

Education, Communication and Outreach (ECO)

Success Stories:

Solving Conservation Problems by Changing Behavior

a report prepared for the

U.S. Fish and Wildlife Service
National Conservation Training Center
Division of Education Outreach

by

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10 June, 2003

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Executive Summary

This study identified and analyzed sixteen “case-study” examples in which education, communication, and outreach (ECO) approaches have influenced human behaviors that affect conservation targets – such as threatened and endangered species, migratory birds, and critical habitats. Nine of these cases involved U.S. Fish and Wildlife Service activities, and seven others involved other agencies or organizations. The origin of this study lies in a request from the U.S. Fish and Wildlife Service Southeast Regional Office for information about how effective education and outreach have been in solving conservation problems. That office was interested in using education and outreach approaches in its manatee conservation program in Florida, but first wanted evidence about how effective such approaches might be in that situation.

Each of the cases reviewed here was selected because: 1) it had an explicit *behavioral objective*, and, 2) information on the human behavior and the status of the conservation target was available both from before and after the education, communication, and outreach interventions, making it possible to demonstrate *measurable results*.

The case studies selected and analyzed here demonstrate clearly, and without a doubt, that ECO interventions can produce measurable changes in actions, choices, and behaviors that threaten wildlife, and thereby improve the status of threatened species and habitats. These cases also show, however, that successfully changing harmful behaviors isn’t simple. Simplistic views of behavior and how to change it – such as the idea that providing information alone will be sufficient – aren’t likely to work. Instead, careful up-front assessment of stakeholders, target audiences, the ecological impact of behavior, and the factors that motivate it are needed. Based on this information, interventions can be designed to affect the relevant factors, with a good probability that harmful behaviors can eventually be controlled.

Analysis of the case studies shows that information, social norms, options, and laws and enforcement are often the most important factors in influencing conservation-relevant behaviors. Information and knowledge is almost never a sufficient factor in changing behavior, but it may be necessary in almost all cases, and in some cases it can be a catalytic factor. Information is needed to enable other factors that influence behavior to work. For example, information about options, skills, economic incentives, and laws and enforcement must reach the appropriate target audiences in order for these factors to influence their behavior. Changing values is never a major factor in influencing specific conservation behaviors, at least in the short term. Behavior can change with no change in values. Positive economic incentives do not seem to be used very much in programs to influence conservation-relevant behaviors, but they seem to be effective in some cases where they have been used. Most successful interventions to change behaviors that harm species or habitats influence two, three, or more of the factors that can influence behaviors. Programs that provide information and knowledge, influence social norms, create options, and also include laws and enforcement can be quite successful at changing behavior, even in complex situations. Finally, it is clear that the need for expensive law enforcement can be reduced by first carrying out activities to provide information, develop options and skills, and to change social norms. These interventions, often cheaper than law enforcement, can reduce the number of “doers” of the behavior that will require enforcement action.

Introduction

Background

The origin of this project lies in a request from the Office of External Affairs, U.S. Fish and Wildlife Service Southeast Regional Office, in Atlanta, Georgia, for information about how education, communication, and outreach have helped the Fish and Wildlife Service solve conservation problems. That office has been working to implement an agreement on manatee conservation in Florida, made in 2001, which resulted from the legal settlement of a lawsuit brought against the Fish and Wildlife Service and the Army Corps of Engineers by the Save the Manatee Club, Defenders of Wildlife, and more than a dozen other conservation and animal protection organizations. The agreement committed the FWS to create new refuges and sanctuaries for manatees in Florida, and to develop and enforce “incidental take” guidelines for this endangered species under the Marine Mammal Protection Act, and it committed the U.S. Army Corps of Engineers to assess the impact on manatees of any new permits for docks and other boating access developments (Save the Manatee Club, 2003a).

A significant part of the “incidental take” of manatees is death caused by being hit by boats. In 2002, 305 manatees died in Florida waters, and 95 of those deaths, or 31%, were caused by watercraft collisions. (Save the Manatee Club, 2003b). The Florida Marine Research Institute of the Florida Fish and Wildlife Conservation Commission has studied the causes of manatee death since 1974, so there is good, long-term data. In the case of watercraft collisions as a cause of death, these data in one sense provide a baseline record of human behavior.

The FWS Southeast Regional Office is interested in incorporating education, communication, and outreach components into their plans for implementing their commitments under this agreement. They requested information about the effectiveness of education and outreach activities from the Chief of the Division of Education Outreach of the Service’s National Conservation Training Center (NCTC), in Shepherdstown, West Virginia.

In 1999, the NCTC’s Division of Education Outreach supported a study to collect examples of the use of education, communication, and outreach throughout the FWS. The study was designed to inform a new National Outreach Strategy that was then under development. Fourteen case studies were analyzed, and the results made available to FWS staff and other natural resource managers worldwide (Ady, et al., 1999; Byers, 2000 – see References section, at end of report, for all citations). That database of case studies continues to be expanded and used in training courses at the NCTC. This “Education and Outreach Case Study Matrix” project now includes approximately 50 case studies, and the analysis presented here draws its cases in part from those.

Objectives

This study identified and analyzed examples in which education, communication, and outreach (ECO) approaches have influenced human behaviors that affect conservation targets such as threatened and endangered species, migratory birds, and critical habitats. The objectives of the study were:

- to draw conclusions and develop recommendations, based on the lessons of these “ECO success stories,” which will help FWS staff incorporate ECO components into their resource management and conservation strategies and plans, and,
- to suggest ways in which ECO components can cost-effectively enhance or substitute for other methods of influencing behaviors, such as law enforcement, area closures, banning certain types of activities, economic incentives and disincentives, and legal disputes.

Methods

In this study, examples of programs and activities that aimed to influence behavior through education, communication, and outreach were identified and analyzed. Published literature, unpublished reports, telephone interviews, and internet-based research were used to find these cases. Cases with relevance to the challenge of manatee conservation in Florida were particularly sought. Sixteen cases were identified, nine from the FWS and seven others:

Fish & Wildlife Service Cases

- Biologists on Mississippi River Barges
- Black Duck Identification
- Bull Trout Identification
- Geese in Alaska
- Grizzly Bear Safety
- Loons and Lead Poisoning
- Mexican Wolf Recovery Program
- Migratory Birds and Oil Field Waste Pits
- Snowy Plovers in California

Non Fish & Wildlife Service Cases

- Abalone in California
- Keeping People on Trails in Mt. Rainier National Park
- Reducing Roadkill
- Scuba Divers and Coral Damage
- Seabirds in Quebec
- Tidepool Conservation in California
- Tourists Feeding Dolphins in Australia

Each of these projects or activities was selected because it met two criteria:

- 1) the project had an explicit **behavioral objective** (or a clearly identifiable, but implicit, behavioral objective), and
- 2) baseline measurements were available from **before** the intervention (in most cases) and were made **after** it, making it possible to look for **measurable results** – in other words, to demonstrate that the intervention worked to change behavior.

