

Some fish in Laurel Creek

Laurel Creek, which flows through the University of Waterloo campus, is reported to contain at least thirty-eight species of fish. Some of these species are presently represented by living specimens in an aquarium in a Biology-Earth Sciences Museum display cabinet which is on the ground floor foyer of the Biology Building. These specimens were taken from Laurel Creek near the Village. This attractive display is the work of Dr. J. Dodson.

Many species of freshwater fish in this area belong to the minnow and carp family, the **Cyprinidae**. These fish have one dorsal fin and one anal fin. The pelvic fins are abdominal in position, as with all primitive teleost fishes, and the scales are cycloid (as opposed to the tenoid or comb-like scales of the more highly evolved teleosts). The fins are supported by soft rays; usually there are no spines.

The swim bladder in these fish connects with the throat, like lungs, and is used for regulating the buoyancy of the fish. A series of bones, the Weberian ossicles, which are derived from the first four vertebrae, connect the swim bladder with the inner ears. Vibrations travelling through the water are transmitted through the body tissues of the fish to the swim bladder, thence through these ossicles to the inner ear. This is their method of hearing. Fish can also detect water vibrations by means of the lateral line, a longitudinal row of sensory pores along either side of the body.

Probably the most interesting feature of the carp family is the fact that the jaws of these fish are completely toothless, but that teeth occur on the lower bones of the pharyngeal arches in the throat, just behind the jaws. These throat teeth are used to crush food against pads on the base of the skull, thus replacing the jaws for chewing. In the true carp, **Cyprinus carpio**, these throat teeth are somewhat suggestive of the flat surfaced, high crowned molar teeth in the jaws of herbivorous mammals. Cyprinids are abundant in the freshwaters of southern Canada. The family is naturally represented in North America, Europe, Asia, and Africa, but some species have also been introduced by man into Australia and South America.

Among the cyprinids displayed are the Creek chub, **Semotilus atromaculatus**; the Golden shiner, **Notemigonus crysoleucas**; and the Common shiner, **Notropis cornutus**.

By J. Frank Brookfield
Biology Curator
Biology and Earth Sciences Museum

Catostomus commersoni. Suckers are somewhat similar to the cyprinids in external appearance, and like them, have teeth on the lower pharyngeal bones and no teeth on the jaws. The pharyngeal teeth are comb-like. These fish differ from the **Cyprinidae** in having the mouth directed downward and with thick lips covered by small papillae. There is a cleft in the midline of the lower lip. The tail fin is forked.

Spring is the spawning time for the white sucker, and from two to four males spawn with one female. This species makes no nest. The eggs, which are adhesive, are dropped onto gravel or are carried by current into quieter areas. A maximum length of 25 inches has been given for this species; it is thought that such an individual would be about 17 years old. These fish are bottom feeders, as the form of the mouth would suggest, and they sometimes consume the eggs of other fish.

The display also includes a **Brown bullhead**, **Ictalurus nebulosus**, a species of catfish. The catfishes, which make up the Family Ictaluridae, have no scales. The forepart of the body is rotund, but laterally flattened behind the level of the dorsal fin. The head is large and flattened, and has several pairs of whisker-like barbels around the mouth. These barbels are equipped with "taste" receptors and are used to detect food in the bottom mud or sand.

The dorsal and pectoral fins of a catfish are armed with a serrate spin in front; in some species these have a groove and a poison sac, so catfish should be handled carefully. The anal fin is quite long, and there is an adipose fin, which is really a vestigial second dorsal fin (this fin has no spine or rays) an adipose fin is also present in salmon and trout.

The Brown bullhead is usually 8 to 14 inches long as an adult. It has four pairs of barbels. Its dorsal fin is situated ahead of the midpoint of its body. The dorsal and pectoral spines of these species can be held in an erect position, as if locked. The upper parts of this fish vary in colour from yellowish brown, olive grey to bluish black. The lower sides are dirty white, while the undersurface ahead of the pelvic fins is either yellow or white.

breeding males the colours are more intense. The young are at first transparent, and then turn silvery or dull pale green. Some adult individuals may be grey-blue or red and lack the bars seen in the normal coloration.

The Yellow perch spawns in the spring. They move shoreward and spawn in shallow water, usually several males to a single, larger female. No nest is built, and the spawning is nocturnal.

The eggs are transparent and about 3.5 mm. in diameter. They are laid in a transparent, gelatinous accordion-folded string or tube up to 7 feet in length, 2 to 4 inches in width and 2 pounds in weight. This egg mass is aerated by water circulating through its central canal, and holes, adheres to the aquatic vegetation and is semi-buoyant, undulating with the water movements. These egg masses can be washed ashore and are not protected by the parents.

