CONTEXT

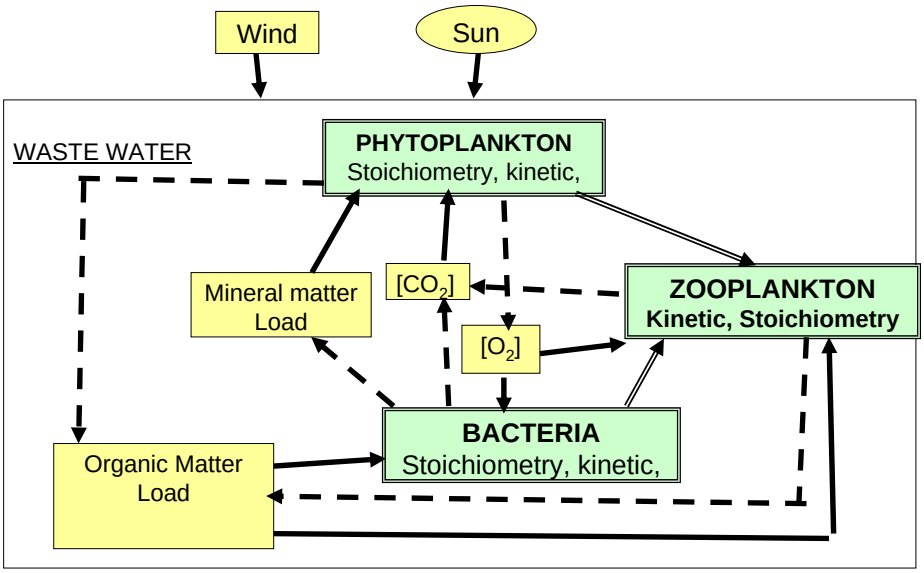
« … in sub-Saharian Africa and Southern Asia, less than 50% of population has an access to a sanitation…» *(UNICEF and WHO,* 2004)

« ... more than 50% of beds in hospitals are occupied by patients affected by unhealthy water and a defective sanitation **»** *(UN-Water, 2005)*

Causes ?

Growing interest for combination of zooplankton's production and waste water treatment

OBJECTIVES : Seek available data for **modelling**



Outline

Various types of Wastewater Stabilisation Ponds (WSP)

Zooplanktons of WSP

Available data

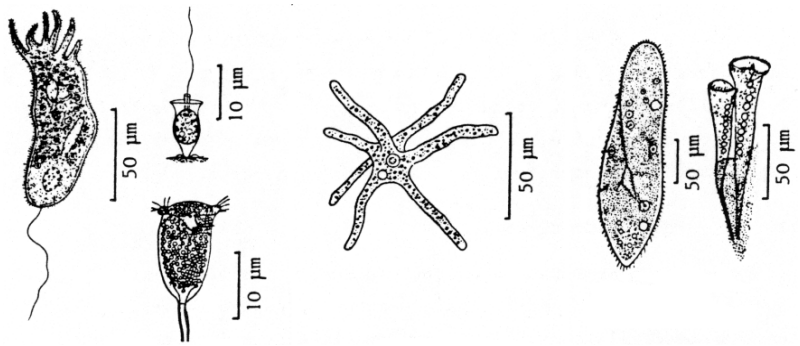
Conclusion and Prospects

WSP types

CHARACTERISTICS	TYPE OF WASTE STABILIZATION			
	Facultative WSP	**Aerated WSP**	**Anaerobic pond**	**High-rate algal pond**
Biological component	**algae** bacteria, zooplankton	Aerobic bacteria Few **algae**, Zooplankton	Very few or not **algae**, Anaerobic Bacteria	strong **algal** biomass, bacteria, little zooplankton
Airing mode	Photosynthesis Diffusion water-air interface	Mechanical aerators or Blowers	Diffusion with the water-air interface	Aerators (paddle wheel) or Blowers
Mixing mode	Flow Wind	Mechanics	Flow Wind	Paddle wheel
Purification mechanism	Sedimentation, Aerobic, anoxic and anaerobic degradation Predation	Aerobic degradation, Predation	Sedimentation Degradation mainly anaerobic, Predation	Aerobic degradation, Predation

