BEFORE THE SECRETARY OF THE INTERIOR

***Procambarus* (*Leconticambarus*) *latipleurum* lateral view © Edwin Keppner**

***Procambarus* (*Leconticambarus*) *latipleurum*, dorsal view © Edwin Keppner**

PETITION TO LIST THE WINGTAIL CRAYFISH, *PROCAMBARUS* (*LECONTICAMBARUS*) *LATIPLEURUM*, AS THREATENED OR ENDANGERED UNDER THE ENDANGERED SPECIES ACT

January 6, 2014

CENTER FOR BIOLOGICAL DIVERSITY

Notice of Petition

Sally Jewell, Secretary
U.S. Department of the Interior
1849 C Street NW
Washington, D.C. 20240
exsec@ios.doi.gov

Dan Ashe, Director
U.S. Fish and Wildlife Service
1849 C Street NW
Washington, D.C. 20240
Dan_Ashe@fws.gov

Douglas Krofta, Chief
Branch of Listing, Endangered Species Program
U.S. Fish and Wildlife Service
4401 North Fairfax Drive, Room 420
Arlington, VA 22203
Douglas_Krofta@fws.gov

Cynthia Dohner, Southeast Regional Director
1875 Century Blvd., Suite 400
Atlanta, GA 30345
Cynthia_Dohner@fws.gov

PETITIONER

The Center for Biological Diversity ("Center") is a non-profit, public interest environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center is supported by more than 625,000 members and activists including members in Florida. The Center and its members are concerned with the conservation of endangered species and the effective implementation of the Endangered Species Act.

Submitted this 6th day of January, 2014

Pursuant to Section 4(b) of the Endangered Species Act ("ESA"), 16 U.S.C. § 1533(b); Section 553(e) of the Administrative Procedure Act, 5 U.S.C. § 553(e); and 50 C.F.R. § 424.14(a), the Center for Biological Diversity and Tierra Curry hereby petition the Secretary of the Interior, through the United States Fish and Wildlife Service ("FWS," "Service"), to protect the Wingtail Crayfish (*Procambarus latipleurum)* as a threatened or endangered species.

FWS has jurisdiction over this petition. This petition sets in motion a specific process, placing definite response requirements on the Service. Specifically, the Service must issue an initial finding as to whether the petition "presents substantial scientific or commercial information indicating that the petitioned action may be warranted." 16 U.S.C. § 1533(b)(3)(A). FWS must make this initial finding "[t]o the maximum extent practicable, within 90 days after receiving the petition." *Id*.

EXECUTIVE SUMMARY

Crayfishes are among the most imperiled freshwater animals in North America (Butler et al. 2003). Nearly 50 percent of crayfish species are at risk of extinction (Taylor et al. 2007). Crayfish play an important role in the environment because their digging behavior creates habitat used by a variety of other animals. Crayfishes are considered to be a keystone species in their freshwater habitats because the burrows they create can be used by more than 400 different kinds of animals for shelter (Loughman 2008). Crayfish also serve an important role in the food web because they consume decaying matter and smaller animals and are in turn themselves eaten by mammals, birds, reptiles, amphibians, and fishes. More than 240 species are known to prey upon crayfish (Butler et al. 2003).

Procambarus latipleurum Hobbs, 1942, the Wingtail Crayfish, is a small secondary burrowing crayfish endemic to a single drainage in Gulf County, Florida. The species has a small range and is known with certainty from only 11 locations, seven of which are in very close proximity to one another and are susceptible to catastrophic loss from a variety of threats. The crayfish is susceptible to numerous factors which threaten to modify or eliminate existing known habitat and populations including urbanization, water pollution and hydrological regime alteration.

The Endangered Species Act states that a species shall be determined to be endangered or threatened based on any one of five factors (16 U.S.C. § 1533 (a)(1)). The Wingtail Crayfish is threatened by at least three of these factors and thus warrants listing as a threatened or endangered species:

Loss and Degradation of Habitat

The Wingtail Crayfish is threatened by dredging and filling of its wetland habitat for residential, commercial, and industrial development, and by infrastructure and maintenance associated with such development. It is also threatened by silvicultural activities that modify the hydropattern (water distribution, quantity and duration) of its habitat. The crayfish needs seasonal inundation of its habitat, and drought, groundwater pumping and climate change all threaten to reduce groundwater levels below the burrowing capability of the Winged Crayfish which will cause loss of populations. It is also threatened by water pollution.

Disease and Predation

The Wingtail Crayfish is potentially threatened by diseases and parasites and by competition from non-native crayfishes. It is also potentially threatened by invasion of its habitat by range expansion of other native crayfishes.

Inadequacy of Existing Regulatory Mechanisms

There are no existing regulatory mechanisms at the state, federal, or local level which adequately protect the Wingtail Crayfish or its habitat.

Other natural or humanmade factors affecting its continued existence

The Wingtail Crayfish is highly vulnerable to extinction because of its narrow geographic range. Endemic species with restricted geographic ranges and specific habitat requirements are at heightened risk of becoming extinct due to a variety of factors. The crayfish is also threatened by drought, flooding, global climate change and rising sea level, and off-road vehicle use.

Due to its highly restricted range and the numerous threats facing the Wingtail Crayfish, it warrants protection under the Endangered Species Act.

TABLE OF CONTENTS

INTRODUCTION

The Wingtail Crayfish *(Procambarus* (*Leconticambarus*) *latipleurum)* Hobbs, 1942 is a small tan crayfish with red spots that is endemic to Gulf County, Florida. It is known with certainty only from an area of flatwoods west and south of Wewahitchka. Within its tiny range, it has been lost from several sites and needs Endangered Species Act protection in light of ongoing threats to its survival at the small group of known locations where it still occurs.

This petition summarizes what is known about the natural history of the Wingtail Crayfish, the conservation and population status of the species, and the threats to the crayfish and its habitat. The petition shows that, in the context of the ESA's five statutory listing factors, the crayfish warrants listing as endangered or threatened under the Act due to loss or curtailment of habitat or range, disease and predation, the inadequacy of existing regulatory mechanisms to safeguard the species, and other factors including drought, flooding and global climate change. Lastly, the Center requests that critical habitat be designated for the Wingtail Crayfish concurrently with listing.

NATURAL HISTORY

Taxonomy

The Wingtail Crayfish is in the Order Decapoda, Infraorder Astacidea, Family Cambridae, Genus *Procambarus*, subgenus *Leconticambarus* (Crayfish Taxon Browser 2013). Hobbs (1942) described *P. latipleurum*, and Hobbs (1972) placed it in the subgenus *Leconticambarus*. Its status as a valid species has not been questioned and synonyms do not exist.

