150 million years strong
We are not an evolutionary fad
We are not primitive, we are persistent

150 millones de años siendo fuertes
No somos una moda evolutiva
No somos primitivos, somos persistentes

PROGRAM AGENDA FOR THE

JOINT MEETING OF THE

INTERNATIONAL NETWORK FOR LEPISOSTEID FISH RESEARCH AND MANAGEMENT

AND THE

SOUTHERN DIVISION OF THE AMERICAN FISHERIES SOCIETY ALLIGATOR GAR TECHNICAL COMMITTEE

25 – 28 MAY 2010
NICHOLLS STATE UNIVERSITY
THIBODAUX, LOUISIANA 70310

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SPONSORS AND SUPPORTERS

We appreciate the support and contributions of the following organizations. This meeting would not be possible without their support and contributions!

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Department of Biological Sciences at Nicholls State University
Bayousphere Research Lab
International Network for Lepsisosteid Fish Research and Management
Louisiana Chapter of the American Fisheries Society
Southern Division of the American Fisheries Society

TRANSLATION SERVICE

The USFWS generously provided support for the rental of translation equipment. Ms. Marla Gomez and Dr. Joelle Bonamy of Nicholls State University provided translation services for this meeting. Thank you for your time and contributions!

Planning Committee for the Joint Meeting of the International Network for Lepisosteid Fish Research and Management and the Alligator Gar Technical Committee

Allyse Ferrara, General Meeting Chair
Quenton Fontenot, Registration and Abstract Chair
Leith Adams, Audio-Visual Chair
Gary LaFleur, Poster Chair
Gabriel Marquez-Couturier, President of the International Gar Network
Maurizzio Protti-Quesada, President-Elect of the International Gar Network
Ricky Campbell, Chair of the Alligator Gar Technical Committee
Lee Holt, Chair-Elect of the Alligator Gar Technical Committee
Lindsey Lewis, Information Officer of the Alligator Gar Technical Committee
Allyse Ferrara, Secretary-Treasurer of the Alligator Gar Technical Committee

TUESDAY 25 MAY 2010: Room 201 Gouaux Hall, Nicholls State University (NSU)

10:00 – 4:00 Gar Aging Workshop (Lunch Provided; Pre-registration required)

The goals of this workshop are to compare current techniques for aging garfish, to develop or recommend standard techniques and to identify future research needs.

Workshop participants are asked, but are not required, to bring hard structures for aging, to include but not limited to otoliths, otolith sections, branchiostegal rays, scales, scale sections, fin spines, fin spine sections, and digital images of hard structures. Isomet saws and microscopes will be available for use by participants. If participants need special equipment to demonstrate methods, please contact Allyse Ferrara (allyse.ferrara@nicholls.edu).

WEDNESDAY 26 MAY 2010: 101 Gouaux Hall, NSU

8:30 – 4:00 **Registration Open**

9:30 – 10:00 **Welcome and Introductory Remarks.** Allyse Ferrara and Dr. Stephen Hulbert, President of Nicholls State University

10:00 – 10:50 **Key Note Address. Season of the Gar: Exploring the Ecotone Between Science, History, Lepisosteid Management, and Creative Nonfiction**. Mark Spitzer

10:50 – 11:20 **Restoration of Garfish *Atractosteus tropicus* (Pisces: Lepisosteidae) in the Refugio Nacional de Vida Silvestre Caño Negro, Costa Rica: A New Alternative for its Management and Conservation in Costa Rica.** M. Protti Q.*, G. Márquez – Couturier, A. Sevilla C. and J. B.Ulloa R

11:20 – 11:40 **BREAK**

11:40 – 12:00 **Current Alligator Gar Management Activities in Alabama.** David L. Armstrong* and Ryan Peaslee

12:00 – 12:20 **Pre- and Post-Regulation Harvest Rates of Alligator Gar *Atractosteus spatula* at Trinity River Bowfishing Tournaments.** Dan Bennett

12:20 – 1:50 **LUNCH ON YOUR OWN**

1:50 – 2:10 **Movements and Habitat Use of Adult Alligator Gar in a Tributary of the Arkansas River.** Edward R Kluender*, Lindsey Lewis, and Reid Adams

2:10 – 2:30 **Movement and Habitat Use of Alligator Gar in the Trinity River, TX.** Nathan G. Smith*, David L. Buckmeier, and Daniel J. Daugherty

2:30 – 2:50 **A Preliminary Analysis of Range-wide Population Structure in Alligator Gar.** Gregory R. Moyer* and Brian R. Kreiser

2:50 – 3:20 **Influence of Anabolic Hormones on Alligator Gar Breeders and Their Effect in Larvae.** Roberto Mendoza* and Carlos Aguilera

3:20 – 3:40 **BREAK**

3:40 – 5:40 **Alligator Gar Technical Committee Meeting (Everyone welcome to attend)**

THURSDAY 27 MAY 2010: 101 Gouaux Hall, NSU

7:30 – 4:00 **Registration Open**

8:00 – 8:10 **Welcome and Introductory Remarks.** Allyse Ferrara

8:10 – 8:30 **Effect of Grading Frequency on Production of Alligator Gar Fingerlings in Tanks.** Steve E. Lochmann* and Lael A. Will

8:30 – 8:50 **Evaluation of Structure, Forage and Stocking Density on Fingerling Production of Alligator Gar *Atractosteus spatula.*** Peter Perschbacher

8:50 – 9:30 **Characterization of the Supply Network of the Tropical Gar (*Atracosteus tropicus*) in Tabasco, Mexico.** Vázquez-Navarrete*, C.J. and G. Márquez-Couturier

9:30 – 9:50 **Optimal Feed Rates for Juvenile Alligator Gar *Atractosteus spatula* Reared in Recirculating Systems.** Tim A. Clay*, Mark D. Suchy, Wendell Lorio, Allyse M. Ferrara, and Quenton C. Fontenot

9:50 – 10:10 **BREAK**

10:10 – 10:50 **Preliminary Results of the *Atractosteus tropicus* (Pisces: Lepisosteidae) L Larvae Rearing Using Two Different Culture Systems in Costa Rica.** M. Protti Q.*, G. Márquez-Couturier, A. Sevilla C. and J. B.Ulloa R

10:50 – 11:10 **Preliminary Results of a Florida Gar *Lepisosteus platrhynchus* Age and Growth Study.** Gintas Zvadzkas*, Tim Clay, Quenton Fontenot, and Allyse Ferrara

11:10 – 11:30 **Countergradient Variation in Growth of Spotted Gar (*Lepisosteus oculatus*) From Different Latitudes, With Implications for Conservation.** Solomon David*, R. Kik IV, M.J. Wiley, E.S. Rutherford, and J.S. Diana

11:30 – 11:50 Effects of Ambient Salinity on Plasma Osmolality of Juvenile Alligator Gar *Atractosteus spatula*, Spotted Gar *Lepisosteus oculatus* Paddlefish *Polyodon spathula*, and Lake Sturgeon *Acipenser fulvescens.* Quenton C. Fontenot*, Mark Suchy, Tim Clay, Ricky Campbell, Wendell Lorio, and Allyse Ferrara

11:50 – 12:10 Effects of Salinity Acclimation on Growth, Plasma Osmolality, and Metabolic Rate of Juvenile Alligator Gar. Daniel E. Schwarz* and Peter J. Allen

12:10 – 1:30 LUNCH SERVED ON SITE (Plantation Suite of Student Union)

1:30 – 1:50 Standard Metabolic Rate of Alligator Gar *Atractosteus spatula* at Three Temperatures. Nick Barkowski*, Brandon Baker, Brett Timmons, Alf Haukenes, and Steve E. Lochmann

1:50 – 2:10 Effects of Salinity on Growth and Survival on Larval and Juvenile Alligator Gar *Atractosteus spatula*. Quenton C. Fontenot*, Mark Suchy, Tim Clay, Wendell Lorio, and Allyse Ferrara

2:10 – 2:30 Mercury Concentrations in the Muscle Tissue of Longnose Gar *Lepisosteus osseus* in Coastal North Carolina with Additional Contributions to the Life History. Jillian H. Osborne* and R. A. Rulifson

2:30 – 3:10 An Outgroup for Functional Analysis of the Teleost Genome Duplication: The Spotted Gar *Lepisosteus oculatus.* John Postlethwait*, Angel Amores, Yi-Lin Yan, Julian Catchen, Allyse Ferrara, and Quenton Fontenot

3:10 – 3:40 Functional Analysis of *sox9* in the Spotted Gar *Lepisosteus oculatus*. Angel Amores*, John Postlethwait, Yi-Lin Yan, Julian Catchen, Allyse Ferrara, and Quenton Fontenot

3:40 – 3:50 BREAK

3:50 – 4:10 Use of Digestive Physiology to Design of Microdiets for the Larviculture of Tropical Gar *Atractosteus tropicus.* C.A. Frías-Quintana, C.A. Álvarez-González, N. Perales-García, G. Márquez-Couturier, W.M. Contreras-Sánchez*

4:10 – 4:30 Tropical Gar, *Atractosteus tropicus*, Culture in Southeastern Mexico. Contreras-Sánchez, W.M.*; Marquez-Couturier, G.; Hernández-Vidal, U.; Hernández-Franyutti, A.; Alvarez-Gonzalez, C.A.; Paramo-Delgadillo, S.; Arias-Rodríguez, L.

4:30 – 5:00 Physiological Response of Alligator Gar (*Atractosteus spatula*) to Pollution. Carlos Aguilera*, Julio Cruz, Roberto Mendoza, and Ramón Chacón

6:00 – 9:00 Crawfish Boil at the Nicholls State University Farm with Live Cajun Music Performed by Treater.

FRIDAY 28 MAY 2010: 101 Gouaux Hall, NSU

8:30 – 10:00 Registration open

9:00 – 9:20 Bacteriocidal Activity of Spotted Gar Serum Mediated by Complement Protein. Justin Merrifield* and Rajkumar Nathanial

9:20 – 9:40 Reproductive Characterization of Spotted Gar *Lepisosteus oculatus* in the Upper Barataria Estuary, Louisiana. Olivia A. Smith*, Allyse M. Ferrara, Quenton C. Fontenot, and Gary J. LaFleur, Jr.

9:40 – 10:00 Evaluating Habitat Utilization and Diet of the Threatened Spotted Gar (*Lepisosteus oculatus*) in Rondeau Bay with the Aid of Radiotelemtry and Gastric Lavage. William Glass*, Lynda Corkum and Nicholas E. Mandrak

10:00 – 10:20 Preliminary Analysis of Alligator Gar *Atractosteus spatula* and Spotted Gar *Lepisosteus oculatus* Diets Collected in a Drainage Canal in Port Sulphur, Louisiana. Rachel Ianni*, Allyse Ferrara, and Quenton Fontenot

10:20 – 10:40 The Neurotoxic Potency of Gar Oocyte Extract Peaks at Spawning. Nicole Broussard, Hamilton Farris, Allyse Ferrara, and Gary LaFleur, Jr*.

10:40 – 11:00 Strategies for the Commercial Pilot Scale Culture of Tropical Gar (*Atractosteus tropicus*) in Tabasco, Mexico. Márquez-Couturier, G. Vázquez-Navarrete*, C.J. Olive-Alvarez, I.C. Olive-Alvarez, O. Alvarez-González, C.A.

11:00 – 11:40 Small-Scale Experimental Culture and Cost Analysis of Tropical Gar *Atractosteus tropicus* in Earthen Ponds in Tabasco, Mexico. Ulises Hernández-Vidal*, Alejandro Macdonal-Vera, Juan M. Vidal-López, Wilfrido M. Contreras-Sánchez, Arlette A. Hernández-Franyutti

11:40 – 12:00 Tropical Gar *Atractosteus tropicus* Culture in PVC-Lined Circular Tanks in Tabasco, Mexico. Ulises Hernandez-Vidal, Alejandro Macdonal-Vera, Wilfrido M. Contreras-Sánchez , Otilio Mendez-Marin, Sergio Hernandez-Garcia, Lenin Arias-Rodriguez, Arlette A. Hernandez-Franyutti

12:00 – 12:30 International Gar Network Business Meeting (All are welcome to attend)

POSTER SESSION: 101 Gouaux Hall Lobby, NSU

Early Growth and Survival of Larval Alligator Gar *Atractosteus spatula* Reared on Artificial Floating Feed With or Without a Live *Artemia* spp. Supplement. Tim A. Clay, Mark D. Suchy, Wendell Lorio, Allyse M. Ferrara, and Quenton C. Fontenot

Allometric Growth in Cuban Gar *Atractosteus tristoechus* Larvae. Yamilé Comabella, Julia Azanza, Andrés Hurtado and Tsai García-Galano

