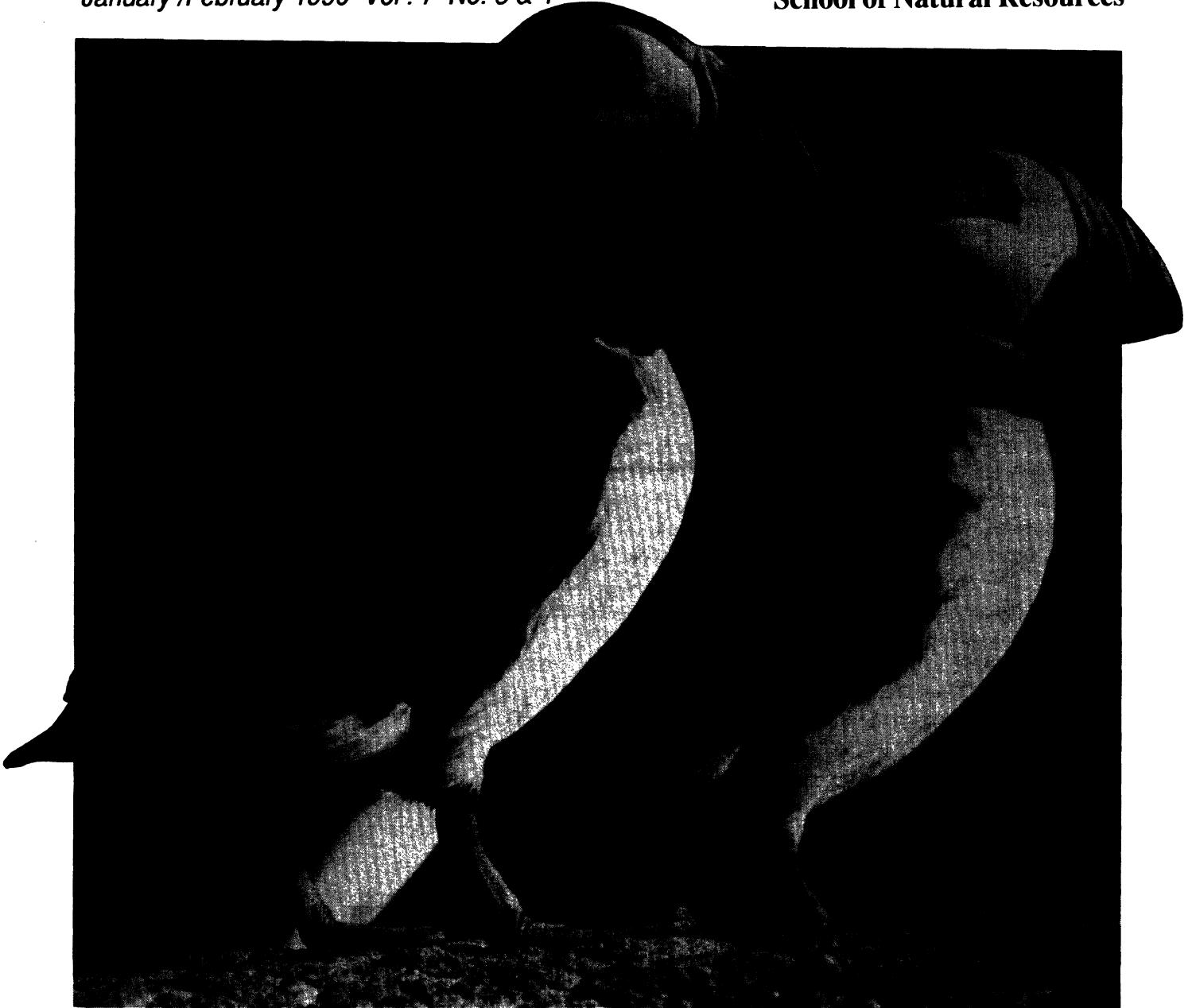


# Endangered Species UPDATE

*Including a Reprint of the latest USFWS  
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School of Natural Resources



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# Culture and Conservation: Strategies For Reversing Population Declines In Seabirds

by

Kathleen A. Blanchard and Martha C. Monroe

Many biologists would agree that environmental conservation should pay much closer attention to the socio-cultural context, and that the preservation of biocultural diversity — linking goals of biological and cultural conservation — should be an integral component of the agenda for the 1990s. Fortunately, the goals of both biological and cultural conservation need not be in conflict, even in cases where traditional practices have led to overharvest of wildlife populations and the depletion of resources. By examining the root causes of the overharvest, wildlife managers can avoid the common mistake of treating the problem's symptoms through enforcement, a short-term solution at best. This can be achieved by paying closer attention to the socio-cultural context, and by building in a high degree of local participation.

