Petition to List
the Striped Newt, *Notophthalmus perstriatus*,
as a Federally Threatened Species
under the Endangered Species Act of 1973

by

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BACKGROUND

Taxonomy and Description

The striped newt, *Notophthalmus perstriatus*, was formally described by Bishop (1941) from specimens collected in Alachua and Leon counties, Florida, and Charlton Co., Georgia. Originally called *Triturus perstriatus* by Bishop (1941), Neill (1952, 1954) and Schmidt (1953) called the species *Diemictylus perstriatus* until the name became stabilized as *Notophthalmus perstriatus* by Smith (1953). Allozyme data (Reilly 1990) indicated that the closest relative of the striped newt is the black-spotted newt, *N. meridionalis*, and not the common newt, *N. viridescens*, with which it is geographically sympatric and sometimes syntopic.

Bishop (1941) gave detailed descriptions of the morphology and coloration of adults (Fig. 1) and a brief description of older larvae and the eft. Carr and Goin (1955) described the adults as "A small, reddish-brown salamander with a bright red stripe down each side of the back. Head widest at eyes, slightly converging posteriorly, anteriorly tapering to a rather blunt snout. No well-developed cranial ridges. Male with 3 pits on each side of the head; pits lacking in the female. Body slender, slightly compressed. No distinct costal grooves. Gular fold normally well developed. Legs slender; 4 toes on front foot, 5 toes on hind foot. Tail compressed with a dorsal keel in aquatic adults. Skin somewhat granular. Tongue small and oval. Vomero-palatine teeth in 2 long series; arising opposite the posterior margins of the internal nares and extending posteriorly for 2/3 of their length, then diverging abruptly. Dorsal color brownish-red to olive with a bright red stripe on each side of the back running from above the eye to the base of the tail. Length from 2 to 3 inches."

Fig. 1. Striped newt aquatic adult female.

No detailed description has been given for the eggs. Hatchlings are about 8.0 mm in total length, legless, and possess elongate, thin balancers protruding from the head just behind the eye. Two broad dorso-lateral stripes, dark gray to black in color with irregular edges, extend from just below and slightly behind the eyes to the tip of the tail. These disappear within a week and a half after hatching. A full description of the hatchling is given in Mecham and Hellman 1952.

Larvae from the Florida panhandle (Fig. 2) have bushy gills at the side of the neck and are dark gray to dark brown dorsally and heavily mottled with 60 –70 large, somewhat oval blotches of darker pigment (the dark blotches distinguish the larvae of the striped newt from larvae of the central newt, *Notophthalmus viridescens*, which are uniformly light brown dorsally and laterally). A prominent dorsal fin extends down the back from the rear of the head and smoothly joins the prominent dorsal tail fin. A prominent ventral tail fin extends from the vent between the legs to the tip of the pointed tail. A bold demarcation between dorsal pigmentation and clear yellow ventral surfaces begins on the lower lip and sweeps through the middle of the eye and extends to the insertion of the hind limbs. The belly and chin, in other words, are cream to light yellow in color without any melanophores. A prominent, pigmentless lateral line appears as a series of white dashes along the middle of the sides of the larvae and out onto the top of the muscled part of the tail. Larvae can reach the size of aquatic adults, 2 to 3 inches long, especially when they stay in the breeding pond and become sexually mature. Retention of larval morphology while sexually mature is a condition in some salamanders called neoteny. A sexually mature larva is called a neotene (sometimes paedomorph).

Fig. 2. Larvae of the striped newt (above 3) compared with larvae of the central newt (below 3).

Efts are a terrestrial stage with dry skin, a dull orange or reddish brown ground color, and bold dorsolateral red stripes. The stripes begin between the eyes and run down the upper middle of the sides and then out onto the middle of the upper half of the tail to the tip. Fig. 3).

Fig. 3. Eft of the striped newt (above) in comparison with the eft of the central newt (below), both from southern Leon County, Florida.

Ecology and Life History

Archie Carr (1940) had earlier treated this species as "*Triturus viridescens symmetrica* (Harlan), striped newt." He had seined "fifty-two individuals out of a fluctuation pond near Gainesville, the night of February 14, 1933. The females were all gravid and the eggs apparently ripe...." Eggs are deposited singly or in clumps of 2 to 5 in aquatic vegetation (Carr and Goin 1955).

