# Public Service Company of New Mexico (PNM) Fish Passage Facility
# 2011
# Annual Report

Submitted By:

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To:

The San Juan River Basin Recovery Implementation Program

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## INTRODUCTION

The federally endangered Razorback sucker (*Xyrauchen texanus*) and Colorado pikeminnow (*Ptychocheilus lucius*) found in the San Juan River are a focus for recovery efforts within the San Juan River Basin Recovery Implementation Program (SJRRIP). The decline in abundances of all native fishes in the San Juan River is thought to be a function of altered flow regime, loss of physical habitat through water development, and negative interspecific interactions from introduced, non-native species (SJRRIP 2010, Brooks et al. 2000). For over a decade, management efforts aiming to recover the two endangered species have included large scale non-native fish removals, operation of Navajo dam to mimic a natural hydrograph, and large scale endangered fish augmentation. These efforts have primarily been focused between river mile (RM) 180 (the confluence with the Animas River, New Mexico) downstream to RM 0 (Near Piute Farms, Utah). At river mile 0, a large waterfall created an upstream barrier separating the San Juan arm of Lake Powell from the San Juan River and at RM 166.6 a river-wide weir obstructs movement upstream except at high flow events and when the Public Service Company of New Mexico (PNM), fish passage is in operation.

This river wide obstruction at RM 166.6, a 3.25' diversion dam (weir) constructed in 1971, transects the entire width of the San Juan River, near Fruitland, NM at river mile (RM) 166.6. This weir includes a concrete barrier, a series of screened intake structures, an intake channel, a settling channel, and a pump house, which impede the ability of native and endangered fishes to move upstream (BOR 2001). Studies have shown that some upstream movement could likely occur when flows reach 7,000 cfs or greater; however, flows that reach 7,000 cfs are relatively rare (BOR 2001). The weir diverts water to be used at the nearby San Juan Generating Station and fish passage is needed to allow native fishes access to habitats above this diversion during critical periods (i.e., reproductive periods) and for refugia and foraging habitat. Adult monitoring upstream of the weir has continued to show use by endangered fishes and other native fishes. Non-native species, particularly channel catfish, have lower densities in this reach than other reaches (Ryden 2009). These factors, along with increased efforts for recovery river-wide, provide increased opportunities for the overall recovery of the San Juan River endangered fishes.

## METHODS

The NNDFW is responsible for the operation of the PNM fish passage under the guidance and direction of the SJRRIP. The passage is operated seven months of the year (April through October), seven days a week. Generally, the passage is operated and fish processed at approximately 11:00 am each day, thus the passage is set to capture fish over an approximate 24 hour period. There are two entrapment bays, however only one bay is normally used. If there is a high density of fishes than both bays can be operated.

Water intake is controlled by a mechanical gate on the upstream end of the entrapment facility. The gate is opened as far as needed to allow the maximum amount of flow through the facility that the river is able to provide at any given flow. We try to maintain flow through the passage that consistently supplies enough volume to provide an adequate "cue" for fish to find the passage entry from the river. Once fishes move up the 400 foot artificial ladder, they enter an upstream angled grate, with an opening of approximately 5 inches. Once they have passed through this grate, fish are trapped in a concrete basin between a ¾" sieve at the upstream end and the angled grate at the downstream end, which is designed in a manner so fish cannot find the opening while having to swim in an upstream direction against the current.

The water intake control gate is closed prior to netting the captured fishes, as to de-water the basin for ease of capture. A large crane-mounted net is lowered into the capture basin while fishes are dip-netted and placed into the large crane net. Once all fishes have been collected from the basin, they are hoisted and placed in a holding table with 8" of water for processing. The passage and all sieves, gates and basins are then cleared of any debris.

All fishes captured are enumerated. Endangered fishes (Colorado pikeminnow and razorback sucker) are measured for total length (TL - mm), standard length (SL - mm), and weight (WT - grams). They are scanned for a PIT tag and if a code is not found, a 134.2 kHz Passive Integrated Transponder (PIT) tag is implanted. All other native and non-native fishes are only enumerated and recorded. When all fishes have been processed they are released into a 200 gallon holding tank and flushed through an eight inch PVC pipe that directs them upstream of the PNM weir. A minimum wait of 15 to 20 minutes is generally implemented before opening the water control

gate to minimize the event of any stressed/exhausted fishes, which have just been released, potentially being swept into the upstream end of the passage and being held upon the ¾" sieve by the current.

