

Rediscovering the *Rivulus* of Peru: Visiting the Type Localities of Fels & de Rham

Fritz Rohde and Scott Smith



Figure 1. Map of region around Iquitos, Peru and type localities. A=Iquitos, B=Nauta, 1=Isla Padre, 2=Quistococha, 3=El Varillal, 4=Janero Herrera. Alexander von Humboldt is not shown and is off the lower part of the map.

Over the last decade our group has made multiple expeditions into the Brazilian and Peruvian Amazon with one shared goal: to find and sample the type localities of some of the most iconic *Rivulus*-group killifishes described by Fels & de Rham in the early 1980s. Their original descriptions were tanta-

lizing but vague, and to our knowledge many locations had never been revisited. After our earlier trips from 2014–2018 (Rohde et al. 2021; Rohde & Smith 2023), we realized that several key questions remained, questions that could only be answered with fresh material, new DNA sequences, and boots



Figure 2. *Anablepsoides ornatus* from Brazil. © Scott Smith.

back in the jungle.

Fels and de Rham (1981, 1982) had described six new species of *Rivulus* from Peru, including five in the vicinity of Iquitos, Loreto Department, Peru: *R. intermittens*, *R. iridescens*, *R. rubrolineatus*, and *R. speciosus* [all now in *Anablepsoides*], and *R. rectocaudatus* [now *Laimosemion*] and one they called *Rivulus ornatus* [now *Anablepsoides*]. Their sixth described species, *R. elongatus*, was found at Alexander von Humboldt, southwest of Pucallpa, Ucayali Department, Peru, roughly 600 kilometers south-southwest of Iquitos (Figure 1).

Our goal in 2017 was to intensively sample killifish habitats around Iquitos, including getting genetic material at the type localities of *A. intermittens* and *A. speciosus*, both of which were collected near Iquitos as was *L. rectocaudatus*. The goal of our 2018 trip to Manaus, Brazil was to collect *A. ornatus* at or near its type locality near Manaus, Brazil and compare it to *A. ornatus*-looking fish that we had collected in Peru (Rohde et al. 2021). Based on our genetic analysis, the Brazilian *A. ornatus* is a valid species (Figure 2) with *A.*

obscurus as a synonym.

Just as we were digesting the results of our 2018 work, Dr. Jean Huber added a new twist to the story by describing *Rivulus collieri* (now *Anablepsoides collieri*) based on preserved aquarium stock donated by Alan and Barbara Brown (Huber 2021), presumably progeny from fish originally collected by Fels and de Rham near Iquitos. Rohde and Smith (2023) opined that fresh material needed to be collected from Padre Isla (Huber's type locality for *A. collieri*); only a vague location with a dot in the center of the island is shown in Fels and de Rham (1982) and approximated by Huber (2021). These specimens need to be compared (genetically, color patterns, morphologically, etc.) to its supposed sister species, *A. speciosus*, and to the *A. sp. aff. ornatus* that we had collected at several other localities in Peru. Upon completion of 2018 trip and with all the genetic analyses done, we determined that there were several questions that still needed to be answered and that one more trip was needed to collect at the type localities for *A. collieri*, *intermittens*, *iridescens*, and *rubrolineatus* and to compare them



Figure 3. The gang of six. From left to right: Jorge Castillo, Frans Vermuelen, Scott Smith, Jesse Bissette, Dustin Smith, and Fritz Rohde. © Jorge Castillo.



Figure 4. *Moema hellneri* from Belen, Peru. © Jesse Bissette.

Have a friend who is interested in killies? Direct him or her to www.aka.org for information on joining the American Killifish Association!

to specimens that we had caught elsewhere. We already had tissue for *A. speciosus* and *A. elongatus* and there is no doubt about the validity of *L. rectocaudatus*. So, we (Fritz and Scott) went back to Peru in the fall of 2022 with friends Dustin Smith and Jesse Bissette, aided by our local contact, Jorge Castillo. We also coordinated with well-known *Rivulus* expert, Frans Vermuelen, who asked to tag along on our trip (Figure 3).

Anablepsoides collieri

Type Locality

Isla Padre, a fluvial island in the Amazon River northeast of Iquitos. Coordinates approximate, interpreted from Fels & de Rham (1982) and later by Huber (2021).

