

Aquatic Invasions Records

Presence of the invasive red lionfish, *Pterois volitans* (Linnaeus, 1758), on the coast of Venezuela, southeastern Caribbean Sea

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Abstract

We report the presence of the invasive Indo-Pacific red lionfish (*Pterois volitans*) in 23 localities of the Venezuelan coast, southeastern Caribbean Sea. This finding is based on ten specimens collected at Parque Nacional Archipiélago de Los Roques (PNAR, Dependencias Federales), Playa Cal, Caraballeda and Puerto Carayaca (Estado Vargas) and 30 specimens observed in 18 localities of PNAR, Parque Nacional Morrocoy (Estado Falcón), Bahía de Cata, Ensenada de Cepe (Estado Aragua), Puerto Cruz, Chichiriviche de La Costa, Mamo, Catia La Mar, La Guaira, Macuto, Caraballeda (Estado Vargas) and Farallón Centinela (Dependencias Federales). The specimens were collected and observed from November 2009 to June 2010. This is the first published report documenting their occurrence in Venezuela.

Key words: *Pterois volitans*, lionfish, invasion, Western Atlantic, southeastern Caribbean Sea, Venezuela

The introduction of exotic or non-native species to natural ecosystems has been identified as the second greatest threat to biodiversity after habitat destruction (Gracia et al. 2009). It produces dramatic effects to biological productivity, habitat structure and species composition (Pérez et al. 2007; Gracia et al. 2009). When conditions are favorable, this introduction usually is followed by the establishment, competition and displacement of native species. This is the case of the lionfish in the Western Atlantic. The establishment and invasion of this species is of particular importance for the ecosystem and the human health, due to its venomous spines, predation on other fish species and lack of any known predators (Whitfield et al. 2002).

Lionfishes (genus *Pterois* (Linnaeus 1758)) contain nine valid species native to the Red Sea and Indian Ocean throughout the Western Pacific (Schultz 1986). Two similar species, the red lionfish *Pterois volitans* (Linnaeus, 1758), and the devil firefish *P. miles* (Bennett, 1828), documented by morphological and molecular studies (Schultz 1986; Kochzius et al. 2003; Whitfield et al. 2007), are recent invaders of the

Western Atlantic and Caribbean Sea. Molecular analyses have shown that both lionfish are present within this region, with *P. volitans* being more common than *P. miles* (Hamner et al. 2007).

During the last ten years, the red lionfish has been recognized among the most alarming invasive species in the Western Atlantic and Caribbean Sea (Schofield 2009). The first confirmed record of a red lionfish in the Atlantic waters was in the Florida Peninsula (eastern coast of USA) by a specimen collected in October 1985 (Morris and Akins 2009). Later, an escape of six specimens from a sea-side aquarium in south Florida, damaged during Hurricane Andrew (August 1992) (Courtenay 1995) occurred. Since then, internet databases (USGS-NAS 2010) and published studies, from 1999 to 2010, confirm an alarming dispersion, along the east coast of the USA (New York to Florida), Bermuda, North Caribbean (Bahamas, Turks and Caicos, Cuba, Jamaica, Cayman, Hispaniola, Puerto Rico and US Virgin Islands), Gulf of México (St. Petersburg coast, Dry Tortugas in Florida and North Yucatán Peninsula, México), Western Caribbean (México,

Belize, Honduras, San Andrés and Providencia Archipelago, Costa Rica, Panamá) and the South Caribbean Sea (Colombian coast, Curaçao and Bonaire) (Whitfield et al. 2002; Brown and Ruiz-Carus 2006; Ruiz-Carus et al. 2006; Snyder and Burgess 2007; Chevalier et al. 2008; Guerrero and Franco 2008; González et al. 2009; Molina-Ureña 2009; Schofield 2009; USGS-NAS 2010; Aguilar-Perera and Tuz-Sulub 2010).

