Survey of American Dipper (*Cinclus mexicanus*) Distribution, Abundance and Reproductive Success as a Baseline Indicator of Stream and Riparian Health on the Fryingpan River, Basalt, Colorado.

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I wish to thank the Roaring Fork Conservancy for their dedication to protecting healthy, living rivers. Rivers connect the land the people and the wildlife. I am grateful to the Conservancy for this opportunity to participate in the process of conservation that reconnects us all.

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INTRODUCTION

Concerns over the health of the fishery in the Fryingpan River in Colorado have led to a call for an assessment of stream health. Certain native wildlife species, because of their biology, can be especially good indicators of habitat condition. American Dippers (*Cinclus mexicanus*) are aquatic songbirds that inhabit fast-flowing mountain streams in western North America. As top level specialists Dippers are particularly vulnerable to habitat alteration. Dippers integrate a suite of environmental characteristics in selecting breeding habitat to enable reproductive success. These environmental characteristics include the same characteristics that define healthy mountain stream ecosystems. Dippers are dependent on clean, fast-flowing streams with abundant aquatic insect prey and a sustainable riparian tree canopy. Because Dippers require both healthy stream and riparian habitat, alteration to either will likely result in changes to Dipper population abundance, distribution and reproductive success. Because Dipper success is closely tied to these environmental characteristics, Dippers are excellent biological indicators of stream and riparian health. Surveys of American Dippers and their stream and riparian habitat on the Fryingpan River below Ruedi dam were conducted to provide baseline information for future monitoring and evaluation of the condition of the river. Additionally, the stream and riparian habitat assessment can be used in future monitoring efforts to analyze future Dipper abundance and stream condition.

Dippers have evolved as specialists in mountain stream ecosystems, utilizing aquatic macroinvertebrates for food and the complex physical habitat that natural streams provide for foraging, nest sites and protective cover. These specializations have resulted in a bird that is superbly adapted to this rigorous habitat but also in dependency on a narrow range of food resource and habitat characteristics. Dippers select territories based on suitability of nesting habitat (Price and Bock 1983). Sites are chosen to enhance survival and reproductive success. Nest sites are located close to fast water, inaccessible to predators, protected from floods, located on a horizontal ledge or other support, and typically located 2-3 m above water (Bakus 1959).

Factors that limit Dipper success, and consequently population distribution and abundance, include food density, foraging habitat, and availability of nest sites. Where these factors are impaired Dipper populations are reduced. Dippers rarely choose to breed if food density or nest site quality is below a certain threshold (Price and Bock 1983). Diet of the American Dipper consists almost exclusively of a variety of macoinvertebrates and fish. However, breeding Dippers are more selective in their food choice; nestlings are fed a much larger proportion of Ephemeroptera than adults consume in winter (Vickery 1992). Because the presence of “EPT” ((Ephemeroptera-Plecoptera-Trichoptera) macroinvertebrate taxa communities are indicators of good water quality (Ward and Kondratieff, 1992) and because Dippers positively select “EPT” taxa they can also effectively be used as indices of biotic integrity for the bioassessment of streams. (Feck and Hall 2004). Dippers also need riffles to forage in and mid-stream boulders as perches (Tyler and Ormerod 1994). The physical structure of a stream in combination with the hydrologic regime, form a template that enables successful foraging. Alteration to either factor diminishes habitat conditions essential to Dipper foraging success. Nest sites are commonly located on rocky ledges along streams, behind waterfalls, on large rocks in the stream, and under bridges or other man-made structures (Kingery 1996). Four general requirements for nest sites are that they are: "1) close to water, 2) above high water, 3) inaccessible to terrestrial predators, and 4) on a horizontal ledge or crevice for support" (Price and Bock 1983). Finally, riparian vegetative cover stabilizes and provides a protective refuge for Dippers and also provides nest sites. In Colorado, vegetation cover was significantly related to the distribution of dippers during the summer (Price and Bock 1983).

Changes to stream or riparian habitat that alter the physical structure or biological characteristics of Dipper habitat will impact population characteristics and ultimately survivability. Knowledge of the current distribution and abundance of the American Dipper on the Fryingpan River provides a good baseline indicator of stream health. Future Dipper monitoring and habitat assessments can be used to analyze trends and correlations between changes in Dipper abundance and stream condition.

METHODS

Surveys for American Dippers were conducted three times during the breeding season of 2014 on the Fryingpan River from the base of Ruedi dam to the confluence of the Roaring Fork River. Concurrently an assessment of stream and riparian habitat condition was conducted using EPA's Rapid Bioassessment protocol (Appendix 2). In preparation for the surveys, Roaring Fork Conservancy sent letters to landowners along the river requesting stream access . Only those properties for which written permission was granted were surveyed.

Initial surveys were conducted at the onset of breeding season which, at these elevations on the west slope in Colorado, occurs during late March and April. During this phase of reproduction Dippers are establishing territories and pair bonds and sing intensively, engage in territorial defense displays and nest building and consequently are readily detected (Figure 1). Surveys were conducted by walking slowly along the streambank so that both banks were visible. The number of birds seen and their location was recorded with a GPS. Nests sites of all documented Dipper pairs were subsequently found and their location recorded with a GPS. Detailed maps with Dipper pair locations, and nest sites are provided in Appendix 1. Double counting was avoided by noting if birds were flying up or downstream, by noting their turning at the edge of their territorial boundary and by observations of Dipper territorial encounters.

Figure 1: American Dipper building nest (nest site three).

A second round of surveys was conducted during the nesting phase of reproduction. All nest sites which had been previously located during the first round of surveys were re-visited to document nesting success. Observations of adults delivering food to the nests served as evidence that nestlings were present and that reproduction was successful (Figure 2). During surveys, care was taken to not disturb broods by remaining at a distance of greater than 30 meters from the nest site.


Figure 2: Adult Dipper delivering food to nestlings (nest site number 19).

A third and final round of surveys was conducted during the fledging phase of reproduction while juveniles are moving within their parents' territory and still being fed by their parents. As confirmation of reproductive success previously documented nest sites were again visited, this time to determine if nestlings had fledged. Observations of adults feeding young provided evidence that parents had successfully fledged nestlings which provided confirmation of reproductive success (Figure 3).

Figure 3: Dipper parent feeding fledgling (nest site four).

Concurrent with the first round of Dipper surveys, stream reaches were delineated according to Rosgen's classification (1994) and an assessment of stream and riparian habitat quality was conducted for each delineated reach using EPA's rapid bioassessment protocol (Appendix 2). Maps and UTM positions of delineated reaches are also provided in Appendix 1. Observations during the initial survey indicated that Dipper nest habitat was of higher quality compared to the surrounding matrix of riparian-stream habitat. Observations also indicated that when Dippers have young in the nest, foraging typically occurs within 50m of the nest site. Therefore, an additional stream-riparian habitat quality survey, also using EPAs rapid bioassessment protocol, was conducted which targeted habitat 50m up and downstream of Dipper nest sites.

