

Harperocallis flava
Harper's beauty

**5-Year Review:
Summary and Evaluation**



Apalachicola National Forest, Liberty County
Photos by Vivian Negrón-Ortiz

**U.S. Fish and Wildlife Service
Southeast Region
Panama City Field Office
Panama City, Florida**



5-YEAR REVIEW

***Haperocallis flava* (Harper's beauty)**

I. GENERAL INFORMATION

A. Methodology used to complete the review

This review was accomplished using information obtained from the Recovery Plan of June 1994, unpublished field survey results, reports of current research projects, peer reviewed scientific publications, unpublished field observations by Service, State and other experienced biologists, and personal communications. These documents are on file at the Panama City Field Office. A *Federal Register* notice announcing the review and requesting information was published on April 16, 2008 (73 FR 20702). No part of this review was contracted to an outside party. This review was completed by the Service's lead Recovery botanist in the Panama City Field Office, Florida. See Appendix A for a summary of the peer review.

B. Reviewers

Lead Field Office: Dr. Vivian Negrón-Ortiz, Panama City Field Office, 850-769-0552 ext. 231

Lead Region: Southeast Regional Office: Nikki Lamp, 404-679-7091

Peer reviewers:

Ms. Lisa Keppner, 4406 Garrison Road, Panama City, Florida 32404

C. Background

1. FR Notice citation announcing initiation of this review: 73 FR 20702 (April 16, 2008): Endangered and threatened wildlife and plants: 5-Year Status Review of 18 Southeastern Species.

2. Species' status: Stable (Recovery Data Call 2008). Overall, the species status is stable in areas surveyed: most plants were flowering and a few were producing fruits. The status of the other historical locations is unknown; more surveys are needed.

3. Recovery achieved: 2 (26-50% recovery objectives completed); see section II.B.3 for details on recovery criterion and actions, and how each action has or has not been met.

4. Listing history

Original Listing

FR notice: 44 FR 56862-56863

Date listed: November 1, 1979

Entity listed: species

Classification: Endangered

5. Associated rulemakings: Not applicable

6. Review History

Status Review: No formal 5-year reviews have been conducted on *H. flava* since the Recovery Plan was written and approved.

Recovery Data Call: 2003; 2004; 2005; 2006; 2007; 2008 (stable)

7. Species' Recovery Priority Number at start of review

The Harper's beauty is assigned a recovery priority of 7 because the degree of threat is moderate, it is a monotypic genus, and has a high recovery potential.

8. Recovery Plan or Outline

Name of plan: Harper's beauty (*Harperocallis flava*) recovery plan

Date issued: 1983

Dates of previous revisions: N/A

II. REVIEW ANALYSIS

A. Application of the 1996 Distinct Population Segment (DPS) policy

The Act defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any vertebrate wildlife. This definition limits listing DPS to only vertebrate species of fish and wildlife. Because *H. flava* is a plant, the DPS policy is not applicable and not addressed further in this review.

B. Recovery Criteria

1. Does the species have a final, approved recovery plan containing objective, measurable criteria?

Yes. The recovery plan includes recovery objectives and measurable criteria for downlisting and delisting the species. For downlisting the species from endangered to threatened the goal is to have five populations, each with two colonies¹ or when there are three populations with three colonies each. Delisting

¹ Colony: the recovery plan uses the term to indicate major clumping within a population.

requires a minimum of five secured (protected and managed) wild populations with a minimum of three colonies each in habitat similar to the type locality and away from the roadside. According to the recovery plan, the criteria of the minimal percent frequency and cover for each colony needs to be set and requires prior research.

2. Adequacy of recovery criteria.

a. Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat?

No. The recovery criteria were based on the available data at the time the plan was published 26 years ago.

b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)?

No. The recovery plan only addressed factors A-habitat destruction and modification, which is still a threat, B-overutilization for commercial, recreational, scientific, or educational purposes, and D-Inadequacy of existing regulatory mechanisms. See sections II.B.3 and II.C.2 for description of current information and threats.

3. List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information. For threats-related recovery criteria, please note which of the 5 listing factors² are addressed by that criterion. If any of the 5-listing factors are not relevant to this species, please note that here.