In my attempt to identify FWS cases that demonstrated successful behavior change resulting from ECO interventions, I reviewed most of the fifty cases that are now part of the “Education and Outreach Case Study Matrix” project that has been continuing since 1999. Seven of the nine FWS cases summarized here were selected after reviewing many of the fifty cases that have now been collected by the “matrix” project. A surprising finding of that search was that only a small subset of those 50 case studies have a clear behavioral objective, and very few provide the information needed to convincingly demonstrate measurable results. In most cases no information was presented about a “before and after” measurement of what the project was trying to achieve. I could not use such cases in this analysis, because it was not possible to determine if the intervention had “worked” or not.

This surprising finding suggests that, in trying to solve conservation problems through ECO interventions, we could be much more effective if we had clear behavioral goals from the beginning, and if the actions or practices targeted by the intervention were measured before and after the intervention, in order to provide convincing evidence that the intervention was working.

Influencing Conservation Behavior through ECO Interventions

Before examining the specific cases that show how education, communication, and outreach has succeeded in changing behaviors that harm species and damage ecosystems, it is useful to review some of what has already been learned about understanding and influencing behaviors. The ideas and concepts reviewed briefly here can serve as a framework for analyzing the cases that are summarized in the next section of this report.

Involving Stakeholders and Identifying Target Audiences

Effective interventions to influence behavior generally begin with some type of applied social research that identifies *who* has interests in the natural resource or conservation issue in question, and *which* people or groups among them are behaving in ways that affect that situation.

Stakeholders are people or organizations with an interest in the use and management of the biodiversity of a particular place. They include local people who may depend on natural resources for their livelihoods, government agencies, and non-governmental organizations. They can range from local people with a personal, direct interest in a species, place, or natural resources, to members of national-level government agencies with a legal mandate to manage a species, place, or resource. Different stakeholders may have very different views of the threats to biodiversity in a given situation, and very different ideas about acceptable solutions.

The main reason for involving all stakeholders in the design of environmental education, communication, and outreach activities -- from the very beginning of the process -- is that all of the stakeholders are needed to help identify the actions and practices that threaten a particular species or habitat, and to learn about the motivations for those critical behaviors. Involving stakeholders is simply part of good communication.

The appropriate ***target audiences*** for activities that aim to influence behavior are usually one or more subgroups among the stakeholders. Whose behavior is unsustainable or harmful to biodiversity? Why are they doing what they are doing? Do they know that their behavior is damaging to a species or habitat? These and other questions should be answered with the stakeholders -- since, as discussed above, stakeholders may disagree on the answers. Once target behaviors have been agreed upon, identifying the people or groups who engage in that behavior identifies the target audience for activities that aim to change the behavior (Byers, 2000a; Day and Monroe, 2000).

Understanding Factors That Influence Behavior

Before activities designed to influence conservation-relevant behaviors can be developed, an understanding of what motivates a given behavior is needed. A large number of factors can determine, motivate, or influence a particular behavior. A seven-year study by the Biodiversity Support Program (BSP) identified the following factors, for example (Byers, 2000a):

- information and knowledge
- values
- social norms
- sociocultural factors (religious beliefs, taboos, etc.)
- options
- skills
- economic incentives
- laws
- policies
- gender
- resource access or “ownership”

One way of beginning to learn which of these factors are more or less important in a given case is to compare people who do the behavior (“doers”) with those who don’t (“non-doers”). This may reveal differences in knowledge, values, options, skills, wealth, gender, access to resources, and other factors that influence behavior (Byers, 2000a; Day and Monroe, 2000). In Florida, if we know *which* boaters are hitting manatees we might learn more about what is different about those boaters compared to the boaters who aren’t hitting manatees.

Another way to look at these factors is as “benefits” and “barriers.” What are the perceived benefits of the behavior to people who do it? What are the barriers to persuading them to adopt a less harmful behavior? One way to look at ECO interventions is as a way of reducing the benefits of the harmful behavior and/or decreasing the barriers to it among the group of “doers.”

The behavioral motivations and perceived benefits and barriers of a particular behavior depend partly on whether:

- 1) the behavior is done deliberately to harvest or kill a certain species (e.g., shooting reintroduced wolves; harvesting abalone; killing black bears in order to sell their gall bladders in the Chinese medicine market);
- 2) the behavior is targeted at another species but inadvertently hurts the threatened species (e.g., catching bull trout instead of other common trout, shooting black ducks instead of other common ducks, shooting grizzlies instead of black bears); or,
- 3) a behavior done for a non-related purpose inadvertently harms the resource (e.g., hitting deer or other wildlife while driving, hitting manatees while boating, hiking off of designated trails to enjoy the scenery).

Designing and Implementing Activities to Influence Motivations

Once the key factors that motivate a particular behavior have been identified, activities to influence those motivations can be designed (Byers, 2000a; Day and Monroe, 2000). For example, if the people doing something that threatens biodiversity do not know that the behavior is damaging or unsustainable, providing information may be enough to change the behavior. Knowledge and awareness are relatively simple to address through education and communication programs – but these will only be effective if lack of awareness and knowledge is the critical barrier to the adoption of new, biodiversity-friendly practices.

Often, however, the lack of information and knowledge is not the reason that people do things that threaten biodiversity (Jacobson, 1997; McKenzie-Mohr and Smith, 1999). For example, people may know that a behavior threatens biodiversity but do not care; they may lack viable options and alternatives that do not damage it; or they may lack the skills or means to take advantage of options that do exist. Once the key factors that motivate or determine environmentally-damaging behaviors have been identified, activities to influence those motivations can be designed.

For example, Orams and Hill (1998) propose that there are three types of “management responses” to try to reduce “ecotourism impacts” – essentially, the behaviors of tourists which have a negative impact on the species or places they are visiting:

- 1) Education strategies “are those that seek to inform tourists and encourage them to voluntarily control their behavior so that it is appropriate to the environment.”
- 2) Physical responses “are actions that seek to control tourists’ behavior by physically separating them or restricting their movement within the natural environment.”
- 3) Regulatory responses “are rules and regulations that seek to control tourists’ behavior through threats of punishment for noncompliance.”