The eggs usually hatch in 8 to 10 days. On hatching the young are about 5 mm. long, transparent, and are inactive for about 5 days while they absorb their yolk sacs. Females grow faster than males and therefore, are larger as adults. Yellow perch are usually 8 to 12 inches long. The present angler record is 4 pounds, 3 1/2 ounces.

Yellow perch often move in schools, closely packed in summer and more widely separated in winter. They are active in the daytime and rest on the bottom at night. These fish eat insect larvae, small fish, crustaceans, molluscs and other invertebrates. They also prey on the eggs and young of other fish. The Yellow perch is the bony fish commonly used for dissection in biology teaching laboratories.

The **Rainbow darter** is sometimes found in Laurel Creek, but is not so common here as the other species discussed in this article. Its average length is about 2 inches. The teeth occur in brushlike bands on the jaws. In the breeding season the male Rainbow darter is one of the most vividly colored of our native freshwater fishes. There are brilliant shades of green and blue on the head and on the vertical bars on the sides of the body. The ground color is red or orange. The dorsal and anal fins are all banded with these same colors and have an outer blue margin. Females are much less vividly colored. Unfortunately the specimen in our display has become much paler; originally it was brilliant. This may be due to so much exposure to the aquarium lights; light tends to fade the colours of aquarium fishes.

The **Golden shiner** is olive to olive green on the back and silvery to silvery white from the sides to the belly. Breeding males may have a rosy cast or other tints. There is a black spot at the base of the caudal (tail) fin, and often an inconspicuous lateral stripe, extending from head to caudal fin. This stripe is more pronounced in the young. The throat teeth in this species are hooked.

Creek chubs breed in the spring. The male excavates a trench-like nest in a gravel stream bottom, into which the females deposit their adhesive eggs. As in most bony fish, fertilization takes place outside the female's body. Males may grow to twelve inches long in about seven years. The Creek chub is omnivorous, eating both plant and animal matter, mainly insects and their larvae, but also cladocerans (a group of small crustaceans), crayfish, small fish, and algae.

The **Golden shiner** and the **Common shiner** look much alike. The Golden shiner is more deep bodied and its dorsal fin begins at a level behind the bases of the pelvic fins. In the Common shiner the dorsal fin arises slightly ahead of the pelvics. The Golden shiner has been known to grow to 10 inches, and the Common shiner to 7.9 inches. A near record specimen of the Common shiner was taken from Laurel Creek on October 14, 1974 by Dr. Thomas Hamor of the UW Department of Biology. The specimen was 150 mm. (5.91 inches) in length.

Breeding for both species occurs in the spring. The Golden Shiner lays its adhesive eggs over aquatic algae, while the Common shiner lays its eggs on a gravel bottom. These shiners feed on small invertebrate animals, particularly aquatic insects, and also on algae.

The **carp**, *Cyprinus carpio*, is probably the best known of the cyprinids. This species is not on display in the Biology Building. Although common now in Ontario and other parts of North America, it is actually native to Eurasia. It was introduced by man into North America in the nineteenth century (and into England in the reign of Henry VIII). Carp are often reported over 10 pounds in weight, and 58 pounds is recorded for one caught in Lake Erie off Ohio. A 39 pound carp is recorded from a poundnet near Port Dover on Lake Erie.

Carp are omnivorous and will eat Molluscs, annelid worms, aquatic insects, aquatic plants and even tree seeds. They are extremely prolific and lay their adhesive eggs randomly over underwater vegetation. About 2,208,000 eggs have been reported from a 33.5 inch female. These fish spawn in spring and early summer. In some Old World countries carp are raised for food in fish farms.

The familiar Goldfish, *Carassius auratus*, is also a member of the *Cyprinidae*, and originally was brought from China and Japan.

One species of sucker, Family *Catostomidae*, is represented in our display; this is the **White sucker**,

pelvic fins is either yellow or white.

Brown bullheads breed in late spring and summer, and may spawn even twice a year. One or both of the sexes clear a shallow depression in the bottom for a nest, in from six inches to several feet of water. Sometimes burrows are made. These catfish often nest under boards, in hollow stumps, or even inside submerged automobile tires. The spawning takes place in the daytime, and the sexes caress one another with their barbels. The eggs are up to 3 mm. in diameter, are adhesive, and covered with a gelatinous coat. The eggs and young are cared for by both parents.

