Macroalgae average productivities — For a detailed explanation of this data and references, see the online supplement "OMA Discussion of Macroalgae Production and Density"

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Ref Date	Species	Type of Environment	Location	Author	Reported data average tonnes dry wt/ha/y	Reported data Ash-free %	Authors' Summary Ash-free t/ha /yr	Authors' Summary average Ash-free g dry wt/ m2/day	Notes	Ash Ref
2010	Average	cultivated in ocean	Worldwide	Roesijadi, et al.	30	68%	20	6	Varying nutrient levels from upwellings & shore runoff	use average ash-free yields
2010	Average	cultivated in ocean	Worldwide	Oilgae	50	68%	34	9	Probably assumes high nutrient levels?	use average ash-free yields
2008	Average	cultivated in ocean	China	Roesijadi, et al.	10	68%	7	2	Varying nutrient levels from upwellings & shore runoff	use average ash-free yields
2002	Average	cultivated in ocean	Worldwide	Chynoweth	11	68%	7	2	Varying nutrient levels from upwellings & shore runoff	use average ash-free yields
1994	Average including: *Macrocystis, Laminaria, Ecklonia, Sargassum*	uncultivated	Worldwide	Gao & McGinley	50	68%	34	9	Varying nutrient levels from upwellings & shore runoff	use average ash-free yields
1987	average for US	cultivated	USA	Chynoweth, et al.	50	68%	34	9	Varying nutrient levels from upwellings & shore runoff	use average ash-free yields
					Averages		**23**	**6**	Note that we use 18 tons/ha/yr = 5 g/m2/day in our calculations	

Macroalgae productivity for different species

Date	Species	Type of Environment	Location	References	Reported Data Min Density kg dry wt/m2	Reported Data Max Density kg dry wt/m2	Reported Data average tonnes dry wt/ha/y	Reported Data ave. kg dry wt/ m2/y	Reported Data average g dry wt/ m2/day	Reported Data ave. g C/ m2/yr (Gao)	Authors' Summary ave. tonnes dry wt/ha/y	Authors' Summary Ash-free %	Authors' Summary Ash-free t/ha /yr	Authors' Summary average Ash-free g dry wt/ m2/day	Notes	Ash Ref
1990	*Ascophyllum nodosum*	in wild	Massachusetts	Roman et al.				3.5		1179	35	68%	24	7	Unknown if significant nutrient runoff from rivers	use average ash-free yields
1984	*Ascophyllum nodosum*	in wild	Nova Scotia, Canada	Cousens			23			959	23	68%	16	4	Unknown if significant nutrient runoff from rivers	use average ash-free yields
1984	*Ascophyllum nodosum*	in wild	Spain	Cousens			23				23	68%	16	4	Unknown if significant nutrient runoff from rivers	use average ash-free yields
1987	*Ecklonia cava*	in wild	Japan	Yokohama, et al.				2.9		1044	29	55%	16	4	Unknown if significant nutrient runoff from rivers	Lamare & Wing (2001)
1986	*Ecklonia radiata*	in wild	Australia	Larkum				3.1			31	55%	17	5	Unknown if significant nutrient runoff from rivers	Lamare & Wing (2001)
1984	*Ecklonia radiata*	in wild	New Zealand	Novaczek				says up to 6, use 5		2160	50	55%	28	8	Unknown if significant nutrient runoff from rivers	Lamare & Wing (2001)
1981	*Eichhornia crassipes*	cultivated	Florida	Debusk, et al.		1			24		87	75%	65	18	Unknown nutrient levels	use average ash-free yields
