Text S1. Sources And Constructions Of Standing Stock Biomass Data

MICROALGAE

For the Balgzand tidal flat system, it was assumed that the main primary producers fueling the food web were marine phytoplankton, freshwater phytoplankton and microphytobenthos (Jung et al. 2019).

Marine phytoplankton (C_{PHYT}; mg C m^{-2})

The biomass of marine phytoplankton (B_{PHYT}; mg CHLa m^{-3}) has been monitored as chlorophyll-*a* concentrations at the NIOZ Jetty, a station located close to the research area (Fig. 1), since the 1970s. Measurements at this station were always taken at high tide, therefore more likely representing the phytoplankton population of the coastal North Sea than that of the central Wadden Sea. Results from Duran-Matute et al. (2014) indicate that the water of Balgzand contains a considerable amount of freshwater originating from lake IJsselmeer (Fig. 1). In addition, freshwater might also have been imported via the discharge from the Balgzand channel (Fig. 1). The percentage of (additional) freshwater on the Balgzand (compared to that of the coastal North Sea) was estimated via the salinity of the water of the Balgzand area as compared to the salinity measured at the Jetty. The results led to estimations of the coastal water fractions (84% and 81% in the 1980s/1990s and 2000s/2010s, respectively), the biomass of coastal waters (mg CHLa m^{-3}) and the average water depth of the Balgzand (Table 1) were then used to estimate the local chlorophyll-*a* mass (mg CHLa m^{-2}), which was subsequently converted to carbon mass (mg C m^{-2}) by applying a fixed conversion factor of 38 mg C mg $CHLa^{-1}$ (de Jonge 1980, Riemann et al. 1989).

Freshwater phytoplankton (C_{FWTR}; mg C m^{-2})

As indicated in the previous paragraph, the total biomass of freshwater microalgae (B_{FWTR}; mg CHLa m^{-3}) in the study area was assumed to be the sum of the supply from lake IJsselmeer and the Balgzand channel. Biomass of freshwater microalgae was calculated by multiplying the long-term chlorophyll-*a* concentrations in the water of lake IJsselmeer at Den Oever (52.9345665˚ N, 5.10387334˚ E) as measured by the Rijkswaterstaat (http://live.waterbase.nl/; mg CHLa m^{-3}) by the estimated fraction of freshwater on the Balgzand (16% and 19%, see the above section of marine phytoplankton). We assumed that freshwater algae were not affected during their transfer from their main sources to the brackish waters of the Balgzand tidal flat system. These chlorophyll-a concentrations, the average depth of the Balgzand (Table 1) and a fixed conversion factor of 38 mg C mg $CHLa^{-1}$ (de Jonge 1980, Riemann et al. 1989) were subsequently used to estimate the local carbon mass (C_{FWTR}; mg C m^{-2}) of freshwater microalgae.

Microphytobenthos (C_{MPB}; mg C m^{-2})

Since no long-term data on microphytobenthos were available, biomass of these benthic microalgae in the top 0.5 cm of the sediment ($B_{MPB0.5}$; mg CHLa m^{-2}) was derived from an empirical relationship with average annual air temperature (AT; ˚C) as was found for the Ems estuary by de Jonge et al. (2012):

$B_{MPB0.5} = 26176*AT - 15499$

For the Balgzand tidal flat area, mean air temperature (˚C) values were obtained from the KNMI meteorological station at the airport of Den Helder ("De Kooy", see Royal Netherlands Meteorological Institute, https://www.knmi.nl/nederland-nu/klimatologie/maandgegevens). Assuming that microphytobenthos occurred to depth of 2 cm instead of 0.5 cm in the sediment of the tidal flats (Revsbech & Jørgensen 1986, de Jonge et al. 2019), microphytobenthos biomass at 0.5 cm ($B_{MPB0.5}$; mg CHLa m^{-2}) was multiplied by 1.7 to derive at total microphytobenthic biomass (B_{MPB}; mg CHLa m^{-2}) in the sediment (de Jonge & Colijn 1994). Subsequently, total benthic biomass (B_{MPB}; mg CHLa m^{-2}) was converted to total carbon (C_{MPB}; mg C m^{-2}) by using a ratio of 38 mg C mg $CHLa^{-1}$ (de Jonge 1980, Riemann et al. 1989).

BACTERIA

Pelagic bacteria (C_{PBAC}; mg C m^{-2})

Since no data were available, annual averages of biomass of pelagic bacteria were derived from the annual averages in chlorophyll-a concentration of phytoplankton as measured in the Marsdiep tidal inlet. Hereto, CHLa concentration of phytoplankton (B_{PHYT}; mg CHLa m^{-3}) was first converted to bacterial density (N_{BACT}; cells ml^{-1}) according to Bird & Kalff (1984):

$$\text{Log}_{10} N_{BACT} = 5.87 + 0.78 \log_{10} B_{PHYT}$$

Bacterial cell densities were subsequently converted to biovolume (V_{BACT}; μm^3 ml^{-1}) by using a mean volume of 0.11 μm^3 per cell (van Duyl & Kop 1988). Biovolume was finally converted to carbon concentration (C_{PBAC}; mg C m^{-2}) by applying a carbon to volume ratio of $1*10^{-13}$ mg C μm^{-3} (Rublee et al. 1978) and taking the mean water depth (0.67 m) of the Balgzand area into account.

Benthic bacteria (C_{BBAC}; mg C m^{-2})

In the 1980s, biomass of benthic bacteria concentration in the upper 3 mm of the sediment (C_{BBAC3}; mg C m^{-2}) at the Balgzand tidal flats was, on average, 150 mg C m^{-2} (van Duyl & Kop 1990). Assuming that the top 2cm should be considered as being biologically important (Revsbech and Jørgensen 1986, de Jonge et al. 2019) and that benthic bacteria are homogeneously distributed up to this depth, then total biomass of benthic bacteria (C_{BBAC}) was 1000 mg C m^{-2}. This value fits well with those found for other estuaries (Austin & Findlay 1989). Due to a lack of data for other periods, the biomass of benthic bacteria was considered to be similar during all other periods.

ZOOPLANKTON (C_{ZOO}; mg C m^{-2})

Because no zooplankton data were available, annual averages of biomass of zooplankton (C_{ZOO}; mg C m^{-2}) were based upon an empirical relationship between zooplankton densities (N_{ZOO}; n m^{-3}) and sea surface temperature in the first half year (January till May; SST; ˚C) as found in the north-eastern part of the Wadden Sea (Martens & van Beusekom 2008), according to:

$N_{ZOO} = 6.0068\ SST - 14.099$

Sea surface temperatures (SST; ˚C) were taken from the long-term field observations at the NIOZ Jetty as annual average values from January till May between 1982 and 2010. Zooplankton densities (N_{ZOO}; numbers m^{-3}) were subsequently converted to zooplankton mass (C_{ZOO}; mg C m^{-2}) by assuming a carbon content of 0.01 mg C per individual (Löder et al. 2011) and taking the average depth (0.67 m) of the study area into account.

BENTHIC FAUNA

Meiofauna (C_{MEIO}; mg C m^{-2})

In the 1970s, the density of meiofauna (N_{MEIO}; n m^{-2}) at the Balgzand tidal flats was 2.44 10^6 individuals m^{-2} and the community consisted of Nematodes, Harpacticoids, Turbellaria and Annelida (see Witte & Zijlstra 1984, Table 2). Assuming a mean carbon content of 0.153846 µg C per individual (Bouwman et al. 1984), this density represented a mean biomass of meiofauna (C_{MEIO}; mg C m^{-2}) of 375.23 mg C m^{-2}. For the 1980s, we assumed that meiofauna biomass was equal to that in the 1970s. For the 1990s, 2000s and 2010s, meiofauna biomass (C_{MEIO}; mg C m^{-2}) was derived from an empirical relationship with median grain size (µm) and silt content (%) of the top layer (2 cm) of the sediment of the tidal flats according to (U. Schückel et al., unpublished):

Meiofauna (n m^{-2}) = median grain size (µm) * silt content (%)

Data on median grain size and silt content of the Balgzand were obtained from Beukema and Cadee (1997) and unpublished data of the Royal Netherlands Institute for Sea Research (NIOZ) data base.

Macrozoobenthos ($C_{MZBSPEC}$; mg C m^{-2})

The ecosystem network analysis approach includes 20 species of macrozoobenthos, grouped into four feeding guilds (Baird et al. 2012). Biomass of each of these macrozoobenthic species ($B_{MZBSPEC}$; mg AFDM m^{-2}) used in the analysis was obtained from the NIOZ long-term monitoring program (Beukema & Cadee 1997 and unpublished data). Although sampling nowadays takes place in late summer (July/August) and late winter (February/March), only winter samples are available for the full study period. Samples were taken during low tide with a core along 12 transects and at 3 quadrats to a depth of about 30 cm, and sieved over a 1mm^2 sieve (see Beukema & Cadee 1997 for a detailed description of sampling methods). Biomass was originally determined as ash-free dry mass (mg AFDM m^{-2}) and converted here into carbon content ($C_{MZBSPEC}$; mg C m^{-2}) by using a conversion factor of 0.58 mg C mg AFDM^{-1} (Asmus & Asmus 1998) for all species.

