

Field Guide to the CRAYFISH OF THE WHITE RIVER WATERSHED, East-Central

Written by Jennifer Guarino Cristina Gastador Emily Miller

Illustrated by Susan Sawyer

Developed by White River Partnership Verdana Ventures LLC

May 2012

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Written by

Jennifer Guarino, Cristina Gastador, and Emily Miller

Illustrations © Susan Sawyer



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Developed by



The White River Partnership



Verdana Ventures, LLC

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# **Contents**

Introduction	5
Why Focus on the Crayfish of the White River?	5
The White River Watershed	5
Crayfish "Residency"	7
Pertinent Vermont Laws	7
GENERAL CRAYFISH INFORMATION	8
Taxonomy	8
Ecology	8
Niche	8
Habitat	8
Behavior	8
Anatomy	9
Life Cycle	12
Molting	12
Reproduction	13
Hybrids	14
SPECIES PROFILES	15
Species Maps	15
Northern Clearwater Crayfish	16
Virile Crayfish	18
Rusty Crayfish	20
Big Water Crayfish	22
An Investigation Challenge	24
Crayfish Research Questions	24
How to Catch Crayfish	24
How to Hold a Crayfish	25

GLOSSARY	26
REFERENCES	27
ADDITIONAL RESOURCES	28

Fig	gures	Page Numbers
1.	The White River watershed, its river system, and towns.	1
2.	General Crayfish Anatomy	11
3.	Male and Female Anatomy	12
4.	A molted (hollow) exoskeleton.	13
5.	Photos of Form I male and female.	14
6.	The northern clearwater crayfish can hybridize with the rusty crayfish.	15
7.	Documented locations of crayfish species in Vermont	16
8.	Dark band along the abdomen of the northern clearwater crayfish	17
9.	White bumps on the blue chelae of the virile crayfish.	19
10.	Rounded corners on the rostrum of the big water crayfish.	21
11.	A minnow trap set in rocks to catch crayfish.	24
12.	Lots of crayfish were caught in one trap!	25
13.	Hold a crayfish so as not to hurt it and not to GET hurt by the claws.	25

## INTRODUCTION

# Why Focus on the Crayfish of the White River?

This field guide is designed to educate students, teachers, community members, and others about the four species of crayfish that have been found in the White River watershed in Vermont. It contains general information on crayfish ecology and a profile of each species with a description and illustrations for use in identification. A series of maps shows where these species have been documented across Vermont. Useful terms are defined in a GLOSSARY at the end.

Interest in the crayfish of the White River comes from the need to better understand their ecological role in this watershed, especially the role of introduced crayfish species. In the summer of 2010, a new species, the big water crayfish (Cambarus robustus), was discovered behind the White River National Fish Hatchery in Bethel and in the Green Mountain National Forest in Rochester. More research will reveal whether this introduced species occupies other parts of the White River watershed and how it may be affecting the river's ecosystem. Another introduced species, the rusty cravfish (Orconectes rusticus), is highly invasive and could cause adverse environmental impacts in our watershed similar to those it has caused in Great Lakes states and in other parts of the country.

We hope to enlist you, the reader, to help us build new information about the crayfish populations in our watershed. A section in the field guide called AN INVESTIGATION CHALLENGE lists some questions that researchers are asking about the crayfish of the White River and encourages you to ask your own questions. If you are interested in participating in authentic crayfish research in the White River watershed, please read the section in this field guide called "How to Catch

Crayfish" and contact the White River Partnership to receive training.

White River Partnership P.O. Box 705, 4266 Vermont Route 14 South Royalton, VT 05068 (802) 763-7733 info@whiteriverpartnership.org www.whiteriverpartnership.org

#### The White River Watershed

The White River, located in east-central Vermont, is important in many ways. Its watershed encompasses 21 towns, over 25 schools, 3 colleges, and various businesses. Local economic activities such as agriculture, logging, maple sugaring, recreation, and tourism rely on its abundant, healthy natural resources. It is one of the last free-flowing rivers in the State of Vermont and the longest un-dammed tributary to the Connecticut River, which has been designated an American Heritage River. The White River is a Special Focus Area of the Silvio O. Conte National Fish and Wildlife Refuge because it provides critical habitat for Atlantic salmon, and an Environmental Protection Agency Clean Water Action Plan National Showcase Watershed.

While the White River is generally healthy and has good water quality overall, there is growing concern over such issues as non-point source pollution and the spread of invasive species.

