Progress Report
on
Los Lunas Floodplain Monitoring
2003-2005

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Introduction

On June 29, 2001, the U.S. Fish and Wildlife Service (USFWS) issued a Biological Opinion (BO) regarding the effects of certain water management practices upon the Rio Grande silvery minnow (*Hybognathus amarus*), the southwestern willow flycatcher (*Empidonax traillii extimus*), the bald eagle (*Haliaeetus leucocephalus*), the interior least tern (*Sterna antillarum*), and the experimental-nonessential population of the whooping crane (*Grus americana*). All are either threatened or endangered species (USFWS 2001). Specifically, the BO evaluated the implications of the U.S. Bureau of Reclamation's (BOR) discretionary actions related to water management and the U.S. Army Corps of Engineer's (Corps) water operations rules and non-federal actions related to ordinary operations on the Middle Rio Grande. The USFWS concluded that these management practices would likely jeopardize the continued existence of the Rio Grande silvery minnow (RGSM) and southwestern willow flycatcher (SWWF) and, therefore, developed a nested set of recommendations, or Reasonable and Prudent Alternative (RPA), that they believe must be implemented in order to avoid a jeopardy condition in accordance with the Endangered Species Act (ESA) 16 U.S.C. 1531 *et seq*. The Corps and the BOR made an initial determination to accept and implement the general provisions of the RPA.

The Los Lunas, New Mexico Habitat Restoration Project was subsequently initiated and was intended to fulfill the requirement of habitat restoration in the Belen Reach- one of eight reaches in which habitat restoration must be conducted in accordance with Element J of the RPA. Further, it was meant to fulfill the requirement to initiate construction on at least one restoration project within six months from the date of the BO.

The objectives of the Los Lunas project are to improve habitat conditions for the RGSM and SWWF such that in combination with other elements of the RPA a jeopardy condition for the two species could be avoided. In general, the project was formulated to mechanically widen the active river channel and improve adjacent riparian habitats. The design goals of this project were to produce inundation of certain areas in the project area at flows of greater than or equal to 2,500 cfs. The floodplain was lowered to ensure some inundation at a wide range of flows and at flows less than 2,500 cfs. These alterations within the historic floodplain were intended to produce a variety of additional shallow water/low velocity egg-retention and nursery habitats for the RGSM during spring spawning flows. According to the "flood pulse concept" (Junk et al. 1989) the flood pulse is the principal driving force controlling of river-floodplains, and is responsible for the existence, productivity and interactions of the major biota in the river-floodplain. Flooding is predicted to trigger an increase in the magnitude of biological processes that occur during both the rising and falling limb of the pulse (Valett et al. 2005). Junk et al. (1989) argue that the overwhelming bulk of the riverine animal biomass derives directly or indirectly from production within the floodplain and not from the downstream transport of organic matter produced elsewhere in the basin.

The Los Lunas site is located on the west bank of the Rio Grande adjacent to Mid Valley Airpark, Los Lunas, New Mexico. Dimensions of the overbank area are approximately 1829 m along the existing riverbank with a generally uniform width of 107 m encompassing an area of approximately 16.2 hectares. The site is bounded on the west by an earthen and rootwad berm approximately two meters high. The greater restoration area suffered a severe fire in April of 2000. As a result, the site offered an exceptional opportunity for restoration as it avoided impacting an intact riparian area.

The goals of this project required a great deal of work and therefore the project was divided into three broadly defined phases. First, approximately 1,400 Kelner jetty jacks (historic flood control/bank stabilization structures) were removed. Second, the excavation of approximately 53,500m^3 (70,000yd^3) of floodplain material would be moved to allow for active channel widening and, accordingly, the creation of more extensive RGSM habitat. Lastly, all areas of terrestrial disturbance were revegetated with native plant species, which should stimulate the process of post-fire reclamation and hopefully lead to a diverse array of higher-value riparian habitats. Although temporally separated, the various phases of construction were completed over the following two years. Various forms of monitoring activities are ongoing. This restoration projects differs from others in the inclusion of a long term monitoring program to assess the success or failure of the project.

<u>2003 Monitoring</u>

The narrative for this monitoring report may contain what may seem superfluous information, but it is included to demonstrate the dynamic nature of this environment. The Los Lunas floodplain is a dynamic environment that can change within hours or days depending on flow. Observations were made on a daily or weekly basis depending on flow. Equipped with a camera, stadia rod, and water sample bottles, monitoring commenced on 16 May 2003. Habitats (habitats) were numbered 1-17 north to south. Photo stations were established at the northeast margin of each habitat. A time series of photographs was used to provide documentation of short-term flow dynamics. The floodplain and habitats were dry prior to a flood pulse from a scheduled release on 15 May 2003 from Cochiti Dam. The floodplain was barren with the exception of three small groups of native cottonwood trees that were left in place and some small shrubs and grasses along the river margin.

