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This document presents an overview of the scripts we used in our publication:   
**Samuel Dijoux, David Boukal. Community structure and collapses in multi-channel food webs: role of consumer body size and mesohabitats productivities. *Authorea.* December 04, 2020** (DOI: [10.22541/au.160709305.53088087/v1](https://doi.org/10.22541/au.160709305.53088087/v1)) (Preprint).

Following the PSPManalysis approach described by A.M. de Roos (https://staff.fnwi.uva.nl/a.m.deroos/PSPManalysis/index.html), we conducted a set of demographic, equilibrium and co-dimension bifurcation analyses applied to tri-trophic chain and multi-channel food webs. Each analysis was conducted using R scripts and *.h* model extensions described as follow:

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| --- | --- | --- |
| **Analyses** | **Outcomes  Figs and SI)** | **Scripts material** |
| Demographic analyses | Fig.2 | Demography.R Tritrophicmod5\_demography.h Tritrophicmod5\_demography2.h Tritrophicmod5\_demography3.h |
| Equilibrium analyses and co-dimension bifurcation analyses for trophic chain | Figs.3A, 4A | EQ\_3sp.R Tritrophicmod5\_fin.h |
| Equilibrium analyses for multi-channel food webs | Figs.4, S6-7 | EQ\_5sp.R EQ\_3sp.R & Tritrophicmod5\_fin.h |
| Co-dimension bifurcation analyses for multi-channel food webs | Figs.3, 5A, S3-5 | Codim\_5sp\_K1Beta.R Codim\_5sp\_K1K2.R Codim\_5sp\_K2Beta.R EQ\_3sp.R & Tritrophicmod5\_fin.h |

***Specification for equilibrium and co-dimension bifurcation analyses conducted for multi-channel food webs***

We first use *EQ\_3sp.R* to compute the successive invasions of consumer *C*i and predator *P* on resource *R*i along productivity gradient *K*i for fixed values of β and *K*j (with i ≠ j and i = 1 or 2). Relative to fixed β and *K*i, we then compute the invasion of *Cj* in either of the *R*i-*C*i or *R*i-*C*i-P system along *K*j gradient.  
Any detection of invasion/extinction threshold points for consumer (as *BP* in the computations) or predator (as *BPE*) and presence of tipping point (*as* *LP*) are then computed in the Codim\_5sp R scripts.

For clarity, we used a specific nomenclature in the Codim\_5sp R scripts to name the data vectors. Each vectors combined two parameter terms separated by ‘*X*’, i.e. as ***P1***X***P2*** with *P*1 referring to fixed productivity values (*K*1 or *K*2) and *P*2 to fixed relative body size β:

*P*1 terminology: IA) Ki = 1 10-5 g.L-1; IB) Ki = 2 10-5 g.L-1; IC) Ki = 3 10-5 g.L-1; IIA) Ki = 5 10-5 g.L-1; IIB) Ki = 8 10-5 g.L-1; IIC) Ki = 1 10-4 g.L-1; IIIA) Ki = 2 10-4 g.L-1; IIIB) Ki = 3 10-4 g.L-1; IIIC) Ki = 4 10-4 g.L-1 (i =1 or 2).

*P*2 terminology: OA) β = 0.3; OB) β = 0.5; IA) β = 0.8; IB) β = 1.0; IC) β = 1.2; IIA) β =1.5; IIB) β = 2.0; IIC) β = 2.5; IIIA) β = 3.0.

Table *Codim\_5sp\_K1Beta.R*: co-dimension bifurcation analyses along *K*1 and β gradients for increasing fixed resource productivity *K*2.

|  |  |  |  |
| --- | --- | --- | --- |
| ***K*2 values (P1)** | **β values (P2)** | **Vector names** | **Description** |
| 1 10-5 | 0.5 | 7 IAXOB 14 IAXOB 15 IAXOB 16 IAXOB 17 IAXOB | EQ R1C1P + Inv C2  BP C1  BP C2  BPE  LP |
| 2 10-5 | 0.8 | 7 IBXIA 14 IBXIA 15 IBXIA 16 IBXIA 17 IBXIA | EQ R1C1P + Inv C2  BP C1  BP C2  BPE  LP |
| 3 10-5 | 1.0 | 7 ICXIB 14 ICXIB 15 ICXIB 16 ICXIB 17 ICXIB | EQ R1C1P + Inv C2  BP C1  BP C2  BPE  LP |
| 5 10-5 | 1.0 | 7 IIAXIB 14 IIAXIB 15 IIAXIB 16 IIAXIB 17 IIAXIB | EQ R1C1P + Inv C2  BP C1  BP C2  BPE  LP |
| 8 10-5 | 1.0 | 7 IIBXIB 14 IIBXIB 15 IIBXIB 16 IIBXIB 17 IIBXIB | EQ R1C1P + Inv C2  BP C1  BP C2  BPE  LP |
| 1 10-4 | 1.0 | 7 IICXIB 14 IICXIB 15 IICXIB | EQ R1C1P + Inv C2  BP C1  BP C2 |
| 2 10-4 | 1.0 | 7 IIIAXIB 14 IIIAXIB 15 IIIAXIB | EQ R1C1P + Inv C2  BP C1  BP C2 |
| 3 10-4 | 1.0 | 7 IIIBXIB 14 IIIBXIB 15 IIIBXIB | EQ R1C1P + Inv C2  BP C1  BP C2 |
| 4 10-4 | 1.0 | 7 IIICXIB 14 IIICXIB 15 IIICXIB | EQ R1C1P + Inv C2  BP C1  BP C2 |

