The following appendix accompanies the article

Aldehyde-induced insidious effects cannot be considered as a diatom defence mechanism against copepods

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Appendix 2. Additional figures

Fig. A1.
Comparisons between systems commencing with mixed copepod populations, or with populations dominated by young or old individuals (all with the same initial total copepod biomass).
Four scenarios are shown –
(a) Control, with non-toxic diatoms and non-noxious flagellates
(b) With PUA+ diatoms, which adversely affect the survival of copepod nauplii (Egg + Naup stage in plots). Flagellates are non-noxious.
(c) With flagellates that become noxious when nutrient stressed; these are avoided by both copepods and microzooplankton. Diatoms are non-toxic.
(d) With PUA+ diatoms and noxious flagellates

In each instance the left hand panel shows the biomass concentrations for diatoms, flagellates, microzooplankton (μZ), total copepods, and voided particulate organic C (POC). The right hand panel shows the breakdown of the total copepod biomass (total shown in the corresponding left hand panel) into eggs and non-feeding naupli, feeding naupli, copepodites and reproducing adults. Nutrients became limiting for phytoplankton growth from Day 10 onwards for at least the next 20 days.

Main paper Figs. 1 and 2 show the same results as Figs. A1a and A1b (though in a different format); they are reproduced here to aid comparison with the other model outputs.

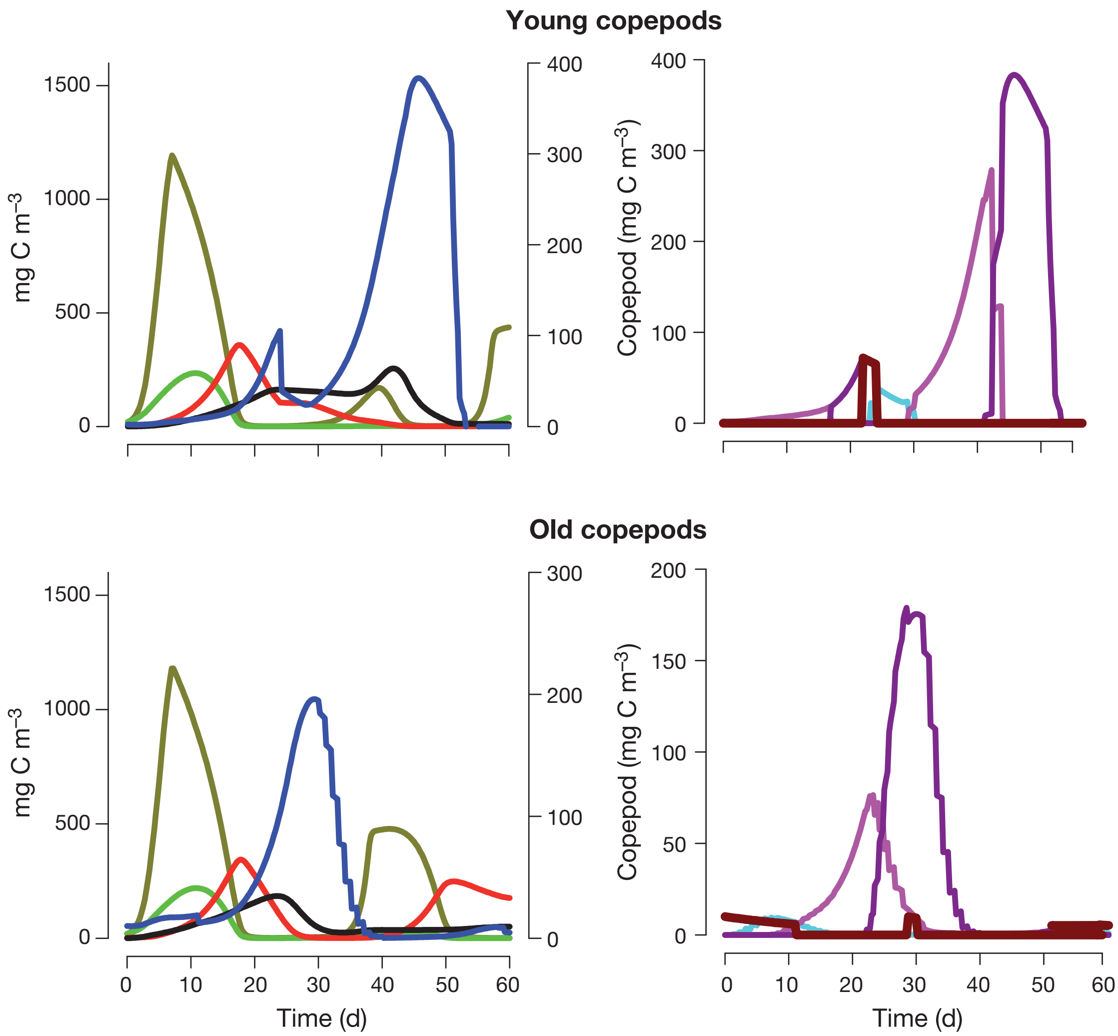

Fig. A1a. Control showing impact of different copepod populations on system dynamics