Observations made 16 May revealed that Rio Grande water had intruded into some of the habitats and in places up to the rootwad berm. Observations made the following day (17 May) revealed that all habitats were inundated and water had broken through to the overflow channel (OVFL). Flow was calculated using linear regression of USGS measured flows at Albuquerque and Bernardo. The initial flow was calculated to be 650 cfs on 17 May and decreased to 275 cfs by 19 May. Observations made on 19 May revealed that the Rio Grande had receded and left some habitats dry while others were fully inundated. Although flow was not measured within the floodplain, flow was sufficient to cause incision in the OVFL. Habitats where water had receded and shallow (<3 cm) contained large areas of *awfuchs* (algal biofilm) and associated bubbles. The bubbles were presumably oxygen indicating that photosynthesis was occurring.

Observations made 23 May revealed that all but habitat 13 were dry with the exception of some small isolated pools within the floodplain. Water intrusion into habitat 13 was due to a sandbar island in the river that deflected water into the habitat. A rain event on 27 May increased flow to 400 cfs on 28 May. Observations made the following day (28 May) revealed that all habitats and the OVFL were again inundated and in some places water had penetrated to the rootwad berm. In areas along the habitat margin silt had been deposited onto the sand substrate indicating that aggradation was occurring. Sedimentation was more pronounced in the northwest corner in each of the habitats where flow decreased. Observations of water entering the habitat revealed a shear zone where Rio Grande water had a higher sediment load than the lower velocity water in the habitats (see photo 3 in appendix). Observations made the following day revealed that flow into and out of some the habitats had created a “U-shaped” channel (see photos 4 and 5). Along the habitat margin and the area within the “U” channel was now higher than the original elevation. Flow into these habitats did not provide a low velocity habitat for RGSM as planned.

Observations continued on 4 June and revealed that water had receded. Most habitats were now only contained mud with the exception of some isolated pools in the OVFL channel. Isolated pools contained hundreds to thousands of tadpoles. Dense stands of grass now covered most habitats and adjacent floodplain. Observations on 7 and 13 June revealed that much of the previously wetted habitats were desiccating as evident by cracking mud. Only the 13^{th} habitat remained wetted due to water deflected by a sandbar island.

By 26 June the entire floodplain was dry and covered by dense stands of short grasses. No further monitoring was performed during summer 2003. Observations made during 26 June revealed that many; perhaps thousands of fish were dead or dying in isolated pools just outside of the habitat boundaries (see appendix photo 2). There was evidence that wading birds had been eating stranded fish since they are easily preyed upon in the shallow pools. Small fish were absent with the exception of channel catfish, and larger fish had eyes pecked out. Observations made during the monitoring period indicate that aggradations have occurred leaving most habitats above the original excavation elevation resulting in nonfunctional habitats for RGSM. No further sampling was performed for the summer of 2003 due to water diversions and river drying. Monitoring of the Los Lunas site was suspended until flows returned in late October.

On 1 Oct. 2003 while the floodplain and river were still dry, H.A. Magaña and BJ Weibell initiated a series of aquatic invertebrate colonization studies. B.J. Weibell is a PhD student at the University of Alabama at Tuscaloosa. A series of fence posts were erected along the river margin just outside of the floodplain proper. To each fence post two pieces of native woody debris (30 x 5 cm) were attached at the base of the fence post approximately 30 and 50 cm above the riverbed substrate. This woody debris was collected at 30 and 60 days after flow returned. The woody debris was processed at UNM biology annex and sent to the University of Alabama at Tuscaloosa for identification of aquatic invertebrates. Results from this study are being analyzed by H.A. Magaña and will be available by the end of study.

Results

Results from water samples taken from selected Los Lunas habitats (Fig. 1) indicate that nutrient concentrations fluctuated corresponding to changes in flow. During the first 11 days of flooding, surface nitrate (NO_3-N) concentrations increased from a baseline of 430 to 830 μg/L. Nutrient concentrations for NO_3-N reached a maximum of 830 μg/L after a rain event on Memorial Day 2003. Increases in NO_3-N concentration were possibly due to nitrification. Over the next three days NO_3-N concentrations declined, but remained higher than those observed at the onset of flooding. Nitrate concentrations decreased from 830 to 610 μg/L between 28 May and 31 May possibly due to denitrification.

