Paul Hirt: 

Jennifer Sweeney

00:00:00

Recording.

Paul Hirt

00:00:02

This is Paul Hirt and Jennifer Sweeney, of Arizona State University, interviewing Richard Valdez at the SWCA [SWCA Environmental Consultants] offices in Salt Lake City on March 4, 2020. Rich, thanks for interviewing with us today.

Rich Valdez

00:00:16

Thank you for asking me.

Paul Hirt

00:00:18

Would you just start out by telling us, um, the positions that you've held in the Adaptive Management Program over the years and the years that you were participating?

Rich Valdez

00:00:27

Yeah. Thank you. I, um, I started working, um, in the Grand Canyon with Glen Canyon Dam operations in (Pause) in 1989. That was when it was the Glen Canyon Environmental Studies, GCES, under Dave Wegner, and the [U.S.] Bureau of Reclamation.And, uh, at that time I was contracted to do a life history and ecology of the humpback chub through the Grand Canyon. So that was my first time there. And as a result of that involvement, I, uh, I also did some other things.I worked some with the Hualapai Tribe. So we extended a lot of our investigations below Diamond Creek, all the way to Pearce Ferry. So we were doing about two hundred and seventy-five, two hundred eighty miles of river that we were surveying for fish populations. And with that, uh, I then was asked to convene several, uh, panels of scientists. One in 1999 to look at the possibility of a second population of humpback chub in the Grand Canyon. And I met with the geneticists and biologists to look at ideas of how to start humpback chub in the Grand Canyon. That was about 1999. In, uh, in 2000 I was involved in the Low Steady Summer Flow experiment. I did the fisheries evaluation of that experiment. And then in, um (Pause) in 2003, I was part of a team of scientists that were looking at the possibility of a Temperature Control Device [TCD] for Glen Canyon Dam, and that was being coordinated by the Bureau of Reclamation. And in, uh, in 2004, I coordinated a survey of some of the tributaries in the Grand Canyon with Steve Carothers. So we looked not only at the mainstem, but also fisheries populations in places like Shinumo or Bright Angel Creek or Havasu Creek and some of the others, uh, in the system. And then in 2010, I was asked by the, um, the Bureau of Reclamation to convene a science panel on reintroducing razorback sucker into the Grand Canyon. And, uh, and then in, uh, in 2012, I was asked to convene another science panel by the, uh, seven Colorado River Basin states, to evaluate possible alternatives that would become part of the 2016

LTEMP [Long-Term Experimental and Management Plan] EIS [Environmental Impact Statement]. LTEMP was of course the Long-Term Experimental Management program for the Grand–Glen Canyon Dam. And then, and then most recently, uh, I was, uh, asked to be a member of the brown trout management team, looking at options of how to manage brown trout. Worked with, uh, Mike Runge and Charles Yackulic to look at the options of how to manage brown trout and reduce predation by brown trout on, uh, on humpback chub and on other trout species in the system, especially in the tailwater. So, it's pretty much spanned from about 1989 to, here most recently, 2019.

Paul Hirt

00:03:43

That's a nice long tenure.

Rich Valdez

00:03:45

Yeah.

Paul Hirt

00:03:46

Um, how much of the work that you did was, uh, say contract research work with SWCA versus work, um, directly as a participant in the Glen Canyon Dam Adaptive Management Program, like with AMWG [Adaptive Management Work Group] or TWG [Technical Work Group]? Can you–?

Rich Valdez

00:04:05

Yeah, most of it was contract work. Most of it was contract work either through BIO-WEST or through SWCA. And the BIO-WEST work was that initial, uh, study of fisheries, the life history ecology of humpback chub through the Granya–through the Canyon. And then the, uh, subsequent to that, uh, it's been through BIO-WEST. And I was involved in a number of AMWG and TWG meetings, but pretty much always as a, uh, as a linkage to one of these two companies.

Paul Hirt

00:04:38

Mm-hmm, great. So let's, um, drill down a bit on, um, the role of the humpback chub in the Adaptive Management Program. You're probably going to be the most knowledgeable expert we interview on the life history and the status and the recovery efforts of the humpback chub so, talk a little bit about how that all got started and developed over time.

Rich Valdez

00:05:06

Yeah, it's an important part of, uh, of the Glen Canyon Dam operations, because the humpback chub is perhaps one of the keystone species, if not the keystone species, for, for that particular project and that operation. Um, I've been, uh, the, the recovery team leader for the humpback chub recovery team since 2015, so it's put me close to some of the populations, not only in the Grand Canyon but in the Upper [Colorado River] Basin as well. But the interesting part about it is the, the genesis of how the humpback chub came into the importance and significance that it holds in the Grand Canyon. I started working in the Upper Colorado River Basin in 1968, uh, with a fellow graduate student. He was doing work on the Colorado and Green rivers and I was doing work in Alaska, so we would trade ea–trade off helping each other. And, uh, after that,

then I was, um, uh, I got involved in some of the work, earlier research–now, this is before the Endangered Species Act [ESA] was passed in 1973. And at that time, um, the humpback chub and the, what was at that time known as the Colorado squawfish, and is now called the Colorado pikeminnow. At that time, those species were, were included under the Endangered Species Conservation Act, uh, the Preservation Act of ’66, and then the Conservation Act of ’69, prior to the passage of ESA. So, uh, in 1973, when, uh, the Endangered Species Act was enacted and signed by President Nixon, those species then became part of this suite of species in this country that people had to protect somehow, but no one ex–knew–no one knew exactly how to do it. And so I was in on some of the original, uh, Environmental Impact Statements, the EAs [Environmental Assessments] that affected some of these species. Uh, the, that took place in the, uh, especially in the Upper Colorado River Basin. But it’s interesting to note that in, um, and I was with [U.S.] Fish and Wildlife Service starting in 1979. I was hired by the Service to start a field station in Grand Junction, Colorado. To do that, specifically to evaluate the distribution and abundance of these fish in the Upper Colorado River Basin, so, above Lake Powell, basically. And in (Pause) and in, and until 1980, from the time that the [Endangered Species] Act was passed in ’73, we had these Biological Opinions that all declared jeopardy. In other words, that the action would, would likely continue to jeopar–or, continue to jeopardize the existence of the species. Um, in 1980, with the a–with the amendments to the Endangered Species Act, that concept of reasonable and prudent alternatives was then put into the Act, which really opened the door and allowed agencies, now, to start doing good things for the species to offset or mitigate those potential bad things. And that, that became the heart of what became, then, the Glen Canyon Dam EIS, is basically those reasonable and prudent alternatives that were put forward.

Rich Valdez

00:08:32

Now, the first EIS was done, of course, in 1995, when the, uh, humpback chub was, um, was listed, and the Biological Opinion was under a jeopardy determination. In other words, it was

declared that the operation of Glen Canyon Dam was likely to jeopardize the continued existence of the species. That changed in 2008, when the [U.S.Fish and Wildlife] Service came up with a non-jeopardy determination, and decided that, instead, they would go with conservation measures, which was, which were finalized in 2010. So now we have an agency, or agencies, the Bureau of Reclamation and the [National] Park Service, in that case, that were looking at ways to do things better as a way to benefit, not just to mitigate the potential jeopardy effects, but also to benefit the species. So (Pause) so the humpback chub underwent a whole, I think evolution of understanding of how that species worked out with the Endangered Species Act, how the Act was going to apply to that species specifically. And the Grand Canyon became kind of the (Pause) the stage for that to all take place. Where the Grand Canyon supported the largest population of humpback chub known in the Basin. Uh, there were six other populations in the Upper Basin, but they were all smaller. Uh, but the humpback chub was the main driver, I think, of a lot of the actions that took place in that system.

Paul Hirt

00:10:11

And actions in terms of modifying dam operations? Or, um, actions in terms of, uh, improving habitat or reducing predation, all of those things?

