

## 5. Biology of the Lower Olentangy River Watershed

The Olentangy River watershed is part of the **Teays-Old Ohio Freshwater Ecoregion** (Abell, Olson, Dinerstein, *et al.*, 2000). This freshwater ecoregion is considered to be globally outstanding because of the sheer numbers of aquatic species found within it: 206 native fish species, 122 unionid mussel species, 49 species of crayfish, and 60 native species of amphibians and aquatic reptiles. The great diversity of the biotas in rivers and streams in this region is the result of the diversity of upland and lowland habitats and the presence of both glaciated and unglaciated stream systems. Twelve percent of the fish, 14% of the mussels, 47% of crayfish, and 5% of the reptiles and amphibians are restricted to this ecoregion and found nowhere else.

In pre-settlement times (prior to the 19<sup>th</sup> Century), the landscape across this ecoregion was heavily forested. However, much of the area has been extensively logged, often repeatedly, since the arrival of Europeans. Row-crop agriculture is the predominant land use across the region with well over 50% of the land cover altered from its original post-glacial nature. Streams throughout the area have also been significantly altered and currently face the entire litany of threats faced by stream systems in the 21<sup>st</sup> Century. These include impoundments, point source and non-point source pollution, excessive sedimentation, nutrient enrichment, hydromodification of the original stream channel and the associated flood plain, habitat loss, and urbanization.

### Aquatic Biotas in the Lower Olentangy Sub-basin

Ohio EPA's Division of Surface Water and ODNR's Division of Natural Areas and Preserves Scenic River program both regularly use aquatic biotas as indicators of water quality in Ohio streams. The focus for both agencies has been on the abundance and diversity of **pollution-intolerant species** relative to the abundance of pollution-tolerant species. Pollution-intolerant species are specialized forms that have a narrow range of tolerance for a specific suite of environmental parameters, including dissolved oxygen, temperature, water clarity, salinity, substrate conditions, stream depth and velocity, nutrient levels, food resources, and the presence/absence of chemical contaminants in water or sediment. These species typically cannot live in stream environments impacted by excessive nutrients, sedimentation, or the influx of pollutants.

These "**sentinel**" species and their presence and abundance in a stream serve as an indication of good to excellent water quality conditions. Their scarcity or absence suggests the presence of negative factors – pollutants and/or physical or chemical changes to stream habitats that have adversely impacted populations of these species in the stream. Pollution-intolerant species typically have specific habitat requirements. In Ohio rivers and streams, these species are primarily riffle-dwelling species- species that require shallow, high velocity, highly oxygenated, clear water conditions over silt-free, hard substrates – features characteristic of good riffle habitat. Good quality, naturally flowing rivers and streams typically have an abundance of such riffle zone habitat and support diverse and abundant populations of pollution-intolerant aquatic species.

Ohio EPA's use of biological indicators to assess water quality utilizes a combination of measurements of the abundance and diversity of pollution-intolerant fish and **benthic macro-invertebrates** in rivers and streams. Benthic macro-invertebrates are bottom-dwelling animals that lack backbones and which are visible with the naked eye. They include animals like crayfish, mussels, snails, worms, and a variety of aquatic insect larvae. ODNR's Scenic Rivers volunteer monitoring program focuses on riffle-dwelling benthic macro-invertebrates alone. The following describes the occurrence of both pollution intolerant fish and benthic macro-invertebrate species in the Lower Olentangy River Sub-basin and their significance with regard to what they tell us about water quality along this stretch of the river.

## Fish

Fish have been used widely as biological indicators of stream water quality. Fish are useful as water quality indicators as: 1) they are fully aquatic throughout their life cycle; 2) different species have different tolerances to amounts and types of pollution; 3) they are relatively easy to collect; 4) they are relatively easy to identify; and 5) they are comparatively long-lived and mobile, hence are indicators of general conditions across a large area [indicators of macro-habitat quality rather than micro-habitat quality]. Their use as indicators centers on the abundance and diversity of pollution-intolerant species and also the health and appearance of individual fish. Information regarding fish species in Ohio streams and their relative tolerance of pollutants has been compiled by Ohio EPA's Division of Surface Water (1999, Table 11). Pollution-intolerant species have been further divided into rare-intolerant species (R), special intolerant species (S), pollution-intolerant species (I), and moderately intolerant species (M).

Fish are a major part of Ohio EPA's current stream water quality evaluation process. The Division of Surface Water has developed several measures using fish biotas as water quality indicators. The Index of Biotic Integrity (**IBI**) measures multiple parameters – 12 “metrics” including the abundance and diversity of pollution-intolerant fish species, trophic composition (carnivores vs. insectivores vs. herbivores), plus fish biomass and physical condition (Ohio EPA, 1995). The Modified Index of Well-Being (**MIwb**) is also used, calculating fish biomass and density and factoring out the effects of 13 common pollution-tolerant species.

Data with regard to the occurrence and abundance of pollution-intolerant fish in the Lower Olentangy River include results of fish sampling carried out by Ohio EPA along this stretch of the river in the summer of 1999 (C. Bouche, pers. comm., 2001) and historical data collected by Ohio EPA along the entire course of the river between 1979 and 1999 (D. Mishne, pers. comm., 2001). These data are presented in Table 11. Ohio EPA has collected similar data for other central Ohio streams (Big Darby Creek, the Middle Scioto River, Alum Creek, and Big Walnut Creek).

