

# Black Creek Crayfish

## *Procambarus pictus*



Photograph copyright Barry Mansell.

### Species Overview

**Status:** Listed as state Threatened on Florida’s Endangered and Threatened Species List.

#### Current Protections

- 68A-27.003(a), F.A.C. No person shall take, possess, or sell any of the endangered or threatened species included in this subsection, or parts thereof or their nests or eggs except as allowed by specific federal or state permit or authorization.
- 68A-27.001(4), F.A.C. Take – to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in such conduct. The term “harm” in the definition of take means an act which actually kills or injures fish or wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. The term “harass” in the definition of take means an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding or sheltering.

### Biological Background

This section describes the biological background for this species and provides context for the following sections. It focuses on the habitats that support essential behaviors for the Black Creek crayfish, threats faced by the species, and what constitutes significant disruption of essential behaviors. The Black Creek crayfish is medium-sized, about 7.6 cm (3 in) with dark claws and a dark carapace that has a white or yellowish mid-dorsal stripe, white spots or streaks on its sides, and a rust-colored abdomen. This distinctive pattern is unique among cambarid crayfish (Franz et al. 2008), and accounts for this species to be also known as the “spotted royal crayfish.” Its color pattern makes for good camouflage and allows the species to hide during the day in stream bottom detritus, tree roots, and vegetation (Franz 1994). The specific epithet *pictus*, Latin for “picture,” is presumably a reference to the striking color pattern. The Black Creek crayfish is endemic to northeast Florida (Clay, Duval, Putnam, and St. Johns counties). The great majority of occurrence records for Black Creek crayfish are in streams and tributaries within the extensive Black Creek drainage, but it is also known from a handful of other drainages, all of which are tributary to the St. Johns River. As is true with other crayfish species, male Black Creek crayfish periodically alternate between a reproductively ready form (Form I) and a form that is not reproductive (Form II). Reproductive males occur from January-September (Franz 1994). A female crayfish carries her eggs on the underside of her abdomen, attached to leg-like appendages called swimmerets, and they are protected there in a sort of “brood chamber.” The clutch of eggs can number from 47-146, and the newly hatched young hold onto the swimmerets and each other. They may remain with the mother, protected by her, for 2-weeks. Black Creek crayfish young that hatch in late summer are mature by the following spring (Franz 1994). Black Creek crayfish can live up to 16 months (Franz 1994), so a female apparently produces just 1 clutch of eggs in her lifetime. Black Creek crayfish have similar

food habits as other stream-dwelling crayfish. They eat aquatic plants, dead plant and animal material, and detritus.

### **Habitat features that support essential behavioral patterns**

Streams occupied by Black Creek crayfish are often referred to as “high-quality” streams due to their cool, unpolluted water, constant flow, and high oxygen content. The small gill chamber of the Black Creek crayfish is an adaptation requiring highly oxygenated cool waters (Franz et al. 2008). Habitat attributes include a sandy bottom with aquatic vegetation and woody debris to serve as daytime retreats, plus a forested

overstory (with sunny openings) that gives shade, cools the air and water, and provides a consistent influx of leafy and woody debris to serve as food sources (Franz et al. 2008, Florida Fish and Wildlife Conservation Commission [FWC] 2010). Water pollution, including siltation, change in water temperature, damming, extensive clearing of stream bank vegetation, or other changes in water or habitat quality in the described watershed may cause take of the species.

### **Threats**

Primary threats to this species include changes in water quality and quantity, river impoundments for water supply, stream dry-downs, channel dredging, habitat alteration, encroachment of urbanization, and point



*Typical stream habitat for Black Creek crayfish. Photograph by Paul Moler, FWC.*

source and non-point source pollution. Potential threats to the Black Creek crayfish are those that would impact the high-quality streams where it dwells. These threats include pollution, change in water temperature, siltation, damming, and other changes in water and habitat quality (Franz and Franz 1979, Brody 1990, Florida Natural Areas Inventory [FNAI] 2001). For example, damming immediately changes the character of a stream and its suitability for Black Creek crayfish, resulting in reduced oxygen, increased siltation, and higher water temperature.