Upon hatching, the young are transparent and yellow, about 6 mm. long, and each has an enormous yolk sac on its belly. Because of this yolk sac the young only lie on their sides in the nest; they cannot swim or feed. They derive their nourishment at this time from their yolk. This situation lasts for seven days, by which time the yolk is used up and they begin searching for food. They are now tadpole-shaped and jet black, and are escorted by their parents for several weeks, by which time they are about 2 inches long. Then they disperse and are on their own. In Canada, Brown bullheads may grow up to 14 inches long and weigh 3/4 to one pound. They have been reported from Florida to weigh from 6 to 8 pounds. The maximum age appears to be 6 to 8 years.

Brown bullheads are more tolerant of pollution than many other species; they are the only species in some heavily polluted streams near Montreal. These fish are omnivorous and seek their food in the bottom with their barbels. They eat offal, molluscs, insects and their larvae, leeches, crayfish, and planktonic crustaceans.

The Family *Percidae*, the perch and darters, is also represented in Laurel Creek. These fish have the pelvic fins thoracic in position and attached to the pectoral girdle, almost directly below the pectoral fins which are situated higher up on the sides of the body. There are two separate dorsal fins, the first supported by spines and the second by soft rays. There are one or two spines in the anal fin. They have tenoid scales. The swim bladder, when present, is closed off from the throat. Bands of villiform teeth occur on the jaws and also on bones in the roof of the mouth. Perch occur in both North America and Eurasia, while the darters are found only on this continent. This family is represented in the display by two specimens from the creek: the Yellow perch, *Perca flavescens*, and the Rainbow darter, *Etheostoma caeruleum*.

The **Yellow perch** has an average length of from 4 to 10 inches. The colour depends on the size of the fish and its habitat. The back colour, which extends down either side of the body in about seven tapering bands, is bright green to olive or golden brown. The sides are yellow-green or yellow, and the belly varies from grey to milk-white. In

Rainbow darters spawn in spring over gravel. The males, larger than the females, do much sham fighting, erecting their fins and displaying their vivid colours to intimidate each other. A female enters a male's territory and tunnels into the gravel head first. The male moves over her and fertilizes her eggs as they emerge. Then she leaves and the eggs remain buried in the gravel. One female may do this several times and lay a total of about 800 eggs. The eggs average 1.5 to 1.8 mm. in diameter and hatch in 10 to 12 days at a water temperature of 62.2 - 65.3°F. These darters eat aquatic insect larvae, snails, and small crayfish. They also eat the eggs of minnows and lampreys.

The Family *Centrarchidae* were originally represented in our display by the Pumpkinseed sunfish, *Lepomis gibbosus*. It is hoped that another specimen can be obtained. This family includes the sunfishes, crappies, and basses. These fish are similar to the *Percidae*, but differ in having the two dorsal fins (spiny and soft rayed) joined to varying degrees. They have villiform teeth in the jaws, the roof of the mouth and on the tongue of most species. These fish are often very colorful.

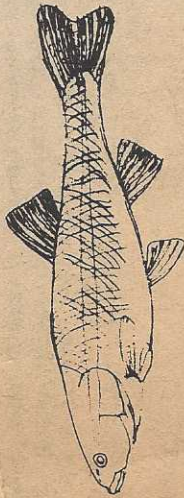
The **Pumpkinseed sunfish** is disc-like in shape and about 7 to 9 inches in length. The back of the fish is golden brown to olive. The lower sides are golden with wavy interconnecting blue-green lines. The undersurface is bronze to red-orange, and the sides of the body and head are flecked with olive, orange or red spots and have blue, emerald or green reflections. There are vague vertical bars on the sides of the body. Several wavy, blue-green stripes occur on the sides of the head. The opercular (gill cover) flap has a wide, black center, a narrow border of white or yellow, orange or blue, and a small red halfmoon spot at the tip. Females are paler and their vertical bars on the sides are more distinct. Breeding males become more intense in their coloration.

In late spring or early summer the male makes a nest in the bottom of a shallow lake, pond or slow flowing stream. Nests are shallow depressions among water plants and are frequently close together. They are 4 to 16 inches in diameter. A courtship display with swimming in a circular path accompanies the mating. The eggs are laid and fertilized during those circulations. The males may spawn more than once in a season, in the same nest and with different females or the same one. The eggs, 1 mm. in diameter, are pale amber and adhere to soil patches on the bottom. The eggs are guarded and fanned by the male. The newly hatched young are also guarded by the male parent for the first eleven days of life. The eggs may hatch in as few as 3 days at 82.4°F.