A comparison of the diversity and abundance of pollution-intolerant fish species in central Ohio streams is presented in Table 12. From these data, it can be seen that pollution-intolerant species made up 40% of the total species collected from the Lower Olentangy River in 1999. These same pollution-intolerant species comprised 43% of the total number of fish collected from this stretch of the river the same year. These numbers compare

favorably with those indicated for Big Darby Creek in Franklin County (37% and 46%, respectively). Big Darby Creek is considered by Ohio EPA, the Nature Conservancy, and others to be the highest quality stream remaining in central Ohio; supporting the highest diversities of aquatic biotas, including large numbers of pollution intolerant species often found nowhere else in the region. In terms of both pollution-sensitive fish species and pollution-intolerant individuals, the lower part of the Olentangy River ranks second among central Ohio streams behind Big Darby Creek. The presence of these species suggest good to excellent water quality conditions and the local occurrence of good riffle habitat along this portion of the Olentangy mainstem.

Based on the 1999 fish survey of the Lower Olentangy River (Ohio EPA, 2001), numerically predominant species included the spotfin shiner (13.9%), golden redhorse (9.5%), smallmouth bass (8.6 %), bluntnose minnow (7.6 %), and the bluegill sunfish (7.5%). In terms of biomass, dominant species were the common carp (30.3%), golden redhorse (23%), silver redhorse (10.3 %), black redhorse (6.4 %), and quillback carpsucker (4.5 %).

Data from Ohio EPA (D, Mishne, 2001) and from ODNR's Natural Heritage database (2001) indicated the presence of four endangered, threatened, or special interest fish species in the Lower Olentangy River mainstem. These included the endangered Northern Brook Lamprey (*Ichthyomyzon fossor*), the endangered Spotted Darter (*Etheostoma maculatum*), the threatened Bluebreast Darter (*E. camurum*), and the state special interest River Redhorse (*Moxostoma carinatum*). It is of interest that all of these species occur in the heavily urbanized stretch of the river between I-270 and the confluence with the Scioto River in Franklin County as well as in more pristine stretches of the Olentangy River paralleling High Banks Metro Park (MORPC. 1997; ODNR Natural Heritage database, 2001).

Data from Ohio EPA (2001) also indicate that the Olentangy River is one of the premier Smallmouth Bass streams in central Ohio (Tables 13,14). The Smallmouth Bass (*Micropterus dolomieu*) is one of Ohio's most sought after sport gamefish. It is limited to clearer waters over rocky-bottomed portions of Lake Erie and to deeper pools with gravel or rock bottoms and a viable current in streams and rivers across Ohio. Smallmouth Bass in the Olentangy River comprise a larger percentage of the total number of fish collected (8.6%) compared to all other central Ohio streams (Table 13). Only the Scioto River in Delaware and Franklin counties has yielded a greater number of individuals of this species and this is due, in part, to this stretch of the Scioto River being sampled much more frequently than the Olentangy mainstem (D. Mishne, 2001).

With regard to the site-specific distribution of fish (Tables 14, 15), the greatest number of individual fish collected by Ohio EPA in 1999 (N=1,713) was at a locality south and downstream of the Delaware WWTP (RM 24.5). However, at this location, over 50% of the fish collected belonged to a single species, the Spotfin Shiner. The greatest number of pollution-intolerant fish species (N=15 species) came from the "Scenic River" portion of the river at the Powell Road bridge upstream of High Banks Metro Park (RM 15) in southern Delaware County and, more surprizingly, from the river in the vicinity of Kenny Park, just east of Bethel Road (RM 7.8) in a more heavily urbanized area between Worthington and Clintonville in Franklin County. The state threatened Bluebreast Darter was collected from both of these localities as well (Ohio EPA, 2001).

Smallmouth bass constituted significant numbers of the total fish collected at a number of sites north and south of the city of Delaware in Delaware County (Table 14). This popular sportfish was most abundant at the Panhandle Road site north of the city (21% of total fish collected at RM 27.9) and from the river in the vicinity of the US Rt. 23 Bridge, just south of the city (RM 22.3; 19% of the total fish collected).

Downstream portions of the river, even in urban-impacted stretches near the river's mouth in the city of Columbus, supported significant numbers of several pollution-intolerant, round-bodied, "redhorse" sucker species. The Golden Redhorse, a river species with a moderate intolerance to pollutants, is a dominant species in collections made in 1999 from the Powell Road Bridge at the High Banks Metro Park to the Olentangy's confluence with the Scioto River in Columbus. This species commonly comprises 10-20% of the total number of fish collected at these localities (Table 15).

These fish data generally demonstrate that the mainstem of the Lower Olentangy River is certainly "fishable", one of the desired goals of the federal Clean Water Act.

### **Freshwater Mussels**

Freshwater mussels belonging to the bivalve family Unionidae are an important, if often inconspicuous group of benthic macroinvertebrates common to many Ohio waterbodies, including the Olentangy River. Living partially to mostly buried on the bottoms of lakes, rivers, and streams, mussels are well camouflaged and often mistaken for rocks. The mussels live by absorbing dissolved oxygen and filtering microscopic food particles from the water. They are part of the waterways' natural purification system. Because of their largely sedentary lifestyle and their habit of filtering particles out of the water, plus sensitivity to pollutants, sedimentation, and low dissolved oxygen levels, they are considered to be "sentinel species" and natural barometers of stream water quality.

The history of freshwater mussels in the Scioto River Basin (including the Olentangy River Watershed), has been investigated by Dr. David Stansberry and his students at The Ohio State University. These investigations identified 29 species of native mussels from the Olentangy River, although three of these species were believed to have been extirpated from the river, represented only by dead "subfossil" shells (C. B. Stein, 1963). Dr. Stein identified 17 common living mussel species from the river just downstream of the 5<sup>th</sup> Avenue dam, south of the OSU campus, in the early and mid-1960. After channelization and partial realignment of the river's channel as part of the construction of State Rt. 315 in 1968, she returned to this stretch of the river in 1971 to find only a few live specimens belonging to only three mud-tolerant species. A more recent survey of mussels in this portion of the river (2000) revealed only five living species (Table 16).

