Tour Information

* Camanche Dam was constructed in 1964. What is the purpose of Camanche Reservoir and Dam?
	+ Water storage for municipal, irrigation, and recreation
	+ To provide flood control protection.
	+ Water Turbines produce Power/Electricity
		- Hydro-Electricity
* The Mokelumne River Fish Hatchery construction was also finished in 1964 to offset the 12 miles fish spawning habitat lost between the Camanche Dam and Pardee Reservoir
	+ - In July of 2002, East Bay Municipal Utility District (EBMUD) remodeled the Mokelumne River Fish Hatchery.
		- By enlarging the rearing space to promote fish health, survival rates, and production efficiency, they helped increase the numbers of returning fish to spawn.
		- They also implemented several programs to improve the water flow, quality, and physical habitat in the lower Mokelumne River
* Why do we spawn fish?
	+ To mitigate for loss of habitat from the construction of Camanche Dam
	+ To help balance and improve our Eco-System
	+ To produce fish for commercial, sport and tribal fisheries
* Salmon Egg Life
	+ The female makes a redd, or fish nest, in the gravel by laying on her side and flapping her caudal fin several times. When finished, she signals the male and they deposit her eggs and his milt into the redd.
	+ Over several days, the female will make 2 to 3 redd’s.
	+ One female has approximately 5,000 eggs yearly.
	+ It takes us 6.5 million eggs to raise 5.5 million fish.
	+ (Pass around sample)
	+ Eggs in 50°F water generally hatch in 50 days. Warmer water speeds egg development.
	+ A Green Egg is a newly fertilized egg at 0 days old.
	+ An Eyed-Egg is starting to develop tiny eyes at 26 days old.
		- As the Eyed-Egg continues development of the embryo the eyes become larger and more distinct. This occurs at 39 days old.
	+ Sac-Fry or Alevin are hatching out of their eggshell at 50 days old. Note the yolk sac.
	+ Fry is the first stage of being a fish, generally at 85 days old. The yolk is nearly absorbed and they are ready to start feeding.
* Fish Facts
	+ Chinook salmon, A.K.A. “King Salmon,” are an anadromous fish. This means that juveniles or smolts (A.K.A. fingerlings), up to a year old, migrate downstream to the ocean to mature and grow. As adults, they migrate upstream to spawn in freshwater rivers. They have 17 different runs that have been categorized into 6 Evolutionary Significant Units.
* Southern Oregon and Northern California Coastal Chinook Salmon
* California Coastal Chinook Salmon
* Upper Klamath - Trinity River Chinook Salmon
* Central Valley Fall and Late Fall-run Chinook Salmon
* Central Valley Spring-run Chinook Salmon
* Sacramento River Winter-run Chinook Salmon
	+ Chinook salmon, both male and female, do not eat during spawning season and die a few days after spawning.
	+ A steelhead trout is an anadromous subspecies of rainbow trout. When they go to the ocean, they stay for one or more years before returning to spawn. Unlike salmon, after spawning they return to the ocean and may spawn again another year.
	+ There are two reasons that they change color: camouflage and spawning
		- With camouflage they are blending into their environment to protect them from predators. While they live in the ocean, they are lighter and shinier. Their top side becomes darker as they move up river, blending in to the riverbed from above.
		- During spawning season their color becomes olive brown and maroon.
* Salmon smell their way back to where they were born which is called imprinting. Each segment of water has chemical cues that can be traced back to their spawning grounds. The imprinting process begins while they are still eggs.
* Spawning salmon and steelhead in a fish hatchery. Here at Mokelumne River Fish Hatchery we raise Fall-run Chinook Salmon *Oncorhynchus tshawytscha*, and steelhead (a subspecies of Rainbow Trout *Oncorhynchus mykiss*.)
* How do salmon and steelhead smell their way back when spawned at the hatchery instead of in the river?
	+ We use water from the Mokelumne River when spawning our fish. They can smell the difference where the rivers merge downstream.
	+ We release our near spawning salmon and steelhead in the Delta waters to help ensure they make it upriver to the Camanche Dam area.
		- Between the ocean and the Delta waters, there are many predators that eat fish.
		- In the past few years, the drought has negatively affected our salmon and steelhead. Shallow water means warmer river water that these fish don’t like and it can also strand them down river.
		- Pesticides and herbicides often used by farmers and homeowners that drain into the river can harm the fish.
* Tagging and Tracking
	+ 1 of 4 fish here has been tagged.
	+ There are several different kinds of tags: Carlin, Peterson, Spaghetti, Dart, and T-Bar tags are located near the dorsal fin. Opercle tags are located near the gills.
	+ Coded wire tags (CWT) are smaller than a piece of pencil led and implanted into the fish.
	+ Passive Integrated Transponder or PIT tags use a microchip. We have two PIT tag detectors set up here to track the incoming Salmon.
* Otoliths
	+ Otoliths are fish ear bones.
* They consist of three pairs of small carbonate bodies that are found in the head of teleost fish (bony fish).
	+ The three pairsof otoliths are called the asteriscus, lapillus, and sagittae.
	+ Functioning similar to our inner ear, the otoliths are used by fish for balance, orientation and sound detection.
* These pairs of otoliths differ in location, function, size, shape, and structure.
* In Pacific salmon, the asteriscus and lapillus are usually quite small, only a millimeter in size. The sagittae are much larger, ~5 mm, making them easier to study.
	+ The otolith is a crystal that grows by the precipitation of ions on its exposed surfaces.
* In this process, varying amounts of protein and calcium carbonate are laid down on the surface of the otolith, which differ with time and season.
* Similar to rings of a tree trunk, thin sections of an otolith can reveal a detailed microstructure consisting of bands of opaque and translucent material.
* These patterns are a natural record or they can be induced by man.
	+ Otoliths are widely used in fisheries management because they provide useful information on age, growth rate, life history, recruitment, and taxonomy.
* What is the rarest fish that we have here?
	+ Blue steelhead
* AKA “Blue” “Bubblegum” “Moby” “Nemo”
	+ - He was spawned here
		- He lived to be 5 years old, 2013-2018
		- Blue was rare because he was the only known blue steelhead
		- At age 4 Blue was ½ the size of a 2 year old steelhead



* + Occasionally we do get other albino or blue colored fish.
		- Albino coloring is a natural occurrence where the fish lacks all or some of the pigment melanin, which is what gives the living creatures their color. This is caused by two fish (that don’t have to be albino) of the same species breeding, that share a chromosome that causes albinism.
		- Blue coloring is a rare but natural occurrence in rainbow trout and even rarer in brown trout.
			* They can range from iridescent metallic blue to cobalt blue in color.
			* Some studies have shown that the blue color comes from two different possibilities.
1. Autosomal Recessive Inheritance
2. “A structural arrangement of melanin inducing a Tyndall effect, so that it was impaired by the lack of melanin when associated with the depigmenting gene.” *Journal of Heredity*, Volume 97, Issue 1, 1 January 2006, Pages 89–93, <https://doi.org/10.1093/jhered/esj010>