

Short communication

A population of the alien jellyfish, *Cassiopea andromeda* (Forsskål, 1775) (Cnidaria: Scyphozoa: Rhizostomea) in the Ölüdeniz Lagoon, Turkey

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Abstract

An established population of the alien jellyfish *Cassiopea andromeda* is present in Ölüdeniz Lagoon, off southwestern Turkey. This is the third record of this invasive species off the Turkish coast. The high abundance of the species in the Ölüdeniz Lagoon and along the Turkish coast is of great concern as it may annoy bathers and impact tourism.

Key words: *Cassiopea andromeda*, alien species, Scyphozoa, Ölüdeniz Lagoon, Turkey, Specially Protected Area

Cassiopea andromeda (Forsskål, 1775) entered the Mediterranean Sea via the Suez Canal (Galil et al. 1990). The first Turkish record consisted of a single specimen, from Sarsala Bay, Fethiye, Göcek (Bilecenoğlu 2002). Subsequently, six specimens were reported from the Bay of İskenderun (Çevik et al. 2006). We report the presence of an established population in Ölüdeniz Lagoon.

Ölüdeniz Lagoon is located 14 km south of the Fethiye, on the southwestern coast of Turkey (Figure 1). The lagoon is approximately 1300 m long and 650 m wide, with maximum depth of 39 m. Its mouth is 7 m wide and 5 m deep. The surface water temperature in August, 2003 was 29.9°C, and in March, 2004, 17.2°C. Salinity was highest (38.8 PSU) near the inlet and lowest (34.5 PSU) inside the lagoon (TUDAV 2004).

Cassiopea andromeda was first observed in August, 2000, in the north shallow end of the Lagoon (station 4b, Figure 2). In 2003 and 2004 large numbers were observed in several locations in the lagoon. However, Öztürk et al. (2005), who studied the biodiversity of the lagoon misidentified it as *Cotylorhiza tuberculata* (Macri, 1778). Öztürk et al. (2005) reported five other alien species as well established in the lagoon: *Halophila stipulacea* (Forsskål)

Ascherson, *Callinectes sapidus* Rathbun, 1896, *Strombus persicus* (Swainson, 1821), *Pinctada radiata* (Leach, 1814), and *Synaptula reciprocans* (Forskål, 1775). The mode of introduction *C. andromeda* is unclear. The juvenile benthic stage may have arrived in ships' hull-fouling; the pelagic stage in ballast water, or ephyrae may have reached the area with water currents from the Levantine coast (Çevik et al. 2006). Ölüdeniz Lagoon is located 15 nautical miles from the port of Fethiye.

Between August, 2003 and May, 2004, the presence and mean abundance of *C. andromeda* was studied in six stations, representing different habitat types in the lagoon (Figure 2). The abundance was calculated by line transect method; counting the individuals in a 100 m² (5m-wide by 20m-long) rectangular plot. Large numbers of *C. andromeda* were observed in the stations 1a, 1b, 2, 4a, 4b, 5 and 6 (Annex 1). Stations 1a,b consist of a steep rocky shore to depth of 6m and a deeper muddy silty bottom. Station 2 consists of a shallow, marshy area with *Zostera marina* beds at the depths of 4-10 m. Station 3 has a rocky coastline and muddy bottom at a depth of 6 m. Stations 4a and 4b are shallow and marshy. Between these two stations is a touristic sandy beach. Station 5 has a dense

Figure 1. Map of Gulf of Fethiye (South west coast of Turkey), indicating the location of the Ölüdeniz Lagoon.

