Use of Oyster Reef Communities in the Design and Monitoring of Everglades Restoration Projects

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Greater Everglades restoration in South Florida is the largest ecosystem restoration project in United States history, and concerns both terrestrial and estuarine habitats. Restoration is governed by a federally legislated partnership through multi-agency consensus following a strict protocol. For estuarine projects, the American oyster, *Crassostrea virginica,* is being used as a bioindicator of estuarine health, as a tool for establishing restoration targets, and as a measure of restoration effectiveness. The purpose of this presentation is to illustrate the utility of oyster biology and reef ecology in the restoration planning process. The protocol adopted for Everglades restoration consists of nine steps: (1) defining restoration goals, (2) characterizing current conditions, (3) establishing the pre-alteration state, (4) designing alternative restoration scenarios, (5) establishing performance measures and targets, (6) modeling to evaluate each scenario, (7) designing an effectiveness monitoring plan, (8) implementing a restoration scenario, and (9) initiating adaptive management. Oysters and their reef communities are being used in steps 2, 3, 5, and 7. Oyster growth, standing stock, recruitment, susceptibility to disease, living density, aerial extent of reefs, and the diversity and richness of the reef community serve as bioindicators of estuarine health (step 2). Step 3 is achieved either by comparing the present distribution of oyster reefs with pre-alteration, historical surveys or by comparison with neighboring pristine estuaries. The same aspects of physiology and ecology are used to define targets and performance measures (step 5). Finally, the restoration project's success can be gauged (step 7) by how close the system approaches a given target.

Special Session – Coastal Molluscan Assemblages as Environmental Indicators and Monitors of Restoration Efficiency

The Utility of Molecular Phylogenetics for Unionid Conservation: Identifying New Populations of the Endangered Winged Mapleleaf *Quadrula fragosa* (Bivalvia: Unionidae)

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Members of the freshwater mussel genus *Quadrula* are known for their conchological diversity and apparent phenotypic plasticity. For this reason, the taxonomy and validity of many *Quadrula* species have been controversial. One such species is the federally endangered winged mapleleaf, *Quadrula fragosa*, which historically occurred widely in the Mississippi, Tennessee, Ohio, and Cumberland river drainages. The species was believed to be extinct until a living population was rediscovered in 1985 in the St. Croix River between northwestern Wisconsin and east-central Minnesota. Recently, several *Quadrula* specimens have been found outside of the St. Croix River that appear morphologically similar to *Q. fragosa*. We used DNA sequence of the mitochondrial ND1 gene to determine the genetic distinctiveness of *Q. fragosa* from other *Quadrula* species and its phylogenetic placement in the genus. In addition, we tested the identification of putative *Q. fragosa* from Arkansas, Missouri, and Oklahoma using molecular phylogenetic methods. Our results indicate that *Q. fragosa* is a genetically distinct species and extant populations of this species exist in at least two localities outside of the St. Croix River.

Contributed Session IV – Freshwater Mollusks

Phylogeny of the Neogastropoda: A Morphological Perspective Considering Its Relationship with the Caenogastropoda

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During a decade the anatomy of almost 300 species of gastropods have been studied in detail. The first step of the project was to analyze representatives of each family of all superfamilies of the Caenogastropoda, defining phylogenetically each superfamily. The second step was to analyze the Caenogastropoda as a whole, having the superfamilies as terminal groups. The final result of these two phases of the project was to portray cladograms of each superfamily and another single cladogram with the superfamily ground plans as terminal taxa. A set of Patellogastropoda, Vetigastropoda, Neritimorpha, and Heterobranchia was used as outgroups. Based on this, Caenogastropoda can be defined by 39 morphological synapomorphies (from which six undergo reversions) and the cladogram arrangement has successively the following superfamilies: (1) Cyclophoroidea, (2) Ampullarioidea; (3) Viviparioidea; (4) Cerithioidea; (5) Rissooidea; (6) Stromboidea; (7) Calyptraeoidea; (8) Naticoidea; (9) Cypraeoidea; (10) Tonnoidea; (11) Conoidea; (12) Muricoidea; and (13) Cancellarioidea. Representatives of some of the presently considered caenogastropod superfamilies, not mentioned here, were actually mixed with these taxa. Neogastropoda resulted as a monophyletic taxon, supported by seven synapomorphies. The main goal is to focus on the neogastropod superfamilies. Some aspects will be explored, such as the present concept on the Conoidea taxonomy, in particular, which must be reanalyzed. The Cancellarioidea and the Muricoidea share at least three synapomorphies, and most probably they can be considered as a single superfamily. However, because of the high diversity and large number of included families, Muricoidea is still under analysis in the present level. The analysis of the Muricoidea itself is considered as large as the remainder of the project. The present phase aims at analyzing a set of each muricoidean family, which varies from 12 to 16 (according to different authors), defining phylogenetically each family and, at the end, to analyze the superfamily as a whole, with the family ground plan as terminal taxa. Some provisional results are given in the form phylogenetic analyses of the Pseudolividae, Marginellidae, Olividae, and Muricidae.

