STATUS OF THE SAN JUAN TAILWATER FISHERY

A White Paper

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BACKGROUND

Anglers from around the world travel to fish the San Juan River. Surveys have estimated that anglers spend 45,000 days per year on the 4-mile section of the Special Trout Water (STW). Anglers generate 20-30 million dollars a year for the local economy. The value of the San Juan River trout fishery to the New Mexico Department of Game and Fish (NMDGF) and the state of New Mexico is significant and the long-term management is an important component of the economic and recreational resources of the state.

This document is designed to update all stake holders (agencies, sportsmen's groups, conservation organizations, and interested individuals) concerning the current status of the San Juan tailwater fishery and allow them an opportunity to participate in management of the STW on the San Juan River. Input provided by these stakeholders will be used by NMDGF to guide future management actions.

There are three sections in this document. The first section details information associated with operation of Navajo Dam. The second section details information related to the San Juan River Basin. The third section details information related to monitoring and management of the San Juan tailwater fishery.

SAN JUAN RIVER STUDY SITE

For management and monitoring purposes, the San Juan tailwater fishery is divided into two stretches. The special trout water section (STW) extends 4 miles downstream from Navajo Dam. The regular river section (RR) extends 3 miles from the end of the STW to Gobernador Canyon. Each stretch is further divided into reaches (Figure 1). The RR stretch includes reaches A-D and the STW stretch includes reaches E-I. The STW is sometimes further divided into a lower section (reaches E and F, designated LSTW) and an upper section (reaches G-I, designated USTW).

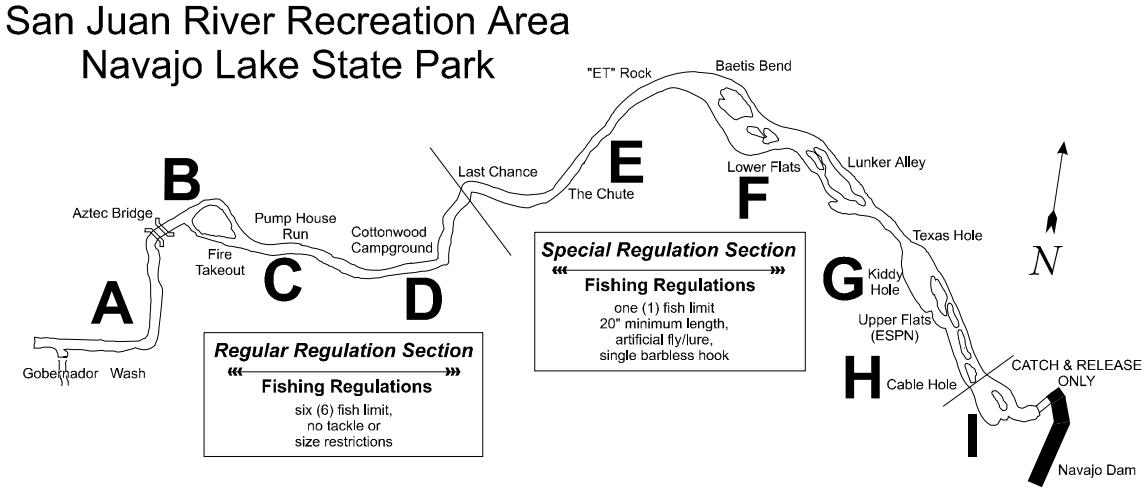


Figure 1. Designation of reaches for management and monitoring purposes along the San Juan tailwater.

NAVAJO DAM OPERATIONS

In general, water management of Navajo Reservoir is under the purview of the U.S. Bureau of Reclamations (BOR). Specific guidelines for management of the conservation pool are set forth in the Chapter 3 Public Law 485 *Colorado River Storage Project-Authority to Construct, Operate and maintain* (http://www.wildlife.state.nm.us/recreation/fishing/documents/NavajoDamEnablingLegislation.pdf). After completion of Navajo Dam in 1962, criteria governing releases of water from Navajo Dam focused primarily on meeting irrigation needs, providing flood control, and maintaining a suitable recreation pool in Navajo Reservoir. During the last decade, the criteria and associated patterns for releasing water from the dam have changed. The purpose of modifying the operation of Navajo Dam and Reservoir was to implement the flow requirements of the Endangered Species Act (ESA).

Current and future discharge patterns from Navajo Dam comply with guidance provided in *Flow Recommendations for the San Juan River* (http://www.fws.gov/southwest/sjrip/DR_FRR.cfm). This document was developed by several different federal, state, tribal agencies, and private groups, including Bureau of Indian Affairs, U.S. Fish and Wildlife Service (FWS), BOR, Jicarilla Apache Tribe, Navajo Nation, Southern Ute Tribe, Colorado Division of Wildlife, NMDGF, water users in the basin, and Bureau of Land Management (BLM).

These recommendations enable water development in the basin to proceed in compliance with Federal and State laws, interstate compacts, court decrees, and Indian trust responsibilities. To accomplish these, Navajo Dam and Reservoir is operated to provide water releases designed to maintain and improve habitat for the razorback sucker and the Colorado pikeminnow, while maintaining the authorized purposes of Navajo Reservoir.

In 2006, BOR completed a final environmental impact statement (EIS, http://www.usbr.gov/uc/envdocs/eis/navajo/navresops_Feis.html) on the operation of the reservoir to meet ESA related flow recommendations for the San Juan River. The flow recommendations were developed by the San Juan River Basin Recovery Implementation Program and adopted by the FWS to conserve populations of Colorado pikeminnow and razorback sucker consistent with recovery goals established under the ESA, and proceed with water development in the basin in compliance with Federal and State laws, interstate compacts, court decrees, and Federal trust responsibilities to Native American Tribes. *Flow Recommendations for the San Juan River* calls for Navajo Reservoir to be operated in such a manner as to better mimic the natural (pre-dam) hydrograph of the San Juan River, which is characterized by high peak flows in the spring and lower base flows the rest of the year. BOR has operated the reservoir in this manner since 1999.

The EIS was necessary because *Flow Recommendations for the San Juan River* called for releases to be as low as 250 cubic feet per second (cfs), which was outside the historical, normal operating limits. In the development of the EIS, BOR considered 3 alternatives, no action, a 250 cfs minimum release and 5,000 cfs maximum release alternative (250/5000), and a 500 cfs minimum release and 5,000 maximum release alternative (500/5000). The no action and 500/5,000 alternatives were rejected due to these alternatives not fully meeting the flow recommendations by not storing sufficient

water to provide the necessary spring peak releases. Meeting the flow recommendations is important to avoid jeopardizing the continued existence of endangered fish. Therefore, the 250/5,000 alternative action was accepted.

Average annual discharge rates from Navajo Dam from 1963-2007 were 1,109 cfs. Discharge rates ranged from a high of 2,546 cfs in 1985 to a low of 320 cfs in 1963. Average discharge was highly variable across years (Figure 2). Average daily discharge rates during an average year were fairly stable during winter and spring months, ranging from 500-1,000 cfs (Appendix, Figure A1). Discharge rates then typically increased to 5-6,000 cfs for 1-2 months (typically May, June, or July) before decreasing back to previous rates. The main difference between discharge rates for average years and high and low discharge years were the extent and magnitude of the late spring or early summer increases (Appendix, Figure A1). Average daily discharge rates from 1963-1999 fell below 500 and 250 cfs 20.9 and 2.2% of the time, respectively. For the period 2000 to 2007, average daily discharge fell below 500 and 250 cfs 47.1 and 3.7% of the time, respectively.

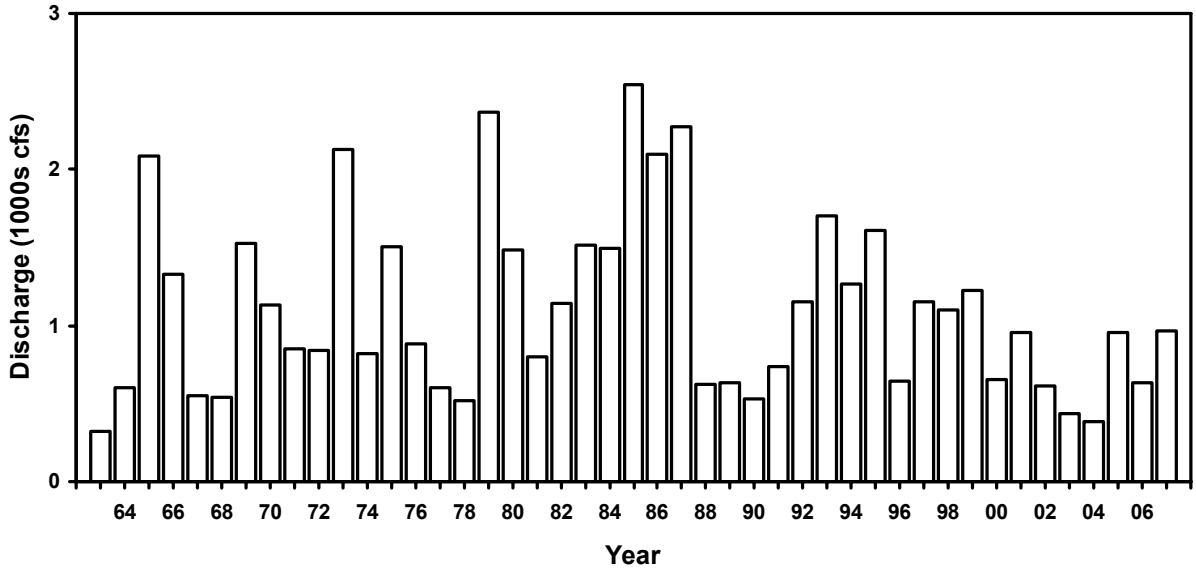


Figure 2. Annual mean daily discharge rates for the San Juan tailwater, 1955-2007.

SAN JUAN RIVER WATERSHED

Management of site facilities at Navajo Lake and along the San Juan River is primarily under the jurisdiction of New Mexico State Parks (NMSP). Land ownership in the San Juan River watershed is a combination of NMSP, BOR, BLM, and private entities.

The watersheds of the San Juan River are composed of sandstone, shale, siltstone, and mudstone. Each of these components is highly erodible, especially given the low frequency, high intensity storm events that characterize the region. The United States Geological Service (USGS) conducted a study of the impact of oil and gas development on sedimentation in Largo Canyon in San Juan County, New Mexico (*Effects of Roads and Well Pads on Erosion in the Largo Canyon Watershed, New Mexico, 2001–02*,

http://pubs.usgs.gov/sir/2006/5039/pdf/sir2006-5039.pdf). Largo Canyon is located along the San Juan River below the STW. Because of the proximity of this study area and the similar geology to the area along the STW, erosion rates determined from this study were used to generate potential sediment outputs from areas surrounding the STW.

The three watersheds impacting the San Juan River in and around the STW include Simon Canyon/Rex Smith Wash, Pump Canyon, and Lower Gobernador Canyon (Figure 3) and were defined using USGS Hydrologic Unit Maps (http://water.usgs.gov/GIS/huc.html).

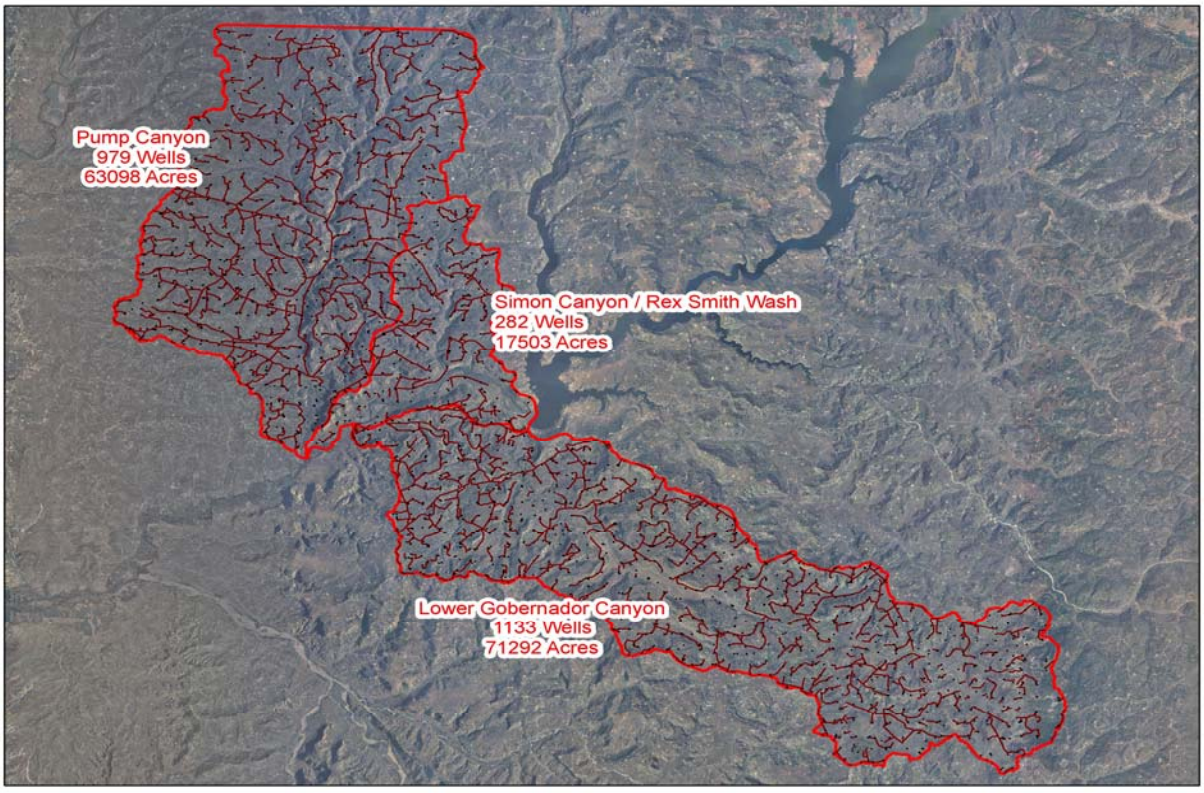


Figure 3. Three watersheds impacting the upper San Juan River. Access roads and numbers of wells are shown for each watershed. Well data was obtained from the New Mexico Oil Conservation Division and confirmed with data from BLM. Road information was obtained from the BLM.

The potential sediment contribution of roads, well pads, and hillslopes in each of the three watersheds can be estimated by application of the erosion rates determined by information provided in *Effects of Roads and Well Pads on Erosion in the Largo Canyon Watershed, New Mexico, 2001–02,* and was used to estimate the potential contribution of each of the components for each of the watersheds (Table 1; Appendix, Table A1). Across all three watersheds potential sediment contributions of each component were similar, with roads contributing approximately 1%, well pads 12%, and hillslopes 87%. These erosion data indicate that while oil and gas development contributes some

sediment, the vast majority of the sediment entering the San Juan River is caused by natural erosive processes.

Table 1. Sedimentation potential for roads, well pads, and hillslopes for each watershed.

Watershed	Surface Type	Surface Area (ft^2)	Sediment Potential (ft^3/yr)	Percent Contribution
Simon Canyon/ Rex Smith Wash	Roads	32,937,770	32,937	1.3
	Well Pad	28,256,682	31,0823	12.7
	Hillslopes	701,236,228	2,103,708	85.9
Pump Canyon	Roads	32,937,770	32,937	0.4
	Well Pad	98,096,779	1,079,064	12.5
	Hillslopes	2,617,514,331	7,852,543	87.1
Lower Gobernador Canyon	Roads	36,224,078	36,224	0.4
	Well Pad	115,870,777	1,274,578	12.0
	Hillslopes	2,953,384,665	8,860,154	87.6

The New Mexico Environment Department completed an impairment study of the San Juan River in September 2004 (http://www.nmenv.state.nm.us/swqb/Projects/SanJuan/SBD/DRAFT-SJR_SBD_Protocol09_14_04.pdf). The study determined the reach from Navajo Dam to Canon Largo fully supported aquatic life and there was no impairment based on sediment. The study also detailed the geology of the region and states that sedimentation is to be expected in this region based on the geology and intense summer precipitation. These findings provide additional support for the erosion analysis detailed above.

SAN JUAN TAILWATER FISHERY

Management of fisheries resources associated with the San Juan River is the responsibility of the NMDGF. The NMDGF actively manages the San Juan tailwater by extensively monitoring of both sport fish communities and anglers. This information is then used to develop stocking programs, develop and implement sound regulations, and initiate habitat enhancement projects.

Monitoring

Sport Fish Community Surveys

Methods

Annual electrofishing surveys were conducted in mid-to-late fall to determine the relative health of the sport fish community. Sampling effort was evenly distributed among both stretches of the tailwater. The primary method of collection incorporated a

Smith-Root 5.0 GPP electrofisher mounted on a 14 foot rubber raft with a globe-shaped fixed electrode suspended from a boom on the bow of the raft. Stunned fish were netted by one or two individuals who place the trout in a live well for processing. Fish were weighed, measured and examined before being released back into the river. In 2000 no survey was conducted due to adverse weather conditions.

Results

Electrofishing catch rates for the San Juan tailwater from 1995-2007 were almost 380 fish/hr of sampling. Catch rates ranged from a high of over 650 fish/hr in 2004 to a low of 100 fish/hr in 2002 (Figure 4). Overall there seemed to be an increase in catch rates from 1995-2007, as well as a decline in catch rates from reach I downstream through reach A (Figure 5) and from stretch 1 downstream through stretch 3 (Figure 6). Annual trends in catch rates by reach (Appendix, Figure A2) and by stretch (Appendix, Figure A3) were similar to those just described.

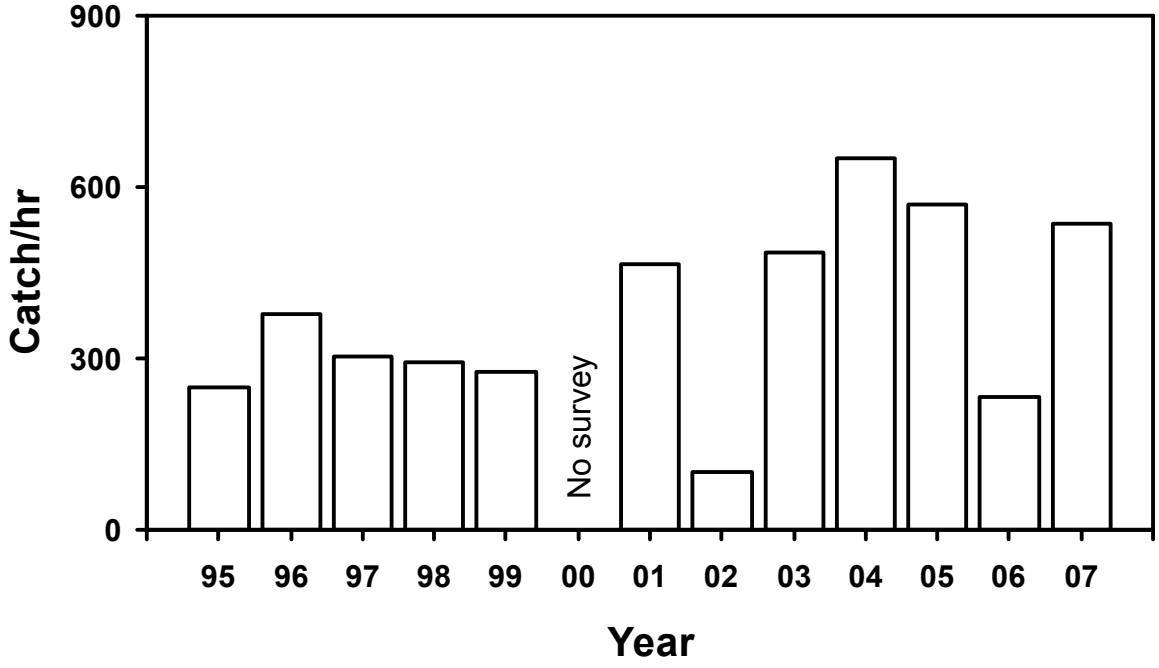


Figure 4. Annual electrofishing catch rates for the San Juan tailwater, 1995-2007.