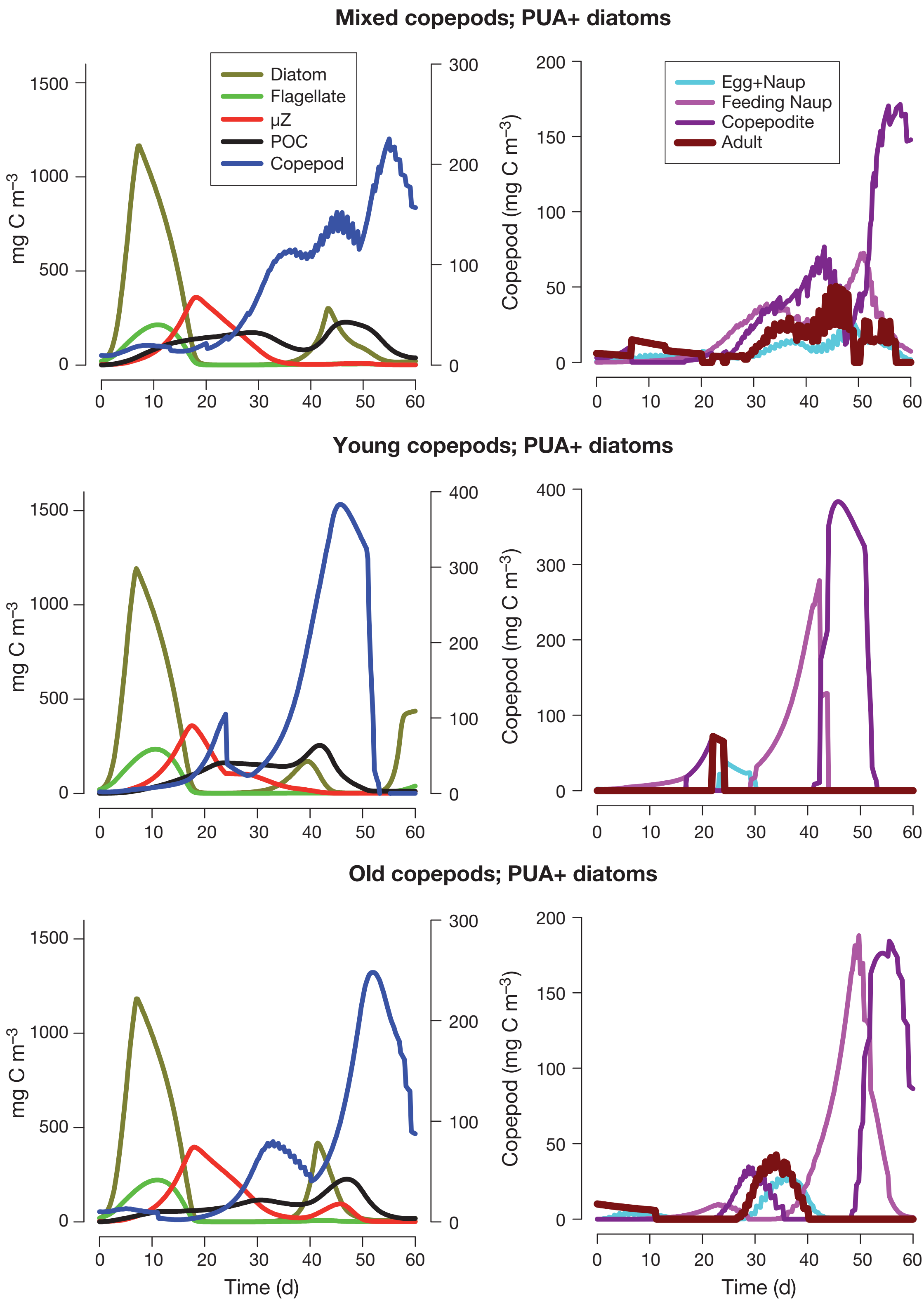

Fig. A1b. With PUA+ diatoms, there is no enhancement of diatom population growth, and evidence of the contrary. Copepod production is displaced in time relative to Fig. A1a

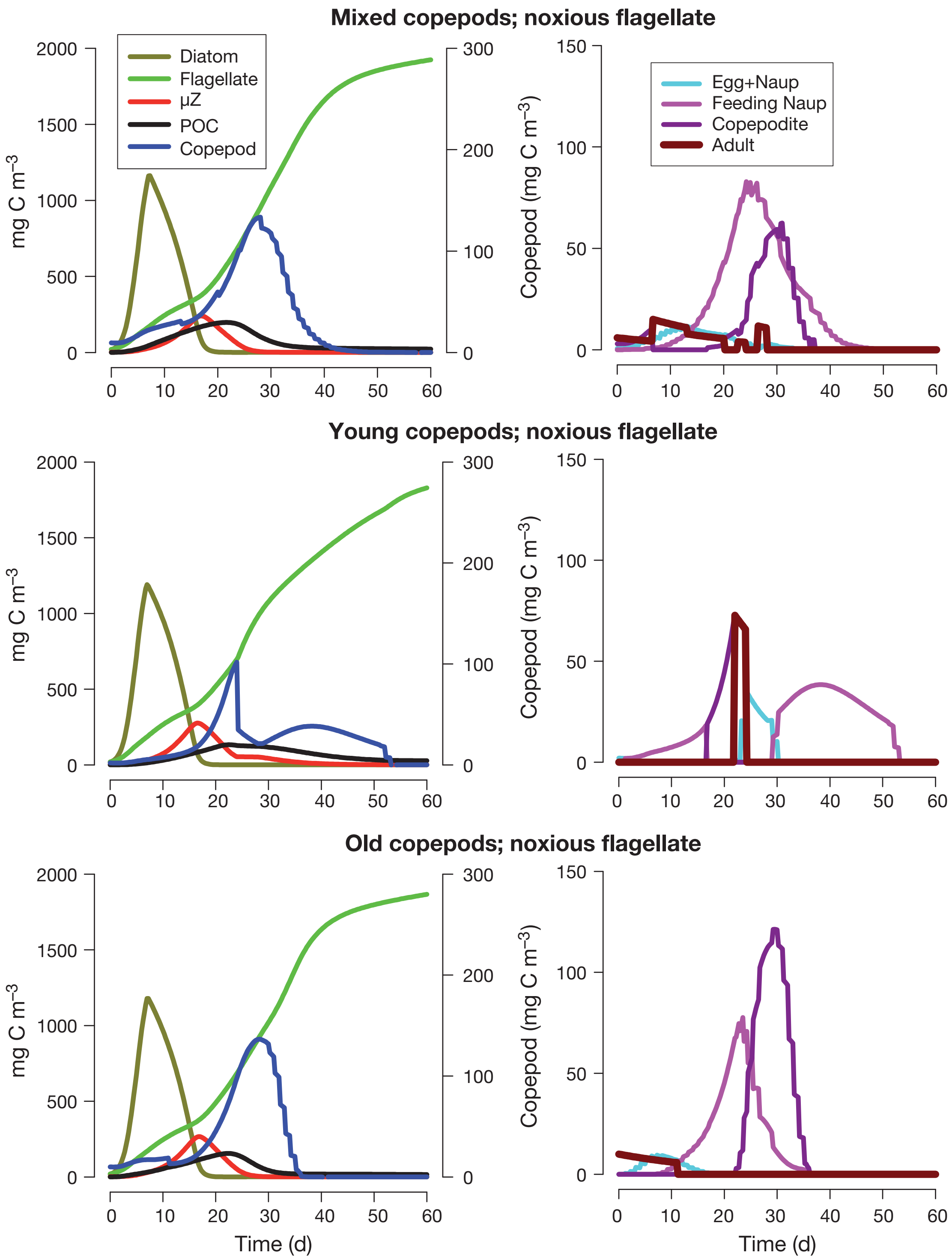

Fig. A1c. With flagellates that become noxious when nutrient stressed, flagellates rather than diatoms come to dominate

