What Tradition Teaches

INDIGENOUS KNOWLEDGE COMPLEMENTS WESTERN WILDLIFE SCIENCE

By Paige M. Schmidt, Ph.D., and Heather K. Stricker

Courtesy of Paige M. Schmidt

Paige M. Schmidt, Ph.D., is a Research Wildlife Biologist for the USDA Wildlife Services National Wildlife Research Center in Sandusky, Ohio.

Credit: Mississippi State University

Heather K. Stricker is the Wildlife Resources Program Director for the Forest County Potawatomi Community in Crandon, Wisconsin.

In 1977 scientific surveys revealed that bowhead whales (*Balaena mysticetus*) in the Beaufort Sea were in trouble, with fewer than 1,000 individuals remaining. The International Whaling Commission took action to put a moratorium on native hunts in order to protect the species. Yet local Inuit hunters didn't see what the fuss was about. Their own estimates, gleaned from time and experience, put bowhead numbers at 7,000. The Inuits also disputed western scientists' contentions that whales couldn't swim under offshore ice and that they did not feed during migration. Researchers responded to these criticisms by developing a new survey method to census the population, incorporating Inuit understanding of whale behavior. In 1991 the new survey estimated that bowheads numbered 8,000—an affirmation of the ecological knowledge held by individuals who depended upon the whales for food, fuel, and shelter (Freeman 1995).

As indigenous sovereignty and other rights become recognized around the globe, many governments are developing strategies to work with indigenous communities to co-manage land and resources (Colchester 2004). In navigating this often daunting process, a new challenge has arisen: How to accept and incorporate into western science the traditional ecological knowledge and cultural norms that guide how indigenous communities use and manage natural resources.

Traditional ecological knowledge (TEK) is defined by the University of Manitoba's Fikret Berkes and colleagues as "a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment" (Berkes *et al.* 2000). Many scientists, managers, and policymakers view TEK as static and historically based, and therefore not reflective of or relevant to modern changes in ecosystems (Ross and Pickering 2002). Some researchers—trained to be critical thinkers—may balk at the lack of opportunities to statistically validate TEK. But we believe that

Credit: Grant Gilchrist

A freshly killed seal will soon become lunch for an Inuit and a group of scientists from Environment Canada, who are working with the Inuit people to learn about marine birds in Nunavut Territory. This cooperative effort has given researchers insights about the birds' winter ecology that would have gone undetected by typical western scientific methods.

incorporating TEK into how we as wildlife professionals do our jobs will not only strengthen indigenous communities, but will also improve the effectiveness of wildlife conservation and management.

Informing Science

In some ways, TEK and western ecological science (WES) could hardly be more different. While TEK relies on qualitative observations collected by resource users from one place over long time periods, WES routinely uses quantitative data collected by a few specialized professionals from several locales over short time periods (Kimmerer 2002). To make sense of these differences, early research focused on validating TEK using concordant scientific data. For example, interviews with Cree elders in northern Ontario confirmed that their knowledge of sharp-tailed grouse biology—including migratory habits, reproductive biology and behavior, and disease ecology—was consistent with previous scientific research (Tsuji 1996).

As TEK has become more accepted in the last decade, many researchers and decision makers view it as complementary to scientific data or even as valuable stand-alone data (Huntington *et al.* 2004). The degree of integration varies, however. "For our tribe…staff incorporate contemporary natural resource management styles into traditional tribal concepts and try to not disrespect our understanding of how things are supposed to be," says Arlen Washines, Wildlife, Range, and Vegetation Program manager for the Yakama Nation. "We manage in a manner that recognizes humans [are] on the bottom of the totem pole and everything else is above us in terms of importance."

TEK can prove especially valuable in three specific situations: 1) where standard monitoring surveys are not cost effective, 2) when designing surveys for species in remote regions or areas that are poorly known to western science, and 3) when in need of information about species that are rare, remote, or hard to observe (Huntington 2000, Gilchrist *et al.* 2005, Fraser *et al.* 2006).

For example, researchers have used Inuit TEK to establish historical changes in an Arctic tundra caribou population (*Rangifer tarandus*) in remote regions of Canada (Ferguson and Messier 1997) and to monitor migratory birds (Gilchrist *et al.* 2005). In the latter instance, Inuit in the Hudson Bay region documented a dramatic population decline in common eiders (*Somateria mollissima*)—a fall of 75 percent in a decade—and its cause: severe winter ice leading to a mass starvation. Both would have gone undetected by western scientists. Inuit TEK has also provided information on the distribution and ecology of harlequin ducks (*Histrionicus histrionicus*) in remote regions, where western science-based monitoring surveys are prohibitively expensive.

Though wildlife scientists can reap helpful information from TEK, it is important to understand its limitations and how it differs from WES. The migratory bird study, for instance, found that Inuit TEK was inconsistent about ivory gulls (*Pagophila eburnea*) in the Baffin Islands' Arctic Bay, and therefore not useful for such studies.

