

2020-04-22

Unpublished Mediterranean records of marine alien and cryptogenic species

Kleitou, P

<http://hdl.handle.net/10026.1/15590>

BioInvasions Records

Regional Euro-Asian Biological Invasions Centre

All content in PEARL is protected by copyright law. Author manuscripts are made available in accordance with publisher policies. Please cite only the published version using the details provided on the item record or document. In the absence of an open licence (e.g. Creative Commons), permissions for further reuse of content should be sought from the publisher or author.

CORRECTED PROOF

Data Paper

Unpublished Mediterranean records of marine alien and cryptogenic species

Stelios Katsanevakis*, Dimitris Poursanidis, Razy Hoffman, Jamila Rizgalla, Shevy Bat-Sheva Rothman, Ya'arit Levitt-Barmats, Louis Hadjioannou, Domen Trkov, Joxe Mikel Garmendia, Miraine Rizzo, Angela G. Bartolo, Michel Bariche, Fiona Tomas, Periklis Kleitou, Patrick J. Schembri, Demetris Kletou, Francesco Tiralongo, Christine Pergent, Gérard Pergent, Ernesto Azzurro, Murat Bilecenoglu, Alice Lodola, Enric Ballesteros, Vasilis Gerovasileiou, Marc Verlaque, Anna Occhipinti-Ambrogi, Eleni Kytinou, Thanos Dailianis, Jasmine Ferrario, Fabio Crocetta, Carlos Jimenez, Julian Evans, Michail Ragkousis, Lovrenc Lipej, Joseph A. Borg, Charalampos Dimitriadis, Giorgos Chatzigeorgiou, Paolo G. Albano, Stefanos Kalogiourou, Hoesin Bazairi, Free Espinosa, Jamila Ben Souissi, Konstantinos Tsiamis, Fabio Badalamenti, Joachim Langeneck, Pierre Noel, Alan Deidun, Agnese Marchini, Grigorios Skouradakis, Laura Royo, Maria Sini, Carlo Nike Bianchi, Yassine-Ramzi Sghaier, Raouia Ghanem, Nikos Doumpas, Jeanne Zaouali, Konstantinos Tsirintanis, Orestis Papadakis, Carla Morri, Melih Ertan Çinar, Jorge Terrados, Gianni Insacco, Bruno Zava, Emna Soufi-Kechaou, Luigi Piazza, Khadija Ounifi Ben Amor, Emmanouil Andriotis, Maria Cristina Gambi, Mohamed Mourad Ben Amor, Joaquim Garrabou, Cristina Linares, Ana Fortič, Markos Digenis, Emma Cebrian, Maïa Fourn, Maria Zotou, Luca Castriota, Vincenzo Di Martino, Antonietta Rosso, Carlo Pipitone, Manuela Falautano, María García, Rym Zakhama-Sraieb, Faten Khamassi, Anna Maria Mannino, Mohamed Hédi Ktari, Ioanna Kosma, Mouna Rifi, Paraskevi K. Karachle, Sercan Yapıcı, Arthur R. Bos, Paolo Balistreri, Alfonso A. Ramos Esplá, Jonathan Tempesti, Omar Inglese, Ioannis Giovos, Dimitrios Damalas, Said Benhissoune, Mehmet Fatih Huseyinoglu, Wafa Rjiba-Bahri, Jorge Santamaría, Martina Orlando-Bonaca, Andres Izquierdo, Caterina Stamouli, Monica Montefalcone, Hasan Cerim, Raúl Golo, Sultana Tsioli, Sotiris Orfanidis, Nikolas Michailidis, Martina Gaglioti, Ergün Taşkın, Emilio Mancuso, Ante Žunec, Ivan Cvitković, Halit Filiz, Rossana Sanfilippo, Apostolos Siapatis, Borut Mavrič, Sami Karaa, Ali Türker, Françoise Monniot, Jana Verdura, Najib El Ouamari, Mohamed Selfati, Argyro Zenetos

Affiliations:

Stelios Katsanevakis, Eleni Kytinou, Michail Ragkousis, Maria Sini, Konstantinos Tsirintanis, Orestis Papadakis, Emmanouil Andriotis, Maria Zotou, Ioanna Kosma: Department of Marine Sciences, University of the Aegean, Lofos Panepistimiou, 81100 Mytilene, Greece, emails: stelios@katsanevakis.com, ekytinou@gmail.com, ragkousis.diving@gmail.com, mariasini@marine.aegean.gr, ksirintanis@marine.aegean.gr, orestis0202@yahoo.gr, mar15004@marine.aegean.gr, m.maryzotou@gmail.com, i.kosma@marine.aegean.gr

Dimitris Poursanidis: Foundation for Research and Technology—Hellas (FORTH), Institute of Applied and Computational Mathematics, Remote Sensing lab, N. Plastira 100, Vassilika Vouton, 70013 Heraklion, Greece, email: dpoursanidis@gmail.com

Razy Hoffman: The Steinhardt Museum of Natural History, Israel National Center for Biodiversity Studies, Tel Aviv University, Tel Aviv 69978, Israel, email: razyho@hotmail.com

Jamila Rizgalla: Department of Aquaculture, Faculty of Agriculture, University of Tripoli, Tripoli, Libya, email: jamilarizgalla@gmail.com

Shevy Bat-Sheva Rothman, Ya'arit Levitt-Barmats: School of Zoology, The George S. Wise Faculty of Life Science, Tel-Aviv University, Tel Aviv 69978, Israel, emails: rshevy@gmail.com, lyaarit@gmail.com

Nikolas Michailidis: Department of Fisheries and Marine Research, 101 Vithleem Str., 1416 Strovolos, Nicosia, Cyprus, email: nikolasmichailidis@gmail.com

Louis Hadjioannou, Carlos Jimenez: Enalia Physis Environmental Research Centre; Acropoleos 2, Aglantzia 2101, Nicosia, Cyprus, emails: l.hadjioannou@enaliaphysis.org.cy, c.jimenez@enaliaphysis.org.cy

Lovrenc Lipej, Martina Orlando-Bonaca, Borut Mavrič, Ana Fortič, Domen Trkov: Marine Biology Station Piran, National Institute of Biology, Fornace 41, 6330 Piran, Slovenia, emails: Lovrenc.Lipej@nib.si, Martina.Orlando@nib.si, Borut.Mavric@nib.si, Ana.Fortic@nib.si, Domen.Trkov@nib.si

Fiona Tomas, Laura Royo, Jorge Terrados: Mediterranean Institute of Advanced Studies, IMEDEA (CSIC-UIB), C/ Miquel Marqués, 21, 07190 Esporles, Spain, emails: fiona@imedea.uib-csic.es, lauraroyo@yahoo.es, terrados@imedea.uib-csic.es

Joxe Mikel Garmendia: AZTI, Marine Research Division, Herrera kaia, Portualdea z/g, 20110 - Pasaia, Spain, email: jgarmendia@azti.es

Miraine Rizzo, Angela G. Bartolo: ERA, Hexagon House, Spencer Hill, Marsa, MRS 1441, Malta, emails: miraine.rizzo@era.org.mt, angela.bartolo@era.org.mt

Michel Bariche: Department of Biology, American University of Beirut, 11-0236 Beirut, Lebanon, email: michel.bariche@aub.edu.lb

Periklis Kleitou, Demetris Kletou: Marine & Environmental Research (MER) Lab, 202 Amathountos Av, Marina Gardens, Block B, Off. 13-14, Limassol, Cyprus, emails: pkleitou@merresearch.com, dkletou@merresearch.com

Patrick J. Schembri, Julian Evans, Joseph A. Borg: Department of Biology, University of Malta, Msida MSD2080, Malta, emails: patrick.j.schembri@um.edu.mt, julian.evans@um.edu.mt, joseph.a.borg@um.edu.mt

Francesco Tiralongo, Antonietta Rosso, Rossana Sanfilippo: Department of Biological, Geological and Environmental Sciences, University of Catania, Corso Italia, 57, 95129 Catania, Italy, emails: francesco.tiralongo@unict.it, rosso@unict.it, sanfiros@unict.it

Christine Pergent, Gérard Pergent: EqEL, FRES 3041 – UMR 6134, University of Corsica, BP 52 20250 Corte, emails: pmartini@univ-corse.fr, pergent@univ-corse.fr

Ernesto Azzurro: Italian National Research Council (CNR-IRBIM), Largo Fiera della Pesca, 2, 60125 Ancona AN, Italy email: eazzurro@gmail.com

Murat Bilecenoglu: Department of Biology, Faculty of Arts and Sciences, Aydin Adnan Menderes University, 09010 Aydin, Turkey, e-mail: mbilecenoglu@adu.edu.tr

Alice Lodola, Anna Occhipinti-Ambrogi, Jasmine Ferrario, Agnese Marchini: Department of Earth and Environmental Sciences, University of Pavia, 27100 Pavia, Italy, emails: alice.lodola@unipv.it, anna.occhipinti@unipv.it, jasmine.ferrario@unipv.it, agnese.marchini@unipv.it

Enric Ballesteros, María García, Emma Cebrian: Centre d'Estudis Avançats de Blanes, Consejo Superior de Investigaciones Científicas (CEAB-CSIC), Blanes, Catalonia, Spain, emails: kike@ceab.csic.es, maria@ceab.csic.es, emma@ceab.csic.es

Vasilis Gerovasileiou, Thanos Dailianis, Giorgos Chatzigeorgiou, Grigorios Skouradakis, Markos Digenis: Institute of Marine Biology, Biotechnology and Aquaculture, Hellenic Centre for Marine Research, P.O. Box 2214, 71003 Heraklion, Greece, emails: vgerovas@hcmr.gr, thanosd@hcmr.gr, chatzigeorgiou@hcmr.gr, gskouradakis@hcmr.gr, markosdigenis@gmail.com

Marc Verlaque: Mediterranean Institute of Oceanography (UMR_D 235 MIO) & GIS Posidonie, Aix-Marseille University - 13288 Marseille, e-mail: marc.verlaque@mio.osupytheas.fr

Fabio Crocetta, Maria Cristina Gambi, Martina Gaglioti, Ernesto Azzurro: Department of Integrative Marine Ecology, Stazione Zoologica Anton Dohrn, 80121 Napoli, Italy, emails: fabio.crocetta@szn.it, mariacristina.gambi@szn.it, mart.gaglioti@gmail.com, eazzurro@gmail.com

Charalampos Dimitriadis: National Marine Park of Zakynthos, El Venizelou1, 29100 Zakynthos Island, Greece, email: xdimitriadis@marine.aegean.gr

Paolo G. Albano: Department of Palaeontology, University of Vienna, Althanstrasse 14, A-1090 Vienna, Austria, email: pgalbano@gmail.com

Stefanos Kalogirou: Hellenic Centre for Marine Research, Hydrobiological Station of Rhodes, 85100 Rhodes, Greece, email: stefanos.kalogirou@gmail.com

