The following supplement accompanies the article

Lanice conchilega structures carbon flows in soft-bottom intertidal areas

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Table S1. Site-specific biomass data (mmol C m^{-2}) of the different compartments (primary producers and macrofaunal consumer species) for the eight food webs.

		BMSM				Boulogne			
		Autumn		Spring		Autumn		Spring	
Compartment	Abbr.	Control	Reef	Control	Reef	Control	Reef	Control	Reef
Microphytobenthos (Primary producer)	MICPHY	43.70	38.40	18.21	41.52	11.32	21.98	32.23	144
Phytoplankton (Primary producer)	PHYTOP	2.17	1.19	15.14	16.36	1.10	1.24	7.19	14.37
Lanice conchilega (Polychaeta)	LANCON	–	6189	–	3203	–	18225	–	22212
Arenicola marina (Polychaeta)	AREMAR	17.81	1752	–	284	–	378	4.56	–
Capitella capitata (Polychaeta)	CAPCAP	0.0733	0.5892	0.2886	0.8240	–	15.55	–	8.41
Eumida sanguinea (Polychaeta)	EUMSAN	–	1	–	3.29	–	6.77	–	112
Heteromastus filiformis (Polychaeta)	HETFIL	0.9427	0.8031	0.2619	1.12	–	15.28	–	14.52
Nephtys cirrosa (Polychaeta)	NEPCIR	6.92	0.9427	13.50	0.7856	11.57	9.95	14.11	20.16
Nephtys hombergii (Polychaeta)	NEPHOM	3.30	65.96	–	40.33	–	–	0.2619	–
Nereis sp. (Polychaeta)	NERESP	–	–	–	–	–	18.70	–	22.78
Notomastus latericeus (Polychaeta)	NOTLAT	–	1	–	0.0524	–	1.45	–	8.48
Phyllodoce mucosa (Polychaeta)	PHYMUC	–	0.3142	–	1.31	–	4.90	–	28.01
Pygospio elegans (Polychaeta)	PYGELE	0.1047	0.1571	–	0.0471	–	15.01	–	0.8607
Scolelepis squamata (Polychaeta)	SCOSQU	–	0.1047	–	–	–	–	0.8249	–
Scoloplos armiger (Polychaeta)	SCOARM	13.09	–	5.50	–	–	–	–	–
Spio sp. (Polychaeta)	SPIOSP	0.0419	0.0209	0.2933	0.0524	0.0524	0.0209	0.2374	0.6285
Spiophanes bombyx (Polychaeta)	SPIBOM	0.1571	–	–	–	0.5106	1.61	–	1.41
Tellina tenuis (Bivalvia)	TELTEN	22.58	–	12.76	–	–	23.61	–	–
Cerastoderma edule (Bivalvia)	CEREDU	–	7535	165	4380	–	–	–	–
Macoma balthica (Bivalvia)	MACBAL	44.16	1477	47.82	610	–	0.6104	–	–
Eurydice pulchra (Isopoda)	EURPUL	–	–	–	–	0.7110	0.0970	0.0970	4.75
Idotea balthica (Isopoda)	IDOBAL	0.1409	0.0470	–	–	–	–	–	–
Idotea linearis (Isopoda)	IDOLIN	0.0046	0.0563	0.0498	0.0528	–	–	–	–
Lekanesphaera monodi (Isopoda)	LEKMON	–	2.04	0.5845	0.7758	–	0.3876	–	–
Gammarus sp. (Amphipoda)	GAMMSP	0.0209	0.0189	0.1334	0.0879	0.0006	0.0087	–	0.0031
Urothoe poseidonis (Amphipoda)	UROPOS	0.8310	3.79	0.7031	3.27	0.1278	28.69	–	35.85
Urothoe sp. juvenile (Amphipoda)	UROJUV	–	0.2216	0.4261	0.5199	–	19.29	0.0639	3.79
Gastrosaccus spinifer (Mysida)	GASSPI	0.0011	0.0064	0.0547	0.0008	0.0014	0.0001	0.0031	0.0005
Mesopodopsis slabberi (Mysida)	MESSLA	0.0800	0.7721	–	0.0040	–	0.0006	0.0108	0.4817
Schistomysis kervillei (Mysida)	SCHKER	0.0205	0.0053	0.1856	0.0885	0.0002	–	0.0006	0.0120
Schistomysis spiritus (Mysida)	SCHSPI	0.0826	0.0474	0.0024	0.0042	–	0.0003	0.0004	0.0002
Carcinus maenas (Decapoda)	CARMAE	0.0101	25.21	0.0079	0.6164	1.15	7846	187	848
Crangon crangon (Decapoda)	CRACRA	0.9724	1.41	0.5870	2.13	1.75	48.66	0.3323	4.09
Diogenes pugilator (Decapoda)	DIOPUG	0.0073	0.0028	–	–	–	–	–	–
Palaemon serratus (Decapoda)	PALSER	–	0.0084	–	–	–	0.0201	–	–
Pisidia longicornis (Decapoda)	PISLON	0.0005	0.0016	–	0.0001	0.0004	–	–	–
Portumnus latipes (Decapoda)	PORLAT	0.0734	–	0.0203	0.0008	–	–	–	–
Loligo vulgaris (Cephalopoda)	LOLVUL	0.1153	0.0635	–	–	–	–	–	–
Dicentrarchus labrax (Osteichthyes)	DICLAB	–	–	0.1372	0.5009	0.1173	0.2075	–	0.1013