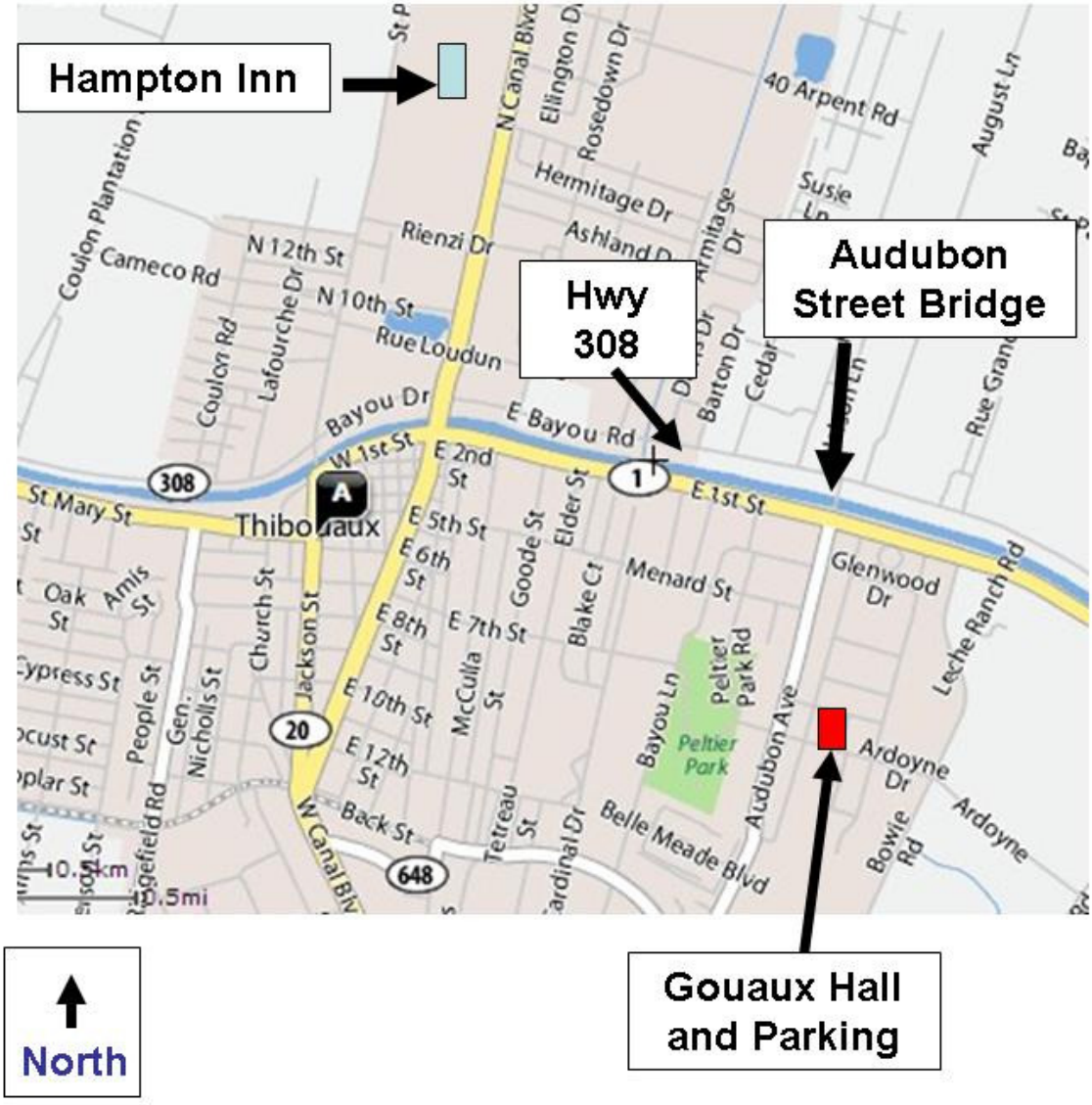
Molecular Evolution of the Inhibin α-Subunit in Holostean Fishes. deGravelle G.L., Moore B.C., McClellan M. I., McLachlan J.A.

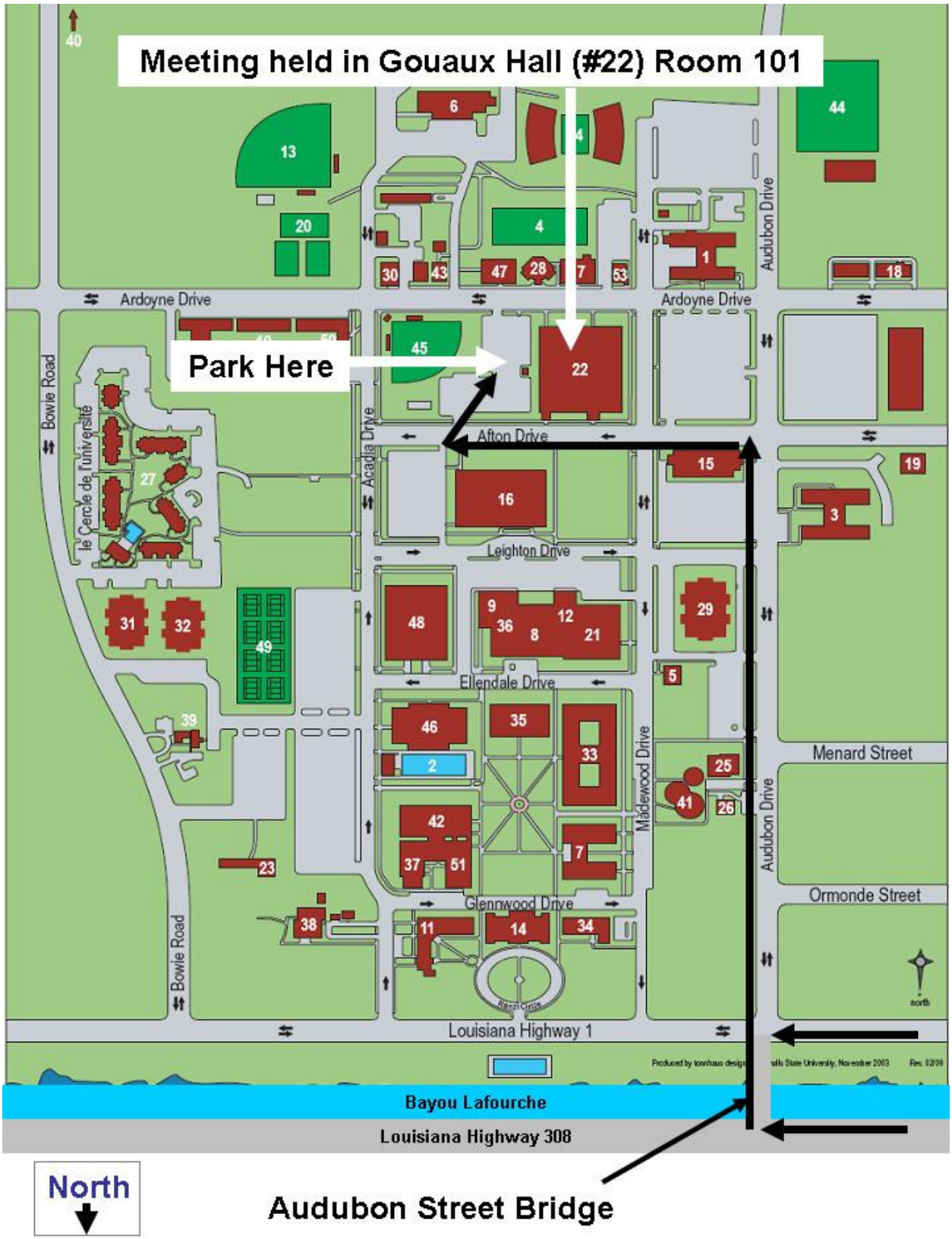
Alternate Aging Techniques for Alligator Gar. Kayla DiBennedetto

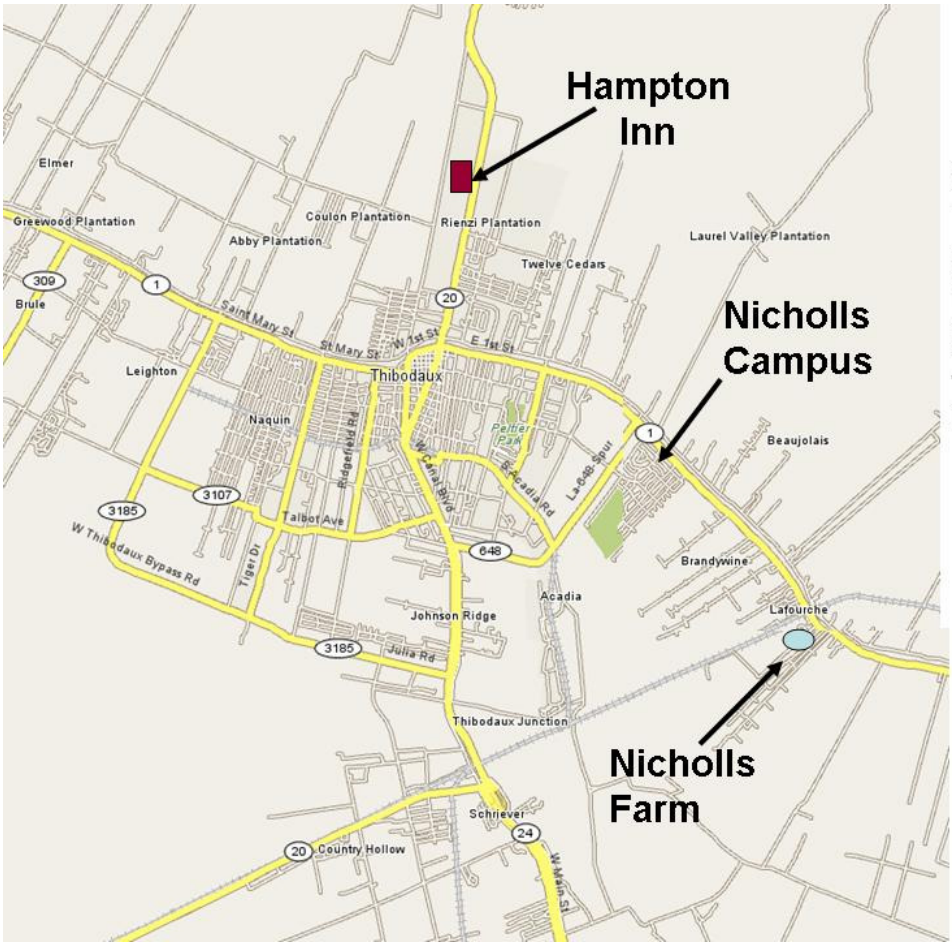
Comparison of Non-Linear Modeling for Alligator Gar Growth. Lin Xie, Peter Perschbacher, and Steve Lochmann

Alligator Gar *Atractosteus spatula* Intensive Culture Program at Warm Springs National Fish Hatchery, Warm Springs, Georgia. Jaclyn Zelko and Carlos Echevarría

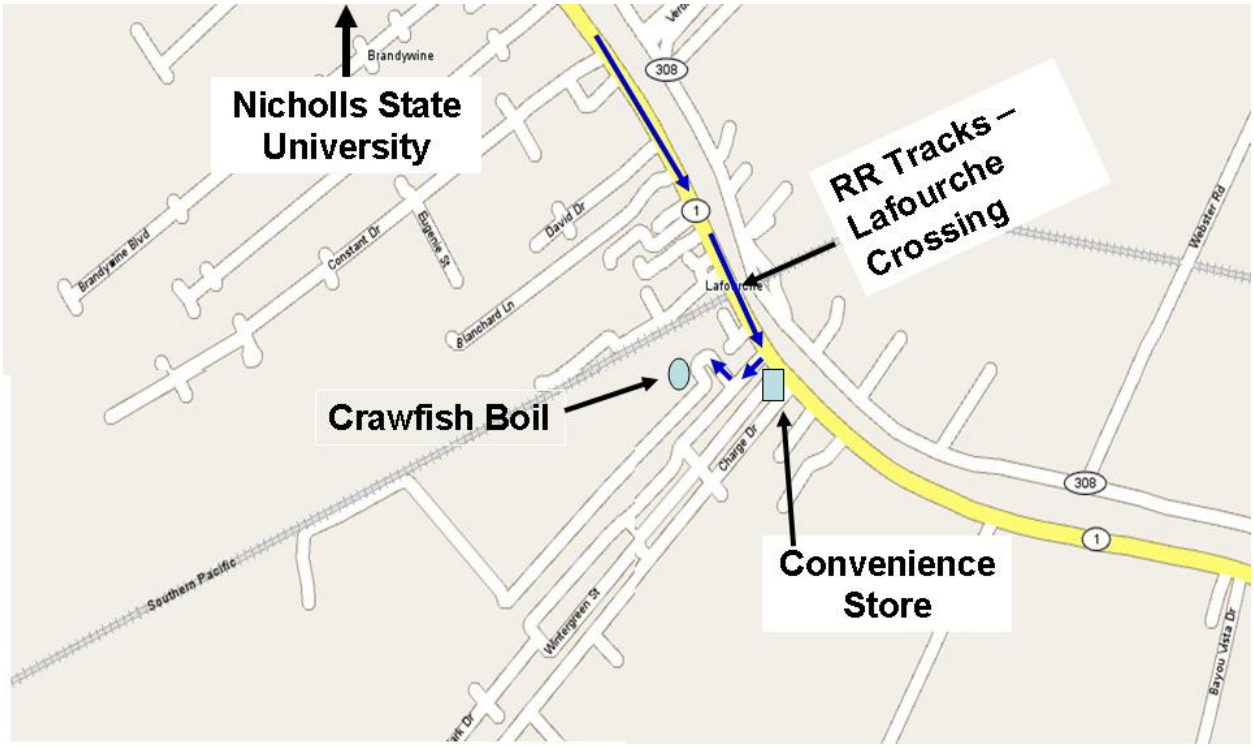
As you leave the Hampton Inn, turn right (South) onto Highway 20. Turn left onto Hwy 308 (Rouses Supermarket on your left, CVS on your left). Continue on Hwy 308, then turn right at the next traffic light onto Audubon. Turn left onto Afton Dr., cross over Madewood Dr., then turn into the parking lot behind Gouaux Hall. Enter Gouaux Hall at the entrance near the Greenhouse and continue straight until you reach the Auditorium (campus map next page).




Meeting held in Gouaux Hall (#22) Room 101
Park Here
Ardoyne Drive
Ardoyne Drive
Audubon Drive
Bowie Road
Le Cercle de l'université
Acadia Drive
Afton Drive
Leighton Drive
Ellendale Drive
Madewood Drive
Menard Street
Audubon Drive
Ormonde Street
Glenwood Drive
Bowie Road
Louisiana Highway 1
Bayou Lafourche
Louisiana Highway 308
North
Audubon Street Bridge



Crawfish Boil – Thursday Evening at the Nicholls Farm (approximately 3 – 4 miles from the Nicholls Campus)



Directions For Crawfish Boil: Follow Hwy 1 south for about 3 – 4 miles past Nicholls State University and take the first right (Thoroughbred Drive) past the RR tracks (you'll pass underneath them). Turn right to enter the Nicholls Farm and follow the drive around to the large gray barn. Follow the smell to the crawfish!

