

PROGRESS IN UNDERSTANDING SCYPHOMEDUSA OUTBREAKS IN THE MEDITERRANEAN SEA: DISTRIBUTION AND PHENOLOGY



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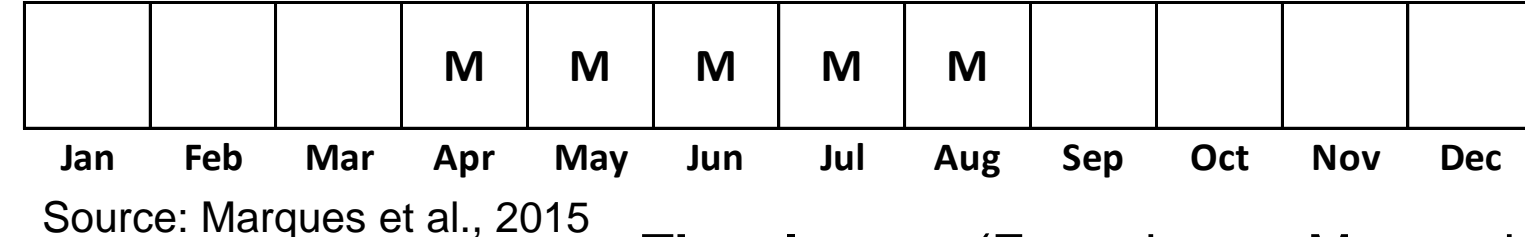
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I. Distribution and Phenology

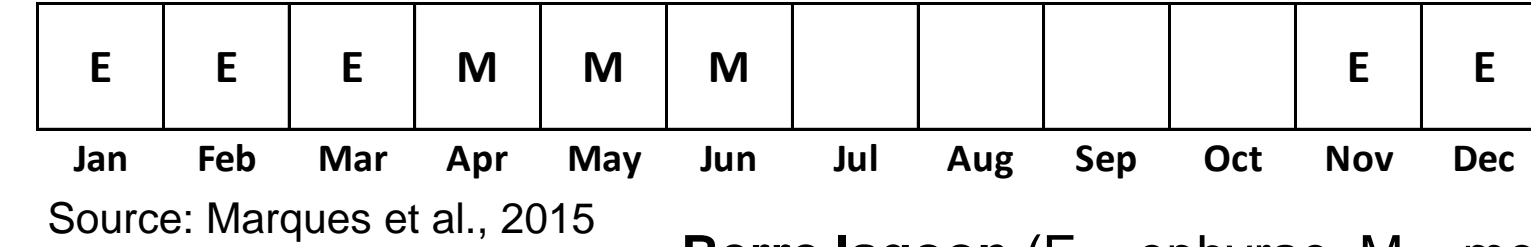
MATERIALS & METHODS

Distribution and phenology of Scyphomedusae in the Mediterranean Sea were determined from published data combined with our own observations/monitoring, fishery and regional agency monitorings and from evaluated news reports and citizen science applications.

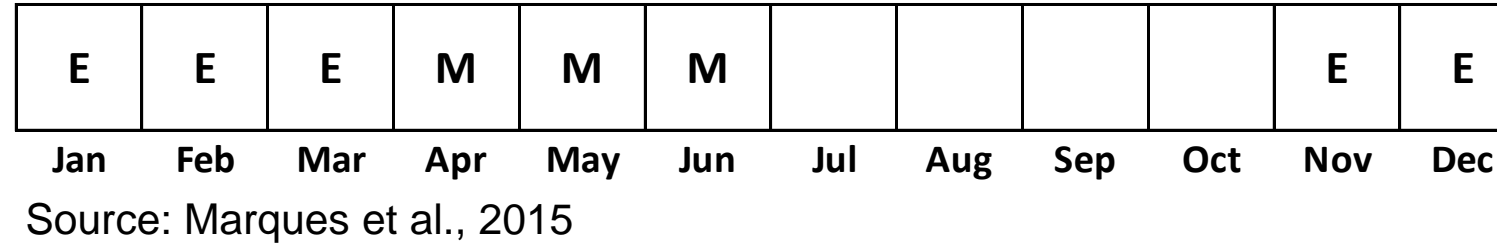
Bages- Sigean lagoon (M – medusae)



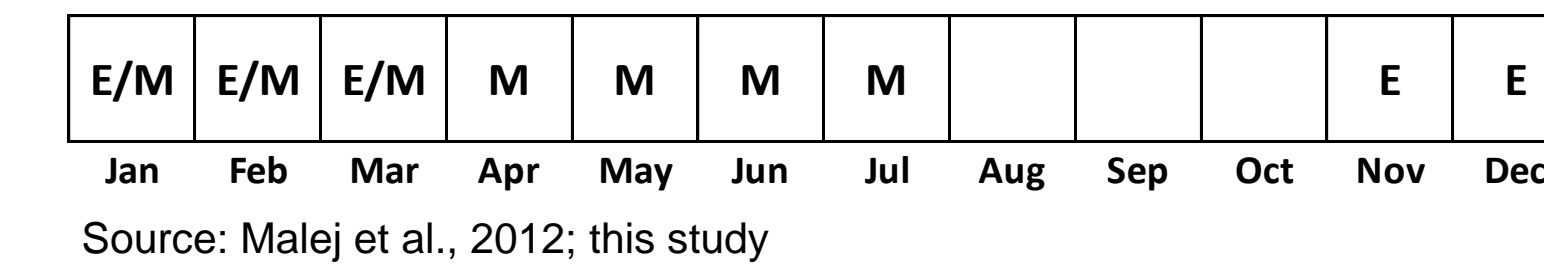
Thau lagoon (E – ephyrae, M – medusae)



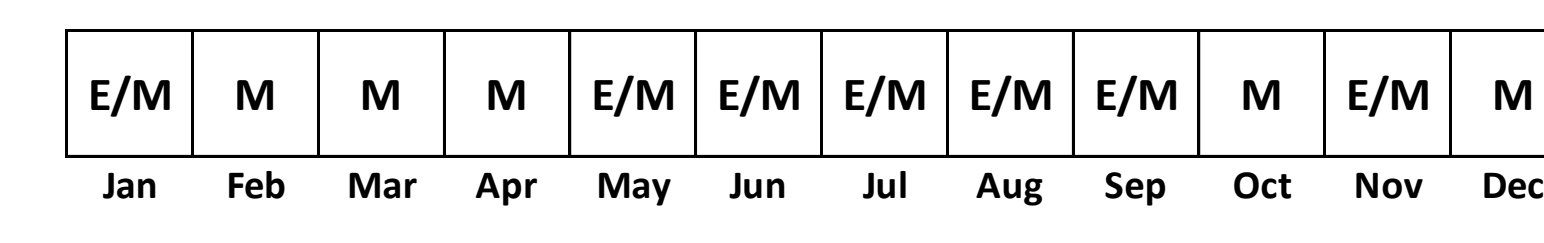
Berre lagoon (E – ephyrae, M – medusae)