Compartment	Abbr.	BMSM				Boulogne			
		Autumn		Spring		Autumn		Spring	
		Control	Reef	Control	Reef	Control	Reef	Control	Reef
Echiichthys vipera (Osteichthyes)	ECHVIP	0.0054	—	—	—	—	0.4902	—	—
Platichthys flesus (Osteichthyes)	PLAFLE	—	—	—	0.2039	0.2589	0.4539	—	—
Pleuronectes platessa (Osteichthyes)	PLEPLA	0.1547	—	0.0721	0.6088	0.5657	2.56	0.2155	—
Pomatoschistus lozanoi (Osteichthyes)	POMLOZ	0.5128	0.3179	0.1003	1.39	0.0635	0.0363	—	—
Pomatoschistus microps (Osteichthyes)	POMMIC	0.0386	0.9581	0.0510	0.0627	0.0416	1.67	—	0.1949
Pomatoschistus minutus (Osteichthyes)	POMMIN	0.1072	0.1708	—	0.0852	2.46	6.62	—	0.0240
Scophthalmus rhombus (Osteichthyes)	SCORHO	—	—	—	—	0.1236	0.3678	0.1246	—
Solea solea (Osteichthyes)	SOLSOL	2.10	1.79	—	—	—	—	—	—
Syngnathus rostellatus (Osteichthyes)	SYNROS	—	—	0.0028	0.0035	—	0.0104	—	0.0009
Total biomass		160	17102 0	282	8593 0	32	26695 0	247	23485

Table S2. Site-specific stable isotope data ($\delta^{13}C$, ‰) of the different compartments (primary producers and macrofaunal consumer species) for the eight food webs.

