

Pterois volitans 正體中文

System: Marine

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Actinopterygii	Scorpaeniformes	Scorpaenidae

Common name scorpion volitans (English), peacock lionfish (English), Indo-Pacific red lionfish (English)

Synonym *Scorpaena volitans* , (Linnaeus, 1758)
Pterois zebra , Quoy and Gaimard, 1825
Brachirus zebra , (Quoy and Gaimard, 1825)
Pterois cristatus
Pterois geniserra
Pterois muricata
Gasterosteus volitans

Similar species *Pterois miles*

Summary The Indo-Pacific red lionfish (*Pterois volitans*) is a beautiful but dangerous tropical fish that has spread to new marine environments through the aquarium trade. The lionfish has invaded the Northwestern Atlantic and the Caribbean in one of the most rapid marine finfish invasions in history. In some areas, it has the potential to displace commercially important species such as the grouper and reduce recruitment of juvenile fishes, which in turn disrupts marine ecosystem processes.



[view this species on IUCN Red List](#)

Species Description

Pterois volitans has elongated venomous dorsal fin spines and anal fin spines. It has 13 dorsal spines, 10 to 11 dorsal soft rays, 3 anal spines, 6 to 7 anal soft rays. Coastal populations are generally darker, sometimes almost black in estuaries (FishBase 2006). The membranes of fins are often spotted. The body is white or cream coloured with red to reddish-brown vertical stripes. The vertical stripes alternate from wide to very thin and sometimes merge along the flank to form a V (Schofield and Fuller 2006). The maximum length of an adult is 38cm (FishBase 2006) and the maximum body weight is 1.1kg to 1.2kg (Fishelson 1997). Reports of a 43cm individual have been obtained in its introduced range.

Notes

Lionfish comprises a species complex whose native range encompasses the Red Sea, the Indian Ocean and the western Pacific (Schultz 1986, in González *et al.* 2009). While traditional taxonomy indicates that *P. volitans* (Linnaeus 1758) and *Pterois miles* (Bennett 1828, in González *et al.* 2009) (devil firefish) comprise two different valid species (Schultz 1986, in González *et al.* 2009), recent molecular studies suggest that there is uncertainty in determining whether the two entities represent species or populations (Kochzius *et al.* 2003, Whitfield *et al.* 2007, in González *et al.* 2009). This species profile focuses on information on *Pterois volitans*; information on *P. miles* is included where appropriate.

Lifecycle Stages

Larval stage descriptions for *Pterois miles* and *P. volitans* are incomplete with only one report by Imamura and Yabe (1996, in Morris *et al.* 2008) describing five *P. volitans* larvae collected off northwestern Australia.

Scorpaenid larvae exhibit two morphologically distinct groups characterized as “morph A” and “morph B”; pteroine larvae are grouped among the morph B morphotypes, whose traits include: large head, relatively long and triangular snout, long and serrated head spines, robust pelvic spine, and pigment confined to the pectoral fins and postanal ventral and dorsal midlines (Leis and Rennis 2000, Washington *et al.* 1984, in Morris *et al.* 2008). *Pterois* sp. meristic characters are reported as 12 to 13 dorsal spines, 9 to 12 dorsal rays, three anal spines, 5 to 8 anal rays, 12 to 18 pectoral rays, one pelvic spine, five pelvic rays and 24 vertebrae (Imamura and Yabe 1996, Leis and Rennis 2000, in Morris *et al.* 2008).

The size of *P. miles* or *P. volitans* larvae at hatching is unmeasured, but is likely to be approximately 1.5 mm based on reports for *P. lunulata* (Mito and Uchida 1958, Mito 1963, in Morris *et al.* 2008). The specific planktonic larval duration of lionfish is also unknown, although it is estimated to be between 25 to 40 days based estimates for *Scorpaena* (Laidig and Sakuma 1998, Hare and Whitfield 2003, in Morris *et al.* 2008).

Uses

Pet/aquarium trade: The red lionfish is a popular species among tropical fish enthusiasts (Schofield and Fuller 2006).

Fisheries: Commercial fisheries of red lionfish exist in the lionfish’s native range (FishBase 2006) and it is reportedly a viable commercial species in its introduced range also, although encouraging such fisheries may encourage the intentional dispersal of the fish (see Management Information).

Bioprospecting: Work by Sri Balasubashini and colleagues (2006a, 2006b, in Morris *et al.* 2008) indicated that lionfish (*P. volitans*) venom produces antitumor, hepatoprotective, and antimetastatic effects in mice suggesting a promising application for cancer research.