The following case study involving seabirds of the remote North Shore of the Gulf of St. Lawrence illustrates how depleted wildlife populations may be restored while maintaining the integrity of local culture. The emphasis is on educational strategies that lead to behavior change — a method whose effectiveness is highly debated among sociologists and psychologists. The difference is that this project stresses education which respects and utilizes socio-cultural patterns, and results in local participation in the ongoing management and education process.

## PROBLEM DEFINITION

Populations of seabirds nesting in sanctuaries along the North Shore of the Gulf of St. Lawrence experienced dramatic declines during the period 1955-1978, including an 84 percent decline among razorbill (*Alca torda*), and 76 percent decline for Atlantic puffin (*Fratercula arctica*) (Chapdelaine 1980, Blanchard 1987). Decreases also occurred among common eider (*Somateria mollissima*), common murre

(*Uria aalge*), and black guillemot (*Cepphus grylle*) (Chapdelaine 1980, Chapdelaine et al. 1986). Reasons for the declines centered around an illegal harvest of birds and eggs by residents, and deteriorating conditions in the sanctuaries, as reviewed by Blanchard (1984, 1987).

A face-to-face survey of 140 Lower North Shore heads-of-households conducted in 1981-1982 found abundant lack of local knowledge regarding wildlife laws and regulations, a universal utilitarian perspective on wildlife, and high incidence of nongame and out-of-season hunting. The harvest in 1981-1982 included eggs, young, or adults of all nesting alcids and larids. Results showed that 95 percent of heads-of-households considered it acceptable to harvest seabirds for food, and that approximately 70 percent participated in illegal harvest. Antecedent to the harvest was a semi-subsistence lifestyle in which seabirds and their eggs comprised an important food source for residents (Blanchard 1984).

Obstacles to better control of the hunting factor included aspects of geography, local tradition and group norms, lack of local incentives, and the changing economy. The Lower North Shore comprises 400 kilometers of coast, where no road links all fifteen villages to the outside world. Seasonal subsistence activities — wood gathering, berry picking, bird harvesting — supplement the market economy where approximately 50 percent of the work force is employed in cod fishing. Electricity, introduced in the early 1960s, impacted subsistence activities by allowing residents to store meat in freezers throughout winter. Residents still value wild birds and eggs as sources of fresh food; they value the preparation and consumption of a meal of birds as an important tradition. But the rapidly evolving economy, with its emphasis on unemployment insurance, enables

residents to acquire cash for fuel and ammunition, plus free time to engage in recreational hunting. Wildlife regulations are often disregarded, while behavior is tempered by group norms and personal ethics.

## METHODOLOGY

With backing from the Canadian Wildlife Service (CWS), the nonprofit Quebec-Labrador Foundation (QLF) responded to the problem by launching the Marine Bird Conservation Project beginning in 1978. The project's goal is to help restore depleted wildlife populations by reducing the threat of illegal harvest in a manner sensitive to the local culture. The objectives presumed that a lasting reduction in illegal harvest depended on more than police power restrictions and an information-based education program. The objectives were to do the following: (1) teach practical seabird biology and conservation principles; (2) encourage the development of a conservation ethic; (3) train residents to take an active role in conservation; and (4) build local support for wildlife policies and regulations (Blanchard 1987). Cognizant of the potentially antagonistic message the programs would carry, concepts known to conflict with social patterns and ethics were introduced in a low-key manner involving local leadership.

## Youth Programs

The cornerstone strategy was a four-day, experiential, youth conservation program at the St. Mary's Islands Seabird Sanctuary, 23 kilometers from the village of Harrington Harbour. Using a former lightstation as classroom and dormitory, the program provided hands-on instruction in seabird biology, sanctuary etiquette, and wildlife law to youth from families experienced in bird or egg harvest. The curriculum emphasized biological and human factors affecting breeding success in seabirds.

Participants took field trips twice daily to the seabird colonies and interacted with student instructors, visiting wardens, and biologists. Lesson plans utilized local dialect and norms. Participants returned to their families with increased knowledge and greater concern about seabirds. The program received universal acclaim among families and schools, cooperation from local businesses, and support from Canadian foundations.