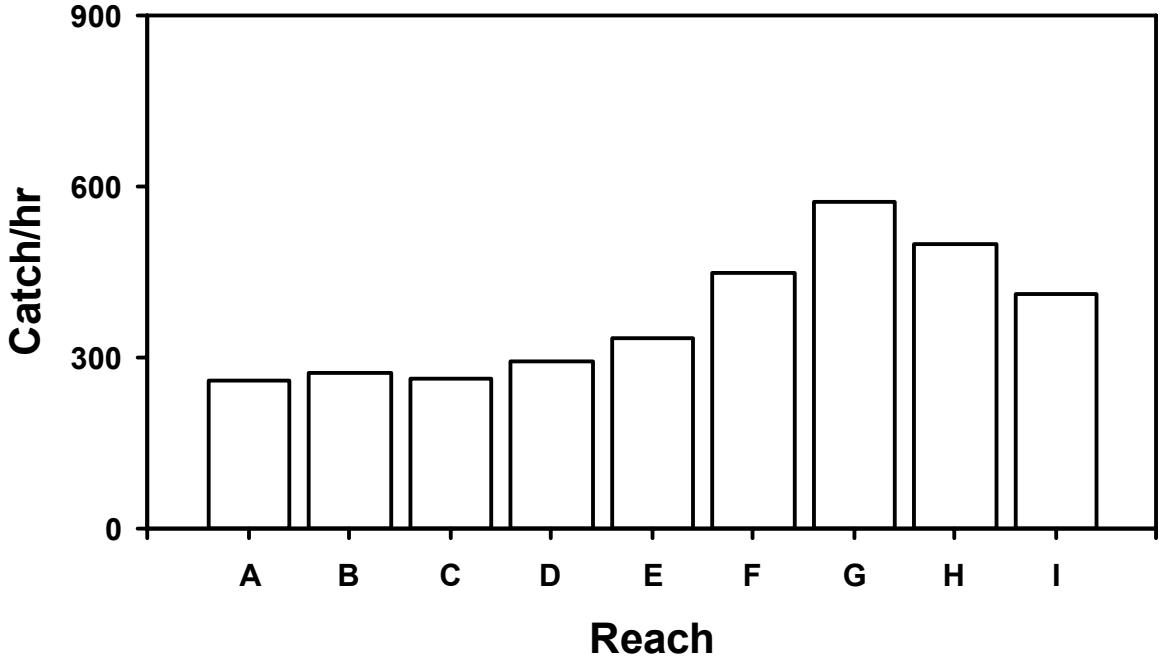


Figure 5. Electrofishing catch rates by reach for the San Juan tailwater, 1995-2007.

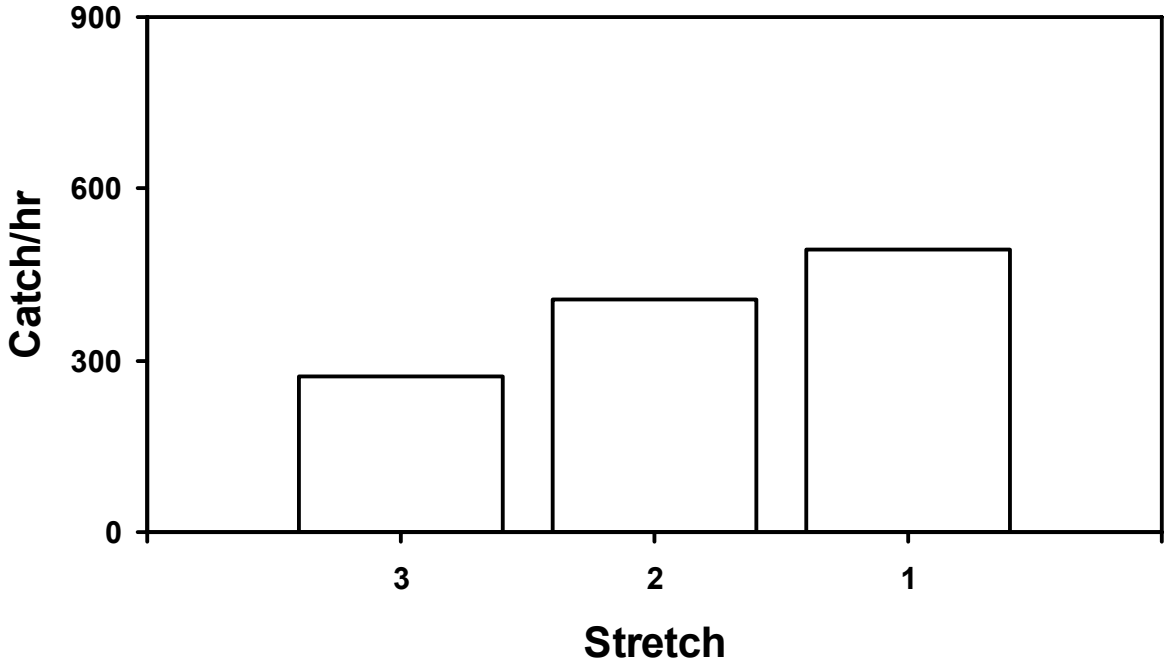


Figure 6. Electrofishing catch rates by stretch for the San Juan tailwater, 1995-2007.

Condition (K) factors are based on fish lengths and weights and are used to determine the overall health of a fish. Fish are considered healthy when their K-factor equals or exceeds “1.” Mean K-factor for fish collected in the San Juan

tailwater from 1995-2007 was 1.16. K-factors ranged from a high of 1.202 in 1998 to a low of 1.082 in 2004. Fish health was high across all years (Figure 7) as well as all reaches within the STW (Figure 8). Annual trends in condition by reach (Appendix, Figure A4) were similar to those just described.

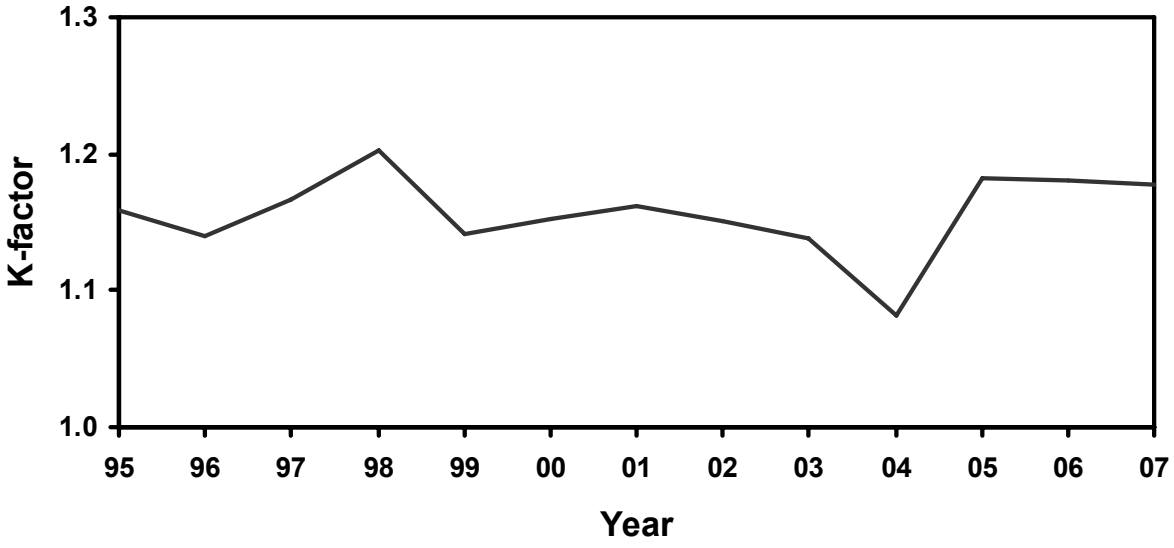


Figure 7. Average annual estimates of health of fish collected with electrofishing in the San Juan tailwater, 1995-2007.

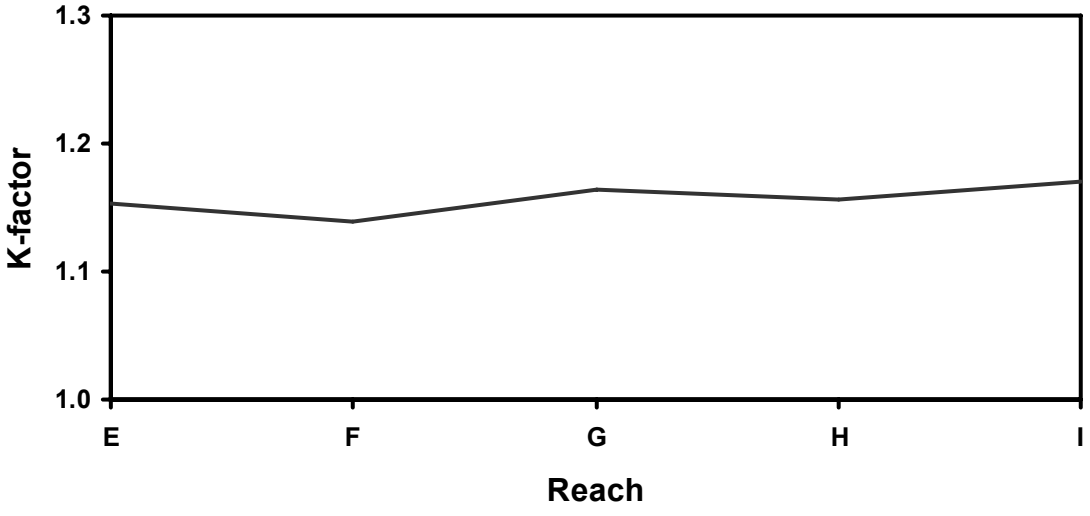


Figure 8. Average estimates by reach of health of fish collected with electrofishing in the San Juan tailwater, 1995-2007.

Angler Surveys

Methods

Angler use and catch surveys were conducted using standardized methods developed by the NMGF. Surveys were evenly distributed among all reaches of the tailwater. Angler use was estimated using information derived by conducting standardized pressure counts. These methods included counting the number of anglers in each section observed at 1100 hours on any given day, and counts were conducted several times each month. The average number of anglers in each section was multiplied by the number of days in a particular month to get an estimate of total number of anglers. Anglers were also interviewed at the end of their angling day and asked to provide information on hours fished, numbers of fish caught, numbers of fish harvested, sizes of fish caught, residence, and (beginning in 2004) satisfaction with there angling experience. This information was used to calculate pressure estimates, catch rates, percent of fish >20" caught, angler origin, and levels of angler satisfaction. An average of almost 1,000 anglers were interviewed annually from 1995-2007. Numbers of anglers interviewed ranged from a high of 1,832 in 2000 to low of 389 in 2005 (Figure 9). Numbers of interviews declined to an annual average of 400 starting in 2003 because of manpower shortages. However, 400 interviews is the minimum number needed to provide statistically reliable information.

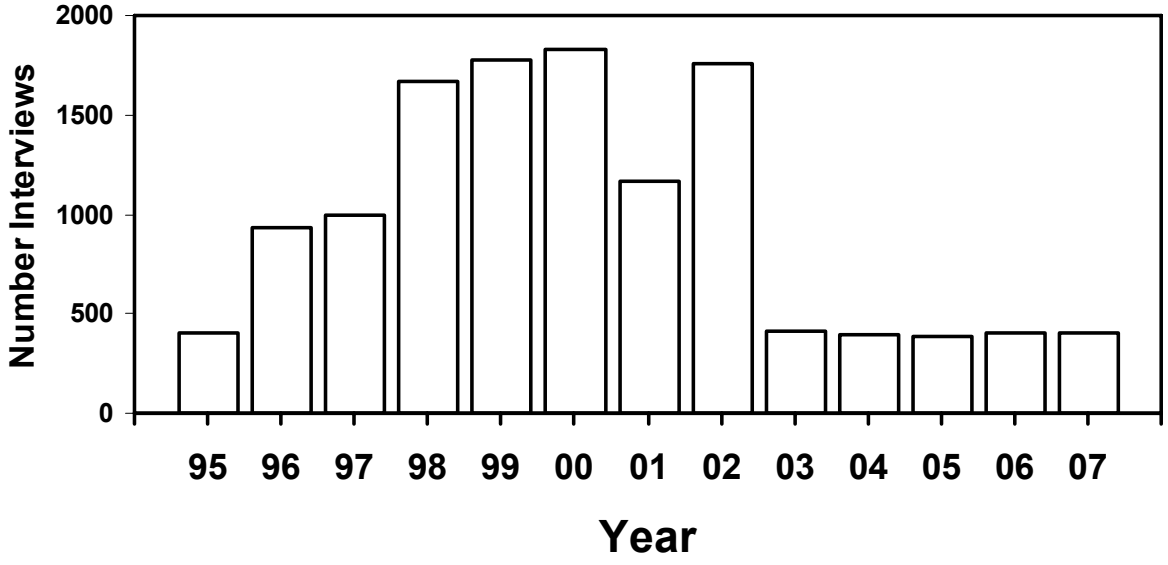


Figure 9. Numbers of anglers interviewed while conducting creel surveys in the San Juan tailwater, 1995-2007.

Results

Almost 3.5 million hours of angling pressure was expended in the San Juan tailwater fishery from 1995-2007. Annual average pressure estimates were about 269,000 hr and ranged from a high of 337,000 hr in 1996 to a low of 220,000 hr in 1995 (Figure 10). During a typical year, angling pressure increased from January through March, declined

slightly through May, and then increased to its greatest levels from July through October (Figure 11). Angling pressure is typically greater in the STW (especially reaches F, G, and H) and less in the RR (especially reach C; Figures 12, 13). Annual trends in angling pressure by month and reach (Appendix, Figure A5) and month and stretch (Appendix, Figure A6) were similar to those just described.

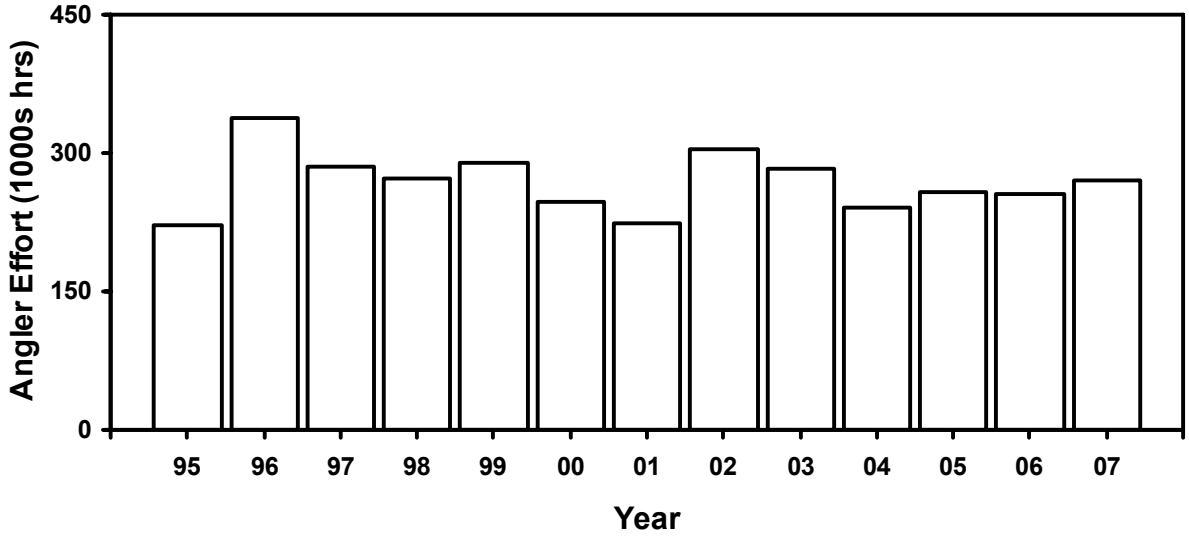


Figure 10. Annual estimates of angling pressure for the San Juan tailwater, 1995-2007.

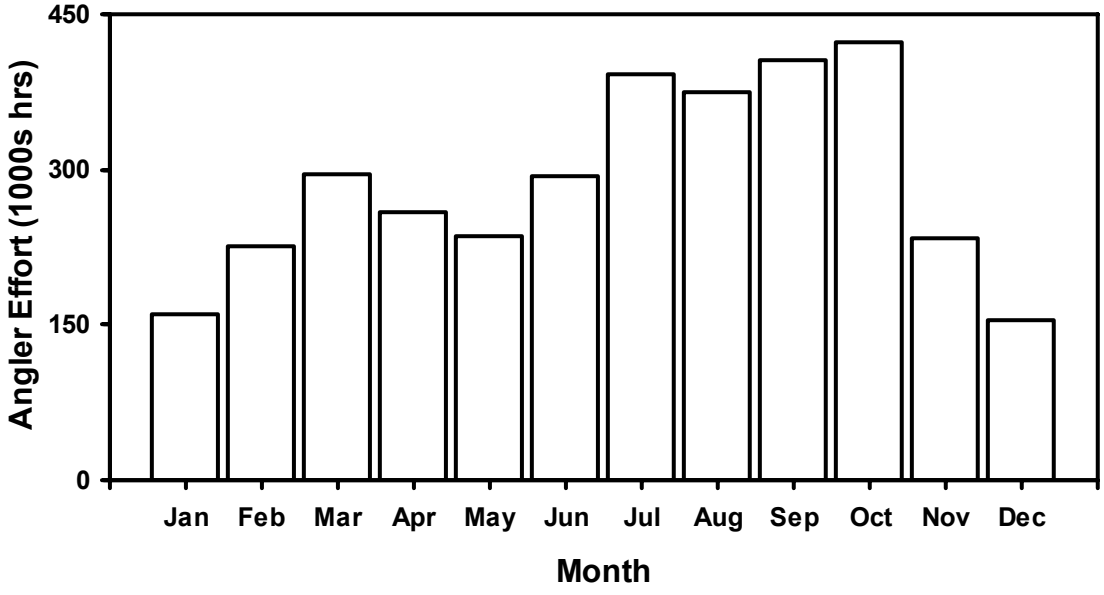


Figure 11. Estimates of angling pressure by month for the San Juan tailwater, 1995-2007.

