J. Mar. Biol. Ass. U.K. (2004), **84**, 617–618
Printed in the United Kingdom

Abundances of *Metridia lucens* in the western Irish Sea

William Ll. Rowlands*§, Mark Dickey-Collas†‡, Audrey J. Geffen*∫ and Richard D.M. Nash*

*University of Liverpool, Port Erin Marine Laboratory, Port Erin, Isle of Man, IM9 6JA, British Isles.
†Department of Agriculture and Rural Development, Agriculture and Environmental Sciences Division, Newforge Lane, Belfast, BT9 5PX, UK. Present addresses: ‡RIVO, Postbus 68, 1970 AB IJmuiden, The Netherlands.
∫Department of Fisheries and Marine Biology, Postbox 7800, University of Bergen, 5020 Bergen, Norway.
§Corresponding author, e-mail: willr@liverpool.ac.uk

Interannual and spatial differences in the abundance of *Metridia lucens* are reported from the Irish Sea from 1996 to 2001. In most years the abundance in spring is very low ($<50\,m^2$), however in 2001 the abundance was high and this enabled a rare study of the vertical distribution of *M. lucens* in coastal waters. The vertical distribution differs with time of day and water column structure. Abundances were always higher in stratified deeper waters compared with mixed or coastal waters.

This note reports on estimates of abundance of the large calanoid copepod *Metridia lucens* (Boeck) in various water types of the western Irish Sea, its vertical distribution in the water column and variations in its interannual abundance from 1996 to 2001. Two sampling programmes took place: one with approximately weekly sampling of a grid of 18 stations to the west of the Isle of Man in the springs and summers of 1996 to 2001 and one at four fixed stations in April and May 2001 during a year of high abundance (Figure 1A&B).

Each station in the experimental grid west of the Isle of Man was sampled with a double oblique deployment (surface to seabed to surface) of a Gulf VII high-speed plankton sampler (280-μm mesh, Nash et al., 1998) thus ensuring coverage of the entire water column. The volume of water filtered by the sampler and sampling efficiency, were estimated by internal and external flowmeters (Nash et al., 1998), with mean abundance per sampling date estimated from the abundance of *M. lucens* (per m^2) at all stations. The survey of specific stations (Stations 1–4) in 2001 used a hydrobios multiplankton sampler (mesh, 280 μm; Weikert & John, 1981) with two replicate hauls taken every 3 h over a 24 h cycle. The multiplankton sampler allowed for up to four discrete depths to be sampled during each deployment (20 min in this survey). Samples were taken at surface waters, bottom waters and at one intermediate depth for shallow stations (<50 m), and two for deeper waters (>50 m). The volume of water sampled was determined from the aperture of the sampler and the distance towed, assuming constant water flow. The abundance at each depth (per m^2) was estimated from the catch of copepods in the volume sampled and the height of depth band sampled. This sampling method would not work well in years with an average abundance of *M. lucens* but in 2001 the abundance was much higher than average. Despite the use of different sampling gear (all with 280-μm mesh), the abundance estimates of this study and those of a previous study in this area where 280-μm mesh samplers were used (Gowen et al., 1998) are of similar magnitude, suggesting that the sampling assumptions are robust.

The sampling grid to the west of the Isle of Man (Figure 1B) covered both stratified and coastal mixed water types. Large differences in the abundance of *M. lucens* were seen between the years, being most abundant in the springs of 1996 and 2001 by a factor of at least 100 compared with 1998 and 1999, suggesting fluctuations in the influx or reproductive strength of *M. lucens* in this area between years.