Due to the alarming and rapid expansion of the red lionfish since early 2009, a group of Venezuelan researchers and science professionals (Bellatrix Molina: Fundación Científica Los Roques; Bladimir Rodríguez: Fundación

Museo del Mar, Juan Fernandez: Fundación Caribe Sur, along with the authors of this manuscript), began a campaign of information alerting Venezuelan coast users (divers, fishermen, swimmers, etc.) to the imminent invasion of these species, and the possible consequences for the native marine fauna and public health.

As a result of this campaign, between November 2009 and June 2010 we received several reports and specimens of red lionfish in 23 localities of the Venezuelan coast. Thirty specimens were observed, and some were photographed (Figure 1), by recreational SCUBA

Figure 1. Specimens of lionfish (*Pterois volitans*) observed (A, B, C and D) and collected (E) on the Venezuelan coast.

A: specimen (~12 cm total length) photographed by Gustavo Quiroga on December 19, 2009 at 16 m depth, in Cayo del Norte, Parque Nacional Morrocoy. **B:** specimen (~14 cm total length) photographed by Rene Sleiman on January 3, 2010 at 27 m depth, in Chichiriviche de La Costa. **C:** specimen (~12 cm total length) photographed by María Padrón on January 9, 2010 at 17 m depth, in Cayo del Norte, Parque Nacional Morrocoy. **D:** specimen (~22 cm total length), photographed by Gabriela Carías on April 3, 2010 at 27 m depth, in Gran Roque, Parque Nacional Archipiélago de Los Roques. **E:** specimen (141 mm total length) collected by D. Granados and O. Correa on March 26, 2010 at 8 m depth in Playa Cal, east of Chichiriviche de La Costa (MHNLS 25906, Annex 1). Photo by O. Lasso-Alcalá.