Table *Codim\_5sp\_K2Beta.R*: co-dimension bifurcation analyses along *K*2 and β gradients for increasing fixed resource productivity *K*1.

|  |  |  |  |
| --- | --- | --- | --- |
| ***K*1 values (P2)** | **β values (P2)** | **Vector names** | **Description** |
| 1 10-5 | 1.2 | 8 IAXIC 18 IAXIC 19 IAXIC 20 IAXIC 21 IAXIC | EQ R2C2P + Inv C1  BP C1  BP C2  BPE  LP |
| 2 10-5 | 1.0 | 8 IBXIB 18 IBXIB 19 IBXIB 20 IBXIB 21 IBXIB | EQ R2C2P + Inv C1  BP C1  BP C2  BPE  LP |
| 3 10-5 | 1.0 | 8 ICXIB 18 ICXIB 19 ICXIB 20 ICXIB 21 ICXIB | EQ R2C2P + Inv C1  BP C1  BP C2  BPE  LP |
| 5 10-5 | 1.0 | 8 IIAXIB 18 IIAXIB 19 IIAXIB 20 IIAXIB 21 IIAXIB | EQ R2C2P + Inv C1  BP C1  BP C2  BPE  LP |
| 8 10-5 | 0.8 | 8 IIBXIA 18 IIBXIA 19 IIBXIA | EQ R2C2P + Inv C1  BP C1  BP C2 |
| 1 10-4 | 0.8 | 8 IICXIA 18 IICXIA 19 IICXIA | EQ R2C2P + Inv C1  BP C1  BP C2 |
| 2 10-4 | 0.8 | 8 IIIAXIA 18 IIIAXIA 19 IIIAXIA | EQ R2C2P + Inv C1  BP C1  BP C2 |
| 3 10-4 | 0.8 | 8 IIIBXIA 18 IIIBXIA 19 IIIBXIA | EQ R2C2P + Inv C1  BP C1  BP C2 |
| 4 10-4 | 0.8 | 8 IIICXIA 18 IIICXIA 19 IIICXIA | EQ R2C2P + Inv C1  BP C1  BP C2 |

Table *Codim\_5sp\_K1K2.R*: co-dimension bifurcation analyses along *K*1 and *K*2 gradients for increasing fixed relative body size β.

|  |  |  |  |
| --- | --- | --- | --- |
| ***K*i values (P1)** | **β values (P2)** | **Vector names** | **Description** |
| 1 10-5 | 0.3 | 8 IAXOA 10 IAXOA 11 IAXOA 12 IAXOA 13 IAXOA | EQ R2C2P + Inv C1  BP C1  BP C2  BPE  LP |
| 1 10-5 | 0.5 | 7 IAXOB  8 IAXOB 10 IAXOB 11 IAXOB 12 IAXOB 13 IAXOB | EQ R1C1P + Inv C2  EQ R2C2P + Inv C1  BP C1  BP C2  BPE  LP |
| 2 10-5 | 0.8 | 7 IBXIA  8 IBXIA 10 IBXIA 11 IBXIA 12 IBXIA 13 IBXIA | EQ R1C1P + Inv C2  EQ R2C2P + Inv C1  BP C1  BP C2  BPE  LP |
| 3 10-5 | 1.0 | 8 ICXIB 10 ICXIB 11 ICXIB 12 ICXIB 13 ICXIB | EQ R2C2P + Inv C1  BP C1  BP C2  BPE  LP |
| 3 10-5 | 1.2 | 7 ICXIC  8 ICXIC 10 ICXIC 11 ICXIC 12 ICXIC 13 ICXIC | EQ R1C1P + Inv C2  EQ R2C2P + Inv C1  BP C1  BP C2  BPE  LP |
| 8 10-5 | 1.5 | 7 IIBXIIA  10 IIBXIIA 11 IIBXIIA  12 IIBXIIA  13 IIBXIIA | EQ R1C1P + Inv C2  BP C1  BP C2  BPE  LP |
| 8 10-5 | 2.0 | 7 IIBXIIB  10 IIBXIIB 11 IIBXIIB  12 IIBXIIB  13 IIBXIIB | EQ R1C1P + Inv C2  BP C1  BP C2  BPE  LP |
| 8 10-5 | 2.5 | 7 IIBXIIC  10 IIBXIIC 11 IIBXIIC  12 IIBXIIC  13 IIBXIIC | EQ R1C1P + Inv C2  BP C1  BP C2  BPE  LP |
| 8 10-5 | 3.0 | 7 IIBXIIIA  10 IIBXIIIA 11 IIBXIIIA  12 IIBXIIIA  13 IIBXIIIA | EQ R1C1P + Inv C2  BP C1  BP C2  BPE  LP |