PHYSIOLOGICAL RESPONSE OF ALLIGATOR GAR (*Atractosteus spatula*) TO POLLUTION

Carlos Aguilera*, Julio Cruz, Roberto Mendoza, Ramón Chacón

Facultad de Ciencias Biológicas, Universidad Autónoma de Nuevo León, Apartado Postal F-96, San Nicolás de los Garza, N.L, C.P. 66450, Mexico. caguilera@fcb.uanl.mx

Many lepisosteid populations have declined and many are now threatened as a consequence of habitat loss and alteration. However, little is known about the effects of pollution on the physiology of these primitive fishes. Alligator gar has ideal features for pollution monitoring such as their ability to grow in waters of low quality, the fact that most of the time they thrive in the bottom where pollutants accumulate and their top position in the food web. Alligator gar inhabits the rivers draining into the Gulf of Mexico and at the present the basic technology for its culture has already been developed. Culture of native fish species provide organisms that can be used for other purposes, such as environmental risk assessment. Nowadays, several molecules are used as biochemical pollution biomarkers in fishes, among these enzymes are: esterases, ethoxyresorufin-o-deethylase (EROD), glutathione s-transferase (GST) and superoxide dismutase (SOD) which are popular due to their role in detoxification of xenobiotics and other molecules like vitellogenin (Vtg) are considered a regular tool for testing endocrine-disrupting chemicals. Therefore, the present research was aimed to evaluate the response and sensitivity of these biomarkers in alligator gar.
Bioassays were conducted using cultured alligator gar undifferentiated juveniles of 6, 12 and 24 months. These were exposed to different concentrations of β-naphtophlavone, a hydrocarbure (H); diazinon, an organophosphorate pesticide (OP); 17β-Estradiol, an estrogenic compound (EC); and menhaden fish oil as a control (FO). Substances were applied by intraperitoneal injection at 50 µg/kg dissolved in FO. Samples of liver, plasma, gills and mucus were taken after 48 h exposure period. Enzymatic activities were determined spectrophotometrically using p-nitrophenyl acetate as substrate for measuring carboxylesterase (CaE), acetylthiocoline and s-butyrylthiocholine for acetylcholinesterase (AChE) and butirylcholinesterase (BuChE), 4-nitrophenyl phosphate for alkaline phoshatase (Alp), 1-chloro-2,4-dinitrobenzene for GST and tetrazolium salt for SOD. Measurement of Vtg was performed by a previously standardized homologous ELISA immunoassay.

Activities of CaE, BuChE and AChE in the liver were significantly lower in those individuals treated with OF. Alp activity was higher in fish treated with EC and OP. GST and SOD liver activities decrease when fish were exposed to EC, H and OP, while Vtg concentration was significantly higher in fish treated with EC. The response of these biomarkers was validated by exposing fish to the same pollutants by different pathways such as direct exposure in the water and food.

FUNCTIONAL ANALYSIS OF *sox9* IN THE SPOTTED GAR *Lepisosteus oculatus*

Angel Amores[1], John Postlethwait[1], Yi-Lin Yan[1], Julian Catchen[1], Allyse Ferrara[2], Quenton Fontenot[2]

[1] Institute of Neuroscience, University of Oregon, Eugene OR 97403

[2] Department of Biological Sciences, Nicholls State University, Thibodaux, LA 70310

Sox9 is a member of the *SoxE* gene family of transcription factors. *Sox9* is an important and ancient regulator of skeletal, glial, and gonad development. Teleosts have two co-orthologs of the tetrapod *Sox9* gene with genomic properties consistent with their origin in the teleost genome duplication. Expression analyses show that in general, the sum of the expression patterns of the two teleost co-orthologs approximates that of the tetrapod gene. But discrepancies exist that would be informed by an appropriate non-duplicated outgroup. For example, in teleost gonads *sox9a* is expressed preferentially in the male gonad but *sox9b* is expressed primarily in the female gonad. In contrast, the mouse and chicken *sox9* genes are expressed in the testis but not the ovary.

Alternative hypotheses can account for this result. One hypothesis is that the last common ancestor of tetrapods and teleosts expressed *Sox9* in both the ovary and the testis; subsequently, the tetrapod lineage lost expression in the ovary while the teleost lineage partitioned the ancestral *Sox9* gonadal subfunctions between the ovary and the testis. An alternative hypothesis is that the last common ancestor of teleosts and tetrapods expressed *Sox9* only in the testis and the teleost *sox9b* gene evolved its ovarian domain by neofunctionalization. The investigation of *sox9* expression in an unduplicated outgroup of teleosts could help resolve the question.

To determine if spotted gar is a suitable unduplicated outgroup, we cloned *sox9* from spotted gar cDNA and genomic DNA. We identified a single *sox9* gene, and phylogenetic analysis showed that the gar *Sox9* protein clusters together with sturgeon *Sox9* and outside of the teleosts *Sox9a* and *Sox9b* clades. The expression domains exhibited by gar embryos is in general the summed of expression patterns displayed by the two teleost *sox9* genes. Analysis of genomic DNA sequences upstream and downstream of *sox9* identified conserved non coding sequences (CNEs) between the spotted gar and teleosts that were not found using tetrapods as an outgroup. Some of these CNEs are present in both teleost *sox9a* and *sox9b* genomic regions, while others are only present in the teleost *sox9a* or *sox9b* clade. Transgenic analysis of these CNEs revealed that some can drive transgene expression in a temporally and spatially restricted fashion. These results suggest that spotted gar will be an ideal outgroup for the study of gene duplicates in teleosts.

CURRENT ALLIGATOR GAR MANAGEMENT ACTIVITIES IN ALABAMA

David L. Armstrong, Jr., Alabama Division of Wildlife & Freshwater Fisheries, District V Office, 30571 Five Rivers Boulevard, Spanish Fort, AL 36527, Contact: 251-626-5153; david.armstrong@dcnr.alabama.gov

Ryan Pésale, Alabama Division of Wildlife & Freshwater Fisheries, Marion State Fish Hatchery, Route 3, Box 85, Marion, AL 36756, Contact: 334-683-6550; ryan.peaslee@dcnr.alabama.gov

The Alabama Division of Wildlife and Freshwater Fisheries (ADWFF) is responsible for the management, conservation, protection, and enhancement of alligator gar (*Atractosteus spatula*) populations in Alabama. In Alabama, Alligator gar (ALG) are considered a "regulated nongame" fish and a "species of moderate conservation concern". Despite their status, they provide a local fishery for both bow and hook-line anglers within the greater Mobile-Tensaw Delta area. The current creel limit is one (1) gar per angler per day (Regulation 220-2-.35) Management activities for ALG during 2008 and 2009 focused on collection of brood stock, spawning and rearing of young, as well as stocking of advanced-size juveniles within this species former range. Brood fish were collected using floating multifilament gillnets of varying lengths (75 to 200-feet) and mesh sizes (4 to 6-inch bar)

In 2008, collection efforts (35 net-sets, all 4-inch bar) yielded 29 (0.40/net-hour) ALG $\geq$ 39-in total length (TL). The U.S. Fish and Wildlife Service (USFWS), provided cooperative assistance by transporting 21 adults to Private John Allen National Fish Hatchery (PJANFH) in Tupelo, Mississippi, for artificial spawning. This process yielded 2,000 fertilized eggs (approx.) that were transported to rearing facilities at Warm Springs National Fish Hatchery (WSNFH), Warm Springs, Georgia. Larvae were pellet-reared to advanced-size juveniles of 8- to 14-in TL. The surviving 159 juvenile ALG were PIT tagged, transported back to Alabama, and stocked within Claiborne Lake. This reservoir is the lowermost impoundment on the Alabama River within ALG documented range.

In 2009, 22 ALG were collected (127 net-sets, 0.043/net-hour) and 15 were transported to Marion State Fish Hatchery (MSFH) in Marion, Alabama. The reduced catch rate is due in part to increased use of larger mesh sizes (5 to 6-inch bar). This was done to reduce catch of small (< 48-in TL) and potentially immature ALG (R. Campbell, personal comm.). Brood fish were held at MSFH and artificially spawned with the assistance of staff from both PJANFH and WSNFH. Spawning was performed in early May with egg hatch occurring a few days later. Surviving larvae were reared at both the MSFH and WSNFH to 8- to 16-in TL. During July and August, 592 gar were PIT tagged prior to release in Claiborne Lake. All ALG brood fish were returned to the Mobile-Tensaw Delta.

STANDARD METABOLIC RATE OF ALLIGATOR GAR *Atractosteus spatula* AT THREE TEMPERATURES

Nick Barkowski, Brandon Baker, Brett Timmons, Alf Haukenes, and Steve E. Lochmann*

Aquaculture/Fisheries Center, University of Arkansas at Pine Bluff, 1200 N. University Dr., Mail Slot 4912, Pine Bluff, AR 71601, slochmann@uaex.edu

Populations of alligator gar have been negatively influenced by exploitation and habitat alteration throughout much of their distribution. Several state natural resource agencies within the U.S. are considering reintroductions or supplemental stockings. Alligator gar are also being stocked to control exotic species in at least two states. The ability of alligator gar to influence the biomass of exotics, and the ability of habitats to support this apex predator with adequate forage, can be estimated with bioenergetics. However, this type of modeling requires knowledge of metabolic rates. Metabolic rates (MO_2; mg $O_2 \cdot kg^{-1} \cdot h^{-1}$) and Q_{10} values for three alligator gar (80.43, 122.34, and 94.77g) were calculated at three different temperatures (8.0, 11.9, and 16.0 ºC) in an intermittent flow respirometer (2.77-L; Loligo Systems, Tjele, Denmark). Alligator gar were placed individually into the respirometer, which was submerged in a tank covered with a black tarp, to eliminate external stimuli. Each fish was acclimated to the respirometer for 12 h. Metabolic rates were determined with Resp-edu software (Qubit Systems, Ontario, Canada). Average MO_2 values at each temperature were used to calculate Q_{10} values. Oxygen consumption values ranged from 19.6 to 87.3 mg $O_2 \cdot kg^{-1} \cdot h^{-1}$. Mean Q_{10} values ranged from 3.4 to 6.9. These data will be useful in balancing bioenergetic equations and determining ration requirements at typical growth rates for alligator gar.

PRE- AND POST-REGULATION HARVEST RATES OF ALLIGATOR GAR (*Atractosteus spatula*) AT TRINITY RIVER BOWFISHING TOURNAMENTS

Dan Bennett, Texas Parks and Wildlife Deparment, Tyler, TX. Dan.Bennett@tpwd.state.tx.us

The Trinity River is believed to contain one of the best remaining populations of alligator gar in Texas as well as the United States. Due to the suspected vulnerability of alligator gar to overexploitation, a one-fish per day state-wide bag limit was adopted and went into effect September 1, 2009. Bowfishing is believed to represent a substantial portion of the recreational alligator gar fishery in Texas. To obtain supplemental data estimating alligator gar harvest pre- and post-regulation, we attended three organized bowfishing tournaments in 2009 and four tournaments in 2010. In 2009, 256 anglers participated in three bowfishing tournaments and harvested 56 alligator gar. Harvest rates of alligator gar at 2009 tournaments were 0.012, 0.015, and 0.04 fish/angler tournament hour.

THE NEUROTOXIC POTENCY OF GAR OOCYTE EXTRACT PEAKS AT SPAWNING

Nicole Broussard, Hamilton Farris[1], Allyse Ferrara, Gary LaFleur, Jr.
Department of Biological Sciences, Nicholls State University, Thibodaux, LA.
Gary.Lafleur@nicholls.edu

[1]LSUHSC Neuroscience Center

A toxin in the oocytes of gar was first documented in 1850 when Brooks reported on a family suffering from vomiting, diarrhea, and the induction of a comatose state caused by their ingestion of cooked roe. We have been conducting experiments to further characterize this toxin. Using a crayfish paralysis assay we found that during oogenesis, the toxicity of the extract increases: at a gonado-somatic index of 0.22 %, time to paralysis was 424.09 ± 83.49 seconds while at a GSI of 1.39 %, time to paralysis was only 141.54 ± 19.22 seconds (Fig 1). Furthermore, as larvae grew, their toxicity was reduced (Fig 2). We found 0% survival after boiling the extract for 0, 30, and 60 seconds, but 100% after boiling for 10 minutes. By injecting animals from different phyla that share the aquatic habitat with gar we found that crustaceans were the only aquatic animal found to be affected. Our results suggest that the gar neurotoxin increases in potency during oogenesis until spawning, after which its activity decreases with larval age. This work was supported by NIH COBRE Grant P20RR16816 in collaboration with LSUHSC Neuroscience Center.

Figure 1. Average time to paralysis for crawfish injected with oocyte extract from varying gonadosomatic indices. Each diamond represents the average time to paralysis with standard error bars.

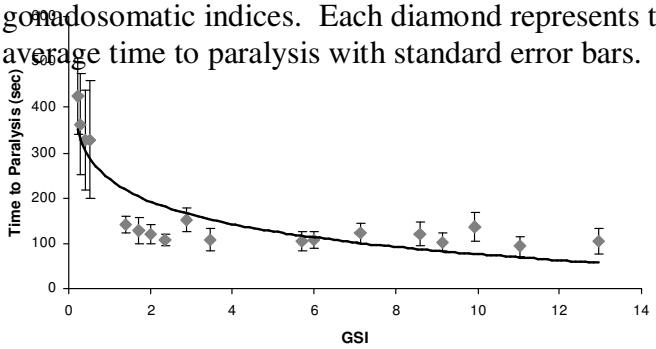
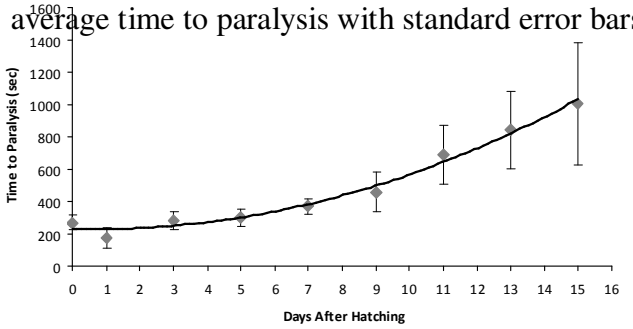


Figure 2. Average time to paralysis for crawfish injected with larval homogenates prepared at varying days after hatching. Diamonds represent average time to paralysis with standard error bars.



