

## ADVENTURES IN ICHTHYOLOGY

### Pacific Northwest Fish of the Lewis and Clark Expedition

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Captains Meriwether Lewis and William Clark and other members of their expedition collected and identified nearly 400 species of plants and animals during their voyage of discovery. Of this total, 31 species of fish were included in Burroughs' summary of the natural history of the expedition, including 12 fish considered unknown to science at that time. While there is little doubt of the identity of fish for which Lewis and Clark provided detailed descriptions in their daily logs, other species designations were largely conjecture based on later scholars' interpretations of Lewis and Clark's accounts. Unlike other biological specimens encountered during the expedition, no fish were brought back for study. As a result, the identity of some was never resolved. Many other fish were reclassified during the past century based on updated scientific methods.

As Lewis and Clark's party crossed the Continental Divide in August 1805 in search of a water route to the Pacific Ocean, they reached the upper Columbia River watershed and crossed the threshold toward a whole new assemblage of freshwater fish. Their encounters with Native American fishermen and fish were well-documented in some instances. Other accounts were sketchy at best. In addition to their daily log, Lewis and Clark wrote long passages summarizing life history and taxonomic features of several fish species while within the rainy confines of Fort Clatsop in March 1806. Many reconstructed notes were of fish encountered several months earlier when the expedition crossed the Rockies. Given the dreary backdrop and the time that had passed since their original observations, some details were likely embellished or lost.

Certain accounts of Columbia River fish remain confusing to this day. For example, Clark wrote on October 25, 1805, while near The Dalles, "One of the guards saw a Drumfish today." We know that freshwater drum (fish that made a peculiar noise by forcing air from the swim bladder) did not occur in the Columbia River basin. The distinct shape of these fish, as well as their long, double dorsal fin with spines, would make it difficult to mistake them with anything present in the lower Columbia River. Lewis and Clark also alluded to the "whale and the porpus" in a list of fish they saw, apparently being confused about the proper zoological classification of these finned mammals as well. Like all pioneering naturalists, they made mistakes. However, they also set the table for others with more specialized interests.

Trout and salmon are one of the most visible groups of fish in the Pacific Northwest. They are highly valued by sports and commercial fishermen and have great cultural significance to Native American tribes. Up to 20 million adult Pacific salmon and steelhead returned to spawn in the Columbia River and its tributaries two centuries ago. Resident trout also ranged throughout the many waterways. Clearly, salmon and trout were the most abundant group of fish present in the Columbia and Snake rivers when the Lewis and Clark expedition passed through this region.

Our bold explorers encountered and described what appeared to be five species of fish from the trout and salmon family. The original or type species *Salmo* had already been described by Walbaum in 1792 based on Russian forms. However, no resident or anadromous (*i.e.*, seagoing) forms of the genus *Oncorhynchus* had been previously collected in the United States. Lewis and Clark's list of species included the "common salmon" (chinook or king salmon), "red charr" (sockeye or red salmon), "white salmon trout" (coho or silver salmon), "salmon trout" (steelhead), and "spotted trout" (cutthroat trout). Resident rainbow trout are the same genus and species as the steelhead, the difference being that they do not migrate to the ocean and back.

Several western passages included reference to the common salmon, beginning with an entry from August 19, 1805. There is little doubt that Lewis and Clark's common salmon was the Chinook salmon, the most abundant of all salmon species in the Columbia and Snake rivers. Chinook salmon also had the widest geographical distribution. Entries such as, "It is this species that extends itself into all the rivers and little creeks on this side of the Continent and to which the natives are so much indebted for their subsistence," indicate that the explorers recognized the extensive range and sequence of migration for this salmon. They were, however, confused by the semipalmerous (*i.e.*, die after spawning) nature of adult salmon as evidenced by Clark's entry in mid October 1805 near the forks of the Columbia and Snake rivers: "The Cause of the emence numbers of dead Salmon I can't account for." Just upstream of this location is the present-day Hanford Reach, the principal spawning area for fall Chinook salmon in the Columbia River. Other taxonomic details from journals, including the relative size of scales, spotting pattern, and body size of the common salmon, provide important clues that clearly separate Chinook salmon from other species known to be present in the Columbia River at the time.

Red charr were first referred to by Lewis and Clark in early winter 1805 near Grays Bay on the lower Columbia River: "We purchased of the Indians 19 red charr which we found to be excellent fish." They noted that some of these salmon had sides and bellies that were mostly red in color. Spawning males of both sockeye and coho salmon turn deep red when breeding. That red charr were not "variagated with the dark spots" suggests these fish were sockeye salmon.

