

Conservation of the Conchos Trout: a white paper on history of its discovery, report on its status, and an urgent plea for action



by

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Abstract

A broad-scale survey of potential trout habitats in upper tributaries of the Río Conchos of Chihuahua, México resulted in the re-discovery in 2005 of a long-lost native, endemic, and now endangered, undescribed trout species that we call the “Conchos Trout.” We are currently in the process of scientifically describing this rare trout, the only native Mexican trout known from an Atlantic drainage. Our extensive field efforts to date clearly indicate that this species was formerly much more widely distributed historically. Though surveys should continue, our extensive field surveys found only one small isolated and extremely vulnerable population, leaving us less than optimistic that many other, if any, additional populations will be found.

Persistence of this new critically endangered endemic Conchos Trout clearly requires rapid conservation action. Our consensus expert opinion is that we cannot over-emphasize the urgency of protection for this critically endangered population of this unique trout, and so we have produced this “white paper” in hopes that it might encourage others to join us in initiating appropriate conservation programs. The potentially viable population is restricted to a short reach of a very small stream where it and another newly discovered, undescribed fish species, a sucker (and likely another unique taxon), could be relatively easily protected, studied and managed. Additionally, adjoining arroyos where the species recently occurred offer the possibility of restoring native fish populations to them following appropriate protection and habitat restoration efforts.

All members of our highly qualified and diversely specialized, binational “Truchas Mexicanas” team stand prepared to join collaborators and invest personal resources in hands-on actions to help this new species persist. We recommend immediate establishment of a small reserve centered around currently occupied habitat and adjacent streams having suitable habitat, combined with education and compensation of local residents for their cooperation with reserve management. We recognize that we are largely ignorant of the local political and cultural systems via which conservation actions will have to proceed and are limited with regard to our ability to raise funds. We thus hope that readers of this white paper will add their financial and in-kind support and additional expertise to help us conserve the Conchos Trout!

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History

Since 1997 our binational group, Truchas Mexicanas, has been surveying fishes, focusing primarily on trout, in Pacific drainages of the Sierra Madre Occidental. Our work has extended the distribution of native trouts further south than had been previously recognized and we have conducted genetic analyses that demonstrate that these trouts, including those previously thought to be introduced to southern drainages, are in fact native and endemic Mexican species (Hendrickson et al. 2003 – a review paper available at <https://webpace.utexas.edu/deanhend/www/>). Our work clearly demonstrates that a substantial proportion of the economically important trouts of the genus *Oncorhynchus* is endemic to Mexico, but only two of these endemic species have been scientifically named. We are currently in the process of naming these new species and continuing to report other results of our studies in peer-reviewed literature, while concurrently continuing our explorations and promoting conservation of this little-known component of Mexico's natural heritage, it's valuable and amazingly diverse, endemic and endangered trouts.

Although native Mexican trouts have been known to biologists for well over a century, scientists, as well as the general public, remain surprisingly ignorant of them. The first Mexican trout collection was made in the 1880's by Nathaniel T. Lupton, Professor of Chemistry at Vanderbilt University. Lupton gave the specimens to Edward Drinker Cope, who wrote a brief paragraph about them in the *American Naturalist* (Cope 1886.). Unfortunately, Cope did not know the exact collection locality and never formally described the species, and the specimens, believed deposited at the American Museum of Natural History, were ultimately lost. With discovery of other trout populations in Pacific drainages of Mexico, subsequent researchers decided that Lupton's specimens were Mexican golden trout (*Oncorhynchus chrysogaster* – from the Pacific rivers, Fuerte, Culiacán and Sinaloa). Archival research by Truchas Mexicanas team members, however, uncovered not only letters that supported a Conchos basin locality for Lupton's specimens (Hendrickson et al. 2003), but also found other strong independent circumstantial (i.e., without collection of voucher specimens) evidence that trout existed in the Río Conchos basin. Truchas Mexicanas therefore increased sampling efforts in the Río Conchos basin in an effort to re-discover populations and describe and conserve the diversity first seen by Lupton.

