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FELIPE POEY OF CUBA AND HIS "MEMORIAS"

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New York, 10024

Felipe Poey y Aloy (1799-1891), the great Cuban naturalist, malacologist, and savant, in spite of his many serious contributions to many fields of knowledge (see Boss and Jacobson, 1975, for details of his life, personality, and works) was a cheerful, poetic, and at times playful and unconventional individual. His cheerful, funloving temperament appears often in his most important published works, *Memorias sobre la Historia natural de la Isla De Cuba*. It was published between 1851 and 1861, and almost all of the 53 separate reports which are contained in the two wolumes, are the work of Poey. In scope of topics treated, if not in actual bulk, it bears some resemblance to Humboldt's masterpiece, *Cosmos*. It was composed, wrote Poey (1:4), not only for the attention of the specialist, but also for the ordinary reader in whom the author wanted to arouse a love of the Cuban countryside. Hence, although much of it is devoted to scientific descriptions of land shells, butterflies, insects, and especially fishes, there are also many most readable accounts of anthropology, history, linguistics, grammar, philosophy, and religion. Also, as we shall see, a few old wives' tales. Poey, in addition to his other gifts, had a reputation as a poet and a man of letters, and his skillful, captivating style of writing is apparent throughout his *Memorias*. He was also a consummate artist, and almost all the superb, mainly colored illustrations which enhance the *Memorias* are the work of his hand. He was, however, no mere illustrator, and wrote that he exaggerated the important features so as to bring out the points of his discussion. Nor did he overlook the artistic side of his work. 'I did not feel,' he stated (1:4), 'that anything should prevent me from representing these objects in the most picturesque position which my artistic instinct inspires me to depict.' (Note: all translations by MJK).

His sense of humor enlivens even his most sober scientific discussions. Thus, in his observations on a new species of land shell, he wrote (1: 104): 'Since I have called the former species *Cyclostoma honestum* or 'the chaste, modest one' because it demurely covers its umbilicus as it grows older, it would not be a bad idea to call the present species *Cyclostoma procax*, 'the shameless, wanton one' since it openly displays its naked bellybutton all through its life.' He was serious enough about this to use the word *pudica* (chaste, modest, maidenly) in descriptions where ordinarily the word 'imperforate' or 'non-umbilicate' is used (1: 102, 103, etc.).

When he wrote about the behavior of the animals, he did so with much skill and humor (1:401): 'It is no easy matter to observe I*Farcimen*I when they move about, because they display such a tremendous amount of laziness and torpor when the time comes to be active. After newly collected specimens are placed on a table in a humid atmosphere, and one of them gets ready to take a walk, he begins by extending his foot very very slowly, taking long resting periods after each small exertion. When his head is entirely free of the shell, as much as an entire hour may go by before he makes another movement. He sits there, tentacles drooping, as though he were dead. Finally a slow movement begins, the heavy shell falls to one side, then plunges to the floor, its weight dragging the owner along.'

Poey had a poet's ear and objected to the monotony which accompanies the recitation of a long list of family names each with the same ending. 'The terminations,' he wrote, 'should vary so that they sound most agreeable to the ear.' He objected (1: 308 f) to the 'continual hammering on the same consonants' as in Silphalidae, Ptinioidae, Rhysodidae, Scaphilidae, Lepturidae, etc. He preferred Silphales, Ptiniores, Rhysodides, but Scaphidilia, Lepturetae. The family names should be the nominative plural, taking their gender from the gender of the generic name, but trying for euphony all the time. Thus he felt that Scaphidilia is OK Scarabeilia not, Silphales sounds fine but neither Carabales nor Chrysomelales is acceptable, Sphaeridiota is good, but Hispidota is not as good as Hispidae, etc. Of course, those of us who lack completely the finesse of a poet's ear cannot detect all the subtle differences which Poey's finer senses experience.

At one point in the *Memorias* (1: 449), Poey discussed the question of 'modesty' in a writer. He found that some 'malignant readers' had objected to his use of his own name after each species described by himself instead of the more effacing 'mihi' or 'nobis' which authorities in his days were accustomed to use. He did this, he assured us, not out of a lack of modesty, but because he is a lover of the pure truth. 'If I write your name, why can't I write mine? And if a species is indeed *mihi* (mine) and not *tibi* (yours), why should I write *nobis* (ours)? And do not be offended that in most of my writings I use *yo* (I) and not *nos* (we). To my mind *nos* means me and all the parasites I carry around with me. And I am certain that normally I don't carry many parasites.'

Poey also had some ideas on nomenclature not recognized today. Like other of his contemporaries he altered names when he felt that they were incorrect. Thus he emended (1: 466) *Helicina luteopunctata* to *H. luteoapicata* (synonym of *Troschelviana scopulorum* (Morelet) *teste* Clench & Jacobson, 1971) because he noted that it was only the apex which was yellow. He also felt (1: 367) that the names of organisms wrongly described should not be granted nomenclatural status. In this he had ample justification forhis time, since in those days new species were rarely figured and notions of type designations were vague. He felt strongly about this and set up a Latin aphorism to express himself universally. It reads: *'Descriptio manca interdum prioritatem servare queat; erronea autem descriptio sub jugum synonymiae mittenda,'* which might be rendered as 'An incomplete description in the meantime establishes priority; but an erroneous description must pass under the yoke of synonymy.'

Even when it came to making up new names for new species, Poey did not lose his sense of humor. When he had to select a name for the troublesome Cuban beach midge, a kind of no-see-um, he based it upon the Greek word *oicactes*, meaning 'beach dweller.' He decided to make the generic name masculine since the Cubanscalled themidge 'el jején,' that is masculine. 'But (1: 238) my friend, Dr. Gundlach, with whom I entered into serious consultation on this matter, game me a humorous answer which I think is not unworthy of being included here, despite the seriousness of the subject. This was that jején's mode of attack, silently and with a short stiletto is 'propio del sexo femenino,' quite unlike the attack of the mosquito which advances boldly to battle, music blaring and brandishing its long spear or lance, just like a man.' Thus the species name was written *Oectata furens*, that is feminine. It might be observed that the credentials of the gentle naturalist Juan Gundlach on the true nature of women were questionable: although he died at age 86, he never married. Also it should be noted that Poey overlooked the fact that it is the female mosquito which attacks in such a bold, 'manly' fashion.

In a letter to the American malacologist Thomas Bland (May 2, 1857), Poey lets his imagination have free rein. This is how he describes a collecting trip which Gundlach undertook for him in the province of Oriente, home of some of the grandest camaenids of the world: 'Just imagine a general who is invading an enemy country. He advances on the capital and on the way conquers provinces, overcomes fortresses, etc. Such is Gundlach; he has already captured *petitiana* on the heights of Trinidad, he has overwhelmed *dennisoni* while advancing on Cabo Cruz, at Santiago he has dispersed the armies of *picta* and *muscarum*, at Guantánamo he made prisoners of *crassilabris*, and when he arrives at Baracoa, he will launch an assault on the great *imperator*.' There was a sequel to this which showed that Bland could go along with the gag. On August 24, 1857 Poey wrote that Gundlach was much flattered with the portrait Bland had painted of him, bearing the words, *'Veni, vidi, vici.'*

In the case of the library beetle (1: 228 ff), which Poey named *Anobium bibliothecarum* (*Anobium*--without life--because it plays dead when touched), he found a good lesson for man in its habits. It was probably sent us as a wise visitation from Providence to declare war against laziness and empty ostentation. The beetle attacks only unused or neglected books and dusty and overlooked herbaria and skin collections. But books and collections in constant and diligent use are safe from its predations. How wise is Providence in all its manifestations! Carrion, which is of no use to anyone, is rapidly destroyed by insects which make up for their diminutive size by their enormous fecundity and rapid growth. But *Anobium* attacks man's archives and the storehouses of his knowledge. Hence Providence gives him a fair chance to preserve these priceless treasures. It sends down an enemy of low fecundity, small destructive powers, and weak flying ability. A single unused volume can feed and shelter many generations of the beetle. Thus man, with ordinary diligence, can protect his books from attacks of this destroyer. In fairness I should add that in this beautifully written and highly informative essay, Poey gives many useful hints to librarians as to how to preserve their volumes, such as making sure that the areas where they are kept are dry and well ventilated, etc.

Most of Poey's articles in the *Memorias* deal with ichthyology, but even here his knowledge of, and interest in, anthropology serve to enrich his elaborate scientific discussions. When discussing the Cuban salmons, Poey tells us (1: 222) that in ancient, decadent Rome, where the fish was much esteemed, it was permitted to die slowly in the presence of the brutalized guests before it was cooked for their dinner. They found much pleasure in looking upon it as, in its dying agony, it ran a whole gamut of intensity in the red color of its scales. As to its flavor, Poey adds, opinions vary. Cuvier said it was the most popular fish in the market. But the Cuban savant found it to be just ordinary, not deserving of its high reputation.

With true literary grace, Poey described two incidents he witnessed inside a beehive (1: 142): 'At one time a slug entered a beehive; the inhospitable inhabitants immediately fell upon it with their barbarous stings and soon put it to death. When they realized it was too large and heavy to be dragged out, and feating the unpleasant consequences of its decaying, they encased the dead creature in a heavy coating of beeswax and thus provided the unhappy victim with embalmed tomb right in their own home.' And again: 'Another time a shelled snail crawled past the incautious warders at night and entered the hive. When dawn came it was already pasted to the ealls of the hive with a layer of wax over the aperture alone. The entire animal did not need to be encased. The snail had entered the hive bearing its own coffin on its back.'

At times Poey broke out in a truly poetic rapture as when he addressed the Lepidoptera. 'Graceful daughters of the air, winged flowers, symbols of innocence and guilelessness, may the crude hands of man never tarnish the delicate scales of your wings. May you come to me to ease my mind and to drive off the bitter cares which dealings with my fellow men so often bring me. But I deserve to suffer from these cares because I capturedyou, and then, instead of taking from you the tranquil felicity which you might have provided, I chose instead to undertake the study which began with a crime and ended with bitter sacrifices.' He quoted the French poet Lamartine to make his point: 'Deux chemins différents devant vous vont s'ouvrir:/ L'un conduit au bonheur, l'autre mène à la gloire;/ Mortels, il faut choisir.' (Two different roads lie open before you:/one leads to happiness, the other to glory;/ Mortals, it is for you to choose).

In his essay on the small freshwater fish of Cuba, he writes thus engagingly (1:374, ff): 'If we consider the small size of these fishes, we might be inclined to look upon them with contempt. But if we realize that they live in the lakes, creeks, and ditches of our fields and gardens -- which they adorn and enliven with their presence at the same time as, by a decree of Providence, they are purifying these waters by eating the slime and digesting the organic bits of matter -- we must look upon them as useful little fellow creatures and companions who are as pleasing as they are innocent. Whoever contemplates nature will not disdain these tiny fish in their games, their love affairs, their little wars, their gentle evolutions, their flashing and rapid flight. At times they come together in numerous clusters, at times they swim about one by one just above the bottom mud into which they plunge at the slightest sign of danger and hide in the roiled water. Sometimes they come to the surface to capture the flies and ants which other struggles and other games have precipitated into the liquid element. Or else they swallow the seeds blown by the wind and dragged along by the current. While the fascinated onlooker follows the thousand twistings and turnings of the fish, he is also delighted by the green, golden, and purplish reflections given off by the glittering scales. Happy indeed is the man who adorns his crystal fountains with them, and in their company forgets the burdens of life.'

There is charm even in Poey's instructions to fish breeders: 'All the species of small freshwater fish are viviparous. You can, dear reader, if you like, breed them in a transparent bowl in your own home and see them bring forth the fruits of their wombs. You will see the recently emerged young move around immediately with ease. You will make note of the day of their arrival, and every month you will record their growth in millimeters. You will soon note that the males are one-third retarded in their growth as compared with the females. You will see how day by day the abdominal area of the female becomes more obese. You will write down the first day that they give birth. How many childred were born? Are you sure that the mother hasn't already eaten some? It is safer to remove the young to another glass bowl. A month later you will see the mother give birth for a second time. If at first she produced 30 young, now she delivers 50. And she does this virtuously, because if you listened to my advice, you will not have introduced a male into the container during the last transfer. There is another delivery the following month and you will make a note of how long these continue. If you don't tire of the bother, you will finally count 200 young in one delivery. Now we should like to find out if the females who make these deliveries are as virtuous as the mothers; or if they, like Réaumur's aphids, remain fertilized for nine generations. This is not likely, but you might perform the experiment anyway. And to be certain, be sure to isolate a female from the moment of her birth' *(Ibid.)*.

At times Poey betrayed a fetching naiveté. When he was given a half dozen specimens of an undescribed species -- which he later named *Helicina titanica* because of its huge size (now *Emoda pulcherrima titanica teste* Clench & Jacobson, 1971a) each of which bore a large worn hole inside the parietal wall of the aperture, he decided that this was the work of the animal itself. 'It would appear,' he wrote (1: 111) 'that the aged animal finds itself too crowded in its cramped shell. Therefore with some part of its body rubbing against the wall, aided by some sort of corrosive liquid, it wears a hole through to make more room for itself. The presence of this hole,' he concluded, 'is sufficient to recognize the new species.' (It's sufficient to recognize members of the type-lot at any rate). Although Pfeiffer informed him by mail (1: 413) that it was doubtless the work of *Pagurus*, a land hermit crab, Poey was reluctant to surrender his opinion.

Even more naive is his report entitled *Account of a snake which lived in a human stomach* (1: 255 ff) (Historia de un ofidio que vivió en un estomago humano). It tells the story of a prominent lady in Havana who in 1852 expelled a live snake about 9 inches long from her mouth. At first Poey doubted the story and thought it was the result of some oversight on the part of the lady or a practical joke played on her by her servants. But finally he was convinced that the lady had indeed swallowed the snake *(Typhlops cubae)* when it was very small, and that it had lived and grown in her stomach. *Typhlops*, he noted, needs very little oxygen, lives in very humid surroundings, and often feeds in water. How about the digestive juices? They did not kill it, because, apparently, the infant snake was swallowed when the lady's stomach was in poor condition and hence not very active; only weak doses of the fluids were secreted. Moreover, the lady suffered from an upset stomach for the seven years she harbored the snake and lived only on rice and other bland substances. Hence the stomach dweller had to contend with only non-lethal amounts of digestive acids. The lady reported that she had felt the contortions of the snake in her stomach for seven years. After she spit it out her dispepsia vanished and she felt fine. In corroboration of the bizarre tale, Poey reported the account of a Panamanian priest who saw a woman expel a lizard from her stomach. This is indeed a strange account to be found cheek and jowl with some of the best descriptions of new fish, mollusks, and butterflies ever written.

Like many of his contemporaries, Poey believed in a scale of life reaching from the one-celled animals right up to man. A good deal of his philosophical cogitations were devoted to determining which animal is 'higher' on the scale. Like C. B. Adams and others, Poey put the land operculates ahead of the inoperculate pulmonates. His justification for this point of view is ingenious. Obviously, he stated, *Chondropoma* -- which is merely a kind of *Turbo* -- is ahead of the prosobranch because it breathes air, and air breathing is more advanced than water breathing. *Chondropoma* is also superior to *Helix* because it is dioecious -- obviously an advanced state in the 'scale'--and because it has an alternating means of locomotion like us; *Helix*, on the other hand, is hermaphroditic--a low state--and walks only on a single long sole, quite unlike the lords of creation.

Poey was an intensely religious man and believed firmly in purpose in nature and in the divine creation of all life--a thoroughgoing teleologist who believed that everything was created to fill a special purpose (2: 407 ff). Hence he did not take lightly to the ideas of Charles Darwin. The *Origin of the species* appeared in 1859, only two years before the last of the *Memorias* was written. This apparently was not enough time for Poey to digest fully the new ideas. He did not at first quite understand them. Thus he wrote (2: 407): 'They say that at the beginning the creature was not as perfect as it is considered to be now, that it led a dismal and painful existence, but after thousands of years, although many individuals perished, others succeeded in perfecting themselves, generation after generation, as a consequence of their needs and habits.' He notes that this must be false because Paleontology has no records of such 'imperfect' creatures. Curiously enough at one point (2: 111) Poey had actually rejected the term 'degeneration' in favor of 'modification' which appeared to him to be more correct. However, he believed that only superficial changes in 'created' fundamental characters were involved. Of course, Poey lived for 33 years after the publication of the last of the *Memorias* and may well have changed his mind about Darwinism. But that is the subject of another article.

In the same *Memoria* where these thoughts appear and in which a strong argument is made for divine purpose in the scheme of nature, Poey wrote a beautiful dithyramb on the Great Creator. I select a few of the verses: 'It is the Lord who guides the stork on its route from far Scandinavian valleys to the banks of the Niger and from the Lake of Niagara to the headwaters of the Orinoco; who discolsed to Kepler the laws of the stars; who guided Herschell and his telescope; who placed in Newton's head the idea of the fulcrum sought by old Archimedes to move the universe; who led Franklin to draw electricity from the skies; who opened the new world to Christopher Columbus; who gave Lavoisier the match with which, with a loud explosion, he set flame to hydrogen and oxygen and produced water; who made manifest to Cuvier the bowels of the earth and led him to the discovery of hosts of ancient and extinct animals; who taught architecture to the beaver and geometry to the bees; who moistens the wings of the breezes over the surface of the waters to refresh the earth seared by the pitiless rays of the sun,' and so on, often like parts of a psalm of David, eloquent and beautiful. But this reader was caught up short when he read: 'It was the Lord who dictated to Linnaeus the names of the plants and animals.' Genesis tells us that 'whatsoever the man would call every living creature, that was to be the name thereof' (2: 19). The faults, it seems, should rest with the great Swede and not with the Lord.

There are many other charming and intriguing articles in the *Memorias* discussion of which must be omitted for wwnt of space. But they should at least be mentioned. For instance the charming account of the honey bee (1: 222 ff) full of historical, lyrical, mythological, and classical allusions; the attractive account of a collecting trip to regions in Pinar del Río Province, the richest land shell collecting areas in Cuba (2: 17 ff); the absorbing discussion (2: 73) of the possibility of horse hairs turning into worms and other popular superstitions (Poey gently refuted all) such as spontaneous generation; the discussion of the blind fish and other troglodytes and how they came to be that way (2: 95 ff); the description of the life of the solitary wasp (2: 78) which includes a sprightly dialogue between writer and reader regarding the origin of the 'plants' (fungus) which grow from the insects in the fall, and others. All in all, fine reading for the curious reader with a strong taste for superlative writing, in addition to being a storehouse of important and original zoological information.

The *Memorias*, originally published in Havana, were reprinted in 1975 by Antiquariaat Junk in Lochem, Netherlands. The quotations from Poey's letters to Thomas Bland appear here through the courtesy of the Museum of Comparative Zoology library in Harvard University where this entire correspondence is on file.

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NEW COUNTY RECORDS OF LAND SNAILS OF TEXAS

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Collection of land snails in various regions of Texas over the past several years has resulted in numerous new county reports. All of the records which follow are from extant *in situ* populations; records from flood debris are not included in the following list because original provenance cannot be determined.

Personal records were compared with published records of the series by the Dallas Museum of Natural History for those families already covered (Cheatum and Fullington, 1971, 1973; Fullington and Pratt, 1974). For those families not yet covered by this series, Pilsbry (1939-1948) was chosen as a record of previous collections. For those snail species not listed by county in Pilsbry (e. g. 'entire state'), Strecker (1935) was utilized as the latest compilation. In addition, the recent literature was surveyed in order to eliminate duplication of county records by collections published subsequent to the above publications (e. g. Cheatum *et al.*, 1972; Pratt, 1965). The various introduced snails listed for Travis County have been previously listed (Neck, 1976) but are repeated here because the original reference is unlikely to be seen by malacologists.

Anguispira strongylodes (Pfeiffer). Goliad State Park, Goliad Co.; U.S. 59 and Guadalupe River, Victoria, Victoria Co.; Mother Neff State Park, Coryell Co.; San Bernard River near Old Ocean, Brazoria Co.; Stephen F. Austin State Park, Austin Co.

Carychium mexicanum (Pilsbry). Palmetto State Park, Gonzales Co.; Caddo Lake State Park, Harrison Co.; Sabinal Canyon State Park, Bandera Co.; Goliad State Park, Goliad Co.; San Bernard River near Old Ocean, Brazoria Co.; Stephen F. Austin State Park, Austin Co.; Fort Parker State Park, Limestone Co.

Catinella vermeta (Say). Mother Neff State Park, Coryell Co.; Goliad State Park, Goliad Co.

Deroceras laeve (Müller). Austin, Travis Co.; Brownsville, Cameron Co.; Lake Somerville State Park (Birch Creek Unit), Burleson Co.; Huntsville State Park, Walker Co.

Euconulus chersinus trochulus (Reinhardt). Goliad State Park, Goliad Co.; Caddo Lake State Park, Harrison Co.; U.S. 67 and Brazos River, Somervell Co.; San Bernard River near Old Ocean, Brazoria Co.; Stephen F. Austin State Park, Austin Co.

Euglandina singleyana (Binney). Sabinal Canyon State Park, Bandera Co.; Pedernales Falls State Park, Blanco Co.; Garner State Park, Garner Co.

Gastrocopta contracta (Say). Caddo Lake State Park, Harrison Co.; Austin, Travis Co.; Goliad State Park, Goliad Co.; Ebony Hill Research Station (near junction of 1604 and 471), Bexar Co.; Lake Brownwood State Park, Brown Co.; Stephen F. Austin State Park, Austin Co.

Gastrocopta cristata (Pilsbry & Vanatta). Longfellow, Pecos Co.

Gastrocopta pellucida hordeacella (Pilsbry). Goliad State Park, Goliad Co.; U. S. 59 and Guadalupe River, Victoria, Victoria Co.; Mother Neff State Park, Coryell Co.; Lake Brownwood State Park, Brown Co.; Athens, Henderson Co.

Gastrocopta pentodon (Say). Garner State Park, Uvalde Co.; Palmetto State Park, Gonzales Co.; Goliad State Park, Goliad Co.

Gastrocopta procera procera (Gould). Alpine, Brewster Co.; Raymondville, Willacy Co.; Brownsville, Cameron Co.; U. S. 59 and Guadalupe River, Victoria, Victoria Co.; Big Spring State Park, Howard Co.; Athens, Henderson Co.

Gastrocopta tappaniana (C.B. Adams). U.S. 59 and Guadalupe River, Victoria, Victoria Co.

Glyphyalina roemeri (Pilsbry & Ferriss). Sabinal Canyon State Park, Bandera Co.; Garner State Park, Uvalde Co.

Glyphyalina umbilicata (Cockerell). Caddo Lake State Park, Harrison Co.; Stephen F. Austin State Park, Austin Co.; Brownsville, Cameron Co.; Goliad State Park, Goliad Co.; Palmetto State Park, Gonzales Co.; Lake Brownwood State Park, Brown Co.; San Bernard River near Old Ocean, Brazoria Co.; Mother Neff State Park, Coryell Co.; Cleburne State Park, Johnson Co.; Upper Guadalupe River State Park, Kendall Co.; U. S. 59 and Guadalupe River, Victoria, Victoria Co.; Sabinal Canyon State Park, Bandera Co.

Hawaiia minuscula (Binney). Fort Parker State Park, Limestone Co.

Helicina orbiculata (Say). Goliad State Park, Goliad Co.; Goose Island State Park, Aransas Co., Stephen F. Austin State Park, Austin Co.

Helicodiscus eigenmanni Pilsbry. Sabinal Canyon State Park, Bandera Co.; Austin, Travis Co.; Ebony Hill Research Station (near junction of 1604 and 471), Bexar County.

Helicodiscus parallelus (Say). Caprock Canyons State Park, Briscoe Co.; Fort Parker State Park, Limestone Co.

Helicodiscus singleyanus (Pilsbry). Longfellow, Pecos Co.; Goliad State Park, Goliad Co.; Palmetto State Park, Gonzales Co.; Ebony Hill Research Station (near junction of 1604 and 471), Bexar Co.; Brownsville, Cameron Co.; Sabinal Canyon State Park, Bandera Co.; Lake Brownwood State Park, Brown Co.; Garner State Park, Uvalde Co.; Mother Neff State Park, Coryell Co.; Aransas National Wildlife Refuge, Aransas Co.; Stephen F. Austin State Park, Austin Co.

Helix aspersa Müller. Austin, Travis Co.; Lubbock, Lubbock Co.

Lehmannia poirieri (Mabille). Austin, Travis Co.

Limax flavus L. Austin, Travis Co.

Mesodon roemeri (Pfeiffer). Lake Brownwood State Park, Brown Co.; Enchanted Rock, Gillespie Co.; U.S. 90 and San Marcos River, Caldwell Co.; Cleburne State Park, Johnson Co.; Goliad State Park, Goliad Co.

Mesodon thyroidus (Say). Goliad State Park, Goliad Co.; Stephen F. Austin State Park, Austin Co.

Mesomphix friabilis (Binney). Goliad State Park, Goliad Co.; Stephen F. Austin State Park, Austin Co.; Martin Dies Jr. State Park, Jasper Co.

Microceramus texanus (Pilsbry). Sabinal State Park, Bandera Co.

Milax gagates (Draparnaud). Austin, Travis Co.

Opeas pyrgula Schmacker & Boettger. Austin, Travis Co.

Otala lactea Müller. Austin, Travis Co.

Otala vermiculata Müller. Austin, Travis Co.;

Philomycus carolinianus flexuolaris Rafinesque. Martin Dies Jr. State Park, Jasper Co.; Caddo Lake State Park, Harrison Co.; Shef's Woods, Smith Co.; Huntsville State Park, Walker Co.; Atlanta State Park, Cass Co.

Polygyra mooreana (Binney). Sabinal Canyon State Park, Bandera Co.; Goliad State Park, Goliad Co.; Dinosaur Valley State Park, Somervell Co.; Mother Neff State Park, Coryell Co.

Polygyra septemvolva volvoxis (Pfeiffer). Raymondville, Willacy Co.; Austin, Travis Co.

Polygyra texasiana texasiana (Moricand). Goliad State Park, Goliad Co.; Lake Brownwood State Park, Brown Co.

Praticolella berlandieriana (Moricand). Lake Corpus Christi State Park, San Patricio Co.

Praticolella pachyloma (Menke). Athens, Henderson Co.; Goliad State Park, Goliad Co.

Pupisoma dioscoricola (C. B. Adams). Goliad State Park, Goliad Co.

Pupoides albilabris (C. B. Adams). Goliad State Park, Goliad Co.; Raymondville, Willacy Co.; Stephen F. Austin State Park, Austin Co.; Lake Brownwood State Park, Brown Co.; Upper Guadalupe State Park, Comal Co.; Copper Breaks State Park, Hardeman Co.

Rabdotus alternatus alternatus (Say). Beeville, Bee Co.

Rabdotus dealbatus dealbatus (Say). Goliad State Park, Goliad Co.

Rabdotus mooreanus (Pfeiffer). Dinosaur Valley State Park, Somervell Co.

Rumina decollata (L.). Lubbock, Lubbock Co.; Midland, Midland Co.; Sabinal Canyon State Park, Bandera Co.; U.S. 67 and Brazos River, Somervell Co.

Stenotrema leai aliciae (Pilsbry). U.S. 59 and Guadalupe River, Victoria, Victoria Co.; Bastrop, Bastrop Co.; Goliad State Park, Goliad Co.

Strobilops aenea Pilsbry. San Bernard River near Old Ocean, Brazoria Co.

Strobilops texasiana Pilsbry & Ferriss. Sabinal Canyon State Park, Bandera Co.; Cleburne State Park, Johnson Co.; Mother Neff State Park, Coryell Co.; Stephen F. Austin State Park, Austin Co.; Goliad State Park, Goliad Co.; Caddo Lake State Park, Harrison Co.

Succinea luteola Gould. Alamo, Hidalgo Co.

Thysanophora hornii (Gabb). Sabinal Canyon State Park, Bandera Co.; Goliad State Park, Goliad Co.

Vallonia parvula Sterki. Caprock Canyons State Park, Briscoe Co.

Zonitoides arboreus (Say). Brownsville, Cameron Co.: Raymondville, Willacy Co.; Aransas National Wildlife Refuge, Aransas Co.; Lake Somerville State Park (Birch Creek Unit), Burleson Co.; San Bernard River near Old Ocean, Brazoria Co.; Goliad State Park, Goliad Co.; Athens, Henderson Co.; Atlanta State Park, Cass Co.; Caddo Lake State Park, Harrison Co.

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RECOLONIZATION OF *BITHYNIA TENTACULATA* (LINNAEUS) (MOLLUSCA, GASTROPODA, PROSOBRANCHIA) IN THE ZONE AFFECTED BY HEATED WATER OVERFLOWS FROM THE GENTILLY NUCLEAR PLANT, QUEBEC, CANADA

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ABSTRACT

Following the shutdown of the reactor of the Gentilly (Quebec) nuclear generating plant, we have studied, during the years 1973 and 1974, the recolonization of **Bithynia tentaculata** in the hot water receptive zone. Our results were compared with those obtained in a zone farther upstream. It appears that the effects of thermal pollution are more than instantaneous and may still be present two years after the return to initial conditions.

INTRODUCTION

Since June 1970, we have had the opportunity of studying the fauna and flora of a given segment of the Saint Lawrence River, before, during, and after the beginning of operation of the Gentilly nuclear plant. Our studies have permitted us, among other things, to notice that the molluscan fauna had been unable to tolerate a temperature increase of the order of 10° C. The death rates observed in the gastropod and bivalve populations inhabiting the heated water receptive zone were of 100 percent after only three months of operation.

In November 1972, owing to a heavy water shortage, the Gentilly I nuclear plant ceased operations With the closing down of the reactor, an exceptional situation arose, affecting studies on recolonization, by mollusks, of the zone affected by hot water.

Studies of this nature are rarely found in literature on the subject. This study had the advantage of enabling us to determine thermic effects in relation to time and consequently to verify the possible existence of a recolonization process. Where this existed, it was possible to determine the recolonization rate.

We studied the species *Bithynia tentaculata* (Linnaeus), formerly the most abundant in this bay; this species, incidentally, has always been numerically the best represented in surrounding biotopes.

MATERIALS AND METHODS

We have sampled on three transects (Fig. 1), each comprising 2 sample points. They are: transect A, situated upstream from the nuclear plant, whose depths at points 1 and 2 were respectively 1 and 1.5 m and transect B, located in the hot water receptive zone, where the depths are similar to those measured at transect A. Both transects are situated in zones characterized by similar biotopes, meaning that the distribution of aquatic plants in these stations is identical, the vegetation is composed of the same plant species and the substratum is composed mainly of mire. We are therefore in the presence of two zones capable of supporting a population of gastropods which are qualitatively and quantitatively similar. Transect C, situated 1200 m downstream from the effluent canal, is free from the lethal effects of the thermal impact; this has already been demonstrated by the use of infrared aerial photographs (Vaillancourt *et al.*, 1974). Not having studied the principal physical, chemical, and biological characteristics of this transect, we cannot compare it with transects A and B. However, mollusk sampling in this zone enables us to notice the presence of gastropods towards the downstream area and out of reach of the heated overflow.

The frequency of sampling is established as follows: one sampling at two-week intervals from May 1 to August 20, and a monthly sampling from September to December.

The gathering of benthos was carried out with a 1260 cm^2 Petersen dredge. At least four samples were taken from each station. After being brought to the laboratory, the samples were screened and the gastropods were sorted out and classified. They were then measured and weighed.

