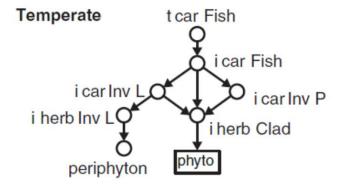


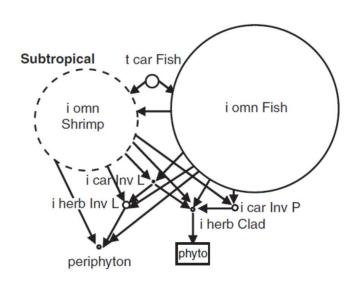




# WET模型 模块化构建原理与应用

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2024年10月14日-16日
江苏 南京





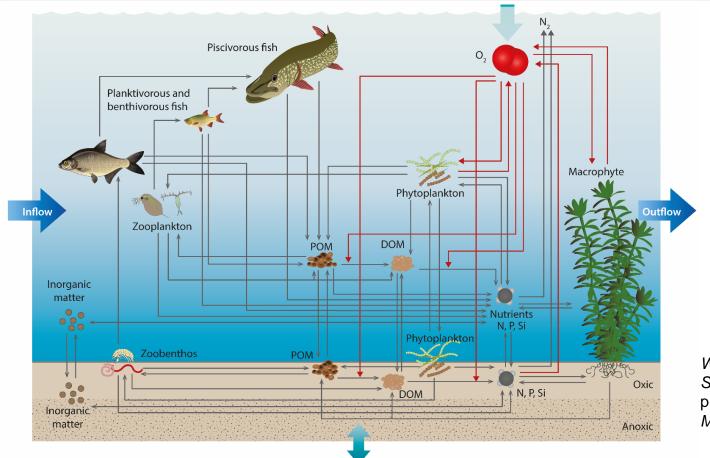
### **Subtropical Temperate** FWL+1 SC<sub>2</sub> SC<sub>1</sub> SC<sub>1</sub> IC<sub>2</sub> **FWL** PC<sub>1</sub> PC<sub>2</sub> PC<sub>1</sub> $R_2$ CR<sub>3</sub> CR<sub>2</sub>

Conceptual model from stable isotope analysis

Iglesias et al (2016) Hydrobiologia

# WET (Water Ecosystems Tool)

The configuration of the conceptual ecosystem model is flexible, but by default it describes interactions between multiple trophic levels, including piscivorous, zooplanktivorous and benthivorous fish, zooplankton, zoobenthos, phytoplankton and rooted macrophytes. The ecosystem model also accounts for oxygen dynamics and a fully closed nutrient cycle for nitrogen and phosphorus.

