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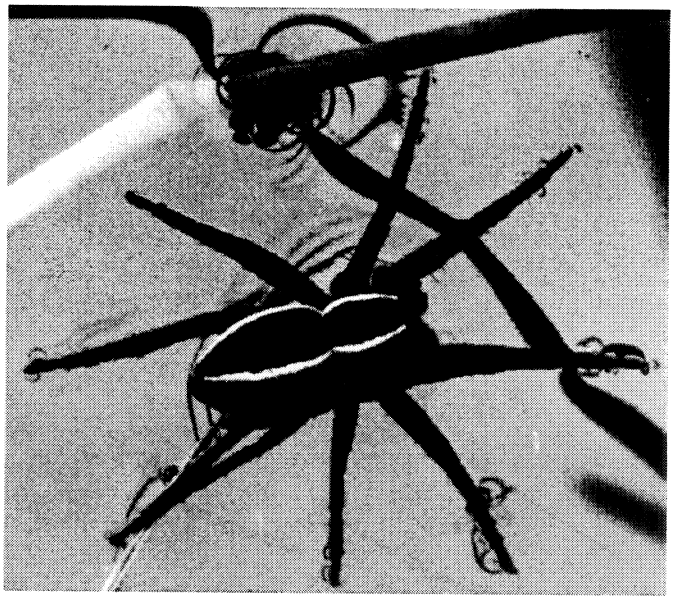
# Fen raft spider project: interim summary report for 1997



species RECOVERY

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# Fen raft spider project: interim summary report for 1997

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This report summarises the results of monitoring and management work completed as part of the Fen Raft Spider (*Dolomedes plantarius*) Recovery Project at Redgrave and Lopham Fen NNR in 1997. The work was jointly funded by EN and the SWT. The background to the work is detailed by Smith (1992, 1993, 1994, 1995, 1996).

## Water levels

### Little Fen

Water levels were extremely low during the winter, although fewer pools were empty in January than in 1996 (Table 1). Levels in the unirrigated pools remained extremely low until mid-May, when rainfall resulted in a progressive recovery which lasted until mid-July (Figure 1). Levels at that time were *c* 25 cm higher than at the same time in 1996 and were amongst the highest July levels recorded since census work began in 1991. Drought during late July and August then resulted in a rapid fall in levels. By early September, a strong gradient was established away from the irrigated pools, with many pools in the north and west of the compartment virtually empty (Table 1).

The irrigation water supply, started on 18 April, resulted in rapid recovery in the irrigated pools and their hinterland (Figure 1). As levels began to fall from mid-July onwards, the volume supplied was increased by 25% on 24 July and a further 25% during the week beginning 11 August, using the extra capacity obtained as a result of the Water Company's drought order. These measures were very successful in maintaining consistently high water levels.

### Middle Fen

Winter water levels on Middle Fen were, as usual, higher than those on Little Fen. In January they were similar to those in 1996. Although levels in the unirrigated pools fell during April, the summer rainfall resulted in mid-July levels over 55cm higher than in 1996, when most unirrigated pools dried up (Table 1). Levels dropped rapidly from this peak, during late July and August (Figure 2).

To aid more even distribution of irrigation water on Middle Fen (see Smith 1996), the Water Company lengthened the main feeder pipe to cover the whole length of the path between the irrigated pools and also increased to number of outlets to the pools from five to 10. The start of irrigation and the June rainfall together resulted in mid-July levels in these pools *c* 45cm higher than in 1996. The subsequent fall in levels was exacerbated from the beginning of August by pumping operations on the adjacent section of the Waveney, as part of the river-bed restoration work. The first two increments to the irrigation supply failed to arrest the losses and it also became clear at this time that the additional outlets were not working. A third increment, again of 25% of the original total, was made on 20 August, all of which was directed to Middle Fen (the first two increments were shared in the ratio established in 1996). The outlets were properly connected by 22 August. These measures resulted in much better maintenance of levels in the irrigated Middle Fen pools than in previous years (Figure 2).

The new pools excavated on Middle Fen in 1996 had a mean mid-July level 1.5cm above the April 1992 datum (Smith 1992), 66.5cm higher than at the same time in 1996. They lost *c* 14cm over the following three weeks.

