

DID THE FIVE-METER-LONG LARGETOOTH SAWFISH THAT HANGS FROM THE RAFTERS AT THE UNIVERSITY OF IOWA ONCE SWIM IN LOUISIANA WATERS?



Jason C. Seitz and John D. Waters

Gainesville, FL

Little Canada, MN

The five living members of the sawfish family Pristidae are a fascinating lot. Of the over 35,000 species of living fishes, only five have the combination of growing to a huge size and having a saw-like forward projection of the skull for which sawfishes earned their name. Two species of sawfish occur (or occurred) in US waters—the Largetooth Sawfish *Pristis pristis* and the Smalltooth Sawfish *Pristis pectinata* (Faria et al. 2013). Largetooth Sawfish have been reliably documented to reach 705 cm total length (TL) (Devadoss et al. 1989) while Smalltooth Sawfish reach at least 553 cm TL (Bigelow and Schroeder 1953, Weigmann 2016). It can be difficult to distinguish Largetooth Sawfish from Smalltooth Sawfish rostral specimens in museum and private collections due to overlapping rostral tooth counts, with Largetooth Sawfish having 14–24 rostral teeth per side and Smalltooth Sawfish having 20–30 teeth per side (Last et al. 2016). Principal component analysis can be used to determine species for rostra showing cryptic characters (Seitz and Hoover 2017). For complete specimens, characteristics of other parts of the body, such as the placement of the first dorsal fin relative to the pelvic fins and the presence or absence of a ventral lobe on the caudal fin, are used for distinguishing between these two species (Last et al. 2016). In the US, the Smalltooth Sawfish historically occurred along the Gulf of Mexico coast south through the Florida Keys and north along the eastern seaboard to North Carolina, but today the species is confined predominately to southern Florida and the Florida Keys (Waters et al. 2014). The range of the Largetooth Sawfish in the US was not well under-

stood until recently. Although nearly all records of Largetooth Sawfish in the US are from Texas (Table 1), some authors have included states east of Texas as part of its range (e.g., Briggs 1958, Duarte-Bello 1959, Robins and Ray 1986). del Monte-Luna et al. (2009) went so far as to state that the Largetooth Sawfish was “once common and even plentiful in Florida waters,” attributing this idea (erroneously) to Bigelow and Schroeder (1953). The species was never abundant in US waters, and there are no reli-



Figure 1. The 96.5-cm rostrum is the only authentic portion of the 500-cm-long Largetooth Sawfish that hangs from the rafters at the University of Iowa. (Photo courtesy of C. Opitz, UI. © 2020 The University of Iowa Museum of Natural History.)

Jason Seitz is a senior biological scientist at ANAMAR Environmental Consulting in Gainesville, Florida. He has over two decades of experience as a professional biologist including positions with the Florida Fish and Wildlife Conservation Commission, US Fish and Wildlife Service, Florida Museum of Natural History, county government, non-profit organizations, and private consulting firms. Mr. Seitz holds an MS in Soil and Water Science from the University of Florida, a BS in Biology from SUNY Brockport, and an AAS in Fisheries Technology from SUNY Cobleskill. Sawfish have held a special place his heart since first seeing a stuffed specimen hanging in a bait shop in southeastern Florida in 1998. Contact him at floridasawfish@gmail.com.

John D. Waters is President and lead biologist with the Aquatic Research & Conservations Society in Little Canada, Minnesota. He has 10 years of experience as a fisheries biologist including positions with the Florida Program for Shark Research, Minnesota Department of Natural Resources, and non-profit organizations. Mr. Waters holds a MEM in Coastal Environmental Management from Duke University and a BS in Biology from Western Colorado University (f.k.a. Western State College of Colorado). Sharks have been a passion for Mr. Waters since first catching a spiny dogfish as a child in Puget Sound and sawfish more specifically since first tagging an adult with colleagues in Florida Bay in 2011.



Figure 2. The 500-cm-long plaster cast of a sawfish that hangs above office space at the University of Iowa shows all the characteristics of a Largetooth Sawfish. The 96.5-cm rostrum is authentic and is tentatively considered to be specimen SUI-17512, although it lacks a specimen label. (Photo courtesy of C. Opitz, UI. © 2020 The University of Iowa Museum of Natural History.)

able records of it from Florida or even Mississippi or Alabama (Seitz and Waters 2018). But what about Louisiana?

