

**Limited twelve hour investigation to
determine variations in the concentrations of
Phosphate, Nitrite and Nitrate over one tidal
cycle at one site on the River Stour**

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Introduction

Following informal discussions with Roger Thorn, a limited survey took place at one site on the River Stour in order to determine whether or not concentrations of nitrate, nitrite, phosphate varied over a 12 hour tidal cycle. The survey was conducted between 0700 hours and 1800 hours on Wednesday 20th September 2000 at Sandwich Marina. This date was chosen because the tidal cycle on the River Stour equated with the tidal cycle of the quarterly boat surveys.

Method

Water samples were collected from the middle of the River Stour by lowering a Cassella into the water from the centre of the tan bridge at Sandwich. Water temperature was recorded hourly and samples were stored on site in a cool box containing ice packs. On return to the laboratory, water samples were filtered through GF/C filters and analysed for Phosphate, Nitrite and Nitrite using an Aquatec Auto Analyser

Results

Low water at Sandwich was at 1246 hours (BSI) and high water at 0526 hours (BST).

Water temperature:

The temperature of water ranged between 15°C, at 7.00 am when the survey began, and 17.5°C, at 1.00 pm. After 1.00 pm the temperature began to drop and between 3.00 and 4.00 pm it had stabilised at 16°C. However, by 5.00 pm it had risen by 0.5°C and was still at that level when the final sample was taken at 6.00 pm.

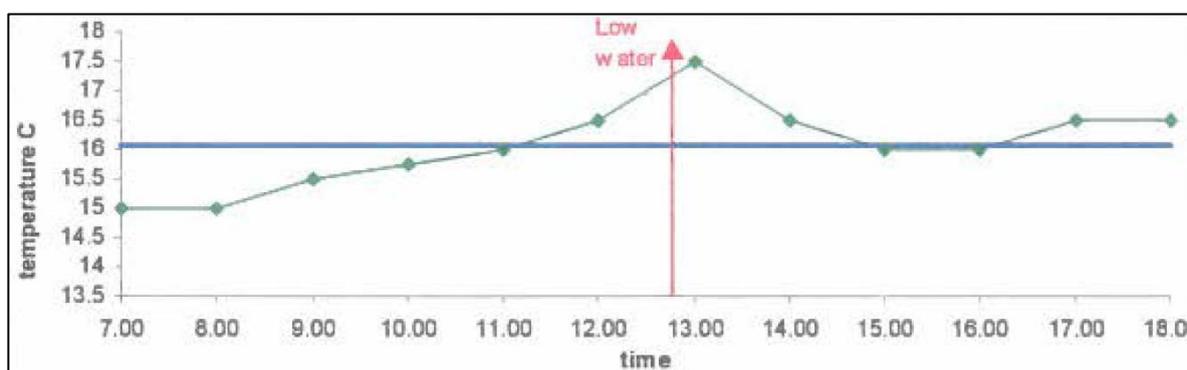


Figure 1. Variation in temperature of water in the River Stour at Sandwich Marina 7.00 am and 6.00 pm on 20th September 2000 between. The bold line denotes the mean temperature during that time.

Phosphate:

Over the 12 hour period of the survey, the concentration of phosphate ranged between 0.669 and 1.096 mg/l (mean 0.838, SD \pm 0.118). Phosphate concentrations in two of the samples were above the 95% confidence limit and four were below.