Epibenthos (C_{EPI}; mg C m^{-2})

At the Balgzand tidal flats, the epibenthic community was sampled in 1975-1983, 1986, 1991, 1993-2002, 2007, 2009 and 2014 (see Jung et al. 2017 for more details). The biomass of the epibenthic species, originally determined as wet mass (mg WM m^{-2}), was converted to ash-free dry mass (B_{EPI}; mg AFDM m^{-2}) by using a conversion factor of 0.17 mg AFDM mg

WM^{-1} (de Vlas 1979), and subsequently to carbon mass (C_{EPI}; mg C m^{-2}) by using a conversion factor of 0.58 mg C mg AFDM^{-1} (Asmus & Asmus 1998).

BIRDS ($C_{BIRDSPEC}$; mg C m^{-2})

Since 1975, bird counting took place during high tide on a monthly basis (van Roomen et al. 2005). Data for numbers of birds present on the tidal roosts at high tide were obtained from SOVON (Foundation of bird research in the Netherlands, https://www.sovon.nl/). Assuming that these birds were evenly distributed over the tidal flats during low tide, bird densities ($N_{BIRDSPEC}$; n m^{-2}) were calculated by dividing the total bird numbers at the tidal roosts bordering the submerged area during high tide by the total surface area of the exposed tidal flats during low tide. For each of these bird species, densities ($N_{BIRDSPEC}$; n m^{-2}) were converted to biomass ($C_{BIRDSPEC}$; mg C m^{-2}) by using a species-specific wet body mass (mg WM) taken from Dunning Jr (1992), and a conversion of 0.2 mg C mg WM^{-1} for all species (Horn and de la Vega, 2016).

ORGANIC MATTER

Dissolved Organic Carbon (C_{DOC}; mg C m^{-2})

The DOC standing stock estimations were obtained by using measured DOC concentrations (http://waterinfo.rws.nl/) at two stations in lake IJsselmeer, being "Vrouwezand" (52.810350° N, 5.393138° E) and "Den Oever" (52.9345665° N, 5.10387334° E), and one station in the Marsdiep tidal basin, being "Marsdiep Noord" (52.982540° N, 4.749931° E) (indicated as Rijkswaterstaat in Fig. 1). The salinity at "Marsdiep Noord" was used to calculate the DOC concentrations (C_{DOC}; mg C m^{-3}) of the Balgzand water (see also the procedure followed for the freshwater algae) and was then converted to mg C m^{-2} using the water depth of the area (0.67 m).

Suspended Particulate Organic Carbon (C_{SUSPOC}; mg C m^{-2})

The basis for all calculations on susPOC is the Rijkswaterstaat (RWS) monitoring data on suspended particulate organic carbon and suspended particulate matter (SPM) at the station "Marsdiep Noord" (http://waterinfo.rws.nl/). Standing stock of susPOC as measured by RWS (here indicated as ALL susPOC) contains also carbon coming from compartments already integrated into our model (such as phytoplankton, zooplankton, and pelagic bacteria). To avoid double counting, these categories were excluded from the susPOC values. Over the years the fraction of ALL susPOC in comparison to the SPM at the station was 0.0543 (calculated from the Rijkswaterstaat data http://waterinfo.rws.nl/).

In addition to the measurements at "Marsdiep Noord", SPM measurements for the Amsteldiep tidal channel at the eastern border of the Balgzand area (Fig. 1) for the period 1973-1975 were used as reference for the correctness of the calculations based on station "Marsdiep Noord". On average, the 1973-1975 value of the "Amsteldiep" station was a factor 2.36 times higher than the SPM values at station "Marsdiep Noord" during the same years. We assumed that this ratio was constant over time. Since measured ALL susPOC values were available for all years at station "Marsdiep Noord", these SPM values were multiplied by the factor 2.36 to get the values for Balgzand. The SPM values were then used to calculate the ALL susPOC values with the factor mentioned above. Finally, the detritus susPOC concentrations (C_{SUSPOC}; mg C m^{-3}) was calculated as the ALL susPOC values minus the biomass of phytoplankton (C_{PHYT}), zooplankton (C_{ZOO}), and pelagic bacteria (C_{PBAC}).

Sediment Particulate Organic Carbon (C_{SEDPOC}; mg C m^{-2})

Particulate organic matter in the sediment is not part of any monitoring program. For this study values published by van Duyl and Kop (1990) and originating from Etcheber et al. (1988) as measured in 1986 were used. They report a value of 1.953 g organic carbon per liter wet sediment. Assuming that the volume of a 2 cm slice of one square meter equals 20 L of sediment (2x100x100 = 20.000 cm^3 = 20 dm^3 = 20 L), we arrive at a concentration of POC in the sediment (C_{SEDPOC}) of 39060 mg C m^{-2} (1.953g C L^{-1} * 20 L). Due to the lack of data in this area, no statement on the variability of the sediment carbon over time can be made. POC was therefore assumed to be similar for all periods.

Table S1. Mean biomass (mg C m^{-2}) and the daily input, output, consumption, production, respiration and egestion (mg C m^{-2} d^{-1}) per compartment per decade as used in the four respective networks (BZ1980s, BZ1990s, BZ2000s and BZ2010s).

