Determination to Detect Recruitment of American Eel (*Anguilla rostrata*) in Texas

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Introduction

American Eel, *Anguilla rostrata,* has a unique and complex life history (Fig. 1). They are facultative catadromous fish with six distinct life stages. Data are lacking related to juvenile (glass eel and elver) recruitment along the continental shelf and bays and estuaries of the Gulf of Mexico. American Eel are a Species of Greatest Conservation Need by the Texas Parks and Wildlife Department (TPWD). The goal of the study is to document the ingress of glass and elver American Eel, and to better understand their recruitment timing, distribution, density, and habitat associations. This is a summary of work completed to date, and a preview of on-going efforts to detect recruiting American Eel in Texas.

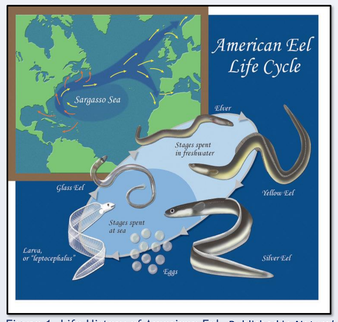
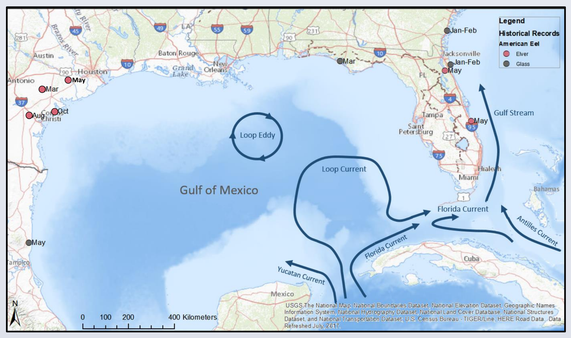


Figure 1. Life History of American Eel. Published in *Natural History* Magazine: November 2009 Issue. ©2009 Melisa Beveridge.

Historical Distribution

- >340 records of yellow eel, detected in all major river basins in Texas (except the Canadian)



- Elvers: 4 records in Texas (Fig. 2)
- Glass eel: 1 record in Florida
- Leptocephalus: movement into western Gulf of Mexico is poorly understood

Figure 2. Historical records of glass and elver American Eel life stage.

Fyke Net Field Effort

- Two-year field effort using small-mesh fyke nets (Fig. 3), specifically designed and deployed to select for small-bodied organisms that display a net upstream movement.
- Biweekly net sets using six to eight nets deployed overnight for up to 24 hours to maximize coverage of a full incoming tidal cycle.
- Phase 1 included year-round sampling (June 2018 - July 2019)
- Phase 2 focused on sub-set of phase 1 sites with intensified sampling during likely recruitment window (March 2020 – July 2020)
- A total of 330 net sets were deployed at 130 unique sites.

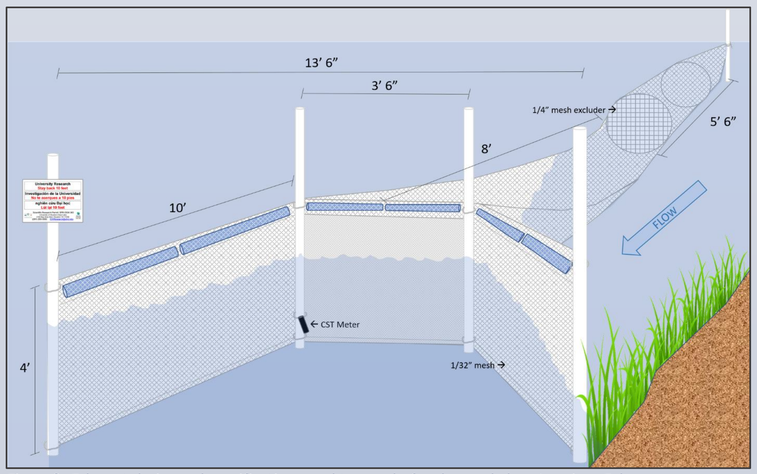


Figure 3. Fyke net design and specifications used to sample for glass and elver American Eel.

Fyke Net Results

- Cumulative soak time for all deployments was 6,852 hours
- Captured 130,860 fishes from 71 species across 34 families
- Overall catch per unit effort (CPUE) was 19.1 fish per hour
- No American Eel captured throughout the fyke net study.
- Fyke nets were effective at sampling other Elopomorphs (18,170 Ladyfish – *Elops saurus,* and 2,305 Speckled Worm Eel – *Myrophis punctatus*).
- Most abundant fish species were Gulf Menhaden (*Brevoortia patronus*), Rainwater Killifish (*Lucania parva)*, Bay Anchovy (*Anchoa mitchilli*), Ladyfish (*Elops saurus*), Sheepshead Minnow (*Cyprinodon variegatus*), and Atlantic Croaker (*Micropogonias undulatus*).

Patterns in Elopomorph Distribution and Abundance

- Speckled Worm Eels and Ladyfish were captured in highest numbers in late winter and early spring (Fig. 4).

