

An ecosystem model for predicting the effects of micropollutants on aquatic environments

M3 Workshop

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Germany

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Canada Research Chair
in Water Quality Modeling



Modeling endocrine disruption

Mechanism rather than endpoint:

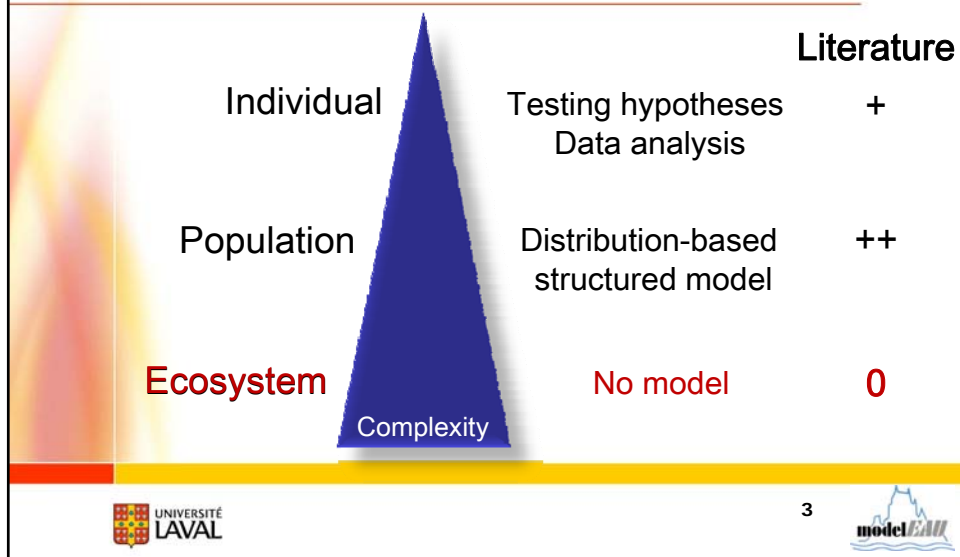
- Intersex fish
- Reproductive disturbances



