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Lestes Survival at High Temperature and Low Water

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During the 2008 odonate season we observed a large number of *Libellula luctuosa* emerging from a very small pond on our property. It was a bit of a surprise and we took no notes or counts or measurements but vowed to enter the 2009 season considerably more prepared. As it turned out the large *Libellula* emergence phenomenon did not repeat itself, but was replaced by a remarkable effort by a number of *Lestes* larvae that survived some very inhospitable conditions.

The pond is simply a small flat depression created to catch the overflow from a series of other wildlife ponds. It rarely reaches capacity, only in times of great snowmelt and for a very short time thereafter. Most of the time it is a foot or less deep, only 9 X 30 meters or less in area and bears little vegetation. Nonetheless it seems attractive to a number of patrolling and ovipositing dragonflies and damselflies, most likely themselves overflowing from the other neighboring ponds.

Before winter ice set in we measured the depth of this little pond at 9 inches. It froze completely during a very cold winter, then fared poorly due to no snowmelt or spring rains. We were dismayed at the amount of water that was left in the spring.

On 1 May 2009 the depth was a mere 4.75 inches with the area only 6 X 25 meters with only one tiny clump of vegetation. Two dips into the bottom mud with a small aquarium net produced 1 libellulid larva.

May was a dry month with little rain, so by 21 May the water level had dropped to 3.5 inches. The area was down to 5 X 25 meters with only a clump or two of emergent vegetation. Two *Gomphus spicatus* emerged and there were hundreds of tiny toad tadpoles. A few painted turtles had scoped the area, evident by their tracks in the mud, but did not remain.

By early June the weather turned very warm and the water began to evaporate and shrink rapidly. Now the water was only 2.5 inches. Some tiny clumps of *Chara* and *Eleocaris* sp. provided little cover or food but the water remained clear. We assume the tadpoles kept the algae from blooming.

On 5 June a few *Lestes* emerged on one of the short *Eleocaris*. Others were visible in the clear shallow water, milling around the clumps of *Chara* and *Eleocaris*. There were larvae queuing up at the rare emergence sites, jostling for position, so extra support was provided (by human hand) in the form of last years Goldenrod stems placed in the mud near the margin. This was well received, and by 8 June a total of 22 exuviae were collected. The heat continued.

On June 9 the water was only 1.5 inches, with an area of just 23 X 4.5 meters. Air temperature was stifling. Water temperature on this day was measured at 92 degrees. 9 *Lestes* emerged.

We thought the remaining larvae would surely perish, however they continued to emerge for the next 7 days. Slightly cooler weather and a few sprinkles prevented the water level from falling any more than on that day. The final total was 76 *Lestes* of three species (*rectangularis* [64], *unguiculatus* [11] and congener [1]). The majority emerged AFTER the hottest day, and no dead larvae were ever observed.

Odonate larvae may seem well equipped to survive high temperatures but most studies have been conducted with Anisoptera, many of which burrow and aestivate or seek shelter within vegetation or debris. These more delicate Zygopteran larvae had no such means or refugia and were subjected to baking conditions for several days running yet prevailed for another week.

As an aside, 1 Libellulid did indeed survive and emerge, and all the toad tadpoles completed their development into tiny toadlets crowding the waters edge.