

Goldfish featuring Christine Boston

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!, your audio almanac of all the fish. It's Monday, December 19 2022. This year, we're excited to take you on a week by week tour of fish across the country with guests from all walks of life. I'm Katrina Liebich with the US Fish and Wildlife Service in Alaska,

and I'm Guy Eroh. This week, we're gonna be tackling the Carassius snack that smiles back. We're talking about the goldfish, folks. So get ready, buckle in.

That's a good one Guy.

I'm rhyming over here.

That was awesome. We're very pleased to welcome our guest, Christine Boston. She's an aquatic and research biologist with Fisheries and Oceans Canada and is joining us from Ontario, correct?

Yes, I'm about an hour west of Toronto.

Yeah, welcome.

So I'm really excited to talk about goldfish finally, I think probably just about everyone is familiar with this fish, whether you've gotten one in a bag at the fair, or had a fish tank or been to a wedding and taken goldfish that were part of the decorations that was me, or been obsessed trying to catch them out of the local pond with a net unsuccessfully as a kid (that was also me), or have one in your office named Blubby. That said, How much does the average person really know about goldfish biology and what happens when they're released into the wild? And those are some of the things that we're hoping to sort out today with you guys. So Christine, I've seen the photos of the football sized goldfish you all are catching in Ontario waters, they kind of look like pinatas that are about to pop. And I have a lot of questions about that. But maybe we can start with how many goldfish are you finding up there?

Oh, that's a good question. It depends where I am I guess I started really noticing goldfish in electrofishing catches in Hamilton Harbor, which is a Great Lakes embayment, a Great Lakes area of concern that I work in at the western end of Lake Ontario. So we started to see them quite regularly in our catch. But over the last two years, I've been working in urban ponds, stormwater management ponds, and we found anywhere from one to about 50,000 goldfish in a pond.

That's a lot. That's a lot of goldfish.

Yeah.

So for people who aren't super familiar with kind of where goldfish fit in, or koi, which is another popular aquarium fish, how do these guys relate to one another? So you've got your goldfish, we've got Koi, and then we've got carp, which has a number of different species too. How are these fish related?

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Yes. So they're not carp, they're goldfish. They're different species.

Different genus too.

Yeah, goldfish is *Carassius auratus*. common carp *Cyprinus carpio*.

I know I'm getting ready, we're gonna do a common carp episode next year. And I'm glad we made that distinction.

So they all belong to the same family. Koi are actually carp that are bred for their colors. And goldfish are goldfish. And they're very similar, like a wild population of goldfish has very similar coloring to a wild population of common carp that isn't bred for the colors. So they're both very popular aquarium and water garden fishes. One of the ways you can tell them apart, if you're not really super familiar with the species is that the common carp has two sets of barbels and the goldfish doesn't have any.

And the koi have barbels, too?

Yes. So the Koi, again, is just *Cyprinus carpio*, it's just bred for those colors. So it's the same species. But goldfish is a different species and a different genus than carp.

Awesome. And all of those variety of Goldfish are just different breeds that have come from, is it a common kind of basically the common goldfish?

Like dogs? I guess?

Yeah, like, even though there's so many different varieties like dogs, they're actually their DNA, isn't that different is what we're finding. It's pretty much the same. There are other species in the genus that we're also concerned about in Alberta and Saskatchewan. So Western Canada, the Prussian carp, so I'm, I don't know if you guys have heard about the Prussian carp but they're not as widespread as the goldfish thank goodness, but apparently, they're coming east our way. So...

Oh, man.

Yeah. Yeah.

Can I ask a question about that? And I'll tie it back into the our species of focus. This week, you think about goldfish, okay. It's easy to understand how those get introduced. They're pets. People are little soft hearted, weak minded, whatever you want to call them.

Oh Guy.

They put them in the wild. And they get big and they they start reproducing themselves. This Prussian carp. I've never heard of anyone keeping those in a tank how those get introduced?

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Well, we actually think that they were introduced through the aquarium and water garden trade as well just as probably misidentified as a goldfish.

Oh.

They're very hard to tell apart to somebody that isn't trained. Even to the trained eye apparently, as well as the Prussian Carp, which is another type of goldfish. They're all really hard to tell apart.

Interesting.

Yeah.