Guiding Management and Policy

The value of TEK goes beyond the theoretical. In many instances, indigenous groups have relied upon knowledge from their own community to craft wildlife management plans, formal or otherwise. For example:

- The Huna Tlingit of Alaska used their community's TEK to sustainably harvest glaucous-winged gull (*Larus glaucescens*) eggs by only gathering eggs from nests with one or two eggs and leaving nests with three or more eggs (Hunn *et al.* 2003).
- TEK of indigenous people in the Solomon Islands identified sensitive habitats for the vulnerable bumphead parrotfish (*Bolbometopon muricatum)* and led to the creation of two marine protected areas to conserve fish populations (Aswani and Hamilton 2004).
- Maasai pastoralists in Tanzania used TEK about indicator plant species to assess rangeland health and classify landscape features, resulting in grazing and cropping practices that improved biodiversity at macro and micro-landscape scales (Mapinduzi *et al.* 2003).
- Similarly, nomadic pastoralists in Mongolia rely on ecological knowledge to guide herding practices and pasture use (Fernandez-Gimenez 2000).

Credit: Doug Milek

An elder of the Taku River Tlingit First Nation indicates features of caribou habitat in northern British Columbia. Interviews with indigenous people can help researchers piece together ecological knowledge gathered from generations of regional experience.

Management plans informed by TEK can be hugely successful, but traditional methods often differ from and sometimes conflict with western approaches

(Horstman and Wightman 2001). Though collecting glaucous-winged gull eggs is a traditional subsistence activity for the Huna Tlingit, for example, the practice is illegal under U.S. law. And in Australia, aboriginal fire management practices include using fire in habitats and seasons not routinely accepted by Euro-Australian fire managers (Lewis 1989).

These and other challenges can make it difficult to determine how and to what extent TEK should inform policy decisions. Washines of the Yakama Nation, where roughly 12,000 feral horses roam the reservation's 1.2 million acres, says his people have struggled with formulating a plan to manage these overpopulated animals. Although horses are a vital part of tribal life and are still considered sacred in the culture, he notes that they now pose a threat to other natural resources (see article on page 50). "What do we do and how does science play a part in helping the system balance?" Washines wonders. Though funding has limited the Yakama's horse management options, they have caught 500 horses over the last five years to sell to private owners, and, along with four other tribes, formed the Northwest Tribal Horse Coalition to have a voice in how federal agencies manage excess horses.

Despite some disconnects, many TEK-informed management practices, such as multi-species management, resource rotation, and creation of mosaic landscapes, are consistent with WES (Berkes *et al.* 2000). Such practices have the added benefit of allowing indigenous communities to respond to disturbances and make their surrounding environment more resilient—critical abilities in the face of future challenges such as climate change and increasing development. TEK can also improve wildlife population monitoring, resulting in better-informed and cross-cultural decision making and policy development (Moller *et al.* 2004).

TEK in the Classroom

Wildlife conservation can be so complex that it only makes sense to approach it with every source of knowledge and mode of inquiry possible. This inclusivity can start in the classroom, with courses

How TEK Can Help Conserve Caribou

by Jean Polfus

A marker stone is still visible in British Columbia's Atlin Lake, indicating the starting point of an ancient network of fences that ran through the boreal forest. Indigenous peoples once used these structures to funnel woodland caribou (*Rangifer tarandus caribou*) for hunting, relying on the animals' meat, fur, and bones for survival.

Today, caribou still occupy a sacred place in the culture of many First Nations peoples. Yet in the far northwestern corner of British Columbia—the traditional territory of the Taku River Tlingit First Nation (TRTFN)—and in other remote regions of Canada, populations of the northern mountain ecotype of woodland caribou are in decline. A combination of hunter overharvest, habitat loss, and other factors prompted federal managers to list this ecotype as a species of special concern under the Canadian Species at Risk Act (SARA) in 2004.

Using traditional ecological knowledge (or TEK, see main article), offers a chance to provide new information to manage caribou and encourage a culturally appropriate management response to the declining populations.

A Respectful Comparison

For the last few years, I have worked with the TRTFN, the nonprofit Round River Conservation Studies, and colleagues at the University of Montana to examine the strengths and weaknesses of western scientific models and TEK approaches to understanding caribou habitat selection, specifically of the Atlin herd in southern Yukon and northern British Columbia, which now numbers approximately 800. Expert Tlingit hunters estimate that the population has

Credit: Jean Polfus

Credit: Jean Polfus

A field crew (left) collects wolf hair near Atlin, British Columbia, for stable isotope analysis to understand the role of predation on area woodland caribou, (above). Members of the Taku River Tlingit First Nation have depended on caribou herds for generations.

dedicated entirely to TEK, or by incorporating examples of TEK into lectures and lab exercises (Kimmerer 2002). In 2008, the Centers for Ocean Science Education Excellence and the University of Hawaii began collaborating to introduce traditional knowledge into K-12 classroom lessons as a way of boosting ocean literacy among Hawaiian schoolchildren (COSEE 2008).

