Upstream Passage Plan for American Eel at Toledo Bend Hydropower Dam, TX-LA, Sabine River, Gulf of Mexico

2017 Southern Division of American Fisheries Society

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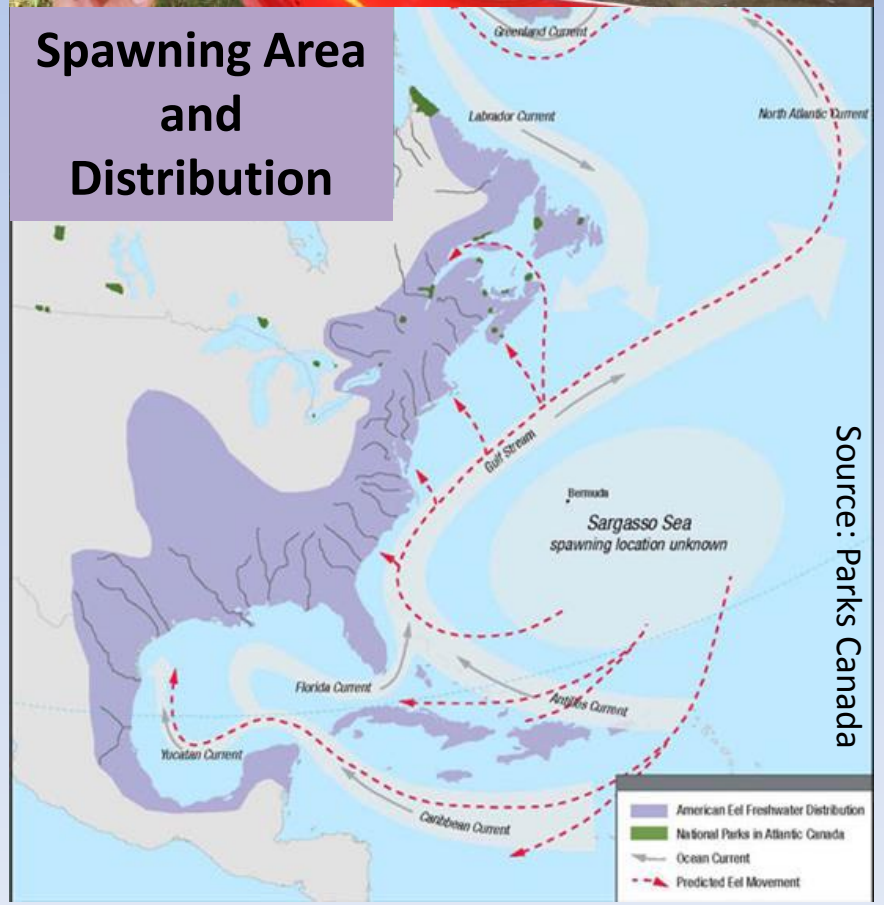
American Eel

- Catadromous (Facultative)
  - Spawns in ocean → migrates to coastal or freshwaters to grow and mature
- Abundance and distribution has declined range-wide
  - **Migration barriers**, overharvest, changing ocean conditions, etc.
- Migration Barriers
  - Impede inland migration and extirpate eels from rivers
  - Inland sub-populations produce large fecund females

Source: Josh Newhard/USFWS

Spawning Area and Distribution



Source: Parks Canada

Toledo Bend Hydropower Dam

- Located on Sabine River
  - River Mile 146
- Sabine River
  - Low gradient waterway
    - Sandy alluvial soils
    - Bottomland hardwoods
  - 560 miles long
  - Headwaters in NE Texas
  - Mouth at Sabine Lake Estuary

Toledo Bend Hydropower Dam

- Sabine River Authority of TX and Sabine River Authority, State of LA
  - Owns/operates
  - Hydroelectric Power
    - 240,000 Megawatt-hrs/year
- Hydro Facilities
  - Dam
    - 112 feet tall
    - Downstream-most dam
  - Spillway & Powerhouse
    - Two turbines
    - Capacity 86 MWs
  - Toledo Bend Reservoir

Federal Energy Regulatory Commission (FERC)

- Licenses hydropower dams in U.S. per Federal Power Act (FPA)

- Requires hydropower licensees to consult with fish and wildlife agencies on license conditions

- Fish and wildlife agencies
  - Evaluate effects of hydropower on fish and wildlife
  - Recommend license conditions to protect and mitigate damages to fish and wildlife per Section 10(j) FPA