So the fish that you're catching on your surveys, we can go on electrofishing. Do you think those are ones that have been introduced just first generation into the pond? Are these mostly wild recruited fish?

Well, I think there's an established population for sure in Hamilton.

They're reproducing?

Yeah, they're reproducing, I think once you start to see them reverting back to their sort of their natural colors, olive green brown color, you can be pretty safe that you have like a wild established population. For example, in this harbor, we do still see quite a few orange ones. And those could potentially be ones that have been recently released into the harbor.

So that coloration, yeah, well, once they get into a wild situation, I was curious if that stays and it sounds like it does start reverting back.

Yeah, because they're bred to be that color, like Koi. So koi are actually carp. They're just like the colorful...they're bred for those colors. And they're called Koi, but they're just the colorful version of a common carp. And the goldfish is bred for that color. But once it's been introduced into the wild, and it starts to reproduce, yeah, it reverts back to that color. So nature selects against the brightly colored ones. They're easy prey for birds before they get too big, like herons and gulls and terns.

For those you guys listening, I have a really awesome picture that Christine sent me it's a big goldfish. His name is chunk. I've got chunk in my hands. You guys can't see him. But Christine, can you describe?

Why are they so fat? I think is just because they have the resources to grow. They're growing fast, because the waters that they're we're finding them in are very trophic. So there's lots of nutrients for them. They can eat anything from Blue Green Algae all the way to vertebrates, I don't know of them really eating any fish, not really Piscivores. They're just generalists, but they can take advantage of any food source. And the Hamilton Harbor does not have a healthy fish community. So the percentage of top predators in the system is quite low. So they have an opportunity to grow fast. And once I think they probably reach their second year of life, there's not really much that can eat them, because there's

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football size, they're so robust, you'd have to have a pretty big deep size to be able to swallow one of them.

So we know that goldfish can get pretty old you and keep them in a bowl on your table for a long time. And no matter how long you feed them, they're not going to get to these massive sizes like you're finding. I'm curious, what's the minimum size of a water body you need for a fish to get this big? And just how big are we talking?

So in Hamilton Harbor, which is part of Lake Ontario, they're big. So when we catch them, in general, they're anywhere from 250 millimeters to 400 millimeters in size. And I tried to convert that for you the common sort of size range that we catch them in, is 10 to 14 inches.

Big, pretty big.

Bigger than most fish bowls.

Yeah.

And anywhere from I would say, two to four pounds. The biggest one that we've captured, actually, so I had a search for that in my data set was 465 millimeters in length, which is about 18 inches and weighs 2.6 kilos, which is almost six pounds. So I've been working in like urban ponds for the last two years studying goldfish. And most of the ponds, the average size, I would say is about maybe eight to 10 inches would be like the maximum size they get, except for in a couple of the ponds where we saw these really huge ones. And they weren't very big at all those ponds. Like I said, maybe point 2.3 hectares in size.

I've seen these guys in ponds. So the one that was near my house when I was a kid, it was a very small pond and there were like frogs in it. But yeah, the goldfish would go in the middle and they were big like that as well. And I've stopped at like gas stations driving or like rest stops. And there have been little ditches on the side I've seeing goldfish down in the south. It seems like they're really able to yeah, take advantage of kind of smaller spaces and, and make a living there in a pretty wide area. I mean, I grew up in Virginia, you're there in Canada, we actually had a population up here in Anchorage a few years ago that Alaska Department of Fish and Game eradicated from a local pond right here in town, but they were quite big as well. It's pretty neat to see him across that large space. And I guess there's something to be said for the types of conditions that they can survive. And so I'd be curious if we could maybe just talk a little bit about do they have certain types of habitat preferences or what kind of temperatures can they handle? I mean, they're all the way from the southern US up to Alaska. It's pretty impressive where they can live.

I know here in Canada, we also have them in the Yukon. Hey, yeah. And recently, I've talked to a scientist who works in British Columbia. And they're actually having a problem with them in British Columbia in rainbow trout lakes, if you believe that they're actually competing with rainbow trout, and they're spending quite a bit of money to eradicate them from these lakes, which is a whole other thing. But goldfish like in their native range are from tropical to temperate regions of eastern Asia. So China,

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Korea, something known as the Ameer River Basin. So it's a really large area, and it covers a very wide range of temperatures from below freezing to high 30s. Again, sorry, I'm talking in Celsius metric. You guys can just jump in and say what it is in Fahrenheit,

I'd have to get my own conversion thing out as well.

