Overview

Rio Grande Above Tidal:
Lower Rio Grande between Anzalduas and the El Jardin weir

Tidal Rio Grande:
From El Jardin weir to the mouth at Boca Chica
“The Rio Grande is the only river I ever saw that needed irrigation.”

--Will Rogers
Ecologically Sound Environment
Rio Grande Above Tidal

Application of this definition (focused on the current condition and whether it supported sustainable populations of native species) to the above tidal portion of the Rio Grande from above the Anzalduas flood control structure downstream to the El Jardin weir indicates that an ecologically sound environment would:

- Sustain a riparian plant community dominated by a diverse group of native riparian plants;
- Have an absence of invasive, exotic aquatic plants like water hyacinth, water lettuce, and Hydrilla, and
- Provide sufficient freshwater inputs to support an aquatic community including:
  - One or more threatened amphibians, for example the Rio Grande siren (*Siren intermedia texana*), black-spotted newt (*Notophthalmus meridionalis*), or Mexican white-lipped frog (*Leptodactylus fragilis*)
  - Two or more species of native turtles
  - A mixed community of native fishes, including approximately two-thirds to three-quarters of the species being primary freshwater species (also native species with a range of feeding habits including top predators), which is not dominated by exotic fish species and approximately one-quarter to a third of the species being secondary freshwater or estuarine species.
The Rio Grande has changed:

Literature Cited


*The Southwestern Naturalist* 36(2):201-212.


*Reviews in Fisheries and Fish Biology* 12(2):219-240.


Lower Rio Grande Silt Loads

(Falcon Dam Closed 1953)

(Data from U.S.G.S.)
Mean Flows in the Lower Rio Grande (1900-2000)

(Data from U.S.G.S.)
Anzalduas Dam near Mission, Texas
**Water sample 1:**
- Total bacteria: Too many to count
- Coliform bacteria: Present
- Fecal coliform bacteria: Present/70 cfu/100 ml
- E. Coli bacteria: Present

**Water sample 3:**
- Total bacteria: 312 cfu/ml
- Coliform bacteria: Present
- Fecal coliform bacteria: Present/332 cfu/100 ml
- E. Coli bacteria: Present

**Water sample 5:**
- Total bacteria: 840 cfu/ml
- Coliform bacteria: Present
- Fecal coliform bacteria: Present/258 cfu/100 ml
- E. Coli bacteria: Present

- cfu: Colony forming units
1981-2007
N = 397,288

○ 10 or More Samples
● 1-9 Samples
Freshwater Ecological Affinities

Middle Segment

Falcon Reservoir

Segment A

Anzalduas

Brownsville

Matamoros

Segment B

Above Tidal Portion

Ecological Affinities
- Freshwater
- Estuarine
- Marine

Year
- 1850s
- 1953
- 1975
- 1981-2000

%
15 Most Abundant Species Middle Segment

- Amazon Molly
- Sailfin Molly
- Sheepshead minnow
- Western Mosquitofish
- Inland Silverside
- Mexican Tetra
- Rio Grande Cichlid
- Blue Tilapia
- Red Shiner
- Gizzard Shad
- Bullhead Minnow
- Threadfin Shad
- Gulf Killifish
- Common Carp
- White Crappie
Mouth of Rio Grande in 1981
Mouth of Rio Grande in 2001
Following heavy rains in the Lower Rio Grande basin

November 7, 2002
Lower Segment

Falcon Reservoir

50 Km

Anzalduas
Brownsville
Matamoros

Tidal Portion Segment C

Ecological Affinities
- Freshwater
- Estuarine
- Marine

Year

1850s 1953 1975 1981-2000

%
Rio Grande Tidal

• Application of this definition to the tidal portion of the Rio Grande from the El Jardin weir downstream to the mouth indicates that an ecologically sound environment would:

  – Sustain a riparian plant community dominated by a diverse group of native riparian plants,
  – Have an absence of invasive, exotic aquatic plants like water hyacinth, water lettuce, and *Hydrilla*, and
  – Provide sufficient freshwater inputs to support a mixed aquatic community including a mixed community of fish including approximately 10-20% of the species being primary freshwater species (including native species with a range of feeding habits including top predators, and continuous flows to the Gulf of Mexico) to allow for all life stages of estuarine and marine species to have access the nursery grounds of the tidal portion throughout the year.
  – Focus on river closure as it changes the entire ecosystem
Fig. 4.1.2. Bottom salinity along Rio Grande tidal segment, 1992 to 1997 (from TPWD, Brownsville, Coastal Fisheries Lab.)
Figure 4.1.4. Summary of flow data in daily average cubic feet per second from IBWC monitored river gage south of Brownsville, Texas, February 2000 to October 2001.
Recommendation #1

- **Minimum Flows**: Minimum flow of 60 cfs at all times to maintain a salinity transition zone that supports the vegetative communities that transition along the length of the estuary and helps keep the mouth of the river open. It is 25% greater than the 45 cfs identified (Ernest et al. 2007) as necessary to keep the mouth open and it is higher than the average flow of 39 cfs into the tidal reach for the 28 days prior to the mouth closing in February 2001.

- **Pulse Flows to Keep the Mouth Open**: Daily average flow of 175 cfs at least once every 2 months (based on flows during 1999, which had lower total inflow than all but one other year during the period of record from 1934 to 2010), when there were 7 pulse periods with at least one day of daily average flow exceeding 175 cfs.

- **Daily Average Flows**: Daily average flow of 880 cfs at least once each year (based on the November 3, 2002 flow of 915 cfs which was part of a wet period that helped naturally reopen the river mouth by November 7, 2002). No pulse flows of this magnitude occurred from February 4, 2001 through November 3, 2002, during which period the river mouth was closed (except when artificially opened in late July 2001).
Recommendation #2

- Hydrologic stream flow data documents the highly pulsed, episodic nature of inflows to the estuary (IBWC 2010). Under very reduced flows, this could produce excessive salinity levels in the upper reaches of the estuary and create unnatural conditions for the ecological functioning of this part of the ecosystem.
- City of Brownsville Water Permit for the Brownsville-Matamoros Weir contains a flow restriction for water diversion at the El Jardin site.
- When salinity rises to a value of 2,250 uS cm\(^{-1}\) at river mile 23.6, then water cannot be diverted unless flows are 25 cfs or higher. This salinity level is the highest value recorded in recent years during extremely low flow periods, which were reached when the river mouth became plugged.
- In a recently completed monitoring study over the period 2000-2009 (Machin 2009), it was shown that low river flows will produce these elevated bottom salinities at mile 23.6; thus diversions at El Jardin would need to be curtailed at even higher flows than 25 cfs. The BBEST recommends maintaining this 25 cfs flow minimum, but cautions that an even higher flow threshold could be necessary as a result of further monitoring and data analysis.