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On the occurrence of rayed pearl oyster *Pinctada imbricata radiata* (Leach, 1814) in Western Greece (Ionian Sea) and its biofouling potential

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Received: 16. March 2018 / Accepted: 02. August 2018 / Available online: 18. August 2018 / Printed: June 2019

Abstract. The rayed pearl oyster *Pinctada imbricata radiata* (Leach 1814) has been present in the Hellenic waters (Aegean Sea) at least from the early 1960s. However, up to day the species has been reported from the Ionian Sea only from the island of Kefalonia. Live and dead animals (shells) were collected from the central and northern part of western Greece during 2016. The species has been established particularly in the coastal area of Thesprotia, which is the most north-western continental area of Greece, suggesting that Ionian Sea is the main corridor for natural (i.e. via currents) and human-mediated (i.e. maritime transport) range expansion to the Adriatic Sea and central Mediterranean. Moreover, the species shows significant abundance of both spat and adult specimens attached on fish farm cages nets. These findings coupled with the current distribution of the species in the Hellenic seas, indicate that the rayed pearl oyster has strong invasion potential, it is locally adapted and increasingly spreading in the Ionian Sea.

Key words: Rayed pearl oyster, *Pinctada imbricata radiata*, invasion, aquaculture biofouling, Ionian Sea, Greece.

Introduction

The sub-tropical rayed pearl oyster *Pinctada imbricata radiata* (Leach 1814) is of Indo-Pacific origin and has a long record of appearance, characterised as non-indigenous species (NIS) in the eastern Mediterranean Sea in 1892 by Dautzenberg (1895). It seems that the species is well established in certain regions of the Levantine Sea (Egypt, Libya, Tunisia, Israel, Cyprus) with significant occurrence in Sicily, Malta, nearby islands and up to France (Gofas & Zenetos 2003, Zenetos 2004a, Pancucci-Papadopoulou et al. 2005, Streftaris et al. 2005, Tlig-Zouari et al. 2010, Antit et al. 2011, Lodola et al. 2013).

In the Aegean Sea, the first reporting of its occurrence was during 1963 in Saronikos Gulf (Serbetis 1963), where it was introduced for aquaculture purposes (Kallopissis 1981). Since then, there have been reports (Galil & Zenetos 2002, Zenetos et al. 2004a,b, Zenetos et al. 2005a,b, Streftaris & Zenetos 2006) of its occurrence in the SE Aegean (islands of Karpathos and Rodos), in the NE Aegean (island of Lesbos; Zenetos et al. 2008, Evagelopoulos et al. 2015), in central Aegean around the island of Evia (1992-1994) and recently in Maliakos Gulf (Theodorou & Tzovenis, in Zenetos et al. 2015a). Reports for its occurrence became public for Lakonikos Gulf (south Peloponnissos peninsula in 2002), Serifos (in 2006, Zenetos et al. 2008), Andros (in 2012, Zenetos et al. 2013) and Kriti (in 2003 and in 2012, Zenetos et al. 2008, 2013, respectively). All these locations in southern Aegean represent areas without mollusc farming activities. These reports indicate that *P. imbricata radiata* has migratory potential compliant with the Lessepsian migration pattern (Galil 2000, 2007).

The species has also established populations in the Adriatic Sea in Albania (i.e. in Saranda & Ksamil, Katsanevakis et al. 2011, in Vlora Bay; Xharahi, Crocetta & Golemaj, in Gerovasileiou et al. 2017) and Croatia (Dogan et al. 2008; Gavrilović et al. 2017). Therefore, the Ionian Sea is an important corridor for north-western expansion of the species either via natural spread of veligers and/or via shipping. Concerning western Greece (Ionian Sea), the species has been re-



Figure 1. Distribution of rayed pearl oyster in the Ionian Sea, Greece (dots and bold shoreline represent locations and areas with established populations). New occurrences are shown by stars (1: Argostoli, Kefalonia, 2: Nidri, Lefkada, 3: Drepano Bay, Igoumenitsa 4: Sagiada strip, Thesprotia (map modified after Zenetos et al. 2015b).

ported in the literature only from the island of Kefalonia (at Lixouri by Zenetos et al. 2015b, Fig. 1, and in the port of Argostoli; Spinos et al. 2016).