The recovery plan lists a downlisting criterion to have five populations, each with two colonies or three populations with three colonies each, and a delisting criterion to adequately secure (protect and manage) five wild populations with a minimum of three colonies each having been either found or established in habitat similar to the type locality and away from the roadside. These recovery criteria address factors A, B, and D. Currently, factors A, D, and E are relevant for this species; factors B and C are not relevant to *H. flava*.

We summarize our progress below under existing recovery actions. Recovery action 1 addresses factor D; recovery actions 2-5 address factor A; and recovery action 6 addresses factor B.

² A) Present or threatened destruction, modification or curtailment of its habitat or range;
B) Overutilization for commercial, recreational, scientific, or educational purposes;
C) Disease or predation;
D) Inadequacy of existing regulatory mechanisms;
E) Other natural or manmade factors affecting its continued existence.

1. Protect habitat and existing colonies of Harper's beauty

1.1. Secure sites on Forest Service lands

To date, about 17 protected populations have been secured at Apalachicola National Forest (ANF), Liberty and Franklin Counties. The ANF land is federal property and is therefore protected under the Endangered Species Act (Act).

Note: The number of colonies has not been reported by surveyors. A better, more useful term might be "clumps."

1.2. Encourage the State to list Harper's beauty

This action has been met. Harper's beauty was listed as endangered by the State of Florida in 1991 (D. Weaver, 2009, pers. comm. to M. Jenkins, Florida Division of Plant Industry).

1.3. Secure sites on State right-of-ways

A large population of *H. flava* occurs in ANF SR 65 ROW. This roadside population is protected by the Forest Service, but is subjected to impacts when road maintenance occurs.

1.4. Secure sites on other lands

This action has not been met.

2. Conduct searches for new colonies

This recovery action is ongoing and conducted primarily by the Forest Service, FWS botanist, and Florida Natural Areas Inventory (FNAI). No populations of Harper's beauty were found on a 2008 survey conducted in the northwest portion of Tate's Hell State Forest (FDF 2008).

3. Preserve existing germplasm

This action has been partially met. The Historic Bok Sanctuary (Bok Sanctuary), Lake Wales, Florida, possesses 835 seeds in storage (416 in ambient conditions and 419 refrigerated) from a total of 1,312 seeds obtained from seven capsules collected in 2006 and 2007 by L. Keppner (Peterson and Campbell 2007) from the private owner of the Bay County population (L. Keppner, 2009, pers. comm.).

A pollen bank has not been initiated but perhaps is not necessary because *H. flava* is primarily selfing and lacks genetic variation.

4. Establish additional colonies

This action has not been initiated.

5. Monitor and manage colonies to assist and maintain recovery

This action has been partially met. See below activities.

5.1 Collect baseline data

Current populations have been mapped primarily by FNAI, the U.S. Forest Service (Forest Service), and the U.S. Fish and Wildlife Service (Service), and the following baseline data have been collected:

Seed germination: Germination studies were conducted at Bok Sanctuary from seeds collected in 2006 and 2007 (Peterson and Campbell 2007). Of the 1,312 seeds, 477 were used in the seed experiments following Wagner and Spira's (1996) germination protocol. Fifty-one percent of the seeds collected in 2007 germinated, while no germination occurred for the seeds collected in 2006. No additional work was pursued in 2008 (Campbell, Bok Sanctuary, 2009, pers. comm.).

Wagner and Spira's (1996) preliminary germination trials indicated that seeds are not dormant when they mature. Germination was high from freshly collected seeds grown at 21/10°C conditions and increased with cold stratification.

Demography: Walker and Silletti (2005) studied the population dynamics of *H. flava* in ANF for three years. The authors described the ramet size, reproductive status, and mortality and recruitment rates. Six sites were selected, ≥ 3 permanent plots/site were established totaling about 300 ramets/site, and individual ramets were marked. The total number of ramets declined from year to year. Larger ramets were more likely to produce reproductive structures, but the number of reproductive ramets was low and varied with site and year. Small ramets suffered higher mortality. Low recruitment and high mortality suggested that populations were declining possibly due to a decrease in precipitation. The authors observed crayfish induced ramet mortality but the effect of their activity at larger scales is unknown. Therefore, we do not have enough data for developing effective monitoring and management strategies for *H. flava*.

Genetics: Genetic studies were conducted by Godt et al. (1997); see section II.C.1.b. for more information.

Other studies, such as understanding how prescribed fire management practices affect *H. flava* demography, have not been undertaken and are crucial for ensuring the long-term success of this rare plant species.

