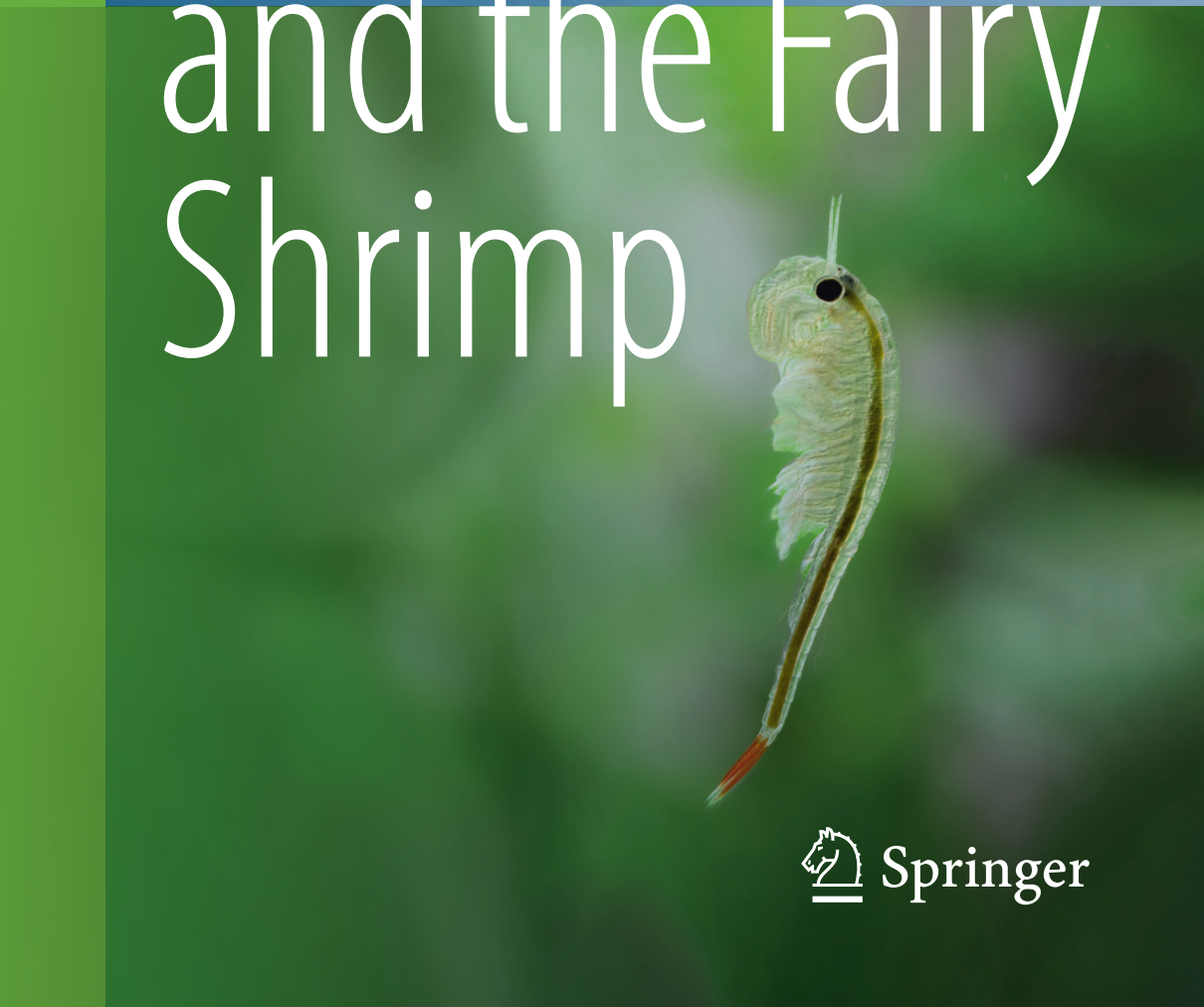
James H. Thorp

The Otter and the Fairy Shrimp



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About the Author

The Author: James Thorp often claims that he is considerably "older than dirt but still kicking"! In his wandering life, he has received a master's degree for freshwater studies of green hydra from North Carolina State University (NCSU) and a Ph.D. from NCSU with a dissertation focused on marine biology and estuarine grass shrimp. Most of his doctoral courses were taken at the Duke University Marine Laboratory, but shortly afterwards he migrated upstream to freshwater studies. After serving as a Dean of Science, Chair of Biology, and Field Station Director at various universities, he returned in 2001 to his undergraduate *alma mater* (University of Kansas) as a tenured Professor and Senior Scientist. He has conducted freshwater research in fields ranging from physiological, behavioral, and community ecology, all the way up (spatially) to macrosystem ecology in multiple US states and even continents. Although he has published studies of fish and amphibians, his focal creatures have often been invertebrates. In fact, he has more than a dozen books authored or edited on freshwater invertebrates from around the world. James and his wife Margaret live in an 1860s stone house in Lawrence, Kansas.