It should be mentioned that land managers of public conservation lands do not necessarily manage stream habitat and the fauna that live in it. Populations on public lands (Camp Blanding and Jennings State Forests) may receive some protection, but no range-wide conservation actions have yet been undertaken for the Black Creek crayfish. Sites on private lands may be especially threatened with expanding urbanization, mining, and silviculture (Franz and Franz 1979, Brody 1990, FNAI 2001). Improperly controlled effluent from mining sites may degrade water quality and negatively impact Black Creek crayfish populations. Brody (1990) reports the lack of crayfish and other stream fauna from a stream (Boggy Creek) that receives effluent from



*Female Black Creek crayfish carrying eggs (“in berry”). Source: Nelson and Floyd (2011, Photograph 201). FWC photograph.*

the mine tailing ponds of a titanium extraction operation. This stream is a tributary to the North Fork of Black Creek just north (and downstream) of Camp Blanding.

Road crossings can be sources of toxic substances from illegal dumping and vegetation control (Franz et al. 2008). Road construction and roadwork associated with bridges being newly constructed, repaired, or retrofitted are potential sources of impact to water quality, primarily through siltation and other construction-related pollution. As with bridges, construction and maintenance activities on utility corridors and associated infrastructure (e.g., substations, transmission rights of way, and equipment maintenance yards) have the potential to negatively impact streams that they cross or are near.

Little is known about the potential impact of disease and parasites on Black Creek crayfish. Specimens with an apparent fungal disease have been reported by Franz et al. (2008) and Nelson and Floyd (2011). Infected specimens had chalky white muscle tissues visible through the exoskeleton on the underside of the abdomen. Franz stated this condition is believed to be highly contagious and often fatal, but the impact on crayfish populations is unknown (Franz et al. 2008, FWC 2010). Further research on this disease is warranted, and precautions should be taken to ensure that no individuals exhibiting this condition are moved where they could potentially infect other crayfish.

Proactive partnerships with public and private landowners and land managers will be critical to ensure that the stream systems known to harbor Black Creek crayfish remain suitable and as undisturbed as possible.

#### **Potential to Significantly Impair Essential Behavioral Patterns**

Since this species is only found in a limited geographic range and within a single watershed (lower St. Johns River) comprised of the Black Creek drainage and 10-12 surrounding creeks, the potential area where take could occur is limited. Much of the core of the range of this species is on publicly owned lands, including Camp Blanding and Jennings State Forest, and staff are working to gain access to other potential occurrence sites. Activities that impact water quality or quantity could result in significant impairment of Black Creek crayfish essential behaviors (breeding, feeding, and sheltering) and could cause take. For example, toxic effluent from industrial activities upstream or uphill could severely impair water quality. Dredging or other activities that cause the removal of woody debris or loss of submerged aquatic vegetation important for crayfish food and sheltering could result in incidental take. Activities that impede the year-round stream flow required by the Black Creek crayfish, including impoundments and water extraction, could also result in significant impairment of Black Creek crayfish essential behaviors and could cause take.

## Distribution and Survey Methodology

The range map (right) represents the principal geographic range of the Black Creek crayfish, including intervening areas of unoccupied habitat. This map is for informational purposes only and not for regulatory use.

**Counties:** Clay, Duval, Putnam, St. Johns.

### Recommended Survey Methodology

Surveys can be used to determine if Black Creek crayfish are present in an area. Surveys are not required, but are recommended during project planning. If surveys are conducted in accordance with the methodology described below and crayfish are not detected, no FWC review or coordination is needed.

