

Electric Catfish (*Malapterurus electricus*)

Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, Web Version, 2/9/2018



Photo: Biopix. Licensed under Creative Commons BY-NC. Available: http://eol.org/data_objects/19171791. (February 2017).

1 Native Range and Status in the United States

Native Range

From Azeroual et al. (2010):

“*Malapterurus electricus* is widely distributed, from Senegal (and possible Mauritania) to Ethiopia, and along the entire length of the Nile from Egypt to Rwanda and the Great Lakes south to Malawi.”

“Benin; Burkina Faso; Burundi; Cameroon; Central African Republic; Chad; Congo, The Democratic Republic of the; Côte d'Ivoire; Egypt; Ethiopia; Ghana; Guinea; Malawi; Mali; Niger; Nigeria; Senegal; South Sudan; Sudan; Tanzania, United Republic of; Togo; Uganda; Zambia”

Status in the United States

There are no confirmed records of *M. electricus* in the United States.

From Arizona Administrative Code (2015):

“Fish listed below are considered restricted live wildlife [in Arizona]: [...] The species *Malapterurus electricus*. Common name: electric catfish.”

From FFWCC (2017):

“Prohibited nonnative species are considered to be dangerous to the ecology and/or the health and welfare of the people of Florida. These species are not allowed to be personally possessed or used for commercial activities. Very limited exceptions may be made by permit from the Executive Director for research or for public exhibition by facilities that meet biosecurity criteria [...] Electric catfishes – Family Malapteruridae, all species”

From Hawaii Department of Agriculture (2006):

“LIST OF PROHIBITED ANIMALS [...] FAMILY Malapteruridae
Malapterurus electricus catfish, electric”

From Texas Parks & Wildlife (2017):

“The organisms listed here are legally classified as exotic, harmful, or potentially harmful. No person may possess or place them into water of this state except as authorized by the department. Permits are required for any individual to possess, sell, import, export, transport or propagate listed species for zoological or research purposes; for aquaculture [...]; or for aquatic weed control [...] Electric Catfishes, Family Malapteruridae
All species”

Means of Introductions in the United States

There are no confirmed records of *M. electricus* in the United States.

Remarks

From GBIF (2016):

“SYNONYMS
Malopterurus electricus (Gmelin, 1789)
Silurus electricus Bonnaterre, 1788
Silurus electricus Gmelin, 1789”

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2017):

“Kingdom Animalia
Subkingdom Bilateria
Infrakingdom Deuterostomia
Phylum Chordata
Subphylum Vertebrata
Infraphylum Gnathostomata
Superclass Osteichthyes
Class Actinopterygii
Subclass Neopterygii
Infraclass Teleostei
Superorder Ostariophysi
Order Siluriformes
Family Malapteruridae
Genus *Malapterurus*
Species *Malapterurus electricus* (Gmelin, 1789)”

“Current Standing: valid”

Size, Weight, and Age Range

From Froese and Pauly (2016):

“Max length : 122 cm SL male/unsexed; [Gosse 1986]; max. published weight: 20.0 kg [Ita 1984]; max. reported age: 10 years [Skelton 1993]”

Environment

From Froese and Pauly (2016):

“Freshwater; benthopelagic; pH range: 7.0 - 8.0; dH range: ? - 20; potamodromous [Riede 2004].”

“[...] 23°C - 30°C [Riehl and Baensch 1991; assumed to be recommended aquarium water temperatures]”

Climate/Range

From Froese and Pauly (2016):

“Tropical; [...] 35°N - 30°S”

Distribution Outside the United States

Native

From Azeroual et al. (2010):

“*Malapterurus electricus* is widely distributed, from Senegal (and possible Mauritania) to Ethiopia, and along the entire length of the Nile from Egypt to Rwanda and the Great Lakes south to Malawi.”

“Benin; Burkina Faso; Burundi; Cameroon; Central African Republic; Chad; Congo, The Democratic Republic of the; Côte d'Ivoire; Egypt; Ethiopia; Ghana; Guinea; Malawi; Mali; Niger; Nigeria; Senegal; South Sudan; Sudan; Tanzania, United Republic of; Togo; Uganda; Zambia”

Introduced

From NOBANIS (2017):

“*Malapterurus electricus* [*sic*] in Germany [...] Time of introduction: 1974 [...] Type of introduction: Intentional [...] Frequency: Extinct”

From Brummett (2005):

“[...] on the Ntem River in Southern Cameroon, insecticide fishing disrupted local aquatic ecosystems to the point where the electric catfish, *Malapterurus electricus* was able to extend its habitat into the small rivers where they were previously not found.”