5.2 Conduct autoecological research

5.2.1. Identify pollinators or vectors of dissemination

Pitts-Singer et al. (2002) studied the pollinator-plant relationship at two sites located on the ANF. The authors observed five insect species visiting the

flowers, but only halictid bees gathered pollen from the flowers. According to the pollination study conducted by Wagner and Spira (1996), selfing might be the main reproductive mechanism for *H. flava*; this would explain the lack of genetic diversity (see section II.C.1.b). Therefore, pollinator services are potentially not necessary for this species, but the flowers' pollen may be a food resource for the bees.

5.2.2. Identify limiting factors

Harper's beauty has an extremely narrow distribution. The Florida Department of Environmental Protection ranks this species as FACW, indicating Harper's beauty is a facultative wetland species (i.e., usually occurs in wetlands but may be found occasionally in uplands). Soils in these habitats are hydric, generally high in sand and peat, and strongly acidic. About 85 to 98% of herb bog habitat has been estimated to be lost (Folkerts 1982); consequently, the rarity of this species' habitat is a limiting factor.

Harper's beauty occurs in fire-prone habitats. Walker and Silletti (2005) suggested that fire might be important for promoting growth and fecundity by increasing availability of nutrients and light. Lack of fire, or reduced fire frequency, and subsequent growth of shrubs and saplings in the understory, reduces *H. flava* abundance in areas where it was previously at high density (Negrón-Ortiz, 2007, pers. observ.).

Seed germination and seedling establishment are not understood. If matured ovules lack dormancy (Wagner and Spira 1996), perhaps a persistent seed bank is not present, and if the established individuals are eliminated, a population cannot re-establish itself.

5.3 Monitor colonies

A three-year monitoring study was conducted by Walker and Silletti (2005) (for details see recovery action 5.1). Additional monitoring has not been initiated.

5.4 Determine effective management options and implement them.

This recovery action is ongoing.

Management/general monitoring in ANF:

Management is an ongoing action conducted by the Forest Service. The ANF has a yearly 120,000⁺ acre prescribed burning program (L. Kirn, Forest Service, 2009, pers. comm.). According to L. Kirn (2009, pers. comm.), two to three compartments are burned every year during the growing and dormant seasons.

Management of ROW: Mowing is a common practice to maintain rights-of-way (ROWs) in Florida, and the Florida Department of Transportation (FDOT) has implemented a program of reduced mowing along state highways in order to decrease costs for maintenance roadsides and to encourage the growth of native wildflowers (L. Keppner, Keppner Biological Services, 2009, pers. comm.). Apalachicola National Forest SR 65 is under a restrictive mowing schedule due to the occurrence of the Harper's beauty within the ROW (L. Haddock, FDOT, 2009, pers. comm. to Negron-Ortiz). Protective measures such as restricting the amount of area and timing of mowing were established in the early 1990s to allow seeds to mature and disperse. Currently, these measures are inadequate. For instance, a reoccurring problem of unauthorized mowing outside of dates specified had occurred over the past decade (S. Simpkins 2006, pers. comm. to D. Wolfe, FDOT). Thus, alternative measures should be sought.

In addition to mowing restrictions, the Forest Service only allows spot treatment application of herbicide in the ANF to control invasive and exotic species.

6. Determine appropriate means of public education

This action has not been initiated.

C. Updated Information and Current Species Status

1. Biology and Habitat

a. Abundance, population trends

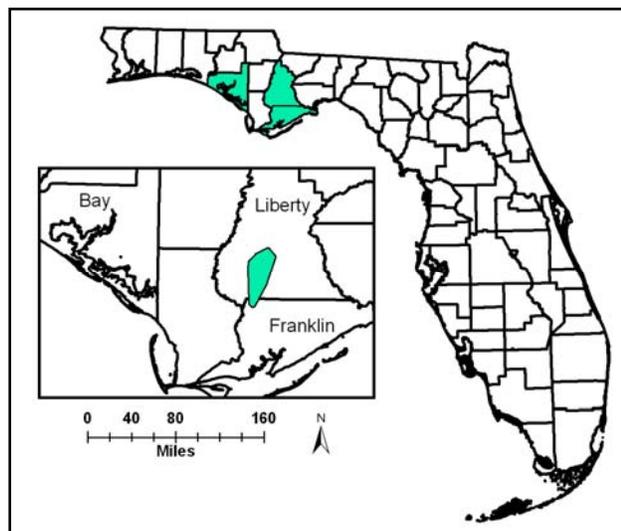


Fig. 1. Map of Florida showing the counties and locations of *H. flava* (inset).

