

Table S1. Echinoderm oxygen consumption rate

Species	Class	Depth of collection (m)	Mass-specific O <sub>2</sub> consumption rate (mmol O <sub>2</sub> h <sup>-1</sup> g <sup>-1</sup> )	Wet mass (g)	Measurement location	References
<i>Asterias forbesi</i> (mean 151–156 g, N=2)	Asteroidea	1	0.357	153.476	Lab	Cole and Burggren, 1981
<i>Asterias forbesi</i> (mean 20–100 g, N=9)	Asteroidea	1	0.582	59.866	Lab	Cole and Burggren, 1981
<i>Asterias forbesi</i> (mean 9–11 g, N=2)	Asteroidea	1	1.200	9.826	Lab	Cole and Burggren, 1981
<i>Astropecten armatus</i>	Asteroidea	1	0.777	27.100	Lab	Webster, 1975
<i>Coscinasterias calamaria</i>	Asteroidea	13	0.457	33.000	Lab	Johnson, 1973
<i>Coscinasterias calamaria</i>	Asteroidea	13	0.432	81.000	Lab	Johnson, 1973
<i>Ctenodiscus crispatus</i> (mean 3–11 g, N=13)	Asteroidea	100	0.169	8.222	Lab	Schmid, 1996
<i>Dermasterias imbricata</i>	Asteroidea	1	0.335	23.500	Lab	Webster, 1975
<i>Echinaster sepositus</i>	Asteroidea	3	0.728	80.000	In situ	Houlihan and Duthie, 1981
<i>Helaster kubinji</i>	Asteroidea	1	0.795	106.200	Lab	Webster, 1975
<i>Leptasterias aequalis</i>	Asteroidea	1	1.197	1.500	Lab	Webster, 1975
<i>Leptasterias hexactis</i> (mean 1–5 g, N=18)	Asteroidea	1	0.094	2.944	Lab	Menge and Menge, 1974
<i>Linkia laevigata</i>	Asteroidea	1	0.098	100.300	Lab	Webster, 1975
<i>Mediaster aequalis</i>	Asteroidea	1	0.683	15.300	Lab	Webster, 1975
<i>Odantaster validus</i>	Asteroidea	20	0.219	18.500	Lab	Belman and Giese, 1974
<i>Orthasterias columbiensis</i>	Asteroidea	1	1.134	20.800	Lab	Webster, 1975
<i>Patiria miniata</i>	Asteroidea	1	0.469	11.600	Lab	Webster, 1975
<i>Pentagonaster pulchellus</i>	Asteroidea	1	0.170	12.000	Lab	Webster, 1975
<i>Pentagonaster pulchellus</i> (mean 10–15 g, N=2)	Asteroidea	85	0.185	12.400	Lab	Johnson, 1973
<i>Pisaster brevispinus</i>	Asteroidea	1	0.549	19.900	Lab	Webster, 1975
<i>Pisaster giganteus</i>	Asteroidea	1	1.134	1.300	Lab	Webster, 1975
<i>Pisaster ochraceus</i> (mean 1–6 g, N=18)	Asteroidea	1	0.092	3.311	Lab	Menge and Menge, 1974
<i>Pisaster ochraceus</i> (mean 207–537 g, N=6)	Asteroidea	1	0.100	334.673	Lab	Menge and Menge, 1974
<i>Pisaster ochraceus</i> (mean 7–11 g, N=4)	Asteroidea	1	0.102	9.303	Lab	Menge and Menge, 1974
<i>Pycnopodia helianthoides</i>	Asteroidea	1	0.438	26.200	Lab	Webster, 1975
<i>Zoroaster evermanni</i>	Asteroidea	1	0.250	52.900	Lab	Webster, 1975
<i>Antedon bifida</i>	Crinoidea	15	1.809	0.900	Lab	Fox, 1936 in Warnock and Liddell, 1985
<i>Antedon bifida</i>	Crinoidea	10	1.094	1.340	Lab	Warnock and Liddell 1985
<i>Antedon petasus</i>	Crinoidea	35	1.041	2.200	Lab	Fox, 1936 in Warnock and Liddell, 1985
<i>Antedon petasus</i>	Crinoidea	35	1.584	2.200	Lab	Fox, 1936 in Warnock and Liddell, 1985