Description

The Wingtail Crayfish is a small tan crayfish that is about two inches long. It has a narrow, pointed face and is heavily freckled with red spots. Its tail is made up of unique shield segments that hang lower than on other crayfishes and overlap in a scalloped pattern, giving the crayfish its common name. Its chelae, or claws, are small and narrow.

Hobbs (1942) examined 54 specimens of *P. latipleurum* collected within a 13- mile radius of Wewahitchka, Gulf County, Florida during April, October, and November and provided the original description of the species as follows: Rostrum narrow and acute with or without lateral spines; if spines are present they are small and close to the tip; aerola relatively broad with about six punctations in narrowest part; males with hooks on ischiopodites of third and fourth periopods, hooks on fourth periopod bulbiform; palm of chela of first form male not bearded within; chela slender and weak with no (except sometimes on immovable finger) well developed tubercles on opposable surfaces of fingers; postorbital ridges terminating cephalad in a small tubercle or spine; no lateral spines present on carapace. First pleopods of male form I, reaching coxopodite of third periopod and terminating in four distinct parts; mesial process corneus, extremely long, spiculiform, directed distolaterad, distinctly curved; cephalic process small and corneus, forming a hook which somewhat overhangs the central projection; caudal process somewhat truncate but having a corneus caudodistal edge; a distinct depression on lateral surface

of main body of appendage at base of this process; central projection small and corneus, compressed cephalocaudad and directed cephalodistad, somewhat overhung by the cephalic process; cephalodistal setae-bearing surface rounded; pleura of abdomen conspicuously broad. Annulus ventralis almost square in outline, lateral side rounded; small acute tubercles present on cephalolateral margins; sinus originates on cephalic margin along midventral line and runs caudad slightly dextrad of the midventral line to middle of annulus where it makes a sharp turn across the midventral line forming an arc and terminates just before it reaches the caudal margin, slightly sinistrad of the midventral line.

Hobbs and Hart (1959) stated that the acute lanceolate rostrum, the absence of spines or tubercles on the lateral surface of the carapace, the spiniform tubercles on the cephalolateral border of the annulus ventral of the female, and the spiculiform cephalically-curved spine on the first pleopods of the male readily distinguish this crayfish from any others. They stated that no color notes were available. Figure 1 is from Hobbs (1989) showing the main characters used in the identification of *P. latipleurum*:

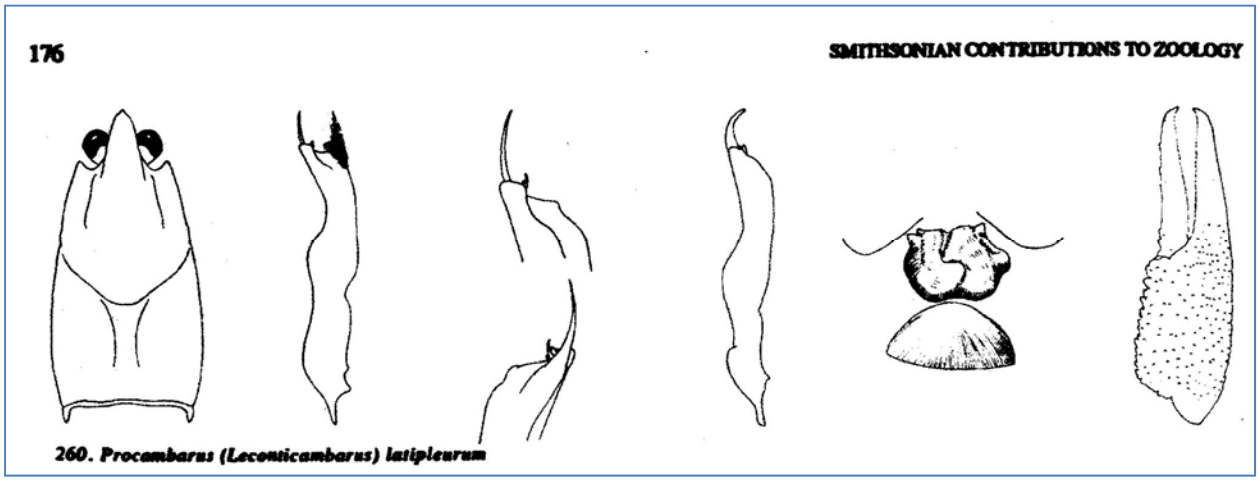

Figure 1. Diagnostic Characters of *Procambarus latipleurum* from Hobbs (1989). (*a*, dorsal view of carapace of male, form I; *b*, lateral view of first pleopod of male, form I; *c*, lateral view of distal part of first pleopod of male, form I; *d*, mesial view of distal part of first pleopod of male, form I; *e*, lateral view of first pleopods of male, form II, annulus ventralis and postannular sclerite; *g*, dorsal view of right chela of male, form I.)

Habitat

The Wingtail Crayfish is found in temporary ponds and pools in flatwoods areas (longleaf pine-wiregrass ecosystem). Hobbs (1942) states that *P. latipleurum* is most likely a secondary burrower, and Hobbs (1942, 1981) describes secondary burrowing crayfish as inhabiting depressions and swales in flatwoods or along roadsides that are inundated during the rainy season(s) and support herbaceous vegetation. Secondary burrowers are normally in surface water when it is present on the hydric soils they inhabit. They construct burrows as the surface water of their habitat recedes, and they occupy burrows as refuges when surface water is absent or during periods of extreme water temperatures. They emerge from the burrows when surface water is

present again or when water temperatures are favorable. Their burrows are usually rather straight tunnels to the water table, but a side chamber may occasionally be present and a second opening to the surface may exist. Secondary burrowers can often be collected from surface waters, though they may retreat to burrows even when surface water is present. During dry seasons or drought when surface water is not present, they must burrow to the water table to survive. It appears that they can survive significant periods of drought in their burrows as long as they can maintain contact with the water table.

Hobbs (1942) stated that *P. latipleurum* is apparently confined to flatwoods conditions where it occupies temporary bodies of water. Its burrows are simple, never having more than two branches, usually consisting of a single vertical tunnel which penetrates the water table within two feet below the surface of the ground. Hobbs and Hart (1959) stated that this species was collected from pools in roadside ditches and borrow pits, sluggish streams, and simple burrows at four locations in the vicinity of Wewahitchka, Florida.