Hocein Bazairi, Mohamed Selfati: BioBio Research Center, BioEcoGen Laboratory, Faculty of Sciences, Mohammed V University in Rabat, 4 Avenue Ibn Battouta, B.P. 1014 RP, 10106, Rabat, Morocco, emails: hocein.bazairi@um5.ac.ma, selfatimohamed@gmail.com

Free Espinosa: Laboratorio de Biología Marina, Departamento de Zoología, Universidad de Sevilla, Avda. Reina Mercedes 6, 41012, Sevilla, Spain, email: free@us.es

Jamila Ben Souissi, Raouia Ghanem, Wafa Rjiba-Bahri, Khadija Ounifi Ben Amor, Emna Soufi-Kechaou, Mouna Rifi: University Tunis El Manar, Biodiversity, Biotechnology and Climate Change Laboratory (LR 11ES09), 1002, Tunis, Tunisia emails: jbensouissi@yahoo.com, raouia-ghanem@hotmail.fr, wafa.rjiba@yahoo.fr, ounifkhadija@yahoo.com, esoufi@gmail.com, mounarifi3@gmail.com

Jamila Ben Souissi, Jeanne Zaouali, Raouia Ghanem, Wafa Rjiba-Bahri, Emna Soufi-Kechaou, Faten Khamassi, Mouna Rifi: University of Carthage, National Institute of Agronomy of Tunis (INAT), 1082, Tunis, Tunisia, emails: jbensouissi@yahoo.com, jeanne.zaouali@planet.tn, raouia-ghanem@hotmail.fr, wafa.rjiba@yahoo.fr, esoufi@gmail.com, faten.khamassi@gmail.com, mounarifi3@gmail.com

Konstantinos Tsiamis: European Commission, Joint Research Centre (JRC), Ispra, Italy, email: konstantinos.tsiamis@ec.europa.eu

Fabio Badalamenti, Carlo Pipitone: CNR-IAS, Lungomare C. Colombo 4521, 90149 Palermo, Italy, emails: fabio.badalamenti@cnr.it, carlo.pipitone@cnr.it

Joachim Langeneck, Jonathan Tempesti: University of Pisa, Department of Biology, via Derna 1, 56126 Pisa, Italy, emails: jlangebeck@biologia.unipi.it, tempesti.jonathan@gmail.com

Pierre Noel: UMS 2006 AFB-CNRS-MNHN, "Patrimoine Naturel", Centre d'expertise et de données sur la nature, Muséum national d'Histoire naturelle, 43 rue Buffon - Bat. 48, 75231 Paris cedex 05, email: pierre.noel@mnhn.fr

Alan Deidun: Department of Geosciences, University of Malta, Msida, Malta MSD 2080, email: alan.deidun@um.edu.mt

Carlo Nike Bianchi, Carla Morri, Monica Montefalcone: DiSTAV (Department of Earth, Environment and Life Sciences), University of Genoa, Corso Europa 26, 16132 Genova, Italy, emails: carlo.nike.bianchi@unige.it, carla.morri.ge@gmail.com, monica.montefalcone@unige.it

Yassine-Ramzi Sghaier, Rym Zakhama-Sraieb: University of Tunis El Manar, Faculty of Sciences of Tunis, Research Laboratory of Diversity, Management and Conservation of Biological Systems, LR18ES06, Tunis, Tunisia, emails: yassineramzi.sghaier@spa-rac.org, zakhamarim@yahoo.fr

Yassine-Ramzi Sghaier: Regional Activity Centre for Specially Protected Areas, Boulevard du Leader Yasser Arafat - B.P. 337 - 1080 - Tunis Cedex - Tunisia, email: yassineramzi.sghaier@spa-rac.org

Nikos Doumpas, Ioannis Giovos, Periklis Kleitou, Francesco Tiralongo: Environmental Organization for the Preservation of Aquatic Ecosystems, iSea, Agios Pavlos, 55438, Thessaloniki, Greece, emails: nikolaos.doumpas@isea.com.gr, ioannis.giovos@isea.com.gr, pkleitou@merresearch.com, francesco.tiralongo@unict.it

Melih Ertan Çinar: Ege University, Faculty of Fisheries, Dept. of Hydrobiology 35100 Bornova, Izmir, Turkey, email: melih.cinar@ege.edu.tr

Gianni Insacco, Bruno Zava: Museo Civico di Storia Naturale di Comiso, Via degli Studi n° 9, 97013 Comiso (RG), Italy, emails: g.insacco@comune.comiso.rg.it, wildernessbz@hotmail.com

Luigi Piazzi: Department of Chemistry and Pharmacy, University of Sassari, Via Piandanna 4, 70100 Sassari, Italy, email: lpiazzi@uniss.it

Khadija Ounifi Ben Amor: Université de Tunis El Manar, Faculté des Sciences de Tunis, Laboratoire de Biodiversité, Biotechnologie et Changement Climatique, LR11ES09, 1002, Tunis, Tunisia, email: ounifkhadija@yahoo.com

Mohamed Mourad Ben Amor: Institut National des Sciences et Technologies de la Mer, port de pêche, 2025 La Goulette, Tunisia, email: benamor7@yahoo.fr

Joaquim Garrabou: Institute of Marine Sciences, CSIC, Passeig Marítim de la Barceloneta, Barcelona 37-49 08003 Spain, email: garrabou@icm.csic.es

Cristina Linares: Department of Evolutionary Biology, Ecology and Environmental Sciences, Institut de Recerca de la Biodiversitat (IRBIO), University of Barcelona, Av. Diagonal 643, 08028 Barcelona, Spain, email: cristinalinares@ub.edu

Emma Cebrian, Jorge Santamaria, Raúl Golo, Jana Verdura: GRMAR, Institute of Aquatic Ecology, University of Girona, E-17071 Girona, Catalonia, Spain, emails: emma@ceab.csic.es, jorge.santamaria@udg.edu, raul.gonzalez@udg.edu, jana.verdura@udg.edu

Maïa Fourt: Institut Méditerranéen de Biodiversité et d'Ecologie marine et continentale, Aix-Marseille Université, CNRS, IRD, Avignon Université, Station Marine d'Endoume, Rue de la Batterie des Lions, 13007 Marseille, France, email: maiafourt@gmail.com

Luca Castriota, Manuela Falautano: Italian Institute for Environmental Protection and Research, Lungomare Cristoforo Colombo n. 4521 (ex complesso Roosevelt), Località Addaura, 90149, Palermo, Italy, emails: luca.castriota@isprambiente.it, manuela.falautano@isprambiente.it

Vincenzo Di Martino: CNR/ISAFoM (National Research Council of Italy/Institute for Agricultural and Forestry System in the Mediterranean), via Empedocle 58, 95128 Catania, Italy, email: vincenzo.dimartino@cnr.it

Anna Maria Mannino: Department of Biological, Chemical and Pharmaceutical Sciences and Technologies, University of Palermo, 90123 Palermo, Italy, email: annamaria.mannino@unipa.it

Mohamed Hédi Ktari: Tunis El Manar University, Faculty of Science of Tunis, Tunisia, email: mohamedhedi.ktari@yahoo.fr

Paraskevi K. Karachle, Dimitrios Damalas, Argyro Zenetos, Apostolos Siapatis, Caterina Stamouli: Institute of Marine Biological Resources and Inland Waters, Hellenic Centre for Marine Research, 576 Vouliagmenis Ave., Argiroupoli, Attika, 164 52, Greece, e-mails: pkarachle@hcmr.gr, shark@hcmr.gr, zenetos@hcmr.gr, siapatis@hcmr.gr, kstamouli@hcmr.gr

Sercan Yapıcı, Halit Filiz, Hasan Cerim, Ali Türker: Muğla Sıtkı Koçman University, Faculty of Fisheries, 48000, Muğla/Turkey, e-mails: sercanyapici@mu.edu.tr, halit.filiz@mu.edu.tr, hasancerim@mu.edu.tr, aliturker@mu.edu.tr

Arthur R. Bos: The American University in Cairo, Department of Biology, Cairo, Egypt, email: arbos@aucegypt.edu

Paolo Balistreri: Vicolo Giotto N 6, 91023 Favignana (TP), Italy, email: requin.blanc@hotmail.it

Alfonso A. Ramos-Esplá, Andrés Izquierdo: Marine Research Center of Santa Pola (CIMAR), University of Alicante, 03080 Alicante, Spain, emails: alfonso.ramos@ua.es, andres.izquierdo@ua.es

Mehmet Fatih Huseyinoglu: Faculty of Maritime Studies, University of Kyrenia, 99350 Girne, Cyprus, email: mehmetfatih.huseyinoglu@kyrenia.edu.tr

Omar Inglese: Mediterraneo Servicios Marinos, Nueva Dársena Pesquera s/n Buzones 50 y 51 03008 Alicante, Spain, email: arqueologia@mediterraneoserviciosmarinos.com

Said Benhissoune: Association 'Action Bleue Maroc', Rabat, Morocco, email: saidbenhissoune@gmail.com

Soultana Tsioli, Sotiris Orfanidis: Fisheries Research Institute, Hellenic Agricultural Organization-Demeter, 64007 Nea Peramos, Kavala, Greece, emails: stsioli@inale.gr, sorfanid@inale.gr

Ergün Taşkın: Department of Biology, Faculty of Arts and Sciences, Manisa Celal Bayar University, Muradiye-Manisa 45140, Turkey, e-mail: ergun.taskin@cbu.edu.tr

Emilio Mancuso: Istituto per gli Studi sul Mare, Viale Gadio 2, Milano 10121, Italy, email: emilio.mancuso@verdeacqua.org

Ante Žunec, Ivan Cvitković: Institute for Oceanography and Fisheries, Šetalište Ivana Meštrovića 63, 21 000 Split, Croatia, emails: zunec@izor.hr, cvite@izor.hr

Sami Karaa: Institut National des Sciences et Technologies de la Mer (Centre Sfax) BP. 1035, Sfax 3018, Tunisia, email: k-sami@hotmail.fr

Françoise Monniot: CNRS, Muséum national d'histoire naturelle, 55 rue Buffon 75005 Paris, email: francoise.monniot@mnhn.fr

Najib El Ouamari, Mohamed Selfati: National Institute of fisheries research, 13, Bd Zerkouni, BP 493, Nador, Morocco, emails: azir46@hotmail.com, selfatimohamed@gmail.com