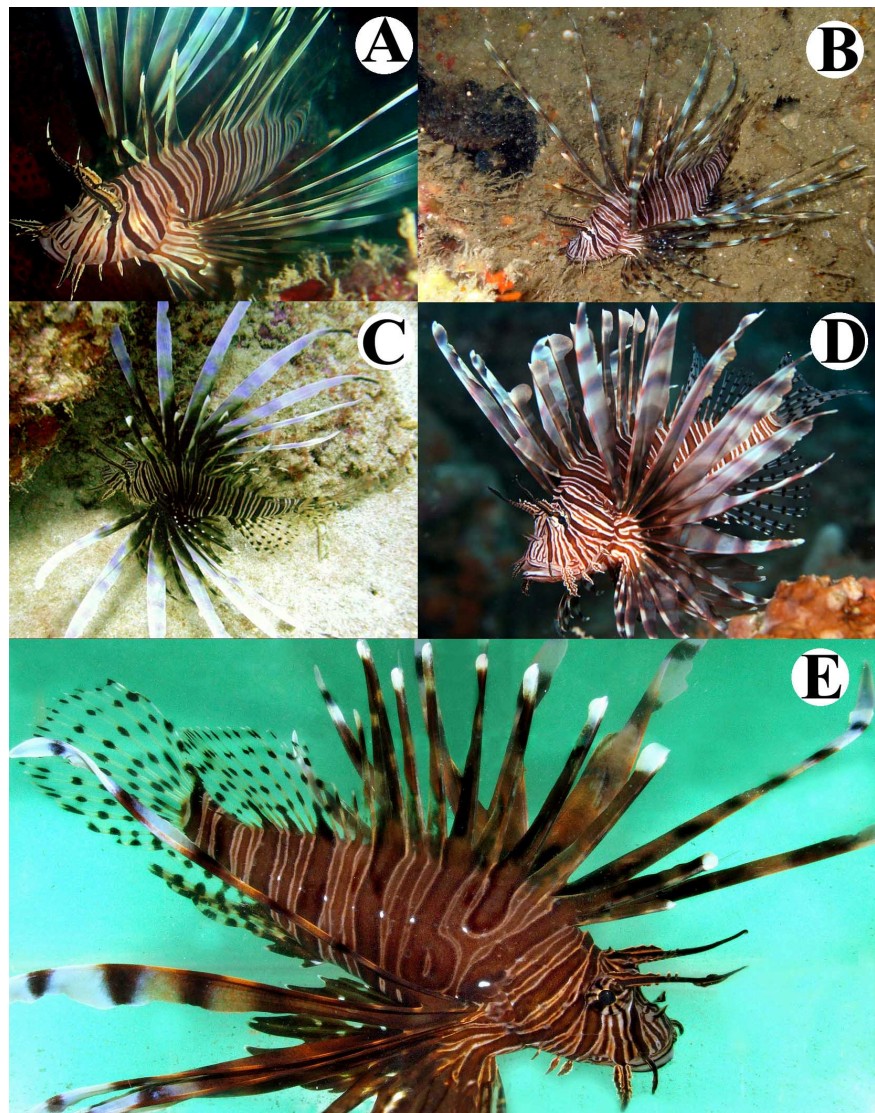
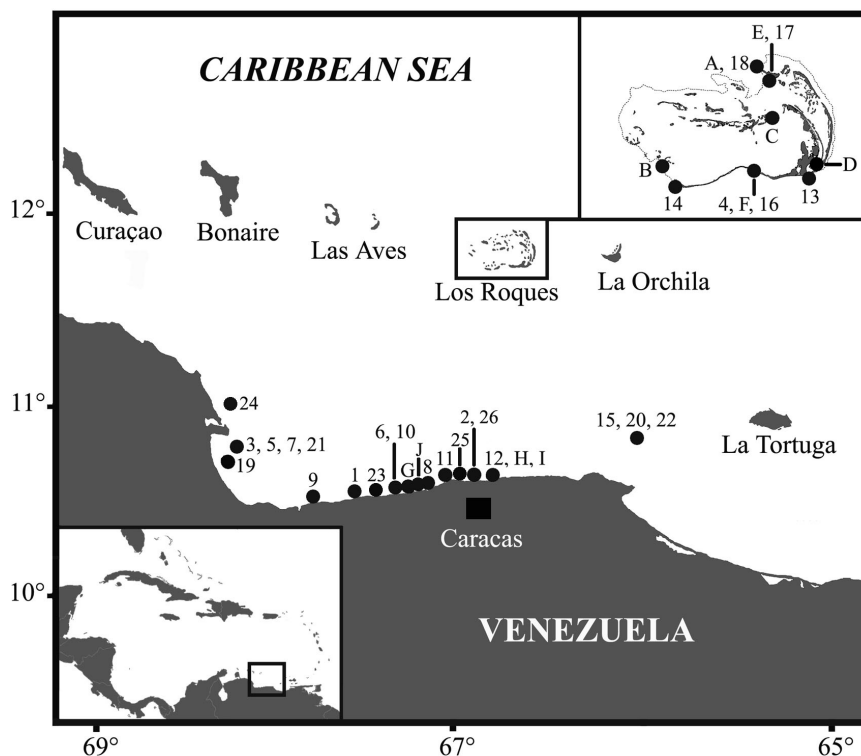


Figure 2. Distribution of *Pterois volitans* on the Venezuelan coast, southeastern Caribbean Sea. Each point corresponds to a locality. Records of observed specimens in numbers (see Annex 1). Records of collected specimens in letters (see Annex 2).



divers and local fishermen in the eastern and central regions of the Venezuelan coast, specifically at 18 sites of Parque Nacional Archipiélago de Los Roques (PNAR, Dependencias Federales), Parque Nacional Morrocoy (Estado Falcón), Bahía de Cata and Ensenada de Cepe (Estado Aragua), Puerto Cruz, Chichiriviche de La Costa, Mamo, Catia La Mar, La Guaira, Macuto, Caraballeda (Estado Vargas) and Farallón Centinela (Dependencias Federales) (Figure 2 and Annex 1). The specimens were observed from 1 to 27 m depth over coral, rock and sandy bottoms. These records were deposited into an electronic database available on the internet (<http://pezleon.cbm.usb.ve/>), which was created in February 2010 to follow the progress of the invasion of this species in Venezuelan waters.