ON THE HUNT FOR TRUTHINESS

While critically reviewing all available sources of information to clarify the US range of this enigmatic species, my coauthor and I came across information on an interesting Largetooth Sawfish specimen housed within the University of Iowa's Museum of Natural History that was purported to be from Louisiana.

A 500 cm TL cast replica of a Largetooth Sawfish hangs from the rafters at the University of Iowa (UI; also known as the State University of Iowa [SUI]) (Figures 1 and 2). An authentic 96.5-cm rostrum, attached to the cast, is thought to be specimen SUI-17512, although no label was found on the rostrum or cast to confirm its identity according to the collections manager, C. Opitz (pers. comm.,

04/07/16). Specimen SUI-17512 was stated by Fernandez-Carvalho et al. (2013) to have been captured in Louisiana waters in 1917 or 1918 and to measure 488 cm TL. These authors cited SUI-17512 as evidence of Largetooth Sawfish having historically occurred in Louisiana waters. We knew we needed to confirm or refute this record, and leave no stone unturned, so that future conservation efforts for potential refugia for any remaining Largetooth Sawfish in the US are not wasted in areas having invalid records.

SUI-17512 lacks locality data and the date of collection. The specimen is catalogued simply as "Saw of Saw-fish" "Deposited by C. C. Nutting" according to Opitz (pers. comm., 08/30/16).

Charles Cleveland Nutting (1858–1927) was an avid naturalist interested primarily in hydroids and birds (Calder 2004). Legendary ichthyologist David Starr Jordan was among Nutting's teachers and reportedly influenced Nutting as a naturalist. Nutting was curator at the (then-named) Cabinet of Natural History at UI (renamed the Museum of Natural History in 1887) during 1886–1927 (Taylor 1943, Calder 2004). The SUI-



Figure 3. This plaster cast of a Largetooth Sawfish was likely made between 1916 and 1918 under the direction of Louisiana State University curator and supervisor of its taxidermy laboratory, Alfred Bailey, based on information in LSM's Sixth Biennial Report (1918). The cast may have been based on a specimen received from a local fisherman, although the capture locality is not clear. The characteristics of the mount are very different from that of the 500-cm-long cast now hanging from the rafters at the University of Iowa. It may have been re-mounted as shown in Figure 1, or it may represent an entirely different specimen from SUI-17512. (Photo provided by C. Opitz and The University of Iowa Museum of Natural History.)

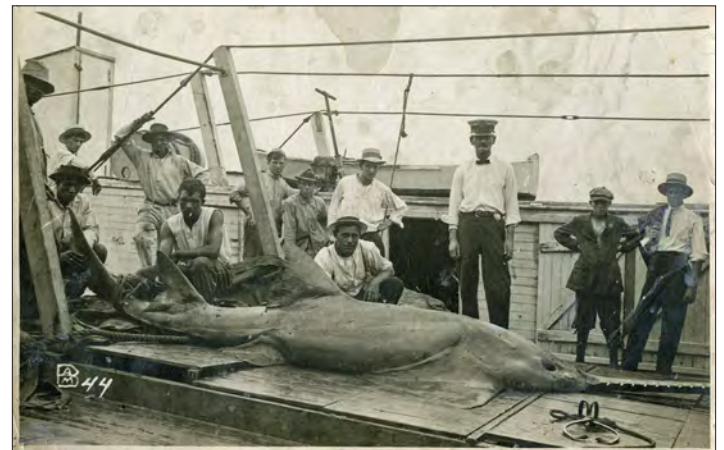


Figure 4. A cropped version of this photo of a Largetooth Sawfish on a boat was included in LSM's Sixth Biennial Report (1918) together with the caption "Fifteen-foot sawfish taken on board the boat." The same report also states that "The most important acquisitions [sic.] [to the Louisiana State Museum] were two immense sawfishes (*Pristis pectinatus*) from Barataria Bay, contributed by Mr. Leo Marrero, of Gretna, La., and Mr. W. G. Fischer, one of which was mounted by the taxidermy department." (Photo provided by C. Opitz and The University of Iowa Museum of Natural History.)