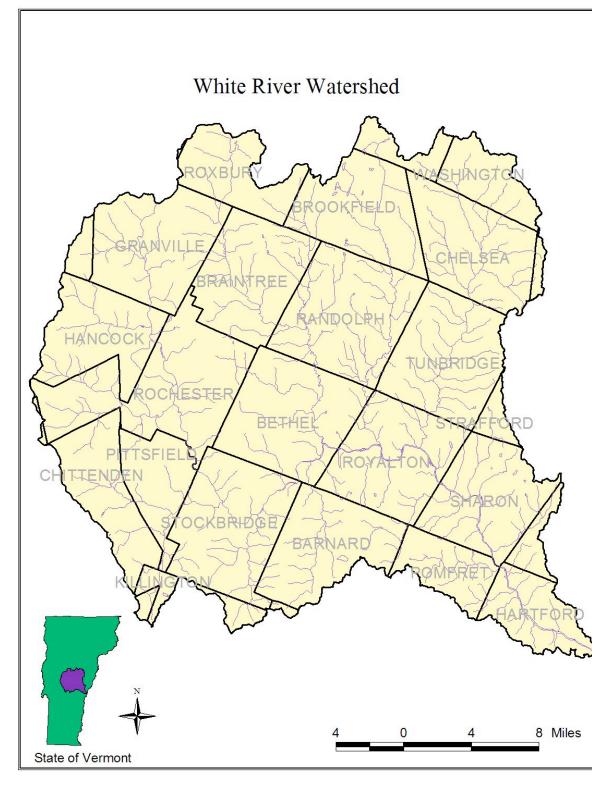


Figure 1. The White River watershed, its river system and towns.

#### Crayfish "Residency"

There are four crayfish species that have been documented in the White River watershed: the northern clearwater, the virile, the rusty and the big water. Each of these crayfish species belongs to one of the following "residency" categories.

- A **native species** is one that has always inhabited a particular area and is in balance with other organisms living there. The northern clearwater crayfish is the only one of the four species found in the White River watershed that is considered to be native to Vermont. <sup>1</sup>
- A non-native species has been introduced into an area either by people or by expansion of its natural range. The virile, rusty and big water crayfish are all non-native species found within the White River watershed.

Other terms, such as naturalized, alien, invasive or nuisance, are sometimes used to describe non-native species. These terms can be confusing because experts do not agree on definitions; people some use them interchangeably while others feel there are distinct differences. Most people agree that an invasive species is a non-native species that spreads rapidly and causes harm to an ecosystem, economic activities, and/or human health. It is widely agreed that the rusty crayfish (Orconectes rusticus) is invasive because it can destroy aquatic plants, outcompete other crayfish species, disturb fish nurseries, and fend off predators that might otherwise control its population.

The lack of consensus on terms can be a particular problem when it comes to laws and regulations. For the purposes of legislation, the state of Vermont uses the term *aquatic* nuisance species to describe those aquatic species that threaten the diversity or abundance of native species, ecological stability, and/or commercial, agricultural, aquacultural or recreational activities.<sup>2</sup>

#### Pertinent Vermont Laws

Vermont and other states are working to control the spread of aquatic invasive species through legislation and education. Two laws that pertain to working with crayfish are summarized below.<sup>3</sup>

- Felt-Soled Boots and Waders Ban. 10 V.S.A. §4616. "It is unlawful to use external felt-soled boots or external felt-soled waders in the waters of Vermont, except that a state or federal employee or emergency personnel, including fire, law enforcement, and EMT personnel, may use external felt-soled boots or external felt-soled waders in the discharge of official duties."
- Transport of aquatic plants and aquatic nuisance species. 10 V.S.A. §1454. (a) "No person shall transport an aquatic plant or aquatic plant part, zebra mussels (Dreissena polymorpha), quagga mussels (Dreissena bugensis), or other aquatic nuisance species identified by the secretary by rule to or from any Vermont waters on the outside of a vehicle, boat, personal watercraft, trailer, or other equipment. This section shall not restrict proper harvesting or other control activities undertaken for the purpose of eliminating or controlling the growth or propagation of aquatic plants, zebra mussels, quagga mussels, or other aquatic nuisance species. (b) The secretary may grant exceptions to persons to allow the transport of aquatic plants, zebra mussels, quagga mussels, or other aquatic nuisance species for scientific or educational purposes. When granting exceptions, the secretary shall take into consideration both the value of the scientific or educational purpose and the risk to Vermont surface waters posed by the transport and ultimate use of the specimens. A letter from the secretary authorizing the transport must accompany the specimens during transport."

<sup>&</sup>lt;sup>1</sup> Crocker, 1979

<sup>&</sup>lt;sup>2</sup> Aquatic Nuisance Species Task Force

<sup>&</sup>lt;sup>3</sup>The VT Statutes

# GENERAL CRAYFISH INFORMATION

#### **Taxonomy**

Crayfish belong to the Phylum Arthropoda, which includes insects, spiders, centipedes, crayfish, and many other organisms. Arthropods have jointed legs, segmented bodies, and a hard outer shell called an exoskeleton. Crayfish are classified in the Subphylum Crustacea, whose organisms have two pairs of antennae, one pair of compound eyes, gills to take dissolved oxygen from water, and other features. Crabs, shrimp, crayfish, and their relatives belong to the Order Decapoda, which means 10 legs. The full taxonomic chart for crayfish is as follow:<sup>4</sup>

Kingdom: Animalia Phylum: Arthropoda Subphylum: Crustacea Class: Malacostraca Order: Decapoda

Family: Astacidae (crayfish)

Within every family of organisms, there is one or more genera (plural of genus), and each genus contains one or more species. There are approximately 400 crayfish species in North America, many of which reside in Louisiana. As of 2011, only four species have been identified in the White River watershed; three species in the genus *Orconectes* and one species in the genus *Cambarus*. It is possible that new species will be discovered here in the future, and that one or more current species will disappear.