Soil type is a major factor determining crayfish distribution. The known locations for *P. latipleurum* are in wetland soil types that are characterized as somewhat poorly drained (Leefield Sand) to poorly drained (Alapaha Loamy Fine Sand, Aquents, Pelham Sand, and Rains Fine Sandy Loam). These soils are inundated during the rainy seasons and have a water table close to the surface during dry seasons.

Depending on precipitation, different soil types can act as sources or sinks for crayfish populations. For example, Keppner and Keppner (2004) discussed the importance of soil types to the distribution of the Panama City Crayfish (*Procambarus* (*Leconticambarus*) *econfinae)* in Bay County, Florida and separated the soil types from which the species was collected into primary soils that served to perpetuate populations during severe drought and that serve as a source of juveniles for dispersal under non-drought conditions and secondary soil types that supported populations of the species during normal periods of annual precipitation but acted as sinks during drought.

Acosta and Perry (2001) studied the impact of hydropattern disturbance on crayfish dynamics in seasonal wetlands. They found that long hydroperiod habitat for the secondary burrower, *Procambarus alleni*, served as a source for dispersal of juveniles and short hydroperiod habitat served as a sink for the species. Dorn and Volin (2009) studied the effects of wetland drying on a species of secondary burrowing crayfish and a primary burrowing crayfish. They concluded that the effects of drying of substrate depend on the species of crayfish and the soil type, and that although some species of secondary burrowers can survive without surface water for extended periods of time, they do not survive as long under these conditions if the water table falls below their reach. For the Wingtail Crayfish to persist long-term, the water table must remain within its burrowing reach, a condition which is threatened by hydrologic regime alteration, groundwater pumping, and drought.

Reproductive Biology

Little is known about the specific reproductive biology of this species. Butler et al. (2003) provide an overview of crayfish of North America and state that crayfish mate, in general, in fall

through winter, and after insemination, the female glues the fertilized eggs to her swimmerets and sequesters herself in a safe place while she is "in berry" (the egg mass resembles berries). Upon hatching, the young remain with the female for the first three molts before leaving for an independent existence. Hobbs (1942) mentioned collecting immature males and females in April, form I and form II males and immature females in October, and form II and mature females in November. Hobbs and Hart (1959) stated that no females with eggs or young have been reported.

Ecology

Nothing has been recorded regarding the food habits of *P. latipleurum*, but Butler et al. (2003) state that crayfish play an important role in their ecosystems, because they are, in general, omnivores or detritivores that process organic matter and transfer energy between different levels of the food web.

RANGE

Hobbs (1942) and Hobbs and Hart (1959) describe *P. latipleurum* as endemic to Florida with only three known locations in a 13-mile radius (about 300 square miles) west of Wewahitchka, Gulf County, Florida. They state that because closely related species have been found in abundance to the south and west of its range and well drained areas exist to the north and east of its range, it seems probable that the range is limited. Hobbs (1942) designated the type location as a roadside excavation and intermittent stream 5.8 miles west of Wewahitchka, Gulf County, Florida along SR 22. Hobbs and Hart (1959) described the known locations as 5.8 miles west of Wewahitchka on SR 22, 6.1 miles south of Wewahitchka on SR 71, and 12.6 miles south of Wewahitchka on SR 71.

International Union for Conservation of Nature (IUCN)

The IUCN (2013) states that this species is endemic to Gulf County, Florida, north of the Wetappo Canal (Gulf Intracoastal Waterway), and that it has an estimated extent of occurrence of 770 km^2 or about 297 square miles. Its IUCN conservation status is assessed as Data Deficient. The range map in the IUCN account is erroneous and contradicts the range described in the narrative by delineating too large of an area. The erroneous map depicts the range as extending from the Gulf of Mexico north along the Apalachicola River to Lake Seminole, then east of the Chattahoochee River and then north almost to Dothan, Alabama, to west of US 231 and then south along a line west of US 231, then southwest to Lynn Haven, Bay County, Florida and then south to the Gulf of Mexico. The map is erroneous in that it shows a larger range than has been validated by scientific collections and extends into Alabama, whereas the Wingtail Crayfish is endemic to a single drainage in Florida.

Biological Information Serving Our Nation (BISON)

BISON (2013) cites seven locations, two of which are georeferenced and supported by voucher specimens. The two records with voucher specimens are a Moler and Cook collection from 2012 from just north of CR 381 on SR 71 and a 2010 location from Moler (see Table 1, below).

Current Interpretation of the Range

The range of *P. latipleurum* should be based on the number of the known locations supported by voucher specimens that meet certain standards of inclusion. Table 1 is a list of locations for *P. latipleurum* for which voucher specimens are known. Note that two locations indicated by an * are essentially the same location and the two locations indicated by ^ are also very close together and can be considered one location. Practically, there appears to be only nine separate locations known that are supported by voucher specimens. The Florida Natural Areas Inventory (FNAI) has the records of locations for *P. latipleurum* that have been provided to them including records provided by Franz (1994) that are not supported by voucher specimens (FNAI 2013).

Table 1. Locations for *P. latipleurum* with Voucher Specimens.

Latitude	Longitude	Species	Description/ Source	County	Date
29.93697	-85.19020	*P. latipleurum*	Hobbs 1942 type locality	Gulf	?
30.14309	-85.28858	*P. latipleurum*	Hobbs & Hart 1959	Gulf	?
30.02658	-85.17943	*P. latipleurum*	Hobbs & Hart 1959	Gulf	?
30.14387	-85.32412	*P. latipleurum*	Hobbs & Hart 1959	Gulf	?
29.90964	-85.17467	*P. latipleurum*	Keppners 2013, Doc Whitfield Road	Gulf	1/29/13
30.00760	-85.17490	*P. latipleurum**	Moler	Gulf	2/16/12
30.14110	-85.25610	*P. latipleurum*	Moler	Gulf	?
30.00756	-85.17466	*P. latipleurum**	Keppners SR 71 ditch	Gulf	2/15/13
30.00121	-85.17301	*P. latipleurum*^	Keppners SR 71 ditch	Gulf	2/15/13
29.92831	-85.19470	*P. latipleurum*	Keppners SR 71 ditch	Gulf	2/15/13
30.00100	-85.17600	*P. latipleurum*^	Moler record from BISON range map	Gulf	8/30/10

* = Same ditch within about 50 feet. ^ = within about 900 feet

Franz (1994) stated that *P. latipleurum* was found at two locations in Pine Log State Forest in Bay County, Florida (4.7 mi S of Ebro and 0.3 mi E of SR 79 Moore's Pasture, depression and 4.7 mi S of Ebro and 1.9 mi E of SR 79 Moore's Pasture) Bay County, Florida. Franz (1994) also stated that the crayfish was collected from a ponded area in a ditch along east CR 388, 2.4 mi northeast of SR77, but this identification is likely erroneous or the Wingtail Crayfish is no longer extant in the area. Keppner (2013) visited the location along CR 388 three times in 2013 and collected only *P. apalachicolae (*pers. comm.). Keppner sampled a number of locations in Pine Log State Forest, in the vicinity of and including both of the Franz locations, but collected only *P. pycnogonopodus* at the first Franz location, collected no crayfish at the second location, and collected only *P. hubbelli* Hobbs, 1940 at one of the other 16 locations sampled in the area. Due to the absence of voucher specimens for the locations provided by Franz (1994), the presence of the species at those locations in the past cannot be confirmed or denied with certainty. In the absence of voucher specimens for these locations, they should not be used to establish a range for *P. latipleurum*.

