

Long-term shifts in intertidal predator and prey communities in the Wadden Sea and consequences for food requirements and supply

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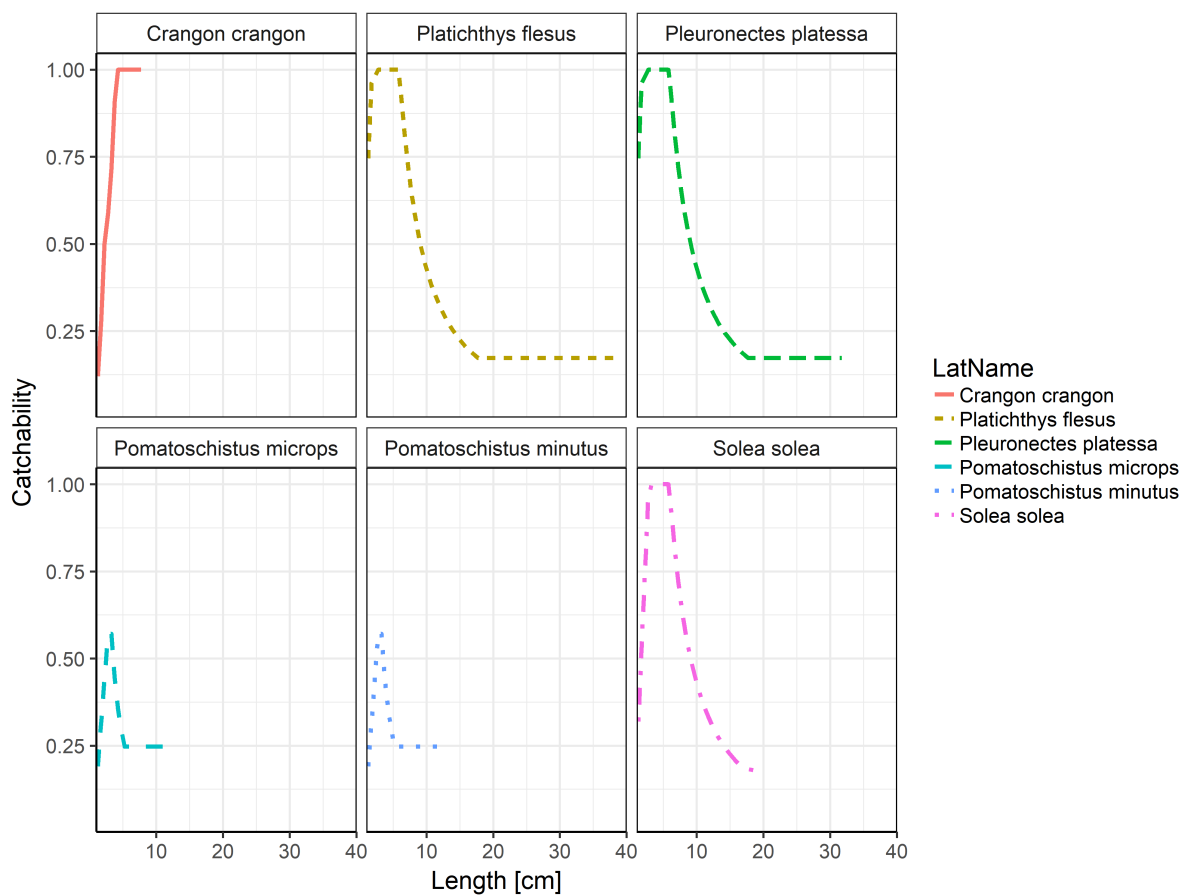


Figure S1: Net efficiency for different species and animal length taken from several references (*Pleuronectes platessa* Kuipers, 1975; *Platichthys flesus*: van der Veer et al., 1991; *Solea solea*: van der Veer et al. 2001; *Crangon crangon*: van Lissa 1977; *Pomatoschistus microps* and *P. minutus*: van Beek, 1976)

Table S1: List of all sampling dates, years separated by thick border.

