It is not enough to identify with the system as a whole. Without seeing integration as an important task, organization members will perform their contributions often in blissful ignorance of what the rest of the organization requires." (4) "Scan the system's parts for relevant solutions or contributions. Use the best solutions regardless of their origins. Every organization should examine the ability of its intratelligence system [what an organization knows about itself] to do this. It may be useful to develop formal exercises to generate alternatives. The fruits of these exercises should be formally transmitted and acknowledged." (5) "Reward communications and activities that show a desire to contribute to the entire system's thought processes. Although today's contribution may not be the answer sought, tomorrow's contribution will never come unless today's is recognized. 'Good try' is always superior to 'No good.'" (6) "Avoid over-structuring. Most of the organization's resources should be used in coping with problems, not in building up the private domains of its leaders. It is a natural tendency for parts of systems to entrench themselves. It is equally certain that resisting this tendency is necessary to maintain generativity." (7) "Examine mistakes honestly. Generative systems characteristically deal with mistakes as system problems rather than as person problems. While genuine negligence should be punished, oversights and inadequacies are human. The important issue is to identify the source of the mistake, not punish the person who made it. The ability of the system to repair its problems is strongly related to the willingness of people in it to open themselves to criticism. This willingness is greatest when criticism is dispassionate and impersonal."

The myriad ideas and approaches covered here can be boiled down to a single notion, best expressed by Morgan (1986:91): "In essence, a new philosophy of management is required, to root the process of organizing in a process of open-ended inquiry. . . . The whole process of learning to learn hinges on an ability to remain open to changes occurring in the environment, and on an ability to challenge operating assumptions in a most fundamental way." Institutions that deal with the conservation of endangered species in America, including the professions, science, government management agencies, and the non-profit sector, are currently not organized this way.

Conclusions

It is widely perceived that current endangered species conservation is not working as expected. Extinction rates are high and accelerating; few endangered species have been returned to healthy, viable populations. ESA reauthorization efforts provide an opportunity to improve conservation significantly at the legislative level. Numerous other practical opportunities for improvement exist at the individual and organizational levels in many field efforts (Clark et al. 1994). Learning is an approach that could be widely applied. Active, explicit, and systematic learning about human systems (organizations, professions, policy making, etc.), as well as endangered species and ecological systems, would ground conservation efforts in realism and enlarge their scope significantly.

In recent years, new responses to biodiversity conservation have come forward. Ecosystem management proposes to conserve biodiversity in large regional biotic systems with protected core areas, buffer zones, and interlinking corridors. This would be accomplished by coordinating management on large spatial and temporal scales based on watersheds and natural biotic communities, thus protecting more species and habitats than previously and, it is hoped, preventing species declines. Comprehensive regional planning has also been suggested as a way to integrate planning and management for wildlife (including endangered species), natural resource use, land use, air and water quality, development, and transportation at local, regional, state, and federal levels (e.g., California Governor Wilson's "Strategic Growth Plan"). These two initiatives to "scale up" conservation efforts contain the seeds of a learning approach at multiple levels, but neither one embodies a fully-recognized focus on learning as a significant tool to improve conservation.

Michael (1995) concludes that "there are two kinds of learning: one for a stable world and one for a world of uncertainty. Learning appropriate for the former world has to do with learning the right answers and learning how to adapt and settle into another mode of being and doing. Learning appropriate for our world has to do with learning what are the useful questions to ask and learning how to keep on learning since the questions keep changing" (p. 484). The future health of the nation and the planet is directly linked to the maintenance of the biotic enterprise on which all human activity ultimately depends. The opportunity for significant improvement in biological conservation exists in the cultivation and expansion of our learning abilities, i.e., in learning how to learn and applying the lessons of our experience.

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Tim Clark is Professor Adjunct at Yale University's School of Forestry and Environmental Studies, and President of the Board at the Northern Rockies Conservation Cooperative, Box 2705, Jackson, WY 83001.

("Atlantic Salmon" continued from p. 4)

cormorant, harbor seal, gray seal, harp seal, and ringed seal.

The Atlantic salmon compete with other fish species for food and habitat and are a source of prey for some predators. Those interactions become more complex as new species are introduced, naturally or artificially, to rivers where they were not historically present and did not co-evolve with Atlantic salmon. Introduced species such as smallmouth bass, chain pickerel and brown trout have been documented to prey upon juvenile Atlantic salmon (Baum et al. 1995). Species assemblages and abundances have also changed in estuaries utilized by Atlantic salmon with the recent increase in populations of striped bass, seals and birds.

Atlantic salmon are susceptible to a number of diseases and parasites that can result in high mortality. Parasites of Atlantic salmon are the gill maggot, freshwater louse, leach, flukes, tapeworms, spiny-headed worms, roundworms, the skin parasite *Gyrodactylus salaris*, sea louse, and sea lamprey. Atlantic salmon are susceptible to numerous bacterial, viral and fungal diseases, including furunculosis, bacterial kidney disease and vibriosis. Disease-related mortality is primarily documented for hatcheries and aquaculture facilities. Disease epizootics in wild salmon are uncommon. In New England, furunculosis is the only known source of disease-related mortality in wild Atlantic salmon.

4) Inadequacy of existing regulatory mechanisms

Management of anadromous fish, such as Atlantic salmon, is a complex issue. There are a variety of demands being placed on the riverine, estuarine and marine habitats utilized by the Atlantic salmon. The challenge is to manage these multiple uses in a way that allows the various needs to be met without compromising the health and natural resources of the river.

Management of Atlantic salmon in the State of Maine is conducted by the Maine Atlantic Sea Run Salmon Commission (ASRSC) which was created in 1947 to focus efforts on recovering stocks of Atlantic salmon in Maine. Over the years the ASRSC has monitored river population studies, evaluated the relative success of stocking methods, and participated in tagging studies. The Atlantic salmon restoration program focuses on sixteen river systems in the state ranging from the Aroostook River in the north to the Saco River in the south. The goals of the ASRSC are to restore river specific stocks of Atlantic salmon through the following means: preserving existing populations and habitat; restocking of fry; reducing removals; and eliminating or minimizing threats. Recently the state of Maine replaced the ASRSC with a new management entity called the Maine Salmon Authority.

In 1990 the Atlantic Sea Run Salmon Commission and the U.S. Fish and Wildlife Service signed a Cooperative Agreement and established a Technical Advisory Committee (TAC). The purpose of the TAC is to advise the ASRSC and the FWS on technical matters related to the Atlantic salmon restoration program in Maine, to review and comment on proposals for cooperative research, and to provide assistance in developing and updating restoration plans.

Many federal and state laws and programs have affected the abundance, health and survival of anadromous Atlantic salmon populations in the United States. However, they have not prevented the decline of the species. The effectiveness of certain existing laws and regulations could be strengthened by more stringent implementation and enforcement. Aquaculture facilities are located within 20 kilometers (km) (12 miles) of the mouths of five of the rivers within the DPS. Atlantic salmon that have been released or that have escaped from aquaculture pens are known to have entered some of these rivers. Released aquaculture Atlantic salmon can impact wild populations through competition, genetic dilution or the introduction of diseases (Kapuscinski and Jacobson 1987; Utter et al. 1993).

5) Other natural or manmade factors affecting the species continued existence

Scientific evidence suggests that

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