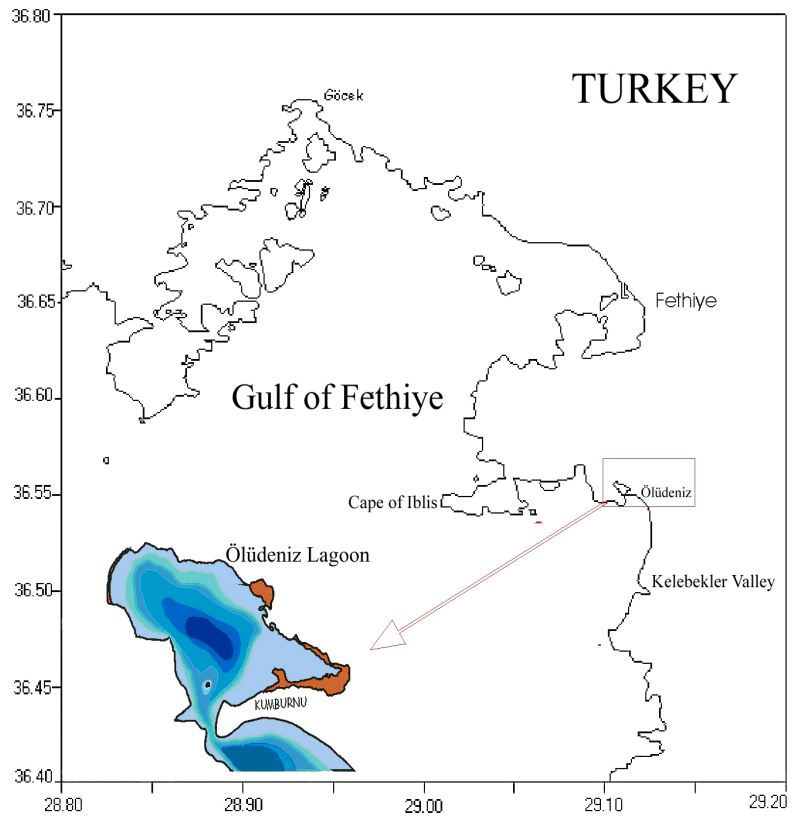


Figure 2. Map of the Ölüdeniz Lagoon, indicating the depth levels and the stations with marshy coastline in dark green color.

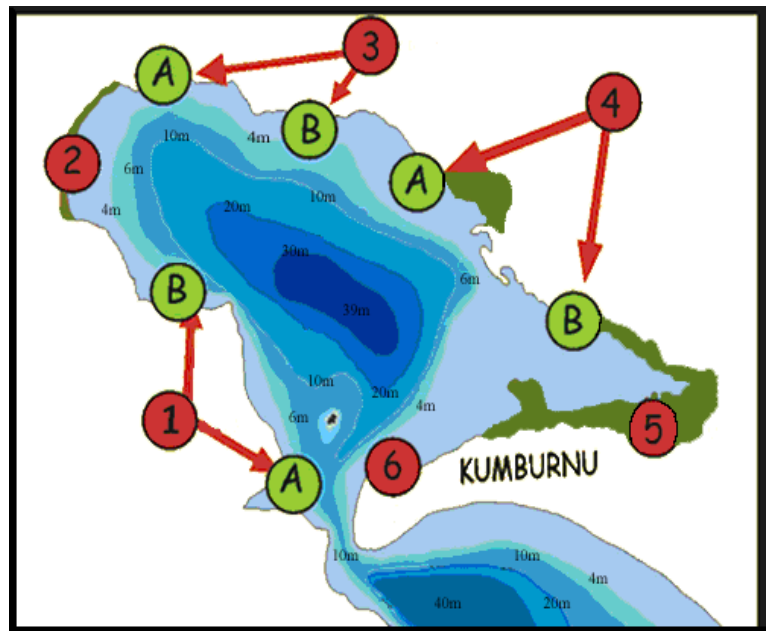




Figure 3. *Cassiopea andromeda* in the Ölüdeniz Lagoon, lying mouth upward on the bottom (Photographed by Mert Keçeci).

marshy coast with extended silty, muddy bottoms and waters shallower than 4m. Station 6 is a touristic sandy beach.

Ölüdeniz Lagoon was declared a Specially Protected Area (SPA) by the Turkish Ministry of Environment in 1988. It is also a popular tourist destination, visited by 500.000 persons each summer. Like other jellyfish, *Cassiopea* is armed with nematocysts which stings may cause welts, rashes, itching, vomiting and skeletal pains depending on the person's sensitivity to the nematocyst toxin (Eldredge and Smith 2001). The high abundance of the species in the Ölüdeniz Lagoon and along the Turkish coast is of great concern as it may annoy bathers and impact tourism. We call for further studies to map the distribution of the species along the coast and examine its possible ecological impact on native species.

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Annex I. The abundance of *Cassiopea andromeda*, calculated by line transect method; counting the individuals in a 100 m² (5m-wide by 20m-long) rectangular plot, at each season, station, and depth levels. Coordinates show the starting and ending points of the transects at each station and depth levels.