RESULTS

Initial Dipper surveys documented 28 mated pairs and 28 active nests in the survey area. However, a second round of surveys documented that only 23 of those 28 nests were successful while 5 of the 28 were not. Maps and UTM positions of the survey area with Dipper pair sightings and nest location of nests are provided in Appendix 1. Dippers chose to build their nests in a variety of sites including cliffs, boulders, bridges and tree limbs that overhang the stream. At all but one site (nest site number seven) nests were located over deep, fast flowing water and consequently inaccessible to most predators (Figure 4). Nest site seven is located on a cliff face on the cutbank side of the stream and, although the site was historically located over a fast-deep flow regime, due to dam-induced flow alteration, the nest site is over dry land. Nest locations varied in height above water level from 1 meter on boulders to up to 4 meters on cliff faces and up to 5 meters when nests were built under bridges.

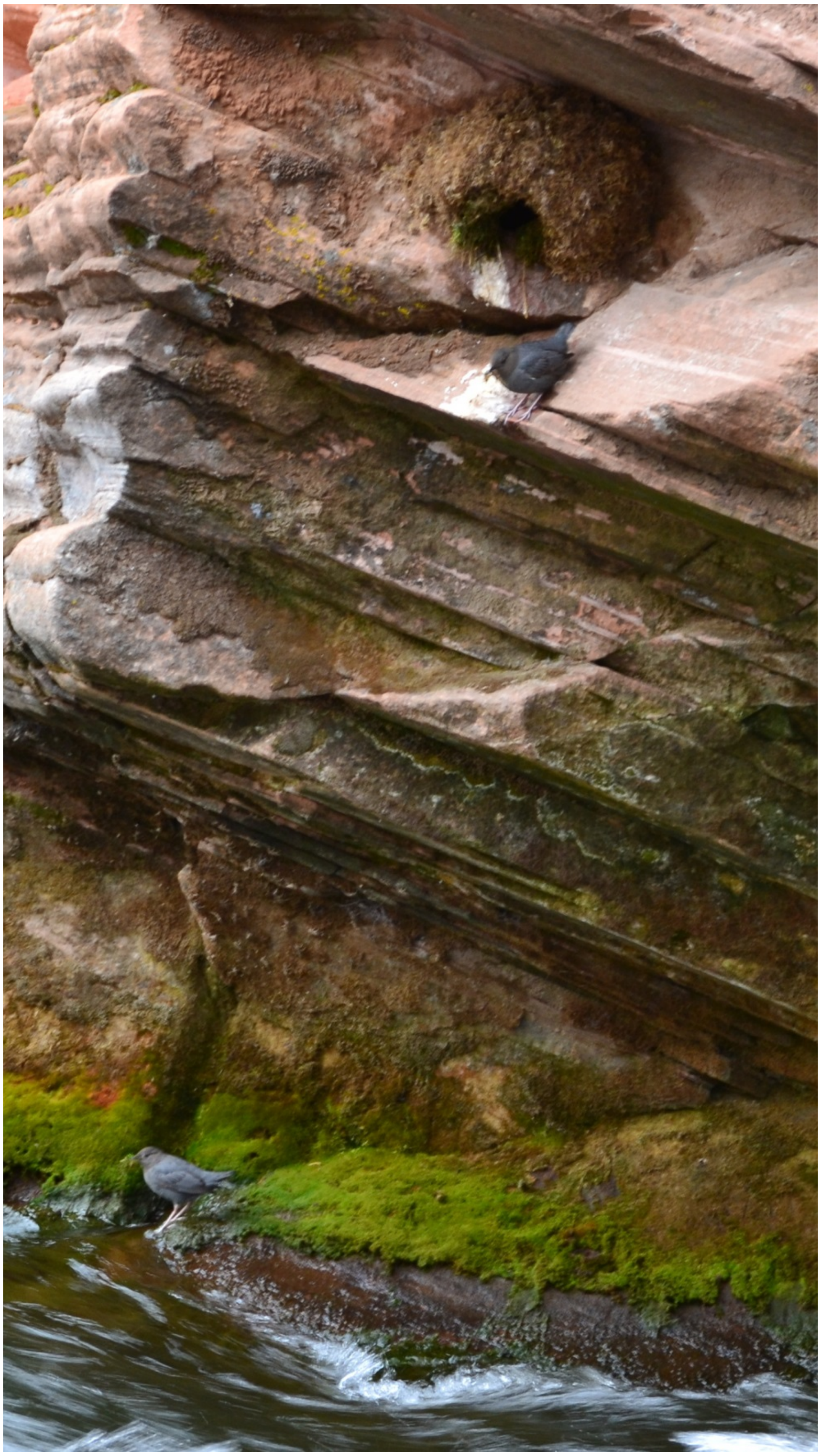


Figure 4: Dippers typically select nest sites that are located over fast, deep flows, using moss from surrounding rocks as nest material.

Typically, parents foraged near their nest sites (within 50m) and delivered food every 1 to 2 minutes, often singing while foraging. Sounds of nestling begging began only when parents were within a few feet of the nest but could be heard even above the sounds of the river. Food delivery occurred by one of two methods; either the parent would enter the nest to deliver food or would hover at the nest entrance while feeding nestlings (Figure 5). However, parents would only deliver food to their nestlings if I was greater than 30 -40m from the nest; if I approached to a distance closer than 30-40m, parents stopped deliver food to their nestlings, their behavior became agitated with rapid dipping and blinking and singing ceased. Food delivery would begin again upon my retreat to greater than 30m distant but only after a waiting period of two to three minutes.

Figure 5: Dipper parent delivers food to nestlings while hovering.

Stream-riparian habitat quality 50m up and 50m downstream of Dipper nest sites differed significantly from habitat quality of the surrounding matrix stream-riparian habitat (Figure 6). Reach Habitat scores were compared with Nest Habitat scores using a Paired Difference Test (PDT). The PDT was used to statistically evaluate the difference between average nest scores and average reach scores. Analysis indicates that the difference between nest and reach scores is statistically significant at the 99.5% confidence limit. Stream-riparian reach scores varied from 116 to 155 out of a possible high score of 200. Nest habitat scores varied from 126 to 176. Habitat condition ranges from optimal for scores that range from 200-166, suboptimal from 113-165, marginal from 60-112, and poor for scores below 60. Reach number 13 at the base of Ruedi dam and nest site 24 which, was located on a dam abutment and was later destroyed, were judged to be anomalous and were not included in the analysis. Habitat score results are summarized in Table 1. Scoring data for reach and nest habitat data are provided in Appendix 2.