| Cruiseid | Date |
|----------|------------|
| 197501 | 02.04.1975 |
| 197502 | 17.04.1975 |
| 197503 | 02.05.1975 |
| 197504 | 15.05.1975 |
| 197505 | 29.05.1975 |
| 197506 | 14.06.1975 |
| 197507 | 01.07.1975 |
| 197508 | 11.07.1975 |
| 197509 | 29.07.1975 |
| 197510 | 12.08.1975 |
| 197511 | 28.08.1975 |
| 197512 | 08.09.1975 |
| 197513 | 11.09.1975 |
| 197514 | 24.09.1975 |
| 197515 | 08.10.1975 |
| 197516 | 24.10.1975 |
| 197517 | 07.11.1975 |
| 197601 | 03.04.1976 |
| 197602 | 05.05.1976 |
| 197603 | 19.05.1976 |
| 197604 | 02.06.1976 |
| 197605 | 16.06.1976 |
| 197606 | 01.07.1976 |
| 197607 | 02.08.1976 |
| 197608 | 08.09.1976 |
| 197609 | 13.10.1976 |
| 197610 | 10.11.1976 |
| 197701 | 29.03.1977 |
| 197702 | 05.05.1977 |
| 197703 | 02.06.1977 |
| 197704 | 04.07.1977 |
| 197705 | 01.08.1977 |
| 197706 | 20.09.1977 |
| 197707 | 20.10.1977 |
| 197801 | 30.03.1978 |
| 197802 | 13.04.1978 |
| 197803 | 25.04.1978 |
| 197804 | 10.05.1978 |
| 197805 | 29.05.1978 |
| 197806 | 07.06.1978 |
| 197807 | 27.06.1978 |
| 197808 | 26.07.1978 |
| 197809 | 04.09.1978 |
| 197810 | 02.10.1978 |

| Cruiseid | Date |
|----------|------------|
| 197901 | 02.04.1979 |
| 197902 | 18.04.1979 |
| 197903 | 01.05.1979 |
| 197904 | 14.05.1979 |
| 197905 | 29.05.1979 |
| 197906 | 12.06.1979 |
| 197907 | 25.07.1979 |
| 197908 | 10.09.1979 |
| 198001 | 19.02.1980 |
| 198002 | 06.03.1980 |
| 198003 | 24.03.1980 |
| 198004 | 10.04.1980 |
| 198005 | 21.04.1980 |
| 198006 | 06.05.1980 |
| 198007 | 19.05.1980 |
| 198008 | 01.06.1980 |
| 198009 | 13.06.1980 |
| 198010 | 02.07.1980 |
| 198011 | 14.07.1980 |
| 198101 | 09.02.1981 |
| 198102 | 24.02.1981 |
| 198103 | 09.03.1981 |
| 198104 | 23.03.1981 |
| 198105 | 07.04.1981 |
| 198106 | 21.04.1981 |
| 198107 | 06.05.1981 |
| 198108 | 18.05.1981 |
| 198109 | 03.06.1981 |
| 198110 | 19.06.1981 |
| 198111 | 08.07.1981 |
| 198201 | 20.03.1982 |
| 198202 | 06.04.1982 |
| 198203 | 14.04.1982 |
| 198204 | 28.04.1982 |
| 198205 | 10.05.1982 |
| 198206 | 24.05.1982 |
| 198207 | 08.06.1982 |
| 198208 | 21.06.1982 |
| 198209 | 06.07.1982 |
| 198210 | 21.07.1982 |
| 198211 | 09.08.1982 |
| 198301 | 31.05.1983 |
| 198601 | 21.01.1986 |
| 198602 | 19.03.1986 |