## RESULTS

The passage operated for a total of 202 days between April 1 and October 31, 2011. There was a total of 28,292 fish captures comprised of 16 species. There was a 12 day period in June, during the high flow event, when the passage was operated non-selectively. During this period the capture gates and water control gates were left open to maintain flushing of sediment and debris that would otherwise clog the facility and create large sediment deposits both upstream and downstream of the passage.

### *Native Species*

Captures were generally consistent throughout the operating season; however, there was a distinct spike in frequency during the descending limb of the high flow event and relatively few captures later in the season during September and October (Figure 1).

Bluehead suckers moved through the passage at relatively higher numbers during early/mid season (May – July) while flannelmouth suckers were captured in high densities as soon as the passage was opened in April (Table 1). Both, bluehead and flannelmouth suckers, peaked in capture frequency in July, and frequency of occurrence declined rapidly in September and October. The catch of razorback suckers was relatively low (n=39) which makes confidently identifying seasonal trends difficult; however, catch rates show the majority of captures in the early part of the operation season then declining to very few captures in the last two months. Though captures of razorback were rare, frequency increased by eight individuals from 2010. Colorado pikeminnow captures peaked in July and August, and relatively low number of individuals was caught in other months. The number of pikeminnow captures (n=707) is the largest ever documented moving through the passage facility and is nearly 9 times the number that was captured in 2010 (n=87).

Speckled dace are generally captured each day of operation; however, they are not selective to

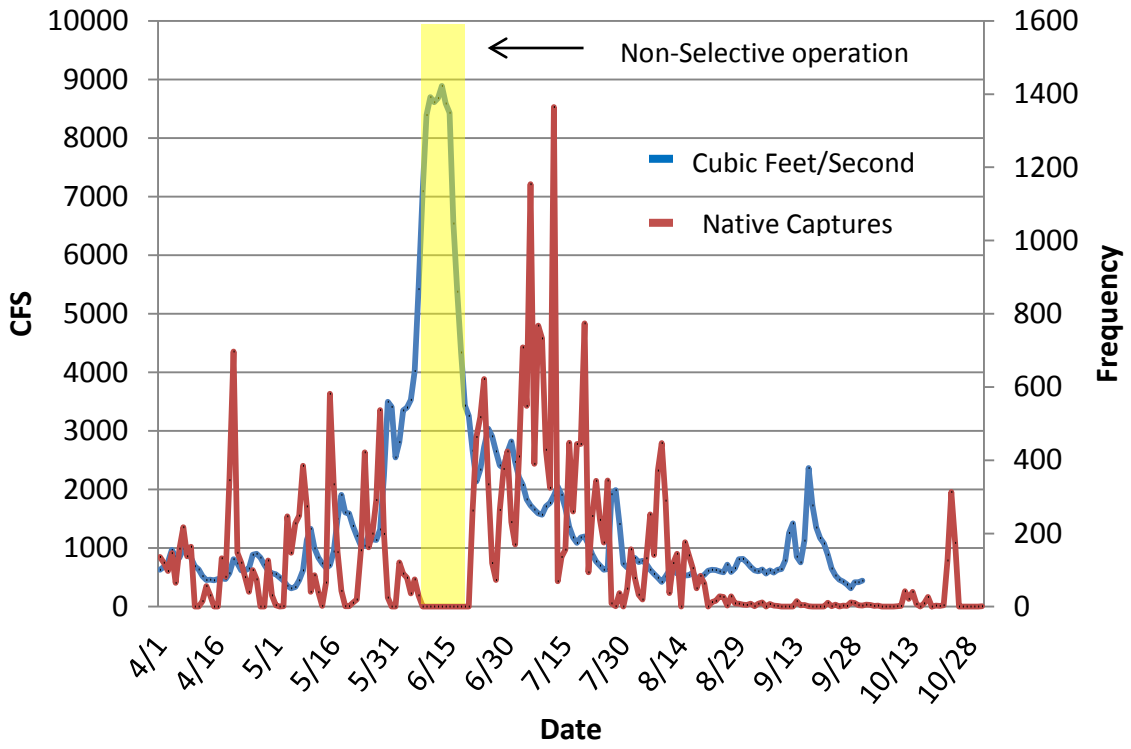


Figure 1. Native captures from April through October, 2011 and associated hydrograph for that period. The yellow portion indicates a period of 12 days when the passage was in non-selective operation.

the passage as they have the ability to move in or out of the capture basin through grates. Therefore, it was concluded that speckled dace (and other small-bodied fish) would not be considered and enumerated during passage operation. Juvenile Colorado pikeminnow also have the same ability to move out of the capture basin, but they are easily identified relative to other small-bodied fish and are captured when possible and included in our data collection protocol.