Finding the Species

Based on our 2023 comment in JAKA, we had planned on visiting Isla Padre to try and collect this species. After arriving in Iquitos in late September, based on advice from Jorge and

Frans, we decided to first visit the area around Barrio de Belen, a “suburb” of Iquitos accessible by paddling across a questionable looking section of the Itaya River used both for bathing and sewage disposal. There are only two roads leading away from the village and the first we took led directly to the Amazon River. We made six collections that day and while initially only collecting *A. elongatus* and surprisingly *Moema hellneri* (Figure 4), we did find fish that strongly resembled *A. collieri* at two other locations (Figure 5). Later in the week we decided that attempting to visit Isla Padre was too problematic and since we had already caught potential *A. collieri* somewhat near Isla Padre (roughly 15 kilometers southwest) we decided to return to Belen and go down the other road where Frans had previously collected presumed *A. collieri*. The site looked bone-dry. Absolutely lifeless. We started joking about Frans’ “legendary” locality memory, until he suddenly stomped down into the cracked mud like he was squashing grapes (Figure 6). Within seconds water



Figure 5. *Anablepsoides collieri* from Belen, Peru. © Jesse Bissette.



Figure 6. Frans and his *A. collieri* dance on the dried-up mud flat. © Fritz Rohde.

seeped up, forming a tiny muddy pool... and out came *Anablepsoides collieri* in his dipnet. A moment of pure *Rivulus* sorcery.

Identification & Notes

Genetics settled the question: *A. collieri* is absolutely a valid species.

The Belen specimens are virtually identical genetically to specimens from:

- Rio Yanayacu (2015) (Figure 7)
- Barrio Florida (2017)

This cluster forms a tight group clearly distinct from *A. speciosus*. Huber (1992) had hinted at this relationship decades earlier; our data confirm it.

Anablepsoides elongatus

Type Locality

“National Forest Park, Alexander von Humboldt, 86 km SW of Pucallpa, on the route Pucallpa–Tingo Maria.” (Fels & de Rham 1981; translated by Huber 1992).

Finding the Species

This species wasn’t a major priority, but we did collect it in 2016 close to the type locality, 42 km northeast of Alexander von Humboldt, near Campoverde. The habitat was classic: leaf litter, quiet water, and the right depth/clarity combination.

Genetically and morphologically, this fish (Figure 8) is practically indistinguishable from specimens of *A. elongatus* we caught at Nauta and Belem, near Iquitos (Figure 9).

Anablepsoides intermittens

Type Locality

“Forest Station El Varillal, 34 kms from Iquitos, on the road to Nauta” (Fels & de Rham 1981; translated by Huber 1992).

Finding the Species

Finding the type locality for this species proved to be more problematic for us: where is Forest Station El Varillal? Since we could find no indication



Figure 7. *Anablepsoides collieri* from Rio Yanayacu, Peru. © Scott Smith.



Figure 8. *Anablepsoides elongatus* from near Campoverde, Peru. © Scott Smith.



Figure 9. *Anablepsoides elongatus* from Belen, Peru. © Jesse Bisette.

where it was located during various internet searches, in 2017 we collected at six locations along the road to Nauta, roughly 34 kilometers from Iquitos. We caught *L. rectocaudatus* and many others we assumed to be *A. intermittens*. But after getting back to North Carolina and examining our photographs more closely, along with the DNA results, we determined they were *A. aff. rubrolineatus* (Figure 10). Drats! So, in 2022, we were even more determined to collect this species and discussed other possible locations with Frans. After collecting at 10 spots (even one at 34 kilometers from Iquitos according to a road post) along the Nauta Road and only catching again *L. rectocaudatus* and *A. sp. aff. rubrolineatus*, we ventured east off the road onto a sandy washboard road from hell and stopped at two locations, approximately 25 kilometers from Iquitos and 5.8 kilometers south of Varillal that were heavily covered with vegetation (Figure 11). Bingo! Both produced *A. intermittens* (Figure 12), later confirmed by Frans back at the hotel, which the trip back there took longer than expected after one of our mototaxis broke down on the rough road. Subsequent DNA results confirmed their identity.

Postscript: After returning from the 2022 trip, Fritz took a closer look at a translation of Fels and De Rham's publication. "Forest station 34 km from Iquitos **on the road to Nauta**, about 18 km past Quisto Cocha.... The site is a small east-west thalweg, perpendicular to the road, with soils on the two sides that are different, where *Rivulus intermittens* and *Rivulus rectocaudatus* were captured." They go on and give further details, which should make finding the site easier – next trip.

Anablepsoides iridescens

Type Locality

"Arboretum, 3 kms east of Janero Herrera towards Colonia Angamos" (Fels & de Rham 1981; translated by Huber 1992).

Finding the Species

Once on the road leading to nowhere from Janero Herrera, it became apparent that the kilometer markers had been remeasured at some point, and now two sets of markers existed and they did not match. At the new KM 4 marker, just past the Arboretum, we easily found a creek matching the description of the type locality and collected many *A. iridescens* (Figure 13) within a few minutes. We also collected the species at two nearby wet areas similar to the type locality. (Figure 14)

Anablepsoides rubrolineatus

Type Locality

"14 km east of Janero Herrera, towards Colonia Angamos" (Fels & de Rham 1981; translated by Huber 1992).