*Corresponding author

Citation: Katsanevakis S, Poursanidis D, Hoffman R, Rizgalla J, Rothman SB-S, Levitt-Barmats Y, Hadjioannou L, Trkov D, Garmendia JM, Rizzo M, Bartolo AG, Bariche M, Tomas F, Kleitou P, Schembri PJ, Kletou D, Tiralongo F, Pergent C, Pergent G, Azzurro E, Bilecenoglu M, Lodola A, Ballesteros E, Gerovasileiou V, Verlaque M, Occhipinti-Ambrogi A, Kytinou E, Dailianis T, Ferrario J, Crocetta F, Jimenez C, Evans J, Ragkousis M, Lipej L, Borg JA, Dimitriadis C, Chatzigeorgiou G, Albano PG, Kalogirou S, Bazairi H, Espinosa F, Ben Souissi J, Tsiamis K, Badalamenti F, Langeneck J, Noel P, Deidun A, Marchini A, Skouradakis G, Royo L, Sini M, Bianchi CN, Sghaier Y-R, Ghanem R, Doumpas N, Zaouali J, Tsirintanis K, Papadakis O, Morri C, Çınar ME, Terrados J, Insacco G, Zava B, Soufi-Kechaou E, Piazzoli L, Ounifi Ben Amor K, Andriotis E, Gambi MC, Ben Amor MM, Garrabou J, Linares C, Fortić A, Digenis M, Cebrian E, Fourt M, Zotou M, Castriota L, Di Martino V, Rosso A, Pipitone C, Falautano M, García M, Zakhama-Sraieb R, Khamassi F, Mannino AM, Ktari MH, Kosma I, Rifi M, Karachle PK, Yapıcı S, Bos AR, Balistreri P, Ramos Esplá AA, Tempesti J, Inglese O, Giovos I, Damalas D, Benhissoune S, Huseyinoglu MF, Rjiba-Bahri W, Santamaría J, Orlando-Bonaca M, Izquierdo A, Stamouli C, Montefalcone M, Cerim H, Golo R, Tsioli S, Orfanidis S, Michailidis N, Gaglioti M, Taşkın E, Mancuso E, Žunec A, Cvitković I, Filiz H, Sanfilippo R, Siapatis A, Mavrić B, Karaa S, Türker A, Monniot F, Verdura J, El Ouamari N, Selfati M, Zenetos A (2020) Unpublished Mediterranean records of marine alien and cryptogenic species. *BioInvasions Records* 9 (in press)

Received: 27 February 2020

Accepted: 31 March 2020

Published: 22 April 2020

Handling editor: Vadim E. Panov

Copyright: © Katsanevakis et al.

This is an open access article distributed under terms of the Creative Commons Attribution License (Attribution 4.0 International - CC BY 4.0).

OPEN ACCESS

Abstract

Good datasets of geo-referenced records of alien species are a prerequisite for assessing the spatio-temporal dynamics of biological invasions, their invasive potential, and the magnitude of their impacts. However, with the exception of first records on a country level or wider regions, observations of species presence tend to remain unpublished, buried in scattered repositories or in the personal databases of experts. Through an initiative to collect, harmonize and make such unpublished data for marine alien and cryptogenic species in the Mediterranean Sea available, a large dataset comprising 5376 records was created. It includes records of 239 alien or cryptogenic taxa (192 Animalia, 24 Plantae, 23 Chromista) from 19 countries surrounding the Mediterranean Sea. In terms of records, the most reported Phyla in descending order were Chordata, Mollusca, Chlorophyta, Arthropoda, and Rhodophyta. The most recorded species was *Caulerpa cylindracea*, followed by *Siganus luridus*, *Magallana* sp. (cf. *gigas* or *angulata*) and *Pterois miles*. The dataset includes records from 1972 to 2020, with the highest number of records observed in 2018. Among the records of the dataset, *Dictyota acutiloba* is a first record for the Mediterranean Sea. Nine first country records are also included: the alga *Caulerpa taxifolia* var. *distichophylla*, the cube boxfish *Ostracion cubicus*, and the cleaner shrimp *Urocaridella pulchella* from Israel; the sponge *Paraleucilla magna* from Libya and Slovenia; the lumpfish *Cyclopterus lumpus* from Cyprus; the bryozoan *Celleporaria vermiformis* and the polychaetes *Prionospio depauperata* and *Notomastus aberans* from Malta.

Key words: non-native species, non-indigenous, distribution, citizen science, invasive alien species, geo-referenced records, Mediterranean Sea

Introduction

The biodiversity of the Mediterranean Sea faces many cumulative threats due to anthropogenic activities and global change (Coll et al. 2012; Micheli et al. 2013). Biological invasions, often facilitated by climate change, have been considered as a major driver of change in Mediterranean marine ecosystems (Katsanevakis et al. 2014a; Azzurro et al. 2019a; Morri et al. 2019) with important impacts at all levels of biodiversity (Katsanevakis et al. 2014b). Therefore, substantial effort is put by both marine scientists and managers to increase our knowledge on the spatio-temporal dynamics and impacts of alien species in the region, with the ultimate aim of deploying mitigation actions in order to protect native biodiversity and ecosystem functioning.

Effective management and conservation of marine ecosystems require suitable spatio-temporal information on the distribution of species and the status of ecological features, which, in the Mediterranean Sea, is often incomplete or lacking adequate detail (Levin et al. 2014). Regularly updated geo-referenced records of alien species are valuable for assessing their invasion progress and temporal dynamics, investigating their ecological requirements, and developing species distribution models to forecast their present and future distributions. However, while new records in the Mediterranean at basin-, ecoregion-, or country-scale are commonly published, observations of species presence often remain unpublished when they are not “first records” in a given country or ecoregion and fall

within the already documented invasion range. Thus, useful spatio-temporal information remains buried in the personal files of researchers or scattered repositories. Such information is valuable for a multitude of research efforts, especially in light of the current hastened pace of climate change and anthropogenic impacts on coastal habitats (He and Silliman 2019).

To collect such spatio-temporal information, an invitation to submit unpublished records of alien and cryptogenic species in the Mediterranean was sent to numerous marine biologists from all Mediterranean countries. The main goal was to create a collective large dataset that will be freely available to the scientific community and the public, complementing already published records. The aims of this paper are to make this dataset available and describe its taxonomic and spatio-temporal coverage.

Dataset compilation

In total, 126 marine scientists from 16 countries participated in this effort and contributed 5376 records (see Supplementary material Table S1). Each record was represented by one line in an Excel sheet, and corresponded to the observation of an alien or cryptogenic species at a specific point in space and time. The required fields for each record, providing the most essential data, were species name, latitude, longitude, country, year, the name of the “observer”, and the “type of observation”.

“Observer” was the marine scientist who made the identification of the species. In cases where a specimen was either collected or photographed/filmed by a citizen, and delivered to a marine biologist for identification, both the name of the scientist and the name of the citizen (in brackets) appear in the field “observer”. Unpublished data collected through citizen-science initiatives were only included if species identifications were adequately verified by scientists. Specifically, such unpublished data by the following citizen science projects were included in the present dataset: “Is it Alien to you? Share it!!!” (Giovos et al. 2019), “Seawatchers” (Azzurro et al. 2013), “Corsica Alien Network” (Barralon et al. 2019), “Aliens in the Sea” (Mannino et al. 2017).

“Type of observation” was a binomial selection of either “visual only” or “collected specimen”, in order to indicate respectively whether the record was based only on visual observation (e.g. during SCUBA diving or snorkelling, or photo/video taken by a citizen) or specimen collection and identification in a laboratory.

In addition to the required fields, there were additional optional fields, which included: exact date, depth of observation/collection, habitat, number of individuals observed, and additional comments. The Kingdom and Phylum of each species, as well as its biogeographic status (alien or cryptogenic *sensu* Essl et al. 2018) were also included. This information was retrieved from the European Alien Species Information Network (EASIN),



Figure 1. Taxonomic coverage of the dataset: (A) distribution pool by Kingdom; (B) frequency distribution of the number of records per species; (C) records by Phylum; (D) records by species (for the twenty most frequently observed species).

which has a transparent mechanism for quality assurance and updates through an Editorial Board of experts (Tsiamis et al. 2016).

Taxonomic coverage

The dataset includes 239 taxa, of which 192 are Animalia, 24 Plantae, and 23 Chromista. Most of the taxa (206) were classified as alien, and only 33 as cryptogenic. In terms of individual records, the majority belong to Animalia (67.1%), followed by Plantae (27.7%) and Chromista (5.2%) (Figure 1A). The Phylum with most records is Chordata with 1477 records

(of which 89.7% were Actinopterygii and 10.3% Ascidiacea), followed by Mollusca, Chlorophyta, Arthropoda and Rhodophyta (Figure 1C). The majority of taxa observed (55.2%) were recorded no more than 5 times (Figure 1B), although there were four taxa with more than 200 records: *Caulerpa cylindracea*, followed by *Siganus luridus*, *Magallana* sp. (cf. *gigas* or *angulata*) and *Pterois miles* (Figure 1D). Taxa were identified based on collected specimens for 25.9% of the records, or visually (either *in situ* or through photos/video) for the remaining 74.1%.

Spatial and temporal coverage

The dataset includes observations made between 1972 and January 2020. Only 1.6% of the observations were recorded in the '70s, '80s, and '90s. The year with the most records is 2018 (23.7%), followed by 2019 (17.1%) and 2017 (12.1%) (Figure 2A). There are records from 19 countries, with the highest number of records reported from Greece (22.7%), followed by Italy (14.4%), Malta (12.7%), and Spain (10.3%) (Figure 2B). The species recorded in the highest number of countries is *Caulerpa cylindracea*, followed by *Fistularia commersonii*, *Siganus luridus*, and *Percnon gibbesi* (Figure 2C).

As anticipated, the records are not uniformly distributed in the Mediterranean, as their spatial distribution is driven both by the actual distribution patterns of alien and cryptogenic species and the specificities of this dataset, reflecting the uneven distribution of experts, taxonomic expertise, and sampling effort. A high density of records is observed in several locations, e.g. Malta, Slovenia, Venice lagoon (Italy), SE Cyprus, Lebanon, while records along the continental coastline of France and the north African coastline are scarce, with the exception of Tunisia (Figure 3).

In 77.6% of the records, the depth or depth range is indicated, with most records in shallow waters. Among these records, depths ≤ 1 m are reported in 30.1% of cases, depths between 1–5 m in 36.1%, and depths between 30–100 m in only 9.9%, whereas only four observations took place at depths > 100 m.