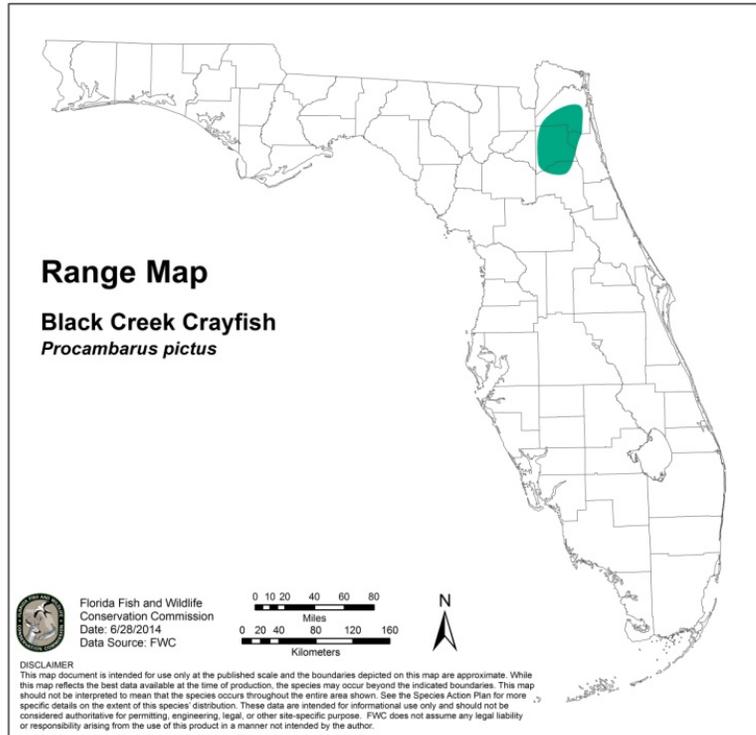
Surveys that collect, handle or remove crayfish from the water require a scientific collecting permit.

Standardized survey methodology is described in Nelson and Floyd (2011), and involves the use of a heavy duty dipnet pulled through areas crayfish are likely to be found. Such areas include submerged leaf litter accumulations, living tree root mats, woody debris, undercut banks, and aquatic plants (Franz et al. 2008). Surveys should be conducted 61 m (200 ft) upstream and downstream from potential impact area. After 10 sweeps, dipnet contents are emptied into a bucket with a small amount of water, and sorted through to identify any collected crayfish. If no crayfish are found in the first 10 sweeps, the process is repeated 2 times. If Black Creek Crayfish are found on site during surveys, FWC coordination may be needed.

## Recommended Conservation Practices

Recommendations are general measures that could benefit the species but are not required. No FWC permit is required to conduct these activities.

- Avoid causing changes that would degrade aquatic habitats inhabited by Black Creek crayfish. Minimize activities that degrade water quality in waterways inhabited by crayfish. Guidelines for minimizing erosion and runoff from roadways can be found in the State of Florida Best Management Practices (BMPs) for [stormwater runoff](#) and within the Florida Department of Agriculture Consumer Services (FDACS) [silviculture BMPs](#).
- Avoid activities that would remove excess water from rivers and streams, especially during times of drought.
- Avoid activities that could degrade or alter riparian zones adjacent to areas inhabited by Black Creek crayfish.
- Prevent upland erosion into streams and rivers.



- Install siltation fencing or hay bales to divert erosion from bridges, roads, or foot traffic.
- Minimize contaminants from machinery operating near rivers and streams containing Black Creek crayfish.
- Avoid application of herbicides or pesticides within 10.6 m (35 ft) of stream (Franz et al 2008).
- Locate stormwater management systems to provide the maximum treatment for any potential input into occupied stream systems.
- Establish streamside management buffers similar to those recommended by the U.S. Fish and Wildlife Service (USFWS 2001). The Natural Resources Conservation Service (NRCS) and Florida Department of Agricultural and Consumer Services (NRCS 2012, FDACS 2008) describe a riparian forest buffer as “a multipurpose practice designed to accomplish one or more of the following:
  - Create shade to lower water temperatures and improve habitat for aquatic animals.
  - Provide a source of debris necessary for healthy robust populations of aquatic organisms and wild-life.
  - Act as a buffer to filter out sediment, organic material, fertilizer, pesticides, and other pollutants that may adversely impact the water body, including shallow groundwater.”
  - Where possible, maintain a riparian buffer of 100–200 m (328–656 ft) in order to minimize potential impacts to inhabited waterways.

## Measures to Avoid Take

### Avoidance Measures that Eliminate the Need for FWC Take Permitting

This section describes all measures that would avoid the need for an applicant to apply for an FWC take permit.

- Bridge/culvert work that follows standard road construction best management practices and does not have a major instream impact.
- Avoid activities that cause channelization, diminish water flow, or degrade water quality (i.e., siltation) in waterways inhabited by Black Creek crayfish.
- Avoid activities that degrade riparian zones. Best Management Practices state that a 61 m (200 ft) buffer on both sides of Outstanding Florida Waters is sufficient to avoid degradation (FDACS 2008, Florida Department of Environmental Protection [DEP] 2011).