OPTIMAL FEED RATES FOR JUVENILE ALLIGATOR GAR *Atractosteus spatula* REARED IN RECIRCULATING SYSTEMS

Tim A. Clay[1], Mark D. Suchy[1], Wendell Lorio[2], Allyse M. Ferrara[1], and Quenton C. Fontenot[1]

[1]Bayousphere Research Laboratory, Department of Biological Sciences, Nicholls State University, Thibodaux, LA 70310 USA

[2]Golden Ranch Plantation, 146 Coteau Du Cypre, Gheens, LA 70355 USA

Alligator gar *Atractosteus spatula* aquaculture methods are currently being developed to restore native populations and to potentially create a new commercial market. Juvenile alligator gar were exposed to two different experiments to determine the effects of feeding frequency and feed amount. To determine the effect of feeding frequency, juvenile alligator gar were fed 4% body weight daily split among 2 feedings or 3 feedings. Juvenile alligator gar fed 3 times daily had a lower feed conversion ratio. (FCR) than those fed 2 times daily. To determine the effect of feed amount juvenile alligator gar were fed 1, 2, 4, 6, 8, 10, or 12% body weight daily split among 3 feedings. Highest growth rates occurred when fed 6% or higher feed rates and fish fed 4% had a lower FCR than those fed 1, 8, 10 or 12%. Based on regression curves of FCR juvenile alligator gar experience minimal FCR at 3% feed. Based on regression curves and ANOVA results, juvenile alligator gar should be fed 7.4% feed to maximize SGR while still minimizing FCR.

EARLY GROWTH AND SURVIVAL OF LARVAL ALLIGATOR GAR *Atractosteus spatula* REARED ON ARTIFICIAL FLOATING FEED WITH OR WITHOUT A LIVE *Artemia* spp. SUPPLEMENT (Poster)

Tim A. Clay[1], Mark D. Suchy[1], Wendell Lorio[2], Allyse M. Ferrara[1], and Quenton C. Fontenot[1]

[1]Bayousphere Research Laboratory, Department of Biological Sciences, Nicholls State University, Thibodaux, LA 70310 USA

[2]Golden Ranch Plantation, 146 Coteau Du Cypre,Gheens, LA 70355 USA

Growth, survival, and cannibalism rates were determined for larval alligator gar *Atractosteus spatula* fed pelleted floating feed only or fed pelleted floating feed supplemented with live *Artemia* spp. nauplii for the first 7 days of exogenous feeding [5 days after hatching (DAH) to 12 DAH]. Fish supplemented with *Artemia* were heavier and longer by 12 DAH than fish fed only floating feed. Specific growth rate was higher at both 12 DAH and 20 DAH for fish that received the *Artemia* supplement. Survival was higher for fish supplemented with *Artemia* (71%) than for the floating feed only treatment (43%). Cannibalism was the primary cause of mortalities and was higher in fish fed floating feed only (44%) compared to the *Artemia* supplemented fish (19%). *Artemia* may elicit a stronger feeding response and improve acceptance of pelleted floating feeds. Based on growth and survival, larval alligator gar should be supplemented with live *Artemia* spp. nauplii for the first seven days of exogenous feeding.

ALLOMETRIC GROWTH IN CUBAN GAR (*Atractosteus tristoechus*) LARVAE

Yamilé Comabella[1], Julia Azanza[1], Andrés Hurtado[2] and Tsai García-Galano[1]

[1]Centro de Investigaciones Marinas. Universidad de la Habana. Calle 16 # 114 e/ 1ra y 3ra, Miramar, Playa, Cuba (e-mail: ycomabella@uh.cu)
[2] Centro de Reproducción de la Ictiofauna Indígena, Ciénaga de Zapata, Cuba

Allometric growth of Cuban gar (*Atractosteus tristoechus*) was determined in larvae reared at a constant water temperature (28±1°C) from hatching to 18 days after hatching (DAH). Two different phases were detected in allometric growth in weight. From hatch to 14 DAH growth was slow negatively allometric (b=0.91) reflecting utilization of yolk for morphogenesis and growth. After this inflexion point the growth coefficient increased (b=2.08) in exotrophic phase indicating a complete an efficient exogenous feeding. From 18 morphometric characters measured, only 6 showed isometric growth as a function of total length but other body proportions and growth coefficients changed considerably during early stages of development indicating a continuous and gradual change in a few body characters and discontinuity and abrupt changes in many others. Head and snout length growth (*b*=1.38 and *b*=2.36 respectively) were positively allometric with the same inflexion point (6 DAH). Head height and width and snout width were negatively allometric and showed biphasic growth patterns too. Similarly, eye diameter, trunk length, pectoral and peduncle height grew negatively allometric throughout the entire period of study. However pectoral and pelvic fins increase in length with positive allometric growth and biphasic patterns (b=1.26; b=2.69, respectively), both with same inflexion point (8 DAH). The allometries obtained related to head, trunk and tail growth indicated a discontinuity and abrupt changes in body size and proportions, and reflect priorities of the developing organism where important organs are being developed first (mainly supporting feeding function) for the enhancement of juvenile survival.

Key words: fish larvae; allometry; development; early life history; growth.

TROPICAL GAR, *Atractosteus tropicus*, CULTURE IN SOUTHEASTERN MEXICO

Contreras-Sánchez, W.M.[1]*; Marquez-Couturier, G.[1]; Hernández-Vidal, U.[1]; Hernández-Franyutti, A.[1]; Alvarez-Gonzalez, C.A.[1]; Paramo-Delgadillo, S.[1]; Arias-Rodríguez, L.[1]

[1]Laboratorio de Acuicultura Tropical, DACBiol-UJAT, 86039 Villahermosa, Tabasco, Mexico. *contrerw@hotmail.com

The tropical gar, *Atractosteus tropicus*, inhabits wetlands of southeastern Mexico, functioning as a top predator, regulating populations of other species of fish. Its local market is very important since the demand for traditional culinary dishes is very high. This resource has been overexploited and natural populations have declined dramatically. Due to this situation, we initiated the first attempts to culture the species in our laboratory 23 years ago. The history of this long but successful story initiated with the first studies on ecology and general biology of tropical gars in Tabasco during mid 80´s. At the same time, the first attempts to reproduce the species were initiated, obtaining the first tropical gar larvae in 1988. During the 90´s, our efforts were directed towards finding feeding strategies, sources of live food during early development, feeding regimes and induction of reproduction using OVAPRIM™. Our students developed very innovative methods for artificial substrates where females deposit the adhesive eggs and timing for transferring the larvae from live food to commercial diets. During the early 2000´s, our efforts focused on the use of GnRh analogs for induction of reproduction, identification of gar nutrient requirements and formulation of practical diets specific for gars. Methods for grow-out have been evaluated -including floating cages, earthen and concrete ponds, and circular tanks.

To date, we have helped establishing six tropical gar hatcheries in Tabasco and Chiapas that provide fingerlings to growers (our own laboratory included). Our extension personnel provide technical assistance and training to farmers and governmental extension agents. The knowledge concerning the Biology of the species is considerably larger since several studies have generated information on early sex differentiation, reproductive histology, early digestive enzyme activity, and fluctuations of vitelogenin in plasma and mucus (just to mention some examples). We are currently running cost-assessment analyses to determine best conditions for larger profits and provided this information to farmers to help them make decisions in their farms. New research will focus on enhancing hatchery techniques, determination of differential growth between males and females and evaluation of practical diets at large scale.

Funding for this program has been partly provided by several institutions; our thankfulness to CONACyT Mexico, A-CRSP, SAGARPA, UJAT and Gobierno del Estado de Tabasco.

COUNTERGRADIENT VARIATION IN GROWTH OF SPOTTED GAR (*Lepisosteus oculatus*) FROM DIFFERENT LATITUDES, WITH IMPLICATIONS FOR CONSERVATION.

David, S.R., R. Kik IV, M.J Wiley, E.S. Rutherford, and J.S. Diana. University of Michigan, School of Natural Resources & Environment, Dana Building, 440 Church Street, Ann Arbor, MI 48109-1041

The spotted gar (*Lepisosteus oculatus*) is one of seven extant members of the family Lepisosteidae and ranges from the southern Great Lakes region to the Gulf Coast. The spotted gar has a disjoint distribution and is more common in the Mississippi River basin than the Great Lakes Region. The Great Lakes basin population (peripheral) is poorly studied and may exhibit different life history traits from the Mississippi River basin population (core). We hypothesized that the peripheral population of spotted gars exhibited a faster growth rate and capacity for growth than those from the core population due to countergradient variation, which compensates for shorter length of growing season at higher latitudes. We reared young of the year spotted gars from both populations (N=60) in a common garden environment for 160 days to test for countergradient variation in growth. Individual fish were fed ad libitum and weighed and measured weekly to estimate growth. Results indicated gars from the peripheral population grew significantly larger and faster than those from the core population, suggesting countergradient variation in growth. DNA and morphometric analyses suggested increased divergence between peripheral and core populations, providing a strong basis for further conservation efforts.

MOLECULAR EVOLUTION OF THE INHIBIN A-SUBUNIT IN HOLOSTEAN FISHES
(Poster)

deGravelle G.L., Moore B.C., McClellan M. I., McLachlan J.A.

Tulane-Xavier Center for Biolenvironmental Research, New Orleans, LA

Inhibin is a member of the transforming growth factor β (TGFβ) superfamily that has endocrine and paracrine functions as an antagonist to activin signaling. Analysis of the structure of the inhibin α-subunit across vertebrates demonstrates insertion-deletion (indel) modifications of the N-terminus region, but the number of teleost fishes examined was limited within Zhu's study. [Zhu et al., 2010]. To elaborate on these findings, we cloned additional α-subunit sequences from a phylogenetically diverse range of holostean fishes. Examination of inhibin sequence protein alignment of species in this study exposes large conserved motifs across all species; however, two regions displayed significant variation. Gars and bowfin displayed a shorter N-terminus region due to one specific area compared to most teleost fishes. Cypriniformes also displayed a shorter N-terminus region due to deletions in two specific areas instead of just one. Compared to reptiles and birds, the N-terminus region in mammals shows a pattern of insertion(s) resulting in an elongation that increases the antagonistic activity of inhibin. Putatively, the N-terminus modifications shown in this work are driven by a mechanism of convergent evolution, and the length of the N-terminus region may also correlate to the strength of the antagonistic activity of fish inhibin.

ALTERNATE AGING TECHNIQUES FOR ALLIGATOR GAR (Poster)

Kayla DiBenedetto, U.S. Fish and Wildlife Service, Baton Rouge Fish and Wildlife, Conservation Office, 235 Parker Coliseum, LSU, Baton Rouge, LA 70803

The technique of aging alligator gar *Atractosteus spatula* has proven to be more difficult than other species of fishes. This study primarily focused on age determination and alternate aging techniques such as sectioned otoliths and sectioned scales of a commercially-exploited alligator gar population in south Louisiana. From 10 April 2007 through 21 May 2008, alligator gar were collected with jug lines from Bayou DuLarge and surrounding areas with the aid of a local commercial fisher. Otolith (316) and scale (215) sections of individual alligator gar were examined for annuli independently by two different readers without knowledge of fish length, weight, or sex, and were assigned an age. Gar ages ranged from 1 to 26 years with a mean age of 5 years for males based on sectioned otoliths (N = 194) and sectioned scales (N = 144). Mean age for females based on sectioned otoliths (N = 122) was 5.5 years, and 5.8 years based on sectioned scales (N = 71). Sectioned otoliths yielded the highest precision between readers (0.46, Average Percent Error) and presented fewer complications during age determination as compared to sectioned scales. Accuracy can not be determined at this point because age validation is not yet possible due to the lack of known age fish. Age information from this study will aid with understanding the complex and variable nature of the Bayou DuLarge alligator gar population and will be useful to agencies in the development of future management programs for this unique species.

EFFECTS OF AMBIENT SALINITY ON PLASMA OSMOLALITY OF JUVENILE ALLIGATOR GAR *Atractosteus spatula*, SPOTTED GAR *Lepisosteus oculatus* PADDLEFISH *Polyodon spathula*, AND LAKE STURGEON *Acipenser fulvescens*

Quenton C. Fontenot[1], Mark Suchy[1], Tim Clay[1], Ricky Campbell[2], Wendell Lorio[3], and Allyse Ferrara[1]

[1]Bayousphere Research Laboratory, Department of Biological Sciences, Nicholls State University, Thibodaux, LA quenton.fontenot@nicholls.edu

[2]Private John Allen National Fish Hatchery, U.S. Fish & Wildlife Service, Tupelo, MS

[3]Golden Ranch Plantation, Gheens, LA

Osmoregulation can account for a significant portion of the metabolic energy demand for juvenile fishes, and the ability to maintain plasma osmolality at different levels of ambient salinity varies among species. We conducted a series of trials to determine how acclimation affects the ability to regulate plasma osmolality for four non-teleost species. Juvenile alligator gar A*tractosteus spatula* and spotted gar *Lepisosteus oculatus* were obtained by inducing spawning of wild-caught adults and rearing larvae to the juvenile stage. Juvenile paddlefish *Polyodon spathula* and lake sturgeon *Acipenser fulvescens* were provided by the Private John Allen National Fish Hatchery, Tupelo, Mississippi, USA. All fish were maintained at 0 ppt salinity until exposure to treatments. Plasma osmolality (mOsm) was measured for fish exposed to various salinities (0 – 37 ppt) with or without an acclimation period and all experiments were conducted in triplicate. Acclimation consisted of increasing salinity by 1 ppt per day. Fish were exposed to either 0, 4, 8, 12, 16, 20, 24, 28, or 32 ppt for 24 hrs without an acclimation period (transferred directly from 0 ppt to treatment salinity). Salinity treatments for each species did not increase once 100 % mortality was observed. The salinity treatment that resulted in an increase in plasma osmolality for the non-acclimated trials varied among species. An increase in plasma osmolality was observed at the 4 ppt treatment for paddlefish and lake sturgeon, 12 ppt for spotted gar, and 16 ppt for alligator gar. Treatment levels that resulted in 100 % mortality also varied among species. The 16 ppt treatment resulted in 100 % mortality for both paddlefish and lake sturgeon, whereas 100 % mortality occurred at 20 ppt for spotted gar and 32 ppt for alligator gar. The salinity treatment that resulted in an increase in plasma osmolality for the acclimated trials also varied among species. An increase in plasma osmolality was observed at the 8 ppt treatment for paddlefish and lake sturgeon, 10 ppt for spotted gar, and 27 ppt for alligator gar. Treatment levels that resulted in 100 % mortality also varied among species. Paddlefish mortality was 100 % for the 14ppt treatment and lake sturgeon mortality was 100 % for the 15 ppt treatment. Spotted gar had 100 % survival up to 30 ppt and alligator gar had 100 % survival up to 37 ppt for the acclimated trials. We underestimated upper lethal limits for salinity and therefore did not begin the trial with enough fish to determine the upper lethal limits for salinity for spotted gar and alligator gar when allowed to acclimate to increasing salinity by 1 ppt/d. The gars have a much high tolerance to variation in salinity compared to paddlefish and lake sturgeon.