Case Study Summaries

For each of the cases summarized below, a standard format has been used in reporting the information for ease in comparing the cases. Information given is:

- Topic or Situation
- Region and Division (for FWS cases)
- Length of Intervention
- Contact or Source
- Goal
- Techniques
- Measurable Results
- Comments

In the comments on each case, I point out which of the *main factors* that influence or motivate the behavior in question have been targeted by the intervention in that case. These factors – such as information, values, social norms, options, skills, economic incentives, and laws and enforcement – were discussed in the previous section.

FWS Cases

Biologists on Mississippi River Barges

Region and Division: Region 3, Fisheries and Habitat Conservation/Ecological Services Division

Length of intervention: 1990 to present, and continuing

Contact or Source: Robert Clevestine, Rock Island (IL) Field Office, Tel: 309-793-5800; Ady, *et al.*, 1999

Goal: To change a number of behaviors of barge operators that harm endangered species and ecological resources: for example, to stop tying barges up to trees on the banks of islands (which are public lands) in the Mississippi River, either while awaiting passage through locks, or awaiting loading, unloading, or cleaning; to avoid dropping anchor on mussel beds and submerged plant beds; and to slow down in backwater areas.

Techniques: FWS biologists rode with tow barge operators (1990-1995) to learn about the problems they faced. This led to a program to provide alternatives to tying to trees on islands, such as mooring buoys and other anchoring options. These alternative anchoring areas can be sited away from mussel beds and other critical habitats.

Measurable Results: No statistical data collected before interventions, and so far only a couple of places where mooring buoys have been established, so there hasn't been enough time yet to see whether the behavior is changing (Clevestine, personal communication).

Comments: The most important intervention in this case was to provide *options*; secondary intervention was to provide *information*.

Black Duck Identification

Region and Division: Multiple and international

Length of Intervention: 1990 to present, and continuing

Contact or Source: Jerry R. Longcore, USGS, Tel: (207) 581-2874; Black Duck Joint Venture <<http://www.pwrc.usgs.gov/bdjv/bdjvlist.htm>>

Goal: To reduce the harvest of the threatened black duck by hunters so that populations of this species have a better chance of increasing to levels that the current habitat can support.

Techniques: To place legal restrictions on the take of black ducks by hunters to allow the population to rebound; to provide information to hunters to help them identify ducks in flight so that they don't shoot black ducks by mistake. Duck identification information is available on the internet from a number of sources (USGS, 1992; Environment Canada, 2003; Remington, 2003). "Hunters can contribute to their own sport by not firing at those species that are either protected or scarce, and needed as breeders to restore the flocks. It can add to their daily limit, when extra birds of certain species can be taken legally, hunters who know their ducks on the wing come out ahead." (Environment Canada, 2003).

Measurable Results: Research has shown that "Between the periods 1967-1982 and 1983-1995... the long-term decline of the black duck population was related to excessive harvest. Recent more stringent hunting regulations in the United States and Canada seem to have caused a decline in the retrieved harvest [of black ducks], and perhaps not coincidentally, the Midwinter Survey for black ducks in North America and for the Atlantic Flyway has stabilized." [<http://biology.usgs.gov/s+t/SNT/noframe/ne123.htm>]

Comments: Main intervention here is to change *skills* by providing information; *laws and enforcement* provided motivation to hunters to learn duck identification skills.

Bull Trout Identification

Region and Division: Region 6, Fisheries and Habitat Conservation Division

Length of Intervention: 1993 to present, and continuing

Contact or Source: Wade Fredenberg, Tel: (406) 758-6872; Ady, et al., 1999.

Goal: The goal of this intervention was to give anglers the information they need to distinguish endangered bull trout from other trout species so that they can choose to release that species. Bull trout are legally protected, but look similar to other trout species to uninformed anglers. In some streams with heavy fishing pressure and a diversity of trout species, misidentification is thought to be a significant cause of bull trout mortality. In some places, large bull trout are deliberately harvested, illegally, during the spawning season; another goal was to change this practice.

Techniques: Bull trout "awareness" materials, including T-shirts, posters, fish identification cards for distribution with fishing licenses, and fish identification displays for high-volume fishing license agents; web-based information including a training program and test for testing skill at identifying "virtual" trout [<http://www.fwp.state.mt.us/bulltroutid/default.htm>] Enforcement activities were used in cases of deliberate illegal harvest in addition to the awareness and information campaign.

Measurable Results: In fact, surveys showed almost no increase in the percentage of anglers who could distinguish bull trout before and after the awareness campaign, but there has been no controlled experiment done to test this carefully. The anecdotal feeling among FWS staff is that the awareness campaign is holding the fish identification skill-level steady, whereas without the campaign it would have declined for other reasons.

Comments: The main technique in this case is to impart or improve *skills* by providing information. Some older anglers don't like bull trout because they think they harm other trout species, and so changing *values* and *social norms* related to deliberate killing of bull trout is also important.

Geese in Alaska

Region and Division: Region 7, Refuges, Migratory Birds

Length of Intervention: 1985-1988

Contact or Source: Ady, Janet C. 1989. Teach about geese: Environmental education responds to a conservation issue in Alaska. *Proceedings of the Annual Conference of the North American Association for Environmental Education*, pp. 111-115.

Blanchard, Kathleen. 1987. Strategies for the Conservation of Seabirds on Quebec's North Shore and Geese on Alaska's Yukon-Kuskokwim Delta: A Comparison. *Transactions of the 52nd North American Wildlife and Natural Resources Conference*, pp. 108-117.

Pomerantz, Gerri A., and Kathleen A. Blanchard. 1992. Successful Communication and Education Strategies for Wildlife Conservation. *Transactions of the 57nd North American Wildlife and Natural Resources Conference*, pp. 156-163.

Goal: To increase compliance with new regulations in the Yukon-Kuskokwim Delta Goose Management Plan (YKDGMP), about goose hunting by subsistence Yup'ik Eskimo hunters, especially of threatened goose species with declining populations.

Techniques: Informational materials were developed, including: a 30-page booklet outlining the plan and regulations; poster describing restrictions on goose hunting; children's comic book about goose conservation; school poster contest; wall calendar featuring art from poster contest winners; teaching materials for classroom teachers; teacher workshops. Project also trained bilingual, Alaska native residents as "Refuge Information Technicians," to bridge the communication gap between local people and refuge managers.

