Lake Lily Revisited

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by

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In 1994, members of the Delaware County Aquarium Society (DCAS) conducted a collection of fishes from Lake Lily in Cape May Point, New Jersey. Residents of that town became alarmed at the gradual decline of the lake's appearance. Elders recalled a freshwater oasis bejeweled with water lilies, flush with sunnies, bass and carp, and serving birds on an ancient migratory route along the Atlantic coast. Now it is a tepid alkaline pool choked with algae. What we at the DCAS were asked to provide was a survey of the fish life in the pond to aid the township in their plans for remediation.

In 1995, we returned to Lake Lily to see if anything had changed. Our first impression was identical to that of 1994, save for the water level that was markedly lower as a consequence of 1995's drought. However, upon closer examination, it could be seen that the algal mats that pervaded the pond previously had been supplanted by a plague of an aquatic weed (*Potomogeton* sp.?). Whenever algae relinquishes its hold to a higher plant, it can be taken as a positive sign, but the grass that took over Lake Lily seems to have the same drawbacks as the algae it replaced. As this grass dies and is decayed by bacteria, it will consume oxygen in the process and nutrify the lake with the products of that decay. This threatens to happen in a pond that is low in oxygen and is fighting to keep ahead of the unrelenting addition of bird droppings
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from the resident geese, ducks and swans. Realizing the negative impact of these tame birds and the local practice of feeding them, the township has posted signs warning against it. Old habits die hard, however, and the battle promises to be a long one.

The thick growth of grass rooted in the sand and floating on the surface hampered our seining operations. Alternatively, we found dip netting to be a more practical and productive method in this circumstance. Aided by the use of a flat-bottomed boat, a tool that was unavailable in 1994, we sampled areas throughout Lake Lily. The most frequently caught fish were sheepshead minnows (*Cyprinodon variegatus*). Attractive and hardy, these pupfish are well-suited to an aquarium environment. The vast majority of sheepsheads we caught were juveniles, but many were already showing sexual characteristics. Such stunting can be attributed to the usual stressors of overcrowding, poor water quality, or poor diet.

Male sheepsheads were rare among the fish old enough to be sexed. Only a single fish showed the golden yellow belly and electric blue shoulder patch that dresses up these otherwise drab killies. Only about a half dozen other small males could be sorted out of the hundreds of females identified by small spots on the posterior dorsal rays. Sheepsheads can approach three inches in length, and we found only two that were over one inch. Thousands of fish were half that size.

Legendary in their tenacity to cling to life in waters where few other fishes can find purchase, sheepsheads are tolerant of every insult that a coastal tidal environment can muster. They live in everything from pure freshwater to the saltiest brine, and from freezing seas to hot shrinking puddles. That the humble *variegatus* killie should be king of this pond is a testament to the survival dividends paid by its resilience. It is also a clear reminder that the freshwater lake has not only an historical link to the Atlantic Ocean, but an ongoing relationship with the sea that still knocks at the door.

Another tough fish found in good numbers was the aggressive mosquitofish, *Gambusia affinis*. Evidently introduced—unwisely—to control mosquitoes, a stable population continues, giving the struggling native fishes something more to worry about. But not even the *Gambusia* seemed to be faring well. Again, males were in short supply, and the females were smaller, leaner and less gravid than the year before.

Rainwater killies (*Lucania parva*) proved to be a pleasant surprise. In 1994 only a few specimens were caught, but the numbers were up in 1995 with males in the lead. Like the sheepshead, rainwater killies are small, attractive fish perfect for the native aquarium. They are a sleeker, more elegantly shaped fish, lacking the typically robust pupfish profile of the sheepshead. Coloration, though not spectacular, is appealing. Males possess a yellowish cast over an olive-brown background. Their scales are accentuated with dark borders resulting in a striking fishnet pattern over the body. The pelvic fins are yellow to orange, and the anal fin can have a nice mother-of-pearl blue sheen that glistens with strong light. A distinctive spot on the anterior dorsal clinches the identification. Unfortunately, most of the more subtle hues disappeared quickly when the fish were transported home. For all their hardiness in the wild, they stress quickly and travel poorly. With only a modicum of consideration, however, they will do fine. We kept them dark and cool, aerated them with battery-operated field pumps, and did not crowd them.