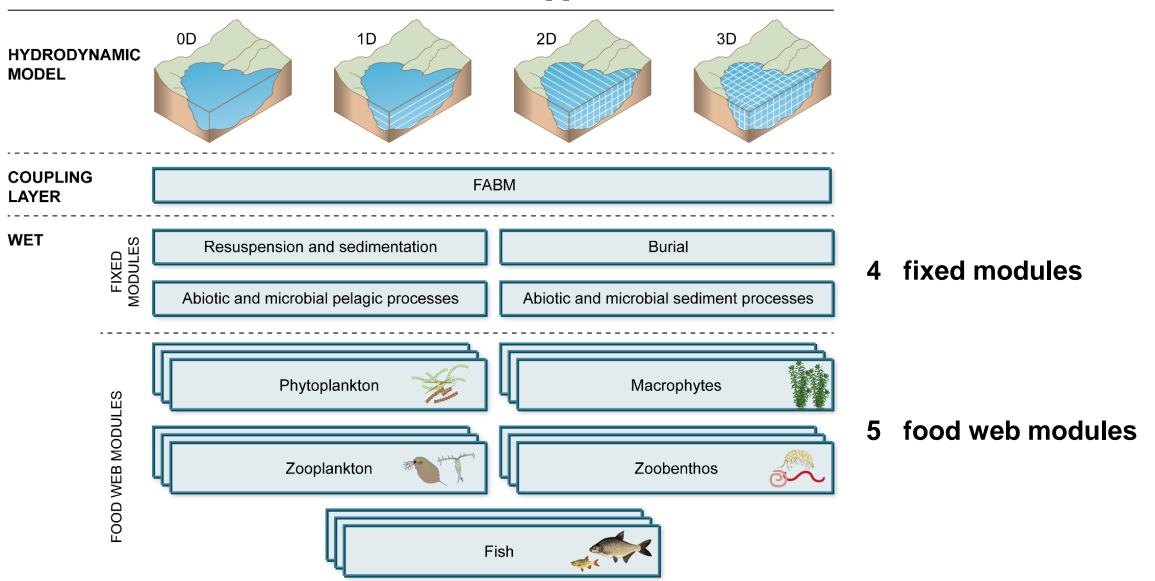


Burial

WET conceptual model from Schnelder-Meyer et al. in prep.

Model developed by AU.

# WET allows for flexible model configuration



# WET food web configurations

Food web modules

Fish

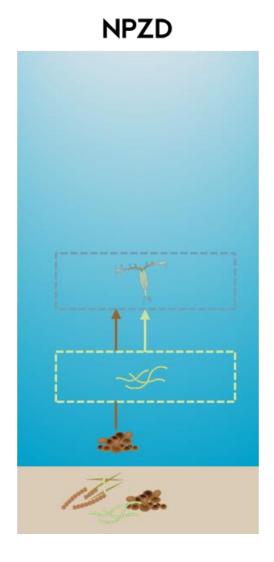
Zooplankton

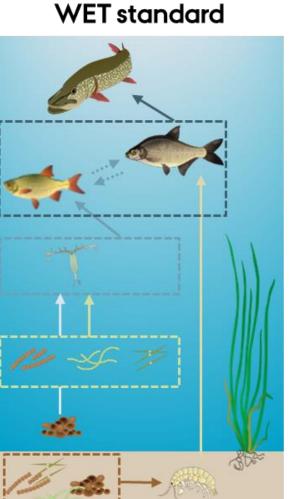
Phytoplankton

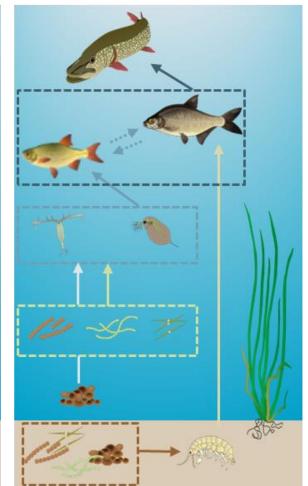
Macrophytes

**Detritus** 

Zoobenthos







WET advanced

## 如何增加一个变量

- 1. First, copy the lines for an existing species in the configuration file and then change the name of the copy instance.
- 2. Secondly, one would go through the **couplings and parameters sections** in the new instance, modifying these to fit the desired organism.
- 3. Finally, one would modify the instances of any predators to include the new instance in their diets.

Thus, adding or subtracting instances to a model setup is relatively easy, and testing for the optimal food web configuration in a specific case is possible, if not usually feasible, by calibrating several different module setups and comparing their performance.

### **Phytoplankton**

```
diatoms:
  long name: diatom phytoplankton
 model: wet/phytoplankton
  parameters:
    cAffNUpt: 0.2
    cAffPUpt: 0.2
    cCPerDW: 0.4
    cChDMax: 0.01152067786579087
    cChDMin: 0.004551645037006276
    cDMinS: le-05
    cDMinW: 0.0001
    cExtSp: 0.25
    cLOptRef: 14.25958425306334
    cMuMax: 2.679774536438407
    cNDMax: 0.04543062298800925
    cNDMin: 0.008669738123303882
    cNFixMax: 0.01
    cPDMax: 0.01003725855292473
    cPDMin: 0.002424574658996565
```

