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Sixty Years of Sverdrup: A Retrospective of Progress in the Study of Phytoplankton Blooms

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Supplementary Bibliography

- Alasaarela, E. 1979. Phytoplankton and environmental-conditions in central and coastal areas of the Bothnian Bay. *Annales Botanici Fennici* 16:241–274.
- Alkire, M., E. D'Asaro, and C. Lee. 2012. Estimates of net community production and export using high-resolution, Lagrangian measurements of O₂, NO₃-, and POC. *Deep Sea Research Part I: Oceanographic Research Papers* 64:157–174.
- Anderson, G.C. 1964. The seasonal and geographic distribution of primary productivity off the Washington and Oregon coasts. *Limnology and Oceanography* 9:284–302.
- Apollonio, S. 1980. Primary production in Dumbell Bay in the Arctic Ocean. *Marine Biology* 61:41–51.
- Aron, W. 1959. Midwater trawling studies in the North Pacific. *Limnology and Oceanography* 4:409–418.
- Aron, W. 1962. The distribution of animals in the eastern North Pacific and its relationship to physical and chemical conditions. *Journal of the Fisheries Research Board of Canada* 19:271–314.
- Azam, F., T. Fenche, and J. Field. 1983. The ecological role of water-column microbes in the sea. *Marine Ecology Progress Series* 10:257–263.
- Backhaus, J., H. Wehde, E. Hegseth, and J. Kämpf. 1999. “Phyto-convection”: the role of oceanic convection in primary production. *Marine Ecology Progress Series* 189:77–92.
- Backhaus, J., H. Wehde, E. Hegseth, X. Irigoien, K. Hatten, and K. Logemann. 2003. Convection and primary production in winter. *Marine Ecology Progress Series* 251:1–14.
- Bannister, T. 1974. A general theory of steady state phytoplankton growth in a nutrient saturated mixed layer. *Limnology and Oceanography* 19:13–30.
- Banse, K. 1992. Grazing, temporal changes of phytoplankton concentrations, and the microbial loop in the open sea. Pp. 409–440. in *Primary Productivity and Biogeochemical Cycles in the Sea*. P. G. Falkowski and A. D. Woodhead eds., PlenumPress, New York, New York, USA.
- Banse, K. 2002. Steemann Nielsen and the zooplankton. *Hydrobiologia* 480:15–28.
- Behrenfeld, M., and P. Falkowski. 1997a. A consumer's guide to phytoplankton primary productivity models. *Limnology and Oceanography* 42:1479–1491.
- Behrenfeld, M., and P. Falkowski. 1997b. Photosynthetic rates derived from satellite-based chlorophyll concentration. *Limnology and Oceanography* 42:1–20.
- Behrenfeld, M., E. Boss, D. Siegel, and D. Shea. 2005. Carbon-based ocean productivity and phytoplankton physiology from space. *Global Biogeochemical Cycles* 19.
- Behrenfeld, M.J. 2010. Abandoning sverdrup's critical depth hypothesis on phytoplankton blooms. *Ecology* 91:977–989.
- Behrenfeld, M.J., and E.S. Boss. 2013. Resurrecting the ecological underpinnings of ocean plankton blooms. *Annual Review of Marine Science* 6:1–28.

- Beklemis, C.W., H.J. Semina, N. V Parin, and A.A. Neyman. 1972. Biotope in marine environment. *Marine Biology* 15:57.
- Berger, S., S. Diehl, H. Stibor, G. Trommer, and M. Ruhstroth. 2010. Water temperature and stratification depth independently shift cardinal events during plankton spring succession. *Global Change Biology* 16:1954–1965.
- Berger, S., S. Diehl, H. Stibor, G. Trommer, M. Ruhstroth, A. Wild, A. Weigert, C. Jager, and M. Striebel. 2007. Water temperature and mixing depth affect timing and magnitude of events during spring succession of the plankton. *Oecologia* 150:643–654.
- Berland, B.R., D.J. Bonin, and S. Maestrin. 1974. Enrichment experiments on surface sea-water samples from north-western part of Mediterranean Sea during mediprod-i cruise of RV Jean-Charcot (1969) with special reference to factors limiting primary productivity. *Annales De L Institut Oceanographique* 50:5–25.
- Berland, B.R., D. Bonin, B. Coste, S. Maestrin, and H.J. Minas. 1973. Influence of winter conditions on phytoplankton and zooplankton production in Northwestern-Mediterranean .3. characterization of surface waters by means of algal cultures. *Marine Biology* 23:267–274.
- Bigelow, H. 1926. Plankton of the offshore waters of the Gulf of Maine. 968:Govt. print. off.
- Bindloss, M.E. 1976. The light-climate of Loch Leven, a shallow Scottish lake, in relation to primary production by phytoplankton. *Freshwater Biology* 6:501–518.
- Bindloss, M.E. 2012. Estimates of net community production and export using high-resolution, Lagrangian measurements of O₂, NO₃–, and POC through the evolution of a spring diatom bloom in the North Atlantic. *Deep Sea Research Part I: Oceanographic Research Papers* 64:157–174.
- Blain, S., P. Tréguer, S. Belviso, E. Bucciarelli, M. Denis, S. Desabre, M. Fiala, V. Martin Jézéquel, J. Le Fèvre, P. Mayzaud, J.-C. Marty, and S. Razouls. 2001. A biogeochemical study of the island mass effect in the context of the iron hypothesis: Kerguelen Islands, Southern Ocean. *Deep Sea Research Part I: Oceanographic Research Papers* 48:163–187.
- Boccaletti, G., R. Ferrari, and B. Fox-Kemper. 2007. Mixed layer instabilities and restratification. *Journal of Physical Oceanography* 37:2228–2250.
- Boss, E., and M. Behrenfeld. 2010. In situ evaluation of the initiation of the North Atlantic phytoplankton bloom. *Geophysical Research Letters* 37.
- Boss, E., D. Swift, L. Taylor, P. Brickley, R. Zaneveld, S. Riser, M.J. Perry, and P.G. Strutton. 2008. Observations of pigment and particle distributions in the western North Atlantic from an autonomous float and ocean color satellite. *Limnology and Oceanography* 53:2112–2122.
- Breitbart, M. 2012. Marine viruses: truth or dare. *Marine Science* 4:425–448.
- Briggs, N., M.J. Perry, I. Cetinić, C. Lee, E. D’Asaro, A.M. Gray, and E. Rehm. 2011. High-resolution observations of aggregate flux during a sub-polar North Atlantic spring bloom. *Deep Sea Research Part I: Oceanographic Research Papers* 58:1031–1039.
- Browne, C. 1942. Liebig and the law of the minimum. *Liebig and after Liebig. Publication* 16:71–82.
- Calbet, A., and M. Landry. 2004. Phytoplankton growth, microzooplankton grazing, and carbon cycling in marine systems. *Limnology and Oceanography* 49:51–57.