| Cruiseid | Date |
|----------|------------|
| 198603 | 17.04.1986 |
| 198604 | 22.05.1986 |
| 198605 | 25.06.1986 |
| 198606 | 18.09.1986 |
| 198607 | 09.10.1986 |
| 198608 | 05.11.1986 |
| 199101 | 21.05.1991 |
| 199102 | 25.06.1991 |
| 199301 | 15.03.1993 |
| 199302 | 14.04.1993 |
| 199303 | 27.04.1993 |
| 199304 | 10.05.1993 |
| 199305 | 25.05.1993 |
| 199306 | 08.06.1993 |
| 199307 | 21.06.1993 |
| 199308 | 19.07.1993 |
| 199309 | 18.08.1993 |
| 199401 | 15.03.1994 |
| 199402 | 30.04.1994 |
| 199403 | 18.04.1994 |
| 199404 | 02.05.1994 |
| 199405 | 17.05.1994 |
| 199406 | 31.05.1994 |
| 199407 | 13.06.1994 |
| 199408 | 27.06.1994 |
| 199409 | 25.07.1994 |
| 199410 | 22.08.1994 |
| 199501 | 07.03.1995 |
| 199502 | 21.03.1995 |
| 199503 | 03.04.1995 |
| 199504 | 19.04.1995 |
| 199505 | 02.05.1995 |
| 199506 | 16.05.1995 |
| 199507 | 31.05.1995 |
| 199508 | 15.06.1995 |
| 199509 | 29.06.1995 |
| 199510 | 13.07.1995 |
| 199511 | 14.08.1995 |
| 199601 | 28.02.1996 |
| 199602 | 27.03.1996 |
| 199603 | 09.04.1996 |
| 199604 | 22.04.1996 |
| 199605 | 06.05.1996 |
| 199606 | 20.05.1996 |

| Cruiseid | Date |
|----------|------------|
| 199607 | 03.06.1996 |
| 199608 | 17.06.1996 |
| 199609 | 04.07.1996 |
| 199610 | 31.07.1996 |
| 199611 | 28.08.1996 |
| 199701 | 27.02.1997 |
| 199702 | 10.03.1997 |
| 199703 | 26.03.1997 |
| 199704 | 08.04.1997 |
| 199705 | 22.04.1997 |
| 199706 | 13.05.1997 |
| 199707 | 26.05.1997 |
| 199708 | 09.06.1997 |
| 199709 | 24.06.1997 |
| 199710 | 07.07.1997 |
| 199711 | 04.08.1997 |
| 199712 | 11.09.1997 |
| 199801 | 17.03.1998 |
| 199802 | 01.04.1998 |
| 199803 | 17.04.1998 |
| 199804 | 29.04.1998 |
| 199805 | 12.05.1998 |
| 199806 | 26.05.1998 |
| 199807 | 11.06.1998 |
| 199808 | 25.06.1998 |
| 199809 | 16.07.1998 |
| 199810 | 28.07.1998 |
| 199811 | 11.08.1998 |
| 199901 | 25.02.1999 |
| 199902 | 08.03.1999 |
| 199903 | 24.03.1999 |
| 199904 | 19.04.1999 |
| 199905 | 03.05.1999 |
| 199906 | 10.05.1999 |
| 200001 | 13.01.2000 |
| 200002 | 14.02.2000 |
| 200003 | 24.02.2000 |
| 200004 | 13.03.2000 |
| 200005 | 04.04.2000 |
| 200006 | 18.04.2000 |
| 200007 | 02.05.2000 |
| 200008 | 14.05.2000 |
| 200009 | 06.06.2000 |
| 200010 | 19.06.2000 |
| 200011 | 17.07.2000 |
| 200012 | 02.08.2000 |

| Cruiseid | Date |
|----------|------------|
| 200013 | 03.10.2000 |
| 200101 | 26.02.2001 |
| 200102 | 12.03.2001 |
| 200103 | 26.03.2001 |
| 200104 | 10.04.2001 |
| 200105 | 24.04.2001 |
| 200106 | 07.05.2001 |
| 200107 | 28.05.2001 |
| 200108 | 13.06.2001 |
| 200109 | 20.07.2001 |
| 200110 | 21.08.2001 |
| 200201 | 18.02.2002 |
| 200202 | 04.03.2002 |
| 200203 | 20.03.2002 |
| 200204 | 02.04.2002 |
| 200205 | 17.04.2002 |
| 200206 | 09.05.2002 |
| 200701 | 19.02.2007 |
| 200702 | 07.03.2007 |
| 200703 | 26.03.2007 |
| 200704 | 10.04.2007 |
| 200705 | 23.04.2007 |
| 200706 | 07.05.2007 |
| 200707 | 22.05.2007 |
| 200708 | 04.06.2007 |
| 200709 | 19.06.2007 |
| 200710 | 19.07.2007 |
| 200711 | 23.08.2007 |
| 200712 | 11.10.2007 |
| 200901 | 03.03.2009 |
| 200902 | 31.03.2009 |
| 200903 | 15.04.2009 |
| 200904 | 19.05.2009 |
| 200905 | 02.06.2009 |
| 200906 | 15.06.2009 |
| 200907 | 29.06.2009 |
| 200908 | 27.07.2009 |
| 200909 | 25.08.2009 |
| 200910 | 23.09.2009 |
| 201401 | 21.01.2014 |
| 201402 | 24.02.2014 |
| 201403 | 21.03.2014 |
| 201404 | 03.04.2014 |
| 201405 | 14.04.2014 |
| 201406 | 01.05.2014 |
| 201407 | 02.06.2014 |