File Edit Search View Encoding Language Settings

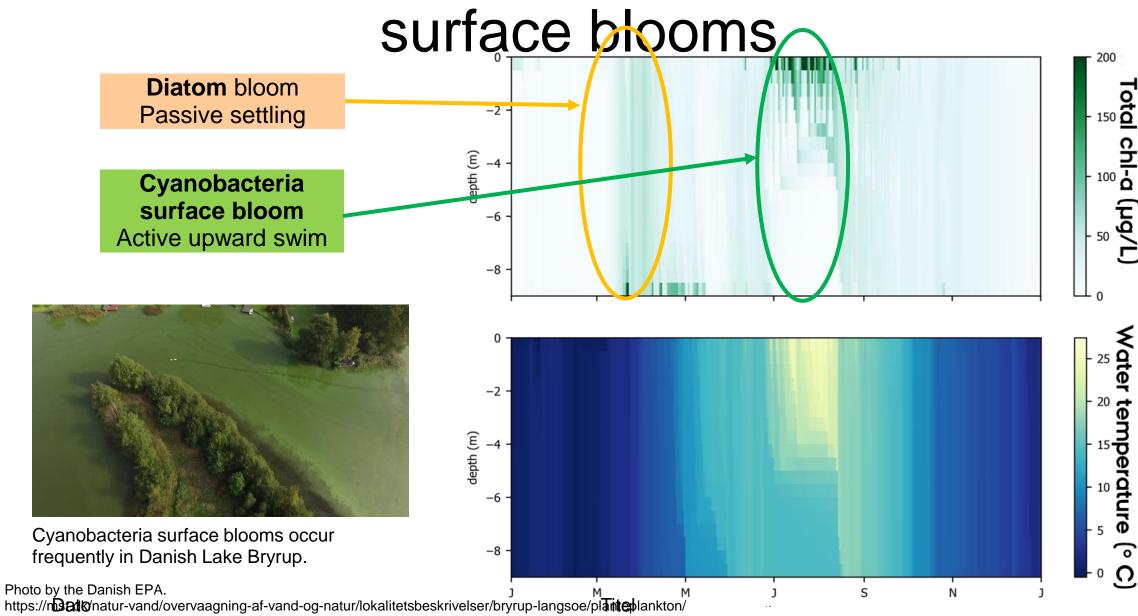
Tools Macro Run Plugins Window ?

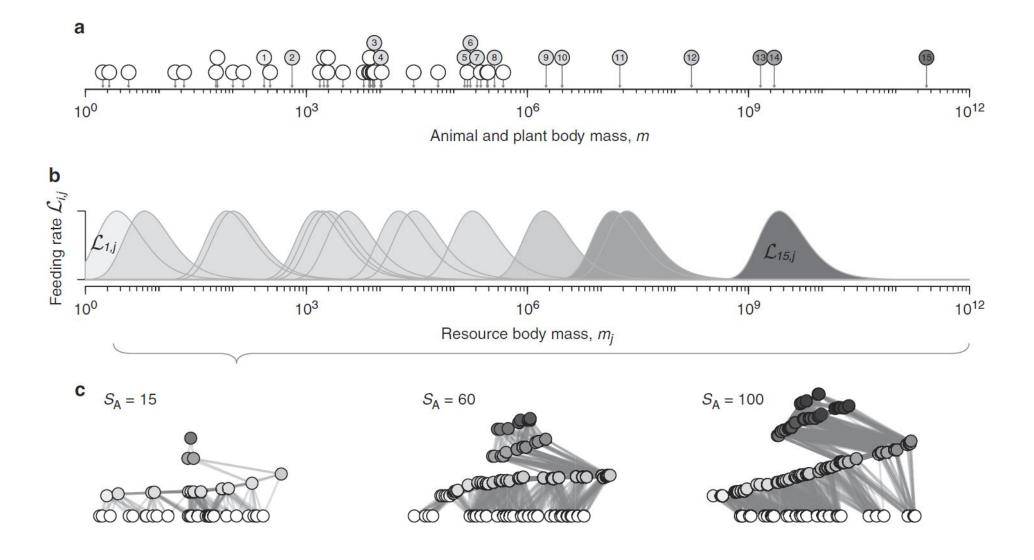
File Edit Search View Encoding Language Settings File Edit Search View Encoding Language Settings X Tools Macro Run Plugins Window ? Tools Macro Run Plugins Window ? 