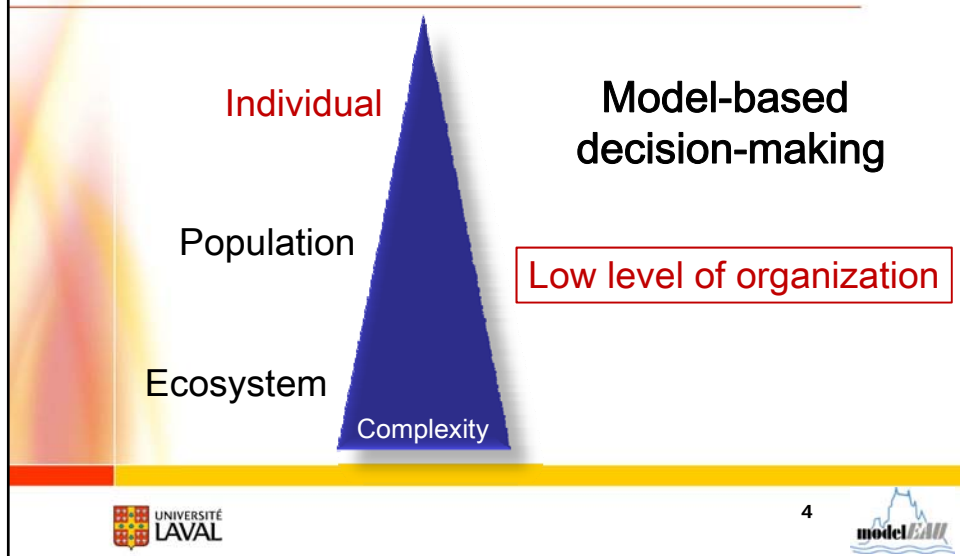
*Joanne Parrott



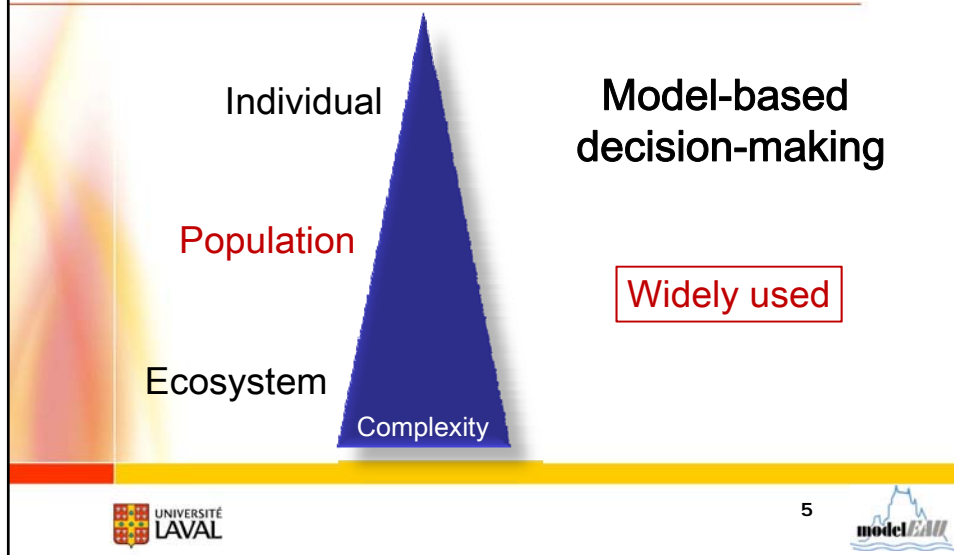
Modeling endocrine disruption