- Capone, D.G. 1997. Trichodesmium, a Globally Significant Marine Cyanobacterium. *Science* 276:1221–1229.
- Carlson, C., H. Ducklow, and A. Michaels. 1994. Annual flux of dissolved organic carbon from the euphotic zone in the northwestern Sargasso Sea. *Nature* 371:405–408.
- Carmack, E.C., C.B.J. Gray, C.H. Pharo, and R.J. Daley. 1979. Importance of lake-river interaction on seasonal patterns in the general-circulation of Kamloops Lake, British-Columbia. *Limnology and Oceanography* 24:634–644.
- Carvalho, M.C., and B.D. Eyre. 2012. Measurement of planktonic CO₂ respiration in the light. *Limnology and Oceanography: Methods* 10:167–178.
- Caswell, H. 1988. Theory and models in ecology: A different perspective. *Ecological Modelling* 43:33–44.
- Charette, M.A., M.E. Gonnea, P.J. Morris, G. Fones, H. Planquette, I. Salter, and A.N. Garabato. 2007. Radium isotopes as tracers of iron sources fueling a Southern Ocean phytoplankton bloom. *Deep Sea Research Part II: Topical Studies in Oceanography* 54:1989–1998.
- Chisholm, S.W., R.J. Olson, E.R. Zettler, R. Goericke, J.B. Waterbury, and N.A. Welschmeyer. 1988. A novel free-living prochlorophyte abundant in the oceanic euphotic zone. *Nature* 334:340–343.
- Chisholm, S.W., S.L. Frankel, R. Goericke, R.J. Olson, B. Palenik, J.B. Waterbury, L. West-Johnsrud, and E.R. Zettler. 1992. Prochlorococcus marinus nov. gen. nov. sp.: an oxyphototrophic marine prokaryote containing divinyl chlorophyll a and b. *Archives of Microbiology* 157:297–300.
- Chiswell, S. 2011. Annual cycles and spring blooms in phytoplankton: don't abandon Sverdrup completely. *Marine Ecology Progress Series* 443:39–50.
- Claustre, H., Y. Huot, I. Obernosterer, B. Gentili, D. Tailliez, and M. Lewis. 2008. Gross community production and metabolic balance in the South Pacific Gyre, using a non intrusive bio-optical method. *Biogeosciences* 5:463–474.
- Cole, J.J., and N.F. Caraco. 2001. Carbon in catchments: connecting terrestrial carbon losses with aquatic metabolism. *Marine and Freshwater Research* 52:101–110.
- Colebrook, J.M. 1979. Continuous plankton records: Seasonal cycles of phytoplankton and copepods in the North Atlantic ocean and the North Sea. *Marine Biology* 51:23–32.
- Conover, S.A.M. 1975. Nitrogen utilization during spring blooms of marine phytoplankton in Bedford Basin, Nova Scotia, Canada. *Marine Biology* 32:247–261.
- Corner, E.D.S., and A.G. Davies. 1971. Plankton as a factor in nitrogen and phosphorus cycles in the sea. *Advances in Marine Biology* 9:101–204.
- Coste, B., J. Gostan, and H.J. Minas. 1972. Influence of winter conditions on phytoplankton and zooplankton production in northwestern part of Mediterranean .1. hydrological structures and nutrient distribution. *Marine Biology* 16:320–348.
- Croft, M.T., A.D. Lawrence, E. Raux-Deery, M.J. Warren, and A.G. Smith. 2005. Algae acquire vitamin B12 through a symbiotic relationship with bacteria. *Nature* 438:90–93.