## The distribution and abundance of *D. plantarius*

### Little Fen

Both the numbers of pools and the area of Compartment 5 occupied by *D. plantarius* in July increased following the severe contraction in 1996 (Table 2, Figure 3). However, many pools in which spiders were recorded in July dried out by late August. The distribution remained more restricted than in 1993 and 1994, when spiders were found at the northern and eastern edges of the compartment.

Maximum numbers recorded also showed a recovery, with the highest totals since the present census began in 1993 (Table 3). Densities of spiders recorded on both irrigated and unirrigated pools were also higher than at any time in the last five years, although none of the differences between years is significant (Table 5). The annual indices, which allow comparison with data from the previous census, in 1991 and 1992, show that the 1997 index is only slightly lower than that for the peak year of 1992 (Table 4). These indices are significantly higher than those for two of the intervening years. As in previous years neither linear trend nor null models provided adequate descriptions of annual variations in numbers (see Smith 1996).

### Middle Fen

1997 was the third consecutive year in which *D. plantarius* was confined to pools in the irrigated area (Figure 4). The maximum numbers recorded were the lowest since the present census began in 1993, with densities just above the previous low of 1993 (Tables 3 and 5). The conspicuous absence of small spiders reflects the loss of water and unsuitability of the Middle Fen pools for breeding in 1996. The annual population index for Middle Fen was the lowest since census work began in 1991 and was significantly lower than in 1994 and 1995 (Table 4). The results for Middle Fen are complicated this year by the colonisation by *D. plantarius* of the pools dug in spring 1997, behind the existing line of irrigated pools (below). The migration of some animals from the pools included in the census into these new areas may have resulted in a slight overestimation of the decline in the Middle Fen population. However, densities on these new pools were low, and the small size classes were again absent, indicating that the decline on Middle Fen was both real and substantial. As on Little Fen, there was no evidence of any linear trend in the annual indices. As in previous years, the pattern of annual variation on Little and Middle Fens differed significantly.

## Breeding success

1997 saw a substantial improvement in the number of breeding attempts on Little but not on Middle Fen compared with the previous two years (Table 6). However, the maintenance of substantially higher water levels in Middle Fen than last year, together with the additional breeding habitat provided by the new pools (below), make it likely that the breeding attempts there will be much more successful than last year.

## Pools excavated on Middle Fen in 1996

By July the pools excavated on Middle fen in spring 1996 (Smith 1996) were fringed by *Cladium mariscus*. This was particularly tall and dense around the pools on the south side of the irrigated pools. Many pools also had an emergent fringe of vigorous *Phragmites australis* occupying deeper water than the *C. mariscus*. *D. plantarius* had successfully colonised most of these pools

(Figure 4). They were recorded using binoculars from one or two points on the banks of each pool during three visits in July and August (24/7, 3/8 and 17/8). Densities on these pools appeared to be low, as on the irrigated pools, and most individuals seen were large or adult. Breeding females, some with nursery webs, were recorded on five of the 12 pools.

## *Stratiotes aloides* (water soldier) introduction

By mid-July, numbers of rosettes had increased from a mean of 18.5 (range 10-17) introduced in September 1996 (Smith 1996) to a mean of 25.9 (range 10-46). However, relatively few of the plants looked healthy and none provided structures in which *D. plantarius* could breed. From the time that the plants first rose to the surface in spring, their leaves were heavily red-pigmented. Many plants remained just below the surface and retained this pigmentation. Some plants had partially emergent leaves, all of which were green, although some of these showed signs of yellowing. No spiders were recorded in association with these plants.

It is possible that a severe frost in late May resulted in tissue damage to the newly-surfacing plants. The condition of the plants appeared to be worse in pools exposed to the north by on their northern banks in autumn 1996. The damage was almost certainly unrelated to the surface sterilisation carried out prior to introduction (Smith 1996). Plants subject to higher concentrations of hypochlorite bleach sterilant, and subsequently grown in a near-by but sheltered garden pond, were all healthy, with long emergent leaves and no red-pigmentation.

### Management work

**1. Bottoming out irrigated pools on Little Fen**

All pools which were not deepened in spring 1996 were deepened in 18 and 21 April. The grab on a snowcat was used to removed *c* 30cm of sediment from the pool centres.

**2. New pools on Little Fen**

Four new pools were excavated in Compartment 4, to the south of the irrigated pools and three in Compartment 5, to the north of the irrigated pools in mid-June (Figure 3). All were within the areas of sedge cut in April. The high rainfall during June, together with irrigation water in the target area, made working conditions very difficult and attempts to dig further pools were abandoned.