Hydropower Licensing and Fish Passage

- USFWS can prescribe fishways at hydropower dams per Section 18 FPA
  - Can also reserve authority to prescribe fishways at later time
  - Fishways- include physical structures and operations necessary to pass fish

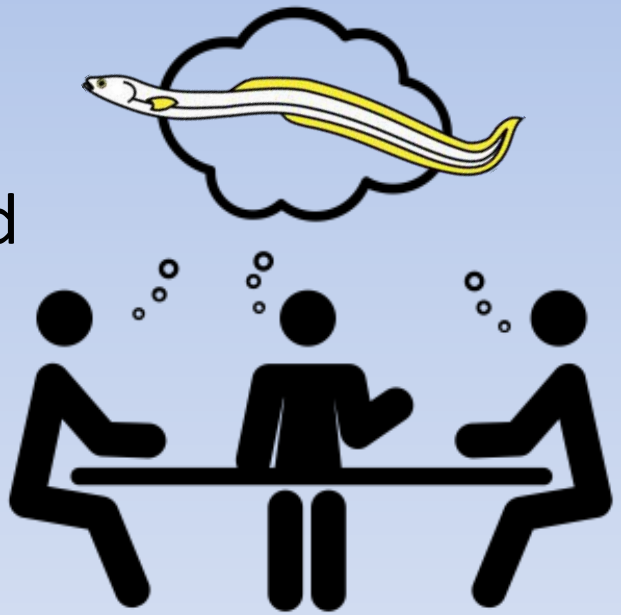
- FERC required to include fishways prescribed by agency in license
  - Licensee responsible for construction and operation

Eel Passage Structures

Source: Bob Graham/Dominion Generation

Toledo Bend Relicensing

- FERC issued 50-year license to Sabine River Authority for Toledo Bend in 1963
  - Expired 2013, renewed 2014 for 50-yr term
- Fish and wildlife agencies recommended studies of aquatic resources to:
  - Evaluate hydropower effects on downstream fish community
  - Determine if dam serves as barrier to migratory fish
  - Develop new license conditions to protect fish and wildlife resources



American Eel Relicensing Study Results

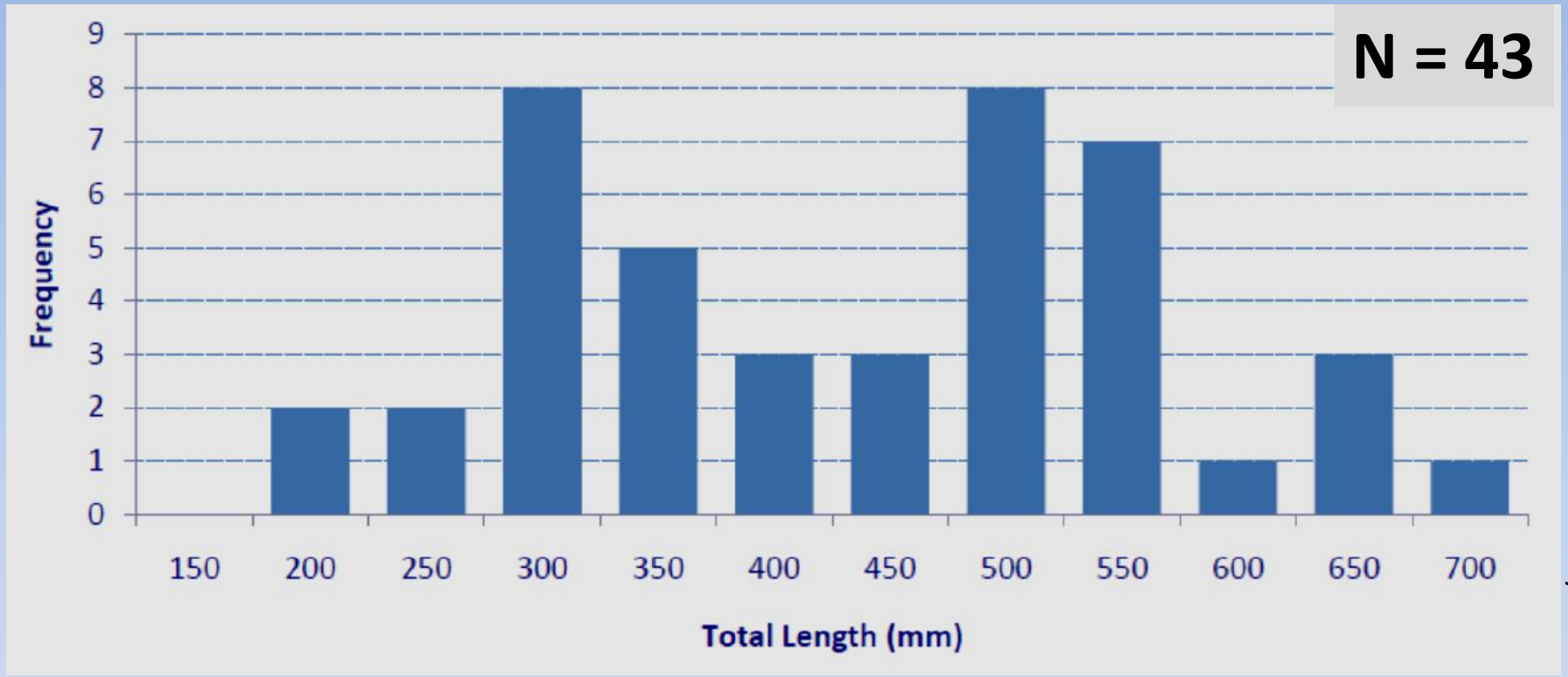
Daytime Boat Electrofishing CPUE (no. of eels/hr)