Means of Introduction Outside the United States

From Brummett (2005):

“[...] on the Ntem River in Southern Cameroon, insecticide fishing disrupted local aquatic ecosystems to the point where the electric catfish, *Malapterurus electricus* was able to extend its habitat into the small rivers where they were previously not found.”

Short Description

From Ng (2000):

“The body is elongate and cylindrical, and the head is slightly depressed. The eyes are small, the lips are rather thick, and the snout is rounded with widely separated nostrils. The gill openings are narrow and restricted to the sides. *Malapterurus* species have three pairs of barbels, and lack a dorsal fin. The pectoral, pelvic and caudal fins are rounded. The pectoral fins lack spines and have 8 to 9 fin rays. The pelvic fins have 6 fin rays and are inserted approximately halfway between the tip of the [*sic*] snout and the base of the caudal peduncle. The anal fin has 9 to 10 rays and is located anterior to the adipose fin, which is low and has a rounded posterior edge.”

“Species in *Malapterurus* are generally grayish-brown on the back and sides, fading to an off white or cream color on the ventral surfaces of the head and body. There are irregular black spots or blotches randomly distributed on the sides of the body. The posterior half of the caudal peduncle usually has a dark brown or black vertical bar and a cream vertical bar immediately anterior to it. The distal margins of the anal and caudal fins have a cream margin, and the base of the caudal fin has a cream region and a dark brown crescentic band immediately posterior to it.”

Biology

From Froese and Pauly (2016):

“Occur among rocks or roots; favors sluggish or standing water. Active at night, feeding mainly on fish stunned by electric shocks. The electric organ, capable of discharging 300-400 V, is derived from pectoral muscle and surrounds almost the entire body. It is used both for prey capture and defense. Electric organ discharge (EOD) is intermittent and the amplitude increases with size of the fish [Møller 1995]. Responds immediately to cyclic light changes, exhibiting maximum EOD activity shortly after sunset and lowest activity just after sunrise [Belbenoit 1979]. Its EOD duration decreased from 1.5 to 0.3 ms in response to increased temperature from 15 to 30°C [Bauer 1968]. Adults form pairs and breed in excavated cavities or holes [Skelton 1993]. [...] It is assumed that the male tends the clutch. Others report that the male takes the eggs into his mouth. It is also unknown how the fry is immune to the electric shocks by the parents [Riehl and Baensch 1991].”

Human Uses

From Froese and Pauly (2016):

“Fisheries: subsistence fisheries; gamefish: yes”

From Ng (2000):

“*Malapterurus electricus* is eaten as food in parts of Africa. Along the shores of Lake Kainji, smoked electric catfish is a popular delicacy (Moller, 1995). Besides being a food fish, *M. electricus* is also occasionally encountered in the pet trade as an aquarium fish.”

“The electric organs of *Malapterurus* have been used in studies of neuronal metabolism, axonal transport, and transmitter release (e.g. Volkandt & Zimmermann, 1986), being particularly suited for this task because of their innervation by only one giant neuron (Janetzko et al., 1987). (Janetzko, et al., 1987; Moller, 1995; Volkandt and Zimmermann, 1986)”

Diseases

From Omeji et al. (2014):

“Investigation on the ecto and intestinal parasites of *Malapterurus electricus* from the Upper River Benue was carried out using a total of two hundred specimens of the fish. A total of 304 parasites belonging to five species of nematode (*Camallanus* sp, *Capilaria* sp, *Contracaecum* sp,

Eustrongylides sp and *Caenorhabditis briggsae*), two species of cestode (*Diphilobothrium lactum* and *B. aegypticus*), one species each of protozoa and trematode (*Henneguya* sp and *Clinostomum* sp) were observed. The prevalence of infections obtained was 47.0%.”

Threat to Humans

From Ng (2000):

“Aside from giving an unpleasant surprise to the occasional careless fisherman who handles it (the EOD an electric catfish generates is not known to be fatal to humans), there are no other known negative effects of *M. electricus* on humans.”