*Non-native Species*

Twelve non-native species were captured over the 2011 operating season at the fish passage facility (Table 1). The two species of bullhead (yellow and black) were compiled together, as well as the white sucker hybrid with bluehead and flannelmouth, as accurate identification can be difficult and confidence over all identification efforts was low for these species. There were generally a very low number of nonnatives captured throughout the 2011 season (n=785); less than 3% of the total capture over all species. Unlike the trend with native fish, non-native fish

Table 1. 2011 PNM Fish Passage Captures by Species – April 1 through October 31

| Species | April | May | June | July | Aug | Sept | Oct | Total |
|---|---|---|---|---|---|---|---|---|
| ***Native*** | | | | | | | | |
| Colorado Pikeminnow (*P. lucius*) | 0 | 9 | 16 | 297 | 333 | 23 | 29 | 707 |
| Razorback Sucker (*X. texanus*) | 8 | 12 | 0 | 5 | 8 | 3 | 3 | 39 |
| Flannelmouth Sucker (*C. latipinnis*) | 2536 | 1949 | 2065 | 3619 | 403 | 73 | 521 | 11166 |
| Bluehead Sucker (*C. discobolus*) | 778 | 2931 | 1811 | 7578 | 2241 | 20 | 236 | 15595 |
| | | | | | | ***Native Total*** | | **27507** |
| ***Non-native*** | | | | | | | | |
| Channel Catfish (*I. punctatus*) | 0 | 0 | 0 | 82 | 493 | 1 | 0 | 576 |
| Common Carp (*C. carpio*) | 0 | 2 | 9 | 15 | 5 | 0 | 0 | 31 |
| Bullhead (*Ameiurus spp*) | 0 | 1 | 1 | 13 | 5 | 1 | 1 | 22 |
| Bluegill (*L. macrochirus*) | 0 | 1 | 0 | 2 | 3 | 1 | 0 | 7 |
| Largemouth Bass (*M. salmoides*) | 0 | 1 | 0 | 4 | 1 | 1 | 0 | 7 |
| Green Sunfish (*L. cyanellus*) | 1 | 1 | 0 | 3 | 1 | 1 | 0 | 7 |
| White Sucker (*C. commersonii*) | 2 | 0 | 32 | 27 | 4 | 0 | 2 | 67 |
| White Sucker Hybrid | 7 | 9 | 0 | 10 | 1 | 0 | 0 | 27 |
| Brown Trout (*S. trutta*) | 4 | 2 | 11 | 18 | 0 | 0 | 0 | 35 |
| Rainbow Trout (*O. mykiss*) | 1 | 3 | 1 | 1 | 0 | 0 | 0 | 6 |
| | | | | | | | ***Non-Native Total*** | **785** |

were not captured in high abundances prior to the high flow event, but a major spike of occurrences did occur on the descending limb of the hydrograph, much like the native fish (figure 2). However, the spike was driven primarily by channel catfish which were captured in the passage in high densities (n=576) during a relatively small time period in late July and early August (Table 1). It is thought the reason for this large number of channel catfish occurrences (relative to previous years' captures) is due to a reduction in non-native removal efforts in the PNM to Hogback reach. White sucker occurred second most frequently (n=67) and white sucker hybrids were identified for the first time at the passage during the 2011 season (n=27). Brown trout occurred relatively frequently (n=35) and were captured during the first four months of

operation, presumably a function of being displaced downstream during spring run-off. Common carp had a similar frequency as that of brown trout (n=31). Other non-native fishes (largemouth bass, green sunfish, bullhead, bluegill, and rainbow trout) were found in low numbers, generally ≤25 individuals.