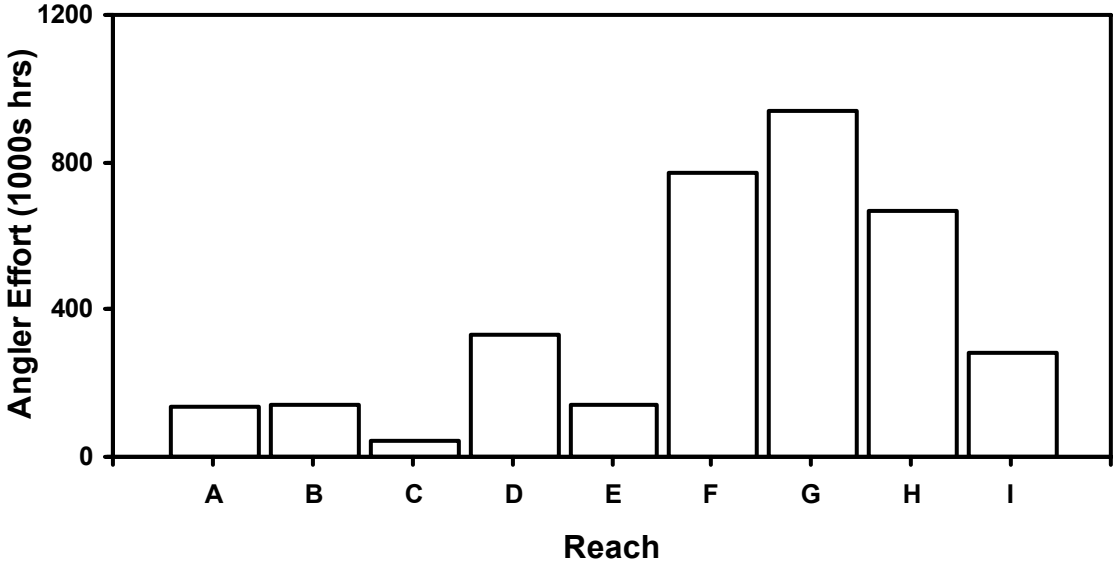


Figure 12. Estimates of angling pressure for the San Juan tailwater by reach, 1995-2007.

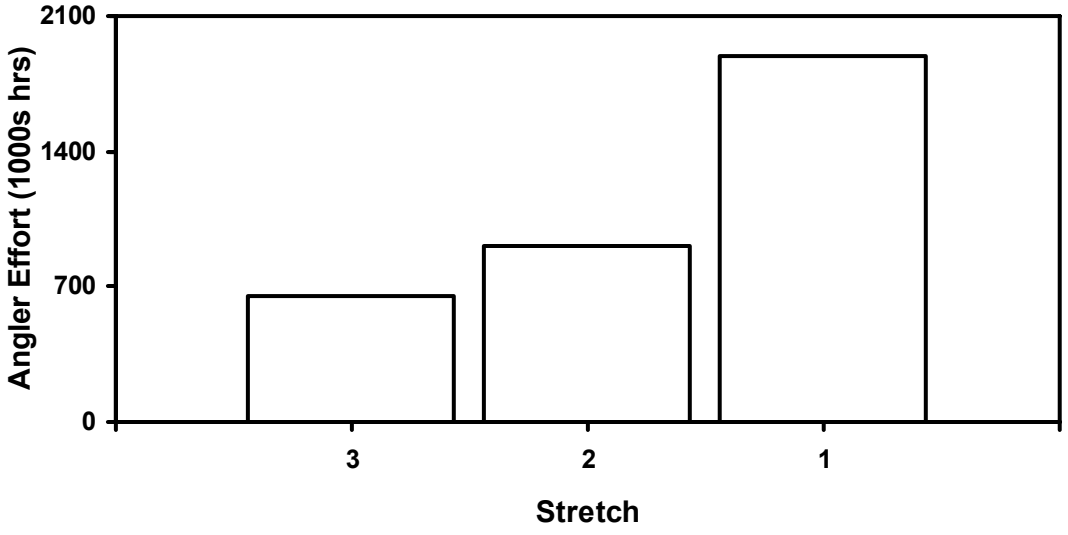


Figure 13. Estimates of angling pressure for the San Juan tailwater by stretch, 1995-2007.

Angler catch rates in the San Juan tailwater averaged almost 1 fish/hr hour from 1995-2007. Catch rates for the RR, LSTW, and USTW were 0.54 fish/hr, 1.14 fish/hr, and 1.22 fish/hr, respectively. Annual catch rates were fairly consistent over all years

and ranged from 1.22 fish/hr in 1996 to of 0.81 fish/hr in 1995 (Figure 14). During a typical year, angler catch rates increased from January through July, declined in August, and then increased again in November (Figure 15). Annual trends in angler catch rates by month and stretch were similar to those just described (Appendix, Figure A7).

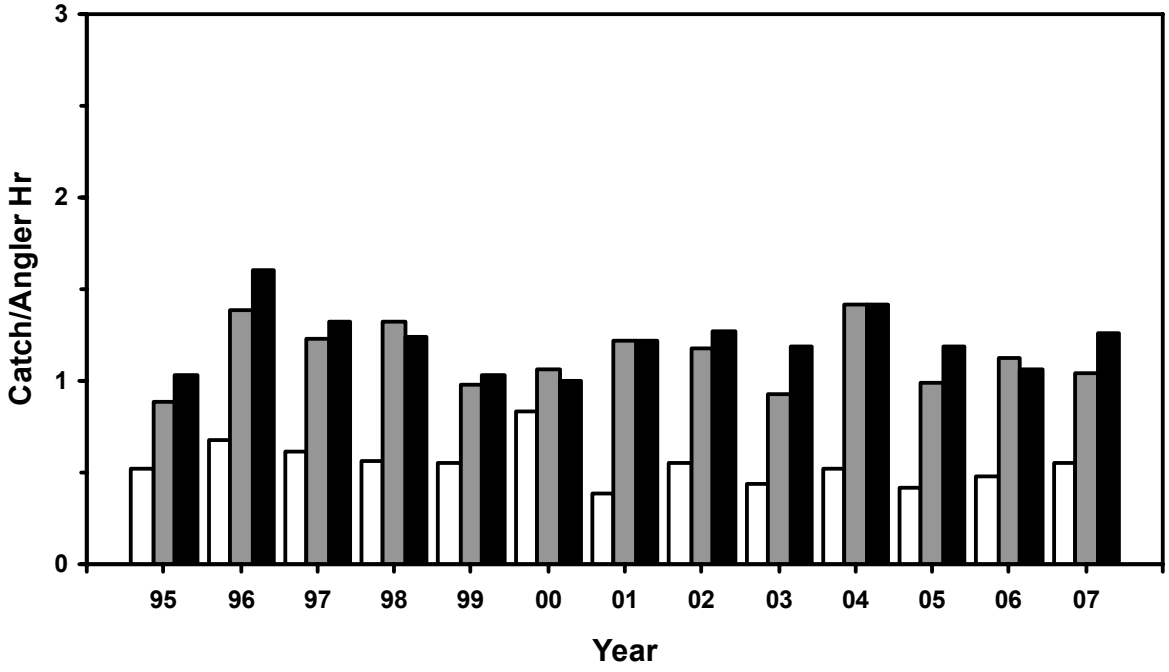


Figure 14. Annual estimates of angler catch rates by stretch (□=RR, ■=LSTW, ■=USTW) for the San Juan tailwater, 1995-2007.

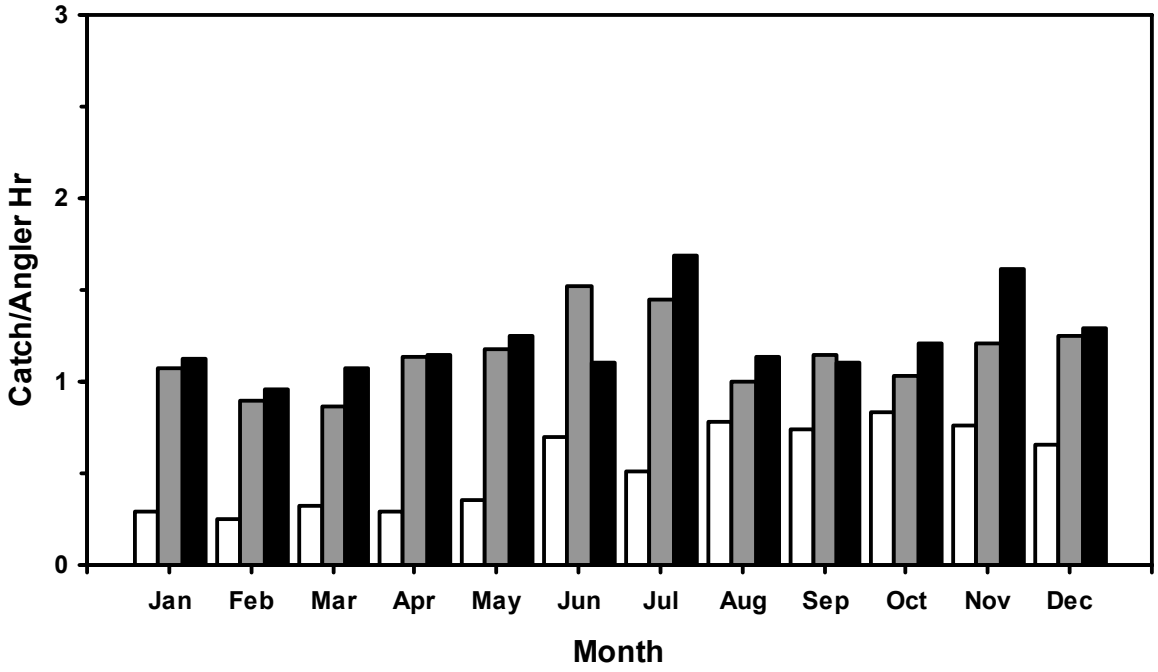


Figure 15. Estimates of angler catch rates by month and stretch (□=RR, ■=LSTW, ■=USTW) for the San Juan tailwater, 1995-2007.

Over 5% of fish caught in the STW from 1995-2007 were >20". Percentages of fish >20" caught in the LSTW and USTW were 6.4 and 5.3, respectively. Estimates showed no distinct annual or seasonal trends (Figures 16, 17). Similarly, no distinct trends by river stretch were evident. (Appendix, Figure A8).

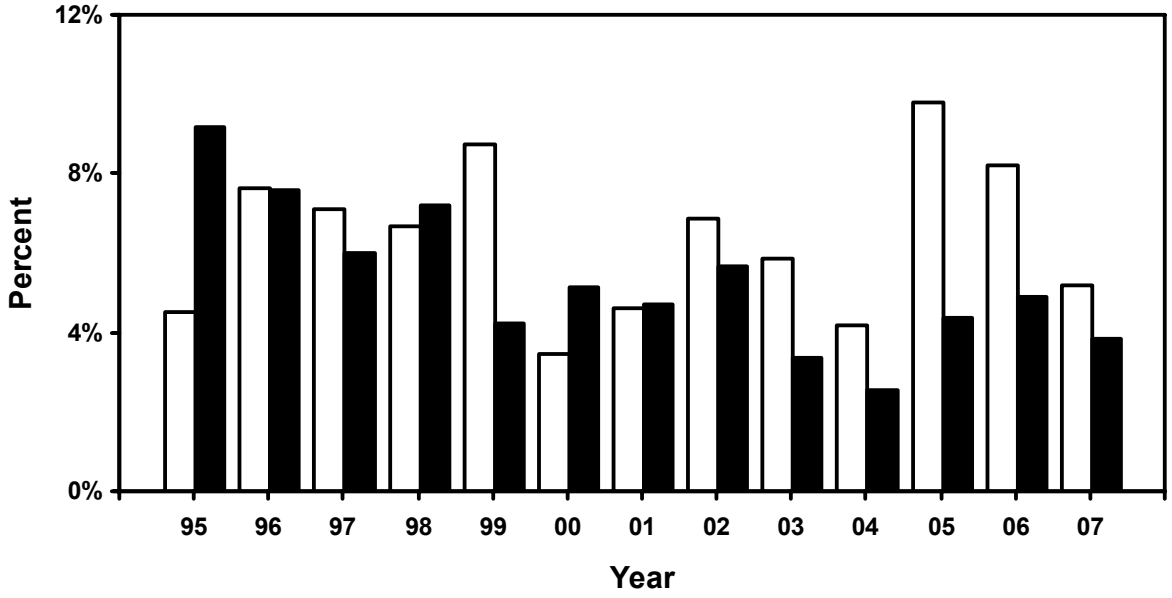


Figure 16. Annual percentage of fish >20" caught by stretch (□=LSTW, ■=USTW) for the San Juan tailwater, 1995-2007.

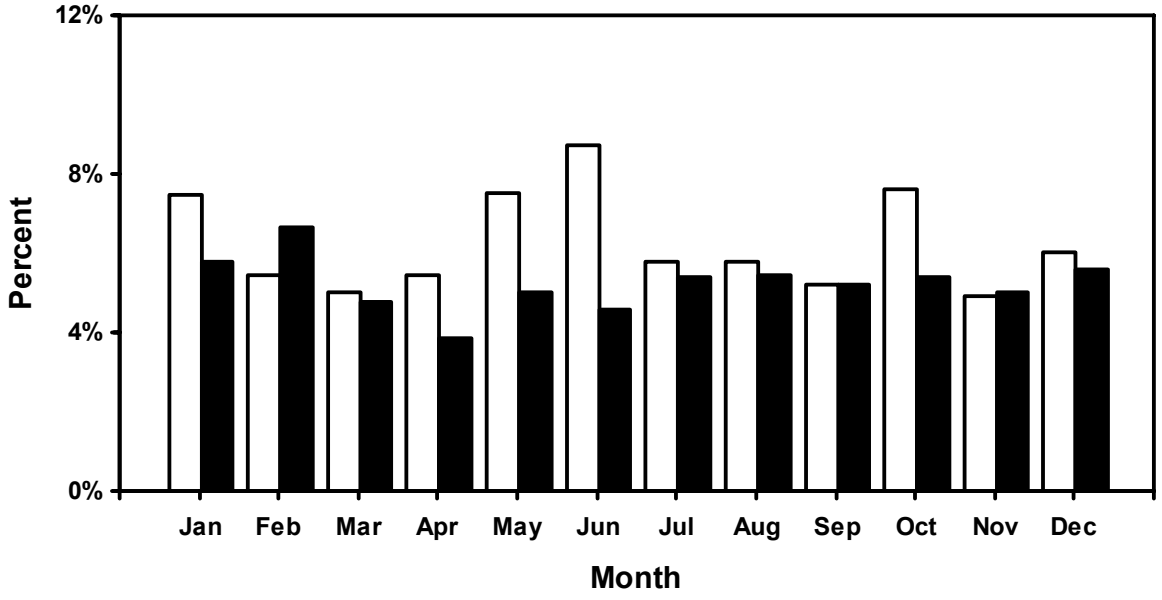


Figure 17. Percentage of fish >20" caught by month and stretch (□=LSTW, ■=USTW) for the San Juan tailwater, 1995-2007.

Evaluation of residence of anglers fishing the San Juan tailwater indicated 62% were from “out-of-state”, 28% were from New Mexico, and 10% were from San Juan County. Percentage of residency across years was fairly consistent (Figure 18).

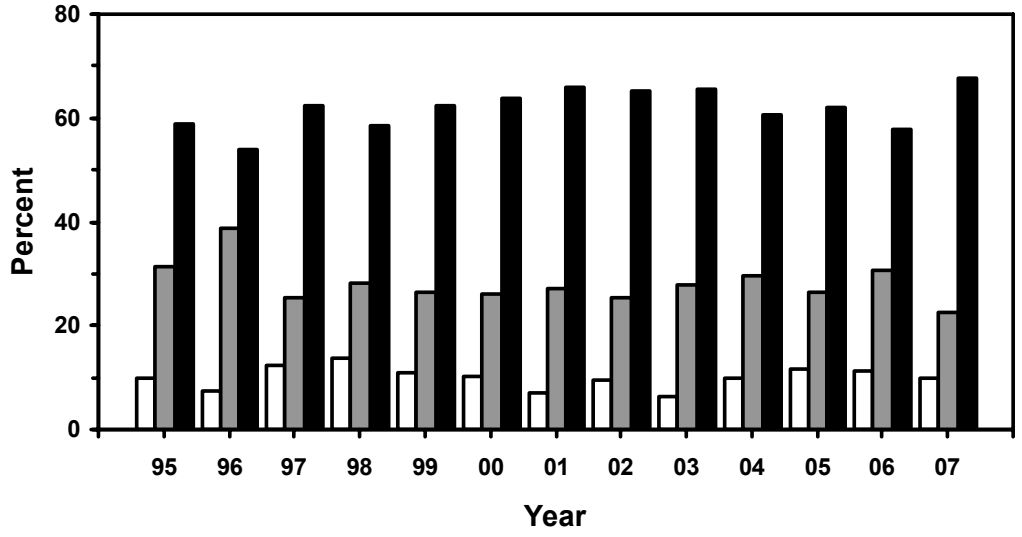


Figure 18. Annual percentage of angler residency (□=San Juan County, ■=New Mexico, ■=”out-of-state”) for anglers fishing in the San Juan tailwater, 1995-2007.

When asked the question “How satisfied are you with your fishing experience?” 92% of anglers fishing the San Juan tailwater responded they were satisfied. This level of satisfaction was consistent across years (Figure 19).

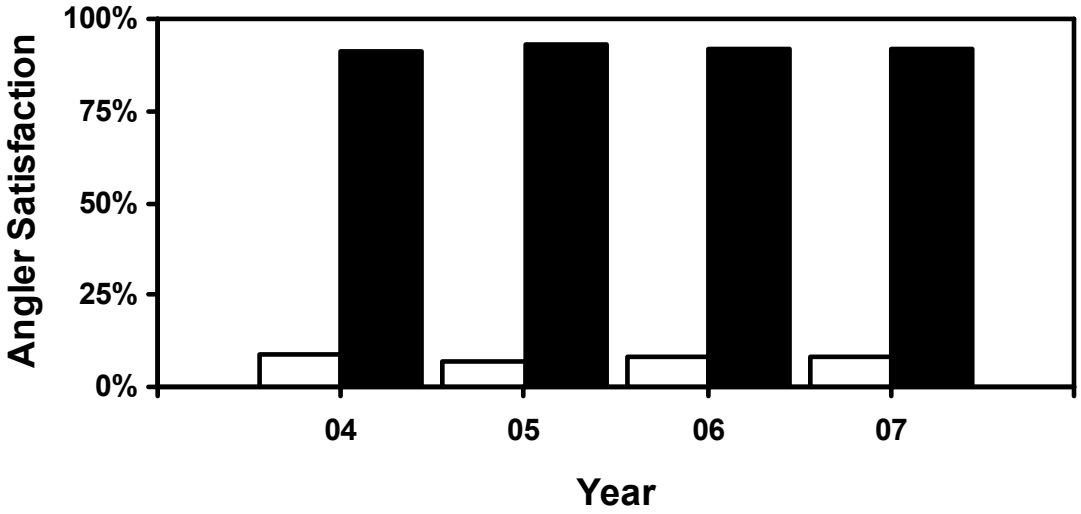


Figure 19. Annual percentage of angler satisfaction (□=not satisfied, ■=satisfied) for anglers fishing in the San Juan tailwater, 2004-2007.