The Lower Olentangy River in Clintonville, between Kenney Park to the north and the North Broadway bridge to the south, has largely remained in its natural state, retaining a mosaic of aquatic habitats, including shallow riffle zones, deeper low-energy pools, and intermediate sand or gravel-bottom flats and runs, all flanked by variably-developed wooded riparian corridors (Ohio EPA, 2001).

FLOW members carried out surveys of mussels from four localities along this stretch of the Olentangy River in 1998, 1999, and 2000. These surveys indicate that this portion of the river still supports a diverse, abundant mussel biota of at least 14 living species (Table 17), including viable populations of two state “special interest” species -- the Round Pigtoe (*Pleurobema sintoxia*) and the Wavy-lined Lampshell (*Lampsilis fasciola*). Two additional species may also be present based on the occurrence of articulated, fresh-dead shells (with intact ligaments, periostracum, and nacre) of these forms. These include the state endangered Snuffbox (*Epioblasma triquetra*) and the Round Hickory Nut (*Obovaria subrotunda*).

Downstream sections of the river south of Henderson Road are dominated by numerous specimens of the “Three-Ridge Shell” (*Amblema plicata*) and the “White Heel-Splitter” (*Lasmigona complanata*). Upstream of the bridge there are greater numbers of the “Plain Pocketbook” (*Lampsilis cardium*) and the “Fat Mucket” (*Lampsilis radiata luteola*). Other common species include the “Elktoe” (*Alasmidonta marginata*), the “Fluted Shell” (*Lasmigona costata*), the “Kidneyshell” (*Ptychobranchnus fasciolaris*), the Round Pigtoe (*Pleurobema sintoxia*), and the Wavy-Lined Lampshell (*Lampsilis fasciola*). These latter five species have all been described as being limited to “good quality streams” (T. Watters, 1995).

Mussels surveys by Hoggarth *et. al.* in 1989 and Frey in 2001 indicate living specimens of 10 mussel species from the vicinity of High Banks Metro Park in southern Delaware County (Table 18). Hoggarth (1990) remarked on the declining numbers of silt-sensitive species, including *Fusconaia flava*, *Pleurobema sintoxia*, *Lasmigona costata*, and *Ptychobranchnia fasciolaris* and suggested that these species appeared to be headed toward extirpation from the river. Ten years later, none of the first three species and only a single living specimen of *P. fasciolaris* were observed from this portion of the river (Table 18). Comparisons of similar mussel surveys from an upstream locality at the Orange Road Bridge in 1989 and 2001 indicated a more dramatic decrease in live mussels (Table 19). Hoggarth (1990) inferred that increased siltation from agricultural run-off and development was the likely cause of the decline of these silt-sensitive species from the river. This part of southern Delaware County is currently the fastest growing area in the state. With increased development comes the threat of increased sedimentation and its adverse effects on biotas living in the river, especially the bottom-dwelling organisms.

Studies of collections of mussels at the OSU Museum of Biodiversity indicate significant numbers of the federally endangered “Clubshell” (*Pleurobema clava*), the state-endangered “Rabbitsfoot” (*Quadrula cylindrica*), the state-endangered “Snuffbox” (*Epioblasma triquetra*), and the state-threatened “Pondhorn” (*Unio meris tetralasmus*) were collected from the Lower Olentangy River within Franklin County prior to the late 1960’s. After 1968 and the channelization and realignment of the Olentangy River in the Worthington and OSU campus areas, these species largely disappeared from the river.

As indicated above, fresh-dead specimens of the “Snuffbox” have been collected from the Olentangy River between Kenney Park and the North Broadway Bridge in Clintonville. The “Snuffbox” is also reported from the Olentangy River north of the city of Delaware and below the Delaware Dam and from the river at High Banks Metro Parks (Hoggarth, 1990; ODNR Natural Heritage Database, 2000). ODNR also reported the occurrence of the state-endangered “Rayed Bean” (*Villosa fabilis*) from the section of the river between the dam and the city of Delaware.

Fresh-dead specimens of the state-threatened “Pondhorn” have been collected by FLOW members (2000) from macrophyte-stabilized, low-energy backwater areas just below the 5<sup>th</sup> Avenue Dam. These occurrences suggest that small populations of this species still exist in the Lower Olentangy River.

In contrast, the “Clubshell” and the “Rabbitsfoot” appear to have been locally extirpated from the Lower Olentangy River, evidently as the result of habitat alteration and destruction associated with the construction of State Rt. 315 in Franklin County.

Studies of the current distribution of unionid mussels in the Lower Olentangy River Watershed illustrate the importance of intact riparian corridors and natural in-stream habitat to the maintenance of good water quality conditions and diverse aquatic biotas in urban-suburban streams, including the Olentangy River. The abundance and continued diversity of mussels in those portions of the river that retain these features intact attest to the good water quality still present in these portions of the river. However, the history of unionid mussels in the Olentangy River and elsewhere in the Scioto Basin also documents the negative impacts that urbanization and extensive modification of stream habitat and adjacent flood plain environments have had on the river’s overall water quality and its ability to sustain pollution-intolerant species. Extensive channelization and destruction of in-stream habitat associated with the construction of State Rt. 315 in the late 1960’s and the early 1970’s appears to have led to the local extirpation or, at least, severe reductions in the numbers of five previously viable species in the Lower Olentangy River, including three “endangered” and one “state-threatened” species. Continued development in the Lower Olentangy Watershed, especially in southern Delaware County, will continue to pose a serious threat to these environmentally sensitive aquatic species.