Additionally, ten specimens were collected by local fishermen and recreational divers in Parque Nacional Archipiélago de Los Roques (11°44' – 11°58'N, 66°33' – 66°57'W), Playa Cal (10°33'11"N, 67°14'07"W), Caraballeda (10°37'18"N – 66°51'04"W) and Puerto Carayaca (10°34'13"N – 67°08'01"W) between February and June 2010 (Annex 2, Figure 1 and 2). The specimens measured between 127 and 215 mm total length (TL) and were found from 4 to 20 m depth over coral and rock bottoms. The

specimens have been deposited in the fish collection of the Museo de Historia Natural La Salle, Caracas, Venezuela (MHNLS 25900 to 25906, 26032 to 26034; Annex 2).

After examination of the available material and based on the diagnostic characteristics defined by Schultz (1986), we conclude that all specimens collected in Venezuela are *Pterois volitans*. Comparisons with meristic data from populations along the Atlantic coast of USA (Whitfield et al. 2002; Ruiz-Carus et al. 2006), Gulf of Mexico (Aguilar-Perera and Tuz-Sulub 2010) and Southwestern Caribbean (González et al. 2009), confirm this assessment (Annex 3).

In addition to *Pterois volitans*, we have registered five other species of introduced fishes on the coast of Venezuela, originating from Indo-Pacific seas, North American Atlantic coast, Gulf of Mexico and the African continent waters: *Omobranchus punctatus* (Valenciennes, 1872) (Blenniidae), *Eleotris picta* Kner, 1863, *Butis koilomatodon* (Bleeker, 1879) (Eleotridae), *Gobiosoma bosc* (Lacepède, 1800) (Gobiidae) and *Oreochromis mossambicus* (Peters, 1852) (Cichlidae). These species, except *E. picta* and *G. bosc*, are established in the western and eastern regions of the country (Lasso-Alcalá et al. unpublished data).