Rich Valdez

00:10:22

It was all of those things, and initially, as a fish biologist, my first reaction to seeing, uh, a large dam put in the middle of a river that used to be occupied by these fish, was that of course–that dam, first of all, backed up Lake Powell for about two hundred miles, and that meant there was two hundred miles of river that were under a lake. So it eliminated that habitat to the species. And these are not lake dwellers, except for the razorback sucker. Uh, the humpback chub and the

pikeminnow don't do well in lakes, or reservoirs. So that eliminated that habitat. But also what the dam did is it was now drawing water from dee–from the depths of the reservoir, what is known as the hypolimnion, and that's the cold region, so you had cold releases going downstream, that we all knew was not good for the warm-water native fish like humpback chub. So our first reaction was to, and then I–I talk, I say that collectively for most fish biologists, was to say, we're going to somehow need to offset that cold water coming out of the dam by some kind of temperature control devices. So the TCD became a pretty important and controversial, I might say, uh, proposal, starting in about 2002 or 2003. Where some of us were advocating to have the dam modified to allow warmer water, warmer, more surface water to, to be released, and warm the water downstream for the humpback chub. In retrospect, as it turns out, that probably was (Pause) uh, a lack or a, uh, not a good enough understanding by the biologists to really know what was going on. As it turns out, it could be (Pause) it could very well be that the cold releases have been part of the savings grace for the humpback chub in Grand Canyon.

Paul Hirt

00:12:29

How so?

Rich Valdez

00:12:30

In that those cold releases now prevent, or at least inhibit, other non-native warm-water fish that are predators or competitors to the humpback chub, from entering and coming into the system. And, in addition to that, the humpback chub in the Grand Canyon has been using the Little Colorado River, which is a seasonally warm system, for spawning, so it made, and still does, it makes for an ideal situation for that fish to be able to live as adults in the mainstem, and then migrate annually into the Little Colorado River and spawn in, in warmer water, and then their

young then descend down into the mainstem. So that's the way that, that's the way the situation is today. And, and we didn't know that, of course, at that time. Many of us were advocating to have a Temperature Control Device, and in fact, uh, we had a series of meetings, uh, with the Bureau of Reclamation and many scientists. And in fact, Reclamation even did a, a rough estimate of what it would cost to put in a (Pause) a selec–what's known as a selective withdrawal Temperature Control Device, which would mean that, that the, uh, the gates at the penstocks, where the water leaves the reservoir and it goes through the dam, the gates would be modified with elevators, so that they would, you'd have the option of basically withdrawing water from any level that you wanted within a given range. So you could mix it, warm with cold, and get target temperatures. The only problem was that (Pause) the estimated price tag was about a hundred million dollars. And, um, that, um, of course raised many eyebrows, and caused much concern as to how serious we really wanted to get, uh, about that proposal.

Rich Valdez

00:14:34

So, um (clears throat), so one of the lessons we learned, I think, as scientists in going through Glen Canyon Dam and evaluating the effects and sitting d–sitting down together and coming up with different alternatives was that, in the end, uh, it's Mother Nature that really drives everything. And, as we were considering a Temperature Control Device, of course, the elevations of both Lake Powell and Lake Mead were dropping. And with the decline in elevation of, uh, of Lake Powell, we now started to see warm water being released from the reservoir. By warm, I mean what had been ten degrees centigrade, eight to ten degrees centigrade releases were now twelve, thirteen, fourteen, maybe even up to fifteen or sixteen degrees centigrade. But that water was, that warm water was coming out in October and November. In the fall. And the reason for that is that, um, in the fall, the reservoir overturns, there is what is known as a fall overturn. And as that warmer surface water is mixing with the lower water, it comes in contact with the, those penstocks, where water is being withdrawn through the dam. And so that's why we see that

warmer water at that time. Well, it just so happens, though, that that was not what the humpback chub necessarily needed, because the humpback chub is a spring spawner. So we were not seeing warmer water in the spring, we were seeing warmer water in the fall. But we were seeing warmer water nevertheless. (Pause) So, that was one thing that we didn't fully understand and expect or appreciate when we started talking about a Temperature Control Device. Now, ironically, if you look at the system in the Grand Canyon, uh, if you, if one were to consider the continued trend or pattern of lowering reservoir elevations and more warm releases, one might even go as far as to say that maybe we do need a Temperature Control Device, but in fact to cool it.

Paul Hirt

00:16:50

Wow.

Jennifer Sweeney

00:16:53

Um, can I ask you a question, Rich, about the, um, humpback chub spawning in the, uh, LCR [Little Colorado River]? Is that something that's always occurred or is that, uh, something that developed after the, after the dam was built?

Rich Valdez

00:17:08

As far as we know it's always occurred, or at least, uh, in recent history. The, there were two brothers, the Kolb brothers, who are famous for their explorations in the Grand Canyon and their photography in the Grand Canyon. And we have historic photographs of the Kolb brothers going down to the Little Colorado River at about the time that the fish would be spawning and talking

about that there were a lot of fish in that system and they took their rod, their fishing poles and caught all they wanted for, to eat. The earlier studies that were done in about the 1970s also show that the fish were using that system that way, so it's probably part of the historic, uh, use of the species, that is, the Little Colorado River. But we also suspect there was (Pause) there was spawning also occurring in the mainstem of the Colorado as well. That is, prior to closure of Glen Canyon Dam in, and in the 60s. And then, uh, the releases of cold water. So, if anything did change, it was probably humpback chub could no longer spawn in the mainstem, but they were still using the Little Colorado, and that was providing the young to sustain the population. So, the changes in the elevation of Lake Powell was one little bit of a surprise from Mother Nature. The other, which is somewhat related to that, was also declining reservoir elevation in Lake Mead, which now increased the length of the Colorado River into the Lake Mead Basin between about Separation Rapid, it was Separation Rapid, which is where the, uh–.

Paul Hirt

00:18:54

Powell.

Rich Valdez

00:19:54

Powell, historically, and the Howland brothers, historically, left or abandoned the Powell Expedition. Uh, between there, for about, uh, some sixty-five or so, seventy miles, all the way down to Pearce Ferry. (Pause) And so now, uh, what was under, uh, Lake Powell [Lake Mead]–and I surveyed that area and then I, in the 90s, when it was in fact under Lake Powell at the time and there was a very–.

Paul Hirt

00:19:21

Do you mean Lake Mead?

Rich Valdez

00:19:22

I'm sorry, Lake Mead, excuse me. Thank you. And there was a thick layer of sediment in there. There was the deposits of, uh, of Lake Mead. Now, uh, with the receding levels of Lake Mead, the Colorado River has carved out its original channel. And much of that historical habitat has been restored. And in fact, the most, um (Pause) productive population that we have of humpback, of humpback chub is probably in that, what we've referred to as the western Grand Canyon. Which is downstream of Diamond Creek, and all the way down to about Pearce Ferry. So, that area is, uh, if you go down to that area now, and sample some of the backwaters in that area, you'll catch primarily native fish. Not just humpback chub, but flannelmouth suckers and bluehead suckers and speckled dace, the other species that are also there. And so, that has been another unexpected, uh, twist from Mother Nature, like I said. Uh, where one can sit and plan all the things that you anticipate are going to happen, but there's some things you just don't expect that, that will occur, and take place.

Paul Hirt

00:20:38

Um, the other thing that you brought up that I found fascinating is, not only does nature surprise us, but, um, when we make (Pause) science is a practice of developing a hypothesis, doing some research, developing a kind of a limited knowledge base. And then in adaptive management, we go do a management action, try to monitor it and find out if the response is what we expected, so it's constant learning. And what you–the, the stories that you were telling us, is about how

fisheries biologists come up with a hypothesis, and then do some experiments and then learned that that's part of the story, but it's more complicated. And we're constantly developing a knowledge base over time. That's–.

