Species Action Plan:

Timber Rattlesnake (*Crotalus horridus*)

Purpose: This plan provides an updated five-year blueprint for the actions needed to attain near-term and, ultimately, long-term goals for the conservation and recovery of the Timber Rattlesnake. The action plan is a living document and will be updated as needed to reflect progress toward those goals and to incorporate new information as it becomes available.

Goals: The immediate conservation goal for the Timber Rattlesnake is to identify and maintain the rattlesnake populations that are under greatest threat in Pennsylvania. The long-term recovery goal is to maintain viable, reproducing populations of Timber Rattlesnake in the Commonwealth.

Natural History

Taxonomy: Class Reptilia, Order Squamata (lizards and snakes), Family Viperidae (pit vipers), Timber Rattlesnake (*Crotalus horridus*)

Description: The general coloration consists of dark brown or black crossbands on a ground color of sulfur yellow, brown, gray, or black. The crossbands frequently take the shape of chevrons, but at the anterior portion of the body the bands may instead be broken to form blotches (one mid-dorsal and two lateral). The crossbands are typically outlined with light yellow scales. A faint chestnut-brown, mid-dorsal stripe is often evident. The tail is black, both dorsally and ventrally, and in most specimens there is considerable darkening of the coloration and pattern in the posterior quarter of the body. The venter is lighter in color than the dorsum, particularly anteriorly, and some individuals have a white chin (Hulse et al. 2001). Newborns are always crossbanded with dark markings on a light gray ground color. At birth, rattlesnakes have a single rattle segment (button) at the tip of their tail. One additional segment is added to the base of the rattle with each molting. It is common for older (posterior) segments of the rattle to break off, and rattles rarely consist of more than 14 segments. Adults average 90-120 cm (35-47 inches) in total length with Pennsylvania specimens rarely exceeding 150 cm (60 inches). Adult males average

Figure 1. Timber Rattlesnake (*Crotalus horridus*). Photo by Steve Shaffer.

greater lengths than adult females (Reinert 2005).

Habitat: In Pennsylvania *C. horridus* inhabits deciduous, hardwood forest (Reinert, 1984a). Suitable habitat for *C. horridus* in Pennsylvania consists of three major components: 1) overwintering sites (hibernacula), 2) gestation/basking sites, and 3) foraging areas.

Overwintering hibernacula are typically located on forested, rocky hillsides having a southeastern to western exposure. However, hibernacula are not restricted to such areas and several hibernacula have been discovered on north- facing slopes (H. Reinert, pers. obs.). The area immediately surrounding most hibernacula is densely forested by a broadleaf, deciduous over story. The hibernaculum itself may consist of a single large rock isolated from other outcroppings or it may be a dispersed rocky area of small to moderate boulders. In some cases the hibernacula's entrance is a single hole in the ground, resembling a small mammal burrow, appearing not to be associated with any visible rock structure. In outward appearance these sites are usually indistinguishable from dozens of other similar areas on the slopes. However, many hibernacula appear to be located near topographic depressions that eventually lead to spring seeps farther down slope (H. Reinert, pers. obs.).

In Pennsylvania most basking sites are rocky, open areas (< 20% over story canopy closure) and exposed rock ledges (Reinert, 1984b). These areas typically have a southerly exposure, but this does not appear to be an essential characteristic. Basking sites that are used by snakes following spring emergence are typically located within 200 m (~ 655 feet) of the hibernaculum. The high visibility and density of snakes at such sites have often caused basking sites to be mistakenly identified as hibernacula (dens) in Pennsylvania.

Foraging habitat is typically composed of deciduous forest having canopy cover averaging nearly 70% closure (Reinert, 1984b). Males and non-gravid females spend the bulk of their active season in such habitat. Rocks are not an essential structural element of foraging habitat; however, the availability of fallen logs that serve as ambush sites for rodents may be an important characteristic of good foraging habitat (Reinert *et al*., 1984). Radio telemetry studies (Reinert and Rupert, 1999) have found foraging animals in eastern Pennsylvania range an average of 1700 m (1.0 mile) from their hibernaculum over the summer season, but may travel as far as 7000 m (4.3 miles). Complete season foraging ranges encompass an average of 105 ha (260 acres) for males and 50 ha (124 acres) for non-gravid females.

Life History: The Timber Rattlesnake is a long-lived (> 30 years), late-maturing (5-9 years) species with a low reproductive rate (small litters produced at 3-year intervals). *C. horridus* is exothermic with low energy requirements, and it remains inactive during a 5-6 month overwintering period annually (Hulse *et al*., 2001).

Emergence from hibernation typically begins in April with a return to hibernacula beginning in late September. Individual *C. horridus* establish a strong affinity for a particular hibernating site and will return to the same site every winter, possibly for their entire lifetime. Genetic studies indicate that *C. horridus* exhibit a metapopulation structure where hibernacula represent local populations linked to nearby hibernacula through gene flow mediated by landscape features such as available basking sites (Bushar *et al*., 1998).