COMPARTMENT NUMBER			BIOMASS				INPUT				OUTPUT				PRODUCTION				RESPIRATION				CONSUMPTION				EGESTION			
1980s/1990s	2000s/2010s	COMPARTMENT	1980s	1990s	2000s	2010s	1980s	1990s	2000s	2010s	1980s	1990s	2000s	2010s	1980s	1990s	2000s	2010s	1980s	1990s	2000s	2010s	1980s	1990s	2000s	2010s	1980s	1990s	2000s	2010s
1	1	Phytoplankton	226,43	225,18	205,21	162,93	176,67	165,94	672,51	343,24	21,55	0,00	0,00	0,00	176,67	99,30	97,43	88,55	62,54	35,15	34,49	31,35	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2	2	Microphytobenthos	5848,94	6964,98	8114,84	7679,42	322,28	383,77	479,05	423,14	0,00	0,00	0,00	0,00	322,28	383,77	447,13	423,14	85,08	101,32	118,04	111,71	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
3	3	Freshwater algae	388,04	384,93	330,21	335,41	238,79	236,88	203,21	206,41	0,00	0,00	0,00	0,00	19,40	19,25	16,51	16,77	6,87	6,81	5,84	5,94	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
4	4	Pelagic Bacteria	35,34	35,23	31,81	26,45	0,00	0,00	5,01	0,35	0,00	0,00	0,00	0,00	10,60	10,57	9,54	7,93	10,60	10,57	9,54	7,93	21,21	21,14	19,08	15,87	0,00	0,00	0,00	0,00
5	5	Zooplankton	13,94	17,80	21,02	20,18	0,00	0,00	0,00	0,00	5,33	6,30	7,68	5,54	8,32	10,62	12,54	12,04	9,87	12,60	14,88	14,29	27,72	35,42	41,81	40,15	9,54	12,19	14,39	13,82
6	6	Benthic Bacteria	1000,00	1000,00	1000,00	1000,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	156,80	156,80	156,80	156,80	174,40	174,40	174,40	174,40	392,00	392,00	392,00	392,00	60,80	60,80	60,80	60,80
7	7	Meiofauna	375,23	136,16	125,52	123,08	4,34	13,09	16,69	16,29	0,00	0,00	0,00	0,00	8,22	2,98	2,75	2,70	31,27	11,35	10,46	10,26	53,74	19,50	17,98	17,63	14,26	5,17	4,77	4,68
8	8	Peringia ulvae	352,29	530,41	555,35	1509,33	8,97	10,31	11,95	11,75	0,00	0,00	0,00	0,00	1,41	2,12	2,22	6,04	2,17	3,27	3,42	9,30	14,09	21,22	22,21	60,37	10,51	15,83	16,57	45,03
9	9	Littorina littorea	38,31	24,41	90,99	165,44	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,08	0,05	0,18	0,33	0,23	0,15	0,55	0,99	0,77	0,49	1,82	3,31	0,46	0,29	1,09	1,98
10	10	Arenicola marina	2988,21	2841,00	2322,12	2447,19	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	20,92	19,89	16,25	17,13	19,46	18,50	15,12	15,94	139,45	132,58	108,37	114,20	99,07	94,19	76,99	81,14
11	11	Eteone sp	13,36	20,28	30,84	28,26	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,04	0,06	0,09	0,08	0,44	0,67	1,02	0,93	0,54	0,82	1,25	1,15	0,06	0,09	0,14	0,13
12	12	Hediste diversicolor	1029,04	1433,28	1544,38	1328,09	3,47	0,00	0,00	1,73	0,00	0,00	0,00	0,00	3,09	4,30	4,63	3,98	12,50	17,41	18,76	16,13	48,24	67,19	72,39	62,25	32,65	45,48	49,00	42,14
13	13	Nereis spec.	38,74	102,44	261,89	282,26	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,12	0,31	0,79	0,85	0,47	1,24	3,18	3,43	1,82	4,80	12,28	13,23	1,23	3,25	8,31	8,96
14	14	Heteromastus filiformis	747,03	1091,92	1483,26	436,18	0,00	0,00	0,00	1,62	0,00	0,00	0,00	0,00	3,74	5,46	7,42	2,18	7,11	10,40	14,13	4,15	58,36	85,31	115,88	34,08	47,51	69,45	94,34	27,74
15	15	Lanice conchilega	147,46	385,34	496,45	98,63	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,81	2,12	2,73	0,54	1,55	4,05	5,22	1,04	3,04	7,94	10,23	2,03	0,68	1,77	2,28	0,45
16	16	Marenzelleria viridis	0,17	348,99	1709,80	186,63	0,12	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	4,89	23,94	2,61	0,01	13,96	68,39	7,47	0,02	37,58	184,13	20,10	0,01	18,74	91,80	10,02
17	17	Nephtys hombergii	131,85	162,61	163,45	71,98	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,45	1,79	1,80	0,79	1,38	1,70	1,71	0,75	7,84	9,67	9,72	4,28	5,01	6,18	6,21	2,74
18	18	Scoloplos armiger	251,68	196,31	177,03	220,93	1,43	1,72	1,92	2,88	0,00	0,00	0,00	0,00	0,25	0,20	0,18	0,22	1,92	1,50	1,35	1,69	7,19	5,61	5,06	6,31	5,02	3,91	3,53	4,40
19	19	Corophium spp	317,89	65,00	141,36	217,10	1,54	2,85	2,85	4,35	0,00	0,00	0,00	0,00	1,27	0,26	0,57	0,87	5,97	1,22	2,65	4,08	8,71	1,78	3,87	5,95	1,47	0,30	0,65	1,00
20	20	Gammarus spp.	1,39	1,93	2,05	2,00	0,01	0,07	0,06	0,25	0,00	0,00	0,00	0,00	0,01	0,01	0,01	0,01	0,04	0,05	0,05	0,05	0,06	0,08	0,08	0,08	0,01	0,02	0,02	0,02
21	21	Cerastoderma edule	2591,14	3058,69	1910,17	3410,44	3,78	1,15	7,61	8,41	0,00	0,00	0,00	0,00	12,96	15,29	9,55	17,05	4,06	4,80	2,99	5,35	64,78	76,47	47,75	85,26	47,76	56,38	35,21	62,86
	22	Magallana gigas	0	0	369,07	355,70	0	0	0,00	0,00	0	0	0,00	0,00	0	0	0,37	0,36	0	0	4,80	4,62	0	0	5,54	5,34	0	0	0,37	0,36
22	23	Ensis leei	7,53	209,27	1992,79	891,62	0,27	0,00	4,61	8,15	0,00	0,00	0,00	0,00	0,15	4,19	39,86	17,83	2,26	62,78	597,84	267,49	4,14	115,10	1096,04	490,39	1,73	48,13	458,34	205,07
23	24	Limecola balthica	2185,74	1715,90	407,01	469,07	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	17,49	13,73	3,26	3,75	3,26	2,56	0,61	0,70	112,81	88,56	21,01	24,21	92,07	72,28	17,14	19,76
24	25	Mya arenaria	4481,92	5354,19	7962,46	3711,79	0,00	0,00	1,22	1,80	0,00	0,00	0,00	0,00	8,96	10,71	15,92	7,42	20,85	24,90	37,03	17,26	44,82	53,54	79,62	37,12	15,01	17,93	26,66	12,43
25	26	Mytilus edulis	1340,48	1291,41	968,24	971,20	1,31	1,57	0,00	0,00	0,00	0,00	0,00	0,00	1,34	1,29	0,97	0,97	7,37	7,10	5,32	5,34	9,93	9,57	7,17	7,19	1,22	1,18	0,88	0,89
26	27	Scrobicularia plana	170,39	214,57	109,67	127,89	0,00	0,00	0,50	0,78	0,00	0,00	0,00	0,00	0,85	1,07	0,55	0,64	0,66	0,83	0,42	0,49	4,26	5,36	2,74	3,20	2,75	3,47	1,77	2,07
27	28	Carcinus maenas	7,84	9,16	14,72	41,61	1,36	0,57	0,00	0,00	0,00	0,00	0,00	0,00	0,03	0,04	0,06	0,17	0,05	0,06	0,09	0,26	0,72	1,41	2,46	5,64	0,64	1,32	2,31	5,22
28	29	Crangon crangon	90,71	114,42	129,93	207,32	0,50	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,00	1,26	1,43	2,28	26,31	33,18	37,68	60,12	46,90	49,56	55,78	86,31	19,59	15,12	16,67	23,91
29	30	Ammodytes tobianus	0,26	0,41	0,46	0,38	0,00	0,00	0,00	0,00	0,00	0,00	0,03	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
30	31	Clupea harengus	0,80	2,15	4,21	1,45	0,00	0,00	0,00	0,00	0,01	0,02	0,00	0,00	0,01	0,02	0,03	0,01	0,01	0,03	0,07	0,02	0,03	0,07	0,13	0,05	0,01	0,02	0,03	0,01
31	32	Myoxocephalus scorpius	0,09	0,03	0,01	0,13	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
32	33	Osmerus eperlanus	0,82	0,28	0,31	0,55	0,00	0,00	0,00	0,00	0,01	0,00	0,01	0,01	0,01	0,00	0,00	0,01	0,01	0,00	0,00	0,01	0,04	0,01	0,01	0,03	0,02	0,01	0,01	0,01
33	34	Platichthys flesus	23,56	9,18	4,24	1,95	0,00	0,00	0,00	0,00	0,07	0,03	0,03	0,03	0,07	0,03	0,01	0,01	0,15	0,06	0,03	0,01	0,58	0,34	0,22	0,15	0,36	0,26	0,18	0,13
34	35	Pleuronectes platessa	335,73	7,40	4,28	4,23	0,00	0,00	0,00	0,00	2,35	0,05	0,23	1,09	2,35	0,05	0,03	0,03	3,52	0,08	0,04	0,04	13,09	0,81	0,73	0,80	7,22	0,68	0,66	0,72
35	36	Pomatoschistus microps	0,95	7,55	9,59	40,30	0,01	0,00	0,00	0,00	0,00	0,19	0,19	0,37	0,03	0,23	0,29	1,21	0,03	0,23	0,29	1,21	0,08	0,81	0,72	4,02	0,02	0,36	0,15	1,60
36	37	Pomatoschistus minutus	3,59	10,67	8,39	16,43	0,00	0,00	0,00	0,00	0,07	0,28	0,00	0,00	0,11	0,32	0,25	0,49	0,11	0,32	0,25	0,49	0,27	0,89	0,57	1,95	0,05	0,25	0,07	0,96
37	38	Solea solea	1,24	0,45	0,43	0,13	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,00	0,00	0,00	0,00	0,05	0,01	0,02	0,01	0,13	0,04	0,06	0,02	0,07	0,02	0,03	0,01
38	39	Syngnathus rostellatus	0,13	0,21	0,24	1,85	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,00	0,00	0,00	0,01	0,00	0,00	0,01	0,04	0,00	0,00	0,00	0,02
39	40	Zoarces viviparus	0,93	0,10	0,09	0,11	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00
40	41	Anas acuta	1,00	1,74	4,27	4,81	0,00	0,00	0,00	0,00	0,00	0,01	0,00	0,00	0,00	0,01	0,01	0,01	0,06	0,11	0,26	0,29	0,10	0,17	0,42	0,47	0,03	0,06	0,15	0,17
41	42	Anas platyrhynchos	2,69	4,25	5,20	2,05	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,06	0,09	0,11	0,04	0,09	0,15	0,18	0,07	0,03	0,05	0,06	0,03
42	43	Calidris alpina	1,42	2,92	3,46	4,06	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,01	0,00	0,01	0,01	0,01	0,02	0,05	0,06	0,07	0,29	0,61	0,72	0,84	0,27	0,55	0,65	0,76
43	44	Calidris canutus	5,48	5,61	2,72	3,56	0,00	0,00	0,00	0,00	0,02	0,02	0,06	0,06	0,02	0,02	0,01	0,01	1,08	1,10	0,53	0,70	1,38	1,41	0,69	0,90	0,28	0,29	0,14	0,18
44	45	Haematopus ostralegus	32,44	31,49	22,20	21,23	0,00	0,00	0,00	0,00	0,09	0,09	0,00	0,00	0,09	0,09	0,06	0,06	0,88	0,85	0,60	0,57	4,17	4,05	2,85	2,73	3,21	3,11	2,19	2,10
45	46	Larus argentatus	6,74	6,34	2,41	1,66	0,00	0,00	0,00	0,00	0,01	0,01	0,00	0,00	0,01	0,01	0,00	0,00	0,30	0,29	0,11	0,07	0,40	0,37	0,14	0,10	0,08	0,08	0,03	0,02
46	47	Larus canus	0,57	0,86	1,39	2,13	0,00	0,00	0,00	0,00	0,00	0,00	0,02	0,02	0,00	0,00	0,00	0,00	0,02	0,03	0,05	0,08	0,03	0,04	0,07	0,11	0,01	0,01	0,01	0,02
47	48	Larus ridibundus	3,88	4,29	4,29	4,48	0,00	0,00	0,00	0,00	0,02	0,02	0,01	0,01	0,02	0,02	0,02	0,02	0,21	0,23	0,23	0,24	0,39	0,43	0,43	0,45	0,16	0,18	0,18	0,19
48	49	Limosa lapponica	2,06	2,38	2,74	3,94	0,00	0,00	0,00	0,00	0,01	0,01	0,07	0,07	0,01	0,01	0,01	0,01	0,33	0,38	0,44	0,63	0,42	0,48	0,56	0,80	0,08	0,10	0,11	0,16
49	50	Numenius arquata	11,78	20,07	24,66	26,58	0,00	0,00	0,00	0,00	0,03	0,05	0,00	0,00	0,03	0,05	0,07	0,07	0,39	0,66	0,81	0,88	1,22	2,08	2,56	2,76	0,80	1,37	1,68	1,81
50	51	Pluvialis apricaria	0,33	1,48	1,08	0,71	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,03	0,02	0,02	0,01	0,04	0,03	0,02	0,00	0,01	0,01	0,00
51	52	Recurvirostra avosetta	0,70	1,13	0,85	0,57	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,00	0,00	0,00	0,00	0,05	0,07	0,06	0,04	0,07	0,11	0,08	0,06	0,02	0,04	0,03	0,02
52	53	Somateria mollissima	6,04	8,99	3,29	2,55	0,00	0,00	0,00	0,00	0,02	0,02	0,05	0,06	0,02	0,02	0,01	0,01	0,15	0,23	0,08	0,07	0,82	1,22	0,45	0,35	0,65	0,97	0,35	0,27
53	54	Tadorna tadorna	14,46	17,55	17,43	22,13	0,00	0,00	0,00	0,00	0,04	0,05	0,00	0,00	0,04	0,05	0,05	0,06	0,38	0,46	0,45	0,58	1,95	2,37	2,35	2,99	1,54	1,87	1,85	2,35
54	55	Tringa totanus	0,83	1,00	1,31	0,98	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,01	0,01	0,28	0,34	0,44	0,33	0,27	0,33	0,43	0,32
55	56	DOC	2042,90	1913,97	1748,55	1833,98	444,92	424,83	372,56	361,45	452,53	398,95	323,56	356,65	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
56	57	Sediment POC	39060,00	39060,00	39060,00	39060,00	0,00	0,00	0,00	0,00	318,89	445,12	70,08	180,99	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
57	58	Suspended POC	4348,67	1333,64	2122,98	2382,71	303,75	413,85	505,65	548,76	205,97	237,53	688,79	606,84	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Table S2. Ratios between production and biomass (P/B; d^{-1}), production and respiration (P/R; -) and production and consumption (P/C; -) for each ENA compartment per decade as used in the four networks (BZ1980s, BZ1990s, BZ2000s and BZ2010s). Sources (with numbers in square brackets referring to compartment numbers in 2000/2010): [20] Baird et al. 2004. Mar Ecol Prog Ser 279:45-61; [6-14, 17-19, 21, 24-27, 29] Schückel et al. 2015. Mar Ecol Prog Ser 536:25-38; [1-5, 15-16, 28, 30-40, 43, 45, 48, 50-55] unpublished data supplied by Ulricke Schückel (Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung, Wadden Sea Station Sylt Hafenstr. 43, D-25992, List/ Sylt, Germany); [22-23, 41-42, 44, 46-47, 49] unpublished data supplied by Sabine Horn (Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung, Wadden Sea Station Sylt Hafenstr. 43, D-25992, List/ Sylt, Germany).