The fixed station study took place in 2001, a year of elevated *M. lucens* abundance and as expected from the west coast sampling, *M. lucens* was more abundant in May compared with April (Figure 1C). A consistent pattern was seen in relation to abundance vs water type in 2001, with abundances at the deep stratified station higher than at the deep mixed station. At both shallower coastal stations *M. lucens*' abundance was shown to be lower than at either of the deeper water stations. Gowen's previous observations in this area (Gowen et al., 1998), suggested *M. lucens* was more abundant in the deeper mixed waters of the North Channel compared with the stratified region, which contradicts the finding of this report. The lower abundances of *M. lucens* found in the shallower coastal waters of the study were not unexpected as *M. lucens* is generally considered to be an oceanic copepod (Farran, 1948). However, it does suggest that comparing the deeper mixed waters of the North Channel with the shallower waters to the south of the Isle of Man in terms of *M. lucens* is inappropriate, as depth rather than water type may be the determining factor of abundance. Therefore the stratified region of water, which forms the centre of a cyclonic gyre (Hill et al., 1994), may cause the increased abundance of *M. lucens* due to better production or retention of copepods, or both, but this has yet to be determined.

Vertical distributions were compared for the 2001 fixed station study (Figure 2) except at Station 1 where abundances were too low for any comparisons. However, there were clear trends in the vertical distribution of *M. lucens* throughout the day at the other stations. In the surface waters, abundance was lowest at mid-day at all stations with peaks at sunrise and sunset. This trend was not apparent below 25 m at the mixed or frontal stations suggesting only limited diel migration. However, in the

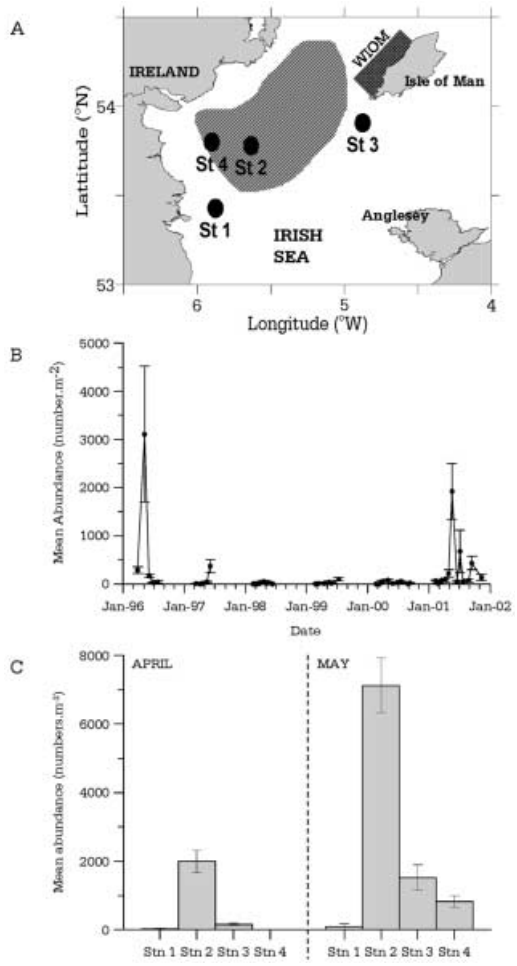

Figure 1. (A) Sampling sites in the central and western Irish Sea, hashed area in the western Irish Sea shows region of seasonal water column stratification; (B) the seasonal and annual changes in abundance (±1 SE) of *Metridia lucens* on the west side of the Isle of Man; (C) the mean abundance (±1 SE) of *M. lucens* in the western Irish Sea in 2001, note that no sample was taken at Station 4 during the April study.