Symposium – Relationships of the Neogastropoda

Delineating the Distributions of Alien Terrestrial Mollusks in North America

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Many alien species of terrestrial mollusks are established in North America. With expanding world trade, the opportunity for the introduction of new alien species continues to increase. The potential costs of these alien species on agriculture or the environment are largely unknown, but potentially immense. Despite the possible risks posed by alien snails and slugs it is unclear in many cases which species are established in North America, especially among closely related species of slugs. While the distribution of native species in eastern North America is well known, the distribution of alien species is not. The USDA, through the Cooperative Agricultural Pest Survey (CAPS) program, is surveying anthropogenic and natural habitats to detect newly introduced snail and slug species and better delineate the distributions of previously reported alien species in North America. Preliminary results are reported for New York, Rhode Island, and West Virginia.

Special Session – Snails and Slugs as Agricultural and Horticultural Pests

Terrestrial Mollusks from the Papuan Peninsula, Papua-New Guinea

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Surveys during 2002−2003 have uncovered remarkable radiations of terrestrial snails on the geologically complex and poorly sampled Papuan Peninsula, Papua-New Guinea. The eastern end of the peninsula includes the Cloudy Mountains to the south, and the disjunct terminus of the Owen Stanley Range to the north, separated from the main Owen Stanley uplands by extensive lowlands west of Mount Suckling. Many species appear to have distributions limited to particular mountain groups on the extreme eastern terminus of the Papuan Peninsula. Species in close proximity or sympatry share unique shell, genital, and radular characters, which suggests local speciation and poor dispersal ability. Diversity in eastern Papua-New Guinea has been underestimated and it is likely that there are many species yet to be discovered with narrow geographic and ecological ranges in the under-explored mountains of New Guinea.

Contributed Session II – Terrestrial Gastropods

Mapping the Potential Distribution of Invasive Mollusks in North America

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The Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine, of the United States Department of Agriculture is charged with protection in the United States of agriculture and environment from threats of exotic invasive pests, including mollusks such as *Achatina fulica* (giant African snail), *Monacha cartusiana* (cartusian snail), *Pomacea canaliculata* (channeled apple snail), and *Xerolenta obvia* (no common name). One of the management tools APHIS uses is predictive climatic mapping using Geographic Information Systems (GIS) to create maps. Such climatic maps assist in management and eradication strategies for invasive exotic mollusks.

Special Session – Snails and Slugs as Agricultural and Horticultural Pests

Bayesian Inference of Anomalodesmatan Phylogeny (Bivalvia: Heterodonta)

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The morphologically heterogeneous and often highly aberrant Anomalodesmata became firmly established in recent molecular phylogenetic studies as one of the basal lineages of the Heterodonta. The relationships of the 14 anomalodesmatan family-level taxa have hitherto been assessed by 18S rRNA sequences only. Although several robust monophyla could be identified, e.g. that of Lyonsiidae + Pandoridae + *Brechites* and Thraciidae + Myochamidae, the basal nodes of the anomalodesmatan tree were found unstable. To improve resolution and branch support, we assembled a dataset of three ribosomal markers, 18S, 28S, and 16S rRNA, and morphological data. Separate and combined analyses of the molecular data using maximum parsimony, maximum likelihood, and Bayesian inference yielded similar topologies. Tree resolution and robustness, however, increased with combined data. Laternulidae is the well-supported sister taxon to the lyonsiid-pandorid clade, and this clade is sister group to the remaining anomalodesmatans. The thraciid-myochamid clade is confirmed, now including *Thraciopsis*. The relationships of the septibranchs remain unresolved although the monophyly of Poromyidae, Verticordiidae, and Lyonsiellidae is better supported than by 18S data alone. The identity and relationships of two *Myonera* species are enigmatic: They are not monophyletic, and neither clusters with the Cuspidariidae. Plotting morphological data on the molecular tree indicates extensive convergent evolution in several character complexes such as, for example, hinge morphology and shell microstructure.