### **Benthic Macroinvertebrates (Aquatic Insects)**

Ohio EPA’s Division of Surface Water’s Biological and Water Quality Surveys and ODNR’s Ohio Scenic River Stream Quality Program both use the presence and abundance of pollution-sensitive benthic invertebrates, primarily aquatic insects, as indicators of stream water quality. Pollution-sensitive insect species typically include the so-called “EPT Metric”; members of the insect orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). The relative low tolerance for pollutants and other poor water quality conditions (low dissolved oxygen and turbidity) characteristic of most members of these three insect groups is well documented and these insect groups usually dominate gravel and cobble riffle habitats in good quality rivers and streams. Other common indicators of good water quality conditions in central Ohio streams, including the Olentangy River, include an abundance of “water pennies” (aquatic beetle larvae), “hellgrammites” (larval stage of the Dobsonfly), and various species of gilled snails.

Determinations of Ohio EPA’s Invertebrate Community Index (**ICI**) involve the use of stationary Hester-Dendy multi-plate artificial substrate samplers to obtain quantitative samples of benthic invertebrates, primarily insect larvae or nymphs. The emphasis is on the identities, diversity, and abundance of species of mayflies, caddisflies, and midges collected from these samples (Ohio EPA, 1987; Deshon, 1995). ODNR’s Stream Quality Monitoring Program is more inclusive and involves the use of kick-seines to sample rivers and streams

more qualitatively, measuring the diversity and relative abundance of pollution-sensitive benthic macroinvertebrates whose presence or absence is used to calculate a cumulative stream quality index using the occurrence of these key species as indicators of water quality. The emphasis is on the number of different key pollution-sensitive species (EPT, water pennies, hellgrammites, gilled snails) relative to the total number of invertebrates collected.

## Ohio EPA 1999 Biological and Water Quality Study

Ohio EPA's biological and water quality study of the Lower Olentangy River carried out in the summer of 1999 indicated a variety of water quality conditions in the main stem of the river, resulting in benthic invertebrate communities with **ICI** scores ranging from excellent (ICI=48-52) to poor (ICI = 12). Exceptional aquatic insect communities were collected from sites in the vicinity of High Banks Metro Park and were dominated by net-spinning caddisfly larvae and clinging and swimming mayfly nymphs with correspondingly high EPT metrics (=21-23). Poor ICI scores were recorded from impounded and modified portions of the river within Franklin County (upstream of the Fifth Avenue dam and at the confluence with the Scioto River) with biotas dominated by midge larvae and aquatic worms (Ohio EPA, 2001).

## FLOW River Monitoring Results (1998-2001)

FLOW has systematically monitored benthic macroinvertebrates at select sites along the Lower Olentangy River for the past two years. Kick-seines are used to collect benthic invertebrates from identified riffle areas at least three times a year with samples usually taken in the late spring, the mid-summer, and the late summer or early fall. Screened invertebrates are identified as their general group (mayflies, stoneflies, caddisflies, gilled snails, etc.) and counted with regard to their relative abundance. As indicated above, these data are used to calculate a **cumulative stream quality index (=CSQI)**. Pollution-sensitive species count more than pollution-tolerant species and the higher the index value the better the water quality of the stream. Data for two riffle localities, one downstream and one upstream of the Henderson Road bridge in Clintonville, are presented in Table 20.

Collected biotas from the sites north and south of the Henderson Road bridge are dominated by pollution-sensitive species, including "water pennies" (*Psephenus herricki*), both clinging (*Stenonema* spp.) and swimming mayfly nymphs (*Isonychia* sp.), net-spinning caddisfly larvae (*Hydropsyche* spp.), and riffle beetles (*Elmidae*). The site upstream of the Henderson Road Bridge also regularly supported abundant populations of high-spined gilled snails (cf. *Goniobasis* spp.). The downstream site had significant populations of stonefly nymphs (*Acroneuria evoluta*, *Isoperla* spp.), especially in the late spring and early summer months. These results indicate consistent water quality values in the good or excellent range (CSQI values 18-27). The only low value (=14, fair quality) resulted from a sample collected in the early spring (4/10/99) possibly before many insect larvae had hatched out or become active.

## Other Biotas Found in the Lower Olentangy Watershed

Mammals such as beaver, mink, and muskrat can be found in and along the banks of the Olentangy River. More terrestrial species, such as white-tailed deer, coyotes, raccoons, red fox, the eastern cottontail rabbit, eastern gray squirrel, red squirrel, groundhogs, and a variety of smaller rodents including deer mice, field mice, and the meadow vole, occur in forested

riparian corridors surrounding the main stem of the river, even in more heavily urbanized portions of Franklin County. Along with these mammals, a diverse avian fauna, including migratory neotropical songbirds as well as a variety of wading birds, ducks, raptors, and perennial songbirds, have been observed along the river's corridor in Delaware and Franklin County.

The garter snake, northern water snake, painted turtle, snapping turtle, and spiny soft-shelled turtle along with the American toad, bullfrog, green frog, and leopard frog, live in and along the river's banks.