Compartment nr			P/B				P/R				P/C			
1980/ 1990	2000/ 2010	Compartment name	1980	1990	2000	2010	1980	1990	2000	2010	1980	1990	2000	2010
1	1	Phytoplankton	0.780	0.441	0.475	0.543	2.825	2.825	2.825	2.825				
2	2	Microphytobenthos	0.055	0.055	0.055	0.055	3.788	3.788	3.788	3.788				
3	3	Freshwater algae	0.050	0.050	0.050	0.050	2.825	2.825	2.825	2.825				
4	4	Pelagic Bacteria	0.300	0.300	0.300	0.300	1.000	1.000	1.000	1.000	0.500	0.500	0.500	0.500
5	5	Zooplankton	0.597	0.597	0.597	0.597	0.843	0.843	0.843	0.843	0.300	0.300	0.300	0.300
6	6	Benthic Bacteria	0.157	0.157	0.157	0.157	0.899	0.899	0.899	0.899	0.400	0.400	0.400	0.400
7	7	Meiofauna	0.022	0.022	0.022	0.022	0.263	0.263	0.263	0.263	0.153	0.153	0.153	0.153
8	8	Peringia ulvae	0.004	0.004	0.004	0.004	0.649	0.649	0.649	0.649	0.100	0.100	0.100	0.100
9	9	Littorina littorea	0.002	0.002	0.002	0.002	0.333	0.333	0.333	0.333	0.100	0.100	0.100	0.100
10	10	Arenicola marina	0.007	0.007	0.007	0.007	1.075	1.075	1.075	1.075	0.150	0.150	0.150	0.150
11	11	Eteone sp	0.003	0.003	0.003	0.003	0.091	0.091	0.091	0.091	0.074	0.074	0.074	0.074
12	12	Hediste diversicolor	0.003	0.003	0.003	0.003	0.247	0.247	0.247	0.247	0.064	0.064	0.064	0.064
13	13	Nereis spec.	0.003	0.003	0.003	0.003	0.247	0.247	0.247	0.247	0.064	0.064	0.064	0.064
14	14	Heteromastus filiformis	0.005	0.005	0.005	0.005	0.525	0.525	0.525	0.525	0.064	0.064	0.064	0.064
15	15	Lanice conchilega	0.005	0.005	0.006	0.006	0.523	0.523	0.523	0.523	0.267	0.267	0.267	0.267
16	16	Marenzelleria viridis	0.014	0.014	0.014	0.014	0.351	0.350	0.350	0.350	0.130	0.130	0.130	0.130
17	17	Nephtys hombergii	0.011	0.011	0.011	0.011	1.053	1.053	1.053	1.053	0.185	0.185	0.185	0.185
18	18	Scoloplos armiger	0.001	0.001	0.001	0.001	0.131	0.131	0.131	0.131	0.035	0.035	0.035	0.035
19	19	Corophium spp	0.004	0.004	0.004	0.004	0.213	0.213	0.213	0.213	0.146	0.146	0.146	0.146
20	20	Gammarus spp.	0.004	0.004	0.004	0.004	0.167	0.167	0.167	0.167	0.111	0.111	0.111	0.111
21	21	Cerastoderma edule	0.005	0.005	0.005	0.005	3.189	3.189	3.189	3.189	0.200	0.200	0.200	0.200
	22	Magallana gigas			0.001	0.001			0.077	0.077			0.067	0.067
22	23	Ensis leei	0.020	0.020	0.020	0.020	0.067	0.067	0.067	0.067	0.036	0.036	0.036	0.036
23	24	Limecola balthica	0.008	0.008	0.008	0.008	5.371	5.371	5.371	5.371	0.155	0.155	0.155	0.155
24	25	Mya arenaria	0.002	0.002	0.002	0.002	0.430	0.430	0.430	0.430	0.200	0.200	0.200	0.200
25	26	Mytilus edulis	0.001	0.001	0.001	0.001	0.182	0.182	0.182	0.182	0.135	0.135	0.135	0.135
26	27	Scrobicularia plana	0.005	0.005	0.005	0.005	1.300	1.300	1.300	1.300	0.200	0.200	0.200	0.200
27	28	Carcinus maenas	0.004	0.004	0.004	0.004	0.640	0.640	0.640	0.640	0.044	0.026	0.024	0.029
28	29	Crangon crangon	0.011	0.011	0.011	0.011	0.038	0.038	0.038	0.038	0.021	0.025	0.026	0.026
29	30	Ammodytes tobianus	0.006	0.006	0.006	0.006	7.087	7.194	7.150	7.212	0.625	0.624	0.624	0.625
30	31	Clupea harengus	0.008	0.008	0.008	0.008	0.500	0.500	0.500	0.500	0.250	0.250	0.250	0.250
31	32	Myoxocephalus scorpius	0.004	0.004	0.004	0.004	1.842	1.833	3.000	1.857	0.385	0.407	0.429	0.388
32	33	Osmerus eperlanus	0.010	0.010	0.010	0.010	0.704	0.703	0.703	0.704	0.208	0.208	0.208	0.208
33	34	Platichthys flesus	0.003	0.003	0.003	0.003	0.479	0.479	0.479	0.479	0.121	0.080	0.057	0.039
34	35	Pleuronectes platessa	0.007	0.007	0.007	0.007	0.667	0.667	0.667	0.667	0.179	0.064	0.041	0.037
35	36	Pomatoschistus microps	0.030	0.030	0.030	0.030	1.000	1.000	1.000	1.000	0.359	0.278	0.398	0.301
36	37	Pomatoschistus minutus	0.030	0.030	0.030	0.030	1.000	1.000	1.000	1.000	0.406	0.359	0.438	0.253
37	38	Solea solea	0.002	0.002	0.002	0.002	0.056	0.073	0.042	0.046	0.022	0.028	0.016	0.018
38	39	Syngnathus rostellatus	0.003	0.004	0.003	0.004	0.461	0.463	0.461	0.462	0.149	0.150	0.150	0.150
39	40	Zoarces viviparus	0.004	0.004	0.004	0.004	1.806	1.810	1.789	1.792	0.380	0.380	0.382	0.384
40	41	Anas acuta	0.003	0.003	0.003	0.003	0.048	0.048	0.048	0.048	0.029	0.029	0.029	0.029
41	42	Anas platyrhynchos	0.001	0.001	0.001	0.001	0.027	0.027	0.027	0.027	0.017	0.017	0.017	0.017
42	43	Calidris alpina	0.003	0.003	0.003	0.003	0.159	0.159	0.159	0.159	0.013	0.013	0.013	0.013
43	44	Calidris canutus	0.004	0.004	0.004	0.004	0.019	0.019	0.019	0.019	0.015	0.015	0.015	0.015
44	45	Haematopus ostralegus	0.003	0.003	0.003	0.003	0.100	0.100	0.100	0.100	0.021	0.021	0.021	0.021
45	46	Larus argentatus	0.002	0.002	0.002	0.002	0.033	0.033	0.033	0.033	0.026	0.026	0.026	0.026
46	47	Larus canus	0.002	0.002	0.002	0.002	0.046	0.045	0.046	0.045	0.035	0.034	0.035	0.034
47	48	Larus ridibundus	0.005	0.005	0.005	0.005	0.094	0.094	0.094	0.094	0.050	0.050	0.050	0.050
48	49	Limosa lapponica	0.004	0.004	0.004	0.004	0.023	0.023	0.023	0.023	0.018	0.018	0.018	0.018
49	50	Numenius arquata	0.003	0.003	0.003	0.003	0.082	0.082	0.082	0.082	0.026	0.026	0.026	0.026
50	51	Pluvialis apricaria	0.001	0.001	0.001	0.001	0.036	0.036	0.036	0.036	0.027	0.027	0.027	0.027
51	52	Recurvirostra avosetta	0.003	0.003	0.003	0.003	0.041	0.041	0.041	0.041	0.027	0.027	0.027	0.027
52	53	Somateria mollissima	0.003	0.003	0.003	0.003	0.106	0.106	0.106	0.106	0.020	0.020	0.020	0.020
53	54	Tadorna tadorna	0.003	0.003	0.003	0.003	0.104	0.104	0.104	0.104	0.020	0.020	0.020	0.020
54	55	Tringa totanus	0.003	0.003	0.003	0.003	0.270	0.270	0.270	0.270	0.008	0.008	0.008	0.008