- Cushing, D.H. 1959. The seasonal variation in oceanic production as a problem in population dynamics. *Journal Du Conseil* 24:455–464.
- Cushing, D.H. 1962. An Alternative Method of Estimating the Critical Depth. *ICES Journal of Marine Science* 27:131–140.
- Cushing, D.H. 1966. Biological and hydrographic changes in British Seas during last 30 years. *Biological Reviews of the Cambridge Philosophical Society* 41:221–256.
- Cushing, D.H. 1971. Upwelling and production of fish. *Advances in Marine Biology* 9:255–334.
- D'Asaro, E.A. 2008. Convection and the seeding of the North Atlantic bloom. *Journal of Marine Systems* 69:233–237.
- Dale, T., F. Rey, and B. Heimdal. 1999. Seasonal development of phytoplankton at a high latitude oceanic site. *Sarsia* 85:419–435.
- Dandonneau, Y. 1979. Chlorophyll concentrations in the southwest tropical Pacific - a comparison with other tropical oceanic areas. *Oceanologica Acta* 2:133–142.
- Davis, C.S., S.M. Gallager, M. Marra, and W. Kenneth Stewart. 1996. Rapid visualization of plankton abundance and taxonomic composition using the Video Plankton Recorder. *Deep Sea Research Part II: Topical Studies in Oceanography* 43:1947–1970.
- Denman, K., and A. Gargett. 1983. Time and Space Scales of Vertical Mixing and Advection of Phytoplankton in the Upper Ocean. *American Society of Limnology and Oceanography* 28:801–815.
- Dillon, T.M., and D.R. Caldwell. 1980. The Batchelor spectrum and dissipation in the upper ocean. *Journal of Geophysical Research* 85:1910.
- Doyle, R.W., and R. V Poore. 1973. Nutrient competition and division synchrony in phytoplankton. *Journal of Experimental Marine Biology and Ecology* 14:201–210.
- Droop, M.R. 1974. Nutrient status of algal cells in continuous culture. *Journal of the Marine Biological Association of the United Kingdom* 54:825–855.
- Ducklow, H., and R. Harris. 1993. Introduction to the JGOFS North Atlantic bloom experiment. *Deep Sea Research Part II: Topical Studies in Oceanography* 1–8.
- DuRand, M.D., R.J. Olson, and S.W. Chisholm. 2001. Phytoplankton population dynamics at the Bermuda Atlantic Time-series station in the Sargasso Sea. *Deep Sea Research Part II: Topical Studies in Oceanography* 48:1983–2003.
- Dusenberry, J.A., R.J. Olsen, and S.W. Chisholm. 1999. Frequency distributions of phytoplankton single-cell fluorescence and vertical mixing in the surface ocean. *Limnology and Oceanography* 44:431–435.
- Ebert, U., M. Arrayás, N. Temme, B. Sommeijer, and J. Huisman. 2001. Critical conditions for phytoplankton blooms. *Bulletin of Mathematical Biology* 63:1095–1124.
- Edmondson, W.T. 1956. The relation of photosynthesis by phytoplankton to light in lakes. *Ecology* 37:161–174.

- Eilertsen, H. 1989. *Phaeocystis pouchetii* (Hariot) Lagerheim, a key species in Arctic marine ecosystems: life history and physiology. *Rapp Pv Reun Cons Int Explor Mer.*
- Eilertsen, H., and H.C. Ellertsen. 1993. Spring blooms and stratification. *Nature* 363:24–24.
- Eilertsen, H., B. Schei, and J. Taasen. 1981a. Investigations on the plankton community of Bals-fjorden, Northern Norway: The phytoplankton 1976–1978. Abundance, species composition, and succession. *Sarsia* 66:129–141.
- Eilertsen, H., S. Sandberg, and H. Tøllefsen. 1995. Photoperiodic control of diatom spore growth; a theory to explain the onset of phytoplankton blooms . *Marine Ecology Progress Series* 116:303–307.
- Eilertsen, H.C., B. Schei, and J.P. Taasen. 1981b. Investigations on the plankton community of Bals-fjorden, Northern Norway. *Sarsia* 66:129–141.
- Evans, G.T. 1988. A framework for discussing seasonal succession and coexistence of phytoplankton species. *Limnology and Oceanography* 33:1027–1036.
- Evans, G.T., and J.S. Parslow. 1985. A model of annual plankton cycles. *Biological Oceanography* 3:327–347.
- Falkowski, P.G., and T.G. Owens. 1978. Effects of light-intensity on photosynthesis and dark respiration in six species of marine-phytoplankton. *Marine Biology* 45:289–295.
- Falkowski, P.G., and A.D. Woodhead. 1992. *Primary Productivity and Biogeochemical Cycles in the Sea*. PlenumPress, New York, 550 pp.
- Falkowski, P.G., R. Barber, and V. Smetacek. 1998. Biogeochemical Controls and Feedbacks on Ocean Primary Production. *Science* 281:200–206.
- Fauchereau, N., and A. Tagliabue. 2011. The response of phytoplankton biomass to transient mixing events in the Southern Ocean. *Geophysical Research Letters* 38.
- Fenchel, T. 1982. Ecology of heterotrophic microflagellates. II. Bioenergetics and growth. *Marine Ecology Progress Series* 8:225–231.
- Fitzwater, S., G. Knauer, and J. Martin. 1982. Metal contamination and its effect on primary production measurements. *Limnology and Oceanography* 27:544–551.
- Fogg, G.E. 1991. The phytoplanktonic ways of life. *New Phytologist* 118:191–232.
- Fortier, L., and L. Legendre. 1979. Short-term control of the variability of estuarial phytoplankton - vertical stability and critical depth. *Journal of the Fisheries Research Board of Canada* 36:1325–1335.
- Fox-Kemper, B., R. Ferrari, and R. Hallberg. 2008. Parameterization of mixed layer eddies. Part I: Theory and diagnosis. *Journal of Physical Oceanography* 38:1145–1165.
- Francisco, D., R. Mah, and A. Rabin. 1973. Acridine orange-epifluorescence technique for counting bacteria in natural waters. *Journal of the American Microscopical Society* 92:416–421.
- Franks, P. 2002. NPZ models of plankton dynamics: their construction, coupling to physics, and application. *Journal of Oceanography* 58:379–387.