Given that relevant published data for this species distribution in this region are extremely scarce, the present work aims to present the available data on the occurrence of the species in western Greece (central and northern Ionian Sea) and a case of severe biofouling in an aquaculture cage farm.

Materials and methods

Available information was collected through contacts with ichthyologists, collection of shells/live specimens and field visits to fish farms. The identification on species level was based on major morphological characteristics of the shell (Fig. 2) as demonstrated by

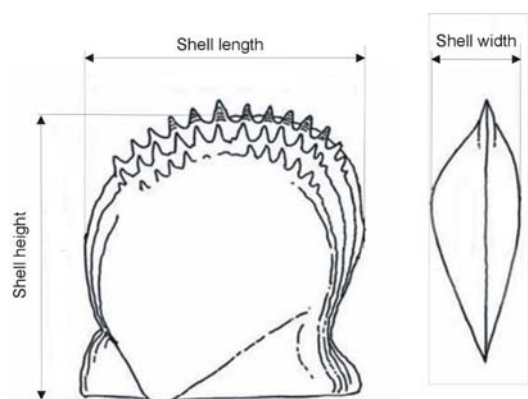


Figure 2. Shell morphometric measurements of the rayed pearl oyster (adapted from Hwang et al. 2007, Tlig-Zouari et al. 2010).

Tlig-Zouari et al. (2010). Sixteen animals were collected during the low tide period from the dock of the port of Argostoli, Kefalonia ($38^{\circ} 10' 50.20''$, $20^{\circ} 29' 24.74''$; Fig. 3). After shell cleaning from derbis and mud, as described in earlier similar studies of the *Pinctada* genus (Hynd 1955, Hwang & Okutani 2003), a digital vernier calliper were used to measure a) the shell height; b) the shell length, and c) the shell width to the nearest 0.01 mm. The total wet weight was measured close to 0.01g, with a portable digital scale. Condition index (CI) was calculated according to the following formula: (wet meat weight/shell weight) X 100 (Davenport & Chen 1987).

Results

One empty shell collected in February 2016 at the Drepano beach close to the Igoumenitsa Bay ($39^{\circ} 30' 42.78''$, $20^{\circ} 13' 06.74''$) was identified as *P. imbricata radiata*. According to G. Kondylatos (Rhodes, pers. comm. 2017), the species is frequently found in the eastern shore of Lefkada island (around the city of Nidri; $38^{\circ} 42' 21.32''$, $20^{\circ} 42' 36.59''$). All live specimens collected in the port of Argostoli were adults. Their mean biometric values (n=16) were 23.77 ± 4.57 mm



Figure 3. Rayed pearl oyster collected from the port of Argostoli, island of Kefalonia.

(height), 62.22 ± 9.13 mm (length), 59.09 ± 8.20 mm (width) and 11.04 ± 6.30 g (wet weight) (Table 1). Finally, numerous specimens in various sizes from spat to large adults of +50 mm were attached on cage nets of a fish farm in the Sagiada strip (22 September 2017; $39^{\circ} 39' 50.10''$, $20^{\circ} 05' 30.93''$; Fig. 4a,b).

Discussion

The current work verifies the occurrence of the species in the island of Kefalonia. The population in the port of Argostoli was particularly abundant, suggesting that the species is established in central Ionian Sea. Moreover, new occurrences in northern parts of the Ionian Sea such as in the island Lefkada and particularly the established populations in Thesprotia (i.e., in Sagiada strip and possibly in Igoumenitsa Bay), underlines the on-going process of northward range expansion. All these locations/areas not only receive inflow from the Ionian Sea, which helps spat drifted in by currents, but they are also located close to ports able to accommodate ships with ballast water tanks, as well as numerous smaller vessels.