The rare striped newt (Christman and Means 1992) has one of the most complex life cycles of any amphibian (Johnson 2002). Sexually mature adults migrate from the surrounding uplands to the pond for breeding purposes in mid-winter, November-February. Courtship, copulation, and egg-laying take place from January to April and eggs hatch beginning about mid-April. Newts have protracted courtship and oviposition with females laying eggs one at a time over the course of several months (Johnson 2005). Externally gilled larvae grow in the temporary pond environment for several months until the pond dries in mid-summer.

Once larvae reach metamorphosis size, larvae may either undergo metamorphosis and exit the pond as immature terrestrial efts or remain in the pond and grow, eventually maturing as gilled aquatic adults (neotenes) (Petranka 1998, Johnson 2005). There is evidence that small larvae can metamorphose by at least three months of age, at which time they lose their external gills, develop lungs for air-breathing, and become a relatively dry-skinned animal called an eft. The eft stage is adapted for life in the longleaf pine-wiregrass forest of the adjacent hot and dry sandhills (Means 2006).

Striped newts breed exclusively in small, ephemeral ponds that lack fish (Johnson 2003, Petranka 1998, Christman and Means 1992). These breeding ponds are typically sinkhole ponds in sandhills and cypress and bay ponds in the pine flatwoods communities (Christman and Means 1992). Newts exhibit phenotypic plasticity in the timing of breeding migrations. This characteristic may allow them to take advantage of temporary breeding habitats and is likely an adaptation to living in an unpredictable environment (Dodd 1993b, Johnson 2002).

As with other pond-breeding amphibians, striped newts spend the majority of their life in the pine uplands that surround their breeding ponds. Terrestrial adults can move 500 to 700 m from ponds after breeding (Dodd 1996, Johnson 2003). Johnson (2003) found that at least 16% of individuals breeding at a single pond migrated in excess of 500 m from the pond.

After living as an eft in the uplands for an unknown period of time, possibly for as long as a decade, individuals return to the pond to breed and undergo a partial second metamorphosis. There they develop fins on their tail and hind limbs to assist in swimming and courtship and take up a life in the water again, but at this time in their life they must come to the water's surface to gulp air into their lungs. The life cycle is completed when they court and produce viable eggs. This is not the complete life story, however. In times when the breeding pond has retained water all year long, the larvae bypass the eft stage and remain in the pond until the next breeding season when some individuals become sexually mature as gilled larvae. Retention of larval characteristics when sexually mature in salamanders is known as neoteny. The neotenes complete the life cycle without ever leaving the pond. It is assumed that the post-breeding neotenes and post-breeding lunged adults return to the uplands again to live through additional breeding cycles, but is not known whether they metamorphose back into the eft morphology again. The striped newt has survived in captivity as an aquatic adult for 12-15 years (Grogan and Bystrak 1973), although such a long aquatic life probably rarely occurs in nature because of the ephemeral nature of the breeding ponds.

Very little is known about the terrestrial life of the striped newt. In order to effectively assess the population status of this species, important life history and ecology information is needed, such as 1) distances dispersed away from the breeding pond; 2) types of upland vegetation preferred; 3) microhabitat characteristics (under grass clumps, under leaf litter, in burrows, etc.), 4) prey items utilized in the uplands; 5) longevity in the terrestrial phase of its life; 6) breeding site fidelity; 7) whether adults metamorphose back into efts and continue the cycle again; 8) sensitivity to human impacts on uplands; 9) vulnerability to habitat fragmentation by roads; and 10) effects of highway mortality on population size, to name but a few.

Distribution and Ownership

The natural global distribution of the striped newt is small and restricted to parts of south Georgia and the northern half of the Florida peninsula and (Conant and Collins 1991). The species occurs in two separate regions, the Dougherty Plain of southwest Georgia and the adjacent Florida Panhandle, and a second region associated with eastern sand ridges and river terraces on the Atlantic Coastal Plain of southeastern Georgia and peninsular Florida (Dodd et al. 2005). Surveys conducted over the past 15 years have demonstrated a severe loss of known breeding sites in both Florida and Georgia (Dodd and LaClaire 1995, Franz and Smith 1999, Johnson and Owen 2005, Means 2007).