<i>Antedon petasus</i>	Crinoidea	35	2.041	2.200	Lab	Fox, 1936 in Warnock and Liddell, 1985
<i>Cenocrinus asterius</i>	Crinoidea	280	1.125	54.100	Lab	Baumiller and LaBarbera, 1989
<i>Comachinia echinoptera</i>	Crinoidea	280	2.438	3.900	Lab	Baumiller and LaBarbera, 1989
<i>Democrinus conifer</i>	Crinoidea	280	1.938	0.300	Lab	Baumiller and LaBarbera, 1989
<i>Florometra serratissima</i>	Crinoidea	150	1.192	4.500	Lab	Webster, 1975
<i>Holopus rangii</i>	Crinoidea	315	0.531	6.900	Lab	Baumiller and LaBarbera, 1989
<i>Nemaster discoidea</i>	Crinoidea	14	3.000	3.600	Lab	Baumiller and LaBarbera, 1989
<i>Nemaster rubiginosa</i>	Crinoidea	14	1.844	7.700	Lab	Baumiller and LaBarbera, 1989
<i>Nemaster rubiginosa</i>	Crinoidea	14	1.906	4.800	Lab	Warnock and Liddell, 1985
<i>Abatus cordatus</i> (mean 14–23.5 g, N=2)	Echinoidea	1	0.347	18.880	Lab	Magniez and Feral, 1988
<i>Abatus cordatus</i> (mean 3–9 g, N=5)	Echinoidea	1	0.835	5.438	Lab	Magniez and Feral, 1988
<i>Allocentrotus fragilis</i>	Echinoidea	150	0.231	50.400	Lab	Webster, 1975
<i>Arbacia lixula</i>	Echinoidea	3	0.934	80.000	In situ	Houlihan and Duthie, 1981
<i>Echinarachnius parma</i>	Echinoidea	1048	0.165	4.200	Lab	Hargrave et al., 2004
<i>Echinocardium pannatifidum</i>	Echinoidea	1	0.268	20.000	Lab	Shick, 1983
<i>Echinometra lucunter</i>	Echinoidea	1	0.594	3.100	Lab	Webster, 1975
<i>Echinometra mathaei</i>	Echinoidea	1	0.210	28.000	Lab	Webster, 1975
<i>Echinocrepis</i> sp. (mean 83.4 g, N=2)	Echinoidea	4115.0	0.160	83.4	In situ	B. D. Wigham, D. M. Bailey and D. O. B. Jones (unpublished)
<i>Evechinus chloroticus</i>	Echinoidea	13	0.275	589.000	Lab	Johnson, 1973
<i>Evechinus chloroticus</i>	Echinoidea	13	0.226	954.000	Lab	Johnson, 1973

<i>Goniocidaris umbraculum</i>	Echinoidea	1	0.179	12.100	Lab	Webster, 1975
<i>Goniocidaris umbraculum</i> (mean 4–11.3 g, N=2)	Echinoidea	85	0.194	7.750	Lab	Johnson, 1973
<i>Lytechinus anamesus</i>	Echinoidea	1	0.665	3.700	Lab	Webster, 1975
<i>Paracentrotus lividus</i>	Echinoidea	3	0.390	80.000	In situ	Houlihan and Duthie, 1981
<i>Psammechinus miliaris</i>	Echinoidea	1	1.876	5.500	Lab	Hughes, 2010
<i>Psammechinus miliaris</i> (mean 12–16 g, N=3)	Echinoidea	1	0.894	13.870	Lab	Hughes, 2010
<i>Sphaerechinus granularis</i>	Echinoidea	3	0.322	80.000	In situ	Houlihan and Duthie, 1981
<i>Sterechinus neumayeri</i>	Echinoidea	20	0.156	71.600	Lab	Belman and Giese, 1974
<i>Sterechinus neumayeri</i>	Echinoidea	10	0.397	5.500	Lab	Brockington and Peck, 2001
<i>Strongylocentrotus droebachiensis</i>	Echinoidea	3	0.863	8.300	In situ	Miller et al., 1971
<i>Strongylocentrotus droebachiensis</i>	Echinoidea	10	0.238	40.000	Lab	Siikavuopio et al., 2008