Table 1. Weight and morphometric measurements of rayed pearl oyster individuals collected in the port of Argostoli, island of Kefalonia.

Specimen	Total Wet weight (g)	Flesh weight (g)	Shell weight (g)	Shell height (cm)	Shell length (cm)	Shell width (cm)	CI (%)
1	62.9	21.02	41.88	2.827	7.323	7.653	50
2	53.8	19.83	33.97	2.575	6.886	6.158	58
3	58.63	21.52	37.11	2.266	7.377	6.709	58
4	44.93	15.32	29.61	2.206	6.779	6.225	52
5	42.04	17.76	24.28	2.305	6.172	5.977	73
6	32.08	10.96	21.12	2.001	5.981	5.665	52
7	48.41	10.58	37.83	2.835	7.132	6.696	28
8	21.28	5.64	15.64	1.951	5.74	4.672	36
9	50.13	12.4	37.73	2.849	7.281	6.665	33
10	83.25	10.12	73.13	3.378	6.408	5.989	14
11	41.73	7.55	34.18	2.807	6.68	6.294	22
12	44.69	6.49	38.2	2.299	5.958	5.765	17
13	23.69	5.67	18.02	2.145	5.183	4.905	31
14	15.61	4.01	11.6	1.976	5.156	4.901	35
15	12.35	2.91	9.44	1.659	4.483	5.342	31
16	19.43	4.97	14.46	1.963	5.026	4.936	34
Mean	40.93	11.04	29.88	2.37	6.22	5.91	39
STDEV	19.3	6.30	15.78	0.45	0.91	0.82	0.16

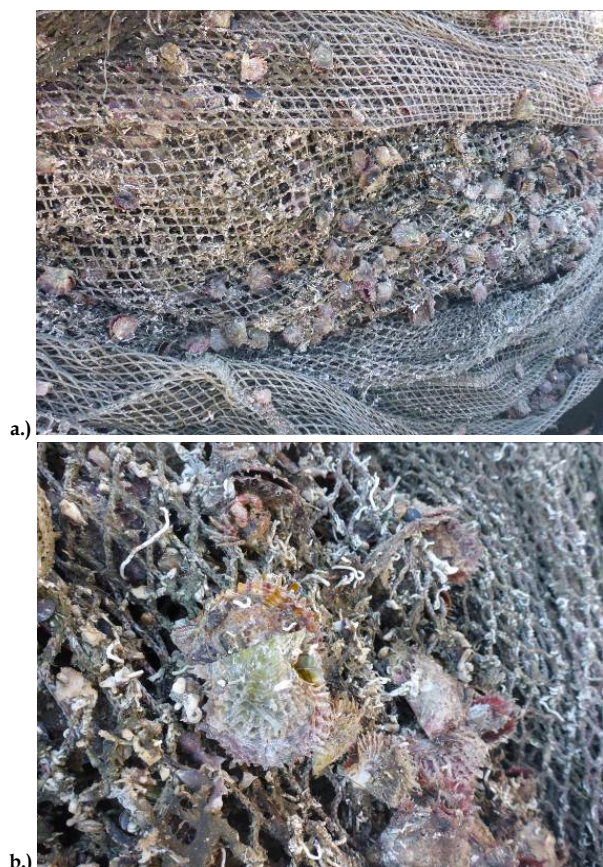


Figure 4. Rayed pearl oysters attached on fish cage nets in Sagiada strip. a - Attached on the entire net; b - Specimens in detail.