Dodd and LaClaire (1995) surveyed 108 ponds and wetlands in Georgia which were at or near historically-known breeding locations. Twenty-six striped newts were encountered at five widely spaced sites. Based upon the newt's limited distribution and low number of breeding ponds in Georgia, Dodd (1993b) recommended the "...initiation of immediate efforts to conserve and manage known striped newt breeding ponds."

More numerous striped newt surveys have been conducted in Florida, although almost exclusively on public lands. Striped newt distribution on private lands is unknown, but on privately owned lands, the preferred native longleaf pine ecosystem has been severely degraded or entirely replaced by development, agriculture, plantations of off-site tree species, and other largely unsuitable habitats. The striped newt has five stronghold areas in Florida: Jennings State Forest, Camp Blanding Training Site, Ocala National Forest, Katharine Ordway Preserve, and the Apalachicola National Forest (Johnson and Owen 2005).

In a survey of the distribution and status of the striped newt in Florida, Franz and Smith (1999) documented the historical occurrence of the species from 81 breeding ponds, but were able to verify that the species was active in only 27 localities, all on publicly owned lands. Franz and Smith (1999) believed that the paucity of recent records strongly suggested a serious decline in the striped newt throughout its Florida range. They concluded that "...this salamander is threatened throughout its range and that there is sufficient evidence to warrant both state and federal listing."

During 2005-2007, the Florida Fish and Wildlife Conservation Commission (FFWCC) collaborated with land managers around the state sampling for striped newts, with an emphasis on finding new sites on public land (K. Enge, FFWCC). While in no way exhaustive, this survey represented the first large-scale survey for striped newts in Florida that focused on known and potential breeding sites on public lands. Striped newts were captured at only 28 ponds in nine localities (K. Enge, Fish and Wildlife Conservation Commission, unpublished data).

The Coastal Plains Institute has intensively studied and sampled the Munson Sandhills, within the Wakulla Ranger District of the Apalachicola National Forest from 1995-2007 (Means 1996, 1999, 2001, 2006a,b, 2007, Means and Means 1997, 1998a,b, 2005, Means and Printiss 1996a,b, Means et al. 1994a,b) and reported that the striped newt was present in only 18 of 265 ponds surveyed (Means 2005, 2007, Means and Means 1998a). The Wakulla Ranger District contains one of the largest number of known newt localities within any of the globally known stronghold sites. Alarmingly, no striped newt larvae have been captured on the Apalachicola National Forest in the past 10 years, despite repeated sampling efforts. Coastal Plains Institute biologists believe that a precipitous decline in striped newts is underway in the Wakulla Ranger District. Such a decline in the world’s largest known striped newt metapopulation would signify a global decline in the entire species.

Summary of Factors Affecting the Species

A. The present or threatened destruction, modification, or curtailment of its habitat or range.

Striped newts appear to be sensitive to disturbance of upland soils and replacement of native longleaf pine vegetation surrounding breeding ponds. In a study of the effects of sand pine silviculture on pond-breeding amphibians, Means and Means (2005) found striped newts completely absent from lands converted to pine plantation. Research by Dodd and LaClaire (1995), Franz and Smith (1999) and Johnson and Owen (2005) also attribute the loss of striped newts to the conversion of native forests to pine plantations, agriculture, or urban development. Greenberg et al. (2003) identified striped newts as one of the species sensitive to hardwood invasion as a result of upland fire suppression.

B. Over-exploitation for commercial, recreational, scientific, or educational purposes.

In the 1970s and 1980s, some striped newt adults from the Munson Sandhills populations were collected by at least one Tallahassee, Florida, resident and sold on the pet trade market (D. B. Means, unpublished data). However, Enge (2005) collected data on the commercial pet trade in Florida. Of the over 200,000 wild-originated reptiles and amphibians sold during a 4-year period, none were striped newts. There is no evidence to suggest over-exploitation is a cause for striped newt decline.

