

## Unraveling the hidden lives of warm-water fish communities

Reviewing: William J. Matthews and Edie Marsh-Matthews, *Stream Fish Community Dynamics: A Critical Synthesis*, 2017 Johns Hopkins University Press, 330 pp

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Community dynamics are often difficult relationships to describe because they encompass multiple taxa involved in numerous types of interactions of varying strengths, all of which may shift over space and time. Gaining insights from a suite of several long-term projects is difficult logistically and can be difficult to sustain. However, in their book *Stream Fish Community Dynamics: A Critical Synthesis*, Matthews and Marsh-Matthews offer a deeper understanding of warm-water fish community dynamics from a commitment to their research over their shared lifetimes.

Partners in productivity, Matthews and Marsh-Matthews have written about much more than warm-water stream fish communities; rather, they capture their own major scientific advancements, incorporating new and old concepts while highlighting insights and details from their separate and combined discoveries over the past 40 to 50 years. The book reads as a collection of scientific work focused around warm-water stream fish communities, with understandings that can only be gained by sampling the same systems over a lifetime and insights that are not found elsewhere. For example, they find that in most of their study systems there has been little change in qualitative composition of fishes,

few changes in more abundant species, and a tendency for loose equilibrium in community structure at a local and global scale and from months to decades (p. 214). Data sets used in the book are publically available, so that they can be used in classes and for further analyses.

Each of the ten chapters has a stand-alone topic rich with new insights from their work, placed in the context of key papers in the field, suggestions for methods, and heaps of details from their experience. The introduction familiarizes the audience with stream fish communities and addresses advantages and challenges of seining for assessing fish communities. Chapters 1 and 2 provide a sense of place by describing the authors' study systems in Oklahoma and Arkansas, with sampling generally using small-meshed seines to capture and subsequently identify fishes. Chapter 3 taxonomically characterizes the stream fish communities focusing on 18 fish families with implications often for the families and not at the species level. Some environmental traits led to emergent communities structure and dynamics, including intermittency, upland–lowland, and land use as well as stream width, depth, gradient, and temperature. Chapters 4 and 5 tease out mechanisms underlying stream fishes. For example, an increase in sunfish, a mesopredator, have the potential to reduce minnows from streams. Chapters 6, 7, and 8 address how and why communities change through space and time. For instance, during low flow conditions when stream temperatures are elevated Leopard Darters *Percina patherina* can be found at the bottom of deep pools (4–5 m deep) accessing thermal refugia microhabitats. Chapter 9 shows how community dynamics can emerge to affect ecosystems. The last chapter attempts to

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synthesize a lifetime of their collected work and emphasizes the importance of scale of analysis, environmental conditions, community trajectories, and context for stream fish communities. An overarching conclusion for their work is that their results are strongly context-dependent, related to factors such as floods, droughts, temperature, and the spatial and temporal variation in fish densities. They find that “a given species can have quite differing effects under different conditions, and finding simple generalities [for fish communities]...may be elusive” (p. 288).

They are able to place the effects of droughts and floods on fish communities into a broader context using several data sets from multiple study systems over time, as well as many anecdotal accounts. For example, they write, “Droughts may have longer-lasting consequences than floods in the dynamics of fish communities” (p. 178), which is an insight that can only be supported by multiple lines of anecdotal, quantitative, and experimental evidence.

They find that some environmental factors support fish community ecology, and others are scale dependent, leading to different conclusions in local (site-specific) versus global communities (sum of fish across multiple sampling sites in each watershed). For example, higher elevation and higher stream gradient were linked to more variability for their global communities than for local communities (p. 71–72). Although it is usually easy to determine which data sets support their conclusions, sometimes, as in this example, is not as clear.

As we begin to generate ideas for our own stream work in western North America, we often refer to their book. We find that it helps us rethink hypotheses about our stream fishes and their relationships to each other and to their habitat, and add context to questions related to climate change. At the end of our careers, we can only hope that our cumulative scientific work will be significant enough to be published as a book like this one.