wolves for prey.

5. Wolf-Human Conflicts

Human-caused mortalities of wolves are major threats to wolf populations in Europe and America. Wolf-human conflicts, such as wolf attacks to livestock or perceived threats to people, often result in increasing demands for wolf control (Boitani 2000; Montana Wolf Management Advisory Council 2002). Dairy farming is one of the major industries in Hokkaido. It is not common to pasture livestock in large wooded areas. If wolves are released in Hokkaido, livestock depredations will occur. However, depredation patterns may be different from those in Europe and the United States. Wolf attacks on domestic dogs can occur. There is a possibility that wolf-dog hybrids are bred and cause trouble to humans.

In recent years, wolf attacks on humans are rare in Europe and the North America because rabies, the major cause of wolf attacks, is controlled at low levels with vaccination programs (Linnel et al. 2002). Rabies was eradicated from Japan in 1960 and rabies vaccinations are required for domestic dogs. Therefore, wolf attacks on people will be uncommon.

Preventing and managing wolf-human conflicts are essential to wolf conservation. How and by whom will released wolves be managed outside of the park? Where will the budget come from? Who will compensate for damages by wolves? Without sufficient systems to manage conflicts, the wolf reintroduction will not be accepted by the public.

6. Sociological Aspects

In Hokkaido, public attitudes towards wolves are not well-known. On the main island (Honshu), a survey of public attitudes in the urban area was taken (Nanbu 2005) According to the survey, 20% of respondents liked wolves, 10% disliked wolves, and another 60% had no opinion. Public acceptance is critical for wolf recovery. More surveys and public education will be needed.

In the case of Yellowstone, wolf reintroduction brought economic profit for local communities (Bishop 1992; Smith et al. this volume). Many visitors have purchased wolf-related merchandise and participated in wolf-watching programs. The same effect will be expected in Shiretoko.

7. Legal Aspects

According to Kato (2005), there are no laws prescribing reintroduction of extinct species in Japan. Wolves are not designated as a target species in the Law for Conservation of Endangered Species of Wild Fauna and Flora Conservation Act (1993) nor Invasive Alien Species Act (2004). The latter prohibits introductions of invasive species and it may restrict the wolf as an exotic species if the genetic distances of the source population is great. In Japan, the government does not provide compensations for agricultural damage caused by wildlife. Reintroduction of wolves will not be accepted by the rural public without compensations for the damages.

8. Conclusion

Ecologically, wolf populations can be established and maintained in Hokkaido if their habitat is productive enough and human-caused mortality is low. Wolf recovery will need large-scale consideration, beyond the boundary of Shiretoko National Park. It is premature to implement wolf reintroduction in Japan because many biological and social issues remain unresolved. Further biological and socioeconomical studies are needed. Prevention and management of wolf-human conflicts, compensation for depredation, enough funding, and public education should be developed for the wolf reintroduction.

9. The Mesocarnivores of Yellowstone National Park
Observed and Potential Responses to Wolf Reintroduction

Eric M. Gese

Abstract

Changes in the number of one carnivore species can lead to changes in the abundance and/or

behavior of another carnivore (e.g., mesopredator release or suppression). Wolves (*Canis lupus*) were reintroduced into Yellowstone National Park in 1995 and 1996, after an absence of over 60 years. Prior to wolf reintroduction, coyotes (*C. latrans*) were the top canid predator in the park and possibly impacted smaller sympatric carnivores. With the return of the wolf, coyote numbers have been observed to have declined in the Lamar River Valley of the northern range. This decline was precipitated by both direct mortality (wolves killing coyotes) and possibly by displacement of pack members (dispersal of coyotes in areas of high use by wolves). Behaviorally, coyotes are responding to wolves by increasing the use of wolf-killed ungulate carcasses, increasing the amount of time spent traveling, and decreasing the amount of time they spend resting. Other mesocarnivores, mainly red fox (*Vulpes vulpes*), bobcat (*Lynx rufus*), and lynx (*L. canadensis*) may benefit from a decline in the coyote population following wolf reintroduction; coyotes may compete for shared prey species, limit their distribution, and inflict direct mortality on these three sympatric species. The potential impacts of wolf reintroduction on the other mesocarnivores in Yellowstone, namely badger (*Taxidea taxus*), raccoon (*Procyon lotor*), marten (*Martes americana*), fisher (*M. pennanti*), and wolverine (*Gulo gulo*) are less well understood. These species may benefit from mesopredator release (i.e., badgers compete with coyotes for ground squirrels) and increased scavenging opportunities at wolf-killed carcasses. Cascading effects among the trophic levels are complex and may take many years to be realized. As the vegetation responds to changes in elk (*Cervus elaphus*) distribution, concurrent changes likely will occur in the small mammal community as a result of vegetation changes. Behavioral modifications following wolf reintroduction among all the sympatric carnivores may bring about a redistribution and shifting of niche overlap and demographics of the mesocarnivores occupying the Yellowstone ecosystem.