Harperocallis flava is endemic to the Florida Panhandle, and occurs in Bay, Franklin, and Liberty Counties (Fig. 1). Several locations appear to be extirpated by development, and/or habitat modification (USFWS 1983). Because surveys were conducted irregularly, with most sites visited only once, and the actual counts of plants rarely provided, we have poor information regarding trends. The information below is organized by county.

Bay County

Only one population on private land has been reported for Bay County. It was first observed in 2003, and surveyed in 2006 and 2007 (Keppner and Anderson 2008). The authors observed a 61% decline in the number of plants during the surveyed years (from 115 to 70 plants) possibly due to drought, a dense mid-story, human error during surveying, or other unknown factors. This population is not protected and conservation measures are needed for the recovery of the species.

Franklin County

Five surveys conducted in Franklin County between 1965 and 2008 indicated the presence of two occurrences, but the points are within 1 km and should be associated with one EO³ (A. Jenkins, FNAI, 2008, pers. comm.); therefore, this would technically consider one EO to be present (FNAI 2008). This population is protected since it is in ANF. About 31 plants were reported for this occurrence. No populations of Harper's beauty were found on a 2008 survey conducted in the northwest portion of Tate's Hell State Forest (FDF 2008).

Liberty County

Six surveys conducted in Liberty County between 1982 and 2008 indicated the presence of 19 locations (FNAI 2008, L. Kirn, unpubl. data). Since points within 1 km should all be associated with one EO, these 19 locations actually comprise 16 EOs. These occurrences are protected and managed at the ANF.

Estimated counts of plants were provided for only 12 occurrences, ranging from 993 to 2,066+ plants (FNAI 2008). Between 2003 and 2005, L. Kirn (unpubl. data) estimated counts for most of the 16 EOs, totaling 8,583 plants. However, surveys were conducted irregularly and based on qualitative visual estimates of the density of *H. flava*, thus we don't have accurate numbers for this county.

Four occurrences were re-surveyed in 2008; plants were found by the FWS botanist for two of these sites: ANF SR 65 population totaled 153 plants, and FNAI location # 4 totaled seven plants. The other two locations had dense understory and plants were not observed (V. Negrón-Ortiz, 2008 surveys).

b. Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.)

Godt et al. (1997) examined genetic diversity in 464 individuals collected from ANF seepage bogs and roadside ROW. The authors found no discernable genetic

³ Element Occurrence (EO): an area of land and/or water in which a species or natural community is, or was, present. For species, it corresponds with the local population (portion of a population or a group of nearby populations). It is also referred to as occurrence, location, or site.

variation between or among the populations; the species was monomorphic for the 22 loci scored. The lack of allozyme variation was explained by the possibility that the progenitors of *H. flava* had limited genetic diversity and/or that the species may have gone through several bottlenecks during its evolutionary history.

c. Taxonomic classification or changes in nomenclature:

Kingdom: Plantae
Division: Magnoliophyta
Class: Liliopsida
Order: Alismatales
Family: Tofieldiaceae
Genus: *Harperocallis*
Species: *flava* McDaniel
Common name: Harper's beauty

The Angiosperm Phylogeny Group (APG) revised and updated the classification for the families of the flowering plants (APG II 2003). The APG II classification system assigned many of the Liliaceae (family that Harper's beauty belonged prior to the new taxonomic classification) to different families based on genetic relationships; however, many scientists still use Liliaceae *s.l.* rather than the APG system. The APG II transferred Harper's beauty to the Tofieldiaceae, a family now composed of four genera and embedded in the clade of Alismatales (Tamura et al. 2004).