Station No. (Map Ref.)	Transect coordinates		Record date	Sampling Depth (m)	Abundance (ind.m ⁻²)	Collector
	Latitude,°N	Longitude,°E				
1a	36°33.016' 36°33.067'	29°06.558' 29°06.515'	10.08.2003	6-8	0.06	E.Özgür&AÜrün
1a	36°33.025' 36°33.071'	29°06.563' 29°06.525'	10.08.2003	10-12	0.05	E.Özgür&AÜrün
1a	36°33.038' 36°33.083'	29°06.565' 29°06.526'	10.08.2003	15-18	0.03	E.Özgür&AÜrün
1a	36°33.016' 36°33.067'	29°06.558' 29°06.515'	20.10.2003	6-8	0.05	E.Özgür&AÜrün
1a	36°33.025' 36°33.071'	29°06.563' 29°06.525'	20.10.2003	10-12	0.06	E.Özgür&AÜrün
1a	36°33.038' 36°33.083'	29°06.565' 29°06.526'	20.10.2003	15-18	0.04	E.Özgür&AÜrün
1a	36°33.016' 36°33.067'	29°06.558' 29°06.515'	06.01.2004	6-8	0.04	E.Özgür&M.Keçeci
1a	36°33.025' 36°33.071'	29°06.563' 29°06.525'	06.01.2004	10-12	0.08	E.Özgür&M.Keçeci
1a	36°33.038' 36°33.083'	29°06.565' 29°06.526'	06.01.2004	15-18	0.05	E.Özgür&M.Keçeci
1a	36°33.016' 36°33.067'	29°06.558' 29°06.515'	08.05.2004	6-8	0.04	E.Özgür&M.Mantıkçı
1a	36°33.025' 36°33.071'	29°06.563' 29°06.525'	08.05.2004	10-12	0.07	E.Özgür&M.Mantıkçı
1a	36°33.038' 36°33.083'	29°06.565' 29°06.526'	08.05.2004	15-18	0.05	E.Özgür&M.Mantıkçı
1b	36°33.167' 36°33.213'	29°06.367' 29°06.325'	10.08.2003	6-8	0.07	E.Özgür&AÜrün
1b	36°33.168' 36°33.218'	29°06.378' 29°06.346'	10.08.2003	10-12	0.06	E.Özgür&AÜrün
1b	36°33.169' 36°33.221'	29°06.384' 29°06.361'	10.08.2003	15-18	0.05	E.Özgür&AÜrün
1b	36°33.167' 36°33.213'	29°06.367' 29°06.325'	20.10.2003	6-8	0.05	E.Özgür&AÜrün
1b	36°33.168' 36°33.218'	29°06.378' 29°06.346'	20.10.2003	10-12	0.04	E.Özgür&AÜrün
1b	36°33.169' 36°33.221'	29°06.384' 29°06.361'	20.10.2003	15-18	0.04	E.Özgür&AÜrün
1b	36°33.167' 36°33.213'	29°06.367' 29°06.325'	06.01.2004	6-8	0.04	E.Özgür&M.Keçeci
1b	36°33.168' 36°33.218'	29°06.378' 29°06.346'	06.01.2004	10-12	0.07	E.Özgür&M.Keçeci
1b	36°33.169' 36°33.221'	29°06.384' 29°06.361'	06.01.2004	15-18	0.05	E.Özgür&M.Keçeci
1b	36°33.167' 36°33.213'	29°06.367' 29°06.325'	08.05.2004	6-8	0.07	E.Özgür&M.Mantıkçı
1b	36°33.168' 36°33.218'	29°06.378' 29°06.346'	08.05.2004	10-12	0.05	E.Özgür&M.Mantıkçı
1b	36°33.169' 36°33.221'	29°06.384' 29°06.361'	08.05.2004	15-18	0.04	E.Özgür&M.Mantıkçı
2	36°33.204' 36°33.230'	29°06.304' 29°06.239'	10.08.2003	1-3	0.01	E.Özgür&AÜrün
2	36°33.262' 36°33.276'	29°06.261' 29°06.322'	10.08.2003	4-6	0.02	E.Özgür&AÜrün
2	36°33.204' 36°33.230'	29°06.304' 29°06.239'	20.10.2003	1-3	0.01	E.Özgür&AÜrün
2	36°33.262' 36°33.276'	29°06.261' 29°06.322'	20.10.2003	4-6	0.03	E.Özgür&AÜrün

Annex 1 (continued)