Figure 5. This photo of a Largetooth Sawfish onboard a vessel may or may not be the same specimen as in Figure 4. The fish shown in Figure 4 has a cut across the base of the rostrum, while the fish in this photo has the base of the rostrum still intact. (Photo provided by C. Opitz and The University of Iowa Museum of Natural History.)

17512 specimen may have been captured in the Gulf of Mexico during the period of Nutting's tenure at UI. Indeed, a transcript of an 1888 presentation delivered by Nutting includes mention of a sawfish captured in the Gulf of Mexico (Nutting 1888). However, there are other possible scenarios to consider for the provenance of SUI-17512.

One alternative scenario is that SUI-17512 was obtained from UI alumnus and ex-curator and supervisor of the taxidermy laboratory at the Louisiana State Museum (LSM) (July 1, 1916–September 1, 1919), Alfred M. Bailey, and Professor Homer R. Dill of the LSM through Bailey. This possibility was suggested to the authors by Opitz (pers. comm., 04/07/16) and it would help explain how Fernandez-Carvalho et al. (2013) made a connection between SUI-17512 and Louisiana as well as the date of capture these authors assigned to it (1917 or 1918). However, if this is the case, then there are still several possibilities as to where the specimen had been collected.

A photo stored at UI of a large Largetooth Sawfish on a boat was included in LSM's Sixth Biennial Report (1918) together with the caption "Fifteen-foot sawfish taken on board the boat" (Figures 3, 4, and 5); however, the stated length of the fish in the photo (457 cm, presumably referring to TL) does not match that of the mounted specimen. The same biennial report states that "two immense sawfishes (*Pristis pectinatus*) from Barataria Bay contributed by Mr. Leo Marrero, of Gretna, La., and Mr. W. G. Fischer, one of which was mounted by the taxidermy department." The species identification in the report is not necessarily reliable so we cannot rule out the Largetooth Sawfish. Mr. Marrero's sawfish is later stated as being 427 cm long and from the Gulf of Mexico, and Mr. Fischer's sawfish was stated as 457 cm long and having been caught in Barataria Bay, Louisiana. In the April 1919 issue of the *Iowa Alumnus*, Bailey (1919) references a 488-cm-long sawfish caught while working with shrimp trawl fishers.

Based on the above information, the capture location for the SUI-17512 specimen could be attributed to the Gulf of Mexico, Barataria Bay, or an unspecified area in the case of the trawler-caught sawfish (LSM 1918, Bailey 1919). Although the first two specimens were reported as Smalltooth Sawfish, the species identifications could not be verified and so we could not rule out the Largetooth Sawfish. In the case of the sawfish captured by trawl, the fish was retained, the meat harvested, and the rostrum was likely added to the LSM collection. The reported TL for the trawler-caught sawfish (488 cm) was closest in size to the 500-cm mounted specimen. Further, this TL agrees with the one attributed to SUI-17512 by Fernandez-Carvalho et al. (2013). However, the capture location for the trawler-caught sawfish was not reported by Bailey (1919).

There is still another scenario to consider. It is even possible that the SUI-17512 rostrum instead refers to one of three rostra that were accessioned into the LSM collection in 1910 from unrecorded localities (LSM 1910). At a minimum, SUI-17512 may have been collected at an unspecified locality in the Gulf of Mexico, from Barataria Bay, or from an entirely unrecorded locality.

It is unclear why Largetooth Sawfish have not been reliably documented in Louisiana, Mississippi, Alabama, or Florida. What is clear is that the lack of reliable records is not due to a lack of people able to observe these big fish along the coastlines of these states. In the words of Bigelow and Schroeder (1953), "This [Port Arthur, Texas] seems to mark the usual limit to its range in that direction [east], for it could hardly have been overlooked if it occurred in any numbers along the northern shore of the Gulf of Mexico."