☐ fabm.yaml 🔀		Fabm.ya	aml 🔀		fa	bm.yar	ml 🔀	
339 🖨 di	iatoms:	418	gr	eens:	497	Ė	cyanobacteria:	
340	long_name: diatom phytoplankton	419		long_name: green phytoplankton	498		long_name: cyanobacteria	
341	model: wet/phytoplankton	420		model: wet/phytoplankton	499		model: wet/phytoplankton	
342	parameters:	421 E		parameters:	500		parameters:	
343	cAffNUpt: 0.2	422		cAffNUpt: 0.2	501		cAffNUpt: 0.2	
344	cAffPUpt: 0.2	423		cAffPUpt: 0.2	502		cAffPUpt: 0.8	
345	cCPerDW: 0.4	424		cCPerDW: 0.4	503		cCPerDW: 0.4	
346	cChDMax: 0.01152067786579087	425		cChDMax: 0.007214584180037665	504		cChDMax: 0.008412088364390585	
347	cChDMin: 0.004551645037006276	426		cChDMin: 0.00905217121045621	508		cChDMin: 0.004912935215492827	
348	cDMinS: le-05	427		cDMinS: le-05	506		cDMinS: le-05	
349	cDMinW: 0.0001	428		cDMinW: 0.0001	507		cDMinW: 0.0001	
350	cExtSp: 0.25	429		cExtSp: 0.25	508		cExtSp: 0.35	
351	cLOptRef: 14.25958425306334	430		cLOptRef: 40.59286016376461	509		cLOptRef: 20.14226790634071	
352	cMuMax: 2.679774536438407	431		cMuMax: 0.8934043168583331	510		cMuMax: 1.195246880034123	
353	cNDMax: 0.04543062298800925	432		cNDMax: 0.09121202838848275	511		cNDMax: 0.07953522779930783	
354	cNDMin: 0.008669738123303882	433		cNDMin: 0.01960693948453999	512		cNDMin: 0.01086677240813844	
355	cNFixMax: 0.01	434		cNFixMax: 0.01	513		cNFixMax: 0.01	
356	cPDMax: 0.01003725855292473	435		cPDMax: 0.02111459115262903	514		cPDMax: 0.004258340591562401	
357	cPDMin: 0.002424574658996565	436		cPDMin: 0.001157806782377292	518		cPDMin: 0.001764581188430707	
358	cResusExp: -0.379	437		cResusExp: -0.379	516		cResusExp: -0.379	
359	cSiD: 0.15	438		cSiD: 0.15	517		cSiD: 0.15	
360	cSigTm: 13.43618677185775	439		cSigTm: 15.34217962225144	518		cSigTm: 8.482930941426433	
361	cTmOpt: 13.48410651314662	440		cTmOpt: 18.84681634009118	519		cTmOpt: 27.62511363911044	
362	cVNUptMax: 0.07	441		cVNUptMax: 0.07	520		cVNUptMax: 0.08	
363	cVPUptMax: 0.02641622157526907	442		cVPUptMax: 0.01424632819466629	521		cVPUptMax: 0.03340891092005887	