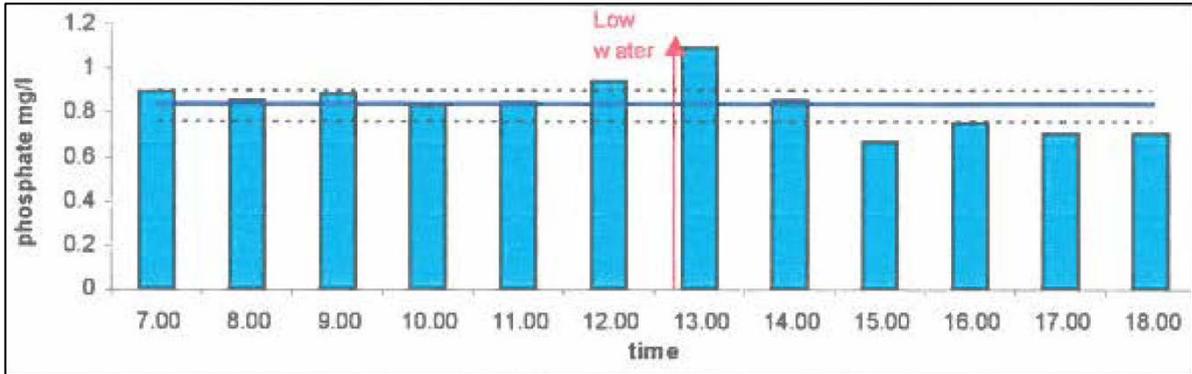


Figure 2. Variation in the concentration of phosphate in the River Stour at Sandwich Marina between 7.00 am and 6.00 pm on 20th, September 2000. The bold line denotes the mean phosphate concentration and the broken lines the upper and lower 95% confidence limits.

Nitrite:

Nitrite concentrations varied between 0.069 and 0.092 mg/l (mean 0.076, SD \pm 0.0.008) over the 12 hours of sampling. Nitrite concentrations in three of the samples were above the 95% confidence limit, three were below and one was level with the lower limit

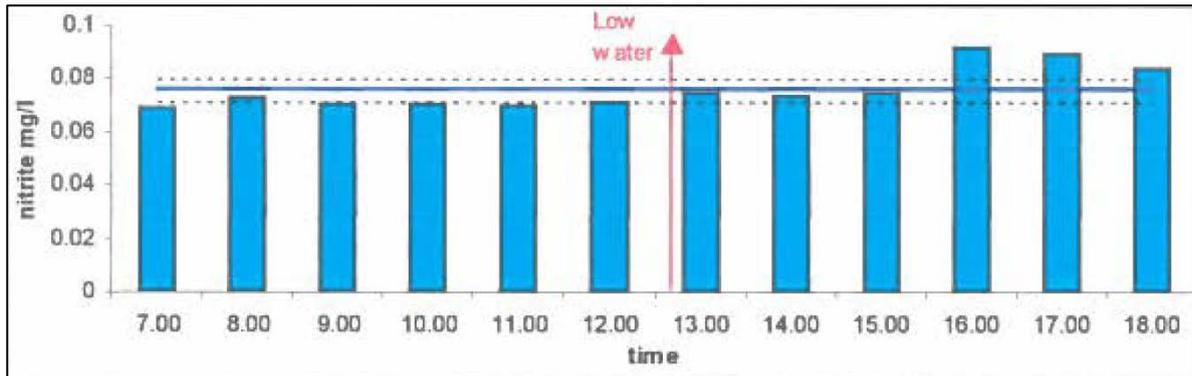


Figure 3. Variation in the concentration of nitrite in the River Stour at Sandwich Marina between 7.00 am and 6.00 pm on 20th September 2000. The bold line denotes the mean nitrite concentration and the broken lines the upper and lower 95% confidence limits

Nitrate:

Concentrations of nitrate varied between 1.727 and 5.377 mg/l (mean 3.274, SD \pm 1.236) during the 12 hour survey period. Nitrate concentrations in of eight of the 12 samples fell outside the 95% confidence limits, four below and four above.

