# CONSIDER THE SOURCE

## *reassessing the curious case of the Amazon*

by WEST HANSEN

AMAZON EXPRESS WHITE WATER MEMBERS JUAN ANTONIO DE UGARTE, RAFAEL ORTIZ, WEST HANSEN, AND TINO SPECHT PADDLE DOWN THE RÍO GASHAN AFTER LEAVING LAGO ACOCOCHA. LAGO ACUCOCHA MAY BE THE DRY-SEASON SOURCE OF THE AMAZON RIVER. PHOTOGRAPH BY ERICH SCHLEGEL.


A TEXAS-BASED KAYAKER, WEST HANSEN WAS THE LEADER OF THE 2012 NATIONAL GEOGRAPHIC AMAZON EXPRESS AND THE 2014 VOLGA RIVER EXPEDITIONS. HE HAS SET SEVERAL SPEED RECORDS ON THE MISSOURI RIVER 340 AND THE 260-MILE TEXAS WATER SAFARI. THIS JULY HE IS ATTEMPTING TO BREAK THE SPEED RECORD CIRCUMNAVIGATING VANCOUVER ISLAND, SELF-SUPPORTED IN A SEA KAYAK.

In his article "Elusive Origins of the Amazon," which appeared in the Winter 2015 edition of **THE EXPLORERS JOURNAL**, noted Polish explorer and kayaker Piotr Chmielinski wrote, "According to the widely accepted definition, the source of a river is a point where its most distant and continually (year-round and uninterrupted) running tributary rises." Chmielinski then went on to make a case for Lake Ticlla Cocha, which feeds the Carhuasanta Creek, one of a number of tributaries of the Apurímac River, being the most distant source of the mighty Amazon. While it is indeed true that the Apurímac meets the criteria he put forth, it is important to note that the criteria themselves are anything but widely accepted, by either hydrologists or geologists or the institutions that support them. Moreover, the criteria in question have yet to be used as a benchmark against which the accepted sources of the remaining great rivers of the world have been measured.

To help explain the source issue, let us consider the longest rivers on each of the seven continents: the Nile (Africa), the Volga (Europe), the Yangtze (Asia), the Murray-Darling (Australia), the Onyx (Antarctica), the Missouri-Mississippi River (North America), and lastly, and the Amazon (South America). All but one—the Amazon—has a formally declared source, and the flow of each of the remaining six is disrupted from its accepted origin by either seasonal drought, freezing, or man-made constructions that block or divert its waters.

At the head of the Volga, for example, flow is completely stopped for hundreds of kilometers each year due to freezing, while the Onyx is frozen for its entire length during the Antarctic winter. The Murray-Darling is completely dry for hundreds of kilometers annually, due to seasonal drought. As for as

man-made obstacles, each of the rivers has multiple dams, save for the Onyx, which has one man-made rock weir. In spite of these dams, which stop, divert, or limit the flow of water daily, hourly, weekly, or seasonally, the sources of these rivers have not been called into question, except for the Nile, whose most distant source was discovered during a *National Geographic* expedition in 2006.

So why has determining the source of the Amazon proved so problematic? The answer lies in both its history and semantics.

In 1560 the madman-conquistador Lope de Aguirre, followed by Pedro Acosta a decade later, concluded that the source of the Amazon was the waterway that contributed the greatest volume, the Marañón River. Their contention was supported by later missionaries, including Fray Laureano de la Cruz and Padre Samuel Fritz. In 1689, the latter became the first person on record to complete a source-to-sea expedition on the Amazon and in the process produced the first accurate maps of the river.

During the 1700s, a few more explorers, armed with superior scientific methods, scouted the river, including Padre Manuel Sobreviela, Narciso y Barcelo, and Alexander von Humboldt, all of whom verified the Marañón as the source of the Amazon. Sobreviela was the first to explore the upper reaches of the Ucayali, Urubamba, Mantaro, and Apurímac, and produced a map that is remarkably accurate even by today's standards. He also noted that the Ucayali extended a far greater distance than the Marañón.

During the nineteenth century, explorers by and large maintained that the Marañón was the source of the Amazon, simply by virtue of its volume. However, a new paradigm emerged as William Lewis Herndon, Henry Lister Maw, John Randolph Tucker, James Orton, William Smyth, and many others formally recognized the Ucayali as being longer than the Marañón, in the process of establishing a viable trade route from the Pacific to the Atlantic Ocean. This called into question the definition of the source. Should the emphasis be place on volume, length, a combination of both, or something else altogether?

