Distribution and Status of the Boreal Toad *(Bufo boreas boreas)* in Wyoming

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ERRATA

1) Page 6, third paragraph, third line should read:

As a result of a WYGF survey, one adult female was found on May 25, 2000 and taken into captivity to supplement the stock at Sybille Wildlife Research Center.

2) Page 6, fourth paragraph, third line should read:

One adult female was found, photographed and released during a WGFD survey on May 22, 2000 near a string of ponds along Bird Creek. Another adult female was found on the following day and taken into captivity to supplement stock at Sybille Wildlife Research Center.

Biology

Description

Boreal toads are stout bodied with a short and blunt head. Their body coloration varies from brownish olive to black with a conspicuous white or yellowish mid-dorsal stripe, a light throat, and, many black spots on the sides and belly. Immature toads have bright yellow or orange flecks on the ventral surface of the feet and body. Males are generally 2.4 to 3.2 in. (60 to 80 mm) long from snout to vent and females are 3 to 4 in. (75 to 100 mm) long. During breeding season, mature males have a dark patch on the inner surface of the innermost digit of the forefeet, lack a vocal sac, and may produce chirping sounds when handled. Boreal toads are distinguished from other Wyoming toads by the absence of cranial crests and by a distinctive musky odor. They are further distinguished from spadefoots by having round pupils and two tubercles on the hind foot that lack well developed cutting edges. (Hammerson 1999; Baxter and Stone, 1985).

The round, black eggs are linearly spaced in 1 to 3 rows within long strings of two-layered jelly and are laid in shallow water. Tadpoles are uniformly black or dark brown and tend to aggregate in shallow water. Their eyes are about halfway between the dorsal midline and the lateral edge of the head. Fully developed larvae are about 34 to 37 mm long, including the tail. Toadlets are similar in appearance to adults but have reddish-orange coloration on the toes and often lack the middorsal stripe, especially when small (Stebbins 1985).

Distribution and Taxonomy

The boreal toad (*Bufo boreas boreas*) is one of two subspecies of the western toad found in the western United States (Figure 1). The boreal toads found in New Mexico, Colorado, and southeastern Wyoming form the southern rocky mountain populations, which is geographically isolated from the northern populations by dry, non-forested basins and valleys. These populations are genetically different and probably represent independently evolving lineages (Goebel, 1996; Hammerson, 1999). There is evidence that boreal toads in northern Utah may be of the same lineage as those in the SRMP, but additional data is needed to confirm that hypothesis.

Southern Population: With the possible exception of New Mexico, boreal toads continue to be found in much of their historic range, but within this range most populations have been greatly reduced and toads are currently present is as little as one percent of historic breeding areas (BTRT, 2001). Historically boreal toads of the southern population were considered common throughout high elevations of Colorado and southeastern Wyoming (USFWS, 1994; BTRT, 2001), down to the southern range boundary of in New Mexico's San Juan Mountains (specifically Lagunitas, Canjilon, and Trout Lakes; (BTRT, 2001; USFWS, 1994; Stuart and Painter, 1994). The boreal toad is now very rare in southeastern Wyoming, and perhaps extirpated from most historic breeding ponds. It is apparently extirpated from its former range in northern New Mexico.

Habitat

Rangewide: Boreal toads occupy three different types of habitat during the course of a year: breeding "ponds", summer range, and winter hibernaculae, all of which occur in lodgepole pine or spruce-fir forests. Breeding ponds are areas of shallow, quiet water in lakes, marshes, bogs, ponds, and wet meadows. Post-breeding summer range includes use of upland montane sites in the vicinity of breeding ponds (usually within 100 - 300 m), particularly around spring seeps, with female toads potentially ranging farther from breeding ponds than males BTRT, 2001; Hammerson, 1999; Jones, 1998; Campbell 1970a). During inactive periods toads often seek shelter under logs and rocks or in below-ground spaces such as rodent burrows. Hibernacula are usually found in terrestrial habitats near breeding ponds and are often ground squirrel burrows descending below the frost line.

Wyoming: Boreal toads are found in wet habitats in foothills, montane, and subalpine areas, including subalpine meadows, aspen and spruce-fir forests, and all riparian habitat types (Baxter, 1980). Montane amphibians in general are limited to areas where predatory fish are absent and there is suitable breeding habitat. Toads have also been found in kettle ponds, beaver ponds, and old oxbow lakes with still shallow water and a mud or silt bottom (Garber, 1995).