Remarkable new records of alien species

Among the records of the dataset, there is one first record for the Mediterranean Sea, of a new invasive alien seaweed species, from the Levantine shore of Israel, namely *Dictyota acutiloba* J. Agardh (Figure 4A). Many first country records of other aliens are also included in our dataset: first record of the green alga *Caulerpa taxifolia* var. *distichophylla* (Sonder) Verlaque, Huisman & Procaccini, from Israel (Figure 4B); first record of the sponge *Paraleucilla magna* Klautau, Monteiro & Borojevic, 2004 from Libya (Figure 4C) and Slovenia; first record of the lumpfish *Cyclopterus lumpus* Linnaeus, 1758 from eastern Mediterranean (Cyprus) (Figure 4D); first record of the cube boxfish *Ostracion cubicus* Linnaeus, 1758 from Israel (Figure 4E); first record of the cleaner shrimp *Urocaridella pulchella*

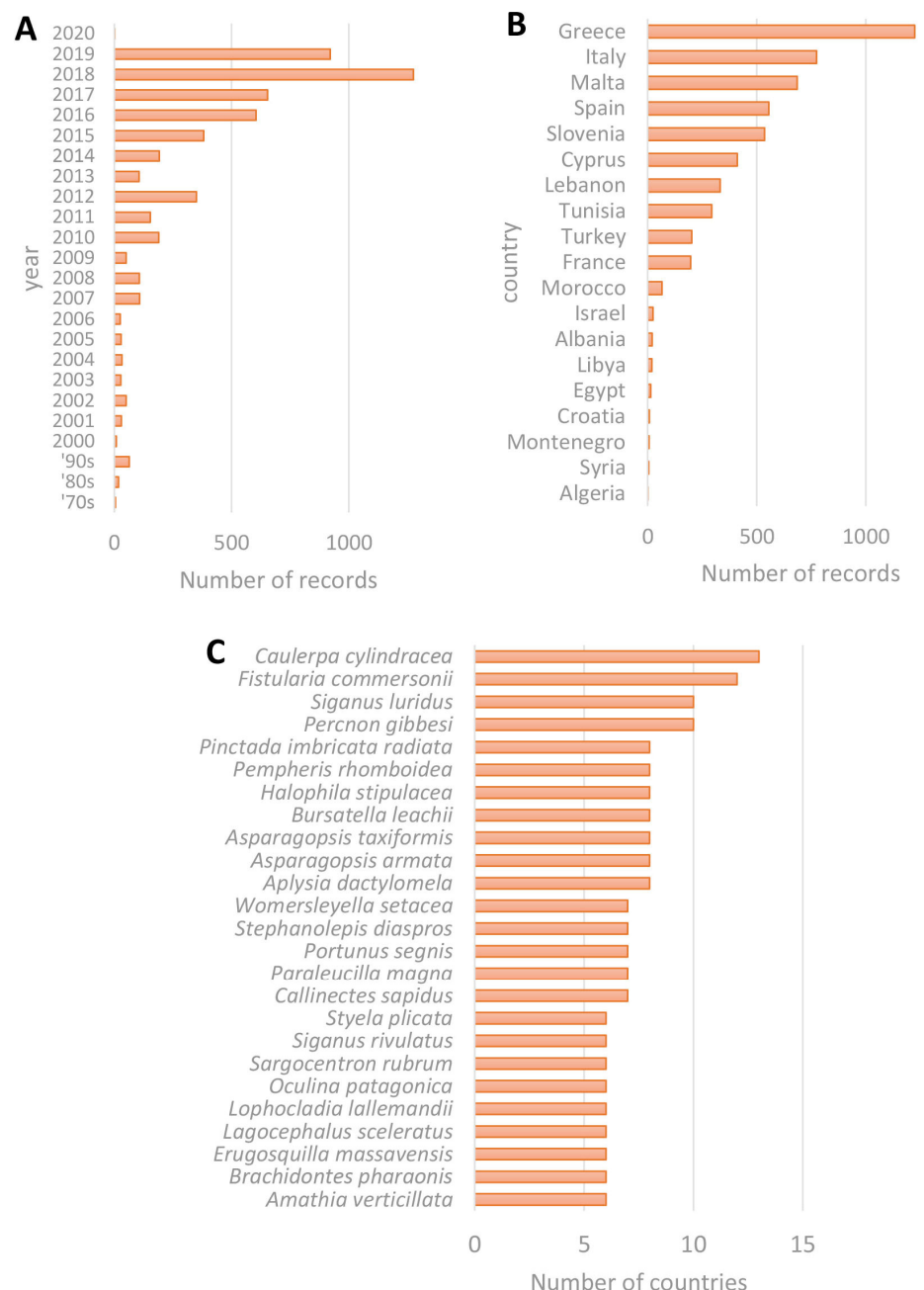


Figure 2. Spatio-temporal coverage of the dataset: (A) temporal distribution of records; (B) records per country; (C) country-coverage of species (for species recorded in more than 5 countries).

Yokeş & Galil, 2006 from Israel (Figure 4F); first record of the bryozoan *Celleporaria vermiformis* (Waters, 1909) from Malta; first records of two polychaete species from Malta, i.e. *Prionospio depauperata* Imajima, 1990, and *Notomastus aberans* Day, 1957.

Dictyota aculitoba is a brown seaweed that probably originated from the Pacific region. This species has a south Pacific distribution (Guiry and Guiry 2020). It was first observed growing on subtidal rocks, near the port of the city of Haifa, at the end of the first decade of the present millennium. Therefore, we assume that it arrived through shipping. However, the ID of this newcomer was not clear until recently. Morphological and molecular

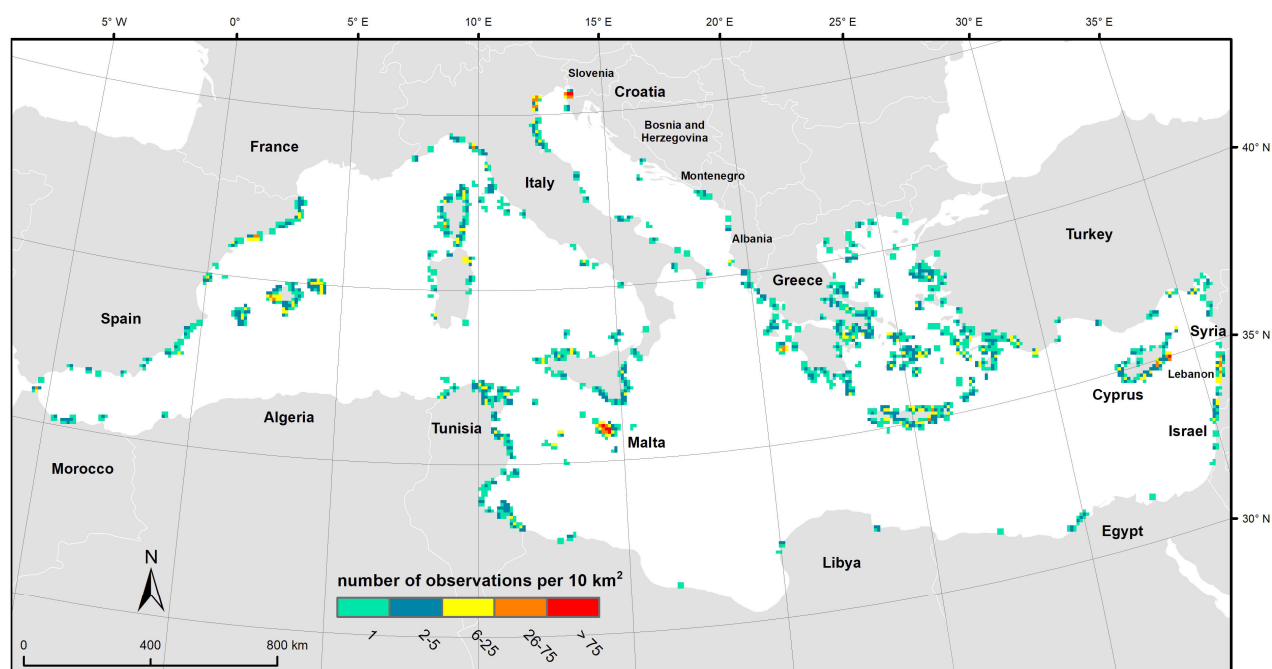


Figure 3. Number of alien and cryptogenic records per 10 km × 10 km grid cell, included in the dataset.

studies indicated that it was not one of the local Mediterranean species among the genus *Dictyota*. Although the presence of *D. aculitoba*, as an alien in the Mediterranean Sea, was mentioned in Tsiamis et al. (2020), there was no previous information regarding its distribution in this sea, and Tsiamis et al. (2020) posted in their table of Appendix B only rankings, indicating its presence and invasiveness. Since the first observation in Haifa Bay, it became invasive and spread northwards up to the border of Lebanon. High blooms, pointing at its invasiveness, are mainly observed during spring and summer along over 35 km of the northern shore of Israel. There is a high chance that it is also present in South Lebanon.

Caulerpa taxifolia var. *distichophylla* is a gracile variant of the famous invasive green seaweed species *Caulerpa taxifolia*, known for its unflattering name as the “killer alga”, because it has negative effects on the local marine flora and causes a loss of biodiversity in native marine ecosystems (Hoffman 2014). This variety probably originated from the South Pacific and Australia (Guiry and Guiry 2020). It was first observed and collected from the Mediterranean Sea in 2003, from Syria, successively recorded from Turkey in 2006, Sicily (Jongma et al. 2013), Malta (Schembri et al. 2015), Cyprus (Çiçek et al. 2013), Greece (Aplikioti et al. 2016), Lebanon (Bitar et al. 2017), Libya (Shakman et al. 2017), Tunisia (Chartosia et al. 2018) and Algeria (Kousteni et al. 2019). Lately, Bitar et al. (2017) also provided distribution for this taxon from Lebanon with a southern distribution in Byblos. The first specimen from Israeli waters was collected more than 100 km south of the latter location, at a subtidal site, nearby Nahlieli Islet. *Caulerpa taxifolia* var. *distichophylla* appears to mainly grow on sandy bottom (as seen in Figure 4B).