Beginning in 1983, summer youth programs started in five villages for children who were unable to travel to the St. Mary's Islands. These conservation clubs, such as the "Hawkeyes," were led by university students and local teenagers hired under federal employment grants. The programs received widespread parental support.

In one village, where local attitudes toward conservation were most hostile, project staff produced a play for children in which the actors, who in real life were the sons and daughters of local poachers, played the major roles of seabirds. By practicing their lines at home, these children taught their parents about the biology and conservation of seabirds, and won their support for the project following performances in their village and neighboring communities.

From 1985 to 1988, project staff made presentations in schools of every village. The presentations focused around a specially produced slide-tape program, a seabird workbook, and a poster and poem contest about seabirds. The contest culminated in a final judging by representatives of five Canadian conservation organizations and the production of a 1989 calendar of children's wildlife art.

### Leadership Training

Between 1983 and 1989, more than 40 local volunteer and paid staff were trained in field research, teaching, species identification, and community work. Many local students returned to work for several summers; a few entered careers in conservation. One teenager described his experience as "life changing." There is universal parental support for the obvious contribution to student employment.

Leadership support was provided to

well-respected members of Harrington Harbour, who in 1984 organized the first coast-wide society for wildlife conservation and cultural preservation. The QLF provided technical assistance and a major grant towards the refurbishing of an historic building, using local labor, as the society's headquarters. Presently, QLF and CWS are working with the local wildlife society to assume co-ownership of one of the St. Mary's lightstation buildings. This action is perceived locally and abroad as a commitment to a shared responsibility for the well-being of the sanctuary. Restoration of the building is in progress, with help from Transport Canada, CWS, foundation support to QLF, and local skilled labor. The mutual goal for the facility is to maintain it as a research, education, and conservation laboratory. It will be managed locally as a facility for researchers, university students, wardens, and local youth. Supplemental income will be derived from a limited tourism operation.

### Education Materials

The use of posters, pamphlets, signs, and other printed materials to introduce wildlife concepts and regulations was given lower priority in an effort to emphasize a more personal, empathetic, and interactive style of education. The average educational level among heads-of-households along the Lower North Shore was grade seven (Blanchard 1984); communication was largely by spoken word. Therefore, printed materials were introduced gradually, in a low-key manner, and distributed door-to-door, in schools, and in community stores. They were produced using colloquial names for birds, abundant illustrations and cartoons, and recognizable place names. The materials included: (1) a seabird poster on identification, biology, and laws protecting nongame species; (2) a slide-tape program utilizing local scenes, persons, and customs; (3) a citizen's guide, "Seabird Conservation: It's Up to Us," with forewords by leaders from English and French communities; (4) a newsletter for elementary schoolchildren; and (5) a 1989 calendar of children's wildlife art and poetry. All materials were well-received locally and outside the region.

## Endangered Species UPDATE

*A forum for information exchange on endangered species issues*

January/February 1990  
Vol. 7 No. 3&4

Suzanne Jones.....Editor  
Dr. Terry Root.....Faculty Advisor

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Readers include a broad range of professionals in both scientific and policy fields. Articles should be written in an easily understandable style for a knowledgeable audience. Manuscripts should be 10-12 double spaced typed pages. For further information please contact Suzanne Jones at the number listed below.

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### Cover:

Atlantic puffins (*Fratercula artica*)

Photo by Henry Harding, QLF/Atlantic Center for the Environment

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## Broadening Support for Conservation

Study tours to local sanctuaries were conducted in 1983, 1984, and 1987, in order to stimulate local interest in deriving income from tourism, heighten perceived value of the resource, and broaden responsibility for the sustainability of the resource and long-term maintenance of local culture. Representatives of several Canadian conservation organizations were selected for the thematic tours, which focused on the anniversaries of visits by John James Audubon and Jacques Cartier and the establishment of wildlife sanctuaries in Canada. Homestays in a remote village and public forums on the seabird issue were vital components of the tours. The tours generated new income for conservation, inspired local action, heightened the perceived value of seabirds, and fostered alliances between local and regional conservation organizations.

Table 1. Population changes of seabirds nesting in sanctuaries of the Quebec North Shore (Chapelaine and Brousseau, in press).

	1977	1988
Common murre	10,200	26,000
Razorbill	3,600	7,000
Atlantic puffin	15,200	35,100
Common eider	3,000	8,500
Common & Artic tern ( <i>Sternus</i> sp.)	1,500	2,000

In cooperation with QLF, the Canadian Broadcasting Corporation produced documentary film and radio programs which helped broaden the support nationwide. In the 1987 film "Home of the Birds" (The Nature of Things production), and a 1989 nine-part documentary radio series, coastal residents played the leading roles. The productions documented important local norms and concerns, plus triggered interest among politicians, conservationists, and the general public in conservation on the coast.