Yeah, so they're established in almost all non polar parts of the world. Covers a huge range of water quality conditions, they seem to do well, in any type of habitat. They're found in like a wide range of conditions and extreme conditions, which I think is why they're so successful. They're really tolerant of temperature fluctuations, very low dissolved oxygen, turbidity, and those type of things.

What are some of the issues once these goldfish are introduced to a pond in terms of you mentioned competition with trout, but what are all of the different issues they can cause once they're introduced to a system,

So we started seeing them in Hamilton Harbor, about 10 years after we had seen a significant decline in the common carp population that we had been managing. So Hamilton Harbors a Great Lakes area of concern. And one of the road blocks I guess, to rehabilitating some of the marshes, the big marshes in the harbor was the common carp. So the common carp are very destructive the way they feed, and...

They're like pull up vegetation and stuff.

They have that they call like a second spit way of feeding. So they uproot the vegetation, they increase the turbidity in the water, stuff like that. So really big fish barriers have been built to Cootes paradise, which is the last large remaining wetland in Hamilton Harbor. So Prime, it's the spawning habitat for native fishes, all our important warm water species like Pike, and perch and bass and things that we're trying to rehabilitate. And so we were managing for this species. And after about 10 years of managing them, we're starting to see a significant decline in the population, we started to see goldfish in our catches. And I think it's just trading one for the other. So basically, they have the same type of feeding strategy, very destructive, competing with native fish for food and habitat.

I guess there's like diseases issues too potentially come in from if they're coming from a fish tank, either. You saw that there, but just I think, in general, for introductions from aquaria. That's probably something to be thinking about too with native fishes.

Yeah, for sure. I know. There's 23 diseases, I think there is the goldfish carry in North America. And I know like in BC, where they're trying to deal with them in these rainbow trout lakes. They know there's some of the viruses or diseases that they carry have led to like large salmon die offs in rivers and stuff. So they're worried about that.

It's not good.

Yeah. So stormwater ponds in my area and in southern Ontario are sort of a more recent development. Like I would say, in the last 20 years, as we've seen population increases, we've seen an increase in

development, like expanding into the watershed. And they've been designing these offline ponds, which connect to natural water courses. Every time we have a significant rain event, like something like 25 millimeters, the engineers tell me, and we're worried that we might be creating some kind of super invader type of goldfish in these ponds, because there's such extreme environments. So this is something that one of my colleagues, Nick Mandrak, who is a professor at the University of Toronto, he's a big invasive species guy, like that's one of the things that he's concerned about, like he's trying to determine if these ponds are creating goldfish that are more tolerant than the goldfish that were already seen in the wild. And should we be more concerned about them? With water warming with climate change, and things like that? Like, is it going to give these goldfish a competitive edge over our native species? So those are some of the things we're kind of worried about with these goldfish, but in general to like just like a common carp. They're very destructive and compete with native species and destroy habitat.

And it seems like those ponds I've seen those in developing areas and it looks like maybe a closed system, but like you mentioned, if there's a high water events, I guess people aren't always familiar if there's like an inlet coming in or an outlet going out or if water is able to escape that pond during high flows. But yeah, when you release a pet, it seems like those are things that, yeah can be problematic they can get out of that pond that you initially put them in and cause harm elsewhere too.

Yeah, over the last few years, we've surveyed about 35 of these ponds and 40% of the ponds have goldfish in them. And the ponds that do have the goldfish in them are always in a suburban neighborhood so close to houses or close to a really well utilized trail every time. So,

are you guys planning any sorta, you know, kill your pets PSA campaign?