Table S3. Diet matrices of the models for each predator compartment in percent (%) of the total diet. The value 0.0 % (set to 0.00001 %) is indicating that the prey species is part of the diet but for our study quantitatively not very relevant. Diet matrices for the BZ1980s and BZ1990s networks are the same, as well as the ones for the BZ2000s and BZ2010s networks.

vertical	Pelagic Bacteria	Zooplankton	Benthic Bacteria	Meiofauna	Peringia ulvae	Littorina littorea	Arenicola marina	Eteone sp	Hediste diversicolor	Nereis spec.
PERIOD	All decades	All decades	All decades	All decades	All decades	All decades	All decades	All decades	All decades	All decades
Phytoplankton	0	0,24975	0	0	0	0	0	0	0,14985	0,14985
Microphytobenthos	0	0	0	0,18	0,75	0,73	0,1	0	0,3	0,3
Freshwater algae	0	0,00025	0	0	0	0	0	0	0,00015	0,00015
Pelagic Bacteria	0	0,05	0	0	0	0	0	0	0	0
Zooplankton	0	0,1	0	0	0	0	0	0	0	0
Benthic Bacteria	0	0	0	0,3	0,125	0,14	0,35	0	0,1	0,1
Meiofauna	0	0	0	0	0	0	0	0	0,1	0,1
Peringia ulvae	0	0	0	0	0	0	0	0,7	0,05	0,05
Littorina littorea	0	0	0	0	0	0	0	0	0	0
Arenicola marina	0	0	0	0	0	0	0	0	0	0
Eteone sp	0	0	0	0	0	0	0	0	0	0
Hediste diversicolor	0	0	0	0	0	0	0	0	0	0
Nereis spec.	0	0	0	0	0	0	0	0,1	0	0
Heteromastus filiformis	0	0	0	0	0	0	0	0	0	0
Lanice conchilega	0	0	0	0	0	0	0	0	0	0
Marenzelleria viridis	0	0	0	0	0	0	0	0,2	0	0
Nephtys hombergii	0	0	0	0	0	0	0	0	0	0
Scoloplos armiger	0	0	0	0	0	0	0	0	0	0
Corophium spp	0	0	0	0	0	0	0	0	0	0
Gammarus spp.	0	0	0	0	0	0	0	0	0	0
Cerastoderma edule	0	0	0	0	0	0	0	0	0	0
Magallana gigas	0	0	0	0	0	0	0	0	0	0
Ensis leei	0	0	0	0	0	0	0	0	0	0
Limecola balthica	0	0	0	0	0	0	0	0	0	0
Mya arenaria	0	0	0	0	0	0	0	0	0	0
Mytilus edulis	0	0	0	0	0	0	0	0	0	0
Scrobicularia plana	0	0	0	0	0	0	0	0	0	0
Carcinus maenas	0	0	0	0	0	0	0	0	0	0
Crangon crangon	0	0	0	0	0	0	0	0	0	0
Ammodytes tobianus	0	0	0	0	0	0	0	0	0	0
Clupea harengus	0	0	0	0	0	0	0	0	0	0
Myoxocephalus scorpius	0	0	0	0	0	0	0	0	0	0
Osmerus eperlanus	0	0	0	0	0	0	0	0	0	0
Platichthys flesus	0	0	0	0	0	0	0	0	0	0
Pleuronectes platessa	0	0	0	0	0	0	0	0	0	0
Pomatoschistus microps	0	0	0	0	0	0	0	0	0	0
Pomatoschistus minutus	0	0	0	0	0	0	0	0	0	0
Solea solea	0	0	0	0	0	0	0	0	0	0
Syngnathus rostellatus	0	0	0	0	0	0	0	0	0	0
Zoarces viviparus	0	0	0	0	0	0	0	0	0	0
Anas acuta	0	0	0	0	0	0	0	0	0	0
Anas platyrhynchos	0	0	0	0	0	0	0	0	0	0
Calidris alpina	0	0	0	0	0	0	0	0	0	0
Calidris canutus	0	0	0	0	0	0	0	0	0	0
Haematopus ostralegus	0	0	0	0	0	0	0	0	0	0
Larus argentatus	0	0	0	0	0	0	0	0	0	0
Larus canus	0	0	0	0	0	0	0	0	0	0
Larus ridibundus	0	0	0	0	0	0	0	0	0	0
Limosa lapponica	0	0	0	0	0	0	0	0	0	0
Numenius arquata	0	0	0	0	0	0	0	0	0	0
Pluvialis apricaria	0	0	0	0	0	0	0	0	0	0
Recurvirostra avosetta	0	0	0	0	0	0	0	0	0	0
Somateria mollissima	0	0	0	0	0	0	0	0	0	0
Tadorna tadorna	0	0	0	0	0	0	0	0	0	0
Tringa totanus	0	0	0	0	0	0	0	0	0	0
DOC	1	0	0	0	0	0	0	0	0	0
Sediment POC	0	0	1	0,42	0,125	0,13	0,55	0	0,15	0,15
Suspended POC	0	0,6	0	0,1	0	0	0	0	0,15	0,15