### Examples of Activities Not Expected to Cause Take

This list is not an exhaustive list of exempt actions. Please contact the FWC if you are concerned that you could potentially cause take.

- Activities that occur in waterways or on lands not adjacent to Black Creek crayfish habitat.
- Silvicultural activities that follow the agricultural BMPs for streamside management zones (SMZ).

### Florida Forestry Wildlife BMPs and Florida Agricultural Wildlife BMPs

- Agriculture, as defined in Section 570.02, F.S., conducted in accordance with Chapter 5I-8, F.A.C., and the wildlife best management practices adopted in Rule 5I-8.001 and 5M-18.001, F.A.C., by the Department of Agriculture and Consumer Services pursuant to Section 570.94, F.S., is authorized and does not require a permit authorizing incidental take despite any other provision of Rule 68A-27.007 or 68A-27.005, F.A.C.
- Participation in the Florida Forestry Wildlife BMPs and Florida Agricultural Wildlife BMPs program and implementation of these BMPs provides a presumption of compliance with regard to incidental take of Black Creek crayfish.

- Florida Department of Agriculture Consumer Services Florida Forestry Wildlife Best Management Practices apply to this species through the application of Streamside Management Zones.

#### **Other authorizations for Take**

- As described in Rule 68A-27.007(2)(c), F.A.C., land management activities (e.g., wetland restoration, prescribed fire, mechanical removal of invasive species, and herbicide application) that benefit wildlife and are not inconsistent with FWC Management Plans are authorized and do not require a permit authorizing incidental take.
- Emergency water management actions for human health and safety, such as flood control.

## **Coordination with Other State and Federal Agencies**

The Florida Department of Environmental Protection coordinates the development and implementation of basin management action plans (BMAPs) to assess, monitor, and improve the water quality of water bodies in the basin that are considered “impaired” by pollution. “Total maximum daily loads (TMDLs) are water quality targets for specific pollutants (such as fecal coliforms) that are established for impaired waterbodies that do not meet their designated uses based on Florida water quality standards” (DEP 2010). A BMAP prepared for tributaries to the Lower St. Johns River (DEP 2010) addresses water quality issues for some drainages in or near the range of the Black Creek crayfish. Currently, the great majority of known Black Creek crayfish sites are in high-quality, “pristine,” streams with clear, unpolluted water. However, TMDLs have been established for two urbanizing streams, Big Davis Creek and Durbin Creek, where Black Creek crayfish have been documented. These streams are in southeastern Duval and northwestern St. Johns counties, separated by the St. Johns River from the Black Creek and other drainages that harbor most known Black Creek crayfish populations.

The FWC participates in other state and federal regulatory programs as a reviewing agency. During review, FWC identifies and recommends measures to address fish and wildlife resources to be incorporated into other agencies’ regulatory processes. FWC provides recommendations for addressing potential impacts to state listed species in permits issued by other agencies. If permits issued by other agencies adequately address all requirements for issuing a State-Threatened species take permit, the FWC will consider these regulatory processes to fulfill the requirements of Chapter 68A-27, F.A.C., with a minimal application process. This may be accomplished by issuing a concurrent take permit from the FWC, by a memorandum of understanding with the cooperating agency, or by a programmatic permit issued to another agency. These permits would be issued based on the understanding that implementation of project commitments will satisfy the requirements of Rule 68A-27.007, F.A.C.

#### **Review of Land and Water Conversion projects with State-Listed Species Conditions for Avoidance, Minimization and Mitigation of Take**

- FWC staff, in coordination with other state agencies, provides comments to federal agencies (e.g., the Army Corps of Engineers) on federal actions, such as projects initiated by a federal agency or permits being approved by a federal agency.
- FWC staff works with landowners, local jurisdictions, and state agencies such as the Department of Economic Opportunity on large-scale land use decisions, including long-term planning projects like sector plans, projects in Areas of Critical State Concern, and large-scale comprehensive plan amendments.
- FWC staff coordinates with state agencies such as the Department of Environmental Protection (DEP) and the 5 Water Management Districts on the Environmental Resource Permitting (ERP) program,

which regulates activities such as dredging and filling in wetlands, flood protection, stormwater management, site grading, building dams and reservoirs, waste facilities, power plant development, power and natural gas transmission projects, oil and natural gas drilling projects, port facility expansion projects, some navigational dredging projects, some docking facilities, and single-family developments such as for homes, boat ramps, and artificial reefs.