EFFECTS OF SALINITY ON GROWTH AND SURVIVAL ON LARVAL AND JUVENILE ALLIGATOR GAR *Atractosteus spatula*.

Quenton C. Fontenot*, Mark Suchy, Tim Clay, Wendell Lorio[1], and Allyse Ferrara

Bayousphere Research Laboratory, Department of Biological Sciences, Nicholls State University, Thibodaux, LA 70310 quenton.fontenot@nicholls.edu

[1]Golden Ranch Plantation, Gheens, LA

Because ambient salinity can influence growth rates and can be a major component of production cost, we conducted a study to determine the effect of salinity on growth and survival for yolk sac larvae, 20 d old, and 50 d old alligator gar. Yolk sac larvae were exposed to 0, 2, 4, 6, 8, 10, 12, or 14 ppt until the yolk sac contents were visibly consumed (5 days; temperature = 23.4 ± 0.11 ºC). All fish exposed to salinities less than 8 ppt survived and all fish exposed to salinities greater than 8 ppt died. Survival in the 8 ppt treatment was 13.3 ± 11.6 %, and surviving individuals in the 8 ppt treatment were shorter and weighed less than fish in the lower salinity treatments. To determine the effect of salinity on growth and survival, 20 d old juvenile alligator gar were reared in 0, 4, 8 or 12 ppt for 31 days (3 rep's per treatment; temperature = 28.1 ± 0.1 ºC). Rearing tanks were independent recirculating systems housed in a greenhouse. Fish were initially stocked at 5 per L in 60 L of water. Growth was greatest for the 4 and 8 ppt treatments and least for the 0 and 12 ppt treatments. Also, survival was greatest for the 4 ppt treatment compared to the 0 and 12 ppt treatment. A second growth trial exposed 50 d old juvenile alligator gar (initially stocked at 0.5 per L in 60 L of water) to 0, 6, 12, or 18 ppt salinity (temperature = 29 ± 0.1 ºC) for 27 days. Fish in the 0 ppt treatment grew the fastest, with no difference in survival rates among treatments. Based on the results of this study, it appears that 4 ppt is an ideal salinity to rear larval and early juvenile alligator gar. However, the results of the growth trial for the 50 d old juveniles indicate that alligator gar 50 d old grow best without a salt addition. Total ammonia-nitrogen and nitrite-N differed among some treatments for both juvenile growth trials, but were below levels that should affect growth rates. Future work should be conducted to better define optimal salinities for rearing of 50 d old alligator gar.

USE OF DIGESTIVE PHYSIOLOGY TO DESIGN OF MICRODIETS FOR THE LARVICULTURE OF TROPICAL GAR *Atractosteus tropicus*

C.A. Frías-Quintana, C.A. Álvarez-González*, N. Perales-García, G. Márquez-Couturier, W.M. Contreras-Sá

Laboratorio de Acuicultura Tropical, DACBIOL-UJAT. Carr. Villahermosa-Cárdenas km 0.5, 86039, Villahermosa, Tabasco, Mexico. *alvarez_alfonso@hotmail.com

Tropical gar (*Atractosteus tropicus*) is a fishery resource with great expectations for aquaculture in Southeast Mexico, which has allowed the development of culture technology and scale commercial level; however, it is necessary to perform studies on the digestive capacity of larvae that allow to improve juvenile production by assessing changes in the digestive enzyme activities (alkaline and acid proteases, trypsin, chymotrypsin, aminopeptidase, carboxypeptidase A, lipase, amylase, and acid and alkaline phosphatase) from the embryo (day 0 after hatching, DAH) until 31 DAH, using biochemical and electrophoretic techniques. Our results show that alkaline proteases, chymotrypsin, carboxypeptidase A, lipase, α-amylase and acid and alkaline phosphatase activities were detected from embryo increasing gradually until reach the maximum values at 31 DAH, meanwhile acid protease activity was detected from 5 DAH. In addition, trypsin and leucine aminopeptidase activities were detected from 19 DAH, showing a gradual increase until reach its maximum peak at 31 DAH. Acid proteases zymogram (PAGE) allowed to detected two isoforms at 5 DAH (0.4 and 0.5 rf's) a third isoform (rf 0.3) at 31 DAH. Additionally, alkaline protease zymogram (SDS-PAGE) allowed to identify two isoforms (26.3 and 24.9 kDa) at 5 DAH, and revealed a third isoform (44.1 KDa) at 7 DAH. In this sense, *A. tropicus* larvae have high ability to digest different foods from yolk absorption, maximizing its activity from 15 DAH onwards. Based on our results, several microparticulated diets were design and tested using in vitro hydrolysis degree (HD%, pH STAT technique) and in vivo bioassay on growth and survival of tropical gar larvae. Previously to these studies, GH and total free amino acid release (FAAR) of several proteinic ingredients were tested using multienzymatic extracts of larvae at three ages (9, 15, and 31 DAH). Our results confirmed that for three ages *A. tropicus* larvae extracts had high HD for shrimp and blue crab meals, on the other hand, the highest FAAR was obtained for fish hydrolizate. From these results, we designed five diets formulated with 1) fish diet (FD), 2) squid meal diet (SQD), 3) mix of pork and chicken meal (RD), 4) mix of fish meal with wheat gluten (F/WD), 5) mix of pork and chicken meal with wheat gluten (R/WD), and commercial trout diet (CD). Results of HD of microparticulated diets showed high values for SQD and the highest FAAR for R/WD. Subsequently in vivo bioassay, showed that larvae fed with the FD and RD had the highest growth (Fig. 1) and survival (105 mm and 75%, 98 mm and 68% respectively) compared with other treatments. Therefore, the designed based on digestive physiology allowed to improve growth and production of *A. tropicus* juveniles.

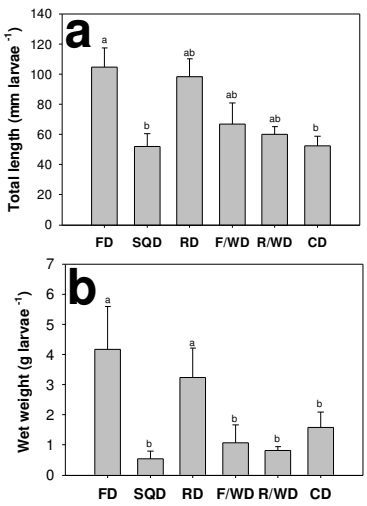


Figure 1. Growth in length (mm ± SD) and wet weight (mg ± SD) larvae fed the microparticulated diets.

EVALUATING HABITAT UTILIZATION AND DIET OF THE THREATENED SPOTTED GAR (*Lepisosteus oculatus*) IN RONDEAU BAY WITH THE AID OF RADIOTELEMTRY AND GASTRIC LAVAGE

William Glass[1], Lynda Corkum[1] and Nicholas E. Mandrak[2]

1. University of Windsor, 401 Sunset Ave, Windsor ON, Canada

2. Department of Fisheries and Oceans, 867 Lakeshore Rd, Burlington ON, Canada

Spotted Gar is a species designated as Threatened in Canada under the federal Species at Risk Act. Identification and protection of critical habitat is an important component of recovering species at risk. Identification of critical habitat requires and understanding of habitat utilization by life stage. To better understand the habitat utilization of the Spotted Gar in Rondeau Bay, a shallow coastal wetland of Lake Erie, external radio transmitters were surgically attached to 37 specimens in May of 2007. These individuals were tracked throughout the summer and fall of 2007. Habitat and water chemistry data were collected at all gar locations found by tracking. Tracking resulted in 212 discrete locations. Preliminary analyses indicated that aquatic macrophytes were present at 192 (91%) of these sites. Based on the tracking locations, home range was calculated. General movement patterns showed individuals utilized nearshore habitat in the spring, and moved offshore as the summer progressed, often taking up residence in offshore weedbeds.

In order to determine the diet of the Spotted Gar in Rondeau Bay, 40 individuals were captured using electrofishing and their stomach contents were sampled non-lethally using gastric lavage. Preliminary results show that Central Mudminnow, young of the year centrarchids, and cyprinids were the most common food items.

The results of this study are being used by the Spotted Gar Recovery Team to identify critical habitat in Rondeau Bay.

SMALL-SCALE EXPERIMENTAL CULTURE AND COST ANALYSIS OF TROPICAL GAR *Atractosteus tropicus* IN EARTHEN PONDS IN TABASCO, MEXICO.

Ulises Hernández-Vidal*, Alejandro Macdonal-Vera, Juan M. Vidal-López, Wilfrido M. Contreras-Sánchez, Arlette A. Hernández-Franyutti

Laboratorio de Acuacultura, Universidad Juárez Autónoma de Tabasco.
Carretera Villahermosa-Cárdenas km 0.5, Entronque Bosques de Saloya, CP 86039
Villahermosa, Tabasco, México.
uliseshv44@hotmail.com

The tropical gar *A. tropicus* is a valuable species of fish in Central America, it is used as food in the traditional cuisine and is also sold as ornamental species in the aquarium trade. Recent studies at laboratory scale indicate a favorable growth performance in high densities and resistance to poor water quality conditions. However, more technical information is necessary to elucidate if the tropical gar culture is feasible under different systems in order to promote it to commercial scale. To evaluate the grow-out of gars, two rural farms facilities were used in the study, farms are located in Cucuyulapa and Morelos in Tabasco, Mexico. For initial growth, one 1,000 m^2 earthen-pond was used in each farm. Eleven-thousand gars were stocked in 50 m^2 mosquito mesh enclosures and fed with trout floating 1.5–3.5 mm minipellets during three months. For the grow-out phase, five tropical gar juveniles per squared meter were released in the same pond and fed daily with 5.5 mm trout pellets. Water quality was maintained by pumping fresh water and temperature data recorded. At the end of the initial period; final weight and length of fish were higher in Cucuyulapa than in Morelos, but mortality was high in both farms. This mortality was associated to bacterial infections promoted by low water temperature and cannibalistic behavior. In the grow-out stage, better results in final weight and length were obtained in Cucuyulapa than in Morelos, probably associated to handling practices and higher water temperature observed during the dry season in this farm. Same results were obtained in the estimated FCR.
Based on total yield of 1,684 Kg and total income of $8,420 USD; indicate that fish food and gar fry are the main source of cost in the system. Farm labor activities contributions are mainly from fish and feed handling. Other charges including fuel, electricity and general farm supplies contribute as the third expense. In aquaculture, main cost production is associated to feed costs, in this case, cost of fingerlings is high, affecting the cost of the final product and consequently the market price. In order to obtain more benefits, new strategies are needed to reduce the total production expenses (reduction of fry and supply costs). Tropical gar aquaculture to marketable size is feasible in earthen ponds at small-scale; however, it is necessary to refine the correct handling practices in order to improve survival during the initial growing period.

Farm	*Period*							
	Initial growth					*Grow-out*		
	Initial weight	Initial length	Final weight	Final length	Survival	Final weight	Final length	Survival
Cucuyulapa	6.0	11.0	24.2	17.5	43	457.0 ± 10.7	39.3 ± 0.2	74
Morelos	6.0	11.0	14.5	16.5	65	244.8 ± 8.4	35.3 ± 8.4	71

Project sponsored by COMISION NACIONAL DE ACUACULTURA Y PESCA-MEXICO.

TROPICAL GAR *Atractosteus tropicus* CULTURE IN PVC-LINED CIRCULAR TANKS IN TABASCO, MEXICO.

Ulises Hernandez-Vidal, Alejandro Macdonal-Vera, Wilfrido M. Contreras-Sánchez , Otilio Mendez-Marin, Sergio Hernandez-Garcia, Lenin Arias-Rodriguez, Arlette A. Hernandez-Franyutti

Laboratorio de Acuacultura, Universidad Juarez Autonoma de Tabasco.
Carretera Villahermosa-Cárdenas km 0.5, Entronque Bosques de Saloya, CP 86039
Villahermosa, Tabasco, México.
contrerw@hotmail.com

The evaluation of growth performance of the tropical gar, *Atractosteus tropicus,* in different culture conditions has become a priority for new research in aquaculture in southeastern Mexico. During the last years there has been an increasing demand for native species culture in the regional market. A system that is becoming popular in rural areas consists of plastic or PVC circular tanks. To evaluate grow-out of gars, data were recorded from rural facilities located in the biosphere reserve "Pantanos de Centla" in Tabasco, Mexico. Facilities were based on a system including 9m-diameter PVC-lined circular ponds. Two thousand gar fry were stocked in each pond at the initial length of 11.06 cm and weight of 6.34 g. Commercial trout pellets were offered according to fry and juvenile size from 1.5 to 5.5 mm particles. In order to avoid cannibalistic behavior, fishes were classified by size at different times and water quality was maintained by pumping clean water from the river or water reservoirs. Fish weight and length were recorded monthly. Results indicate that tropical gars in this system grow faster than in traditional earthen-ponds and reach marketable size of 41.6 cm and 526.2 g in about 7 months of culture (fig. 1). Future experiments related with water quality and fish density will be necessary to determine profitable culture condition.