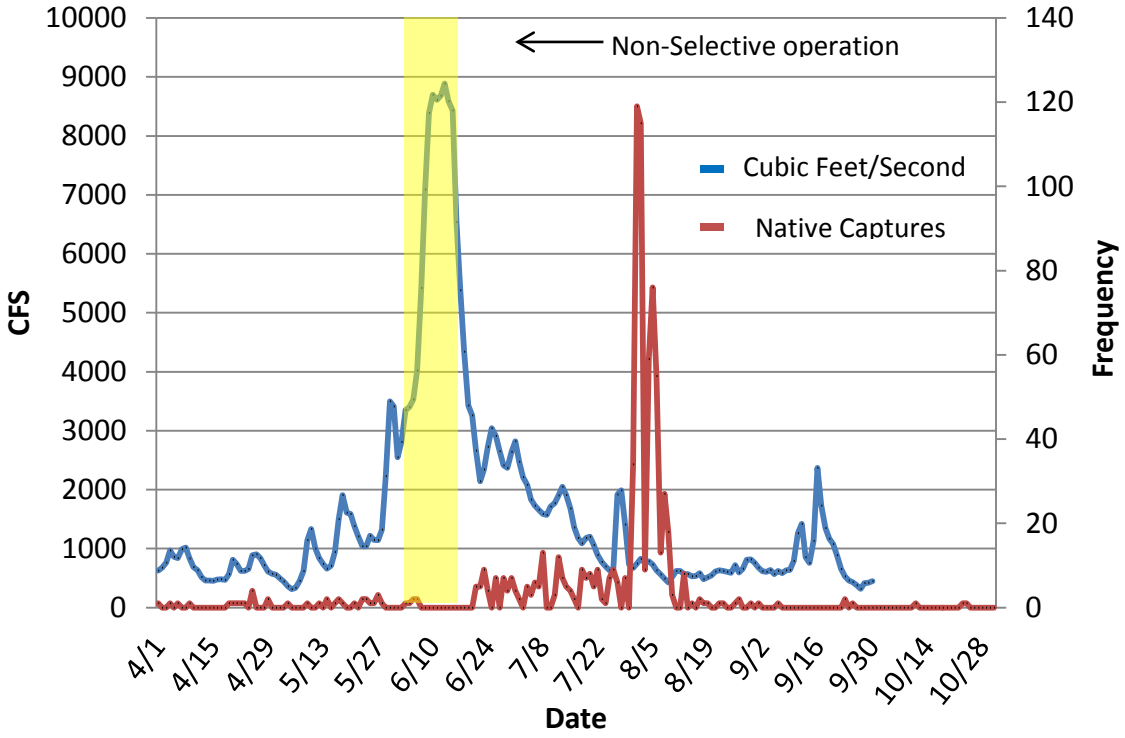


Figure 2. Non-native captures from April through October, 2011 and associated hydrograph for that period. The yellow portion indicates a period of 12 days when the passage was in non-selective operation.

*Razorback Sucker*

There were 39 total captures of razorback suckers. Five individuals were first encounters and each individual was PIT tagged at the passage upon capture. The remaining 34 razorback suckers were recaptures. The majority of razorbacks were between 326 and 450 mm total length, though there were fish captured on both ends of the normal distribution curve (figure 3). Capture histories were researched for all fish that were documented previously in the SJRIP database; the majority of the fish were of the 2008 year class (Table 2), the majority were originally stocked

from NAPI ponds (Table 3), and though most fish have been in the river less than year, there were some fish that have been documented to be in the river for 5 and 10 years (Figure 4).