The more one tries to glean conclusive information that red charr were always sockeye salmon, the more confusing it gets. For example, individual journal entries did not always match what is known about sockeye salmon. In one instance, Clark suggested salmon-trout were further along in their spawning cycle than the red charr, a fact inconsistent with their life history. Another passage on red charr—"this fish we did not see until we decended below the grat falls of the Columbia"—does not help resolve the issue of species identification because Chinook, sockeye, and coho salmon, and steelhead all migrated to locations upstream of Celilo Falls. Despite a long list of inconsistencies, it appears that most accounts of the red charr provide evidence that sockeye salmon were encountered by Lewis and Clark.

Several detailed descriptions were provided by Lewis and Clark for white salmon trout, a species generally agreed to be the coho salmon. One passage on "the white species" indicated this salmon spawned later than the common salmon. This fact is consistent with what we know about the spawning cycle of Pacific salmon. In mid March, while at Fort Clatsop, Lewis wrote, "The white salmon trout which we had previously seen only at the great falls of the Columbia has now made its apearance in the creeks near this place." A few weeks later, in April, Clark wrote that the Wallah Wallah tribe "take a fiew Salmon trout of the white kind," but he provided no further details about when the harvest took place.

These observations are all in accord with life history requirements of coho salmon. While Lewis's detailed sketch of white-salmon trout provided a reasonable likeness of coho salmon, the number of anal fin rays overlaps with the upper end for steelhead or salmon-trout. It should be noted that steelhead spawn in creeks and rivers of the Columbia River system during February to May. Thus, we are left hanging with a few facts on white-salmon trout that are not always in harmony.

Most naturalists agree that Lewis and Clark's salmon-trout was an upstream migrating adult steelhead rather than another species of salmon. A passage written in late October 1805, while the party was at the Great Falls (Celilo), is consistent with an encounter with an early winter-run steelhead: "We met this fish of a Silvery white colour on the belly and sides and a bluish light brown on the back and head." While at Fort Clatsop, Clark wrote: "In this neighbourhood we have met with another species which does not differ from the other in any particular except in point of Colour." He goes on to describe a color pattern that includes various shades of brown, yellow, and red. Clark was most likely describing an adult steelhead in spawning coloration. He also wrote that this fish was proportionally narrower in length than both the common salmon and red charr. The passages appear to be reconstructed, so details might have been blurred. Details of many fishing stories often take new form over time.

Clark also wrote, "I think it may be Safely asserted that the Red Charr and both species of salmon-trout remain in season longer of the fall of the year than the common salmon." This statement reinforces the view that Lewis and Clark encountered steelhead and at least three different species of salmon. However, it does not help resolve all the uncertainty about Clark's ability to consistently differentiate among the four species of salmon and steelhead the expedition encountered.

One species of trout, now known as the Yellowstone cutthroat, was readily collected by the expedition in the Lemhi/Salmon River drainage. These fish were similar to what they knew as a "mountain" or "speckled trout" from the eastern slope of the Rockies and were easily identified by their spotting pattern, color, and presence of vomer teeth: "The trout are the same which I first met with at the falls of the Missouri" (Lewis, August 19, 1805). Another trout species was alluded to in a journal entry eight days later: "I now for the first time saw 10 or a douzen of a whte speceis of trout. They are of a silvery colour except on the back and head, where they are a bluish cast." This second species of trout was probably a resident form of rainbow trout known to live among local cutthroat trout populations.

The journals of Lewis and Clark as well as the notes of other members of the expedition provide no record of either pink (humpy) or chum (dog) salmon—both species of which occurred in the Columbia River system. What happened to those humpies and dogs? One reason for their absence from the record may have been that both pink and chum salmon are more common to smaller river systems along the Pacific Coast. Their run timing is another factor. The principal spawning and upriver migration period of pink and chum salmon did not correspond to Lewis and Clark's presence in the lower Columbia River and at Fort Clatsop. No resident bull trout and seagoing Dolly Varden trout were documented in the Columbia River system during the expedition. Their absence is also somewhat surprising. Why were they not seen and described? Perhaps the true charrs were less common in the Columbia River than people now assume.

Taken collectively, the journal entries of Lewis and Clark, as well as those of other members of their party, provide strong evidence that Lewis and Clark encountered four of the most abundant species of salmon and the steelhead. However, verifying that each observation was

accurate is more problematic. The truth is that the explorers compiled so few details that an active imagination is required to sort out the facts. It is also conceivable that Lewis and Clark were confused by variants of a species. That there was uncertainty in species identification because of variations in color and size would not be surprising. The taxonomy of various trout and salmon species was in considerable flux during most of the 19th century. For instance, George Suckley, in an 1861 treatise on North American salmon and trout, described a total of 43 species! His compilation can be compared with Robert Behnke's current list of 15 species.