Reproduction and Survivorship

Boreal toad breeding begins as the snowpack around bredding ponds starts to thaw, which is usually from mid-May to July depending on elevation and weather. Egg laying continues from mid-May to early mid-July, and egg hatching from late June to late September. Tadpoles are present from mid-July to late August and juveniles are present from mid-July to late September (Garber 1995). In areas with short breeding seasons, tadpoles may fail to transform before winter at these high elevations, and these populations are probably maintained by breeding adults moving up from lower elevations (Baxter and Stone, 1985).

Breeding and egg laying occur mainly in shallow areas of ponds and lakes that are less than 15 cm deep, often with emergent vegetation (Hammerson, 1999). Unlike other toads, males do not use a loud breeding call, but may emit a short, soft chirp, either single or in series (Baxter and Stone, 1985). In the Snowy Range above 10,000 feet (3655 meters), toads have bred in shallow water along the north shoreline of small lakes where exposure to the sun warms the water. Breeding can take place in temporary ponds, but successful larval development through metamorphosis often requires permanent or semipermanent water (Hammerson, 1999).

There is evidence that male toads do not breed until they are four years old and females don't breed until they are six years old (Hammerson, 1999; Carey, 1976). Further, female toads may only breed every other year or even less frequently (Hammerson, 1999; Carey, 1976). Mortality in boreal toads through the second year of life has been estimated to be as high as 95 to 99% due to environmental conditions and predation (Samallow 1980; Campbell 1970a) and perhaps as high as 100% in areas infected by chytrid fungus. It is thought that adult toads can live to nine years or older (Hammerson 1982; Campbell 1976).

Food Habits

Boreal toads eat a variety of invertebrates, mainly insects, which they find using olfactory cues (Dole et al. 1981; Shinn and Dole 1979a). Ants may constitute a large portion of the diet.

Metamorphosed individuals feed on various small terrestrial invertebrates and larvae filter suspended plant material or feed on bottom detritus.

Activity Patterns

Boreal toads hibernate during cold winter months, emerging from hibernaculae shortly after the ground thaws, generally in early May to early June, depending on elevation. They return to hibernation in late August to mid September, but may re-emerge to bask near the hibernacula entrance during warm days in September and October (Hammerson, 1999). Boreal toads are mainly diurnal, but may be active at twilight or night if conditions are sufficiently mild. At night, toads may range away from water (Finch 1992). Toads bask in sunlight to increase body temperature during cool days. During the hottest portions of the day, toads seek cooler microclimates, often burying themselves in loose soil, entering small mammal burrows, or hiding under rocks and logs. Ambient air temperatures when toads are active appear to lie between 12˚C and 20˚C. They seek shelter under logs or rocks, in rodent burrows, or in other below-ground spaces.

Population Status

Occurrences in WYNDD's Database

For actively tracked species such as the boreal toad (particularly the southern population) the number of recent element occurrences in WYNDD's database gives some indication of the distribution and status of animal populations in Wyoming. Each element occurrence often contains multiple observations from several years in a localized area. For example, the Bird Creek area of the Medicine Bow National Forest is listed as one occurrence, which represents a historical boreal toad breeding location and that has been surveyed repeatedly over several years.

Southern population: WYNDD has 29 element occurrences; 3 breeding sites (1 since 1995), 14 observations (6 since 1995), and 12 locations where specimens were collected (Figure 2). All records occur within Medicine Bow National Forest.

Northern population: WYNDD has 104 element occurrences; 33 breeding sites (23 since 1995), 45 observations (15 since 1995), and 26 locations where specimens were collected (Figure 2). All records occur within Grand Teton National Park, Yellowstone National Park, Shoshone National Forest, Bridger-Teton National Forest, Targhee National Forest, the Jackson National Elk Refuge, or montane BLM lands.

Trends and Recent Observations in Wyoming

Southern Population

The southern population continues to be in serious decline. Although boreal toads were formerly widespread and numerous in southern Wyoming, Colorado, and northern New Mexico, breeding populations are now confined to a few areas in Colorado. Corn et al. (1989) found that the toad was absent from 94% of the historic sites in the Southern Rocky Mountains. The cause of the decline has been the subject of much speculation. The impacts of chytrid fungus and habitat degradation are generally considered the main contributing factors, but there is still no concrete resolution to the issue.

As of the November 15, 2000 Boreal Toad Recovery Team meeting, there were 32 known active breeding localities (all in Colorado), but many of these sites showed decreasing activity as evidenced by reduced numbers of egg masses, metamorphs, and adults. Several new breeding sites were found in 2000, but these were largely offset by declines at known sites. Where egg masses are found, recruitment seems to be very low, possibly due to chytrid fungus causing mortality in the metamorphs. (BTRT, 2000).