Station No. (Map Ref.)	Transect coordinates		Record date	Sampling Depth (m)	Abundance (ind.m ⁻²)	Collector
	Latitude, °N	Longitude, °E				
2	36°33.204' 36°33.230'	29°06.304' 29°06.239'	06.01.2004	1-3	0.02	E.Özgür&M.Keçeci
2	36°33.262' 36°33.276'	29°06.261' 29°06.322'	06.01.2004	4-6	0.03	E.Özgür&M.Keçeci
2	36°33.204' 36°33.230'	29°06.304' 29°06.239'	08.05.2004	1-3	0.01	E.Özgür&M.Mantıkçı
2	36°33.262' 36°33.276'	29°06.261' 29°06.322'	08.05.2004	4-6	0.04	E.Özgür&M.Mantıkçı
3a	36°33.271' 36°33.267'	29°06.333' 29°06.398'	10.08.2003	6-8	0.00	E.Özgür&AÜrün
3a	36°33.257' 36°33.261'	29°06.325' 29°06.388'	10.08.2003	10-12	0.00	E.Özgür&AÜrün
3a	36°33.271' 36°33.267'	29°06.333' 29°06.398'	20.10.2003	6-8	0.00	E.Özgür&AÜrün
3a	36°33.257' 36°33.261'	29°06.325' 29°06.388'	20.10.2003	10-12	0.00	E.Özgür&AÜrün
3a	36°33.271' 36°33.267'	29°06.333' 29°06.398'	06.01.2004	6-8	0.01	E.Özgür&M.Keçeci
3a	36°33.257' 36°33.261'	29°06.325' 29°06.388'	06.01.2004	10-12	0.00	E.Özgür&M.Keçeci
3a	36°33.271' 36°33.267'	29°06.333' 29°06.398'	08.05.2004	6-8	0.00	E.Özgür&M.Mantıkçı
3a	36°33.257' 36°33.261'	29°06.325' 29°06.388'	08.05.2004	10-12	0.00	E.Özgür&M.Mantıkçı
3b	36°33.301' 36°33.284'	29°06.434' 29°06.497'	10.08.2003	6-8	0.00	E.Özgür&AÜrün
3b	36°33.291' 36°33.274'	29°06.436' 29°06.497'	10.08.2003	10-12	0.00	E.Özgür&AÜrün
3b	36°33.301' 36°33.284'	29°06.434' 29°06.497'	20.10.2003	6-8	0.00	E.Özgür&AÜrün
3b	36°33.291' 36°33.274'	29°06.436' 29°06.497'	20.10.2003	10-12	0.00	E.Özgür&AÜrün
3b	36°33.301' 36°33.284'	29°06.434' 29°06.497'	06.01.2004	6-8	0.00	E.Özgür&M.Keçeci
3b	36°33.291' 36°33.274'	29°06.436' 29°06.497'	06.01.2004	10-12	0.00	E.Özgür&M.Keçeci
3b	36°33.301' 36°33.284'	29°06.434' 29°06.497'	08.05.2004	6-8	0.00	E.Özgür&M.Mantıkçı
3b	36°33.291' 36°33.274'	29°06.436' 29°06.497'	08.05.2004	10-12	0.00	E.Özgür&M.Mantıkçı
4a	36°33.235' 36°33.223'	29°06.768' 29°06.702'	15.08.2003	1-3	0.01	E.Özgür&AÜrün
4a	36°33.200' 36°33.201'	29°06.773' 29°06.712'	15.08.2003	4-6	0.04	E.Özgür&AÜrün
4a	36°33.235' 36°33.223'	29°06.768' 29°06.702'	22.10.2003	1-3	0.03	E.Özgür&AÜrün
4a	36°33.200' 36°33.201'	29°06.773' 29°06.712'	22.10.2003	4-6	0.06	E.Özgür&AÜrün
4a	36°33.235' 36°33.223'	29°06.768' 29°06.702'	02.01.2004	1-3	0.03	E.Özgür&M.Keçeci
4a	36°33.200' 36°33.201'	29°06.773' 29°06.712'	02.01.2004	4-6	0.04	E.Özgür&M.Keçeci
4a	36°33.235' 36°33.223'	29°06.768' 29°06.702'	08.05.2004	1-3	0.03	E.Özgür&M.Mantıkçı
4a	36°33.200' 36°33.201'	29°06.773' 29°06.712'	08.05.2004	4-6	0.06	E.Özgür&M.Mantıkçı
4b	36°33.172' 36°33.135'	29°06.797' 29°06.834'	15.08.2003	1-3	0.06	E.Özgür&AÜrün
4b	36°33.168' 36°33.113'	29°06.773' 29°06.778'	15.08.2003	4-6	0.09	E.Özgür&AÜrün