### **Other Fish of the Expedition**

Lewis and Clark described several other fish common to the Pacific Northwest, including the eulachon or candlefish, sturgeon, mullet, bottlenose, and chub. Their accounts, although not always conclusive, had either sufficient taxonomic detail or information on life history and timing to provide reasonable certainty as to their identification.

One of the best examples of the explorers' attempt at careful documentation was the detailed likeness of a eulachon drawn while the expedition wintered at Fort Clatsop. The drawing was life-size and complete with measurements of various body parts and counts of fin rays. Lewis was most enamored with this small fish, finding it "more delicate and lussious than the white fish of the lakes." The eulachon was highly prized by Indians because it migrated earlier in the spring than salmon, had a high oil content, and could be easily captured using long-handled dip nets.

Sturgeon also regularly found their way to the meal table of the expedition when salmon were not available in the lower Columbia River. While they shared nothing of the life history or habitats of sturgeon, we learn how they were prepared by local tribes. According to Lewis, sturgeon that had been "cut into large flatfishes" were laid on top of fire-heated stones, then layered with small boughs or leafy branches. Once all the meat was laid down, the stack was covered with mats and water poured over it and among the hot stones. This process created steam that cooked the fish in an hour or so. Patrick Gass also made reference to obtaining a large sturgeon from Indians in March 1806. The accounts likely refer to white sturgeon, the most common species in the Columbia River. Green sturgeon were present in the lower Columbia River at that time, but they are more rare, particularly in fresh water.

Lewis and Clark made many references to fish that were later construed to be either suckers or large minnows. The principal challenge for verifying these species designations is the paucity of details. In many cases the early naturalists did not provide enough information to differentiate between other closely related species that may have been present in the Columbia River system. The first Northwest entry on mullet was made during the expedition's return leg up the Columbia River. "At the rapids the natives subsist chiefly on...considerable quantities of a small indifferent mullet of an inferior quality." A more detailed account of a mullet caught in the vicinity of Grayling, Montana, corroborates the use of the term mullet for fish now called suckers:

*We hauled and caught a larger number of fine trout and a kind of mullet about 16 inches long which I had not seen before. the scales are small, the nose is long and obtusely pointed and exceeds the under jaw. The mouth is not large but opens with foalds at the sides, the colour of it's back and sides of a bluish brown and belley white; it has the faggot bones, from which I suppose it to be the mullet kind.*

Lewis and Clark were presented with a platter of roasted mullet while in the company of the Wallah Wallah tribe. Based on the Montana account and Clark's details of tribal collections in the lower Walla Walla River, the western mullet would appear to be largescale sucker. Suckers were highly valued by the Sahaptin-speaking people of the mid-Columbia region, according to Eugene Hunn, second in importance to salmon.

Two journal entries refer to curious-looking fish known as bottlenose. The first entry was in late summer 1805 while the party was in the upper Missouri River drainage. At the time, the term bottlenose appeared restricted to a species now known as the mountain sucker. However, the passage is confusing because the mountain sucker was described as white in color with a mouth shape similar to that of mountain whitefish, a common resident fish that is related to salmon and trout.

There is less doubt that a fish mentioned while the party was in the vicinity of Livingston, Montana, was a mountain sucker: "One of the men brought me a fish of a species I am unacquainted with; it was 8 inches long, formed like a trout. Its mouth was placed like that of a Sturgeon—a red streak passed down each side from the gills to the tail."

Although the reference to a trout-like shape is confusing, the size and color pattern closely match a breeding mountain sucker. Interestingly, there were no site-specific observations of the bottlenose from the west side of the Continental Divide, but rather a general reference made in March 1806 by Clark at Fort Clatsop to a fish species in the mountains similar to what was called a bottlenose in the eastern United States. Probably the most useful part of this notation is the comparison. The mountain sucker occurs in both the upper Columbia and Missouri drainages, plus Canada, lending credibility to the observation. I believe bottlenose were mountain whitefish, a common resident fish and a close relative of the rainbow trout. Mountain whitefish are abundant throughout the Rocky Mountain region and were no doubt present. However, whether Lewis and Clark actually found them west of the Continental Divide remains disputable.

One of the more controversial accounts of fish was made on the Columbia River near Wallula Gap in late April 1806 when Lewis described how a small Indian boy caught several "chubbs" using a small hook-shaped bone. Chub is a widely used common name for members of the minnow family *Cyprinidae*, which includes fish from the Mississippi, Saskatchewan, and Mackenzie River systems. Many species from this taxonomic group are similar in appearance to Columbia River fish.