Habitat Description

Pterois volitans is a tropical marine fish which usually occurs in waters with temperatures of between 22°C and 28°C. Lower temperature ranges have been observed in the USA (14°C to 24°C) (Meister *et al.* 2005). The depth range of this species is 10 to 175 meters (Schofield & Fuller 2006). The red lionfish favours coral reefs and rocky outcrops (DaCosta-Cottam *et al.* 2009), although it has been observed over coral patches, near sandy bottoms and in mangrove, seagrass and even canal habitats (Schofield 2009; González *et al.* 2009). It is also found in lagoons and harbours (FishBase 2006). It hides in unexposed places during the daytime often with its head down, practically immobile.

Richter (2009) hypothesises that the range of the lionfish will reach the Gulf of Mexico and expand south along the eastern coast of South America until it reaches a southern latitude where it cannot tolerate low temperatures (Hare and Whitfield 2003, in Richter 2009). The southernmost sighting has been in Columbia, though there is potential for the lionfish to extend past that (Schofield 2009, in Richter 2009). The northern limit of the range is North Carolina; a functional expansion northward is unlikely unless the lionfish population undergoes a rapid evolution to thermal tolerance; some juveniles have been seen as far north as Long Island Sound, although they cannot become established due to cold winters (Richter 2009). Temperature is a possible factor limiting; the mean chronic lethal minimum is 10°C and the mean temperature of feeding cessation is 16°C, indicating that the lionfish might over-winter on the southeast United States continental shelf, with a northern limit of Cape Hatteras (Kimball *et al.* 2004).

Reproduction

Lionfish reach sexual maturity at around 18cm or 140g to 160g (approximately 1 to 2 years of age); they are external fertilizers that produce a pelagic egg mass following a courtship and mating process (Fishelson 1997; Florida Museum of Natural History 2006; DaCosta-Cottam *et al.* 2009). Reportedly females may produce up to 30 000 eggs a month, each of which will hatch in four days. The Pteroinae, including *P. miles* and *P. volitans*, are gonochoristic; males and females exhibit minor sexual dimorphism only during reproduction (see Fishelson 1975, in Morris *et al.* 2008). Lionfish courtship has been well described by Fishelson (1975, in Morris *et al.* 2008) who provided a detailed description for the pigmy lionfish (*Dendrochirus brachypterus*) and reported similar courtship behaviors for *Pterois* spp. According to Fishelson, lionfish courtship, which includes circling, side winding, following, and leading, begins shortly before dark and extends well into nighttime hours; following the courtship phase, the female releases two buoyant egg masses that are fertilized by the male and ascend to the surface; the eggs and later embryos are bound in adhesive mucus that disintegrates within a few days, after which the embryos and/or larvae become free floating. \n\n

P. miles and *P. volitans* ovarian morphology is similar to that reported for *D. brachypterus* (Fishelson 1978, in Morris *et al.* 2008) in that these fishes exhibit cystovarian type ovaries (Hoar 1957, in Morris *et al.* 2008) with oocytes developing on stalks or peduncles. The oocytes are terminally positioned near the ovary wall, which secretes the encompassing mucus shortly before spawning. \n\n

The seasonality of lionfish reproduction throughout their native range is unknown; invasive lionfish collected off North Carolina and in the Bahamas suggests that lionfish are reproducing during all seasons of the year (Morris *et al.* 2008).

Nutrition

Pterois volitans is an ambush predator that preys on small and juvenile fish, crustaceans (crabs and shrimps), molluscs and isopods. Lionfish are relatively quick to adapt to novel prey types, and quickly learn to avoid toxic prey (Fishelson 1997); in its invaded system in Caribbean reef ecosystems it uses its oversized, ornate pectoral fins to herd and ambush small reef fishes and crustaceans (Albins & Hixon 2008; Albins 2008). Analysis of gut contents and aquarium feeding trials confirm that the lionfish preys on a wide variety of native animals, including bony fishes and crustaceans, and that lionfish are capable of consuming large numbers of prey and large-sized prey relative to their body size (Albins 2008). For example, analysis of gut contents of 291 lionfish caught off the coast of Quintana Roo, Mexico, revealed the following prey items: bluehead wrasse, yellowhead wrasse, clown wrasse, creole wrasse, lizard fish, filefish, cardinal fish, blue chromis, brown chromis, fairy basslet, peppermint basslet, masked goby, goldspot goby, glass goby, rusty goby, spotted goatfish, trumpet fish, Spanish hogfish, spotted goatfish, slender filefish, redband parrot fish, hamlet fish, octopus, banded coral shrimp and night shrimp (D. Ponce-Taylor Pers. Comm.; Y.G. Hernandez Pers. Comm.). Assessments of invasive lionfish feeding suggest that lionfish are largely piscivorous, but also feed on a number of crustaceans; the particular taxa of highest importance in invasive lionfish diet will likely vary by habitat type and prey availability (Morris *et al.* 2008). A diet study of Bahamian lionfish was conducted by Morris and Akins (In Press) that showed that lionfish primarily eat teleost fishes (they documented 41 species in 21 families) as well as some crustaceans (about 15% of the diet by volume) (in Schofield 2009). \n