Evidence that *P. latipleurum* has not existed and does not exist outside of a small area of Gulf County includes the facts that voucher specimens for the three locations reported by Franz (1994) are unavailable and recent sampling at the locations and surrounding area did not yield *P. latipleurum*. Additional evidence is the locations sampled for crayfish in all of Bay, Gulf,

Calhoun, Washington, and Walton counties since 1994 that have not yielded any records regarding the presence of *P. latipleurum* outside of the locations in Gulf County.

The currently known range of the Wingtail Crayfish includes only small groups of known locations located along Florida Highways (SR 22 and SR 71) that are susceptible to extinction from a number of human and natural factors.

Figure 1 shows the vouchered locations of *P. latipleurum* and a possible range of about 290 square miles based upon the range proposed by Hobbs (1942) and Hobbs and Hart (1959).

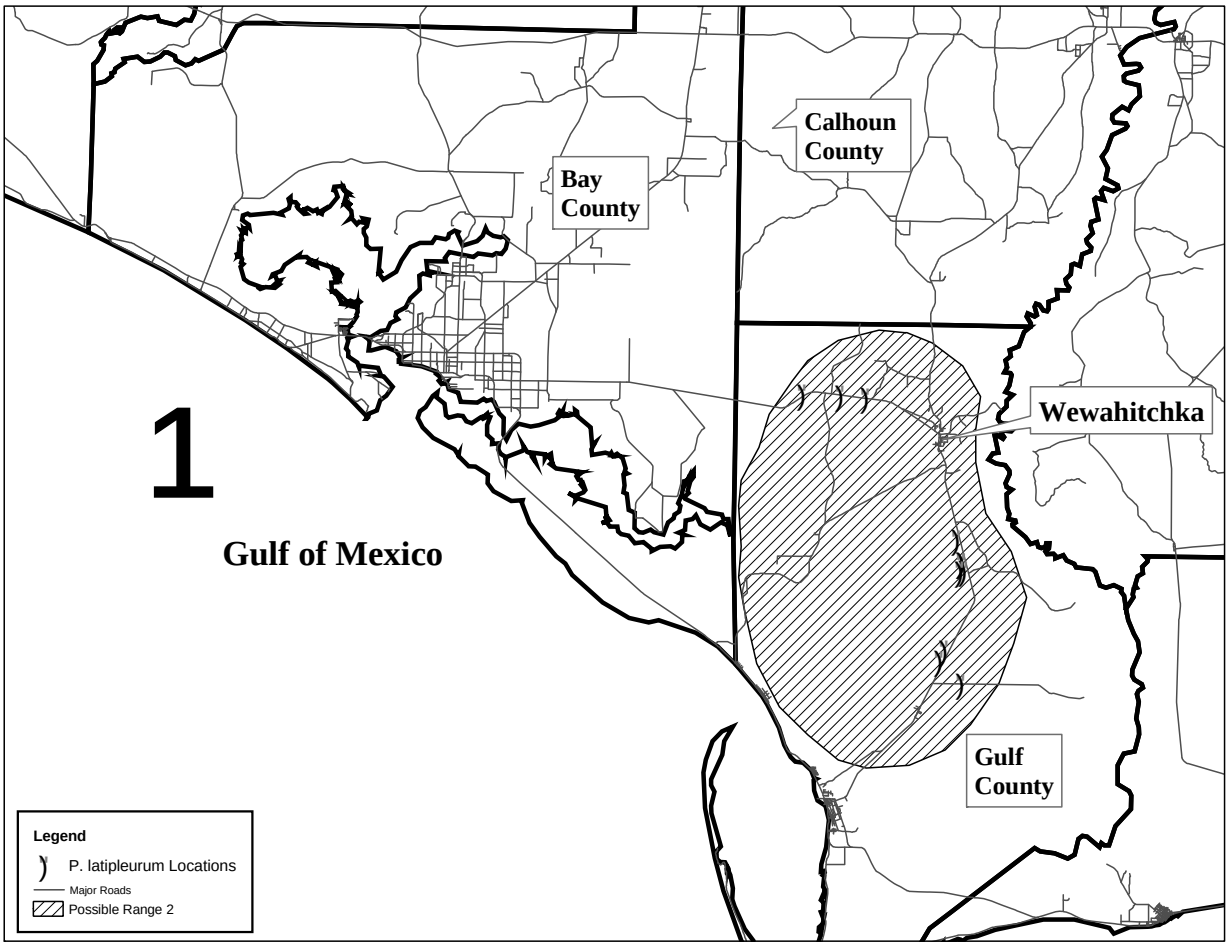

Figure 2. Wingtail Crayfish Vouchered Locations and Range. Based on Hobbs (1942) and Hobbs and Hart (1959).

CONSERVATION STATUS

The Endangered Species Committee of the American Fisheries Society (Taylor et al. 2007) provided an assessment of the conservation status of crayfishes of the United States and Canada, and listed *P. latipleurum* as vulnerable (a species or subspecies that may become endangered or threatened by relatively minor disturbances to its habitat and deserves careful monitoring of its

abundance and distribution). The criterion for listing as vulnerable is based on the restricted range of the species. The Wingtail Crayfish is ranked by the Florida Natural Areas Inventory (2013) and NatureServe (2013) as imperiled (G2S2) because of the low number of occurrences and vulnerability to extinction. The IUCN (2013) ranked *P. latipleurum* as vulnerable in 1996 and data deficient in 2010. The State of Florida (2011) includes *P. latipleurum* as a Species of Greatest Conservation Need, and lists it as a range-limited species.