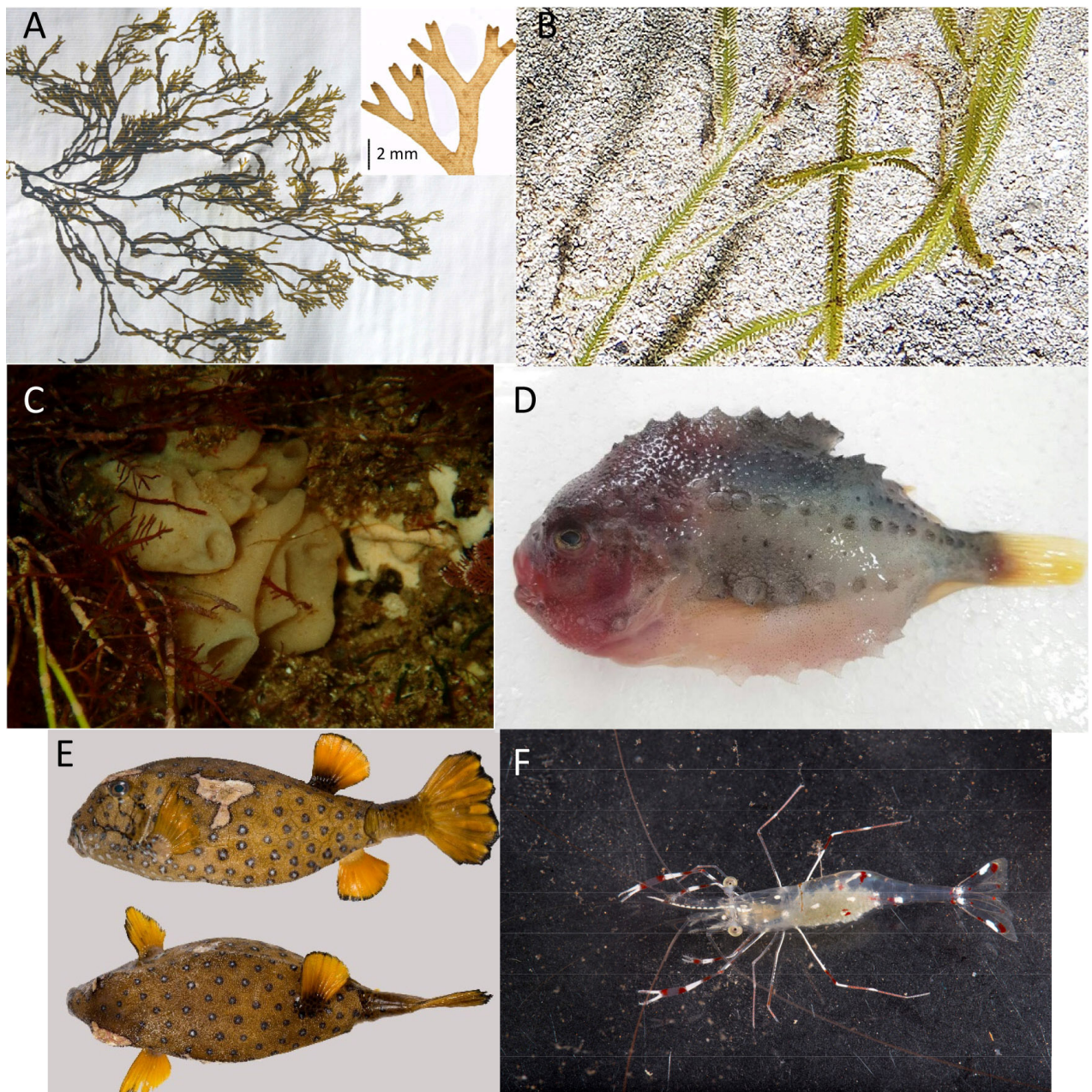


Figure 4. Remarkable new records included in the dataset: (A) *Dictyota acutiloba*, a first record in the Mediterranean Sea, observed in Israel, recorded by Razy Hoffman (photo: Razy Hoffman); (B) first record of *Caulerpa taxifolia* var. *distichophylla* in Israel, recorded by Razy Hoffman (photo: Shevy Rothman); (C) first record of the calcareous sponge *Paraleucilla magna* in Libya, recorded by Jamila Rizgalla (photo: Jamila Rizgalla); (D) first record of *Cyclopterus lumpus* in Cyprus, recorded by Louis Hadjioannou (photo: Christos Christofi); (E) first record of *Ostracion cubicus* in Israel, recorded by Shevy Rothman (photo: Oz Rittner); (F) Ovigerous-female of *Urocaridella pulchella*, first record in Israel, recorded by Ya'arit Levitt-Barmats (photo: Oz Rittner).

Paraleucilla magna is a calcareous sponge occurring at shallow depths in turbid waters, commonly as fouler in mussel farms and marinas, with a high capacity to colonize hard substrata (Longo et al. 2007). It is also found in clean and calm waters (Klautau et al. 2004). *P. magna* was first collected and described in Brazil (Rio de Janeiro State), being found in abundance along the entire Brazilian coast (Klautau et al. 2004). The species was first recorded in the Mediterranean in 2000 in Spain (Longo et al. 2004, backdated by Frotscher and Uriz 2008) and then in Mar Piccolo and Mar

Grande of Taranto (Italy) in 2001 by Longo et al. (2004), who suggested it was an alien species. Subsequently it spread to other localities along the Italian coast (Longo et al. 2007), followed by Malta (Zammit et al. 2009), Croatia (Cvitković et al. 2013), Turkey (Sea of Marmara by Topaloğlu et al. 2016; Aegean Sea by Evcen and Çinar 2020, including material collected in 2004), the Iberian Peninsula (Dailianis et al. 2016; Guardiola et al. 2016), Cyprus (Ulman et al. 2017), Montenegro (Mačić and Petović 2017), Greece (Gerovasileiou et al. 2017), France (Ulman et al. 2017), Tunisia (Chebaane et al. 2019), and Algeria (Bachetarzi et al. 2019). Described as a species with strong seasonality (Klautau et al. 2004), adults were observed to disappear following larval release (Guardiola et al. 2011; Longo et al. 2012). It is believed to have spread in the Mediterranean basin aided by bivalve farming, known among Italian mussel farmers for over 20–30 years as “pane”, i.e. the Italian word for bread (Longo et al. 2007). The speed by which it spread to various locations almost simultaneously suggests shipping traffic as another possible vector (Longo et al. 2007; Ulman et al. 2019). Here we report for the first time the presence of *P. magna* in Libya (Figure 4C) and Slovenia. Specimens of this sponge were found in the sites of mussel farms in Slovenia, growing down to 2 m depth. In Libya, sponges were found during multiple field surveys extending from May to October 2019 in a natural bay called “Regatta”, about 12 km from the Tripoli Harbour. Several *P. magna* specimens were found with sizes ranging between 5 and 10 cm in height. The species was most abundant between May and June 2019, attached to rocks at 0.5–1.0 m depth. Its abundance declined, and it ultimately disappeared in the following months from July to September, and then reappeared in the beginning of October. The surveyed area was of mixed sandy and rocky substrate covered by sponges and algae.

The lumpsucker or lumpfish *Cyclopterus lumpus*, the only member of the genus *Cyclopterus*, is a primarily benthic species found on rocky substrates in the north-east and north-west Atlantic, in cold waters, mainly at high latitudes (Kudryavtseva and Karamushko 2002). Until now, it has been recorded only once in the Mediterranean, in September 2004, when one specimen was caught 13 km from the coast, off Molunat Bay, southern Adriatic (Dulčić and Golani 2006). Here we report a second record for the Mediterranean and the first in the Levantine Sea. A single specimen was found in a market in Cyprus (Figure 4D), caught by a professional fisher by net at around 25 m depth in June 2017 off Protaras (35.028°N; 34.060°E). Like Dulčić and Golani (2006), we also postulate that this fish may have arrived in the region either by ballast water, or even as an escape/release from public or private aquaria, since it is a popular aquarium fish that survives well in aquaria (Dulčić and Golani 2006).

The yellow boxfish *Ostracion cubicus* naturally occurs in the Indo-Pacific Ocean, in the Red Sea and East Africa, the Persian Gulf, to the Hawaiian and Tuamotu islands (Froese and Pauly 2019). It was first

recorded in the Mediterranean Sea in January 2011 off the northern Lebanese coast, where a single individual was speared, photographed and then discarded (Bariche 2011). Later, in March and November 2015, two additional records from Tyre and Beirut, respectively, were reported from Lebanon (Dailianis et al. 2016). Finally, in April 2017 a single individual was observed and photographed by a SCUBA diver in the Gulf of Antalya, Turkey (Gerovasileiou et al. 2017). We hereby report the fifth and southernmost occurrence of *O. cubicus* in the Mediterranean Sea, which constitutes the first record of this species from the Israeli coastline. In December 2017, a single individual was speared by a fisher at 8 m depth on a breakwater in Ashdod port, southern Israel. A second individual with a bluish body colouration, presumably an adult male, was visually detected during the same dive; however, this report could not be further verified. The specimen (Figure 4E) measured 290 mm in total length, fresh coloration yellow with scattered pale blue spots edged with dark margins. The specimen had large lesions above its left eye and on the middle left side of the body, which may have been inflicted by a prior injury (Figure 4E). A fresh tissue sample from the caudal peduncle was taken for genetic analysis. The contiguous COI sequence and its trace files were uploaded to BoLD system www.boldsystems.org under the BIM project (Biota of the Israeli Mediterranean; accession voucher BIM641-19). While *O. cubicus* has been assumed to have entered the Mediterranean through the Suez Canal (Bariche 2011), the present record from an artificial structure inside an international port suggests it may have entered Israeli waters via maritime shipping.

Urocaridella pulchella is the first representative of this genus from the Mediterranean Sea (Yokeş and Galil 2006). The genus members are considered cleaner shrimps, found usually in small groups, in shallow-water reef substrates and crevices throughout the Indo-Pacific Ocean (Anker and De Grave 2016; Prakash and Baeza 2018). The species was first collected and described in 2003 from Turkey (Kaş), and was suggested to be an alien species (Yokeş and Galil 2006). Only a few years later the species was recorded from the Red Sea—Saudi Arabia (Ďuriš 2017) and Egypt (Horká et al. 2018)—supporting that *U. pulchella* is indeed of Red Sea origin. The first record from Israel, reported herein, is the second record of the species from the Mediterranean Sea, visually observed and photographed in 2014 in Nahariyya (northern Israel), during a night dive. A year later several other individuals were observed along Tel Aviv beach (central region of Israel). In 2016, five specimens were collected at 20 m depth during a dive in Akhziv reservoir (northern Israel), including three ovigerous-females (Figure 4F). COI and 16S sequences were obtained for two specimens, one from Turkey and the second from Israel, using Geneious R7 (v.7.1.5; <http://www.geneious.com>; Kearse et al. 2012). Using Maximum-likelihood (ML) method, the Mediterranean specimens clustered

together with the Egyptian one (GenBank accession no. KY197952 and KY197943 for COI and 16S, respectively). This molecular analysis also demonstrated the difference between *U. pulchella* and *U. antonbruunii* (Bruce, 1967), known from Gulf of Aqaba (Y. Levitt-Barmats *pers. observ.*).

In the framework of a two-year monitoring program conducted on behalf of the Maltese Environment and Resources Authority (AIS/ERA), extensive surveys were conducted in Maltese waters, and the related data (part of this dataset) included first records of *Celleporaria vermiformis*, *Prionospio depauperata*, and *Notomastus aberans*. *Prionospio depauperata* is a NE Pacific species, first reported from south Turkey in 2005 (Dagli and Cinar 2009) and later (2009) from the Aegean Sea, Turkey (Dagli et al. 2011). Its present records in Malta at two soft-sediment sites at depths 17–18 m, are the first records in the central Mediterranean. *Notomastus aberans* is a species originating from the Indian Ocean-Red Sea, first reported from France and Greece (Harmelin 1968), already known from the central Mediterranean since 1965 (Tunisia: de Gaillande 1970), and also reported since 1992 from the Strait of Messina (Cosentino and Giacobbe 2006). Herein, we report records of 27 individuals from 11 soft-bottom sites. *Celleporaria vermiformis* is a recently reported Red Sea bryozoan (first reported in Lebanon: Harmelin 2014) that was recently discovered in fouling marinas in Turkey, Cyprus and Greece (Ulman et al. 2017). Its present record in Malta was from artificial substrates, pontoons and other structures in harbour areas.

