WILDLIFE REHABILITATION AND DISEASE EMERGENCE: OPPORTUNITIES, CHALLENGES, AND RESPONSIBILITIES

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INTRODUCTION

The author gave a presentation at the 1994 International Wildlife Rehabilitation Council (IWRC) conference in San Diego, California, titled "Diseases of Wildlife: Changing Patterns and Emerging Trends" (Friend 1995a). That subject area is the foundation for this paper, because the microbes and parasites have been working overtime. As a result, disease emergence has become an increasing threat for our wildlife resources (Daszak et al. 2000; Friend 1995b; Friend et al. 2001). Disease emergence has implications for the wildlife rehabilitation community and warrants revisiting two of the areas stressed by the author during the 1994 IWRC conference:

1) Development of stronger linkages between wildlife rehabilitation activities and those of wildlife disease specialists can enhance wildlife disease surveillance.
2) Development of standards for the release of rehabilitated wildlife can help to minimize the potential for disease introductions and disease establishment and spread in free-ranging wildlife populations.

In addition, this paper describes an opportunity that could result in the development of enhanced relations between activities of wildlife rehabilitators and the National Wildlife Refuge System.

DISEASE EMERGENCE

From a public health infectious disease perspective, the later part of the 20th century is reflected in the title of Laurie Garrett's Pulitzer Prize winning book, *The Coming Plague* (Garrett 1994). Human society throughout the world has experienced a plethora of new disease problems, the reemergence of diseases once thought to be conquered, and increased frequency of occurrence and spread of long-established diseases (Dasilva and Laccarino 1999; Gubler 2001; Levins et al. 1994). Numerous scientific papers, books, and even new scientific journals resulted in response to this changing pattern of disease. Humans are not alone in this problem. Wildlife and other biota are being similarly impacted (Berger et al. 1998; Kennedy et al. 2000; Roelke-Parker et al. 1996; Rupprecht et al. 1995; Thomas and Cole 1996).

Newspapers and magazines frequently contain articles about the latest plague to strike various life forms of our planet. An undeniable fact is that today is an era of increasing problems associated with emerging and reemerging diseases. This situation is likely to continue into the foreseeable future and has direct relevance for wildlife rehabilitators because of the increased probability that wildlife brought to wildlife rehabilitation facilities may be infected with unfamiliar diseases. A substantial number of the emerging and reemerging diseases of humans are of animal origin. Those types of diseases are commonly referred to as zoonoses. Well known recent examples include Lyme disease (Dennis 1998), hantavirus infections (Nichol et al. 1993), cryptosporidiosis (Guerrant 1997), and West Nile fever (CDC 1999; Lanciotti et al. 1999), among many others, including rabies (Rupprecht et al. 1995) and salmonellosis (Friend 1999c).

The Centers for Disease Control and Prevention has defined emerging infectious diseases as "Diseases of infectious origin whose incidence in humans has increased within the past two decades or threatens to increase in the near future" (CDC 1994). Stephen Morse (1995) expanded that concept somewhat with his definition. "Emerging diseases are infections that have newly appeared in a population or have existed, but are rapidly increasing in incidence or geographic range." Extending this concept to diseases of biota results in the inclusion of noninfectious diseases of microbial origin (Friend et al. 2001). Disease emergence is affecting biological resources on a worldwide basis and is appearing in a wide variety of ecosystems (Daszak et al. 2000; Friend et al. 2001).

The unprecedented increase in disease presents a greater challenge for the sustainability of desired population levels of wildlife species

than ever before. The foundation for this perspective lies in the draconian reductions of habitat quantity and quality for numerous wildlife species (Dahl 1990). Those losses often result in the redistribution of species and animal numbers in a manner that facilitates enhanced losses from disease and other mortality factors. Disease events resulting from those changes are confounded by the diminished capacity of the compromised habitat base to adequately replenish population numbers for some species following catastrophic losses or to offset high levels of attrition during the species' life cycle. Increases in disease emergence, in combination with reduced resiliency among the affected populations, poses a major threat that must be addressed aggressively.

