Mediterranean Marine Science

Vol 18, No 3 (2017)

The arrival of a second 'Lessepsian sprinter'? A first record of the red cornetfish Fistularia petimba in the Eastern Mediterranean

NIR STERN, GUY PAZ, YANA YUDKOVSKY, HADAS LUBINEVSKY, BARUCH RINKEVICH

doi: 10.12681/mms.14144

Short Communication

Mediterranean Marine Science
Indexed in WoS (Web of Science, ISI Thomson) and SCOPUS
The journal is available on line at http://www.medit-mar-sc.net
DOI: http://dx.doi.org/10.12681/mms.14144

The arrival of a second 'Lessepsian sprinter'? The first record of the red cornetfish *Fistularia petimba* in the Eastern Mediterranean

NIR STERN, GUY PAZ, YANA YUDKOVSKY, HADAS LUBINEVSKY and BARUCH RINKEVICH

Israel Oceanographic and Limnological Research, National Institute of Oceanography,
Tel Shikmona, P.O. Box 8030, Haifa 31080, Israel

Corresponding author: nirstern@ocean.org.il

Handling Editor: Paraskevi Karachle

Received: 26 June 2017; Accepted: 25 September 2017; Published on line: 29 December 2017

Abstract

Here we document the first occurrence of the red cornetfish *Fistularia petimba* in the Levantine Basin. This species identity has been confirmed using morphological and molecular tools, and is presented here with simplified illustrations for accurate future identification. This report voices a concern regarding another blitz invasion of a cornetfish into the Mediterranean, following its Lessepsian sprinter congeneric, *F. commersonii,* one of the most efficacious invaders of the Mediterranean Sea. The wide intra-specific genetic distances found between sympatric *F. petimba* specimens in the available literature resources may also demonstrate the presence of cryptic diversity within this taxon.

Keywords: Lessepsian invasion, alien fishes, population establishment, cryptic diversity.

Introduction

The Suez Canal, an artificial pathway that connects the Red Sea with the Mediterranean Sea, is a major 150 years old route for conveying invasive tropical marine biota into the Mediterranean Sea (Galil & Goren, 2013). This massive biotic influx, also termed 'Lessepsian migration' (Por, 1978), has attracted significant scientific interest as an inimitable case of anthropogenic associated marine invasion and continuously provides a diverse assortment of newly-recorded documentations.

The literature on invasive fish in the Mediterranean reveals wide ranges of invasive taxa, episodes and species distributions, with esoteric documentations for just a single specimen records (Salameh *et al*., 2011; Stern & Goren, 2013), as opposed to cases that demonstrate a rapid population outburst (Edelist *et al*., 2011; Stern *et al*., 2014) and a quick geographic spread throughout the entire Mediterranean Sea (Karachle *et al*., 2004).

The cornetfish family (Fistulariidae) contains a single genus, *Fistularia*, with four valid species. These shallow waters predatory fishes are naturally distributed globally in tropical and subtropical seas (Fritzsche, 1976). In the Mediterranean, the bluespotted cornetfish, *Fistularia commersonii* Rüppell, 1838 is considered to be one of the worst Indo-Pacific alien fishes (Streftaris & Zenetos, 2006), with remarkably fast spreading rates into wide geographical ranges and a successful population establishment throughout its invaded terrain (Karachle *et al*., 2004). Recorded in the beginning of the millennium (Golani 2000), with a seemingly 'unsuccessful' invasion event in 1975 (Bariche *et al*., 2013), *F. commersonii* has managed to colonize the entire Mediterranean Sea in less than a decade, with an average invasiveness momentum of more than 1,000 km per year (Azzurro *et al*., 2013), thereby justifying the title of 'Lessepsian sprinter' (Karachle *et al*., 2004). Such extraordinary invasion alacrity has granted *F. commersonii* extensive scientific attention (Kalogirou *et al*., 2007; Sanna *et al*., 2011; Azzurro *et al*., 2013; Bernardi *et al*., 2016;).

Here we record the first occurrence of a second cornetfish species in the Eastern Mediterranean, the red cornetfish *Fistularia petimba* Lacepède, 1803, caught near the southern coast of Israel. *F. petimba* has a wide geographic distribution throughout the tropical Atlantic and the Indo-West Pacific Ocean, with confirmed records in the Red Sea (Dor, 1984), the East Atlantic (Azevedo *et al*., 2004; Bañón & Sande, 2008) and the Western Mediterranean, off the Spanish coast of La Línea de la Concepción (Cárdenas & Berastegui, 1997) (Fig. 1). In order to minimize future taxonomic misidentifications between the two invasive cornetfish congeners in the Eastern Mediterranean, suitable distinguishing morphological and genetic characteristics are provided.