RESULTS

The density of *B, tentaculata* in the samples of transect A from stations 1 and 2 is constant from year to year (Table I). We have thus collected dur-

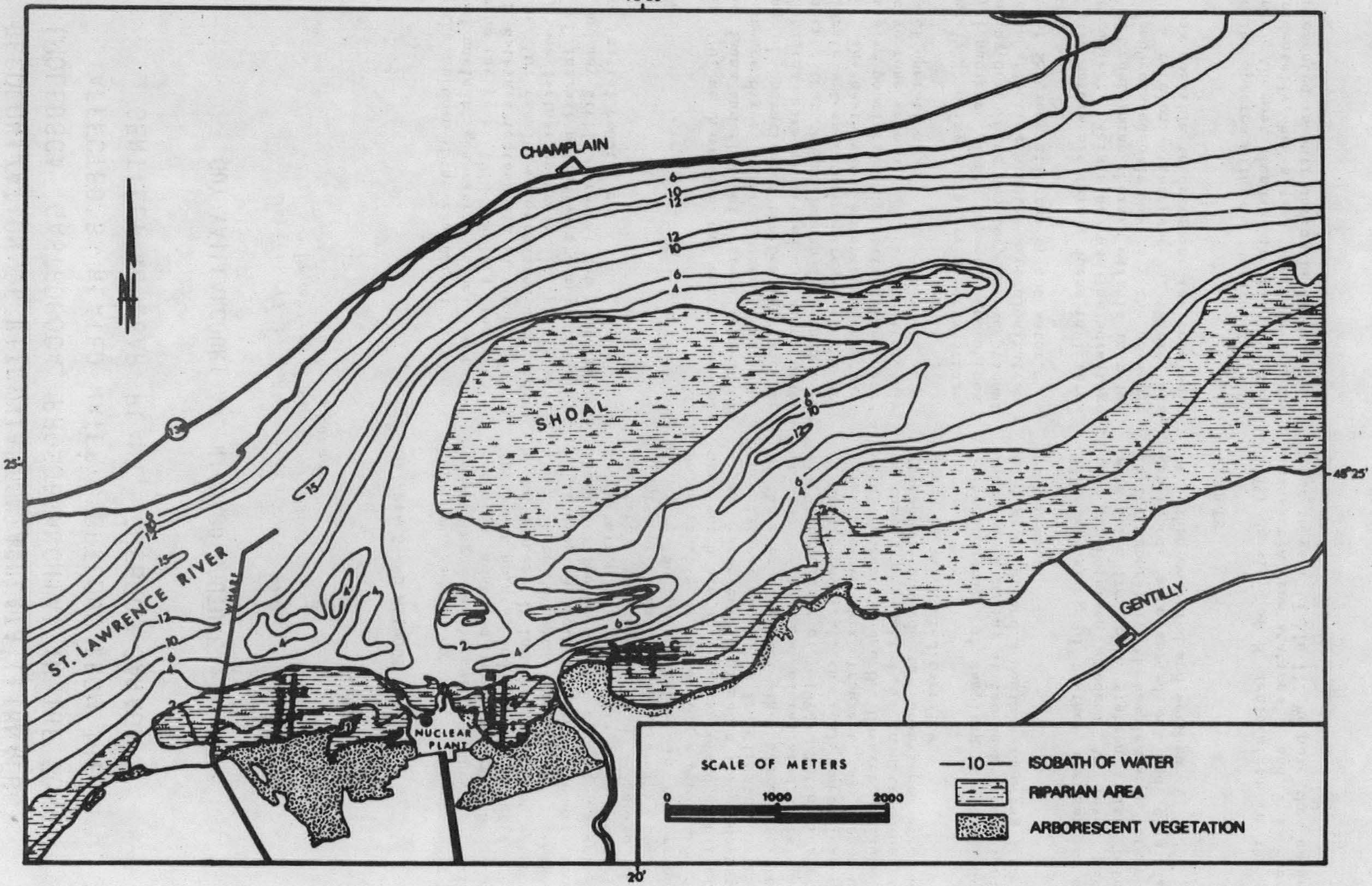

Figure 1. Region of the Gentilly nuclear plant.

ing the years 1973 and 1974 an average of 33.5 and 34.7 individuals per sampling. On the other hand, the density at station 1 is slightly inferior to the estimated density at station 2. Indeed, in 1973, we have gathered an average of 24 specimens at station 1, compared with 53.1 at station 2. However, in 1974 we obtain an average of 31.6 specimens at station 1 and 37.8 at station 2. These variations during the same season are the result of normal monthly variations which are, as demonstrated by Vaillancount and Couture (1974), related to local displacements and reproduction phenomena.

TABLE I. Monthly mean average per sampling of the number of living *Bithynia tentaculata* (Linnaeus) for the stations of transect A.

MONTH	1973 St. 1	1973 St. 2	1974 St. 1	1974 St. 2
May	30	77	56	5
June	10	45	6	13
July	19	17	5	24
August	21	75	66	89
September	--	--	5	16
October	21	51	56	80
November	43	54	--	--
	24	53.2	31.6	37.8
Mean	33.5		34.7	

Table II illustrates clearly the very low density of *B. tentaculata* in the zone affected by the thermal overflows. Indeed, in 1973, we find no specimens living at station 1; it is not until October that 7 individuals are found at station 2. However, in 1974, the first specimens taken into inventory were collected in October at station 1. At station 2, we sampled 3 individuals in May, 8 in June, 1 in August, and 8 in October, for a total of 20 specimens, compared with 7 in 1973. Therefore, only station 2 of transect B possesses enough living specimens capable of setting off the repopulating process of the little bay of Gentilly.

TABLE II. Monthly mean average per sampling of the number of living *Bithynia tentaculata* (Linnaeus) for the stations of transect B.

MONTH	1973 St. 1	1973 St. 2	1974 St. 1	1974 St. 2
May	0	0	0	3
June	0	0	0	8
July	0	0	0	0
August	0	0	0	1
September	–	–	0	0
October	0	7	2	8
November	–	–	–	–
	0.0	1.4	0.33	3.33
Mean	0.7		1.8	

– : no sample

We observe the presence of *B. tentaculata* at stations 1 and 2 of transect C (Table III). This sampling zone, situated 1200 m downstream from the heated overflow, is not affected by the hot water. This enables us to define the boundaries of the thermal effects of the Gentilly I nuclear plant; it would seem that the effects of the hot water are not felt beyond the Gentilly River.

TABLE III. Montnly mean average per sampling of the number of living *Bithynia tentaculata* (Linnaeus) for the Stations of transect C.

MONTH	1973 St. 1	1973 St. 2	1974 St. 1	1974 St. 2
May	–	–	14	16
June	–	–	6	6
July	13	5	2	9
August	9	8	27	3
September	–	–	2	1
October	14	5	52	4
November	15	21	–	–
	12.8	9.8	17.2	6.5
MEAN	11.3		11.9	

– : no sample

DISCUSSION AND CONCLUSION

The effects of thermal pollution are more than instantaneous and they may still be present two years after a return to initial conditions. In fact, two years after the end of operations at the Gentilly nuclear plant, the density of mollusks estimated in transect B is in marked contrast with the densities of transects A and C by the almost total absence of life. Nevertheless, the presence of 22 individuals in the summer of 1974 has permitted us to hope for the repopulation of *B. tentaculata* in this sector, as well as that of other species such as *Helisoma trivolvis* (Say), *Gyraulus parvus* (Say), and *Physa gyrina* (Say), which are widely distributed in the zones outside the cone of dejection.

We must note, however, that the geographic configuration of the zone affected by the hot water could slow down the rate of the process of recolonization which should normally take place by means of recruitment and migrations. Another factor likely to slow down the rate of recolonization could be the presence of disequilibrium inside the biota of this zone, even though we have not been able to detect it.

We have demonstrated in our previous works (Vaillancourt and Couture, 1972) that the density of *B.*

tentaculata was in a ratio of 3/2 at transect A in relation to transect B. Taking this ratio into account, as well as the rate of growth of the population of transect B in 1973 and 1974, we can predict, using the population growth formula

$$N_t = N_o e^{rt}$$

N_t : number of individuals at time t

N_o : number of individuals

e : base of natural logarithms

r : rate of population increase

t : elapsed time

that it will take 3.45 years (1977) to reach the normal density of *B. tentaculata* at transect B.

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DR. JARED P. KIRTLAND, CLEVELAND'S FIRST MALACOLOGIST AND SOME OF HIS CORRESPONDENCE 1/

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INTRODUCTION

When Dr. F.C. Waite gave his presidential address to the Ohio Academy of Science in 1930 entitled 'Jared Potter Kirtland--physician, teacher, horticulturist, and eminent naturalist,' he stated, 'It is especially fitting that the Ohio Academy of Science should acknowledge its indebtedness to the pioneers of science in Ohio' (Waite, 1930). So, too, should we recognize our indebtedness to the pioneers of American malacology. Biographical studies on Dr. Kirtland have been published by Garlick (1878), Silliman (1878), Whittlesey (1885), Newberry (1886), Mendenhall (1915), Waite (1930), Curtis (1941), Gehr (1950), Anonymous (1961), Mayfield (1965), and Dexter (1972).

Jared Potter Kirtland (1793-1877) was born at Wallingford, Connecticut, in 1793. He was raised largely by his grandfather, Dr. Jared Potter, who stimulated interest in both natural history and medicine in his young namesake. At the tender age of 15, young Kirtland discovered parthenogenesis in the silkworm moth by his own experiments and 50 years ahead of professional biologists (Newberry, 1886). (It is well known that many naturalists begin their studies of natural history early in life). In 1810 he joined his father at Poland, Ohio, a suburb of Youngstown founded by the elder Kirtland as an agent for the Connecticut Land Co. While in residence there, the young Kirtland collected mollusks from the Mahoning River. After teaching school for one year, he returned to Connecticut to study medicine at Yale and the University of Pennsylvania. He was awarded his M. D. degree by Yale in 1815. He then entered upon the practice of medicine and the study of natural history in Connecticut. After the tragic loss of his young family, he returned to Poland in 1823 where he established a medical practice and continued to study local mollusks. In 1829, he discovered separate sexes in the Unionidae, which he published in 1834. He wrote, 'It is a disputed point, whether they are androgynous or whether they possess distinct sexes.' After reviewing various opinions he continued, 'In the course of the three last years, I have dissected many hundreds of them [freshwater bivalves], and carefully observed their habits, under a variety of circumstances, until I am persuaded, that the sexes are distinct, and that each sex possesses a peculiar organization of body, associated with a corresponding form of the shell, sufficiently well marked to distinguish it from the other.' He then related this matter to problems of species identification. He pointed out that, 'It will be found, on pursuing this subject that some which have been described, as distinct species, differ from others, only in sex. The *Unio formus* of Lea is probably the male of *U. triangularis* of Barnes; and the *U. ridibundus* of Say, the female of the *U. sulcatus* of Lea.' (Kirtland, 1834).

Soon afterwards he discovered the byssus in the larval stage of freshwater mussels. 'On raising these animals from their beds at the bottom of the streams,' Kirtland wrote, 'a small silky filament could frequently be seen issuing from between the valves of the shell, and on tracing it to its origin, it was found to arise from the margin of the animal immediately behind the base of the muscular process, which is usually termed the foot.--It is in fact a bysus, similar in many respects to that with which the Chama and certain other bivalves are furnished, and by means of which they adhere to other bodies.' In describing it he stated, 'The length of this bysus when unextended, is from 4 to 6 inches; the size that of the finest sewing silk, and the strength is so great that it will resist the force of the strong-

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1/ This paper is based upon a report given at the 40th Annual Meeting of the American Malacological Union held at the Springfield Museum of Science, Springfield, Mass., on 6 August 1974. Acknowledgement is made to the Museum of Science, Boston, Mass., for permission to quote from the Kirtland correspondence on file in its archives, and to Dr. David H. Stansbery of the Ohio State University, Columbus, for his help with molluscan nomenclature.

est current of water, even after the animal is raised out of its bed.' (Kirtland, 1840).

During 1836-37, he was in charge of zoology for the first Geological Survey of Ohio (especially for mollusks, fishes, reptiles, birds, and mammals). Kirtland's 'Report on the Zoology of Ohio' appeared in 1838 in the Second Annual Report of the Ohio Geological Survey. He listed 169 species of Ohio mollusks.

In his account of the bivalves he followed the arrangement of Isaac Lea, but wrote concerning *Unio kirtlandianus* Lea that 'probably only a compressed variety of *U. subrotundus*--a regular gradation from one species to the other' (Kirtland, 1838). He also published frequent contributions to the Proceedings of the Boston Society of Natural History in which society he was an active member.

Soon he established an experimental farm at East Rockport (now Lakewood, west of Cleveland) primarily for developing new varieties of horticultural plants. He remained in residence there during the remainder of his long life. Between 1837-1842, he taught medicine at the Ohio Medical College in Cincinnati. During 1841-1842, he taught medicine at the Willoughby Medical School in northeastern Ohio. In 1843, he was one of the founders of the medical department of Western Reserve College in Cleveland and remained on the staff until 1864.

In addition to his medical and horticultural interests, he continued his studies in the natural sciences. He was a founder of the American Society of Geology and Natural History (1840) which became the American Association for the Advancement of Science five years later. At that time, Dr. Kirtland was elected to the Board of Managers at the Smithsonian Institution in Washington. With a group of mutual friends interested in natural history, known locally as the 'Arkites' (see Hendrickson, 1962), he organized the Cleveland Academy of Natural Sciences to provide a museum for the new medical department at Western Reserve College. Kirtland contributed especially specimens of mollusks and birds to this museum used in training medical students. He also read papers at the meetings, including studies on mollusks, and served the Academy as its President for 25 years. Eventually the Proceedings (1845-1859) were published in 1874. Cutler (1918) has traced briefly the origin of the Cleveland Academy of Natural Sciences. (Later this Academy became the Kirtland Society of Natural History (1869-1885) when the museum was no longer needed at the medical school. Eventually this formed the nucleus for the Cleveland Museum of Natural History. In recent years the Cleveland Museum of Natural History has published a series of research reports in a bulletin entitled *Kirtlandia* first published in 1967.

Dr. Kirtland had a lifelong interest in mollusks, fishes, and birds. He exchanged specimens with other naturalists and published papers on his studies of Ohio land and freshwater mollusks. He was a member of the American Society of Conchology. In 1851 he delivered a paper 'Remarks on the sexes and habits of some of the Acephalous bivalve Mollusca' at the Cincinnati meeting of the American Association for the Advancement of Science (Kirtland, 1851).

The following species of mollusks were named after Dr. Kirtland:

Ancylus kirtlandi Walker
Lymnaea kirtlandiana Lea
Melania kirtlandiana Lea, now known as *Oxytrema (Goniobasis) semicarinata* (Say)
Anculotus kirtlandianus Anthony, now known as *Spirodon dilatata* (Conrad)
Quadrula kirtlandiana (Lea)
Unio kirtlandianus Lea, now known as *Fusconaia subrotunda kirtlandiana* (Lea)
Pisidium kirtlandi Sterki

Dr. Kirtland corresponded with Louis Agassiz at the Museum of Comparative Zoology and with officials of the Boston Society of Natural History, including Dr. D. Humphrys Storer. Dr. Storer (1804-1891) was trained at the Harvard Medical School and became professor of obstetrics at that institution. He was a member of the commission for a Natural History Survey of Massachusetts, assembled a large shell collection of his own, and published on mollusks as well as his specialty on fishes. His professional career has been traced by White (1892). (It has been noted earlier that many outstanding naturalists of the 19th century were either practicing physicians or trained in medicine (See Dexter, 1972).

Dr. Kirtland wrote to Dr. Storer 28 November 1841, 'A few days before I left home [E. Rockport, now Lakewood, suburb of Cleveland] an unusual southerly gale drove the waters out of the Cleveland Harbor so as to expose sand bars that I never saw before. My nephew, by my directions, went upon them and obobtained numerous and fine specimens of the *Unio nasutus* [now *Ligumia nasuta* (Say)] and *Anodonta salmonia* of Lea [now *Anodonta grandis* Say].'

Dr. Kirtland wrote again to his friend 25 December 1841, 'Permit me to suggest that my friend J.G. Anthony [John Gould Anthony] of this city (Cincinnati) is without exception the best conchologist in the western country. He is the standard to which we all refer in this vicinity for authority touching the science of conchology. [This was before he developed eye trouble.] As a collector he is ardent and persevering and his cabinets are extensive and rich in both foreign and native shells, all of which are scientifically and beautifully arranged. He has, I believe, furnished the Boston Academy [Boston Society of Natural History] with descriptions of several new species of shells *(Helix striatella* [now *Discus cronkhitei* (Newcomb)] and *Paludina cincinnatiensis* [now *Amnicola integra* (Say)] and he is constantly laboring to diffuse specimens of our western shells [Ohio, Kentucky, Tennessee] and a knowledge of their habits by means of numerous correspondents.'

J. G. Anthony mentioned in his letter was John Gould Anthony (1804-1877) from Providence, Rhode Island. He was an accountant and businessman in Cincinnati. He became a noted amateur shell collector who was later brought to the Museum of Comparative Zoology by Louis Agassiz to become the first curator of mollusks at that Museum serving from 1863 to 1877. Anthony published many papers on land and freshwater mollusks. His biography and complete bibliography with taxa described by him have been published by Turner (1946).

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THE FRESHWATER NAIADS OF OHIO, PART I: ST. JOSEPH RIVER OF THE MAUMEE

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INTRODUCTION

The lack of information on the fauna and flora of most of Ohio streams makes it difficult to evaluate the changes which have occurred in the past, and to postulate the effects of those in the future. Details pertaining to specific areas in Ohio are generally lacking in the literature but they seem to abound in the files of many Ohio scientists. The federal, state, and local governments, as well as environmental societies are alarmed at the changes which are taking and will take place with our present methods of advancing or improving our standard of living. Consequently, this paper attempts to make available data collected from the St. Joseph of the Maumee by the author and Henry van der Schalie, and to assemble scattered published and unpublished information on that river.

Although it lies in one of the crossroads by which two major molluscan faunas of the United States merge, the naiades (mussels) of this stream received only casual consideration.

This information was not the result of a planned study, but contains compilations of unscheduled collections as well as some made by Henry van der Schalie and Harold Harry serving to supplement those of the author.

GEOLOGY

As was clearly stated (Anon. 1964) 'The present land surface of the St. Joseph River basin is the product of intermittent continental glaciation which began about one million years ago, and ended only a few thousand years ago. Four invasions of ice separated by long interglacial periods occurred. The last glacier, the Wisconsin, is mainly responsible for the existing land forms. Evidence of pre-Wisconsin glaciation is found south of Hillsdale where logs reveal a layer of muck, a former land surface, about one hundred feet below the present surface.'

'The glacial land forms in the St. Joseph (Maumee) Basin, such as moraines formed when the ice front was pushing outward and dumping great masses of intermixed clays, sands, gravels and boulders; till plains, fairly level deposits of morainic materials laid down by the washing of stagnant ice; and outwash deposits of sand and gravel washed from the melting ice front--have all been altered by subsequent erosion and soil formation.'

The drainage area of the St. Joseph River is gently rolling to moderately hilly, due to the uneven deposition of a thick layer of glacial till. It has the rolling surface, smooth rounded slopes, sandy or gravelly plains, and nearly level clay plains characteristic of glacial origin. Marshes and bogs abound on the unmodified drift, especially in the upper portions of the drainage area. Extensive peat deposits and muck deposits occur throughout the basin, especially around the lakes, and numerous tamarack bogs are present. Hundreds of lakes, ranging up to acres in size are scattered throughout the upper reaches of the basin. Most of the headwater streams arise in the lakes or bogs and carry clear water. Their courses are varied in direction for, in general, they are governed by accidents of glacial deposition. Headwater streams of the St. Joseph Rivers (of the Maumee and Lake Michigan), such as Crooked Creek, Pigeon, Turkey, and Fish creeks occupy old glacial channels (Smith, Tharp, Bashnell, and Ulrich, 1940).

The divide between the Mississippi and the St. Lawrence drainages passes just west of Fort Wayne, Indiana and around the rather vague headwaters of the Eel River in eastern Noble County, Indiana. 'This divide is nowhere high and is not sharply defined. In places it is so indefinite that water near it at times goes either w y, as in the old glacial water routes near Ft. Wayne and South Bend. During the flood of March, 1913, water from the St. Marys River passed over the broad flat divide immediately west of Ft. Wayne in a stream several feet deep and nearly one-half mile wide.' (Malott, 1922).

The indefinite nature of this drainage divide is illustrated in comments by Dyer (1892), 'The most important of these water gaps is the Pigeon-Fish Valley, which cuts through the entire moranic system from the St. Joseph of the Maumee to the St. Joseph of Lake Michigan. Its course across the moraines is thirty miles long, its average width about one mile, and its depression below the surface on either side within the limits of 150 feet.' (1892).

The lakes of the Pigeon River Chain are strung in a course 25 miles long, with Cedar Lake or bog at the head, from which the stream flows southward into Long Lake in the Pigeon-Fish Valley. A low divide exists between the waters of Pigeon Creek and Pleasant Lake, and those of Fish Creek and the St. Joseph of the Maumee (Dyer, 1892).

In a discussion of *Notropis heterodon* (Cope), Gerking (1947) evidently referred to this possible connection in the Pigeon-Fish Valley between the Pigeon River, a tributary of the St. Joseph River of Lake Michigan and Hamilton Lake which drains into Fish Creek and the St. Joseph of the Maumee. Gerking (1945) reported *Ericymba* from the St. Joseph of Lake Michigan as well as from Hamilton Lake. Wallace (1973) stated in reference to the above, 'Thus if *E. buccata* arrived too late to use the Maumee Outlet, it may have reached the Lake Erie drainage by crossing the watershed drainages in Indiana and Ohio. Possibly both of these means were utilized.'

PHYSIOGRAPHY

The St. Joseph of the Maumee arises in the uplands of Hillsdale County, Michigan. It flows in a southwest direction through Williams and Defiance Counties, Ohio and DeKalb and Allen Counties, Indiana to its junction with the St. Marys at Ft. Wayne to form the Maumee River. One major tributary, Fish Creek, extends from Ohio into the Indiana counties of Steuben and DeKalb.

This river is 100 miles long (Flynn & Flynn, 1904) of which approximately 35 miles of the main stream flows through Indiana, 39.5 miles in Ohio and 24.5 miles in Michigan. According to Brown (1944), 150 miles of tributary streams of the Maumee River (its tributary the St. Joseph River) drain the Michigan area of the basin. Sherman (1932) found the entire St. Joseph River Basin to include 1060 square miles. A map of Ohio showing the principal streams and their drainage areas (1964) indicates that 603 square miles of this area lies in Indiana, 238 in Ohio and 219 in Michigan.

The St. Joseph River arises as a small stream at an elevation of about 1050 feet above sea level, and falls 313 feet (an average of 3.1 feet per mile) throughout its course (Flynn & Flynn, 1904). Leverett (1897) estimated a fall of nearly two feet per mile. Sherman (1932) reported the same average for the Ohio portion. An average fall in feet per mile of 7.5 was reported for Fish Creek, 11.11 for Bear Creek, 10.7 in Eagle Creek, 7.74 in Nettle Creek, 8 for the West Branch of the St. Joseph River, 11.9 for the East Branch, and 12.3 for Silver Creek.

Leverett (1897) stated that the stream flowed throughout most of its course in a narrow plain between two moranic ridges and its descent was determined by that plain. He also reported that its valley cuts only 25 to 50 feet into the plain, and that its bottoms are narrow. In the Ohio Water Inventory Report (No. 11, 1960), the river is described as meandering widely as it, '.... follows the course of an old preglacial stream called Montpelier Creek' (Stout, Ver Steeg, and Lamb, 1943).

Soil types of the drainage area are reflected in water percolation and stream flow. The upper East Branch of the St. Joseph River drains an area of fairly light soils and has a stream flow constant and cool enough to maintain trout (Anon. 1964). The capacity of the drainage area to store and release water into the stream is illustrated by Kirsch's (1895) report of a flow of 55,000 gallons per minute in the entire six miles southwest of Hudson, Michigan, and a discharge of 2,000 gallons per minute from Fish Lake (Hamilton Lake, Indiana) into Fish Creek. The Michigan report on water conditions and usages (Anon. 1964) shows a wide variation in the stream flow near Hudson, from 3,360 c.f.s. in April, 1956 to no flow in August, 1964. The Ohio report on water pollution in the Lake Erie Basin (1966) listed maximum and minimum flows of 10,000 c.f.s. and 1.6 c.f.s. for the St. Joseph River.

Kirsch (1893) described the headwaters of the East Branch as having a gravel bottom in most places with some areas of mud. He also reported large drifts of wood. Farther downstream, the channel of bluish clay had eroded unevenly, leaving many projections and numerous holes, with long stretches of quiet water with depths up to four feet. Riffles were few, aquatic vegetation scarce, and the water not clear. The banks of the channel were six to eight feet high. Near Edgerton, he describes the main stream as 45 to 50 feet in width with almost perpendicular banks 8 to 10 feet high. Riffles were few and the stream was almost free of vegetation. He described Fish Creek as having the upper end dredged, but with the remainder crooked, swinging from side to side across the bottom land. Two miles from the source, its bed was mostly sand, at some places covered with coarse gravel; but in three woodland areas, it had largely a mud bottom. Many ditches and springs enter the creek increasing its volume rapidly. It was approximately 13 feet wide immediately below Fish Lake, but averaged only seven inches in depth. Everywhere in shallows, the channel was covered with water weeds and algae. Lizards tail was most common along the shore.

Near Edgerton, Fish Creek was 20 to 25 feet wide with clay banks about five feet high (Kirsch, 1893). 'The bottom of the channel is also clay and where not covered with sand or gravel is very slippery.' (Kirsch, 1893). He added that the stream was almost free of vegetation. He described Cedar Creek as having widths of 10 to 12 feet in the upper reaches, with depths of eight to 10 inches and a bottom mostly of mud, but gravelly on the riffles. It was dredged and straightened for two miles below Cedar Lake; but the remainder was very crooked with many deep holes and frequent gravelly shoals.

An anonymous author (1964) stated, 'The land use pattern of the Maumee Basin is today virtually what it was a century ago.' It continues, 'Because of the continuing stability of land use in the basin, traditional water resource demands and uses have not changed appreciably for many decades. Stream flow, as it is influenced by land use, appears to remain virtually unchanged.'

The St. Joseph River Basin is rather narrowly hemmed in between the Ft. Wayne moraine at the east and the Wabash moraine on the west. The morainic belt extends in a northeast-southwest direction from the junction of the St. Joseph and St. Marys Rivers at Ft. Wayne, Indiana into the headwaters in Hillsdale County, Michigan. The drainage basin of the St. Joseph lies almost wholly on its western bank.

WATER QUALITY

Water quality data were not obtained when the naiad collections were made, and can only be postulated from many isolated bits of data in a variety of reports. Gallagher (1941) described a fish kill on August 23, 1941. It was reported extending into Indiana. Fourteen species were identified, and local residents were amazed at the large population present. The kill started immediately below the point of discharge of tomato wastes from a cannery. The correspondence indicates that milk and other cannery wastes were present. It also revealed that a similar kill had occurred three years prior, at about the same time of year, and at the same location. A letter to the editor of the Record Harold, Butler, Indiana on July 23, 1942 reports cannery pollution from Edgerton, and the loss of fish downstream into Indiana. A letter dated November 18, 1941, from Thomas Gallagher to L. W. Lawton, Dayton, Ohio, is based on a fish kill at Edgerton which was correlated with the canneries. A reduction in cannery wastes followed the joint investigation of this fish kill by the Ohio Department of Health and Division of Conservation and Natural Resources, and no other fish kills were reported in a later letter (Gallagher, 1949).

Gerking (1945) reported Cedar Creek, Indiana, was polluted with cannery wastes and city sewage. He stated that near Auburn, sewage from both that city and Garrett entered the stream. He found only eight species of fish at his collection station four miles below Auburn, but 21 species above the city near Waterloo, even though some cannery wastes were seasonally deposited in the stream near that point. He reasoned that the sewage from Garrett and Auburn have been effective in limiting the fish population for a few miles downstream. He added, 'Experience in the field has led to the belief that the absence of darters .... from a stream, particularly the riffles, is a good indication of the presence of pollution.'

Table 6-2 (Anon. 1964) indicates that the section of the St. Joseph River from Montpelier to an area about one-half way through Defiance County contains industrial wastes including phenols, oil, cyanide, C.O.D., zinc, chromium and C.K. Below this area and to Ft. Wayne, the stream was found to contain phenol, oil, cyanide, zinc, copper, nickel, and high levels of carbon dioxide. This report estimated an annual runoff of 30,000 tons of calcium per year, 20,000 tons of sulfate, 9,000 tons of magnesium, 6,500 tons of chlorides, 3,700 of silicates, 4,100 sodium, 800 of potassium, 500 tons of total nitrogen, and 140 of phosphate. Table 6-1 of this report indicates that the combined municipal wastes of Montpelier, Ohio, Butler, Auburn, and Garrett, Indiana have a BOD of approximately 3,500 pounds per day.

The over-all water quality of the St. Joseph River was considered good (Anon. 1966); but a BOD of 764 pounds per day was reported for the Montpelier sewage treatment plant. Dissolved oxygen records of 2 mg/l were recorded several times in summer below Montpelier; and biological conditions of gross pollution were apparent at these times.

The stream receives plating wastes of rinse water of 30 gallons per minute containing cyanides, chromium, cadmium, and copper at Edgerton, Ohio (Anon., 1953). At low flow these wastes produce critical conditions. Cannery wastes below Edgerton must be controlled to maintain desirable water quality; and Edon has no public sewer system (Anon. 1953).

At Auburn, a gas manufacturing plant, located on a tributary ditch which empties into the St. Joseph River, has at times discharged wastes high in phenol content (Anon. 1953). This report also reveals that the city of Ft. Wayne, with its waterworks intake located approximately 23 miles below the point of discharge of these wastes, has frequently reported phenol problems.

Garrett, Waterloo, and Butler, all in Indiana and located on small tributaries, need to provide secondary treatment (85 to 95% reduction of BOD Anon., 1953). The report adds that Auburn, Indiana provides secondary treatment, but does not treat all sewage discharged into the stream. Adequate collection of sewage is needed in Avilla and Grabill, Indiana.

Water quality of the St. Joseph River at State Highway 30 near Blakeslee, Ohio was reported by Hubble and Collier (1960) as follows:

	10/5/55	4/25/56
Silica	7.40 ppm	3.10 ppm
Iron	.03	.03
Calcium	67.00	85.00
Magnesium	25.00	23.00
Sodium	10.00	6.10
Potassium	2.30	1.00
Sulfate	41.00	74.00
Chloride	7.05	12.00
Fluoride	.40	.30
Nitrite	1.60	1.80
Phosphate	.03	
Dissolved solids	350.00	305.00
Hardness, magnesium	270.00	307.00
Hardness, noncarbonate	34.00	90.00
pH	7.90	8.00
Color	12.00	15.00
Dissolved oxygen saturation	82.00%	79.00%
Dissolved oxygen	8.00 ppm	9.40 ppm

Allison (1965) described the West Branch of the St. Joseph River as having high water quality not influenced by pollution, with stable flow levels that support smallmouth and rockbass populations.

The upper reaches of the St. Joseph River in Michigan includes the villages of Camden, Montgomery, and Reading with a total population of 1924 (Anon., 1964). This report indicated that Camden had no sewage collection or treatment at that time, and some untreated and treated sewage entered the stream from the other two communities. The area contains some silt and clay soils which together with bank and sheet erosion contribute substantial amounts of suspended solids to the flowing water.

Instances of pollution in tributaries probably had some adverse effects on the main stream below their mouths. Kills occurred in Brush Creek in 1953, 1954, 1956, 1962, and 1969. Dissolved oxygen was reduced to 1.2 ppm in 1956. In 1959, a kill in Bear Creek below Edon affected an area at least four miles downstream and thousands of fish, comprised of ten species, died when the oxygen dropped to 0.9 ppm on September 2.