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References

- Aguilar-Perera A, Tuz-Sulub A (2010) Non-native, invasive Red lionfish (*Pterois volitans* (Linnaeus, 1758): Scorpaenidae), is first recorded in the southern Gulf of Mexico, off the northern Yucatan Peninsula, Mexico. *Aquatic Invasions* 5 (Supplement 1): S9–S12, doi:10.3391/ai.2010.5.S1.003
- Brown J, Ruiz-Carus R (2006) First-known lionfish caught in Florida's Gulf Coast waters. Fish and Wildlife Research Institute. http://research.myfwc.com/features/view_article.asp?id=27520 (Accessed on January 19, 2010)
- Chevalier P, Gutiérrez E, Ibarzal D, Romero S, Isla V, Calderín J, Hernández E (2008) Primer reporte de *Pterois volitans* (Pisces: Scorpaenidae) para aguas cubanas. *Solenodon* 7: 37–40
- Courtenay WR (1995) Marine fish introductions in southeastern Florida. American Fisheries Society Introduced Fish Section Newsletter 1995: 2–3
- Gonzalez J, Grijalba-Bendeck M, Acero A, Betancur R (2009) The invasive red lionfish, *Pterois volitans*, in the southwestern Caribbean Sea. *Aquatic Invasions* 4: 507–510, doi:10.3391/ai.2009.4.3.12
- Gracia A, Medellín-Mora J, Gil-Agudelo D, Puentes V (2009) Guía de las especies introducidas marino-costeras de Colombia. INVEMAR, Serie de Publicaciones Especiales No. 15. Ministerio de Ambiente, Vivienda y Desarrollo Territorial. Bogotá, Colombia. 128 p
- Guerrero KA, Franco AL (2008) First record of the Indo-Pacific red lionfish *Pterois volitans* (Linnaeus, 1758) for the Dominican Republic. *Aquatic Invasions* 3: 255–256, doi:10.3391/ai.2008.3.2.21
- Hamner RM, Freshwater DW, Whitfield PE (2007) Mitochondrial cytochrome b analysis reveals two invasive lionfish species with strong founder effects in the western Atlantic. *Journal of Fish Biology* 71: 214–222, doi:10.1111/j.1095-8649.2007.01575.x
- Kochzius M, Soller R, Khalaf MA, Blohm D (2003) Molecular phylogeny of the lionfish genera *Dendrochirus* and *Pterois* (Scorpaenidae, Pteroinae) based on mitochondrial DNA sequences. *Molecular Phylogenetics and Evolution* 28: 396–403, doi:10.1016/S1055-7903(02)00444-X
- Molina-Ureña H (2009) Comisión nacional sobre el pez león: enfrentando una nueva amenaza a las comunidades arrecifales de Costa Rica. Abstracts of the 62th Annual Gulf and Caribbean Fisheries Institute Meeting. Cumaná, Venezuela: 141–142 (Resumen)
- Morris JA, Jr., Akins JL (2009) Feeding ecology of invasive lionfish (*Pterois volitans*) in the Bahamian archipelago. *Environmental Biology of Fishes* 86: 389–398
- Morris JA, Jr., Akins JL, Barse A, Cerino D, Freshwater DW, Green S, Muñoz R, Paris C, Whitfield PE (2009) Biology and ecology of the invasive lionfish *Pterois miles* and *Pterois volitans*. *Proceedings of the Gulf and Caribbean Fisheries Institute* 61: 409–414.
- Pérez J, Alfonsi C, Salazar S, Macsotay O, Barrios J, Martínez R (2007) Especies marinas exóticas y criptogénicas en las costas de Venezuela. *Boletín Instituto Oceanográfico de Venezuela* 46: 79–96
- Ruiz-Carus R, Matheson RE, Roberts DE, Whitfield PE (2006) The western Pacific red lionfish, *Pterois volitans* (Scorpaenidae), in Florida: Evidence for reproduction and parasitism in the first exotic marine fish established in state waters. *Biological Conservation* 128: 384–390, doi:10.1016/j.biocon.2005.10.012
- Schofield PJ (2009) Geographic extent and chronology of the invasion of non-native lionfish (*Pterois volitans* [Linnaeus 1758] and *P. miles* [Bennett 1828]) in the Western North Atlantic and Caribbean Sea. *Aquatic Invasions* 4: 473–479, doi:10.3391/ai.2009.4.3.5
- Schultz ET (1986) *Pterois volitans* and *Pterois miles*: two valid species. *Copeia* 3: 686–690, doi:10.2307/1444950
- Snyder DB, Burgess GH (2007) The Indo-Pacific red lionfish, *Pterois volitans* (Pisces: Scorpaenidae), new to Bahamian ichthyofauna. *Coral Reefs* 26: 175–175, doi:10.1007/s00338-006-0176-8
- USGS-NAS (2010) USGS Nonindigenous Aquatic Species Database, Gainesville, FL <http://nas.er.usgs.gov/queries/specimenviewer.asp?SpecimenID=261964> (Accessed 10 March 2010)
- Whitfield PE, Gardner T, Vives SP, Gilligan MR, Courtenay WR, Ray GC, Hare JA (2002) Biological invasion of the Indo-Pacific lionfish *Pterois volitans* along the Atlantic coast of North America. *Marine Ecology Progress Series* 235: 289–297, doi:10.3354/meps235289
- Whitfield PE, Hare JA, David AW, Harter SL, Munoz RC, Addison CM (2007) Abundance estimates of the Indo-Pacific lionfish *Pterois volitans/miles* complex in the Western North Atlantic. *Biological Invasions* 9: 53–64, doi:10.1007/s10530-006-9005-9

Red lionfish on the coast of Venezuela

Annex 1. Specimens of *Pterois volitans* observed on the Venezuelan coasts (southeastern Caribbean Sea), in chronological order.