Measurable Results: "Few violations of the YKDGMP were reported in 1985 and 1986 nesting seasons with respect to egg gathering, hunting during the nesting season, and the driving of flightless birds." (Blanchard, 1987, p. 403)

Comments: Main technique was to influence *values* and *social norms* of adults by providing information, mainly through their school-age children.

Grizzly Bear Safety

Region and Division: Region 6, Law Enforcement and International Affairs

Length of intervention: 1998 to present, and continuing

Contact: Dominic Domenici, FWS; Tim Eicher, FWS

Goal: To reduce the number of grizzly bears killed by people, especially hunters, in "self defense."

Techniques: Main intervention was a training program for hunting guides and outfitters about how to behave safely in grizzly country. Information provided in the training included, for example, how to tell grizzlies from black bears, how to set up a bear-safe camp, and how to use pepper spray to deter a bear attack.

Measurable Results: "Self-defense" killings by hunters and guides decreased from an average of 7-9 per year before 1998, when the training course was first offered, to an average of 4-5 since 1998 (i.e., for the past 5 hunting seasons). Law enforcement investigations of self-defense killings of grizzlies seldom find that the guides and hunters were completely ignorant about how

to camp safely in grizzly country, and were doing everything wrong, as was often the case before the training began. Now the incidents more often seem to be the result of the behavior of particular bears, rather than the bad behavior of the hunters. Finally, since the classes began in 1998, only one of the trained guides has killed a grizzly in self defense; all of the other killings (now 4-5 per year) have been by **untrained** guides or hunters. (About one-third of the outfitters and guides operating in Wyoming each year have been trained.)

Comments: The main intervention involved changing **options** and **skills** through provision of relevant information.

This case really shows a trade-off between “ECO” interventions and law enforcement – when a grizzly is killed by a hunter or guide, because it is an endangered species the case has to be investigated to decide whether to prosecute or not – and it takes a lot of law enforcement resources to do the research on the case. This training program seems to have significantly reduced such incidents, so it seems to be a clear savings in time and money. It is therefore very relevant to the Florida manatee case, where there is a question about how to apportion funds for ECO interventions and for law enforcement.

For a related case, see information on the Montana Fish, Wildlife & Parks Department’s black and grizzly bear identification program, on the internet at <<http://www.fwp.state.mt.us>> In Wyoming, according to Dominic Domenici, about 3 grizzlies a year are killed by black bear hunters who mistakenly identify them as black bears. These cases also trigger law enforcement investigations.

Loons and Lead Poisoning

Region and Division: Region 5, Migratory Bird Management

Length of intervention: 1989 to present, continuing

Contact: Drew Major, FWS, Tel: (603) 223-2541; New Hampshire Fish and Game Department, 2003; Loon Preservation Committee, 2003; Harry Vogel, Director, Loon Preservation Committee, Tel: (603) 476-5666

Goal: to convince fishermen to stop using lead sinkers and jigs and switch to “non-toxic tackle” because: “a cooperative effort funded in part by the Service’s New England Field Office (NEFO) has been underway to research threats to the common loon. Study results have consistently revealed that the number one cause of death of New England’s adult loons is lead poisoning from the ingestion of lead sinkers and jigs.”

Techniques: an informational brochure was distributed with fishing licenses in New Hampshire; media stories, e.g. newspaper articles and radio reports; “tackle exchange program” – non-toxic tackle distributed at “angling events”; legislation to ban lead tackle (took effect in NH in 2000; in Maine in 2002)

Measurable Results: In New Hampshire, despite the fact that a law banning lead tackle on lakes and ponds (loon habitats) has been in effect for three years, there has not been a statistically significant reduction in loon deaths from lead poisoning. According to the Loon Preservation Committee (Vogel, personal communication), before the lead tackle ban 56 percent of loon deaths could be attributed to lead; now, three years after the ban, about 53 percent are due to lead.

Comments: Main technique was to provide **options**; second was to influence behavioral choices through providing **information**; third was to limit harmful options through **laws**. However, a legal loophole in New Hampshire allows the sale of lead tackle for use on streams and rivers, and there is no effective enforcement of the ban on its use in lakes. Fishermen must still be using lots

of lead tackle in loon habitats, either because they don't know, don't care, or don't take advantage of options.

Mexican Wolf Recovery Program

Region and Division: Region 2, Endangered Species

Length of intervention: 1998 – 2003

Contact: Brian Kelly, Mexican Wolf Recovery Leader, P.O. Box 1306
Albuquerque, NM 87103-1306. Tel: 505-248-6656, Brian_T_Kelly@fws.gov

Goal: To get ranchers and hunters to stop killing wolves (of 54 reintroduced to the wild in 1998, 6 were shot the first year).

Techniques: In this case the interventions involved improving communication between local residents and the FWS; an economic compensation plan (run by Defenders of Wildlife); and the development of “wolf-friendly” certified beef, to add an economic incentive for local ranchers to tolerate wolves.

Measurable Results: About 75 wolves have now been released, and in last 4 years about 7-9 more have been shot. Although statistical tests might not show a difference with such a small sample, it seems pretty clear that a rate of 6/54 shooting deaths in year 1 is higher than 7-9/75 in last 4 years. This suggests that the outreach program for the Mexican wolf is starting to increase the “tolerance level” of local ranchers for wolves (Brian Kelly, personal communication, 6/4/03).

Comments: Main intervention here was to provide positive *economic incentives* for tolerating wolves; second was *laws and enforcement*, with their negative economic incentives (i.e., fines). This is a very sophisticated effort, a great case to study, and nearly unique in having positive economic incentives for changing the behavior.

Oil Field Waste Pits and Migratory Birds

Region and Division: Region 6; Migratory Bird Management

Length of intervention: 1995 +; continuing, and has expanded to Region 2

Contact: Gary Mowad, a FWS “Special Agent”

Goal: To get small oil producers to obey federal and state laws which require all oil to be removed from waste water put into pits in oil fields.