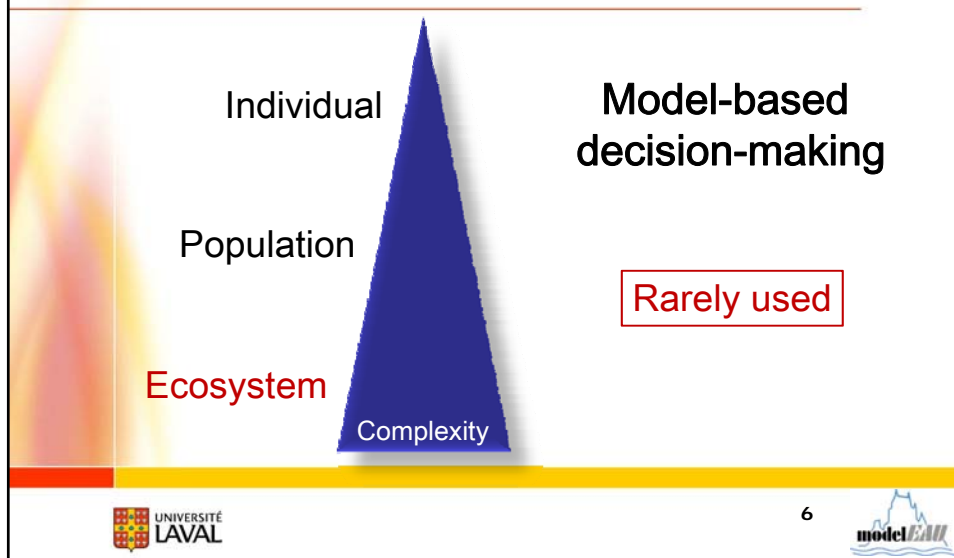
Ecological risk assessment (ERA)



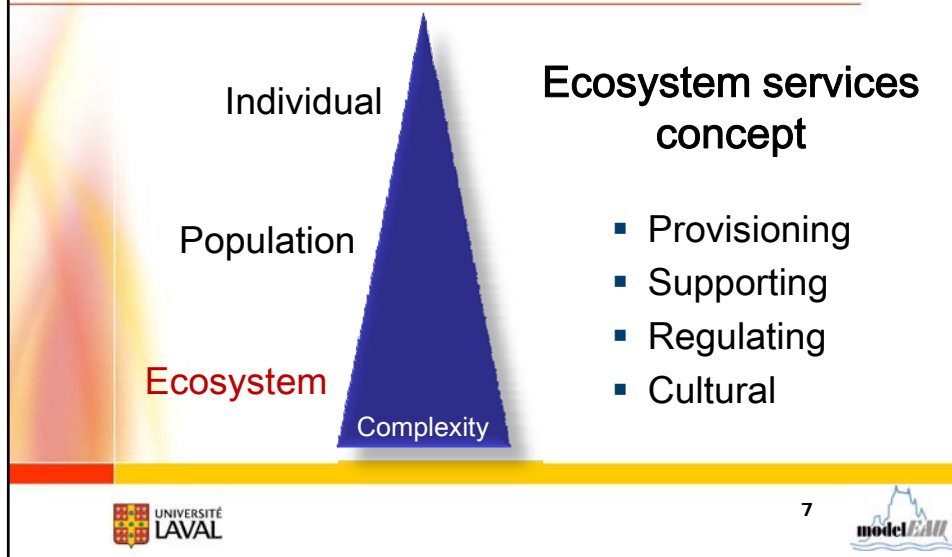
Ecological risk assessment (ERA)