Table 1: American Dipper Survey on the Fryingpan River: Summary Data

1st Survey Date	2nd Survey Date	3rd Survey Date	Reach #	Dipper Pair #	Nest Site #	Successful Nest Yes/No	Successful Fledging Yes/No	Nest Location	Nest Habitat Quality Score	Reach Habitat Quality Score	Dominant Riparian Vegetation	Photo #s
4/7/2014	5/9/2014	6/21/2014	R1	069	001	yes	Yes	Bridge	126	116	POAN/SAEX-ACGL-COSE	1-1.1
4/7/2014	5/9/2014	6/21/2014	R1	071	002	yes	Yes	Bridge	127		POAN/SALIX-COSE	2-2.1
	No Access		R2						No Access			
3/26/214	5/9/2014	6/21/2014	R3	035	003	yes	Yes	Boulder	175	155	POAN/mixed shrubs	3 -3.5
3/16/2014	5/10/2014	6/21/2014	R3	004	004	Yes	Yes	Cliff face	176		POAN/ALIN-COSE	4 - 4.3
3/17/2014	510/2014	6/22/2014	R4	007	005	Yes	Yes	Boulder	174	137	POAN-PSME-PIPU/Alin-Cose	5 - 5.1
3/17/2014	NA		R5		No Suitable Nest Habitat					124		R5
4/5/2014	5/10/2014	6/22/2014	R6	068	006	Yes	Yes	Cliff face	158	133	POAN/SAEX/EQVA	6-6.1
3/21/2014	5/13/2013	6/22/2014	R6	011	007	Yes	Yes	Cliff face	157		POAN/BECO-COSE	7-7.2
3/21/2014	5/13/1900	6/22/2014	R6	013	008	No	NA	Cliff face	155		LB:PIPU/ALIN; RB: POAN/SAEX-COSE	8
3/21/2014	5/13/2014	6/22/2014	R6	015	009	No	NA	Cliff face	157		LB: PIPU/ALIN; RB: SALIX-COSE	9 -9.1
3/23/2014	5/13/2014	6/22/2014	R6	018	010	No	NA	Cliff face	136		LB:PIPU/ALIN; RB: SALIX-COSE	10-10.5
3/23/2014	5/13/2014	6/22/2014	R6	021	011	No	NA	Tree limb	146		LB: POAN-PIPU/ALIN; RB: SALIX-COSE	11-11.5
3/23/2014	5/13/2014	6/24/2014	R6	023	028	Yes		Cliff face	144		LB:POAN-PIPU/ALIN; RB: POAN/COSE	28-28.1
3/28/2014	NA		R7		No Suitable Nest Habitat					147		R7
3/28/2014	5/13/2014	6/23/2014	R8	037	012	Yes	Yes	Bridge	132	119	POAN/BEOC-COSE-SAEX	12 - 12.2
3/24/2014	5/17/2014	6/23/2014	R8	026	013	Yes	Yes	Bridge	138		POAN/SALIX-COSE	13 -13.2
3/24/2014	5/17/2014	6/23/2014	R8	025	014	Yes	Yes	Bridge	135		POAN/ALIN-COSE	14-14.2
3/31/2014	5/17/2014	6/23/2014	R9	040	015	Yes	Yes	Bridge	134	120	POAN/ALIN-BEOC-COSE	15 -15.2
3/31/2014	5/17/2014	6/24/2014	R10	038	016	Yes	Yes	Tree limb	170	133	LB: PIPU/ACGL; RB: POAN/BEOC-COSE	16.1-16.2
4/1/2014	5/17/2014	6/24/2014	R10	045	017	Yes	Yes	Cliff face	167		LB: PIPU/ACGL; RB: POAN/ALIN-COSE	17-17.7
4/1/2014	5/17/2014	6/24/2014	R10	047	018	Yes	Yes	Boulder	160		LB:PIPU/ALIN-BEOC-COSE; RB: POAN/BEOC-COSE	18.1-18.2
4/1/2014	5/17/2014	6/24/2014	R10	049	019	Yes	Yes	Cliff face	169		PIPU/ALIN-COSE	19.1-19.2
4/4/2014	5/18/2014	6/24/2014	R11	057	020	Yes	Yes	Bridge	143	132	LB: PIPU/ALIN-COSE; RB: POAN/ALIN-BEOC-COSE	20.1-20.3
4/4/2014	5/18/2014	6/24/2014	R11	060	021	Yes	Yes	Cliff face	164		LB: PIPU/ALIN; RB: POAN/ALIN-SALIX	21-21.2
4/4/2014	5/18/2014	6/24/2014	R12	061	022	Yes	Yes	Cliff face	163	125	LB: PIPU/ALIN/EQVA; RB: POAN/mixed shrubs	22-22.2
4/4/2014	5/18/2014	6/24/2014	R12	063	023	Yes	Yes	Footbridge	150		LB: PIPU/ALIN/EQVA; RB: POAN/ALIN/EQVA	23-23.1
4/3/2014	5/25/2014	6/24/2014	R12	052	025	Yes	Yes	Boulder	157		PIPU/BEOC-COSE	25-25.2
4/3/2014	5/25/2014	6/24/2014	R12	056	026	Yes	Yes	Boulder	157		PIPU/BEOC-SALIX-COSE	26-26.2
4/3/2014	5/25/2014	6/24/2014	R12	054	027	Yes	Yes	Boulder	157		PIPU/BEOC-COSE	27-27.3
4/4/2014	5/25/2014	NA	R13	067	024	No	NA	Dam	85	110	BEOC-ALIN-SAEX-COSE	

Some, but not all, instream and riparian habitat parameters differed between reach and nest habitat. Those parameters that were relatively constant between reach and nest habitat included channel flow status, embeddedness and sediment deposition. Channel flow status scored optimal throughout the survey area due to dam-controlled flows. Embeddedness and sediment deposition parameters scored between suboptimal and marginal throughout the survey area, also a consequence of dam-controlled stream flows. Those parameters that differed between reach and nest habitat and that consistently scored higher in nest habitat included epifaunal substrate, velocity/depth regime, channel alteration and all parameters that consider vegetative cover. Reach habitat did not score higher in any category compared to nest habitat, except for reach 13..

Figure 6: Small pockets of good quality nest habitat is surrounded in a matrix of lower quality habitat such as results from the roadcut that is seen in the distance.

Riparian vegetation on lower reaches is characterized by narrowleaf cottonwood-alder (*Populus angustifolia-Alnus incana*) woodlands interspersed with willow (*Salix* spp.) and red-osier dogwood (*Cornus sericea*) shrublands. Riparian vegetation at higher elevation reaches are characterized by Colorado blue spruce-narrowleaf cottonwood/Alder-river birch (*Picea pungens-P. angustifolia*/*A. incana-Betula occidentalis*) woodlands in a mosaic with red-osier dogwood and willow shrublands. Throughout the survey area the tree canopy is dominated by mature and decadent individuals with little recruitment to replace dying trees. Dam-controlled stream flow has diminished flooding flows and altered the timing of receding flows. Consequently throughout the survey area there is only minimal cut bank-point bar development to enable seedling establishment and recruitment of young trees to replace decadent and dying trees. Throughout the survey area floodplain is drying as indicated by the encroachment of more drought-tolerant vegetation. Further, excessive soil deposition at the base of cliffs on the cutbank side of the stream has enabled the colonization of vegetation and consequent elimination of potential nest sites.

DISCUSSION

Dam-controlled streams flows in the Fryingpan River below Ruedi dam in combination with anthropogenic development have altered many of those environmental factors essential to the reproductive success of American Dippers. Factors that limit Dipper reproductive success include suitable nest habitat which consists of available nest sites, abundant and accessible forage, sufficient bank vegetative cover and disturbance.

Reproduction is energetically expensive. Parents must feed themselves as well as their fledglings, protect their territory and guard against predators. Nest habitat conditions must be optimal for successful reproduction. Thus successful reproduction can be an excellent indicator of habitat quality. Surveys documented that five of 28 initial nest attempts were not successful. Four of the nests were abandoned and one was destroyed. Additionally, an abundance of appropriate but unoccupied nest sites are present. The presence of a greater number of potential nest sites than active, successful nests indicates that factors other than nest site availability are limiting Dipper abundance on the Fryingpan River.