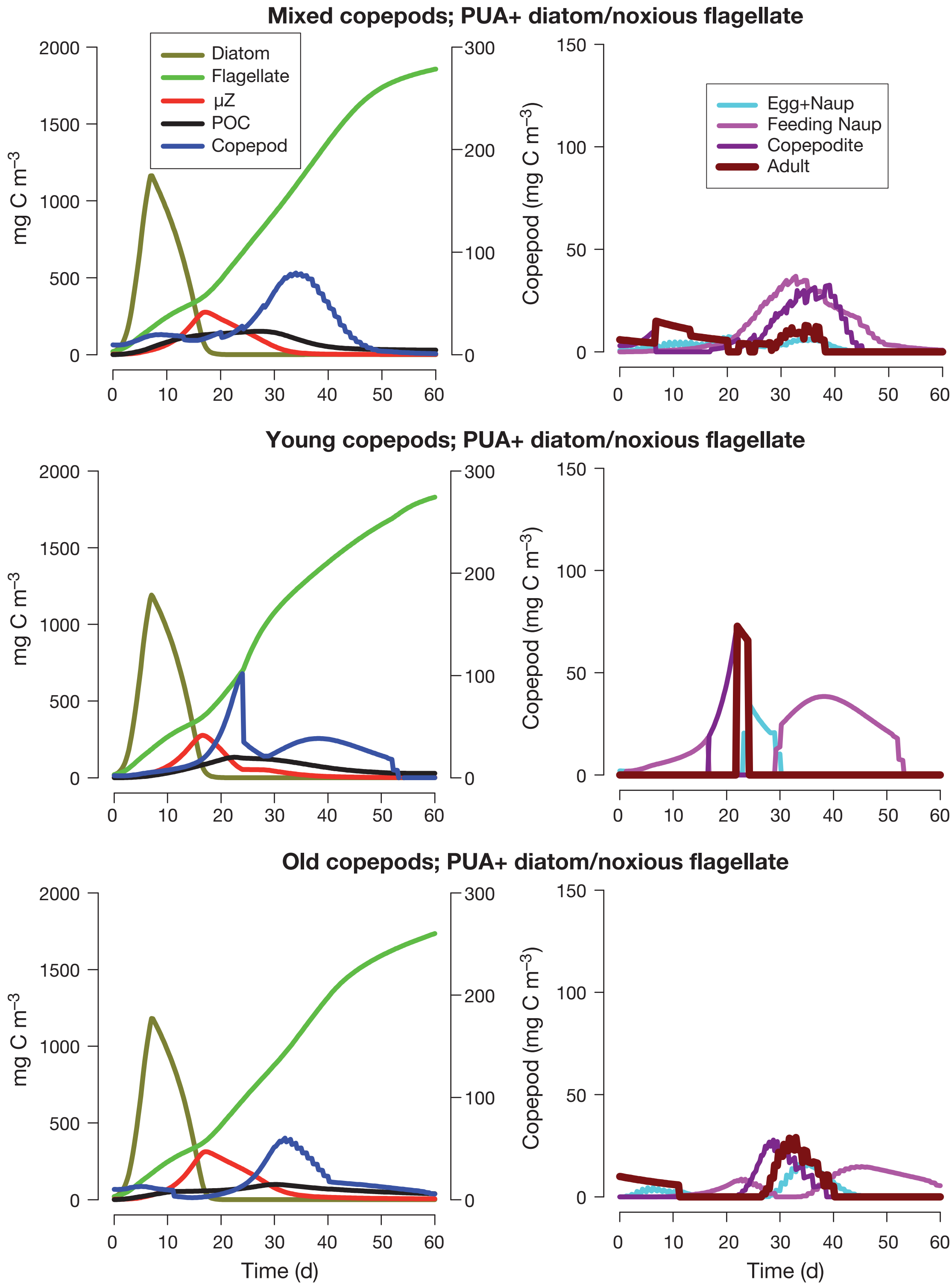

Fig. A1d. A combination of PUA+ and noxious flagellates shows the advantage in immediately affecting the predator effort

Fig. A2.
Comparisons between systems commencing with mixed copepod populations.

Seven scenarios are shown –

(a) Control, with non-toxic diatoms and non-noxious flagellates – these are the same as in Fig. A1a for the mixed copepod systems

(b) With higher mixing rates (0.02 d^{-1} rather than 0.01 d^{-1})

(c) With a lower (quarter control) initial phytoplankton biomass

(d) With elevated nutrients (eutrophic) such that phytoplankton did not exhaust nutrients.

(e) With no microzooplankton (only copepod predators) present

(f) With elevated nutrients (eutrophic) such that phytoplankton did not exhaust nutrients and with no microzooplankton (only copepod predators) present.

(g) With only diatoms (no flagellates) present

In each instance the left hand panel shows the biomass concentrations for diatoms, flagellates, microzooplankton (µZ), total copepods, and particulate organic C (POC). The right hand panel shows the breakdown of the total copepod biomass (total shown in the corresponding left hand panel) into eggs and non-feeding naupli, feeding naupli, copepodites and reproducing adults.