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Poster Session

The Mitochondrial Genomes of Two Limid Bivalves, and Their Significance for Bivalve and Molluscan Mitochondrial Evolution

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Mitochondrial genome organization has become a valuable marker for phylogenetic reconstruction in Metazoa. In contrast to the highly conserved mitochondrial gene order in Arthropoda and Vertebrata, Mollusca are extremely variable in this aspect. Of the 15 presently available molluscan mt-genomes, those of the polyplacophoran *Katharina* and the squid *Loligo* most closely resemble that of other invertebrates. The Bivalvia contribute significantly to the variability sharing only few gene junctions with *Katharina*. The high rate of gene rearrangements and the small taxon sample for bivalves make it difficult to use of the mt-genome data for phylogenetic inference. To better assess the phylogenetic signal in mt-gene order we sequenced the mt-genome of two species of the pteriomorph family Limidae, *Limaria hians* and *Lima inflata*. In both species, all genes are encoded on the same strand and the gene for the ATPase-8-subunit is missing. *Limaria hians* possesses multiple tRNA genes for Val, Phe, Cys, and Gln, whereas *Lima inflata* features two tRNA-Pro genes. A putative origin of replication is located between *nadh6* and *cox1*. The two limids have similar gene arrangements differing only in the position of *nadh5* and the relative position of *cox3* + *nad3* to *rrnS* + *rrnL* (disregarding tRNAs). Comparison with other molluscan mt-genomes shows the two limids less similar to other bivalves than to the polyplacophoran *Katharina tunicata*. This result indicates that high gene rearrangement rates is not a common bivalve feature but may have originated independently several times in their evolutionary history.

Supported by the Austrian Science Fund (FWF) project P16954-B12.

Contributed Session III – Marine Mollusks

Chemical Control of Invasive Snails: The Approach and Strategy Utilized by USDA, APHIS, PPQ Toward Eradication

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Three sites for quarantine of invasive snails at different stages of chemical eradication efforts are located in Sunny Point, North Carolina; Detroit, Michigan; and Chicago, Illinois. Six invasive species targeted include *Monacha syriaca* (Ehrenberg, 1831), *Monacha cartusiana* (Müller, 1774), *Cernuella virgata* (Da Costa, 1778) *Trochoidea pyramidata* (Draparnaud, 1801), *Xeropicta* sp., and *Xerolenta obvia* (Menke, 1828). Site evaluation forms the foundation of the eradication process. By factoring population size, obstacles, and environmental parameters (including impacted parties) a grid can be set for treatment. A treatment plan may also include countermeasures for problematic snail host material and terrain. Mini-pelletized metaldehyde bait has proven to be the chemical of choice thus far in eradication. The Sunny Point site initiated the search for an appropriate formulation and the need to address product labeling issues. For more than sixty years, the chemical metaldehyde has been at the forefront of molluscicides and has proven effective when applied according to label instructions. Invasive species eradication requires planning that is adaptable and receptive to innovative and changing conditions.