FISHES OF THE ST. JOSEPH RIVER

Fish are credited as the means by which the Maumee and Lake Erie Basins were stocked with fresh water naiads. Their movements through the Wabash-Maumee outlet were described by Barney (1926), Greene (1935) and Hubbs and Lagler in 1947. The close association of mussel glochidia is well known; but the hosts or carriers of individual species is not well enough documented to theorize on the population of naiads to be expected in a stream on the basis of the fish population. The habitat or ecological conditions could probably be more closely correlated with naiad populations than fish species which may have been migrants or at best temporary visitants at the time they were captured. This supposition is also supported by the large number of fish in Nettle Lake as compared with the limited number of species of naiads in the lake (Table 1). This table also provides data on the fish population of the mainstream and major tributaries. These records may sometime be valuable in correlating information on the relation of fish and naiad distribution.

It is noted (Table 1) that 47 species of fish have been reported from Nettle Lake, 41 from the mainstream of the St. Joseph River in Ohio, 36 from the Ohio portion of Fish Creek and 36 fish species and one lamprey from the Michigan headwater tributaries, 27 from the Ohio waters of the West Branch, 21 from both Nettle and Silver Creeks, 16 from Bear and nine from Eagle Creeks in Ohio wwters. The bulk of the species recorded were provided by 1949 through 1955 stream surveys. The Ohio Division of Wildlife's records, in recent years, seldom list a dozen species of fish at any collecting site. These do not compare with the early records of the author which contained as many as 27 species taken during one seining survey at Nettle Lake, 27 at one site in the St. Joseph River, 24 in Fish Creek, as in the West Branch of the St. Joseph, 16 in Nettle and 15 in Silver Creeks in the years covered by this study (Table 1).

Table 1 reports 62 species and subspecies of fish taken from the Ohio waters of the St. Joseph River. These 62 species include representatives of the Ohio families of fish which are normally found in Ohio streams.

The well known runs of walleye and northern pike, white bass, and suckers may be nothing more than a movement upstream to the most desirable spawning areas. The large numbers of hatch-of-the-year smallmouth bass and suckers, and the adult minnows and darters found in headwater streams, which normally dry up in August, indicate that fish can and do move into the extreme headwaters as well as carry out the limited movements indicated by most fish movement studies.

A vast reservoir of information is available on the movements of fish; and it is generally comparable with the data presented by Funk (1955). He presented a concept of a sedentary and a mobile group within the population of most species. He found that the population of some species contains more of the sedentary group while other species include more of the adventurous, far roaming individuals, and that this adventurous group was often comprised of certain size or age groups.

Movements of minnows and darters, as well as larger species also occurs; but less information on them is available. Page and Smith (1971) reported annual migration patterns for both *Percina phoxocephala* and *P. sciera*, but could not determine the winter habitat. Page (1974) reported that after hatching, '.... young *Etheostoma squamiceps* dispersed throughout the Big Creek system, mostly moving downstream.' May (1969) reported a small number of *Etheostoma variatum* moved nearly three miles. Peckham and Dineen (1957) reported that Abbott (1970) had observed nearly ripe female mud minnows moving upstream.

Although the sedentary nature of some fish and homing of some others has definitely been proven (Gerking, 1950 and Larimore, 1952), the limited movements of large numbers of fish or the long distance travels of a few fish carrying sometimes hundreds of glochidia could result in a gradual expansion of the distribution of a mussel population, if habitat conditions were favorable.

THE NAIAD FAUNA OF THE ST. JOSEPH RIVER

Call (1896) called attention to the fact that several Ohio drainage mollusks are found in the Maumee River, close to the headwaters of the East Fork of the Aboite River near Ft. Wayne. He also called attention to the relation of the Wwbash and Erie Canal which had existed long enough to permit some interchange of faunas. He indicated that this relationship to distribution in terms of glaciation and its physiographic results already in an earlier paper of 1886.

Table 1. Fishes of the St. Joseph River and tributaries in Ohio

Species	Fish Creek	Bear Creek	Eagle Creek	Nettle Creek	Nettle Lake	W. Br. St. Joe	Silver Creek	St. Joe. River
Amia calva Linnaeus								
Dorosoma cepedianum (Lesueur)					X			X
Umbra limi (Kirtland)		X	X		X			
Esox americanus vermiculatus Lesueur	X			X	X	X	X	X
Esox lucius Linnaeus					X			
Compostoma anomalum (Raf)		X	X	X	X	X		X
Cyprinus carpio Linnaeus	X			X	X			X
Ericymba buccata Cope	X	X		X	X	X	X	X
Hybopsis amblops (Raf)	X					X	X	X
Nocomis biguttatus (Kirtland)							X	X
Nocomis micropogon (Cope)	X	X		X	X		X	X
Notemigonus crysoleucas (Mitchill)					X	X		
Notropis cornutus chrysocephalus (Raf)	X				X	X	X	X
Notropis cornutus frontalis (Agassiz)						X	X	X
Notropis emiliae (Hay)					X			
Notropis photogenis (Cope)	X					X		X
Notropis rubellus (Agassiz)	X				X	X		X
Notropis spilopterus (Cope)	X				X	X	X	X
Notropis stramineus (Cope)	X	X			X	X		X
Notropis umbratilis (Girard)	X	X		X		X	X	
Notropis volucellus (Cope)	X					X		X
Phenacobius mirabilis (Girard)		X						
Pimephales notatus (Raf)	X	X	X	X	X	X	X	X
Pimephales promelas Rafinesque	X	X	X	X		X	X	X
Rhinichthys atratulus (Hermann)	X							X
Semotilus atromaculatus (Mitchill)	X	X	X	X		X	X	X
Carpiodes cyprinus (Lesueur)		X			X	X		
Catostomus commersoni (Lacepede)	X	X	X	X	X	X	X	X
Erimyzon oblongus (Mitchill)					X	X		X
Hypentelium nigricans (Lesueur)				X	X	X	X	X
Minetrema melanops (Raf)				X	X			
Moxostoma erythrurum (Raf)	X				X			X
Ictalurus melas (Raf)		X		X	X		X	X
Ictalurus natalis (Lesueur)	X			X	X			X
Ictalurus nebulosus (Lesueur)					X			X
Ictalurus punctatus (Raf)					X			X
Noturus flavus Rafinesque	X				X	X	X	X
Noturus gyrinus (Mitchill)					X			
Noturus miurus Jordan	X				X	X	X	X
Fundulus notatus (Raf)	X	X		X	X	X		X
Labidesthes sicculus (Cope)					X			
Ambloplites rupestris (Raf)	X				X	X		X
Lepomis cyanellus Rafinesque	X				X	X		X
Lepomis gibbosus (Linnaeus)					X			
Lepomis gulosus (Cuvier)					X	X		X
Lepomis macrochirus Rafinesque				X	X	X		
Lepomis megalotis Rafinesque	X				X	X		X
Lepomis humilis (Girard)	X				X			X
Micropterus dolomieu Lacepede	X			X	X	X		
Micropterus salmoides (Lacepede)	X			X	X	X		
Pomoxis annualaris Rafinesque	X			X	X			X
Pomoxis nigromaculatus (Lesueur)					X			
Ammocrypta pellucida (Putnam)	X					X		X
Etheostoma blennioides Rafinesque	X		X	X		X	X	X
Etheostoma caeruleum Storer	X					X		X
Etheostoma exile (Girard)					X			
Etheostoma nigrum Rafinesque	X	X	X	X	X	X	X	X
Etheostoma flabellare Rafinesque						X	X	
Etheostoma spectabile (Agassiz)	X	X	X		X			
Perca flavescens (Mitchill)					X			X
Percina caprodes (Raf)					X	X		
Percina maculata (Girard)	X				X	X	X	X
Stizostedion vitreum (Mitchill)					X			X
Cottus bairdi Girard	X					X	X	

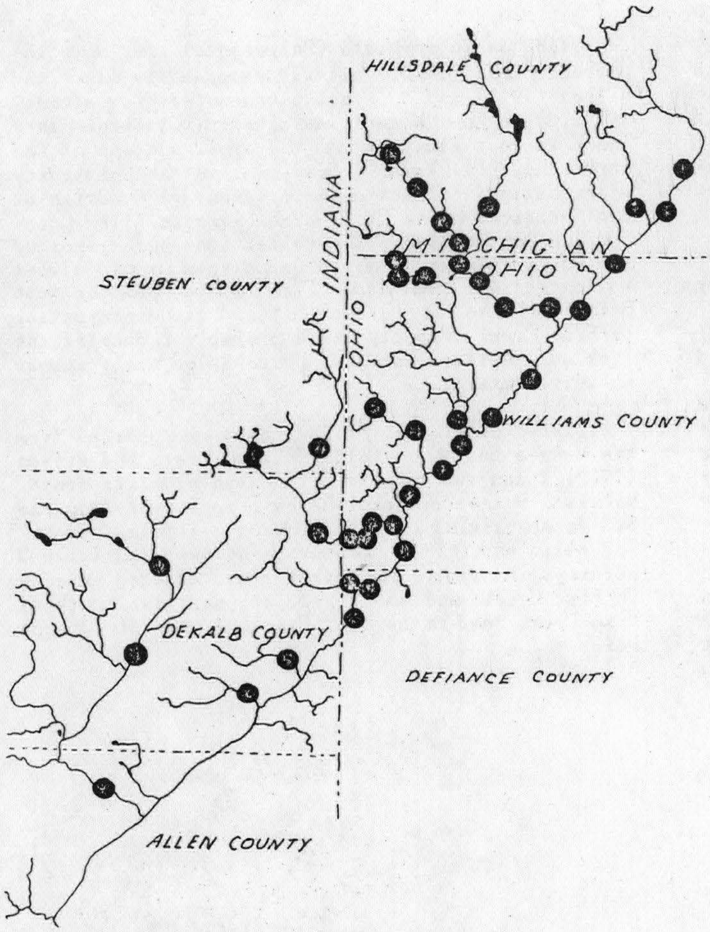


Fig. 1. Distribution of the collection stations of naiads which provide the basis for this report on the St. Joseph River.

According to Walker (1913), the preglacial fauna of the St. Lawrence system was exterminated during the glacial period. Later the naiad fauna of Lake Erie was established by fish carrying mussels into Lake Erie through the Maumee River during post-glacial Lake Maumee period. He gave *Alasmidonta marginata, Actinonaias carinata*, and *Lampsilis fasciola* as examples of mussels that entered which now have discontinuous distribution patterns in the Lake Erie Basin. Goodrich (1914) reported that the Little Wabash and St. Marys Rivers approach within three miles of each other southwest of Ft. Wayne, Indiana. The divide between the streams is not noticeable and flood waters connected them in 1913. Ortmann (1924) supported Walker's theories, but showed that invasion of the area could also have occurred during the Trent Outlet Stage when the Maumee River extended through the Lake Erie Basin which was then practically dry area (Ortmann, 1924). Henry van der Schalie (1939), in a discussion of facts presented by Walker (1913) and Ortmann (1924) stated, 'In these accounts there is ample evidence to show that mussels crossed these present divides only when rivers had formerly crossed them'

PRESENTATION OF SPECIES DATA

Amblema costata Rafinesque was reported by Kirsch from Cedar Creek near Waterloo, Indiana (1895) but it was not included in the naiads of the Maumee by Call (1900). It was considered by Clark and Wilson (1912) as second in abundance in the Maumee during their survey. They reported this species as abundant in the St. Joseph at Robinson Park and in the feeder canal at Ft. Wayne, and stated that they obtained large specimens at both places. Goodrich and van der Schalie (1944) noted that the 'three-ridge' was reported from the St. Joseph River northeast of Ft. Wayne. Goodrich collected specimens in the river about eight and one-half miles northeast of Ft. Wayne and in Silver Creek, Williams County, Ohio in 1941. Marsh collected it in the St. Joseph in Hillsdale County, Michigan, near Waldron, in 1941. These specimens are in the University of Michigan, Museum of Zoology. It was taken at 18 of the 40 sites collected during this study. Most specimens came from larger streams.

Fusconaia flava (Rafinesque). Call's 1896a and 1900 all inclusive comments on distribution of this species in Indiana would indicate it was found in the St. Joseph River. His statements are supported by Clark and Wilson (1912) who found it to be, '...

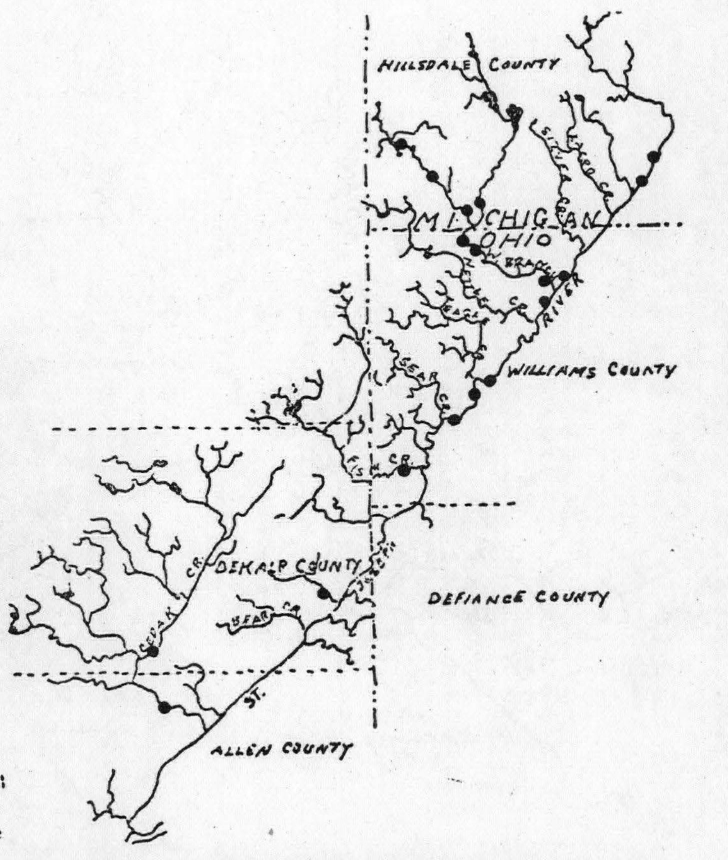


Fig. 2. Distribution of *Amblema costata* Rafinesque in the St. Joseph River Basin.

fairly common all along the Maumee and its tributaries ....' and, '...abundant in the feeder canal and reservoir at Ft. Wayne, Indiana.' Collections in the Museum of Zoology at Michigan indicate that it was found by most collectors in the drainage at most of their stations. Table 2 shows its wide distribution throughout the St. Joseph River basin with greater abundance in the tributaries rather than the main stream.

Quadrula cylindrica (Say) was not mentioned by Call in 1894, 1896, or 1900 as being found in the Maumee drainage of Indiana. Clark and Wilson (1912) found a few in the feeder canal at Ft. Wayne and two half shells in the mouth of the St. Joseph. They considered this the form *Q. c. strigillatus* since those taken from the quiet waters of the canal were beautifully marked with green triangles and fine capillary rays. Goodrich and van der Schalie (1944) indicate that this species crossed from the Ohio drainage over the low divide into the Maumee drainage. Live specimens were taken during this study in the main stream of the St. Joseph, Fish Creek and the West Branch of the St. Joseph. Not more than four were taken at any location. Dead shells were taken at two other sites in the main stream; but none was found in Indiana.

Cyclonaias tuberculata (Rafinesque) was not reported by Call (1900), but was recorded by Clark and Wilson (1912) as, '... not a common species of mussel ...' in the Maumee and its tributaries. They found it most abundant in the upper portion of the stream near Ft. Wayne. Specimens in the University of Michigan's collection were taken by Goodrich at two locations in the St. Joseph River in Allen County, Indiana in 1941. The collections here reported include specimens from the mainstream in Ohio almost to Montpelier, and from Fish Creek and the West Branch of the St. Joseph River. Its distribution in Fish Creek is spotty which probably indicates the lack of a uniform habitat. When found, they appear in fair numbers.

Elliptio dilatatus Rafinesque was reported from the Maumee Basin by Call (1896). Clark and Wilson (1912) found two in the St. Joseph near its mouth. Michigan Museum collections have specimens from the St. Joseph giving its distribution upstream throughout Allen and DeKalb Counties, Indiana; and Table 2 portrays its range in tributaries centered chiefly in Fish Creek and the St. Joseph near the mouth of Fish Creek, and in the West Branch of the St. Joseph River.

Fig. 3. Distribution of *Fusconaia flava* (Rafinesque) in the St. Joseph River Basin.

Fig. 4. Distribution of *Quadrula cylindrica* (Say) in the St. Joseph River Basin.

Table 2. The distribution of the freshwater naiads of the St. Joseph River (of the Maumee) drainage.

Locality	Amblema costata Raf.	Fusconaia flava (Raf.)	Quadrula cylindrica (Say)	Cyclonaias tuberculata (Raf.)	Elliptio dilatata (Raf.)	Pleurobema clava (Lamarck)	Pleurobema cordatum coccineum (Conrad)	Alasmidonta calceolus (Lea)	Alasmidonta marginata Say	Anodonta grandis Say	Anodonta imbecilis Say	Anodontoides ferussacianus (Lea)	Lasmigona compressa (Lea)	Lasmigona costata (Raf.)	Strophitus rugosus (Swainson)	Actinonaias carinata (Barnes)	Carunculina glans (Lea)	Dysnomia sulcata (Lea)	Lampsilis fasciola (Raf.)	Lampsilis siliquoidea (Barnes)	Lampsilis ventricosa (Barnes)	Ligumia recta latissima (Raf.)	Obovaria subrotunda (Raf.)	Villosa fabilis (Lea)	Villosa iris (Lea)	Ptychobranchus fasciolare (Raf.)
Cedar Cr. Allen Co., Ind. S.R. 427	X	X			X				X					X	X					X	X					
Cedar Cr. Allen Co., Ind. S.R. 6 east of Auburn	X	X						X		X		X	X							X					X	
Cedar Cr. De Kalb Co., Ind. north of Waterloo		X						X				X			X	X			X	X	X					
Bear Cr. De Kalb Co., Ind. north of St. Joe		X										X														
Tributary in De Kalb Co., Ind. north of Newville	X	X		X		X										X			X				X			
St. Joe. R. Defiance Co., Ohio Milford Twp., Sec. 7		X	X													X			X			X				
Big Run Defiance Co., Ohio Milford Twp., Sec. 5																						X				
St. Joe. R. Defiance Co., Ohio Milford Twp., Sec. 5		X	X													X					X					
St. Joe R. Williams Co., Ohio St. Joe. Twp., Sec. 27				X	X									X		X						X				
Fish Cr. Williams Co., Ohio St. Joe. Twp., Sec. 16		X	X	X	X	X	X	X	X					X	X			X	X	X					X	
Fish Cr. Williams Co., Ohio St. Joe. Twp., Sec. 17	X	X							X					X						X					X	
Fish Cr. Williams Co., Ohio St. Joe. Twp., Sec. 20		X	X	X		X	X	X	X	X			X	X	X	X	X		X	X	X				X	X
Fish Cr. Williams Co., Ohio St. Joe. Twp., Sec. 19		X	X	X	X	X	X	X	X			X	X	X	X	X			X	X	X		X		X	X
Fish Cr. De Kalb Co., Ind. Troy Twp., Sec. 29		X		X	X	X	X	X	X				X	X	X				X	X	X				X	X
Fish Cr. Steuben Co., Ind. Richland Twp., Sec. 30	X	X						X		X		X	X						X	X					X	
St. Joe. R. Williams Co., Ohio St. Joe. Twp., Sec. 10		X		X	X	X	X			X					X	X					X					
Bear Cr. Williams Co., Ohio Florence Twp., Sec. 23										X																
Bear Cr. Williams Co., Ohio Florence Twp., Sec. 22									X	X																
St. Joe. R. Williams Co., Ohio Florence Twp., Sec. 36	X	X	X	X	X	X	X						X	X	X	X			X	X	X		X	X	X	X
St. Joe. R. Williams Co., Ohio Superior Twp., Sec. 30	X	X		X		X									X	X				X	X		X			
Eagle Cr. Williams Co., Ohio Superior Twp., Sec. 19										X										X						
St. Joe. R. Williams Co., Ohio Superior Twp., Sec. 16	X	X		X					X	X		X				X					X		X			
Nettle Lake Williams Co., Ohio Northwest Twp., Sec. 13										X	X									X						
Nettle Cr. Williams Co., Ohio Northwest Twp., Sec. 15								X				X														
Nettle Cr. Williams Co., Ohio Northwest Twp., Sec. 10										X		X								X						
St. Joe R. Williams Co., Ohio Madison Twp., Sec. 32	X	X					X	X		X		X			X						X					
W. Br. St. Joe. Williams Co. Ohio, Bridgewater Twp., Sec. 30	X	X	X				X						X	X	X	X				X	X		X		X	
W. Br. St. Joe. R. Williams Co. Ohio, Bridgewater Twp., Sec. 26										X					X					X						
W. Br. St. Joe. R. Williams Co. Ohio, Bridgewater Twp., Sec. 16	X	X				X	X	X					X	X	X	X			X	X	X				X	X
W. Br. St. Joe. R. Williams Co. Ohio, Bridgewater Twp., Sec. 17	X	X			X	X	X	X	X				X	X	X	X			X	X	X					X
W. Br. St. Joe. R. Hillsdale Co. Mich., Amboy Twp., Sec. 6		X			X	X	X	X	X	X		X	X	X	X				X	X	X				X	X
W. Br. St. Joe. R. Hillsdale Co. Mich., Camden Twp., Sec. 36	X	X			X		X	X	X	X			X	X	X				X	X	X				X	
W. Br. St. Joe. R. Hillsdale Co. Mich., Camden Twp., Sec. 23	X									X					X					X						
W. Br. St. Joe. R. Hillsdale Co. Michigan, Camden Twp., Sec. 8	X									X	X									X						
W. Br. St. Joe. R. Hillsdale Co. Mich., Woodbridge Twp., Sec. 28	X	X			X	X	X	X				X		X	X	X			X	X	X				X	X
St. Joe. R. Williams Co., Ohio Madison Twp., Sec. 21	X	X						X		X		X	X		X					X	X		X			
St. Joe. R. Williams Co., Ohio Madison Twp., Sec. 11												X	X							X						
Bird Cr. Hillsdale Co., Mich Ransom Twp., Sec. 24								X		X		X														
St. Joe. R. Hillsdale Co., Mich. Wright Twp., Sec. 31	X	X										X	X		X											
St. Joe. R. Hillsdale Co., Mich. Wright Twp., Sec. 20	X	X					X	X				X	X		X											

Pleurobema clava (Lamarck) is listed by Call (1896b) from the St. Joseph River, but no definite locations were given. Two empty shells were found by Clark and Wilson (1912) in the St. Joseph River, and only 20 in the entire Maumee Basin. Goodrich (1914) reported its range as far downstream as Defiance, Ohio in the Maumee, but did not mention that they were in the St. Joseph. However, specimens housed in the Museum of Zoology in Michigan indicate that he collected it from the St. Joseph at Newville, Indiana and at Edgerton, Ohio. He later (1932) reported a specimen taken by M. L. Winslow from the Maumee Basin in Hillsdale County, Michigan. It was taken at 11 of the 40 sites reported in this study: one in a small tributary in Indiana, four in Fish Creek, four in the West Branch and two in the main stream. Clark and Wilson (1912) rated it as fairly well distributed along the upper course of the Maumee, but nowhere abundant. This pattern may be true for it in the St. Joseph as shown by the 1939 to 1953 collections. However, the 1975 collections produced 56 in one area not more than 500 feet long, in two hours of collecting. More were available if continued collecting were undertaken.

Pleurobema cordatum coccineum (Lamarck). Goodrich and van der Schalie (1944) discuss the confusion existing in the taxonomy of the forms of this species. Call (1900) referred to it as *P. coccineus* Lea, and described it as common in all parts of Indiana, including the St. Joseph River. Clark and Wilson (1912) indicated that '*Quadrula coccinea* (Conrad)' was not as common as *Cyclonaias tuberculata* in the Maumee Basin. Specimens collected by Goodrich in the St. Joseph River, Allen County, Indiana, and by others from the West Branch of the St. Joseph in Hillsdale County, Michigan are in the Michigan Museum collections. Goodrich and van der Schalie (1944) include it as among the Maumee River fauna. Its distribution was rather spotty in the smaller portion of the main stream and in the tributaries. It centered around Fish Creek and the West Branch.

Alasmidonta calceolus (Lea) was reported from the Maumee Basin by Call (1896a). Records available include: specimens from Cedar Lake and Cedar Creek near Waterloo, DeKalb County, Indiana, the St. Joseph, Bird Lake and Bird Creek near Pittsford, Michigan, the West Branch of the St. Joseph in Wright Township, Hillsdale County, Michigan, and the St. Joseph River in Madison Township, Williams County, Ohio, all in the University of Michigan's collections. The collections forming the basis of this paper reveal it as found chiefly in the tributaries of the St. Joseph, but was never taken in large numbers. It is clearly a headwater or small stream species.

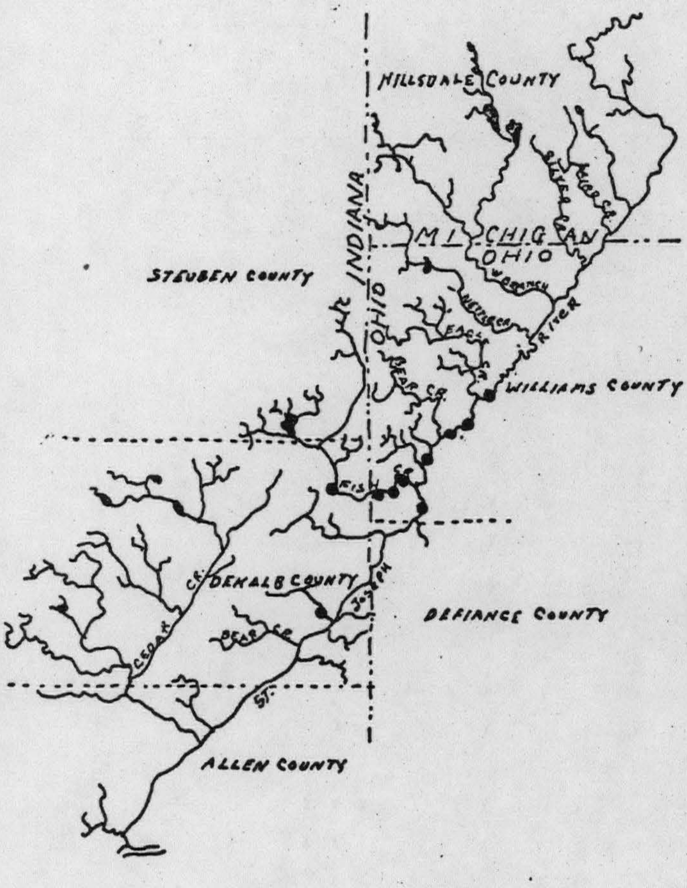


Fig. 5. Distribution of *Cyclonaias tuberculata* (Rafinesque) in the St. Joseph River Basin.

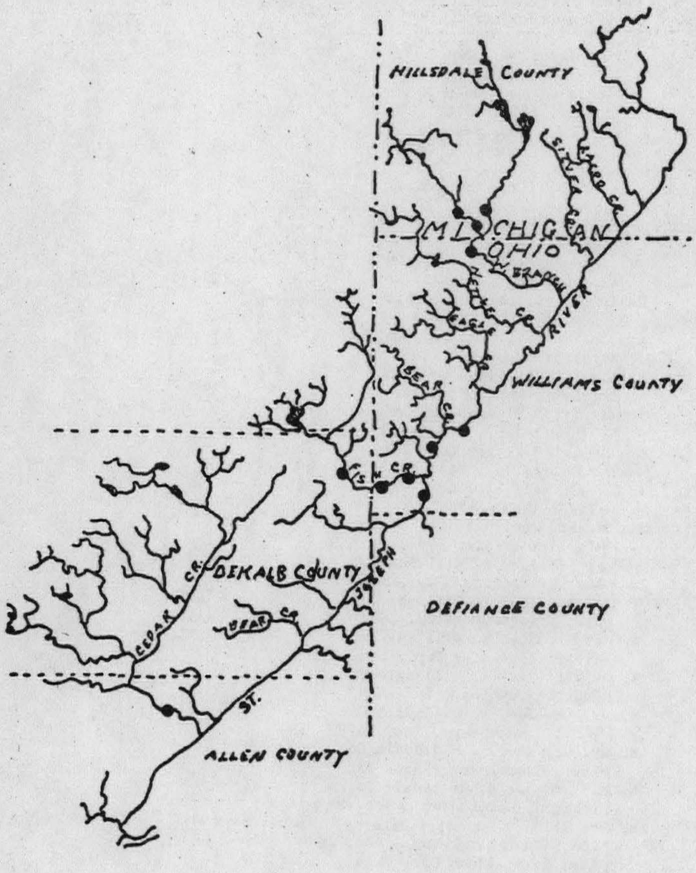
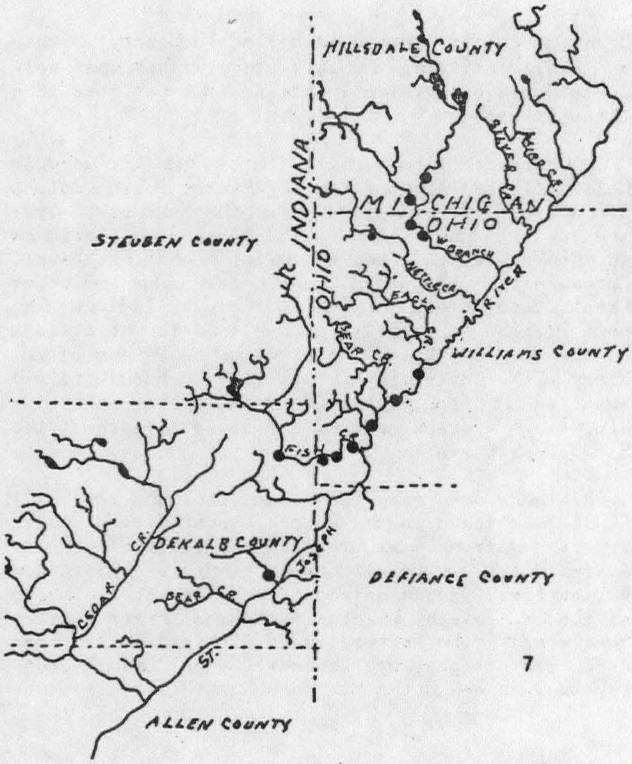


Fig. 6. Distribution of *Elliptio dilatata* (Rafinesque) in the St. Joseph River Basin.