Techniques: To provide information to increase level of voluntary compliance in order to minimize the need for law enforcement responses through an outreach program that would educate oil producers about the problem—and give them a chance to correct the problem voluntarily. By getting the majority of producers to respond voluntarily, FWS personnel could concentrate their efforts on what they referred to as the “slow learners.” They worked with the American Petroleum Institute and the Interstate Oil and Gas Compact Commission (IGCC) as they developed the outreach program. Gary Mowad, the FWS Special Agent, noted that oil industry representatives were supportive and agreed with FWS assessments and program concepts privately, but tended to distance themselves from government agencies in public. Technical options are possible in this case. Small companies often cannot afford the process to separate the water and oil, and even a thin layer of oil on top of wastewater creates a death trap for migratory birds and other wildlife. A number of straightforward and simple solutions exist to prevent wildlife mortalities at these facilities, including installing nets to keep birds and animals out of the pits. In order to better focus enforcement on the producers who really couldn't be persuaded to voluntarily follow the law, the sequence of intervention involved first providing information about legal requirements and options for solutions; a period of time to allow

voluntary compliance; then inspection and warnings to non-compliant producers; then another time lag; and finally, enforcement with fines to the non-compliers.

Measurable Results: In most cases, it only took information, not legal action, to get companies to change their practices. In Colorado, the oil industry responded dramatically to the problem. “When we started our surveys in Colorado during the summer of 1995, 77 percent of the pits were either completely or partially covered with oil and posed a threat to migratory birds,” he said. By the end of that year, the number was down to 10 percent. A similar, but less dramatic response was seen in Wyoming.

Comments: Providing ***information*** about the law and technical ***options*** for compliance; influencing ***values*** and ***social norms*** through information; and ***laws and enforcement*** are all involved here. In Florida, the FWS could work with boater organizations and the boating industry to develop an outreach program for boaters, and on the development of options for reducing manatee collisions.

Snowy Plovers in California

Region and Division: Region 1, Endangered Species

Length of Intervention: 1994 to present, and continuing

Contact or Source: Steve Henry, FWS Ventura Office (805) 644-1766; Lompoc Online, 2002; Vandenberg AFB, 2002; Coal Oil Point Reserve, 2003; Lafferty, 2001a; Lafferty, 2001b.

Goal: To reduce disturbances to the nests of western Snowy Plovers on California beaches.

About 200 of these threatened shorebirds nest on beaches at Vandenberg Air Force Base, and about the same number winter in the same areas. The beaches also support a variety of recreational activities, such as surfing, fishing, swimming, picnicking, horseback riding, jogging, beach combing, sunbathing, and birdwatching. Base officials and the Fish and Wildlife Service (FWS) have developed a management plan aimed at minimizing the disturbance to plover nesting from these recreational. At Coal Oil Point Reserve, plovers had stopped breeding in the early 1970s due to human disturbance, and numbers of wintering birds were declining to very low numbers. In 1999, FWS biologists concluded that recreational use of the beach was leading to a “take” (i.e., harm, harassment, loss) of western Snowy Plovers that was illegal under the Endangered Species Act (Coal Oil Point Reserve, 2003).

Techniques: At Vandenberg AFB interventions to try to reduce human disturbance to wintering and nesting plovers began in 1994 and involved: 1) seasonal, well-enforced beach closures during the seven-month nesting season from March 1 to September 30; and, 2) informing the beach users about plovers and about rules for minimizing disturbance to nests through informational signs and public contact by volunteer beach “docents.” At Coal Oil Point Reserve a management plan for reducing disturbance to plovers while allowing recreational access and use of the beach was implemented in 2001, and involved: 1) educational signs and informational displays about Snowy Plovers at beach entrances; 2) volunteer docents on the beach talking to beach users, and inviting plover observation through spotting scopes; 3) “symbolic fencing” -- using posts and rope -- of a core plover area to close it to people and dogs; 4) closure of a beach-access trail that went through the middle of the plover roosting area; and, 5) consistent enforcement of the dog leash law through cooperation with UC Santa Barbara campus police.

Measurable Results: At Vandenberg AFB, the number of violations of the closed beach areas has dropped every year. Hatching rates of snowy plovers increased from 41 percent in 1996 to 59 percent in 2001. Nest numbers increased from 140 in 2000 to 182 in 2001, and the estimated adult population increased from 107 in 2000 to 135 in 2001.

At Coal Oil Point Reserve, Snowy Plovers stopped breeding in the early 1970s due to increasing levels of human disturbance, but continued to use it as a winter roosting and feeding area. In 2001 only 7 percent of dogs on beach were leashed; in 2002, after one year of education and outreach, 90 percent were leashed. Monitoring of people and plovers showed that informational signs and displays increased awareness of plovers, but disturbance did not decrease until “symbolic fencing” was erected. In 2002, one year after reducing human disturbance to core plover area of beach, plovers began nesting again after three decades, and fledged 14 chicks.

Comments: This case involved attempting to influence *values* and *social norms* through *information*; providing non-harmful *options*, in the form of closed core areas for plovers and leash rules for dogs (Coal Oil Point Reserve) that allow recreational use while minimizing plover disturbance, and *laws and enforcement* to minimize beach use during the nesting season.

Non-FWS Cases

Abalone in California

Length of intervention: unknown, but continuing

Contact or Source: Burd, Erik. 1997. "Comparing red abalone populations on the Sonoma County, California coast." <<http://erikburd.org/projects/abalone/>>

Goal: Stop illegal harvest of abalone. Reduce mortality of undersized abalone that are pried off by divers – to measure? – but mortally wounded in the process.

Techniques: "Currently, a combination of volunteer divers called SCAN (Sonoma County Abalone Network), aggressive law enforcement and prosecution of abalone poachers have been helping to preserve the abalone population." (Burd, 1997)

Measurable Results: There is a statistically significant difference in abalone abundance between a reserve where no abalone harvesting is permitted and a comparable area where abalone harvesting is permitted under the legal guidelines of the state of California.

Comments: Main technique used in this case – and it was quite effective -- is ***laws and enforcement.***

Dolphin Feeding in Australia

Length of Intervention: 1992 - 1994

Contact or Source: Orams, Mark B., and Greg J.E. Hill. 1998. *Journal of Environmental Education*, Vol. 29, No. 3: pp. 33-38.

Goal: to improve compliance with behavioral guidelines for dolphin protection in tourists who were allowed to feed wild dolphins by hand

Techniques: 1) information on whales and dolphins provided through a number of media (posters, displays, videotapes, books) in a tourist education center, which any tourist wanting to feed dolphins was required to visit; 2) information on procedures and rules for feeding dolphins presented in a mandatory briefing presentation just before the feeding session; and, 3) a public address system that allowed staff to talk to both feeders and observers during the feeding sessions.