Flooding of the connected floodplain resulted in an increase in phosphate concentrations with the northern inlet (1^{st} channel) measuring 180 μg/L and the southern outflow measuring a maximum value of 260 μg/L all other habitats (2-17) fluctuated between 10-86 μg/L for the duration of the sampling period. Ammonium concentrations remained low (11 to 30 μg/L) in all habitats until water levels decreased and the habitats dried out.

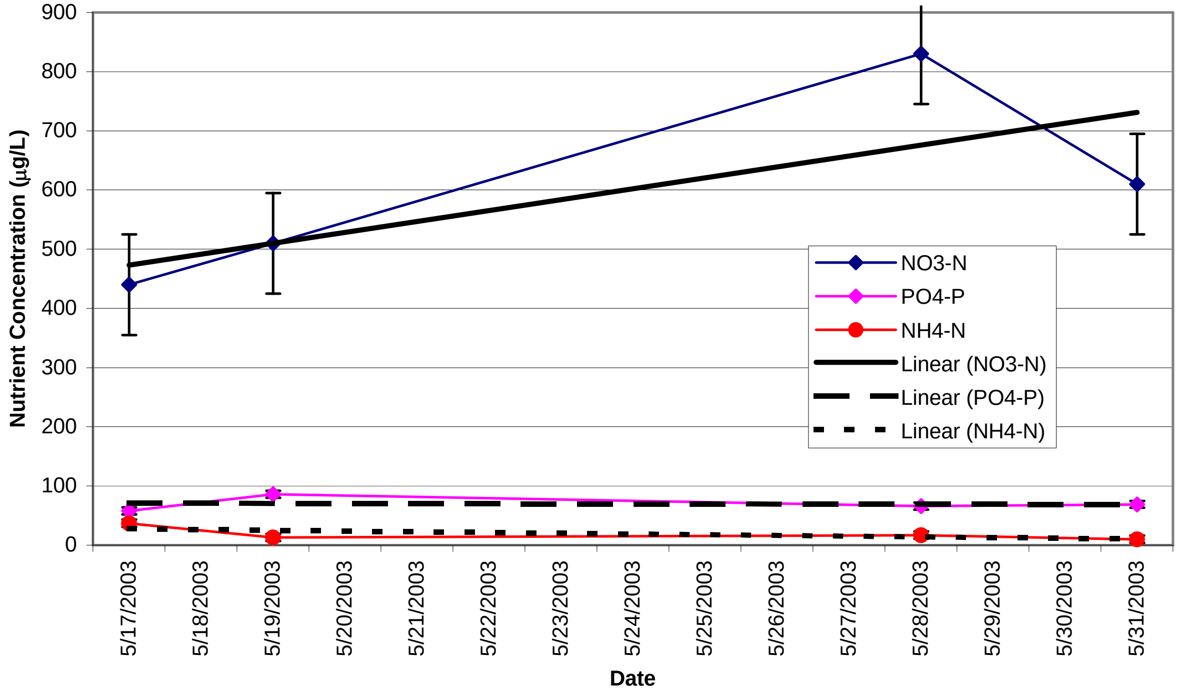

Fig. 1. Los Lunas habitats nutrient concentrations at habitat margin summer 2003.

<u>2004 Monitoring</u>

For the 2004 monitoring period, additional monitoring equipment were incorporated into the study. The addition of a multiparameter probe (YSI 556) to measure water quality and a Marsh-McBirney pressure sensor to measure water velocity provided for a more complete understanding of floodplain dynamics. Monitoring of the floodplain commenced on 10 May 2004. The floodplain was covered with a variety of tall grasses and small willows. Rio Grande water was observed flowing into the floodplain at habitats 4, 5, 6, 7, 11, and 13 directly to the high flow channel and at places up to the base of the rootwad berm. Flow through these habitats created deep channels that directed flow into the high flow channel. The short-circuiting of water to the overflow channel eliminated any low velocity water within the habitats. Sediment in habitats 7, 13, and 15 had been deposited to a depth of approximately 31-46 cm. Algal mats were observed in the area of habitat 13 where fish were seen surfacing. Water in the floodplain was observed exiting to the Rio Grande at habitat 14. Sediment depth in the floodplain ranged from 30-90cm with an average depth of 45cm.

