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Panama. Additional material may show that variable species are involved here. The distribution patterns of the species groups suggest that the present species probably arose from five widely distributed sublittoral species which, with the full emergence of the teredinids, survived only in deeper water. Unfortunately the fossil record is not sufficient to prove this point at the present time.

TREE SNAILS *(LIGUUS)* OF CUBA, HISPANIOLA, AND FLORIDA

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The genus *Liguus* is limited in its distribution to Cuba, the Isle of Pines, Hispaniola, and the southern part of Florida. It ranged on the mainland of southern Florida from near Pompano south to Florida City in hammocks on the Miami ridge and the hammocks or tree islands in the Everglades from north of Pinecrest south to the Bay of Florida and west to near Marco. The northernmost record is from Immokalee which is 34 miles southeast of Fort Myers.

Liguus is not closely related to any bulimoid genera now existing in Central or South America. The nearest appears to be the genus *Corona* of northern South America. Even here the gap between the two genera is large in shell morphology, size, and type of coloration. The occurrence of *Liguus* in Florida is probably due to hurricanes which transported them from Cuba and have since been responsible for their dispersal throughout the islands in most of the Everglades.

Color pattern alone indicates that there have been probably at least three separate introductions: the *fasciatus solidus* group which now occurs on the Lower Keys from Big Pine Key to Key West, the *fasciatus lignumvitae* group of Lower Matecumbe and Lignumvitae Keys, and lastly the *fasciatus roseatus* group which occurs on Key Vaca, Upper Matecumbe to Elliotts Key and all of the southern tip of Florida. Typical *L. fasciatus fasciatus* is limited to Cuba, in Matanzas and Habana Provinces.

The advent of *Liguus* in Florida is relatively recent. According to R. A. Daly (1934, Changing World of the Ice Age, p. 175) the Princess Anne marine terrace was formed in the third Wisconsin Interglacial stage. At this time the eustatic ocean level was some 13 feet higher than at present. Epicontinental seas would have covered all of southern Florida and of course, much of the present coastal areas as well. This would indicate that the present populations of *Liguus* in Florida had their origin in late Pleistocene, possibly only since the last 100,000 years.

Liguus feed on lichens which grow on the bark of trees. On smooth bark trees their feeding tracks can be used as a clue for additional hunting, particularly where there are vines under which they can hide.

Coloration is apparently non-selective as there must be little ocular predation. This appears to be true for tree snails the world over, particularly on insular areas. Color forms in Florida range from white to brownish black with most of the remaining colors present. Color patterns exist as a wash of solid color or as spiral bands, axial streaks, or in combinations of these three types.

Liguus are fast disappearing in Florida. Land clearing for motels, fishing camps, and other building operations are rapidly destroying the hammocks and stands of broad leaf trees where they live. The draining of the 'glades has added materially to the number of fires which occur during the dry season. So far, there appears to be nothing in the immediate future to lessen these destructive forces.

NOTES ON AMERICAN *HASTULA*

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(ABSTRACT)

The genus *Hastula* includes species of Terebridae that live in the intertidal surf-zone of sandy beaches and that burrow under the sand everytime a wave washes them out, just as do the Coquina clams (*Donax*). A search for the identity of some *Hastula* found living near Vera Cruz City, Mexico led to a review of that group. The four known American species of *Hastula* are different in details of shell sculpture, radular teeth, and geographic distribution.