POPULATION STATUS

Overall population data are not available for this species. Within its highly limited range, "it is not scarce where it occurs" (Cordeiro et al. pers. comm. cited in IUCN 2010).

LAND MANAGEMENT/OWNERSHIP

Known locations for *P. latipleurum* occur in ponded areas in roadside swales and an artificial pond (borrow pit) that is surrounded by private property primarily in pine plantations. The extent of possible habitat within the pine plantations is unknown. The known locations are managed as roads and road drainages and could be altered should the adjacent land use change or the roads be resurfaced, re-routed, or widened.

PROCAMBARUS LATIPLEURUM WARRANTS PROTECTION UNDER THE ESA

The Wingtail Crayfish is threatened by at least three of the five listing factors under the Act including modification or curtailment of habitat or range, the inadequacy of existing regulatory mechanisms to prevent its extinction, and other factors including alteration of hydropattern by drought, human activities, and climate change. It is highly vulnerable to extinction due to its limited range and it warrants federal protection.

THREATS

MODIFICATION OR CURTAILMENT OF HABITAT OR RANGE

Numerous factors threaten the habitat of the Wingtail Crayfish including development, groundwater decline, water pollution, and silvicultural activities. Crayfish with restricted ranges, including the Wingtail Crayfish, are exceedingly vulnerable to extirpation resulting from habitat altering activities and/or chemical pollution (Taylor et al. 2007). The IUCN (2013) identifies urbanization and water pollution as local threats to the Wingtail Crayfish. Given the crayfish's restricted range within a single county, local threats threaten the survival of the species.

Development and Human Population Growth

Human population growth in the Florida Panhandle, with its attendant demands for infrastructure, threatens the Wingtail Crayfish with extinction. Municipal, residential, and industrial development is a present and increasing threat to the habitat of *P. latipleurum*.

Crayfish survival is threatened by activities that alter the hydropattern (eg. Acosta and Perry 2001, Dorn and Volin 2009). Direct mortality and loss of habitat results from development activities that fill in wetlands or that modify the hydropattern crayfish need to survive.

The known locations of *P. latipleurum* are in roadside swales contiguous with ponded areas off of the right-of-way and an artificial pond (borrow pit). Long-term survival of the species in these locations is threatened by a number of factors related to human activities.

Roadside ditch maintenance and dredging, and infrastructure development are altering the hydrology, hydropattern, and configuration of the Wingtail Crayfish's habitat, making it unsuitable for crayfish and destroying crayfish burrows. Infrastructure development such as underground pipe lines and electrical lines are often placed in or along the roadside ditches and swales. The placement of utilities in wetland habitats alters features during construction and can modify water flow permanently. In particular, roadside ditch maintenance and dredging, and infrastructure development, can kill, harm, or displace crayfish as soil is removed from sites with heavy machinery. Fill placed on sites in preparation for construction activities can entomb crayfish in their burrows because they are unable to escape.

Maintenance dredging of the ditch system where the Wingtail Crayfish lives could alter the hydropattern of the ditch and pond system sufficiently to chronically reduce, drastically reduce, or eliminate the existing populations or isolate them from one another. Chronic loss of individuals can eventually lead to extirpation of local isolated populations (Gilpin and Soulé 1986).

The Wingtail Crayfish's habitat is further threatened by alterations to ditch and temporary pond morphology. Alteration of the form of ditch habitat resulting from changing swales to box cut deep ditches promotes rapid movement of water and renders the habitat unsuitable.

Construction and improvement of roads also degrades and modifies crayfish habitat. Sedimentation from dirt roads, construction sites, or upland alterations modifies soil characteristics and vegetation in *P. latipleurum* habitat.

There has been a recent change in emphasis of land management on private lands in Gulf County and neighboring Bay County from silvicultural activities to real estate development. The human population in Gulf and Bay counties, though lagging behind the rapid growth experienced in much of Florida, has increased steadily since 1960 and growth is expected to continue (U.S. Census Bureau, Table 2).

Table 2. Human Population Growth in Florida 1960-2010. U.S. Census Bureau.

	1960	1990	2010
Florida	4,951,560	12,937,926	19,317,568
Bay County	67,131	126,994	168,852
Gulf County	9,937	11,504	15,863

Groundwater Decline

The Wingtail Crayfish is threatened by lowering of the water table due to increasing demand for water for human usage. The crayfish will desiccate if it is not able to burrow down to freshwater (eg. Acosta and Perry 2001). Its habitat is threatened by declining groundwater levels and by saltwater intrusion.

Public water supply demand in the region where the crayfish occurs (Region V) was estimated at 5.85 million gallons per day in 2005. Demand is expected to increase to 7.05 million gallons per day by 2025. Overall water demand is projected to increase 20.5 percent from 2005 to 2025, an increase of 1.2 million gallons per day (Northwest Florida Water Management District 2007). Region V has also been identified as an Area of Special Concern for water supply due to the potential for saltwater intrusion into the upper portion of the Florida Aquifer resulting from a decline in the potentiometric surface of the aquifer caused by groundwater withdrawals (Ibid.).

Groundwater development of the Floridan aquifer system began in the 1880's and continues to the present. The groundwater is used for many purposes including municipal supplies, irrigation, pulp and paper processing, citrus production and processing, and phosphate mining. By 1950, withdrawals of freshwater from the Floridan Aquifer for all purposes totaled about 630 million gallons per day; by 1980 three billion gallons per day were being pumped. Groundwater withdrawal has affected the potentiometric surface of the Upper Floridan Aquifer and many areas now show deep depression cones and greatly lowered hydraulic heads. Regional declines of up to 30 feet have occurred in some places, and declines of more than ten feet have occurred in the Western Panhandle (USGS 2009). The reversal of local potentiometric gradients creates the potential for saltwater encroachment, threatening freshwater habitats and species such as the Wingtail Crayfish.

In addition to human population growth, consolidation of existing utilities, expansions of water service areas into previously un-served areas, and the availability of public funds and resources to assist in water supply development are all factors that are expected to increase the level of projected demand for public supply in Gulf County (Northwest Florida Water Management District 2007).

Water Pollution

Short-term and long-term declines in water quality are known to present a significant threat to crayfishes (Cook et al. 2006). Water quality declines that are harmful to crayfish can range from anoxic conditions resulting from algal blooms or sewage spills to pollution originating from roadway runoff or chemical spills (Acosta and Perry 2001).

The known locations for *P. latipleurum* along SR 71 are in the roadside ditches and contiguous ponded areas off of the right-of-way. The locations along SR 71 may be connected through the roadside ditches and could be considered a single population. A single catastrophic event such as a spill into a ditch of hazardous materials toxic to crayfish could eliminate the species from all known locations along SR 71.