Special Session – Snails and Slugs as Agricultural and Horticultural Pests

Utility of Kidney Morphology in Phylogeny of the Neogastropoda

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Ever since the landmark study by Rémy Perrier on the anatomy and histology of the kidney of "prosobranch" gastropods published in 1889, it has been recognized that neogastropods possess kidneys with two distinct lobes of lamellae of separate structure and function. Although this fact was acknowledged many decades ago, few investigators since that time have examined organization and circulation patterns of neogastropod kidneys in detail. Typically, only degree of interdigitation of the primary lamellae (supplied by the ventral branch of the afferent renal vessel) and secondary lamellae (supplied by the dorsal branch of the afferent renal vessel) has been indicated in descriptions of the kidney — an attribute that has been shown to vary within some neogastropod families. Thus, this organ system has remained relatively poorly known. More importantly, existing descriptions have not been placed into a comparative framework with specific hypotheses of homology. The result has been that, with rare exception, neither gross nor fine structure of the renal organ has been used as a potential resource for characters in phylogenetic analyses of the Neogastropoda, nor in hypotheses of sister-group relationship to the latter. However, recent studies have revealed a number of new characters relating to renal organization and circulation. These characters will be reviewed in a broad comparative context, including interpretations of homology to other caenogastropod kidneys and the potential relevance of these characters in assessing the relationships and affinities of neogastropods.

Symposium – Relationships of the Neogastropoda

Hitchhiking Mollusks on Tile Shipments from Italy

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Snails are frequent hitchhikers in Italian tile shipments entering the United States. Italian tile products, including ceramic tile, limestone, granite, and other quarry products are imported into the United States in large quantities and thus represent a major pathway of entry for snails of agricultural concern. Miami, Florida, receives the largest quantities of any seaport in the United States, with more than 12000 containers a year. An analysis of Italian tile mollusk interceptions by federal inspectors in Miami from 1997−2003 indicate that they are concentrated around two months: November and May. This bimodal pattern of occurrence may be associated with seasonal aestivation and/or dispersal behavior of the snails commonly found: *Cernuella cisalpina, Hygromia cinctella*, and *Xerotricha conspurcata* (Hygromiidae) and *Cryptomphalus aspersus* and *Eobania vermiculata* (Helicidae). Pallets of tile awaiting shipment are often stored in or adjacent to weedy fields and it is hypothesized that snails seeking aestivation and new hiding sites preferentially crawl into these pallets most frequently during these times of year.

Special Session – Snails and Slugs as Agricultural and Horticultural Pests

Achatina fulica in Brazil: The Current Situation

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The giant African snail *Achatina fulica* Bowdich, 1822, was introduced into Brazil, for commercial purposes ("escargot" farming), probably in the state of Paraná, in the 1980s. It is now widespread in at least 15 of the 26 Brazilian states, including the Amazonian region and some islands, such as Ilha Grande in the state of Rio de Janeiro. Among the reasons for the rapid dispersal of *A. fulica* is its high reproductive capacity and the tendency for people to release specimens into the wild. *Achatina fulica* generally occurs in dense populations in urban areas where it attacks ornamental gardens, vegetable gardens, and small-scale agriculture. Also of concern is the damage caused to the environment, and the effects on native terrestrial mollusks, as seen in other countries where the snail has been introduced. In addition to its importance as an agricultural and environmental pest, its role in the epidemiology of the transmission of helminthoses of medical and veterinary interest should be considered. It may act as intermediate host of *Angiostrongylus cantonensis* (Chen, 1935), a nematode that can cause meningoencephalitis in humans, reported in some Asian countries and Pacific islands. It is also considered potential host of another congeneric species *Angiostrongylus costaricensis* Morera and Céspedes, 1971, causing abdominal angiostrongylosis, a zoonosis that occurs from the southern United States to northern Argentina.

Special Session – Snails and Slugs as Agricultural and Horticultural Pests

Status of *Melanoides tuberculatus* in Brazil

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The first record of the Afro-Asiatic *Melanoides tuberculatus* (Müller, 1774) in Brazil was in 1967 in Santos, state of São Paulo. Since then, it has been recorded in the states of Ceará, Distrito Federal, Minas Gerais, Paraíba, Rio de Janeiro, Paraná, Santa Catarina, Bahia, Espírito Santo, Goiás, Mato Grosso, Mato Grosso do Sul, Pará, Pernambuco, Piauí, Rio Grande do Norte, and Tocantins. This species has been studied as intermediate host in helminthoses of medical and veterinary interest and is known to displace native species. The alarming spread of *M. tuberculatus*, the lack of any control or monitoring, and the relatively little amount of information available on Brazilian freshwater mollusks indicate that serious damage to the ecosystem and probable implications to public health are to be expected.