Measurable Results: This was a quantitative study of "inappropriate behavior," defined as behavior that didn't comply with the management's rules for dolphin feeding, which were developed to protect the health and the natural behavior of dolphins. Behavior was monitored before and after a structured education program had been implemented.

The structured education program resulted in [statistically] significant reductions in "noncompliant behavior" for each of 3 behavioral indicators that were measured:

- number of touches of dolphins – reduced from 6.73 per 100 feeding events to 1.17 per 100 feeding events (an 83% reduction)
- warnings by staff over the public address system to certain tourists that they were violating rules – reduced from 2.62 warnings per 100 feeding events to 1.23 warnings per 100 feeding events (a 53% reduction)
- "other inappropriate behaviors" (e.g., photography, wearing large or sharp hand jewelry, letting children under 8 years old feed dolphins, swimming)

"The study supports the claim that education is an important strategy when compliance with management regulations is necessary to protect wildlife in ecotourism settings." (Orams and Hill, 1998)

Comments: The main factors in the success of this program in changing behavior are ***information*** and ***social norms***; ***laws and enforcement*** also play a less-strong but important role. “Despite the widespread advocacy for education as a solution to minimizing ecotourists’ impacts on the natural environment, few empirical tests of the effectiveness of education programs in controlling tourists’ behavior have been conducted. If rules against touching were enforced, or if staff warnings were going to become enforced, education would reduce need for enforcement actions by somewhere between 50% and 80%. In New Zealand it has been said related to dolphin ecotourism, that “Although some on-water enforcement will always be possible, in view of the large, diverse and unorganized nature of the target audience, public education is probably the only practicable compliance option for the Department to adopt.” (Orams and Hill, 1998).

Keeping People on Trails in Mt. Rainier National Park

Length of Intervention: 1986 – 1992

Contact or Source: Rochefort, Regina M. and Stephen T. Gibbons. 1992. Mending the Meadow: High-Altitude Meadow Restoration in Mount Rainier National Park. *Restoration & Management*, Vol. 10, No. 2, Winter 1992.

Goal: To keep people from walking off of trails in fragile meadow habitat at Paradise, near timberline on Mount Rainier, Mount Rainier National Park.

Techniques: Field tests were first conducted using 7 different sign texts, 2 kinds of barriers, and the presence of a uniformed park ranger to deter off-trail hiking.

Measurable Results: The most effective sign was one threatening fines for off-trail hiking: “Off-trail hikers may be fined.” 1.7 % of hikers passing this sign later left trail, compared to 4.9 % of hikers who passed the old sign (text message not given in article). This enforcement threat, the most effective text message on signs, reduced off-trail use by 75 % compared to previous sign. The second most effective message reduced off-trail hiking by 52 %. “One of the most interesting findings of the study was that ‘the mere presence of a uniformed person reduces off-trail use to a negligible level. This result is both interesting and disappointing because it suggests that most visitors did know that they were supposed to stay on maintained trails [so, at least, the informational signs had worked], but chose to walk off-trail.” Consequently, “meadow roves by uniformed personnel have also been increased, with rangers emphasizing education rather than law enforcement.”

Comments: The main factors involved in this experimental intervention are a combination of ***social norms***, ***enforcement***, and some effect of ***information***.

This case shows the use and importance of applied research to understand which factors influence a behavior and to profile the “doers” and “non-doers.” “Development of protection and prevention methods included a sociological study designed to provide a profile of ‘non-compliers’ (off-trail hikers) and an assessment of the effectiveness of signs and barriers currently in use in the Paradise area.” (Rochefort and Gibbons, 1992)

Reducing Roadkill

Length of Intervention: 2-year experimental study of effective techniques

Contact or Source: Danielson and Hubbard, 1998 (report available at <http://www.iastate.edu/~codi/Deer/litreview2.htm>)

Goal: To reduce deer-vehicle collisions in the state of Iowa by determining the best techniques for preventing this behavior.

Techniques: “The proposed project will evaluate the effectiveness of a combination of fencing, remote -sensing motion detectors (e.g., infra-red or microwave), and flashing warning signs triggered by the animals themselves to alert motorists to deer in the right-of-way. Although deer-proof fencing has been shown to be effective in preventing accidents, it is prohibitively expensive. However, fencing may not need to be so elaborate (and thus expensive) if the goal is to direct deer to specified crossing locations rather than simply prevent them from crossing the road. We propose to warn motorists of deer at these crossings. However, it is well known that motorists tend to ignore static deer warning signs, such as those signs currently in use. We propose to overcome this problem by equipping these crossings with detectors that would trigger active warning signs only when deer are present. Further, our analyses of the deer-vehicle accident database coupled with Geographic Information Systems (GIS) technology maps of the Iowa landscapes will allow us to identify specific stretches of roadway where habitat features are conducive to this approach.”

“A public information & education program will be created utilizing the brochure, news releases, and public service announcements (PSAs). Information will include likely locations for accidents, avoidance strategies, research results and recommendations, and additional "deer-accident awareness" activities. Based on interest and research results, the DVAR project may produce a videotape highlighting the project's activities and results, system implementation and accident avoidance procedures.” <<http://www.iastate.edu/~codi/Deer/proposal2.htm>>

Measurable Results: None from the Iowa State project yet. See literature review at <<http://www.iastate.edu/~codi/Deer/litreview2.htm>> for a review of past results (Danielson and Hubbard, 1998). Despite a very high economic and health cost of deer-vehicle collisions in the U.S., research is not yet really sufficient to determine the most effective ways of reducing them. “Regardless of the reasons for deer-vehicle collisions, determining methods for reducing those accidents is important to the public and state and federal transportation agencies throughout the country. Animal-vehicle collisions amount to a significant annual monetary total, however, the relative effectiveness and cost of different deterrent methods is poorly understood. Published literature on methods used to reduce deer-vehicle collisions is limited, and most of that literature is in non-peer reviewed state agency publications. Techniques selected to reduce animal-vehicle collision are often arbitrary, without any follow-up analysis of their effectiveness. Romin and Bissonette (1996) stated that of the various techniques used in attempts to reduce deer-vehicle collisions, "few rigorous evaluations regarding the effectiveness of these techniques exist; yet they continue to be used. In most cases, evaluation of success were based on opinion, hardly a solid foundation upon which to base successful remedial management actions." Putman (1997) indicated that selection of appropriate measures for reducing deer-vehicle collisions is dependent on understanding the actual pattern of those accidents. "Without such biological understanding, we cannot really determine where preventative measures should be concentrated, or suggest, a

priori, which of a variety of deterrent options is likely to be most effective in given circumstances.” (Danielson and Hubbard, 1998)