As development increases, the use of pesticide, herbicides, and fertilizers will also increase. Crayfish are vulnerable to applications of pesticides and fertilizers (Paul and Simonin 2006). Pesticides and herbicides applied to silvicultural areas or at human-altered crayfish sites can result in direct mortality or cause long-term population declines due to reductions in fecundity. Application of pesticides and herbicides can also reduce groundcover upon which crayfish rely as a food source. Run-off of fertilizers into crayfish locations can lead to algal blooms and anoxic conditions that, when prolonged, can be lethal to crayfish. Evans and Edgerton (2002) discussed ammonia and nitrite exposure on crayfish and stated elevated concentrations of ammonia and nitrite may have adverse effects on crayfish. They also noted the relative toxicity ranking of insecticide groups with synthetic pyrethroids being the most toxic followed by organophosphates, organochlorines, and carbamates. Accidental spills of chemicals, such as petroleum products and acids, into active crayfish locations could decimate entire subpopulations within a short period of time.

Silviculture

Most of the wet pine flatwoods that are the potential natural habitat of *P. latipleurum* have already been altered or lost primarily through conversion to pine silviculture. Silvicultural practices utilized on plantations degrade or eliminate potential or actual crayfish habitat and can cause loss of crayfish sites. Practices such as ditching and bedding, roller chopping, installation of fire breaks, and road construction alter the hydrology and hydropattern of crayfish sites, create physical barriers to movement, and destroy underground burrows and structure. Fire suppression and high tree density on silvicultural sites change natural shrub habitat and groundcover to dense monocrop stands of pine tree with little wildlife habitat value.

Silvicultural activities that drain the wetland habitat of *P. latipleurum* can alter the hydropattern sufficiently to exclude the species from the drained areas. Bedding of pines in wetland areas permanently destroys the wetland habitat value by altering the hydropattern.

DISEASE AND PREDATION

Evans and Edgerton (2002) provide information regarding the viral, bacterial, and fungal diseases known from crayfish as well as infestations by external and internal parasites. Crayfish can be infected by a number of species of these disease agents and parasites. Resistance to infection or infestation is dependent on the existing health status of the host at the time of exposure which is in turn determined by prior exposure to environmental stressors and by inherited immune-competence characteristics (Evans and Edgerton 2002). Disease is not known to currently threaten Wingtail Crayfish populations, but in light of the extremely limited range of the species, disease potentially poses a dire threat to its survival.

It has recently come to light that crayfish are susceptible to chytrid fungus, also known as *Bd* (*Batrachochytrium dendrobatidis)* (McMahon et al. 2013). Chytrid fungus has caused the extinction of numerous species of amphibians and its prevalence has been magnified by other stressors including global climate change (Pounds et al. 2006). The spread of chytrid fungus should be regarded as a serious potential threat to freshwater crayfishes.

More than 240 animals are known to prey on crayfishes (Butler et al. 2003). Predators of crayfishes include fishes, mammals including raccoons, opossums, muskrats, otters, and foxes, herpetofauna including bullfrogs, turtles, and snakes, and numerous birds including crows, grackles, kingfishers, owls, hawks, and wading birds (Huner 1994). Wading birds are common in the habitat of *P. latipleurum* including Great Egrets, Great Blue Herons, and other wading predatory birds. The effect of natural predators on the populations of *P. latipleurum* is unknown.

INADEQUACY OF EXISTING REGULATORY MECHANISMS

There are no existing regulatory mechanisms at the federal, state, or county level which are adequate to protect *P. latipleurum* and its habitat from destruction.

The State of Florida identifies the Wingtail Crayfish as a Species of Greatest Conservation Need, but this designation provides no regulatory protection for the species or its habitat.

Theoretically the Clean Water Act should provide some benefit to the crayfish, but the provisions of the law do not provide specific protection for the animal's habitat.

The U.S. Army Corps of Engineers regulates the placement of fill material in wetlands in compliance with Section 404 of the Clean Water Act. The agency, however, does not assert jurisdiction over certain features including swales or erosional features (e .g., gullies, small washes characterized by low volume, infrequent, or short duration flow) or ditches (including roadside ditches) excavated wholly in and draining only uplands and that do not carry a relatively permanent flow of water (EPA 2008). Swales and ditches provide important habitat for the crayfish, but they are not protected features. The Corps also routinely issues permits allowing for the dredging and filling of isolated, temporarily inundated wetlands such as those that support *P. latipleurum.*

The State of Florida Department of Environmental Regulation and the Northwest Florida Water Management District (NWFWMD) share the permitting of projects involving the dredging and filling of wetlands. On November 1, 2010, the NWFWMD became responsible for issuing Environmental Resource Permits for work in certain waters and wetlands of the state including isolated wetlands (Florida Bureau of Environmental Resource Permitting 2010). The general permits issued by the agency are not adequately protective of the crayfish's habitat. There are numerous exceptions and low permit thresholds that allow ongoing degradation of wetlands, and numerous exemptions are issued for certain small activities.

The regulatory mechanisms currently in place either do not have jurisdiction over *P. latipleurum* habitat or are not required to evaluate the impacts of permitting habitat alterations on *P. latipleurum* habitat. The State of Florida and the U. S. Fish and Wildlife Service do not provide protection for the species making the protection afforded by the Endangered Species Act essential to the long-term survival of the species.

OTHER NATURAL OR HUMANMADE FACTORS AFFECTING ITS CONTINUED EXISTENCE

The Wingtail Crayfish is threatened by several other factors including high vulnerability to extinction, drought, flooding, competition from other crayfishes, and off-road vehicle use.

High Vulnerability to Extinction

The Wingtail Crayfish is highly vulnerable to extinction because of its narrow geographic range. Endemic species with restricted geographic ranges and specific habitat requirements are at heightened risk of extirpation due to a variety of factors (Gilpin and Soule 1986).

Drought

Prolonged or extreme drought can adversely impact populations of crayfish by reducing or eliminating the period of inundation of habitat required by secondary burrowing crayfish and reducing the water table to levels not reachable by species such as *P. latipleurum*. Dorn and Volin (2009) studied the effects of wetland drying on a species of secondary burrowing crayfish and a primary burrowing crayfish. They concluded that the effects of drying of substrate depend on the species of crayfish and the soil type, and that although some species of secondary burrowers can survive without surface water for extended periods of time, they do not survive as long under these conditions if the water table falls below their reach. Acosta and Perry (2001) studied the impact of hydropattern disturbance on crayfish dynamics in seasonal wetlands. They found that long hydroperiod habitat for the secondary burrower, *Procambarus alleni*, served as a source for dispersal of juveniles and short hydroperiod habitat served as a sink for the species. Factors that reduce the hydroperiod of a habitat unit have negative effects on crayfish populations. Prolonged drought combined with dropping of the water table due to groundwater withdrawal could drive the Wingtail Crayfish to extinction.

