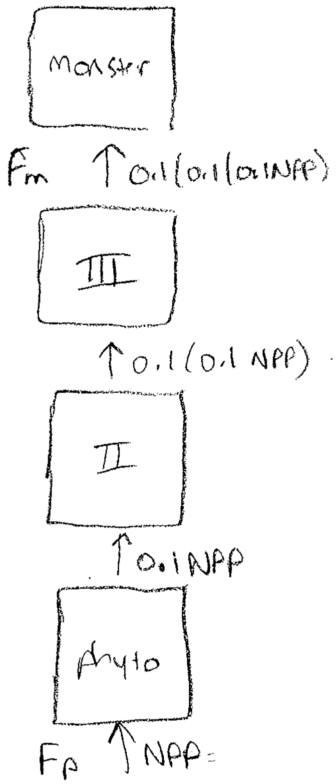

IN LAB

monster: trophic level 4
monster is fish
mass = elephant = 4000 kg

Assumptions

1. Steady State
2. Today: Two trophic levels btwn monster & phyto
3. mass ~ elephant

Input to monsters = $F_m = 0.1 \cdot 0.1 \cdot 0.1 \cdot NPP = 0.001\,NPP = \boxed{0.001 F_p}$

NPP use TP: 10 mg/m³, 5 mg/m³

$$\log_{10} NPP = 0.83(\log_{10}[TP]) + 0.56$$

@ 10 mg/m³:

$\log_{10} NPP = 0.83(\log_{10}[10\,mg/m^3]) + 0.56$

$\log_{10} NPP = 0.83 \cdot 1\,mg/m^3 + 0.56$

$\log_{10} NPP = 1.39\,mg/m^3$

$10^{1.39} = NPP$

$\boxed{NPP = 24.5\,gC/m^2/yr}$

@ 5 mg/m³:

$\log_{10} NPP = 0.83(\log_{10}[5\,mg/m^3]) + 0.56$

$\log_{10} NPP = 0.83 \cdot 0.699\,mg/m^3 + 0.56$

$\log_{10} NPP = 1.14$

$10^{1.14} = NPP$

$\boxed{NPP = 13.8\,gC/m^2/yr}$

Empirical Relationship: units do not match

NEW

@ TP: 10 mg/m3

$F_m = 0.001 F_p = 0.001 NPP = 0.001(24.5 gC/m^2/yr) = 0.0245 gC/m^2/yr$

@ TP: 5 mg/m3

$F_m = 0.001 F_p = 0.001 NPP = 0.001(13.8 gC/m^2/yr) = 0.0138 gC/m^2/yr$

Turnover Time

For Fish: $T = 133(W^{0.28})$ units: Time: days, Weight: g

$W_m = 4000 kg = 4{,}000{,}000 g$

$T = 133(4{,}000{,}000 g^{0.28}) = 9385 days = 25.7 yrs$

S_m

$T_m = \frac{S_m}{F_m}$ $S_m = T_m \cdot F_m$

@ 10 mg/m3: $S_m = 25.7 yr \cdot 0.0245 gC/m^2/yr = 0.630 gC/m^2$

@ 5 mg/m3: $S_m = 25.7 yr \cdot 0.0138 gC/m^2/yr = 0.355 gC/m^2$

Areal Biomass → S_m: ~Total (areal) biomass that can be supported in lake

Need to split into individuals

$W = 4{,}000{,}000 g$ → Convert to C units (5% C by mass)

Monster individual biomass = $4{,}000{,}000 g \cdot 0.05 = 200{,}000 gC$

Surface area = $57 km^2 = 57 km^2 \cdot \frac{1000 m}{1 km} \cdot \frac{1000 m}{1 km} = 57{,}000{,}000 m^2$

NEW

Number of individuals:

@ 10 mg/m³: $S_m = 0.630 gC/m^2$

Total biomass that can be supported $= S_m \cdot$ Surface Area

$= 0.630 gC/m^2 \cdot 5.7 \times 10^7 m^2$

$= 3.59 \times 10^7 gC$

individuals $= \frac{3.59 \times 10^7 gC}{200{,}000 gC}$ = 180 monsters

per individual weight → 200,000 gC

@ 5 mg/m³: $S_m = 0.355 gC/m^2$

Total biomass that can be supported $= S_m \cdot$ Surface Area

$= 0.355 gC/m^2 \cdot 5.7 \times 10^7 m^2$

$= 2.02 \times 10^7 gC$

individuals $= \frac{2.02 \times 10^7 gC}{200{,}000 gC}$ = 101 monsters

NEW