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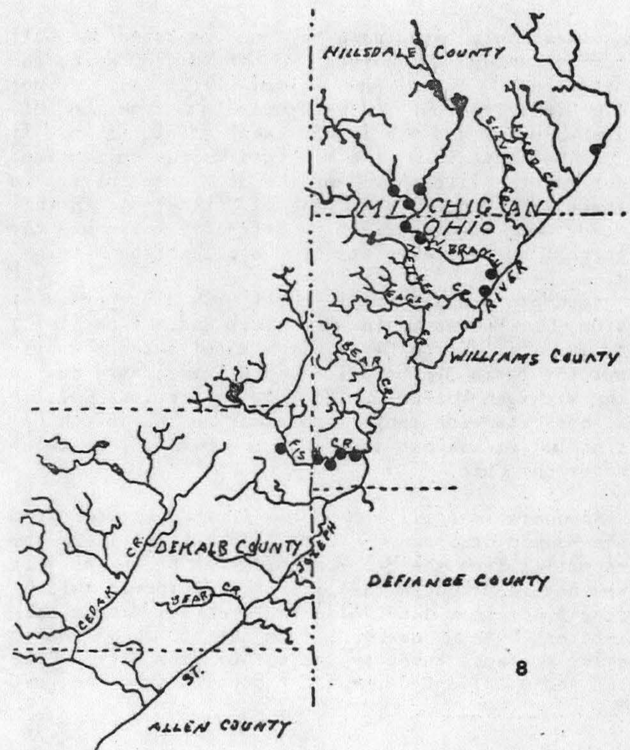

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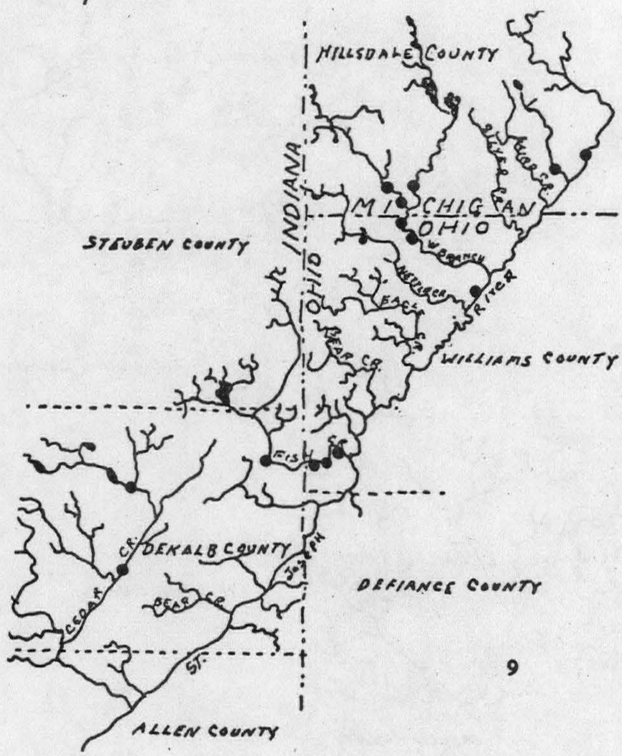

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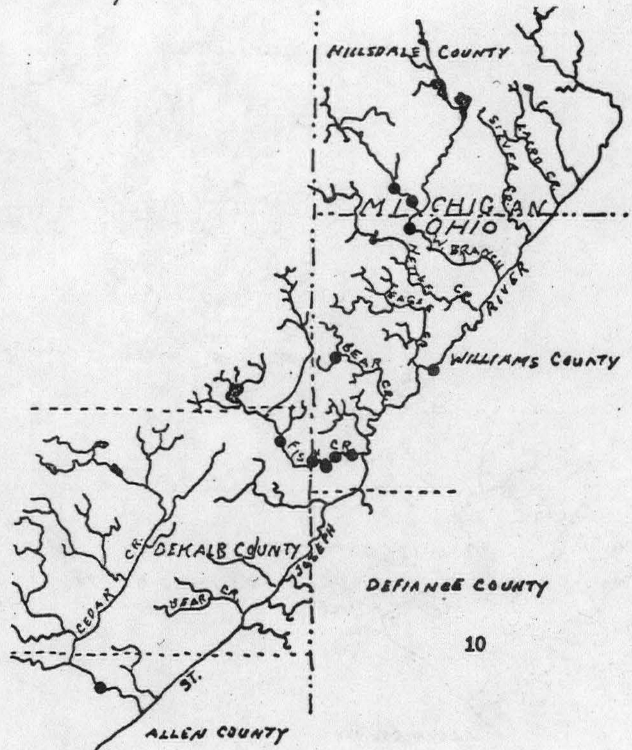

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Fig. 7. Distribution of *Pleurobema clava* (Lamarck) in the St. Joseph River Basin.

Fig. 9. Distribution of *Alasmidonta calceolus* (Lea) in the St. Joseph River Basin.

Fig. 8. Distribution of *Pleurobema cordatum coccineum* (Conrad) in the St. Joseph River Basin.

Fig. 10. Distribution of *Alasmidonta marginata* Say in the St. Joseph River Basin.

Alasmidonta marginata Say was reported by Call (1896a) among the naiads of the Maumee Basin, and described by Clark and Wilson (1912) as, '....not especially common.' They record it from the St. Joseph River and the feeder canal at Ft. Wayne. It does not appear in the Michigan Museum collections nor in the literature on the St. Joseph River in lower Michigan. Ten of the 11 collections in this study were from tributary streams. Five was the largest number taken at any one collecting site.

Anodonta grandis (Say). Call (1896a) reported it from the Maumee Basin and Clark and Wilson (1912) from the St. Joseph River. It was collected throughout the basin by Goodrich and specimens are now in the Michigan Museum of Zoology collections. Table 2 shows its wide range throughout the St. Joseph Basin; but it was not found in the main stream below Edgerton, Ohio.

Anodonta imbecillis Say was first reported from the Maumee drainage by Clark and Wilson (1912) who report it from the St. MarysRiver at Ft. Wayne. It was not reported in the literature covering this area, since that date. Also the Michigan Museum collections have no specimens from the St. Joseph River prior to those taken by the author from Nettle Lake and those collected by van der Schalie from the West Branch of the St. Joseph in Hillsdale County, Michigan while assisting in this study. They were collected from only three locations, but not more than three at each.

Anodontoides ferussacianus (Lea) was included in Call's (1896a) list as from the Maumee Basin; but he did not specify its presence in the St. Joseph system. Clark and Wilson (1912) seven dead specimens in the Maumee drainage, all in Spy Run at Ft. Wayne. Specimens are recorded from Cedar Lake and Cedar Creek, Bear Creek in DeKalb County, Indiana, the West Branch in Michigan as well as the mainstream of the St. Joseph and deposited in the Museum of Zoology of the University of Michigan. La Rocque (1967) reported it from Silver Creek, Williams County, Ohio. It is a creek species and found throughout the St. Joseph Basin.

Lasmigona compressa (Lea) was included by Call (1896a) as found in the Maumee Basin. Kirsch (1895) reported it from Cedar Creek, a tributary of the St. Joseph River in DeKalb County, Indiana. Clark and Wilson (1912) found only one specimen, at the mouth of the St. Joseph, in their Maumee River survey. Specimens in the University of Michigan collections establish its presence in Cedar Creek, DeKalb County, Indiana and in the St. Joseph in Hillsdale Coun-

Fig. 11. Distribution of *Anodonta grandis* Say in the St. Joseph River Basin.

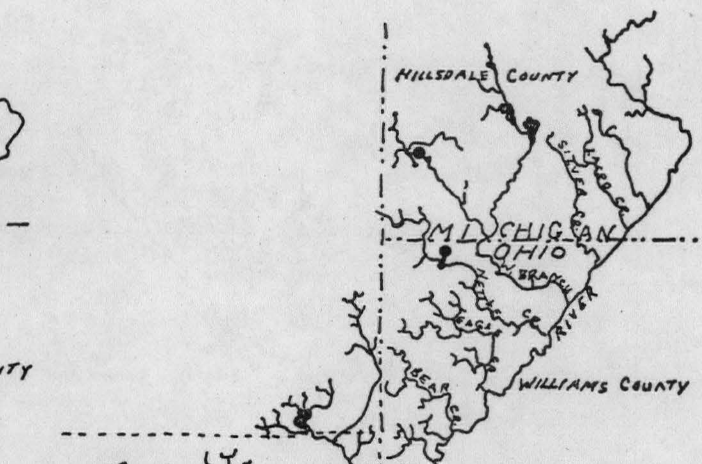
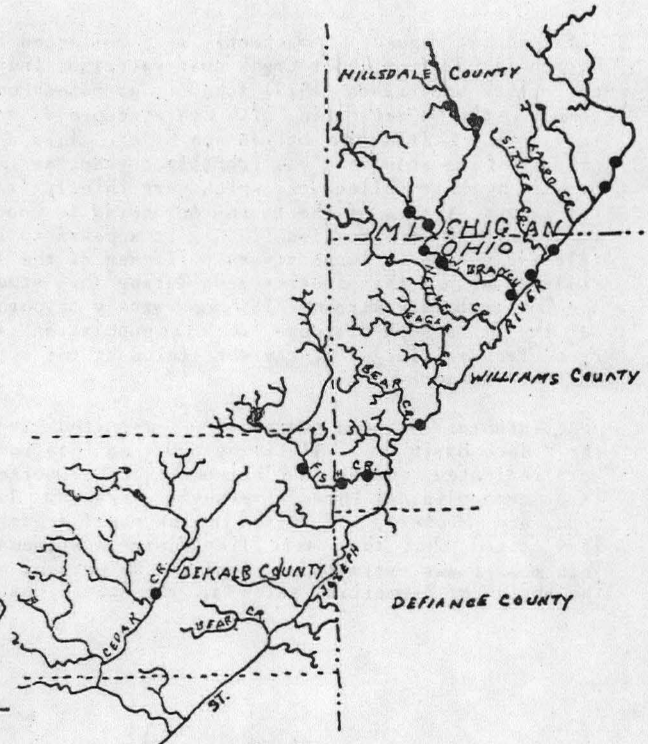


Fig. 12. Distribution of *Anodonta imbecillis* Say in the St. Joseph River Basin.

ty, Michigan. Table 2 indicates that it is mainly a creek species. It was taken in the upper reaches of the St. Joseph River and from its tributaries.

Lasmigona costata Rafinesque. Call's statement, 'This shell is found in every large stream and most smaller ones in Indiana.' seems to report it from the Maumee drainage in that state (Call, 1900). Although Clark and Wilson (1912) considered this naiad as fairly common in the Maumee River throughout most of its length, no mention was made of its presence in the St. Joseph River. In this study, it was found at 14 of the 40 stations included in this report. It is widespread throughout the drainage and occurs most often as a headwater species.



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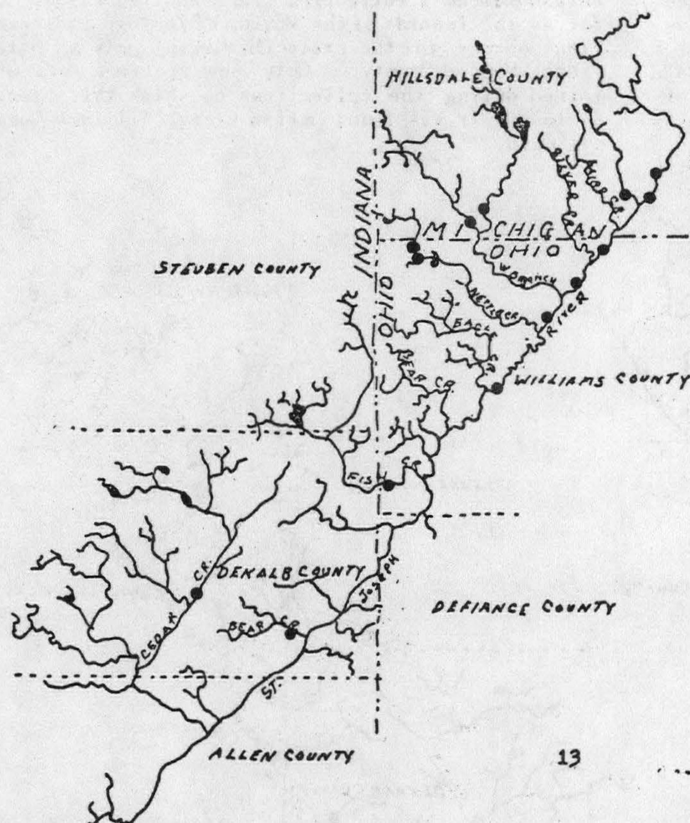

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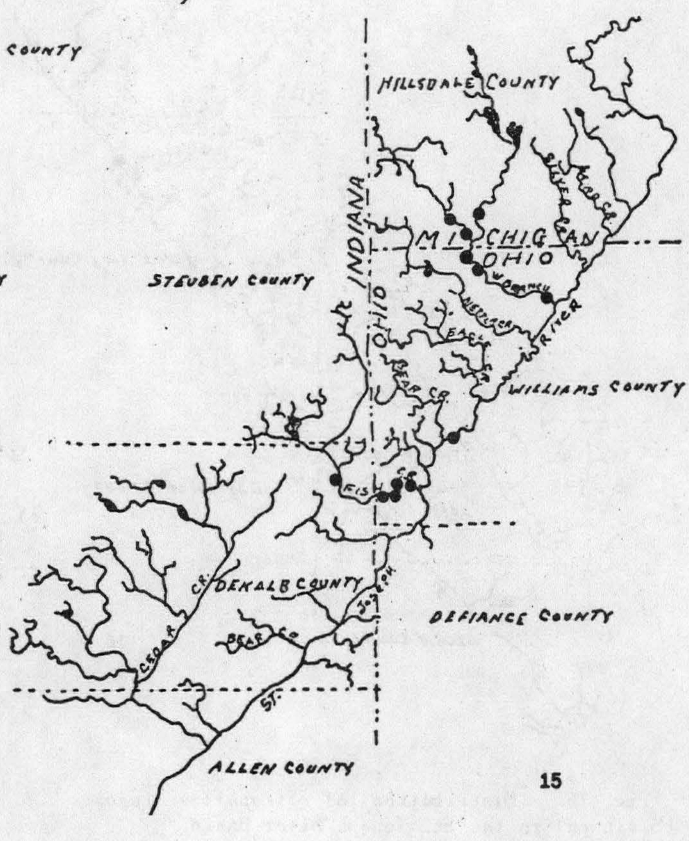

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Fig. 13. Distribution of *Anodontoides ferussacianus* (Lea) in the St. Joseph River Basin.

Fig. 14. Distribution of *Lasmigona compressa* (Lea) in the St. Joseph River Basin.

Fig. 15. Distribution of *Lasmigona costata* (Rafinesque) in the St. Joseph River Basin.

Strophitus rugosus (Swainson) was collected by Kirsch (1895) from Cedar Creek near Waterloo, Indiana. Clark and Wilson (1912) found it as rather uncommon in the Maumee Basin, although widespread; and they took it from the St. Joseph River. This appraisal of its abundance was probably correct as indicated by their collections which were chiefly from the larger streams of the basin. According to Goodrich and van der Schalie (1944), it appears to be relatively rare in large rivers. Fifteen of the 19 collections of this species made during this study are from tributary streams. It ranges widely throughout the St. Joseph drainage, but its population in Fish Creek was large. Forty were taken at one site in that stream.

Actinonaias carinata (Barnes) was reported from the Maumee Basin by Call (1896a), but no locations were indicated. Clark and Wilson (1912) reported it as common in all three rivers (St. Marys, St. Joseph and Maumee), and also in the canal feeder. They stated that they were fine, large specimens. This mussel was estimated to comprise 90 percent of the shells of commercial value in the Maumee Basin (Clark & Wilson, 1912) as based on its value to the button industry of that day. Specimens in the Michigan Museum collection, taken by Goodrich, indicate that it occurred in the St. Joseph near Spencerville, Indiana, northeast of Fort Wayne, and near Cedarville in Allen County, Indiana. A specimen from Cedar Creek near Waterloo, Indiana is also in the Michigan collection. This species was found to be widely distributed in the St. Joseph Basin, but in relatively small numbers.

Carunculina glans (Lea) was first reported from the Maumee River by Call (1896a); but only six were found by Clark and Wilson (1912): one in the St. Joseph River near its mouth, four in the feeder canal, and one in the reservoir at the end of the canal. Half of a dead shell collected by Goodrich in the St. Joseph in Allen County, Indiana, is in the Michigan Museum's collection. He reported (1932) 'So far as the records of the Museum of Zoology indicate, *glans* occurs in the state (Michigan) only in Otter Creek, Monroe County.' Only one specimen was obtained during the collections on which this report is based. It was found in Fish Creek, Williams County, Ohio.

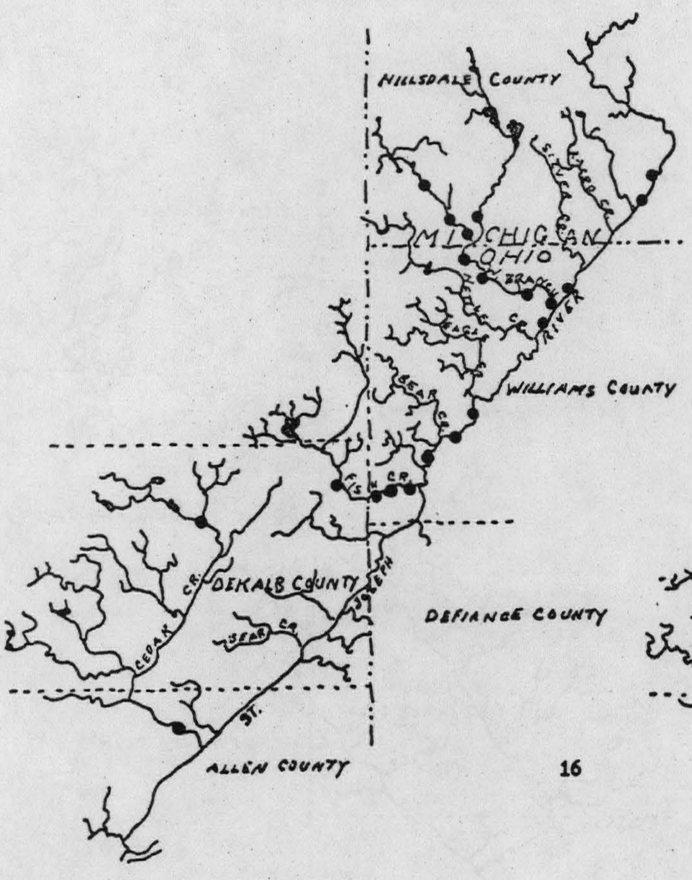

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Fig. 16. Distribution of *Strophitus rugosus* (Swainson) in the St. Joseph River Basin.

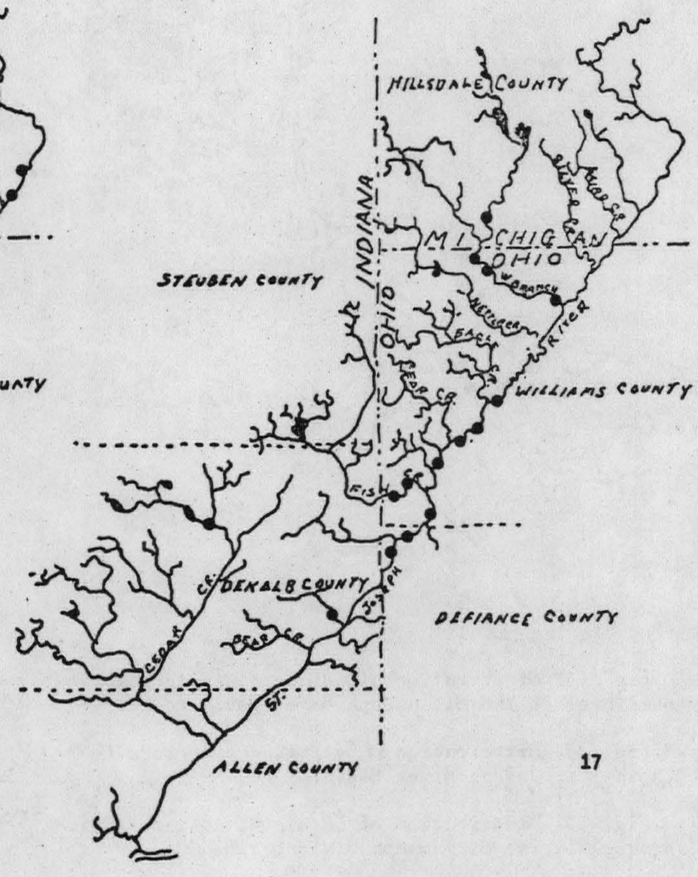

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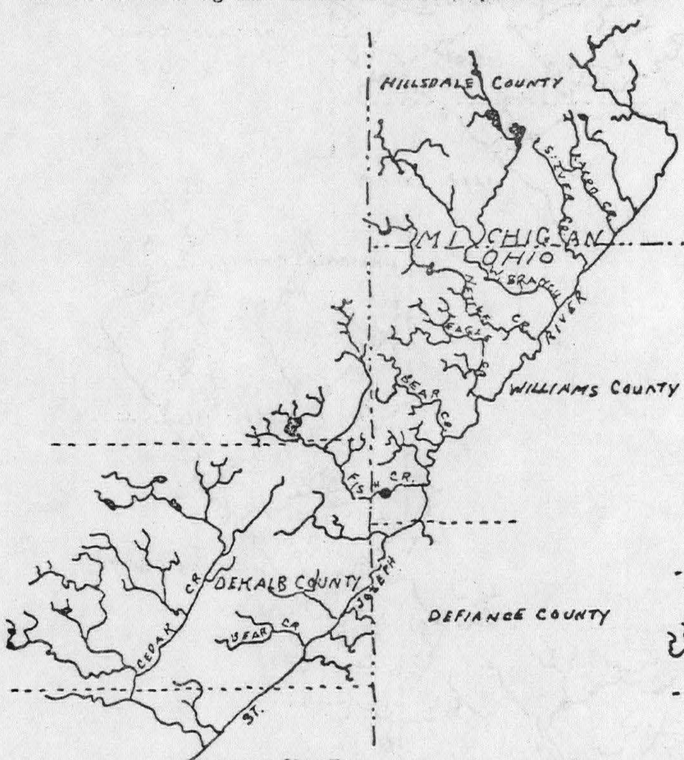
Fig. 17. Distribution of *Actinonaias carinata* (Barnes) in the St. Joseph River Basin.

Dysnomia sulcata (Lea). This species was reported by Call (1900) as, '... usually considered as being rare,' but he made no mention of its presence in the Maumee drainage. Clark and Wilson (1912) stated that it was, '... never very common, was not found below Defiance, Ohio.' They found it as dead shells along the mouth of the St. Joseph River. They took only one live specimen, in the Auglaize River, and only 15 shells were found in the Maumee Basin. Goodrich and van der Schalie (1944) reported *D. sulcata* from the Maumee Basin. Michigan Museum's collection contains a specimen taken from the St. Joseph in Ft. Wayne, Indiana.

Lampsilis fasciola Rafinesque was included in the mussel fauna of the Maumee by Call (1896a). It was considered as not common in the basin by Clark and Wilson (1912). They found it in the St. Joseph River and in the feeder canal at Ft. Wayne. Its Michigan distribution was plotted by van der Schalie (1941); but no records for the St. Joseph Basin were included. The Michigan Museum's collections as well as those forming the basis of this report (Table 2) indicate it has a 'not common' status as given by these early authors. They do indicate its wide and scattered distribution, especially in the tributaries. As many as 20 were taken in one hour from the West Branch of the St. Joseph River; but usually only one or two were taken from 14 of the 40 collecting sites.

Lampsilis siliquoidea (Barnes) was reported by Call (1896a) from Cedar Creek, Allen County, Indiana and from the Maumee and St. Marys Rivers at Ft. Wayne. Clark and Wilson (1912) found it in about the same locations as *Actinonaias carinata*, but not in as great abundance. The Michigan Museum's collections show it has wide distribution, as do the data presented in this report (Table 2). Its abundance varied greatly; but such finds as 32 in 45 minutes in Eagle Creek were not too unusual.

Lampsilis ventricosa (Barnes) was not reported from the Maumee drainage by Call's papers of 1896 or 1900. Clark and Wilson (1912) found it was not especially common, but stated that they found 18 at



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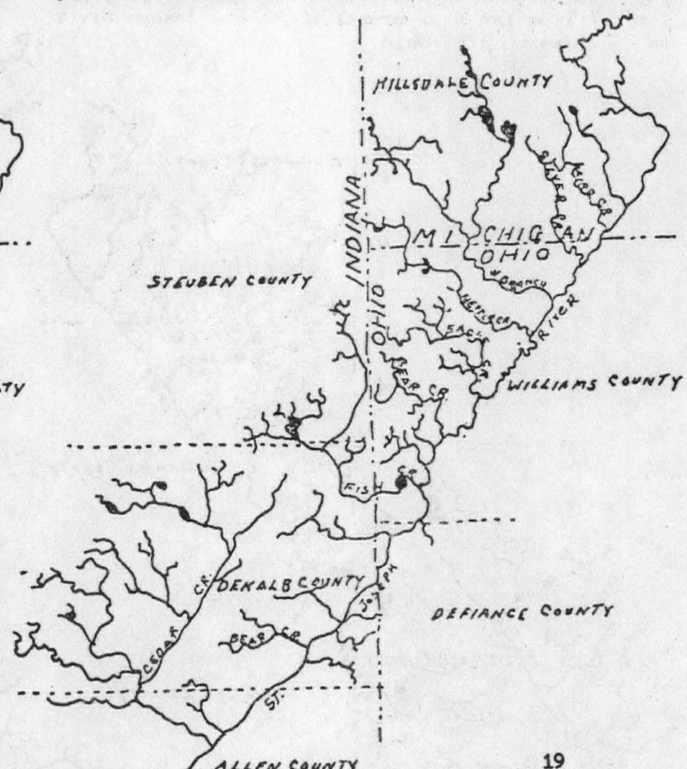

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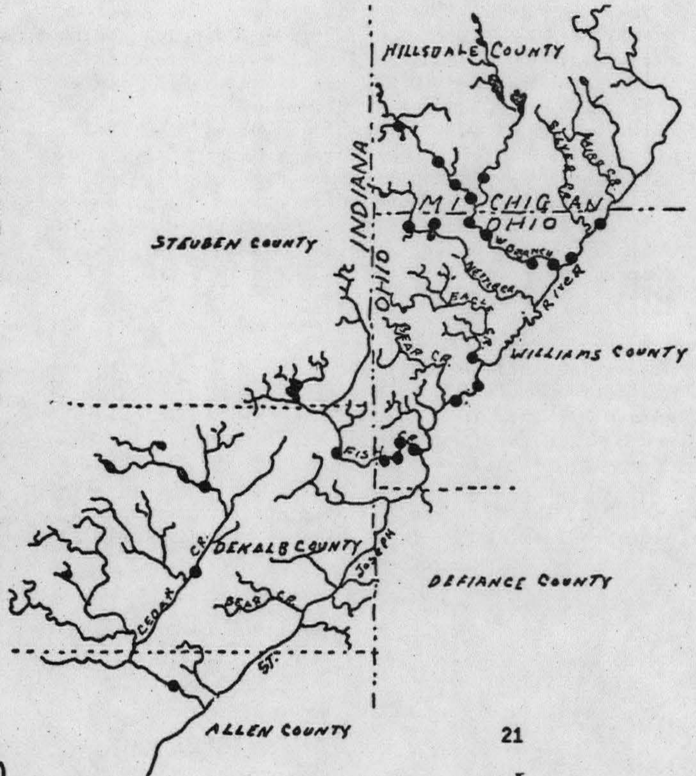
Fig. 18. Distribution of *Carunculina glans* (Lea) in the St. Joseph River Basin.

Fig. 19. Distribution of *Dysnomia sulcata* (Lea) in the St. Joseph River Basin.

the mouth of the St. Joseph River. They wrote, 'Although well-marked specimens of this species are easily recognized, it has many deviations from the typical form,' They found some specimens to approach *Proptera capax* (Green) and others *L. siliquoidea;* but that those from the Maumee Basin were well marked and fairly uniform. Several in the Michigan Museum collection are labeled *L. ventricosa* and some of those taken during the 1939 to 1953 period were tentatively identified as L. ovata. Goodrich and van der Schalie (1944) stated, '*L. ovata* is definitely a species that inhabits large rivers and there are transitions into the headwaters that connect *L. ovata* through the form *L. o. ventricosa* with *L. ventricosa.* The majority of the St. Joseph specimens probably best fit the *L. o. ventricosa* group, even though *L. ventricosa* is considered the northern form. Cvancara (1963) demonstrated a north-south cline and raised doubts concerning the taxonomic status of the *L. ventricosa* and *L. ovata* group. Table 2 indicates this mussel is found throughout the St. Joseph River Basin, but not in large numbers. The most taken at any one site during this study was some 17 from the West Branch of the St. Joseph River in Williams County, Ohio.



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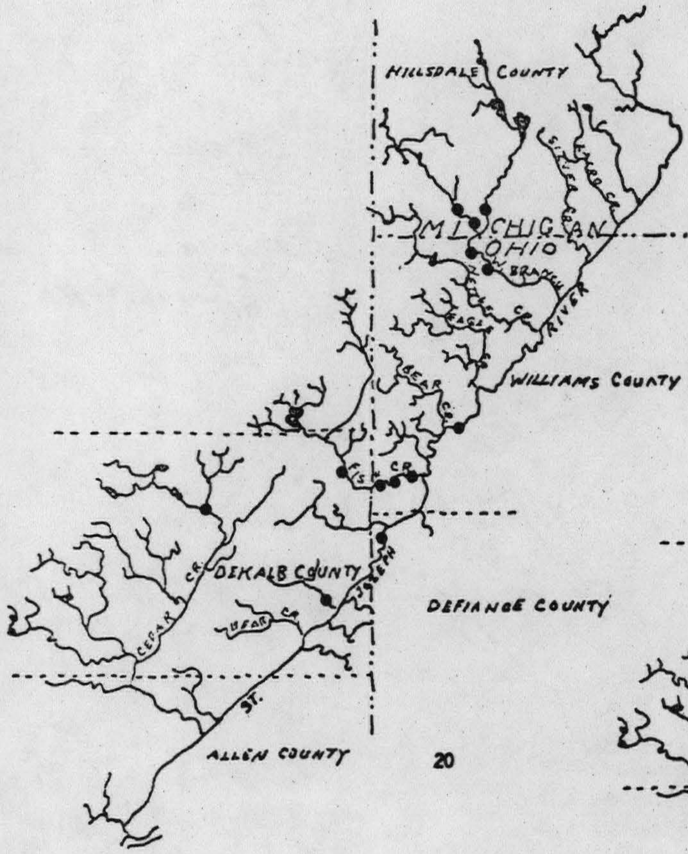

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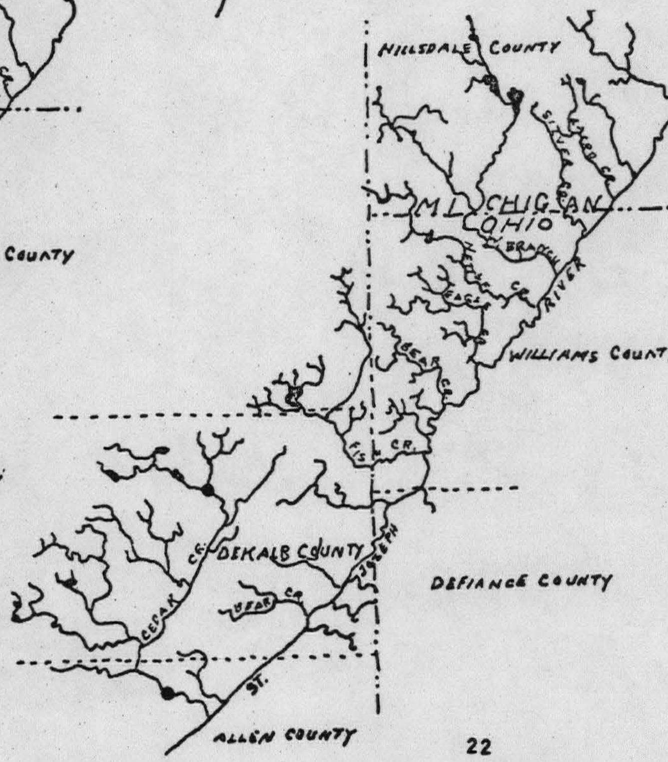

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Fig. 20. Distribution of *Lampsilis fasciola*(Rafinesque) in the St. Joseph River Basin.