C. Disease or Predation.

Dramatic declines in amphibian populations have been the subject of much attention in the scientific literature for nearly two decades (Blaustein and Wake 1990, Lannoo 2005). Most of the declines have involved frogs and, although many declines are due to habitat loss or overexploitation, other, unidentified processes threaten almost 50% of the rapidly declining species (Stuart et al. 2004). Declines due to unidentified processes are called "enigmatic amphibian declines" because no obvious causative agent has been recognized. One of the most pernicious potential causes is disease pathogens, some of which have been identified recently as viruses, bacteria, and especially a chytrid fungus (Daszak et al. 1999, 2003). Mass mortality and population declines due to chytridiomycosis have been reported from North, South, and Central America, Australia, Europe, New Zealand, and Africa (Daszak 2003). Until the conclusion of a 12-year study of the striped newt in the Munson Sandhills of north Florida (Means 2007) there was little reason to expect that an enigmatic decline had taken place in the striped newt because catastrophic reproductive failure is common in pond breeding salamanders (Taylor et al. 2005). However, the 12-year study clearly demonstrated that in the first four years when water was present in Study Pond 1, the striped newt bred every year and successfully brought off metamorphs, and yet in the following 8 years there was no evidence that successful reproduction has taken place in any of 18 potential breeding ponds. While some amphibian declines elsewhere in the southeastern US have been attributed to climate and not chytridiomycosis (Daszak et al. 2005), others are as yet unexplained (Dodd 1998, Means and Travis 2007). It would seem better to err on the side of caution and assume that something unusual is happening to the striped newt…that it is experiencing an enigmatic decline, the cause of which urgently needs determination.

D. The inadequacy of existing regulatory mechanisms.

The striped newt is not formally recognized at any governmental level in either of the two states in which the species naturally occurs (Georgia, Florida). Since the natural range of the striped newt and known number of breeding ponds is smaller than the federally threatened flatwoods salamander, and because striped newt populations have declined drastically in the 67 years since the species was first recognized, it is imperative that federal and state environmental agencies enact rules and regulations to protect, restore, and maintain the remaining populations before the species declines further and even goes extinct.

Despite their obvious importance to various species across the country, ephemeral ponds benefit from little federal regulatory protection. The main federal regulatory program protecting wetlands is the Clean Water Act (Section 404), implemented by the U.S. Army Corps of Engineers (U.S. Department of Energy 2003). Section 404 requires a permit for discharging dredge or fill material into “waters of the United States” and “navigable waters” if the degradation or destruction of which could impact interstate commerce. Whether isolated wetlands are included in this protection is unclear as of a 2001 decision by the U.S. Supreme Court in Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers (SWANCC) (531 U.S. 159). The U.S. Supreme Court ruled that isolated wetlands were not necessarily protected under the Clean Water Act by nature of their use as habitat for migratory birds, which are under federal jurisdiction (Bryant and Ervin 2004). Legislation to clarify federal jurisdiction over isolated wetlands, in the form of The Clean Water Authority Restoration Act, has been in Congress since 2003. No decision has been made to date.

In Florida, where the majority of striped newt populations occurs, wetland protection is regulated by the five Water Management Districts (WMDs) and the Florida Department of Environmental Protection. All WMDs except Northwest Florida Water Management District (NWFWMD) include isolated wetlands in their Environmental Resource Permit (ERP) process, which means that a permit is required for activities in, on, or over wetlands. The NWFWMD is scheduled to adopt Phase II of their ERP program during fall 2008, which expands the regulation of activities and will include isolated wetlands (NWFWMD 2008). Below a minimum permitting threshold size of 0.2 ha, impacts to fish and wildlife and their habitat are not addressed for mitigation unless a threatened or endangered species is involved, it is located in an area of critical state concern, is connected by standing or flowing surface water at seasonal high water level to one or more wetlands and they total greater than 0.2 ha, or the wetland is of more than minimal value to fish and wildlife. Under Chapter 373.406 F.S., agriculture (which includes silviculture) has broad exemptions to alter topography provided it is not for the sole or predominant purpose of impounding or obstructing surface waters.

The cumulative effect of ephemeral pond destruction in the Southeast has not been measured, but studies by Semlitsch and Bodie (1998) and Gibbs (1993) illuminate the problems associated with the loss of small wetlands. Small wetlands are crucial for maintaining regional biological diversity and are important because they support plants, microcrustaceans, and aquatic insects that would be negatively impacted by their loss. From an amphibian metapopulation standpoint, reducing the number of wetlands reduces the amount of young individuals dispersing into surrounding uplands. Ephemeral pond reduction also increases the dispersal distance among wetlands. While some amphibians can travel up to 2 km (Franz et al. 1988), these dispersal distances appear to be rare. The majority of striped newts appear to stay within 1 km of their breeding wetland (Johnson 2003), so increasing dispersal distance could negatively impact amphibian populations. An increase in dispersal distance also may increase the extinction rate of populations of small mammals, turtles, and other less vagile species (Gibbs 1993).