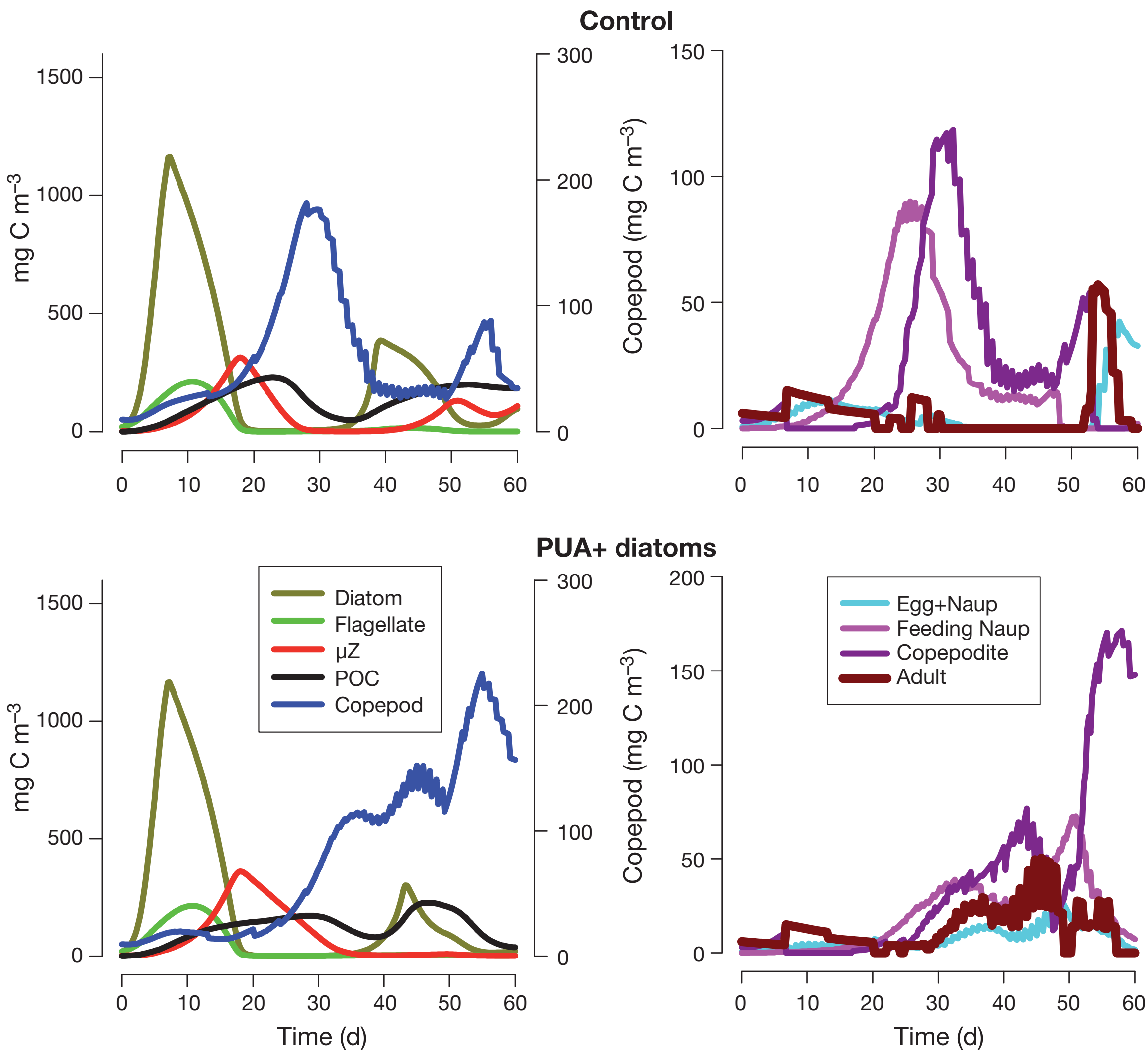

Fig. A2a. Baseline (control) simulations for the following graphs (Fig. A1a–g) for systems started with a mixed copepod population with non-noxious flagellates, with or without PUA+ diatoms. Being PUA+ does not enhance diatom population growth but does temporally displace copepod production

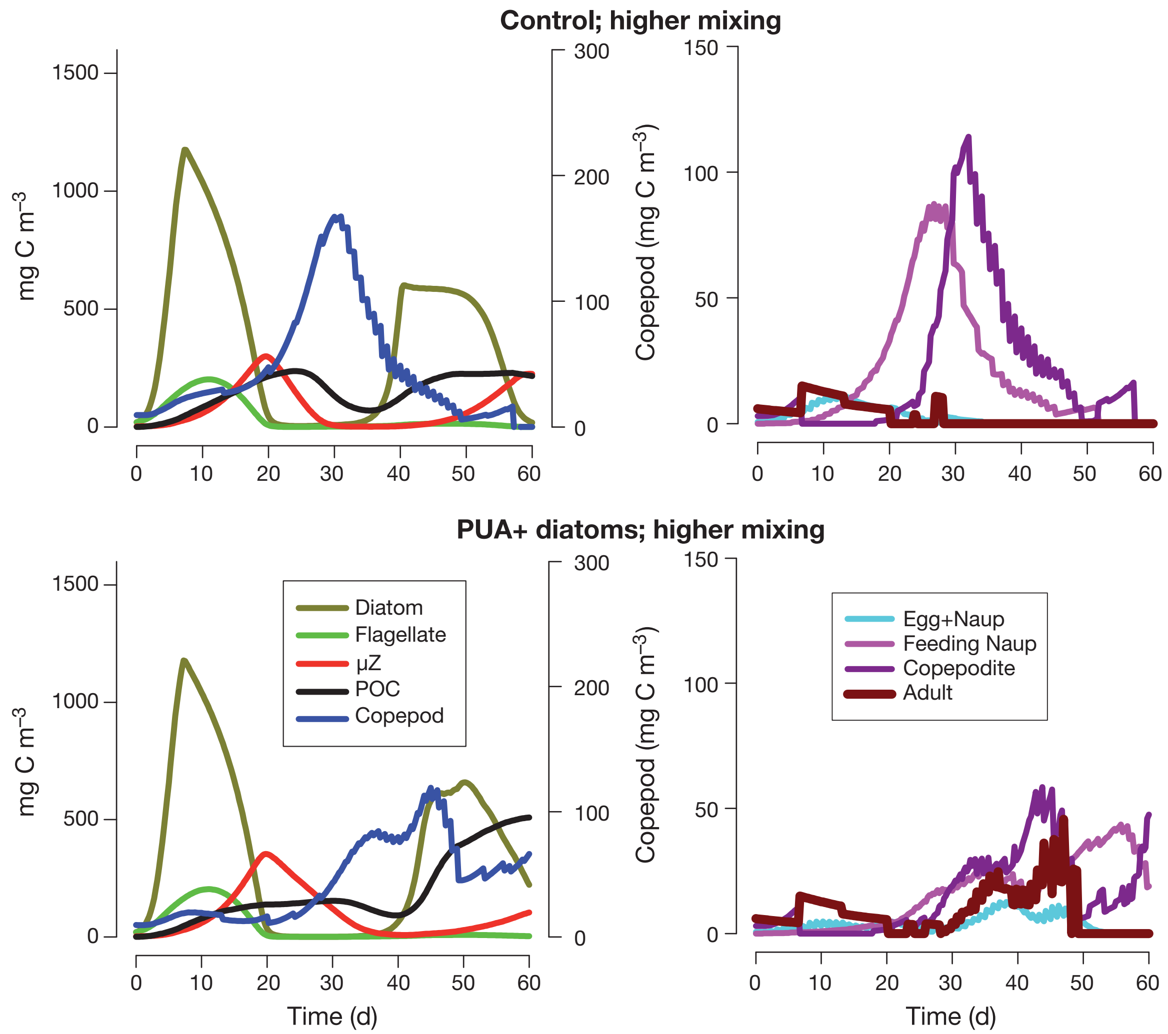

Fig. A2b. As Fig. A2a, but with a higher mixing rate, removing plankton (but not larger copepods) and introducing more nutrients. Being PUA+ does not enhance diatom population growth but temporally displaces copepod production