Fig. 21. Distribution of *Lampsilis siliquoidea* (Barnes) in the St. Joseph River Basin.

Fig. 22. Distribution of *Lampsilis ventricosa* (Barnes) in the St. Joseph River Basin.

Ligumia recta latissima (Rafinesque) was reported from the Maumee drainage by Call (1896a) and from the St. Joseph in 1900. It was fairly common and well distributed in the Maumee Basin, but not particularly abundant (Clark and Wilson, 1912). They found it in the feeder canal at Ft. Wayne and the St. Joseph River, but reported only 63 from the entire Maumee Basin. The 1939 through 1953 collections include 15 live and dead specimens taken at nine sites (Table 2).

Obovaria subrotunda (Rafinesque) was listed by Call (1896a) from the Maumee Basin, and from the St. Joseph River (1896a), but he does not indicate which of the two St. Joseph Rivers in Indiana. H. van der Schalie (1963) considered Call's listing as from the St. Joseph River of the Maumee. Clark and Wilson (1912) found it to be, '...fairly common in the feeder canal where 16 specimens were secured, and in the St. Joseph River near its mouth, where we obtained 10.' Goodrich 1932) intimated that it was not found in Michigan waters of the St. Joseph drainage, but specimens collected by him in 1941 from the main stream near Newville, DeKalb County, Indiana are deposited in the Michigan Museum. Table 2 indicates that this mussel was taken in four locations in the mainstream, three in Williams County, Ohio, two from two Williams County tributaries, and one from an Indiana tributary (Table 2).

Villosa fabalis (Lea) was considered by van der Schalie (1936) as reported from the Maumee drainage by Call (1900). Clark and Wilson (1912) considered this species as, '.... exceedingly abundant in the Feeder Canal ...,' where in 1909 several hundred were found. Goodrich took two specimens from the St. Joseph River northeast of Ft. Wayne in 1941. Goodrich did not report it from the St. Joseph drainage in Michigan (1932). One specimen was found in the mainstream in Williams County, Ohio during this study.

Villosa iris (Lea) was reported by Call (1896a) from the Maumee Basin. Clark and Wilson (1912) found four specimens in the St. Joseph River near its mouth, and two in the feeder canal. They qualified their shortage of specimens by stating, 'It is probably more common than collections would indicate, as it is frequently found in abundance late in the fall after muskrats have begun collectiong, where it is difficult to find in numbers before this.' The Michigan collections contain specimens from Cedar Creek, DeKalb County, Indiana, Lake Baw Bee, Hillsdale County, Michigan and the St. Joseph River at Edgerton, Ohio. It is a headwater species (Table 2)

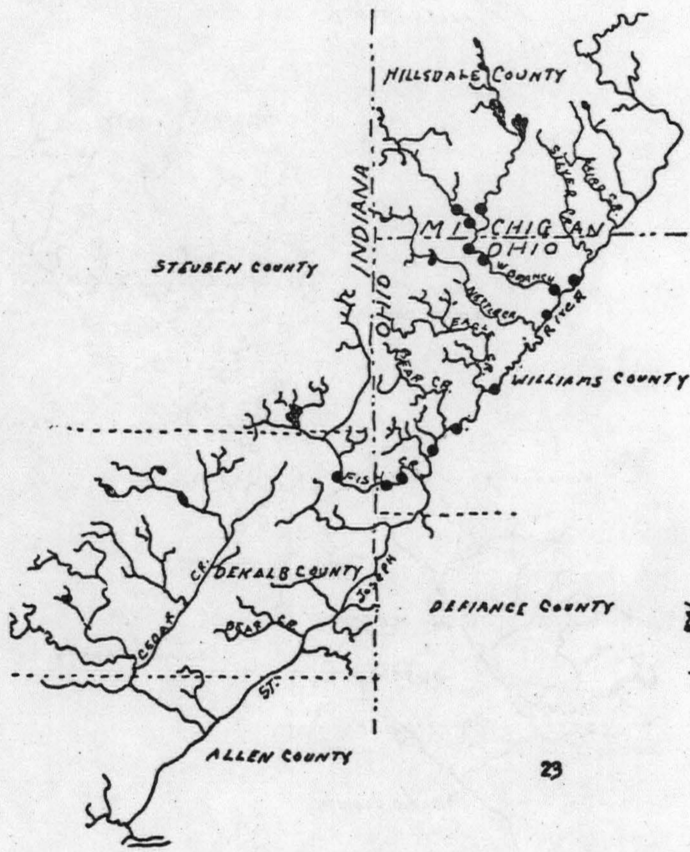


Fig. 23. Distribution of *Ligumia recta latissima* (Lamarck) in the St. Joseph River Basin.

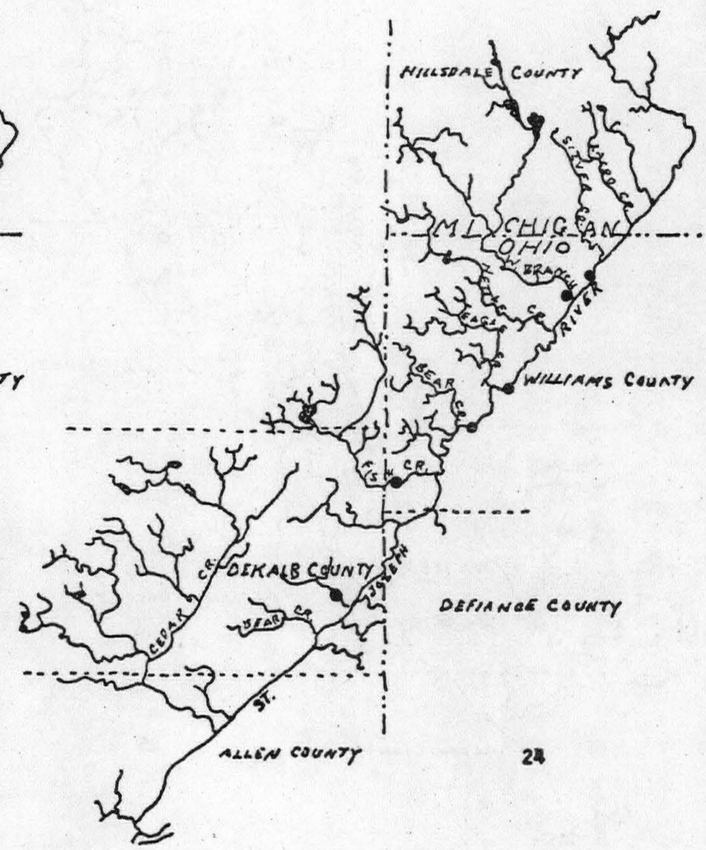
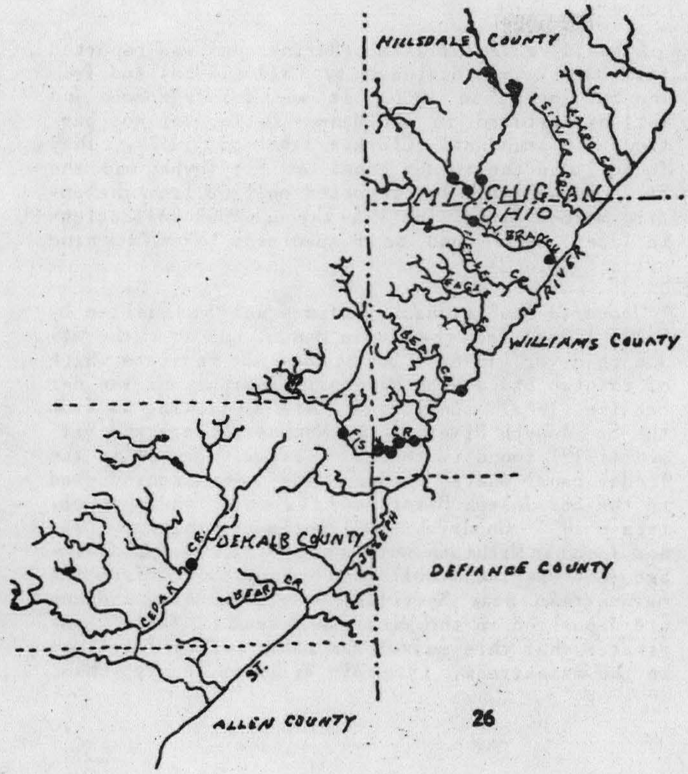


Fig. 24. Distribution of *Obovaria subrotunda* (Rafinesque) in the St. Joseph River Basin.

which was found most numerous in Fish Creek and the West Branch of the St. Joseph River. In general, only one to three specimens were taken at any location, but 94 were found at one station in Fish Creek in 1945 and 27 more found at another site in the stream in 1975.

Ptychobranchus fasciolaris (Rafinesque) was listed by Call (1896a) as found in the Maumee Basin, but was not mentioned as such in his 1900 illustrated catalogue. Clark and Wilson (1912) stated, 'This species was not abundant anywhere in the Maumee Basin, but was scattered along the length of the river. In the autumn of 1907 a fair number were obtained in the feeder canal. We found 16 good specimens in the St. Joseph River at Ft. Wayne ...' Goodrich and van der Schalie (1944) wrote, 'Apparently this species has gone northward by the Wabash-Miami route, entering Lake Erie and the tributary streams of the lake.' It was collected by Goodrich in 1941 northeast of Ft. Wayne, Indiana. Table 2 shows it inhabits the tributary streams, with one exception. It was taken at eight of the 40 collecting stations. The 1975 collections in Fish Creek produced from 44 to 62 specimens in about three hours of collecting at any one of the three sites examined.



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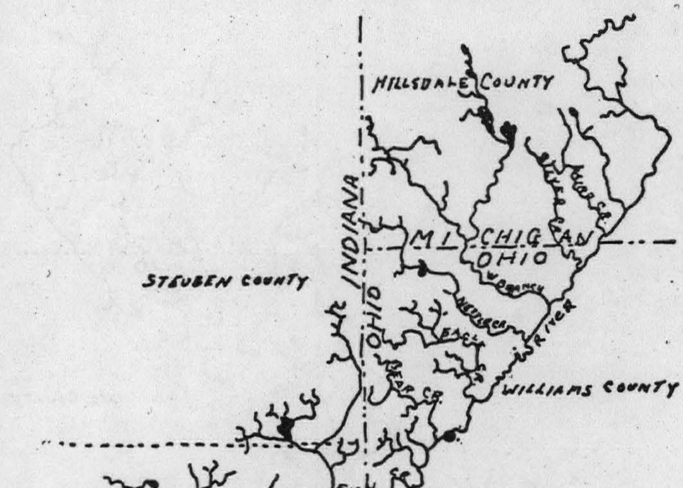

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Fig. 25. Distribution of *Villosa fabalis* (Lea) in St. Joseph River Basin.

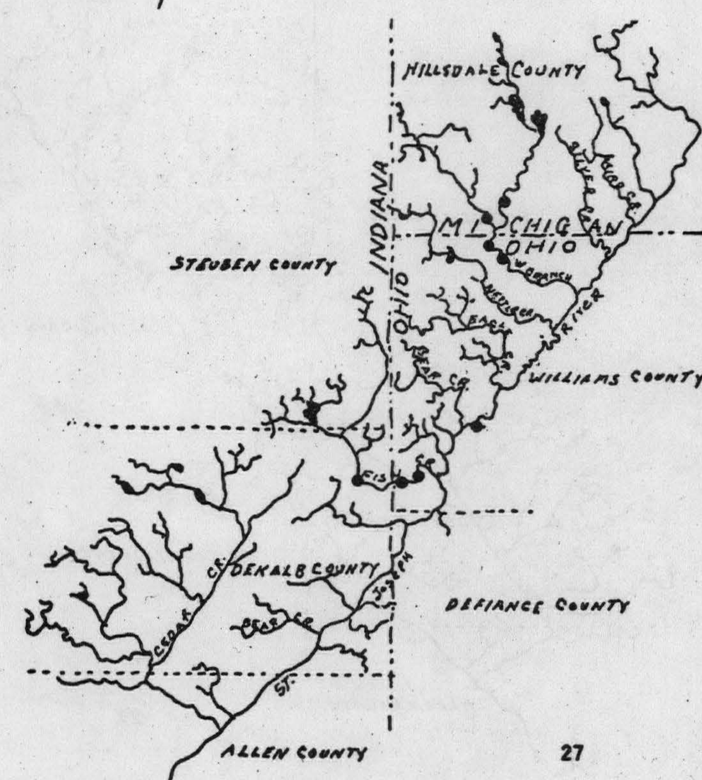

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Fig. 26. Distribution of *Villosa iris* (Lea) in the St. Joseph River Basin.

Fig. 27. Distribution of *Ptychobranchus fasciolaris* (Rafinesque) in the St. Joseph River basin.

SPECIES NOT RECENTLY FOUND BUT REPORTED PREVIOUSLY

Quadrula pustulosa (Lea) was listed from the Maumee drainage by Call (1896b) and was found by Clark and Wilson (1912),'... throughout the length of the River (Maumee), but most abundantly in the central portion. A few ... were found at Ft. Wayne ....'

Quadrula quadrula (Rafinesque) was in the lower portion of the Maumee according to Clark and Wilson (1912), and reported from Lake Erie by van der Schalie (1941).

Megalonaias gigantea (Barnes). Call (1896a) reported it from the Maumee Basin; but no other author has indicated its presence here. It could have been a large *Amblema*.

Lasmigona complanata (Barnes) was reported from the Maumee Basin by Call (1896). Clark and Wilson (1912) found it common near Ft. Wayne. They took five from the mouth of the St. Joseph River. Goodrich (1914) did not mention a location from which it was taken, but stated that it was one of the species which crossed the Wabash-Maumee divide. He did not mention it from the St. Joseph in Michigan (1932).

Actinonaias ellipsiformis (Conrad). The Michigan distribution by Goodrich included, '... and St. Joseph River of the Maumee, Hillsdale County,' but this record was accepted by van der Schalie and van der Schalie (1963). Its distribution does not include southeast Michigan.

Carunculina parva (Barnes) was listed among the Maumee River species of naiads, but has not been reported by later authors.

Dysnomia perplexa (Lea), '... has crossed over from the Wabash drainage into the Maumee River system and has gotten into Lake Erie where an occasional specimen is found.' (Goodrich and van der Schalie, 1944).

Dysnomia triquetra (Rafinesque), ',,, is found in the Wabash, White, St. Joseph and Maumee drainages' (Goodrich and van der Schalie, 1944).

Leptodea fragilis (Rafinesque), '... has crossed over into the Maumee drainage.' (Goodrich and vander Schalie, 1944).

Ligumia nasuta (Say) is another species considered by van der Schalie (1936) to have been mistakenly reported by Call (1900) from the St. Joseph of Lake Michigan rather than the St. Joseph of the Maumee.

Obovaria olivaria (Rafinesque) was reported by Call (1900) as present in the St. Joseph River in Indiana. Call's report was considered to be in error by van der Schalie (1936) who believed that Call was referring to the St. Joseph of the Maumee.

Obovaria retusa (Lamarck). Goodrich (1914) states, 'Call records *Obovaria retusa* (Lamarck) from the St. Joseph ...,' and, 'It is highly probable that he had before him specimens of *Quadrula pustulosa*, much produced forward, free of tubercles and suggestive of *retusa*.'

Proptera alata (Say). Clark and Wilson wrote, 'This species is of occasional occurrence in the Maumee Basin but not abundant. Along the upper parts of the basin they were rather rare. Three were obtained in the St. Joseph River at Ft. Wayne ...'

Truncilla donaciformis (Lea) was taken in the Auglaize River by Clark and Wilson (1912), but not in the Maumee above Grand Rapids, Ohio.

Truncilla truncata Rafinesque was found in the Maumee at Defiance, Ohio by Clark and Wilson (1912).

Obliquaria reflexa Rafinesque was not found in the Maumee River above Defiance, Ohio, but was fairly common below that point (Clark and Wilson, 1912).

DISCUSSION OF DATA

Unfortunately the lower portion of the St. Joseph River was not collected as thoroughly as the upper two-thirds of the stream. Recent efforts to collect the lower area were thwarted by high water. The presence of dams which raised the water level and water quality such as earlier presented were also hampering factors. As expected, a river some 100 miles long, and its tributaries provides a wide variety of habitats, especially when the drainage area includes glacial till. Yet among the 26 species taken from the basin, 14 or more were found at 10 of the 40 collecting stations. *Fusconaia flava* came from 27 of the 40 sites, *Lampsilis siliquoidea* from 26, *Strophitus rugosus* from 21, and *Amblema costata* and *Lampsilis ventricosa* were taken at 19 and 18 stations respectively. Although the stream bed varied greatly, sets of conditions combined in these many locations to produce similar populations of naiads.

Only four species were taken at less than five stations, and only eight at less than 10 sites of the 40 sampled. Only one *Villosa fabalis* was taken among the 40 sites; but it was collected together with 18 other species. One *Dysnomia sulcata* and one-half of an extremely fresh shell were found together with 13 other species. *Carunculina glans* was found only once but with 19 other species. It thus appears that habitats, unless they were essentially microhabitats, were not the determining factors in the maintenance of these species.

A haphazard pattern of distribution of most species is apparent from both Table 2 and the species distribution maps. This difference is probably a result of uneven distribution of habitat conditions throughout the drainage basin; or it may also indicate that each area collected was a composite of habitats, some more favorable to some species than to others, and collectively capable of supporting up to 27 species at once. Except for a paper by Van Cleave (1940), the study of habitat niches or microhabitats of naiad species has received little attention; but it seems that *Pleurobema clava* would provide an excellent species, in Fish Creek, for such a study. During the three days of collecting in 1975, the author walked a couple of miles of stream and postulated the presence of this species from the type of bottom. In nearly every instance, they were buried in patches of pea to hickory-nut size gravel, in fairly clean broad riffles, in 3 to 10 inches of water at the low water and fall period of the year.

The mainstream of the St. Joseph River included only one of the sites at which 14 or more species of naiads were collected, as compared with nine in the tributaries. Seven of the collection sites from which nine or more species were taken were located in the river as compared with eight in the tributaries. No live specimens were taken from the river below Edgerton, or in the tributary stream at Newville, Indiana about nine miles below Edgerton. Yet in spite of a reported BOD of 764 pounds per day from the Montpelier sewage disposal plant, and oxygen levels of 2 mgl in the stream below during the 1960s (Anon., 1966), it would appear that the water quality prior to that time must have been better since naiads were present at two and four miles below the village in 1938 and 1948. In 1948, the site about 11 river miles downstream from this village produced the best collection of naiads taken in the mainstream of the St. Joseph River. If pollution were present in 1960, it must have been in the 1938 through 1948 period when this area was collected. Yet, no fish-kill reports are available in the Ohio Division of Wildlife's files for that period.

Bear Creek has had several fish kills in recent years; but in general the tributary waters in the larger tributary waters are relatively free of extensive pollution. Domestic pollution enters the extreme headwaters of the West Branch of the St. Joseph and in Lairds Creek. No specimens were found in the latter stream. The reported fall of from 100 to 200 feet from the source of the branches of the St. Joseph in Michigan (Anon., 1964) would indicate that the cleansing ability would normally be high, a fact borne out by Allison's (1965) statement of the high water quality of the West Branch.

We are prone to believe that a direct relationship exists between water quality and the loss of many of our rarer species. *Quadrula cylindrica* was found only as shells at the two stations about three and five miles below Edgerton in 1948. This is the area in which pollution has been reported as a problem for many years, and in which Gallagher (1949) stated that no fish kills had been reported since the big one of 1941. The empty shells were in such condition as to indicate that they could not have lain in that stream for seven years, nor did they indicate that they were eroded by being washed downstream for four or five miles from water of better quality above the village. If they were introduced after the 1941 fish kill, their growth per year was greater than the shell growth lines would indicate to have reached their size when collected. The author has observed survival of fish during several fish kills in isolated unusual sets of conditions which provide a habitat in which a few specimens can survive. The many springs in the area could produce such conditions in a small section of the stream bed, in which these *Quadrula* could have survived. More live specimens were taken in Fish Creek in 1975 than had formerly been taken in the entire stream during the years 1939 through 1953. Four were taken at one station in three hours of collecting. Two half shells, which were not in advanced stages of erosion, were also taken at the same site.

The live specimens of *Dysnomia sulcata*, and the half shell found in excellent condition at a muskrat midden, represent the second report of this species since the work of Clark and Wilson (1912). Another specimen number 91,409 in the Michigan Museum collection was found at Ft. Wayne.

The third reported rare and endangered species (Stansbery, 1970) in the St. Joseph River collections is *Pleurobema clava*. It was taken at 12 sites, most of which were in the tributaries, and eight were in Fish Creek and the West Branch of the St. Joseph. It would appear that it requires very clean water since only one specimen was taken about nine miles below Montpelier; but 11 were taken about two miles farther downstream where the largest number of species and specimens were taken from the main stream. The diversification and large size of the naiad population at this point, above Beaber Creek, would indicate that the St. Joseph River's rapid ability to recover its water quality in this area. The specimen taken from the tributary near Newville, Indiana was dead. Otherwise, four of the collections contained one specimen each, one three specimens and the others ranged from 11 to 33 from each station. The follow-up collection in 1975 produced 1, 18, and 46 specimens at three sites in Fish Creek.

It is unfortunate that a type of 'index of abundance' has not accompanied collecting information to permit some comparisons of abundance. It is noted that Clark and Wilson (1912) stated that *Ligumia recta* was fairly common in the Maumee Basin, and yet they took only 63 specimens at 28 stations scattered throughout the entire basin. They considered *Leptodea fragilis* as rather abundant below the dam at Defiance, Ohio where they found 19 specimens; but they reported it as abundant at Grand Rapids where only 16 were found. Can one assume from the 15 *Dysnomia sulcata* by Clark and Wilson (1912) that this species was twice as abundant as *Strophitus rugosus* because only eight of the latter were taken in the basin? Can we make a direct comparison with the collections listed in Table 2? If so, the collecting time was approximately the same. One could not consider that *Pleurobema clava* was absent when the 1948 collections were made or that it is three times as abundant today than it was in 1953. In the days when water quality was not considered a major problem, before harvest was considered as depleting the population, and when malacologists thought of pristine populations, Call (1894) stated, 'The habits of our mollusks are so peculiar that certain seasons present sometimes many forms which fail to appear again for several years.' Clark (1976) discussed the incongruities of sampling which indicate that the entire stream bottom needs to be checked before positive statements on the populations can be made, and that the experience of the collectors in the areas being collected is important. Krumholz, Bingham and Meyer

(1970) illustrate the difference in harvest from the same area by the same method in two consecutive years. The behavior of naiads also may be involved in the estimates of abundance. All four *Quadrula cylindrica* and the *Dysnomia sulcata* collected in 1975 in Fish Creek were lying on the surface of the gravel bottom, completely exposed. Yet, all the *Pleurobema clava* were buried and were found only by raking the locations.

Fish Creek contained 24 of the 26 species found in the St. Joseph drainage, including the rare and endangered species. The numbers of each species found in this creek are probably equal to or exceeded those found at other collecting sites in the St. Joseph Basin. The naiad information available (Table 2) presents the naiad population of the St. Joseph River under its best habitat conditions.

The West Branch contained 22 of the 26 species found in the St. Joseph Basin, but included only *Pleurobema clava* and *Quadrula cylindrica* of the rare and endangered species (Table 2). The numbers of individuals of each species were not equal to those of Fish Creek, except for *Lampsilis fasciola* which was more abundant in this stream. *Anodonta imbecillis* was found only in the upper end of the West Branch and in Nettle Lake, but not elsewhere in the entire drainage. The desirability of small, clear water streams as locations for stream impoundments is a possible threat to the habitat of both smallmouth bass and some naiads. However, the effects of the construction of small reservoirs on such streams has not been documented for Ohio. Collections by the author would indicate a tremendous increase in numbers of *Amblema costata* and *Quadrula quadrula* in the Auglaize River above the power dam at Defiance, Ohio, as compared with the findings of Clark and Wilson (1912) before the dam was built. Yet, there is little question that some species would be adversely affected, at least in a limited area. Such development has already been started on the West Branch.

The list of species previously reported from the St. Joseph River which have not been recently found is impressive. It again raises the question of taxonomy and of methods and conditions of collecting, as well as to true changes in the population, and or habitat. The actual presence of some of these species in the St. Joseph River is subject to question, based on their present and past distribution.

As previously mentioned, fish are generally accepted as the carriers or hosts necessary for the development of glochidia, and they provide distribution in water areas. However, according to the list of hosts of naiad glochidia published by Parmalee (1967), but taken from Baker (1928), it appears that relatively little is known of the specificity of hosts except for a few species. The work of Stein (1973), which more than doubled the known hosts of *Amblema costata* (Say), indicates the same possibility for other species. Parmalee (1967) listed as unknown the hosts of 15 of the species of naiads found in the St. Joseph River.

The maximum number of species of naiads were taken in Fish Creek, which contained all but *Anodonta imbecillis* and *Villosa fabalis* (Table 2) of the 26 species found in the St. Joseph Basin. Yet, only 36 species of fish are known from Fish Creek (Table 1) as compared with 48 species from Nettle Lake, 41 from the mainstream of the St. Joseph and 37 from the West Branch. Even though 48 species of fish were taken from Nettle Lake, only three species of naiads were collected from the lake. Nettle Lake contained seven species of fish not found at other sites in the St. Joseph Basin, and Bear Creek contained one not found elsewhere. Although Fish Creek and the West Branch, in general, produced the best collections from the Basin, they did not contain any species of fish not found in the other streams. One collecting site in the mainstream of the St. Joseph River and two in Fish Creek produced the greatest numbers of species of naiads, but only one fish, *Rhinichthys stratulus* (Hermann) was found with them and not elsewhere. Three species of fish, *Notropis photogenis* (Cope), *N. volucellus* (Cope), and *Ammocrypta pellucida* (Putnam) were found in Fish Creek, West Branch, and the St. Joseph River, but not at other sites sampled in the drainage area. The author's memory for many years has carried an association between the fish *Ammocrypta pellucida* and the naiad *Obovaria subrotunda*. Original field collection data for fish are available in the author's files for six of the seven sites at which *Obovaria subrotunda* was taken in the stream system. The darter and the naiad were found together at five of the six naiad collecting sites, and the naiad was found at only five sites at which the darter was taken. These correlations may be superficial, but appear to be the only ones which are apparent.

Interesting and supporting information on the habitat preferences or stream size can be made with the data reported from the Huron River in southeastern Michigan (1938) and the distribution of the naiads collected for this report. Stream size appears to be correlated with certain sets of conditions which result in rather distinctive populations which can, in general, be predicted prior to collecting the area.

SUMMARY AND CONCLUSIONS

Between 1938 and 1953, the author, aided by Drs. Henry van der Schalie and Harold Harry collected naiads in 39 stations of the St. Joseph River of the Maumee. Twenty-six species were found. The author also collected fish from 63 Ohio stations in the drainage area and took 64 species of fish. Recent concern about rare and endangered species prompted a recheck of some of these early collection sites. Fish Creek was selected for this purpose because it appears to have been least affected by changes occurring throughout the St. Joseph River Basin. Three locations were visited in October 1975 to make collections which might be correlated with the data collected earlier.

The naiad population of the St. Joseph portrays the invasion of the Mississippi fauna into the St. Lawrence assemblage. The spotty distribution of many species seems to indicate considerable variation in habitat in the St. Joseph; but concentrations of certain species might also be interpreted as suggesting that small but similar habitat conditions are also scattered throughout the basin. It does not appear that the less frequently found species required specific habitats for they were usually taken in sites which produced the large numbers of species, or species which were widely distributed throughout the stream system. A microhabitat approach might reveal the reasons for their occurrence.

TABLE 3. Comparison of collections from Fish Creek for the years 1948, 1953, and 1975, Williams County, Ohio, St, Joseph Township.

Date	10/3/48	7/4/53	10/15/75
Location, Section	19	19	19
Species list			
Fusconaia flava	10	9	7
Quadrula cylindrica	--	--	1
Cyclonaias tuberculata	--	--	14
Elliptio dilatata	--	--	3
Pleurobema clava	--	14	46
Pleurobema cordatum coccineum	--	--	1
Alasmidonta calceolus	--	--	1
Alasmidonta marginata	4	4	2
Anodonta grandis	1	—	7
Anodontoides ferussacianus	1	1	--
Lasmigona compressa	1	1	11
Lasmigona costata	--	8	8
Strophitus rugosus	2	2	17
Actinonaias carinata	6	--	3
Lampsilis fasciola	--	2	2
Lampsilis siliquoidea	3	5	23
Lampsilis ventricosa	10	5	17
Villosa iris	3	9	15
Ptychobranchus fasciolaris	--	--	62
Total specimens	41	60	228

Although the main stream was severely polluted below Edgerton in the early period prior to 1941, it appears that conditions must have improved for a few years to permit the appearance of some dead shells found there during the late 1940s. These data seem to indicate that the water quality below Montpelier was poor, but improved rapidly before it was affected by the wastes from Edgerton. It would appear that little or no naiad population was present in the mainstream below Edgerton. Dead shells collected in this area in 1948 suggest the possibility of some specimens surviving the periods of acute pollution under very limited habitat conditions, possibly springs in the stream bottom. However, the large populations, both in species and numbers, were found in the tributaries having high water quality.

There appears to be no direct correlation between the fish found in the streams and the naiads collected in them. Nettle Lake contained the largest number of naiad species and individual fish per acre; but it had the smallest number of naiad species. The only correlation, which may be tenuous, appeared to exist between *Obovaria subrotunda* and *Ammocrypta pellucida*. Those water areas containing the larger numbers of fish species did contain maximum numbers of species of naiads and vice versa.

Abundance, as reported in the literature, seems to have little meaning because of the conflicting reports and the lack of indices which would permit comparisons. Even the present data are not comparable because of variations in collecting, and conditions under which they were made. Although the collecting time for the naiads taken in 1948, 1953, and 1975 (5able 3) was approximately the same, the species taken and numbers varied greatly. One of the species considered as rare and endangered was 'three times as abundant' in 1975 as in 1953, and none was taken at that location in 1948. It would seem that a variety of physical, chemical, and climatic conditions, as well as collecting methods and experience of the collector, produces discrepancies in the findings of the same collector. There are apparent variations in abundance of both species and abundance in populations at the same location when collections over a period of years are compared, but these may be more superficial than real.

The Fish Creek Basin provides an excellent example of an area in which land use has varied little over the past century and will probably continue much the same for some time. The naiad populations are probably as representative of the early inhabitants of the stream of the St. Joseph Basin as can be found today. The protection of this stream and its aquatic communities *now* offers the chance to preserve a 'relic' of the past for future comparisons with the then existing habitats and populations. Scenic Rivers, Wild Rivers, and other programs have been initiated to preserve a unique situation for a definite purpose; why not a stream for its unique aquatic habitat and aquatic communities?

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AMU MEETING PLANNED JULY 11-15 AT NAPLES, FLA.

A symposium on the Evolution of Mollusca will highlight the 43rd annual meeting of the American Malacological Union, Inc. (AMU) July 11-15 at Naples, Florida.

Dr. George M. Davis, AMU president, said the Naples Shell Club will be host for the meeting, with virtually all activities to be at the Naples Beach Club Hotel.

Costs per room will range from $19 per day per single to $22 for a couple (European Plan). The hotel is on 135 acres with 1,000 feet of beach frontage. Facilities include an Olympic size swimming pool, tennis courts, a golf course and seven meeting rooms.

The symposium will be held jointly with the Systematics Association of Great Britain. Papers on other aspects of malacology will also be read during the meeting.

