Hey to all you fish enthusiasts out there. Whether you're an avid angler or just curious about fish, we'd like to welcome you to Fish of the Week! It's Monday, September 27 2021 and we're excited to talk about all the fish. I'm Katrina Liebich with the US Fish and Wildlife Service in Alaska.

and I'm Guy Eroh, the other co host of this audio program.

The specific fish we're talking about today is the sheefish, also called the inconnu, and locally referred to as the sii. We've got two fish biologist with us. We've got Ray Hander who's at our Fairbanks Fish and Wildlife Conservation Office, and we've got Bill Carter who works at the Selawik National Wildlife Refuge. So very happy to have you to join us today.

Welcome.

Thank you.

Thanks.

Okay, so we heard from Siikauraq Martha Whiting earlier this year, and she spoke to the winter sheefish fishery in Kotzebue and made us all hungry with the amazing ways she prepares sheefish. And today we're hoping to focus in on the biology of these fishes a little bit more. And also learn a little bit more about the permafrost thaw slump along the upper Selawik River and what implications that might have for these fish and the people who live in the area and depend on them. So first off, to ground us in where these fish live in this part of the state and their life history, can one of you take us to the Selawik and Kobuk area and describe the system of water bodies that sheefish use seasonally throughout the course of a year?

So sheefish in Alaska occur in the Kuskokwim is the one farthest to the south. And then you go up the western Alaska shoreline you get to the Yukon River. The next major populations are in the Selwik and kobuk rivers within the Kotzebue area.

In Kotzebue, the two spawning populations use a common feeding and rearing area in Selawik Lake and Hotham Inlet locally known as Kobuk Lake, and they even venture out into some of the lagoons farther out in Kotzebue sound. And they're caught around the Baldwin Peninsula which is where Kotzebue is. Especially in the winter ice fishery as Siikaruraq talked about.

what is the landscape around this area look like? Are you so far north that you're not seeing as many trees and what is the bank? Like is the river Do you have really deep holes or is it generally kind of flat and shallow?

Both rivers have some extensive wetlands associated with their deltas, we kind of call it the "green ditch" because if you're in the river, you see a lot of green. But if you can get out on the bank, then you get this big open vistas of just open tundra.

So I've had the pleasure of going up this Selawik with you guys a couple times and it's I mean it's a really sinuous windy river. So what about this river the selawik River in particular is conducive to shellfish living and spawning there.

So the selawik River doesn't have any salmon spawning in it, we get an occasional salmon but the lower river is really like a very slow moving Lake until you get up into the confluence of what we shorten to the "Tag." The river goes from a relatively deep 20 feet or more kind of just big bowl with not a whole lot of contours or rocks. It's very slow moving muddy kind of, well, the waters not muddy but the banks are silt mud. And then as you go farther up either the Tag or the Selawik it turns to sand and then gravel and the sheefish are spawning in those gravel areas. The spawning area kind of lands right in the middle from between the headwaters and that confluence with the Tag

Compared to some of the large Refuges in Alaska, Selawik seems fairly small. I was just curious about why is the refuge there?

Well, the refuge is mostly here for three reasons. The Western Arctic caribou herd traverses it. The wetlands complex that the two deltas create. And then sheefish spawning area is the main one.

Can one of you walk us through a typical life history of a sheefish? We know they've got similarities with salmon in some ways and some differences. We know they're long lived species and this has implications for how you might study them.

So what would you call a year in the life of a sheefish? We'll start say in June, they are probably still feeding somewhat in Selawik Lake and Hotham Inlet. They start making a slow migration up each of their respective rivers. That's a slow migration. These rivers are not terribly long, and so they make their way up to their spawning grounds and in roughly September, maybe late August, but certainly September and then they just kind of hold in place in those areas and spawn near freeze up so late September, early October. These fish are broadcast spawners, so the eggs and sperm come together in the water column and then those eggs are a little bit negatively buoyant and they filter down through the water and land on the substrate, the gravel, and the filter inside these little crevices in the gravel, and that's where they overwinter. And so two things start happening there, you've got you got eggs now, but in the adults that have just spawn, they almost immediately turn around and head back down river into Selawik Lake and Hotham Inlet to where they overwinter. And that's where they do the majority of their feeding. And so that would be you know, late October, back to June.