Materials and Methods

Collection details

During a biodiversity bottom-trawl campaign conducted by the Israeli National Institute of Oceanography on the 11th of December 2016, a single juvenile specimen of *F. petimba* was caught off the coast of Ashdod, Israel, in a depth of 80 m, coordinates 031°48.837N 034°27.583E (Fig. 1). Following morphological measurements and DNA sampling, the fish was deposited at

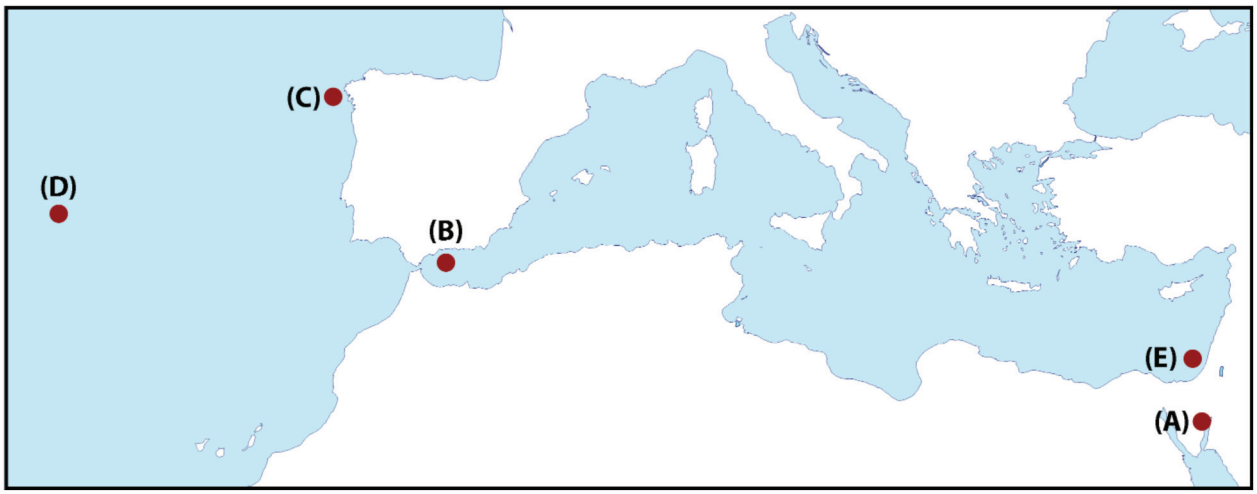

Fig. 1: Mediterranean and its surrounding observations of *Fistularia petimba*. (A) Red Sea (Dor 1984); (B) Mediterranean Spain (Cárdenas & Berastegui 1997); (C) Atlantic Spain (Bañón & Sande 2008); (D) Azores Islands (Azevedo *et al*. 2004); (E) Israel (this study).

Fig. 2: *Fistularia petimba* Lacepède, 1803. Ashdod, Israel. SMNHTAU P. 15902.

the Steinhardt Museum of Natural History in Tel Aviv University (SMNHTAU) under the voucher number SMNHTAU P. 15902.

In order to verify whether it is indeed the first *F. petimba* collected near the Levantine coasts, the entire cornetfish collections of the SMNHTAU and the Hebrew University of Jerusalem (HUJI) were further inspected.

Genetic analysis - DNA barcoding

Total genomic DNA was extracted from a muscle tissue using a standard phenol/ chloroform/isoamyl alcohol protocol. Next, approx. 50 ng of template DNA were used to amplify a 694bp fragment of the mitochondrial cytochrome c oxidase subunit I gene (COI) using the primer Fish-F1, and following the protocol of Ward *et al*. (2005).

The contiguous sequence and its trace files have been uploaded to the BOLD platform (Barcode of Life Data System) under the accession number BIM525-17. Pairwise genetic comparisons with previously published sequences were computed in MEGA, v.7 (Kumar *et al*., 2016), under the Kimura 2-parameter (K2P) corrected genetic distance model.

Results

Fistularia petimba Lacepède, 1803 (Fig. 2)

Fistularia petimba Lacepède, 1803 (New Britain, Isle of Reunion, equatorial Pacific).

Fistularia serrata Cuvier, 1816; after Bloch 1797 (America).

Fistularia immaculata Cuvier, 1816: 349 (Sea of the Indies).

Fistularia villosa Klunzinger, 1871: 516 (Al-Qusair, Egypt, Red Sea).

Fistularia starksi Jordan & Seale, 1905: 520 (Hong Kong).

Fistularia rubra Miranda Ribiero, 1903 (Ilha Rasa, Rio de Janeiro, Brazil).