1. Introduction

Carnivore populations are under threat of decline in many areas throughout the world (Schaller 1996). Reasons for these declines include habitat loss and fragmentation, illegal poaching, disease, conflicts with agricultural interests, changes in land-use practices, overharvest, declines in native prey, and increased competition with other carnivores bringing about intraguild predation. Interactions between carnivore species are common and occur in most major ecological communities worldwide (Johnson et al. 1996; Creel et al. 2001). These interactions generally bring about resource partitioning between the two competing species in terms of spatial and temporal avoidance and may result in direct mortality of the smaller species (Johnson et al. 1996; Creel et al. 2001). Mesopredator release or suppression may cause changes among various species in different trophic levels and reshape ecosystem and community dynamics (Soulé et al. 1988; Crooks and Soulé 1999; Ripple and Beschta 2004).

Within the carnivore family, researchers have documented the various impacts of larger canids interacting with smaller sympatric canids (e.g., Kitchen et al. 1999; Schauster et al. 2002; Kamler et al. 2003) as well as smaller sympatric felid species (e.g., Major and Sherburne 1987; Litvaitis and Harrison 1989; Thornton et al. 2004). In North America, studies of red foxes have found that they tend to spatially avoid coyote territories and may persist in boundary areas between coyote territories (Voigt and Earle 1983; Sargeant et al. 1987; Harrison et al. 1989). Theberge and Wedeles (1989) documented how red foxes persisted amongst coyotes because they utilized more alternative prey during a snowshoe hare (*Lepus americanus*) decline. In a more human-modified landscape, Gosselink et al. (2003) reported how red foxes used human-associated habitats (farms and urban areas) as refugia from coyotes and avoided habitats used by coyotes.

The interaction between coyotes and wolves has been documented in various studies in North America. Results of these interactions were variable, ranging from complete extinction of coyotes by wolves to localized changes in coyote numbers to increases in the coyote population following wolf recovery. On Isle Royale, Michigan, Krefting (1969) reported that the coyote population went from an estimated 150 animals on the main island in 1948 to no evidence of coyotes after 1958 following the arrival of wolves to the island. On the Kenai Peninsula, Alaska, Thurber et al. (1992) found coyotes and wolves coexisting with minimal exploitation competition and coyote home ranges overlapping wolf territories. Similarly in Riding Mountain National Park, Manitoba, Paquet (1991) documented spatial and temporal overlap of coyotes and wolves. In northwestern Montana. Arjo and Pletscher (1999) reported an increase in coyote pack size following wolf recolonization as coyotes scavenged wolf-killed ungulates. Paquet (1992) similarly found coyotes following wolf tracks and scavenging wolf-killed ungulates.

Within the Greater Yellowstone Ecosystem (GYE: Yellowstone National Park and surrounding national forests), many carnivore species exist in what many consider to be an intact ecosystem. No native mesocarnivore species are missing from the ecosystem, although some are considered extremely rare (Buskirk 1999). Additionally, no exotic mesocarnivores have invaded the park. Buskirk (1999) listed the following species as mesocarnivores in Yellowstone: badger, bobcat, coyote, fisher, lynx, marten, mink (*Mustela vison*), raccoon, red fox, river otter (*Lutra canadensis*). striped skunk (*Mephitis mephitis*), and wolverine. With regards to the impacts of wolf reintroduction on these mesocarnivores, this paper will focus on the major species occupying areas in the northern range of Yellowstone National Park and the ones most likely impacted by mesopredator release or suppression. Thus, this paper will not include possible impacts of wolf reintroduction on fisher, river otter, mink, and striped skunk. Fisher have rarely been reported in the park (Buskirk 1999). River otters are tied to the rivers and lakes which are more prevalent in the central part of the park (Buskirk 1999). Mink are also found along rivers and streams and are considered uncommon (Buskirk 1999). Striped skunks occur mainly at lower elevations along the Yellowstone and Snake River valleys (Buskirk 1999). While many mesocarnivores occur in the park, little or no data exists on many species (i.e., numbers or population trends) with the exception being studies on coyotes. Buskirk (1999 : 168) states "Our ignorance of mesocarnivores of the GYE is profound and longstanding."