Monitoring continued on 27 May 2004. Equipment failure (YSI) on this date prevented collection water quality parameter data. Water depth throughout the floodplain ranged from 0 to 80 cm. Water velocities ranged from 0 to 74 cm/s. Habitats 1 and 3 were dry while habitat 2 had some Rio Grande penetration (8-10m) but did not provide low velocity nursery habitat. Rio Grande water penetrated into south end of habitat 4 directly into the high flow channel and water was ponded along the rootwad berm. Water velocity at the berm measured 0.0 m/s and signs of fish were observed. Habitats 5, 7, and 10 can be described as mud flats that were devoid of life. Signs of aggradation were noted in these habitats. Deep channels at habitats 6 and 11 continued to short-circuit water to the OVFL and did not provide low velocity water needed for larval fish.

Water in the floodplain and OVFL exited to the Rio Grande at habitats 14, 15, and at the southern outflow.

While the OVFL was disconnected from the river it provided deep, near-zero velocity water. Three larval fish light traps were deployed at this location on this date and allowed to passively capture for 12 hours. The following morning fish were transferred from the light trap into 10% formalin and later transferred to 35% ETOH. Mike Farrington identified larval fish at the Museum of Southwestern Biology (MSB). Fish community species listed in table 1. Larval fish captures were performed under Dr. Tom Turner (federal permit number TE038055-0).

One week later (3 June) the 1st channel and 1st habitat were dry. It is possible that tractor furrows may have affected RGSM egg transport and diverted eggs back into the river. Habitat 2 showed that Rio Grande water had penetrated 3-5m, however, this did not provide habitat for RGSM. Habitats 3-7 were dry and barren. The OVFL channel was now disconnected from the Rio Grande at Return to Rio Grande (RtoRG). The water level had dropped approximately 60cm. Habitat 10 was dry with a scattering of short grasses. Habitat 11 continued to short-circuit water directly to the OVFL channel. The Rio Grande veered to the East and habitats 12-17 were dry with the exception of return flow from the OVFL channel to the Rio Grande. Sediments had aggraded between 40-60cm in habitats 16 and 17. Some water was observed exiting the floodplain at the outflow.

The following week (9 June) habitats 1-10 were generally dry and devoid of vegetation. The habitat 11 channel continued to flow into the OVFL channel. Habitats 12-17 were dry and barren. Water no longer entered the floodplain or OVFL at any of the previous channels. Habitat 2, RtoRG, and the disconnected OVFL channel continued to hold water. Observations made 15 June to 16 July all habitats were dry with the exception of habitat 2 and RtoRG and a series of isolated pools in the OVFL. Vegetation was now sprouting in and around the habitats.

Monitoring commenced again on 1 October 2004. The Rio Grande was dry and all habitats were dry. The absence of water allowed for measurements to be made from the river bottom to the floodplain surface. In places the difference in elevation exceeded 1.5 meters. During this reconnaissance depressions in the floodplain and habitats were identified and mapped as dangerous places when water returned. The entire floodplain was covered with wild sunflowers and sticker burr plants. Taller vegetation marked the boundary around the habitats.

By 1 November water was again running down the Rio Grande. At habitats 1 and 2 the Rio Grande flowed along the margin and there was evidence of overbanking. At habitat 3 the river veered to the east and away from the floodplain. At habitat 4 the river had returned to the floodplain margin and had penetrated in places up to 2m. Habitats 5-7 were dry at habitat RtoRG and the OVFL contained water and there signs of fish ands aquatic invertebrates. The Rio Grande penetrated into the floodplain OVFL via a channel at the south end of habitat 11. Water in the OVFL continued south past habitat 14 where it became a small trickle. The Rio Grande again veered away from the floodplain at habitat 13 and habitats 13-17 remained dry.

Reconnaissance on 1 December revealed that most of the floodplain was covered in snow and where Rio Grande water had penetrated into the floodplain ice had formed. There some penetration at habitat 2, but did not provide slow water habitat. A sand bar had formed at the margin of habitat 3 directed the river away from the floodplain. Ice covered the margin of the habitat and algae were observed under the ice. Samples of these algae were collected and returned to the lab for analysis. Water had penetrated 12-15m at habitat 4 and into the OVFL. Water depth was ~10cm and the odor of treated water permeated. The source of this odor was presumed to be from the Los Lunas wastewater treatment plant located ~2.5km to the north.

Water in the OVFL was very shallow and was frozen over. Habitat RtoRG was also frozen over. Habitat 10 was covered with dead vegetation. Habitat 11 was completely inundated and a channel at the south end connected the river to the OVFL. Habitats 12 and 13 were slightly inundated. Water exited the OVFL at habitat 14. Habitats 15-17 were dry and covered with dead vegetation.