It is possible that the associated hypoxic zone adjacent to the Mississippi River delta impeded the eastward dispersal of Largetooth Sawfish into the northeastern Gulf of Mexico as it is a somewhat obscure zoogeographic division (Rahel 2007). This massive zone extends far out into the Gulf (Hoese and Moore 1998, Turner et al. 2006) and is known to affect the distribution of some fish species, such as those within the American sole genus *Gymnachirus*, the blenny genus *Chasmodes*, and the puffer genus *Sphoeroides* (Walls 1975). However, if the Mississippi delta represents a barrier to the Largetooth Sawfish, then why doesn't it represent a barrier to the Smalltooth Sawfish in the same way? Further, it seems counterintuitive that this delta

Table 1. List of Largetooth Sawfish records from Texas from the available literature and public and private collections and databases including the International Sawfish Encounter Database (NSED) at the University of Florida. Some total lengths (TLs) are extrapolated from a measured rostrum, or a rostrum-less body, using morphometric data in Whitty et al. (2014).

Date	County	TL (cm)	Source(s), Notes
1968	Nueces	Not recorded	NSED-05900; "Port Aransas?"
06/24/1961	Nueces	Not recorded	NSED-04108; Big Shell (now called Padre Island). Bob Hall Pier
09/xx/1957	Galveston	Not recorded	NSED-04285; Texas City, ship channel near the turning basin
1951	Galveston	Not recorded	NSED-04098; Beach in Galveston
1951	Galveston	Not recorded	NSED-04063
1948	Not recorded	Not recorded	JCS-894 of JCS private database; Texas
1947	Nueces	Not recorded	NSED-04111; Port Aransas
1947	Kleberg/Kennedy	Not recorded	NSED-04406; Padre Island south jetty
1942 (summer)	Galveston	427–530 ($n = 7$)	Baughman (1943); coll. E.F. Reid; City of Galveston; at least one female and several males; 226–590 kg
06/16/1940	Aransas and Nueces	566	Baughman (1943); Aransas Pass; 544 kg
09/01/1940	Galveston	Not recorded	NSED-04345; Galveston
08/28/1940	Galveston	Not recorded	NSED-04347; Bettison Pier at Galveston North Jetty
08/28/1940	Galveston	Not recorded	NSED-04348; Bettison Pier at Galveston North Jetty
06/16/1940	Aransas	Not recorded	NSED-04019; Aransas Pass
09/08/1938	Nueces	Not recorded	NSED-04152; Port Aransas area
09/04/1938	Galveston	444.5	JCS-XXX (photo and interview records) in private database; J. Richard of Florida Sportsman, pers. comm., 01/14/05; B. Reynolds of International Game Fish Association (IGFA), pers. comm., 04/08/05; fish weighed 333.8 kg; coll. G. Pangarakis; Galveston North Jetty; this fish is an IGFA record (La Monte 1958)
05/14/1938	Galveston	Not recorded	NSED-04099; High Island
10/11/1935	Nueces	Not recorded	NSED-04377; Corpus Christi Bay Channel in Corpus Christi Bay
1929–1930	Galveston	Not recorded	NSED-04369; Galveston North Jetty
1925–1930	Cameron	399 (extrapolated)	JCPP241009 of JCS private collection; rostrum; Brownsville; TL extrapolated from 91.9-cm standard rostral length
1925	Cameron	Not recorded	NSED-04151; Port Isabel
1917	Nueces	467 (extrapolated)	Hoover (2008); coll. E.W. Brown; near Port Aransas; TL extrapolated from 112-cm total rostral length; head of specimen is currently housed at Denver Museum of Nature and Science
Not recorded (< 1943)	Aransas and Nueces	498	Baughman (1943); Aransas Pass area
Not recorded (< 1943)	Aransas and Nueces	601 (extrapolated)	Baughman (1943); Aransas Pass area; rostrum previously removed; fish was previously harpooned and shot; all wounds reported healed; TL based on 457-cm body and predicted total rostral length of 144 cm
Not recorded (< 1943)	Brazoria	Not recorded	Baughman (1943); shrimp trawler out of Freeport
Not recorded (< 1943)	Galveston	427	Baughman (1943); City of Galveston
Not recorded (< 1943)	Galveston	445	Baughman (1943); City of Galveston
Not recorded (< 1943)	Galveston	457	Baughman (1943); City of Galveston
Not recorded (\leq 1925)	Cameron	523	Hoover (2008); Port Isabel, photo postcard postmarked 1925
Not recorded	Galveston	Not recorded	NSED-04104
Not recorded	Galveston	Not recorded	NSED-04065
Not recorded	Not recorded	288 (extrapolated)	JCSPP270103 of JCS private collection; rostrum; Texas; TL extrapolated from 66.4-cm standard rostral length

should represent a barrier to the eastward expansion of such a huge and powerful fish species and one that is known to inhabit rivers and freshwater lakes (Thorson 1976, Compagno and Cook 1995). Still, this possibility is difficult to rule out.