2. The Mesocarnivores

Coyotes – Coyotes are common throughout the park and likely benefited from the extirpation of the wolf from the park in the early 1930s (Murie 1940; Buskirk 1999). The coyote population in Yellowstone National Park has not been persecuted for several decades, thus it exhibits a high level of tolerance to human presence (Figure 2-9-1). This observable nature of coyotes in Yellowstone has allowed an examination of many facets of the behavioral ecology of coyotes and documentation of how coyotes deal with fluctuations in temperature, snow depth, snow pack hardness, and food availability (e.g., Gese et al. 1996a, 1996b, 1996c). Also, we have been able to document various forms of communication in coyotes (Gese and Ruff 1997, 1998) and the influence of a dominance hierarchy on territoriality, foraging behavior and resource acquisition, and fitness (Gese 1998, 2001, 2004). All of these previous studies were conducted from January 1991 to July 1993, before wolves were reintroduced to Yellowstone National Park. In 1995, the first 14 wolves were released into the park (Bangs and Fritts 1996; Smith et al. this volume), mainly in the northern range with specific release sites located in the Lamar River Valley where the previous coyote work was conducted. In 1996, an additional 17 wolves were released (Bangs and Fritts 1996). Following wolf reintroduction, Switalski (2002, 2003) documented the behavioral activities of the coyotes in the Lamar River Valley from December 1997 to July 2000.

Before wolves arrived, the coyotes in the Lamar River Valley were organized into five relatively large packs with distinct territories (Gese et al. 1996a, 1996c). Mean pack size ranged from a low of 4.6 coyotes/pack in January 1991 to a high of 6.9 coyotes/pack in January 1994 with an average of 6.2 coyotes/pack across all five years prior to wolf reintroduction (Gese et al. 1996a, 1996c; S. Grothe, unpublished data). Mean pack sizes were the known observed pack size on January 15 of that year and represented the winter/pre-whelping pack size. These resident packs remained spatially stable, except in the winter of 1992-1993 when the Soda Butte pack usurped a part of the Norris pack territory (Gese 1998). Territorial boundaries of resident packs were scent-marked and actively defended; transient home ranges were not scent-marked or defended (Gese and Ruff 1997; Gese 2001). Each resident pack comprised an alpha pair and associated pack members (Figure 2-9-2), usually related offspring (Hatier 1995; Gese et al. 1996c). Associate animals that remained in the pack over winter usually helped feed and care for the offspring whelped by the alpha pair the subsequent spring (Hatier 1995). Dominance matrices for each pack demonstrated the presence of a social order or dominance hierarchy among both females and males (Gese et al. 1996c), similar to that described in a wolf pack (Mech 1970). The presence of a dominance hierarchy in these packs played a major role in pack dynamics, foraging ecology, territorial maintenance, and ultimately individual fitness (Gese 2004). The large packs we observed were probably a consequence of the combination of abundant prey biomass (Bekoff and Wells 1981; Geffen et al. 1996; Gese 2004) and the lack of human exploitation in the study area (Knowlton et al. 1999; Frank and Woodroffe 2001).

With wolf reintroduction into the valley in 1995 and 1996, the coyote population remained in the five packs (Switalski 2002) as previously found before wolves arrived, but the mean coyote pack size declined from 3.7 coyotes/pack in 1998 to 2.7 coyotes/pack in the winter of 1999-2000 (Switalski 2002; Smith et al. 2003). Thus, during the prewolf period, mean coyote pack size was 6.2 coyotes/pack and has declined to a mean of 3.8 coyotes/pack during the post-wolf period (Smith et al. 2003). Much of the decline in the coyote population appears to be related to wolves killing coyotes at wolf-killed carcasses (Crabtree and Sheldon 1999), or displacement/dispersal of individuals from the valley. With a current estimate of >160 wolves in Yellowstone (Smith 2005; Smith et al. this volume), the long-term population response by the coyotes is unknown. Some animals will learn to avoid wolves and survive, while naive animals will perish. Whether the coyote population will respond with increased pack size as avoidance of wolves is passed to other generations, or if this is now the natural state between these two sympatric canids is presently unknown. Studies elsewhere have documented complete extinction of a local coyote population with wolf reintroduction, but that was on an island (Krefting 1969). In contrast, Arjo and Pletscher (1999) documented an increase in coyote pack size from singletons and pairs to pairs and small packs as wolf recolonized northwestern Montana. The coyotes also relied more on ungulates after wolves came back, whereas previously they persisted mainly on lagomorphs and plants (Arjo and Pletscher 1999).