In the Red Sea, individuals of the closely related *P. miles* were reported to feed on assorted taxa of benthic fishes including damselfish, cardinal fish, and anthias (Fishelson 1975 1997, in Morris *et al.* 2008). However, in the Pacific Ocean, *P. lunulata* were observed to feed primarily on invertebrates including penaeid and mysid shrimps (Matsumiya *et al.* 1980, Williams and Williams 1986, in Morris *et al.* 2008). \n\n

Lionfish stomachs can expand over 30 times in volume when consuming a large meal; lionfish are capable of long-term fasting and are able to withstand starvation for periods of over 12 weeks without mortality (Fishelson 1997, in Morris *et al.* 2008). Lionfish (ranging from 30 to 300g) consume approximately 2.5% to 6% of their body weight per day (at 25°C to 26°C) in their native range; adults (ranging from 300 to 400 g) consume approximately 8.5 g of prey per day, which translates to 230 kg per year for 80 adult fish on a 1 kilometer stretch of coral reef (Fishelson 1997). Preliminary observations suggest that lionfish in their invaded range consume piscine prey at rates greater than in their native range (Morris *et al.* 2008).



GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: *Pterois volitans*

General Impacts

For a detailed account of the environmental impacts of *Pterois volitans* please read: [Pterois volitans \(Indo-Pacific Red Lionfish\) Impacts Information](#). The information in this document is summarised below. Invasive lionfish are a concern to coastal managers due to their potential threat to fisheries resources, native fish communities and human health (Morris *et al.* 2008).

Ecosystem change: While few ecological studies have been conducted (but see Albins & Hixon 2008) it is clear that the lionfish's presence in the Caribbean is a worrying one. Lionfish are highly piscivorous and reduce the recruitment of juvenile fishes, which in turn disrupts marine ecosystem processes and reduces reef biodiversity (Albins and Hixon 2008; Morris *et al.* 2008).

Reduction in native biodiversity: If their populations are allowed to continue growing unchecked, lionfish have the potential to severely reduce reef biodiversity, with the possible extinction of several species; although it is still too early to be definitive, anecdotal evidence from the Bahamas corroborates this premise (Dell 2009).

Predation: Albins and Hixon (2008) showed that lionfish can drastically reduce recruitment of native fishes on small patch reefs in the Bahamas. They are potentially capable of decimating indigenous reef fish populations in the Caribbean due to their lack of natural predators and voracious appetite (Valdez Mascari & Aguiar 2009).

Competition: Not only do lionfish consume large quantities of juvenile fish (such as grouper and yellow-tail snapper) but they also out-compete native species (such as scamp, gag, and yellow-mouth grouper) for food (Morris *et al.* 2008; Dell 2009).

Economic/Livelihoods: In addition, by reducing populations of commercially important species such as grouper (Albins and Hixon 2008) they may as a consequence damage the economy of island communities which are dependent on such fishing industries.

Human health: Lionfish are venomous with their spines containing apocrine-type venom glands (Morris *et al.* 2008). Lionfish venom has been found to cause cardiovascular, neuromuscular, and cytolytic effects ranging from mild reactions such as swelling to extreme pain and paralysis in upper and lower extremities (Kizer *et al.* 1985, in Morris *et al.* 2008). The toxin in lionfish venom contains acetylcholine and a neurotoxin that affects neuromuscular transmission (Cohen and Olek 1989, in Morris *et al.* 2008). Lionfish spines can prove dangerous to divers, snorkelers and aquarium enthusiasts (Morris *et al.* 2008; Schofield 2009). Stings are not fatal, but intensely painful and often requiring hospitalisation (Morris *et al.* 2008). Lionfish stings can be treated by heating the afflicted part in hot water (to 45° C) for 30 to 90 minutes and applying corticoids to the area (FishBase 2006); medical attention should be sought immediately (Cayman Islands Government Undated).



GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: *Pterois volitans*

Management Info

For a detailed account of management of *Pterois volitans* please read: [Pterois volitans \(Indo-Pacific Red Lionfish\) Management Information](#). The information in this document is summarised below.

Preventative measures: Where the lionfish has not yet become properly established, preventative controls may include education of fishermen and other locals and encouraging the public to kill the fish on-sight and record positional data (Richter 2009). Some countries have urged recreational divers and snorkelers to record locations of lionfish sightings; other governments and programs have given monetary incentives to fishermen to catch and record positional data of lionfish (REEF 2009, in Richter 2009).