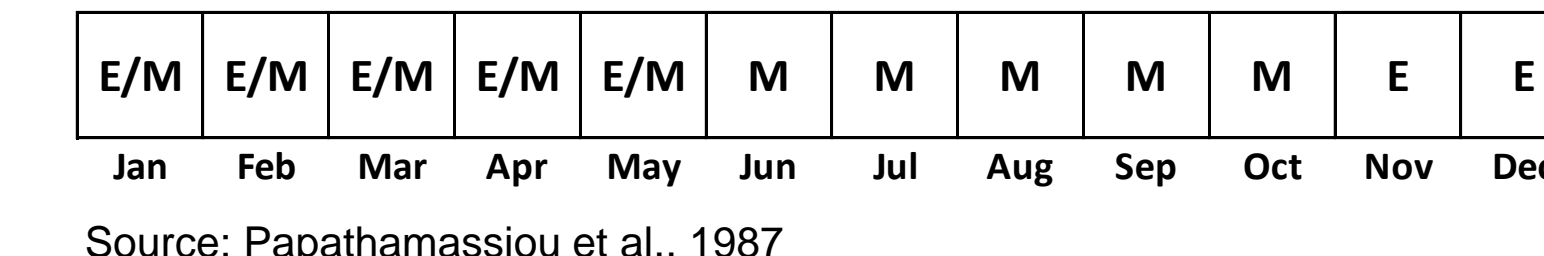
Gulf of Trieste (E – ephyrae, M – medusae)



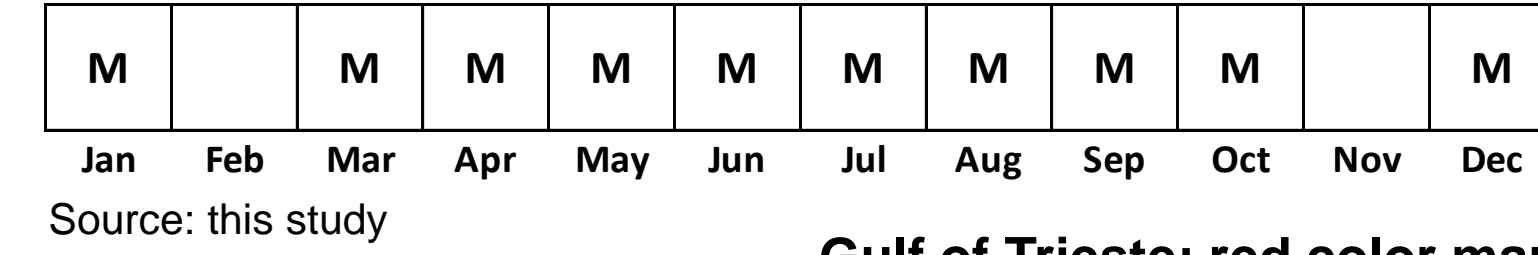
Veliko jezero, Mijet Island (E – ephyrae, M – medusae)