Rich Valdez

00:21:31

And, and it takes that opportunity to be able to get involved at the, at the beginning of planning something like, uh, Glen Canyon Dam EIS, and trying to structure those alternatives, and doing intense analyses of all the available data, and testing of hypotheses, to try to anticipate or predict the response by resources to different management actions or scenarios. But it takes that opportunity, and then, to go back years later, and, and looking to see how right or wrong we were [P.H.: Mm-hmm]. And, and it emphasizes that concept of Carl Walters' adaptive management, whereby it's all a learning process. If one were to believe that you could structure something in a way that's definitive, with predictable results and responses, that of course is not true at all. You learn as you do. You learn as you go. And so that was, that to me that was the biggest lesson from this. Not only the way that resources responded to the things that we predicted were going to happen, but also this, this, these tricks from Mother Nature. Also Mother Nature throwing little things at us like climate change and lowering reservoir elevations or different volumes of water coming down at different years. Or perhaps, uh, bigger floods or smaller floods out of the Paria River or the Little Colorado River, that deliver different amounts of sediment into the system. There was always something going on that one, somehow, cannot always anticipate or, or make sure you cover as you're working on this and so, it really does, especially as you get involved in a–as one gets involved in a project from the beginning, and you think you've really got this right, and then you start looking at the responses down along the road a few years later and then look back at it twenty or thirty years later and you realize, wow, we learned a lot. We got some things right. We got some things not so right. And there were some absolute surprises.

Paul Hirt

00:23:49

So, in addition to the surprises related to the role of temperature, river temperature, on the viability and health of the chub, uh, population, there's also been some interesting surprises in the role of predation. Some of our other interviewees talked about how early hypotheses about predation, um, evolved over time as we learned more. Can you talk a little bit about that?

Rich Valdez

00:24:18

Yeah. Um, the, the Colorado River, um, is an historic (Pause) an historical river.In that it was, it has been isolated from other river–other surrounding or nearby river basins for probably the last, uh, three to four million years or more. The historical river in the Upper Basin is very much like it has been for about that period of time. Through the Grand–through the Grand Canyon, of course, we know that more recently, as the plateau rose and the river carved its way through the canyon and captured some of the streams in the Lower Basin, we know that's a, a little bit younger, uh, geologically. But because the Colorado River has been isolated for so many years, the diversity of fish species in the system has always remained quite low. And in fact, if you look at the main Colorado River, not in–not including the species that would be marine species or that would use the estuary, not including those, there's only about fourteen species that are native to the entire Colorado River Basin. And if you compare that to, for example, the Mississippi or the Missouri, where you have hundreds of species, you can now begin to understand that you have a very, very different, very unique evolutionary scheme that has taken place in these systems. A, uh, a situation where you have few predators, and therefore have few adaptive traits to be able to cope with predators if they get introduced into the system, alien predators from other, other systems.

Rich Valdez

00:26:07

The species in the Colorado River are, and all you have to do is look at them and you can tell, these are special. Very, very special fish. They're very uniquely adapted. You look at something like the humpback chub. It is a species that is very torpedo-shaped to deal with high-velocity current. It is a species that has large falcate fins, to be able to soar in that current. Not to necessarily swim into it at high velocity–in fact, the humpback chub is a very poor swimmer in laboratory experiments. They're not even as good a swimmer as any salmon species, or striped bass, or any riverine species. But they're smart. They know how to deal with these high currents by finding small eddies or small pockets of low velocity. And, and I, I am fortunate enough to have been in the–have worked with the species in the Upper Basin, and to have worked with the species in the Lower Basin and Grand Canyon, where the water was clear and I could now see the fish. And it's fascinating to watch humpback chub, uh, and how that fish is able to maneuver through currents in the Grand Canyon. And I–and I like to equate that somewhat to a raptor that is soaring on the edge of a cliff or a rim, and is using those thermals to maintain its position. And all you see is it tweaks one wing a little bit, or a feather, and it's able to stay there with relatively little energy expenditure. Well, humpback chub do the same thing, except that they're in a water environment. And, in addition, the river also delivers food to them as they're sitting there, with little energy expenditure. So it's a fascinating species, they have very, uh, they have deeply embedded scales. They have thick leathery skins, to resist the, the um, the scouring of a sand-laden system. They have a flattened, uh, rostrum or, the top of their head is flattened, so that it allows water to pass by. And, also, they have that hump, which is, which is the origin of their name, of course.

Paul Hirt

00:28:28

What is the purpose of that hump? Does anybody know?

Rich Valdez

00:28:30

Well, Robert Rush Miller, that, who identified the fish, or described the fish initially, taxonomically, in 1946, thought–and I, and I think there's a lot to it, that they're, it's part of uh, a hydrodynamic, uh, feature, that enables or allows the fish to maintain that position in the–in a river current. It–there is no bony structure in it at all, it's simply a fleshy structure, unlike the razorback sucker. The razorback sucker has a–in fact, it was also called the humpback sucker for many years. The razorback. Now it's called the razorback sucker. The razorback sucker does, in fact, have a modified bony structure that forms the razor, or the hump. Not so with humpback chub, the humpback chub has a fleshy protrusion behind the head that takes place, so it helps to stabilize. So, if you look again at the different species, you can see these adaptations. You see razorback sucker with a, a (Pause) a hump on their back, that if you look at it from the front, appears to be this very nicely designed, hydrodynamic, uh, feature, that would allow that fish to stabilize itself and to maneuver around. It also has a very thick skin, and also has fairly large fins. And so, these fish were very, very specifically and very highly adapted to the environment that is the Colorado River. Now, along comes (Pause) uh, well, in the, um (Long pause) in the nineteen, uh, starting in the 1930s, of course, with Lake Mead, and then through the Colorado River Storage Projects, uh, with Glen Canyon Dam in '63 and then, uh, Flaming Gorge, '62, '63, and then Navajo also. The states looked at the formation of these reservoirs as a great opportunity for recreational fisheries.

Rich Valdez

00:30:31

And so, with that, they started introducing things like largemouth bass and crappie and bluegill and green sunfish and bullheads and fathead minnows and red shiners, all kinds of fish. And in fact all together today, you've got fourteen fish that are native to the system and you've got

upwards of about thirty to thirty-five that are alien or from other river basins. And, you have fish that are not–are ill-adapted, that is, the humpback chub, ill-adapted to coping with those, with those alien predators or competitors. And they're also vectors for diseases and parasites as well. So (Pause) so now we go back to this idea of a Temperature Control Device, and what protections the, uh, cold water releases out of Glen Canyon Dam have provided to the humpback chub. Now we began to better understand how that cold water has in fact, been a barrier or at least, uh (Pause) discouraged the invasion of many of these alien fish, that could have come up from Lake Mead or could have come down from Lake Powell. Yes, they are in the system, but they are not thriving as you might otherwise expect if it was a warm-water system. So predation is a, is a key issue. And it is in the Grand Canyon. Interestingly enough though, in the Grand Canyon, predation is not necessarily from (Pause) warm-water fish. Predation is principally from the cold-water fish, that is rainbow trout and brown trout.

Paul Hirt

00:32:12

And they were introduced for a fisheries-based or recreation–fisheries recreation, right?

Rich Valdez

00:32:19

Yeah. The, the, uh–.

Paul Hirt

00:32:20

Those are not native to–.

Rich Valdez

00:32:21

Both the rainbow trout (Pause, clears throat) both the rainbow trout and the brown trout were introduced by the National Park Service in the 1920s. Into, initially into Bright Angel Creek. And of course at that time (Pause, clears throat) excuse me, the Colorado River was a warm, muddy, turbid river. And yet there was Grand Canyon National Park that had just been established. And, so there was a need to have–people have some kind of recreational opportunity, you wouldn't imagine fishing this dirty, warm mainstem Colorado River, but you would gain enjoyment, and in fact a unique opportunity to fish for trout, literally in the middle of the desert. And so–.

Paul Hirt

00:33:12

In these side streams.

Rich Valdez

00:33:13

In these side streams. Exactly, in places like Bright Angel Creek. And Bright Angel Creek was one of the places, in fact, it was the main place, where trout were brought in by the Park Service, in the ni–.

Paul Hirt

00:33:24

I heard they brought them in in Clear Creek too, a little ways upstream from Bright Angel.

Rich Valdez

00:33:30

They did, they did. And in fact–.

