

## An easy method for measuring surface wave signals

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An easy method for measuring surface wave signals is presented. The system is based on microscope lamp, photodiode and oscilloscope. Surface wave signals of waterstriders are used as an example.

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### 1. Introduction

Surface waves as signals in communication and prey detection of insects have been studied intensively (see e.g. Wilcox 1979, Lang 1980, and references in them). The different kinds of apparatus for measuring the small waves are, however, quite specialized and seldom belong to the standard equipment of biology laboratories (e.g. silver/silverchloride emitter electrode and a receiver electrode, Rudolph 1967, or galvanometer attached to styrofoam on water surface,

Wilcox 1972). This paper describes a system based on standard equipment in a biology laboratory and supplemented with a cheap and commercially available item.

### 2. Description of the system

The study organism is in a basin of water. The light ray of a binocular microscope lamp is directed onto the surface of the water in the basin. The reflection of the ray from the water surface is received by a photodiode with a point-formed receiver. The signal from the photodiode can be transmitted to

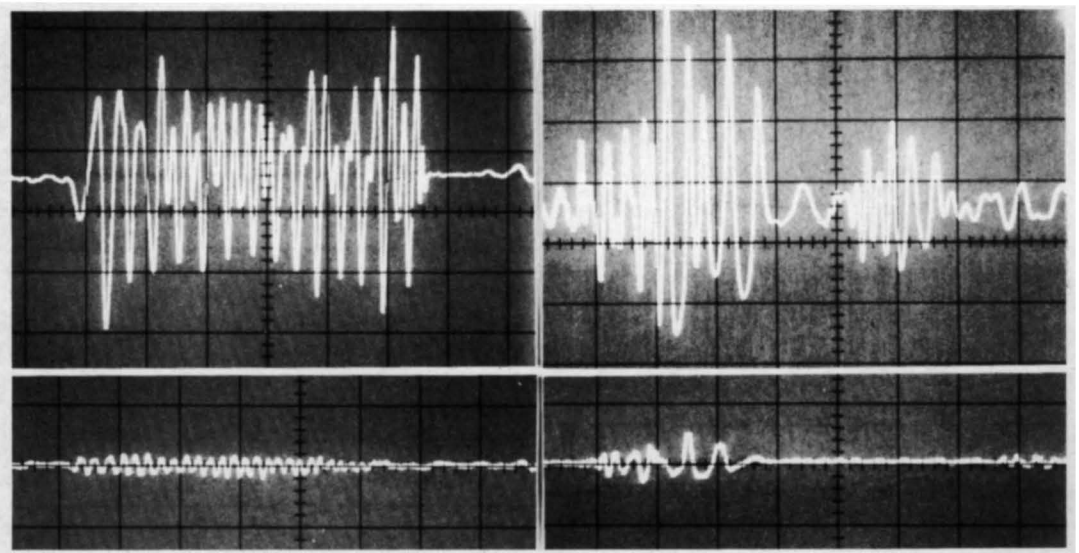


Fig. 1. Oscilloscope photos of surface wave signals of the waterstrider *Limnoporus rufoscutellatus*. On the right side skating and on the left side HF-signal of male (see Wilcox 1979). Time scale on the x-axis is 0.2 s per square. Upper photos are taken using a rectifier, and the y-axis scale is 2 mV per square; lower without rectifier, the y-axis scale being 10 mV per square.

an oscilloscope or a tape recorder etc. It is easiest to use with as low angle of reflection as possible. In order to avoid the disturbing waves reflected from the walls it is best to locate the reflecting point of the ray just beside the wall.

### 3. Discussion

The only supplement to standard laboratory equipment is the photodiode. This can be purchased from any well-equipped electrical goods shop. Its current price (in Finland) is about USD 10. Setting up and dismantling the apparatus takes about 10 minutes, so it is also easy to use in the field if electricity is available. The low light intensity of the microscope lamp does not permit the use of large basins. In this case it can be replaced e.g. with a low intensity laser ray (the price of a transmitter is about USD 1000). To display and record the signals 1) an oscilloscope (with memory to enable photography) or 2) a pen

recorder can be applied. The signals e.g. of waterstriders are of such high frequencies that a conventional pen recorder is not able to track them (Fig. 1). This drawback can be compensated by a tape recorder to slow down the input speed of the signals fed into the pen recorder. Alternating current causes some background noise, which is visible in the recorder. If necessary, it can be eliminated using a rectifier (Fig. 1). The apparatus is also easy to combine with the wave signal recording, analysis and playback system of Wilcox & Kashinsky (1980).

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