

**SJRIIP PIT ANTENNA INSTALLATION—VARIOUS LOCATIONS
2021 Project Proposal**

Principal Investigators:

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BACKGROUND:

PIT tag antennas are used throughout the Colorado Basin to develop various vital rates for endangered fish, including survival, population size, movements and habitat use (Pennock et al. 2020, in press; Stout et al. 2020 a, b, Cathcart et al. 2018 a, b, 2019). Various fish species captured through various projects directly supported by the SJRIIP or funded through other agencies and projects (CPW, BOR, BLM, NMGF, and UDWR) are PIT-tagged. Stationary PIT Tag antennae have been installed at various locations in the San Juan River Basin to passively detect fish as they swim above, through, or underneath the antennas (Table 1).

Table 1. Current PIT-tag antenna sites

Site	Number of antennas	Number of arrays	River-wide
PNM Fish Passage and Weir	5	5	No, but detect most fish
Hogback Diversion and Fish Weir	6 in SJR 5 in Fish Weir	2 in SJR	No, but will be 9/2020
Shiprock Restored Channel	3	3	No, located on 2 ⁰ channel
RERI/TNC Phase II	4	2	No, located on 2 ⁰ channel
McElmo Creek	9	4	Yes, span McElmo in 4 places
Piute Farms Waterfall	1	1	No

OBJECTIVE:

This SOW proposes to install three more single, pass-over antennae at three additional sites in the San Juan River. Antennae would consist of a single 20-foot HDPE antenna (Figure 1) that would be anchored to the riverbed using duck-bill anchors and a hydraulic hammer (Figure 2). Antennae placement will occur near gravel beds that are stable and submerged at all flows. They will also be placed near bends in the river where most of the flow is typically on one side of the river.

Figure 1. Example of the proposed 20-foot antenna to be installed in San Juan River.



Figure 2. Anchoring the antenna using duck-billed anchors and a hydraulic hammer.



Electronics and power for the antennae would consist of:

- Solar panel with 4 X 115 AH batteries
- IS1001 reader with instream enclosure
- 200' DOP cable

These antennae would not be part of a "design" but could provide more detections of fish in these sections of the river as well as information on a potential spawning bar for Colorado pikeminnow that may be located in the vicinity of the second antenna. Since this would not be a multiple-array system the data would only provide information on species, number, and timing of movements.

POTENTIAL ANTENNA SITES:

These proposed antenna sites will be evaluated during a river-long reconnaissance trip to evaluate suitability. Suggested antennas sites are:

- 1) Gravel bar near the RERI/TNC Restoration site. This antenna would serve as a good comparison to the antennae located in the secondary channel (Figure 3)
- 2) In gravel adjacent to the bank near the "Powerline takeout" (Figure 4) .

- 3) In large backwater or secondary channel, depending on flows approximately 1 km upstream of the 4-Corners Bridge (Figure 5). This location is near a potential Colorado pikeminnow spawning bar.
- 4) The bend just above Slickhorn Canyon (Figure 6). This is a potential Razorback Sucker spawning bar.
- 5) Somewhere between Montezuma Creek and Butler Wash (No site has been identified).

Figure 3. Potential PIT-tag antenna locations near RERI/TNC Restoration site.

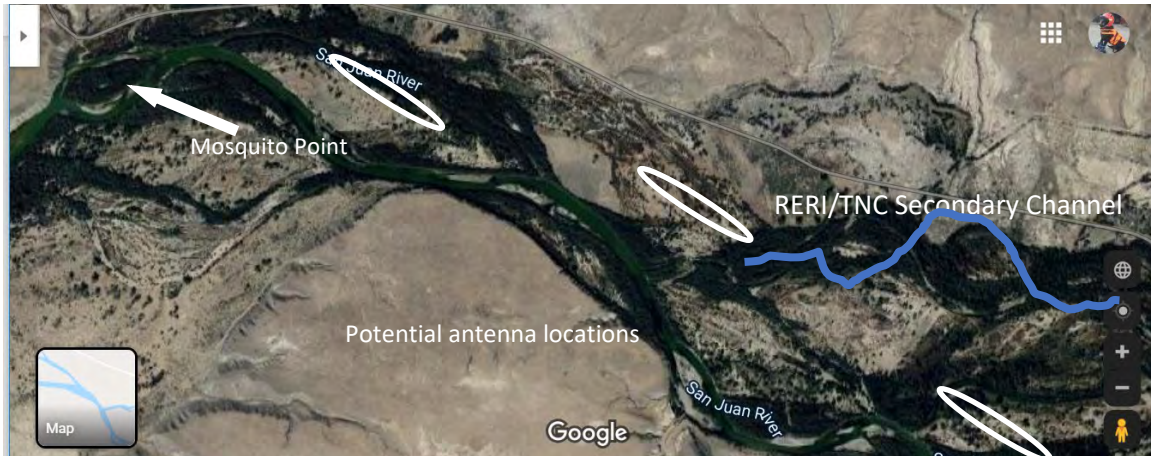


Figure 4. Potential PIT-tag antenna site near Powerline access point.