Contributed Session IV – Freshwater Mollusks

The Allen Archer Collections at Auburn University:
A Global Portrait of Terrestrial Snail Biodiversity

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Allen Frost Archer authored about 26 scientific papers and described a number of terrestrial snail taxa in a malacological career that spanned more than 30 years. When the Auburn University Natural History Learning Center and Museum (AUNHLCM) acquired the collection of Dr. John C. Hurd (LaGrange College, Georgia) in 2002 it also received approximately 1600 lots of terrestrial snails comprising the personal collection of Allan Archer. This material includes representatives of at least 60 presently recognized land snail families. Many specimens predate Dr. Archer's collecting career and were presumably obtained by trades with museums. One of Dr. Archer's many areas of interest was polygyrids of southeastern North America, and his collection includes 216 lots, 21 genera, and 84 species of polygyrids. Camaenids are the second most diverse group in the Archer collection with 133 lots, 70 species and 19 genera represented. Dr. Archer's collecting activities were not restricted to southeastern North America; during the later years of his life he made collections from throughout North and South America, Europe, Asia, and many Pacific and Caribbean Islands. The AUNHLCM invites malacologists to use this historic resource.

Poster Session

A Joint Venture for the American Malacological Society, American Fisheries Society, and Others — Building an Aquatic Species Inventory and Prototype Warning System for Invasive Species

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Managers need to know when a species is introduced to their region and where they can get information on whether it will become invasive to help them formulate response strategies. With a warning system, managers will be better prepared to prevent alien species and mitigate impacts. To meet the needs of living resource managers, the National Ocean Service, the United States Geological Survey, the Smithsonian Institution, the American Fisheries Society (AFS), and many others initiated in Fiscal Year 2002 a project that will produce:

- An up-to-date inventory of United States and Canadian aquatic species
- A reporting and verification system for species not on the inventory
- Timely warnings for species new to aquatic ecosystems
- Risk assessments/information on alien species

That project, implemented through *A Hawaiian Pilot Inventory and Warning System,* is now being tested. Data from other regions will be added in Fiscal Year 2004, including monitoring data and species lists from the Gulf of Mexico and Alaska that are being gathered to prepare the third edition of the *Names of Mollusks* (an AMS and AFS partnership since 1983). A draft United States and Canadian species inventory and warning system could be ready as early as Fiscal Year 2008. Visitors to the Web site will be able to check new collections against a baseline inventory of United States and Canadian species, map distributions, and get in-depth information on invasive species. If a species not on the inventory is confirmed as alien, a warning will be posted automatically to managers.

Contributed Session III – Marine Mollusks

What is New on the Biodiversity of Opisthobranch Mollusks?

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Understanding the origins and causes of the Recent diversity of opisthobranch mollusks has been hampered by the absence of comprehensive inventories, reliable phylogenetic hypotheses, and information management tools. In recent years, the availability of comprehensive databases on the Internet (Clemam, Malacolog), has provided malacologists with new tools to access and analyze large amounts of distributional information. Analyses of these data have produced interesting new evidence on dispersal patterns with broad implications for addressing regional biodiversity questions. Additionally, new available phylogenetic hypotheses have revealed repetitive patterns in different clades of opisthobranchs that indicate strong evidence for major vicariant events that would have shaped the evolutionary history of this group. Finally, intensive deep-sea collecting in the tropical Indo-Pacific (MUSORSTOM Expeditions) has revealed an unexpectedly rich opisthobranch deep-sea fauna, and produced a wealth of distributional and bathymetric data. The analysis of these data in the framework of phylogenetic systematics has provided a new interpretation on the processes involved in the evolution of deep-sea opisthobranchs. This presentation discusses some of these new findings and suggests hypotheses that attempt to explain global and local biogeographic patterns within some opisthobranch clades.

Special Session – Biodiversity of Marine Mollusks

Diversity of Hosts and Form in Commensal Galeommatoidean Bivalves

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Most, if not all, of the species represented in the Galeommatoidea (Bivalvia) live in association with an invertebrate host or assemblage. The galeommatoids are found in all oceans and embody an impressive array of shell and body forms, often reflecting their host relationships. Recent molecular and reproductive studies have suggested that many species are difficult to discriminate using traditional morphological methods, and thus indicate a far more diverse galeommatoid fauna than previously assumed.