Acknowledgment

This book would have suffered significantly without the help of my colleague Christopher F. Frazier, an aquatic ecologist and photographer who was born in southwestern Michigan. He provided some original photographs and tracked down other free ones for our use from the web. Christopher was first enamored by freshwater animals after being introduced to Great Lakes zooplankton communities while earning his B.S. at Central Michigan University. His work then led him to earn his M.S. at Western Michigan University studying aquatic insect communities in Lake Michigan's coastal wetlands. Since finishing his graduate education, he has been involved in research projects spanning Michigan wetlands, Texas coastal streams, and ephemeral wetlands across the North American Great Plains region through the University of Kansas. All those studies have been primarily focused on aquatic invertebrates. While sharing the mysteries of the natural world via research has been great, he found in 2019 that high-quality images typically evoke much more emotion from the public than graphs typically do and has since been an avid photographer to spread his love of wildlife. Naturally, his favorite subjects are those that live in the water: aquatic invertebrates, waterfowl, wading birds, and aquatic and semi-aquatic mammals, but he also rarely declines a chance to take a few photos of charismatic terrestrial animals!

About This Book

Most of us encounter rivers, lakes, or wetlands on a regular basis even if from a distance, but very few of us know more than a few facts about the organisms that inhabit them and what ecological factors control their lives. One purpose of this book, therefore, is to begin to rectify that information deficit for a broad range of the general public from teenagers to retirees. Another goal is to inform the public about aquatic systems in the hope that this will eventually produce an electorate better able to judge issues on the ballot or in community meetings that might impact these ecosystems. Although my normal audience over the decades as a professor and aquatic ecologist has been undergraduates, graduate students, and fellow scientists, I have tried to write this book using terms more familiar to the general public and in a manner that reveals many of the exciting aspects of freshwater ecology. Most chapters include information from around the world, though the majority is naturally drawn from ecosystems and scientists in the northern hemisphere where I have more field experience. Because the audience for this book is likely to be international, I have employed both metric units (e.g., kilograms and meters) and imperial units (e.g., pounds and feet).

This book is organized into ten chapters, with six on organisms and four on the aquatic systems where they live, such as lakes, rivers, caverns, and bogs. I have tried—with only partial success—to avoid repeating the same information in multiple chapters, but this is a very challenging task when it comes to aquatic organisms that live in multiple habitats and have diverse attributes worthy of discussion from multiple perspectives. Chapter 1 focuses on aquatic mammals, primarily otters. Fairy shrimp and a large diversity of freshwater invertebrates are described in Chap. 2. Aspects of the lives and times of fish are discussed in Chap. 3, though this topic is also covered in other ways in Chaps. 4 and 6. Behemoths of the freshwater world—from hippos to giant snakes—are the subject of Chap. 4. The theme of Chap. 5 is aquatic architects with coverage of some organisms that you would expect—like beavers—but also with some unexpected topics like the nature of "houses" made by caddisfly insects. Most of Chap. 6 is focused on freshwater species that are usually considered denizens of the ocean, including sharks, rays, dolphins, seals, and manatees. From that major six-part section of the book, the focus

then shifts to a four-part analysis of the physicochemical and ecological attributes of aquatic habitats including lakes (Chap. 7), rivers (Chap. 8), underground aquatic systems (Chap. 9), and wetlands (Chap. 10). Having a better understanding of the nature of these ecosystems should provide readers with critical information on the ecological advantages and disadvantages for the existing and potential residents of those systems.

Contents

Chapter 1
Otterly Wonderful

Or should that be "utterly" wonderful? Well, the answer will depend somewhat on your perspective because each of us examines life through a different lens. Many readers will focus on the unique attributes of this very intelligent and playful mammal, but others may be annoyed by the havoc river otters can sometimes cause whether interacting with city dwellers—as in Singapore—or competing with anglers on a fishing trip, but more on those aspects later, and let's start with some basic scientific observations.