The southern population seems nearly extirpated from its historic range in Wyoming. There have been no recent, confirmed observations in southern Laramie Range. A few small breeding populations may remain in the Medicine Bow and Sierra Madre Mountains, but in the last few years there were only two observations of boreal toads in this area, as noted below. WYGF surveys during the 2000 season were limited to Lake Owen, Bird Creek and Rock Creek. Two more areas, one east of Sand Lake Road (T16N, R78W, S16/17) and another in the vicinity of Long Lake (T18N, R80W, S34), were surveyed by Greg Eaglin of the USFS. Informal surveys of several other historic boreal toad breeding locations near Bird Creek T13-14N, R78-79W) and Fox Park (T12-13N, R78W) were conducted by Doug Keinath of WYNDD. During the 1999 season WYGF surveyed approximately 28 other locations in Medicine Bow National Forest and found no boreal toads.

1) Rock Creek approximately 8 miles north-northwest of Centennial, Medicine Bow National Forest (T17N, R78W, S32, NE¼S).

As a result of a WYGF survey, one adult female was found on June 6, 2000 and taken into captivity to supplement the stock at Sybille Wildlife Research Center. No egg masses or tadpoles were found during this survey. A similar survey in 1999 resulted in the location of one living and one dead adult. Elizabeth Williams of the State Veterinary Laboratory examined the dead toad, but the cause of death was undetermined. Historically, this site was a productive breeding area. (For more detailed information contact Don Miller of the Wyoming Game and Fish Department in Laramie, Wyoming.)

2) Bird Creek approximately 2 miles west-northwest of the town of Albany, Medicine Bow National Forest (roughly T14N, R78W, S9).

Two adult females were found during a WYGF survey on May 22, 2000 in a string of ponds along Bird Creek. Both toads were taken into captivity to supplement stock at the Sybille Wildlife Research Center. During a later survey on June 6 one adult female was found and taken into captivity. No egg masses or tadpoles were found during either survey. Although this site has also been historically productive no toads were found during a similar survey in the summer of 1999. A survey in 1998 resulted in the location of 10 juvenile toads. (For more detailed information contact Don Miller of the Wyoming Game and Fish Department in Laramie, Wyoming.)

Northern Population

The northern population of the boreal toad seems to have been historically more widespread than it is today. It does not appear to be declining as quickly as the southern population, but since there has been little coordinated effort to inventory the northern population in Wyoming, this is largely conjecture. Moreover, the discovery of chytrid fungus in the northern population brings the future stability of the population into question and highlights the need for more

monitoring and protection of known breeding locations and surveys of historic breeding sites and potential breeding habitat. Currently, less than 12 breeding sites are being regularly monitored. Large regions of potential habitat, predominantly on land of the Bridger-Teton and Shoshone National Forests in the Absaroka, Wind River, and Wyoming Mountain Ranges, have not been systematically surveyed.

In 2000, there were five new observations of boreal toads of the northern population reported in Wyoming, although field data are still being compiled. They are as follows:

1 & 2) Wind River Range, Bridger-Teton National Forest, Jackson Ranger District

In September, 2000 Mark Novak, a fisheries biologist for the Jackson Ranger District of the Bridger Teton National Forest incidentally observed boreal toads in the northern Wind River Mountains. Two adult toads where observed near Little Devils Basin Creek (T41N, R110W, S2, center) and two more near Stove Creek (T41N, R110W, S8, SW¼S). No evidence of breeding was found at either site. (For more information contact Mark Novak of the Bridger-Teton National Forest, Jackson Ranger District in Jackson, Wyoming.)

3) Wyoming Range, Bureau of Land Management, Pinedale Field Office

In mid July, 2000 Erin Muths of the U.S. Geological Survey found several adults, tadpoles and metamorphs about 10 miles northwest of La Barge, on BLM land in the foothills of the Wyoming Range [T28N, R114W, S22, SW¼S]. Toads were found in beaver ponds just downstream of the confluence of Middle and South Sawmill Creeks. Field personnel collected voucher specimens. (For more information contact Erin Muths of the U.S. Geological Survey in Fort Collins, Colorado.)