GEOGRAPHIC SPREAD OF DISEASES

Infectious disease is of special concern because of the legacy of recurrence and disease spread associated with disease carriers and/or disease vectors. The negative impacts on the abundance and distribution of Hawaiian forest birds by avian malaria and avian pox is a vivid example of "real world" consequences associated with disease emergence in wildlife populations (Warner 1968; van Riper et al. 1986; Atkinson et al. 1995).

Disease establishment and geographic spread is highly variable and influenced by a host of factors. Current knowledge is insufficient to predict within reasonable levels of precision the future pattern of disease following an initial event. Sufficient high impact situations have occurred, such as the introduction of raccoon rabies in the eastern United States (Rupprecht and Smith 1994; Rupprecht et al. 1995), to warrant more aggressive response to new situations than is often taken. The following brief examples serve to highlight the variability seen following the initial occurrence of infectious diseases in free-ranging bird populations.

Avian cholera has been recognized as an important disease of domestic poultry in the New World since European settlers brought poultry to North America. Nevertheless, the first documented occurrence in wild waterfowl did not occur until the simultaneous and independent January 1944 epizootics in the San Francisco Bay area of California and the Texas panhandle. There was little geographic spread of this disease, despite the migratory habits of the affected waterfowl populations and reoccurring outbreaks of avian cholera in both states. It took approximately two decades for this situation to change. Since that time, avian cholera has become the most important infectious disease of wild waterfowl because of its broad geographic distribution

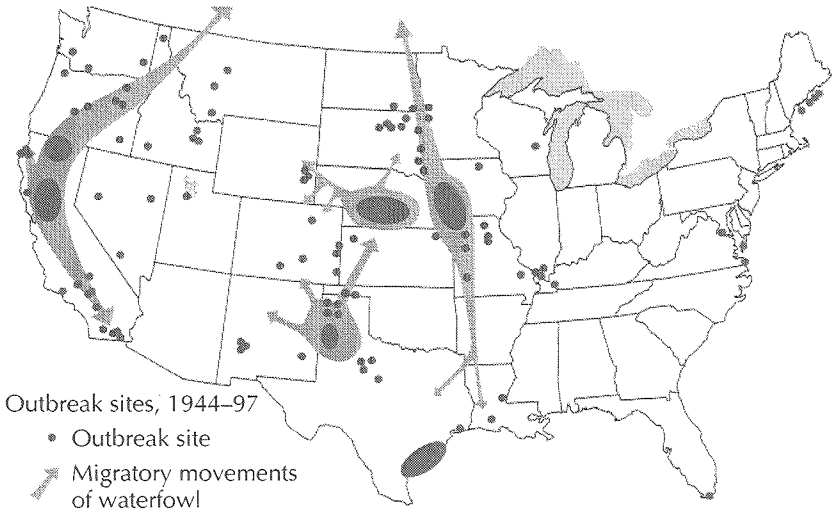

Figure 1. The occurrence of avian cholera in waterfowl seems to be closely related to bird movements west of the Mississippi River. There is no apparent pattern for outbreaks along the Atlantic seaboard.

(Figure 1), the magnitude of bird losses, and the variety of species affected (Friend 1999a).

Duck plague first appeared in the United States in January 1963, most likely from domestic European ducks. The initial duck plague events were followed by a slow, chronic pattern of geographic spread, the majority of which involved resident waterfowl rather than migratory populations. There have only been two major events involving free-ranging waterfowl. The first, in January 1973, killed approximately 40 percent of the mallard ducks (*Anas platyrhynchos*) wintering at the Lake Andes National Wildlife Refuge in South Dakota and resulted in the development of the National Wildlife Health Center. The second killed more than 1,200 wintering waterfowl (number of carcasses retrieved) on the Finger Lakes in upstate New York in 1994. Unlike the broad spectrum of species affected by avian cholera, duck plague only affects waterfowl. Concerns about duck plague involve the potential for large-scale die-offs, such as occurred at Lake Andes, and the high mortality rate that has commonly been associated with outbreaks in domestic ducks in other parts of the world (Converse and Kidd 2001; Friend 1999b).