Management

Stocking

Rainbow trout reproduction in the San Juan River is limited. Consequently, NMDGF has consistently stocked the tailwater below Navajo Dam since its completion in 1963. NMDGF has two different strategies for managing the San Juan River trout fishery. The management strategy for the STW is to create a quality trout angling experience. Therefore on average almost 60,000 fingerling-sized (<8”) rainbow trout have been stocked annually in this section of the river from 1998-2007 (Figure 20). The primary reason for stocking fingerlings is that trout grown in the river are more likely to exhibit wild traits. For example, they convert to natural sources of food, they are typically stronger and therefore fight harder when caught, and they are more aesthetically pleasing to anglers. The reminder of the river is managed as a put-and-take fishery. Consequently, on average about 46,000 catchable-sized (8-12”) rainbow trout have been stocked annually from 1998-2007. This section has also on occasion been stocked with fingerlings (Figure 21).

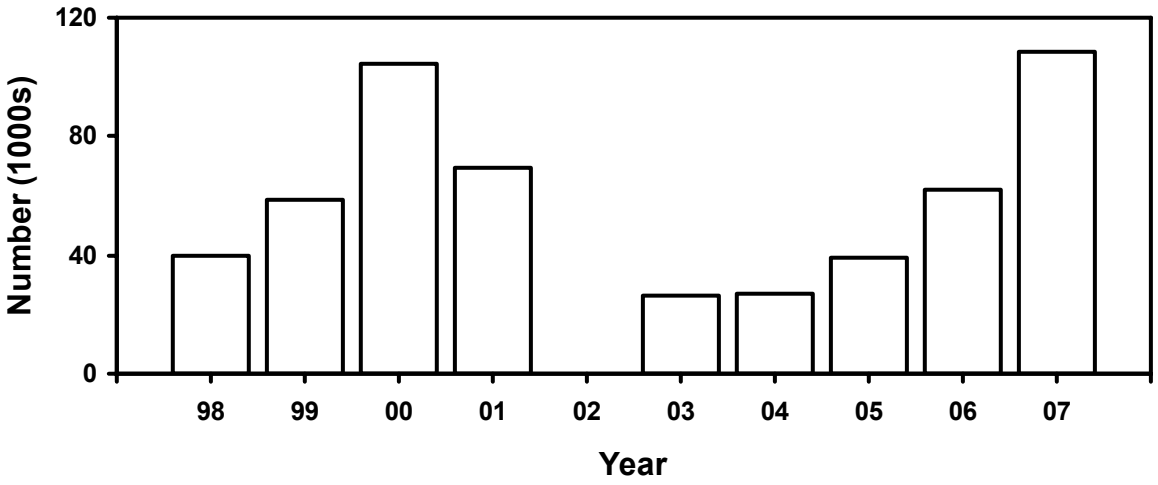


Figure 20. Annual numbers of fingerling-sized rainbow trout stocked in the STW section of the San Juan tailwater, STW, 1998-2007.

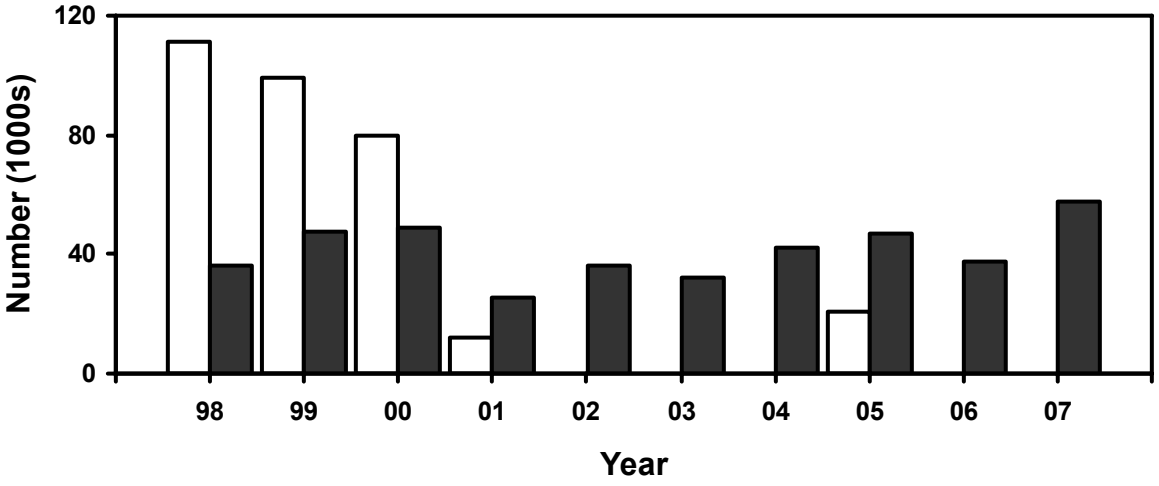


Figure 21. Annual numbers of fingerling-sized (□) and catchable-sized (■) rainbow trout stocked in the RR section of the San Juan tailwater, 1998-2007.

Regulations

The STW portion of the San Juan River is divided into two management units, each having different fishing regulations. The first 0.25-mile section (Reach I) is managed with a catch-and-release fishing regulation and a tackle restriction of a 2-fly limit with single, barbless hooks only. Regulations in the next 3.75-mile section (Reaches E-H) have changed several times since 1966 (Table 2). The current regulation is a tackle restriction of a 2-fly limit with single, barbless hooks only, but allows a daily bag limit of one trout with a minimum size limit of 20 inches. The RR portion of the San Juan tailwater (Reaches A-D) provides opportunities for anglers to catch a 5 fish limit using baits, lures, and flies with no size restriction.

Table 2. History of regulation changes for the STW portion of the San Juan tailwater.

Year	Bag limit	Size limit (in)	Tackle Restriction	STW length (m)
1966	6	12	Artificial fly, barbed lure	1
1971	4	15	Artificial fly, barbed lure	2.75
1980	2	16	Artificial fly, barbed lure	2.75
1983	1	18	Artificial fly, barbless lure	3
1985	1	20	Artificial fly, barbless lure	4
2008	1	20	Artificial fly, 2-fly limit, barbless lure	4

Habitat Enhancement

The EIS estimated the 250/5000 flow recommendation would potentially lead to a reduction in trout habitat of 30% in the USTW and 37% in the LSTW. As a result, BOR has expressed an interest in working with NMDGF and other agencies as resources and funding become available to implement measures to lessen the effects of these flows on the San Juan tailwater in general and trout habitat in particular.

Habitat enhancement projects were initiated in the San Juan River immediately downstream of Navajo Dam to improve trout habitat. These efforts were a cooperative venture involving several agencies, including NMDGF, NMSP (Navajo Lake State Park), BOR (Durango Office), BLM (Farmington Field Office), and several private entities that provide additional funding. The overall goals were as follows:

- Increase the sediment transport over the affected river stretch thereby exposing gravel/cobble substrate. The accessibility of gravel/cobble substrate would increase invertebrate production and in turn enhance the prey base for trout.
- Increase invertebrate standing crop.
- Provide additional spawning habitat for trout in the form of exposed gravel.
- Create pools of deeper water where trout can rest, feed and be somewhat immune from avian predation and the impact of low flows.
- Create more structural complexity within the stream channel which would provide variation in water velocity, depth, temperature and cover.

The first phase of the in-stream habitat improvement project was completed in December 2005, and consisted of 5 line structures (2 large J-hook structures and 3 large cross veins) and 12 boulder clusters in approximately 3/8 mile of river. The second phase was completed in November 2006, and consisted of 6 line structures (6 large cross veins) and 12 boulder clusters in approximately 3/8 mile of river. The third phase was completed in November 2007, and consisted of 4 bank weirs, 4 log/debris piles, numerous boulder clusters, channel shaping, and pool excavation. The overall project placed approximately 1,100 tons of boulders and 24 large cottonwoods trees in approximately 1.5 miles of the LSTW.

Figure 21. Example of a J-hook structure constructed as part of habitat enhancement projects in the San Juan tailwater.

In conjunction with in-stream habitat improvement projects riparian projects were also implemented. Sites containing native cottonwoods were identified along the river channel and adjacent riparian corridor in the USTW. Protective fencing was installed for existing cottonwood trees from 2005-2007 to reduce predation and enhance the riparian corridor. Approximately 600 trees were fenced during this period and plans are in place for additional projects as funding becomes available.

Removal of non-native vegetation such as salt cedar and Russian olive has been conducted in selected areas, including the BOR Primary Jurisdiction area directly below the dam, the north side of the river channel from Simon Canyon to the end of the STW and the Pump House day-use area. Cut-stump methods were selected for removing salt cedars and Russian olives. This method consists of cutting the shrub approximately 10 inches above ground level and immediately spraying the stump with an herbicide approved for use adjacent to water-ways. This is an on-going project conducted when funds and personnel are available.

Conclusions

The *Management Plan for the San Juan River, 2004-2008* (http://www.wildlife.state.nm.us/recreation/fishing/documents/SanJuanRiverManagementPlan.pdf), a management plan approved by the NM State Game Commission, outlined specific management goals for the San Juan tailwater fishery, including the following:

- An average angler catch-rate of not less than 1.0 fish/hr in the STW (exceptional catch-rate).

- Five percent of the trout population in the STW exceeds 20” (good trophy potential).
- Fish in the STW appear vigorous, healthy, and provide a memorable angling experience (good fighting characteristics).
- Maintain a 75 percent or higher angler satisfaction rating for the STW.

Results of angler surveys indicate catch rates in the STW averaged 1.18 fish/hr from 1995-2007. Anglers reported that 5.3% of the fish they caught were >20”. Finally, on average 92% of angler reported they were satisfied with their angling experience. The K-factor of fish collected during electrofishing surveys averaged 1.52, indicating they were extremely healthy.

RECOMMENDATIONS

NMDGF must address numerous complex issues associated with the management of the San Juan River tailwater fishery. Flow alterations designed to improve conditions for native fish downstream and for water development in the basin have the potential to impact the aquatic habitat in the STW. Oil and gas development in the San Juan River Basin also has the potential to adversely impact the fishery. Finally, the popularity of the fishery continues to increase, to the point that angling pressure is currently almost 3 times as high as it was in the mid 1980’s.

NMDGF has and will continue to develop strategies to better understand the dynamics of the San Juan tailwater while working to maintain the “World Class” fishing experience currently characterizing the fishery. Stream habitat modifications along with riparian improvements are continuing to be developed to mitigate the effects of potential habitat losses. Long-term studies have also been developed to better understand the effects of current stocking strategies, flow modifications, and habitat modifications on growth rates, natural reproduction, population density and biomass, and angler use. Management recommendations and options to consider include the following:.

- Continue partnering with BOR, BLM, and USFWS to implement in-stream habitat improvement measures that will sustain fish populations through low flow periods.
- Continue partnering with BOR, BLM, NMSP, and USFWS to develop and implement land management activities to reduce sediment run-off and sediment/facility conflicts.
- Continue partnering with BLM, USFWS, and NMSP to install in-stream structures that increase sediment transport.
- Continue partnering with BLM and NMSP to install protective fencing around native cottonwoods to reduce predation.
- Continue partnering with BLM, USFWS, and NMSP to remove non-native vegetation from the riparian zone in the STW.
- Continue partnering with NMSP to improve access to areas underused by anglers.
- Investigate the potential for a limited-entry system.

- Investigate user-days for guides and outfitters to reduce angler pressure on the fishery.
- Investigate extending the STW another 3 miles downriver to Gobernador Canyon.
- Investigate the potential benefits of a San Juan tailwater trout stamp, the proceeds of which would be earmarked for habitat projects along the San Juan River.

APPENDIX

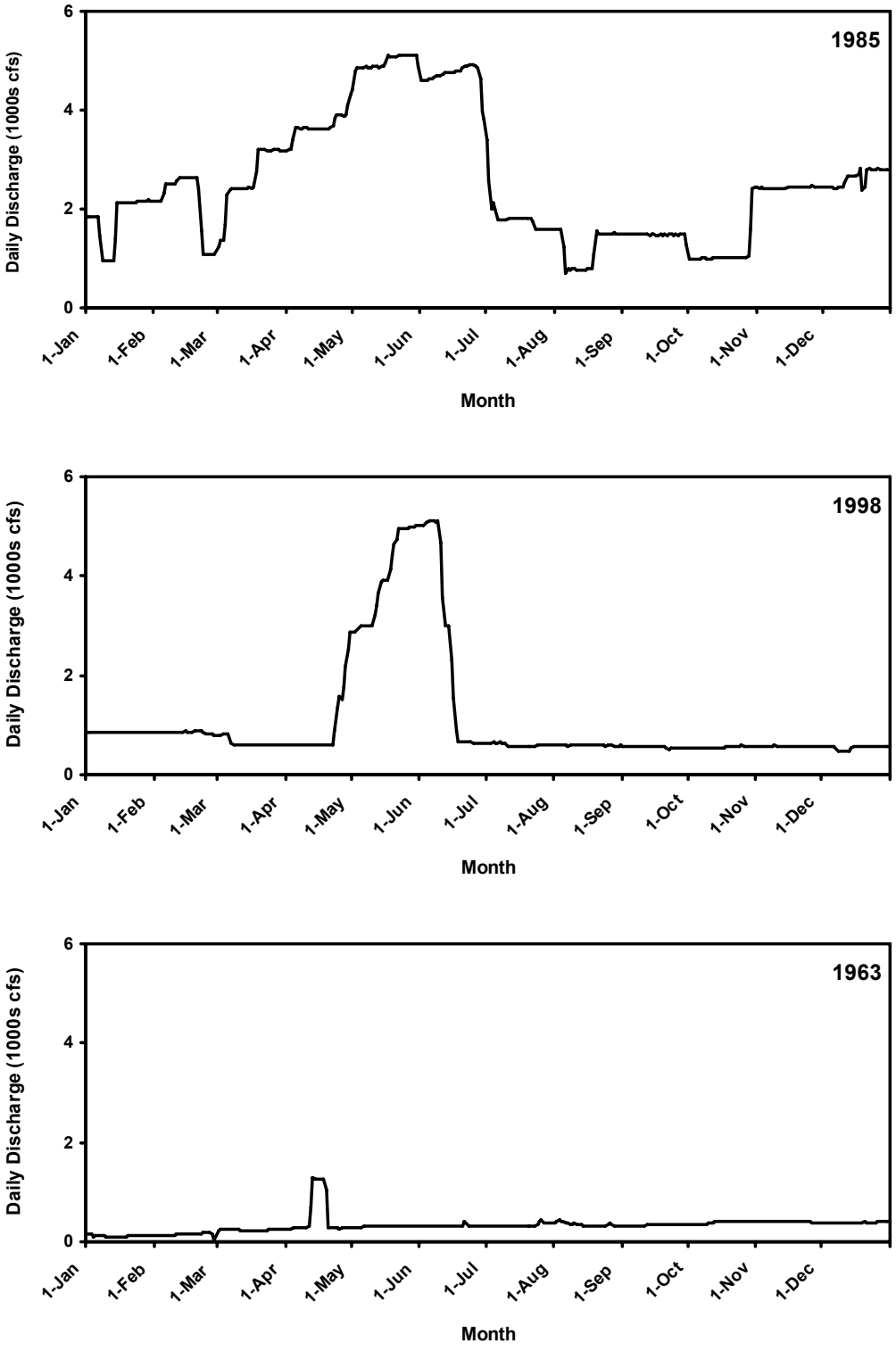


Figure A1. Estimates of daily discharge for the San Juan tailwater for 1985 (a high discharge year, 1998 (an average discharge year), and 1963 (a low discharge year).

