



What the Heck is an ESU?

By: Leslie B. Dick Chairman, American Livebearer Association

The sub-family Goodeinae, comprised of some 40 species and about 80 distinct populations, is endemic to Mexico and are nearly all at risk in the wild. Each of these distinct populations has been geographically separated from one another for, in some cases, thousands of years. As a result, each has likely evolved with its own unique set of genetic characteristics. Some species of goodeids have quite a few known distinct populations and it is important to keep them separated in captive breeding programs to prevent possible hybridization. Should two distinct populations of the same species be housed together, hybridization could occur. The resulting offspring may lose the unique genetic characteristics of their parents, leaving what is known as “aquarium strain” fish.

This is where ESUs come into play. Dr. John Lyons, the Chairman of the North American Goodeid Working Group (NAGWG), received his Ph.D. in Zoology with an emphasis on fish ecology and ichthyology from the University of Wisconsin-Madison and has been involved in conservation efforts of goodeids since 1986. At the second annual meeting of the NAGWG held at a recent American Livebearer Association convention, John introduced “Evolutionarily Significant Units” or ESUs, the technical term for genetically distinct populations of evolutionary and conservation significance, as a method to maintain and track known goodeid diversity.

Let’s take a look at how ESUs work. Please note that the charts used in this article are abstracted from Lyons’ spreadsheet; general information for each genus is in the yellow rows, while ESU numbers and location information for each population are in the gray rows. ESU codes are based on a formula that has the first three letters as an abbreviation of the genus name and the last two letters as an abbreviation of the species name, followed by a number for the particular species or ESU. For some species, there is only one known population. *Ameca splendens* is one of the most well-known goodeid species. The current species number is 13, the current ESU number is 20 and the location information is identical for the species and the ESU.

Count	Genus	Species	Code	Basin(s)	Waters
13	<i>Ameca</i>	<i>splendens</i>	Amesp0	Ameca, Magdalena, Sayula	Manantial and Rio Teuchitlan, Rio Ameca, Presa La Vega, Manantial Almoloya, Tangue El Molino, Cuyacapan, Sayula
20	<i>Ameca</i>	<i>splendens</i>	Amesp1	Ameca	Manantial and Rio Teuchitlan, Rio Ameca, Presa La Vega, Manantial Almoloya, Tanque El Molino, Cuyacapan, Sayula

With another popular goodeid, *Xenotoca eiseni*, there is 1 species with 5 distinct populations. Here, the current species number is 34, the current population ESUs are 62 through 66. Note that the population locations are unique to the ESUs.



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Count	Genus	Species	Code	Basin(s)	Waters
34	<i>Xenotoca</i>	<i>eiseni</i>	Xenei0	Santiago, Coahuayana, Armeria	See ESU's
62	<i>Xenotoca</i>	<i>eiseni</i>	Xenei1	Santiago	Manantial 6 de enero, Manantial el Sacristan, Rio Santiago
63	<i>Xenotoca</i>	<i>eiseni</i>	Xenei2	Compostela	Rio Compostela
64	<i>Xenotoca</i>	<i>eiseni</i>	Xenei3	Coahuayana	Rio Tamazula
65	<i>Xenotoca</i>	<i>eiseni</i>	Xenei4	Armeria	Rio Ayuquila
66	<i>Xenotoca</i>	<i>eiseni</i> (cf. <i>eiseni</i>)	Xenei5	Ameca, Magdalena	Rio San Marcos, Granja Sahuaripa, Etzatlan, Laguna Palo Verde, Manantial Almoloya, Manantial El Tanque, Rio Caliente
16	<i>Chapalichthys</i>	<i>pardalis</i>	Chapa0	Balsas	See ESU's
23	<i>Chapalichthys</i>	<i>pardalis</i>	Chapa1	Balsas	Manantial Tocumbo
24	<i>Chapalichthys</i>	<i>pardalis</i> (<i>peraticus</i>)	Chapa2	Balsas	Presa San Juanico

These species are quite straightforward. There are several goodeid species where there is 1 species number, in this case, number 16 and the genus name is the same but, the species names are different, such as with *Chapalichthys pardalis*, current ESU 23. *Chapalichthys pardalis* is only found in Manantial Tocumbo, while *C. peraticus*, current ESU 24, is only found in Presa San Juanico.

If we look at *Characodon*, the information is even more complicated. We find there are 2 species (*Characodon audax* and *C. lateralis*) with current species number 17 and 9 known populations with current ESU numbers 25 through 33.