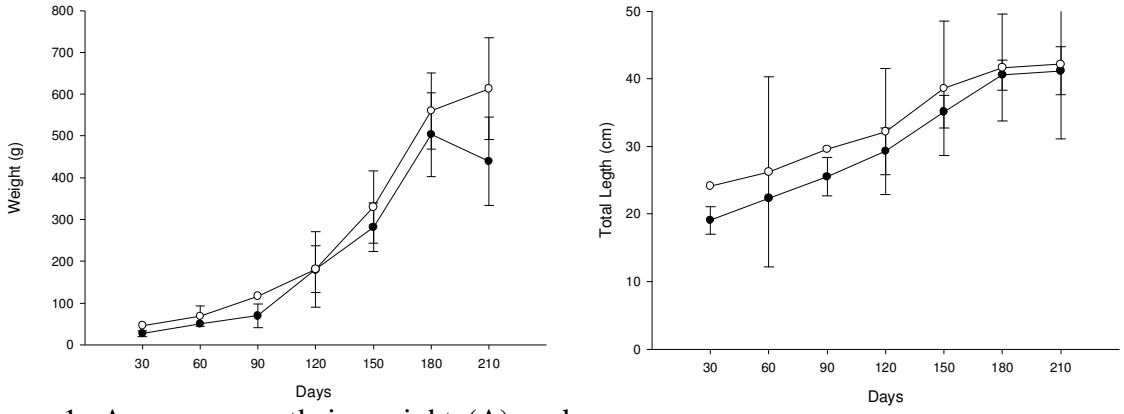


Figure 1. Average growth in weight (A) and Total Length (B) of tropical gar juveniles.

Project partly sponsored by COMISIÓN NACIONAL DE AREAS NATURALES PROTEGIDAS.

PRELIMINARY ANALYSIS OF ALLIGATOR GAR *Atractosteus spatula* AND SPOTTED GAR *Lepisosteus oculatus* DIETS COLLECTED IN A DRAINAGE CANAL IN PORT SULPHUR, LOUISIANA.

Rachel Ianni, Allyse Ferrara, and Quenton Fontenot

Bayousphere Research Laboratory, Department of Biological Sciences, Nicholls State University, Thibodaux, LA 70310

In the spring of 2009 non-native tilapia *Oreochromis* spp., were indentified in a canal near Port Sulphur, Louisiana. After rotenone treatments were administered to eradicate the tilapia population, several native predator fish species (including but not limited to alligator gar *Atractosteus spatula* and spotted gar *Lepisosteus oculatus*) were stocked as a means to control any possible remnant tilapia post-rotenone treatment. The alligator gar were stocked in December 2009 through January 2009 and included adults (N=18; 1156 ± 166 mm), 19 month old (N=159, 625 ± 63 mm) or 7 month old (N=183, 373 ± 29 mm) fish that were produced by spawning wild-caught brood stock. Several prey species (i.e., *Lepomis* spp.) were also stocked as a predator food source. The objectives of this study are to quantify the diets of predator fish and to determine if the diets contain tilapia. Monofilament gill nets (bar mesh of 2.5, 3.5, 5.1 and 12.7 cm) were used to sample the fish community either the two hours immediately following sunrise or the two hours immediately prior to sunset. Sampling occurred between 29 March 2010 and 10 May 2010, but will continue through December 2010. Stomach contents were retrieved via gastric lavage, placed in individually labeled containers, and held on ice until they could be transferred to 70% ethanol. All individuals were returned on site alive. Although some items were identified to species, diet contents were categorized as fish, crustacean, reptile, insect, or unidentifiable. The percent of stomachs classified as empty varied among species and was 58% for alligator gar (26 out of 45 samples) and 83% for spotted gar (5 out of 6 samples). Although these results represent a small portion of an ongoing study, it appears that there is prey choice variation among the gar species (Table 1). Although we have not identified tilapia in any diet, we have not been able to identify all fish species found due to the state of digestion. At this time, we can not make a strong conclusion on the presence of tilapia in the diet, but will compare skeletal structures to known specimens in the future.

Table 1. Total number of individuals enumerated in the diets for three predators collected in a drainage canal near Port Sulphur, Louisiana during the late winter and Spring of 2010. The number in parenthesis includes the number of stomachs that had identifiable contents.

	Fish	**Crustacean**	**Insect**	**Reptile**	**Unidentified**
Alligator gar (26)	49	13	6	1	6
Spotted gar (1)	2	0	0	0	0

MOVEMENTS AND HABITAT USE OF ADULT ALLIGATOR GAR IN A TRIBUTARY OF THE ARKANSAS RIVER

Edward R Kluender[1*] erkluender@gmail.com, Lindsey Lewis[2] lindsey_lewis@fws.gov, and S. Reid Adams[1] radams@uca.edu

[1]U of Central Arkansas Dept of Biology, 201 Donaghey Ave, 180 Lewis Science Center, Conway, AR 72035

[2]US Fish and Wildlife Service Arkansas Field Office, 110 South Amity Rd., Suite 300, Conway, Arkansas 72032

The Fourche LaFave River of west-central Arkansas accommodates a viable population of alligator gar. The relatively unaltered status of the river allows recruitment by maintaining connectivity with spawning locations in the tributaries, making it attractive as a model for the movements and habitat use of periodic fishes in a contiguous system. Over four trips, 32 adult alligator gar were captured with gill nets from a deep bend on the Fourche LaFave River and externally tagged with Advanced Telemetry Systems F2090B radio transmitters. They were also tagged with passive integrated transponder (PIT) tags and t-bar Floy tags. Lengths (147.0 cm – 224 cm) and weights (25.0 kg – 84.5 kg) ranged widely. Tracking began January 2009 and will continue until the summer of 2010. Basic descriptive analyses reflect seasonal differences in macrohabitat use, particularly between the main channel of the river and its tributaries. Further tracking will add to the body of data describing movement patterns and habitat use and selection on various temporal scales. Microhabitat data have been collected throughout the project and use versus availability will be a strong focus during the remainder. Additionally, we will seek to analyze the patterns of movement from the larger space of the watershed into an identified over-wintering location. The majority of existing gar life history data are from lentic and estuarine populations; data describing riverine alligator gar are lacking. This study will also provide direction for future studies and stewardship efforts in Arkansas and similar regions.

EFFECT OF GRADING FREQUENCY ON PRODUCTION OF ALLIGATOR GAR FINGERLINGS IN TANKS

Steve E. Lochmann*, and Lael A. Hill, Aquaculture/Fisheries Center, University of Arkansas at Pine Bluff, 1200 N. University Dr., Mail Slot 4912, Pine Bluff, AR 71601, slochmann@uaex.edu

Survival of alligator gar during fingerling production may be influenced by cannibalism. Tank production allows manual grading, but the process is time consuming and the benefits have not been clearly demonstrated. Our objective was to determine how well manual grading separates size classes, and whether grading influences growth, survival, or size distributions of young alligator gar. Eight day post hatch (dph) larvae were initially stocked into 75-L clear acrylic tanks at a density of 2 larvae/L. Grading occurred every day, every other day, or every third day. During each grading effort, larvae were redistributed among four 75-L tanks (representing four size classes) to minimize size variability within a tank. One tank was ungraded through the entire study. Until day 23 of the study, larvae in each tank were offered *Artemia* nauplii at a rate of 5 nauplii/mL/d divided into two feedings. Larvae were also fed combinations of Silver Cup moist starter, moist #1, moist #2, and 1.5 mm extruded floating pellets at a rate of 10% of body weight/d divided into two feedings. Tank bottoms were siphoned twice daily, and water quality (temperature, dissolved oxygen, pH, hardness, and TAN) was monitored throughout the study. On day 43 of the study (50 dph) alligator gar were individually counted, weighed, and measured. Average (SD) weight of fingerlings was 2.7 (0.9) g. Survival ranged from 53% to 65%. Growth rates ranged from 1.5 to 1.8 mm/d. There was a significant difference in size frequency distributions among the grading frequencies ($\chi^2 = 138.25$, df = 24, $P < 0.001$), with more smaller larvae present when grading occurred every day, and more larger larvae without grading. At the end of the study, only mean length of alligator gar in the largest size class was significantly larger than mean length from the other three size classes. This suggests that grading influences size structure of fingerlings, but manual grading did not allow for isolation of larvae of different lengths in most size classes.

STRATEGIES FOR THE COMMERCIAL PILOT SCALE CULTURE OF TROPICAL GAR (*Atractosteus tropicus*) IN TABASCO, MEXICO

Márquez-Couturier, G.,* Vázquez-Navarrete, C.J**, Olive-Alvarez, I.C***, Olive-Alvarez, O*** and Alvarez-González C.A*.

*Laboratorio de Acuicultura Tropical, División Académica de Ciencias Biológicas, UJAT. México

**Colegio de Postgraduados, Campus Cárdenas

***OTOT-IBAM Sociedad de Producción Rural RL de CV
gmctabasco@hotmail.com *

Tropical gar is one of the native freshwater fish that reaches the highest length and weight in natural environments. In Tabasco it's an overfished resource, official documents back from thirty years report captures of up to 600 tons annually, but its natural abundance has been reduced up to 75%. Aquaculture has allowed producing tropical gar fry for biological conservation by restocking ecosystems. It also produces meat using different culture systems (cages, circular tanks, and artificial ponds). In the present study strategies were designed to take on rearing of fry produced out of the natural breeding season (August). On December 9th 2009 a collective spawning was induced using 9 females and 27 males. Females were anesthetized with MS222, they were weighed and inyected Lhrh-a with a single dose 0.45 milligrams/Kg. Larviculture initiated by placing 81000 5-day after hatching larvae in a recirculating 81-tank system with 100 L capacity each. It was carried out for 30 days by a gradual increase in volume every 10 days (20, 40, and 60 liters). Larvae were fed with *Artemia sp* nauplii for 3 days, subsequently were co-fed with commercial trout feed and frozen *Artemia* biomass for the next 20 days. At the end of the 30 day culture the fish were weaned to the formulated feed. At this stage an 84% survival was achieved, of which, 81.5% were classified as HEALTHY, 168 ABNORMAL fish were observed (0.20%), 173 fish did not accept the feed resulting MALNOURISHED (0.21%) and 1805 were CANNIBALS (2%). Juveniles were cultured in 28, 40 and 72 M^2 tanks at a 25-50-75 fish/M^2 density respectively, for a 60-day period. Abnormalities were observed in jaws, nostrils, vertebral column, swim bladder, eyes, fins, albinism and hypermelanosis varying on expression. Malnourished organisms are singled out due to their distinct dark pigmentation, erratic swim, social isolation, and an evident wider head than the rest of the body. Cannibals were later adapted to the feeds. The base of the strategy for the commercial pilot scale culture was to initiate with juveniles that do not stop their growth (stivation) during the colder season January-March, the first stages were done in high density, feeds used are very close to their nutritional requirements, fish were fed to satiation, and adequate handling of the fish during monthly adjusting of size and vital space.
The results will be published in a manual written in native Chontal language and translated into Spanish and English.

INFLUENCE OF ANABOLIC HORMONES ON ALLIGATOR GAR BREEDERS AND THEIR EFFECT IN LARVAE

Roberto Mendoza and Carlos Aguilera. Facultad de Ciencias Biológicas, Universidad Autónoma de Nuevo León, Apartado Postal F-96, San Nicolás de los Garza, N.L, C.P. 66450, Mexico.

Natural populations of alligator gar (*Atractosteus spatula*) have declined significantly due to the effects of commercial and sport fisheries and the species has been considered vulnerable to extirpation in most of its native range. Their rapid growth is among the characteristics that have been advantageous to their survival. Their fast growth rate and their large adult size have also motivated much interest in their culture and sport fishing. Within this context, thyroid hormones (TH) and growth hormone (GH) are paramount among several anabolic hormones implicated in the growth process. In previous studies performed by our research group the coding sequence of GH from alligator gar was obtained and its expression throughout larval development was studied. The relative expression of GH along larval stages indicates substantial expression of this hormone in unfertilized eggs, declining thereafter during organogenesis and the yolk depletion period and increasing after the formation of the pituitary. On the other hand, the nature of the growth promoting effect of TH in larval alligator gar metamorphosis and their influence on the maturation of the digestive tract and accessory organs were also studied

In order to assess the real expression (protein instead of mRNAs) of GH in embryos and to gain understanding in the role of TH, female alligator gar breeders will be treated with TSH, T3, GH, Ghrelin and a treatment consisting in a combination of T3 and GH. Heterologous (porcine) and homologous TSH and GH (purified from pituitaries of alligator gar adults) will be used. At the same time myostain will be determined to assess the role of GH at these stages

In relation to the way that TH reach oocytes, overall results in fish are contradictory, because some authors claim that VTG is the vehicle to incorporate TH in oocytes, while others mention that it is independent. To clarify this aspect VTG levels will be measured in adult females, as well as the incorporation of TH in VTG and the plasmatic concentration of TH. Another interesting aspect is that according to present evidences marine fish embryos have a higher amount of T3, while freshwater fish have a higher level of T4. In this case the ratio of T4/T3 will be measured in embryos and larvae as alligator gar is eurihaline.

Egg quality will be evaluated by measuring Cathepsin D activity and levels of amino acids. While the RNA/DNA ratio will be determined for assessing larvae condition.

Finally, we will consider other variables such as survival, specific growth rate, FCR, nitrogen retention (PER, PPV, etc.) and key development enzymes such as alkaline phosphatase for larvae of the different treatments.