An organism's scientific name contains the genus name (capitalized) followed by the species name (not capitalized). Usually, scientific names are italicized. An example is the virile crayfish: *Orconectes virilis*.

#### **Ecology**

#### Niche

Crayfish are omnivores, consuming anything that can be picked up with their claws or mouthparts, such as plants, aquatic insects, detritus, and even other crayfish. They are eaten in turn by fish, otters, raccoons, bullfrogs, herons, and other predators that hunt in and along water bodies. Studies have shown that crayfish are usually very important members of their communities and can strongly influence the ecology of a system<sup>5</sup>.

#### Habitat

Crayfish can be found globally in a variety of habitats, in lakes, ponds, large rivers, small streams, wetland areas and sometimes even in caves, but the crayfish that are found in the White River watershed all have fairly similar habitat preferences. <sup>6</sup> The three *Orconectes* species, found in both streams and lakes, prefer rocky substrates (although they can be found on sand or mud or in areas with dense plant growth). These crayfish usually hide under rocks or dig shallow pits under rocky debris, but they have been known to create more extensive burrows when cover is inadequate. The Cambarus species found in the White River watershed, the big water crayfish, is found in rivers and streams generally in or around areas of high water flows (such as rapids or waterfalls).

#### **Behavior**

Crayfish crawl along the bottom of water bodies and can shoot backwards by rapidly contracting the abdomen and tail. Most species hide under rocks or logs and are active at night. In contrast, the rusty crayfish is often seen out in the open during the day.

Crayfish are territorial yet are not overly aggressive, using speed to escape potential

<sup>&</sup>lt;sup>4</sup> Animal Diversity Web, University of Michigan Museum of Zoology (http://animaldiversity.ummz.umich.edu/).

<sup>&</sup>lt;sup>5</sup> Reynolds and Souty-Grosset, 2012.

<sup>&</sup>lt;sup>6</sup> Ontario Crayfish Identification Guide.

threats. An exception is the rusty crayfish, which adopts a defensive stance when approached by a predator. It opens its claws and raises them in front of its body in preparation for a fight.

#### Anatomy

The crayfish has two main body parts, the cephalothorax and the abdomen. Each is described below.

1. The **cephalothorax** has two fused sections, a head and a thorax, which are covered by a shield known as the *carapace*. On top of the head is the *rostrum*, which can be used in identification because its shape can vary between species (see SPECIES PROFILES). Crayfish have a pair of antennae for touch, taste, and smell, as well as a pair of smaller antennules for balance, touch, and taste.

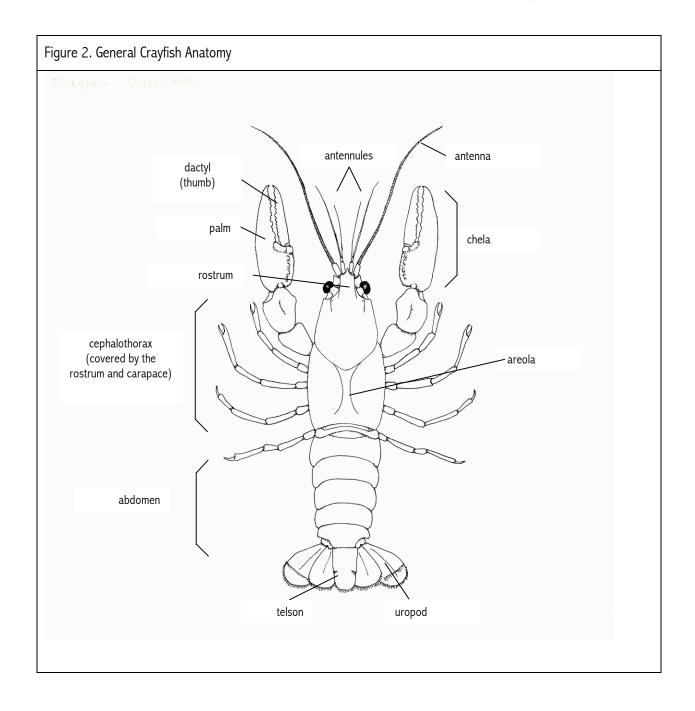
Five pairs of legs are attached to the underside of the cephalothorax. Each leg of the first pair ends in a large *chela* or claw with two parts: the *dactyl* (moveable "thumb") and the *palm*. The next two

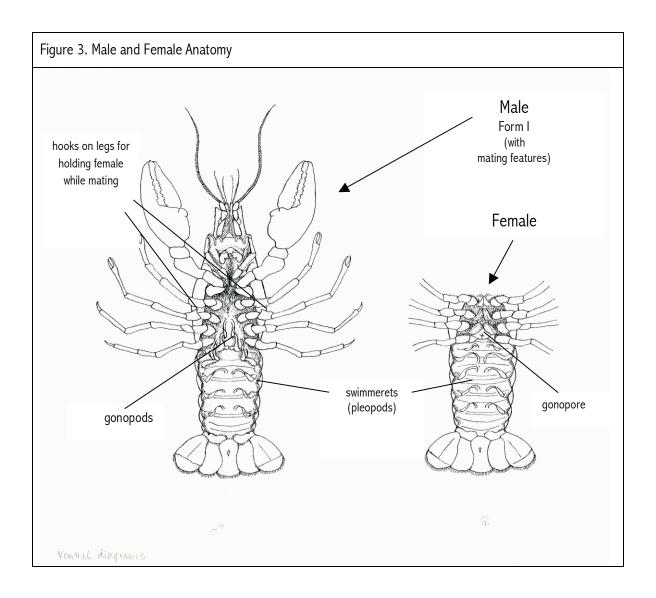
pairs of legs also have hinged claws, but they are much smaller.