Will the Real Otter Please Step Forth?

Sorry, "no can do" … because our globe supports 13 species of otters on 6 continents, all of which are members of the scientific family Mustelidae. That large taxonomic family of mammals in the order Carnivora also contains many other less publicized species, such as badgers, ferrets, martens, minks, weasels, and the large and dangerous wolverines. Because of its close contact with residents in coastal cities of the northern and eastern North Pacific Ocean and its star coverage on many television documentaries, the marine sea otter (scientific name = *Enhydra lutris*) has garnered the most attention from the general public. In contrast, the more petite, semiaquatic river otter (*Lontra canadensis*) of North America (Fig. 1.1) is more widespread geographically but tips the scale at only 11–31 lb (0.5–14 kg). While the North American river otter is still impressive in size when viewed in the wild, its largest relative is the giant river otter (*Pteronura brasiliensis*) of South America, which weighs 49–57 lb (22–26 kg). Because of this book's nature, of course, the river otter is an important focus of this chapter. Other otter species are well-known to the public in some countries, including urban populations of two species of otters in the city nation of Singapore: the smooth-coated otter and the Asian small-clawed otter, as discussed later in this chapter. Many urban otters are undergoing important

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Fig. 1.1 Close-up view of the river otter *Lontra canadensis* shown eating a fish at Baker Wetlands near Lawrence, Kansas, USA. (Photograph courtesy of Christopher F. Frazier)

behavioral modifications while adjusting to humans and the opportunities and constraints associated with living in close proximity to us and our pets. Before investigating urban populations with their human-otter interactions, let's learn more about the North American river otters in the wild.

Where or Where Can My Otter Be?

To avoid confusing some of my readers at the start of this chapter, I should explain two facts. First, the term "river" otter is a misnomer because they are not confined to rivers! Indeed, these mammals inhabit freshwater streams, ponds, and wetlands from the mountains to the sea. Moreover, in rare occasions, they can be observed in the upper regions of estuarine habitats along marine coasts. However, don't waste much of your time searching for them there and certainly not in the kelp beds of the US West Coast where their marine otter relatives frolic and dominate the scene. Second, the original range of river otters included much of North America where natural, relatively permanent aquatic systems existed. In modern times, however,

Fig. 1.2 Side view of *Lontra canadensis*. (Photograph courtesy of Flickr contributor Thomas Koerner at the US Fish and Wildlife Service)

urbanization, pollution, and hunting have constricted their range mostly to rural Canada and the USA. The latter includes coastal areas, a few midwestern states, and mountainous regions where human disturbance is minimal and water is plentiful. They have almost disappeared from much of the Great Plains states except where otter families (or "romps") have been reintroduced. However, they are occasionally spotted in the Kansas River and in the wetlands on the southern edge of Lawrence, KS (my hometown) (Fig. 1.2). In some rare cases, these reintroductions to central and western states have been so successful that trapping seasons have been re-implemented—much to the dismay of most nature lovers who are shocked that we continue killing any animal species for its pelt.

Otters are rarely spotted by humans even though they occupy many aquatic habitats because they are mostly nocturnal or at least crepuscular. They spend much of their time—especially during daylight hours—within their terrestrial homes, which are typically located where sufficient cover exists from trees, other abundant vegetation, and/or large rocks to provide some protection when they are foraging. Less desirable to the average otter is being forced to build a lodge under a fallen tree or other debris where exposure to predators is greater. Their burrows are lined with grass, leaves, moss, and other forms of dead vegetation that are suitable for padding and warmth. Their homes are always located close to a relatively permanent water body and may consist of a new dwelling or a burrow previously occupied by another mammal species, such as a beaver, fox, muskrat, or woodchuck. The otter is wise enough to have, if at all possible, at least two openings to its den (or "holt"), one of

which preferably opens underwater. Daylight activity tends to increase somewhat in winter months when temperatures are at least minimally adequate and potential predators are less active in general.

Menu Preferences and Food Acquisition

Otters have a rather eclectic diet focused entirely on live animals—with menu selections based on their personal inclination for what looks tasty that day and the prey's relative availability and difficulty of capture. Fish and crayfish often top the list of preferred consumables (Fig. 1.3), but the relative proportion of their diet varies with the season of the year and the local availability of items that can realistically be captured. The cuisine is also known to periodically include clams and snails, aquatic insects, frogs and salamanders, small rodents, turtles, and wading or molting birds that are temporarily incapable of aerial escape. Even a small dog might be attacked and eaten if it strays into the water and is drowned by the otter! Small prey can be eaten while the otter floats in the water, but larger prey are usually first taken to shore. It is not unusual to see two or more otters cooperating to capture larger prey.

