

Long-term data on the freshwater tidal Hudson River

These data are annual means of several important ecological variables for the growing season (1 May – 30 September) for the freshwater tidal Hudson River in eastern New York State. They were collected as part of a long-term study of the Hudson River ecosystem by researchers at the Institute of Ecosystem Studies. This work was supported by grants from the Hudson River Foundation, the National Science Foundation, New York Sea Grant, and the Hudson River Estuary program of the New York State Department of Environmental Conservation (we note that none of these funding agencies endorses or guarantees these data or the conclusions we reach from the data).

Zebra mussel populations are sampled using divers and grabs. We have used these protocols to sample zebra mussel populations since 1993 (Strayer et al. 1996, Strayer and Malcom 2004). Populations living on hard bottoms are sampled by a diver, who collects 10 rocks at each of 7 sampling sites in June and again in August. These rocks are put into coolers and returned to the lab, where zebra mussels are counted and the projected area of the rock estimated by tracing its outline. A subset of zebra mussels are measured for shell length ($n=300/\text{site}$) and to develop length-dry mass regressions ($n=50/\text{site}$), and samples are archived in ethyl alcohol and in the freezer. Populations living on soft bottoms are sampled in July using a standard PONAR grab (0.05 m^2) at 48 sites deployed in a stratified random design throughout the freshwater estuary. Sediments collected by the grab are sieved through a 2.8-mm mesh brass sieve; the sieve residue is frozen. In the laboratory, the sample is thawed, and all bivalves in the sample counted and identified. A subsample of zebra mussels is measured for shell length. As a by-product of the soft-sediment survey, we identify, count, measure, and weigh all native unionid bivalves, continuing our long-term study of these animals and their response to the zebra mussel invasion (Strayer et al. 1994, Strayer and Smith 1994, 1996). These animals also are archived for future studies.

Phytoplankton are sampled weekly at our long-term station near Kingston throughout the year and in 2 sets of spatially distributed samples. We sample phytoplankton and many other variables (see below) at 6 “cardinal stations” arrayed over 120 km of the Hudson 4–6 times per year. In addition, 4–6 times a year, we sample phytoplankton and basic water chemistry and clarity every 2–4 km along the entire freshwater tidal Hudson River. These “transect” samples provide detailed spatial resolution of phytoplankton and other key variables. We have used this combined temporal and spatial approach since 1988 and began the intensive temporal study in 1986 (Caraco et al. 1997, 2004). As a measure of phytoplankton biomass we measure chlorophyll-*a* on every sample in methanol extracts using a Turner Designs fluorometer; these are calibrated to HPLC measurements of chlorophyll *a* on selected samples (Cole et al. 1992). Species composition of the larger phytoplankton is examined weekly on fresh samples, and samples for full phytoplankton species identification are preserved with Lugol’s solution. Phytoplankton primary production is modeled from measurements of biomass, light, and temperature using prior extensive measurements of production using the ^{14}C method at a range of light levels (P-I curve approach – see Cole et al. 1992).

Zooplankton are sampled every 2 weeks during the ice-free season at our long-term study site near Kingston. Macrozooplankton (postnaupliar copepods and cladocerans) are sampled by pumping $>100 \text{ L}$ of water through a 70–80 μm mesh net. Microzooplankton (nauplii, rotifers, tintinnids) are sampled by passing 2 L through a 35 μm mesh net. All

plankton samples are taken in triplicate. Densities are determined from microscopic counts. Mean weights derived from earlier studies (Pace et al. 1992) are used to convert densities to biomass. Abundances of zooplankton are measured 4-6 times in April-October at the 6 cardinal stations along the length of the Hudson. We have used these methods since the late 1980s (Pace et al. 1998, Pace and Lonsdale 2004).

In addition to these key variables, we measure water temperature, light penetration, pH, dissolved oxygen, suspended sediments, dissolved and particulate organic matter, dissolved inorganic carbon, dissolved inorganic and total nitrogen and phosphorus, and bacterioplankton abundance and productivity in our weekly samples at Kingston and at the 6 cardinal stations (Caraco et al. 1997, 2000, 2004, Raymond et al. 1997, Findlay et al. 1991, 1998, Lampman et al. 1999, Findlay 2004).

The following papers contain additional information about sampling and analysis methods, and provide interpretation of the data.

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