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Disappearance of Pacific Water in the northwestern Fram Strait

Eva Falck,[1] Gerhard Kattner, and Gereon Budéus

Alfred-Wegener-Institut für Polar- und Meeresforschung, Bremerhaven, Germany

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[1] Water of Pacific origin, entering the Arctic Ocean through the Bering Strait, exits the Arctic Ocean through the Canadian Archipelago and the Fram Strait. The amount and timing of Pacific Water export through these gates depend on the upper circulation of the Arctic Ocean and react accordingly on changes. Nutrient and hydrographic data from four cruises to the area north of the Fram Strait in 1984, 1990, 1997, and 2004 show that substantial changes have occurred lately in the amount of Pacific Waters delivered to the Fram Strait and hence further to the Atlantic Ocean. While the data from 1984, 1990, and 1997 all showed considerable amounts of Pacific Water above the shelf and slope northeast of Greenland, this strong signal had completely vanished in 2004. The arrival of a previously not observed cold halocline layer at the area can be recognized in 1997. **Citation:** Falck, E., G. Kattner, and G. Budéus (2005), Disappearance of Pacific Water in the northwestern Fram Strait, *Geophys. Res. Lett.*, *32*, L14619, doi:10.1029/2005GL023400.

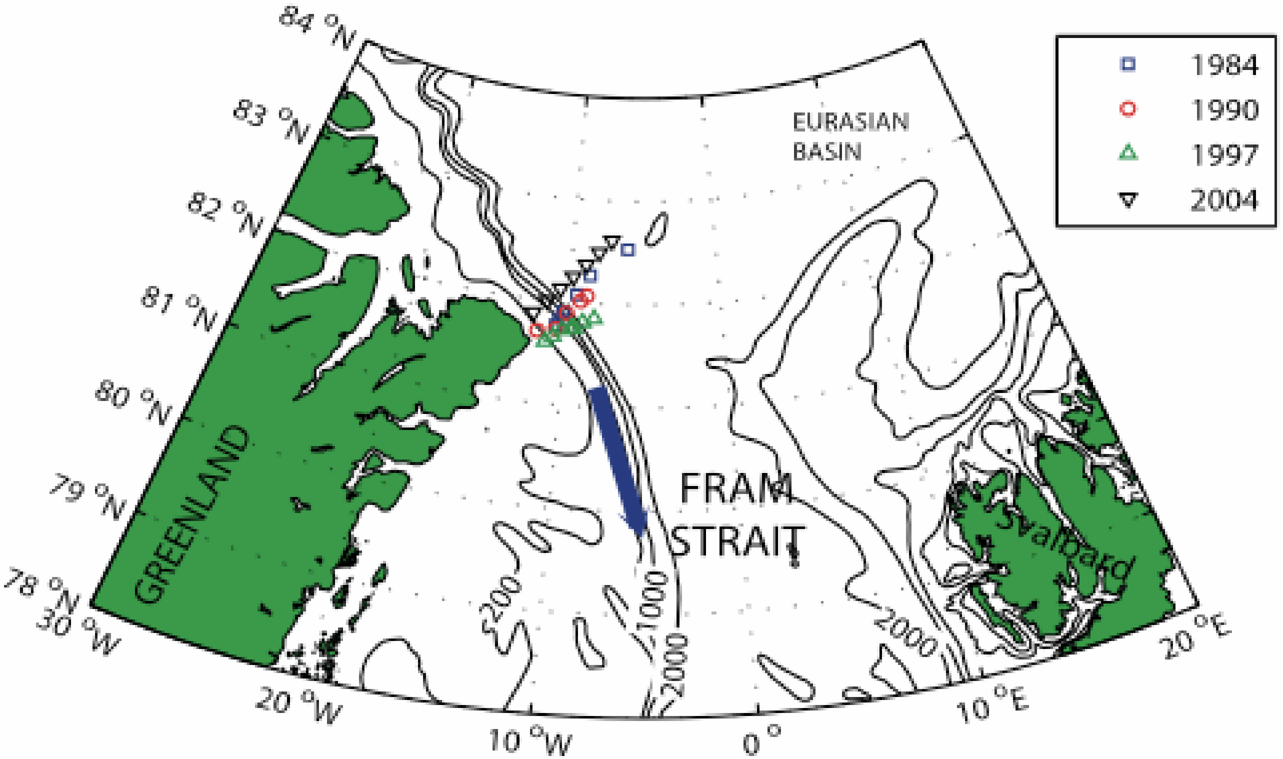

Figure 1. Map of the Fram Strait with station positions for 1984, 1990, 1997, and 2004. Thin lines show the bathymetry, in meters. Blue arrow show the East Greenland Current.

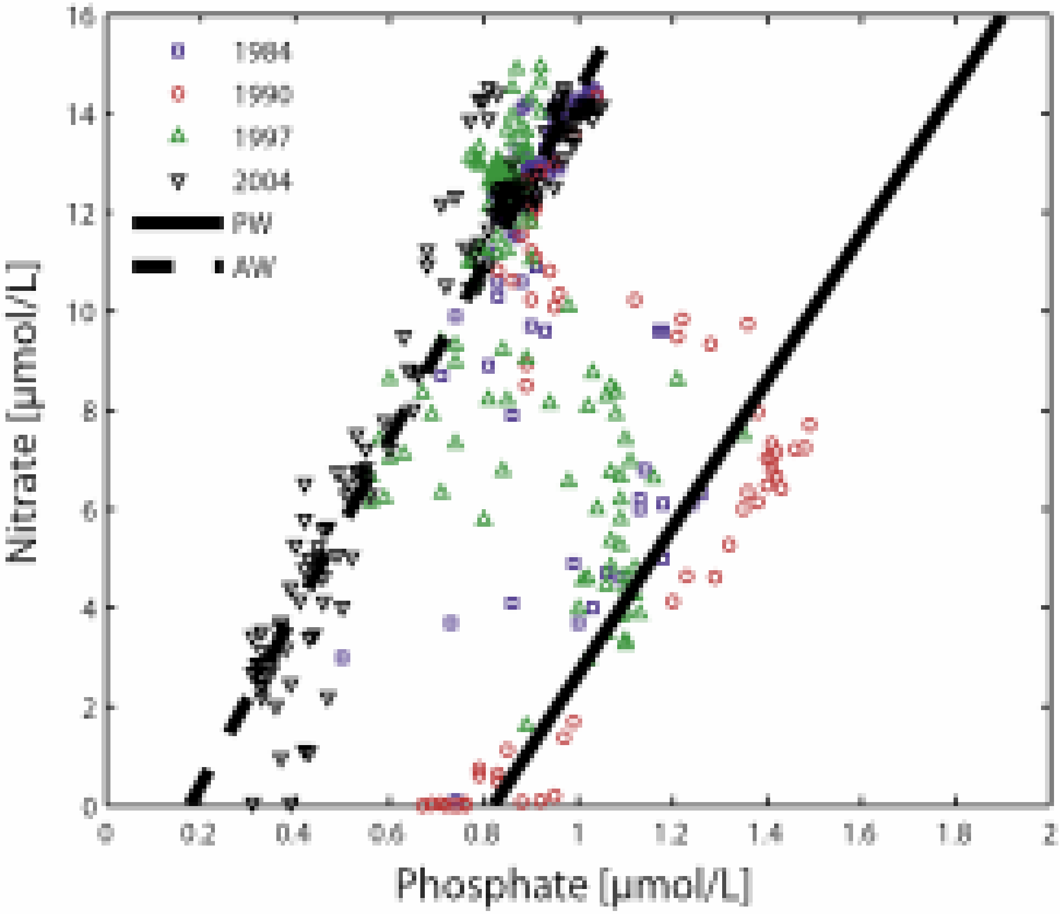

Figure 2. Nitrate-phosphate relationships for 1984, 1990, 1997, and 2004. The lines represent the nitrate-phosphate relationship of Pacific (PW) and Atlantic Water (AW).