Special Session – Biodiversity of Marine Mollusks

Foraging by the Hydrothermal Vent Octopus,
Vulcanoctopus hydrothermalis

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Octopuses of *Vulcanoctopus hydrothermalis* appear to be endemic to hydrothermal vents on the East Pacific Rise. During DSV ALVIN dive 3939, I observed a dozen individuals of this species of octopus on sulfide spires adjacent to a giant tube worm (*Riftia pachyptila)* cluster at Parigou, a vent near 13° N. Three swarms of the vent amphipod, *Halice hesmonectes*, which can reach densities of up to 1000 individuals per cubic liter, were positioned near the base of the spires, over the tube worms. The octopuses repeatedly opened their arm crown and extended their web to sweep the immediate area, including the amphipod swarm. The octopuses then closed their web, beginning at the arm tips with the contraction moving toward the mouth. To determine whether the octopuses, which had been reported to prey on crabs, were foraging on amphipods, the pelagic sampler of the ALVIN sampled the swarm and its multi-chamber suction sampler collected four octopus specimens. The specimens were preserved after the submersible emerged, roughly two hours later. Dissection of the octopuses revealed amphipods *H. hesmonectes* in their digestive tract. The use of tactile feeding by this species living at more than 2600 m depth is not surprising, as light would appear to be limited in this habitat. Speculative hunting that targets the water column rather than the sediment or rock has to my knowledge never been previously reported.

Contributed Session III – Marine Mollusks

Unlocking the Key to Flow in Fissurellids

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Most fissurellids, or keyhole limpets, are characterized by a cap-shaped shell with an apical opening. Their mantle cavities contain paired organs, including a large pair of gills, which are believed to represent the primitive condition for gastropods. The apical opening has been proposed to function to prevent incoming clean seawater from mixing with waste-laden excurrent water. This is supported by the pattern of flow in these animals; water enters at either side of the head, passes through the gills, and exits through the apical opening. Some species of keyhole limpets, however, lack an apical opening. We compared the patterns of flow and morphology of fissurellids that have apical openings with those that do not. The Australian fissurellid *Amblychilepas negrita* and the North American *Diodora aspera* have apical openings and the expected flow-through pattern of mantle circulation. The Australian fissurellids *Scutus antipodes*, *Clypidina rugosa*, and *Tugali parmophoidea*, which lack apical openings, formed siphons at the central anterior regions of their mantles through which the water exited their mantle cavities. In addition, they brought their gills together in a point above their heads, thus using the gills to manipulate the flow.

Contributed Session I – Marine Gastropods

Terrestrial Snail Survey of the Sipsey Wilderness Area in Northwestern Alabama

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A survey of terrestrial gastropods was conducted from August 2003 to the spring of 2004 in the Sipsey Wilderness area of northwestern Alabama, which is located within Bankhead National Forest. Snails were collected by hand and from samples of leaf litter from 13 sites. To date, 50+ species have been found representing ~14 families of snails. The findings revealed several species that were not reported in previous surveys conducted in the 1960s by L. Hubricht. These results indicate a need for more detailed survey work of terrestrial snails.

Poster Session

Impact of Boat Wakes on Intertidal Reefs of the Oyster C*rassostrea virginica:* A Comparison of Reefs in South Carolina Tidal Channels Versus a Florida Estuary

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Resource managers are increasingly concerned that huge increases in recreational boating activities may be negatively impacting intertidal reefs generated by the Eastern oyster, *Crassostrea virginica,* now viewed as an economically and ecologically important species. Using a variety of hull designs, engine profiles (trim angles) and velocities, we experimentally evaluated the impact of recreational boating on reefs from two of the dominant habitat types in the southeastern United States: (1) narrow tidal channels in South Carolina with 1–2 m tidal range, and (2) shallow estuaries in Florida with small tidal amplitudes. In replicated trials, we have been measuring shell dispersal (as it is an excellent proxy for oyster recruitment success) using painted surfaces, turbidity, wind speed, and flow rates generated after each replicated boat pass. Wind alone rarely moved shells. However, significant shell movement and turbidity spikes were associated with boat-generated wakes. The results were especially dramatic on the sheer slopes of SC tidal channels and on reefs in Florida estuaries where prior activity (harvesting or die-offs) created steeply sloped, unstable accumulations of disarticulated shells along the seaward edges of the oyster reefs. Specifically, for Florida, when reef-wake distance was maximized, very few shells were dispersed, even at high speed, whereas in South Carolina, all vessels tested moved shells in large numbers. Implications are discussed for restoration and shellfish resources.