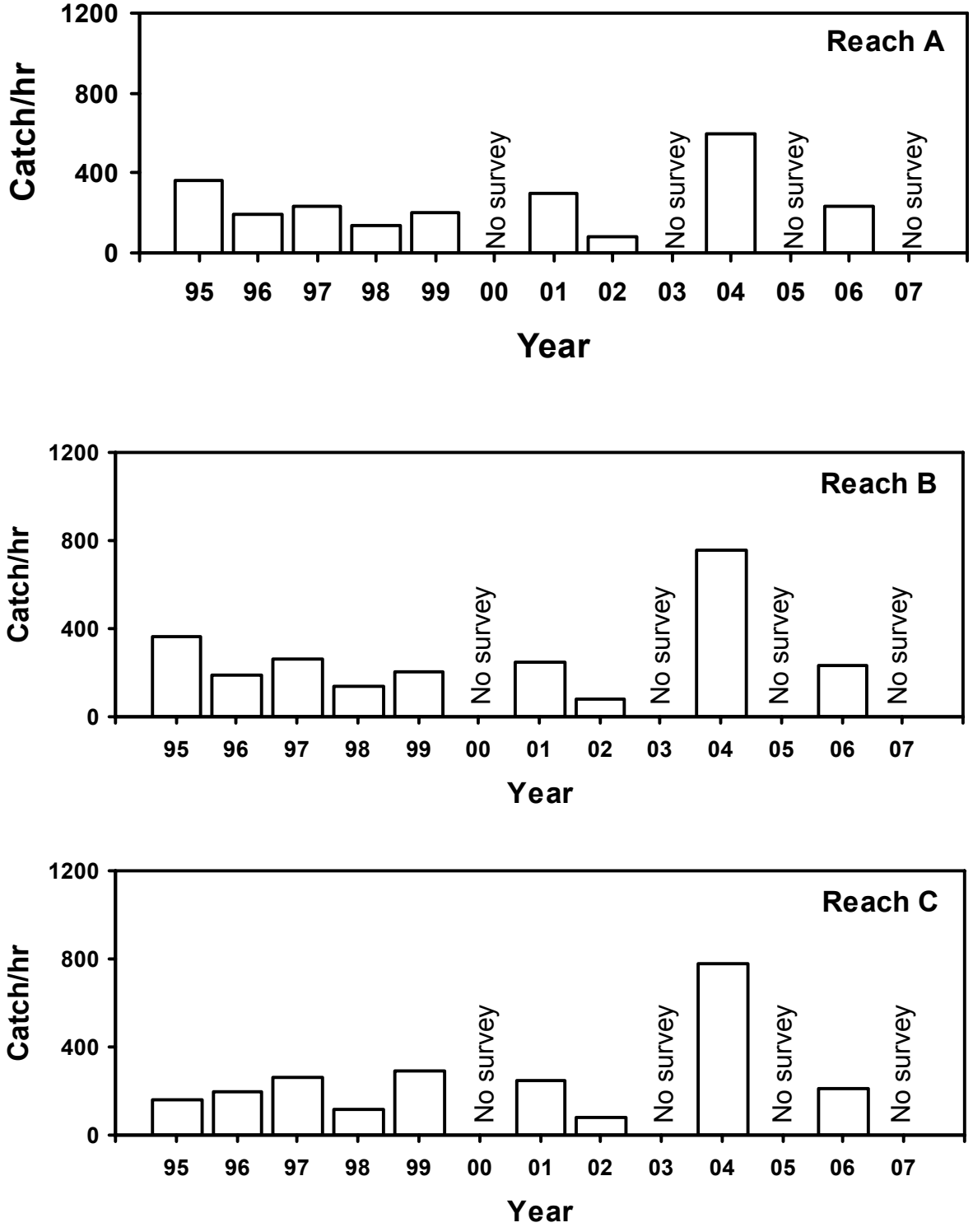
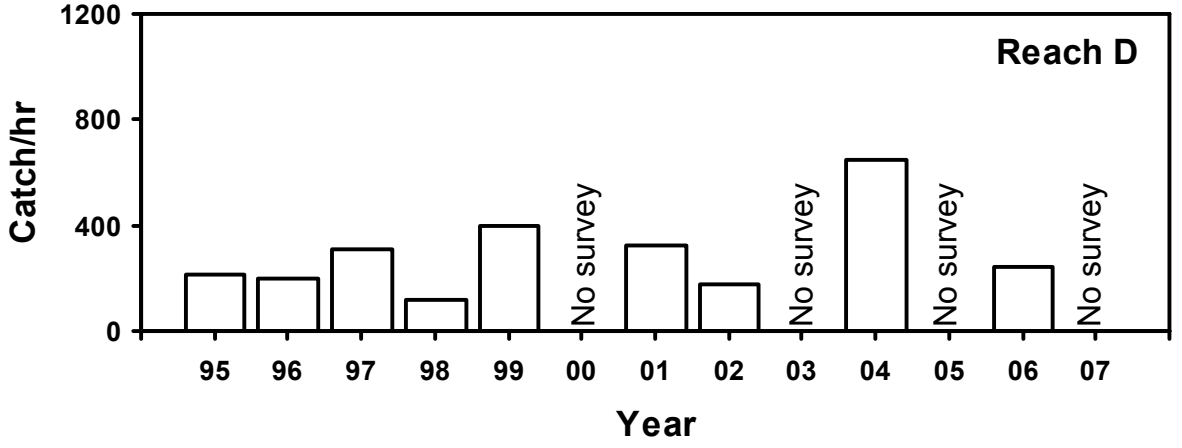
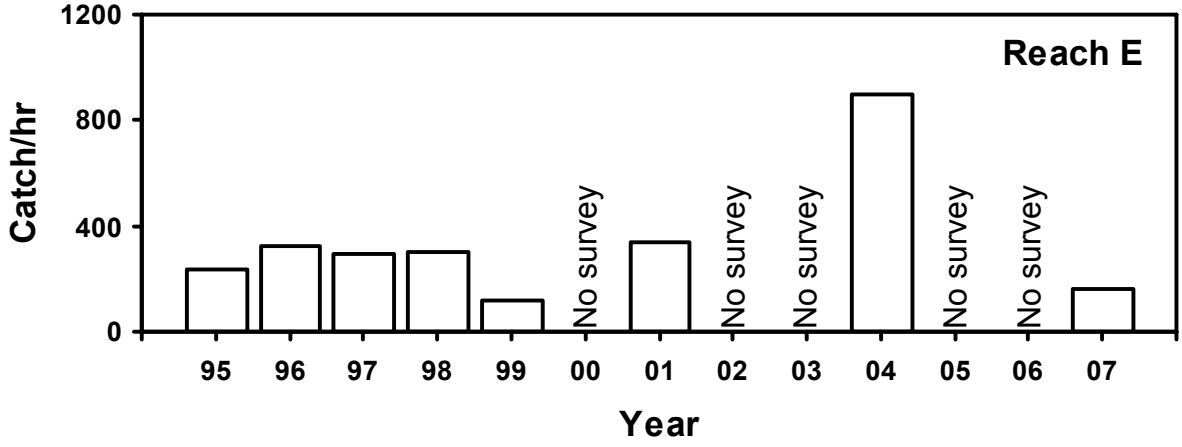
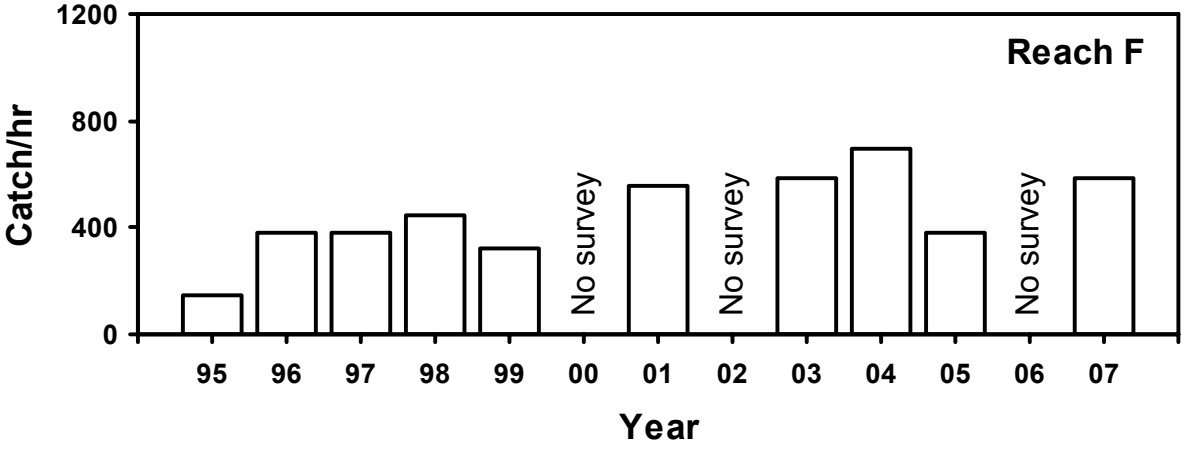


Figure A2. Annual estimates of electrofishing catch rates by reach for the San Juan tailwater, 1995-2007.







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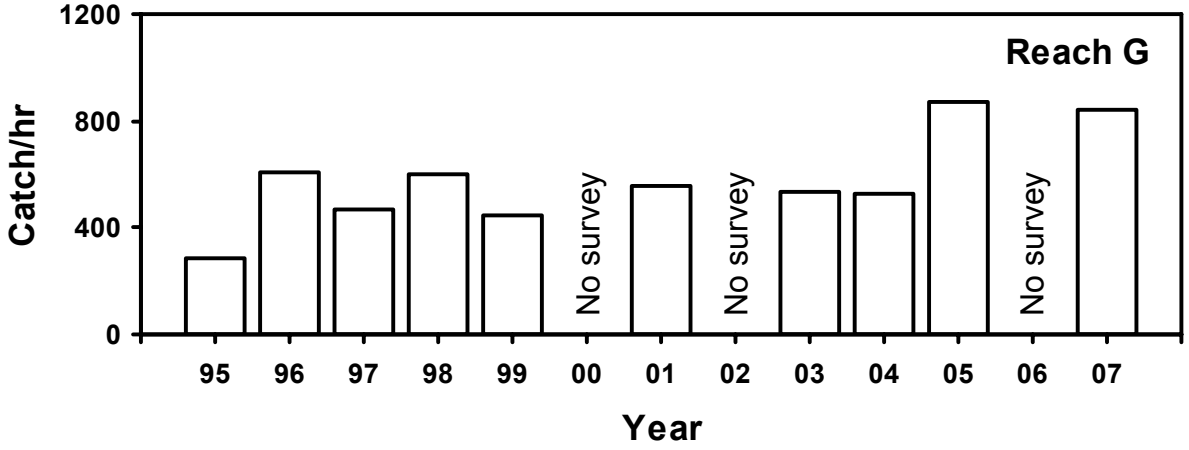

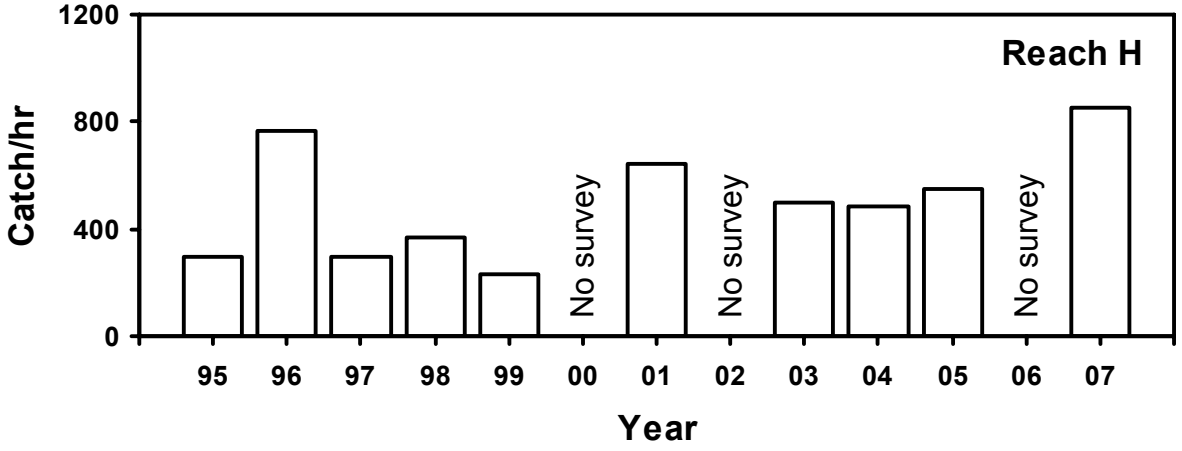

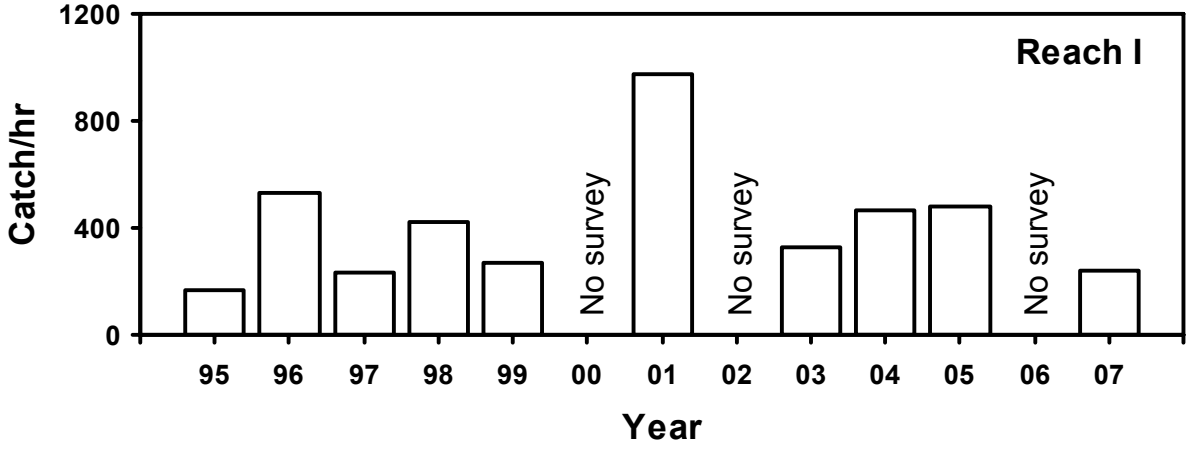

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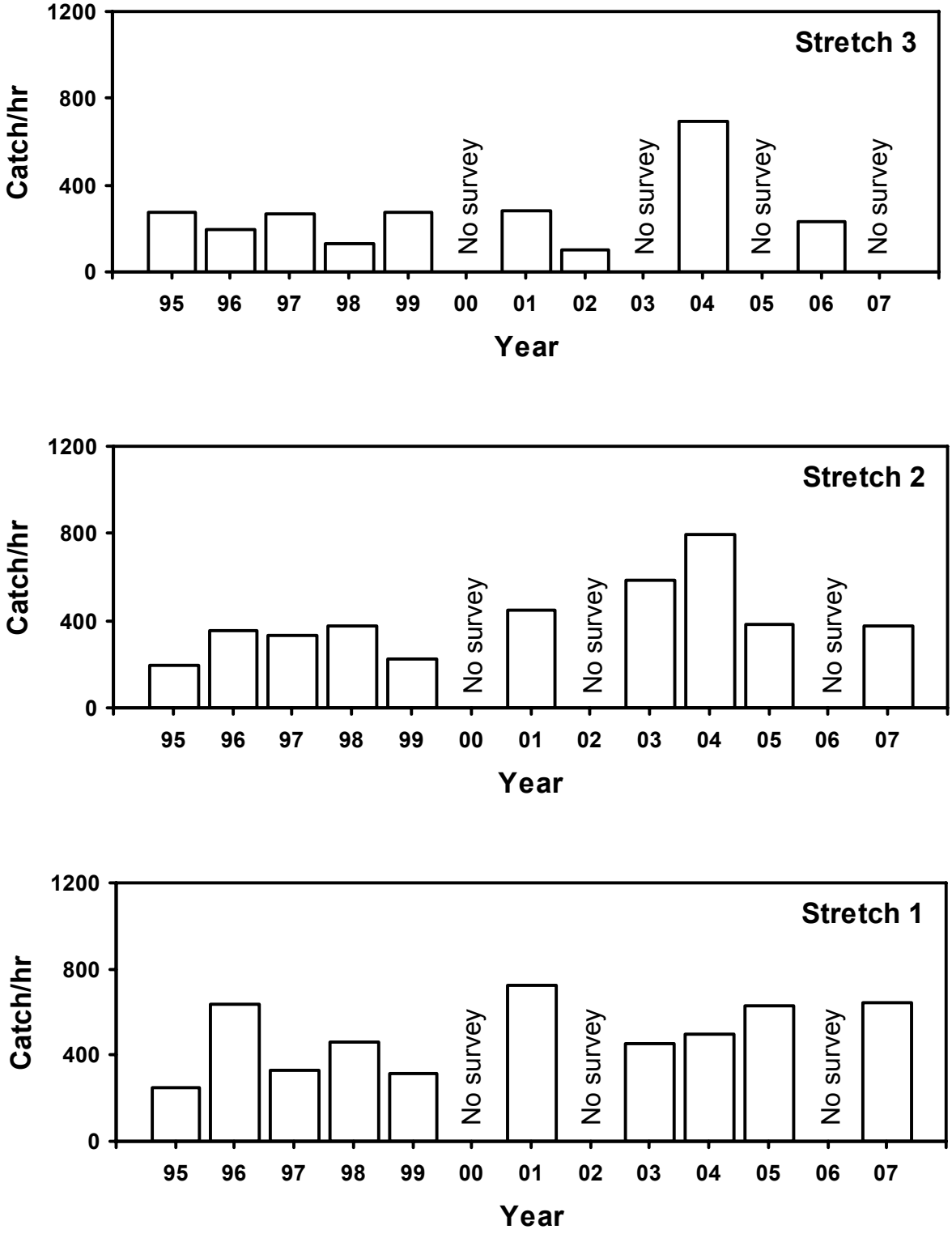


Figure A3. Annual estimates of electrofishing catch rates by stretch for the San Juan tailwater, 1995-2007.

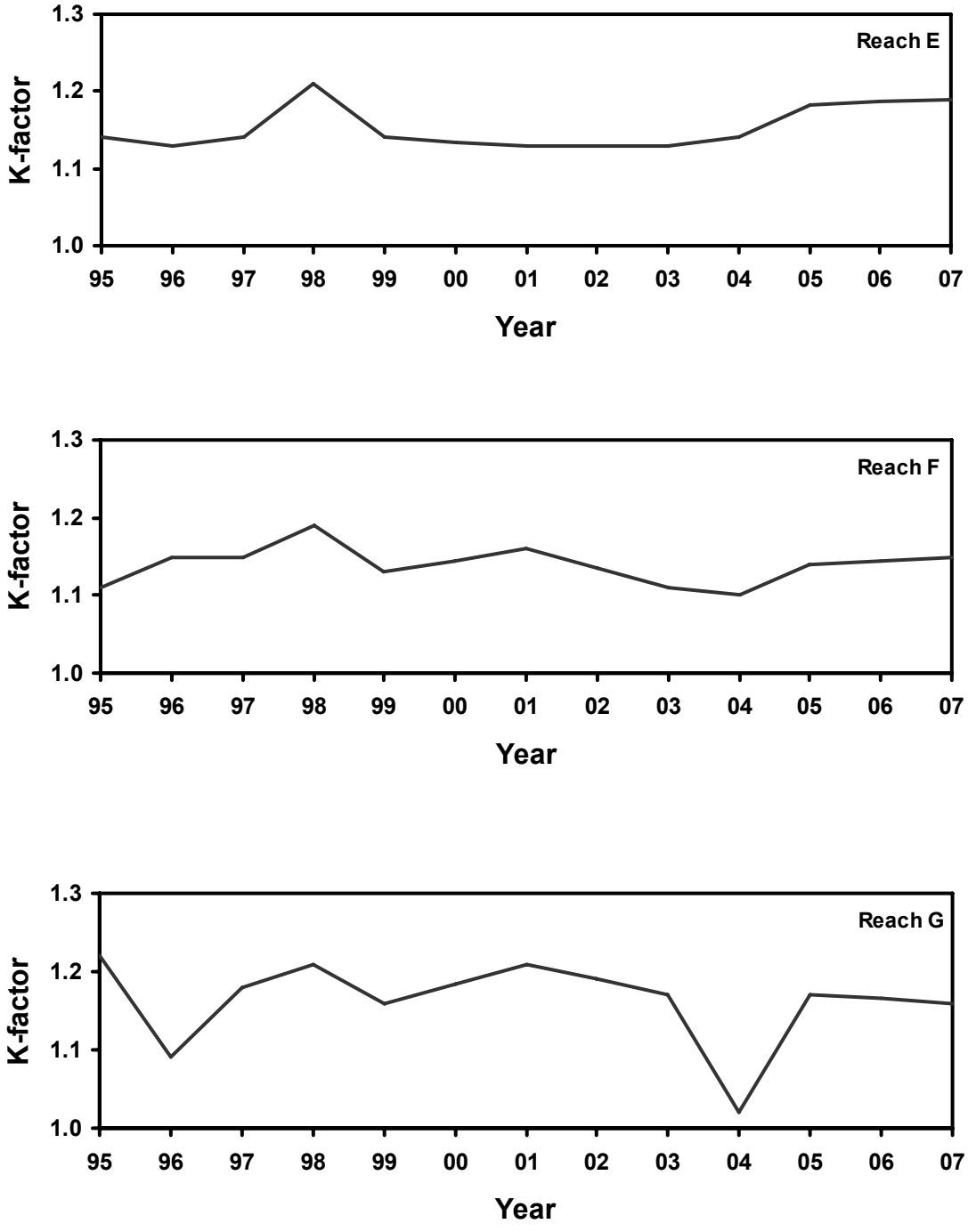
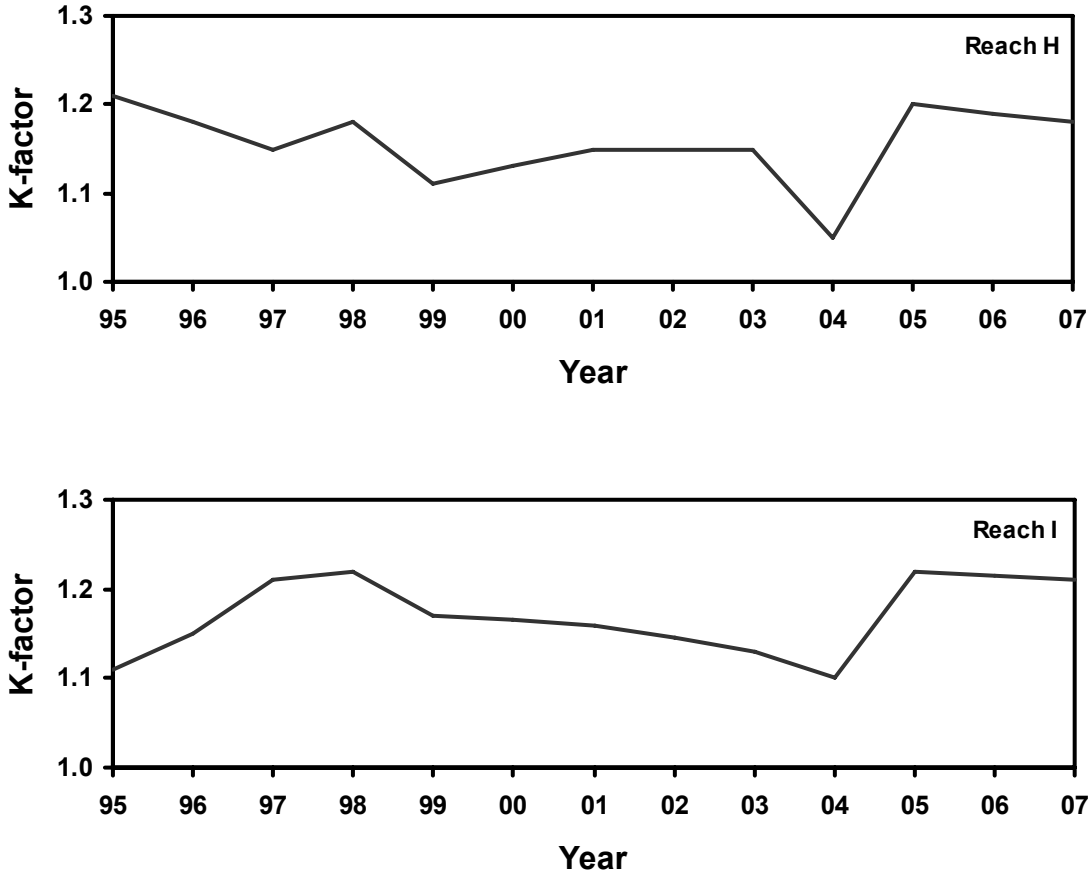


Figure A4. Annual estimates of condition of fish collected in the San Juan tailwater by electrofishing, 1995-2007.