Typically, the species reaches length of 50-65 mm, but it may exceed 100 mm (Lodola et al. 2013). The gametogenetic cycle of the bivalve (which is a protandric hermaphrodite species with sex inversion occurring in shells of 32-57 mm length; Tlig-Zouari & Zaouali 1994), as well as growth and survival in relation to the local environmental conditions, have to be estimated in order to evaluate the local adaptation and forecasting the future expansion and invasion pattern. Yigitkurt & Lok (2007) in an effort to collect spat in Karantina Island (38°22'44N; 260°47'12E) on the west side of Izmir Bay (Turkey), showed that the first settlement was observed in August, while maximum spat was obtained in November (61.53 mm) and December (41.6 mm) on both collectors (bags and shells) that were deployed in June 2003. The temperature ranged between 27°C in August and 12.5°C in December, while salinity was stable at 36 ppt. Total Particulate Matter (TPM) and chlorophyll-a picks were recorded in August and September with their lower values recorded in July and December, respectively. Given that (a) the length of some collected specimens in Kefalonia exceeded 7 cm; (b) their mean CI (39%) reflects a good fitness status; and (c) temperature/salinity profiles of Karantina Island (Acarli et al. 2011) are similar to the Ionian Sea conditions, it is reasonable to suggest that Ionian Sea is suitable for further establishment and invasion.

Moreover, based on the production cycle of 22 months in the fish farms in the Sagiada strip, which involves net changes at least every eight months, the presence of large size specimens on them suggests fast growth. This can be at-

tributed to the reduced competition due to rich nutritional environment and to the availability of vast surfaces as attaching substrates. Moreover, the presence of spat in large numbers on the nets strongly indicates that the species has formed a reproductively autonomous population. Such biofouling pressure is currently not a serious problem to most of the farms in Sagiada strip. However, the biofouling load is expected to increase with time which could affect the handling of nets, possibly decrease available oxygen to fish stocks inside the cages in heavily loaded nets and even require more manual efforts to remove them from cages, barges and mooring systems (i.e. from buoys, ropes and chains).

Rayed pearl oyster is currently listed among the worst alien species in the Streamlining European 2010 Biodiversity Indicators on invasive alien species (European Environment Agency 2007). The application of GloBallast Partnership (GBP) could help reduce the risks and impacts of marine bio-invasions caused by international shipping, in ship models that are technologically able to comply with all the ballast exchange recommendations. However, the surfaces of hulls (e.g. of pleasure yachts and other vessels) as well as fishing nets and other fishing equipment represent a sufficient invasion vector. Accordingly, a risk assessment has to be performed in order to estimate the effects of the on-going local invasion (McKindsey et al. 2007, Frederick et al. 2008) and competition particularly towards native mollusc species, in order to give a qualitative and quantitative approach to managerial decision making, similarly to other aquatic taxa (Kolar 2004, Mumford et al. 2010, Verbrugge et al. 2012, Copp et al. 2014).

Overall, it seems that the rayed pearl oyster is rapidly spreading and new populations are continuously being formed and established along the shoreline of the Ionian Sea. The species' abundance on the presented case of fish cage farm, suggests that it has the potential to become a predominant bio-foulant. Within this context, the authorities should evaluate its invasive potential and consider its NIS status during the formation of future guidelines for fisheries and aquaculture management.

Acknowledgement. This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

References

- Acarli, S., Lök, A., Acarli, D. (2011): Preliminary spat settlement of fan mussel *Pinna nobilis* Linnaeus 1758 on a mesh bag collector in Karantina Island (Eastern Aegean Sea, Turkey). *Fresenius Environmental Bulletin* 20(10): 2501-2507.
- Antit, M., Gofas, S., Salas, C., Azzouna, A. (2011): One hundred years after *Pinclada*: an update on alien Mollusca in Tunisia. *Mediterranean Marine Science* 12(1): 53-73.
- Copp, G.H., Russell, I.C., Peeler, E.J., Gherardi, F., Tricarico, E., MacLeod, A., Cowx, I.G., Nunn, A.D., Occhipinti-Ambrogi, A., Savini, D., Mumford, J., Britton, J.R. (2014): European Non-native Species in Aquaculture Risk Analysis Scheme - a summary of assessment protocols and decision support tools for use of alien species in aquaculture. *Fisheries Management and Ecology* 3(1): 1-11.