Annex 1 (continued)

Station No. (Map Ref.)	Transect coordinates		Record date	Sampling Depth (m)	Abundance (ind.m ⁻²)	Collector
	Latitude, °N	Longitude, °E				
4b	36°33.172' 36°33.135'	29°06.797' 29°06.834'	22.10.2003	1-3	0.06	E.Özgür&AÜrün
4b	36°33.168' 36°33.113'	29°06.773' 29°06.778'	22.10.2003	4-6	0.09	E.Özgür&AÜrün
4b	36°33.172' 36°33.135'	29°06.797' 29°06.834'	02.01.2004	1-3	0.04	E.Özgür&M.Keçeci
4b	36°33.168' 36°33.113'	29°06.773' 29°06.778'	02.01.2004	4-6	0.06	E.Özgür&M.Keçeci
4b	36°33.172' 36°33.135'	29°06.797' 29°06.834'	06.05.2004	1-3	0.08	E.Özgür&M.Mantıkçı
4b	36°33.168' 36°33.113'	29°06.773' 29°06.778'	06.05.2004	4-6	0.11	E.Özgür&M.Mantıkçı
5	36°33.112' 36°33.082'	29°06.864' 29°06.918'	15.08.2003	0.5-2	0.10	E.Özgür&AÜrün
5	36°33.081' 36°33.082'	29°06.834' 29°06.771'	15.08.2003	2-4	0.14	E.Özgür&AÜrün
5	36°33.112' 36°33.082'	29°06.864' 29°06.918'	22.10.2003	0.5-2	0.07	E.Özgür&AÜrün
5	36°33.081' 36°33.082'	29°06.834' 29°06.771'	22.10.2003	2-4	0.10	E.Özgür&AÜrün
5	36°33.112' 36°33.082'	29°06.864' 29°06.918'	02.01.2004	0.5-2	0.06	E.Özgür&M.Keçeci
5	36°33.081' 36°33.082'	29°06.834' 29°06.771'	02.01.2004	2-4	0.09	E.Özgür&M.Keçeci
5	36°33.112' 36°33.082'	29°06.864' 29°06.918'	06.05.2004	0.5-2	0.09	E.Özgür&M.Mantıkçı
5	36°33.081' 36°33.082'	29°06.834' 29°06.771'	06.05.2004	2-4	0.13	E.Özgür&M.Mantıkçı
6	36°33.036' 36°33.027'	29°06.788' 29°06.719'	15.08.2003	1-3	0.02	E.Özgür&AÜrün
6	36°33.015' 36°33.013'	29°06.685' 29°06.619'	15.08.2003	4-6	0.03	E.Özgür&AÜrün
6	36°33.053' 36°33.028'	29°06.728' 29°06.663'	15.08.2003	8-10	0.01	E.Özgür&AÜrün
6	36°33.036' 36°33.027'	29°06.788' 29°06.719'	22.10.2003	1-3	0.01	E.Özgür&AÜrün
6	36°33.015' 36°33.013'	29°06.685' 29°06.619'	22.10.2003	4-6	0.03	E.Özgür&AÜrün
6	36°33.053' 36°33.028'	29°06.728' 29°06.663'	22.10.2003	8-10	0.03	E.Özgür&AÜrün
6	36°33.036' 36°33.027'	29°06.788' 29°06.719'	02.01.2004	1-3	0.00	E.Özgür&M.Keçeci
6	36°33.015' 36°33.013'	29°06.685' 29°06.619'	02.01.2004	4-6	0.01	E.Özgür&M.Keçeci
6	36°33.053' 36°33.028'	29°06.728' 29°06.663'	02.01.2004	8-10	0.02	E.Özgür&M.Keçeci
6	36°33.036' 36°33.027'	29°06.788' 29°06.719'	06.05.2004	1-3	0.02	E.Özgür&M.Mantıkçı
6	36°33.015' 36°33.013'	29°06.685' 29°06.619'	06.05.2004	4-6	0.03	E.Özgür&M.Mantıkçı
6	36°33.053' 36°33.028'	29°06.728' 29°06.663'	06.05.2004	8-10	0.03	E.Özgür&M.Mantıkçı