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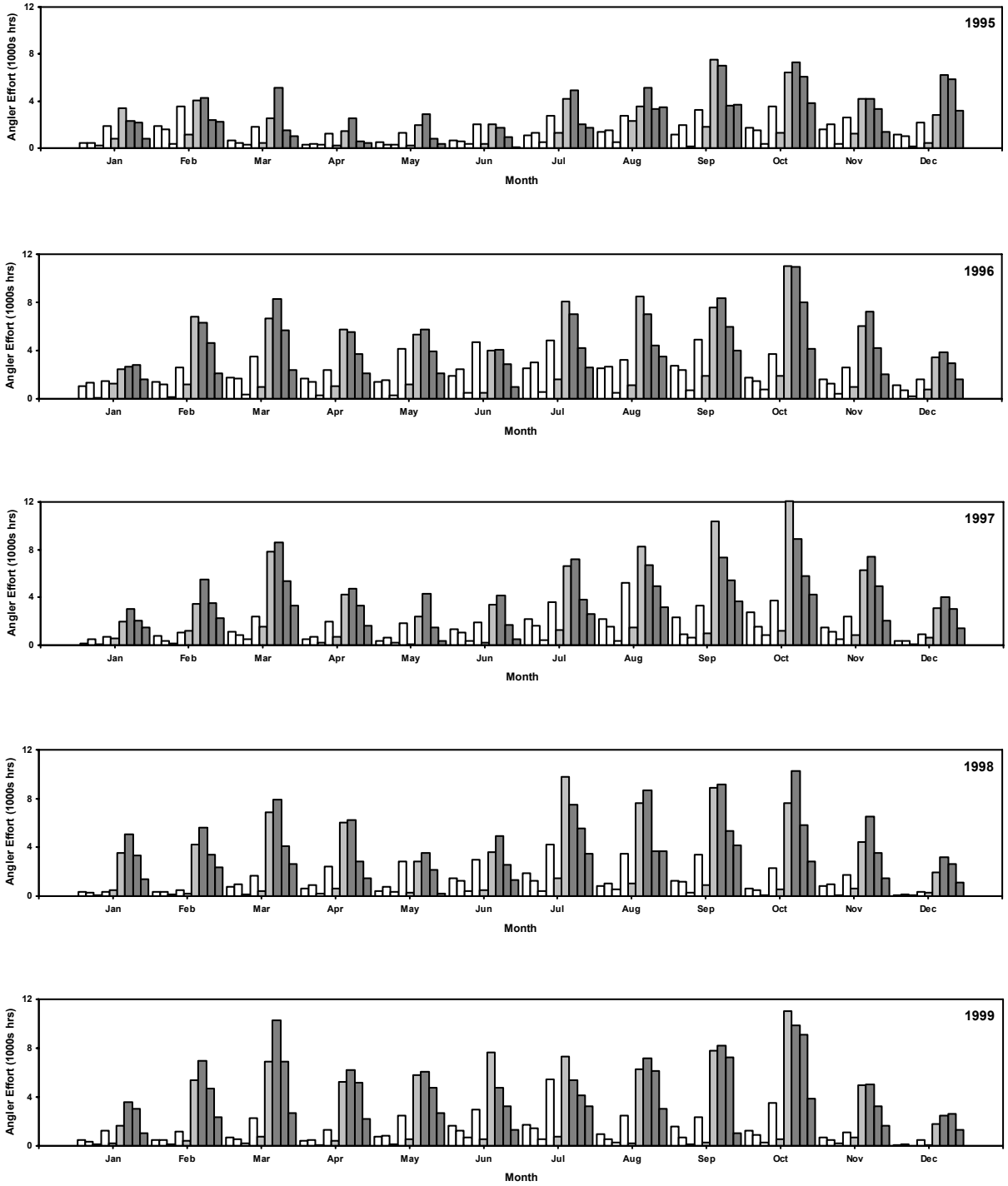
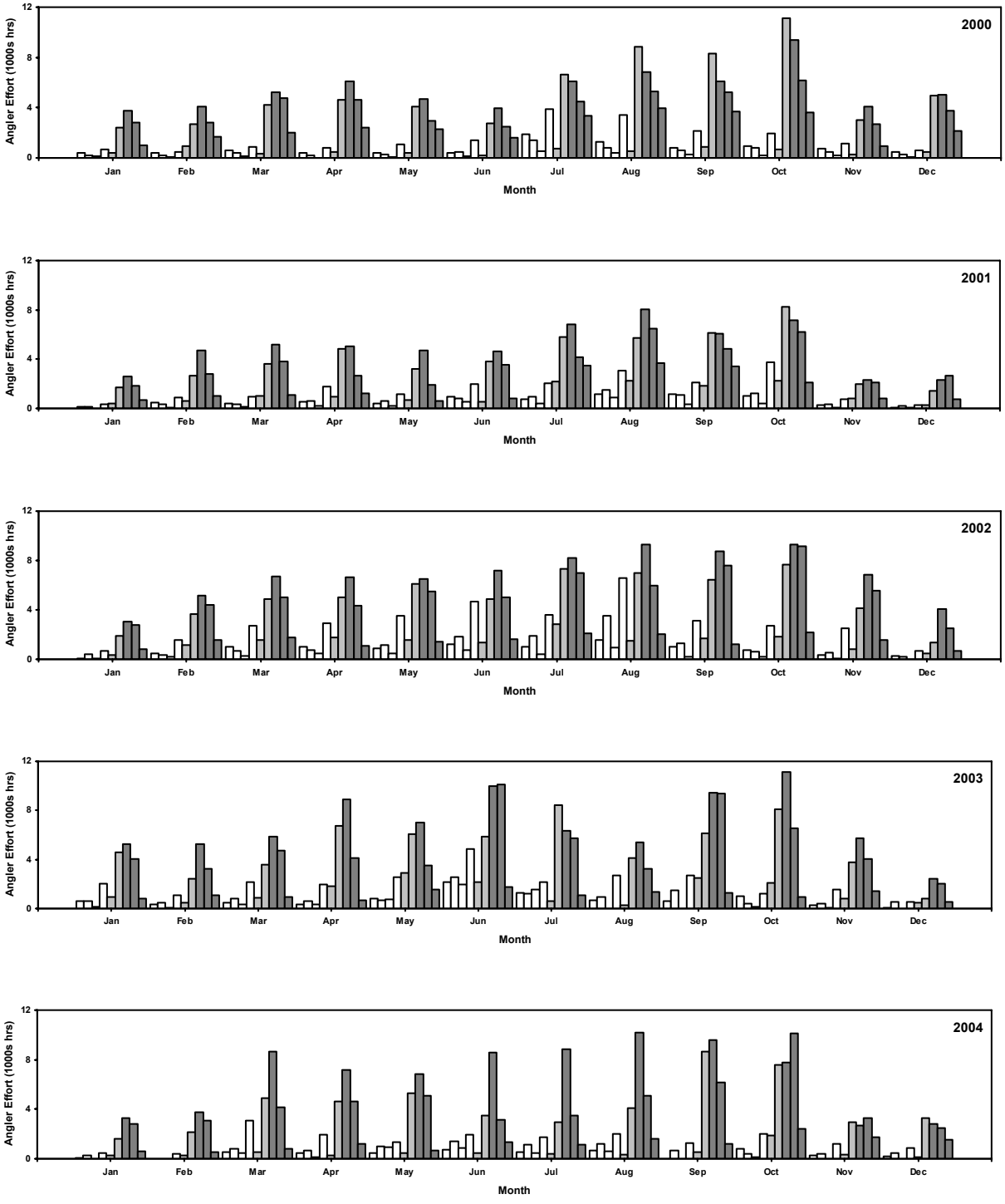


Figure A5. Annual estimates of angling pressure by year, month, and reach (□=A-D, ▒=E-F, ■=G-I) for the San Juan tailwater, 1995-2007.



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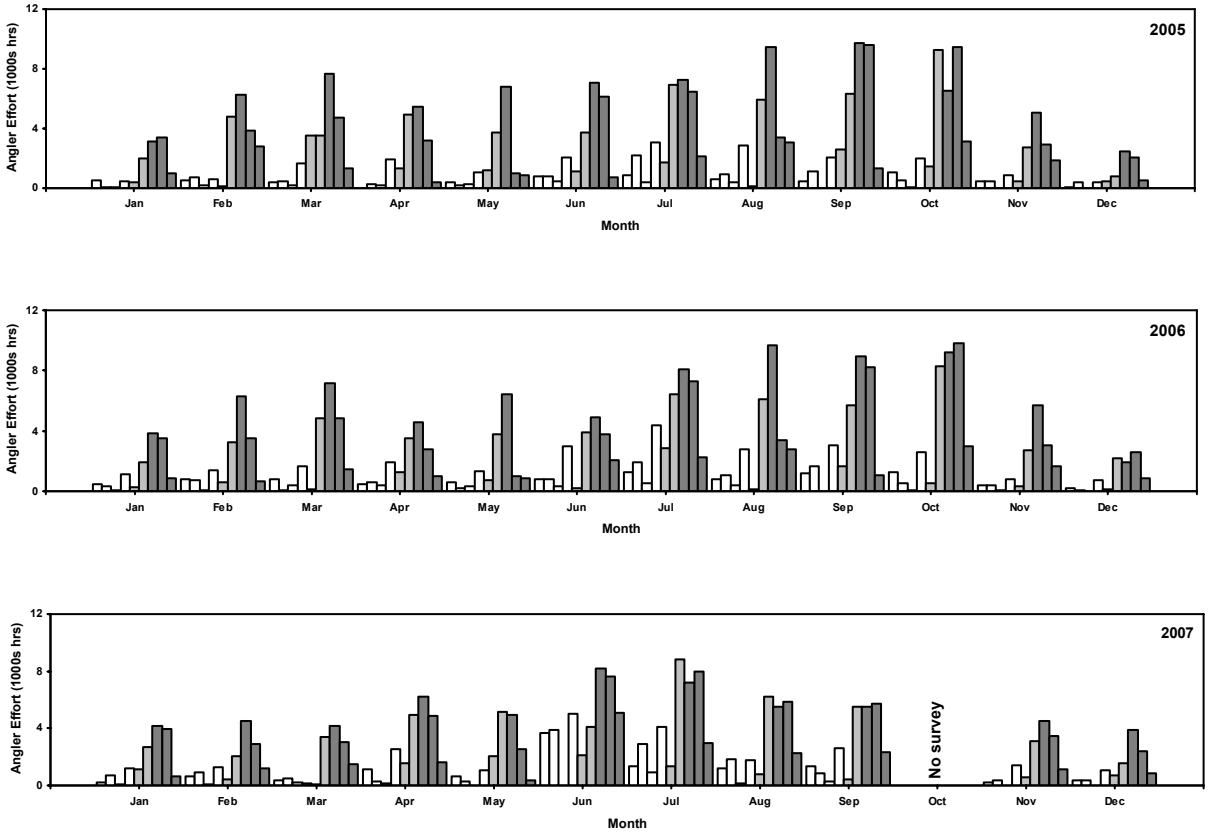

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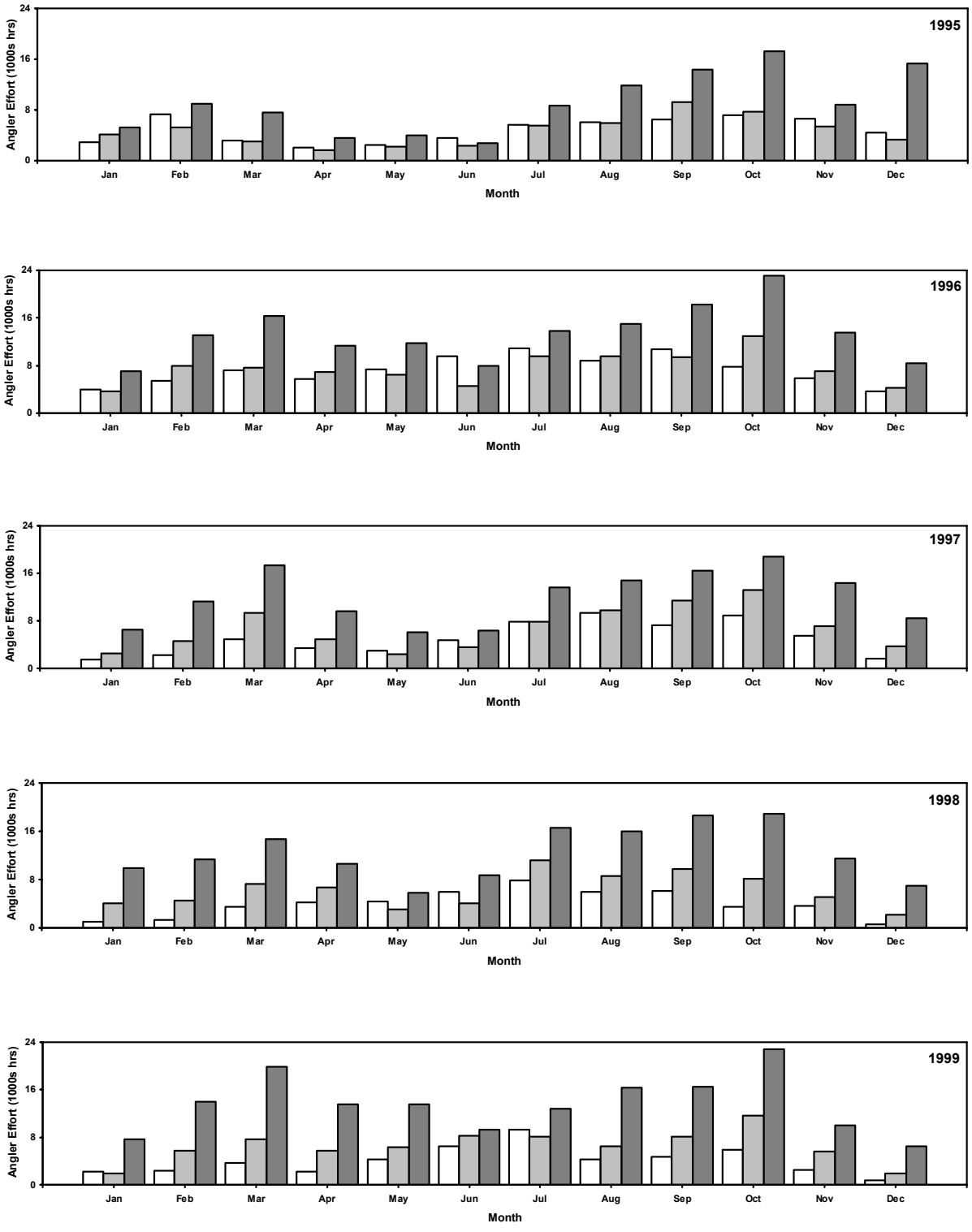
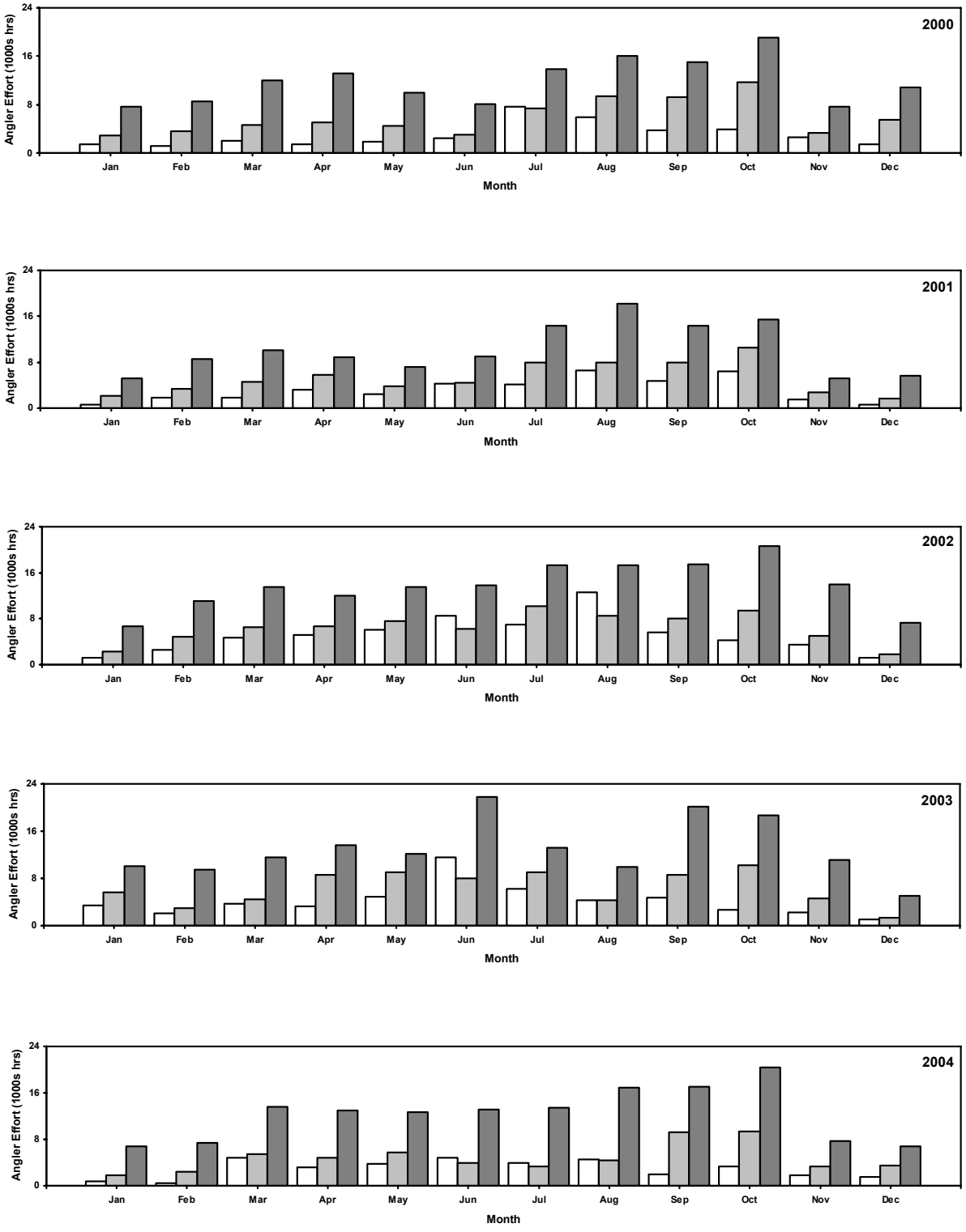


Figure A6. Annual estimates of angling pressure by year, month, and stretch (□=RR, ■=LSTW, ■=USTW) for the San Juan tailwater, 1995-2007.