- Dautzenberg, P. (1895): Campagne de la Melita, 1892: Mollusques recueillis sur les côtes de la Tunisie et de l'Algérie. Mémoires de la Société Zoologique de France 8: 363-373.
- Davenport, J., Chen, X. (1987): A comparison of methods for the assessment of condition in the mussel (*Mytilus edulis* L.). Journal of Molluscan Studies 53(3): 293-297.
- Dogan, A., Nerlovic, V. (2008): On the occurrence of *Pinctada radiata* (Mollusca: Bivalvia: Pteriidae) an alien species in Croatian waters. Acta Adriatica 49(2): 155-158.
- European Environment Agency (2007): Halting the loss of biodiversity by 2010: proposal for a first set of indicators to monitor progress in Europe. EEA Technical Report, No.11: 182 pp. <http://reports.eea.europa.eu/technical_report_2007_11/en, accessed at 2017.09.20>
- Evangelopoulos, A., Poursanidis, D., Papazisi, E., Gerovasileiou, V., Katsiaras, N., Koutsoubas, D. (2015): Records of alien marine species of Indo-Pacific origin at Sigri Bay (Lesvos Island, north-eastern Aegean Sea). Marine Biodiversity Records 8: e35.
- Frederick, R., Krassoi, F.R., Brown, K.R., Bishop, M.J., Kelaher, B.P., Summerhayes S. (2008): Condition-specific competition allows coexistence of competitively superior exotic oysters with native oysters. Journal of Animal Ecology 77: 5-15.
- Galil, B.S. (2000): A sea under siege-alien species in the Mediterranean. Biological Invasions 2: 177-186.
- Galil, B.S., Zenetos, A. (2002): A sea change - exotics in the Eastern Mediterranean Sea. pp.325-336. In: Leppakoski, E., Gollash, S., Olenin, S. (eds.), Invasive aquatic species in Europe. Distribution, impacts and management. Kluwer Academic Publishers.
- Galil, B.S. (2007): Seeing red: alien species along the Mediterranean coast of Israel. Aquatic Invasions 2(4): 281-312.
- Gavrilović, A., Piria, M., Guo, X. Z., Jug-Dujaković, J., Ljubučić, A., Krkić, A., Iveša, N., Marshall B.A., Gardner, J. P. (2017): First evidence of establishment of the rayed pearl oyster, *Pinctada imbricata radiata* (Leach, 1814), in the eastern Adriatic Sea. Marine Pollution Bulletin 125(1-2): 556-560.
- Gerovasileiou, V., Akel, E.S.H.Kh., Akyol, O., Alongi, G., Azevedo, F., Babali, N., Bakiu, R., Bariche, M., Bennoui, A., Castriota, L., Chintiroglou, C.C.; Crocetta, F., Deidun, A., Galinou-Mitsoudi, S., Giovos, I., Gokoglu, M., Golemaj, A.; Hadjioannou, L., Hartingerova, J., Insacco, G., Katsanevakis, S., Kleitou, P., Korun, J., Lipej, L.; Malegue, M., Michailidis, N., Mouzai Tifoura, A., Ovalis, P., Petovic, S., Piraino, S., Rizkalla, S.I., Rousou, M., Savva, I., Sen, H., Spinelli, A., Vougioukalou, K.G., Xharahi, E.; Zava, B., Zenetos, A. (2017): New Mediterranean Biodiversity Records (July, 2017). Mediterranean Marine Science 18(2): 355-384.
- Gofas, S., Zenetos, A. (2003): Exotic mollusks in the Mediterranean basin: Current status and perspectives. Oceanography and Marine Biology: An annual Review 41: 237-277.
- Hynd, J.S. (1955): A revision of Australian pearl shells. Genus *Pinctada*. Australian Journal of Marine and Freshwater Research 6: 98-137.