The forested corridor along the Lower Olentangy is dominated by large, towering specimens of American Sycamore and Cottonwood, stabilizing the riverbank, providing a canopy over the river channel, and providing a diverse habitat for a variety of riparian birds and mammals. Exposed root balls along the channel provide cover and habitat for an additional number of aquatic species. Smaller Box Elder and Black Willow trees further complete the forest corridor. Protected, isolated areas within the steep ravines flanking most of the tributaries of the Lower Olentangy River may support diverse humidity and temperature sensitive floras, including a variety of wild flowers, ferns, and mosses that often are found no place else in central Ohio.

Even though an urban environment surrounds much of the Olentangy River corridor in Franklin County, many different species can be found living in the parks and open spaces along the river. The 2001 City of Columbus Parks and Recreation "BioBlitz" provided abundant evidence of this diversity. Over the course of a rainy two-day period, a volunteer cadre of field scientists and other biology professionals conducted an inventory of all of the species found in the vicinity of the river in Kenny, Antrim, and Delawanda parks. A total of 1,030 species were observed and identified (shown in Table 7).

## **National Heritage Database Records for the Lower Olentangy Watershed**

As part of the National Heritage Database, the Ohio Department of Natural Resources, Division of Natural Areas and Preserves, has catalogued information regarding the presence of a number of rare, unusual, or unique species of plants and animals in the Lower Olentangy River mainstem and adjacent portions of the watershed. Table 8 lists a number of rare and endangered aquatic species listed from the mainstem of the river (fish and freshwater mussel species). A significant number of rare or endangered bird and plant species are shown in Table 9. A list of unique preserves, parkland and special features (including several "champion" trees) are shown in Table 10. (See Appendix D.3 for a map and chart of unique places of interest and recreational resources).

Many of these observations were made in the "Scenic River" portion of the Lower Olentangy Watershed, which, up until recently, remained little impacted by human development in the watershed. All of this has changed in the last several years with this portion of the watershed being one of the fastest growing areas in Ohio. These occurrences further document the importance of maintaining the river and its flanking riparian corridor in a more natural state, preserving a variety of natural habitats which, in turn, support a diversity of animals and plants, many of which are unique to this area.

**Table 7: Columbus City Parks and Recreation BioBlitz Results (2001)**

<b>Animal or Plant Group</b>	<b>Number of Species identified</b>
Arthropods (Insects, spiders, etc.)	570
Mollusks (snails, mussels, clams)	14
Fish	16
Amphibians	4
Fungi	7
Lichens	3
Mosses	24
Grasses/Sedges	36
Wildflowers	227
Shrubs	19
Trees	40
<b>Grand Total</b>	<b>1,030 species</b>

**Table 8: Unique Biological Life- Aquatic**

<b>Unique Aquatic Life:</b>			
<b>Location(s)</b>	<b>Common Name</b>	<b>Scientific Name</b>	<b>State Status</b>
Confluence of Adena Brook	Northern Brook Lamprey	<i>Ichthyomyzon fossor</i>	Endangered
North of Antrim and Delawanda Parks, north of Bartholomew Run, North of City Delaware	Snuffbox	<i>Epioblasma triquetra</i>	Endangered
Confluence of Flint Ravine and Rush Run, North of Henderson Rd. Bridge and adjacent to Highbanks and Kenny Park	Bluebreast Darter	<i>Etheostoma camurum</i>	Threatened
Just south of St Rt 161 and north of the City of Delaware	Rayed Bean	<i>Villosa fabalis</i>	Endangered
Adjacent to Lambourne Ave.	Spotted Darter	<i>Etheostoma maculatum</i>	Endangered
Just north of I-270 and downstream and upstream of 750, and adjacent to Liberty Church. Downstream of trailer park in Del Co.	Mollusk Bed (Wavy- Rayed Lampmussel)	<i>Lampsilis faciola</i>	Special Interest
Adjacent to a gravel pit in Del. Co. 1 mile downstream from the Del Dam.	Mollusk Bed (Rayed Bean & Wavy-Rayed Lampmussel)	<i>Villosa fabalis</i> <i>Lampsilis faciola</i>	Endangered Special Interest
South of 5 <sup>th</sup> and north of 3 <sup>rd</sup> Ave.	Pondhorn	<i>Uniomernus tetralasmus</i>	Threatened

<b>Table 9: Unique Biological Life – Birds and Plants</b>			
<b>Unique Birds:</b>			
<b>Location(s)</b>	<b>Common Name</b>	<b>Scientific Name</b>	<b>State Status</b>
Adena Brook & Highbanks	Yellow-Crowned Night Heron	<i>Nyctanassa violacea</i>	Endangered
Bill Moose Run & Highbanks & 5277 Forest Ave.	Yellow Bellied Sapsucker	<i>Sphyrapicus varius</i>	Endangered
Bill Moose Run & Highbanks & 5277 Forest Ave	Magnolia Warbler	<i>Dendroica magnolia</i>	Endangered
Bill Moose Run & Highbanks & 5277 Forest Ave	Cerulean Warbler	<i>Dendroica cerulea</i>	Special Interest
Bill Moose Run & 5277 Forest Ave	Hermit Thrush	<i>Catharus guttatus</i>	Endangered
Highbanks & Bill Moose Run	Golden Winged Warbler	<i>Vermivora chrysoptera</i>	Endangered
Highbanks & 5277 Forest Ave.	Canada Warbler	<i>Wilsonia canadensis</i>	Endangered
Highbanks	Dark-eyed Junco	<i>Junco hyemalis</i>	Endangered
Highbanks & 5277 Forest Ave.	Double-crested Cormorant		Special Interest
Highbanks	American Bittern	<i>Botaurus lentiginosus</i>	Endangered
Highbanks	Black Vulture	<i>Coragyps atratus</i>	Special Interest
Highbanks	American Black Duck		Special Interest
Highbanks	Northern Harrier	<i>Circus cyaneus</i>	Endangered
Highbanks & 5277 Forest Ave.	Sharp-shinned Hawk	<i>Accipiter striatus</i>	Special Interest
Highbanks	Red-shouldered Hawk	<i>Buteo lineatus</i>	Special Interest
Highbanks	Sora	<i>Porzana carolina</i>	Special Interest
Highbanks	Common Moorhen	<i>Gallinula chloropus</i>	Special Interest
Highbanks	Sandhill Crane	<i>Grus canadensis</i>	Endangered
Highbanks	Upland Sandpiper	<i>Bartramia longicauda</i>	Threatened
Highbanks	Long-eared Owl	<i>Asio otus</i>	Special Interest
Highbanks	Northern Saw-whet Owl	<i>Aegolius acadicus</i>	Special Interest
Highbanks	Purple Martin	<i>Progne subis</i>	Special Interest
Highbanks & 5277 Forest Ave.	Winter Wren	<i>Troglodytes troglodytes</i>	Endangered