Behaviorally, the coyotes in the Lamar Valley have taken advantage of more ungulate carcasses becoming available from wolf kills (Switalski 2003). Prior to wolf reintroduction, coyotes spent 2.1% of their time feeding on ungulate carcasses (Gese et al. 1996a). With more wolf-killed ungulates now available, Switalski (2003) found the coyotes spent 8.7% of their time feeding on carcasses and carcasses are now utilized year-round due to the wolves. Previously, carcasses were available mainly in winter due to winter-stress and an occasional coyote predation (Gese and Grothe 1995; Gese et al. 1996a). With wolves present, ungulate carcasses are now available year-round (Switalski 2003). With wolf reintroduction, the coyotes also spend more time traveling (prewolf: 27%; postwolf: 31%) and less time resting (prewolf: 51%; postwolf: 41%). Other coyote activities (Figure 2-9-3) such as the percent time spent hunting small mammals, howling, or being vigilante remained unchanged.

Red Fox — Red foxes (Figure 2-9-4) are considered common in the park (Buskirk 1999). With the possible decline in the coyote population following wolf reintroduction, a close competitor of the coyote, the red fox, will likely benefit through mesopredator release. Red foxes are frequently observed interacting with coyotes in Yellowstone, mainly scavenging from ungulate carcasses (Gese et al. 1996d). In the winter of 1992-1993, we observed seven individual red foxes residing in the Lamar River Valley. Red foxes may increase in number as the coyote population declines in response to wolf reintroduction, but no studies have monitored the red fox population in the park. Also, the foxes in the valley scavenged winter-killed ungulates as a source of food (Gese et al. 1996d) and will likely continue to use wolf-killed carcasses. Changes in the small mammal prey base also may occur with a decline in the coyote population and red foxes may benefit from both reduced competition with coyotes for small prey as well as increased numbers of small mammals. Studies across North America have reported red foxes being excluded or avoiding areas and habitats used by coyotes (Voigt and Earle 1983; Sargeant et al. 1987; Harrison et al. 1989). Thus, if areas become devoid of coyotes (i.e., areas of intense use by wolves), then red foxes may also be able to occupy these vacant areas as they often are tolerated by wolves

(Mech 1970).

Bobcat — In Yellowstone, Murie (1940) wrote that "bobcats, once common, now are apparently gone." As a competitor with coyotes, bobcats (Figure 2-9-4) would also benefit from a decline in the coyote population if they are present in the area (Litvaitis 1992). However, current information on bobcat distribution and abundance is lacking for Yellowstone (Buskirk 1999).

Badger — Buskirk (1999) reported that badgers have been mentioned as common generally in sagebrush steppe habitats. However, no information is available regarding distribution or abundance. Badgers and coyotes compete for certain prey species in the park, particularly Uinta ground squirrels (*Spermophilus armatus*). Local reductions of coyotes could benefit badgers in some areas due to reduced competition. Otherwise, there appears to be little direct competition or intraguild predation between these two sympatric carnivores.

Lynx — The lynx was recently listed as a federally threatened species under the Endangered Species Act. Buskirk (1999) stated that lynx are reported from forest areas of the Yellowstone Plateau. Presently, lynx are considered rare in the park. However, two individual lynx were recently identified by DNA analysis of scat. Thus, a few lynx may be present. Kerry Murphy, a park biologist, is conducting surveys in the park using DNA analysis from scats and hair snares to determine the status of lynx in the Yellowstone ecosystem. With wolf reintroduction and declines in localized coyote populations, lynx numbers may increase due to reduced competition with coyotes for their principle prey, snowshoe hares. Direct mortality may also occur with coyotes killing young and adult lynx, thus areas with fewer coyotes may result in increased survival rates of lynx.