Discussion

This collective effort is providing open access to a large dataset of alien and cryptogenic species records from the Mediterranean Sea. It can be used extensively in assessments of biological invasions in the region by complementing published records. This effort demonstrates that there is a huge amount of information related to the marine environment, scattered in personal databases and repositories, which could be retrieved easily, homogenized and made available to the scientific community. It also demonstrates that effective state-level monitoring networks in the Mediterranean are largely missing despite the requirements by EU (e.g. for the implementation of the Marine Strategy Framework Directive 2008/56/EC) and the Barcelona Convention (e.g. UNEP/MAP 2017).

Such not-yet-openly-available information exists for all fields of marine sciences (physical, chemical, geological and biological), which would greatly benefit from similar efforts to utilize previously collected and unreported data. Hence, this work can serve as a paradigm for other fields of marine sciences as well, provided that a large number of scientists are willing to participate in such a coordinated effort.

It has been estimated that less than 1% of the ecological data collected is accessible after the publication of associated results (Reichman et al. 2011). The more data made available and usable, the greater the benefit for

science and society, and the better use of public money supporting research. However, encouraging scientists to share their data can be a big challenge. We believe that such collective efforts are beneficial for all contributors as their new published data are recognized and cited, and a large dataset that can be used for research objectives is provided, which may stimulate new collaborations. These benefits should be sufficient to overcome the – often observed – cultural reluctance to publish data openly. By continuing this effort on a regular basis, valuable datasets will continuously be made available to the scientific community, supporting monitoring efforts of biological invasions in the Mediterranean.

The great amount of information provided here is also a further evidence of the potential of engaging fishers and other sea users in the process of data collection and monitoring. Such a strategy could be effective beyond the local scale, at the sub-regional or even regional scale (Azzurro et al. 2019b).

As a next step, datasets like this one can feed large regional or global and subject-oriented data collections, e.g. the Global Biodiversity Information Facility (GBIF 2020), and EASIN (Katsanevakis et al. 2015). Such collections aim to further benefit research by making vast quantities of biodiversity information usable, thus assisting large-scale assessments and meta-analyses.

Our dataset, although partly representative of the status of biological invasions in the Mediterranean Sea, is not unbiased, as the included records were dependent on the specific group of participating scientists and their taxonomic and geographical areas of research, varying sampling effort among countries, unbalanced development of citizen science initiatives among countries, and specificities of each species (e.g. some can be identified visually with very high certainty, while others require examination of specimens in the laboratory by experts or even molecular studies). Nevertheless, some patterns observed in the data are indicative of the degree of establishment (as a proxy for the invasiveness of some species). For example, *Caulerpa cylindracea*, the most invasive alien seaweed species known from the Mediterranean Sea (Katsanevakis et al. 2016) was the most reported species in this dataset, with 738 new records, from more countries than any other species.

Acknowledgements

The publication of this article is supported by the Open Access Publishing Fund of the International Association for Open Knowledge on Invasive Alien Species (INVASIVESNET; www.invasivesnet.org). Stelios Katsanevakis, Maria Sini and Konstantinos Tsirintanis were supported by the Hellenic Foundation for Research and Innovation (H.F.R.I.) under the “First Call for H.F.R.I. Research Projects to support Faculty members and Researchers and the procurement of high-cost research equipment grant” (Project Number: HFRI-FM17-1597). Enalia Physis acknowledges Pantelis Patsalou for his support with field-logistics and links with fishers. Fiona Tomas would like to acknowledge funding from FECYT FCT- 14-9319 (¡OJO A LAS INVASORAS! BIODIVERSIDAD Y ESPECIES INVASORAS DEL MEDITERRÁNEO BALEAR). Vasilis Gerovasileiou, Thanos Dailianis and Maria Sini acknowledge the support by the MARISCA project (www.marisca.eu), co-funded (85%) by EEA GRANTS, 2009–2014, and the Public Investments Program (PIP) of the Hellenic Republic (15%). Razy Hoffman acknowledges funding by Yad-Hanadiv foundation, through the Israel Society of Ecology and

Environmental Sciences and Israel Nature and Parks Authority (An integrated program for establishing biological baselines and monitoring protocols for marine reserves in the Israeli Mediterranean Sea). Argyro Zenetos and Paraskevi K. Karachle would like to thank the citizen-scientists collaborating with the Ellenic Network on Aquatic Invasive Species (ELNAIS – elnais.hcmr.gr). Nikolaos Doumpas, Ioannis Giovos, Periklis Kleirou and Francesco Tiralongo would like to thank all the citizen-scientists that contributed with their shared records and data in the citizen-science project “Is it alien to you? Share it!!!” (<https://www.facebook.com/groups/104915386661854/>). Data from Gyaros Island marine reserve were collected under the “GyarosMPA” project, funded by “MAVA Fondation pour la Nature”. Data from Corsica coastline were mainly collected in the framework of the “Corsica Alien Network” initiated by “Office de l’Environnement de la Corse”. Carla Morri and Carlo Nike Bianchi received financial support from FFARB (funds for basic research activities) by the Italian Ministry of Education, University and Research. Ergün Taşkın has been supported by TÜBİTAK, Ankara, Turkey (Project Number: 114Y238). The Slovenian authors would like to acknowledge their financial support from the Slovenian Research Agency (research core funding No. P1-0237) and the Ministry of Agriculture, Forestry and Food of the Republic of Slovenia. Mehmet Fatih Huseyinoglu thanks University of Kyrenia’s Scientific Research Project numbered GRN-2019-1-004. Fabio Crocetta was funded by the COST (European Cooperation in Science and Technology) Action TD1209 Alien Challenge project. The FRI (HAO DEMETER) team is very grateful to the Marine Strategy Project for financial support. Records of NIS in Jbel Moussa, the National Park of Al Hoceima and Cap des Trois Fourches sites from Morocco were obtained during surveys conducted within the framework of the MedKeyHabitats and the MedMPAnet Projects implemented by UNEP/MAP-RAC/SPA in close collaboration with the Haut Commissariat aux Eaux et Forêts et à la Lutte Contre la Désertification (HCEFLCD) and financially supported by RAC/SPA, Tunisia and the MAVA Foundation, Switzerland (MedKeyHabitats Project) and the European Commission (EC), the Spanish Agency for International Cooperation to Development (AECID), and the French Global Environment Facility (MedMPAnet Project). Jamila Ben Souissi was partially funded by BiodivMex /Chantier MISTRALS. Konstantinos Tsiamis sampling records were retrieved during his post in the Hellenic Centre for Marine Research, which he would like to thank for. Periklis Kleitou and Demetris Kletou were supported by the LIFE financial instrument of the European Union – RELIONMED project [Grant Agreement LIFE16 NAT/ CY/000832]. Some of the data included in the dataset were obtained through the marine citizen science platform Observadores del Mar www.observadoresdelmar.es with the support of FECYT FCT-17-12469, LIFE IP Intemares and Fundació Marilles, and through the citizen science site of the Italian Marine Protected Area of “Regno di Nettuno” (islands of Ischia, Procida and Vivara): www.citizensciencerdn.org. Most data from Lebanon were retrieved from social media dedicated to citizen science (Facebook group: Sea Lebanon <https://www.facebook.com/groups/109615625861815/>) or fishers and scuba divers WhatsApp groups). Jamila Rizgalla wishes to thank the administration of Regatta for granting a free pass to conduct field surveys and the security personnel for providing a safe environment. Anna Occhipinti-Ambrogi was supported by European Community’s Seventh Framework Program VECTORS (Vectors of Change in Oceans and Seas Marine Life, Impact on Economic Sectors). The long lasting collaboration with the ICES Working Group on Introductions and Transfer of Marine Organisms (WGITMO) has been a good forum where many information and ideas could be exchanged within some of the authors (Anna Occhipinti-Ambrogi, Argyro Zenetos, Agnese Marchini, and a wider community of scientists working on biological invasions). A. Rosso and R. Sanfilippo received grants from the Catania University Research Plan 2016/2018. Data from Kuriat island were collected under the “Kuriat project”, funded by “MAVA Fondation pour la Nature” executed by SPA/RAC in partnership with the Coastal Protection and Management Agency (APAL) and Notre Grand Bleu (NGB) NGO. The AIS/ERA (Environment and Resources Authority) Maltese data were obtained from the EU funded project EMFF 8.3.1 under the European Maritime and Fisheries Fund 2014–2020 with a total cost of €1.6 million in public eligible EMFF funds (75% EU 25% MT), managed by AIS/ERA (Environment and Resources Authority). The ultimate goals of this European Maritime and Fisheries Fund (EMFF 2014–2020) project are to devise a holistic approach towards marine monitoring and develop a comprehensive database of data collected about the Maltese waters. We thank the anonymous reviewers for their useful comments.

Disclaimer

The responsibility for correct identification and reporting rests with the observer of each record, as stated in the Supplementary material Table S1.