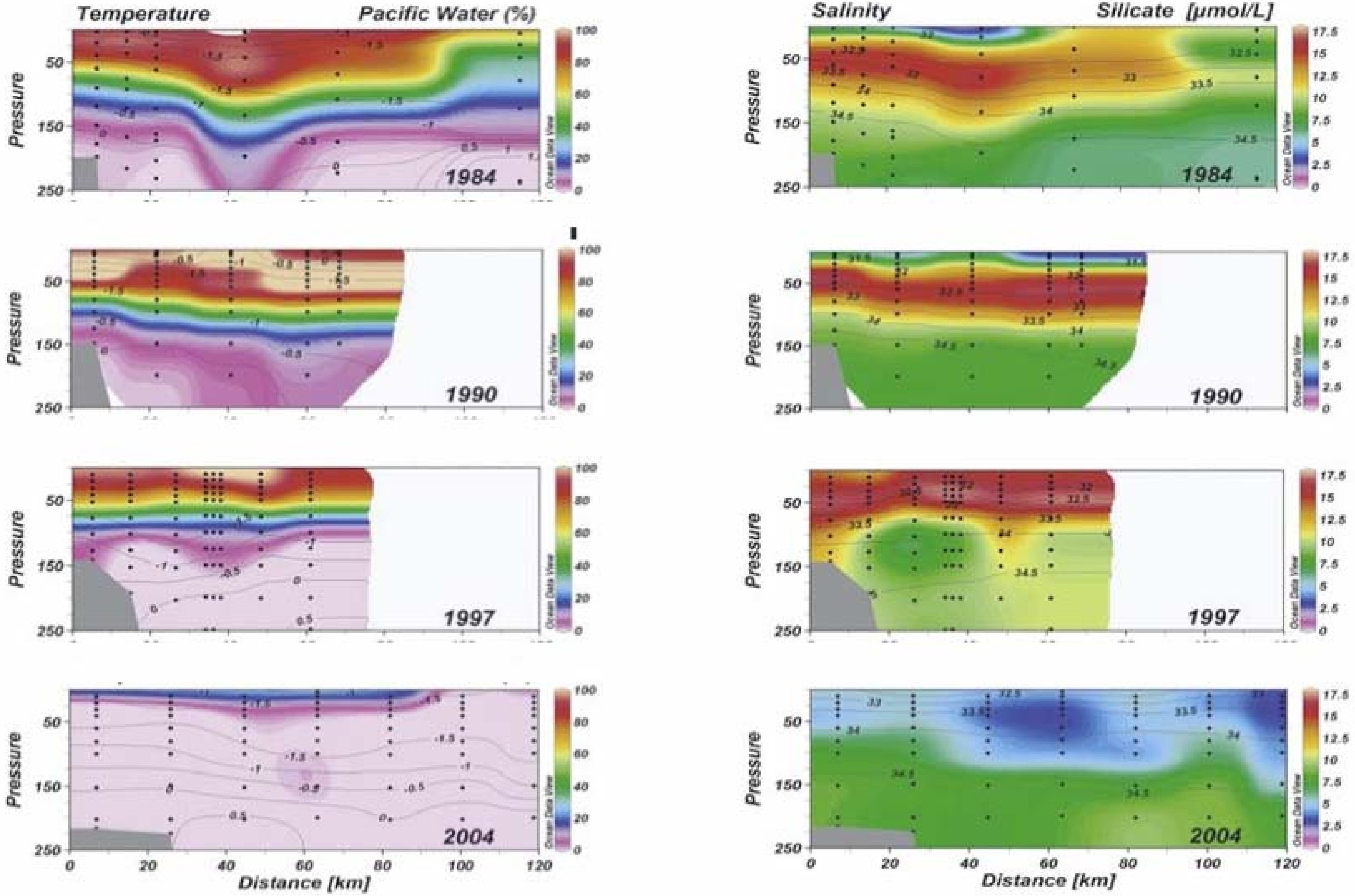

Figure 3. Vertical sections of Pacific Water (in %) and silicate (µmol L^{-1}) shown with colour scales and temperature and salinity shown as contour lines. Dots indicate sampling depths. All of the four sections start near the shelf break, as indicated by the grey area in the lower left corner of each panel, and are directed in a north-easterly direction.

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Bloom dynamics in early opening waters of the Arctic Ocean

Jean-Éric Tremblay[1]
Department of Biology, McGill University, 1205 Dr. Penfield, Montréal, Québec H3A 1B1, Canada

Christine Michel
Freshwater Institute, Fisheries and Oceans Canada, 501 University Crescent, Winnipeg, Manitoba R3T 2N6, Canada

Keith A. Hobson
Prairie and Northern Wildlife Research Center, Canadian Wildlife Service, Saskatoon, Saskatchewan S7N OX4, Canada

Michel Gosselin
Institut des sciences de la mer (ISMER), Université du Québec à Rimouski, 310 allée des Ursulines, Rimouski, Québec G5L 3A1, Canada

Neil M. Price
Department of Biology, McGill University, 1205 Dr. Penfield, Montréal, Québec H3A 1B1, Canada

Abstract

We measured the isotopic composition and accumulation of particulate organic matter (POM) and the uptake of carbon (C) and nitrogen (N) in an early bloom of the most productive recurring polynya of the Arctic Ocean. The estimated compensation irradiance at the onset of the bloom was similar to the average for the North Atlantic Ocean, implying that shallow mixing was of critical importance for the bloom's early initiation. Planktonic POM had a much lower δ^{13}C than ice POM, suggesting that ice-algae contributed little to the pelagic biomass. The overall isotopic fractionation of pelagic N during bloom development was consistent with in situ diatom growth under saturating irradiance and limiting NO_3^-. Soon after the ice cleared, rapid physiological changes induced an order of magnitude increase in the C and NO_3^- uptake capacity of diatoms, leading to very high *f* ratios (NO_3^- uptake : total N uptake). Most of the NO_3^- taken up appeared in the POM, so that little net release of reduced N occurred during the period of active growth. Given the tight coupling between photosynthesis and NO_3^- uptake under N limitation, the magnitude of primary production in the Arctic Ocean is expected to respond to changes in N supply.