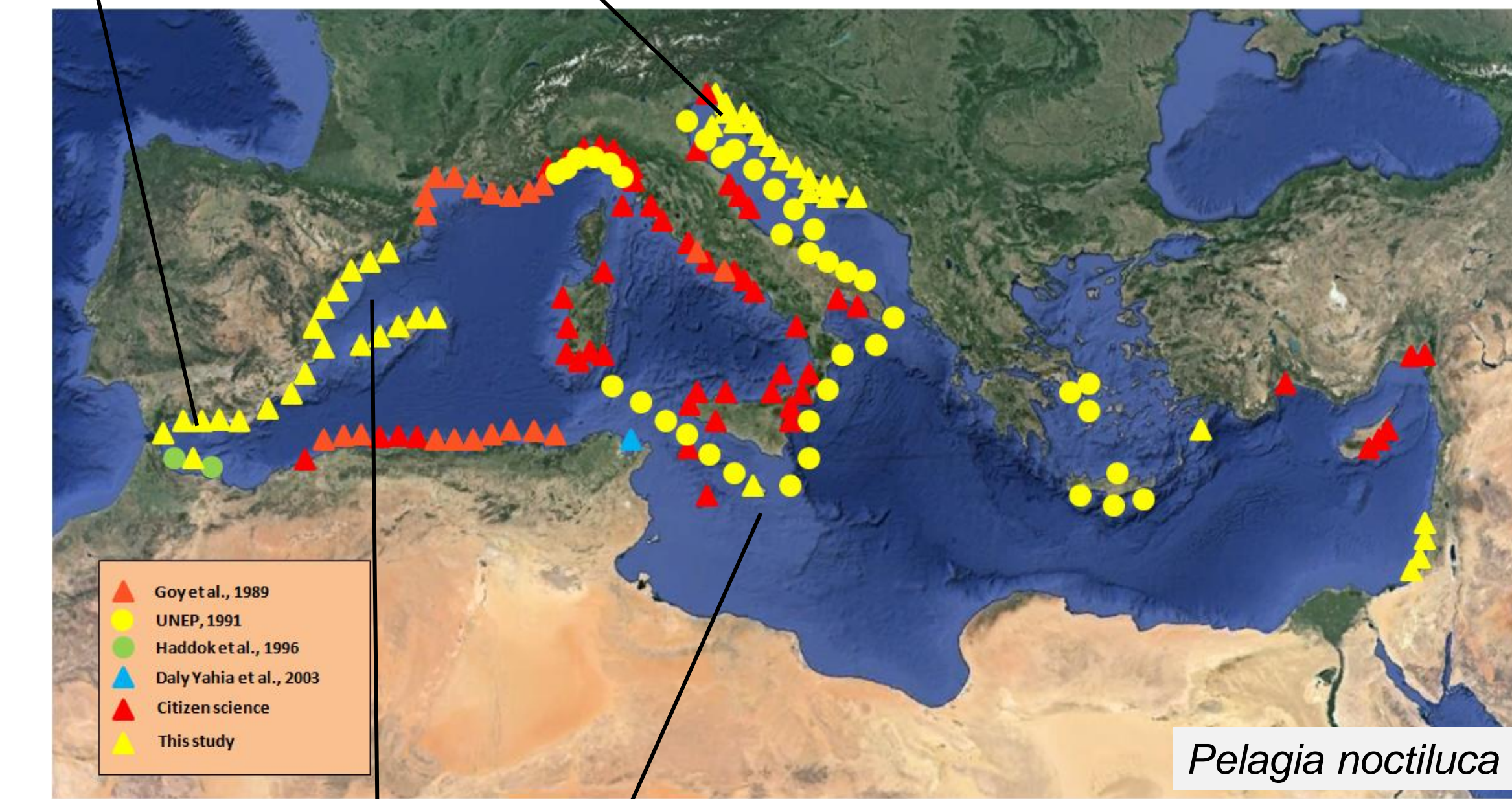
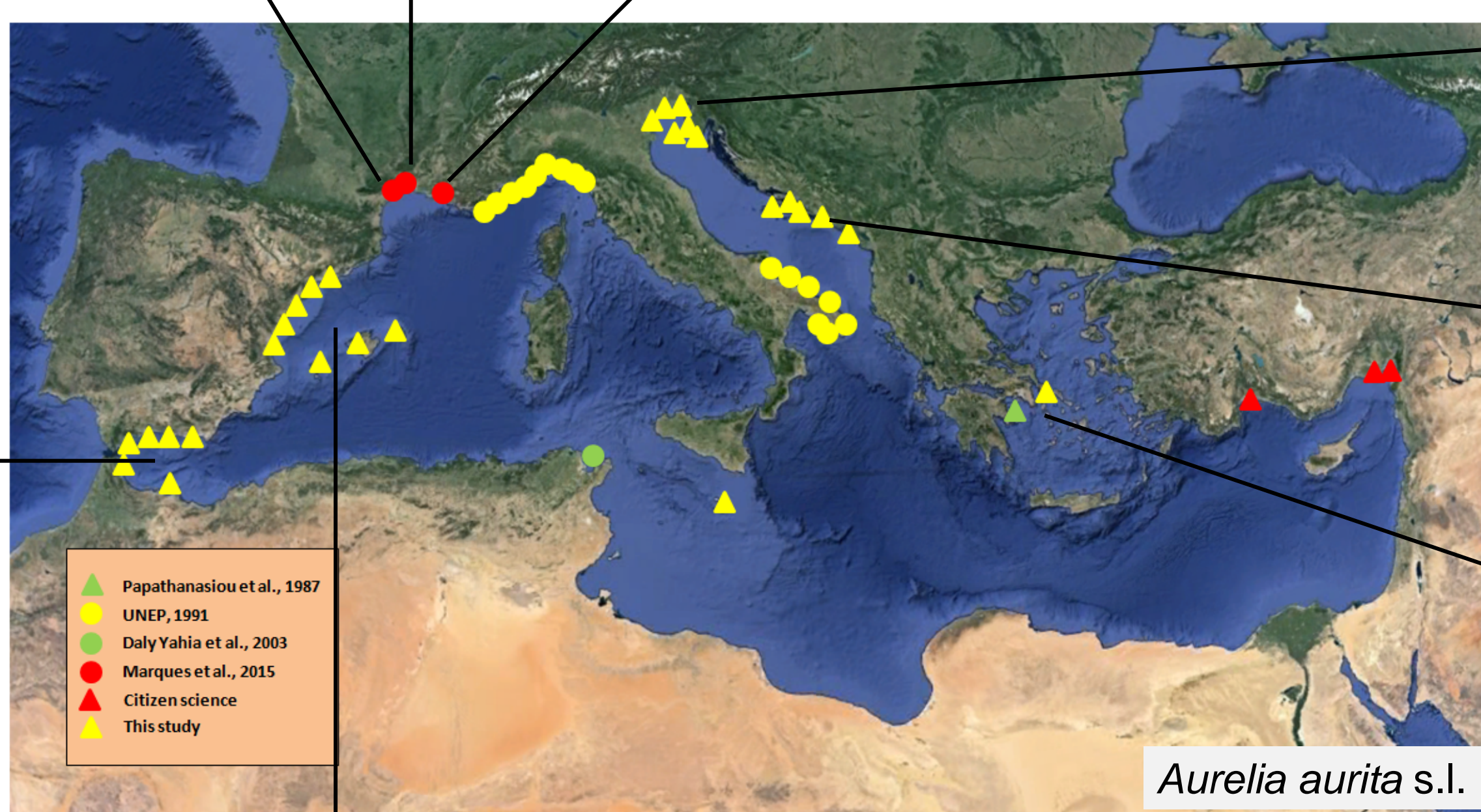
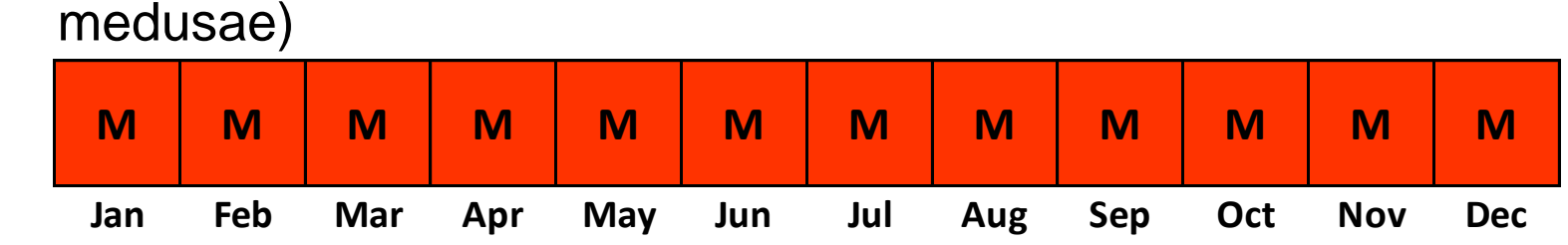
Saronikos gulf (E – ephyrae, M – medusae)