One clue to the identity of the mystery fish was that it was described as being about nine inches long. This size eliminates the possibility that the chubs were redbelly shiner or dace because neither of these common Northwest fish exceeds four to five inches in length. One more clue we can glean from the explorers' notes is that the fish congregated along the shoreline in late spring (*i.e.*, several were caught in a short time period), and yet another is that they struck an artificial lure because the bone hook did not appear to be baited. Three of the larger minnows native to the Columbia River (*i.e.*, the northern pikeminnow, peamouth chub, and chiselmouth) gather in schools during their spring spawning season and easily reach nine inches in length. The northern pikeminnow (formerly known as squawfish) is piscivorous, or a predator on other fish. As a result, it is more commonly caught on lures than the other two species. However, it should be noted that many fish strike lures, possibly as a territorial response.

Lewis wrote that Columbia River chub were "white on the sides and belly and a bluish brown on the back." Both chiselmouth and pikeminnow fit this general description. However, it seems

the yellowish fins and the large, toothless mouth of a pikeminnow would have been noted. If the chub of Lewis and Clark were indeed peamouth chub, as most historians agree, they were not breeding males, which exhibit a bright red lateral stripe during the spawning season.

Two other key descriptions from Lewis's entry—"small where the tail joined the body" and "the upper exceeded the under jaw...the latter is truncate at the extremity"—appear to narrow the fish in question to either peamouth chub or chiselmouth. Both fish have narrow caudal peduncles, giving the impression of a flaring caudal or tail fin. Would the mouth shape help solve the mystery? *The Oxford Universal Dictionary* defines truncate as "ending abruptly as if cut off from the base or tip." A peamouth chub has a small, pointed, and somewhat oblique mouth. Chiselmouth have inferior mouths that are more snubbed off than a peamouth and closer to being truncate. Their common name comes from having a dense cartilagenous plate in the lower jaw that resembles a carpenter's chisel. Surely this characteristic would have been mentioned. The weight of evidence (disregarding a discrepancy in fin ray counts) brings us back full circle to what most historians have agreed on—"chubb" must be peamouth chub. But, as is often the case with many of Lewis and Clark's fish facts, uncertainty reigns.

### **What Happened to the Rest?**

Assuredly, many other fish species inhabited the Columbia and Snake River systems during the early 1800s. This is evident from a list of fish known to Sahaptin-speaking people that roamed the mid-Columbia region around the time of the expedition. Their classification scheme included 20 kinds of fish corresponding to about 30 of the ichthyologist's. Lewis himself noted, "I have no doubt there are many other speceis of fish, which also exist in this quarter of different seasons of the year, which we have not had the opportunity of seeing."

Even if Lewis and Clark had collected more information on fish, certain designations would be different by now. That taxonomy was in a state of flux was evident in 1854 when Surgeon-General Charles Girard wrote, "The method I follow is the natural, the true method, that which has superseded the artificial method of the last century." Wouldn't Girard be surprised to learn that few of his species names are still in use? Science advances by the application of new tools to old problems and by new ways of thinking. What we call a species and how we describe taxonomic relationships of fish is no different.

This analysis of fish encountered by Lewis and Clark is not widely disparate from general naturalists' accounts. For example, Paul Cutright described eight fish species from the Pacific Northwest, listing four designations as "questionable." Raymond Burroughs acknowledged there was sufficient information about only the salmon, steelhead, and eulachon to "leave little doubt about the identity." He went on to conclude that other identifications were less certain: "It appears that some of the 31 (fish) species mentioned in the diary may or may not be valid." Despite the caveats, we can pretty much lock into a list of eleven different fish seen by members of Lewis and Clark's party, including the two estuarine species, during the western part of their journey. The emphasis here is on different fish rather than on exactly what fish and when.

The contributions of Lewis and Clark to our knowledge of natural history were significant enough that we can forgive them for not providing more information on fish. While Lewis had scientific training in botany and in zoology, Clark was more versed in map-making and Indian customs. Neither had formal training in ichthyology or the study of fish. Indeed, they had little to say about any fish except for the ones used to supplement their diet. This emphasis makes good sense. After all, their marching orders were to provide the most detail on those "animals

of the country" that were edible and easy to collect. The era of specializing within the broader field of biology had also begun. It was up to later zoologists such as Charles Girard, George Suckley, David Starr Jordan, Charles Gilbert, and Barton Evermann to more thoroughly document the occurrence and distribution of Pacific Northwest fish during the latter half of the 19th century.

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