House finch conjunctivitis, caused by *Mycoplasma gallisepticum*, is an example of the rapid spread of disease. This disease first appeared in house finches (*Carpodacus mexicanus*) during late winter 1994 in

the Washington, DC, area. Within 3 years, house finches within virtually the species' entire eastern range were found to be infected (Fischer et al. 1997; Hartup et al. 2001).

Leyogonimus polyoon, a newly reported North American trematode, or fluke, has caused the deaths of thousands of American coots (*Fulica americana*) in northeastern Wisconsin. This Old World disease of the coot and common moorhen (*Gallinula chloropus*) was first observed during the fall of 1996, when more than 1,500 coots died on Shawano Lake, Wisconsin. During the fall of 1997, more than 11,000 coots died from infection by this parasite at that location. Mortality has persisted at Shawano Lake (1 to 2 thousand die annually). Infected snail hosts were observed in two other lakes within the watershed, but bird mortality has not yet been detected at those locations. Disease spread and maintenance is more complex than that for the previous diseases, because two intermediate hosts are required for the parasite to complete its life cycle. Without appropriate intermediate hosts, the parasite cannot survive or be transmitted in nature (Cole and Friend 1999).

West Nile fever is the current high-visibility emerging disease of birds in the United States. This disease also has multiple factors associated with disease maintenance and spread. Mosquitoes are the vehicles for disease transmission. West Nile fever has received national attention, primarily due to the human deaths associated with the 1999 occurrence of this disease in the New York City area, rather than the thousands of bird mortalities that occurred (CDC 1999; Steele et al. 2000). Caution and vigilance are advised because of the significance of events to date and the potential for this disease to jeopardize wildlife rehabilitation operations. The following points about West Nile fever should be considered.

- West Nile virus is a human pathogen.
- West Nile fever is an exotic disease in North America, and all reasonable actions should be taken to avoid furthering disease establishment and spread.
- Corvids appear to be the most susceptible species to West Nile virus, but many other species have also become infected.
- The cause of illness or death for free-ranging corvids in the immediate vicinity of a rehabilitation facility, as well as corvids that are admitted and die, should be evaluated for West Nile virus.
- Assistance for West Nile surveillance should be sought through the state health department, because the surveillance program has been organized with state health departments having lead responsibility within each participating state.

- Prudence suggests that wildlife rehabilitators develop and maintain current knowledge about the geographic distribution of this disease and consider that information in bird accessions. Current information on the geographic distribution of West Nile virus and disease activity can be obtained from the USGS Atlas website: <www.nationalatlas.gov/virusmap.html>.
- Information about West Nile virus in wildlife can be obtained from the USGS National Wildlife Health Center in Madison, WI: <bob_mclean@usgs.gov>; phone: (608)270-2401.

EMERGING DISEASE OF UNKNOWN ETIOLOGY

Recurring wildlife mortality events of unknown cause pose a special problem, because both the potential for the causative agent to be transmitted and the risks for other species are unknown. Prudence suggests that such situations be dealt with as if a highly contagious agent capable of infecting multiple species is involved. This approach should be followed until scientific findings indicate less stringent actions can safely be taken. Examples of wildlife mortality situations of unknown cause follow.

Avian vacuolar myelinopathy. Avian vacuolar myelinopathy (AVM) is a disease of special interest because of the extensive efforts that went into a search for the cause and the differences in the picture of AVM today vs. the first 2 years of known occurrences. Avian vacuolar myelinopathy was first detected in 1994, when 29 bald eagles (*Haliaeetus leucocephalus*) were found dead during the fall and winter at De Gray Lake in southwestern Arkansas (National Wildlife Health Center database). Pathologists at the National Wildlife Health Center provided a name for this disease on the basis of the descriptive pathology seen. However, to date, extensive diagnostic evaluations involving specialists from across the United States and Canada and experimental studies have failed to determine the causative agent. Originally this disease was only seen at De Gray Lake and only in bald eagles, although dead American coots have been reported since, at De Gray Lake in 1994, prior to mortality being seen in bald eagles. Since coot specimens were not submitted for disease diagnostic evaluations, the cause of that mortality is unknown.