1987	*Eucheuma sp.*	cultivated	Philippines?	Doty			36	4.32		1440	43	66%	29	8	Unknown if significant nutrient runoff from rivers	Freile-Pelegrín & Robledo (2007)
2007	*Gracilaria*	cultivated in inter-tidal ponds	Taiwan	Cordover				3.6			36	90%	32	9	Not nutrient limited.	Esteves, et al. (2005) for Gracilaria sp
2007	*Gracilaria*	suspended cultivation at sea	Chile	Cordover				4.8			48	90%	43	12	Nutrient input not reported.	Esteves, et al. (2005) for Gracilaria sp
1992	*Gracilaria chilensis*	in wild	Chile	Ugarte & Santileces				1		800	10	90%	9	2	This is nutrient limited.	Esteves, et al. (2005) for Gracilaria sp
1990	*Gracilaria tikvahiae*	in ponds	Taiwan	FAO training manual			12				12	90%	11	3	Details unavailable, could be nutrient limited.	Esteves, et al. (2005) for Gracilaria sp
2011	*Gracilaria/Laminaria*	Line cultivation (offshore)	?	Lenstra, et al.			37				37	77%	28	8	Varying nutrient levels from upwellings & shore runoff	Lenstra, et al. 2011
2011	*Gracilaria/Ulva*	Tidal Flat farm	?	Lenstra, et al.			22				22	77%	17	5	Varying nutrient levels from upwellings & shore runoff	Lenstra, et al. 2011
1987	*Hedophyllum sessile*	in wild	Washington state	Leigh, et al.	1.4	2.7		2			20	65%	13	4	Leigh gives range1.4-2.7 dw kg/m2/year.	Paine & Vadas (1969)
1981	*Hydrilla verticillata*	cultivated	Florida	Debusk, et al.					4		15	68%	10	3	Nutrient input not reported.	use average ash-free yields
1976	*Iridaea cordata*	in wild	Washington state	Waaland									3	1	Varying nutrient levels from upwellings & shore runoff	Ash-free yield reported by author
2012	*Kelp (unspecified species)*	unclear if cultivated or wild	Chile	Kashiyama			40				40	59%	24	6	Nutrient input not reported.	Leese 1976 (range 55.5 - 62.4%) Lamare same
2009	*Laminaria hyperborea*	wild near shore	Scotland	Bruton, et al.			30				30	60%	18	5	Varying nutrient levels from upwellings & shore runoff	Chynoweth et al., 1987
2009	*Laminaria japonica*	cultivated in ocean	China	Bruton, et al.			25				25	60%	15	4	Varying nutrient levels from upwellings & shore runoff	Chynoweth et al., 1987
1987	*Laminaria japonica*	cultivated	China	Tseng			18				18	60%	11	3	Varying nutrient levels from shore runoff	Lenstra, et al. 2011
1994	*Laminaria japonica*	cultivated	?	Brinkhuis et al.			150				150	60%	90	25	Probably assumes high nutrient levels?	Lenstra, et al. 2011
1984	*Laminaria japonica*	cultivated	China	Wu et al.				6.6		2200	66	66%	44	12	Varying nutrient levels from shore runoff	Paine & Vadas (1969) ave for 3 other Laminaria sp
1990	*Laminaria longicruris*	in wild	Long Island, CT	Egan & Yarish		5.64		5.8		1116	58	66%	38	10	(report wet wt totalled 11 kg in 1986 and 48 kg/yr in 1987, used latter times dry weight is reported about 12% of wet weight) How much nutrient input from Thames River, CT?	Paine & Vadas (1969) ave for 3 other Laminaria sp
1972	*Laminaria longicruris*	in wild	Canada	Mann				6		2000	60	66%	40	11	Varying nutrient levels from shore runoff	Paine & Vadas (1969) ave for 3 other Laminaria sp
1980	*Laminaria longicruris*	in wild	Canada	Sharp				2.4			24	66%	16	4	Actual harvest was 2.4 kg/m2 of 4 kg/m2, regarded as sustainable.	Paine & Vadas (1969) ave for 3 other Laminaria sp