**3. Sedge cutting**

Approximate boundaries of blocks cut in areas occupied by *D. plantarius* are shown on Figures 1 and 2, together with cutting dates.

On Little Fen 'windows' were cut into the marginal vegetation fringing the irrigated pools adjacent to the blocks cut in April, in the same way as on the more westerly pools in 1996 (Smith 1996). Marginal vegetation around old pools within this block was cut, leaving only occasional emergent clumps of *C. mariscus* for cover. When the extensive blocks on the north and west of Compartment 5 were cut, in late July and August, all marginal vegetation was initially left around the larger pools because birds were still breeding.

Because no spiders were recorded within most of this area and the pool edges were very overgrown, all marginal vegetation was subsequently cut, in early August.

On Middle Fen, the block of sedge cut to the south of the pools in Compartment 5 stopped a *c* five metres short of the pools and no 'windows' were cut as on the area to immediately to the east, cut in 1996. In mid-September

## Recommendations

1. **Water Levels**. The capacity to irrigate pools in the core areas, to maintain as constant as possible summer water levels, should be retained. The need for this must be dependent on the timing of recovery of the water table but it would be useful to be able to call on additional water supplies, **if required**, for at least another two years.

2. **Sedge-cutting dates**. Cutting *C. mariscus* both in 1996 (Middle Fen) and in April 1997, appears to have exacerbated the increase in *P. australis* which has been occurring in the sedge beds during the last five years. Little *C. mariscus* remains around the more easterly irrigated pools on Little Fen, which are now so densely shaded by *P. australis* that they appear to be unsuitable for *D. plantarius*. Cutting during the traditional months of July and August appears to be most effective in controlling *P. australis* in the sedge beds. This presents a dilemma since it coincides with the peak of the *D. plantarius* breeding season. If, however, the spider population expands to the extent that the blocks of sedge cut each year occupy only a minor proportion of its range, the losses incurred should be sustainable. The present policy of leaving a few clumps of emergent sedge at each pool should be maintained.

3. **Irrigation outlets** on Middle Fen need adapting to ensure that water does not flow directly into the pools. Little Fen outlets need some re-positioning during winter for the same reason.

4. **Cutting of marginal vegetation around irrigated pools**. The policy adopted in 1996, of cutting *c* one third of the margins of pools adjacent to cut blocks of sedge has now left *c* two-thirds of the margins of most pools and all of the margins of some pools uncut for two or more years. These margins are becoming overgrown and will need to be cut in 1998. Cutting in the second week of August is likely to minimise damage to nursery webs. Once the spider population has increased substantially, irrigated pools should be included in the normal cutting rotation, and treated in the same way as older pools within these blocks.

5. **Scrub and reed removal from Middle Fen pools**. All unirrigated, and increasing numbers of irrigated, pools are now shaded, often densely, by both surrounding scrub and emergent reed. This is resulting in irrigated pools becoming progressively less suitable for spiders and in unirrigated pools being unsuitable for future recolonisation. Scrub removal is less problematical than reed control. In previous reports I have suggested that summer cutting of emergent reed is unlikely to be cost-effective because its effects are so short term. Bottoming-out of these pools in winter, as has been successfully completed on Little Fen, should control the problem in the short term. Consideration of medium term solutions may be best postponed until it is more clear (1) what effect restoration of the

Fen's natural water supply will have on reed encroachment and (2) whether the restoration work will result in an expansion of suitable habitat for *D. plantarius*.

6. **Monitoring.** Provision has been made to continue the standard summer census, including monitoring the *S. aloides* introduction and new Middle Fen pools, in 1998. Regular monitoring of water levels in the census pools is need again in 1998 (1) as a basis for making decisions about the irrigation strategy and (2) to help interpret changes in spider numbers.

7. **Autecological work.** As ever (Smith 1996, 1995, 1994, 1993).