- Gachter, R., R. Vollenwe, and W. Gloosche. 1974. Seasonal-variations of temperature and nutrients in surface waters of Lakes Ontario and Erie. *Journal of the Fisheries Research Board of Canada* 31:275–290.
- Gallegos, C.L., and T. Platt. 1982. Phytoplankton production and water motion in surface mixed layers. *Deep Sea Research Part A. Oceanographic Research Papers* 29:65–76.
- Ghosal, S., and S. Mandre. 2003. A simple model illustrating the role of turbulence on phytoplankton blooms. *Journal of Mathematical Biology* 46:333–346.
- Del Giorgio, P.A., and P.J. le B. Williams. 2005. *Respiration in Aquatic Ecosystems*. Oxford University Press, 326 pp.
- Giovannoni, S., and K. Vergin. 2012. Seasonality in ocean microbial communities. *Science* 335:671–676.
- Gostan, J., and P. Nival. 1963. Oceanographie - distribution hivernale des caractéristiques hydrologiques en Mer Ligure et estimation de la bonté du phytoplancton par la méthode des pigments. *Comptes Rendus Hebdomadaires Des Séances De L'Academie Des Sciences* 257:2872–&.
- Gran, H., and T. Braarud. 1935. A quantitative study on the phytoplankton of the Bay of Fundy and the Gulf of Maine (including observations on hydrography, chemistry and morbidity). *Journal of Biology Board Canada* 1:219–467.
- Grant, H., R. Stewart, and A. Moilliet. 1962. Turbulence spectra from a tidal channel. *Journal of Fluid Mechanics* 12:241–268.
- Grant, H., B. Hughes, W. Vogel, and A. Moilliet. 1968a. The spectrum of temperature fluctuations in turbulent flow. *Journal of Fluid Mechanics* 34:423–442.
- Grant, H.L., A. Moilliet, and W.M. Vogel. 1968b. Some observations of the occurrence of turbulence in and above the thermocline. *Journal of Fluid Mechanics* 34:443–448.
- Gregg, M. 1991. The study of mixing in the ocean: A brief history. *Oceanography* 4:39–45.
- Haas, L.W. 1977. Effect of spring-neap tidal cycle on vertical salinity structure of James, York and Rappahannock Rivers, Virginia, USA. *Estuarine and Coastal Marine Science* 5:485–496.
- Hansen, E., and H.C. Eilertsen. 2007. Do the polyunsaturated aldehydes produced by *Phaeocystis pouchetii* (Hariot) Lagerheim influence diatom growth during the spring bloom in Northern Norway? *Journal of Plankton Research* 29:87–96.
- Hansen, G., and H. Eilertsen. 1995. Modelling the onset of phytoplankton blooms: a new approach. *Ecology of Fjords and Coastal Waters* 73–83.
- Harris, G. 1984. Phytoplankton productivity and growth measurements: past, present and future. *Journal of Plankton Research* 6:219–237.
- Hedges, J., R. Keil, and R. Benner. 1997. What happens to terrestrial organic matter in the ocean? *Organic Geochemistry* 27:195–212.
- Heimdal, B. 1974. Composition and abundance of phytoplankton in the Ullsfjord area, North Norway. *Astarte*.

- Henson, S., I. Robinson, J. Allen, and J. Waniek. 2006. Effect of meteorological conditions on interannual variability in timing and magnitude of the spring bloom in the Irminger Basin, North Atlantic. *Deep Sea Research Part I: Oceanographic Research Papers* 53:1601–1615.
- Heukelekian, H., D. Bloodgood, N. Chamerlin, G. Edwards, M. Ettinger, I. Gellman, C. Henderson, R. Hoak, R. Ingols, P. Kabler, M. Katz, R. Kountz, R. Manganelli, G. McDermott, P. McGauhey, W. Moggio, W. Moore, H. Orford, R. Palange, C. Palmer, G. Rohlich, L. Setter, D. Smith, C. Tarzwell, H. Trebler, Tsivoglou, and L. Van Kleeck. 1955. A critical review of the literature of 1954 on sewage, waste treatment, and water pollution. *Sewage and Industrial Wastes* 27:633–688.
- Hickel, W. 1967. Investigations on phytoplankton bloom in Western Baltic. *Helgolander Wissenschaftliche Meeresuntersuchungen* 16:3–66.
- Himmelman, J.H. 1975. Phytoplankton as a stimulus for spawning in 3 marine invertebrates. *Journal of Experimental Marine Biology and Ecology* 20:199–214.
- Himmelman, J.H. 1979. Factors regulating the reproductive-cycles of 2 Northeast Pacific chitons, *Tonicella-lineata* and *Tonicella-insignis*. *Marine Biology* 50:215–225.
- Hiscock, M.R., V.P. Lance, A.M. Apprill, R.R. Bidigare, Z.I. Johnson, B.G. Mitchell, W.O. Smith, and R.T. Barber. 2008. Photosynthetic maximum quantum yield increases are an essential component of the Southern Ocean phytoplankton response to iron. *Proceedings of the National Academy of Sciences of the United States of America* 105:4775–4780.
- Hobbie, J., R. Daley, and S. Jasper. 1977. Use of nucleopore filters for counting bacteria by fluorescence microscopy. *Applied and Environmental Microbiology* 33:1225–1228.
- Hobson, L.A. 1966. Some influences of Columbia River effluent on marine phytoplankton during January 1961. *Limnology and Oceanography* 11:223–234.
- Hollibaugh, J., D.L.R. Seibert, and W.H. Thomas. 1981. Observations on the survival and germination of resting spores of three *Chaetoceros* (Bacillariophyceae) species. *Journal of Phycology* 17:1–9.
- Huisman, J., and F. Weissing. 1994. Light-limited growth and competition for light in well-mixed aquatic environments: an elementary model. *Ecology* 75:507–520.
- Huisman, J., and F. Weissing. 1999. Biodiversity of plankton by species oscillations and chaos. *Nature* 402:407–410.
- Huisman, J., and B. Sommeijer. 2002. Population dynamics of sinking phytoplankton in light-limited environments: simulation techniques and critical parameters. *Journal of Sea Research* 48:83–96.
- Huisman, J., P. van Oostveen, and F. Weissing. 1999a. Species dynamics in phytoplankton blooms: incomplete mixing and competition for light. *The American Naturalist* 154:46–68.
- Huisman, J., P. van Oostveen, and F.J. Weissing. 1999b. Critical depth and critical turbulence: Two different mechanisms for the development of phytoplankton blooms. *Limnology and Oceanography* 44:1781–1787.
- Huisman, J., A.M. Johansson, E.O. Folmer, and F.J. Weissing. 2001. Towards a solution of the plankton paradox: the importance of physiology and life history. *Ecology Letters* 4:408–411.
- Huisman, J., M. Arrayás, U. Ebert, and B. Sommeijer. 2002. How do sinking phytoplankton species manage to persist? *The American Naturalist* 159:245–254.

