References for kelp biomass turnover

Attwood CG, Lucas MI, Probyn TA, McQuaid CD, Fielding PJ (1991) Production and standing stocks of the kelp *Macrocystis laevis* Hay at the Prince Edward Islands, Subantarctic. *Polar Biology* 11:129–133. https://doi.org/10.1007/bf00234275.

Bell LE, Kroeker KJ (2022) Standing crop, turnover, and production dynamics of *Macrocystis pyrifera* and understory species *Hedophyllum nigripes* and *Neoagarum fimbriatum* in high latitude giant kelp forests. *Journal of Phycology* 58:773–788. https://doi.org/10.1111/jpy.13291.

de Bettignies T, Wernberg T, Lavery PS, Vanderklift MA, Mohring MB (2013) Contrasting mechanisms of dislodgement and erosion contribute to production of kelp detritus. *Limnology and Oceanography* 58:1680–1688. https://doi.org/10.4319/lo.2013.58.5.1680.

Blain CO, Hansen SC, Shears NT (2021) Coastal darkening substantially limits the contribution of kelp to coastal carbon cycles. *Global Change Biology* 27:5547–5563. https://doi.org/10.1111/gcb.15837.

Borum J, Pedersen M, Krause-Jensen D, Christensen P, Nielsen K (2002) Biomass, photosynthesis and growth of *Laminaria saccharina* in a high-arctic fjord, NE Greenland. *Marine Biology* 141:11–19. https://doi.org/10.1007/s00227-002-0806-9.

Brady-Campbell MM, Campbell DB, Harlin MM (1984) Productivity of kelp (*Laminaria* spp.) near the southern limit in the northwestern Atlantic Ocean. *Marine Ecology Progress Series* 18:79–88. https://doi.org/10.3354/meps018079.

Chapman ARO, Lindley JE (1981) Productivity of *Laminaria solidungula* J. Ag. in the Canadian high arctic: a year-round study. In: Levrig T (ed) *International Seaweed Symposium (Xth)*. Walter de Gruyter, Berlin, New York, pp. 247–252. https://doi.org/10.1515/9783110865271-025.

Davis TR, Nimbs MJ, Coleman MA (2025) Seasonal and spatial variation in the growth, biomass production, mortality and potential blue carbon production of golden kelp (*Ecklonia radiata*) off Eastern Australia. *Austral Ecology* 50:e70120. https://doi.org/10.1111/aec.70120.

Dieckmann GS (1978) Aspects of growth and production of *Laminaria pallida* (Grev.) J. Ag. off the Cape Peninsula. MSc, University of Cape Town. http://hdl.handle.net/11427/17787.

Drew EA (1974) An ecological study of *Laminaria ochroleuca* Pyl. growing below 50 metres in the Straits of Messina. *Journal of Experimental Marine Biology and Ecology* 15:11–24. https://doi.org/10.1016/0022-0981(74)90059-8.

Dunton KH (1984) An annual carbon budget for an arctic kelp community. In: Barnes PW, Schell DM, Reimnitz E (eds) *The Alaskan Beaufort Sea: Ecosystems and Environments*. Academic Press, Orlando, pp. 311–325. https://doi.org/10.1016/b978-0-12-079030-2.50021-6.

Dunton KH, Reimnitz ERK, Schonberg S (1982) An arctic kelp community in the Alaskan Beaufort Sea. *Arctic* 35:465–484. https://doi.org/10.14430/arctic2355.

Dunton KH, Schell DM (1986) Seasonal carbon budget and growth of *Laminaria solidungula* in the Alaskan High Arctic. *Marine Ecology Progress Series* 31:57–66. https://doi.org/10.3354/meps031057.

Egan B, Yarish C (1990) Productivity and life history of *Laminaria longicruris* at its southern limit in the Western Atlantic Ocean. *Marine Ecology Progress Series* 67:263–273. https://doi.org/10.3354/meps067263.

Fairhead VA (2001) The ecophysiology and production ecology of the kelp *Ecklonia radiata* (C. Agardh) at West Island, South Australia. PhD, University of Adelaide. https://hdl.handle.net/2440/21777.