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**Table 1.** Numbers of pools which were either completely dry or were dry at their measuring gauges during 1997. Equivalent numbers are given for 1996 where data are available.

| Date | Little Fen | | | | Middle Fen | | | |
|---|---|---|---|---|---|---|---|---|
| | No. dry | | No. dry at gauge | | No. dry | | No. dry at gauge | |
| 28/1 | 5 | (16) | 0 | (11) | 0 | (0) | 0 | (0) |
| 18/3 | 3 | | 2 | | 0 | | 0 | |
| 15/4 | 5 | | 2 | | - | | 0 | |
| 22/4 | 0 | | 1 | | 0 | | 0 | |
| 20/5 | 0 | | 0 | | 0 | (0) | 0 | (0) |
| 17/6 | 0 | | 0 | | 0 | | 0 | |
| 15/7 | 0 | (10) | 0 | (4) | 0 | (18) | 0 | (3) |
| 5/8 | 0 | | 0 | | 0 | | 0 | |
| 5/9 | 0 | | 13 | | 0 | | 3 | |

**Table 2.** Numbers of census pool on which *D. plantarius* was recorded in July 1993-1997

| Year: | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|
| **Little Fen** | 11 | 10 | 16 | 9 | 13 |
| **Middle Fen** | 8 | 10 | 7 | 5 | 6 |

**Table 3.** Maximum numbers of *D. plantarius* counted in Little and Middle Fen census areas in July 1993, 1994, 1995, 1996 and 1997

| | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|
| Little Fen | | | | | |
| Large | 5 | 4 | 8 | 13 | 20 |
| Medium | 8 | 7 | 27 | 3 | 27 |
| Small | 1 | 8 | 6 | 4 | 19 |
| **Total** | **14** | **19** | **41** | **20** | **66** |
| Middle Fen | | | | | |
| Large | 6 | 13 | 3 | 7 | 7 |
| Medium | 7 | 21 | 63 | 14 | 8 |
| Small | 8 | 10 | 36 | 20 | 0 |
| **Total** | **21** | **44** | **102** | **41** | **15** |

**Table 4.** Multiplicative annual indices for *D. plantarius* on Little and Middle Fens in July 1991-1997, generated by a poisson regression model (TRIM). Note that Middle Fen Index is based on a sample of 14 irrigated pools, comprising the seven usually included in the census and an additional seven included as part of the water soldier monitoring.

| Year | Little Fen | | Middle Fen | |
|---|---|---|---|---|
| | Annual index | Std.err. | Annual index | Std.err. |
| 1991 | 1.000 | 0.000 | 1.000 | 0.000 |
| 1992 | 2.741 | 0.717 | 1.476 | 0.329 |
| 1993 | 0.577 | 0.193 | 0.532 | 0.147 |
| 1994 | 0.393 | 0.147 | 1.646 | 0.349 |
| 1995 | 1.316 | 0.273 | 3.218 | 0.624 |
| 1996 | 0.663 | 0.287 | 1.251 | 0.361 |
| 1997 | 2.558 | 0.810 | 0.516 | 0.163 |

**Table 5.** Mean numbers of *D. plantarius* on irrigated and unirrigated pools within the census area in 1993, 1994, 1995, 1996 and 1997. Data are means of the maximum count for each census period (no spring or autumn census after 1994). Two S.Es. of the mean are given in parentheses for the July counts. There were 25 unirrigated and 7 irrigated pools on Little Fen and 23 unirrigated and 7 irrigated pools on Middle Fen.