Compartment	Abbr.	BMSM				Boulogne			
		Autumn		Spring		Autumn		Spring	
		Control	Reef	Control	Reef	Control	Reef	Control	Reef
Microphytobenthos (Primary producer)	MICPHY	-14.08	-11.17	-9.74	-6.84	-19.58	-15.38	-12.67	-16.51
Phytoplankton (Primary producer)	PHYTOP	-21.29	-21.39	-21.40	-21.48	-23.53	-23.63	-21.15	-20.51
Lanice conchilega (Polychaeta)	LANCON	—	-17.40	—	-18.55	—	-18.99	—	-18.02
Arenicola marina (Polychaeta)	AREMAR	-15.94*	-15.94	—	-15.94*	—	-17.27	-17.27*	—
Capitella capitata (Polychaeta)	CAPCAP	-16.93†	-16.93†	-16.93†	-16.93†	—	-16.93†	—	-16.93†
Eumida sanguinea (Polychaeta)	EUMSAN	—	-16.27†	—	-16.27†	—	-16.27†	—	-16.27†
Heteromastus filiformis (Polychaeta)	HETFIL	-19.27‡	-19.27‡	-19.27‡	-19.27‡	—	-19.27‡	—	-19.27‡
Nephtys cirrosa (Polychaeta)	NEPCIR	-16.56	-16.21	-15.88	-15.88*	-16.33	-17.61	-16.59	-16.59*
Nephtys hombergii (Polychaeta)	NEPHOM	-15.40*	-15.40*	—	-15.40	—	—	-15.40*	—
Nereis sp. (Polychaeta)	NERESP	—	—	—	—	—	-15.41†	—	-15.41†
Notomastus latericeus (Polychaeta)	NOTLAT	—	-19.27*	—	-19.27*	—	-19.27	—	-19.27*
Phyllodoce mucosa (Polychaeta)	PHYMUC	—	-18.10*	—	-18.23*	—	-18.10	—	-18.23
Pygospio elegans (Polychaeta)	PYGELE	-16.25‡	-16.25‡	—	-16.25‡	—	-16.25‡	—	-16.25‡
Scolelepis squamata (Polychaeta)	SCOSQU	—	-16.25‡	—	—	—	—	-16.25‡	—
Scoloplos armiger (Polychaeta)	SCOARM	-16.25	—	-16.25*	—	—	—	—	—
Spio sp. (Polychaeta)	SPIOSP	-16.25‡	-16.25‡	-16.25‡	-16.25‡	-16.25‡	-16.25‡	-16.25‡	-16.25‡
Spiophanes bombyx (Polychaeta)	SPIBOM	-16.25	—	—	—	-16.25	-16.25	—	-16.25
Tellina tenuis (Bivalvia)	TELTEN	-15.32‡	—	-15.94‡	—	—	-15.32‡	—	—
Cerastoderma edule (Bivalvia)	CEREDU	—	-17.03	-18.50	-18.42	—	—	—	—
Macoma balthica (Bivalvia)	MACBAL	-15.32	-15.32	-15.94	-15.81	—	-15.32*	—	—
Eurydice pulchra (Isopoda)	EURPUL	—	—	—	—	-20.70	-20.70*	-20.70*	-20.70*
Idotea balthica (Isopoda)	IDOBAL	-17.52*	-17.52	—	—	—	—	—	—
Idotea linearis (Isopoda)	IDOLIN	-16.61	-15.49	-19.39	-19.39*	—	—	—	—
Lekanesphaera monodi (Isopoda)	LEKMON	—	-17.63*	-21.22*	-21.22	—	-17.63*	—	—
Gammarus sp. (Amphipoda)	GAMMSP	-19.17	-18.99	-20.49	-19.71	-21.07	-21.07*	—	-19.48
Urothoe poseidonis (Amphipoda)	UROPOS	-19.66*	-19.66*	-19.66*	-19.66*	-19.66*	-19.66	—	-19.66*
Urothoe sp. juvenile (Amphipoda)	UROJUV	—	-19.21*	-19.21*	-19.21*	—	-19.21	-19.21*	-19.21*
Gastrosaccus spinifer (Mysida)	GASSPI	-18.57	-18.57*	-19.76	-19.76*	-20.78	-20.78*	-17.62	-17.62*
Mesopodopsis slabberi (Mysida)	MESSLA	-17.54	-17.54*	—	-17.54*	—	-16.86*	-17.23	-16.86
Schistomysis kervillei (Mysida)	SCHKER	-17.59*	-18.05*	-17.59	-18.05	-16.91*	—	-16.91	-16.91*
Schistomysis spiritus (Mysida)	SCHSPI	-16.61	-16.61*	-18.78*	-18.78	—	-16.61*	-18.78*	-18.78*
Carcinus maenas (Decapoda)	CARMAE	-18.17*	-18.17	-18.17*	-18.17*	-16.62	-16.49	-16.08	-16.05
Crangon crangon (Decapoda)	CRACRA	-13.14	-13.02	-13.30	-14.38	-16.39	-15.99	-17.13*	-17.13
Diogenes pugilator (Decapoda)	DIOPUG	-16.74	-15.59	—	—	—	—	—	—
Palaemon serratus (Decapoda)	PALSER	—	-16.91	—	—	—	-16.91*	—	—
Pisidia longicornis (Decapoda)	PISLON	-16.74‡	-15.59‡	—	-15.59‡	-16.74‡	—	—	—
Portumnus latipes (Decapoda)	PORLAT	-13.70	—	-13.70*	-13.70*	—	—	—	—
Loligo vulgaris (Cephalopoda)	LOLVUL	-17.92	-16.05	—	—	—	—	—	—
Dicentrarchus labrax (Osteichthyes)	DICLAB	—	—	-14.12	-14.12	-16.54	-16.73	—	-16.73*
Echiichthys vipera (Osteichthyes)	ECHVIP	-17.31*	—	—	—	—	-16.58	—	—