One of the last expeditions to use volume of water as a determining factor for defining the source of the Amazon was in the early 1950s, when Sebastian Snow and John Brown conducted observations to verify the Marañón as having a heavier flow than the Ucayali, therefore making it the source of the Amazon. Brown toured Lake Villafro, at the headwaters of the Apurímac and determined that the flow of water as substantially less, though the river system was longer than the Marañón's. It is interesting to note that a few expeditions over the past 30 years have claimed the Blue Nile as the "source" of Africa's Nile, using the volume paradigm and ignoring the length paradigm–without the benefit of a formal definition.

Guided by aerial photos taken in the 1950s, Loren McIntyre, on assignment from *National Geographic*, joined a 1972 Peruvian government expedition, following which he famously proclaimed Carhuasanta Creek, at the base of Mt. Mismi as the most distant source of the Amazon–using Occam's razor to cast aside any definition that included volume of water. Prior to that, in the late 1960s, Helen and Frank Schreider, also on assignment from *National Geographic*, recognized a different stream in the same valley as the source of the Amazon. It is regrettable that the Schreider and McIntyre groups never studied the Mantaro or any other river. In fact, they never questioned whether the Apurímac was actually the most distant source of the Amazon, just which stream at the head of the river was longest–taking the results of previous expeditions at their word.

For the next 30 years, the question of the Amazon's source would volley between four tiny rivulets of water west of Cailloma, Peru, varying in distance by a few kilometers.

McIntyre would spend the next 20 years exploring the Amazon, authoring three books, and in time coming to a somewhat different conclusion, which he wrote about in a 1992

edition of the *South American Explorers Journal*. He theorized that the source of the Mantaro River at Cordillera Rumi Cruz would be the most distant source of the Amazon. He accurately described the route to this source, above Lago Punrun, just north of Lago Junin.

Then in 2012, James Contos, with the aid of computer-mapping techniques, shook up the world of Amazon exploration by concluding that the Mantaro River was in fact substantially longer than the Apurímac at exactly the same point that McIntyre theorized.

Interestingly, Contos, a neuroscientist and avid kayaker, was unaware of McIntyre's theory until after his expedition was completed, as McIntyre's article had not been highly publicized. Moreover, although the Mantaro River had been measured before Contos' assessment, a universal standard of measurement hadn't been established. Cartographers measured the river only up to Lago Junin–disregarding the Rio Blanco, Rio San Juan, and other feeder streams that extended 68 to 70 kilometers beyond, to the Cordillera Rumi Cruz, just as McIntyre had proposed. Contos shared his findings in the peer-reviewed journal *AREA*, published by the Royal Geographical Society.

In his paper, Contos added a qualifier not taken into account by other rivers. He concluded that (a) the Marañón flowed with the largest average volume of water of any upstream branch, (b) the Mantaro was the most distant source stream of the Amazon–but with man-made dams on it, and (c) the Apurímac could be considered the most distant source stream that was still undammed or "uninterrupted." In his conclusion, he suggested using two main definitions for any river's source: (1) "principle source"–where the most water originates (Marañón) and (2) "most distant source"–where the farthest source point is found (Mantaro). But he also suggested considering a third potential definition: "most distant source of uninterrupted flow" (Apurímac).

With regard to the Marañón being the "principle source," using Contos' definition:

### 1560

Conquistador Lope de Aguirre (El Loco) identifies the Marañón as the source of the Amazon based on the volume of water it contributes.

### 19TH CENTURY

William Lewis Herndon, Henry Lister Maw, John Randolph Tucker, James Orton, William Smyth, and many others recognize the Ucayali as being longer than the Marañón.

### EARLY 1950S

Sebastian Snow and John Brown conduct observations, concluding that the Marañón has a heavier flow than the Ucayali, confirming it as the source of the Amazon based on volume.

### LATE 1960S

Helen and Frank Schreider and others begin making the case for one of four tiny rivulets feeding the Apurímac as the most distant source of the Amazon.

### 1972

Loren McIntyre proclaims Carhuasanta Creek, at the base of Mt. Mismi, a feeder to the Apurímac, as the most distant source of the Amazon.