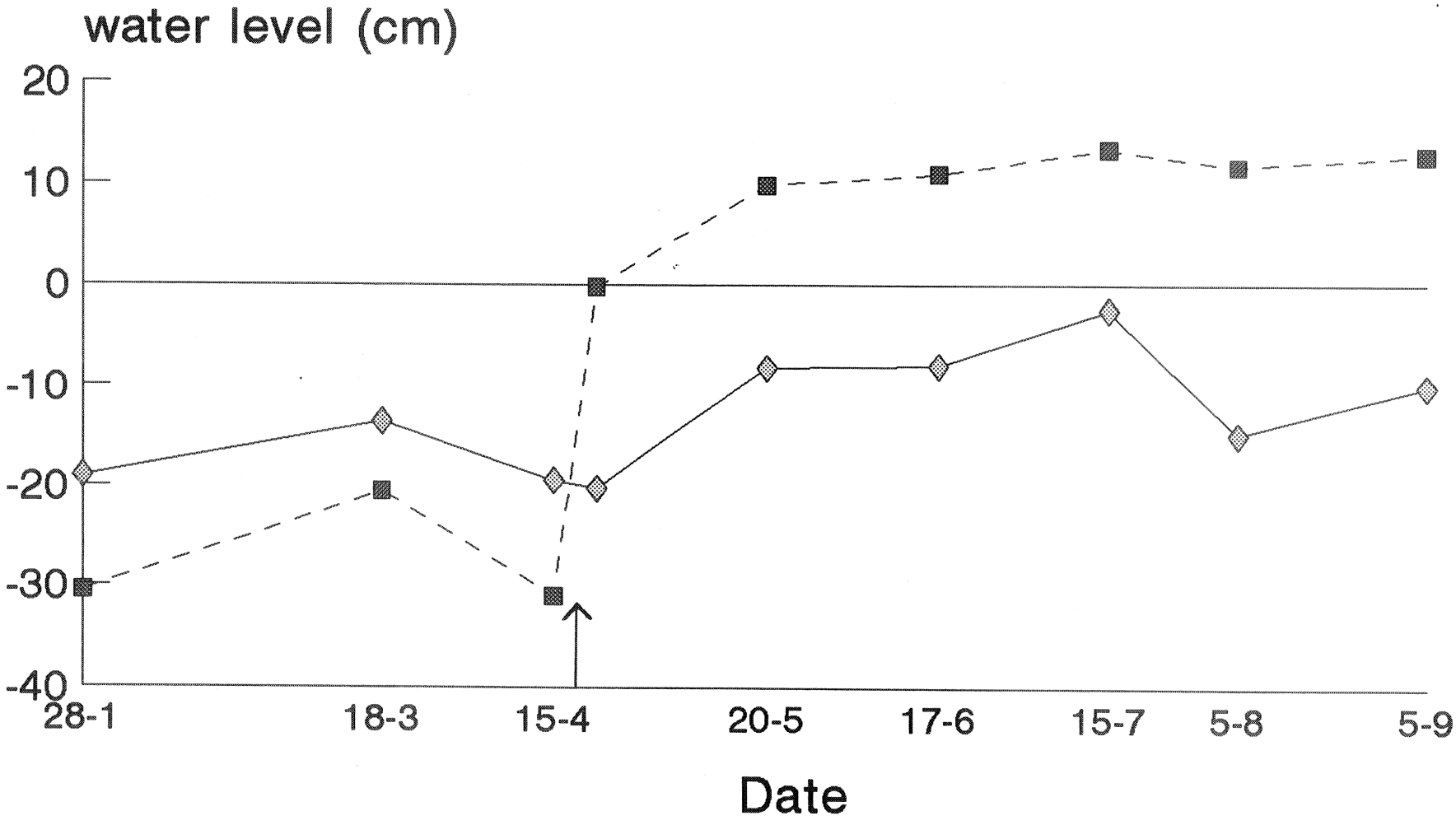
| (a) | Little Fen | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Census period | Unirrigated | | | | | Irrigated | | | | |
| | 1993 | 1994 | 1995 | 1996 | 1997 | 1993 | 1994 | 1995 | 1996 | 1997 |
| Spring | 0.32 | - | - | - | - | 1.57 | - | - | - | - |
| Summer | 0.48 | 0.33 | 1.00 | 0.46 | 1.50 | 0.29 | 0.86 | 1.71 | 0.29 | 2.29 |
| | (0.31) | (0.23) | (0.57) | (0.36) | (1.32) | (0.37) | (1.11) | (1.13) | (0.37) | (1.84) |
| Autumn | 0.60 | 0.96 | - | - | - | 1.71 | 0.86 | - | - | - |

| (b) | Middle Fen | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Census period | Unirrigated | | | | | Irrigated | | | | |
| | 1993 | 1994 | 1995 | 1996 | 1997 | 1993 | 1994 | 1995 | 1996 | 1997 |
| Spring | 0.09 | 0.04 | - | - | - | 1.78 | 1.71 | - | - | - |
| Summer | 0.13 | 0.35 | 0.00 | 0.00 | 0.00 | 2.00 | 3.71 | 14.3 | 5.57 | 2.14 |
| | (0.19) | (0.41) | (0.00) | (0.00) | (0.00) | (1.07) | (1.21) | (7.64) | (4.07) | (1.54) |
| Autumn | 0.00 | 0.17 | - | - | - | 2.86 | 2.71 | - | - | - |

**Table 6** Numbers of adult females at different stages of the breeding cycle in the Little and Middle Fen census areas during the July census 1995, 1996 and 1997 (individuals recorded at more than one stage are listed for the most advanced stage only)

| | 1995 | 1996 | 1997 |
|---|---|---|---|
| Little Fen | | | |
| Pregnant | 3 | 2 | 0 |
| with egg sacs | 3 | 3 | 7 |
| **Total** | **6** | **5** | **16** |
| Middle Fen | | | |
| pregnant | 0 | 1 | 0 |
| with egg sacs | 1 | 4 | 6 |
| with webs | 1 | 0 | 0 |
| **Total** | **2** | **5** | **6** |