Finding the Species

Finding this species required a lot more work, most notably due to the condition of the road, and the lack of functioning vehicles for hire in the village. After much haggling we convinced two drivers to take us down the muddy trail and into the jungle. Somewhere around kilometer 9, we had to leave Fritz and Frans behind as their taxi was not up to the challenge of the muddy road, and we still had a lot of ground to cover. Fels and de Rham (1981) recorded the type locality as "14 km east of Janero Herrera, towards Colonia Angamos", but given the conflicting kilometer markers mentioned earlier and the terrible state of the road Scott with Dustin and Jesse had to convince their driver to reluctantly press on to



Figure 10. *Anablepsoides aff. rubrolineatus* from Nauta Road, near Iquitos, Peru.
© Jesse Bissette.

KM 14. The time to reach this point was drastically underestimated, and it came to our attention that our return boat trip was scheduled to leave now, and we had just arrived at the type locality. The site required sliding down into a ravine on the north side of the road, where a dried aguajal dominated the landscape. We quickly realized the lack of water was going to make this difficult and split up to explore the area. After about 15 minutes of searching, the silence was broken with a yell of “Rivulus!”. Dustin and Jesse quickly made their way to Scott’s location, and with their help they collected the species (Figure 15). Sliding into a ravine it turns out is much easier than climbing back out!

Anablepsoides speciosus

Type Locality

“Quisto Cocha, 18 km S of Iquitos towards Nauta” (Fels & de Rham 1981; translated by Huber 1992).

Finding the Species

Quistococha is a small village and a natural protected and tourist area centered around Laguna Quistococha southwest of Iquitos. Fels and de Rham collected the species along the marshy edges of the laguna. Since it is now a protected area, any collecting is prohibited so we had to find an alternative. Our friend Jorge had worked nearby at

a facility locally called University Ponds where Arapaima were being cultured. A hill separated this facility from the laguna and in 2016, accompanied by our friend, the late Brian Perkins, we descended down the hill towards the ponds. We first discovered a cemented-in pool that contained abundant *L. rectocaudatus* (Figure 16). As we stumbled through the dense undergrowth we found a wet area where we collected two fish that we later determined to be *A. collieri*. Upon our return in 2017, we made visiting this area a priority. Again, with Brian and Jorge, we started at the top and Brian found a “trail” that we followed along a narrow ridge line, again with dense undergrowth. Part way down was a wet, mucky area located in the heavily wooded area just off the path. It was too deep to wade so we sat at the edge and reached out to catch what we could find. And find fish we did – many little guys that we called “blue eyes.” As it turned out we collected *A. speciosus* (Figure 17), *A. collieri*, and another unknown dwarf *Anablepsoides*. When we returned on October 5, 2022, with high hopes of catching more of these three species, the area was much drier and while we caught *L. rectocaudatus* in the same cement-ringed pool as we did in 2016, we were unsuccessful in finding *A. speciosus* or anything else nearby, even though we crisscrossed the area.



Figure 11. Scott collecting *A. intermittens* in the jungle (aguajal). © Fritz Rohde.

Laimosemion rectocaudatus

Type Locality

"Forest Station El Varillal, 34 km from Iquitos, on the road to Nauta" (Fels & de Rham 1981; translated by Huber 1992).

Finding the Species

The type locality for this species is the same as *A. intermittens*. Since we never found the exact place where Fels and de Rham caught both species, obviously we did not collect it at its type locality. But we did collect it at various nearby locations along the road to Nauta, near El Varillal (Figure 18), as well as downstream of Iquitos near Barrio Florida.

Epilogue - Trip to Janero Herrera

During the planning stages for the 2022 trip, we had discussed doing an overnight trip to Janero Herrera, type locality for both *A. iridescens* and *A. rubrolineatus* since it was several hours upstream from Nauta. Shortly after arriving in Iquitos, Frans, Scott, and Jesse did an overnight trip up the nearby Napo River in search of an undescribed *Anablepsoides* that Frans had collected on an earlier visit. That trip proved to be more difficult than envisioned when planning it back in North Carolina, so, with the help of our local friend Jorge Castillo and our driver Antonio, we went to Plan B for the trip to Janero Herrera and dropped the overnight option. Antonio picked up the five of us that morning at 6 am along with another local friend, Yuri, who was to be our liaison. After an adventurous 1-1/2 car ride to Nauta, we arrived to find our boat ready for the trip upstream. It turned out to be pleasantly seaworthy, powered by an "impressive" 60-hp outboard motor. Since we were going against the current of the Ucayali River (one of the main branches of the

Amazon in Peru), it took us three hours of slow travel before we finally arrived in Janero Herrera. As we disembarked, the boat driver said to be back at 1 pm! Two hours! Yuri quickly found us two mototaxis and off we headed down the only road that exits the village (Figure 19).