- Huntsman, S.A., and R.T. Barber. 1977. Primary production off northwest Africa: the relationship to wind and nutrient conditions. *Deep Sea Research* 24:25–33.
- Huntsman, S.A., and W.G. Sunda. 1980. The role of trace metals in regulating phytoplankton growth with emphasis on Fe, Mn and Cu [iron, manganese, copper]. *Studies in Ecology* 7.
- Iverson, R.L., H.C. Curl, and J.L. Saugen. 1974a. Simulation model for wind-driven summer phytoplankton dynamics in Auke Bay, Alaska. *Marine Biology* 28:169–177.
- Iverson, R.L., H.B. Oconnors, D. Kirk, and K. Zakar. 1974b. Summer phytoplankton blooms in Auke-Bay, Alaska, driven by wind mixing of water column. *Limnology and Oceanography* 19:271–278.
- Jackson, G. 2008. Effect of mixed layer depth on phytoplankton removal by coagulation and on the critical depth concept. *Deep Sea Research Part I: Oceanographic Research Papers* 55:766–776.
- Jewson, D.H. 1976. Interaction of components controlling net phytoplankton photosynthesis in a well-mixed lake (Lough-Neagh Northern-Ireland). *Freshwater Biology* 6:551–576.
- Johnson, L. 1966. Temperature of maximum density of fresh water and its effect on circulation in Great Bear Lake. *Journal of the Fisheries Research Board of Canada* 23:963–973.
- Johnson, L. 1975. Physical and chemical characteristics of Great Bear Lake, Northwest Territories. *Journal of the Fisheries Research Board of Canada* 32:1971–1987.
- Karl, D.M., M.J. Church, J.E. Dore, R.M. Letelier, and C. Mahaffey. 2012. Predictable and efficient carbon sequestration in the North Pacific Ocean supported by symbiotic nitrogen fixation. *Proceedings of the National Academy of Sciences* 109:1842–1849.
- Kierstead, H., and L. Slobodkin. 1953. The size of water masses containing plankton blooms. *Journal of Marine Research* 12:141–147.
- Kimmel, B.L., and O.T. Lind. 1972. Factors affecting phytoplankton production in a eutrophic reservoir. *Archiv Fur Hydrobiologie* 71:124–141.
- Körtzinger, A., U. Send, R.S. Lampitt, S. Hartman, D.W.R. Wallace, J. Karstensen, M.G. Villagarcia, O. Llinás, and M.D. DeGrandpre. 2008. The seasonal p CO₂ cycle at 49°N/16.5°W in the northeastern Atlantic Ocean and what it tells us about biological productivity. *Journal of Geophysical Research* 113:C04020.
- Landry, M., R. Barber, R. Bidigare, F. Chai, K. Coale, H. Dam, M. Lewis, S. Lindley, J. McCarthy, M. Roman, D. Stoecker, P. Verity, and J. White. 1997. Iron and grazing constraints on primary production in the central equatorial Pacific: An EqPac synthesis. *Limnology and Oceanography* 42:405–418.
- Landry, M., and R. Hassett. 1982. Estimating the grazing impact of marine micro-zooplankton. *Marine Biology* 67:283–288.
- Landry, M., J. Kirshtein, and J. Constantinou. 1995. A refined dilution technique for measuring the community grazing impact of microzooplankton, with experimental tests in the central equatorial Pacific. *Marine Ecology Progress Series* 120:53–63.
- Lawerence, C., and S. Menden-Deuer. 2012. Drivers of protistan grazing pressure: seasonal signals of plankton community composition and environmental conditions. *Marine Ecology Progress Series* 459:39–52.

- Laws, E., and J. Caperon. 1976. Carbon and nitrogen-metabolism by Monochrysis-lutheri - measurement of growth-rate-dependent respiration rates. *Marine Biology* 36:85–97.
- Lewis, M.R., D. Hebert, W.G. Harrison, T. Platt, and N.S. Oakey. 1986. Vertical nitrate fluxes in the oligotrophic ocean. *Science* 234:870–873.
- Longhurst, A., and W.G. Harrison. 1989. The biological pump: profiles of plankton production and consumption in the upper ocean. *Progress in Oceanography* 22:47–123.
- Longhurst, A., S. Sathyendranath, T. Platt, and C. Caverhill. 1995. An estimate of global primary production in the ocean from satellite radiometer data. *Journal of Plankton Research* 17:1245–1271.
- Lorenzen, M., and R. Mitchell. 1973. Theoretical effects of artificial destratification on algal production in impoundments. *Environmental Science & Technology* 7:939–944.
- Lozier, M.S., A.C. Dave, J.B. Palter, L.M. Gerber, and R.T. Barber. 2011. On the relationship between stratification and primary productivity in the North Atlantic. *Geophysical Research Letters* 38.
- Lucas, L., J. Cloern, J.R. Koseff, S.G. Monismith, and J.K. Thompson. 1998. Does the Sverdrup critical depth model explain bloom dynamics in estuaries? *Journal of Marine Research* 56:375–415.
- Lund, J.W.G., and J.F. Talling. 1957. Botanical limnological methods with special reference to the algae. *Botanical Review* 23:489–583.
- Mahadevan, A., and A. Tandon. 2006. An analysis of mechanisms for submesoscale vertical motion at ocean fronts. *Ocean Modelling* 14:241–256.
- Mahadevan, A., E. D'Asaro, C. Lee, and M.J. Perry. 2012. Eddy-driven stratification initiates North Atlantic spring phytoplankton blooms. *Science* 337:54–58.
- Mandelli, E.F. 1967. Enhanced photosynthetic assimilation ratios in Antarctic polar front (convergence) diatoms. *Limnology and Oceanography* 12:484–491.
- Margalef, R. 1978. Life-forms of phytoplankton as survival alternatives in an unstable environment. *Oceanologica Acta* 1:493–509.
- Marra, J. 1978a. Phytoplankton photosynthetic response to vertical movement in a mixed layer. *Marine Biology* 46:203–208.
- Marra, J. 1978b. Effect of short-term variations in light intensity on photosynthesis of a marine phytoplankton: A laboratory simulation study. *Marine Biology* 46:191–202.
- Marra, J., and C. Ho. 1993. Initiation of the spring bloom in the northeast Atlantic (47 N, 20 W): a numerical simulation. *Deep Sea Research Part II: Topical Studies in Oceanography* 40:55–73.
- Marra, J., and R. Barber. 2005. Primary productivity in the Arabian Sea: A synthesis of JGOFS data. *Progress in Oceanography* 65:159–175.
- Martin, J., and S. Fitzwater. 1988. Iron deficiency limits phytoplankton growth in the north-east Pacific subarctic. *Nature* 331:341–343.
- Martin, J.H., R.M. Gordon, and S.E. Fitzwater. 1990a. Iron in Antarctic waters. *Nature* 345:156–158.