Since 1978, QLF staff have delivered more than 100 presentations about the project to universities, colleges, conservation organizations, and schools in North America and abroad, in an effort to promote the importance

of local involvement in wildlife conservation. These lectures have generated a constant influx of top-notch university students as instructors and researchers on the project. Students' character, enthusiasm, and empathy towards local people are important ingredients to the project's effectiveness.

## RESULTS

Results of the Marine Bird Conservation Project are measured in terms of changes between 1978 and 1989 in the following: (1) population levels for seabirds nesting in sanctuaries; (2) knowledge, attitudes, and hunting behavior of residents; (3) management policy by CWS; and (4) local involvement in conservation.

### Changes in Populations of Nesting Seabirds

As reported by CWS, between 1977 and 1988, increases occurred in all families of birds nesting in sanctuaries of the Quebec North Shore. Most notable of the increases occurred among the alcids. (See Table 1.)

Populations of seabirds nesting in sanctuaries on the North Shore of the Gulf of St. Lawrence have been surveyed on a five-year basis since 1925. The current upswing in population levels for most species is a significant change from the serious declines experienced between 1955 and 1978.

### Changes in Local Knowledge, Attitudes, and Hunting Behavior

Results of a follow-up survey of heads-of-households conducted by QLF in 1988 showed several significant changes in local knowledge of wildlife law, attitudes toward hunting and regulations, and level of harvest of birds and eggs. Table 2 shows the significant changes in percentages of heads-of-households which correctly stated the legal status of seabird species. The vast majority of respondents in both years knew the legal status for common eider.

The percentage of respondents

Table 2. Changes in knowledge of wildlife law: Percentages of heads-of-households correctly stating the legal status of seabirds.

	1981	1988	p	X <sup>2</sup>
Atlantic puffin	70.7	76.5	0.0	16.0
Razorbill	62.1	70.3	0.0	22.9
Common murre	47.1	64.1	0.0	26.3
Herring gull ( <i>Larus argentatus</i> )	78.6	79.3	0.009	9.35

which believed it is "okay" to take seabirds and eggs for food dropped significantly from 95.0 in 1981, to 89.6 in 1988 ( $p=0.039$ ,  $X^2=6.5$ ). The percentage of respondents which believed that it should be legal to hunt puffin dropped significantly from 54.3 in 1981, to 26.9 in 1988 ( $p=0.0$ ,  $X^2=22.22$ ); the percentage which believed it should be legal to hunt razorbill dropped from 58.5 in 1981, to 37.9 in 1988 ( $p=0.002$ ,  $X^2=12.53$ ); and the percentage which believed it should be legal to hunt common murre dropped from 76.4 in 1981, to 64.8 in 1988 ( $p=0.038$ ,  $X^2=6.56$ ). There were no significant changes in the percentages which believed that it should be legal to hunt common eider (91.4 in 1981, 91.0 in 1988,  $p=0.276$ ,  $X^2=2.57$ ), or herring gull (46.4 in 1981, 33.1 in 1988,  $p=0.051$ ,  $X^2=7.75$ ).

Despite the continued belief that birds should be harvested, individuals' behavioral intention changed dramatically. The mean response to the question, "What percent of families in your village harvest seabirds and eggs?" dropped significantly from 76.27 percent in 1981, to 48.02 percent in 1988 ( $p=.0001$ ,  $t=7.19$ ). The average number of birds reported as needed per year by families dropped from 43.98 in 1981, to 23.58 in 1988 ( $p=.0078$ ,  $t=2.68$ ). The percentage which claimed their families needed birds for food declined from 51.4 in 1981, to 28.9 in 1988 ( $p=0.0$ ,  $X^2=27.2$ ); the percentage which claimed they needed wild eggs dropped from 14.2 in 1981, to 7.6 in 1988 ( $p=0.0$ ,  $X^2=19.8$ ).

There were few changes in demographic variables for respondents to the 1988 versus 1981 surveys. The mean number of years residence on the coast was 44.6 in 1988, 44.1 in 1981. There was a mean of 3.8 occupants per house-

(Continued on UPDATE page 4)

hold in 1988, 4.8 in 1981. There were about ten percent fewer fishermen drawn in the 1988 sample (n=140).