### 1992

McIntyre reconsiders his position, theorizing that the source of the Mantaro River, at Cordillera Rumi Cruz, would be the most distant source of the Amazon, given that the Mantaro is longer than the Apurímac.

### 2012

James Contos definitively concludes that (a) the Marañón flowed with the largest average volume of water of any upstream branch, (b) the Mantaro was the most distant source stream of the Amazon–but with man-made dams on it, and (c) the Apuímac could be considered the most distant source stream that remained undammed or "uninterrupted."

### 2015

Piotr Chmielinski makes a case for Lake Ticlla Cocha, which feeds the Carhuasanta Creek, as the most distant source, reaffirming a claim McIntyre had long since abandoned based on uninterrupted water flow. (This will change when engineers break ground for the first dam on the river in late 2016.)

"the most distant upstream point in the drainage giving rise to the stream from which all other joining streams have lower average annual discharge," this adds a great deal of clarity to the discussion and sufficiently rules out the Madeira, a substantial tributary downstream, due to the Amazon proper presenting a greater volume of water at their confluence.

As well, the definition of the Mantaro River being "most distant source" is established clearly by "the most distant upstream point in the drainage along the natural course of the river or its tributaries from which a drop of rain will make its way to the river's mouth." This is simple, clear, accurate, and universally applicable to other rivers. Occam would be proud.

What remains in question is labeling the Apurímac as "most distant source of uninterrupted flow." This definition is not commonly applied to the source of any river. Part of its problem is that it will often result in changing source streams for all rivers, as "interruptions in flow" can occur from both man-made (i.e., dams) and natural events (e.g., landslides, freezing, or drought) and are temporary. Furthermore, Contos acknowledges its somewhat quasi status in his discussion, where he suggests that only the two primary definitions be used: "principal source" and "most distant source," with the third "uninterrupted flow source" being simply a "potential" definition that "can be recognized."

In a personal communiqué, Contos later told me, "Actually, I was not going to include the third category of source point (most distant source of uninterrupted flow)—it was prompted primarily by an influential person who requested to include the Apurímac in the discussion as a potential source point, given the argument could be made that the Mantaro can be considered shortened by the Tablachaca diversion. While I also felt the Apurímac deserved some mention since it was the long-standing source point and is still completely undammed, the wording that I chose is a bit unfortunate—it really should be considered the longest source stream 'uninterrupted by dams.' Also, part of my argument about the 'entire' Mantaro being diverted was unbased—it is likely that at least a trickle of water makes it past Tablachaca dam even in the dry season."

With regard to the claim that the Mantaro runs only seasonally, proponents of this view rely on the fact that the Mantaro River has three dams—the Upamayo, the Malpaso, and the Tablachaca. The Tablachaca, they claim, diverts every single drop of water from the Mantaro River through a hydroelectric tunnel in the mountains during the dry season, thereby cutting off some 160 kilometers of the river, making it shorter than the Apurímac.

In spite of this claim, there is measurable evidence to the contrary. During the dry season of 2012, I led the first of two expeditions that paddled the waters of the Mantaro River from the downstream foot of Tablachaca Dam to the Atlantic Ocean—the alleged "de-watered" section. (The other, in 2013, was undertaken by David Midgley, Darcy Gaechter, and Don Beveridge.) Video is available from both expeditions, as are witnesses, including Chmielinski, who was a supporting member of my expedition, the first to paddle the entire length of the Amazon from its most distant source. Daily engineering reports from the Tablachaca Dam staff indicate the volume of water that flows through the dam. These reports do show a severe, though temporary, reduction in the volume of water during the dry season, yet the Mantaro still flows through.

For decades, expeditions have debated which of the four creeks above the Apurímac has a trickle of water that flows more continuously than the others. Using the same criteria, only a trickle is required to flow through Tablachaca Dam in order to fulfill the requirement set up previously. Finally, when McIntyre concluded, in 1972, that the source of the Amazon lay at Mt. Mismi, the Tablachaca Dam had yet to be constructed–though he admitted that volume wasn't a factor. By the time he published his revised findings in 1992, the

AMAZON RIVER EXPLORER PIOTR CHMIELINSKI, LEFT, AND DAVID KELLY, AMAZON EXPRESS WHITE WATER TEAM MANAGER, GO OVER DETAILED TOPOGRAPHIC MAPS AT LAGO ACUCOCHA NEAR ALPAMARCA, PERU. PHOTOGRAPHS BY ERICH SCHLEGEL.