The zooplankton of WSP

PROTOZOA



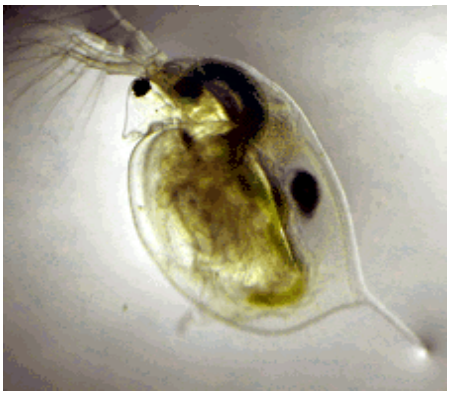
Flagellate Rhizopodes Rhizopodes

The zooplankton of WSP

ROTIFERS

Philodina

CLADOCERS



Daphnia magna

Wastewater ponds' zooplankton

COPEPODS

Copepoda, *Cyclops* sp

Available data

Factors influencing daphnids activity

✓ **food**

BACTERIA → **non exclusive Food**
BACTERIA → **Detoxication**
BACTERIA → **Provision of chemical substances**

Available data

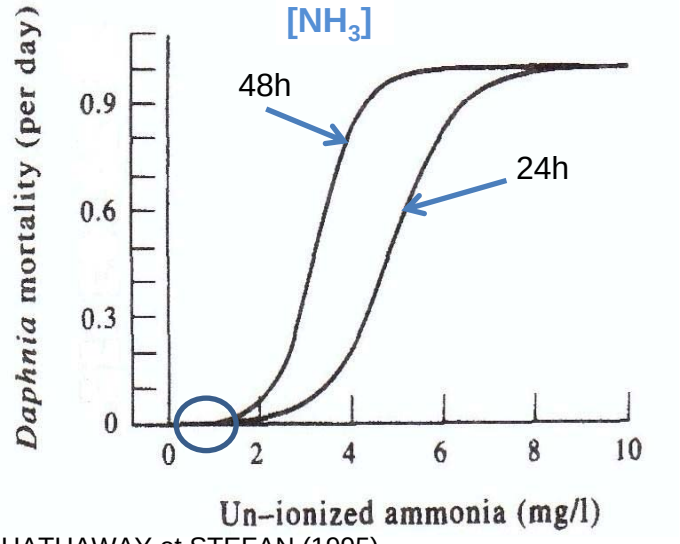
factors influencing daphnids activities

ALGAE → **Food (non gathered)**
ALGAE → **Obstruction of apparatuses filterers (big size)**
ALGAE → Toxic substances release

PARTICULATE ORGANIC MATTERS AND NANOFLAGELLATE ⟷ **~80% food** **(CAUCHIE, 2000)**

Factors influencing daphnids activities

✓ **Environmental physico-chemical conditions**



Source: HATHAWAY et STEFAN (1995)

Factors influencing daphnids activities

✓ **Environmental physico-chemical conditions**

Temperature → **Growth and production kinetics**

$[O_2]$ → **Species selection**

Help for increasing contribution to water treatment and its probable production

Existing models on zooplankton

Comparison criteria		Daphnid population (HATHAWAY and STEFAN, 1995)	R.W.Q.M. n°1 (IWA task group, 2001)
Growth	Ponderal	-	+
	Parthenogenetic	+	+
	Sexual reproduction	+	-
Disappearance	Toxic effect	+	-
	Death	+	+
	Endogenous respiration	+	+
	Predation	+	-
Clearing out of pond		+	-
Sedimentation		+	-
Organic particulate matters		-	+
Algae		+	+
Bacteria		-	+

Order of magnitude concerning ingestion and filtration rate

Species /Condition	Substrate	Ingestion rate (% of Biomass /day)	Ingestion rate (% of production/j)	Filtration rate (en $L.m^{-2}.day^{-1}$)
Daphnia magnal aerated WSP	Phytoplankton	66 to 92 (including 171 in)	2 to 90 (including 310 in July)	2233.3 to 3137.3 (including 5816.5 in July)
	Bacteria	0.1 to 17,6	0,8 to 226	4 to 599,9
Experimental conditions	*E-coli*	134,4 millions/hour	-	-

Data on identified expressions

$$k_{gro,CON,T_0} e^{\beta_{CON}(T-T_0)} \frac{S_{O_2}}{K_{O_2,CON}+S_{O_2}} X_i X_{CON}$$

Diversity of expressions and units

$$1 - \frac{e^{\alpha_{O_2} S_{O_2}}}{\xi_{O_2} + e^{\alpha_{O_2} S_{O_2}}}$$

CONCLUSION AND PERSPECTIVES

- ✓ Orientations given by these Data
- ✓ WSP adapted to Southern countries contexts
- ✓ Zooplankton production in WSP all over the year
- ✓ Two complementary models exist
- ✓ Some data on kinetics of northern species