Results

Results from water samples taken from selected Los Lunas habitats (Fig. 2) indicate that nutrient concentration fluctuated with in flow. During the first 12 days of flooding, surface nitrate (NO_3-N) concentrations increased from a baseline of 440 to a maximum of 810 μg/L. Increases in NO_3-N concentration during the rising limb of the hydrograph were possibly due to nitrification. Over the next three days NO_3-N concentrations declined, but remained higher than those observed at the onset of flooding. Nitrate concentrations decreased from 810 to 510 μg/L between 28 May and 31 May during the falling limb of the hydrograph possibly due to denitrification. The overall trend was an increase in surface nitrate concentration.

Flooding of the connected floodplain resulted in an increase in phosphate concentrations during the first seven days from a baseline of 60 μg/L at the onset of flooding to a maximum value of 100 μg/L. Over the next five days phosphate concentrations decreased to 70 μg/L and remained at this concentration until the floodplain dried out. Ammonium concentrations initially was 40 μg/L and decreased to a minimum of 10 μg/L in all habitats until water levels decreased and the floodplain dried out. The trend for phosphate and ammonium was flat during the sampling season.

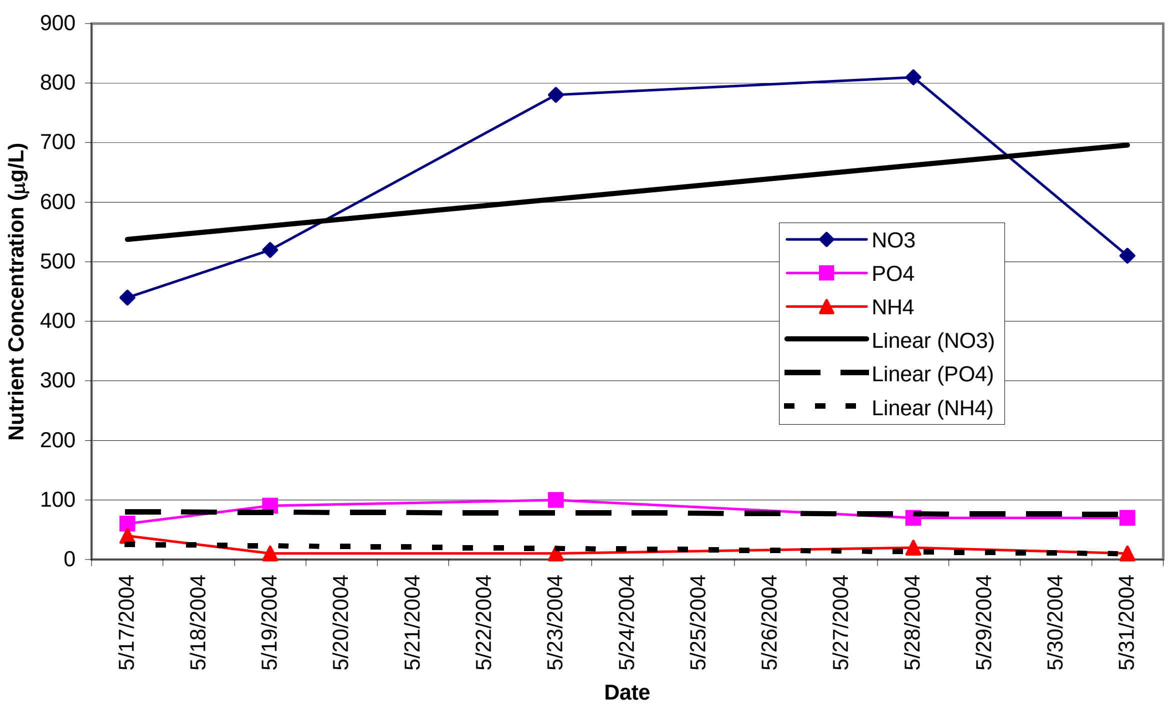

Fig. 2. Los Lunas habitats nutrient concentrations at habitat margin Summer 2004.

2005 Monitoring

The 2005 monitoring season was sampled more aggressively and therefore more volunteers and technicians were employed to collect data. All of the same sampling equipment from 2004 season was used to collect data. Sampling was limited to the northern half of the floodplain because some areas in the southern half of the floodplain contained deep holes that could not be seen and the area was deemed too dangerous. The 2005 sampling season began on 29 March. On this date only habitat RtoRG wetted and was sampled for algae, fish, and water quality. Algae were observed along the margin of the habitat in a "bathtub ring" fashion as described by Bunn et al. (2003). Four species of fish (RGSM, fathead minnow, red shiner, and mosquitofish) were captured and retained for gut content analysis.