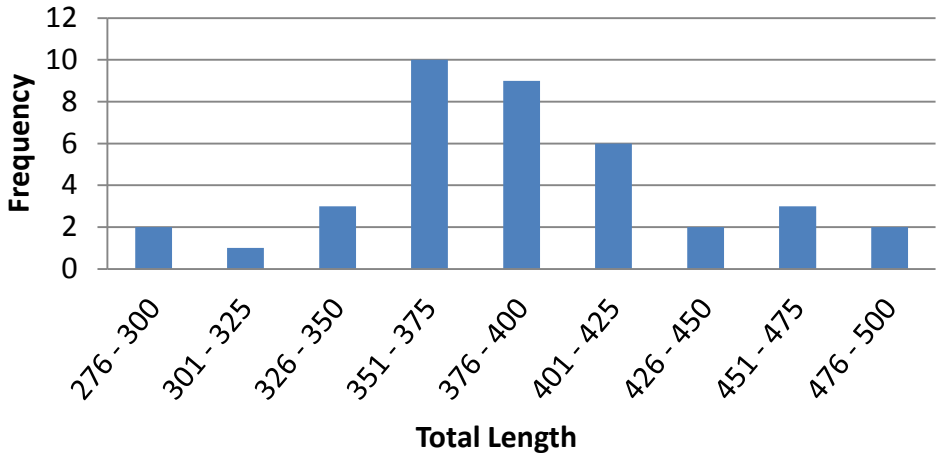


Figure 3. Length frequency histogram of razorback sucker captures in 2011.

Table 2. Year class, Number, and Percentage of fish with known recapture histories.

| Year Class | N | % |
|---|---|---|
| 2000 | 1 | 3.3 |
| 2006 | 1 | 3.3 |
| 2007 | 2 | 6.7 |
| 2008 | 20 | 66.7 |
| 2009 | 6 | 20 |

Table 3. Source of recaptured fish that had previously been stocked.

| Stocking Source | N |
|---|---|
| Uvalde | 3 |
| NAPI – 6 Pack | 2 |
| NAPI – Avocet East | 5 |
| NAPI – Avocet West | 18 |
| NAPI - Hidden | 4 |

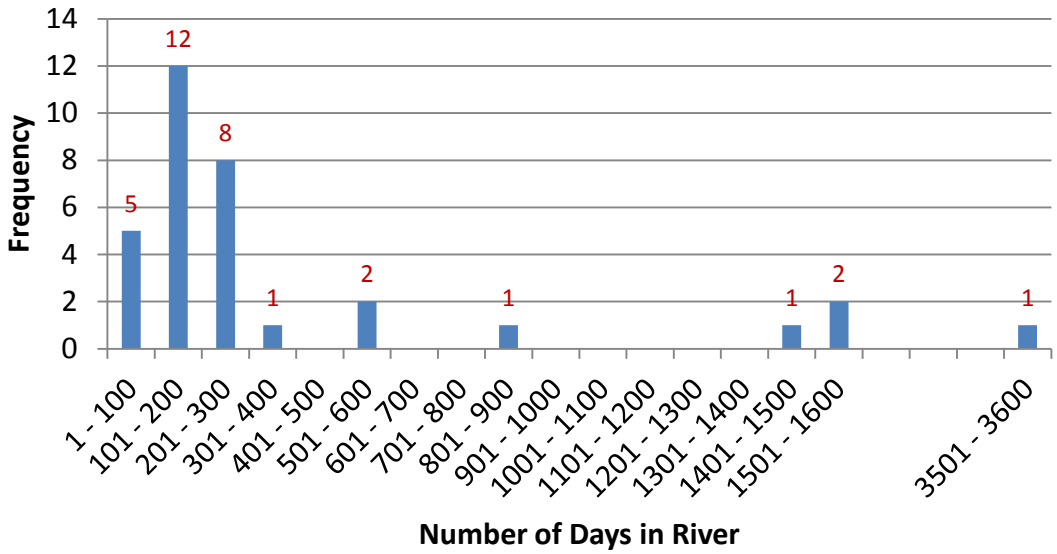


Figure 4. Number of days recaptured razorback suckers are determined to be in the river based on recapture histories.

Movement analysis of within year recaptures events show that two fish had moved from the lower reaches of the river to the fish passage, one within 6 days, and one within 12 days, respectively. We also detected a fish that had previously been captured in Lake Powell during SJRIP survey efforts that had moved upstream, presumably during inundation of the Piute waterfall. One individual detected moving through the passage in 2011 had also been captured in 2010; this is the first instance where the passage has documented a fish utilizing the facility multiple times.

*Colorado Pikeminnow*

There were 707 total Colorado pikeminnow captures; 395 individuals were first encounters, and 312 were recaptures. Of the 395 first encounters, TL ranged from <100mm to 525mm, with the majority occurring between the 251-425mm range (Figure 5). These individuals were represented by the 2008, 2009, and 2010 year class, with the majority (63.8%) from the 2009 class. All first encounters with a total length ≥150mm received a PIT tag.

