

The soft-shell clam *Mya arenaria*: Biology, fisheries, and mariculture

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With the publication of *The soft-shell clam Mya arenaria: Biology, fisheries, and mariculture*, Victor Kennedy and Brian Beal have beautifully edited the definitive source of information on this delectable and ungainly clam. As an indicator of how the 16 separately authored chapters have been melded into a whole, consider simply the name of this clam, which is called “soft-shell” throughout, despite nearly a hundred common names to choose among. Chapters cover systematics, anatomy, reproduction, physiology, synecological controlling factors, population genetics, population dynamics, 54 predator taxa, diseases, and harmful algae. Chapter 11 sets these ecological factors in context of an acidifying and warming ocean. Synthetic chapters at the end are deeply rooted in historical documents, including a wealth of direct quotes from sources over many hundreds of years, and explore global invasions, fisheries, fisheries management, mariculture prospects, and *M. arenaria*'s numerous common names. If there's something you want to look up about soft-shell clams, you'll surely find it here.

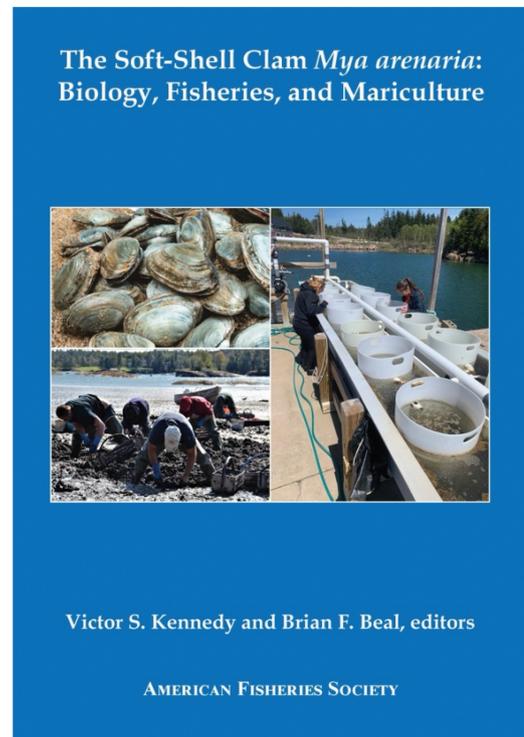
But really, these clams are a tiny fishery in a restricted region around the Gulf of Maine. So, what's in the book for those who don't have anything they want to look up about soft-shell clams? I came away from reading the chapters with a renewed sense of wonder about the relationship between people and coastal resources. Soft-shell clams epitomize many of our current ocean challenges, and what a reader can glean about the intersections of overexploitation, thermal challenges, pollution, disease, and nonnative predators is by no means restricted to the book's focal animal.

Soft-shell clams are both nonnative in parts of their range (chapter 12) and affected by nonnatives in others. As they expanded along western North America in the late 1800s after their unintentional introduction with eastern oysters *Crassostrea virginica*, they were briefly considered a huge boon to food security. But their hockey stick increase was followed by a precipitous drop as the system adjusted to the newcomer. Of course, lost to history are the dynamics after

their 13th century introduction from eastern North America to Europe by Vikings.

Given that the clams are widespread latitudinally, many of the chapters address the geographic pattern of the focal topic, clearly reviewed in tables of site-specific data for reproductive phenology and age at maturity (chapter 3), density with and without predator protection (chapter 6), and demographic values in life tables (chapter 7). Chapter 10 summarizes the compelling geographic case for adaptive evolution of resistance to an algal toxin, while clarifying that resistant clams generate a greater risk of accumulating the neurotoxin that also harms humans.

As a stage for contentious scientific issues, chapter 7 tackles terminology related to recruitment, chapter 5 defines correlated aspects of seston quality, chapter 4 provides a



framework for how to link population genetics to a species' distributional history, and chapter 1 outlines several phylogenetic hypotheses of how molluscs in general and *M. arenaria*, in particular, fit into the tree of life. For the evidence of everything that might eat a clam, see chapter 8, and for a clear categorization of pathogens and parasites, see chapter 9, which also makes sense of neoplasias, the transmissible cancers now known from 32 bivalve species.

Throughout are beautiful micrographs, including pathogens, gonad tissue, and larvae as small as 0.1 mm. Several chapters have reprinted historic photographs showing methods for collecting and processing clams, and also how these clams were woven into the social and economic fabric of the 19th and 20th century northeastern USA.

As should be evident by now, the book is thorough, filling nearly 600 pages. Along with its extensive detail, there are gems of natural and cultural history. I don't want to give them all away, but it's too good to leave out two reasons that likely contributed to overexploitation—the New England clam bake, at least one of which attracted 10,000 people to the beach; and the highway restaurant Howard Johnson's all-you-can-eat fried clams, which were initiated with soft-shells.

The dedication in chapter 10 celebrates a 20th century biologist, Betty Twarog, who contributed to the discovery of the neurotransmitter serotonin and to the action of paralytic shellfish toxins from harmful algae (*Alexandrium*), which block voltage-gated sodium channels in electrically excitable cells. And then there are the Algonquin variant names for the soft-shell clam, derived from mananosay (“the creature that digs”) and sickissuog (“he spits, squirts water”).

Today's soft-shell populations are sparse and harvests generally a small fraction of their documented peaks in the mid-1900s, and even these records likely pale in comparison to clam beds of hundreds of years ago, when people were already complaining of declines. But the book provides a blueprint for hope. Some of this derives from the wealth of biological data that can inform mariculture practices, along with careful control of steps in the lifecycle (chapter 15), while positive outcomes could also emerge from the co-management and ecosystem-based management frameworks described in chapter 14. Our relationship with this species has been a complex one. The stories in the book never overlook that complexity but clarify how we have learned about its traits and role and where we might go from here.