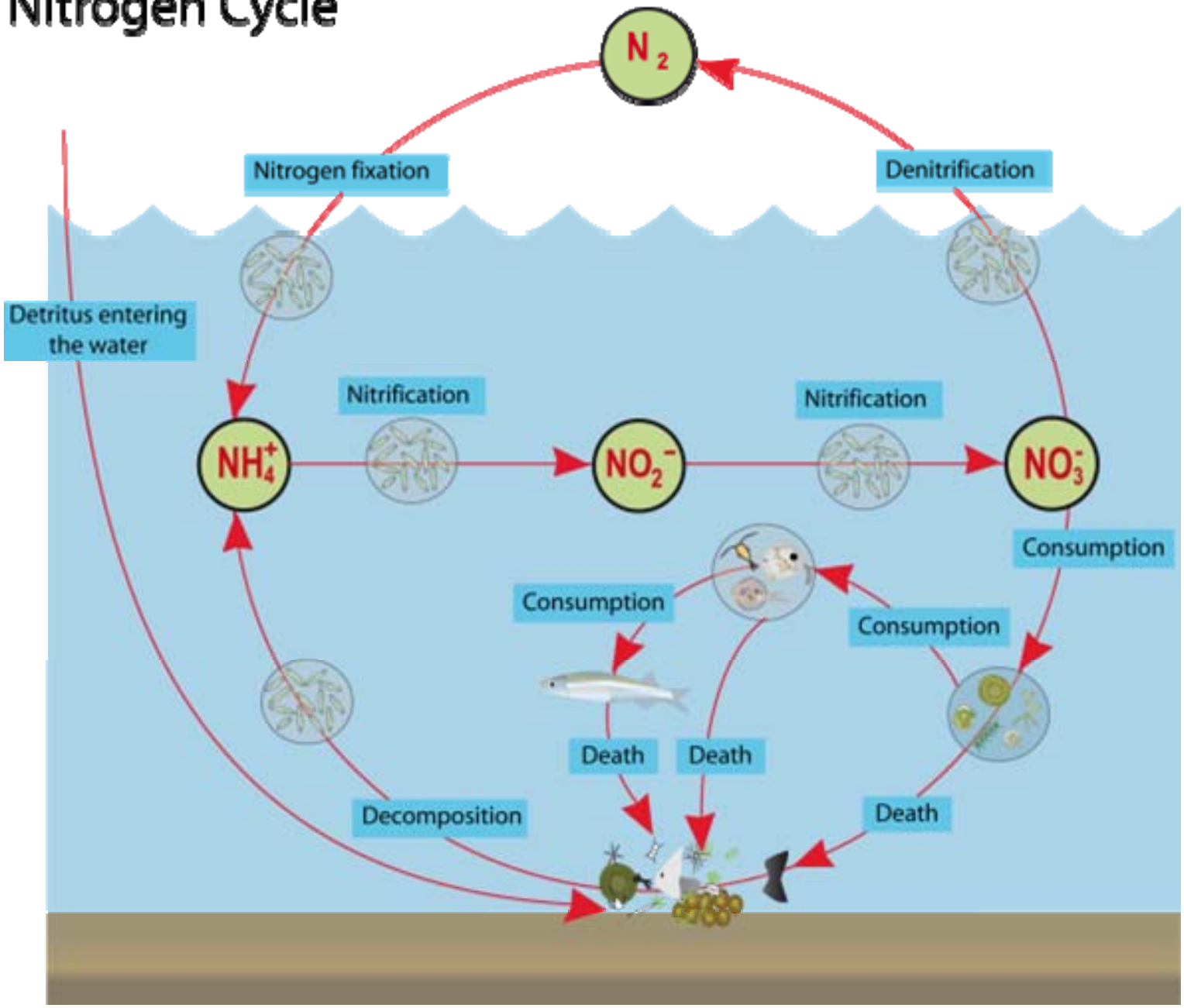
Nitrogen cycle in the oceans

Arvind Singh
GEOMAR
Helmholtz Centre for Ocean Research Kiel
Düsternbrooker Weg 20
24105 Kiel, Germany
Email: asingh@geomar.de

Why do we care about Nitrogen?

Nitrogen is critical in the building blocks of proteins, and therefore essential to all life. Although nitrogen is 78% in our atmosphere but this form (N_2) is unavailable to most living organisms because of triple bond (N≡N) strength of N_2. Nitrogen's conversion processes in the ocean is known as nitrogen cycle.

Nitrogen Cycle



Marine Dinitrogen (N_2) fixation

To be biologically useful, nitrogen must be converted to a reduced, or "fixed," state. N_2 fixation is major process through which ocean receives nitrogen in reduced form.

***Trichodesmium*: N_2 fixer**

***Trichodesmium* bloom in ocean**

Denitrification

is a multi-step process in the deeper ocean through which ocean loses “fixed” nitrogen

$$NO_3^- \rightarrow NO_2^- \rightarrow NO \rightarrow N_2O \rightarrow N_2$$

This process is more important because it also produces N_2O, which is a green house gas and responsible for global warming.

Nitrification

Oxidation of NH_3 or NH_4^+ to nitrate or nitrite by an organism, as means of producing energy.

$$NH_4^+ + 3/2O_2 \rightarrow NO_2^- + H_2O + 2H^+$$

$$NO_2^- + 1/2O_2 \rightarrow NO_3^-$$

Other important N cycle processes include

- ***Ammonium assimilation***
- ***Assimilatory nitrate reduction***
- ***Ammonification (Mineralization)***
- ***Annammox***
- ***Dissimilatory nitrate reduction to ammonium (DNRA)***

Doing ocean research is more fun because you can see the places which you can dream otherwise!