Paul Hirt

00:33:31

And they did well there.

Rich Valdez

00:33:33

They did quite well. And in fact, there was a hatchery facility that was set up at Bright Angel Creek.

Paul Hirt

00:33:38

Wow.

Rich Valdez

00:33:39

To culture rainbow trout and brown trout. And–.

Paul Hirt

00:33:43

Now I'm curious, we have native trout in Arizona, like the Apache trout. Um, I wonder, I've never heard anybody say that, um, there were any Apache trout native in these side streams. Were there any trout in the side streams, or were they all imported?

Rich Valdez

00:33:58

The, um, the Apache trout and the Gila trout are, um (Pause) were derived from a, uh (Pause) a fish that was more closely akin to the salmon species, as opposed to the mountain cutthroat trout. The Apache trout and the Gila trout, uh, are not in tributaries of the Grand Canyon. They are, they're native of the tributaries of the Gila River. That eventually does go into the Colorado River, but further downstream. And so, uh, historically and even today, we don't have Apache trout or Gila trout in either headwaters of the Little Colorado River, or in Havasu Creek or any of the other, uh, tributaries that come in on that side or, for that matter, on the other, on the North Rim, either out of Bright Angel or Shinumo or any of the other tributaries there as well. So those were outside of the system so, the fish that were introduced were in fact, uh, rainbow trout from, uh, from hatcheries in California, and then brown trout from hatcheries in Michigan, that eventually came from Europe. Because the brown trout is a European species.

Paul Hirt

00:35:24

And, um, you were talking about, um, their role in, in predation on the humpback chub. Where does that come in?

Rich Valdez

00:35:32

Yeah. And so, um (Pause) the rainbow trout, of course, has been concentrated principally in the tailwater, uh, of, of Gle–of Glen Canyon Dam. The fifteen miles from the dam down to, uh, down to Lees Ferry. And that of course has become a world-renowned blue-ribbon trout fishery. People come from all over the world to fish there. Uh, there have not been many brown trout in that system, perhaps because the water was too cold. Brown trout, historically, or that–that is, after the dam was completed in, uh, 1963, brown trout were, were principally concentrated around Bright Angel Creek. And that's of course where they were introduced originally. And there were some in the mainstem as well. We would catch brown trout at the mouth of the Little Colorado River, which is upstream of Bright Angel Creek. And, they were moving up there and then evidently moving back, and then spawning in Bright Angel Creek. With the increasing temperature, as a result of lowered elevations in Lake Powell, and warmer water coming out of the dam, it has apparently enabled or allowed brown trout to move around more in the mainstem. So they perhaps are not as closely tied to Bright Angel Creek, for example, as they were historically. They can now start using the mainstem more because they're a warmer-water fish species than, say, rainbow trout. Recently, we have found brown trout up in Lees Ferry. And in fact in, in sizeable numbers. And a concern is that brown trout may in fact be competitors and predators for the rainbow trout at Lees Ferry.

Paul Hirt

00:37:25

Really?

Rich Valdez

00:37:26

And then–in 2017, uh, the GCDAMP [Glen Canyon Dam Adaptive Management Program] asked to convene a science panel that was headed up by Mike Runge of the USGS [U.S.Geological Survey] and Charles Yackulic from GCMRC [Grand Canyon Monitoring and Research Center], myself, and other biologists in that program, to look at what alternatives might be available for controlling brown trout, removing them, and reducing that predation and competition threat, not just for rainbow trout in the tailwater, but the potential is that if brown trout were to expand, then they could end up in prime humpback chub habitat. Which is, uh, which is at the LCR, River Mile 61, so about seventy-five miles or seventy-six miles downstream from the dam. So that's a concern that we have now, is the potential for brown trout being a major predator in that system.

Paul Hirt

00:38:23

I can remember, um, one of our interviews, uh, somebody mentioned that, uh, early on, the thinking was that both species of trout were probably eating humpback chub and depressing the population. And after further research, it was determined that the rainbow, basically, weren't, and the brown trout were. Is that correct in your mind?

Rich Valdez

00:38:47

Yeah, there was–.

Paul Hirt

00:38:48

How did we learn that?

Rich Valdez

00:38:49

Yeah, there was, there was some excellent work that was done by, uh, Mike Yard, uh, on looking at the effects of predation by both species. And, it followed up on some of the work that we had done there earlier, when we were doing the life history and ecology studies on the humpback chub, and what Mike found is that, uh, brown trout–both species eat humpback chub. They both will prey on them. But brown trout eat them, as I recall, something like three to four times more (Pause) they'll eat three to four times more humpback chub than rainbow trout do. So the pr–so for one brown trout, you're going to have a fish that would equal maybe three or four rainbow trout in terms of the numbers of humpback chub that that fish might eat. So predation was a, is a real problem, especially with brown trout. Um, the other species that we're seeing in the system is, is the smallmouth bass. And we're especially concerned about smallmouth bass, because they in fact are a cool-water species. They do tolerate cooler water than, say, largemouth bass or crappy or bluegills or some of the warm-water fish. That fish has now recently gotten into the Grand Canyon. To my knowledge, there is–there's no evidence of reproduction in that system yet, but it's certainly a, a river that would be suitable for reproduction by the, by that species. So that's another one we're kind of keep an eye–our eye on.

Paul Hirt

00:40:16

And you expect them to be predators on humpback chub?

Rich Valdez

00:40:20

They are–they are intensive predators. In fact, um, the Upper Colorado River [Endangered Fish] Recovery Program that manages these, these endangered fish in the Upper Basin above Lake Powell, currently spends about forty percent of its budget controlling, mechanically removing, smallmouth bass and northern pike in the Upper Colorado River, specifically in the Yampa–.

Paul Hirt

00:40:45

There's northern pike in the Colorado River (Laughs)?

Rich Valdez

00:40:50

Yes, there are. They were introduced by the state of Colorado into Elkhead Reservoir some years back, and they escaped–both northern pike and smallmouth bass. And in fact, today, there are guided tours for fishing for northern pike in the Yampa River [P.H.: Wow]. You can hire a guide out of Colorado to take you down the Yampa River and catch these twenty-pound northern pike out of the Yampa River [P.H.: Wow]. Now those fish are more, uh, aligned with cold conditions, cold-water conditions, you don't see them leaving the Yampa much, although we catch them in the Green River as well, but not as much. But the, the, the smallmouth bass is a much more, uh, plastic species in terms of temperature, it can tolerate a big range of temperatures. And that's one that I, that I believe could be a real problem in the Grand Canyon in the years to come, because it fills that intermediate niche between the cold-water species and the warm-water species, and could probably do quite well in a place like the Grand Canyon.

Paul Hirt

00:41:53

So, um, where are we at today with the recovery of the humpback chub? I heard recently that there was talk about downlisting it from "endangered" to "threatened." Um, what's the status now and where do you think we're going in the near future?

Rich Valdez

00:42:12

Yeah, the humpback chub is currently listed, of course, as endangered. Um (Pause) it was brought into–it was grandfathered into the Endangered Species Act in 1973. It was included in the original list of endangered species in 1966. Um, and so, it has been listed as endangered for, you know, since (Pause) fundamentally–.

Paul Hirt

00:42:41

Half a century?

Rich Valdez

00:42:42

Yeah, yeah. Since, yeah, right. Half a century. Um (Pause) because of the, uh, expanding numbers of humpback chub that we see especially in the Grand Canyon (Pause) the, the increased abundance of humpback chub in the western Grand Canyon, and how well the species is doing in the main g–in the main Grand Canyon. In addition to the fish that are in the Little Colorado River, there are about, oh, about six or seven other, what we refer to as aggregations. They're small groups of fish that are located usually in, in springs, warm-water spring areas like

Fence Fault, at 30 Mile, near Vasey's Paradise. Or around the Little Colorado River, which is a seasonally warm system. Or around, uh, perhaps, um, uh, Havasu Creek.