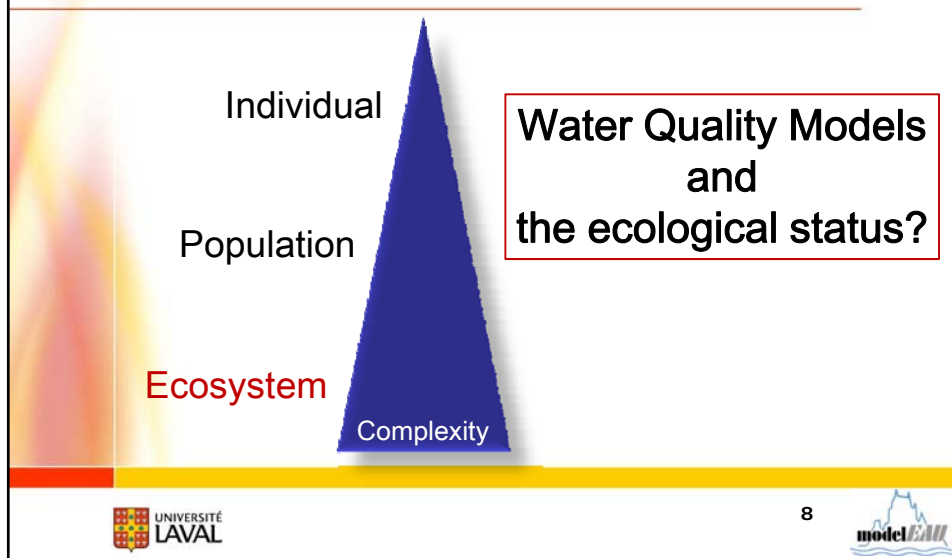
Ecological risk assessment (ERA)



Ecological risk assessment (ERA)



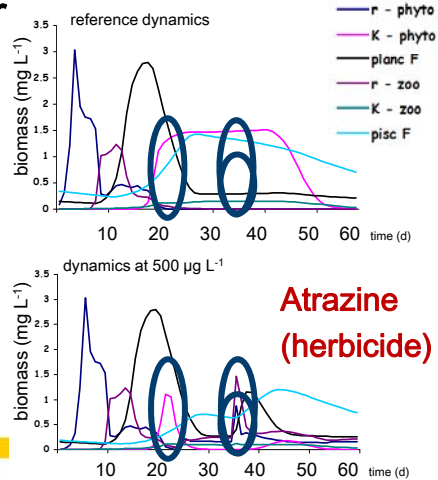
Ecological risk assessment (ERA)



Ecosystem model: Acute toxicity

Frederik De Laender
(PhD thesis, 2007)

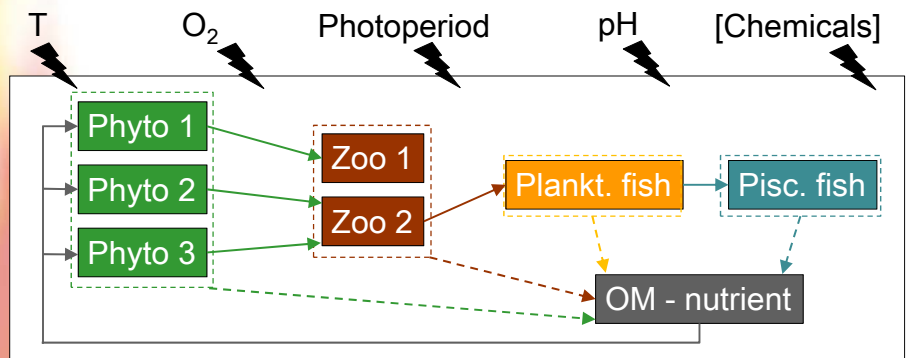
- Disappearance of one phyto
- Appearance of another phyto
- Appearance of one zoo