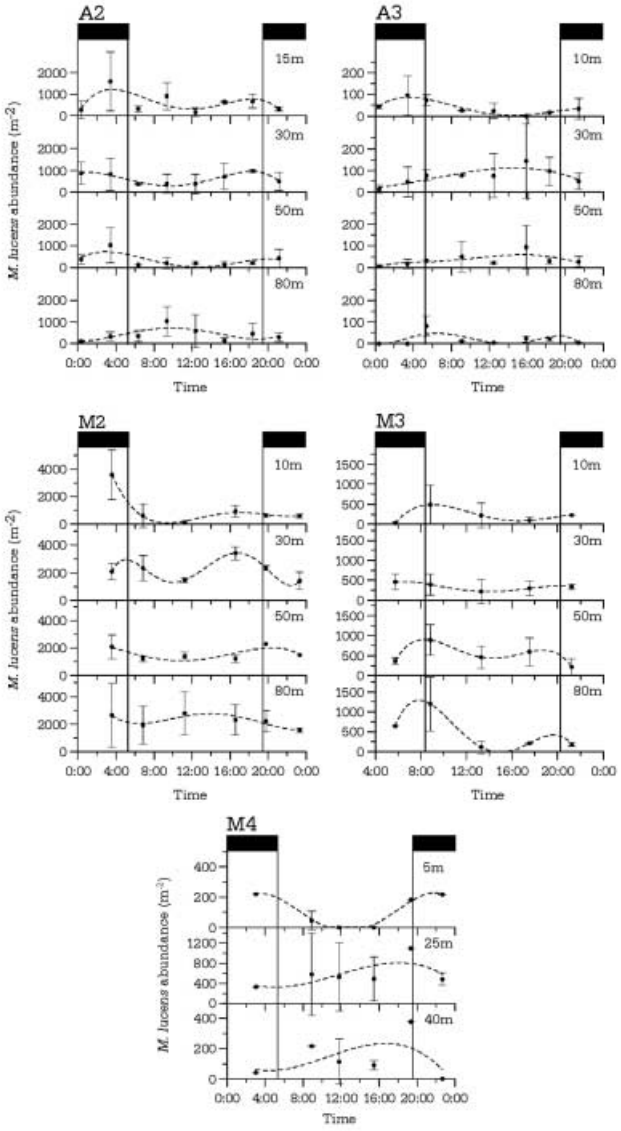

Figure 2. Vertical distribution (±1 SE) of *Metridia lucens* in April (A) and May (M) for stratified water (2), mixed water (3), and frontal water (4) stations, with fitted trend lines added. Black bands refer to hours of night and numbers to the right of each graph are the depths in the water column at which samples were taken.

stratified waters of Station 2 this pattern of abundance occurred to at least 50 m with increased abundance also seen at the deepest depth at midday, suggesting greater vertical migration or even split level migrations within the water column. The abundance of *M. lucens* is usually very low in the Irish Sea, but during years of high abundance there are distinct patterns in the vertical distribution of *M. lucens* in different coastal water column structures. Interestingly, the years of high and low abundance also correspond with those of good and bad cod recruitment (ICES, 2003). This suggests that *M. lucens* may have a greater biological importance than expected for its relatively low abundance in comparison with other copepod species (Gowen et al., 1998).

REFERENCES

Farran, G.P., 1948. Copepoda. *Conseil International pour l'Exploration de la Mer, Zooplankton Identification Sheets*, no. 14.

Gowen, R.J., McCullough, G.M., Dickey-Collas, M. & Kleppel, G.S., 1998. Copepod abundance in the western Irish Sea: relationship to physical regime, phytoplankton production and standing stock. *Journal of Plankton Research*, **20**, 315–330.

Hill, A.E., Durazo, R. & Smedd, D.A., 1994. Observations of a cyclonic gyre in the western Irish Sea. *Continental Shelf Research*, **14**, 479–490.

ICES, 2003. Report of the working group of the assessment of northern shelf demersal stocks. *International Council for the Exploration of the Sea (CM Papers and Reports)*, CM 2003/ACFM:04.

Nash, R.D.M., Dickey-Collas, M. & Milligan, S.P., 1998. Descriptions of the Gulf VII/PRO-NET and MAFF/Guildline unencased high speed plankton samplers. *Journal of Plankton Research*, **20**, 1915–1926.

Weikert, H. & John, H.-Ch., 1981. Experiences with a modified Bé multiple opening–closing plankton net. *Journal of Plankton Research*, **3**, 167–177.

Submitted 25 February 2003. Accepted 16 March 2004.