From Brummett (2005):

“Because of the powerful shocks emitted by this fish, women have been forced to abandon their traditional dam fishing in the area.”

From Obasohan et al. (2006):

“The concentrations of heavy metals in two tropical fish species (*Malapterurus electricus* and *Chrysichthys nigrodigitatus*) from Ogba river in Benin City, Nigeria, were investigated between November 2002 and October 2003 in order to ascertain the pollution status of the river. The results showed varying levels of accumulation of Cu, Mn, Zn, Pb, Cr, Ni, and Cd in the fishes. The levels of Cu, Mn, Cr and Ni, in both fishes were higher than the WHO and FEPA recommended maximum allowable standards in food fish [...]”

3 Impacts of Introductions

From NOBANIS (2017):

“Impact: Not known”

From Arizona Administrative Code (2015):

“Fish listed below are considered restricted live wildlife [in Arizona]: [...] The species *Malapterurus electricus*. Common name: electric catfish.”

From FFWCC (2017):

“Prohibited nonnative species are considered to be dangerous to the ecology and/or the health and welfare of the people of Florida. These species are not allowed to be personally possessed or used for commercial activities. Very limited exceptions may be made by permit from the Executive Director for research or for public exhibition by facilities that meet biosecurity criteria [...]

Electric catfishes – Family Malapteruridae, all species”

From Hawaii Department of Agriculture (2006):

“LIST OF PROHIBITED ANIMALS [...]

FAMILY Malapteruridae

Malapterurus electricus catfish, electric”

From Texas Parks & Wildlife (2017):

“The organisms listed here are legally classified as exotic, harmful, or potentially harmful. No person may possess or place them into water of this state except as authorized by the department. Permits are required for any individual to possess, sell, import, export, transport or propagate listed species for zoological or research purposes; for aquaculture [...]; or for aquatic weed control [...]

Electric Catfishes, Family Malapteruridae

All species”