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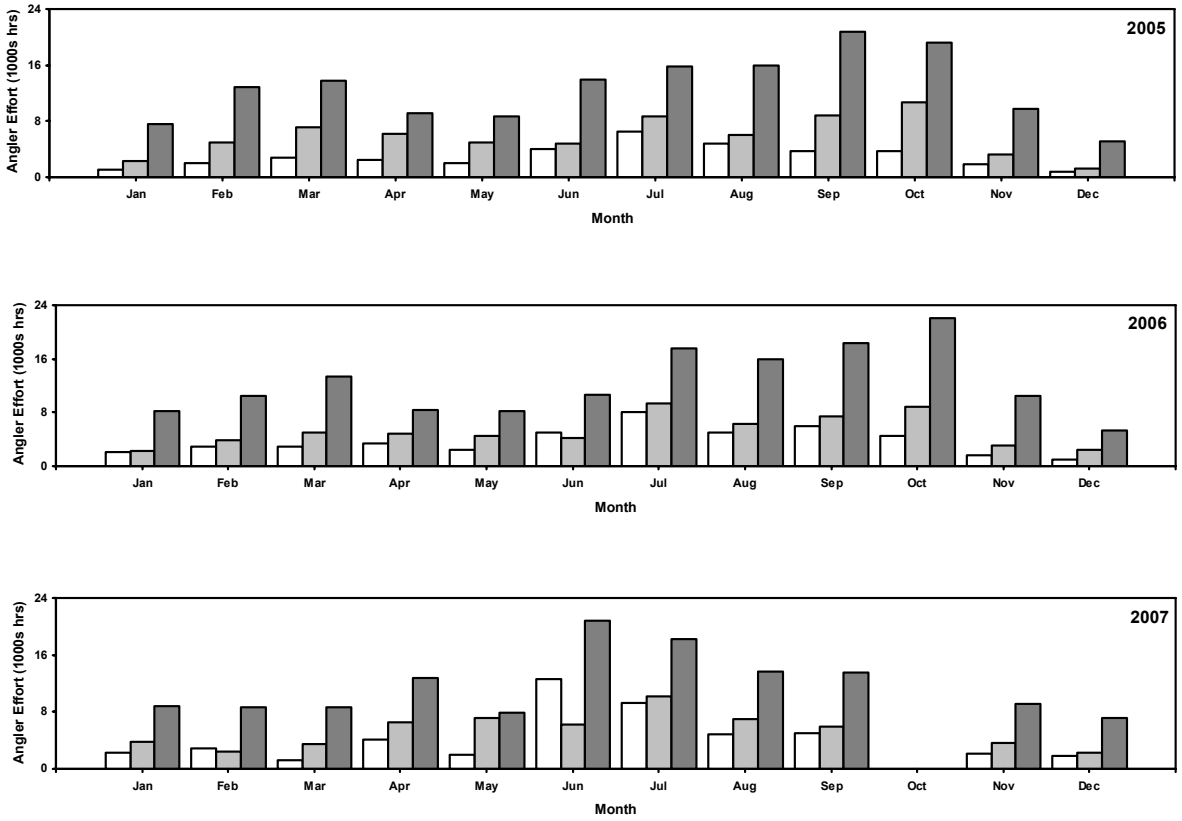

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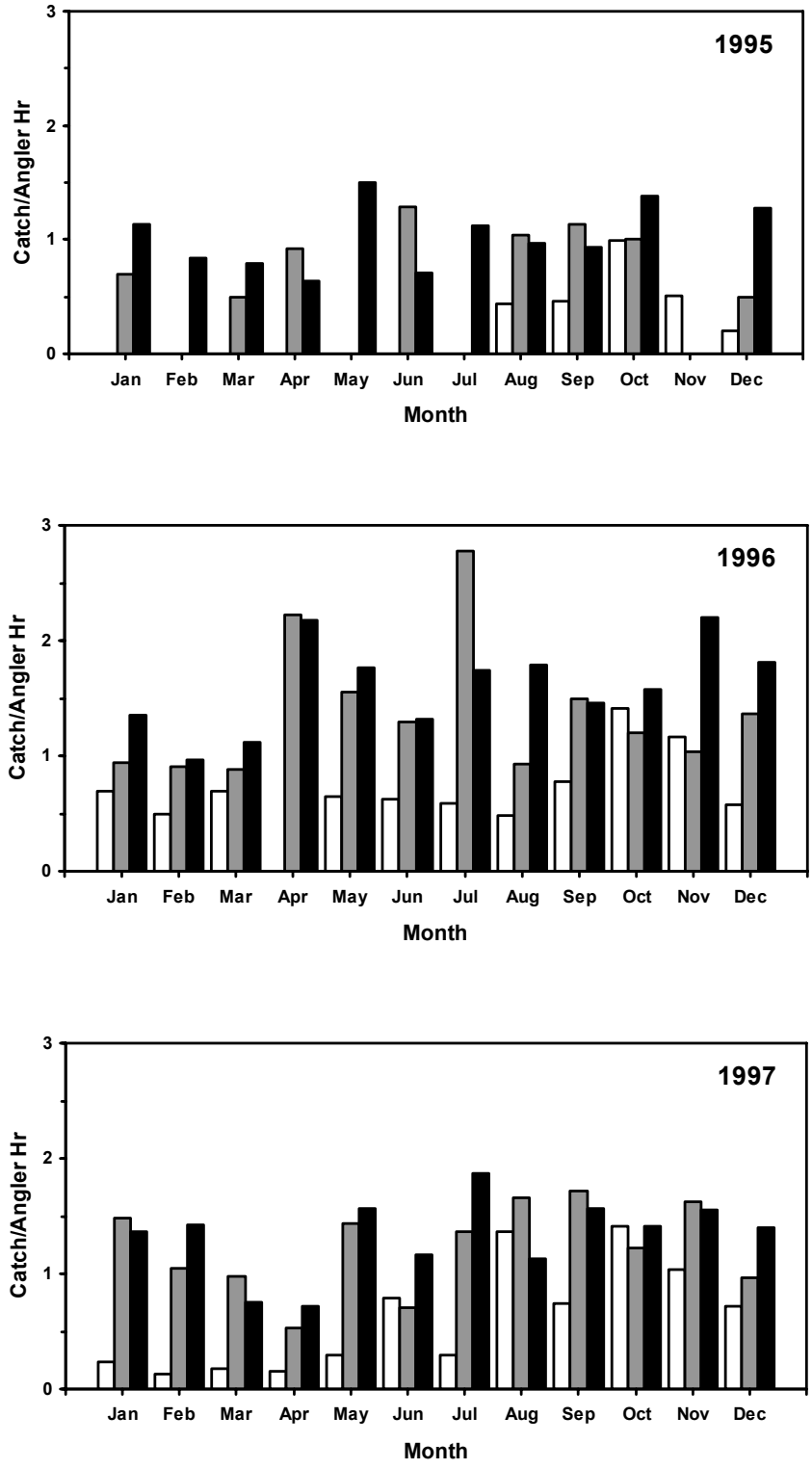
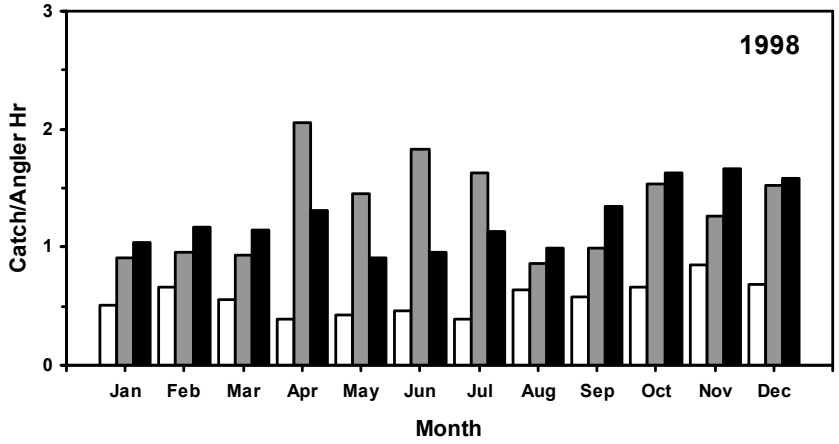
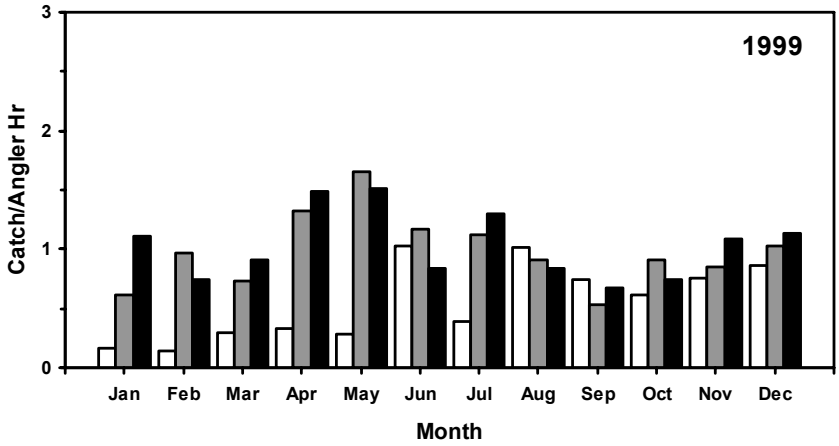
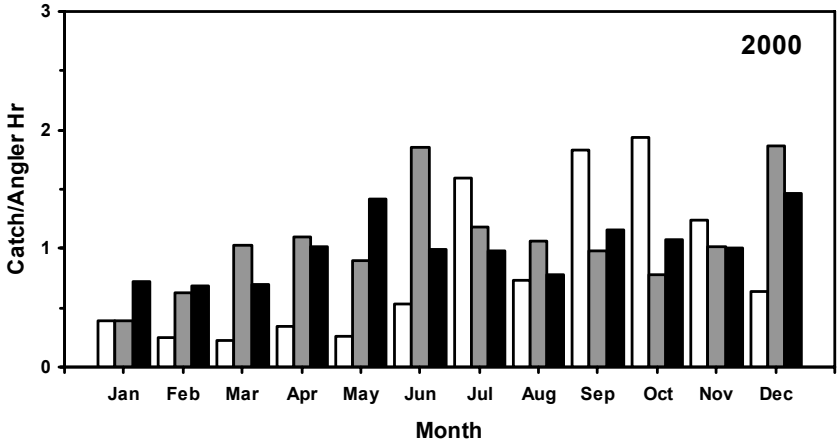


Figure A7. Annual estimates of angler catch rates by stretch (□=RR, ■=LSTW, ■=USTW) and month for the San Juan tailwater, 1995-2007.







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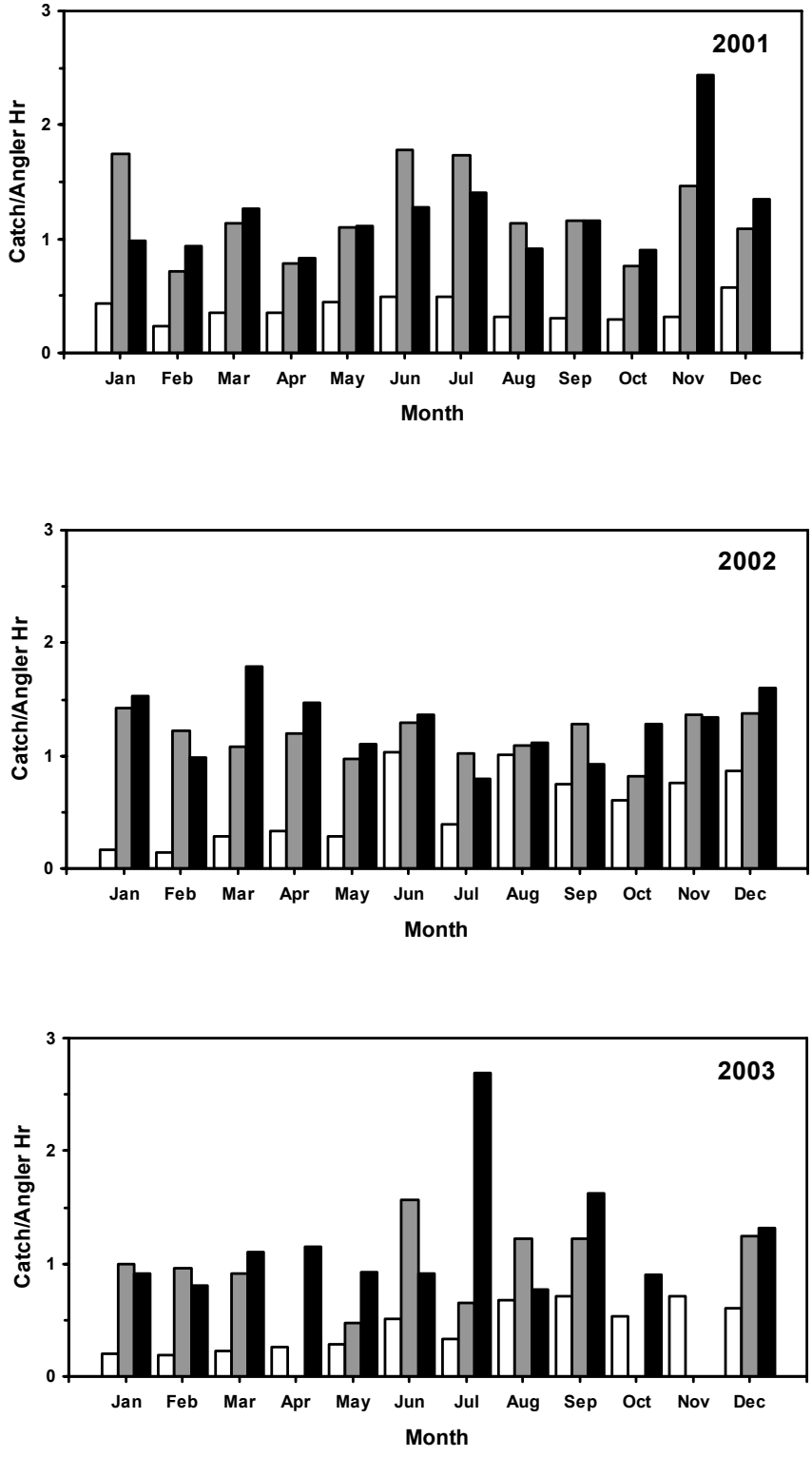

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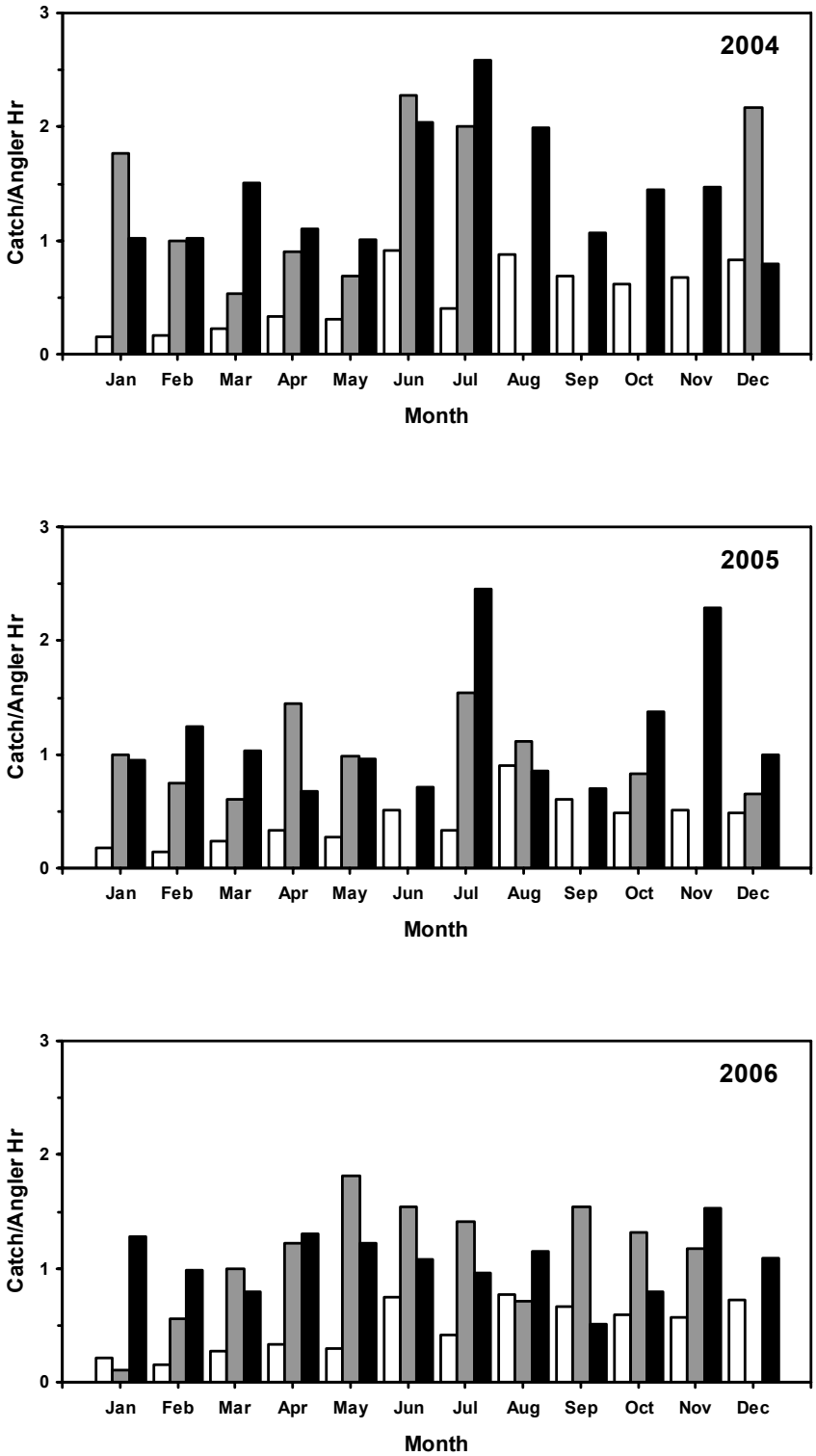