Marten — Murie (1940) reported marten to be moderately common. Marten appear to be widespread in forested areas of the Yellowstone ecosystem, but long-term trends in distribution and abundance are lacking (Buskirk 1999). While not a direct competitor with coyotes, wolf reintroduction and the subsequent decline in coyote numbers may reduce indirect competition between martens and coyotes for small mammal prey.

Raccoon — Buskirk (1999) reported that raccoons generally occur at low density and at lower elevations in the park. Information on distribution and abundance of raccoons is lacking for the area. Coyotes are known to kill raccoons (Gehrt 2003), thus wolf reintroduction may benefit raccoons by decreasing coyote numbers.

Wolverine — Considered uncommon in the park, information on the distribution and abundance of wolverines is lacking. Currently, park service biologist Kerry Murphy is leading an effort to determine the status of wolverines in the area using noninvasive sampling and DNA analysis. South of the park, in the Teton Range, a multiyear research project is underway to determine population demographics and distribution of wolverines. Several wolverines have been captured and radio-collared, and the project continues under the direction of Bob Inman of the Wildlife Conservation Society.

3. Ecosystem Changes and Trophic Cascades

Buskirk (1999: 170) states that "the major factors that structure mesocarnivore communities are food abundance, habitat structure, interference competition, and humans, especially their trapping." Carnivores have been interacting with one another for thousands of years, evolved together, and can shape ecosystem structure and function by influencing vegetation and lower trophic levels (Crooks and Soulé 1999; Berger et al. 2001). With wolf reintroduction into the park, the carnivore guild is now complete and these evolutionary interactions are now reestablished among all the sympatric species. As a result of wolves coming back into the ecosystem, short-term changes in carnivore densities and distribution are expected to continue for several years. Whether this translates to long-term changes is unknown. Trophic cascades are being documented in the park with wolf reintroduction and these changes will likely affect community structure and the mesocarnivore guild (Smith et al. 2003; Ripple and Beschta 2004; Smith 2005).

As wolf numbers have increased following the 1995 and 1996 reintroductions, elk numbers have declined and distribution has shifted away from areas of high wolf densities, thereby creating areas of "plant refugia" (Ripple et al. 2001; Ripple and Beschta 2004). Elk have responded to the increased predation risk from wolves and shifted their concentration of foraging activities away from riparian zones bringing about a release of willow and cottonwood from browsing pressure (Ripple and Beschta 2003). With riparian areas recovering from overbrowsing by elk, other community responses may occur in the avian assemblage (Berger et al. 2001) and the small mammal community. In areas where willow is recovering, beaver are becoming reestablished in these areas that have not had beaver for several decades (Smith 2005). These changes are illustrative of the indirect effects of wolf reintroduction on elk behavior, more so than their effect on elk numbers. Aspen regeneration is also being documented in areas with high wolf densities and reduced elk abundance (Ripple et al. 2001), but these results appear to have been short-term as elk browsed the new regrowth in the subsequent winter. While these changes suggest cause and effect, these interactions are complex with many factors influencing community structure and function (Berger and Smith 2005). Research on the trophic cascades in Yellowstone is still continuing and effects of these changes will continue to be debated (Smith 2005). Detection of top -down or bottom-up regulation of ungulates by large carnivores can be difficult without long-term data covering various factors (e.g., predators, prey, vegetation, climate, soil) influencing community interactions, linkages, processes, and functionality (Bowyer et al. 2005).

4. Policy and Management

Currently, Park Service policy for mesocarnivores reflects the overall Park Service policy of natural regulation. There is no legal trapping for harvest of any of the mesocarnivore species in the park. The only management action that generally occurs is if an individual animal becomes a nuisance or problem animal, then that individual is usually removed from the population if it can be located. Unfortunately, these types of problems are the fault of humans with the individual animal paying the ultimate price for a human's ignorance. For example, usually the scenario begins with an individual coyote that frequents an area near a place where humans are concentrated (e.g., a camping area or picnic site). During the animals travels looking for food, an ignorant human throws it a sandwich or cookie, either thinking it's cute, or somehow they are helping the animal by feeding it, or they want to be close to the animal, or perhaps photograph it. The animal now associates food with humans. Soon the animal becomes more bold in its attempts to acquire food. This behavior alone may lead to the demise of the animal or could lead to a more serious confrontation in which a person is bitten. Reports of the habituated animal are received by the park rangers and it is sought out and destroyed. The human starting this sequence of events is unknown and goes unpunished. The Park Service does have strict rules against feeding wildlife, but enforcement is difficult with over three million visitors annually to Yellowstone National Park.