Recaptured Colorado pikeminnow ranged from 200mm to 575mm, with the majority representing a size class between 251-425mm, much like the first encounter individuals (Figure

6). These individuals were represented by year classes 2005 – 2010, with the majority from the 2008 and 2009 year class (50.2 % and 43.8%, respectively).

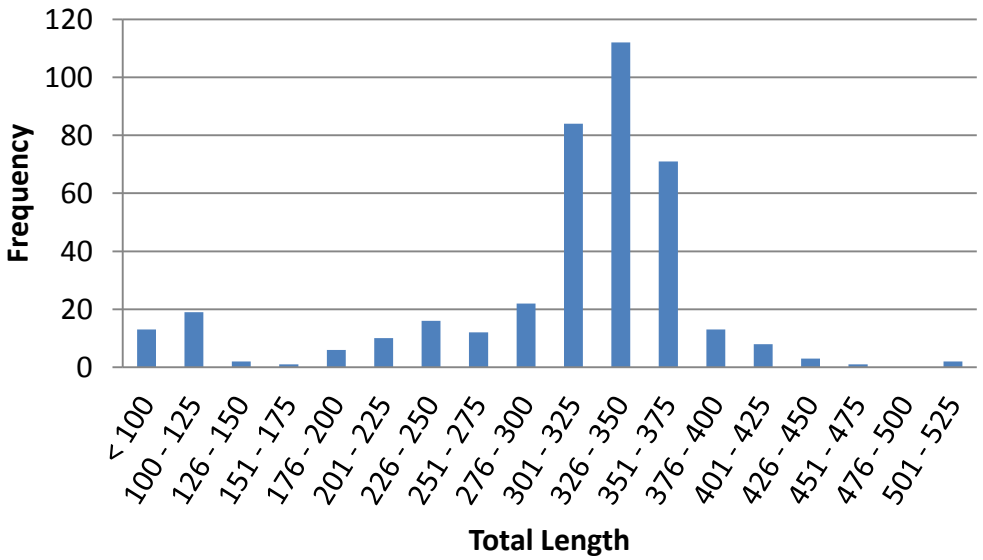


Figure 5. Length frequency histogram for "first capture" Colorado Pikeminnow, 2011.

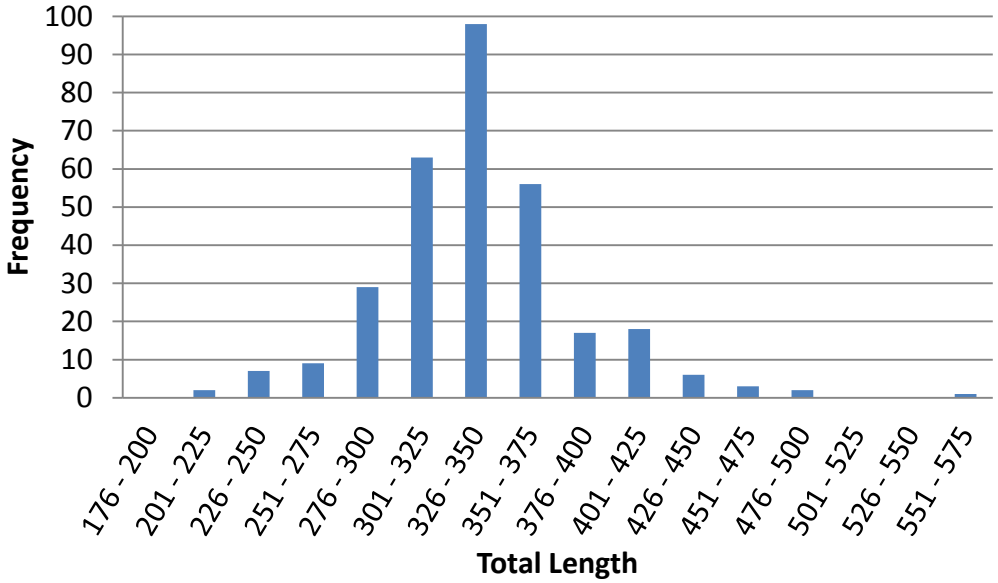


Figure 6. Length frequency histogram for recaptured Colorado pikeminnow, 2011.