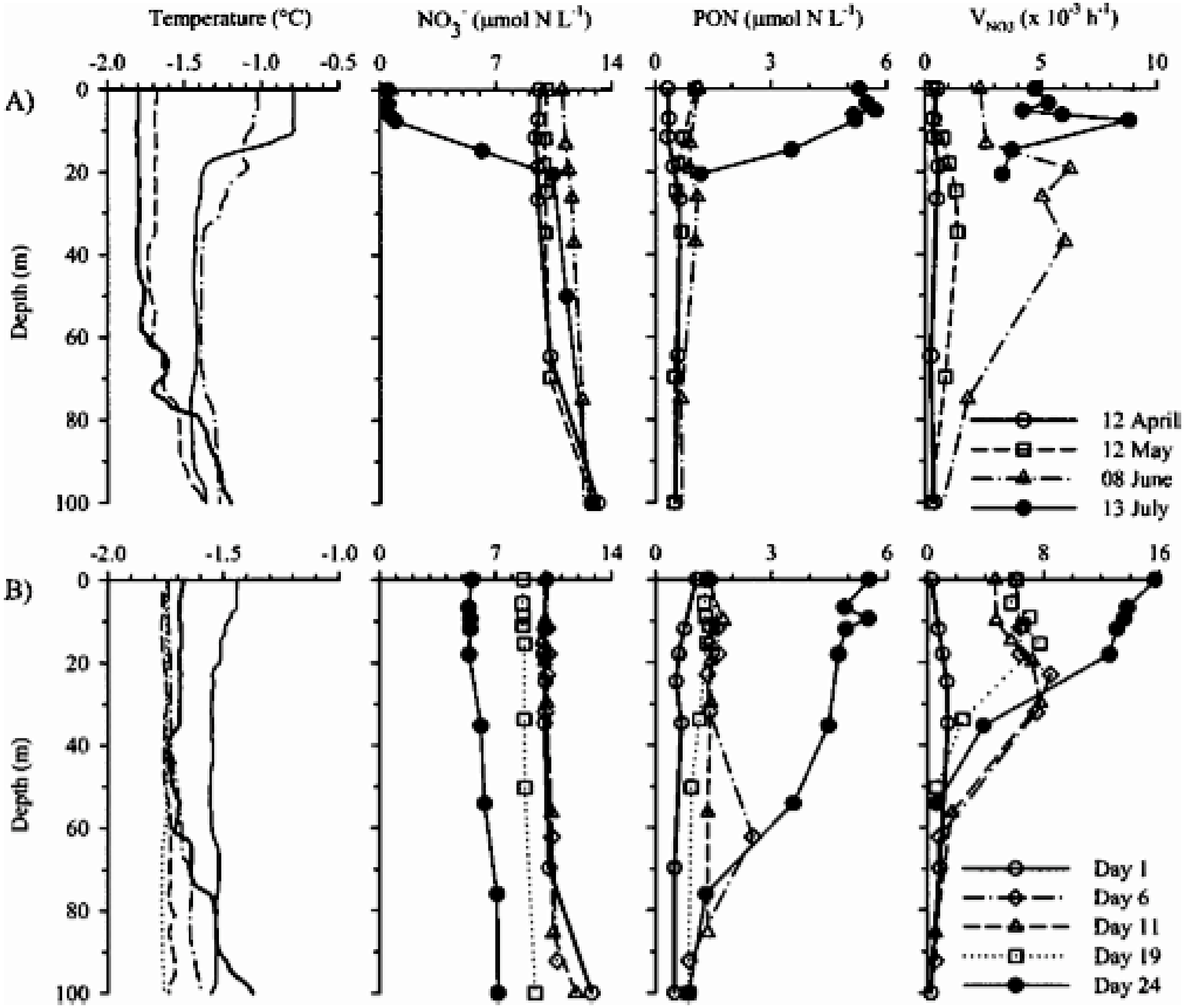

Fig. 3. Changes in temperature, NO_3^-, PON, and V_{NO_3} in pure SRAW (A) in the northwest of the survey grid (Stas. 2 and 7) from 12 April to 13 July, and (B) during the southward transit of SRAW in May. In (B), the main axis of the flow passed through Sta. 7 (Day 1), Sta. 2 (Day 6), Sta. 14 (Day 11), Sta. 31 (Day 19), and Sta. 44 (Day 24).