Throughout the survey area, except in those limited areas where Dipper nests are located, the velocity/depth regime has been simplified as a consequence of diminished flooding flows and anthropogenic development. Flooding flows sculpt the stream, carving out and creating the shallow riffles and pools required by Dippers for foraging (Figure 7 and 8). Throughout the survey area, stream substrate is excessively embedded with fine sediment. Flooding flows cleanse the stream of excessive sediment that clogs interstitial spaces between cobbles that provides habitat where macroinvertebrates live and Dippers forage. Algal growth on the stream substrate is excessive throughout the survey area and inhibits Dipper foraging (Figure 9). Flooding flows “flush” the stream of excessive nutrients that result in excessive algal growth and redeposit those nutrients on surrounding floodplains. Flooding flows thus replenish riparian soils with the sediment, nutrients and water required by riparian vegetation. Receding flooding flows deposit soils, building point bars where cottonwood seedlings can establish and eventually replace mature and decadent trees. Road-induced channelization is extensive and has eliminated vegetation and straightened the stream (Figure 10). A naturally meandering stream with a natural flow regime, replete with flooding flows of a natural duration with and period of recession, creates the intricate template upon which biological diversity develops and thrives. Dam and development-induced habitat simplification has diminished the resources needed by Dippers.

Figure 7: Quality Dipper nest habitat is found where complex instream and riparian habitat create foraging, nesting and cover resources.


Figure 8: The physical structure of a stream in combination with the hydrologic regime, form a template that enables success. Boulders provide important perch sites while foraging.


Figure 9: Excessive sediment and a heavy algal coat characterize the stream substrate through the majority of the survey area.


Figure 10: Anthropogenic development has simplified instream structure thereby eliminating Dipper foraging habitat and nest sites.

During the nesting phase of Dipper reproduction, although adults must continually feed nestlings, the parents behavior is secretive and cautious and the nestlings are silent (Figure 11). Upon approach of the adults, begging nestlings become noisy enough to be heard above the roar of the stream. However, if I was closer than 30-40m adults did not approach the nest to feed – regardless of the outcry from the nestlings. Only when the observer was at a distance of typically greater than 50m did adults deliver food to nestlings. Implications of human disturbance to nesting success can be implied from these observations. Recreational use of the Fryingpan by fishermen is intense and is often focused near nest sites where habitat for fish is also improved compared to surrounding habitat. Frequent disturbance by fishermen will likely result in reduced feeding of nestlings and may impact reproductive success.

Figure 11: Parents must deliver food to nestlings almost continuously.

American Dippers persist in the Fryingpan in isolated patches of higher quality habitat that provide the resources essential to successful reproduction (Figure 12). Management of the Fryingpan River that included restoration of a natural flow regime, sustainable riparian vegetation and reduced anthropogenic disturbance would likely see increased abundance of American Dippers and restoration of a healthy river system.

Figure 12: Good quality Dipper habitat includes protected nest sites, foraging habitat and bank vegetation cover (nest site 26).

Recommendations for Future Monitoring

Suitable nest habitat, as indicated by the presence of available nest sites, was mapped for future monitoring efforts (Appendix 1). Suitable habitat is identified as well as successful and unsuccessful nest sites. Suitable habitat and nest sites should be surveyed yearly for presence/absence of Dippers during phenologically appropriate times. Stream reaches should be surveyed in detail every five to ten years. Yearly presence/absence surveys will indicate statistically significant, short-term watershed trends while detailed surveys will enable a statistical look at long term stream reach trends.

LITERATURE CITED

Feck, J. and R.O. Hall, Jr. 2004. Response of American dippers (*Cinclus mexicanus*) to variation in stream water quality. Freshwater Biology, 49, 1123–1137.

Kingery H. E. 1996. American Dipper. In The Birds of North America, No. 229 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA and the American Ornithologists' Union, Washington, D.C.

Price F. E. 1975. A study of population dynamics in the dipper, Cinclus mexicanus [Ph.D.]. Boulder, CO: University of Colorado. 198 pp.

Price F. E., C. E. Bock. 1983. Population ecology of the dipper (Cinclus mexicanus) in the Front Range of Colorado. Studies in Avian Biology 7:1-84.

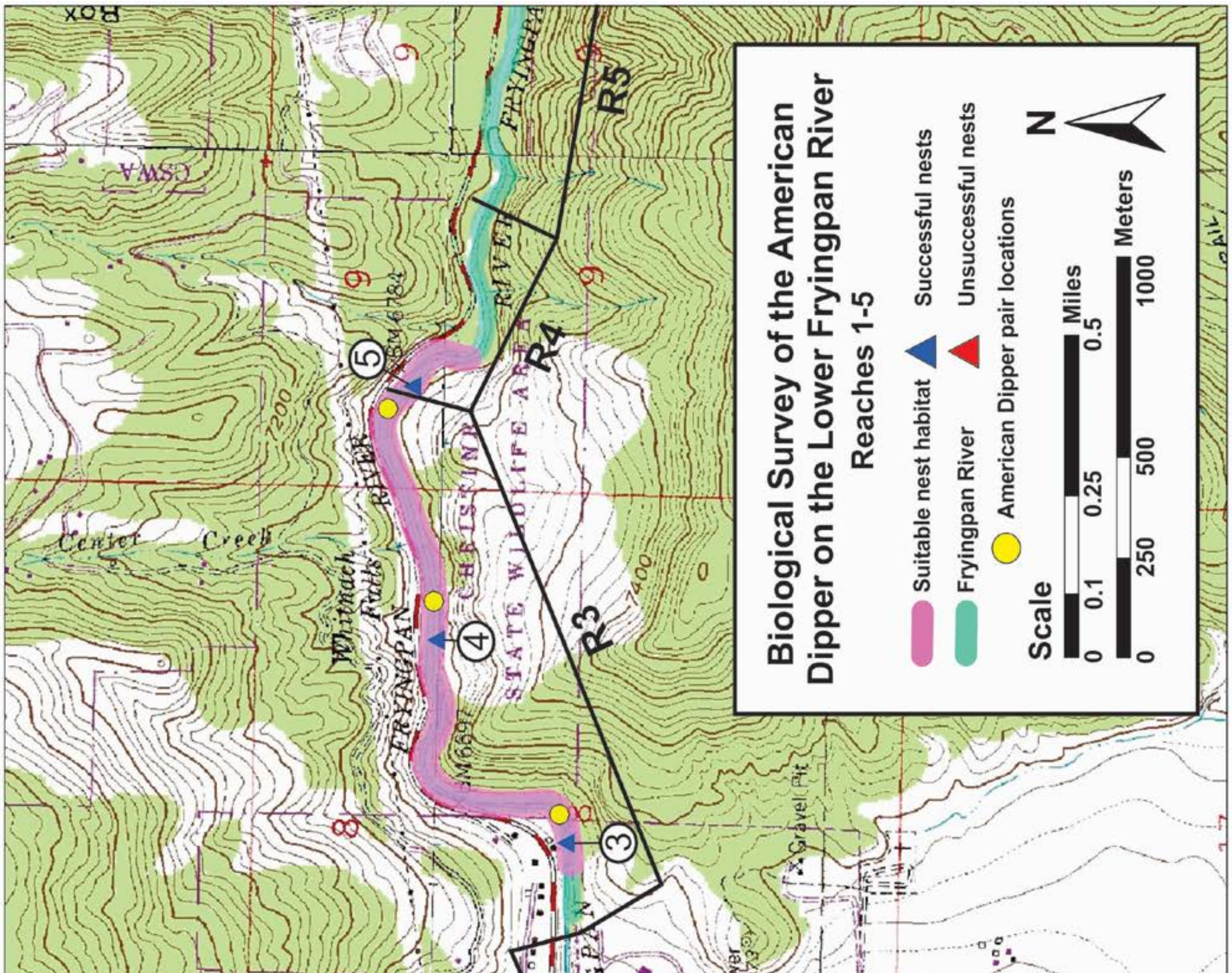
Rosgen, D.L., 1985. A stream classification system. In: Riparian Ecosystems and Their Management. First North American Riparian Conference. Rocky Mountain Forest and Range Experiment Station, RM-120, pp. 91-95.