A small number of bald eagles also died from AVM at De Gray Lake during 1995. During 1996 and 1997, at least 26 eagles died from AVM at De Gray Lake and at two other southwestern Arkansas lakes. Coots were also affected (Thomas et al. 1998). The perspective that this was a localized problem associated with the reservoir system of southwestern Arkansas was shattered in 1998 when affected coots were found on lakes in Georgia and North Carolina. The following year (1999), additional existing perspectives about AVM were shattered when AVM was found in waterfowl and South Carolina was added to the geographic area where AVM is know to occur. The list of affected wildlife species and the number of locations where AVM has been diagnosed continues to increase. AVM is a neurologic disease. The most probable cause is thought to be a toxin of natural or human origin (National Wildlife Health Center database).

Atlantic brant mortality. There have been two very recent die-offs of black brant (*Branta bernicla*) in New Jersey for which the cause remains elusive. More than 2,000 sick and dead brant were found during early November 2000. More than 700 carcasses were found in association with the event during mid-January 2001. Clinical signs included sick birds being isolated from the flock and a hunched appearance with wings extended and heads hanging down to the side. Affected birds had difficulty flying or swimming. Sick birds tended to die shortly after being captured and handled. No other species were affected (National Wildlife Health Center database).

Vulture decline. Since the mid-1990s, it has become apparent that vultures on the Indian subcontinent, particularly the white-backed vulture (*Gyps bengalensis*), have declined catastrophically (Rahmani and Prakash 2000). Recent field observations and limited pathological assessments of affected birds indicate that a disease process, probably of viral etiology, is threatening the continued existence of white-backed and long-billed vultures (*G. indicus*). Populations of these species over much of India have fallen over the past 3 to 5 years to less than 5 percent of their former abundance. Dead vultures continue to be found, indicating that the decline is continuing (Riseborough 2000). Affected birds dropped from their roosts dead, died on perches and remained suspended by the branches, or died on the nests. Fledglings were found dead in the nests.

The period of clinical signs is reported to reach 32 days. Typically, affected birds appear to be drowsy. The neck falls limp and hangs. After waking, birds raise their heads, but then let the head fall again. Birds in this condition are reported to fly short distances and even feed their young (Riseborough 2000). The disease is affecting vultures in Pakistan and may be involved in the catastrophic declines among Asian vultures.

Common eider decline. Eider populations in the Finnish Archipelago of the Baltic Sea have suffered a major decline. An ongoing joint research effort of investigators from the United States and Finland was initiated in 1992. Low duckling survival rates (1 to 5 percent) along with major die-offs of adult birds are reducing common eider (*Somateria mollissima*) populations in the Gulf of Finland, but nowhere else in Finland. Viral isolations were made from affected birds, but the significance of those agents relative to the ongoing mortality and population decline remains under investigation (Hario 1998; Hollmén et al. 1999, 2000).

The key points associated with the information provided to this point are:

- Disease emergence is a widespread and increasing problem for free-ranging wildlife populations.
- The full spectrum of types of infectious agents are involved.
- Many variables influence the outcome of initial incidents of infectious disease relative to establishment, species involvement, geographic spread, and magnitude of wildlife losses.
- Because the quality of the habitat base for many wildlife species has been severely reduced, it is more difficult for fewer wildlife to overcome catastrophic die-offs and high levels of chronic loss from disease.
- Increased vigilance is needed to prevent the establishment of new diseases and the spread of enzootic diseases.