- Huang, J.J., Okutani, T. (2003): Taxonomy and distribution of the genera Pteria and Pinctada (Bivalvia: Pteriidae) in Taiwan. Journal of Fisheries Society of Taiwan 30: 199-216.
- Hwang, J.J., Yamakawa, T., Aoki, I. (2007): Growth of wild pearl oysters *Pinctada fucata*, *Pinctada margaritifera* and *Pinctada sugillata* (Bivalvia: Pteriidae) in Taiwan. Fisheries Science 73:132-141.
- Kalopissis, J. (1981): Individus perliers de *Pinctada radiata*, Leach dans les eaux du Golfe de Saronique. Thalassia Salentina 11:105-108.
- Katsanevakis, S., Zenetos, A., Macic, V., Beqiraj, S., Poursanidis, D., Kashta, L. (2011): Invading the Adriatic: spatial patterns of marine alien species across the Ionian-Adriatic boundary. Aquatic Biology 13(2):107-118.
- Kolar, C. (2004): Risk assessment and screening for potentially invasive fishes. New Zealand Journal of Marine and Freshwater Research 38: 391-397.
- Lodola, A., Nicolini, L., Savini, D., Deidun, A., Occhipinti-Ambrogi, A. (2013): Range expansion and biometric features of *Pinctada imbricata radiata* (Bivalvia: Pteriidae) around Linosa Island, Central Mediterranean Sea (Italy). Italian Journal of Zoology 80(2): 303-312.
- Mumford, J.D., Booy, O., Baker, R.H.A., Rees, M., Copp, G.H., Black, K., Holt, J., Leach, A.W., Hartley, M. (2010): Non-native species risk assessment in Great Britain. In: What makes an alien invasive? Risk and policy responses. Aspects of Applied Biology 104: 49-54.
- McKindsey, C.W., Landry, T., O' Beirn, F.X., Davies, I.M. (2007): Bivalve aquaculture and exotic species: A review of ecological considerations and management issues. Journal of Shellfish Research 26(2): 281-294.
- Pancucci-Papadopoulou, M.A., Zenetos, A., Corsini-Foka, M., Politou, C.Y. (2005): Update of marine alien species in Hellenic waters. Mediterranean Marine Science 6(2): 147-158.
- Serbetis, C.D. (1963): L'acclimatation de la Meleagrina (*Pinctada margaritifera* (Lam.) en Grèce. Rapport Commission Internationale Mer Mediterranee 17: 271-272.
- Spinos, E., Vavasis, C., Simotas, G., Konstantinidis, E., Kondylatos, G., Perdikaris, C. (2016): Recent records of invasive alien and range expanding species in the coastal zone of Kefalonia and Ithaca islands, Greece. pp. 173-176. In: Proceedings of 16th Pan-Hellenic Conference of Ichthyologists, 6-9 October 2016, Kavala, Greece.
- Streftaris, N., Zenetos, A., Papanthasiou, E. (2005): Globalisation in marine ecosystems: the story of non-indigenous marine species across European seas. Oceanography and Marine Biology: An Annual Review 43: 419-453.
- Streftaris, N., Zenetos, A. (2006): Alien Marine Species in the Mediterranean - the 100 'Worst Invasives' and their Impact. Mediterranean Marine Science 7(1): 87-118.
- Tlig Zouari, S., Zaouali, J. (1994): Reproduction of *Pinctada radiata* (Leach, 1814, Mollusque, Bivalve) dans les îles Kerkennah (Tunisie). Marine Life 4(1): 41-45.
- Tlig-Zouari, S., Rabaoui, L., Irathni, I., Diawara, M., Ben Hassine, O.K. (2010): Comparative morphometric study of the invasive pearl oyster *Pinctada radiata* along the Tunisian coastline. Biologia 65(2): 294-300.
