

Supporting Information

Woodson and Litvin 10.1073/pnas.1417143112

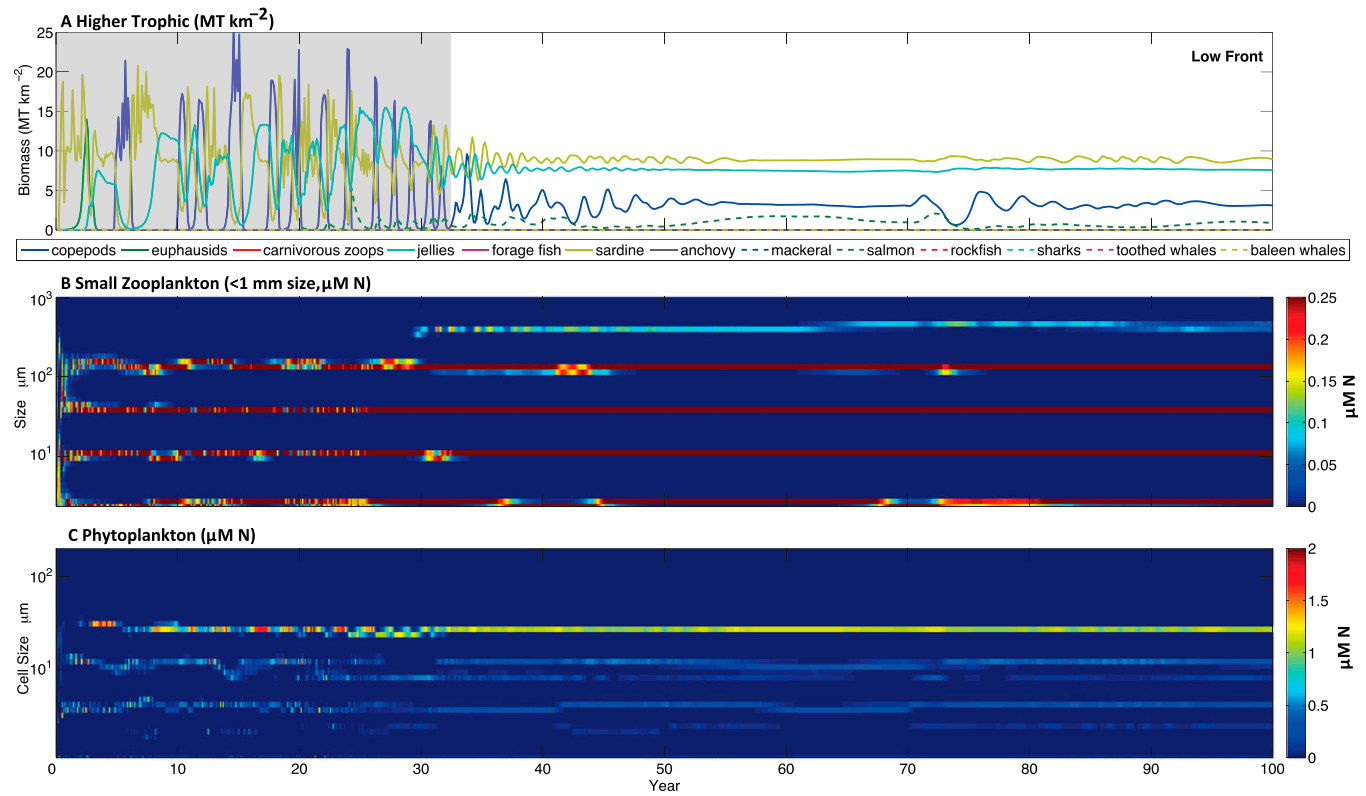


Fig. S1. Time series of abundance for all species classes for the no front model run. Convergence, $\Delta U/\Delta x = 0 \text{ s}^{-1}$, and nutrient supply was $1 \mu\text{M N-d}^{-1}$. (A) Higher trophic-level abundance in metric tons per square kilometer. (B) Microzooplankton abundance in micromolar N. (C) Phytoplankton abundance in micromolar N.