Those wishing to present papers should write to Dr. Davis, Academy of Natural Sciences, Mollusk Department, 19th and Parkway, Philadelphia, Pa. 19103.

Those wishing information on other aspects of the program and accommodations should contact Jerome M. Bijur, 135 Seventh Ave. N., Naples, FL 33940. Information on meeting details will be sent to AMU members as it becomes available.

THE LAND SNAILS OF CARTER CAVES STATE PARK, CARTER COUNTY, KENTUCKY

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Hubricht (1968) noted that a comprehensive treatment of the land snails of Kentucky had yet to appear in the literature. In his attempt to rectify the problem, he reviewed specimens which were a part of his own collections to provide the most complete checklist of Kentucky snails yet to appear at that time (Hubricht, 1968). His collections were, however, quite scanty for some counties. Branson and Batch (1971) provided a similar list of Kentucky Mollusca which filled in some of the distributional gaps of Hubricht. In an earlier paper by Branson and Batch (1968) a checklist of 43 species of land snails was compiled for Pine and Big Black Mountains of southern Kentucky. The regional approach to examination of molluscan fauna is prevalent in the literature of Kentucky land snails (Price, 1900; Hubricht, 1964; Bickel, 1967). This method presents problems to future investigators of the fauna of a geopolitical area. Difficulty arises in synthesizing many reports into a whole, but one advantage is that more complete collection of a specific area allows a more accurate distributional pattern to be delineated. The present paper is a report on the land snails of Carter Caves State Park, Carter County, Kentucky which provides additional distributional data for eastern Kentucky: an area of the state either poorly collected or generally ignored in previous studies.

DESCRIPTION OF THE STUDY AREA

Carter Caves State Park is located in the northwest quarter of Carter County, Kentucky. Carter County, located in the northeast portion of the state, is bounded on the north by Greenup County, on the east by Boyd County, on the south by Lawrence and Elliott Counties, and on the west by Lewis and Rowan Counties. The average elevation of the county is 260 m above sea level and the county is part of the Eastern Mountains of Kentucky and forms a part of the naturally dissected Allegheny Plateau (Funkhouse and Webb, 1932). The caves, which honeycomb the Mississipian limestone are a typical aspect of the regional Karst topography. The primary drainage of the county is Tygart's Creek which flows northeasterly to drain into the Ohio River. Tygart's State Forest forms the western and northern boundaries of the park and Tygart's Creek touches the southeast boundary. The park encompasses 5.12 square kilometers. Oak-hickory climax forest prevails throughout the park.

COLLECTION STATIONS

Snails were collected from June 15 to November 20, 1976. Five collection stations were visited. These stations are described as follows:

Station 1. Below mouth of a cave 0.32 km northwest of the park entrance on Kentucky State Route 182 along the bank of a small unnamed tributary of Tygart's Creek on a southwest-facing slope.

Station 2. North-facing slope overlooking Tygart's Creek Bridge, Kentucky State Route 182, with moist leaf duff covering the slope.

Station 3. Area in and around a large rock shelter 300 m north of Tygart's Creek Bridge, Kentucky State Route 182, on a heavily wooded, moist, east-facing slope.

Station 4. Southeast-facing hillside along a park service road 200 m southeast of the park information center.

Station 5. Relatively dry north-facing roadcut with shale rubble 400 m southeast of the park information center.

Collection station numbers precede the numbers of specimens collected, which are enclosed in parentheses.

Voucher specimens of all snails listed in this paper are located at the Marshall University Malacological Collection, Department of Biological Sciences, Marshall University, Huntington, West Virginia 25701

LAND SNAILS INDIGENOUS TO CARTER CAVES STATE PARK

Anguispira alternata (Say). Collections: 2 (1).
Anguispira alternata angulata Pilsbry. Collections: 2 (2), 3 (1), 4 (3).
Discus patulus (Deshayes). Collections: 1 (1), 2 (11), 3 (15), 4 (5), 5 (4).
Punctum minutissimum (Lea). Collections: 5 (1).
Retinella cryptomphala (Clapp). Collections: 2 (1), 4 (1).
Retinella indentata (Say). Collections: 3 (1).
Retinella cumberlandiana (Clapp). Collections: 5 (2).
Retinella raderi (Dall). Collections: 5 (1).
Mesomphix inornatus (Say). Collections: 1 (3), 2 (9), 3 (45), 5 (4).
Mesomphix cupreus (Rafinesque). Collections: 2 (14), 3 (8), 4 (4), 5 (4).
Mesomphix andrewsi (Pilsbry). Collections: 5 (16).
Mesomphix vulgatus Baker. Collections: 5 (16).
Hawaiia minuscula (Binney). Collections: 3 (2).
Ventridens acerra (Lewis). Collections: 2 (15).
Ventridens demissus (Binney). Collections: 3 (7), 5 (7).
Paravitrea multidentata (Binney). Collections: 3 (2).
Haplotrema concavum (Say). Collections: 1 (1), 2 (9), 3 (7), 4 (1), 5 (2).
Stenotrema hirsutum (Say). Collections: 2 (20), 3 (4), 4 (2).
Stenotrema stenotrema (Pfeiffer). Collections: 1 (1), 2 (2), 4 (1).
Stenotrema stenotrema form *nudum* Pilsbry. Collections: 2 (1), 3 (6), 4 (1), 5 (1).
Stenotrema edvardsi (Bland). Collections: 1 (1), 2 (7), 3 (2), 4 (4), 5 (5).
Stenotrema fraternum (Say). Collections: 5 (2).
Stenotrema leai (Binney). Collections: 2 (1).
Mesodon appressus (Say). Collections: 1 (4), 2 (12), 3 (4), 4 (1), 5 (1).
Mesodon sayanus (Pilsbry). Collections: 1 (4), 2 (2), 3 (2), 4 (3).
Triodopsis fraudulenta (Pilsbry). Collections: 2 (1), 3 (2).
Triodopsis tridentata (Say). Collections: 1 (5), 2 (2), 3 (4), 4 (7), 5 (8).
Triodopsis denotata (Férussac). Collections: 3 (1).
Triodopsis albolabris (Say). Collections: 1 (1), 2 (1), 3 (1).
Vertigo gouldi (Binney). Collections: 2 (1).
Gastrocopta contracta (Say). Collections: 2 (1).
Carychium nannodes Clapp. Collections: 2 (1), 3
Pomatiopsis lapidaria (Say). Collections: 5 (11).

DISCUSSION

Hubricht (1968) reported the presence of only three land snails from Carter County, Kentucky: *Stenotrema hirsutum*, *Mesodon appressus*, and *Triodopsis tridentata*. Thus, the snails listed above represent new county records. Collation of the above checklist with other reports of Kentucky land snails revealed that *Retinella raderi*, *R. cumberlandiana*, and *Mesomphix andrewsi* are here reported for the first time from Kentucky.

Leslie Hubricht (personal communication, 1976) states that the hairy form of *S. stenotrema* is sporadic in occurrence and thus, does not merit recognition. *P. lapidaria* is generally regarded as an aquatic snail and is omitted from works on land snails. Hubricht (1968) however, considers it a land snail and feels it should be treated as such.

ACKNOWLEDGEMENT

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batur, pullulaverat. 29 Junii pars amputata pedis, dextra pars labii, tentaculumque dextrum restitutum erat; perfectam quidem longitudinem hoc nondum habebat, nervus vero opticus niger, solito crassior, novam colli partem & tentaculum ad apicem usque percurrens, puncto nitido terminabatur. Hoc tentaculum valde irritabile minimo tactu sese totum capite condidit. Latere sinistro sola colli & capitis inferior pars restituta erat, absque ullo tentaculi & labii rudimento. Susceptum iter ab ulteriori integrascentium capitum inquisitione avocavit, allatæ vero observationes summa cura peractæ restitutionem partium amissarum in limacibus indubitatam præstant. Addi meretur, Lacertam *agilem*, Lumbricum *terrestrem* & *variegatum*, Limacem *album* & Helicem *nemoralem* (ut *Naides* & *Nereides* taceam) quorum partes amissæ, cauda nempe in illis, tentaculorum alterum in his repullescebant, in nemoribus mihi obviam fuisse, adeoque experimenta, quæ *audax Japeti genus* novissime instituit, ab animalibus in animalibus inde a rerum initio sine strepitu fieri.

In observationibus circa redintegrationem Limacum multa singularia & scitu digna occurrunt, quibus immorari heic non eſt locus; addendum tamen: præter reſtitutionem partium amiſſarum pluribus vermibus communem, genti limacinæ proprium eſſe, quod de nullo animali hucusque conſtat, inediam ultra annum perferre, tantumque temporis intervallum absque capite organisque ſenſoriis vivere *), pro re nata teſta exire, circumvagari, rurſusque condi non capitatam, aperturamque operculo, pro lubitu efficto, claudere.

Summa

*) Hæc mihi ſæpius obſervata cum effatis clariſſ. virorum *Argenville* Zoomorph. p. 79. & *Bomare* ægre conciliantur; huic cochleæ 52, quibus caput amputaverat, mox periere, illi ex centenis, quas collegerat, 25 tantum vitam in craſtinum produxerunt; utrique absque dubio limaces impoſuere, teſta haud ad nutum obſervatorum prodeuntes.

Prima de limacis decollati producta vita obſervatio, cujus palmam *Wattel* in libello, Mercure de France 1768, p. 161. clariſſ. *Spalanzani* eripere tentat, neutri debetur; *Ziegenbalg* enim, Profeſſor Matheſeos Havnienſis, Tranquebari Danorum natus, limaces truncatos fere tres menſes vixiſſe, caſuque occiſos fuiſſe, viginti abhinc annis in Mercure danois, Fevrier 1754, indicavit. - Limaces, viſcere cinereo cum corde exſecto, ad quatriduum vixiſſe, corque exſectum a pulſu ad aliquot horas ceſſaſſe, ſalivaque madefactum iterum pulſaſſe, hoc quoque circa 12 horas eodem eventu iteratum fuiſſe, jam *Liſter* refert; idem teſtudines terreſtres capitibus præciſis libere & valide ad ſex menſes ambulare *anat.* p. 150.

Summa æque miratione dignum est, limaces forma, ut ovum ovo, simillimos; testas non coloribus & pictura tantum, sed ipsa figura, exsudare diversissimas; quantus organorum, omnem visum & conceptum humanum eludentium apparatus huic operi necessarius, oculis tamen nil nisi massa mera viscida conspicitur.

Etenim tot figuras, tot colorum differentias, tot appendices testarum distincte verbis congruis exponere, superat vires vulgaris Philosophi; difficilius adhuc ex multiplici testarum compage eruuntur earum differentiæ specificæ, quæ nisi constituantur justæ, manet vaga, obscura & nunquam capienda Testaceorum Historia.
KLEIN. Plin. ill. p. 3.

GENS TESTACEA.

*) Testa nulla.

Tentaculis linearibus: LIMAX.

**) Testa univalvi.

A. Tentaculis linearibus.

a. *quatuor*: HELIX.
b. *binis*: VERTIGO.

B. Tentaculis truncatis.

a. *introrsum oculatis*: ANCYLUS.
b. *postice oculatis*: CARYCHIUM.

C. Tentaculis triangularibus: BUCCINUM.

D. Tentaculis setaceis.

a. *extrorsum oculatis*: NERITA.
b. *introrsum oculatis*. PLANORBIS.
c. *postice oculatis*: VALVATA.

***) Testa bivalvi.

Siphone duplici.

a. *brevi*: MYTILUS.
b. *elongato*: TELLINA.
c. *nullo*: MYA.

XXII. LI-

XXII. LIMAX.

Vermis nudus, tentaculis quatuor linearibus, oculis apice majorum.

199. LIMAX LÆVIS.

LIMAX niger, glabriusculus.

Dan. GLAT - SNEGLEN.

long. 5 lin.
lat. 1 lin.

Corpus totum nigrum, nitidum, absque rugulis nudo oculo in clypeo aut abdomine conspicuis; nec striæ ullæ margine abdominis supra aut subtus. Planum inferius utrinque nigrum absque striis transversis, area media longitudinali sola pallida. Ope lentis in clypeo striæ transversæ undulatæ, non interruptæ; in dorso abdominis rudimenta rugularum conspiciuntur.

Quavis

Nota specifica perperam desumitur ex distantia clypei a capite, aut ex contractione corporis, minima enim attentio monstrat, hoc vermis pro lubitu mutari.

Mensura in summa limacis extensione acta est.

Quavis ætate LIMACE *atro* angustior est. Rependo collum in longitudinem clypei extendit.

Ob summam cum FASCIOLA *terrestri* similitudinem primum inter limaces locum obtinet, tentacula enim si demas, vix diversus crederetur.

In Muscis, mense Octobri, haud frequens.

200. LIMAX ATER.

LIMAX niger, rugosus.

α aterrimus, subtus pallidus.

LIMAX ater. LIST. *anim angl.* p. 131. t. 2. f. 17. *Synops.* f. 102. *Tab. anat.* 5. f. 1. 23. *Exer. anat.* t. 3. f. 1 - 5.

LIMAX ater. LIN. *Syst.* 1.

COCHLEA nuda. GESN. *aquat.* p. 254.

HILL. *anim.* p 87. t. 3.

SIBBALDI *prodr. nat. hist. Scot.* pars 2. lib. 3. p. 34.

ARGENVILLE *Conch.* t. 28. f. 28.

Berl. Magazin. 3. B. p. 341. t. 5. f. 72.

Dan. SORT - SNEGLEN.

Suec SKOG - SNIGEL.

Germ. DIE SCHWARZE WALD - SCHNECKE.

Angl. BLAK - LIMAX.

Gall. LIMACE NOIRE.

β ater, carina dorsi pallide virente.

long. 5 unci.
lat. 3 lin.

Corpus

Corpus supra aterrimum; *Clypeus* punctis confertis scaber; *Abdomen* dorso sulcis rugosum. Margo sive ora corporis lineis transversis atrioribus striata est; lineæ hæ in plurimis adultorum obscurantur, & fere disparent; in junioribus vero, quorum margo pallidus est, distinctiores ipsam oram tessulatam reddunt.

Subtus in junioribus corpus album est, margine laterali nigricante absque striis conspicuis. In adultis pagina corporis inferior in tres areas æquales per longitudinem dividitur, quarum media alba, laterales obscuræ, striatæ, lineis transversis æqualiter remotis, nigris.

γ niger, ora lutescente; subtus albus.

SWAMMERD. *Bibl. Nat.* t. 9. f. 1.

δ fusco-castaneus, ora lutescente; subtus albus.

LIMAX subrufus. LIST. *Synops.* t. 101. a. f. 103.

LIMAX subrufus montanus. LIST. *app.* t. 2. f. 1.

LIMAX subrufus. LIN. *Syst.* 3.

Berl. Magaz. 3. B. p. 339. t. 6, f. 71.

ε obscure fuscus, ora strigaque utrinque lutescente.

long. 16 - 19 lin.

Hi an varietates *atri*, an species ambigo. Tentacula in omnibus nigra sunt. *β* a vulgari *atro*, abdomine antice passim, carinaque dorsi glauco colore imbutis, tantum differt, cæterum magnitudine & omni parte idem. *γ* & *δ* subtus toti albi; *ε* subtus albus margine summo ochroleucho, supra utrinque marginem versus pallidus. Omnes clypeo, punctis confertis scabriusculo, dorso abdominis sulcis rugoso, & ora corporis lineolis nigris transversis tessulata, conveniunt; ora vero ochreæ colore, ac *δ* præsertim ſtriga longitudinali clypeum & abdomen utrinque percurrente, discrepant. Pullos & adultos *atri* ſæpiſſime reperi, ſuperiori corporis parte ſemper aterrimos; hinc diverſus color non ætati debetur.

Ex deſcriptione Limacis ſubrufi montani *Liſteri*, in Berl. Magaz. 3. B. p. 340. patet (Liſteri enim append. nulla opera uspiam Hafniæ offendere potui) eundem eſſe cum noſtro δ, at cum figuræ quoque conveniunt, ſynonyma autorum huic ſubſtituere vix dubito. Dies docebit, an ab *atro* diſtincta ſpecies ſit.

α in ſylveſtribus vulgaris. β, in nemoroſis, γ, δ, ε, in horto *Fridrichsbergenſi*, rariores.

201. LIMAX ALBUS.

LIMAX albus.

α *albus totus.*

β *albus margine flavo.*

Efterretning om Svampe. p. 61.

γ *albus margine & ſincipite aurantio.*

δ *albus tentaculis nigris.*

Dan. HVID - SNEGLEN.

long. 5 unc. 3 lin.

Hic magnitudine, punctis clypei & rugis abdominis præcedentem refert, diverſus tamen colore conſtanter albo, immaculatus, ac flavedine marginis in varietatibus; hæc eadem in junioribus & ætate provectis.

Puncta

Puncta apice tentaculorum, in α, β, γ, sola-nigra.

Duo specimina reperi, quibus tentaculum dextrum ad medium usque una cum oculo defuit, remanente vestigio dilacerationis in parte superstite.

In Nemore & Sylvis agri *Fridrichsdalensis* haud infrequens; in insula *Haaöen* sinus Christianiensis Norvegiæ semel reperi.

202. LIMAX CINEREUS.

LIMAX cinereus, maculatus & immaculatus.

LIMAX maximus cinereus, striatus. LISTER *exerc. anat.* t. 3. f. 6. 7. 9. 10.

Dan. GRAA-SNEGLEN.

Germ. DIE GROSE NACKENDE WALD-SCHNECKE.

long. 5 unc. 3 lin.

α cinereus immaculatus, clypeo nigro-cæruleo.

CORPUS absque omni macula. *Clypeus* striis minimis curvatis, confertis. ABDOMEN glaucum, subtus area media longitudinali, alba, lateralibus nebulosis, striis transversis remotis albis.

Varietatem β limacis atri e copula var. α *atri* cum variet. α *cinerei* enatam vix ullus dubito.

β cinereus, clypeo maculis abdomine fasciis longitudinalibus nigris.

LIMAX cinereus maximus, striatus & maculatus. LIST. *an. angl.* p. 127. t. 2. f. 15.

LIMAX cinereus maculatus. LIN. *Syst.* 4. *It. oel.* p. 62.

COCHLEA nuda domestica. SWAMMERD. *Bl. Nat.* t. 8. f. 7.

SIB. *pr. h. nat. sc.* p. 2. l. 3. p. 33.

SCHIRACH *von Erd- Schnecken* tab. 2. f. 10.

Berl. Magaz. 3. B. p. 336. t. 9. f. 69.

Caput & *Tentacula* sordide fulvescentia, puncto apicis sive oculo, nigro; nervus tamen opticus inconspicuus. *Collum* sub clypeo punctatum; supra lineis tribus nigris inter tentacula excurrentibus. *Clypeus* maculis flexuosis, sive undulatis, atris. *Abdomen* striatum; dorso fasciis longitudinalibus nigris, utrinque tribus, infima subinterrupta. Margo punctatus est. *Subtus* totus albus.

Terrefactus caput tantum clypeo condit, abdomenque corripit, minus vero caput, caudam & totum corpus clypeo tegere valet, uti autores dixerunt.

Maximus perperam dicitur; LIMACES enim *atri*, *albi* uti quoque varietates *cinerei* magnitudine æquales sunt. Si definitioni & synonymiæ fidendum, Limax, cujus mentionem facit ill. LIN. in itinere *Oeland.* noster *cinereus* est, si descriptioni, *ater* erit.

γ cinereus clypeo abdominique maculis nigris.

LIMAX variegatus, sive fasciatus, cellarius. LIST. *Synops.* f. 104. *tab. anat.* 5. f. 6 - 10.

ARGENVILLE *Conchyl.* t. 28. f. 31. Limax cellaria.

Supra undique maculis nigris insignitus, subtus totus albidus. *Clypeus* glabriusculus, maculis variis nigris. *Abdomen* striatum, dorso seriebus nigris septem interruptis, alternatim angustioribus; margine utrinque punctis sparsis nigris.

δ cinereus

δ cinereus, abdomine ſtriis quinque albidis, infima abrupta.

Nulla in hoc macula nigra. *Carina* dorſi alba ſtriam mediam ad extremum caudæ ductam efficit, ſtria extima abrupta eſt.

ε cinereus, abdomine rugis albis cinereisque, ac maculis nigris ordine duplici.

Clypeus cinereus ſtriis ſubtilibus gyroſis, latere ſiniſtro punctis albis. *Abdomen* rugis papilloſis, plurimis albis, paucis cinereis, dorſo maculæ atræ nitidæ duplici ſerie, duodecim in ſingula. Iuxta baſin utrinque maculæ duæ nigræ, initium novæ ſeriei. *Subtus* area media longitudinalis alba, laterales cinereæ lineis transverſis albis.

ζ cinereus, margine albo.

Supra cinereus, margine & ſubtus totus albus. *Tentacula* nigra. Ora corporis lineis variis nigris transverſim ſtriata.

Varietates hæ, uti *Helicis nemoralis* copula promiſcue junguntur, ſaltem α & ε, individua enim variet. α inter ſe, & α cum ε juncta deprehendi.

Omnes in extenſione æquali fere magnitudine, ζ excepta, quæ minor, ætate forte ab α diverſa.

α vulgaris in nemoroſis; β minus frequens, γ in horto, ε in ſilvis, utraque rara, δ, ζ in umbroſis, nec vulgares.

203. LIMAX SUCCINEUS.

LIMAX ſupra ſubrufus, ſubtus albus.

LIMAX ſubrufus. LIN. *Syſt.* 3.
HILL. *anim.* p. 87. t. 3.

Dan. RAV - SNEGLEN.

long. $1\frac{1}{2}$ unc.

Rufo - fuſcus vel ſuccini coloris eſt absque maculis aut cingulo. *Tentacula* majora ſuperne nigra; inter hæc linea obſcura.

In umbroſis.

In littoribus apricis Inſulæ *Amagriæ* medio Octobris plures reperi huic ſimillimos, longiſſime ab omni umbra remotos, quod in Limacibus inſolitum.

204. LIMAX AGRESTIS.

LIMAX albidus; tentaculis nigris.

LIMAX cinereus, parvus, immaculatus, pratenſis. LIST. *anim. angl.* p. 130. t. 2. f. 16.

LIMAX parvus cinereus. LIST. *Synopſ.* f. 101. tab. anat. 5. f. 11. *Exerc. anat.* t. 3. f. 11.

LIMAX cinereus immaculatus. LIN. *Syſt.* 6.

ARGENVILLE *Conchyl.* t. 28. f. 27.

Berl. Magaz. 36. p. 345. t. 8. f. 74.

SCHIRACH *von Erd- Schnecken* t. 1.

Dan. AGER - SNEGLEN.

Svec. MASK PÅ SÄDEN.

Germ. DIE WIESEN-SCHNECKE, DIE KLEINE GRAUE FELD-SCHNECKE, ACKER - SCHNECKE.

long. 2 - 9 lin.

α albidus, dorſo cinereo.

Subtus & lateribus totus albidus, pellucens; dorſo cinereus, linea obſoleta clypeum & abdomen utrinque percurrente.

β albidus

β albidus, atomis nigris ſparſis.

Linea nigra clypeum & abdomen utrinque percurrit.

γ albidus, capite nigro.

δ albus, immaculatus.

ε albus, clypeo flaveſcente.

Frons, & linea a tentaculis ad clypeum utrinque excurrens, nigra. In hoc & proxime præcedente nullum clypei & abdominis lineæ longitudinalis veſtigium.

Tentacula in omnibus nigra, parva; minora congenerum minima. *Clypeus* a collo diſtingui vix oculo armato videtur, diſtinctus tamen, quod pater, qvoties vermis caput clypeo ſubdit.

Tactus digito quaſi mortuus viſcoſitate adhæret, ac in eo ſtatu totum diem permanet, vereque mortuum crederes; at occidente ſole reviviſcit, victumque quærendo circumvagatur; tum ſi digito rurſus tangatur, tentacula quidem condit, mox vero exſertis, vagando pergit.

In agris & nemoribus ab initio menſis Maji in Decembrem uſque.

205. LIMAX CINCTUS.

LIMAX flaveſcens, clypeo abdomineque cingulo cinereo.

STRÖM *Söndmör*, 1. p. 203. no. 3.

Dan. GIORD - SNEGLEN.

long. 2. unc.

Succini coloris *ſupra* absque omni macula. *Subtus* totus albus. *Clypeus & abdomen* dorſo ſtriga cinerea cingitur.

In nemoroſis haud frequens.

206. LIMAX MARGINATUS.

LIMAX cinereus, clypeo utrinque ſtriga obſcura, abdomine pallide cæruleſcente.

Dan. BÖG - SNEGLEN.

long. 2. unc.

Striga *Clypei* in omnibus nota conſtans; maculæ raræ nigræ in *abdomine* paucorum. Carina dorſi alba, utrinque cinereo-ſubcæruleſcens.

Juniores & adulti iisdem coloribus.

In Fago vulgaris primo Vere & Novembri.

207. LIMAX RETICULATUS.

LIMAX fuſcus, clypeo punctis, abdomine lineolis nigris.

SCHÆFFER *Verſuche mit Schnecken* 1. St. t. 1. & t. 2. f. 1. 2. 3.

Dan. NET - SNEGLEN.

long. 1½. unc.

Clypeus punctis ſparſus majoribus & minoribus nigris. *Abdomen* rugis longitudinalibus, maculisque linearibus nigricantibus quaſi reticulatum.

In horto *Roſenburgenſi* & *Fridrichsdalenſi* vulgaris.

208. LIMAX FLAVUS.

LIMAX flavus immaculatus.

Dan. GUUL - SNEGLEN.

long. 1½. unc.

Supra flavus absque omni macula. *Subtus* albus. *Tentacula* lineaque inter hæc & clypeum nigra. *Clypeus* imprimis flavissimus absque rugis concentricis.

Octobri alium semel reperi ab hoc diversum *clypeo* brevi tumido rugis concentricis instructo, *collo* albido, hoc, quod rarum in Limace, extensum clypeo longius. Abdomen pallide flavum, cæterum idem. Tumore Clypei antico, ac collo longissime extenso singularis.

In umbrosis Daniæ & Norvegiæ.

209. LIMAX FUSCUS.

LIMAX rufescens, linea laterali dorsoque nigricante.

Dan. BRUUN - SNEGLEN.

long. 8. lin.

Supra rufescens, dorso clypei & abdominis macula longitudinalis fusca; utrinque linea nigricans clypei sinuata. Subtus albus. Tentacula nigra.

In nemorosis. Plures magnitudine æquales, juniores forte, Decembre reperi.

210. LIMAX TENELLUS.

LIMAX virescens, capite tentaculisque nigris.

Dan. SPÆD - SNEGLEN.

long. 10 unc.

Totus albidus. *Clypeus* in luteum, *abdomen* in virescentem colorem aliquantum vergit; ille margine postico, hoc apice supra nigricat.

In Fossulis Nemorum foliis aridis repletis; primo vere.

XXIII. HELIX.

Vermis cochleatus, tentaculis quatuor linearibus, oculis apice majorum.

* Depressæ :

211. HELIX LAMPAS.

Helix testa imperforata, carinata, supra planiuscula, subtus gibba; anfractibus cicatricosis: extimo divaricato.

Dan. DEN RÖDGULE LAMPE.

diam. 31 lin.

Facies

Depressæ: imperforatæ: 211 — — 220.
perforatæ: 221 — — 227.
umbilicatæ: 228 — — 242.
Globosæ: imperforatæ: 243 — — 254.
perforatæ: 255 — — 263.
umbilicatæ: 264 — — 272.
Trochiformes. 273 — — 283.
Ovatæ: 284 — — 286.
Conicæ: 287 — — 304.
Cylindraceæ: 305 — — 313.
Turritæ: 314 — — 329.
Carinatæ; depressæ: 211, 212, 216, 217, 221, 222, 226 — 228, 235, 240 — 242.
globosæ: 263, 269.
trochiformes: 273, 278, 279, 283.
Sinistrorsæ: 242, 244, 266, 289, 291, 294, 307, 316, 317, 318.
Indigenæ: 215, 223, 230 — 234, 240, 243, 246 — 249, 258, 259, 267, 268, 277, 280, 297, 303 — 305, 316, 317.

Modus & gradus depressionis in speciebus diversis multiplex, quædam totam paginam superiorem, quædam inferiorem depressam habent, Facies H. *Carocollæ* at magnitudine, levitate, &c. diversa.

Testa fulva, subtilius striata, supra minus, subtùs magis convexa, quam in *Carocolla*, cicatricibusque crebris ubique notata. *Carina* acuta, subalbescens. *Anfractus* quatuor lati, planiusculi, leviter eminentes; extimus carinam versus utrinque depressus, aperturam versus a recto tramite, i. e. a carina vicini deorsum deflectit. Testa *subtus* ad axin elevatior, seu gibba, juxta carinam depressa, in quibusdam profundius striata. *Centrum* tectum labio aperturæ. *Apertura* transversa, aurem simulat. *Labrum* aurantium, glabrum valde reflexum, in adultis parieti aperturæ opposito adnatum. *Faux* lutescens.

Grana similia ac in Nerita *Rubella* hanc passim occupant, quæ detrita annulum ovalem in testa superstitem ostendunt, mihi ova potius peregrini vel parasitici animalculi, quam pulli Helicis.

In Museo illustrissimi Comitis a Moltke, Equitis aurati, ordinis Elephantini, Scientiarum & artium Mæcenatis immortalis, *Lucernarum* hæc rarissima in duplo conspicitur.

212. HELIX LUCERNA.

Helix testa imperforata, carinata, alba, supra planiuscula, subtus gibba; apertura transversa, bidentata.

Dan. DEN HVIDE LAMPE.

diam. 13 lin.

Facies *Placentæ* at decuplo minor, colore, apertura, dentibusque diversa.

habent, aliæ verticem vel spiras minores depressas, aliæ e contra has elevatas, illum planiusculum, vel v. v. habent. Subdivisio exinde sumi potuit, at cum foraminulum & umbilicus nota splendidior generaliorque sit, hanc prætuli.

Testa alba absque omni stria; subtus elevatior, pone aperturam sinuata. *Anfractus* valde depressi. Centrum clausum labro aperturæ. Hæc transversalis margine labii reflexo, introrsum dentibus duobus notato, extrorsum sinuato.

In Museo reverendis. *Chemnitz*, antistitis Havniensis præsidiarii.

213. HELIX MURALIS.

HELIX testa imperforata, subdepressa, striata, albida maculis fuscis; labro albo.

COCHLEA terrestris depressa basi albida, superius marmoris instar variegata, oris apertura ovali & candida. *Gualt. test.* t. 5. f. F.

TURBO variegatus LIST. *Synops.* t. 74. f. 74.

COCHLEA Pouchet ADANS. *Senegal.* p. 18. t. 1. f. 2.

SERPENTULUS ore labiato, acutangulo, varius. KLEIN. *ostroc.* p. 9. t. 1. f. 18.

Dan. MUUR-SNEKKEN.

diam. 7 lin.

Testa depressiuscula supra albida, striis obliquis, confertis, profundis notata, strigisque fuscis insignita, subtus alba glabra, minus striata, immaculata. *Apertura* fusca; *Labrum* album acutum subreflexum. *Anfractus* quatuor.

Quædam specimina maculis fuscis punctulata sunt.

In Italia.

214. HELIX.

214. HELIX CARTUSIANA.

HELIX imperforata, subdepressa, alba, anfractibus sex.

COCHLEA testa utrinque convexa alba; sex spirarum, labro vix reflexo. GEOFR. *conchyl.* IV.

SCHRÖTER *von Erd-konchylien um Thangelstedt.* p. 205. n. 74. t. 2. f. 27?

Dan. KARTHEUSER-SNEKKEN.