Poster Session

A Molecular Phylogeny of Physidae (Gastropoda: Basommatophora) Based on Mitochondrial DNA Sequences

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The family Physidae (Pulmonata: Basommatophora) is a group of freshwater hermaphroditic snails that have a Holarctic distribution with extension into Middle and South America. Despite considerable literature justifying various taxonomic schemes and groupings, no classification has been proposed using modern phylogenetic methods. In an effort to expand what is known concerning the evolutionary relationships of Physidae, we examined a portion of the mitochondrial 16S rRNA and cytochrome c oxidase subunit I (COI) genes from 66 specimens representing 28 taxa. The molecular phylogeny based on mitochondrial sequences supports the monophyly of the family Physidae, with the Planorbidae+Ancylidae clade representing the closest related basommatophoran families. There were six major Physidae clades uncovered in the analysis, which corresponded to penial morphology. These six groups include the following recommended phylogenetic species and species groups: *Aplexa* (*Aplexa*) *elongata* (Say), *Aplexa*-1 group; *Physa* (*Stenophysa*) *marmorata* Guilding, *Aplexa*-3 group; *P*. (*Physa*) *fontinalis* (Linneaus), *P*. (*Physa*) *jennessi* Dall, and *P*. (*Physa*) *vernalis* Taylor and Jokinen, *fontinalis* group; *P*. (*Physella*) *gyrina* Say and *P*. (*Physella*) *ancillaria* Say, *gyrina* group; *P*. (*Alampetista*) *acuta* Draparnaud, possibly *P*. (*Alampetista*) *billingsii* Heron, *P*. (*Alampetista*) *spelunca* Turner and Clench, *P*. (*Alampetista*) sp. (John's Island) and *P*. (*Alampetista*) *zionis* Pilsbry, *acuta* group; and *P*. (*Costatella*) *pomilia* Conrad and *P*. (*Costatella*) *hendersoni* Clench, *pomilia* group.

Contributed Session IV – Freshwater Gastropods

Cytochrome Oxidase I (COI) Sequence in Florida *Isognomon alatus* – Implications for Systematics and Population Genetics

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Samples of *Isognomon alatus* were taken from the shoreline of Florida, with the northernmost populations being found in Clearwater on the western side of the peninsula and near Fort Pierce on the eastern side. Partial COI sequences were isolated from individuals sampled from these populations using the primers developed by Matsumoto. These sequences are then compared to existing sequences from other species within the family to form a rudimentary phylogenetic tree and compared among each other using both AMOVA and Bayesian clustering techniques to show population boundaries along the coastline of Florida.

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Poster Session

The Quarantine Procedures in the Caribbean and the Potential Agricultural Impact on the United States

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Agricultural quarantine procedures were reviewed in the Lesser Antilles and serious quarantine issues were identified that could jeopardize the agriculture of neighboring islands in the Caribbean and the United States. Problems included: minimal inspection of agricultural cargo, little training of agricultural employees, customs officials making agricultural decisions, extreme financial stress and frequent lack of access to computers, microscopes, and other equipment. Some islands are located in close proximity to islands infested with one or more species of giant African snails, but do not have adequate cargo inspection procedures to prevent their introduction. Some airport customs declarations did not require travelers to declare snails or slugs upon entry to the islands and baggage inspections were rare to minimize the inconvenience to tourists. Increasing mollusk identification fees in remote locations, the lack of local malacology taxonomists, and few recent local mollusk surveys indicate a tremendous need for malacologists that could identify newly introduced and already present mollusks. While trade and tourism continues, the potential threat of invasive pests entering or spreading in the Lesser Antilles and ultimately to the United States, becomes even greater as more islands become infested with mollusk, noxious weed or insect pests, or infected with plant or animal diseases.

Special Session – Snails and Slugs as Agricultural and Horticultural Pests

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