To acquire aquatic food, otters must obviously be adept at swimming and locating prey (Fig. 1.4). Fortunately, their relatively long tails (nearly 40% of their body length) and powerful hind feet are ideal attributes for this activity. Indeed, they are remarkably fast swimmers at nearly 7 mph/ll kph and moderately deep divers (66 ft/20 m), with the capacity to stay underwater for up to 4 min. The underwater time must obviously include time to locate and capture the victim and then return to the surface. In comparison with the otter's underwater velocity, the fastest human

Fig. 1.3 Young river otter eating a fish. (Photograph courtesy of Flickr contributor "marneejill")

Fig. 1.4 Swimming otter from Baker Wetlands. (Photograph courtesy of Christopher F. Frazier)

swimmer has reached 6 mph/1.6 kmh in Olympic competition. Acquiring and retaining prey are aided by the notable tactile sensitivity of their facial whiskers and the agility of their paws to grab and hold the prey. The otter's well-refined senses of hearing and smell greatly enhance prey detection and locating potential predators in both day and night. Their visual attributes have evolved in ways that have allowed them to acquire aquatic prey, including possessing relatively transparent, nictitating membranes to protect their eyes underwater. When submerged, otters close their nostrils and ears but keep their eyes open. Their evolved visual aptitude for underwater hunting comes at a cost, however, as that visual acuity is accordingly reduced when the otter peers above the water or is on land. Their noted near-sightedness when above water may be responsible for periodic observations that otters will approach fairly close to a boat occupied by humans before retreating to safe environs upon realizing their potentially dangerous error.

Rapid and moderately long swimming events are possible because otters have evolved the requisite body structures and senses, including the eyes that are perched high on their head (Fig. 1.5). Their slim head and tapered, streamlined body lower underwater drag and reduce energy expenditures, thereby allowing increased swimming speed. Their swimming power is also enhanced by short legs, webbed feet, and a long powerful tail. Also contributing to their aquatic abilities is their dense undercoating of hairs which traps air for insulation and which is itself overlain by a layer of long water-resistant hairs. This body structure makes them ideal freshwater mammals (though slower than freshwater dolphins), but it is less desirable for terrestrial locomotion. Nonetheless, a river otter can run on land at speeds up to

Fig. 1.5 Close-up view of the head of an otter. (Photograph courtesy of Flickr contributor from the Maritime Aquarium at Norwalk)

15 mph/24 kph—though only for short distances. By comparison, the fastest human has been clocked at almost 28 mph/45 kph—also for very brief periods.

Social Structure and Interactions

When not hunting or playing, an individual or pair of otters and their pups, if present, typically occupy a burrow, which is also known as nests, dens, holts, or couches. They frequent their dens during daylight hours when they would otherwise be more exposed to predators. Ideally this burrow has a primary underwater entrance to maximize protection for the adults and young when entering or leaving their lodgings. The burrow resides in a home range of highly variable size depending on the otter's gender, nature of the environment, presence of other otters, a female's reproductive stage, and frequency of human interactions. Home ranges typically range from 3 to 15 sq. mi (7.8–39 sq. km) and are as large as 30 sq. mi/78 sq. km, with smaller ranges being more common. Home ranges of males tend to be larger than those of females.

Otters become reproductively active at an age of 2–3 years. They most often mate in the water in late winter or early spring, with a gestation period typically lasting 9.5–12.5 months. Pregnant females commonly stay alone in their burrows until the young are born. A litter most often contains one to three "pups or kittens" (Fig. 1.6), but rarely up to six have been noted. Baby otters are born blind and are highly dependent on their mothers for the first 2 months before they can leave the burrow temporarily to roam the adjacent pond or stream. They may depart for an independent existence after 6 months or stay with their mother for up to a year. A typical adult will survive up to 9 years in the wild, but individuals have lived twice as long or even slightly more in zoos.

Otters are a social species even though they may nest individually. Indeed they are usually considered the most social animals within their taxonomic family, which as stated earlier includes badgers, ferrets, martens, minks, weasels, and wolverines.