Paul Hirt

00:43:33

I saw a bunch at Havasu Creek, mouth of Havasu Creek [R.V: Yup, yup]. And it was clear water, so I got to take pictures of them while I'm standing kind of over them, and they're swimming around in that sandy bottom. It was cool.

Rich Valdez

00:43:43

And in fact, yeah, in fact, many people who travel down the Grand Canyon now, raft down the Grand Canyon, uh, observe that one of the most common fish they see is in fact the humpback chub. [P.H.: Wow.] If there's scraps of food or whatever fall in the river, they're the first ones there, and they often almost are begging like a bunch of little puppy dogs (Laughter), waiting to be fed. Uh, they're a very social species. They usually, uh, move around in schools as groups of individuals. And so, um, that population of humpback chub is doing quite well. In addition to that, there are also, uh, five other populations in the Upper Colorado River Basin, in Black Rocks, Westwater [Canyon], Cataract Canyon, Desolation [Canyon], Gray Canyon and Yampa Canyon. The Yampa Canyon population has recently been declared as functionally extirpated. [P.H.: Oh.] Uh, we did a species status assessment for the humpback chub about two years ago, and determined that the numbers of fish in that population were pretty much gone. We recently convened a, uh, part of the humpback chub recovery team to look at the prospect of translocating humpback chub back into the Yampa River, and establishing a population there connected with Echo Park and Whirlpool [Canyon] in the Green River, which is below Flaming Gorge, to try to reestablish that population. The other populations are either stable or perhaps in slight decline, so

they're not doing quite as well, perhaps, as the Grand Canyon population, but they're, they're self-sustained, they produce young every year. Uh, we see, you know, good numbers of them in these populations. And so, the [U.S. Fish and Wildlife] Service has decided that, uh, if we examine the, the terms of the Endangered Species Act and what's defined as an endangered species, one likely to go extinct within the foreseeable future, that the humpback chub is in fact probably not that. It is an, a, a species that faces threats. And so, uh, perhaps the classification of threatened is more appropriate. So the, uh, U.S. Fish and Wildlife Service here, uh, about a month ago, which would be back in about February sometime–.

Paul Hirt

00:46:00

2020?

Rich Valdez

00:46:01

2020, yeah. Of this year, correct. Uh (Pause) initiated the process of a downlist proposal for the species. The proposal was published in the Federal Register about a, about a month ago, which would be about February 2020. And, is open to comment, I think, 'til the end of March, 2020. If it is determined that uh, that it's appropriate to downlist the species, the humpback chub could be downlisted within (Pause) within the next year. (Pause) Uh, that would be determined, of course, as part of the, uh, ruling in the Federal Register. So that, that's one, that's one prospect. The likelihood, I think, of that is pretty good. Um, given that the population is doing so well in the Grand Canyon, and given that the population in the Upper Basin are holding their own, perhaps in a little decline, perhaps, in some years, they go back up, and if we can get fish into the Yampa River, I think we'll be in pretty good shape. But it certainly does not meet the definition of endangered, if you look at it that way. Um, there is, there is another species that's also being

considered, now, in the Grand Canyon, and that's the Colorado pikeminnow. Colorado pikeminnow is also an endangered species. And there is, uh, there is currently, um (Pause) an evaluation of possibly reintroducing the Colorado pikeminnow into the Grand Canyon.

Paul Hirt

00:47:40

It's extirpated from the Grand Canyon right now?

Rich Valdez

00:47:42

It has been extirpated from the Grand Canyon since about 1975.

Paul Hirt

00:47:47

As a result of the changes in the river due to the construction of Glen Canyon Dam, or something else?

Rich Valdez

00:47:53

Probably, um, all of the above, where, uh, it was a highly it's p–it's what's known as a potadromous [or potamodromous] species. In other words, it's highly migratory within a given river system so, we believe that Colorado pikeminnow, at one time, probably migrated all the way from, say, Yuma, Arizona, which is where it was warmer, and perhaps even went into the [Colorado River] estuary to feed. And, uh, the evidence is strong that the fish got to about six

feet or so in length and weighed a hundred pounds. Uh, North America's largest minnow. And we've got bone fragments and remains that support that contention. Now, the biggest fish we see are about twenty-five, maybe thirty pounds. Uh, so, we're not quite seeing the large fish now. Perhaps, because they're restricted to the Upper Basin, and perhaps because they don't have the full, uh, regime of temperature year-round to, to allow that growth.

Paul Hirt

00:48:47

So we don't have any below Lake, uh, Hoover Dam and Lake Mead.

Rich Valdez

00:48:52

No, there are none below, um, there are none below Glen Canyon Dam.

Paul Hirt

00:48:58

Okay.

Rich Valdez

00:48:59

At this time. Everything is above Glen Canyon Dam. Except for small numbers that were introduced. They're not natural, but they were introduced into the Salt and Verde rivers, tributaries of the Gila [River]. And those are known, those are now currently called 10(j) populations, or experimental nonessential populations. In other words, they are there just to have

them there to maintain, but they're not part of recovery targets at this time. So, the idea is being entertained right now, by U.S. Fish and Wildlife and Arizona Game and Fish Department and the National Park Service, to perhaps look at the possibility of bringing Colorado pikeminnow into the Grand Canyon. At least to have them there. The, I think it's questionable whether all the life history requirements are there for the species to be self-sustained, I don't think so at this time. Uh, that fish needs, uh, long rivers to migrate, to spawn in clean headwater areas, warm temperatures. The young drift, uh, perhaps, many miles, up to fifty, sixty miles or more, into, uh, small sand backwaters, where they can feed and live for most of the, most of the rest of the year. It's a summertime spawner, they spawn in, usually, about late June, July sometime. Those, those key life history elements are probably not present in the Grand Canyon, but I think that that's still being looked at, at least to have the species there. To say that they are someplace in the Lower Basin. Um (Long pause) so, so at this point in time, the, um (Pause) again, the humpback chub is being proposed for downlisting. I think there's information that would warrant that at this time. We'll see what the public decides and what others decide as well. If that li–if that downlisting takes place, it really would not change much in terms of how Glen Canyon Dam is operated. The difference between an endangered species and a threatened species is (Pause) is small relative to Section 7 of the envir–of the Endangered Species Act. Um, it can open some opportunities for additional conservation measures. For example, there is a section of, in the Endangered Species Act called the 4(d) rule, that is a provision that allows the states, now, to become more active and more participant in part of the conservation measures. It gives, for example, the states the opportunity to define take. What is known as take. In other words, how you can take or kill or capture or maintain these, these individual, individual fish. So it might give some flexibility to, to management, which I think would be good.

Paul Hirt

00:52:07

Um, can, can you say to what extent the um, improved health of the humpback chub population in the Grand Canyon is traceable to the Adaptive Management Program (Soft laughter) and, you know, changes in dam operations? I mean, how much of it is just serendipity, and how much of it is the results of our efforts to recover the species?

Rich Valdez

00:52:34

That, that is–that is a thing of, uh, scientists' nightmare (Laughter) uh, where one spends a lifetime trying to be smart enough to come up with a right management actions and then implements a program like Glen Canyon Dam LTEMP EIS, and then looks back upon it twenty years later or whatever (Pause) and again, we're not that far away from it yet, but we're going to be. Uh, and you realize that many of the things that you did either made a difference or didn't make a difference, most of them, perhaps, didn't make much of a difference. And then, the word serendipity is perhaps the most, uh, the best word for that. How many things took place naturally or normally? Part of the, of the, um, the expanded, uh, distribution and abundance of the humpback chub is, in fact, due to reoperation of Glen Canyon Dam, and the actions that were put in place by the federal agencies in cooperation with the states and other stakeholders. Part of that recovery is directly attributed. Part of it, however, is, in fact, serendipitous relative to the changing elevations of Lake Powell and Lake Mead. Warmer releases from the dam and also, uh, re-excavation of the historic river channel downstream of Diamond Creek and all the way down to Pearce Ferry. Now specifically, the things that were put in place that have really helped, I think the humpback chub is that, um, prior to 1995, the, uh, Glen Canyon Dam operation was, um (Pause) was a, uh (Pause) a hydropower generation type facility, where hydropower is maximized by having flows as low as three [thousand] or 5,000 cubic feet per second [cfs] and uh, in, in the middle of the night, and then at about four o'clock in the morning, uh, start ramping those releases up to, say, 30,000 cubic feet per second, which is the capacity of the power plant. And, you would see then, about a twenty-foot increase in the elevation of the river right there

below the dam. And this of course would generate this, uh, kinematic wave all the way downstream, and fundamentally that was, uh, almost a daily flushing of the Grand Canyon, if you may, I mean, to be a little extreme perhaps, but that, that was kind of the effect. And so when I first got involved, that was what was happening is we had these very, very high fluctuations, and of course, people will tell stories about when you were down there with the big rafts, that you had to make sure you parked those boats in such a place that you wouldn't be stranded on the beach for the next day, until those flows, you know, came back up.