Germ. DIE KARTHEUSER NONNE; DIE WEISSE WALDSCHNECKE.

Gall. LA CHARTREUSE.

diam. 6 lin.

Testa pellucida alba, utrinque convexa, supra tamen depressiuscula. *Anfractus* fere sex. Labium candidum, crassiusculum, ora tenuiori. Juniores perforatæ, foramen tamen in adultis, uti in pluribus congenerum, clauditur.

Synonyma clarif. *Martini* huic minus conveniunt, figuraque cl. *Schröter* nimis convexa faciem H. *nemoralis* præbet.

In Gallia. Clariss. *Geoffroi* dedit.

215. HELIX PELLUCIDA.

HELIX testa imperforata, depressiuscula, nitida, subviriscente; anfractibus tribus.

HELIX subrotunda, convexa, anfractibus tribus, apertura subrotundo-lunata. STRÖM. *act. Nidr.* vol. 3. p. 435. t. 6. f. 15.

Cochlea

Cochlea testa tota pellucida, fragili, subvirescente, utrinque convexa, spiris tribus. Geofr. *conchyl.* VIII.

Schröter *Erd - Schnecken um Thangelstedt.* p. 187. n. 21. t. 1. f. 11.

Dan. GLAS - SNEGLEN.

Gall. LA TRANSPARENTE.

diam. $\frac{1}{8}$ - $1\frac{1}{2}$ lin.

Primo intuitu glebulam viscosam mentitur, eamque ob caussam inquirenti facile imponit.

Testa tenerrima vitrea, pellucidissima, politissima, & perquam fragilis; animalculo foeta flaveola, vacua albido - virens apparet; utrinque convexa absque striis aut foramine umbilicali. *Anfractus* supra vix tres, subtus unicus. Apertura lunata, repanda.

Limax albidus tempestate pluvia vivacissimus, puncta tentaculorum nigra sive oculos omni momento citissime in corpus retrahit, ac rursus protrudit, nervo optico inconspicuo, serena vero, aut in testa latet, aut extra eandem quiete moratur, vel in perpoliendo testam occupatur. Hæc politio non uti in Helice *hortensi* ope maxillæ peragitur, sed organo huic usui & ipsi H. *pellucidæ* proprio. *Pallium* nempe, quo limaces testa instructi cinguntur, supra dorsum hujus aliquantum protenditur, ac a dextra in laciniam longam dividitur. Pars corpori incumbens albida est, ac atomis nigris sparsa, oram aperturæ acutam obvolvit, ac, clypei instar in nudis limacibus, anticam dorsi partem ad basin tentaculorum usque condit; lacinia alba vero, in testam revoluta, octavam testæ partem tegit, ac crebris frictionibus undulatoriis in verticem protenditur. A perpendiculari ad angulum acutum interdum utrinque moveri vidi, at non ultra.

Motus cordis, seu musculi candidi, peristalticus in latere sinistro pellucidam testam transparet. Vita limacis æque ac testa fragilissima;

fragilissima; octiduum enim in theca servati exanimes conperiebantur.

Limacem in aqua perire affirmat Clarif. *Geofroi*; hoc sese nobis, etiamsi periculum in pluribus fecerimus, minus probavit; in aquam enim immissi, fundum statim petierunt, ac totum corpus e testa protulerunt, tentacula tamen in aqua, quod pluribus terrestrium commune, non exseruerunt; Hoc situ immobiles mortuos quidem simulant, at intra paucas horas partim aqua exeunt, & observatori minus cauto perduntur, omnes vero, si ex aqua, immo post elapsum duodecim horarum spatium, tollantur, mox tentacula porrigunt, incedunt, ac brevi sese testa condunt.

In *Jungermannia* platophylla sub finem Augusti, in fimo equino plures Octobri, & in virgultis medio Decembris reperi.

216. HELIX RINGENS.

HELIX testa imperforata, subcarinata, apertura resupinata, utrinque dentata.

Helix testa subcarinata, imperforata, convexa, apertura resupinata: labio postice quadruplicato. LIN. *Syst.* 664.

Cochlea variegata, septem dentibus donata, duobus in fundo oris & quinque ad labrum claviculæ. LIST. Syn. t. 99. f. 100.

ARGENVILLE Conchyl. 1. t. 28. f. 13. 14.

ANGYSTOMA fimbriatum & dentatum clavicula inversa, i.e. ore obtorto ad turbinis apicem respiciente. KLEIN. *ostrocod.* p. 11. §. 31. e. 1.

BON. *Mus. Kirch.* p. 471. f. 331. 332.

Berl. Magaz. 2. B. p. 623. t. 4. f. 42.

LESSER. Testac. p. 118. n. X. §. 42. X.

Dan. VRÆNGE SNEKKEN.

Germ. DAS GEZÄHNELTE MUNDSTÜCK.

diam. 13 - 17 lin.

Testa orbiculata pellucida utrinque convexa, subcarinata, candida, maculis ex fulvo - aureis subtus & ad carinam sparsis. *Anfractus* quinque fascia lineari maculis concolore juxta juncturam verticem versus evanescente. Subtus anfractus unicus, qui non in circulum absolvitur, sed ultra mediam recta extensa in aperturam resupinatam finitur; hinc in inferiori pagina rima transversalis, quasi radius circuli. Hic aperturæ situs superiorem paginam spectans huic speciei propriissimus est. *Apertura*, si excavationem spectes, lunata est, si extensionem labri, fere circularis, nullo modo elongata, nec ut in H. *Carocolla*. *Labium* exterius reflexum candidum, interius dilatatum, spiris oppositis adnatum. *Dentes* compressi, quinque intra labium & tres in ipsa carina anfractus. *Sinus* duo vel tres in exteriori labri parte.

In Museo *Moltkiano*.

217. HELIX SINUATA.

HELIX testa imperforata, subcarinata, brunnea, carina candida, apertura transversa dentata, postice triplicata.

COCHLEA subrufa, quatuor dentibus ex parte columellæ donata, adversus quos extra totidem sinus conspicui. LIST. *Syn.* t. 97. f. 98.

COCHLEA subrufa quatuor dentibus donata, quibus tamen extra tantum duo sinus respondent. LIST. *Syn.* t. 98. f. 99.

ANGYSTOMA fimbriatum & dentatum, tetraodon, subrufum, quatuor dentibus sinus formantibus. KLEIN. *ostroc.* p. 11. §. 31. d. 1.

Dan. TAND - BUGT - SNEKKEN.

diam. 9 lin.

Testa

Testa flavo - brunnea, scabriuscula, oculo armato punctis minimis convexis pulchre cooperta, supra & subtus planiuscula. *Anfractus* quinque teretes, carina in medio candidissima; *Apertura* transversalis, elongata. *Labrum* reflexum: sub sinistro labio extrorsum ipsi spiræ plicæ tres impressæ, introrsum in apertura dentes quatuor. Canaliculus in ipso centro inter spiram & columellam descendens. Variat testa fusco colore.

Sinus centro proximi labro, prout augetur, conduntur.

In America.

218. HELIX LACTEA.

HELIX testa imperforata, depressa, grisea, atomis lacteis, apertura fusco - sanguinea, labro concolore dentata.

Dan. DEN GRÜNEDE SNEKKE.

α *grisea, immaculata.*

diam. 12 lin.

β *griseo - lutescente, fascia media lactea.*

diam. 10 lin.

γ *alba, fasciis quatuor fuscis.*

COCHLEA fasciata, clavicula compressiore, labro repando, ex fusco variegata & fasciata. LIST. *Syn.* t. 51. f. 49.

PETIV. *gazophyl.* t. 153. f. 8.

diam. 14 lin.

ɛ *alba, fasciis tribus obsoletis rufis.*

Cochlea & fasciis & ipso ore nigricante unico dente columella distincta. List. *Syn.* t. 95. f. 96.

diam. 18 lin.

Licet magnitudine adeo differunt, quævis tamen incrementum testæ jam absolverat.

Facies H. *nemoralis*, at griseo-alba atomis confluentibus calcareis obducta. Anfractus quinque; major, qua apertura cingitur, minus solito inclinatur, areamque centri, quam in cæteris, elatiorem habet. *Apertura* & paries oppositus saturate cruentus, sive rufo-fuscus, nitidus; labium aperturæ concolor, in minoribus subreflexum, in majoribus dilatatum, dente in margine interiori, solitario. In γ dens minus distinguitur, labrum vero dentis loco subsinuatum est.

219. HELIX VERMICULATA.

Helix testa imperforata, subdepressa, fasciis rufis, lineolis albis, labio reflexo candido.

Dan. NUDEL-SNEKKEN.

1. *lævis, fasciis quatuor rufis.*

Cochlea terrestris vulgaris quatuor fasciis cincta, maculata & eleganter variegata. Gualt. *test.* t. 1. f. G.

Cochlea Pisana hortensis Petiv. *gazophyl.* t. 52. f. 11.

diam. 12 lin.

Testa glabra absque atomis linearibus, fasciæ duæ inferiores angustiores integræ, superiores latiores tessellatim interruptæ; hinc vertice pulchre variegata.

2. *lineo-*

2. *lineolata, fasciis quatuor rufis.*

diam. 13 lin.

TESTA tota extus lineolis albis confertissimis atomorum instar in fasciis & in interstitiis obsita. Fascia uti in præcedente, at in quibusdam obsoletæ.

3. *lineolata fascia, unica rufa.*

diam. 10 lin.

Hæc minor, fascia media ruso & albo tessulata, cæterum uti præcedens atomis linearibus obruta.

Hujus varietates porro videntur figuræ *Gualtieri* A. & B. t. 3. & *Bonani* 333. in Mus. Kirck. Cl. 3.

Licet specimina primæ varietatis adeo lævia sint, ut ne ullum quidem lineolarum vestigium reperiri queat, & sequentium lineolis undique vestita, specie tamen differre vix crederem, cum structura & magnitudine eadem, lineolæque forte detritæ sint. *Testa* utrinque convexa, vertice planiusculo. *Apertura* candida; *Labrum* dilatatum reflexum, candidum, nitidum. *Anfractus* quinque.

In Italiæ sabulosis juxta torrentes.

220. HELIX PUNCTATA.

HELIX testa imperforata, subdepressa, grisea, fasciis fuscis, atomisque lacteis, apertura fusca, labro reflexo albo.

Dan. PUNKT - SNEKKEN.

diam. 10 - 12 lin.

H. *lacteam & vermiculatam* refert, area vero centrali minus elevata, apertura edentula & labro albo ab illa, apertura & pariete oppoſito fuſco ab hac differt, forte trinæ hæ meræ varietates, loco natali inquirendæ.

Teſta griſea, ſive pallida, punctis albis notata, ac faſciis quatuor fuſcis diſtincta, ſuperioribus plerumque confluentibus; vel ſi mavis fuſco-brunnea faſciis tribus albis; quouis reſpectu faſciarum una paginæ inferiori inſcribitur. *Anfractus* quinque. *Apertura* ſubfuſca, paries oppoſitus nitide brunneus. *Labrum* ſubreflexum album, in junioribus margine inferno centrum verſus denticulum mentitur. *Juniores* perforatæ ſunt, nec foramen clauditur, antequam *labrum* omnibus numeris abſolutum ſit.

In Italia.

221. HELIX EXILIS.

HELIX teſta perforata, depreſſa, ſubcarinata, pallida, faſcia rufa albæ adnata; anfractibus ſtriatis.

Dan. DEN TYNDE SNEKKE.

diam. 10 lin.

In plurimis H. *groſſæ* accedit, at figura differt, cum ſit depreſſa, hinc valde dubius, an varietas illius dici poſſit; *Teſta* pellucida, tenera, albida, ſupra depreſſa, argute transverſim ſtriata, ſubtus convexa, alba, ſtriis minus diſtinctis. *Anfractus* quinque carinati; carina candida eſt; huic infra approximata eſt faſcia parallela anguſta, rufa. Centrum ſubtus pervium, area centri rufofuſca. *Apertura* lunata margine acuto.

In Muſeo clariſſ. *Fabricii*, Oeconomiæ Profeſſoris Havnienſis.

222. HELIX LÆVIPES.

HELIX teſta perforata, ſubdepreſſa, ſubcarinata, ſiniſtrorſa, pallida, faſcia rufa albæ adnata.

Dan. DEN LÆTTE SNEKKE.

diam. 12 lin.

Prima

226. HELIX ALBINA.

HELIX testa perforata, planiuscula, carinata, alba, subtus gibba, apertura quadrangulari.

LIST. *Syn.* t. 86. f. 86?

Dan. DEN HVIDE TAND-SNEKKE; KREBS-ÖIET.

diam. 3 lin.

Prima facie H. *explanatam* aliquantum refert, nota vero splendida, dente in medio anfractus aperturæ oppositi mox distinguitur.

Testa alba immaculata (injuria forte aëris). *Anfractus* supra tres, medio parum convexi, subtus unicus valde convexus, margine acuto. Centrum subtus perforatum. *Apertura* figuram subquadratam mentitur.

In Museis passim.

227. HELIX MACULATA.

HELIX testa perforata, planiuscula, subcarinata, alba, atomis fuscis, subtus gibba, fasciis linearibus.

Dan. DEN SPÆTTEDE KANT-SNEKKE.

diam. $4\frac{1}{2}$ lin.

Testa alba, supra planiuscula, fasciis duabus ex maculis minimis fuscis, spatio intermedio lineari albo. Summus margo, seu ipsa carina alba, subtus valde convexa, lineis juxta marginem imprimis concentricis fucescentibus. *Anfractus* supra tres, subtus unicus; *Centrum* subtus pervium. Junior est, nec absoluta.

228. HELIX EXPLANATA.

HELIX testa umbilicata, plana, carinata, alba, subtus gibba; apertura semicordata.

HELIX testa carinata umbilicata, planiuscula, subtus gibba; apertura semicordata. LIN. *Syst.* 658.

COCHLEA terrestris depressa & umbilicata, albida, fascia punctata rufa per medium anfractuum & maculis concoloribus eleganter depicta. GUALT. *test.* t. 3. f. Z.

COCHLEA alba umbilicata, limbo acuto circumdata, clavicula omnino plano sive compressa. LIST. *Syn.* t. 64. f. 62.

COCHLEA alba umbilicata, margine acuto, clavicula plana. LIST. *Syn.* t. 80. f. 81.

COCHLEA trium orbium. LIST. *Syn.* t. 140. f. 46. & 47.

Dan. PLAT - SNEKKEN.

diam. $5\frac{1}{2}$ lin.

Testa glabra, alba, subtilissime transversim striata, immaculata, figuræ tamen *Gualtieri*, nisi quod major sit, exacte convenit. Supra planissima, subtus valde convexa, margo hinc anfractuum acutus, sive carinatus, paginam superiorem spectat. *Anfractus* supra quinque, subtus in umbilico tres visibiles. *Apertura* formam cordis dissecti præfert. Descriptiones *Listeri* conveniunt, figuræ t. 64. & 80. quodammodo, t. 140. optime.

Injuria forte aëris dealbata Linneo *albella* dicitur.

In Museo perillustris a *Suhm*, a consiliis Conferentiæ.

229. HE-

229. HELIX OBVOLUTA.

HELIX testa umbilicata, utrinque depressa, spiris obvolutis.

Dan. SKÆV MUNDEN.

Germ. DIE SAMMET SCHNECKE MIT DREYECKIGTEM MUNDE.

Gall. LA VELOUTEE A BOUCHE TRIANGULAIRE.

α albida, glabra, apertura triangulari, labro reflexo.

COCHLEA terrestris umbilicata, fusca, ore triangulari. GUALT. *test.* t. 2. f. S.

COCHLEA terrestris, foveata, complanata; SCHLOTT. *act. helv.* Tom. 5. p. 280. t. 3. f. 16.

Berl. Magazin 2. B. t. 3. f. 37.

SCHRÖTER *Erdkonchylien um Thangelstedt*, p. 196. n. 67. t. 2. f. 24. a.

diam. 4 - 5 lin.

Testa albida, supra planiuscula, centro depresso, subtus convexa; armato oculo subtilissime striata. *Anfractus* sex & septem contorti. *Umbilicus* patulus, profundus. *Apertura* triangularis; Labrum reflexum, candidum, politum, parum sinuatum.

β fusca, hispida, apertura lunari.

COCHLEA testa fusca, hispida, supra plana, subtus perforata, spiris sex, apertura triangulari, labro reflexo luteo. GEOFR. *test.* 12.

SCHRÖTER *Erdkonchylien um Thangelstedt*. p. 194. n. 66. t. 2. f. 24

diam. 4 lin.

Testa ruso-susca; setis hispida; Ansractus quinque & sex; Apertura formam lunæ in primo quadrante, non trianguli, præfert; cæterum eadem, junior enim incrementum nondum absolverat, formaque aperturæ triangularis labro sinuoso formatur. Aperturam claudit massa calcarea albissima, ut in H. *pomatia*. Setæ forte in hac, ut in H. *hispida* ætate teruntur.

Structura, ansractibus sibi invicem obvolutis adeo *Planorbem contortum* refert, ut ejus generis seu aquaticam esse diceres; at labro splendido reflexo terrestrem se probat.

Perfectam α clariss. *Bassi* ex Italia, β vero clariss. *Schröter* e Saxonia misit.

230. HELIX CELLARIA.

HELIX testa umbilicata, depressa, lutescente, nitida, subtus lactea; apertura larga.

SCHRÖTER *von Erdkonchylien um Thangelstedt.* p. 200. n. 70. f. 73. t. 2. f. 26.

Dan. KIELDER-SNEKKEN.

diam. 3½ lin.

Testa glaberrima, pellucida, politissima, supra planiuscula, subtus convexa, limace foeta, lutea sive ruso-susca; vacua ex albo lutescens, subtus in utroque casu lactei coloris. *Ansractus* supra quinque, subtus unicus. *Umbilicus* prosundus. *Apertura* larga, lunata.

Limax totus albus. *Nervus* opticus cæruleus; *Oculus* niger. Rependo tentacula alternando, licet nullum obstaculum obviam sistitur,

ſiſtitur, ad medium dorſi uſque retrahit, ac momento rurſus porrigit. Quoniam corpus beſtiolæ pellucidum eſt, motus nervi & puncti viſorii retrogradus & progreſſivus non absque voluptate conſpicitur.

In cellis vinariis Havniæ copioſe.

231. HELIX ROTUNDATA.

HELIX teſta umbilicata, ſubdepreſſa, lineis transverſis elevatis, maculisque ferrugineis.

COCHLEA teſta ſupra convexa, ſubtus concava, ſtriata; cornea lineis transverſis ferrugineis, quinque ſpiris rotundatis. GEOFR. *Conchyl.* 9.

ARGENVILLE *Conchyl.* 2. t. 9. f. 10.

SCHRÖTER *von Erdkonchylien um Thangelſtedt*, p. 199. n. 68. & 69. t. 2. f. 25. at non ſynonyma.

Dan. KNAP-SNEKKEN.

Germ. DER KNOPF.

Gall. LE BOUTON.

diam. $2\frac{1}{4}$ lin.

Teſta ſupra planiuſcula, ſubtus convexa, alba, pulchre ſtriata; variat maculata & immaculata omni ætate; utriusque enim varietatis juniores $\frac{1}{4}$ lineæ diametro & adultas ſæpius vidi. Maculæ transverſæ ferrugineæ teſtam teſſulatam reddunt *Anfractus* 4, 5, 6 ſupra, ſubtus unicus, at in umbilico valde perforato proſpiciuntur tres minores. *Apertura* arcuata absque labro.

Limax albus, punctis minimis obſcuris poſtice in dorſo, antice niger eſt, uti *caput* & *tentacula*; *Oculus* ater. Tentacula

 inferiora

inferiora tubercula minima referunt. Raro e testa exit; quoties enim elicere tentarem, brevi partem corporis in ipsa apertura produxit, at omnes licet cautelæ adhiberentur, tranquilla ut omnia essent, & ne halitum auræ quidem sentiret, duæ fere horæ præterierunt, antequam foris apparuerit.

In palis putridis, truncis & muscis Daniæ vulgaris, Norvegiæ vero rarior.

232. HELIX PULCHELLA.

HELIX testa umbilicata, subdepressa, alba, glabra, apertura circinnata; labro tereti, reflexo.

COCHLEA testa utrinque convexa, subtus perforata, striata, alba, quatuor spirarum, ore reflexo. GEOFR. *Conchyl.* 6.

Dan. DEN LILLE HVIDE SNEKKE.

Gall. LA PETITE STRIEE.

diam. 1 lin.

Testa tota alba, glabra, subpellucida, supra planiuscula, subtus aliquantum convexa. Vertex testæ, dum limax eam inhabitat, luteolus. *Anfractus* vix quatuor, subtus unicus. *Apertura* fere circularis, limbo elevato, tereti, reflexo. *Testa* quidem striata est, at striæ microscopio tantum visibiles.

Limax lacteus: tentacula minora armato etiam oculo difficulter conspicua; punctum majorum nigrum sive oculus ad minimum tactum velocissime ad medium fere dorsi retrahitur: Bestiola difficillime e testa elicitur, nec apparet, Claris. *Geofroi* eam unquam vidisse. Diu dubius fui, an esset limax; massa enim gelatina foris prodibat, sese movebat, nec ullum artuum vestigium prodebatur, tandem oculi & tentacula sese spectando præbuerunt.

Striatam

Striatam *parvam* f. 7. t. 9. part. II. Conchyl. *Argenville* huic perperam tribuit Clariſſ. *Geofroi*; ipſe enim autor eandem eſſe ac ſtriata *magna*, quæ eſt Coch. V. *Geofr.* pronunciat, ac figura probat, in qua nec labrum, noſtræ *pulchellæ* proprium, conſpicitur.

In humidis muſcoſis frequens.

233. HELIX COSTATA.

HELIX teſta ſubdepreſſa, umbilicata, cinerea; ſpiris coſtatis; apertura circulari; labro albo, reflexo.

Dan. RIB-BEEN-SNEKKEN.

diam. 1 lin.

Teſta convexiuſcula, opaca, ſupra fuſceſcens, ſubtus pallida. *Anfractus* quatuor externe coſtati, ſive plicis transverſis armati; in majori anfractu triginta numeravi; hic ſubtus glaber eſt. *Apertura* circularis; vix duodecima peripheriæ pars ab anfractu oppoſito interſecatur, cum in antecedente fere quarta. Coſtæ, ſi teſta lumini obvertatur, in ſola apertura transparent. *Labrum* album, planum, reflexum.

Hujus plurima ſpecimina miſit Clariſſ. *Martini* ſub denominatione *Serpentuli exigui* Berl. Mag. 4. B. p. 267. t. 8. f. 25, at nec deſcriptio nec figura ſatis convenit, cum de ſtriis elevatis ſive coſtis ac labro reflexo altum ſilentium ſit, fluviatilisque dicatur, ſpeciminum labra reflexa terreſtrem probant.

In loco elevato *Fridrichsdalenſis* ab aquis remoto, rariſſima.

234. HELIX NITIDA.

HELIX testa umbilicata, subdepressa, fulvo-cornea, pellucida, substriata, apertura larga.

COCHLEA minor lucens. PETIV. *gaz.* t. 93. f. 14.

COCHLEA minuta, leviter depressa. SWAMM. *Bibl. Nat.* t. 8. f. 3.

COCHLEA testa utrinque convexa, subtus perforata, cornea pellucida, nitida; quinque spirarum GEOFR. *Conchyl.* 7.

ARGENVILLE t. 28. f. 4. at nostris duplo major.

HELIX testa umbilicata, planiuscula, anfractibus quatuor, apertura subrotunda lunata. STRÖM. *act. nidros.* 3. p. 435. t. 6. f. 16.

SCHRÖTER *von Erdkonchylien um Thangelstedt* p. 201. n. 71.

Dan. GLIS SNEKKEN.

Germ DIE GLÄNZENDE WIESEN-SCHNECKE.

Gall. LA LUISANTE.

diam. 1 - 4 lin.

Testa nitida, pellucida, substriata, limace foeta, nigra: vacua brunnea: *Anfractus* quatuor vel quinque, subtus unicus. Apertura larga, lunata; margo acutus.

Limax pallide cæruleus.

Aliam albam, hyalinam, pellucidissimam, striatam reperi; hujus an sequentis varietas?

In muscosis humidis, præsertim in *Sphagno*, ac in scala lapidea horti *Fridrichsbergensis*.

235. HELIX

235. HELIX POLITA.

HELIX testa umbilicata, subdepressa, subcarinata, candida, striata.

> HELIX testa subcarinata, umbilicata, convexa, striata, subtus gibbosiore, apertura subrotundo - lunata. LIN. *Syst.* 659?

Dan. FISKE - ÖIET.

diam. 2½ lin.

Testa convexa, candidissima glaberrima, oculo armato argute striata; facie & statura H. *hispidæ*. *Umbilicus* patulus; *Apertura* lunata. In uno specimine intra marginem aperturæ labium duplex sive margo acutus elevatus, qualis unicus in junioribus H. *arbustorum*, videtur. Anfractus quinque.

In ripis torrentum *Lombardiæ*.

236. HELIX ERICETORUM.

HELIX testa umbilicata, depressa, lutescente, fascia unica vel pluribus fuscis.

Dan. LYNG - SNEKKEN.

Gall. LE GRAND RUBAN; LE RUBAN PLAT.

α *fascia unica.*

diam. 11 lin.

> COCHLEA terrestris depressa & umbilicata, umbilico satis conspicuo candida, transversim striata, unica fascia pulla ad ipsum marginem primi orbis distincta. GUALT. *test.* t. 3. f. O.

COCHLEA testa alba supra plana, subtus sinu amplo perforato, spiris quinque, fascia ferruginea. GEOFR. *test.* 13.

Testa suborbicularis, lutescens, supra depressa, subtus planiuscula. *Fascia* unica fusca in medio majoris spiræ, in reliquis nulla. *Umbilicus* largus ad verticem usque; spiræ tres in eo conspicuæ. *Apertura* lunata, fascia fusca pellucente. *Labrum* nullum. *Anfractus* fere sex.

β *fasciis quatuor.*

COCHLEA cinerea albidave fasciata ericetorum LIST. *an. angl.* t. 2. f. 13.

Berl. Mag. 26. p. 613. t. 4. f. 46.

diam. 7 lin.

Fasciæ superiores inferioribus latiores sunt. *Spiræ* quatuor in umbilico conspicuæ.

γ *fasciis tribus.*

COCHLEA terrestris umbilicata, exigua, leucophæa, lineis alba pullaque circumdata. GUALT. t. 2. f. M.

diam. 5 lin.

Anfractus duo in umbilico conspicui.

δ *alba fasciis novem.*

COCHLEA terrestris, umbilicata, minor, lineis rufis picta. GUALT. *test.* t. 2. f. L.

diam. $4\frac{1}{2}$ lin.

Anfractus

Anfractus non adeo depressi, quam in α, meræ tamen varietates videntur, β, γ, ε, vix ullum dubium admittunt.

Fasciæ fuscæ vel rufæ. Vertex summus in β, γ, δ, fuscus est. In δ octo priores fasciæ tenuissimæ velut per paria positæ; terium par fere coadunatum, fascia nona lata est. Variat fasciis octo, supremis duabus æqualibus latis; inferiores tenuissimæ, in figura *Gualteri* punctulatæ. *Anfractus* duo in umbilico conspicui.

In Italia.

237. HELIX ZONARIA.

HELIX testa umbilicata, depressa; apertura transversali; labro candido, reflexo.

HELIX testa umbilicata, convexa, depressiuscula, apertura oblongiuscula marginata. LIN. *Syst.* 681.

Dan. BÆLTE-SNEKKEN.

diam. 11, 12, 13 lin.

α *alba, fascia dorsali unica rufa.*

Fascia in medio anfractus majoris.

β *alba, immaculata fasciis, dorsalibus duabus rufis.*

Fascia in medio anfractus, suprema angustissima.

γ *alba, maculis lacteis, fasciis duabus dorsalibus rufis.*

Fasciæ in medio anfractus; Testa supra maculis undulatis transversalibus, subtus minoribus concentricis albis notata. Variat pellucida, subtus transversim striata.

δ *alba, fasciis dorsalibus tribus rufis.*

Testa candidissima, polita; fasciæ tres in medio anfractus, suprema latior reliquis.

ε *alba, fasciis dorsalibus quinque rufis.*

Testa candidissima, polita, fasciæ 2 & 5 (a basi numerando) reliquis latiores.

ζ *alba, fasciis duabus ventralibus rufis, tertia dorsali.*

Fasciæ tres, suprema angusta juxta juncturam anfractus, media infra marginem paginam inferiorem spectat, infima in ipsa inferiore pagina, utraque lata est. Cæterum a sociis splendide differre videtur pagina superiore, non depressa, sed in verticem elevata, anfractuque extimo aperturam versus gibbere transverso insignito.

η *alba, fasciis binis ventralibus, binisque dorsalibus rufis.*

A præcedenti tantum differt fascia altera angustissima dorsali; gibbus uti in antecedente.

ϑ *alba, fasciis quatuor rufis, suprema angustissima.*

Fasciæ ventrales & inferior dorsalium æquales.

ι *alba, fasciis quinque rufis, dorsalibus angustis.*

Testa adeo depressa, ut subcarinata videatur; fasciæ tres dorsales æquales.

ι *lutea*

κ. *lutea tota.*

Maculæ ſparſæ obſolete albidæ, faſciæque complures lineares confertæ, obſcuræ, extimum anfractum cingunt. Labrum uti in ſociis candidum.

λ *lutea, faſcia rufa.*

Faſcia lata rufa infra marginem extimi anfractus hanc a præcedenti diſtinguit.

μ. *pallide incarnata, faſciis marginalibus albis & rufis alternis.*

Faſciæ inæquales ſex in ipſo margine majoris anfractus albo & rufo alternantes.

ν *ſupra pallide incarnata, ſubtus alba, faſciis albis & rufis alternis.*

Faſciæ inæquales plures totum anfractum occupant, ſuprema latiſſima rufa.

ο *alba maculata, faſciis rufis ſex inæqualibus.*

Faſciæ tres ventrales, quarta ex pluribus compoſita marginalis, quinta anguſta & ſexta lata dorſales.

π *cinerea maculata faſciis tribus rufis.*

Color ſqualido-cinereus; maculæ luteæ; faſcia rufa in dorſo, altera in margine, ſuperadjacente tertia anguſtiori. In hac nec faſciæ nec lineæ concentricæ ventrales.

Has H. *Zonariæ* varietates haud ſuperfluum duxi in gratiam artis minus peritorum enumerare.

Fasciæ, quæ dorso sive superiori anfractus parti inscribuntur, omnes spiras ad verticem usque percurrunt, ea excepta, quæ juncturæ maxime vicina, in eadem perditur; quæ ventri seu inferiori parti, in apertura visui se subducunt. Quæ nulla fascia ventrali pinguntur, lineis concentricis pallidis loco fasciæ plerumque instruuntur. Fasciæ in fauce transparent. Anfractus in omnibus quinque vertice depresso, varietates ζ & η si excipias; *Umbilicus* patulus spiris ad apicem usque conspicuis. *Apertura* transversa, oblonga. *Labrum* candidum, reflexum & aliquantum dilatatum. Descriptio *Linnæi* convenit, at minus synonymon ex *Gualtieri* desumtum; minime, quæ perperam subjungit editor operis *Listeriani*.

In australibus Europæ.

238. HELIX STRIATA.

HELIX testa umbilicata, subdepressa, striata, alba.

SCHRÖTER *von Erdkonchylien um Thangelstedt* p. 183. n. 60. t. 2. f. 20.

diam. 6 lin.

Testa alba, argute striata, unicolor; subtus convexa, supra convexiuscula. *Umbilicus* distinctissimus, pervius. *Anfractus* fere sex rotundati absque carina. *Apertura* lunata; Labrum in mea nondum absolutum.