4 Global Distribution

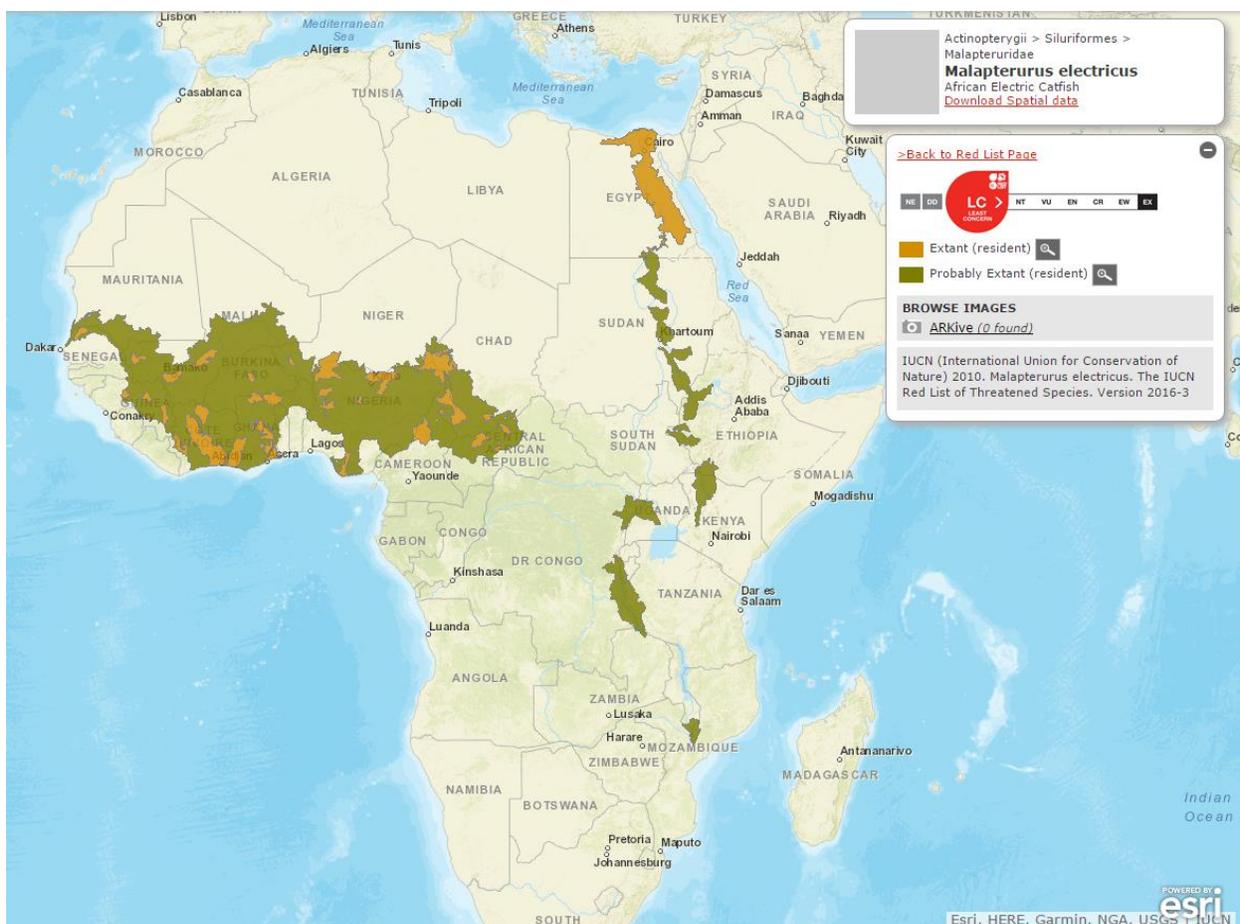


Figure 1. Known global distribution of *Malapterurus electricus*. Map from Azeroual et al. (2010).

5 Distribution Within the United States

There are no confirmed records of *M. electricus* in the United States.

6 Climate Matching

Summary of Climate Matching Analysis

The climate match (Sanders et al. 2014; 16 climate variables; Euclidean distance) was medium high in inland southern California, Arizona, and southern Nevada. Southern Texas, southern Florida, and small, scattered areas of the Interior West were medium climate matches. The climate match was low for the remainder of the contiguous U.S. Climate 6 proportion indicated a medium climate match overall with the contiguous U.S. The proportions indicating a medium climate match are those greater than 0.005 and less than 0.103; the Climate 6 proportion for *Malapterus electricus* was 0.027.