OPPORTUNITIES, CHALLENGES AND RESPONSIBILITIES

Allchurch (1999) stated that moving animals from the wild to captivity, and ultimately reintroducing them to the wild, presents them with significant health challenges. The statement, from a short paper titled "Conservation Medicine: An Emerging Science," is oriented at zoo captive breeding programs for endangered species. Wildlife rehabilitation programs have a similar challenge and a greater potential for disease emergence, because impaired rather than generally healthy animals are being brought into the facility. However, an even more taxing challenge is to minimize the potential for disease transfer into "nature" with the release of wildlife from the rehabilitation facility. That focus is different than the concern for zoo releases cited above. Captive breeding program concerns involve released animals succumbing to disease present in the wild, thus negating the contributions being sought from the captive breeding program. Disease introductions by the animals released is not considered because animals released by zoos are subject to stringent protocols for health screening.

The degree of rigor associated with that health screening and adherence to those protocols is variable. In general, the establishment of protocols and their utilization is self-generated and sustained by the zoo community itself, rather than by government regulation and oversight. A similar degree of health screening is generally lacking within the wildlife rehabilitation community and other groups involved with the release of wildlife into the wild. As noted earlier, disease posses a greater threat for the sustainability of wildlife populations than ever before. As a result, disease introductions are unacceptable for situations where reasonable actions can be taken to minimize the potential for introductions. The wildlife rehabilitation community needs to step forward and develop and implement actions for minimizing a risk that has resulted in disease occurrence and spread. Accomplishing this task will not be easy, but it is clearly a challenge that must be addressed to discharge the responsibilities that are inherent within the concept of wildlife rehabilitation. Addressing this need is consistent with Item 10 of the *Wildlife Rehabilitators Code of Ethics* (Miller 2000): "Disease introduction is not an acceptable conservation ethic, nor does it reflect an attitude of wildlife stewardship."

The wildlife rehabilitation community also has an opportunity to help combat emerging disease through enhancement of wildlife disease surveillance. Disease surveillance is an important factor in the early detection of new diseases, for detecting the geographic spread of existing diseases, and for detecting disease transfer into new species and populations. Information about accessions and the causes for mortality encountered within wildlife rehabilitation operations could serve as a valuable enhancement to other types of disease surveillance activities, if organized and routinely reported or made available in other ways.

Wildlife rehabilitation data could be organized and presented in a manner that would provide useful trend information, could highlight geographic areas and species situations in need of follow-up disease investigations, and could serve as another link in the early detection of new and emerging diseases. Analogies involving wildlife conservation are the useful information generated by the National Audubon Society's Christmas Bird Count and the wildlife observation data that used to be gathered by rural letter carriers. Wildlife disease specialists and other groups interested in wildlife mortality should be consulted regarding data organization and reporting. That approach is an important aspect of networking with others and could result in associated contributions from those groups, such as selective disease diagnostic assistance, that could benefit wildlife rehabilitation activities as well. That interface

should be pursued in a coordinated manner rather than on an ad hoc basis, because the greatest values associated with those data are the collective whole rather than isolated pieces.

The final area for comment is the interface between the wildlife rehabilitation community and natural resources agencies. That association has become an important aspect of the Salton Sea Restoration Project in California because of efforts to combat disease problems involving migratory birds. Type C avian botulism has been affecting white pelicans (*Pelecanus erythrorhynchos*) and California brown pelicans (*P. occidentalis*) at the Salton Sea on a large scale since 1996. This is an unprecedented situation, since fish-eating birds usually are not victimized by type C avian botulism. The massive outbreak that occurred in 1996 killed an estimated 15 to 20 percent of the western population of white pelicans and a substantial number of brown pelicans and served to focus national attention on the Salton Sea. Attempts to capture sick pelicans and rehabilitate them were overwhelming due to the numbers of birds involved, the lack of on-site facilities to provide initial treatment, and an absence of an established adequate interface with the wildlife rehabilitation community and other factors.