Another issue regarding management of any of the mesocarnivore species is the interface along the park boundary. This really is not a management action for the mesocarnivores per se, but more of a human management issue. Certain areas, mainly the entrances to the park, are "hard boundaries" between the park and the human settlements at the park entrance (i.e., gateway communities). While the park side of the boundary is a refugium for predators, the gateway community to the park contains numerous sources of food (i.e., garbage or pets). Thus, some animals may wander into these human communities in search of food and come into conflict with humans by raiding garbage or killing pets at night (even during the day in some instances). These animals may then retreat back into the park before daylight. These conflicts, though rare, can strain relations between the Park Service and humans in these gateway communities. This hard boundary can also work against some mesocarnivore species when humans set traps along the park border, but within the forest boundaries just outside the park. Animals which venture outside the park are vulnerable to these devices (they have little fear of humans in the park) and can be harvested easily. The frequency of this occurring is presently unknown.

A third concern regarding mesocarnivore management is the transmission of diseases. The same gateway communities mentioned previously also contain numerous pets. Transmission of canine or feline diseases could occur between domestic pets and native carnivores whenever a wild animal ventures into town or a pet wanders into the park (Haydon et al. 2002). Even the failure to pick up the feces deposited from an infected pet could prove devastating to an unprotected carnivore population. In the Serengeti, a high-density population of domestic dogs bordering Serengeti National Park was likely the source of canine distemper virus infection and caused a decline in the native lion (*Panthera leo*) population in the Serengeti (Roelke-Parker et al. 1996; Cleaveland et al. 2000).

In summary, little information on all of the mesocarnivore species in Yellowstone is available. The lone exception is coyotes. Coyote numbers and behavior have changed in response to wolf reintroduction. How these changes will affect the other mesocarnivores is unknown. Some mesocarnivores will likely benefit, while other species may not. Changes in elk behavior appear to be affecting the vegetation, with subsequent cascading impacts to other trophic levels. The duration and magnitude of these trophic cascades remains to be documented. Continued long-term research studies will be the best possible resource to determine the direct and indirect impacts of wolf reintroduction on the mesocarnivore community and ecosystem processes in Yellowstone National Park.

10. Current Status of Mesocarnivores in Shiretoko National Park and the Surrounding Area

Takahiro Murakami, Hideharu Tsukada

Abstract

Among mesocarnivores, two species of canids and five species of mustelids are distributed throughout Shiretoko National Park (SNP). The canids are red fox (*Vulpes vulpes*) and raccoon dog (*Nyctereutes procyonoides*), and the mustelids are Japanese sable (*Martes zibellina*), ermine (*Mustela erminea orientalis*), least weasel (*M. nivalis*), Japanese weasel (*M. itatsi*), and mink (*M. vison*).

The red fox is a common species on the Shiretoko Peninsula. Outside of SNP, red foxes sometimes prey on agricultural products such as calves and chickens. On the other hand, within SNP, the red fox population decreased because of the spread of sarcoptic mange in 1994, and still it remains at a low level. Some foxes show habituation to human foods and exhibit begging behavior to tourists. Although human foods are not the major foods of the red fox, those foods affect their habitat use. Raccoon dog may be fewer than red fox in SNP, and their current status in the park is nearly unknown. We rarely see mustelids in SNP, but sometimes we observe road-killed carcasses. The most common are sables. The diet of sables includes various food items such as small mammals, insects, and fruits in SNP and high diversity of natural food resources is an important component for sables' habitat. Both species of Japanese weasels and minks had been artificially introduced into Hokkaido from Honshu island and America, respectively and have spread over Hokkaido. However, their impacts on the natural ecosystem in SNP have not been studied. The least weasel may be a common species in SNP, but little is known. Some reports showed that the raccoon (*Procyon lotor*), which had been introduced into Hokkaido, inhabits the Shiretoko Peninsula. In 2005, raccoon was also found inside SNP (Shiretoko Nature Foundation, unpublished data). They may affect the other carnivore species. Japanese wolf (*Canis lupus*) was driven to extinction in the late 19th century and river otter (*Lutra lutra*) in the early 20th century in Hokkaido. Some scientists suggest that wolves should be restored. However, the social acceptance for wolf restoration seems highly difficult in Japan (Kameyama this volume).