4 & 5) Greater Yellowstone Parks and Refuges

Throughout the summer of 2000, Debra Patla, working through Idaho State University, monitored known breeding sites and conducted amphibian surveys in suitable habitat in the northwest corner of Wyoming. Specifically, surveys were conducted on the National Elk Refuge, in Yellowstone National Park (Hayden Valley, Arnica Creek, and Specimen Creek), and around String Lake and Flagg Ranch in Grand Teton National Park. Of these surveys, one new toad breeding site was located on the elk refuge, bringing the total there to two known active sites, one of which has been invaded by chytrid fungus. Another new site was found near Colter Bay on Jackson Lake in Grand Teton and breeding was confirmed at the Snake River Quarry south of Flagg Ranch. No new sites were found in Yellowstone. (For more information contact Debra Patla of Idaho State University's Biological Science Department.)

There is also ongoing monitoring of historic boreal toad breeding sites in Yellowstone National Park (six sites) and nearby national forest lands (three sites). Only one site outside the park, along the Buffalo River near the Blackrock ranger station, is still productive, and there seems to be relatively high adult toad mortality from raven predation at this location. More complete accounts of these sites will be compiled within the next several months as field data are compiled and analyzed.

Threats and Reasons for Decline

There are numerous scenarios that could explain the drastic decline in boreal toads and other amphibians over the past several decades. The most recent explanation seems to be that some environmental variable is placing stress on toads, and allowing them to contract fatal diseases (e.g., chytrid fungus) to which they were formerly resistant (BTRT, 2001; Carey, 1993). Likely, the decline has resulted from a combination of threats and no one factor is solely to blame. Several classes of threats are briefly described below.

Chytrid Fungus

Chytrid fungus (*Batrachochytrium dendrobatidis*) has caused mass deaths of amphibians in Arizona, California, Colorado, Central and South America, and Australia (Berger et.al. 1998). This fungus has be found throughout the southern rocky mountain population and has been shown to be present when population declines were initially documented in the 1970's and 1980's (BTRT, 2001). Some experts feel that this fungus is primarily responsible for the drastic declines in the southern population of boreal toads and most (if not all) experts think it is at least partly. Therefore, chytrid fungus was discussed extensively at the last meeting of the Boreal Toad Recovery Team (November 15, 2000), during which much of the following information was presented.

Although likely a major component of decline, infections have not been conclusively determined as the main cause of mortality or population declines in Wyoming and northern Colorado. Chytrid fungus was present in several Wyoming toad moralities at Sybille Wildlife Research Center, but there has been no sign of chytrid infections in the captive boreal toads (BTRT, 2000). Debra Patla has discovered chytrid fungus in the northern population at the Jackson National Elk Refuge during Summer 2000 (D. Patla, pers. comm.). Discovery of chytrid on the refuge is apparently the first documentation of the disease in northwest Wyoming.

The chytrid fungus attacks keratin in the skin of metamorphosed amphibians, causing 90-100% mortality in some species. Death generally occurs within 30 days of infection. Clinical signs can be highly variable, but infections tend to be concentrated on the feet and abdomen. Unlike many other fungal infections, chytrid infections are intracellular, however the fungus can live outside a host, so contact is not required for disease transmission. Amphibian larvae can be non-lethally infected because keratin is present only in mouth parts. Such individuals can carry the disease and succumb after metamorphosis, when more extensive keratinatious tissue develops.

Treatment of infected captive animals with baths of the anti-fungal agent Itraconazol have resulted in cessation of symptoms, but it is not know whether infection was eliminated or merely reduced, since subclinical infection is very hard to detect without tests, such as the PCR technique addressed below. Also, Itraconazol cannot be used on larvae.

Work is currently being done at the University of Maine to develop a PCR probe to detect the chytrid fungus infecting boreal toads (*Batrachochytrium dendrobatidis*) without given false positive readings from other fungi. This work uses nuclear DNA containing highly conserved ribosomal genes flanked by highly variable internal transcribed spacer regions. The probe will hopefully be available to test tissue samples in early 2001, but the test cannot be applied directly to soil or water samples without the use of "sentinel" animals that are exposed to the environment in question. New field protocols must be developed to insure proper collection and

preservation of tissue samples for testing with this method. The Boreal Toad Recovery Team will likely publish appropriate methods, but in the meantime an EDTA buffer solution is recommended to preserve all toad specimens and tissue samples (rather than the standard formalin solution, which interferes with the test).