“Signs that warn motorists of high deer-crossing probabilities are the most common approach to reducing deer-vehicle collisions. Romin and Bissonette (1996) suggested that deer crossing signs may be effective if drivers' would reduce their vehicle speed. However, deer crossing signs may not be useful in the long term because warning signs are common for long stretches of road and drivers become complacent unless the warning on the sign is reinforced by actual experience. In Colorado, mule deer-vehicle accidents were not affected by signs. When motorists were shown that a danger existed, they exhibited a greater response than if they were merely warned of danger by a deer-crossing sign. They evaluated this assumption by placing three dead deer carcasses on the highway shoulder, next to a deer-crossing sign. Vehicle speed was reduced by 7.85 mph after passing the carcasses.” (Danielson and Hubbard, 1998)

Comments: Main techniques likely will involve technical or physical *options* that minimize deer-car collisions, probably by influencing the behavior of both animals and drivers. Some behavior change may come about through more effective provision of *information* (such as warning signs which flash only when deer are present).

Scuba Divers and Coral Damage

Length of Intervention: 8-week experimental period

Contact or Source: Medio, D., R.F.G. Ormand, and M. Pearson. 1997. Effect of briefings on rates of damage to corals by scuba divers. *Biological Conservation*: Vol. 79: pp. 91-95.

Goal: To stop “incidental damage to corals” by divers, which is becoming an increasingly significant environmental impact on coral reefs frequented by recreational divers. “Damage due to divers is now the main cause of coral mortality at the most heavily used dive sites” at the Ras Mohammed National Park on the Red Sea in Egypt. p.91

Techniques: This was a quantitative study of the rate of touching of corals by divers before and after an “ecological briefing,” which covered various aspects of coral biology, and the impacts of divers in protected areas, supported by sketches and photographs. Measurable Results: “A single environmental awareness briefing reduced the rate of divers contact with reef substrates from 1.4 to 0.4 contacts per diver per 7 minute observation period.” (a reduction of 71%) – reduction in damaging behavior is highly statistically significant. p. 91 “Given this conclusion, it is encouraging to confirm that diver behaviour may be influenced by the use of educational tools.”

Comments: The success of this intervention comes mainly from providing *information*.

Seabirds in Quebec

Length of Intervention: 1978 - 1989

Contact or Source: Blanchard, Kathleen A. 1994. Culture and seabird conservation: the north shore of the Gulf of St Lawrence, Canada. *Birdlife Conservation Series*, no. 1, pp. 294-310.
Blanchard, Kathleen A., and Martha C. Monroe. 1990. Culture and Conservation: Strategies for Reversing Population Declines in Seabirds. *Endangered Species UPDATE*, Vol. 7, No. 3 & 4, pp. 1-5.
Blanchard, 1987; Pomerantz and Blanchard, 1992. (see Goose Conservation in Alaska, FWS cases, above)

Goal: To change the behaviors of rural people regarding illegal harvest of nesting seabirds and their eggs nesting in sanctuaries along the north shore of the Gulf of St Lawrence.

Techniques: summer youth conservation programs; school presentations; informational materials (seabird poster on identification, biology and laws; slide-tape program; “citizen’s guide” on Seabird Conservation, in English and French; newsletter for elementary school children; children’s wildlife art calendar in 1989); study tours to local sanctuaries; Canadian Broadcasting Corporation documentary film.

Measurable Results: Initial surveys conducted in 1981-82 showed widespread practice of, and acceptance of, seabird harvesting (eggs, chicks, and adult birds); approximately 70% of the population participated in illegal harvesting, 95% of heads of households considered it acceptable to harvest seabirds for food. A survey in 1988, after the program had been working with local communities for about ten years, showed significant changes in knowledge, values, behaviors (Blanchard and Monroe, 1990), and recovery of the populations of birds themselves. Statistically significant increases in the percentage of people who knew that Atlantic puffins, razorbills, and common murres were legally-protected species occurred, although these changes were not dramatic – for example, in 1981 62 percent knew that razorbills were protected, and 70 percent knew in 1988. More dramatic were self-reported changes in values: about 54 percent of respondents said hunting puffins should be legal in 1981, but by 1988 the percentage had dropped to 27 percent. Self-reported behavior changed dramatically as well. In 1981, 76 percent of families harvested seabirds and eggs, but by 1988 this had decreased to 48 percent. Economic development seemed to be correlated with this behavioral change. Before the project, 51 percent of respondents said they needed birds for food, and 14 percent said they needed seabird eggs for food; by 1988 only 29 percent said they needed birds for food, and 8 percent said they needed eggs. Populations of most of the threatened seabirds nesting on sanctuary islands roughly doubled during the ten or so years in which the program was working to change the behaviors that threatened these birds, a clear measure of success.

Comments: Changes in behavior resulted from changes in several factors that influence them: ***social norms, economic incentives, information, and values.***

This case shows that community behavior really can be changed in a significant way, but it shows how long and multifaceted a commitment it takes to create such change in behavior. In this case, there was a change from a situation where the ***majority*** of the community accepted and practiced harmful behaviors, which were ***deliberate*** and which had an economic significance. It should be ***much easier*** to influence the community of Florida boaters regarding manatees! Summer “manatee camps” or youth conservation programs might be developed, parallel to what was done in Quebec.

Tidepool Conservation in California

Length of Intervention: 10-week research period in summer of 1969

Contact or Source: Chan, Gordon L. 1972. Effects of visitors on a marine environment.

Goal: To change the behavior of biology students and teachers visiting a marine intertidal area (Duxbury Reef, Marin County, CA) so that they did not collect and remove so many organisms for classroom dissections and study collections. This behavior was shown through research to pose a serious, unsustainable threat to the biodiversity of this intertidal ecosystem.

Techniques: Informational handouts, signs, talks, and guided tours provided for all reef visitors.

Measurable Results: 11,000 organisms collected during the control period; less than 1,000 (actually 894) during the informational campaign period – clearly a very striking change in behavior due (primarily) to information, and maybe a bit to social norms (i.e., the presence of the campaign staff on the reef).

Comments: Main technique here was to provide *information*, but *social norms* probably also contributed to the success of the intervention.

Preliminary research developed a profile of “resource users” – what kinds of different people visited the reef at low tide, for what purposes. This was a good way of characterizing the potential “target audiences” for informational messages aimed at influencing behavior and causing behavior change.