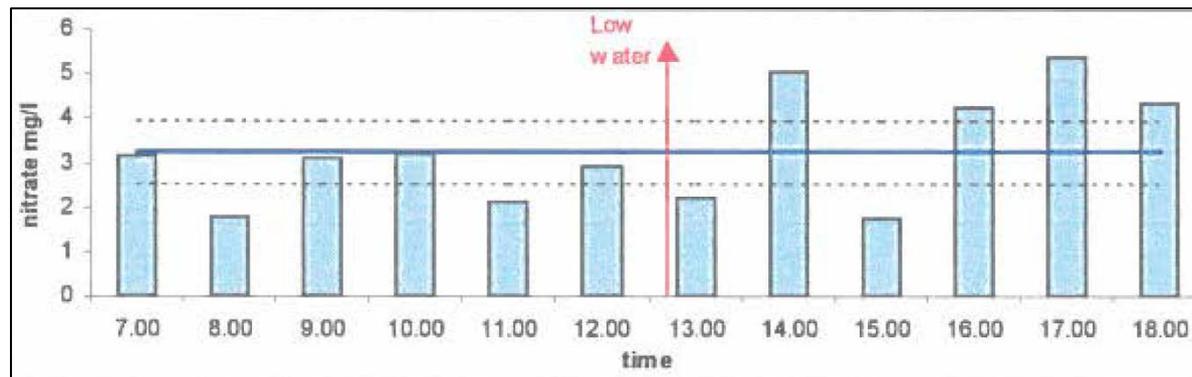


Figure 4. Variation in the concentration of nitrate in the River Stour at Sandwich Marina between, 7.00 am and 6.00 pm on 20th September 2000. The bold line denotes the mean nitrate concentration and the broken lines the upper and lower 95% confidence limits.

Discussion

The River Stour surveys that Canterbury Christ Church University College conduct quarterly as part of their Pfizer contract begin on an ebbing tide. Surveys are timed so that the site at Sandwich Marina is reached at approximately 0100 hours BST at low tide. On this survey, low tide at Sandwich Marina was at 1246 hours BST, so some comparisons can be made between this and previous September surveys.

Concentrations of phosphate, nitrite and nitrate varied throughout the 12 hour survey period, with half of the phosphate and nitrite concentrations, and two thirds of the nitrate concentrations falling either above or below the 95% confidence limits.

The highest concentrations of nitrate were between two and three times that of the lowest concentrations.

During previous September surveys, phosphate concentrations of between 0.25 mg/l (December 2000) and 2.0 mg/l (September 1996) have been recorded at Sandwich Marina. During this 12 hour survey, the concentration of phosphate at 0100 hours (low tide at Sandwich Marina) was 1.096 mg/l, and at no time over the 12 hour survey period were concentrations as low as the 0.25 mg/l recorded in December 2000.

During this 12 hour survey, the nitrite concentration at low tide was 0.075 mg/l. Nitrite concentrations at Sandwich Marina during Septembers 1995 - 2000 surveys varied between 0.02 and 0.1 mg/l, so the concentration recorded on 20th September 2000 was within previously recorded September levels. They also fell between the lowest previously recorded concentration of 0.02 mg/l (March 1999) and highest previously recorded concentration of 0.21 mg/l (December 1997).

Concentrations of nitrate during previous September surveys ranged between 4.93 mg/l (2000) and 9.0 mg/l (1996). At low tide on September 20th 2000, a nitrate concentration of 2.243 mg/l was recorded. The lowest concentration during this survey was 1.727 mg/l, which is approximately one third the lowest concentration that has previously been recorded during a September survey (4.93 mg/l) and just over half the lowest concentration ever recorded at Sandwich Marina (December 2000, 3.86 mg/l).

Because of the limitations of this study, there is no indication as to whether the fluctuations in phosphate, nitrite and nitrate concentrations recorded over the 12 hours of the survey are a feature of Sandwich Marina in particular, or whether similar fluctuations occur along the length of the River Stour. Also, the limits of this survey precluded investigation of other parameters such as BOD, chlorophyll a, organic material, etc. over the 12 hour monitoring period.

It is known from the quarterly surveys of the River Stour that concentrations of all parameters investigated vary between sites and over time. Although we have information about the changing nature of some of the biological and physical aspects of the River Stour from Grove Ferry to Shell Ness, there is no in-depth information about variations in the chemical parameters. For example, are these variations between the sites attributable to the individual sites and independent of the tidal cycle or, do they move from site to site along the length of the river with the changing tidal cycle. It is considered that better knowledge of the River Stour could be gained by conducting a survey of approximately six sites for a wide range of biological, physical and chemical parameters over a 13 hour cycle of the tide.