Rich Valdez

00:55:34

Um, that operation of these very, very large changes in flow, and river elevation, were probably, um (Pause) were not beneficial to young humpback chub that used the shoreline for nursery areas. The fish would come out of the Little Colorado River as four- or five-month-old fish, and then they would hang out along the shoreline, which was the better place for them to escape predators and to find food. With flows going up and down, even as far down as the LCR, maybe as much as four, five, six feet or more, then you would have displacement of these fish, and they would either be displaced downstream or de–be displaced away from that cover, and be exposed to predation by, by another fish. So that was good. That, the idea of what was known as the Modified Low Fluctuating Flow, MLFF, that came about in (Pause) in 1995, basically, as a result of those, those studies that were done prior to that. Um, that was good. Tha–and so that, that made the, the habitat for the humpback chub a little bit more stable. Now, admittedly, I was one of the biologists that were saying–that was saying at the time, in fact, you have to try to get those flows even more stable, because if you look at summertime in the Colorado River, except for places where there's monsoonal storms that would be large enough to increase flow, by and large, the flow of the Colorado River during the summertime was relatively stable. It didn't fluctuate.

Paul Hirt

00:57:13

And low.

Rich Valdez

00:57:13

And low, correct. Low. And that's what brought about the Low Steady Summer Flow concept, the flow that we had in 2000, to test that hypothesis. But what we found out, and thanks to some of the work done by Bill Pine and, and others, is that in fact the humpback chub was quite plastic in terms of its ability to be able to move with those flows, and use those talus slopes. If you look at the, at the slopes in Grand Canyon, for example, downstream of the Little Colorado River, where you have young humpback chub, they are in fact slopes of talus that are continuous rock and boulder mixture all the way up the slope. So, all humpback chub has to do is just move with the water and it's at a new interface that is still that boulder-talus habitat, where it can still use those areas for, for cover.

Paul Hirt

00:58:06

(Speaking simultaneously) Get behind in the backwater, you mean.

Rich Valdez

00:58:08

Get behind in the little, little eddies and backwaters and little cubbyholes, in and between these boulders [P.H.: Uh-huh]. So, the large fluctuations that we saw, prior to MLFF, were probably

not good for the humpback chub. The more modified fluctuations have probably helped to benefit the species, and in fact probably do help, even stimulates, maybe, some production along those shorelines when you have that water moving around the way it does. So that, that, that did help out. The other thing where we think there was quite a bit of benefit is, is there was in fact mechanical predation, mechanical predator removal in the Grand Canyon, um (Pause) even before the LTEMP EIS. Where we were removing, uh, brown trout and rainbow trout from the system as well as others, other species, removing ca–channel catfish or carp from the Little Colorado River as well.

Paul Hirt

00:59:07

Are catfish also predators on humpback chub?

Rich Valdez

00:59:10

Absolutely. Very much so that–.

Paul Hirt

00:59:12

But not carp, because–.

Rich Valdez

00:59:13

Well, carp, we know, are, are voracious predators of fish eggs.

Paul Hirt

00:59:20

Oh, okay.

Rich Valdez

00:59:21

And I've watched uh, red shiners spawning in Spencer Creek, which is the lower end of Grand Canyon. And then as the red shiners were spawning early one morning, it wasn't but five minutes, and here comes a, an entire herd of humpback (Laughter)–of, excuse me, of carp, common carp that came up and just vacuumed that entire area for eggs. So they're very–.

Paul Hirt

00:59:45

And they're not native, either. That's a European fish, correct? (Speaking simultaneously).

Rich Valdez

00:59:46

They're not native either. That's correct. Yeah. And that, that's another species that we may underestimate in terms of their effect to, to these native fish is how, how much effect they may have on eggs and on larvae, and, and their predation there as well. So, um (Pause) so that, so that was another thing is, is modifying those uh, fluctuating flows. Doing some predator control to reduce the, the predation on those fish. The other, the other thing that probably did help humpback chub was, um (Pause) was these High Flow Experiments [HFEs] that provided, uh,

large sandy beaches and deposits in the large recirculating eddy complexes of the Grand Canyon. And as part of that recirculating complex, of course, what happens is that the water is laden with sediment because it, it is a higher volume, higher velocity. Uh, the base flows may be at uh, fifteen, twelve, fifteen, ten, fifteen, 12,000 cubic feet per second. With a High Flow Experiment, you're going up to 45,000, which is the, for–the 30,000 out of the power plant and then the 15,000 out of the bypass valves. So, when you've got 45,000 cfs going down the system, you are lifting, activating, energizing the sediment in the system, suspending it, and then when it gets to these large recirculating eddies, it slows down and drops out in the eddy. Well, as part of that large sandy beach, there is the recurrent channel, which is that little stream of high-velocity water that goes right against the bank and behind that sandbar. That recurrent channel forms a backwater. Which is very nice habitat for fish. And, hu–while humpback chub don't necessarily use those that often, they are there nevertheless, and the High Flow Experiments do help to provide that environment for the fish, but also other native species like flannelmouth suckers and bluehead suckers and speckled dace do use those habitats. So it has helped. So those are some of the things that the reoperation has done to benefit the fish, but like I said, many of the others are, like you said, serendipitous, because they are tied to Mother Nature and climate change and availability of water in different years.

Paul Hirt

01:02:14

That's great explanation. Thank you. Um, you did some studies of the early High Flow Experiments, to determine whether they were being effective or not. Can you talk about how the science, and our understanding of the impacts of those High Flow Experiments, has evolved from the ver–the first one was sometime in the 1990s, right? And that's when you were looking at that, and you have a couple of publications from 1999 and 2001 on that.

Rich Valdez

01:02:45

Yes.

Paul Hirt

01:02:46

So how did our understanding of those High Flow Experiments evolve over time?

Rich Valdez

01:02:51

Well, the first experiment of course was the 1996 controlled flood. We called it the controlled flood through Grand Canyon. [P.H.: Mmm.] And of course, uh, I was fortunate enough to, uh, edit a book with, uh, Bob Webb, Jack Schmidt and Dick Marzolf called The 1996 Controlled Flood in the Grand Canyon [The Controlled Flood in Grand Canyon]. And it's available through the [American] Geophysical Union, it's available on the internet. And that archived many of the studies that were done at that time and what we found out about a High Flow Experiment. Now prior to that, it was, it was called the, uh, Beach Habitat Building Flow. BHBF. That was a terminology that was supposed to be descriptive of what it was supposed to do and that was to beach–to build habitat, to build beaches.Beach Habitat Building Flow. But the history of that is, is, I think, even more interesting. The Natio–when, when Dave Wegner was, uh, head of the Glen Canyon Environmental Studies, GCES, this is all the way back into the, um, the mid-80s, he asked the National Academy of Sciences to do a review of studies and, and the program GCES in the Grand Canyon. And of course that was just after the high flow of 1983 and '84, where the capacity of Lake Powell was practically exceeded. And there were these emergency releases, you, you can read about it in, uh, the book by Kevin Fedarko–.

Paul Hirt

01:04:33

The Emerald Mile.