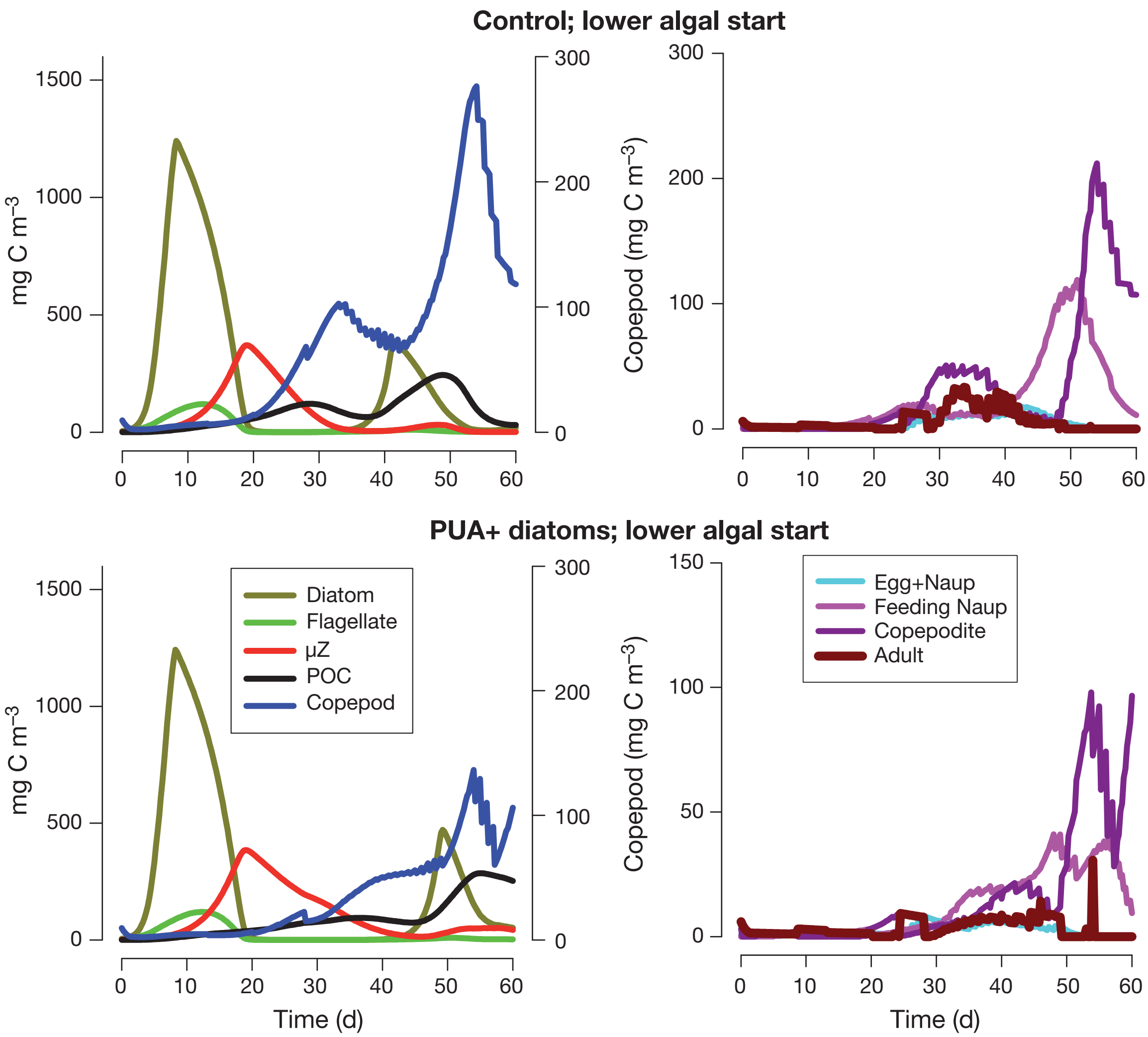

Fig. A2c. As Fig. A2a, but with a lower initial algal biomass. This disturbs the temporal dynamics. Being PUA+ does not enhance diatom population growth but temporally displaces copepod production

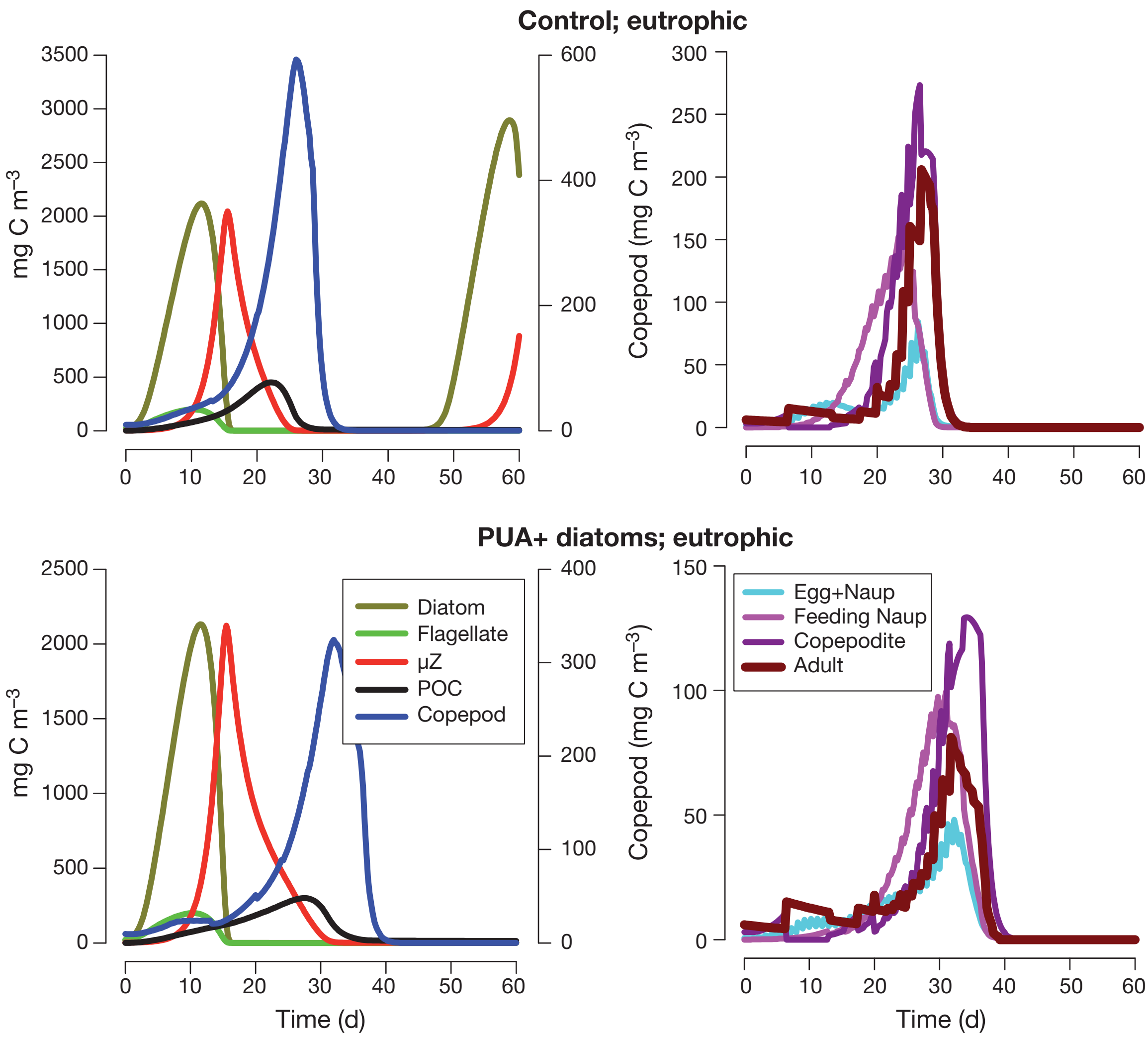

Fig. A2d. As Fig. A2a but due to higher nutrient loadings (100 µM rather than 10 µM each nitrate and silicate) phytoplankton growth is more light than nutrient limited. The diatom dominates due to its faster growth rate. Being PUA+ does not enhance diatom population growth but temporally displaces copepod production