TRUTHINESS REVEALED. KINDA.

The lack of locality data for this Largetooth Sawfish record prevents it from being reliably assigned to Louisiana, or any other state, despite an extensive search of all available data. Baughman (1943) stated that no Largetooth Sawfish have been reported from Louisiana and we agree that none can be attributed to this state.

WHAT ABOUT THE LONE STAR STATE?

All the Largetooth Sawfish records from Texas that include a TL are for large individuals. Of the 38 records that we know of from Texas, 18 included either a stated TL or we were able to extrapolate the TL from a measured rostrum, or rostrum-less body, using morphometric data from Whitty et al. (2014). These TLs ranged from 288 to 601 cm (Table 1). So, the Texas saying “everything’s bigger in Texas” would seem to fit well here. Although Baughman (1943) thought that Largetooth Sawfish reproduced in Texas waters based on his interviews with shrimp trawl fishers at Galveston and Freeport, we know of no records of very young Largetooth Sawfish from Texas despite a search of all available literature, databases, and museum records (see Seitz and Waters 2018 for methods). It is possible that these shrimp fishers had mistaken Smalltooth Sawfish for what they considered to be gravid Largetooth Sawfish. Eleven of the Texas records listed in Table 1 include the month of the sawfish encounter, and all were recorded during the warmer months of the year (May–September). An additional seven Largetooth Sawfish were reported by Baughman (1943) as having been taken during summer in Galveston. Taken as a whole, the available information suggests that Texas does not represent important habitat to this species during modern times. The occurrence of Largetooth Sawfish there may well have been merely a product of the occasional wanderings of large, particularly mobile individuals from Mexican and Central American waters during the warmer months.

This species has not been recorded from Texas since the 1960s (Table 1) and, to our knowledge, only two individuals have been recorded from southern Gulf waters off Mexico since then (see Bonfil et al. [2017] for records from Mexico). It seems improbable that any additional Largetooth Sawfish will be recorded from US waters until such time that the species is able to re-establish itself in the southern Gulf. It is hoped that this time will come, and when it does, we may even be able to add a reliable record or two from Louisiana, and Sawfish aFishmentos everywhere can collectively rejoice.

ACKNOWLEDGEMENTS

We thank the following people for their help. C. Opitz (UI) graciously provided photos and information on SUI-17512 and happily answered our many queries regarding the possible provenance of this specimen. The University of Iowa Museum of Natural History granted us permission to publish

their archived photos. T. Bowling (Florida Program for Shark Research, Florida Museum of Natural History, UF) provided records from the International Sawfish Encounter Database. C. Steen (ANAMAR) helped improve and provided helpful suggestions on an earlier draft. Support was provided by Jenny Seitz and Amy Waters.

