A MIGRATORY SHRIMP’S PERSPECTIVE ON HABITAT
FRAGMENTATION IN THE NEO TROPICS: EXTENDING OUR
KNOWLEDGE FROM PUERTO RICO

BY

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ABSTRACT

Migratory freshwater fauna depend on longitudinal connectivity of rivers throughout their
life cycles. Amphidromous shrimps spend their adult life in freshwater but their larvae develop
into juveniles in salt water. River fragmentation resulting from pollution, land use change,
damming and water withdrawals can impede dispersal and colonization of larval shrimps.
Here we review current knowledge of river fragmentation effects on freshwater amphidromous
shrimp in the Neotropics, with a focus on Puerto Rico and Costa Rica. In Puerto Rico, many
studies have contributed to our knowledge of the natural history and ecological role of migratory
neotropical shrimps, whereas in Costa Rica, studies of freshwater migratory shrimp have just
begun. Here we examine research findings from Puerto Rico and the applicability of those
findings to continental Costa Rica. Puerto Rico has a relatively large number of existing dams
and water withdrawals, which have heavily fragmented rivers. The effects of fragmentation
on migratory shrimps’ distribution have been documented on the landscape-scale in Puerto
Rico. Over the last decade, dams for hydropower production have been constructed on rivers
throughout Costa Rica. In both countries, large dams restrict shrimps from riverine habitat
in central highland regions; in Puerto Rico 27% of stream kilometers are upstream of large
dams while in Costa Rica 10% of stream kilometers are upstream of dams. Research about
amphidromy specific to non-island shrimps is increasingly important in light of decreasing
hydrologic connectivity.

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Migratory shrimps are an important component of the aquatic fauna in many regions of the new and old world tropics (Pringle et al., 1993; Crowl et al., 2001). Many migratory shrimp are amphidromous, living primarily in freshwater but dependent on saltwater for parts of their life cycle (Chace & Hobbs, 1969). Adult shrimp spawn in freshwaters, and then larval shrimp passively drift from upstream freshwater reaches to salt water where they develop into juveniles. They then migrate back upstream, where they spend the majority of their lifetime. Migratory shrimps play an important part in stream food webs and ecosystem function, particularly as organic matter processors (i.e., leaf “shredders” and algal consumers). In addition, they are conduits for movement of energy and matter between marine and freshwater systems.

Freshwater migratory shrimps can be negatively affected by river fragmentation, which occurs when rivers lose hydrological connectivity where dams, water withdrawals or water pollution create un-passable stream reaches for downstream drift of shrimp larvae or upstream juvenile migration (Holmquist et al., 1998; Pringle & Scatena, 1999b). Research on effects of fragmentation on migratory stream biota has been heavily concentrated in temperate regions and overwhelmingly biased towards fishes (Pringle et al., 2000; March et al., 2003). Nevertheless, tropical rivers are becoming increasingly fragmented, with losses in connectivity threatening the long-term persistence of migratory shrimps (Greathouse et al., 2006a). The relatively little knowledge of general shrimp ecology and limited information on the effects of river fragmentation in the tropics makes predicting shrimp response to river fragmentation more challenging. The exception to this case is Puerto Rico, where decades of research has examined the ecology of freshwater migratory shrimps and documented the impacts of fragmentation on their distribution and abundance (fig. 1; Pringle et al., 1993; Holmquist et al., 1998; Crowl et al., 2001).

We suggest that lessons from Puerto Rico may provide insights for other Neotropical regions inhabited by migratory shrimps that are under similar increasing pressure for river development. Here, we review what is known about the ecology and migratory behavior of shrimps in Puerto Rico and summarize effects of river fragmentation. We then use Costa Rica as a case study to test the broad applicability of this knowledge to other tropical countries.