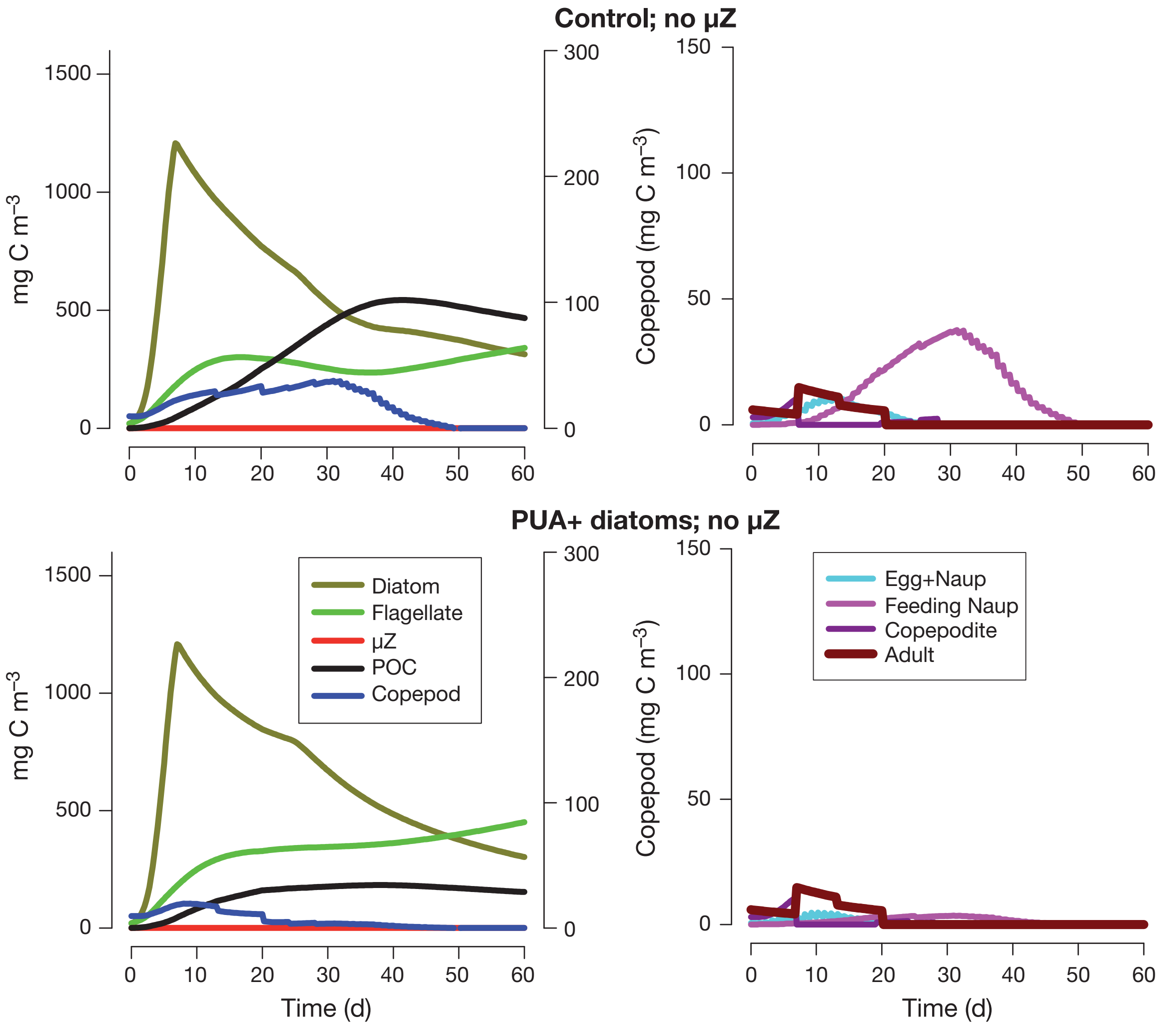

Fig. A2e. As Fig. A2a, but with no microzooplankton. Because of the importance of microzooplankton in consuming phytoplankton, recycling nutrients and hence maintaining the nutrient status of the phytoplankton, the stoichiometric value of the phytoplankton as food becomes very poor and inadequate for the support of the copepods. Being PUA+ has no consequence for the diatoms. Diatoms became increasingly silica limited, hence the success of flagellates