Our first expedition to the Rio Conchos in 2002 (funded by a grant from the National Science Foundation) focused primarily on southern and eastern tributaries and failed to find any native trout populations. Despite these results and still suspecting the existence of an undescribed Rio Conchos Trout, we utilized newly developed bioinformatic and algorithmic tools to focus our search for the species. We input our extensive and recent native trout collection localities from all adjacent Pacific drainages, as well as all other native trout collection localities from museum databases for the same drainages, into the computer algorithm Desktop GARP (Genetic Algorithm for Rule-set Production) (Stockwell & Peters 1999; <http://www.lifemapper.org/desktopgarp/>). We also input into Desktop GARP available topographic and remotely sensed physical habitat data for the same known trout localities, thus allowing the program to extract multivariate correlations between the known trout localities and these physical parameters. Once the model was developed for the Pacific Slope Mexican trout species, using the same topographic and remotely sensed physical data sets for the Río Conchos drainage, we asked Desktop GARP to predict the distribution in that drainage of any

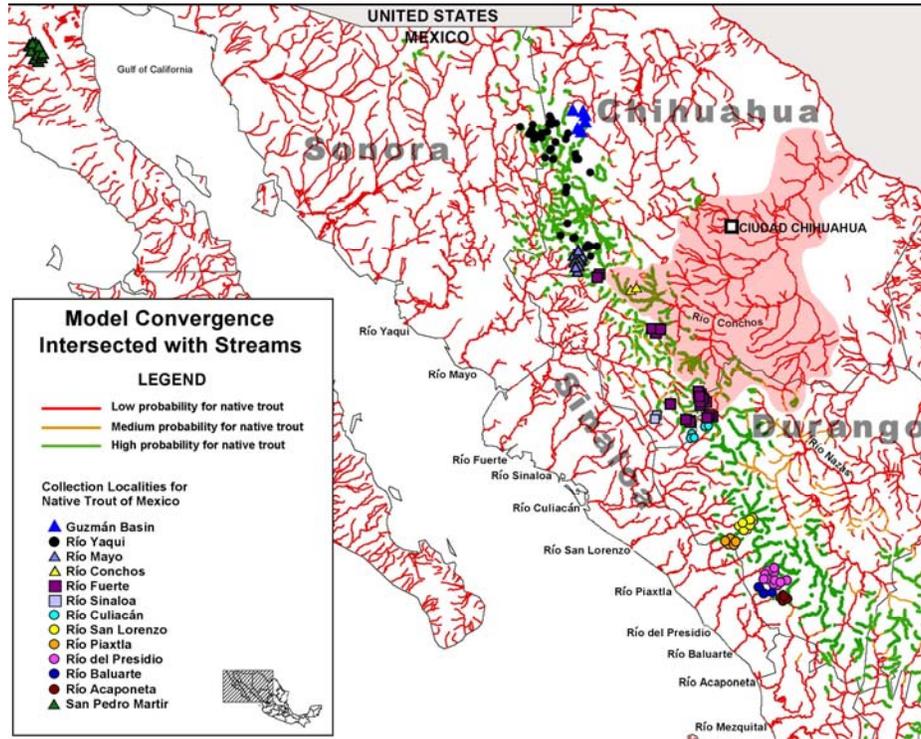


Figure 1. Results of GARP modeling based on native trout locality data from Pacific drainages. Conchos basin highlighted pink. Colors of streams indicates GARP-modeled (see text) probabilities of having native trout habitat.

species with similar ecological parameters. Assuming that Conchos Trout would have habitat requirements similar to those of trout native to the Pacific drainages, the GARP model indicated considerable potential trout habitat in the Río Conchos (Figure 1).

The validity of GARP modeling for Mexican trout is bolstered by the fact that modeling based on subsets of our data from Pacific drainages accurately predicted the

omitted subsets of known trout localities. Validity of extending our model to the Conchos basin is also bolstered by the fact that the GARP model predicted both locations where we have not found Conchos Trout to have a high probability of supporting trout. We thus consider the GARP model predictions to be a reasonable representation of the maximal, theoretical distribution of trout in the Conchos basin. However, various lines of evidence make it clear to us that human impacts, impossible to model in GARP, have dramatically restricted the area native trout now occupy, thus leading us to the topic of conservation.