Monitoring: Determining the extent of the lionfish invasion is necessary for effective management (Richter 2009). Organizations such as the Reef Environmental Educational Foundation (REEF) and the United States Geographical Survey-Nonindigenous Aquatic Species (USGS-NAS) have collected data of GPS locations, dates, water depth, and locality description of lionfish sightings (Richter 2009).

Biocontrol: Groupers, a known natural predator of the lionfish, could hold the key to controlling this invasive species, however, this remains uncertain and unfortunately Atlantic populations of grouper are suffering from over-fishing (IUCN 2009). There is hope that through the establishment of Marine Protected Areas (MPAs) sufficient levels of groupers will return, providing an effective and natural means to control lionfish (IUCN 2009).

Physical: In order to control and manage the lionfish invasion, culling programs have been introduced in the Cayman Islands, Bermuda and the Bahamas (*4th UK CBD Report 2009*; Adam-Whitmore 2009).

Integrated Pest Management: Although bio-economic evaluations are necessary to determine the most effective management scheme, Richter (2009) suggests the establishment of a lionfish fishery may prove to be effective (Richter 2009). With the advent of an invasive species fishery, there are certain precautions, however; with the introduction of a potentially economically viable fishery, there lies the risk that people who reap the economic benefits may seek to maintain wild populations of the lionfish (Carlton, Pers. Comm., in Richter 2009).

Pathway

Eggs and larvae of the red lionfish may be transported via ballast water (Whitfield 2002).

Principal source:

Compiler: National Biological Information Infrastructure (NBII) & IUCN/SSC Invasive Species Specialist Group (ISSG)

Updates with support from the Overseas Territories Environmental Programme (OTEP) project XOT603, a joint project with the Cayman Islands Government - Department of Environment

Review:

Publication date: 2010-08-10

ALIEN RANGE

[3] ATLANTIC - WESTERN CENTRAL

[1] BARBADOS

[1] BERMUDA

[4] CAYMAN ISLANDS

[4] COLOMBIA

[2] CUBA

[1] DOMINICAN REPUBLIC

[1] HAITI

[1] JAMAICA

[12] MEXICO

[2] BAHAMAS

[1] BELIZE

[1] BES ISLANDS (BONAIRE, SINT EUSTATIUS AND SABA)

[1] COASTS OF THE CARIBBEAN

[2] COSTA RICA

[1] CURACAO

[1] GREATER ANTILLES

[1] HONDURAS

[1] LESSER ANTILLES

[1] NICARAGUA



GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: *Pterois volitans*

[1] PANAMA
[1] TURKS AND CAICOS ISLANDS
[1] VENEZUELA
[1] WEST INDIES

[1] PUERTO RICO
[23] UNITED STATES
[2] VIRGIN ISLANDS, U.S.

BIBLIOGRAPHY

44 references found for *Pterois volitans*

Management information

[Adam-Whitmore, S. 2009. The Lionfish Invasion of Caribbean Waters, London Grip.](#)

Summary: Available from: http://www.londongrip.com/LondonGrip/Ecology:_LionFish_Sharon_Adam-Whitmore.html [Accessed 11 November 2009]

Albins, Mark A. & Mark A. Hixon., 2008. Invasive Indo-Pacific lionfish *Pterois volitans* reduce recruitment of Atlantic coral-reef fishes. *Marine Ecology Progress Series* Vol. 367: 233-238, 2008

[Brice X. Semmens, Eric R. Buhle, Anne K. Salomon and Christy V. Pattengill-Semmens. 2004. A hotspot of non-native marine fishes: evidence for the aquarium trade as an invasion pathway. *Marine ecology progress series* 266: 239-244.](#)

Summary: This paper stresses on aquarium trades as an invasion pathway and the urgency of invasive species control based on evaluations of their ecological impacts.

Available from: http://www.reef.org/data/meps_exotic.pdf [Accessed 16 November 2006]

[Cayman Islands Government. Undated. *Lionfish*.](#)

Summary: Available from: http://www.gov.ky/portal/page?_pageid=1142,4332603&_dad=portal&_schema=portal [Accessed 10 November 2009]

[Central Caribbean Marine Institute. 2007-2009. *Research > Invasive Species*](#)

Summary: Available from: http://www.reefresearch.org/ccmi_website/research/research_06.htm [Accessed 10 November 2009]

[Centre for Environment, Fisheries & Aquaculture Science \(CEFAS\)., 2008. *Decision support tools-Identifying potentially invasive non-native marine and freshwater species: fish, invertebrates, amphibians*.](#)

