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## ROLE OF FISH HATCHERIES IN THE FUTURE <sup>AFS</sup>

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The role of fish hatcheries in the restoration and management of the nation's fisheries resources has come under increased scrutiny and, in some cases, attack. What is the basis for this situation and where are we going in the future? Management has always had a critical role in directing the hatchery programs. Management has not always assumed these responsibilities or, in many cases, they have not been given the opportunity to direct hatcheries to produce the specific stocks needed. Hatcheries have not always been able to produce the requested fish because of limited disease-free egg sources, production capabilities, quality control, etc. It is time for both management and hatcheries to work together to provide specific products for specific management situations. Management

will be called upon to prepare comprehensive stocking plans which define their specific product needs. These plans would also contain a monitoring component to evaluate whether or not the stocking was successful. Hatcheries will be called upon to furnish a quality product which will match the fish requested by management. When the program is directed at the restoration or recovery of a listed species or species in serious decline, the hatchery will prepare comprehensive propagation and genetics management plans before any actions are taken. These fish will be produced in new facilities designed to rear fish under more natural conditions. All planned actions will be evaluated on the basis of genetic risk.

## BIOLOGICAL SCIENCES - TERRESTRIAL ECOSYSTEMS

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### RIPARIAN-WETLAND INVENTORY PROCEDURES <sup>AFS</sup>

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In 1987, the Montana State Office of the Bureau of Land Management (BLM) and the Montana Riparian-Wetland Association started to develop riparian-wetland inventory procedures. The procedures were designed to meet the

needs of field specialists in BLM Resource Areas. Field specialists identified condition or ecological health, and potential of riparian-wetland areas as the items most needed. The specialists also thought that the

inventory procedures must be repeatable over time. The procedures are the minimum information that will be gathered on BLM riparian-wetland areas. More detailed information may be added by the field offices as needed. The procedures have been field tested on approximately 2,500 miles of riparian-wetland areas by BLM in Montana, North Dakota, South Dakota and Idaho. They have been used by the U.S. Fish and Wildlife Service, Bureau of Reclamation, Atlantic Richfield Corporation (ARCO), Forest Service,

National Park Service and the Bureau of Indian Affairs on three reservations. The inventory provides information about vegetation, soils, hydrology, and stream banks for specific polygons delineated on a map. The field information is entered on a health evaluation form, and each polygon rated as being in good ecological health, at risk, or in poor ecological health. The most important features of the inventory are that it is accepted by the field offices and that it is working on the ground.

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### TRITOMARIA IN WESTERN NORTH AMERICA<sup>MAS</sup>

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The six taxa of *Tritomaria* in North America west of the hundredth Meridian are discussed, keyed, and provided with distribution maps. *Tritomaria polita* is new to Colorado and Washington; *T. quinquedentata* var.

*quinquedentata* is new to the Northwest Territories, Oregon and Saskatchewan; var. *turgida* is new to the Yukon Territories; *T. exsecta* and *T. exsectiformis* are new to the Northwest Territories.

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### A PRELIMINARY LIST OF BRYOPHYTES FROM RAMSAY ISLAND, QUEEN CHARLOTTE ISLANDS, CANADA<sup>MAS</sup>

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The bryophyte flora of Ramsay Island and Queen Charlotte Islands, contains 18 families, 21 genera and 25 species of Musci and 17 families, 23

genera, 37 species, 4 subspecies and a variety of Hepaticae. All of these taxa are reported from Ramsay Island for the first time.

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COMPARISON OF EPIPHYTIC SPECIES DIVERSITY AMONG MAJOR SPECIES OF TREES  
ON RAMSAY ISLAND AND QUEEN CHARLOTTE ISLANDS, CANADA <sup>MAS</sup>

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On 24 supporting trees — including 8 *Alnus rubra*, 8 *Thuja plicata* and 8 *Tsuga heterophylla*, a total of 144 quadrats (20 X 20 cm) were placed on the north and the south sides of the trunks at heights of 1 m, 2 m, and 3 m. A total of 8 taxa of mosses, 14 taxa of liverworts, 2 taxa of lichens and a taxon of fern were recognized. The epiphytic communities on each part of the trees were described

on the basis of growth form. Generally, hepatics are more abundant on the north sides of trunks than on the south sides, and most abundant at the height of 1-2 m for both number of species and mean cover. Five epiphytic communities were recognized: *Isothecium myosuroides*, *Plagiothecium undulatum*, *Scapania bolanderi*, *Frullania nisquallensis* and *Bazzania denudata*.