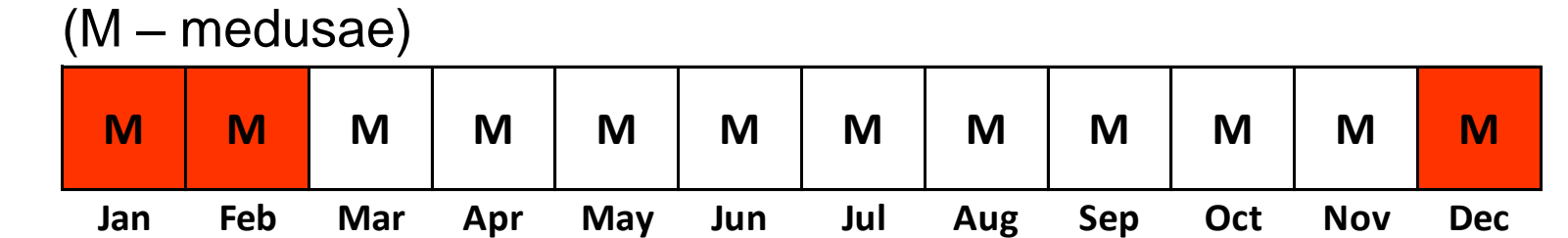
Alboran Sea (M – medusae)



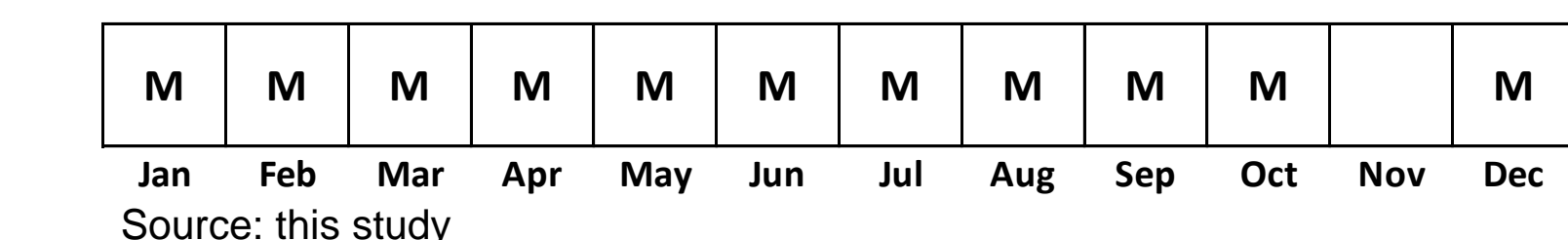
Gulf of Trieste; red color mark reproductive period (M – medusae)



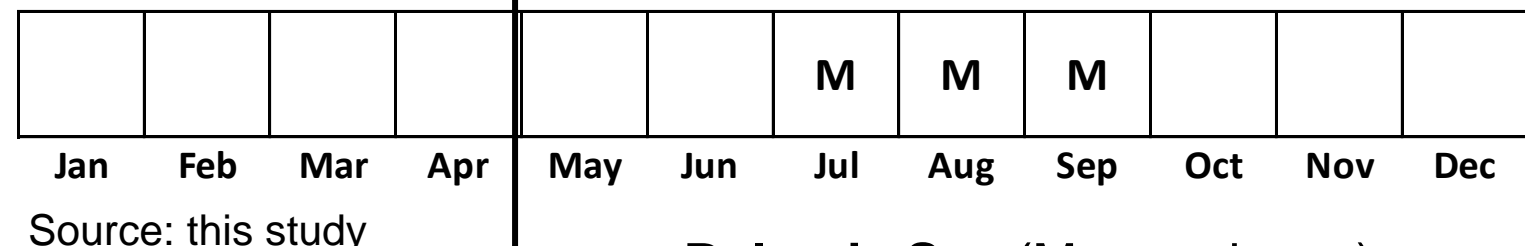
Central Mediterranean Sea; red color mark reproductive period (M – medusae)



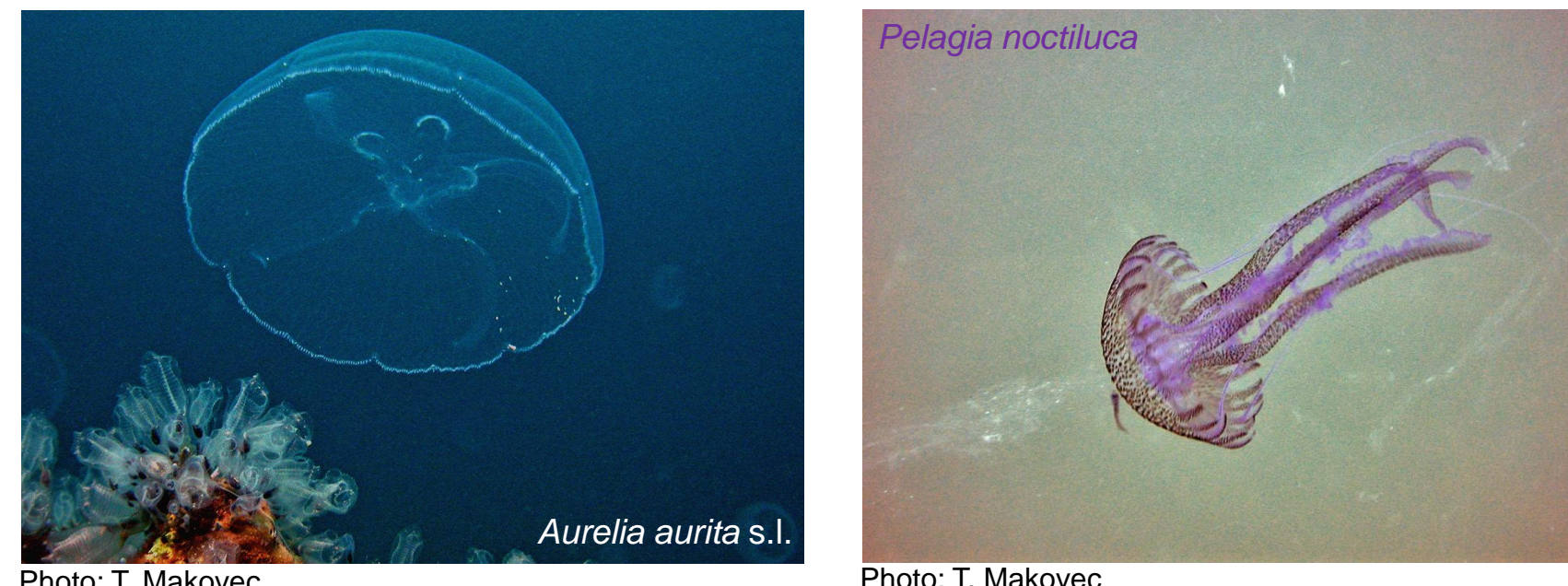
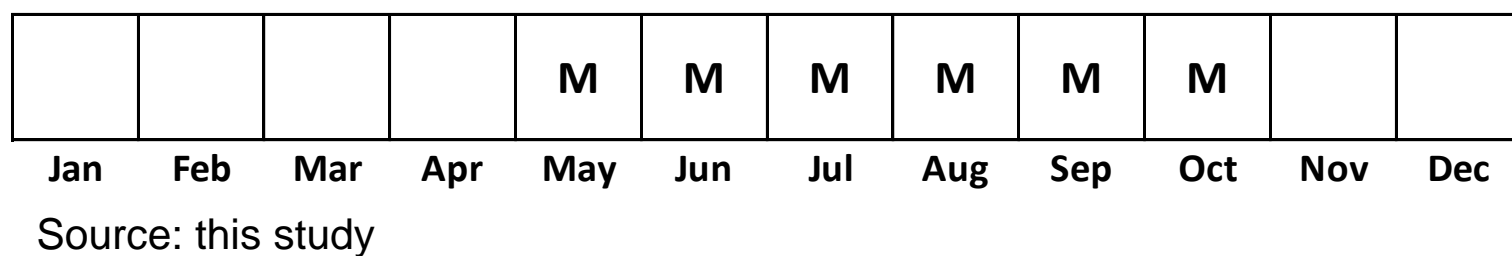
Balearic Sea (M – medusae)