Flooding

Normal flood events that fill the swale and depression habitats of secondary burrowing crayfish serve to disperse the juveniles to adjacent or distant suitable and unsuitable habitats where they survive or die. Roadside swales and drainage ditches function to remove surface water from areas, and extreme flooding may wash entire ditch populations downstream to the disposal point for the stormwater runoff where they will perish.

Global Climate Change and Sea Level Rise

Global climate change threatens the Wingtail Crayfish for several reasons. Increased frequency and intensity of severe weather events including flooding and drought could extirpate the crayfish within its narrow range. Gulf County is expected to undergo an increase of 2.5 degrees Celsius in mean annual temperature (USGS 2013) which could lead to quicker dryer of surface water and reduced hydroperiod threatening the crayfish with desiccation. Florida is also at high risk of sea-level rise in the near future, which will lead to coastal land loss and intrusion of salt

water into freshwater habitats (Noss 2011). Combined with increasing human population growth and displacement of human communities inland, habitat loss from the effects of climate change threaten the Wingtail Crayfish with extinction.

Direct Competition with Indigenous and/or Nonindigenous Species. The introduction of nonindigenous crayfish has contributed to declines of native crayfish populations (Holdich 1987, Hobbs III et al. 1989, Taylor et al. 2007). Currently there is no indication that a nonindigenous species of crayfish is present in the known range of *P. latipleurum*, but the threat of invasion poses a potential threat to the Wingtail Crayfish. Taylor et al. (2007) discuss an example of a species of crayfish native to one section of the United States (*Orconectes rusticus*) that, when introduced into another section of the country expanded its range and led to the complete elimination of local populations and reductions in total ranges of native species in at least three midwestern states.

Range expansion of other native crayfishes could also threaten the Wingtail Crayfish through competition or predation. Hobbs and Hart (1959) stated that *P. latipleurum* crayfish associates are *Procambarus pycnogonopodus* (tertiary burrower with a very broad range), *Procambarus pygmaeus* Hobbs, 1942 (primary-secondary burrower with a broad range), and *Procambarus kilbyi* (an endemic secondary burrower with a broad range). The introduction of native secondary burrowers into the range of *P. latipleurum* could have negative effects on the species populations.

Off-Road Vehicles

Off-road vehicle use in wetlands can disrupt the hydropattern of *P. latipleurum* habitat, crush individuals in surface water, and may entomb individuals in their burrows during periods of absence of surface water in the habitat. Off-road vehicle use can decrease water quality at sites, reduce vegetation, and crush burrows. Ditch maintenance vehicles can also adversely impact *P. latipleurum* directly by crushing individuals in surface waters or crushing burrows, and alter local hydrology, hydropattern and habitat by rutting and destroying vegetation.

Misidentification

It can be difficult to distinguish one species of crayfish from another species. Even experienced experts can have difficulty identifying juvenile males and females in the field. Misidentification of a specimen could lead to loss of populations that are believed to be a different crayfish species. Misidentification could also lead to potential inflation of the number of known locations that are actually inhabited by closely related species. Sites misidentified as those with another species of crayfish may not be properly protected and could be developed or altered, making them unsuitable for *P. latipleurum*. Conversely, locations misidentified as those with *P. latipleurum* may be given protection and management attention that would be better focused on correctly identified locations.

In sum, the Wingtail Crayfish is at risk of extinction due to numerous factors including development, water pollution, groundwater pumping, silviculture, drought, flooding, global climate change, off-road vehicle use, and inherent vulnerability to extinction due to its restricted range. There are no existing regulatory mechanisms which adequately protect the crayfish, and it warrants protection under the Endangered Species Act.

REQUEST FOR CRITICAL HABITAT DESIGNATION

Petitioners urge the Service to designate critical habitat for *P. latipleurum* concurrently with its listing. Critical habitat as defined by Section 3 of the ESA is: (i) the specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the provisions of section 1533 of this title, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) the specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 1533 of this title, upon a determination by the Secretary that such areas are essential for the conservation of the species. 16 U.S.C. § 1532(5).

Congress recognized that the protection of habitat is essential to the recovery and/or survival of listed species, stating that: classifying a species as endangered or threatened is only the first step in insuring its survival. Of equal or more importance is the determination of the habitat necessary for that species' continued existence… If the protection of endangered and threatened species depends in large measure on the preservation of the species' habitat, then the ultimate effectiveness of the Endangered Species Act will depend on the designation of critical habitat. H. Rep. No. 94-887 at 3 (1976).

Critical habitat is an effective and important component of the ESA, without which *P. latipleurum's* chance for survival diminishes. Petitioners thus request that the Service propose critical habitat for *P. latipleurum* concurrently with its proposed listing.

CONCLUSION

The Endangered Species Act requires that the Service promptly issue an initial finding as to whether this petition "presents substantial scientific or commercial information indicating that the petitioned action may be warranted." 16 U.S.C. § 1533(b)(3)(A). There is no question that under the five listing factors of the Act, protecting *P. latipleurum* may be warranted. The species is threatened by loss or curtailment of habitat or range due to a variety of human activities, disease and predation, and various other factors including drought, and possible hydropattern alterations resulting from global climate change. There are no existing regulatory mechanisms which are adequate to protect *P. latipleurum*. For this species to have the best chance at survival, it should be promptly protected under the Act with designated critical habitat.

On behalf of all parties,

Tierra R. Curry, M.Sc.
Senior Scientist
Center for Biological Diversity
PO Box 11374
Portland, OR 97211

WORKS CITED

Acosta, C.A. and S.A. Perry. 2001. Impact of hydropattern disturbance on crayfish population dynamics in seasonal wetlands of Everglades National Park. Aquatic Conserv: Mar. Freshw. Ecosyt. 11:45-57.

Butler, R.S., DiStefano, R.J., and Schuster, G.A. Crayfish: An Overlooked Fauna. Endangered Species Bulletin 28(2):10-11.

Cook, D., R. Franz, P. Kelly, D. Lawrence, and P. Moler. 2006. Biological Status Report Panama City Crayfish (*Procambarus econfinae*). Florida Fish and Wildlife Conservation Commission. Tallahassee, FL. 45 pp.