364	cVSed: 1.658215988806708	443		cVSed: 0.3255787505599667	522		cVSed: 0.1031467018994392	
365	cVSet: -1.998923444813331	444		cVSet: -0.3187191270333716	523		cVSet: -0.02242893726726897	
	cVSwim: 10	445		cVSwim: 10	524		cVSwim: 0.25	
367	FDOMS: 0.01259771008927171	447		FDOMS: 0.02124417612230302	526		FDOMS: 0.09877847265277258	
369	fDCMW: 0.08530204574289701 fDissMort: 0.2	447		fDOMW: 0.05823760752712179 fDissMort: 0.2	526		fDCMW: 0.07131369323275408 fDissMort: 0.2	
370	fLVMmin: 0.025	449		fLVMmin: 0.025	528		fLVMmin: 0.1295983162307262	
371	fMuNFix: 0.9	450		fMuNFix: 0.9	529		MuNFix: 0.9	
372	fNutLimVMdown: 0.675	451		fNutLimVMdown: 0.675	530		fNutLimVMdown: 0.67	
373	fNutLimVMup: 0.75	452		fNutLimVMup: 0.75	531		fNutLimVMup: 0.75	
374	hLRef: 4.516178770417071	453		hLRef: 25.95380653706244	532		hLRef: 35.59562609331731	
375	hO2BOD: 1.0	454		hO2BOD: 1.0	533		hO2BOD: 1.0	
376	hSiAss: 0.01	455		hSiAss: 0.01	534		hSiAss: 0.09	
377	kDResp: 0.1	456		kDResp: 0.075	535		kDResp: 0.03	
378	kMortS: 0.05	457		kMortS: 0.05	536		kMortS: 0.2	
379	kMortW: 0.01	458		kMortW: 0.01	537		kMortW: 0.01	
380	kResusMax: 0.25	459		kResusMax: 0.25	538		kResusMax: 0.25	
381	lNfix: false	460		lNfix: false	539		lNfix: false	
382	1Si: true	461		1Si: false	540		lSi: false	
383	qLightMethod: 2	462		qLightMethod: 2	541		qLightMethod: 2	
384 -	qTrans: 1	463	-	qTrans: 1	542		qTrans: 3	
385	coupling:	464	1	coupling:	543	Ė	coupling:	
386	DOM_DW_pool_sediment: abiotic_sedimer	465		DOM_DW_pool_sediment: abiotic_sedimer	544		DOM_DW_pool_sediment: abiotic_sedimer	
387	DOM_DW_pool_water: abiotic_water/sDDC	466		DOM_DW_pool_water: abiotic_water/sDDC	545		DOM_DW_pool_water: abiotic_water/sDDC	
388	DOM_N_pool_sediment: abiotic_sediment	467		DOM_N_pool_sediment: abiotic_sediment	546		DOM N pool sediment: abiotic sediment	
389	DOM N pool water: abiotic water/sNDOP	468		DOM N pool water: abiotic water/sNDOP	547		DOM N pool water: abiotic water/sNDON	
<	>	<		>	<		>	
1 220 C-1-1	1 MGs davie (CR LE) LITE 0 INC		C 1 40	MG-d(CD1E) LITE 0 INC		07 6	Cal. 17 Minday (CRIE) LITE 9 INC	