		BMSM				Boulogne			
		Autumn		Spring		Autumn		Spring	
Compartment	Abbr.	Control	Reef	Control	Reef	Control	Reef	Control	Reef
Platichthys flesus (Osteichthyes)	PLAFLE	–	–	–	-13.99*	-13.99*	-13.99*	–	–
Pleuronectes platessa (Osteichthyes)	PLEPLA	-15.51	–	-15.51*	-15.51*	-15.96	-16.29	-24.99*	–
Pomatoschistus lozanoi (Osteichthyes)	POMLOZ	-15.77	-15.32	-15.29	-15.23	-16.76	-16.38	–	–
Pomatoschistus microps (Osteichthyes)	POMMIC	-15.77	-15.32	-15.29	-15.23	-16.76	-16.38	–	-17.96
Pomatoschistus minutus (Osteichthyes)	POMMIN	-15.77	-15.32	–	-15.23	-16.76	-16.38	–	-17.96
Scophthalmus rhombus (Osteichthyes)	SCORHO	–	–	–	–	-16.58	-17.24	-16.58*	–
Solea solea (Osteichthyes)	SOLSOL	-14.67*	-14.67	–	–	–	–	–	–
Syngnathus rostellatus (Osteichthyes)	SYNROS	–	–	-18.27	-18.27*	–	-17.59*	–	-17.59

* ^{13}C value adopted from a different sampling area, season or location
‡ ^{13}C value adopted from a taxonomically related species
† ^{13}C value adopted from the reference situation of a ^{13}C pulse-chase experiment (De Smet *et al.* 2016)

Table S3. Algorithms for the calculation of the network indices (upper table) and the nomenclature of the symbols (lower table)

Index name	**Code**	**Formula**
Total system throughput	$T..$	$\sum_{i=1}^{n+2}\sum_{j=0}^{n} T_{ij}$
Number of links	L	$\sum_{i=1}^{n+2}\sum_{j=0}^{n} (T_{ij}>0)$
Average link weight	$\overline{T}_{ij}$	$T../L$
Connectance	C	$\frac{L_{int}}{n(n-1)}$ where $L_{int} = \sum_{i=1}^{n}\sum_{j=1}^{n} (T_{ij}>0)$
Average mutual information index	AMI	$\sum_{i=1}^{n+2}\sum_{j=0}^{n} \frac{T_{ij}}{T..} \log_2 \frac{T_{ij}\, T..}{T_{i.}\, T_{.j}}$

Term	**Description**
n	Number of internal compartments in the network, excluding 0 (zero), $n + 1$ and $n + 2$
$j = 0$	External source (*i.e.* dissolved inorganic carbon and detritus input)
$j = n + 1$	Useable export from the food web (*i.e.* secondary production)
$j = n + 2$	Unusable export from the food web (*i.e.* respiration and detritus production)
T_{ij}	Flow from compartment *j* to *i* where *j* represents the columns of the flow matrix and *i* the rows
$T_{i.}$	Total inflows to compartment *i*
$T_{.j}$	Total outflows from compartment *j*
T_i	Total inflows to compartment *i* excluding inflow from external sources
T_j	Total outflows from compartment *j* excluding outflow to external sources

Fig. S1. Food web flows (mmol C m^{-2} d^{-1}) returned by the linear inverse food web models for the soft-bottom intertidal area of Boulogne-sur-Mer (Boulogne): (A) bare sand, autumn, (B) reef, autumn, (C) bare sand, spring, (D) reef spring. Note the different magnitudes of the plotted flows between seasons: (A,B) autumn: $3x10^{-7}$ to 240 mmol C m^{-2} d^{-1} ; (C,D) spring: $5x10^{-6}$ to 137 mmol C m^{-2} d^{-1}. See Tables S1 & S2 for full names of the food web compartments. Phytop = phytoplankton; micphy = microphytobenthos; detpro = external outflow to detritus, Detrit = external inflow of organic matter (OM), Dissic = dissolved inorganic carbon, Secpro = external outflow of secondary production. Minimum and maximum values as well as the parsimonious solution of the most important food web flows are given in Fig. S3.