When biologists measure crayfish, they often measure this section (tip of the rostrum to the junction between the carapace and abdomen) and refer to it as the *carapace length*.

2. The **abdomen** is divided into seven segments. The first five segments contain *swimmerets*, or pleopods, which help with movement and reproduction. The male's reproductive organs, called *gonopods*, are located between the swimmerets and the legs. The female has a small, rounded structure, called the *gonopore*, between the swimmerets and the legs.

The tail contains a central section called the *telson* and several side sections called *uropods*. The anus is on the underside of the telson.





#### Life Cycle

#### **Molting**

Crayfish undergo a shedding process called molting that allows them to grow. Just before molting, the exoskeleton splits between the carapace and the abdomen. The crayfish pushes its body through this crack and leaves behind an intact, hollow exoskeleton (see Fig. 4). During this time, the crayfish may appear dead and is soft to the touch. In this condition, it can grow bigger and begin to grow back lost legs. If a crayfish has one claw that is much smaller than the other, it is probably a replacement claw that will increase in size with every molt.

Within a few days, the soft outer covering of a recently-molted crayfish will harden into a new exoskeleton. Crayfish are weak when molting and are more vulnerable to predation at this time.

Juvenile crayfish typically undergo many molts per year. Adult females molt only once per year in the summer, after the young have left. Adult males molt twice a year: to Form I in summer, which prepares them for mating, and to Form II in the spring, at which time they are not able to mate. These forms are described as follows:

- Form I males have large chelae, hooks on one pair of legs for holding a female during mating, and hardened gonopods for transferring sperm to the female.
- Form II males do not have these characteristics and look more like females.

Because adult males molt twice a year and adult females molt only once a year, males tend to be larger than females. Crayfish can live approximately two to four years in the wild. They live longer in captivity, probably because they face little or no predation. Researchers have found a correlation between age and size in crayfish – bigger crayfish tend to be older.



A molted (hollow) exoskeleton. Notice the raised carapace. During molting, the exoskeleton splits between the carapace and the abdomen, creating a crack through which the crayfish pushes itself out (see

arrow). Photo by Jennifer Guarino.

#### Reproduction

During mating, the male's gonopods transfer sperm to the female's sperm receptacle, a rounded structure on her underside called the gonopore. The sperm is stored here until conditions are favorable for fertilization of the eggs.

Once conditions are favorable (generally due to an increase in water temperature), the female secretes a sticky substance called glair onto the underside of her abdomen, the underside of her tail fan, and on her swimmerets. The female then releases her eggs and the stored sperm and external fertilization occurs.

The fertilized eggs remain stuck to the glair until hatching. The female is said to be "in berry" while carrying the eggs because the eggs resemble a large raspberry or cluster of grapes. The newly-hatched young cling to the underside of their mother for several weeks.





Fig.5. A Form I male (top) and female (bottom). Both individuals were taken from the White River and are covered with algae and muck. Arrows point to gonopods (top) and gonopore (bottom). Photos by Emma Kimball.

#### Hybrids

Generally, two different species cannot mate, but occasionally mating between species takes place and produces a hybrid. Sometimes the hybrid offspring are inferior or cannot themselves reproduce, but certain crayfish species can mate with other species to produce fertile hybrids. The rusty crayfish has been shown to hybridize with the northern clearwater crayfish. Studies have found that these adult hybrids actually do better than the pure northern clearwater. Genetically pure northern clearwaters must compete with both rusty and rusty-clearwater hybrids, so they often become less and less common in successive generations (even though some of their genes may still be present in the hybrids). This is one way in which the rusty crayfish may be diminishing crayfish diversity in the White River watershed.

If a crayfish displays physical and behavioral characteristics of two different species, it may be a hybrid. The most accurate way to confirm a hybrid is to study its genetics. More information and research are needed to understand the identification of hybrid crayfish and their effects on ecosystems.





Figure 6.

The northern clearwater crayfish (above) can hybridize with the rusty crayfish (below). Top photo by C. Chris Lukhaup (crayfishworld.com/internationalusa 2003b.htm), bottom photo by Susan Sawyer.

<sup>&</sup>lt;sup>7</sup> Perry et al., 2001.

## **SPECIES PROFILES**

This section describes the four crayfish species found in the White River watershed - the northern clearwater, the virile, the rusty, and the big water - to aid in their identification. Crayfish identification keys for larger watersheds often require close examination of small reproductive parts of Form I adult males in order to clearly identify each species. But since the White River watershed has so few species, each with relatively distinctive markings, we can generally use their external features to correctly identify our crayfish. Please refer to the field guides and identification keys listed in the REFERENCE SECTION for further help. *Please note: Dates given for molting and the reproductive cycle are approximate and may vary locally*.