Harper's beauty is a monotypic genus described in 1968. It is a grass-like perennial plant that blooms from mid-April through May, with fruits maturing in July. The leaves are basal and narrow, and the yellow flowers are solitary, perfect, and born on a stalk much longer than the leaves. The flowers consist of six tepals that are 9 to 15 mm long and become green when the plant is in fruit, six stamens, and a superior ovary with 3 to 4 carpels. It reproduces both sexually via seeds and asexually via rhizomes. No controversial taxonomic or nomenclatural problems exist since it is monophyletic (Tamura et al. 2004).

d. Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.):

Originally, the Recovery Plan (1983) reported the species for Liberty County. Since then, the geographic distribution has extended to Franklin and Bay Counties (FNAI 2008, Keppner and Anderson 2008). In addition to the geographic distribution, the number of populations has increased from three to 16 (USFWS 1983, FNAI 2008, L. Kim, unpubl. data) due to better surveys. Most populations occur inside ANF.

e. Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):

Harper's beauty occurs on gentle slopes, seepage savannas between pinelands, and cypress swamps to open roadside depressions. It has been observed growing in pine flatwoods bog areas surrounded with titi (*Cyrilla racemiflora*), wiregrass (*Aristida stricta*), and slash pine (*Pinus elliottii*); along roadsides, and in damp roadside ditches adjacent to planted pines near flatwoods. Typically, this species occurs in wet prairies, in transitions to wetter shrub zones and roadside ditches. Wet prairie is characterized as a treeless plain with a sparse to dense ground cover of grasses and herbs, and dominated by wiregrass in the ANF. Wet prairie occurs on low, relatively flat, poorly drained terrain of the coastal plain, which is seasonally inundated or saturated for 50 to 100 days each year and burns every 2 to 4 years (Jenkins et al. 2007).

2. Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

The primary threat to these plants is the adverse modification of its habitat: forestry practices, fire suppression, and soil and hydrological disturbances. In addition, this species is threatened by its very limited range and small population number.

a. Present or threatened destruction, modification or curtailment of its habitat or range:

Forestry practices and residential/commercial development

The timber industry in North Florida became well established in the 1850s (FNAI 2005). Privately owned companies farm trees for their byproducts by mechanically preparing the site for planting, planting seedlings, and mechanically harvesting the trees typically by thinning and later clear cutting the site; then the process is repeated. The St. Joe Timberland Company (Timberland Company) is currently the largest Timber Company in the eastern region of the Panhandle with over 450,000 acres in silviculture, plus several other timber companies operate in the Panhandle. The timber industry is currently thriving and there is no indication that it will decline in the foreseeable future. Therefore, tree farming remains a threat to this species in that there may be sites within these silvicultural areas that could support this species but have not yet been identified and are not being managed for its protection.

In addition to being one of the largest private landowners in northwest Florida, the Timberland Company is also one of the largest real estate operating companies in the Southeast. This Company develops both residential and commercial properties along roadways and near or within business districts in the region. Urbanized land in Florida, statewide, is projected to double by 2060 along with doubling of the population to 36 million

(<http://www.1000friendsofflorida.org/PUBS/2060/01-Northwest-Florida>). Since the species occurs on Company-owned property in Bay County, Florida, there is no guarantee that this property will not be utilized for residential or commercial development in the near future. Therefore, residential or commercial development is a threat.

Fire suppression

Suppression of fire continues to threaten the pineland and savanna's flora as fire is an important factor in the maintenance of flatwoods (Abrahamson and Hartnett 1990). Fire influences community structure and composition (Abrahamson and Hartnett 1990), and with insufficient frequency in longleaf pine communities, a woody midstory quickly develops (Glitzenstein et al. 1995), negatively affecting the understory diversity. Several studies have shown that frequent prescribed fire regimes are important for maintenance of flatwoods diversity (Hiers et al. 2007). Lack of fire, and subsequent growth of shrubs (particularly encroachment of *Cyrilla racemiflora* L., commonly known as swamp titi) and saplings in the understory, inhibits this species emergence (Negrón-Ortiz, 2008, pers. observ.; FNAI 2008), reducing its abundance in areas where it was previously observed in great quantities (FNAI 2008). Therefore, frequent prescribed burnings are needed to maintain optimal habitat for *H. flava* populations.