Tyler, S.J. and S.J. Ormerod. 1994. The Dippers. T & AD Poyser Ltd. London.

Vickery, J. 1992. The Reproductive Success of the Dipper, Cinclus cinclus, in relation to the acidity of streams in south-west Scotland. Freshwater Biology. Oxford. Vol 28, no 2 pp 195-205.

Ward and Kondratieff 1992. An Illustrated Guide to the Mountain Stream Insects of Colorado. University of Colorado Press. 191pp.

APPENDIX 1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Reaches 1-5
Suitable nest habitat
Fryingpan River
American Dipper pair locations
Successful nests
Unsuccessful nests
N
Scale
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0.25
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Miles
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250
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R2
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2
3
4
5
Basalt
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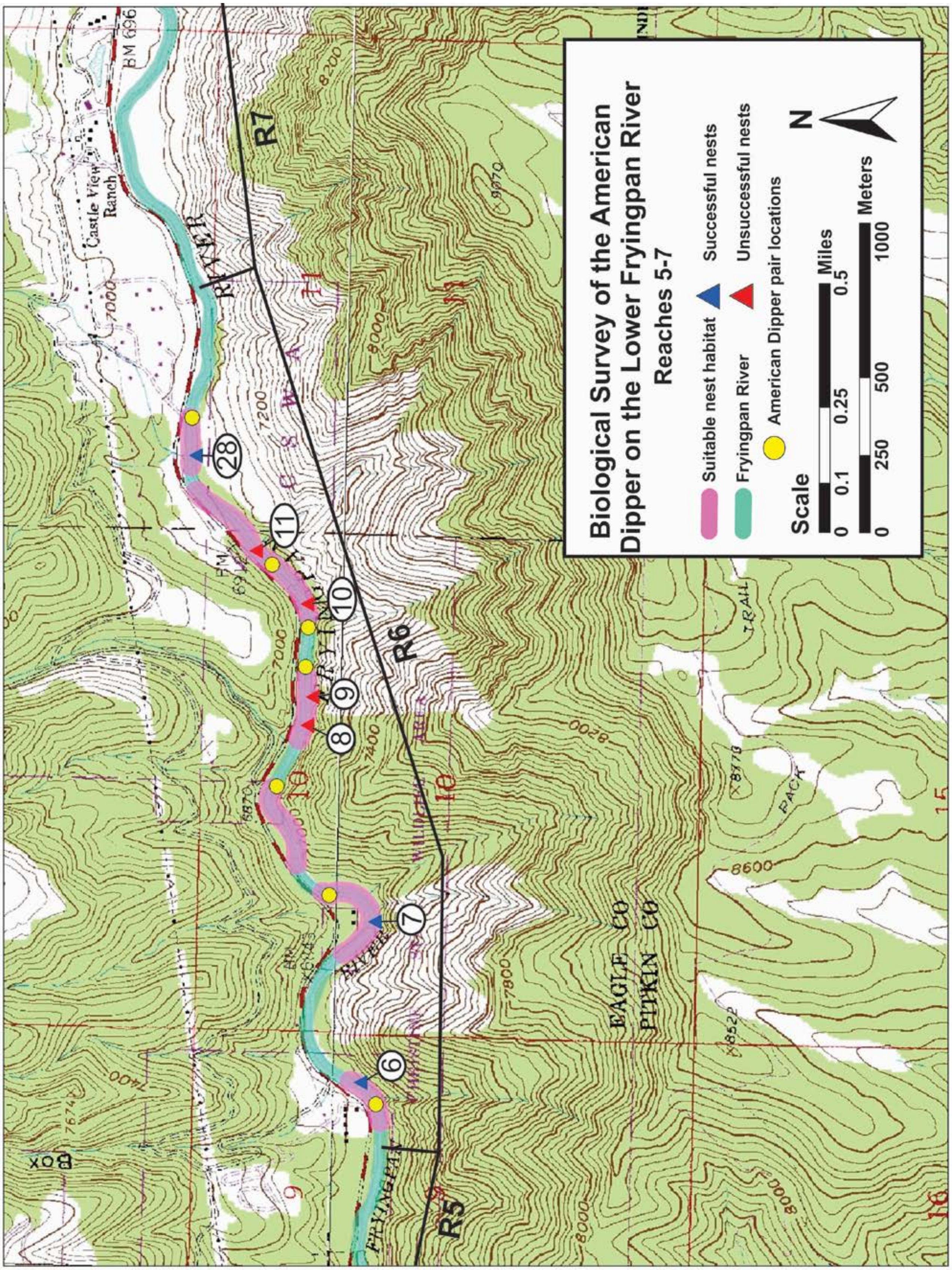
STATE WILDLIFE AREA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Fryingpan River
American Dipper pair locations
Successful nests
Unsuccessful nests
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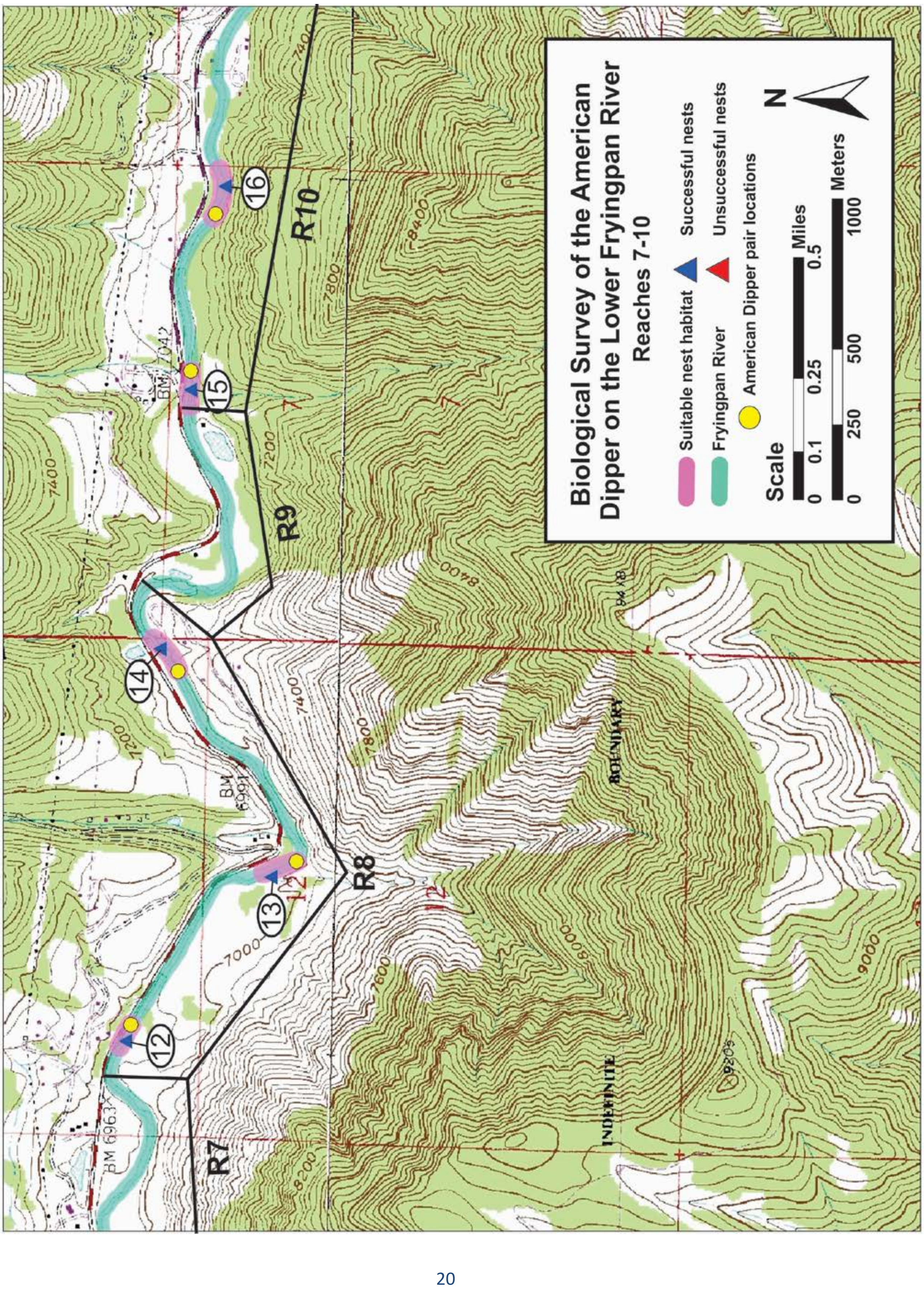
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Successful nests
Fryingpan River
Unsuccessful nests
American Dipper pair locations
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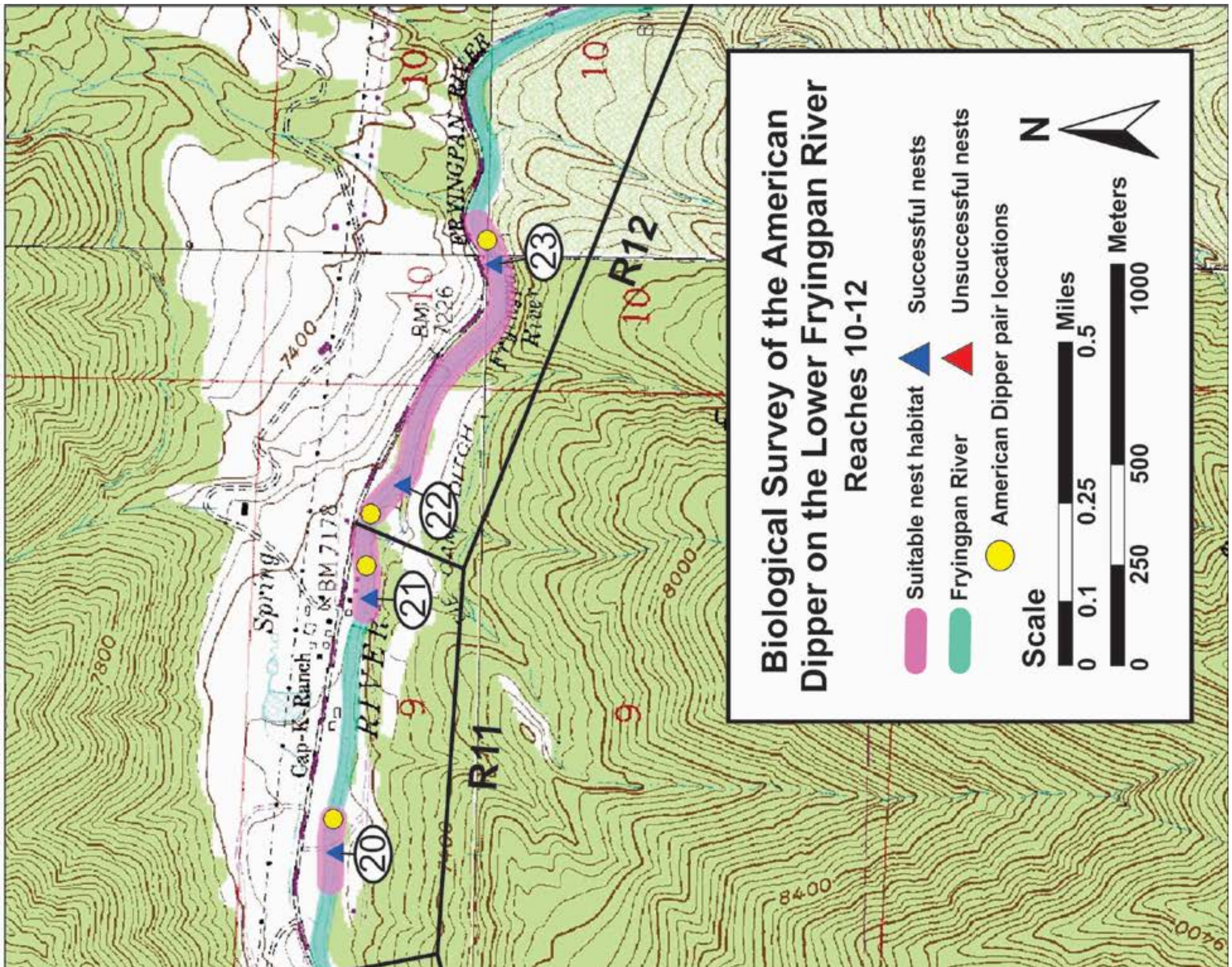