vertical	Heteromastus filiformis	Lanice conchilega	Marenzelleria viridis	Nephtys hombergii	Scoloplos armiger	Corophium spp	Gammarus spp.	Cerastoderma edule	Magallana gigas	Magallana gigas
PERIOD	All decades	All decades	All decades	All decades	All decades	All decades	All decades	All decades	1980s/1990s	2000s/2010s
Phytoplankton	0	0,84915	0	0	0	0	0	0,2	0	0,19
Microphytobenthos	0,05	0	0,1	0	0,1	0,65	0,35	0,21	0	0,15
Freshwater algae	0	0,00085	0	0	0	0	0	0,416	0	0,488
Pelagic Bacteria	0	0,01	0	0	0	0	0	0,01	0	0,01
Zooplankton	0	0	0	0	0	0	0	0	0	0
Benthic Bacteria	0,2	0	0,1	0	0,4	0,13	0,29	0	0	0
Meiofauna	0	0	0,01	0,33	0	0	0	0	0	0
Peringia ulvae	0	0	0	0	0	0	0	0	0	0
Littorina littorea	0	0	0	0	0	0	0	0	0	0
Arenicola marina	0	0	0	0	0	0	0	0	0	0
Eteone sp	0	0	0	0	0	0	0	0	0	0
Hediste diversicolor	0	0	0	0	0	0	0	0	0	0
Nereis spec.	0	0	0	0	0	0	0	0	0	0
Heteromastus filiformis	0	0	0	0,01	0	0	0	0	0	0
Lanice conchilega	0	0	0	0	0	0	0	0	0	0
Marenzelleria viridis	0	0	0	0	0	0	0	0	0	0
Nephtys hombergii	0	0	0	0	0	0	0	0	0	0
Scoloplos armiger	0	0	0	0,02	0	0	0	0	0	0
Corophium spp	0	0	0	0	0	0	0	0	0	0
Gammarus spp.	0	0	0	0	0	0	0	0	0	0
Cerastoderma edule	0	0	0	0	0	0	0	0	0	0
Magallana gigas	0	0	0	0	0	0	0	0	0	0
Ensis leei	0	0	0	0	0	0	0	0	0	0
Limecola balthica	0	0	0	0	0	0	0	0	0	0
Mya arenaria	0	0	0	0	0	0	0	0	0	0
Mytilus edulis	0	0	0	0	0	0	0	0	0	0
Scrobicularia plana	0	0	0	0	0	0	0	0	0	0
Carcinus maenas	0	0	0	0	0	0	0	0	0	0
Crangon crangon	0	0	0	0	0	0	0	0	0	0
Ammodytes tobianus	0	0	0	0	0	0	0	0	0	0
Clupea harengus	0	0	0	0	0	0	0	0	0	0
Myoxocephalus scorpius	0	0	0	0	0	0	0	0	0	0
Osmerus eperlanus	0	0	0	0	0	0	0	0	0	0
Platichthys flesus	0	0	0	0	0	0	0	0	0	0
Pleuronectes platessa	0	0	0	0	0	0	0	0	0	0
Pomatoschistus microps	0	0	0	0	0	0	0	0	0	0
Pomatoschistus minutus	0	0	0	0	0	0	0	0	0	0
Solea solea	0	0	0	0	0	0	0	0	0	0
Syngnathus rostellatus	0	0	0	0	0	0	0	0	0	0
Zoarces viviparus	0	0	0	0	0	0	0	0	0	0
Anas acuta	0	0	0	0	0	0	0	0	0	0
Anas platyrhynchos	0	0	0	0	0	0	0	0	0	0
Calidris alpina	0	0	0	0	0	0	0	0	0	0
Calidris canutus	0	0	0	0	0	0	0	0	0	0
Haematopus ostralegus	0	0	0	0	0	0	0	0	0	0
Larus argentatus	0	0	0	0	0	0	0	0	0	0
Larus canus	0	0	0	0	0	0	0	0	0	0
Larus ridibundus	0	0	0	0	0	0	0	0	0	0
Limosa lapponica	0	0	0	0	0	0	0	0	0	0
Numenius arquata	0	0	0	0	0	0	0	0	0	0
Pluvialis apricaria	0	0	0	0	0	0	0	0	0	0
Recurvirostra avosetta	0	0	0	0	0	0	0	0	0	0
Somateria mollissima	0	0	0	0	0	0	0	0	0	0
Tadorna tadorna	0	0	0	0	0	0	0	0	0	0
Tringa totanus	0	0	0	0	0	0	0	0	0	0
DOC	0,3	0	0	0	0	0	0	0	0	0
Sediment POC	0,45	0	0,6	0,64	0,4	0,13	0,36	0	0	0
Suspended POC	0	0,14	0,19	0	0,1	0,09	0	0,164	0	0,162

vertical	Ensis leei	Limecola balthica	Mya arenaria	Mytilus edulis	Scrobicularia plana	Carcinus maenas	Crangon crangon	Ammodytes tobianus	Clupea harengus	Myoxocephalus scorpius
PERIOD	All decades	All decades	All decades	All decades	All decades	All decades	All decades	All decades	All decades	All decades
Phytoplankton	0,527	0,2	0,15	0,2	0,15	0	0	0	0	0
Microphytobenthos	0,21	0,3	0,3	0,18	0,29	0,08	0,05	0	0	0
Freshwater algae	0,1	0,248	0,41	0,456	0,344	0	0	0	0	0
Pelagic Bacteria	0,01	0	0,01	0,01	0	0	0	0	0	0
Zooplankton	0	0	0	0	0	0	0	0,75	1	0
Benthic Bacteria	0	0,075	0	0	0,05	0,02	0,1	0	0	0
Meiofauna	0	0	0	0	0	0,05	0,1	0,1	0	0
Peringia ulvae	0	0	0	0	0	0	0,12	0,02	0	0
Littorina littorea	0	0	0	0	0	0	0	0	0	0
Arenicola marina	0	0	0	0	0	0	0	0,01	0	0
Eteone sp	0	0	0	0	0	0	0	0	0	0
Hediste diversicolor	0	0	0	0	0	0,15	0,04	0,01	0	0
Nereis spec.	0	0	0	0	0	0	0	0	0	0
Heteromastus filiformis	0	0	0	0	0	0	0,04	0,01	0	0
Lanice conchilega	0	0	0	0	0	0	0	0	0	0
Marenzelleria viridis	0	0	0	0	0	0	0	0	0	0
Nephtys hombergii	0	0	0	0	0	0	0	0	0	0
Scoloplos armiger	0	0	0	0	0	0	0,03	0	0	0
Corophium spp	0	0	0	0	0	0	0,05	0,05	0	0
Gammarus spp.	0	0	0	0	0	0	0	0,05	0	0
Cerastoderma edule	0	0	0	0	0	0,23	0,24	0	0	0
Magallana gigas	0	0	0	0	0	0	0	0	0	0
Ensis leei	0	0	0	0	0	0	0	0	0	0
Limecola balthica	0	0	0	0	0	0,05	0,11	0	0	0
Mya arenaria	0	0	0	0	0	0	0	0	0	0
Mytilus edulis	0	0	0	0	0	0,02	0,02	0	0	0
Scrobicularia plana	0	0	0	0	0	0,06	0	0	0	0
Carcinus maenas	0	0	0	0	0	0,03	0	0	0	0,497
Crangon crangon	0	0	0	0	0	0,17	0	0	0	0,45
Ammodytes tobianus	0	0	0	0	0	0	0	0	0	0
Clupea harengus	0	0	0	0	0	0	0	0	0	0
Myoxocephalus scorpius	0	0	0	0	0	0	0	0	0	0
Osmerus eperlanus	0	0	0	0	0	0	0	0	0	0
Platichthys flesus	0	0	0	0	0	0	0	0	0	0
Pleuronectes platessa	0	0	0	0	0	0	0	0	0	0
Pomatoschistus microps	0	0	0	0	0	0,02	0	0	0	0,046
Pomatoschistus minutus	0	0	0	0	0	0,02	0	0	0	0,007
Solea solea	0	0	0	0	0	0	0	0	0	0
Syngnathus rostellatus	0	0	0	0	0	0	0	0	0	0
Zoarces viviparus	0	0	0	0	0	0	0	0	0	0
Anas acuta	0	0	0	0	0	0	0	0	0	0
Anas platyrhynchos	0	0	0	0	0	0	0	0	0	0
Calidris alpina	0	0	0	0	0	0	0	0	0	0
Calidris canutus	0	0	0	0	0	0	0	0	0	0
Haematopus ostralegus	0	0	0	0	0	0	0	0	0	0
Larus argentatus	0	0	0	0	0	0	0	0	0	0
Larus canus	0	0	0	0	0	0	0	0	0	0
Larus ridibundus	0	0	0	0	0	0	0	0	0	0
Limosa lapponica	0	0	0	0	0	0	0	0	0	0
Numenius arquata	0	0	0	0	0	0	0	0	0	0
Pluvialis apricaria	0	0	0	0	0	0	0	0	0	0
Recurvirostra avosetta	0	0	0	0	0	0	0	0	0	0
Somateria mollissima	0	0	0	0	0	0	0	0	0	0
Tadorna tadorna	0	0	0	0	0	0	0	0	0	0
Tringa totanus	0	0	0	0	0	0	0	0	0	0
DOC	0	0	0	0	0	0	0	0	0	0
Sediment POC	0	0,075	0	0	0,05	0,1	0,1	0	0	0
Suspended POC	0,153	0,102	0,13	0,154	0,116	0	0	0	0	0