#### Species Maps

The maps in Figure 7 show the locations across the state where each of the four crayfish species found in the White River watershed has been documented. You can help to add more red dots to these maps if you conduct crayfish surveys following the protocol established by the White River Partnership and send us your data! Please see AN INVESTIGATION CHALLENGE below.

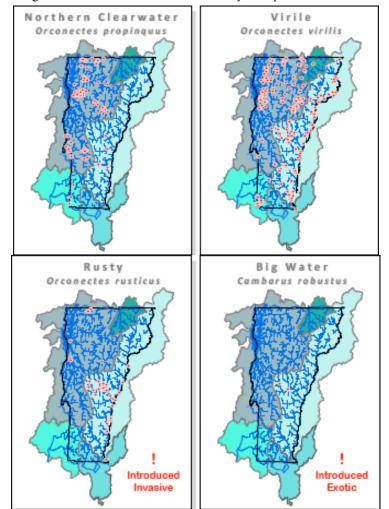


Figure 7. Documented Locations of Crayfish Species in Vermont

Maps made by Leslie Matthews, Environmental Scientist, Vermont Water Quality Division. March 2011.

# Northern Clearwater Crayfish

#### Orconectes propinquus

#### "Residency"



#### **Physical Description**

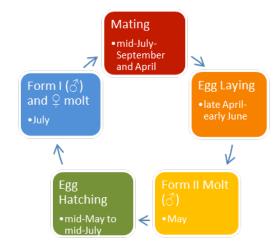
This is a small crayfish, with the carapace of an average adult measuring 2.3 cm (0.9 in).8

- Body is brown-green with a broad, dark band down the center of the abdomen.
- Chelae (claws) tend to have orange tips.
- The best feature for identification is a prominent carina (keel) on its rostrum.

#### **Behavior**

This crayfish lives an average of two years.

#### Typical Lifecycle<sup>9</sup>



#### May Be Confused With

- Orconectes obscurus (the Allegheny crayfish). This small crayfish has orange-tipped chelae and a dark band along the abdomen. It does not have a carina.
- Procambarus acutus (the White River crayfish). This larger crayfish has a dark band along the abdomen, but it has hooks on both the third and fourth pair of legs (Form I males). Its chelae are curved and more slender than those of the northern clearwater.
- Procambarus clarkia (the Red Swamp crayfish). As with P. acutus, this crayfish has a dark band along its abdomen, hooks on both the third and fourth pair of legs (of Form I males) and curved chelae. Unlike that of P. acutus, its areola is very narrow or absent.



Figure 8.

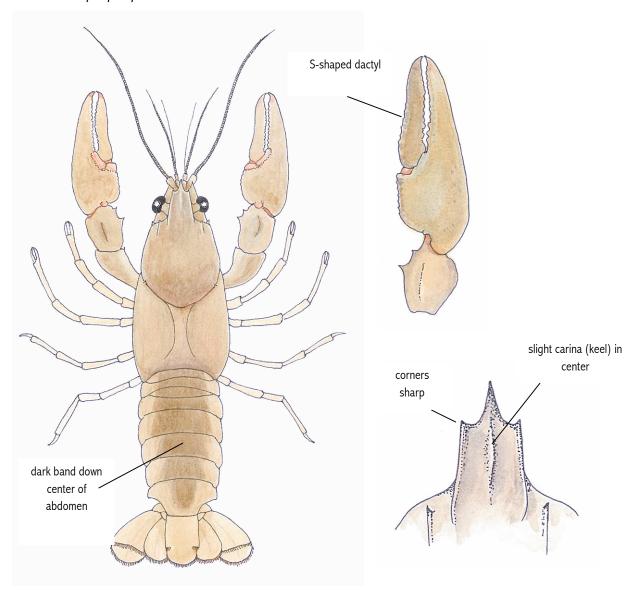
Dark band along the abdomen of the northern clearwater crayfish.

<sup>&</sup>lt;sup>8</sup> Ontario Crayfish Identification Guide.

<sup>&</sup>lt;sup>9</sup> Ontario Crayfish Identification Guide and Fielder, 1972..

# Northern Clearwater Crayfish

Orconectes propinquus



# Virile Crayfish

#### Orconectes virilis

#### "Residency"

native non-native

This is a very widespread species in Vermont. Some experts believe that its introduction has been disruptive to the ecosystem.

#### **Physical Description**

This is a medium to large species, with a maximum observed carapace length of 5.5cm (2.2in). 10

- Body is typically olive brown.
- Some individuals may have chelae (claws) and legs that range from olive brown to light blue to deep ocean blue.
- Tips of chela are orange.
- Chela have many pronounced bumps.
- The corners of the rostrum are sharp.
- The areola on the carapace is narrow.
- Each segment of the abdomen tends to have a pair of dark brown spots.