Fairhead VA, Cheshire A (2004) Rates of primary productivity and growth in *Ecklonia radiata* measured at different depths, over an annual cycle, at West Island, South Australia. *Marine Biology* 145:41–50. https://doi.org/10.1007/s00227-004-1308-8.

Fernández C, Niell FX (1981) Discusión sobre los métodos usados en la estimación de la producción en macrófitos intermareales. *Oecologia Aquatica* 5:43–52. https://revistes.ub.edu/index.php/oecologiaaquatica/article/view/26920.

Field JG, Jarman, NG, Dieckmann, GS, Griffitsh, CL, Velimirov, B. and Zourendyk, P (1977) Sun, waves, seaweed and lobsters: the dynamics of a west coast kelp-bed. *South African Journal of Science* 73:7. https://hdl.handle.net/10520/AJA00382353_3875.

Flores-Moya A, Fernández JA, Niell FX (1993) Reproductive phenology, growth and primary production of *Phyllariopsis purpurascens* (Phyllariaceae, Phaeophyta) from the Straits of Gibraltar. *European Journal of Phycology* 28:223–230. https://doi.org/10.1080/09670269300650331.

Foreman RE (1984) Studies on *Nereocystis* growth in British Columbia, Canada. *Hydrobiologia* 116/117:325–332. https://doi.org/10.1007/bf00027696.

Franco JN, Sainz Meyer H, Babe Ó, Martins M, Reis B, Sanchez-Gallego Á, Lemos MFL, Dolbeth M, Sousa-Pinto I, Arenas F (2025) Potential blue carbon in the fringe of southern European kelp forests. *Scientific Reports* 15:29573. https://doi.org/10.1038/s41598-025-09361-9.

Fuji A, Kawamura K (1970) Studies on the biology of the sea urchin—VII. Bio-economics of the population of *Strongylocentrotus intermedius* on a rocky shore of southern Hokkaido. *Bulletin of the Japanese Society of Scientific Fisheries (Nippon Suisan Gakkaishi)* 36:763–775. https://doi.org/10.2331/suisan.36.763.

Gerard VA, North WJ (1984) Measuring growth, production, and yield of the giant kelp, *Macrocystis pyrifera*. *Hydrobiologia* 116/117:321–324. https://doi.org/10.1007/bf00027695.

Gerard VA, Mann KH (1979) Growth and production of *Laminaria longicruris* (Phaeophyta) populations exposed to different intensities of water movement. *Journal of Phycology* 15:33–41. https://doi.org/10.1111/j.1529-8817.1979.tb02958.x.

Gerard VA (1976) Some aspects of material dynamics and energy flow in a kelp forest in Monterey Bay, California. PhD, University of California Santa Cruz. https://escholarship.org/uc/item/028959vr.

Gilson AR, White LJ, Burrows MT, Smale DA, O'Connor NE (2023) Seasonal and spatial variability in rates of primary production and detritus release by intertidal stands of *Laminaria digitata* and *Saccharina latissima* on wave-exposed shores in the northeast Atlantic. *Ecology and Evolution* 13:e10146. https://doi.org/10.1002/ece3.10146.

Gunnarson K (1991) Populations de *Laminaria hyperborea* et *Laminaria digitata* (Phéophycées) dans la Baie de Breiðifjorður, Islande. *Rit Fiskideildar* 12:1–141. https://researchgate.net/publication/341179594_Populations_de_Laminaria_hyperborea_er_Laminaria_digitata_Pheophycees_dans_la_baie_de_Breidifjordur_Islande_Repartition_biomass_et_densite_distribution_d'age_croissance_et_production.

Hatcher BG, Chapman ARO, Mann KH (1977) An annual carbon budget for the kelp *Laminaria longicruris*. *Marine Biology* 44:85–96. https://doi.org/10.1007/bf00386909.

Haxen PG, Grindley JR (1985) *Durvillaea antarctica* production in relation to nutrient cycling at Marion Island. In: Siegfried WR, Condy PR, Laws RM (eds) *Antarctic nutrient cycles and food webs*. Springer, Berlin, Heidelberg, pp. 637–640. https://doi.org/10.1007/978-3-642-82275-9_87.