Sample Event	River Mile							Dam		Dam
	64	72	90	105	120	132	139	141TR	143	146SW
Sep-09	0.0	0.0	0.0	0.0	0.0	2.6	0.0	13.2	0.0	23.7
Dec-09					0.0	0.0	0.0	0.0	0.0	8.4
Apr-10					0.0	0.0	2.6	0.0	0.0	5.0
Jul-10	0.0	0.0	0.0	0.0	3.8	0.0	3.1	0.0	3.3	25.6
Average	**0.0**	**0.0**	**0.0**	**0.0**	**0.9**	**0.6**	**1.4**	**3.3**	**0.8**	**15.7**

Source: Sabine River Authority 2011

- CPUE Range: 0-25 eels/hr
- Highest CPUE at dam
- CPUE increased upstream to dam
- **Eels concentrating below dam**

American Eel Length Frequency Distribution



Source: Sabine River Authority 2011

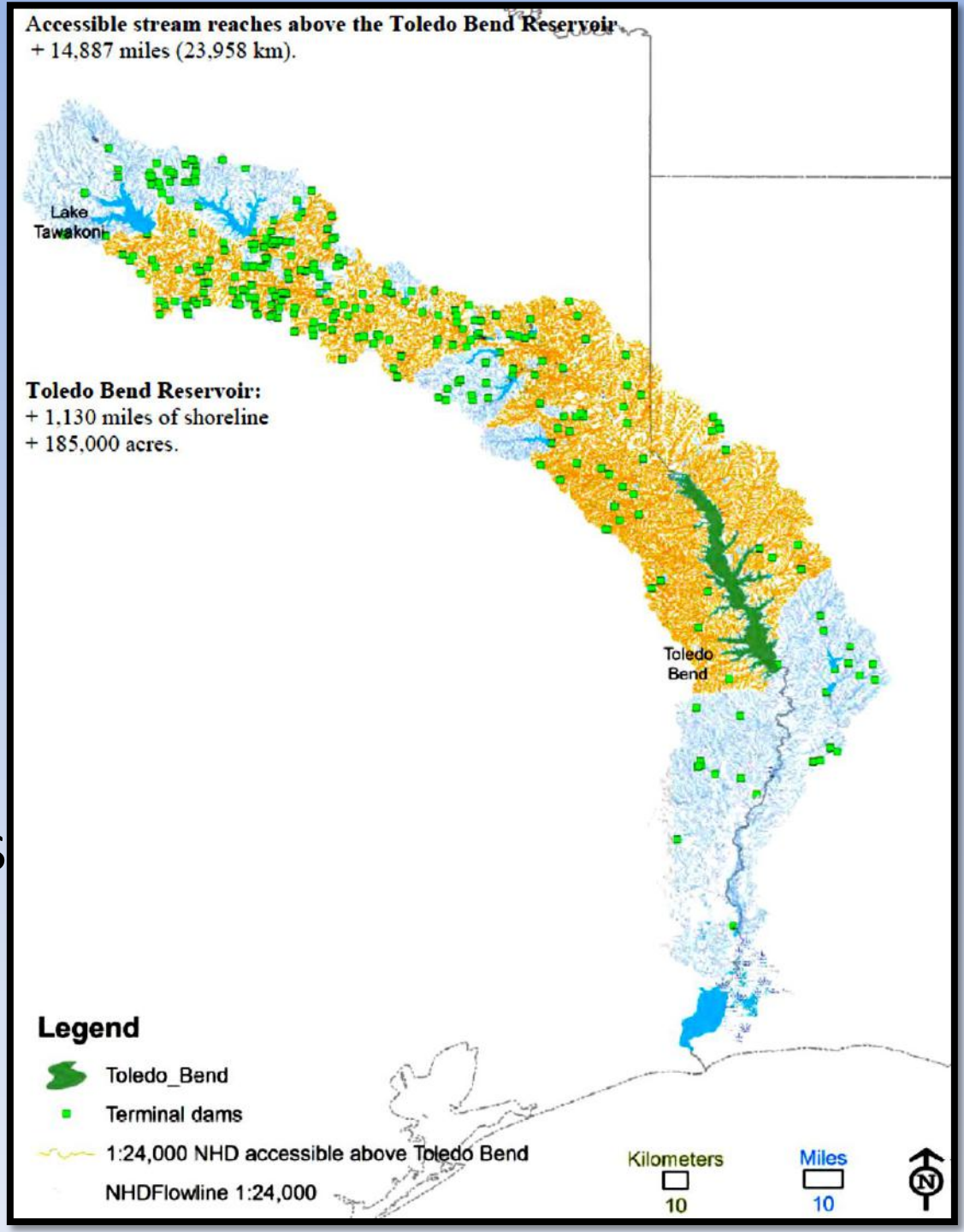
- Mean: 411-mm TL
- Majority ≥ 250-mm TL
- **Multiple year classes and recruitment events to dam**