#### Behavior

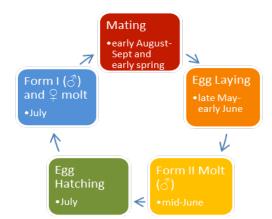
Some have speculated that immature virile crayfish are more likely to die during winter because they don't move into deep waters as the adults often do. 11

Virile crayfish may be more affected by fish predation or the threat of fish predation than the rusty or northern clearwater crayfish. 12



Figure 9. Close-up of the virile crayfish. Note the slightly blue chelae with many prominent bumps. Photo by Jennifer Guarino.

#### Typical Lifecycle 13



#### May Be Confused With

• Orconectes immunis (the Calico crayfish). This crayfish has a sizable notch in the dactyl and a pale zone bordered by dark splotches on the center of the abdomen rather than paired dark spots.

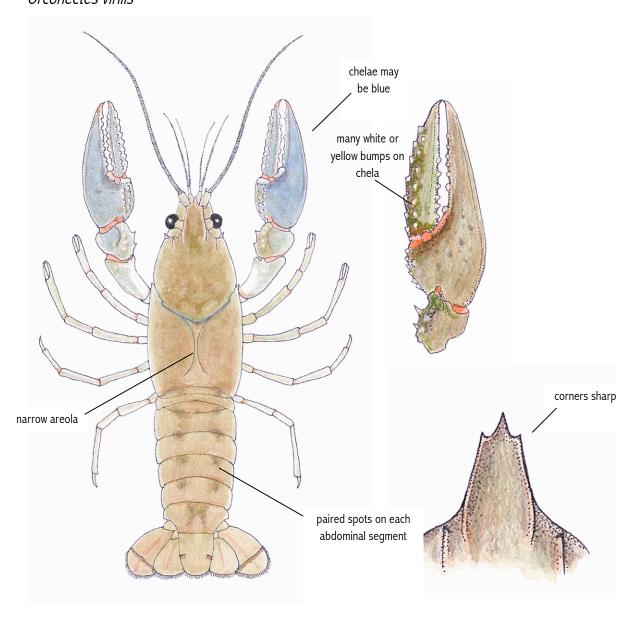
<sup>&</sup>lt;sup>10</sup> Ontario Crayfish Identification Guide.

<sup>&</sup>lt;sup>11</sup> Aiken, 1968.

<sup>12</sup> Hill and Lodge, 1999.

<sup>&</sup>lt;sup>13</sup> Summarized from the Ontario Crayfish Identification Guide.

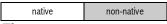
# Virile Crayfish *Orconectes virilis*



# Rusty Crayfish

#### Orconectes rusticus

#### "Residency"



This is an invasive species.

#### **Physical Description**

This medium to large species has a maximum observed carapace length of 5.4 cm (2.1in). See Figure 6 for an excellent image of a rusty.

- Has a rusty spot on either side of its carapace and sometimes orange patches on its cheeks. Sometimes the growth of algae on the exoskeleton makes this hard to see.
- Chelae have orange tips and black bands.
- Dactyl ("thumb") is often S-shaped.
- There is an oval opening when chelae are closed.
- Rostrum has sharp corners.
- Edges of the mandible are straight.

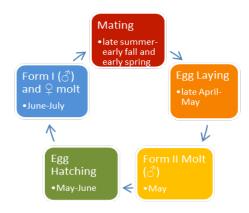
#### **Behavior**

Rusty crayfish are native to Ohio, Kentucky, and Tennessee in the Ohio River basin. They can be found in great numbers in the White River mainstem, and in smaller numbers in the Third Branch of the White River. This invasive crayfish can harm rivers by destroying aquatic plants<sup>15</sup>, out-competing other crayfish species<sup>16</sup>, and damaging fish nurseries and food sources<sup>17</sup>. The rusty crayfish has a higher metabolic rate than most other crayfish species, which causes it to eat great quantities of food. It is very aggressive and can often fend off predatory fish, which may cause other crayfish to be eaten in greater numbers by fish.

Rusty crayfish can hybridize with northern clearwater crayfish, which further crowds out the native northern clearwater. Hybrids may have physical characteristics of both species, making identification particularly challenging.

<u>Please Note</u>: If you remove a rusty crayfish from a water body, DO NOT return it, or release it in another water body. You can humanely kill it by freezing it. You can also cook and eat it!

#### Typical Lifecycle<sup>20</sup>



#### May Be Confused With

- Orconectes limosus (the Spinycheek crayfish): this crayfish has orange-tipped chelae with black bands, but it also has spines on its cheeks and dark blotches on its abdomen.
- Orconectes neglectus (the Ringed crayfish): this crayfish has orange and black tipped claws and dark stripes along the outer margins of the abdomen. It also has a dark band on the carapace where it meets the abdomen.

<sup>&</sup>lt;sup>14</sup> Ontario Crayfish Identification Guide.

<sup>15</sup> Lodge and Lorman, 1987; Lodge et al., 1994

<sup>&</sup>lt;sup>16</sup> Hill and Lodge, 1999; Perry et al., 2001

<sup>&</sup>lt;sup>17</sup> Lodge et al., 1985; Minnesota Sea Grant's Rusty Crayfish: a Nasty Invader

<sup>&</sup>lt;sup>18</sup> Jones and Momot, 1983

<sup>&</sup>lt;sup>19</sup> See the Minnesota Sea Grant's Rusty Crayfish: a Nasty Invader or Perry et al., 2001 for more detail.