Road widening/Infrastructure improvements

Many *H. flava* plants are found along ANF SR 65. SR 65 is a major north-south corridor through ANF and plans are currently underway to improve the roadway to facilitate hurricane evacuation by repairing or replacing culverts, elevating pavement, and widening travel lanes. Construction activity may directly kill individual plants or convert habitat to unsuitable space; widening may convert native habitat to managed roadside; and culvert modification may change drainage patterns, which may change seasonal hydrology. Therefore, road widening and new roads continue to pose a threat to the species from habitat loss.

b. Overutilization for commercial, recreational, scientific, or educational purposes:

The Recovery Plan identified this as a threat to *H. flava*. Specifically, the Plan suggested that this species is of interest to lily enthusiasts due to its uniqueness as a monotypic genus, restricted distribution, and occurrence along the roadsides. Currently, there is no evidence to suggest that this factor is a threat.

c. Disease or predation:

There is no evidence to suggest that this factor is a threat.

d. Inadequacy of existing regulatory mechanisms:

Section 7(b)(4) and 7(b)(2) of the Act generally do not apply to listed plants species. However, limited protection of listed plants from take is provided to the extent that the Act prohibits the removal and reduction to possession of federally

listed threatened and endangered plants or the malicious damage of such plants on areas under federal jurisdiction, or the destruction of endangered plants on non-federal areas in violation of state law or regulations or in the course of any violation of a state criminal trespass law.

While the Act requires federal agencies to carry out programs for the conservation of endangered and threatened species, no such programs are stipulated for private landowners. The Act does not provide for protection of plants on private lands as long as the activity is permissible under state/local laws. The State requires permission of private landowners for collecting of state-listed plants from their property.

Harperocallis flava is protected under Florida State Law, chapter 85-426, which includes preventions of taking, transport, and the sale of the plants listed under the State Law. The rule Chap. 5B-40, Florida Administrative Code, contains the "Regulated Plant Index" (5B-40.0055) and lists endangered, threatened, and commercially exploited plant species for Florida; defines the categories; lists instances where permits may be issued; and describes penalties for violations (<http://www.virtualherbarium.org/EPAC>).

The Bay County Code of Ordinance (Chapter 19- Environmental Standards), under sections 1907 and 1909, provides restrictions, constraints and requirements to protect and preserve designated habitat conservation areas for rare, threatened, or endangered species, and wetlands (<http://www.municode.com/Resources/gateway.asp?pid=14281&sid=9>). Franklin and Liberty Counties do not have such regulations.

Harperocallis flava occurs in ANF SR 65 ROW. Highway ROW maintenance activities are not always reviewed for threatened and endangered species impact. However, if there is an activity (e.g., construction, mowing, or maintenance projects) affecting protected species, then the Service can recommend consultation to the FDOT under the Act (M. Mittiga, FWS, 2009, pers. comm.). The FDOT routinely consults with the Service on all major road construction activities. Consultation should conform to specifications and coordination between FDOT, the Service, and the Forest Service.

Currently, these plant protections are inadequate.

e. Other

Crayfish activity wasn't a threat at the time the Recovery Plan was written. However, while conducting their demographic study, Walker and Silletti (2005) observed that crayfish mounds and chimneys buried many ramets. At the end of the three-year demographic study, ramet mortality was significantly higher in bog sites (22.2%) than in shrub sites (3.6%). Therefore, crayfish activity poses a threat to the species.

D. Synthesis

Harper's beauty is a monotypic genus, described in 1968 and placed on the federally endangered species list in 1979. It is endemic to the Florida Panhandle, and occurs in open pineland bogs and along roadside ditches of Bay, Franklin, and Liberty counties. The main threat for this species is habitat destruction or modification (i.e., urban development, timbering, and inadequate fire management).

This species occurs in fire-prone habitats. Lack of fire, or reduced fire frequency, and subsequent growth of shrubs and saplings in the understory, reduces *H. flava* abundance in areas where it was previously at high density. Where fire management is implemented, it stimulates the emergence of individuals and maintains healthy, stable populations. No problems have been detected with disease or predation, but crayfish activities at the ANF populations poses a new threat to this plant.

The species occurs on both private and public lands. The populations at ANF are protected and adequately managed. However, since surveys were conducted irregularly and based on qualitative visual estimates of the density of Harper's beauty (Jenkins et al. 2007), a comprehensive population survey is needed in order to update the current EOs. Informal consultation has resulted in minimizing impacts from development, specifically for ANF SR 65. The privately owned population at Bay County is not protected and conservation measures are needed for the recovery of the species.