1. Mesocarnivores in SNP and the Surrounding Area

Mesocarnivores in SNP include two canids, five mustelids and raccoon. Red foxes are the most common mesocarnivores and are widespread in SNP. Some foxes are provisioned by tourists (Watanabe and Tsukada 1995; Tsukada 1997b; Tsukada 2000), which cause some conservation problems. The population of raccoon dogs in Shiretoko may be smaller than that of red foxes. The raccoon dog is omnivorous and mainly dependant on insects, small invertebrates and fruits (Table 2-10-1). Road-killed carcasses of raccoon dogs were collected mainly outside SNP

ライオン（*Panthera leo*）の減少を招いたジステンパーウイルスの感染源は、おそらく隣接居住区に数多く住む飼い犬であったとされる（Roelke-Parker et al., 1996; Cleaveland et al., 2000）。

イエローストーンに生息するほとんどの中型食肉目について、詳しいことはわかっていないのが現状である。唯一の例外はコヨーテである。コヨーテの個体数と行動はオオカミの再導入によって変化した。これらの変化が他の中型食肉目にどう影響するのかは不明である。ある種にはプラスに、ある種にはマイナスに作用するであろう。エルクの生息地選択の変化は植生に影響を与え、さらなる他の栄養段階へのカスケード効果が予測される。その期間と規模に関する調査は今後の課題である。長期的調査を継続することが、YNPの生態系の変化と中型食肉目群集に対するオオカミ再導入の直接的・間接的影響を明らかにする最良の方策であろう。

図2-9-1 表頭カラーグラフに収録 Figure 2-9-1 on color gravure page at the begining of this book

図2-9-2 「ドルイド」群と名づけられたコヨーテの群れ（パック）。ワイオミング州、イエローストーン国立公園のラマー渓谷にて。オオカミ再導入後、こうした大きな群れはあまり見られない。
Figure 2-9-2 The Druid coyote pack in the Lamar River Valley, Yellowstone National Park, Wyoming. Large packs such as this are no longer as prevalent since wolves were reintroduced to the valley.