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EVALUATING IMPACTS OF HUMANS ON RECOLONIZING WOLVES IN  
NINEMILE, MONTANA <sup>TWS</sup>

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Wolves (*Canis lupus*) initially began recolonizing remote areas in northwestern Montana in 1982. In 1994 at least 6 wolf packs existed in Montana, however wolves continue to recolonize in areas where habitat has been altered by humans. We are completing the second year of our study which evaluates the impacts of human activity on: 1) habitat selection, 2) food habits, 3) population dynamics and 4) movements of wolves in Ninemile, Montana. Over the past 5 years, at least 23 wolves have inhabited the Ninemile Valley, 10 of which have been radio-collared. Seven hundred radio locations were used to estimate home range, identify den and rendezvous sites, and develop a Geographic Information System data base. Wolves fed extensively on white-tailed deer (*Odocoileus virginianus*), based on examination of 75 ungulate carcasses fed on by wolves and 934 prey

items identified in 762 wolf scats collected in Ninemile. Wolves fed on 54 white-tailed deer, 1 mule deer (*Odocoileus hemionus*), 2 moose (*Alces alces*), 3 domestic steers, and 1 dog. We documented 4 successful litters, while pack size ranged from 1 to 9 wolves. The Ninemile Pack's home range overlaps 6 U.S. Forest Service grazing allotments as well as hundreds of acres of private ranch land that supports several hundred cattle. We are examining wolf-cattle interactions by radio-collaring domestic cows and intensively monitoring wolves and cattle on an hourly basis. We recorded 826 radio-locations of wolves and cattle during a 2 month period when cattle were out on U.S. Forest Service grazing allotments. Vehicle traffic is being monitored seasonally to determine if increased road use affects wolf travel patterns. Wolves are tracked daily on

the ground during winter to determine how often they travel on roads compared to non-roaded areas, what

type of roads are used, and how wolf movement patterns are affected by the presence of humans.

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### EVALUATION OF BIGHORN SHEEP IN THE TEN LAKES SCENIC AREA <sup>TWS</sup>

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Demographic characteristics and distribution and movements of the Phillipps Creek herd of bighorn sheep (*Ovis canadensis canadensis*) were investigated during July through September 1991 and all of 1992. The most conservative population estimate for December 1992 was 82 (0.95 C.I. = 49  $\leq X \leq$  106). Lamb:ewe ratio for June 1992 was 90:100 and declined to 47:100 by December. The herd spent winter, spring and the rutting period in British

Columbia. Their spring range was an enlarged winter range. Rutting occurred on the winter range. Two lambing-nursery areas were located in Montana, 17 and 24 km south of the winter/spring range. Mixed groups (ewes, lambs, young rams) used areas both north and south of the International Border, during summer/fall. During this same period, ram groups were most often observed south of the Border.

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### AN EVALUATION OF 0.5% PERMETHRIN DUST FOR CONTROL OF FLEAS IN BLACK-TAILED PRAIRIE DOG BURROWS ON THE UL BEND NATIONAL WILDLIFE REFUGE <sup>TWS</sup>

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The UL Bend National Wildlife Refuge and Bureau of Land Management lands north of the Refuge in north-central Montana were selected as a reintroduction site for black-footed ferrets (*Mustela nigripes*) in 1993. Sylvatic plague (*Yersinia pestis*) was verified in black-tailed prairie dog (*Cynomys ludovicianus*) colonies in this area during 1992 and resulted in about a 50% loss in prairie dog acreage. By 1993, three of the five proposed release sites had been decimated by plague. Prairie dog burrows at the two remaining release sites were dusted during June 1993 with 0.5% permethrin dust to control fleas. A total of 830 ha in

16 prairie dog colonies were dusted. The permethrin was injected into burrows with PD-5 dusters at a rate of 7-9 g per burrow. Flea counts were made by flagging 100 prairie dog burrows pre and post-treatment at treated and non-treated colonies to evaluate the efficacy of 0.5% permethrin dust for control of fleas. A significant decrease in flea counts was noted in the treated colonies while flea counts in the non-treated colony did not change significantly. Effects of dusting on other arthropods is discussed. The reintroduction effort was subsequently postponed due to widespread reproductive failure at black-footed ferret breeding facilities.