### **Changes in Management Policy**

Changes in CWS management policy between 1978 and 1989, with respect to seabird populations of the Quebec North Shore, showed increased funding, greater number of enforcement officers, and increased cooperation with other federal and provincial agencies. The number of federal migratory bird wardens increased from one in 1986, to six seasonal wardens or assistants beginning in 1987. There was strong collaboration with the Canadian Parks Service in patrolling two sanctuaries. There was increased funding for research into the productivity levels for some species. Conservation education programs by QLF were given greater support. There was meaningful collaboration with local residents. These changes reflect a return to the comprehensive management philosophy of Harrison Lewis, first head of the CWS, which characterized the period 1925 to 1955, and recognition of the important role of education and local involvement in restoring wildlife populations.

### **Greater Public Involvement**

Membership in the local wildlife society has grown since its incorporation in 1984. Approximately six local teenagers apply for summer jobs in conservation each year. During the past five years, the local demand for the St. Mary's Island youth program has roughly doubled. Membership in the youth conservation clubs has grown. Citizens of Harrington Harbour are helping to protect the buildings at St. Mary's Island. There is increased interest in the seabird resource for tourism development. Increasing numbers of citizens are outspoken about conservation on radio and television.

### **DISCUSSION**

Why did the knowledge, attitudes, and behavior of residents change, especially in the face of research that indicates education programs do little to change attitudes and behavior? There are many models which specify the variables that account for behavior, but few models reliably predict behavior

changes after manipulation of the variables (Fishbein 1967, Hines et al. 1986-87, DeYoung 1985-86). Several key variables include the following: (1) knowledge of the problem (i.e. why a change should be considered); (2) knowledge of what to do (i.e. how the change should be implemented); (3) attitudes specific to the behavior and consonant with the change; (4) feelings of competence and confidence in one's ability to implement the change, and the sense that one's new behavior will make a difference in the problem; (5) intrinsic motivations, such as compliance with social norms that support the new behavior, or internal satisfactions such as frugality; (6) modeling of the new behavior, as by community leadership; and (7) extrinsic motivations, such as fines, punishments or other incentives for immediate changes.

Most education programs only provide information in an attempt to change attitudes without regard for social norms, group leaders, communication channels, intrinsic motivations, etc. Actually, most education programs try to reach such a diverse audience that these elements are rarely identified, known, or manipulable.

On the Lower North Shore, some of the same factors that created a difficult environment for enforcement to operate effectively were conducive to producing a successful educational program. These factors include aspects of geography, local tradition, group norms, lack of short-term extrinsic incentives, and the lack of reactance-inducing enforcement. The relative isolation of the small villages meant there was little competition for extra-curricular activities for youth, and they were eager to try new programs. The local tradition strongly supported killing only as many birds as were needed so the populations would not be decimated. Several community leaders were deeply concerned about the current status of the bird populations, and as Katz and Lazarsfeld (1955) would suggest, this type of influence in small communities is critical. Most heads of households shared their concern: 71 percent were either somewhat or very concerned about the future number of seabirds along the coast (Blanchard 1984).

One of the most serious limitations of extrinsic incentive-based efforts to change behavior is that they have regularly failed to produce durable, long-term change in behavior (Katzev and Pardini 1987-88). Furthermore, heavy-handed enforcement, a form of strong extrinsic motivation, is not just unlikely to produce durable change. It is also likely to trigger reactance which induces behavior in the opposite direction: people devise means for getting around the imposed rules (Brehm 1966, Brehm and Brehm 1981). On the Lower North Shore, this could be seen in the form of night raids to the seabird colonies for eggs. Durable behavior change requires the use of other techniques such as social commitment (Katzev and Johnson 1987), intrinsic behavior (DeYoung 1985-86, DeYoung and Kaplan 1985-86), and supporting attitudes (Heberlein 1981).

In addition, other opportunities for producing a successful educational program existed. For 25 years, the founder of QLF served as minister, floatplane pilot, and leader in social service programs for residents. He was accepted as an integral member of the local communities. Because the average village population consisted of 350 long-term residents, new ideas were quickly disseminated through well-worn communication channels to a large percentage of community residents.