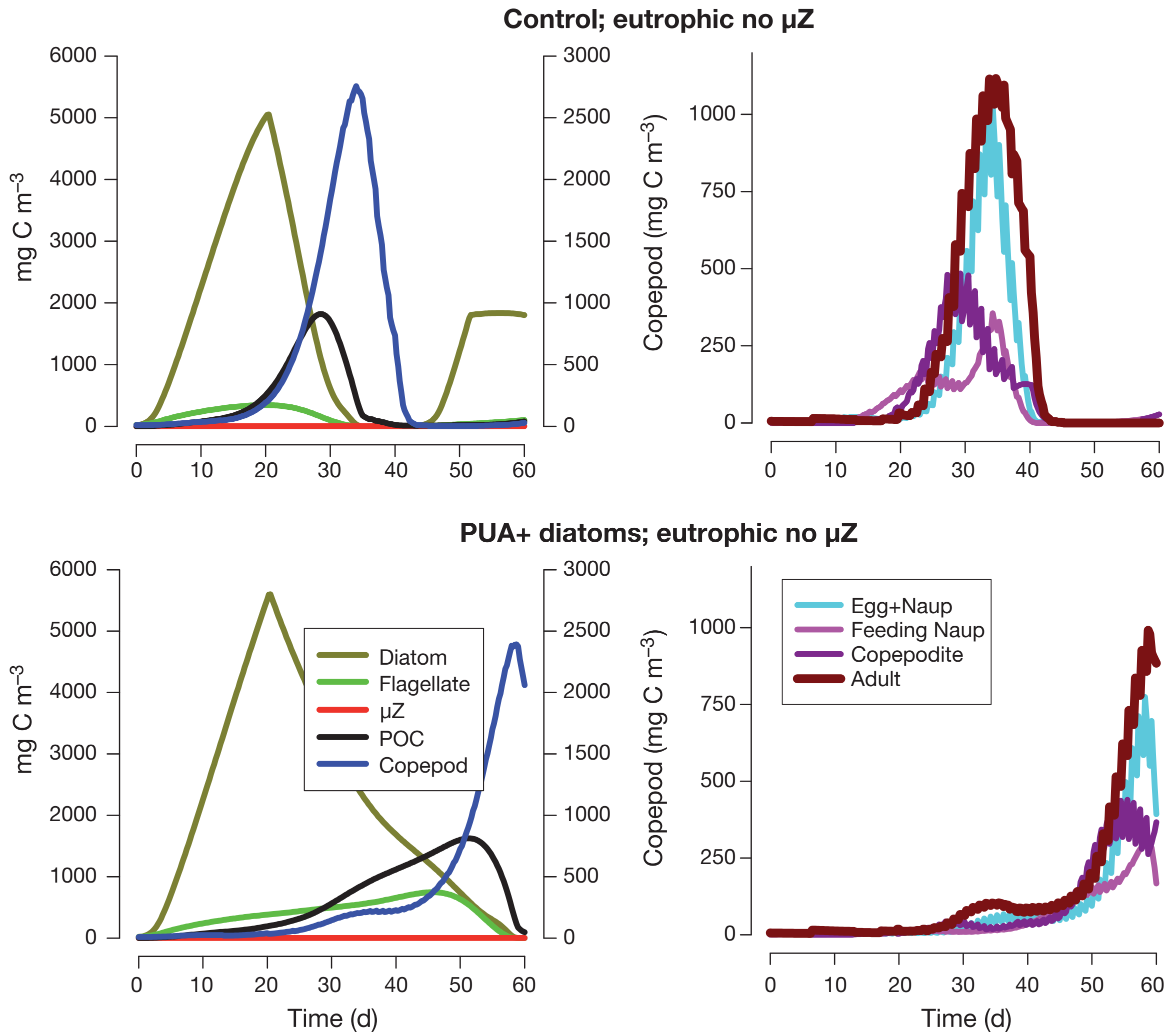

Fig. A2f. As Fig. A2a but phytoplankton growth is more light than nutrient limited. Compare with Fig. A2d,e. The diatom dominates due to its faster growth rate. Being PUA+ does not enhance diatom population growth but temporally displaces copepod production

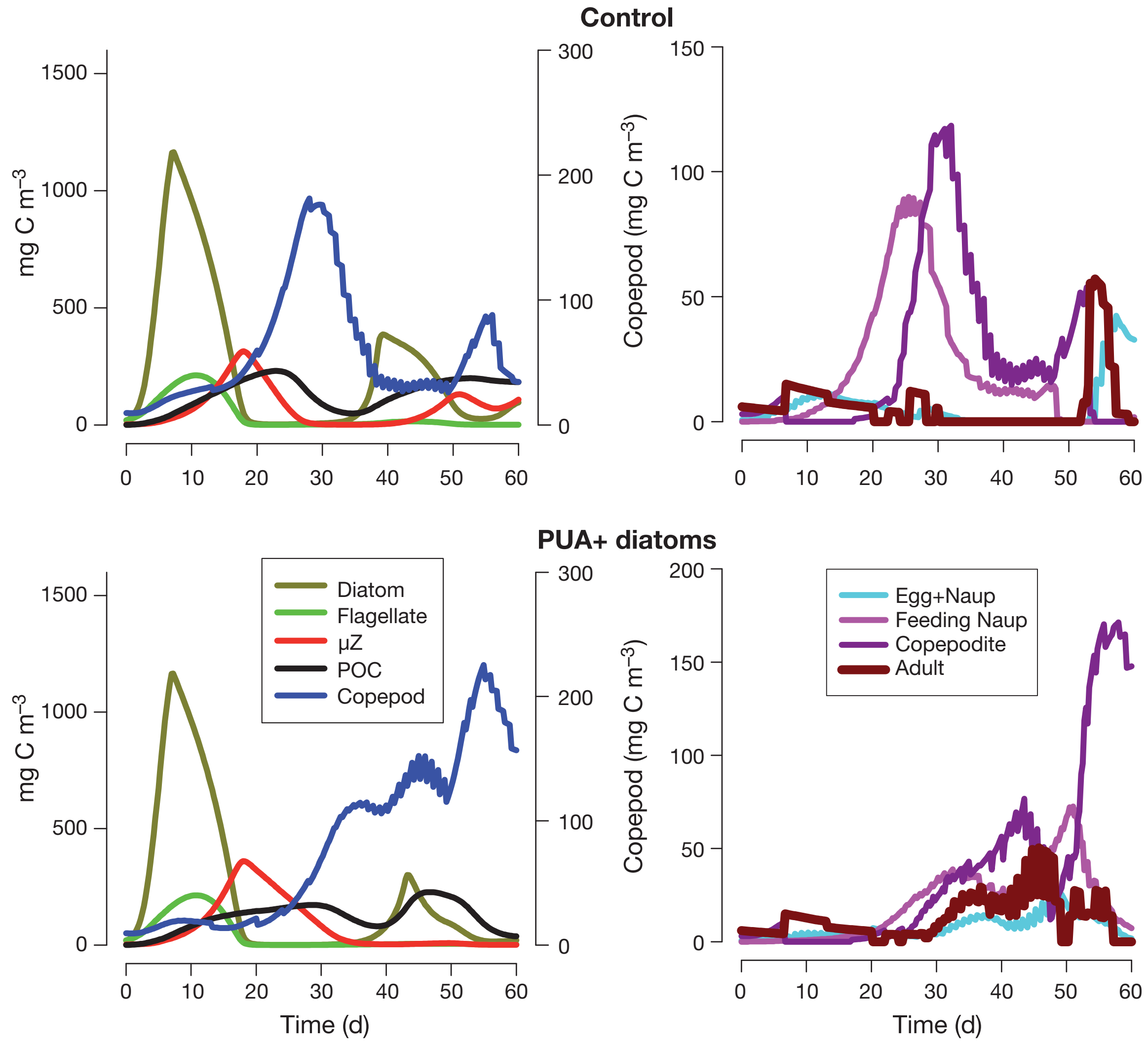

Fig. A2g. As Fig. A2a, but with only diatoms present. There is little difference in comparison with Fig. A2a as the diatoms dominate the algal biomass. Being PUA+ is of no benefit to the diatoms

Fig. A3.