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**BEYOND BEEF - BACK TO BISON:**  
**AN ECOSYSTEM APPROACH TO RED MEAT PRODUCTION** <sup>TWS</sup>

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Historical notes indicate that bison (*Bison bison*) were abundant in Montana east of the Continental Divide during the early 1800s but were largely extirpated from this area by 1885. Loss of this wildlife resource was a result of ecological sabotage orchestrated by the U.S. Congress, the War Department, and the Department of Interior to subdue Plains Indian tribes. Bison were not eliminated for any specific biological reason. In fact, an ecological comparison of bison to cattle reveals that bison are a vastly superior animal in all respects as a primary range herbivore. Bison are more mobile, have higher digestion efficiency on native vegetation, have lower water requirements, and are more cold hardy than domestic cattle. Most range management problems associated with behavioral traits of cattle can be effectively eliminated in the prairie environment by grazing bison. Recent

discussion of range management reform by the Department of Interior does not consider bison as an alternative to grazing domestic cattle. Recently, several Plains Indian Tribes have taken the initiative to return bison to Indian lands, forming the InterTribal Bison Cooperative (ITCB) in 1990 to coordinate this effort. The Fort Belknap Indian Reservation, home of the Assiniboine and Gros Ventre tribes in north-central Montana, is a member of the ITCB and is engaged in a bison restoration effort. Traditionally, bison have cultural, religious, and economic significance to the Assiniboine and Gros Ventre people and restoration of bison provides an opportunity to maintain these traditions. Lessons and principles learned from this restoration effort are discussed. Significantly, large pasture bison herds provide a means to more efficiently produce red meat without environmental degradation.

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**DOWN THE DRAIN:**  
**THE CAUSE AND CONSEQUENCES OF THE GREAT FLOOD OF 1993** <sup>TWS</sup>  
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One of the world's most extensive terrestrial ecosystems is the North American prairie biome. Today, this ecosystem has been extremely fragmented by human activity. Causes of this fragmentation are chiefly the elimination of native grasses to grow monocultures of cereal crops and the

planting of tame grasses and forbs for pasture. Very little upland prairie remains outside of Federally controlled lands and much of this remaining prairie has been converted to (or invaded by) exotic grass species. A visual inspection of former grassland sites during July 1993 in Montana,

North Dakota, South Dakota, Minnesota, Wisconsin, and Illinois shows extreme soil erosion due to agricultural conversion of prairie grasslands to wheat, corn, and soybean production. Observations of water runoff on cultivated, tame grassland, and forested sites strongly suggest that the Great Flood of 1993 was due to degraded watersheds in the upper Midwest and Northern Plains. Seventy percent of the grain produced in this region is used as livestock feed.

Domestic cattle have high digestion efficiencies on grain and alfalfa but low digestive efficiencies on native grasses. Bison feeding on native rangeland have higher digestion efficiencies than cattle and offer the opportunity to produce comparable quantities of red meat without the environmental degradation, and huge fossil fuel expenditures needed to maintain the present agricultural regime. An example of a bison restoration effort was given.

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### CERVID-WOLF RELATIONSHIPS ALONG THE NORTH FORK OF THE FLATHEAD RIVER<sup>TWS</sup>

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We began a study of the interactions between wolves (*Canis lupus*) and their prey in the North Fork of the Flathead Valley in northwestern Montana and southeastern British Columbia in summer, 1992. This study integrates and expanded on work begun by the Wolf Ecology Project (University of Montana) and three masters' degree studies on deer, elk, and moose (University of Montana). Four wolf packs have occupied the study area; at least 21 and 22 pups were produced in 1992 and 1993, respectively. Survival rates and population trends of white-tailed deer (*Odocoileus virginianus*), elk (*Cervus elaphus*), and moose (*Alces alces*) were examined, and characteristics of prey selection by wolves were documented. Wolves, mountain lions (*Felis concolor*), humans, grizzly (*Ursus arctos*) and black bears (*Ursus americanus*), and coyotes (*Canis latrans*)

all killed radio-tagged ungulates to varying degrees. Survival rates were 0.74, 0.77, and 0.90 for deer, elk, and moose respectively. Deer and elk populations appeared to be stable or declining based on population trend data. Wolves selected white-tailed deer as their primary prey item. Wolves traveled in areas of relatively high deer density and killed deer in areas of greater deer density than was found at random along their travel routes. There was no difference between deer density where deer were killed by wolves and control sites located 500 m from killsites. Wolves killed deer in areas of greater hiding cover than was available at control sites. There was no difference in snow depth or canopy cover at killsites and control sites. Wolves and lions killed their ungulate prey at sites that were similar in hiding cover and canopy cover.