Hay CH (1977) A biological study of *Durvillaea antarctica* (Chamisso) Hariot and *D. willana* Lindauer in New Zealand. PhD, University of Canterbury. https://doi.org/10.26021/7263.

Jackson GA (1987) Modelling the growth and harvest yield of the giant kelp *Macrocystis pyrifera*. *Marine Biology* 95:611–624. https://doi.org/10.1007/bf00393105.

John DM (1971) The distribution and net productivity of sublittoral populations of attached macrophytic algae in an estuary on the Atlantic coast of Spain. *Marine Biology* 11:90–97. https://doi.org/10.1007/bf00348025.

Johnston CS, Jones RG, Hunt RD (1977) A seasonal carbon budget for a laminarian population in a Scottish sea-loch. *Helgoländer Wissenschaftliche Meeresuntersuchungen* 30:527–545. https://doi.org/10.1007/bf02207859.

Jupp BP, Drew EA (1974) Studies on the growth of *Laminaria hyperborea* (Gunn.) Fosl. I. Biomass and productivity. *Journal of Experimental Marine Biology and Ecology* 15:185–196. https://doi.org/10.1016/0022-0981(74)90044-6.

Kain JM (1977) The biology of *Laminaria hyperborea* X. The effect of depth on some populations. *Journal of the Marine Biological Association of the United Kingdom* 57:587. https://doi.org/10.1017/s0025315400025054.

Kamohara S, Hattori K, Harada Y, Waku M, Shiba S, Kurashima A, Maegawa M, Suzuki T (2009) Annual net production and annual carbon and nitrogen absorptions of *Eisenia arborea* in the eastern coast of Ise Bay. *Bulletin of the Japanese Society of Scientific Fisheries (Nippon Suisan Gakkaishi)* https://doi.org/10.2331/suisan.75.1027.

King NG, Moore PJ, Pessarrodona A, Burrows MT, Porter J, Bue M, Smale DA (2020) Ecological performance differs between range centre and trailing edge populations of a cold-water kelp: implications for estimating net primary productivity. *Marine Biology* 167:137. https://doi.org/10.1007/s00227-020-03743-5.

Kirkman H (1989) Growth, density and biomass of *Ecklonia radiata* at different depths and growth under artifical shading off Perth, Western Australia. *Marine and Freshwater Research* 40:169–177. https://doi.org/10.1071/mf9890169.

Kirkman H (1984) Standing stock and production of *Ecklonia radiata* (C. Ag.): J. Agardh. *Journal of Experimental Marine Biology and Ecology* 76:119–130. https://doi.org/10.1016/0022-0981(84)90060-1.

Krumhansl KA, Scheibling RE (2011) Detrital production in Nova Scotian kelp beds: patterns and processes. *Marine Ecology Progress Series* 421:67–82. https://doi.org/10.3354/meps08905.

Lapointe BE, Niell FX, Fuentes JM (1981) Community structure, succession, and production of seaweeds associated with mussel-rafts in the Ria de Arosa, NW Spain. *Marine Ecology Progress Series* 5:243–253. https://doi.org/10.3354/meps005243.

Larkum AWD (1986) A study of growth and primary production in *Ecklonia radiata* (C. Ag.) J. Agardh (Laminariales) at a sheltered site in Port Jackson, New South Wales. *Journal of Experimental Marine Biology and Ecology* 96:177–190. https://doi.org/10.1016/0022-0981(86)90241-8.

Lees DC, Houghton JP, Erickson DE, Driskell WB, Boettcher DE (1986) Ecological studies of intertidal and shallow subtidal habitats in lower Cook Inlet, Alaska. National Oceanic and Atmospheric Administration, Anchorage. https://osti.gov/biblio/6158236.

Leigh Jr. EG, Paine RT, Quinn JF, Suchanek TH (1987) Wave energy and intertidal productivity. *Proceedings of the National Academy of Sciences* 84:1314–1318. https://doi.org/10.1073/pnas.84.5.1314.

Levitt GJ, Anderson RJ, Boothroyd CJT, Kemp FA (2002) The effects of kelp harvesting on its regrowth and the understorey benthic community at Danger Point, South Africa, and a new method of harvesting kelp fronds. *African Journal of Marine Science* 24:71–85. https://doi.org/10.2989/025776102784528501.