These plots show the cumulative difference in diatom and flagellate production (C-fixation) for test scenarios in comparison with the control situation where neither algal group was noxious or toxic. The main paper Fig. 3 gives the Day 60 values for some of these comparisons (those in Fig. A3a); here a more comprehensive comparison is made over the period of each simulation.

Two pairs of plots are given.

(a) Differences within the main scenarios, with different copepod age structures; main simulations shown in Fig. A1.

(b) Differences within the additional scenarios, commencing with a mixed copepod age structure; main simulations shown in Fig. A2.

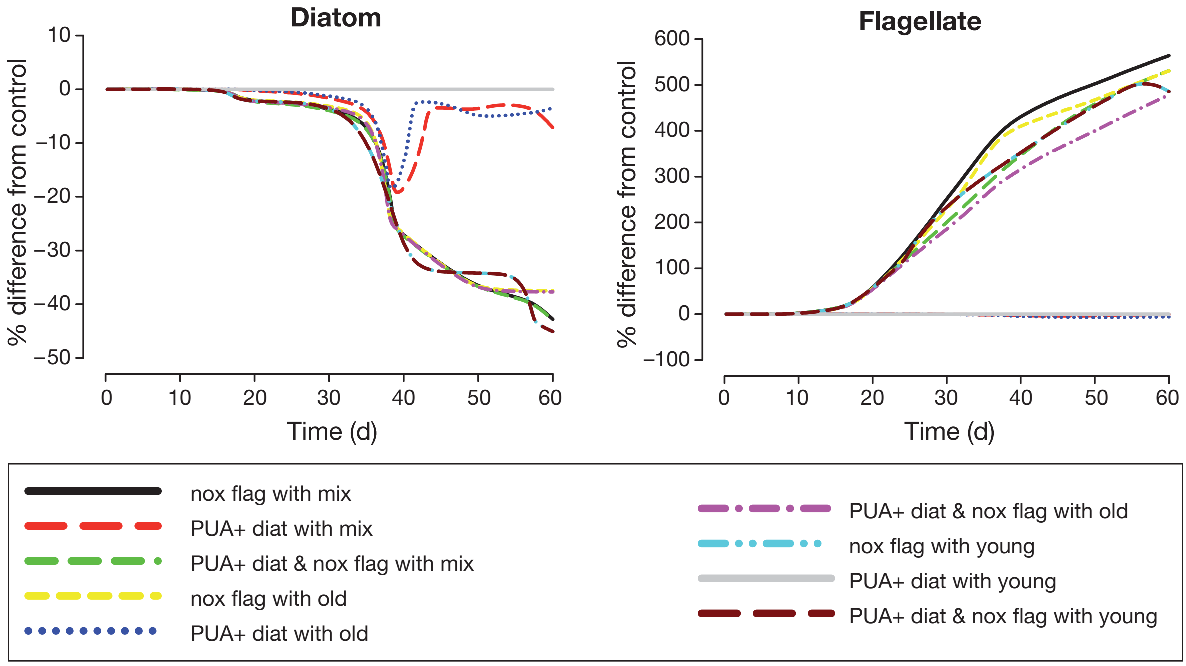

Fig. A3a. Differences between outputs from the main scenarios (Fig. A1), containing initial copepod populations that were either mixed (mix), old or young in composition. The comparison data were from simulations in which the flagellates were non-noxious, and the diatoms were not PUA+. In all instances being PUA+ was disadvantageous to the diatoms (negative differences). In contrast, becoming noxious during nutrient stress was clearly advantageous to the flagellates (large positive differences for noxious flagellate configurations)

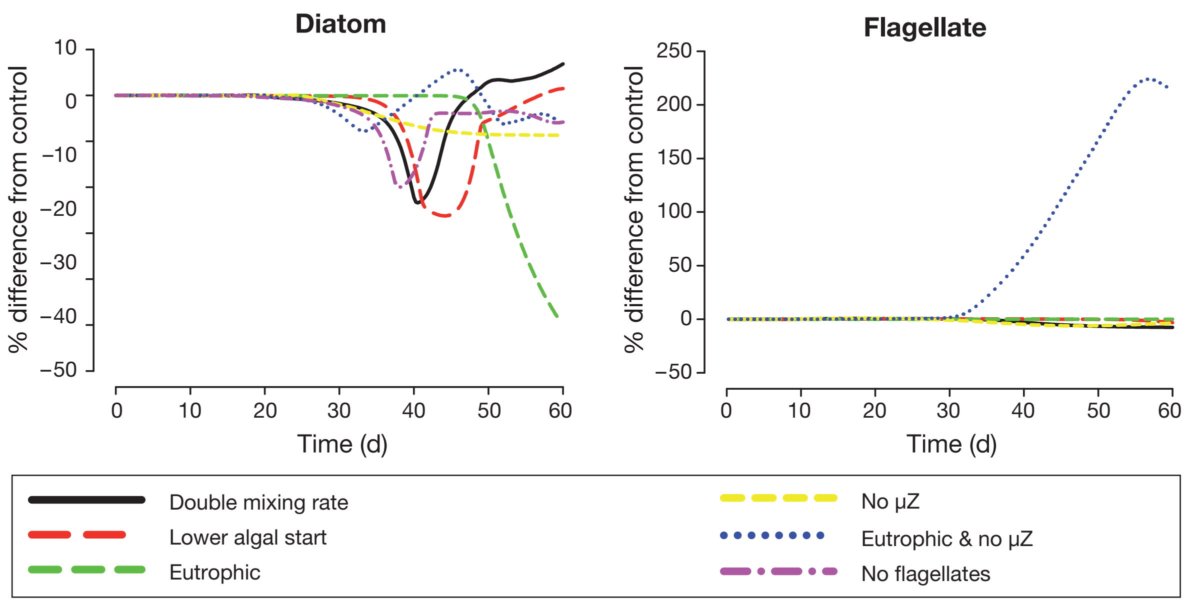

Fig. A3b. Differences between outputs from the additional scenarios (Fig. A2), containing initial copepod populations that were mixed in composition. The comparison data were from simulations in which the flagellates were non-noxious, and the diatoms were not PUA+. The different scenarios were a doubling in mixing rate (cf. Fig. A2b), a lower algal biomass start (cf. Fig. A2c), eutrophic conditions (cf. Fig. A2d), no microzooplankton (μZ; cf. Fig. A2e), eutrophic & no μZ (cf. Fig. A2f), and no flagellates (cf. Fig. A2g). In most instances being PUA+ was disadvantageous to the diatoms (negative differences); positive differences, where they occurred, were small. In the eutrophic & no μZ scenario, the presence of PUA+ diatoms was more advantageous to the flagellates than to the diatoms