And you mentioned some of the you know, the spawners are heading up what are the other non-spawners doing? Are they spawning? They're not spawning every year. They're a little bit different than salmon that they can return back downstream. They don't die after spawning. What's the I guess, what's the deal with the spawners and non spawners?

Yeah, correct. You mentioned earlier about their age, these fish can easily live in excess of 30 years. The oldest one that that we've been able to age using otoliths aging has been 41. So just because you're an adult, and you are a spawning age, that doesn't mean that you go to spawn every year. So you may you may go to spawn every year, you may skip a year, you may skip 1,2,3, maybe up to four

years. So if you are not spawning, you're hanging out any of the slower lower river parts of both the Kobuk and the Selawik River.

After the eggs hatch, how long do they stay in the river before they start making it down into the lake or into the estuary?

Well, these, these fish when they hatch basically look like threads with eyes, they're really small, so they just get swept down river. They can't really swim against any of the current so all the whitefish just get spread out into anything that's flooded in the springtime. So they unfortunately may get washed into a lake that doesn't have a connection, they may just get washed down stream there they go all over the place. The ones that managed to get into places that they can get out of are the ones that survive

So they go from threads with eyes to large fish can you describe what these fish look like?

So unlike all the other whitefish, sheefish are piscivorous so they're eating other fish. And they start looking like sheefish pretty quickly. I think I've got the smallest sheefish that I've seen is only a couple inches long and it looks like a sheefish. It's already very predatory looking, it's got a big mouth. If you're in the southeast anywhere they are very similar to snook. They've got big mouths and kind of elongate bodies.

No teeth.

No teeth, they eat very much like a large mouth bass, they basically engulf their prey and then close their mouth around it. Unlike pike they don't like grab things that they may not be able to fit in their mouth. You know, pike will eat anything they can get their mouth around, and then figure out how to get it down their throat whereas sheefish are mostly looking at things that are about the size of their mouth, like herring and smelt and things like that, that they can just engulf by opening their mouth really quickly. Creating a vacuum basically.

Oh, their mouths are impressive when you see one of these, the full adult fish, you can probably easily fit a softball size. They obviously can't swallow something that big, but when they open their mouth and they pull that water and you know whatever fish they're after is probably, yeah, doesn't have much of a chance.

So we've talked a little bit about their spawning behavior and how they broadcast spawn over this gravel. And we know there's a permafrost thaw slump that's happening or has been happening upstream of that spawning area. Can one of you guys describe what that is exactly and you know what it might do to a species like this, I guess and why you're studying them.

So the permafrost thaw slump is about 40 kilometers I believe upstream from the spawning area river kilometers because sinewy river, it's in what's considered ice rich permafrost, which means there's a lot of water in between the grains of soil that are holding that together. And what happened is it's a south facing slope, it heated up in a very hot summer. And it started pouring out basically like wet cement into the river, it had a pretty dramatic head wall that was up to 70 feet tall at one point. And then about 2012

it, it started to fill itself in and stabilize. And then 2015, we had a tundra fire above it, and some rainy weather, and it reactivated in 2019. And it's still filling itself in rather than dumping a lot of sediment into the river. And now it's just a little turbid.

And this is a massive scale. I've seen a picture of someone like standing next to it and they look like a little dot, how big is it roughly?

So the last time the volume was estimated, which is kind of at its peak of what was being put into the river, it's equivalent to a 35 story building with a footprint the size of a football field is what has been evacuated. And about two thirds of that, which is about a 20 story building is what actually been mobilized into the river.