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<b>Table 9: Unique Biological Life – Birds and Plants</b>			
<b>Unique Birds:</b>			
<b>Location(s)</b>	<b>Common Name</b>	<b>Scientific Name</b>	<b>State Status</b>
Mirror Lake-OSU	Barn Owl	<i>Tyto alba</i>	Endangered
1.5 miles south of the Delaware Dam; Highbanks	Bald Eagle	<i>Haliaeetus leucocephalus</i>	Endangered Federal LT
Highbanks, 4277 Forest Ave.; Whetstone Park.	Osprey	<i>Pandion haliaetus</i>	Endangered
373 Charleston Ave.; Bill Moose Run	Little Blue Heron	<i>Egretta caerulea</i>	Endangered
<b>Unique Plants:</b>			
<b>Location(s)</b>	<b>Common Name</b>	<b>Scientific Name</b>	<b>State Status</b>
Highbanks	Weak Spear-Grass	<i>Poa languida</i>	Potentially Threatened Species
Highbanks	Spotted Coral Root	<i>Corallorhiza maculata</i>	Potentially Threatened Species
North and south of Camp Lazarus	Snow Trillium	<i>Trillium nivale</i>	Potentially Threatened Species
Delaware Run Park	Shining Ladies Tresses	<i>Spiranthes lucida</i>	Potentially Threatened Species
Woodlot east of Delaware Run	Grove Sandwort	<i>Arenaria lateriflora</i>	Potentially Threatened Species
Delawanda Park	Early Buttercup	<i>Ranunculus fascicularis</i>	Potentially Threatened
OSU Campus Oval	Silverbell	<i>Halesia carolina</i>	Presumed Extirpated

<b>Table 10: Unique Preserves, Parkland and Special Features</b>	
<b>Location</b>	<b>Feature</b>
Stratford, Delaware County	Stratford Woods State Nature Preserve
Beechwood Ave. Columbus, Franklin Co.	Champion Tree- Black Walnut
Highbanks Metro Park, County line	Cliffs
Highbanks Metro Park, County line	Concretion Deposit
Bartholomew Run	Oak-Maple Forest
Olentangy Indian Caverns	Cave or Cavern
West of C&O RR, Delaware County	Champion Tree- Bur Oak
OSU- near Mirror Lake	Glacial Erratic

(See Appendix D.3 for a map and chart of Unique Places of Interest and Recreational Resources)

**Table 11: Pollution-Intolerant Fish Species Collected from the Olentangy River (Ohio EPA, 1999; 1979-1999)**

Species	Feeding Guild	Tol.	Hab. Pref.	Lower Olentangy (1999)	Olentangy (1979-1999)
<i>Black Redhorse</i>	I	I	P	276 (2.6%)	717 (1.5%)
<i>River Redhorse</i> *	I	I	P	8 (0.07%)	36 (0.08%)
<i>Silver Redhorse</i>	I	M	P	126 (1.5%)	300 (0.7%)
<i>Golden Redhorse</i>	I	M	P	935 (9.5%)	1,878 (3.9%)
<i>Shorthead Redhorse</i>	I	M	P	2 (0.02%)	3 (0.01%)
<i>Northern Hogsucker</i>	I	M	R	399 (3.4%)	1,022 (1.8%)
<i>River Chub</i>	I	I	B	8 (0.07%)	76 (1.6%)
<i>Silver Shiner</i>	I	I	P	65 (0.6%)	227 (0.4%)
<i>Rosyface Shiner</i>	I	I	R	3 (0.03%)	4 (0.01%)
<i>Rosefin Shiner</i>	I	M	P		182 (0.3%)
<i>Sand Shiner</i>	I	M	B	497 (5.5%)	640 (1.45%)
<i>Mimic Shiner</i>	I	M	B		1 (0.001%)
<i>Stonecat Madtom</i>	I	I	R	104 (1.0 %)	151 (0.24%)
<i>Brook Silverside</i>	I	M	P	37 (0.34%)	141 (0.35%)
<i>Smallmouth Bass</i>	C	M	P	1,036 (8.6%)	2,765 (5.4%)
<i>Longear Sunfish</i>	I	M	P	514 (4.9%)	2,937 (5.7%)
<i>Logperch</i>	I	M	B	153 (1.3%)	266 (0.5%)
<i>Greenside Darter</i>	I	M	R	149 (1.07%)	1,818 (2.9%)
<i>Banded Darter</i>	I	I	R	164 (1.45%)	233 (0.43%)
<i>Bluebreast Darter</i> **	I	R	R	4 (0.03%)	6 (0.01%)
<i>Rainbow Darter</i>	I	M	R	72 (0.6%)	484 (0.76%)

Total Number Fish Collected 1999 = 10,789 (48 species);

Total Number of Fish Collected 1979-1999 = 55,256 (68 species)

\* = State Special Interest species

\*\* = State Threatened species

Feeding Guild = What the fish eats.