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## STATUS REPORT OF THE WHITE-TAILED PTARMIGAN IN YELLOWSTONE <sup>MAS</sup>

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The White-tailed Ptarmigan (*Lagopus leucurus*) is the most diminutive of all the grouse species in North America. It inhabits very hostile mountain environments, namely windswept alpine areas above timberline. Historical ptarmigan records were examined in detail, along with recent extensive travels into the remote alpine areas of Yellowstone National Park in search for this elusive species. Findings from this research concluded that detailed information, especially from historical times, is lacking. The distribution of the white-tailed ptarmigan in Yellowstone is based on two realistic records. One of these observations causes concern, due to the location of the bird in question (i.e. below timberline.). The other observation was made by a good

observer, but is totally based on the bird being found a half mile from the nearest tree. There are other questions as well. Did the reporter see the bird, or was it second hand information? Also, could it be possible a blue grouse was mistaken for this species? Bird field guides depict the current distribution of the white-tailed ptarmigan as occurring in Yellowstone National Park. Current field research has resulted in finding no ptarmigan to date, and doubts whether the bird ever occurred or maybe it was an accidental. Until more detailed reliable information is collected on the white-tailed ptarmigan in Yellowstone, all field guides and scientific publications should refrain from depicting Yellowstone as definitive habitat for white-tailed ptarmigan.

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## MOVEMENT PATTERNS OF BULL ELK ON THE THEODORE ROOSEVELT MEMORIAL RANCH, MONTANA <sup>TWS</sup>

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During 1987-1993, bull elk were radio-collared and monitored on the Boone and Crockett Club's Theodore Roosevelt Memorial Ranch (TRM Ranch), 80 miles northwest of Great Falls, in north central Montana. Radio transmitters were placed on 25 bull elk ranging in age from calves to five year olds. Elk were captured on the Dupuyer Creek and Blackleaf winter ranges and monitored as they dispersed to summer ranges. Bulls moved widely throughout the year, mingling frequently with other

herds. Five major summer ranges were identified: the Middle Fork of the Flathead River, the Badger-Two Medicine River drainages, the North Fork of the Sun River, and Blackleaf-Dupuyer Creeks (Blackleaf Wildlife Management Area and TRM Ranch). Some of the collared bulls travelled into agricultural areas where no elk use had previously been documented, such as the Pine Butte Swamp Preserve (The Nature Conservancy) and adjacent riparian habitat along the Teton River.

Early season, or bugle, hunting in the Bob Marshall Wilderness accounted for the greatest mortality among collared bulls. A second wave of mortality occurred during migration from summer range to winter range, typically in mid-November. Guided hunters accounted for 30 percent of bull mortality, unguided hunters 25%, suspected illegal harvest 15%, known illegal 10%, winter kill and wounding loss 10%, and unknown fate 10%.

Overall, 94% of collared bulls were removed in 36 months. Hunting seasons in District 441 (the Rocky Mountain Front) became progressively more restrictive as hunter harvest and seasonal movement information became available. As a result of these changes in season structure, post-hunt bull/cow ratios steadily improved since 1986. The elk herd grew from approximately 180 in 1980 to over 500 in 1993.

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### EFFECTS OF NEST PREDATION ON GROUND-NESTING BIRD COMMUNITIES IN NORTHWESTERN MONTANA <sup>TWS</sup>

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I studied two separate areas on the Flathead Indian Reservation in northwestern Montana to assess the effects of skunk removal on nongame ground-nesting bird communities. Skunk removal has taken place in the Ninepipe National Wildlife Refuge area since 1988, while no skunk removal has taken place in the Pablo National Wildlife Refuge area. These two areas were searched by nest-dragging selected areas, and nests of all bird species found were monitored for hatching success. Both areas experienced fairly high rates of nest success, but sample sizes did not

allow for statistical comparison between areas. Predation accounted for the majority of failed nests in both areas. Relative predator abundance, as indicated by scent station data, indicated that the skunk trapping program was effective in reducing the density of skunks in the Ninepipe area. Results of artificial nest transects in both areas indicated more predation in the Pablo area, but the results were only marginally significant. This study should be regarded as a baseline from which to further investigate ground-nesting bird communities in this area.

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### LICHENS AS FOOD FOR MOUNTAIN GOATS IN THE ABSAROKA RANGE, SOUTHWESTERN MONTANA <sup>MAS</sup>

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The food habits of mountain goats in the Absaroka Range, south central Montana, were investigated. Data on fall diet were collected by rumen sample analysis. Primary forage items were graminoids (82%), forbs (13%), and

lichens (2.5%). Three species of lichens were found in the rumens. It was concluded that lichens were important forage items for mountain goats during the winter stress periods when other forage items are scarce.