Figure 5. Potential PIT-tag antenna site near Four-Corners Bridge.



Figure 6. Potential PIT-tag antenna site above Slickhorn Camp A.



METHODS:

- 1) Antennas will be installed using hydraulic hammers and electronics will be placed in a small job box with a single solar panel and battery to power the system.
- 2) Antennae will be checked at least twice yearly and downloaded. Data will be uploaded to STReaMS database for use by other researchers.

Evaluation

The evaluation of the data that comes from these antennas is beyond the scope of this work. Pit tag detections are used in many projects and have been used to assess survival (Durst et al.), movements (Cathcart et al. 2018a, b, 2019, Pennock et al., 2020, in press) and population size (Stout et al. 2020). This data would be used in similar analyses and evaluations.

TASKS – 2021

1. Conduct reconnaissance trip to identify specific locations for antennae
2. Conduct 1-3 field trips to install antennas using vehicle or boat access.

FY 2021 BUDGET - \$96,019.56

Budget is for UDWR employee. All other costs are contract costs for Biomark. See quote attached.

**FY 2021 Draft Budget
San Juan River PIT Antenna Installation
Utah Division of Wildlife Resources**

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2021 Costs for UDWR- Moab

San Juan River PIT Atnenna Installation

Task 1. Antenna Installation (2 trips x 7 days x 2 people (only one on first trip))

Labor: salary + benefits + applicable overtime

	Rate	Hours	Cost
Project Leader	\$38.10	0	\$0
Biologist	\$33.91	200	\$6,781
Technician	\$17.08	100	\$1,708
		subtotal	\$8,489

Food and Transport

	Rate	Quantity	Cost
Monthly fleet rental (1 truck)	\$199.37	1	\$199
Mileage (1 truck x 500 miles x 2 trips)	\$0.40	1000	\$400
Food (5 days/trip)	\$35.00	15	\$525
Out-of-state Per Diem (2 days/trip)	\$46.00	6	\$276
Hotel (2 nights/trip)	\$105.00	6	\$630
Shuttle (Mexican-Clay Hills)	\$180.00	2	\$360
		subtotal	\$2,030

Equipment

	Rate	Quantity	Cost
Camping gear repair/replacement:			\$250
Sampling gear repair/replacement:			\$0
Boating gear repair/replacement:			\$750
		subtotal	\$1,000

Task 1		
Subtotal:		\$11,520

Task 2. Site selection, project coordination, reporting

Labor: salary + benefits + applicable overtime

Rate	Hours	Cost
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Project Leader	\$38.10	10	\$381
Biologist	\$33.91	40	\$1,356
Technician	\$17.08	0	\$0
		subtotal	\$1,737
Total Expenses			\$13,257
Administrative Overhead (16% on all personnel services)			\$1,636.26
UDWR-Moab Total			\$14,893

Budget Summary



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SUMMARY	Subtotal	Grand Total	Cumulative Total
Phase 1: Site Visit	\$8,513	\$8,513	\$8,513
Phase 2: System Test	\$43,864	\$43,864	\$52,376
Phase 3: Installation	\$28,751	\$28,751	\$81,127
Phase 4: O&M	\$0	\$0	\$81,127
TOTAL	\$81,126.56		

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SUMMARY (all Phases)

Labor		Hours	Rate	Subtotal
(1) Project Manager	00410	33.8625	\$165.00	\$5,587
(2) Chief Scientist		0	\$141.00	\$0
(3) Senior Scientist		0	\$127.00	\$0
(4) Scientist (Biology)		0	\$91.00	\$0
(5) Fisheries Specialist	00390	10.75	\$99.00	\$1,064
(6) Technician (Biology)		0	\$64.00	\$0
(7) Typist/Clerical		0	\$64.00	\$0
(8) Electronic Technician	00380	215	\$113.00	\$24,295
(9) Senior Electronic Eng.		0	\$154.00	\$0
Labor Total		259.6125		\$30,946.56
Nonlabor				
Travel	00470			\$6,500
Equipment				\$43,680
Nonlabor Total				\$50,180.00
Total				\$81,126.56

28 **Literature Cited**

29

30 Cathcart, C.N., M.C. McKinstry, and P.D. MacKinnon. 2019. A tribute to tributaries:
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44 Creighton, D. S. Elverud, and B. J. Schleicher. In Press. Movements of imperiled
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46 experimental translocations to aid conservation. Aquatic Conservation

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49 classy: Differentiating between live fish and ghost tags detected with a mobile
50 PIT tag interrogation system using an innovative analytical approach. Canadian
51 Journal of Fisheries and Aquatic Sciences

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53 Stout, J.B., M. Conner, P. Budy, P. Mackinnon, and M. McKinstry. (2019). We ain't
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55 ghost tags under differing flow conditions in a sand bed river. North American
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60 **Response to comments**
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Scope #	Project	PI(s)
32b	<i>SOW-32b-SRJIP Antenna Installation – Various Locations</i>	Hines; UDWR McKinstry; USBR

Steve Davenport, USFWS Region 2, BC member

How can the technical aspects of this SOW be improved?