Material examined

SMNHTAU P. 15902: 295 mm total length (excluding tail filament), 11.65 g total weight.

D15; P15; V6; A14; no gill rakers.

Diagnosis

F. petimba differentiates from its three congeneric species by sharp retrorse spines along the posterior lateral line ossifications (Fig. 3A). In *F. commersonii*, for instance, these spines are blunt, i.e., trimmed at their edges (Fig. 3B). In addition, *F. petimba* has elongated bony plates embedded in the skin along the midline of its back (Fig. 3C) (Fritzsche, 1976).

Brief description

A species of *Fistularia* with the typical extremely elongated and depressed body, which has sharp serrations

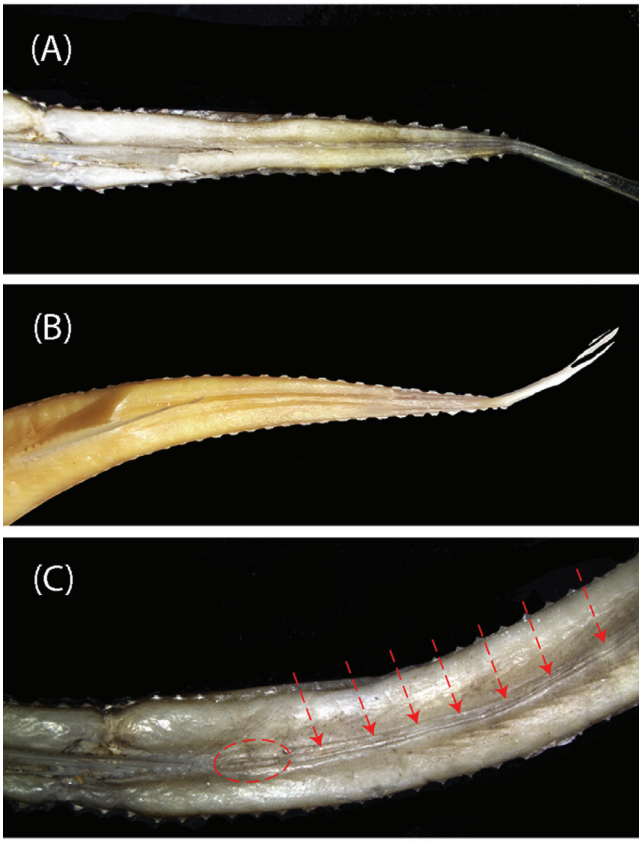

Fig. 3: Distinguishing morphological characters within the genus *Fistularia*. (A) Posterior lateral line ossifications, dorsal view, sharp spines in *F. petimba*, SMNHTAU P. 15902; (B) Posterior lateral line ossifications, dorsal view, blunt ending of spines in *F. commersonii*, Ashdod, Israel, SMNHTAU P. 13686; (C) Elongated dorsal bony plates of *F. petimba*, SMNHTAU P. 15902. Red circle indicates a clear bony plate; red arrows point approximate positions of the embedded plates.

on the snout as well as on the pre-orbital and post-orbital ridges. Body colorations is brown to grey above its mid body and bright grey to silvery-white below. Due to its juvenescence, this individual did not yet reach the unique reddish coloration seen in adults (Fritzsche, 1976). Further meristic values and morphometric computations are given in Table 1, in accordance with the taxonomic revision of Fritzsche (1976).

Genetic characterisation

Inter-specific comparisons of our *F. petimba* specimen revealed a 20.4% genetic distance in *COI* sequences from Belizean *Fistularia tabacaria* L. (BOLD number BZLWB466-06), and 15.9% from Mediterranean *F. commersonii* specimen (BOLD number BIM305-15).

Intra-specific comparisons revealed an exceptionally wide gradient of genetic distances among the published *F. petimba* sequences. The closest resemblance to our specimen was valued at 0.18%, 0.36% and 0.54% genetic distances between Indian specimens, BOLD numbers ANGEN181-15, ANGBF9248-12 and ANGEN181-15, respectively, while the most diverse genetic distances ranged from 2.4% up to 11.64% between various localities around the West Atlantic and the West Pacific Oceans.

Table 1. Selected meristic and morphometric measurement for *Fistularia petimba*, SMNHTAU P. 15902.