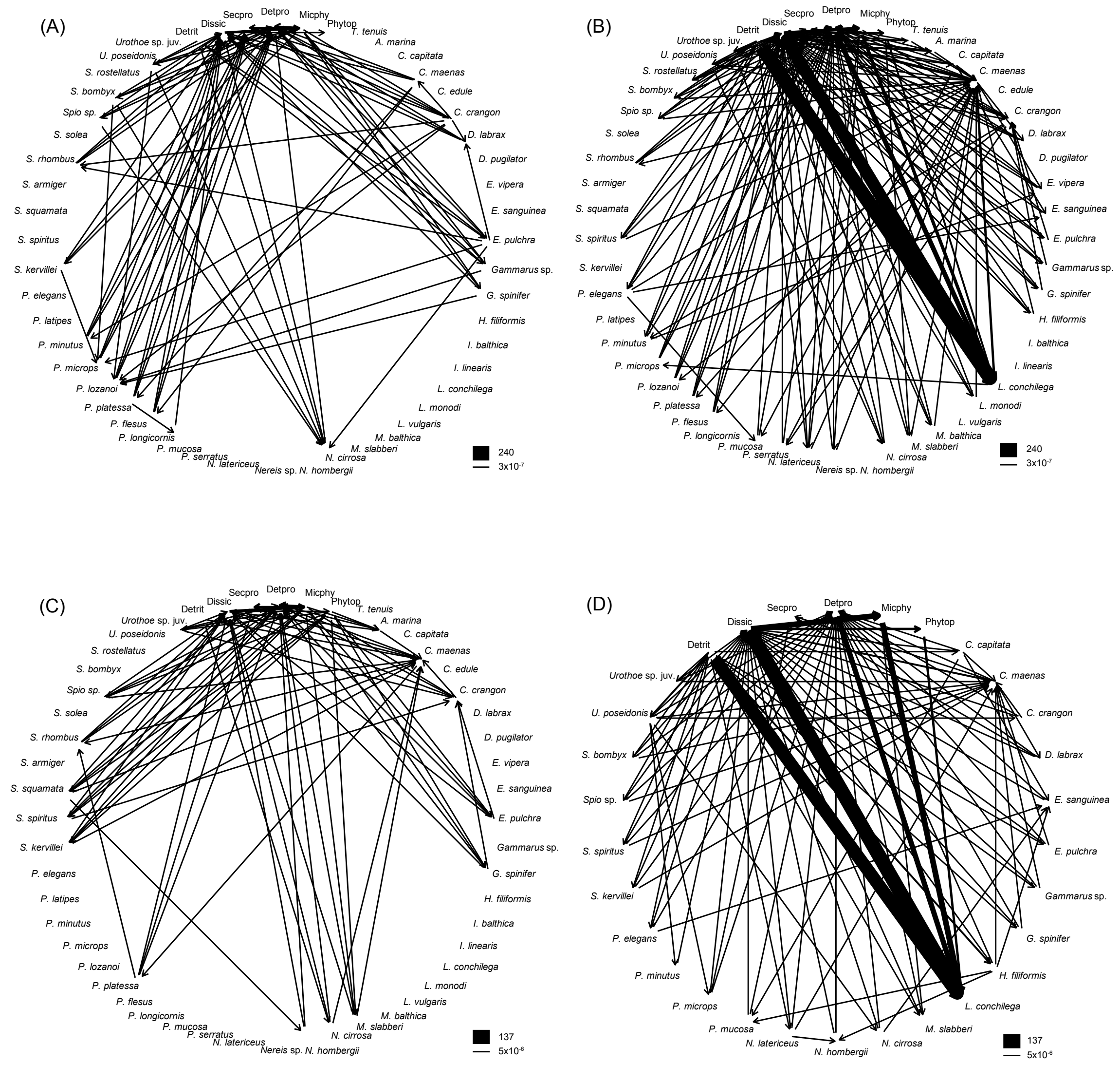

Fig. S2. Plot with the parsimonious (simplest) solutions encompassed by their range for the 30 highest flows in the different food webs of the intertidal area of the Bay of Mont Saint-Michel (BMSM) returned by the food web model.