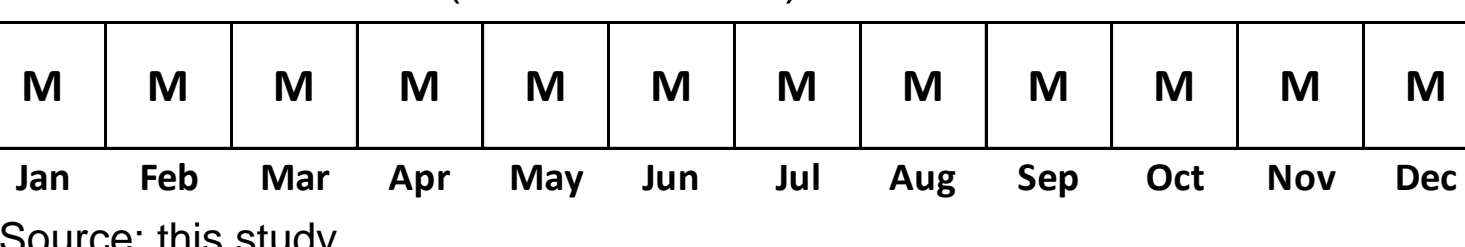
Alboran Sea (M – medusae)



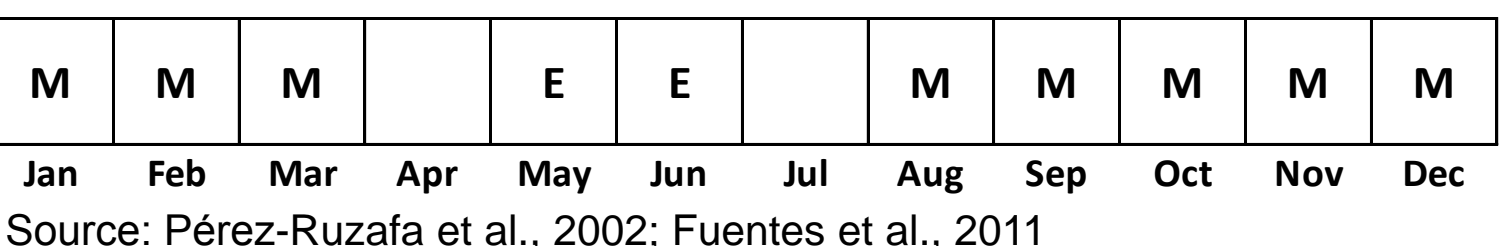
Balearic Sea (M – medusae)



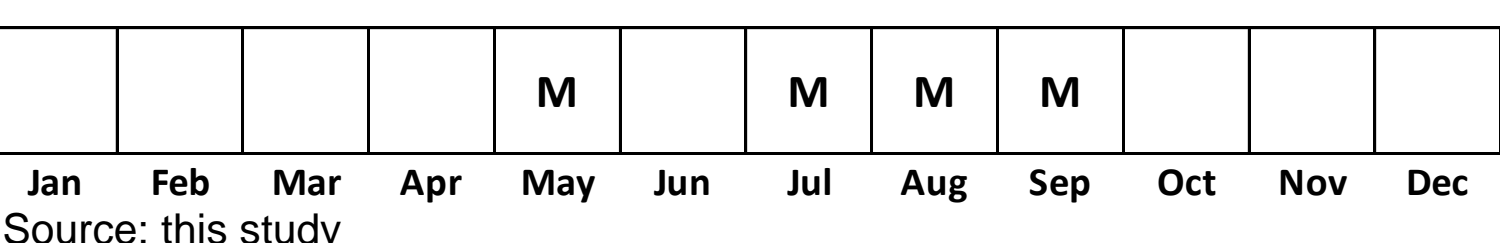
northern Adriatic (M – medusae)