Harperocallis flava continues to meet the definition of an endangered species as a result of habitat destruction or modification and the effect of this threat in this plant's present narrow distribution. The recovery criteria for *H. flava* indicates that the species could be considered for 1) downlisting: when there are five populations, each with two colonies or when three populations have three colonies each, or 2) delisting: when a minimum of five secured (protected and managed) wild populations with a minimum of three colonies each have been either found or established in habitat similar to the type locality and away from the roadside. We consider this a conservative number of populations needed for recovery. There are currently 18 populations with 17 of those populations being secured; however, the number of colonies is presently undetermined. *Harperocallis flava* lacks the genetic variation to cope with or adapt to different environmental pressures, and the populations have a greater risk of extinction or extirpation if the environment changes. According to the recovery plan, the criteria for establishing the minimal percent frequency and cover for each colony needs to be set and requires prior research. Therefore, we are not recommending reclassification of *H. flava* from endangered to threatened. The existing recovery plan for *H. flava* contains objective, measurable criteria that need to be updated when the recovery plan is revised.

III. RESULTS

A. Recommended Classification

No change is needed

B. New Recovery Priority Number: 7C

The change from a recovery priority number of 7 to 7C is recommended because the species is in conflict with development and growth.

IV. RECOMMENDATIONS FOR FUTURE ACTION

1. Determine what comprises a colony and evaluate the current populations to determine how many colonies exist in each population, and establish the minimal percent frequency and cover for each colony.
2. Monitoring/censusing

A comprehensive census (e.g., the total number of individuals, number of flowering vs. non-flowering plants, and whether seedling recruitment is occurring) throughout the present distribution, including all the historical locations, is needed.

 - A repeatable method should be employed. If the target population is small (e.g., 200 m²), it is recommended to walk the entire area and count each individual. If the target population covers a large area, then permanent marked transects should be established in key selected areas that reflect the larger area.
 - Population census data will help predict extinction risks and the smallest size at which a population can exist without facing extinction (i.e., the minimum viable population size) by using computer simulations known as population viability analyses.
3. Conduct surveys/inventories on potentially new sites. This action can include the use of species distribution modeling methods to initially determine potential sites, with subsequent validation or inspection of the sites for plants.
4. Continue fostering conservation practices for utility and highway ROWs with the Forest Service, Talquin Electric, FDOT, and the Service; a management plan should be developed and implemented.
5. Secure the privately-owned population from Bay County via land acquisition, conservation easement, or by implementing permanent conservation measures between the Service and the Timberland Company.
6. The effect of fire on demography (including winter vs. growing season prescribed fire, fire frequency, intensity, duration, and timing) should be investigated and monitored.
7. Investigate reproduction, seed germination, recruitment; the viability of dry-stored seeds, the timing of germination, and whether a persistent seed bank is present.
8. The recovery plan should be updated to define objective measurable criteria and better address the five factors.

V. REFERENCES

Abrahamson, W.G., and D.C. Hartnett. 1990. Pine flatwoods and dry prairies. *In*, R. Myers and J.J. Ewel [editors]. *Ecosystems of Florida*, Univ. Press of Florida, Florida.

- Angiosperm Phylogeny Group (APG II system). 2003. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG II. Bot. J. Linnean Society. 141:399–436.
- Florida Division of Forestry (FDF), Plant Conservation Program. 2008. Harper's Beauty (*Harperocallis flava*) survey on Tate's Hell State Forest-northwest portions. Conducted by Michael R. Jenkins, Plant Conservation Biologist.
- Florida Natural Areas Inventory (FNAI). 2005. History: Timbering in North Florida. Apalachicola region resources on the web. FNAI.org/ARROW.
- Florida Natural Areas Inventory (FNAI). 2008. *Harperocallis flava* elements of occurrence spatial data.
- Glitzenstein, J.S., J.S. Glitzenstein, W.J. Platt, and D.R. Steng. 1995. Effects of fire regime and habitat on tree dynamics in north Florida longleaf pine savannas. Ecological Monographs. 65:441–476.
- Godt, M.J.W., J. Walker, and J.L. Hamrick. 1997. Genetic diversity in the endangered lily *Harperocallis flava* and a close relative *Tofieldia racemosa*. Conserv. Biol. 11:361–366.
- Hiers, J.K., J. J. O'Brien, R.E. Will, and R.J. Mitchell. 2007. Forest floor depth mediates understory vigor in xeric *Pinus palustris* ecosystems. Ecological Applications. 17:806–814.
- <http://www.municode.com/Resources/gateway.asp?pid=14281&sid=9>. Municode.com. Information accessed in 2008.
- <http://www.1000friendsofflorida.org/PUBS/2060/01-Northwest-Florida.pdf>. 2006. Florida 2060: A Population Distribution Scenario. A Research Project Prepared for 1000 Friends of Florida by the GeoPlan Center at the University of Florida. Information accessed in 2008.
- Jenkins, A.M., P.K. Diamond, and G.E. Schultz. 2007. United States Forest Service: Rare plant monitoring, Apalachicola National Forest and Ocala National Forest. Florida Natural Areas Inventory, Tallahassee, Florida.
- Keppner, L.A., and L. Anderson. 2008. Notes on Harper's beauty, *Harperocallis flava* (Tofieldiaceae), in Bay County, Florida. Southeastern Naturalist. 7:180-184.
- Peterson, C.L., and C.C. Campbell. 2007. Seed collection and research on eight rare plants species of the Florida Panhandle region. USFWS grant agreement 401815G173.
- Pitts-Singer, T.L., J.L. Hanula, and J.L. Walker. 2002. Insect pollinators of three rare plants in a Florida longleaf pine forest. Florida Entomologist. 85:308-316.