By 31 March, water had receded and the OVFL was again disconnected from the Rio Grande. A scheduled release of water (~5000cfs) from Cochiti Reservoir on April () for overbank purposes resulted in flooding many portions of the bosque, which had not been flooded in decades. Observations on 9 April revealed that the Rio Grande had again penetrated into the floodplain and flooded most of the habitats. Water depth had increased to 5cm at the margin and 95cm at the thalweg. Water velocity was slow at 0-2 cm/s at the margin and thalweg respectively.

Ichthyofauna sampling on 9 April at habitat RtoRG and 11th habitat OVFL resulted in the capture of 178 fish (Table 2) of which only two adult RGSM were retained for gut content analysis. Observations made on 18 April revealed that all habitats were now inundated up to the rootwad berm. Depth in the floodplain varied between 8cm at the margin and 80cm in the thalweg. Water velocity remained slow and measured between 0cm/s at the margin and 2cm/s in the thalweg. Many fish species were observed spawning on vegetation in many locations within the floodplain. Sampling on this date revealed that water depth and velocity in the floodplain had stabilized. Sampling during 20 April revealed that water depth and velocity had increased throughout the floodplain. Water depth increased dramatically from 5 to 85 cm and water velocity increased from 0 to 75cm/s. Rio Grande water penetrated directly into the OVFL and exited at habitat 14.

Sampling continued on 27 April. Water depth further increased throughout the floodplain and measured between 22-85cm. Water velocity also increased and measured between 39-83cm/s. Water was observed entering the floodplain at a right angle from the river directly into the OVFL. Observations on 4 May revealed that water was receding, however, water depth measured between 12-64cm throughout the floodplain. Copious amounts of unidentified filamentous algae were observed at habitats 1-4. The receding water revealed that aggradation was occurring at the center of the habitats creating small islands. A channel at the south end of habitat 4 directed Rio Grande water into the OVFL. Water depth and velocity in the channel measured 47cm and 76cm/s respectively.

On 19 May water levels reached the high water mark. On this date, larval fish light traps were deployed to coincide with seasonal spawning of the RGSM. Light traps were deployed on a weekly to basis to try and determine the age at which RGSM shift from endogenous food resources (yolk sac) to exogenous food resources (diatom algae). Three traps were placed within the floodplain in areas (habitat 1, 10, and 12) where water depth exceeded 40cm and velocity was low (e.g. 2-31cm/s). Traps were allowed to capture for 12 hours prior to retrieval. Less than 10% of captured fish and aquatic invertebrates were retained for further analysis. Light traps were deployed on 23 May, June 6, 13, 20, and 28 at six locations within the floodplain and retrieved the following morning. Light traps were deployed at the same locations for the remainder of the sampling season. Water depth and velocity at the trapping sites ranged 28-63cm and 2-16cm/s respectively for the remainder of the trapping season. To date, identification of larval fish have not been completed, but will be completed by the end of the year.

Sampling of water quality continued on 26 May. At habitat 1st channel water was receding, but water velocity had increased from 6 to 27 cm/s. Water continued to recede and depth ranged from 21-106cm. Habitats 1-3 showed signs of aggradation. At habitat 4, water entered the floodplain directly into the OVFL. Habitat 4, 5, 6, and 7 were completely inundated and no demarcation was evident between the habitats and OVFL. Sediment at these locations was deep (~25-30cm). In areas where water was shallow a layer of biofilm was observed. At habitat RtoRG water depth measured 40cm, however, sediment at this location was ~30cm and made travel difficult.

During 3 June sampling, variation in floodplain elevation became more noticeable. Throughout the floodplain water depth ranged from 18-80cm and velocity ranged from 1-99cm/s. Habitat 1 water level was up while habitats 2 and 3 were lower. Wading birds were seen fishing in both of these latter habitats. Habitat 4 and 5 were inundated to the OVFL and habitat 6 was inundated to the rootwad berm. The channel at the south end of habitat 6 measured slightly over one meter deep. At habitat 7, water flowed out from the OVFL to the Rio Grande. Water was receding at habitat RtoRG and sand bars were appearing.