In contrast to the rest of the population, gravid female *C. horridus* will occupy basking sites throughout most of the active season. The movements of gravid snakes are not extensive because they do not forage during the later periods of gestation (Reinert *et al*., 1984).

The diet of *C. horridus* consists predominantly of small mammals which are captured by ambush. White-footed mice (*Peromyscus leucopus*), Red-backed Voles (*Clethrionomys gapperi*), Meadow Voles (*Microtus pennsylvanicus*), Pine Voles (*Microtus pinetorum*), and Chipmunks (*Tamias striatus*) form the bulk of the diet; however, red squirrels, gray squirrels, and small rabbits are also taken by the larger males.

Mating occurs from mid-July through September (Brown, 1995). Females store sperm and ovulation occurs after emergence from hibernation the following spring (Brown, 1991). Parturition may occur from mid August through September. Females produce broods of eight young on average once every three to five years (Hulse *et al*., 2001).

Distribution and Status

National Distribution: *Crotalus horridus* is distributed widely from New Hampshire southward through the Appalachian Mountains to northern Florida and westward along the Gulf Coast to eastern Texas, Oklahoma, and Kansas. In the Midwest it is found as far north as Minnesota and Wisconsin within the Mississippi River drainage and in southern Illinois, Indiana, and Ohio (Ernst and Ernst, 2003).

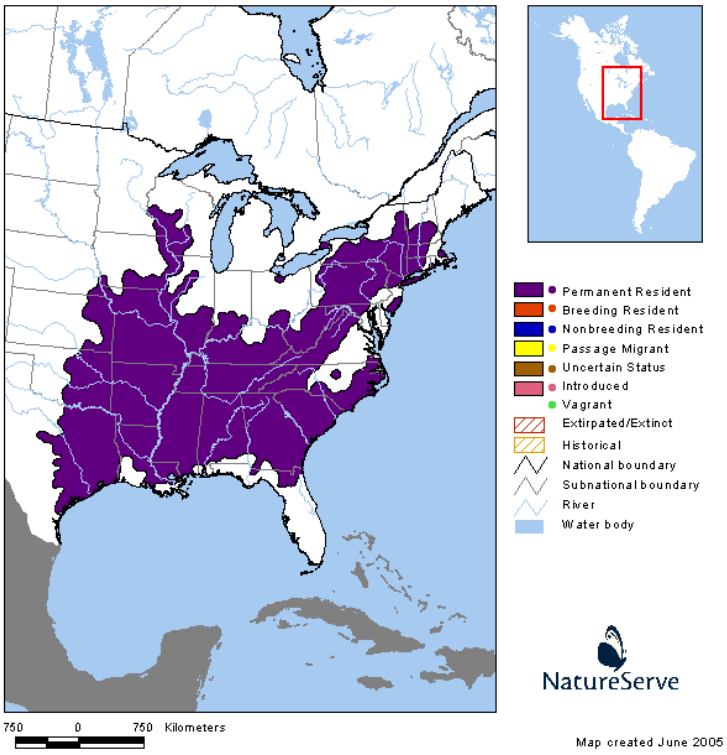

Figure 2. Distribution of the Timber Rattlesnake (*Crotalus horridus)* in North America (Source: NatureServe 2010).

Pennsylvania Distribution: Presently, *C. horridus* is restricted to the heavily forested mountains that transverse the central portion of the Commonwealth in a wide band from northeast to southwest. The leading ridge of the Appalachian Mountains (the Kittatinny Ridge) currently defines the southern extent of the range with the exception of the South Mountain, which is an extension of the Blue Ridge Mountain chain, entering southern Pennsylvania near Blue Ridge Summit and spanning northeast along the Franklin/Adams, Cumberland/Adams, Cumberland/York County boundaries, for 40 miles to US Route 15. Rattlesnakes are now absent from all of the Piedmont and Atlantic Coastal Plain Provinces in the southeast. The western slopes of the Allegheny High Plateau and Pittsburgh Plateau Sections of the Appalachian Plateau Province define the western edge of the range.