References

- Anker A, De Grave S (2016) An updated and annotated checklist of marine and brackish caridean shrimps of Singapore (Crustacea, Decapoda). *Raffles Bulletin of Zoology* 34: 343–454
- Aplikioti M, Louizidou P, Mystikou A, Marcou M, Stavrou P, Kalogirou S, Tsiamis K, Panayotidis P, Küpper FC (2016) Further expansion of the alien seaweed *Caulerpa taxifolia* var. *distichophylla* (Sonder) Verlaque, Huisman & Procaccini (Ulvophyceae, Bryopsidales) in the Eastern Mediterranean Sea. *Aquatic Invasions* 11: 11–20, <https://doi.org/10.3391/ai.2016.11.1.02>
- Azzurro E, Bariche M, Broglio E, Maynou F (2013) Seawatchers: an interactive website to monitor the occurrences of exotic fishes in the Mediterranean Sea. *Rapports de la Commission Internationale pour l'Exploration Scientifique de la Mer Méditerranée* 40: 599
- Azzurro E, Sbragaglia V, Cerri J, Bariche M, Bolognini L, Ben Souissi J, Busoni G, Coco S, Chryssanthi A, Fanelli E, Ghanem R, Garrabou J, Gianni F, Grati F, Kolitari J, Letterio G, Lipej L, Mazzoldi C, Milone N, Pannacciulli F, Pešić A, Samuel-Rhoads Y, Saponari L, Tomanic J, Topçu NE, Vargiu G, Moschella P (2019a) Climate change, biological invasions, and the shifting distribution of Mediterranean fishes: A large-scale survey based on local ecological knowledge. *Global Change Biology* 25: 2779–2792, <https://doi.org/10.1111/gcb.14670>
- Azzurro E, Bolognini L, Dragičević B, Drakulović D, Dulčić J, Fanelli E, Grati F, Kolitari J, Lipej L, Magaletti E, Marković O, Matić-Skoko S, Mavrič B, Milone N, Joksimović A, Tomanić K, Scarpato A, Tutman P, Vrdoljak D, Zappacosta F (2019b) Detecting the occurrence of indigenous and non-indigenous megafauna through fishermen knowledge: A complementary tool to coastal and port surveys. *Marine Pollution Bulletin* 147: 229–236, <https://doi.org/10.1016/j.marpolbul.2018.01.016>
- Bachetarzi R, Dilmi S, Uriz MJ, Vázquez-Louis M, Deudero S, Rebzani-Zahaf C (2019) The non-indigenous and invasive species *Paraleucilla magna* Klautau, Monteiro & Borojevic, 2004 (Porifera: Calcarea) in the Algerian coast (Southwestern of Mediterranean Sea). *Acta Adriatica* 60: 41–46, <https://doi.org/10.32582/aa.60.1.3>
- Bariche M (2011) First record of the cube boxfish *Ostracion cubicus* (Ostraciidae) and additional records of *Champsodon vorax* (Champsodontidae) from the Mediterranean. *Aqua, International Journal of Ichthyology* 17(4): 181–184
- Barralon E, Buron D, Donini J, Labbe C, Lerissel K, Monnier B, Pergent G, Pergent-Martini C (2019) The Corsica Alien Network: a tool for monitoring and tracking marine exotic species. In: Langar H, Ouerghi A (eds) Proceedings of the 1st Mediterranean Symposium on the Non-Indigenous Species, Antalya, Turkey, 17-18 January 2019, SPA/RAC publications, pp 23–28
- Bitar G, Ramos-Esplá AA, Ocaña O, Sghaier YR, Forcada A, Valle C, El Shaer H, Verlaque M (2017) The introduced marine macroflora of Lebanon and its distribution on the Levantine coast. *Mediterranean Marine Science* 18: 138–155, <https://doi.org/10.12681/mms.1993>
- Chartosia N, Anastasiadis D, Bazairi H, Crocetta F, Deidun A, Despalatović M, Di Martino V, Dimitriou N, Dragičević B, Dulčić J, Durucan F, Hasbek D, Ketsilis-Rinis V, Kleitou P, Lipej L, Macali A, Marchini A, Ousselam M, Piraino S, Stancanelli B, Theodosiou M, Tiralongo F, Todorova V, Trkov D, Yapici S (2018) New Mediterranean Biodiversity Records (July 2018). *Mediterranean Marine Science* 19: 398–415, <https://doi.org/10.12681/mms.18099>
- Chebaane S, Sempere-Valverde J, Dorai S, Kacem A, Ramzi Sghaier Y (2019) A Preliminary inventory of alien and cryptogenic species in Monastir Bay, Tunisia: spatial distribution, introduction trends and pathways. *Mediterranean Marine Science* 20: 616–626, <https://doi.org/10.12681/mms.20229>
- Çiçek BA, Kurt O, Taşkin E, Öztürk M (2013) First report of *Caulerpa taxifolia* var. *distichophylla* (Sonder) Verlaque, Huisman & Procaccini (Caulerpaceae, Chlorophyta) from northern Cyprus. *Rapports de la Commission Internationale pour l'Exploration Scientifique de la Mer Méditerranée* 40: 600
- Coll M, Piroddi C, Albouy C, Ben Rais Lasram F, Cheung WWL, Christensen V, Karpouzi VS, Guilhaumon F, Mouillot D, Paleczny M, Palomares ML, Steenbeek J, Trujillo P, Watson R, Pauly D (2012) The Mediterranean under siege: spatial overlap between marine biodiversity, cumulative threats and marine reserves. *Global Ecology and Biogeography* 21: 465–481, <https://doi.org/10.1111/j.1466-8238.2011.00697.x>
- Cosentino A, Giacobbe S (2006) A case study of mollusc and polychaete soft-bottom assemblages submitted to sedimentary instability in the Mediterranean Sea. *Marine Ecology* 27: 170–183, <https://doi.org/10.1111/j.1439-0485.2006.00088.x>
- Cvitković I, Despalatović M, Grubelić I, Nikolić V, Pleše B, Žuljević A (2013) Occurrence of *Paraleucilla magna* (Porifera: Calcarea) in the Eastern Adriatic Sea. *Acta Adriatica* 54(1): 93–99
- Dagli E, Çinar ME (2009) Species of the subgenera *Aquilaspio* and *Prionospio* (Polychaeta: Spionidae: *Prionospio*) from the southern coast of Turkey (Levantine Sea, eastern Mediterranean), with description of a new species and two new reports for the Mediterranean fauna. *Zootaxa* 2275: 1–20, <https://doi.org/10.11646/zootaxa.2275.1.1>

- Dagli E, Çinar ME, Ergen Z (2011) Spionidae (Annelida: Polychaeta) from the Aegean Sea (eastern Mediterranean). *Italian Journal of Zoology* 78: 49–64, <https://doi.org/10.1080/11250003.2011.567828>
- Dailianis T, Akyol O, Babali N, Bariche M, Crocetta F, Gerovasileiou V, Ghanem R, Gökoğlu M, Hasiotis T, Izquierdo Muñoz A, Julian D, Katsanevakis S, Lipej L, Mancini E, Mytilineou Ch, Ounifi Ben Amor K, Özgül A, Ragkousis M, Rubio-Portillo E, Servello G, Sini K, Stamouli C, Sterioti A, Teker S, Tiralongo F, Trkov D (2016) New Mediterranean Biodiversity Records (July 2016). *Mediterranean Marine Science* 17: 608–626, <https://doi.org/10.12681/mms.1734>
- De Gaillande D (1970) Note sur les peuplements de la zone centrale du golfe de Gabès (Campagne Calypso, 1965). *Téthys* 2(1): 131–138
- Dulčić J, Golani D (2006) First record of *Cyclopterus lumpus* L., 1758 (Osteichthyes: Cyclopteridae) in the Mediterranean Sea. *Journal of Fish Biology* 69: 300–303, <https://doi.org/10.1111/j.1095-8649.2006.01077.x>
- Đuriš Z (2017) Palaemonid shrimps (Crustacea: Decapoda) of Saudi Arabia from the ‘Red Sea Biodiversity Survey’ 2011–2013, with 11 new records for the Red Sea. *Marine Biodiversity* 47: 1147–1161, <https://doi.org/10.1007/s12526-017-0681-8>
- Essl F, Bacher S, Genovesi P, Hulme PE, Jeschke JM, Katsanevakis S, Kowarik I, Kühn I, Pyšek P, Rabitsch W, Schindler S, van Kleunen M, Vilà M, Wilson JR, Richardson DM (2018) Which taxa are alien? Criteria, applications, and uncertainties. *BioScience* 68: 496–509, <https://doi.org/10.1093/biosci/biy057>
- Evçen A, Çinar ME (2020) Sponge species from inner and middle parts of İzmir Bay (Aegean Sea, Eastern Mediterranean). *Ege Journal of Fisheries and Aquatic Sciences* 37: 149–155, <https://doi.org/10.12714/egejfas.37.2.05>
- Froese R, Pauly D (eds) (2019) FishBase. www.fishbase.org version 12/2019 (accessed 25 January 2020)
- Frotscher PJ, Uriz MJ (2008) Reproduction and life cycle of the calcarean sponge *Paraleucilla magna* in the Mediterranean Sea. XV Simposio Ibérico de Estudios de Bentos Marino (Funchal, Madeira, September 2008), p 121
- GBIF (2020) The Global Biodiversity Information Facility - What is GBIF? <https://www.gbif.org/what-is-gbif> (accessed 27 January 2020)
- Gerovasileiou V, Akel EHK, Akyol O, Alongi G, Azevedo F, Babali N, Bakiu R, Bariche M, Bennoui A, Castriota L, Chintiroglou CC, Crocetta F, Deidun A, Galinou-Mitsoudi S, Giovos I, Gökoğlu M, Golema A, Hadjoannou L, Hartingerova J, Insacco G, Katsanevakis S, Kleitou P, Korun J, Lipej L, Malegue M, Michailidis N, Mouzai Tifoura A, Ovalis P, Petović S, Piraino S, Rizkalla SI, Rousou M, Savva I, Şen H, Spinelli A, Vougioukalou KG, Xharahi E, Zava B, Zenetos A (2017) New Mediterranean Biodiversity Records (July 2017). *Mediterranean Marine Science* 18: 355–384, <https://doi.org/10.12681/mms.13771>
- Giovos I, Kleitou P, Poursanidis D, Batjakas I, Bernardi G, Crocetta F, Doumpas N, Kalogirou S, Kampouris TE, Keramidas I, Langeneck J, Maximidi M, Mitsou E, Stoilas VO, Tiralongo F, Romanidis-Kyriakidis G, Xentidis NJ, Zenetos A, Katsanevakis S (2019) Citizen-science for monitoring marine invasions and stimulating public engagement: a case project from the eastern Mediterranean. *Biological Invasions* 21: 3707–3721, <https://doi.org/10.1007/s10530-019-02083-w>
- Guardiola M, Frotscher J, Uriz MJ (2011) Genetic structure and differentiation at a short-time scale of the introduced calcarean sponge *Paraleucilla magna* to the western Mediterranean. *Hydrobiologia* 687: 71–84, <https://doi.org/10.1007/s10750-011-0948-1>
- Guardiola M, Frotscher J, Uriz MJ (2016) High genetic diversity, phenotypic plasticity, and invasive potential of a recently introduced calcareous sponge, fast spreading across the Atlanto-Mediterranean basin. *Marine Biology* 163: 123, <https://doi.org/10.1007/s00227-016-2862-6>
- Guiry MD, Guiry GM (2020) AlgaeBase. National University of Ireland, Galway. <http://www.algaebase.org> (accessed 28 January 2020)
- Harmelin JG (1968) Note sur trois Capitellidae (Annélides Polychètes) récoltés en Méditerranée, avec description d’un nouveau genre: *Peresiella*. *Recueil des Travaux de la Station Marine d’Endoume* 43: 253–259
- Harmelin JG (2014) Alien bryozoans in the eastern Mediterranean Sea - new records from the coasts of Lebanon. *Zootaxa* 3893: 301–338, <https://doi.org/10.11646/zootaxa.3893.3.1>
- He Q, Silliman BR (2019) Climate change, human impacts, and coastal ecosystems in the Anthropocene. *Current Biology* 29: R1021–R1035, <https://doi.org/10.1016/j.cub.2019.08.042>
- Hoffman R (2014) Alien benthic algae and seagrasses in the Mediterranean Sea and their connection to global warming. In: Goffredo S, Dubinsky Z (eds), *The Mediterranean Sea: Its history and present challenges*. Springer, Dordrecht, Netherlands, pp 159–181, https://doi.org/10.1007/978-94-007-6704-1_10
- Horká I, De Grave S, Fransen CHJM, Petrusek A, Đuriš Z (2018) Multiple origins and strong phenotypic convergence in fish-cleaning palaemonid shrimp lineages. *Molecular Phylogenetics and Evolution* 124: 71–81, <https://doi.org/10.1016/j.ympev.2018.02.006>
- Jongma DN, Campo D, Dattolo E, D’Esposito D, Duchi A, Grewe P, Huisman J, Verlaque M, Yokeş MB, Procaccini G (2013) Identity and origin of a slender *Caulerpa taxifolia* strain