- Sector plans, developments of regional impacts, and county comprehensive plans are all reviewed currently and FWC provides conditions that would be beneficial to the Black Creek crayfish. Upper Black Creek (Clay County), Kingsley Lake and Black Creek (North Fork) downstream to the northern line of Section 23, Township 5 South, Range 23 East, including all tributaries along this segment of Black Creek, are listed as Outstanding Florida Waters in Rule 62-302.700(9), F.A.C.

## FWC Permitting: Incidental Take

As defined in Rule 68A-27.001, F.A.C., incidental take is take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. An FWC permit should be obtained for activities that result in take of Black Creek crayfish (see [above](#) for actions that do not require a permit). Permits may be issued when there is a scientific or conservation benefit to the species and only upon showing by the applicant that that the permitted activity will not have a negative impact on the survival potential of the species. Scientific benefit, conservation benefit, and negative impacts are evaluated by considering the factors listed in Rule 68A-27.007(2)(b), F.A.C. These conditions are usually accomplished through a combination of avoiding take when practicable, minimizing take that will occur, and mitigating for the permitted take. This section describes the minimization measures and mitigation options available as part of the Incidental Take Permit process for take of this species. This list is not an exhaustive list of options.

### Minimization Options

The options below are intended to address the evaluation factors required for consideration when issuing an incidental take permit. These options can lessen the impact of activities, and ultimately may reduce what is needed to achieve a conservation or scientific benefit (see below).

#### Seasonal, Temporal, and Buffer Measures

- Upland activities that have the potential to disturb riparian zones should follow Outstanding Florida Waters recommendations and minimize activities within 60-91 m (200-300 ft) of the waterway, 15.2 m (50 ft) minimum in all other areas (DEP 2011, Wegner 1999).

#### Design Modification

- Avoid activities in priority sub watersheds or sensitive areas – areas with sandy bottoms and woody debris that indicate crayfish may be present.
- Place roads at least 61 m (200 ft) from streams and avoid areas occupied by Black Creek crayfish and utilize specific stormwater treatment systems for potential runoff into the system.
- Maintain in-stream woody debris and vegetation (provides food and shelter).
- Minimize the amount of sedimentation and erosion to waterways by using turbidity and sediment screens and by following guidelines described within the [Silviculture BMP Manual](#).
- Follow buffer measures (above) to limit the amount of runoff entering waterways.
- Use of bridge class culverts with open bottoms.

#### Method Modification

- Sediment screens, bales, other methods to limit sedimentation from upland site activity.

- Stage construction materials at least 91.4 m (300 ft) away from the stream or further if the staging area is intended as storage for fill material.
- When creating waterway crossings, top down bridge construction would minimize impacts to Black Creek crayfish and other aquatic species. Specific project guidance can be obtained by contacting the [Florida Department of Transportation](#).
- Installation of specific stormwater treatment systems for occupied habitat.

### **Mitigation Options**

Mitigation is scalable depending on the impact, with mitigation options for significant impairment or disruption of essential behavioral patterns constituting take. Potential options for mitigation are described below.

#### **Scientific Benefit**

This section describes research and monitoring activities that provide scientific benefit, per Rule 68A-27.007, F.A.C. Conducting or funding these activities can be the sole form of mitigation for a project.

- Surveys on private lands within the watershed, surveying a minimum of 20 drainage basins with at least three visits over a 2-year period, using FWC approved methodology. [Contact FWC](#) for approved methodology and permits to collect the species.
- Scientific studies can help address life history questions. These projects should be conducted with input from FWC.

#### **Habitat**

Habitat acquisition or management may be a mitigation option.

- Easement or acquisition near existing conservation lands, or adjacent to sites with Black Creek crayfish.
- Easements or acquisitions that target connecting drainage basins.
- Restoration of natural hydrology.
- Restoration of disturbed riparian forest buffer.