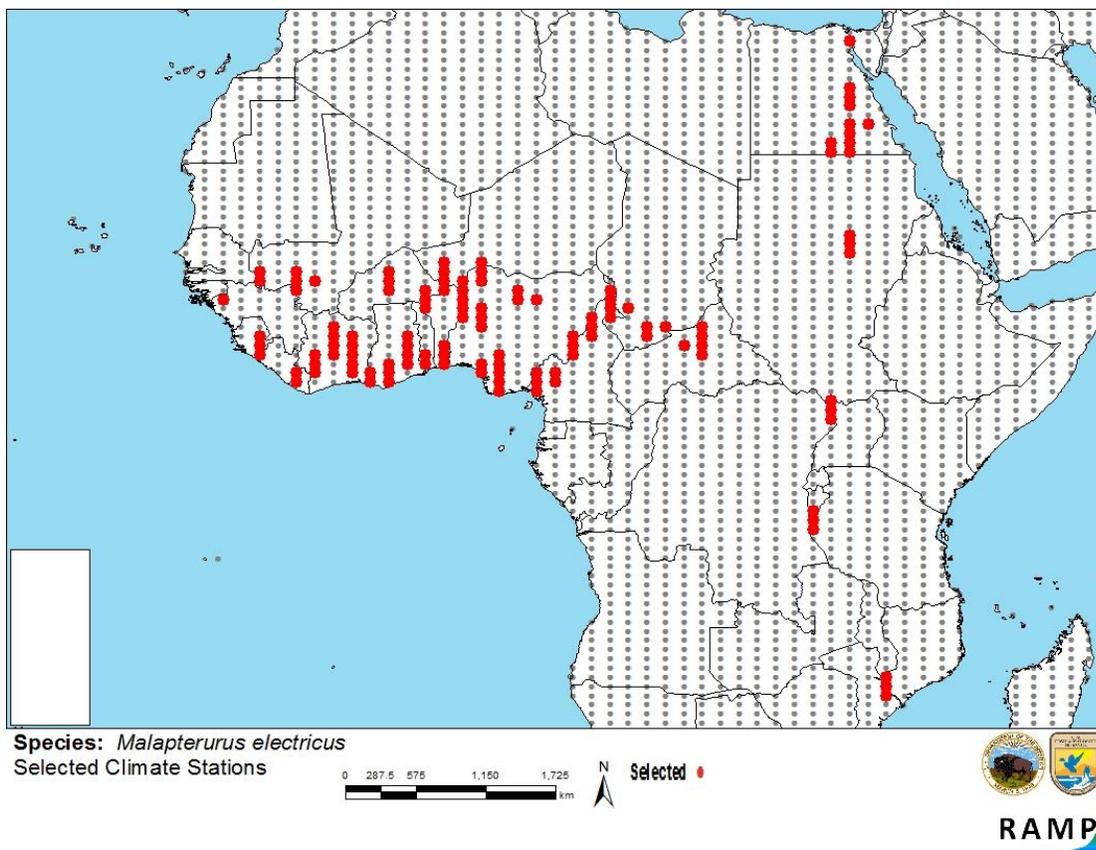


Figure 2. RAMP (Sanders et al. 2014) source map showing weather stations selected as source locations (red) and non-source locations (gray) for *Malapterus electricus* climate matching. Source locations from GBIF (2016); one location in the U.S. was excluded because of uncertainty over the origin and location of the specimen, and additional locations were excluded from parts or all of the following African countries because they lay outside the described native range (Figure 1): Botswana, Cameroon (southern), Democratic Republic of the Congo (southern), Egypt (Sinai Peninsula), Equatorial Guinea, Gabon, Guinea-Bissau, Mozambique, Republic of the Congo, Senegal, and Zimbabwe.