Other Disease

The focus on chytrid fungus has shifted attention away from other toad pathogens. Others that have been noted include the bacteria *Aeromonas hydrophila* and the fungus *Basidiobolus ranarum*, which are known to cause mycotic dermatitis on boreal toads. Recently, a new and potentially fatal condition has also been identified in some captive toad populations, including those at Colorado Division of Wildlife's Native Aquatic Species Restoration Facility, CDOW's Fort Collins office, and Wyoming's Sybille Wildlife Research Center. The condition seems to cause inflammation of the heart, fluid accumulation, and death due to heart failure. The cause is not yet known, but bacterial infection is a possibility. Affected toads appear bloated due to fluid accumulation. Any toads exhibiting such symptoms should be reported to the Boreal Toad Recovery Team Chuck Loeffler, Colorado Division of Wildlife, Fort Collins, Colorado).

Anthropogenic Impacts

Human disturbance of wetland habitats is detrimental to boreal toads throughout their range. The form these threats take is varied and may include conversion of small ponds into larger reservoirs by damming, water level manipulation in reservoirs and stockponds, timber harvest in montane habitats, and recreation (Finch 1992). Further, increased UV radiation in the egg stage (presumably resulting from ozone depletion) may lead to malformed or non-viable toads, pesticides designed to reduce forest pests can harm tadpoles, and intense livestock use of breeding ponds may eliminate critical breeding habitat. Humans can also facilitate expansion of natural and introduced predators, such as bullfrogs (*Rana catesbeiana*), ravens (*Corvus corax*) and tiger salamanders (*Ambystoma tigrinum*). In short, all resource management activities that negatively affect quality or quantity of alpine wetlands within the current range of boreal toads are potentially detrimental to the toads (BTRT, 2001).

Natural Predation

Although some tissues of the boreal toad may contain toxins making them unpalatable to some predators, predation can still remove significant portions of breeding populations (Corn, 1993). As listed in by the BTRT (2001), natural predators of the boreal toad include, but are not restricted to, the common raven (Corn 1993; Olson 1989), gray jay (*Perisoreus canadensis*) (Beiswenger 1981), western garter snake (*Thamnophis elegans*) (Jennings et al. 1992; Arnold and Wassersug 1978), tiger salamander (*Ambystoma tigrinum*) (Hammerson 1982), badger (*Taxidea taxus*) (Long 1964), spotted sandpiper (Actitis macularia) (Hammerson, 1999), red fox (*Vulpes vulpes*), robin (*Turdus migratorius*), mallard duck (*Anas playtrhynchos*) (Hammerson, 1999), and racoon (*Procyon lotor*) (Jones, 1998). Predacious diving beetle larvae (*Dytiscus* sp.) also prey on the tadpoles (Livo 1998) as could may non-native trout species (e.g., Bradford 1989, Bradford et al. 1993, Corn 1994) and bullfrogs. Domestic dogs and cats may also prey on adult toads. Wood frog larvae can be effective predators of toad eggs and hatchlings and it seems that toads will avoid laying eggs in ponds inhabited by wood frogs (Hammerson, 1999; e.g., Petranka et al., 1994).

Management Considerations

Conservation Plans

The inexplicable and rapid decline in amphibian populations world-wide makes proper management and monitoring of this species even more urgent. In general, the following steps comprise a conceptual recovery plan similar to that developed for the southern population (e.g., BTRT, 2001):

1) identify and inventory potential toad habitat throughout the historic range;
2) monitor breeding populations identified via inventories with the goal of attaining reliable trend data;
3) identify and investigate known and potential threats;
4) establish recovery goals based on population viability estimates that incorporate genetic factors;
5) protect and manage critical populations with respect to known threats;
6) pursue opportunities to expand the size and number of breeding populations, including transplantation and captive reintroduction;
7) conduct a public education campaign concurrent to the above recovery efforts.

Thus, with regard to boreal toads, inventory and monitoring efforts are needed followed by the development of recovery plans, conservation strategies, and conservation agreements among all relevant public and private institutions. Plans should include monitoring environmental factors at breeding sites, identifying potentially suitable habitat, raising and re-introducing toads, conducting population viability analyses, and educating the public. An effort should also be made to determine the effects of UV-radiation, contaminants, and disease on populations (Goettl et al. 1997). In addition, managers need to assess the effects of logging and exotic salmonids on montane amphibians. Potential breeding habitat (i.e., moist, forested montane areas) should be preserved whenever possible.