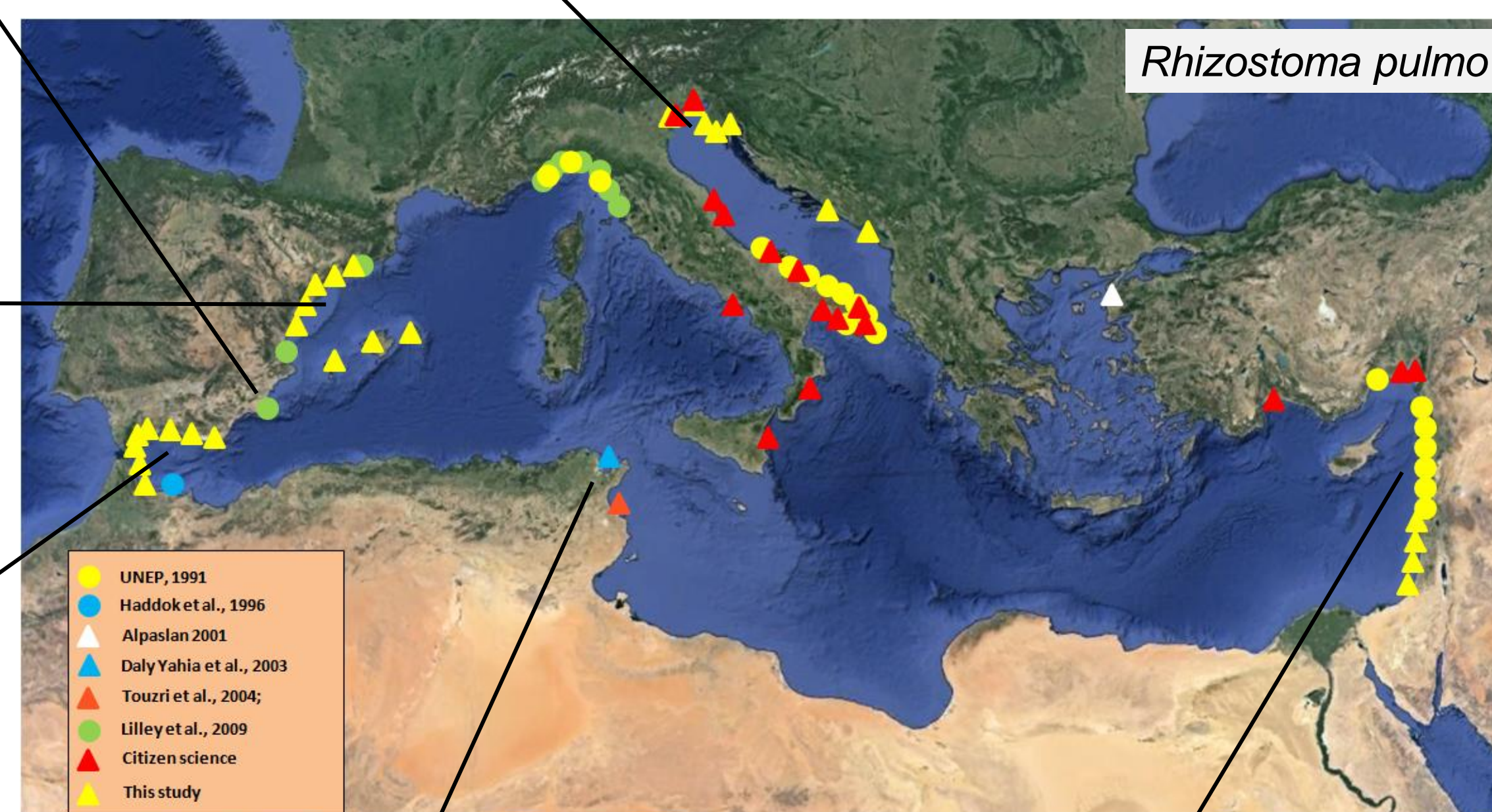
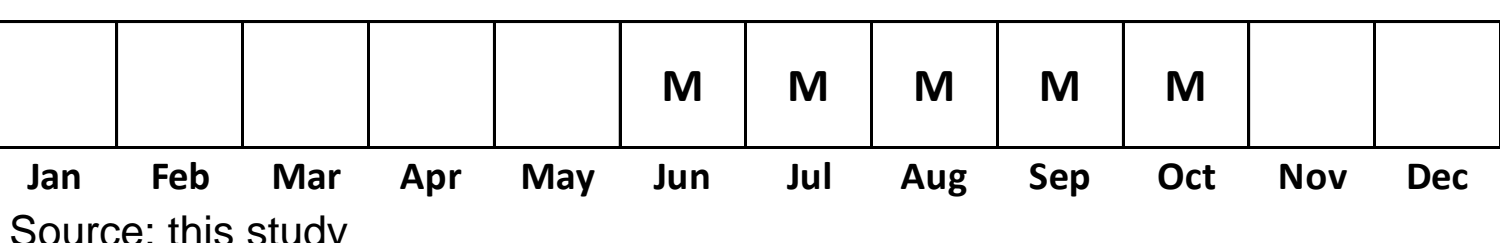
Mar Menor (M – medusae)



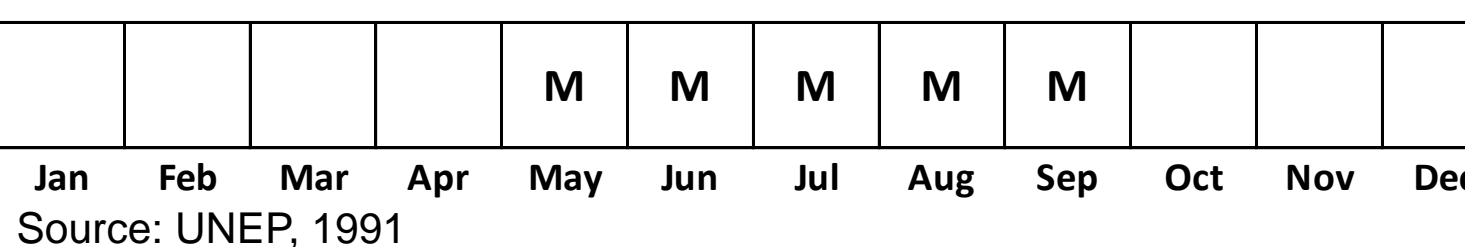
Catalan coast (M – medusae)



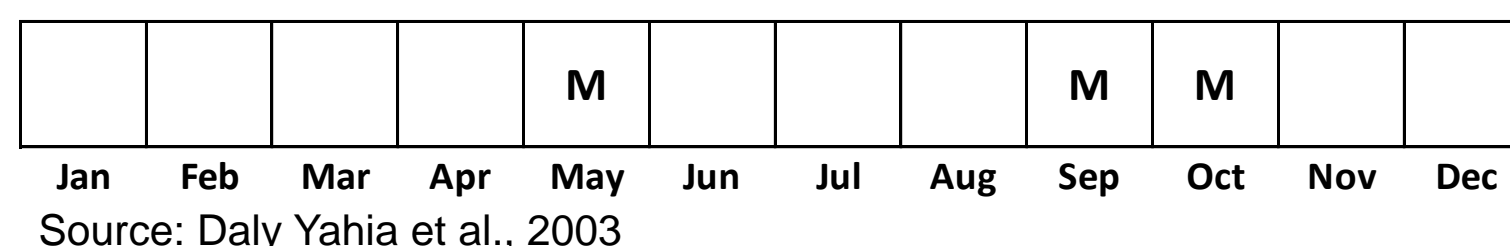
Alboran Sea (M – medusae)



Lebanese coast (M – medusae)