<i>Strongylocentrotus droebachiensis</i>	Echinoidea	10	0.143	65.000	Lab	Siikavuopio et al., 2008
<i>Strongylocentrotus droebachiensis</i>	Echinoidea	10	0.120	100.000	Lab	Siikavuopio et al., 2008
<i>Strongylocentrotus franciscanus</i>	Echinoidea	1	0.300	44.700	Lab	Webster, 1975
<i>Strongylocentrotus intermedius</i>	Echinoidea	10	0.462	55.500	Lab	Sedova, 2000
<i>Strongylocentrotus intermedius</i>	Echinoidea	10	0.574	53.400	Lab	Sedova, 2000
<i>Strongylocentrotus nudus</i>	Echinoidea	9	0.404	75.000	Lab	Ohsaki, 2001
<i>Strongylocentrotus nudus</i>	Echinoidea	9	0.537	75.000	Lab	Ohsaki, 2001
<i>Strongylocentrotus nudus</i>	Echinoidea	9	0.724	75.000	Lab	Ohsaki, 2001
<i>Strongylocentrotus pallidus</i>	Echinoidea	1048	0.201	83.200	Lab	Hargrave et al., 2004
<i>Strongylocentrotus purpuratus</i>	Echinoidea	1	1.306	10.073	Lab	Farmanfarmaian, 1966
<i>Strongylocentrotus purpuratus</i>	Echinoidea	1	0.357	55.000	Lab	Webster, 1975
<i>Strongylocentrotus purpuratus</i> (mean 33–89 g, N=7)	Echinoidea	1	0.300	63.135	Lab	Webster and Giese, 1975
<i>Strongylocentrotus purpuratus</i> (mean 4–15 g, N=2)	Echinoidea	1	0.911	9.730	Lab	Webster and Giese, 1975
<i>Tripneustes ventricosus</i>	Echinoidea	1	0.697	5.200	Lab	Webster, 1975
<i>Actinopyga mauritiana</i> (mean (368–470 g, N=3)	Holothuroidea	1	0.160	402.333	Lab	Takemae et al., 2009
<i>Benthodutes gosarsi</i> (mean 1107–1193 g, N=2) Elasipodid	Holothuroidea	3406	0.008	1149.829	In situ	This paper
<i>Cucumaria frondosa</i>	Holothuroidea	1048	0.152	755.000	Lab	Hargrave et al., 2004
<i>Enypniastes eximia</i> (mean 121–489 g, N=19)	Holothuroidea	760	0.097	271.100	In situ	Bailey et al., 1994
<i>Enypniastes eximia</i> (mean 527–918 g, N=9)	Holothuroidea	760	0.069	693.257	In situ	Bailey et al., 1994
<i>Enypniastes eximia</i> (mean 78–105 g, N=3)	Holothuroidea	760	0.068	91.159	In situ	Bailey et al., 1994
<i>Eupentacta quinquesemita</i>	Holothuroidea	1	0.782	5.500	Lab	Webster, 1975
<i>Heterocucumis steineni</i>	Holothuroidea	14	0.056	80.340	Lab	Fraser et al., 2004
<i>Heterocucumis steineni</i>	Holothuroidea	14	0.102	80.340	Lab	Fraser et al., 2004
<i>Heterocucumis steineni</i>	Holothuroidea	14	0.109	80.340	Lab	Fraser et al., 2004
<i>Holothuria atra</i>	Holothuroidea	1	2.070	240.000	Lab	Uthicke, 1998
<i>Holothuria atra</i>	Holothuroidea	1	0.190	11.000	Lab	Uthicke, 1998
<i>Holothuria edulis</i>	Holothuroidea	1	0.200	25.000	Lab	Uthicke, 1998
<i>Holothuria edulis</i>	Holothuroidea	1	0.820	358.000	Lab	Uthicke, 1998
<i>Holothuria forskali</i>	Holothuroidea	13	0.193	37.400	Lab	Astell and Jones, 1991
<i>Holothuria forskali</i>	Holothuroidea	13	0.329	113.000	Lab	Astell and Jones, 1991
<i>Holothuria polii</i>	Holothuroidea	3	0.545	80.000	In situ	Houlihan and Duthie, 1981