Meristic characters	**Value**	
Dorsal-fin rays	15	
Anal-fin rays	14	
Pectoral-fin rays	15	
Pelvic-fin rays	6	
Morphometric measurements	**In mm**	**% of Standard length**
Total length (including tail filament)	415.0	
Total length (excluding tail filament)	295.0	
Standard length	280.0	
Snout length	85.5	30.5
Eye diameter	8.7	3.1
Post-orbital length	14.6	5.2
Maxilla length	5.6	2.0
Head depth	8.8	3.1
Pre-dorsal length	235.0	83.9
Dorsal fin height	23.1	8.2
Anal fin height	20.5	7.3

Remarks

Comprehensive inspection of the vouchered Mediterranean specimens of *F. commersonii* from SNMHTAU and HUJI revealed accurate taxonomic identifications in both collections. Therefore, this report of *F. petimba* marks its first documentation in Israeli Mediterranean water.

Discussion

Although *F. petimba* is naturally distributed in the East Atlantic, with only a single documentation in the Western Mediterranean (Cárdenas & Berastegui, 1997), the genetic similarities between our specimen and published Indian samples strongly implies that the route of its invasion was through the Suez Canal, as is true for other tropical invasive fishes (Rothman *et al*., 2016; Stern *et al*., 2016).

Predicting the future impact and geographical spread of any Red Sea alien species at the time of its first documentation is understandably speculative, due to the intricacy of this phenomenon. Selective forces such as the environmental conditions prevalent at the invaded habitat and the expected competitive and mutualistic interactions with the local fauna, combined with the number of

founding invading individuals and invasion events, may greatly influence the establishment success of any alien species (Sakai *et al*., 2001; Keller & Taylor, 2008; Bernardi *et al*., 2016).

Considering the remarkable invasion success of *F. commersonii* in the Mediterranean (Azzurro *et al*., 2013) and its biological and ecological similarities with *F. petimba* in both prey and habitat preferences (Froese & Pauly, 2017), we assume the latter has the same capabilities to quickly sprawl throughout the eastern Mediterranean waters. Moreover, the sympatry of these two congeners throughout their natural habitats points to the possible existence of character displacement in either ecological, behavioral or physiological parameters between these species (Grant, 1972), and in turn may minimize competition in their novel invaded Mediterranean ecosystems.

Lastly, the wide sympatric genetic distances found in this study clearly indicates the presence of a cryptic diversity within this taxon. Resolving this conundrum requires a more revisionary study that is now in progress.

Note: On November 26th, 2017, five additional juvenile specimens of *F. petimba* have been caught in the southern coast of Israel, from a shallow depth of 20m. This finding confirms the establishment of this species along the Israeli Mediterranean coast.

Acknowledgements

We are grateful to Captain L. Ornoy of the F/V Moty for his long time cooperation and assistance. We also thank M. Goren of SMNHTAU and D. Golani of HUJ for granting access to their fish collections. This study was supported by a grant from the Israeli Ministry of Infrastructure and is part of the National Israeli Marine Barcoding project (BIM) at IOLR.

References

Azevedo, J., Raposeiro, P.M., Rodrigues, L., 2004. First records of *Fistularia petimba* and *Diodon eydouxii* for the Azores, with notes on the occurrence of three additional species. *Journal of Fish Biology*, 65, 1180-1184.

Azzurro, E., Soto, S., Garofalo, G., Maynou, F., 2013. *Fistularia commersonii* in the Mediterranean Sea: invasion history and distribution modeling based on presence-only records. *Biological Invasions,* 15, 977-990.

Bañón, R., Sande, C., 2008. First record of the red cornetfish *Fistularia petimba* Syngnathiformes: (Fistularidae) in Galician waters: a northernmost occurrence in the eastern Atlantic. *Journal of Applied Ichthyology,* 24, 106-107.

Bariche, M., Kazanjian, G., Azzurro, E., 2013. A lag of 25 years: evidence from an old capture of *Fistularia commersonii* Ruppell, 1838 from Lebanon (Mediterranean Sea). *Journal of Applied Ichthyology,* 30, 535-536.

Bernardi, G., Azzurro, E., Golani, D., Miller, M.R., 2016. Genomic signatures of rapid adaptive evolution in the bluespotted cornetfish, a Mediterranean Lessepsian invader. *Molecular ecology,* 25, 3384-3396.

Cárdenas, S., Berastegui, D., 1997. First record of *Fistularia petimba* Lacepéde, 1803 (Pisces, Fistulariidae) off the coast of Cadiz (southern Iberian Peninsula). *Boletin del Instituto Espanol de Oceanografia* 13, 83-86.

Dor, M., 1984. *CLOFRES, Checklist of the fishes of the Red Sea.* Israel Academy of Sciences and Humanities, Jerusalem, Israel.

Edelist, D., Golani, D., Rilov, G., Spanier, E., 2011. The invasive venomous striped eel catfish *Plotosus lineatus* in the Levant: possible mechanisms facilitating its rapid invasional success. *Marine Biology,* 159, 283-290.