Record number	Location	Geographic coordinates		Record date	Number /Total length (cm)	Depth (m)	Habitat	Observers
		Latitude, N	Longitude, W					
1	Ensenada de Cepe, Estado Aragua	10°31'24"	67°30'49"	21 November 2009	1 (~12)	8	Rock bottom	C. Fischer
2	Macuto, Estado Vargas	10°36'53"	66°52'14"	12 December 2009	1 (~10)	16	Rock bottom	D. Granados and O. Correa
3	Cayo del Norte, Parque Nacional Morrocoy, Estado Falcón	10°47'04"	68°11'38"	15 and 19 December 2009	1 (~12)	14	Coral bottom	G. Quiroga
4	Boca de Cote, South Barrier, Parque Nacional Archipiélago de Los Roques. Dependencias Federales	11°46'42"	66°42'47"	31 December 2009	1 (~15)	22	Coral bottom (<i>Porites porites</i>)	G. Rojas
5	Cayo del Norte, Parque Nacional Morrocoy, Estado Falcón	10°47'04"	68°11'38"	2 January 2010	1 (~10)	14	Coral bottom	I. Santana
6	Chichiriviche de la Costa, Estado Vargas	10°33'40"	67°14'15"	2 and 3 January 2010	1 (~14)	27	Rock bottom	M. Padrón, R. Sleiman and J. Bastidas
7	Cayo del Norte, Parque Nacional Morrocoy, Estado Falcón	10°47'04"	68°11'38"	9 January 2010	1 (~10)	17	Coral bottom	M. Padrón
8	Mamo, Estado Vargas	10°35'36"	67°03'44"	16 January 2010	1 (~15)	1	Rock bottom	D. Granados and O. Correa
9	Bahía de Cata, Estado Aragua	10°30'00"	67°44'20"	30 January and 1 February 2010	1 (~15)	20	Sandy bottom	R. Echeverría, M. Guardiano and J. Monari
10	Chichiriviche de La Costa, Estado Vargas	10°33'40"	67°14'15"	6 February 2010	1 (~12)	23	Rock bottom	M. Padrón
11	Catia La Mar, Estado Vargas	10°36'19"	67°02'23"	25 February 2010	1 (~13)	15	Rock bottom	D. Granados
12	Caraballeda, Estado Vargas	10°37'18"	66°51'04"	26 February 2010	1 (~12)	15	Rock bottom	N. Rodríguez
13	Las Uvas, South Barrier, Parque Nacional Archipiélago de Los Roques. Dependencias Federales	11°45'20"	66°37'20"	26 February 2010	1 (~13)	15	Coral bottom	G. Hernández
14	Cayo Sal, Parque Nacional Archipiélago de Los Roques. Dependencias Federales	11°45'54"	66°52'29"	6 March 2010	1 (~15)	10	Coral bottom	J. Cabrera
15	Farallón Centinela, Estado Vargas	10°48'59"	66°05'00"	13 March 2010	1 (~22)	24	Rock bottom	H. Silva
16	Boca de Cote, South Barrier, Parque Nacional Archipiélago de Los Roques. Dependencias Federales	11°46'42"	66°42'47"	30 March 2010	1 (~22)	16	Coral bottom	R. Sleiman

Annex 1 (continued).

Record number	Location	Geographic coordinates		Record date	Number /Total length (cm)	Depth (m)	Habitat	Observers
		Latitude, N	Longitude, W					
17	Gran Roque, Parque Nacional Archipiélago de Los Roques. Dependencias Federales	11°57'19"	66°40'16"	3 April 2010	1 (~22)	27	Coral bottom	G. Carias
18	La Guasa, Parque Nacional Archipiélago de Los Roques. Dependencias Federales	11°57'52"	66°42'22"	3 April 2010	1 (~15)	27	Coral bottom	R. Ojeda
19	Cayo del Sur, Parque Nacional Morrocoy, Estado Falcón	10°43'41"	68°39'37"	17 April 2010	2 (15 ~ 20)	12	Coral bottom	A. Urdaneta
20	Farallón Centinela, Estado Vargas	10°48'59"	66°05'00"	24 April 2010	1 (~20)	22	Coral bottom	J. Saleta
21	Cayo del Norte, Parque Nacional Morrocoy, Estado Falcón	10°47'04"	68°11'38"	26 April 2010	1 (~20)	12	Coral bottom	M. Padrón
22	Farallón Centinela, Estado Vargas	10°48'59"	66°05'00"	08 May 2010	2 (~20)	21	Coral bottom	A. Golding
23	Puerto Cruz, Estado Vargas	10°32'36"	67°20'43"	30 May 2010	1 (~15)	19	Rock bottom	M. Padrón
24	Norte de Cayo Borracho, Parque Nacional Morrocoy, Estado Falcón	10°58'59"	68°14'49"	17 June 2010	1 (~12)	14	Coral bottom	W. Vidal
25	Puerto de La Guaira, Estado Vargas	10°36'21"	66°56'51"	18 June 2010	1 (~20)	17	Rock bottom	D. Granados and O. Correa
26	Macuto, Estado Vargas	10°36'53"	66°52'14"	25 June 2010	3 (3~20)	15	Rock bottom	D. Granados and N. Rodríguez