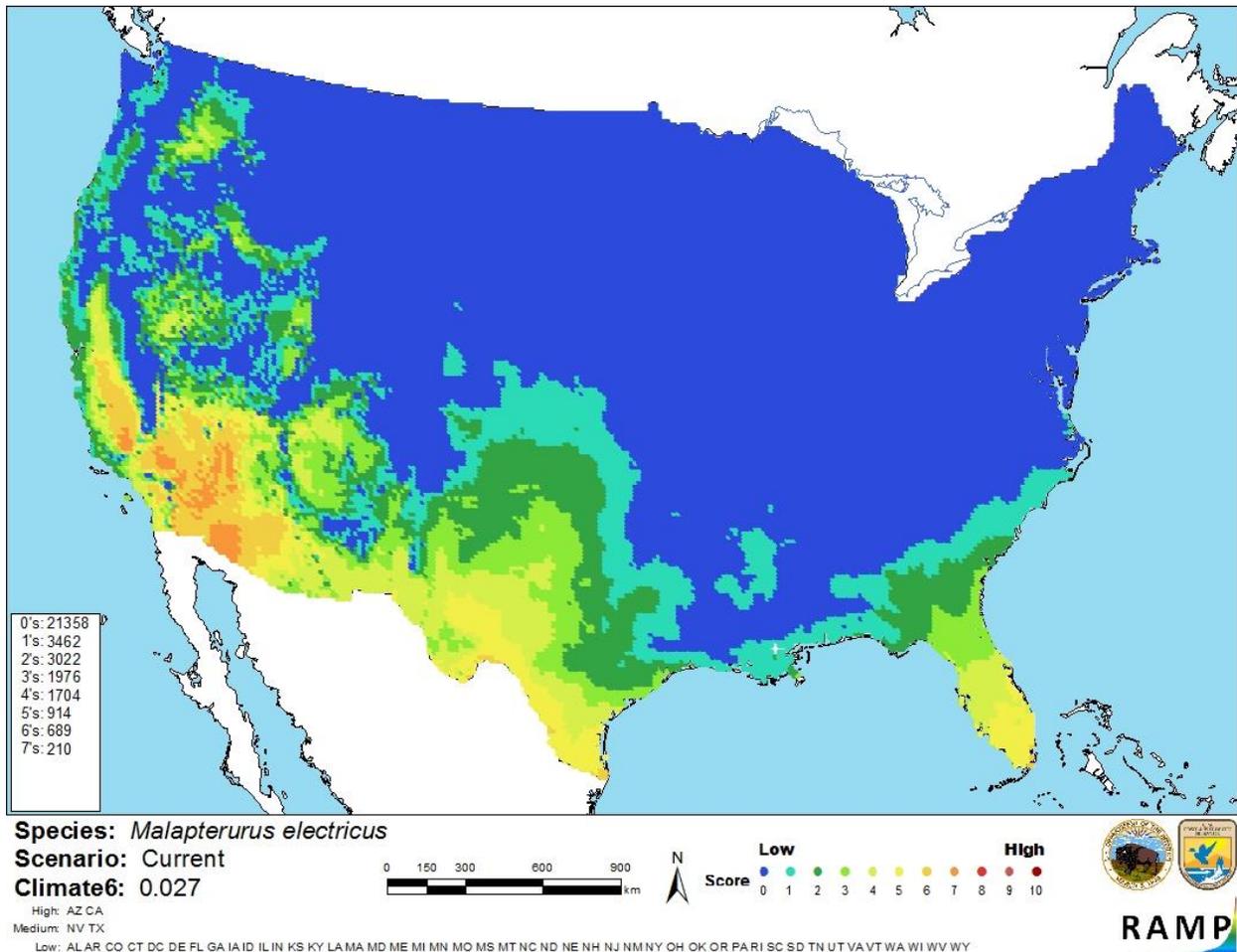


Figure 3. Map of RAMP (Sanders et al. 2014) climate matches for *Malapterurus electricus* in the contiguous United States based on source locations reported by GBIF (2016). 0= Lowest match, 10=Highest match. Counts of climate match scores are tabulated on the left.

The “High”, “Medium”, and “Low” climate match categories are based on the following table:

Climate 6: Proportion of (Sum of Climate Scores 6-10) / (Sum of total Climate Scores)	Climate Match Category
$0.000 \leq X \leq 0.005$	Low
$0.005 < X < 0.103$	Medium
≥ 0.103	High

7 Certainty of Assessment

Information is available on the biology and distribution of *Malapterurus electricus*, and certain aspects of its biology have been studied extensively. However, impacts of introduction of the species are unknown due to a very limited history of introduction outside its native range. Certainty of this assessment is low.

8 Risk Assessment

Summary of Risk to the Contiguous United States

Malapterurus electricus, the electric catfish, has a broad native distribution on the African continent. The species is notable for its electric organ, used for prey capture and defense. The electric organ discharge can be uncomfortable for humans but is not fatal. Only one introduction of this species is known aside from minor range expansion through migration. That introduction, which occurred in Germany, apparently failed before its impacts could be studied. Climate match with the contiguous United States is medium. Overall risk posed by this species is uncertain.

Assessment Elements

- **History of Invasiveness (Sec. 3): None Documented**
- **Climate Match (Sec. 6): Medium**
- **Certainty of Assessment (Sec. 7): Low**
- **Overall Risk Assessment Category: Uncertain**

9 References

Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in Section 10.

Arizona Administrative Code. 2015. Arizona Administrative Code, R12-4-406.

Azeroual, A., M. Entsua-Mensah, A. Getahun, P. Lalèyè, and J. Kazembe. 2010. *Malapterurus electricus*. The IUCN Red List of Threatened Species 2010: e.T182850A7985142. Available: <http://dx.doi.org/10.2305/IUCN.UK.2010-3.RLTS.T182850A7985142.en>. (February 2017).

Brummett, R. E. 2005. Ornamental fishes: a sustainable livelihoods option of rainforest communities. FAO Aquaculture Newsletter 33.

FFWCC (Florida Fish and Wildlife Conservation Commission). 2017. Prohibited species list. Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida. Available: <http://myfwc.com/wildlifehabitats/nonnatives/regulations/prohibited/>. (February 2017).

Froese, R., and D. Pauly, editors. 2016. *Malapterurus electricus* (Gmelin, 1789). FishBase. Available: <http://www.fishbase.se/summary/Malapterurus-electricus.html>. (February 2017).

GBIF (Global Biodiversity Information Facility). 2016. GBIF backbone taxonomy: *Malapterurus electricus* (Gmelin, 1789). Global Biodiversity Information Facility, Copenhagen. Available: <http://www.gbif.org/species/2342026>. (February 2017).