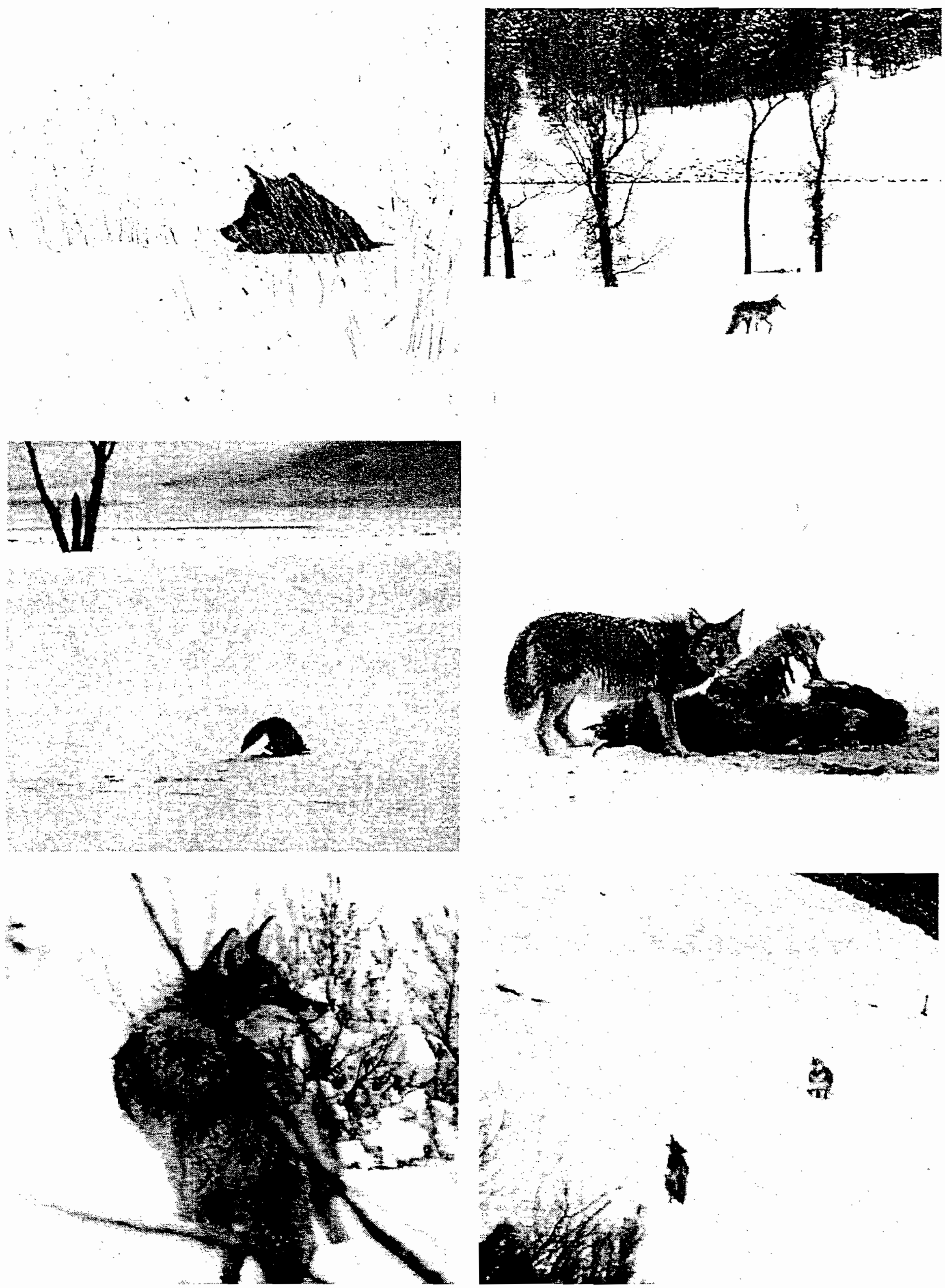

図 2-9-3　観察・記録されたコヨーテの行動。休憩（左上）、移動（右上）、小型哺乳類捕獲（左中）、偶蹄類死体の摂食（右中）、警戒（左下）そして遠吠え（右下）。

Figure 2-9-3 Coyote behaviors observed and recorded include resting (top left), traveling (top right), hunting small mammals (middle left), feeding on ungulate carcasses (middle right), vigilante (bottom left), and howling (bottom right).

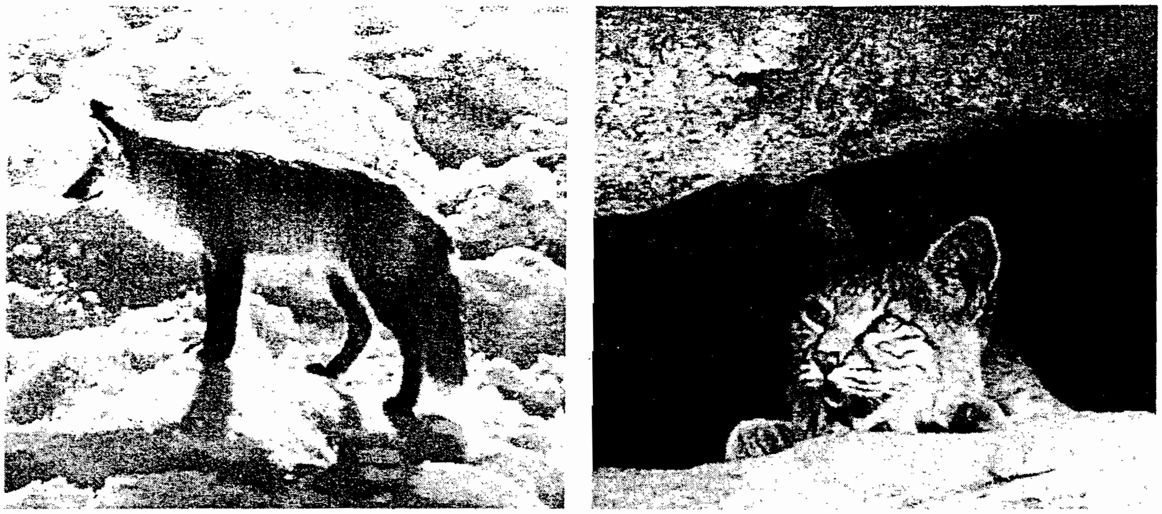

図 2-9-4　オオカミの再導入によるコヨーテ減少によってもっとも影響を受けると思われる2種の中型肉食動物、アカギツネ(左)とボブキャット（右)。

Figure 2-9-4 Two mesocarnivores that may be most directly impacted by wolf reintroduction and declines in the coyote population include the red fox (top) and the bobcat (bottom).