Crayfish Taxon Browser. 2013. http://iz.carnegiemnh.org/crayfish/NewAstacidea/species.asp?g=Procambarus&s=latipleurum&ssp=.

Dorn, N.J. and J.C. Volin. 2009. Resistence of crayfish (Procambarus spp.) populations to wetland drying depends on species and substrate. J. North Amer. Benthol. Soc. 28(4)766-777.

Evans, L.H. and B.F. Edgerton. 2001. Chapter 10. Pathogens, Parasites and Commensal. In: D. M. Holdich, edit. Biology of Freshwater Crayfish. Blackwell Science Ltd. Oxford, England. pp. 377-438.

Florida Fish and Wildlife Conservation Commission. 2003. Management plan, Panama City crayfish, *Procambarus enconfinae*. FFWCC, Tallahassee, FL.

Florida Fish and Wildlife Conservation Commission. 2011. Florida's State Wildlife Action Plan. A Comprehensive Wildlife Conservation Strategy. FFWCC, Tallahassee, FL. 637 pp.

Florida Natural Areas Inventory. 2013. Tracking List. www.fnai.org.

Franz, R. 1994. Econfina Creek Project Final Report. Submitted to the Florida Natural Areas Inventory. Florida Museum of Natural History, Gainesville, Florida. Pp. 1-78.

Gherardi, F. 2002. Chapter 7, Behaviour. Pp. 258-290 *In*: Holdich, D.M. (ed.). Biology of Freshwater Crayfish. Blackwell Science, Ltd., Oxford. 512 pp.

Gilpin, M.E. and Soule, M.E. 1986. Minimum viable populations: processes of species extinction. In: Soule, M.E. edit. Conservation Biology. The science of scarcity and diversity. Sinauer Associates, Inc. Sunderland, MA. pp.19-34.

Hobbs, H.H., Jr. 1942. The Crayfishes of Florida. Univ. Florida Press, Biol. Ser., 3(2): 1-179.

Hobbs, H.H., Jr. 1972. The Subgenera of the Crayfish Genus Procambarus (decapoda: Astacidae). Smithsonian Contributions to Zoology No. 117, 22 pp.

Hobbs, H.H. Jr. 1981. The Crayfishes of Georgia. Smithsonian Contributions to Zoology No. 318, 549 pp.

Hobbs, H.H, Jr. 1989. An Illustrated Checklist of the American Crayfishes (Decapoda: Astacidae, Cambaridae, and Parastacidae). Smithsonian Contrib. to Zoology, No. 480. 236 pp.

Hobbs, H.H., Jr. and Hart, C.W. 1959. The Freshwater Decapod Crustaceans of the Apalachicola Drainage System in Florida, Southern Alabama, and Georgia. Bulletin of the Florida State Museum. Biological Sciences 4(5):145-191.

Huner, J. (ed.) 1994. Freshwater Crayfish Aquaculture in North America, Europe, and Australia. Haworth Press. 336 pp.

International Union of Conservation Biologists. 2013. *Procambarus latipleurum*. IUCN ver. 3.1 at www.iucnredlist.org.

Keppner, E. J. and Keppner, L. A. 2004. Survey and Assessment of the Panama City Crayfish on St. Joe Property in Eastern Bay County, Florida. Report Submitted to the St. Joe Company April 4, 2004. 37 pp. + plates, tables, and photographs.

Loughman, Z.J. 2008. Muddling with Mudbugs: West Virginia's Burrowing Crayfishes. West Virginia Wildlife. Spring 2008. 3 pp.

McMahon, T.A., L.A. Brannelly, M.W. Chatfield, P.T. Johnson, M.B. Joseph, V.J. McKenzie, and J.R. Rohr. 2013. Chytrid fungus *Batrachochytrium dendrobatidis* has nonamphibian hosts and releases chemicals that cause pathology in the absence of infection. Proceedings of the National Academy of Sciences 110(1): 210-215.

Nature Serve Explorer. 2013. www.natureserve.org/explorer/

Northwest Florida Water Management District. 2010. Environmental Resource Permiiting (ERP) in Florida's Panhandle. Phase 2. NWFWMD Brochure, NWFWMD, Havana, FL. 2 pp.

Northwest Florida Water Management District. 2007. Regional Water Supply Plan Region V, Franklin and Gulf Counties. Water Resources Assessment 07-01. Available at: http://www.nwfwmd.state.fl.us/pubs/rwsp/Region%20V%20RWSP.pdf

Noss, R.F. 2011. Between the devil and the deep blue sea: Florida's unenviable position with respect to sea level rise. Climatic Change 107(1-2): 1-16.

Paul, E.A. and H.A. Simonin. 2006. Toxicity of three mosquito insecticides to crayfish. Bull. Environ. Contam. Toxicol. 76:614-621.

Pounds, J.A. et al. 2006. Widespread amphibian extinctions from epidemic disease driven by global warming. Nature 439.7073: 161-167.

Taylor, C.A., G. A. Schuster, J. E. Cooper, RJ. DiStefano, A.G. Eversole, P. Hamr, H. H. Hobbs III, H. W. Robison, C. E. Skelton, and R. F. Thoma. 2007. A Reassessment of the Conservation Status of Crayfishes of the United States and Canada after 10+ Years of Increased Awareness. American Fisheries Society 32(8):372-389.

U.S. Army Corps of Engineers. 2008. Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in Rapanos v. United States & Carabell v. United States. Guidance Memorandum to Corps Districts and EPA Regions, Dated December 2, 2008. 13 pp.

U.S. Census Bureau.2012. State and County QuickFacts. Available at: http://quickfacts.census.gov/qfd/states/12/12045.html

U.S. Geological Survey. 2009. Floridan Aquifer System, Groundwater Atlas of the United States, Alabama, Florida, Georgia, South Carolina.HA 730-G. Available at: http://pubs.usgs.gov/ha/ha730/ch_g/G-text6.html

U.S. Geological Survey. 2013. Biodiversity Information Serving Our Nation (BISON). 2013. Distribution Maps for *Procambarus apalachicolae*, *P. kilbyi*, *P. econfinae,* and *P. hubbelli*. USGS website http://bison.usgs.ornl.gov/.

U.S. Geological Survey. 2013. NEX-DCP30 Viewer, Climate and Land Use Change Research and Development Program. Available at: http://www.usgs.gov/climate_landuse/clu_rd/apps/nex-dcp30_viewer.asp