<sup>&</sup>lt;sup>20</sup> Minnesota Sea Grant's, *Rusty Crayfish: a Nasty Invader* and the Ontario Crayfish Identification Guide.

# Rusty Crayfish orange tips, Orconectes rusticus black bands S-shaped dactyl oval opening when chela is closed corners sharp red-orange "fingerprints" on either side of carapace

# Big Water Crayfish

#### Cambarus robustus

#### "Residency"

native non-native

Will it become invasive? Will it compete with the rusty?

#### **Physical Description**

This is a large crayfish species, with some individuals having a carapace length of more than 5cm (2in).<sup>21</sup>

- Corners on the rostrum are rounded (with no sharp corners like the other species).
- Large chelae (claws) with wide palms that are somewhat dome-shaped with a depression on the outer margin.
- Chelae have two rows of bumps on the inner margin of the palm.
- The body is greenish-brown.

#### **Behavior**

This alien species was discovered in the mainstem of the White River in Bethel and in the Green Mountain National Forest in Rochester in summer 2010. More research is needed to determine whether it could become invasive.

It is known to survive in acidic lakes<sup>22</sup> and may be able to tolerate streams that have elevated sediment and pollutant concentrations<sup>23</sup>.

#### Typical Lifecycle<sup>24</sup>

The lifecycle of the big water crayfish is less predictable than those of the *Orconectes* species. It was once thought that reproduction might occur throughout the year, but more recent studies have shown that mating and molting occur only between April and

October. Females with eggs have been observed from the end of June through July. Form I and Form II males have been observed simultaneously throughout the summer. More research is needed to better understand the lifecycle of this crayfish.



#### May Be Confused With

• Cambarus bartonii (the Appalachian crayfish). The corners of its rostrum rounded, but there is only one row of bumps on the inner margin of the palm and no depression on the outer margin of the palm.



Figure 10.

Rounded corners on the rostrum of the big water crayfish. Photo by Lindsey Cole.

<sup>&</sup>lt;sup>21</sup> Hamr and Berrill, 1985.

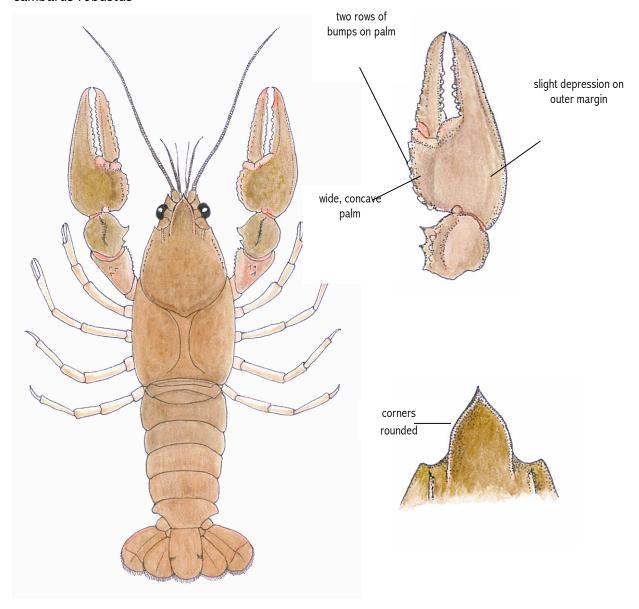
<sup>&</sup>lt;sup>22</sup> Taylor et al., 1995.

<sup>&</sup>lt;sup>23</sup> Ontario Crayfish Identification Guide.

<sup>&</sup>lt;sup>24</sup> Hamr and Berrill, 1985 and Corey, 1990.

# Big Water Crayfish

#### Cambarus robustus



# An Investigation Challenge

#### Crayfish Research Questions

The White River Partnership and the Vermont Water Quality Division are interested in learning more about crayfish in the White River watershed. Their crayfish questions include the following:

- 1. Where are different crayfish species found in the White River watershed? (Biologists are especially interested in locations of the big water crayfish, which was found in the mainstem behind the White River National Fish Hatchery in Bethel and within the Green Mountain National Forest in Rochester.)
- 2. What types of habitat do White River crayfish species prefer?
- 3. Which species are found living in the same places?
- 4. Where are northern clearwater / rusty hybrids found? Are pure northern clearwater crayfish found in the same locations as these hybrids?
- 5. What crayfish species are found in ponds and lakes within the watershed? (Most research thus far has focused on rivers.)

We encourage you to think of your own questions and explore the rivers and ponds in your area for crayfish. Use this field guide to identify the species and gender of those you find. Information below on catching crayfish can get you started on your investigations.

We are looking for citizen scientists to help us collect valid data on crayfish in the White River watershed. Please contact the White River Partnership (see below) if you would like to receive training on crayfish monitoring and submit your data to our database.