- Martin, J.H., R.M. Gordon, S. Fitzwater, and W.W. Broenkow. 1989. Vertex: phytoplankton/iron studies in the Gulf of Alaska. *Deep Sea Research Part A. Oceanographic Research Papers* 36:649–680.
- Martin, J.H., W.W. Broenkow, S.E. Fitzwater, and R.M. Gordon. 1990b. Yes, it does: A reply to the comment by Banse. *Limnology and Oceanography* 35:775–777.
- Matthews, J.B. 1968. On acclimatization of *Calanus finmarchicus* (Crustacea Copepoda) to different temperature conditions in North Atlantic. *Sarsia* 34:371–382.
- McGowan, J.A., and T.L. Hayward. 1978. Mixing and oceanic productivity. *Deep Sea Research* 25:771–793.
- McQuoid, M.R., and L.A. Hobson. 1995. Importance of resting stages in diatom seasonal succession. *Journal of Phycology* 31:44–50.
- Melack, J.M., and P. Kilham. 1974. Photosynthetic rates of phytoplankton in East-African alkaline, saline lakes. *Limnology and Oceanography* 19:743–755.
- Menzel, D.W., and J.H. Ryther. 1961. Annual variations in primary production of the Sargasso sea off Bermuda. *Deep Sea Research* 7:282–288.
- Michaelis, L., and M.L. Menten. 1913. Die kinetik der invertinwirkung. *Biochem z* 333–369.
- Miki, T., and S. Jacquet. 2008. Complex interactions in the microbial world: under-explored key links between viruses, bacteria and protozoan grazers in aquatic environments. *Aquatic Microbial Ecology* 51:195–208.
- Mills, E.L. 1989. *Biological Oceanography: An Early History, 1870-1960*. Cornell University Press, 378 pp.
- Mook, D. 1983. In defense of external invalidity. *American Psychologist* 38:379–387.
- Moore, C.M., M.M. Mills, A. Milne, R. Langlois, E.P. Achterberg, K. Lochte, R.J. Geider, and J. La Roche. 2006. Iron limits primary productivity during spring bloom development in the central North Atlantic. *Global Change Biology* 12:626–634.
- Morel, A. 1991. Light and marine photosynthesis: a spectral model with geochemical and climatological implications. *Progress in Oceanography* 26:263–306.
- Moum, J.N., D.R. Caldwell, and C.A. Paulson. 1989. Mixing in the equatorial surface layer and thermocline. *Journal of Geophysical Research* 94:2005.
- Munawar, M., and I.F. Munawar. 1975. Observations on growth of diatoms in Lake Ontario with emphasis on *Melosira-binderana kutz* during thermal bar conditions. *Archiv Fur Hydrobiologie* 75:490–499.
- Murphy, G.I. 1971. Clarifying a production model. *Limnology and Oceanography* 16:981–983.
- Nasmyth, P. 1973. Turbulence and microstructure in the upper ocean. *Mémoires de La Société Royale Des Sciences de Liège* 47–56.
- Nelson, D., and W. Smith. 1991a. The role of light and major nutrients. *Limnology and Oceanography*.
- Nelson, D.M., and W.O.J. Smith. 1991b. Sverdrup revisited: Critical depths, maximum chlorophyll levels, and the control of Southern Ocean productivity by the irradiance-mixing regime. *Limnology and Oceanography* 36:1650–1661.

- Nielsen, E. 1960. Productivity of the oceans. *Annual Review of Plant Physiology* 11:341–362.
- Nielsen, E.S. 1958. The balance between phytoplankton and zooplankton in the sea. *ICES Journal of Marine Science* 23:178–188.
- Nival, P. 1965. Sur le cycle de dictyocha fibula ehrenberg dans les Eaux de surface de la rade de Villefranche-Sur-Mer. *Cahiers de Biologie Marine* 6:67–82.
- Oakey, N. 1982. Determination of the rate of dissipation of turbulent energy from simultaneous temperature and velocity shear microstructure measurements. *Journal of Physical Oceanography* 12:256–271.
- Oakey, N., and J. Elliott. 1982. Dissipation within the surface mixed layer. *Journal of Physical Oceanography* 12:171–185.
- Obata, A., J. Ishizaka, and M. Endoh. 1996. Global verification of critical depth theory for phytoplankton bloom with climatological in situ temperature and satellite ocean color data. *Journal of Geophysical Research* 101:20657–20667.
- Obrien, W.J. 1974. Dynamics of nutrient limitation of phytoplankton algae - model reconsidered. *Ecology* 55:135–141.
- Ōkubo, A. 1980. *Diffusion and Ecological Problems: Mathematical Models*. Springer-Verlag, Berlin-Heidelberg-New York, 254 pp.
- Olson, R., and H. Sosik. 2007. A submersible imaging-in-flow instrument to analyze nano-and microplankton: Imaging FlowCytobot. *Limnology and Oceanography: Methods* 5:195–203.
- Osborn, T. 1974. Vertical profiling of velocity microstructure. *Journal of Physical Oceanography* 4:109–115.
- Owen, R.W. 1989. Microscale and finescale variations of small plankton in coastal and pelagic environments. *Journal of Marine Research* 47:197–240.
- Ozmidov, R. 1965. On the turbulent exchange in a stably stratified ocean. *Atmospheric and Oceanic Physics* 8:853–860.
- Packard, T.T. 1979. Respiration and respiratory electron-transport activity in plankton from the Northwest African upwelling area. *Journal of Marine Research* 37:711–742.
- Parker, R.R., and J. Sibert. 1973. Effect of pulpmill effluent on dissolved oxygen in a stratified estuary—I. Empirical observations. *Water Research* 7:503–514.
- Parker, R.R., J. Sanderso, C.R. Horwood, and D.H. Heller. 1972. Some facets of impact of pulp mill effluent on Alberni Inlet. *Pulp and Paper Magazine of Canada* 73.
- Parsons, T.R. 1975. Biological oceanography in Canada - perspective and review. *Journal of the Fisheries Research Board of Canada* 32:2231–2268.
- Parsons, T.R., L.F. Giovando, and R.J. LeBrasseur. 1966. The advent of the spring bloom in the Eastern Subarctic Pacific Ocean. *Journal of the Fisheries Research Board of Canada* 23:539–546.
- Partensky, F., W. Hess, and D. Vaulot. 1999. Prochlorococcus, a marine photosynthetic prokaryote of global significance. *Microbiology and Molecular Biology Reviews* 63:106–127.