vertical	Osmerus eperlanus	Platichthys flesus	Pleuronectes platessa	Pomatoschistus microps	Pomatoschistus minutus	Solea solea	Syngnathus rostellatus	Zoarces viviparus	Anas acuta	Anas platyrhynchos
PERIOD	All decades	All decades	All decades	All decades	All decades	All decades	All decades	All decades	All decades	All decades
Phytoplankton	0	0	0	0	0	0	0,0999	0	0	0
Microphytobenthos	0	0	0	0	0	0	0,02	0	0	0
Freshwater algae	0	0	0	0	0	0	0,0001	0	0	0
Pelagic Bacteria	0	0	0	0	0	0	0	0	0	0
Zooplankton	0,5	0,05	0	0,4	0,4	0	0,8	0	0	0
Benthic Bacteria	0	0	0	0	0	0	0	0	0	0
Meiofauna	0	0	0,01	0,15	0,15	0,4	0	0,2	0	0
Peringia ulvae	0	0,15	0	0	0	0,05	0,02	0	0,3	0
Littorina littorea	0	0	0	0	0	0	0	0	0	0
Arenicola marina	0	0,25	0,2	0	0	0,11	0	0	0	0
Eteone sp	0	0,01	0	0	0	0	0	0	0,04	0,09
Hediste diversicolor	0	0,1	0,3	0,06	0,06	0,11	0	0	0,2	0,08
Nereis spec.	0	0	0	0,01	0,01	0	0	0	0	0,05
Heteromastus filiformis	0	0,04	0	0,03	0,03	0	0	0	0,04	0,03
Lanice conchilega	0	0	0,03	0	0	0	0	0	0	0,03
Marenzelleria viridis	0	0	0	0	0	0	0	0	0,04	0,05
Nephtys hombergii	0	0	0	0	0	0	0	0	0,04	0,21
Scoloplos armiger	0	0	0	0,05	0,05	0	0	0	0	0,46
Corophium spp	0	0	0	0,05	0,05	0,1	0	0,4	0	0
Gammarus spp.	0	0	0	0,04	0,04	0,01	0	0	0,04	0
Cerastoderma edule	0	0,05	0,14	0	0	0	0	0	0,21	0
Magallana gigas	0	0	0	0	0	0	0	0	0	0
Ensis leei	0	0,03	0,03	0	0	0,02	0	0	0	0
Limecola balthica	0	0	0,13	0,1	0,1	0	0	0,05	0,04	0
Mya arenaria	0	0	0	0	0	0	0	0	0	0
Mytilus edulis	0	0	0	0	0	0	0	0	0,04	0
Scrobicularia plana	0	0	0	0	0	0	0	0	0	0
Carcinus maenas	0	0,05	0,08	0,06	0,06	0	0	0,15	0,005	0
Crangon crangon	0,5	0,22	0,08	0,05	0,05	0,1	0,02	0,2	0,005	0
Ammodytes tobianus	0	0	0	0	0	0	0	0	0	0
Clupea harengus	0	0	0	0	0	0	0	0	0	0
Myoxocephalus scorpius	0	0	0	0	0	0	0	0	0	0
Osmerus eperlanus	0	0	0	0	0	0	0	0	0	0
Platichthys flesus	0	0	0	0	0	0	0	0	0	0
Pleuronectes platessa	0	0	0	0	0	0	0	0	0	0
Pomatoschistus microps	0	0,025	0	0	0	0,05	0,02	0	0	0
Pomatoschistus minutus	0	0,025	0	0	0	0,05	0,02	0	0	0
Solea solea	0	0	0	0	0	0	0	0	0	0
Syngnathus rostellatus	0	0	0	0	0	0	0	0	0	0
Zoarces viviparus	0	0	0	0	0	0	0	0	0	0
Anas acuta	0	0	0	0	0	0	0	0	0	0
Anas platyrhynchos	0	0	0	0	0	0	0	0	0	0
Calidris alpina	0	0	0	0	0	0	0	0	0	0
Calidris canutus	0	0	0	0	0	0	0	0	0	0
Haematopus ostralegus	0	0	0	0	0	0	0	0	0	0
Larus argentatus	0	0	0	0	0	0	0	0	0	0
Larus canus	0	0	0	0	0	0	0	0	0	0
Larus ridibundus	0	0	0	0	0	0	0	0	0	0
Limosa lapponica	0	0	0	0	0	0	0	0	0	0
Numenius arquata	0	0	0	0	0	0	0	0	0	0
Pluvialis apricaria	0	0	0	0	0	0	0	0	0	0
Recurvirostra avosetta	0	0	0	0	0	0	0	0	0	0
Somateria mollissima	0	0	0	0	0	0	0	0	0	0
Tadorna tadorna	0	0	0	0	0	0	0	0	0	0
Tringa totanus	0	0	0	0	0	0	0	0	0	0
DOC	0	0	0	0	0	0	0	0	0	0
Sediment POC	0	0	0	0	0	0	0	0	0	0
Suspended POC	0	0	0	0	0	0	0	0	0	0

vertical	Calidris alpina	Calidris canutus	Haematopus ostralegus	Haematopus ostralegus	Larus argentatus	Larus canus	Larus ridibundus	Limosa lapponica	Numenius arquata	Pluvialis apricaria
PERIOD	All decades	All decades	1980s/1990s	2000s/2010s	All decades	All decades	All decades	All decades	All decades	All decades
Phytoplankton	0	0	0	0	0	0	0	0	0	0
Microphytobenthos	0	0	0	0	0	0	0	0	0	0
Freshwater algae	0	0	0	0	0	0	0	0	0	0
Pelagic Bacteria	0	0	0	0	0	0	0	0	0	0
Zooplankton	0	0	0	0	0	0	0	0	0	0
Benthic Bacteria	0	0	0	0	0	0	0	0	0	0
Meiofauna	0	0	0	0	0	0	0	0	0	0
Peringia ulvae	0,2	0	0	0	0	0	0	0,01	0	0,48
Littorina littorea	0	0	0	0	0,004	0	0	0,01	0	0
Arenicola marina	0,09	0	0,05	0,05	0	0	0,55	0,3	0,29	0
Eteone sp	0,01	0	0	0	0	0	0	0,01	0	0,06
Hediste diversicolor	0,09	0	0,04	0,04	0,01	0,0129	0,08	0,25	0	0
Nereis spec.	0,04	0	0	0	0	0,0012	0	0,1	0	0
Heteromastus filiformis	0,09	0	0	0	0	0	0,01	0,02	0	0
Lanice conchilega	0,04	0	0	0	0	0	0,01	0,02	0	0
Marenzelleria viridis	0,01	0	0	0	0	0	0	0	0	0
Nephtys hombergii	0,125	0	0	0	0,011	0,032	0,05	0,08	0,019	0,16
Scoloplos armiger	0	0	0	0	0	0	0,1	0,05	0	0,3
Corophium spp	0,125	0	0,02	0,02	0,015	0,017	0	0	0	0
Gammarus spp.	0	0	0	0	0	0	0	0	0,001	0
Cerastoderma edule	0,01	0,81	0,28	0,28	0,19	0,76	0,1	0,02	0,5	0
Magallana gigas	0	0	0	0,01	0	0	0	0	0	0
Ensis leei	0	0	0	0	0	0	0	0,02	0	0
Limecola balthica	0,04	0,19	0,25	0,25	0,15	0,1769	0,1	0,05	0,13	0
Mya arenaria	0	0	0,01	0,01	0	0	0	0	0	0
Mytilus edulis	0	0	0,26	0,25	0,6	0	0	0,02	0	0
Scrobicularia plana	0	0	0,05	0,05	0	0	0	0	0	0
Carcinus maenas	0,09	0	0,02	0,02	0,02	0	0	0,02	0,05	0
Crangon crangon	0,04	0	0,02	0,02	0	0	0	0,02	0,01	0
Ammodytes tobianus	0	0	0	0	0	0	0	0	0	0
Clupea harengus	0	0	0	0	0	0	0	0	0	0
Myoxocephalus scorpius	0	0	0	0	0	0	0	0	0	0
Osmerus eperlanus	0	0	0	0	0	0	0	0	0	0
Platichthys flesus	0	0	0	0	0	0	0	0	0	0
Pleuronectes platessa	0	0	0	0	0	0	0	0	0	0
Pomatoschistus microps	0	0	0	0	0	0	0	0	0	0
Pomatoschistus minutus	0	0	0	0	0	0	0	0	0	0
Solea solea	0	0	0	0	0	0	0	0	0	0
Syngnathus rostellatus	0	0	0	0	0	0	0	0	0	0
Zoarces viviparus	0	0	0	0	0	0	0	0	0	0
Anas acuta	0	0	0	0	0	0	0	0	0	0
Anas platyrhynchos	0	0	0	0	0	0	0	0	0	0
Calidris alpina	0	0	0	0	0	0	0	0	0	0
Calidris canutus	0	0	0	0	0	0	0	0	0	0
Haematopus ostralegus	0	0	0	0	0	0	0	0	0	0
Larus argentatus	0	0	0	0	0	0	0	0	0	0
Larus canus	0	0	0	0	0	0	0	0	0	0
Larus ridibundus	0	0	0	0	0	0	0	0	0	0
Limosa lapponica	0	0	0	0	0	0	0	0	0	0
Numenius arquata	0	0	0	0	0	0	0	0	0	0
Pluvialis apricaria	0	0	0	0	0	0	0	0	0	0
Recurvirostra avosetta	0	0	0	0	0	0	0	0	0	0
Somateria mollissima	0	0	0	0	0	0	0	0	0	0
Tadorna tadorna	0	0	0	0	0	0	0	0	0	0
Tringa totanus	0	0	0	0	0	0	0	0	0	0
DOC	0	0	0	0	0	0	0	0	0	0
Sediment POC	0	0	0	0	0	0	0	0	0	0
Suspended POC	0	0	0	0	0	0	0	0	0	0