<i>Leptosynapta inhaerens</i>	Holothuroidea	1	0.621	2.400	Lab	Webster, 1975
<i>Parastichopus californicus</i>	Holothuroidea	1	0.857	27.300	Lab	Webster, 1975
<i>Peniagone azorica</i> (mean 25–77 g, N=5)	Holothuroidea	3645	0.028	51.250	In situ	This paper
<i>Psolus</i> spp.	Holothuroidea	1048	0.210	40.600	Lab	Hargrave et al., 2004
<i>Scotoplanes globosa</i> (mean 0.5–0.8 g, N=2)	Holothuroidea	1300	0.452	0.639	In situ	Smith, 1983
<i>Scotoplanes globosa</i> (mean 7–9.5 g, N=3)	Holothuroidea	1300	0.195	8.371	In situ	Smith, 1983
<i>Stichopus chloronotus</i>	Holothuroidea	1	0.280	6.000	Lab	Uthicke, 1998
<i>Stichopus chloronotus</i>	Holothuroidea	1	1.830	535.000	Lab	Uthicke, 1998
<i>Zygothuria lactea</i>	Holothuroidea	2226	0.217	130.200	In situ	This paper
<i>Amphiodia occidentalis</i>	Ophiuroidea	1	0.134	0.750	Lab	Webster, 1975
<i>Hemipholis elongata</i> (mean 0.2–0.8 g, N=4)	Ophiuroidea	1	2.315	0.515	Lab	Christensen and Colacino, 2000
<i>Hemipholis elongata</i> (mean 0.2–1 g, N=4)	Ophiuroidea	1	2.773	0.645	Lab	Christensen and Colacino, 2000
<i>Ophiacantha abyssicola</i>	Ophiuroidea	1048	0.554	2.200	Lab	Hargrave et al., 2004
<i>Ophiacantha bidentata</i> (mean 0.2–0.7 g, N=11)	Ophiuroidea	100	0.526	0.367	Lab	Schmid, 1996
<i>Ophiactis resiliens</i> (mean 0.2–0.53 g, N=7)	Ophiuroidea	1	3.443	0.331	Lab	Pentreath, 1971
<i>Ophiocten sericeum</i> (mean	Ophiuroidea	100	1.132	0.236	Lab	Schmid, 1996

0.1–0.5 g, N=7)							
<i>Ophiomusium armigerum</i> (mean 0.8–1.2 g , N=2)	Ophiuroidae	3650	1.248	1.054	<i>In situ</i>	Smith, 1983	
<i>Ophiomusium lymani</i>	Ophiuroidae	1230	2.298	0.451	<i>In situ</i>	Smith, 1983	
<i>Ophionereis fasciata</i> (mean 0.5–2.6 g, N=9)	Ophiuroidae	1	2.623	1.410	Lab	Pentreath, 1971	
<i>Ophiothrix aculeata</i>	Ophiuroidae	3	0.677	1.000	<i>In situ</i>	Miller et al., 1971	
<i>Ophiopterus normani</i> (mean 0.3–1g, N=9)	Ophiuroidae	1230	1.619	0.693	<i>In situ</i>	Smith, 1983	
<i>Ophioptera borealis</i> (mean 12–17 g, N=8)	Ophiuroidae	100	0.605	13.903	Lab	Schmid, 1996	
<i>Ophiopterus antipodum</i> (mean 5–6g, N=2)	Ophiuroidae	1	0.923	5.760	Lab	Pentreath, 1971	
<i>Ophiopterus antipodum</i> (mean 0.5–2 g, N=5)	Ophiuroidae	1	2.408	1.275	Lab	Pentreath, 1971	
<i>Ophiopterus antipodum</i> (mean 2.5–3.8 g, N=4)	Ophiuroidae	1	1.137	3.280	Lab	Pentreath, 1971	
<i>Ophioscolex glacialis</i> (mean 4–9 g, N=7)	Ophiuroidae	100	0.311	6.486	Lab	Schmid, 1996	
<i>Ophiura irrorata concreta</i> (mean 7–9.2 g, N=3)	Ophiuroidae	3513	0.113	8.333	<i>In situ</i>	This paper	
<i>Ophiura sarsi</i>	Ophiuroidae	1048	1.224	1.400	Lab	Hargrave et al., 2004	

## REFERENCES

- Astall, C. M. and Jones, M. B. (1991). Respiration and biometry in the sea cucumber *Holothuria forskali*. *J. Mar. Biol. Assoc. UK* **71**, 73-81.
