



# Swimming up the Land Bridge: The Dispersal and Evolution of the Drum *Aplodinotus*



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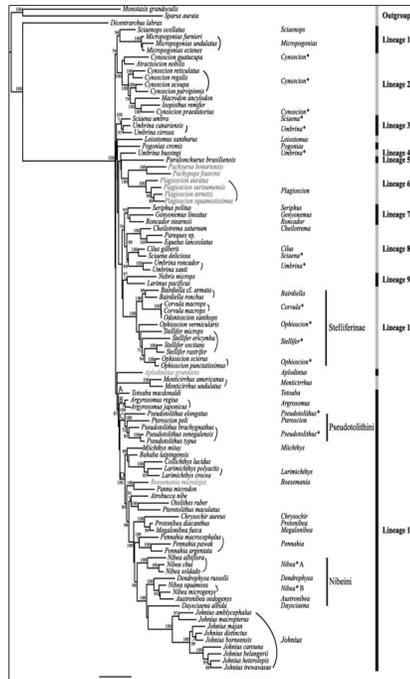
## Background

The Great American Biotic Interchange (GABI) of the Middle to Late Miocene was the migration of North America fauna southward and South American fauna northward after the formation of the Panama Isthmus that connects the two continents. However, the land mammals, the traditional lens through which GABI is examined, are limited in the information that they can provide about the state of the ecological state of the isthmus at the time of their migration. A freshwater fish genus such as *Aplodinotus* is much more limited in its method of migration and therefore can give a clearer idea of ecology.

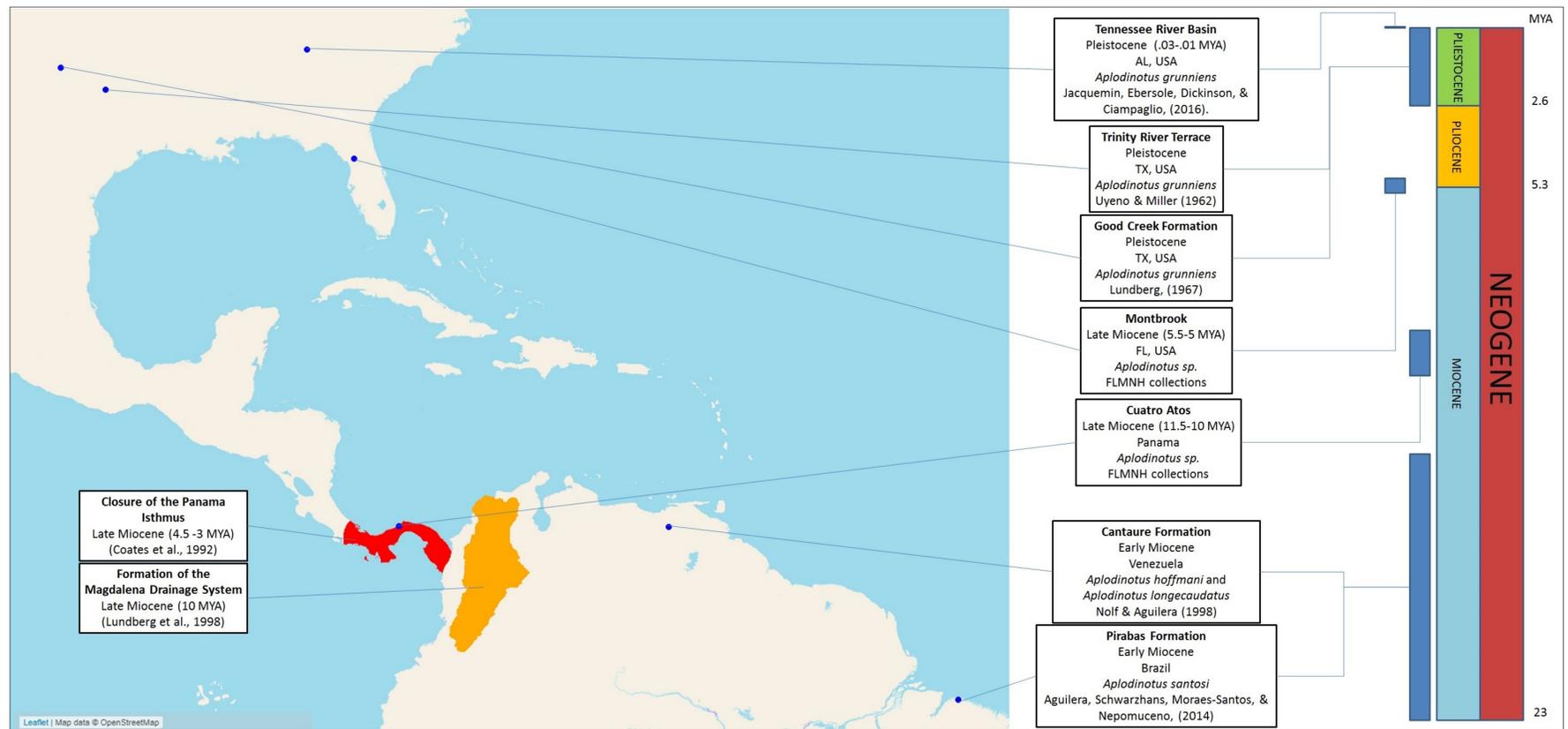
The genus *Aplodinotus* is represented by only one extant species, *Aplodinotus grunniens*, the freshwater drum. *A. grunniens* has evolved to feed primarily on the thin shells of freshwater bivalves, decapods, and diphtheria (Grubich, 2000) (French, 1997). *A. grunniens* has a purely North and Central American range, however DNA studies indicates close relationships with South American drums (Lo et al., 2015). Establishing the time period during which the northward migration of *Aplodinotus* occurred will shed light on the ecological conditions of the Panama Isthmus and the Gulf Coast along with clarifying drum evolution.