Type C avian botulism has persisted in pelicans at the Salton Sea and is a major emphasis for scientific inquiry attempting to determine why and how this is occurring. There is also a major effort by the Sonny Bono Salton Sea National Wildlife Refuge staff to rehabilitate pelicans stricken with type C avian botulism. Considerable progress has been made in providing early detection, capture of sick birds, and initial on-site treatment. Treated birds must then be transferred to the wildlife rehabilitation community for further care. Interactions with that community have been uneven. Excellent assistance was provided in some instances and difficulties occurred in other instances. The situation at the Salton Sea provides an unparalleled opportunity for developing enhanced relations between the wildlife rehabilitation community and the National Wildlife Refuge System. The Salton Sea also provides a unique training opportunity because of the number of birds involved.

During the late summer months (August and September), the Refuge staff nearly doubles to provide airboat crews and other assistance needed to search the 35-mile-long by 15-mile-wide Salton Sea for sick and dead birds and process them. Weather permitting, searches are essentially daily between mid-May and mid-October during major botulism outbreaks. The number of sick pelicans picked up from 1996 through 2000 ranged from a low of 117 during 1998 to a high of 1,092 during 2000. The first afflicted birds can appear as early as May, and

these events typically last into November. August and September are the peak months, but a substantial numbers of birds are also handled during July and October. Ambient daytime temperatures during August and September are generally in excess of 100°F and commonly are in the 110 to 115°F range. Those harsh conditions place an additional challenge on affected birds and humans as well.

Sick pelicans are transferred in the field from the rescue airboats to pickup trucks and then directly to the Refuge "pelican hospital" for initial treatment to stabilize the birds. Birds are held overnight and then transferred in plastic pet carriers to facilities that care for the birds until they are releasable. Releases occur on the coast of California. Approximately 65 percent of the birds entering rehabilitation facilities during the past two years were released back into nature.

The new Refuge Manager and the Refuge Senior Wildlife Biologist are interested in developing enhanced working relations with the wildlife rehabilitation community. They offer an opportunity to develop a collaborative effort by providing on-site housing for volunteers assisting with the pelican rehabilitation effort. Interested parties should contact the Senior Wildlife Biologist Charles Pelizza, Sonny Bono Salton Sea National Wildlife Refuge Complex, 906 West Sinclair Road, Calipatria, CA 92233-9744, telephone number: (760) 348-5278.

CONCLUSIONS

The following personal perspectives are offered to place the issue of emerging diseases in a context for consideration as an organization and as wildlife rehabilitators. Participants at the 2001 NWRA symposium attended because of their love for wildlife and their desires and commitments to provide for wildlife's well being through the actions they pursue as individuals. We are all part of a wildlife conservation ethic that has many facets. In general, wildlife conservation and the stewardship responsibilities associated with such activities are about the sustainability of free-ranging wildlife populations, so that everyone can continue to enjoy the wildlife heritage for which wildlife rehabilitators and professions biologists serve as stewards. The obligation is to the future as much as it is to the present. While the future cannot be foreseen or controlled, the actions taken — or not taken — during "our watch" can greatly affect what future human generations will encounter and whether an enhanced or diminished "wildlife trust fund" is provided for today's children and their children to manage.

Wildlife conservation within the United States evolved to a large extent in response to destructive human behaviors that robbed genera-

tions of humans of wildlife species (species with population levels so great that they seemed inexhaustible) and greatly diminished the abundance and distribution of many other species. Everyone's obligation is to be a better steward of wildlife than past generations of American society. One of the challenges is to address the changing pattern of threats to wildlife resources, rather than to dwell on past transgressions. If the destructive force of disease was fully appreciated, we would not be so cavalier in our considerations of disease. Those unfamiliar with the force of disease should consider that some recent and past individual outbreaks of avian botulism each killed from 100,000 to more than 1,000,000 birds (Kalmbach 1968; Kuznetsov 1992; Rocke and Friend 1999). Infectious diseases have gained prominence during the past three decades and outbreaks frequently claim thousands to tens of thousands of wildlife.