Rich Valdez

01:04:34

The Emerald Mile, correct. Did an excellent job of documenting what was happening at that time. But, um, what the National Academy of Sciences concluded after that, uh, after those, that experience with those high flows, was that, in fact, high flows are bad for the Grand Canyon, because in fact they transport large amounts of sediment.

Paul Hirt

01:04:57

Out.

Rich Valdez

01:04:58

Out of the system. Correct. And so the initial thought was, “Oh my goodness, we can’t allow these high flows to take place in the Grand Canyon.” A second review by the National Academy of Sciences a few years later said, “No, there’s perhaps more to it than that.” Perhaps we can use certain releases from Glen Canyon Dam to in fact suspend that sediment and not transport all of it out of the system, but, but in fact entrain some of it in these large recirculating eddies, and it was people like Jack Schmidt, then other scientists, that said this, this is a way perhaps to

preserve sediment, sand in the Grand Canyon, as beaches for river runners, for camping and as substrate for riparian habitat for, all the way from Southwest Willow flycatchers to, uh, reptiles and lizards and all kinds of animals that rely on those riparian areas. And so, in the, um, leading up to the 1995 EIS, the concept was, was developed, uh, of Beach Habitat Building Flows, BHBFs. And as a result of that, uh, the Secretary of Interior approved a high flow release, which was, which was really significant because it in fact, um, was a release that not only involved the full power plant capacity of 30,000 cubic feet per second, but also involved the bypass valves. Now the bypass valves, or are what are known as the jet tubes, do not have hydropower generating facilities. And so, there was in fact the costs associated with them and then–.

Paul Hirt

01:06:46

Lost hydropower revenue cost, you mean?

Rich Valdez

01:06:48

Exactly. And so, the first, uh, ni–the 1996 experiment went for, uh, gosh, almost, almost two weeks, as I recall.It went for a long period of time. But again, we learned a lot from it, because what we learned is in fact the majority of that sediment was moved in about the first two or three days. So we learned that you don't need to have these for a very long period of time, you can only ha–you can have them for just fort-eight to, say, ninety-six hours, something like that. And that's more than enough to move that sediment. Um (Pause) so, so the uh, so what happened is that, um, as that understanding was becoming better known, then, uh, there was eventually a protocol developed for releasing water from Glen Canyon Dam. That was both a fall HFE and a spring HFE. For the possibility of releasing water depending on when sediment was available. Now, it just so happens that the major sources of sediment to Grand Canyon now, because all of

the sediment from the Upper Basin is trapped in Lake Powell, the major sources of sediment are of course (sound of a passing truck), the Paria River, which is fifteen miles downstream from the dam, and the Little Colorado River, which is about seventy-six miles downstream from the dam. The Paria River is principally a fall monsoonal storm-driven system. So that that sediment is usually driven in the late, uh, is usually transported in the late summertime. In about July, August, during the monsoonal storms. The LCR, the Little Colorado River, further downstream, is a spring flood system. So that sediment is available at a different time of year. Initially, uh, the High Flow Experiments were being done in the springtime, with the idea that it was more simulating the natural hydrograph. That, you know, those were spring floods. Um, eventually, it became better understood that the majority of sediment in fact would be available from the Paria, because it was right there just downstream from the dam, and you could release it in a timely way, that you could take advantage of that large amount of sediment. Besides, the majority–many of those large recirculating complexes that entrain that sediment are located upstream of the Little Colorado River. So it's that area around, uh, from Vasey's Paradise on down, all the way down, pretty much, to the LCR. That's, that's where a lot of the benefit would come, although there are other areas downstream as well.

Rich Valdez

01:09:37

Now, um (Pause) so HFEs, then, High Flow Experiments, became, initially were spring High Flow Experiments, and then became fall High Flow Experiments. Now, most recently, and here's, here's adaptive management coming into play, right? Where, most recently, the people that are looking at, uh, production of insects in the Grand Canyon and production of algae and everything else, are saying, "We're seeing a real decline in our food base in the Grand Canyon, and we think part of the reason is it's tied to these fall High Flow Experiments." Whereas–where in the fall, when you have a High Flow Experiment, you have got 40,000 or so cubic feet per second coming out of the dam. You've got a real scouring effect, especially on that, uh, where

most of that primary production takes place, and that's in that fifteen-mile reach of Lees Ferry. So if you scour that production at that time of year, you are now at the point in this–in the year, to where you've got a low sun angle. And you don't have as much potential photosynthetic production taking place as you might otherwise. And then you've got the entire winter period, where that community does not have a chance to recover, and have, you know, and be back and productive again as you might otherwise think. So that's one of the things we're learning, the fall HFEs may be beneficial for storage of sediment because it maximizes that sediment availability, but it also might be net negative or detrimental to, to production in the system, which drives the whole, the whole food base in the system.

Paul Hirt

01:11:22

We've been hearing about low Bug Flows lately. Can you explain that?

Rich Valdez

01:11:26

Yeah. Um (Long pause) the combination of cold water releases through the Grand Canyon, in a uniform manner without seasonal warming, because the water is always coming out or, you know, at one, at about one temperature. Before, before Lake Powell went down, it was always at about eight to ten degrees centigrade. Now it's between ten, twelve, maybe thirteen. But it's not warming up to, say, hist–what the river used to be historically, which was twenty-five degrees centigrade. So you don't see that seasonal warming. [P.H.: Mm-hmm.] That, combined with the fluctuating flows that we see, has precluded, uh (Pause) the establishment of certain, uh, species of invertebrates, especially mayflies, stoneflies, caddisflies. Species that–.

Paul Hirt

01:12:26

Fish food.

Rich Valdez

01:12:27

Fish food. Exactly. Fish food. The basis [of] production in the system. Um (Pause) species of insects that are what we refer to as multivoltine species, or species that require both a warm period and a very cold period, to complete their life cycle. So those species are not in the system, there are univoltine species which can, which can, uh, survive and exist in places like we have in the Grand Canyon now. And so, the idea came up, a gentleman named Ted Kennedy who's with GCMRC, came up with the idea of what are known as the Bug Flows. So that, on weekends, especially, when there's not that much power demand and we have more flexibility in dam operations, then, then perhaps instead of fluctuating, then you run the flow at a certain level, and then you allow these bugs to crawl up on the rocks and deposit their eggs and keep the eggs wet, so they don't dry out and die. And then you have hatching of those, and you've got at least some reinstatement of some of that historical bug community, so to speak.

Paul Hirt

01:13:37

Is that working?

Rich Valdez

01:13:38

It, it appears to be working. The experiments are limited, of course, at this time, because they're being done on a limited time basis. But they do appear to be working. There–they do appear to be, uh, there are more, uh, of certain species of insects in the system, that are potentially food for the fish. And so that in and of itself is working, however the issue of fall HFEs and their scouring effect on production is still one that's being–.

Paul Hirt

01:14:07

A problem–.

Rich Valdez

01:14:07

Considered. Uh, and, and talked about. And in fact, there is, uh, consideration of, of now switching perhaps back to spring HFEs or switching back and forth perhaps, and not having these continuously during the fall. So, um–.

Paul Hirt

01:14:23

As I understand it, they won't even do an HFE if they haven't determined that a certain amount of sediment has come down one of those two tributaries and is available to push down the Colorado .So some years they won't (Pause) do they do one every fall, or do th–some falls they don't do an HFE at all if there isn't enough sediment?

Rich Valdez

01:14:42

Yeah. There, there's two factors that determine the, the um, uh, an HFE taking place. One of course is the availability of water. Availability of enough volume to be able to release that volume that may not otherwise be part of normal operations. And then the second is the availability of the sediment, the amount of sediment in the system. And of course that's monitored on an, on an ongoing basis to make sure that there's enough sediment there that if you do an HFE, you're going to have some benefit from it. So yes, there are some times when an HFE is not (Pause)–.

Paul Hirt

01:15:17

Authorized.

Rich Valdez

01:15:18

Authorized, or suitable, because of the lack of sediment.

Paul Hirt

01:15:23

How about if we take a short break now, and then come back in about five minutes?