Southern population: This process is underway for the southern population, but limited funds have precluded any large-scale coordinated action. The multi-agency Boreal Toad Recovery Team was formed in 1994 to provide coordinated recommendations on the conservation and management of the southern population. A recovery plan was finalized in the same year (Goettl et al., 1997) and a conservation plan followed in 1998 (BTRT, 1998) and will be updated in early 2001 (i.e., BTRT, 2001). As stated in the draft of the revised conservation plan (BTRT, 2001), management objectives are:

> to (1) prevent the extirpation of boreal toads from the area of their historic occurrence in the southern Rocky Mountains, which includes eleven mountain ranges, or geographic areas, covering southern Wyoming, northern New Mexico, and much of Colorado, (2) to avoid the need for federal listing of the boreal toad under the ESA, and (3) to recover the species to a population and security level that will allow it to be de-listed from its present endangered status in Colorado and New Mexico.

Detailed descriptions of down-listing and de-listing requirements (within Colorado) and population viability are provided in the conservation plan (BTRT, 2001). In general, for a population to be considered viable a specified minimum number of toads must successfully breed (i.e., there must be significant recruitment) for a set number of years and external threats to the habitat, health, or environmental conditions of the population must be eliminated. Down-

listing and/or de-listing will be considered when a specified number of viable populations over an adequate geographic area are confirmed. Currently, there is no portion of the southern population that meets established viability standards.

Northern population: No coordinated efforts have thus far been made with respect to the northern rocky mountain population of boreal toads, although much of the conceptual and biological information generated for the southern population will be loosely applicable to the northern population.

Conservation Status

There are two geographically (and likely genetically- Goebel, 2000; C. Carey, pers. comm.) distinct populations of boreal toads in Wyoming; the Southern Rocky Mountain Population (southern population) and the Northern Rocky Mountain Population (northern population) (Table 1; Figure 1). The Global Heritage Rank of this species is G4, owing to more extensive populations in the northern US and Canada, but both local populations are ranked considerably higher due to declines in abundance and (in the case of the southern population) regional endimism.

Southern Population: The southern population is a regionally endemic taxon that is disjunct from the main species distribution. Its range in Wyoming is limited to disjunct patches in the Medicine Bow Mountains of Albany, Laramie, and Carbon counties (Figures 1 and 2). It is listed as a sensitive species by Region 2 of the U.S. Forest Service (USFS) and as a first order Species of Special Concern by the Wyoming Game and Fish Department (WYGF). It has been listed as endangered in New Mexico since 1976 and Colorado since 1993 and has been proposed as a candidate for listing under the U.S. Endangered Specie Act (ESA). In March 1995, USFWS determined that listing was warranted but precluded by actions of higher priority (Federal Register, 25 October 1999). An emergency listing petition is possible, but unlikely. Even if an emergency listing is approved, it is unlikely to generate any more federal funding in the near future, since USFWS's budget is currently be driven solely by litigation (BTRT, 2000).

Northern Population: The portion of the northern population in Wyoming is at the southern periphery of the species contiguous range, occurring in scattered pockets throughout the mountains in the northwestern corner of the state. Although it has not been considered for federal ESA listing, the USFS has listed it as a sensitive species in Region 2 and the WYGF has listed is as a second order Species of Special Concern.

Captive Propagation and Reintroduction

Southern population: There are currently captive boreal toads collected from the southern Rockies population being held at several facilities. Colorado toads are held at the Colorado Division of Wildlife Native Aquatic Species Restoration Facility, the Toledo Zoo, the Chyenne Mountain Zoo, and several smaller operations. In total, there are currently 29 genetic lots from Colorado in captivity deriving from 758 metamorphs, 36 sub-adults, and 15 adults (BTRT, 2000). Additional toads will be taken into captivity over the next several years to increase the viable stock and enhance genetic diversity. Also, breeding will be attempted where an official "studbook" system is followed to track the breeding success of individual toads.
Wyoming toads were all collected from either Rock Creek or the Bird Creek in the Medicine Bow Mountains and are held at the Sybille Wildlife Research Center in Wyoming. As of

November, 2000 Sybille housed 26 adult toads and although chytrid fungus has been documented at the facility, none of the boreal toads seem to be infected.

Past reintroduction and transplantation efforts have been largely unsuccessful. In Wyoming, the Wyoming Game and Fish Department released 4,300 toadlets (mid August, 1996) and 950 tadpoles (July 25, 1997) in beaver ponds near Owen Lake in the Medicine Bow Mountains. The site was surveyed repeatedly in subsequent years, and although juvenile toads were found in 1997 (3 in mid July and 2 in late July) no evidence of boreal toads were found in 1998 - 2000 (Loeffler, 1999; Don Miller, Wyoming Game and Fish, Laramie, Wyoming, pers. comm.).