I = Insectivore; C = Carnivore;

Tol. = Pollution Tolerance

R = Rare, Intolerant; I = Intolerant; M = Moderately Intolerant

Hab. Pref. = Habitat Preference

P = Pool, R = Riffle, B = Both

<b>River</b>	<b># Pollution-Intolerant Species</b>	<b># Pollution-Intolerant Individuals</b>
Olentangy River (Entire, 1972-1999)	21/68 species (31%)	13,887/55,256 (25%)
Lower Olentangy River (1999)	19/48 species (40%)	4,582/10,789 (43%)
Big Darby Creek (Franklin County, 1979-2000)	26/71 species (37%)	13,164/28,492 (46%)
Scioto River (Delaware & Franklin Counties, 1979-2000)	25/88 species (28%)	27,539/113,490 (24%)
Alum Creek (from dam to confluence, 1986-2000)	19/68 species (28%)	6,542/24,537 (27%)
Big Walnut Creek (Port Columbus to confluence, 1979-2000)	24/70 species (34%)	7,941/17,902 (44%)
Data from Ohio EPA Division of Surface Water (2001)		

<b>River</b>	<b>Number of Individuals</b>	<b>Total % Of Fish Collected</b>
Entire Olentangy River	2,765	5.4
Lower Olentangy River	1,036	8.6
Big Darby Creek (Franklin County)	660	2.3
Scioto River (Delaware & Franklin Counties)	6,132	5.5
Alum Creek	138	<1.0
Big Walnut Creek	702	4.1
Data from Ohio EPA Division of Surface Water (2001)		

<b>Table 14: Distribution of Fish Species Collected at Individual Collection Sites on the Lower Olentangy River Mainstem in Delaware County (Ohio EPA, 1999)</b>					
<b>River Mile</b>	<b>Location</b>	<b>Number of Fish</b>	<b>Number of Species</b>	<b>Pollution Intolerant Species</b>	<b>Most Abunant Fish Species Collected</b>
32	Main Road, below Delaware Dam	659	28	8	Bluegill = 19% Black Crappie = 15% O. S. Sunfish = 12%
27.9	Panhandle Road, Delaware Co.	490	22	9	Spotfin Shiner = 31% Smallmouth B.= 21% C. Stoneroller = 9%
25.4	Upstrm Delaware WWTP, Delaware	530	27	12 River Redhorse*	Bluegill = 19% Carp = 10% Spotfin Shiner = 9%
25.3	Delaware WWTP mixing zone	170	21	9	Bluegill = 12% Carp = 12% Smallmouth B. = 7%
24.5	Dwnstrm Delaware WWTP	1,713	23	9	Spotfin Shiner = 51% C. Stoneroller = 14% Smallmouth B. = 12%
22.3	U.S. Rt. 23 bridge, Delaware Co.	859	18	8	Spotfin Shiner = 43% Smallmouth B. = 19% C. Stoneroller = 8%
19.4	Hyatts Road Bridge, Delaware Co.	589	26	12	Spotfin Shiner = 22% Smallmouth B. = 18% C. Stoneroller = 12%
15	Powell Road bridge at High Banks Metro Park	663	31	15 Bluebreast Darter*	Gold Redhorse=20% Smallmouth B. =14% Spotfin Shiner =12%
13.4	OECC WWTP mixing zone, Delaware Co.	133	9	5	Spotfin Shiner =40% Bluntnose Min.= 34% Banded Darter =11%

\* State Endangered, Threatened, or Special Interest Species

<b>River Mile</b>	<b>Location</b>	<b>Number of Fish</b>	<b>Number of Species</b>	<b>Pollution Intolerant Species</b>	<b>Most Abundant Fish Species Collected</b>
12.4	At Mt. Air north of I-270 Worthington	601	25	13	Gold. Redhorse=25% Blk. Redhorse = 14% Bluntnose Min. =13%
7.8	Kenny Park at Bethel Road, Clintonville	423	29	15 Bluebreast Darter*	Banded Darter = 13% Sand Shiner =13% Gold. Redhorse=12%
6.8	Henderson Road bridge, Clintonville	579	26	12	Gold. Redhorse=21% Sand Shiner =17% Silver Redhorse=10%
5.5	North Broadway bridge	363	20	6	Gold. Redhorse=22% Longear Sunfish=16% Green Sunfish =15%
3.9	Dwnstrm Dodridge Road dam	728	28	13	Bluegill = 13% Longear Sunfish=11% Gold. Redhorse=11%
2.0	Upstrm 5 <sup>th</sup> Avenue dam at OSU	537	23	7	Longear Sunfish=26% Bluegill = 16% Gold. Redhorse=12%
1.8	Dwnstrm 5 <sup>th</sup> Avenue Dam, Columbus	617	26	12	Bluntnose Min. =21% Sand Shiner =13% Gold. Redhorse=11%
0.7	At Goodale Road, Columbus	477	22	8 River Redhorse*	Longear Sunfish=12% Gizzard Shad =12% Gold. Redhorse=10%
0.3	Just above confluence with Scioto	658	25	9	Gizzard Shad = 17% Bluegill = 14% Bluntnose Min. = 9%
* State Endangered, Threatened, or Special Interest Species					