- Verbrugge, L.N.H., Van der Velde, G., Hendriks, A.J., Verreycken, H., Leuven, R.S.E.W. (2012): Risk classifications of aquatic non-native species: application of contemporary European assessment protocols in different biogeographical settings. Aquatic Invasions 7: 49-58.
- Yigitkurt, S., Lok, A. (2007): Preliminary results on rayed pearl oyster (*Pinctada radiata*, Leach 1814) spat collection at Karantina Island in Izmir Bay (Turkey). pp. 613-614. In: Proceedings of European Aquaculture Society Conference 'Aquaculture Europe', 24-27 October 2007, Istanbul, Turkey.
- Zenetos, A., Gofas, S., Ruso, G., Templado, J. (2004a): CIESM Atlas of Exotic Species in the Mediterranean, Vol. 3, Molluscs. Monaco, CIESM Publishers.
- Zenetos, A., Dosi, A., Abatzopoulos, T.J., Triantafyllidis, A., Bejaoui, N., Soufi, E., Ammar, I.A., Ibrahim, A. (2004b): Study to investigate an invading bioindicator in the Mediterranean, *Pinctada radiata* (Leach, 1814). Communication presented at ICES/IOC/IMO Study Group on Ballast and Other Ship Vectors, 22-24 March, 2004, Cesenatico, Italy.
- Zenetos, A., Koutsoubas, D., Vardala-Theodorou, E. (2005a): Origin and vectors of introduction of exotic molluscs in Greek waters. Belgian Journal of Zoology 135(2): 279-286.
- Zenetos, A., Çinar, M.E., Pancucci-Papadopoulou, M.A., Harmelin, J.G., Furnari, G., Andaloro, F., Bellou, N., Streftaris, N., Zibrowius, H. (2005b): Annotated list of marine alien species in the Mediterranean with records of the worst invasive species. Mediterranean Marine Science 6(2): 63-118.
- Zenetos, A., Vassilopoulou, V., Salomidi, M., Poursanidis, D. (2008): Additions to the marine alien fauna of Greek waters (2007 update). Marine Biodiversity Records 1: e91.
- Zenetos, A., Koutsogiannopoulos, D., Ovalis, P., Poursanidis, D. (2013): The role played by citizen scientists in monitoring marine alien species in Greece. Cahiers de Biologie Marine 54(3): 419-426.
- Zenetos, A., Akel, E., Apostolidis, C., Bilecenoglu, M., Bitar, G., Buchet, V., Chalari, N., Corsini-Foka, M., Crocetta, F., Dogrammatzi, A., Drakulić, M., Fanelli, G., Giglio, G., Imsiridou, A., Kapiris, K., Pkarachle, P., Kavadas, S., Kondylatos, G., Lefkaditou, E., Lipej, L., Mavrić, B., Minos, G., Moussa, R., Pancucci-Papadopoulou, M., Prato, E., Renda, W., Rios, N., Rizkalla, S., Russo, F., Servonnat, M., Siapatis, A., Sperone, E., Theodorou, J., Tiralongo, F., Tzovenis, I. (2015a): New Mediterranean Biodiversity Records (April 2015). Mediterranean Marine Science, 16(1): 266-284.
- Zenetos, A., Arianoutsou, M., Bazos, I., Balopoulou, S., Corsini-Foka, M., Dimiza, M., Drakopoulou, P., Katsanevakis, S., Kondylatos, G., Koutsikos, N., Kytinou, E., Lefkaditou, E., Pancucci-Papadopoulou, M-A., Salomidi, M., Simboura, N., Skoufas, G., Trachalakis, P., Triantaphyllou, M., Tsiamis, K., Xentidis, N.J., Poursanidis, D. (2015b): ELNAIS: A collaborative network on Aquatic Alien Species in Hellas (Greece). Management of Biological Invasions 6(2): 185-196.