Monitoring resumed on 18 June. Water had receded significantly (~10cm) at habitat 1 channel and the light trap was relocated further south within the floodplain. Isolated pools were forming between the river, rootwad berm, and habitat 1 and 2. Larval fish were observed swimming in the shallow water. Habitat 1, 2, 3 were shallow, but small channels continued to direct flow into the OVFL. Sandbars were appearing at the margin of the habitat margin. Habitat 4 was inundated and Rio Grande water flowed into the OVFL. Habitat 5 was dry with the exception of a small channel that flowed into the OVFL. Water continued to flow into habitat 6 through a channel that had formed at the south end. Water flowed out of the OVFL at habitat 7. While water receded islands began emerging in habitats 6 and 7. Habitat RtoRG remained inundated and the light trap from habitat 1 channel was redeployed here.

The last sampling was on 28 June. Habitats 1-3 observed to be dry. Habitat 4 remained wetted and flow was entering through to the OVFL. Habitat 5 contained some isolated pools. Habitat 6 continued to channel water into the OVFL. Habitat 7 contained isolated pools with fish that were identified as *Gambusia affinis*. Habitat RtoRG was reduced to a shallow channel. An adjacent isolated pool contained copious amounts of filamentous algae. No further sampling was performed after this date. A reconnaissance of the floodplain on 5 August revealed that the floodplain was now dry with the exception of scattered isolated pools. Further reconnaissance of the floodplain continues and future reports will include data from aquatic invertebrate and fish community structure.

Results

Results from water samples taken from Los Lunas habitats (Fig. 3) indicate that at the beginning of spring runoff surface nutrient concentrations (nitrate, phosphate, and ammonium) were high (537, 392, and 233μg/L respectively) and decreased to one-half concentration over the next 11 days. By 18 April nitrate and phosphate spiked to 500 and 420 mg/L respectively, however, ammonium was not detectable. From mid-April to mid-June nutrient concentrations showed a trend of continuous decline. From mid-June to mid-July surface nutrients increased with ammonium showing an order of magnitude increase in concentration. The overall trend for all nutrients from initial sampling to the end of the sampling season was a decrease in surface nitrate concentration.

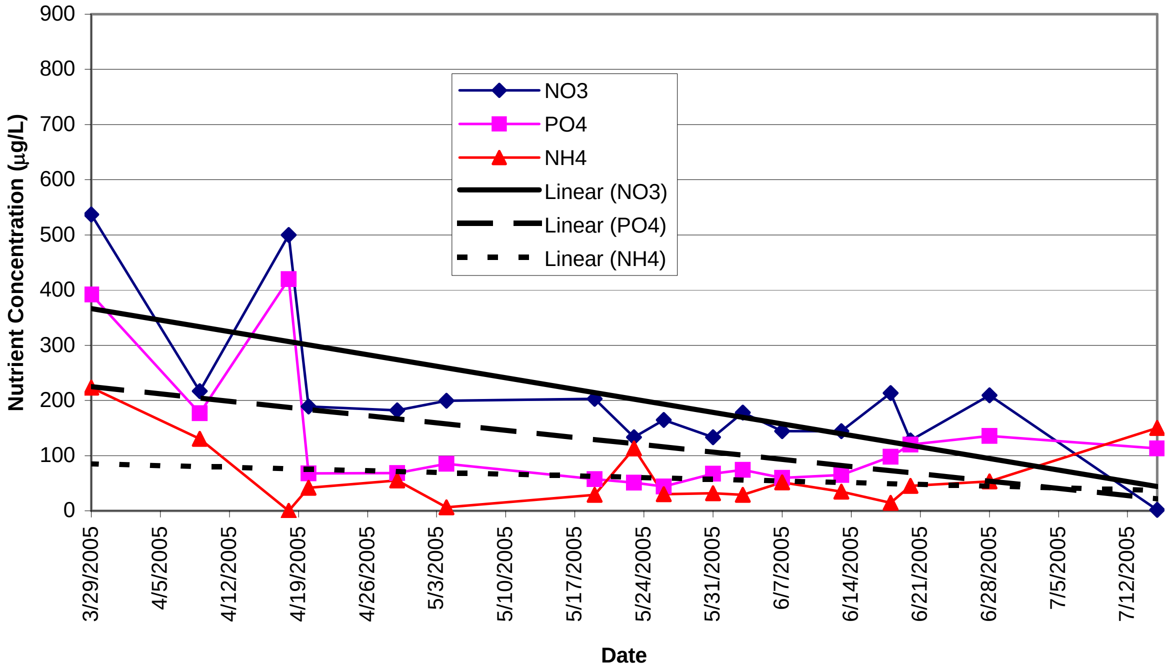

Fig. 3. Los Lunas habitats nutrient concentrations at habitat margin 2005.