Lüning K (1969) Standing crop and leaf area index of the sublittoral *Laminaria* species near Helgoland. *Marine Biology* 3:282–286. https://doi.org/10.1007/bf00360961.

Mann KH (1972) Ecological energetics of the sea-weed zone in a marine bay on the Atlantic coast of Canada. II. Productivity of the seaweeds. *Marine Biology* 14:199–209. https://doi.org/10.1007/bf00348280.

Mann KH (1973) Seaweeds: their productivity and strategy for growth. *Science* 182:975–981. https://doi.org/10.1126/science.182.4116.975.

Miller RJ, Reed DC, Brzezinski MA (2011) Partitioning of primary production among giant kelp (*Macrocystis pyrifera*), understory macroalgae, and phytoplankton on a temperate reef. *Limnology and Oceanography* 56:119–132. https://doi.org/10.4319/lo.2011.56.1.0119.

Nardelli AE, Visch W, Farrington G, Sanderson JC, Bellgrove A, Wright JT, Macleod C, Hurd CL (2024) Primary production of the kelp *Lessonia corrugata* varies with season and water motion: implications for coastal carbon cycling. *Journal of Phycology* 60:102–115. https://doi.org/10.1111/jpy.13408.

Newell RC, Lucas MI, Velimirov B, Seiderer LJ (1980) Quantitative significance of dissolved organic losses following fragmentation of kelp (*Ecklonia maxima* and *Laminaria pallida*). *Marine Ecology Progress Series* 2:45–59. https://doi.org/10.3354/meps002045.

Nielsen MM, Krause-Jensen D, Olesen B, Thinggaard R, Christensen PB, Bruhn A (2014) Growth dynamics of *Saccharina latissima* (Laminariales, Phaeophyceae) in Aarhus Bay, Denmark, and along the species' distribution range. *Marine Biology* 161:2011–2022. https://doi.org/10.1007/s00227-014-2482-y.

Novaczek I (1984) Development and phenology of *Ecklonia radiata* at two depths in Goat Island Bay, New Zealand. *Marine Biology* 81:189–197. https://doi.org/10.1007/bf00393117.

Ortiz M (2010) Dynamic and spatial models of kelp forest of *Macrocystis integrifolia* and *Lessonia trabeculata* (SE Pacific) for assessment harvest scenarios: short-term responses. *Aquatic Conservation: Marine and Freshwater Ecosystems* 20:494–506. https://doi.org/10.1002/aqc.1126.

Pedersen MF, Filbee-Dexter K, Norderhaug KM, Fredriksen S, Frisk NL, Fagerli CW, Wernberg T (2020) Detrital carbon production and export in high latitude kelp forests. *Oecologia* 192:227–239. https://doi.org/10.1007/s00442-019-04573-z.

Pedersen MF, Nejrup LB, Fredriksen S, Christie H, Norderhaug KM (2012) Effects of wave exposure on population structure, demography, biomass and productivity of the kelp *Laminaria hyperborea*. *Marine Ecology Progress Series* 451:45–60. https://doi.org/10.3354/meps09594.

Pessarrodona A, Foggo A, Smale DA (2019) Can ecosystem functioning be maintained despite climate-driven shifts in species composition? Insights from novel marine forests. *Journal of Ecology* 107:91–104. https://doi.org/10.1111/1365-2745.13053.

Quartino ML, Boraso de Zaixso AL (2008) Summer macroalgal biomass in Potter Cove, South Shetland Islands, Antarctica: its production and flux to the ecosystem. *Polar Biology* 31:281–294. https://doi.org/10.1007/s00300-007-0356-1.

Rassweiler A, Reed DC, Harrer SL, Nelson JC (2018) Improved estimates of net primary production, growth, and standing crop of *Macrocystis pyrifera* in Southern California. *Ecology* 89:2068–2068. https://doi.org/10.1002/ecy.2440.

Reed DC, Rassweiler A, Arkema KK (2008) Biomass rather than growth rate determines variation in net primary production by giant kelp. *Ecology* 89:2493–2505. https://doi.org/10.1890/07-1106.1.