Summary: The electronic tool kits made available on the Cefas page for free download are Crown Copyright (2007-2008). As such, these are freeware and may be freely distributed provided this notice is retained. No warranty, expressed or implied, is made and users should satisfy themselves as to the applicability of the results in any given circumstance. Toolkits available include 1) FISK- Freshwater Fish Invasiveness Scoring Kit (English and Spanish language version); 2) MFISK- Marine Fish Invasiveness Scoring Kit; 3) MI-ISK- Marine invertebrate Invasiveness Scoring Kit; 4) FI-ISK- Freshwater Invertebrate Invasiveness Scoring Kit and AmphISK- Amphibian Invasiveness Scoring Kit. These tool kits were developed by Cefas, with new VisualBasic and computational programming by Lorenzo Vilizzi, David Cooper, Andy South and Gordon H. Copp, based on VisualBasic code in the original Weed Risk Assessment (WRA) tool kit of P.C. Pheloung, P.A. Williams & S.R. Halloy (1999).

The decision support tools are available from:

<http://cefas.defra.gov.uk/our-science/ecosystems-and-biodiversity/non-native-species/decision-support-tools.aspx> [Accessed 13 October 2011]

[The guidance document](#) is available from http://www.cefas.co.uk/media/118009/fisk_guide_v2.pdf [Accessed 13 January 2009].

[Clearwater, Susan J.; Chris W. Hickey and Michael L. Martin. 2008. *Overview of potential piscicides and molluscicides for controlling aquatic pest species in New Zealand. Science for conservation* 283. March 2008, New Zealand Department of Conservation](#)

Summary: Available from: <http://www.doc.govt.nz/upload/documents/science-and-technical/sfc283entire.pdf> [Accessed 20 March 2008]

[Courtenay W. R, Robins C. R., 1973. Exotic aquatic organisms in Florida with emphasis on fishes: a review and recommendations. *Trans AFS* 102:1-12](#)

Summary: This paper highlights the importance of informing the public about the legality and environmental impacts of exotic-species introductions.

[DaCosta-Cottam, M., Olynik, J., Blumenthal, J., Godbeer, K.D., Gibb, J., Bothwell, J., Burton, F.J., Bradley, P.E., Band, A., Austin, T., Bush, P., Johnson, B.J., Hurlston, L., Bishop, L., McCoy, C., Parsons, G., Kirkconnell, J., Halford, S. and Ebanks-Petrie, G. 2009. *Cayman Islands National Biodiversity Action Plan 2009*. Cayman Islands Government. Department of Environment.](#)

[Gomez, Yadira. 2010. *Status of the lionfish \(Pteroris sp.\) in the Sian Ka'an and the Sian Ka'an Reefs Biosphere Reserves IUCN/SSC Invasive Species Specialist Group \(ISSG\).*, 2010. *A Compilation of Information Sources for Conservation Managers*.](#)

Summary: This compilation of information sources can be sorted on keywords for example: Baits & Lures, Non Target Species, Eradication, Monitoring, Risk Assessment, Weeds, Herbicides etc. This compilation is at present in Excel format, this will be web-enabled as a searchable database shortly. This version of the database has been developed by the IUCN SSC ISSG as part of an Overseas Territories Environmental Programme funded project XOT603 in partnership with the Cayman Islands Government - Department of Environment. The compilation is a work under progress, the ISSG will manage, maintain and enhance the database with current and newly published information, reports, journal articles etc.

[Kimball, M.E., Miller, J.M, Whitfield, P.E. & Hare, J.A. 2004. Thermal tolerance and potential distribution of invasive lionfish \(*Pterois volitans/miles* complex\) on the east coast of the United States, *Marine ecology. Progress series* 283: pp. 269-278.](#)

[Lee Richter. 2009. *Population and range assessment of the invasive Lionfish \(Pterois volitans/miles\) and discussion of regional-specific effective management strategies*.](#)

Summary: Available from: envstudies.brown.edu/theses/LeeRichterThesisProposal.doc [Accessed 11 November 2009]

[Mendoza, R.E.; Cudmore, B.; Orr, R.; Balderas, S.C.; Courtenay, W.R.; Osorio, P.K.; Mandrak, N.; Torres, P.A.; Damian, M.A.; Gallardo, C.E.; Sanguines, A.G.; Greene, G.; Lee, D.; Orbe-Mendoza, A.; Martinez, C.R.; and Arana, O.S. 2009. Trinational Risk Assessment Guidelines for Aquatic Alien Invasive Species. Commission for Environmental Cooperation. 393, rue St-Jacques Ouest, Bureau 200, Montréal \(Québec\), Canada. ISBN 978-2-923358-48-1.](#)