Conclusions

The results from monitoring show that topographic features in the floodplain change constantly with each flood pulse event. Key observations thus far:

1) Areas designed for nursery habitat along the river margin were poorly designed.
2) The OVFL was highly successful in providing nursery habitat for RGSM and other Rio Grande ichthyofauna.
3) Short-term flooding (e.g. 2003 and 2004) provided a pulse in nutrient concentrations which setoff a series of events
4) Fish community dominance changes from month to month and year to year
5) Terrestrial vegetation changes yearly

The shape, size, and exit flow locations of each habitat influenced the direction and velocity of flow. The key observations were: a) through-flow in habitats eliminated slow-velocity nursery habitat, b) width of habitat mouth and angle of inlet controlled water inflow/outflow patterns, c) width to length ratio of habitats needs to be increased to enlarge the drift zone.

The OVFL while not intended to provide nursery habitat became an unintentional success. Key observation: a) The OVFL provide near-zero flow in many areas thus providing spawning and nursery habitat for Rio Grande ichthyofauna.

Short-term flooding triggered an increase in the magnitude of biological processes that occur during both the rising and falling limb of the pulse as predicted by Junk et al. (1989). Within days primary productivity was evident as seen in the large areas of *awfuchs* (biofilm). It is also clear that the flood pulse plays an important role in determining functional characteristics of floodplains and the rivers that inundate them as described by Valett et al. (2005).

Sampling the Rio Grande ichthyofauna revealed that species dominance change from month to month and year to year. No one species has been identified to dominate.

Cottonwood seedlings are sprouting up all over the floodplain in and among other vegetation. Information gained from this project will help Rio Grande managers and others design and construct effective habitat restoration projects for the endangered RGSM. Further monitoring over the long-term will provide information whether this restoration project was a success for the RGSM.

Acknowledgements

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Appendix

Date	Location	Common	Taxonomic	Size (mm SL)	Numbers
05/27/04	RtoRG North	Common carp	*Cyprinus carpio*	11-20	22
05/27/04	RtoRG North	RGSM	*Hybognathus amarus*	8-12	93
05/27/04	RtoRG North	Fathead minnow	*Pimephales promelas*	11-14	4
05/27/04	RtoRG North	River carpsucker	*Carpiodes carpio*	11-15	76
05/27/04	RtoRG South	Common carp	*Cyprinus carpio*	8.2-21	42
05/27/04	RtoRG South	RGSM	*Hybognathus amarus*	8.2-13	89
05/27/04	RtoRG South	Fathead minnow	*Pimephales promelas*	7.4-13	3
05/27/04	RtoRG South	River carpsucker	*Carpiodes carpio*	12-15	33
05/27/04	RtoRG South	White sucker	*Catostomus commersoni*	13	1
05/27/04	RtoRG South	Mosquitofish	*Gambusia affinis*	6.8-16	2
05/27/04	4th habitat	Common carp	*Cyprinus carpio*	6.3-27	38
05/27/04	4th habitat	RGSM	*Hybognathus amarus*	8.7-12	49
05/27/04	4th habitat	Fathead minnow	*Pimephales promelas*	6.2	1
05/27/04	4th habitat	River carpsucker	*Carpiodes carpio*	13-16	14
05/27/04	4th habitat	Common carp	*Cyprinus carpio*	14-22	1
05/27/04	4th habitat	Mosquitofish	*Gambusia affinis*		1

Table 1. Fish species captured.

Species	Number	Percent
Catostomus commersoni	2	.04
Gambusia affinis	3	.06
Pimephales promelas	8	1.7
Cyprinus carpio	102	21.7
Carpiodes carpio	123	26.2
Hybognathus amarus	231	49.3
Total	469	100

Table 1B. Ichthyofauna community composition 5/27/2004.

Date	Location	Species	0-2 cm	2-4 cm	4-6 cm	6-8 cm	8-10 cm	Total
4/9/2005	RtoRG	*Gambusia affinis*	3	5				8
		Cyprinella lutrensis		2	3	9		14
		Pimephales promelas				1		1
		Hybognathus amarus			1			1
4/9/2005	11th Hab	*Gambusia affinis*	4	39	3			46
		Cyprinella lutrensis		5	27	51		83
		Pimephales promelas				23	1	24
		Hybognathus amarus				1		1
Total								178

Table 2. Fish species captured April 9, 2005.

Species	Number	Percent
Hybognathus amarus	2	1.1
Pimephales promelas	25	14
Cyprinella lutrensis	54	30.3
Gambusia affinis	97	54.5
Total	178	99.9

Table 2B. Ichthyofauna community composition 4/9/2005.

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