Fritzsche, R.A., 1976. A review of the cornetfishes, genus *Fistularia* (Fistulariidae), with a discussion of intrageneric relationships and zoogeography. *Bulletin of Marine Science,* 26, 196-204.

Froese, R., Pauly, D., 2017. FishBase. World Wide Web electronic publication. *www.fishbase.org, version (06/2017)* 2017.

Galil, B., Goren, M., 2013. Metamorphoses: Bioinvasions in the Mediterranean Sea. p. 463-478. In: *The Mediterranean Sea: Its history and present challenges*. Goffredo, S., Dubinsky, Z., (Eds). Springer, Dordrecht.

Golani, D., 2000. First record of the bluespotted cornetfish from the Mediterranean Sea. *Journal of fish biology,* 56, 1545-1547.

Grant, P.R., 1972. Convergent and divergent character displacement. *Biological Journal of the Linnean Society,* 4, 39-68.

Kalogirou, S., Corsini, M., Kondilatos, G., Wennhage, H., 2007. Diet of the invasive piscivorous fish *Fistularia commersonii* in a recently colonized area of the eastern Mediterranean. *Biological Invasions,* 9, 887-896.

Karachle, P.K., Triantaphyllidis, C., Stergiou, K.I., 2004. Bluespotted cornetfish, *Fistularia commersonii* Rüppell, 1838: a Lessepsian sprinter. *Acta Ichthyologica et Piscatoria,* 34, 103-108.

Keller, S.R., Taylor, D.R., 2008. History, chance and adaptation during biological invasion: separating stochastic phenotypic evolution from response to selection. *Ecology Letters,* 11, 852-866.

Kumar, S., Stecher, G., Tamura, K., 2016. MEGA7: Molecular Evolutionary Genetics Analysis version 7.0 for bigger datasets. *Molecular biology and evolution,* 33, 1870-1874.

Por, F., 1978. *Lessepsian migration: the influx of the Red sea biota into the Mediterranean by way of the Suez Canal.* Springer-Verlag, Berlin-Heidelberg-New York.

Rothman, S.B., Stern, N., Goren, M., 2016. First record of the Indo-Pacific areolate grouper *Epinephelus areolatus* (Forsskål, 1775) (Perciformes: Epinephelidae) in the Mediterranean Sea. *Zootaxa,* 4067, 479-483.

Sakai, A.K., Allendorf, F.W., Holt, J.S., Lodge, D.M., Molofsky, J., With, K.A., Baughman, S., Cabin, R.J., Cohen, J.E., Ellstrand, N.C., 2001. The population biology of invasive species. *Annual Review of Ecology and Systematics,* 32, 305-332.

Salameh, P., Sonin, O., Edelist, D., Golani, D., 2011. First record of the Red Sea orangeface butterflyfish *Chaetodon larvatus* Cuvier, 1831 in the Mediterranean. *Aquatic Invasions,* 6, S53-S55.

Sanna, D., Merella, P., Lai, T., Farjallah, S., Francalacci, P.,

Curini-Galletti, M., Pais, A., Casu, M., 2011. Combined analysis of four mitochondrial regions allowed the detection of several matrilineal lineages of the lessepsian fish *Fistularia commersonii* in the Mediterranean Sea. *Journal of the Marine Biological Association of the United Kingdom,* 91, 1289-1293.

Stern, N., Goren, M., 2013. First record of the moray eel *Gymnothorax reticularis* Bloch, 1795 in the Mediterranean Sea, with a note on its taxonomy and distribution. *Zootaxa,* 3641, 197-200.

Stern, N., Levitt, Y., Galil, B., Diamant, A., Yokeş, M., Goren, M., 2014. Distribution and population structure of the alien Indo-Pacific Randall's threadfin bream *Nemipterus randalli* in the eastern Mediterranean Sea. *Journal of fish biology,* 85, 394-406.

Stern, N., Rinkevich, B., Goren, M., 2016. Integrative approach revises the frequently misidentified species of *Sardinella* (Clupeidae) of the Indo-West Pacific Ocean. *Journal of fish biology,* 89, 2282-2305.

Streftaris, N., Zenetos, A., 2006. Alien marine species in the Mediterranean - the 100 'Worst Invasives' and their impact. *Mediterranean Marine Science,* 7, 87-118.

Ward, R.D., Zemlak, T.S., Innes, B.H., Last, P.R., Hebert, P.D.N., 2005. DNA barcoding Australia's fish species. *Philosophical Transactions of the Royal Society B: Biological Sciences,* 360, 1847-1857.