- p>introduced into the Mediterranean Sea.
- Botanica Marina*
- 56: 27–39,
- <https://doi.org/10.1515/bot-2012-0175>
- Katsanevakis S, Coll M, Piroddi C, Steenbeek J, Ben Rais Lasram F, Zenetos A, Cardoso AC (2014a) Invading the Mediterranean Sea: biodiversity patterns shaped by human activities. *Frontiers in Marine Science* 1: 32, <https://doi.org/10.3389/fmars.2014.00032>
- Katsanevakis S, Wallentinus I, Zenetos A, Leppäkoski E, Çinar ME, Öztürk B, Grabowski M, Golani D, Cardoso AC (2014b) Impacts of marine invasive alien species on ecosystem services and biodiversity: a pan-European review. *Aquatic Invasions* 9: 391–423, <https://doi.org/10.3391/ai.2014.9.4.01>
- Katsanevakis S, Deriu I, D'Amico F, Nunes AL, Pelaez Sanchez S, Crocetta F, Arianoutsou M, Bazos I, Christopoulou A, Curto G, Delipetrou P, Kokkoris Y, Panov V, Rabitsch W, Roques A, Scalera R, Shirley SM, Tricarico E, Vannini A, Zenetos A, Zervou S, Zikos A, Cardoso ACC (2015) European Alien Species Information Network (EASIN): supporting European policies and scientific research. *Management of Biological Invasions* 6: 147–157, <https://doi.org/10.3391/mbi.2015.6.2.05>
- Katsanevakis S, Tempera F, Teixeira H (2016) Mapping the impact of alien species on marine ecosystems: the Mediterranean Sea case study. *Diversity and Distributions* 22: 694–707, <https://doi.org/10.1111/ddi.12429>
- Kearse M, Moir R, Wilson A, Stones-Havas S, Cheung M, Sturrock S, Buxton S, Cooper A, Markowitz S, Duran C, Thierer T, Ashton B, Meintjes P, Drummond A (2012) Geneious Basic: An integrated and extendable desktop software platform for the organization and analysis of sequence data. *Bioinformatics* 28: 1647–1649, <https://doi.org/10.1093/bioinformatics/bts199>
- Klautau M, Monteiro L, Borojevic R (2004) First occurrence of the genus *Paraleucilla* (Calcarea, Porifera) in the Atlantic Ocean: *P. magna* sp. nov. *Zootaxa* 710: 1–8, <https://doi.org/10.11646/zootaxa.710.1.1>
- Kousteni V, Bakiu R, Benhmida A, Crocetta F, Di Martino V, Dogrammatzi A, Doumpas N, Durmishaj S, Giovos I, Gökoğlu M, Huseyinoglu MF, Jimenez C, Kalogirou S, Kleitou P, Lipej L, Macali A, Petani A, Petrović S, Prato E, Rubino F, Sghaier YR, Stancanelli B, Teker S, Tiralongo F, Trkov D (2019) New Mediterranean biodiversity records (April, 2019). *Mediterranean Marine Science* 20(1): 230–247
- Kudryavtseva OY, Karamushko OV (2002) Biology of the lumpfish *Cyclopterus lumpus* during reproduction in the Murman near shore zone. *Journal of Ichthyology* 42: 309–313
- Levin N, Coll M, Fraschetti S, Gal G, Giakoumi S, Göke C, Heymans JJ, Katsanevakis S, Mazor T, Öztürk B, Rilov G, Gajewski J, Steenbeek J, Kark S (2014) Biodiversity data requirements for systematic conservation planning in the Mediterranean Sea. *Marine Ecology Progress Series* 508: 261–281, <https://doi.org/10.3354/meps10857>
- Longo C, Scalera-Liaci L, Manuel M, Corriero G (2004) Note sui poriferi del Mar Grande e del Mar Piccolo di Taranto (Mar Ionio). *Biologia Marina Mediterranea* 11: 440–443
- Longo C, Mastrototaro F, Corriero G (2007) Occurrence of *Paraleucilla magna* (Porifera: Calcarea) in the Mediterranean Sea. *Journal of the Biological Association of the UK* 87: 1749–1755, <https://doi.org/10.1017/S0025315407057748>
- Longo C, Pontassuglia C, Corriero G, Gaino E (2012) Life-cycle traits of *Paraleucilla magna*, a calcareous sponge invasive in a coastal Mediterranean basin. *PLoS ONE* 7: e42392, <https://doi.org/10.1371/journal.pone.0042392>
- Mačić V, Petrović S (2017) New data on the distribution of the alien sponge *Paraleucilla magna* Klautau, Monteiro & Borojević, 2004 in the Adriatic Sea. *Studia Marina* 29(1): 63–68
- Mannino AM, Balistreri P, Deidun A (2017) Citizens and scientists work together to monitor marine alien species in Sicilian waters (central Mediterranean). EMSEA 2017 Conference (Malta 7–10 October 2017), University of Malta, p 45
- Micheli F, Halpern BS, Walbridge S, Ciriaco S, Ferretti F, Fraschetti S, Lewison R, Nykjaer L, Rosenberg AA (2013) Cumulative human impacts on Mediterranean and Black Sea marine ecosystems: assessing current pressures and opportunities. *PLoS ONE* 8: e79889, <https://doi.org/10.1371/journal.pone.0079889>
- Morri C, Montefalcone M, Gatti G, Vassallo P, Paoli C, Bianchi CN (2019) An alien invader is the cause of homogenization in the recipient ecosystem: a simulation-like approach. *Diversity* 11: 146, <https://doi.org/10.3390/d11090146>
- Prakash S, Baeza JA (2018) A new species of shrimp of the genus *Urocaridella* Borradaile, 1915 (Decapoda: Caridea: Palaemonidae) from Papua New Guinea. *Journal of Crustacean Biology* 38: 206–214, <https://doi.org/10.1093/jcblol/rux113>
- Reichman OJ, Jones MB, Schildhauer MP (2011) Challenges and opportunities of open data in ecology. *Science* 331: 703–705, <https://doi.org/10.1126/science.1197962>
- Schembri PJ, Barbara J, Deidun A, Lanfranco E, Lanfranco S (2015) It was only a matter of time: occurrence of *Caulerpa taxifolia* (Vahl) C. Agardh var. *distichophylla* (Sonder) Verlaque, Huisman and Procaccini in the Maltese Islands (Chlorophyta, Ulvophyceae, Caulerpacae). *BioInvasions Records* 4: 9–16, <https://doi.org/10.3391/bir.2015.4.1.02>

- Shakman EA, Abdalha AB, Talha F, Al-Faturi A, Bariche M (2017) First records of seven marine organisms of different origins from Libya (Mediterranean Sea). *BioInvasions Records* 6: 377–382, <https://doi.org/10.3391/bir.2017.6.4.13>
- Topaloglu B, Evcen A, Çinar ME (2016) Sponge fauna in the Sea of Marmara. *Turkish Journal of Fisheries and Aquatic Sciences* 16: 51–59, https://doi.org/10.4194/1303-2712-v16_1_06
- Tsiamis K, Gervasini E, D’Amico F, Deriu I, Katsanevakis S, Crocetta F, Zenetos A, Arianoutsou M, Backeljau T, Bariche M, Bazos I, Bertaccini A, Brundu G, Carrete M, Çinar ME, Curto G, Faasse M, Justine JL, Király G, Langer MR, Levitt Y, Panov VE, Piraino S, Rabitsch W, Roques A, Scalera R, Shenkar N, Sirbu I, Tricarico E, Vannini A, Asbjørn Vøllestad L, Zikos A, Cardoso AC (2016) The EASIN Editorial Board: quality assurance, exchange and sharing of alien species information in Europe. *Management of Biological Invasions* 7: 321–328, <https://doi.org/10.3391/mbi.2016.7.4.02>
- Tsiamis K, Azzurro E, Bariche M, Çinar ME, Crocetta F, De Clerck O, Galil B, Gomez F, Hoffman R, Jensen K, Kamburska L, Langeneck J, Langer M, Levitt-Barmats Y, Lezzi M, Marchini A, Occhipinti-Ambrogi A, Ojaveer H, Piraino S, Shenkar N, Yankova M, Zenetos A, Žuljević A, Cardoso AC (2020) Prioritizing marine invasive alien species in the EU through Horizon Scanning. *Aquatic Conservation: Marine and Freshwater Ecosystems* 30: 794–845, <https://doi.org/10.1002/aqc.3267>
- Ulman A, Ferrario J, Occhipinti-Ambrogi A, Arvanitidis C, Bandi A, Bertolino M, Bogi C, Chatzigeorgiou G, Çiçek BA, Deidun A, Ramos-Esplá A, Koçak C, Lorenti M, Martinez-Laiz G, Merlo G, Princisgh E, Scribano G, Marchini A (2017) A massive update of non-indigenous species records in Mediterranean marinas. *PeerJ* 5: e3954, <https://doi.org/10.7717/peerj.3954>
- Ulman A, Ferrario J, Forcada A, Arvanitidis C, Occhipinti-Ambrogi A, Marchini A (2019) A Hitchhiker’s guide to Mediterranean marina travel for alien species. *Journal of Environmental Management* 241: 328–339, <https://doi.org/10.1016/j.jenvman.2019.04.011>
- UNEP/MAP (2017) Action Plan concerning Species Introductions and Invasive Species in the Mediterranean Sea. United Nations Environment Program/Mediterranean Action Plan, Athens, Greece, 14 pp
- Yokeş B, Galil BS (2006) New records of alien decapods (Crustacea) from the Mediterranean coast of Turkey, with a description of a new palaemonid species. *Zoosystema* 28(3): 747–755
- Zammit P, Longo C, Schembri P (2009) Occurrence of *Paraleucilla magna* Klautau et al., 2004 (Porifera: Calcarea) in Malta. *Mediterranean Marine Science* 10: 135–138, <https://doi.org/10.12681/mms.114>

Supplementary material

The following supplementary material is available for this article:

Table S1. Dataset of unpublished Mediterranean Records.