- Patten, B.C. 1961. Negentropy flow in communities of plankton. *Limnology and Oceanography* 6:26–30.
- Pingree, R.D., P.M. Holligan, and G.T. Mardell. 1978. The effects of vertical stability on phytoplankton distributions in the summer on the northwest European shelf. *Deep Sea Research* 25:1011–1028.
- Pingree, R.D., P.M. Holligan, G.T. Mardell, and R.N. Head. 1976. Influence of physical stability on spring, summer and autumn phytoplankton blooms in Celtic Sea. *Journal of the Marine Biological Association of the United Kingdom* 56:845–873.
- Platt, T. 1972. Local phytoplankton abundance and turbulence. *Deep Sea Research and Oceanographic Abstracts* 19:183–187.
- Platt, T., D.F. Bird, and S. Sathyendranath. 1991. Critical depth and marine primary production. *Proceedings of the Royal Society B: Biological Sciences* 246:205–217.
- Pomeroy, L.R. 1974. The ocean's food web, a changing paradigm. *BioScience* 24:499–504.
- Redfield, A. 1934. On the proportions of organic derivatives in sea water and their relation to the composition of plankton. *University Press of Liverpool* 176–192.
- Richardson, T.L., and G.A. Jackson. 2007. Small phytoplankton and carbon export from the surface ocean. *Science* 315:838–840.
- Richardson, T.L., G.A. Jackson, H.W. Ducklow, and M.R. Roman. 2004. Carbon fluxes through food webs of the eastern equatorial Pacific: an inverse approach. *Deep Sea Research Part I: Oceanographic Research Papers* 51:1245–1274.
- Richardson, T.L., G.A. Jackson, H.W. Ducklow, and M.R. Roman. 2006. Spatial and seasonal patterns of carbon cycling through planktonic food webs of the Arabian Sea determined by inverse analysis. *Deep Sea Research Part II: Topical Studies in Oceanography* 53:555–575.
- Riley, G. 1946. Factors controlling phytoplankton populations on Georges Bank. *Journal of Marine Research* 6:54–73.
- Riley, G., and D. Bumpus. 1946. Phytoplankton-zooplankton relationships on Georges Bank. *Journal of Marine Research* 6:33–47.
- Riser, S.C., and K.S. Johnson. 2008. Net production of oxygen in the subtropical ocean. *Nature* 451:323–325.
- Ryther, J.H., and C.S. Yentsch. 1958. Primary production of continental shelf waters off New York. *Limnology and Oceanography* 3:327–335.
- Schei, B. 1974. Phytoplankton investigations in Skjomen, a fjord in North Norway, 1970-1971. *Astarte* 7:17–42.
- Scholin, C., G. Massion, E. Mellinger, and M. Brown. 1998. The development and application of molecular probes and novel instrumentation for detection of harmful algae. *Ocean Community Conference '98 Proceedings* 1:367–370.
- Semina, H. 1960. The influence of vertical circulation on the phytoplankton in the Bering Sea. *Internationale Revue Der Gesamten Hydrobiologie* 45:1–10.