WATERS OF THE MANTARO RIVER FLOW BELOW TABLACHACA DAM DURING THE DRY SEASON.

## DAM POWERFUL

AMAZON EXPRESS EXPEDITION LEADER WEST HANSEN AND RAFT GUIDE JUAN ANTONIO DE UGARTE PADDLE TOWARD A HUGE BLAST OF WATER RELEASED FROM THE PIPES OF ELECTROPERU IN CAMPO ARMIÑO, PERU. WATER FROM THE MANTARO RIVER IS PIPED 19.8 KILOMETERS FROM TABLACHACA DAM TO THE HYDROELECTRIC COMPLEX, WHICH GENERATES 900 MEGAWATTS OF POWER. PHOTOGRAPH BY ERICH SCHLEGEL.

RAFAEL ORTIZ AND WEST HANSEN PORTAGE THEIR KAYAKS THROUGH A SNOWSTORM AT LAGO ACUCOCHA. PHOTOGRAPHS BY ERICH SCHLEGEL.

WEST HANSEN IS SWALLOWED UP BY A CLASS IV RAPID ON THE LOWER MANTARO RIVER.

Tablachaca Dam, as well as the two other dams on the Mantaro had been in place for 17 years. Although the Apurímac may indeed be the "most distant source of uninterrupted flow" for the Amazon, this definition is unusual, and Contos suggests that other immutable and natural aspects be considered.

Worldwide, it is much more common to have a river defined by its streambed, rather than the amount of water flowing down that streambed at any given time, so long as the interruption in flow is temporary, i.e., that there is no permanent diversion, such as with the Erie Canal.

In a vague acknowledgment of Contos' discovery, *National Geographic* published an article in their online edition on February 15, 2014, addressing the newly recognized most distant source of the Amazon. Though his work was the subject of the article, Contos was not approached for an interview nor given the chance to defend his paper–while *National Geographic*'s head geographer Juan José Valdés was interviewed. Valdés was quick to discredit the findings regarding the Mantaro and supported the Apurímac, saying, "you can have the longest tributary, but if it doesn't have continuous flow, then it's a moot point."

Further confusing the issue, Valdés had taken a much more ambiguous approach when asked to comment on the newly determined source of the Nile back in 2010, saying, "the concept of a river's source is not a clearly defined one and is open to a number of interpretations…In the case of the Nile, as with the Amazon, the enormity and complexity of the river system makes the use of the term 'source' a troublesome issue."

The course of a river, and subsequently the most distant source, is more accurately and consistently measured using the existing streambed defined by Contos, instead of the volume of water or the year-round consistency of the flow. For example, the Rio Grande, which borders the United States and Mexico, has its source high in the Rocky Mountains. For the past few years, the Rio Grande has dried up completely from El Paso for 580 kilometers until reaching a feeder stream on the Mexican border near the town of Presidio. In spite of the desiccation, no one questions whether this dry riverbed is still the Rio Grande or whether its source has changed locations. The same can be said for the massive Colorado River, which carved the Grand Canyon. Though it has been decades since the water has reached the Sea of Cortez, the source or route of the Colorado isn't in question.

Seasonal flow and the presence of dams is the rule, rather than the exception. Year-round flow and routes unhindered, temporarily rerouted, or temporarily blocked by man-made dams are very rare and have only recently been called into question, and only when discussing the Amazon. Defining the source of a river requires a pragmatic balance between the pedantic and the oversimplified, but most important, if it must be applicable to all rivers, then the sources of the longest rivers on each continent and all other rivers must be changed to accommodate this definition used for a single river–the Amazon.

"Most distant source of uninterrupted flow" is exceptional, subjective, and inapplicable to all but the Amazon, in the group of world's longest rivers, and perhaps most others. And if I might add an interesting footnote, the Apurímac, the only proposed river source of our group that hasn't been dammed, will soon lose that status, as engineers break ground this year for the first dam on the river at La Angostura, a few kilometers from Cailloma.

Contos made a great effort to establish universally applicable standards when defining the "principal" and "most distant" sources. The definitions are applicable to all rivers and do not change with the simplest sprinkle of rainfall or temporary redirection or blockage, man-made or otherwise. In short, these definitions rely on a minimal number of variables and remain constant, regardless of immediate fluctuations in flow. In this light, only the headwaters of the Mantaro River can be considered the most distant source of the Amazon.