Salland N, Wilding C, Jensen A, Smale DA (2024) Spatiotemporal variability in population demography and morphology of the habitat-forming macroalga *Saccorhiza polyschides* in the Western English Channel. *Annals of Botany* 133:117–130. https://doi.org/10.1093/aob/mcad181.

Sheppard CRC, Jupp BP, Sheppard ALS, Bellamy DJ (1978) Studies on the growth of *Laminaria hyperborea* (Gunn.) Fosl. and *Laminaria ochroleuca* De la Pylaie on the French Channel coast. *Botanica Marina* 21:109–116. https://doi.org/10.1515/botm.1978.21.2.109.

Smale DA, Pessarrodona A, King N, Burrows MT, Yunnie A, Vance T, Moore P (2020) Environmental factors influencing primary productivity of the forest-forming kelp *Laminaria hyperborea* in the northeast Atlantic. *Scientific Reports* 10:12161. https://doi.org/10.1038/s41598-020-69238-x.

Smith BD (1986) Implications of population dynamics and interspecific competition for harvest management of the seaweed *Laminaria*. *Marine Ecology Progress Series* 33:7–18. https://doi.org/10.3354/meps033007.

Smith BD (1988) Comparison of productivity estimates for *Laminaria* in Nova Scotia. *Canadian Journal of Fisheries and Aquatic Sciences* 45:557–562. https://doi.org/10.1139/f88-066.

Stuart MDM (1997) The seasonal ecophysiology of *Undaria pinnatifida* (Harvey) Suringar in Otago Harbour, New Zealand. PhD, University of Otago. https://hdl.handle.net/10523/9869.

Tala F, Edding M (2005) Growth and loss of distal tissue in blades of *Lessonia nigrescens* and *Lessonia trabeculata* (Laminariales). *Aquatic Botany* 82:39–54. https://doi.org/10.1016/j.aquabot.2005.02.009.

Tala F, Edding M (2007) First estimates of productivity in *Lessonia trabeculata* and *Lessonia nigrescens* (Phaeophyceae, Laminariales) from the southeast Pacific. *Phycological Research* 55:66–79. https://doi.org/10.1111/j.1440-1835.2006.00447.x.

Tominaga H, Serisawa Y, Ohno M (2004) Seasonal changes in net production of the bladelets and size of the proximal blade of *Ecklonia cava* in Tosa Bay, Kochi Prefecture. *Japanese Journal of Phycology (Sôrui)* 52:13–19. http://sourui.org/publications/sorui/list/52_01.html.

van Tussenbroek BI (1993) Plant and frond dynamics of the giant kelp, *Macrocystis pyrifera*, forming a fringing zone in the Falkland Islands. *European Journal of Phycology* 28:161–165. https://doi.org/10.1080/09670269300650251.

Vadas RL, Beal BF, Wright WA, Nickl S, Emerson S (2004) Growth and productivity of sublittoral fringe kelps (*Laminaria longicruris*) Bach. Pyl. in Cobscook Bay, Maine. *Northeastern Naturalist* 11:143–162. https://doi.org/10.1656/1092-6194(2004)11[143:GAPOSF]2.0.CO;2.

Weigel BL, Pfister CA (2021) The dynamics and stoichiometry of dissolved organic carbon release by kelp. *Ecology* 102:e03221. https://doi.org/10.1002/ecy.3221.

Wheeler WN, Druehl LD (1986) Seasonal growth and productivity of *Macrocystis integrifolia* in British Columbia, Canada. *Marine Biology* 90:181–186. https://doi.org/10.1007/bf00569125.

Yatsuya K, Kiyomoto S, Yoshimura T (2014) Seasonal changes in biomass and net production of *Ecklonia kurome* Okamura community off Gounoura, Iki Island, northern Kyushu, Japan. *Algal Resources* 7:67–77. https://doi.org/10.20804/jsap.7.2_67.

Yokohama Y, Tanaka J, Chihara M (1987) Productivity of the *Ecklonia cava* community in a bay of Izu Peninsula on the Pacific coast of Japan. *The Botanical Magazine (Shokubutsugaku Zasshi)* 100:129–141. https://doi.org/10.1007/bf02488318.