Specific details could be included on the types of statistical models to analyze the data this project will collect, and a description of the estimable parameters for the various model types (i.e. robust design models to estimate capture probability, annual survival and abundance; multi-state models to estimate annual survival and immigration, etc) **Response: Analysis by the Program Office and other PIs on other projects will use this data.**

What is this SOW's contribution to recovery?

This SOW provides a method to collect important data in a non-invasive and inexpensive manner. This work is especially important considering that it will allow the evaluation of recovery goals post 2023.

Vince Lamarra, Navajo Nation, BC member

How can the technical aspects of this SOW be improved?

I have been an advocate for this proposal for some time and I am supportive of this project. However, the logic for the placement of the smaller antenna needs to be clearly stated. Are we just interested in local comparisons (for example, in the main channel near the Phase II secondary array) or should we be looking at a river-wide comparison of data? I also feel that a data analysis component needs be added this proposal that rather than just placing the data in STREAMS. In addition, only twice a year downloads may not be enough. The site near RM 17 will be problematic, it maybe be safer below Slickhorn where current and gradient is lower. **Response: Analyses of data derived from these antennas will be analyzed under other SOWs. This is outside the scope of this SOW. Antenna locations were only suggestions. We may move some of them depending on logistics.**

What is this SOW's contribution to recovery?

No comment

Jacob Mazzone, Jicarilla Apache Nation, BC member

How can the technical aspects of this SOW be improved?

Due to the nature of the installs I understand why a more specific study design is hard to pin down. Some contingency for equipment repair/replacement/maintenance/Data analysis is hopefully considered if these

systems are required to perform for any duration of time. **Response: O&M is covered under another SOW.**

What is this SOW's contribution to recovery?

It appears as the program moves toward 2023 and novel stocking/tagging techniques of Colorado Pikeminnow these arrays could provide useful information for *minimal* investment. I recall that we had fairly certain information that there were limited “missing fish” from analysis S. Durst and/or the PO has presented, so more arrays might not gain us as much as we hope?

Bill Miller, Southern Ute Indian Tribe, BC member

How can the technical aspects of this SOW be improved?

The objective as stated is a more a description of the work than what is expected from the installations. There should be an hypothesis for the SOW. If the only objective is to put more antennas in the river it is lacking in contribution to the Program. There should be an associated data analysis with this project. There should be an objective that states why the antennas are being installed and how the data collected would be evaluated. Colorado Pikeminnow move locally during summer and fall post spawning to feed in or near riffles. A location that is near a riffle may provide additional data on both long range movement in combination with other antennas and local movement post-spawning.

Response: Data analyses is outside the scope of this SOW. Data will be analyzed under other projects just like antenna data from other locations are used. We would like to install an antenna near a suspected COPM spawning site by 4-Corners Bridge.

What is this SOW's contribution to recovery?

The use of passive remote sensing could provide data on fish presence/numbers in place of some of the future active monitoring. This SOW could provide data to evaluate the use of this type of monitoring for a wider range of the river.

Ben Schleicher, USFWS R6, BC member

How can the technical aspects of this SOW be improved?

I like the idea of putting these semi-permanent antennas in. My concern is in location, with ease of shore access for PIs means ease of shore access for vandalism. Figure 4 is a great location however it is a high traffic area for locals and is also shifting sand and large rocks. Figure 5 is another great location where many RBS and CPM have been captured however the substrate is silt and at times over waste deep (personal experience). Site visits are planned in the SOW and that could alleviate my concerns with locations. Also, CDOT was going to add an antennas to the 4 Corners Bridge as part of their mitigation for fixing some erosion issues on the upstream river right bank, which is in close proximity of this proposed site. **Response: Antenna locations were only suggestions. We may move some of them depending on logistics.**

What is this SOW's contribution to recovery?

While I don't believe there is a direct contribution to recovery, and there is no specific question that is trying to be answered (as stated in the SOW) this information can be helpful with larger data synthesis reports, survival estimates, strategical timing of trips, etc...

Tom Wesche, Water Development Interests, BC member*How can the technical aspects of this SOW be improved?*

This SOW would benefit by placing the need for three additional PIT antennae within the context of our existing antennae system and describing in additional detail what new information they will gather. Do the benefits of these three sites outweigh the need identified at recent Biology Committee meetings for several cross-channel arrays throughout the system? Also, what criteria will be used to select the three best of the possible five sites listed. Before adding more antennae, I think the Program would benefit from a bit of longer-term system-wide planning for determining the best direction for our PIT tag efforts.