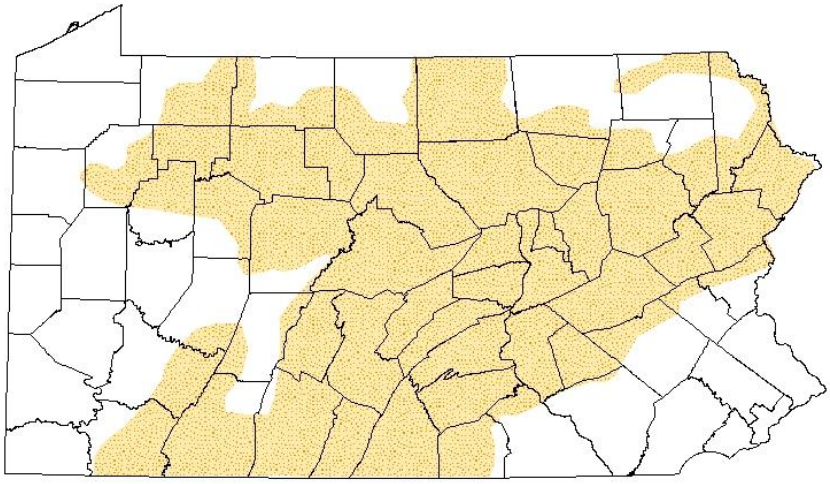

Figure 3. Distribution of the Timber Rattlesnake (*Crotalus horridus)* in Pennsylvania (Source: PFBC 2022).

In comparison to many states within its range, *C. horridus* continues to persist in relatively large population densities across some regions of Pennsylvania, though some of these populations are disjunct and peripheral populations appear to be declining (PFBC unpublished data). Consequently, Pennsylvania may function as a stronghold for the continued survival of this species (Reinert 2005).

Pennsylvania Legal Status: After a 12-year State Wildlife Grant funded status assessment project, the Timber Rattlesnake was removed from the state Candidate list (58 Pa. Code §75.3) in 2016 due to no criterion being met for Candidate, Threatened or Endangered Species listings. However, as a species of special concern, known critical habitats (overwintering and gestation sites) where multiple snakes are known to congregate, are protected through the environmental review process. In addition, Timber Rattlesnakes are protected through possession limits and a special permit that includes a 6-week restricted hunting season and take limit of (1) adult male and minimum size length (≥42 inches) per permit (58 Pa. Code §79.3, §79.6). The PFBC also regulates five (5) annual Organized Snake Hunts, which permit individual hunters to catch and release Timber Rattlesnakes for length and weight contests (58 Pa. Code §79.7).

Other States Legal Status: In the northeast, the Timber Rattlesnake is extirpated from Maine, Rhode Island, and Ontario. It is listed as state endangered in New Hampshire, Vermont, Massachusetts, Connecticut, Ohio, and New Jersey. It is listed as threatened in New York and considered a species of concern in West Virginia and Maryland.

Management Status

The status of *C. horridus* was one of the first non-game issues addressed by the Pennsylvania Fish and Boat Commission in 1974. The snake has remained a constant topic of discussion, controversy, and regulatory action within the Agency. With the aid of the Pennsylvania Wild Resource Conservation Fund, the PFBC had initiated several projects in the past two decades that provided information useful for the conservation of *C. horridus*. These included studies of organized rattlesnake hunts, the effect of translocation on *C. horridus*, the genetic structure of selected *C. horridus* populations, and an assessment of the characteristics of *C. horridus* hibernacula. The Pennsylvania Department of Conservation and Natural Resources (Bureau of Forestry) supported another study to examine the impact of commercial timbering operations on rattlesnake populations (Reinert 2008). Since 2004, Several State Wildlife grant projects have also funded numerous projects pertinent to Timber Rattlesnake management, including a genetic metapopulation assessment, and statewide status assessment from 2004-2016 (PFBC unpublished reports). Well over 2,000 Timber Rattlesnake critical habitats were identified in 51 of 67 counties in the Commonwealth (Urban and Chestney 2012, PFBC unpublished reports). A current State Wildlife Grant, among other habitat management projects, is focused on locating new sites in data gap areas by conventional on the ground research teams, and the use of radio tracking of individual snakes in data gap areas, as well as managing gestation habitats (daylighting) at prioritized sites. More recently, the PFBC has partnered with East Stroudsburg University researchers to develop a rapid assessment protocol for surveying monitoring sites and have initiated a collaborative study with the PA Game Commission looking at the effects of fire management on Timber Rattlesnakes occurring in various Pennsylvania State Gamelands.

Threats

1) Habitat loss
   a. Natural resource extraction and associated infrastructure development
   b. Construction of residential and commercial developments
   c. Loss of gestation sites due to forest succession
   d. Habitat destruction or disturbance in hibernacula areas
   e. Increase of human activity within habitat range

2) Fragmentation of populations
   a. New road construction
   b. High vehicular traffic on previously low volume roadways
   c. Other development

3) Targeted mortality
   a. Wanton killing and destruction of rattlesnake habitat.
   b. Poaching of individual snakes, e.g., Timber Rattlesnakes are sought in the black market trade.

Conservation and Recovery

1) Continue to compile state-wide location data of viable Timber Rattlesnake populations.
   a. Continue to investigate and inventory statewide data gap areas for the presence of Timber Rattlesnakes.
   b. Re-assess/re-visit dated inventory sites to assess current status.