In this case, the communities along the Lower North Shore were small, cohesive units, the group leaders were easily identified, and the social norms that supported the behavior change could be identified and enhanced. Because the educational program did not begin with the faceless force of authority, but rather was introduced by a known and respected leader and implemented by students and local youth, it was initially accepted. Although the youth programs directly worked with youngsters, several elements of the programs were designed to involve families and other adults. Not wanting to be left out of a new community ethic, many adults, no doubt, were quite interested in learning along with their children. Neither did the educational programs attempt to change behavior unilaterally. Rather, the youth programs

were one element of a campaign designed to enable community leaders to influence other adults through community meetings, local art and music events, television and radio programs, and employment opportunities.

Another difference between this program and others may be that stopping a behavior (e.g., poaching), and substituting a behavior (e.g., another form of recreation), are different from beginning a new one. The image of beginning a new behavior may connote helplessness or uncertainty if participants perceive the behavior to be difficult or out-of-the-ordinary. If substitutes are available, however, ending an existing behavior requires that the individual and/or community justify and support the change.

Results of the harvest/attitude survey suggest that the educational programs did not convince participants that it is wrong to kill birds. Rather the programs took advantage of the double-edged hunting tradition that also taught that it is wrong to take more than one needs. With modern transportation and food storage, the need to harvest birds declined, but it took the educational programs to make evident this change, and the conflict between tradition and behavior. Information about bird population biology that reached and was accepted by the entire community helped change the social norm away from approval of widespread seabird harvest. Note that the data report a change in the harvesting behavior of "others in my village." This indicates that the respondents are aware of others' behavior. Such knowledge is likely to have an effect on their own behavior.

Results also suggest that residents are better informed about regulations and understand the rationale behind them. However, the basic norm still remains: it is acceptable to harvest birds for an occasional meal, especially if they are needed as food. The large drop in the percentage of respondents which believe it should be legal to hunt puffins may be partly explained by the increasing aesthetic value residents place on that species. A larger percentage still believe that it should be legal to hunt murre, probably because there is a season on murre for residents of

nearby Newfoundland and Labrador.

Chapdelaine and Brousseau (in press) cite other possible explanations for changes in the populations of nesting seabirds: immigration among common eider, and changes in the supply of prey fish. Nonetheless, these factors do not detract from the obvious impact of controlling the hunting factor.

## CONCLUSION

Educational programs along the Quebec Lower North Shore were part of a campaign to motivate the public to conserve their seabird populations, and were complemented by an increased enforcement presence by the CWS. Although many of the programs targeted youth, the educational message reinforced the traditional conservation practice. This practice and concern was voiced by respected community leaders, whose efforts to mobilize the local wildlife society reinforced the educational programs. Youth employment opportunities and study tours voice the same message, while supporting the local economy and helping the villagers take pride in their wildlife resource.

The increase in police power enforcement probably had significant impact on the control of illegal harvest during the period 1978-1989. However, the introduction of extrinsic motivation without regard to other factors such as communication channels, group leaders, social norms, and intrinsic motivation, can be expected to fail either by producing reactance or a "quick-fix" that lasts only as long as the incentive. In this case, knowledge, attitudes, and behaviors of residents changed with respect to harvesting seabirds. The educational programs were part of the intervention that seemed to make the difference. But this campaign to change knowledge, attitudes, and behaviors was integrally woven into the web of the local culture, such that the success of the program cannot belong to the information effort alone.

## ACKNOWLEDGEMENTS

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cation and concern of the people of the coast.

[Note: This article is adapted from: "Effective educational strategies for reversing population declines in seabirds." 55th N. Amer. Wildlife and Natural Resources Conference (in press) 1990.]