It is clear that disease impacts are at least as great as other forces that have been dealt with aggressively. Disease importance is strengthened by the legacy of infectious diseases that resulted in disease carriers capable of initiating additional outbreaks at additional times and locations, the pyramidal escalation of numbers of individuals that can become infected when contagious disease agents are involved, and the sheer destructive capability of many infectious agents.

The nature of wildlife rehabilitation activities places the wildlife rehabilitation community on the "front lines" relative to disease emergence, irrespective of any lack of interest or interests in becoming involved with wildlife disease. There is a high probability that wildlife rehabilitators will be the first to encounter new and emerging disease situations. There is also a high probability that those situations will not be detected unless the event results in large-scale morbidity or mortality.

The high probability for "first encounter" by wildlife rehabilitators is associated with the fact that wildlife rehabilitators are often contacted first by the public when they encounter impaired wildlife. Wildlife rehabilitators are also contacted by wildlife agencies and other organizations that do not have internal capabilities for wildlife rehabilitation. Most individuals would not knowingly submit wildlife affected by infectious disease; however, the clinical signs for many infectious diseases are not sufficiently distinct from other conditions to conclude whether or not an infectious disease is involved. In addition, impaired animals may be harboring pathogens that result in disease after animals are brought into facilities for treatment.

The high probability that the first encounter of a disease will appear in wildlife rehabilitation facilities, but go undetected, is associated with

the low percentage of intensive diagnostic evaluations done for animals that die within those facilities. This is not meant to be a criticism. Valid reasons are involved for why this situation exists. However, selective enhanced diagnostic activities would be beneficial. The prime benefactors are the species and populations that wildlife surveillance and wildlife rehabilitation programs are intended to serve. The detection of biologically significant disease situations results in obligations and responsibilities that can become hurdles that prevent the implementation of such actions. Depending on the disease detected, obligations for reporting may occur because of a jeopardy situation for domestic animals or humans in addition to wildlife. Response to such situations could result in a facility quarantine being imposed, on-site investigations by authorized individuals of the U.S. Department of Agriculture (e.g., exotic Newcastle disease), state agriculture or public health agencies (depending on the disease involved), possible destruction of some animals within the facility, and the determination that some of the animals are not releasable.

As difficult as these potential outcomes may be, failure to conduct such evaluations because of the potential for undesirable findings is disingenuous if wildlife conservation is used as a reason for carrying out wildlife rehabilitation. Even if the goal is different, there are moral and ethical issues associated with any judgments to avoid disease evaluations or not to be guided by the findings from such evaluations. Human behavior is a major factor in disease emergence that is impacting humans, domestic animals, and wildlife alike. Those committed to the conservation and sustainability of wild animals need to act on behalf of the wildlife and to speak on behalf of wildlife. Those actions include adjusting human behaviors to minimize impacts that are detrimental for the sustainability of wildlife populations and species.

Please note that the focus of the author's comments/concerns is on species and free-ranging populations, not on individual animals or confined situations. That difference does not negate the actions taken on behalf of individual animals. Instead, the focus is on the difficult crossroad that must be negotiated relative to disease prevention and reduction when actions on behalf of the individual may jeopardize the population. Human behavior impacts the outcome, and the individuals involved must take responsibility for that outcome. Failure to see or utilize the road signs along the path to the crossroad does not remove the responsibility to be borne as a result of breaching the intersection and causing a disease event. The outcome is not an accident. Although that perspective may ease personal anguish, it is also denial of the risk

taken for personal reasons that resulted in a negative outcome. There is little relevance to the fact that the same risk may have been taken many times before without resulting in any negative consequences.

The previous comments may make some wildlife rehabilitators uncomfortable. They are not intended as personal attacks, but are intended to stimulate introspective evaluation of actions associated with wildlife rehabilitation. Those comments should not be interpreted to mean that wildlife rehabilitation activities are the primary cause for disease emergence and spread in free-ranging wildlife populations. That is not the case. However, wildlife disease events have occurred in association with wildlife rehabilitation and a host of other activities. Learn from past history and actions, and take steps that minimize the potential for future disease.