BACTERIOCIDAL ACTIVITY OF SPOTTED GAR SERUM MEDIATED BY COMPLEMENT PROTEIN

Justin Merrifield and Rajkumar Nathanial. Department of Biological Sciences, Nicholls State University, Thibodaux, LA

Serum complement has been well characterized in teleost fish; however, little work has been done looking at holosteids. This study aims to evaluate serum complement potency of spotted gar (*Lepisosteus oculatus*) from southern Louisiana. Concentration, temperature and kinetic dependence of complement activity was evaluated using rabbit red blood cell hemolysis. Serum concentrations ranging from 5% to 50% in phosphate-buffered saline was combined with rabbit red blood cells, incubated for 20 minutes at room temperature and hemolysis measured spectrophotmetrically at 540nm. Spotted gar serum kinetic properties were measured by drawing aliquots at various times from samples run at 4 different concentrations over a one hour period. Samples in the temperature study were acclimated overnight at various temperatures before being assayed for hemolytic activity. Antibacterial properties were tested by incubating 10^6 CFU of *Aeromonas hydrophilla* in serum. Bacteria were enumerated every 30 minutes for two hours by colony counts. Immunoblots for complement C3 in Gar serum was performed with anti-human C3 polyclonal sera. The study shows a concentration and time dependence, with complement activity peaking near 15% concentration, with most kinetic activity in the first 2 minutes of incubation. Complement was not shown to have temperature dependence between 5°C and 35°C. Bacterial inhibition was near 75% vs control tests. Gar C3 was found to migrate at ~185 kDa with the C3□ at ~115 kDa and C3□ chains at ~70 kDa. This is the first report of complement activity in a gar species.

A PRELIMINARY ANALYSIS OF RANGE-WIDE POPULATION STRUCTURE IN ALLIGATOR GAR

Gregory R. Moyer - Warm Springs Fish Technology Center, Conservation Genetics Lab, U.S. Fish and Wildlife Service, 5308 Spring Street, Warm Springs, GA 31830

Brian R. Kreiser - Department of Biological Sciences, 118 College Drive #5018, University of Southern Mississippi, Hattiesburg, MS 39406

Characterizing geographic patterns of population structure is one important step in developing management plans for wide-ranging species. We obtained samples (16-67 individuals per site) of alligator gar from a number of colleagues for eight populations scattered across its range. Two of these were in the Mississippi River drainage: St. Catherine Creek NWR (Ricky Campbell) and the Fourche LaFave River (Reid Adams & Lindsey Lewis). The remaining six sites were from coastal areas or drainages along the Gulf of Mexico: Mobile Bay (Ricky Campbell), Mississippi coast (Dennis Riecke), Bayou DuLarge (Allyse Ferrara), Trinity River (Dave Buckmeier, Lindsey Lewis & Tommy Inebnit), Cedar Lakes and Aransas Bay (Bill Karel). Each individual was genotyped for 10 microsatellite loci. A moderate amount of genetic variation was found within each population with the average number of alleles per locus ranging from 3.4-5.7 and the average expected heterozygosity ranging from 0.422-0.582. Genetic differentiation (F_{ST}) between populations ranged from being negligible (Mississippi Gulf coast – Mobile Bay; 0.0046) to quite extensive (Trinity – Fourche LaFave; 0.121). The greatest amount of differentiation was found between Mississippi River populations and those along the Gulf coast. However, even within these regions most populations were still characterized by moderate to relatively high levels of differentiation (e.g., F_{ST} was 0.058 between St. Catherine Creek and Fourche LaFave). Analysis of these data by the program STRUCTURE confirmed the qualitative assessment that the strongest genetic break was between populations from the Mississippi River and Gulf coast.

Mercury Concentrations in the Muscle Tissue of Longnose Gar (*Lepisosteus osseus*) in Coastal North Carolina with Additional Contributions to the Life History

Osborne, J.H., and Rulifson, R.A. Institute for Coastal Science and Policy, and Department of Biology, East Carolina University, Greenville NC 27858

The longnose gar, *Lepisosteus osseus*, is a fast-growing top-level predator that inhabits fresh and brackish watersheds in coastal North Carolina. This study examined the mercury concentrations found in the muscle tissue of longnose gar collected from 2005 to 2009 from the Lake Mattamuskeet National Wildlife Refuge located in Hyde County, North Carolina. Mercury concentrations (mg/kg: PPM wet weight) were measured using a modified EPA method 7473 with a Milestone DMA-80 mercury analyzer. Mercury concentrations found in the muscle tissue were compared with the sex, size, and relative health of the fish. Concentrations of mercury ranged from 0.0650 to 1.4765 mg/kg. Females showed a higher average mercury concentration than males, which showed a higher average concentration than immature fish. Overall comparison of mercury concentration (mg/kg) to total weight (g) showed that mercury concentration increased with increased weight: $y = 0.0001 x + 0.372$ ($r^2 = 0.1229$). Mercury concentrations also increased with increased relative health of the fish: $y = 0.0447e^{6.5117x}$ ($r^2 = 0.1665$). Three samples showed mercury concentrations greater than the proposed safe level of 0.3 milligram per kilogram criterion advised by the Environmental Protection Agency.

EVALUATION OF STRUCTURE, FORAGE AND STOCKING DENSITY ON FINGERLING PRODUCTION OF ALLIGATOR GAR *Atractosteus spatula*

Peter Perschbacher, Aquaculture/Fisheries Department, University of Arkansas at Pine Bluff, Pine Bluff, AR 71601, Pperschbacher@uaex.edu

Alligator gar *Atractosteus spatula* is the largest gar and of interest to fishermen of large fishes, primarily bowhunters, and to the Hispanic population, to whom it and other gar are popular food fish. Populations are much reduced and restocking is of increasing interest. Unfortunately, information on production of alligator gar fingerlings for stocking of 10 in. (250 mm) is limited, and advanced fingerling survival is expected to be less than 10% due to cannibalism. Cover was reported to increase survival. From pike and muskellunge culture, forage fish and grading increased survival. Thus an experimental trial was performed in 24, 1000 gal. (3785 l) outdoor pools at UAPB. Structure, forage, and controls at high (12,000/ac, 30,000/ha) and low (6000/ac., 15,000/ha) stocking densities with all combinations three replications each were compared. In addition, each pool was provided with 45% protein 1.5-mm, floating steelhead pellets at a rate of 10% body weight per day by two 5-hr continuous feeders. Forage fish were provided at ¼ the size of gar and 4 fish per gar (assuming 50% survival). Approximately 300 3-g gar were stocked on July 8 and harvested on Aug. 20. No grading was performed.

No significant differences were found between the high and low stocking levels and they were combined for this analysis. Survival was significantly higher in the forage treatment (68.7%) compared to control (40.7%) and structure (32.4%). Mortalities were cannibalism-related and no disease was noted. Water quality was adequate. Growth rates were 4.5-5g/d. The largest fish was 420 mm and 420 g (10g/d). Forage and feeding only treatments will be scaled up to 0.1 ac (0.0045 ha) pond trials.

Table 1. Results from 42-d Alligator gar fingerling trials. All treatments were fed.

	Control	Forage	Structure	Structure + Forage
Survival %	40.7 ± 16.4[b]	68.7 ± 26.4[a]	32.4 ± 24.5[b]	55.2 ± 19.4[ab]
TL (mm)	317.9 ± 27.8[a]	339.0 ± 16.0[a]	338.7 ± 39.5[a]	339.1 ± 9.3[a]
Wt (g)	197.8 ± 54.2[a]	208.3 ± 48.0[a]	197.8 ± 70.2[a]	203.1 ± 19.7[a]

AN OUTGROUP FOR FUNCTIONAL ANALYSIS OF THE TELEOST GENOME DUPLICATION: THE SPOTTED GAR *Lepisosteus oculatus*

John Postlethwait[1], Angel Amores[1], Yi-Lin Yan[1], Julian Catchen[1], Allyse Ferrara[2], and Quenton Fontenot[2]

[1] Institute of Neuroscience, University of Oregon, Eugene OR 97403

[2] Department of Biological Sciences, Nicholls State University, Thibodaux, LA 70310

The content and structure of Teleost genomes can be explained parsimoniously by a round of genome duplication that occurred at the base of the Teleost radiation. This genome duplication event serves as a model for the two rounds of genome duplication that appear to have preceded the radiation of vertebrates and now shape the human genome. An understanding of the mechanisms by which gene functions evolve after genome duplication requires an appropriate outgroup, an experimentally tractable comparator species whose lineage diverged shortly before the duplication event. Here we ask three major questions: 1) Is spotted gar an appropriate outgroup for the Teleost genome duplication? 2) Are gar gene expression patterns as predicted by the duplication, degeneration, complementation hypothesis and subfunctionalization? And 3), does the gar genome serve as a more useful species than those already available for the identification of conserved non-coding elements in duplicated teleost genes?

Sequence analysis of multiple gar genes (fgf8, runx2, eng1, eng2, furin, irx3, sox4 and others) showed that gar sequences fall as an outgroup to the duplicated teleost genes; that the expression of each of the gar genes is as expected for a sum of the two zebrafish paralogs and that gar genomic DNA serves as an excellent outgroup for identifying conserved non coding regions in and around the Teleost paralogs and that this elements appear to be differentially resolved between the Teleost duplicated paralogs. This finding suggest that spotted gar will be an essential species for understanding the mechanism of gene function evolution in all Teleost fish.

PRELIMINARY RESULTS OF THE *Atractosteus tropicus* (PISCES: LEPISOSTEIDAE) LARVAE REARING USING TWO DIFFERENT CULTURE SYSTEMS IN COSTA RICA

M. Protti Q[1]., G. Márquez – Couturier[2], A. Sevilla[1] C. & J. B.Ulloa R[2].

1. Escuela de Ciencias Biológicas, Universidad Nacional de Costa Rica, Heredia, Costa Rica

2. Laboratorio de acuicultura tropical, Dirección Académica de Ciencias Biológicas. Universidad Juárez Autónoma de Tabasco, Villahermosa, Tabasco, México

The aim of this work was to compare the growth performance of *A. tropicus* larvae reared in two different culture systems using ten days post exogenous feeding fish. Circular fibroplastic containers of 1000 l with a biological filter and continuous aeration were used in system I whereas in system II fish were cultured in circular plastic containers of 15 l without recirculation and additional aeration. The same feeding protocol was used in both culture systems: *Artemia salina* naupli and a 42% protein formulated feed that were supplied to the fish according to a given feeding table. After 60 days of feeding, the fish from system I showed a weight (0.92 ± 0.366 g vs. 0.76 ± 0.24 g) and length (76.82 mm ± 9.81 mm vs. 69.85 ± 7.18 mm) significantly higher than those of system II (Kruskal – Wallis, $P \leq 0.01$). The bigger volume of culture units, the better water quality together with the lower changes in water temperature in system I seems to be the major explanations for the higher growth performance achieved with fish maintained in system I. The information obtained by this first experience can be of great utility to improve the design, structure and management conditions for future spawning and culture of *A. tropicus* larvae in Costa Rica.

RESTORATION OF GARFISH *Atractosteus tropicus* (PISCES: LEPISOSTEIDAE) IN THE REFUGIO NACIONAL DE VIDA SILVESTRE CAÑO NEGRO, COSTA RICA: A NEW ALTERNATIVE FOR ITS MANAGEMENT AND CONSERVATION IN COSTA RICA

M. Protti Q[1]., G. Márquez – Couturier[2], A. Sevilla[1] C. & J. B.Ulloa R[2].

1. Escuela de Ciencias Biológicas, Universidad Nacional de Costa Rica, Heredia, Costa Rica

2. Laboratorio de acuicultura tropical, Dirección Académica de Ciencias Biológicas. Universidad Juárez Autónoma de Tabasco, Villahermosa, Tabasco, México

A female of *A. tropicus* was induced to spawn using LH-RHa, (35 µg/k body weight). The fertilized eggs were hatched in 1000 l fibroplastic containers with a biological filter and recirculated water. From this fish population, a batch of 1500 fingerlings of 65 days post hatching with a mean length and weight of 71.98 mm ± 7.67 mm and 0.72 g ± 0.21 g respectively were obtained and transported to the Refugio Nacional de Vida Silvestre Caño Negro, Costa Rica. These fish were used to partially restore the natural population in this wetland. Despite of the amount of fish introduced into the natural ecosystem was relatively small; this first experience appeared to be successful. The selected fish for restoration had good health conditions and their behavior and the management during the process of liberation into the wild environment was considered satisfactory. The great potential that showed the controlled reproduction of *A. tropicus* will allow the utilization in the future of other alternatives to manage and preserve this fish species in its ecosystem. With the implementation of this kind of strategies, such as restoration, the pressure of fisheries on the natural populations of the garfish in Costa Rica can be alleviated and this resource may be managed more appropriately.

Effects of Salinity Acclimation on Growth, Plasma Osmolality, and Metabolic Rate of Juvenile Alligator Gar

Daniel E. Schwarz and Peter J. Allen, Department of Wildlife, Fisheries and Aquaculture, Box 9690, Mississippi, dschwarz@cfr.msstate.edu

Alligator gar (*Atractosteus spatula*) are anadromous fish that once occurred from Veracruz Mexico to Illinois and Ohio, USA, but have been declining in the last few decades. Currently, naturally sustaining populations are restricted to the southeastern United States, mainly Louisiana, Texas, and Mississippi, and northern Mexico. Because alligator gar are found in the Gulf of Mexico, questions arise as to when they are able to enter high-salinity habitats and how they are able to cope with changing salinities. To answer these questions, two different age groups (2 months and 6 months post hatch) of juvenile alligator gar will be exposed to different salinities (0, 8, 16, and 24 ppt) for a 30-day period in order to determine the effects on growth and ion- and osmoregulation. For growth determinations, dry and wet weight gain and food conversion efficiency will be compared between treatments. For an understanding of ion- and osmoregulatory capabilities, measurements of drinking rate, aerobic metabolic rates, plasma ionic concentrations and gill and tissue Na^+, K^+-ATPase activities will be made. This research will provide valuable direction to regulatory agencies through an understanding of habitat limitations at early-life history stages of alligator gar.

MOVEMENT AND HABITAT USE OF ALLIGATOR GAR IN THE TRINITY RIVER, TX.