LITERATURE CITED

- Bailey, A. 1919. A-field in Louisiana. *Iowa Alumnus*, Apr: 208–211.
- Baughman, J.L. 1943. Notes on sawfish, *Pristis perotteti* Müller and Henle, not previously reported from the waters of the United States. *Copeia* 1943:43–48.
- Bigelow, H.B., and W.C. Schroeder. 1953. Sawfishes, Guitarfishes, Skates and Rays. *Fishes of the Western North Atlantic*. Memoir Sears Foundation for Marine Research Number 1, Part 2, Yale University, New Haven, CT.
- Bonfil, R., O.U. Mendoza-Vargas, M. Ricano-Soriano, P.Y. Palacios-Barreto, and N. Bolano-Martinez. 2017. Former widespread abundance and recent downfall of sawfishes in Mexico as evidenced by historical photographic and trophy records. *Fisheries* 42:256–259.
- Briggs, J.C. 1958. A list of Florida fishes and their distribution. *Bulletin of the Florida State Museum, Biological Sciences* 2(8):223–318.
- Calder, D.R. 2004. From birds to hydroids: Charles Cleveland Nutting (1858–1927) of the University of Iowa, USA. *Hydrobiologia* 530/531:13–25.
- Compagno, L.J.V., and S.F. Cook. 1995. The exploitation and conservation of freshwater elasmobranchs: status of taxa and prospects for the future. *Journal of Aquaculture and Aquatic Science* 7:62–90.
- del Monte-Luna, P., J.L. Castro-Aguirre, B.W. Brook, J. de la Cruz-Agüero, and V.H. Cruz-Escalona. 2009. Putative extinction of two sawfish species in Mexico and the United States. *Neotropical Ichthyology* 7:509–512.
- Devadoss, P., J.C. Gnanamuttu, S. Srinivasarangan, and S. Subramani. 1989. On the landing of a large saw fish at Madras. *Indian Council of Agricultural Research: Marine Fisheries Information Service* August 1989:13.
- Duarte-Bello, P.P. 1959. *Catalogo de Peces Cubanos*. Monografia 6, Universidad de Villanueva, Marianao, Cuba.
- Faria, V.V., M.T. McDavitt, P. Charvet, T.R. Wiley, C.A. Simpfendorfer, and G.J.P. Naylor. 2013. Species delineation and global population structure of critically endangered sawfishes (Pristidae). *Zoological Journal of the Linnean Society* 167:136–164.
- Fernandez-Carvalho, J., J.L. Imhoff, V.V. Faria, J.K. Carlson, and G.H. Burgess. 2013. Status and the potential for extinction of the largetooth sawfish *Pristis pristis* in the Atlantic Ocean. *Aquatic Conservation: Marine and Freshwater Ecosystems* 24:478–497.
- Hoese, H.D., and R.H. Moore. 1998. *Fishes of the Gulf of Mexico, Texas, Louisiana, and Adjacent Waters*. Texas A&M University Press, College Station, TX.
- Hoover, J.J. 2008. Searching for sawfish: a history of the hunt. *American Currents* 34(2):1–15.
- La Monte, F. 1958. *North American Game Fishes*. Doubleday & Company, Inc., Garden City, NY.

Last, P.R., W.T. White, and G.J.P. Naylor. 2016. Sawfishes, Family Pristidae. In: Last, P.R., W.T. White, M.R. de Carvalho, B. Séret, M.F.W. Stehmann, and G.J.P. Naylor (eds.). Rays of the World. CSIRO Publishing, Clayton South, Australia.

LSM (Louisiana State Museum). 1910. Second Biennial Report of the Board of Curators: April 1st, 1908, to March 31st, 1910. New Orleans, LA.

LSM. 1918. Sixth Biennial Report of the Board of Curators: January 1, 1916, to December 31, 1917. New Orleans, LA.

Nutting, C.C. 1888. Teeth from a zoological standpoint. Transactions of the Iowa State Dental Society 1888:122-130.

Rahel, F.J. 2007. Biogeographic barriers, connectivity and homogenization of freshwater faunas: it's a small world after all. Freshwater Biology 52:696-710.

Robins, C.R., and G.C. Ray. 1986. A Field Guide to Atlantic Coast Fishes, North America. Houghton Mifflin Co., New York, NY.

Seitz, J.C., and J.J. Hoover. 2017. Taxonomic resolution of sawfish rostra from two private collections. Endangered Species Research 32:525-532.

Seitz, J.C., and J.D. Waters. 2018. Clarifying the range of the endangered largemouth sawfish in the United States. Gulf and Caribbean Research 29:15-22.

Taylor, W.L. 1943. Charles Cleveland Nutting. The Palimpsest, Sept 1943.

Thorson, T.B. 1976. Observations on the reproduction of the sawfish, *Pristis perotteti*, in Lake Nicaragua, with recommendations for its conservation. Pp. 641-650 In: Thorson, T.B. (ed.). Investigations of the Ichthyofauna of Nicaraguan Lakes. School of Live Sciences, University of Nebraska, Lincoln, NE.