Jennifer Sweeney

01:15:27

Okay, pausing recording.

Recording paused.

Jennifer Sweeney

01:15:32

Resuming recording.

Paul Hirt

01:15:36

Um, one of the topics we touched on in the first half of the interview was the, um, topic of mechanical removal of predatory fish that, uh, impact the chub population, brown trout in particular, but also rainbow. Um, can you talk a little bit about how mechanical removal–what role mechanical removal has played in fish management, and what happened when it was adopted for the Glen Canyon [Dam] Adaptive Management Program?

Rich Valdez

01:16:06

Yeah. Uh, the threat of predation especially, and to a certain degree competition, on especially the humpback chub, was a common theme across the Colorado River Basin. In all populations, one of the biggest concerns was the numbers of young fish, especially, that would be lost to, uh, things like smallmouth bass or largemouth bass or channel catfish or other species, literally eating those young, removing them from the population. So, um, the idea–there were, there were

many ideas that were, that were discussed in terms of how to manage these non-native species. Uh, and one of the, of course, most outstanding and most direct was the concept of mechanical removal. That is, you simply just put people out there in electrofishing boats or nets or whatever gears you can use, and catch as many of those non-native fish as you can and remove them from the system. With presumably the desired outcome that you would have fewer of them, and therefore you would have less predation and fewer of the native fish– more of the, more of the native fish surviving, and helping to sustain the population. So, um, in the Grand Canyon (Pause) going back to pretty much–pretty much after the 1995, uh, Biological Opinion and the 1996, uh, Record of Decision on the final Environmental Impact Statement, at that time one of the biggest threats to the humpback chub was seen as, uh, as predation. And, because we recognized it was a cold-water system, we acknowledged the possibility of, of, uh, competition and predation from warm-water fish. Um, but we, we knew that there weren't that many, we knew that the cold water was pretty much limiting the populations in the Grand Canyon, but we began to recognize that, uh, perhaps the biggest threat was predation and competition, especially predation from rainbow trout and brown trout. And like I mentioned earlier, uh, Mike Yard did a, I think, a very good, uh, piece of work there when he looked at those proportions of fish that were being taken by the two species and found out that the big predator was, was brown trout. However, um, rainbow trout were still far, far more abundant than brown trout in the Grand Canyon. Carl Walters brought up the idea that, if you look genetically and historically at the rainbow trout, it really is the, uh, progeny of an anadromous species, right? A species that moves or migrates. So we should not discount the possibility that fish–and at that time, the rainbow trout were in fact being actively introduced every year by Arizona Game and Fish Department to sustain the fishery. Because the water was literally too cold for rainbow trout to reproduce in the Grand Canyon, and the fluctuations were so great that it stranded and isolated their eggs, so self-su–the population of trout in the Grand Canyon was not self-sustainable until we went to Modified Low Fluctuating Flows.

Rich Valdez

01:19:29

Those high fluctuating flows were simply not allowing trout to sustain themselves in the Grand Canyon. So once, once that population became more self-sustainable in the Lees Ferry reach, then we started to see some of those younger trout moving downstream. And, we were concerned that that movement downstream, all they have to do is go from the, from Lees Ferry down to the LCR, is sixty-one miles. So they don't have to go very far to be in humpback chub (Pause) heaven, let's say. Humpback chub territory. Um, and so, we, uh, came up with the idea that one of the things we could do was set up a, uh, Lees Ferry to Badger, to Badger Creek, removal, as, as being intensive removal in that area, at key times of the year when we thought that those rainbow trout would be moving downstream. To, so to speak, to intercept them, before they would reach the Little Colorado River. So it actually was, it was called the Paria-to-Badger, uh, proposal. Paria-to-Badger mechanical removal proposal. And there were some experiments that were done, there was some removal, there was a, a complete, uh–in fact, there was a high, uh, an EA, an Environmental Assessment, done on that, coordinated by Mike Runge, to look at that prospect of doing that and then linking that to the 1995 EIS.As a way to, um, authorize that removal. Now, while–.

Paul Hirt

01:21:11

So the research on that and the proposal for that was before the 1995 EIS was being developed. Or at the time it was being developed.

Rich Valdez

01:21:17

It was after. And, immediately after.

Paul Hirt

01:21:20

And immediately after.

Rich Valdez

01:21:20

And it was after, correct. Right. And then, uh, starting in the early 2000s, then, uh, the idea was floated that, um, we could also be just targeting and removing fish, trout that is, from around the Little Colorado River. Because the–trying to intercept them in that Paria-to-Badger reach was, perhaps, more (Pause) chance, than something more certain, and instead go to the source itself, go to the end point and remove them there. So that became, uh, a program that was designed as a multi-year experiment, to where there were, there were multiple trips, I think there was something like six or eight removal trips, through that area, uh, of the Little Colorado River, both upstream and below, uh, the Little Colorado River, where electrofishing boats were removing trout in mass, and just taking them from the system. (Pause) Now, that became complicated to a certain degree, because you had two issues, one is what do you do with them once you pull them from the system, you have a mass of, uh–.

Paul Hirt

01:22:29

Protein. (Laughs)

Rich Valdez

01:22:30

You know, of several hundred, yeah, several hundred pounds of fish protein, what do you do with it? The [National] Park Service would not let us grind them up and put them back into the system. We thought of burying them in some riverside pits or something, but that didn't go over very well either. So, someone came up with the idea of something called the "bass-o-matic," which was a, basically a huge grinder, and you would just put them through a grinder and then put all that, pour all that soup into, um, I think they were, like, thirty-gallon barrels, that were put on boats and then floated out all the way to Diamond Creek, and then taken out and made available for fertilizer. And they were used by, uh, the Hualapais, and I think others too, as fertilizer. Eventually, it became, we had a, we eventually had a surplus of fish soup, that, no one had any further use for those, so we didn't quite know what it, what to do. Meantime, the Native American tribes, and, and rightfully so, um, had concerns about taking life in the Grand Canyon, what was referred to, the sanctity of life, which we of course wanted to make sure was respected. So, um, so those removal, that–those removal experiments went on for, I think, about three years, and the information was written up, and what we found is that they were effective as long as that removal was ongoing. But as soon as it was relieved for about a year or so, you started to see the influx, then, of additional fish to, to repopulate that area, and I'm talking specifically rainbow trout.And so, it became questionable whether that was, in fact, a sustainable management action. Whether you could keep doing that or whether, you know, maybe something else would be better, maybe.

Rich Valdez

01:24:24

So then we started thinking, okay, so what would the humpback chub population need to reach? How many, how many adults? Five thousand? Ten thousand? Fifteen thousand or more? In order to be able to sustain a certain amount of predation by rainbow trout. And so that became, then, we developed triggers around that. We said, okay, we won't implement non-native fish removal

until it's necessary to do so. And the trigger will be, not just the abundance of rainbow trout in that area, not how many fish are there, but also how low that humpback chub population is, and how much, how susceptible it might be to effect[s] of predation. So those two factors came into effect and that was all, eventually that was all part of the consideration of the, uh, of the 2016 LTEMP EIS. But by the time we got there, people like Mike Yard had done these studies on the relative, uh, effect of predation by brown trout versus, versus rainbow trout. And it was determined that in fact, probably brown trout were, perhaps, a bigger threat than rainbow trout. So, instead of implementing the Paria-to-Badger, uh, strategy, or removal around the LCR, um, it was decided instead to go to Bright Angel Creek, and try to go to the source of brown trout that were primarily spawning, uh, in Bright Angel Creek. And you see these ten-pound brown trout, and we've caught them off the mouth of Bright Angel Creek, that go into Bright Angel Creek to spawn. So they're using the, the main river a lot like humpback chub. They are living and being sustained in the main Colorado River. And, and every year in the fall, they're fall spawners, they migrate and go into Bright Angel Creek to spawn. And then that's where they're young are hatched and that's where they come out.

The automated transcript ended at the 1:26:20 minute mark; the audio file continues until the 2:20:36 minute mark.