#### **Funding**

- No funding option has been identified at this time. However, funding options as part of mitigation will be considered on a case by case basis.

#### **Information**

- Mitigation can be used to support research projects consistent with actions in the [Species Action Plan for the Black Creek Crayfish](#).
- Surveys using approved survey methodology in surrounding basins (described above), and providing to FWC documentation and locality data for Black Creek crayfish encountered.
- Access to private properties to allow surveys to occur.

#### **Programmatic Options**

- Camp Blanding Candidate Conservation Agreement with Assurances (2016) specifies conservation actions to be conducted in forested wetlands and surface waters on Camp Blanding to benefit the Black Creek crayfish and other at-risk species.

#### **Multispecies Options**

- None identified at this time.

## FWC Permitting: Intentional Take

Intentional take is not incidental to otherwise lawful activities. Per Chapter 68A-27, F.A.C., intentional take is prohibited and requires a permit. For state-Threatened species, intentional take permits may only be considered for scientific or conservation purposes (defined as activities that further the conservation or survival of the species taken). Permits are issued for state-Threatened species following guidance in Rule 68A-27.007(2)(a), F.A.C.

### Intentional take for human safety

- There are no circumstances for which Black Creek crayfish may be taken for human safety.
- Permits will be issued only under limited and specific circumstances, in cases where there is an immediate danger to the public's health and/or safety, including imminent or existing power outages that threaten public safety, or in direct response to an official declaration of a state of emergency by the Governor of Florida or a local governmental entity. Applications submitted for this permit must include all information that is required from any other applicant seeking a permit, along with a copy of the official declaration of a state of emergency, if any. This permit process may be handled after the fact or at least after construction activities have already started. An intentional take permit may be issued for such purposes.

### Aversive Conditioning

- Not applicable for the Black Creek crayfish.

### Permits Issued for Harassment

- Not applicable for the Black Creek crayfish.

### Scientific Collecting and Conservation Permits

- Scientific collecting permits may be issued for the Black Creek crayfish using guidance found in Rule 68A-27.007(2)(a), F.A.C. Activities requiring a permit include any research that involves capturing, handling, or marking wildlife; conducting biological sampling; or other research that may cause take. Black Creek crayfish that are used for education and outreach events should have a Scientific Collecting permit.

### Considerations for Issuing a Scientific Collecting Permit

- 1) Is the purpose adequate to justify removing the species (if the project requires this)?
  - Permits will be issued if the identified project is consistent with the goal of the Species Action Plan (i.e., improvement in status that leads to removal from Florida's Endangered and Threatened Species List), or addresses an identified data gap important for the conservation of the species.
- 2) Is there a direct or indirect effect of issuing the permit on the wild population?
- 3) Will the permit conflict with program intended to enhance survival of species?
- 4) Will purpose of permit reduce likelihood of extinction?
  - Projects consistent with the goals of the [Species Action Plan for the Black Creek Crayfish](#) or that fill identified data gaps in species life history or management may reduce the likelihood of extinction. Applications should clearly explain how the proposed research will provide a scientific or conservation purpose for the species.
- 5) Have the opinions or views of other scientists or other persons or organizations having expertise concerning the species been sought?

- 6) Is applicant expertise sufficient?
- Applicants must have prior documented experience with this or similar species; applicants should have met all conditions of previously issued permits.

### Relevant to all Scientific Collecting for Black Creek Crayfish

- All scientific collecting surveys require a permit.
- FWC permit conditions will describe disposition of vouchered specimens and coordination on genetic and disease studies.
- Spreadsheet and electronic submission is allowed. As a minimum, GPS coordinates (DD), habitat, date, time of day, number collected, disposition of specimens.
- Any mortality should be reported immediately to the FWC at the contact information below. The FWC will provide guidance on proper disposition of specimens.
- Geographical or visual data gathered must be provided to FWC in the specified format.
- A final report should be provided to the FWC in the format specified in the permit conditions.

## Additional information

Information on the Economic Assessment of these guideline can be found at <http://myfwc.com/wildlifehabitats/imperiled/management-plans/>, within the Environmental Economics, Inc. reference, “Economic analysis for the Imperiled Species Management Plan with statement of estimated regulatory costs.” The Black Creek crayfish is specifically mentioned in Table 3b, pp. 10 and 13, and in Table 4, p. 15.