The newly hatched young are transparent. Sexual maturity is reached in 2 years. The maximum size in Ontario for this species appears to be about 10 inches, and 17 ounces in weight, at 8 to 10 years. The Pumpkinseed

Fish

feeds on insects, salamanders, amphipods, roundworms and snails, and sometimes small fish. Food is taken from the surface of the water as well as from the bottom.



Creek chub



White sucker

Six engineers given medals

The first Sandford Fleming Foundation medals for academic achievement were presented at the convocation for graduating engineers, held May 28.

Medals for outstanding performance in the work-related aspect of the co-operative engineering program at Waterloo were presented at an inaugural dinner meeting of the Foundation earlier this spring.

In both cases, a graduating student from each engineering department was cited.

The awards for academic achievement went to Howard Katz of Ottawa, in chemical engineering; Tai Tung Wong, of Toronto, in civil engineering; David J. Gould, of Toronto, in electrical engineering; Henry Hong-Ming Wong, of Ottawa, in mechanical engineering, and David W. Rowat, of Ottawa, in systems design.

Summer cooling starts early

UW's buildings will be cooled to two different temperatures this summer, says plant engineer Helmut Krueger.

The official summer temperature is 75 Fahrenheit (24 Celsius), Krueger notes, and most buildings will be cooled to that level.

"However," he continues, "some buildings continued

winter, and dress accordingly. It's also wise to keep windows shut and pull the drapes to keep heat out, he suggests, and to switch off lights and other devices that produce heat.

"Last but not least," he said, "keep your cool and don't get excited because of the heat. You will only generate more BTU's and make things even hotter."

Nearby bank closes in July

The Bank of Montreal branch at University Avenue and Philip Street will close down as of July 22. It was the first bank to be set up near the university when it was established in 1962 as a sub-branch of the main downtown Waterloo BofM branch.

John Smith, the manager, advises customers to transfer their accounts as soon as possible to avoid inconvenience. There are three other branches in the area—at King and Erb downtown, on Weber North in Lakeshore Village (it's open Saturday mornings), and at University and Weber.

Rising expenses are the reason for the closing, Smith said. Always a busy branch because of student business, it at one time had 40 employees. But it didn't get enough commercial business to keep it viable, particularly whenever interest rates were increased.

It is understood all staff members are being transferred to other branches. One problem involved in the closing will be locating

renowned visitor to the campus each term to talk on a subject of fairly broad, general interest.

Social conflict to be discussed

A student conference examining minority group conflicts with society will be held at Conrad Grebel College next fall.

The social and political problems confronting American and Canadian Indians when dealing with white society is one subject of the session, sponsored by the Mennonite Central Committee.

The students, who are members of the Mennonite Intercollegiate Peace Fellowship, will congregate on campus October 20-22. They will come from many Mennonite colleges and seminaries.

The plight of blacks and Canadian immigrants will also be looked at by the students. In addition, they will discuss the relationship between minorities and the Mennonite church.

"Conference planners hope to encourage students to become involved in peacemaking on the local level and to provide opportunities for discussion on careers in peacemaking and conciliatory activities," says a conference press release.

The conference is open to the public and further information can be gotten from the Mennonite Central Committee Peace Section, 21 South 12th Street, Akron, Pennsylvania 17501.

PROFILE

Vic Neglia: computer buff

Vic Neglia is a bit vague about his official job title. "Programmer, consultant, analyst," he suggests; what matters is that he's one of the four staff plus one faculty member in the arts computing office, and the broad range of work the ACO does means he has to be versatile.

The office, on the first floor of the Psychology building, exists to help faculty (and students) in arts departments make use of the computing centre's services. Consulting is provided free, and programming is on a user-pay basis. The ACO's services go beyond those offered in the computing centre itself; Neglia may actually sit down in front of a computer terminal and do things to your data for you.

The ACO also manages the Arts Remote Terminal Station, a room full of input and output devices, which provide Art's users with remote access to a host of facilities in the Computer Centre.

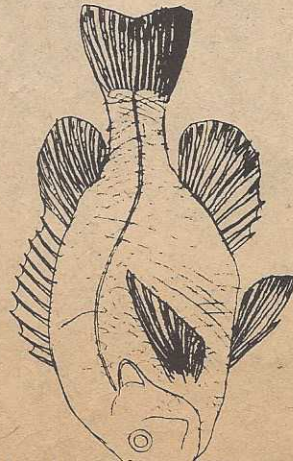




Brown bullhead



Rainbow darter



Pumpkinseed sunfish

with terminal reheat systems, will keep thermostat settings of 69 Fahrenheit (20.6 Celsius) as they were in winter."