Ecosystem model: Object-oriented



AQUATOX-WEST



Ecosystem model: F. De Laender

$$\frac{dFish}{dt} =$$

Transformation

- + Consumption
- Defecation
- Respiration
- Excretion
- Mortality
- Predation
- + Recruitment
- Promotion
- Gamete Loss

Transport

- + Loading
- Wash_out
- + Wash_in
- ± Diffusion_{seg}
- ± Migration
- Entrainment
- Fishing

Ecosystem model: F. De Laender

$$\frac{dFish}{dt} =$$

Transformation

- + Consumption
- Defecation
- Respiration
- Excretion
- Mortality
- Predation
- ~~+ Recruitment~~
- ~~- Promotion~~
- ~~- Gamete Loss~~

Transport

- ~~+ Loading~~
- ~~- Wash_out~~
- ~~+ Wash_in~~
- ~~± Diffusion_{seg}~~
- ~~± Migration~~
- ~~- Entrainment~~
- ~~- Fishing~~

$$\frac{dBiomass_{animals}}{dt} = Consumption - Defecation - Respiration - Excretion - Mortality - Predation$$

Ecosystem model: L. Clouzot

$\frac{dFish}{dt} =$

**Endocrine
disruptions**

Transformation

- + Consumption
- Defecation
- Respiration
- Excretion
- Mortality
- Predation
- + Recruitment
- Promotion
- Gamete Loss

Transport

- ~~+ Loading~~
- ~~- Wash_out~~
- + Wash_in
- \pm Diffusion_{seg}
- \pm Migration
- ~~- Entrainment~~
- ~~- Fishing~~

$$\frac{dBiomass_{animals}}{dt} = Consumption - Defecation - Respiration - Excretion - Mortality - Predation$$

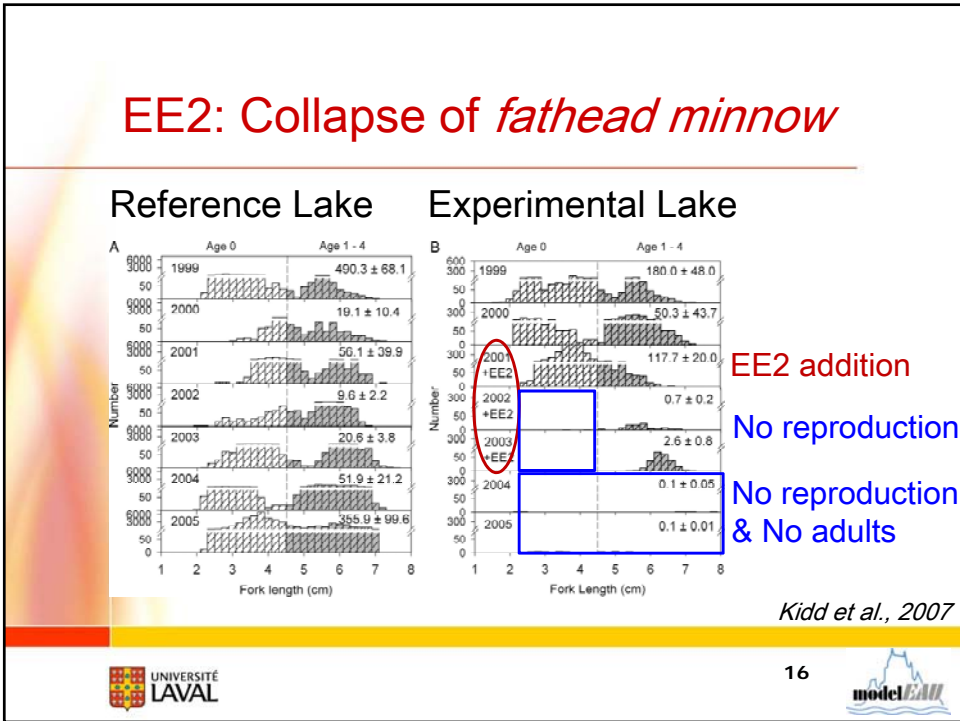
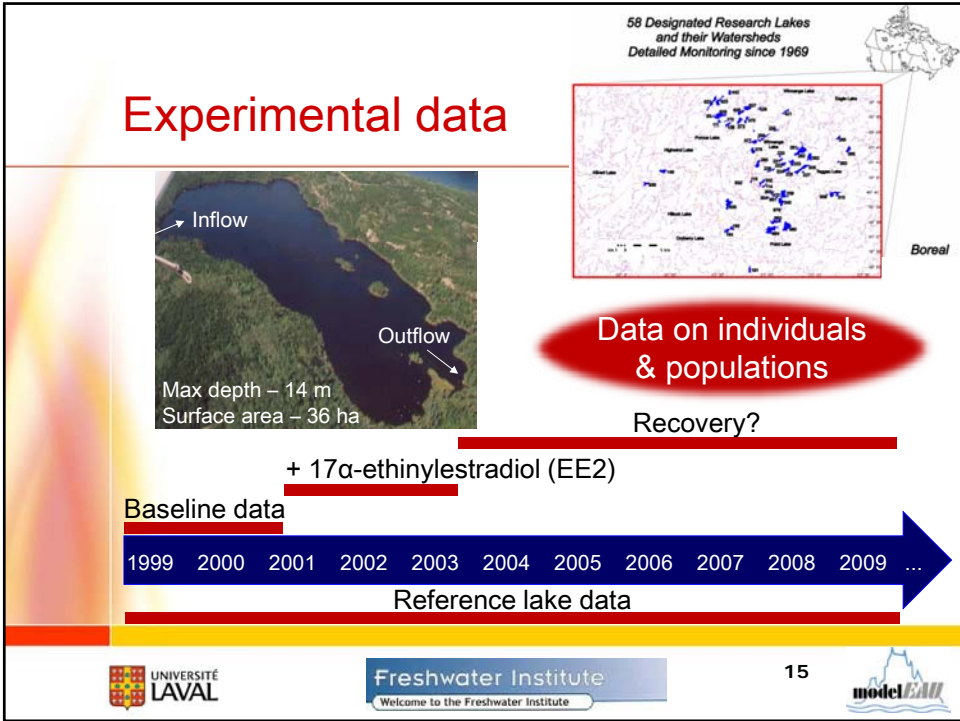
$$+ Recruitment - Promotion - GameteLoss$$