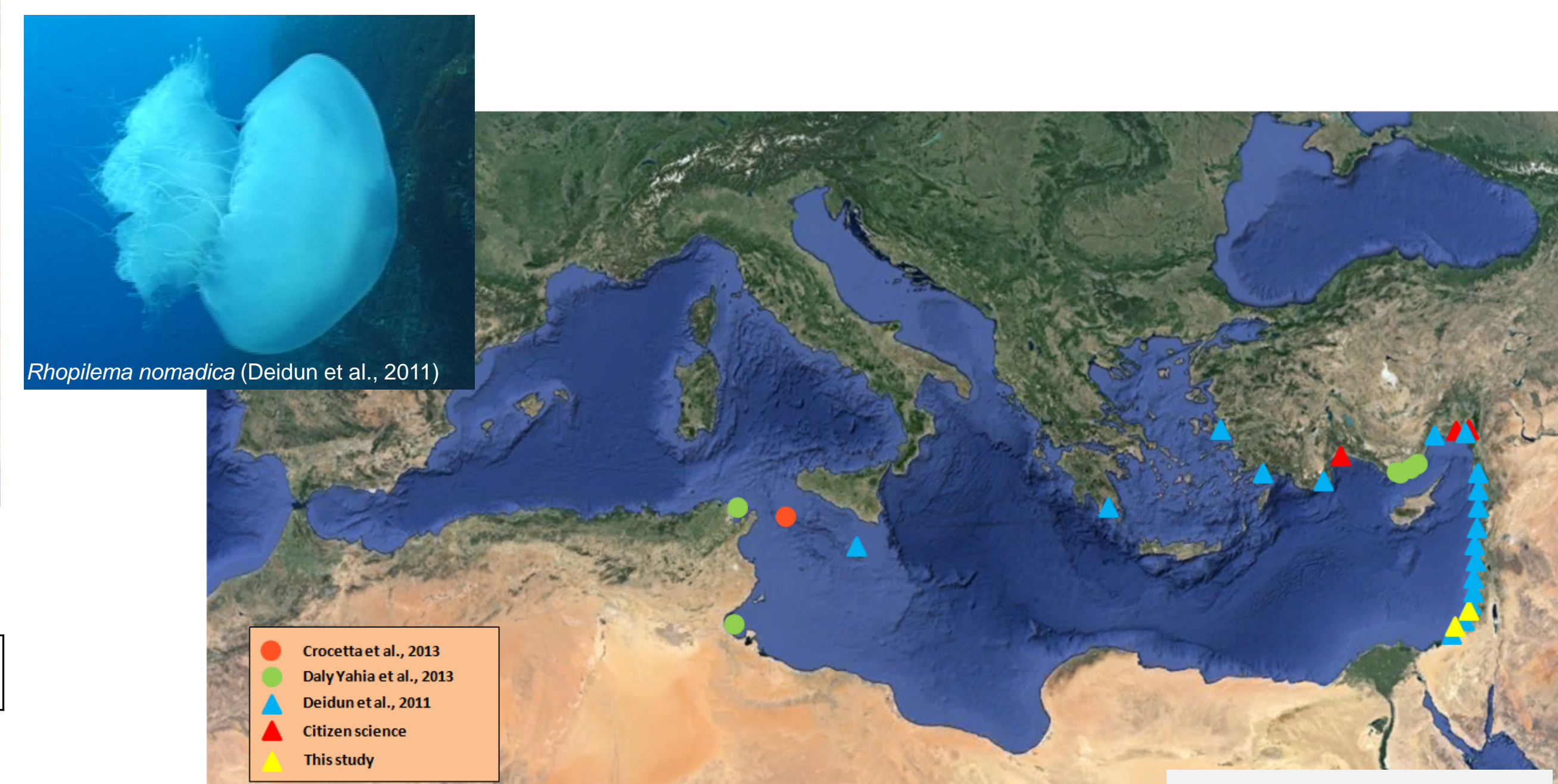


Gulf of Tunis (M – medusae)



CONCLUSIONS:

Our results revealed intra- and inter-species variations in phenology across the basins of the Mediterranean Sea. The intra-species variation detected for *Aurelia* and *R. pulmo* medusae populations occur mostly in the enclosed or semi enclosed areas, possibly due to the adaptations to local environmental conditions. In contrast, *P. noctiluca* may be present throughout the year across the Mediterranean Sea, even in the nAd where it is a non-resident species. Nevertheless, timing of the reproduction period of *P. noctiluca* seems to differ locally.



II. Coastal visual count of jellyfish

METHOD:

Visual censuses of jellyfish abundance were carried out weekly along three shoreline transects and bi-monthly/monthly along an offshore transect in the Gulf of Trieste, the northern Adriatic Sea (nAd). Visual counting was performed from the shore by walking along the same track of fixed distance in calm weather at the time of the predicted high tide. An observer identified and counted jellyfish along the offshore transect using the same procedure as for coastal transects.