## LITERATURE CITED

- Blanchard, K.A. 1984. Seabird harvest and the importance of education in seabird management on the North Shore of the Gulf of St. Lawrence. Ph.D. thesis. Cornell University, Ithaca, NY, 242pp.
- Blanchard, K.A. 1987. Strategies for the conservation of seabirds on Quebec's North Shore and geese on Alaska's Yukon-Kuskokwim Delta: a comparison. Trans. N. Amer. Wildl. and Natur. Resour. Conf. 52: 399-407.
- Brehm, J.W. 1966. A theory of psychological reactance. Academic Press, New York, 135pp.
- Brehm, J. and J.W. Brehm. 1981. Psychological reactance: a theory of freedom and control. Academic Press, New York, 432pp.
- Chapdelaine, G. 1980. Onzieme inventaire et analyse des fluctuations des populations d'oiseaux marins dans les refuges de la Cote-Nord du Golfe Saint-Laurent. Can. Field-Nat. 94: 34-42.
- Chapdelaine, G., P. Dupuis, and A. Reed. 1986. Distribution, abundance et fluctuation des populations d'eider a duvet dans l'estuaire et le Golfe du Saint-Laurent. In A. Reed, ed., Eider Ducks in Canada. Canadian Wildlife Report Series No. 47, 177pp.
- Chapdelaine, G. and P. Brousseau. In press. Thirteenth census of seabird populations in the sanctuaries of the North Shore of the Gulf of St. Lawrence. Can. Field-Nat.
- DeYoung. 1985-86. Encouraging environmentally appropriate behavior: the role of intrinsic motivation. J. of Env. Systems. 15: 281-292.
- DeYoung and Kaplan. 1985-86. Conservation behavior and the structure of satisfactions. J. of Env. Systems. 15: 233-242.
- Fishbein, M. 1967. Attitude and the prediction of behavior. Pages 477-492 in M. Fishbein, ed., Readings in attitude theory and measurement. John Wiley, New York, 499pp.
- Hines, J., H.R. Hungerford, and A. Tomera. 1986-87. Analysis and synthesis of research on responsible environmental behavior: A meta-analysis. J. of Env. Education. 18: 1-8.
- Katz, E. and P.F. Lazarsfeld. 1955. Personal influence: The part played by people in the flow of mass communications. The Free Press, New York, 400pp.
- Katzev, R.D. and T.R. Johnson. 1987. Promoting energy conservation: An analysis of behavioral research. Westview Press, Boulder, CO, 218pp.
- Katzev, R.D. and A. Pardini. 1987-88. The comparative effectiveness of reward and commitment approaches in motivating community recycling. J. of Env. Systems. 17: 93-113.
- Heberlein, T. 1981. Environmental attitudes. Zeitschrift fur Umweltpolitik. Feb: 241-270.
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# Technical Notes

## A Control Strategy for Invasive Species

By Stuart B. Weiss and Dennis D. Murphy

Invasions of introduced species are among the most immediate biological threats to the integrity of nature reserves. Indeed, increasing attention in conservation biology is being directed at the control and eradication of ecologically disruptive plant and animal species. The U.S. National Park Service recognizes biological invasions as the single greatest threat to the biological integrity of park lands, and many endangered species are threatened either directly or indirectly by the impacts of invasive species on key resources. Despite the immediacy of these problems, signs of communication between those addressing theory, processes, and consequences of species invasions, and those implementing control measures in the field, remain few. (See for contrast, Drake et al. 1989. *Biological Invasions*. John Wiley and Sons., and articles in *Restoration and Management Notes*.)

With limited availability of "magic bullets," such as voracious species-specific herbivores or virulent diseases, most control programs rely on expensive and labor-intensive mechanical, chemical, and manual treatments. In the face of financial constraints, strategies need to be developed to maximize the biological effectiveness of control programs. To that end, we offer what might be viewed as a first rule for invasive species control.

The priority for effective control of an invasive species must be to limit its spread into new habitat areas. The spatial distribution of an invasive species generally consists of two demographic elements: a large central focus (or foci) where the species is well-established and may even dominate an ecological community; and nascent, or satellite, foci where the species is moving into habitats otherwise dominated by native species. Managers must decide whether central or nascent satellite

foci should receive top priority in a control program.

This crucial question has been addressed in an important recent paper that deserves the attention of biologists and field managers (M.E. Moody and R.N. Mack. 1988. *Jour. Appl. Ecol.* 25: 1009-1021.). Moody and Mack use a simple simulation model that demonstrates the value of immediate control of satellite foci, as opposed to central foci. They show that spreading satellite foci can rapidly become more extensive than central foci, and they convincingly argue that initial resources will almost always be best applied in the eradication of satellite foci while they are still limited in extent. This control strategy appears to be applicable to organisms that exhibit a wide range of life histories; while the paper deals with plant invasions, the principles also appear to be applicable to animal invasions.

In practice, we suggest that control strategies should follow a priority ranking scheme for local infestations that is based on the short-term goal of protecting extant native habitat with a minimum level of effort. This goal nearly automatically leads to the assignment of high priority to small satellite foci far from the main infestation. Not only does this strategy remove the immediate threats of invasive species to native habitats, but it also services areas most likely to be revegetated naturally by native vegetation. Where control retreatments are necessary, then eradication of satellite foci is favored to an even greater extent. Only when all satellite foci have received treatment should select portions of central foci be treated, again, according to a priority scheme that directs maximum initial effort at containment around edges. A key "political" consideration in this treatment strategy is that realistic expectations be maintained — complete eradication of invasive species over

short time periods is generally not feasible.