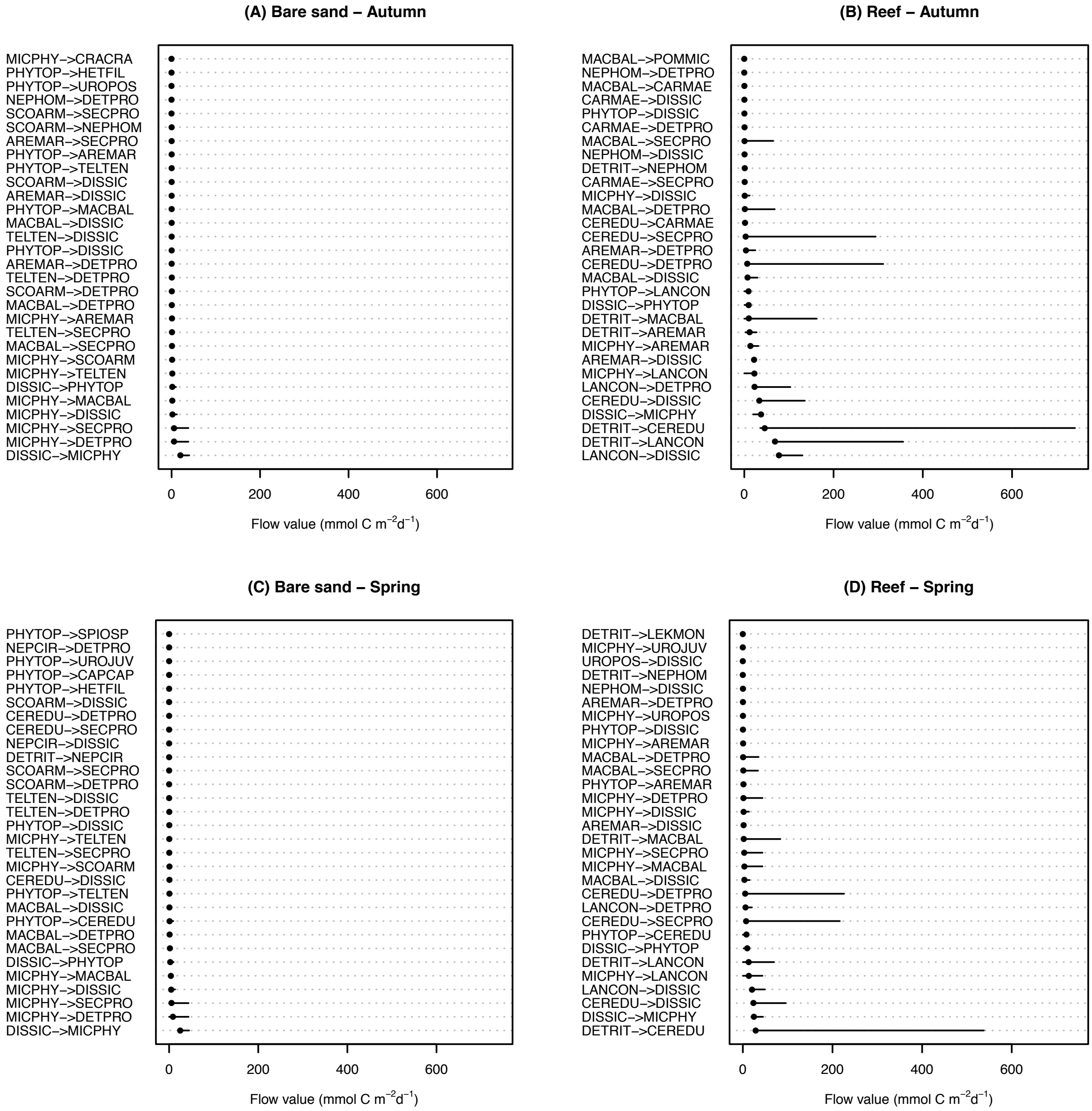

Fig. S3. Plot with the parsimonious (simplest) solutions encompassed by their range for the 30 highest flows in the different food webs of the intertidal area of Boulogne-sur-Mer returned by the food web model.