E. Other natural or unnatural forces affecting its continued existence.

Ecological succession as a possible cause of striped newt decline.—In the Munson Sandhills of the Apalachicola National Forest, Study Pond #1 has been observed for more than 35 years and some dramatic changes have been noted in the limesink depression vegetation (Fig. 4). In 1970, the pond basin was dominated by grasses and forbs, with no woody component inside the 0.8-ha littoral zone (Fig. 4). As time progressed, slash pines and buttonbush (*Cephalanthus occidentalis*) slowly encroached into the basin. By 2007 the buttonbush zone had become a thick woody shrub zone around the normal water's edge of the two potholes. What impediments to movement or other effects the buttonbush shrubbery might have on the striped newt, if any, is unknown. The common newt also did not recruit new metamorphs into the adult population in the six years following the severe drought, but a few more adults moved in and out of the pond than the striped newt. Also, the common newt bred successfully in Study Pond 1 in the spring of 2005 because neotenes were dipnetted in March 2006. However, while neotenes might have been present in the pond, metamorphs might not have been able to emigrate from the pond into the longleaf pine uplands. Unfortunately, with the drift fence out of operation by this time, there was no way to monitor the emigration of metamorphs.

The ecological succession that has taken place in Study Pond 1 basin was strictly due to the absence of fire sweeping through it. Buttonbush is highly sensitive to fire, which kills the plant when the duff at the base of it is burned. Likewise, young slash pines are killed by fires. Although at least 2 prescribed burns were done in the longleaf pine uplands adjacent to Study Pond 1 during the 10 years of drift fence operation, the fires did not sweep down into the basin. This was because efforts were made to prevent the silt screen drift fence from burning up.

Nov. 1970 June 1989

July 1996 April 1998

December 2004 January 2007

Figure 4. 37-year photographic record of Study Pond #1 showing invasion of buttonbush, *Cephalanthus occidentalis*, due to the absence of fire. The upper left image (November 1970) was photographed to the NW from the SE side of Pothole #1. All other images were taken towards the SW from the NE side of Pothole #1. The white PVC pipe in middle of Pothole #1 is a water depth gage.

Ecological succession has been taking place in the adjacent longleaf pine uplands, as well, and this ecological change may have a more serious impact on the striped newt population than changes in the breeding pond basin. The frequency of prescribed burns in these uplands (5+ years) is longer than the natural fire return frequency of 1-3 years (Means 1996a, Platt 1999). In the longleaf pine forest, turkey oak and other woody plants have increased in the midstory, shading the ground and changing the ecological conditions of the groundcover. This has been going on for a long time, since the clearcutting of the original old-growth longleaf pines in the early 1900s. The prescribe burning regime that has been applied to the uplands surrounding Study Pond 1 has been inadequate for restoring the open grassland savanna that once dominated the Munson Sandhills. One or two prescribe burns per decade since about the 1930s has not been sufficient to restore the grassland aspect, and has allowed a hardwood midstory to develop. How this might have affected the striped newt and other vertebrates that live in the local sandhills is unknown. However, since both the ecological conditions of the pond basin and of the adjacent uplands have been slowly changing, ecological succession must be considered as a potential cause of striped newt decline.

The reduced fire-return interval over the years has enabled hardwoods (oaks, sweetgum, tree sparkleberry) to increase their presence, especially in the first 100+ feet of the tree zone surrounding the upper pond basin. The ecology of this zone has changed more dramatically than that of either the pond basin or the more distant uplands. This zone, once an open, grassy savanna, has become choked with hardwoods and the ground is now heavily shaded and deep in decomposing leaf litter. We do not know where most of the efts and terrestrial phases of the striped newt spend most of their lives, but if it is in this zone, then the dramatic ecological changes that have been taking place in it may be the principal reason for the striped newt decline.