2) Identify and prioritize Timber Rattlesnake populations that are currently being threatened by anthropogenic activities.
   a. Where deemed necessary, consider hunting prohibitions in areas where documented declining populations are in need of recovery.
   b. Prioritize gestation areas to be managed (e.g. daylighted).

3) Long-term monitoring
   a. Continue to monitor long-term sites
   b. Develop a rapid assessment monitoring program
   c. Analyze monitoring data to assess both the short and long-term trends in Timber Rattlesnake populations.
   d. Establish multiple long-term monitoring sites representing each region.

4) Continue and expand ongoing protection measures for Timber Rattlesnake populations.
   a. Review and comment on permit applications that involve proposed temporary and/or permanent disturbances to known habitat areas.
      i. Mitigate for both direct and indirect impacts to the Timber Rattlesnake habitat.
      ii. Spot check projects to confirm adherence to recommended avoidance, minimization and mitigation actions.
   b. Continue to develop best management practices to avoid and minimize impacts to Timber Rattlesnake critical habitats.
   c. Continue to manage/enforce the PFBC Venomous Snake and Organized Hunt Permits.

5) Maintain and expand cooperative working relationships with Federal and PA State agencies regarding conservation practices of Timber Rattlesnake populations on public lands.
   a. Work with state and federal partners to require the adoption of a no-kill policy for contractors, sub-

contractors, and their respective field employees while working on publicly owned lands.

b. Assist with the development and implementation of habitat maintenance and /or habitat improvement programs for specific management units, targeting existing gestation sites.
c. Work with supervising foresters on public lands to notify PFBC immediately if field crews encounter high concentrations of rattlesnakes (>4 rattlesnakes in 2 m^2 area).
d. Cooperate with design and review of Timber Rattlesnake research on public lands.

6) Provide outreach to the public to provide information and promote tolerance of the Timber Rattlesnake.

7) Review the regulations and policies concerning the Timber Rattlesnake and provide recommendations as deemed necessary.

References

Brown, W. S. 1991. Female reproductive ecology in a northern population of the Timber Rattlesnake, *Crotalus horridus*. Herpetologica 47: 101-115.

Brown, W. S. 1995. Heterosexual groups and the mating season in a northern population of Timber Rattlesnakes, *Crotalus horridus*. Herpetological Natural History. 3:127-133.

Bushar, L. M., H. K. Reinert, and L. Gelbert. 1998. Genetic variation and gene flow within and between local populations of the Timber Rattlesnake, *Crotalus horridus* . Copeia 1998:411-422.

Ernst, C. H. and E. M. Ernst. 2003. Snakes of United States and Canada. Smithsonian Books, Washington, D. C.

Galligan, J. H. and W. A. Dunson. 1979. Biology and status of Timber Rattlesnake (*Crotalus horridus*) populations in Pennsylvania. Biological Conservation 15:13-58.

Hulse, A. C., C. J. McCoy, and E. Censky. 2001. Amphibians and Reptiles of Pennsylvania and the Northeast. Cornell University Press, Ithaca, NY.

NatureServe. 2010. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: April 21, 2011).

Reinert, H. K. 1984a. Habitat separation between sympatric snake populations. Ecology 65:478-486.

Reinert, H. K. 1984b. Habitat variation within sympatric snake populations. Ecology 65:1673-1682.

Reinert, H. K. 1985. Timber Rattlesnake, *Crotalus horridus* Linnaeus. Special

Publication of Carnegie Museum of Natural History Number 11:282-285.

Reinert, H. K. 1990. A profile and impact assessment of organized rattlesnake hunts in Pennsylvania. Journal of the Pennsylvania Academy of Science 64:136-144.

Reinert, H. K. 1991. Translocation as a conservation strategy for amphibians and reptiles: some comments, concerns, and observations. Herpetologica 47:357-363.

Reinert, H. K. 2005. Timber Rattlesnake: CWCS priority species account. Pennsylvania's Wildlife Action Plan version 1.0.a. Pennsylvania Game Commission and Pennsylvania Fish and Boat Commission, eds.

Reinert, H. K. 2008. The impact of commercial logging operations on Timber Rattlesnakes (*Crotalus horridus*) in Pennsylvania. Report submitted to Pennsylvania Department of Conservation and Natural Resources.

Reinert, H. K. and R. R. Rupert, Jr. 1999. Impacts of translocation on behavior and survival of Timber Rattlesnakes, *Crotalus horridus*. Journal of Herpetology 33:45-61

Reinert, H. K., D. Cundall and L. M. Bushar. 1984. Foraging behavior of the Timber Rattlesnake, *Crotalus horridus* . Copeia 1984:976-981.

Urban, C.A. and J. E. Chestney. 2012. Timber Rattlesnake Site Assessment and Inventory Project – Phase 2. T-23-P-1 Final Performance Report to the U.S. Fish and Wildlife Service.