This paper focused on disease emergence because of the significant threat that exists for wildlife. Stewardship of North America's wildlife heritage includes the responsibility for disease prevention and control. Just as with human and domestic animal health, the greatest gains can be realized from actions taken to minimize the potential for disease emergence and establishment, rather than from responding to crisis events that could have been prevented by those actions. Two recommendations made by Friend (1995a) are fundamental actions that can be of benefit in the battle against disease. Much more needs to be done regarding those actions because of the increasing importance of disease and the increasing role wildlife rehabilitation programs are having in the conservation of wildlife species.

1) Increase networking between the wildlife rehabilitation community and local, state, and federal wildlife disease programs for the purpose of enhanced disease monitoring and surveillance (e.g., establish routine information exchanges, such as disease alerts and updates that are provided to the rehabilitation community, and reciprocal reporting by that community of unusual observations and numbers of accessions to the wildlife disease programs).

Considerable benefits could result from this action. There are many ways to approach this need. One of the most productive initiating actions may be the participation of the wildlife rehabilitation community in a disease surveillance and monitoring panel discussion at a Wildlife Disease Association meeting. This type of session might be organized by working with the National Wildlife Health Center. It should include a variety of organizations, rather than being focused on wildlife rehabilitation programs.

2) Develop and implement standards that provide reasonable protection against disease introductions when wildlife are being released back into nature.

This situation is more complex than assessment based upon the visual appearance of animals to be released. Here again, networking with wildlife disease specialists can be useful, not only for the dialogue regarding conceptual approaches, but also for the development of strategies for evaluations needed. These standards could include how support might be obtained to provide those evaluations where internal capabilities do not exist and are unlikely to be developed. Provision of evaluations is closely linked with disease surveillance and monitoring activities.

The commitments of the wildlife rehabilitation community on behalf of wildlife and the continued progress being made to assure that high standards are developed and achieved in the conduct of wildlife rehabilitation activities is commendable. The workshops associated with the 2001 National Wildlife Rehabilitators Association's annual symposium serve as strong testimony to the emphasis being placed on education so that those who become involved with wildlife rehabilitation can do the best that can be done. If each individual recognizes and acts as if they make a difference, great challenges can be overcome on behalf of North America's wildlife heritage. Disease is one of those challenges. Hopefully, this paper has enhanced recognition of this challenge and will stimulate actions against the increasing threat posed by disease for the well being of all wildlife resources.

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CHANGES IN ATTITUDES: EVOLVING RELATIONSHIPS BETWEEN WILDLIFE CONSERVATION AGENCIES AND WILDLIFE REHABILITATION GROUPS

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The author has been a wildlife veterinarian in the employ of the California Department of Fish and Game (CDFG) for over 23 years. I was the first wildlife veterinarian hired by CDFG, and this has allowed me to observe changes in various kinds of attitudes and relationships firsthand. Most of my professional efforts have been directed toward improving capture techniques for free-ranging wildlife, epidemiology and pathology of diseases, and most recently, marine animal ecotoxicology. I have followed the maturation of wildlife rehabilitation in California with interest. Early in my career I was involved in raptor rehabilitation and fracture repair and visited and interacted with many wildlife rehabilitators, such as Gary Bogue, Dave Garcelon, Pegin Barrett, Jan White, and Martine Collette. Although I have generally had very positive interactions with wildlife rehabilitators, I have occasionally been drawn into intense interactions and confrontations with and between members of the wildlife rehabilitation community. Most recently, I have had the opportunity to help develop one of the first state wildlife agency programs that actually utilizes private wildlife rehabilitation groups, that integrates wildlife care into wildlife resource management, and that provides training, equipment and supplies, and in some cases, financial support for building or improving wildlife care centers. This represents a significant change in attitude.

The experience that most clearly demonstrated to me the change