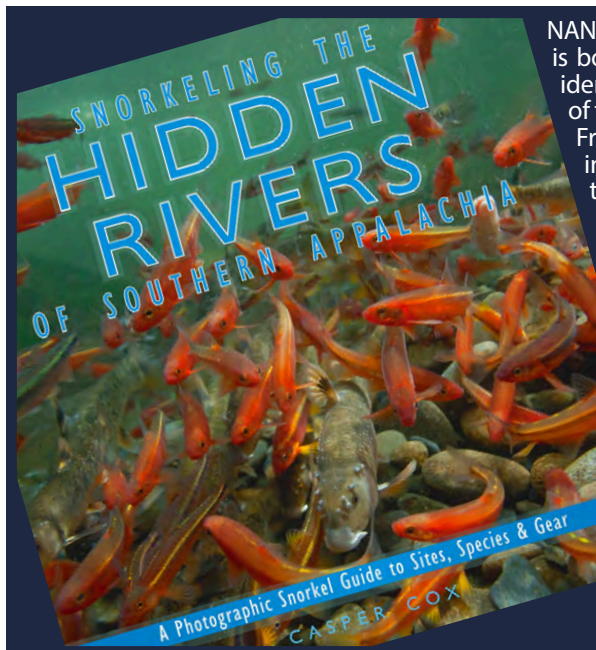
Turner, R.E., N.N. Rabalais, and D. Justic. 2006. Predicting summer hypoxia in the northern Gulf of Mexico: riverine N-, P-, and Si loading. Marine Pollution Bulletin 52:139-148.

Walls, J.G. 1975. Fishes of the Northern Gulf of Mexico. T.F.H. Publications, Inc., Neptune City, NJ.

Waters, J.D., R. Coelho, H. Fernandez-Carvalho, A.A. Timmers, T. Wiley, J.C. Seitz, M.T. McDavitt, G.H. Burgess, and G.R. Poulakis. 2014. Use of encounter data to model spatio-temporal distribution patterns of endangered smalltooth sawfish, *Pristis pectinata*, in the western Atlantic. Aquatic Conservation: Marine and Freshwater Ecosystems 24(6):760-776.

Weigmann, S. 2016. Annotated checklist of the living sharks, batoids and chimaeras (Chondrichthyes) of the world, with a focus on biogeographical diversity. Journal of Fish Biology 88:837-1037.

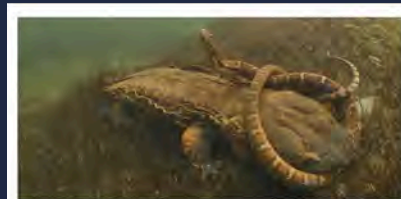
Whitty, J.M., N.M. Phillips, D.C. Thorburn, C.A. Simpfendorfer, I. Field, S.C. Peverell, and D.L. Morgan. 2013. Utility of rostra in the identification of Australian sawfishes (Chondrichthyes: Pristidae). Aquatic Conservation: Marine and Freshwater Ecosystems 24:791-804.



NANFA's very own Snorkelmeister, Casper Cox, has written a snorkeling guide that is both useful (with maps and information about locations, access, biodiversity, identification, safety and more) and beautiful (with dozens of color photos by some of the best underwater photographers in the world). Written to complement the Freshwaters Illustrated film "Hidden Rivers," the book is a distillation of Casper's interests, experiences and skills, as well as a love letter to his favorite waters and their inhabitants.

75+ pages, lay-flat spiral binding, 3rd printing. \$30 each

NANFA receives a donation for each copy sold through <http://www.nanfa.org/cart.shtml#guide>



Helibenders, aka Devil Dogs or Snot Otters, are also found in the Hiwassee River. The clean water, large flat stones and an abundance of crayfish provides an excellent watery world for them to live in. If you were to spend a day here you may well see one, especially in the early dawn or dusk hours as they are generally nocturnal hunters. They breathe through the folds of skin running down their sides and remain in the water year round. Some people are afraid of them but you have nothing to fear. They are not venomous as some unknown people claim. Consider yourself very fortunate to see a Helibender in one of the few remaining rivers they still thrive in. They are North America's largest salamander reaching lengths of 24 inches or more.

David Herasimtschuk was honored with an international first place award in London for this stunning photo. By the way, the Northern Water Snake got away, a bit too much for the Devil Dog.