Members of the Florida Museum of Natural History Crew dig at the Montbrook site. Image Credit: Courtesy of the FLMNH

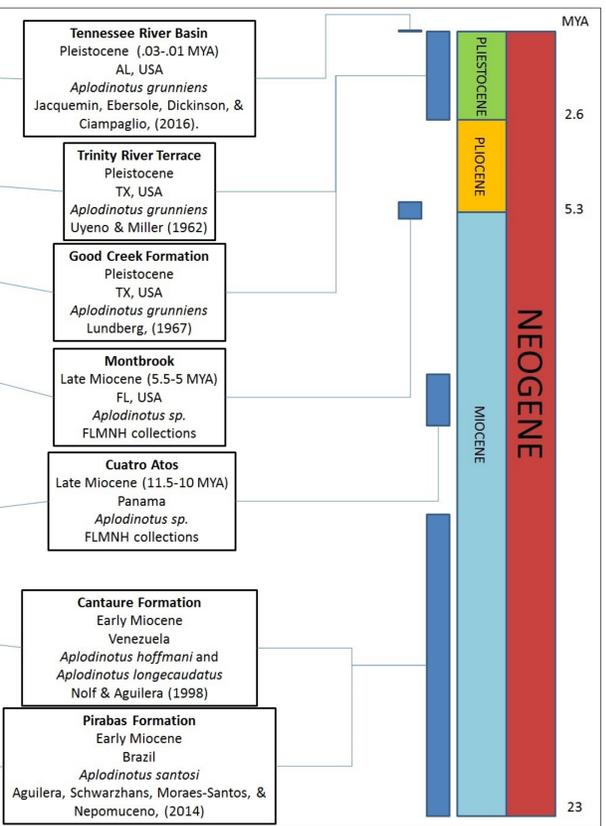


Phylogenetic tree from Lo et al. (2015)



Closure of the Panama Isthmus  
Late Miocene (4.5 -3 MYA)  
(Coates et al., 1992)

Formation of the Magdalena Drainage System  
Late Miocene (10 MYA)  
(Lundberg et al., 1998)



### Hypothesis: The *Aplodinotus* genus migrated north from South America during the late Miocene using river systems.



Dorsal spines from *Aplodinotus* sp. from Montbrook site.

## Methodology

The morphological analysis was conducted through morphological comparisons of fossil specimens to extant taxa, particularly *Aplodinotus grunniens* and *Pogonias cromis*. In the absence of comparable fossil specimens of earlier *Aplodinotus* species, *Pogonias* was used due to the genus' close evolutionary relationship with *Aplodinotus* (Lo et al., 2015) and the early appearance of its modern form (Takeuchi & Huddleston, 2008). I looked through the existing literature on *Aplodinotus* specimens and plotted the coordinates of the sites on a map and then compared location to the time period of origin. I added the time and localities of my own morphological research to the data and looked for trends.