| Cruiseid | Date |
|----------|------------|
| 201408 | 30.06.2014 |
| 201409 | 28.07.2014 |
| 201410 | 25.08.2014 |
| 201411 | 23.09.2014 |
| 201412 | 21.10.2014 |
| 201413 | 10.11.2014 |
| 201414 | 15.12.2014 |

Table S2: Specific species coefficients a and b of the length (L; cm) wet mass (W; g) relationships $W = (a \cdot L)^b$ after Leopold et al. (2001)

| Species | a | b |
|-------------------------------|------|------|
| <i>Clupea harengus</i> | 0.18 | 3.11 |
| <i>Osmerus eperlanus</i> | 0.17 | 3.40 |
| <i>Syngnatus rostellatus</i> | 0.07 | 3.99 |
| <i>Ammodytes tobianus</i> | 0.13 | 3.46 |
| <i>Zoarcetes viviparus</i> | 0.16 | 3.34 |
| <i>Pomatoschistus minutus</i> | 0.21 | 2.83 |
| <i>Myoxocephalus scorpius</i> | 0.23 | 3.19 |
| <i>Gasterosteus aculeatus</i> | 0.20 | 3.21 |
| <i>Pleuronectes platessa</i> | 0.22 | 3.02 |
| <i>Platichthys flesus</i> | 0.22 | 3.00 |
| <i>Solea solea</i> | 0.20 | 3.05 |
| <i>Pomatoschistus microps</i> | 0.22 | 3.27 |
| <i>Carcinus maenas</i> | 0.38 | 2.81 |
| <i>Crangon crangon</i> | 0.17 | 3.18 |

Table S3: Annual food requirement [g AFDM m⁻² y⁻¹] by epibenthos at the Balgzand intertidal over the period 1975-2014. Empty cells indicate that the species was not counted in these years, in bold years all analysed species have been sampled over a sufficient period.