Terminal reheat systems involve cooling the air to 55 degrees, then reheating it just as it enters the room, to match the local thermostat setting. Heating it only to 69 is cheaper than heating it all the way to 75. The terminal reheat system is "the Cadillac of air conditioning", says Krueger, but that's what was installed in certain UW buildings, designed in the days of cheap energy.

These are the buildings which will be cooler this summer for that reason:

Engineering I (east wing), III (the part constructed along with E4), and IV, and Engineering Lecture.

Biology II (exterior offices), Math and Computer, Health Services, and Chemistry II.

The Faculty Club, Psychology, Optometry (part) and Humanities (part).

Elsewhere on campus, it should be 75 degrees for the next few months.

The air conditioning was turned on early this year because of the mid-May heat wave, Krueger says. Once the monthly meter-reading for "peak demand" was made on May 13, the cooling was turned on gradually, starting with buildings where the windows can't be opened, and the system was in full operation by May 27.

The usual date for the start of the cooling season is June 2.

Krueger suggests that people accept that it's warmer in summer than in

hundreds of students with accounts and loans who are now out of town until September.

NY engineer speaks Tuesday

Prof. George Bugliarello, president of the Polytechnic Institute of New York, will be giving a distinguished lecture on campus Tuesday, June 14, at 10:30 a.m., in room 116, arts lecture hall.

The lecture, to be entitled "Socio-political and Socio-technological Aspects of Engineering Education and the Engineering Profession," is primarily aimed at engineering students.

Prof. Bugliarello, a renowned speaker, is also highly regarded as a teacher and research scientist. As a university administrator he has succeeded in bringing financial and administrative stability to PNY, which was formed by combining Brooklyn Polytechnic and the engineering school of New York University at New York.

As a researcher, Prof. Bugliarello has been active in a wide variety of fields, over the past 20 years, including flood flow over spillways, development of problem-oriented computer languages, biological engineering, water resources economics and the implications of technological development.

The Bugliarello lecture is open to the public. It is part of a series of distinguished lectures sponsored by the department of civil engineering which brings a

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\$1 for 25 words
cash in advance
deadline Monday noon

For sale
1977 Camaro, Brown, 305 V8, automatic, loaded, under warranty, 8000 miles. Must sell today. Asking \$5,200 or best offer. Call Ext. 3437 or Elora 846-5719.

Garage Sale
Saturday, June 18 (Rain Date June 19), 121 University Avenue East, (Village on the Green). Up to 100 Families Participating. Snack Bar.

Curious for Curious George
Summer adventures for children ages 6-8. Program includes community excursions, nature appreciation, large and small group experiences, human relationships. One staff to 4 children. July and August, full or half-day. Contact Klemmer Farm House Daycare at 885-1211, ext. 2369.

For sale
New 3-bedroom bungalow, fully carpeted, with car-port and mature trees. Close to university, modern styling. Must be seen, \$43,900. Call builder at 885-1539, 425 Karn St. Kitchener.

For rent
Lovely 2-bedroom apartment in quiet 6-plex. Near Universities. Utilities, appliances included. Available immediately. Call 886-2446 after 5 p.m. or 886-2074.

For rent
Furnished 3-bedroom house. Ten minute drive from university. Price negotiable. Available Sept. 15-Dec. 30. Call ext. 3118.

Rear wheel missing
Anyone witnessing removal of rear wheel from blue Peugeot bicycle parked in bike stands outside Math building (between Math & Chem 2 buildings) Tuesday, May 31 (10 a.m. - 4 p.m.) please contact Judy McBride, ext. 2505.

"We have a number of ongoing projects that we're doing for people," explains Neglia in his cluttered office. He immediately adds that there are more projects than time really allows, and some of them get shelved—especially this year, while the ACO's director, Dr. Phil Smith, is on sabbatical and Neglia has the extra duties of acting director.

He got interested in computing while he was a physics student at UW. Neglia says, in the days when the IBM 1620 was a commonly-used machine. "I bought a couple of manuals and just played with the system," he recalls. There came an evening when he was working on the computer at 6:30 and was due in the Theatre of the Arts at 7:00 for a meeting to organize the stage crew, which he wanted to join. He kept running his programme once more and once more: "It was midnight before I left there. I never got to the meeting, and after that I knew I was hooked."

When he graduated he got a "temporary" job with the Humanities Computer Assisted Research Group; the job became permanent and HCARG became WATCHUM and then the Arts Computing Office, and Neglia has been working there six years now.

In the off hours, "I try to go roller-skating once a week," he says. "I'm also trying to get my pilot's licence." And he plays squash and is taking a French course.