Established for the first time in 2011, like the razorback sucker detections, was the occurrence of multiple captures of the same individuals at the passage facility. There were 45 pikeminnow that had previously been captured at the facility; one had been captured in 2008, 10 had been captured the previous year in 2010, and 35 had been captured at least once previously since the passage opened on April 1. One fish was captured moving through the passage 3 times. The majority of recaptures had been in the river 1 to 2 years, as capture histories indicate (Figure 7). However, there were several fish that show retention for 3, 4, and 5 years.

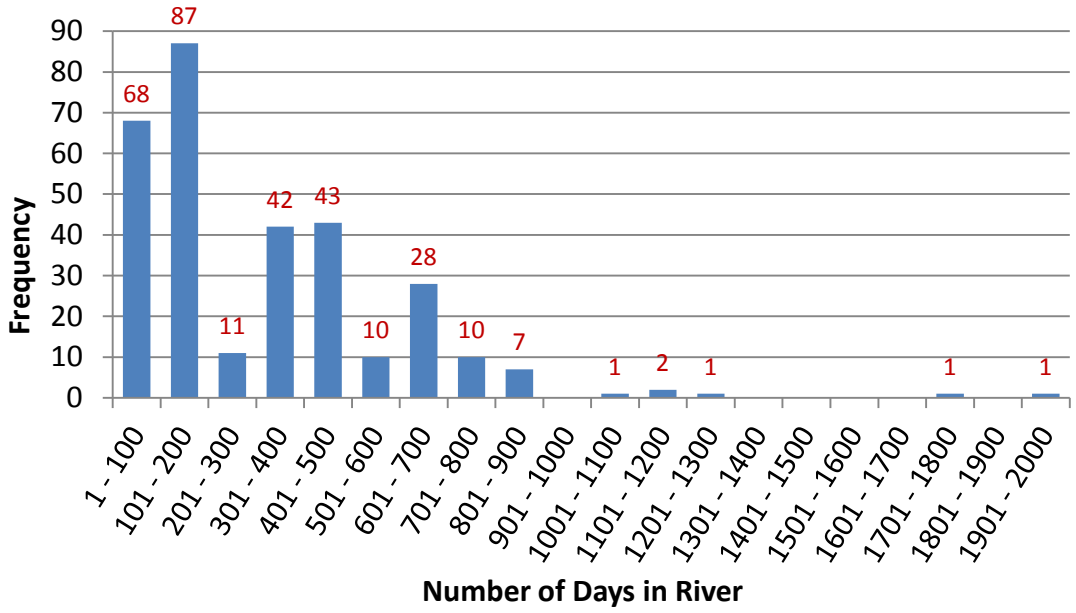


Figure 7. Number of days recaptured Colorado pikeminnow are determined to be in the river based on recapture histories.

Movement seems to be highly variable within the year. The largest movement patterns are from reach 7, which is above the fish passage (Figure 8). Capture histories show these fish had recently been stocked within the year near the San Juan and Animas River confluence. Therefore, these fish moved downstream over the weir, then moved upstream through the passage facility. There were relatively large numbers of individuals that moved from the lower reaches (reaches 1 and 2) that were detected at the passage, as well.