Northern Population: No reintroduction efforts have been implemented or proposed for the northern population within Wyoming.

Information Needs

Studies are underway to determine the taxonomic status of the southern and northern populations of the boreal toad. Additional surveys are needed in both montane and lowland habitats to document new sites and to monitor population trends. Annual population monitoring at all extant and historical sites is needed to determine population viability. Data are also needed on home range size, dispersal patterns, hibernacula requirements, and the effects of logging and non-native trout on breeding sites and dispersion. Recent die-offs in Colorado attributed to chytrid infections suggest that disease research is a priority.

Tables and Figures

Table 1: Official status of Wyoming boreal toad populations

Taxon	Heritage Rank	Federal and State	WY Counties	Range Notes
Southern population	G4T1Q/S1	USFWS Candidate USFS R2 Sensitive WYGF SSC1	ALB, CAR, LAR	Reg. endm.
Northern population	G4T4/S2	USFS R2 Sensitive WYGF SSC2	FRE, LIN, PAR, SUB, SWE, TET, UIN	SE periph.

Notes on codes used in Table 1

HERITAGE RANKS: WYNDD uses a standardized ranking system developed by The Natural Heritage Network to assess the global and statewide conservation status of each plant and animal species, subspecies, and variety. Each taxon is ranked on a scale of 1-5, from highest conservation concern to lowest. Codes are as follows:

G - Global rank: rank refers to the rangewide status of a species.
T - Trinomial rank: rank refers to the rangewide status of a subspecies or variety.
S - State rank: rank refers to the status of the taxon (species or subspecies) in Wyoming. State ranks differ from state to state.
1 - Critically imperiled because of extreme rarity (often known from 5 or fewer extant occurrences or very few remaining individuals) or because some factor of a species' life history makes it vulnerable to extinction.
2 - Imperiled because of rarity (often known from 6-20 occurrences) or because of factors demonstrably making a species vulnerable to extinction.
3 - Rare or local throughout its range or found locally in a restricted range (usually known from 21-100 occurrences).
4 - Apparently secure, although the species may be quite rare in parts of its range, especially at the periphery.
5 - Demonstrably secure, although the species may be rare in parts of its range, especially at the periphery.

FEDERAL MANAGEMENT STATUS: USFS Region 2 (Rocky Mountain Region) and 4 (Intermountain Region) have developed official Sensitive species lists to track organisms warranting special attention on USFS lands. Sensitive species are defined as "those plant and animal species identified by the Regional Forester for which population viability is a concern as evidenced by: (a) significant current or predicted downward trends in population numbers or density, and/or (b) significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution." US Forest Service Region 2 includes Bighorn, Black Hills, Medicine Bow, and Shoshone National Forests and Thunder Basin National Grassland. US Forest Service Region 4 includes Ashley, Bridger-Teton, Caribou, Targhee, and Wasatch-Cache National Forests.

WYOMING STATE MANAGEMENT STATUS: Wyoming Game and Fish Department (WYGF): The WYGF has developed a matrix of habitat and population variables to determine the conservation priority of all native, breeding bird and mammal species in the state. Six classes of Species of Special Concern (SSC) are recognized, of which classes 1, 2, and 3 are considered to be high priorities for conservation attention.

SSC1: Includes species with on-going significant loss of habitat and with populations that are greatly restricted or declining (extirpation appears possible).
SSC2: Species in which (1) habitat is restricted or vulnerable (but no recent or significant loss has occurred) and populations are greatly restricted or declining; or (2) species with on-going significant loss of habitat and populations that are declining or restricted in and distribution (but extirpation is not imminent).
SSC3: Species in which (1) habitat is not restricted, but populations are greatly restricted or declining extirpation appears possible); or (2) habitat is restricted or vulnerable (but no recent loss has occurred) and populations are declining or restricted in numbers or distribution (but extirpation is not imminent); or (3) significant habitat loss is on-going but the species is widely distributed and population trends are thought to be stable.