Summary: In 1993, Canada, Mexico and the United States signed the North American Agreement on Environmental Cooperation (NAAEC) as a side agreement to the North American Free Trade Agreement (NAFTA). The NAAEC established the Commission for Environmental Cooperation (CEC) to help the Parties ensure that improved economic efficiency occurred simultaneously with trinational environmental cooperation. The NAAEC highlighted biodiversity as a key area for trinational cooperation. In 2001, the CEC adopted a resolution (Council Resolution 01-03), which created the Biodiversity Conservation Working Group (BCWG), a working group of high-level policy makers from Canada, Mexico and the United States. In 2003, the BCWG produced the Strategic Plan for North American Cooperation in the Conservation of Biodiversity. This strategy identified responding to threats, such as invasive species, as a priority action area. In 2004, the BCWG, recognizing the importance of prevention in addressing invasive species, agreed to work together to develop the draft CEC Risk Assessment Guidelines for Aquatic Alien Invasive Species (hereafter referred to as the Guidelines). These Guidelines will serve as a tool to North American resource managers who are evaluating whether or not to introduce a non-native species into a new ecosystem. Through this collaborative process, the BCWG has begun to implement its strategy as well as address an important trade and environment issue. With increased trade comes an increase in the potential for economic growth as well as biological invasion, by working to minimize the potential adverse impacts from trade, the CEC Parties are working to maximize the gains from trade while minimizing the environmental costs. Available from: English version: http://www.cec.org/Storage/62/5516_07-64-CEC%20invasives%20risk%20guidelines-full-report_en.pdf [Accessed 15 June 2010]

French version: http://www.cec.org/Storage/62/5517_07-64-CEC%20invasives%20risk%20guidelines-full-report_fr.pdf [Accessed 15 June 2010]

Spanish version: http://www.cec.org/Storage/62/5518_07-64-CEC%20invasives%20risk%20guidelines-full-report_es.pdf [Accessed 15 June 2010].

[Morris, J.A., Jr. \(Ed.\). 2012. Invasive Lionfish: A Guide to Control and Management. Gulf and Caribbean Fisheries Institute Special Publication Series Number 1, Marathon, Florida, USA. 113 pp.](#)

Summary: Available from:

http://lionfish.gcfi.org/manual/499BE7B10AA2991737C40A572B7EC9E9/InvasiveLionfishGuide_GCFI_SpecialPublicationSeries_Number1_2012.pdf [Accessed October 4 2012]

[Morris, J.A., Jr., J.L. Akins, A. Barse, D. Cerino, D.W. Freshwater, S.J. Green, R.C. Muñoz, C. Paris and P.E. Whitfield. 2009. Biology and Ecology of the Invasive Lionfishes, *Pterois miles* and *Pterois volitans*, *Proceedings of the 61st Gulf and Caribbean Fisheries Institute November 10 - 14, 2008 Gosier, Gouadeloupe, French West Indies.*](#)

Summary: Available from: http://www.ccfhr.noaa.gov/documents/morrisetal_2009.pdf [Accessed 10 November 2009]

[USDA NAL NISIC \(National Invasive Species Information Center\). 2009. Home > Aquatic Species > Species Profiles > Lionfish](#)

Summary: Available from: <http://www.invasivespeciesinfo.gov/aquatics/lionfish.shtml> [Accessed 11 November 2009]

[Varnham, K. 2006. Non-native species in UK Overseas Territories: a review. JNCC Report 372. Peterborough: United Kingdom.](#)

Summary: This database compiles information on alien species from British Overseas Territories.

Available from: <http://www.jncc.gov.uk/page-3660> [Accessed 10 November 2009]

General information

[Albins, M.A. 2008. Short-term effects of the invasive Indo-Pacific lionfish \(*Pterois volitans/miles* complex\) on Bahamian coral-reef fish abundance and diversity.](#)

Summary: Available from: http://www.nova.edu/ncri/11icrs/abstract_files/icrs2008-001644.pdf [Accessed 11 November 2009]

[Albins, M.A. & M.A. Hixon. 2008. Invasive Indo-Pacific lionfish *Pterois volitans* reduce recruitment of Atlantic coral-reef fishes, *Marine Ecology Progress Series 367*: 233-238.](#)

Summary: Available from: http://media.eurekalert.org/aaasnewsroom/MCM/FIL_000000000296/Albins_Hixon_2008_MEPS.pdf [Accessed 11 November 2009]

[CBD, 2009. 4th UK CBD Report. Fourth National Report to the United Nations Convention on Biological Diversity: United Kingdom.](#)

Summary: Available from: www.cbd.int/doc/world/gb/gb-nr-04-en.doc [Accessed 11 November 2009]

[Centro de Biodiversidad Marina -Universidad Simón Bolívar. 2009. Pez león en Venezuela](#)

Summary: Available from: <http://pezleon.cbm.usb.ve/> [Accessed 24 February 2010]

[Chevalier, Pedro P., Elena Gutierrez, Diana Ibarzabal, Sara Romero, Víctor Isla, Julio Calderin, Ernesto Hernandez., 2008. Primer registro de *Pterois volitans* \(Pisces: Scorpaenidae\) para aguas cubanas. *Solenodon 7*: 37-40, 2008](#)