- Results indicated dam serves as barrier to upstream migrating eels

- No records of eel occurrence from upstream of dam dated later than 1970
  - Suggests dam is complete barrier to migration
  - Fisheries databases searched in 2011:
    - Fishes of Texas
    - Texas Cooperative Wildlife Collection
    - Louisiana Museum of Natural History
    - Tulane University

Riverine Habitat Above Dam

- ~15,000 unobstructed river/stream miles above dam
  - Gross estimate of habitat
  - Analysis made with GIS and NHD flowline data



Credit: Mark Cantrell/USFWS

Upstream Passage at Toledo Bend

- USFWS/NMFS prescribed fishways at Toledo Bend to pass eels upstream dam
  - Fish passage conditions negotiated with SRA in 2012
  - FERC issued new license with passage conditions in 2014
  - SRA worked with USFWS, NMFS, TPWD, and LDWF to develop upstream passage plan in 2016

- SRA-TX/SRA-LA will deploy and operate eel passage structures at dam to trap eels and transport upstream

Ramp Trap Design

Spraybar
8-11 liter per min.

Cover

Aluminum Ramp
2 ft. Wide x 3-5 in. Deep

≤ 45°

Holding Tank

Attraction Flow
150 liter per min.

Ramp Substrates

- Milieu, Inc. Eel Substrates
  - Made of plastic; cylinders fixed to ramp bed
  - Used at several passage facilities U.S. and Canada

- Two designs to be used to pass eels up to 800-mm TL
  - Cylinder diameter: 1 and 2 inches
  - Cylinder height: 1.5 and 4.5 inches
  - Spacing: 1.3 and 2.5 inches