Including TEK in educational curricula also teaches students to weigh cultural considerations when making conservation management decisions. "The imposition of western systems of land tenure, capitalism, governance, and education in the past 200 to 500 years has resulted in diminished rights and incentives to gather, hunt, and fish using TEK," writes Sylvia Spalding and Charles Ka'ai'ai of the Western Pacific Regional Fishery Management Council, a group mandated by Congress to manage fisheries in the waters surrounding the U.S. Pacific Islands. Spalding and Ka`ai`ai note that many indigenous Pacific islanders desire to pass on TEK so their traditional practices continue. "Implementing TEK into

Credit: Western Pacific Regional Fishery Management Council

Henry Chang Wo (kneeling at left), shows Hawaiian children a sample of seaweed, known as limu in the Hawaiian language, while teaching them to learn with their eyes and ears. Along with the Western Pacific Regional Fishery Management Council, Chang Wo works to encourage sustainable seaweed harvest based on traditional cultural practices.

fallen as much as 50 percent in the last 20 to 30 years, and population models predict that the herd will likely decline further in coming years due to low levels of calf recruitment.

Our study tested the ability of both TEK and western science to predict the locations of radio and GPS-collared caribou. To collect TEK, we interviewed members of the TRTFN who were known to be expert hunters, gatherers, or community elders, asking them to explain cultural uses of caribou as well as to describe their knowledge and observations of caribou habitats, foraging strategies, distributions, and availability of resources in the animals' range. Using this TEK, we developed seasonal habitat suitability index (HSI) models, which represent the habitat quality of a given area at different times of year. Then, implementing a common western science approach, we used data from 10 GPS-collared caribou to develop resource selection function (RSF) models, which predict how caribou choose habitat by examining their use or avoidance of a resource relative to its availability.

Our analyses revealed that the western science-based RSF models and the TEK-based HSI models both successfully predicted independent caribou locations. Each approach had its strengths. For instance, in some cases the RSF models predicted habitat selection in response to slope, aspect, indexes of vegetation greenness, and winter snow cover with levels of precision that would be difficult to extract from TEK data. In winter, however, we found that the TEK model predicted habitat quality better than the RSF model in an area that burned 60 years prior, and thus lacked the lichen caribou depend on in that season. Overall both types of models provided data that will be valuable to managers charged with deciding which areas of habitat are most important to preserve (Polfus 2010)—crucial data as the region may experience increased development pressures in coming years.

Putting TEK into Action

Currently, the TRTFN are engaged in a groundbreaking land-use planning process with the government of British Columbia. The resulting plan, a draft of which is currently in public review, will help facilitate collaborative fish and wildlife habitat conservation, including management of caribou habitat (Atlin Taku Framework Agreement). The results of our study will help guide this management by providing ecological information based on the knowledge and experience of the Taku River Tlingit.

Jean Polfus recently completed her master's degree in wildlife biology at the University of Montana.

Credit: Jean Polfus

educational programs within the U.S. Pacific Islands is one step toward reaching this goal," they say. Doing so could also help legitimize TEK as a rational approach in scientific inquiry and conservation.

Challenges to Overcome

There are some hurdles that must be cleared in order to strengthen the role of TEK in wildlife science, management, and policy.

Methods. Wildlife scientists are not typically trained in the social science methods used in most TEK studies. However, methods for accessing and using TEK are available in the peer-reviewed literature (see Huntington 2000), and many academic natural resources programs are now providing socio-cultural training.

Culture. Wrongs committed by governments and dominant societies have perpetuated a sense of mistrust among some members of indigenous groups, causing some TEK holders to try to limit or control its use (Huntington 2000). In addition, the diversity among the many hundreds of indigenous groups and misunderstanding of TEK itself can make it difficult for non-indigenous individuals to know how to interact with TEK holders in a culturally appropriate way. Non-indigenous individuals may also be uncomfortable with TEK's holistic nature or feel that science and decision making should be free from cultural beliefs, hindering TEK's acceptance (Kimmerer 2002).

Policy. Some government policies require managers and decision makers to incorporate TEK or work with indigenous groups—such as Canada's Species at Risk Act, which stipulates that indigenous groups must be consulted before listing a species. Often, however, these policies are vague, inconsistent, or fail to provide guidance or funding for implementation (Usher 2000, Schmidt and Peterson 2009). To mitigate this issue, indigenous groups and agencies must work to clearly define the steps involved in implementing inclusive policies.

Increasing the Role of TEK

Wildlifers should apply TEK where "it makes a difference in the quality of research, the effectiveness of management, and the involvement of resource users in decisions that affect them," writes Henry Huntington, an independent researcher who studied Inuit TEK (Huntington 2000). In recent decades, much has been learned about TEK's benefit to wildlife science, management, and policy. But despite steps to include the perspective of Native Americans in important policies, such as President Obama's recent Memorandum on Tribal Consultation (see page 72), TEK still does not have a place in U.S. federal policy. To counter this, indigenous communities must be proactive.

As today's students mature into professionals, they will face an increasingly diverse human population, a more-diverse scientific community, and, hopefully, increased inclusion of indigenous communities in management decisions. We cannot delay in finding a way to incorporate TEK for the benefit of wildlife resources: As the younger generations of indigenous communities assimilate into mainstream society, TEK is in danger of being lost. ■

TechnoSmart

See this article online at *www.wildlife.org* to access a full bibliography and to read a short article on gaining and using traditional ecological knowledge.