Summary: Abstract: The presence of the fish *Pterois volitans* (Linnaeus, 1758) in Cuban waters is confirmed. This invasive species has been recorded since 2000 in the East coast of United States, Bermudas and Puerto Rico. About its introduction there are several hypothesis, but the most probable seems to be the releasing into the ocean by aquarists. In this paper we provide areas in the Cuban archipelago where it have been collected or observed. Confirmed. This invasive species has been recorded since 2000 in the East coast of United States, Bermudas and Puerto Rico. About its introduction there are several hypothesis, but the most probable seems to be the releasing into the ocean by aquarists. In this paper we provide areas in the Cuban archipelago where it have been collected or observed.

[CONABIO. 2008. Sistema de información sobre especies invasoras en México. Especies invasoras - Peces. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad. Fecha de acceso.](#)

Summary: English:

The species list sheet for the Mexican information system on invasive species currently provides information related to Scientific names, family, group and common names, as well as habitat, status of invasion in Mexico, pathways of introduction and links to other specialised websites. Some of the higher risk species already have a direct link to the alert page. It is important to notice that these lists are constantly being updated, please refer to the main page (<http://www.conabio.gob.mx/invasoras/index.php/Portada>), under the section Novedades for information on updates.

Invasive species - fish is available from: http://www.conabio.gob.mx/invasoras/index.php/Especies_invasoras_-_Peces [Accessed 30 July 2008]

Spanish:

La lista de especies del Sistema de información sobre especies invasoras de México cuenta actualmente con información acerca de nombre científico, familia, grupo y nombre común, así como el hábitat, estado de la invasión en México, rutas de introducción y ligas a otros sitios especializados. Algunas de las especies de mayor riesgo ya tienen una liga directa a la página de alertas. Es importante resaltar que estas listas se encuentran en constante proceso de actualización, por favor consulte la portada (<http://www.conabio.gob.mx/invasoras/index.php/Portada>), en la sección novedades, para conocer los cambios.

Especies invasoras - Peces is available from: http://www.conabio.gob.mx/invasoras/index.php/Especies_invasoras_-_Peces [Accessed 30 July 2008]

Courtenay, W.R., Jr. 1995. Marine fish introductions in southeastern Florida. Newsletter of the Introduced Fish Section, American Fisheries Society 14(1):2-3.

Summary: This resource records information of exotic marine fish introduction to southeastern Florida.

[Dell, C. 2009. Reporting Lionfish Sightings.](#)

Summary: Available from:

http://www.reefresearch.org/ccmi_website/research/research_invasive_species/20090502_invasive_species_reporting_lionfish.pdf [Accessed 10 November 2009]

[Eric T. Schultz . 1986. Pterois volitans and Pterois miles: Two Valid Species. Copeia 3: 686-690.](#)

Summary: This article explores the synonyms names of *Pterois volitans* and compares the difference between *Pterois volitans* and *Pterois miles*.

Available from: <http://www.jstor.org/view/00458511/ap050400/05a00130/0> [Accessed 27 November 2006]

[Fish and Wildlife Research Institute \(FWRI\). 2006. First-known lionfish caught in Florida's Gulf coast waters.](#)

Summary: This resource provides distribution information of red lionfish in Florida, USA.

Available from: http://research.myfwc.com/features/view_article.asp?id=27520 [Accessed 21 November 2006]

Fishelson, L. 1997. Experiments and observations on food consumption, growth and starvation in *Dendrochirus brachypterus* and *Pterois volitans* (Pteroinae, Scorpaenidae). Environmental Biology of Fishes 50: 391-403.

Summary: This paper focus on the feeding habits and nutritional requirements of *P. volitans*.

[Froese, R. and D. Pauly. Editors. 2006. Pterois volitans Red lionfish. FishBase. World Wide Web electronic publication. www.fishbase.org, version \(06/2006\).](#)

Summary: FishBase is a global information system with all you ever wanted to know about fishes . FishBase on the web contains practically all fish species known to science. FishBase was developed at the WorldFish Center in collaboration with the Food and Agriculture Organization of the United Nations (FAO) and many other partners, and with support from the European Commission (EC). Since 2001 FishBase is supported by a consortium of seven research institutions. You can search on [Search FishBase](#)

This species profile is available from: <http://www.fishbase.org/Summary/SpeciesSummary.php?id=5195> [Accessed 15 November 2006]

[González, J., M. Grijalba-Bendeck, A. Acero & R. Betancur. 2009. The invasive red lionfish, Pterois volitans \(Linnaeus 1758\), in the southwestern Caribbean Sea \(Short communication\)](#)

Summary: Available from: http://www.aquaticinvasions.net/2009/AI_2009_4_3_Gonzalez_etal.pdf [Accessed 11 November 2009]

[ITIS \(Integrated Taxonomic Information System\), 2006. Online Database Pterois volitans \(Linnaeus, 1758\).](#)

Summary: An online database that provides taxonomic information, common names, synonyms and geographical jurisdiction of a species. In addition links are provided to retrieve biological records and collection information from the Global Biodiversity Information Facility (GBIF) Data Portal and bioscience articles from BioOne journals.