That would go well!

the city that I live in the city of Hamilton, we've done an acoustic telemetry study where we track them in Hamilton Harbor for two years. So just like that kind of information, got the attention of the press. And it was the sort of the drainage superintendent from the City of Hamilton who contacted me and said, Hey, I think we're, we might be contributing to your goldfish problem in the harbor. So we partnered with them. And they've helped us develop the signs that they're putting up at every stormwater management pond in the city. So in Hamilton, there's about 80 wet ponds. So they're putting them up at all the wet ponds, basically telling them, you know, how just not to do it. It's destructive. I mean, I can't imagine people are doing that to do something malicious. I think like you said, most people are just trying to save their pet.

and there are some good ways to break up with your goldfish, I guess. I mean, before that happens, you can be proactive and think about Yeah, these guys can live decades. So really thinking long term? What are you going to do with this pet? You're going to really have it for 30 years are to being proactive there. But yeah, I think re homing it with people. I know that I've gotten a lot of my fish off of like marketplace or Craigslist and have them in aquariums at my house here. So I know there are options online to do rehoming. I think pet stores take pets back a lot. And then you can also reach out to a

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veterinarian and see if there's humane ways to euthanize a goldfish if some of those options don't pan out.

Yeah.

MS Triple Two

Can I quickly tell you about the telemetry study that we're doing?

Oh, yeah. So Wait, was that for? Yeah, you brought that up? I was gonna ask a follow up because you're trying to like identify different habitat usage or something like that, or why we're looking at telemetry,

We started to see this big declining curve. And we're like, Yay, we're, we're making some progress here. And then "oh, no, it's just been replaced by goldfish." And so we tagged a bunch of them and followed them around for two years. So acoustic telemetry is remote tracking, because we wanted to see where they were going. And, you know, maybe give it some insight on how we can manage them. And we found out that they did have very specific areas that they overwinter that and also that they targeted for spawning in the spring. So as daylight and water temperatures decrease, they move downwards. And they overwintered at anywhere from five to 10 meters of water. And as early as January, they started moving upwards in the water column. So before the water even started to warm, but the days are getting longer, they started to move upwards in the water column. And by March, they were already in shallow water like less than two meters at areas that we identified as spawning habitat. So they were already there ready to go before the water was even warm enough for them to spawn. So like we thought that was really interesting. And that was cool, because we think we can target them at that time before they start to spawn and try and get rid of a lot of these big mature spawners. The other really cool thing. They didn't try to leave Hamilton Harbor, they stayed within the harbor. Whereas we saw, there's one other study in Australia where they acoustically take goldfish and one of those fish moved to around 31 kilometers over a year, which is crazy. But ours didn't even leave the harbor. They were like, yeah, it was too cold. We're gonna stay in here. We got lots of food. We're good.

Are you guys employing any different technologies like eDNA or anything to find goldfish as well? Or how are you going about capturing these things? What are you doing with them?

So that stormwater project a big part of that project is we're trying to develop eDNA is a sampling tool. So we're trying to develop an early detection tool for Carassius genus. And we are also trying to look at abundance. So that's why that's part of the reason we've been working in these small water bodies is to develop the tool. So also look at the risk associated with these ponds as a source of invasives to our natural waterways. And at the same time, and really, probably even the biggest part of this project was the Edna side of things. So of these 30, 35 ponds that we've sampled over the last two years, we've actually drained 10 of them to count every single fish in them so we can develop this tool and primer for Carassius.

Okay, interesting.

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And that's a horrible job. Let me tell them, you know what there's so hard to get rid of. So, two of the ponds that we sampled, that we drained in 2021, we removed almost 20,000 Goldfish from both of those ponds, each pond had close to 20,000 Goldfish. And when you're trying to remove them, you can't get every single one because they actually go down into the mud. Like they're unbelievable. And you could just see them burrowing into the mud and they look like they're doing just fine. I'd say we removed about 95% of the fish from those ponds. And then after we got out of there, the contractors finished the de watering, removed X number of feet of sediment. And here when we went back, there's 10,000 Goldfish. We drained it again, I had almost 10,000 So whatever was left in there was able to survive, or survivors.

What was the gap in time between the initial getting rid of the goldfish and then coming back and finding the 10,000?

A year.

Oh, that's that sounds like an unsolvable problem.

Don't release your goldfish folks!

I am much more pessimistic now.

Oh, my goodness.

one of the things that makes goldfish have such an advantage over our native species. And like I said, we think they're surviving in the stormwater ponds is because they are able to live under anoxic conditions. So they've evolved this special metabolic system that can enable them to survive without oxygen. We know that they can live for three, four months without oxygen. Most of these ponds are freezing right to the bottom, so there's no oxygen, so they're really impressive. Yeah, so both goldfish and the crucian carp, which is another type of goldfish, has evolved a special metabolic system that can sometimes enable them to survive up to five months without oxygen. So

Whoa.