Response: Antenna locations were only suggestions. We may move some of them depending on logistics. We agree a bigger look at antenna systems and data is good, but we proposed this in response to a request by the committee to install more antennas. Full river-wide antennas would be good, but they are expensive and difficult to install. This seems like a good compromise and could give us good information on fish survival and movements.

What is this SOW's contribution to recovery?

While almost all PIT tag information can be helpful for informing us regarding fish survival, movements and habitat use, I think some additional thought is needed here before we commit to additional antennae installation.

Matt Zeigler, NMDGF, BC member*How can the technical aspects of this SOW be improved?*

This SOW is simple and technically sound.

Improvements can be made to inform the reader on the abilities of the proposed equipment (e.g. antennae read range, estimated upkeep costs, etc.), what has been accomplished with the antennae already in place, and what is the best-case scenario for the use of the data that will be collected.

Some additional site locations to consider include (1) within or at the mouth of an irrigation diversion that is most suspect of entraining endangered fishes, and (2) at the upstream mouth of the lower canyon near Mexican Hat. An antenna

located at an irrigation diversion could provide valuable information on a potentially significant source of mortality, especially considering what has been observed in the Upper Colorado River Basin. An antenna placed at the mouth of the lower canyon could provide valuable information on seasonal movements of Colorado Pikeminnow. These seems even more pertinent now that it appears that wild fish from the 2016 cohort appeared to remain in the lower canyon and move upstream in the summer. **Response: Antenna locations were only suggestions. We may move some of them depending on logistics.**

Given the five potential locations in the SOW and my two additional locations, I would suggest placing antennas at (1) Mexican Hat, (2) 4-Corners Bridge, and (3) RERI/TNC Restoration Site. **Response: Antenna locations were only suggestions. We may move some of them depending on logistics.**

What is this SOW's contribution to recovery?

PIT tag antennas installed at several limited locations in the San Juan River basin have provided an amazing amount of data. However, apart from assessing the efficacy of the PNM fish weir, I am unsure how all of this data is being used. Without a “design” or any idea of how the data will be used, it is difficult to assess how much benefit these additional antennas will be. I am in favor of installing these antennas, but the Program needs to begin assessing how all of this data can be used for the benefit of recovery. Until the Program demonstrates their worth, installation and O&M costs will always be in question.

Wayne Hubert, Peer Reviewer

How can the technical aspects of this SOW be improved?

The SOW is to install three more single, pass-over antennas at three sites in the San Juan River to the array of PIT antennas in the system. The proponents state that “these antennae would not be part of a ‘design’ but could provide more detections of fish in these sections of the river as well as information on a potential spawning bar for Colorado pikeminnow that may be located in the vicinity of the second antenna.” PIT tagging efforts in the SJR system lack of an overall experimental design. Definition of system-wide goals and objectives for PIT tagging work along with an overall experimental design and protocols for data storage and analyses are needed. PIT-tagging efforts and locations of antennas appear to be piece meal and without direction or project-wide organization. **Response: We agree a bigger look at antenna systems and design, as well as the data, is good, but we proposed this in response to a request by the committee to install more antennas. This seems like a good compromise and could give us good information on fish survival and movements.**

What is this SOW's contribution to recovery?

PIT data can provide valuable insights into movement patterns and demographics of the endangered species that may inform decision regarding the recovery of the species.

Mel Warren, Peer Reviewer

How can the technical aspects of this SOW be improved?

I have no suggestions for improvement, and I hope this can get done.

Minor typos (highlighted text)

What is this SOW's contribution to recovery?

Detecting endangered fish (multiple hits over time) and monitoring local and long distance movements contribute to survival estimates and potential location of spawning location, both of which have allowed the Program important information about recovery. I strongly support the installation of these antennas. I wish we could go riverwide.

Program Office

How can the technical aspects of this SOW be improved?

- Provide a river-wide map of current and proposed locations.
- What are pros and cons of each site?
- What is the expected question that installing an antenna at each site would answer?
- What would be used to determine which 3 of these 5 sites would be chosen for installation?
- Wasn't the idea for another river-spanning system? Are any of these installations going to provide that?

Wasn't another idea to get more down-river detections and are any of these locations going to provide that? **Response: Antenna locations were only suggestions. We may move some of them depending on logistics. We will work with PO to determine answers to these questions.**

What is this SOW's contribution to recovery?

PIT tag antennas can help reduce the need to capture and handle individuals, which could directly reduce mortality rates. Antenna information could be used to increase population estimates and clarify seasonal movements that could inform identification of important spawning areas and causes of mortality (i.e., Colorado Pikeminnow movement over the waterfall).