Littoral zone destruction by off-road vehicles.—In the 12 years since the overall project began, impacts to breeding ponds have increased dramatically. The littoral zone is critically important habitat to the striped newt and many pond-utilizing vertebrates because it is the shallow water at the edge of ponds where most primary productivity takes place. The shallow water is warmer there and most of the pond invertebrates are concentrated there with tadpoles. It is in the shallow waters of temporary ponds where adults and larvae of the striped newt are mostly found, probably because that is where the prey of these carnivores is concentrated. Pond water levels are highly dynamic in response to local rainfall, or its absence, with the result that the critical littoral zone moves upslope and downslope as the volume of water in ponds waxes and wanes. Fig. 5 shows the healthy, vegetated littoral zone of Study Pond 1, and contrasts that with the bare soil conditions created by off-road vehicles (ORVs)(Fig. 5, 6). When the critical aquatic habitat of the striped newt lies over the bare sand, there is no cover for larvae or their invertebrate prey, making them vulnerable to wading birds. Little macrophyte primary productivity occurs in the shallow water over bare sand and the absence of rooted vegetation and presence of white sand makes insolation more severe. As a result, the critical habitat for the striped newt and other animals of temporary ponds in the Munson Sandhills has been severely impacted by ORV use.

Fortunately for assessing ORV impacts, but unfortunately for pond-breeding animals, study ponds are photographed on most survey rounds. Fig. 7 demonstrates how ORV presence in the littoral zone of Study Pond 6, the largest and possibly most important striped newt pond in the Munson Sandhills, has converted a healthy littoral zone with high primary productivity to a barren, sandy beach unsuitable for the striped newt. Likewise, ORV impacts have been severe in Study Pond

Fig. 5.—Littoral zone of an undisturbed pond (Study Pond #1, top) versus ORV-impacted pond (Study Pond #4, below) on the Apalachicola National Forest during dry season. Vegetation of the fluctuating littoral zone is the critical habitat of pond larvae.

Fig. 6.--Aerial views of temporary ponds south of Tallahassee on Apalachicola National Forest. Littoral zone impacted by ORV traffic. Both photos taken November 1990.

Fig. 7.—Study Pond #6. Top photographed in May 1993, showing valuable littoral zone habitat of one of the best natural pond breeding habitats known for the striped newt and gopher frog. Middle = same view 5 years later in May 1998 with first ORV impacts. Bottom = same view in Feb. 2004 showing physical damage and nearly complete destruction of plants in the ecologically important littoral zone. Photos © D. B. Means.

Fig. 8.--Study Pond #3 (borrow pit) west of U. S. Hwy 319, a breeding pond of the striped newt and gopher frog. Top taken May 1993 before severe ORV impacts. Bottom taken February 2003, ten years later, showing ORV physical damage and loss of plant life in the important littoral zone. Person in top image stands near black tire in both images.

Fig. 9.—Study Pond 26 showing massive ORV impacts in Apalachicola National Forest, April 1999. This is a proven breeding pond of the striped newt and gopher frog.

3 (Fig. 8). The impacts can be so severe that, in smaller, shallower ponds, the entire pond bottom can be obliterated (Fig. 9). There can be no doubt that ORV presence in temporary ponds in the Munson Sandhills is damaging to the critical aquatic habitat of the striped newts and ecologically negative overall, to the entire pond ecosystem. In 1994, 27 of 100 ponds were found to be damaged by off-road vehicles, including 3 of 18 striped newt ponds (Means et al. 1994b). By 2006, ORV impacts had been recorded for nearly every pond. In addition to a growing metropolitan human population in the nearby City of Tallahassee, demand for ORV riding areas increased tremendously in the 1990s when St. Joe Paper Company, the largest private landowner in Florida, leased out its lands to hunt clubs which immediately put locked chains across all access roads and posted the lands against any trespass. People who were using St. Joe lands for ORV recreation before land closure almost immediately switched off-road vehicle use onto nearby Apalachicola National Forests lands after St. Joe lands were closed.

Long-term regional drought.--The effects of a long-term drought that began in 1999 have been so strong in the Munson Sandhills of the Apalachicola National Forest that many study ponds have been dry for long periods of time (>16 months), and the striped newt has declined or disappeared from almost all of its breeding ponds. During a two-year period (24 February 2004 – 31 March 2006), water filled Study Pond 1, but only 2 adult striped newts entered the pond in years 7 – 10.