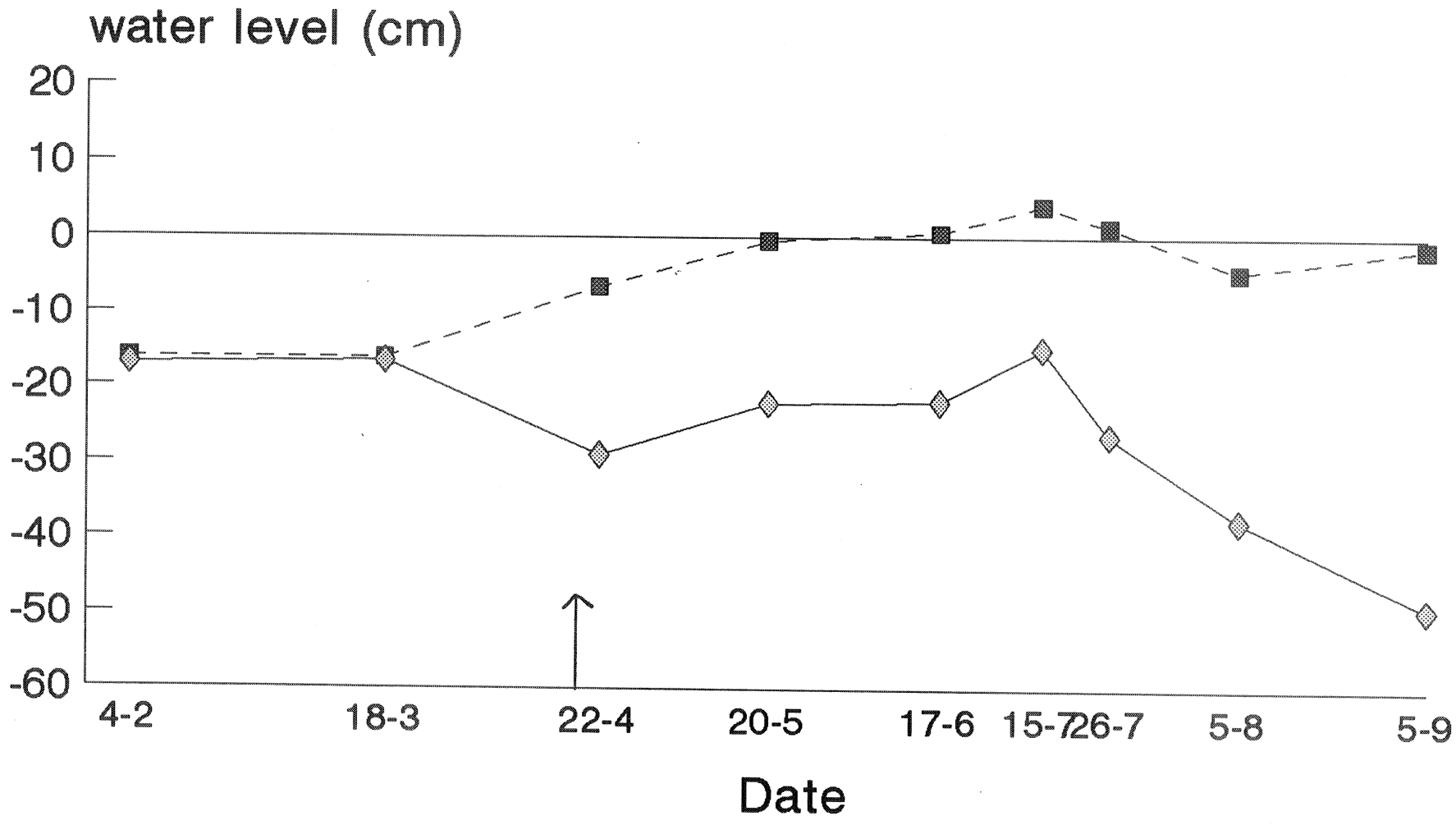
**Figure** 1 Mean water levels in pools censused on Little Fen in 1997