Conservation Status of Conchos Trout

Unfortunately, our extensive efforts found only two populations of Río Conchos Trout. When we discovered the first population in 2005 it appeared small (< 100 individuals) and restricted to a short stream segment (<0.5 km) with, at best, marginal habitat and limited evidence of recruitment. Returning in 2006, we were unable to find more specimens in this same stream and saw increased evidence of extensive fishing. Laboratory analyses of DNA sequences of the specimens collected in 2005, however, clearly revealed this trout to be a new species endemic to the Río Conchos basin, and a relative of the undescribed trout endemic to the southern Yaqui and Mayo basins. Anxious to expand our data set beyond this small population and to more accurately determine the distribution and conservation status of the new species, we (see attached list of participants/signatories) returned in March 2006 to conduct additional sampling of stream reaches having a high probability of supporting the Conchos Trout.

We have long been aware that native trouts are known to the Rarámuri (Tarahumara) by the name “apari” or “aparique,” and that most locals, especially Rarámuri, clearly distinguish them from similar-looking introduced, non-native rainbow trout (locally “trucha arco iris”). We have spoken with many local, older residents who quickly and correctly identified Conchos Trout from a large set of illustrations of an array of similar trouts and indicated the species occurred in nearby streams (ones we had identified with GARP as probable trout habitats). Unfortunately, after confirming they had seen and captured the species locally, the residents almost invariably proceeded to explain that they had not seen “apariques” for 3 to 10 years and our sampling of those streams substantiated their observations. The combination of our own collection efforts and observations by locals convince us that not only is this undescribed endemic Mexican trout fading from local memory, but is also critically endangered and rapidly disappearing throughout its small remaining range.

Our data regarding this dismal conservation situation is not just anecdotal. Including the 2006 samples we have now visited 16 locations in the upper Río Conchos (and 13 in the southern Conchos basin) that our own personal expertise, Desktop GARP, and local residents indicate to be likely to, or which did, harbor native trout. Extensive and intensive sampling during March 2006 further substantiated our earlier suspicion that the population sampled in 2005 was nearly extirpated, but we also discovered a new population of the same trout in another small stream. The extensive fieldwork leading to discovery of the new population revealed a strong negative correlation between human occupation along arroyos (one parameter we could not input into GARP) and the existence of native trout. Throughout the Río Conchos basin, siltation related to timber harvest, crop cultivation, and overgrazing is clearly linked to elimination of native trout

spawning habitat and degradation of water quality. Our survey efforts in 2005 and 2006 also revealed that humans are depleting native trout populations via direct capture methods (spears and hands), and also locally available natural (roots of at least 2 common local plants) and other toxins (e.g. lye). Furthermore, it appears that the widespread practice of using detergents for washing laundry in streams may be having significant impacts on the water quality in streams where the Conchos Trout was found or is currently known to exist. Cumulatively, these activities have decimated native trout populations in the Río Conchos drainage in recent years and pose substantial challenge to conservation of the single known surviving population. It is also probably worth mentioning that many of these impacts (e.g. grazing, logging, etc.) also diminish stream flows and/or increase temporal variance in discharge. The same factors that impact trout thus exacerbate the well known water management issues in the Río Conchos basin that have recently been the focus of much heated debate, both domestically within México, and well as internationally, between México and the United States. Native trout conservation is thus undeniably and inextricably intertwined with sustainable water management in the Conchos basin.

Conservation Status of the last possibly viable population

Given the inferences from sampling multiple locations for trout through the Sierras and the state of other natural trout populations, it was not surprising that the recently discovered population of the Río Conchos Trout, in a very small stream, was found in the least impacted arroyo that we sampled. This population is constrained to an area near the headwaters in a narrow, high-gradient canyon with almost no available tillable land. The stream's discharge is exceptionally small (on March 22, 2006 about 0.2 to 0.267 liters per second (L/s) near top of trout population to 28 L/s below it), thus limiting irrigation possibilities. Human population density in the canyon is low; only last year was the first house built, immediately below the trout population in this arroyo. These new residents of the canyon are grazing goats and cutting trees to make bowls and other saleable items. While we found no evidence that they are currently capturing trout, it would be extremely easy for them to do so in this tiny stream, with potentially disastrous impacts on the population. They did indicate that they are aware of the presence of *apariques* and many other regional residents explained to us that locals traditionally fish *apariques* at Easter, which will be about when readers of this document will first receive it.

