Supplementary Material

Methods

Gelatinous and non-gelatinous zooplankton sampling. A total of 410 gelatinous zooplankton *Mnemiopsis leidyi* samples were collected at monthly intervals using a plankton net (mesh size 500 µm) during June 2001-August 2006 from inshore waters of the southern Caspian Sea (36.41 °N - 51.30 °E and 36.52 °N - 53.17 °E, the Mazandaran province of Iran) from a total of 12 stations along three transects from the coast to 15 km offshore. Samples were obtained via vertical towing from the bottom (maximum depth 50 m) to the surface for all stations. On completion of each tow, the codend was immediately passed into a container to enumerate ctenophores by naked eye. The density of *Mnemiopsis leidyi* (per m^2) was calculated from the net diameter and tow depth. The ctenophores were sorted in length groups of 0-5 mm, 6-10 mm, 11-15 mm and so on, for determining the abundance of different size groups. Length measurements were converted to weight by using an empirically-derived equation [6]. Non-gelatinous zooplankton samples (total 245), often sampled simultaneously along with *Mnemiopsis leidyi*, were taken with a net of 100 µm mesh size and 0.36 m diameter from July 2001 to August 2006 in the same region and preserved to have a 4% formaldehyde concentration. Afterwards they were analysed with an inverted microscope. Phytoplankton samples were taken at monthly intervals from surface (112 samples) from the same sampling stations with *M. leidyi* between July 2001 and September 2002. Phytoplankton samples were held in 0.5 L dark bottles and preserved using buffered formaldehyde to obtain a final concentration of 2.5% and analyzed under microscope.

Satellite chl*a* .Values used in this study were obtained after calibration and atmospheric correction of top-of-atmosphere data from the Sea-Viewing Wide-Field-of-View Sensor (SeaWiFS) and the Moderate Resolution Spectroradiometer (MODIS). Satellite chl*a* concentrations are average monthly composite values for the southern Caspian Sea (<40.33 °N) during September 1997 - August 2006, (see also http://oceancolour.jrc.ec.europa.eu/cgi-bin/OC/select.pl?CASP).

NOAA/ NASA AVHRR Oceans Pathfinder sea surface temperature. Data were derived from the 5-channel Advanced Very High Resolution Radiometers (AVHRR) on several polar orbiting satellites. Monthly averaged data for descending pass (night time) were used for the southern Caspian Sea (<40.3 °N) at 9 km resolution between August 1997 and May 2003 and at 4 km resolution between June 2003 and December 2005 (http://poet.jpl.nasa.gov).

Statistical analyses. The hypothesis that the seasonality changed with respect to year was investigated statistically by modelling the dependence of chlorophyll *a* on month and trend or 'absolute time' using non-parametric regressions. We fitted the following two generalised additive models [Hastie, T.J. and Tibshirani, R.J. (1990) Generalised Additive Models. London: Chapman and Hall] to the chlorophyll a data:

Chlorophyll a = smooth(month) + smooth(trend)+error … (1)

Chlorophyll a = smooth(month,trend)+ error………………(2)

After examining the residuals for any unexplained patterns and checking that the lags in the autocorrelation functions were clear, a straightforward analysis of variance between the two nested models is an acceptable test for interaction between trend and month [Hastie and Tibshirani, 1990]. The results confirmed that model 2) above was the most appropriate, i.e. the variance it explained, compared to model (1) was statistically significant ($F = 3.42$, $p = 0.0001837$). Hence we can say (statistically) that month covaries or interacts with trend or (scientifically) that the shape of the chlorophyll *a* seasonal cycle actually changed with respect to the long-term trend.