- Sevigny, J.M., M. Sinclair, M.I. Elsabh, S. Poulet, and A. Coote. 1979. Summer plankton distributions associated with the physical and nutrient properties of the Northwestern Gulf of St-Lawrence. *Journal of the Fisheries Research Board of Canada* 36:187–203.
- Siegel, D., S. Doney, and J. Yoder. 2002. The North Atlantic spring phytoplankton bloom and Sverdrup's critical depth hypothesis. *Science* 296:730–733.
- Skellam, J. 1951. Random dispersal in theoretical populations. *Biometrika* 38:196–218.
- Smetacek, V., and U. Passow. 1990. Spring bloom initiation and Sverdrup's critical-depth model. *Limnology and Oceanography* 35:228–234.
- Smith, W., and D. Nelson. 1985. Phytoplankton bloom produced by a receding ice edge in the Ross Sea: spatial coherence with the density field. *Science* 227:163–166.
- Sommer, U. 2012. Experimental induction of a coastal spring bloom early in the year by intermittent high-light episodes. *Marine Ecology Progress Series* 446:61–71.
- Sommer, U., and K. Lengfellner. 2008. Climate change and the timing, magnitude, and composition of the phytoplankton spring bloom. *Global Change Biology* 14:1199–1208.
- Souza Lima, H.D., and P. Williams. 1978. Oxygen-consumption by planktonic population of an estuary - Southampton Water. *Estuarine and Coastal Marine Science* 6:515–521.
- Stadelma.P, J.E. Moore, and E. Pickett. 1974. Primary production in relation to temperature structure, biomass concentration, and light conditions at an onshore and offshore station in Lake Ontario. *Journal of the Fisheries Research Board of Canada* 31:1215–1232.
- Steele, J.H. 1959. The quantitative ecology of marine phytoplankton. *Biological Reviews of the Cambridge Philosophical Society* 34:129–158.
- Steele, J.H. 1962. Environmental control of photosynthesis in the sea. *Limnology and Oceanography* 7:137–150.
- Steele, J.H., and D.W. Menzel. 1962. Conditions for maximum primary production in the mixed layer. *Deep-Sea Research* 9:39–49.
- Stefan, H., T. Skoglund, and R.O. Megard. 1976. Wind control of algae growth in eutrophic lakes. *Journal of the Environmental Engineering Division-Asce* 102:1201–1213.
- Steyaert, J. 1973. Difference in diatom abundance between 2 summer periods of 1965 and 1967 in Antarctic inshore waters (Bred-Bay). *Investigacion Pesquera* 37:517–531.
- Stramska, M., and T. Dickey. 1994. Modeling phytoplankton dynamics in the Northeast Atlantic during the initiation of the spring bloom. *Journal of Geophysical Research* 99:10241–10253.
- Strickla, J. 1965. Phytoplankton and marine primary production. *Annual Review of Microbiology* 19:127–162.
- Strom, S., M. Brainard, J. Holmes, and M. Olson. 2001. Phytoplankton blooms are strongly impacted by microzooplankton grazing in coastal North Pacific waters. *Marine Biology* 138:355–368.
- Strom, S.L., C.B. Miller, and B.W. Frost. 2000. What sets lower limits to phytoplankton stocks in high-nitrate, low-chlorophyll regions of the open ocean? *Marine Ecology Progress Series* 193:19–31.

- Sunda, W., and S. Huntsman. 1997. Interrelated influence of iron, light and cell size on marine phytoplankton growth. *Nature* 2051:1193–1197.
- Sverdrup, H. 1953. On conditions for the vernal blooming of phytoplankton. *Journal Du Conseil* 18:287–295.
- Takahashi, M., J. Barwellclarke, F. Whitney, and P. Koeller. 1978. Winter condition of marine plankton populations in Saanich Inlet, BC, Canada .1. phytoplankton and its surrounding environment. *Journal of Experimental Marine Biology and Ecology* 31:283–301.
- Talling, J.F. 1961. Photosynthesis under natural conditions. *Annual Review of Plant Physiology and Plant Molecular Biology* 12:133–154.
- Tang, Y., F. Koch, and C. Gobler. 2010. Most harmful algal bloom species are vitamin B1 and B12 auxotrophs. *Proceedings of the National Academy of Sciences* 107:20756–20761.
- Taylor, J., and R. Ferrari. 2011. Shutdown of turbulent convection as a new criterion for the onset of spring phytoplankton blooms. *Geophysical Research Letters* 38:2293–2307.
- Tett, P., and A. Wallis. 1978. General annual cycle of chlorophyll standing crop in Loch Creran. *Journal of Ecology* 66:227–239.
- Thomas, C.W. 1966. Vertical circulation off Ross Ice Shelf. *Pacific Science* 20:239–245.
- Thorpe, S. 1977. Turbulence and mixing in a Scottish loch. *Philosophical Transactions for the Royal Society of London. Series A, Mathematical and Physical Sciences* 286:125–181.
- Thorpe, S. 2005. *The Turbulent Ocean*. Cambridge University Press, New York, NY, 439 pp.
- Tilzer, M.M., and C.R. Goldman. 1978. Importance of mixing, thermal stratification and light adaptation for phytoplankton productivity in Lake Tahoe (California-Nevada). *Ecology* 59:810–821.
- Townsend, D., and M. Keller. 1992. Spring phytoplankton blooms in the absence of vertical water column stratification. *Nature* 360:59–62.
- Townsend, D., and L. Cammen. 1994. Causes and consequences of variability in the timing of spring phytoplankton blooms. *Deep Sea Research Part I: Oceanographic Research Papers* 41:747–765.
- Vanderho, L., B. Dana, D. Emerich, and R.H. Burris. 1972. Acetylene reduction in relation to levels of phosphate and fixed nitrogen in Green Bay. *New Phytologist* 71:1097–1105.
- Vegter, F. 1977. Closure of Grevelingen Estuary - its influence on phytoplankton primary production and nutrient content. *Hydrobiologia* 52:67–71.
- Venrick, E.L., J.A. McGowan, D.R. Cayan, and T.L. Hayward. 1987. Climate and chlorophyll a: Long-term trends in the Central North Pacific Ocean. *Science* 238:70–72.
- Walsh, J.J. 1971. Relative importance of habitat variables in predicting distribution of phytoplankton at ecotone of Antarctic upwelling ecosystem. *Ecological Monographs* 41:291–309.
- Ward, B., and J. Waniek. 2007. Phytoplankton growth conditions during autumn and winter in the Irminger Sea, North Atlantic. *Marine Ecology Progress Series* 334:47–61.

- Williams, P.J. le B., and D. Lefèvre. 2008. An assessment of the measurement of phytoplankton respiration rates from dark ^{14}C incubations. *Limnology and Oceanography: Methods* 6:1–11.
- Winter, D.F., K. Banse, and G.C. Anderson. 1975. Dynamics of phytoplankton blooms in Puget Sound, a fjord in Northwestern United-States. *Marine Biology* 29:139–176.
- Yoder, J., and C. McClain. 1993. Annual cycles of phytoplankton chlorophyll concentrations in the global ocean: A satellite view. *Global Biogeochemical Cycles* 7:181–193.
- Zentara, S.J., and D. Kamykowski. 1977. Latitudinal relationships among temperature and selected plant nutrients along west coast of North-America and South-America. *Journal of Marine Research* 35:321–337.