HASTULA LUCTUOSA Hinds 1844. This eastern Pacific species was illustrated by Keen (Sea Shells of Trop. W. Am., 1958, fig. 981). It is recorded in the USNM collections only from Cape San Lucas, Baja California; Mazatlán, Acapulco, and Tehuantepec, Mexico; Panama, and San José, Pearl Islands, Panama. Such scattered locality records indicate a lack of collection rather than limited occurrence. Morrison 1968. Am. Mal. Union Ann Rep. for 67

HASTULA MARYLEEAE R. D. Burch 1965. This most recently described American species (Veliger 7: 242, pl. 31, fig. 4) is known from Galveston Island, Texas, southward all the way to Playa El Morro, south of Vera Cruz City; from Mujeres Island, Quintana Roo; and from the east coast of British Honduras. Morrison 1968 Am Mal Un. Ann. Rep for 1967

HASTULA SALLEANA Deshayes 1859. This terebrid is recorded only from Gulf of Mexico shores. It has been found living from Mexico Beach, Bay County, Florida; west across Alabama and the barrier islands of Mississippi, to Chandaleur Island, Louisiana; from Cameron Parish, Louisiana, along the Texas coast (Pulley, Tex. Journ. Sci., 1952, p. 177, pl. 3, fig. 10) and southward to Vera Cruz, Mexico. The beaches along the south shore of the Gulf of Mexico in Vera Cruz, Tabasco, Campeche, and Yucatan provinces have not yet been searched for *Hastula*. Morrison 1968 Am. Mal. Un. Ann Rep. for 1967

HASTULA CINEREA Born 1778. This is the West Indian species first figured from Barbados by Lister in 1685. For many years all western Atlantic *Hastula* were lumped under this name because the specific characters of the group were not understood. Now we know that *H. cinerea* (Abbott, Am. Sea Shells, 1954, p. 266, pl. 26g) lives only on the east coast of Florida, from Talbot Island, Duval County, southward; on the shores of the Bahamas, Cuba, Jamaica, Hispaniola, Puerto Rico, St. Thomas, St. Croix, St. Kitts, Nevis, Guadeloupe, Dominica, Barbados, Grenada, Tobago, and Trinidad Islands; and on the continental shores from Wounta Haulover, Nicaragua, southward to Devils Beach, near Colón, Panama; Cartagena, Colombia; and eastward on Brazilian shores between Goyanna, Pernambuco, and Itanhaem Beach, 60 miles

south of Santos, São Paulo. The excellent study by the Drs. Marcus [Bol. Fac. Fil., Cien. Letr., Univ. S. Paulo, no. 260, Zoology no. 23, 1960] has shown that *H. cinerea* paralyzes with its poison teeth and then swallows whole, small Polychaete worms of the families Spionidae and Opheliidae.

The overlapping locality records for *H. salleana* and *H. maryleeae* tell an interesting story. In nearly every gathering from the Texas coast, and from near the city of Vera Cruz, these two forms were found living in the same or adjacent sands, and so were usually left as mixed samples in museum and private collections. The shell sculpture separates the two as species; *maryleeae* completely lacks the spiral rows of pits (punctae) so evident on the shells of *salleana*. These two species may live together without direct competition. Because the hypodermic (poison) teeth of *maryleeae* are only one-fourth the size of those of *salleana*, we assume they are predators on different food-animals in the same sands.

Dr. Morrison illustrated his talk with kodachrome slides of the four American species, of the microscopic sculpture of the shells of each, and of the radula (hypodermic-needle poison teeth) of *maryleeae, salleana,* and *cinerea*. Of particular interest was the slide showing the "blonde" and "brunette" color phases of *maryleeae* (all white to very dark purplish shells) that were collected with the grayish *salleana* in the sand of one Texas beach.

COLLECTING MEXICAN FRESHWATER MUSSELS

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(Abstract)

At the invitation of Dr. Salas, the Director, and other scientists of the Institute of Geology of the University of Mexico, I spent November and December of 1966 in southern Mexico.

The freshwater mussel fauna of Mexico includes members of three families:

The South American MUTELIDAE (MYCETOPODIDAE) are represented by the larger smooth shells of the group of *Anodontites* (*Patularia*) *glauca* Lamarck 1819, living as far north as Mazatlán; by the smaller, darker colored *Anodontites* (*Euryanodon*) *bambousearum* Morelet 1851, from the Usumacinta River system; and by *Anodontites* (*Euryanodon*) *cylindracea* Lea 1838, from the Alvarado system south of the City of Vera Cruz.