Following discovery of this population we focused on better documenting local habitat conditions via quick preliminary studies where the trout lived and in adjacent arroyos that locals and GARP also indicated had trout. We determined that the newly discovered population consists of perhaps 300 individual native trout >100 mm total length distributed over approximately 2.5 km of high-gradient stream. Based on the release of eggs by at least one female that we handled, spawning was occurring at the time of our visit, and our collection included at least 4 size classes, indicating reasonable and recent recruitment for at least several years. All evidence, ranging from reports by local residents and our own evaluation, indicates that a somewhat larger stream nearby which enters the stream fed by the stream with the trout population about 2 km further upstream, recently supported the native *aparique*. Extensive fish surveys there during 2005 and 2006, however, failed to produce specimens (though our team observed one

specimen in 2006). We attribute the near absence of apariques in the other stream to heavy fishing pressure, as evidenced by levers wedged under many boulders in the stream. This technique appears to be in widespread use by local residents throughout the region and is highly effective and surely capable of rapidly decimating small populations already impacted by myriad other factors. cursory examination of invertebrate samples from both arroyos with and without apariques suggest that toxins might be responsible for paucity of apariques in the one lacking them, an observation that merits further study. Despite having flows that we believed sufficient for supporting trout, no apariques were found in a small tributary immediately below the new house. Seepage of toxins from an abandoned upstream mine might explain their absence from the tributary, as well as their absence below the mouth of this tributary..

We were told that another small tributary between the two streams mentioned above never did harbor apariques, and we did not sample it for fishes, but we did visit a small impoundment (“presita”) on it about 200 m above its mouth. This impoundment, apparently built recently with support obtained by the local municipality, had been stocked in January 2006 with 500 fingerling rainbow trout. We have documented many areas in other drainages where rainbow trout are interacting with natives (via competition and hybridization) to the detriment of the natives, and rainbow trout could easily leave this presita and invade native trout habitats. We therefore recommend removal of rainbows from this presa (and better, removal of the dam so it cannot be re-stocked) and erection of a barrier on the lower reaches of the stream that harbors apariques to prevent upstream movement of non-native fishes.

What to do

All members of Truchas Mexicanas are fully committed to conservation of Conchos Trout. We not only conclude that it is endangered throughout the basin, but the only viable extant population we know is critically endangered.

The most obvious solution for preservation of the only known potentially viable population of the new Conchos Trout is intensive management. We propose declaration of a small reserve that includes the entire drainages of the stream described above. The total area would be approximately 100 km². The only humans directly affected by such a reserve would be those occupying the new house on the stream that harbors the population, immediately below the lowermost collection of apariques. At a minimum, this family should be made fully aware of all ways in which they currently (grazing, tree-cutting), or potentially might (fishing, plowing/planting fields, washing clothes or other discharges of contaminants) impact the species and should be compensated for protecting it by changing the ways in which they use resources. The best solution would probably be to compensate this family to move elsewhere, but we realize this might not be possible. All land that we propose to be declared a reserve is (as far as we can determine) property of an ejido, and presumably, the family living on the stream harboring the aparique population is a member of that ejido.

To further justify its protection and management, it appears to us that the intrinsic value of this newly discovered Conchos trout stream and the nearby streams we propose protecting goes well beyond having the only known, manageable population of Conchos Trout. We also collected specimens of a unique, and previously unknown and

undescribed species of sucker (apparently a relative of *Catostomus plebeius*) from the stream that also harbors the apariques and are in the process of also describing it. In addition to these undescribed species, the same stream also supports Mexican stoneroller *Campostoma ornatum*, ornate shiner *Codoma ornata*, and Conchos chub *Gila pulchra*. Our study of other invertebrates and other organisms was very cursory, but all of the arroyos described above are unusual in the upper Rio Conchos because they flow to the north, are mostly uninhabited, and consequently likely harbor a unique assemblage of trees, forbs and other organisms otherwise uncommon in the Conchos basin. The stream that apparently once harbored apariques, but where we saw only one trout, has ancient caves with petroglyphs from prehistoric inhabitants along its banks.