- Tamura, M.N., S. Fuse, H. Azuma, and M. Hasebe. 2004. Biosystematic studies on the family Tofieldiaceae I. phylogeny and circumscription of the family inferred from DNA sequences of *matK* and *rbcL*. *Plant Biol.* 6:562-567.
- U.S. Fish and Wildlife Service. 1979. Determination that *Harperocallis flava* is an endangered species. *Federal Register.* 44: 56862-56863.
- U.S. Fish and Wildlife Service. 1983. Harper's Beauty Recovery Plan. U.S. Fish and Wildlife Service, Atlanta, Georgia. 32 pp.
- Wagner, L. K. and T. P. Spira. 1996. Germination and reproduction in *Harperocallis flava*, an endangered Florida endemic: a preliminary assessment. *Am. J. Bot.* 83:Supplement.
- Walker J. L., and A.M. Silletti. 2005. A three-year demographic study of Harper's beauty (*Harperocallis flava* McDaniel), an endangered Florida endemic. *J. Torrey Botanical Society.* 132:551-560.

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of HARPEROCALLIS FLAVA (HARPER'S BEAUTY)

Current Classification: Endangered

Recommendation resulting from the 5-Year Review

No change is needed

Reclassification Priority Number: 7C

The review was completed by botanist Dr. Vivian Negrón-Ortiz, Panama City Field Office.

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve *H.A.A. Camody* Date *9/11/09*

REGIONAL OFFICE APPROVAL:

Acting
Lead Regional Director, Fish and Wildlife Service

Approve *Aaron L Vata* Date *9-11-09*

APPENDIX A
Summary of peer review for the 5-year review of
***Harperocallis flava* (Harper's beauty)**

A. Peer Review Method

The document was peer-reviewed internally by Lorna Patrick and Mary Mittiga of the Panama City Field Office. Once the comments were added to the document, it was sent to two outside reviewers (see below). The outside peer reviewers were chosen based on their qualifications and knowledge of the species.

B. Peer Review Charge: The below guidance was provided to the reviewers.

1. Review all materials provided by the Service.
2. Identify, review, and provide other relevant data that appears not to have been used by the Service.
3. Do not provide recommendations on the Endangered Species Act classification (e.g., endangered, threatened) of the species.
4. Provide written comments on:
 - Validity of any models, data, or analyses used or relied on in the review.
 - Adequacy of the data (e.g., are the data sufficient to support the biological conclusions reached). If data are inadequate, identify additional data or studies that are needed to adequately justify biological conclusions.
 - Oversights, omissions, and inconsistencies.
 - Reasonableness of judgments made from the scientific evidence.
 - Scientific uncertainties by ensuring that they are clearly identified and characterized, and those potential implications of uncertainties for the technical conclusions drawn are clear.
 - Strengths and limitation of the overall product.
5. All peer reviews and comments will be public documents, and portions may be incorporated verbatim into our final document with appropriate credit given to the author of the review.

C. Summary of Peer Review Comments/Report

Ms. L. Keppner provided editorial comments. She recommended determining what comprises a colony and evaluating the current populations to assess how many colonies exist in each population, as well as establishing the minimal percent frequency and cover for each colony.

Ms. L. Kirn, after accepting to be a peer reviewer for this document, did not provide comments.

D. Response to Peer Review

All peer reviewer comments were evaluated and incorporated where appropriate.