1987	*Laminaria setchellii*	in wild	Washington state	Leigh, et al.	3.3	6.8		2.4			24	64%	15	4	Leigh gives range 1.6-3.3 dw kg/m2/year	Paine & Vadas (1969)
2009	*Laminaria sp.*	cultivated in ocean	Ireland	Bruton, et al.			20				20	60%	12	3	Varying nutrient levels from upwellings & shore runoff	Chynoweth et al., 1987
1981	*Lemma minor*	cultivated	Florida	Debusk, et al.					4		15	68%	10	3	Nutrient input not reported.	use average ash-free yields
1987	*Lessoniopsis littoralis*	in wild	Washington state	Leigh, et al.	4	4.6		7.7			77	64%	49	14	Leigh gives range 6.9-8.6 dw kg/m2/year; grows only on wave-beaten shores	Lamare & Wing (2001) for L. variegata
1982	*Macrocystis*	In wild, but fertilized	California	North et. al.									14	4	Varying nutrient levels from upwellings & shore runoff	Ash-free yield reported by author
1982	*Macrocystis*	in wild	California	Neushul et al.									8	2	Varying nutrient levels from upwellings & shore runoff	Ash-free yield reported by author
2011	*Macrocystis*	Nearshore cultivation	?	Lenstra, et al.			70				70	60%	42	12	Varying nutrient levels from upwellings & shore runoff	Lenstra, et al. 2011
1986	*Macrocystis integrifolia*	in wild	Canada	Wheeler & Druehl			70				70	60%	42	12	Varying nutrient levels from upwellings & shore runoff	Lenstra, et al. 2011
2005	*Myagropsis myagroides*	in wild	Japan	Yatsuya, et al.				1.2			12	70%	8	2	Unknown if significant nutrient runoff from rivers	Taylor & Steinberg (2005) Sargassum sp.
1987	*Postelsia palmaeformis*	in wild	Washington state	Leigh, et al.	2	7.3		9			90	81%	73	20	Leigh gives range 3.8-14.6 dw kg/m2/year; grows only on wave-beaten shores	Paine & Vadas (1969)
2011	*Sargassum*	Floating cultivation	?	Lenstra, et al.			49				49	68%	33	9	Varying nutrient levels from upwellings & shore runoff	Lenstra, et al. 2011
1988	*Sargassum horneri*	in wild	Japan	Taniguchi & Yamada				1.5			15	70%	10	3	Unknown if significant nutrient runoff from rivers	Taylor & Steinberg (2005) Sargassum sp.
2005	*Sargassum macrocarpum*	in wild	Japan	Yatsuya, et al.				2.1			21	70%	15	4	Unknown if significant nutrient runoff from rivers	Taylor & Steinberg (2005) Sargassum sp.
2005	*Sargassum patens*	in wild	Japan	Yatsuya, et al.				2.4			24	70%	17	5	Unknown if significant nutrient runoff from rivers	Taylor & Steinberg (2005) Sargassum sp.
2005	*Sargassum piluliferum*	in wild	Japan	Yatsuya, et al.				1.5			15	70%	10	3	Unknown if significant nutrient runoff from rivers	Taylor & Steinberg (2005) Sargassum sp.
2005	*Sargassum siliquastrum*	in wild	Japan	Yatsuya, et al.				1.5			15	70%	10	3	Unknown if significant nutrient runoff from rivers	Taylor & Steinberg (2005) Sargassum sp.
2002	*Sargassum yezoense*	in wild	Japan	Agatsuma, et al.				0.9			9	70%	6	2	Unknown if significant nutrient runoff from rivers	Taylor & Steinberg (2005) Sargassum sp.
1997	*Ulva* (holey sea lettuce)	cultivated	Japan	Masatoshi		1		4.9			49	68%	33	9	Unknown if significant nutrient runoff from rivers	use average ash-free yields
													23.5	**6.4**	**Averages**	
															Note that we use 18 tons/ha/yr = 5 g/m2/day in our calculations	