Biological Survey of the American Dipper on the Lower Fryingpan River
Reaches 10-12
Suitable nest habitat
Fryingpan River
American Dipper pair locations
Successful nests
Unsuccessful nests
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0 250 500 1000 Meters
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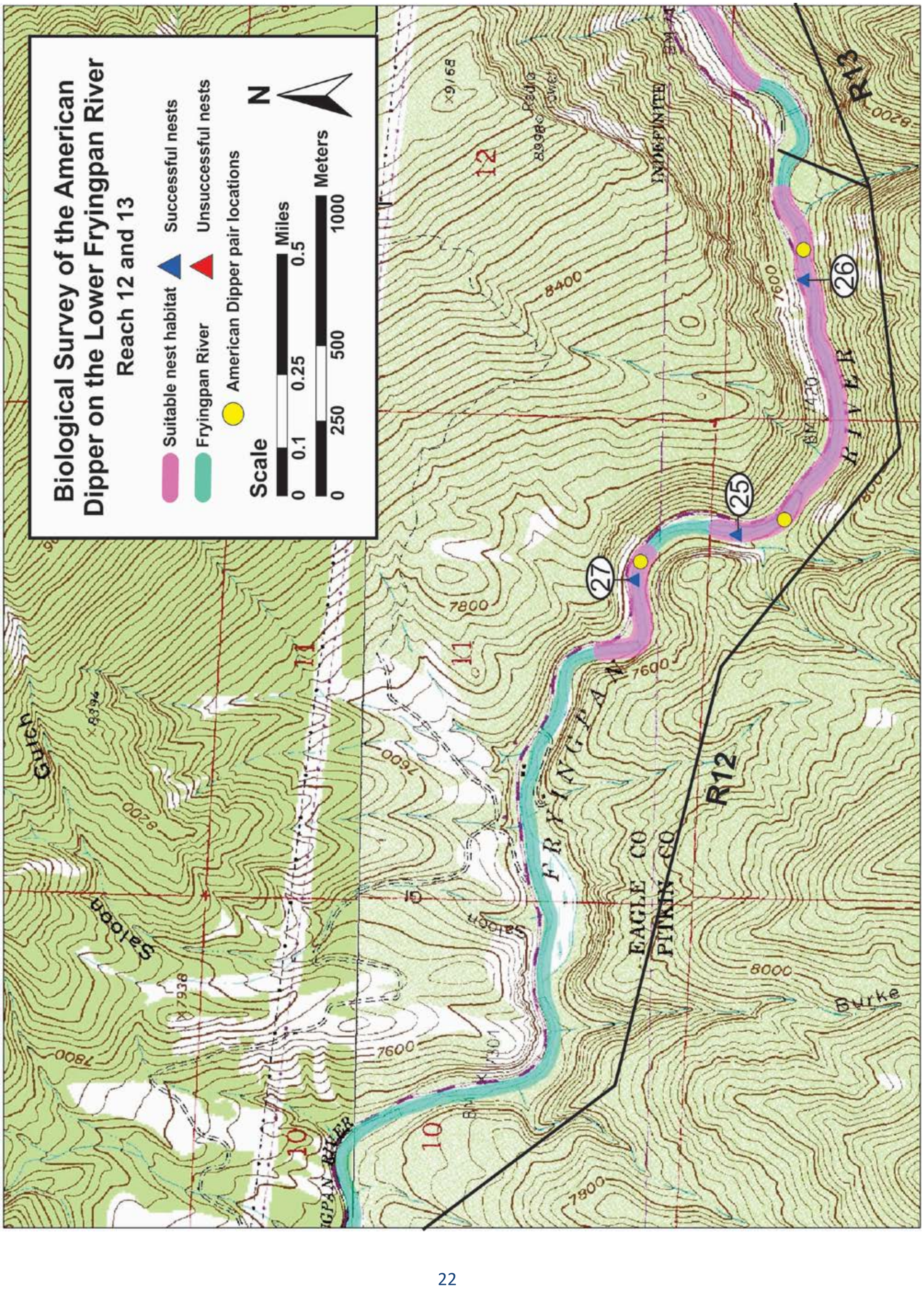
Wilson
Creek
FRYINGPAN RIVER