Nathan G. Smith, David L. Buckmeier, and Daniel J. Daugherty

Heart of the Hills Fisheries Science Center, Texas Parks and Wildlife Department, Inland Fisheries, 5103 Junction HWY, Mountain Home, TX 78058

Increasing demands for water and modified release patterns from Lake Livingston Dam may substantially alter downstream fisheries habitat in the lower Trinity River, Texas. Such hydrologic and habitat alterations could affect the aquatic fauna of the river, including alligator gar. We used ultrasonic telemetry to examine seasonal movement patterns and habitat use for alligator gar in order to predict the effects of altered hydrology on the species. From September 2008 to August 2009, 51 alligator gar (total length range, 800 to 2130 mm) were collected from the lower Trinity River (i.e., Livingston Dam tailrace to Trinity Bay) and tagged with 14-month ultrasonic transmitters. Stationary receivers were deployed at strategic locations (~15 to 20 km apart) throughout the lower Trinity River, and manual tracking efforts were conducted quarterly to determine individual fish locations and provide more detailed seasonal habitat use information. Additional manual tracking was conducted during spring of 2009 to identify potential alligator gar spawning areas. A bathymetric survey of the lower Trinity River was conducted to evaluate available habitat for comparison with habitat usage information. Preliminary results indicate that alligator gar occupied deep ($\geq$ 4 m) pools during normal low-flow periods (i.e., 25 to 50 m^3/s). Fish typically moved less than 20 km from their original site of capture and movements appeared to be between deep pools. During spring flood pulses (> 250 m^3/s) in April and May 2009, alligator gar left deep pool habitats and moved into tributary and backwater areas. While no fish were observed spawning, gar eggs were collected. These eggs could not be positively identified as alligator gar eggs. Alligator gar tagged in the lower portion of the river frequently moved through the lock and dam at Wallisville, TX into Trinity Bay and back. Although a few alligator gar have moved more than 100 km, results to date suggest that most fish occupy a relatively small home ranges associated with deep pool habitats during the majority of the year with little interaction between fish tagged in the upper river and those tagged near Trinity Bay. This project is ongoing and is scheduled to continue through summer 2010.

REPRODUCTIVE CHARACTERIZATION OF SPOTTED GAR *Lepisosteus oculatus* IN THE UPPER BARATARIA ESTUARY, LOUISIANA

Olivia A. Smith*, Allyse M. Ferrara, Quenton C. Fontenot, and Gary J. LaFleur, Jr.

Bayousphere Research Laboratory, Department of Biological Sciences, Nicholls State University, Thibodaux, Louisiana 70310.

Gonadal histology is useful for the classification of gonadal developmental phases, which can be used to describe the reproductive cycles of fish populations. The goal of this study was to characterize spotted gar reproduction in the upper Barataria Estuary in southeastern Louisiana using standard histological techniques. This study also focused on total fecundity, gonadosomatic index (GSI), egg sizes, and age-at-maturity. From 5 October 2006 to 26 September 2007, spotted gar were collected biweekly to weekly from the upper Barataria Estuary, using monofilament gill nets, hook and line, and electrofishing. For both sexes, histological samples of gonads were used to classify individuals into reproductive phases (immature, developing, spawning capable/actively spawning, regressing, and regenerating) based on gonadal development. Based on histological and macroscopic analyses, males (N = 94) may be capable of spawning year round; however, spawning did not occur year round. Females exhibited determinate fecundity and group-synchronous oocyte development. GSI peaked in the spring and decreased through the summer for males (N = 215) and females (N = 253). Based on histological analyses and GSI, spawning occurred from March through May. Mean total fecundity was 6,493 ± 4,225 eggs per fish (N = 192; mean TL = 579 ± 44 mm). However, according to macroscopic analyses, the majority of females did not spawn all of their late vitellogenic eggs and, instead, retained and reabsorbed some of their eggs (atresia). In our samples, males matured by age 1 and 344 mm TL and females by age 2 and 410 mm TL. Classification of reproductive phases will aid in the assessment of reproductive potential of gars by incorporating rates of incomplete spawning and egg atresia.

SEASON OF THE GAR: EXPLORING THE ECOTONE BETWEEN SCIENCE, HISTORY, LEPISOSTEID MANAGEMENT, AND CREATIVE NONFICTION

Mark Spitzer, Professor of Writing at the University of Central Arkansas

Mark Spitzer, will present a PowerPoint overview of his recently released gar book by the University of Arkansas Press: *Season of the Gar: Adventures in Pursuit of America's Most Misunderstood Fish*. This first book ever published about "a fish so ugly only a mother could love it" is described as "a fang-infested, monster-headed, armor-plated romp through the prehistoric swamps and murky rivers of America's most feared and demonized fish . . . [that] draws on folklore, science, history, [Spitzer's] own pet gar, and even gar recipes to tell a unique and exciting literary eco-tale about a fish that has inspired imaginations." Spitzer will then read an excerpt on the changing climate of alligator gar fisheries management and harvesting laws, with commentary on the future of the species in general. A question and answer session and book-signing will follow.

CHARACTERIZATION OF THE SUPPLY NETWORK OF THE TROPICAL GAR (*Atracosteus tropicus*) IN TABASCO, MEXICO

Vázquez-Navarrete, C.J.* G. Márquez-Couturier.

Colegio de Postgraduado, Campus Tabasco. Periferico Carlos A. Molina s/n, H. Cárdenas, Tabasco, 86570, México. vcesar@colpos.mx

Tropical gar, an ancient native fish, has a special place in the food preferences of people from Tabasco in Mexico. Tropical gar is normally captured from different water sources such as rivers, lagoons, swamps and wetland, and is distributed into the different fishery markets and restaurants along the State of Tabasco by a set of intermediaries. A combination of factors which include the increasing demand of tropical gar and the diminution of its habitat has led to a reduction of the fishery volume. Therefore, one alternative to face such situation has been the development of an aquaculture system for the tropical gar. However, the success of such technical effort relies on the appropriation of this technology by the final users. The creation and consolidation of a network, which produces, distributes and processes the tropical gar, is the starting point. Nevertheless, there is a lack of information on this regard, for instance who are the different agents participating in that network, what are the barriers to enter, which is the goal of the network, are the agents working together. This study reveals this information by the characterization of the supply network of the tropical gar in Tabasco, Mexico. In order to address this objective, the methodology included two sections. The first consisted of the description of the network by using a supply chain management approach. The second focused on the analysis of the network by employing an Efficiency Quick Assessment Instrument which characterized supply parameters of the network. Case study was used here as the research method. Three main results arose from this study: First, the network consisted of four main linkages: feeding, seed production, meat production and consumers, which are poorly integrated (Figure 1). Second, some technical and economic parameters were different such as productivity, price and quality. Finally, there is no communication along the network, so the lack of a feedback is delaying the consolidation process of the network. In conclusion, the network is slowly expanding and consolidating. This would change if the network could access to public programs such as commodity fish products (e.g. tilapia, oyster and shrimp).

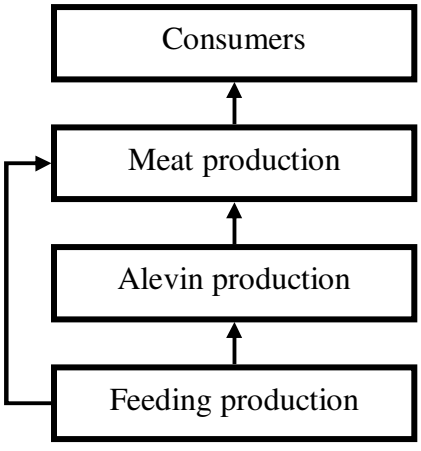


Figure 1. Supply network of tropical gar in Tabasco, Mexico

COMPARISON OF NON-LINEAR MODELING FOR ALLIGATOR GAR GROWTH
(Poster)

Lin Xie, Peter Perschbacher, Steve Lochmann

Aquaculture/Fisheries Department, University of Arkansas at Pine Bluff, Pine Bluff, AR 71601

Alligator gar, *Atractosteus spatula*, is a species of interest during the last decade. Little is known about the growth rate for this species. In the first part of study, a total of 583 sets of measurements for length and weight were taken at 4 time points (5, 50, 74, 101 days) from 346 Alligator Gar, collected during May 14 to July 26 in University of Arkansas at Pine Bluff Aquaculture and Fisheries Station. Weight-Length (grams-millimeters) relationship for alligator gar can be modeled by Log10(W)= -5.695+3.159Log10(L) with $R^2 = 0.998$. Eight nonlinear models have been used to model the relationship between mean length and age (<1 year) for alligator gar fingerling growth. Thermodynamic model fit the data best (MSE =0.0017, $R^2 \approx 1$ AIC= -19.51) among eight nonlinear competing model. In the second part of study, four nonlinear growth models have been used to find the relationship between mean length and age ($\geq$1 year) based on the data collected by Kayla's (2009). Multivariate analysis was used to determine if the estimated growth parameters were significantly different between male and female alligator gar for the four competing nonlinear models. Results of Hotelling's T^2 suggest that parameters estimates are significant different between female and male alligator gar for all four nonlinear competing model. Among four nonlinear model, logistic model (MSE=3048, $R^2 = 0.998$, AIC=142.38) and Gompertz model (MSE=5900, $R^2 = 0.998$, AIC=153.61) have the best fit for adult female and male alligator gar, respectively. Further research using more time points is needed to confirm the findings. Further research using more time points is needed to confirm the findings.

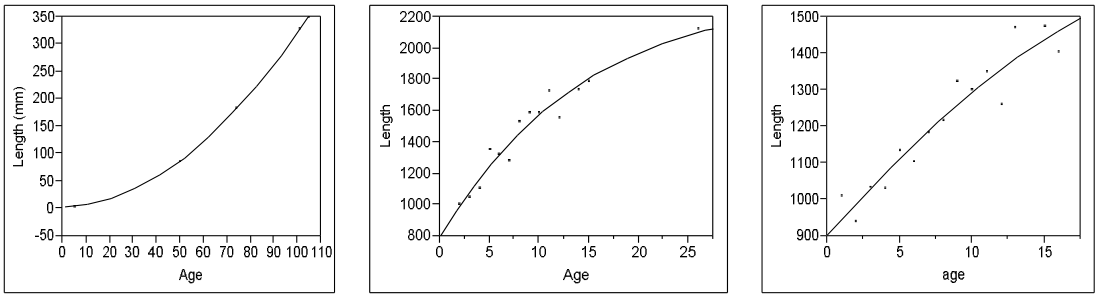


Fig 1-3. Fitted nonlinear growth curves for alligator gar (Thermodynamic model, logistic model, Gompertz model)

ALLIGATOR GAR (*Atractosteus spatula*) INTENSIVE CULTURE PROGRAM AT WARM SPRINGS NATIONAL FISH HATCHERY, WARM SPRINGS, GEORGIA
(Poster)

Jaclyn Zelko, Warm Springs National Fish Hatchery, U.S. Fish & Wildlife Service, Warm Springs, GA, Jaclyn_Zelko@fws.gov

Carlos Echevarría, Warm Springs National Fish Hatchery, U.S. Fish & Wildlife Service, Warm Springs, GA, Carlos_Echevarria@fws.gov

Alligator gar (*Atractosteus spatula*) is one of the largest freshwater fishes and is native to North America. As a top level predator, the species has a unique ecological role within river systems and tributaries. Recent surveys suggest populations are far below historic levels and could be declining further. For these reasons they have been identified as an imperiled species by the American Fisheries Society and a focal species of the U.S. Fish & Wildlife Service. Numerous states have already or are in the process of increasing conservation and management through regulations, habitat restoration, and stocking. Warm Springs NFH began development of intensive culture techniques for rearing early life stages of gar in 2005. The culture program is part of collaborative efforts in Tennessee and Alabama to restore and enhance populations of alligator gar within selected river basins. Fry are received in early May through early June and placed in the system located in the holding house. Several tanks are utilized during the rearing period. These tanks include: 25-gallon round tanks; 50-gallon oval tanks; 130-gallon round tanks; concrete raceways; and a 20' raceway. The tanks maximize surface area for eating, while also minimizing surface disturbances. Fish are graded frequently to minimize density and predation. During the first 5 to 10 days of culture, fry are fed *Artemia* sp. and then weaned on floating SilverCup pellets (ranging in size Starter to 3.2mm). Fish are fed manually during the day and with automatic feeders overnight. The hatchery also employs pond culture to produce and concentrate natural forage for feeding larval and young of year alligator gar. Adjustments in the feeding protocol and improved water quality has yielded higher survival rates in the past five years. Future efforts will include refinement of feeding protocols to include various forms of artificial feed.

PRELIMINARY RESULTS OF A FLORIDA GAR *Lepisosteus platrhynchus* AGE AND GROWTH STUDY

Gintas Zavadzkas[1], Tim Clay[2], Quenton Fontenot[2], and Allyse Ferrara[2]

[1]Fish and Wildlife Dept. Miccosukee Tribe, Miami, Florida, 33144

[2]Bayousphere Research Laboratory, Department of Biological Sciences, Nicholls State University, Thibodaux, LA 70310

An effort to eradicate invasive species so that native species can be reintroduced to a canal on Miccosukee Tribal land in southern Florida has resulted in a substantial collection of Florida Gar *Lepisosteus platrhynchus*. To date we determined sex, age, and growth characteristics for 107 Florida gar and will continue to add individuals to our data set. Individuals that did not have their sex determined (N=26) were not included sex comparisons. There was no difference in mean size between male (N=16; 547 ± 76mm) and female (N=64; 540 ± 72mm) Florida Gar. Also, there was no difference in the length-weight relationship between the sexes, so all individuals (N=107) were used to described the population length-weight relationship: Log10(Weight)=3.6238[Log10(TL)]-7.011. Based on otolith analysis the maximum age for both male and female Florida gar was 6 years old. The youngest Florida gar collected was 2 years old, but it's sex was not identified. There was no difference in total length (TL) between male and female Florida gar for age three, four, and six (no five year old males were collected), so all individuals were used to describe the growth rate for this population: $TL=275.52(Age)^{0.497}$. However, these results are for only 107 individuals and are a reflection of preliminary results for an ongoing study. Additional data will reveal if this population has a strongly skewed sex ratio and confirm our age and growth results.