To a stream named Spring Creek located on the north side of the farm compared to the cold Hiwassee. Though the creek is much better run for easy snorkeling. In early spring River Clubs with and here, just as in the shallow runs of the Hiwassee.



The Hiwassee River is only 30 minutes from the Conasauga River, via US Highway 411 north. A convenient location is the Hiwassee Picnic Site and it's just a few miles from #11, along TN 30 east toward Reliance. The picnic site offers tables, an access ramp, a restroom and a shallow gravel bar to wade out from. Be careful here as the water can dramatically and dangerously rise during power generators surges. While in Reliance, visit the historic Webb Brothers general store and post office. On the other side of the river, at the bridge, is a fly fishing store and deli as well. Free camping is available along Spring Creek and paid camping with facilities at Greer Campground. A visitor center is nearby. The Hiwassee River Picnic Site.

Looking Below the Surface
Snorkeling is a wonderful way to experience another aspect of our world. Not only will you see things that most never will, it is a full sensory experience. Your body and senses are fully awakened, you are one with the watery world, floating freely in its space. Your vision is magnified by an optical enhancement, raising everything appear larger. Aquatic creatures will come near you, as close as you or of them, soon occupying your attention. Unlike on the surface world, where one generally has to view creatures from afar or by the use of binoculars, on the world below the water's surface you can gently approach many aquatic species without being seen inches for a prolonged period of close observation.

Aquatic Diversity
Fishes come in all types of shapes and sizes with their bodies adorned by marbled patterns, gold, red, blue, green and colorful flowing fins. Fishes vary from being strictly gut catching to all backwaters to fully enclosed fish during along the gravelly bottom. Schools of silver shiners by you, shimmering in the sunlight's rays while a Flathead Bass watches, lurking in the shadows of log gaps. A new world of aquatic life awaits, beginning just below the Earth's surface. Back the flow and listen for the sounds of redhorse suction pinging macroalgae mats from the life side of broken logs. In the cracks and crevices tiny iridescent eggs, blue with yellow like another generation of hanging fishes taking their place in the aquatic food web. Schools of air-breathing grass on ripper stones covered with algae, sharing off patches with their brownly sharp as their legs. They are feeding, moving in a band of aquatic castle, grazing on the algae. Return in the spring and some of these sleek stone grazers will have morphed into air-breathing rolling stones and sliding deep trenches into the clear green for the egg filled females. About her eggs, diamond mussels will fertilize and protect the eggs with a cover of porous red stones.

This is a world mostly unseen, yet eager to be witnessed by you. With a mask of temperate gas, a fin, released from gravity's gut, diving through their watery world with a quiet ease. To experience, floating in the web of space, but no, you are here in a medium of long waves, and to experience, exploring new mysteries.

Shiners and Sunfish, Trout and Redfishes, Darters and Clogs, Bullheads and Hog Suckers, Dru, Presbytery Bass and their prey, Lampreys and Minnows, Whitehead Catfish, along with their...



Beaute Darters are the most common darter in the Smoky Hills. I consider them handsome with their many pronouncements of bronze. From shiny brass to muted patinas, they wear their metallic scales proudly. The Latin name for the Beaute Darter is *Percina bifasciata*, which means "The Prince." They seem to enjoy feeding in the capsaicin moss covering the rocks. Rubbing your hand gently over this moss gently dislodges moss debris that these handsome darters will promptly feed upon.



Greenbreast Darters are at their most beautiful in the early spring. During the spawning season the males are out and about parading themselves to entice the more bland colored, gravid females. Being those filled with eggs, most their selected nesting sites. Usually this species tends to live and hide beneath the stones located in or...



Speckled Darters, during the spring spawning season, only the males get the vertical bars of iridescent blue. During most of the year their bodies are a light tan color blending into the sandy substrate they favor, generally found in the calmer flowing areas.



There are many, many other species of fish found in the Conasauga River. Typically on any given day you will see 20 to 30 different fish species at the snorkel hole, and even more as you learn when and where to look. Snorkel the pools and bouldered rapids further downstream and return during other seasons to our new sights. Explore! Below is one of the beautiful crayfish, marked with vermilion over ash.



LOOK BELOW THE SURFACE
CHEROKEE NATIONAL FOREST