Figure 1: Distribution of *Bufo boreas* species in North America and Wyoming

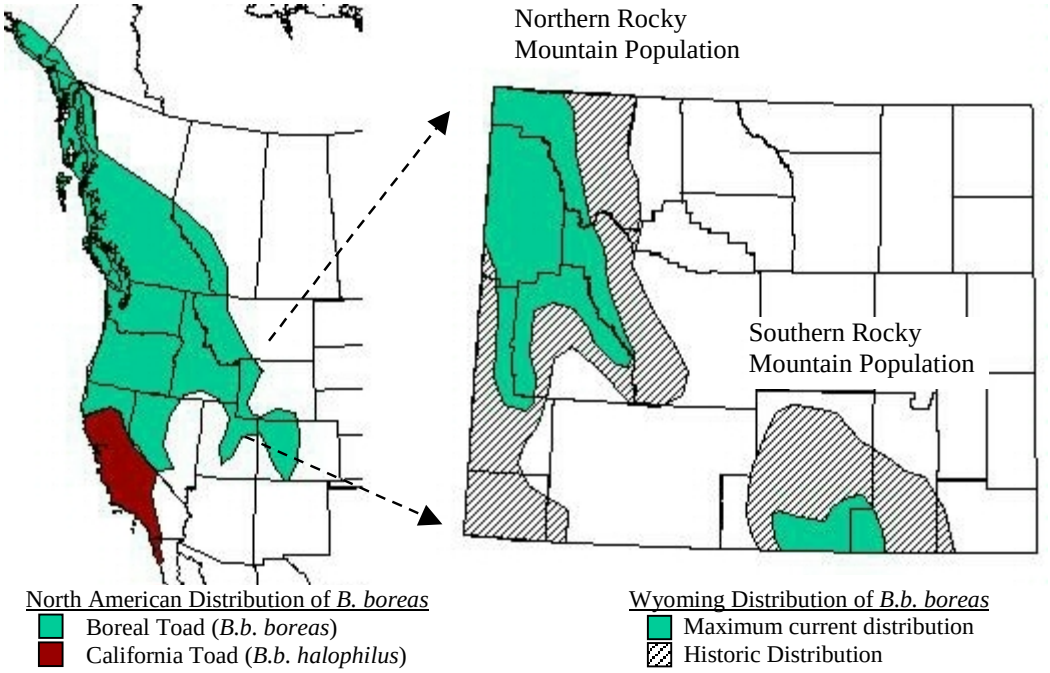
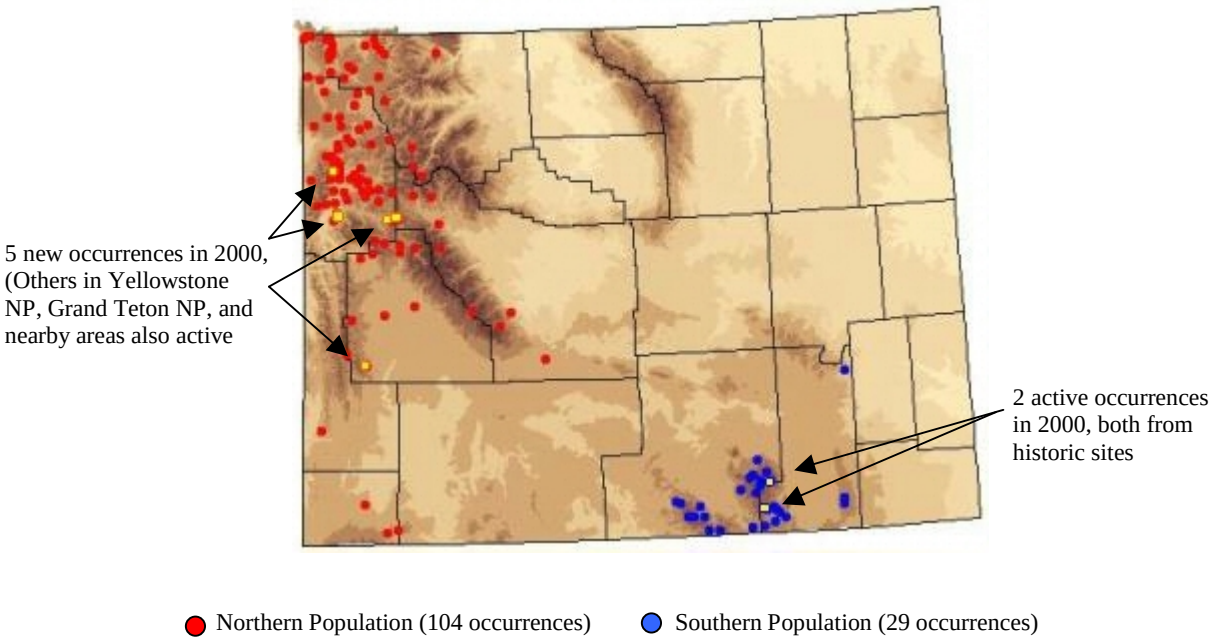


Figure 2: Reported occurrences of *Bufo boreas boreas* in Wyoming.



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