Available from: http://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=166883 [Accessed 21 November 2006]

[IUCN \(International Union for the Conservation of Nature\). 2009.The Beautiful Predator taking over Coral Reefs.](#)

Summary: Available from: http://www.iucn.org/about/union/secretariat/offices/usa/about_usa/invasive/lionfish_florida/ [Accessed 11 November 2009]

[Johnson, B. 2009. Note from Bradley Johnson, Coral-List Digest 9\(4\).](#)

Summary: Available from:

http://www.reefresearch.org/ccmi_website/research/research_invasive_species/20090505_invasive_species_lionfish_count.pdf [Accessed 10 November 2009]

Lesser P. Michael & Marc Slattery, 2011. Phase shift to algal dominated communities at mesophotic depths associated with lionfish (*Pterois volitans*) invasion on a Bahamian coral reef. Biol Invasions DOI 10.1007/s10530-011-0005-z

Paula E. Whitfield, Todd Gardner, Stephen P. Vives, Matthew R. Gilligan, Walter R. Courtenay Jr., G. Carleton Ray, and Jonathan A. Hare. 2002. Biological invasion of the Indo-Pacific lionfish *Pterois volitans* along the Atlantic coast of North America. Marine ecology progress series 235: 289-297.

Summary: This paper reviews the nonindigenous distribution of *P.volitans*, mechanism of introduction and limited impacts on the ecology of affected areas.

[Robert H. Robins. 2006. Red lionfish. Florida Museum of Natural History Ichthyology Department.](#)

Summary: Detailed biological information of *P.volitans*.

Available from: <http://www.flmnh.ufl.edu/fish/Gallery/Descript/RedLionfish/RLionfish.html> [Accessed 21 November 2006]



GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: *Pterois volitans*

Ruiz-Carus, R., R. E. M. Jr., et al. 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.

Summary: This paper documents the initial collections of red lionfish in Florida; presents evidence that lionfish are established in Florida and discusses potential vectors for the introduction and the possible effects on marine communities in Florida.

Available from:

http://research.myfwc.com/engine/download_redirection_process.asp?file=06ruizcarus_1936.pdf&objid=50147&dctype=publication [Accessed 17 November 2006]

Schofield, Pamela J. and Pam Fuller. 2006. *Pterois volitans*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. Revision Date: 11/3/2006

Summary: This resource provides summary information about *P. volitans*: ecology, native range, current invasive areas in USA and the similar species *P. miles*.

Available from: <http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=963> [Accessed 16 November 2006]

Schofield, P.J. 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(3): pp. 473-479.

Summary: Available from: http://www.aquaticinvasions.net/2009/AI_2009_4_3_Schofield.pdf [Accessed 11 November 2009]

Scott Meister, H., David M. Wyanski, Joshua K. Loefer, Steve W. Ross, Andrea M. Quattrini and Kenneth J. Sulak. 2005. Further Evidence for the Invasion and Establishment of *Pterois volitans* (Teleostei: Scorpaenidae) Along the Atlantic Coast of the United States. *Southeastern naturalist* 4(2):193–206

Summary: This paper sums up the occurrence and establishment of red lionfish colonies in southeastern US.

UNEP-WCMC (United Nations Environment Programme World Conservation Monitoring Centre) Species Database. 2006. *Pterois volitans* (Linnaeus, 1758).

Summary: UNEP-WCMC species database maintains information on species of conservation importance including those protected by multilateral environmental agreements. This page details the red lionfish.

Available from:

<http://sea.unep-wcmc.org/isdb/Taxonomy/tax-species-result.cfm?displaylanguage=eng&source=animals&Genus=Pterois&Species=volitans&Country=&tabname=names> [Accessed 21 November 2006]

USGS (United States Geological Survey). 2009. NAS - Nonindigenous Aquatic Species > Lionfish Sightings Distribution

Summary: Available from: <http://nas.er.usgs.gov/taxgroup/fish/> [Accessed 11 November 2009]

Valdez, C., M. Mascari & R. Aguiar. 2009. *The Extent of Invasive Species in Little Cayman Island*.

Summary: Available from: http://hurri.kean.edu/dept/Research/Invasive_Extent.pdf [Accessed 10 November 2009]