<b>Table 16: Living Unionid Mussels Species Recorded from the Olentangy River  just below the 5<sup>th</sup> Avenue Dam In Columbus, Franklin County  (Modified From C. Stein, 1972)</b>			
<b>Mussel Species</b>	<b>1956-1967 (C. Stein, 1972)</b>	<b>1971 (C. Stein, 1972)</b>	<b>2000 (R.C. Frey)</b>
<i>Elliptio dilatatus</i>	X		
<i>Amblema plicata</i>	X		X
<i>Pleurobema sintoxia</i> *	X		
<i>Unio meris tetralasmus</i> **	X		?
<i>Anodonta imbecilis</i>	X	X	X
<i>Anodonta grandis</i>	X	X	X
<i>Alasmidonta marginata</i>	X		?
<i>Alasmidonta viridis</i>	X		
<i>Lasmigona costata</i>	X		?
<i>Strophitus undulatus</i>	X		
<i>Lampsilis cardium</i>	X		X
<i>Lampsilis fasciola</i> *	X		
<i>Lampsilis radiata luteola</i>	X		X
<i>Ptychobranhus fasciolaris</i>	X		
<i>Epioblasma triquetra</i> ***	X		
<i>Toxolasma parva</i>	X		
<i>Villosa iris</i>	X		

? = Species represented by fresh-dead shells only \* = State Special Interest

\*\* = State Threatened species \*\*\* = State Endangered species

**Table 17: Abundance of Live Specimens of Freshwater Mussel Species in the Olentangy River in the Vicinity of Whetstone Park and the Henderson Road Bridge, Franklin County (1998-2000)**

Species	1998	1999	2000
<i>Elliptio dilatatus</i>	1	2	1
<i>Amblema plicata</i>	126	65	115
<i>Pleurobema sintoxia</i> *	2	5	12
<i>Fusconaias flava</i>	0	2	10
<i>Anodonta grandis</i>	16	1	5
<i>Anodonta imbecilis</i>	2	2	1
<i>Alasmidonta marginata</i>	7	9	6
<i>Lasmigona complanata</i>	27	41	65
<i>Lasmigona costata</i>	9	3	16
<i>Strophitus undulatus</i>	1		3
<i>Lampsilis cardium</i>	43	32	23
<i>Lampsilis fasciola</i> *	9	4	5
<i>Lampsilis radiata luteola</i>	55	37	29
<i>Ptychobranchus fasciolaris</i>	1	2	1
<b>Total Number of Individuals</b>	<b>299</b>	<b>205</b>	<b>292</b>

\* = State "Special Interest" Species

**Table 18: Abundance of Living Specimens of Freshwater Mussel Species From the Olentangy River at High Banks Metro Park, Delaware County**

SPECIES	Hoggarth, 1989	Frey, 2001
<i>Elliptio dilatatus</i>	1	
<i>Amblema plicata</i>	3	4
<i>Alasmidonta marginata</i>	1	1
<i>Lasmigona complanata</i>	0	1
<i>Strophitus undulatus</i>	2	0
<i>Lampsilis cardium</i>	1	14
<i>Lampsilis fasciola</i> *	3	4
<i>Lampsilis radiata luteola</i>	6	8
<i>Ptychobranchus fasciolaris</i>	7	1
<i>Epioblasma triquetra</i> **	1	0
<b>Total Number of Individuals</b>	<b>25</b>	<b>33</b>

\* =State "Special Interest" Species

\*\* =State "Endangered" Species

<b>Table 19: Abundance of Living Specimens of Freshwater Mussel Species from the Olentangy River Just Upstream from the Orange Road Bridge, Delaware County</b>		
<b>Species</b>	<b>Hoggarth, 1989</b>	<b>Frey, 2001</b>
<i>Elliptio dilatatus</i>	1	0
<i>Amblema plicata</i>	2	1
<i>Anodonta grandis</i>	0	1
<i>Alasmidonta marginata</i>	7	1
<i>Lampsilis cardium</i>	7	2
<i>Lampsilis fasciola*</i>	6	1
<i>Lampsilis radiata luteola</i>	10	4
<i>Ptychobranchus fasciolaris</i>	10	0
Total Number of Individuals	<b>43</b>	<b>10</b>

\* = State "Special Interest Species"

<b>Table 20: Cumulative Stream Quality Results: F.L.O.W. Sampling of the Olentangy River Upstream &amp; Downstream of the Henderson Road Bridge. Franklin County (1998-2001)</b>			
<b>Downstream of Bridge</b>		<b>Upstream of Bridge</b>	
<b>1998</b>		<b>1998</b>	
10/24/98	NO SAMPLE	10/24/98	CSQI = 27/ EXCELLENT
<b>1999</b>		<b>1999</b>	
4/10/99	NO SAMPLE	4/10/99	CSQI = 14/ FAIR
5/15/99	CSQI = 25/ EXCELLENT	5/15/99	CSQI = 20/ GOOD
9/11/99	CSQI = 24/ EXCELLENT	9/11/99	CSQI = 25/ EXCELLENT
<b>2000</b>		<b>2000</b>	
7/3/00	CSQI = 26/ EXCELLENT	7/3/00	CSQI = 24/ EXCELLENT
8/12/00	CSQI = 20/ GOOD	8/12/00	CSQI = 18/ GOOD
<b>2001</b>		<b>2001</b>	
5/5/01	CSQI = 23/ EXCELLENT	5/5/01	CSQI = 23/ EXCELLENT
6/30/01	CSQI = 22/ GOOD	6/30/01	CSQI = 18/ GOOD

CSQI = Cumulative Stream Quality Index (Kick-Seine Sampling)