Hawaii Department of Agriculture. 2006. List of prohibited animals. Hawaii Department of Agriculture, Honolulu, Hawaii. Available: <http://hdoa.hawaii.gov/pi/files/2012/12/AR-71P.pdf>. (February 2017).

- ITIS (Integrated Taxonomic Information System). 2017. *Malapterurus electricus* (Gmelin, 1789). Integrated Taxonomic Information System, Reston, Virginia. Available: https://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=164142#null. (February 2017).
- Ng, H. 2000. *Malapterurus electricus*. Animal Diversity Web. Available: http://animaldiversity.org/accounts/Malapterurus_electricus/. (February 2017).
- NOBANIS. 2017. *Malapterurus electricus* in Germany. NOBANIS European Network on Invasive Alien Species. Available: <https://www.nobanis.org/national-species-info/?taxaid=18125&countryID=DE>. (February 2017).
- Obasohan, E. E., J. A. O. Oronsaye, and E. E. Obano. 2006. Heavy metal concentrations in *Malapterurus electricus* and *Chrysichthys nigrodigitatus* from Ogba River in Benin City, Nigeria. *African Journal of Biotechnology* 5(10):974-982.
- Omeji, S., L. O. Tihamiyu, P. A. Annune, and S. G. Solomon. 2014. Ecto and intestinal parasites of *Malapterurus electricus* from Upper River Benue. *Journal of Global Biosciences* 3(6):895-903.
- Sanders, S., C. Castiglione, and M. Hoff. 2014. Risk Assessment Mapping Program: RAMP. U.S. Fish and Wildlife Service.
- Texas Parks & Wildlife. 2017. Invasive, prohibited and exotic species. Texas Parks & Wildlife, Austin, Texas. Available: http://tpwd.texas.gov/huntwild/wild/species/exotic/prohibited_aquatic.phtml. (February 2017).

10 References Quoted But Not Accessed

Note: The following references are cited within quoted text within this ERSS, but were not accessed for its preparation. They are included here to provide the reader with more information.

- Bauer, R. 1968. Untersuchungen zur Entladungstätigkeit und zum Beutefangverhalten des Zitterwelses *Malapterurus electricus* Gmelin 1789 (Siluroidea, Malapteruridae, Lacep. 1803). *Zeitschrift für vergleichende Physiologie* 59:371-402.
- Belbenoit, P., P. Moller, J. Serrier, and S. Push. 1979. Ethological observations on the electric organ discharge behavior of the electric catfish, *Malapterurus electricus* (Pisces). *Behavioral Ecology and Sociobiology* 4:321-330.
- Gosse, J.-P. 1986. Malapteruridae. Pages 102-104 in J. Daget, J.-P. Gosse, and D. F. E. Thys van den Audenaerde, editors. Check-list of the freshwater fishes of Africa (CLOFFA), volume 2. ISNB, Brussels, Belgium; MRAC, Tervuren, Belgium; and ORSTOM, Paris.

- Ita, E. O. 1984. Kainji (Nigeria). Pages 43-103 in J. M. Kapetsky, and T. Petr, editors. Status of African reservoir fisheries. CIFA Technical Paper 10.
- Janetzko, A., H. Zimmermann, and W. Volknandt. 1987. The electromotor system of the electric catfish (*Malapterurus electricus*): a fine structural analysis. Cell Tissue Research 247:613-624.
- Møller, P. R. 1995. Electric fishes: history and behavior. Chapman & Hall, London.
- Riede, K. 2004. Global register of migratory species - from global to regional scales. Final report of the R&D-Projekt 808 05 081. Federal Agency for Nature Conservation, Bonn, Germany.
- Riehl, R., and H. A. Baensch. 1991. Aquarien Atlas, volume 1. Mergus, Verlag für Natur-und Heimtierkunde, Melle, Germany.
- Skelton, P. H. 1993. A complete guide to the freshwater fishes of southern Africa. Southern Book Publishers.
- Volknandt, W., and H. Zimmermann. 1986. Acetylcholine, ATP and proteoglycan are common constituents of synaptic vesicles isolated from electric organs of electric eel and electric catfish as well as from a rat diaphragm. Journal of Neurochemistry 47:1449-1462.