Yeah, so it's about 1000 feet across. Now it has grown over the years. And this one, it's situated on kind of a hillside, and it continually erodes its way uphill.

And these sediments are then making their way down river, where she fish spawn and beyond correct and potentially filling in that substrate over which the she fish are spawning.

That's correct. And that's what set off the study that we conducted from 2011 to 2018, or the field seasons. And so our best means of trying to figure out how to assess what effect that might have on ci fish spawners was to try and get at it kind of a backdoor approach, these fish don't mature until they're about 10 years old. And so in the midst of the time that we did our study, we were able to see fish that respond after the slump, started returning to the spawn. And so what we're looking for is to try and understand if there were missing age classes from the spawning population itself, because the spawning population is made up of a variety of age fish anywhere from 10 to 35, whatever.

And along with what Ray was saying, because this, this study that we just completed, was over so many multiple years where usually you have an age, if you're doing an aging study, it's maybe only one or two years. And in highly exploited populations, like in the Yukon, or the Kuskokwim, where they're getting caught mostly is bycatch. In the salmon fishery, you have these really nice smooth bell curves, they're skewed towards the younger fish as they enter recruitment. And as they get bigger, they're more likely to get caught. So there's fewer older fish. But because we have eight years of data for these, both the Kobuk and the Selawik fish showed this pattern of large recruitment events where you have a lot of young fish coming into the population and very few old fish but those young fish as they go through the population, they limit new recruitment. So you see these waves of fish go through where you have good recruitment for several years, and then lower recruitment until those big fish get taken out of the population either by being caught in one of the fisheries or being just getting old and dying.

This is a really neat fish because I mean questions like these really do take that long term investment to answer potentially decades just given the life of these fish. I'm curious, you know, the Native Village of Selawik. What's their role in this project?

Well, we hire a couple of people out of the village to help us with these studies. They're really valuable in their local knowledge of where to catch fish, and also a big part of this project because we're

capturing 200 fish and we've mentioned that we take odorless and otoliths sampling is a lethal sampling and we don't want to waste those fish so the local hires also help us prepare and care for those carcasses. In a way that they can be used for food,

and then the fish get distributed within the village. Yeah, by the folks that you work with. Yeah. What I thought was cool about this project, too. I mean, you guys consulted with the tribe, right? And kind of got buy in to doing the study, because folks were interested in learning how this lump was gonna affect the fish, correct?

That's correct. I think it was 2000. And I went to one of the Selawik Village council meetings and sat down and explained what we were thinking. And everybody kind of knew about the slump and was concerned about it. And kind of right there on the spot, I presented our ideas to the salad village council and voted on it on the spot. So it was they were certainly on board. And I cannot say enough about the salad refuges, interaction and good relations with the native village itself, which makes everybody's job a lot smoother.

I'm curious if we could go into a little bit more detail about what caused this slump, and whether they're, we should anticipate them more like this might happen in the future, if this was just a freak occurrence.

Oh, it's totally a warming of the climate phenomenon. We happen to have one of the largest ones and one of the ones that kind of started the earliest here in the northwest Arctic region. But there's lots of them all across the Arctic, we have with the permafrost expert called warm permafrost, it's only a couple of degrees below freezing. And it's really vulnerable to slight changes in you know, average temperature. So even places that are shaded with different types of trees have warmer and colder permafrost.

Yeah, so similar types of permafrost degradation are happening all across the Arctic, and like in Russia and other places where permafrost occurs. That's, you know, it's just a widespread phenomenon with climate warming.

On the show, we focused in on fishing techniques, a lot of times, I'm curious what kind of technique you're using to catch these fish.

So these fish actually aren't feeding, we've actually, out of all the fish that we've looked at, and it's 1600 fish or so, we found exactly one unfortunate pike, small pike, in the stomach. Every other fish has not had anything in its stomach, but they will hit lures, almost any kind of spoon, we happen to like a particular kind, something that sinks relatively quickly. And then we just kind of cast perpendicular to the river and then let the current swing back in front. They're also very fond of clouser minnows, if you're a fly fisherman, heavy weighted fly, that looks like a small fish.