Biological Survey of the American Dipper on the Lower Fryingpan River
Reach 12 and 13
Suitable nest habitat
Fryingpan River
Successful nests
Unsuccessful nests
American Dipper pair locations
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0 250 500 1000 Meters
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R13
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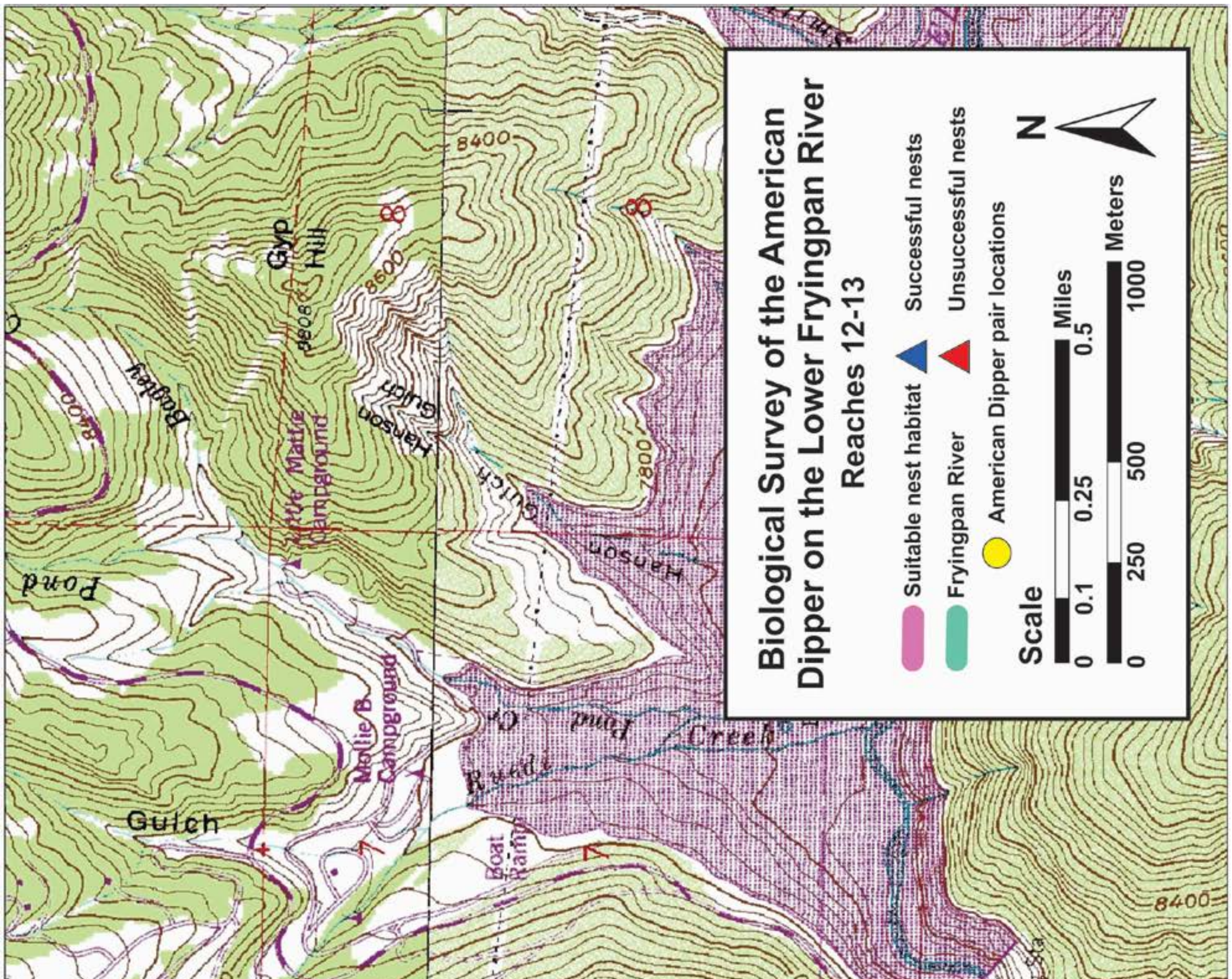
PITKIN CO
Saloon
Gulch
Burke
INDEPENDENCE


Biological Survey of the American
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Reaches 12-13
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Successful nests
Fryingpan River
Unsuccessful nests
American Dipper pair locations
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R12
R13
Red Hill
Gyp Hill
Gulch
Pond
Hanson Gulch
Little Maud Campground
Mollie B Campground
Little Mattie Campground
Boat Ramp
Power Plant
Creek
8400
8000
8600
9,168
24

