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Every five years, rivers and streams across the nation are surveyed as part of the National Rivers and Streams Assessment (NRSA). Using EPA standard methods, researchers quantify ecosystem health and the biotic factors associated with those waterbodies.

14 sites in Texas sampled in 2008, 2013, and 2018 (Figure 1).

Fish abundance and diversity were collected via electroshock fishing (boat, barge, or backpack) or seining (Figure 2) and all fish were identified to species by an experienced fish taxonomist. Collection method was determined based on water depth, conductivity levels, and permitting restrictions.

From those revisited sites, fish abundance and diversity were analyzed and non-native species were identified using the texasinvasives.org database or the Texas Invasive Species Institute to confirm invasive status.

Analysis:
- % invasive fish (per site) = abundance of invasive fish/total abundance
- If same site sampled twice per year, % invasive fish averaged

**Introduction**

Non-native species that are introduced through anthropogenic influences, i.e. invasive species, cause harm to native systems in numerous ways and account for billions of dollars in damages each year. Generally, invasive species have such high success in ecosystems through their ability to outcompete native species, spread and multiply rapidly, and adapt to a variety of environments.

Efforts have been made to mitigate the impacts and spread of invasive species and this analysis seeks to track the spatial and temporal changes of invasive fish species in Texas over the last decade. This research can be used to determine whether suppression efforts have been successful or if more rigorous efforts need to be made.

**Study Area**

![Map of Texas showing major rivers and basins](image)

Figure 1: Study map of Texas showing the major rivers, major river basins, Hydrologic Unit Code (HUC) 02 regions, and the revisited sites.

**Methods**

- Every five years, rivers and streams across the nation are surveyed as part of the National Rivers and Streams Assessment (NRSA). Using EPA standard methods, researchers quantify ecosystem health and the biotic factors associated with those waterbodies.
- 14 sites in Texas sampled in 2008, 2013, and 2018 (Figure 1).
- Fish abundance and diversity were collected via electroshock fishing (boat, barge, or backpack) or seining (Figure 2) and all fish were identified to species by an experienced fish taxonomist. Collection method was determined based on water depth, conductivity levels, and permitting restrictions.
- From those revisited sites, fish abundance and diversity were analyzed and non-native species were identified using the texasinvasives.org database or the Texas Invasive Species Institute to confirm invasive status.

**Results**

**Invasive Species Occurrence**

- Invasive species present for at least one sampling event at 19 of 22 sites.
- Present in all HUC 02 regions & all major basins with revisit sites (Figure 1).

**Invasive Species Abundance and Distribution**

- In 2018, the Texas-Gulf Region had the highest concentration of invasive species while the Arkansas-White-Red region had the lowest.
- The Colorado River Basin contained 2 out of the 3 sites with the highest concentrations of invasive species.
- For all years sampled, no invasive fish were caught at 3 sites: Long Creek (Trinity river basin), North Concho River (Colorado river basin), East Amarillo Creek (Canadian river basin).
- Sites resampled over 10 years (2008-2018; n = 14); (Figure 3)
  - General decrease from 2008-2013 with increase from 2013-2018
- Sites resampled over 5 years (2013-2018; n = 22); (Figure 4)
  - Increase from 2013 to 2018
- Overall changes in total abundance (Figure 5a)
  - The trend observed for total abundance similar to percent invasive fish
  - 13 sites = increase in abundance from 1st sample period to most recent
  - 5 sites = decrease in abundance from 1st sample period to most recent
  - 4 sites show no change:
    - 3 sites no invasive fish captured during sampling events
    - Canadian River - not fished in '08 or '13 due to permit restrictions.

**Conclusions**

- Overall, invasive fish species have increased across Texas since the first NRSA in 2008.
- Suppression efforts have not been sufficient enough to decrease the amount of invasive fish species in Texas’ waterbodies.
- The Colorado and Brazos river basins contain the highest concentrations of invasive species.
- Limitations of this analysis include changes in fish collection methods from 2013 to 2018 due to permitting restrictions, resulting in a lack of data for some sites, and limitations of gear itself in special circumstances, i.e. swift waters, deep pools, etc.

**Future Work**

- The National Rivers and Streams Assessment will continue sampling every 5 years to determine the extent to which rivers and streams support a healthy biological condition and the extent of major stressors that affect them.
- The data collected from the NRSA can be used to continuously monitor invasive populations and their impacts on native communities.
- More in-depth statistical analyses can be made using these datasets.
- More rigorous invasive species suppression efforts need to be made.

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