And are you you guys are just harvesting males correct. This seems like a good method to be pretty targeted with which sex you'd be catching

This eight year project is actually the third project that we've done on the river. So in '94, '95, '96, there was a population estimate done by mark recapture method. And then, in 2004, we started a mark recapture project right when the slump was starting. And we actually had to use big seine nets to catch the fish for the marking portion. So the spawning population from these other two studies showed us that there were far more males in the spawning population and females. And seeing as you don't get babies without eggs, we figured we can just take males and get a good estimate of the age range of the youngest fish and the oldest fish and also what some of the other studies chiefess studies have shown. Males mature before females. So we're going to get the youngest fish out of that definitely the first ones to recruit.

So when you get a fish to hand without killing it and looking to see what it's got inside, what kind of gonads it has, how can you tell a male from a female?

So especially early in the season, it can be a little more difficult, but they're on the spawning ground. And the females are just fat. If we had a poorly hooked fish, and it's gonna die anyhow, because it gets hooked in the gills or something and we have to sacrifice it, we do what's called gonad systematic index which is basically we weigh the whole fish and then we take out the eggs and weigh the eggs separately. And these eggs are about they're actually smaller than like one of those sewing pins. It has a colored ball on the top. They're really small. There's, you know, hundreds of 1000s of eggs in these big females.

What percentage of their weight are the eggs?

They get up into 30% of their weight. His eggs and those, you know, those really big females that have those real big egg masses. They're the ones that are running 10 kilos or more. So they're big, big girls.

I think generally, two to 400,000 eggs would be the range and it probably varies with the age of the fish. I don't recall exactly, but it's a lot of eggs.

So you're saying they're thicc?

Hey, are there they're pretty wide. Like a big, like metre long female is probably four or more inches wide at the top, and then her belly can go out like another half inch or more on each side. They're just yeah, kind of big and round those big females?

Yeah, if you had a, if you had a balloon filled with, like, some kind of heavy jell-o, you know, and you poke your finger into it, you know, there when the eggs become loose in their bellies. It's a very fluid, almost feel.

To kind of wrap things up, are there any messages you want to give to people in the area or folks from outside that are interested in this fish about the species? And you know, or climate change? Or just, you know, just what would you like to tell folks final message?

That's, that's a lot. It's a loaded question.

Asking scientists to make definitive statements is bad thing.

Are sheefish the coolest fish in the Arctic?

If you like sport fishing for a young yeah, they're probably one of the better fish.

Yeah, well, I think as climate warming continues, and we like Bill mentioned earlier that there is the increasing frequency of permafrost thaw occurring. So I think one of the things to be that we as biologists should be paying attention to is how fish adapt, or maybe don't adapt to these changes. It's a it's honest, it's happening as we speak. So I think folks in our field, I think that's what we are trying to do. It's our job to observe and report. It's wildly fascinating, and we're learning a lot. Yeah, just like Katrina said a lot of cool things still to come. And they have we've learned

Cool, well thank you very much you do this was a really neat conversation and we hope everybody gets out there and enjoys all the fish and continues to learn about the sheefish.

Thanks for listening to fish of the week. My name is Katrina Liebich. And my co host is Guy Eroh. Our production partner for this series is Citizen Racecar. Produced and story edited by Charlotte Moore. Production management by Gabrielle Montequin. Post production by Alex Brower. Fish of the Week! is a production of the US Fish and Wildlife Service, Alaska Region Office of External Affairs. As the Service reflects on 150 years of fisheries conservation. We honor thank and celebrate the whole community, individuals tribes, the state of Alaska, our sister agencies, fish enthusiasts, scientists and others who have elevated our understanding and love as people and professionals of all the fish