Ecosystem model: L. Clouzot

Fish: Sex-classes

- Juveniles
- Males
- Females

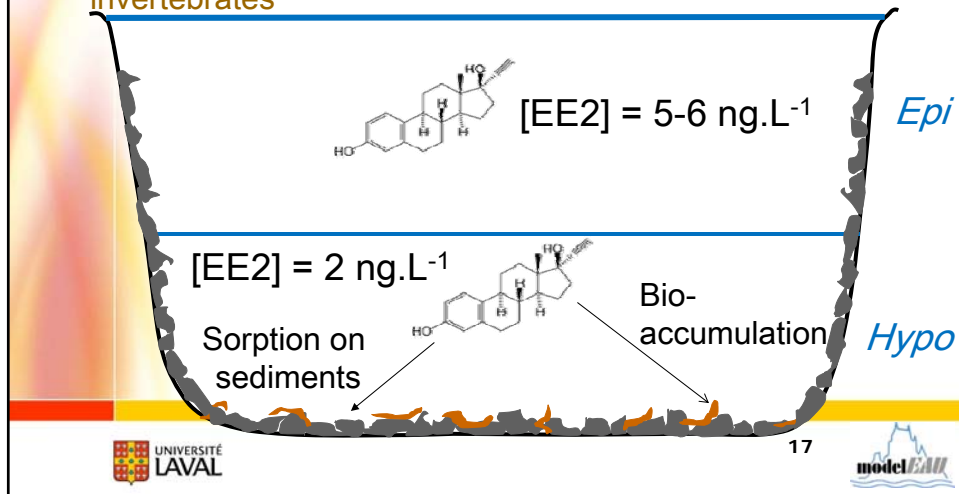




Experimental lake: EE2



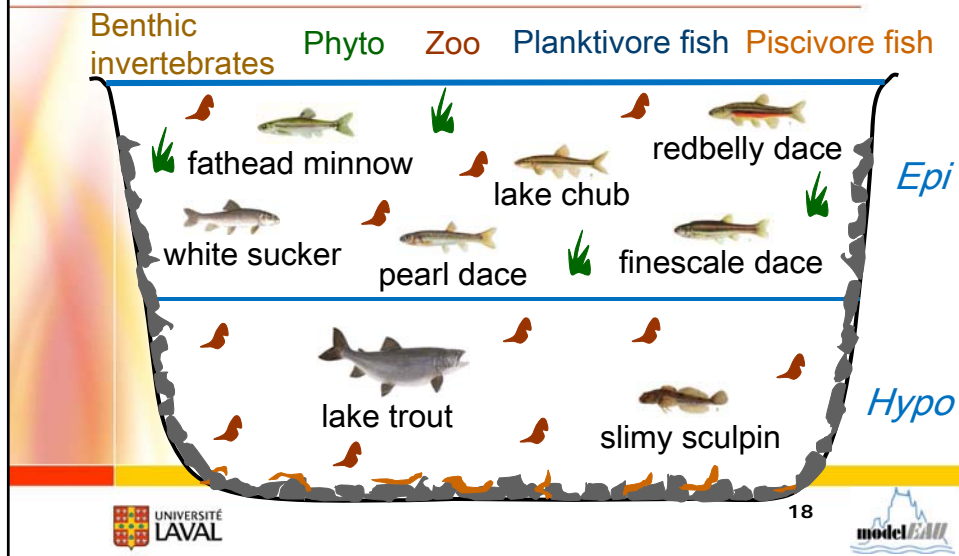
Benthic
invertebrates



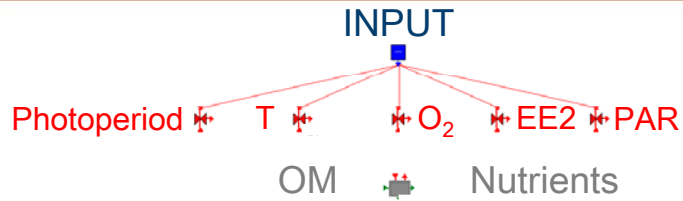
Experimental lake: Biomass



Benthic
invertebrates



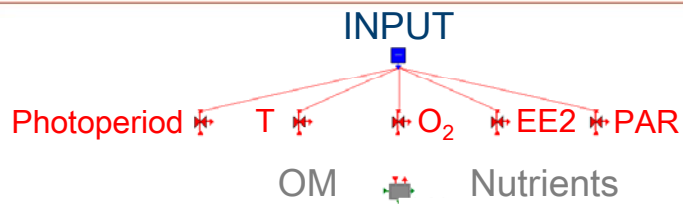
Ecosystem model: WEST



1 icon = 1 model

Sediments † Benthic invertebrates

Ecosystem model: WEST

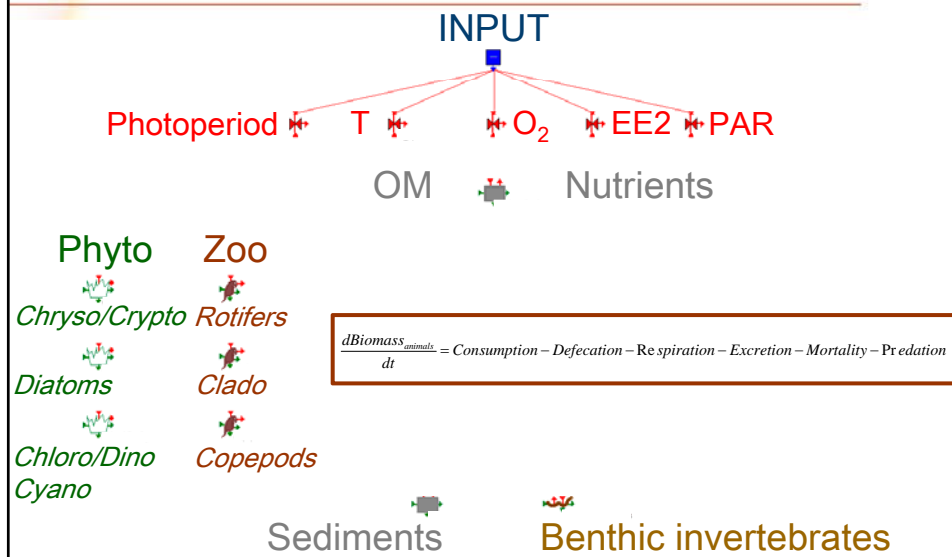


Phyto
 †
Chryso/Crypto
 †
Diatoms
 †
Chloro/Dino
 †
Cyano

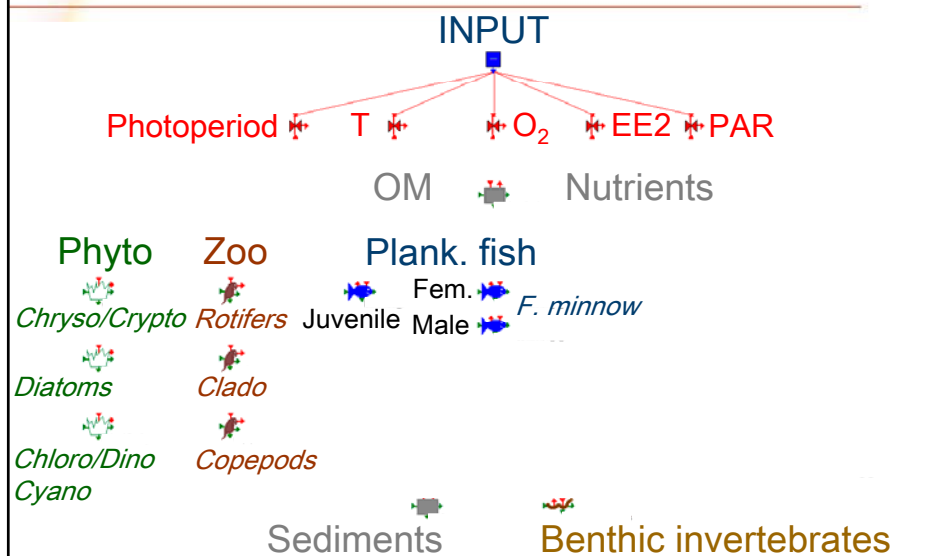
$$\frac{dBiomass_{phyto}}{dt} = Photosynthesis - Respiration - Excretion - Mortality - Consumption_{zo} - Sinking$$