vertical	Recurvirostra avosetta	Somateria mollissima	Tadorna tadorna	Tringa totanus
PERIOD	All decades	All decades	All decades	All decades
Phytoplankton	0	0	0	0
Microphytobenthos	0	0	0	0
Freshwater algae	0	0	0	0
Pelagic Bacteria	0	0	0	0
Zooplankton	0	0	0	0
Benthic Bacteria	0	0	0	0
Meiofauna	0	0	0	0
Peringia ulvae	0,81	0	0,8	0,2
Littorina littorea	0	0,002	0	0
Arenicola marina	0	0	0	0
Eteone sp	0	0	0	0
Hediste diversicolor	0,08	0	0,08	0,1
Nereis spec.	0	0	0	0
Heteromastus filiformis	0	0	0	0
Lanice conchilega	0	0,002	0	0
Marenzelleria viridis	0	0	0	0
Nephtys hombergii	0	0	0	0,1
Scoloplos armiger	0	0	0	0
Corophium spp	0,11	0	0,11	0,3
Gammarus spp.	0	0	0	0
Cerastoderma edule	0	0,45	0,01	0
Magallana gigas	0	0	0	0
Ensis leei	0	0	0	0
Limecola balthica	0	0,026	0	0,1
Mya arenaria	0	0	0	0
Mytilus edulis	0	0,45	0	0
Scrobicularia plana	0	0	0	0
Carcinus maenas	0	0,07	0	0,1
Crangon crangon	0	0	0	0,1
Ammodytes tobianus	0	0	0	0
Clupea harengus	0	0	0	0
Myoxocephalus scorpius	0	0	0	0
Osmerus eperlanus	0	0	0	0
Platichthys flesus	0	0	0	0
Pleuronectes platessa	0	0	0	0
Pomatoschistus microps	0	0	0	0
Pomatoschistus minutus	0	0	0	0
Solea solea	0	0	0	0
Syngnathus rostellatus	0	0	0	0
Zoarces viviparus	0	0	0	0
Anas acuta	0	0	0	0
Anas platyrhynchos	0	0	0	0
Calidris alpina	0	0	0	0
Calidris canutus	0	0	0	0
Haematopus ostralegus	0	0	0	0
Larus argentatus	0	0	0	0
Larus canus	0	0	0	0
Larus ridibundus	0	0	0	0
Limosa lapponica	0	0	0	0
Numenius arquata	0	0	0	0
Pluvialis apricaria	0	0	0	0
Recurvirostra avosetta	0	0	0	0
Somateria mollissima	0	0	0	0
Tadorna tadorna	0	0	0	0
Tringa totanus	0	0	0	0
DOC	0	0	0	0
Sediment POC	0	0	0	0
Suspended POC	0	0	0	0

Table S4. Complete ENA network output of all four models, for explanations or definitions see documentation of the enaR package (Lau et al. 2017), Borrett & Lau (2014) and Fath et al. (2019).

enaR variable	Full name	BZ1980s	BZ1990s	BZ2000s	BZ2010s
Boundary	Boundary (sum of all inputs or sum of all outputs)	1513.84	1656.59	2285.41	1941.34
TST	Total systems throughflow	3697.70	4102.78	6503.27	5032.74
TSTp	Total system throughput	5212.13	5759.37	8788.68	6974.08
APL	Average path length	2.44	2.48	2.85	2.59
FCI	Finn cycling index	0.12	0.11	0.07	0.07
BFI	Boundary flow intensity	0.41	0.40	0.35	0.39
DFI	Direct flow intensity	0.21	0.23	0.34	0.30
IFI	Indirect flow intensity	0.38	0.36	0.31	0.31
ID.F	Ratio of indirect to direct flow	1.77	1.57	0.93	1.03
ID.F.I	Input-oriented ratio of indirect to direct flow intensity	1.60	1.52	1.31	1.32
ID.F.O	Output-oriented ratio of indirect to direct flow intensity	1.68	1.48	1.19	0.90
HMG.I	Input-oriented network homogenization ratio	1.60	1.59	1.55	1.55
HMG.O	Output-oriented network homogenization ratio	1.68	1.65	1.54	1.61
AMP.I	Input-oriented network amplification ratio	9.00	6.00	3.00	3.00
AMP.O	Output-oriented network amplification ratio	17.00	16.00	59.00	47.00
mode0.F	Boundary input	1513.84	1656.59	2285.41	1941.34
mode1.F	Internal first passage flow	1731.89	1985.15	3752.65	2717.21
mode2.F	Cycled flow	452.10	461.04	465.21	374.18
mode3.F	Dissipative equivalent to mode1.F	1731.89	1985.15	3752.65	2717.21
mode4.F	Dissipative equivalent to mode0.F	1513.84	1656.59	2285.41	1941.34
sumInputs	Sum of all inputs	1513.84	1656.59	2285.41	1941.34
sumOutputs	Sum of all outputs	1514.43	1656.59	2285.41	1941.34
H	Flow diversity	5.34	5.43	5.17	5.29
AMI	Average mutual information	1.76	1.78	1.97	1.85
Hr	Residual mutual information	3.58	3.65	3.21	3.44
CAP	Capacity	27838.74	31246.78	45475.24	36897.00
ASC	Ascendency	9166.16	10230.15	17294.51	12901.21
OH	Overhead	18672.58	21016.63	28180.73	23995.79
ASC.CAP	Ascendency-to-capacity ratio	0.33	0.33	0.38	0.35
OH.CAP	Overhead-to-capacity ratio	0.67	0.67	0.62	0.65
robustness	Robustness	0.37	0.37	0.37	0.37
ELD	Effective link density of the network	3.46	3.54	3.04	3.30
TD	Trophic depth of the network	3.38	3.43	3.91	3.60

Continued: Complete ENA network output of all four models, for explanations or definitions see documentation of the enaR package.

enaR variable	Full name	BZ1980s	BZ1990s	BZ2000s	BZ2010s
A.input	Ascendency of just the imports	2366.55	2709.53	4263.90	3255.04
A.internal	Ascendency of just the internal flows	4329.56	4787.15	8516.40	6139.23
A.export	Ascendency of just the export flows	1540.22	1708.22	2089.89	1877.20
A.respiration	Ascendency of just the respiration flows	929.83	1025.26	2424.32	1629.74
OH.input	Overhead of the imports alone	3961.05	4201.39	5653.32	5122.06
OH.internal	Overhead of the internal flows	9707.00	11340.47	15730.21	12755.50
OH.export	Overhead of the exports alone	2560.37	2640.81	2561.00	2826.00
OH.respiration	Respiration portion of system overhead	2444.15	2833.96	4236.19	3292.24
CAP.input	Input portion of system capacity	6327.61	6910.92	9917.22	8377.10
CAP.internal	Internal portion of system capacity	14036.56	16127.62	24246.61	18894.73
CAP.export	Export portion of system capacity	4100.59	4349.03	4650.89	4703.19
CAP.respiration	Respiration portion of system capacity	3373.99	3859.22	6660.51	4921.98
ATL	Average trophic level	2.58	2.58	2.57	2.57
Detritivory	Detritivory, flow from the detrital pool (non-living nodes) to the second trophic level	650.17	706.20	974.85	693.33
DetritalInput	Exogenous inputs to the detrital pool	748.67	838.69	878.22	910.21
DetritalCirc	Internal circulation within the detrital pool	205.97	237.53	688.79	606.83
NCYCS	Number of cycles	4.00	4.00	4.00	4.00
NNEX	Number of disjoint nexuses	4.00	4.00	4.00	4.00
CI	Cycling Index	0.00	0.00	0.00	0.00
Herbivory	Sum of herbivory flows	270.05	377.39	1173.30	664.89
DH	Detritivory Herbivory ratio	2.41	1.87	0.83	1.04
MTL	Mean Trophic Level	2.15	2.12	2.11	2.13
RED_CAP	Redundancy-to-capacity ratio	0.35	0.36	0.35	0.35

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