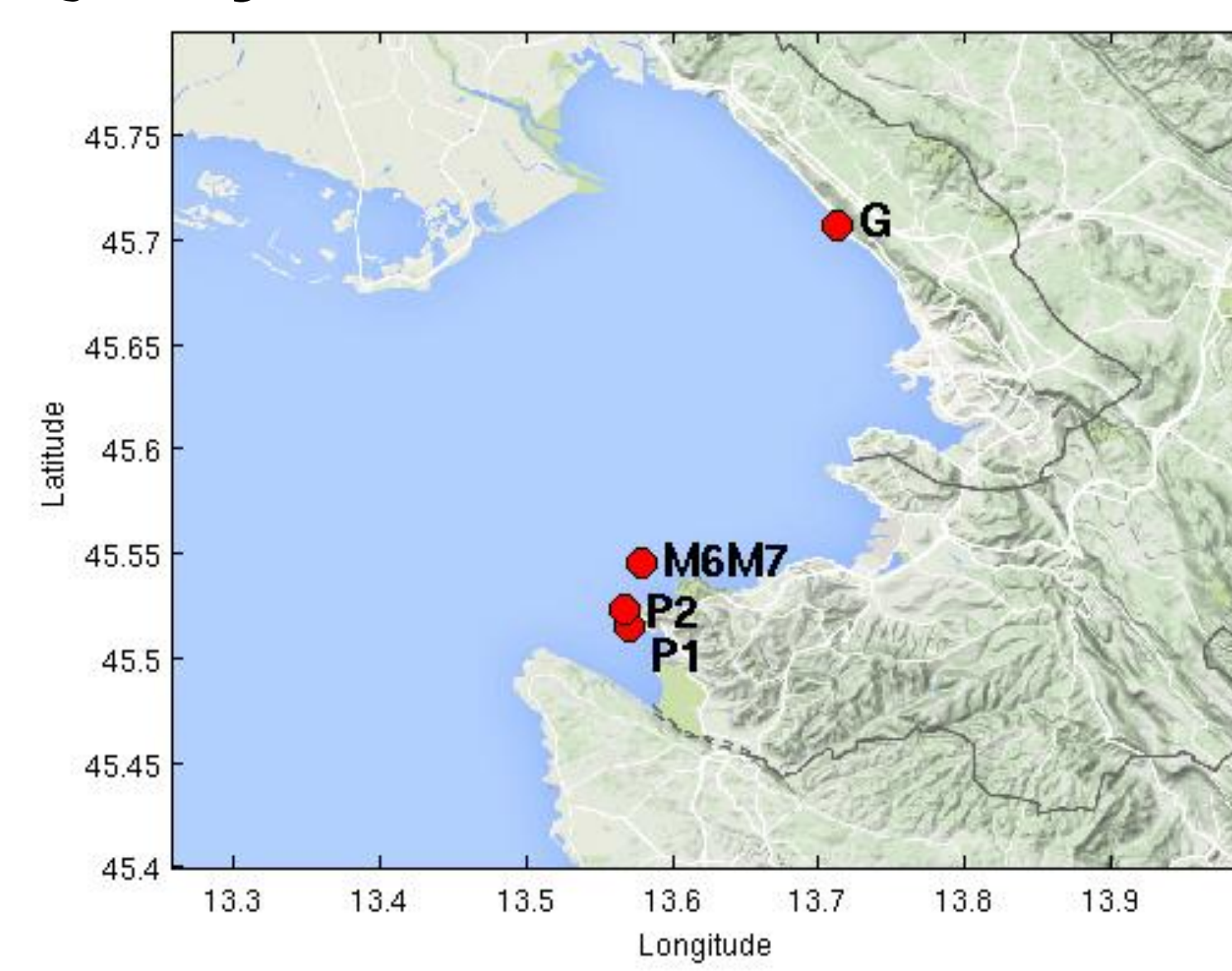


Table 1 Visual count of jellyfish at 3 onshore (P1, P2 and G) and one offshore (M6–M7) transect. A—*Aurelia aurita* s.l., Rp—*Rhizostoma pulmo*; N—number

	P 1	P 2	M6-M7	G
N of counts	51	49	20	19
N of species	1	3	4	4
total N of medusae	97	34	351	58
most common species (N_{sp}/N_{tot})	A (4/4)	A (6/9)	A (7/13)	Rp (5/8)

CONCLUSION:

Observations differ between transects. The offshore count gave higher medusae abundances as well as higher frequency of observations than any of the onshore counts.

Literature: Alpaslan M (2001) Succession of Scyphozoa-Ctenophora in the Harbour of Çanakkale (Çanakkale Limanı) (Mediterranean Sea). *Turkish J. Marine Sciences* 7:59-68; Crocetta, F, Agus D, et al. (2015) New Mediterranean Biodiversity Records (October 2015)-early view. *Mediterranean Marine Science*; Daly Yahia MN, Goy J, & Daly Yahia-Kelli O (2003) Distribution and ecology of Medusae and Scyphomedusae (Cnidaria) in Tunis Gulf (SW Mediterranean). *Oceanologica Acta* 26:645-655; Deidun A, Arigo S, & Pirano S (2011) The westernmost record of *Rhopilema nomadica* (Gall, 1990) in the Mediterranean-off the Maltese Islands. *Aquatic Invasions* 6(1):308-3103; Fuentes Y, et al. (2011) Life cycle of the jellyfish *Rhizostoma pulmo* (Scyphozoa: Rhizostomae) and its distribution, seasonally and inter-annual variability along the Catalan coast and the Mar Menor (Spain, NW Mediterranean). *Marine Biology* 1-20; Goy J, Morand P, & Etienne M (1989) Long-term fluctuations of *Pelagia noctiluca* (Cnidaria, Scyphomedusa) in the western Mediterranean Sea. Prediction by climatic variables. *Deep Sea Research Part A: Oceanographic Research Papers* 36(2):269-279; Haddock S, Pugh P, Mills CE, & Harbison G (1996) Medusae, siphonophores and ctenophores of the Alboran Sea, south western Mediterranean. *Scientia Marina* 60(1):145-163; Kogovšek T, et al. (2012) Interannual size changes of adult *Aurelia* sp. 5 medusae stage in the Marine Protected Area of Mijet Island South Adriatic. *Acta Adriatica* 53(2):233-242; Lilley M, Houghton J, & Hays G (2009) Distribution, extent of inter-annual variability and diet of the bloom-forming jellyfish *Rhizostoma* in European waters. *Journal of the Marine Biological Association of the United Kingdom* 89(01):39-48; Malej A, Kogovšek T, Ramšak A, & Catenacci L (2012) Blooms and population dynamics of moon jellyfish in the Northern Adriatic. *Cahiers de biologie marine* 53(3):337-342; Marques R, et al. (2015) Pelagic population dynamics of *Aurelia* sp. in French Mediterranean lagoons. *Journal of Plankton Research*; Papathanassiou E, Parasytidis P, & Anagnostaki K (1987) Notes on the biology and ecology of the jellyfish *Aurelia aurita* Lam. in Elisfis Bay (Saronikos Gulf, Greece). *Marine Ecology* 8(1):49-58; Pérez-Ruzafa A, et al. (2002) Evidence of a planktonic food web response to changes in nutrient input dynamics in the Mar Menor coastal lagoon, Spain. *Nutrients and Eutrophication in Estuaries and Coastal Waters*. (Springer), pp 359-369; Touzi C, Yahia OK-D, Hamdi H, Goy J, & Yahia MND (2010) Spatio-temporal distribution of Medusae (Cnidaria) in the Bay of Bizerte (South Western Mediterranean Sea). *Cahiers de biologie marine* 51(2):167-176; Rottini-Sandri L, Aviani M, Azok V, Malej A (1983-84) The breeding period of *Pelagia noctiluca* (Scyphozoa, Semeostomae) in the Adriatic and central Mediterranean Sea. *Nova Thalassia*, 6: 65-75; Yahia, M. N. D., O. Kelli-Daly Yahia, et al. (2013) The invasive tropical scyphozoan *Rhopilema nomadica* Gall, 1990 reaches the Tunisian coast of the Mediterranean Sea. *BioInvasions Rec* 2: 319-323.; UNEP (1991) The aspect of jellyfish distribution in the Adriatic Sea. UNEP: Jellyfish blooms in the Mediterranean Proceedings of the II Workshop on Jellyfish in the Mediterranean Sea MAP Tech Rep Ser. 321pp.;