Striatam majorem clariss. *Geofroi* crederem, nisi omne fasciarum vestigium abesset. Reverendiss. *Schröter*, æd. St. Petri & Pauli Weimariæ Diaconus primarius, misit.

In Saxonia.

239. HELIX

239. HELIX OCULUS CAPRI.

HELIX testa umbilicata subdepressa, viridescente, immaculata, anfractibus septem.

COCHLEA subcompressa tenuior, margine acuto, umbilico perforato. BROWN. *jam.* p. 400. t. 40. f. A. B.

ARGENVILLE *Conchyl.* t. 6. f. E.

RUMPH. *Conchyl.* 1. t. 27. f. P.

PETIV. *gazophyl.* t. 21. f. 6.

Dan. BUKKE - ÖIET.

Gall. OEIL DE BOUC.

diam. 12 - 18 lin.

Testa cornea, luteo virescens, in deperditis albida, absque fascia aut macula subtilissime transversim striata, vertice convexo, versus marginem parum depressa; oculo armato testa in junioribus præsertim lineis concentricis confertissimis ex punctis elevatis minimis. *Anfractus* sex & septem, in junioribus subcarinati. *Umbilicus* ad apicem usque perforatus, spiris omnibus conspicuis. *Apertura* lunata acuta absque labro reflexo. Faux alba.

Huic nomen *oculi capri* ab *Argenville* inditum retinemus; quam *Linnæus* oculum capri dicit, ab hoc diversa est, figuram licet ex Argenville ei tribuit; nec synonyma, quæ ex Rumphio & Petiverio petiit, eandem testam denotant.

In Indiis.

240. HELIX

240. HELIX LAPICIDA.

HELIX testa umbilicata, carinata, depressa, maculata, apertura transversa alba.

HELIX testa carinata, umbilicata, utrinque convexa, apertura marginata transversali, ovata LIN. *Syst.* 656. MUS. L. U. 362. *H. Wgoth.* p. 27.

COCHLEA terrestris media acie acuta. PETIV. *gazoph.* t. 92. f. 11.

COCHLEA pulla sylvatica, spiris in aciem depressis. LIST. *an. angl.* t. 2. f. 14. minus bona.

COCHLEA nostra umbilicata, pulla. LIST. *Synops.* t. 69. f. 68.

COCHLEA pulla, compressa, ambitu acuto. LIST. *exerc. anat.* p. 182. t. 5. f. 4.

COCHLEA testa utrinque convexa, subtus perforata, limbo acuto, apertura ovata, transversa, spiris quinque. GEOFR. *Conchyl.* 10.

SCHLOTTERB. *act. Helv.* Vol. 5. t. 3. f. 15.

Berl. Magaz. 2. B. p. 609. t. 5. f. 36.

SCHRÖTER *von Erdkonchylien um Thangelstedt.* p. 191. n. 64. & 65. t. 2. f. 23.

Dan. DEN LILLE LAMPE.

Germ. DIE LAMPE.

Gall. LA LAMPE; LE PLANORBE TERRESTRE.

diam. $8\frac{1}{4}$ lin.

Testa fusco-cornea, maculis ferrugineis; supra marginem versus, complanata, subtus convexa, spira majori medio in angulum acutum dilatata. *Umbilicus* distinctus, pervius. *Anfractus* quinque.

quinque. *Apertura* transversalis elliptica; *Labrum* subreflexum, acutum, candidum, anfractui proximo incumbens. Oculo armato pulchre striata est, striis transversis remotis & aliis minutissimis flexuosis, obliquis, confertissimis.

In trunco fagino sylvæ *Nörreskov* supra præcipitia lacus *Fuursöe* agri *Fridrichsdalensis* unicum exemplar reperi, in truncis abietinis insulæ *Haaöen* sinus Christianiensis plura & quidem sæpius; hinc, si unquam calcem rodit, non sola calce vel decompositis nutritur, sed uti plurima congenerum vegetabilibus vegetis. Clariss. SCHRÖTER varietatem albam misit.

241. HELIX MARGINATA.

HELIX testa subumbilicata, carinata, subdepressa, oblique striata, alba, fasciis rufis, apertura transversali.

Dan. DEN LIDSEDE LAMPE.

diam. 9 lin.

Multum accedit H. *indiscretæ*.

Testa candida, nitida, striata uti *indiscreta*, at subtilius, valde carinata, ita ut carina marginem distinctum, acutum, album formet; supra convexa fasciis angustis tribus rufis in maxima spira, duabus in reliquis; subtus planiuscula, fascia tenui media & marginali utrique paginæ communi; marginalis dividitur a carina prominente, quæ acuta & alba est. *Anfractus* quatuor glabri. Umbilicus pervius quidem est, at unus tantum anfractus in eo conspicitur. *Apertura* transversa subtriangularis. *Labrum* reflexum album. *Fasciæ* in fauce pellucentes.

In Museo *Fabriciano*.

242. HELIX CICATRICOSA.

HELIX testa umbilicata, subdepressa, carinata, rugulosa, flavicante, lineis concentricis rufis; anfractibus sinistrorsis.

ARGENVILLE *Conchyl.* 1. app. t. 1. f. C.

Dan. AR-SNEKKEN.

diam. 12 lin.

Cochlea raritate & pulchritudine nulli sinistrorsarum secunda.

Testa tenera pellucida ex ruso flavicans, supra convexa, rugis transversim undulata, subtus gibba, transversim subtilissime striata. *Anfractus* quinque carinati, sinistrorsi; extimus fasciis plurimis angustis inæqualibus rufis cingitur; harum septem in pagina superiori, duodecim in inferiori numero. *Umbilicus* distinctus ad verticem usque pervius, anfractus tamen in eo ægre conspicui. *Apertura* subquadrata, intus alba, margo acutus, in umbilicum parum reflexus.

Figura *Klein.* t. 1. f. 10. & *Rumph.* Conchyl. t. 27. f. O. quam esse sinistrorsam, in pictura saltem, Clariss. *Chemnitz* minus advertit, & adjecta descriptio, qua dicitur maximam partem brunnea & glabra, nostræ non prorsus adversari videntur. Nec synonyma ex Gualtieri & Linnæo a Chemnitio dictæ figuræ allata quadrant.

Figura *Argenv.* nostra triplo major est.

In Museo *Fabriciano.*

Subglobosæ.

Subglobosæ.

243. HELIX POMATIA.

HELIX testa imperforata, globosa, rufescente, fasciis obsoletis.

HELIX testa umbilicata, subovata, obtusa decolore, apertura subrotundo-lunata. LIN. *Syst.* 677.

COCHLEA testa utrinque convexa, rufescente, quinque spirarum. GEOFR. *conchyl.* 1.

COCHLEA cinerea maxima, edulis. LIST. *an angl.* p. 111. t. 2. f. 1.

COCHLEA cinereo-rufescens, fasciata, leviter umbilicata. LISTER. *Synops.* t. 48. f. 46.

COCHLEA terrestris gypso obserrata, ALDROV. *Exsangu.* 389.

POMATIA GESN. *aquat.* p. 244. & 255. LIST. *exerc. anat.* t. 1. f. 1 - 6.

COCHLEA opercularis Vincarum. SWAM. *Bibl. N.* t. 4.

COCHLEA terrestris vulgaris, maxima, albicans, Pomatia. GUALT. *Test.* t. 1. f. A. minus bona, si revera nostra.

COCHLEA terrestris major, vulgaris, pallide fusca vel albicans. SCHLOTT. *Act. Helv.* vol. 5. p. 276.

ARGENVILLE. *Conchyl.* par. 1. t. 28. f. 1. par. 2. t. 9. f. 4.

Berl. Magazin 2. B. p. 530. t. 1. t. 1.

LEUWENHOEK contin. arcan. nat. p. 25 - 32.

LEUWENHOEK philosoph. transactions, 1697.

BONAN. *recreat.* t. 316. seu ultima.

LIST. *Syn.* tab. anat. 1.

SCHRÖTER *von Erdkonchylien um Thangelstedt*, p. 145. 14. 15. t. 1. f. 10.

GEVE t. 29. f. 330 - 342.

SCHÆFFERS *Versuche mit Schnecken.* 1. St. t. 3. 2. St. t. 1. 2. 3.

Dan. VOLD - SNEKKEN; DEN STORE HAVE - SNEGL.
Germ. WEINBERGS - SCHNECKE; GARTEN - SCHNECKE; DECKEL - SCHNECKE.
Gall. LE VIGNERON.
Belg. WYNGAARDSLAK.
Svec. TRÄGARDS - SNÄKA.
Angl. WINE - GARD SNAIL.

diam. 9 - 16 lin.

Testa hæc, uti hospes ejus, sat nota ulteriori descriptione vix eget, addendum tamen, quod autores non observasse videntur, foramen nempe, quod subtus in junioribus conspicitur, in adultioribus in umbilicum gyrari, in justam ætatem adeptis claudi, hinc in nomine specifico, cum caracter ex perfecto exemplo sumi oportet, *imperforata* dicitur, hoc est: nec perforata, nec umbilicata, cum istæ tantum tali nomine vocari debent, quæ justum incrementum adeptæ, foramen aut umbilicum adhuc apertum monstrant; foramen sinus ille angustus est, intra quem *Lister* specillum demittere potuit. Omnes cochlearum figuræ, quod notandum, in tabulis *List* anim angl contrario situ impressæ sunt; testæ enim dextrorsæ sinistrorsæ conspiciuntur, & in nominibus specificis dextrorsæ dicuntur.

Testa variat alba, fasciis duabus latis, cinereo - fuscis, apice productiore; hucque referenda Cochlea terrestris vulgaris, mucrone productiori fasciata, cinerea *Gualt.* t. 2. f. B.

Pomatiam

Pomatiam ova parere, pullosque ex iis excludi *Leuwenhoeck* vidit, biduoque defectu nutrimenti periisse narrat; quæ mortis causa minus justa videtur, cum hæc species, uti congeneres, plures dies & menses absque pastu apud me vitam produxit.

Pullos inveni diametro 3 lin. fascia albida notatos. Hiemem versus testam operculo calcareo claudit, ultimo vero Aprilis & initio mensis Maji e testa rursus prodit.

Operculata, (Deckel-Schnecke) improprie dicitur, operculum nec pedi adhæret, uti perperam narratur *Arg.* Conch part. 2. p. 82. nec perenne est, quod Neritis proprium; formatur enim & destruitur uti reliqua terrestrium pro lubitu limacis; peculiare tamen huic est, opercula hyberna ex tribus stratis diversis construere. *Interius* nempe mere menbranaceum, pellucidum, flavicans. *Medium* membranaceum, subpellucidum, pagina exteriore calcareum, interiore flavicans, & *exterius* crusta crassiuscula calcarea, extus convexa, compositum. Stratum intermedium primum conficitur, dein extimum, ultimo internum. Dum digitis tenerem, operculum formare & deponere vidi.

In horto Coenobii Virginum Nobilium, quod *Roeskildæ* est, & in munimentis *Havniensibus* vulgatissima, ubi hieme colligitur, culinisque nobiliorum civium infertur.

244. HELIX POMARIA.

HELIX testa imperforata, globosa, sinistrorsa, rufescente, fasciis obsoletis.

diam. 18 lin.

Testa præcedente aliquantum major & sinistrorsa, cæterum adeo perfecte eadem, ut, licet claris. *Chemnitz*, qui hanc primus sinistrorsam observavit, speciem haud controversam putet, mihi adhuc aqua hæreat, varietatem an speciem crederem. Si enim tota testa, uti ipse limax, in ovo lateret, solaque evolutione in majus volumen, prout autores volunt, incresceret, omnis omnino scrupulus de distincta sinistrorsarum specie, quarum maxime similes dextrorsæ repericnperientur, mihi facile adimeretur, dum vero limacem testam novis anfractibus sensim ampliare & demum absolvere video, embryonem casu qualicunque a communi & vulgari tramite deflecti posse, haud absurdum videtur. Huc accedit, quod *pomaria* & *pomatia* iisdem locis degant, licet ob oppositum genitalium situm coire nequeant. Inquisitio, an sinistrorsæ invicem copula jungantur, pullosque sinistrorsos pariant, rem sartam tectam præstaret.

In Circulo Germaniæ *Swewico*, unde maximo dextrorsarum numero perpaucæ sinistrorsæ Viennam afferuntur.

245. HELIX LUCORUM.

HELIX testa imperforata, rotundata, alba, fasciis, strigisque rufis; labro fusco.

HELIX testa imperforata, subrotunda, lævi, fasciata; apertura oblonga, fusca. LIN. *Syst.* 692.

COCHLEA terrestris vulgaris, cinerea, aliquando pulla fasciis quatuor fulvis distincta. GUALT. *test.* t. 1. f. C.

Dan. LUND - SNEKKEN.

diam. 19 lin.

Testa globosa, alba, transversim striata; fasciis circularibus strigisque transversis rufis, numero & situ variantibus interstincta. *Apertura* lunata, intus alba; *Labrum* fuscum, simplex, centrum versus tantum reflexum. *Anfractus* quinque. *Fasciæ* in quibusdam quatuor, in aliis quinque. Hæc, uti pleræque, junior centrum perforatum, adulta clausum habet.

In Italia. Donum Clariss. Ferd. *Bassi*.

246. HELIX NEMORALIS.

HELIX testa imperforata, globosa, labro fusco.

HELIX testa imperforata, subrotunda, lævi, diaphana, fasciata, apertura subrotunda, lunata. LIN. *Syst.* 691.

COCHLEA

COCHLEA testa utrinque convexa, flava, fusco - fasciata, quinque spirarum, labro fusco reflexo. GEOFR. *conchyl.* 3.

COCHLEA citrina aut leucophæa, non raro unicolor, interdum tamen unica, interdum etiam duabus aut tribus, aut quatuor, plerumque vero quinis fasciis pullis distincta. LIST. *an angl.* p. 116. t. 2. f. 3.

COCHLEA interdum unicolor, interdum variegata, item variis fasciis depicta. LIST. *Synops. conchyl.* t. 57. f. 54. *exerc. anat.* t. 5. f. 1 - 3.

COCHLEA hortensis. SWAMM. *Bibl. Nat.* t. 8. f. 6.

ARGENV. *Conchyl.* par. 1. t. 28. f. 8. par. 2. t. 9. f. 5.

GEVE. t. 32. f. 391 - 411.

LESSER. *Testaceo - theologica.* p. 88. n. 1.

Dan. SKOV - SNEKKEN.
Germ. DIE WALD - SCHNECKE.
Gall. LA LIVREE.

diam. 9 - 11 lin.

Variat *ruffa* vel *lutea*, & hæc iterum fusco-fasciata, vel absque omni fascia.

Varietates sequentes mihi obviæ, solo colore & numero fasciarum diversæ.

α rufa tota.

COCHLEA ex toto fusca. PETIV. *gazophyl.* t. 92. f. 10.

β rufa, fascia tenuissima pallida.

GUALT. *test.* t. 2. f. A.

γ rufa,

δ *rufa, fasciis duabus pallidis.*

γ *rufa, fascia latissima fusca.*

ε *rufa, fascia lata fusca.*

GUALT. *test.* t. 1. f. P.

In his juncturæ anfractuum albæ. Fascia transversa lutea fusco superne labro adjacent. Apertura rosea, paries oppositus fuscus.

ζ *rufa, fascia angusta fusca.*

Hujus unicum individuum offendi, cui subtus fasciæ duæ pallidæ.

η *rufa, fasciis tribus fuscis, infima & media latissima.*

COCHLEA vulgarissima variegata. PETIV. *gazophyl.* t. 92. f. 9.

Hanc sub aqua profunditate duarum orgyarum tota æstate in societate viventem vidi.

ϑ *castanea, fascia lutescente.*

ι *incarnata tota.*

COCHLEA ex toto carnea. PETIV. *gaz.* t. 91. f. 11.

κ *incarnata, fasciis tribus saturatioribus.*

λ *incarnata, fascia unica saturatiore.*

COCHLEA carnea fascia singulari. PETIV. *gazophyl.* t. 91. f. 12.

μ *albida,*

μ *albida, fasciis transversis & circularibus subsanguineis.*

Bella varietas; unicum tantum exemplar inveni, labro nondum perfecto.

ν *lutea tota.*

List. *an. angl.* p. 117. 1. & 2.

Cochlea ex toto flavescens. Petiv. *gazoph.* t. 91. f. 9.

Geve. t. 32. f. 399.

Juncturæ spirarum albæ. Fascia sulphurea transversa superne labro fusco approximata. Apertura albida; paries obversus fuscus.

ο *lutea, fascia fusca angusta.*

Gualt. *test.* t. 2. f. D.

Petiv. *gazoph.* t. 91. f. 10.

Geve. t. 32. f. 403.

Lister. *angl.* p. 117. 3. 4.

Seb. th. 3. t. 38. f. 18.

Schröt. *Erdk.* t. 1. f. 13. & t. 2. f. 28.

Seba terrestres & fluviatiles & pictura & descriptione mire miscet, H. nemoralem ο ejusdem speciei cum sua præcedente, quæ fluviatilis est, & quidem noster Planorbis *Purpura*, toto cælo diversus, oscitantur affirmans. Adde, quod figuras omnes contrario situ impressæ sint.

π *lutea, fascia latissima fusca.*

Geve. t. 32. f. 402.

Fasciæ plures ita confluunt, ut unica videatur, totum fere anfractum occupans.

ς *lutea, fasciis duabus fuscis, æqualibus, inferis.*

Geve. t. 32. f. 401. & 411.

Schröt. *Erdk.* t. 1. f. 14. & t. 2. f. 29.

σ *lutea, fasciis duabus fuscis, infima latissima.*

Geve. t. 32. f. 410.

Schlott. *act. Helv.* vol. 5. t. 3. f. 6.

Berl. Magaz. 2. B. t. 3. f. 25.

Apertura rubra; infima fascia in nonnullis interrupta. Hoc ex frequenti restauratione fractæ testæ.

τ *lutea, fascia alba utrinque rufa.*

Pulchra varietas fascia media solitaria alba, linea rufa utrinque cincta, labium nondum acceperat.

υ *lutea, fasciis duabus fuscis, latissimis.*

List. *an. angl.* p. 117. 5. 6.

Seb. th. 3. t. 39. f. 19.

φ *lutea, fasciis tribus fuscis, æqualibus.*

Berl. Magaz. 2. B. t. 3. f. 26.

Geve. t. 32. f. 397.

Schröt. *Erdk.* t. 1. f. 15. & t. 2. f. 30.

χ *lutea, fasciis tribus fuscis, media angustissima.*

Geve. t. 32. f. 409.

ψ *lutea, fasciis tribus fuscis, suprema angustissima.*

ω *lutea, fasciis tribus fuscis, infima latissima.*

Geve. t. 32. f. 396.

αα *lutea,*

αα *lutea, fasciis tribus fuscis, inferioribus æqualibus, suprema angustiore.*

SCHLOTT. *act. Helv.* vol. 5. t. 3. f. 2. & 3.

Berl. Magazin 2. B. t. 3. f. 27. 28. 29.

ββ *lutea, fasciis quatuor fuscis.*

SCHLOTT. *act. helv.* vol. 5. t. 3. f. 9.

Berl. Magaz. 2. B. t. 3. f. 30.

LIST. *an. angl.* p. 117. 9.

GEVE. t. 32. f. 408.

SCHRÖT. *Erdk.* t. 1. f. 16.

γγ *lutea, fasciis quinque fuscis, æqualiter remotis.*

SCHLOTT. *act. helv.* vol. 5. t. 3. f. 10.

Berl. Magaz. 2. B. t. 3. f. 31. 32.

SEB. th. 3. t. 39. f. 12.

GUALT. *test.* t. 2. f. F.

LIST. *an. angl.* p. 117. 7.

SCHRÖT. *Erdk.* t. 1. f. 17.

Fasciæ tres inferiores æquales, superiores tenuiores.

δδ *lutea, fasciis quinque fuscis, inæqualiter remotis.*

ARGENV. *conchyl.* t. 28. f. 8.

Fascia infima latissima, secunda lata, quarta & quinta angustæ, media sive tertia tenuissima; hæc a cæteris inæqualiter distat.

Limaces harum varietatum lutei, nigri, cinerei, albi, plerique promiscue copula junguntur; junctos deprehendi primæ varietatis inter se, & cum χ & γγ, variet. ω cum ο & σ.

Huc referendæ Helices cl. *Schröter* num. 75 - 115, meræ *nemoralis* varietates.

Quot, quot ex Italia possideo, nostratibus aliquantum majores sunt, minores tamen figuris *Gualtieri*.

In hortis & nemorosis vulgatissima; in Gallia & Anglia edulis.

247. HELIX HORTENSIS.

HELIX testa imperforata, globosa, labro albo.

GEVE. t. 30. f. 357 - 367, & t. 31. f. 368 - 390.

Dan. HAVE-SNEKKEN.

diam. $7\frac{1}{2}$ - 8 lin.

α *albida tota*

HELIX major, magis grisea, labris albis. Mus. L. U. 670.

COCHLEA testa pellucida. LIN. it. Westgoth. p. 84.

GEVE. t. 31. f. 381. &. 382.

β *flava tota.*

LIST. *an. angl.* p. 117. 1.

GEVE. t. 31. f. 368, 370.

SCHRÖT. *Erdk.* t. 2. f. 27.

γ *lutea, maculis linearibus obscuris.*

ε *lutea, maculis & punctis nigris.*

ζ *lutea, fascia latissima fusca.*

GEVE. t. 30. f. 367. t. 31. f. 380.

η *lutea*

η *lutea, fasciis duabus latis, fuscis.*

GEVE. t. 31. f. 388.

ϑ *lutea, fasciis duabus fuscis, suprema latissima.*

ι *lutea, fasciis tribus fuscis, superioribus latissimis.*

GEVE. t. 33. f. 366.

λ *lutea, fasciis tribus fuscis, infima & media remotissima.*

κ *lutea, fasciis quatuor fuscis.*

GEVE. t. 31. f. 387.

μ *lutea, fasciis quinque fuscis, decrescentibus.*

GEVE. t. 31. f. 374.

ν *lutea, fasciis quinque fuscis, secunda latiori.*

Hanc, licet cum praecedente vulgaris sit, autores tamen non satis attenderunt, perillustris a LINNE quidem olim in Museo L. U. primae, LIST. & Clariss. MARTINI *Berl. Magaz.* 2. B. p. 540. secundae varietatis mentionem fecerunt, quilibet tamen eorum de reliquis varietatibus silentes hanc meram Helicis *nemoralis* varietatem arbitrabantur. Nos aliter sentimus: monendum tamen prius, memoriae lapsu factum videri, quod *Helix grisea labro albo* a LINNÆO major, & *Helix flava labro fusco* minor dicatur, quae enim labro albo gaudent, semper iis minores, quae labro fusco, & quidem centies reperimus. Helicem *hortensem* speciem a nemorali diversam svadent parvitas (illa enim adulta aetate hac semper minor) nitor testae splendidus, ac labium in majori, sive H. *nem.* constanter fuscum, in minori, sive H. *hortensi* album. His accedit, quod varietates *nemoralis* cum variet.

hortenſis nunquam copula jungi viſæ ſint, etiamſi in eas hoc reſpectu plures annos inquiſiverim.

Utriusque, *nemoralis* & *hortenſis*, teſtæ margo, antequam juſtam magnitudinem adepta ſit, nec labiatus, nec albus aut fuſcus eſt, ſed acutus teſtæ concolor. Adulta enim ætate & perfecto teſtæ incremento, margo aperturæ acutus labro augetur ſubreflexo, ac qui alteri lateri antea centro perpendiculariter inſiſtebat, jam centrum verſus in planum inclinatum deprimitur, foveculamque centralem, quæ in junioribus foraminis inſtar ad verticem usque aperta erat, obturat, novumque colorem induit. Juniores itaque teſtæ perforatæ ſunt & labro carent; fragiliores quoque & magis transparentes ſunt.

Varietates imprimis α & β transparentiam inſignem ad perfectam usque ætatem ſervant, quin etiam labrum album adeptæ, ramificationibus venarum pulcherrimis, rivuloſis ac conſpicuo motu ſyſtoles & diaſtoles in corde adhuc pellucent, quod ſæpiſſime vidi; transparentia tamen in adultis ſenſim minuitur, dum teſta ab intus craſſitie augeatur. Hinc. Ill. a LINNE. *Cochlea pellucida*. It. W. G. p. 84. Oeland. p. 155. & LISTERI *pellucida* p. 117. meræ ætatis differentiæ ſunt. Venæ non diſparent limace e teſta prodeunte, uti *Linnæus* narrat, totam potius teſtam tunc occupant; debentur enim pallio, quod, dum limax extra teſtam vagatur, parietes internos undique veſtit, ſi vero in interioribus teſtæ conditur, pars anfractus majoris pallio, adeoque venis deſtituitur.

Singularem in ſecunda varietate operationem obſervavi, cæteris communem ſuſpicor. In capſula lignea tenebatur, ſtridorem continuum & acutum ego ſentiens, maxillis capſulam rodere, ut ſibi exitum facilitaret, uti Limaces nudi & Hel. *nemorales* in papyro non absque ſucceſſu ſæpius tentaverunt, credidi; caute vero inquirens, vermem in poliendo ſuperficiem teſtæ occupatiſſimum deprehendi, ac ſonum ex frictione maxillæ contra teſtam oriri comperi. Hinc teſtæ hujus ſpeciei *nemorali* poliriores & nitidiores ſunt. Hoc actu organa in capite quædam in motu videbantur; unum nempe album & quinque nigra punctiformia ſub cute pellucentia,

centia, in area tentaculis interjecta ad os descendere & rursus retrogredi, conspiciebantur, stridorque quavis actione, qualis in muribus festucam rodentibus, audiebatur. Puncta sive organa nigra quadratim circa quintum disposita, album vero postice.

Omnes varietates magnitudine æquales decima excepta, quæ cæteris major.

In hortis, minus vulgaris, quam *nemoralis*.

248. HELIX ARBUSTORUM.

HELIX testa imperforata, globosa, fusca, lineolis luteis, labro albo.

HELIX testa umbilicata, convexa, acuminata, apertura suborbiculari bimarginata, antice elongata. LIN. *Syst.* 680.

COCHLEA maculata, unica fascia pulla angustioreque, per medium anfractus insignita. LIST. *an. angl.* p. 119. t. 2. f. 4.

COCHLEA maculata, unica fascia fusca, per medium orbem insignita. LIST. *Synops.* t. 56. f. 53.

COCHLEA indigena terrestris eleganter picta. SEB. thes. 3. t. 38. f. 68.

Berl. Magaz. 2. B. p. 534. t. 3. f. 23.

GEVE. t. 30. f. 345 - 356.

Dan. KRAT - SNEKKEN.

Germ. DIE GEFLECKTE GARTEN - SCHNECKE.

diam. $9\frac{1}{2}$ lin.

Testa fusca, lineis minutissimis, sparsis, flavescentibus, fasciaque media pulla instructa; hæc in quibusdam ita obsoleta est, ut, nisi testa

testa lumini obvertatur, non conspici possit. Juniores pellucidæ, fuscæ vix lineis luteis notatæ, at alia nota noscuntur; intra marginem aperturæ acutum alter quasi margo elevatus candidus, a prima ætate observabilis; testa vero ad justam magnitudinem producta, hic secundus margo evanescit, vel in labium subreflexum album perditur. Oculo armato juniores subtilissime transversim striatæ sunt; striæ hæ in adultis elevantur, nudoque oculo conspiciuntur, vel omnino disparent.

Anfractus $5\frac{1}{2}$. Variat pallida lineis candidis

Testæ sæpe vacuæ reperiuntur. *Lacertam* juniorem hujus testæ penetralibus inhærere non semel vidi, limacem devorandi ergo; in ipso quoque facto lacertam, quam simul cum Helice *nemorali* in theca lignea servavi, deprehendi; suspicio dehinc clar. *Feldmann* ex parte confirmata est.

Diu hæsitavi, an Helix Linnæi nostra esset quod testa ejus *umbilicata*, ac apertura *elongata* dicitur, at forte juniores tantum quorum foramen centrale, uti in H. *Pomatia*, umbilicum nominat, vidit, nec observavit, illud in adultioribus claudi; cur *elongatam* dicit, non video, apertura enim in nostris non magis elongata, quam in *nemorali*. Synonymon, quod huic ex Argenville tribuit, H. nemorali debetur.

In horto *Fridrichsdalensi* rara, in *Rosenburgico* vulgaris.

249. HELIX FULVA.

HELIX testa imperforata globosa pellucida, fulva, labro albo.

Dan. TOPAS-SNEKKEN.

diam. $\frac{1}{2}$ - 3 lin.

Testa pellucida, glabra, striis subtilissimis confertis transversim striata, colore succini transparentis, pulchritudine & teneritate nulli

nulli ſecunda. *Carina* anfractus majoris, ac *junctura* in adultis tantisper albent; hæc albedo lumini pellucenti deberi videtur. *Apertura* arcuata, anguſta. *Labium* album, acutum; *Anfractus* ſupra ſeptem, ſubtus unicus. Nec *umbilicus* nec *foramen* in omni ætate; rudimentum tamen foraminuli, quale in H. *nemorali* nondum labio perfecte tectum, oculo armato conſpicitur. In minoribus, ſive junioribus, ſtriæ ac albedo minus conſpicuæ; anfractus 3 - 5, ac labium teſtæ concolor. *Limax* pallidus, hyalinus; *tentacula* majora, longa, nigra.

Rariſſima eſt hæc cochlea, imprimis adultæ ætatis; hujus enim plures annos inquirenti unicum tantum ſpecimen ſeſe obtulit, juniorum vero, licet revera raræ dici merentur, ultra triginta diverſo tempore.

Inter folia putrida fagina ac in palis humidulis agri *Fridrichsdalenſis*.

250. HELIX EPISTYLIUM.

HELIX teſta imperforata, ſubgloboſa, ſtriata, candida, anfractibus ſeptem.

COCHLEA alba ſex orbium, margine primi orbis pulvinata, ſive trochus jamaicenſis. LIST. *Syn.* t. 62. f. 60.

Dan. PILLE - KNAPPEN.

diam. 12 lin.

Cochlea colore aluminis pellucentis, ſtriaturaque ſpirarum nulli pulchritudine diſpar.

Teſta candido - hyalina, ſupra in conum convexa nitide oblique ſtriata; ſubtus planiuſcula, lævis abſque omni ſtria. Anfractus ſeptem, fere octo. Subtus juniores quidem perforatæ ſunt, at foramen in adultis labio aperturæ tegitur. Apertura lunata;

 Labrum

Labrum reflexum, politum. *Listeri* multo minor nostra, cæterum convenire videtur.

In Museo *Moltkiano*.

251. HELIX CINCTA.

HELIX testa imperforata, subglobosa, alba, fasciis labroque rufis.

Dan. SNOOR - SNEKKEN.

diam. 18 lin.

Sequenti simillima, ut eandem crederem, nisi diversus anfractuum numerus in utraque absoluto incremento (in hac enim quinque, in illa quatuor tantum numero) labrumque rufum, in illa candidum, contrarium persvaserit. Armatus oculus aliam differentiam, strias nempe subtilissimas in hac fasciis parallelas, in illa impressiones variolosas suppeditat.

In Museo *Spengleriano*.

252. HELIX LIGATA.

HELIX testa imperforata, subglobosa, alba, fasciis rufis; labro albo.

COCHLEA terrestris vulgaris pulla, fasciis obscure luteis cincta. GUALT. *test.* t. 1. f. E.

Dan. STRIMMEL - SNEKKEN.

diam. 14 lin.

Testa