Ln:339 Col:11 Windows (CR LF) UTF-8 INS Ln: 418 Col: 10 Windows (CR LF) UTF-8 D

# WET can simulate cyanobacteria



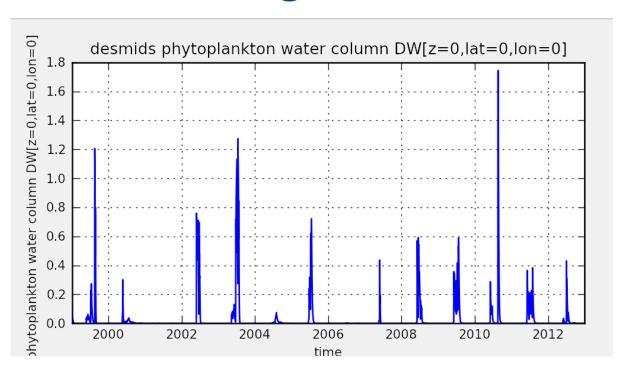


Schneider et al., 2016 Nat Comm.

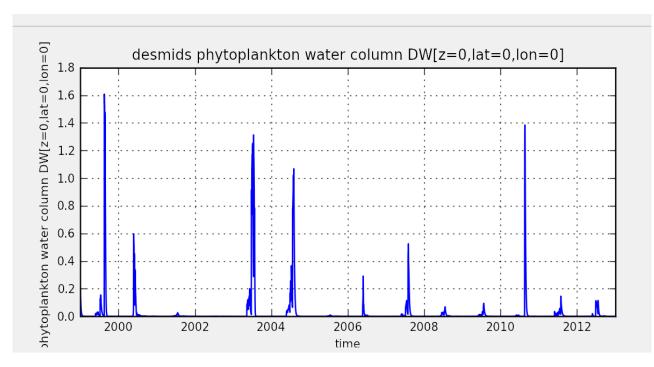
### Desmid (带藻)



### **Original**

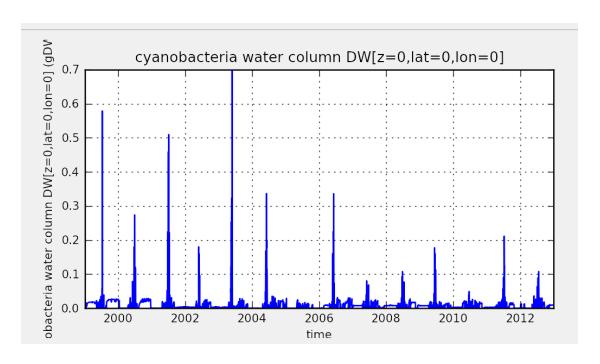


### Add dinoflagellatas

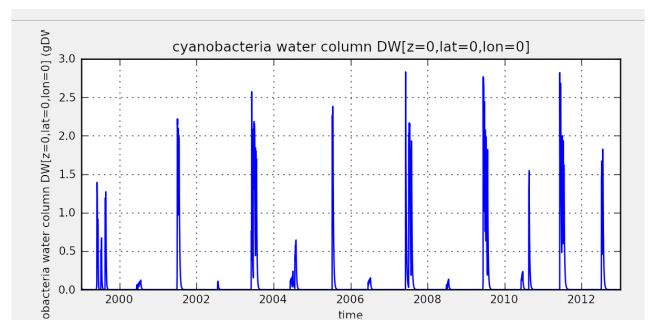




## **Original**



### Fish removal

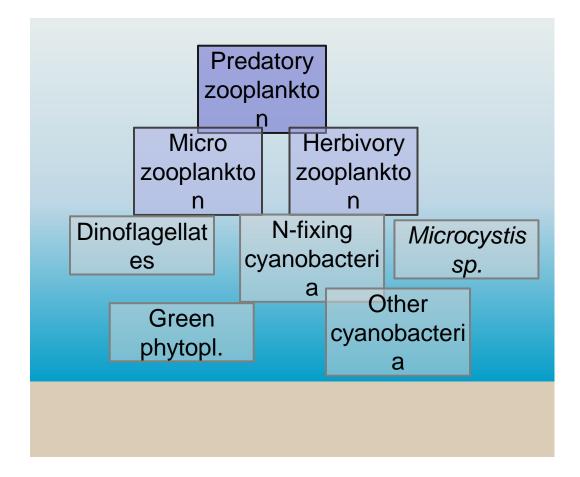


# CSPS framework: a WET example



Regev, Carmel, Gal (2023) Environ. Model. Softw.

Modelling Lake Kinneret (Sea of Galilee), a warm monomictic lake



# GMD paper WET

Geosci. Model Dev., 15, 3861–3878, 2022 https://doi.org/10.5194/gmd-15-3861-2022 © Author(s) 2022. This work is distributed under the Creative Commons Attribution 4.0 License.





# Water Ecosystems Tool (WET) 1.0 – a new generation of flexible aquatic ecosystem model

Nicolas Azaña Schnedler-Meyer<sup>1</sup>, Tobias Kuhlmann Andersen<sup>2,3</sup>, Fenjuan Rose Schmidt Hu<sup>2</sup>, Karsten Bolding<sup>2,3,4</sup>, Anders Nielsen<sup>2,3</sup>, and Dennis Trolle<sup>2,3</sup>