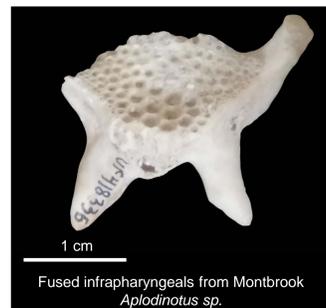
Suprapharyngeals from *Aplodinotus* sp. from Montbrook site. From left, 1-5 right suprapharyngeals, 6-10 left suprapharyngeals.



Infrapharyngeals from *Aplodinotus* sp. from Montbrook site. From left, 1-5 left infrapharyngeals, 6-10 right infrapharyngeals.



Vertebra from *Aplodinotus* sp. from Montbrook site.



Fused infrapharyngeals from Montbrook *Aplodinotus* sp.

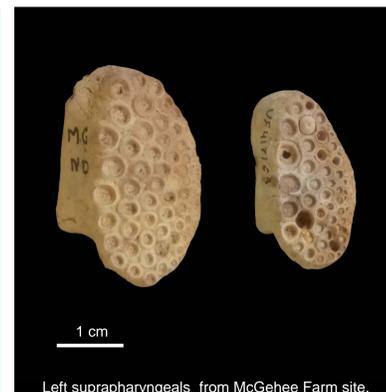
## Results from Analysis

- The small circular pharyngeal teeth and short pharyngeal establish the *Aplodinotus* as primarily a predator of fairly thin shelled mollusks.
- It is likely that the northward migration was enabled by the rivers systems of northern South America.
- The appearance of *Aplodinotus* in North America around the time of the closing of the Panama Isthmus 4-5 MYA suggests that fluvial systems that linked the two continents existed at the time.
- The presence of *Aplodinotus* in Florida specifically suggests that the entirety of the Gulf Coast was at one time connected by a large series of rivers.

## Further Research

- The discovery of older *Aplodinotus* specimens would narrow the time period for the migration.
- The presence, absence, and extent of the North to South migration of another fluvial taxon would shed further light on the Panama river system.
- Information on the *Aplodinotus* migration could be used to analyze changes in the fossil records of mollusks in and around the time period.
- Likewise, the *Aplodinotus* fossil record could be compared to that of possible predators, including other fish.

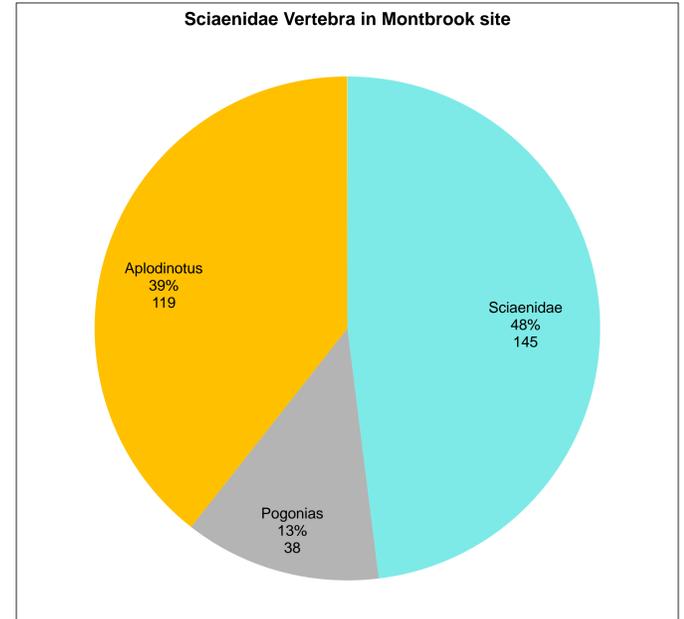
These two suprapharyngeals from the McGehee Farm site, located a few miles north of Gainesville, appear to be possible ancestral variants to the *Aplodinotus* specimens from Montbrook.



Left suprapharyngeals from McGehee Farm site.

## Conclusion

- The *Aplodinotus* genus migrated north from South America before the late Miocene and it is likely that a larger aquatic biotic interchange occurred before the migration of terrestrial vertebrates.
- This migration provides evidence for an extensive fluvial system linking North and South America before the closure of the Panama Isthmus.
- Freshwater and brackish mollusks were established in central Florida in the late Miocene.
- A river system linked the North American Gulf Coast, allowing bidirectional East-West Migration.



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