unirrigated pools irrigated pools

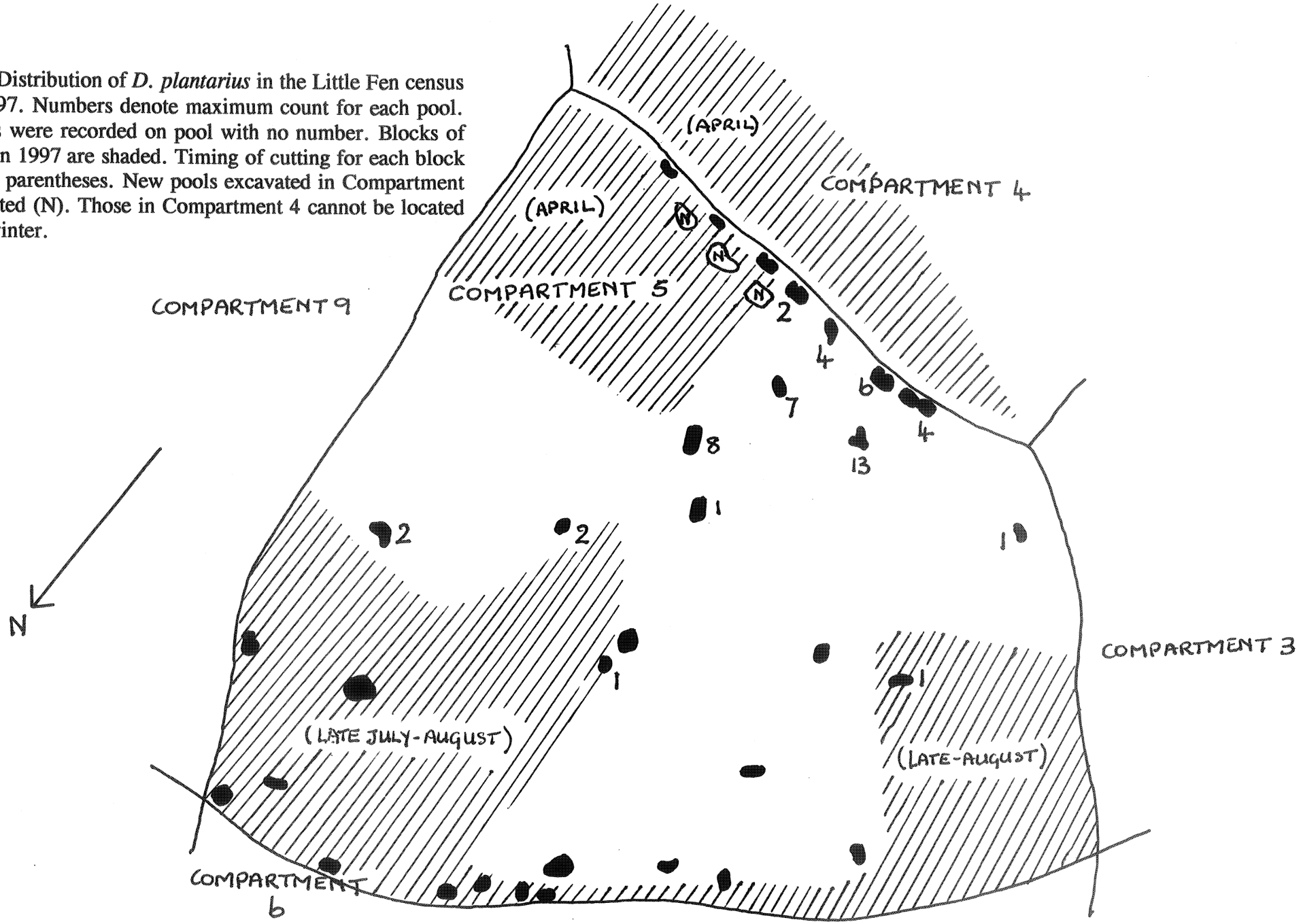
Horizontal line represents the April 1992 datum (Smith 1992)
Vertical arrow shows the start of irrigation

**Figure 2** Mean water levels in pools censused on Middle Fen in 1997




Horizontal line represents the April 1992 datum (Smith 1992)
Vertical arrow shows the start of irrigation

**Figure 3** Distribution of *D. plantarius* in the Little Fen census area in 1997. Numbers denote maximum count for each pool. No spiders were recorded on pool with no number. Blocks of sedge cut in 1997 are shaded. Timing of cutting for each block is given in parentheses. New pools excavated in Compartment 5 are denoted (N). Those in Compartment 4 cannot be located until the winter.