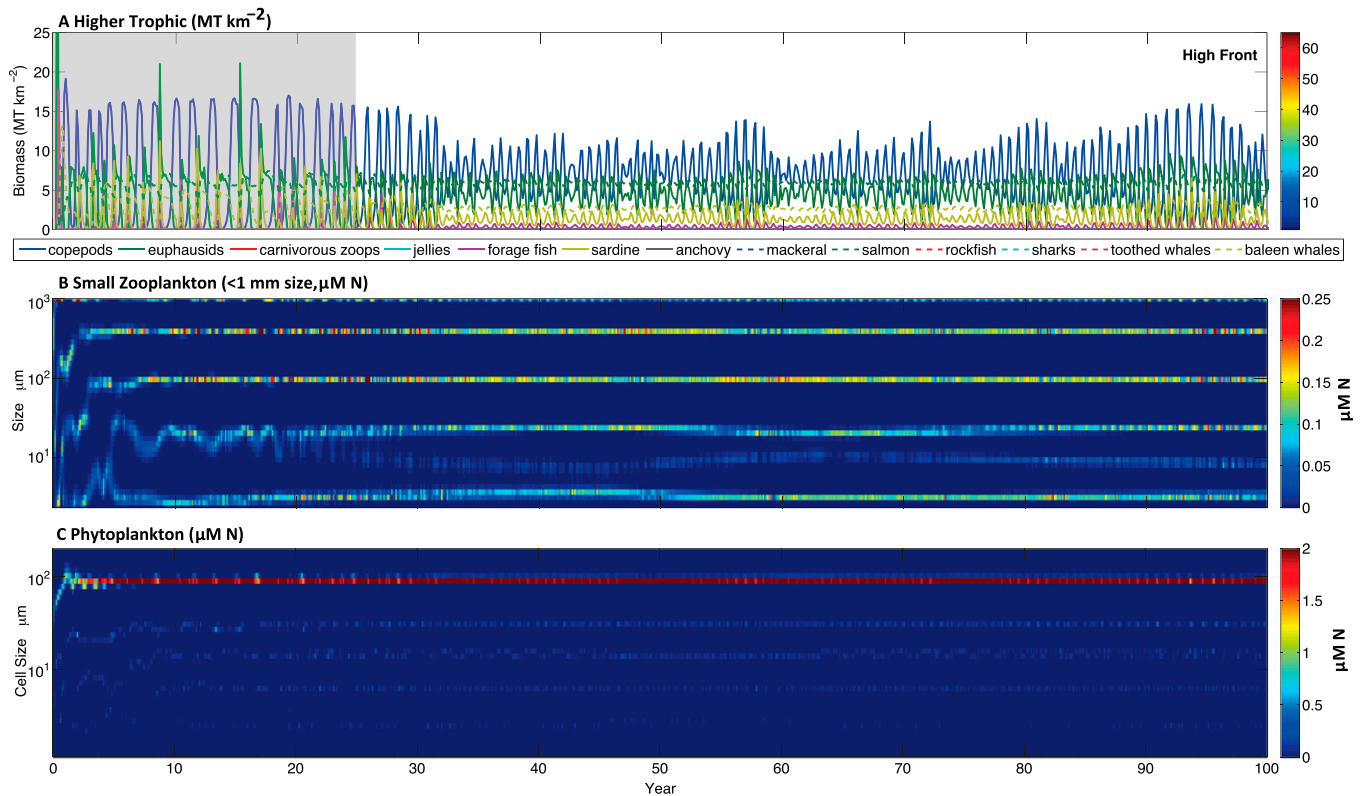


Fig. S2. Time series of abundance for all species classes for the front model run. Convergence, $\Delta U/\Delta x = 0.05 \text{ s}^{-1}$, and nutrient supply was $1 \text{ } \mu\text{M N}\cdot\text{d}^{-1}$. (A) Higher trophic-level abundance in metric tons per square kilometer. (B) Microzooplankton abundance in micromolar N. (C) Phytoplankton abundance in micromolar N.

Table S1. List of terms, definitions, and units

Term	Definition	Units
N	Total amount of nitrate	$\mu\text{M N}$
S	Nutrient flux	$\mu\text{M N}\cdot\text{d}^{-1}$
$\Delta U/\Delta X$	Convergence rate	s^{-1}
Δx	Grid cell size	m
du	Velocity change across grid cell in cross-frontal direction	$\text{m}\cdot\text{s}^{-1}$
$w_{A,B}$	Swimming speed of prey (A) or predator (B)	$\text{m}\cdot\text{s}^{-1}$
$r_{P,Z,H}$	Fraction of nutrient reincorporation for each class	—
P_i	Biomass in terms of N of phytoplankton size class i	$\mu\text{M N}$
μ_P^i	Growth rate of class P_i	d^{-1}
K_S^i	Half saturation rate of P_i	$\mu\text{M N}$
m_P^i	Mortality rate of P_i	—
w_P^i	Mean swim speed of P_i	$\text{m}\cdot\text{s}^{-1}$
Z_j	Biomass in terms of N of zooplankton size class j	$\mu\text{M N}$
ε	Zooplankton growth efficiency	—
f_{eg}	Zooplankton fraction of grazing egested	—
μ_Z^j	Growth rate of class Z_j	d^{-1}
Φ_{ij}	Grazing preference of Z_j on P_i	—
K_S^j	Half saturation rate of Z_j	$\mu\text{M N}$
m_Z^j	Mortality rate of Z_j	—
w_Z^j	Mean swim speed of Z_j	$\text{m}\cdot\text{s}^{-1}$
H_k	Biomass in terms of N of higher trophic class k	$\mu\text{M N}$
μ_H^k	Growth rate of class H_k	d^{-1}
Φ_{jk}	Grazing preference of H_k on Z_j	—
Φ_{kk}	Grazing preference of H_k on H_k	—
K_S^k	Half saturation rate of P_i	$\mu\text{M N}$
m_H^k	Mortality rate of H_k	d^{-1}
w_H^k	Mean swim speed of H_k	$\text{m}\cdot\text{s}^{-1}$

Table S2. Prey preference matrix for higher trophic-level classes

Prey/predator class	Carnivorous zooplankton				Forage fishes				Sharks	Toothed whales	Baleen whales	
	Copepods	Euphausiids	Carnivorous zooplankton	Jellies	Sardines	Anchovies	Mackerel	Salmon				Rockfishes
Phytoplankton	0.80	0.90	0.05	0.05	0.50	0.30						
Microzooplankton	0.20	0.05	0.50	0.20	0.40	0.40						
Copepods		0.05	0.15	0.25	0.45	0.10	0.05	0.10	0.10	0.10		0.05
Euphausiids			0.25	0.15	0.40	0.10	0.30	0.30	0.30	0.40		0.65
Carnivorous zooplankton			0.05	0.35	0.05		0.15	0.20	0.20	0.20		0.30
Jellies												
Forage fishes												
Sardines							0.20	0.30	0.20	0.30	0.30	0.40
Anchovies								0.20	0.20	0.01	0.01	
Mackerel								0.10	0.10	0.01	0.28	0.20
Salmon									0.10	0.20	0.20	0.20
Rockfishes										0.20	0.20	0.20
Sharks												
Toothed whales												
Baleen whales												