This is an excellent study, actually a controlled experiment, in which numbers of animals collected was monitored for a 5-week control period before the information/education campaign, and then behavior was monitored throughout the 5-week period when information was being provided. The study could also have benefited from a “post-campaign” monitoring period to determine whether informational signs would still be effective when campaign personnel were not present.) The study showed that the behavior of school groups changed more than behavior of general public, who were often collecting edible organisms for food.

“This study clearly demonstrated that marine conservation education does reduce the intensity of collecting.” (Chan, 1972)

Conclusions

Lessons from this Analysis

Comparative analysis of the sixteen cases summarized above can be carried out with the help of the table on the next page. The following conclusions emerge from this analysis:

- Information, social norms, options, and laws and enforcement are the most common and often the most important factors in influencing most kinds of conservation behaviors.
- Information and knowledge is almost never a sufficient factor in changing behavior, although it may be necessary in almost all cases.
- Information and knowledge is seldom the major factor in changing behavior, but in certain cases it can be a catalytic factor (see Tidepool Conservation (TC) and Scuba Divers and Coral Damage (SD) cases, for examples).
- Information and knowledge is needed to enable other factors to work; in other words, information about options, skills, economic incentives, and laws and enforcement must reach the appropriate target audiences if these factors are to influence their behavior. The information needed is not biological information in these cases, however.
- Changing values is never a major factor in influencing specific conservation behaviors, at least in the short term. Behavior can change with no change in values.
- Positive economic incentives do not seem to be used very much in trying to influence specific conservation behaviors, but do seem to be effective in certain cases (see Mexican Wolf Recovery Program (MW) and Seabirds in Quebec cases).
- Most successful interventions to change behaviors that harm species or habitats change two, three, or even more of the most critical factors that can influence behaviors. For example, combinations of information, social norms, options, and law enforcement can be quite successful at changing behavior, even in complex situations (see for example: Geese in Alaska (GA), Mexican Wolf Recovery (MW), Seabirds in Quebec (SQ), Grizzly Bear Safety (GB), Loons and Lead Poisoning (LL), Oil Waste Pits and Migratory Birds (OP), and Snowy Plovers in California (SP)).
- The need for expensive law enforcement can be reduced by carrying out cheaper interventions first (for example, providing information, options, and skills, and changing social norms). These cheaper interventions can reduce the number of “doers” of the behavior that will require enforcement action (see for example: Mexican Wolf Recovery (MW), Grizzly Bear Safety (GB), Oil Waste Pits and Migratory Birds (OP)).
- It is not necessarily always easier to influence a harmful conservation behavior when it is inadvertent than when it is deliberate.

Factors motivating behavior and/or affecting behavior change	Cases															
	Deliberate harm, harmed species is target of behavior					Inadvertent harm, another species is target			Inadvertent harm, behavior has unrelated target							
	GA	MW	AB	SQ	TC	BD	BT	GB	MB	LL	OP	SP	MT	RR	SD	DF
Information, knowledge, awareness	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Values	X			X			X				x	x	x			
Social Norms	X	X		X	X		X				X	X	X			X
Options								X	X	X	X	X		X		
Skills						X	X	X								
Economic Incentives (esp. positive)		X		X												
Laws and Enforcement (incl. fines = negative economic incentives)	X	X	X	x			X	X		X	X	X	x			X

Importance of Factor:

X = Major/Most Important; X = Important/Moderately Important; x = minor factor, but plays a role

Letter Codes for Cases Used in Table

Deliberate Harm

GA – Geese in Alaska
 MW – Mexican Wolf
 AB – Abalone in California
 SQ – Seabirds in Quebec
 TC – Tidepool Conservation

Inadvertent Harm A

BD – Black Duck Identification
 BT – Bull Trout Identification
 GB – Grizzly Bear Safety

Inadvertent Harm B

MB – Mississippi Barges
 LL – Loons and Lead
 OP – Oil Waste Pits
 SP – Snowy Plovers
 MT – Meadow Trails
 RR – Reducing Roadkill
 SD – Scuba Divers & Coral Damage
 DF – Dolphin Feeding in Australia

The case studies selected and analyzed here demonstrate clearly, and without a doubt, that ECO interventions can produce measurable changes in actions, choices, and behaviors that threaten wildlife, and thereby improve the status of threatened species and habitats. These cases also show, however, that successfully changing harmful behaviors isn't simple. Simplistic views of behavior and how to change it – such as the idea that providing information alone will be sufficient – aren't likely to work. Instead, careful up-front assessment of stakeholders, target audiences, the ecological impact of behavior, and the factors that motivate it are needed. Based on this information, interventions can be designed to affect the relevant factors, with a good probability that harmful behaviors can eventually be controlled.

Applying the Lessons in New Situations

These conclusions can be used as a guide to develop recommendations for any particular problem faced by the FWS or other conservation stakeholders in situations where human actions, behaviors, or choices are a threat to species or habitats. They could be used in the case of manatees in Florida, for example. In any specific situation, the first step – before trying to use these generic “lessons” or conclusions about ECO interventions that work – is to carefully assess the situation. This case-specific assessment requires the basic steps discussed in the second section of this report, including:

- Involving Stakeholders and Identifying Target Audiences
- Understanding Factors That Influence Behavior
- Designing and Implementing Activities to Influence Motivations

Acknowledgements

Many people have made this study possible, and deserve thanks for making it possible. Christine Eustis, of the External Affairs Office, FWS Southeast Region, initiated the study with her request for help in understanding how education, communication, and outreach might help her office meet its responsibilities to protect manatees in Florida. Janet Ady, Chief of the Division of Education Outreach at the FWS National Conservation Training Center understood the importance of that request, and the need to pull together some example of “ECO success stories” to help FWS staff across the country be more effective in their work. In tracking down personal contacts, case studies, and published literature I was assisted by FWS staffmembers Heather Johnson-Schulz, Barry Stieglitz, and Ann Roy. Susan Jacobson, Holly Johnson, and Martha Monroe helped me find the best current thinking about changing environmental behavior among academic researchers. I learned the details of specific FWS cases from Janet Butler, Bob Clevestine, Dominic Domenici, Wade Fredenberg, Steve Henry, and Brian Kelly. Harry Vogel of the Loon Preservation Committee told me about loons and lead. To one and all, my sincere thanks. Any errors of fact or interpretation found here are my own, of course. I hope that this report can help FWS and other conservation practitioners engage and motivate people to conserve our precious wild heritage.

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