Red lionfish on the coast of Venezuela

Annex 2. Examined specimens of *Pterois volitans* from Parque Nacional Archipiélago de Los Roques (PNAR, Dependencias Federales; 11°44'–11°58'N, 66°33'–66°57'W), Playa Cal (eastern of Chichiriviche de La Costa; 10°33'11"N – 67°14'07"W), Caraballeda (10°37'18" N - 66°51'04"W) and Puerto Carayaca (10°34'13" N - 67°08'01"W), Estado Vargas, Venezuela.

Record number	Location	Geographic coordinates		Record date	Total length (mm)	Depth (m)	Collection #	Collectors
		Latitude,N	Longitude,W					
A	La Guasa, (PNAR)	11°57'52"	66°42'22"	7 February 2010	153	20	MHNLS 25900	S. Orbegozo, C. Borneo and G. Rojas
B	La Pelona, Dos Mosquises Sur, (PNAR)	11°47'14"	66°53'03"	13 February 2010	158	7	MHNLS 25901	C. Rivas
C	Rabusky, (PNAR)	11°52'33"	66°41'24"	14 February 2010	140	5	MHNLS 25902	T. Mata
D	Gresky, (PNAR)	11°45'29"	66°37'28"	20 February 2010	135	7	MHNLS 25903	R. Leiva
E	Gran Roque, (PNAR)	11°57'19"	66°40'16"	22 February 2010	127	7	MHNLS 25904	G. Hernández
F	Boca de Cote, (PNAR)	11°46'42"	66°42'47"	10 March 2010	190	7	MHNLS 25905	G. Rojas and C. Borneo
G	Playa Cal	10°33'11"	67°14'07"	26 March 2010	141	8	MHNLS 25906	D. Granados and O. Correa
H	Caraballeda	10°37'18"	66°51'04"	14 April 2010	128	4	MHNLS 26032	A. Rincón
I	Caraballeda	10°37'18"	66°51'04"	29 May 2010	157	5	MHNLS 26033	A. Rincón
J	Puerto Carayaca	10°34'13"	67°08'01"	18 June 2010	215	17	MHNLS 26034	D. Granados and O. Correa

Annex 3. Meristic data for *Pterois volitans*, from Parque Nacional Archipiélago de Los Roques, Playa Cal, Caraballeda, and Puerto Carayaca, Venezuela, compared to specimens from other geographic areas. References: 1) Schultz 1986; 2) Whitfield *et al.* 2002; 3) Ruiz-Carus *et al.* 2006; 4) Aguilar-Perera and Tuz-Sulub 2010; 5) González *et al.* 2009 and 6) This study.

Parameter	Geographic area					
	Indo-Pacific	North Carolina	Florida	México	Colombia	Venezuela
Dorsal fin	XIII-10,12	XIII-11	XIII-11,13	XIII-11	XIII-11,12	XIII-12
Anal fin	III-5,8	III-7	III-7,8	III-8	III-7,8	III-8
Total length (mm)	85-235	100-120	134-378	137	96-157	127-215
Depth (m)	unknown	39-42	45-38	38	12-20	4-20
Reference	1	2	3	4	5	6