We view a nearby ecotourism facility as a serendipitously fortunate occurrence for protection and recovery of Conchos Trout. The manager, a Spanish-speaking Rarámuri who grew up in the area and is a member of the ejido that owns the streams mentioned above, guided us throughout the area. He is exceptionally knowledgeable regarding local natural history, and interested in the apariques. He introduced us to the owner of a ranch on the lowermost reaches of the stream that harbors apariques (well below the aparique population), who explained he has never eaten aparique and is not interested in them for food. He would thus seem likely to be unaffected by any recovery actions for the trout, but potentially a beneficiary, together with the owners of ecotourism business and the ejido (which we understand receives part of all income from the tourism business). Ecotourism could be easily extended to include the aparique and other aspects of the area's natural history as an additional attraction. Though the aparique population is currently too small to allow catch and release fly fishing, it potentially could still attract economically significant tourism and such a business might one day be possible in the other stream where apariques apparently were once more abundant, and likely elsewhere, provided that the small surviving aparique population is properly managed and conserved. In the meantime, the ecotourism facility provides convenient housing for researchers and conservation workers.

A barrier on the lower reaches of the stream that harbors the aparique population to protect apariques from invasions of rainbow trout (hybridization between rainbows and other natives is a major conservation issue in many other places) is crucial. Truchas Mexicanas members committed not only personal contributions of funds to establish a base for such an effort, but also committed provision of our experience and expertise toward accomplishing construction of such a barrier. Though obviously other, larger efforts are required, especially outreach to, and education of, the local community, we believe construction of a barrier provides not only tangible protection, but is also something that can be quickly accomplished and which is both symbolic and educationally useful. It would be built with local labor, thus demonstrating that conservation of resources, such as aparique, can have tangible and immediate benefits to the local community.

The Truchas Mexicanas team is sincerely interested in conservation of the Conchos Trout, and believes immediate action to conserve the small population we discovered is a critical first step toward this end. However, we realize that as biologists, all foreign to the local area (and in many cases the country) we are highly ignorant of, and mostly unprepared to deal with the complexities of the local political and cultural

systems through which any actions would have to be taken. We therefore offer whatever assistance we can provide with our diverse and highly relevant backgrounds, but depend on the participation of others more qualified to interact with the appropriate local authorities and who can help us generate and administer the required funds.

We cannot emphasize enough the urgency of taking immediate steps to save this exceedingly rare and threatened trout. The impending extinction of this species will affect Rarámuri tradition as well as the local biodiversity. We were fortunate to have located the population we describe, but the situation requires immediate implementation of recovery actions. We are prepared to do whatever we personally can to help conserve this new species, but we clearly need help. Interested collaborators and donors are invited to contact us via the following:



Figure 2. Joe Tomelleri's illustration[©] of juvenile Conchos trout

How to contribute to conservation of the Conchos Trout:

What Truchas Mexicanas is contributing:

As explained above, the Truchas Mexicanas team has diverse and highly relevant expertise that can be applied to conservation of the Conchos Trout. Except for one year when the National Science Foundation funded our travel and genetic analyses, we have traveled at our own personal expense annually to the Sierra Madre Occidental to search for native Mexican trouts. We are formally describing the Conchos Trout and other new species and giving them scientific names so they can then be provided formal protection through the Norma Oficial (Mexican endangered species list). We have members with extensive hands-on experience in all aspects of managing endangered trouts in the southwestern U.S. and northwestern México, and we are all ready to apply that expertise and experience to Conchos Trout conservation efforts. Specifically, we have expertise building fish barriers for trout recovery and reintroductions of native trout to restored habitats and could quickly move forward on that project to benefit the only known potentially viable population of Conchos Trout. Our experience and availability also extends to popular writing and natural history interpretation, as well as trout fishing-related ecotourism. Tomelleri's excellent and beautiful illustrations of trout (<http://www.americanfishes.com>) are excellent for outreach at all levels and the Conchos Trout illustration (Figure 2) will be available for such work. Truchas Mexicanas members are sincerely dedicated and personally invested in Conchos Trout conservation and

produced this document to seek the support of others for this special and very important project.