Because they have evolved an alcohol dehydrogenase anaerobic metabolic pathway that produces alcohol, which exits the fish via the gills.

You'd walked back into the backwoods of Ontario there and you'll find some moonshiners. But instead of just fermenting this stuff, they got a bunch of goldfish and these big aquariums that they're distillin' it. Yeah, wow.

Yeah, invasive species. Once they're in there, they are hard to get out. It's a big process.

The problem too, is they're not designated as an invasive species in Canada. Hmm, yeah.

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I think if they were then you wouldn't be able to sell them. Right.

Okay. Well, I'm curious, just real quick clarification these pallets? Are you finding them at such high densities...Are you still finding them with really large size? Are they more typical goldfish size that people are used to?

Yeah, no, those are more typical goldfish size. So those two ponds, for example, that I was telling you about that had about 20,000? I would say they were anywhere from two to maybe 10 inches, and there would be four or five year classes, but that would be the maximum size they would reach those were in Goldfish only ponds, like some ponds.

You stock some like pike in there or something?

Yeah, well, the interesting thing is so those ponds where we caught the large goldfish also had a very good population, a self sustaining population of largemouth bass and pumpkinseed. I think maybe that's I think there's a better way to design and manage these ponds. And I think what you said Guy, one of them is stocking them with some predators,

and yeah, someone just scarf down these tons of these little fish. Yeah, because

we didn't find any little guys in the ponds where we had bass at the big fish. So it's either they're not reproducing, or the pumpkinseed and goldfish and whatever, and the bass, whatever else is in here, are chomping away on them and keeping it under control.

Yeah, it seems a lot easier to deal with removing a handful of large fish than a seemingly infinite number of tiny fish.

Yes, exactly.

So if someone's out there say that they're fishing and they catch one of these fish. What do you suggest they do with it? Should they just dispatch it? Can people eat them? What? What do you recommend?

I know people do eat them. There's some grocery stores in the greater Toronto Area where I lives that actually sell them.

Interesting.

Yeah, I've never tried one I don't know anybody that eats them. But...

I've eaten the snack ones that you can get out of the bag.

A little different. Guy. Have you caught a goldfish before?

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No, I've seen it. I don't run across many. I want to I want to add it to my list. There was this one. It was lot five of the Baltimore and Ohio Canal outside of DC. And like multiple years in between I've had sightings of it and I keep trying to catch it. And I never can. So if anyone's listening and they caught that fish, please reach out because I want to know what you were using. I was not able to get it done.

What did you try to use?

Basically just had artificials on but I tried everything on pack, I caught common carp out of that same hole. So you know, those aren't particularly easy to catch, especially without bait, I think even tried worms, too. I suppose I probably should have thrown some corn or something at it. But I just didn't have any with me. No, I...goldfish frustrate me.

Did you guys see that video of the goldfish that they taught to drag that little vehicle to get it? Yes. Yeah, that was crazy. And I was thinking about that for this episode. I mean, it really that goldfish was able to learn how to maneuver. Basically a vehicle that had an aquarium on it had wheels, and it would direct itself to line on the wall. And then if he hit the line, it would get a treat, but they're quite smart. And my fish and my tanks like they recognize me, they'll come up when I feed them. And it's just something to think about when you're going to get a pet like a fish. You might be like, Oh, it's just a fish. But they got a lot going on in their little heads, I think.

And apparently they learn to avoid traps quite well. Which is why electrofishing is such a good way to capture them. You have to sneak up on them. But

Maybe that's why I could never catch when I was a kid.

Thank you. Thank you, Christine. That's been great chatting with you. And yeah, thanks again. We'll get out there and enjoy all the fish and if you plan to get a goldfish, you're in it for the long haul.

Thanks for listening the 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 Tasha AF Limley. Production Management by Gabriela Montequin. Post production by Alex Brower. Fish of the Week! is a production of the US Fish and Wildlife Service Alaska Regional Office of External Affairs. We honor thank and celebrate the whole community, individual tribes states, our sister agencies, fish enthusiasts, scientists and others who have elevated our understanding and love as people and professionals of all the fish.