Strangely, we caught no mummichogs (*Fundulus heteroclitus*) as we did in 1994. These fish are the ubiquitous "bait killies" found in bays and estuaries. They are as hardy as the fishes discussed above, and even more tolerant of low oxygen situations than the rainwater killies. Lake Lily has been found to be oxygen poor, and one might be led to think that the mummichogs would have an advantage in this regard. Silversides (*Medidia beryllina*) were another casualty. Plentiful in this lake in 1994, they were conspicuously rare. Silversides are freshwater-tolerant marine fish that have a propensity for dying quickly in nets and buckets. The poorly oxygenated waters of Lake Lily would explain their decline, but why are mummichogs absent?

We did catch a close relative of the mumichog. Striped killies (*Fundulus majalis*) were well represented in 1994 and have the same requirements of habitat as do the mummichogs. We caught only two in 1995 in a stationary bait trap, and they were of a

different sort than we are accustomed to finding. In fact, they so closely resembled *F. heteroclitus* that it led to theories of hybridization. For whatever reason, the striking striped patterns were gone, although the elongated *majalis* snout remained. Coloration was a uniform olive-green with faint vertical bars, not unlike a mature *heteroclitus* female. However, the literature on these fishes suggest a close kinship, and *majalis* sub-populations are known to vary quite a bit. The bar pattern is best descriptive of *majalis* females. *Majalis* females develop the characteristic horizontal stripes. None of these were found.

Most of the collecting we did was at the south end of the lake where the road and beaches make it easy. Two members of our group, Peter Rollo and Bob Kolimaga, took the boat to the north end where the freshwater spring feeding the lake is thought to exist. It was there that a three-spine stickleback (*Gasterosteus aculeatus*) was caught. Sticklebacks are a favorite fish of nature films that revel in their elaborate nest building and ritual courtship behaviors. They are a marine fish that ascends into freshwater in summer to breed. Although not out of place in these parts, it was an unusual catch at Cape May Point.

This trip found us again puzzling over the plight of Lake Lily. Since 1994 there have been no storms of sufficient strength to inundate the lake with saltwater. The fishes that were there the year before would have had no means of escape. In a pond shrinking from drought and heat that cooks essential dissolved oxygen to ever lower levels, the fishes are being squeezed. The spring that is suspected of feeding the lake—if indeed there is one—is not keeping pace. The lake is now virtually a closed system in a no man's land between fresh and salt waters. Impurities are not being flushed out by the changing tides or by freshwater feeds. It is no wonder that only the smallest fishes are surviving, i.e., those with scant needs for oxygen. Were it not for the low oxygen, Lake Lily would be a predator's paradise.

Despite this, our tests showed no measurable phosphate, nitrate, nitrite or ammonia pollution. This indicates a natural balance between the lake's fauna and flora, and the ability of the lake to recycle the waste it produces. (It should be noted that with fewer birds there would be need for fewer plants to process the waste.) While pH increased in alkalinity from a high of 9.0 last year to a near-caustic 10.0, total hardness decreased from 33 dGH last year to 18 dGH this year. Carbonate hardness likewise decreased from a high of 8 dKH in 1994 to only 5 dKH in 1995. Although these values are quite ordinary, the pH has got to be close to hurting!

The township has undertaken some remedial work on the lake, shoring up the island and installing a bulkhead along the south side. The reason for doing this was to forestall the effects of storm erosion, a most legitimate concern. However, in 1995 the twist went in the opposite direction. With the drought, whatever creosote leached from the bulkhead timbers would have concentrated in the lake, and that could be disastrous to the fish and wildlife.

From the earliest recorded times, Lake Lily has been a "sweetwater" pond whose occasional clashes with the mighty Atlantic have left it uniquely inhabited. How such a body of water so close to the sea could be filled with freshwater leads to the assumption that it must be fed by fresh springs. But what was the flow rate of this freshwater into the Lake when it was jumping with sunnies and bass, and filled with the flowers of its namesake lilies? Has society's demand on that underground aquifer reduced that flow? Has this drought dried it up completely? Will it ever be returned to its "natural" state?

As aquarists, we deal with these issues on a micro scale. We manage our tiny aquariums and garden ponds using filtration, aeration, and water changes to mimic what Nature does on a grand scale all around us. Perhaps the time has come to view Lake Lily in much the same way. When our aquariums choke up with weeds, we clean them out lest the plants rot and foul the water. When the bioload increases we either compensate with more filtration or increased water turnover. We can thin out the bioload, flush out the waste, or process it with the help of some remarkable advances in technology. Can an entire lake be viewed with the same simple attitude?

Can it afford not to be?