The true family UNIONIDAE (subfamily ANODONTINAE) includes only species of *Anodonta* in Mexico. *Anodonta*, s.s. is well represented in the Pacific River systems; in the High Plateau of Mexico by *Anodonta impura* Say 1829, and its relatives; and in the Río Grande (Río Bravo) by *henryana* Lea 1857. *Anodonta* (*Pyganodon*) *globosa* Lea 1841, is one of the largest of Mexican mussels. It, or the sub-species *lurulenta* Morelet 1849, was taken alive from a mud-bottom pasture pond near Villa Hermosa, Tabasco; its glochidia are now on record.

The family AMBLEMIDAE (subfamily AMBLEMINAE) (often called Quadrulidae, subfamily Quadrulinae) includes many endemic species described from Mexico. *Quadrula*, s.s. is represented only in the Río Grande (Río Bravo) system by one dwarf species, *Quadrula couchiana* Lea 1860. Our familiar "wash-board," *Megalonaias gigantea* Barnes 1823, ranges southward into the Río Grande (Río Bravo) system; *M. nickliniana* Lea 1834, is from Panuco and/or Alvarado systems; *M. digitata* Morelet 1851, was named from the Usumacinta. *Elliptio opacata* Crosse & Fischer 1893 was taken alive with glochidia in December in Lake Catemaco. It appears to belong to the group of *Elliptio buckleyi* Lea 1843, so abundant in the lakes of Florida. The closely related *Barynaias*, peculiarly beaded over all or part of the shell, may include different species in every Atlantic river system of Mexico. One female *Barynaias* specimen was collected from the Usumacinta system, with glochidia in the outer gills in December.

Members of the genus *Cyrtonaias* were stated by Isaac Lea in 1860 to be relatives of *Elliptio*. *C. coloradensis* Lea 1856, was named from the Colorado River of Texas. In other Texas rivers, including Río Grande (Río Bravo), there is a species named *grandensis* Conrad 1855 (= *berlandieri* Lea 1857). The Panuco system has *C. tampicoensis* Lea 1838, while the Alvarado waters south of Vera Cruz harbor *C. tecomatensis* Lea 1841. *Cyrtonaias* mussels may also have a short breeding season in the cool winter months, as do some of the *Megalonaias* and the *Elliptio* of Lake Catemaco.

The subfamily LAMPSILINAE is represented in the Río Grande (Río Bravo) by species of the genera *Toxolasma, Truncilla,* and *Lampsilis*, s.s. *Actinonaias* and *Disconaias* are among the few groups living in the waters to the south that have been proven Lampsiline, with sexually dimorphic shells. *Pachynaias spheniopsis* with concentrically ridged shells, and the smooth-shelled *Mesonaias explicatus* Morelet 1849, also belong here as endemic Mexican Lampsilinae.

JUVENILE GROWTH OF THE SEA SCALLOP, *PLACOPECTEN MAGELLANICUS*

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(Abstract)

Growth rates of adult scallops, based on shell annuli, have been determined and validated by tagging (Merrill, Posgay, and Nichy 1966). Ring counts cannot be applied however, to scallops smaller than 50 mm since the rings, if present, are poorly defined. Apparently, recognizable rings are first formed at sexual maturity—about 50 mm. When sexual products, which make up one-third of the body weight, develop during late winter and early spring, growth processes are possibly diverted towards gonadal development. The resulting slower growth for the remaining body and shell of the animal produces a ring.

Mean sizes of juvenile sea scallops from natural habitats on the ocean bottom were compared with those from navigation buoys at various times of the year. Growth data were analyzed from 42 collections of small scallops which lived and grew on buoys up to 18 months. Since buoys are on station for known periods of time (Merrill 1965), and the season of spawning is known (Posgay and Norman 1958), information on age is reliable. Scallops from buoys grew, on the average, about 5 mm in 6 months, about 12 mm in 1 year,