Milieu Elver Substrate

Source: Bob Graham/Dominion Generation

Ramp Trap Siting

Spillway: 4 ramp traps at wing walls and sluiceway

Source: Sabine River Authority 2016

Ramp Trap Siting

- Tailrace
  - 2 ramp traps at wing walls

Source: Sabine River Authority 2016

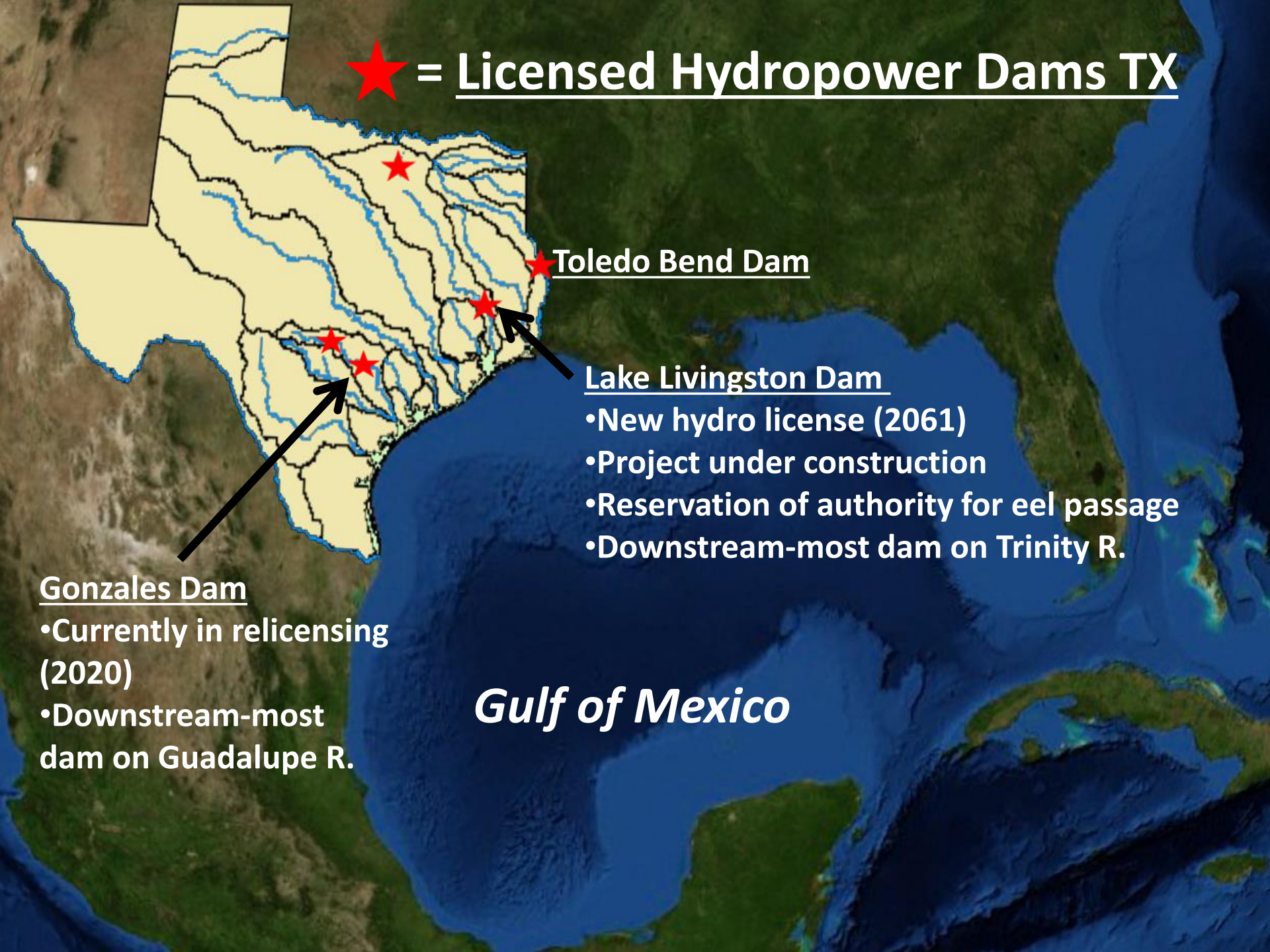
Ramp Trap Operation

- Years 1-2: SRA will operate ramp traps continuously and year round to identify migration period
  - After year 2 will operate during migration period
- Ramp traps will be checked at least once/week
  - Catch data (size, number, date, time etc.) collected
  - Eels released upstream ≥ 1 mile from project
- Ramp trap performance will be evaluated to adjust location, design, operation, etc.
  - With supplemental electrofishing

Performance Measures

- Estimates of total eel abundance not available for Gulf of Mexico drainages
  - Total eel abundance recruited to Sabine River unknown

- Plan includes catch-based performance measure
  - If ramp traps pass more than an **average of 150 eels/yr**, during years 3-5, SRA will continue upstream passage and implement downstream passage
  - If less is passed, SRA can propose to discontinue passage


= Licensed Hydropower Dams TX
Toledo Bend Dam
Lake Livingston Dam
•New hydro license (2061)
•Project under construction
•Reservation of authority for eel passage
•Downstream-most dam on Trinity R.
Gonzales Dam
•Currently in relicensing (2020)
•Downstream-most dam on Guadalupe R.
Gulf of Mexico

Photos courtesy, Brad Littrell

Acknowledgements

- **Texas Parks and Wildlife Department:** Leroy Kleinsasser and John Botros
- **Louisiana Department of Wildlife and Fisheries:** Bobby Reed, Sean Kinney, and Robby Maxwell
- **National Marine Fisheries Service:** Prescott Brownell and Fritz Rohde
- **U.S. Fish and Wildlife Service:** Jerry Ziewitz, Seth Bordelon, Mark Cantrell, and Wilson Laney

Source: Duane Raver/USFWS