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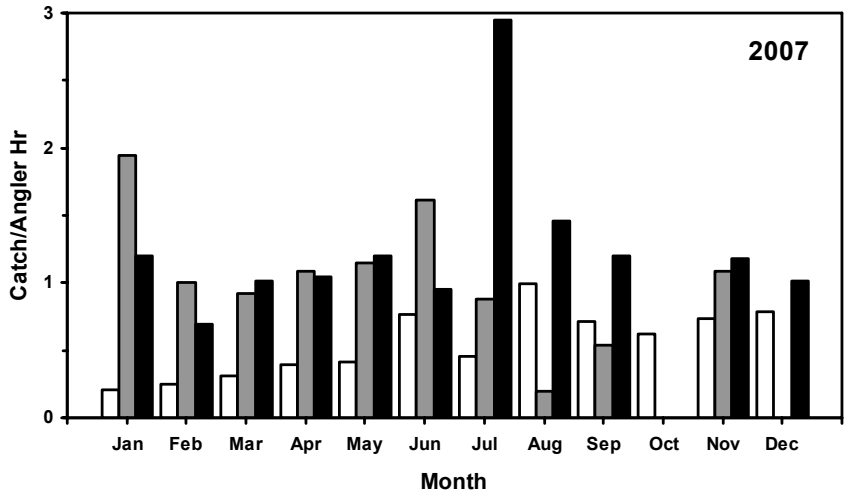

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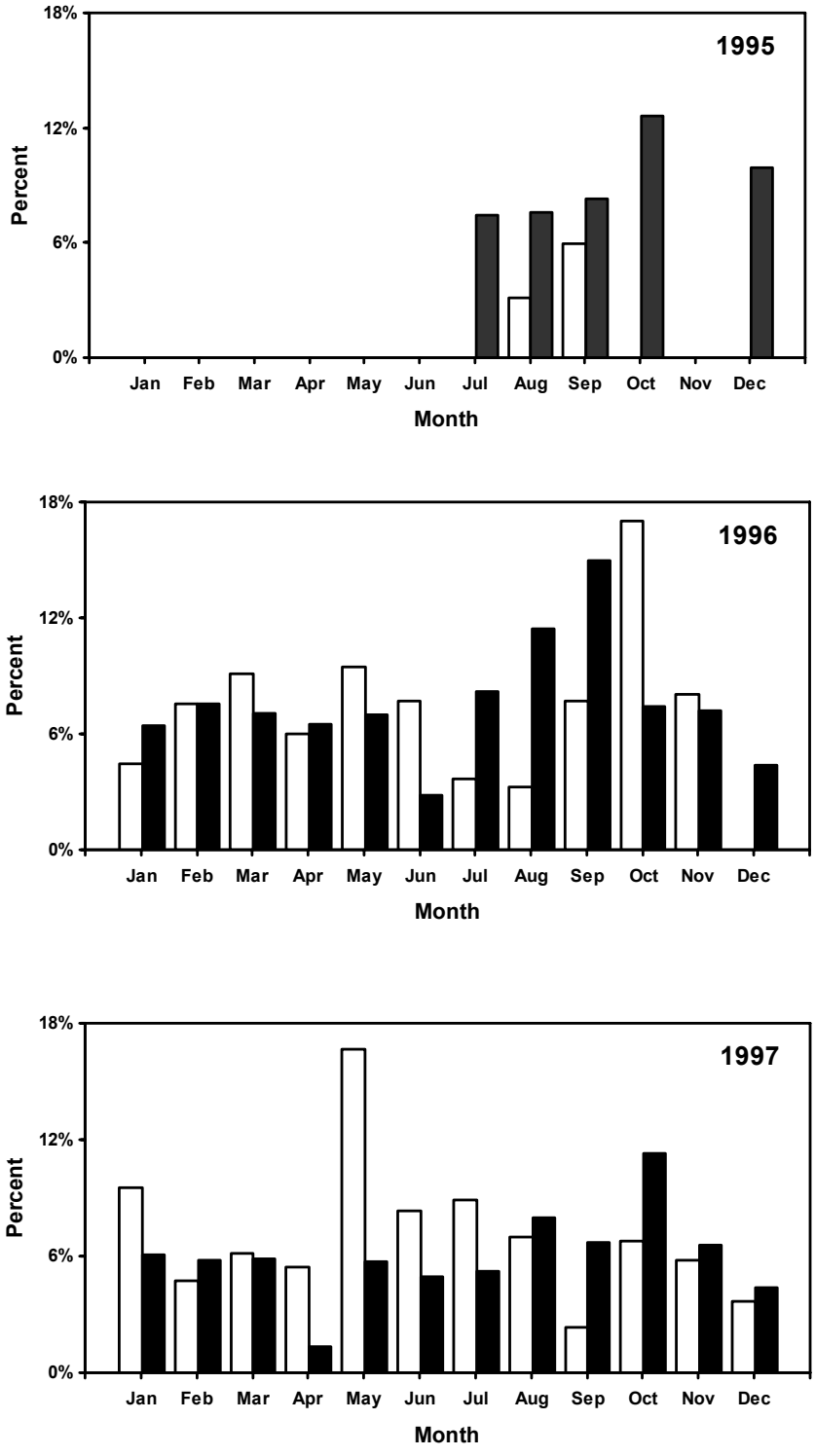
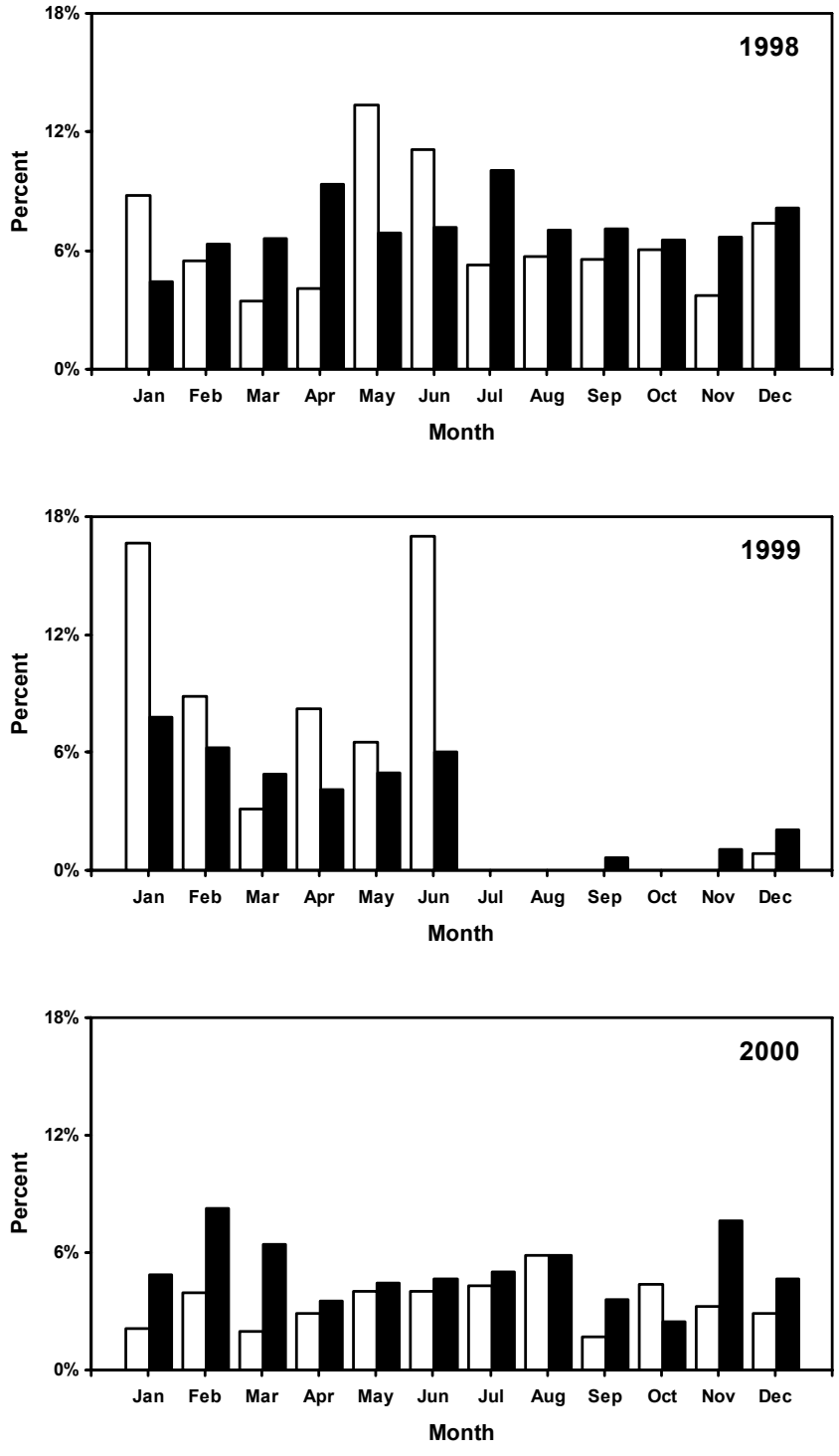


Figure A8. Annual estimates of percent fish >20” caught by stretch (□=LSTW, ■=USTW) and month for the San Juan tailwater, 1995-2007.



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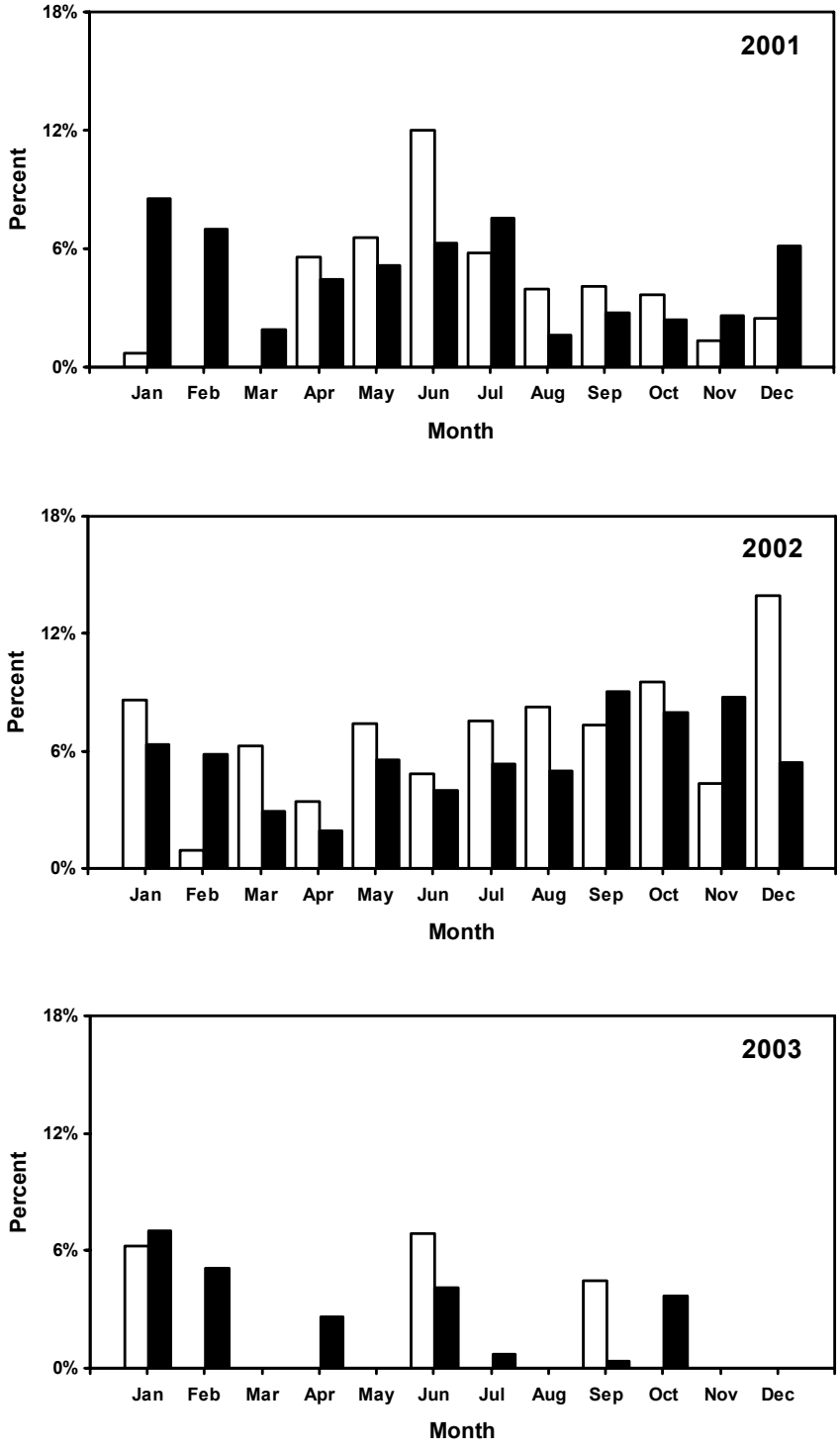

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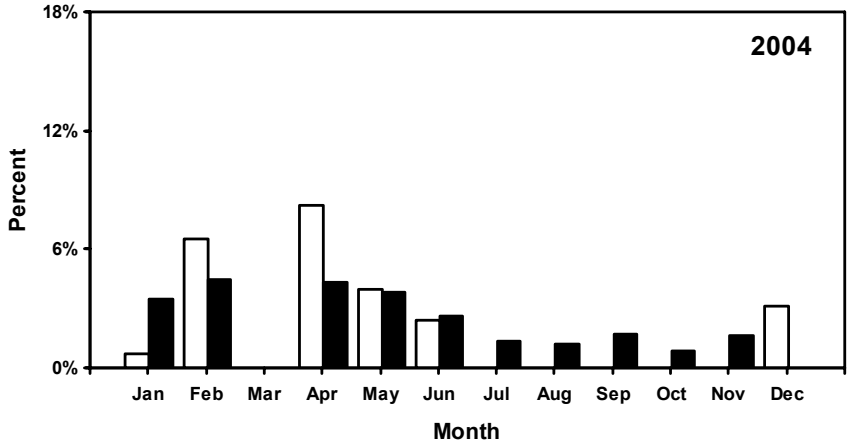

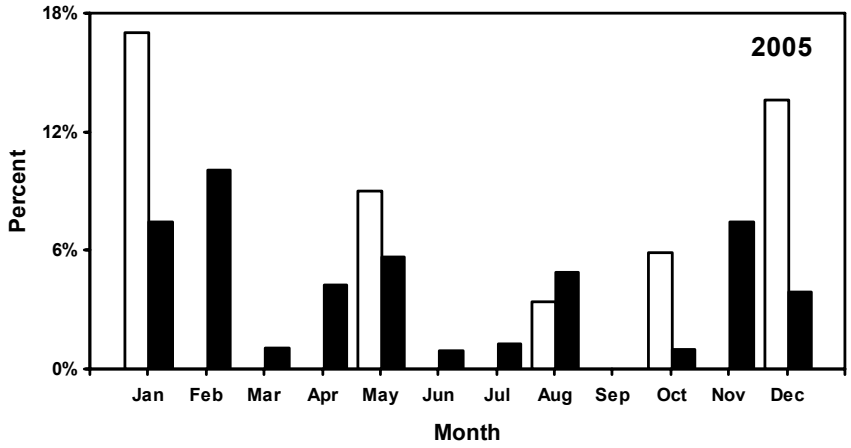

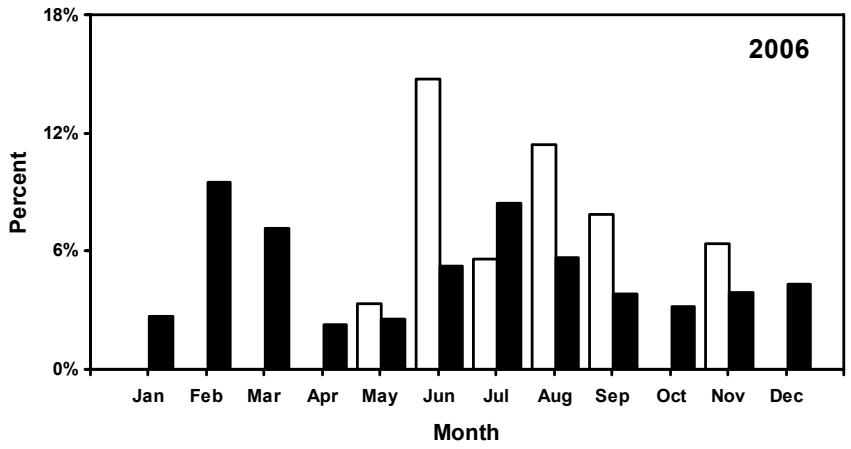

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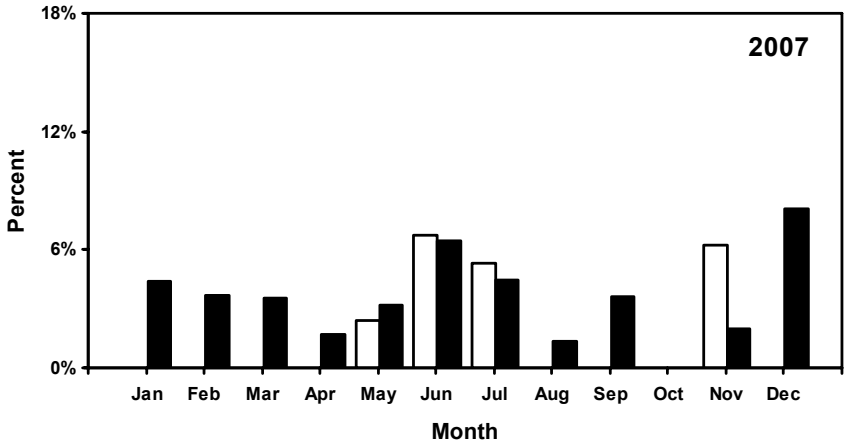

Figure A8. Concluded.

Table A1. Sedimentation potential for roads, well pads, and hillslopes for each watershed.

Watershed	Surface Type	Number	Average Surface Area (ft^2)	Total Surface Area (ft^2)	Erosion Rate	Sediment Potential (ft^3/yr)	Total Sediment Potential (ft^3/yr)	Percent Contribution
Simon Canyon/ Rex Smith	Well Pad	282	100,201	28,256,682	0.011	310,823.5		12.70
Simon Canyon/ Rex Smith	Road		32,937,770	32,937,770	0.001	32,937.8		1.35
Simon Canyon/ Rex Smith	Hillslope			701,236,228	0.003	2,103,708.7	2,447,470	85.95
Gobernador Canyon	Well Pad	1133	102,269	115,870,777	0.011	1,274,578.5		12.53
Gobernador Canyon	Road		36,224,078	36,224,078	0.001	36,224.1		0.36
Gobernador Canyon	Hillslope			2,953,384,665	0.003	8,860,154.0	10,170,957	87.11
Pump Canyon	Well Pad	979	100,201	98,096,779	0.011	1,079,064.6		12.04
Pump Canyon	Road		32,937,770	32,937,770	0.001	32,937.8		0.37
Pump Canyon	Hillslope			2,617,514,331	0.003	7,852,543.0	8,964,545	87.60