APPENDIX 2

NEST SITE HABITAT QUALITIY SCORES															
Reach #	Nest #	% Epi Substrate	% Embedded ness	Velocity/ Depth regime	% Sediment Deposition	Channel Flow Status	Channel Alteration	Riffle Frequency	Bank Stability LB	Bank Stability RB	Veg Protection LB	Veg Protection RB	Riparian Zone % LB	Riparian Zone % RB	Total Score Habitat Quality Score
R1	1	15	15	10	10	20	10	16	8	6	7	5	2	2	126
R1	2	15	15	10	10	20	10	16	7	5	7	5	5	2	127
R2		NO ACCESS													
R3	3	19	15	16	15	20	19	18	9	9	9	8	9	9	175
R3	4	19	15	16	15	20	19	18	9	9	9	9	9	9	176
R4	5	19	15	16	15	20	19	18	8	9	8	9	9	9	174
R5		NO SUITABLE NEST HABITAT													
R6	6	18	15	16	15	20	15	18	9	7	9	5	9	2	158
R6	7	18	11	15	11	20	16	16	9	9	5	9	9	9	157
R6	8	18	11	15	11	20	16	16	9	7	9	7	9	7	155
R6	9	19	11	15	11	20	17	16	9	7	9	7	9	7	157
R6	10	15	11	15	11	20	15	16	9	2	9	2	9	2	136
R6	11	15	11	15	11	20	12	16	9	7	9	7	9	5	146
R6	28	17	11	15	11	20	12	16	9	5	9	5	9	5	144
R7		NO SUITABLE NEST HABITAT													
R8	012	15	13	10	11	20	10	14	9	7	9	5	5	4	132
R8	013	15	13	10	11	20	10	14	8	8	8	6	9	6	138
R8	014	14	13	10	11	20	12	14	9	6	9	5	9	3	135
R9	015	15	11	10	11	20	15	17	7	7	6	6	6	3	134
R10	016	18	15	17	15	20	17	17	8	9	8	9	10	7	170
R10	017	18	15	17	14	20	14	17	9	9	9	9	10	6	167
R10	018	18	12	16	11	20	17	16	10	8	10	7	10	5	160
R10	019	17	15	16	15	20	17	16	10	9	9	8	10	7	169
R11	020	16	14	15	10	20	12	18	8	6	8	6	8	2	143
R11	021	18	16	17	15	20	15	18	9	8	8	8	10	2	164
R12	022	17	14	16	12	20	17	17	9	8	8	8	9	8	163
R12	023	16	14	16	12	20	10	17	9	6	9	6	10	5	150
R12	025	16	14	17	10	20	15	17	10	7	10	6	10	5	157
R12	026	18	14	18	10	20	18	17	9	5	9	5	9	5	157
R12	027	18	14	17	10	20	16	17	10	5	10	5	10	5	157
R13	024	10	11	9	10	20	5	5	9	5	0	0	0	1	85

STREAM REACH QUALITY SCORES														
	% Epi Substrate	% Embedded ness	Velocity/ Depth regime	% Sediment Deposition	Channel Flow Status	Channel Alteration	Riffle Frequency	Bank Stability LB	Bank Stability RB	Veg Protection LB	Veg Protection RB	Riparian Zone % LB	Riparian Zone % RB	Total Score Habitat Quality Score
RF1	15	15	10	10	20	10	16	5	5	2	2	3	3	116
RF2							NO ACCESS							
RF3	15	15	16	15	20	13	18	9	7	8	5	7	7	155
RF4	11	11	11	11	20	11	16	8	8	9	7	9	5	137
RF5	5	15	10	11	20	10	18	9	5	9	1	10	1	124
R6	11	11	15	11	20	10	16	9	4	9	4	9	4	133
R7	14	11	10	11	20	18	10	9	9	9	9	9	8	147
R8	10	13	10	11	20	10	14	7	4	6	4	6	4	119
R9	8	11	10	11	20	10	17	9	2	9	2	9	2	120
R10	12	12	13	11	20	13	13	7	6	7	6	7	6	133
R11	13	14	11	10	20	11	18	7	5	7	5	8	3	132
R12	11	14	11	10	20	10	17	9	2	9	2	9	1	125
R13	10	11	9	10	20	5	5	9	6	9	6	9	1	110

UTM Postion of Stream Reaches				
Reach#	Downstream Point		Upstream Point	
	Easting	Northing	Easting	Northing
1	324743	4359447	325104	4359710
2	No Access			
3	325763	4359992	327063	4360422
4	327073	4360422	327564	4360190
5	327569	4360186	328077	4360126
6	328088	4360125	330832	4360691
7	330842	4360703	331821	4360884
8	331832	4360904	333503	4360813
9	333514	4360793	334121	4360670
10	334155	4360674	336628	4360457
11	336641	4360462	337749	4360370
12	337762	4360365	342215	4358569
13	342232	4358563	343096	4358488

UTM Position of Suitable Nest Habitat				
Suitable Nest Habitat	Downstream point		Upstream Point	
	Easting	Northing	Easting	Northing
1	324798	4359449	324864	4359532
2	325048	4359646	325130	4359747
3	325904	4359994	327165	4360247
4	328,154	4,360,133	328,297	4,360,222
5	328,700	4,360,246	328,902	4,360,302
6	328,994	4,360,394	329,236	4,360,470
7	329,391	4,360,388	329,593	4,360,361
8	329,791	4,360,358	330,192	4,360,715
9	330,264	4,360,738	NA	
10	331,978	4,360,897	NA	
11	332,573	4,360,384	NA	
12	333,291	4,360,748	NA	
13	334,174	4,360,669	NA	
14	334,729	4,360,591	334,891	4,360,570
15	335,658	4,360,242	335,803	4,360,245
16	335,925	4,360,258	336,624	4,360,457
17	336,888	4,360,457	337,034	4,360,451
18	337,568	4,360,369	337,738	4,360,372
19	337,820	4,360,340	338,526	4,360,091
20	340,545	4,359,221	340,870	4,359,081
21	340,950	4,358,840	342,064	4,358,631
22	342,447	4,358,737	342,757	4,358,930

UTM Position of Nest Sites		
Nest Site	Easting	Northing
1	324823	4359471
2	325088	4359689
3	325958	4360006
4	326458	4360323
5	327093	4360389
6	328290	4360187
7	328799	4360142
8	329436	4360360
9	329527	4360343
10	329830	4360365
11	329999	4360528
12	331998	4360883
13	332544	4360405
14	333297	4360765
15	334152	4360667
16	334836	4360551
17	335746	4360204
18	335960	4360250
19	336369	4360314
20	336959	4360441
21	337590	4360356
22	337871	4360276
23	338422	4360049
24	343089	4358508
25	340928	4358783
26	341777	4358561
27	340780	4359128
28	330306	4360718

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION #_________ RIVERMILE_________	STREAM CLASS	
LAT _____________ LONG _____________	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _______ TIME _______ AM PM	REASON FOR SURVEY

	Habitat Parameter	Condition Category			
		Optimal	Suboptimal	Marginal	Poor
Parameters to be evaluated in sampling reach	1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score __________

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION
STATION #________ RIVERMILE________	STREAM CLASS
LAT ____________ LONG ____________	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS	
FORM COMPLETED BY	DATE ________ TIME ________ AM PM / REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score _________