- Baumiller, T. K. and Labarbera, M. (1989). Metabolic rates of Caribbean crinoids (Echinodermata), with special reference to deep-water stalked and stalkless taxa. *Comp. Biochem. Physiol.* **93A**, 391-394.
- Belman, B. W. and Giese, A. C. (1974). Oxygen consumption of an asteroid and an echinoid from the Antarctic. *Biol. Bull.* **146**, 157-164.
- Brockington, S. and Peck, L. S. (2001). Seasonality of respiration and ammonium excretion in the Antarctic echinoid *Sterechinus neumayeri*. *Mar. Ecol. Prog. Ser.* **219**, 159-168.
- Cole, R. N. and Burggren, W. W. (1981). The contribution of respiratory papulae and tube feet to oxygen-uptake in the sea star *Asterias forbesi* (Desor). *Mar. Biol. Lett.* **2**, 279-287.
- Fox, H. M. (1936). The activity and metabolism of poikilothermal animals in different latitudes. *Proc. Zool. Soc. Lond.* **106**, 945-955.
- Hughes, S. J. M. (2010). Towards deep-sea toxicology: experimental approaches with echinoderms, pp. 297. PhD thesis, School of Ocean and Earth Sciences, University of Southampton.
- Houlihan, D. F. and Duthie, G. (1981). Measurement of oxygen consumption and sampling of body fluids of echinoderms in situ. *J. Exp. Mar. Biol. Ecol.* **51**, 97-106.
- Johnson, W. S. (1973). Respiration rates of some New Zealand echinoderms (note). *N. Z. J. Mar. Freshw. Res.* **7**, 165-169.
- Magniez, P. and Féral, J.-P. (1988). The effect of somatic and gonadal size on the rate of oxygen consumption in the subantarctic echinoid *Abatus cordatus* (Echinodermata) from Kerguelan. *Comp. Biochem. Physiol.* **90A**, 429-434.
- Menge, J. L. and Menge, B. A. (1974). Role of resource allocation, aggression and spatial heterogeneity in coexistence of two competing intertidal starfish. *Ecol. Monogr.* **44**, 189-209.
- Miller, R. J., Mann, K. H. and Scarratt, D. J. (1971). Production potential of a seaweed-lobster community in Eastern Canada. *J. Fish. Res. Board Can.* **28**, 1733-1738.
- Takemae, N., Nakaya, F. and Motokawa, T. (2009). Low oxygen consumption and high body content of catch connective tissue contribute to low metabolic rate of sea cucumbers. *Biol. Bull.* **216**, 45-54.
- Uthicke, S. (1998). Respiration of *Holothuria (Halodeima) atra*, *Holothuria (Halodeima) edulis* and *Stichopus chloronotus*: intact individuals and products of asexual reproduction. In *Proceedings of the Ninth International Echinoderm Conference, August 5–9, 1996, San Francisco, California, USA* (ed. R. Mooi and M. Telford), pp. 531-536. Rotterdam: Balkema.
- Webster, S. K. and Giese, A. C. (1975). Oxygen consumption of the purple sea urchin with special reference to the reproductive cycle. *Biol. Bull.* **148**, 165-180.