The *Characodon* known as “The Black Prince” is referred to as *Characodon audax* ‘El Toboso’ and is the only *C. audax* species recognized by Lyons. There are other populations known from a single location that some have also termed as *C. audax* but Lyons feels that until the genus undergoes a detailed taxonomic revision, these populations should be called *C. lateralis*, for example *Characodon lateralis* ‘Los Pinos’ or *C. lateralis* ‘Puente Pino Suarez’.



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Those with multiple locations with the same ESU numbers (looking at ESU 28 as an example) are similarly written as *C. lateralis* 'Guadalupe Aquilera' or *C. lateralis* 'Laguna Seca' based on the location where they have the largest abundance. Two populations that have always been referred to as *C. lateralis* (ESUs 32 and 33) are now also referred to as populations, such as *C. lateralis* 'Armado Nervo'.

Count	Genus	Species	Code	Basin(s)	Waters
17	<i>Characodon</i>	<i>audax</i>	Chrau0	Mezquital	El Toboso
25	<i>Characodon</i>	<i>audax</i>	Chrau1	Mezquital	El Toboso
18	<i>Characodon</i>	<i>lateralis</i>	Chrla0	Mezquital	See ESU's
26	<i>Characodon</i>	<i>lateralis (audax)</i>	Chrla1	Mezquital	Cerro Gordo, Manantial El Carmen, Arroyo San Rafael
27	<i>Characodon</i>	<i>lateralis (audax)</i>	Chrla2	Mezquital	Los Pinos
28	<i>Characodon</i>	<i>lateralis (audax)</i>	Chrla3	Mezquital	Presa Penon del Aguila, Rio Mezquital, Guadalupe Aquilera, Laguna Seca, Aguada de las Mujeres
29	<i>Characodon</i>	<i>lateralis (audax)</i>	Chrla4	Mezquital	Hot Springs, Presa Tunal, Rio Saceda, San Vincente de los Chupaderos
30	<i>Characodon</i>	<i>lateralis (audax)</i>	Chrla5	Mezquital	Abraham Gonzales, Ojo Garabato, 27 de Noviembre
31	<i>Characodon</i>	<i>lateralis (audax)</i>	Chrla6	Mezquital	Puente Pino Suarez
32	<i>Characodon</i>	<i>lateralis</i>	Chrla7	Mezquital	Ojo de Agua de San Juan, Los Berros, Ojo de Nombre de Dios, La Constancia
33	<i>Characodon</i>	<i>lateralis</i>	Chrla8	Mezquital	Amado Nervo

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To further complicate issues, as new distinct population of species are added to this comprehensive spreadsheet, the ESU numbers change. Remember that I referred to “current ESU number”? At one time, there were just 3 known populations of *Xenotoca eiseni* while now there are 5; there were once 5 known populations of *Characodon lateralis* and now there are 8 populations. When these new ESUs are added, they are added in numerical order, so those ESU numbers below these additions receive a new ESU number.

How is one to keep track of a specific population of a species if the ESU numbers don't remain the same? Fortunately, the answer is quite simple – the code associated with each population remains the same, so *Xenotoca eiseni* ‘Rio Tamazula’ will always be known as **Xenei3**, regardless of what is listed as its ESU number.

Count	Genus	Species	Code	Basin(s)	Waters
64	<i>Xenotoca</i>	<i>eiseni</i>	Xenei3	Coahuayana	Rio Tamazula

How do I keep track of known populations of goodeids? In my fish room, I label each tank of goodeids with the genus and species name, from whom and when I received each group and label each tank with the species name and the associated code. I obtain goodeids from known breeders, usually fellow members of the NAGWG, who also maintain detailed records on their colonies. Below are examples of species and ESU code numbers for two of the goodeids under my care:

Should one purchase goodeids at either online or club auctions, look for specific information, such as population location and breeder's name. Without this information, the fish should be considered “aquarium strain” and maintained in their own aquarium until such time as you can backtrack through previous owners of these fish to determine if they came from a known population and haven't been mixed with other populations while in captivity.

With the uncertain future of all species of goodeids in the wild, captive breeding programs such as those with members of the NAGWG, the ALA's Species Maintenance Program, and the CARES Priority List will help ensure their continued existence.

The detailed information contained in the ESU spreadsheet, if used appropriately, will help ensure that unique known populations of goodeids will be maintained with all their genetic diversity intact.



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Thanks very much Leslie, we've really enjoyed this article.