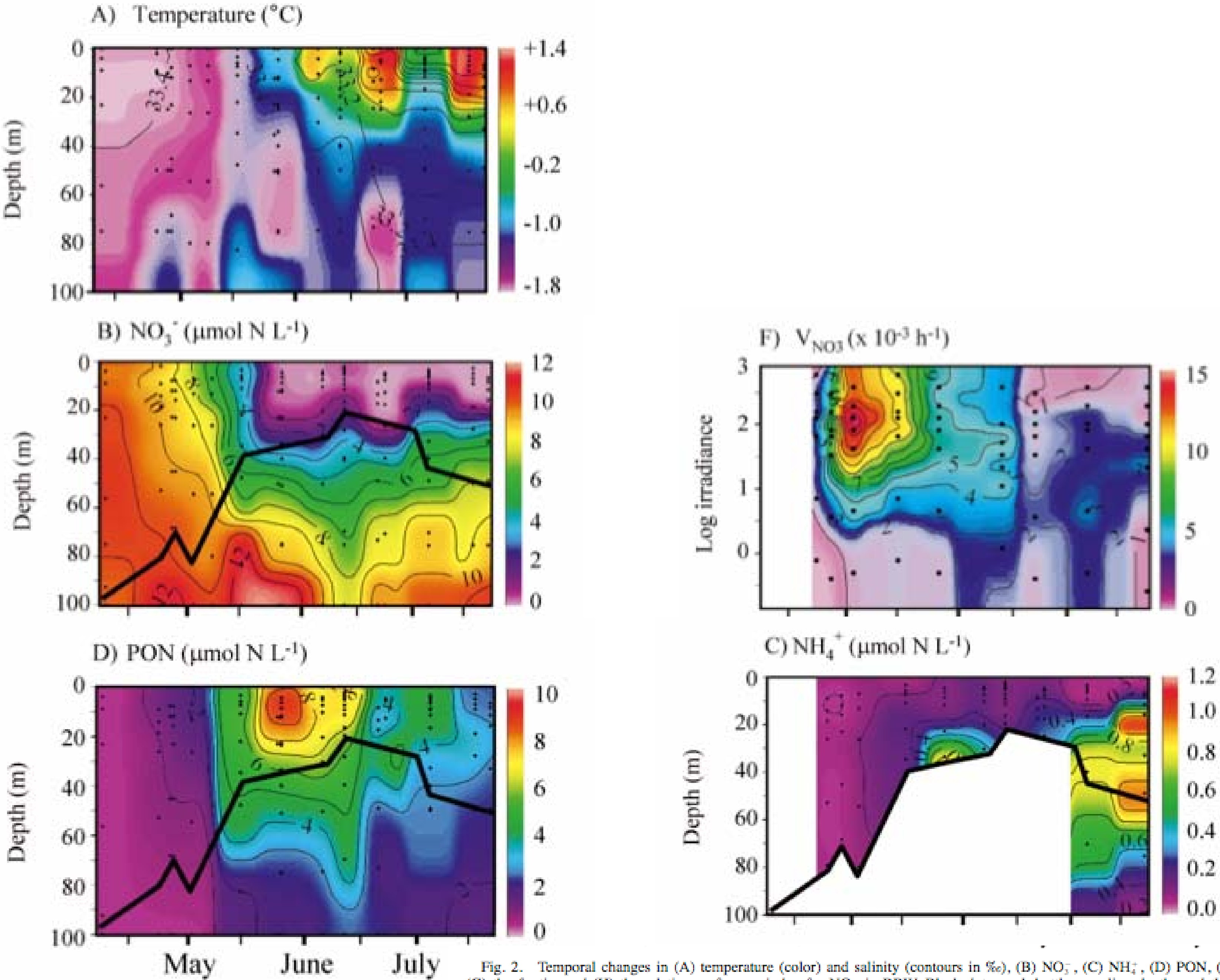

Fig. 2. Temporal changes in (A) temperature (color) and salinity (contours in ‰), (B) NO_3^-, (C) NH_4^+, (D) PON, (E) V_{NH_4}, (F) V_{NO_3}, (G) the *f* ratio, and (H) the relative preference index for NO_3^- in BBW. Black dots mark bottle sampling depths and the thick, solid line indicates the depth of the euphotic zone. Note the change of vertical axis on the right-hand side, where the black dots correspond to those located in the euphotic zone on the left-hand side. Stations used in (A–D) are those that met the Si^{ex} criteria (see text) during legs 1 (Stas. 18, 27, 40, 49, and 54), 2 (Stas. 18, 38, 40, and 54), 3 (Stas. 18, 40, 49, 50, and 54) and 4 (Stas. 40, 54, and 58). Irradiance units are µmol quanta m^{-2} s^{-1}.