| Year | <i>Pleuronectes platessa</i> | | | <i>Platichthys flesus</i> | | | <i>Solea solea</i> | | <i>Pomatoschistus microps</i> | | <i>Pomatoschistus minutus</i> | | <i>Carcinus maenas</i> | <i>Crangon crangon</i> | Total |
|-------------|------------------------------|--------------|--------------|---------------------------|--------------|--------------|--------------------|--------------|-------------------------------|--------------|-------------------------------|--------------|------------------------|------------------------|--------------|
| | 0-group | I-group | II-group | 0-group | I-group | II-group | 0-group | I-group | 0-group | I-group | 0-group | I-group | All ages | All ages | |
| 1975 | 0.907 | 1.498 | 2.655 | | | | 0.071 | 0.000 | 0.321 | 0.066 | 0.377 | 0.012 | | | |
| 1976 | 0.924 | 2.907 | 0.580 | 0.094 | 0.874 | 1.445 | 0.027 | 0.000 | 0.345 | 0.057 | 0.519 | 0.017 | 0.311 | 12.921 | 21.02 |
| 1977 | 1.129 | 4.182 | 1.226 | | | | | | | | | | 0.311 | 7.611 | |
| 1978 | 1.848 | 2.777 | 1.804 | | | | | | | | | | 0.868 | 18.174 | |
| 1979 | 2.259 | | | 0.096 | | | 0.047 | 0.000 | | | | | 0.548 | 22.662 | |
| 1980 | 0.464 | 9.177 | 8.493 | 0.015 | 0.171 | 0.524 | 0.023 | 0.154 | 0.111 | 0.070 | 0.089 | 0.007 | 0.475 | 21.521 | 41.29 |
| 1981 | 0.631 | 5.249 | 3.721 | 0.043 | 0.076 | 0.931 | 0.007 | 0.000 | 0.072 | 0.039 | 0.008 | 0.001 | 0.316 | 20.345 | 31.44 |
| 1982 | 1.091 | 0.000 | 0.000 | 0.016 | 0.004 | 0.000 | 0.014 | 0.055 | | | | | | | |
| 1986 | 1.035 | 1.109 | 0.163 | 0.001 | 0.099 | 0.590 | 0.006 | 0.000 | 0.087 | 0.050 | 0.000 | 0.000 | 0.133 | 16.554 | 19.83 |
| 1993 | 0.283 | 0.100 | 0.027 | 0.030 | 0.090 | 0.975 | 0.009 | 0.000 | 0.895 | 0.023 | 0.214 | 0.023 | 0.633 | 33.798 | 37.10 |
| 1994 | 0.411 | 0.034 | 0.000 | 0.065 | 0.053 | 0.001 | 0.026 | 0.000 | | | | | | | |
| 1995 | 0.347 | 0.042 | 0.017 | 0.082 | 0.112 | 0.010 | 0.041 | 0.000 | | | | | | | |
| 1996 | 0.374 | 0.042 | 0.000 | 0.031 | 0.197 | 0.062 | 0.009 | 0.000 | 0.733 | 0.038 | 0.224 | 0.008 | 0.584 | 26.711 | 29.01 |
| 1997 | 0.302 | 0.047 | 0.000 | 0.003 | 0.030 | 0.021 | 0.002 | 0.003 | 0.297 | 0.043 | 0.925 | 0.009 | 0.886 | 20.511 | 23.08 |
| 1998 | 0.178 | 0.037 | 0.002 | 0.011 | 0.010 | 0.100 | 0.001 | 0.000 | | | | | | | |
| 1999 | 0.220 | 0.002 | 0.000 | 0.020 | 0.012 | 0.003 | | | 0.000 | 0.013 | 0.000 | 0.014 | 0.274 | 4.324 | |
| 2000 | 0.402 | 0.004 | 0.001 | 0.010 | 0.042 | 0.126 | 0.010 | 0.000 | 0.569 | 0.031 | 0.669 | 0.035 | 0.683 | 25.003 | 27.59 |
| 2001 | 0.477 | 0.004 | 0.000 | 0.108 | 0.014 | 0.012 | 0.002 | 0.000 | 0.000 | 0.027 | 0.001 | 0.020 | 1.096 | 11.473 | 13.23 |
| 2002 | 0.284 | 0.038 | 0.000 | 0.009 | 0.027 | 0.016 | 0.007 | 0.015 | 0.000 | 0.020 | 0.000 | 0.015 | 0.325 | 11.474 | |
| 2007 | 0.149 | 0.008 | 0.000 | 0.039 | 0.003 | 0.028 | 0.049 | 0.035 | 0.470 | 0.008 | 0.116 | 0.052 | 0.912 | 39.463 | 41.33 |
| 2009 | 0.149 | 0.006 | 0.000 | 0.048 | 0.042 | 0.062 | 0.006 | 0.001 | 0.974 | 0.017 | 0.624 | 0.031 | 2.250 | 32.270 | 36.48 |
| 2014 | 0.324 | 0.000 | 0.000 | 0.039 | 0.014 | 0.001 | 0.007 | 0.000 | 0.970 | 0.047 | 1.338 | 0.102 | 2.282 | 34.380 | 39.50 |
| Average | 0.64 | 1.30 | 0.89 | 0.04 | 0.10 | 0.27 | 0.02 | 0.01 | 0.39 | 0.04 | 0.34 | 0.02 | 0.76 | 21.13 | 30.08 |
| sd | 0.54 | 2.33 | 1.97 | 0.03 | 0.19 | 0.42 | 0.02 | 0.04 | 0.35 | 0.02 | 0.39 | 0.02 | 0.61 | 9.69 | 8.95 |

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