White River Partnership
P.O. Box 705, 4266 Vermont Route 14
South Royalton, VT 05068
(802) 763-7733, info@whiteriverpartnership.org
www.whiteriverpartnership.org

#### How to Catch Crayfish

Crayfish are easily caught using a minnow trap or crayfish trap that is baited with meat scraps or an open can of catfood (Fig.11). Find a place that you think would provide good cover, such as under a log or behind a big rock. In a river, tie the minnow trap to a solid object so that it is not carried downstream with the current. Leave the trap in place for 24 hours and check it the next day. If you don't catch anything the first day, leave it there for a second day or move your trap to a different spot. People can also catch crayfish with a hand net or a dip net, especially the rusty crayfish, which is active during the day and tends to hold its ground when threatened rather than slip away unnoticed.



Figure 11.

A minnow trap set in rocks to catch crayfish. Photo by Jennifer Guarino.



Figure 12.

Lots of rusty crayfish were caught in one trap! Photo by Jennifer Guarino.

Please Note: If you remove a rusty crayfish from a water body, do not return it or release it in any other water body. It can be humanely killed by freezing it or cooking and eating it. It tastes like its saltwater relative, the lobster!

Consult the list below for appropriate clothing and equipment for crayfish catching.

#### Supplies Checklist:

□ clothes that can get dirty and wet
 □ footwear that can get dirty and wet, such as old sneakers or waders<sup>25</sup>
 □ a minnow trap, crayfish trap, hand net, or dip net
 □ trap bait (meat scraps, wet catfood, etc.)
 □ a rope to anchor the trap
 □ a white plastic basin (to receive caught crayfish)
 □ a magnifying lens

If you are a child, make sure that you have adult supervision while working in a water body.

#### How to Hold a Crayfish

a camera (optional)

Crayfish can pinch, so be careful! To pick one up, push down on its carapace to pin it so that it cannot move. Move your thumb and forefinger to either side of the carapace and pick it up. Hold on firmly but gently. Crayfish often snap their tails to startle predators, so be prepared to hold on if this happens!

If you pick up a crayfish that is soft, it has just molted and is very vulnerable. Please be especially careful with it.

Figure 13. Hold a crayfish so as not to hurt it and not to GET hurt by the claws.

<sup>&</sup>lt;sup>25</sup> Please note that Vermont has a ban on felt-soled waders to prevent the spread of invasive species like didymo. Other equipment used in-stream should be cleaned thoroughly and dried completely before re-use.

## **GLOSSARY**

**Abdomen:** The rear part of the crayfish body containing reproductive organs on the inside and swimmerets on the underside. The abdomen is divided into seven segments.

**Antennae:** A pair of long, thin organs attached to the front of the head used for touch, taste, and smell. Antennae are longer than antennules.

**Antennules:** A pair of long, thin organs attached to the front of the head used for balance, touch, and taste. Antennules are shorter than antennae.

**Areola:** The space between two curved lines along the middle of the carapace; often used for identification.

**Arthropod:** An invertebrate animal that has jointed legs, a segmented body, and a hard exoskeleton. Insects, arachnids, and crustaceans are examples of arthropods.

**Carapace:** The portion of the exoskeleton that covers the cephalothorax. Crayfish are typically measured from the tip of the rostrum to the junction between the thorax and the abdomen; this is known as *carapace length*.

Carina: The ridge along the rostrum of the northern clearwater crayfish; used for identification of this species.

**Cephalothorax:** The part of the body that is made up of the head and thorax, which are fused together.

**Chela** (plural: chelae): The claw of the crayfish that is made up of the palm and the dactyl ("thumb"). It is used for defense and to capture its prey.

**Dactyl:** The moveable "thumb" of the chela.

**Decapod:** A crustacean that has five pairs of appendages and a cephalothorax covered by a carapace.

**Detritus:** Organic debris formed by the decomposition of plants, animals, and other living organisms.

**Ecosystem:** A community of plants, animals, and other organisms and the physical environment in which they live.

**Exoskeleton:** The hardened outside shell on an arthropod that is periodically shed (molted) to allow the animal to grow.

**Form I male:** Male crayfish that has the physical characteristics used in mating, including large chelae, hooks on a pair of legs used for holding the female, and hardened gonopods.

**Form II male:** Male crayfish that lacks the physical characteristics used for mating.

Glair: A sticky substance secreted by a female crayfish to adhere her eggs to the underside of her abdomen.

**Gonopods:** The male crayfish reproductive organs that transfer sperm to the female.

**Gonopore:** The female reproductive organ that accepts the male's sperm.

**Hybrid:** The offspring of two different species that mate.

**Mainstem:** The largest channel of a river system.

**Molting:** The process during which the exoskeleton softens and splits, and the crayfish pushes out of it. Male crayfish undergo two stages of molting: Form I and Form II.

**Palm:** The larger part of the chela.

**Rostrum:** The upper front part of the head. Since its shape is unique in each species, it can be used in identification.

**Swimmerets:** The leg-like appendages attached to the underside of the abdomen that aid in movement and reproduction. Also called pleopods.

**Tail fan:** The broad region at the end of a crayfish's abdomen made up of the uropods and telson.

**Telson:** The central section of the tail fan.

**Uropods:** The sections on either side of the telson on the tail fan.

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## **ADDITIONAL RESOURCES**

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