This consideration runs counter to practice common in eradication and control programs, wherein large central foci tend to be primary points of attack. Expensive and spectacular assaults on main foci may provide short-term satisfaction by offering visually dramatic results. But the reality is that initial efforts are rarely followed by appropriate secondary treatments. In plant invasions, weeds reestablish from seedbanks and resprouting stumps, and native vegetation rarely reestablishes in treated areas. Meanwhile, satellite foci mature, spread, build seedbanks, and become increasingly difficult to eradicate.

With biological invasions threatening virtually every protected area and many endangered species, we can ill afford to waste time, effort, and money on biologically ineffective control programs that allow the continued spread of invaders. Standard measurements of "cost-effectiveness," such as costs/acre treated, need to be reassessed in light of the relative importance of central versus nascent satellite foci. Both theoretical models and empirical examples suggest that eradication of small satellite infestations when they are still small is a crucial first step in virtually all control programs.

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### Publication Schedule for the UPDATE:

*Because the UPDATE follows the publication schedule of the Endangered Species Technical Bulletin, irregularity of our monthly distribution is at times unavoidable. Because our goal is to provide the most current information on the federal endangered species program, we publish and distribute the UPDATE as soon as possible after reprint materials are received.*

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# Bulletin Board

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## Rare Plant Guides

The recently published *Threatened Plants of New Zealand*, now provides the most up-to-date record of threatened plant species in New Zealand—a country where one out of every ten native plant species is under threat of extinction in the wild. This comprehensive guide provides precise botanical descriptions and color photos of over 95 species that are most at risk. The authors also suggest conservation strategies for New Zealand's flora, and present a code of conduct for treatment of rare plants in the wild. Copies are available for \$39.95 from: The Bookshop, DSIR Publishing, PO Box 9741, Wellington, NEW ZEALAND; (04) 858-939.

Also available is *Rare Plants of Colorado*, by The Colorado Native Plant Society. This 75 page volume describes 92 rare and endangered plants, many not listed for protection under the federal Endangered Species Act. Each species description is accompanied by a color photograph or line drawing, a county location map, a habitat description, and information about geology, hydrology, associated plant communities, and history. The book is available for \$7.95 from: Rocky Mountain Nature Assn., Rocky Mt. National Park, Estes Park, CO 80517; (303) 586-2371.

## Endangered Species Symposium

A reminder that a symposium on the Restoration and Recovery of Endangered Species will be held this April 30-May 2, in Chicago, as part of the Second Annual Conference of the Society for Ecological Restoration. Topics to be addressed include: endangered species recovery and restoration planning guidelines and policy issues; genetic, demographic, and ecological factors affecting the maintenance of genetic diversity; and research and monitoring. For more information, contact: Marlin Bowles, The Morton Arboretum, Rt. 53, Lisle, IL 60532; (708) 719-2422. CA 95616; (916) 757-8777.

## Natural Areas/Yosemite Centennial Symposium

A global issues symposium, "Natural Areas and Yosemite: Prospects for the Future," will be held October 13-19, 1990, in Yosemite National Park and the Conference Center in Concord, California. Natural area managers, scientists, journalists, environmentalists, business and government representatives, and students are all invited to submit abstracts for presentation. Oral presentations should be limited to 25 minutes and focus on one of the follow-

ing areas: natural areas protection and management; natural and cultural resources research and management; landscape preservation; environmental interpretation and education; art and literature in natural areas; conservation of genetic and biological diversity; and other global issues. Abstracts must be submitted by April 15, 1990, to: Coordinator, NA/Yosemite Symposium, GGNRA, Fort Mason Bldg. 201, San Francisco, CA 94123; (415) 556-1009.

## Symposium on the Management of Impacted Wildlife

All are invited to submit paper abstracts for presentation at the Fifth Biennial Symposium on Impacted Wildlife to be held April 8-10, 1991, in Snowmass Village, Colorado. Papers should focus on the identification and mitigation of impacts to, and the management of, wildlife resources—both aquatic and terrestrial. Regional approaches are encouraged. Presentations will be limited to 15 minutes. Due date for abstracts of papers and posters is October 1, 1990; selections will be made by November 15. For more information, contact: Susan Q. Foster, Executive Director, Thorne Ecological Institute, 5398 Manhattan Circle, Boulder, CO 80303; (303) 499-3647.

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# Endangered Species UPDATE

School of Natural Resources  
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