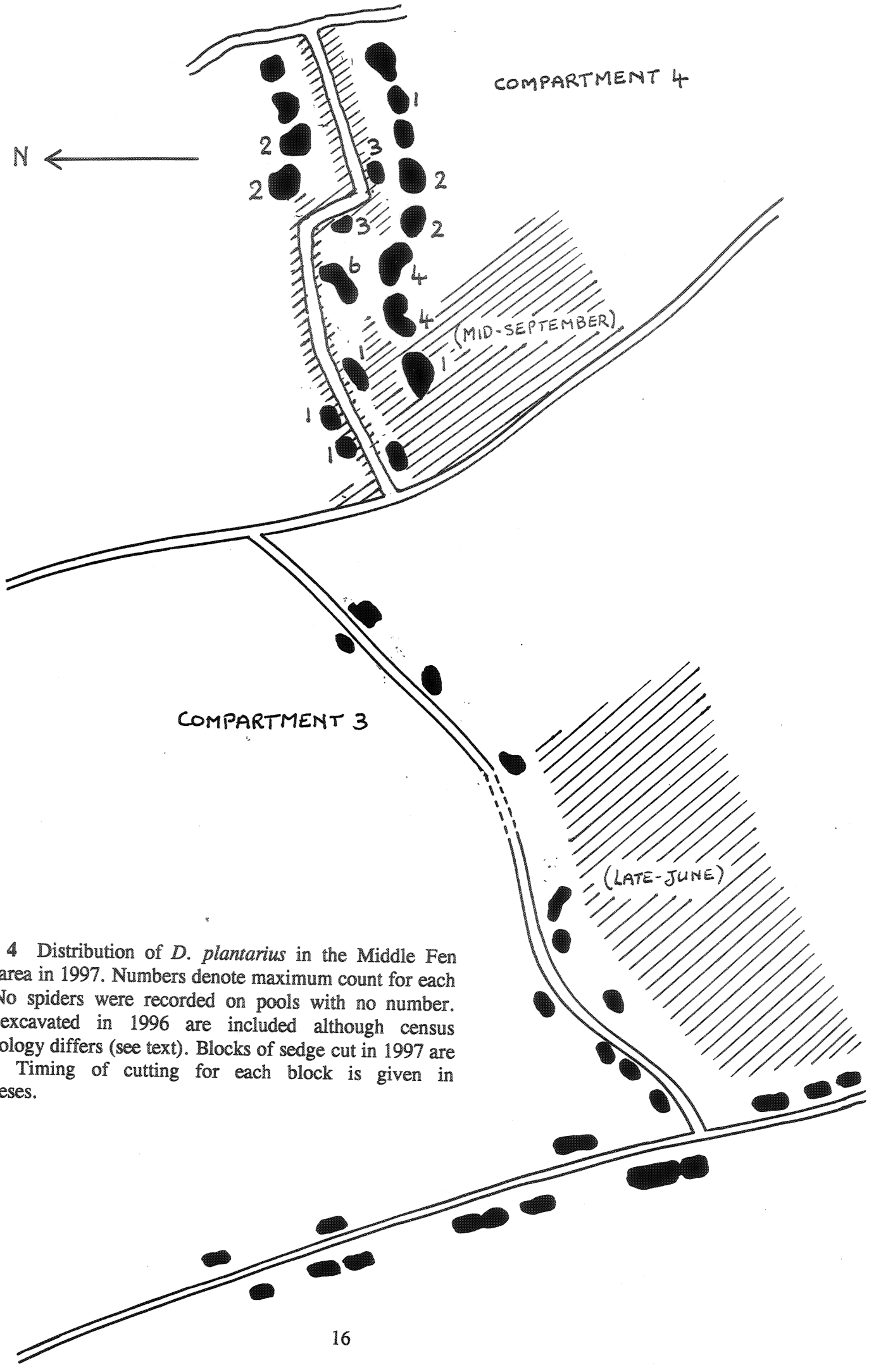



**Figure 4** Distribution of *D. plantarius* in the Middle Fen census area in 1997. Numbers denote maximum count for each pool. No spiders were recorded on pools with no number. Pools excavated in 1996 are included although census methodology differs (see text). Blocks of sedge cut in 1997 are shaded. Timing of cutting for each block is given in parentheses.