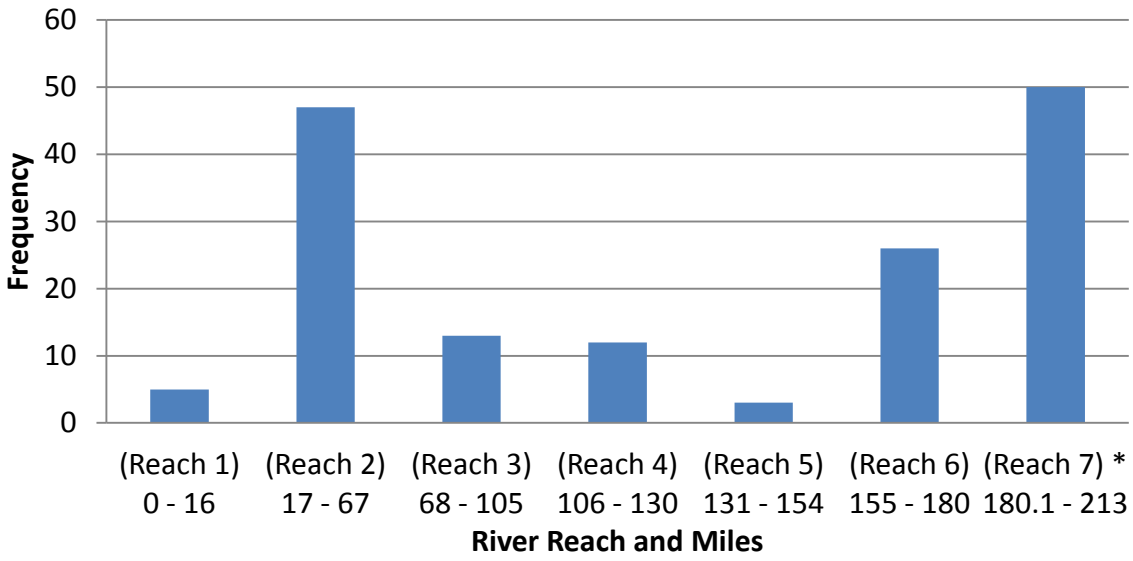


Figure 8. Within-year movement of recaptured Colorado pikeminnow detected at the PNM passage facility. *Note, reach 7 is upstream of the passage facility.

## DISCUSSION

The 2011 PNM fish passage was successful in allowing upstream movement for all native fishes encountered at the passage and removing any non-natives captured. The low number of non-native fish captures in 2011 is encouraging, as well as the higher than normal occurrences of endangered fishes, particularly Colorado pikeminnow. The 2011 season proved productive with record numbers of total fish captures and native fish captures. With exception to the 12 day period in June when the passage was operated non-selectively, operation was able to be maintained on a daily basis, each day of the week, for the entire seven month season. It is difficult to determine exactly what data was "missed" during non-selective operation, but the seasonal non-native and native trends may suggest a moderate number of natives moving through the passage and relatively low number of non-natives moving through the passage.

Native captures tend to be higher during the first part of the season, generally when water conditions are relatively colder, more turbid, and flow relatively high. However, increases in captures occur as flow decreases on the descending limb of the hydrograph. Water conditions are generally beginning to be less turbid and warmer during this period, and this is generally in late July – early August. The spike of captures during this period correlates with all native fish

captures and the non-native channel catfish captures. During the late season (late August, September, and October), river conditions are generally warmer, relatively clear, and flows nearing base flow (500cfs); captures of all fish decline significantly during this period.

Nonnative captures were low overall; however, there was a major increase in channel catfish captures over the previous years. The majority captures of channel catfish notably occurred within an approximate two week period. This influx of catfish is presumably due to a reduction in non-native removal efforts within the removal reach directly downstream of the passage facility (PNM – Hogback reach). Common carp, also a targeted non-native species for removal, remain in relatively low abundances over the operating season, which tends to correlate well with other monitoring and removal analysis within the San Juan River. White sucker had a relatively high abundance and is being identified more frequently relative to previous years. White sucker hybrids also are beginning to be identified as captures at the passage facility. It is difficult to determine if captures white suckers and their hybrids are suggesting an upward trend in occurrence, or whether identification is getting more accurate at the passage. Due to somewhat high turnover with technicians from year to year, fish identification abilities tend to vary.

Razorback sucker captures were quite low; however, there was an increase in 8 individuals over 2010 captures. It is difficult to make any confident trend assessments with only 39 captures, but capture histories show encouraging results that at minimum, there are some relatively large razorback suckers in the river, relatively old fish (representing a 2000 year class and retention up to 10 years), and many fish originating from NAPI, suggesting successful augmentation efforts.

Colorado pikeminnow captures were higher in 2011 than captures over all other years since passage operation began in 2003. This certainly shows an upward trend of pikeminnow occurrences, but is likely also due to more consistent operation of the facility throughout the season. Much like razorback sucker captures, it is encouraging that there are pikeminnow that are retaining in the system long-term (up to 5 years) and there are relatively large pikeminnow (>500mm).

It is difficult to determine what the movement data suggests, but it is clear that a portion of the captured pikeminnow moved downstream over the weir, and then moved back upstream, presumably back to a location near to their stocking origin. There were large movements of both Colorado Pikeminnow and Razorback sucker from the lower reaches of the river in a relatively short amount of time. Some movement occurred over 160 miles in less than a week, suggesting a "determined" behavior, though reason for such movement is largely unknown.

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