How and what you can contribute

Of course, the invitation is always open to others with relevant complementary expertise or other resources to join our collaborative Truchas Mexicanas team. We welcome all interested parties to help further our work on Mexico's important and endangered native trouts, and specifically and most urgently, the Conchos Trout.

Monetary donations – Any efforts to conserve Conchos Trout will require basic funding. At the upper end of our wish list is land acquisition for a private reserve and compensation of local residents, but there are many others ways to aid the cause for much less. We need funds to build a fish barrier, as well as travel support to get management and community outreach expertise to the site and to relevant government and community offices for coordination. We also hope to eventually offer research grants to promote much needed studies of this obviously ecologically very different species and funds will also be needed to produce and deploy outreach materials.

On our behalf, Mexico North (<http://www.mexnor.org>) has established a fund to which tax-deductible (in Mexico and U.S.A.) donations can be made to support work on Conchos Trout conservation. Members of Truchas Mexicanas initiated the fund by each committing \$50 (U.S.) of their personal funds. Please send checks for the **Conchos Trout Fund** made payable to **Mexico North Research Network** to:

Mexico North Research Network
Conchos Trout Fund
231 F. ST., N.E.
Washington, DC 20002 USA
(Telephone 202 546-0801)

Please contact Mexico North (www.mexnor.org; gretadeleon@mexnor.org) for instructions if you wish to send contributions from Mexico to an address or account in that country.

In-kind donations - Truchas Mexicanas is a group of concerned and dedicated scientists and conservationists, but we are novices when it comes to community relations and outreach within the range of the Conchos Trout. We thus seek others willing to help us work with the local community at all levels to manage native trout habitats. We particularly need people with skills ranging from communications with those who live on Conchos Trout streams, to work with relevant ejidos and municipios, the Rarámuri community, and state and federal government. We also welcome volunteers (especially those with Spanish and Rarámuri language skills) to help with things as basic as manual labor on conservation projects. Individuals interested in becoming involved in such efforts should send an email describing their interests and availability to Aparique.Conchos@gmail.com, and one of the Truchas Mexicanas members or a representative will respond.

General inquiries about any aspect of the Conchos Trout project can be sent to Aparique.Conchos@gmail.com. See the Truchas Mexicanas websites (http://www.utexas.edu/tmm/tnhc/fish/research/truchas_mexicanas and <http://www.americanfishes.com/mexico/>) for additional information about our group and its work.

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Authors' affiliations, relevant experience and expertise:

The following members of the Truchas Mexicanas team (listed here in alphabetical order by last name) participated both in the fieldwork that resulted in discovery of the Conchos Trout population that this document proposes be protected and in the production of this document:

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- Dr. Francisco García de León, CIBNOR, La Paz, Baja California Sur (fgarciadl@cibnor.mx)
- Dr. Dean A. Hendrickson, Curator of Ichthyology, Texas Natural History Collections, The University of Texas at Austin (deanhend@mail.utexas.edu; tel. 512 471-9774) – nearly three decades of experience studying evolution and ecology of fishes of northern Mexico, including native trouts. Original organizer of Truchas Mexicanas team fieldwork.
- Dr. Bernard Kuhajda, Collections Manager, The University of Alabama Ichthyological Collection, Department of Biological Sciences, Box 870345, Tuscaloosa, AL 35487-0345 (bkuhajda@bama.ua.edu; tel. 205-348-1822) – study of imperiled

aquatic species, including surveys, systematics, and conservation actions for 20 years, including Mexican trouts since 1997.

Dr. Richard L. Mayden, Professor and Chairman, W. S. Barnickle Endowed Chair of Natural Sciences, Department of Biology, 3507 Laclede Ave, Saint Louis University, St. Louis, Missouri 63103 (cypriniformes@gmail.com; tel. 314-814-0771) – biodiversity and conservation of freshwater fishes, including trout; systematics of trout and other fish species; molecular evolution of trout.

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Dr. David L. Propst, Native Fish Biologist, Conservation Services Division, New Mexico Department of Game and Fish, Santa Fe, NM (tel. 505.476.8103)—over 30 years experience – studying native fishes, including native trouts, of southwestern US and northern Mexico. Leader Gila Trout Recovery Team and responsible for developing and implementing conservation strategies since 1984. Chief co-cook and bottle washer of Truchas Mexicanas team.

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