While the road was either often rough or muddy, there were cement posts conveniently placed every kilometer, however, a second set of kilometer markers that did not agree with the first also existed. Considering Fels and de Rham came through here 40 years ago, we went with the older set. The distance to the *A. iridescens* type locality was only a few kilometers outside the town and everything went smoothly. The distance to the *A. rubrolineatus* locality was another 10 kilometers down and the road and the mototaxi carrying Scott, Dustin, and Jesse was having issues and could not get out of first gear. After limping along for several kilometers, and with the issue of getting back to meet the boat, the older guys (Fritz, Fran, and Yuri) swapped vehicles with the younger crowd who continued on down the road. The other three turned around and hoped they could get back to town under power. Alas, it was not to be, and they were soon walking and pushing the now defunct mototaxi.

Meanwhile, the other group managed to convince their taxi driver to push on, even though the road conditions, and the ability of the vehicle to make the hill climbs, were failing. They visited both the old and new 14 km marks, and after searching an aguajal at the bottom of a ravine, were able to locate *R. rubrolineatus* in a small puddle. The climb out of the ravine was a test, and both Jesse and Scott returned covered in bug bites but ecstatic at having caught their target.



Figure 12. *Anablepsoides intermittens*. © Jesse Bissette.



Figure 13. *Anablepsoides iridescens* from the type locality at Janero Herrera, Peru.
© Jesse Bissette.



Figure 14. Scott and Dustin collecting in *A. iridescens* habitat.
© Fritz Rohde.



Figure 15. *Anablepsoides rubrolineatus* from the type locality near Janero Herrera, Peru.
© Jesse Bissette.

Sometime later, the others caught up with the stranded group and once again swapped vehicles. As it was getting later in the day, Fritz and Frans headed back to town in hopes that the boat was still there, plus send a mototaxi to rescue the others. Scott, Jesse, and Dustin began their shift of walking the 8 km back to the boat, with only a single bottle of water between them after having left their bags on the mototaxi. We don't think the boat driver was happy with us as we finally boarded around 4:30 pm for the return trip to Nauta, which only took about 1-1/2 hours going with the current. As the sun was setting, we docked in Nauta hoping that Antonio was waiting for us. He was and proceeded to set a new land speed record driving the road back to Iquitos; we think he had a "hot" date since he was constantly looking at his cell phone at a dating site as he drove, luckily not hitting a single pedestrian or dog. Back safely to the hotel at 8 pm, we said "Never again!"

References:

- Fels, J.F., and P. de Rham. 1981. Recentés collectes de *Rivulus* (Cyprinodontiés) au Pérou, avec description de six espècesnouvelles,deuxiemepartie. *Revue Francasied'AquariologieHerpétologie* 85 (3): 65-66.
- Fels, J.F., and P. de Rham. 1982. Recentés collectes de *Rivulus* (Cyprinodontiés) au Pérou, avec description de six espècesnouvelles,deuxiemepartie. *Revue Francasied'AquariologieHerpétologie* 85 (4): 97-106.
- Huber, J.H. 1992. Review of *Rivulus*: ecobiogeography,relationships. Société Française d'Ichtyologie, Paris. 572 pp., 12 maps.
- Huber, J.H. 2021. A new but long since misidentified species, *Rivulus collieri* in. sp., from Peruvian Amazon (Cyprinodontiformes, Rivulidae). *Killi-Data Series* 2021: 4-11.
- Rohde, F., S. Smith, and D. Smith. 2021. Collecting *Rivulus* near Manaus, Brazil: A George Maier Fund Award. *Journal of the American Killifish Association* 54(1): 1-24.
- Rohde, F., and S. Smith. 2023. Peruvian adventures (2014-2017) and *Rivulus collieri*. *Journal of the American Killifish Association* 56(1): 1-9.



Figure 16. Scott filming *L. rectocaudatus* with a Go Pro. © Fritz Rohde.



Figure 17. *Anablepsoides speciosus*. © Scott Smith.



Figure 18. *Laimosemion rectocaudatus* from near El Varillal, Peru.
© Jesse Bissette.



Figure 19. Our “wonderful” mototaxis before the breakdown. © Fritz Rohde.



Another Peruvian killifish, *Aphyolebias peruensis* “Santa Anna”. © Frans Vermeulen.