## Contact

For more species-specific information or related permitting questions, contact the FWC at (850) 921-5990 or [WildlifePermits@myfwc.com](mailto:WildlifePermits@myfwc.com). For regional information, visit <http://myfwc.com/contact/fwc-staff/regional-offices>.

## Literature Cited

- Brody, R. W. 1990. Status of habitat and populations of *Procambarus pictus* in the North Fork of Black Creek, Clay County, Florida. St. Johns River Water Management District, Palatka, FL.
- Camp Blanding CCAA. 2016. Candidate conservation agreement with assurances for multiple at-risk species in North Florida. Camp Blanding Joint Training Center, Clay County, FL. Prepared by the U.S. Fish and Wildlife Service, Florida Armory Board, and the Florida Fish and Wildlife Conservation Commission in cooperation with the Florida National Guard.
- Florida Department of Agriculture and Consumer Services [FDACS]. 2008. Silvicultural best management practices handbook. [http://freshfromflorida.s3.amazonaws.com/Media%2FFiles%2FFlorida-Forest-Service-Files%2Fsilvicultural\\_bmp\\_manual.pdf](http://freshfromflorida.s3.amazonaws.com/Media%2FFiles%2FFlorida-Forest-Service-Files%2Fsilvicultural_bmp_manual.pdf). Accessed 23 August 2017.
- Florida Department of Environmental Protection [DEP]. 2010. Lower St. Johns River tributaries basin management action plan II. Lower St. Johns River Tributaries Basin Working Group.
- Florida Department of Environmental Protection [DEP]. 2011. Outstanding Florida waters fact sheet. <https://floridadep.gov/dear/water-quality-standards/content/outstanding-florida-waters-fact-sheet>. Accessed 23 August 2017.

- Florida Fish and Wildlife Conservation Commission [FWC]. 2010. Black Creek crayfish issues meeting – minutes (revised). From meeting held February 17, 2010, at Camp Blanding, Florida.
- Florida Natural Areas Inventory [FNAI]. 2001. Black Creek crayfish, *Procambarus pictus*. Field guide to the rare animals of Florida. Florida Natural Areas Inventory, Tallahassee, FL.
- Franz, R. 1994. Rare: Black Creek crayfish. Pages. 211-214 in M. Deyrup and R. Franz, editors. Rare and endangered biota of Florida. Volume IV. Invertebrates. University Press of Florida, Gainesville, FL.
- Franz, R., and L. M. Franz. 1979. Distribution, habitat preference and status of populations of the Black Creek crayfish, *Procambarus (Ortmannicus) pictus* (Decapoda: Cambaridae). Florida Scientist 42:13-17.
- Franz, R., H. Smith, and A. Hallman. 2008. Survey for Black Creek crayfish (*Procambarus pictus*) at Jennings SF and Camp Blanding Joint Training Center, Clay and Duval counties, Florida. Final report. Florida Fish and Wildlife Conservation Commission, Tallahassee, FL.
- Natural Resources Conservation Service (NRCS). 2012. Conservation practice standard overview. United States Department of Agriculture.  
[https://www.nrcs.usda.gov/Internet/FSE\\_DOCUMENTS/stelprdb1255022.pdf](https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1255022.pdf). Accessed 5 August 2017.
- Nelson, E. B., and M. R. Floyd. 2011. Black Creek crayfish baseline survey at Camp Blanding Joint Training Center, Starke, Florida. Final report for Department of Military Affairs Environmental Division, prepared by Florida Fish and Wildlife Conservation Commission, Tallahassee, FL.
- U.S. Fish and Wildlife Service [USFWS]. 2001. Buffers: An efficient tool for watershed protection.  
[http://fwcg.myfwc.com/docs/Wetland\\_Buffers\\_USFWS.pdf](http://fwcg.myfwc.com/docs/Wetland_Buffers_USFWS.pdf). Accessed 17 July 2017.
- Wegner, S. 1999. A review of the scientific literature on riparian buffer width, extent and vegetation. Office of Public Service and Outreach, Institute of Ecology, University of Georgia, Athens, GA.