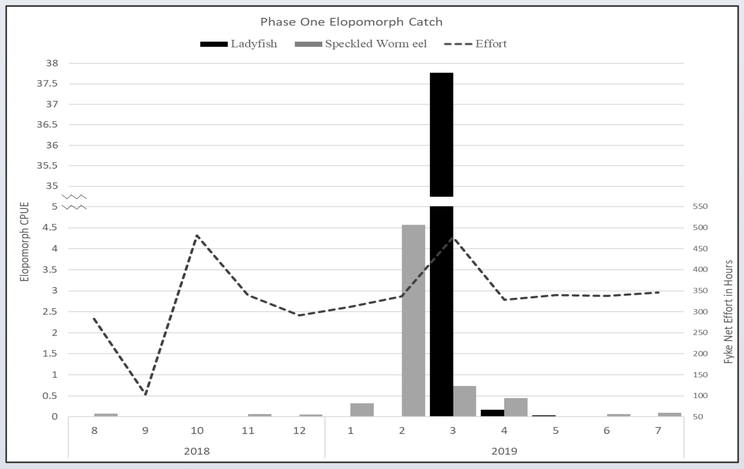


Figure 4. Catch per unit effort (number of fish per net-hour) of all elopomorphs captured in fyke nets.

- Elopomorphs were captured within each major river basin sampled with no apparent spatial pattern observed (Fig. 5).

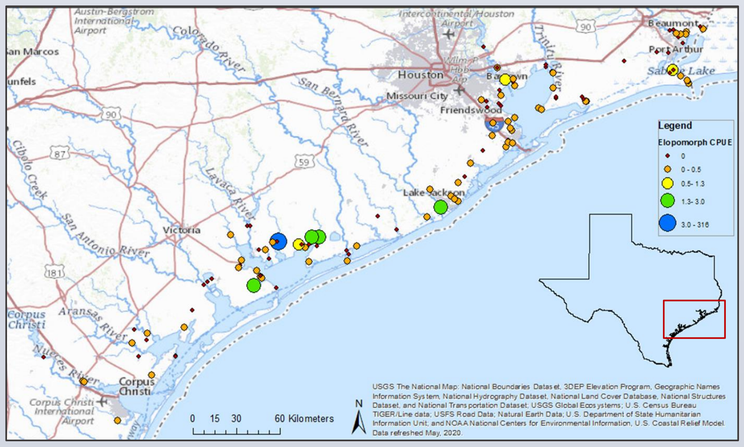


Figure 5. Map of fyke net study sites. Size and color of points represents total Elopomorph catch per unit effort (number of fish per net-hour).

- Salinity, water temperature, water turbidity (secchi) and in-stream cover best explained the likelihood that an elopomorph would be present in fyke net catch (Table 1).

Table 1. Summary of generalized linear model coefficients to predict the presence of Elopomorphs in fyke nets

	Estimate	Std. Error	Z value	P-value
(Intercept)	1.559235	0.615322	2.615	0.011276
Salinity	0.056316	0.018093	3.113	0.001855
Temp	-0.081158	0.022455	-3.614	0.000301
Secchi	-1.866703	0.893193	-2.090	0.036625
Total In-stream Cover	-0.012420	0.006117	-2.030	0.042322

Fyke Net Discussion

- Repeated co-occurrence of Speckled Worm Eel and American Eel (from previous studies conducted in Florida) implies there is likely a shared underlying mechanism driving their ingression.
- Speckled Worm Eel, like American Eel, utilize stream sediment and substrate to hide (burying themselves) and are not typically captured with traditional sampling methods.
- If glass or elver American Eel were present in high abundances during the dates and locations we surveyed, we can reasonably presume that we would have been able to detect their ingression.
- Based on the modeled probability of catching recruiting Elopomorphs, the optimal water quality and habitat conditions for future research should focus at sites with generally higher salinity and lower water clarity, in the late winter and early spring when water temperatures are lowest.

Future Work: Eel Ramps and eDNA

- On-going follow-up study: Eel ramps designed to target glass eels and elvers deployed at 11 sites throughout the central to upper Texas coast (Fig. 6).
- Weekly checks (July 2022 – June 2023).
- Concurrent eDNA sampling at sub-set of 8 ramp locations.
- Preliminary results (only including first month of sampling) suggest presence of American Eel at or near 6 of the 8 eDNA sites.
- No glass or elver American Eel have been captured to date.
  - One elver (85mm) was captured via eel ramp by a partner agency, the Lower Colorado River Authority, in May 2022.
- Evaluate feasibility of plankton sampling for leptocephalus American Eel in major passes, and the mouths of major contributing rivers.
- Mercury analysis of sub-adult American Eel tissue samples from across Texas.

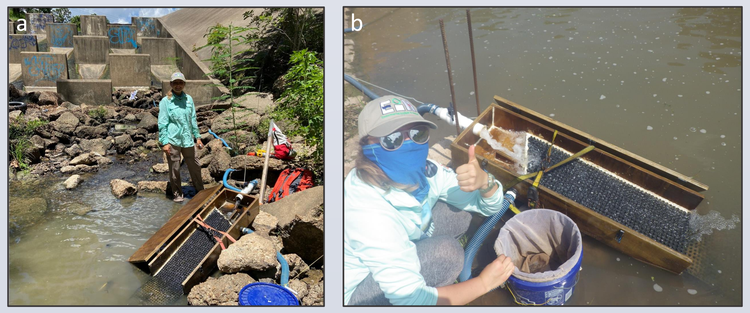


Figure 6. a: Gravity-fed eel ramp deployed at a tributary to Greens Bayou in Houston. b: ramp deployed at steep bank creek, a tributary to the Brazos River in Fort Bend, County.

Acknowledgements

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For more information on the on-going study please visit:

For more information on EIH please visit:

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