In year 10, the drift fence was discontinued because of the termination of the grant. Striped newts and other pond-utilizing animals were thereafter censuses by dipnetting in Study Pond 1 and in most of the 265 other ponds of the Munson Sandhills in years 11 and 12.

Only 3 adult striped newts from 2 of 18 known potential breeding ponds were found in the past 8 years (2001-2008), and none were intercepted by a drift fence or taken by dipnetting during this time from Study Pond 1. The gopher frog and all the other pond-utilizing vertebrates (about 28 species) in the Munson Sandhills have bred in many ponds following the 1999-2000 drought—even though less severe drought conditions have persisted from 2000-2006. Only the striped newt seems not to have recovered.

Droughts, seasonal and long-term, have been normal phenomena in the ecology of the striped newt and other ephemeral-pond-breeding animals throughout their evolutionary history. As a species, the striped newt surely must be more than 10,000 years old. During this time, the geographical region in which the newt is found has undergone many climate changes from arid-cold to humid-warm and experienced droughts probably much more severe than at present. Longevity and ability for long-distance dispersal no doubt are adaptations for depending on ephemeral ponds for early stages of life history. And the ephemerality of those breeding ponds is highly correlated with rainfall or the lack of it. Adults may survive for a decade or two in the uplands adjacent to their breeding ponds, and so long as the upland habitat is maintained in a natural state, eventually a successful reproduction will take place when the pond fills at the correct breeding season and maintains water sufficiently long for recruitment to take place. While drought might explain why so few ponds have been found with either breeding adults or larvae in the past decade, drought may mask real population declines due to other causes.

Long-distance dispersal, which might be a hedge on local population extinction (allowing recolonization), is now disrupted by paved and dirt roads, fields, towns, powerline rights-of-way, gas pipeline rights-of-way, and other constructs of human beings. Vegetative changes may have strongly negative effects on populations, such as the loss or degradation of the native longleaf pine habitat following years of hardwood encroachment in response to lack of frequent fire. Or some disease pathogen might be affecting populations while drought makes it difficult to census local population status.

Summary

The number of breeding ponds known for the striped newt throughout its naturally small geographic range in north Florida and south Georgia has undergone a drastic decline in the 67 years since the species was discovered and named. In Georgia, the striped newt is presently known from less than ten widely separated locations and is listed by the State of Georgia as a threatened species (Stevenson and Cash 2008).

In the Florida peninsula, Franz and Smith (1999) reported 100 records for the striped newt from 22 counties since 1922, but Johnson and Owen (2005), in a resurvey of all these ponds and other potential ones, ranked only 26 ponds as having excellent upland and breeding-pond potential to support striped newt populations, but they did not confirm the presence of the striped newt at all these sites. Most recently, during a 2005-2008 statewide resurvey, the only really viable peninsular populations of the striped newt were thought to be at the Katherine Ordway Preserve (12 ponds), Ocala National Forest (24 ponds), and possibly the Goethe State Forest (4 ponds); during this survey, however, the striped newt was not found at all of these ponds (Kevin Enge, personal communication).

In the Munson Sandhills/Wakulla Ranger District/Apalachicola National Forest of eastern panhandle Florida, one of the largest clusters of breeding ponds for the species in the late 20^{th} Century, has turned up no more than five adults and no larvae in 10 years (1999-2008) from the 18 known breeding ponds of the species in this globally important metapopulation. Another population, once verified by drift fences on the St. Marks National Wildlife Refuge, has not been reconfirmed since 1976, despite several subsequent studies.

Eighteen years ago, the striped newt was ranked as having the highest biological score of any imperiled amphibian in the State of Florida (Millsap et al. 1990) and yet the species still has no official state listing. The striped newt, therefore, has no official protection in Florida.

No Florida or federal protection exists for the striped newt, and yet its known breeding ponds and natural geographic distribution are smaller than the flatwoods salamander, *Ambystoma cingulatum*, which has been federally threatened since 1999. We believe that the striped newt urgently needs federal protection under provisions of the Endangered Species Act of 1973. We therefore petition and urge the U. S. Fish and Wildlife Service to list the striped newt, *Notophthalmus perstriatus*, as a threatened species.

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