Sediments † Benthic invertebrates

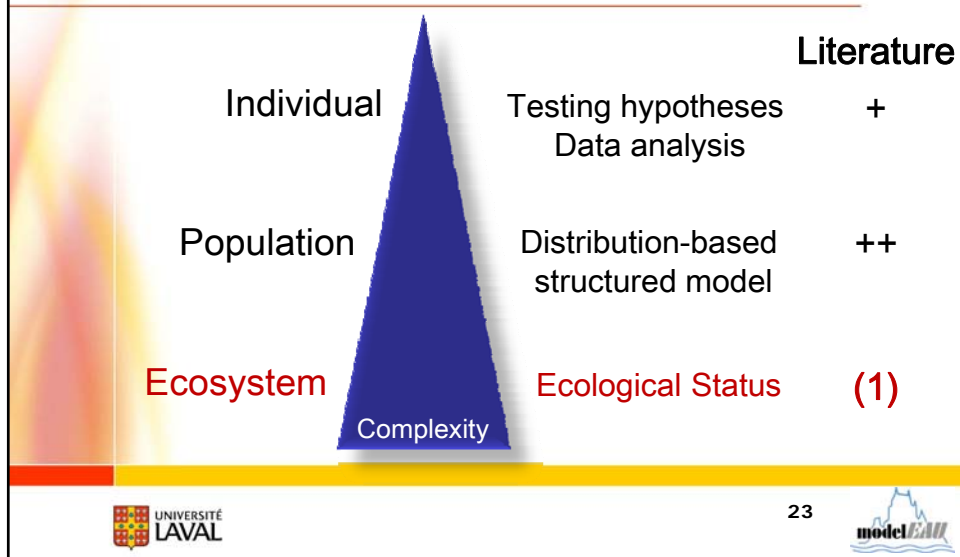
Ecosystem model: WEST



Ecosystem model: WEST



Conclusion



Conclusion

Water Quality Models & Ecological Status:

- Simplified AQUATOX equations in WEST
- Lake dynamics:
 - Data analysis
 - Model development
- Endocrine disruptions:
 - Sex-classes
 - Reproductive factor

Acknowledgement

Freshwater Institute
Welcome to the Freshwater Institute

Karen Kidd
Michael Paterson
Paul Blanchfield
Ken Mills
Michael Rennie
Alain Dupuis



Canada Research Chair
in Water Quality Modeling



Thanks for your attention!

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On-line petitions:

www.saveELA.org